English

Operating Manual

catman®

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1 INTRODUCTION

In the following we assume that:

- you are familiar with your Windows® operating system;
- you know how to use an online help.

☞ The content of this PDF file is the same as the online help.

In this section you will find

1. The system requirements for catman.
2. a description of installation.
3. instructions for uninstalling.
4. information on licensing and registration.
5. an explanation of the conventions and notations used in the help.

See also Quick start.

1.1 System requirements

To operate the current version of catman, your PC should meet the following requirements:

- Intel Pentium or equivalent processor upwards from 1 GHz
- Windows® 8.1, Windows® 10 or Windows® 11 (latest 32-bit or 64-bit versions)

  ☞ The file system should be NTFS.
- Current web browser
- At least 8 Gbyte of RAM
- Graphics card or screen with a resolution of at least 1024 x 768 pixels. We recommend a resolution of 1600 x 900 pixels or higher. With small screens with higher resolution use the Windows Control Panel (**Display** settings) if necessary to enlarge the display of text and other screen elements.
- Approx. 1 GB of free storage capacity for the program installation; at least an additional 1 GB is needed for temporary storage of data; however, you can also use a different drive for this (not a network drive)
- Microsoft or 100% compatible mouse
- Configured standard printer

- One of the following interfaces is required to connect measuring devices:[1]:
  - Ethernet (10/100 MBit) or FireWire (IEEE 1394b[2])
- The following fonts must be installed:
  - Arial (TT), Courier, MS Sans Serif, Small Fonts, Tahoma, Times New Roman (TT), Verdana, Segoe UI and Wingdings. Usually these fonts are installed with the Windows operating system.

Notes

- To be able to save measurement data, you must have sufficient free memory on your storage medium. To make a rough estimate of the space required: approx. 8 bytes are required for each measured value, i.e. for 100,000 values approx. 40 megabytes are necessary for the maximum possible 50 channels. The disk drive, on which the temporary file for the temporary data storage is created, can be changed using the menu **File ► Options** and Data storage (**System** group).
- If there are numerous channels we recommend a **Fixed storage size** for the temporary data storage. This will improve the speed of the (temporary) data recording.
  See also Data storage (**System** group).
- If no more free space is available on the specified storage medium, the measurement is aborted. However, you can see, for example next to the icon in the status line, how long you can continue measuring before this happens (d = days, h = hours). The computation uses 100 megabytes as safety reserve. The background of the status display will change to red as soon as there is less than 1 gigabyte of free space.
- The above requirements are sufficient if you use low sample rates, few channels and carry out only a few graphical tasks. You must use a more powerful PC if you want to use a lot of DAQ or computation channels, or carry out complex graphical tasks using high sample rates.

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1) No interfaces are needed for catman PostProcess.

2) With FireWire only interfaces to IEEE 1394b are supported. The HBM drivers for the interface (including adapters for IP over FireWire) must be installed (included in the catman installation software).

1.2 Installation/Upgrade

See also Licensing and registration.

The installation requires Administrator rights. We recommend that you close all open programs. After installation it may be necessary to restart Windows.

Insert the DVD into your drive. In the standard configuration Windows automatically opens the DVD and the start window appears.

If you have deactivated the self-starting Windows function or downloaded the installation files, look for the file “Start” or “Start.exe” (main folder of the DVD or download) and double-click on its icon to obtain the start window. If the download is a ZIP file, unzip the file first and then start with “Start.exe”.

At the top right of the start window select the installation language at **Language**.

Click on **Install catman** and follow the instructions of the setup program. Read the licensing agreements and specify the folder in which the software is to be installed: Either confirm the suggested target folder or click on **Browse** and choose the one you want. The setup program creates—where necessary—the folder you have specified and then copies all files to it. In the next step you can select the components to be installed:

- **FireWire driver**: The drivers are only needed if you want to operate QuantumX/SomatXR modules via a FireWire interface in your PC. The driver is not needed for connecting a CX27 or MX module with C functionality (e.g. MX471C) via Ethernet to the PC and via FireWire to other QuantumX/SomatXR modules. See also Notes on the FireWire interface (IEEE 1394).
- **NPT time server**: The installation is only practicable with QuantumX/SomatXR, MGCplus, PMX, DMP41 and FS22 BraggMETERs, because they can be supplied via the time server with exact time specifications. The time server from Meinberg is installed. Synchronization of the time server with a time server in the Internet is not required and is also not set up by the automatic installation. The time server is only used for synchronizing the devices taking part in the measurement.
  You can also retrospectively install the NTP time server or install it on another PC; see also www.meinberg.de and Synchronizing several devices.
- **Install legacy TEDS editor**: The installation is normally not necessary, because you can write new (empty) TEDS modules as well as easily modify existing ones via the sensor database; see Using transducers with TEDS. The editor is only needed when you want to view or edit TEDS content as specified in the TEDS standard.

- **PRNF converter**: The converter is only useful if you want to open PRNF measurement files, e.g. files captured with the Evidas program. To do this, the files must first be converted to catman format.

Before actually copying the files into the folder, the installation program will display a summary of the operations to be executed. Confirm these with **Install**.

Note

- We recommend starting catman once directly after installation with administrator rights. Enter the license number and, in the case of FireWire, connect the devices to be operated so that the drivers are fully installed (requires administrator rights).
- The *retrospective* installation of a driver can take many minutes, because Windows first attempts to find the driver via the Internet. We therefore recommend that you install using the program for the driver; see Notes on the FireWire interface (IEEE 1394).

1.2.1 Notes on the Ethernet interface

Windows Firewall

If you establish a connection to an HBM device via the Ethernet interface, it is usually blocked by the Windows firewall or by the firewall of your anti-virus program. An exception is defined for the Windows firewall during the installation of catman. For other programs, enable access for **catmanEasy** or **catmanEasy-AP** (usually requires administrator rights).

Other Firewalls

Depending on the devices connected, open the following ports:

- QuantumX/SomatXR: TCP ports 80, 5001 and 7411, UDP for ports 1200, 1201, UDP-Multicast for ports 1300, 1301, 31 416 and 31 417, for the CX27 the TCP ports as from 50 000,
- MGCplus with CP22/42: TCP port 7 (no UDP or multicast present), MGCplus with CP52: TCP ports 7 and 80, UDP-Multicast for ports 31 416 and 31 417,
- DMP41: TCP port 1234, UDP-Multicast for ports 31 416 and 31 417,
- PMX: TCP port 55 000, UDP-Multicast for ports 31 416 and 31 417,
- FS22 BraggMETER: TCP ports 3500 and 3365,

- Kistler System 2000: UDP for ports 8888 and 8889,
- Kistler KiRoad: TCP ports 6155 and 6158, UDP for port 6156.

Connecting to MGCplus via WLAN

If you are not connecting the MGCplus through cable but instead through a WLAN, with slow networks interruption in the connection (timeout) may occur. In these cases, set the waiting period for the interrogation of the output buffer to a higher value.

⚠ Changes to the Registry using the regedit.exe program should only be made by experienced users, and after backing up the existing Registry, because under some circumstances serious Windows errors might result. If necessary, ask your administrator to make the change.

Under HKEY_LOCAL_MACHINE/SOFTWARE/HBM/CATMAN/SETTINGS create the new string **MGCGetFifoTimeout** and enter a value of above **500** (ms), e.g. **1500**.

1.2.2 Notes on the FireWire interface (IEEE 1394)

The required FireWire drivers can also be installed during the installation of catman (optional components). If it has not already been done, you can also install the drivers retrospectively; see the following description.

☞ The installation requires administrator rights under Windows. If you are using a plug-in card for the FireWire interface, you should insert the card into the PC before the installation. Then the HBM driver for the card is automatically activated.

For the FireWire interface (IEEE 1394b) of the QuantumX/SomatXR modules you have to install the driver supplied by HBM. You can however switch back at any time to the original driver of your interface.

After the installation, start catman as usual and in the Prepare new DAQ project dialog specify **FireWire** as the interface.

IP over FireWire (HBM IEEE1394 IP Adapter)

From Version 3.4 the communication with the QuantumX/SomatXR modules also takes place by FireWire similar to Ethernet. In this respect a virtual interface for each physically existing FireWire interface is set up: *IP over FireWire*. A maximum of two adapters are created and are visible in the network connections. As IP addresses 24.0.0.1 and 25.0.0.1 are used; consequently, the IP over FireWire interface adapters are named **IP over FireWire 24** and **IP over FireWire 25**. (The latter is only present if more than one physical interface is installed in the PC1)[1]). Only the Internet protocol TCP/IP (IPv4) is required for the IP-over-FireWire interface; the client for Microsoft Networks or the QoS Packet Scheduler is not required.

Procedure for the (retrospective) installation of the drivers

1. Go to the “DriverSetups” folder in the installation folder of catman.
2. Double click on HBM IEEE1394 Driver Setup.exe.
3. Read through the license agreements and follow the instructions of the setup program.
   The setup program copies the required files into the appropriate Windows subfolder and sets up the drivers and the IP-over-FireWire adapter.

If you have connection problems, check whether the interface adapter IP-over-FireWire 24 has been correctly set up (Windows Control Panel ► Network and Sharing Center ► **Change adapter settings**). If not, connect a device and double click on “HBM IEEE1394 IP Adapter Wizard.exe” in the “DriverSetups” folder.

Activating the HBM driver with several interfaces

The HBM driver is a modified Thesycon driver.

If your PC has more than one FireWire interface, you must define for which interface the driver is to be used.

1. Start the program “t1394bus_installwizard.exe” (Thesycon T1394bus Setup Wizard) in the folder “HBM IEEE1394 driver”. The folder is created within the “HBM” folder in the “Programs” folder of Windows.
2. Select the required IEEE 1394 host controller by clicking in the list. The “Thesycon T1394bus Setup Wizard” shows all 1394_OHCI_HostController located in the PC. If you have several adapters, you can select one of them. Otherwise click the first entry.
3. Click on **Switch to T1394bus driver** to install the HBM driver.
4. Close the program “Thesycon T1394bus Setup Wizard”. The driver is now installed and ready for use.

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[1] A FireWire card can have, for example, three connections, but despite this it is usually registered in the system as only one interface. In this case only one IP-over-FireWire adapter is set up (HBM IEEE 1394 IP Adapter).

If you want to again activate the original driver of your FireWire interface, restart the "Thesycon T1394bus Setup Wizard", select the relevant IEEE 1394 host controller and click on **Switch to in-box T1394 driver**. This deactivates the HBM driver, but does not uninstall it. You can switch between both drivers at any time.

Remove T1394bus driver from system removes the HBM driver completely from your PC.

Installing the device-specific driver

1. Connect the MX module.
   After a short time, a Windows dialog opens with the message that new hardware has been detected and it asks whether to look for a driver on the Internet.
2. Activate **No, not this time** and click on **Continue**.
3. Activate **Install software automatically**.
   Windows then updates the required files. Please wait until the message "New hardware found" appears in the Windows taskbar. Only then start catman.

1.3 Uninstalling

To uninstall catman open the list of installed Windows applications. Then select the catman installation.

Opening the list of apps under Windows 10

In the taskbar search box type **Change or remove a program** and open the suggested Control Panel program.

Alternatively, you can use **Settings ► System ► Apps & Features** on the Start menu or **All settings ► System ► Apps & Features** in the Info Center.

Opening the list of apps under Windows 8/8.1

From the **Charms** menu on the Windows desktop (not in tile view) open **Settings ► Control Panel**. Double-click on **Programs and Features** (**View**: **Small icons**) or **Uninstall program** (**View**: **Category**).

Notes

- Only the files which were created during the installation are deleted. The files created when using catman and the catman defaults are not removed.
- Together with catman, installed utility programs, such as the NTP time server, are not automatically uninstalled. If you no longer need the applications, use the Control Panel in Windows to uninstall them.

- Programs or drivers that were installed for FireWire, for example, are also not automatically uninstalled. Use the Windows Control Panel to uninstall these drivers.

1.4 Licensing and registration

☞ See also https://www.hbm.com/terms/software for the software license terms (EULA).

When running the program for the first time, you must enter your name and company, and the *license number* sent to you. If you do not enter a license number, catman will start in *Analysis mode* (the program can be run up to 25 times with use of all functions).

Click on **Info** in the catman start window if you want to:

- Enter your license number at a later point in time.
- Change the name or company.
- Produce a file with information about your PC system (system info file) for HBM Support.
- See all activated modules, e.g. EasyMath (mathematical functions and AutoSequences).
- View the release notes for the current version.
  See also What is new in catman? (History).

The current license data is shown in the window on the right. Click on **Modify** to change settings.

Notes on the Map Panel object (only available with and catman PostProcess)

The object loads a map view from the Internet which is made available by Google Ireland Ltd. When querying, no user information or PC parameters are passed to Google apart from the querying IP address.

The maps can only be used in conjunction with catman. Owing to licensing law restrictions, the object is unavailable in some countries, including China and North Korea. You can, however, switch to using Baidu maps if you have a Baidu account. For details refer to the Knowledge Base under “Working with Baidu Maps in China” and https://lbsyun.baidu.com/index.php?title=webapi.

Registration and activation of software maintenance

Please register at systems@hbkworld.com with an email to activate your service contract. HBM needs your registration to be able to ensure that you can be informed when a new version appears and that you receive the license number necessary for this. After completing registration, you will also receive the appropriate telephone numbers from HBM via email for direct access to the catman support in your region. The following information is required:

1. The program name (catmanEasy or catmanAP or catman PostProcess).
2. Your current license number.
3. Your company's name.
4. Your name and, where applicable, department.
5. Your email address.

☞ Reregistration for another name and/or another email address is possible at any time.

Module activation

1. Click on **Options** in the catman start window.
2. Activate your module via **Program functions** (**System** group).
3. Enter your module license number in the following dialog.

☞ The license number is only required the first time you activate the module. You can disable the module via the menu **File ► Options** and **Program functions** (**System** group) later if it is not required. To activate it again, just click in the appropriate box.

All activated modules and your main license number are displayed in the program if you click on **Info** in the start window or on **About catman** in the **Help** menu.

1.5 Conventions used – Help window

See also The program interface, Help on EasyScript (in the script editor).

At the top of each page of the Help there is a blue-shaded header area. If the Help window becomes too small, only the text area is shown, and the hamburger menu is displayed in the top left corner of the header. Click on the icon to display the left side area with the list of contents, index, etc.

With on the first line of the text area you can print the current topic, and with remove the text marks displayed when searching for terms. and on the right side to scroll to the previous or next topic. The second line in the text area (above the header) indicates your current location within the Help. You can click on a topic at any time to go to the relevant section.

For the sake of clarity, some sections are initially hidden. In such a case, ▶ is displayed to the right of the title or text in question. Click on the title or text to reveal the relevant section. The icon then changes to ▼. Click again to hide the section again. With ☰ in the first line of the text area you can show or hide all hidden sections at the same time. At the bottom of each page, click on ⤒ to scroll to the top of a page.

The following symbols denote special paragraphs:

⚠ Stands for Attention.

☞ This symbol indicates an important detail or a special feature.

💡 Paragraphs with this symbol provide a tip or explain an interesting feature.

ℹ This symbol is located in front of links to further information.

Terms that are explained in more detail in the glossary are identified by *this marking* (not all terms can be clicked on in the PDF; please refer to the glossary).

Individual terms within the text are highlighted in *italics*. There are also identifiers for the **entries** you need to make, all **buttons**, **checkboxes**, the names for **input fields**, etc. The **menus**, **commands**, **dialog boxes** and **windows** used in the program, as well as **tabs** and **groups** in the ribbon, are also identified.

We hope these notations will help you identify the relevant sections and menus more quickly, and guide you through the program in a user-friendly way.

☞ All trademarks and brands used in the Help are trade names and/or trademarks belonging to the respective product or the manufacturer/owner. Hottinger Baldwin Messtechnik and Hottinger Brüel & Kjaer GmbH (HBK) do not lay claim to any other than their own trade names/trademarks.

2 QUICK START

See also The program interface, Video tutorials on the HBM website: www.hbm.com/catman-daq-software-knowledge-base, Knowledge Base (via **Help ► Knowledge Base** at the top right of the program interface), Conventions used – Help window.

catman® is the measurement software for the HBM devices QuantumX, SomatXR, MGCplus, PMX, DMP41, and the SI/DI FS22 BraggMETERs for measurement with optical sensors. It enables you to perform different measuring tasks quickly and simply without having to undertake any time-consuming programming. Apart from the HBM devices, you can also connect a GNSS system (GPS), the Vaisala Weather Transmitter WXT520, a GOM Testing Controller (ARAMIS) for optical strain gaging or Kistler RoaDyn sensors (System 2000 or KiRoad) to catman.

catman recognizes not only the configuration of the HBM measuring devices connected, but thanks to the optimum interaction of hardware and software also enables you to automatically configure the entire measuring chain, if you are using TEDS transducers for example. For DAQ channels with conventional transducers, use the integrated catman Sensor database and simply assign the transducers you are using to the individual channels. The Sensor database already contains all HBM transducers as templates, and typical sensors such as thermocouples, Pt100, voltage or current sources, but can also be easily extended to include your own transducer types. CAN signals can also be included in the Sensor database and assigned to CAN reception channels. You can also write the sensor data from the Sensor database into the TEDS module or transfer the data from a TEDS module to the Sensor database.

Use the default settings of catman or define your own measurement sequences, called DAQ jobs: define sample rate, start and/or stop trigger including pre-trigger time and time until stop (post trigger), select time points for start and stop or start and stop the measurement manually. The settings can also be mixed, e.g. start with trigger and stop after a certain time or number of measurements etc. Produce your own visualization with the graphical objects of catman. Graphics showing the DAQ plots during measurement, digital or bar indicators and numerous other objects are available. You can however also use the default settings of catman and immediately start with the measurement. Even during the measurement you may assign further channels to graphs or create new graphical objects.

You can extend the *catmanEasy* basic version with additional (chargeable) modules. The *catmanAP* version contains catmanEasy, all modules, and additional functions such as video recording, parallel recording (Recorder) and GNSS data visualization on cards. The catman *PostProcess* version is restricted to Analysis mode (connection of devices and acquisition of data are not possible).

⚠ Please register with HBM to activate your service contract. HBM needs your registration to be able to ensure that you can be informed when a new version appears and that you receive the license number necessary for this, see Licensing and registration.

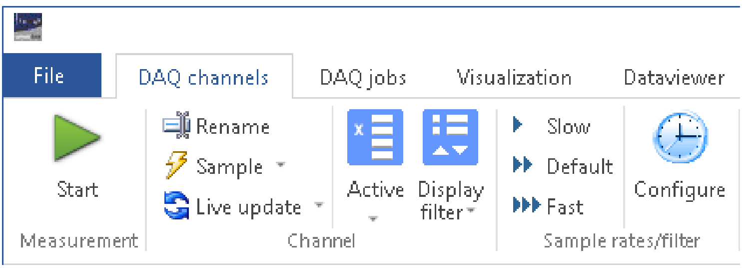
2.1 The user interface

The user interface of catman provides you with a clearly laid-out work space similar to that used by Microsoft from Office 2010 which always offers only the currently required functions: the ribbon. You will soon realize that with this interface it is very easy to prepare, execute and evaluate a measurement.

You can also influence many settings yourself, for example which tab appears when you start DAQ mode, which style is used for the ribbon and the windows, whether catman displays the start window on starting or directly seeks devices. You can also design your own tabs (and hide those of catman), and much more! Test the possibilities: Menu **File ► Options** and **Keyboard shortcuts** in the **System** group or **Style** and **Adapt** in the **User interface** group.

The Ribbon

In the top section of the main window you will find the ribbon, which replaces the earlier menus and toolbars. The tabs on the ribbon each display commands which are relevant to the various ranges of tasks in the applications. Within the tabs various actions are combined into so-called groups, e.g. the group **Sample rates and filters** contains the three sample rates available in catman **Slow**, **Default** and **Fast**, provided the device is supported.



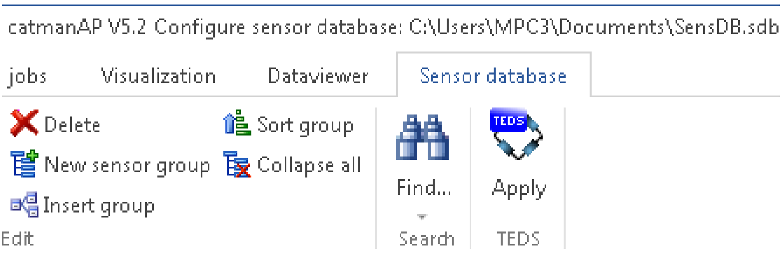
To hide and show the menu ribbon use and on the right above the menu ribbon. Then you have more space available for the main window. Click on the still visible area (the name) of a tab to temporarily display it so as to select an action.

Quick Access Toolbar

The quick access toolbar above the **File** menu can also be displayed in catman. This means, for example, that you obtain a faster access to the **Save** menu. Using the context menu of an action in the ribbon, many of the actions can be added as further buttons on the quick access toolbar. If the icon is not active, show it via **File ► Customize interface** and **Show quick access toolbar**.
See also Program options: Adapt user interface.

Context-related tabs (context tabs)

Certain groups of commands are only relevant when objects of a certain type are to be edited or certain options activated. For example, the Sensor database or the channel check are only interesting when you are editing the channel list, i.e. setting up the channels. When you are designing your visual display, these functions are no longer needed. Therefore, these tabs are only displayed once you have activated the **DAQ channels** tab.



Component windows

Apart from the main window, there are also so-called component windows in which, for example, the Sensor database and the sensors that it contains are displayed or there is another one for the channel information. Once catman has been started, the component windows are first superimposed in the margin of the main window and they display a certain component, e.g. the Sensor database. The arrangement of the component windows is however variable and they can also be "docked" at various locations. You can also temporarily hide the windows (then just a tab is displayed) to obtain more space for the main window.

Hiding/minimizing/showing component windows

Click on in the window title bar to hide a component window (catman then displays a tab at the side for the component). Move the mouse pointer over the tab to display the component window (temporarily). Click on to again permanently display the window or to be able to lock it onto another point.

Moving/docking component windows

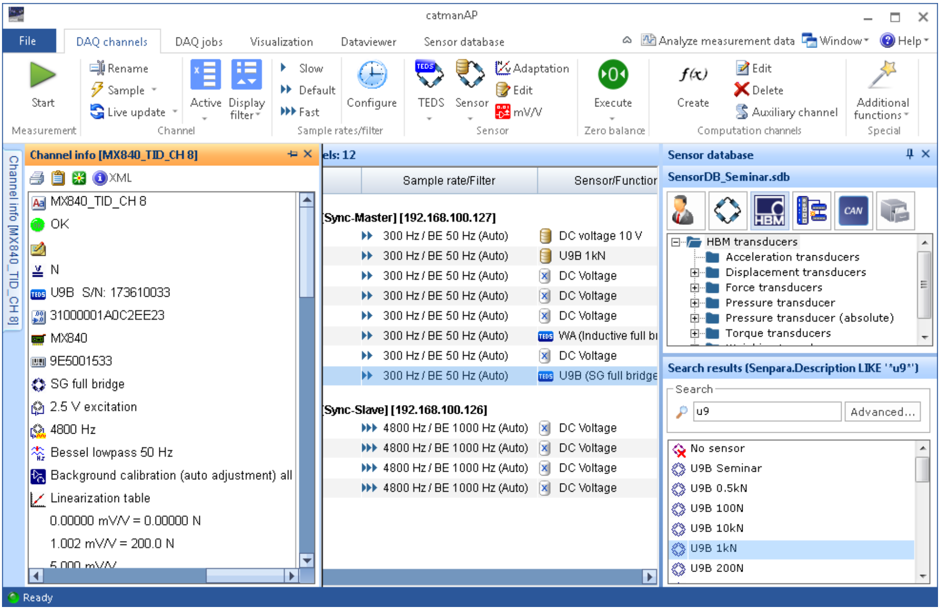
Click in the title bar and move the required window with the left mouse key pressed. You can arrange the component windows as separate windows outside of catman or "lock" them onto various points in the main window, i.e. irrespective of how you change the size or position of the main window, the component windows always cling to the respective edge of it. Move the relevant window to the left, lower or right edge of the main window: Near the edge or corner of the catman main window a frame appears indicating the docking position. Just release the mouse key to dock the component window at this position.

Combining several component windows into one window

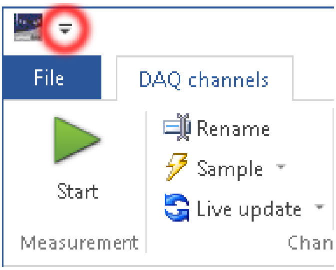
Click the title bar of a component window and with the left mouse key pressed move it onto the title bar of another component window. Then release the mouse key once the frame with the new docking position appears on the desired component window. Tabs which you can use to switch between the different windows are then displayed below the component window (see example with two tabs).

Example component window

On the left is the component window **Channel info** (displayed temporarily), on the right the component window **Sensor database** with the windows **Sensor groups** and the sensors of type **U9B**.

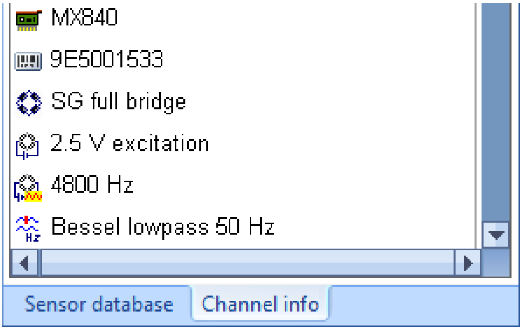


The quick access toolbar



Quick access toolbar actions appear between the red circle and the catman icon. With the icon inside the red circle you can change the position of the quick access toolbar, and minimize the ribbon.

Component window tabs



Two tabs: **Current sensor database** and **Channel info**.

2.2 How do you work with catman?

See also The user interface.

From catman version 3.5 there is a new variant for connecting to QuantumX modules. Current modules with firmware 4.0 or higher and SomatXR modules are connected normally. QuantumX modules with older firmware (lower than 4.0) must be updated beforehand. Please contact HBM Technical support to do so.

Some functions can be disabled with password protection—see Sensor options, Password protection.

Procedure for QuantumX, SomatXR, MGCplus, DMP41 or PMX

1. Start catman.

   Before connecting to a device for the first time, you must specify (once only) the device type, the interface, and where appropriate additional options.

2. Select **New** (new *DAQ project*, open an existing DAQ project or start with **Offline** (work without connected devices), if no measuring device is available.
   See also DAQ projects (DAQ mode).
   To view or analyze data already acquired, select **Analyze** and **New** or **Open** (Load existing analysis project).
   See also Analysis mode: Display/analyze data.

3. If you are not using a transducer with *TEDS*, assign the connected sensors (transducers) to the channels: Find your sensors in the *Sensor database* component window and drag and drop each sensor onto the channel to which it is connected.
   See also Add your own sensors, Changing strain gage settings, Calibrating sensors and Using CAN signals.
4. Assign unique channel names.
   From the **Rename** context menu you can create channel names with consecutive numeration or accept the sensor description.

   ☞ Each channel is identified by its name in catman, therefore as far as possible use meaningful names.
   See also Use sensor description as channel name.

5. Mark the channels which are to be zero balanced and carry out the zero adjustment (*Zero balance*) with (**Zero balance** group) or use the menu item **Zero balance all hardware channels** in the **Zero balance** group.

6. Deactivate channels that are not needed, e.g. channels without a sensor: in the **Channel** group.
7. The **Live display** (**DAQ channels** tab, **Channel** group) is active by default, so you get continuous measurements. Check that all channels are working properly.
8. Start the DAQ job (**DAQ** group).
   catman will suggest different pre-configured visualizations. However, you may also create your own visualizations, even during the measurement.
9. After the measurement enter Analysis mode to analyze your data or to be able to compare them with other measurement data.

Procedure for QuantumX MXFS, FS22 BraggMETER or the GOM Testing Controller (ARAMIS)

See Settings for optical measuring devices, Integrating optical measuring devices, Using optical sensors.

These sections describe the procedure from preparing the devices to configuring the channels.

Optional settings

- Mask out the deactivated channels: Display filter ► **Active** in the **Channel** group.
- Create computation channels: **Create** in the **DAQ channels** tab (**Computation channels** group). Use **Live display** ► **Measure computation channels** (**Channel** group) to activate live display also for computation channels.
  See also Defining computations.
- Set limits or events which you want to monitor.
- You can disable zero balancing for individual channels, e.g. for a channel with a reference force transducer, using the **Zero balancing** group or the context menu. You can then carry out zero balancing for *all* (unblocked) channels.
  See also Configure channels.
- Import channel names (and/or sensors) from an Excel file, see Import channel name and sensor from Excel.
- If you do not want to acquire some channels, such as temperature channels, at the default sample rate with QuantumX/SomatXR, MGCplus or PMX, mark the channels (**DAQ channels** tab) and in the **Sample rates and filter** group select the **Slow** or **Fast** sample rate (the channels are marked with or , as appropriate, instead of ; at the same time the corresponding time channels are generated in the background).
- Create your own visualizations using the **Visualization** tab and the **Visualization objects** group.
- Run a Channel check.
- Define additional DAQ jobs.
  Without configuration, catman will use a predefined DAQ job which measures all existing channels—such as on the QuantumX module MX840—at 300 Hz until you stop the measurement manually (other devices/modules might use different sample rates by default). The data acquired can then be saved or rejected. However, you can specify other start options, such as trigger conditions or certain start and stop times and dates.
  Alternatively, you can also specify special recording conditions for certain channels by using recorders.

Notes

- In the catman PostProcess version only Analysis mode is available.
- catman automatically applies a filter for all channels as default. This is set to approx. 15% of the sample rate as long as the channel has the required

bandwidth.
See also Program option DAQ channels: Filter (automatic filter selection) in the **Channels and sensors** group, Setting filters manually, *Alias* effect, Which sample rate is the right one?

☞ Filters with Bessel characteristic (default setting) do not cause any signal distortion, but they have a relatively flat frequency response. In case of high-frequency interference at *high* amplitudes, you should therefore set the cutoff frequency to 5% of the sample rate, or use filters with Butterworth characteristics.

- catman can also be operated via the keyboard: The default button in the dialogs has a thick frame. Use [↵] to confirm, [Esc] to cancel and close the dialog.

2.3 Available additional modules for catmanEasy

ℹ See also Program options: Program function options for activating the modules.

- With the *EasyMath* module you can define mathematical computations in Analysis mode, filter measurement data or calculate spectra. Using a formula editor you can carry out computations which combine channels and apply numerous functions such as integration, differentiation, sine or cosine.
  See also EasyMath (Analyze measurement data).
- *Autosequences* module (included in EasyMath): In DAQ mode, with the *Autosequences* you have the possibility of automating measurement sequences without programming, for example writing cyclically data into an Excel table.
  See also Autosequences.
- The *EasyScript* module provides a programming language with which you can monitor and control catman. With EasyScript you can expand catman with your own functional features or create complete programs for running measurements or analyzing data. EasyScript is based on the VBA standard (Visual Basic for Applications), which is also used in the Office programs from Microsoft. Due to the open architecture of VBA, other programs, e.g. Excel, Word or the Windows Explorer can also be addressed and controlled as objects.
  See also EasyScript.

Only included in catmanAP

- Using one of the *Video Cameras* modules you can integrate the recordings of up to four video cameras in a measurement.
  See also Setting up video cameras.
- With the *MQTT* module you can send data from catman to an MQTT broker.
  See also Using MQTT.

2.4 What's new in catman? (History)

See also video tutorials on the HBM website: www.hbm.com/catman-daq-software-knowledge-base and Release Notes section in Knowledge Base (via **Help ► Knowledge Base** at the top right of the program interface).

catman has been revised and its range of functions extended. The following list contains the main changes and new possibilities.

New functions

- The new QuantumX MXFS8 SI module is also supported by catman. The MXFS8 DI module is still supported. The new module supports more channels per connector, and more channels in total, but has lower sample rates. All modules use only the decimal sample rate domain; see also Switching sample-rate domains for QuantumX/SomatXR.
- Third-order polynomial scaling for the optical QuantumX modules is supported.
- The Liebherr MDC3 video camera (IP camera) is supported; see Cameras.
- MQTT is supported as of release 2, meaning you can send data from catman to an MQTT broker; see Using MQTT.

Modified functions

- The video connectivity has been modified. You can use the new camera server as well as the “old” variant of catman 5.5 (**Options ► Program functions: Use video camera legacy system**). If you use the new variant, the camera server runs on a dedicated CPU core in parallel with catman, but fewer recording formats are available and no audio can be recorded.
  See also Setting up video cameras.
- In Analysis mode you can now select the order for all filters, see Filter.

- The connectivity to InfluxDB has changed; see Using InfluxDB. SSL encryption with token authentication is also supported, as is version V2.
- Remote UDP: You can now select which channels are used for UDP output; see Remote (UDP output).
- When exporting CAN raw data to a Vector CANalyzer log file, the start time is written to the file header as absolute time in the appropriate time format.
- CAN signal import from ARXML files into the sensor database now also supports version 4.3.
- When changing the sample rate domain, you no longer need to restart catman. Only the module is restarted; see also Switching sample-rate domains for QuantumX/SomatXR.

Removed function

Push notifications are no longer supported by catman. As of release 2, the option has also been removed from the dialog.

2.4.1 What was new in catman 5.5?

New functions

- You can now save measurement data in two different formats after the end of the DAQ job; see Data saving.
- The circuit diagrams for connecting the sensors to QuantumX/SomatXR, MGCplus and PMX are now displayed in the **DAQ channels** tab when you open the **Sensor adaptation and wiring diagram** context menu (the menu item has been renamed).
- The sensor database has new entries. Sensors from Brüel & Kjaer have also been included, for example. The **HBM sensors** group has therefore been renamed **HBK transducers (HBM & BKSV)**.
- After a device search with the HBM Device Manager, you can add more additional devices manually than before.
- For QuantumX/SomatXR modules, you can now also display only the sample rates possible for the module in question; see Sample rate.
- You can also display and record EtherCAT signals received from the CX27C (QuantumX/SomatXR) in catman; see EtherCAT with CX27C (QuantumX).
- For CAN Raw data, the export formats **Vector CANalyzer Log**, **PCAN Trace** and **Vector BLF** (Binary Logging Format) are available in addition to **ASCII** and **HBM catman format**.

- There is a new real-time computation in the Filter functions: Static and dynamic computation for periodic signals. The computation allows you to record both the amplitude of the peak values and the arithmetic mean value of a periodic signal.

Modified functions

- The overload detection has been improved: You can now choose between a display when the sensor (electrical) measuring range is exceeded, when the input range of the measuring amplifier is exceeded, or both; see Setting up channels (measuring chain) (DAQ channels tab).
- The additional modules for catmanEasy have been reduced to two, and the functions of the others have been integrated into either catmanEasy or catmanAP. The EasyPlan, EasyMonitoring, Ethernet-based GNSS and EasyOptics modules have mostly been integrated into catmanEasy. The EasyRoadLoad and Video Camera modules and the recorders (parallel data acquisition in the EasyMonitoring module) have been integrated into catmanAP. Only the EasyMath module (including the Autosequences module) and EasyScript module are now available for catmanEasy.
- The USB port on the MGCplus with CP22 or CP42 is no longer supported as from catman 5.5. As the MGCplus is now only available with CP52, and connecting by USB is less advisable than via Ethernet, support for this driver is being discontinued. Support for connecting CANHEAD modules via a USB adapter (CANHEADdirect) is also being discontinued. The connection of CANHEAD modules via the MGCplus is still supported.
- The eDAQ/eDAQ-lite devices are no longer supported as from catman 5.5.
- The synchronization of multiple PMX devices has been improved, and you can record hardware time channels in ticks; see PMX (Time channels).

2.4.2 What was new in catman 5.4?

New functions

- catman supports the QuantumX module MXFS for the measurement with optical sensors.
  See Settings for QuantumX MXFS, Integrating the QuantumX MXFS, Activating and configuring QuantumX MXFS channels.

- A sensor comment is now applied as a channel comment when assigning the sensor.
- In Analysis mode you can now display the measured values of individual channels without having to load the project: Double-click on a channel in the **Channels** tab (**Test Explorer** tab).
  See also Find files (search functions), Displaying channel data and measured values.
- For the *placeholders*, you can also use only the file name of the backup saving file without the path, for example in a text field or as a graph title: %TestFileName%.
- You can now also use placeholders in Analysis mode.
- In Analysis mode you can search for channels, sensor types etc. across *all* loaded tests, and perform the search with regular expressions.
  See Searching in analysis projects.

Modified functions

- The (old) Interrogators SI/DI are no longer supported as of catman 5.4. The FS22 BraggMETER SI/DI are still supported.
- If you start a DAQ job on the CX22 (QuantumX) and want the job to stop in the event of an error, you now receive a warning if you have activated **Extended safety checks before DAQ start**.
  See also Check DAQ settings before DAQ start, Behavior on errors during the measurement.
- If more than 256 peaks are detected on an FS22 BraggMETER, only the first 256 are included in the channel list; all others are ignored, as catman cannot use more channels per BraggMETER.
- If you are using the QuantumX/SomatXR module, you cannot set all connectors to **CAN-RAW receiver only**. At least one connector must additionally decode signals. At the start of a DAQ project a check is made whether at least one other signal of the module is active, and not only CAN-RAW.
- Logging of FTP transfers has been improved.

Notes

This version is the last version that supports the following devices:

- USB connection of MGCplus with CP22 or CP42. As the MGCplus is now only available with CP52 and connecting by USB is less advisable than via Ethernet, support for this driver will be discontinued with the next version.

- CANHEADdirect: Connection of CANHEAD modules via a USB adapter will be discontinued with the next version.
- eDAQ/eDAQ-lite with TCE-Preview: As the devices will be phased out at the end of 2020, and the eDAQXR uses its own web interface, support by catman will be discontinued as of the next version.

2.4.3 What was new in catman 5.3?

Modified functions

- As of catman 5.3.2, the CP32 for MGCplus and the SI/DI type Interrogators are no longer supported (FS22 BraggMETERs are still supported). Also, it is no longer possible to install catman on a CX22 with WindowsXP.
- Better synchronization of GPS data in hybrid systems. GPS systems that transmit at data rates above a few Hertz were previously only recorded with one new value per read block by the leader device, e.g. an MGCplus. You can now configure the GPS device with a data rate to utilize the maximum speed of your system. To do this, configure the GPS as a device with NTP synchronization; see Synchronization in case 2: different devices (hybrid system) and the Knowledge Base (via **Help ► Knowledge Base** at the top right of the program interface), section headed "Using NTP synchronization for hybrid systems including a GPS".
- The scan option not to change the device filters when connecting has been extended to the sample rates for QuantumX/SomatXR. When the option is active, neither of these is changed, and the sample rates set in the device are applied in catman.
  See Do not change filter and sample rate after connecting device.
- The use of spaces and dashes in channel names is allowed again (had not been allowed since catman 5.2.2).
- Zero balancing is also disabled in the QuantumX/SomatXR modules (hardware lock), and so is also effective in the MX Assistant for example. Any lock already set in the module is likewise considered.
- You can update the layout object text during measurement, to view the current time for example.
- The context and pop-up menus have been changed to make their layout clearer. The explanatory text is no longer located below the menu entries, but is displayed as a tooltip when you place the cursor on the entry in question.

- The date and time in the data files, comments etc. is now formatted independently of the local format configured on the PC. The following format is always used: yyyy/mm/dd hh:mm:ss (e.g. 2018/10/21 09:15:30). Formats such as 09:15 PM are no longer used.
- You can activate and configure the Smart Peak Detection option of the FS22 BraggMETER SI via the **Optical functions** tab. The **FS22 SI Smart Peak Detection** option in the **Prepare new DAQ project** dialog box must be enabled for this; see Advanced options. It is no longer necessary to install the BraggMONITOR software, and the button to run it has been omitted.

New functions

- catman Supports the QuantumX module MX471C with CAN-FD and CAN FD Raw. CAN FD enables higher data rates in the data part of the CAN message. It also enables up to 64 bytes of user data to be transferred rather than 8. However, with MX471C the bit length of an individual message within the 64 bytes may only be 8 bytes, though you can send multiple 8-byte messages in one transmission. CAN FD is standardized in the ISO standard 11898-1.
  See also Using CAN signals/bus reset.
- The QuantumX/SomatXR modules MX590B-R and MX1609TB-R are fully supported.
- Pt500 is supported as sensor for QuantumX/SomatXR MX840B.
- The gateway functionality of the QuantumX modules with C functionality, such as the MX471C, is supported. The modules can be used like the CX27 to transfer the data received from connected modules via FireWire to the PC using Ethernet.
- With MGCplus you can also select the **Bessel 25 Hz** filter for use with CANHEAD modules.
- The support for GPS data has been extended to include the following device families and functions:
  - peplink MAX Industrial Router (Ethernet-based GPS),
  - peplink Surf SOHO (Ethernet-based GPS),
  - Additional channels for yaw, pitch, roll, gyro rates, acceleration, position and velocity with VECTORNAV VN-200 and VN-300,
  - Additional channels for acceleration, yaw, pitch, roll, RTK (gyro rates, baseline, accuracy), heading/gradient and 2D and 3D velocities with EGPS 200 PLUS, i.e. with IMU (**I**nertial **M**easurement **U**nit) and RTK (**R**eal **T**ime **K**inematic) units.
    See also Add additional devices.
- Ethernet cameras, which already deliver a compressed data stream, can now also be connected.
  See Setting up video cameras.
- You can create a sensor scaling assigned from the Sensor database directly as a computation channel using the context menu of the channel on the **DAQ channels** tab. The sensor channel will then only measure the electrical (raw) signal, and the computation will provide you with the scaled measurement value. Internal scaling in the device (e.g. thermocouple or Pt100), cannot be created however.
  See also Sensor modification: gage factor, calibration.

- Sensor groups can be renamed in the Sensor database by way of the context menu.
- For event monitoring, the event type **After start of measurement** has been added; see Available types and conditions of limit values/events.
- To start or stop a DAQ job with a digital signal, you can specify a delay time (debounce) in order to suppress interfering switch chatter and prevent unwanted triggering.
  See Start of recording, Stop of data recording and measurement.
- In the DataViewer you can also search for values identical to zero and identical to the overflow value.
  See also DataViewer (DAQ mode), DataViewer (Analysis mode).
- You can also change the plot styles for all the plots in a graph simultaneously: Choose **All** for **Style** (post-process graph and real-time graph) or select the relevant channels on the **Plots** tab.
  See Configure display objects: Change plot parameters in a graph.
- The formula editor in Analysis mode enables you to use statistical data such as the minimum, maximum, standard deviation or average of a data set in a computation (**Additional functions**).
- With MX471, you can send bus commands for the transmission of information not only when the DAQ job starts but also cyclically. You can send up to 10 CAN messages cyclically to serve CAN transmitters (e.g. ECU, OBD2).
  See Send CAN bus messages.

2.4.4 What was new in catman 5.2?

Modified functions

- Blanks are no longer allowed in channel names, and are automatically converted to underscores ("_"). When you load a project of an earlier version from catman, however, the blanks are retained.
- If you enter an already existing name when creating channel names, you now see a dialog box with various options: either to suffix a number to the existing channel; to reset to the default channel name or a random channel name; or to rename the current channel.
- Now, you can also use channels with different sample rates in one computation in DAQ mode. The sample rate of the first channel is used in the formula as the sample rate of the result channel.

- For inputs in number fields you can also use an algebraic expression, e.g. **3/2** in place of **1.5** or **sqrt(2)** in place of **1.414**. As soon as you the reopen the dialog in question, however, only the result will be displayed, not your original input.
- In the event of **high level crossing**, **low level crossing** and **channel overflow**, you can now specify a time period for which the channel must be overflowing before the event is triggered.
  See also Available types and conditions of limit values/events.
- Strain gage temperature compensation via the polynomial on the package, which was previously only possible through the **Sensor adaptation** dialog, is now additionally possible via the real-time computations, where there are more options for it. In them, you can use 5th order polynomials (instead of just 3rd order), and you can allow for the temperature dependency of the k factor. A computation to determine the strain rate has also been added.
  See also Strain gage computations.
- You can convert the visualization object map for use with Baidu Maps, because Google Maps is not available in China for example.
  See also Objects for real-time indicators.
- In the *Post-process graph* and *Post-process Cursor graph* visualization objects you can also select the point index for the x axis in place of the time channel.
- In the *Real-time graph* and *Post-process graph* visualization objects you can also invert the x axis. (The option is not available for Cursor graphs).
- If you disable compression in the *Real-time graph* and *Post-process graph* visualization objects and then zoom, an overview across the entire measurement period of time is displayed below the graph and the zoomed section is marked.
- You can now also click on the plot legend in the Cursor graph to delete the plot, move it to a different axis layer, or open the plot parameters dialog.
- In the DataViewer you can search for specific measured values, such as values greater than or less than, or two identical consecutive values, etc. Edit mode (if enabled) is now always activated for the entire table, no longer just for one channel.
  See also DataViewer (DAQ mode), DataViewer (Analysis mode).
- In the long-term measurement modules you can now save the snapshots from time to time, and not just at the end of the DAQ job.
- catman now saves the PC's time zone in which the data were recorded (where available) as a test parameter in the test files.

- As from firmware 2.0 of the FS22 BraggMETER SI/DI, the devices can use NTP time synchronization, provided the NTP time server is installed on the PC on which catman is running.
  See also Configure and check time synchronization services.
- Aborting a long-term measurement due to a synchronization problem (Re-Sync message) can be prevented—see Synchronization.

New functions

- catman supports the National Instruments format TDMS for both write and read mode.
  See also File format and resolution, Export data (convert formats).
- catman now supports the ARAMIS camera system from GOM (Gesellschaft für optische Messtechnik) for 3D movement and deformation measurements.
  See Settings for optical measuring devices.
- Band pass and band rejection have been added to the filter functions in real-time computations.
- Password protection has been upgraded with additional features, such as filter settings or event control.
  See Sensor options.
- Frequently used formulas can be saved to and loaded from a *formula collection*. You can create multiple formula collections. The supplied formula collection OpticalFormulas contains formulas to convert the wavelength of optical strain gages into strain or temperature.
  See also Formula editor.
- The **Derivation over time** function has been added to the predefined formulas. All you have to do is specify the measurement channel (DAQ channel). The general function **deriv(y,x)** (dy/dx) is still available in the formula editor (**Additional functions**).
- Parameters for multiple computations of the same type can now be changed simultaneously.
  See also Define/change computation channels in DAQ project, Create/change computations in Analysis mode.
- When creating a DAQ project by Excel parameter setting, you can also specify a GPS module.
  See also Create DAQ project from Excel parametrization file.
- catman supports the UPS function of the CX22B with an event and a special action to save all data and terminate catman in an orderly manner.
  See also Available types and conditions of limit values/events.

- The QuantumX gateway module CX27C is supported. The module has a much higher transfer rate, but no digital I/Os.
- Using the context menu of the *Plot legend*, you can move a curve directly to a *new* y axis (scaling).
  See also Configuring graphs.
- The Test Explorer now provides new search methods in Analysis mode: You can now search not only for file names (or parts thereof) or channels, but also for test parameters and their contents, including sub-folders, and using wild-cards.
  See also Find files (search functions).

2.4.5 What was new in catman 5.1?

Modified functions

- The Windows® XP operating system is no longer supported.
- The designation *PC Card recording* for MGCplus has been replaced by *On-Board recording*, since a PC Card cannot be used with the CP52. In this case a storage medium chosen by the user is connected via USB instead.
- Operation with Spider8 is no longer supported.
- Operation with espressoDAQ is no longer supported.
- In the sensor adaptation dialog there is now the possibility to correct the cable resistance effects for the QuantumX/SomatXR modules MX1615 and MX1616 and strain gage full bridges in 4-wire configuration.
  See Calibrating sensors.

New functions

- The CP52 for the MGCplus is supported, and can, like QuantumX/SomatXR, be found and connected with the HBM Device Manager.
  See Using the HBM Device Manager.
- catman can search for GPS receivers and automatically apply them with the correct interface and baud rate.
  See Add additional devices or Additional devices (add devices manually).
- The RoaDyn® wheel force sensors with the KiRoad system from Kistler are supported in the same way as System 2000 to date.
  See hEasyRoadload with Kistler RoaDyn.
- You can protect sensors from being created and TEDS settings from being over-written with a password. You also have the option to lock the assignment of

sensors, changing of sensor settings and zero balancing by way of a password.
See Sensor options.

- In the Sensor adaptation dialog you can now also change the type of scaling (2-point or table).
- catman supports forwarding of data to Power BI (Azure Cloud from Microsoft). Therefore you can also use Power BI dashboards to display measurements or computations.
  See Using Power BI.
- Additional filter options have been added in Analysis mode, the filters for crash analysis: CFC 60, CFC 180, CFC 600 and CFC 1000.

2.4.6 What was new in catman 5.0?

Modified functions

- The **Test Explorer** tab in Analysis mode has been revised and laid out more clearly. In the test selection a search function is now integrated with which you can search for certain file or channel name components. It is also possible to search for certain files in subfolders.
  See also Test Explorer.
- The option **Automatically consider channels already used in graphs and computations when adding a new test** has been moved to the ribbon and is now called **Use channels automatically**.
  See also Load additional tests.
- The dialog for defining limit values and events has been revised. You create new definitions with **New** and change the definitions by clicking them on the left and entering the new settings on the right. It is no longer necessary to confirm.
  See also Limit values and events.
- The options on data transfer (number of values per transfer, time between transfers) can now be set differently for each DAQ job. They can each be set depending on the sample rate used. The general setting for the options has been removed. When loading older projects the (current) default settings are used.
  See also Data transfer and error handling.
- The printer port (Spider8, MGCplus with CP32) is no longer supported. Use the USB adapter from HBM. With Windows 7 or higher ensure that you use a USB

adapter from HBM with hardware (HW) 2.03 or higher and firmware (FW) 1.70 or higher (imprint on the adapter). Older versions of the adapter do not operate properly under Windows 7 or higher.

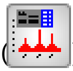
- The **Channel parameters** (DAQ jobs) tab has been renamed **Channels** as further settings can be made here too.
- The multi-bar graph is no longer limited to 12 channels and can now display any number of channels.

New functions

- The Vaisala Weather Transmitter WXT520 is supported and can, for example, supply information on relative humidity, rain or hail.
  See also Additional devices (add devices manually).
- The EasyMonitoring module makes (parallel operating) recorders available to you with which you can specify special recording conditions for individual channels. Start and finish of recording, which channels are to be recorded and the data rate can be defined separately for each recorder of a DAQ job.
  See also Configuring DAQ jobs.
- The EasyMonitoring module also facilitates remote data saving. You can define that after a measurement the data is automatically uploaded to an FTP server.
  See also Remote data saving (FTP/SFTP).
- The dialog to define limit values and events contains new functions, e.g. the time point “With start trigger” and the push notification.
  See also Limit values and events.
- CAN Raw channels: With the QuantumX/SomatXR module MX471 you can create up to four CAN Raw channels using the CAN bus options. You can directly display the messages on the relevant CAN bus via these channels and save them (in addition to the “normal” CAN channels). Alternatively, you can also define that only the CAN Raw channels are acquired on a connection. The QuantumX/SomatXR firmware 4.8 or higher is required for the function.
  See also CAN bus options, Panel object CAN Raw table.
- With the MX471, use of CCP/XCP over CAN is supported.
  See also CCP/XCP (ECU, only MX471).
- catman automatically displays scroll bars, if visualization objects are not visible on the screen area available.
- On the **Visualization** tab you can also shrink () or enlarge () all objects on one page.
- You can use the value of a controller or a text entry field in a computation.
  See also Formula editor.
- In Analysis mode you can define the folders as favorites for quick access. This means that you can also access folders in the network or deep nested folders with one click.
- In Analysis mode you can also load individual channels of a project.
  See also Loading tests or channels.
- The conversion of SIE files has been improved, for example video files are created, no longer single frames.
  See also Converting/merging files.

2.4.7 What was new in catman 4.2?

Modified functions

- The QuantumX/SomatXR Device Manager has been expanded (device scan for PMX for adding manual devices) and is now called the HBM Device Manager.
- The *Compatibility mode* for QuantumX modules with firmware less than 4.0 is omitted. It is however still possible to update older modules using catman.
- Real-time computations are no longer produced in a dedicated dialog, but rather the dialog is displayed in the channel list as a window. This means that the channels can be dragged directly into the dialog.
- With the devices for optical measurements there are various changes:
  - You can assign the sensors from the Sensor database just as for other devices. The new Sensor database (version 4.2) already includes many entries with standard values which only need to be corrected with the data from the relevant data sheet. The measurements are then shown in the same channel. You do not need to create any computation function and also a second channel is not occupied. Optionally, you can however still display the original values and use a computation function.
  - The spectrum on the **Optical functions** tab shows only one channel (connector) in each case.
  - The Optical spectrum visualization object () is omitted in this version, because with some devices the update takes several seconds.
- The video Panel is omitted in this version. The Panel is no longer needed, because the Video replay object has been added to the objects for synchronized display. You can now synchronize any objects in this group with a video.
- The angle function FOS (sector monitoring) has been revised. Instead, there is a new graphical object, the *Angle synchron. graph* (**Display of all recorded samples** section). In the default setting the graph is updated twice per second. The possibility of display (**FOS** tab) in other graphical objects is omitted. With the new graph you can view the progression at the different revolutions after the measurement via the **General** tab. In contrast to the normal post-process graphs here only one trace over the specified angular range or the specified number of revolutions is displayed; see also Angle synchron. graph.
- The Statistic journal function has been revised and has new options.

- The *Log file (System log)* of catman is now not an MS Access database, but rather a normal text file (without symbols). Above a size of 1 Mbyte a new file is created automatically.
- With the Time-at-level and Span pairs functions the y-axis in the histogram is now scaled in percent and the total number is no longer used; see Classing.
- The computation function Outlier (Analysis mode) has been renamed Data cleansing.

New functions

- catman 4.2 also runs under Windows® 10.
- The HBM Device Manager (formerly QuantumX/SomatXR Device Manager also supports PMX and you can manually add other devices, e.g. optical measuring devices or GPS receivers.
- NMEA devices (GPS): catman supports the wind speed and wind direction channels from the MWV sentence; see GPS channels.
- The Sensor database also includes fiber-optical sensors and also has the version 4.2.
- You can drag computation channels to other positions in the channel list with the mouse.
- The Smart Peak Detection of the FS22 BraggMETER is supported.
- For the optical measurement devices and provided you are not using the Smart Peak Detection of the FS22, dynamic peak locking is always carried out. This means that the defined bands (**Range per peak**) move with the peaks in order, for example, not to lose the sensor during larger temperature temperatures, because the wavelengths change too much. The original wavelengths of the peaks are saved with **Lock peaks** and are also included in the project file.
- Sound recording via video cameras is supported.
- In conjunction with GPS data the new Map visualization object facilitates the display of positions and measurements (color-coded) via position data.
- The Flexible table can also display the status of the limits.
- The new Video replay visualization object with the objects for synchronized display replaces the video Panel.
- The new visualization object Angle synchron. graph facilitates the simple display of data over the angular range.
- The assignment of x channels when using multiple y channels in the real-time and post-process graph has been simplified: Drag the x channel onto the legend of a y channel. A context menu then appears by which you can plot the

x channel against this y channel or swap the y channel. You can also assign a color channel to the post-process graphs.

- With the Visualization objects Digital indicator, Analog meter, Bar indicator, LED and Text you can set the background to Transparent.
- The computation Matrix (Analysis mode) has been introduced to be able to display one channel in dependence of two channels.
- catman allows simple report generation with Microsoft Word based on a Word template. In doing this you can now apply a Bookmark (**Office** tab) to many Visualization objects in order to place them at the correct location in the Word document.

2.4.8 What was new in catman 4.1?

Modified functions

- The Sensor database can again be opened by several clients PCs). This means that the Sensor database can, for example, be made available on a server to several PCs with catman.
- In the default setting the write cache has been increased to 64 kB (old setting 32 kB); see also Data storage.
- In the Flexible table (new, it was formerly just *Table*) you can also directly enter formulas in a cell; see Configure flexible table.
- With Interrogators/BraggMETERs, the optical spectrum is no longer automatically updated, and you have to update manually, or activate the **Automatic update** option. Since updating may take a very long time, it can arise that the program does not react in this time period.
- With Interrogators/BraggMETERs the peaks of the optical spectrum are no longer marked automatically; use the appropriate option if you require marking.

New functions

- There is a new table in DAQ mode—the *Flexible table*. The table is similar to the one already present in Analysis mode; you can individually configure each field and display measurements or pictures or compute formulas. See Objects for real-time indicators, Flexible table and Configure flexible table.
- The table in Analysis mode has been renamed Flexible table for better differentiation, because, as with the flexible table in DAQ mode, you can configure each field individually; see Configuring flexible table.

- In Analysis mode there is a new group of objects for the synchronized display of measurements from various channels (synchronization with cursor); see Objects for synchronized display.
- After the measurement a file is produced with the events that have arisen during the measurement (*.event); see What happens after a measurement?
- With filters there is the human vibration filter with various weighting functions to EN ISO 8041 and ISO 2631, e.g. Wd weighting for horizontal whole-body vibrations in the x or y direction.
  See also Filter (real-time computations) and Filter (Analysis mode).
- The new Interrogators from Fiber Sensing, the FS22 BraggMETER SI/DI, are now also supported by catman. The user control in catman is practically identical to the previously used interrogators. The devices are automatically detected if you specify **Optical interrogators** in the **Prepare new DAQ project** dialog; see Configure device scan.
- When using an Interrogator/BraggMETER you can now use low-pass filters which are directly computed in the catman channel. The "detour" via averaging for Interrogators is no longer need.
- In the ASAM MDF 4 format special functions such as Preview and ZIP compression are now also supported.

2.4.9 What was new in catman 4.0?

Modified functions

- The start screen has been completely redesigned to offer you easier and quicker familiarization.
- You can start again with the last configuration used without having to save a project.
- On terminating catman both in the DAQ and Analysis modes the start screen appears again and you can change, for example, to the operating mode. catman is not completely terminated as previously.
- The 3D chart graphical object has been replaced in DAQ mode by the spectrogram object.
- The update rate for real-time indicators (Digital indicator, Analog meter, Bar indicator or LED) has been limited. The objects are now updated every 150 ms at the earliest, a faster update is not possible.
- No equal signs ("=") may now occur in the *Name* of a test parameter. They are, however, still allowed in the *Value*.

- The possibility of using the IRIG-B time option with the MGCplus has been removed. The option continues to be available with QuantumX/SomatXR.
- The IEEE 488.2 interface is no longer supported.
- Various functions have been revised to achieve a higher speed when acquiring and processing data.
- If QuantumX/SomatXR modules are connected to the PC using FireWire and also via Ethernet, the FireWire connection has priority (previously Ethernet).
- The loading of DAQ projects with QuantumX/SomatXR modules, which receive their addresses via DHCP and whose addresses have been changed in the meantime relative to those saved in the project, no longer leads to an error, because the UUIDs (serial numbers) are evaluated and the IP addresses are converted if required.
- The row with the device only shows the device name in the default setting. You can, however, display the **Complete device description** again using the channel list options. The **Channel info** component window always displays the complete information.
  See Channel info component window.
- The (default) arrangement of the columns in the **DAQ channels** tab has been changed. The columns however can be moved as before and arranged as desired.
- The **Sample** column is displayed in bold lettering by default. You can change the setting via the column context menu.
- The symbols and arrangement of the sample rate groups have been changed: The slow sample rate (▸) now comes first, then the default sample rate (▸▸), and finally, as before, the fast sample rate (▸▸▸).
- With an invalid channel configuration it is no longer deactivated automatically on starting the measurement.
- The **Sensor database** component window on the **DAQ channels** tab has been revised. You can now call the groups “My sensors/General sensors/HBM sensors/Sensors supported by the channel/CAN signals” with a click on the corresponding icon.
- In the Sensor database you can now create up to three levels of subgroups in the “My sensors” group.
- The default values for the sample rates with QuantumX/SomatXR have been changed to 10/300/4800 Hz. With the decimal sample-rate domain of QuantumX/SomatXR 10/200/5000 Hz are used.
- Some icons, e.g. with the sample rates, have been omitted to improve readability.

- The synchronization with the System 2000 from Kistler (RoaDyn®) is now ensured using hardware connections. The synchronization using NTP has been omitted.
- Event monitoring: Digital outputs are now reset when the **High level crossing**/**Low level crossing** monitoring method is no longer applicable. Here, the hysteresis is considered. However, with all other types of monitoring the outputs remain unchanged (as before).
- On starting a DAQ job without visualization there are now more options for automatic visualization.
- When the graphical objects Digital indicator, Analog meter, Bar indicator or LED are copied and pasted, they also remain assigned to the channels to be indicated.

New functions

- In the scan options you can now specify that no filter settings and/or no Channel settings are to be changed by catman. This is useful when the device(s) are operated, for example, on a test-rig and catman is to display measurement data only for checking.
- The start of the QuantumX/SomatXR scan server can be suppressed with the start parameter /noscan, when you are not using a QuantumX/SomatXR module.
- Multiple sensors from the **Sensor database** component window can now be assigned to consecutive channels.
- With the real-time computations several new functions are available:
  - The signal generator facilitates the output of various signals such as sine, rectangular or triangular signals.
  - The playback file enables you to read in measured data again and to display them simultaneously with current measurements.
    See Signal generator/playback file.
  - You can compute a signal with an A-weighted sound pressure level in dB (dBA), (available in the DAQ and Analysis modes).
  - The linearization (**Fixed formulas** group) can, as in table scaling, correct non-linear transducer characteristics in the Sensor database using a computation, without however changing the original sensor transducer characteristic.
  - For the filters in DAQ mode you can now state the Cutoff frequency in

  - Hz. The input in percent of the sample rate is also still possible.
  - Bessel and Butterworth filters are also available as high-pass filters.
- You can activate the increased sample rate for the MX410 (192 kHz) using catman; the MX Assistant is no longer needed for this.
  See Configuring channels (measuring chain) (DAQ channels tab).
- The synchronization quality can now be checked also for *PTP*.
- The channel filtering (**Display filter**) includes the most used display filters as buttons. Consequently these filters can be activated more quickly.
- With GPS data, the **Channel info** component window can display and log the original messages (NMEA sentences).
- With the graphs there is the option of automatically displaying the axes in the same color as the associated plots.
- The spectrogram graphical object presents the chronological color-coded trace of the frequency spectrum.
- The section graph tool (only available in Analysis mode) can also compute an FFT for the selected section.
- The frequency spectrum graphical object in DAQ mode (Live FFT) can perform averaging via a time window.
- Further information has been included in the window for the job status during the measurement. You can, for example, observe the processor loading on the CPU core for the job being used and react before it becomes too high.
  See Job status window.
- In Analysis mode you can export the data from a channel as a sound file in WAVE format.
- The decimal sample rates of SomatXR and the QuantumX modules with B functionality are supported. The switch is made via the **DAQ channels** tab and the dialog for sample rate setting.
- With the UDP output you can choose between the formats FLOAT32 (4 bytes) and DOUBLE64 (8 bytes).
- In EasyScript new commands have also been implemented; see Help on EasyScript (in the script editor).

2.4.10 What was new in catman 3.5?

Modified functions

- The communication with the QuantumX modules has been completely changed as from catman 3.5, because the current firmware versions (as of 4.0) offer a whole range of new possibilities: Improved transmission of the measurements; faster scanning; and, in conjunction with current modules with B or C functionality, also new time channel variants (PTP), new sample rates (decimal stepping) and more. From catman 3.5 the SomatXR modules are also supported, which likewise use firmware 4.0 or higher. For older modules you therefore have to make special settings.

⚠ We recommend that you use the current firmware version for the QuantumX modules. Carry out the update directly via catman; see also Checking/updating firmware.

- The start window was revised in Release 2 to show more clearly the various start options in the DAQ and Analysis modes.
- The treatment of sensors with TEDS has been simplified: Create the data as usual in the Sensor database and then transfer the settings to the TEDS module. You can however also transfer the data of a TEDS module into the Sensor database and edit them there. For the cases in which you want to modify specific TEDS data, you still have the (old) TEDS Editor available.
  See Using transducers with TEDS.
- The export of data in the DIAdem format has been revised, so that measurement settings and test parameters can be accepted.
- With problems with the measurement you have more possibilities of how and whether the measurement is to be continued; see Data transfer and error behavior.
- On opening a project a display filter set in the project is again considered, i.e. only the channels originally visible in the project are displayed.
- QuantumX/SomatXRmodules which are connected to a CX27 module are now always found and used. It is no longer necessary to activate a CX27 scan.
- Live display is immediately active after opening a project or starting a new one.
- After connecting to a device, the currently used channel wiring configuration, e.g. strain-gage full bridge, is shown in the channel list. In the traceability data (**Channel info** window) you can also view the measuring range, excitation voltage, etc. The display **No sensor assigned** no longer appears.
- The arrangement of the columns in the **DAQ channels** tab has been changed.

New functions

- If individual devices or modules are not present on loading a project, you can now also automatically (temporarily) remove them from the project; see Program start options.

- On loading a project you can check for changed entries of the sensors used in the Sensor database. If the sensor data have been changed (date of change is in the Sensor database), you receive a message and can automatically update the relevant sensors; see **Sensor options**: After loading a DAQ project.
- On importing a DAQ project from an Excel parametrization file new options have been added; see Create DAQ project from Excel parametrization file.
- The PX460 module of the PMX and TIM-EC are supported.
- Zero balancing in the **DAQ channels** tab can now also take place across all hardware channels of a device without you first having to mark the channels.
- The digital inputs and outputs of the MX879 can now also be used as trigger channels for starting/stopping the measurement and for monitoring the limits and events.
- The *Precision Time Protocol* (PTP) time source of the newer QuantumX modules with B functionality and the SomatXR modules is supported; see Configure time synchronization services.
- You can now parametrize and activate the test signal of the QuantumX/SomatXR module via catman.
- With real-time computations, **Filter** window, you can apply a phase correction to compensate differences in the propagation time of signals due to different filter cutoff frequencies; see Filter.
- The real-time computations facilitate the computation of the electrical power (real, apparent and reactive power as well as power factor) over a selectable time window. The RMS values for current and voltage are also computed; see Electrical power.
- The real-time computations include a signal generator so that you can produce and display test signals. Alternatively, you can also specify a file which is "played back"; see Signal generator.
- The event monitoring has been expanded and enables you, for example, to monitor frequency ranges of a live FFT for their amplitudes, to react to errors during the measurement or to initiate a start or stop trigger; see Limits and events.
- During the measurement a line with the messages about the DAQ job is displayed, enabling you to go back in the list of messages to show older messages again with date and time, which, for example, were only briefly visible in the status bar. The display can be turned off.
- If QuantumX/SomatXR modules are operated in the multi-client mode (several PCs or users access the data of a module), problems may arise if "logging out" does not occur properly, because the number of clients is limited. In the expanded job parameters you now have the possibility of compulsorily terminating

the measurement processes of other clients so that catman can take control; see Synchronization.

- For long-term DAQ, for which the connection to a device would be able to be interrupted, you now have the option of dividing up the DAQ job into single intervals and attempting connection again before each interval, if the connection has been interrupted since the last interval; see Starting the acquisition.
- For the display of live FFTs and JTF graphs the 3D diagram/chart (for DAQ and Analysis modes) has been added; see 3D chart (Analysis mode).
- New formats have been added for data export: UFF58 and Vector MDF 4.1 (ASAM standard); see Data export (convert format) for explanations about the formats.
- When switching from DAQ mode to Analysis mode, you can automatically transfer the graphs produced in DAQ mode as post-process graphs; see Options when changing from DAQ mode to Analysis mode.
- In Analysis mode, the **Section** function is available, which not only enables you to zoom, scale, cut or delete sections, but also to define the minimum and maximum of a section; see Section functions.
- The filter functions in Analysis mode (EasyMath) have been extended: Mean value/RMS over time window, Chebyshev/elliptical filters. With Bessel and Butterworth filters you can now select the order.
- In Analysis mode the video panel can also compute and display an FFT using the current signal.

2.4.11 What was new in catman 3.4?

Modified functions

- Some display objects have been swapped for newer objects with additional options. When you load a project, the objects are configured accordingly, but you should then save the project again so that you do not have to swap every time you load it.
- Windows Media® Player is no longer needed; video playback has been changed to a dedicated object.
- The universal data table (Analysis mode) is now called 'Table', because a new table for data (numbers) only has been introduced which now uses the name 'Data table'.
- The EasyLog module (PC card recording on MGCplus) has been integrated into the EasyRoadload module. It is no longer available as a standalone module.

On-board recording is always available for eDAQ/eDAQ-lite, if such a device is present.

New functions

- catmanEasy/AP supports up to 4 video cameras with the optional *EasyVideocam* module. Camera recording can be activated either together with the DAQ job or via the limit and event monitoring function.
- The new HBM devices PMX and DMP41 are supported.
- QuantumXQuantumX modules can be added or removed in the current DAQ project if the project contains only QuantumX modules.
- The Autocalibration options of some QuantumX modules are now selectable in catman.
- The Channel check supports the new QuantumX module MX1615.
- The optical spectrum of an interrogator can also be displayed in the DAQ job on a Panel.
- The optical spectrum of an interrogator can be exported cyclically.
- Placeholders can be used for e-mail texts and log entries in limit and event monitoring.
- In limit and event monitoring you can also use any text file as a log file.
- A new Panel is available that can be freely placed on-screen, including on a second or third monitor: Floating panel.
- The graphs now have up to 12 scale levels.
- Two new table types have been added for displaying test parameters or trace-ability data in Analysis mode: Traceability table and Metadata table.
- Computations can also be performed in Analysis mode using an EasyScript: Script.
- In Analysis mode, updating (recalculation) is now also possible for a single computation.
- More start parameters have been added; see catman start parameters.

2.4.12 What was new in catman 3.3?

Modified functions

- In the Sensor database the possibility of being able to define a "double scale" when using the MGCplus is now no longer present (scaling with additional correction function).

- The settings possible with the QuantumX for the use of TEDS now have effects on catmanEasy/AP; see Using transducers with TEDS: Special features with QuantumX.
- The Sensor database has been completely revised and in the new design it uses the same sensor symbols as the QuantumX Assistant.
- The **Accept channel name from TEDS** option is no longer handled so strictly: It can now also be renamed despite having been activated.
- When using sensors with linearization via a table or polynomial function, the scaling for QuantumX is now always carried out in the hardware (the QuantumX).
- The **Manual devices** tab (**Device scan** dialog) has been renamed **Additional devices**.
- The synchronization of multiple devices over FireWire (QuantumX only) or NTP has been improved, and most settings are now made automatically.
- The configuration dialogs for the graphs have been improved and are more clearly laid out.

New functions

- Various options improve security against data loss: **Save project automatically every x minutes**, **Save project on starting measurement** and **Create backup copy before saving**; see Options for safety.
- Each channel can be assigned a color which is then used in all graphs (**Default color for plots**). The color assignment is also restored on loading saved measurement data.
- On the **DAQ channels** tab, digital indicators (windows that can be zoomed infinitely variably) can be displayed for individual channels (**Large display**). This means that channels can be viewed better during live display.
- On the **DAQ channels** tab not only the (computed) physical values but also the measured “raw values” can be displayed (**Electrical value**).
- Sensors can be provided with attributes such as “Calibration required” or “may only be assigned to a channel”.
- The limit and event monitoring now also allows for sending emails.
- There are several new visualization objects for interactive operation: (Realtime) Cursor graph, (post-process) Cursor graph, histogram, 3D chart, Statistics table; see Available display objects for Panels/Print pages.
- A range of new objects are also available for AutoSequences and EasyScript; see Objects for predefined actions, clone actions, AutoSequences and EasyScript.

- Many visualization objects have been given further possible settings.
- The file name is now available as **system text** in the visualization object text both with and without the path.
- The optional Road Load Data module allows the connection of a RoaDyn system from Kistler for example. All channels configured on the RoaDyn system are used by catmanEasy/AP and displayed in the channel list (**DAQ channels** tab, **Configure DAQ channels** window). The configuration must be carried on the RoaDyn system itself or via the associated software.
- For user interface customization, the actions presented in catmanEasy/AP on the ribbon are now available as *clone actions*.

2.4.13 What was new in catman 3.2?

Modified functions

- The real-time computations (computations during acquisition) are no longer defined via the **Computation channels** tab of the **Channel tools** context tab, but rather via a dialog which you call with **Create** (**Computation channels** group in the **DAQ channels** tab).
- DAQ jobs which start via trigger and a pre-trigger time: The trigger condition is only monitored when the pre-trigger buffer is filled. If the trigger condition has already been fulfilled once, then while the buffer is still filled, *no* trigger occurs, also not retrospectively once the buffer is full.
- In the channel list of the **DAQ channels** tab the **Sensor** column has been renamed as **Sensor/Function**.
- Also measurement devices can be renamed, not just the channels.
- Windows with the channel list only contain as many rows as there are channels present. The scroll bars therefore only move the list in the region which actually contains channels.
- The Panels now have scroll bars on the sides. This means that even with smaller screens all objects on the page can be brought into the visible region. In addition the possible Panel area has been increased.
- The **Cursor and Annotations** window is now initially displayed at the bottom (below the Panel) and no longer below the configuration and the channel list windows. You can change the position though, as before.

New functions

- The program start can now occur with further options; see Program start options.
- The settings of position and status (permanent, temporary) for the component window are now saved and restored by catmanEasy/AP during a restart.
- In the **DAQ channels** tab a new column can be displayed in the channel list: **Gage factor**. You can also enter the gage factor via this column, however only row by row. When entering for several channels, use the **Strain gage settings** context menu in the **Sensor/Function** column.
- The window with the Sensor database displayed in the **DAQ channels** tab includes a search field which starts the search even as you are typing the search term.
- In the dialog for sensor adaptation the name of the channel is also shown and the physical unit can be changed.
- The analysis functions such as Zoom, Cursor and Annotations have been revised and also included in the ribbon (**Graphics tools** group).
- When zooming in real-time graphs, the values initially left out during compression and therefore not displayed are now loaded from the temporary file and displayed.
- Changing between the configuration dialogs for a graph and for the plots of the graph has been simplified: In each dialog you can switch to the other dialog via a button (**Plots** or **Graph**).
- The possibilities of table design have been expanded: You can now join cells, there are more cell types and with a Picture cell type you can link to a graph in catmanEasy/AP (e.g. on another Panel).
- In Analysis mode, you can clone data sources from one section of the table to another, and you can print or save the table separately from the other Panel objects (**Print/Load/Save** in the context menu).
- The button has new options such as shortcut, picture position and tab index.
- All user settings and options can be reset to the factory settings; see Reset (program behavior).
- The synchronization of different devices via NTP has been revised and simplified. All settings can now be made in a dedicated dialog; see Synchronizing several devices.
- The Matlab (5.0) and RPC III (MTS) storage and respectively export formats have been added.
- Since older firmware versions are no longer supported for QuantumX, the firmware update can also be installed during the installation. The required firmware

with which the catmanEasy/AP (as shipped) interacts is always installed on the PC.

2.4.14 What was new in catman 3.1?

Modified functions

- The installation of FireWire and CANHEAD® drivers is now optional.
- The installation of the FireWire drivers has been simplified; see Notes on the FireWire interface (IEEE 1394).
- The PC Card Explorer from EasyPlan for the transfer of files in MGCplus or eDAQ has been integrated into the Test Explorer of Analysis mode. This means that the catmanEasy/AP start window contains fewer options and is more clearly laid out.
- The video Panel has been converted to the Windows Media Player® (no longer any dedicated control).

New functions

- For the display of the channels in the channel list and in the **DAQ channels** tab various display filters can be set, for example to display only the active channels.
- In the **DAQ channels** tab channels can be more easily deactivated.
- In the **DAQ channels** tab the sample rate and filter of the first DAQ job can be displayed and modified for all DAQ jobs.
- The file and path names for the data storage can be given placeholders, so that not only the job names, but also, for example, the date and time or test parameters can be used in the file name.
- eDAQ and eDAQ-lite (SoMat) are supported. It is also possible to set up an onboard measurement.
- The calibration of sensors is now also possible when using a tabular linearization.
- In the case of QuantumX and sensors with a tabular linearization you can also carry out the linearization in the QuantumX: **Sensor adaptation and wiring diagram** context menu, **Perform in hardware**. Until now the linearization has been exclusively carried out in catmanEasy/AP, and this continues to be the default setting.
- If **no filter** is set as the filter with Spider8, the averaging (mean value formation) in Spider8 is used.

- The function "after a certain time" can be used as a limit condition. This condition is not bound to a DAQ channel.
- The function **Calculate RMS value** has been added to the Mathematical functions.
- For saving data the **Fast Stream** option has been added, which at faster sample rates facilitates faster saving of the data than the previously available options. However, in this case no temporary data file is created and the data are written directly to a file.
- In addition to the (complete) measurement data, a file can be produced containing the minima, maxima and means determined over a selectable time interval: statistics journal; see Specify job parameters.
- Using **Comment** (**DAQ** group in the **Visualization** tab), you can even enter comments during the measurement, which are then saved with date and time as test parameters.
- In Analysis mode, data files created consecutively (same DAQ job) can be combined into one file.
- There are further possibilities of adapting the user interface; see Custom UI options.

2.4.15 What was new in catman 3.0?

The user interface of catmanEasy version 3.0 has been completely redesigned to further simplify using the program. An explanation of the functioning principle and possibilities offered by this interface can be found in The new user interface.

Modified functions

- Toggling between DAQ and Analysis modes is done either via the **File** menu or using the button at the top right above the ribbon: **Analyze measurement data** or **Back to DAQ mode**.
- If you run Analysis mode directly from the Start window, when Analysis mode finishes catmanEasy also terminates.
- Previously, with some setup dialogs a button in the relevant dialog had to be clicked to create a setup or to accept changes (e.g. Sensor database, computation channels). This is now done via relevant buttons on the ribbon.
- There are now three sample rates available instead of two.
- There are now only three limits per channel available instead of four. However, you can define further limits for the same measurements via a computation channel (1*original channel).

- In the device scan options a differentiation is made not only with regard to interfaces, but also devices, which are to be sought.
- The cyclical saving mode has been renamed to periodical saving mode.This clarifies that this type of saving is used periodically during a measurement in contrast to the new cycle dependent or time dependent storage intervals where (in various sequences) either all measurements or just peak values are stored.
- The Post-process graph is no longer automatically refreshed during the measurement (default **Manually**).

New functions

- The Channel check checks various functions of the measuring amplifier and measuring chain.
- The visualization includes the new Frequency Spectrum graph, which automatically performs the computation in real time.
- Selection in the channel lists is now also possible with [⇧] and/or [Ctrl] (as in Windows).
- The DAQ jobs have new storage possibilities for the data, for example, for the last x seconds. Additionally two new storage modes are available for long-term measurements: cycle-dependent or time-dependent storage intervals.
- The new QuantumX modules and eDAQ (SoMat) are supported.
- The CANHEAD® modules can now also be directly connected if you have the PEAK CAN bus interface: CANHEADdirect.
- Many new options have been added: more keyboard shortcuts and visual styles, and you can also customize the new interface yourself.
- The digital outputs of the CP42 are supported for the limits.
- Limits can also execute an EasyScript function, start/stop the data storage and saving or perform a backup, monitor a digital input, and carry out time-controlled actions.
- The procedure for configuring interactive objects has been simplified, and so is now more consistent: For all objects and actions (predefined actions, AutoSequences or EasyScript) toggling between **Design mode** and **Execution mode** is now done via a menu on the right above the ribbon.
- With the predefined actions further execution time-points have been added.

2.4.16 What was new in catman 2.2?

Modified functions

- The channel information display has been reworked.
- The configuration of optical measuring devices has been improved.

New functions

- The QuantumX modules are now supported in this version.
- New computations have been included in the EasyMath module: Eliminate outliers and Interpolation.
- A new storage mode has been added: Peak values per time interval. This is useful, for example, if during material tests you wish to record only the maximum stress through dynamic load change over several days. Despite high sample rates which result in an excellent resolution on the time axis only few data will be stored.
- The measuring devices to be used can now also be defined manually if you do not wish to use the device scan or it is not possible to run it: Additional devices (add devices manually).

2.4.17 What was new in catman 2.1?

Modified functions

- Scope Window and Video Window are no longer objects on a page but have their own panels, i.e. they always fill the page. They have therefore been renamed Scope Panel and Video Panel. Both windows have their own numbering systems, and are not included when other panels or the print pages are numbered.
- Loading of tests in Analysis mode has been completely reworked; this function is now much more simple and comfortable to use. The first test loaded can be used as a template: its computations and the channels displayed in the graphs are then automatically duplicated for every other test loaded, if channels exist with the same names. When removing the data, the plots are also deleted in the graphs and the computations that were generated automatically.
  See also Loading test data.
- CANHEAD® modules connected to the MGCplus can be configured completely in catmanEasy. The dialog corresponds to that of the MGCplus Assistant. If no

sub-channel block is active or no assigned CANHEAD® module is found, the first sub-channel block will be automatically activated.
See also Using CANHEAD modules.

New functions

- The new EasyPlan module option allows you to prepare a DAQ project before connecting devices. You can define sensors and channel names as well as create computations, DAQ jobs and visualizations via **Prepare DAQ project** in the start dialog.
  See also Prepare DAQ project.
- The new EasyOptics module option allows measuring with the HBM devices for optical stress analysis and transducers with Fiber Bragg gratings (optical fibers).
- CANHEAD® modules are better supported: Directly from catmanEasy, you can enable sub-channel blocks, activate (assign) modules or remove assignments. The MGCplus Assistant is no longer required.
- Restoring measurement data: If catmanEasy terminates unexpectedly due to an error, such as a power failure, when you restart catmanEasy you will be prompted to save the data to a file.
  See also Data saving.
- Channel groups: For plug-in units or devices with several sub-channels, e.g. for CAN bus, hide all sub-channels to allow a better overview. You will find the display with [−] or [+] in front of the first channel in the channel lists.
  In the channel list, you also have the option of assigning one transducer type to all sub-channels. If the sub-channels of an ML801 are hidden, simply drag the transducer type onto the first channel.
- New computations can be carried out from the Math libraries tab, and (only when HBM optical strain gages are connected) the Optical sensors tab.
- The **Channel activation** (DAQ jobs) tab has been renamed **Channel parameters**, as additional settings can be made there.
- You can specify different filters for each channel and job. Activate the setting **Allow manual filter settings** in the options on the **DAQ channels** tab. You can then set the required filter for the DAQ job with **Channel parameters** under DAQ jobs.
- You can define whether the data should be saved (temporarily) for each channel and job. Activate or deactivate the desired behavior on the **Channel parameters** tab of the DAQ job.

- The zero balance also works on computation channels, not only on channels to which a transducer has been connected.
- The Scope Panel now has a trigger mode that allows fast periodic signals to be displayed as a stationary picture.
- When saving measured values you can reduce the resolution to save storage space. 4 Bytes are often sufficient for measured data, sometimes only 2 Bytes are sufficient for strain gage measurements.
- In Analysis mode you can also select several channels: [⇧] or [Ctrl] and mark the channels.
- When saving an Analysis project, you can include the measured data in the project file. This makes it easier to transfer an Analysis project as only one file is necessary.

2.4.18 What was new in catman 2.0?

Change of names

- The terms Online/Offline have been replaced by DAQ mode and Analysis mode. Consequently, various menu entries and descriptions change, e.g. Offline project to Analysis project, etc.
- The module Offline maths has been renamed EasyMath, the module PC Card recording has been renamed to EasyLog.

New functions

- Channel names and sensor assignments can also be imported from an Excel file.
- The new module AutoSequences (included in the module EasyMath) gives you the possibility of automating measurement sequences without programming, e.g. of writing cyclically determined measurements in an Excel table.
- New options for DAQ jobs: Number of measurements as job end, cyclic saving during the measurement, (pre-)settings for all DAQ jobs present after the program start can be saved.
- Monitoring of the free hard disk space during the measurement. With fixed measurement time periods you receive the warning already before the start of the measurement that the space available is not sufficient for the intended measuring time.
- More options to prevent a time delay between acquisition and display of the data for slower PCs (Preventing RT lag): a dedicated dialog with options for

deactivating or reducing the frequency of graphical updates. Also for the single graphics objects you can set the update frequency finer.

- Activate a continuous display of the measurements on the DAQ channel tab with **Live readings**, e.g. to check whether all channels are working properly.
- Both in DAQ mode and in Analysis mode, Print pages (and Panels) are available to you. Both can be printed out, but Print pages are optimized for the printout; they show the size of the Print page and possess margin settings as well as header and footer lines. Panels are only printed out as screen copies.
  See also Panels and Print pages, visualizations.
- Panels and Print pages can now also have a background image. The image can be displayed centered, tiled or adapted to the page.
- The new page-sized graph object Scope panel for DAQ mode for quickly configuring and displaying the active channels in a graph. The Scope panel has its own toolbar so that you can carry out the configuration immediately without calling further dialogs.
- A new feature is the page-sized graphics object Video Panel for Analysis mode to link video data to a graph and/or a table. At the same time as displaying your video, a cursor is displayed at the current position of the video in the graph and the table indicates the measured value at this point in time. You can move both the cursor and fast forward or rewind the video to check other points.
- The copying and insertion of text and graphics on Panels and Print pages is simplified by an entry in the context menu. You can also insert a text or graph directly on a page and the corresponding object is generated automatically.
- For transducers with a *TEDS* module, you can call the TEDS Editor from the **Channel settings** window (**Edit sensor** context menu).
- MGCplus users can influence the autocalibration function in the channel list for each channel separately in the **Channel info** window.
- More computation functions have been added in the EasyMath module.
- The Help on EasyScript (in the script editor) is also available as HTMLHelp (previously only as WebHelp).

3 START A DAQ PROJECT (DAQ MODE)

See also Analysis mode: Display/analyze data.

In the catman start window in the **Measure** menu (DAQ mode) you have a choice of four options:

1. **Continue**
   Continue at the point at which you stopped the last time in catman. On termination a still unsaved project is saved under a temporary name and is recalled with this menu item. If you have saved the last project before termination, this DAQ project is loaded (provided it is present).

   ☞ If you have terminated catman irregularly (process terminated using the task manager, crash), in this case the last state is not loaded, but rather the last saved DAQ project is loaded (if present) or the state in which catman was last regularly terminated.

2. **New**
   The interfaces defined with Prepare new DAQ project (device search) are searched for the devices specified and those found are displayed together with the existing channels in the Channel list.
   If you have used the Device Manager once, you can activate **Connect to devices last in use** to connect directly to those devices without having to call up the Device Manager again. In addition to the specified devices, you can also add other devices in the Device Manager that cannot be found by an automatic search, such as a GNSS device (GPS) or an MGCplus with CP42.
   See also Using older QuantumX modules.

   ☞ If after connecting to a device you would like to start an *additional* project with another device type, we recommend first completely terminating catman and restarting.

3. **Load**
   When a DAQ project is opened, the interfaces entered will be activated. If the project settings do not match the interface configuration found, you have the option of correcting the project settings.
   You can load a project created offline or an Excel file with the configuration; see Create DAQ project from Excel parameter file.

4. **Offline**
   Define all settings—the channel assignment, the connected transducers, your computations, visualizations and DAQ jobs before connecting a device. Then

open this project as soon as the devices are connected and you wish to carry out the DAQ project.
Alternatively, you can also load and modify an existing DAQ project.

A project saved in DAQ mode (DAQ project) contains:

- the interface settings of the active devices used,
- the device types used and the type of synchronization,
- the computations and the channels of the **Configure DAQ channels** window defined via the **DAQ channels** tab with all settings for sensors, zero values, scalings, limit values, etc.,
- all settings of the DAQ jobs,
- all visualizations (Panels, print pages, etc.).

3.1 Prepare a new DAQ project: Device scan

See also Add devices manually (options) or Add additional devices (HBM Device Manager) for special devices, Synchronizing several devices.

Access the settings for the device search in the **Measure** menu in the catman start window via **Select device type, interface and additional hardware options** or via the **Options** menu in the catman start window and **Prepare new DAQ project**.

On starting a new DAQ project, the interfaces activated in the device search are searched for those devices activated under **Search device types**. The devices must be switched on and ready for operation, otherwise they will not be found. Therefore, after switching on the devices wait long enough before you start a new project or load an existing one.

Simultaneous connection of different HBM devices is supported by catman, but with restrictions: with PMX and DMP41, only additional devices of the *same* type can be used. QuantumX/SomatXR or MGCplus can also be used together with FS22 BraggMETERs or a GOM Testing Controller (ARAMIS). Only the possible combinations can actually be selected. Irrespective of this you can manually include, for example, a GNSS receiver in the DAQ project via **Options** and the Additional devices tab or the HBM Device Manager and Add additional devices.
See also Connecting with Kistler KiRoad/RoaDyn systems, Settings for optical measuring devices.

FireWire interface

You can only use this interface if your PC has the interface available and you have set up the interface appropriately (HBM driver), see Notes on the FireWire interface (IEEE 1394).

Special features of PMX

If you are using multiple PMXs, you can change the time channels to ticks. This results in better synchronization of the devices in some configurations. Instead of timestamps, the hardware time channels in catman then contain ticks. To do this, create the PMX_USE_TIMETICK (DWORD) entry in the registry in the HKEY_Local_Machine\Software\Wow6432Node\HBM\Catman\Settings section, and give it the value 1.

⚠ Changes to the Registry using the regedit.exe program should only be made by experienced users, and after backing up the existing Registry, because under some circumstances serious Windows errors might result. If necessary, ask your administrator to make the change.

3.1.1 Settings for QuantumX/SomatXR, PMX and MGCplus with CP52

☞ Different QuantumX/SomatXR modules are identified by the module type number; further identification by letters is only added if the modules have different properties. Thus, there is no distinction between MX1615, MX1615B or MX1615B-R, for example. All module types are handled under the designation MX1615.

⚠ You must first update MX modules with a firmware version lower than 4.0 before you can use them with catman.

You have two ways of connecting to QuantumX/SomatXR, PMX, and MGCplus with CP52:

1. Use the HBM Device Manager (recommended method).
   The device manager checks the available interfaces, and displays a list of the devices found.
   See Using the Device Manager.
2. Explicitly use an interface, specifying the IP address or a search range (the latter is not possible with QuantumX/SomatXR).
   See Scan range for TCP/IP device scan.

3.1.2 Using the HBM Device Manager

See also No device found?

QuantumX/SomatXR-modules with firmware 4.0 or higher, PMX and MGCplus with CP52 broadcast their IP address cyclically in the network. These messages are collected and evaluated. So the IP address set on the device is initially not important, as all devices are found which are in the (Ethernet) network (or, with MX modules, can be reached via FireWire).

If you have old MX modules, you must first update the firmware; see Updating MX firmware.

Choose Add additional devices to add more devices, such as optical measuring devices, MGCplus with CP42, or GNSS receivers.

Procedure

- Click on **New module scan** if the device or module is not shown on the **Modules found** tab.
  All devices or modules are listed on the **Modules found** tab, even modules or devices to which no connection is possible.
- For an identification with change the IP address.

  is shown before the module address if the device or module is set and measurements can be supplied. As a rule, the PC and the device must be in the same *network segment* for the purpose.
  See also Change address on the QuantumX/SomatXR or MGCplus with CP52, Change address on the PMX.
- On the QuantumX/SomatXR or MGCplus with CP52, if the text "…update needed" is displayed in the **Firmware** column, you must update the relevant module or device; see Update MX firmware, Update Updating firmware for MGCplus with CP52.

If you have already selected and used devices or modules before in the Device Manager, you can activate **Connect to devices last in use** in the start window (**Measure** menu) to connect directly to these devices (without displaying the Device Manager again).

Order of multiple devices

Multiple MX modules are sorted according to their names, and are imported into the channel list in ascending alphabetical order. To include PMX devices into the channel list in alphabetical order, sort the list in the HBM Device Manager: Click on the **Name** column before connection.

QuantumX/SomatXR modules connected via a gateway, such as a CX27 module or modules with C functionality, such as an MX471C, are displayed in a tree structure below the gateway.

Use an MX module as a gateway

Start a **New DAQ project** as necessary to access the HBM Device Manager. On the **Change module settings** tab, you can enable the gateway functionality. The function is disabled by default.

3.1.2.1 Update MX firmware

☞ The function can be locked with password protection, refer to Sensor options, Password protection.

Various methods are needed, depending on the firmware present in an MX module. The module firmware is shown, for example, in the **Firmware** column on the **Modules found** tab of the HBM Device Manager.

MX modules with firmware 4.0 or higher

1. Mark the device(s) to be updated in the **Selection** column on the **Modules found** tab.
2. Click on **Firmware**.
   Current firmware is installed together with catman and displayed in the default setting in the **Firmware package** field. If this is not (any longer) the case, open your web browser with **Search for new firmware**, and check on the displayed HBM web page whether the required firmware is available there. Download the firmware to a folder of your choice and click ... to specify the file.
3. Click on **Update firmware**.
   The update is started and the progress is displayed in the **Firmware update** tab. After the update a new module scan is carried out and the list on the **Found modules** tab is updated.

