ProfiMessage

HARDWARE MANUAL

ProfiMessage – Installation and start-up



Delphin Technology

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1 Introduction

Dear User,

Thank you for purchasing a device from the **ProfiMessage** series. With this device you have acquired a high quality product with extensive options for data acquisition and processing.

This manual is included in the delivery. Always keep the manual available for reference. To avoid any damage occurring to yourself or your equipment, carefully follow the guidance and safety precautions given in this manual. If your equipment has a problem that this manual does not address, please contact us.

This manual is intended for technicians and engineers or similarly qualified persons wishing to use the device.

If you find errors in the product or in this documentation, or if you have any suggestions for its improvement, we welcome your feedback.

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1.1 Safety advice

WARNING!

Connecting terminals carry electrical potential from the attached sensors/actuators.

Before coming into contact with the connections, ensure the power is off. Check for any voltages at the connecting terminals when the attached sensors have varying degrees of electrical potential or when they have high electrical potentials with earthing, for example, when measuring electrical current for a mains voltage phase.

See also
Potential differences. See also "Potential differences" on page 242.

Installing modules, memory card or battery



Electronic components are sensitive to ESD (**E**lectro-**S**tatic **D**ischarge). Therefore, discharge any electrostatic energy before opening the device, for example to install an I/O module or to replace the integrated memory card. We recommend wearing an anti-static wrist band (static discharge wrist band) and to carry out the work on a conductive surface.

ESD damage can have a number of effects, from deviation in individual specifications to total device failure.

1.2 System requirements

To ensure trouble-free operation of the **Delphin** products, ensure that the hardware requirements listed below are met.

- Operating system
  Microsoft Windows Vista, Windows 7, Windows 8, Windows 10 and Windows Server 2008 R2 in 32-bit or 64-bit versions, each in either English or German editions.
  We recommend using a 64-bit version.
- Main memory
  At least 2 GB;
  Recommended: 3 GB for 32-bit systems, 8 GB for 64 bit systems
- Screen
  Resolution at least 1024×768 pixels, 96 DPI fixed font size (100%)
- CPU
  At least one PC with 2 GHz class dual core processor
  Recommended: System with quad core processor from 3 GHz
- Hard disk
  For ProfiSignal-Go at least 150 MB free hard disk space
  For ProfiSignal-Viewer at least 150 MB free hard disk space
  For ProfiSignal-Klicks at least 1000 MB free hard disk space
  For other ProfiSignal versions, at least 500 MB free hard disk space

1.3 Symbols used

To make reading this help easier for you, we use the following symbols:

To make reading this manual easier for you, we use the following symbols:





Indicates important information.

Info

Refers to a special option or explains an interesting feature.

We use italics to emphasise individual terms in the text. We also highlight keyboard inputs to be made by you. We have highlighted the menus used in the program in grey, the arrows indicate the corresponding submenus to be called: Connect → Add Delphin device. Titles of dialogue boxes, all buttons, and checkboxes, and input field names, and so on, are also highlighted in grey and additionally identified using italics: *Display status*. User inputs are in most cases illustrated with examples and highlighted in yellow: Use *192.168.251.252* as the IP address.

We hope that this helps you to more quickly identify the corresponding fields, buttons, and menus, and to locate these in the program.

Device labelling

CE

CE symbol: The CE symbol guarantees that our products meet the requirements of relevant EU directives.

1.4 Included in delivery:

Included in delivery:

- **ProfiMessage** device
- Three-pin plug with 120-ohm resistor (for connection of slave devices via ext. BUS)
- Connector for power supply
- Brackets for rail mountings
- Ethernet crossover cable
- RS-232 connection cable with D-Sub-D89 connectors
- CAN bus terminating resistor
- DVD of the software **ProfiSignal**

2 Getting started

This section outlines:

- How to establish a connection between a PC and the device.
- The settings required to acquire measurement signals from the device.

For detailed information see these Sections:

- The Section **ProfiMessage** displays and connections gives you an overview of all the interfaces/connections/ports and LEDs.
- The Section Configuration and operation explains the different options for setting up the device for measurement tasks. The Section describes specific settings for **ProfiMessage** devices. The available settings for all devices are available under Common device settings.
  See also Configuration and operation.
- The Section on Examples of connections shows you the options for connecting standard sensors and actuators and how to configure them.
- The Section on Measurement technology notescontains general information and recommendations on applying measurement technology.
- Technical data is available in the Section on Technical specifications.

2.1 Installing the programs



You need administrator rights to install the program.

Install the DVD **ProfiSignal**. During the installation, ensure that you install the *DataService Configurator* as a program (and not as a service).

After default installation you will find both of these symbols on your desktop:



The program works DataService Configurator from **Delphin** as a link between the PC and the measuring hardware. All devices are immediately configured in DataService Configurator.

The ProfiSignal program evaluates and displays measurement data.

Note for administrators

For the connection between PC and the device, you must enable at least ports 80 and 1033.

2.2 PC connection

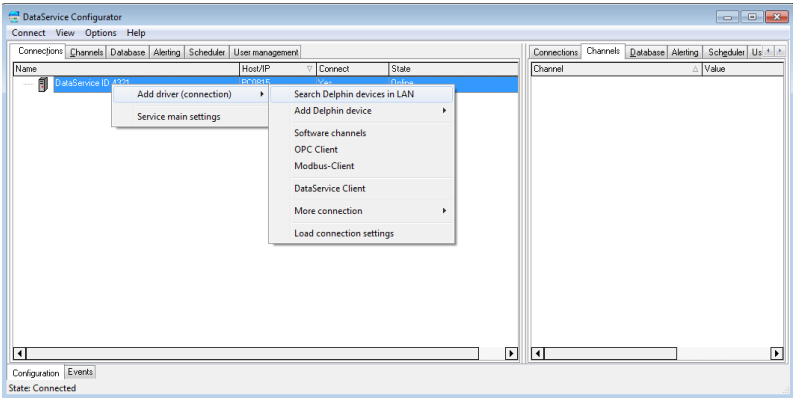
For the connection between PC and the device, you must enable ports 80 and 1033. If you use Windows firewall, you may see a warning message when you add the connection, and a user with administrator rights will need to authorise the connection.
See also XML network configuration template, LAN connection

Preparing the device to PC connection

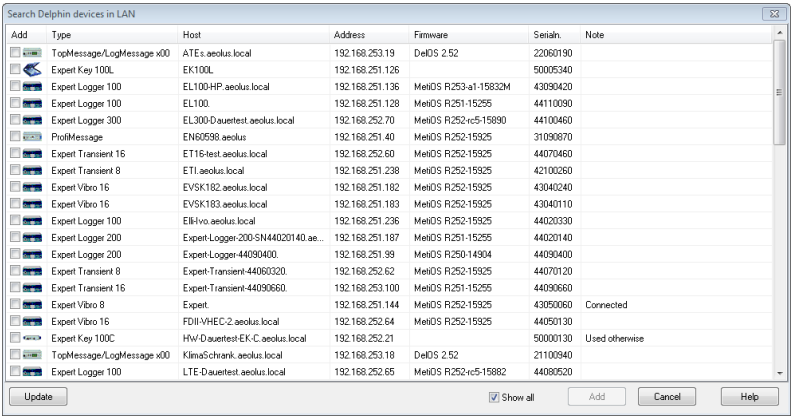
- Connect your PC and the device using the Ethernet crossover cable supplied. Alternatively you can connect the device and PC also via a network hub or switch.

Establish device connection

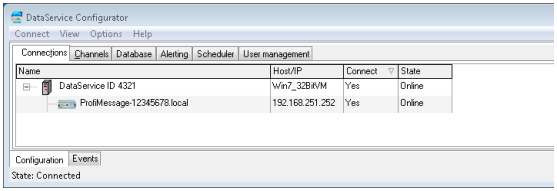
1. Start the DataService Configurator program, to create the connection and make the configuration.
   The DataService starts and the Connections tab is displayed on the left-hand side in the DataService Configurator.
2. Via the menu item Connect→ Find Delphin device on LAN. Also, as shown in the image, you can use the Add driver (connection) context menu in the DataService entry on the left of the window.



3. The device search takes place and a dialogue with the found device(s) is displayed.

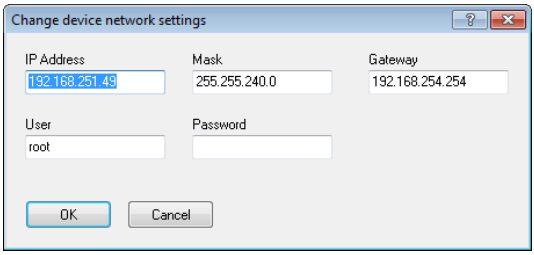


4. In the *Add* column, enable the device or devices that you want to connect to. Then click *Add*.
   If the device IP address does not correspond with that of your PC, you must first assign a different network address. If no devices are found, for example, if the scan required for searching (port 16555) is not permitted in the network, you can either try a direct connection with your PC (with no network) or the method described below for direct connection with PC and fixed address.
5. If the device's User management is enabled, another dialogue opens. Here, under username and password, enter your login data.
   The successful connection is then displayed with IP address and status. The information in the DataService... line, Host/IP column is the hostname or IP address of your
6. PC.



Set different network address

If the device IP address does not correspond with that of your PC, after a device search you will be able to change the address, before you connect to the device:



Enter a suitable IP address corresponding to your PC IP address (similar but not the same) and subnet mask. For a new device, use the *root* user, username and password are then only relevant if you have enabled User management on the device. Enter the required data and click *OK*. The settings are saved and you will need to carry out a new search (click on *Update*).

Alternatively you can also change the IP address using the touch display: click on Network and then on the number to be changed. Using the keys above or below the numbers, you can increase or decrease the displayed numbers.

A third option is configuration via any Internet browser:

1. Launch your Internet browser and in the address bar enter *http://* and the current device address, for example *http://192.168.251.252*.
   The device connection is established and the home page is shown.
2. In the *Settings* section, click on *Network*.
   The page with the network settings is displayed.
3. Enter the desired new address for your network in *IP address*. You can also specify subnet mask and gateway or DNS and NTP servers, refer also to Configuration via an Internet browser.
4. Finally click on*Save* to save your settings.

Direct connection with PC and fixed address

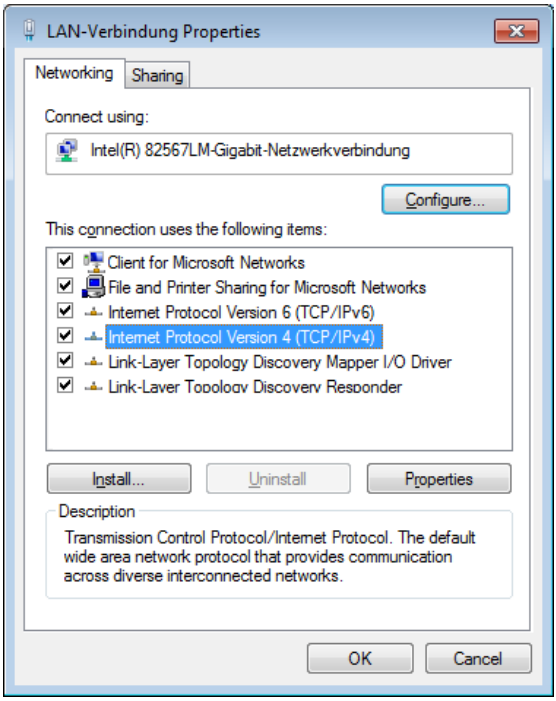
If your network does not allow scanning (port 16555 not enabled), then the DataService Configurator cannot find the device. In this case you will need to establish a direct connection between the PC and device, and set the PC to the device address range in order to be able to make a connection. While you have a connection, you can set your device address to one that is suitable for your network, as described above. Ports 80 (connection via web browser) and/or 1033 (connection via DataService Configurator) must be enabled for the TCP protocol.

The **Delphin** device IP address is identified at the factory with a sticker. If the sticker has been lost during transport and can no longer be found,

please search for it using IP address 192.168.251.252 (net mask: 255.255.240.0).

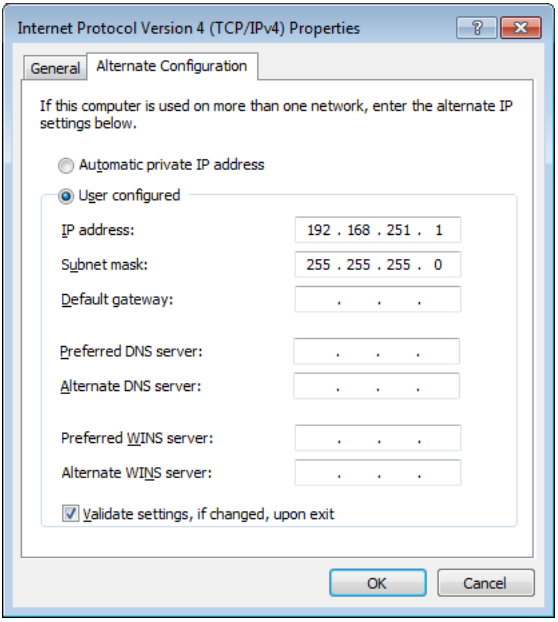
(Temporarily) set your PC to a different address in the same IP segment:

1. Open the dialogue for your network connections.
2. Depending on the operating system, open the dialogue either via the Windows Start button and Network settings or via the Control Panel and Network and Sharing Center.
3. Display the connection (interface) *Properties* via which you want to connect the device (normally called LAN connection). In Windows Vista and in Windows 7, click on *Show status*, and then on *Properties*.
4. Display the Internet protocol *Properties*.



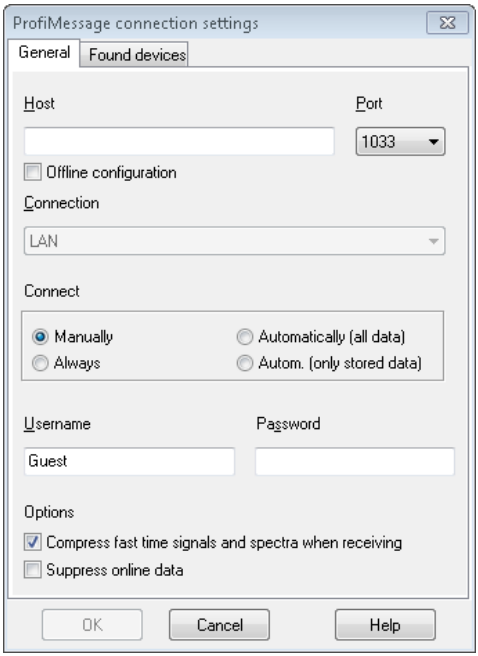
5. In the following dialogue you can either enter a fixed address for your PC or, if the PC is set to DHCP and to be used in the LAN, use the option of specifying an *alternative configuration* for cases where the network (server)

is unavailable (recommended procedure).



6. Enter an address that is within the same segment as the device address (see above figure for an example). Also set the subnet mask.
7. Close the dialogue with *OK*.
   Then try again to make a connection with the device. However, please use the Connect→ Add Delphin device menu to do this, and enter your device type.

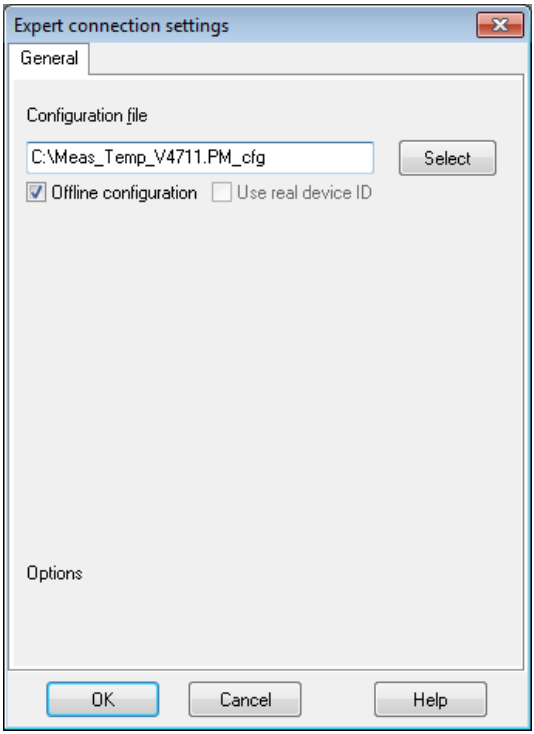
8. Enter the IP address of the device in the dialogue, for example, *192.168.251.252*.

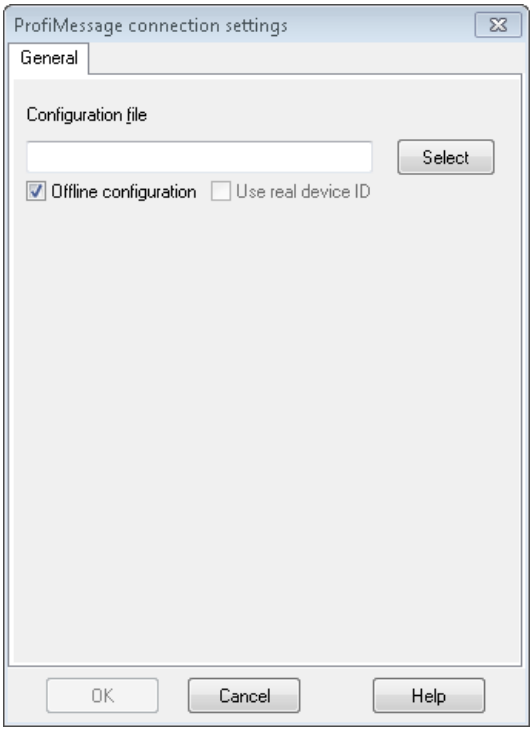


9. If the device's User management is enabled, enter your login data under *Username* and *Password*.
10. For time signals and spectra, you have the option to compress acquired measurement values. Compression reduces memory requirements significantly and comes with losses.
    Note: Compression can cause the min/max characteristic values to not exactly match the time signal or spectrum.
11. Click *OK* to create the connection.
12. While you have a connection, set your device address to an IP address that is suitable for your network, as described above. However do not forget to reset your PC to the original address.

Offline configuration

If you want to work with a saved Configuration offline, select Connect → Add Delphin device and your device type.


Expert connection settings
General
Configuration file
C:\Meas_Temp_V4711.PM_cfg
Select
Offline configuration
Use real device ID
Options
OK
Cancel
Help



Enable *Offline configuration* and enter the path and filename, or click on *Select*, to search for the file.

The configuration file is loaded and the device contained in it is shown in the channel tree as a physically available device.



All changes you make to the configuration are saved directly in the configuration file.



To connect via XML, you must enable port 1035 for TCP (XiMP), and to connect via Web socket you must enable port 1036 for TCP (WiMP).
Refer also to Main settings: services.

2.3 Starting the device

Just a few steps are required to start using the device:

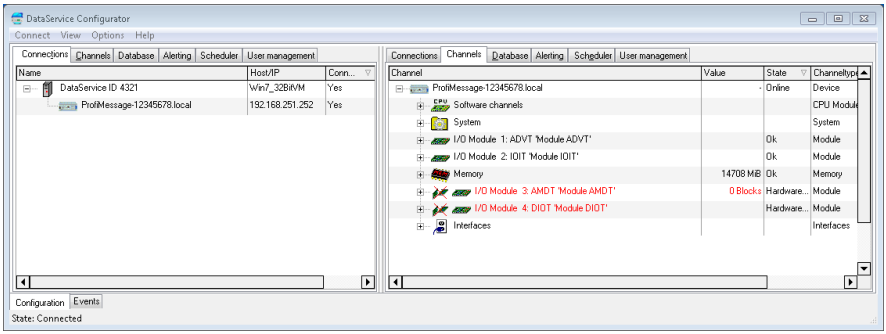
- Unpack the device.
- Plug the three-pinned, grey plug into the socket marked "Power" on the device.
  See also Displays and connections
  The plug is non-interchangeable and polarity-protected and can be inserted into the socket in only one direction.
- Connect the connections + und – of this plug to a power supply with output voltage of 12 … 28 V_{AC} ±10% or 12 … 36 V_{DC} ±10% and with output power of at least 10 W. If you also ordered a power adapter, use it.
  - If the device is fitted with the ADFT I/O module, the input voltage must be at least 18 VAC/DC.
- Connect the power adapter into the mains socket and turn it on.

Refer also to:

- Installing programs
- PC connection
- Basic settings

2.4 Basic settings

The DataService Configurator dialogue is split, enabling a device to be selected on the left in the *Connections* tab and settings to be applied on the right in the *Channels* tab.



Displaying measurement data

Once you have established a connection to the device, you can see the current measured values: double-click your device on the right, then on *I/O Channels* or *I/O module* (for **LogMessage**/**ProfiMessage**) to open the entry and display all available channels or channel groups. If required, click on one of the groups and the on input or output, to view the sub-entry

or sub-entries. The *Value* column continuously updates with new measurement data.

Displaying scaled measurement data

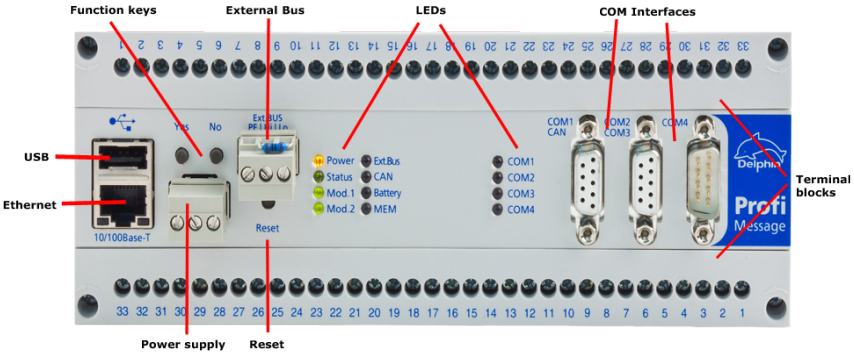
To convert data from the sensor into the required measurement unit requires configuration of the channel. This allows the sensor measurement data to be scaled accordingly or corrected. Right click a channel to display the Properties dialog. A general explanation of dialogs is available under the Settings for all dialogs section. Special settings for different channel types (analogue input, analogue output) can be found in subsections of the Configuring channels (sensors) section, or for ***LogMessage***/***ProfiMessage***/**ProfiMessage D** under Configuring I/O module channels. The dialog also displays connection diagrams. Under I/O module connection terminal blocks, you will find the terminal assignments for the I/O modules of ***LogMessage***, ***ProfiMessage*** or **ProfiMessage D**.

Other settings

- Define digital I/O
  Scaling can also be made for counter inputs. Set which signal (channel) requires output of a constant level.
- Set device-specific settings
  Options are available for system monitoring, e.g. CPU utilization or the available memory, and interface configurations.
- Create computed channels (dependent channels)
  Your **Delphin** device has many options for further processing data before the data is saved or output. The corresponding settings are described in configuring software channels.

3 Displays and connections

ProfiMessage device



Function keys are not currently enabled.

Connections are described in the following Sections:

- Power supply
- LED displays, LAN, USB
- General LED displays
- COM interfaces
- I/O module connections (terminal blocks)
- Connecting slave devices

This section also includes instructions for:

- I/O module installation and removal
- Internal memory card installation
- Internal battery installation

Refer also to Connecting slave devices (Ext. BUS), Device restart (reboot)

3.1 Power supply



Input voltage: 12 … 28V AC ±10% / 12 … 36V DC ±10%

If the device is fitted with the ADFT I/O module, the input voltage must be at least 18 V AC/DC.