MX modules with firmware older than 4.0

For updating older modules, you need the appropriate firmware file. Depending on the existing firmware, you may also have to download the program “QuantumXFirmware Updater” and perform the update in several steps. Contact HBM Technical Support about this.

3.1.2.2 Identifying an MX module (LED)

If you are not sure which MX module belongs to which address, you can make the LED of the module flash. To do this, mark the line with the IP address and the module name on the **Found modules** tab of the HBM Device Manager and then click on the **Flash LED** button.

An alternative is the *UUID* (last-but-one column in the list of modules found): This number uniquely identifies each module, and is also specified on the module (Serial-No.)

3.1.2.3 Renaming MX module or MGCplus with CP52

Mark the device or module in the list on the **Modules found** tab and click on **Rename** to be able to assign a name to the module. Then edit the name in the relevant column.

The name is displayed in catman and also for example in the MX Assistant or MGCplus Assistant.

3.1.2.4 Updating firmware for MGCplus with CP52

☞ The function can be locked with password protection, refer to Sensor options, Password protection.

You update the firmware of the CP52 module in the MGCplus via the HBM Device Manager. MGCplus devices with CP22/42 can only be updated with the MGCpLoad program. To do this download the program and the current firmware from the HBM web site: www.hbm.com/software-firmware-downloads-mgcplus/. It is not possible to update the amplifier plug-in modules of the MGCplus via catman, only via the MGCpLoad program, which you can download from the HBM website specified above.

☞ We recommend keeping all CP52s at the same firmware level, so always transfer the latest firmware to *all* CPs.

Updating the firmware of the CP52 using the HBM Device Manager

1. Select the device(s) you want to update in the **Selection** column on the **Modules found** tab.
2. Click on **Firmware**.
   Current firmware is installed together with catman and displayed in the default setting in the **Firmware package** field. If this is not (any longer) the case, open your web browser with **Search for new firmware**, and check on the displayed HBM web page whether the required firmware is available there. Load the new firmware to a directory of your choice and specify the file with ... .
3. Click on **Update firmware**.
   The update is started and the progress is displayed in the **Firmware update** tab.

3.1.2.5 Renaming a PMX

You have two possibilities of changing the PMX name:

1. You can use a web browser
   Connect to the device via a web browser. At the *ADMINISTRATOR* user level, you can then issue a new name via the menu **SETTINGS ► SYSTEM ► DEVICE ► DEVICE NAME**.
2. You can use the HBM Device Manager
   Carry out a module scan, mark the relevant PMX and go to the **Module info** tab. The tab shows you the same view as a web browser. At the *ADMINISTRATOR* user level, you can then issue a new name via the menu **SETTINGS ► SYSTEM ► DEVICE ► DEVICE NAME**.

Then execute a **New module scan**.

3.1.2.6 Update PMX firmware

You have two possibilities for updating the PMX firmware:

1. You can use a web browser
   Connect to the device via a web browser. At the *ADMINISTRATOR* user level you can then load new firmware via the menu **SETTINGS ► SYSTEM ► DEVICE ► UPDATE FIRMWARE** into the PMX and activate it.
2. You can use the HBM Device Manager
   ☞ The function can be locked with password protection, refer to Sensor options, Password protection.

Carry out a module scan, mark the relevant PMX and go to the **Module info** tab. The tab shows you the same view as a web browser. At the *ADMINISTRATOR* user level, you can then load new firmware via the menu **SETTINGS ► SYSTEM ► DEVICE ► UPDATE FIRMWARE** into the PMX and activate it.

Then execute a **New module scan**.

3.1.2.7 Add additional devices

You can use this to add other devices, such as FS22 BraggMETERs or GNSS receivers (e.g. GPS). As GNSS receivers, NMEA-0183 compatible systems are supported which you can connect via USB or a USB-to-serial converter (NMEA = **N**ational **M**arine **E**lectronics **A**ssociation).

☞ GNSS receivers can also be added to an existing DAQ project (**DAQ channels** tab, **Special** group).

After selecting the additional devices (the devices are displayed in the Device Manager list), click **Connect** in the Device Manager.

Connecting FS22 BraggMETERs or ARAMIS channels (GOM Testing Controller)

Click on **Add additional devices** and select the **Device type** FS22, GOM from the list. Ethernet is permanently set as the interface. Enter the IP address of the device, and the port if necessary, and click on **OK**.

Add NMEA compatible device: GNSS receiver

Click on **Add additional devices** and select the device type **NMEA compatible device** from the list. The easiest way is to click on **Auto-Detect**. catman then checks all COM interfaces with all baud rates (4.8 kBaud … 115.2 kBaud) to determine whether a device was found. During the search the interface and baud rate are displayed next to the button.

The interface normally operates as RS-232 with **19,200 baud** (bits per second), **8 data bits**, **1 stop bit** and **no parity**. If necessary, refer to the instructions for your device regarding the required specifications.

For **Signals** select which channels are to be created, if the relevant data (Sentences) are sent from your device. Carry out the appropriate configuration as necessary directly on your device.

See also Use GNSS channels (GPS).

☞ We recommend that GNSS devices are only used together with other measurement devices (MGCplus, QuantumX/SomatXR etc.).

Click on **OK** to close the dialog.

> Further information on NMEA devices can be found, for example, at www.garmin.com.

peplink MAX Industrial Router and peplink Surf SOHO (Ethernet-based GNSS)

Select **Ethernet TCP/IP** as the interface and **127.0.0.1:6700** as the IP address (local PC with port 6700). Enable ports 6700 and 22 in the firewall on your PC.

Configure the devices via the web interface as follows:

1. In the **Advanced** section, activate **GPS forwarding**.
2. As the IP address specify the address of your PC (on which catman is running) and specify **22** as the port.

EGPS 200 plus and VECTORNAV

Use the VECTORNAV configuration software, and specify **INS ECE2** for the **Async output**.

Adding Kistler KiRoad/RoaDyn or MGCplus with CP42

The advantage of adding these devices manually is that you can first search for other devices, such as QuantumX/SomatXR, using the HBM Device Manager.

Specify the interface for MGCplus; Ethernet is the fixed default for KiRoad/RoaDyn. When using Ethernet, enter the IP address of the device in question and click **OK**.

Integrating Vaisala Weather Transmitter WXT520 and compatible models

Click on **Add additional devices** and select the device type **Vaisala Weather Transmitter** from the list. The easiest way is to click on **Auto-Detect**. catman then checks all COM interfaces with all baud rates (4.8 kBaud … 115.2 kBaud) to determine whether a device was found. During the search the interface and baud rate are displayed next to the button.

The interface normally operates as RS-232 with **19,200 baud** (bits per second), **8 data bits**, **1 stop bit** and **no parity**. If necessary, refer to the instructions for your device regarding the required specifications.

At **Signals** select which channels are to be created.

> Configure your device so that only the "*Composite Message*" is sent automatically, but "PTU" or "Min/Max Wind Direction", for example, are *not* sent. In the Vaisala Weather Transmitter configuration dialog this usually relates to the signals shown on the left.

☞ A Vaisala Weather Transmitter must be used together with other measuring devices (MGCplus, QuantumX/SomatXR, etc.).

Click on **OK** to close the dialog.

3.1.3 Settings for MGCplus with CP42 and DMP41

ⓘ See also No device found?, Possible cases with a connection via Ethernet, Which Ethernet address is to be entered on the device?

Specify the Scan range for TCP/IP device scan. Specify a single address or a (small) address range, as the search takes about 0.5 seconds per address.

Notes

- Neither DHCP nor APIPA can be used for MGCplus with CP22/42 or for DMP41, but you can set the Ethernet interface of the PC to **Alternative configuration** if there is no server in the network.
  For MGCplus with CP52, use the HBM Device Manager.
- You do not have to specify a port number for MGCplus; the default value for MGCplus (7) is used automatically. If you use another port number for your devices, then in the dialog **Prepare new DAQ project** in the field **Scan range for TCP/IP device scan** you must append the port to the address, separated by a colon, e.g. **192.168.169.122:5005**. Alternatively, you can create the project with **Offline** (**Measure** menu in the start window), and enter the port when specifying the device.

3.1.4 Settings for optical measuring devices

Settings for QuantumX MXFS

⚠ If you want to use other QuantumX/SomatXR modules in addition to MXFS, they must support the decimal sample rate domain. This means modules with A functionality, such as an MX840A, cannot be combined; you can only use modules with B or C functionality, such as an MX840B.

Hybrid systems—that is to say, systems in which both QuantumX/SomatXR and other HBM devices, such as MGCplus, are to be used—are not possible.

Specify how many channels to create in the device scan options; see Integrating optical measuring devices.

See also Activating and configuring QuantumX MXFS channels.

Settings for FS22 BraggMETERs

The following applies to the FS22 BraggMETERs SI and DI:

- Up to four devices are supported.
- Each device can use a maximum of 16 slots with up to 128 channels (measuring points or optical strain gages) per slot.
- The total number of channels is limited by catman: a maximum of 4,000 measurement and computation channels.
- The channels with the wavelength can only be zeroed if you assign sensors to the channels. Otherwise, you have to zero-balance the computed channels.

See also Integrating optical measuring devices, Configuring FS22 BraggMETER channels.

Settings for ARAMIS (GOM Testing Controller)

Use is only possible with catmanAP, not with catmanEasy. Use ARAMIS channels only together with other measuring equipment (QuantumX/SomatXR or MGCplus).

catman communicates exclusively with the PC on which the testing software is running (GOM Testing Controller).

Basic procedure on the Testing Controller

1. Create a project on the Testing Controller or load an existing project.
2. Activate the **SCPI server enabled** option (**Tracking settings**) in the Deformation Tracking dialog.
3. Enable the **NTP Client** in the Testing Controller, and specify the time server also used for the HBM devices.
4. Select the desired sample rate for deformation tracking. The sample rate must match one of the sample rates available in catman.
5. Start deformation tracking.

Do not stop deformation tracking while catman is running. Otherwise you will have to exit catman and restart your project.

See also Integrating optical measuring devices, Using ARAMIS channels (GOM testing controller).

3.1.5 MGCplus on-board recording

You can also transfer your DAQ jobs to an MGCplus and run them there: On-board recording (recording to a storage medium on the MGCplus). The term used for this in the MGCplus operating manual is *PC card recording* (CP42) or *stand-alone measurement*. The EasyRoadload module required for this in older versions of catman is no longer necessary.

You can combine the recording with a measurement on the storage medium connected to MGCplus from catman (DAQ job) or execute it autonomously and independently of catman in the device. Use **Download** (**Tools** group) in Analysis mode, **Test Explorer** tab to transfer the measured data to the PC. Here, the files can also be converted or you can carry out the conversion retrospectively (**Convert**).

Restrictions of On-Board recording compared to DAQ jobs of catman

- You should only use transducers with linear scaling. Other linearizations (table, polynomial) cannot be computed by the MGCplus; only the “raw values” in mV/V are measured and recorded on the storage medium. The conversion to the physical quantity must in this case be carried out later using a computation.
- Computation channels are not recorded on the storage medium, only the device channels.
- You can define *one* start and *one* stop trigger for one channel in the device per DAQ job; triggering on computed channels is not possible.
- The post-trigger time (follow-up time) is not supported by the MGCplus.
- The possible pre-trigger time depends on the available memory in the CP42/52 in the MGCplus and is restricted to some 100,000 measurements for all channels, see the Operating Manual for the MGCplus.
- The start of the measurement at a certain point in time (date/time) is not supported by the MGCplus.

3.1.6 Scan range for TCP/IP device scan (TCP/IP scan range)

If you cannot use the HBM Device Manager, specify a search range for the Ethernet addresses for connecting to a device connected via Ethernet so that the search does not take too long or scans through the wrong range of addresses. Either enter just a *single* address (for example **192.168.100.55)** or enter a (small) range including the address. Separate numbers for a range with a minus sign (**10-35**), single addresses with commas

(**3,5,9,46**) and combinations with a semicolon (**192.168.100.10-35;192.168.100.3,5,9,46**).

⚠ Spaces are not allowed. Range specifications are only allowed for the last group in the IP address. Specifying **192.168.100-200.1-255**, for example, is *not possible*. You may however search through several subnets using explicit addresses, e.g. **192.169.100.10-35;192.169.150.10-35**.

☞ The range must be accessible via the network. Ensure that, with different network segments, the subnet masks are set accordingly on device and PC.
It is not possible to specify a range for QuantumX/SomatXR. Use the HBM Device Manager for these devices, or specify individual addresses.

If you want to search through a complete subnet, you will find the subnets that can be reached on your PC in the selection list. The number of displayed subnets depends on the subnet mask and the number of Ethernet interfaces on your PC.

☞ catman connects to *all* devices whose address are in the scan range.

catman stores the addresses entered for the search range in a list. Click on **Clear history** to remove all entries.

3.1.6.1 Which Ethernet address is to be entered on the device?

☞ Also apply case 1 if your PC has two Ethernet ports, of which one is connected to a corporate network and the other is to be connected to the device.

Case 1: You are creating a local network between your PC and your measuring device

Here you require an Ethernet cross cable if you wish to connect only the PC and device. Otherwise you must connect PC and devices to an Ethernet Hub or Ethernet switch (and use standard Ethernet cable).

☞ With most PCs a cross cable is no longer needed as the interface is automatically reconfigured appropriately.

Set the addresses on the devices. Assign the IP address 192.168.100.1 to your PC, for example, and the subsequent addresses 192.168.100.2, 192.168.100.3 etc. for the MGCplus and other devices. The 192.168.xxx.xxx address range is intended for such internal networks, so they will not conflict with Internet addresses, even if your PC is using another Internet access. Enter a **Scan range for TCP/IP device scan** in catman, which contains the device address.

See also Setting the IP address of the PC.

Case 2: Your PC is connected to an Ethernet network, and you want to connect your measuring device to the same network

Contact your system administrator and ask him to give you an Ethernet address that you can set on the device. Then enter a **Scan range for TCP/IP device scan** containing the device address in catman.

3.1.6.2 How is the address set on the QuantumX/SomatXR or MGCplus with CP52?

The factory setting of the devices and modules is *DHCP*. You can also assign a fixed address. The device or module must be present in the list on the **Found modules** tab; otherwise follow the instructions in Using the HBM Device Manager.

Change IP address

1. Activate the start of the device manager via **Search ports** and **HBM Device Manager** in the **Prepare new DAQ project** dialog.
2. Open a new DAQ project in the start window of catman (menu **Measure**, **New**).
3. In the HBM Device Manager mark the relevant device or module and go to the **Change module settings** tab.
4. Specify an IP address which uses an address only differing in the last group of figures (fourth group) from that of your PC (the IP address of your PC is shown under **Network adapters of your computer**). If there are other devices in the network, this address must not be used elsewhere.
5. Set the **Subnet mask** to the same numbers as for your PC.
6. Click on **Apply settings**.
7. Wait until the device or module has been restarted.

After that a new scan will be performed automatically.

3.1.6.3 How is the address set on the PMX?

You have two ways of changing the IP address of the PMX:

1. You can use a web browser
   Connect to the device via a web browser. At the *ADMINISTRATOR* user level, you can then specify the address of the PMX using the menu **SETTINGS ► SYSTEM ► DEVICE ► NETWORK**.

2. You can use the HBM Device Manager
   Carry out a module scan, mark the relevant PMX and go to the **Module info** tab. The tab shows you the same view as a web browser. At the *ADMINISTRATOR* user level, you can then specify the address of the PMX using the menu **SETTINGS ► SYSTEM ► DEVICE ► NETWORK**.

3.1.6.4 How is the address set on the MGCplus?

☞ For an MGCplus with CP52, use the HBM Device Manager; see How is the address set on the QuantumX/SomatXR or MGCplus with CP52?

You can set the address of an MGCplus with CP22 or CP42 via the AB22 menu: **System ► Interfaces ► Ethernet**.

If your device does not have an AB22, you have to connect the MGCplus via a USB port, start the MGCplus Assistant and set the IP address via **System ► CP ► Settings** and the **Communication** tab.

3.1.6.5 How is the address set on the FS22 BraggMETER?

Use the factory default address initially to connect to catman. Then change the IP address on the **Optical functions** tab.
See also Setting the IP address of the PC.

Procedure

1. Configure your PC as shown in the user manual so that you can connect to the FS22 BraggMETER (factory default IP address of FS22 BraggMETER: 10.0.0.150).
2. Connect to the device via catman.
3. Go to the **Optical functions** tab and type the following command in the command window:
   `:ACQU:STOP`
4. Click on **Send**.
5. Enter:
   `:SYST:IPAD:<new IP address>:<subnet mask>:<gateway IP>` (enter all numbers with 3 digits)
6. Click on **Send**.

The device now has the new IP address. Exit catman and reset your PC's IP address.

Example of the command with a new IP address (192.168.100.121)

```
:SYST:IPAD:192.168.100.121:255.255.000.000:000.000.000.000
```

Press and hold the power button for more than 10 seconds to reset the FS22 BraggMETER to its factory default settings.

3.1.6.6 How is the address set on the DMP41?

You can only set the address of the DMP41 using the display on the device. Depending on the device configuration, the entry of a password may be necessary. Otherwise tap on (**Settings**) and then on **Ethernet**.

3.1.6.7 Changing the PC's IP address

Procedure for Windows 10

1. Open, for example using the symbol in the notification area of the taskbar, the **Network and Sharing Center**.
2. Click in the **Show active networks** area on the connection you want (usually **LAN connection**).
3. Click on **Properties** and specify an administrator account or confirm the security prompt.
4. Select **Internet protocol version 4 (TCP/IPv4)** and click on **Properties**.
5. Activate **Use the following IP address** and enter an address with which the first three groups of numbers match the groups of numbers of the HBM device and only the last group of numbers contains a different number between 1 and 254. The last group of numbers must not match the one on the HBM device.
6. At **Subnet mask** enter the same groups of numbers as they are present on the HBM device.
7. Then click **OK** or **Close** to close all open dialogs.

Example:

The IP address of the HBM device is 192.168.169.80, the subnet mask is 255.255.255.0. Enter **192.168.169.123** as the IP address and **255.255.255.0** as the subnet mask on the PC.

Procedure for Windows 8/8.1

1. From the **Charms** menu on the Windows desktop (not in tile view) open **Settings ► Control Panel ► Network and Sharing Center** (**View**: **Small icons**) or **Show network status and tasks** (**View**: **Categories**).

2. Click in the **Show active networks** area on the connection you want (usually **LAN connection**).
3. Click on **Properties** and specify an administrator account or confirm the security prompt.
4. Select **Internet protocol version 4 (TCP/IPv4)** and click on **Properties**.
5. Activate **Use the following IP address** and enter an address with which the first three groups of numbers match the groups of numbers of the HBM device and only the last group of numbers contains a different number between 1 and 254. The last group of numbers must not match the one on the HBM device.
6. At **Subnet mask** enter the same groups of numbers as they are present on the HBM device.
7. Then click **OK** or **Close** to close all open dialogs.

Example:

The IP address of the HBM device is 192.168.169.80, the subnet mask is 255.255.255.0.

Enter **192.168.169.123** as the IP address and **255.255.255.0** as the subnet mask on the PC.

3.1.7 Options when establishing a device connection (device search)

You can use the options of the **Prepare new DAQ project** dialog (click on **Options**) to define:

- Whether directly following establishment of the device connection a *Sensor scan* should be carried out (**General options**).
  During a sensor scan on starting a new DAQ project, the information contained in sensors with *TEDS* or *T-ID* is evaluated.
  See Execute sensor scan after device connection, Using transducers with TEDS.
  - ☞ You can define the behavior on opening an *existing* DAQ project via Sensors (**Channels and sensors** group in the Program options).
- Whether after establishing the device connection a dialog appears in which you can reset the device settings to the factory settings (**General options**).
  See Device reset/factory setting after device connection.
- Whether the configuration of the channel filters can be changed by catman, or is to be blocked.
  See also Do not change filter and sample rate after connecting device.

- Whether the configuration of channel settings (sensor assignment, sensor scaling, TEDS scan, zero balance and filters) may be modified by catman or is to be locked, e.g. on connecting to devices which are used in a test rig.
  See Lock interactive channel configuration.
- How many CAN bus channels are to be created, and whether CAN RAW channels are to be created.
  See CAN bus options (Default setting of number of CAN channels).
- Whether the (hardware) time channels run in the device during the measurement are used instead of the (software) time channels created in catman (**Hardware time channels**).
  See Hardware time channels, Time channels in catman.
- Whether the math functions of specific MX modules are to be accessible, or the maximum number of EtherCAT channels possible for the CX27C.
  See Advanced options.
- Which channel layout to use with QuantumX MXFS (optical sensors), and whether you want to use the Smart Peak Detection of the FS22 SI.
  See Advanced options.
- Whether you want to add additional devices to those already selected. The option allows you to include devices that cannot be found automatically by the Device Manager. If you are not using the Device Manager, you can still add the devices in the Device Manager. Otherwise, add devices here that are not in the list of device types: GNSS receivers, ARAMIS channels (GOM Testing Controller), a Vaisala Weather Transmitter, etc.
  See Additional devices (add devices manually).

3.1.7.1 Execute sensor scan after device connection

☞ This option is only relevant when using transducers with *TEDS* or *T-ID*.

If you carry out a sensor scan, then provided the measurement device supports TEDS, all transducers with TEDS or T-ID module are detected.

For transducers with TEDS, the measuring chain is set up and adjusted immediately. With T-ID, the information is transferred to catman in order to find the correct settings in the Sensor database. If the entry exists, the amplifier is set up appropriately via catman. Otherwise no settings are made and an error message “T-ID not found” is displayed.

⚠ A (new) sensor scan is only performed with QuantumX/SomatXR if the device detects a sensor being plugged in, or the sensor was already plugged in before the device was switched on. With QuantumX/SomatXR modules, if you do not connect the sensor directly to the device, but instead to an extension cable and only plug in after switching on the module, the module does not detect that a (new) TEDS sensor is present. So the existing configuration continues to be used. Therefore, if you use *extension cables and do not plug directly into the module*, you should use the **Force device to reload TEDS content during a sensor scan** option (Program options: Sensors) so that the TEDS content is read out and activated again during a sensor scan (**Options** in catman Start window, **Sensors** in **Channels and sensors** group). Unfortunately, this means that the time required for the sensor scan increases and approx. three seconds per sensor are needed.

☞ The option After loading a DAQ project: Execute sensor scan determines the response to *loading a DAQ project* (**Options** in the start window, **Sensors** in the **Channels and sensors** group).

3.1.7.2 Device reset/factory setting after device connection

☞ When the factory default setting is loaded, settings can be deleted which you have made manually on the device, e.g. via the AB22 of the MGCplus. (The Ethernet address is not reset when a default setting is loaded.)

With a device reset you have the possibility of deleting device settings such as channel names or sensor assignments in the device. The function is not available for FS22 BraggMETERs.
If required, you can also call the dialog via the **DAQ channels** tab and the **Special** group, or the context menu for the device.

With MGCplus when the connection to the device is being established, there could be a *Link resource conflict* for example if an On-Board recording is configured. In this case reset the device and delete the flash settings for the On-Board recording.

A dialog is displayed after each device scan if **Load factory settings after device connection** is activated. The dialog can also be called with **Device reset** in the **Special** group on the **DAQ channels** tab:

1. Load the factory settings for all channels
   With QuantumX/SomatXR all connectors are set to analog mode. However CAN bus channels of the first connector of an MX840/MX840A/MX840B remain unchanged. With MGCplus all plug-in modules except ML77 are reset to their factory settings. You may also exempt ML71 plug-in modules from resetting

(MGCplus only).
With QuantumX MXFS all defined bands are deleted, the sensor assignments are set to **Wavelength** and the channels are deactivated.

2. Reset all channel names
The names of all channels are reset to the default devicename_CH_slotnumber_subchannelnumber. With MGCplus ML77 modules are always ignored; you may specify that ML70 and ML71 are also ignored. Real-time computations and existing data sources in graphs, Digital indicators etc. are redirected or changed to the new names.
3. Delete flash settings for on-Board recording (MGCplus only)
Recording parameter set 0 (flash) is deleted, any running On-Board recording is stopped and the link resources for an AB22 process are freed.

After a reset all channels are reinitialized and the channel list is updated. The whole process may take several seconds per device, with MGCplus up to 30 s.

3.1.7.3 Do not change filter and sample rate after connecting device

The option defines whether the filter settings (filter in the device) may be *automatically* modified by catman after connection to a device or not.

☞ With QuantumX/SomatXR, when the option is active the sample rates of the device are not changed either, but instead applied as sample rates in catman.

In the default setting catman uses approx. 15% of the sample rate as the filter frequency in order to reduce *Alias effects*; see DAQ channel options for other percentage figures. After the scan and connection to a device, catman uses a default sample rate, and the associated filter frequency is set automatically. This setting (and only this one) is prevented by the option. You can modify the filter settings *thereafter*, both on the **DAQ channels** tab and on the **DAQ jobs** tab.
See Lock interactive channel configuration to prevent all further changes, and Measuring (start DAQ job) to change the default settings of a DAQ job.

3.1.7.4 Lock interactive channel configuration

ℹ See also Sensor options, Password protection

The option defines whether channel settings can be modified in catman or are to be locked. With the option active you cannot:

- Change channel names
- Assign sensors
- Perform a TEDS scan
- Change the scaling
- Change the filter settings
- Perform a zero balance

⚠ After the device search and connection to a device, low-pass filters are automatically set (once only) in order to reduce *aliasing*; see DAQ channel options. In addition, activate Do not change filter after device connection, to prevent this change to the filter settings as well.

The option is useful, for example, with a connection to devices which are used in a test-rig or which have been already configured elsewhere. It is however possible to change the sample rate of catman.

☞ Not every sample rate can be used with every filter. If a combination is invalid, catman does not acquire any measurements. The **Sample** column on the **DAQ channels** tab then shows “Sample rate or filter setting is invalid”.

3.1.7.5 CAN bus options (Default setting of number of CAN channels)

ⓘ See also Using CAN signals/bus reset.

Here you can specify how many (empty) CAN channels are to be available for the QuantumX/SomatXR after establishing the device connection, provided the module has connections which support the CAN bus. The setting must be made for each connector, but is used for each module to which catman connects. No channels are created if the CAN bus is not supported by the connected modules. The channels are acquired at the specified sample rate. If the data rate via the CAN bus is lower than the sample rate, the values are repeated until new values are available. An exception is the CAN-RAW format (MX471), in which only the signals actually received are stored.
With MGCplus, only the channels already activated in the device are displayed after the scan.

Maximum number of channels supported by your device:

- 128 (per connector) with QuantumX/SomatXR MX840 (1 connector) and MX471 (4 connectors),
- 128 per plug-in for MGCplus.

Note that catman supports up to 4000 channels. The default setting is 512 channels; see also Data storage options.

QuantumX/SomatXR MX840

The option is only considered when Connector 1 is already configured as a CAN bus connector. If the connector is still configured as an analog input, the number quoted here is used as the default setting only on switching to the CAN bus mode. You can however still change it; see Using CAN signals/bus reset.

The option is used for each module which is found during the scan and which uses Connector 1 for the CAN bus.

QuantumX/SomatXR MX471

You can define the number of CAN channels individually for each of the four connectors. As of catman 5.0, you can also specify that *only* or *additionally* CAN raw messages are received at a connector (additionally: **Activate CAN raw receiver** option).
See also Configuring a CAN Raw table.

Alternatively, you can create only as many channels as are already configured in the device: **Use current device configuration**. The configuration can take place with the last measurement with the device or via the MX Assistant.

☞ To be able to receive CAN-FD raw messages, you must additionally select **CAN-RAW format: FD (max. 64 byte payload)**.

⚠ CAN FD: Only the MX471C supports CAN FD. The MX471 and MX471B cannot be connected to a CAN bus on which CAN FD messages are also sent.

The **Refresh CAN signal list after project load** option re-reads the channels after loading a project with CAN channels. Use the option if the CAN channels are already defined, e.g. via the MX Assistant, and you want to load a project in which a different channel configuration is present. After loading the project, read in the signal list anew to obtain the current configuration without changing other project settings.

MGCplus with ML71

You can also change the number of CAN channels after a scan via the **General settings of CAN bus modules** dialog and the **ML71 channel configuration** tab (**DAQ channels** tab, **Special** group, **CAN configuration**).

⚠ After the change the MGCplus reboots. Settings that may have been made for other channels will be lost. Therefore, configure the CAN channels before making any other settings.

3.1.7.6 Hardware time channels

See also Time channels in catman.

The **Create hardware time channels** option is only available for MGCplus, QuantumX/SomatXR modules, PMX, and FS22 BraggMETERs.

Normally you do not need to activate this option: If, when starting a new DAQ project catman finds that several synchronizable devices are possible (the devices are activated in the **Prepare new DAQ project** dialog), you obtain a dialog with the query of whether you want to synchronize them or not. If you respond here with **Yes**, the required options are automatically activated. When only FS22 BraggMETERs are connected, the option is likewise automatically activated. After the scan display the dialog to check the synchronization. In this dialog you can make the settings required for the time channels; see Synchronizing several devices.

Hardware time channels are generated in the device and are transferred to catman exactly like data from channels with other signals, e.g. from sensors. The main advantage of hardware time channels is that you can use them also to retrospectively synchronize data from different devices, i.e. data from devices which are not synchronized together, or cannot be synchronized, for example because they are too far away from each other, or multiple FS22 BraggMETERs. A prerequisite however is that the devices internally have the precise time available, i.e. all devices must be supplied with the time information from a time server. Apart from *NTP time*, with QuantumX/SomatXR the *IRIG-B* **time** option is also available. In the case of QuantumX modules with B and C functionality, SomatXR modules, and MGCplus with CP52, you can also use *PTP*. You can alternatively synchronize a CX27 module via EtherCAT.
See also Configure and check time synchronization services.

The (software) time channels normally used are computed channels whose values are computed from the sample rates.

NTP time channels do not show local time, but rather *UTC time* (derived from **C**oordinated **U**niversal **T**ime, corresponding to Greenwich Mean Time or London time). The time format is NTP-Unix (dating from 1.1.1970).

MGCplus

The CPU module CP22 cannot generate NTP times. For CP42 you can use NTP; for CP52 you can use NTP or (better) PTP.

QuantumX/SomatXR

All QuantumX/SomatXR modules from firmware version 4.0 upwards can use NTP.

With MX840A/MX840B and MX440A/MX440B IRIG-B is available as an alternative.

For QuantumX modules with B and C functionality, and SomatXR modules, PTP is also available.

EtherCAT is only available when using a CX27 module.

See also Configure and check time synchronization services.

PMX

With PMX you can only use NTP or Ticks: If you are using multiple PMXs, you can change the time channels to ticks. This results in better synchronization of the devices in some configurations. Instead of timestamps, the hardware time channels in catman then contain ticks. To do this, create the PMX_USE_TIMETICK (DWORD) entry in the registry in the HKEY_Local_Machine\Software\Wow6432Node\HBM\Catman\Settings section, and give it the value 1.

⚠ Changes to the Registry using the regedit.exe program should only be made by experienced users, and after backing up the existing Registry, because under some circumstances serious Windows errors might result. If necessary, ask your administrator to make the change.

FS22 BraggMETERs

As from firmware version 2.0 the FS22 BraggMETER SI/DI support NTP time synchronization. Older FS22 BraggMETERs do not have NTP; here the PC time (in the NTP format) is used as a time stamp on receipt of the data. Therefore, with this type of device ensure that the PC clock contains the precise (NTP) time or at least the same time source as the other NTP clients.

See also Configure and check time synchronization services.

3.1.7.7 Advanced options

QuantumX/SomatXR: On-Board math

Activate this option if you are using MX modules which possess math functions and on which you want to configure and apply these functions using catman.

If you are carrying out the configuration via the MX Assistant and also do not need any results of the math functions in catman, you do not need to activate this option. Analog outputs and digital I/Os, e.g. with MX879, are always activated when an appropriate module is detected.

See also QuantumX/SomatXR on-board functions.

EtherCAT with CX27C (QuantumX)

The CX27C allows you to also display EtherCAT signals in catman. Specify what signals to display via the EtherCAT master and the MX wizard. You can display these channels in catman if in **Advanced options** you set the **Maximum number of QuantumX-CX27C channels** to a value at least as high as the number of channels you want (maximum 100 per module). Only the existing channels will be included, however, even if the number in this field is higher.

⚠ If you open a project in which fewer channels are defined than in the current configuration, only the project channels will be set up. So, if necessary, create a few more channels than you currently need.

☞ If you open a project that no longer includes all the project channels, you must disable the ones that are not present. Otherwise measurement will start.

The channels are initially disabled after a device scan. After being enabled, they are acquired at the specified sample rate, and processed like other channels. The data is only read, however; it is not possible to assign sensors, scale, or change the signal source. You can only change the signal name in catman. The amplifier type (CX27C), CX27 serial number and the physical unit of the signal are recorded as traceability data.

If the data rate via EtherCAT is lower than the sample rate, the values are repeated until new values are available.

Defining QuantumX MXFS channel layout

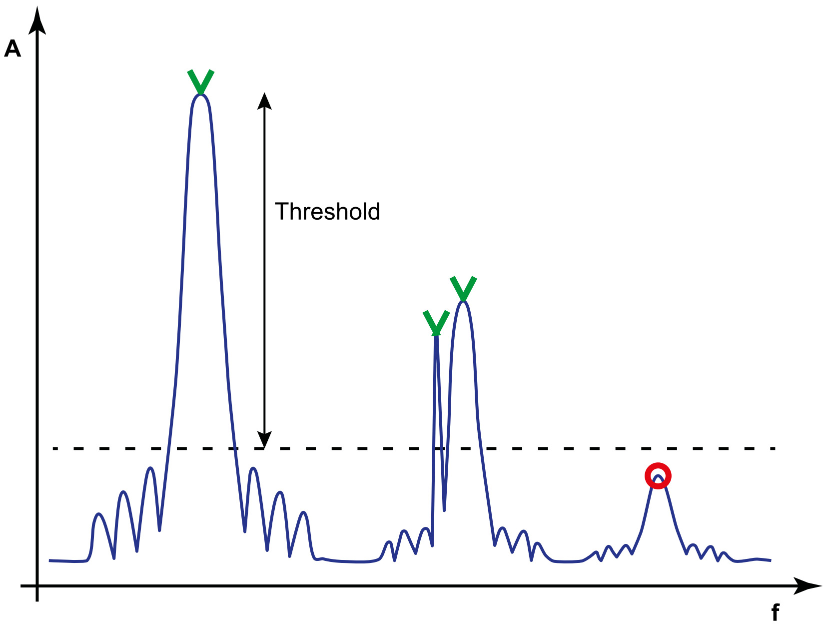
The channel layout determines how many channels catman creates. You can only choose between the configurations offered; custom configuration is not possible. The first number is the number of (occupied) connectors on the device; the second number is the number of measuring points per connector. If, for example, you do not need the maximum possible number of channels, or not all connectors are occupied, you can use this to reduce the number of channels catman creates. The setting **4 x 8** creates only 8 channels for only 4 connectors, meaning only 32 channels in total instead of 128.

⚠ It is not possible to change the number of channels in a project later.

After connecting to the device(s), all channels are initially deactivated. A channel is only activated when you specify the band relevant to it. To do this, use either **Configure ranges** (**MXFS optics** group on **DAQ channels** tab) or Auto Range Detection.
See Activating and configuring QuantumX MXFS channels.

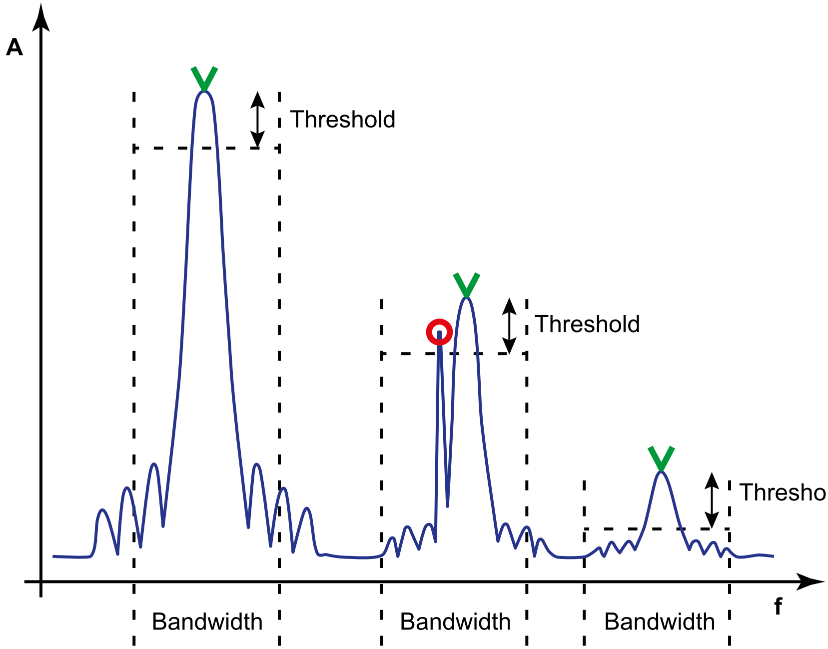
Use Smart Peak Detection for FS22

Smart Peak Detection changes the way the threshold and peak detection work in the FS22 BraggMETER. Without this option, the specified **Relative threshold** is applied to the entire **Sweep range**, i.e. all wavelengths:



Detected peaks are marked in green: 1 peak has not been detected and an interference signal has also been detected as a peak in the center.

With the option active the threshold is only applied to the range specified (**Peak lock bandwidth**) and a maximum of one peak per range is accepted:



Detected peaks are marked in green: All three measuring points have been detected and the interference peak has not been analyzed (only the highest amplitude in the range is valid).

3.1.7.8 Additional devices (add devices manually)

You can use this to add other devices, such as FS22 BraggMETERs or GNSS receivers (e.g. GPS). As GNSS receivers, NMEA-0183 compatible systems are supported which you can connect via USB or a USB-to-serial converter (NMEA = **N**ational **M**arine **E**lectronics **A**ssociation).
See also HBM Device Manager for QuantumX/SomatXR, PMX and MGCplus with CP52: Add additional devices.

☞ GNSS receivers can also be added to an existing DAQ project (**DAQ channels** tab, **Special** group).

Connecting FS22 BraggMETERs or ARAMIS channels (GOM Testing Controller)

Click on **New device** and select the **Device type** (FS22, GOM) from the list. Ethernet is permanently set as the interface. Enter the IP address of the device, and the port if necessary, and click on **OK**.

Add NMEA compatible device: GNSS receiver

Click on **New device** and select the device type **NMEA compatible device** from the list. The easiest way is to click on **Auto-Detect**. catman then checks all COM interfaces with all baud rates (4.8 kBaud … 115.2 kBaud) to determine whether a device was found. During the search the interface and baud rate are displayed next to the button.

The interface normally operates as RS-232 with **19,200 baud** (bits per second), **8 data bits**, **1 stop bit** and **no parity**. If necessary, refer to the instructions for your device regarding the required specifications.

For **Signals** select which channels are to be created, if the relevant data (Sentences) are sent from your device. Carry out the appropriate configuration as necessary directly on your device.

See also Use GNSS channels (GPS).

☞ GNSS devices must be used together with other measurement devices (MGCplus, QuantumX/SomatXR, etc.).

Click on **OK** to close the dialog.

Further information on NMEA devices can be found, for example, at www.garmin.com.

peplink MAX Industrial Router and peplink Surf SOHO (Ethernet-based GNSS)

Select **Ethernet TCP/IP** as the interface and **127.0.0.1:6700** as the IP address (local PC with port 6700). Enable ports 6700 and 22 in the firewall on your PC.

Configure the devices via the web interface as follows:

1. In the **Advanced** section, activate **GPS forwarding**.
2. As the IP address specify the address of your PC (on which catman is running) and specify **22** as the port.

EGPS 200 plus and VECTORNAV

Use the VECTORNAV configuration software, and specify **INS ECE2** for the **Async output**.

Adding Kistler KiRoad/RoaDyn or MGCplus with CP42

The advantage of adding these devices manually is that you can first search for other devices, such as QuantumX/SomatXR, using the HBM Device Manager.

Enter the IP address of the device and click on **OK**.

Integrating Vaisala Weather Transmitter WXT520 and compatible models

Click on **New device** and select the device type **Vaisala Weather Transmitter** from the list. The easiest way is to click on **Auto-Detect**. catman then checks all COM interfaces with all baud rates (4.8 kBaud … 115.2 kBaud) to determine whether a device was found. During the search the interface and baud rate are displayed next to the button.

The interface normally operates as RS-232 with **19,200 baud** (bits per second), **8 data bits**, **1 stop bit** and **no parity**. If necessary, refer to the instructions for your device regarding the required specifications.

At **Signals** select which channels are to be created.

⚠ Configure your device so that only the "*Composite Message*" is sent automatically, but "PTU" or "Min/Max Wind Direction", for example, are *not* sent. In the Vaisala Weather Transmitter configuration dialog this usually relates to the signals shown on the left.

☞ A Vaisala Weather Transmitter must be used together with other measuring devices (MGCplus, QuantumX/SomatXR, etc.).

Click on **OK** to close the dialog.

3.2 Start a new DAQ project

ⓘ See also Prepare a new DAQ project: Device scan, Using Device Manager, Options when establishing a device connection (device search), Execute sensor scan after device connection, Assign CANHEAD modules (activate subchannel blocks), Synchronizing several devices, Special features of PMX, No device found?

Start a new *DAQ project* by clicking on **New** in the **Measure** menu (catman start window). If you are starting a project for the first time, you must first perform the correct settings for the Device search. When starting, the interfaces activated in the **Prepare new DAQ project** dialog are searched for the specified device types. The devices must be switched on and ready for operation, otherwise they will not be found.

☞ If you are using several devices, you should synchronize the devices; see Synchronizing several devices. Otherwise there could be unrecognizable time differences between the measured values of devices participating in the measurement.

⚠ Simultaneous connection of different HBM devices is supported by catman, but with restrictions: with PMX and DMP41, only additional devices of the *same* type can be used. QuantumX/SomatXR or MGCplus can also be used together with FS22 BraggMETERs or a GOM Testing Controller (ARAMIS). Irrespective of this you can include, for example, a GNSS receiver via **Options** and the Additional devices tab or the HBM Device Manager in the DAQ project.
If after connecting to a device you would like to start an *additional* project with another device type, we recommend first completely terminating catman and restarting.

What happens during the start (connecting devices)

After starting a new DAQ project, the devices found and the channels they contain are created in the channel list and the **DAQ channels** tab is opened with the **Configure DAQ channels** window. Exceptions are the CAN channels of QuantumX/SomatXR: Here only the number specified in the **Prepare new DAQ project** dialog are created. With QuantumX/SomatXR you can however still retrospectively change the number of channels with CAN signals; see Using CAN signals.

The default settings for a DAQ job are applied, and the default filters are set. You can create a maximum of 4,000 channels (including computation channels).
See also Do not change filter and sample rate after connecting device, Maximum number of channels.

Several MX modules are sorted according to their names and are accepted into the channel list in increasing alphabetical order. In order to transfer PMX devices into the channel list in alphabetical order it is sufficient if you sort the list in the HBM Device Manager: Click on the **Name** column before connection.
See also Synchronizing several devices.

The channels are then checked and measured, i.e. the **Live display** is active (default setting).

Channels with *TEDS* transducers are automatically configured if you have activated **Execute sensor scan after device connection** on the **General options** tab in the dialog **Pre-**

pare new DAQ project (click on **Options**). Otherwise manually run a TEDS scan with (**Sensor** group).

You can import individual settings such as DAQ jobs, computations, channel settings, limits or visual displays from saved DAQ projects: **File ► Import** menu. You can also transfer channel name, sensor type (name and/or ID), gage factor and channel comment from an Excel file; see Import channel name and sensor type from Excel.

Is a different order of devices/channels required?

You can remove MX modules, PMX or MGCplus devices from the list and add them manually in a different sequence using the menu **Special ► Remove/add module/device**.

QuantumX/SomatXR-Modules connected via a gateway, such as a CX27 module or modules with C functionality, such as an MX471C, are displayed in a tree structure below the gateway. When adding, select the gateway to which the module is connected. You may need to enable the gateway functionality; see Using the HBM Device Manager.

The sequence of the (hardware) channels cannot be changed, as it corresponds to the order of the channels in the device. You can only change the sequencing of CAN channels and computation channels: Click in the column on the far left on the relevant row and while holding down the mouse button move it to the desired position. CAN raw channels (only ML471) are always created below the other CAN channels of the module.

Ports for Ethernet

You do not need to enter a port number for QuantumX/SomatXR and MGCplus, the default values for MGCplus (7) and QuantumX/SomatXR (5001) are used automatically. If you use another port number for your devices, then in the dialog **Prepare new DAQ project** in the field **Scan range for TCP/IP device scan** you must append the port to the address, separated by a colon, e.g. **192.168.169.122:5005**. Alternatively, you can create the project with **Offline** (**Measure** menu in the start window), and enter the port when specifying the device.

3.2.1 Using older QuantumX modules

The communication with the QuantumX modules has been completely changed as from catman 3.5, because the current firmware versions (as of 4.0) offer a whole range of new possibilities: Improved transmission of the measurements; faster scanning; and, in conjunction with current modules with B or C functionality, also new time channel variants (PTP), new sample rates (decimal stepping) and more. From catman 3.5 the SomatXR modules are also supported, which likewise use firmware 4.0 or higher.

For updating older modules, you need the appropriate firmware file. Depending on the existing firmware, you may also have to download the program "QuantumXFirmware Updater" and perform the update in several steps. Contact HBM Technical Support about this.

3.2.2 Integrating optical measuring devices

Integrating the QuantumX MXFS

⚠ If you want to use other QuantumX/SomatXR modules in addition to MXFS, they must support the decimal sample rate domain. This means modules with A functionality, such as an MX840A, cannot be combined; you can only use modules with B or C functionality, such as an MX840B.

Hybrid systems—that is to say, systems in which both QuantumX/SomatXR and other HBM devices, such as MGCplus, are to be used—are not possible.

Procedure

1. In the Scan dialog, specify **QuantumX/SomatXR** as the device type to find.
2. Activate the **HBM Device Manager** to browse the interfaces.
3. Then open the **Options** in the dialog and click on **Advanced options**. Specify there whether:
   - Auto Range Detection is to be used,
   - and which channel layout catman shall use.

The channel layout determines how many channels catman creates. You can only choose between the configurations offered; custom configuration is not possible. The first number is the number of (occupied) connectors on the device; the second number is the number of measuring points per connector. If, for example, you do not need the maximum possible number of channels, or not all connectors are occupied, you can use this to reduce the number of channels catman creates. The setting **4 x 8** creates only 8 channels for only 4 connectors, meaning only 32 channels in total instead of 128.

⚠ It is not possible to change the number of channels in a project later.

When you start a new DAQ project, the QuantumX/SomatXR modules are searched for and displayed in a list. Select the module(s) you want to connect to from it. The **Slot** column in the channel list shows which connector and which grid is displayed: 1-3 is the third Fiber Bragg grid on the first connector of the device.

See also Settings for QuantumX MXFS for general information on usage, Activating and configuring QuantumX MXFS channels regarding channel configuration, i.e. band center and bandwidth, Defining QuantumX MXFS channel layout, Channel list options regarding how to show columns.

Integrating FS22 BraggMETERs

You can configure and perform measurements with the FS22 BraggMETERs SI or DI as usual in catman by a normal DAQ job. The maximum sample rate of the devices depends on the model and lies between 1 Hz and 1 kHz. At a sample rate which is higher than the maximum sample rate of the device you are using, in hybrid systems the relevant last value is repeated until a new value is present.

Procedure

1. In the Scan dialog, specify **FS22** as the device type to find.
2. Under **Search ports** activate **Ethernet** and enter the IP address used for the **Scan range for TCP/IP device scan** or ensure that the IP address being used is in the specified scan range.
   See also How is the address set on the FS22 BraggMETER?
3. If you are using an FS22 BraggMETER SI, open the **Options** in the dialog and click on **Advanced options**, where you can activate **Smart Peak Detection**; see Use Smart Peak Detection for FS22.

If you are using one or more FS22 BraggMETERs together with QuantumX/SomatXR modules, you can also only activate **QuantumX/SomatXR** at **Search device types** and the **HBM Device Manager** at **Search ports**. Then add the BraggMETER(s) manually in the HBM Device Manager: **Add additional devices**, see also Add additional devices.

When you start a new DAQ project, the specified IP address range is scanned. Devices found are checked to see which connectors and how many fiber Bragg gratings they have. The measuring grids found are displayed as channels in the channel list together with the time channel and diagnostic channels of the devices. The **Slot** column in the channel list shows which connector and which grid is displayed: 1-3 is the third Fiber Bragg grid on the first connector of the device.

⚠ As from firmware version 2.0 the FS22 BraggMETER SI/DI support NTP time synchronization, see Configure and check time synchronization services. Activate synchronization via NTP for all devices to get synchronous data acquisition; see also Synchronization in case 2: different devices (hybrid system).

ℹ See also Settings for FS22 BraggMETERs for general information on usage, Configuring FS22 BraggMETER channels, Channel list options regarding how to show columns.

Integrating the ARAMIS system (GOM Testing Controller)

☞ Use is only possible with catmanAP, not with catmanEasy. Use ARAMIS channels only together with other measuring equipment (QuantumX/SomatXR or MGCplus).

ℹ See also Settings for ARAMIS (GOM Testing Controller) regarding preparation of the test controller and Using ARAMIS channels (GOM testing controller).

Procedure

1. Use the HBM Device Manager, for example, to find your HBM device, such as a QuantumX/SomatXR module. In the dialog click on **Add additional devices**.
   If you cannot use the HBM Device Manager for MGCplus with CP42, you have to integrate the Testing Controller via Additional devices (add devices manually) (Show options in **Prepare new DAQ project** dialog).
2. Specify the device type **GOM ARAMIS**.
3. Enter the Ethernet address of your Testing Controller (you do not have to specify the port).

When you start a new DAQ project, the selected HBM devices and the Testing Controller are displayed in the channel list. For the Testing Controller, all the channels defined there, the NTP time channel and the Diag_Sec_Number channel are displayed. Diag_Sec_Number is a sequential numbering of the received data packets. Missing numbers indicate lost data!

Important additional actions

1. Activate synchronization via NTP for the HBM devices; see Synchronization in case 2: different devices (hybrid system).
2. Enable the **NTP Client** in the Testing Controller (in the web interface under **Ethernet**), and specify the time server also used for the HBM devices.

3. In catman set the same sample rate for the channels from the Testing Controller as selected in the Testing Controller.

Notes

- catman cannot check whether the configuration of the Testing Controller still matches the one in the catman project.
- You must create a new catman project if the Testing Controller configuration changes.
- catman cannot carry out any configuration on the Testing Controller, and in particular cannot change the sample rate. So make sure that the sample rates set in catman and in the Testing Controller for deformation tracking are identical.
- Note that the Testing Controller's sample rate is not guaranteed in all circumstances. Interference on a camera image or a high CPU load might reduce the sample rate for example. We therefore recommend dragging the REL_TIME channel onto the x axis of the graph with the Testing Controller data in order to obtain a correct display. The channel contains the NTP time for each data packet sent by the Testing Controller. The NTP time is in UTC and seconds since 1.1.1970 (**C**oordinated **U**niversal **T**ime, i.e. world time, corresponding to Greenwich Mean Time [London time]).
  See also Configuring a y(x) graph.
- Exit catman before stopping deformation tracking.

3.2.3 Connecting to CANHEAD modules

To measure with strain gages or transducers via CANHEAD you need one or more CANHEAD modules and an ML74 in the MGCplus to which the modules are connected. Pay attention to the maximum possible sample rates for the CANHEAD (the maximum sample rate is displayed in the MGCplus Assistant only).

With CANHEAD modules on the MGCplus primarily only those CANHEAD modules actually connected and assigned to the ML74 are accepted into the channel list. However, you have the possibility of including further CANHEAD modules in the measurement via the **Special** group and **Assign CANHEAD modules**. If catman finds an ML74 on connecting to a device, the following possibilities then exist:

1. CANHEAD modules are already activated and assigned.
   For each sub-channel block the corresponding channels are created in the **Configure DAQ channels** window in catman.

2. Usually, (at least) one sub-channel block is activated, but no CANHEAD module is assigned or none of the assigned CANHEAD modules have been found.
   catman activates the first sub-channel block. Then via **Assign CANHEAD modules (Special** group) call the configuration dialog **Configure ML74 channel assignment** for the relevant ML74. Here, you can activate further sub-channel blocks and assign the CANHEAD modules.
3. Not all existing CANHEAD modules have been found.
   Via **Assign CANHEAD modules (Special** group) call the configuration dialog **Configure ML74 channel assignment** for the relevant ML74. Here, you can activate further sub-channel blocks and assign the CANHEAD modules.

⚠ A new device connection is established after changing the configuration. Settings that may have been made for other channels will be lost. Therefore, configure the CANHEAD modules first.

⚠ Filter settings of a CANHEAD module (sub-channel block) are used by *all* channels. Once you select another setting for one channel, the other channels are also changed.
See also Setting filters manually.

3.2.3.1 Assign CANHEAD modules (activate sub-channel blocks)

☞ This function is only available with CANHEAD modules which are connected via an ML74 in the MGCplus.

In the **Configure ML74 channels** dialog (**Assign CANHEAD modules** in the **Special** group), enter the number of sub-channel blocks to be released either from the menu **ML74 ► Define number of sub-channel blocks** or the context menu of any block. This number corresponds to the maximum number of CANHEAD modules that can be connected.

☞ After a change in the number of the released sub-channel blocks, a new device connection is made to be able to correctly establish the channel list. Settings that may have been made for other channels will be lost.

Then assign the existing modules to the available places (activated sub-channel blocks) in the ML74. You can choose between two methods:

1. Automatic assignment of the connected and found modules to the possible channels.
   Select the menu **ML74 ► Assign CANHEADs automatically**.

2. Manual assignment of each individual CANHEAD module.

   Drag the CANHEAD module ( ) from the right onto an activated sub-channel block on the left-hand side.

   ⚠ Modules can only be assigned once. A module once assigned cannot be assigned to another sub-channel block. To do this, you must first remove the first assignment.

Both methods have advantages and disadvantages: With automatic assignment you have no influence on the sequence of channels. Manual assignment of many channels is time consuming, but you can also retrospectively assign further modules or leave a block free between other sub-channel blocks for later expansions.

☞ Automatic assignment is only practicable when no assignment has been made yet or a new start is desirable. *Existing assignments are deleted.*

⚠ Do not forget to activate the new configuration before closing the dialog: **Apply configuration**. catman After closing the dialog, automatically establishes a new device connection.

For each CANHEAD module you can start an LED test for finding the module: Use the module context menu **LED test** or the **Channel info** window and **Flash LED**. The *Status 1* LED on the CANHEAD module connector then flashes for approximately 10 seconds.

3.2.3.2 Remove CANHEAD modules

☞ This function is only available with CANHEAD modules which are connected via an ML74 in the MGCplus.

Assigned modules can be removed again from the channel block with the **Configure ML74 channel assignment** dialog (**Assign CANHEAD modules** in the **Special** group). You will be asked if you want to save the settings in the CANHEAD module first. The module can then be connected to another ML74 or to another MGCplus and all settings with regard to the measuring points are retained if you select **Activate channel settings from CANHEAD** after the new assignment.

3.2.4 Connecting with Kistler KiRoad/RoaDyn systems

Requirements

- For the synchronous measurement operation of the System 2000 or the KiRoad system from Kistler and the HBM devices you must use the clock signal on the HBM device (MGCplus: Configure ML60 as counter, QuantumX/SomatXR: with MX840, MX440 or MX460 use a counter input). The number of measurements transferred by the system is sent via the counter. catman can then assign the correct values using the comparison with the measurements supplied by the HBM device.
- In addition, you must acquire the trigger channel of the System 2000 or KiRoad system. Any 10 V input (DC) is sufficient for the purpose.
- The devices and the Kistler system must be connected together through an Ethernet switch.
- The IP addresses of the devices must lie in the same segment (only the last group of figures differs).
- The ports 8888 and 8889 for UDP must be released for the System 2000.
  For the KiRoad system, ports 6155, 6157 and 6158 must be enabled for TCP and port 6156 for UDP.
- For KiRoad Performance, the firmware version must be at least 2.0.0.6, and the kernel version must be at least 1.0.8.27.

Procedure

1. Configure the RoaDyn® system (number of channels or signals, etc.) using the associated configuration software. The Sensor database cannot be used for configuration of the RoaDyn® sensors.
2. Start catman.
3. In the **Prepare new DAQ project** dialog (**Measure** menu of the start window of catman and **Select device type, interface and additional hardware options** or via the **Options** menu in the start window and **Prepare new DAQ project**), activate **Kistler RoaDyn** among the device types to be found.
4. Close the dialog.
5. Click on **New** to start a new DAQ project.
6. catman asks after the device search via dialog in which channel the counter signal (clock signal) is present and in which channel the trigger signal is present. Specify the channels you are using so that the measurement data can be acquired time-synchronized.

The rest of the configuration and performing a measurement takes place in catman as usual; only the channels transferred from the Kistler system cannot be further configured.
See also Configure and check time synchronization services.

☞ The synchronization used in the earlier versions of catman via NTP is no longer supported.

Information about Kistler RoaDyn®

The RoaDyn® systems are a product of Kistler Group Switzerland, and are available in various versions for cars, SUVs, trucks, tractors and racing cars. The systems are preferably used for road tests. The forces acting on the wheels are transferred by telemetry without contact into the vehicle. The systems consist of the wheel force sensors with integrated 6-component sensors and the wheel electronics as well as the telemetry for power and data transfer to the inner side of the wheel with the connecting cables to the central gateway (System 2000/KiRoad). This system then transfers the readings over Ethernet to catman.

Parameterization must take place using the relevant configuration software of the Kistler system.

Download the Tech Note “Integrating Kistler RoaDyn® Wheel Force Transducers into QuantumX/SomatXR Data Recorder” from the HBM website under **Services & Support ► Downloads ► QuantumX CX22B-W**.

3.2.5 Connecting to MGCplus with on-board recording

If a running recording on the device is found when connecting to an MGCplus, no catman settings are made. You must explicitly confirm the execution of *Sensor scans*, because the measurement may be interrupted by this for up to one second.

The **On-Board status** button is superimposed on the far left in the status line so that you can interrogate the status of a *running* recording to the storage medium connected to the MGCplus (click on them). The window display is refreshed once every second as long as an On-Board recording is running on one of the connected devices.

☞ You can stop one or all recordings via this window.

Procedure for configuring a recording

1. Configure the channels as usual.
2. Define the parameters for the recording; see Prepare On-Board recording (MGCplus).
3. Start your measurement; see Start On-Board recording (MGCplus).
4. After the measurement transfer the data from the storage medium to your PC; see File download.

3.2.6 Synchronizing several devices

If, when starting a new DAQ project catman finds that several synchronizable devices are possible (the devices are activated in the **Prepare new DAQ project** dialog), you obtain a dialog with the query of whether you want to synchronize them or not.

Background information

On connecting several devices there is the problem of how the measurements from the individual devices can be synchronized. With HBM devices the data of several channels which are measured within one device are always synchronized. Since, however, with several *non-synchronized devices* the measurements are started consecutively, even with the same sample rate the actual measurements are not acquired at the same point in time, nor does the acquisition start at the same point in time for all devices. Consequently, a time offset can arise, which, even with two devices that are consecutive in the channel list, can amount to over 200 ms. So, measurements with unsynchronized devices (click on **No** in the dialog) are only practicable for very slow measurements (sample rate < 1 Hz).

There are different variants depending on your device configuration:

1. You have several devices of the same family, which can be synchronized to each other directly (homogeneous system).
   Use the synchronization mode according to Case 1. The devices then acquire all measurements absolutely simultaneously.
2. You have devices from different families (hybrid system): QuantumX/SomatXR or MGCplus and FS22 BraggMETER or a GOM Testing Controller (ARAMIS).
   Use the synchronization mode according to Case 2. The devices then do not measure absolutely simultaneously, but the time correction can be carried out by catman. The remaining difference is less than 1 ms to less than 1 µs, depending on the synchronization mode used.

3. You have several devices of the same family, but the devices are situated too far apart from one another to synchronize them via the synchronization cable.
   Use the synchronization mode according to Case 3. In the case of QuantumX/SomatXR and MGCplus with CP52 the devices are synchronized correctly as in case 1. All other devices then do not actually measure absolutely simultaneously, but a correct time assignment can take place after the measurement via the figures in the time channels and computations.
4. You are using the System 2000 or KiRoad from Kistler (RoaDyn®) with QuantumX/SomatXR or MGCplus.
   When combining HBM devices and Kistler RoaDyn® systems, you have to synchronize the devices using clock signals and triggers; see Connecting with Kistler KiRoad/RoaDyn systems.

Notes

- Not all connectible devices can be synchronized with each other, so some device combinations (hybrid systems) are not enabled by catman.
- The QuantumX MXFS can only be combined with other QuantumX/SomatXR modules with B or C functionality (case 1).
- If the specified type of synchronization does not match that carried out on the devices, when starting the DAQ job you obtain an error message and the measurement cannot be started.
- See also Special features of PMX time channels.

3.2.6.1 Synchronization in case 1: Several devices of the same HBM family, direct synchronization

In this synchronization mode, the devices are connected by cables. Limitations on cable length apply: 100 meters for connections by Ethernet cable and the sync cable of MGCplus with CP42, 5 meters for FireWire. For longer distances, use synchronization as per case 3.

☞ An advantage of this type of synchronization is that the carrier frequencies of the carrier-frequency amplifiers in the participating devices are also synchronized.

QuantumX/SomatXR

Connect the modules via the FireWire connections at the back of the modules. The data can either be acquired similarly via FireWire (interface required on the PC) or via Ethernet.

In the latter case you also need an Ethernet switch to which all modules are connected to be able to transfer data to the PC or to make settings.

Alternatively, you can also use a gateway (CX22, CX27 or MX471C module) which gathers all data from the connected (synchronized) modules via FireWire, and transfers them to the PC via *one* Ethernet interface cable. With the CX27 module there is also the possibility of carrying out the synchronization via EtherCAT instead of using an NTP or PTP time server, if a suitable EtherCAT Leader is available.

☞ To use the MX471C module as a gateway, you need to enable the functionality; see Use an MX module as a gateway.

MGCplus

MGCplus with CP52

Connect the devices via an Ethernet cable from SYNC OUT of the first device to the SYNC IN socket of the second device (a Sync follower), etc. You can use commercially available Ethernet cables (Cat-5 or better) for the purpose.
See Configure and check time synchronization services.

MGCplus with CP42

Connect the devices via the sync cable for MGCplus (round socket). The first device (the Sync leader) normally does not have a plug in SYNC IN; the cable passes from SYNC OUT on the first device to the SYNC IN socket on the second device (a Sync follower), and so on. With cable lengths longer than 15 meters terminating plugs are needed in the first device (SYNC IN) and in the last device (SYNC OUT). At cable lengths over 100 meters, you must use the SY42 synchronization plug-ins in all MGCplus devices; see Synchronized measurement. In cases of doubt contact HBM Technical Support.

In both cases:

You also need an Ethernet switch, to which all devices are connected, to be able to transfer data to the PC or to make settings. All other settings (Sync leader/Follower) are made automatically.

If you are using devices with a very different number of channels, check whether the device being used as Leader (the first device in the chain) has fewer channels than one of the Sync follower devices. In such cases, where applicable, use a waiting period before the start of the measurement. See also Configure and check time synchronization services to identify Leader and Follower devices.

⚠ Sample rates used by a Sync follower device must also be used by the Sync leader device in at least *one* channel.

DMP41, PMX

Connect the devices via the Sync sockets on the devices. Do this by connecting the Sync Out socket of one device to the Sync In socket of the next one. For this, you can use commercially available Ethernet cables (Cat-5 or better). Here, the first device in the chain becomes the Sync leader, and the next device operates as a Sync follower, and is in turn the Sync leader for the next device.

With the DMP1 currently only the carrier frequencies of the participating devices are synchronized, not the measurements themselves.

FS22 BraggMETERs

FS22 BraggMETERs cannot be synchronized with each other directly. As from firmware version 2.0 the FS22 BraggMETER SI/DI support NTP time synchronization. Older devices do not have NTP. Here the PC time (in the NTP format) is used as time stamp on receipt of the data. Therefore, with this device type ensure that the PC clock contains the exact (NTP) time.

See Configure and check time synchronization services.

Checking the synchronization

After deciding on the synchronous mode, you are asked whether you want to check the synchronization. You then get a dialog in which the current status of the synchronization is displayed; see also Configure and check time synchronization services.

3.2.6.2 Synchronization in case 2: different devices (hybrid system)

☞ The QuantumX MXFS can only be combined with other QuantumX/SomatXR modules with B or C functionality (case 1).

This synchronization mode is applicable if you have one of the following hybrid systems:

- (at least one) QuantumX/SomatXR module and (at least one) BraggMETER or a GOM Testing Controller,
- (at least one) MGCplus and (at least one) FS22 BraggMETER or a GOM Testing Controller,
- (at least one) QuantumX/SomatXR and (at least one) MGCplus,
- (at least one) QuantumX/SomatXR with Kistler KiRoad/RoaDyn,

- one of these combinations, or one or more devices from one family together with a GNSS system or a Vaisala Weather Transmitter.

☞ If you are using multiple MGCplus or QuantumX/SomatXR modules, you must synchronize them as in case 1, otherwise only one of the devices will be synchronized with the others.

The devices can supply themselves with the (same) time via a common time server, and add these timestamps to the measured values. The deviation of the device clocks from the NTP time server may in the settled state be less than 1 ms, but this depends on the Ethernet network you are using, and may also be several milliseconds. The deviation with IRIG-B is much smaller, and is less than 1 µs. The PTP deviations with QuantumX/SomatXR are less than 1 µs; with the MGCplus with CP52 they are less than 10 µs. You can add a GNSS system in all combinations; see Use GNSS channels (GPS).

MGCplus with CP52 and QuantumX/SomatXR modules

For MGCplus with CP52 and the QuantumX modules with B or C functionality, as well as SomatXR modules you should use synchronization by *PTP*; see Configure and check time synchronization services: PTP. Synchronization via NTP is possible, but has much larger tolerances, and is therefore not recommended.

MGCplus with CP22/42 and QuantumX/SomatXR modules

Synchronizing these two devices types is not easy, and is subject to certain limits. So as from catman version 4.0 combining MGCplus and QuantumX/SomatXR modules is no longer recommended. Please contact HBM Technical Support for details of potential combination options.

QuantumX/SomatXR or MGCplus with GOM Testing Controller

Activate synchronization via NTP for the HBM devices; see Configure and check time synchronization services: NTP. Set the NTP synchronization and NTP time server for the Testing Controller on the controller. It is not possible via catman.
See also Integrating the ARAMIS system (GOM Testing Controller), Using ARAMIS channels (GOM testing controller).

QuantumX/SomatXR or MGCplus with FS22 BraggMETER

As from firmware 2.0, the FS22 BraggMETERs support synchronization via NTP. In the case of FS22 BraggMETERs with older firmware, the PC time (in the NTP format) is used as a time stamp on receipt of the data. So, with those devices make sure the PC clock contains the exact (NTP) time.
See also Configure and check time synchronization services: NTP, Configuring FS22

BraggMETER channels.

QuantumX/SomatXR with Kistler KiRoad/RoaDyn

With this combination, the synchronization is by hardware. After the dialog-based device search, by default catman queries the channels containing the **Clock signal** (counter signal) and **Trigger signal**. Otherwise, in the **DAQ channels** tab choose **Additional functions ► Configure external time synchronization** to call up the setting dialog, go to the **Synchronization of hybrid systems** tab and specify the channels at the bottom of the dialog.

See also Connecting with Kistler KiRoad/RoaDyn systems.

3.2.6.3 Synchronization in case 3: Multiple devices of the same family; synchronization via Sync cable not possible

Use this synchronization mode for larger distances between the devices/modules that cannot be bridged by cables. If possible, you should use synchronization with PTP or IRIG-B. Otherwise use NTP.

The deviation of the device clocks from the NTP time server may in the settled state be less than 1 ms, but this depends on the Ethernet network you are using, and may also be several milliseconds. The deviation with IRIG-B is usually much smaller, and is about 1 µs. The PTP deviations using the MGCplus with CP52 are less than 10 µs; with QuantumX/SomatXR they are less than 1 µs.

Newer QuantumX modules with B or C functionality, SomatXR modules, and MGCplus with CP52

For these devices you have the option of synchronizing via *PTP*. Though you will need a special (PTPv2-compatible) switch to do so. A PTP time server can be—but does not have to be—additionally configured in the network. Even without a PTP time server the devices interchange the times amongst themselves in this mode and synchronize themselves to the “best” device (Grandleader Clock).

See Configure and check time synchronization services: PTP.

MX840A/MX840B or MX440A/MX440B (QuantumX/SomatXR)

If you are using only these modules, you can also carry out synchronization using *IRIG-B*. In this way catman can find the values from the data stream which have been acquired at the (where possible) same time point, to store and display them “sorted” into the temporary file. However, if the devices are not connected using a synchronization cable, you need in this case one IRIG-B receiver per device.

See Configure and check time synchronization services: IRIG-B.

MGCplus with CP42, FS22 BraggMETERs (as from firmware 2.0), and older QuantumX modules

The devices can supply themselves with the same *NTP time* via a common time server, and add that time to the measured values. Activate **Hardware time channels** in the options of the **Prepare DAQ project** dialog; see Hardware time channels. With QuantumX and MGCplus, too, synchronization of the data acquisition occurs as in case 1, except that the carrier frequency measuring amplifiers are not synchronized.
See Configure and check time synchronization services: NTP.

> ⚠ For FS22 BraggMETERs, you must configure the NTP time server on the PC on which you are running catman. All other devices must then also use that time server.

Older FS22 BraggMETERs

Systems featuring only older FS22 BraggMETERs *cannot* be synchronized. You can, however, synchronize them retrospectively at least *following* a measurement by way of computations based on the time channels contained in the data.

PMX, DMP41

No other option is available for these devices.

3.2.6.4 Configure and check time synchronization services

> ℹ See Synchronizing several devices regarding the preconditions for time synchronization, Synchronization (**DAQ jobs** tab, **Advanced**).

The activation of the time-synchronization services only needs to take place once per device as the devices retain the details and synchronize themselves appropriately and automatically. Call the configuration dialog via the **DAQ channels** tab and the **Special** group: **Configure external time synchronization**.

The **Configure and check time synchronization services** dialog shows you in the **Settings and status** tab which devices are synchronized and how, and whether the status is OK: The **Internal synchronization** column contains the **Sync leader** identifier for the device or module to which the others synchronize. **Sync follower** indicates that this device is controlled by the Sync leader. **Sync single** is shown when the device is not synchronized.

The type of time server used also appears in the **External time source** column, for example **NTP server: 192.168.100.19)** or **System clock**. The **Offset** column displays the value when the dialog is called, if available for the selected time service.

Click on Update status to display the current values or, if the selected synchronization type is available, to display the deviations of the device clocks over a longer time period use the **Check sync quality** tab in order to assess the quality of the synchronization.

Procedure with PTPv2 (only QuantumX modules with B or C functionality, SomatXR modules and MGCplus with CP52)

☞ You can only use the *PTP* time in conjunction with special Ethernet switches.

1. Call the **Configure and check time synchronization services** dialog via **Configure external time synchronization** (**Special** group on the **DAQ channels** tab).
2. Mark your devices in the list.
3. Activate **PTP** in the **Reconfigure time sources of selected devices** area and specify the settings for the protocol if you are using a special PTP time server. Otherwise, use the settings **Auto** and **UDP IPv4**. The setting for **Domain** is only relevant if you are using multiple PTP time servers. You can then select the time server to be used by stating the domain. Otherwise, leave the setting on **0** (first or no special time server).
   With hybrid systems, you can test the quality of the synchronization and block a measurement from starting, and also from continuing: **Always check sync quality before DAQ start**. The maximum time deviation is then 10 µs for QuantumX/SomatXR and 50 µs for MGCplus with CP52.
4. Click on **Activate settings**.
   The setting is transferred to the device(s) and the synchronization process is started. The modules synchronize automatically, and in systems with no external PTP time server the leader is also negotiated automatically. The deviations in module times with this method are less than 1 µs (MGCplus with CP52: 10 µs), and no wait time is necessary after switching on. The maximum distance between devices is 100 m for a connection via Ethernet cable.

Procedure with NTP

You must carry out the following settings so that the NTP time channels are activated and recorded:

1. Install a time server which makes the *NTP time* available. You can do this either when installing catman or later. Alternatively, you can also use a GNSS device that transmits the times to the PC and then synchronize to the time in the PC.
   See also Installation, www.meinberg.de, Synchronization in case 2: different

devices (hybrid system) and Knowledge Base (via **Help ► Knowledge Base** at the top right of the program interface), section headed "Using NTP synchronization for hybrid systems including a GPS".

2. In the **Prepare new DAQ project** dialog activate the relevant devices.
3. On the **Hardware time channels** tab activate **Create hardware time channels**.
4. Establish connection to your device(s) (menu **Measure**, **New** in the start window of catman).
5. If the dialog with the synchronization settings is not automatically offered, call it up with **Configure external time synchronization** (**Special** group in the **DAQ channels** tab).
6. Mark your devices in the list, activate **NTP** and specify the IP address of the time server (**Server address**) in the **Reconfigure time sources of selected devices** panel.

   ☞ For the GOM Testing Controller, the time server's IP address can only be set on the Testing Controller itself.

   An NTP time server must be able to be reached at the specified address, otherwise you will always be receiving the error message that the NTP client could not be started.

   With FS22 BraggMETERs you can activate **Use ntp.conf file** to improve the settling response. (As from firmware version 2.0 the FS22 BraggMETER SI/DI support NTP time synchronization.) With older FS22 BraggMETERs the PC time (in the NTP format) is used as time stamp on receipt of the data. Therefore, with this device type ensure that the PC clock contains the exact (NTP) time.
7. If you have connected devices of different types, you must specify on the **Synchronization of hybrid systems** tab which channels are to be used as reference for the search according to the same time stamps with the data from the other devices.
   If you are using MGCplus devices and QuantumX/SomatXR or MGCplus and FS22 BraggMETERs, you have to use one (any) MGCplus for the **Leader channels**. With a combination of QuantumX/SomatXR with FS22 BraggMETER specify the appropriate channels of one (any) MX module in the list.
   With hybrid systems, you can test the quality of the synchronization and block a measurement from starting, and also from continuing: **Always check sync quality before DAQ start**. The maximum time deviation is then 5 ms for MGCplus, QuantumX/SomatXR and PMX, and 10 ms for FS22 BraggMETERs.

If the other devices acquire their measured values with a delay relative to the device with the NTP leader channels, you can set an output delay for the leader device. The "current" measurements are then delayed by this time period so that catman can correctly assign the measurements of the participating devices in the input buffers. If the time difference is too large, the values of one device are no longer in the input buffer, whereas the values of the other have not yet even been read.
If you know the time delay between the time generator and the Leader device and it is constant, you can correct it using the entry for **Manual synchronization correction**.

8. Click on **Activate settings**.
   The address of the NTP time server is transferred to the devices and the synchronization process is started.
9. After the first configuration wait approx. one to two hours before a measurement until the devices have reached the settled state.

   Check the deviations either via **Update status** or via the **Check sync quality** tab in the same dialog.

The deviation of the device clocks from the NTP time server in the steady state is normally less than 1 ms, but this depends on the Ethernet network used.

To use actual exact times of day the NTP time server must for its part be synchronized, for example via an Internet connection, to an external (exact) time server. This is not necessary for the synchronization function, however, because in it only all devices involved in the measurement need to have the *same* time.

Note

- After switching on the PC with the time server wait several minutes until the NTP time server on the PC has itself settled before connecting to the devices via catman. As long as the time server is not yet settled, the devices cannot synchronize to it.
- Also, wait about 5 minutes before starting a measurement so that the devices are readjusted to the time server.
- The maximum sample rate with synchronization using NTP is 2400 Hz. Faster sample rates are not practicable due to the tolerances on the time stamp.

- With multiple devices or QuantumX/SomatXR modules make sure that at least the NTP time channels are active, the sample rate of which is used in the relevant module or device.
- In combination with MGCplus and the NTP Leader channels, for each sample rate actually being used in the other devices, you must also use this sample rate on at least one channel per MGCplus.
- In systems with FS22 BraggMETERs, the NTP time server for all devices must be located on the same PC on which catman is also running.
- NTP time channels do not show local time, but rather *UTC time* (derived from **C**oordinated **U**niversal **T**ime, corresponding to Greenwich Mean Time or London time).
- The time format is NTP-Unix (from 1.1.1970).

Synchronization for QuantumX/SomatXR and Kistler RoaDyn® (System 2000/KiRoad)

For the synchronous measurement operation of the wheel force sensors from Kistler and the HBM devices you must use the clock signal on the HBM device and acquire the trigger channel of the System 2000 or KiRoad.

Configure an ML60 as a counter for the clock signal on the MGCplus. With QuantumX/SomatXR you need either an MX840, an MX440 or an MX460 module on which you have to configure one input as a counter. Any 10 V input (DC) will suffice for the trigger channel.

If not already done at the start of the DAQ project, you can also specify these channels in the **Configure and check time synchronization services** dialog:

1. Call the dialog via **Configure external time synchronization** (**Special** group on the **DAQ channels** tab).
2. Go to the **Synchronization of hybrid systems** tab.
3. Activate **Synchronize devices via trigger and clock line**.
4. Specify the appropriate channels at **Trigger signal** and **Clock signal**.

Procedure with IRIG-B (only QuantumX/SomatXR MX840A/MX840B and MX440A/MX440B)

1. In the **Prepare new DAQ project** dialog on the **Hardware time channels** tab (**Options**) activate the setting **Create hardware time channels**.
2. Establish connection to your device(s) (menu **Measure**, **New** in the start window of catman).

3. Call the **Configure and check time synchronization services** dialog via **Configure external time synchronization** (**Special** group on the **DAQ channels** tab).
4. Mark your devices in the list.
5. Activate **IRIG-B** in the **Reconfigure time sources of selected devices** area.
6. Specify the current year, if this information is not transferred with your IRIG-B format.
7. Specify the difference of your time zone from the **UTC time zone** (derived from **C**oordinated **U**niversal **T**ime, corresponding to Greenwich Mean Time or London time), if you want to use local time. Also consider any difference due to summer time.
8. If you know the time delay between the IRIG-B time generator and your device and it is constant, you can correct it using the entry for **Time shift**.
9. Click on **Activate settings**.
   The setting is transferred to the device(s).
10. Assign the IRIG-B *sensor* to the channel to which the IRIG time source is connected.
    The deviations in module times with this method are less than 1 µs and no wait time is necessary after switching on.

Procedure with EtherCAT (only for QuantumX CX27)

☞ The MX modules must be connected to the CX27 module(s) and these must be connected to the EtherCAT network with time server (EtherCAT Distributed Clock).

1. Call the **Configure and check time synchronization services** dialog via **Configure external time synchronization** (**Special** group on the **DAQ channels** tab).
2. Mark the CX27 module(s) in the list.
3. Activate **EtherCAT** in the **Reconfigure time sources of selected devices** area.
4. Click on **Activate settings**.
   The setting is transferred to the devices and the synchronization process is started. After the first configuration settling may be prolonged so therefore allow the devices sufficient time.

☞ The time format is NTP-ECAT (EtherCAT, from 1.1.2000).

Background information about NTP synchronization

Devices for which NTP synchronization is activated interrogate the time server approximately every 16 seconds and correct their own time as necessary. The times required for the transmission of the message are appropriately considered by the time server and corrected. Provided these times do not vary too much a deviation from the actual time can be obtained which is significantly less than 1 ms. The NTP time synchronization can therefore be used up to sample rates of 600 Hz, but deviations must be expected above this.

After activation of the NTP synchronization each read block with measurements also contains the corresponding NTP time stamp. In combination with MGCplus and QuantumX/SomatXR the values are first saved by the device drivers in buffers and then compared to find out which time stamp for the values of a device has the best possible match with that of the NTP Leader channel.

3.2.7 Check/update firmware

See also Program options: Options for safety.

The function can be locked with password protection, refer to Sensor options, Password protection.

Some functions are only executed correctly if the connected devices have the latest firmware. When establishing the device connection, the firmware version of a QuantumX/SomatXR, PMX, MGCplus or FS22 BraggMETER is checked and you receive, as applicable, a warning notice or a message that catman cannot operate with this device. If you would like to see which firmware version is used in your device and which is at least recommended, use the menu **Check firmware** in the **Special** group (**DAQ channels** tab).

QuantumX

The communication with the QuantumX modules has been completely changed as from catman 3.5, because the current firmware versions (as of 4.0) offer a whole range of new possibilities: Improved transmission of the measurements; faster scanning; and, in conjunction with current modules with B or C functionality, also new time channel variants (PTP), new sample rates (decimal stepping) and more. From catman 3.5 the SomatXR modules are also supported, which likewise use firmware 4.0 or higher.

Modules with firmware 4.0 or higher

With these modules you can start the updating directly from the dialog with the display of the firmware version. The current firmware is already selected at the bottom of the dialog. Mark the module(s) to be updated and click on **Update firmware**.

See also Update MX firmware for the procedure.

Modules with firmware older than 4.0

For updating older modules, you need the appropriate firmware file. Depending on the existing firmware, you may also have to download the program "QuantumXFirmware Updater" and perform the update in several steps. Contact HBM Technical Support about this.

MGCplus

For MGCplus you can display the firmware version of the CP module, but not of the individual plug-in modules. For MGCplus with CP52 you can update the firmware of the CP module using the HBM Device Manager; see Updating firmware for MGCplus with CP52.

For the modules and for CP22/42 you have to install the appropriate program for updating the firmware separately (MGCpLoad). You can download both the latest firmware and the update program from the HBM website: www.hbm.com/software-firmware-downloads-mgcplus.

PMX

Use the HBM Device Manager for the update; see Updating PMX firmware.

FS22 BraggMETER

For these devices you can only display the firmware version; an automatic update is not currently possible.

DMP41, Kistler KiRoad/RoaDyn, GOM Testing Controller

The option is not available for these devices.

3.2.8 No device found?

If no device is found when establishing the device connection, there are a number of possible causes. Check the following points and then repeat the search.

General reasons

- Is the device really switched on (device LED)?
- Is the interface cable connected?
- Have you activated the correct interface or the correct interface adapter?

You are using the Ethernet interface

- Are you using the correct Ethernet cable?
  Use an Ethernet *switch* with standard cable or a direct connection with cross-over cable.
- Is your Ethernet switch operating correctly?
  If you have no other devices operating on the switch with which you could check the function, try to establish a direct connection between the PC and the measurement device.
- Have you waited long enough for the PC to define its address?
  If the PC cannot find a server in the network, with the **DHCP** settings on the PC **Obtain IP address automatically** or the **Alternative configuration** (**user-defined address**) a server is searched on the network (the symbol for the interface in the Windows tray indicates the search, but the symbol might only appear if the display is configured). It then takes about 20 to 30 seconds before an automatic address (for *DHCP* and *APIPA*) or the stated alternative address is set. During this time, a scan cannot find anything either.
- Is it possible that your firewall is blocking the connection?
  Try deactivating your firewall or open the following ports:
  - QuantumX/SomatXR: TCP ports 80, 5001 and 7411, UDP for ports 1200, 1201, UDP-Multicast for ports 1300, 1301, 31 416 and 31 417, for the CX27 the TCP ports as from 50 000,
  - MGCplus with CP22/42: TCP port 7 (no UDP or multicast present), MGCplus with CP52: TCP ports 7 and 80, UDP-Multicast for ports 31 416 and 31 417,
  - DMP41: TCP port 1234, UDP-Multicast for ports 31 416 and 31 417,
  - PMX: TCP port 55 000, UDP-Multicast for ports 31 416 and 31 417,
  - FS22 BraggMETER: TCP ports 3500 and 3365,
  - Kistler System 2000: UDP for ports 8888 and 8889,
  - Kistler KiRoad: TCP ports 6155 and 6158, UDP for port 6156.
- Is it possible that your antivirus program is blocking the connection?
  Try deactivating your antivirus protection to locate the cause. If the device is then found, refer to the documentation of your virus protection program to find out how to enable access to the network (local subnet) for individual programs. You must open the same ports as those described under the firewall.

- QuantumX/SomatXR:
  - Do you have older modules that still use a firmware version earlier than 4.0? Contact HBM Technical Support to update.
  - Do all the modules connected via a QuantumX gateway module have the latest firmware?
  - Have you enabled the gateway functionality when using the MX471C as a gateway?
    See Using the HBM Device Manager.
- If a WLAN is also active with your PC, test whether the device is found when you temporarily switch off the WLAN (only for the time of the scan). With some WLAN configurations, problems can occur during a scan across all interfaces.
- If your PC has several Ethernet interfaces, try deactivating all other Ethernet interfaces.
- If you are using the device in a large network, contact your network administrator. There are a series of options in managed networks to limit or completely prevent data transmission between the individual nodes. Administrative access control settings may therefore be needed here.

You are using the FireWire interface (QuantumX/SomatXR)

- Have you installed the HBM FireWire driver?
  See also Notes on the FireWire interface (includes installation instructions).
- Is the IP-over-FireWire 24 interface adapter available?
  Check this in the Windows Control Panel ► Network and Sharing Center ► **Change adapter settings**.
  See also Notes on the FireWire interface, procedure for the (retrospective) installation of the drivers.
- Is the driver also activated?
  The software, Thesycon T1394bus Setup Wizard (t1394bus_install-wizard.exe), must indicate that the HBM driver is being used for the adapter to which the MX modules are connected.
  See also Notes on the FireWire interface.

Possible cases and their effects on the connection over Ethernet

With a connection between the PC and the instrument the following cases may arise:

1. No server in the network, the PC has no fixed address (*DHCP* is used), and the measuring instrument (QuantumX/SomatXR, MGCplus with CP52, DMP41, PMX) is likewise set to DHCP (factory default).

When using Windows 7 and higher, temporary addresses are automatically assigned by the PC (*APIPA*); the connection can be established.

2. No server in the network, PC has no setting or is using DHCP, measuring instruments (QuantumX/SomatXR, MGCplus, DMP41, PMX) have a fixed address
No connection can be established with this combination.
3. No server in the network, PC has a fixed address or is using DHCP, measuring instruments (QuantumX/SomatXR, MGCplus, DMP41, PMX) have a fixed address
A connection can normally only be established if the addresses of the PC and the measuring instrument are in the same *network segment*.
4. DHCP server in the network, the PC and measuring instrument (QuantumX/SomatXR, MGCplus with CP52, DMP41, PMX) use DHCP.
The connection can be established.

☞ For MGCplus with CP22 or CP42 you must *always* set an address on the device. These CP modules do not have DHCP functionality. Use the AB22 or the MGCplus Assistant to set the address.

3.3 Prepare DAQ project without device

You can prepare a *DAQ project* with QuantumX/SomatXR, MGCplus, PMX, FS22 BraggMETER, Kistler KiRoad/RoaDyn®, GNSS or Vaisala systems. The DMP41 is not supported by this mode. With QuantumX/SomatXR and Kistler KiRoad/RoaDyn® systems, you have a choice of two variants:

1. Create a complete DAQ project in catman without connected devices.
The DAQ project can include all information about devices, channels and sensors, the DAQ jobs and the visualization. For the measurement open this DAQ project, check the initialization and start the measurement.
2. Create an Excel parameter file.
The file contains all the information about devices, channels and sensors as well as sample rate(s). DAQ jobs and visualization are not however included. For the measurement you open this file which is then compiled into a DAQ project by catman.

Notes

- Channels that are available in the measuring device but not defined in the signal plan will not be displayed later when the project is opened with the devices connected. You can therefore hide unnecessary channels from the outset, i.e.

it's not necessary to deactivate them in the DAQ job.

- The settings for QuantumX and SomatXR differ in the connection views you get when you assign a sensor and open the **Sensor adaptation and wiring diagram** context menu.

3.3.1 Prepare complete DAQ project

☞ The QuantumX/SomatXR MX878, MX879 and MXFS modules are not supported.

Procedure

1. Click on **Measure** and **Offline** in the start window of catman.
2. Use the **Signal plan** tab with **New device** (**Channel** group) to specify which **Device type** is connected in the subsequent test
   You can correct the address of the TCP/IP interface (Ethernet) when you open the project, but you must first enter an address (any).
3. Also set the **Module type**, if necessary for your device.
4. Depending on the device, you can **Create time channels** and/or **Create hardware time channels**.
5. Repeat the actions if you have connected multiple devices or modules.
6. For some devices, selection of the module type also determines the number of channels. Otherwise, you can **Automatically create channels to this device**, provided your configuration is listed in the selection box. If not, choose **New channel** (**Channel** group) to specify which plug-in modules are available.
   If there is more than one device, first mark the device or a channel already specified before calling the dialog in order that the channel is inserted for the correct device. The channels will be sorted automatically by means of their slot or channel number.
   With the CX27 module, a QuantumX/SomatXR module with C functionality (e.g. MX471C) or a CX22B configured as a router, use the **New MX module** menu item to create the modules connected to this module.

   ☞ For multi-channel modules either the maximum number of sub-channels is created or a dialog enables you to specify the number of sub-channels to create. Use **Delete** (**Channel** group) to remove the channels not required.
7. If you are not using a transducer with *TEDS*, assign the connected sensors (transducers) to the channels: Using the **Signal plan** tab, find your sensors in the *Sensor database component window* and drag and drop each sensor onto the channel to which it will be connected.

☞ For sensors with TEDS activate the option **After loading a DAQ project**: **Execute sensor scan**; see Program options: Sensors.

8. Assign unique channel names.
   From the **Rename** context menu you can create channel names with consecutive numeration or accept the sensor description.

   ☞ Each channel is identified by its name in catman, therefore as far as possible use meaningful names.
   See also Use sensor description as channel name.

9. Save the DAQ project (menu **File ► Save ► Project**).

Optional settings

- Specify Real-time computations (Computation channels).
- Specify Limit values.
- Configure your DAQ jobs.
- Create Visualizations.

Note

- When preparing a DAQ project, you can also open an existing project and modify it.
- Double-click on a device in the list **Signal plan** tab to open the configuration dialog and then, for example, modify the TCP/IP address.
- You can also import channel names (and sensor types) from an Excel file in this mode, as in a DAQ project with connected devices.
- The information (columns) to be displayed can be changed via the menu **File► Options** and **Channel list** (**Channels and sensors** group).
- You do not need to enter a port number for QuantumX/SomatXR and MGCplus, the default values for MGCplus (7) and QuantumX/SomatXR (5001) are used automatically.

3.3.2 Create DAQ project from Excel parametrization file

☞ This function is only available for QuantumX/SomatXR modules, GPS modules (GNSS) and RoaDyn® wheel load sensors (System 2000 or KiRoad) from Kistler. If you are using XLS files (Excel 97-2003 workbook), Excel is not required on the PC for this. When using XLSX files, Excel must be installed on the PC.

With this function you can read in the configuration of the devices (interface, address) and channels (name, sensor, sample rate, filter) from an Excel file. In contrast to creating a DAQ project in offline mode, however, you cannot configure DAQ jobs or visualizations here.

☞ Generally, you should assign the sensors through the entry in the Sensor database, but you can also directly define sensors and CAN signals (type of circuit, supply voltage, scaling, etc.).

The Excel workbook consists of at least three worksheets which are described below. Other worksheets (or columns on the required worksheets) are possible—see templates. The worksheets are defined by the names and the columns of the worksheets by the column titles. The column titles must always be located in row 1, the column sequence does not matter. Worksheets with different names are ignored by catman. Similarly, capitalization does not play any role. Usually the cell contents are written in plain text, but with some parameters, e.g. the transducer circuit, codes are used (**353** for full bridge strain gage, for example). Such cells can however include any further text following the number, for example the addition strain gage full bridge (**353 strain gage full bridge**).

In the installation folder of catman you will find in the subfolder "Excel parameterization" templates and examples for Excel parametrization files.

⚠ Make sure that all cells which only contain numbers are also formatted so that all figures are displayed. In the Excel default setting leading zeros are suppressed and the point in an IP address is interpreted as the decimal separator. Enter, for example, an ' (apostrophe) before a number to format the cell as text.

Structure of the Excel workbooks

- Devices worksheet
- Channels worksheet
- SampleRateGroups worksheet

In addition to the minimum required worksheets described here, others are optionally available:

- **Files** for paths and files
- **JobParameters** for job and test parameters
- **Events** for limit value and event monitoring

Restrictions

- The **Table** and **Polynomial** sensor scalings can only be used through the assignment of a sensor from the Sensor database and an entry in the Excel worksheet is not possible.
- The MX878 and MX879 modules are not supported.

3.3.2.1 Devices worksheet

You enter the device name(s), the device and module type and the addresses into the devices worksheet. If there are modules connected via a CX27 module or if CAN connectors are being used, further columns are possible.