Pmax power input: 1_0 W

Pin assignment

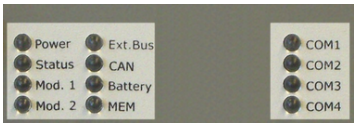
Pin	Label	Description
Left	24V	**Power supply**
Middle	0V	Neutral
Right	PE	Protective Earth, refer to Earthing

3.2 LED displays, LAN, USB



LED	Status	Description
Right	Off	No connection
	Green, permanently on	Connected, data not being transferred
	Green, flashing	Data transfer
Left	Off	Half duplex
	Orange, permanently on	Full duplex
	Orange, flashing	Collision

3.3 General LED displays



LED descriptions

Components	Number of LEDs	Colour	Status/meaning
Power	1	green	Power supply OK
		orange	Hardware failure, e.g. the device connected to the USB port requires too much power
Status	1	red/green	Multifunctional display green flickering: module OK orange flickering: main program has ended (no data acquisition/processing)
Module 1	1	green	Status of I/O module Permanently lit: normal functioning Slow blinking: identification on the bus For ADFT/ADMT: Slow blinking: new firmware being saved Fast blinking: firmware is being downloaded
Module 2	1	green	Status of I/O module
Ext. BUS	1	green	RxD
		orange	TxD
CAN	1	green	RxD
		orange	TxD
Battery	1	red	Battery failure/battery low

Components	Number of LEDs	Colour	Status/meaning
			The battery for the clock and emergency data backup is flat and must be replaced. Refer to Internal battery replacement
MEM	1	green	Access to the internal memory
COM1:	1	green	RxD
		orange	TxD
COM2:	1	green	RxD
		orange	TxD
COM3	1	green	RxD
		orange	TxD
COM4:	1	green	RxD
		orange	TxD

3.4 COM interfaces, CAN

▼COM1/CAN



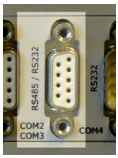
Pin assignment 9-pol. D-SUB connector

Pin	Signal	COM1 RS-485 (IEC 61158) description	CAN (CiA DS102-1) description
Housing	Shield	Shield / protective ground, refer to Earthing	
1	Shield	Shield / protective ground, refer to Earthing	-
2	CANL	-	CAN bus low
3	RxD/TxD-	Receive/transmit data-Plus	-

	P/B	(RS-485)	
4	RTS	Control signal for repeaters (TTL)	-
5	GND/C	Data reference potential/mass	-
6	VP	Supply voltage/Plus (5 V)	-
7	CANH	-	CAN bus high
8	RxD/TxD-N/A	Receive/transmit data-Minus (RS-485)	-
9	-	Not connected	

There is no galvanic isolation between CAN and COM1. CANHL/CANH have an integrated terminating resistor of 120 Ω.

COM2/COM3



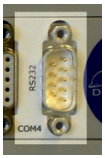
Pin assignment 9-pol. D-SUB connector

Pin	Signal	COM2 RS-485 (IEC 61158) description	COM3 RS-232 description
Housing	Shield	Shield / protective ground, refer to Earthing	
1	Shield	Shield / protective ground, refer to Earthing	
2	RxD	-	Received data (RS-232)
3	RxD/TxD-P/B	Receive/transmit data-Plus (RS-485)	-
4	RTS	Control signal for repeaters (TTL)	-
5	GND/C	Data reference potential/mass	
6	VP	Supply voltage/Plus (5 V)	
7	RTS	-	Request to Send (RS-232)

8	RxD/TxD-N/A	Receive/transmit data-Minus (RS-485)	-
9	TxD	-	Send data (RS-232)

Electrical isolation does not exist between COM2 and COM3.

COM4:



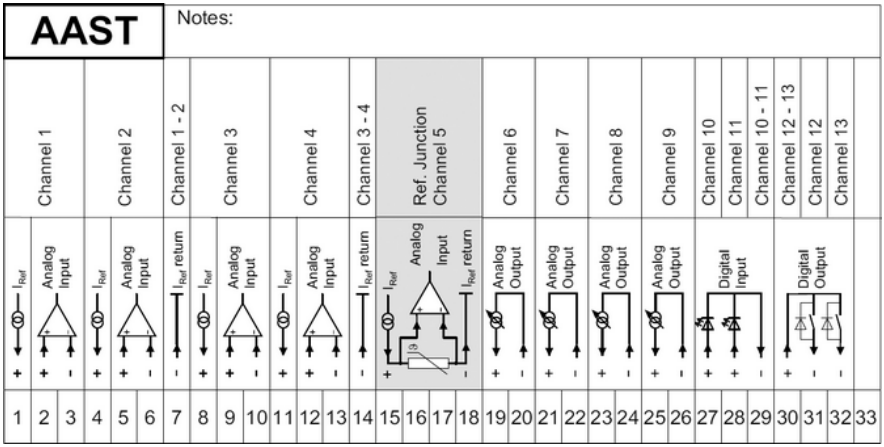
Pin assignment 9-pole Sub-D plug

Pin	Signal	DIN 41 652, part 1 (ISO 4902) description
Housing	Shield	Shield / protective ground, refer to Earthing
1	DCD	Received signal level, Data Carrier Detect (RS-232)
2	RxD	Receive Data (RS-232)
3	TxD	Transmit Data (RS-232)
4	DTR	Data Terminal Ready (RS-232)
5	GND	Signal Ground
6	-	Not connected
7	RTS	Request to Send (RS-232)
8	CTS	Clear to Send (RS-232)
9	-	Not connected

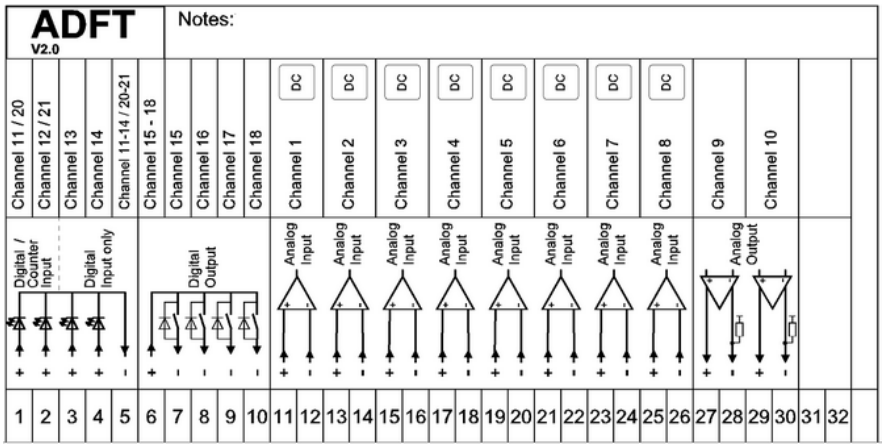
3.5 I/O module connections (terminal blocks)

Devices can be fitted with different modules. Below are the the wiring diagrams/terminal assignments for the various I/O modules.

3.5.1 AAST

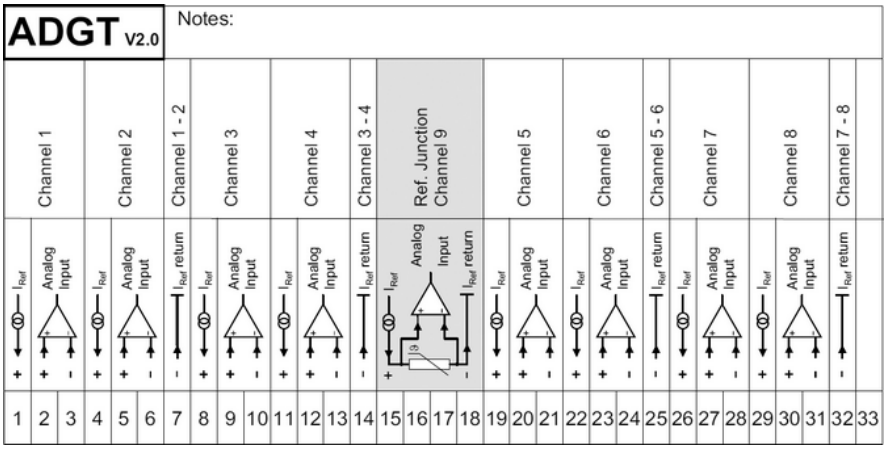


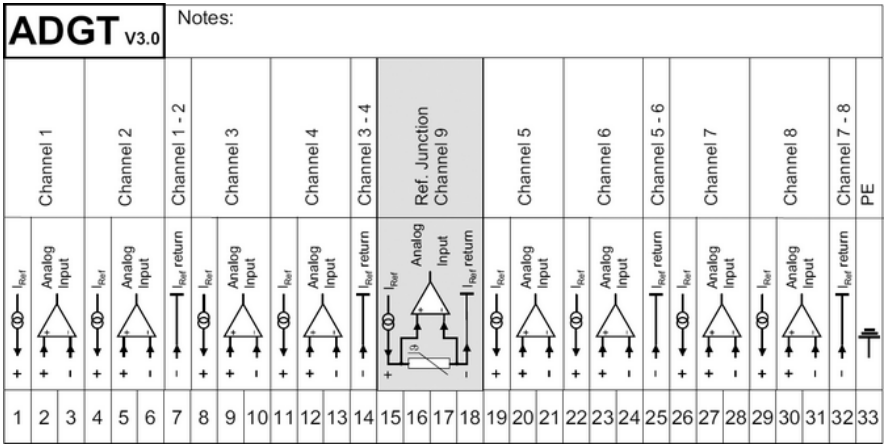
3.5.2 ADFT



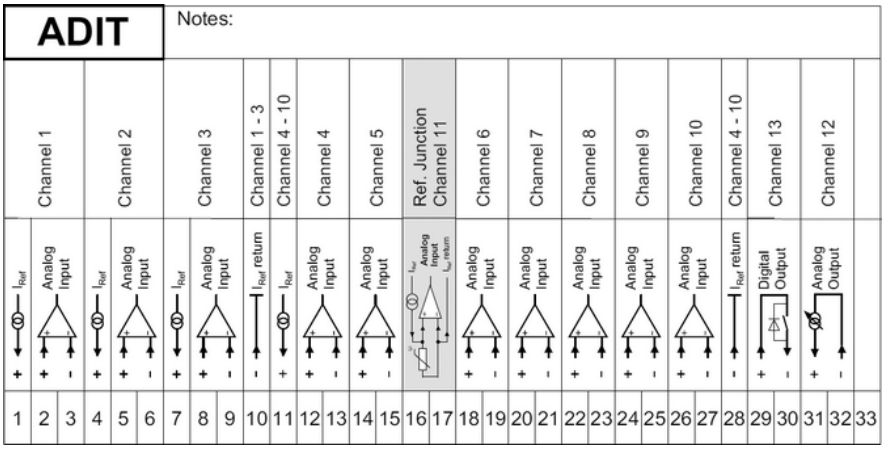
3.5.3 ADGT

Versions 1.0 and 2.0 of the ADGT modules have mechanical switches that enable cyclical selection of individual channels. A faint ticking is therefore audible during operation.