Column name	Description
Name	Name of the device. As far as possible, catman transfers the name into the module and it is displayed in catman.
Type	Currently only the texts **QUANTUMX**, **GPS**, **KIROAD** or **ROADYN** are permissible.
Module	Contains the QuantumX/SomatXR module type or **ROADYN**, **KIROAD** or **GPS** as text. Permissible entries: MX238, MX410, MX411, MX430, MX440, MX840, MX840, MX809, MX1601, MX1609, MX1615, MX1616, MX471, CX27, GPS for GNSS modules and KIROAD for the KiRoad or ROADYN for the RoaDyn® systems from Kistler—see also Connecting with Kistler KiRoad/RoaDyn systems. For modules with A, B or C functionality, specify the corresponding type, i.e. MX840 or MX840A or MX840B. However, no distinction is made between A and B type modules; what is important is the difference between modules without identifiers, the A/B types and the C types.

Column name	Description
Address	Here, this may be an IP address or the *UUID* (serial number) of the module. With a UUID (which clearly differs from an IP address) a FireWire connection is assumed. catman automatically determines in this case the associated IP-over-FireWire address from the UUID. Specify the COM port or IP address and port of an Ethernet-capable GNSS module.
CX27HostAddress	Address of a CX27 module if the module is connected to a CX27 module using FireWire and the communication takes place through it. The CX27 module must also appear in this list!
CAN Baudrate1	Bit rate for CAN Connector 1 in bits/s. Only permitted for MX471 and MX840. Possible bit rates for MX471: 1.000.000, 800.000, 666.666, 500.000, 400.000, 250.000, 125.000, 100.000, 50.000, 20.000 and 10.000 bit/s. Possible bit rates for MX840: 1.000.000, 800.000, 666.666, 500.000, 400.000, 250.000, 125.000 and 100.000 bit/s.
CAN Baudrate2	Bit rate for CAN Connector 2 in bits/s. Only admissible for MX471.
CAN Baudrate3	Bit rate for CAN Connector 3 in bits/s. Only admissible for MX471.
CAN Baudrate4	Bit rate for CAN Connector 4 in bits/s. Only admissible for MX471.
CAN Sample↵ PointRatio1	CAN Classic sample point ratio in percent from 0 to 100 for MX471 and MX471C, CAN slot 1.
CAN Sample↵ PointRatio2	CAN Classic sample point ratio for MX471 and MX471C, CAN slot 2.
CAN Sample↵ PointRatio3	CAN Classic sample point ratio for MX471 and MX471C, CAN slot 3.

Column name	Description
CAN Sample↵PointRatio4	CAN Classic sample point ratio for MX471 and MX471C, CAN slot 4.
CAN Sync↵JumpWidth1	CAN Classic synchronization jump width for MX471 and MX471C, CAN slot 1.
CAN Sync↵JumpWidth2	CAN Classic synchronization jump width for MX471 and MX471C, CAN slot 2.
CAN Sync↵JumpWidth3	CAN Classic synchronization jump width for MX471 and MX471C, CAN slot 3.
CAN Sync↵JumpWidth4	CAN Classic synchronization jump width for MX471 and MX471C, CAN slot 4.
CAN ListenOnly1	Listen-Only mode for MX471 and MX471C CAN slot 1. In Listen-Only mode, MX471 and MX471C do not send Acknowledge packets; only data from the CAN bus is received. 0 or omitted = Listen-Only mode inactive 1 = Listen-Only mode active
CAN ListenOnly2	Listen-Only mode for MX471 and MX471C CAN slot 2.
CAN ListenOnly3	Listen-Only mode for MX471 and MX471C CAN slot 3.
CAN ListenOnly4	Listen-Only mode for MX471 and MX471C CAN slot 4.
CAN Termination1	Connect terminating resistor for MX471, MX471C or MX840A CAN slot 1. 0 or omitted = do not connect terminating resistor 1 = Connect terminating resistor
CAN Termination2	Connect terminating resistor for MX471 and MX471C CAN slot 2.
CAN Termination3	Connect terminating resistor for MX471 and MX471C CAN slot 3.
CAN Termination4	Connect terminating resistor for MX471 and MX471C CAN slot 4.
COM BaudRate	Baud rate for the serial port for a GNSS module.

Column name	Description
COM DataBits	Number of data bits (7 or 8) for the serial port for a GNSS module.
COM StopBits	Number of stop bits (1 or 2) for the serial port for a GNSS module.
COM Parity	Parity (0 = none, 1 = odd or 2 = even) for the serial port for a GNSS module.

↵ denotes the compound spelling of the term, which is separated in the table for space reasons, e.g. SamplePointRatio.

Example 1

Name	Type	Module	Address
MX840_1	QUANTUMX	MX840	192.168.1.10
MX840_2	QUANTUMX	MX840	192.168.1.11

Example 2

Name	Type	Module	Address	CX27Host Address
CX27_Test	QUANTUMX	CX27	192.168.0.1	
MX840_Test	QUANTUMX	MX840A	0009E5000A01	192.168.0.1
MX410_Test	QUANTUMX	MX410	0009E5000A02	192.168.0.1

Example 3

Name	Type	Module	Address	CAN BaudRate1	CAN BaudRate2	CAN BaudRate3	CAN BaudRate4
MX471_Test	QuantumX	MX471	192.168.1.12	10000	10000	50000	50000
MX840_Test	QuantumX	MX840B	192.168.1.14	100000			

3.3.2.2 SampleRateGroups worksheet

The SampleRateGroups worksheet contains the sample rates of the three sample rate groups. In addition, you have to specify the filter setting which is to be used for the channels with this sample rate group.

Column name	Description
SamplerateGroup	Sample rate group. Permissible entries: **Default**, **Slow** or **Fast**.
Samplerate	Sample rate in Hz. The suffix **Hz** is optional.

Column name	Description
Filterfrequency	Frequency in Hz for a low-pass filter applied to all channels of the group. Specify the filter characteristic by a prefixed BU or BE, e.g. **BU 2000**. If the prefix is omitted, Bessel is used. If **AUTO** is specified, or no specification is made, catman automatically determines the frequency matching the sample rate. You can overwrite the setting in the Channels worksheet for each channel separately.

Example

SamplerateGroup	Samplerate	Filterfrequency
Default	100	Auto
Slow	10	Auto
Fast	1200 Hz	100 Hz

3.3.2.3 Channels worksheet

The channels worksheet contains most of the details, because the assignment of the channels and sensors occurs here. You can either specify **Name/description** or **Sensor ID** from the Sensor database or enter the sensor data directly (not possible in the interactive mode).

Column name	Description
Name	Channel name (maximum 64 characters).
Comment	Channel comment (no limit).
Device	Name of the device (as given in the Devices worksheet) to which the channel belongs.
SamplerateGroup	Sample rate group. Permissible entries: **Default**, **Slow** or **Fast**.

Column name	Description
Connector	Module connector (channel), the first connector has the value 1. Permissible entries: MX238: 1 … 2 MX410, MX411, MX430, MX440, MX471: 1 … 4 MX809, MX840: 1 …8 MX1601, MX1609, MX1615, MX1616: 1 … 16 The signal numbers for a GNSS device are predefined and fixed; see Table of GNSS signals.
Subchannel	Only for MX840 (port 1) and MX471: Number of the sub-channel. Permissible entries: 1 … 128.
TriggerSignal	Trigger signal for synchronization between the Kistler RoaDyn® system and QuantumX/SomatXR module. 0 or omit: no specification 1: Use current channel as trigger signal
ClockSignal	Clock signal for synchronization between the Kistler RoaDyn® system and QuantumX/SomatXR module. 0 or omit: no specification 1: Use current channel as clock signal
SensorID	Sensor ID from the Sensor database. If the value is specified, catman accepts the data from the Sensor database. The columns Transducer through to Bridgefactor must not in this case be occupied, otherwise the setting from the Sensor database will be overwritten.
SensorName	Sensor name (**Name/Description**) from the Sensor database. If the value is specified, catman accepts the data from the Sensor database. The columns Transducer through to Bridgefactor must not in this case be occupied, otherwise the setting from the Sensor database will be overwritten.

Column name	Description
Transducer	ID (code number) of the circuit type (see table of trans-ducer circuits). Any further text can follow the number, for example **353 Strain gage full bridge**.
X1	First characteristic point (electrical) in the basic unit of the amplifier, e.g. mV/V (depends on type of circuit).
X2	Second characteristic point (electrical) in the basic unit of the amplifier, e.g. mV/V (depends on type of circuit).
Y1	First characteristic point (physical) in the unit measured by the sensor (engineering unit).
Y2	Second characteristic point (physical) in the unit mea-sured by the sensor (engineering unit).
RangeMax	End of measurement range (nominal value) of the sensor in the unit measured by the sensor. If this column is omitted during an individual parameterization via X1 … Y2, then Y2 is used as the maximum value.
RangeMin	Start of measurement range (minimum value) of the sensor in the unit measured by the sensor. If this column is omitted during an individual parameterization via X1 … Y2, then -Y2 is used as the minimum value (symmetrical range).
Unit	Physical unit (engineering unit) of the channel as text (maximum 12 characters).
Excitation	Excitation voltage in volts. For transducers, which do not use a bridge circuit, e.g. with the **DC voltage 10 V** type, the figure is used as active excitation.

Column name	Description
ExcitationFrequency	Carrier frequency of the excitation voltage in Hz. Permissible entries: 0 = DC AUTO = The module automatically selects the best possible setting. AUTO AC: The module automatically selects the best possible setting, but it must be the carrier frequency. 500 = 500 Hz carrier frequency 600 = 600 Hz carrier frequency 1200 = 1.2 kHz carrier frequency 2000 = 2 kHz carrier frequency 4800 = 4.8 kHz carrier frequency
Gage factor	Gage factor (only needed for strain gages)
Bridge factor	Bridge factor (only needed for strain gages in half or full bridge circuit)
Filters	Frequency in Hz for a low-pass filter. Specify the filter characteristic by a prefixed BU or BE, e.g. **BU 2000**. If the prefix is omitted, Bessel is used. On specifying **AUTO**, catman automatically determines the frequency suitable for the sample rate; see Program options: DAQ channels. The entry overwrites any existing setting for the sample rate group in the Sample rate worksheet.
DisplayFormat	Format for numerical displays, e.g. **"0.000"**.
DisplayColor	Display color in catman, e.g. in a graph. Use the background color of the cell to determine the display color.
ZeroLock	0 = Zeroing allowed 1 = Zeroing locked

Column name	Description
AutoCal	Only for QuantumX/SomatXR modules: Activation or deactivation of Autocalibration. 0 or omit: Do not use Autocalibration (turn off) 1: Automatic setting by the module (best method for sensor type and measuring range)
LV1	First monitoring condition for a channel. A channel can monitor up to three event conditions simultaneously.
LV2	Second monitoring condition for a channel.
LV3	Third monitoring condition for a channel.

Columns for CAN signals

For describing CAN messages and signals there are further columns, the setting of which is described in the following table. The columns are only evaluated when the sensor (*Transducer* column) is of type 100 (CAN).

Column name	Description
CAN_Id	CAN message ID
CAN_FrameFormat	0 = Standard 11 bit ID 1 = Extended 29 bit ID
CAN_ByteOrder	0 = Motorola 1 = Intel
CAN_ByteCount	Number of data bytes (1 ... 8)
CAN_ RawValueFormat	0 = Unsigned Integer 32 bit 1 = Signed Integer 32 bit 2 = Unsigned Integer 64 bit 3 = Signed Integer 64 bit 4 = Real 32 bit 5 = Real 64 bit
CAN_SigType	0 = Standard signal 1 = Mode signal 2 = Mode-dependent signal

Column name	Description
CAN_StartBit	0 … 63
CAN_BitCount	1 … 32
CAN_ScaleFac	Scale factor
CAN_Offset	Offset
CAN_MinVal	Minimum value (not evaluated by HBM systems).
CAN_MaxVal	Maximum value (not evaluated by HBM systems).
CAN_Unit	Engineering unit
CAN_ModeSig	Reserved
CAN_ ModeByteOrder	0 = Motorola Forward MSB 1 = Intel
CAN_ModeMode	Reserved
CAN_ModeStartBit	CAN Classic: 0 … 63 CAN FD: 64 …511
CAN_ModeBitCount	CAN Classic: 1 …64 CAN FD: 65 …512
CAN_BufferValue Format	Reserved. Output format with QuantumX/SomatXR is always 64 bit double precision.
CAN_MaxRepTime	Monitoring of the signal transmission interval in milliseconds. Use 0 for no monitoring.

Table of transducer circuits (IDs for Transducer column)

ID	TYP
100	CAN (only for CAN channels of MX471, MX840 and MX840A)
353	Strain gage transducer, full bridge
354	Strain gage transducer, half bridge
362	Strain gage circuit, full bridge 120 ohms (figures for gage factor and bridge factor needed)

ID	TYP
363	Strain gage circuit, full bridge 350 ohms (figures for gage factor and bridge factor needed)
364	Strain gage circuit, full bridge 700 ohms (figures for gage factor and bridge factor needed)
365	Strain gage circuit, half bridge 120 ohms (figures for gage factor and bridge factor needed)
366	Strain gage circuit, half bridge 350 ohms (figures for gage factor and bridge factor needed)
367	Strain gage circuit, half bridge 700 ohms (figures for gage factor and bridge factor needed)
368	Strain gage circuit, quarter bridge 4-wire 120 ohms (figure for gage factor needed)
369	Strain gage circuit, quarter bridge 4-wire 350 ohms (figure for gage factor needed)
370	Strain gage circuit, quarter bridge 4-wire 700 ohms (figure for gage factor needed)
371	Strain gage circuit, quarter bridge 3-wire 120 ohms (figure for gage factor needed)
372	Strain gage circuit, quarter bridge 3-wire 350 ohms (figure for gage factor needed)
373	Strain gage circuit, quarter bridge 3-wire 700 ohms (figure for gage factor needed)
376	Strain gage circuit, quarter bridge 4-wire 1000 ohms (figure for gage factor needed)
380	LVDT
385	Potentiometer
420	DC voltage

ID	TYP
421	DC current
450	Thermocouple Type J
451	Thermocouple Type K
452	Thermocouple Type T
453	Thermocouple Type S
454	Thermocouple Type B
455	Thermocouple Type E
456	Thermocouple Type R
457	Thermocouple Type N
475	Resistance
500	Pt10
501	Pt100
502	Pt500
503	Pt1000
520	Frequency F1
521	Frequency F1 + F2 signal
523	Frequency 4 times
524	Time
525	Counter
581	IEPE

Table of GNSS signals (NMEA-compatible)

SLOT	SIGNAL
1	Latitude
2	Longitude

SLOT	SIGNAL
3	Altitude
4	Speed over ground
5	Time
6	Date
7	Satellite status
8	Number of satellites (used)
10	Satellites
11	Magnetic heading
12	True heading
14	Wind direction
15	Wind speed
27	EGPS-200-plus RTK Yaw
28	EGPS-200-plus RTK Pitch/Roll
29	EGPS-200-plus Acceleration x
30	EGPS-200-plus Acceleration y
31	EGPS-200-plus Acceleration z
32	EGPS-200-plus IMU Pitch Rate
33	EGPS-200-plus IMU Roll Rate
34	EGPS-200-plus IMU Yaw Rate
35	EGPS-200-plus 2D Speed
36	EGPS-200-plus 3D Speed
37	EGPS-200-plus RTK Baseline
38	EGPS-200-plus RTK Accuracy
39	EGPS-200-plus Heading

SLOT	SIGNAL
40	EGPS-200-plus Gradient
41	EGPS-200-plus Speed Accuracy
42	EGPS-200-plus Position Accuracy
43	EGPS-200-plus Heading Accuracy

3.4 Open DAQ project

On **opening** an existing *DAQ project* in the menu **Measure** you have three options which you can select via the file type in the file dialog:

1. **catman DAQ projects**: Open project file (default).
2. Open **Excel parametrization file** (only possible for QuantumX/SomatXR).
   See also Create DAQ project from Excel parameter file.
3. Open **backup copy**.
   Whether a backup copy exists depends on the settings for the Program option Backup: **Project backup**.

☞ When you double-click on a DAQ project file, catman launches and the project is loaded. You must wait for the **Waiting time before first hardware access** specified in Program start options to elapse before accessing the project device(s).

On opening, the settings for the project are loaded, the specified interfaces are activated and the device configuration is checked. During this procedure different situations can occur:

Special features for QuantumX (older/current modules)

The communication with the QuantumX modules has been completely changed as from catman 3.5, because the current firmware versions (as of 4.0) offer a whole range of new possibilities: Improved transmission of the measurements; faster scanning; and, in conjunction with current modules with B or C functionality, also new time channel variants (PTP), new sample rates (decimal stepping) and more. From catman 3.5 the SomatXR modules are also supported, which likewise use firmware 4.0 or higher. With older modules you must therefore first update the firmware.

If you open a project and catman finds during the device scan that the modules do not use the recommended firmware, then you are requested to update the modules as with a new project.
See Using older QuantumX modules, Updating MX firmware.

CX27C and EtherCAT signals

The CX27C allows you also to display EtherCAT signals in catman; see EtherCAT with CX27C (QuantumX) (**Advanced options**).

⚠ If you open a project in which fewer channels are defined than in the current configuration, only the project channels will be set up.

☞ If you open a project that no longer includes all the project channels, you must disable the ones that are not present. Otherwise measurement will start.

A device is not found, e.g. because the address or interface is different or the device is switched off

Check the device and interface. In the displayed dialog you can search the specified interface with **New scan** in the dialog **Prepare new DAQ project** to see which devices are found. Correct the address on the right-hand side of the dialog as necessary (also possible by drag & drop from left to right) and choose **Repeat connection attempt**.
See also No device found?

A device is found, however, the configuration differs from that given in the project

If the arrangement of the channels or transducers does not match the one in the project, you must either swap the plug-in modules or transducers as appropriate, or open and change the project in offline mode. No measurements can be taken with the “wrong” hardware; at the most you can deactivate the affected channels in all DAQ jobs.
See also Prepare complete DAQ project.

You have other devices of the type QuantumX/SomatXR, MGCplus or PMX, which are to be added

Add further modules after loading a project using the **Special** menu on the **DAQ channels** tab.

☞ A GNSS device (NMEA) or a Vaisala Weather Transmitter is temporarily removed here, and then inserted again as the last device(s).

Some devices of the type QuantumX/SomatXR, MGCplus or PMX are not (or no longer) present/should be removed.

Remove the relevant devices after loading a project using the **Special** menu on the **DAQ channels** tab.

An On-Board recording is active on one of the MGCplus devices

See also EasyRoadLoad, Prepare On-Board recording.

You receive notification that some functions are not available: sensor assignment, zero balance and filters. Since the configuration of the channels should not change during the measurement, all actions in this respect are blocked. You can however view the recording parameters and terminate the recording: **On-Board recording** button in the status line.

In the next step all channels are checked and measured, i.e. the **Live display** is active (default setting). Channels with *TEDS* transducers will be set automatically if, in the Sensor options (**Channels and sensors** group), you have specified **After loading a DAQ project**: **Execute sensor scan**. If a fault occurs during the channel initialization, you may display a description of the problem with the *Initialization log*. The log lists all differences, even small ones, e.g. channel names that do not match. You can also call up and print the initialization log via **Additional functions ► Diagnostics and Logging ► Show initialization log** (**DAQ channels** tab, **Special** group).

If you have activated the option **Check that sensors from Sensor database are up to date**, a check is also made of whether the data of the sensors used in the project have changed in the meantime. You can then carry out an automatic update. In addition, the warning **Sensor data not up-to-date** is displayed in the channel list for the channels affected.
See also Sensor options: After loading a DAQ project.

Notes

- Channels that exist in the measuring device, but are not defined in the project, will not be displayed.
- Channels that do not exist, but are defined in the project, will be displayed. We recommend that you change the project accordingly, or at least deactivate the relevant channels in all DAQ jobs. Otherwise an error will occur when a DAQ job starts causing the channels to be automatically deactivated. Whether an error message must be confirmed depends on the settings in the DAQ channel

options (**Channels and sensors** group): What to do if channel initialization fails (when starting acquisition).

- The **Type expected** column is only available once a project is opened and the (hardware) **Type** column is activated for display. You configure the column display via the Channel list (Program options, **Channels and sensors** group).
- In order to start catman directly with a project, you either create a link to catman or specify the project in the start options; see Program start options. If you want to create a link in Windows, under the link properties, in the **Target** line specify the full name of the project in quotes after the program path, e.g. **"C:\Programs\HBM\catmanEasy\catmanEasy.exe" "C:\My projects\Test project.MEP"**.
- QuantumX MXFS: When loading a project, all channels contained in the project are restored with the respective settings, meaning the band settings are sent to the device and the sensor settings, such as scaling etc., are restored as usual. If no peak is detected for a channel, catman indicates *Overflow*.

4 SETTING UP CHANNELS (MEASURING CHAIN) (DAQ CHANNELS TAB)

See also Sensor scan when connecting a device, Use sensor description as channel name, Import channel name and sensor type from Excel, Channel list options, Create DAQ project from Excel parametrization file.

The **Configure DAQ channels** window with the channel list (**DAQ channels** tab) shows you all the channels currently present, i.e. the DAQ channels and the computation channels (real-time computations). The active channel settings in the devices are displayed and are identified with . For transducers without TEDS nevertheless assign the sensors connected to the channels, because otherwise, for example, a measurement range which is too small or too large could be used. If the video cameras module (catmanAP required) is activated, there is also the **Video** tab for the configuration of up to four cameras; see Setting up video cameras.

You can print out the channel list via the menu **File** and the data of a single channel or a measurement device via the **Channel info** window. You can export the channel name and sensor description to an Excel file via the Channel check (xls format only; Excel does not have to be installed).

If you have opened a saved *DAQ project* and not all channels defined in the project have been found in the connected devices, channels are also displayed that no longer exist. Deactivate these channels in all DAQ jobs, because no measurements can be taken with the “wrong” hardware (error messages occur).

Sensor database and channel information component window

In the default setting of catman on the right side at the top the Sensor database is displayed which facilitates the easy setup of the measuring chain in that in each case you drag the connected sensor or CAN signal onto the appropriate channel. Place the cursor over a sensor to view comments on it.

Under the Sensor database (default setting) information about the marked channel is displayed in the window **Channel info**; see also Channel info.

You can move both windows to other positions on the screen or dock them to the edge of the screen as tabs using **Auto hide**.

Change column display

The information (columns) to be displayed can be changed via the menu **File ► Options** and **Channel list** (**Channels and sensors** group).

A double click on a column heading in the channel list adapts the width of the column (temporarily) to the displayed text. Use the Channel list options to fix the column width.

You can change the font size of the marked line(s) (temporarily) with **+** and **–**. Ctrl-F resets the display.

If a column is not located at the position you require, click in the heading and drag the column to the required position.

Change lines, move channel or module/device

Move CAN signals of a MX471 and computation channels

Click in the column on the far left on the relevant row and while holding down the mouse button move it to the desired position.

Rows with the (physical) channels of a device cannot be moved. Analog transducers also cannot be moved from one channel to another.

Changing the order in which (multiple) devices appear

Choose **Special ► Remove module/device** to remove all displayed devices (initially connecting just one device) and then use **Special ► Add module/device** to add the devices or modules in the desired sequence.

☞ The function is not available for every device.

Displaying measurements

In the default setting the **Live display** is active to display measurements *continuously* and to check whether all channels are working properly. Use the context menu **Large display** in the **Sample** column to display the reading in a window which can be continuously zoomed.

Activate **Live display ► Measure computation channels** to also update the results of computations during the live display.

With live display disabled, click on **Sample** (**Channel** group) to display the current measured value of the selected channels, or double-click on a channel in the **Sample** column.

(**Sensor** group) or **Signal reading ► Electrical values** (**Channel** group) shows the value measured on the device input (raw value).

A measurement is always executed when you assign a sensor. This allows you to see immediately whether the channel is functioning and correctly set up. When you double-click on a computation channel, *one* value is acquired from *all* device channels.

Number of displayed decimal places

In the **Sample** submenu you can define how many decimal places to display for the selected channel(s). The setting is also used for Digital indicators and tables if you specify **Auto format** (default) in the relevant configuration dialog.

Status indicator

As far as possible, in the event of an error and "Overflow" is displayed in the **Sample** column. The function is not available for every device.

Overload detection

catman has three methods to indicate an overload, where supported by the device, such as a QuantumX/SomatXR with firmware higher than 4.40:

1. Sensor overload
   As soon as the electrical measuring range defined for the sensor is exceeded, the LED in the **Measured value** column turns red and "Overflow" is displayed. If you specified a value in Display overflow values as (options for DAQ channels), it will be used as the measured value.

   ☞ Check that your sensors' electrical measuring range is set correctly. This is only automatically the case with **Zero-span** linearization. To do this, open the **Sensor adaptation and wiring diagram** context menu in the **Sensor/Function** column.

2. Channel overload (default)
   The LED in the **Measured value** column turns red and "Overflow" is displayed only when the measuring range (input range) of the DAQ channel is exceeded. If you specified a value in Display overflow values as (options for DAQ channels), it will be used as the measured value. This variant is supported by all devices.

3. Sensor or channel overload
   As soon as the electrical measuring range defined for the sensor is exceeded, the LED in the **Measured value** column turns orange. The status in the Channel info (Component window) changes to "Sensor overload", but the measured value is still displayed. If the measuring range (input range) of the DAQ channel is also exceeded, the LED in the **Measured value** column turns red and "Overflow" is dis-

played. If you specified a value in Display overflow values as (options for DAQ channels), it will be used as the measured value.

You can make the setting for each channel separately, or for a complete device.

☞ As long as the measured electrical values are displayed with , there is no overload indication.

Displaying only possible sample rates with QuantumX/SomatXR

In the **Set Sample rates and filter** dialog (**Configure** in **Sample rates and filter** group), you can specify that only the sample rates that the current device actually supports are displayed to you. The function requires at least firmware version 4.40 in the QuantumX/SomatXR.

⚠ Note that in QuantumX/SomatXR sample rates and filters are linked. If you manually select a very low filter frequency, for example, high sample rates may no longer be available. For example, with the MX840 and a 2 Hz filter you cannot select a sample rate of 19200 Hz.

ℹ Only active sample rate groups are checked. Unused sample rate groups are unaffected.

MX410, MXFS: Use an increased sample rate (highspeed mode)

MX410

With an MX410 module, you can increase the maximum possible sample rate to 192 kHz or 200 kHz (decimal *sample rate*) if you are using only two of the four channels for measurement. Select the increased sample rate via the context menu in the **Sample rate/filter** column (**Highspeed mode**). Here, channels 1 and 2 are always activated and channels 3 and 4 are deactivated; selection of the channels is not possible. The setting can also be undone with the same menu to be able to use all four channels again.
See also Switching sample-rate domains for QuantumX/SomatXR.

☞ The increased sample rate is not available for sensor supply with carrier frequency.

MXFS

With an MXFS module (for optical sensors) you can increase the maximum possible sample rate to 10 Hz (SI module) or 2 kHz (DI module). Select the increased sample rate via the context menu in the **Sample rate/filter** column (**Highspeed mode**). The display resolution is slightly reduced in favor of the speed. The change applies to all connectors of the respective module. The setting can also be undone using the same menu.

⚠ The MXFS modules support only the decimal sample rate domain. If you want to use other MX modules together with MXFS modules, switch this to the decimal sample rate domain (only possible with B and C modules).
See also Switching sample-rate domains for QuantumX/SomatXR.

Deactivate the channels without sensors using **Active** (**Channel** group) so that no data has to be transferred for these channels. You can restrict the channels to be displayed, e.g. to the active channels, via **Display filter** (**Channel** group).
Channels can be activated or deactivated with password protection – see Sensor options, Password protection.

With QuantumX/SomatXR you can generate test signals in the module channels for test purposes.

If an error occurs during the sensor assignment or when changing settings, you can display the complete error description also in the tool-tip which appears when you place the cursor over the channel in the **Sample** column.

⚠ By default, the *Sample rates* and *Filters* settings, and the *Channel activation* on the **DAQ channels** tab, are set for *all* DAQ jobs. However, only the settings for the first DAQ job are shown. If you are using several different DAQ jobs and this behavior is not desired, carry out these settings either on the **DAQ jobs** tab or restrict the changes to the first DAQ job on the **DAQ channels** tab; see Program options: Channel list.

4.1 Using transducers with TEDS

See also Device search.

Requirements

- You must have a *TEDS-compatible measuring device* (QuantumX/SomatXR, MGCplus with connection boards with the identifier i, or PMX) available.
- You must have transducers with TEDS modules connected.
- The relevant channel must support the TEDS module type of connection (zero-wire, 1-Wire®, etc.).

☞ Special scaling, such as tabular scaling or polynomial scaling, is only accepted when the measurement device supports this scaling. Otherwise just 2-point scaling is applied. In case of doubt check whether your device supports special scalings. For example, not all QuantumX/SomatXR modules support polynomial scaling; on MGCplus only the ML38B supports it and the DMP41 does not support any polynomial scaling. Import the TEDS data into the sensor database as necessary, and set the sensor by it, as catman is able to apply such scaling.

Detecting TEDS

Activate **Execute sensor scan after device connection** in the dialog **Prepare new DAQ project ► Options** on the **General options** tab so that connected transducers with a *TEDS* module are detected immediately when starting a DAQ project. In this case, the measuring chain is automatically configured.

You can start a manual search for transducers that have the TEDS module, e.g. with transducers connected *after* the device connection using **TEDS ► Sensor scan ...** (**DAQ channels** tab, **Sensor** group).

With **Live display ► Execute TEDS scan** on the **DAQ channels** tab (**Channel** group) you can define that during live update a check is also made to determine whether a new sensor has been connected.

Activate in the Program options **After loading a DAQ project**: **Execute sensor scan** (**Channels and sensors ► Sensors**), so that the sensor scan is also executed and the measuring chain set up on opening a DAQ project. Any differences between the project and connected sensors are displayed in this case; see Program options: Sensors.

An expiry date for the calibration specified in the TEDS is checked if you activate the **Extended safety checks before DAQ start** (menu **File ► Options ► Safety**). See also Program options: Safety.

Special features with QuantumX/SomatXR

The settings possible with QuantumX/SomatXR modules for TEDS use also affect catman. If, for example, you use the “Ignore TEDS” setting in the MX Assistant, then no TEDS is found by a TEDS scan in catman. Instead the message “TEDS usage is deactivated” is displayed in the **Sample** column. Activation of the TEDS (**TEDS ► Activate TEDS**, **Sensor** group) also fails (“No TEDS found”). Use **TEDS ► Activate TEDS usage Sensor** group) to be able to find the TEDS module with a (following) TEDS scan and to activate it. This corresponds to the setting “Use TEDS if available” in the MX Assistant.

The setting **TEDS ► Deactivate TEDS usage** may be necessary if you have set “TEDS required” in the MX Assistant and

- no TEDS module is connected or
- the connected TEDS module is not described yet (blank) or
- the connected TEDS module is faulty or
- the TEDS settings are not suitable for the channel type.

In these cases no measurements are output for this channel, instead just OV and Overflow when the MX module has read the TEDS module (in this respect refer to the next paragraph). To obtain measurements again you must either—with the TEDS module present—reprogram the TEDS module or assign a sensor from the Sensor database to the channel.

Use of adapter plugs with QuantumX/SomatXR

The TEDS setting with QuantumX/SomatXR is always read out if the sensor connector was either plugged in before the module was switched on or is plugged in directly on the module. However, if you are, for example, working with an adapter plug or an extension and after switching on the module only plug the connector into the end of the extension, the MX module does not detect this. In this case you must either use **Activate TEDS** (**TEDS**, **Sensors** group) or Activate TEDS contents in device on sensor scan (menu **File ► Options**, **Sensors** in the **Channels and sensors** group). The latter carries out the activation again, however, after *each* scan and takes about 3 seconds per channel.

Modify TEDS data

☞ The function can be locked with password protection, refer to Sensor options, Password protection.

Using the **Edit sensor** context menu and with transducers with TEDS module, you can transfer the TEDS data into the sensor database for editing (the sensor is shown in the **TEDS** group).

Before you carry out a measurement of the sensor data, you should, if possible, set a sample rate of 10 Hz and form the mean over one or several seconds: **Measurement options**.

After editing, click on **Apply** (**TEDS** group in the ribbon) to write the data to the TEDS module.

Programming new TEDS/reprogramming TEDS

☞ The function can be locked with password protection, refer to Sensor options, Password protection.

1. With a new, not yet written or an incorrectly programmed TEDS module first create the sensor in the Sensor database; see How to add your sensors to the Sensor database and Help on the sensor database (in the **Help** menu on the right above the ribbon).
2. Assign this sensor to the channel, e.g. using drag and drop.
3. Activate **Apply settings and write them into the TEDS module also** in the dialog and click on **OK**.
   The data is transferred into the TEDS module.

Notes

- Not all details in the sensor database can be saved into a TEDS module; see *TEDS*
- The text for **Name/description** is used as the channel name; **Type/model** is shown in the **Sensor/function** column for HBK sensors. The types of other sensors cannot be displayed because only a numeric value is stored in the TEDS module. This would have to be cross-checked against the manufacturer's list indicating which text belongs to which number. Only the HBM list is available in catman however.
- If you want to write special data to the TEDS module, you can also call the (separate) TEDS editor: **TEDS ► Edit TEDS content with legacy TEDS editor** (**TEDS** group on **DAQ channels** tab). The TEDS Editor has its own help.

4.2 Assigning sensors (transducers) to channels

ⓘ See also Using CANHEAD modules, Changing strain gage settings, Calibrating sensors, Using sensor description as channel name, Program options: Sensors, Use CAN signals, Assigning CAN signals from Sensor database, Using optical sensors.

☞ The function can be locked with password protection, refer to Sensor options, Password protection.

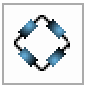
⚠ Activate CANHEAD® modules or other CAN signals in the MGCplus *before* assigning sensors, as a scan must be carried out again after these operations which will delete any assignments already made. With devices in the QuantumX and SomatXR families the number of CAN channels can be changed retrospectively without the channel configuration being lost.

You can also import sensors, sensor types (and channel names) from an Excel file.

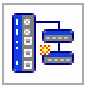
Procedure

1. Click on the **DAQ channels** tab to display the channel list and the **Sensor database** window. Use **Window** (on the right above the ribbon) to display the sensor database again if you have closed or hidden the window.
2. Mark the channel(s) to which the sensors should be assigned.
3. Select one of the sensor groups for display or use the search function ( ), to find the connected transducers.

 shows the sensors you have created (“My sensors” group).

 shows general sensor types like DC voltage, thermocouples, Pt100, optical sensors, etc.

shows the HBK transducers (HBM and selected sensors from BKSV).

 shows the sensors that can be connected to the marked channel.

shows the CAN messages and signals in the sensor database.

 shows all the sensors in the sensor database at the bottom of the window.

4. In the bottom half of the **Sensor database** component window, double-click on the correct sensor or CAN signal.

You can assign a sensor to *one* unmarked channel or to *all marked* channels using drag&drop. If you mark several sensors and *one* channel, they are

assigned to the marked channel and the following channels (as long as there are sensors or channels available). When dragging, keep the [Ctrl] or [⇧] key pressed. During the selection with [Ctrl] ensure that you have not double-clicked the sensor, which you are dragging with the [Ctrl] key pressed, (otherwise the marking is canceled). You can drag the first or last sensor. Assignment is always in the order of the sensors in the Sensor database window.
In the case of CAN signals, the following signals from the Sensor database are also assigned when you assign a signal to the first of multiple selected channels.

☞ In the sensor database you can define that a sensor may only be used on *one* channel. In this case you obtain an error message for multiple or renewed assignment.

5. Repeat these steps until all connected transducers have been assigned.

If only the first channel of a channel group is visible (in the first column), you can assign the same (analog) transducer to all sub-channels by dragging this onto the first channel. With CAN signals, the next signals in the Sensor database will be assigned to the other channels.

Any transducers already defined in the device, e.g. using the Assistant software, are *not* recognized by catman. You should therefore assign sensors to all channels or use transducers with *TEDS*. Otherwise, the settings currently present in the device will be used, but on reloading the project the settings will not be reproduced again.

Immediately after assigning a transducer, the setting will be activated and the channel(s) checked. Should an error message occur, check the transducer connection and whether this transducer type may be connected to this amplifier type (measuring range, excitation voltage etc.). The error text also gives information concerning the origin of the error. If not all of the settings specified in the Sensor database can be accepted, e.g. the desired excitation voltage is not available, a notice provides information. Check the details in the **Channel info** component window as necessary.

Notes

- The Sensor database is continually being revised by HBM and therefore also contains new sensors. If you have already worked with an older version of catman, you should *import* the new sensor database into your (old) sensor database.

- After assigning a sensor, you see the circuit diagram for connecting the sensor to the measuring device in the **Sensor adaptation and wiring diagram** context menu.
- If you have stored a sensor comment in the Sensor database, it is adopted as channel comment.
- With QuantumX/SomatXR modules and linearization via table or polynomial, the scaling is performed in hardware, i.e. in the MX module, as long as the MX module supports that type of linearization (polynomials of max. 4th degree, otherwise you get the message “The sensor is not supported by the hardware”). Note, however, that the computations in the QuantumX/SomatXR modules are performed only with single precision (about 6 to 7 relevant digits). Especially with polynomial scaling, this can lead to deviations, for example with very small coefficients. In such cases, use a computation in catman, catman uses double precision (**Create computation channel from sensor** context menu, and run the channel itself without scaling).
  With DMP41, linearization via table is also performed in the device.
  This means that the linearized values are also available for other channels, such as for analog outputs on QuantumX/SomatXR.
  For all other devices, linearization via table is always performed by catman, meaning the devices only output the “raw values”. The same applies if the device does not support linearization via polynomial.
- With the MX590 (QuantumX/SomatXR special module for connecting pressure hoses) you cannot assign any sensors. This is not necessary with this module, because the measuring range is fixed.

4.2.1 How to add your sensors to the Sensor database

ⓘ See also Sensor database options (path and file name), *Nominal value*, *Characteristic value*, *Sensitivity*, *Excitation voltage*.

Using the **DAQ channels** tab (or **Signal plan**), open the Sensor database for editing using the **Sensor database** tab.

☞ The tab can be masked out using Program functions (Program options, **System** group). Access can also be blocked by password protection—see Sensor options, Password protection.

You can enter more groups and sensors in the sensor database under **Sensor groups**. The *Sensor data base component window* shows all groups or transducers sorted alphabetically.

> Where possible, use the **My sensors** group (the group cannot be renamed), because this group can be directly displayed: Click on  in the **Sensor database** component window of the **DAQ channels** tab. The sensors contained in subgroups are however not displayed, so click on the appropriate subgroup.

More information about entering sensor data can be found in the Help on the sensor database (in the **Help** menu on the right above the ribbon).

Notes

- A maximum of 1024 sub-entries (lower half in the Sensor database component window) per group can be shown in catman. Therefore, use an appropriate structure which ensures that no group exceeds this number of entries.
- Group names must not exceed a maximum length of 50 characters. This also applies if you insert a file with Vector CANdb, for example, as the file name is used as the group name here. In these cases, shorten the group name to 50 characters (including the file extension).
- Sensors with tabular or polynomial scaling are not supported by all devices. In such cases, catman computes the scaling. Note that with polynomial scaling QuantumX/SomatXR only computes internally with single precision (6 to 7 relevant digits). If in doubt, have catman compute the characteristic curve, as it uses double precision.
- If you have a 2D barcode scanner, you can easily set up and import HBM strain gages via the code on the gage's packaging without typing the data.
- If you enter a **serial number**, it is displayed in catman in the **Sensor/function** column in brackets after the sensor description (**Name/description**).
- If you enter a comment, it will be applied as channel comment.

4.2.2 Search database for transducers

> At the bottom of the **Sensor database** component window of the **DAQ channels** tab, it is sufficient to enter one letter of the sensor designation (**Name/Description**) in the search field. The search starts immediately and only

sensors that contain the entered character string are displayed in the window. Each additional entry restricts the displayed selection still further. You do not need to enter placeholders in this field.

You can find transducers according to various search criteria, for example, using the **name/description**, the **serial number**, **sensor ID** or the **calibration expiry (date)**. This is achieved via **Find** on the **Sensor database** tab in the **Find** group in the ribbon or, if the **DAQ channels** tab is displayed, with the **Advanced** button in the **Sensor database** component window.

Activate the relevant search criterion ( ) *before* the **user-specific** search in addition to entering the search text or date you are searching for.

☞ With the (user-specific) advanced search, only results are found which *exactly* match the search text. Therefore use placeholders (*****, **?**) to find all occurrences which only partially contain the search text.

The results of the search are displayed under **Search result** below the sensor groups. In the **DAQ channels** tab click on a group in the upper section to again display the sensors in this group.

4.3 Sensor modification: gage factor, calibration

☞ The function can be locked with password protection, refer to Sensor options, Password protection.

To zero channels (*Zero balancing*), mark them and click on (**Zero balancing** group, **DAQ channels** tab) or use the menu item **Zero balance all hardware channels** in the **Zero balancing** group.

In the following cases, it is useful to modify the values of the sensor database with further details (**Sensor adaptation and wiring diagram** context menu):

1. You are using strain gages and wish to change the gage factor, also called k factor, or other strain gage settings (the strain gage entries in the Sensor database use k = 2.0).

   ☞ As of catman 5.5.3, you have an easy way to configure HBM strain gages in the Sensor database: Scan the barcode on the strain gage packaging. This will record all the data, including the polynomial coefficients for example.

2. A transducer is entered in the Sensor database only with default values and should be calibrated in the installed state. This is recommended, for example, for inductive transducers.
3. You are using optical sensors and temperature compensation.
   In this case you have to specify the temperature channel and perform the “zero measurements”. The dialog is automatically displayed by catman.

If you need the original measured values, e.g. in mV/V or kHz, and additionally the scaled values, after assigning the sensor scaling, from the context menu choose **Create computation channel from sensor**. As a result, the electrical value will again be measured in the original channel, and catman will create a computation with the scaling.
An already measured zero value will be imported into the computation channel. However, you can also zero the original channel, then cancel zero balancing in the computation channel and disable it.

Notes

- With QuantumX/SomatXR, MGCplus and PMX, the **Sensor adaptation and wiring diagram** context menu dialog also displays the circuit diagram for connecting the assigned sensor.
- You can also calibrate channels when no sensor (type) has been assigned. However, the channel must already be capable of measurement, because settings such as the supply voltage, carrier frequency or transducer type, e.g. DC voltage or strain-gage transducer, cannot be changed.
- You can also perform the scaling using a real-time computation; see Algebraic computations: Linearization.

4.3.1 Calibrating sensors

Sensors which have been specified in the sensor database with a polynomial transducer characteristic cannot be calibrated. Password protection can be set for calibration. In this case you cannot perform calibration until the correct password has been entered.

Mark the required channel and use the **Sensor adaptation and wiring diagram** context menu in the **Sensor/function** column, for example. In the following dialog you can measure a characteristic or enter existing measured values, e.g. from a calibration protocol.

☞ The values are changed for this channel or the marked channels only, the Sensor database entry remains unchanged except if you activate **Update in Sensor database**. You can create the newly measured sensor also as a new sensor in the Sensor database: **Create new sensor**. You are asked for the new name when you click on **OK**.

⚠ If you decide to *measure* values, you must measure *all* points on the transducer characteristic.

You can measure or type in any two points of the transducer characteristic. Usually the zero-point (unloaded transducer) and a value with a known load between 20% and 100% of the nominal load is used. However, with transducers which can be loaded in both directions you can also, for example, measure one value at -80% and the second at +80%. Calibration is also possible when using a tabular linearization.

Minimum/maximum

⚠ So that the correct measuring range is used and the amplifier channel is not overloaded, you must also specify the physical range of the transducer (in both directions): **Maximum** and **Minimum**.

Type of (calibration) measurement

With this option you define how the values to be measured are treated. The working principle is similar to synchronous precision zeroing, but here however you can also determine an RMS value. The following methods are available:

1. Instantaneous value (default setting)
   A measurement value with the *current sample rate of DAQ job 1* is retrieved from the device.
2. Mean value
   catman determines the values through the acquisition of many measured values and then forms the mean. The measurement is executed at the *current sample rate of DAQ job 1* over the specified **duration**.
3. RMS value
   The RMS value (RMS = **R**oot **M**ean **S**quare) is calculated from the measured signal. Specify a sufficiently long **duration** so that the RMS value of the signal can be calculated accurately enough.

If required, change the sample rate for the *first* DAQ job via the **DAQ jobs** tab (**Settings** group). The sample rate for the calibration is then also changed.

The second method is better especially for signals with interferences (noise), since not a single measured value is decisive, but the measured values are averaged over a longer period of time. With this method you should use sampling periods of 1 to 5 seconds and sample rates of 10 or 50 Hz.

The third method is practicable with acceleration transducers, for example, because they cannot be statically calibrated. Here, a calibration can be carried out with a sine wave signal. In this case use at least ten periods for the measurement.

☞ With methods 2 and 3, as many measurements are considered as a maximum as fit in the data buffer (default setting 2048). If the number of measurements resulting from the specified **duration** and the sample rate is greater, the excess measurements are not considered.

Example of scaling in a different physical quantity

Instead of displaying the actual physical quantity, you can also convert to another quantity, for example frequency to torque, voltage to flow rate or pressure to force:

For an absolute pressure transducer with 50 bar at 2 mV/V, where 1 bar corresponds to 0 kN and 20 bar corresponds to 13.256 kN, one can calculate: **1st point of input characteristics**, **Electrical value**: **0.04** (mV/V), **Physical value**: **0** and as the unit **kN**. For the **2nd point of input characteristics** enter: **Electrical value**: **0.8** (mV/V) and **Physical value**: **13.256** (kN). As **Maximum** enter **34.2** (bar); use **0** as the **Minimum**. You can also enter **35** (bar) as **Maximum**, as this only determines the measuring range of the amplifier.

Cable resistance correction for MX1615 and MX1616 (QuantumX/SomatXR)

For full bridge strain gages in a 4-wire circuit that are also connected via a 4-wire circuit in the extension cable, you can correct for the effects of cable resistance if you have a corresponding calibration protocol.

Procedure

☞ The sensor must be under no load during the *entire* procedure.

1. Set the **Type of measurement** to **Mean value** and select a **Duration** of **1** or **2** seconds.
2. For **1st point of input characteristics** click on **Measure**. If the value is specified on the calibration protocol, you can also enter it directly in the **Electrical** field.
3. For **Physical measuring range** enter the limits of the range (**Minimum** and **Maximum**, for example ± maximum capacity).

4. For **2nd point of input characteristics** enter the maximum capacity (or nominal/rated force etc.) in the **Physical** field.
5. Activate **Correct cable resistance when calibrating**.
6. Enter the calibration value for the maximum capacity specified in the calibration protocol in mV/V for **mV/V Cal**.
7. Enter the exact bridge resistance of the sensor in the **R-bridge** field, for example **350.4** ohms.
8. In the **2nd point of input characteristics** section click on **Measure**.

catman then uses the internal shunt resistance of the modules to determine the cable resistance, which in turn is used to determine the correction for the electrical value of the 2nd point of input characteristics. Then the corrected value is displayed.

Close the dialog with **OK** to activate the values in the module.

☞ In this type of calibration, only the effects of the cable resistance (loss) for the prevailing temperature at the time of the measurement are compensated. Changes in the cable resistance due to changes in temperature lead to further changes in the measurement signal. Therefore, extension cables should be designed in a 6-wire circuit if possible.

4.3.2 Change strain gage settings (gage factor)

☞ So that you can enter gage and bridge factors, the sensor type **Installed strain gages with gage factor** must be set in the sensor database. Otherwise you can only calibrate a characteristic.

Mark the required channels and use the **Sensor adaptation and wiring diagram** context menu in the **Sensor/function** column, for example. In the following dialog, you can enter the gage factor, bridge factor and excitation voltage, i.e. change the values copied from the database. Additionally, you can define the type of compensation for temperature effects in this dialog.
See also Temperature compensation when using strain gages.

☞ The values are changed for this channel or the marked channels only and the Sensor database entry remains unchanged. You can however create a new sensor: **Create new sensor**. The sensor is inserted into the **My sensors** group.

In the Channel list options (Program options), activate display of the **Gage factor** column. The current gage factor is then also displayed in the **DAQ channels** tab.

Where can you find the gage factor?

The gage factor of strain gages is stated on each package, and is usually between 1.8 and 2.2. Ask the strain-gage installer for the gage factor, otherwise measurement deviations of up to 10% can occur.

Which bridge factor is correct?

The bridge factor depends on the number of active strain gages and their orientation. The strain-gage installer can give you the correct factor: if only one strain gage is active, enter **1**. This factor is also correct if you use an active strain gage and a second one (on a separate piece of your specimen) to compensate for thermal expansion. The latter is not regarded as active, since it only acquires thermal strains and not strains due to the transfer of load. However, if two strain gages are active, a number between 1.2 and 2 may be correct.

Which excitation voltage is needed?

The *Excitation voltage* generally depends on the material on which the strain gage is installed and the size and resistance of the strain gage. Ask the person who installed the strain gage which value is best. Otherwise, if your device allows it, run tests to try to find a suitable excitation voltage: after switching on the device, the measured values for unloaded objects may only change a little. If a drift is detected which only stops after some time (approx. 15 minutes), this could indicate overheating. In this case, contact the person who installed the strain gage and select a smaller excitation voltage or install a strain gage using a higher resistance.

Which measurement range should be chosen?

By specifying the **Measuring range**, you define which measurement range is activated on the amplifier if several are available. With a suitable measuring amplifier high strains can also be measured. On the other hand, a favorable sensitivity is chosen for the normally adequate measurement range of 4000 µm/m (corresponds to a measurement range on the input of the measuring amplifier of approx. 2 mV/V) and a very large measurement range is not normally used. With a measurement range of, for example, 16 mV/V approx. 32,000 µm/m could be measured, but with smaller signals of less than 100 µm/m a higher noise content would arise in this case. In case of doubt check the measurement range (electrical) used in the **Channel info** window.

4.3.3 Temperature compensation when using strain gages

See also Strain gage computations.

The compensation of temperature influences, which is often necessary for strain-gage measurements, can take place in principle in three ways:

1. “Classically” by using an active strain gage and another strain gage of the same type (same lot number of the foil) which only acquires the thermal expansion of the component. Both strain gages are wired in a half bridge and connected as a DAQ channel.
2. By using a separate DAQ channel with the same type of strain gage which only acquires the thermal expansion of the component (separate piece from identical object material). This measurement can be subtracted from many active channels, each containing only one active strain gage. This means that many active channels can be compensated with one compensation strain gage if the temperatures of these strain gages are similar enough. In this case select **Temperature compensation using compensation S/G**. If you wire the compensation strain gage as a separate channel, specify the channel in the **Temperature compensation values from** section.

   ☞ The selection in **Temperature compensation values from** is only possible once **Temperature compensation using compensation S/G** has been activated.
3. By entering the polynomial from the strain gage package and the use of a channel which acquires the temperature at the measuring point. Here too, the compensation for several active strain gages can also take place using one temperature channel. In this case select **Temperature compensation using temperature response polynomial**. Specify the channel which acquires the temperature at the measuring point in the **Temperature data from** section. In addition to the polynomial coefficients a_i you must also specify the thermal expansion coefficients and the reference temperature: $\alpha_{S/G}$ is the thermal expansion coefficient of the strain gage in ppm (10^{-6}/K) as stated on the strain gage package, $a_{Material}$ is that of the material on which the strain gage is installed and T_{Ref} is the temperature in °C for which the polynomial has been determined with a deviation of zero. This is the point at which the polynomial curve passes through the line at zero strain (usually 20°C). To additionally compensate for the temperature dependency of the gage factor ($\alpha_{Gage\ factor}$, approximately 1% per 100°K with Constantan strain gage), also specify the value (in ppm/K). Otherwise leave the field blank or enter **0**.

   If you have read in the strain gage data via a barcode scanner, the polynomial is already included in the channel comment, and you can apply it by choosing **Temperature compensation using temperature response polynomial**. For more information about the barcode, see the "Installed (single) strain gage" section in the Help on the sensor database (in the **Help** menu on the right above the ribbon).

☞ The selection in **Temperature data from** is only possible once you have activated **Temperature compensation using temperature response polynomial**.

Formula for temperature compensation with strain gages

$$\varepsilon = \varepsilon_{\text{Measured}} * \frac{\text{Gage factor}}{C}$$
$$- (a_0 + a_1 T + a_2 T^2 + a_3 T^3 + \ldots) * \frac{2}{C}$$
$$- (\alpha_{\text{Material}} - \alpha_{\text{SG}})(T - T_{\text{Ref}})$$

with $C = \text{Gage factor} * (1 + \alpha_{\text{Gage factor}}(T - T_{\text{Ref}}))$

4.4 Using CAN signals/bus reset

There are two ways of assigning CAN signals to individual channels:

1. Via the Sensor database with drag and drop (all devices which support CAN); see Assigning CAN signals from the Sensor database.
2. Only with MGCplus: By a *Vector-CANdb* (CAN database) that is loaded into the ML71 of the MGCplus; see Assigning CAN signals from a Vector database.

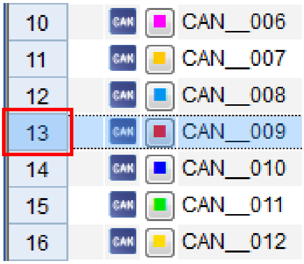
With QuantumX/SomatXR MX471 you can define with the options for the device search that the current device configuration is used; see also Preset number of CAN channels. A further alternative is the use of a configuration file; see CCP/XCP (ECU).

With MGCplus also a manual modification of the signals defined in a CAN database is possible via . However we recommend transferring the CAN signal into the Sensor database and editing there.

See also Help on the sensor database (in the **Help** menu on the right above the ribbon): Import CAN database.

Change the sequence of the CAN channels

Change the sequence of the CAN channels for an MX471 by dragging the channel with the mouse: In the far left column (**DAQ channels** tab), drag the channel to the desired location.



Drag the channel in the column with the red marker.

CAN raw channel (MX471 only)

☞ Activate the reception of CAN Raw signals via the CAN bus options (Default setting of number of CAN channels). Additionally, select **FD (max. 64 bytes payload)** to receive CAN-FD Raw messages.

With a CAN Raw channel, no channel-specific settings are possible. In the **DAQ channels** tab the number of messages since switching on the module is shown in the **Sample** column. Using the context menu, you can call the dialog for the general settings for CAN bus modules.
See also Configuring a CAN Raw table, CAN decoders

⚠ CAN FD: Only the MX471C supports CAN FD. The MX471 and MX471B cannot be connected to a CAN bus on which CAN FD messages are also sent. This also applies to the Raw channel.

☞ If you are using the QuantumX/SomatXR module, you cannot set all connectors to **CAN-RAW receiver only**. At least one connector must additionally decode signals. At the start of a DAQ project a check is made whether at least one other signal of the module is active, and not only CAN-RAW. Otherwise other modules could not deliver any more measurement values.

⚠ CAN-Raw channels can only be stored in **HBM catman standard** or **ASCII** format. The other formats do not support the format for CAN-Raw. You can, however, export the CAN-Raw channel separately to different formats in Analysis mode; see CAN-Raw (Export data (convert formats)).

CAN FD (MX471C only)

Only the MX471C supports CAN FD. The MX471 and MX471B cannot be connected to a CAN bus on which CAN FD messages are also sent. The bit length of an individual message within the maximum 64 bytes may also only be 8 bytes with MX471C.

☞ Select **FD (max. 64 bytes payload)** in the CAN bus options (Default setting of number of CAN channels) to receive CAN-FD Raw messages.

Number of CAN channels with QuantumX/SomatXR

For the MX840 and MX471, you define the number of channels for CAN messages (CAN signals) in the **CAN bus options** of the **Prepare new DAQ project** dialog; see CAN bus options (Default setting of number of CAN channels).

MX840

If connector 1 is configured for analog signals, a dialog is displayed when changing the connection mode to CAN signals where you can define the number of channels. If the connector is already configured for CAN signals, first assign an analog sensor (which clears all CAN channels) and then assign a CAN signal again. This opens the dialog where you can change the number of available channels.

⚠ At the time point of changing over from CAN bus to analog input or vice versa there must not be any plug inserted into the connection, because it may block the changeover.

Although the new configuration changes the channel list, sensors already assigned to other channels (except CAN signals) and computations are retained with QuantumX/SomatXR.

MX471

No changes are possible in the running DAQ project with this module. Although you can specify up to 250 signals per connector for the MX471C, catman only supports 128 per connector.

Modify number of CAN channels for MGCplus

Change the number of the ML71 sub-channels in the **General settings of CAN bus modules** dialog; see Number of sub-channels.

☞ After the change the MGCplus reboots. Settings that may have been made for other channels will be lost. Therefore, configure the CAN channels before making any other settings.

⚠ For MGCplus and CAN channels, you can use a maximum of 512 channels per device in one sample rate group. If you need more channels, you must assign them to a different sample rate group.

In the **General settings for CAN bus modules**, dialog, accessed via **CAN configuration** (**DAQ channels** tab, **Special** group), click on the port to be set in the upper field so that the possible options are displayed. You can then:

- define the bit rate for the CAN port or CAN-FD:
  The figure is saved for each device in the catman DAQ project and each device or module can use its own bit rates. The bit rate and the use of the bus termination resistances are set on loading a project.
- switch in the bus termination resistances for MX471 and MX840B-R,
- perform a bus reset (CAN adapter or module) (**Bus reset before each measurement** is saved in the DAQ project),
- Activate CCP/XCP (ECU),
- load a *Vector CANdb* (CAN database) into the ML71 of an MGCplus,
- change the number of sub-channels for the ML71 plug-in module (MGCplus only),
- send bus commands, e.g. if you need certain initialization sequences for CAN bus devices,
- **Read the signal list again** for MX471. The signal list is normally read out after the device search. With this button you read out anew the list saved in the module.
  Use the option if the CAN channels are already defined, e.g. via the MX Assistant, and you want to load a project in which a different channel configuration is present. After loading the project, read in the signal list anew to obtain the current configuration without changing other project settings. You can also perform this action automatically after each time a project is loaded; see CAN bus options for the device search: Preset number of CAN channels.
  Use the option also after manually loading an ECU definition (**ECU ON**).
  See also Preset number of CAN channels.

Special settings (Sample point ratio, Sync. jump width)

Sample point ratio: With classic CAN, no special setting is usually required here. With CAN FD, however, it is important that the setting in catman matches that of the CAN bus as closely as possible. The entry specifies the time when the sample value of a bit is evaluated. Entering 87.5 %, for example, means that the analysis (determination of the bit status) will take place after 87.5 % of the time between the edges. The time between two edges is determined by the bit rate. The value for the sample point ratio is dependent on the expected signal reflections and the settling time of the signal for example. Different values might be required here depending on the standard being applied. The default is 87.5% according to the CiA (**C**AN **i**n **A**utomation) standard.

Sync. jump width: With classic CAN, no special setting is usually required here. With CAN FD, however, it is important that the setting in catman matches that of the CAN bus as closely as possible. The value determines the tolerance for a bit with jitter in numbers of cycles by which the bit is additionally evaluated. The value is also dependent on the sample point ratio and the bit rate, as there must be enough sample values remaining until the next edge (with the setting in the example above only 12.5% remain). Depending on the bit rate and the sampling rate used for the CAN signal, this might be fewer than the default four cycles.

4.4.1 Assigning CAN signals from Sensor database

ℹ See also Help on the sensor database (in the **Help** menu on the right above the ribbon): Importing/specifying CAN signals.

☞ The function can be locked with password protection, refer to Sensor options, Password protection.

CAN signals that you have either imported into the Sensor database or entered into it can be assigned in the same way as normal transducers: select the signal in the list on the right and drag and drop it onto a CAN channel.

In the current version of the sensor database you can import the classic Vector CANdb formats as well as the ARMXL formats (version 3.2.3 and 4.2.2).

MX840

When a CAN signal is assigned to the first MX840 module connector it will switch, if necessary, from analog to CAN bus mode. You can then specify the number of channels for CAN signals. The channel list will be regenerated after this change has been made; however, sensors already assigned to other channels and computations will remain unchanged.

⚠ At the time point of changing over from CAN bus to analog input or vice versa there must not be any plug inserted into the connection, because it may block the changeover.

Assign several signals

- In the list mark the first CAN channel (**DAQ channels** tab, **Configure DAQ channels** window) for which a signal will be assigned.
- Mark the desired signals in the Sensor database with [⇧] and/or [Ctrl] (**DAQ channels** tab, **Sensor database** window).
- First drag the last signal you marked—while continuing to hold down the [⇧] or [Ctrl] key—to the marked CAN channel.
  The signals are assigned to the following channels, provided channels are available.

4.4.2 CCP/XCP (ECU, only MX471)

⚠ This option requires (prior) configuration of the QuantumX/SomatXR MX471 for use of CCP/XCP over CAN with the MX Assistant program. The program help provides the necessary information.

You can activate sending of the specified information once by clicking **Start CCP/XCP**, or you can specify that the activation is carried out every time before a DAQ job starts (**Start CCP/XCP service before every DAQ start**). Specify the file with the CAN settings and signals (CAN database file) using the MX Assistant.

After manual loading, read the signal list in again using the MX Assistant.

Only the messages and signals contained in the CAN database file are used, and the module is parameterized accordingly as from the first CAN channel when the file is loaded via the MX Assistant. All free CAN channels remain deactivated, and cannot be changed. CAN send messages are also deactivated.

☞ Deactivate the CCP/XCP over CAN function via the MX Assistant to be able to reconfigure the CAN inputs and outputs or to use CAN send messages.

Background information on CCP/XCP

XCP (Universal Measurement and **C**alibration **P**rotocol, the X stands for e**X**tended) is an enhancement of CCP (**CAN** **C**alibration **P**rotocol), and has been standardized by the ASAM (**A**ssociation for **S**tandardization of **A**utomation and **M**easuring Systems, www.ASAM.net). The protocols were developed to make it easier to test, parameterize and calibrate **E**lectronic **C**ontrol **U**nits (ECUs) for automotive electronics. They enable support for plug & play and data acquisition with time stamps, for example. To safeguard system settings against being changed, the settings file can be protected using a method specified by ASAM. A Seed and Key file is generated using a specific algorithm by which the CCP/XCP file can then be checked for authenticity and to ensure it has not been changed.

4.4.3 Loading a CAN database

☞ This function is only available with MGCplus. For all other devices you must import a CAN database into the sensor database.

Procedure

1. Call the **General settings for CAN bus modules** dialog via **CAN configuration** (**DAQ channels** tab, **Special** group).
2. Select the required port by clicking on it.
3. In the dialog click on the **ML71 databases** tab.
4. Specify the CAN database to be loaded (click on ...). The database must be in *Vector CANdb* format.
5. If desired, you can also activate the automatic assignment of the signals contained in the CAN database to the existing sub-channels. Otherwise you can assign them later, see Assigning the CAN signals.
6. Click on **Load**.
7. On the **Bus parameters** tab define the bit rate to be used on the port.

☞ The list of available messages and signals will be read from the ML71 when a DAQ project is started; it is not saved in the DAQ project.

4.4.4 Assigning CAN signals from a Vector database

☞ This function is only available with MGCplus.

Procedure

1. Click on the **DAQ channels** tab to display the channel list and the **Sensor database** window. Use **Window** (on the right above the ribbon) to display the sensor data-base again if you have closed or hidden the window.
2. Double-click on the required port to display the messages in the loaded Vector database (*Vector CANdb*).
3. Click on the required message.

4. Assign the contained signals (below in the Sensor database window) to the individual channels just like normal sensors.

You may also select several channels in the **Configure DAQ channels** window and assign a signal to the first channel: all following signals will then be assigned to the following marked channels.

If there are several ML71, a signal must be assigned to one of the channels of the plug-in module, into which the relevant CAN database has been loaded.

4.4.5 Change number of sub-channels

This function is only available with MGCplus. With QuantumX/SomatXR you define the number of the possible CAN signals via the Prepare new DAQ project dialog. With QuantumX/SomatXR MX840 you can also define the number of CAN signals when first assigning a CAN signal; see Changing the number of CAN signals.

Procedure

1. Call the **General settings for CAN bus modules** dialog via **CAN configuration** (**DAQ channels** tab, **Special** group).
2. Select the desired plug-in module (slot) by clicking on it.
3. In the dialog click on the **ML71 Channel configuration** tab.
4. Change the number of sub-channels.
5. Click on **Apply** and **Close**.

A restart of the MGCplus device(s) and establishing the connection again with the device(s) is necessary to activate the setting. All existing sensor assignments will be overwritten.

You may therefore decide not to activate the new settings: After closing the window select **No** in the following dialog (do not continue the operation). In this case the new configuration is not activated until you restart the MGCplus.

Before changing anything, save the current settings (menu **File ► Save ► Project**). Then load the project after the restart. Excess or non-existing channels are here ignored.

4.4.6 Send CAN bus messages

In order, for example, to send initialization sequences to other devices so that they send data, specify the CAN bus messages (CPO commands) on the **Bus commands** tab that are to be sent to the CAN bus devices before each start of a measurement (once or cyclically while the measurement is running). You can select some ODB2 commands from the list of commands to send and **Insert** them into the list.

☞ With MGCplus the list of CAN bus messages (CPO commands) is saved with the position (slot) of the ML71 in the device. If the position changes, the list will be deleted. With QuantumX/SomatXR the messages for each module are saved in the catman DAQ project, i.e. each module can use its own messages (and bit rate).

4.5 Using optical sensors

See also Integrating optical measuring devices, Settings for optical measuring devices.

Measurement principle of optical sensors

The optical sensors use fiber Bragg gratings in optical fibers. A wavelength is output as measured value. The change of this wavelength resulting from the fiber Bragg grid under mechanical stress or temperature change is a measure for the strain of the grid. As only the wavelength is outputted from the devices, in catman you must still use a conversion that calculates the strain, temperature etc. from the change in wavelength. You do this via the assignment of a sensor or via a real-time computation. The latter has the advantage that the original wavelengths are still visible, but the disadvantage is that two channels per measuring point are needed (the channel itself and the computation).

ARAMIS channels (GOM testing controller)

The ARAMIS 3D camera is a stereo camera system which supplies 3D coordinates based on triangulation and using stochastic patterns or reference point marks. The GOM (**G**esellschaft für **O**ptische **M**esstechnik) Testing Controller controls the image data and analog value recording and the light management. The system measures samples and components made of any materials by non-contact means based on the principle of digital image correlation. It permits wide-area and spot analysis of samples from just a few millimeters in size up to structural components on a scale of several meters.

Measurements can be performed regardless of the geometry and temperature of the samples. catman has no direct access to the camera, and communicates only with the GOM Testing Controller.
See also www.gom.com/3d-testing.

4.5.1 Activating and configuring QuantumX MXFS channels

See also Settings for QuantumX MXFS, Integrating the QuantumX MXFS, Defining QuantumX MXFS channel layout.

What you see after connecting to a module depends on the module:

1. In the factory default setting, all channels specified in the options are initially deactivated, unless you have activated the **QuantumX MXFS Auto Range Detection** option.
2. If you had already created a project with this device, the most recent device settings are active and the respective channels are activated if they are active in the channel layout.

If no channels are active yet, or the settings do not match the current project, you have to change or redefine the relevant frequency bands. To do this, click on **Configure ranges** (**MXFS optics** group on **DAQ channels** tab). Use the context menu to clear existing bands.

Activating channels, defining ranges

You have several options for defining the frequency ranges (bands):

1. Have catman search for the peaks and define ranges.
   Alter the **Width** as necessary at the bottom of the window and click **Create**, or use the **Create bands automatically** context menu in the graph. The function is the same as Auto Range Detection, but you can set the **Width** parameter yourself.
2. Drag the cursor to the desired area in the graph and click on **Create band here** in the context menu.
   You can also influence the order of the channels if you select a row in the table beforehand. The channel will then be created in that row, i.e. in that channel.
3. You enter the frequency values in the table.

In variants 1 and 2, you can also change the values in the table using the cursor or the sliders below. The threshold is determined by the module's firmware, and is shown for information purposes only.

⚠ The values are initially only displayed in the dialog. You must click **Apply** to transfer the settings to the device and activate them.

Configure each connector of your device and click **Apply** for each connector. The dialog always contains only the data for one connector. Close the dialog when all connectors have been configured with the desired channels. The channels for which you have defined ranges are then automatically activated. Any other still existing (empty) channels remain deactivated, and can also not be activated manually.

Configuring channels, assigning sensors

For sensor scaling you can use the Sensor database, and you have several options on the DAQ channels tab:

1. You can measure the absolute wavelength.
   In the **Sensor/Function** column, use the **Sensor adaptation and wiring diagram** context menu to select the **Wavelength absolute** setting.
2. You compute the relative wavelength (default setting).
   In the **Sensor/Function** column, use the **Sensor adaptation and wiring diagram** context menu to select the **Wavelength relative** setting. The **reference wavelength** is the **reference** specified when defining the ranges. The current measured values are subtracted from it.
3. You compute the strain (requires a suitable sensor).
   In the **Sensor/Function** column, use the **Sensor adaptation and wiring diagram** context menu to select the **Strain** setting. Then specify the **Gauge factor** (k factor) and, if you want, select the type of temperature compensation.
4. You compute the temperature or acceleration (requires a suitable sensor).
   In the **Sensor/Function** column, use the **Sensor adaptation and wiring diagram** context menu to select the **Temperature** or **Acceleration** setting as appropriate. Then specify the values for **Calibration factor S0 … S2**.
5. You specify a suitable polynomial for conversion yourself.
   In the **Sensor/Function** column, use the **Sensor adaptation and wiring diagram** context menu to select the **Polynomial** setting. Then specify the **polynomial coefficients**.

When creating the sensors in the Sensor database, enter the (basic) data there. Then you only have to enter the gage factor, for example, in the dialog. The sensors must be created with the correct range, however, otherwise you will get an error message indicating that there is no suitable band on the connector for the sensor.

☞ The zero balance (zeroing) is also stored in the device, but is only offset against the scaled values of the sensor adaptation, not when a wavelength is displayed. The reference wavelength is not changed. Choose **Reset reference wavelength** (**Zero balancing** group on **DAQ channels** tab) to set the currently measured wavelength as the new reference wavelength.

Temperature compensation

You have two options for temperature compensation:

1. You specify a channel that measures the temperature via a temperature sensor such as Pt100 or a thermocouple.
   You can specify any channel that has already been configured here, even if the temperature is measured by another QuantumX/SomatXR module for example. Only channels that measure temperature can be selected.

   ⚠ The unit of the temperature channel must be °C; other units are not converted.
2. You specify a channel with an FBG compensation sensor.
   The channel with this sensor must already be configured, and it must be above the channel being configured in the channel list, so that its temperature value has already been computed when the channel is computed.

Notes

- The **Disconnect sensor** context menu only removes the sensor definition in the software. Use **Disconnect and reset sensor** to reset the sensor to **Wavelength absolute**. The channel is not deactivated in either case.
- After configuring a channel, you can also have the sensor scaling performed by a computation, and display the absolute values in the channel itself: **Create computation channel from sensor** context menu.

4.5.2 Configuring FS22 BraggMETER channels

See also Settings for FS22 BraggMETERs, Integrating optical measuring devices.

You can configure and perform measurements as usual in catman using a normal DAQ job. The maximum sample rate of the devices depends on the model and lies between 1 Hz and 1 kHz. At a sample rate which is higher than the maximum sample rate of the device you are using, in hybrid systems the relevant last value is repeated until a new value is present.

Procedure

1. Go to the **Optical functions** context tab. The context tab is only displayed when you select the **DAQ channels** tab.
2. Activate the desired connector as required (**CH x**).
3. Deactivate **SPD** (for SI) or **Peak Locking** (for DI).
4. If necessary, click on **Update** so that a new spectrum is displayed in the graph.
   - **Auto scaling** (**Spectrum** group) scales the displayed graph such that all signals are located in the displayed range. Otherwise, specify the range to be displayed with **Y_{min}/Y_{max}**.
   - **Mark data points** (**Spectrum** group) shows you how many measured points have been used to acquire a peak.
   - **Mark peaks** (**Spectrum** group) only marks the recognized peaks.
5. Check whether all the sensors you have used have been recognized.
   Check for correct operation using the **Optical functions** context tab (at **Display spectrum of:** select which connector is to be displayed if your device has more than one connector. The context tab is only displayed after you have selected the **DAQ channels** tab. By default, the graph must be updated manually, as displaying the spectrum is quite slow, and the process load when doing so is very high. You can, however, choose **Update automatically** from the menu ribbon. You can also export the spectra, or save them with .
6. If not all sensors have been recognized, you may have to modify the device settings. With DI, click on **Configure device** (**Configuration** group) and change the details for **Gain** and/or **Threshold**, for example, on the **Connector/Chain** tab. **Relative threshold** means that with respect to the maximum level only the levels lying lower by this amount at the most are still considered for the peaks. Then update the spectrum. Finally, repeat the scan: **New scan** (**Configuration** group).
7. Repeat steps 3 to 7 with all channels (connectors) of your FS22 BraggMETER.
8. Activate Smart Peak Detection (**SPD ON** with SI) or click on **Lock peaks** (with DI) to apply the range option. This means that the defined bands (**Range per peak**) move with the peaks in order, for example, not to lose the sensor during larger temperature changes, because the wavelengths change too much. The original wavelengths of the peaks are saved with **Lock peaks** and are also included in the project file. With Smart Peak Detection, the parameters are not stored in the project, only in the device.
   See also Advanced options.
9. Either assign the appropriate sensors from the Sensor database to the channels (mark channels of the same type and assign all of them to the sensor) or create an

appropriate computation for each channel. You can assign sensors of the same type to several channels: mark the channels and double click on the sensor. You can also create the same type of computation for several channels: Mark the channels and drag them into the computation field.
Then modify the data of the individual sensors using the **DAQ channels** tab and the **Sensor adaptation and wiring diagram** context menu (**Sensor/function** column).
Strain measurement: The **Gage factor** is determined by the fiber and is stated on the strain gage pack. In some cases, the **Sensitivity** or the **Calibration factor** is specified instead of the gage factor. catman detects based on the differing magnitude which entry is meant, and converts the value accordingly. If available, also specify the type of **temperature compensation** and then complete the required fields.

Temperature measurement: Specify the **Type of temperature determination**. The appropriate values for the fields then displayed, for example the $\Delta\lambda/\lambda_0$ are stated on the pack.

10. Carry out zero balancing (*Zero balance*) with the original channels if you are working with sensors, otherwise with the computation channels.
11. Deactivate any channels you do not need (diagnostic channels) for the DAQ jobs.

Notes

- If you are operating an FS22 BraggMETERs together with other devices with different sample rates, at least one channel of QuantumX, SomatXR or MGCplus must be active in the same sample rate group which the FS22 BraggMETER is using. The sample rate does not have to be available in the FS22 BraggMETER; catman recomputes the measured values accordingly.
- Some functions, e.g. TEDS or Sensor scan, are not available for the channels of these devices.
- With DI, the device parameters such as **Gain** and **Threshold** are constituent parts of the catman DAQ project.
- To convert from wavelength to strain or temperature, the Optics formula collection is also provided; see Formula collection.
- Further information can be found in the operating manual for your device and in the catman Knowledge Base (via **Help ► Knowledge Base** at the top right of the program interface).

4.5.3 Using ARAMIS channels (GOM testing controller)

See also Settings for ARAMIS (GOM Testing Controller), Integrating optical measuring devices.

catman communicates exclusively with the PC on which the testing software is running (GOM Testing Controller). All channels defined there, the NTP time channel and the Diag_Sec_Number channel are displayed. It is not possible to configure the channels in catman.

Diag_Sec_Number is a sequential numbering of the received data packets. Missing numbers would indicate lost data.

catman cannot carry out any configuration on the Testing Controller, and in particular cannot change the sample rate. So, make sure that the sample rates set in catman and in the Testing Controller for deformation tracking are identical.

Notes

- Exit catman before stopping deformation tracking.
- catman cannot check whether the configuration of the Testing Controller still matches the one in the catman project.
- You must create a new catman project if the Testing Controller configuration changes.
- Note that the Testing Controller's sample rate is not guaranteed in all circumstances. Interference on a camera image or a high CPU load might reduce the sample rate for example. We therefore recommend dragging the REL_TIME channel onto the x axis of the graph with the Testing Controller data in order to obtain a correct display. The channel contains the NTP time for each data packet sent by the Testing Controller. The NTP time is in UTC and seconds since 1.1.1970 (**C**oordinated **U**niversal **T**ime, i.e. world time, corresponding to Greenwich Mean Time [London time]).

4.6 Use GNSS channels (GPS)

See also Additional devices (adding devices manually), Add additional devices, Synchronization in case 2: different devices (hybrid system).

With an NMEA-0183 compatible GNSS device, for example, you can get the following channels (up to 15 channels are possible):

- Geographic longitude [-180 degrees (west direction) to 180 degrees (east direction); up to 6 decimal places are relevant].
- Geographic latitude [-90 degrees (South Pole) to 90 degrees (North Pole)].
- Height above SL (**S**ea **L**evel, here the NMEA message GPGGA must be sent by the device).
- Speed over ground.
- Time channel (UTC date and time, i.e. **C**oordinated **U**niversal **T**ime, corresponding to Greenwich Mean Time [London time]).
- Wind speed and direction.

Depending on the device, further channels may be available. Make sure that the device automatically sends the NMEA data.

Recommended devices

- Navilock GNSS, e.g. NL-8002U USB 2.0, HBM ordering no. 1-GPS-18HZ
- Navilock NL-602U GNSS (USB, GPS and Glonass)
- GARMIN GNSS 18-5 Hz (RS-232)
- GARMIN GNSS 19x HVS (RS-232)
- GARMIN GNSS 35 tracpak (RS-232)
- Racelogic VBSS 5/10/20/100 Hz (RS-232)
- Racelogic VBSS GPS-Speed Sensor 100Hz (RS-232, CAN)

catman reads GNSS device data at approximately 10 Hz. If the device delivers fewer measured values, the last received values are repeated until a new data set has been transferred. A maximum of 20 Hz is useful if you reduce the **Time between two data transfers** under Data transfer and error handling, and the GNSS device is able to deliver it. Use Analysis mode and the Interpolation function to convert to higher sample rates. Higher data rates can possibly be achieved with a GNSS device that has a CAN bus interface and is connected via MX471 or MX840B. With a CAN bus, we recommend using a dedicated port only for the GNSS or IMU (Inertial Measurement Unit) device, if possible.

☞ You must use GNSS or IMU devices together with other measuring devices (QuantumX/SomatXR, MGCplus).

The **Channel info** component window can display the original messages (NMEA Sentences) of GNSS data. To do this, select one of the GNSS channels and click **Start** to start logging messages.

Detailed information on the functioning and connection to QuantumX/SomatXR of various GNSS sensors can also be found in the document “TN063_HBK_QuantumX-SomatXR_GNSS-IMU”, which you can download from the HBM website:

www.hbm.com/downloads ► Firmware & Software ► QuantumX CX22B-W ► Tech Notes ► "Integrating GPS / GNSS / IMU Sensors into QuantumX or SomatXR Data Recorder for Mobile Data Acquisition and Map Based Data Analysis". It also lists other manufacturers of GNSS and IMU equipment.

Background information

A GNSS (**G**lobal **N**avigation **S**atellite **S**ystem) requires at least three satellite signals to provide data. Four satellites are needed to determine the height above SL (Altitude). The more satellites are received, the higher the accuracy of the positional data. Therefore, position the GNSS receiver such that it has a view of the sky as free as possible so the satellites can be received without hindrance.

catman evaluates the following GNSS data (sentences), provided they are transmitted:

- GPRMC
  This information should always be sent; it contains Latitude, Longitude, Speed, UTCTime/Date, SatStatus and True heading.
- GPGGA
  This information can also be present alone, i.e. without GPRMC. It includes Latitude, Longitude, Altitude, Satellites and UTCTime.
- GPVTG
  This information includes True heading and Magnetic reading.
- MWV
  This information includes Wind speed (in m/s) and Wind direction (in degrees, i.e. °).
- A sentence which begins with % is also evaluated and includes Pitch, Roll and Yaw, but is however rarely present.

All other NMEA sentences are ignored.

4.7 Assign channel names and colors

Channel names

Use unique channel names, as you will be selecting channels by name, for example in the graphs. Alternatively, you can also use the sensor description as the channel name. If this is done automatically when assigning the sensors, choose **Accept from sensor database** or **Accept from TEDS**; see Sensors (Program options, **Channels and sensors** group). A retrospective change is nevertheless possible.

To change names, give a double click in the **Channel name** column or mark the channels (⇧ or Ctrl key) and select **Rename** (**DAQ channels** tab, **Channel** group or in the context menu). In the dialog, you can then either *Apply* the sensor designation or generate *Automatic numbering*. You can also assign a channel comment here. The length of the comment is not limited. The comment is displayed when you place the cursor over the channel in the **Channel name** column.

You can also import channel names (and sensors/sensor types) from an Excel file.

Restrictions and notes

- Channel names must be unique. If you try to assign a channel a name that already exists, you see a dialog box: You can either rename the existing channel (you see various options for renaming) or choose a different name for the current channel.
- Double quote marks (**"**), comma (**,**), colon (**:**) or tilde (**~**) are not allowed.
- The channel name must contain at least one letter, pure numbers are not admissible.
- The channel name must not consist of c and a number, e.g. **c1** or **C3** is not allowed.
- The channel name must not be identical to the (internal) name of a math function, i.e. **Deriv**, **Mod**, **Integral** etc. are not admissible. Combinations featuring these terms (without blanks) are allowed however, e.g. **Integral_of_force**.
- We recommend that no round or square brackets, blanks or dashes (minus signs) are used in channel names; use an underscore ("_"), for example, instead. Otherwise, this might lead catman to reject a calculation as invalid.

Automatic channel colors

You can assign any channel a color by which it is identified in visualization objects, such as graphs (the option is enabled by default). The color assignment is also restored when saved measurement data is loaded. The option **Default color of plots** (menu **File ► Options**, **Channel list**) determines, whether the column is displayed and the option **Use channel colors as default for plot colors** (menu **File ► Options**, **Panels**) determines whether the color is used. You can also use one color for multiple channels, e.g. red for all force transducers, blue for pressure transducers.

See also Program options: Channel list, Panels.

4.8 Import channel name and sensor assignment from Excel

If you have an Excel file holding channel names (and the names or IDs from the Sensor database for the connected sensors), you can transfer the data or parts of the data to catman. Provided you are using XLS files (Excel 97-2003 workbook), Excel is not required on the PC. When using XLSX files, Excel must be installed on the PC.

Procedure

1. Click on the **DAQ channels** tab if it is not the active tab.
2. Using **Excel import** in the **Special** group, open the **Import channel parameters** component window.
3. Select the Excel file with **Open** in the component window.
4. In the component window, mark the column which contains the channel names (click on the header line).
5. Select **Channel name** in the drop-down pick list. The header then contains the description **Channel name**.

   ☞ Reselect the entry, even if it is already displayed. The setting has only been accepted by catman when the header line in the Excel table contains the name and replaces the normally displayed letter.

6. If available, mark the column that contains the sensor types.

   ☞ The texts in this column must match the texts in **Name/description** given in the Sensor database.

   Select **Sensor type** in the drop-down pick list. The header then contains the description **Sensor type**.
7. In the list of channels (**Configure DAQ channels** window), mark the first channel of the range for which you wish to import the data.
8. In the **Import channel parameters** window mark the range that you want to assign (use ⇧) and click on **Apply**.

The channel names will be assigned and a search will be made through the Sensor database. If the sensor is available in the Sensor database, the channel will be adjusted accordingly. You will receive an error message if:

- Sensors are not found,
- Not all required settings can be carried out,
- A sensor type on the channel entered cannot be used,
- A channel name exists already or has been issued twice.

4.9 Test signal (only QuantumX/SomatXR)

See also Computation Signal generator.

With a test signal you can output a constant value or a function in the relevant channels of MX modules. The values are recorded like normal measured values and—if the connection to the channel is question is configured as the source for another channel—is relayed to other modules.

Configure and activate test signal

1. On the **DAQ channels** tab select the channel you want to output the test signal.
2. Choose **Test signal** from the context menu of the **Sample** column.
3. Select the **Mode**: **Off**, **Constant**, **Rectangle**, **Sine** or **Triangle**.
4. Enter the **Value** (constant only) or specify the **Level** for the minimum and maximum amplitude. In the case of periodic signals also specify the **Frequency** and **Duty cycle** (only practicable in rectangle and triangle modes).
   Example: **Triangle** with a **Duty cycle** of **99.9** (%) produces a sawtooth signal.

When the test signal is active the connector LED flashes and the **Sample** column displays .

The signal remains active until you call up the dialog again and set **Mode** to **Off** or restart the module. The test signal configuration is not saved in the DAQ project.

4.10 Digital input channels

See also Start and End of measurement, Limit and event monitoring, Splitting a digital input, AutoSequences, EasyScript.

QuantumX/SomatXR

The digital inputs and outputs of the MX879 are detected from firmware 4.0 of QuantumX and for SomatXR; they are acquired with the stated sample rate and displayed as 32 channels. You configure the digital inputs and outputs of the MX879 with **Configure digital I/O** (**On-Board** group on the **DAQ channels** tab).
See also QuantumX/SomatXR On-Board-functions.
You can use the digital inputs of CX22, CX27 and MX879 as trigger channels when starting/terminating the measurement, for limit and event monitoring, in AutoSequences and in EasyScript.
You can also display the status of a digital input directly in an LED.

Disable zero balancing for digital inputs. You can then use the **Zero balance all hardware channels** function (**Zero balancing** group in **DAQ channels** tab), and do not have to select individual channels.

MGCplus

The digital inputs of the ML78 are detected, processed as a bit mask (16 bits) and acquired at the same time as the measurements. Use the function *Split digital input* to extract the individual bits.

The digital inputs of the single channel plug-ins (bits 0 to 7) can only be used in AutoSequences and in EasyScript. The inputs of a CP42 are also available for the limit value and event monitoring or for starting/terminating the measurement (in this case also CP22). With the single channel plug-ins specify the catman channel which also includes the analog input (transducer) and with the CP42/52 specify the device.

PMX

The digital inputs of an PX878 are detected, processed as a bit mask (8 bit) and acquired at the same time as the measurements (slot 10, sub-channel 1) Use the function *Split digital input* to extract the individual bits. You can also use the inputs for starting/terminating the measurement, for limit and event monitoring, in AutoSequences and in EasyScript.

4.11 Digital output channels

Digital outputs can only be addressed by Limit values and events, AutoSequences and EasyScript.

QuantumX/SomatXR

You can use the digital outputs of CX22, CX27 and MX879 for limit value and event monitoring, in AutoSequences and in EasyScript.

You configure the digital inputs and outputs of the MX879 with **Configure digital I/O** (**On-Board** group on the **DAQ channels** tab).

See also QuantumX/SomatXR On-Board-functions.

MGCplus

For the digital outputs of an ML78 with one or two AP75s no separate catman channels are created for the digital outputs. Therefore, specify the catman channel which was created for the digital inputs.

The digital outputs of single channel plug-ins (bits 0 to 3) can only be addressed by Auto-sequences and EasyScript, and the outputs of a CP42/52 only by limits and events. With the single channel plug-ins specify the catman channel which also includes the analog input (transducer) and with the CP42/52 specify the device.

PMX

You can use the digital outputs of a PX878 (slot 10, sub-channel 2) for limit value and event monitoring, in AutoSequences and in EasyScript.

4.12 QuantumX/SomatXR On-board functions

☞ Apart from the digital inputs and outputs, the relevant channels and the **On-board functions** group on the **DAQ channels** tab are only visible if, *before* the start of a new project or loading an existing one, the following option is activated: **QuantumX/SomatXR: Use On-Board math** in the device search options. You can access the options, for example, via the **Measure** menu in the catman start window by choosing **Select device type, interface and additional hardware options** and **Options**. Once connection has been made to a device, the channels in catman are initially deactivated. In the MX Assistant Help you will find detailed descriptions of the functions.
See also Advanced options.

⚠ The modules must be connected via FireWire and the *Isochronous data transfer* must be activated for all signals which are to be used as source signal for another module. In this way the data interchange between the various modules is activated and it is thus ensured that the relevant values are transmitted over FireWire and the other modules are available. The activation is carried out automatically when creating computations in catman; you can also carry them out via the **DAQ channels** tab and **Active** (**Channel** group). If the **ISO** column is displayed, one click in this column is sufficient.
See also Program options: Channel list.

Configure math functions

1. Mark a math channel.
2. Call the dialog for configuration with **Configure math** (**Configure** in the **On-Board functions** group).

Different dialogs are shown depending on the selected channel (**Settings for computation of RMS value**, **Peak value configuration**, **Configure summation/multiplication**, **PID controller** or **MX460 rotation analysis**).

3. Drag the source channel(s) from the channel list out of the **Channel name** column onto the **Input channel x** field(s) or select the channels from the field in the dialog.

   ☞ The isochronous data transfer is automatically activated.

4. **RMS value**: Define the time window for the computation.
   Peak values: Define the desired function.
   Summation/multiplication: Enter the coefficients for the desired formula.
   PID controller: Enter the values for the coefficients K_p, T_i and T_d as well as the setpoint value, or specify an MX channel if you want to use a dynamic setpoint. Two segments of catman are supported.
   Rotation analysis: Specify which function is to be used and define the frequency of the high-pass filter and the scaling factor.
5. Click **OK**.

Configuring analog outputs (MX878, MX879, MX410)

With the MX410 you can only define the scaling; the outputs are permanently assigned to the four inputs.

1. Mark the module with the analog outputs which you want to configure.
2. Call the dialog for configuration with **Configure analog outputs** (**Configure** in the **On-Board functions** group).
3. MX878 only: Drag the source channel from the channel list out of the **Channel name** column onto the **Source** field or select the channel from the **Source** field in the dialog.

   ☞ The isochronous data transfer is automatically activated.

4. By way of the value pairs X_1/Y_1 and X_2/Y_2 you can define the scaling. Check whether the suggested scaling corresponds to your requirements.
5. MX878 only: Specify the filter to be used. The default setting **Off** uses the maximum channel bandwidth.
6. Check that the desired analog output is also switched to active: ☑ in the **Active** column.
7. Click **OK**.

Configure digital I/O (MX879)

1. Mark the module with the digital inputs/outputs which you want to configure.
2. Call the dialog for configuration with **Configure digital I/O** (**Configure** in the **On-Board functions** group).
3. Define which module pins are to be used as input and which as output. With digital outputs you can select the output level by clicking on **Off** or **On** in the **Status** column.
4. Click **OK**.

Configuring MX460 gate monitoring

⚠ The function is only practicable if you are using *one* MX460 and one or more MX410 devices in a *QuantumX backplane*. The function cannot be used with modules which are only connected via FireWire.

The MX460 module can monitor whether a signal on one of its four inputs, which is provided by an angular sensor (incremental sensor with values between, for example, 0 and 360°), lies within a certain angular range. With each entry into this angular range a certain output connected to the mainframe unit is set to TTL HIGH and with each exit the output is again set to TTL LOW. Up to four angular ranges can be monitored and the monitoring can relate to four different channels or the same channel. The MX410 modules are controlled via the mainframe with these signals: HIGH resets the peak-value memory (**Reset** and **Run**) and LOW retains the last peak value (**Hold**). After each exit the corresponding channel of the MX410 therefore contains the peak value which has occurred within the angular range.

Procedure

1. Mark a math channel of the MX460.
2. Call the dialog for configuration with **Configure MX460 gate monitoring** (**Configure** in the **On-Board functions** group).
3. Activate the gate function (**Active** column).
4. Select the source channel from the field in the dialog.

   ☞ You can only select MX460 channels.
5. Specify the angular range to be monitored: **Gate entry** and **Gate exit**.
6. Click **OK**.
7. Specify the channel(s) of the MX460 relevant to the MX410 which are to handle the control of the peak value function (see above).

Notes

- CAN signals cannot be used as sources for functions.
- Some modules can only process their own signals, not the signals of other modules. You will find details in the operating manuals of the relevant modules.
- Zeroing is also possible with the math functions, but not with the peak value functions. You can, however, inhibit the zeroing of a channel via **Lock** (**Zero balancing** group in the **DAQ channels** tab).
- Further information about the On-Board functions of QuantumX/SomatXR and the possible settings can be found in the help for the MX Assistant.

4.13 Time channels in catman

There are two basic types of time channels:

1. Software time channels are the default time channels in catman.
2. Hardware time channels are time channels that are transferred from the connected devices like measured values.
   See also Hardware time channels.

In catman (software) time channels are recorded in the background by default, and are always saved when saving the measurement data. One to three time channels are recorded, depending on how many sample rate groups are active. The calculation of these times is based on the preset sample rate. The time channels are not required by catman itself however: To display a channel in a graph, simply drag the channel into a graph. catman then calculates the time channel for the graph from the sample rate of the channel. This corresponds to the **Time from sample rate** channel displayed in the list of DAQ channels on the **Visualization** tab. If you want to see the actual time since a triggered measurement was started, for example, you need to drag the (software) time channel onto the X axis. Otherwise, if you have overwritten a graph's defaults, drag the **Time from sample rate** channel onto the X axis.
See also Channel list options on how to display the time channels in the channel lists.