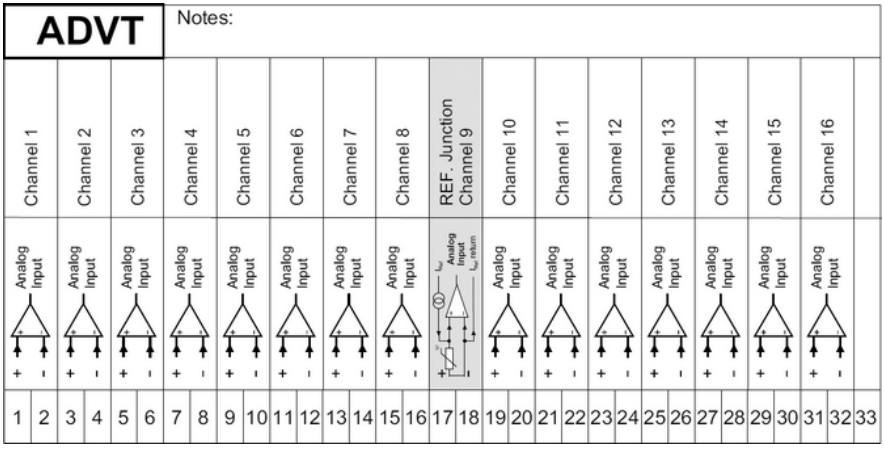

ADGT V2.0
Notes:
Channel 1
Channel 2
Channel 1 - 2
Channel 3
Channel 4
Channel 3 - 4
Ref. Junction Channel 9
Channel 5
Channel 6
Channel 5 - 6
Channel 7
Channel 8
Channel 7 - 8
Analog Input
IRef
IRef return
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33


ADGT V3.0
Notes:
Channel 1
Channel 2
Channel 1 - 2
Channel 3
Channel 4
Channel 3 - 4
Ref. Junction Channel 9
Channel 5
Channel 6
Channel 5 - 6
Channel 7
Channel 8
Channel 7 - 8
PE
Analog Input
IRef
IRef return
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

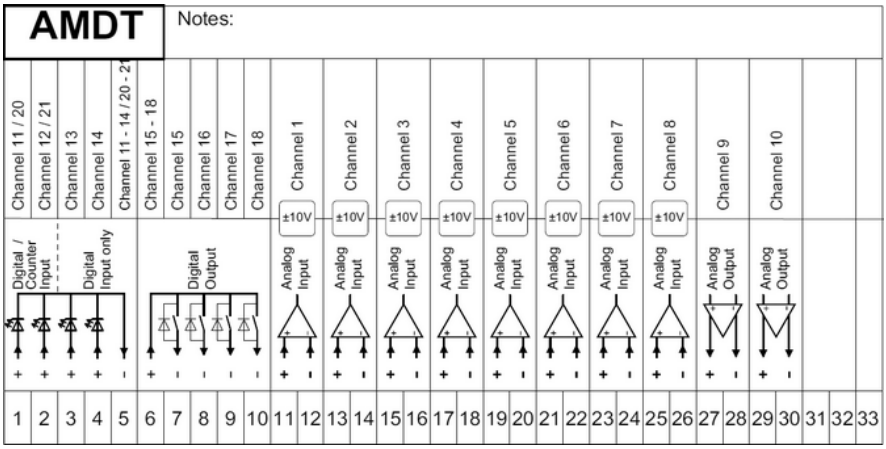
3.5.4 ADIT



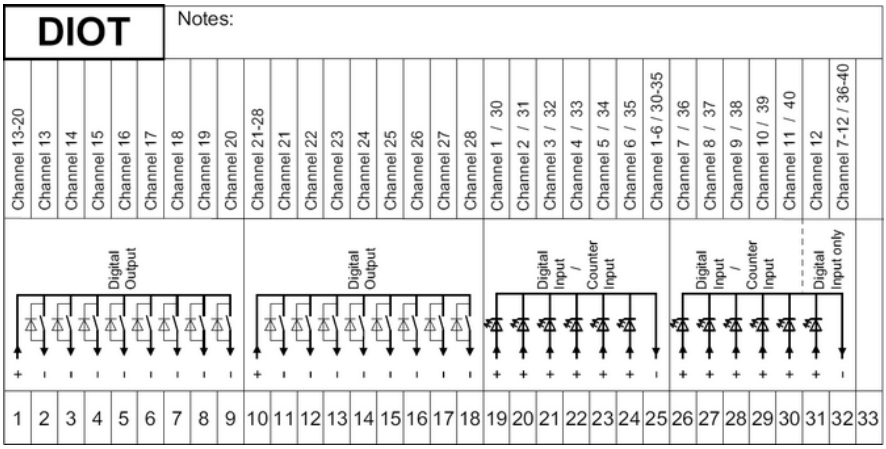
3.5.5 ADVT



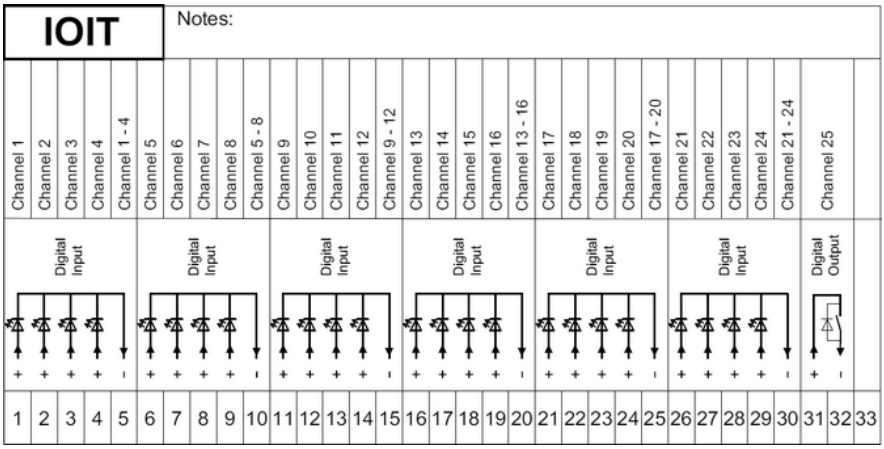
3.5.6 AMDT



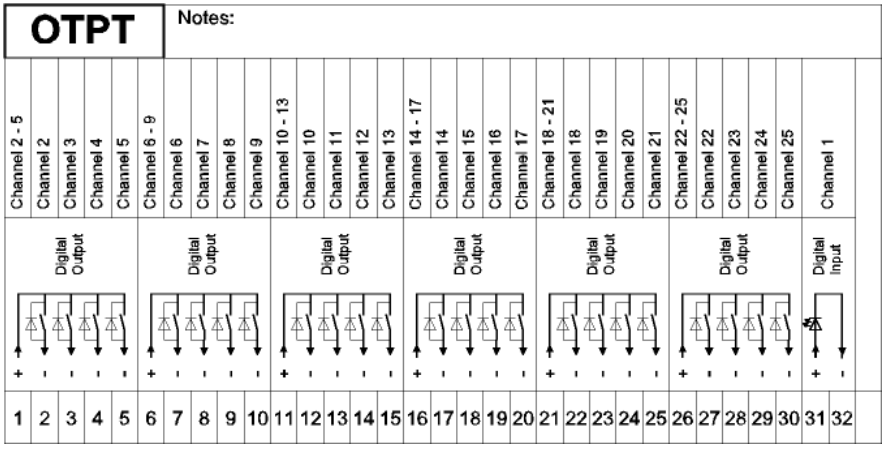
3.5.7 DIOT



3.5.8 IOIT


IOIT
Notes:
Channel 1
Channel 2
Channel 3
Channel 4
Channel 1 - 4
Channel 5
Channel 6
Channel 7
Channel 8
Channel 5 - 8
Channel 9
Channel 10
Channel 11
Channel 12
Channel 9 - 12
Channel 13
Channel 14
Channel 15
Channel 16
Channel 13 - 16
Channel 17
Channel 18
Channel 19
Channel 20
Channel 17 - 20
Channel 21
Channel 22
Channel 23
Channel 24
Channel 21 - 24
Channel 25
Digital Input
Digital Output
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

3.5.9 OTPT


OTPT
Notes:
Channel 2 - 5
Channel 2
Channel 3
Channel 4
Channel 5
Channel 6 - 9
Channel 6
Channel 7
Channel 8
Channel 9
Channel 10 - 13
Channel 10
Channel 11
Channel 12
Channel 13
Channel 14 - 17
Channel 14
Channel 15
Channel 16
Channel 17
Channel 18 - 21
Channel 18
Channel 19
Channel 20
Channel 21
Channel 22 - 25
Channel 22
Channel 23
Channel 24
Channel 25
Channel 1
Digital Output
Digital Input
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

3.6 I/O module installation and removal



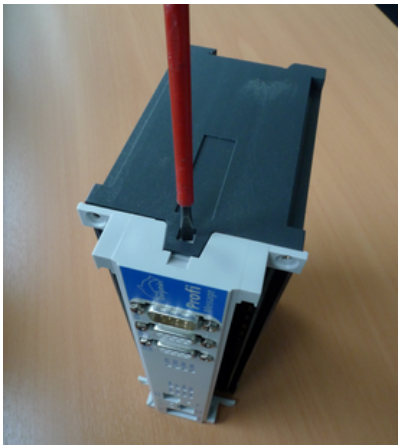
Electronic components are sensitive to electrostatic charge (ESD, *E*lectro-*S*tatic *D*ischarge). Therefore, discharge any electrostatic before opening the device. We recommend wearing an anti-static wrist band (static discharge wrist band) and to carry out the work on a conductive surface.

Removal

1. Disconnect the unit from the power supply.
2. Remove all connectors from the device front.
   When replacing a module with a similar module, leave the cables attached to the terminal blocks.
3. Unscrew the four locking screws at the ends of the two terminal blocks until a distinct cracking sound is heard.
   The screws have retaining rings to prevent them falling out and hence do not fully unscrew.
4. Pull the two terminal blocks forward with effort. Prise off if necessary using a flat screw driver at the sides between the terminal block and housing front (see image).



5. Use a screwdriver to lightly press in the two retaining notches on the sides of the housing front and pull the front forward.



6. Carefully pull the module circuit board from the slots in the board. Be careful not to bend any pins.

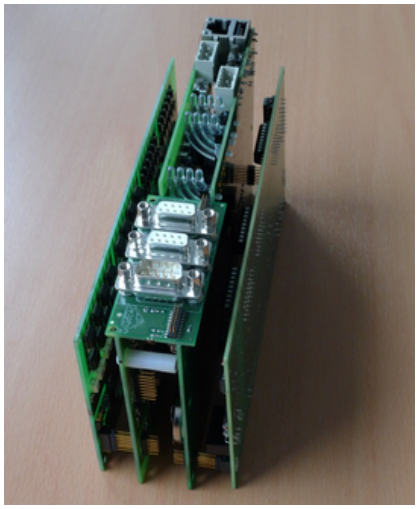


Installation

Follow the above procedures in reverse order, while taking the following into account.

- The side of the I/O module with components must point towards the inner circuit board.

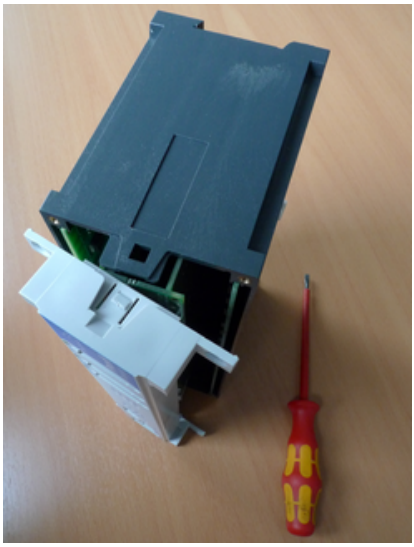
- Check that all connector pins fit into the sockets of the inner board and that the boards are in parallel alignment.



- Ensure that the boards keep within the side slots when installing them into the base board.



- Note that the front fits only in one direction to the bottom part. It may be necessary to rotate the module through 180 degrees.



- Tighten the screws evenly in order, and do not tighten one screw after another.

3.7 Install internal memory card

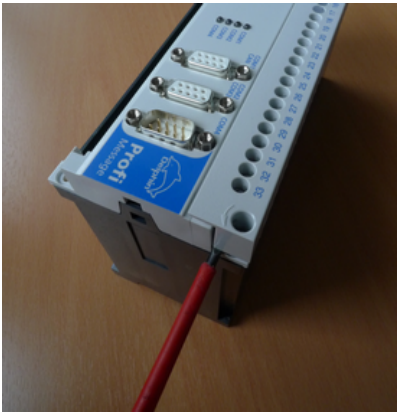


Electronic components are sensitive to electrostatic charge (ESD, *E*lectro-*S*tatic *D*ischarge). Therefore, discharge any electrostatic before opening the device. We recommend wearing an anti-static wrist band (static discharge wrist band) and to carry out the work on a conductive surface.

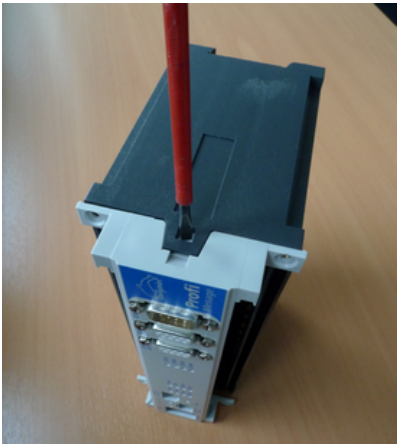
Removing and replacing the memory card

1. Disconnect the unit from the power supply.
2. Remove all connectors from the device front. Leave the cables that are attached to the terminals of the terminal blocks.
3. Unscrew the four locking screws at the ends of the two terminal blocks until a distinct cracking sound is heard. The screws have retaining rings to prevent them falling out and hence do not fully unscrew.

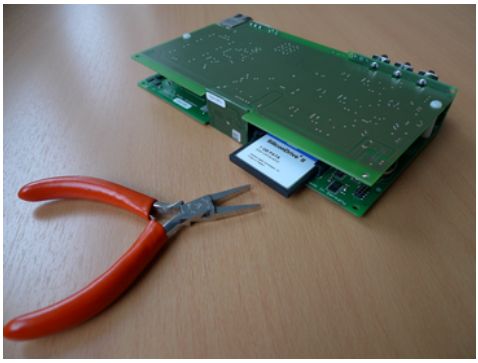
4. Pull the two terminal blocks forward with effort. If necessary, prise off using a flat screwdriver between the side of the terminal block and housing.



5. Use a screwdriver to lightly press in the two retaining notches on the sides of the housing front and pull the front forward.



6. Remove the memory card from its slot using long-nose pliers or a similar tool

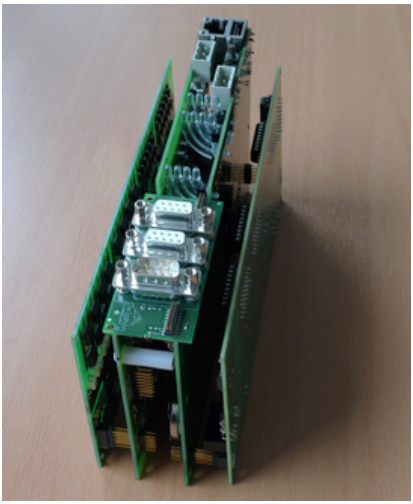


7. Push in the new memory card, with its “handle strip" pointing towards the board, until it stops. Use only gentle pressure and do not force. The card fits in one direction only.

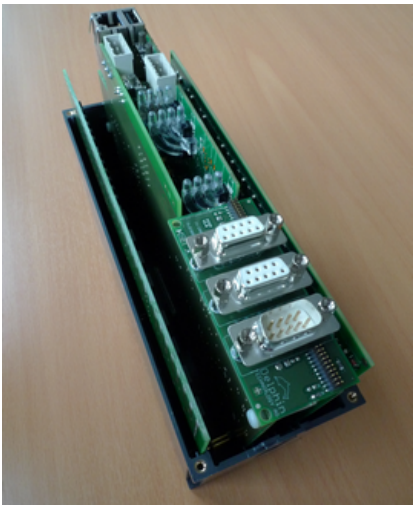
Installation

Follow the above procedures in reverse order, while taking the following into account.

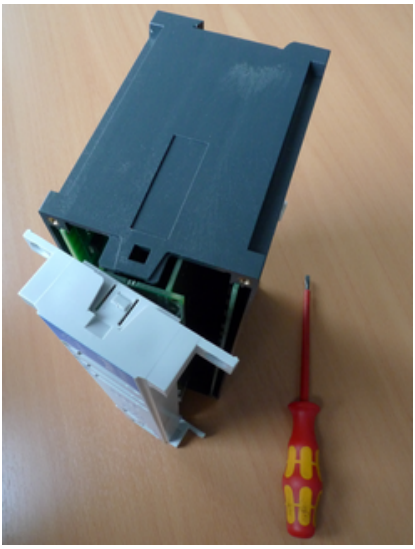
- Check that all connector pins fit into the sockets of the inner board and that the boards are in parallel alignment.



- Ensure that the boards keep within the side slots when installing them into the base board.



- Note that the front fits only in one direction to the bottom part. It may be necessary to rotate the module through 180 degrees.



- Tighten the screws evenly in order, and do not tighten one screw after another.

3.8 Install internal battery



Electronic components are sensitive to electrostatic charge (ESD, *E*lectro-*S*tatic *D*ischarge). Therefore, discharge any electrostatic before opening the device. We recommend wearing an anti-static wrist band (static discharge wrist band) and to carry out the work on a conductive surface.

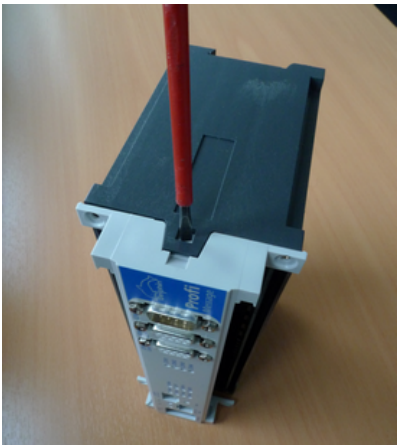
A lithium coin cell battery CR2450 with 3V/575 mAh is used. The battery has a lifespan of at least 10 years.

Removal

1. Disconnect the unit from the power supply.
2. Remove all connectors from the device front. Leave the cables that are attached to the terminals of the terminal blocks.
3. Unscrew the four locking screws at the ends of the two terminal blocks until a distinct cracking sound is heard.
   The screws have retaining rings to prevent them falling out and hence do not fully unscrew.
4. Pull the two terminal blocks forward with effort. If necessary, prise off using a flat screwdriver between the side of the terminal block and housing.



5. Use a screwdriver to lightly press in the two retaining notches on the sides of the housing front and pull the front forward.

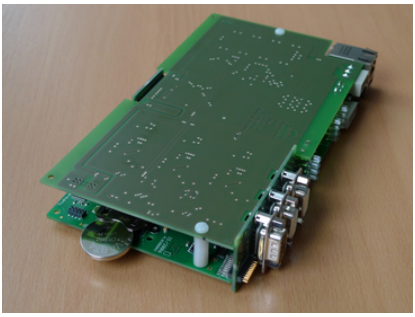


6. Remove the battery from its holder using long-nose pliers or a similar tool.

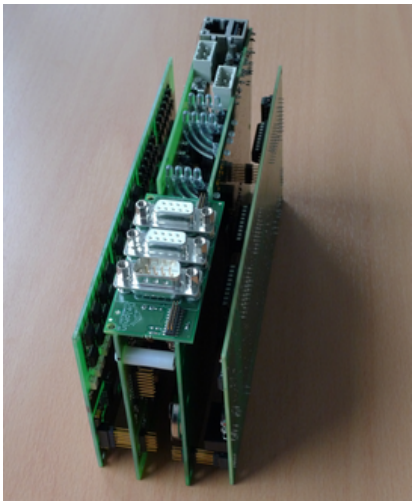
Installation

Follow the above procedures in reverse order, while taking the following into account.

- When inserting the new battery, ensure that the negative pole is towards the board and the plus pole towards the holding bracket.



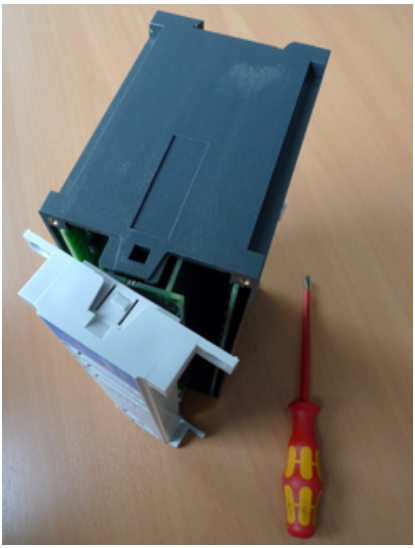
- Check that all connector pins fit into the sockets of the inner board and that the boards are in parallel alignment.



- Ensure that the boards keep within the side slots when installing them into the base board.



- Note that the front fits only in one direction to the bottom part. It may be necessary to rotate the module through 180 degrees.



- Tighten the screws evenly in order, and do not tighten one screw after another.

4 Configuration and operation

The following paragraphs are covered in this Section:

- The basic settings of the device, such as the network settings or the device ID, are described in the section Device configuration.
- The section Connecting slave devices explains the configuration process when multiple devices are being used.
- Configuring the various I/O module channels is described in detail in the section on Configuring module channels.

Settings and operating steps which are the same for all devices are available under Common device settings.

- The Configuration via web browser section explains the (device) settings that you can apply via an internet browser.
  The following functions are available only via the device's web interface: Resetting to factory settings and updating the device's firmware. Some basic settings are also possible, for example to the Ethernet interface or device-clock.
- The Configuring software channels section describes the various ways in which to perform calculations on measurement data or between channels.
- Read the Configuring interfaces section on how to use the various interfaces for connecting or exchanging data with external devices.
- Devices are equipped with internal memories to enable measurement data to be saved. The Device memory Section explains how this storage space can be used, for example for partitioning of different channel groups.
- The Data transfer to USB memory stick Section explains how to externally back up internally stored data.

See also Getting Started and Settings for all dialogues.

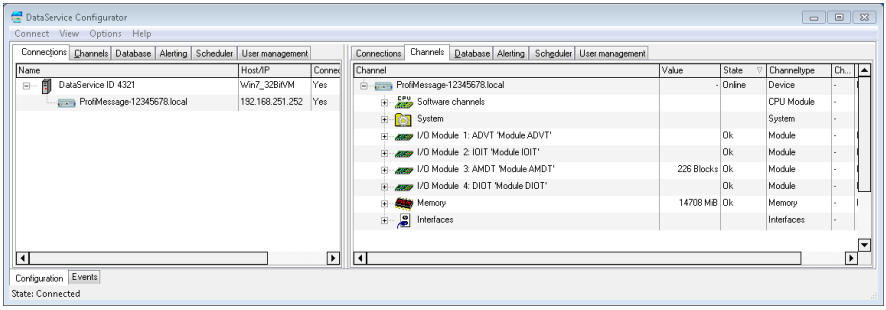
4.1 Overview

See also Getting Started

Configuration of the most important parameters, such as network settings, can be performed using either the Web Interface from the device or the DataService Configurator program. Settings via the Web interface are described in the Configuration via Web browser Section. A detailed description of the program DataService Configurator is available in the manual on DataService Configurator. A detailed description of the program DataService Configurator is available in the manual on DataService Configurator.

ClickingDataService Configurator starts the DataService background program and establishes a connection to the devices (the default for the first

installation is described in the Getting Started section). The DataService Configurator dialogue is split, enabling a device to be selected on the left in the Connections tab and settings to be applied on the right in the *Channels* tab. The device itself is considered a "channel", and in the example is listed as **ProfiMessage** '192.168.253.103', ...".



Channel configuration

Any configuration performed in DataService Configurator is considered a channel configuration, even when not strictly in relation to a measurement channel, but rather a device interface, memory group or module.

Amendments to configurations to take immediate effect with the previous settings being overwritten. The new settings are saved to the non-volatile memory of the **ProfiMessage** device and remain there even following a device reset.

Open the configuration dialog for a channel by double-clicking the channel name or right-clicking and selecting Properties from the context menu. Objects that do not have this entry in their context menus are not configurable via the DataService Configurator but act as containers, that is, as channel groups for (more) sub-channels such as the Software channels' group.

Channels from a channel group are displayed by clicking the corresponding plus sign (⊞) before the group.