4.14 Computation channels

ℹ See also Restrictions on channel names.

☞ You activate the display of the group with the dialogs for the computation functions via the menu **File ► Options**; see Program function options. The function can be locked with password protection, refer to Sensor options, Password protection.

Computation channels enable you to:

- calculate using all measured values of one channel already during the measurement acquisition with the measured values of another channel or with other computations.
- use functions such as integration, differentiation, sine, cosine, etc. on channels.
- determine the effective value of a signal.
- check conditions (measured value greater than ... ?).
- convert measured values from strain gage rosettes into voltages, angles etc. while the measurement is ongoing.
- implement additional filter functions.
- calculate a moving average or the average (mean) value over a specific period of time.
- calculate the electrical power of a signal.
- compensate for the phase delay of filters.
- determine the number of cycles in the case of periodic signals (e.g. in material analyses).
- determine minimums and maximums in the case of periodic signals (e.g. in material analyses).
- monitor specific ranges of the measurement signal (sector monitoring).
- convert the change in wavelength of optical strain gages into strain.
- generate new signals (signal generator).
- import existing measurement data from a file and process them simultaneously with new measured values.

You can define computations of computations or enter complex formulas as on a pocket calculator, which are then analyzed during the measurement for each measured value.

☞ You can also use channels with different sample rates in one computation. The sample rate of the first channel is used in the formula as the sample rate of the result channel.

Activate **Live display ► Measure computation channels** in the **DAQ channels** tab (**Channel** group) to update the computation channels when you require a live display of the computations.
You can also create many calculations for multiple channels: simply drag multiple channels into the field with the input channel(s), or highlight multiple channels and click on next to the field for the input channel.

4.14.1 Define/change computation channels in DAQ project

To create a computation channel, select **Create** in the **Computation channels** group (**DAQ channels** or **Signal plan** tab). In the **Edit computations** window, you have a number of tabs with the various computation functions. Define the computation you want and then click on **Create computation**. Click on **Close** (at the top right of the Panel) to see the full channel list again.

You can also create many calculations for multiple channels: simply drag multiple channels into the field with the input channel(s), or highlight multiple channels and click on next to the field for the input channel.

You can also import computation channels from other projects: Menu **File ► Import ► Import computation channels**. The import overwrites all existing computations, so carry out the import before defining new computations.

If you want to use a computation in another computation, you must create the second computation in the order of the channels *after* the first computation. Otherwise you will see an error message when you start a DAQ job, and the channel will be disabled in all jobs.

You can change the order of computation channels: Click in the *first* column of the channel list and drag the channel in question to a different position in the channel list using the mouse. Alternatively, you can also cut a computation and paste it in front of a highlighted channel.

Assign channels

You have two options for assigning channels for most computations:

- by drag & drop from the **Channel name** column;
- by clicking on to insert selected channels.

In most functions you can also define the computation for multiple channels, provided you use [⇧] or [Ctrl] when selecting the channels to compute or separate the channels by **;** (semicolon). In these cases, "computation_type_channel_name[index]" is used as the name of the computation, but you can also edit names retrospectively: Select the computation from the channel list (**Channel name** column) and choose **Rename** from the context menu.

Changing a computation

To modify a computation, select the computation from the channel list (**Channel name** column) and choose **Edit computation** from the context menu or use **Edit** in the **Computation channels** group. Make your changes and then click on **Apply changes**, or on **Close** if you do not want to make any changes.

To change the parameters for multiple computations of the same type simultaneously, select all the relevant channels (by [⇧] or [Ctrl]).

Notes

- If you define a constant, i.e. a computation, which does not contain any measurement channels, a fictitious sample rate is saved. In a graph this can lead to the time relationship to other channels not being correctly represented. Therefore, in such cases, use a definition which includes a channel with the desired sample rate without taking the value into account, e.g. `y = x + (0 * Channel z)`.
- Via the menu **File ► Options**, you can also deactivate the possibility of defining new computations; see Program function options (**System** group). Computations which have already been defined are retained and will also be executed.

4.14.2 Algebra and formulas (computations)

The **Algebra and formulas** tab offers you several options:

1. Input via the **Formula editor**.
   The formula editor provides the greatest degree of freedom in formulating computations. Enter your formula as on a pocket calculator, e.g. **(MGCplus_1_CH1 + MGCplus_1_CH2)/2**. All measured values of the channels MGCplus_1_CH1 and MGCplus_1_CH2 are added together and the sum is divided by 2. The result is written to a new channel, the computation channel.
   The formula editor also allows you to include values of input objects on Panels in

computations.
Frequently used formulas can be saved to a *formula collection*.

2. Input via **Predefined formulas**.
   The advantage of this form is that the computations are made faster. This makes it useful in time-critical cases, provided the required computation function is available here.
3. Use a table or a polynomial for **Linearization** of characteristic curves.
   Select the desired function and enter the table values or the coefficients of the polynomial as appropriate. In this way can linearize a characteristic curve without having to change the characteristic sensor values from the Sensor database. As a result, the original measured values and the linearized values are available to you after the measurement.
4. Compute current minimum or maximum from multiple channels or compute the dwell time of a channel with **Statistics**.

Computations that you enter using the formula editor require more processing power and time than the predefined formulas. If a computation exists in one of the other groups, you should preferentially use it.

☞ Don't forget to give the new channel a name. Entering a unit is optional.

4.14.2.1 Formula editor

⚠ You always have to enter rational numbers in the **Edit expression** field with a decimal point, not with a comma. The comma is used as a separator for the parameters with some formulas and must therefore not be used for numbers.

Drag the channels you want into the **Edit expression** field. The channel is always inserted at the cursor position and will replace marked text. With drag and drop from the **Channel name** column it is ensured that no typing errors appear in the channel name. Otherwise specify computations as you would enter them on a pocket calculator.

 clears the **Edit expression** input field.

The **Additional functions** *dropdown box* offers you additional computation functions.

Click on  to transfer the selected function into the **Edit expression** field.

Formula collections

Add frequently used formulas to a formula collection so as not to have to keep entering them repeatedly. You can create multiple formula collections.

creates a new formula collection. The file path and name are displayed below the formula collection's input field.

adds the formulas from the currently loaded formula collection currently displayed in the editor. Enter a name for the formulas so as to be able to retrieve them quickly from the formula list in the collection. The description is optional, and is displayed as a tooltip when you move the cursor over a selected formula.

opens an existing formula collection. The file path and name of the currently loaded formula collection are displayed below the formula collection's input field. The supplied formula collection OpticalFormulas in the Templates folder of the catman working directory contains formulas to convert the wavelength of optical strain gages into strain or temperature.
See also Folder options, Working directory.

Inserting values of input objects into computations

Use one of the following functions:

- **Panel input**: input(object name) contains the current value of an object, e.g. the position of a controller or the content of a text box.
  See also Controller, Developer tools (objects for predefined actions, clone actions, AutoSequences and EasyScript).
- **Cursor position X**: cursorx(graph name) contains the current x position of the (first) cursor in the graph.
- **Cursor position Y**: cursory(graph name) contains the current y position of the (first) cursor in the graph.
- Only available with the EasyScript module: procvar(variable name) contains the current value of a process variable. The otherwise usual percent sign (%) before and after the name is omitted here.

You should include a channel in the computation, multiplied by zero if necessary, to define the frequency of the computation. Otherwise the channel is computed with the highest used sample rate.

Don't forget to activate *Execution mode*. Nothing is computed in Design mode.

Example

```
input(BAR_1) + MX840_CH 1 * 0
```

This means that the input of the controller `BAR_1` is accepted and saved with the sample rate of MX840_CH 1.

4.14.2.2 Predefined formulas

This area contains a number of frequently used computations, such as to add or subtract channels or calculate the derivation of a channel. The computations are made faster, meaning they need less processing power than an identical computation that you enter via the formula editor.

Split bitmask (digital input)

ℹ See also Digital input channels.

All digital inputs of a ML78 with AP75 (MGCplus) or of a PX878 (PMX) are combined into a bit mask (max. 16 bits) and assigned to one catman channel. The input signals are acquired at the same time as the measurements.

This tab provides the **Bit test** special function in the **Formula editor** area: You can use it to split a bit-mask channel, i.e. extract the individual bits in their own result channels.

QuantumX/SomatXR

The digital inputs of the MX879 are detected from firmware 4.0 of the QuantumX and with the SomatXR; they are displayed as 32 channels. Therefore, splitting is not necessary here.

MGCplus

For ML78, 8 bits are available for each AP75, i.e. with two AP75, 16 bits are available. The inputs on the single channel plug-in modules are only supported by AutoSequences and EasyScript.

PMX

Per device with PX878, one channel (slot 10, sub-channel 1) with 16 bits is available.

4.14.2.3 Linearization

This section permits linearization by way of a table or polynomial, for example if you want to apply the values of a sensor unscaled, or if you want to reduce the measurement error of a thermocouple. If you have the linearization values in a table, you can paste them from the clipboard. Alternatively, you can save the values to a file and reload them from there. In the table, specify the x values in ascending order.

☞ The values cannot be measured. You must determine the relevant values beforehand, such as by a push-button measurement (with **Manual control** of the storage; see Storage mode).

4.14.2.4 Statistics

The function calculates the current minimum or maximum of multiple channels.

It also provides a simple means of determining the dwell time. The function calculates how long the signal is in a specific amplitude range. You will find dwell time calculations with multiple ranges (classes) in real-time computation Class counting.

4.14.2.5 Mathematical functions

☞ The instruction can differ from the descriptive text in the **Further functions** pick list, e.g. the formula syntax `floor(` is produced for **Next smaller integer**.

Derivation, deriv

deriv(Arg1, Arg2) computes the derivation of channel Arg1 to channel Arg2. Only channels are allowed as parameters.

Example

```
deriv(Chan_Force, Chan_Displacement)
REM Computes the derivation of the force over the dis-
    placement.
```

ABS (absolute value)

abs(Arg) computes the absolute value of Arg.

Examples

```
abs(-25.3)    REM results in 25.3
abs(32.79)    REM results in 32.79
```

acos, asin, atan (inverse trigonometrical functions)

acos(Arg) computes the angle for the specified cosine, asin(Arg) computes the angle for the specified sine and atan(Arg) computes the angle for the specified tangent. The result is given in radians (rad).

Examples

```
acos(0.7604)    REM results in 0.7069 = 40.5°
asin(0.7604)    REM results in 0.8639 = 49.5°
atan(0.7604)    REM results in 0.6501 = 47.25°
```

AND, Boolean operator

Returns 1 if the arguments on both sides are true, otherwise 0.

See also OR.

Examples

```
1 AND 1   REM results in 1
1 AND 0   REM results in 0
```

Bit test

bit(Arg, BitNr.) tests whether a specific bit is set in the argument. For this the argument number is converted into a 32 bit integer. The lowest bit is bit 0. Both numbers and channels are permissible as argument. Produces 1, if the bit is set.

In DAQ mode the function is identical to splitting a digital input.

Examples

```
bit(25, 3)
REM The result is 1, because the third bit (2^3) is set (1 +
    8 + 16 = 25).
bit(25, 2)
REM The result is 0, because the second bit (2^2) is not
    set.
```

ceil

See Next smaller integer.

cos

See sin, cos, tan (trigonometrical functions).

RMS value

☞ The function is only available in DAQ mode. In analysis mode, use the Filter and **RMS over time window** function.
Alternatively, in DAQ mode, you can also use the Filter: **RMS** function, which provides additional low-pass filtering and is faster.

rms(Chan, dt, T) calculates the RMS value of a signal. Specify the time **T** in milliseconds which is to be used for the computation. For the parameter **dt** you can either specify the interval between two measured values (1/sample rate) in milliseconds or 0; then the value is automatically determined from the channel sample rate. Specifying a parameter value not equal to zero is only necessary if an auxiliary channel (AutoSequence, EasyScript) or a computed channel is involved for which no DAQ channel is included in the computation and so no sample rate can be determined.

Example

```
rms(Chan_Force, 0, 500)
REM Produces new function values every 500 ms. The values
     are produced with the sample rate of the Chan_Force
     channel.
```

EXP (exponential function)

exp(Arg) computes the value of the exponential function (e function) for the specified operand.

In DAQ mode the function is also available as a predefined formula.

Example

```
exp(5)   REM results in 148.413
```

floor

See Next smaller integer.

If (condition)

if(condition, TRUE, FALSE) outputs, depending on the condition, either the expression for TRUE or the one for FALSE. Both numbers and channels are permissible as arguments.

Examples

```
if(Channel1 > 0, Channel1, -1 * Channel1)
REM This computation rectifies the signal
if((Channel1 > 350) OR (Channel2 > 740), 1, 0)
REM With this computation you can monitor multiple con-
     ditions using a trigger. Trigger on this computation
     channel, once the value is greater than 0.5.
```

Integral

integral(Arg1, Arg2) computes the integral of channel Arg1 over channel Arg2. Only channels are allowed as parameters.

Example

```
integral(Chan_Force, Chan_Displacement)
REM Computes the integral of the force over the dis-
     placement.
```

INT (integer)

With a computation in DAQ mode int(x) cuts off the decimal places from x. This method is used here to speed up the computation. In Analysis mode, int(x) rounds an argument to the nearest whole number.

See Floor/Ceiling.

Examples for DAQ mode

```
int(2.3)   REM results in 2
int(2.8)   REM results in 2
int(-2.8)   REM results in -2
int(-2.1)   REM results in -2
```

Examples for Analysis mode

```
int(2.3)   REM results in 2
int(2.8)   REM results in 3
int(-2.8)   REM results in -3
int(-2.1)   REM results in -2
```

LN, LOG (logarithm)

ln(Arg) computes the natural logarithm, log(Arg) computes the logarithm to the base 10. If the argument Arg is smaller than or equal to 0, this will result in a run-time error.

In DAQ mode the log() function is also available as a predefined formula.

Examples

```
log(100)   REM results in 2
ln(100)   REM results in 4.605…
```

Max/Min

max(Arg1, Arg2) determines the greater, min(Arg1, Arg2) determines the smaller of two numbers. Both numbers and channels are permissible as arguments. However the channels must be acquired with the same sample rate, because in each case the measurements are examined at the same point in time.

See also Statistical functions.

Examples

```
max(25.3, 27)   REM The result is 27
min(25.3, 27)   REM The result is 25.3
```

Use the display mode **Minimum** or **Maximum** of a Digital indicator, if you want to obtain the extremum over a complete DAQ job.

Modulo division, mod

The modulo division Arg1 mod Arg2 finds the integer remainder from the division of two integer numbers. If you specify floating point numbers, the decimal places are not considered. Both numbers and channels are permissible as arguments.

Example

```
14 mod 3
REM Since only 12 or 15 is divisible by 3, 2 is left as the
     result (indivisible remainder)
```

Next smaller/greater integer, floor, ceil (round)

floor(Arg) rounds Arg to the next smaller integer. The arithmetic sign of Arg is considered in this case.
See also INT.

Examples

```
floor(2.3)   REM results in 2
floor(2.8)   REM results in 2
floor(-2.8)   REM results in -3
floor(-2.1)   REM results in -3
```

ceil(Arg) rounds Arg to the next higher integer. The arithmetic sign of Arg is considered in this case.

Examples

```
ceil(2.3)   REM results in 3
ceil(2.8)   REM results in 3
ceil(-2.8)   REM results in -2
ceil(-2.1)   REM results in -2
```

OR (Boolean operator)

Returns 1 if one of the arguments on both sides is true, otherwise 0.
See also AND.

Examples

```
1 OR 0   REM results in 1
0 OR 0   REM results in 0
```

PWR (power function)

Raises the operand preceding the operator ^ to the power specified in the subsequent operand.

Example

```
2^3   REM results in 8
```

sin, cos, tan (trigonometrical functions)

sin(Arg) computes the sine, cos(Arg) the cosine and tan(Arg) the tangent. The argument Arg must be given in radians (rad).

In DAQ mode the functions sin() and cos() are also available as predefined formulas.

Examples

```
sin(1.5708)   REM results in 1
cos(1.5708)   REM results in 0
tan(0.7854)   REM results in 1
```

SQRT (square root)

sqrt(Arg) computes the square root of Arg. If the argument Arg is smaller than or equal to 0, this will result in a run-time error.

Example

```
sqrt(9)   REM results in 3
```

Statistical functions min/max/mean value and standard deviation across entire data set

The functions calculate these statistical values across an entire data set. Not just one value is stored, however, but usually as many as the data set or another channel contains. You must therefore include a channel in the computation, multiplied by zero for example, to define the frequency of the computation.
See also Max/Min.

Example

```
cstd(channel1) + 0*channel1
```

System time

☞ The function is only available in DAQ mode.

Outputs the elapsed time in milliseconds since the PC was started.

Random number, rnd

rnd(Arg1) returns a random number between 0 and 1. If you frequently require the function, you can determine the starting value of the random sequence generated by the PC via the entry of a number for Arg.

Examples

```
rnd(5)
rnd()
```

4.14.2.6 Mathematical operators

You can use the following operators within mathematical expressions.

Brackets

Use brackets around numerical expressions or function arguments or to enforce a specific analysis sequence.

Examples

```
sin(%P1%)
(%P1% + 5) * 2    REM without brackets %P1% + 10 would be
calculated
```

Boolean operator: AND

Logical AND. The expression is 1 if both expressions on the left and on the right-hand side of the operator are true (equal 1), otherwise 0.

Example

```
%MaxTemp% > 100 AND %MaxPressure% > 50
```

Boolean operator: OR

Logical OR. The expression is 1 if either the expression on the left or on the right-hand side of the operator is true (equal 1), otherwise 0.

Example

```
%MaxTemp% > 100 OR %MaxPressure% > 50
```

Less than, greater than, equal to, not equal to, etc.

Less than (<), greater than (>), does not equal (<>), equal to or greater than (>=), less than or equal to (<=). The expression is 1 if the condition is met, otherwise 0.

The equal operator (=) compares the expressions to its right and left. Results in 1 if both expressions are mathematically equal, otherwise in 0.

+, -, *, /

Add (+), subtract (-), multiply (*), divide (/). If when dividing the divisor = 0, this will result in a run-time error.

Additional text operators for AutoSequences (chaining text, compare)

You can use the following operators with AutoSequences in expressions with texts (in double quotes) or with process variables containing text.
See also Formula expressions in assignments.

In these cases do not use any mathematical operators and functions, because "TEST_" & %Counter% + 1 with a value of 3 for %Counter% would produce the text **TEST_3 + 1**. The value of %Counter%, increased by one, is *not* appended to TEST_ as would normally be the case with the expression %Counter% + 1.

Chaining text

The operator & chains texts with process variables. Use the function command `Format$()` in the EasyScript help (in the script editor), to format process variables that contain numbers as text.

Examples

```
"TEST_" & %CycleCounter% & ".DAT"
"The maximum temperature was: " & Format$(%MaxTemp%,"0.0")
"Kraft: " & Format$(%MaxPressure%,"0.0e+0")
```

Use a double & if an & character itself is to be present in the text.

Example

```
"Use drag && drop to assign the channel"
```

Comparison

The operator = compares the texts to the left and right of it. Results in 1 if both texts are identical, otherwise 0. Upper or lower case is ignored in the comparison, meaning "TEST" = "Test" results in 1.

Example

```
%FileName% = "TEST.DAT"
REM Returns 1, if the expression is true, otherwise 0
```

Use a double equal sign (==) if an equal sign itself is present in the text.

Example

```
"Max. temperature == " & Format$(%Temp%,0.0) & " degrees" =
"Max. temperature == 25.0 degrees"
```

Formula expressions in assignments

A formula expression in an assignment can include numbers, texts, process variables, mathematical functions, brackets and operators.

AutoSequences

Place texts in double quotes `("")` and use the operator & to combine process variables and texts (chaining).

Format process variables which contain numbers and are to be output as text with the function command `Format$()` in the EasyScript help (in the script editor).

Examples:

```
%Temperature% * 5
sqrt(%MaxVal%) + %MaxVal%/2
%MaxTemp% > 100 AND %MaxPressure% < 300
REM Returns 1, if the expression is true, otherwise 0
%FileName% = "TEST.DAT"
REM Returns 1, if the expression is true, otherwise 0
"TEST_" & %CycleCounter% & ".DAT"
REM Returns TEST_1.DAT, TEST_2.DAT etc.
"The maximum temperature was: " & Format$(%MaxTemp%,"0.0")
REM Outputs the temperature with one decimal place
```

4.14.3 Strain gage computations

Stress analysis (strain gage rosettes)

When **Auto-complete** is active, you only need to drag or double click the channel with grid a into the field **a** for the **Strain channels**. The following channels will then be entered automatically as channels for measuring grids b and c.

Select the required computations by clicking them in the section **Create computation channels** and enter the **Rosette type**. With **Single S/G** the strain is only multiplied by Young's modulus (modulus of elasticity), so the computation is therefore only suitable for a uniaxial stress state. With **90° 2-axis** the strain gages must be installed in the direction of the principal normal stresses, otherwise the results are incorrect.

In the **Material properties** area, you can also enter the unit of the Young's modulus next to the value. The unit will be used for the computed stresses as well.

Temperature compensation

The compensation of temperature influences, which is often necessary for strain-gage measurements, can take place in principle in three ways:

1. "Classically" by using an active strain gage and another strain gage of the same type (same lot number of the foil) which only acquires the thermal expansion of the component. Both strain gages are wired in a half bridge and connected as a DAQ channel.
2. By using a separate DAQ channel with the same type of strain gage which only acquires the thermal expansion of the component (separate piece from identical object material). This measurement can be subtracted from many active channels, each containing only one active strain gage. This means that many active channels can be compensated with one compensation strain gage if the temperatures of these strain gages are similar enough.
3. By entering the polynomial from the strain gage package and the use of a channel which acquires the temperature at the measuring point. Here too, the compensation for several active strain gages can also take place using one temperature channel. In this case select the **Strain gage ► temperature compensation** real-time computation. Specify the channel which records the temperature at the measuring point in the **Temperature channel** section. In addition to the polynomial coefficients a_i you must also specify the thermal expansion coefficients and the reference temperature: $\alpha_{S/G}$ is the thermal expansion coefficient of the strain gage in ppm (10^{-6}/K) as stated on the strain gage package, $\alpha_{Material}$ is that of the material

on which the strain gage is installed and **T_{Ref}** is the temperature in °C for which the polynomial has been determined with a deviation of zero. This is the point at which the polynomial curve passes through the line at zero strain (usually 20°C). To additionally compensate for the temperature dependency of the gage factor (**$\alpha_{Gage\ factor}$**, approximately 1% per 100°K with Constantan strain gage), also specify the value (in ppm/K). Otherwise leave the field blank or enter **0**.

Strain rate

The function computes the change in strain over time in µm/m per second.

Abbreviations and formulas used for strain gage rosettes

The following letters are appended to allow you to distinguish between the strain gage computations:

Abbreviation	Computation
AG	Angle
SS1	Principal normal stress 1
SS2	Principal normal stress 2
SH	Shear stress
ES	Reference stress according to von Mises
SSX	Stress X: Stress in the direction of grid a
SSY	Stress Y: Stress prevailing at 90° to grid a. The direction is applied mathematically positive (anticlockwise).
SN1	Principal strain 1: Strain in direction of principle nominal stress 1
SN2	Principal strain 2: Strain in direction of principle nominal stress 2
SNX	Strain X: Strain in the direction of grid a
SNY	Strain Y: Strain prevailing at 90° to grid a. The direction is applied mathematically positive (anticlockwise).
SNA	Shear strain: Strain prevailing at 45° to grid a. The direction is applied mathematically positive (anticlockwise).

With **Type of rosette 90° 2-axis**, the rosette must be installed in the direction of the principal strain. As the angle you get either 0° or 90°.

Formula: SG rosette, angle

The following applies to 0°/45°/90° rosettes:

$$\alpha = \frac{1}{2}\operatorname{atan}\left|\frac{2\varepsilon_B - \varepsilon_A - \varepsilon_C}{\varepsilon_A - \varepsilon_C}\right|$$

The following applies to 0°/60°/120° rosettes:

$$\alpha = \frac{1}{2}\operatorname{atan}\left|\frac{\sqrt{3}\,(\varepsilon_B - \varepsilon_C)}{2\varepsilon_A - \varepsilon_B - \varepsilon_C}\right|$$

☞ The arctangent is calculated so that the angle is output in the correct quadrants I to IV.

Formula: SG rosette, principle nominal stress 1

The following applies to 0°/45°/90° rosettes:

$$\sigma_1 = \frac{E}{1-\nu}\cdot\frac{\varepsilon_A + \varepsilon_C}{2} + \frac{E}{\sqrt{2}(1+\nu)}\cdot\sqrt{(\varepsilon_A - \varepsilon_B)^2 + (\varepsilon_C - \varepsilon_B)^2}$$

The following applies to 0°/60°/120° rosettes:

$$\sigma_1 = \frac{E}{1-\nu}\cdot\frac{\varepsilon_A + \varepsilon_B + \varepsilon_C}{3} + \frac{E}{1+\nu}\cdot\sqrt{\left(\frac{2\varepsilon_A - \varepsilon_B - \varepsilon_C}{3}\right)^2 + \frac{1}{3}(\varepsilon_B - \varepsilon_C)^2}$$

Formula: SG rosette, principle nominal stress 2

The following applies to 0°/45°/90° rosettes:

$$\sigma_2 = \frac{E}{1-\nu}\cdot\frac{\varepsilon_A + \varepsilon_C}{2} - \frac{E}{\sqrt{2}(1+\nu)}\cdot\sqrt{(\varepsilon_A - \varepsilon_B)^2 + (\varepsilon_C - \varepsilon_B)^2}$$

The following applies to 0°/60°/120° rosettes:

$$\sigma_2 = \frac{E}{1-\nu}\cdot\frac{\varepsilon_A + \varepsilon_B + \varepsilon_C}{3} - \frac{E}{1+\nu}\cdot\sqrt{\left(\frac{2\varepsilon_A - \varepsilon_B - \varepsilon_C}{3}\right)^2 + \frac{1}{3}(\varepsilon_B - \varepsilon_C)^2}$$

Formula: SG rosette, shear stress

The following applies to 0°/45°/90° and 0°/60°/120° rosettes:

$$\tau_{xy} = \frac{\sigma_1 - \sigma_2}{2} \sin 2\alpha$$

Formula: SG rosette, reference stress acc. to von Mises

The following applies to 0°/45°/90° and 0°/60°/120° rosettes:

$$\sigma_v = \sqrt{\sigma_1^2 + \sigma_2^2 - \sigma_1 \sigma_2}$$

Formula: SG rosette, stress X

The following applies to 0°/45°/90° rosettes:

$$\sigma_x = \frac{E}{1 - \nu^2} (\varepsilon_A + \nu \varepsilon_C)$$

The following applies to 0°/60°/120° rosettes:

$$\sigma_x = \frac{E}{1 - \nu^2} \left(\varepsilon_A + \nu \frac{2}{3} \left(\varepsilon_B + \varepsilon_C - \frac{\varepsilon_A}{2} \right) \right)$$

Formula: SG rosette, stress Y

The following applies to 0°/45°/90° rosettes:

$$\sigma_y = \frac{E}{1 - \nu^2} (\varepsilon_C + \nu \varepsilon_A)$$

The following applies to 0°/60°/120° rosettes:

$$\sigma_y = \frac{E}{1 - \nu^2} \left(\frac{2}{3} \left(\varepsilon_B + \varepsilon_C - \frac{\varepsilon_A}{2} \right) + \nu \varepsilon_A \right)$$

Formula: SG rosette, principle strain 1

The following applies to 0°/45°/90° rosettes:

$$\varepsilon_1 = \frac{\varepsilon_A + \varepsilon_C}{2} + \frac{1}{\sqrt{2}}\sqrt{(\varepsilon_A - \varepsilon_B)^2 + (\varepsilon_C - \varepsilon_B)^2}$$

The following applies to 0°/60°/120° rosettes:

$$\varepsilon_1 = \frac{\varepsilon_A + \varepsilon_B + \varepsilon_C}{3} + \frac{1}{\sqrt{3}}\sqrt{\frac{(2\varepsilon_A - \varepsilon_B - \varepsilon_C)^2}{3} + (\varepsilon_B - \varepsilon_C)^2}$$

Formula: SG rosette, principle strain 2

The following applies to 0°/45°/90° rosettes:

$$\varepsilon_2 = \frac{\varepsilon_A + \varepsilon_C}{2} - \frac{1}{\sqrt{2}}\sqrt{(\varepsilon_A - \varepsilon_B)^2 + (\varepsilon_C - \varepsilon_B)^2}$$

The following applies to 0°/60°/120° rosettes:

$$\varepsilon_2 = \frac{\varepsilon_A + \varepsilon_B + \varepsilon_C}{3} - \frac{1}{\sqrt{3}}\sqrt{\frac{(2\varepsilon_A - \varepsilon_B - \varepsilon_C)^2}{3} + (\varepsilon_B - \varepsilon_C)^2}$$

Formula: SG rosette, strain X

The following applies to 0°/45°/90° and 0°/60°/120° rosettes:

$$\varepsilon_x = \varepsilon_A$$

Formula: SG rosette, strain Y

The following applies to 0°/45°/90° rosettes:

$$\varepsilon_y = \varepsilon_C$$

The following applies to 0°/60°/120° rosettes:

$$\varepsilon_y = \frac{2}{3}\left(\varepsilon_B + \varepsilon_C - \frac{\varepsilon_A}{2}\right)$$

Formula: SG rosette, shear strain

The following applies to 0°/45°/90° rosettes:

$$\gamma = 2\varepsilon_B - \varepsilon_A - \varepsilon_C$$

The following applies to 0°/60°/120° rosettes:

$$\gamma = \frac{2}{\sqrt{3}}(\varepsilon_B - \varepsilon_C)$$

4.14.4 Filter

In this window you have various filter functions available:

- Mean over a certain time window,
- Running average,
- Running RMS value over a certain time window,
- Low-pass, high-pass, band-pass and band-rejection filters (Bessel and Butterworth),
- Sound pressure filter which computes an A-weighted sound pressure level in dB (dBA),
- Phase correction (propagation time delay).
  The computation enables you to compensate the different propagation times of various filters by appropriately delaying those channels having shorter propagation times.
- Human vibration filters with various weighting functions to EN ISO 8041, e.g. Wd weighting for horizontal whole-body vibrations in the x or y direction. See also ISO 2631.
- Static and dynamic computation for periodic signals.
  The computation allows you to record both the amplitude of the peak values and the arithmetic mean of a periodic signal.

☞ The filters enable you to specify a cutoff frequency. However, it depends on the sample rate whether this frequency can actually be used. With a sample rate of, e.g. 300 Hz, frequencies over 150 Hz cannot be acquired at all and even a filter of 100 Hz is relatively impracticable. For catman a filter is therefore invalid and is not computed when either the sample rate/cutoff frequency < 5 or the sample rate/cutoff frequency > 10,000. The filter cutoff frequency to be specified relates to the -3 dB cutoff frequency (with HBM devices cutoff frequencies are often -

1 dB values; exceptions are PMX and the filters for the decimal sample-rate domain of the QuantumX/SomatXR).
The filters present in older versions of catman can now be found under the **Anti-aliasing filter** function.

Procedure

1. Select the computation with **Function**.
2. Drag the required channel into the **Input channel** field, for example by drag & drop.
3. **Average**, **Running average** and **Running RMS**
   Specify the number of values (**Number of points**) or the **Time window** to be used for the computation. The more points or the longer the time you specify here, the more the measurements are “smoothed”, i.e. the individual original values (brief peaks) have a weaker effect. With periodic signals you should use at least two to five periods as the time span for the RMS value. The **Mean value over time window** function requires less computation time.
   For the mean and RMS values a 4th order low-pass filter is applied after the computation. Specify the filter type and the desired 3 dB Cutoff frequency as a percentage of the sample rate for the **low-pass filter**.
   Filter
   Specify the filter type and the desired 3 dB cutoff frequency. An algorithm is used in which the Cutoff frequency is as close as possible to the specified value. The filters are of the 8th order and are therefore usually steeper than the hardware filters available in the devices. In the case of the anti-aliasing filters you must specify the Cutoff frequency as a percentage of the sample rate. In the case of band-pass and band-rejection filters (only Butterworth, as Bessel is not steep enough) specify the Upper and Lower cutoff frequencies.
   Phase correction
   Specify the difference between the propagation times of the filters as the delay time.
   Static and dynamic computation
   Specify the **Time window** in which the computations are to be performed. The time must be long enough to capture at least one oscillation, but preferably more. The dynamic value then results as (PeakMax – PeakMin)/2, the static as (PeakMax + PeakMin)/2, if you activate the respective computation. By setting the interval overlap you can specify that the time windows for the computations overlap by the specified percentage. The output rate of the result channels is identical to the sample

rate of the input channel. So, you can display the results in the same graph as the original channel, for example.

4.14.5 Peak-Valley (cycle counter, min/max)

With periodic signals this function enables you to calculate the number of periods from the signal itself. In addition, the minimum and maximum of the period are determined. So the function generates a total of *3* result channels.

Drag and drop, for example, the channel with the periodic signal into the **Input channel** field.
Specify the **Hysteresis** (reproducibility and repeatability errors), meaning peak-to-peak amplitude which the signal must have as a minimum to be counted as an oscillation. Any form of signal can be taken and it does not need to be sinusoidal. Favorable values are, for example, 20% of this peak-peak amplitude. The value should be clearly above the signal noise level to prevent erroneous counting. Use a filter as required if you have a signal with short but high perturbation amplitudes.

By default, only one value is generated per cycle (one counter value and a minimum and maximum). With the **Synchronize output to sample rate of input channel** option, you can keep repeating the values until new values are available. This allows you to display the counter value or the minimums or maximums in a graph at the same time with other measurement channels. A disadvantage is that there is no data reduction.

⚠ If there is only one value per cycle, you cannot plot these channels in a graph at the same time with other measurement channels.

☞ The function is similar to the cycle counting during the DAQ job Cycle-dependent intervals (long-term measurements).

4.14.6 Class counting

☞ You should be familiar with the basic principles of class counting to be able to use these computations practically. Otherwise, obtain the information from the appropriate literature.

Drag the required channel into the **Channel to be classed** field, for example by drag & drop.

For the **Counting method** specify which class counting method is to be used. Then, depending on the method, specify the appropriate parameters in the **Configure class counting** window.

Rainflow (FromTo, RangeMean)

This class counting method is used, for example, in the determination of material fatigue. Here, material stresses or strain traces are monitored and analyzed. Expressed simply, the method counts the frequency of occurrence of certain amplitude values. To achieve this, the amplitude range of the output signal is subdivided into sections, the so-called classes.

Time-at-level, span pairs

The time-at-level class counting method determines how long a signal is located in a certain amplitude range. Here too, the amplitude range of the output signal is subdivided into sections, the so-called classes. With span pairs the frequency of occurrence of certain amplitudes is analyzed. Both computations are normally displayed in a histogram.

2-dim dwell time

This class counting method also involves determining how long a signal is located in a certain amplitude range. However, an analysis also takes place of in which amplitude range a second channel is located—the reference channel. An example of this is the monitoring of a speed channel in relationship to the rotational speed which shows the use of the gearshift during a test run.

Special features in DAQ mode

Since at the time of the measurement the amplitudes occurring are normally no yet known, generating the classes is a problem. If you set the limits too large, some classes have no counted values, because they are never reached. If you set the limits too small, you lose information, because most counts fall in the two marginal classes. In cases of doubt use the option **Determine limits from sensor measuring range**.

Displaying results

Drag the results channel to an empty part of a Panel; catman then automatically selects the suitable type of graph (histogram or 3D chart).

Alternatively, you can also display the data in the table object.

☞ The display of class counting data in the DataViewer is currently not possible.

4.14.7 Optical sensors

From catman 4.2 onwards you have two ways of converting the wavelength to strain or temperature:

1. You assign the appropriate sensor to the channel
   The channel then shows the converted quantity and, for example, can be zero-balanced. The original measurements of the wavelength are no longer visible and are also not recorded.
   See Assigning sensors (transducers) to channels.
2. You leave the original channel as it is and create a computation.
   The computation requires an additional channel which can also be zeroed. The original channel can then not be zero-balanced and contains, as before, the original measurements of the wavelength. This means that both values, the wavelength and the converted quantity are acquired.

Procedure for creating a computation

1. Define the type of conversion: to **strain** or to **temperature**.
2. Drag one or several channels into the field **Input channel ...** or mark several channels and click on adjacent to the field.
3. Complete the other fields as required by the computation.
   Strain measurement: The gage factor is determined by the fiber and is stated on the strain-gage pack. If available, also specify the type of **temperature compensation** and then complete the required fields.

   Temperature measurement: Specify the **Type of temperature determination**. The appropriate values for the fields then displayed, for example the $\Delta\lambda/\lambda_0$are stated on the pack.
4. Measure the base wavelength of the sensor or sensors (corresponds to the zero balance).
5. You accept the details with **Create computation**.

4.14.8 Math libraries

You can use this tab to address functions from custom-programmed DLLs which are executed in real time just like the other catman computations.

Requirements

- The DLL that performs the actual computation must be created by HBM.
- The DLL must be copied to the \DRIVERS folder in the catman installation directory.
- The file MATHLIB.INF must be created or modified. This file in the directory DRIVERS must have an entry describing the DLL.

Use the **Math libraries** tab to select the required function from one of the available DLLs. Define the channels to be used for the computation as **Current arguments** (specify the channel names). The **Arguments required** field normally contains explanatory notes on the parameters being specified and their sequencing, so as to help you when defining them. Please contact HBM if you require special functions.

4.14.9 Electrical power

The function creates the computations for various electrical power quantities derived from the voltage and current:

- the root mean square values for current and voltage (RMS_U, RMS_I),
- the product of the current and voltage (UI)
- the real power (REALPOWER)
- the apparent power (APPARENTPOWER)
- the reactive power (REACTIVEPOWER)
- the power factor (POWERFAC), i.e. the ratio of the real power to the apparent power (lies between 0 and 1)
- and the phase (shift) angle (PHI)

⚠ If you are using a current probe or similar for the current measurement (a coil around the conductor carrying the current), you have to correct the phase for the voltage, because a current probe has a delayed indication of the current. If the delay is not specified in the data sheet, you can use a purely resistive load (filament lamp) in which the current and voltage are in phase and you measure the time difference at the zero crossing of the two signals. Enter the value for the **Current clamp delay**. The channel DELAY_U is then also generated and used in the computations.

The results channels are created automatically when you create the computation. Double click on a computation channel to view the relevant computation. If you do not need computations and are not using them in one of the formulas, you can delete them.

Drag and drop the relevant input channels into the **Voltage** and **Current** fields.

☞ The frequency of the input signals should not be significantly above 100 Hz, because otherwise the results may become too inaccurate due to the applied computation function.

Specify the **Time window** over which the computation is to be calculated. The longer the time you specify here, the more the measurements are “smoothed”, i.e. the individual original values (brief peaks) have a weaker effect. With periodic signals you should use at least two to five periods as the time span.

For the RMS computations and the real-power computation a low-pass 4th order filter is also applied to the result. Specify the filter type and the desired 3 dB cutoff frequency as a percentage of the sample rate.

4.14.10 Signal generator/playback file

The signal generator offers you three functions:

1. You can produce any periodic signal (sine, rectangle, triangle, etc.).
   The function enables you to generate test signals. You can also use the signals to test other functions, e.g. filters. In addition to the basic function you can modulate the signal (**Amplitude modulation**) or add a noise level (**Noise**). Also, you can change the signal between 0 Hz and the specified frequency: Specify the rate of change in Hz per second for **Sweep**.
2. You can simulate a CAN raw channel
   You can use the channel for example to check the function of a CAN raw table.
3. You can specify a file (**Playback file**), the values of which are read in synchronously with the measurements.
   The file can be read with any of the sample rate groups which are available (the allocation takes place as usual on the **DAQ channels** tab. Activate the **Redo** option to start from the beginning again when the file reaches the end. Otherwise no more measurements are read (and therefore no more are displayed).

4.14.11 Create new auxiliary channel

The **Auxiliary channel** function (**Computation channels** group in the **DAQ channels** tab) is used to create an “empty” channel which you can fill with data using an AutoSequence or EasyScript. Here, you can choose:

1. Whether the script procedure is contained in an EasyScript project.
2. Whether you want to directly enter the appropriate script code.

In the first case the EasyScript project must be loaded and started when the DAQ job is executed. In the second case you do not need any EasyScript project. The script code is saved in the DAQ project and becomes active on loading the project.

In order that catman knows how many values the channel will contain and so that you can also display the channel in a graph, you have to state which sample rate is to be used for the channel when creating it. Specifying **Manual** enables you to also use fewer values than would be produced with one of the three sample rates.
Entering a **Unit** is optional.

4.15 Limit values and events

☞ You activate the display of the limit values and their monitoring via the menu **File ► Options**; see Program function options. The function can be locked with password protection, refer to Sensor options, Password protection.

Use the LED object if you only want to show the exceeding or undercutting of a level.

With the limit monitoring you can:

- Change the color of a plot in a real-time graph.
- Display via an LED various images or symbols depending on measurements or computed values (self-produced images are also possible).
- Monitor a digital input.
- Set a digital output.
- Play an audio file.
  The audio file can be repeatedly played until the monitored condition is no longer present.
- Send an email.
- Be notified with a push notification.
- Switch the storage of measurements on or off (with Pre- and Post-trigger, i.e. before and after the specified event).
- Switch the video recording on or off or record a single image.
- Make an entry in the *Log file (System log)*.
- Carry out saving of the measured data (saving to a file).
- React to errors during the measurement.
- Call EasyScript functions (requires the optional EasyScript module).

You can also import limit values and events from other projects: Menu **File ► Import ► Limit values**. The import deletes all existing definitions. Therefore, carry out the import before defining new limit values or events.

Working procedure

Assign the monitoring of high level or low level crossings as well as CAN message reception after the generation to one or more channels. The other events are independent of channels and are always monitored during a measurement. The evaluation and execution of an action occurs in each case after measurements have been read in (time between two data transfers); see Data transfer and error handling.

You can monitor up to three limit values per channel. Any order can be used. For example, you can also just use limit value 3. Instead of high or low level crossing, you can also use the **Channel overflow** event type and the Overload detection function.

If you need more than three limit values for a channel, define a computation channel which just uses the unchanged values from the original channel. Then define another three limit conditions for this computation channel.

Show limit values on a panel

The limit values can be displayed in a graph (**Special** tab in the **Configure** window of the graph) as well as in an Analog meter and Bar indicator (**Alarm** tab in the **Configure** window of the object: **Show alarm limits: From limit value**). Use the **Axes** tab in the **Configure** window for the Multi-bar graph. In a Digital indicator you can display the status of the limit values using LEDs: **Display** tab in **Configure** window of digital indicator: **Display limit values**. The LED object can also display limit values.

Notes

- The reaction time to an event is determined by the frequency of the data transfer. In the default setting, new measurements are transferred approximately every 100 ms, and a reaction can only follow once the measurements are present in catman. In the worst case the reaction time is therefore 100 ms or the time between two data transfers.
  See also Transfer of measurement data.
- A *digital output* is set to the defined state when the limit value condition is fulfilled. When monitoring for **high level crossing** or **low level crossing**, the output is reset when the condition is no longer present. For other cases of monitoring define a further limit for resetting, if this is to occur.

- With MGCplus the digital inputs and outputs of an *ML78* and of a *CP42/52* are available. The limit value outputs from single channel plug-in modules, e.g. an ML55, cannot be controlled.
- With the PMX you can use the digital outputs of an PX878 (slot 10, sub-channel 2).
- Open the catman log file via **File ► Special functions ► Show System log**.

4.15.1 Defining/changing limit values/events

Specify limit values/events

1. Open the dialog for defining the conditions using **Configure** (**Limit values/events** group on the **DAQ channels** tab).
2. Click on **New**.
3. Assign a meaningful **Name**.
   ☞ The name should identify the **Event type** (condition) and the associated actions.
4. Define the **Event type**; see Available types and conditions of limit values/events.
5. Check that the event is **Active** (default setting).
6. Define the event condition; see Available types and conditions of limit values/events.
7. Define the Action(s).
8. If required, activate **If alarm condition persists, repeat action after** and enter the time period in seconds.
   Note that, for example, an audio file must be able to be played completely within the repetition period, otherwise the playback is interrupted and starts from the beginning again.
9. If you have entered alarm *and* warning levels, the corresponding actions must also be defined on *both* tabs.
10. On the **General action settings** tab you can define that the actions are not to be triggered too quickly consecutively by specifying a **Pause between actions** ("blocking period"). The definition applies to all actions.
11. Continue with point 2 to assign further events. Otherwise close the dialog.

When creating level monitoring the following steps are needed:

12. Mark the channel(s) in the channel list (**DAQ channels** tab) for which one or more limits are to be monitored.

13. Using the **Limit values/events** group on the **DAQ channels** tab, select the event(s): Open the **Assign** menu, select **Limit value 1** to **Limit value 3**, and click on **Assign**.

For the event CAN (raw) message received, the following steps are necessary:

12. In the channel list (**DAQ channels** tab) mark the CAN raw channel for which one or more messages are to be monitored.
13. Using the **Limit values/events** group on the **DAQ channels** tab, select the event(s): Open the **Assign** menu, select **Limit value 1** to **Limit value 3**, and click on **Assign**.

Changing limit values or events

Click on the condition to the left in the dialog and change the required setting(s) on the right. The new settings are accepted immediately and confirmation is not necessary.

4.15.2 Available types and conditions of limit values/events

High or low level crossing

Define **Alarm level**, **Warning level** and/or **Hysteresis**. Also define the color(s) to be displayed, if with the actions you would like to activate **Change indicator color**.

The *hysteresis* is only considered for the alarm level. Enter the same values for the alarm and warning levels if you do not need a warning level. You must meet the following condition:

Alarm level ≥ warning level in the event of high level crossing

or

Alarm level ≤ warning level in the event of low level crossing

☞ Note for the **Measuring range of channel** setting that here only the alarm function is used and that the level depends on the measurement range of the relevant channel which has been set according to the sensor scaling. Therefore, this really involves an overflow indicator of the amplifier and the value may therefore lie above the sensor load limit.

Display in graph: Define whether on drawing the level the line should be horizontal (on the y axis) or vertical (on the x axis). The default is horizontal.

Title in graph: Define here which text is to appear on the line. You have to define the drawing for the appropriate axis and graph in each case; see Configure graph, Special tab.

Waiting time: The option allows you to hide short disturbance pulses. The defined action is only started when the specified levels are exceeded or not reached for a time longer than entered here. You can also enter your own values in place of the defaults.

High level crossing in frequency range

This monitoring requires the frequency spectrum visualization object (the object shows an FFT chart in real time) on a Panel. Specify the frequency range (**Lower/Upper frequency limit**) to be monitored for the channel(s) shown in this object. Since only the displayed channels are analyzed, you do not have to assign this condition to a channel.

Specify the **Level** from which the alarm is to be triggered and also a value for the *Hysteresis*. The values have the same unit as the frequency spectrum (see y axis of the graph).

Channel overflowing

HBM industrial amplifiers transmit not only measured values but also status information, such as whether the channel is overflowing. You can use this information to trigger an action by way of this event, such as to send a push notification. You can specify a period of time over which this status must occur in order to hide short-time disturbances. Otherwise use **0 s**. Note, however, that the input range of an amplifier is usually much larger than the permissible measuring range of the connected sensor. In this case, the sensor would be destroyed long before an overload occurs.

The overflow state is also signaled by way of the measured values, by default as 1,000,000—see Channel list options.

Digital input

Specify the channel (**Input**) containing the digital signal to be used, and the **Bit/Condition**. With MGCplus you can only use digital inputs of the CP22/42 and of the ML78; the digital inputs of single channel plug-ins are not available.

Receive CAN (RAW) message

You can only use the event if your project includes a CAN raw channel. Specify the **Message ID** to be monitored in decimal or, prefixed with 0x, in hexadecimal notation. The event is triggered when a message with the relevant ID has been read in.

Time interval

Specify an **Interval** and the **Start time**. The **Start time** can also be situated before the start of the measurement; the interval then begins with the start of the measurement. Alternatively, activate **Immediately**.

See also Time-dependent intervals (long term DAQ).

Keyboard event

Specify the desired key combination.

On start/stop trigger

The event is triggered when the start or stop trigger of the current DAQ job occurs. Triggers from recorders are not analyzed.

After starting/terminating the measurement

The event is triggered when you click on **Start** and before the measurement actually starts, or after the end of the DAQ job.

Error during the measurement

With this option you can log the date and time of each error and also react to the error. You should use this condition if you have not chosen the default option for Behavior on errors during the measurement.
See also **Reconnect and initialize devices before start** in Start recording.

Error during local data saving

The event is triggered when an error occurs during data saving (export of the measured values from the temporary file). Local data saving means saving on the PC on which catman is running or to a network drive.

☞ The event is only triggered during the saving of the (temporary) data of a DAQ job, not during the saving of the recording of a recorder.

Error during remote data saving

The event is triggered when an error occurs during transfer of files via FTP or SFTP—see Remote data saving (FTP/SFTP).

Memory space critical

The event is triggered when the free storage and therefore the remaining measurement time are smaller than specified. The computation of the free storage space consider the space required for the storage of the temporary file and for saving the data (from the temporary file) in addition to that for further data, e.g. a video recording.

CX22B power supply interrupted – UPS operation active

The CX22B module contains a UPS (uninterruptible power supply unit) that is able to maintain the power supply for several minutes. The event is triggered as soon as the (external) power supply to the CX22B has been cut. This means you can be notified by a push notification, for example, and use the action **Save data, terminate catman and restart on return of power** to save your measured values and terminate catman in an orderly manner. During this action the *Restart Monitor* is run automatically on the CX22. The program restarts catman if the power supply is restored before UPS mode is ended.

⚠ The UPS powers only the CX22B, not any connected MX modules. If those modules do not have their own UPS, any ongoing measurement is terminated as soon as the modules are no longer being supplied with current. This action is executed before catman terminates the measurement with an error message however. Other errors are then also no longer signaled.

☞ When the CX22B module has been shut down, the next time it is powered up a normal start is initiated. The same applies when the catman *Restart Monitor* restarts. So, you have to make the relevant settings to reload the project and resume the measurement.
See also Program start options, Available limit value/event actions.

RT lag

The event is triggered when an RT lag occurs.
See also Possible problems during measurement, Preventing a RT lag (performance).

EasyScript EA_DAQ.TriggerEvent

The event is triggered when the script calls the name of the event with `EA_DAQ.TriggerEvent`. You require the EasyScript option for this.

4.15.3 Available limit value/event actions

Standard actions

Set digital output

A *digital output* is set to the defined state when the limit value condition is fulfilled. With the **High level crossing** and **Low level crossing** types of monitoring the outputs are reset when the condition is no longer fulfilled. The *hysteresis* is only considered if the alarm and warning levels are identical. With all other types of monitoring the outputs remain unchanged. In these cases, define another limit value if the output is to be reset.

Entry (in the) log file

You can make an entry in the log file of catman or in any text file. Here you can use *place-holders* both in the file name and in the message text.
See also *Log file (system log)*.

Send email

⚠ An Internet connection or connection to an outbound mail server is required for this function.

Click on **Edit** and specify the data for the email to be sent on the **Email** tab. In the message text you can also use *Placeholders*. Then go to the **Sever settings** tab and specify the log-on data for the mail server:

- Address of the outbound mail server (**Server**),
- whether **Authentication** is required (log on before sending),
- **User** (email address of the mailbox owner),
- **Password** of the mailbox owner,
- Return address (**From**, normally also the email address of the mailbox owner),
- The **port** to be used (normally 25, with SSL usually 465 or 587 is used, the figure depends on the provider).

After closing the dialog, the field shows, apart from **Send email**, the recipient's email address in the dialog for checking.
For repetitions note the pause period ("blocking period") specified on the **General** tab.

Example

Server	mail.gmx.net
Authentication	yes
User	UserName@gmx.de
Password	******
of	UserName@gmx.de
Port	465
SSL	yes

Push notification

⚠ An Internet connection is needed for this function.

For the push function you need a sender ID which is generated on the HBM server reserved for this. You can request several different IDs for various events.

Create new ID: Enter a **Title** (description), which will appear as a message on your smart phone. Also specify the **Email address** to which the message is to be sent. Then click on **Request ID**. You then receive a message to the specified email address with the **Push-ID** for this description.

To ensure that the push notification is sent you should check the **Push-ID** after entry with **Verify ID.**

Complete the entries in the other message fields, **Subject** and **Text**. *Placeholders* are also possible.

☞ If you have already installed an older version (1.0) of the HBM Push app, uninstall it and install the current version (1.1). The HBM push app is not updated automatically. Then add your push IDs again.

Perform data saving/storage

☞ Depending on the action, you must use the **Controlled by event monitoring/script** setting for the **Storage mode** and **None** for **Data saving** on the **DAQ jobs** tab so that the event monitoring function can monitor the recording.

The action **Stop DAQ, save data and restart DAQ** is normally only needed for high sample rates: the buffer in the measuring device should not overflow when storing the data. In all other cases you can use **Save data and delete temp.**(orary) **data storage**. In addition, you can also specify for the actions with **… save data …** whether and how long already before the specified point in time (**Pre-trigger**) and after the specified point in time (**Post-trigger**) recording is to take place.
For repetitions note the pause period ("blocking period") specified on the **General** tab.

Save data, terminate catman and restart on return of power

☞ The action is only available if you have selected **CX22B power supply interrupted – UPS operation active** as the event type.

As soon as the (external) power supply to the CX22B has been cut, you can use this action to ensure that all data recorded up to that point are saved and catman is terminated with no further error messages.

⚠ The UPS powers only the CX22B, not any connected MX modules. If those modules do not have their own UPS, any ongoing measurement is terminated as soon as the modules are no longer being supplied with current. This action is executed before catman terminates the measurement with an error message however. Other errors are then also no longer signaled.

☞ When the CX22B module has been shut down, the next time it is powered up a normal start is initiated. The same applies when the catman *Restart Monitor* restarts. So, you have to make the relevant settings to reload the project and resume the measurement.
See also Program start options, Available types and conditions of limit values/events.

Advanced actions

Change display color (plot color) of channel

Specify the colors in the **Level** section. The colors must differ from the standard color of the plot!
The colors are used in the Real-time graph, the Post-process graph, the Cursor graphs and the display objects Digital indicator, Bar indicator and Simple table.

Graphs: The color of the (complete) displayed plot changes. With the post-process graphs this first occurs when the graph is updated, provided the condition is met at this point in time. If you also activate limit condition on the **Special** tab, lines in the corresponding colors are displayed for the alarm and warning levels.

Digital indicator: The measurement is displayed with the alarm color. If you activate the **Show alarm limits** option (**Display** tab), additional color fields are displayed in the Digital indicator.

Bar indicator: The scale range is marked with the colors if you activate the **Show alarm limits** option (**Alarm** tab).

Simple table: If necessary, deactivate the **Disable limit value display** option on the **General** tab so that the columns with the limit values are displayed. The cells are then highlighted with the appropriate colors.

Control video cameras (only with Video Cameras module)

The Video Cameras module is required for this. You also have to use the **By event monitoring or script** setting to **Start/Stop recording** on the **DAQ jobs** tab so that the event monitoring function can monitor the recording. You therefore receive a warning message if this is not the case and can change the setting in this dialog for all DAQ jobs. With subsequently created DAQ jobs check which setting is used.

Play sound file

Plays the specified wav file.

For repetitions note the pause period ("blocking period") specified on the **General** tab.

Run EasyScript function

The EasyScript option is needed for this. Click on **Edit** and enter the code to be executed.

For repetitions note the pause period ("blocking period") specified on the **General** tab.

MX471-CCP/XCP

Switches the send function on or off for the configuration loaded via the MX Assistant. Select the relevant connector of the MX471 to the right.

See also CCP/XCP (ECU, only MX471).

4.15.4 How to delete/deactivate limit values/events

To irrevocably delete a limit value (limit condition), call the settings dialog using **Configure** (**Limit values/events** group on the **DAQ channels** tab), choose the relevant limit value definition on the left in the list and click on **Delete**.

You have a number of ways of deactivating limit values:

1. Using **Configure** (**Limit values/events** group), call the setup dialog and deactivate **Active**.
   The monitoring of this condition is then no longer carried out, but the definition and allocation to channels remains.
2. Using the group **Limit values/events**, select the **Off** setting for the relevant limit value (**Limit value 1** to limit value 3**)**.
   The monitoring is only deactivated for the selected channels.
3. You can **Deactivate Limit value monitoring** (for all limit values) via the **DAQ jobs** tab and **Job parameters** in the **Settings** groups.
   The deactivation applies only to the selected job and the monitoring remains active in all other jobs.

4.16 Using MQTT

☞ Enable the *MQTT* functionality in catmanAP via **Options ► Program functions** in the **Additional Modules** area. The functionality is not available in catmanEasy. If you enable MQTT in an ongoing DAQ project, you need to restart catman.

catman supports MQTT versions 3.1.0, 3.1.1 and 5.0.0 of the MQTT protocol.

The MQTT function in catman offers you three settings for configuring the data stream:

1. **Setup**: MQTT configuration to specify the network properties of the MQTT broker.
2. **Topics**: The MQTT Topics configuration to configure the topic structure of the data being sent.
3. **Advanced**: Additional settings specific to the channels transmitted via MQTT.

catman sends MQTT data to the MQTT broker after each read block. This means that the data is sent at about 10 Hz as soon as, and for as long as, a DAQ job is run.

Procedure

1. Start a new or an existing project in catman.
2. Click on the **DAQ channels** tab.
   When the option is active, you will find the **MQTT** group in the area of the menu bar on the right.
3. Choose **Setup** to specify the data for the broker you are going to use and the transfer.
4. Choose **Topics** to specify the channels from which you want to transfer data, and how.
5. Choose **Advanced** to specify that data is averaged before sending (only for the broker, not in catman).

MQTT data structure

To make the best use of catman's MQTT data stream, you need to know the data structure. This will let the MQTT broker and the other clients know how and where to find the desired information. In the “MQTT” subfolder of the catman installation directory you will find the file “PayloadTemplates.json”, with a description of the templates you can use in addition to the HBK standard format. You can add your own templates to the file at any time, and then select them in the dialog.

In the **HBK standard JSON format**, each topic contains a JSON array with up to n channel objects. The *Average* (moving average) parameter is calculated based on the number of values you specified in the advanced settings (see **Advanced**).

The channel object looks like this:

JSON name	Explanation
Name	Channel name
Unit	Unit of the channel
SampleRateGroup	Number of the sample rate group: 0 = Default, 1 = Slow, 2 = Fast
TimeBetweenSamples	Time between two measured values in ms: e.g. sample rate = 300 Hz -> TimeBetweenSamples = 3.3333 ms
MaxValue	Maximum value of the channel during measurement
MinValue	Minimum value of the channel during measurement
Average	Moving average value of the channel during measurement
NumberOfSamples	Number of measured values
Samples	Array with the measured values

Example

Topic: Force_Left

Channels: *Time 1 - Default sample rate* and *MX410 V-SK 1_CH 1* (Force data) results in:


```
[
   {
   "Name": "Time 1 - Default sample rate",
   "Unit": "sec",
   "SampleRateGroup": 0,
   "TimeBetweenSamples": 0.00333333333333,
   "MaxValue": 0,
   "MinValue": 0,
   "Average": 0,
   "NumberOfSamples": 30,
```

```
"Samples": [
   299.2833475485289,
   299.28668088202056,
   …
   299.38001421978703
   ]
},
{
"Name": "MX410 V-SK 1_CH 1",
"Unit": "V",
"SampleRateGroup": 0,
"TimeBetweenSamples": 3.33333333333333,
"MaxValue": 0.00020463731198l0596,
"MinValue": 0.000103759768535383O5,
"Average": 0.00015511560724751854,
"NumberOfSamples": 30,
"Samples": [
   0.00016284518642351O3,
   0.00012825860176235437,
   …
   0.00018878512491937727
   ]
}
]
```


4.16.1 MQTT configuration

Open the dialog by clicking **Setup** in the ribbon (**DAQ channels** tab, **MQTT** group).
Specify the MQTT broker and the options for the data transfers here.

Broker settings

You can specify both an IP address and a computer/server name in the **IP address** field.
The port is set automatically when you select the security mode, but you can change it.

The **Client ID** identifies each MQTT client that connects to an MQTT broker. The broker also uses the client ID to determine the current status of the client. So this ID should be unique for each client and broker.

Whether a user name and password are required depends on your MQTT broker.

In the current version, various **Security modes** are supported. Each security mode uses a different port. Consequently, the port is automatically changed to the default when you select a mode. Brokers may use other ports too, however, so check the broker you are using. Meanings of the different modes:

- **Plain**: An unsecured connection without authorization; user name and password are not required; the fields are ignored.
- **PlainAuthenticated**: An unencrypted connection, but authorization (user name and password) is required.
- **Secure**: An encrypted connection (TLS), but without authorization; user name and password are not required.
- **SecureAuthenticated**: An encrypted connection (TLS), but authorization (user name and password) is required.
- **WebSocket**: An unsecured connection via WebSocket protocol, without authorization; user name and password are not required; the fields are ignored.
- **WebSocketAuthenticated**: An unencrypted connection via WebSocket protocol, but authorization (user name and password) is required.
- **SecureWebSocket**: An encrypted connection (TLS) via WebSocket protocol, but without authorization; user name and password are not required.
- **SecureWebSocketAuthenticated**: An encrypted connection via WebSocket protocol (TLS), but authorization (user name and password) is required.

If you want to specify **Certificates**, you must use the **Authenticated** procedures, and have, or create, a certificate for your broker. You can then additionally specify whether the certificates in your system must be classed as *Trusted* or not.

Advanced settings

The **Automatic reconnection on** option allows the connection to be restored if contact with the MQTT broker is lost. catman then tries to reconnect within the time specified in the **Reconnecting time** field. The default value is 5 seconds.

The **Clean session** option tells the broker whether or not the client wants to delete all information from a previous connection and start over. If this option is disabled, the broker stores all subscriptions and all missed messages for a client that has logged in with Quality of Service (QoS) level 1 or 2. This means that the messages can still be received at a later time.

Payload template: Select the desired template for the structure of the data transfer here; see also MQTT data structure.

Measurement settings

If you want, you can **Disable MQTT data transfer**. All settings (topics and channels) then remain unchanged. Otherwise, the data will be sent by catman after the start of a DAQ job, and for as long as it is running. No data is sent during the setup phase of a DAQ job, or after the DAQ job has been stopped.

4.16.2 Configuring the MQTT data stream (Topics)

Open the dialog by clicking **Topics** in the ribbon (**DAQ channels** tab, **MQTT** group).

The information being sent is organized in a topic hierarchy. Topics are in essence containers that can contain multiple messages (multiple catman channels). The broker then distributes the information to all clients that have subscribed to the topic in question.

The structure of the MQTT topics is freely editable. That means you can define the number of topics, their names, and how they are nested, as you want. Use topics to differentiate channels by sensor type or location, or both.

Topics configuration

The type of information catman can send via MQTT consists of channel data. You can send any channel in catman (hardware channel, time channel, computation channel or auxiliary channel) via MQTT. The name of the parameter in MQTT is the catman channel name.

In the topic settings, you can choose between the three standard MQTT quality of service (**QoS**) levels:

0. **At most once**: The message is sent once with no acknowledgment, so may be lost.
1. **At least once**: The message is sent until the sender receives confirmation that the recipient has received the package.
2. **Exactly once** It is ensured that the message arrives exactly once even if the connection is interrupted.

Level 0 provides the least security, but is the fastest way to transmit data. In contrast, level 2 offers the best security, but is slower.

The **Retained on** option relates to MQTT retained messages. In this case, the broker stores the last value for the topic, and transmits it when a request is made. Retained messages are useful for a newly added client, as it immediately receives data from the MQTT broker, even if no (new) data was sent at the time of subscribing.

See also **Clean session** in the MQTT configuration section.

Creating a new topic

To create a new topic, click on ✚ below the **Topics** area. It will then be inserted as a subtopic of the current selected topic. To rename the topic, click on it.

Adding signals

To add signals to a topic, highlight the topic and select one or more channels from the channel list (**catman channels**) at the bottom of the window. Select multiple channels as usual with ⇧ (Shift) or Ctrl (Ctrl). Then click ✚ (Add channels) on the right below the **Channels** area.

The channels assigned to each topic are displayed in the topic's channel list on the right-hand side of the window when you select the topic.

Advanced channel functions

Highlight a topic, and click ⚙ below the **Channels** area to access the advanced channel functions.

The window allows you to add a computation that will be sent either in addition to, or instead of, the original signal (**Publish computations only**) in the selected topic. No computation is created in catman when you do this; the computation exists only for the MQTT data stream. In the current version only FFT computation is available.

Reduction: Specifies after every how many computations they are actually sent. Entering 3 sends only every third FFT, even if all three have been calculated.

Click **OK** before exiting the window.

4.16.3 Creating MQTT alarms

You have several options to create alarms in catman. To use them in MQTT, however, you must convert each alarm to a channel, as only channels are sent via MQTT.

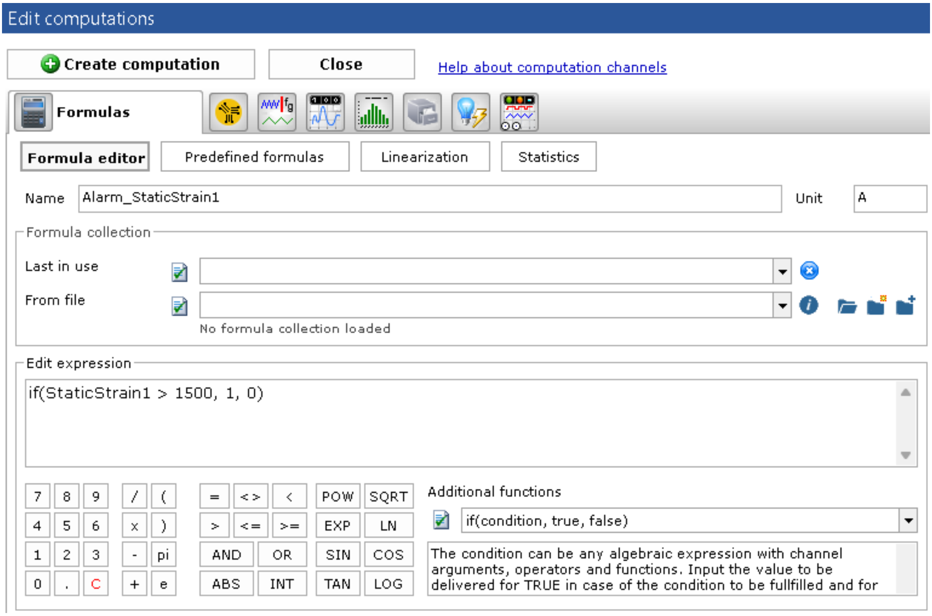
You have two options to do this:

1. Create a computation channel
2. Create an auxiliary channel based on limit values and events, and fill it with EasyScript

Method 1: Create a computation channel

This is the simplest method. Create a computation channel that packages the alarm into a channel that switches from the default value of zero to an alarm value.

To do this, open the **Edit computations** window via **New** (**DAQ channels** tab, **Computation channels** group). Open the list box under **Additional functions**, select **if(Condition,True,False)**, and click . Then replace the **Condition**, **True** and **False** texts.



In the illustration above, the formula creates a computation channel that assumes the value 1 when the *StaticStrain1* channel exceeds the limit of 1500. As long as the *StaticStrain1* channel does not exceed this value, the computation always results in 0.

You can also create a symmetrical computation (greater than OR less than) if you want to monitor the minimum and maximum simultaneously. To check minimum and maximum values separately, you must create two computations.

Method 2: Auxiliary channel based on limit values and events

This method gives you more flexibility than creating computation channels. One disadvantage of this method is that sending the results to an MQTT broker requires an auxiliary channel and some EasyScript. Part of the script is preconfigured, though, and in this section you will find the missing commands for this function.

Each limit value of the **High level crossing** or **Low level crossing** type can use two thresholds:

1. Warning level
2. Alarm level

The warning level must be lower (in absolute values) than the alarm level. Selecting alarm and/or warning levels allows you to set a double alarm when monitoring channels, with the first level triggered by the warning value and the second by the alarm value. You can initiate various actions or make decisions based on the triggered warning or alarm values. The tabs at the bottom of the window provide lots of options for selecting actions that will be performed if the warning/alarm values are met. The actions are limited to catman however. To send a notification via MQTT, you need to create an auxiliary channel, and transfer the warning or alert messages to it by EasyScript.

Create an auxiliary channel with EasyScript

- Click on **Auxiliary channel** (**Computation channels** group), and give the channel a name.
- Select **By entering the script code directly…**
- Click on **Edit script code** to open the EasyScript editor.
  Part of the code for populating the auxiliary channel with values is already written, you just need to add to it.

After the `Dim Count As Integer` line, insert:

```
Dim Status As Integer
```

Before the `For Count = 0 To SampleCount - 1` line, insert:

```
EA_DAQ.GetLIVState("channelname", N, Status)
```

Where “channelname” is the exact name of the channel. Be sure to enclose it in quotes, as it is a string (text). N is the number of the limit value assigned to the channel. 1 is the first limit value, 2 is the second, and so on. Status is the name of the variable you added to the declaration section.

Then replace the `'MVBuf(1) = ...` line with

```
MVBuf(Count) = Status
```

and close the Code Editor.

Example script

```
Sub Main()

Dim SampleCount As Integer
Dim Count As Integer
Dim Status As Integer

EA_DAQ.CurrentBlockSize (0,SampleCount)
ReDim MVBuf(SampleCount) As Double

'**********************************************************
'Your code to fill the sample array MVBuf goes here

EA_DAQ.GetLIVState ("Kanalname", N, Status)
For Count = 0 To SampleCount - 1
     MVBuf(Count) = Status
Next

'**********************************************************
'When done, pass the data to the auxiliary channel buffer
EA_DAQ.SetCurrentBlock 0, 1, SampleCount, MVBuf()

End Sub
```

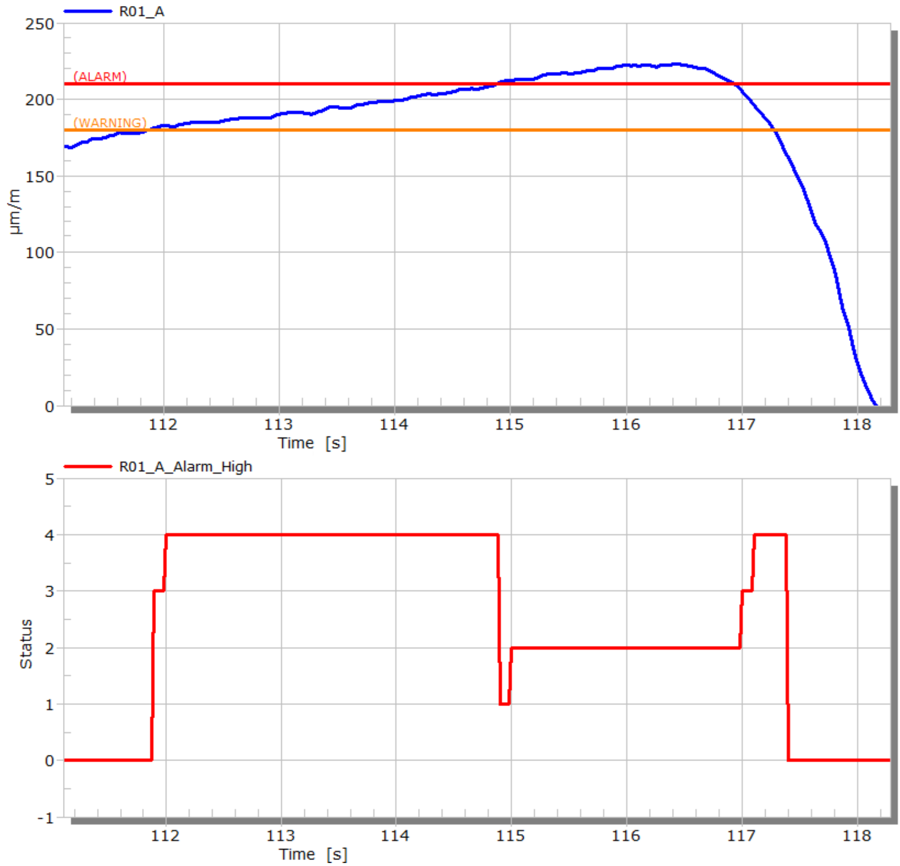
Make sure you select a reference channel for the time interval before you click **OK** and create the auxiliary channel. This places the auxiliary channel in the correct sample rate group. We recommend taking the channel that is monitored.

To create more channels for other messages, copy the code, and then change the channel names.

Channels created in this way provide information based on the actual status of the monitored channel. The channel assumes the following values:

0. No warning or alarm state currently active
1. Alarm state triggered in the current read block
2. Alarm state triggered in a previous read block
3. Warning condition triggered in the current read block
4. Warning condition triggered in a previous read block

To better explain the meaning of these numbers, the following diagram shows a channel that exceeds warning and alarm values, and the associated monitoring auxiliary channel:



The auxiliary channel is assigned the value 3 when the warning value is reached. If the channel remains permanently above the warning value, the auxiliary channel is assigned the value 4. If the channel also exceeds the alarm value, the monitoring auxiliary channel is assigned the value 1 at the moment the limit value is exceeded, then the value 2.

When the channel goes back between the alarm and warning values, the monitoring channel is assigned the values 3 and 4 again. If the channel falls below the warning value, the auxiliary channel is assigned the value 0 again.

4.17 Using Power BI

Power BI is a suite with Analytic Tools from Microsoft in the Azure Cloud. Power BI gives visual analyses at your fingertips with intuitive reporting. You can use data from catman to create visualizations or perform computations and analyses. You can also merge the data from catman with other data of your company.
See also https://powerbi.microsoft.com.

☞ The function is only suitable for channels with relatively slow data recording. The minimum update rate is 0.2 s, which means that a maximum of 2 (individual) measurements are transferred per channel per second. The sample rate set in catman is not relevant as long as it is at least as large as the update rate.

General procedure

The general procedure can be broken down into four steps:

1. Create an account with Microsoft.
2. Create a dataset.
3. Create a dashboard.
4. Link catman with the dashboard.

Power BI offers you various options to control user access or to use other programs for displaying dashboards. Since this is not a catman topic we cover only the basic process of creating such a dashboard here.

Step 1: Create an account

Go to https://powerbi.microsoft.com/en-us/get-started and create an account.

You will need Power BI Pro, if you want to create datasets and dashboards (a trial version is currently also available).

Step 2: Create a dataset

1. Log in with your account: https://powerbi.microsoft.com/.
2. In **My workspace** choose **New ► Streaming dataset**.
3. As type chose **API** and click on **Next**.
4. Specify a name for the dataset (**Dataset name**), for example **Test1**.
5. For each channel from catman that you would like to edit or display in Power BI, create a data stream, i.e. specify a name and the type of data.
   - First create the **Timestamp** channel with type **DateTime**. This channel is required for the x-axis of graphs.

- Now create additional channels. If you know the catman channel name you can specify it directly. You can assign any name and make the assignment to the catman channels later in catman. As the channel type specify **Number**.
- Activate the **Historic data analysis**.
- Click on **Create**.

6. In the **Streaming dataset created** window click on **PowerShell**.
7. Copy the entire text to be displayed in the window under PowerShell into a text file.
8. Save the file, for example as **PowerBI_Test1_Config**. You can use any file extension. If you use **catpbi**, the file will be directly detected by catman.
9. Click on **Done**.

Step 3: Create a dashboard

1. In **My workspace** choose **New ► Dashboard**.
2. Give your dashboard a name, for example **Test1_catman**.
3. **Add a tile** from the **Edit** menu.
4. As the type chose **REAL-TIME DATA (Custom Streaming Data)** and click on **Next**.
5. Choose your dataset from above (**Test1**) and click on **Next**.
6. Choose a **Visualization Type**, for example **Card** (Digital indicator) or **Line chart**.
7. Choose one of your channels (data streams) under **Value**. For the graphs, select **Timestamp** for **Axis** and one of your DAQ channels for **Values**. For diagrams you must also define the **Time window to display**, for example **15 Minutes**. For a digital display, specify the number of post-decimal places to be displayed with (**Value decimal places**). Leave the specification of the **Display units** on **Auto**.
   If you would like to display the unit of a channel, you must specify the unit in the title, subtitle or legend.
8. Confirm the selection with **Next**.
9. In the following dialog you can specify **Title** and **Subtitle**.
10. Confirm your entry with **Apply**.

You can change the size of the thumbnails. When you swipe towards the lower right corner the new size is displayed, however only certain dimensions are possible. If necessary create additional thumbnail or dashboards.

While creating a data set or dashboard, it may be necessary to refresh your browser window. Otherwise changes or newly created settings might not become visible.

Step 4: Link data from catman with the dashboard

1. Start catman as usual and configure the channels as you normally do.
2. Copy the file you created in step 2 (PowerBI_Test1_Config.catbpi) to the catman PC.
3. Specify the file in catman: **Special ► Cloud Data Streaming** (**DAQ channels** tab).
4. Specify the file you created in step 2 (click on ...). If you have selected a filename extension other than catpbi, you must display **All files** in the file dialog.
5. Activate **Enable data transfer**.
6. Choose the sample rate, i.e. how often a (single measured value is sent to Power BI per channel: **Refresh every**.
7. Choose the channels whose data you want to send (☑).
8. If the name of the dataset you chose in step 2 is identical with the catman channel name, no further settings are needed. Otherwise you must specify the assignment of the catman channel: Choose the dataset in the **Streaming Dataset value** column. In addition to channels, you can also specify Digital indicators or Analog meters (**Indicators** tab) or process variables (**Process variables**) tab.
9. Close the dialog with **Close window**.
10. Start the measurement in catman.

4.18 Using InfluxDB

InfluxDB is one of the leading time history database systems. Many dashboard visualization systems are able to access data stored in an InfluxDB database. With its data loggers and scripting languages, a common API across the platform, and a high-performance time history engine, InfluxDB facilitates one-time creation and deployment across multiple products and environments. The database is available, for example, on AWS, Google, and Azure, or on your own servers.
See also https://www.influxdata.com.

☞ The function is mainly suitable for channels with relatively slow data recording. The minimum update rate is 0.2 s, which means that a maximum of 5 (individual) measurements are transferred per channel per second. The sample rate set in catman is not relevant as long as it is at least as large as the update rate.

Procedure for InfluxDB versions 1 and 2

1. Start catman as usual and configure the channels as you normally do.
2. In catman choose **Additional functions ► Cloud Data Streaming** (**Special** group in **DAQ channels** tab).
3. Output the configuration file (.catpbi) containing the InfluxDB server address, database name and DAQ name. A text file of this kind might look like this, for example:
   ```
   SERVICE=INFLUXDB
   $endpoint = "http://192.168.1.5:8086/ap-
   i/v2/write?org=MyCompany&bucket=TestDrives&precision=ns"
   $Measurement = Testdrive_Hockenheim_18112017
   ```
   Think of the DAQ job ("Measurement") as a kind of subsection in the database. If no name exists, one is automatically generated by the InfluxDB server. You can also edit the name in the Cloud Data Streaming Console. A sample configuration file (InfluxDB.catpbi) can be found in the "Examples" folder of the catman application directory (usually "Documents\HBM\catmanEasy\EXAMPLES").
4. Select the channels you want to transfer by clicking the box icon to the left of the channel name in the **Source** column. Both hardware and mathematical channels can be transferred. Note that catman can transfer not only channel data, but also the values of indicators (digital and bar indicators) or process variables. As meters can be used to display not only the current value but also Min/Max/RMS, you can also transfer those values to the InfluxDB database.
5. Select the update rate at which to send the data to InfluxDB. The default is once per second.
6. Activate **Data transfer active** and close the window.

You can also change the configuration while a DAQ job is running. The data will then be sent to the new address on the next transmission. If you have specified a connection text (the endpoint line) in incorrect format, however, further transfers may be blocked even if you subsequently enter the correct settings. In such a case, you will need to reboot catman in order to connect.

(Old) procedure for InfluxDB version 1

Since version 1 also understands the endpoint text of version 2, we recommend always using this format. If you want to address version 1 in the old format, the endpoint text would, for example, be:

```
$endpoint = "http://192.168.1.5:8086/write?db=MyCompany_
TestDrives"
```

Authentication

Authentication via user name and password (format V1) or token (format V2) is supported. Specify the authentication data in the configuration file as well:

```
$user = tester
$password = mypassword
```

or

```
$token = xHi7vkl62YMYS1EgV-
moFQtyUuQK5NvWDaCH2FP0mTbyBQpqo2Ye5sNdGiLhppnq6i-cyPkffWl9EL
```

☞ Authentication is always necessary if you want to use a secure connection via SSL and HTTPS.

Secure connection via SSL and HTTPS

To connect securely via SSL (HTTPS), you must set up your InfluxDB database to support this functionality. Then specify the connection details in the configuration file, for example like this:

```
SERVICE=INFLUXDB
$endpoint = "https//192.168.1.5:8086/ap-
i/v2/write?org=MyCompany&bucket=TestDrives&precision=ns"
$user = tester
$password = mypassword
$measurement = TestDrive_Hockenheim_18112017
```

Connection via HTTPS is supported by both version 1 and version 2.
See also https://docs.influxdata.com/influxdb/v2.2/security/.

Notes

- Data is only transferred after you have started a DAQ job, and for as long as it is running.
- With EasyScript, you can initiate an immediate transfer using the `EA_Job.TriggerPowerBIDataTransfer` method.
  See also EasyScript methods for `EA_Comm.INFLUX`.

4.19 Channel info (Component window)

The **Channel info** window (**Window** ► **Channel info** menu on right above the ribbon) shows you the following information:

- Error status, for example the reason for an overflow indication, problems with a CANHEAD® module (ML74, MGCplus), etc. (not all device types support the display of information),
- Channel comment.
  ☞ Enter the channel comment in the same dialog as the channel name. If a sensor comment exists, it can also be included in the channel comments—see **Sensor options**, Use sensor description as channel name. The comment is displayed when you place the cursor over the channel in the **Channel name** column.
- sensor ID of the assigned/found sensor,
- serial number of the device or channel,
- type of amplifier (for MGCplus with connection board) and set type of connection or bridge,
- currently set excitation voltage for a sensor,
- filter (for the currently set sample rate),
- status of the Autocalibration for QuantumX/SomatXR and MGCplus,
- channel scaling,
- gage (k) and bridge factor as well as measurement range for strain gages,
- zero balance value.

The window also enables you to:

- obtain information, such as the IP address or firmware version of the measurement device (do not mark a channel, but instead mark the device in the list in the window **Configure DAQ channels**),
- print out the data,
- flash the LED of the connector used by the channel (only QuantumX/SomatXR),
- activate the Autocalibration function of the MGCplus,
  You change the type of autocalibration of QuantumX/SomatXR using **Sensor ► Autocalibration** in the **Sensor** group of the **DAQ channels** tab.
- call the PMX web interface,
- view the original data of the device (if available) via **Details**, e.g. the XML data of a QuantumX/SomatXR channel.
  ☞ Mark another channel to switch to the normal display again.

4.20 Channel check

☞ Activate display of the channel check as necessary via Program functions (Program options, **System** group). The option is useful for MGCplus and some QuantumX/SomatXR modules for example.

⚠ Do not confuse the shunt test with a shunt calibration A shunt calibration is only possible with the MX460, because with this module the shunt in the transducer can be activated—assuming appropriate wiring. In all other cases, only a shunt resistance is activated in the measurement device, i.e. a shunt test.

The channel check enables you to check the DAQ channel when resistive transducers are connected in a (Wheatstone) bridge circuit. Depending on the measurement device, you have various possible tests available:

1. Check amplifier channel with *in-device* shunt resistor
   This method is available with the following devices:
   - MGCplus with AP14, AP810, AP814 or AP815.
   - QuantumX/SomatXR MX1615, MX1616 as well as with MX238, MX410, MX430, MX440 and MX840A/MX840B (not with MX840) with the connection of strain gages via the adapter plug SCM-(R-)SG120/350/1000.

   The signal is first measured, then the shunt resistor in the amplifier or the connection board is activated and another measurement carried out. The measurement results to be expected can either be calculated (possible with strain gages) or determined before the test with a reference measurement (**Measure** in the **Nominal unbalance** group) which is practicable for transducers, because here the unbalance cannot be calculated.
2. Check amplifier channel with *external* shunt resistor
   ☞ The activation of a shunt resistor in the transducer is only supported by catman from the MX460. This corresponds to a shunt calibration.

   Use this method for other devices only if you can externally connect a shunt resistor (manually) parallel to an arm of the (Wheatstone) bridge circuit.
   Manual activation is always possible, but is quite difficult and complex in practice. With this method you must always perform a reference measurement (**External shunt** in the **Nominal unbalance** group) before the actual test in order to determine the expected signal.

⚠ The channel check is only carried out for the visible channels and for channels with connected and assigned sensors. Channels to which no sensor has been assigned or which are overflowing and channels which have been masked out by a display filter are not measured.

A display filter set in the **DAQ channels** tab is also considered in the **Channel check** tab. You make changes to the display filter via the **DAQ channels** tab.

Export channel table in the **Test result** group writes the displayed channels with all results (and the expected values) to an Excel file (Excel does not need to be installed on the PC for this). In addition, the device and the device address are logged.

4.20.1 Prepare shunt test (determine nominal unbalance)

To prepare the shunt test, the unbalance due to connecting the shunt must first be determined. Mark the channels for which the preparation is to be made. You have the following possibilities depending on the device and sensor:

1. **Compute nominal unbalance**
   You can only use this method when connecting strain gages. In these cases, the expected unbalance can be calculated from the strain gage resistance, the excitation voltage and the shunt resistance.
   This method is available with the following devices:
   - MGCplus with AP14, AP810, AP814 or AP815.
   - QuantumX/SomatXR MX1615, MX1616 as well as with MX238, MX410, MX430, MX440 and MX840A/MX840B (not with MX840) with the connection of strain gages via the adapter plug SCM-(R-)SG120/350/1000.

   Click on **Compute** (**Nominal unbalance** group); the result is shown in the **Nominal unbalance** column.
2. **Measure nominal unbalance**
   This method is more advantageous when connecting strain gages, because the actual unbalance is measured. It is also possible if you are working with transducers. The shunt resistor in the device can also be activated in these cases, but the resulting signal cannot be computed, because the resistance relationships in the transducer are not known accurately enough.
   This method is available with the following devices:
   - MGCplus with AP14, AP810, AP814 or AP815.
   - QuantumX/SomatXR MX1615, MX1616 as well as with MX238, MX410, MX430, MX440 and MX840A/MX840B (not with MX840) with the connection of strain gages via the adapter plug SCM-(R-)SG120/350/1000.

- With MX460, the shunt built into the transducer is activated by outputting a 5 V signal (pin 15) (typical for torque transducers).

 Click on **Measure** (**Nominal unbalance** group) to perform the measurements. The difference is shown in the **Nominal unbalance** column.

3. **Determine nominal unbalance with external shunt**
 When you select this method two further buttons appear in the **Nominal unbalance** group: **Measurement 1** and **Measurement 2**. First, carry out the first measurement with **Measurement 1** without a shunt. Then connect the shunt to the bridge arm and carry out the second measurement with **Measurement 2**. The difference between the two measurements is calculated and displayed in the **Nominal unbalance** column.

Depending on the sensor and device, the unbalance is shown in the channel unit or in mV/V. Finally, specify the **Difference allowed** for the test later. The deviation is defined in percent of the expected unbalance; you can choose between 0.5% and 5% maximum permissible deviation. The usual deviations mostly lie between about 0.1% and 0.5%, because here both the tolerance of the shunt resistance and also the temperature effects of the shunt resistance and sensor play a role.

⚠ In cases 2 and 3, save the DAQ project, because the measured unbalance is only saved in the project.

You can also change the value displayed in the **Nominal unbalance** column manually: Double-click in the corresponding cell and enter the required value or correct the displayed value.

4.20.2 Perform shunt test

To carry out the shunt test the unbalance, which arises by switching in the shunt, must be known. If you have measured the unbalance during the preparation, load the relevant DAQ project again. Otherwise you can only perform a new computation if there is no value present in the **Nominal unbalance** column; see Prepare shunt test.

Mark the channels for which the shunt test is to be performed. You have two methods of performing the test:

1. **With internal shunt**
 The signal is measured, then the internal shunt resistor is activated and another measurement is carried out. The difference between both measurements is

output in the **Measured unbalance** column and compared with the value stated in the **Nominal unbalance** column. If the deviation is smaller than the selected percent figure (percent referred to the expected unbalance) given under **Allowed difference** in the **Shunt test** group, the result is evaluated as **Shunt test OK**.

☞ Also use this method for MX460. With this module, the output of pin 15 is activated and, if connected correctly, also the shunt built into the transducer too.

2. **With external shunt**
   On selecting this method two further buttons appear in the **Shunt test** group: **Measurement 1** and **Measurement 2**. First, carry out the first measurement with **Measurement 1** without a shunt. Then activate the shunt (manually) and carry out the second measurement with **Measurement 2**. The difference between the two measurements is compared with the value given in the **Nominal unbalance** column. If the deviation is smaller than the selected percent figure (percent referred to the expected unbalance) given under **Allowed difference** in the **Shunt test** group, the result is evaluated as **Shunt test OK**.

☞ Deactivate the channels, for which the channel check could not be successfully carried out, using **Deactivate defective devices** in the **Test result** group in *all* DAQ jobs. Marking the channels is not necessary for this.

Export channel table in the **Test result** group writes the displayed channels with all results (and the expected values) to an Excel file (Excel does not need to be installed on the PC for this). In addition, the device and the device address are logged.

5 SETTING UP VIDEO CAMERAS

☞ The dialog is only available with an active Video Cameras module.
See also Configure video recording.

Use **Rescan** (**Extended functions** group) to find a camera which was connected only after starting catman.

Use the **Video** tab to select your camera(s) and configure the recording parameters. As of catman 5.6, you have two options for this:

1. New method (default)
   A dedicated video recording task is started, which runs in parallel with catman and uses a separate CPU core (if available). Also, not all possible resolution and codec options are displayed; only the variants supported by the camera, such as frame size and frame rate. However, audio recording is currently not possible, and only the AVI and MP4 recording formats are supported.
   ☞ Playback of MP4 files is not supported by the Video object in catman Analysis mode.
2. Old method
   In the dialogs all codecs installed on the PC and various file formats and resolutions are offered. However, you cannot use every combination: Some codecs only operate with certain resolutions and not every codec can be used with every file format or frame rate (FPS, frames per second), etc. For example, if recordings for a certain codec can only be made with a fixed frame rate, the setting in the FPS column is ignored. The camera must also be able to deliver the set frame rate. You can activate this variant via **Options ► Program functions: Use video camera legacy system**.

Check the box in the **Live** column on the tab as required to view the images from the connected camera(s) in the video window. (The subsequent recording is not affected by this.) If the camera image is not displayed, the selected setting is not possible.

Make the settings for starting and stopping (subsequent) recording via the DAQ job and Configure video recording.

Procedure applying the old method

Try out which settings produce a good compromise between the file size generated and the CPU computing load:

- Start a test recording: **Record** (**Test recording** group). The file produced in this way will be deleted by the next start of catman at the latest, otherwise a new recording will overwrite the old file.
- If the recording does not start, the selected combination of compression, file format, resolution, frame rate (FPS) and/or audio settings is not possible. On data acquisition, check whether frames had to be omitted if the PC's speed was insufficient for the codec or frame rate.
- At the end of such a recording (click on **Stop**) the data rate in MB per second and the frame rate achieved are displayed in the video window.

⚠ Since very different settings are possible depending on the configuration of your PC, but generally not all settings can be used, you *must* carry out a recording test with **Record** to check whether the selected settings can be used. Depending on the PC performance, camera driver, codec and file format, it may be that no data is produced, the compression leads to artifacts in the picture or many frames (single pictures) are dropped. Therefore, it is essential to view the produced test recording with **Play** (**Test recording** group).

If the relevant driver or codec supports it, you can make other settings (the dialogs are dependent on the driver or codec) using the **Configure camera/video compression** (**Extended functions** group). Since these settings act directly on the driver or codec software, they are not saved in the DAQ project however.

5.1 Cameras

As a prerequisite, the camera must support Windows DirectShow (except with **IP camera**), meaning there must be drivers which are compatible with WDM (Windows Driver Model) or VfW (Video for Windows). Also, the camera must provide a continuous stream of data. This means high-speed cameras cannot be used, because they first record to an internal memory that must then be read.

You can use most USB cameras, such as the Logitech C910 and C920 models, with catman. Axis Ethernet cameras in combination with Axis Streaming Assistant or Allied Vision's Stingray F-033B/C Firewire cameras have also been used successfully in conjunction with catman. There are some special aspects to consider with regard to the Liebherr MDC3 (see below).

For analog cameras you can also use a video encoder, such as the M7001 model from Axis (www.axis.com), which converts the analog RGB signal to Ethernet. The *AXIS Video*

Capture Driver program must be installed to run it: www.ax-is.com/techsup/software/capture_driver.

☞ You will also find camera models tested with the latest catman version in the catman data sheet; see https://www.hbm.com/Support ► catman.

Special features of IP cameras (compressed video data, RTP stream)

As from catman 5.3.2 you can also use cameras that already transmit a compressed (Ethernet) data stream. To do so, select **Video source**: **IP camera** (new method) or **RTP stream** (old method), as these cameras cannot be automatically detected, and specify the camera's IP address. The advantage of a camera with compression is that catman does not have to do it, so the CPU load due to the camera data is relatively low. Some options, such as (additional) compression, are not available for those cameras however.

☞ Live display from a video source with compressed data is useful only for testing purposes. As the data stream has to be decompressed for this, the CPU load is increased and the advantage of a precompressed data stream is lost.

Using the Liebherr MDC3 camera (IP camera)

Requirements

- You need external software to configure and run camera streaming: Liebherr IP Camera Control.
- You must set the camera's IP address and subnet mask manually.
- You must also specify the IP address of catman manually in the camera software – meaning it should not change.

Restrictions

- All settings are parameterized directly on the camera, not via catman. Refer to the camera documentation on this.
- You cannot perform a factory reset on the camera.

Procedure

1. Start the Liebherr software and set the IP address, subnet mask, and gateway if necessary.
2. Set **53260** as the **Streaming Port**.
3. Specify the **Destination Address** – that is, the IP address of the PC on which catman is going to run.

4. In catman select **IP camera** as the **Video source**.
5. In the next dialog, select **Liebherr MDC3** as the **Camera model**.
6. Enter the camera's IP address and port, separated by a colon, e.g. **udp://192.168.178.44:53260**.
7. Start streaming in the IP Camera Control program.
8. In catman specify when you want recording to start (**DAQ jobs**, **Video** tab in **Settings** group).
9. Start the DAQ job in catman.

Notes

- As there is no way to restore the camera's factory settings with a single click, you should make a note of the IP address, such as on a sticker on the camera. Otherwise the only way you can see the IP address by which the device identifies itself in the network is to use a network analyzer, such as Wireshark. You can only set a different address with the Liebherr IP Camera Control program if you know the address in the first place.
- You can change all the camera settings, such as the frame rate, using the communication protocol described in the camera manual. It is an ASCII-based protocol that accepts commands via TCP/IP.
- As an alternative to starting streaming manually via the Liebherr program, you could use EasyScript to send the required start and stop commands. The syntax of the <Start Streaming> and <Stop Streaming> commands can be found in the camera manual.

5.2 Codecs

By default, the new procedure with a separate catman task is used. Depending on the format, either a Microsoft (AVI) codec is used, or the MP4 encoding is done by the CPU or graphics card (if supported). Start a test recording to check the quality and function of the selected setting: **Record** (**Test recording** group). The file produced in this way will be deleted by the next start of catman at the latest, otherwise a new recording will overwrite the old file. View the generated test recording with **Play** (**Test recording** group), and check that it is OK.

☞ Playback of MP4 files is not supported by the Video object in catman Analysis mode.

Old method

As all codecs installed on the PC are offered in the dialog, you must try out which codec works and has favorable features like low CPU load and high compression. A good compromise between CPU loading and file size is offered by the *Microsoft Windows Media Video 9* codec for example.

☞ The MPEG Layer 3 codec from Microsoft which is included in Windows does not work without problems in conjunction with catman. Use an alternative codec, e.g. LAME Direct Show Filter 3.99.5 or Lame MP3 Encoder 3.99.5 or 3.100. The codec can be download from the Internet, e.g. from
www.free-codecs.com.

Background information about DirectShow

The DirectShow interface has been part of the Windows SDK since November 2007 and the corresponding technologies for the codecs and filters used, e.g. MPEG-1, MP3 (Fraunhofer) or Windows Media Video, are included in the Windows license. In Windows the DirectShow functions are called Enhanced Video Renderer (EVR), for example, and support DXVA 2.0 (DirectX Video Acceleration). Other codecs, e.g. AAC or H.264, can be integrated. Generally however, you must pay license charges for this, i.e. you must either purchase the codecs or filters separately or together with a program.

6 CONFIGURING DAQ JOBS

You can work with just one *DAQ job* or create several DAQ jobs. You can additionally create multiple recorders for each DAQ job (requires catmanAP, and is limited to 512 channels per recorder), and so control the recording (and data rate) of the measured values differently for individual channels. Without a recorder, all channels are recorded simultaneously.

If you have multiple DAQ jobs or recorders, give each one a name to identify and distinguish the respective settings: In the job list, click twice in the relevant name (do not double-click) to activate the editing mode.

What measuring options do you have?

1. Manual start/stop with sample rates from 1 Hz to 100 kHz (depending on the device).
2. Measurement with start and stop trigger and sample rates from 1 Hz to 100 kHz (depending on the device).
3. Measurements in which a measured value is stored only at the push of a button, e.g. to determine a calibration curve. Use a low sample rate, e.g. 10 Hz, and Storage mode **Manual storage control**.
4. Measurements at longer intervals from several seconds to hours. For this use event monitoring and the **Data storage** event, either with a **Time interval** every x seconds (save 1 measured value) or with two **time intervals** which activate and deactivate saving at intervals offset by the desired recording period; see also Limit values and events.
5. For example, there are special measurement and recording procedures for material testing: Cycle-controlled and time-controlled measurement, in which you can define how often, and for how long, all measured values are stored, and how often peak values are stored, over what period of time; see Cycle-dependent intervals (long-term DAQ) and Time-dependent intervals (long term DAQ).

What can you define for a DAQ job?

- Which (maximum) sample rates are to be used (**General** in the **Settings** group),
- Whether—and if so, which—test parameters to save.
- Whether an event log is saved.
- Whether statistical values are determined in addition to the DAQ job (min/max/mean values over a specific period of time).

- How often how much data can be transferred (**Advanced** in the **Settings** group).
- What happens in the event of errors (**Advanced** in the **Settings** group).

If you have catmanAP and are using recorders, you can make the following settings for each recorder separately; otherwise make the settings for the DAQ job:

- How to start or stop the measurement or recording.
- What sample rate is used for the recording.
- Which channels are involved in measuring (**Channels** in the **Settings** group).
- The file to save to after measuring (**Storage** in the **Settings** group).

If you are not using recorders, you can use **Channel** in the **Settings** group to additionally specify whether an active channel is stored in the temporary file, and whether it is included when saving to a file. All active channels of a recorder are also saved.

Default settings

If you do not make an entry, catman performs a continuous measurement at a sample rate of 300 Hz (QuantumX/SomatXR only) or 50 Hz (all other devices) and retain all measured values for saving later. When the measurement stops (**Stop** in the **DAQ** group) catman asks whether the measured values should be saved.

Unattended test

If you are configuring a DAQ job for a test that is to run unattended, you can have catman make some settings that are well suited to the purpose. All settings can be changed afterwards if they do not fit your DAQ job. The DAQ job can be run on a PC or on the CX22 (QuantumX/SomatXR); the same settings are used in both cases.

Click on **Unattended test** (**DAQ jobs** tab, **DAQ jobs** group).

The following options are used: **Reconnect and initialize devices before DAQ start** (General measurement settings (Start/ Stop/ Sample rate)), Storage mode **Faststream** (Storage mode) and **Deactivate failed channels and continue with DAQ** (Data transfer and error handling).

See also catman start parameters, Watchdog function

⚠ The settings of *sample rates* and *filters* as well as the *channel activation* on the **DAQ channels** tab are applied by default for *all* DAQ jobs, unless you have activated the **Apply to first DAQ job only** option in the Channel list options.

Procedure

Create new DAQ jobs and/or recorders, delete those no longer required, or use ⬆ or ⬇ (**DAQ jobs** group) to sort them. The job list contains all active DAQ jobs, and is displayed on the **DAQ channels** and **Visualization** tabs when you click **Start** (**DAQ** group); see also Measuring (Start DAQ job). When you click **Start** on the **DAQ jobs** tab, the DAQ job currently displayed, or the DAQ job of the displayed recorder as appropriate, is started.

☞ You can also import DAQ jobs (and recorders) from other projects. Menu: **File ► Import ► Import DAQ jobs**. The import overwrites all existing DAQ jobs; therefore, carry out the import before defining new DAQ jobs.

💡 You can display the job settings via the Text object and **System text** during data acquisition. You can use an LED to display the status of the data acquisition.

6.1 General measurement settings (Start/ Stop/ Sample rate)

The DAQ settings are divided into three groups:

1. Start of recording
2. Stopping recording and measurement
3. Sample rate

Optional functions

Zero balancing of the hardware channels/computation channels facilitates the zero adjustment (the *Zero balance*) of all released channels (zero balance not locked, **DAQ channels** and Options for safety tabs) when starting the DAQ job, separately for device channels (hardware) and catman computation channels. On-board computation channels of QuantumX/SomatXR modules are not zero-balanced. The action takes some time, depending on the zero balancing method. Also make sure that the desired zero state is set when the job is started.

☞ With QuantumX MXFS, the zero value is only computed with the scaled values of a sensor adaptation, not with the display of a wavelength.

Connect and initialize devices before start: If one of the devices fails, or channels develop errors, during measurement when running repeated jobs (Specify job parameters) and when multiple devices are connected, you can use this option to reconnect (and reinitialize). This option is helpful for long-term DAQ if there is a risk that one or several devices might fail temporarily during the measurement or the connection to them could be interrupted. Then divide your measurement into shorter intervals, for example **End of measurement** after 12 hours, activate this option and repeat the DAQ job correspondingly frequently (**Job parameter** tab). Consequently, reconnection occurs at

the start of each interval and if communication is broken it is re-established.
See also Behavior on errors during the measurement.

catman-Normalize time channels: The option is only useful when starting measurement by trigger. Use the option to start the recorded catman time channels at time 0. Without the option, the recorded time channels will start at the trigger time (since start of measurement) minus the pre-trigger. Hardware time channels are not changed.

6.1.1 Start of recording

The start of recording can take place manually, by using a trigger or at a certain point in time.

> You can also start a DAQ job using a shortcut (**Job parameters**, **Settings** group, see Define DAQ job parameters) or a specific key (Menu **File ► Options**, Keyboard shortcuts in the **System** group).

Immediately

Starts recording with the start of the DAQ job.

With recorders the recording is in this case automatically repeated if the end of recording is restricted (trigger, duration or time-point).

Trigger

☞ The trigger only affects the *recording* of measured values. Values are *displayed* once the acquisition starts.

If you enter **Edge** as the condition for a trigger, the measured value must first be under (over) the level entered, so that the value again exceeds (or falls below) the level, i.e. a rising (or falling) edge exists. With **Level**, the acquisition is started *immediately,* if the value exceeds the level or is below the level at the start of the DAQ job. Note however that, due to noise on analog signals, falling edges can occur even with, for example, an overall increasing signal.

In **Digital-I/O** trigger mode, triggering can occur on the digital inputs of MX879 or a CX22 module (QuantumX/SomatXR), the digital inputs of a PX878 of the PMX or the digital inputs of the CP22/CP42/CP52 with the MGCplus. Depending on the device, the trigger can be activated either on the transition from High to Low (**x LOW**) or from Low to High (**x HIGH**), or it is limited to the transition specified in the device. In Order to fade out short-time interferences (switch chatter), you can additionally specify a time (**Debouncing**) for which the signal must be present before it is recognized as valid.

catman-Normalize time channels: Use the option to start the recorded catman time channels at time 0. Without the option, the recorded time channels will start at the trigger time (since start of measurement) minus the pre-trigger. Hardware time channels are not changed.

Burst mode (not available for recorders): With the burst mode active, once the stop condition has occurred or the post-trigger expired, the start condition is awaited or the pre-trigger buffer is filled without measurements being saved, i.e. without exporting them from the temporary file (save). This only takes place when the specified number of **Max. bursts** has been reached. In the final measurement file there are then a correspondingly large number of consecutive sections, one for each trigger event (including pre- and post-triggers).
See also Configure y(x) graph for display of the measured values.

Pre-trigger: You can specify a time period in which data is already recorded *before the start* of a DAQ job. The time is entered in seconds.

The pre-trigger buffer must initially be filled as it is only then that the measured values are monitored for the trigger condition.

The measured values for the pre-trigger are filed solely in the RAM memory of the PC. You may therefore not exceed the size of the physical memory (you can check for the application in the Windows Task Manager). Approximately 8 bytes per measured value are needed, i.e. approximately 350 MB for 30 minutes with a sample rate of 2400 Hz and 10 channels.
Even without a pre-trigger it may be the values before the trigger level are recorded. Since the measured values are not transferred singly, but in blocks (read blocks), saving of the read block occurs when a value in the read block fulfills the trigger condition.

Repeated recordings/repeats (only with recorders): Repeats the recording with the recorder parameters as long as the DAQ job is active. The recording must in this case be restricted by a trigger, duration or time-point. If the file name is not unique, e.g. via %DateTime%, catman appends a counter.

Also, the recording is repeated with the **Immediately** setting if the end of recording is restricted.

Min. hold time: With this option you can prevent a brief disturbance pulse from initiating the trigger. Only signals which fulfill the trigger conditions for a time period longer than that specified here start the measurement. The time is entered in seconds!

You can also monitor several conditions using a trigger on a computation channel. For example, you might want to start when the measured value is greater than 350 in **Channel_1** (Channel name) or greater than 740 in **Channel_2** (Channel name). Enter the following function in the algebraic computations: **IF((Channel_1>350) OR (Channel_2>740), 1, 0)**. When the condition is fulfilled, this computation channel contains 1, otherwise 0. Trigger on this computation channel, once the value is greater than 0.5.

Special features with the burst mode

- In burst mode, only the storage mode **Keep all data** is permissible.
- The DAQ job must have either the **Trigger** or **Duration** stop condition. In burst mode, this condition does not determine the end of the job, but rather the duration of the burst. The job is only terminated on reaching the number of **Max. bursts**. A manual cancellation (**Stop**) is however possible at any time.
- Trigger events, which occur after the triggering of the start trigger and before the occurrence of the stop trigger or before the expiry of the post-trigger, are ignored.

6.1.2 Stop of data recording and measurement

A measurement can be stopped manually, by a trigger, after a certain period of time, after measuring a certain number of values, or at a certain time (day of the week and time, or every x hours).

You can stop a measurement at any time via **Stop** (**DAQ** group). You can also initiate stopping of a DAQ job using a specific key (menu **File ► Options**, Keyboard shortcuts in the **System** group).

Trigger

If you enter **Edge** as the condition for a trigger, the measured value must first be under (over) the level entered, so that the value again exceeds (or falls below) the level, i.e. a rising (or falling) edge exists. With **Level,** the acquisition is stopped *immediately* if the value exceeds the level or is below the level, whichever is required. Note however that, due to noise on analog signals, falling edges can occur even with, for example, an overall increasing signal.

☞ Since the measurements are not fetched individually from devices, but in small blocks (read blocks), measurements may also be present which were still measured after the trigger conditions were fulfilled, because the analysis takes over the complete read block in which the condition is fulfilled.

In **Digital-I/O** trigger mode, triggering can occur on the digital inputs of MX879 or a CX22 module (QuantumX/SomatXR), the digital inputs of a PX878 of the PMX or the digital inputs of the CP22/CP42/CP52 with the MGCplus. Depending on the device, the trigger can be activated either on the transition from High to Low (**x LOW**) or from Low to High (**x HIGH**), or it is limited to the transition specified in the device. In Order to fade out short-time interferences (switch chatter), you can additionally specify a time (**Debouncing**) for which the signal must be present before it is recognized as valid.

Post-trigger: You can also enter a time period which is still measured *after* a DAQ job stops. The time is entered in seconds.

Max. (number of) **re-triggers** (during post-trigger): The setting is only practicable when the measurement is terminated with a post-trigger. With the option active (>0) and a positive post-trigger time, monitoring for a renewed occurrence of the condition for the start trigger takes place within the post-trigger time. If the condition occurs, the post-trigger time is again awaited from this time-point. This occurs as often as specified for this option.

You can also monitor several conditions using a trigger on a computation channel. For example, you might wish to stop when the measured value is greater than 350 in **Channel_1** (Channel name) or greater than 740 in **Channel_2** (Channel name). Enter the following function in the algebraic computations: **IF((Channel_1>350) OR (Channel_2>740), 1, 0)**. When the condition is fulfilled, this computation channel contains 1, otherwise 0. Trigger on this computation channel, once the value is greater than 0.5.

Maximum measurement duration

As long as your storage medium can store the data temporarily, there is hardly any limitation on the duration of the measurement or the post-trigger with NTFS file systems (NTFS: see Temporary data store). The values for the pre-trigger must be able to be saved in the PC RAM.

In the **Duration** and **Number of samples** settings, catman checks the space available, and outputs a message if the free space is less than would be needed for temporary data storage plus the export (data saving). In other cases, you have to monitor the free space yourself: In the status bar the number adjacent to shows you how long you can still measure (d = days, h = hours). During the computation 100 MB of safety reserve is included. The status indicator is highlighted in red when the free space falls below 1 GB. See also Job status panel, Disk Full event.

Specify another drive for the temporary storage space (see Program options: Data storage), delete unnecessary data on your PC or specify a different drive for the storage file when you receive the message that insufficient free space is available.

☞ catman records a maximum of 2,000,000,000 measurement values per channel (if enough memory is available). Then the measurement is stopped. But we recommend creating smaller files, because files containing so much data become unwieldy and demand heavy resources. Periodically save just 1,000,000 measurement values per channel, for example, or repeat your DAQ job at shorter time intervals.

6.1.3 Sample rate

☞ Changing the sample rate and filter settings can be disabled with password protection—see Sensor options, Password protection.

The *Sample rate* should be about ten times the maximum frequency, which you want to measure reliably. Use a factor of 20 or higher if you want to acquire peak values.

catman automatically uses low pass filters as default (automatic filter selection) which use approx. 15% of the sample rate set as long as the channel allows this, i.e. as long as it does not have a lower bandwidth. This might be the case, for example, with an ML30 (MGCplus, 180 Hz at -3 dB).
See also Program option **DAQ channels** (**System** group): Filter, Setting filters manually, *Alias* effect.

☞ Filters with Bessel characteristic create no signal distortion, but have a relatively flat frequency response. In case of high-frequency interference at *high* amplitudes, you should therefore set the cutoff frequency to 5% of the sample rate, or use filters with Butterworth characteristics..

Sample rate groups Standard, Slow, Fast

With some devices, *Slow* and *Fast* sample rates are additionally available. A slow sample rate is useful, for example with temperature channels, if the values measured are not to be acquired using the same (high) data rate as the other channels or if channels are present which operate slower due to their principle (CAN signals, GNSS). The fields are

not accessible (gray) if no channel uses these sample rates. Select the channel(s) you want to change on the **DAQ channels** tab and choose a different sample rate group from the ribbon.
See also MX410, MXFS: Use an increased sample rate (highspeed mode).

The terms **Fast** and **Slow** for the sample rates are intended for easier orientation. You can also, for example, define **4800 Hz** for **Default**, **100 Hz** for **Fast** and **600 Hz** for **Slow**.

Assigning a sample rate to a channel

Assign which channel is to be acquired with which sample rate on the **DAQ channels** tab (**Sample rates/filters** group); see Configuring channels. Channels for which the slow sample rate is activated are marked with ▸; ▸▸ marks channels with the standard sample rate and ▸▸▸ marks channels with the fast sample rate. The associated time channels are automatically created in the background.

Display only possible sample rates for QuantumX/SomatXR

In the Sample rate groups field you can specify that only the sample rates that the current device actually supports are displayed. The function requires at least firmware version 4.40 in the QuantumX/SomatXR.

Note that in QuantumX/SomatXR sample rates and filters are linked. If you manually select a very low filter frequency, for example, high sample rates may no longer be available. For example, with the MX840 and a 2 Hz filter you cannot select a sample rate of 19200 Hz.

Only active sample rate groups are checked. Unused sample rate groups are unaffected.

Sample rate for recorders

In the DAQ job define the *maximum* possible sample rates. In the recorders you can then define that they record at a slower data rate.

Use the option **Deactivate down-sampling low-pass filter** only if the current process load is too high during the measurement; see The Job status window. In the default setting (option deactivated) the higher frequency components of the original sample rate are reduced using a filter and only then is the specified rate recorded. A Bessel low-pass of the 8th order with a Cutoff frequency of 20% of the original sample rate is used. The “surplus” measurements are omitted from the resulting values and only those needed for the specified sample rate are saved. The computation however requires some computing power.

Sample rates above 4800 Hz

- If you are using sample rates above 4800 Hz, you should increase the write cache in the options for data saving; see Write cache.
- If you are using sample rates above 9,600 Hz, catman automatically increases the data buffer for the transfer of the measurements so that all values can also be transferred. The computed buffer size is however not displayed and is also only used (temporarily) for this job; see Data buffer.

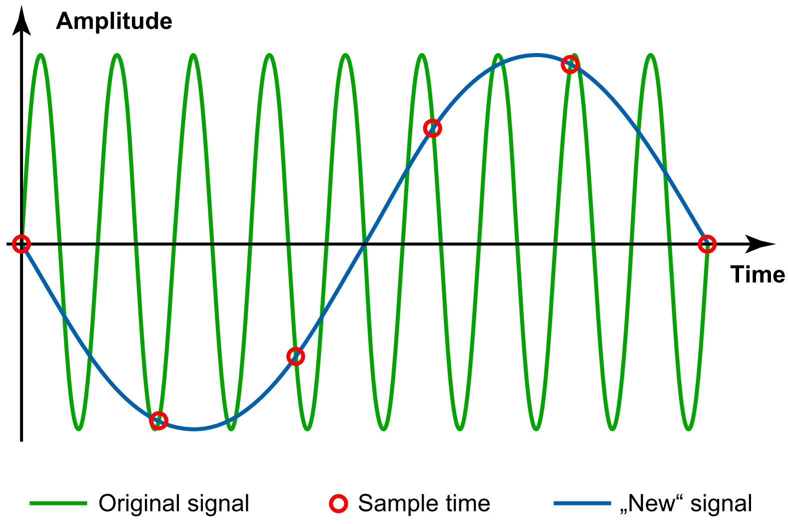
Notes

- Different sample rate groups must not use the same sample rate. Assign all the relevant channels only to one group or check whether you can use recorders.
- For later QuantumX modules with B, and C functionality and SomatXR modules, you get various lists for the available sample rates, depending on the *Sample-rate domain* used by the module; see Sample-rate domains for QuantumX/SomatXR.
- With some QuantumX/SomatXR modules the maximum sample rates are only available in the DC operating mode, not with carrier frequency. The modules perform the switchover automatically and independently of the sensor configuration. If necessary, check which settings are being used via the **Channel info** component window.
- With the QuantumX/SomatXR module MX410, you can switch to the increased sample rate (192 kHz, or 200 kHz with decimal *sample-rate domain*) via the context menu in the **Sample rate/Filter** column (**Highspeed mode**). Here, channels 1 and 2 are always activated and channels 3 and 4 are deactivated; selection of the channels is not possible. The setting can also be undone with the same menu to be able to use all four channels again.

6.1.3.1 Which sample rate is the right one?

A question often asked in digital measurement technology is that of the correct *sample rate*, or measurement rate. The following illustration shows what happens when you choose a sample which is too low on a sampling measurement system.

Aliasing with a sample rate which is too low



In the picture the blue line shows the plot displayed by a graph when the sample rate is too low. The green line shows the original signal which is sampled at certain times. We call the effect *Alias*, i.e. you see a completely different plot. Therefore, many devices which operate by sampling have so-called *Anti-alias filter*.

Sample rate with HBM devices

With the default settings of catman an alias effect is unlikely, as an appropriate filter is used to suit the sample rate (menu **File ► Options**, **DAQ channels** (**Channels and sensors** group) and Filter section). However, if you deactivate this filter (**Allow manual filter settings** and use the setting **Working without filter** in the channel parameters of the DAQ jobs), aliasing can also occur with these devices. In this case, enough values will be acquired *in the device,* however, not all measured values are also *transferred* to catman.

Determining the correct sample rate

So that *no* aliasing occurs, the amplitude of the highest *measured* frequency must be less than the smallest step value of the A/D converter (LSB = least significant bit) and the conversion or sample rate must be twice as high as this frequency. The specified bandwidth is however the frequency at which the amplitude has only fallen to about 90% (-1 dB). The frequency at which the amplitude has fallen to values which are small enough is far higher. The minimum sample rate which you have to use is double this (unknown) value. In practice this means that the useful bandwidth is with certainty less than one third of the sample rate. To be on the safe side, you ought to use even less than 5%. However, you do not need to draw on the smallest increments of the A/D converter; you can also define an amplitude below which you do not want to consider any further measurements.

☞ If you want to be sure that no information is lost, i.e. that all relevant frequencies are measured, select an amplifier with the largest possible analog bandwidth (ML10, ML55), use the highest possible sample rate and **Filter**: **10% sample rate**. Then perform an analysis of the signals (for example with a frequency spectrum of a channel) to clarify which signal frequencies are to be measured.

6.1.3.2 Switching sample-rate domains for QuantumX/SomatXR

☞ Switching *sample-rate domain* is only possible with more recent QuantumX modules with B or C functionality, and SomatXR modules.

⚠ All modules of a DAQ project used must apply the same sample-rate domain; mixed operation is not possible and leads to an error message.

Procedure for switchover

1. Go to the **DAQ channels** tab.
2. Mark the relevant module.
3. Click on **Configure** in the **Sample rates and filter** group.
4. In the dialog window at the top select **Decimal** or **Classic** at **Sample-rate domain**.
5. Close the dialog with a click on **OK**.
6. Terminate the catman DAQ project.
7. Wait about ten seconds and then switch off the QuantumX/SomatXR module, then on again.
   The waiting period is needed, because the module must first save the new setting in order to be able to use it for the next start. If you switch off the module too soon, the new setting is not accepted.
8. Start a new catman DAQ project.
9. Check whether the sample rate set by the module after the switchover and the filter are suitable for your measurement.

6.2 Data storage and backup (settings: Storage)

⚠ If the file system of your storage medium is not NTFS, you can *only record a certain number of measured values*; see Temporary data storage.

Special features of recorders

The **Storage mode**, **Data saving**, **File format**, **Resolution** and **Saving depth** settings are not available for recorders. With recorders, data is first saved in *FastStream* format and converted into the *standard catman format* after recording.

☞ Auxiliary channels with a manual time base are always recorded at the preset sample rate; no downsampling takes place here.

The conversion starts automatically as soon as the file has been saved.
Use Analysis mode and export your data if you need other formats.

If you want to suppress automatic start of conversion, you can set the following key to 1 in the Windows Registry: HKEY_CURRENT_USER\Software\VB AND VBA Program Settings\catmanEasy\Defaults\RECORDERNOAUTOFSCONVERT.

⚠ Changes to the Registry using the regedit.exe program should only be made by experienced users, and after backing up the existing Registry, because under some circumstances serious Windows errors might result. If necessary, ask your administrator to make the change.

Check the following input fields and change the catman defaults as necessary:

- Storage mode
- Data saving (and interval)

💡 You can still change the file comment, *test parameters* or the file name before saving, if when saving the data you either specify **Prompt on DAQ termination** or activate the option **Edit test parameters on DAQ termination** at **Automatically on DAQ termination**. However, you can use **Comment** in the **DAQ** group (**Visualization** tab) to also enter comments independently of that *during* the measurement. The comments are then saved as additional test parameters with the date and time of the entry. The comments in the **DAQ comments** window are deleted before each measurement.

- Saving depth
- File format (and resolution)

Saving file: Using *placeholders* you can integrate different variable texts in your file name or folder path, e.g. date or time or the (present) test parameters. If you add more test parameters, they are also displayed; see Defining test parameters on this. Process variables of an AutoSequence are also selectable. The placeholders are directly replaced before data saving. For example, the placeholder %DateTime% is replaced by the character string "Year_Month_Day_Hour_Minute_Second"; the final file name then includes, for example, the character string "2016_08_05_12_01_35".

The placeholder is inserted at the current cursor position in the input field for the file name. You can use multiple placeholders in the file name and/or path. If folders do not exist, they are automatically generated. Note that Windows limits the length of path and file names, so you should not use more than 240 characters.

Display parameters such as the file name, job name or commentary by way of the Text and **System text** objects during measurement.

In catman 5.0 or higher you can save your measurement data not only locally (on the PC running catman) but additionally on another PC (FTP server): Remote data saving.

6.2.1 Storage mode

See also Temporary data store.

Decide here whether catman should retain *all* data (**Keep all data**) or whether you wish to decide which measured values should be kept (*temporarily* saved) (**Manual storage control**). With this storage mode you can carry out a *measurement at the press of a key,* because the currently measured value is only saved with a click on . The latter is, for example, useful when acquiring a calibration characteristic, as only some points have to be measured on the transducer characteristic. However, you can activate a continuous storage of all measurements also in this storage mode.

With **Manual storage control**, all values are displayed in a real-time graph. However, they *cannot be saved in a file after the measurement or displayed in a Post-process graph.* Here, only the manually saved measurements are available.

Controlled by event monitoring/script is interesting if you want to control the saving of values *exclusively* via an Autosequence or a script. In this case *no* data is stored by catman itself.

Peak values per time interval

Cycle-dependent intervals (long term DAQ)

Time-dependent intervals (long term DAQ)

Fast Stream is a special recording method which is intended for high sample rates (20,000 Hz and more) and/or many channels. Here, the data is *not*, placed in temporary data storage as otherwise usual, but written directly to a file. This method is also used if you select **Unattended test**, i.e. if no graphical output of the measured values on a panel is required during measurement. However, this leads to a few restrictions:

- If, during the measurement, you add a further channel to a real-time graph, the data of the last seconds are not shown as otherwise usual. Only the data acquired from this time point are displayed.
- The data acquired in this mode cannot be displayed in DAQ mode in a post-process graph. This is only possible in Analysis mode.
- You cannot use the angle-synchronous graph object () in this recording mode.
- Data from these files cannot be analyzed directly. When first loading a test containing such files, they are therefore converted to files with the catman standard format. With larger files (> 1 GB) this may take a few minutes. Therefore, on opening you receive a dialog with which you can cancel the operation.

6.2.1.1 Peak values per time interval

See also Time-dependent intervals (long-term DAQ).

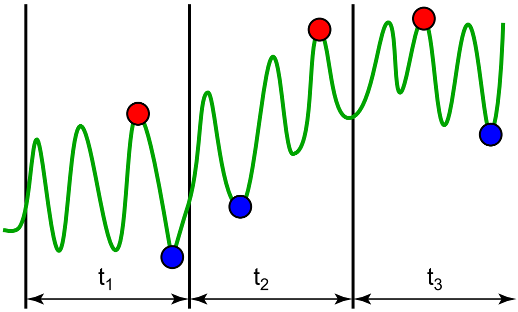
Peak values per time interval is a special method for measuring which results in a lot of data, ultimately however only the peak values (minimum and maximum) are required that occur within a certain time-frame. With this storage mode, you can acquire short peak values using a high sample rate, nevertheless only a few values will be saved. This is useful, for example, if during material tests you wish to record only the maximum stress through dynamic load change over several days. In real-time graphs all values (during the measurement) are still displayed. The option affects only the recording of the values.

Drag the time channel, e.g. the **Default sample rate**, on to the x axis of the graph in order to display the peak value channel in a post-process graph over time (Activate display of time channels in the Channel list options!). Use the plot style **Points**

only (scatter), as otherwise the min/max values will be connected with straight lines. For further computations you can separate the min/max values; see Curve section.

☞ Do not insert any channels into your real-time graphs during the measuring if you are working in the **Peak values per time interval** mode. Either define all plots before you start the DAQ job or create a new graph if you wish to see more channels.

Example of peak values per time interval



6.2.1.2 Cycle-dependent intervals (long-term DAQ)

With this storage mode, you can acquire short peak values using a high sample rate, nevertheless only a few values will be saved (the example in the Peak values per time interval section shows three time intervals; the function is similar for cycle-dependent intervals). This is useful, for example, if during material tests you wish to record only the maximum stress through dynamic load change over several days. In real-time graphs all values (during the measurement) are still displayed. The setting affects only the recording of the values. Additionally, you can periodically record one or more complete cycles or a single value (snapshot).

Click on **Configure** to define the parameters for the measurement. You have three options for how catman can detect a cycle:

1. You have a channel containing a (numeric) cycle counter: **Counter channel**.
   This might be a CAN channel or a counter channel (pulse counter), for example, which receives one pulse from the controller of your measurement system in every cycle.

☞ Choose **Reset on start** to specify whether *0* is to be used as the start value (option activated), or the original or last value of the counter in catman since the start. Note that the measurement will not start if the counter value is higher than the last recording cycle.

2. You define a period corresponding to exactly one cycle: **Cycle period**.
   Use this variant if you are able to specify the cycle period on the controller of your measurement system over a period of time, and that time is adhered to with sufficient accuracy.
3. Each cycle delivers an approximately sinusoidal or triangular signal in one of your DAQ channels, meaning *a* minimum and *a* maximum are produced in every cycle. This signal is analyzed by catman using the **Peak-Valley detection** function, and a corresponding cycle counter is generated from the minimums and maximums. To determine whether a value is a minimum or maximum, or whether the current value is merely a signal spike created by noise, you must specify a **Hysteresis**—that is to say, a minimum range which the signal must pass through in order to obtain a valid extreme (minimum peak-to-peak amplitude). Use 20% of the peak-to-peak amplitude (in units of the channel) for this value for example. Use a filter as necessary if you have a signal with short but high thresholds.

Then specify the **total number of cycles** (to be monitored). The measurement is terminated after this number; the stop condition of the DAQ job is ignored in this operating mode. Then in the table for the **Sequence plan** define how this number is to be divided up into the various measurement intervals and sequences. Here, you can specify just one sequence or any number, but sequences must not overlap nor should there be any gaps. Each sequence (a row in the table) requires the following details:

- **First cycle**: The sequence begins with this cycle. The first sequence begins with 1.
- **Last cycle**: Last cycle in the sequence. When you click in the **First cycle** field, the total number of cycles is always entered here; change the displayed number accordingly. The last cycle in all sequences must correspond to the total number of cycles.
- **Interval for continuous storage**: Here you specify the number of measured cycles after which a snapshot (single value) or one or more complete cycles (all measured values) is/are to be saved again. You can select one of the default intervals or enter a number yourself. Entering **All** (or 1) causes all values in the cycles concerned to be saved to a file. Activate **Continuous storage into one file** to also save all the cycles in further sequences to the same file. If

you select **Never** (or 0), peak values at the most are saved, if this is specified by **Interval for peak storage**.

- **No. Cycles to store**: Enter the number of cycles here (click in the field and type in a number) in which you want all measured values to be recorded and saved in sequence. In the default setting a new file is created per storage process except when you save snapshots (single values) or activate the option **Continuous storage into one file**. Snapshots are always saved in a single file. The current date and time, the keyword "complete" and the current cycle number are appended to the file name specified for the DAQ job, e.g. Job1_20090813_143558_complete22.
- **Interval for peak storage**: Here you define whether, and if so, after how many measured cycles, the minimum and maximum over those cycles are to be saved. You can select one of the default intervals or enter a number yourself. The peak values are stored in the catman temporary file and at the end of the measurement are saved in *one* file. The current date and time and the keyword "peaks" are appended to the file name specified for the DAQ job, e.g. Job1_20090827_220318_peaks. The peak values are displayed as dedicated channels in the channel list, so that they are available for Post-process graphs.

  With longer intervals or acquisition times record the time channel as time of day and date: **Create absolute time stamps for peak values**.

Click on **Create** to generate another row in the table. The **First cycle** and **Last cycle** columns are completed automatically, but you can still change the details.

After a click on **Check** catman checks whether all fields have been correctly completed and whether the defined sequences can be processed in this way, e.g. whether the definition of settings for any cycles has been forgotten during retrospective changes. Erroneous sequences (rows in the table) are shown with a red background.

Create a short sequence as the first sequence and specify **All** for the interval of the peak values in order to be able to check the correct operating procedure, e.g. in a graph (a graph is only drawn when more than two values are present). In the **Refresh peak values in temporary storage** option, specify a number of seconds appropriate for the interval so that the new values can be displayed in a post-process graph. Use the same value for the graph refresh rate.

Refresh peak values in temporary storage: Defines how often the computed peak values are transferred to temporary storage. Set the update rate of the graph to a similar value so that the new values are displayed. However, the duration should not be significantly shorter than one cycle, otherwise no new data will arrive. Specify an appropriate value for the update rate of the graphs in question.

☞ The dialog definition applies to the current DAQ job, so you can provide a different definition for each DAQ job. Only **Immediately** or **Time of day** are allowed as start conditions of the DAQ job, and only **Manual**, **Duration** or **Number of values** as stop conditions. Other conditions are ignored.

With **Save snapshots periodically to file**, specify the intervals at which a backup file ("Saving file") is to be created so that the individual snapshots are not saved to a file only *after the DAQ job has ended*. If you save complete cycles, each cycle will be saved immediately.

6.2.1.3 Time-dependent intervals (long term DAQ)

With this storage mode, you can measure even short-term peaks with a high sample rate, and still only a few measured values will be stored (the example in the Peak values per time interval section shows three time intervals). This is useful, for example, if during material tests you wish to record only the maximum stress through dynamic load change over several days. In real-time graphs all values (during the measurement) are still displayed. The setting affects only the recording of the values. In addition, you can occasionally record all values over a certain time period.

> The Event monitoring offers you an alternative to this type of measurement with the **Time interval** (equidistant times) event type.

Click on **Configure** to define the parameters for the measurement. Then specify the **Total duration of job**. The measurement is terminated after this time; the stop condition of the DAQ job is ignored in this operating mode. Then in the table for the **Sequence plan** define how this time period is to be divided up into the various measurement intervals and sequences. Here, you can specify just one sequence or any number, but sequences must not overlap nor should there be any gaps. Each sequence (a row in the table) requires the following details:

- **Start**: The sequence begins at this time of day. The first sequence begins with 0 (minutes, hours or days); a value of 1 is however also accepted.
- **End**: The sequence finishes when this time period expires. With a value of 5 minutes the sequence then terminates at 5 minutes and 59 seconds; from the 6th minute the next sequence starts. With a click in the field **Start time** the total time is always entered here; change the displayed figure appropriately. The end time of all sequences must correspond to the total time.

- **Time unit**: You can define minutes, hours or days as the unit to be used for **Total duration of job**. The setting applies to all sequences. The start and finish times for *new* sequences are appropriately converted.
- **Interval for continuous storage**: Here you can define after how many minutes all measurements are to be saved for the specified **Storage duration**. You can select one of the default intervals or enter a number yourself. Specifying **Once** (or 1) causes a snapshot or the specified **Storage duration** to be acquired only at the beginning of the sequence. With the selection of **Never** peak values at the most are saved, if this is specified at **Interval for peak storage**.
- **Storage duration**: Here, you enter for how long all measurements are to be saved. In the default setting a new file is created per storage process except when you save snapshots (single values) or activate the option **Continuous storage into one file**. Snapshots are always saved in a single file. The current date and time, the keyword "complete" and the current minute (since the start of the measurement) are appended to the file name specified for the DAQ job, e.g. Job1_20090813_143558_complete15.

  ☞ The storage duration must not be longer than the total duration of the sequence. The shortest possible time is 100 ms (0.1 s).
  If you are saving to one file, then for the subsequent analysis use a time channel for the x axis to obtain the correct time relationship.

- **Interval for peak storage**: Here, you define whether, and if so, after how many minutes the minimum and maximum over this interval are each to be saved. You can select one of the default intervals or enter a number yourself. The peak values are stored in the catman temporary file and at the end of the measurement are saved in *one* file. The current date and time and the keyword "peaks" are appended to the file name specified for the DAQ job, e.g. Job1_20090827_220318_peaks. The peak values are displayed as dedicated channels in the channel list, so that they are available for Post-process graphs.

  With longer intervals or acquisition times record the time channel as time of day and date: **Create absolute timestamps for peak values**.

Click on **New sequence** to generate another row in the table. The **Start** (time) and **End** (time) columns are completed automatically, but you can still change the details.

After a click on **Check** catman checks whether all fields have been correctly completed and whether the defined sequences can be processed in this way, e.g. whether times or settings have been forgotten during retrospective changes. Erroneous sequences (rows in the table) are shown with a red background.

Create a short sequence as the first sequence and specify **Every minute** for the interval of the peak values in order to be able to check the correct operating procedure, e.g. in a graph (a graph is only drawn when more than two values are present).

Refresh peak values in temporary storage: Defines how often the computed peak values are transferred to temporary storage. Set the update rate of the graph to a similar value so that the new values are displayed. However, the duration should not be significantly shorter than one cycle, otherwise no new data will arrive. Specify an appropriate value for the update rate of the graphs in question.

The dialog definition applies to the current DAQ job, so you can provide a different definition for each DAQ job. Only **Immediately** or **Time of day** are allowed as start conditions of the DAQ job, and only **Manual**, **Duration** or **Number of values** as stop conditions. Other conditions are ignored.

With **Save snapshots periodically to file**, specify the intervals at which a backup file ("Saving file") is to be created so that the individual snapshots are not saved to a file only *after the DAQ job has ended*. If you save complete cycles, each cycle will be saved immediately.

6.2.2 Data saving

See also Program options: Folders, End of measurement: Maximum measurement duration, event: Error during data saving.

The file is written to the default folder for measurement data if you do not specify any folder path.

If the intended file name already exists, catman appends a counter to the file name and increments it for the further job starts. If this file also exists, a further counter is appended, etc. A counter is also appended if a file name which was created using *Placeholders* already exists.

If, during a job repetition, the files with all figures from 001 up to 999 exist in the target folder, catman appends a further figure. Above 9999 another figure is appended, etc.

Activate **Additional data saving in second format** if you want to save the measurement data in catman format as well as in Excel format, for example. The file formats must be different, because the same file name is used, and only the file extensions differ.

Prompt

In this mode, after the recording stops you obtain a window in which you can change both the file path and file name as well as creating other test parameters or completing existing ones.

Automatic

In **Automatically on DAQ termination** mode, the data is saved to the specified file without any further request. In order to be able to enter test parameters with this setting, activate the option **Editing of test parameters after job termination**.

Periodic

Use **Periodically during measurement** for long-term measurements and define an interval after which the measurements are to be saved as a precaution against power failure. If you use **All intervals in one file** as the mode of periodical saving, then any already existing file is renamed to T_DATABACKUP.BAK after this time expires, saving occurs again and T_DATABACKUP.BAK is deleted. If the PC was turned off *during* saving, specify the file extension .BAK in the Test Explorer to be able to load the file. The file is written to the same folder to which the final file is written. In all other cases the file provided for the measurements contains the last state. In the **One file per interval** mode new files are created and numbers appended to the file name. Activate **Merge single files after DAQ job** to produce one complete file from the single files. However, you can also carry this out retrospectively in Analysis mode. **Merge files** (**Test Explorer** tab, **Tools** group).
See also Converting/merging files.

No saving to a file

Use **None (test mode)** for example to check that the measuring chain is operating as required. No prompt is given to save the measurements, but you can still save the acquired values using the menu **File ► Save as ► Save last DAQ job**.

> For a trial measurement create a dedicated job and specify an appropriate name for the job, e.g. **Trial measurement without saving** so that it is clear that no saving is to take place.

Note

- If you end catman without saving measured data, the next time you start catman you will be asked whether the data should be saved in a file. The same applies if catman was interrupted unexpectedly, e.g. through loss of power. So, after a power cut, restart catman without deleting any files or folders.

- In **Prompt on DAQ termination** mode, you are not only prompted to save data, but also if you do not save any data you are notified that the data can also be saved later. Choose **Don't show this message in the future** if you don't want to see the notification again. The suppression of this notice can be undone via the menu **Window ► Show again prompt window** on the right above the ribbon.
- When recording to a storage medium (MGCplus with CP52) or to a PC card (MGCplus with CP42), no folders can be specified, only a file name is admissible.

6.2.3 File format and resolution

All information about the measurement (traceability data), such as the transducers used, zero point and serial number of the amplifier, as well as the measurement settings and test parameters, are saved only in **catman**, **ASCII + channel info**, **NI TDMS**, **NI DIAdem** and **Excel ...** formats.

Notes on Excel formats

In the **MS Excel ...** format the measured values start at row 50; the rows above are used for saving the channel information.

Import the file with the same name as the Excel file but with extension TSX into a worksheet, if you need the test parameters in Excel.

Excel must be installed to be able to save data in the Excel format. You can save a maximum of 65,000 values in a worksheet in the **MS Excel 97-2003** format. Therefore, more values than this are not exported by catman. In Excel 2007 and later, up to 1 million measured values can be saved, though the default setting for the file format in Excel should be **MS Excel Office XML** or **MS Excel Office Binary** (*not* **MS Excel 97-2003**).
However, in all cases consider the increased time required compared to saving in the **catman** format.

If you do not enter a file extension, this will be added automatically.

Use the file formats **NI DIAdem**, **nSoft DAC**, **MDF 3**, **MDF 4**, **MATLAB**, **RPC III**, **HBM nCode s3t** or **UFF58** only if you have the corresponding programs available. Files in these formats cannot be imported into catman again.

catman records a maximum of 2,000,000,000 measurement values per channel (if enough memory is available). Then the measurement is stopped. But we recommend creating smaller files, because files containing so much data become unwieldy and demand heavy resources. Periodically save just 1,000,000 measurement values per channel, for example, or repeat your DAQ job at shorter time intervals.

Resolution

Formats HBM catman Standard, Vector MDF 3 and ASAM MDF 4.1

You can define the following resolutions in these formats:

- **8 Byte** saves with full resolution (default). The format is also called Double Precision.
- **4 Byte** uses so-called Single Precision values when saving. The format is sufficient for measuring values from analog transducers (mostly only 16 to 24 bits, i.e. maximum 3 bytes) and saves storage space. However, if you perform further computations using the measured values, this could lead to a rounding-off fault, as these results are also saved only in 4-byte format.
- **2 Byte**: In this format, the minimum and maximum values of the channel are first determined, then all values of the channel will be converted to the number range of ±32,000 and saved as whole numbers. The format takes up the least amount of storage space, the resolution is however limited to ±32,000 steps and the conversion requires time.

⚠ If you are acquiring the time in the NTP or IRIG format, you have to use the **8 Byte** format, because the times can only be saved (completely) in this format. With GNSS data check whether a resolution with less than eight bytes is sufficient. See also Hardware time channels.

In the **ASAM MDF 4.1 format** you can also set the compression level and the data reduction.

Formats ASCII and ASCII + Channel info

In the formats **ASCII** and **ASCII + Channel info** you can define the number of decimal places to be saved:

- **Full Precision**: The operating system decides on the number of relevant places and the representation. For a value saved with eight-byte resolution, more than ten places can arise in this manner, but an exponential representation can also be used.
- **Auto**: An appropriate number of decimal places is used depending on the number of places in front of the decimal point. With very small (< 10^{-5}) or very large

numbers (from six places) the exponential representation is used. Otherwise the following applies: up to |10| three, up to |100| two, up to |1000| one decimal place(s) are used; over 1000 no decimal place is used. There is an exception for channels in the units µm/m and °C: here one decimal place is always used.

In catman 5.2 or higher, blank spaces before or after numbers are removed prior to exporting.

The file formats

HBM catman standard format

Files in this format can only be imported again by catman itself. They contain all the information which catman has available: measured values, traceability data and measurement and test parameters. You should therefore first save data in this format and only export in other formats as required.

HBM nCode s3t

Files in this format can be directly processed by the software GlyphWorks and nCode DesignLife.

GlyphWorks is a software program for the analysis of test data; it processes a large amount of data and offers a graphical, process-orientated user interface. You can create a workflow for the analysis using drag & drop of analysis modules.

nCode DesignLife is a program for lifetime analysis. nCode DesignLife uses FEM results and operational strength tests for the lifetime assessment.

Further information on HBM's nCode software can be found at

https://www.hbmprenscia.com/.

HBM Playback (only available in Analysis mode)

Generates one file per channel in a format which can be read in and "played back" by catman in DAQ mode.

See Signal generator/playback file.

ASCII/ASCII with channel info

Files exported in this format can be read in again by many programs. A file in the format ASCII with channel info also includes the traceability data and can be read in again by catman almost free of loss; only the measurement resolution is restricted to the number of places present in the ASCII file.

MS Excel 97-2003

☞ Excel must be installed for the export.

Exports the measurements to an Excel workbook. In addition, a second file of the same name and with the TSX file name extension is created in which the test parameters are saved.

⚠ In this format up to 65,000 measurements can be saved, because this is the maximum number of rows on a sheet in the MS Excel 97-2003 format. If there are more measurements, they are not exported.

MS Excel Office 2007 XML/Binary

☞ Excel 2007 or higher must be installed for the export.

Exports the measurements to an Excel workbook. In addition, a second file of the same name and with the TSX file name extension is created in which the test parameters are saved.

The default setting for the file format in Excel should be **MS Excel Office XML** or **MS Excel Office Binary** (*not* **MS Excel 97-2003**).

⚠ In this format up to 1,000,000 measurements can be saved, because this is the maximum number of rows on a sheet in the MS Excel Office 2007 format. If there are more measurements, they are not exported.

NI TDMS

Files (*.TDMS or *.TDM) exported in this format can be directly read in by the data analysis software, DIAdem® from National Instruments Engineering GmbH & Co KG. Files generated in this format by catman can also be read again by catman. As all the data in catman is also stored in this format, the format is equivalent to the HBM catman standard format.

Files in this format which were generated by other programs can normally also be read by catman; only channels in text (string) format cannot be read, and are skipped.

Further information can be found at www.ni.com.

NI DIAdem

Files (*.DAT) exported in this format can be directly read in by the data analysis software, DIAdem® from National Instruments Engineering GmbH & Co KG. As all the data in catman is also stored in this format, the format is equivalent to the HBM catman standard format.

A header file and a data file are produced when exporting data in this format. Also, the header file can be directly interpreted by DIAdem® and the data file is in the format REAL64.

Further information can be found at www.ni.com.

MATLAB (5.0)

Files in this format can be directly processed by the data analysis software MATLAB® (from version 5.0) from the company The MathWorks Inc.

Further information can be found at www.mathworks.com.

Vector MDF 3

MDF (**M**easurement **D**ata **F**ormat) is a binary file format which was developed in 1991 by Vector Informatik GmbH in cooperation with Robert Bosch GmbH. The format is now primarily used in the automotive sector. See also MDF 4.

Further information on Vector Informatik GmbH can be found at

www.vector.com.

ASAM MDF 4.1

MDF (**M**easurement **D**ata **F**ormat) is a further development of the MDF 3 format and in this version is an ASAM standard (Association for Standardization of Automation and Measuring Systems). With this development there is no 2 GB restriction as with MBF 3 (theoretically 2^{64} bytes, i.e. 10^{10} Tbyte per file can now be written). In addition, the format has far-reaching possibilities of saving metadata (test parameters). Also, special functions such as data compression or Quick Preview (data reduction for preview channels) are supported by catman.

Further information on ASAM can be found at www.asam.net and wiki.asam.net/display/STANDARDS/ASAM+MDF.

See also Vector MDF Validator (vector.com/vi_mdf_tools_en), catman Knowledge Base (via **Help ► Knowledge Base** at the top right of the program interface).

RPC III (MTS)

Files in this format can be directly processed by the data analysis software RPC® III from MTS® Systems Corporation. As the format does not permit custom channel lengths, so-called groups of 2048 values are always stored. If the channels to be exported do not have values with a multiple of this size, the missing values are filled in with zeros. You should therefore preferably acquire or export a multiple of 2048 measurements. Since integer values with 16 bits always have to be saved in this format, catman uses the minimum and the maximum of each channel and correspondingly scales all values of this channel.

Further information on MTS® Systems Corporation can be found at

www.mts.com.

UFF58 (Universal File Format 58)

The Universal File Format was originally developed in the 1970s by Structural Dynamics Research Corporation (SDRC) to standardize data transfer between CAD data (**C**omputer **A**ided **D**esign) and measured data. It is often used, for example, in modal analysis.

The UFF58 format can be saved as a binary or ASCII file. catman for safety uses the ASCII format, because it is always supported.

Audio (.WAV, only available in Analysis mode)

Produces one file per channel in the WAVE format (PCM coded with 16 bits). Before saving, minimum and maximum measurements are determined and scaled to the available value range (normalized). The files can, for example, be played back by Windows Media Player.

nSoft DAC

Exports the data for the evaluation and analysis package nSoft® from HBM nCode in the time series format (*.DAC). Here, an equidistant measurement series is written to a file, i.e. each channel produces one file. The file name is composed of the name you specify, the channel name appended with an underscore and the file name extension DAC.

Further information on HBM nSoft® can be found at

https://www.hbmprenscia.com/.

6.2.4 Saving depth

See also Use fixed storage size.

This setting enables you to save only the last few seconds or minutes of the measurement when the measurement stops (manually or due to a trigger event). The setting is independent of the mode selected under **File ► Options** for **Data storage** (**Fixed storage size**, **Cyclic storage mode**). You do not have to use a cyclic storage mode or a fixed storage size. However, data can only be permanently saved once it has been acquired. If measurements have not been taken for long enough, or if you are using a fixed size for the temporary data store, that data is the maximum that can be stored.

6.2.5 Remote data saving (FTP/SFTP)

See also Remote (UDP output).

Remote data storage enables you to upload the files arising during a measurement to another PC (server). To do this you have to be able to establish a connection to the relevant PC, e.g. through a network, and an FTP or an SFTP file server must be active on this PC.

It is sufficient if you use an FTP file server (server with **F**ile **T**ransfer **P**rotocol), e.g. FileZilla, provided the PC can be reached in the company internal network. If possible, use an SFTP file server (**S**ecure **F**ile **T**ransfer **P**rotocol), if the transfer takes place over an extraneous network, e.g. via the Internet.

Certain ports, which vary depending on the program, generally have to be released for this to function correctly. If in doubt, ask your system administrator which these are in your case and how you should proceed.

No automatic start (manually or by EasyScript): For manual starting use the Job status panel.

Target folder: Here you can enter a subfolder to which the files of the relevant recorder are to be transferred. Make sure that you possess the appropriate rights to create such folders, or use an existing folder for which you have writing rights (letter **w** in the **User rights** column).

 Creating a new folder.

 Deletes the marked folder or the marked files.

 Transfers a single file to the server. You receive a dialog in which you can select the file.

 Updates the list of files in the current folder.

.. Changes to the higher level folder on the server.

Working procedure

When files become available for transfer, they are automatically transferred using a background process unless you have activated **No automatic start**. Since the transfer takes place using a background process, the operation of catman is not impaired by this. If several files are available for transfer, a list is formed and the files are transferred consecutively. If you attempt to terminate catman during the transfer, you receive a dialog in which you can interrupt the transfer. In this case the transfer continues the next time you start catman.

☞ While a transfer is pending or taking place, you cannot change the server settings.

Server settings

There are various ways of establishing the connection and transferring files via FTP or SFTP. catman does not support all possible variants. Which method you can use depends however on your server and its configuration as well as on whether you implement the connection within a company internal network or (have to) use an extraneous network.

FTP

☞ TLS for the login is not supported by catman.

With this type of transfer there are basically two variants. Normally however passive FTP is used. The server can usually be configured such that requests may only come from certain IP addresses. Generally, a user name and a password are needed.

Active FTP

With active FTP catman opens a random port and informs the server of it together with its own IP address. The data transfer at the server end here occurs via port 20. The advantage is that during the data transfer catman can communicate with the server. However, a wider port range must be open on the server for the random port.

Passive FTP

A passive FTP sends a special command to catman, the server opens a port, which or the range of which can normally be defined on the server, and transfers it together with the IP address to catman. The advantage of this procedure is that the PC with catman can also be located behind a router or a firewall.

What details do you have to provide?

You need:

1. the name or IP address of the **server**, e.g. ftp.myftpserver.com or 192.168.05.1,
2. the **port** on which the server awaits requests, e.g. 21,
3. the **User name** and **Password** for your access to the server,
4. whether to **Establish passive connection** or not.

Optionally, you can define that the transferred files are compressed into a ZIP archive.

See also Using a proxy server.

SFTP

☞ catman only supports DSA and RSA encryption for SSH authentication.

The data are transferred encrypted with this type of transfer. However, you need a key file, the private key and the associated passphrase for the connection. catman also supports the facility to connect using only a user name and password. However, since the password is transferred with each connection, this is not particularly secure. The variant with key files is more secure, because the private key is only present on the client (catman) and the public key is only present on the server. In addition, the private key is protected with a passphrase. None of this information is sent to the server during a connection.

What details do you have to provide?

You need:

1. the name or IP address of the **server**, e.g. sftp.mysftpserver.com or 192.168.10.1,
2. the **port** on which the server awaits requests, e.g. 22,
3. the **User name** for your access to the server,
4. the **Password**, if you are not using a key file.

When using key files, instead of the password you need:

4. the private key (DSA or RSA private key in the PEM format),
5. the associated passphrase.

Use, for example PuTTYgen, if your private key is present as a PPK file. With this program you can load the PPK file and save it in a PEM file using **Conversions ► Export OpenSSH key**.

See also Using a proxy server.

Using a proxy server

You can also establish the connection to an FTP or SFTP server via a proxy server. Here, catman supports various types of connection. Specify the one to be used in the dialog.

For FTP

- **Socks V4**: Use a SOCKS (Socket Secure) V4 proxy server.
- **Socks V5**: Use a SOCKS V5 proxy server.
- **SITE Hostname**: Connects to the proxy server and sends "SITE <Proxy server name>"; then the login takes place with **User name** and **Password**.
- **USER Logon**: Connects to the proxy server, logs in with proxy **User** and proxy **Password** to then connect to the FTP server by sending "USER <User name>@<Proxy server name>".
- **USER No Logon**: Connects to the proxy server and sends "USER <User name>@<Proxy server name>".
- **OPEN**: Connects to the proxy server and sends "OPEN <Proxy server name>".
- **Pipe**: Connects to the proxy server, then the login takes place with **User name** and **Password**.

With SFTP

- **HTTP Connect** (no other option available).

Additionally specify:

2. **Server** (proxy server name), e.g. myserver.com or 192.168.25.10,
3. **Port**, on which the proxy server waits for requests, z. B. 1080 for FTP or 6588 for SFTP,
4. **User name** and **Password** for your access to the proxy server.

6.3 Channel parameters for data acquisition

☞ Changing a channel's activation and filter settings can be disabled with password protection – see Sensor options, Password protection.

Activate/deactivate a single channel for this job

Click on in the **Channels** window (**DAQ jobs** tab, **Channels** in the **Settings** group) to deactivate a channel or click on to activate it. Only active channels (marked with) take part in the measurement.

☞ If you use the option *Deactivate the devices which caused an error and continue measurement without interrupt*, you must manually activate channels (use the context menu) which have been automatically deactivated in **all** DAQ jobs – see also What to do in case of initialization errors.

Deactivate saving for a single channel (temporary file) in this job

With in the **Save** column you can deactivate temporary storage on a per channel basis. Measuring data for a channel will then not be available in any file after a measurement, as the values are not saved. You can however use the values in computations and, during the data acquisition, display them in graphs. Use this function if, for example, you wish to carry out rosette computations and are only interested in the results of these computations, not in the "raw" data. Therefore, the data files saved will be smaller, as only data for the relevant channels are saved.

Deactivate saving to file for a single channel in this job

With in the **Save** column you can (only) *deactivate* saving to the file with the measurement data for each channel separately.

☞ The settings specified in **Data storage** (**Settings** group) of a DAQ job as **Storage mode** and **Data saving** can only be disabled by these functions. If no saving occurs at all, the settings **Save**: **On** () or **Save**: **On** () no effect.
See also Data storage.

Activate channel for statistic journal

Statistics journal: Here, activate for each channel (and DAQ job) whether minimums, maximums, mean values and/or the last current value of a time interval of a channel are to be saved in a separate file. The time interval, which values and the (basic) generation of the file are activated via the job parameters.

Enable channel for UDP

UDP output: Here you select whether each channel (and DAQ job) is included in UDP output. Make the settings for the output under **Advanced** (**DAQ job** tab, **Settings** group); see Remote (UDP output). The column is displayed only after you have enabled UDP output.

Setting filters manually

☞ If required, activate the option **Allow manual filter settings** (**Filter** section) via the menu **File ► Options** and **DAQ channels** (**Channels and sensors** group) to be able to set filters manually. Otherwise the corresponding column in the **Channels** window of the DAQ jobs tab is hidden.

There are four possibilities for filter settings:

1. Use current channel settings
   To set the filter in the device you must use the corresponding device setup Assistant, catman does not change any of the device settings.
2. Use automatic anti-aliasing filters
   This is the catman default setting. As long as the filter is supported by the device at the selected sample rate, a filter with the characteristics set in the DAQ channel options dialog is used.
   See also Program option DAQ channels: Filter.
3. Select filter characteristic and filter frequency
   With this option you can set the required filter for each channel and each DAQ job. However another filter will be selected if the required filter cannot be used by the channel. If you select first the sample rate (**General** in the **Settings** group) and then the filter, a message will be displayed in DAQ mode that the next possible setting will be taken and the new setting is displayed. Otherwise use **Validate filters** in the context menu.

   ⚠ With MGCplus multi-channel plug-in modules, *all plug-in module channels* use the same filter settings.
4. Working without filter (only QuantumX/SomatXR)
   With QuantumX/SomatXR the low pass filter of the channel is deactivated and the channel uses its maximum bandwidth.

☞ Filters with Bessel characteristic create no signal distortion, but have a relatively flat frequency response. In case of high-frequency interference at *high* amplitudes, you should therefore set the cutoff frequency to 5% of the sample rate, or use filters with Butterworth characteristics.. The frequency displayed by HBM devices is usually the -1 dB Cutoff frequency; exceptions are PMX and the filters for the decimal sample-rate domain of the QuantumX/SomatXR.

6.4 Specify job parameters

ⓘ See also Shortcuts (Program options **System** group) for starting and stopping a DAQ job

In the **Job parameters** window (**DAQ jobs** tab, **Settings** group) you can

- change the job name (e.g. **Test measurement**),
- allocate a *Shortcut* for the start,
- deactivate the job (so that it is skipped during the execution of all DAQ jobs),
- deactivate the limit value monitoring for this job,
- specify whether the event log is saved,
- automatically delete the existing entries in an event log before starting,
- store statistical data (Statistics journal) additionally,
- on starting the job browse to a certain Panel or Print page,
- specify job repetitions with or without a break.

6.4.1 Compute statistics after DAQ job

The option computes the minimum and maximum for all channels over the whole measuring time *after* a measurement. With appropriate configuration of the objects this is displayed in Digital indicators, tables or text objects.

You can then see at the end of a measurement any extreme value that has occurred at any time in a channel. Assign Limit values to the channels to also display the limit infringements of certain values in color.

With the option active select the desired display (Minimum/Maximum) in the configuration dialog, for example of the digital indicator, via the **Display** tab and **Show statistics after DAQ job**.

The computation takes some time, so the start of a directly following DAQ job is slightly delayed.

ⓘ See also Statistics journal.

6.4.2 Statistic journal

With this function you can save the Minima, Maxima and Mean values channels and/or the last current value of the time interval to a separate file parallel to and independent of normal data saving.

☞ The computation does not occur automatically with the activation of the option for all channels. With **Channels** (**Settings** group) go to the **Channels** window of the DAQ job, and for each DAQ job and channel define whether the computation is to actually take place. Consider the actual time requirement needed for the computation and only activate the required channels.
See also Defining channel parameters for data acquisition.

Specify the desired time interval for the computation (**Update interval**) and activate the option. The time interval is not maintained precisely; the tolerance is in the range of the time interval between two data transfers (see Program options: DAQ channels). Select **Also active during waiting for trigger** to produce the journal also in the time when waiting for the trigger event to initiate (normal) recording.

At sample rates ≥9600 Hz use an update interval of 5 minutes or longer to keep the load on the processor at a low level.

☞ At intervals of 5 minutes or longer, the data is acquired at “rounded” times. For example, an interval of 10 minutes and a start shortly after 9:00 h would result in storage at 9:10, 9:20, 9:30, etc.

During the measurement an ASCII file is first written (file extension .stat) and at the end of all DAQ jobs the file is automatically converted to the catman format (*.bin). The file receives the same name as the file with the measurement data, but “_StatJournal” is appended. With long-term DAQ specify a **backup** interval, then the conversion to the catman format occurs in separate files with a suffixed counter within that interval, and you can view the data even before the measurement has finished.

Structure of the ASCII file

Time	K1_ Sn	K1_ Min	K1_ Max	K1_ Mean	K2_ Sn	K2_ Min	...
	V	V	V	V	N	N	
43.665	7.2	-3.8	8.9	5.4	-352.63	-800.45	
43.666	4.5	-4.2	5.3	5.1	-23.55	-750.33	
...							

Meaning of the abbreviations: K1_Sn: Channel1_Snapshot, K1_Min: Channel1_Min etc.

6.4.3 Test parameters

Activate **Add DAQ settings after job termination** to add the following data automatically:

- Start/end time of job
- Sample rate used
- Number of acquired measurements
- Start/stop mode
- Trigger mode, trigger level and channel, time of trigger event as absolute date and time value and relative to the start of the data acquisition (if start or stop triggers have been used).

With test parameters you define further information concerning the measurement in addition to the file comment (General settings). To do this, click on **New parameter**, then double-click on the fields in the **Name** and **Value** columns. When importing measurement data, these parameters are displayed additionally to the file comment in the Test Explorer (see Analysis mode). The default information **Operator**, **Department** etc. can be deleted or overwritten with your own values. You can define up to 128 job parameters.

☞ No equal signs ("=") may occur in the *Name* of a test parameter. On the other hand, it is allowed in the *Value*.

The test parameters and the file comment can still be changed before they are saved, if you have specified **Prompt on DAQ termination** for Data saving (**DAQ jobs** tab, **Data storage** in the **Settings** group).

💡 You can use **Comment** in the **DAQ** group (**Visualization** tab) to also enter comments independently of the file comment *during* the measurement. These comments are then saved as further test parameters with the date and time of the entry. The comments in the **DAQ comments** window are deleted before each measurement.

Using **Save as (Test parameters** group) you can save the displayed test parameters as a template and load them again later. If you save the template under the file name TESTPARDEFAULT.VPT to the "TEMPLATES" subfolder in the *catman working directory*, this default setting is used for *each new job*.
See also Program options: Folders.

💡 If you save all the job settings as a template, then also the current test parameters are saved; see Define default settings for DAQ jobs.

Creating a test parameter file with selectable entries

The standard entries in a test parameters file are:

Operator
Department|
Comments|

You can create a predefined text after each entry, or preset a selection by placing multiple entries after "|" (vertical line) separated by ";" (semicolon).

Example

Operator|Andrea;Georg;Hans;Michaela;Vanessa;Vera;
Department|AV;BD;WZ;V
Humidity|Currently =

Create the file, as a text file, in Notepad for example, with the extension VPT. Load the file via **Test parameters ► Load** (**Test parameters** group). Then *only* the names or abbreviations listed are available for selection under Operator and Department respectively. It is no longer possible to make free entries in these two fields. However, the current value can (and should) be entered after "**Humidity**" – "**Currently**" when a measurement has been made.

6.5 Prepare On-Board recording (MGCplus)

See also MGCplus on-board recording for restrictions of on-board recording, Start On-Board recording, File download.

With more than one MGCplus the devices must be synchronized (sockets Sync IN/Sync OUT). You also need to enable Sync leader/Follower mode; see Advanced (**DAQ jobs** tab, **Settings** group) and Synchronizing several devices.

On-Board in the **Settings** group of the **DAQ jobs** tab enables you to define the parameters for recording to the storage medium connected to the MGCplus, and to delete files located on the storage medium. You define how the recording occurs (only on the storage medium, or only on the PC, or on both) first with Start of DAQ job. Enter Analysis mode to transfer files to the PC; see File download.

Procedure

1. Define your DAQ job as usual.
2. Click on **On-Board** in the **Settings** group (**DAQ jobs** tab), and activate **Mark job for On-Board recording**. The icon for the job changes to in the list of DAQ jobs.
3. Enter the file name for the data file.
   Auto-ident (append device address and date to file name) automatically generates a file name consisting of the date and the IP address of the device. Use this option, for example, with a number of devices, because then all files bear different names and cannot be unintentionally overwritten during the transfer to the PC.
   If you are using only high sample rates (≥ 2400 Hz), you can also use the format **2 bytes per value (INT)**. The **4 bytes per value (FLOAT)** format is only useful if you want to read the measured values later with a program of your own. In this case the values are fully scaled before saving.
   ⚠ If you need the status (e.g. limit) and error information (e.g. overflow) of the MGCplus, you must use the (default) format of **4 bytes per value (INT)**. This data is not saved in the other formats.

Optional settings

You can also create a second file in which only the min/max values from e.g. every 2000 measured values are written. In this example, this gives the compression factor 1000, i.e. the file is 1000 times smaller. The file can therefore be loaded quicker and a search for values will also be faster.

Choose **Delete** to delete the selected files from the storage medium. The files are irretrievably deleted!

☞ If you need time channels for the data recorded on the storage medium, activate the *NTP* or *PTP* (CP52 only) time in the device, and specify in the Device search settings that hardware time channels are to be used. Otherwise only the sample rate and start time of the relevant channel are saved.
See also Hardware time channels, Synchronizing several devices.

6.6 Configure video recording

☞ The dialog is only available with an active Video Cameras module. The camera must be already selected and the recording format to be used must be defined;

see Setting up video cameras.

In this window you define the start and stop conditions for the video recording.

You can choose between three different start and stop conditions:

1. **Automatic with start/stop of the DAQ job**
   The recording is started with the start of the DAQ job (i.e. not necessarily with the start of the measurement). The recording is terminated with the end of the DAQ job (stop including post-trigger).
2. **With start trigger** or **With stop trigger**
   The recording is started or stopped with the occurrence of the trigger event. With the recording a pre-trigger is not possible and is therefore not considered; a post-trigger is considered.
3. **Manually**
   Use this setting when you want to start or stop recording either manually using the limit value and event monitoring or using script or AutoSequence.

In the default setting the path and file name for the measurements (%TestFile%) are used as the file name for the video files and only the camera name (%Camera%) is appended. However, you can:

- Manually select another path and file name.
- Only specify one (other) file name. The file is then written to the standard folder for measurement data.

In addition, you can integrate various variable texts using *Placeholders*, e.g. date and time or the (existing) test parameters. If you add more test parameters, they are also displayed; see Defining test parameters on this. Process variables of an AutoSequence are also selectable. The placeholders are directly replaced before data saving. For example, the placeholder %DateTime% is replaced by the character string "Year_Month_Day_Hour_Minute_Second"; the final file name then includes, for example, the character string "2012_08_05_12_01_35".

⚠ The space requirement for the video file is not immediately considered in the calculation of the memory space available. Since the free space is however determined dynamically during the measurement, the display of the residual possible measurement duration in the status line is at the start still incorrect. Then, during the measurement it quickly returns to a realistic value, but can however also change again in the course of the measurement depending on the video compression.

Background information on saving video data

The path and file name for the file with the measurements is defined only at the end of the measurement. Therefore, the video file is initially only temporarily saved and at the end of the measurement it is renamed and—if necessary—transferred into the appropriate folder.

6.7 Advanced (job) settings

See also Using Power BI.

6.7.1 Synchronization

Time synchronization

Synchronize clocks (only possible for MGCplus): Choose **Synchronize clocks in PC and device upon DAQ start** to transmit the PC time to the measuring instrument when starting the DAQ job. The time is transmitted every time a new DAQ job is start, though not when jobs are repeated.

> The PC clock should have been synchronized via an (external) time server, for example, otherwise an incorrect time might be transmitted.

See also Synchronizing several devices.

Synchronized measurement

You should always synchronize multiple devices as far as possible, and activate this option. If you are connecting to multiple devices, you can enable synchronized mode, and thus this option, in advance in the dialog. The mode will then be displayed when connecting. In this case **Synchronized measurement** is already active. The possible device combinations and settings are explained in the section headed Synchronizing several devices.

Continue measurement also in case of Re-Sync messages

In unfavorable circumstances, it might happen that a Re-Sync message is sent by a device during measurement:

- The devices use NTP or PTP time synchronization, and the quality of one device's time data is poor, as a result of long phase delays or severe jitter for example.

- On QuantumX/SomatXR modules a FireWire connection was removed or cut during measurement.
- On QuantumX/SomatXR modules a reset of the FireWire bus was performed.

In these cases, the device in question sends a Re-Sync request, but will continue also transmitting data. Normally in this case catman would terminate measurement with an error message. But if you are running a long-term test, it is perhaps more important to keep recording data. At low sample rates especially, a small time delay in the range of a few milliseconds will not have such a severe impact over a short period of time. Activate the option when you want to continue measurement even when such a message is sent.

Use SY42 synchronization

For cable lengths of more than 100 meters, the synchronization module SY42 is available for the MGCplus. This enables synchronization by hardware even over lengthy distances. The plug-in must be present on all MGCplus devices and with the option active it is used by catman to start a synchronous measurement.

Activate the plug-in module in the **DAQ jobs** tab and **Advanced** (**Settings** group) at **Synchronization**: **Use SY42 synchronization**.

Waiting time before Sync leader start (MGCplus only)

With MGCplus, the devices are classified as Sync leader and Sync follower based on their connection by the sync cables. The Sync leader subsequently controls measurements. You can use this option to set a (short) waiting time so that even fully configured Sync follower devices have safely completed their initialization phase when the Sync leader starts measuring. This is recommended if, for example, the Sync leader has far fewer channels than one of the Sync follower devices. In this case the Sync leader would also finish its initialization much earlier and try to start the measurement. If the Sync followers are not yet ready, an error will occur when starting the measurement.

6.7.2 Data transfer and error handling

Transfer of measurement data, data buffer

Data buffers are required to gather all the values which are read via an interface (read block) before they are processed (executing computations, copying into the temporary storage, etc.). In this section you define how large they are and how often data is transferred and written to the buffer.

⚠ With sample rates above 19,600 Hz you should change the following settings so that all values can be transferred. You can reduce the time between two data transfers so that all measured values can be transferred and also increase the number of values per transfer, or adjust both values simultaneously.
If you do not change any values, catman will calculate the required minimums automatically. However, the values calculated by catman are not displayed, but only used for the relevant DAQ job in the background.

catman uses the following formula for the computation of a suitable size if no larger value is set:

1.2 * Highest sample rate *Time between two data transfers in milliseconds / 1000

If a buffer size of 32,000 values is exceeded, you obtain an error message. The default is 4000.

☞ With high sample rates we recommend also increasing the write cache; see Program options Data storage.

Maximum number of samples per data transfer (read block): This defines how many values can be transferred as a maximum per channel and per data transfer (read process). The buffers are created in the PC RAM.

Time between two data transfers: This defines how often the data transfers occur. The specified time is however only considered when it is shorter than 100 ms. For sample rates ≤10 Hz 1/sample rate is always used.

When reducing this time, remember that after each transfer the graphs are also redrawn with the new values. This means that with smaller values the process load or the load on the graphics card is increased. You can compensate for this by decreasing the refresh (update) rate for graphics however; see Update rate.

⚠ Since the data is only transferred to catman in blocks after this time interval, any reaction to the measurements can only occur after this time period. catman is therefore not suitable for real-time control systems. Also, the setting of analog or digital outputs via a script command or the event monitoring can only occur when the data to be processed are available. In the worst case the reaction time is therefore 100 ms or the time between two data transfers.

☞ QuantumX/SomatXRmodules can supply new data every 50 ms minimum.

Example: Sample rate 96,000 Hz

Set the **Maximum number of samples per data transfer** to 10,000, for example, and enter **75 ms** for the **Time between two data transfers**. This means that theoretically up to 133,000 measured values per second can be transferred and you still have some “reserve” in the settings.

Timeout for data transfer: This figure is only of interest if multiple MGCplus devices or QuantumX/SomatXR modules are connected. In this case catman requests measurements from all devices simultaneously. The data is then acquired first from the device which responds first. In this field you can define the period after which this (asynchronous) reading of data is aborted if no data is obtained. The value of 3,000 ms should only be changed in special cases.

☞ When loading an older project without these settings, the default settings are used or the size of the read block is recalculated.

Asynchronous transfer mode

⚠ This setting can only be used for projects in which *exclusively* MGCplus devices are connected. If other devices are detected, the option is not available.

This setting is interesting when several MGCplus devices are connected via Ethernet: The measurements of all devices are then requested simultaneously and read in asynchronously. This means that in total a higher overall speed is achieved, because the devices can transfer their measurements once the network is free.

Use PC timing

Normally during a DAQ job HBM devices generate the measurements based on their internal timing and buffer the incoming values. catman then transfers a data block out of this buffer approx. 10 times per second. With PC-controlled timing catman requests one measurement per channel in the time interval determined by the default sample rate. In this way one single measurement is started in the device, the value is determined and transferred to catman.

With default sample rates < 1 Hz, catman automatically switches to PC-controlled timing, but with this option you can also force the mode for higher sample rates. However, the sample rate should not be above 10 Hz, because otherwise the measurement may possibly not be able to be executed fast enough, i.e. the measurements would be recorded with a lower sample rate than desired.

Measurements with PC-controlled timing are therefore useful when you are using two devices of different types in the same DAQ project which do not permit synchronization via NTP or the like.

⚠ The two other sample rates (slow/fast) are ignored when using PC timing. Channels which belong to one of these sample rate groups are also measured with the default sample rate.

With measurements with PC-controlled timing, the time interval between two measurement time-points can vary. With sample rates which are too high the interval can even be significantly larger than would be expected with the standard sample rate. So, use the “Default sample rate” time channel to generate the x values for a graph (display the time channels; see Channel list options and drag the channel into the area below the x axis).

You can view the actual time stamp for example in the **Table** component window (**DataViewer**) tab.

Behavior on errors during the measurement

This setting is only relevant when multiple devices are connected: If a device fails during the measurement or the connection to it is broken, with this option you can specify what should be done.

Stop measurement with error message

This is the default setting. The measurement is terminated and a message with information about the error is displayed. The data acquired up to this point are dealt with as specified in the job setting regarding the memory mode and data storage, e.g. stored in a file.

Stop measurement without error message

Activate this option only when you want to deal with the error yourself via the Event monitoring or EasyScript. Otherwise the measurement is terminated “earlier ” than planned and you have no indication of the cause of the termination.

Deactivate the devices which caused an error and continue measurement without interrupt

If one of the devices involved fails during the measurement, you can continue the measurement with this option to at least acquire the data of the other devices. After the measurement the channels of the failed devices then contain fewer measurements than the other channels.

Restart of measurement

catman initially terminates the measurement in this case (and saves all files as required). Then the measurement is restarted and catman attempts to establish a connection to all devices again. If this is not successful, the devices not responding are deactivated and measurement continues with the other devices. This then corresponds to the previous option. You can combine the arising measurement files with **Merge files** (Analysis mode, **Test Explorer** tab), but the gap in the time channel is retained.

You can also divide a long-term DAQ into several measurements over shorter intervals, for example **End of measurement** after 12 hours and initiate a connection again before each interval: Activate **Reconnect and initialize devices before DAQ start** on the **General** tab and repeat the DAQ job correspondingly frequently (**Job parameters** tab). Then at the start of each interval an attempt is made to establish communication, not just once per failure of the device as with the option **Restart of measurement**.

6.7.3 Remote (UDP output)

See also Channel parameters for data acquisition, Remote data saving (FTP/SFTP).

Output via UDP requires that you have an application that immediately reads the data from the network. Repeating is not possible. Since the time requirements are therefore generally very high, a fast programming language should be used, because otherwise values will be lost. The application must know the order in which the data of which channels comes; no information such as channel name or unit is sent.

You can use UDP measurement output to specify that all measured values of the channels you selected under **Channels** (**DAQ job** tab, **Settings** group) are sent by UDP protocol immediately after input in the network. The column to activate this is visible only after you enable UDP output. This output is possible in addition to a standard DAQ measurement.

The UDP output is not intended for real-time control, because the measurements are only sent approx. every 50 to 100 ms (the typical *UDP output rate* is 10 Hz). New measured values may therefore only be available after 100 ms.
See also **Time between two data transfers** under Data buffer.

Specify the **Port** and either a single address or one or more Ethernet segments in which the output is to occur. For the port we recommend that a port number over 10,000 is used.

☞ The subnet mask of the PC must allow output to the desired network segment. The figures in brackets after the segment indicate the required Subnet mask. Check that your PC is using the appropriate Subnet mask.

Format of the UDP packet

Byte	Meaning	Explanation
0-1	Identifier (always #0)	
2-3	Number of channels in UDP packet (INT16)	The UDP data stream does not contain any information about the channel name or the unit. The channels, and thus the sequence of the data (channel list), must therefore be known.
4-7	Output counter	Enables detection of lost packets
8-11 or 8-15	Measured value of channel 1 (FLOAT32/64)	The measured value output is scaled in the respective physical unit. Depending on the format setting, 32 bits (**4-Byte Single-Precision**) or 64 bits (**8-Byte Double-Precision**) are outputted.
12-15 or 16-23	Measured value of channel 2 (FLOAT32/64)	
...	...	

6.8 Define default settings for DAQ jobs

Use this option to define all currently configured jobs with their settings as the default setting for the DAQ jobs present after the start. Only the channel activation is not considered.

Click on **Use as default** (**DAQ jobs** tab, **DAQ jobs** group) to save *the displayed settings* of the following windows *for all DAQ jobs:*

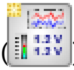
1. All settings in the **General** window.
2. All settings on the **Storage** window.
3. The filter, save/backup and statistics journal settings of the **Channels** window. The activation settings are not considered.
4. All settings on the **Job parameters** window.
5. All settings in the **Video** window.
6. All settings of the **On-Board recording** window (MGCplus only).
7. All settings in the **Advanced** window.

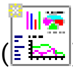
Click on **Default** (**DAQ jobs** tab, **DAQ jobs** group) to reactivate the default settings of catman.

7 VISUALIZATION: PANELS AND PRINT PAGES

Panels and Print pages are used in catman for the visualization of your measurements. Up to 64 Panels and 64 pages may be created. You can graphically display the measured values with various objects, which present the values in tabular form, in Digital or Bar indicators as well as displaying further information with text or images. The visual displays for DAQ mode are saved in the DAQ project and those for Analysis mode are saved in the Analysis project.
See also Visualization in Analysis mode.

Differences and restrictions for Panels and Print pages

Panels () are optimized for screen output during measurement, and can utilize the full screen. When printing a Panel only a screen copy (pixel) is passed to the printer.

Print pages () display the available space for the selected page format (portrait/landscape) to aid layout of the results printout after a measurement. Additionally, you have header and footer lines as well as configurable page margins available. Print pages are optimized for the visualization objects of the **Data analysis** group which are printed at maximum printer resolution. The objects of the **Real-time indicators** group are only printed as pixel graphics.
The number of all objects per Panel or Print page is restricted to 128. You define the possible numbers of the various objects on all Panels and Print pages using the Panels options (Program options, **Visualization** group).

Since you need more than one Panel in most cases, you can also create more Panels by a direct click on . In addition to the Panels and Print pages, in DAQ mode you also have the Scope and the Floating panel available (click on the arrow below the icon to be able to create other Panels or Print pages).
You can also carry out measurements with catman without creating visual displays yourself: If no visual display exists, you can choose on starting the measurement which of the predefined visualizations you wish to use. Alternatively, you can open a file with a visual display already produced.

Predefined visualizations

- **Automatically** (only QuantumX/SomatXR): In this process up to four channels per module are automatically assigned, and a Scope panel with (four) Scope graphs is created per module. The **Allow automatic visualization layout** option must be activated, otherwise the visualization is not offered; see Panel options).
- Scope panel
- Floating panel
- Simple table
- y(t) real-time graph
- Simple measurement table and y(t) real-time graph
- **y(t) real-time graph with multiple axes** (3 axes = scaling levels) if you are measuring on channels with different scalings.
- **From file** enables you to use a stored visualization.

Create visual displays yourself

You have two options:

1. Drag one or more channels to a blank point on a Panel or a Print page. You get a popup menu from which you can select one of the most frequently used objects. If the object is able to display multiple channels (graphs), only one object is generated showing all selected channels, otherwise there is one for each channel.
2. Click on an icon in the **Visualization objects** group on the **Visualization** tab to select the object you want. To do this, where applicable, open the group by clicking on the arrow at the right margin. Then drag one or more channels onto the object.

Once they have been created, you can move the objects, change them in size and configure them further—see Configure display objects.

Notes

- All real-time visualizations are updated simultaneously, even if the page on which they are located is not being displayed. In this case the graph is not redrawn, but the current values are however written to the graphics buffer and processed. If you are using many graphs and real-time indicators on your Panels and Print pages, to reduce the processor load you can “stop” the graphs and real-time indicators which are not visible (no longer updated): **Performance** in the **DAQ** group (**Visualization** tab); see Prevent real-time lag.

- By default, an (active) channel is pre-assigned when an object has been generated. Disable the **Auto-assign channels when creating new objects** option if you do not want it—see Panel (and print page) options.
- Add existing visualizations (all Panels, Print pages, etc.) or individual Panels or Print pages to the existing Panels with **File ► Open ► Complete visualization** or **► Visualization Panel**.
- You can also import visualizations from projects: **File ► Import ► Import visualization**. You can choose whether the visualization will replace the existing one or be loaded additionally.

7.1 Configuring Panels and Print pages

☞ Click on a blank place of a Panel or Print page (no other object must be activated) to obtain the window for setting up. You may need to display the window again: ► **Object properties** window (on the right above the ribbon).

If you have already saved *DAQ projects*, you can also import the complete visualization for DAQ mode from them: Menu **File ► Import ► Import visualization**. You can choose whether the visualization will replace the existing one or be loaded additionally.

New Panels and Print pages are inserted after the current page. To change the order of the Panel or Print page tabs, drag the tab of the relevant Panel to another point.

☞ The Panel located in the first position cannot be deleted. You can however drag the Panel tab to another position and then delete.

Names and symbols

Panels and *Print pages* are numbered consecutively; they are not enumerated separately. Scope and Floating panels each use their own counts however. For better identification, use a name (**Title** in the component window **Configure: Panel**). For Panels and print pages you can also, if you want, Show icon at page tab.

Floating panels

The Floating panels are always displayed *above* Panels, Print pages or Scope panels. You can only minimize a Floating panel. The advantage of Floating panels is that they can be moved to a second (or third) monitor. With the Scope panel or the normal Panels and Print pages this is not possible as they are always displayed in the main window of

catman.
See also Floating panel.

Snap on grid

Snap the visualization objects to the grid when moving and resizing, adjust the grid size (grid width), or display the grid to make it easier to format the pages (component window **Configure: Panel**).
See also Panels (Program options, **Visualization** group).

Zoom in/out, scroll bars

Click on the **Visualization** tab in the **Panel/page** group **(Full screen mode)** or on (on the right above the ribbon) to hide or minimize the ribbon.
In the full screen mode the ribbon and all component windows are then hidden, and there is more space available for the display of the graphics objects. Press, for example, Esc, to revert to the normal view.
With only the ribbon groups are hidden; displays them again.
Use and to zoom into or out of all objects on the current page.
If not all visualization objects are visible, catman automatically displays scroll bars.

Background image

You can use a *background image* on Panels and on Print pages, and either adapt it to the page size or display it in its original size or tiled. Click on to select an image or to delete a background image. Despite their name, background images can also be displayed in the foreground: Select **To front** from the context menu.
See also **Default folder for images** in Folders (Program options, **System** group).

Print

Panels (also Scope and Floating panels) are only printed as screen copies (with pixel resolution). The section between the ribbon and the lower status line is copied, appropriately scaled if required, and the dialog for selecting a printer is displayed.
Floating panels can only be printed via the dialog of the Panel itself: Click on the arrow next to and choose **Print Panel**.

Print pages offer additional options: For each page you can specify different header and footer lines or define a different page format (portrait/landscape). Use page margins to be able to more easily arrange the layout. The header and footer lines are always printed directly on the set edge in the region of the page margin. In addition, all graphs from the

Display of all recorded samples area are printed as vector graphs with the set printer resolution.

> In the Panel options you can specify that when printing a visualization (multiple pages) only the Print pages are printed, not the Panels: **Print pages only**.

Show icon at page tab

Use and on the **General** tab to display or remove icons on the tabs of Panels and Print pages. For this, specify the size of the icon to be used (16x16 to 48x48 pixels) and the file containing the icon. If you have more than 16x16 pixels, also increase the height of the tab with and a corresponding value in the selection field.

7.2 Available display objects for Panels/Print pages

With the display objects you arrange your visualization which displays your data and computations on the screen during or after the measurement as well as your Print pages for the printout of the results after a measurement. You do not have all objects available depending on the operating mode of catman, the type of page and the activated modules.

Click on the desired object in the **Visualization objects** group. To do this, open the group as necessary by clicking on the arrow at the right margin of the group. The following sections give you an overview of the available objects, their possible applications and their configuration.

In Scope and Floating panels, only the objects displayed at the top of the Panel are available. The configuration process is similar to that for these objects on Panels or Print pages, except that the dialog for it is located within the Scope or Floating panel.

See also Scope panel, Floating panel.

The number of visualization objects which can be created on all Panels together depends on the object type and can be configured in the Options for Panels and Print pages (Program options). With Scope and Floating panels a maximum of 64 objects are possible in each case.

> You can also create several display objects simultaneously by selecting multiple channels with ⇧ or Ctrl in the channel list and dragging the last channel selected onto a Panel or a page. When you select a graph, all channels are displayed in *one* graph; the other objects are generated adjacent to one another, provided there is enough space, otherwise one below the other (the entire Panel is used, however, even if part of it is hidden by a component window). You can also

generally define a specific object type for the creation process: Program option [Panels](Visualization group) and **Dropping a channel on a Panel ... produces**.

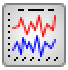
7.2.1 Objects for real-time indicators

Click on an object to display the **Configure** component window associated with that object. If necessary, use **Window ► Object Properties** (on the right above the ribbon) to display the window again if you have closed it.

The Real-time graphic to LED or Video (optional module) objects display the data during a measurement (DAQ job execution), so this is the **Real-time indicators** group. The objects are provided with data even when the panel or the page they are on is not displayed. There is no plotting, however; only the data buffers are filled. The Post-process graph to Statistics table or Metadata table (Analysis mode) objects display *all* data, and should therefore preferentially be used after the measurement.

See also Scope panel, Floating panel, Objects for the display of all recorded samples.

A special position is held by the object Angle synchron. graph in the group **Display of all recorded samples**, which displays values both *during* and *after* the measurement, restricted however to one or several revolutions.



Real-time graph

Displays the measured values in real time (during the measurement). You can also use any channel instead of the time (default) for the x axis.

The limit value levels can be displayed as lines: Select in the **Configure** window the corresponding y axis (scaling layer) on the **Axes** tab and then choose on the **Special** tab which limit values to display. See also Limit values.

At high sample rates with y(t) graphs compression to min/max values occurs; see also Compression.

If you disable compression and then zoom, an overview across the entire measurement period of time is displayed below the graph and the zoomed section is marked.

Digital indicator

Shows the present measurement or the minimum or maximum of the current DAQ job as a number. In contrast to the display with the Simple table the extrema are calculated from all the measurements, i.e. they are the actual extreme values. Enter 0 if you do not want the extreme values to decay.

Optionally, you can also display one of the extreme values after the measurement (after the DAQ job has terminated). To do this, check that the **Compute statistics after DAQ job** option is active (**DAQ jobs** tab, **Job parameters** in the **Settings** group).

The Digital indicator can also display the status of limits via one or several LEDs (**Configure** window, **Display** tab, **Show alarm limits**), see also Limit values.

The object is — apart from the configuration as peak, RMS or mean value indicator — only practicable with sample rates below 50 Hz, because otherwise not all values will be displayed, i.e. there is the risk of an alias.

Simple table

Displays the current measured value, minimum and maximum value as well as whether one of the limit conditions has been reached. From the **General** tab (**Configure** window), you can delete the statistical value or limit conditions display from the table and reset the current minimum/maximum values at once or when starting a DAQ job. The displayed min/max values simulate a drag indicator: approx. every 50 ms the current measurement is compared to the previous extremum. Use Digital indicators or an AutoSequence to detect short-term peaks.

The configuration of the columns for the Simple table cannot be changed; you can only occupy complete rows with one channel.
See also Flexible table and in Analysis mode Data table, Statistics table.

The object is only practicable with sample rates below 50 Hz, because otherwise not all values will be displayed.