DataService Configurator options

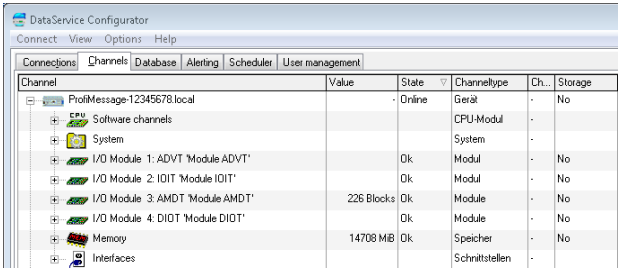
- Hide or show columns for the different tabs on or off: *View* → *Left panel* → *Visible columns ...* or View → *Right panel* → *Visible columns...*
- Set the DataService Configurator time zone: *View* → *Timezone*.
- Change the DataService Configurator's display language via *Options* → *Language*.

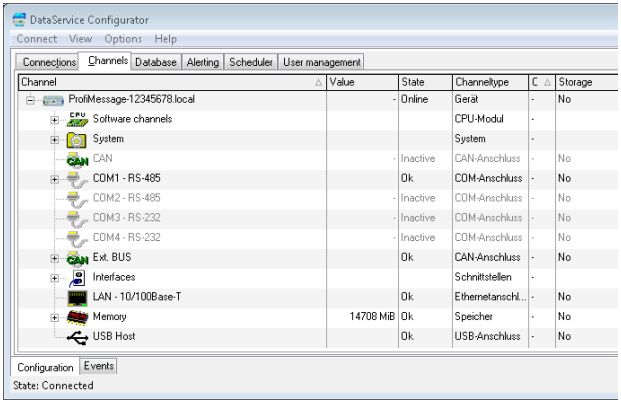
- Suppress confirmation requests:
  Options→ *Don't prompt for confirmation*.
- Change channel order via *Options* → *Activate channel move / link* (only available in the User-defined view).

Further information is available in the DataService Configurator manual.

4.2 ProfiMessage device configuration

The next level is the *user-defined view* (left panel) and displays the I/O modules, the interfaces, memory and the software channels.DataService Configurator The hardware view (right panel) displays the various system interfaces, memory and software channels. The hardware view (right panel) displays the various system interfaces, memory and software channels.





This Section explains the settings that you can make for the device itself. This takes place via "**ProfiMessage** '192 .168.100.116'..." in the *Channels* tab in DataService Configurator (see example). Use the Properties

context menu to amend a device name and ID or to enter a description for the device. Use Main settings context menu to change network and NTP settings.
Refer to Configuring main device, Network settings, NTP

For explanations of other settings, see:

- Device memory for internal memory
- Configuring module channels for I/O modules
- Configuring interfaces for CAN, COM and PROFIBUS interfaces
- Configuring software channels for system monitoring and calculations



Info

For general information on configuration dialogs (including header and footer), see Settings for all dialogs.

4.3 Connecting slave devices

Slave devices can only be connected with **ProfiMessage** devices. The **ProfiMessage** system uses CAN-bus and Delphin CAN Protocol **Delphin** (DCP) to connect to I/O modules. A **ProfiMessage** device can be fitted with two I/O modules. The CAN-connection is established internally.

The DCP CAN bus for I/O extensions uses the "Ext. BUS" port. If a **ProfiMessage** device has an insufficient number or type of input channels, a slave device can then be connected to the **ProfiMessage** device via this port. (Refer to Device connections).

Connecting the extension bus

Use twisted pair shielded cable (e.g. braided LiYCY 2x0.14 mm2 TP). Ensure that the start and end connections (i.e. at the master and at the final slave device) use the supplied 120-ohm resistors. These produce the bus signal level and prevent interference from signal reflection. The Hi (CAN High) designated ports must be connected to other devices via Hi, and Lo (CAN Low) with Lo.

Illustration in DataService Configurator

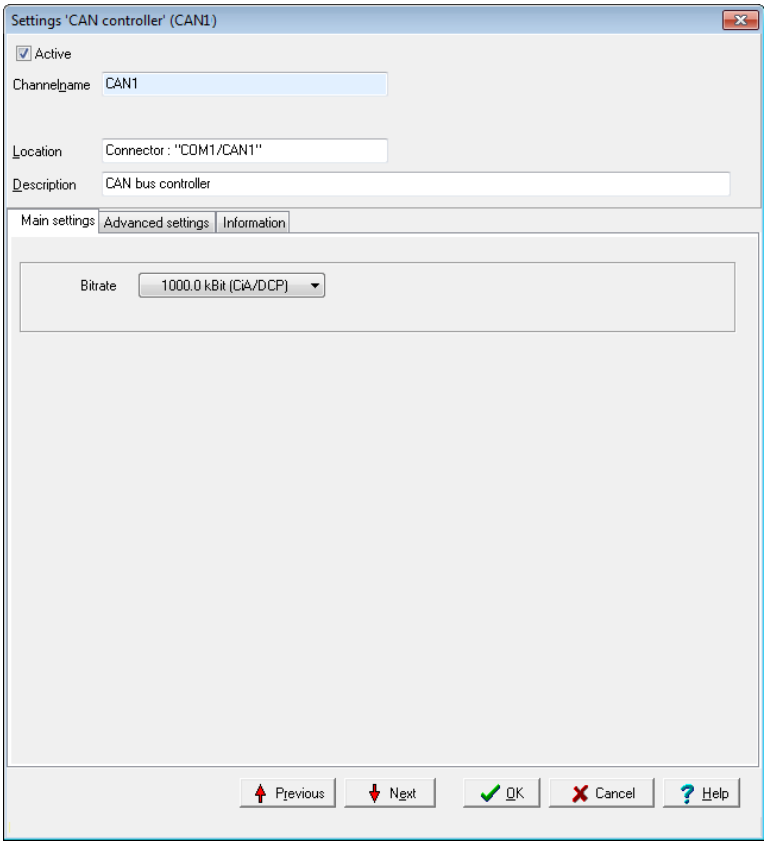
The *Channels* tab lists the modules currently connected according to the type of view selected (hardware view or user-defined) in the group "Extension (CAN) bus" group or as I/O modules from the (master) device.

Extension-Bus	0x26090880 5B621380	
DCP	0x26090880 3F2EBBB3	Ok
E/A Modul 1: ADVT 'Module ADVT'	0x26090880 24D2CD9C	Ok
E/A Modul 2: IOIT 'Module IOIT'	0x26090880 4046825E	Ok
E/A Modul 3: ADIT 'Module ADIT'	0x26090880 13DB6355	Ok
E/A Modul 4: ADGT 'Module AD...	0x26090880 306FEC32	Ok

I/O module configuration is explained in Configuring module channels.

Configuring the extension bus

The extension bus protocol cannot be changed and is set to *DCP* (**Delphin**CAN Protocol).



Baud rate

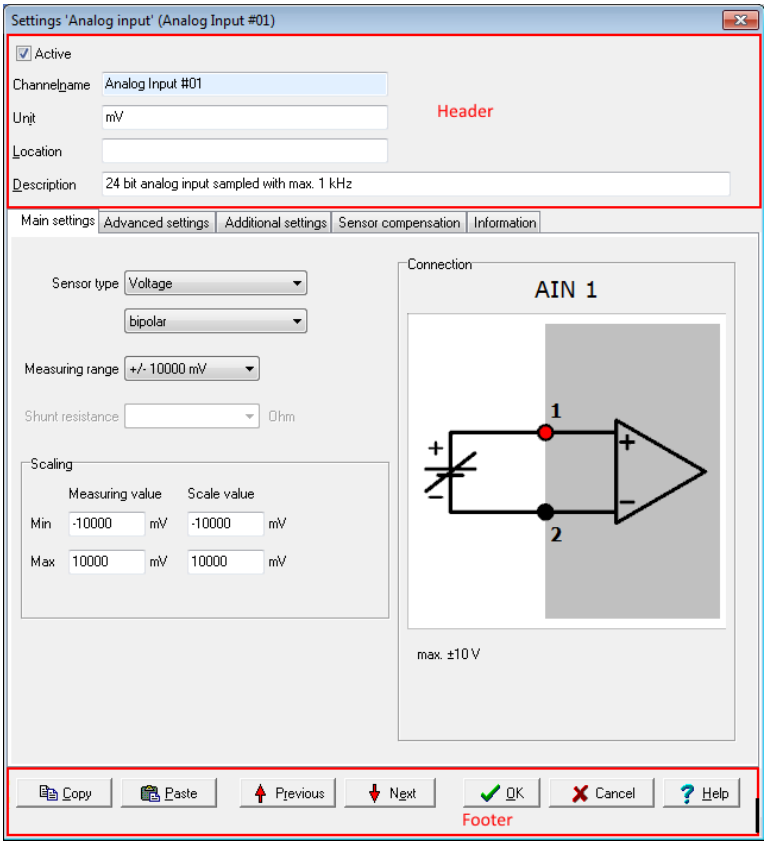
The baud rate states the number of characters transferred per second via the interface. Selection depends on the properties of the connected devices and the cable length between the devices: For longer lines, a lower baud rate should be selected to achieve error-free communication.

The following rates can serve as a guide:

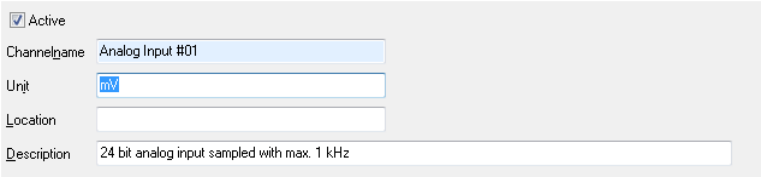
- from 15 m: 1000 kbaud (standard setting)
- up to 30 m: 500 kBaud
- up to 45 m: 333.3 kbaud
- up to 60 m: 250 kBaud
- up to 150m: 100 kbaud

4.4 Settings for all dialogues

A configuration dialogue for the relevant item (channel) opens after double-clicking one of the channels, an interface or another item in the channel list. Different tabs are displayed depending on the channel type. The listings in the tabs also depend on the channel type. Many of the settings are the same for all dialogues, especially in the upper and lower sections, and are hence explained here in general terms.



Upper section



Active: Enables or disables the channel.

Channel name: Enter a meaningful and unique name to identify the channel.

Unit: Enter the unit of measurement.

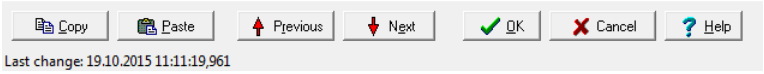
Info

The unit for memory groups should be left as % (default). Occupied storage space is always shown as a percentage.

Location: Information on the position of the sensor or signal source can be entered here.

Description: A description or comment can be entered here. After creating a function (software channel), a description of the function appears here (in English).

Lower section



Copy copies the settings shown, which you can then adopt in another channel by *inserting* .

Previous or *Next*: Changes to the configuration dialogue of the previous or next channel in the channel view. The dialogue's current settings are applied before the dialogue changes (the equivalent of clicking on *OK).*

OK: Applies all the settings and closes the dialogue.

Cancel: Cancels the configuration and closes the dialogue. The settings are ignored and no changes are made within the device.

Help: Opens online help. The relevant topic is displayed where available.

The date and time display of the last setting change for the channel is displayed in the lower left corner (15.6.2015 in the example).

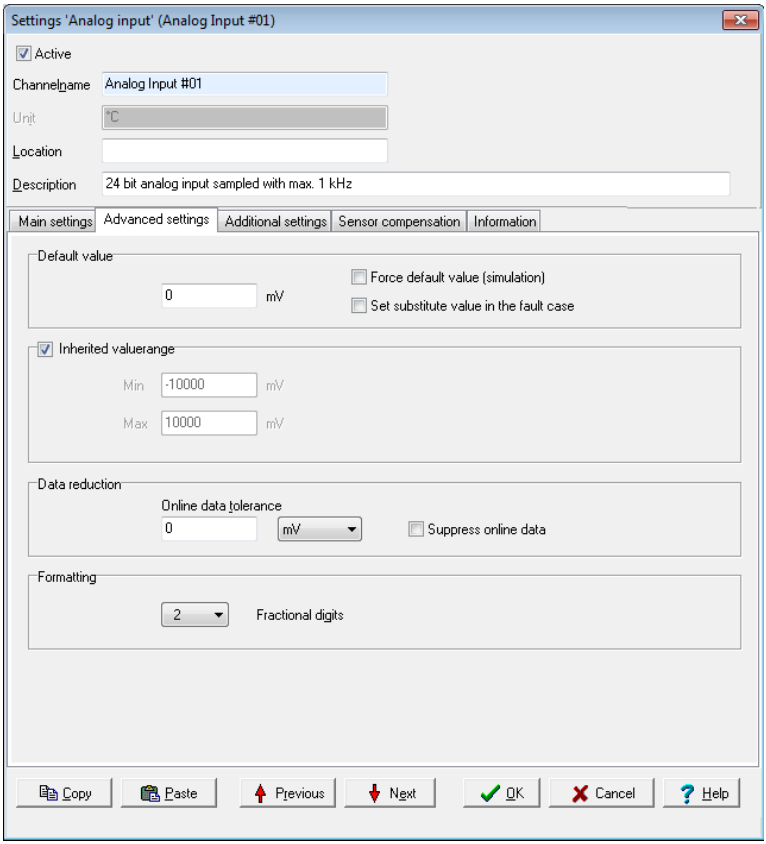
Tabs in the dialogue's main section

Depending on the type of channel, different tabs are available. Not all the tabs are available for every channel type. The following (general) tabs are explained in this section as they are very similar for different devices.

- Additional settings
- Sensor compensation
- Information

The *Main settings* tab is always specific to the channel. It can hence be found under the relevant device- and channel type. There are also other tabs that relate to specific channels, e.g., *Extended settings* or *Filter* and are, therefore, described under these channels.

4.4.1 Additional settings tab



Replacement value: This is used in the event of an input or output failure (refer also to Status monitoring). The settings depend on channel type. For example, digital inputs only have the options Off and On.

> *Force substitute value (simulation)*: Sets the channel's output value to the given substitute value. This setting is useful during installation to simulate certain conditions or activate system responses.
> Do not forget to disable the option for normal operation!

Inherited validity range (not available for all channel types): Enter the valid range in which measurement values are valid.

Depending on the channel type, the validity range can be optionally inherited. If the validity range can be inherited, the validity will be adopted, depending on the channel type, either from scaling (see *Main settings* tab) or the data source of the channel.

The validity range is also used for displaying percentage trend, the percentage data reduction and for displaying certain visual elements.

Data reduction (not available for all channel types): A signal is fed through the channel input, processed within the channel and then released at the channel output. The tolerance specifies the extent of change a signal must undergo following processing before being output via the interface. In the example, the processed input value is output only when it differs by more than 0.1 mA from the preceding value. The *Data reduction* function reduces the data rate on the interface and thus assists the PC in the further processing. The internal processing of measurement values is not affected by this.

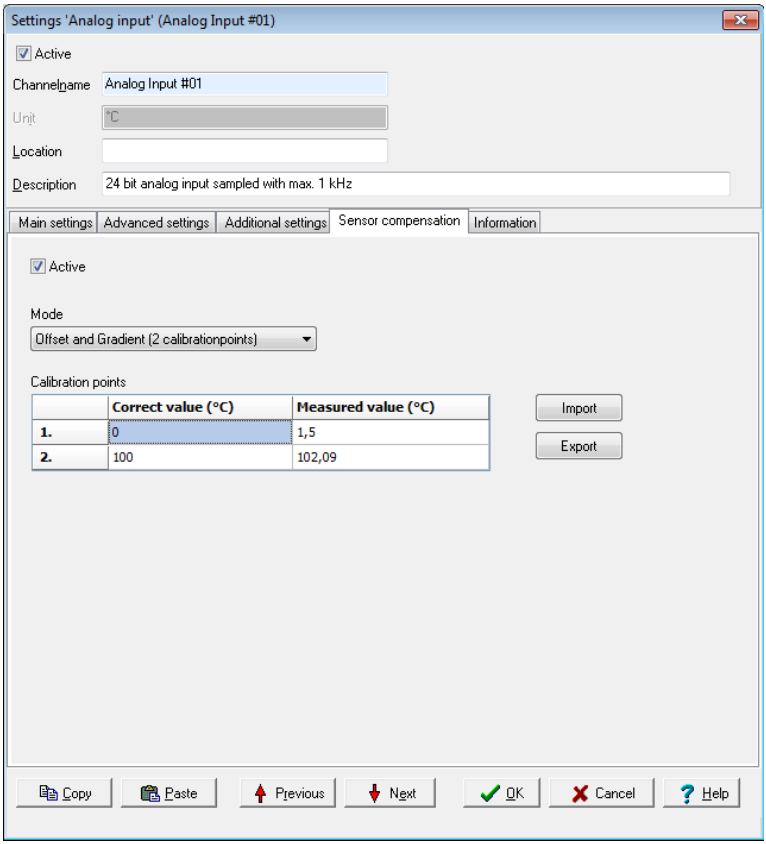
The tolerance value can be expressed as an absolute measurement unit or as a relative value in relation to the *validity range*. Some channel types do not have a validity range and, therefore, you can only give the tolerance value as an absolute measurement unit of the channel.

Formatting (not available for all channel types): Here the resolution for the channel's values can be set.

Persistence (not available for all channel types): The currently valid output value (refer to data reduction) is stored to a non-volatile memory. The channel uses this value following a restart or power outage. This function is particularly important for outputs in order to establish a defined state following power outage.

4.4.2 Sensor compensation tab

In this tab you can specify corrections for sensors or analogue outputs. Conversion takes place according to scaling settings in the *Main settings* tab for the signal delivered by the sensor.



Active: Enables sensor compensation.

Mode: There is a choice of modes

- *Offset*
  An offset shifts the curve by a fixed value, for example the given value is added to the measurement value.
- *Offset and slope*
  Allows a shifting of the curve and an increase in its slope.
- *Quadratic*
  Generates a quadratic curve through the given points to linearise the measured values.
- *Linear interpolation*
  Set a table for converting measured values into display values. Linear interpolation takes place between the given points.

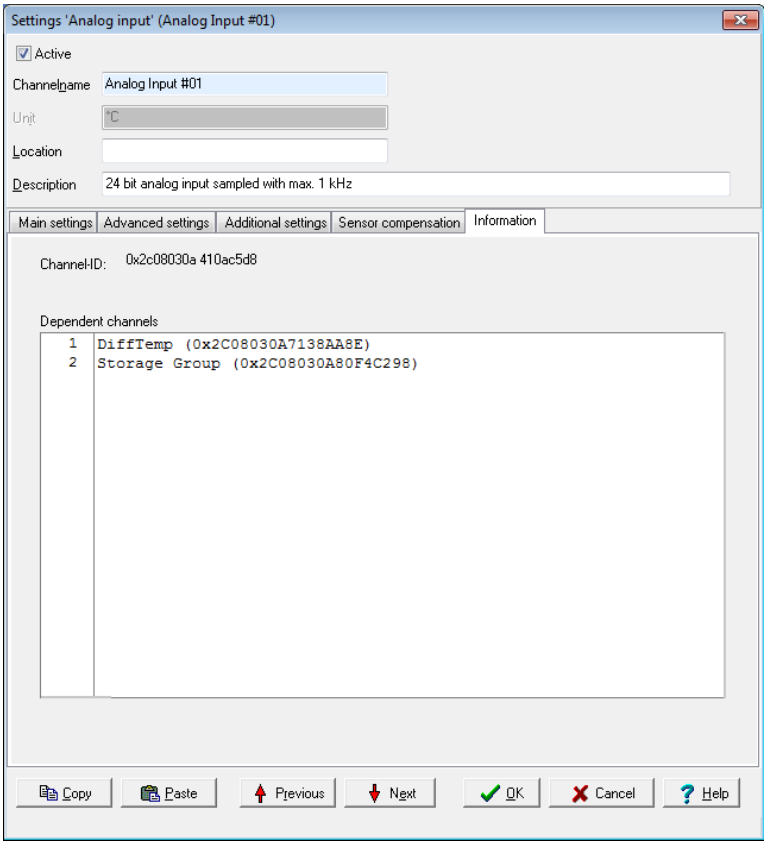
- *Spline interpolation*
  An optimal fitting polynomial 3rd degree (cubic spline) is determined using spline interpolation for the given values which is then used to to convert the measured values.



Info

You can use copy and paste to transfer data from an Excel table into the dialog table. Position the cursor in the table's top left field of the first row. Extra rows are created automatically when this is permitted by the selected mode.
Click on a row and use the *Del* key to delete unwanted rows. Insert extra rows in a linear interpolation using the *Return* key.
A created table can be exported and then re-imported later: *Export* and *Import*.

4.4.3 Information tab

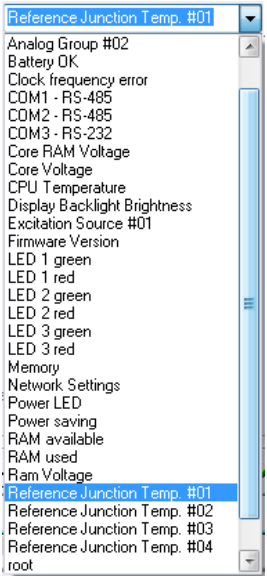


The tab shows you the channels dependent on a channel or an event.

4.4.4 Basic channel selection

Many dialogues require a channel to be selected as a source or a target. A basic or advanced channel selection is thus available.

The basic channel selection is accessed directly from the configuration dialogue. All configured channels are listed by clicking the arrow on the drop-down list:



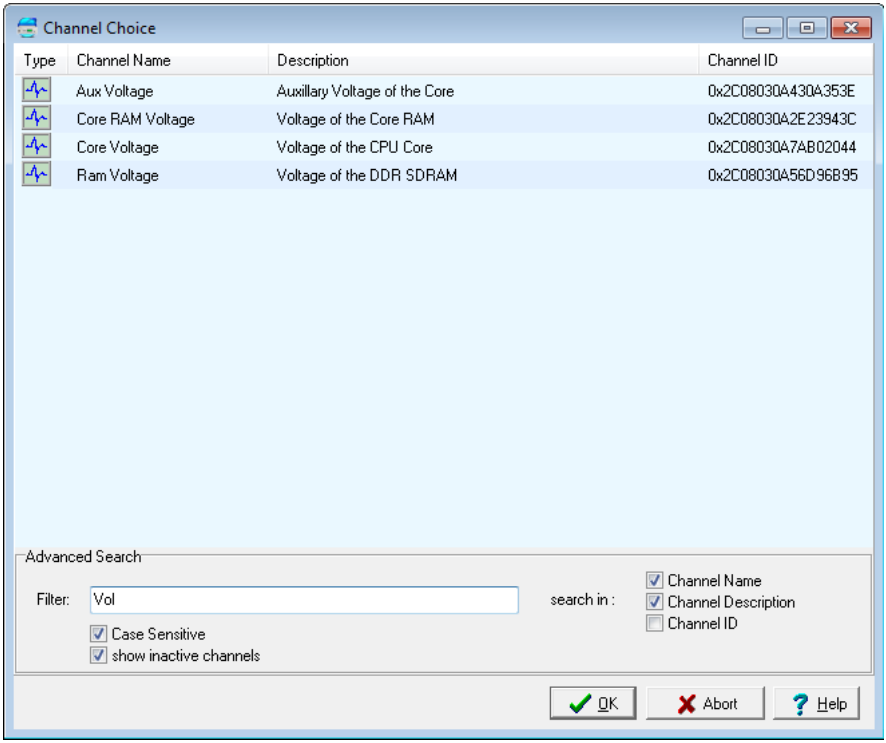
Click the required channel.
If the channel name is known, it can be input from the keyboard. The list is filtered down while letters are keyed in, which makes selection easier.

4.4.5 Advanced channel selection

This method of display and selection is more convenient for a large number of configured channels because the advanced filtering function enables only specific channels to be searched and displayed.