Flexible table

The Flexible table offers a large number of options. You can:

- make different entries for *each cell*,
- display the current measurement of a channel,
- display statistical values (Min/Max),
- enter formulas in fields as in Excel (**Configure** window, **Cells** tab),
- span cells,
- configure interactive objects for Autosequences or EasyScript,
- display images,
- link to a graph on another panel (**Configure** window, **Cells** tab, **Picture**: **From panel object**).

Drag a channel onto any field to open the dialog for selection.

A Flexible table can have up to 100,000 rows. If you would like to view more data, you have to use the Data table or a DataView window or create a plot section.
See also Configure flexible table, Flexible table in Analysis mode.

For the display of current measurements, the object is only practicable with sample rates below 50 Hz, because otherwise not all values will be displayed. The display of minimum or maximum refers to the whole measurement (duration of the DAQ job).

Analog meter

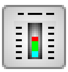
Displays the current measured value with a pointer. You can also configure this object like a car fuel display (**Configure** window, **General** tab, **Template**). The display of the numeric value as can be deactivated: On the **Layout** tab select **Pointer digital** and deselect **Display value**.

Use the **Layout** and **Style** tabs to adapt the display, e.g. the opening angle, to your requirements. Note here that some of the controls on the **Layout** tab have a mutual influence.

The limit levels can be displayed via the **Alarm** tab in the **Configure** window: Activate **Show alarm limits**, and select the desired one at **From limit value**; see also Limit values.

If you display alarm values, the configuration possibilities on the **Layout** tab expand: You can separately change the colors of the individual warning and alarm ranges. For example, for **Band** in the field to the right select **ID1**, **ID2** or **ID3** for the different ranges.

The object is — apart from the configuration as peak, RMS or mean value indicator — only practicable with sample rates below 50 Hz, because otherwise not all values will be displayed, i.e. there is the risk of an alias.



Bar indicator

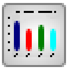
The bar indicator has many configuration possibilities: different horizontal or vertical bar layouts, thermometer or tank level display **Configure** panel, **General** tab, **Template**). The display of the numeric value as can be deactivated: On the **Layout** tab select **Pointer digital** and deselect **Display value**.

Use the **Layout** and **Style** tabs to adapt the display, e.g. the aperture angle, to your requirements. Note here that some of the controls on the **Layout** tab have a mutual influence; see also Change layout.

The limit levels can be displayed via the **Alarm** tab in the **Configure** window: Activate **Show alarm limits**, and select the desired one at **From limit value**; see also Limit values.

If you display alarm values, the configuration possibilities on the **Layout** tab expand: You can separately change the colors of the individual warning and alarm ranges. For example, for **Band** in the field to the right select **ID1**, **ID2** or **ID3** for the different ranges.

The object is — apart from the configuration as peak, RMS or mean value indicator — only practicable with sample rates below 50 Hz, because otherwise not all values will be displayed, i.e. there is the risk of an alias.



Multi-bar graph

The object displays a number of channels in the form of bars with or without a gradient (graded color change). The bar spacing does not need to be the same; you can also define any coordinates for the individual bars.

You can display the levels of limit values as lines (select **Configure** window, **Axes** tab, Limit values in the **Show alarm limits** section).

See also Limit values, Configure Multi-bar graph.

The object is only practicable with sample rates below 50 Hz, because otherwise not all values will be displayed.

Frequency spectrum (live FFT)

Displays the frequency distribution in the present signal.

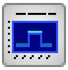
Specify the window function and the number of measurements over which the amplitude spectrum is to be calculated on the **General** tab (**FFT** and **Window** in the **Configure** window of the graph).

If you assign a number of channels to the graph, you can select with **Channels** whether you want to view the channel spectra separately (**Singular**) or display the **Vector sum** (the single spectra are added vectorially, i.e. squared and summed). **Phase difference** is only practicable with two channels; here the difference between both phases is then computed.

With unsteady signals with a quickly varying composition you can obtain a steadier display using **Averaging**. In general, you should choose a time here, because otherwise the computation only takes place over the current read block (each 100 ms) (**Averaging: Off**).

Peak detection: With active detection a table containing the detected peaks is shown in the graph. For **Threshold** specify the value (amplitude) from which a peak is to be detected. **Width** is the consecutive number of measurements used for the determination. Depending on the polynomial computation used, three or four values are usually

optimum. If you do not obtain any results, try with five or six values. Generally, higher values worsen the results.
See also Spectrogram, Frequency analysis.



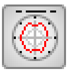
Spectrogram

☞ The object is only available with catmanAP or with an active EasyMath additional module.

The Spectrogram replaces the waterfall-diagram object in DAQ mode from catman 4.0. It computes the frequencies contained in a signal with the associated amplitudes which are shown color-coded. Specify the window function and the number of measurements over which the amplitude spectrum is to be calculated on the **General** tab (**FFT** and **Window** in the **Configure** window of the graph).

One spectrum per read block is computed and shown as a column with a width of one pixel. The **time window** is given automatically from the number of pixels for the width of the graph and is shown in the graph. The overlapping is given by the number of measurements for an FFT and the sample rate. Manually define the color scale for the amplitudes (**Contour** tab); only the frequency axis can be determined completely automatically.

Peak detection: With active detection a table containing the detected peaks is shown in the graph. For **Threshold** specify the value (amplitude) from which a peak is to be detected. **Width** is the consecutive number of measurements used for the determination. Depending on the polynomial computation used, three or four values are usually optimum. If you do not obtain any results, try with five or six values. Generally, higher values worsen the results.
See also Frequency spectrum, Frequency analysis.

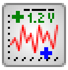


Polar diagram

Displays the measurements in real time (during the measurement) via the angle (polar coordinates). You must specify a channel for the x axis (angle).
See also Channels as x data sources.

The object is, for example, well suited to the visualization of measurements of rotating measurement objects, such as engines, because here the values can be displayed related to the angular position.

☞ Annotations or multiple axes as with the Real-time graph are not possible here and the zoom and cursor functions are restricted.



(Real-time) Cursor graph

Displays the measured values in real time (during the measurement). You can also use any channel instead of the time (default) for the x axis. In contrast to the Real-time graph, the graph uses *no* compression and therefore shows *all* measured values. With large time windows this can lead to a high burden on the PC and therefore to a possible RT lag. Check the settings as necessary: menu **File ► Options Safety** group, **Extended safety checks before DAQ start**.

The limit value levels can be displayed as lines: Select in the **Configure** window the corresponding y axis (scaling layer) on the **Axes** tab and then choose on the **Special** tab which limit values to display. See also Limit values.

☞ Change the plot parameters (color, line style) for this graphical object on the graph's **Plots** tab; the **Configure: Plot** dialog is not available here.

LED

Through various images, the LED displays the status of a digital input, a limit value, a high or low level crossing or the status of the measurement. You can also control the LED via an AutoSequence or EasyScript.

For the display of the limit value statuses there are three freely selectable images (LED symbols) available; only the images for **Default** and **Alarm** are used as status indicator. **Toggle** sets one of the states as the default. catman uses all image files in the formats BMP, ICO, GIF, JPEG and WMF which are located in the standard folder for LED symbols. See also Program option Folders (**System** group), **Default folder for LED symbols** and Limit values.

Video camera display

☞ The object is only available with an active Video Cameras module.

The object displays the (live) picture of one of the active video cameras. During a recording various items of information are displayed, e.g. the file name and the current file size. With the use of *Placeholders* they are initially displayed and the actual file name used is only shown after saving.

☞ Live display from a video source with compressed data is useful only for testing purposes. As the data stream has to be decompressed for this, the CPU load is increased and the advantage of a precompressed data stream is lost.

Map

☞ The object is only available with catman AP and catman PostProcess; see also Licensing and registration.

The object loads a map view from the Internet which is made available by Google Ireland Ltd. When querying, no user information or PC parameters are passed to Google apart from the querying IP address.

You can choose between **Road map**, **Satellite** image, a map showing the mountains and valleys (**Terrain**) and an overlay display of the road map and satellite image (**Hybrid**).

⚠ The maps can only be used in conjunction with catman. Owing to licensing law restrictions, the object is unavailable in some countries, including China and North Korea. You can, however, switch to using Baidu maps if you have a Baidu account. For details refer to the Knowledge Base under “Working with Baidu Maps in China” and https://lbsyun.baidu.com/index.php?title=webapi.

Choose either with the graphics tools **R-Zoom** or **H-Zoom** sections or by stating the coordinates, the positioning buttons and the zoom selection on the **Map** tab of the object (**Configure** window of the graph).

☞ In the smaller zoom levels (0 and 1), i.e. with the display of whole continents, the map display is slightly distorted due to the curved surface of the Earth.

Save the map once you have selected the size of the graphics, the type of map and a suitable section so that the display is also available without an Internet connection.

If you change the size of the graphics without an Internet connection, the image that is available is only scaled, i.e. single pixels may show up in the display. It is not possible to change the map section.

☞ Contact HBM if you would like to use maps from another source, e.g. from HERE.

Display of position data

Drag the channel with the values for the longitude onto the x axis and the channel with the values for the latitude onto the y axis.

CAN Raw table

The object displays the individual bytes of CAN raw messages in a table. You can use the **Configure** dialog to access various displays; see Configuring a CAN raw table.

The object synchronizes in both DAQ and analysis mode with a cursor in a post-process graph or Cursor graph (first cursor only). As soon as you place the cursor at a position in the graph, the line that (most closely) matches the corresponding point in time is marked.

7.2.2 Objects for the display of all recorded samples

Click on an object to display the **Configure** component window associated with that object. If necessary, use **Window ► Object Properties** (on the right above the ribbon) to display the window again if you have closed it.

The Real-time graphic to LED or Video (optional module) objects display the data during a measurement (DAQ job execution), so this is the **Real-time indicators** group. The Post-process graph to Statistics table or Metadata table (Analysis mode) objects display *all* data, and should therefore preferentially be used after the measurement.

See also Scope panel, Floating panel, Objects for real-time indicators.

A special position is held by the object Angle synchron. graph in the group **Display of all recorded samples**, which displays values both *during* and *after* the measurement, restricted however to one or several revolutions.

As a long measurement can result in many measured values, you should not have these objects updated so frequently, or do it only manually ( ). The objects are updated only when the panel or the page they are on is displayed. When browsing to the page, and at the end of the measurement, a one-time automatic update is performed. You can set it to update more frequently however (Refresh rate). Note in this case that a more frequent update also requires more processing power and that it can possibly lead to an RT lag.

☞ The following overview shows *all* possible objects; some of them are only available in Analysis mode however.

Post-process graph

This object displays *all* the measured values in a graph and is mainly intended for displaying the data after a measurement.

Not all values are drawn in the graph immediately. If more measurements are present than specified on the **Special** tab under **Compress from (data points)** (default 2000 data points), with y(t) graphs initially a compression to min/max values is carried out. However, once you zoom into a region, the original values are reloaded—at a sufficient zoom stage. This means that post-process graphs are quickly drawn even when plots are assigned with 10,000,000 measurements. If you disable compression and then zoom, an overview across the entire measurement period of time is displayed below the graph and the zoomed section is marked.
See also Configure y(x) graph, Compress.

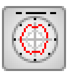
Enter a time unit, e.g. **hh:mm:ss**, on the **General** tab of the **Configure** window (**x axis in**) to display the date and time on the x axis.
In addition you have the possibility of using the entries with **... (abs)**. This means that the data are displayed related to the first data record of the graph and you can recognize different start times of individual measurements.

(Post-process) Cursor graph

This object displays *all* the measured values in a graph and is mainly intended for displaying the data after a measurement. The object is particularly well suited for analysis with the cursor; up to two cursors can be displayed.

Not all values are drawn in the graph immediately. If more measurements are present than specified on the **Special** tab under **Compress from (data points)** (default 100,000 data points), with y(t) graphs initially a compression to min/max values is carried out and displayed. However, once you zoom into a region, the original values are reloaded—at a sufficient zoom stage. This means that post-process graphs are quickly drawn even when plots are assigned with 10,000,000 measurements.
See also Configure y(x) graph, Compress.

☞ Change the plot parameters (color, line style) for this graphical object on the graph's **Plots** tab; the **Configure: Plot** dialog is not available here.



Polar diagram

Displays the measurements in real time (during the measurement) via the angle (polar coordinates). You must specify a channel for the x axis (angle).
See also Channels as x data sources.

The object is, for example, well suited to the visualization of measurements of rotating measurement objects, such as engines, because here the values can be displayed related to the angular position.

Angle synchron. graph

The object is only available with catmanAP or with an active EasyMath supplementary module.

The graph shows one or several channels against angular values. This occurs both in real time during the measurement (the default setting for the update rate is **2 x per second**) as well as after the measurement, as is usual with this type of graph.

The values of the angle channel do not have to be present from 0° to 360°; catman evaluates the minimum and maximum channel values. The figures shown in the graph are just pure labels and do not depend on the actual values. Depending on the selected angular axis minimum and maximum values at 0° and 350° or at 180° and +180° etc. are displayed. Therefore, choose a setting which fits your data.

Gear factor: Defines over how many minima and maxima of the angle channel the data is to be displayed. In the setting **2**, for example, the data is shown from a minimum to the *second* following maximum. The setting is helpful when the angular data does not originate from the actual observed shaft, but rather from a sensor operating through a flange-mounted gearbox with the sensor passing through more (or less) revolutions that the observed shaft.

Zero point: Shifts *all* plots by the specified amount on the x axis. Positive values move the plots to the left, negative ones to the right. Use the **Offset** tab in the **Configure** dialog of a plot to move an individual plot.

Revolutions: Defines how many of the curve sections, which arise from the settings made above, are visible simultaneously in the graph. You have to go via the control field and  the appropriate number of curve sections through the data record to view more than one section.

Apply to all: Has the effect that a click on one of the control fields acts on all Angle synchron. graphs.

In the default setting the compression of the data records for this graph starts at 64,000 values.
See also Compression threshold.

Contour graph

This type of graph facilitates the display of the value distribution on a z axis using colors.

Histogram

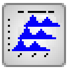
This type of graph is particularly suitable for displaying histograms (see also Class counting).

On the **Axes** tab activate the **Counts in %** option to display the class counts as percentages of the total.

3D chart

This type of graph is particularly suitable for displaying 3D data.

See also Class counting, JTF spectrum, 3D chart, Spectrogram.



3D diagram (only available in Analysis mode)

This type of graph is particularly suitable for displaying data records which change with time. Here, several 2D data records can be displayed stacked three-dimensionally. You can freely rotate the view in all directions using the scroll bars. The object can display the same data as the 3D chart, but is more versatile in configuration.

See also Counting, JTF spectrum, 3D chart, Spectrogram.

Frequency spectrum (only available in Analysis mode)

☞ The object is only available with catmanAP or with an active EasyMath supplementary module.

Displays the frequency distribution of all measurements.

Specify the window function and the number of measurements over which the amplitude spectrum is to be calculated on the **General** tab (**FFT** and **Window** in the **Configure** window of the graph).

With unsteady signals with a quickly varying composition you can obtain a display with less noise using **Averaging**.

See also Displays the frequency distribution in the present signal., Spectrogram, Frequency analysis.

Spectrogram (only available in Analysis mode)

☞ The object is only available with catmanAP or with an active EasyMath supplementary module.

The Spectrogram is additionally available from catman 4.0. It directly computes a JFT spectrum; you do *not* need to produce a computation function. The spectrogram computes the frequencies contained in a signal with the associated amplitudes which are shown color-coded. Specify the window function and the number of measurements over which the amplitude spectrum is to be calculated on the **General** tab (**FFT** and **Window** in the **Configure** window of the graph).

The **time window** is given automatically from the measurement time. The number of measured values is divided by the number of pixels for the width of the graph. In each case a column with FFTs is calculated and displayed over this number of values. Manually define the color scale for the amplitudes (**Contour** tab); only the frequency axis can be determined completely automatically.

Click in the area of the graph to display the spectrum for this time-point. Click in the graph frame to hide the spectrum again.
See also Spectrogram (real-time), Class counting, JTF spectrum, 3D chart, 3D diagram, Frequency analysis.

Map

☞ The object is only available with catman AP and catman PostProcess; see also Licensing and registration.

The object loads a map view from the Internet which is made available by Google Ireland Ltd. When querying, no user information or PC parameters are passed to Google apart from the querying IP address.

You can choose between **Road map**, **Satellite** image, a map showing the mountains and valleys (**Terrain**) and an overlay display of the road map and satellite image (**Hybrid**).

⚠ The maps can only be used in conjunction with catman. Owing to licensing law restrictions, the object is unavailable in some countries, including China and North Korea. You can, however, switch to using Baidu maps if you have a Baidu account. For details refer to the Knowledge Base under “Working with Baidu Maps in China” and https://lbsyun.baidu.com/index.php?title=webapi.

Choose either with the graphics tools **R-Zoom** or **H-Zoom** sections or by stating the coordinates, the positioning buttons and the zoom selection on the **Map** tab of the object (**Configure** window of the graph).

☞ In the smaller zoom levels (0 and 1), i.e. with the display of whole continents, the map display is slightly distorted due to the curved surface of the Earth.

Save the map once you have selected the size of the graphics, the type of map and a suitable section so that the display is also available without an Internet connection.

If you change the size of the graphics without an Internet connection, the image that is available is only scaled, i.e. single pixels may show up in the display. It is not possible to change the map section.

☞ Contact HBM if you would like to use maps from another source, e.g. from HERE.

Display of position data

Drag the channel with the values for the longitude onto the x axis and the channel with the values for the latitude onto the y axis.

Flexible table (only available in Analysis mode in this group)

The table offers even more options than the table with the same name in DAQ mode. You can:

- make different entries for *each cell*,
- enter formulas in fields as in Excel (**Configure** window, **Advanced** tab),
- span cells,
- display all measurements of the channel. The values are always entered in the same column.
- display statistical values (Min/Max etc.),
- display channel information (excitation voltage, zero-balance value, serial number of the amplifier or sensor ID),
- display test parameters,
- display data relevant to the measurement, such as sample rate or number of measurements (measurement parameters),
- link to a graph on another panel (**Configure** dialog, **Cells** tab, **Picture**: **From panel object**).

Drag a channel onto any field to open the selection dialog, or use **Window ► Data sources for drag and drop** (on the right above the ribbon). Mark the required channel in the **Analysis project** window and drag and drop the required information into the appropriate cell.

Activate **Append channel name and unit** so as not to receive just the numerical values in the table. In this case four consecutive cells in a row are taken up.

A Flexible table can have up to 100,000 rows. If you would like to view more data, you have to use the Data table or a DataView window or create a plot section.

See also Flexible table (real-time), Configure flexible table, Data table, Simple table (in Analysis mode).

Data table

The Data table displays only measurements and is not restricted to 100,000 values like the Flexible table.

Statistics table

The Statistics table shows only the statistical data of channels. You can choose between the display of Min/Max/Mean and the display of **Extended statistics data** (includes, for example, standard deviation and variance), but the displayed values cannot be individually defined.

Traceability table (only available in Analysis mode)

The Traceability table (only available in Analysis mode) includes the traceability data in a form similar to the **Channel info(rmation)** window in the **DAQ channels** tab: excitation voltage, zero balance, amplifier serial number, sensor ID, etc.

Meta data table (only available in Analysis mode)

The meta data table (only available in Analysis mode) enables you to display all test parameters together in a table. Drag the main entry *Test parameter* onto this table.

Display the individual entries, e.g. the number of measurements, with the Text object.

CAN Raw table

The object displays the individual bytes of CAN raw messages in a table. You can use the **Configure** dialog to access various displays; see Configuring a CAN raw table.

The object synchronizes in both DAQ and analysis mode with a cursor in a post-process graph or Cursor graph (first cursor only). As soon as you place the cursor at a position in the graph, the line that (most closely) matches the corresponding point in time is marked.

7.2.3 Objects for synchronized display (only Analysis mode)

☞ These objects are only available in Analysis mode, and are only used to display measured values at the cursor position in graphs.

Use these objects together with a graph (cursor or post-process graph) to display the values of (any) channels at the position of the (first) cursor. All objects of this type on a panel or a page are synchronized with the active graph.

Map

☞ The object is only available with catman AP and catman PostProcess; see also [Licensing and registration](#).

The object loads a map view from the Internet which is made available by Google Ireland Ltd. When querying, no user information or PC parameters are passed to Google apart from the querying IP address.

You can choose between **Road map**, **Satellite** image, a map showing the mountains and valleys (**Terrain**) and an overlay display of the road map and satellite image (**Hybrid**).

⚠ The maps can only be used in conjunction with catman. Owing to licensing law restrictions, the object is unavailable in some countries, including China and North Korea. You can, however, switch to using Baidu maps if you have a Baidu account. For details refer to the Knowledge Base under “Working with Baidu Maps in China” and https://lbsyun.baidu.com/index.php?title=webapi.

Choose either with the graphics tools **R-Zoom** or **H-Zoom** sections or by stating the coordinates, the positioning buttons and the zoom selection on the **Map** tab of the object (**Configure** window of the graph).

☞ In the smaller zoom levels (0 and 1), i.e. with the display of whole continents, the map display is slightly distorted due to the curved surface of the Earth.

Save the map once you have selected the size of the graphics, the type of map and a suitable section so that the display is also available without an Internet connection.

If you change the size of the graphics without an Internet connection, the image that is available is only scaled, i.e. single pixels may show up in the display. It is not possible to change the map section.

Contact HBM if you would like to use maps from another source, e.g. from HERE.

Display of position data

Drag the channel with the values for the longitude onto the x axis and the channel with the values for the latitude onto the y axis.

Video playback

Shows a video and in the representation follows either the cursor position of the active graph or controls the cursor position or display in other graphical objects. Drag the video file from the test parameters (**Video file from camera ...**) into the object. Alternatively, you can also specify the video file in the object's configuration dialog.

Playback of MP4 files is not supported by the Video object in catman Analysis mode.

Above the picture various items of information are displayed, e.g. the file name and the duration. Using the buttons under the picture, you can change the replay speed, pause the video, play frame by frame forward or reverse or change the volume. The current position in the video is displayed below these buttons.

If the video and the measurement data do not start simultaneously, enter the offset on the **General** tab.

Digital indicator

Displays the measurement at the cursor position as a number.

Simple table

Displays the measurement at the cursor position as a number.

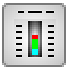
The configuration of the columns for the Simple table cannot be changed; you can only occupy complete rows with one channel.

Analog meter

Displays the measurement at the cursor position with a pointer. You may also configure this object like a car fuel display (**Configure** window, **General** tab, **Template**).

Use the **Layout** and **Style** tabs to adapt the display, e.g. the opening angle, to your requirements. Note here that some of the controls on the **Layout** tab have a mutual influence.

Colored limit values can be configured via the **Alarm** tab in the **Configure** window: activate **Show alarm limits**.



Bar indicator

The Bar indicator shows the measurement at the cursor position and has various possible configurations: different horizontal or vertical bars or thermometers (**Configure** window, **General** tab, **Template**).

Use the **Layout** and **Style** tabs to adapt the display, e.g. the aperture angle, to your requirements. Note here that some of the controls on the **Layout** tab have a mutual influence.

Colored limit values can be configured via the **Alarm** tab in the **Configure** window: activate **Show alarm limits**.

Frequency spectrum (FFT)

☞ The object is only available with catmanAP or with an active EasyMath additional module.

Displays the frequency distribution in the vicinity of the cursor. In each case the half of the values to the left and right of the cursor are used for the computation for the **FFT**.

Specify the window function and the number of measurements over which the amplitude spectrum is to be calculated on the **General** tab (**FFT** and **Window** in the **Configure** window of the graph).

With unsteady signals with a quickly varying composition you can obtain a steadier display using **Averaging**.

Peak detection: With active detection a table containing the detected peaks is shown in the graph. For **Threshold** specify the value (amplitude) from which a peak is to be detected. **Width** is the consecutive number of measurements used for the determination. Depending on the polynomial computation used, three or four values are usually optimum. If you do not obtain any results, try with five or six values. Generally, higher values worsen the results.

7.2.4 Layout objects

Text and Background image provide you with various options for formatting and displaying system texts.

Text

Use this object, for example, for headings, labels or the display of (single) measurement or channel parameters. The formatting defined always refers to the entire text.

You can also use the object for images; the object Background image is identical to the object Text.

DAQ mode

With **System text** you can also display DAQ job parameters or the date and time. Activate the **Update during DAQ job** option (**General** tab), to view the current time for example.

Analysis mode

Drag a parameter from the **Analysis project** component window into the **Text** field of the component window **Configure** to display channel parameters such as minimum, maximum, channel name, comment, etc. The component windows for configuring the object and for the loaded analysis projects must be visible for this at the same time.

In the **Text** field the parameter is displayed enclosed in tags, e.g. <P>XY</P>, but on a Panel or a Print page the *content* of the parameter is always displayed. Do not change the parameter definition, otherwise the associated information can no longer be found by catman. If you load a new test, the same parameter—if available—is displayed for the new test.

Use the meta data table or the traceability table if you want to display all the information.

Background image

The object is identical to the object Text and is suitable for images or logos in the formats JPEG, BMP (Windows Bitmap) or GIF (Graphics Interchange Format). The Background image was introduced, because with the object Text it is not immediately obvious

that it can also display images. The images used are also saved in the default settings in the project file. The background image can also be shown in the foreground (**To front** context menu), but the name is retained.
See also Folders program option (**System** group) and Configuring Panels and Print pages for background images over a complete Panel.

Frame

With this object you can arrange a frame around other objects. Grouping does not take place and the frame is a purely graphical object which however offers you many design possibilities in color and thickness. You can also display a background image and/or text in the frame.

7.2.5 Controller, Developer tools (objects for predefined actions, clone actions, AutoSequences and EasyScript)

ℹ See also Program options: Program functions (**System** group), Autosequences, EasyScript.

Click on **Design mode** (on the right above the ribbon) to switch to **Execution mode** and vice versa. Only in *Execution mode* are assigned AutoSequences, clone actions, predefined actions or EasyScript procedures also executed, or controller values applied in computations.

☞ As long as you are in the Execution mode you cannot move any interactive object. Configuration is also restricted. You can however switch between the modes, even during a measurement.

The following (interactive) objects are available in the **Controller** and **Developer tools** groups.

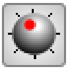
Controller

You can use the values set in these objects in real-time computations or send them to analog or digital outputs of the connected QuantumX/SomatXR modules.

Slide control

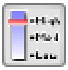
Object which allows the user to continuously input numerical values. The object is comparable with the slide switch, but facilitates continuous input.

Use **Panel input** (**Additional functions**) in the **formula editor** (real-time computations) for polling.
EasyScript: Use `EA_Panel.GetValue` for polling.
AutoSequence: Use **Read out user input/selection** in the **Panel** section for polling.



Rotary knob

Object which allows the user to continuously input numerical values
Use **Panel input** (**Additional functions**) in the **formula editor** (real-time computations) for polling.
EasyScript: Use `EA_Panel.GetValue` for polling.
AutoSequence: Use **Read out user input/selection** in the **Panel** section for polling.



Slide switch

Object which allows the user to input discrete states (positions). The object is comparable with the slide control, but facilitates discrete input.
Use **Panel input** (**Additional functions**) in the **formula editor** (real-time computations) for polling.
EasyScript: Use `EA_Panel.GetValue` for polling.
AutoSequence: Use **Read out user input/selection** in the **Panel** section for polling.

On/off switch

The object provides a switch with caption and LED.
Use **Panel input** (**Additional functions**) in the **formula editor** (real-time computations) for polling.
EasyScript: Use `EA_Panel.GetValue` for polling.
AutoSequence: Use **Read out user input/selection** in the **Panel** section for polling.

Developer tools

Button

Use this object to start predefined actions, AutoSequences or script procedures.
See also Configure button.

Checkbox/radio button

Depending on the selection at **Operating mode** (**Configure** window, **General** tab) the object acts as a checkbox or radio button (single or multiple).
EasyScript: Use `EA_Panel.GetValue` for polling.
AutoSequence: Use **Read out user input/selection** in the **Panel** section for polling.

Combo box

Object for selecting one entry from many entries (texts or numbers).
EasyScript: Use `EA_Panel.GetValue` or `EA_Panel.GetListboxSelIndex` for polling.
AutoSequence: Use **Read out user input/selection** in the **Panel** section for polling.

Text box

Object allowing the user to input texts.
EasyScript: Use `EA_Panel.GetValue` for polling.
AutoSequence: Use **Read out user input/selection** in the **Panel** section for polling.

(Script) table

In its functioning principle the object corresponds to the Flexible table: Each cell is independent and can be filled with other data. You assign texts or numbers to the cells via AutoSequences or EasyScript.
EasyScript: Use `EA_Panel.SetCell` to enter data into a cell and `EA_Panel.GetCell` to read out a cell.
AutoSequence: Use **Output text/selection/condition** in the **Panel** section for the output and **Read out user input/selection** in the **Panel** section for polling.

☞ Interactive use is *not* possible.

LED array

The object provides a range of displays in the form of bars, round LEDs or ramps.
EasyScript: Use `EA_Panel.SetValue` to set a value for the display.
AutoSequence: Use **Output text/process variable** in the **Panel** section for the output.

Canvas

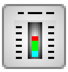
This object provides you with a drawing canvas for EasyScript. You can draw in this area with the script commands Lines, Points, Circles or Texts.
EasyScript: Use `EA_Panel.CanvasSetText` and `EA.GetObject`.

***Analog meter* and *Bar indicator* are also available as input objects:**

Analog meter

On the **General** tab activate the **Mode** as **Controller** and define how your input object is to be displayed using the **Layout** and **Style** tabs.

EasyScript: Use `EA_Panel.SetValue` to set a value for the display and `EA_Panel.GetValue` for polling.
AutoSequence: Use **Read out user input/selection** in the **Panel** section for polling.



Bar indicator

On the **General** tab activate the **Mode** as **Controller** and define how your input object is to be displayed using the **Layout** and **Style** tabs.

EasyScript: Use `EA_Panel.GetValue` for polling.
AutoSequence: Use **Read out user input/selection** in the **Panel** section for polling.

7.3 Configure display objects

By default, the **Configure** component window of an object is displayed as soon as you click on the object (see Program options: Panels). Use the **Properties** context menu or **Window ► Object properties** / **Settings** (at the right above the ribbon) if you have closed the window. For the Floating panel display the window again with the menu in .
You have two options for creating display objects and assigning channels:

1. Drag one or more channels to a blank point on a panel or print page. You get a popup menu from which you can select one of the most frequently used objects. If the object is able to display multiple channels (graphs), only one object is generated showing all selected channels, otherwise there is one for each channel.

2. Click on an icon in the **Visualization objects** group on the **Visualization** tab to select the object you want. To do this, where applicable, open the group by clicking on the arrow at the right margin. Then drag one or more channels onto the object.

☞ By default, an (active) channel is pre-assigned when an object has been generated. Disable the **Auto-assign channels when creating new objects** option if you do not want it – see Panel (and print page) options.

General configuration options

Move object

In the object, click and hold down the left-hand mouse key and drag. With the Video camera display click on the upper section in the window. Objects will be aligned even if the grid is not visible, if **Align objects to grid** is activated in the Panel options (**Visualization** group).

Notes

- You may lock the objects with 🔒 (**Visualization** tab, **Panel/page** group). Click on 🔒 to be able to move the objects again.
- Graphs cannot be moved when one of the zoom modes, section mode, scroll mode or the cursor is active. Deactivate the zoom, section, scroll mode or the cursor using **Edit** in the **Graph tools** group.
- Graphical objects cannot be moved if you have activated *Execution mode*.

Move/edit several objects

In order to move, delete, copy or change font settings for several objects, hold down the [Ctrl] key and click on the required objects. The selected objects will be marked in the top right-hand corner with ☑.

Assign/remove channel(s) to be displayed

Drag a channel from the channel list (**Window ► Channel list** on the right above the ribbon) onto the object or (for graphs) the required axis. Select multiple channels with [⇧] or [Ctrl] and drag the last channel you selected onto the graph.
From a channel group (plug-in units with more than one channel) all channels can be assigned simultaneously by hiding the group (⊳ is displayed) and then dragging the first visible channel onto a graph.

With this type of channel assignment Time is always used as the x channel. Here, the scaling is determined from the channel sample rate (time from sample rate). If you want to display data acquired in burst mode, you have to drag a time channel onto the x axis – see Time channel in Burst mode.
See also Configuring a y(x) graph.

To remove *one* channel from a real-time or post-process graph click on the *Plot legend* or a point on the plot in the graph and then click on **Delete plot**. In the Cursor graph delete the graphs with the **Plots** tab in the configuration dialog of the graph. Press Del or to remove channels from a table (**Columns and rows** tab in the **Configure** window). In all other objects, it is enough to assign a *new* channel.

All channels assigned to a graph can be deleted with .

Changing plot attributes in a graph

For the real-time and post-process graphs click on the *Plot legend* or the plot to display the plot attributes in the **Configure** window (**Window ► Object properties**). Here you can:

- change the display (plot style, line type, etc.),
- change the plot name (for the legend),
- define the related x channel (see also Channels as x data sources),
- delete the plot with ,
- draw an equalizing plot with (best fit, linear interpolation) or to (polynomial interpolation of 2nd to 4th order) in the post-process graph over all measured values. The calculated coefficients are displayed in the legend; a figure such as **1.5e-2** signifies **$1.5 * 10^{-2}$**.

☞ With the *Cursor graph* you do not change the plot attributes in the **Configure: Plot** dialog, but rather in the **Plots** tab in the *Graph* configuration dialog (click on the graph once).

Left-click on the *Plot legend* to directly

- move a plot into a new axis layer (axis scaling),
- delete the plot,
- go directly to the plot parameters dialog.

You can also change the plot styles for all the plots in a graph simultaneously: Choose **All** for **Style** (post-process graph and real-time graph) or select the relevant channels on the **Plots** tab.

Even if you are using automatic channel colors you can deactivate this option for *one* graph and define other plot colors in this graph. In the dialog, which is displayed after the change of color, click on **Yes** or deactivate the option **Use channel colors for plots** on the graph **Layout** tab. The graph then uses a different plot color for each newly assigned channel.

Use color channels (display plot color-coded by measurements)

☞ The function is only available in post-process graphs.

Drag the channel you want to use as a color channel onto the *Plot legend* or click on the **Color channel** tab in the **Setup** dialog and specify the channel to use. catman calculates the minimum and maximum values of the channel and allocates the colors red and blue to them. You can change the allocation by entering different values, but the colors cannot be changed. All the values between the minimum and maximum are given the intervening colors.
The color channel used is displayed in the plot legend.

Increase the thickness of the **Line** on the **General** tab to make the colors more easily visible.

Save current object as template

Use to define the current configuration as the *template* for *all* new objects of this type. resets to the default template.

☞ The option to save *multiple* templates is *not* available for the following objects of the **Real-time indicators** and **Display of all recorded samples** groups: Polar diagram, 3D diagram, 3D chart and Spectrogram.
For the objects in the **Layout** group the function is only available for frames and for objects in the **Developer tools** group it is available only for the table.

Select the object you want and use the **Save** context menu to save the current view of an object.
Select a newly created object and choose the **Load** context menu to assign the object one of the stored templates.

Change layout

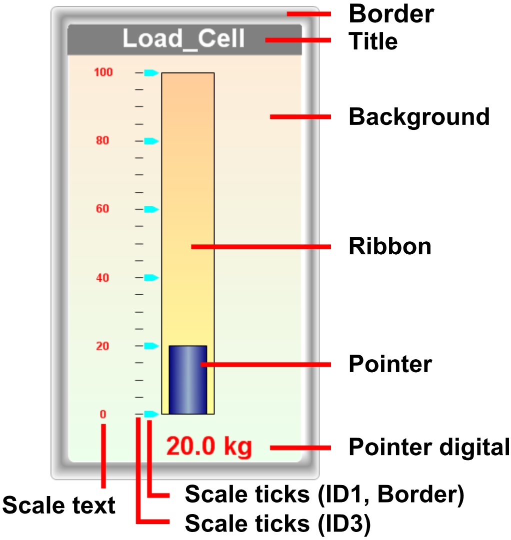
On the **Layout** tab you can change the fonts of title, axes, values, etc., depending on the object, and also change their colors. With many objects you can separately alter the foreground and background colors or external and internal areas in a graph. You can also specify color gradients: from top to bottom or vice versa; from left to right; linear; or radially from the center outward, etc.

Adapt font size dynamically: When this option is active the font size in a graph is also changed during enlargement or reduction.

The plots or numeric values can be displayed automatically in the color defined in the **DAQ channels** tab (**Use … channel colors**), if you have set **Use channel colors as default** in the Panel options. Otherwise this option cannot be selected on the **Layout** tab.

With some objects you can also configure several areas, e.g. with the scale marks you can configure several scales by selecting or creating *IDs*. For example, with the Bar indicator with **ID2** and **ID4** you have the possibility of also displaying scale marks to the right of the bar. Set the **Transparency** to **255** (corresponds to visible) in order to display the marks.

The following example shows a Bar indicator and which parts of the graph are influenced by which settings. Note that, for example, there is also the **Frame** setting for the scale marks: in this case it is a frame around the line thickness (**Thickness**). With the values for the start and finish 0 is the outer left pixel and 1 the outer right pixel in the graph. **Number of ticks** sets the number of marks.



Choose **Scale text** and **Font...** to specify the font size and style (ID1 acts on the left-hand scale, ID2 on the right).

Office tab

☞ The **Office** tab is not available for the Multi-bar graph and LED objects.

For exporting to an MS Word document, you can specify here the point in the document to which the graph is to be copied. To do this you set up a bookmark in Word and enter the name of the bookmark here. If you specify a different mark for each object you are exporting, the export will be collective, for example by way of the **Export/Print** context menu of any graph.
See also Create report, Export or print a graph.

Creating a bookmark in Word

1. Click on the point at which you would like to insert a bookmark.
2. Select **Bookmark** in the **Insert** tab (**Hyperlinks** group).
3. Under **Bookmark name**, select or enter a name.
   Names of bookmarks must begin with a letter and can contain numbers, but no space characters. You can however use underscore to separate words, e.g. **First_ picture**.
4. Click on **Add**.

Notes

- If an object is partly hidden by another, select **To front** or **To back** from the context menu.
- Do not position several objects over one another.
- To change *numerical values* after entering them click either on **Apply** (if present) or press ↵ to activate the entry.
- Some objects do not allow scale labels and title to be formatted separately. In such cases, delete the title (input spaces) and use a text object, which you position above or on top of the object.
- To change *colors*, you first have a *palette* of colors available. Click on **More colors** to display the color picker.
- The **Background transparent** option present with some objects only functions with static backgrounds, not with changing backgrounds, such as a Video camera display.

Special object configurations

Configure graph
Configuring a y(x) graph
Configure real-time displays
Export or print a graph
Configure Multi-bar graph
Set up a Flexible table
Configuring a CAN raw table
Configure button

See also Configuration of the special panels

Scope panel
Floating panel

7.3.1 Configuring graphs

See also General notes, Configure y(x) graphs, Configure real-time indicators.

 deletes *all* channels that are displayed from the active graph. Left-click on the *Plot legend* or a point on the plot in a real-time or post-process graph to call the con-

figuration dialog for the plot where you delete *only this plot* with **Delete plot**. In the Cursor graph delete the graphs with the **Plots** tab in the configuration dialog of the graph.

Title (header)

Use the pipe sign (**|**, vertical stroke) to divide the graph title up into a left aligned section, a centered one and a right aligned one:

Left aligned text|Centered text|Right aligned text

Without the pipe sign (|) the text is centered. Otherwise always enter *both* signs.

You can also use *Placeholders* in the title (and subtitle).

Axes and scalings

The various axes (x axis, left y axis, right y axis, etc.) of a graph can be obtained via the **Axis** selection field on the **Axes** tab (**Configure** window). In real-time and post-process graphs (not cursor graphs) you can also click on the relevant axis in the graph.

In the *post-process graph* and the *post-process Cursor graph* you can also select the point index for the x axis instead of the time channel (tab **General**, **x axis in**).

Activate **Auto color** (**Axes** tab) to obtain the y axes of the graph in the same color as the plot last allocated to it.

With real-time and the post-process graphs and with several y axes you can change the size (height) of the y axes interactively: Lock the graphs (**Panel/page** group) and click on the separating line (x axis) between two axes. Then move the axis with the mouse button pressed. The configuration is not saved however.

With real-time and the post-process graphs use the **Layout** selection field to define how many scales (y axes) you want to use. Up to 12 scales (scale levels) are possible.

Using the context menu of the *Plot legend*, you can also move a curve to a new y axis (scaling).

On the *Cursor graph* further axes are only displayed if you move one of the assigned plots on the **Plots** tab into the corresponding scale level or if you activate visibility of the scale level in the **Axes** tab. Up to 3 scales (scale levels) are possible.

Auto-Range enables you to specify a range which is to be displayed. This range is in each case moved such that the current measurements lie within the range. When the measurements run out of the range, the scaling is adapted. You can thus have the scaling following the current values.

The **Sensor** scale uses the measurement range of the amplifier as positive and negative scale end values. If the measurement range of the amplifier (e.g. 4 mV/V) is significantly larger than the senor measurement range (e.g. 1 mV/V), you obtain however a scale which is too large.

(Axes) **format** (label format): apart from the formats available in the selection field, you can also define a free format. For this, enter the text to be displayed and the numerical format as follows (a vertical line is used as a delimiter):

Text to left of numeric value|Format for numeric value|Text to right of numeric value

Entry example	Display (example)
.00	487.35
|.0| mm	2.3 mm
U = |.000| mV/V	U = 0.556 mV/V

Enter a time unit, e.g. **hh:mm:ss**, on the **General** tab (**x axis in**) to display the date and time on the x axis.
In addition with post-process graphs you have the possibility of using the entries with **... (abs)**. This means that the data are displayed related to the first data record of the graph and you can recognize different start times of individual measurements/data.

Assigning the time channel again to a y(x) graph, time channel when using the Burst mode

To reassign the normal time channel to an x axis, all you have to do is drag the **Time from sample rate** channel onto the x axis. If you have recorded data in Burst mode, however, the actual time must be plotted on the x axis. A time channel computed from the sample rate would not include the times between the bursts, unless you activate **Burst detection** in the real-time and post-process graphs (in the realization a gap will then be left, or the graph null value will be used). Display the time channels in a cursor graph: Deactivate program option Channel list, **Hide time channels in channel tables**. Then drag the corresponding time channel to the x axis.

Font/color

To change *colors*, you first only have a *palette* of colors available. Click on **More colors** to display the color picker.

Best-fit approximation in the post-process graph

You can calculate a best-fit approximation in the post-process graph: Activate the desired function in the plot **Configure** dialog (by left-clicking on the legend). The computed coefficients are then displayed within the graph at the top. The interpolation is shown as an additional plot.

Linear interpolation

Interpolation with 2nd degree polynomial

Interpolation with 3rd degree polynomial

Interpolation with 4th degree polynomial

See also Change plot parameters in a graph.

Maximum number of plots

The maximum number of plots which can be displayed in a graph is limited to 12 in the default setting; see also Program option Panels: **Maximum number of plots**. You can however increase the number at any time in both the default setting for all (new) graphs as well as individually per graph. On panels and print pages up to 32,000 plots in all panels/print pages can be displayed. On Scope and Floating panels up to 8 plots per graph are possible.

Refresh rate, compression threshold (Special tab)

So that real-time graphs do not put too much stress on the PC during a measurement, you can select slower refresh (update) rates on the **Special** tab than **Always**. With post-process graphs you are asked already when creating them whether the default setting **Manual** is to be used or whether a more frequent update is required. However, note that a frequent update also requires more processing power and can possibly lead to an RT lag.

The setting of **Update** on the **Special** tab does *not* affect the data acquisition, *only* the screen display. For the manual update use, for example, (**Update** in the **Panel/page** group of the **Visualization** tab.

The setting **Compress from (data points)** determines how many values are visible in the graph and also the speed of the display and therefore the stress on the PC. The effect on the display is however different for the various types of graph:

- With y(t) graphs a minimum and a maximum value are determined in each case and displayed for the range to be compressed. With a sufficient zoom level however, all measurements are reloaded from the stored data (temporary data storage) and displayed. So here you can leave the default values unchanged as the default setting of **2000** for the y(t) graph or **100,000** for the y(t) cursor graph is already high enough.

- With *y(x) graphs* (real-time and post-process) "excess" values are always omitted and *no* min/max compression is used. The number of values defined with **Compression threshold (data points)** is displayed; all others are omitted and an *Alias* effect may occur. So, increase the number of the data points to be displayed, or in the post-process graph disable compression, if the compression would result in too many "omitted" values.
  See also Configure y(x) graphs.
- The *real-time cursor graph* is never compressed. With large time windows or high sample rates this can lead to a high burden on the PC and therefore to an RT lag. Check the settings as necessary: **Options ► Safety**, **Extended safety checks before DAQ start**.

If you disable compression in the *Real-time graph* and *Post-process graph* visualization objects and then zoom, an overview across the entire measurement period of time is displayed below the graph and the zoomed section is marked.

☞ With high sample rates (≥ 4800 Hz) and many displayed channels (in particular in several graphs and on several panels) we recommend setting *manual* scaling (*not* **Auto**). If the PC load is still too high, on the **Special** tab select for example the setting **Update: 1 x per second** and stop the invisible graphs. otherwise a time delay might occur between the measurement and display—see Preventing a RT lag and Job status window to view the processor load.

Additionally, you can display the limit values as lines with the **Special** tab: In the **Configure** window select the corresponding y axis (scaling layer) on the **Axes** tab or click the axis in the graph and then on the **Special** tab choose which limit values to display.
See also Limit values, Available limit value conditions: Level.

7.3.2 Configuring a y(x) graph

Graphs in which one channel is to be plotted against another channel (and not against time) have some special features:

1. You have to define the x channel manually (in the default setting the time channel is always on the x axis).
2. The type of representation differs from the representation for y(t) graphs.

Channels as x data sources

There are various possibilities of using a channel as x data source depending on the graph:

1. Real-time graph and post-process graph: Drag the channel onto the *Plot legend* of the y channel which is to be displayed against this channel and select **Use as x axis** from the context menu.
   Only this plot is shown against this x channel; the assignment of the other channels remains unchanged.
2. All graphs: Drag a channel onto the x axis of a graph.
   All plots (y axes) in the graph are shown against this channel.
3. All graphs: Via the context menu of the channel list (**Window ► Channel list** on the right above the ribbon), add the channel to the x data sources (**Add to x data sources**).
   Real-time graph and post-process graph: Select the channel in the **Configure** window of the relevant *plot* (click on the plot legend) in the **x data** field.
   Cursor graph: In the **Configure** window of the *graph* on the **Plots** tab select the channel for the **x data**.

☞ If you want to display several channels with different x channels in a post-process graph, you must assign the appropriate x channel to each plot.

Real-time graph and post-process graph: Use the first method. First, assign all plots to the y axis and then drag the x channels onto the appropriate plot legend. Cursor graph: Use the third method. First, assign all plots to the y axis, then mark all channels which are to be added to the x axis and then add them to it. Then, go to the graph **Configure** dialog and sort the associated y and x channels on the **Plots** tab.

You can also call the list of **x data sources** from the context menu of a graph and remove channels from it.

Assigning a y(x) graph to the time channel again

To reassign the normal time channel to an x axis, all you have to do is drag the **Time from sample rate** channel onto the x axis. If you have recorded data in Burst mode, however, the actual time must be plotted on the x axis. A time channel computed from the sample rate would not include the times between the bursts, unless you activate **Burst detection** in the real-time and post-process graphs (in the realization a gap will then be left, or the graph null value will be used). Display the time channels in a cursor graph: Deactivate program option Channel list, **Hide time channels in channel tables**. Then drag the corresponding time channel to the x axis.

Presentation of plots in y(x) graphs, compression

If the sample rate multiplied by the time window or the number of the readings gives a number greater than 2,000 with the standard graphs (real-time and post-process) or 100,000 with the post-process cursor graph, the data will be displayed incompletely. Per plot initially always only 2,000 (100,000) values (pairs) are displayed; the rest of the values are not displayed, but instead left out. However, if you zoom in the graph, then with a sufficient zoom level all values are displayed if the values have been saved in the temporary file.

⚠ Unlike with a y(t) graph, with a y(x) graph a min/max compression cannot be carried out, because, for example, the y maxima do not necessarily coincide with the x maxima.

Depending on the performance of your PC, the number of channels, the sample rate and the number of graphs, you can increase the number of data points to be displayed for individual graphs on the **Special** tab or—in the post-process graph—turn off compression. With real-time graphs you may have to reduce the update rate. With a post-process graph the additional time requirement for drawing is only irrelevant if you do not have more than 100,000 measurements, you have an up-to-date PC, and the update is set to **Manual** or **1 x per second**.

Therefore, for the graph in question increase the number of data points to be displayed on the **Special** tab and reduce the update rate if required.

See also Configure graph.

The cursor is *deactivated* in the post-process graph if the product of **Compress data from … points** and **Max. plots** is above 900,000 (graph configuration dialog, **Special** tab). In these cases, reduce the maximum possible number of plots or use the cursor graph.
The maximum buffer size for the post-process graph is 1,000,000 (with max. 12 plots) and for the overview cursor graph it is 10,000,000.

7.3.3 Configure real-time indicators

See also Refresh rate/compress (Special tab), Configuring an y(x) graph, Preventing an RT lag (performance)

Objects which only display one value per channel (also the multi-bar graph) should only be used when using a *Sample rate below 50 Hz*. Not all values can be displayed with higher sample rates, and this can lead to unwanted effects: The effect is similar to a film where the wheels of a car moving forwards suddenly seem to turn backwards. An optical illusion could also happen here during faster operations. With y(t) graphs the trace is correctly displayed.

With higher sample rates do not display the current value, but rather, for example, the minimum, maximum or mean, etc. These values are calculated from *all* currently read-in measured values, though this display is not possible with the tables and multi-bar graph.

Display of channels with different sample rates

The display of channels with different sample rates in one or several y(t) real-time graphs is no problem: As usual, drag the channels into the graph.

The representation of two channels with different sample rates in one y(x) real-time graph is however not possible, because here there are fewer measurements present for one channel than for the other. The relevant associated x and y channels must therefore be present with the same sample rate. In Analysis mode you must either manually assign the relevant x and y channels (**Configure: Plot**, **X data**) or convert the sample rates accordingly.

See also Channels as x data sources, Interpolation.

Performance of a display in real-time

If you call a dialog during a measurement, this can delay the transfer of values. With the mouse button held down the transfer can be *completely cut*. If the buffer on the measuring device overflows during this time period, an error message is issued and the measurement stopped.

You obtain information during the measurement about the performance of your PC and whether it can process and display the data fast enough, for example via the status bar and (RT lag) or via the dialog which you access by clicking on **Additional** in the status bar at the far right. Using the dialog **Optimize performance and prevent real-time lag** (**Performance** in the **DAQ** group), you can reduce the refresh rates of the display objects at high sample rates and/or implement no updating of the graphs on the invisible pages. Use the configuration dialog of a graph (**Special** tab) to reduce the update (refresh) rate of a single graph or to change the number of displayed points.

See also Refresh rate, Compress (Special tab), RT lag

7.3.4 Export or print a graph

Using the context menu of a graph you can export the current graph, all graphs on the page or all graphs in the project to the clipboard or a file or print them out. Depending on the format and output medium you may be able to carry out further settings.

Scope panel: Use the menu **File ► Clipboard ► Export visualization object** or **Print ► Print object**.

Floating panel: Use ► **Panel into clipboard** or **Print Panel**.

If MS Office is installed on your PC, you can also insert the graphs directly into an open document. Use the **Office** tab (graph **Configure** window) to set the bookmarks (positions in the document) for the respective graphs; see also Office tab, Create report.

7.3.5 Configure Multi-bar graph

See also Configure real-time indicators.

The Multi-bar graph display offers some configuration options (**Configure** window) that are not available with other graphs:

- Enter **Vertical** on the **Axes** tab for the *x axis* if the channel names are so long that they run into each other.
- The width of all bars can be changed simultaneously on the **General** tab.
- Normally the bars are all the same distance away from each other. You can however change the alignment. Activate **Variable x coordinates** on the **General** tab. Then click on one of the assigned channels and enter its position in the field **x =**.
- **Gradient** displays the bars with a color gradient.

7.3.6 Set up a Flexible table

The (flexible) table offers you substantially more extensive possibilities than the Simple table or the special tables such as, for example, the Statistics table in Analysis mode. In both DAQ and Analysis mode you have numerous configuration possibilities, because you can configure each individual cell. Therefore, the Flexible table is also suitable, for example, for creating report pages.

The differences between DAQ mode and Analysis mode arise from the data which is available: in DAQ mode essentially the current measurements are available, whereas in Analysis mode the traceability data and the measurement and test parameter are present. The selection of the cell data occurs in both cases via a popup menu or window.

The following are used for configuration:

1. The **Configure** window for changing the number of rows and columns, configuration of the display and content of the cells, e.g. also the entry of formulas.
2. In DAQ mode the popup menu for selecting a measured or statistical value when dragging a channel onto a cell.
3. In Analysis mode a menu window (**Data sources for table drag and drop**) for statistical values, all data of a channel, traceability data (excitation voltage, zero-balance value, serial number of the amplifier or sensor ID) and data relevant to the measurement such as sample rate or number of measurements. The window is shown when you drag a channel onto any cell in the table or open it via **Window ► Data sources for table drag and drop** (on the right above the ribbon).

☞ In DAQ mode, you can mark all cells to which a data source has been assigned using **Select all** (**Data source selected cell**, **General** tab).

For the documentation of the settings used during the measurement use the traceability or the meta data table. After selecting a channel (by drag & drop), these show in the individual columns and rows *all* traceability data (channel parameters), or after selecting a test (by drag & drop) *all* test parameters.

As in Excel, you can create several *sheets* in a table: **General** tab, **Sheets**.

A sheet can have up to 100,000 rows and 256 columns. If you would like to view more data, you have to use the data table or a DataView window or create a curve section.

Change column width/row height

Display the header row or column as appropriate to change the *width* of columns or the *height* of rows (**Configure** window, **Columns/rows** tab). Then drag the border between two cells in the header row or column.

To be able to change *all* rows or columns, click in the field in the upper left corner of the table ( ) to mark the complete table and then move the separator between the two cells in the header row or column.

Marking cells

- You mark individual cells by clicking with the mouse.
- You mark several cells with the mouse by clicking the appropriate corners of the area while holding down the ⇧ key. Alternatively, you can inhibit

"movement" of the table with **Lock** in the **Panel/page** group (**Visualization** tab) and then mark the required area with the mouse key pressed (drag over the cells). After the configuration do not forget to **unlock** the movement of objects.

- You mark several cells with the arrow keys by pressing the appropriate arrow keys while holding down the ⇧ key.

Joining and separating cells

Mark the required cells with the mouse and select **Span cells** or **Remove cell span** from the context menu.

Assigning the value to be displayed

DAQ mode: Drag the relevant channel onto a cell and select the required information from the popup menu.

Analysis mode: Drag the relevant channel onto a cell to open the selection window **Data sources for table drag and drop**. Alternatively, you can also mark the channel and open the window via the **Window** menu (on the right above the ribbon). You then drag the desired information into the relevant cell.

With the menu window open you have two possibilities of assigning further information to individual cells:

1. You want to assign further information from the *same channel* to a cell: Drag the information into the required field. The channel does not need to be marked again.
2. You want to assign the *same information* for a different channel of a cell: Mark the entry in the selection window and drag the relevant *channel* into the required field. See also Configure the same settings/displays for several channels

Configure the same settings/displays for several channels (Analysis mode only)

Paste column/row: These menu items from the **Clone data sources** context menu allow you to easily duplicate a column or row configuration (content *and* layout) for another channel.

1. Mark a cell in the relevant column or row and then choose **Copy column** or **Copy row**.
2. Then in the **Analysis project** window click on the channel which is to be used in the copy.
3. In the table mark a cell in the intended column or row and select **Clone data sources ► Paste column/row**.

Whole columns or rows are always copied, but you can delete entries no longer required:

Mark the range, and in the **Configure** window click **Delete data** (**General** tab).

The function is only available for measured channels, not for channels from computations.

Field type, formatting (Cells tab)

Using the **Cells** tab, you can define whether a cell is to contain text, a number, an image or interactive elements, such as a button. For numbers the formatting can also be defined. For interactive elements, specify the desired action using the **Action** tab.

Display a Post-process graph of another Panel in cells

Mark the cell range in which the graph is to be displayed and select **Span cells** in the context menu. In the table configuration dialog on the **Cells** tab specify **Picture** as the cell type and define which graph of the current project is to be used with **From Panel object**.

Formula (Cells tab)

With the **Numeric (editable)** cell type you can also enter a formula in the **Formula** field similar as in Excel. Specify the cell references via the column letters and the row numbers: A1 (first row and column) or C4 (third column and fourth row). Enter cell ranges separated by a colon: A1:B27 for the range of columns A and B from the 1st to the 27th row. Unhide the header row and column as necessary using the using the **Table** tab. As from version 4.1, you can also enter formulas directly by marking the cell and starting the entry with **=** (only click the cell *once*, otherwise the Edit mode will be activated. The cell must already be configured as **Numeric (editable)**).

Example: The formula for calculating the sum of rows 1 to 27 of the third column is **SUM (C1:C27)** or **=SUM(C1:C27)** when entering in a marked cell.

Numbers in formulas must be entered with a decimal point; the decimal comma is not permissible.

Available formulas for the flexible table

ABS(<value>)

Calculates the absolute value.

ACOS(<value>)

Calculates the angle to the specified cosine.

ACOSH(<value>)

Calculates the inverse hyperbolic cosine.

ADD(<value1>, <value2>)

Adds two values.

AND(<bool1>, <bool2>, …)

Returns 1 if all arguments are true, otherwise 0. A maximum of 30 arguments are possible.

ASIN(<value>)

Calculates the angle to the specified sine.

ASINH(<value>)

Calculates the inverse hyperbolic sine.

ATAN(<value>)

Calculates the angle to the specified tangent.

ATAN2(<x-value>, <y-value>)

Calculates the angle to the specified tangent, taking into account the sign.

ATANH(<value>)

Calculates the inverse hyperbolic tangent.

AVERAGE(<value1>, <value2>, …)

Calculates the mean value of the arguments. A maximum of 30 arguments are possible.

CEILING(<value1>, <value2>)

Rounds a number to the nearest larger multiple of <value2>. CEILING(4.65, 2) gives 6, CEILING(-2.78, -1) gives -3.

CHAR(<value>)

Returns the character corresponding to the transmitted numeric value in ANSI code.

CLEAN(<text>)

Removes all non-printable characters from the transmitted text.

CODE(<text>)

Returns the ANSI code of the first character of the transmitted text.

COMBIN(<value1>, <value2>)

Calculates the number of possible combinations (<value1> over <value2>).

CONCATENATE(<text1>, <text2>, …)

Links the transmitted texts. A maximum of 30 arguments are possible.

COS(<value>)

Calculates the cosine to the specified angle.

COSH(<value>)

Calculates the hyperbolic cosine to the specified angle.

DATE(<year>, <month>, <day>)

Calculates the date in serial date-time format (Windows format).

DAY(<date>

Calculates the day of the month at the specified date.

DEGREES(<value>)

Calculates the angle to the specified radian value.

EVEN(<value>)

Rounds to the nearest even whole number (INTEGER). EVEN(5) gives 6, EVEN (-2.5) gives -4.

EXACT(<text1>, <text2>)

Compares two texts and returns 1 if they are equal, 0 otherwise. Case sensitivity is considered.

EXP(<value>)

Calculates e^{value}.

FIND(<text1>, <text2>, <value>)

Searches for <text1> in <text2> starting with the position <value>. Returns the start position or 0.

FLOOR(<value1>, <value2>)

Rounds a number to the nearest smaller multiple of value2. FLOOR(4.65, 2) gives 4, FLOOR(-2.78, -1) gives -2.

HOUR(<time>)

Returns the hour at the specified time.

IF(<condition>, <value1>, <value2>)

Evaluates the condition and returns <value1> if the condition is true, otherwise <value2>.

INT(<value>)

Rounds a number to the nearest whole number.

INVERSE(<value>)

Calculates the inverse of the specified number (1/<value>).

ISBLANK(<cell>)

Returns 1 if the cell is empty, otherwise 0. ISBLANK(B1) gives 1 if B1 is blank.

ISEVEN(<value>)

Returns 1 if the specified value is an even number, otherwise 0.

ISNONTEXT(<value>)

Returns 1 if the specified value is not text, otherwise 0.

ISNUMBER(<value>)

Returns 1 if the specified value is a number, otherwise 0.

ISODD(<value>)

Returns 1 if the specified value is an odd number, otherwise 0.

ISREF(<value>)

Returns 1 if the specified value is a cell reference, otherwise 0.

ISTEXT(<value>)

Returns 1 if the specified value is a text, otherwise 0.

LEFT(<text>, <value>)

Returns the first <value> characters of <text>.

LEN(<text>)

Returns the number of characters in <text>.

LN(<value>)

Calculates the natural logarithm to <value>.

LOG(<value1>, <value2>)

Calculates the logarithm of <value1> to the base <value2>.

LOG10(<value>)

Calculates the decadic logarithm of <value> (logarithm to base 10).

LOWER(<text>)

Converts text to lowercase.

MAX(<value1>, <value2>, …)

Calculates the maximum of the arguments. A maximum of 30 arguments are possible.

MID(<text>, <value1>, <value2>)

Returns <value2> characters as from position <value1> in <text>.

MIN(<value1>, <value2>, …

Calculates the minimum of the arguments. A maximum of 30 arguments are possible.

MINUTE(<time>)

Returns the minute at the specified time.

MOD(<value1>, <value2>)

Performs a modulo division. MOD(255, 16) gives 15.

MONTH(<date>)

Returns the month at the specified date.

NEG(<value>)

Inverts the sign of the argument.

NOT(<value>)

Inverts the logical value of the argument.

NOW()

Returns date and time in serial date-time format (Windows format).

ODD(<value>)

Rounds to the nearest odd whole number (INTEGER). ODD(4) gives 5, ODD(-2.5) gives -3.

OR(<value1>, <value2>, …)

Returns 1 if one of the arguments is true, otherwise 0. A maximum of 30 arguments are possible.

PI()

Returns the number Pi.

POWER(<value1>, <value2>)

Calculates $\text{<value1>}^{\text{<value2>}}$.

PRODUCT(<value1>, <value2>, ...)

Calculates the product of all arguments. A maximum of 30 arguments are possible.

PROPER(<text>)

Converts all the first letters of the words in the text to uppercase.

RADIANS(<value>)

Calculates the radian value to the specified angle.

RAND()

Generates a random number between 0 and 1.

REPLACE(<text1>, <value1>, <value2>, <text2>)

Replaces in <text1> as from position <value1> for <value2> characters with <text2>.

REPT(<text1>, <value>)

Generates a text with <value> repetitions of <text>.

RIGHT(<text>, <value>)

Returns the last <value> characters of <text>.

ROUNDDOWN(<value1>, <value2>)

Rounds to <value1> down to <value2> places.

ROUNDUP(<value1>, <value2>)

Rounds to <value1> up to <value2> places.

ROUND(<value1>, <value2>)

Rounds to <value1> to <value2> places.

SECOND(<time>)

Returns the second at the specified time.

SIGN(<value>)

Returns the sign of <value>.

SIN(<value>)

Calculates the sine to the specified angle.

SINH(<value>)

Calculates the hyperbolic sine to the specified angle.

SQRT(<value>)

Calculates the (positive) square root.

SQUARE(<value>)

Calculates the square.

STDEV(<value1>, <value2>, …)

Calculates the standard deviation of the arguments. A maximum of 30 arguments are possible. n(n-1) is used.

STDEVP(<value1>, <value2>, …)

Calculates the standard deviation of the arguments. A maximum of 30 arguments are possible. n is used.

SUBSTITUTE(<text1>, <text2>, <text3>[, <value>])

In <text1> replaces <text2> with <text3>. If the text occurs more than once, you can use <value> to specify which occurrence to replace. If you do not specify, all occurrences will be replaced.

SUM(<value1>, <value2>, …)

Calculates the sum of the arguments. A maximum of 30 arguments are possible.

SUMSQ(<value1>, <value2>, …)

Calculates the sum of the square roots of the arguments. A maximum of 30 arguments are possible.

TAN(<value>)

Calculates the tangent to the specified angle.

TANH(<value>)

Calculates the hyperbolic tangent to the specified angle.

TIME(<hour>, <minute>, <second>)

Returns the time in serial date-time format (Windows format).

TODAY()

Returns date and time in serial date-time format (Windows format).

TRIM(<text>)

Removes all multiple and leading spaces, and any spaces at the end of the text.

UPPER(<text>)

Converts text to uppercase.

VAR(<value1>, <value2>, ...)

Calculates the variance of the arguments. A maximum of 30 arguments are possible. n (n-1) is used.

VARP(<value1>, <value2>, ...)

Calculates the variance of the arguments. A maximum of 30 arguments are possible. n is used.

WEEKDAY(<date>, <value>)

Returns the day of the week at the specified date. Use <value> to specify how the week is defined: 1 = from Sunday (1) to Saturday (7), 2 = from Monday (1) to Sunday (7), 3 = from Monday (0) to Sunday (6).

XROOT(<value1>, <value2>)

Calculates $\text{<value1>}^{1/\text{<value2>}}$

YEAR(<date>)

Returns the year at the specified date.

7.3.7 Configuring a CAN raw table

ⓘ See also CAN decoders.

In DAQ mode, the messages of a CAN Raw channel are written to the temporary measurement data store with the time stamps of their arrival in the module. The CAN Raw table can display all the messages stored, and the bytes in them. By default, in DAQ mode as many messages as the table has rows are displayed in real time. The display then scrolls so that the last x messages (number of rows) are always shown. So, if you receive multiple messages per second in DAQ mode you should make additional settings in the **Configure** dialog.

Options in DAQ mode

Live update: This option is active by default, so that the latest messages are always displayed. Deactivate the option to view all messages up to the time of deactivating.

⚠ If a table has a lot of rows and receives multiple messages per second, the **Live update** option imposes quite a high workload on the CPU. Check the load as necessary in the Job status window.

Using filters

Next to enter the message ID or—if *Vector-CANdb* is loaded—the message name to be displayed. clears the field.

Separate multiple IDs with **;** (semicolon). Then click on to display only these messages in the order in which they occur. Use **Message ID in hex** to choose whether to show IDs in decimal or hexadecimal (default) notation.

Using Vector-CANdb

If you have a *Vector-CANdb* for some or all of the received messages, specify it. As a result:

- The **Message name** column displays the corresponding names from the CANdb.
- In the filter field (next to) you can select a message to be displayed in the order of its occurrence; and
- You can use the **Decode message** context menu in the table to decode the individual signals of a message (does not work while Live Update is active).

You can only specify *one* Vector-CANdb per table. But each table can use a different CANdb.

7.3.8 Configure button

See also AutoSequences, EasyScript.

You can carry out predefined actions, clone actions, AutoSequences or script procedures during or after a DAQ job with a single click on a button; for this catman must not be executing any DAQ job. However, you must first activate the execution so that it does not occur already during the configuration of the button: To do this, click on **Design mode** (on the right above the ribbon); the menu item then changes to **Execution mode**. The defined actions, AutoSequences or script procedures are only executed in *execution mode*.

The button can be displayed in various styles (**Font/colors** tab), and with multiple buttons you can define the sequence in which the buttons are addressed on pressing the tabulator key (**Tab index** in the **General** tab). Instead of having to click the button, you can also define a *Shortcut* for the action.

You have four different ways of executing actions:

1. Start one of the predefined actions.
2. Start one of the clone actions.
   A clone action is an action for which a menu exists in the ribbon. You use clone actions to be able to compile your own menus and groups in the ribbon or to hide the ribbon and to allocate the required menus to buttons.
3. You start an AutoSequence.
   See Start AutoSequences via buttons.
4. Start an EasyScript procedure.
   You can execute a single subprogram (Sub) or a complete script. The script can be a constituent part or an EasyScript project or be saved as an action directly with the button (free code). You will find a description of the methods in the Help on EasyScript (in the script editor).

☞ AutoSequences and EasyScript are only available if you have activated these modules; see Program options: Program functions.

Starting predefined actions via Buttons

1. Open the window for configuring the button (**Window ► Object properties** on the right above the ribbon).
2. On the **Action** tab open the **Predefined actions** entries (click on ⊞...).
3. Click on the action to be executed.
4. The dialog for setting up the action is displayed. If the dialog has already been displayed once, you have to click on **Configure** below the list. Specify the parameters, such as job name or Panel, as necessary.
5. Close the dialog with **OK**. The action is displayed in the **Standard action** field.
6. Define the **Caption** of the button (**General** tab) and/or images to be displayed (**Font/Color** tab).

   ☞ Picture formats ICO, BMP, JPG, EMF and WMF are supported.
7. If desired, you can also specify a shortcut or define whether and in which order the button is selected on pressing the tabulator key (⇥) (**Tab index** and **Tab stop**).

Start clone actions via buttons

1. Open the window for configuring the button (**Window ► Object properties** on the right above the ribbon).
2. On the **Action** tab open the **Clone of** entries (click on ⊞...).
3. Click on the action to be executed which is shown in the **Clone of** field.

4. Define the **Caption** of the button (**General** tab) and/or images to be displayed (**Font/Color** tab).

Notes

- Not all clone actions you can select are logical. For example, some actions require that you first select an object or channel to which the action will be applied. This must be possible and known to a user for the button to work as desired.
- Picture formats ICO, BMP, JPG, EMF and WMF are supported.

7.4 Analysis functions (evaluation in graphs)

Zoom, scroll, cursor and annotations are available for analysis of your plots, as are also the section functions in Analysis mode. You label particular points on your plots with the annotations. For the cursor mode and annotations, a dedicated window with two tabs is displayed which shows the positions and is used for changes or entries.

☞ You can always activate *only one* mode—either the segment, zoom, scroll, cursor or annotations mode.

Click on a graph and choose the required function in the group **Graphics tools**: **H zoom** (horizontal zoom), **R zoom** (rectangular zoom), **Scroll** or **Cursor** or **Annotations**. To deactivate a function again, click on **Edit**.

> You may create new sub-channels, which contain the current zoom section of the x axis as a limit, directly from a post-process graph. Select **Create plot sections** from the context menu.
> See also Curve operations.

Notes

- You cannot move (relocate) a graph while a segment, zoom, scroll or cursor mode or the annotations are active.
- Neither the zoom mode nor the zoom status (section) are saved in a DAQ project. If required, you can change the scaling to a manual scaling.
- The cursor is *deactivated* in the post-process graph if the product of **Compress data from … points** and **Max. plots** is above 900,000 (graph configuration dialog, **Special** tab). In these cases, reduce the maximum possible number of plots or use the cursor graph.
  See also Maximum number of plots per graph.

7.4.1 Section functions (Analysis mode)

See also Cursor functions, Annotations, Scroll functions.

You can always activate only one mode—the segment, zoom, scroll, cursor or annotations mode.
The section functions are only available in Analysis mode (in the visualization and in the DataViewer).

You have five different section functions available; newly generated data records (except FFT) are displayed in the graph immediately instead of the old ones.

- Zoom ()
  The function operates similar to horizontal zoom, but with active autoscaling of the y axis the scale is matched to the zoom.
- Statistics ()
  Displays minimum and maximum of all channels represented in the graph in a window. The values are shown in a table without separating lines. To copy the data mark the area which you want to copy and click on **Copy**.
- Copy ()
  Copies the marked area and generates a new data record for all channels shown in the graph. The new channels are given the name TempEdit_, an incremented number and the identifier REGION_COPY_ with details of the point indexes used. Use **Modify computation** (**Edit** group on the **Computations** tab) to change the name. If you require a display which consider the starting time of the section, use the **abs** setting for the x axis; see (Axis) format.
- Remove ()
  Creates a new data record for all channels illustrated in the graph in which the marked area is deleted from the values. The new channels are given the name TempEdit_, an incremented number and the identifier REGION_CUT_ with details of the point indexes used. Use **Modify computation** (**Edit** group on the **Computations** tab) to change the name.

  After removal the *new* channels are displayed in the graph, i.e. not the original channels.
- FFT ()
  Computes the FFT over the section. catman opens a dialog after selection in which you can specify the number of points, window function and overlap, as

well as the desired unit. The new channels are given the name TempEdit_, an incremented number and the identifier REGION_FFT_ with details of the point indexes used. Use **Modify computation** (**Edit** group on the **Computations** tab) to change the name.
See also Frequency analysis.

- Edit data ()
With this function you have four options: You can carry out an (automatic) drift correction, remove spikes, scale the plot, or assign a constant value to the section. The new channels are given the name TempEdit_, an incremented number and the identifier REGION_RESCALED_ with details of the point indexes used. Use **Modify computation** (**Edit** group on the **Computations** tab) to change the name.

  Drift correction: For the drift correction a best-fit straight line is placed through the section. The measurements are then corrected such that the straight line is horizontal. This means that the end value is approximately equal to the starting value. The deviations of the measurements from an ideal straight line between the two end points are however retained.
  Remove spikes: Specify the amplitude (**Relative change**) by which a value must be higher than the previous one in order to be replaced by the previous one. The substitution takes place until the measurement is again located in the range of the last measurement ± relative change.
  Constant: Specify the **Value** which is to be used instead of the readings.
  Rescale: Specify the constant shift (**b**) and the scaling factor (**m**) with which the data is to be computed

Some of the section functions are also available in the **Cursor and Annotations** window on the **Cursor** tab. With the standard graph however you have to first set a reference point; see Cursor functions.

7.4.2 Cursor functions

See also Annotations, Section functions, Scroll functions.

You can always activate only one mode—the segment, zoom, scroll, cursor or annotations mode.

Activate the cursor via **Cursor** in the **Graph tools** group. The window with the cursor position and annotation settings is displayed as well as a cursor in the graph. As default, the cursor always snaps to the measured data points on a plot. With the cursor graphs you can use up to *two* cursors: Activate **Visible** (**Cursor and Annotations** window).

☞ In the post-process graph, after activation the cursor is often located first on the left-hand edge of the graph. Use the arrow keys or click on any point on the plot (cursor changes to ☝) to move the cursor to this position. Drag the cursor crosshair in the Cursor graph.

Snap cursor 1 uses a crosshair for the display, **Snap cursor 2** a square.

Moving the cursor (only post-process graph)

[←] and [→] move the cursor from value to value to the left/right.

[Page↓] Use [Page↑] to move the cursor a greater distance to the left/right.

[↓] and [↑] to change to the next/previous data set (plot) on the graph.

☞ The cursor is *deactivated* in the post-process graph if the product of **Compress data from … points** and **Max. plots** is above 900,000 (graph configuration dialog, **Special** tab). In these cases, reduce the maximum possible number of plots or use the cursor graph.

Measure differences

Cursor graph: Activate the second cursor. Both the positions and the differences between the cursor positions are shown in the **Cursor and Annotations** window.

Standard graph: Use 📌 to set the current cursor position as reference. You can then position the cursor on another data point and read the differences for the plots shown in the **Cursor and annotations** window. The reference point is deleted when you switch over to another mode.

💡 In Analysis mode the Section functions are also available in the **Cursor and annotations** window on the **Cursor** tab. With the standard graph you must however first set a reference point as described above.

Deactivate cursor mode

Closing the window with the cursor positions (**Cursor and annotations**) or switching to another mode deactivates the cursor mode. However, you can also click in another graph to activate the cursor mode for this graph.

☞ You cannot move a graph while the cursor mode is active.

7.4.3 Annotations

ℹ See also Cursor functions, Section functions, Scroll functions.

☞ You can only activate one mode at a time: section mode, zoom mode, scroll mode, cursor mode or annotation mode.

To create an annotation, you should move the cursor to the required position in the graph so that the current coordinates are included in the annotation. After the cursor is activated, the window with the cursor position is displayed and a cursor is shown in the graph. By default, the cursor always snaps to the measured data points on a plot.

☞ The cursor is hidden when you switch to annotations in the post-process graph.

Creating annotations

1. Place the cursor at the position where you want the annotation to appear.
   To do this, click on a (measured) point on the plot in the post-process graph. The mouse pointer changes to , when it is positioned over a measured point on the plot. A click on the connecting line between two points does not work, the cursor cannot snap in here.
   For the cursor graph, drag the cursor at the crosshairs to the desired position.
   You can also use the arrow keys to move between the plot points in the post-process graph:
   [←] and [→] move the cursor left/right from measured value to measured value.
   [Page↓] Use [Page↑] to move the cursor a greater distance to the left/right.
   [↓] and [↑] to change to the next/previous data set (plot) on the graph.
2. Create the annotation with (**New annotation at cursor position**).
3. Switch to the **Annotations** tab (**Graph tools** in the ribbon).
4. Modify the annotation type as necessary: **Text only** (annotation) and/or one of the symbols.
   With anchored text (post-process graph only) a line is drawn between the measurement point and the text. The fine position of the text can be defined with a prefix; Positioning annotation texts.
   Specify the formatting of the annotation: Text color, filling, (background color), etc. or symbols (only post-process graph) for the symbol size.
   ☞ Post-process graph: The text and symbol sizes apply to *all* annotations in the active graph.

The field with the annotation text can also be modified later.

To change an annotation, you must first select it: Click once on the annotation in the cursor graph, double-click on the annotation in the post-process graph.

You can also move annotations after creating them: drag them with the mouse to the new position.

Notes

- Moving the annotation is reset when the graph is redrawn (changing axis settings, deleting plots). We therefore recommend moving this annotation type just before print or copy operations.
- Annotations cannot be saved, not even together with a project.
- You cannot move a graph while the annotation window is open (or the cursor is active).
- The cursor is *deactivated* in the post-process graph if the product of **Compress data from … points** and **Max. plots** is above 900,000 (graph configuration dialog, **Special** tab). In these cases, reduce the maximum possible number of plots or use the cursor graph.

Positioning annotation texts

Enter the prefix given below before your text to position the text accordingly.

Prefix	Position
|c	Centered
|l	Left-justified
|r	Right-justified
|e	Top, vertical and centered
|E	Bottom, vertical and centered
|m	Bottom, vertical, right side
|M	Top, vertical, left side
|s	Bottom, vertical, left side
|S	Top, vertical, right side

Prefix	Position
|d	Centered, vertical, left side
|D	Centered, vertical, right side

7.4.4 Scroll functions

See also Cursor functions, Section functions.

The **Scroll** function (**Graph tools** group) is only available for the cursor graphs. You can only activate one mode at a time: section mode, zoom mode, scroll mode, cursor mode or annotation mode.

Scrolling

1. For the real-time cursor graph specify a **buffer** (**General** tab) to be able to scroll over a larger range than the time window. Bear in mind, though, that large buffers will cause heavy load on the PC, and might result in an RT lag, because the graph is not compressed, meaning *all* buffer values are displayed.
2. Click on **Scroll** (**Graph tools** group).
3. Move the segment displayed in the graph by holding the left mouse key pressed.
4. Deactivate Scroll mode to be able to move the graph (click on **Edit** in the **Graph tools** group) or, for example, to be able to use the cursor functions (click on **Cursor**).

7.5 Special Panels: Scope- and Floating-Panel

You generate the Scope and Floating panels (only in DAQ mode) via **New** in the **Panel/page** group. The Scope panel always fills the complete screen, but the Floating panel can be placed on the screen independently of catman. If you have several monitors available, you can display each Floating panel on a different screen. The Panels are first (separately) numbered through without considering other Panels or Print pages, but they can be renamed (**Panel** tab).

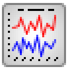
Before printing, switch with **Color scheme** (**Scope tools** group) to a color scheme which uses a white background.

7.5.1 Scope panel

See also Objects for real-time indicators, Configure display objects

The Scope panel is only available in DAQ mode, and has its own configuration tab (**Settings** window on the left). The position of the (component) window can be configured. You can create a maximum of 8 Scope panels and use up to 64 visualization objects together over all Scope panels.

Configuration is carried out as for objects for standard Panels. You have the choice of the following graphical types:



Scope (Cursor graph) displays the sampled values during measurement.

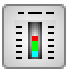
Post-process graph generates a post-process cursor graph, meaning the values are only displayed in this graph after the measurement.

Numer. table generates a Simple table in which multiple channels with their current measurements can be displayed.

Live FFT generates a (live) frequency spectrum (graph with computation). You set the computation parameters in the **Settings** window on the **FFT** tab.

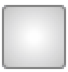
Angular sync. produces a (normal) angle synchron. graph.

Digital indicator generates a (normal) digital indicator.



Bar indicator creates a (normal) bar chart display.

Pointer creates a (normal) pointer instrument (analog meter).



Placeholder creates an empty frame. In this way you can modify the layout of the other visualization objects in that you, for example, move an empty frame adjacent to an object or above an object and adapt it in size appropriately.

Change the window name using the **Panel** tab in the **Settings** component window (**Window ► Settings** on the right above the ribbon).

Advantages of the Scope panel

- The display can occur triggered (**Trigger** tab) in order to obtain a steady picture with periodic signals.
- The Scope panel provides a minimum time window of 10 microseconds (compared to the 0.5 seconds for the other graphics).
- The display of the values can be paused at any time to zoom into the graphs or to use the cursor analysis. At the end of the pause the plots are redrawn using the temporarily saved values.
- You have two cursors available:
- Multiple graphs can be synchronized (zoom/cursor/scroll).

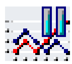
7.5.1.1 Configuring a Scope panel

Click on one of the symbols at the top in the ribbon (**Scope tools** group) to create the relevant object. The deletion of the first graph or table is not possible.

Click in  on the **Plots** tab in the **Settings** component window to display the channel in a graph. You can assign up to 30 plots per graph. Mark the channel to change the plot color.

Actions such as Zoom, Scroll or Cursor only affect the active window; therefore, click on one of the windows to activate it. The active graph is marked in the frame header with a red LED (this is not the case when **Hide border** is active in the **Panel** tab).
Change the axis settings, such as the displayed range of the x axis (time), autoscaling and the grid via the **Axes** tab (**Configuration** component window). With multiple graphs per Panel here you can also make the *synchronization settings*.

7.5.1.2 Analysis in the Scope panel (Cursor)

During a running measurement, you can stop the graph refresh with  to be able to analyze the graph.
In the **Scope tools** group switch between rectangular zoom (**R-Zoom**), horizontal zoom (**H-Zoom**), i.e. zooming without changing the y scaling, scroll mode (**Scroll**), i.e. moving of displayed extract after a zoom and cursor mode (**Cursor**). Only one mode can be active at a time, but settings, e.g. the zoom status, are not cleared when you activate another mode.
The cursor positions can be found on the **Cursor** tab (**Settings** component window). Here, you can also have the cursor snap onto the points on the plot.

On the **Axes** tab you can synchronize the cursor, zoom and scroll functions for all Panel graphs.

7.5.1.3 Scope panel trigger (tab)

In the usual display of a real-time graph the plots usually move across when the plot reaches the right-hand side of the object. However, a stationary picture is better for quick periodic signals. On the **Trigger** tab (**Settings** component window) define the channel to be monitored and the level at which the display (of all plots) should start.

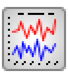
☞ The measurement must be started; if no DAQ job is running, no values can be collected and displayed. In the **Continuous** and **Single shot** trigger modes, the plots will only be displayed when all values to be drawn on the graph are available. Set the x-axis (time) on the **Axes** tab accordingly.
The trigger is synchronized one read block at a time. Therefore, the plots do not always start at exactly the same point.

In **Continuous** mode, when the trigger threshold has been reached and all values have been acquired the plot(s) will be drawn once. Then the device waits for the next trigger event.
In **Single shot** mode, the trigger event monitoring only starts when you click on **Start** (next to Single shot); the plots are then drawn and the measurement is finished.
Save data on the **Trigger** tab allows you to export the values displayed in the graph in all formats supported by catman.

7.5.2 Floating panel

See also Objects for real-time indicators, Objects for displaying all recorded samples, Configuring display objects

Use the Floating panel (only available in DAQ mode) to obtain a separate window which can be moved to a second (or third) monitor. The Panel has its own tab for configuration (► **Settings**); the position of this window is configurable. You can create a maximum of 32 Floating panels and use up to 64 visualization objects together over all Floating panels.
Configuration is carried out as for objects for standard Panels. You have the choice of the following graphical types:

 generates a line recorder (Cursor graph).

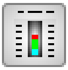
 generates a post-process graph (Post-process graph), i.e. the values are only displayed in this graph after the measurement.

 generates a Simple table in which several channels with their current measurement can be displayed.

 generates a (live) frequency spectrum (graph with computation). You set the computation parameters in the **Settings** window on the **FFT** tab.

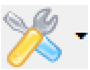
generates a (normal) Angle synchron. graph.

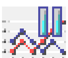
generates a (normal) Digital indicator.

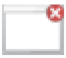
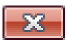
 generates a (normal) Bar indicator.

 generates a (normal) Analog meter.

 generates a blank window or shows the live picture of a video camera, a picture from a file or an HTML page. You can modify the layout of the other visualization objects with a blank window in that, for example, you move an empty window adjacent to an object or above an object and adapt it in size appropriately. You can use the object also as a video camera display or background image. The function as an HTML display (web browser), in which any HTML file can be displayed in the object, is only present with this object.

 duplicates, saves or loads a Panel. You can also copy or print the Panel, hiding the frame around the Panel objects.

 pauses all graphs in the Panel. Then you can, for example, zoom in the graphs. The data continue to be acquired during the pause.

 deletes the Floating panel, as  only minimizes the Panel.
The zoom, cursor and scroll functions are identical to those of the normal Panels.

You change the window name via the **General** tab in the **Settings** component window. Closing a Floating panel minimizes the displayed window, and you can display it again via the taskbar.

Advantages of the Floating panel

- The Floating panel window can be moved freely on or to the screens (outside of the catman window).
- The display can occur triggered (**Trigger** tab) in order to obtain a steady picture with periodic signals.
- The Floating panel provides a minimum time window of 10 microseconds (compared to the 0.5 seconds for the standard graphs).
- The display of the values can be paused at any time to zoom in the graphs or to use the cursor analysis. At the end of the pause the plots are redrawn using the temporarily saved values.
- There are two cursors available in the graphs.
- Multiple graphs can be synchronized (zoom/cursor/scroll).

7.5.2.1 Configuring a Floating panel

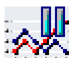
Click on one of the symbols at the top in the Panel window (tool bar) to produce the appropriate object. If the tool bar has been hidden, display it again using the context menu.

In  click on the **Channels** tab in the **Settings** component window to display the channel in a graph. You can assign up to 30 plots per graph. Mark the channel to change the plot color.

Actions such as Zoom, Scroll or Cursor only affect the active window; therefore, click on one of the windows to activate it. The active graph is marked in the frame header with a red LED (this is not the case when **Hide border** is active in the **General** tab).

Change the axis settings, such as the displayed range of the x axis (time), autoscaling and the grid via the **Axes** tab (**Configuration** component window). With multiple graphs per Panel you can also set the synchronization settings in this window.

7.5.2.2 Analysis in the Floating panel (cursor)

During a running measurement, you can stop the graph refresh with  to be able to analyze the graph.

Using the symbols at the top in the Panel window switch between rectangular zoom (**R-Zoom**), horizontal zoom (**H-Zoom**), i.e. zooming without changing the y scaling, scroll mode (**Scroll**), i.e. moving of displayed extract after a zoom and cursor mode (**Cursor**). Always only one mode can be active, but settings, e.g. the zoom status, are not cleared when you activate another mode.

The cursor positions can be found on the **Cursor** tab (**Settings** component window). Here, you can also have the cursor snap onto the points on the plot.

On the **Axes** tab you can synchronize the cursor, zoom and scroll functions for all Panel graphs.

7.5.2.3 Save/copy/print Floating panel

Use the context menu or click on the arrow next to  to save or print a Floating panel (separately).

Menu or context menu also enables you to copy (clipboard) or to duplicate a Panel.

7.5.2.4 Floating panel trigger (tab)

In the usual display of a real-time graph the plots usually move across when the plot reaches the right-hand side of the object. However, a stationary picture is better for quick periodic signals. On the **Trigger** tab define the channel to be monitored and the level at which the display (of all plots) should start.

☞ The measurement must be started; if no DAQ job is running, no values can be collected and displayed. In the **Continuous** and **Single shot** trigger modes, the plots will only be displayed when all values to be drawn on the graph are available. Set the x-axis (time) on the **Axes** tab accordingly.
The trigger is synchronized one read block at a time. Therefore, the plots do not always start at exactly the same point.

In **Continuous** mode, when the trigger threshold has been reached and all values have been acquired the plot(s) will be drawn once. Then the device waits for the next trigger event.

In **Single shot** mode, the trigger event monitoring only starts when you click on **Start** (next to Single shot); the plots are then drawn and the measurement is finished.

7.6 DataViewer (DAQ mode)

The **DataViewer** tab gives you a quick overview of the measurements for individual channels. In the window **DataView** you are shown in three sub-windows statistical data and traceability data (**Channel info**), the measurements as figures (**Table**) and as graph (**Preview**). Use **Window** (on the right above the ribbon) to display the sub-windows again if you have closed them. You can define whether the **DataViewer** tab is displayed in DAQ mode using Program functions (Program options, **System** group).

Display channels

Double-click on one of the loaded channels (**DAQ channels** window) or mark the desired channel(s) and click on **Add channel** in the **Window** group.

If you do not want to display a channel in the graph, deactivate **Auto preview** in the **Preview** group before adding the channel or deactivate **In preview** in the **Channel info** window.

A zoomed display in the preview is reset when you add a new channel to the DataView.

Remove channels from the display

You have three options:

1. Double-click again on the loaded channel (**DAQ channels** window).
2. Mark the loaded channel(s) in this window and click on **Remove channel** in the **Window** group.
3. Use the **Remove channel** context menu in the **Table** or **Channel info** window.

y(x) representation in the preview

A y(x) representation is also possible in the preview: Drag the required x channel onto the x axis legend in the graph. Note though that with y(x) graphs no min/max compression is carried out. So increase the number of points to display as necessary: **Configure** context menu or **Configure** in the **Preview** group, **General** tab, **Data compression from**.
See also Representation of plots in y(x) graphs.

Drag a time channel or the channel **Time from sample rate** onto the x axis to delete the x channel. You can delete the available x channels using **x channels** in the **Axes** group.

Displaying a large number of measurements

If a channel contains more than 5,000,000 measurements, you are asked whether the computation of the statistics data should also take place, because this may take several seconds. You can save the setting for the next start of catman.

Displaying many channels/multiple DataView windows

You create further DataView windows with **New DataView** window in the **Window** group. Switch between the individual windows with the tabs displayed at the bottom of the **DataView** window. The names of the individual windows (DataView 1, DataView 2, …) cannot be changed. A maximum of 12 DataViews is possible.

Find measured values

Click **Go to** (**Table** group) to find specific measured values or value changes. You can then choose in the dialog whether you want to

- display a specific row,
- find a value greater than or less than a specific value,
- find two consecutive values with a difference between them greater than or less than a specified value,
- two identical consecutive values,
- a measured value identical to zero or to the overflow **(OVFL)** value.
  See also DAQ channel options: Display overflow values as.

The search starts on the current selected row. Choose **Find next** or press **F3** to search for the next occurrence.

Editing measurements

If editing stored measurement data is enabled in the options (Program options: **Program functions** (**System** group), you can enable or disable edit mode by clicking on **Edit** (**Table** group).

See also Program function options.

8 MEASURING (START DAQ JOB)

Click on **Start** (**DAQ** group) to show the list of active DAQ jobs (job list). If only one DAQ job exists or the **DAQ jobs** tab is active, this DAQ job or the marked DAQ job is started directly, unless it is marked for the On-Board recording. With the list (for several DAQ jobs) you can also use **Execute all DAQ jobs**. The **DAQ** group is displayed in several tabs to give you the possibility of starting the measurement quickly.

For the measurement the **Visualization** tab is displayed. If no visualization objects have been created, you are asked during the first start, whether you would like to use one of the visualization variants of catman; see Predefined visualizations.

> Choose **Use as default** from the ribbon to define the current DAQ job settings as the presets for the next catman startups.

Indications in the status bar (are displayed below or above the panel section)

- which DAQ job is currently running ( )
- whether the measurement is already running ( ) or whether it is waiting for a trigger ( )
- what type of data saving mode has been set for this job: **Manual after measurement (, query)**, **Automatic ( )**, **Periodic ( )** or **None ( )**,
- which sample rates are used (= Default, = Slow, = Fast),
- whether the measured values are being transferred fast enough (, **RT lag**),
- how many values have already been acquired ( ),
- how much space is still free on your storage medium ( ),
- whether synchronization is active for multiple devices (**Sync leader/ Follower**).

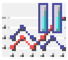
You can call the window with the Job status via **Additional**.

Display in the message bar (below the ribbon)

Since during the measurement only the current message can be displayed in the status line, all messages occurring since the start of catman are gathered in a list with the date and time of their occurrence and are displayed in the *Message bar*. Click on **Previous** to view older messages. Alternatively, you can also close the message bar and view the events in the Job status window on the **Events** tab.

> Choose **Quick Setup** (**DAQ** group) to change the key measurement parameters of the first DAQ job (e.g. sample rate and data backup) directly without having to call

up the corresponding windows for the DAQ job (the function is not available for long-term measurements).
You can also use **Comment** in the **DAQ** group (**Visualization** tab) to enter comments *during* measurement. The comments are then saved as test parameters with the date and time of the entry. The comments in the **DAQ comments** window are deleted before each measurement.

Using  in the **DAQ** group you can pause all the graphs. Then you can, for example, zoom in the graphs. The data continue to be acquired during the pause.

8.1 The Job status window

See also The Recorder Console.

To open the window, click on **Additional** at the bottom right in the status line or use **Window ► System status**.

The **Job status** window shows you:

- the momentary load on the processor core used for catman (only some DLLs/drivers use more than one processor core),
- how much space has been reserved on your storage medium for temporary storage,
- how much space has been occupied on your storage medium for data saving (data export),
- the key DAQ job settings on the **General** tab,
- the events from the message bar as a list on the **Events** tab,
- on the **FTP uploads** tab, the status of the data transfer or information about which files can be uploaded, if you have configured Remote data saving (FTP).

Processor load

In normal operation the load should not go beyond 50%. In this case the data is fetched at the interval specified in the options (**DAQ jobs ► Advanced ► Data transfer and error handling**, Time between two data transfers). At a load of 100% the time has already doubled, i.e. catman can only fetch new data half so frequently. Therefore, from a load of 50% you should consider whether you can reduce the processor load; see Preventing an RT lag.

Temp. storage/data saving

Shows the space on the drive(s) taken up for temporary storage and that selected for data saving. If both files are saved on the same drive, the figures are identical. Initially, the display only shows how much space has been reserved and the space has not yet been actually occupied. If the display used extends beyond 90%, you should delete the files not required from the drive or select a different drive for data saving (if possible) or terminate the measurement prematurely.

See also Data storage options, Folder options.

☞ If no more free space is available on the specified storage media, the catman measurement is aborted.
See also Possible problems during measurement

FTP uploads

The tab shows which files are available for uploading, and whether and how the transfer is running.

If you have activated the No automatic start of upload option for **Remote data saving (FTP)**, you can control the upload manually:

Pauses the transfer.

Starts the transfer.

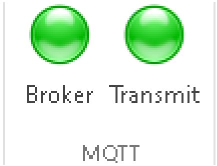
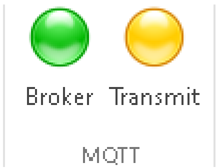
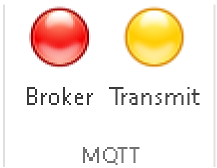
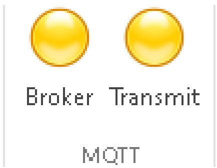
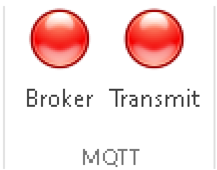
Cancels the transfer.

☞ If an FTP upload is run after a DAQ job, this dialog remains open.

8.2 MQTT status display

The status display is only available when the option is active; see Using MQTT.

As soon as data acquisition is running in catman, the **MQTT** group indicates the status of the broker and the data stream in the **Visualization** tab.

LED colors	Explanation
	The connection to the MQTT broker has been made, and data is being transferred.
	The connection to the MQTT broker has been made, but no data is being transferred (MQTT data transfer OFF in the Options).
	The connection to the MQTT broker has failed; the transmitted data cannot reach its destination. Check the settings of the MQTT broker.
	The MQTT broker is visible, but no connection is possible. Check your user name and password, and the security mode.
	Data acquisition is not running, no connection has been made, and no data is being sent.

8.3 The Recorder Console

See also The Job status window.

The Recorder Console opens automatically when you start a DAQ job that contains recorders.

You can zoom the window in or out to display the status of up to three recorders at the same time. If there are more than three recorders, they are combined into recorder groups. Click on the relevant group at the top of the window.

☞ Use the Windows taskbar to display the window if it is not visible, for example if it is displayed in the background or minimized.

In the Recorder Console, you can start or stop recording for individual recorders even if they are not set to **Manual** in the job settings.

The current status, the key recorder settings and actions performed are displayed. Activate **Log user defined events and limit value tripping in the system log** if you want information on starting or stopping of recorders to be recorded in the *log (system log)*; see Options: Safety.

8.4 Start On-Board recording (MGCplus)

See also Prepare On-Board recording, MGCplus on-board recording.

At the start of the measurement you define whether:

1. The DAQ job will *only* be executed in catman (in this case if On-Board recording is selected it will be ignored): **Computer recording**.
2. An On-Board recording controlled by catman will be started: **Start On-Board recording**.

   ☞ This method can only be applied to a *single* on-board DAQ job.
3. The DAQ job for the PC Card should be carried out in parallel in catman and on the CP42/52 for the storage medium: **Computer + On-Board recording**.
   If you **Execute all DAQ jobs**, the individual jobs will be carried out according to their marking only by catman or by catman with additional on-board recording. The status of the DAQ job (activated/deactivated) will also be taken into consideration.
4. The MGCplus with the CP42/52 will be set for an autonomous measurement without PC: **Prepare On-Board recording**.

In the latter case, there are also other options. You can define whether:

1. The MGCplus waits for the AB22 key **Start/Stop recording** after switching on.
2. The MGCplus starts the DAQ job immediately after switching on.
3. After switching on the MGCplus, you can select one of the jobs using the AB22 key **Load rec. param. set** before you start it with the AB22 key **Start/stop recording**.

4. After switching on the MGCplus, you can select one of the jobs using the AB22 key **Load rec. param. set** and start it immediately.

Start in this case means that trigger conditions will be monitored. The measurement will only start immediately if no trigger conditions have been defined.

The DAQ job is also or exclusively executed in the device:

- Once the DAQ job has started, the (flashing) **On-Board** button in the status line enables you to check the recording parameters and stop on-board recording.
- You can terminate the DAQ job in catman as well as catman itself at any time without the autonomous measurement being terminated. Only when you want to reconnect to the device do certain restrictions apply; see MGCplus on-board recording.

8.5 Possible problems during measurement

- If the error message “The maximum available memory ... is not sufficient for the duration of this measurement” appears, check your settings for End of measurement: More data is generated than there is space for on your storage medium. The Maximum measurement duration section contains further information and suggestions for a solution.
- If the measured values are not being transferred quickly enough, there will be a *time delay (RT lag)* between the measured values and the displayed values. The values already measured must first be written to the buffer of the measuring device if the PC cannot fetch the data fast enough.
  See also Prevent RT lag (performance).

  > ⚠ With a *time delay* the measurement is *stopped*, once the measuring device buffer is full.

- If the message “Start time too far in the past or future” is displayed, the QuantumX/SomatXR modules are not synchronized or the synchronization is not working correctly, i.e. the measuring times of the modules are not identical. Check the cable connections. Maybe a plug is not contacting for example.
- If the message “The size of the write cache may be too small in some circumstances for the sample rate used” appears, you should increase this value in the program options; see Data storage options.
- If no more free space is available on the specified storage medium, the measurement is aborted. Next to the icon in the status line, you can see how long you

can continue measuring before this happens (d = days, h = hours). The computation uses 100 megabytes as safety reserve. The background of the status display will change to red as soon as there is less than 1 gigabyte of free space.
See also Stopping the measurement: Maximum measurement duration.

8.6 Preventing a RT lag (performance)

(RT lag) in the status line indicates whether the performance of your PC is sufficient and whether it can process and display the arising measurement data fast enough. If the times displayed here increase, your PC is too slow or the processor load of computations and graphical output is too high. So, a *time delay* (real-time lag) arises between the measured values and the displayed values, because the values already measured must first be written into the buffer of the measurement device if the PC cannot fetch the data fast enough.
See Job status window to view the processor load.

> With a *time delay* the measurement is *stopped*, once the measuring device buffer is full.

Device buffer size

QuantumX/SomatXR: 5 seconds or at least 30,000 values per channel; therefore, catman uses a further (non-configurable) buffer in the PC (in the device driver DLL)

MGCplus with CP42/52: 6,000,000 measurements for all channels (default)

MGCplus with CP22: 1,000,000 measurements for all channels (default)

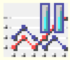
PMX: approx. 1,000,000 measurements for all channels

FS22 BraggMETER SI/DI: 2000 measurements per channel

You have a number of ways of reducing the processor load:

1. Using **Performance** (**Measure** group), you can reduce the refresh rate for real-time indicators and/or real-time graphs or you can completely cancel refreshing.
   The less often the graphical objects need to be redrawn, the less processor load there is. You can also refresh the graphs manually with (**Panel/page** group).
   With many lines and messages the CAN raw table object in particular also needs a large amount of processing power.

- Use **Stop all invisible** (graphs and Scope panels) to reduce the processor load. The disadvantage is that during browsing the graphs with the last displayed data appear and the new measurements are appended behind them, i.e. the measurements acquired between them are missing in the real-time graphs.

  Alternatively, you can also use  in the **DAQ** group to pause all graphs.

2. Reduce the refresh rate for individual graphs via the configuration dialog (**Properties** context menu, **Special** tab).
3. Check whether smaller graphs are possible.
   The smaller the graph, the fewer pixels need to be “moved". Therefore, smaller graphs are drawn more quickly.
4. Check whether all graphs on a page are necessary, and delete graphs as necessary.
5. Check how many data points are used for the individual graphs (**Special** tab); see also Configure graph.
6. Check whether all real-time computations are needed or whether some computations can also be made after the measurement.

- The update rate for real-time indicators (Digital indicator, Analog meter, Bar indicator or LED) is limited. The objects are updated every 150 ms at the earliest, a faster update is not possible.

8.7 What happens after a measurement?

After the measurement the data is saved, for example, then possibly a defined waiting period is allowed to expire and the DAQ job repeated or the next DAQ job carried out, depending on the settings you have made for your DAQ jobs. If you have specified **Prompt on DAQ termination** for the saving mode a dialog appears in which you can still make entries or changes. If you decide not to save the measurements, you are informed in another dialog that you can also save the measurements from the last test via the menu **File ► Save as**. This information window can be permanently hidden (and displayed again via the menu **Window ► Show again prompt window** on the right above the ribbon).

With a standard DAQ job the following files are saved:

- The file with the measurement and traceability data (*.bin),
- the file with the measurement settings and test parameters as well as the reference to the bin file (*.tst),
- the video file if a video recording was made.

Optionally, you can also save the following files:
- the file with the events which have occurred during the measurement (*.event)
- and the files for the statistics journal. The files <testname>_StatJournal.bin and <testname>_StatJournal.tst are created in the process. The name of the file with the measurement and traceability data is used instead of <Testname>.

You can open both the tst file and also the event file with a normal text editor. Apart from the video file and the statistics files, all files have the same name.

Special features for recorders

In the case of recorders, the recorder name is used instead of the job name (%Job%). If there are multiple recorder files, a counter is appended if the file names are not unique. The file format is always the binary catman format for the measurement and traceability data; the tst files are additionally saved for each recording.

9 AUTOSEQUENCES

With AutoSequences you can carry out further tasks in DAQ mode in addition to the actions which you define with the DAQ jobs or limit values:

- perform further measurements or special computations depending on measured values, computed values or user input,
- initiate special tasks,
- start other programs or
- simply only analyze the measured values statistically and write them to an Excel table.

Despite these extensive possibilities you do not need to learn any programming language for AutoSequences. All functions are transferred by drag and drop as symbols in the order of their execution into a list where they are parameterized by dialog.

Activate the AutoSequences module using Program functions (Program options, **System** group).

Examples of AutoSequence can be found in directory "...\Documents\HBM\catmanEasy\Examples".

9.1 How do you use AutoSequences?

You have basically two different ways of employing AutoSequences:

1. You use *different* AutoSequences which extend one or many DAQ jobs in their functionality or define additional functions that are executed at the press of a Button. Start the AutoSequences via *buttons* or at *various points in time*, e.g. after each reading of new measurements, after each job and after all jobs, you check the measurements and execute certain actions depending on the result.
2. You use *one* AutoSequence which controls the whole measurement. You start a DAQ job via the AutoSequence, control the measurement results and thus determine the further execution or the start of other jobs. You can also interrogate user entries, start other programs, carry out actions and include the results again into the execution of further DAQ jobs.

AutoSequences cannot be executed in parallel, i.e. always only one AutoSequence can be active.

In addition to executing AutoSequences using buttons you can also execute predefined actions and clone actions with buttons. You can also execute many catman actions, e.g. starting a DAQ job, with the predefined actions and clone actions without defining AutoSequences yourself.
See also Trigger predefined actions via a button.

Therefore, decide first whether the whole execution of the measurement is to be controlled via an AutoSequence, whether AutoSequences are to be triggered via various Buttons or assigned to the possible execution times and then started. So, depending on circumstances, you create one or more AutoSequences.

In order to be able to start AutoSequences via buttons, you must switch from *Design mode* to *Execution mode* (click on **Design mode** on the right above the ribbon).

9.2 How do you create an AutoSequence?

Procedure

1. Click on the **AutoSequence Editor** tab to call up the editor.
2. Drag the desired action from the left side of the window onto the desired row on the right side (drag and drop).
   - Place the cursor over an action to view the description of the action in the field under the list of available actions.
3. Configure the action: double click on the icon in the list. Provide a defining description for the action so that on reading the list the purpose is immediately apparent. Depending on the action, you can or must specify further parameters, e.g. variables or channels.
   - You can create new variables for the result of an action either by typing into the field or by selecting ones already available in the list. Otherwise you define variables via **Process variables** (**Project** group).
4. Define all actions in the required order. The list is executed from the top to the bottom.
   See also Positioning actions.
5. If you want to define more than one AutoSequence, create additional AutoSequences via **Add AutoSequence** (**Project** group).

9.3 Useful information on creating AutoSequences

See also Mathematical functions, Mathematical operators.

In the following sections you will find information on various topics for creating and editing AutoSequences. You will find special information on individual actions in the section Information on the actions.

Positioning actions

- You position actions which are to be executed before one that already exists, directly below the text of the action situated immediately above.
- Cut out incorrectly positioned actions (context menu) and use context menu items **Insert before** or **Insert after** to place them at the correct point.

If you wish to move a number of associated actions, create an action block via the comment (REM), see General). Then close the block, cut it out and insert it at the desired point.

Process variables

- Using **Process variables** (**Project** group) you can pre-assign values to variables and delete variables.
- You can also define new process variables in the field for the result of an action.
- Define variables, which are to apply in a number of AutoSequences, as **Global**: **Process variables** dialog (**Process variables** in the **Project** group).

Entering numbers, variables and channels

- Enter numbers in formulas with a decimal point, not with a decimal comma.
- Enter the channel name exactly as it appears in the **Channel settings** window (**DAQ channels** tab), i.e. where applicable, with spaces.
- Blank parameter fields are not permissible. Specify where appropriate a process variable which is not needed, e.g. **%dummy%**.
- Variables can be specified in various ways:
  - By picking in drop-down lists or typing in; % is not needed before nor after the name in this case.
  - By drag and drop from the field **Process variable** into a formula or output

field. You join texts using &.

- By entering the name enclosed in %, e.g. `%Test%`.

Entering texts

- *Always* enter text in quote marks `("")`. Use & for chaining, e.g. `"This makes " & %Counter% & " tests so far"`.
- When you use the operator & for chaining, you cannot use any more mathematical operators in the same expression.

Formula expressions in assignments

A formula expression in an assignment can include numbers, texts, process variables, mathematical functions, brackets and operators. Place texts in double quotes `("")` and use the operator & to combine process variables and texts (chaining).

Format process variables which contain numbers and are to be output as text with the function command `Format$()` in the EasyScript help (in the script editor).

Examples:

```
%Temperature% * 5
sqrt(%MaxVal%) + %MaxVal%/2
%MaxTemp% > 100 AND %MaxPressure% < 300
REM Returns 1, if the expression is true, otherwise 0
%FileName% = "TEST.DAT"
REM Returns 1, if the expression is true, otherwise 0
"TEST_" & %CycleCounter% & ".DAT"
REM Returns TEST_1.DAT, TEST_2.DAT etc.
"The maximum temperature was: " & Format$(%MaxTemp%,"0.0")
REM Outputs the temperature with one decimal place
```

What is saved where with AutoSequences?

- AutoSequences are saved automatically with the DAQ project. To use the displayed AutoSequence in other DAQ projects use **Export as** in the **AutoSequence** group.
- Breakpoints (☝) are saved and exported together with an AutoSequence.

Miscellaneous

- Check for blank entries with `TestVar = ""`. The result is 1 if `TestVar` is blank.
- Automatically inserted comment lines, e.g. with the action Execute DAQ job, may be deleted.

9.4 Notes on the Autosequence actions

See also Mathematical functions, Mathematical operators.

All dialogs start with an explanation of the action, which also provides information about the parameters or results. The following notes therefore only contain additional information or tips relating to the actions.

All actions include a line where you can enter a description text. Use the line for comments and explanatory notes about the action. This will make it easier to read the Autosequences, and understand the actions performed and their purpose.

The following sections are organized according to the groups in the Autosequence Editor.

9.4.1 General

Comments

Use this action to comment on your actions and to group action blocks or fold them: create an action with **<B>** as the comment text which you insert before the action block and create another one with **</B>** as the comment text which you insert after the action block. The block, labeled in this way, can be folded or unfolded and can be cut out and pasted in the folded state.

Notification/Confirmation

This action is helpful both for pure outputs, e.g. information or warnings as well as for simple interrogations to which only Yes/No or Yes/No/Cancel are the responses.

Show window non-modal: normally a message window is displayed until a button is clicked. During this time no other action in the AutoSequence is executed. With this option you can display the window for a certain time and at the same time allow the

AutoSequence to continue execution. The option **Close window automatically after x s** (seconds) is only effective when a non-modal window is displayed.

File selection

You can set the **Filter for file type** for only one file type or for many. Each statement consists of a text, the vertical line and specification of the file extension including asterisk and period, i.e. **Excel files|*.XLS** sets the filter for files with the file extension XLS. The specification of **All files|*.*** sets no file filter, because all files are displayed. The advantage of specifying this is that in the file dialog the text "All files" is also displayed.

9.4.2 Measurement

Retrieve current measured value

The action may *only* be used within the Execute DAQ job action ( ) – end of the DAQ job ( ).

Snapshot (single storage)

Specify **Control via event monitoring/script** for the **Storage mode** (**Save** in the **Settings** group) of the DAQ job; otherwise all measurements are saved automatically or an additional window appears for manual storage.

Continuous storage ON

Specify **Control via event monitoring/script** for the **Storage mode** (**Save** in the **Settings** group) of the DAQ job; otherwise all measurements are saved automatically or an additional window appears for manual storage.

9.4.3 I/O

Acquire single measurement value

The action may *only be used outside* of the Run DAQ job action ()—end of the DAQ job (). A single measurement for all active channels is requested from the measurement devices.

Set digital output

Define another action which resets the output.

See Digital output channels regarding the specification of bit position and channel for MGCplus and PMX.

Read digital input

See Digital input channels regarding the specification of bit position and channel for MGCplus and PMX.

Send device commands (not for QuantumX/SomatXR)

You can send commands which apply to the whole instrument to any channel. Specifying the channel is only essential when the channel must be selected for the command (some commands for the MGCplus). In all other cases only the relevant device is addressed.

QuantumX/SomatXR modules can only be addressed with the EasyScript commands `QXWrite` and `QXRead`.
See also Help on EasyScript (in the script editor)

Example:

Command	Process variable for response
"IDN?"	%DevMess1%
"EST?"	%DevMess2%

For an MGCplus you obtain, for example:

```
%DevMess1% = "HBM,CP42,0,P4.36"
%DevMess2% = 0,0
```

9.4.4 Analyze

See also Mathematical functions, Mathematical operators, Storage mode, EasyMath.

All analyzing functions use the values from the file last saved. They do not use values from the temporary data storage. Therefore, save your measurement data before using a computation.

Algebraic computations with channels

Enter the channel name exactly as it appears in the **Channel settings** window, i.e. where applicable, with spaces. Texts must be set in double quotes `("")` and variables must be enclosed in %. All values of the specified channels are used in the computation. If one of the channels contains fewer values, then the results channel is shortened to this length.

Only compute with values from channels measured with the same sample rate.

Read out single sample from channel

The function only uses values located in the file; no measurement is executed. The position corresponds to the index of the respective measurement. For new measurement values use either  or  if a DAQ job is currently running.

9.4.5 Panel

Output text/process variable

Digital indicator: To display measurements with the correct unit, specify it as the second parameter: **%Value% "kg"**. Use `Format$,` if you want to display a specific number of decimal places, e.g. **Format$(%Result%, 0.00)** for two decimal places. Do not use & to link the two statements.

Text object, Table: Specify the full text linked with &: **"Result of measurement:" & %Result% & " kg"** or just **Format$(%Result%, 0.00) & " kg"**.

☞ Use (Table for AutoSequences and EasyScript) to be able to produce outputs in a table. The Simple Table () cannot be addressed via AutoSequences.

Read out user input/selection

Combo box: The entries are read out as texts or numbers depending on the **Type of user input** setting.

Checkbox: Depends on the configuration.

- If the Checkbox only has one line (default), then the status of this option is returned (0 = Not ticked, 1 = Ticked).
- If the Checkbox has a number of options and is configured as a radio button, then the selected option is returned. The first option has the index 1.
- If the checkbox has multiple options, and is configured as a checkbox, the states of the selected options are returned as a bit mask. The bits of the selected options are set. The first option is in the least significant bit (bit 0).

Change LED status

The symbols in the dialog only illustrate the status; the symbols defined for the LED are defined on the Panel or Print page.

Save Table

The object (Table for AutoSequences and EasyScript) is written to a file. In **Excel** format (Excel 97-2003) the file extension .XLS is automatically added; in other cases specify the file extension together with the file name.

9.4.6 Control flow

Free assignment to process variable

Specify only the expression to be assigned: **5 * %Test%** computes five times the variable %Test% and assigns the result to the process variable specified below in the dialog.

Loop

You must specify both the number of passes and a process variable for the counter, even if it is no longer needed.

9.4.7 MS Excel

Open Excel workbook

The number of newly created worksheets is defined in the default settings of Excel.

However, you can create further worksheets with .

Set cell content

The cell formatting is set together with the cell content. First read out the content if you only wish to change the formatting.

9.4.8 MS Access

Open database

The action opens various databases. Refer to the documentation of your database to find out whether a connection string must be specified, and if so, which.

Example

Open an ODBC database with database name = MyDB, user name (UID) = Tom, password (PWD) = whoknows; the DSN (Data Source Name) is unknown, therefore the SQL server name is specified via the parameter SERVER. Specify **"ODBC;DATABASE-E=MyDB;UID=Tom;PWD=whoknows;SERVER=SQLSERVER7;"** as the connection string.

SQL query

Enter a valid SQL query, e.g. **SELECT * FROM Publisher WHERE [City] = 'New York'**, to select all data sets in the table "Publisher" with headquarters in New York. Use double quotes `("")` if the query is made up of different parameters and texts.

Specify current data set

After changes, update the current data set with before you browse to a new data set. Otherwise all the changes are lost.

Create new data set

After changes, update the current data set with before you create a new data set. Otherwise all changes of the current data set are lost.

9.4.9 Special

Execute EasyScript code

Use the Help on EasyScript (in the script editor) to call the online help for this action. The help contains a description of the editor, all EasyScript and VBA commands and an introduction to the use of EasyScript in AutoSequences.

9.5 How do you test an AutoSequence?

Define *break points* to test an AutoSequence: Click on a line and click (**Set/remove break point** in the **Execution** group).

The AutoSequence will stop before executing the line with the breakpoint and the debug window is displayed. In the debug mode you cannot create any new actions, but you can edit all the actions which have not yet been executed. The existing variables and their content are displayed below in the window.

As required, change the variable content by a double click in the appropriate line below in the window.

If the breakpoint is located in the first line, then the AutoSequence is stopped already on calling and you can observe further execution step by step with . You continue the execution to the next breakpoint with .

Use (**Deactivate** in the **Action** group) or the context menu **Deactivate/Activate action** to eliminate lines from the execution and to execute only the rest of the actions.

(**Terminate** in the **Execution** group) ends the execution of the current AutoSequence if you started it via the **AutoSequence** tab. Otherwise you get the new group **AutoSequence** on the **Visualization** tab which also provides a **Terminate** button.

9.6 Configure automatic execution at certain times

Define the required time-points using the **AutoSequence Editor** context tab and **Auto execution ...** in the **Execution** group:

1. Mark the AutoSequence to be used at the top in the list of **Available AutoSequences**.
2. Click on the execution time-point.
3. Click on **Assign**.

You can also drag and drop an AutoSequence onto an execution time-point.

Remove deletes the marked AutoSequence from an execution time-point.

If you specify a number of AutoSequences for one point in time, they are executed in the order in which they are listed. New assignments are always added below existing ones; if necessary, delete assignments and insert them again to obtain the correct sequence.

Execution time-points (in the order of their occurrence)

After starting catman

The time-point is located after the display of the **DAQ channels** tab (the link to the device is established) or the **Test Explorer** tab. It is suitable, for example, for masking out the GUI of catman or for making other general default settings.

After device scan (New DAQ project)

The time-point allows you to assign sensors and start other actions, which are also performed interactively after a device scan. The device(s) is/are connected but not yet configured.

Before loading a project

The time-point is suitable for saving all settings before loading a new project (with new settings).

Before closing the file on loading a project

The time-point is only of interest to programmers of add-ins.

After loading a project

At this time-point you can either change settings before the user executes his own actions or, for example, start a DAQ job.

Before DAQ job (start)

The time-point is located at the beginning of the execution of a DAQ job, i.e. before the channel initialization and directly after the **Start** button is clicked. With repeated DAQ jobs any specified pause only starts after this time-point. Any specified switchover to another Panel also occurs after this time-point.
See also Specify job parameters.

Before channel initialization

This almost corresponds to the setting **Before DAQ job**. However, the channel initialization is only completely executed on the first start of the jobs in the job list and thereafter only if the channel settings have changed.

After channel init(ialization)

The time-point is located directly after the channel initialization and before the start of the measurement. The channel initialization is however only fully executed on first starting the jobs in the job list and thereafter only if the channel settings have changed.

Before DAQ start

The time-point is located after the time-point **After channel init** and directly before the start of a measurement (if executed). At this point in time you can, for example, communicate via low-level commands with a device and directly change settings before the measurement without the worry that this setting will again be overwritten during a possible initialization. The video recording is started only after this time-point; the traceability data is determined beforehand however.

During DAQ job

Use this execution time carefully: The time-point is called more frequently during a DAQ job than **After read block transfer**, and so also consumes more processing power. It was introduced for real-time applications that need to run faster than every 100 ms.

After (the occurrence of) a start trigger.

This time-point is well suited if you want to react to the occurrence of the trigger event. Depending on the trigger event, in the last read block the condition has been fulfilled or the corresponding action initiated (keyboard, script, time condition).

After transfer (of a) DAQ data block

This time-point is well suited to the checking of measurements. catman does not read the measurements singly, but rather in small blocks, the read blocks. At this time-point after each read-in you can therefore check the newest values, find the minimum or maximum of the read block and compare it with old values.

After online (real-time) computation

The specified computations have been carried out, but the values have not been plotted yet. At this time-point you could still execute your own computations which would then also be plotted during the “normal” update. The values of the current read block at this time-point have not yet been stored in the temporary file.

After storing a DAQ data block

This time-point is located in the temporary file after the values are stored and is well suited if you want to access not just the newly read-in values, but instead *all* values (temporarily) stored up to that point.

After a complete data transfer cycle

If you want to cancel a DAQ job, this is the first possible time-point; cancellation is not possible before this. Also, the start of a (new) DAQ job is only possible after this time-point.

After DAQ stop

The measurement is stopped when the condition defined for the DAQ job (End of measurement) has occurred. At this time-point the stop command has been sent to the device(s).

Before saving the measurement data

If you still want to execute your own computations or analyses before the data are saved, this is a suitable time. At this time-point you can also determine the file name used for saving (carried out immediately afterwards) using `EA_Test.ResolvePlaceholdersInFileName`.

☞ If there are no plans for saving the data (job settings), actions at this time-point are also not carried out.

Before saving the measurement data

The measurement data has been saved, the (final) file name is therefore known, if placeholders have been used. You can use this time-point, for example, to carry out further data saving.

After DAQ termination

The end of the DAQ job is reached when all actions to be carried out after a measurement have been executed by catman. The time-point is located after the end of the measurement and before the repetition of a DAQ job.

After all DAQ job repetitions

The time-point is located after the complete processing of a DAQ job including the repetitions and before any possible start of the next DAQ job in the job list.

After (the execution of) all DAQ jobs

The time-point corresponds to the end of the measurement acquisition, i.e. at the end of the last DAQ job in the job list.

After DAQ error

With this time-point you can run a script procedure that checks for possible errors in the measurement and either generates a notification and/or tries to fix the error.

After Panel change

A Panel change occurs when the user browses to another page. The page may be a Panel or a Print page.

The time-point is not bound to the execution of a DAQ job; the action is executed when the browsing occurs.

After cursor sync

In Analysis mode, a cursor in a graph synchronizes the objects for synchronized display. The execution starts after a cursor movement in a graph (also in the angle-synchronous graph), or in the map object, or when a new video frame is displayed. You can query the current time in EasyScript with `EA.AutoExecParam`.

Before saving a project

This time-point enables you to influence the saved settings before saving a project, e.g. setting certain default settings for next time when the project is loaded.

Before closing the file on saving a project

The time-point is only of interest to programmers of add-ins.

After saving a project

Saving has finished at this time-point and you can, for example, load a new (different) project.

After loading a test (Analysis mode)

The time-point enables you, for example, to analyze the loaded data, i.e. to execute computations or plot graphs with the data.

Before terminating catman

This time-point is suitable if you want to save the current settings before termination.

Notes

- The execution time-points are available for AutoSequences or for EasyScript procedures. You can assign either AutoSequences or EasyScript procedures to an execution time-point, but not both.
- The execution time-points are saved in the DAQ project or in the analysis project and in the (user-specified) working directory of catman.
  See also catman working directory.

9.7 Start AutoSequences via Buttons

See also Starting predefined actions via buttons.

You can also start AutoSequences by clicking on a button. The actions themselves are executed without a running DAQ job, but you must be in *Execution mode*: If required, click on **Design mode** (on the right above the ribbon); the menu item then changes to **Execution mode**.

Procedure

1. For the configuration switch to Design mode (if necessary, click on **Execution mode** on the right above the ribbon).
2. Call the configuration dialog for the button (**Properties** context menu).
3. On the **Action** tab open the entries of **Start AutoSequence** (click on ).
4. Click on the AutoSequence to be executed.
5.  is superimposed before the AutoSequence.
6. Define the **Caption** of the button and/or images to be displayed with the **General** and **Font/color** tabs.

9.8 Restrictions of AutoSequences

- Per AutoSequence you can define 2,048 actions, i.e. you can use up to 2,048 lines.
- You can create a maximum of 32 AutoSequences.
- AutoSequences cannot be executed in parallel, i.e. always only one AutoSequence can be active. You can however execute different AutoSequences at different times.
- AutoSequences are only executed in the DAQ mode, not in the Analysis mode.
- The debug mode for AutoSequences completely executes an EasyScript action. Use the debugger of the EasyScript action to debug this action.

10 ANALYSIS MODE: DISPLAYING/ ANALYZING MEASUREMENT DATA

ℹ See also Analyzing functions of graphs, Configure display objects.

☞ In the catman PostProcess version *only* Analysis mode is available.

In the Analysis mode you can analyze data that has already been measured, compare it with other data, display it graphically on the screen, create layouts for the printout or convert the data into other formats. Any connected devices are not considered.

You can either change from DAQ mode to Analysis mode directly after a measurement and the saving of your data (**Analyze data** on the right above the ribbon) or you can call Analysis mode from the start window.

When changing from DAQ mode to Analysis mode, catman starts with the DataViewer tab and the last *saved* file is loaded (except with recorders); otherwise catman starts with the Test Explorer tab.

Options when changing from the DAQ mode to the Analysis mode

1. Set the visualization up yourself (analyzing the measurement with the current analysis project).
   If you have already changed between the DAQ mode and the Analysis mode, the last settings are available to you again, otherwise you start with a blank Analysis project. You can however either in the Analysis mode load an analysis project from a file or use the next option.
2. Use the visualization of the current DAQ project.
   With this option all real-time graphs from your DAQ project are converted into post-process graphs. Existing post-process graphs are taken over unchanged. Any panels present in the analysis project are however deleted; therefore, with a second change from the DAQ mode to the Analysis mode it is better to select the previous option.

   ☞ The graph titles remain unchanged, so a “real-time graph” present here is retained. Despite this however, a post-process graph is involved (see Configuration dialog).
3. To analyze the measurement in catman with an Analysis project assigned to the DAQ project.
   Insert one or more Analysis projects into the list **Analysis projects assigned** of the dialog, so that this DAQ project can be analyzed with them.

You can freely modify names shown in the list, because the file name is just the default setting.

If you have changed from DAQ mode to Analysis mode, you can also change back to DAQ mode (**Back to DAQ mode** on the right above the ribbon), and in this case the current DAQ project is restored.

Save analysis project

You can save analysis projects similar to DAQ projects. All visualizations (panels, print pages, etc.), computations and – if required – the references to the loaded tests will be saved. If you want to pass on the analysis project, choose **Add test data files to project**. The query of what is to be done with the data occurs automatically *after* the selection of the path and file name for the project to be saved.

If you do not save any references to the data, you can use the project computations and displays as a *template* for the treatment of imported data; see also Loading other tests.

Neither the zoom mode nor the zoom status (section) or annotations are saved in an analysis project. If required, you can change the scaling to a manual scaling.

10.1 Test Explorer

The Test Explorer provides an overview of the tests and measurement data stored on your PC. Similarly to the Windows Explorer, it display the folders on your PC on the left, the tests/files in the selected folder in the center Panel, and the already loaded tests on the right. You use it to specify which tests you want to load for further processing.

Set up folders as *Favorites* for quick access: From the folder's context menu choose **Add to favorites**. This means that you can also access folders in the network or deep nested folders with one click.

You can also open the Windows file dialog with **Extended file selection** (**Analysis project** group), and select and load multiple tests with ⇧ or Ctrl.

Do not rename catman measurement data files in Windows Explorer. As catman creates at least two files, and the TST file contains the link to the bin file, you would have to modify all the files *and* the link. So, use the **Rename test** context menu in the catman Test Explorer.

10.1.1 Find files (search functions)

In the middle panel of the Test Explorer you can set various filters so that, for example, only files containing the specified character string, or specific test parameters, are displayed.

Search sub folders also displays files in sub-folders of the folder selected on the left. In this case the path is displayed below the files.

Display file comments displays the comments in the *.bin files below the file in question.

Filter by file type

In the selection field in the middle panel specify which files you want to see in the file selection list. You can use one of the entries here or enter your own file extension, e.g. *.txt to only display text files. Specify the file extension **.BAK** to be able to load files which have arisen due to a power failure occurring during periodical saving and where only the backup file T_DATABACKUP.BAK is available.
See also Data saving.

Use search filters

You can use the search filter in the right-hand selection field of the middle window to search for specific files or test parameters, or to search within a file for specific channels. The search box may contain * or ? as wildcards. You cannot mix the three search variants however.

1. **Search for files**
   Enter the character string you are looking for in the search field and press (Return), or click on . Only files matching the search box criteria are displayed.

   If so selected, this also applies to all files in sub-folders. clears the input field.
2. **Search for test parameters**
   Enter the test parameter you are looking for and the desired value for the parameter. You can search by **Operator=JohnDoe** or by **serial number=*** for example. If so selected, the search also covers all files in sub-folders. Files that have the test parameter with the value you are searching for are displayed. You can also search multiple test parameters by linking them by logical AND or OR functions: **Operator=JohnDoe AND Jobname=*Brakes***. (In older catman versions, **Name** is the test parameter for the job name.) clears the input field.

3. **Search for channels**
   Select a file on the **File selection** tab. Then open the **Channels** tab to display the channels in the file. Enter the character string you are looking for in the search field and press (Return), or click on . Only channels containing that character string are then displayed. clears the input field.

Displaying test parameters

As soon as you select a file in the middle window, the **Test parameters** tab appears at the bottom of the window. All the test parameters and measurement settings are displayed on this tab.

The information displayed depends on the settings when saving (measurement and test parameters); see Define job parameters.

Displaying channel data and measured values

As soon as you select a file in the middle window, the **Channels** tab appears at the bottom of the window. This tab displays various information on the channels in the file, such as the sample rate and number of values.

Double-click on a channel to display a window with the graphical plot of the measured values and the traceability data of the channel. You can also create several windows and display them simultaneously.

10.1.2 Toggle views (Show channel properties/configuration)

In the **View** group (on the ribbon) of the Test Explorer you can choose between the following views:

1. **Show channel properties**
   For the loaded tests this displays the properties (traceability data) of the marked channel, e.g. sensor ID, filter, zero value.
2. **Show XML configuration** (QuantumX/SomatXR only)
   With loaded tests this displays the XML configuration data of the channel if the measurement was carried out with QuantumX/SomatXR modules.
3. **Show SXR/TCE configuration** (only for CX23 and eDAQ)
   Shows the configuration of a CX23 or eDAQ when tests are loaded.
   Back to test selection
   Restores the default view after you have selected one of the above views.

10.1.3 Loading tests or channels

Display the test selection as necessary (**Back to test selection** in **View** group) and load your measurement data. You have several options for this:

1. Drag and drop the test into the **Analysis project** window (area on right).
2. Use the **Load test** context menu.
3. Mark the file(s) and click on (**Load test** in the **Analysis project** group).
4. **Load all tests** in the context menu of a file loads *all* tests in the same folder.

You can also load individual channels of a test. Select the desired file, activate the **Channels** tab, and drag the relevant channel into the **Analysis project** window.

10.1.4 Load additional tests

If you load additional files originating from tests with the same channel names, you should disable the **Use channel colors as default for plot colors** option (Panel options).
The plot colors used in the measurement are saved together with the measured values. Otherwise, when loading identical channels from different tests all the channels would be displayed in the same color. Alternatively, you can disable the option for individual graphs only; see Change plot parameters in a graph.

The **Use channels automatically** option (in the window showing the files in the selected folder) assigns a special position to the *first* loaded test: It then acts as a template. When you load an additional test with the option enabled, catman performs the following actions:

- All the computations you created from the first test by way of the **Algebra**, **Frequency analysis**, **Filter**, **Strain gage stress analysis**, **Curve operations**, **Interpolation**, **Peak values** or **Class counting** tabs are also generated for the new test if the channel names match.
  - Computations using data from multiple tests cannot be generated automatically.
- All the channels (and computations) of the first test already displayed in graph objects and existing in the new loaded test under the same channel name are likewise displayed in the objects.

You can choose whether the newly loaded test will be plotted in the same graphs as the first one (**in existing Panels**) or whether new Panels will be created with the same graphs for the newly loaded test (**in new Panels**).

You also get similar functionality if you save a project without references to the test data. When you open this analysis project and load measurement data into it, they are also computed and displayed if the channel names match.

You can also open the Windows file dialog with **Extended file selection** (**Analysis project** group), and select and load multiple tests with [Shift] or [Ctrl].

10.1.5 Remove or delete tests?

When *deleting* a test, the test with *all measurement data* is deleted from the folder; the deletion must therefore be first confirmed. Deletion is *only* possible via the **Delete test** context menu for the test marked in the test selection (middle window with the **File selection** tab active).

When *removing* a test (**Remove test** in the **Analysis project** group), you are asked whether you also want to remove the channel links to graphs and computations, i.e. which channel is used in computations or displayed in graphs, and how. If you answer **No**, when a (new) test is loaded the defined plots will be displayed again, and the computations will be performed if channels with the same name exist.

10.1.6 Converting/merging files

See also [File download](#).

You can convert the following file types into the catman format via **Convert** in the **Tools** group (**Test Explorer** tab):

1. ASCII files
   Select **File type**: **ASCII files (*.DAT;*.TXT;*.ASC)** or **All files (*.*)** to display the files. Then mark the files and in the following dialog specify which characters are used to separate the values of several channels and whether, where necessary, rows are to be skipped or details such as channel name and unit included. Call the context menu in the appropriate row and select **Ignore row** or select which data this row contains: **Channel name**, **Unit**, etc. The setting applies to all columns in the file.

The maximum file size is limited to 2 GB. Files in the UNIX format (only LF as end of line) can also be read in.

2. SIE files

   These files are produced by the CX23-R or eDAQ/eDAQ-lite during an autonomous measurement. Select **File type**: **Somat CX23-R/eDAQ test files (*.MEA)** to display the files. Video frames are converted into a file with the file extension video. The file is shown in the Analysis project as a channel and you can drag it directly onto the Video playback object. CX23 burst mode is also supported. GNSS sentences (including time stamp) can be extracted to a separate text file.

   The files must be present on the PC. Otherwise use **Download** (**Tools** group) for the transfer of files. Here, you can also convert the files.

3. MEA files

   These files are produced by the MGCplus on the storage medium connected to CP42/52 during an autonomous measurement. Select **File type**: **MGCplus CP recordings (*.MEA)** to display the files.

   The files must be present on the PC. Otherwise use the **File download** (**Tools** group) for the transfer of files. Here, you can also convert the files.

4. Fast Stream files

   These are files generated in **Fast Stream** storage mode. The files cannot be directly processed by catman; they must first be converted into the catman standard format. The function converts *all* files in the current folder.
   You can also load a file into the analysis project via the context menu and the conversion then occurs on demand just for this file.

Merge (**Tools** group) combines the selected files of a folder to form one file. The function is only practicable when the files contain the same channels and, for example, originate from different measurements.

Converting Fast-Stream files via the command line (Console window)

In the catman installation folder you will find the program “FSConverter.exe”, with which you can perform a conversion without starting catman. You call the program as follows:

FSConverter /in:<path+file name>

For <path+file name> insert the complete path and the file name. The resulting file has the same name as the Fast-Stream file and is saved in the same folder, i.e. the original file is overwritten.

To convert all files of a folder you use:

FSConverter /in:<path>*.*

For <path> insert only the path name.

To suppress the output of messages in the Console window you can also use the parameter /silent:

FSConverter /in:<path+file name> /silent

10.1.7 File download

☞ Direct download from a device to the PC is only possible with MGCplus with CP42 or SomatXR CX23-R. In all other cases, transfer the files to the PC first.

With **Download** (**Tools** group in the **Test Explorer** tab) you can

- transfer files from a storage medium in or on the device to the PC,
- delete files that are no longer needed from the storage medium, and
- identify the remaining space on the storage medium.

Configure the device scan, if applicable using the submenu for **Download**, such that the device(s) are found when you have started catman in Analysis mode and not changed from DAQ mode to Analysis mode (click on the arrow at **Download**). Otherwise, the storage medium must be located in one of the PC slots. On starting the function, a dialog is displayed in which you can select the location.

Copy the data to your PC and/or convert the files into different formats. Use the **catman** format to further process the data in catman. During transfer to the PC in **catman** format the TST files required for the Test Explorer are also generated.

Terminate the Download with **Exit** in the **Download manager** group in order to restore the Explorer window.

If, on starting catman a PC card, recording is running on one of the devices found, then, in contrast to DAQ mode, the **On-Board status** button is not shown. So, it is not possible to stop recording; to do this change to DAQ mode: Exit Analysis mode and choose **Measure ► New**.

10.2 Searching in analysis projects

The **Analysis project** window allows you to search across *all* loaded test files. The window is displayed as a component window in the **Visualization** and **Computations** tabs.

Procedure

1. Enter the text you want to search for in the combo box.
2. Below, select the category in which you want to search, such as all **channel names** (default). You cannot search in the test parameters.
3. Click on or use (Enter key).

deletes the text in the combo box and displays all tests again. Click on the arrow to select one of the latest search entries.

Search options

- You do not need wildcards to search for a part of a text or term. Simply enter the search text; all terms in the selected category that contain the search text will be found and displayed.
- Another possibility is to use "regular expressions". If you are not familiar with them, please see this *short introductory guide*.

10.3 DataViewer (Analysis mode)

The **DataViewer** tab gives you a quick overview of the measurements for individual channels. In the window **DataView** you are shown in three sub-windows statistical data and traceability data (**Channel info**), the measurements as figures (**Table**) and as graph (**Preview**). Use **Window** (on the right above the ribbon) to display the sub-windows again if you have closed them.

Display channels

Double-click on one of the loaded channels (**DAQ channels** window) or mark the desired channel(s) and click on **Add channel** in the **Window** group.

If you do not want to display a channel in the graph, deactivate **Auto preview** in the **Preview** group before adding the channel or deactivate **In preview** in the **Channel info** window.

☞ A zoomed display in the preview is reset when you add a new channel to the DataView.

Remove channels from the display

You have three options:

1. Double-click again on the loaded channel (**DAQ channels** window).
2. Mark the loaded channel(s) in this window and click on **Remove channel** in the **Window** group.
3. Use the **Remove channel** context menu in the **Table** or **Channel info** window.

y(x) representation in the preview

A y(x) representation is also possible in the preview: Drag the required x channel onto the x axis legend in the graph. Note though that with y(x) graphs no min/max compression is carried out. So increase the number of points to display as necessary: **Configure** context menu or **Configure** in the **Preview** group, **General** tab, **Data compression from**.
See also Representation of plots in y(x) graphs.

Drag a time channel or the channel **Time from sample rate** onto the x axis to delete the x channel. You can delete the available x channels using **x channels** in the **Axes** group.

Displaying a large number of measurements

If a channel contains more than 5,000,000 measurements, you are asked whether the computation of the statistics data should also take place, because this may take several seconds. You can save the setting for the next start of catman.

Displaying many channels/multiple DataView windows

You create further DataView windows with **New DataView** window in the **Window** group. Switch between the individual windows with the tabs displayed at the bottom of the **DataView** window. The names of the individual windows (DataView 1, DataView 2, …) cannot be changed. A maximum of 12 DataViews is possible.

Find measured values

Click **Go to** (**Table** group) to find specific measured values or value changes. You can then choose in the dialog whether you want to

- display a specific row,
- find a value greater than or less than a specific value,
- find two consecutive values with a difference between them greater than or less than a specified value,
- two identical consecutive values,
- a measured value identical to zero or to the overflow **(OVFL)** value.
  See also DAQ channel options: Display overflow values as.

The search starts on the current selected row. Choose **Find next** or press **F3** to search for the next occurrence.

Editing measurements

If editing stored measurement data is enabled in the options (Program options: **Program functions** (**System** group), you can enable or disable edit mode by clicking on **Edit** (**Table** group).
See also Program function options.

Section

The section function in the **Zoom and cursor** group has the same options as in Analysis mode; see also Section functions (Analysis mode).

10.4 Display data in Analysis mode

See also Objects for display of all recorded samples, Visualization (general), Analysis functions in graphs.

Panels and Print pages are used for the graphical visualization of your measurements. You can create up to 128 Panels and Print pages. A tabular display can also be obtained via the **DataViewer** tab. The objects are basically the same as those available in DAQ mode, but without the real-time graphics. In addition, some special objects are available, e.g. the 3D diagram, table objects for traceability data or test parameters (metadata), and the synchronous objects.

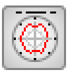
You can also call the computations from this tab (requires the EasyMath module); see Computations in Analysis mode. Using the Report function (also contained in the module), you can copy graphs and some other visualization objects into a Word template; see Create report.

Possible graphical objects

Window **Display of all recorded samples**


Post-process graph


Cursor graph

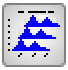

Polar graph


Angle synchron. graph

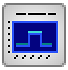

Contour graph


Histogram


3D chart


3D diagram (alternative to 3D chart)


Frequency spectrum


Spectrogram


Map


Flexible table

Data table


Statistics table


Traceability table


Meta data table

See Objects for the display of all recorded samples.

Window **Synchronized display of channels**


Map

Video playback

Digital indicator

Simple table

Analog meter

Bar indicator

Frequency spectrum

See Objects for the synchronized display.

Layout window

Text

Background image

Frame

See Layout objects.

Developer tools window

Button

If AutoSequences or EasyScript is activated, you can use further objects in this group; see Controller, Developer tools (objects for predefined actions, clone actions, AutoSequences and EasyScript).

Procedure

1. Create the required display objects by clicking the icons in the **Visualization objects** group on the **Visualization** tab. To do this, where applicable, open the

group by clicking on the arrow at the right margin. Once they have been created, you can move the objects, change them in size and configure them.

2. Drag the required channel from the list in the **Analysis project** window into a graph object. If the **Analysis project** window is not visible, display it via the **Window** menu (on the right above the ribbon).
   You can also assign a number of channels: [⇧] or [Ctrl] and mark the channels, then drag them into a graphical object.

Alternatively, you can drag one or more channels to an empty location on a Panel. In contrast to DAQ mode, however, a post-process graph is always generated here; no selection is possible.

You can move single plots in a post-process graph in the x and y directions: **Shift plot** tab in dialog **Configure: Plot** (click on the *plot legend*).

10.5 Computations in Analysis mode (EasyMath)

The EasyMath module (catmanAP or license required) enables you to carry out the following in Analysis mode:

- Calculate using all measured values of one channel with the measured values of other channels or with other computations.
- apply functions such as integration, derivation, sine, cosine etc. to channels.
- Check conditions (measured value greater than ... ?).
- Determine the frequency spectrum of a channel.
- Filter measurements: Running average, Savitzky-Golay smoothing, as well as low, high and band-pass filters and band-rejection filter with Butterworth characteristic or low-pass filters with Bessel characteristic are available to you.
- Compute an A-weighted sound pressure level in dB (dBA).
- Convert measurements from strain gage rosettes to stresses, angles, etc.
- Cut out curve sections.
- Offset plots (e.g. by a certain time interval)
- Type in new data or modify existing data
- Remove errors (data cleansing, interference pulses) from the data.
- Convert measurement data to other sample rates.
- Convert data so that, e.g. force-displacement plots or torque-angle plots from different tests can be compared mathematically. This allows you to determine the deviation of a plot from the optimum plot shape or the difference between two plots.
- Determine peak values in a certain time interval or referred to an angular range.

- Carry out a computation with EasyScript functions (requires the EasyScript optional module).
- Compute a three-dimensional characteristic field (matrix), i.e. display the values of one measurement series in relation to two others.
- Decode the individual signals of a CAN raw channel using a Vector CANdb.

Here, you can define calculations of computations or complex formulas, such as they are entered into a pocket calculator, which are then evaluated for each measured value.

☞ Activate the EasyMath module using Program functions (Program options, **System** group).

10.5.1 Create/change computations in Analysis mode

Click on **Computations** to display the tab with the computations or on **New computation** on the **Visualization** tab to open the computations dialog. Once created, computations are displayed in the *Computations* group among all the loaded measurement data in the **Analysis project** Panel. The test index will be displayed in square brackets after each computation consisting of values from only one test. For the actual tests the index is positioned before the test and file names.

⚠ Each computation requires a *unique* name before it can be created. Don't forget as the final step to click on **Create computation** in the **Edit** group or click at the bottom right in the dialog box to make sure the computation is in fact created.

Assign channels

You have three options for assigning channels for most computations:

- with drag & drop,
- by double-clicking on a channel (where there is more than one input channel either only the first field is populated or the following channels are also used);
- by clicking on ➔ (the selected channel is inserted).

With most functions you can also define the computation in one step for several channels, if you separate the channels with a **;** (semicolon) or ⇧ or Ctrl, when selecting the channels to be computed. In this case "computation_type_channel_name[index]" is used as the name of the computation, but you can also edit names retrospectively (**Modify computation**.

Modify computation

To change a computation, go to the **Computations** tab, select the computation and choose **Modify computation** from the **Edit** group. Make your changes and then click on **Apply changes**.

To change the parameters for multiple computations of the same type simultaneously, select all the relevant channels (by ⇧ or Ctrl).

10.5.2 Algebra (formulas)

You always have to enter rational numbers (numbers with commas) in the **Edit expression** field with a decimal point, not with a comma. The comma is used as a separator for the parameters in some formulas and must therefore not be used for numbers.

Drag the required channels into the **Edit expression** field or place the cursor where you want in the **Edit expression** field and double-click on a channel. The channel is always inserted at the cursor position and will replace marked text. Dragging and dropping ensures that the channel name contains no typographical errors.

If the data originate from a file, the test index is suffixed to the channel name in square brackets in the formula editor. The test index is a consecutive number which increases with each loaded test, otherwise it would not be possible to differentiate between channels with the same name.

Enter your formula as on a pocket calculator, e.g. **(MGCplus_1_CH1 + MGCplus_1_CH2)/2**. All measured values of the channels MGCplus_1_CH1 and MGCplus_1_CH2 are added together and the sum is divided by 2. The result is written to a new channel, the computation channel.

You can insert further functions via the **Additional functions** dropdown box at the bottom of the window; see Mathematical functions and Mathematical operators.

Don't forget to give the new channel a name. Entering a unit is optional.

Formula collections

Add frequently used formulas to a formula collection so as not to have to keep entering them repeatedly. You can create multiple formula collections.

creates a new formula collection. The file path and name are displayed below the formula collection's input field.

adds the formulas from the currently loaded formula collection currently displayed in the editor. Enter a name for the formulas so as to be able to retrieve them quickly from the formula list in the collection. The description is optional, and is displayed as a tooltip when you move the cursor over a selected formula.

opens an existing formula collection. The file path and name of the currently loaded formula collection are displayed below the formula collection's input field. The supplied formula collection OpticalFormulas in the Templates folder of the catman working directory contains formulas to convert the wavelength of optical strain gages into strain or temperature.
See also Folder options, Working directory.

Predefined formulas

This area contains a number of frequently used computations:

- Derivation of a channel,
- Computation of minimums or maximums across multiple channels,
- to add linearizations,
- to remove a DC component,
- to remove a zero offset that was present at the start of the measurement.

The computations are made faster, meaning they need less processing power than an identical computation that you enter via the formula editor.

10.5.3 Frequency analysis

The frequency analysis calculates a spectrum (amplitude, phase or power spectrum) using FFT. The computation will possibly be carried out several times over a part of the measuring value, depending on the **Frequency resolution** set. The advantage of this method is that the measurements which are available are also then analyzed as far as possible if a quantity of 2^n measurements is not present. Either specify **From FFT number of points** for the **Frequency resolution** and the number of values (points) to be used under **FFT** or define the desired **Frequency resolution**.

When you specify a **Frequency resolution**, then depending on the number of measurements available and the sample rate used, either all the measurements are used for a computation or a number of spectra can also be computed here, each using a portion of the measurements. In this case the mean is formed over all the computed spectra unless you activate the option **Create Joint-Time-Frequency spectrum**.

Activate **Create frequency data set** to have the frequency channel also available for export. The channel is not needed for the display in a post-process graph.

Overlap

During the computation of several FFTs and with a setting of **Overlap 0%**, the individual FFTs are always obtained using new measurements. With an FFT over 512 values this means the first FFT uses the values 1 to 512, the second the values 513 to 1024, etc. This often leads to significant differences between the individual FFTs producing distortion in the result. Consequently, “overlapping” of the individual FFTs is normally applied, for example, with an overlap of 50% the values 1 to 512 are used for the first FFT, whereas the values 257 to 768 are used for the second FFT, etc.

Example of the specification of the desired frequency resolution

Measurement with 1200 Hz sample rate for 60 seconds (72,000 measured values), frequency resolution 2 Hz, overlap 0%.

With 1200 Hz sample rate and 2 Hz resolution, 300 values are required for the result, the nearest 2^n value is 512. This means that the spectra are calculated using 1,024 values, i.e. a total of 70 spectra. Finally, the mean is determined and the result is saved for the display. In this case, the last 320 measuring values will not be considered. With a normal FFT a maximum of 65,536 values would have been used for the computation. The frequency resolution would then have been higher, but 6,464 values would not have been considered.

Joint Time Frequency spectrum

With this type of computation, no averaging occurs as otherwise, but rather all spectra are saved individually. You therefore need a graph, which can reproduce the three-dimensional data, e.g. the contour plot. Drag the results channel to an empty part of a Panel; catman then automatically selects the suitable type of graph.

From catman 4.0 you have the spectrogram available which carries the *computation and display*. You therefore do not need to create this computation in order to view the result in catman.

10.5.4 Filter

In this window you have various filter functions available:

- running average,
- Savitzky-Golay smoothing,

- mean value over time window with a subsequent Butterworth low-pass filter,
- RMS value over time window with a subsequent Butterworth low-pass filter,
- low-pass and high-pass filters, band-pass and band-stop with Bessel, Butterworth, Chebyshev and elliptical characteristics,
- sound pressure filter which computes an A-weighted sound pressure level in dB (dBA),
- filter for crash analysis: CFC 60/180/600/1000,
- human vibration filters with various weighting functions to EN ISO 8041 such as Wd weighting for horizontal whole-body vibrations in the x or y direction. See also ISO 2631.

☞ The filters enable you to specify a cutoff frequency. However, it depends on the sample rate whether this frequency can actually be used. With a sample rate of, e.g. 300 Hz, frequencies over 150 Hz cannot be acquired at all and even a filter of 100 Hz is relatively impracticable. For catman a filter is therefore invalid and is not computed when either the sample rate/cutoff frequency < 5 or the sample rate/cutoff frequency > 10,000. The filter cutoff frequency to be specified relates to the -3 dB cutoff frequency (with HBM devices cutoff frequencies are often -1 dB values; exceptions are PMX and the filters for the decimal sample-rate domain of the QuantumX/SomatXR).

Procedure

1. Select the computation for the **Filter type**.
2. Drag the required channel into the **Source channel** field, for example by drag & drop.
3. **Running average**, **Savitzky-Golay smoothing**, **RMS over time window**, **mean value over time window** or **sound pressure evaluation** (dBA)
   Specify over how many values (**Number of data points in window**) or which **Time window** is to be used for the computation. The more points or the longer the time you specify here, the more the measurements are “smoothed”, i.e. the individual original values (brief peaks) have a weaker effect. With periodic signals you should use at least two to five periods as the time span for the RMS value.
   With computations over a time window low-pass filtering takes place after the actual computation. Specify the desired **Cutoff frequency**.
   Low pass, high pass, band pass and **band-stop**
   Specify the filter type and the desired **Cutoff frequency** or, with band-pass and band-stop filters, the **Upper** and **Lower cutoff frequencies**. You can also select the filter order. The higher the order, the steeper a filter is, though more computing

time will be required.
For the Chebyshev filters specify the permissible **ripple** in the pass range. For the elliptical filters also specify the minimum **attenuation** in the suppression range (40 dB corresponds to a suppression rate of 1:100, i.e. 1%).

Eliminating phase delay

With the filter functions phase delays (propagation times) occur, i.e. the output signal appears delayed with respect to the input signal. You can prevent this "shift in the time domain" for most computations by activating the **Phase correction** option. Since with this option the computation is applied twice, the order of the filter is also doubled and the cutoff frequency is lower than that specified (-6 dB is achieved at the specified frequency).

☞ Use the Curve operations computation as an alternative or to compensate for the phase shifts due to filter propagation times with data that has already been measured.

10.5.5 Strain gage stress analysis (strain gage rosettes)

ℹ See also Strain gage computations.

When **Auto-complete** is active, you only need to drag or double click the channel with grid a into the field **a** for the **Strain channels**. The following channels will then be entered automatically as channels for measuring grids b and c.

Select the required computations by clicking them in the section **Create computation channels for**.

In the **Material properties** area, you can also enter the unit of the Young's modulus next to the value. The unit will be used for the computed stresses as well.

This computation generally results in a number of results channels which are displayed under the computations in the **Analysis project** window in a node with the **Name** of the rosette computation. The single computations of the node cannot be deleted separately. You can only delete the main node.

10.5.6 Plot operations (Curve section, Shift plot)

Create curve section

The function cuts out the specified section of a channel.

You can create sub-channels directly in a post-process graph. Choose **Create curve sections** from the graph context menu, to obtain the current zoom section of the x axis as the limit for the curve sections. In this case the original name(s) are appended.
Alternatively, you can also use the section functions or the cursor functions.

Maxima and **Minima from peak value channel** separate the Min/Max value pairs in a channel so that only the minimums or maximums are present. Channels with min/max value pairs occur when using the **Peak values per time interval** storage mode, see also Peak values per time interval.

Shift plot

The **Shift plot** function shifts all values of a channel in the positive or negative direction depending on the arithmetic sign of the **Shift**. After the computation the computed channels contain precisely as many values as the original channels, i.e. at one end values are lost and at the other end new values are gained. The specified time or frequency interval is rounded if necessary, because only existing values are moved. Interpolation does not occur.

As “replacement values” you can either use a fixed value (**User specified value**) or the **Graph null value**; see Program options: Panels. In the Post-process graph this value is then not displayed. However, you see a line up to the first or from the last measurement to the zero line or to the lower or upper limit of the display area, so that the correction remains visible. One advantage of this option is that when using autoscaling, the graph is not rescaled.

The function enables you, for example, to compensate for the different time delay (propagation time) of various filter Cutoff frequencies or filter characteristics.

10.5.7 Data series

Use this function to create a new channel and fill it with data. You can:

1. Enter values manually
   Enter a number into the first line and press [↵]. The next line is then inserted automatically.
2. Copy data from a channel and modify specific values
   Mark a channel in the list of loaded tests on the left-hand side and click on **From DAQ channel**. Then modify the data in the table as required.

3. Insert values from the Windows clipboard
Specify how many lines are to be accepted as a maximum (**Max. lines**) and click on **Insert**.
4. Specify a formula which is to be used to calculate values
Enter the formula to be used in frame **f(x)**. Then specify the start value, the Δx increment and the number of values to create.
Formula example: **25+7*x+3*x^2-5.27*x^4**
☞ The values in the table may be changed after creating them.

Give the data series a name, specify a **Unit** as necessary, and the time interval (**dt**) between two values (1/sample rate), and click **Create computation** (**Edit** group) to create it.

Create *two* data series if you want to obtain a table of x and y values. Then assign the two data series to a graph like normal channels; see also Channels as x data sources.

Usually only references to test files and computation rules are stored in an Analysis project (menu **File ► Save**), no values. As data series typed in manually do not contain any definitions, catman can also store this data in the project file: **Save data with project**. However, you should save only data which you need for further analysis, for example data for a tolerance band, because otherwise the project files may become very large.

10.5.8 Data cleansing

There are two basic methods of detecting undesired data:

1. The value is below or above a certain level.
2. The difference to the previous value exceeds a certain value (threshold).

For **Difference to previous value too large** specify with **Difference larger than** the amplitude difference that must be present in order to flag a value. **Threshold**. When an amplitude *change* in the signal for consecutive values occurs which is larger, the relevant value is replaced if the number of values specified under **Max. number of consecutive values ...** is not exceeded. In this case it is assumed that this is not a single interference pulse but a “real” signal or a massive malfunction that should not be masked out.

As “replacement value” you can either use the last value before the malfunction (**Last valid value**) any value you choose (**Different values**) or the **Graph null value**; see Program options: Panels. This value is then not displayed in the post-process graph. However, you will see a gap in the measured values so that the correction remains visible. One advantage of this option is that when autoscaling is used, the actual signal can still be recognized and does not become unrecognizable due to a single large perturbation amplitude which would re-scale the graph.

☞ The computed channels contain just as many values after the computation as the original channels.

10.5.9 Interpolation

There are two main applications for this function:

1. Measuring data should be converted to another sample rate (higher or lower)
   Example: A channel should be displayed over another channel that was measured using a considerably higher sample rate. The channel with the higher sample rate must be converted to the lower sample rate.
2. The data from two data series should be compared to each other or to reference values.
   Example: Several force-displacement plots are to be compared. As both the forces and the displacements were measured over the time, the displacement values measured (x values) are never exactly the same and cannot be compared. Therefore, the force values must first be recalculated to *specific* displacement values, i.e. a new x channel with equidistant values (reference points) must be used, in order to compare the forces that are applied on *specific* displacements.

   ⚠ The measuring plots must be unique, i.e. there must not be *two* y values for *one* x value (hysteresis plots). Such plots exist, e.g. with force-displacement plots when returning to the starting position. Calculate relevant curve sections as necessary beforehand. Strong noise levels are also unfavorable for the computation; here you should first use a filter.

Procedure

1. Specify the required destination of the computation (use **New sample rate** or **x channel**).
2. Drag the channel to be computed into the **y channel** field or double click on the channel.
3. With **Use x channel** drag the relevant channel into the **x channel** field.
4. Then complete the remaining fields in accordance with the computation.

Available interpolation methods

1. Linear interpolation (straight line)
2. Polynomial (3rd grade, i.e. 4 reference points are used)
3. Rational function
4. Cubic spline

If one of the interpolation methods is not possible, for example because not enough symmetrical adjacent points exist around the new x reference point in the original data record, then a *linear* interpolation will be automatically carried out or, if the x reference point lies outside of the original data record, an extrapolation is carried out.

☞ The x channel with the reference points is computed automatically if you select **Use x channel**.

10.5.10 Peak values

ⓘ See also Storage mode **Peak values per time interval**.

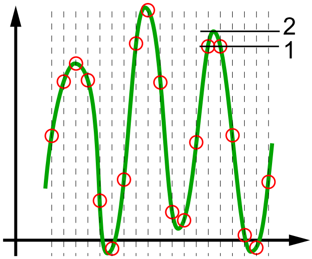
Specify whether you want to compute the **Minimum** or **Maximum** in the interval, and how the interval is defined. You have two options:

1. Time interval
   The minimum or maximum value is computed in the selected interval. *The number of measurements in the time interval is however the same* except if you specify a new **Sample rate for result channel in Hz**. For example, with a time interval of ten seconds, use a (new) sample rate of 0.1 Hz to obtain only one extreme value per time interval.
2. Angular sector
   Specify the sector (angular range) in which the respective extreme values are to be computed and drag the channel with the angular measurements into the **Angle channel** field. *The number of measurements is the same, however,* except if you specify a new **Sample rate for result channel in Hz**.

The **Use interpolation** option helps you to obtain better values for the extreme values. Since an interpolation occurs here over a number of measurements (cubic spline), in some cases the actual peak values in the measurement signal are better determined, in particular if the number of samples is not very high in relation to the signal frequency.

Example

Whereas the peaks of the first and second maximum have been reliably acquired, the measurement points for the third maximum are unfavorable: Here a value that is too low has been acquired (1). The interpolation leads to an improved value (2), because the trace of the plot is considered.



10.5.11 Class counting

☞ You should be familiar with the basic principles of classification to be able to use these functions practically. Otherwise, obtain the information from the appropriate literature.

In **Counting method** specify which class counting method is to be used. Then, depending on the method, specify the appropriate parameters in the **Configure class counting** window.

Rainflow (FromTo, RangeMean)

This class counting method is used, for example, in the determination of material fatigue. Here, material stresses or strain traces are monitored and analyzed. Expressed simply, the method counts the frequency of occurrence of certain amplitude values. To achieve this, the amplitude range of the output signal is subdivided into sections, the so-called classes.

Time-at-level, span pairs

The time-at-level class counting method determines how long a signal is located in a certain amplitude range. Here too, the amplitude range of the output signal is subdivided into sections, the so-called classes. With span pairs the frequency of occurrence of certain amplitudes is analyzed. Both computations are normally displayed in a histogram.

2-dim dwell time

This class counting method also involves determining how long a signal is located in a certain amplitude range. However, an analysis also takes place of in which amplitude range a second channel is located—the reference channel. An example of this is the monitoring of a speed channel in relationship to the rotational speed which shows the use of the gearshift during a test run.

Have catman determine the class limits. Option: **Determine limits from Min/Max of DAQ channel**.

Displaying results

Drag the results channel to an empty part of a Panel; catman then automatically selects the suitable type of graph (histogram or 3D chart).

Alternatively, you can also display the data in the table object.

☞ The display of class counting data in the DataViewer is currently not possible.

10.5.12 Script

☞ The computation function requires the optional EasyScript module.

Here, you can create an EasyScript which executes a computation. The resulting computation channel cannot be used in a graph or as an argument in another computation. But you can output results in the Panel objects using script commands, as usual with EasyScript. If a new channel is to be used, you must create it with the instruction `EA_Test.CreateChannel`.

The functioning principle is similar to that of a button with free code (direct entry of a script).

The computation function (the script) is executed when you click **Refresh selected computation** or **Refresh all** (**Edit** group on the **Computations** tab).

10.5.13 Matrix

The computation enables you to display the distribution of the measurements of a channel in dependence of two other channels. This means, for example, that you can display how the fuel consumption of an engine depends on the rotational speed and vehicle speed. In this case you could use the rotational speed and the vehicle speed for the x and y channels and the fuel consumption in the z channel. Then, drag the result of the computation onto a free position in a Panel or Print page.

Grid: The setting determines the number of sections for dividing up the x and y axes. For a setting of **50 x 50** the measurements on the x axis are divided up into 50 sections between the minimum and maximum values. The same applies to the measurements on the y axis. Then for each section the value with the largest magnitude on the z channel is found which occurred during the measurement. The value is saved with its arithmetic sign.
The higher the setting on the grid, the finer the display resolution becomes. However, the computation time and the time required for the display increase.

Example

A field (section) contains the following z values: -10, +3, +7, -5. -10 is saved in the z channel, because Max (|value|) = 10 and the arithmetic sign of the value is negative.

10.5.14 CAN decoders

The computation extracts the individual signals from a CAN raw channel using a *Vector-CANdb*.
When you specify a CANdb in Vector format, all signals contained in this file are displayed in the field below. You can either choose **Decode all signals** or press [⇧] (SHIFT) and [Ctrl] to select the signals.

If you activate the **Create time channels from the time stamps of the messages** option, the times at which the respective signals arrived at the measuring device are determined and written to a separate channel. Otherwise, catman computes an average value from the time differences at which the signals arrived. This means, for example, that only the averaged time is jumped to when synchronizing with a graph cursor in the CAN raw table. Likewise, when comparing CAN signals with other signals in a graph, the time allocation is only correct in this case if the signals were acquired with a constant cycle time.

☞ Use the computed time channel as the x axis for the CAN signal; see Channels as x data sources.

10.6 Export data (convert formats)

When exporting, you can export all or individual channels of one or more loaded tests or computations to a file. All formats available in catman in the DAQ mode can also be selected here; in addition, the HBM Playback and audio (WAV) formats are available. If all the channels to be exported are from the same measurement file, then with some formats the associated test parameters are also saved (from the test file *.TST).

Procedure

1. Click on the **Export** tab.
2. Drag the required channels from the **Analysis project** window (left) into the list of channels to be exported (top right field).
3. If you want to export channels with the same names from different tests, you should enter a new description in the **Alias names** column. This will then be used *instead* of the original channel name, so that the channel will later have a unique identification in the file.

   ☞ Change the sequence of the channels to be exported with **Up** ( ) and **Down** ( ) in the **Configure list** group.
4. Enter—if required and supported in export format—a file comment.
5. Define the file format and with some formats also the resolution (**Export** group).
6. Open the Windows file dialog by clicking on **Export** to enter the folder and file name for the export.

The list of channels to be exported can be saved via **Save export list** and loaded via **Load export list** (**Configure** group) to or from a file in order to be able to export the same channel configurations of other tests as well.

CAN-Raw

Data of a CAN Raw channel can be exported together with other channels only in the **HBM catman standard** format. Use the list of channels in the **Analysis project** window and the **Export data** context menu of the CAN-Raw channel (only one channel is exported) for other formats. In ASCII format, the result is a file in which the data is formatted in columns as in the CAN-Raw table object. The export formats **Vector CANalyzer Log**, **PCAN Trace** and **Vector BLF** (Binary Logging Format) are additionally available.

The file formats

HBM catman standard format

Files in this format can only be imported again by catman itself. They contain all the information which catman has available: measured values, traceability data and measurement and test parameters. You should therefore first save data in this format and only export in other formats as required.

HBM nCode s3t

Files in this format can be directly processed by the software GlyphWorks and nCode DesignLife.

GlyphWorks is a software program for the analysis of test data; it processes a large amount of data and offers a graphical, process-orientated user interface. You can create a workflow for the analysis using drag & drop of analysis modules.

nCode DesignLife is a program for lifetime analysis. nCode DesignLife uses FEM results and operational strength tests for the lifetime assessment.

Further information on HBM's nCode software can be found at

https://www.hbmprenscia.com/.

HBM Playback (only available in Analysis mode)

Generates one file per channel in a format which can be read in and "played back" by catman in DAQ mode.

See Signal generator/playback file.

ASCII/ASCII with channel info

Files exported in this format can be read in again by many programs. A file in the format ASCII with channel info also includes the traceability data and can be read in again by catman almost free of loss; only the measurement resolution is restricted to the number of places present in the ASCII file.

MS Excel 97-2003

☞ Excel must be installed for the export.

Exports the measurements to an Excel workbook. In addition, a second file of the same name and with the TSX file name extension is created in which the test parameters are saved.

⚠ In this format up to 65,000 measurements can be saved, because this is the maximum number of rows on a sheet in the MS Excel 97-2003 format. If there are more measurements, they are not exported.

MS Excel Office 2007 XML/Binary

☞ Excel 2007 or higher must be installed for the export.

Exports the measurements to an Excel workbook. In addition, a second file of the same name and with the TSX file name extension is created in which the test parameters are saved.

The default setting for the file format in Excel should be **MS Excel Office XML** or **MS Excel Office Binary** (*not* **MS Excel 97-2003**).

⚠ In this format up to 1,000,000 measurements can be saved, because this is the maximum number of rows on a sheet in the MS Excel Office 2007 format. If there are more measurements, they are not exported.

NI TDMS

Files (*.TDMS or *.TDM) exported in this format can be directly read in by the data analysis software, DIAdem® from National Instruments Engineering GmbH & Co KG. Files generated in this format by catman can also be read again by catman. As all the data in catman is also stored in this format, the format is equivalent to the HBM catman standard format.

Files in this format which were generated by other programs can normally also be read by catman; only channels in text (string) format cannot be read, and are skipped.

Further information can be found at www.ni.com.

NI DIAdem

Files (*.DAT) exported in this format can be directly read in by the data analysis software, DIAdem® from National Instruments Engineering GmbH & Co KG. As all the data in catman is also stored in this format, the format is equivalent to the HBM catman standard format.

A header file and a data file are produced when exporting data in this format. Also, the header file can be directly interpreted by DIAdem® and the data file is in the format REAL64.

Further information can be found at www.ni.com.

MATLAB (5.0)

Files in this format can be directly processed by the data analysis software MATLAB® (from version 5.0) from the company The MathWorks Inc.

Further information can be found at www.mathworks.com.

Vector MDF 3

MDF (**M**easurement **D**ata **F**ormat) is a binary file format which was developed in 1991 by Vector Informatik GmbH in cooperation with Robert Bosch GmbH. The format is now primarily used in the automotive sector. See also MDF 4.

Further information on Vector Informatik GmbH can be found at

www.vector.com.

ASAM MDF 4.1

MDF (**M**easurement **D**ata **F**ormat) is a further development of the MDF 3 format and in this version is an ASAM standard (Association for Standardization of Automation and Measuring Systems). With this development there is no 2 GB restriction as with MBF 3 (theoretically 2^{64} bytes, i.e. 10^{10} Tbyte per file can now be written). In addition, the format has far-reaching possibilities of saving metadata (test parameters). Also, special functions such as data compression or Quick Preview (data reduction for preview channels) are supported by catman.

Further information on ASAM can be found at www.asam.net and

wiki.asam.net/display/STANDARDS/ASAM+MDF.

See also Vector MDF Validator (vector.com/vi_mdf_tools_en), catman Knowledge Base (via **Help ► Knowledge Base** at the top right of the program interface).

RPC III (MTS)

Files in this format can be directly processed by the data analysis software RPC® III from MTS® Systems Corporation. As the format does not permit custom channel lengths, so-called groups of 2048 values are always stored. If the channels to be exported do not have values with a multiple of this size, the missing values are filled in with zeros. You should therefore preferably acquire or export a multiple of 2048 measurements. Since integer values with 16 bits always have to be saved in this format, catman uses the minimum and the maximum of each channel and correspondingly scales all values of this channel.

Further information on MTS® Systems Corporation can be found at

www.mts.com.

UFF58 (Universal File Format 58)

The Universal File Format was originally developed in the 1970s by Structural Dynamics Research Corporation (SDRC) to standardize data transfer between CAD data (**C**omputer **A**ided **D**esign) and measured data. It is often used, for example, in modal analysis.

The UFF58 format can be saved as a binary or ASCII file. catman for safety uses the ASCII format, because it is always supported.

Audio (.WAV, only available in Analysis mode)

Produces one file per channel in the WAVE format (PCM coded with 16 bits). Before saving, minimum and maximum measurements are determined and scaled to the available value range (normalized). The files can, for example, be played back by Windows Media Player.

nSoft DAC

Exports the data for the evaluation and analysis package nSoft® from HBM nCode in the time series format (*.DAC). Here, an equidistant measurement series is written to a file, i.e. each channel produces one file. The file name is composed of the name you specify, the channel name appended with an underscore and the file name extension DAC.

Further information on HBM nSoft® can be found at

https://www.hbmprenscia.com/.

10.7 Create report

The EasyMath module (catmanAP or license required) helps you to create a report in Microsoft Word in Analysis mode containing some or all of the graphs and other visualization objects of your Panels. The function is displayed on the **Visualization** tab.

☞ The function is available for all versions from Word 2003 onwards if MS Word is installed on the PC. The chosen format (doc, docx, pdf) must however be supported by the installed version of Word.

⚠ The visualization objects must be fully visible on the screen area available so that they are transferred completely to Word. For parts which are not visible on the screen, e.g. because the screen used for the configuration was larger than the current one, only the contents up to the edge of the screen are copied.
The visualization objects must not be wholly nor partially covered by other objects, nor should they overlap.

Procedure

1. In catman create the visualization objects which are to be used in the report.
You can use all objects except multi-bar graphs and LED.
2. For the objects on the **Office** tab define the bookmarks (names) which you will later use in Word.
3. Create the Word template which is to be used for the report. Insert bookmarks at the places where pictures or text from catman is to appear; see Create a bookmark in Word.
4. Configure the report generation. If you have not yet configured anything, you can click on . Otherwise click on the symbol at the lower right in the corner of the group ().
5. Specify the path and the file name for the template created in Step 3.
6. Define the file name and the file format for the finished report. If you do not specify a path, the same folder is used as for the template. You can use *Placeholder*s both in the path and in the file name.
7. Decide whether the report is to be printed automatically after generation (standard printer at the start of catman) or whether the report is to be opened. In this case you can check everything again, e.g. whether all pictures (graphs) are present in the correct size.
8. Close the dialog with **OK**.
9. Click on to generate the report.
If one or more Word documents is already open, the graphical objects are copied directly into the active document provided the bookmarks exist. Otherwise, i.e. with no document open, the specified document template is used.

If you start the report generation a number of times with a document opened, then the visualization objects are also copied many times. Therefore, delete the objects before trying again.

Create the template and do not close it. In the configuration dialog of catman leave the field **Open document template from** blank and open the report after generation. If you then generate the report, you can view the results and correct the report as necessary, such as altering the size of graphs.

Size of the objects in MS Word, scaling

The size or scaling of the visualization objects depends on where you have positioned your bookmark.

1. Bookmark at the beginning of a paragraph
   The object is used with the same size as in catman; no scaling occurs.
2. Bookmark in a text field
   If the area available is smaller than the object size in catman, the object is scaled. Here, the aspect ratio is retained. Otherwise no scaling occurs.

   ⚠ If you delete a visualization object from a text field, make sure that the bookmark is not deleted too.
3. Bookmark in a table cell
   In the default setting of tables in Word the object with the same size as in catman is used in the cell; no scaling of the object occurs and only the cell is enlarged (by Word) if required. However, you can specify in Word that the cell should have a fixed size. Then the object is scaled if the area available is smaller than the object size in catman. Here, the aspect ratio of the object is retained.

Creating a bookmark in Word

1. Click on the point at which you would like to insert a bookmark.
2. Select **Bookmark** in the **Insert** tab (**Hyperlinks** group).
3. Under **Bookmark name**, select or enter a name.
   Names of bookmarks must begin with a letter and can contain numbers, but no space characters. You can however use underscore to separate words, e.g. **First_picture**.
4. Click on **Add**.

11 EASYSCRIPT

See also Licensing and registration, EasyScript options.

EasyScript is the programming language with which you can monitor and control catman. With EasyScript you can: Extend

1. catman with your own functionalities.
   Execute your own functions at certain times, e.g. before starting a DAQ job, or analyze measurement data and transfer the computed values to Excel.
   See also Configure automatic execution at certain times.
2. Create complete programs.
   Define the sequence of measurements or e.g. the analysis of the data. The start of such a program can occur, for example, by a button or when starting catman.

Activate the EasyScript module using Program functions (Program options, **System** group). The script must be started so that the script actions can be executed. The start can also take place when loading a project, see EasyScript options.

A stored measurement (DAQ) or analysis project also contains the files for EasyScript (file extensions ESP, BAS and CLS, if existing). When the project is loaded, these files are unpacked into a subfolder as a backup. As the folder name, **_Temp** is suffixed to the name of the project. The script is still searched for in the original folder when starting, however; the files are only a backup.

Further information

Further information and the reference for the script language can be found in the Help on EasyScript (in the script editor). The help is only available in English.

In the "Examples\EasyScript" subfolder of the catman installation folder you will find various examples for EasyScript programming.
Further application examples can be found in the "Tech Notes" subfolder.

12 CATMAN WEB SERVER

This section describes the catman web server, and how to create web pages using HTML and EasyScript.

Take a look at the precompiled pages and scripts in the "WebServer\Root\" and "WebServer\Root\SCRIPT" subfolders of the catman installation directory to see how dynamic page content can be created.

General

The catman web server is designed to deliver static pages, meaning it does not provide a highly dynamic live data display like the web server in PMX for example. The content of the page returned by the server can be manipulated using EasyScript however. This allows you to create dynamic pages. All you have to do is insert the line `CATSCRIPT:-:=MyScript.bas;` into your HTML page. The returned page content, such as display of the current measured values of all channels, changes depending on what the script does. Independently of catman, you can of course insert any other code supported by the browser, such as Javascript.

Starting the web server

The catman web server is located in the catman installation directory. The web server is not started by default.

1. Open the "ADD_INS.CAT" file from the catman working directory in a text editor. See also catman working directory.
2. Insert the following line (write on one line):
   ```
   NAME=catmanAP WebServer-
   ,CLASS=catWebServer.catWeb,DESCRIPTION=Basic WebServer for cat-
   man,AUTORUN=1,PROJECT=1
   ```

The flag AUTORUN=1 means the server starts along with catman. If you set the flag to 0, you can start the server in catman via **File ► Special functions ► Add-In Manager**.

Do not delete any pre-existing lines in the file!

Web server directories, port

By default, the web server expects the folder "WebServer\Root" in the catman working directory. You can change this folder by an entry in the registry. To do this, edit the key `WEBSERVERROOT` (string) in the following branch:

```
HKEY_CURRENT_USER\SOFTWARE\VB and VBA Program Set-
tings\catmanEasy\Defaults
```

Then specify the path in this key.

In the registry you can also change the port of the web server (default 80): To do this, edit the key `PORT` (string) in the following branch:

```
HKEY_CURRENT_USER\Software\VB and VBA Program Set-
tings\CATWEBSERVER\OPTIONS
```

⚠ Changes to the Registry using the regedit.exe program should only be made by experienced users, and after backing up the existing Registry, because under some circumstances serious Windows errors might result. If necessary, ask your administrator to make the change.

Place the files needed for the web server in the root directory "WebServer\Root" and its subfolders. Depending on the file type, you must create the following subfolders:

- HTML files (*.htm, *.html) with no path prefix are searched for in the root directory ("\WebServer\Root").
- HTML files (*.htm, *.html) with a path prefix (e.g. "\MyPagesIndex.htm") are searched for in the path relative to the root directory, so in the example the path "\Root\MyPages" must exist.
- Stylesheets are searched for in "Root\Resources\Stylesheets".
- An EasyScript file (*.bas file) to be run is expected in "Root\Script".
- A Javascript file (*.js) is expected in "Root\Script".
- Images (<img src="...">) with no path prefix are searched for in "Root\Images".
- Images (<img src="....">) with a path prefix (e.g. "\MyImages\Logo.png") are searched for in the path relative to the root directory, so in the example the path "\Root\MyImages" must exist.

All other files are either searched for in the root or you must specify a path relative to the root.

12.1 Create dynamic page content with EasyScript

Each page requested by the browser is analyzed by catman before it is delivered. If the page contains the text "CATSCRIPT:=MyScript.bas;", catman runs the script. The CATSCRIPT tag can appear anywhere in the document. catman removes it before the page is delivered.

You have two options to specify the server's response by a script:

1. Change the page content
2. Deliver a file

Change the page content

Normally, your script will create a dynamic content and place it somewhere in the page being returned. The `EA_Web` class in EasyScript provides two methods for this:

`EA_Web.GetPage(strPage As String)` returns the document body as a string.

`EA_Web.SetPage(strPage As String)` replaces the document body from a string, meaning everything between `<Body>` and `</Body>` is replaced.

With these two methods you request a document, make some changes to it, and return it to the server. The server then replaces the original body of the document with the new one, and sends the HTML file back to the browser.

Transfer a file

Alternatively, your script can create a completely new HTML page and save it to a file. The script can notify the server about this file awaiting delivery (in place of the original request) by the following method:

```
EA_Web.SetResponseFile(ByVal FileName As String)
```

⚠ The file name must contain the full path; no search is carried out in the root directory for example.

By default, the server determines the content type from the file extension. However, you can use the following method to force a content type:

```
EA_Web.SetResponseType(ByVal ResponseType As Integer)
```

The ResponseType can have the values `0 = RESPONSETYPE_AUTO` or `1 = RESPONSETYPE_DOWNLOAD`.

Transfer keys/value pairs

The web client can transfer additional keys/value pairs along with the HTML file name, such as for a user login or to enter additional information such as a channel name. Your script can read the value of a key by `EA_Web.GetRequestItem(ByVal Key As String, Value As Variant)`.

12.2 Create advanced page layouts

The catman web server hosts all the necessary files so that you can use jquery and bootstrap in your pages. This means your pages do not need to reference the files (*.js, *.css) via a URL to their providers. You get them from the catman file server instead.

Example

```
<link rel="stylesheet" href-
f="resources\stylesheets\bootstrap.min.css">
<link rel="stylesheet" href-
f="resources\stylesheets\bootstrap-theme.min.css">
<script src="script\jquery-2.1.4.min.js"></script>
<script src="script\bootstrap.min.js"></script>
```

Versions used by the catman server:

- jquery: Version 2.1.4
- bootstrap: Version 3.3.4

13 PROGRAM OPTIONS

See also Scan options.

With the settings of the **Options** dialog you define how catman should behave in different situations and in the available tabs. You can also personalize the user interface here.

Call the dialog from the menu **File ► Options** and click on the required area on the left-hand side. In the start window of catman you access the options via **Options ► General options**. The options are divided into categories.

You call the options for the device search via the catman start window, **Measure** menu, and **Select device type, interface and additional hardware options**.

Program behavior (general) and active functions

- Program functions *Info* Enable computations/limit values/DataView/diagnostics/channel check, activate additional modules (EasyMath, EasyLog, ...)
- Safety *Info* Check channels, save project automatically, backup copy
- Data storage *Info* Save where, max. number of channels, cache size, ...
- Folders *Info* Default folders for data etc., working directory of catman
- **Reset to default settings**: Reset all options and program settings to their factory defaults. Additionally, all recently used paths and files in the dialog boxes and all temporary files created by catman are deleted, and the positions of the component Panels are reset.
- See also catman start parameters, Watchdog function

Behavior when carrying out important actions

- Sensors *Info* Which sensor database, what happens automatically when assigning, ...
- Zero balancing *Info* How is it done? Averaging?
- Channel list *Info* Live display active after device scan? Which DAQ jobs do changes affect? Display time channels?
- Device search (not in the Options dialog) *Info* Which devices to search for, and on which interfaces; handling of special channels (CAN, hardware computations, analog outputs), what is done automatically, ...

Default settings for the tabs

- DAQ channels tab and the Channel list (appears in multiple windows) *Info* Filter settings, display overflow, channel names, transfer settings, which columns are displayed, display time channels, ...
- Panels tab (and Print pages) *Info* Assign channel automatically, channel drop generated ..., grid, number of plots per graph, ...
- AutoSequences tab
- EasyScript tab

catman Personalize

- Program start *Info* What should happen at startup, e.g. load a DAQ project and start the first DAQ job, user interface (GUI) ...
- Keyboard shortcuts *Info* Define shortcuts: You can set shortcuts to scroll between Panels so you don't have to use the mouse, for example
- Style *Info* Define color scheme/skin, ...
- Adapt user interface *Info* Hide tabs/menu groups, create own tabs/menu groups, ...

Options for specific device types

- QuantumX/SomatXR: Device search, Enter address, CAN signals/channels, Activate on-board math, Activate analog outputs, Hardware time channels, Switch sample-rate domains with MX module, Use increased sample rate with MX410 (high-speed mode), Use increased sample rate with MXFS (high-speed modus)
- MGCplus: Device search, Enter address, Hardware time channels
- FS22 BraggMETER: Enter address, Hardware time channels
- GNSS devices: Additional devices (add devices manually)

13.1 catman start parameters

catman enables you to influence the program behavior through various start parameters. Some of the parameters can also be combined, for example **/project** and **/data**. You can also access some functions via the startup options (**File ► Options** menu, then click on **Program start** in the **System** group on the left).

Start parameter	Description
/AutoStartDAQ	Starts the first DAQ job. This parameter is only practicable if you have simultaneously specified the **/project** parameter. If you use the parameters **/AutoStartDAQ** and **/scan** together, after the scan the DAQ job defined as default for your catman is started. See also Define default settings for DAQ jobs.
/blank	Starts catman with a blank DAQ project. This corresponds to the start mode **Empty DAQ project**.
/data:filename	Starts catman in the Analysis mode and loads the specified data file. Enter the file name in quotes if it contains space characters. We recommend that the full path and file names are given. If an analysis project with the file name DEFAULT.OFP exists in the same folder as the data file, it is loaded first. Otherwise use the start parameter **/project** in addition in order to load an analysis project. The file extension for the Test Explorer (displaying test data) specified in the data saving options is ignored in this case; the specified file is loaded even if the file extension is different.
/DefaultStartup	Starts catman with the start screen, i.e. without one of the options specified under **Program start**. Thereby you can force a “normal” start of catman, although start options are set, for example that a certain project is to be started.
/HideGUI	Hides all menus, the component windows and all tabs, apart from the **Visualization** tab. Use the option together with a start parameter to load a project or define, for example, a DAQ project to be loaded, in the Program start options. Otherwise initially the (normal) start screen is displayed.

Start parameter	Description
/noscan	Suppresses start-up of the QuantumX/SomatXR or CP52 scan server. This is useful when you are not using a QuantumX/SomatXR module or an MGCplus with CP52, because then catman starts up faster. As an alternative to **/noscan**, you can also set the string `NOSCANLISTENER` to `1` in the registry under `HKEY_CURRENT_USER\SOFTWARE\VB and VBA Program Settings\CATMAN_BASE_SERVICES\Startup`. ⚠ Changes to the Registry using the regedit.exe program should only be made by experienced users, and after backing up the existing Registry, because under some circumstances serious Windows errors might result. If necessary, ask your administrator to make the change.
/NoWarn	Suppresses all warning messages and dialogs during the program *start*, for example the query whether the data of the last measurement are to be stored (if this did not take place last time) or the query about checking the synchronization. The option is, for example, practicable when catman is to start with a certain project. The option is not identical to **Deactivate failed devices**; in this respect see What to do if channel initialization fails when starting acquisition.
/print	Prints an analysis project. This parameter is only practicable when you simultaneously specify the **/project** parameter, if the analysis project contains data or you are simultaneously using the **/data** parameter.
/project:filename	Starts catman with a DAQ or analysis project. Depending on the project type, the corresponding mode is called and the project loaded. Enter the file name in quotes if it contains space characters. We recommend that the full path and file names are given. The option corresponds to the start mode **Existing DAQ project** or **Existing analysis project**.
/QXAssist	Starts catman and calls the HBM Device Manager.

Start parameter	Description
/RecoveryStartup	When catman starts, registry entries, the temporary file for the measured values and files for initialization are deleted and restored with default values. The option corresponds to the **Reset to default settings** function in the **Options** dialog, and is useful if a configuration error causes the catman user interface to shut down with an error message at startup without displaying a window or dialog.
/reg	Re-registers all DLLs when catman starts.
/scan	Tries to establish a device connection after the start of catman. This corresponds to the start mode **Automatic device scan**; see Program options: Program start.
/script:filename	Starts catman, loads the stated script project (*.ESP) and executes it. Enter the file name in quotes if it contains space characters. We recommend that the full path and file names are given. The start parameter cannot be used with **/project**. Either the script must load a DAQ project or you use only **/project**. The project contains the script and one of the options **Start script automatically** is active; see Program options: EasyScript. Simultaneously specifying **/NoWarn** is possible, and usually also practicable.

Example

1. Create a link with catman on the desktop.
2. Using the **Properties** context menu, call the dialog for entering a link (the **Shortcut** tab is displayed automatically).
3. Click in the **Target** line at the end of the text.
4. Supplement the text with your start parameters:
   /project:"c:\HBM_Projects\My Project.MEP" /NoWarn /AutoStartDAQ.
5. Close the dialog.

A double click on this link loads the specified project, the channels are initialized and the first DAQ job is started.

13.2 Watchdog function

Use the watchdog function to safeguard continuous running in a DAQ project in which catman is to record data unsupervised for a lengthy period of time.

Enabling the watchdog function

In the Windows Registry, set the following key to 1:
HKEY_CURRENT_USER\Software\VB AND VBA Program Settings\catmanEasy\Defaults\WATCHDOG.

⚠ Changes to the Registry using the regedit.exe program should only be made by experienced users, and after backing up the existing Registry, because under some circumstances serious Windows errors might result. If necessary, ask your administrator to make the change.

Reset the key to 0 to disable the function.

Function

When the option is enabled, an additional process ("WatchDog.exe") is started when catman boots up. After connecting to one or more devices, catman modifies the "Watchdog.txt" file in the *catman working directory* every second. The watchdog process checks this modification, and reacts if no modification takes place for more than 30 seconds. In this case, catman is initially forced to shut down if catman is active in the memory but not responding. catman is then restarted, and the watchdog process terminates, as it is also restarted after catman boots up.

⚠ catman is only started, no projects are automatically loaded or measurements resumed. Configure this by way of the catman startup options; see Program start options: Start mode **With an existing DAQ or analysis project**. However, any error messages during startup are suppressed in this case, and not displayed as in interactive mode.
If you run the first DAQ job automatically, note that a trigger event, for example, must also occur before recording is started.
Also consider whether you want to temporarily remove non-connectible devices from the project.
See also Data transfer and error handling, Unattended test.

To be able to continue measuring even after a possible power failure, you have to create a shortcut link with catman in the Windows Autostart folder.

13.3 Program function options

Call the dialog via the menu **File ► Options** and then click on **Program functions** (**System** group) on the left side.

Specify here whether:

1. New real-time computations (computation channels) can be defined.
   Any existing real-time computations will be carried out during an acquisition; however, the dialogs cannot be called to change or create new computations.
2. Limit values are to be displayed and monitored.
   ☞ Limit values or events which have already been defined are not deleted.
3. The Sensor database can be edited.
   Assigning sensors from the sensor database is always possible. With this option only the **Sensor database** tab is no longer displayed, and any changes to sensor data (**Edit** context menu) cannot be saved in the sensor database.
4. Editing of measured values in the DataViewer is possible (in Analysis mode *and* in DAQ mode if the DataViewer is displayed in that mode).
5. The Channel check tab is to be displayed.
6. The DataViewer tab is to be displayed in DAQ mode.
7. Diagnostics and logging is to accessible.
   ☞ It is advisable to enable these functions only when you are in contact with HBM Technical Support, or if you are very familiar with the device commands (terminal).
8. Additional modules are to be activated.

13.3.1 Diagnostics and logging

☞ These menu commands are intended for experienced users or for when you are contacting HBM Technical Support. In all other cases you can disable the option. The catman system log is always written, and can also be called up via **File ► Special functions ► Show system log**.

Call the dialog via the menu **File ► Options** and then click on **Program functions** (**System** group) on the left side.

You enable the following functions when this option is active:

- Turn communication log on/off
- Show communication log

- Reset (clear) communication log
- Command terminal
- Show *Log file (System log)*

When this option is activated, all functions are accessible via **Diagnostics and logging** in the **Special** group (**DAQ channels** tab).

Communication log

If you enable communication logging (**Special ► Diagnostics and logging ► Communication log**), all commands sent to the device together with the responses are written to the file COMLOG.LOG. In addition, all entries are provided with a time stamp with 1 ms resolution. You can also view the communication log via **Diagnostics and logging** in the **Special** group. The default number of entries is limited to 5,000. The last five data items are kept, older files are deleted by default.

The file COMLOG.LOG is always created in the *catman work folder*. The function is deactivated again when you restart catman, meaning you have to reactivate it. Alternatively, specify that the log is always written; see also Safety prompts and logging (Options for safety).

You can change the number of entries by an entry in the Windows Registry: HKEY_CURRENT_USER/Software/VB and VBA Program Settings/catmanEasy/DEFAULTS/ComLogSize. Create the entry ComLogSize (type string), if it does not exist.
The number of files can also be changed via an entry in the Registry: HKEY_CURRENT_USER/Software/VB and VBA Program Settings/catmanEasy/DEFAULTS/MAXCOMLOGFILES.

⚠ Changes to the Registry using the regedit.exe program should only be made by experienced users, and after backing up the existing Registry, because under some circumstances serious Windows errors might result. If necessary, ask your administrator to make the change.

Command terminal

When using more than one device, mark first the line with the required device in window **Channel settings**. Then call this menu item which allows you to send commands directly to the device and see the response. You will find the allowed commands and parameters in the Operating Manual of the corresponding device.

13.3.2 Additional modules

In addition to the basic modules included in catmanEasy, further modules are available:

1. EasyMath
2. AutoSequences (included in the EasyMath license)
3. EasyScript
4. Video Cameras (use video camera, only available in catmanAP)

You can activate the modules in catmanEasy 25 times for testing. After that you have to purchase a license from HBM or—for the Video Cameras module—upgrade to catmanAP; see Licensing and registration. In catmanAP all modules are included.

☞ The EasyPlan, EasyMonitoring, Ethernet-based GNSS and EasyOptics modules used in older versions of catman have mostly been integrated into catmanEasy. The EasyRoadLoad module and the recorders (parallel data acquisition in the EasyMonitoring module) have been integrated into catmanAP.

13.4 Options for safety

Call the dialog via the menu **File ► Options** and then click on **Safety** (**System** group) on the left.

Check DAQ settings before DAQ start

Before starting DAQ jobs (after the click on ▶), you can check various settings. If one or more possible problems are found, a dialog window appears with appropriate warnings. Click on the **Details** tab to view the individual messages.

Extended safety checks before DAQ start: Checks whether, for example, the valid calibration period of the sensors used has expired, the settings of sample rate and filters are not appropriate to one another, invalid graph settings, unsuitable job settings (PC timing) or deactivated limit values are present.

Report inactive channels: With the option active, deactivated channels are also reported *in addition* to the general checks.

Report channels without sensor: With this option active, *in addition* to the general checks, active channels are also reported to which no sensor has been assigned or for which no TEDS has been detected.

Measure synchronized and Check internal synchronization of devices: This option is only practicable when you are working with multiple QuantumX/SomatXR modules. catman then checks, for example before the start of a measurement, whether the MX modules process the internal synchronization without errors (module LED not orange), whether the FireWire connection appears to be correct, and whether the modules are synchronized together with Sync leader and Sync follower, provided that can be checked with the selected time synchronization. Depending on the method, complete checking is not possible in all cases. For example, with PTP a configuration may be correct in which none of the modules operates as the Sync leader.

Periodic check of the devices for loss of connection (only QuantumX/SomatXR, MGCplus and PMX): When you make settings on the **DAQ channels** tab, the option checks approximately every 5 seconds whether there is still a connection to the device (s). If the connection has been interrupted (before device and channels), you can restore the connection via **Reconnect to device** (device context menu in the **Sample** column, **DAQ channels** tab). The option gives you a prompt indication when problems occur with the connection.

Project backup

The option offers various possibilities of saving the current project automatically. If no project name exists yet, you are requested, to specify the project folder and project name.

Save automatically all x minutes: Saves the current DAQ or analysis project after the specified time period has expired. If you have still not specified any path and file name for the project, you are then requested to do so.

Always save project on DAQ start: Saves the current DAQ project on starting DAQ jobs (after clicking on).

Create backup copy before saving: Renames the existing project file as *.MEP_BAK and then saves the current DAQ project. If a backup file already exists, it is deleted beforehand.

Check firmware

☞ The function is only available for QuantumX/SomatXR, MGCplus and FS22 BraggMETERs.

The option checks after the device connection is established whether the connected devices contain the correct firmware. With some devices with outdated firmware, you can initiate an update directly in the dialog; see Check/update firmware.

Security prompts and logging

Confirm deletion of objects: Displays a dialog before deletion of (complete) visualizations, computations or panels, allowing you to cancel the action.

☞ catman has no *Undo* function, so any deletion is always final.

Extensive event logging in system log: All actions on the **DAQ channels** tab, such as sensor assignment, zero balancing, filter settings, etc. are logged with the date and time. The option is practicable when certain actions are not being executed as desired and you are in contact with the HBM Technical Support.

Log user defined events and limit value tripping in the system log: All the conditions defined in limit/event monitoring generate an entry with the date and time of their occurrence. An entry is also generated when the definition contains no action; it is sufficient if the condition is satisfied. The start and stop of recorders are also logged if you are using recorders.
Open the catman log file via **File ► Special functions ► Show System log**.

Always log device communication: If you have activated the Diagnostics and logging option in the Program options, you can generate a communication log in the **DAQ channels** tab via the **Special** group. However, the function is deactivated when catman restarts. With the option here you can define that a log is always written. Note, however, that additional time is needed for this, and more files are generated in the *catman working directory*.

☞ This option is only intended for experienced users and should only be used under instruction from the Technical Support at HBM.

Password protection for critical operations

With password protection you can prevent users who do not know the password from performing the following actions:

- Assign a sensor to a channel,
- Edit a sensor definition in the sensor database (the **Sensor database** tab can then not be displayed),
- Modify a sensor definition in the **DAQ channels** tab (**Sensor adaptation and wiring diagram**),

- Change/reprogram a TEDS module,
- Zero balancing,
- Create or change limit values and events,
- Create or change real-time computations (computation channels),
- Activate or deactivate channels,
- Change sample rates or filter settings,
- Firmware update.

The setting applies to *all* users of the PC. If a user wants to perform one of the selected actions, the password prompt appears. Then you can also deactivate the query for the rest of the catman session without turning off the option in general.

☞ To change the settings for protection, you must first cancel password protection.

The setting is identical to the one in the sensor options (Sensor database (location, password protection)).

13.5 Data storage options

Call the dialog via the menu **File ► Options** and then click on **Data storage** (**System** group) on the left.

☞ The following settings are irrelevant in the **Fast Stream** storage mode, since here writing is done directly to a file.
See also Configure DAQ jobs, Storage mode.

Temporary data storage

ℹ See also System requirements, Folder options.

To be able to retain the measurement data until you have decided on the next processing steps (at the end of the acquisition), catman uses a temporary storage. In the default setting, a special file is produced for this in the *catman work folder*. If the path for this user folder is a network path, on starting catman you receive the notice that this is not admissible. Then in the following dialog specify a local path (a folder on your PC's storage medium). catman then creates all the required files in that path.

With several PC users with different Windows accounts (user names), we recommend using one file for all users so that a large amount of space is not reserved for these files unnecessarily. However, be sure to select a folder to which all users have read and write access. Specify this folder for all users of catman.

When using an operating system with the NTFS file system, this file can grow dynamically as long as there is free space available on the storage medium. Therefore, all data can be acquired and exported after the measurement into a “normal” file. The status message “Setting up temporary data storage” displayed during the start of catman signifies that this special file is being initialized.

⚠ If the file system of your storage medium is *not NTFS*, you must use a fixed storage size (**Use fixed storage size**), and specify the size of the temporary data store. The *maximum* number of values per channel that you can acquire with your configuration (number of channels and storage space) will be displayed.

How do you identify your storage medium's file system?

Call the **Properties** context menu in the main folder of the storage medium disk (e.g. C:\). The third entry in the following dialog shows the file system used.

☞ If the storage medium of your PC was not already formatted with NTFS at the factory, we recommend that you do this afterwards. Usually the PC supplier provides a conversion program for this purpose. Otherwise, try CONVERT.EXE (in the SYSTEM32 subdirectory of Windows) with the parameters `c:` Start `/fs:ntfs`, if c: is the drive that needs to be converted `(CONVERT.EXE c: /fs:ntfs)`. The conversion takes place without any loss of data, but for security reasons you should make a backup of your storage medium first.

As a reference value for estimating the size of the temporary file, use 8 bytes per measured value, i.e. with 1,000,000 values (about 7 minutes at 2,400 Hz sample rate) approx. 400 megabytes are needed for 50 channels.

⚠ If no more free space is available on the specified storage medium, the measurement is aborted. However, you can see, for example next to the icon in the status line, how long you can continue measuring before this happens (d = days, h = hours). During the computation 100 MB of safety reserve is included. The status indicator is highlighted in red when the free space falls below 1 GB.

When should you use another disk drive or folder?

You should use another drive if

- the drive is not of type NTFS,
- there is not enough free space on the specified disk drive, e.g. when you are configuring a measurement and you receive the message that not enough free space is available,

- you have more than one storage medium available (the system drive C is being used by the operating system and is therefore slower).

⚠ Make sure that you have permission to write to the specified storage medium and folder location.

If all users of a PC are to use the *same* temporary file, make sure that a folder is selected to which all users have read and write access and specify this folder for all users of catman.

☞ Where possible, do not use any compact flash media or similar devices, because here the writing speeds are usually slower than with normal hard disks or SSDs.

A modified setting will only be effective when catman is restarted.

Maximum number of channels

You can reduce the number of *possible* channels to speed up starting catman. 16 is the minimum number of channels you may use; however, consider that each time channel and each computation require a channel. Select some (at least 10) channels more than absolutely necessary so as to have a reserve for further computations, e.g. **35** channels for a QuantumX/SomatXR with 8 channels and 16 computations.
The figure is the number of *possible* channels, not the number of channels actually used!

Use fixed storage size

This improves the speed of (temporary) data recording where there is a large number of channels, except in **Fast Stream** mode. In that mode data is saved directly to a file, not to the temporary file; see also Storage mode.

☞ The number of samples shown in the dialog can be acquired *per channel*. However *all* channels—even those not presently used—have the *same memory allocation*. If more space is required per channel, reduce the maximum number of DAQ and computation channels.

Cyclic storage mode

This enables you to wait for an event with high sample rates over a long period of time, recording all data, but without the file becoming too large. When you stop the measurement once the event has occurred, the temporary data storage contains the prehistory, i.e. a type of pre-trigger. The maximum possible time duration depends on the sample rate, the maximum number of channels and the chosen size of the cyclical memory. The

cyclical memory always contains only the values last acquired.
You can also write less than these (temporarily) saved measurements to a file, see Saving depth.

Write cache

Enlarge the write cache for sample rates above 9,600 Hz. The cache is created in the RAM of the PC and improves the speed for the display and for saving measurements. Use 512 kB for sample rates of 96 kHz or higher, otherwise 128 kB is sufficient.

☞ During the first 5 minutes, or as long as the write cache has not been filled at least once, the data captured by catman is only written to the write cache and not stored in the temporary file. If catman is terminated unplanned within this time, you will be notified after restarting catman that all data has been lost. Otherwise, you can at least save the data in the temporary file. But the data in the write cache will be lost in any case. So with a slow sample rate set the cache to a small size, so as to minimize data loss.
See also Storage interval for write cache.

Storage interval for write cache

For DAQ jobs with small sample rates, the setting can ensure that the cache is not written to the temporary memory (on the storage medium) only when the specified memory is full (**Auto** setting). With a sample rate of 5 Hz and a cache size of 128 kB this would otherwise only occur after over 50 minutes. Then use the **5 minutes** setting for example.

File name extension for Test Explorer

The setting specifies which data types are initially displayed in the Test Explorer (Analysis mode). You can change the selection at any time in the Test Explorer; the setting here is only a default setting.

13.6 Folder options

Call the dialog via the menu **File ► Options** and then click on **Folders** (**System** group) on the left.

In this dialog you specify the folders which are to be used for certain files. All settings are saved specific to the user (Windows user name). catman Though catman does remember the last setting in many other dialogs. The entries set out below are also only initial default settings. As soon as you select a different path in these dialogs, that is the new default.

Default folder for measurement data

This default setting for measurement data is used when you have not specified any path. Once you have selected a path in the file selection dialog, it is retained and also again displayed in the file selection dialog when catman is restarted.

☞ The path for projects is independent of the path for measurement data.

Default folder for exported data (Analysis mode)

This default setting is used for the export of data in Analysis mode if you have not specified a path. Once you have selected a path in the file selection dialog, it is retained and also again displayed in the file selection dialog when catman is restarted.

Default folder for images

This default setting for images is used when you have not specified any path.

Save images with project: In the default setting all images (the object Background image and the images which are displayed in other objects) are saved together with the DAQ or Analysis project. If you use many large pictures in your projects, this results in large project files. Here, you can specify that images are only saved as references in the project. Then, for the transfer of a project to another PC, copy the images also to the project file.

Save images with project

Some images are saved only as a link, or taken from the default folder for LED symbols. Enable this option if you want to share a project with images, to ensure that all images are included.

Default folder for LED symbols

catman has a directory containing some symbols (images) for the LED object. You can either copy more symbols into that folder or select another folder for symbols here.

catman working directory

⚠ The catman working directory must not be created on a network drive.

After the installation of catman all other files and folders required by catman, such as for the sensor database, saving data or projects, and the temporary data store, are created in the catman working directory. You can modify some of these folders or paths with the appropriate options. However, the catman working directory is also needed, for example, for the temporary storage of data during computations and it contains the AutoSequence examples. In the default setting the catman working directory is generated in the "My Documents\HBM" folder of the user logged in to Windows. If this is a network path, when starting catman you then receive the message that this is not admissible. With this option you can specifically select a folder for saving the data required by catman.

If multiple users logging in to Windows with different names are to use the *same* settings, specify a folder which is shared by all users. Otherwise it is sufficient to use the same sensor database for all users (see Program options: Sensors), and where appropriate define the same path for the temporary data store.

13.7 Program start options

See also catman start parameters, Watchdog function.

Call the dialog via the menu **File ► Options** and then click on **Program functions** (**System** group) on the left.

Start mode

Here you choose how catman is to start:

1. With the normal start window.
2. Directly with a device scan (**Automatic device scan**, equivalent to clicking on **New** in the **Measure** menu of the start window).
3. With a blank DAQ or analysis project.
4. With an existing DAQ or analysis project.
5. With a device scan followed by the import of all settings from an (existing) project (**Device scan with import ...**).

The latter variant is practicable if you do not know whether the address of the currently used device matches the one used in the project, but the device is an identical type (QuantumX/SomatXR) or has the same plug-in equipment (MGCplus). If you are using transducers with TEDS and have saved the channel name in TEDS, transducers can then also be found and activated when they are connected to other channels: Activate the **Execute sensor scan** options under point 4 (see After loading a DAQ project: Execute sensor scan) or **Execute sensor scan after device connection** (point 5, see Execute sensor scan after device connection), and in both cases **Accept from TEDS** (see Use sensor description as channel name).
You can additionally specify whether the *first* DAQ job or *all* DAQ jobs should be started automatically after loading or importing.

Enter *.* as the file name, catman browses all root directories on the connected drives for a DAQ project (*.MEP). The first project found is loaded. This enables you to load a project from a USB storage device for example.

Waiting time before first hardware access: The option is helpful when you switch on the PC and measurement device simultaneously and catman is started automatically. Enter a “delay period” here so that the measurement device(s) are ready when the search for devices is carried out. Depending on the device and configuration, up to two minutes may be needed after switch-on, e.g. with a connection via WLAN, before a connection can be established with the device. The time to be specified here is the waiting period after the start of catman.

☞ The waiting time is also inserted when you double-click on a DAQ project file before catman launches.

Remove/deactivate unconnectable devices temporarily from the project/show dialog: The options are practicable for larger projects with many devices, if not all the project devices can be found when automatically loading a project, e.g. because they are switched off or defective. Then the project is run with the devices available, depending on the option either without changing the original file or after saving the changed project file.
See also Data transfer and error handling.

Load GUI extensions

Ribbon extensions: Here you can specify a file which contains your settings for the user interface (Ribbon); see Program options, User interface: Adapt.

Default script: If catman is always to load and execute a script, enter the script file here. The option is independent of the automatic start of a script on opening a project (Program options: EasyScript).

Load visualization

Specify the files here from which the visual displays (Panels and Print pages) are to be loaded during the start. You can specify files which contain a single Panel (menu **File ► Save ► Current Panel/page**), the complete visualization (menu **File ► Save ► Complete visualization**) or DAQ and analysis projects (menu **File ► Save ► Project)**.

13.8 Shortcut options

Call the dialog via the menu **File ► Options** and then click on **Keyboard shortcuts** (**System** group) on the left.

Set specific keys as shortcuts for switching between DAQ and Analysis modes, scrolling to other Panels, or other actions.

Procedure

1. Use the tabs in the dialog to choose whether the keyboard shortcut is to act on DAQ channels, the measurement or the visualization, etc.
2. Click in the field for which you would like to define a keyboard shortcut.
3. Enter the character or double-click the required special character in the list on the right. You can also mark the character in the list on the right and click **Insert**.
   If you are using a special character which has to be combined with the key (all characters with +), e.g. **Ctrl+** (Ctrl), click again in the setting field and suffix an additional character to the special character, e.g. **s**, to trigger the action by pressing **Ctrl** (Ctrl) and **s** simultaneously. In the example you can also specify **Ctrl+Shift+s** (Ctrl+⇧+s). In this case you must then press three keys to trigger the action.

Notes

- Key F5 for starting/stopping DAQ jobs starts and stops *all* DAQ jobs. If several DAQ jobs are present, the selection list is superimposed on starting. Although the key can be changed, it cannot be activated.
- Jobs for which you have defined *Keyboard shortcuts* are also started with the key defined here. But you can also use it to *stop* any job (does not work with shortcuts).
  See also Specify job parameters.
- The **Delete selected object** function (**Visualization** tab) cannot be used for the table objects, because they require the Remove function for their fields and do not transmit to catman.

13.9 Options for CX22

Call the dialog via the menu **File ► Options** and then click on **CX22** (**System** group) on the left side.

There you can specify **Reset all CX22 digital outputs on DAQ start**. This means that the LEDs are also reset and any current indication of an error is cleared.

By default, the **RECORDING** and **ERROR** status LEDs are used by catman to display the status of measured value recording and the error status respectively. If you do not want this, and want to configure the outputs yourself, you can disable **automatic usage of status LEDs** here.

Automatically connect status LEDs with digital outputs: The option connects the RECORDING status LED to digital output 1 (terminal 4) and the ERROR status LED to digital output 2 (terminal 5). You can then trigger further actions via the digital outputs or, for example, visualize the status by a larger display.

To also be able to configure a DAQ project with CX22-specific settings on a different PC (that is, not on a CX22) you must enable the **Allow CX22-specific configurations** option. This enables you to assign functions to the digital inputs and outputs of the CX22 for example.

13.10 DAQ channel options

Call the dialog via the menu **File ► Options** and then click on **DAQ channels** (**Channels and sensors** group) on the left.

Transfer channel and device names into device

ℹ See also Use sensor description as channel name.

☞ This option is only possible with QuantumX/SomatXR, MGCplus, PMX and DMP41.

The channel names are saved in the device and will then be available when performing the next device scan. As a result, the *same* channel names are used in the AB22 of the MGCplus and in catman for example.

Channel names can also be stored in the TEDS module of a sensor, and with QuantumX/SomatXR are then also displayed in catman if you connect the sensor before the device scan. and the **Accept from TEDS** (Use sensor description as channel name) option is active.

Save settings

☞ This option is only useful with MGCplus, PMX and DMP41. With QuantumX/SomatXR all settings are always saved in the device.

The channel settings that can be saved in the device, e.g. the excitation voltage, are saved secure from power failure (EEPROM) and are then available later for operating even without catman.

All settings are first written into the RAM of a device. In QuantumX/SomatXR they are also transferred approx. every 10 seconds into the flash EPROM. However, with other devices this is not done automatically and the RAM holds the settings only for a few hours after the device has been switched off. After that the settings are lost. The **Save configuration upon exit** option allows you to save the settings permanently in the device EEPROM; however additional time is required when shutting down catman as the system will first check whether the settings have been transferred.

Filter (automatic filter selection)

ⓘ See also Which sample rate is the right one?

Unless there are special circumstances, we recommend leaving it at the default **15% of the sample rate**, since no *alias* effects usually occur in the process.

☞ Filters with Bessel characteristic create no signal distortion, but have a relatively flat frequency response. In case of high-frequency interference at *high* amplitudes, you should therefore set the cutoff frequency to 5% of the sample rate, or use filters with Butterworth characteristics. (**Preferred characteristics**).

If you choose a percentage figure which is too high, an aliasing effect can arise if the amplitudes of interference frequencies above half the sample rate are not suppressed sufficiently by the filter in the measuring amplifier.

Provided the device supports it, the **Allow manual filter settings** option (active by default) enables you to apply different filter settings for each channel by choosing **Configure** (**Sample rates and** filter group) on the **DAQ channels** tab or **Channels** (**Settings** group) on the **DAQ jobs** tab. If you make the settings on the **DAQ jobs** tab, you can also make different settings for each DAQ job and channel. In the **DAQ channels** tab, a change may affect *all* DAQ jobs, but only the setting of the first job is displayed.

See also Setting DAQ job parameters via the channel list, Setting filters manually.

What to do if channel initialization fails (when starting acquisition)

All active channels are initialized before a measurement, with one exception. Exception: the channels have already been initialized and the settings have not changed. If an error occurs during the initialization, i.e. the channel is unable to carry out a measurement, catman issues an error message (default). Use the **DAQ channels** tab to call up the **Configure DAQ channels** window in order to find the origin of the error and correct it.

However, if you wish to process several DAQ jobs automatically, this would in effect end the acquisition, as catman waits for confirmation of the error message. You can prevent this by using the **Deactivate the devices which caused an error and continue measurement without interrupt** option. The option is also practicable when you are measuring using very many channels and the failure of individual channels during the measurement can be tolerated.

See also Event monitoring: Error during measurement and DAQ jobs: Data transfer and error handling.

⚠ With this option the defective channel will be *deactivated* in all DAQ jobs. You have to re-enable it *manually* via the **DAQ jobs** tab and **Channels** in the **Settings** group in *all* DAQ jobs (use the **Activate in all DAQ jobs** context menu).

Display overflow values as

Here, enter a value which does not arise with “normal” measurement data. This enables overflow values to be found easier, because the same number is always involved. Otherwise the measurement for the overflow depends on the measurement range and scaling of the measurement device. The default is -1,000,000. You can also search for this value (OVFL value) in the DataViewer, and the values are also not displayed in graphs; see Zero values for graphs.

13.11 Channel list options

Call the dialog via the menu **File ► Options** and then click on **Channel list** (**Channels and sensors** group) on the left.

Specifying columns to display in the DAQ channels tab (channel table)

Specify here which columns are displayed in the **Configure DAQ channels** window (**DAQ channels** tab or – in offline mode – **Signal plan**), and in what font, font size, and foreground, background and highlight colors.

If the **Use channel colors as default ...** option is active (see Panel (and print page) options), you can show the **Default color of plots** column and so change the plot color for all graphs or display texts, including at a later time. You can disable the function for individual graphs however: **Use channel colors for plots** in the graph configuration.

Sample rates/filter: The setting of sample rates and filters on the **DAQ channels** tab is applied for *all* DAQ jobs. If you frequently use *many different* DAQ jobs, you should not display this column and, using the Program option User interface, you should also hide the **Sample rates/Filter** group (deactivate **Visible**).

QuantumX/SomatXR Isochronous transfer: Displays a column which shows whether **Isochronous data transfer** is active for a channel. The *Isochronous data transfer* must be activated for all signals which are to be used as source signal for another module. In this way the data interchange between the various modules is activated and it is thus ensured that the relevant values are transmitted over FireWire and the other modules are available. You can activate it by clicking in the **ISO** column or via the **DAQ channels** tab and **Active** (**Channel** group).

☞ The **Type expected** column on the **DAQ channels** tab is only available once a project is opened and the **Hardware type** column is activated here.

Complete device description: If the option is inactive, only the device name is shown (if available). If the option is active, UUID, the synchronization state and address, for example, are also displayed. The details shown however depend on the device type.

Fixed column width: With the option active the width of the columns no longer changes automatically, but instead only column widths are used which you set manually.

You can also change the arrangement of the columns: In the **DAQ channels** tab, drag the column header (the cell with the heading) to a different position. The setting is also retained after a restart of catman.

Font and colors

In the default setting, **Alternating colors for even and odd rows** is active so that the channel list is more easily readable. If you do not like the display of the marked channels (bright blue), select a different marking color, e.g. a bright yellow.

Signal reading

You can also change the display format—that is to say, the number of decimal places—for the **Sample** column in the **DAQ channels** tab. You can also set the format for each channel separately using the context menu in the **DAQ channels** tab.
See also Setting up channels (measuring chain) (DAQ channels tab).

Time channels

Hide time channels in channel tables (default setting active): The normally used (software) time channels are computed channels, the values of which are calculated from the sample rate specified for the relevant channel. Since catman knows the sample rate for each channel, during the assignment of a channel to a graph, the associated time channel is automatically transferred. The time channels are therefore generally only required for the export of data and therefore for other programs. They do not though have to be displayed in the lists with the channels when working with catman.
Exception: In measurements with PC controlled timing and with the **Peak values per time interval** measurement method, you should leave the time channels visible, because then you have to use a time channel in order to generate the x values for a graph. Since the channels are however only masked out, you can also display them at any time as required.

Setting DAQ job parameters using the channel list

By default, the *Sample rates* and *Filters* settings, and the *Channel activation* on the **DAQ channels** tab, are set for *all* DAQ jobs. However, only the settings for the first DAQ job are shown. If you are using several different DAQ jobs, you should make these settings either on the **DAQ jobs** tab or restrict the changes to the first DAQ job: **Only use for DAQ job 1**.

Live signal reading

From catman version 4.0, live display of measurements is activated by default in the **DAQ channels** tab after starting or opening a DAQ project. You can alter this behavior here.

It might be better to disable the option, as then error messages for a channel, for example, are displayed until you either double-click on the channel or activate **Live display** via the ribbon.

13.12 Sensor options

Call the dialog via the catman menu **File ► Options** and then click on **Sensors** (**Channels and sensors** group) on the left side.

13.12.1 Sensor database (location, password protection)

Database file

Enter here the name and path of the Sensor database file which should be used. The file can be write-protected to prevent changes to the Sensor database. In this case however no new transducer can be created. As an alternative you can also hide the tab using Program functions (Program options); then the sensor database can be used, but not edited.

We recommend that you use one database as the reference file and, after making any changes, copy this onto the relevant PC. The file uses MS Access format, other fields or tables may be added.

☞ An MX Assistant or MGCplus Assistant (from version 4.0) sensor database can also be used, as the files are backward compatible.

Password protection

With password protection you can prevent users who do not know the password from performing the following actions:

- Assign a sensor to a channel,
- Edit a sensor definition in the sensor database (the **Sensor database** tab can then not be displayed),
- Modify a sensor definition in the **DAQ channels** tab (**Sensor adaptation and wiring diagram**),
- Change/reprogram a TEDS module,
- Zero balancing,
- Create or change limit values and events,
- Create or change real-time computations (computation channels),
- Activate or deactivate channels,
- Change sample rates or filter settings,
- Firmware update.

The setting applies to *all* users of the PC. If a user wants to perform one of the selected actions, the password prompt appears. Then you can also deactivate the query for the rest of the catman session without turning off the option in general.

☞ To change the settings for protection, you must first cancel password protection.

The setting is identical to the one for Options for safety.

13.12.2 After loading a DAQ project

Execute sensor scan

☞ This option is only relevant when using transducers with *TEDS* or *T-ID*.

After a *Sensor scan* the sensor IDs stored in the project are compared to the sensor IDs found in the TEDS or T-ID module connected to the device. If the sensor IDs do not agree, different transducers are connected! The differences found are written into the *Initialization log* and displayed in a dialog.

☞ The *sensor scan* when starting a *new* DAQ project is not affected by this option; see Execute sensor scan after device connection.

Check that sensors from Sensor database are up to date

☞ This option is only relevant when using sensors from the Sensor database.

The sensor data saved in the project contain all the necessary details for balancing the channels correctly. However, if a sensor has been recalibrated in the meantime, the values saved in the project no longer agree with the currently applicable values. If the option is active, catman checks when the sensors used were last changed in the Sensor database. If this occurred after the project was saved, you obtain a dialog with the possibility of automatically updating the sensors affected. In addition, the warning **Sensor data not up-to-date** is displayed in the channel list for the channels affected.

13.12.3 Use sensor description as channel name

There are two different situations in which these options will be evaluated:

1. After a *sensor scan*.
2. When assigning a sensor.

The first option is only relevant if you are using TEDS-compatible devices together with *TEDS* or *T-ID* sensors.

⚠ The sensor descriptions should be unique. In any case *a unique channel name must* result. Otherwise catman cannot differentiate between the channels, i.e. a graph would always show only the first channel of this name. Therefore, if there are identical channel names, an index is added to the channel name and a warning is issued.

Use description after a sensor scan

If you carry out a sensor scan, then with TEDS-compatible devices transducers with TEDS or a T-ID module will be recognized. With the **Accept from TEDS** option you can also set the channel names to those stored in the TEDS (Template HBM Channel Name) or—with T-ID modules—the sensor descriptions stored in the Sensor database. In the case of CAN signals, the signal name can also be used as channel name if you have enabled the relevant option.

See also Transfer channel names into device, Activate TEDS.

The following cases are possible:

1. The TEDS module contains a channel name (HBM Template Channel Name), **Accept from TEDS** is activated
   The channel name is accepted.
2. The TEDS module contains *no* channel name, **Accept from TEDS** is activated.
   A default name is generated (DeviceX_ChanY).
3. The sensor ID of a T-ID module is found in the Sensor database and **Accept from TEDS** is activated.
   The sensor data are accepted for adjusting the measuring amplifier.
4. **Accept from CAN signal** is activated.
   The signal name is accepted as channel name. With MGCplus this also happens if a CAN database is found loaded in the ML71.
   See also Using CAN signals.

Use description when assigning sensors

- The sensor description will be used as channel name if you assign a sensor from the Sensor database and **Accept sensor from Sensor database** is activated. If a sensor comment exists, it is adopted as a channel comment.

  ⚠ If a channel name or comment already exists, it is overwritten when a new one is assigned.

  ☞ If you are using strain gages, you should not activate the option, because usually one definition of circuit configuration and resistance is used for multiple channels. The channel names here would be suffixed by numbers.

- The CAN signal name is used as channel name if you assign a CAN signal from the Sensor database and **Accept from CAN signal** is activated.
  See also Using CAN signals.

13.12.4 TEDS

Activate TEDS contents during sensor scan in device

ℹ See also Execute sensor scan after device connection.

☞ The option is only relevant when using QuantumX/SomatXR modules and transducers with *TEDS*.

The option is intended for QuantumX/SomatXR modules and the case where sensors are not connected directly to the device, but rather via an extension cable:

> The QuantumX/SomatXR modules only read out the TEDS contents on switch-on (power supply) and when a sensor is plugged directly on the device. For this reason, when a transducer is plugged in (or replaced on) the extension cable *after the device has been switched on*, the connection process is not recognized and the TEDS content is not read out.

You should therefore activate this option if you *use extension cables and not connect directly to the module*. Unfortunately, this increases the time needed for the sensor scan, it takes about 3 seconds per sensor. Otherwise you always have to call the sensor scan with the menu item **Activate TEDS**.

When assigning sensors from the Sensor database, also update TEDS content.

ℹ See also Password protection.

If this option is active, the TEDS module is written (overwritten) *without further query* when you assign a sensor from the Sensor database to a channel with a TEDS sensor.

In the default setting, the option is not active and a dialog appears during assignment whether only the setting of the measurement device channel should be changed or whether the TEDS module should also be overwritten.

13.12.5 Software T-ID

☞ We recommend that you only activate this MGCplus option in exceptional cases.

If a transducer is activated at least once, its unique number from the *TEDS* or *T-ID* module is saved in the MGCplus. With new settings a check can then be made of whether these match the saved sensor ID. However, the transducer with the number saved in the device must no longer be connected as there is the risk that incorrect settings may be used. For this reason, catman ignores the software sensor ID saved in the MGCplus in default setting and uses only the sensor IDs actually existing, i.e. the TEDS or T-ID modules will be *read each time* there is a *Sensor scan*, if this option is deactivated.

13.12.6 Clear zero-balance value and adjustment values on sensor assignment

We recommend that the option is left activated, because on the assignment of a new sensor, a new zero balance should take place (each sensor has a different zero point). The same applies when calibrating a sensor, because after the calibration a different characteristic might be present and a new zero balance is also then needed. Otherwise erroneous measurements can arise!

If however a transducer has to be replaced during a measurement and the zero state (initial state) cannot be established, you can (temporarily) deactivate the option. The "original" zero value (offset) is then retained. After concluding your measurement, measure the "offset" of the new transducer in the zero state in order to be able to correct your measurements accordingly. Alternatively, you can also enter or correct zero values manually (**DAQ channels** tab).

13.13 Zero balancing options

☞ Zero balancing can be disabled with password protection—see Sensor options, Password protection.

Call the dialog via the menu **File ► Options** and then click on **Zero balancing** (**Channels and sensors** group) on the left side.

Define here how the hardware channels of a device are *zero-balanced*:

1. Default method
   The default method uses either the zero balance or the taring function in the device or—if the transducer scaling is carried out via catman—a single measurement is carried out.
2. Synchronous high-precision zero balancing with averaging
   catman determines the zero values by measuring multiple samples and then averaging them. The measuring is carried out simultaneously on all channels using the sample rate entered.

   ☞ A maximum of 4,096 measured values are considered. If the number of measured values resulting from the time and sample rate entered is larger the surplus of measured values will not be considered.

The second method is better especially for signals with disturbances (noise), as not a single measured value is used. Instead the measured values are averaged over a longer period of time. This means however that more time is required for the zero balance: Internal zero balancing in each device takes about 10 ms. For averaging, measuring times of 1 to 5 seconds and sample rates of 10 to 300 Hz are useful.

Disable zero balancing for temperature channels, voltage inputs, counter channels and digital inputs. You can then use the **Zero balance all hardware channels** function (**Zero balancing** group in **DAQ channels** tab), and do not have to select individual channels.

Notes

- Do not use precision zero balancing for digital channels or counter values if the values change during the balance (lock zero balancing via in the **Zero balancing** group of the **DAQ channels** tab). Otherwise this can lead to invalid values, e.g. 0.3 as zero value for a digital input that can only be 0 or 1 but has changed its status during the measurement.
- You have to reset computation channels of a device (On-Board functions) using the appropriate function, for example with **Reset** for a peak value memory.
- For QuantumX MXFS, you can set the currently measured wavelength as a new reference wavelength by choosing **Reset reference wavelength** (**Zero balancing** group on **DAQ channels** tab). The 'normal' zero balance is only computed with the scaled values of a sensor adaptation, not with the display of a wavelength.

13.14 Panel (and print page) options

Call the dialog via the menu **File ► Options** and then click on **Panels** (**Visualization** group) on the left.

Drop of channel onto a panel in DAQ mode creates

When a channel is dragged onto a blank location of a panel in DAQ mode, in the default setting a dialog is shown in which you can select the object to be created. You can however also create other objects without a query. A post-process graph is always generated in Analysis mode.

Max. number of objects per type in the project

The specified number applies to all panels and print pages together and each of the objects specified in brackets. In the default setting you can therefore create a total of 256 digital indicators *and* 256 bar indicators *and* 256 analog meters on all panels and print pages together. Note that memory in the PC RAM is reserved for all (possible) objects, so do not set the values unnecessarily high. If required, you can save a project, increase the number and then reload the project and create further objects. The maximum number of objects of one type is 32,000.

Maximum number of plots per graph

Default setting, which you can change in any graph if you want to display more plots; see Configure graph. Since the setting applies to all graphs, and requires additional memory, it is better to change the setting only for the graphs that you want to display more plots.

Allow automatic visualization layout (only QuantumX/SomatXR)

The option has the effect that with no visualization on starting a DAQ job in the dialog for the visualizations, a further option is shown—the automatic visualization layout. In this process the existing channels are automatically assigned, and a Scope panel with four Scope graphs is created per QuantumX/SomatXR module.

Auto-assign channels when creating new objects

By default, when an object is created it is always assigned a DAQ channel to display. For the first object the first DAQ channel, then the second, etc.

> For the standard objects, it is enough to drag one or more channels to an empty location in the panel to display those channels in one or more objects (you get a selection menu).

Print pages only

If you are using panels and print pages, you can print everything using the menu **File ► Print ► Print visualization**. Activate this option to print only the print pages, but not the panels. To be able to only print a panel despite this, display the panel and use the menu **File ► Print ► Print panel/page**.

Use channel colors as default for plot colors

Activates use of the assigned colors in the **DAQ channels** tab (or **Signal plan**) when adding channels to the graph and the multi-bar graph. Each channel is initially shown in the defined color, but you can change the color for individual objects via the configuration of the relevant plot. You can hide the column with the colors in the **DAQ channels** tab if you deactivate the option; see Program options Channel list.

☞ If you want to load multiple files of a DAQ project in Analysis mode (same channels or channel name), you should deactivate the option. Since the plot color is saved with the measurements, this has the effect that the same channel always receives the same color from several tests and the tests cannot be differentiated from one another in a graph.

Use channel colors as default for display text

The colors assigned on the **DAQ channels** tab (or **Signal plan**) are used for displaying the channel (unit and measured value) in a digital indicator.

Align objects to grid

The option allows positioning and resizing of objects on grid positions only, even if the grid is not visible.

You can also enable display of the grid, the grid width and the alignment directly in the configuration dialog of a panel.

Allow panel size larger than screen size

The option is only still available for compatibility reasons. If not all visualization objects are visible, catman automatically displays scroll bars.

Switch visualization to execution mode during the DAQ job execution

The option is helpful when you are using buttons or other input objects (**Developer tools**, **Controller** group). The switch to *execution mode* then occurs automatically after the start of a DAQ job. A disadvantage is that in this mode the creation or configuration of visualization objects is no longer possible. However, with the option active you can also switch back to Design mode via the **Execution mode** menu (on the right above the ribbon).

Graph null value

The option is used to suppress the display of unwanted values. The function is used for example to suppress the display of invalid measurements. The default value is 0 for the x axis and -1,000,000 (overflow value) for the y axis.
See also Display overflow values as, Data cleansing.

Display of units

Here you can define how the representation of the unit is to appear after the title of an axis legend. As standard, for example, **in %u**. The notations often used, **[%u]** and **(%u)**, are not permissible according to DIN 1313, DIN 461 and EN ISO 80000-1.

Graph export dialog

The option defines the default settings for the dialog which you are shown on calling the **Export/print** context menu for a graph. You can change the values in the dialog before the required action.

13.15 Style options

Call the dialog via the menu **File ► Options** and then click on **Style** (**User interface** group) on the left.

The dialog enables you to choose from various color schemes for the display of the ribbon and windows. Restart catman to see the effect of changes.

13.16 Customize user interface options

See also Show icon on tab (of Panels and Print pages).

Call the dialog via the menu **File ► Options** and then click on **Adapt** (**User interface** group) on the left.

With this dialog you can customize catman according to your needs and preferences. The following list sets out some potential applications: Don't forget to save your changes so that they will be available the next time catman starts. When saving, catman automatically asks if you want to load the settings on the next startup; see also Program start options.

Hiding the ribbon (temporarily)

To hide and show the menu ribbon use and on the right above the menu ribbon. Then you have more space available for the main window. Click on the still visible area (the name) of a tab to temporarily display it so as to select an action.

With **Hide all catman tabs**, **Hide catman menu** or **Hide ribbon bar and menu completely** you can permanently hide the components in question. The options are only useful if you are able to execute the required actions via buttons or a dedicated menu or ribbon.

Specify which tab is displayed first in DAQ mode and which in Analysis mode

Click on the tab you want under **catman tabs**, and on the right choose **Default tab in DAQ project/Analysis project**. The only setting that is not possible is the setting for switching from DAQ to Analysis mode. Here, the **DataViewer** tab is always displayed first.

Hide individual tabs or groups within a tab

Click on the tab you want under **catman tabs**, or call up the tab's groups view and click on the group you want. Deactivate **Visible …** on the right.

☞ Some tabs or groups are only displayed if the related actions are supported by one of the connected devices. The **Optical measurement** group on the **DAQ channels** tab, for example, is only displayed if a device of that type is connected. You do not need to explicitly mask this group out if you do not have an FS22 BraggMETER.

If you mark **catman tab**, you can hide various sections of the user interface on the right under **General settings**. This is useful, for example, when a user is only to be able to start one DAQ project. Then carry out the "key" actions to start or stop measurement using buttons on the Panels for example.

Specify, how the program window is to be displayed

In the dialog at the bottom right you can set a specific size or, for example, leave the window permanently maximized. If you activate **Hide minimize button**, then catman cannot be unintentionally minimized (reduced) to the Windows start bar.

Define your own groups on the tabs of catman

Select the tab you want and click on **New group**. On the right assign the **Name** (only necessary for EasyScript and AutoSequences) and **Title**. If applicable also define an icon. Then mark your new group and produce a **New control** (button in the group). As actions, which can be controlled by such buttons, you have the predefined actions and the clone actions (as for Buttons), AutoSequences and EasyScript available.

Create your own tabs (user tabs)

Select **User tab** and click on **New tab**. On the right assign the **Name** (only necessary for EasyScript and AutoSequences) and **Title**, and specify how and when the tab is to be displayed. Then produce groups and buttons which are to be displayed on the tab and assign the actions. As actions you have the predefined actions and the clone actions (as for Buttons), AutoSequences and EasyScript available.

Create your own context menu entries

Select the context menu entry under which you want the new entry to appear and click on **New control**. On the right side issue the **Name** (only necessary for EasyScript and AutoSequences) and **Title**, and specify how and when the context menu is to be displayed. As actions you have the predefined actions and the clone actions (as for Buttons), AutoSequences and EasyScript available.

☞ Icons for a GUI file are initially searched for in the same folder as the GUI file. If they are not found there, the default folder for images is searched; see Program options: Folders.

13.17 EasyScript options

ℹ See also EasyScript.

Call the dialog via the menu **File ► Options** and then click on **EasyScript** (**Developer** group) on the left side. The EasyScript option must be enabled in order to use the setting.

Display Script Quick Access Window automatically on program start

This window gives you access to the key script functions without opening the **Script Editor** tab. With the Quick Start window you can:

- Open an EasyScript project
- Start a script
- Terminate a script
- Run individual procedure
- Open the EasyScript editor

Start script automatically on opening the DAQ job

This starts an EasyScript contained in the project on opening a DAQ or Analysis project.

Start script automatically on starting the DAQ job

Starts the currently loaded script on starting a DAQ job. This means that you can terminate a script after execution if it is no longer needed after a DAQ job. It is then automatically started again during the next start of the DAQ job.

Enable catman basic services

Since catman accesses the catman Professional data acquisition software via ActiveX, you too can also access functions of the catman Professional DLL. When you activate the option, the object catman is created and made available for the script. You can then address the ActiveX interface via this object.

⚠ There is normally no need to access the catman Professional object. In rare cases however it may prove to be useful to have access to the catman basic services, for example, to execute a catScript command. You should only use this if you are very familiar with how catman Professional works. Otherwise this may lead to the catman program crashing.

☞ ActiveX interface commands are listed in a document in the catman installation folder ("catInterface_Help.chm").

Help and Code Builder

In the default setting the Code Builder works together directly with the EasyScript Help: On clicking a function or action in the Code Builder, the associated syntax description is already superimposed in the lower section of the editor. With these options you can:

- Superimpose the Code Builder in the default setting (on calling the editor). Then you have more space available for the script editor.
- Deactivate the automatic display of the syntax description (context help).
- Display the help in a dedicated window (WebHelp). This is especially advantageous when working with two screens, because then the help can be displayed on the second screen and does not take up space in the catman window.

You can also call the EasyScript Help as HTMLHelp (without context help): "EasyScriptHelp.chm" in the catman installation folder.

Code generation: Automatically insert #uses directive when creating a new module

Each module which wants to run a procedure from another module must declare the name of this module with `'#uses`. If the declaration is missing from the module header, the procedure to be called will not be recognized. On starting the script you then obtain the error message "Unknown identifier" at the point of the call.

With this option you specify that catman automatically inserts the #uses directive in all existing modules when adding a new module.

☞ If catman does not find the module specified in a #uses directive, then your script does not start.

13.18 Options for AutoSequences

See also AutoSequences.

Call the dialog via the menu **File ► Options** and then click on **AutoSequence** (**Developer** group) on the left.

In the default setting DAQ jobs are terminated when an error occurs in the AutoSequence or the sequence has been terminated manually.

In the default setting the time channels, as in the interactive mode, are also not displayed anywhere. Here, you can define that the time channels are displayed in the pick list of the AutoSequence commands.

14 TECHNICAL SUPPORT

Please always have your license number ready. You will find this in the catman info window (**About catman** menu item in the **Help** menu).

If you encounter any problems when working with catman, you can use the following services from HBM:

E-mail support

support@hbkworld.com

Telephone support

Telephone support is available on all working days from 09:00 to 5:00 PM (CET):

+49 6151 803-0

Fax support

+49 6151 803-9100

We recommend that you complete the registration dialog (see Licensing and registration) and send the data to HBM. You will then receive separate telephone numbers from HBM for direct catman support. In addition – provided your maintenance and service contract is valid – you will be informed when a new version is available and will also receive your new license number.

System info file

To enable you to give HBM support information about your PC system, generate a system info file using the dialog with the license details (**Info** in the start window or **About catman** item in the **Help** menu). Before producing the file CATMAN_SYSINFO.TXT, you can select the file path and the path is also displayed again after it is produced.

The following possibilities are also available

Use the video tutorials on the HBM website:

www.hbm.com/catman-daq-software-knowledge-base/

or the HBM seminars:

www.hbm.com/seminars-trainings-events-tradeshows.

HBM Support and Sales International

www.hbm.com/worldwide-contacts

Download software updates from HBM

https://www.hbm.com/Support

Please note that new software versions (e.g. 5.0, 5.1, etc.) also require a new license number. Therefore make sure you register (see Licensing and registration), thereby activating your service contract. If you are just downloading a later release (error correction, e.g. 5.3.1, 5.3.2 etc.), you do not need a new license number.

15 GLOSSARY

This section contains explanations of various terms used in catman or in measurement equipment operated by catman.

15.1 Alias, Alias effect

See also Which sample rate is the right one?, *Anti-alias filter*

Signal in the output of an A/D converter, which does not correspond to any measuring signal and occurs due to under-sampling (too low sample rate) of the analog signal. An anti-alias filter is often used to prevent this. The effect arises when signals with more than half the sampling frequency are present on the input of the A/D converter.

15.2 Anti-alias filter

See also Filters, Setting filters manually, Which sample rate is the right one?

This filter is necessary in some measuring devices so that the A/D converter will not receive any frequency located above half the sample rate. This would lead to incorrect values: oscillation of a (very low) frequency, which is not present in the signal, would be displayed. Such a filter is not necessary for QuantumX/SomatXR and MGCplus, as the A/D converter converts using a much higher frequency than the signal bandwidth of the respective amplifier channel. Through this and the integrated conversion procedure, high frequency noise will be effectively suppressed and no aliasing will occur in the measuring device. However, a similar effect can arise if *not all* measured values are *passed on* to catman. Therefore a filter with 15% of the sample rate is used as default.

Filters with Bessel characteristic create no signal distortion, but have a relatively flat frequency response. In case of high-frequency interference at *high* amplitudes, you should therefore set the cutoff frequency to 5% of the sample rate, or use filters with Butterworth characteristics..

15.3 APIPA

Automatic **P**rivate **IP A**ddressing is a method of interconnecting devices in local networks in which no configuration is necessary. The devices automatically configure their network interfaces, find each other mutually and are then able to exchange data with each other. The mechanisms required to do this are available in Microsoft Windows and in the QuantumX/SomatXR modules as well as the CP52 of MGCplus. They are only used if no fixed address is set, which means that *DHCP* must be set.

15.4 Autocalibration

The so-called *autocalibration* improves the long-term stability (aging) and—if there are temperature changes where the measurement device is located—also the short-term stability of a measuring amplifier. The autocalibration function differs however depending on the device type and can only be influenced on the MGCplus and some module types of QuantumX/SomatXR.

MGCplus

The autocalibration of the MGCplus interrupts the measurement, because during the autocalibration (approx. 300 ms) no measured values are available from transducers but rather only the internal calibration signals (zero and reference signal) are available. Therefore, the autocalibration is switched off as factory default. If you are carrying out a slow measurement using sample rates under 10 Hz, you can however activate a cyclic autocalibration (approx. every 5 minutes).

⚠ During autocalibration, the last measured values will be output both via the interface and also via the analog output (if available) until new measured values are available.

☞ You can activate or deactivate the autocalibration of the MGCplus via the **Channel info** window.

QuantumX/SomatXR

MX840, MX440

With full and half bridges (strain gauge or inductive), with LVDTs and potentiometric transducers all four possible settings are available. With measurement with thermocouples and in the 100 mV direct voltage measurement range the settings 1 and 4 as well as a modified variant of setting 3 are available: By measuring the zero signal, (only) an offset correction (zero-point drift) is performed. For all other sensors and measuring ranges no autocalibration takes place (autocalibration deactivated).

MX1615/MX1616

With strain-gauge full and half bridges you can choose between the settings 1, 3 and 4. Setting 2 is not available for this module. For all other sensors and measuring ranges no autocalibration takes place (autocalibration deactivated).

Available settings

1. **Off**
   The autocalibration is deactivated. This setting is only recommended for short-term measurements.
2. **Background calibration**
   This is the type of calibration preferred for the module. Every x minutes (**period**) the second measuring amplifier (see background information below) is disconnected for about 300 ms from the measurement signal and calibrated. The actual amplifier is adjusted based on the data obtained. However, with very small signals and high resolutions this disconnection and reconnection may lead to (slight) distortion in the measurement signal.
3. **Direct calibration**
   Every x minutes (**period**) the measuring amplifier is disconnected from the measurement signal and calibrated. The measurement signal is frozen during this time (about 300 ms) (results in a plateau in the signal curve). This corresponds to the autocalibration process of the MGCplus.
4. **Automatic**
   The setting for this module recommended by HBM and the selected measurement range are used. This is generally the background calibration if this is available.

☞ You change the type of autocalibration of the MX module using **Sensor ► Autocalibration** in the **Sensor** group of the **DAQ channels** tab.

Background information

Really, the term autocalibration is incorrect, because here not only are any changes in the zero-point and gain of the measuring amplifier *measured*, they are also *corrected*. It is therefore actually an auto-adjustment. The term autocalibration is however widely used for this process in measurement technology.

Internally, the MX modules use two measuring amplifiers which are located on one chip and therefore have practically identical behavior. One of them performs the actual measurement, the other is calibrated with a high-precision calibration signal. For this purpose, after the specified period this amplifier is connected to the calibration signal for about 300 ms. If different values are then produced at the output of this amplifier, the amplifier is readjusted accordingly with the actual measurement signal.

15.5 catman working directory

See also Folder options.

All the files and folders required by catman, for example for the sensor database, saving data or projects and the temporary data storage, are created in the catman working directory. You can change some of these folders and paths with catman options. The catman working directory also contains some examples, such as the AutoSequence examples.

In the default setting the catman working directory is generated in the “My Documents\HBM” folder of the user logged in to Windows.

15.6 Characteristic value

This is the output signal of the transducer at *Nominal value*, e.g. 2 mV/V at 50 kN.

Depending on the manufacturer, however, you will also find transducers where the sensitivity is not referred to the *Excitation voltage*, e.g. 20 mV with 10 V Excitation voltage (corresponding to 2 mV/V). Another possibility is to specify the sensitivity for a transducer as a measurement under certain conditions, e.g. 0.2019 mV with 10 V excitation voltage and 1 bar, together with the specification of the nominal load (500 bar). This corresponds to a value of 0.02019 mV/V with 1 bar or a sensitivity of 10.1 mV/V (for 500 bar).

15.7 Compatibility mode

Compatibility mode is no longer available since catman 4.1.2. You need to update older modules.

For updating older modules, you need the appropriate firmware file. Depending on the existing firmware, you may also have to download the program “QuantumXFirmware Updater” and perform the update in several steps. Contact HBM Technical Support about this.

15.8 DAQ job

A DAQ job contains the definition, such as how and with which channels measurements have to be made and what happens to the data after the measurement as well as how and which parameters are saved. You can define multiple jobs and execute them singly or all together (one after another).

With the MGCplus, you can transfer the job settings also to the CP42/52 and have the MGCplus execute the measurement autonomously (On-Board recording).

Using AutoSequences you can execute and change jobs also controlled by the process.

15.9 DAQ project

A DAQ project contains all settings required for setting up the measuring chain (sensor description, zero values, scalings), all settings for the measurement and for the visualization. DAQ projects, which you save in the Analysis or Demo modes, contain in the default setting only the computation templates and visualization settings, but you can also save measurement data.

If you load a DAQ project having channels which are no longer available in the current device configuration, these channels will be deactivated. A warning is shown, if a different channel configuration is found. Check the *Initialization log* which contains a full description of the problem. However, if the device specified is not found, the loading process will be canceled. If another device is found, you have the possibility of applying the settings for devices where the addresses are different to the original ones. If the project sensors are not present in the Sensor database, they cannot be updated. With CAN signals the channel names as well as the messages and signal numbers are checked; otherwise the setting will not be transferred. We recommend however that you check the signals. Even using this method, there is no guarantee that the same signal as in the original project is concerned.

If errors occurred during loading, you are asked whether you want to see the initialization log. However, you can always open (and print out) the initialization log with **Initialization log** (**DAQ channels** tab, **Special** group).

☞ When loading a project, all zero values saved (*Zero balancing*) are restored, depending on the device used either in the device or in catman.

15.10 DHCP

In conjunction with a server, DHCP (**D**ynamic **H**ost **C**onfiguration **P**rotocol) facilitates the automatic assignment of an IP address in the network. When this automatic reference of the address is set on a module (client), you do not need to do anything else. On switching on the module an address is requested from the server and it is then set. In addition other parameters can be defined by the network administrator which can also be set.

If you would like to work with DHCP with the QuantumX/SomatXR, we recommend despite this, that a permanent address is issued from the server via the *MAC address* by the network administrator, because then the module is always accessible via the same address. This is better for some programs, because here when changing addresses, the configuration must always be modified.

15.11 Electrical measuring range

The electrical measuring range of a transducer is the maximum electrical signal that the transducer produces under operating conditions. As a rule, this is the output signal at nominal load. This value must sometimes be specified to ensure that the amplifier connected is not overloaded.

15.12 Excitation voltage

Many transducers are passive, particularly all strain gage and piezoresistive transducers. Therefore a excitation voltage is required in order to obtain an output signal. Different voltages ranging from 0.5 V to over 10 V are allowed, depending on the transducer. Check the technical data: If a *nominal* excitation voltage is given, it must be used. If a range is given, it is recommended that you use the maximum excitation voltage of that range in order to receive the best possible signal (signal to noise ratio).

With strain gages, select an appropriate voltage, depending on the size of the strain gage, its resistance and the material onto which it is cemented. This will usually be in the range 0.5 V to 5 V. If in doubt, ask the person who installed the strain gages.

15.13 Execution mode

As soon as you use an interactive object, such as a controller or a button, or have activated one of the additional modules, AutoSequences or EasyScript, the **Design mode** menu item appears on the right above the ribbon.

Click on **Design mode** to switch to **Execution mode** and vice versa. The following is done only in execution mode:

- AutoSequences assigned to an object, predefined actions, clone actions, or EasyScript procedures,
- values of input objects (**Controller** group) applied in computations.

☞ As long as you are in **Execution mode** (on the right above the ribbon) you cannot move any interactive object. Configuration is also restricted.

15.14 File extensions used by catman

catman uses the following file extensions for identification:

*.MEP: DAQ project

*.OFP: Analysis project

*.MEV: DAQ project visualization

*.OFV: Analysis project visualization

*.PAN: Panel

*.GRF: Template for various graphical objects

*.METER: Template for Digital indicators, Analog meters and Bar indicators

*.GUI: GUI extension

*.SDB: Sensor database

*.VPT: Test parameters

*.EXP: Analysis project export list

*.BIN: Measured data in binary form

*.TST: Test parameters related to the measured data (also used with Fast Stream)

*.EVENT: Events occurring during the DAQ job.

*.XLS or XLSX: Measured data in Excel format (Excel workbook)

*.TSX: Test parameters for Excel export (in ASCII format)

*.DAT: NI DIAdem format

*.DAC: nSoft DAC (nCode) format

*.MDF: MDF 3 format

*.MAT: MATLAB format

*.TIM: RPC III time history format

*.S3T: HBM nCode s3t format

*.MF4: MDF 4 (ASAM) format

*.UFF: UFF58 (Universal File Format 58)

For AutoSequences the following file extensions are used:

*.TSQP: AutoSequence project

*.TSQ: Single AutoSequence

For EasyScript the following file extensions are used:

*.ESP: Script project

*.BAS: Code module

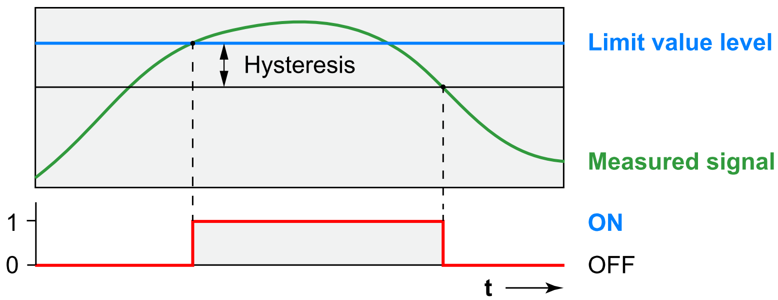
*.CLS: Class module

15.15 Hysteresis

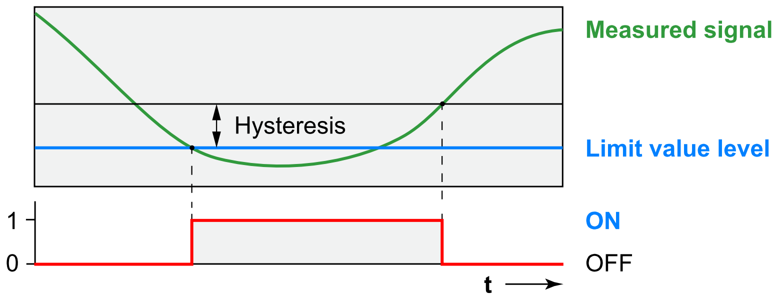
The optimal level of the hysteresis (hysteresis bandwidth) depends on the interference level on your signal. It is only considered if the alarm and warning levels are identical.

Hysteresis prevents 'jitter' of the limit switch on reaching the switching threshold due to noise or interference on the signal. Depending on the switching direction, the hysteresis is located below or above the switching level.

Example of a high level crossing



Example of a low level crossing



Examples

Alarm level 2 kg, Warning level 1 kg, Hysteresis 0.1 kg

In the **High level crossing** switching direction the *Warning* limit action is triggered on exceeding the 1 kg level; the *Alarm* limit action is triggered on exceeding the 2 kg level. When 2 kg is undercut, initially no change occurs. Resetting the alarm condition here only occurs when the warning level of 1 kg has also been undercut.

Alarm level 2 kg, Warning level 2 kg, Hysteresis 0.1 kg

In the **High level crossing** switching direction the *Alarm* limit action is triggered on exceeding the 2 kg level. Resetting of the alarm condition occurs on undercutting 1.9 kg (2—0.1).

15.16 Initialization log

The **Initialization log** (**DAQ channels** tab, **Special** group) contains all errors which occurred when opening a project and initializing the channels. Column **Cause** contains possible explanations and helps you in solving the problem.

15.17 IRIG-B

IRIG (**I**nter **R**ange **I**nstrumentation **G**roup) is a United States Air Force organization. The IRIG time is used primarily in the military sector for video and data recordings. Here, there are various variants which are differentiated by an additional letter; they are not compatible to one another. Current standards are IRIG 200-98 (1998) and IRIG 200-04 (2004).

The QuantumX/SomatXR modules MX840A/MX840B and MX440A/MX440B can use the IRIG-B process. For this you have to assign IRIG-B as a sensor to the channel to which the IRIG time source is connected.

In some formats IRIG-B uses the number of seconds since the start of the current year, so you must then also state the current year and the time zone in the dialog for the time synchronization.

15.18 Isochronous data transfer

The Isochronous data transfer must be activated for all signals which are to be used as source signal for another module. In this way the data interchange between the various modules is activated and it is thus ensured that the relevant values are transmitted over FireWire and the other modules are available. The activation is carried out automatically when creating computations in catman; you can also carry them out via the **DAQ channels** tab and **Active** (**Channel** group). If the **ISO** column is displayed, one click in this column is sufficient.

See also Specifying columns to display (Channel list options).

15.19 Job list

List of the active DAQ jobs. You can change the sequence of the DAQ jobs in the list and run the list. catman then executes all the DAQ jobs consecutively as given in the list. A break can only be made to repeat a DAQ job, not between the different DAQ jobs.

15.20 Limit load

Maximum load on the transducer (force, displacement, pressure, torque, etc.). If this limit is exceeded, the transducer is damaged.

15.21 Link resource conflict

See also Device reset/factory settings

A link resource conflict can only occur with the MGCplus.

With the multi-channel plug-in modules only one signal per channel can be output, i.e. not gross and net signals simultaneously. If other plug-in modules, for example an ML70, an ML78 or an On-Board recording, access one signal, an attempt to measure the other signal leads to a link resource conflict.

If you do not wish to carry out a measurement via On-Board, you should delete the parameter set 0 (flash memory). The settings defined there are activated each time the MGCplus is switched on, thus determining the "selected" signals of the individual channels, even when no measurement is taking place.

Example

A plug-in module, for example an ML78, is connected to the gross signal of a multi-channel plug-in module and an On-Board recording is defined. When you now attempt to measure the net signal, a link resource conflict arises, because the gross signal is already assigned.

15.22 Log file (system log)

In the *log* catman enters the start and termination of the program with the date and time. Other entries are not currently carried out by catman. However, using the options, you can specify that further information is to be logged; see Options for safety.

Call the log via **File ► Special functions** or via **Special ► Display system log** on the **DAQ channels** tab.

Since the system log from catman 4.2 is a normal text file, you can edit the content with any text editor.

☞ Above a file size of 1 MByte, the current log file is saved with the current date and time as the file name, and a new file is created in the catman work folder. Delete old files manually as required. Larger files arise particularly when you carry out further entries in the log, e.g. to log events and limit infringements.

15.23 MAC address

Internationally this is the unique address of an Ethernet adapter. Often the address is coded in the hardware and cannot be changed. This means that in networks a device can be unambiguously identified even without an IP address. The MAC address of a QuantumX/SomatXR is stated on the MX module and is identical to the *UUID* or the serial number. However, in contrast to the serial number, it is stated in hexadecimal notation.

15.24 Message bar

The message bar is located below the ribbon and is used for various purposes:

- Start and termination of a DAQ job are indicated.
- All events (limit/event monitoring) since the start of catman are brought together in a list with the date and the time of their occurrence. You can display this list here during the measurement. Click on **Previous** to view older messages.

See also Job status window.

15.25 MQTT

MQTT (originally MQ Telemetry Transport) is an open publish-subscribe network protocol for machine-to-machine communication. The MQTT protocol defines two types of network entities: a broker and a number of clients.

An MQTT broker is a server that receives all messages from the clients and forwards them to their destination clients. An MQTT client is any device (controller, PC, server) that is running an MQTT instance and connects to an MQTT broker via a network. catmanAP works as an MQTT client, and can make data available to other clients (publish), but cannot itself receive data (subscribe).

15.26 Nominal value

The (physical) nominal value of a transducer is the nominal load (or force, displacement, pressure, torque, etc.) value of the transducer. This indicates the end of the usable measuring range, as the technical data, such as the linearity deviation, is only guaranteed up to the nominal value. If the transducer is subjected to higher loads, the specifications can be exceeded. If the *Limit load* is also exceeded, the transducer is damaged.

15.27 Network segment

A larger Ethernet network is usually divided into several segments, e.g. for the various departments. For example, the same network segment is present with the following addresses: 192.168.169.21 and 192.168.169.84. Both groups of numbers are identical apart from the last group and are therefore located in the same segment. With suitable subnet masks however addresses in which only two groups of numbers are identical can also be used for communication and data transfer.

15.28 NTP time

The NTP (**N**etwork **T**ime **P**rotocol) time is the number of seconds elapsed since midnight (00:00 hours) on January 1, 1970, with a resolution of better than one microsecond. It is always stored in catman in 8-byte format (double precision), and a separate time channel is used for each sample rate. An NTP time server can be, but does not have to be, synchronized with a time server on the Internet.
Further information can be found at www.meinberg.de and www.pool.ntp.org.

15.29 Panel

See also Panels and Print pages, visualizations

Window for displaying the measurement data during the measurement. Use the bar above the Panel for browsing if you have created a number of Panels or Print pages. You can position various graphics objects for displaying measurements or texts (toolbar on the far right) on a Panel.

Panels are only printed as screen copies (with pixel resolution). The section between the list of available Panels and the lower status line is copied, appropriately scaled if required, and the dialog for selecting a printer displayed.

Panels and *Print pages* are numbered incrementally and there is no dedicated counting method just for Panels or just for Print pages, but you can issue names for better identification. The Scope and Floating panels use their own numbering, but can be renamed.

15.30 Placeholders

See also Standard folders.

You can use placeholders at various points:

- With the DAQ jobs in path and file names.
- With the limit value and event monitoring in path and file names for the log file.
- With files for video recordings in path and file names.

- With the limit value and event monitoring in the email subject and in the email message.
- In titles for graphs.

During the execution of an action the placeholders are then replaced by the actual texts, e.g. the date or time inserted in the file names, a measurement in the log file or in an email message.

Not all placeholders are possible at all places; this is indicated in the following overview.

Placeholders	Explanation
%ProjectDir%	Uses the path from which the project was loaded or where the current project was last saved. The last action determines the name. If no project has been loaded or saved since starting ..., you are prompted to give the project a path and file name when starting the DAQ job. The current project is saved when you do so.
%TestFile%	Path and file name of the file with the measurement data are inserted. This placeholder is only available for the path and file name of a video recording and is supplemented in the default setting with the name of the camera (%Camera%). You can also use the placeholder as a graph title.
%TestFileName%	File name of the file with the measurement data are inserted. You can use the placeholder as a graph title for example.
%Camera%	The name of the current camera is inserted. This placeholder is only available for the file name of a video recording.
%Job%	The name of the current DAQ job is inserted.
%DateTime%	Year, month, day, hour, minute and second are each linked with _ and inserted as double-figure numbers.
%yy%	The current year number is inserted as a double-figure number (the last two places).
%mm%	The current month is inserted as a double-figure number.
%dd%	The current day is inserted as a double-figure number.

%h%	The current hour is inserted (single or double-figure).
%m%	The current minute is inserted (single or double-figure).
%s%	The current second is inserted (single or double-figure).
%hhmmss%	The hours, minutes and seconds are each linked with _ and inserted as double-figure numbers.
%00% and %000%	Generates a counter with two or three digits, i.e. with leading zeros. Every time you save the counter is incremented by one; the start value is 01 or 001. The count is saved when you exit catman, and is also used the next time catman starts if you specify one of the counter placeholders in the file name. The count is saved system-wide (per PC), i.e. not separately for each user. Reset the counter with **Counter reset** or the script command `EA_Job.GlobalTestCounter`.
%Event%	The name of the event or limit value is inserted. This place-holder is only practicable with limit value and event mon-itoring.
%EventChannel%	The name of the channel is inserted which has triggered the event. This placeholder is only available with limit value and event monitoring.
%MV_<Channel_Name>%	The current measured value of the specified channel is inser-ted. Replace the <Channel_Name> by the name of the channel whose measured value is to be used. This placeholder is only available with limit value and event monitoring.
%UN_<Channel_Name>%	The current unit of the specified channel is inserted. Replace the <Channel_Name> by the name of the channel whose unit is to be used. This placeholder is only available with limit value and event monitoring.
Test parameters	Test parameters can also be inserted; for this, use the name of the test parameter, preceded and followed by a %. For example write **%Department%** for the test parameter Depart-ment.

☞ No equal signs ("=") may occur in the *Name* of a test parameter. On the other hand, it is allowed in the *Value*.

Example of an email text

In the channel Force_le_top the limit value of 85 N was exceeded by 10:13, and in this case 93.3128 N was recorded in the channel Force_ri_top. In order to retain this entry (the event is triggered by exceeding 85 N in the channel Force_le_top), enter the following in the field for the email text:

In the channel %EventChannel% the limit value of 85 N was exceeded by %h%:%m%, and in this case %MV_Force_ri_top% %UN_Force_ri_top% was recorded in the channel Force_ri_top.

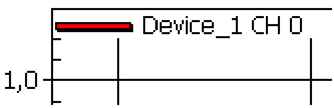
Example of file name

C:\Data\Force measurements\2012_12_06\Job1_John_11_27_18.bin. To obtain this file name when the DAQ job has the name **Job1** and the test parameters **Operator** (**John**) and **Test_type** (**Force measurements**) exist, enter the following into the field for the file name:

C:\data\%test_type%\20%yy%_%mm%_%dd%\%Job%_%operator%_hhmmss%

15.31 Plot legend

The plot legend displays the color, style and name of a plot. It is located at the top edge of a graph:



Left-click on the plot legend to move a plot into a new axis layer (axis scaling).

15.32 Print page

See also Panels and Print pages, visualizations

This is a window for arranging pages which are to be printed out. Use the bar above the print page to browse if you have created several Panels or print pages. The page has the page format (portrait/landscape) set in the configuration dialog. Since Print pages are first printed out after a measurement, it is not practicable to use real-time displays. The selection of these objects is therefore rejected with an appropriate message.

For each page you can specify different header and footer lines or define a different page format.

☞ *Panels* and Print pages are numbered incrementally and there is no dedicated counting method just for Panels or just for Print pages, but you can issue names for better identification. The Scope and Floating panels use their own numbering, but can be renamed.

15.33 PTP

The **P**recision **T**ime **P**rotocol (PTP) is a network protocol that handles the synchronization of devices in a (local) Ethernet network. There can be a special time server in the network, but also all devices can "communicate" with each other, and use the best as the Sync leader. Devices can therefore be both Sync follower and Sync leader. PTP is usually implemented in hardware, such as in the newer QuantumX modules with B and C functionality, and SomatXR modules, thereby achieving very high accuracy. The time deviation is smaller than with *NTP*, and is less than 1 µs (MGCplus with CP52: 10 µs). PTP is defined in IEEE 1588 and BS IEC 61588.

⚠ The protocol requires special Ethernet switches, and QuantumX modules with B or C functionality or SomatXR modules.

A PTP time server can be configured on the network in order to use the PTP time format. This is not essential, however, because in this mode even without a PTP time server the devices exchange times with each other and synchronize to the "best" module (Grandleader Clock).

15.34 Regular expression

This section provides a brief introduction to regular expressions, with examples. Further information can also be found on numerous Internet websites. Note, however, that all functions that allow you to replace text, for example, are not available in catman, as only search criteria can be used.

A regular expression in effect depicts a search pattern. There are some special characters that are used to control settings, and consequently must be entered in a specific way if you want to search for them. The most important of them is the backslash \. So to search for it you have to enter \\. This is also referred to as an escape sequence. In conjunction with the backslash, there are a number of special escape sequences that you can use to control your search; see table.

If you are using regular expressions for the first time, you should be aware that formulating them is not easy. You can certainly generate quite complicated searches. But sometimes the results can be rather surprising—at least initially—and not as you first thought. If that happens, try to find results with part of your search text first, and add more parts subsequently.

Control codes of importance for searching

<table>
<tr><th>Control code</th><th>Meaning</th></tr>
<tr><td>( )</td><td>Groups a search input</td></tr>
<tr><td>[ ]</td><td>Allows you to specify multiple characters that are, or may be, contained in the text you are searching for (depends on the expression after the bracket).</td></tr>
<tr><td>[^]</td><td>Finds everything except the characters in brackets after the ^.</td></tr>
<tr><td>{n}</td><td>Corresponds to the previous element exactly n times.</td></tr>
<tr><td>{n,}</td><td>Corresponds to the previous element at least n times.</td></tr>
<tr><td>{n, m}</td><td>Corresponds to the preceding element at least n times, but no more than m times.</td></tr>
<tr><td>?</td><td>Corresponds to the previous element not at all or once.</td></tr>
<tr><td>*</td><td>Corresponds to the previous element not at all or more than once.</td></tr>
<tr><td>+</td><td>Corresponds to the previous element once or more than once.</td></tr>
<tr><td>|</td><td>Corresponds to any element separated by a vertical line, i.e. an OR operation logically linking multiple elements.</td></tr>
<tr><td>.</td><td>The dot corresponds to any character.</td></tr>
<tr><td>\r</td><td>Corresponds to a carriage return, i.e. Return or Enter (CR).</td></tr>
<tr><td>\n</td><td>Corresponds to a line feed. In Windows \r\n is usually used (CR+LF).</td></tr>
<tr><td>\w</td><td>Corresponds to any alphanumeric character. Corresponds to [a-zA-Z_0-9].</td></tr>
<tr><td>W</td><td>Corresponds to any character that is not an alphanumeric character.</td></tr>
</table>

Control code	Meaning
\s	Corresponds to any blank (space).
\S	Corresponds to any non-blank character.
\d	Corresponds to any decimal digit.
\D	Corresponds to any character that is not a decimal digit.
^	The match must start at the beginning of the string.
$	The match must be at the end of the string or before \n at the end of the string.

Examples

<table>
<tr><th>Regular expression</th><th>What is found?</th></tr>
<tr><td>hallo</td><td>Finds all texts that contain “hallo”, including in composites.</td></tr>
<tr><td>a|b</td><td>Corresponds to a or b.</td></tr>
<tr><td>gray|grey</td><td>Finds gray and grey.</td></tr>
<tr><td>[a-z]</td><td>Finds everything with the lower case letters from a to z.</td></tr>
<tr><td>[A-Za-z]{5}[0-5]{1,2}</td><td>Finds a word with 5 ASCII letters (upper or lower case) and 1 or 2 digits from the range 0 to 5 after it (without spaces). If you want to search for umlauts, you must specify them likewise, e.g. [a-zäöü].</td></tr>
<tr><td>[^abc]</td><td>Finds everything except a, b and c.</td></tr>
<tr><td>gr(a|e)y</td><td>Also finds gray and grey.</td></tr>
<tr><td>b[aeiou]bble</td><td>Finds babble, bebble, bibble, bobble and bubble.</td></tr>
<tr><td>[b-chm-pP]at|ot</td><td>Finds bat, cat, hat, mat, nat, oat, pat, Pat and ot.</td></tr>
<tr><td>colou?r</td><td>Finds color and colour.</td></tr>
<tr><td>rege(x(es)?|xps?)</td><td>Finds regex, regexes, regexp and regexps.</td></tr>
<tr><td>go*gle</td><td>Finds ggle, gogle, google, gooogle, goooogle, …</td></tr>
</table>

Regular expression	What is found?
go+gle	Finds google, googoogle, googoogoogle, googoogoogoogle, ...
g(oog)+	Finds google, googoogle, googoogoogle, googoogoogoogle, ...
z{3}	Finds zzz.
z{3,6}	Finds zzz, zzzz, zzzzz and zzzzzz.
[Bb]rainf**k	Finds Brainf**k and brainf**k.
1\d{10}	Finds an 11-digit number starting with 1.
[2-9]|[12]\d|3[0-6]	Finds a number in the range 2 ... 36 (inclusive): the terms are logically OR-linked. The first term finds the numbers from 2 to 9, the second term finds all numbers that start with 1 or 2 and have an additional digit, i.e. 10 ... 29, and the third term finds all numbers that start with 3 and have as their second digit a number between 0 and 6, i.e. 30 ... 36.
[a-zA-Z]{3,}\d{1}	Finds all instances where a word with 3 letters and 1 number occurs.
\d+(\.\d\d)?	Finds a positive integer or a floating-point number with exactly 2 digits after the decimal point.
^time	Finds all instances beginning with "time".
rate$	Finds all instances ending with "rate".
^dog$	Finds all instances beginning with exactly "dog" as text (and nothing else).

15.35 Sample-rate domain

Sample-rate domain denotes the lists available for the sample rates for newer QuantumX modules with B or C functionality, and SomatXR modules.

Classic sample-rate domain

This is the gradation of sample rates used up to now in all HBM devices, derived from the amplifier carrier frequencies. For the MX modules, sample rates of ... 20, 25, 50, 75, 100, 200, 300, 600, 1200, 2400, 4800, 9600, 19,200, 48,000, 96,000 and 192,000 Hz are available, provided they are supported by the module. Particularly at the higher sample rates, the gradation with a portion or multiple of 4.8 kHz, the standard carrier frequency, is notable.

Decimal sample-rate domain

These sample rates are only available for newer QuantumX modules (B and C functionality), and SomatXR modules. The sample rates are useful, for example, when MX modules are used together with other devices that use such a sample rate gradation. For the MX modules, sample rates of ... 20, 50, 100, 200, 500, 600, 1000, 2000, 2500, 5000, 10,000, 20,000, 25,000, 50,000, 100,000 and 200,000 Hz are available here, provided they are supported by the module.

15.36 Sample rate

See also *Alias*, Filter (automatic filter selection), Which sample rate is the right one?

The sample rate is the speed at which the measured values are delivered *from the measuring instrument to the PC*. If not all data recorded by the measuring instrument (sample rate of the A/D converter) is also passed on to the PC, the same effect as with undersampling can occur (measured values are omitted).

15.37 Sensitivity

Another way of stating a *characteristic value* for a transducer, e.g. 0.05047 mV at 10 V *excitation voltage* and 1 bar with a nominal load of 500 bar. This corresponds to a value of 0.005047 mV/V at 1 bar or a characteristic value of 2.5235 mV/V (for 500 bar).

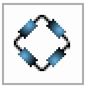
15.38 Sensor database component window

See also Using CAN signals, Help on the sensor database (in the **Help** menu on the right above the ribbon).

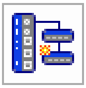
The **Sensor database** component window is only displayed with the **DAQ channels** and **Signal plan** tabs. If it has been hidden, restore it with **Window ► Sensor database** (on the right above the ribbon).

Depending on the selected symbol, only certain sensors or all sensors are displayed:

 shows the sensors you have created (“My sensors” group).

 shows general sensor types like DC voltage, thermocouples, Pt100, optical sensors, etc.

 shows the HBK transducers (HBM and selected sensors from BKSV).

 shows the sensors that can be connected to the marked channel.

 shows the CAN messages and signals in the sensor database.

 shows all the sensors in the sensor database at the bottom of the window.

The upper half of the window shows the groups in the selected range and the lower half shows the list of sensors in the selected group. The list is sorted *alphabetically*.

In addition you have the possibility of configuring the CAN settings, e.g. setting the bit rate (**CAN configuration** context menu of a CAN data base).

Place the cursor over the sensor to view comments on it (if available).

15.39 Sensor ID

See also Program options: Sensors (**Channels and sensors** group).

The sensor ID is used both for the unique identification string for a sensor in the Sensor database and for the world-wide unique series number of a TEDS or T-ID module.

When a device connection is established, the sensor ID of a T-ID module is read and a search is made in the Sensor database. If the Sensor database from which the sensor was assigned no longer matches that of catman the sensor ID will not be found. Then either redefine the sensor (copy the sensor ID using the context menu) or import the sensor from the other Sensor database.

☞ The sensor ID of a T-ID module need not necessarily be imported into the Sensor database. In this case, ignore the message that the sensor ID was not found in the Sensor database.

15.40 Sensor scan

ℹ See also Execute sensor scan after device connection (Device search options) as well as the program option Sensors (**Channels and sensors** group) **After loading a DAQ project**: **Execute sensor scan** and **Use sensor description as channel name**.

☞ This option is only relevant when using sensors with *TEDS* or *T-ID*.

You can carry out the sensor scan manually (**DAQ channels** tab, **TEDS scan** in the **Sensor** group or **Sensor scan** context menu) or automatically when you create or load a DAQ job. Here, provided the measurement device supports TEDS, all transducers with TEDS or T-ID module are detected. Channels for transducers with TEDS modules with be adjusted immediately, a search will be made in the Sensor database for the sensor ID of transducers with T-ID and, if available, the channel will also be adjusted.

Depending on the settings under the sensor options, you can also set the channels names to the channel name saved in the TEDS (template HBM Channel Name) or—for T-ID modules—set them to the sensor description saved in the Sensor database (**Sensor description as channel name**).

⚠ If a sensor scan is initiated manually later, changes of channel names will not be transferred, i.e. computations still use the old channel names and will therefore not be executed.

15.41 Shortcut

Function key, e.g. F1, a single key, e.g. 2 or a key combination, e.g. Ctrl+⇧+P. You can define shortcuts at various points in catman:

- Start a certain DAQ job; refer to Specify job parameters.
- Change to a certain tab, Panel, etc.; refer to Program options: Shortcut.
- Executing the function assigned to a button; refer to Configure button.

15.42 Switch

A switch (Ethernet switch) is a network component which facilitates the connection of several devices in an Ethernet network. It ensures that data do not randomly reach all the devices in the network, but rather are sent directly from the source address to the destination address. Since network devices can operate with different speeds for data transfer, many switches have the possibility of individually defining the speed on each connector. This can occur either automatically or—with so-called Managed Switches—be determined manually.

In some cases it can occur that the speed may not be correctly detected or is frequently repeated unnecessarily. The data transfer is then at least erroneous and consequently very slow or it is not even established. With problems in the communication with MGCplus or QuantumX/SomatXR set your switch to 100 Mbits Full Duplex.

15.43 T-ID

Transducer **Id**entification. The T-ID module consists of a chip that contains a globally unique number, and is usually mounted at the sensor or in the connector housing. In a *sensor scan* the number is read, e.g. from the QuantumX/SomatXR module or MGCplus (here only for connection boards with the identifier i). The number can be compared against the entries in a sensor database on the PC. If the number is in the sensor database, the corresponding settings are transferred to the channel during initialization. Otherwise no settings are made and an error message “T-ID not found” is displayed.

15.44 TEDS

Transducer **E**lectronic **D**ata **S**heet. The TEDS module consists of a chip which contains an internationally unique number, and is generally fitted in the transducer. This chip holds the complete transducer data according to the standard IEEE 1451.4. During a *Sensor scan* e.g. by a QuantumX/SomatXR module or an MGCplus (here only with connection boards with the identifier i), the data is read out and the measuring amplifier set appropriately.

☞ Special scaling, such as tabular scaling or polynomial scaling, is only accepted when the measurement device supports this scaling. Otherwise just 2-point scaling is applied. In case of doubt check whether your device supports special scalings. For example, not all QuantumX/SomatXR modules support polynomial scaling; on MGCplus only the ML38 supports it and the DMP41 does not support any polynomial scaling. If necessary, transfer the TEDS data into the Sensor database and set the sensor appropriately, because catman can accept such scaling.

Using **Sensor ► Edit sensor** in the **Sensor** group (**DAQ channels** tab), you can edit the TEDS data for transducers with a TEDS module.

The following data from the Sensor database can be accepted into a TEDS module (depending on the transducer type, not all entries may be used):

- Name/Description
- Serial number
- Type/model (for HBM sensors only)
- Manufacturer (only when the manufacturer is listed)
- Calibration date
- Validity of calibration
- Transducer type (SG full bridge, frequency F1, etc.)
- Excitation voltage
- Bridge resistance
- Type of characteristic curve (Zero—Span, two-point, table, etc.)
- Rated outputs and table of calibration values

15.45 UDP

UDP (**U**ser **D**atagram **P**rotocol) is a minimal network protocol which is substantially more simply structured than that used for a network based on TCP/IP. So-called ports are used to make data available. A port corresponds in this case to an address, but there are only about 65000 addresses of which some are already taken up by standard functions.

QuantumX/SomatXR modules, PMX, DMP41 and MGCplus with CP52 use UDP in order to be recognized in the network, even when the IP address is not (yet) known. The function is triggered by the PC on searching the network for the devices. Since the port is known, the method finds the devices very quickly.

Depending on the devices connected, open the following ports:

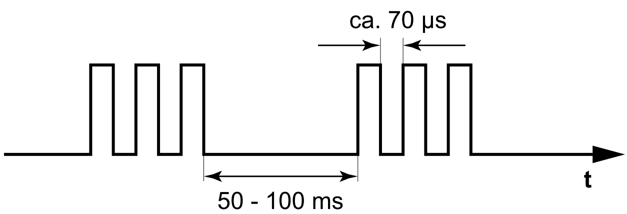
- QuantumX/SomatXR: TCP ports 80, 5001 and 7411, UDP for ports 1200, 1201, UDP-Multicast for ports 1300, 1301, 31 416 and 31 417, for the CX27 the TCP ports as from 50 000,
- MGCplus with CP22/42: TCP port 7 (no UDP or multicast present), MGCplus with CP52: TCP ports 7 and 80, UDP-Multicast for ports 31 416 and 31 417,

- DMP41: TCP port 1234, UDP-Multicast for ports 31 416 and 31 417,
- PMX: TCP port 55 000, UDP-Multicast for ports 31 416 and 31 417,
- FS22 BraggMETER: TCP ports 3500 and 3365,
- Kistler System 2000: UDP for ports 8888 and 8889,
- Kistler KiRoad: TCP ports 6155 and 6158, UDP for port 6156.

UDP is however not suitable for the reliable data transfer of readings (data can be lost).

15.46 UDP output rate

UDP packets are sent approx. every 50 to 100 ms. This occurs once all measurements from all channels have been read in, i.e. after the retrieval of a read block. The actual data can be output on an interval of approx. 70 µs.



15.47 UUID

The UUID (**U**niversally **U**nique **ID**entifier) is a unique number for a QuantumX/SomatXR module which can also be determined via an interface command. It is identical to the serial number and is stated on each module. Generally, the hexadecimal notation is used instead of decimal, so that the identification also contains the letters A to F.

15.48 Vector CANdb (CAN database)

The CAN database from Vector Informatik GmbH has been defined by leading European automotive manufacturers as the standard for the acquisition of devices in internal CAN data communications in cars. It contains a list with the symbolic names and the settings of all CAN devices which may be relevant to data acquisition. In the current version of the sensor database you can import the classic Vector CANdb formats as well as the ARMXL formats (version 3.2.3 and 4.2.2). These versions cannot be loaded into the MGCplus.

MGCplus

A Vector CANdb present in the ML71 is displayed in the *Sensor database component window*. Using the **CAN configuration** context menu for the entry of **CAN databases**, you can also load a new Vector CANdb into the ML71.

See also Loading a CAN database.

Further information can be found in the help for MGCplus Assistant in section ML71, CAN bus plug-in.

QuantumX/SomatXR

Import your CANdb into the Sensor database. Then assign CAN signals just like analog sensors.

15.49 Zero balance

See also *Zero value*, Program options: Zero balancing (**Channels and sensors** group).

The function can be locked with password protection, refer to Sensor options, Password protection.

in the ribbon of the **DAQ channels** tab sets the output signals of all marked channels to zero. The values determined during zero balancing are deducted from all subsequent measured values as the *zero balance value*. A different process is used depending on the measuring device:

- QuantumX/SomatXR
  The zero balancing is always carried out in the device.
  With QuantumX MXFS, the zero value is only computed with the scaled values of a sensor adaptation, not with the display of a wavelength.
- MGCplus
  Taring is carried out for channels with sensors and linear characteristic. For sensors that use special characteristics or characteristic corrections, the zero balancing is carried out in catman (software zero). In all other cases, zero balancing is used in the MGCplus, for example, sensors that measure using the electrical base unit (µm/m, ohms or mA).

  With MGCplus, the *net signals* are *always* measured by catman. Measurement of more than one signal simultaneously (for example gross and net) is not supported.

- Computation channels
  The zero balance is carried out in catman (software zero). Current measured value samples are collected from *all* device channels beforehand however. A check of which channels are included in a particular computation is not carried out here.

You can prevent the zero balancing of a channel via catman by selecting **Lock** for the channel (click on the arrow in **Execute** in the **Zero balancing** group).

The lock is not set in the device, only zeroing via catman is prevented.

Use the menu item **Zero balance all hardware channels** in the **Zero balance** group to set all the (not locked) hardware channels of the connected devices to zero.

15.50 Zero value

See also *Zero balancing*.

The output signal of the transducer under no load. Except for absolute pressure transducers, you can use this value with all resistive transducers (sensors with strain gages) to check for transducer overload: If the zero value of the transducer has changed substantially compared to the zero value on shipping (by about 1 to 5%, depending on the quality of the transducer), there is most likely mechanical damage, meaning the transducer is defective. The value has no practical significance beyond this, because after installation of the transducer there is usually a completely different zero value. That value is eliminated by *zero balancing* the channel.

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