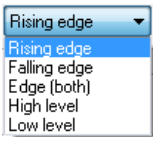
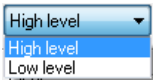
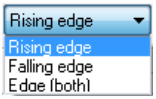
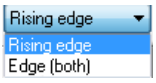
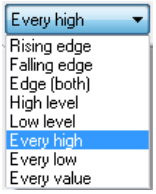
Open the dialogue box by clicking on  (the symbol is shown next to the entry field). The channels are displayed by name, description and channel ID.

Enter a filter criterion in the *Advanced search* field. The relevant selection then appears in the upper section of the dialogue. Selected the required channel and click *OK.*



4.4.6 Trigger options

Many dialogues have input fields with options for different trigger functions according to edge or level states. The following options and combinations are available:

Edge and level	Level	Edge (full)	Edge (basic)	Every
				

Explanation of options

Setting	Description
Rising edge	The event is triggered when changing from "Low" to "High"
Falling edge	The event is triggered when changing from "High" to "Low"
Edge (both)	The event is triggered at every change
High level	The event is triggered when (and for as long as) the level is "High"
Low level	The event is triggered when (and for as long as) the level is "Low"
Every high	The event is triggered for each value larger than 0. The function is generally only recommended with digital signals.
Every low	The event is triggered for each value that is 0. The function is only recommended with digital signals.
Every value	The event is triggered as soon as there is a (new) value.

4.4.7 Inherit status

This option sets whether the source's status as well as its value is to be used for the function. This can be used, for example, to prevent invalid input values in the calculation. Channel status values are available in status monitoring.

An example of inheriting: The case of an analogue input exceeding a range is displayed in the software channel as a wire break.

4.5 System channels

This Section explains the settings for the System group. The settings for drives available only for expert devices can be found in Drives.

4.5.1 Time and clock settings

In this group, some channels are already set by default, which are relevant to the time and date settings:

- Battery OK (a System Monitor software channel setting)
- Clock frequency error, Stratum (synchronisation chain) or Sync (synchronisation available) are Clock software channel settings
- Time (zone) and clock (synchronisation) settings (the channel is also available as a copy in Network settings)

Synchronisation via NTP

The NPT time (Network Time Protocol) is a number that contains the number of seconds that have passed since midnight (00:00 h) on 1 January 1970, with a resolution greater than one microsecond. The NPT time refers to GMT (Greenwich Mean Time).
Further information is available from http://www.meinberg.de and http://www.pool.ntp.org.

Enter the IP address of one or more available NTP time servers to enable correct time settings for the device. The NTP time server can be any other network device such as a PC or other device. You can also specify several NTP servers and the device will choose the best time source automatically.

The integrated Windows time server SNTP (Simple Network Time Protocol) is however not recommended due to it having insufficient information on synchronisation status. The device accepts NTP server times but only when this is synchronised to an Internet time server or to DCF77 or GPS and is able to provide information on the quality of synchronisation.

A suitable NTP server is located in the NTP subfolder on the installation CD.



NTP synchronisation requires up to five minutes to adjust to the NTP time server after the device has been switched on. The *NTP status* will be invalid during this period and will display the message 'Synchronised to unspecified at stratum 13'.

Using GPS clock

Depending on the device, there are different ways for GPS-based synchronisation. You can activate GPS synchronisation in addition to NTP synchronisation and the device will choose the best time source automatically.

To connect a GPS source to COM3, such as Holux GR-213, select the *GPS antenna COM3* setting. The corresponding channel (*Device→ Interfaces→ COM3 RS-232*) must be switched off (disable *Active*) to enable reception.

Some devices have an integrated GPS receiver and only one antenna is required to receive the signal. Connect the antenna supplied to the GPS connection of the device and activate here *GPS antenna WWAN*.

Once the GPS receiver receives a valid satellite signal, after a short time NTP status will display `'Synchronized to UHF radio at stratum 1'`.

Use *Data Service/Local Clock*.

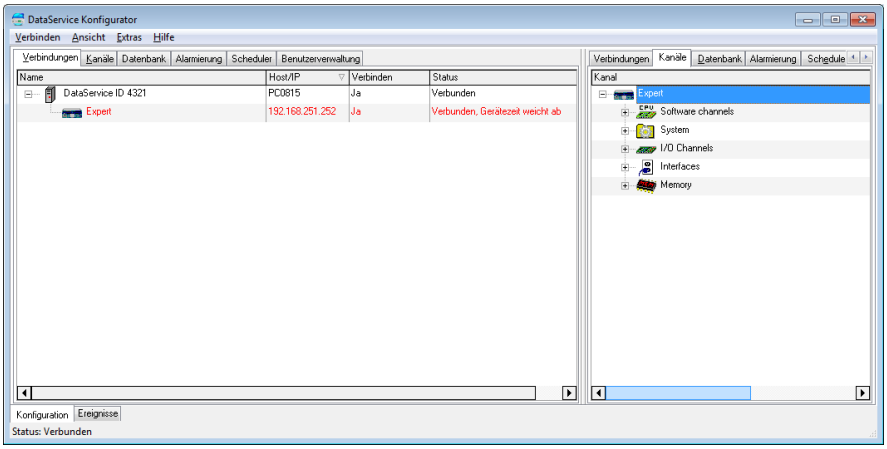
You can also enable direct synchronisation with a connected DataService without using a NTP server. Thus, the current time of the device's connected PC is used as a reference and the device begins to set itself to this time. This process may take more than an hour. Select the *DataService* setting. Only use this setting when no NTP server is available on your network. The time will be as accurate as that of the PC connected to the device.

Also synchronise large time differences

This setting enables NTP server time setting, even where there is a large deviation between the current device time and the NTP time. This option is helpful where the device was not registered on the network for a period of time and, for example, has the wrong date. Overall NTP allows a deviation of less than 1 ms to be reached.

Incorrect time synchronisation

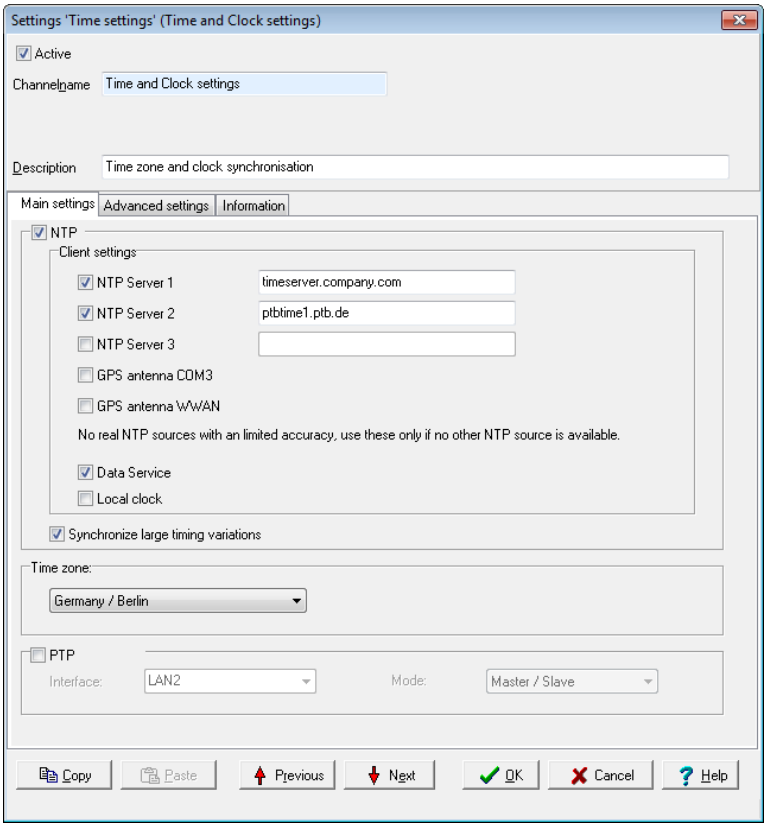
Example of absent or incorrect time synchronisation DataService Configurator:



Setting the time zone

In the *Time and Clock Settings* dialog, enter the device time zone. Otherwise, the unadjusted time (GMT) will be used.

For the UK, enter *GMT*. Alternatively, you can enter one of the entries for the UK, for example, *UK/London*. If you operate the device in a different time zone, you can also set the required time difference from GMT (Greenwich Mean Time) for that country, or a country within the same time zone, in this field.



Info

There is no automatic setting of daylight saving time (e.g., CET to CEST).

Synchronisation via PTP

In addition, as an alternative to NTP (or GPS), you can use PTP (Precision Time Protocol). PTP time deviations are often less than with NTP, however you require either a PTP server on your network or an additional **Delphin** device. You can designate one device as *Master* and the other as *Slave*. If the master device additionally receives the exact time via NTP, all devices will use the most accurate (as possible) NTP time, but are synchronised (usually better) with each other via PTP.

Only one device may be designated as Master.

The **Delphin** device uses a software algorithm for PTP synchronisation.

4.5.2 Directory (User management)

With the User management, you can specify which users have access to your device. The users Administrator, Guest and root are preset and cannot be deleted. In additions, their modification options are limited.

Important

You have to activate User management after configuration. See "System Settings" on page 85.

Guest

The *Guest* user is used for anonymous connection. In order to enable anonymous connections, enable this user and here and also allow anonymous login in System Settings. Set the *User Rights* to the required level.

Administrator

The Administrator has the rights to update all device settings. The default password is SUPERVISOR.

root

Has the same rights as the Administrator, but in addition has permission to log in to the operating system console. The default password is 'root'.

Important

For security reasons, change the device's Administrator and root passwords once User management is enabled.

Create new entry

You can create a new entry in the context menu Create → User in Directory.

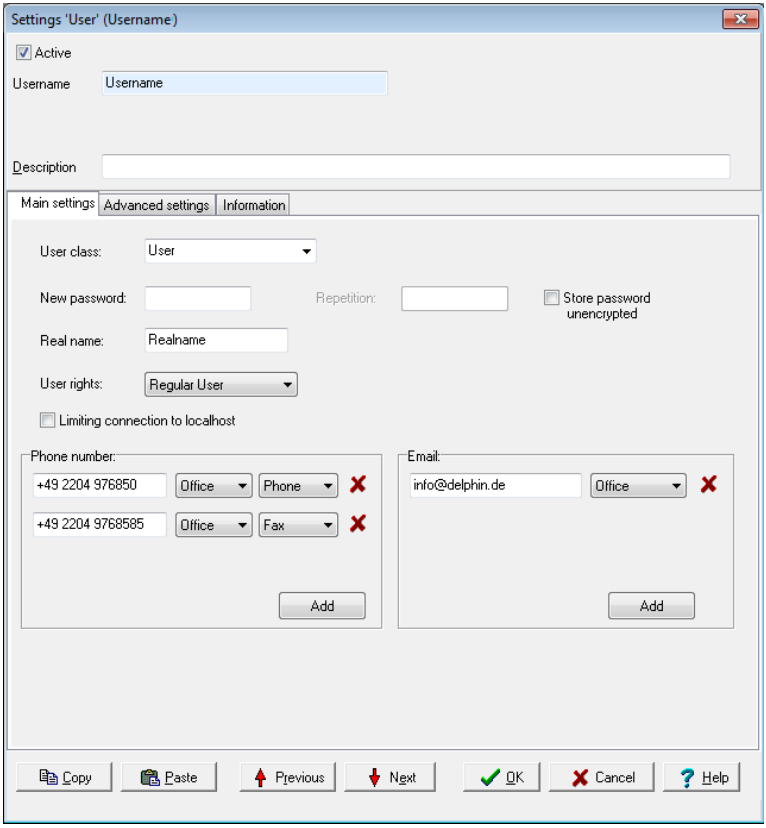
First, specify the *User class*: *User* adds a new user, *Group* is helpful when several users are to log on with the same name, *Login data* creates an entry that you can use to log the device into a mail server, for example.

Then, specify the login name (*username*), the *user right* and the *password*. You must enter the password twice to prevent typing errors from occurring. Only once both entries are identical will the red background colour be removed. If you enable *Store password unencrypted*, the password is stored and transmitted unencrypted.

Enter the user's full name in *Real name*.

If you limit the *connection to localhost*, this user will be able to work only locally, that is, not via one of the interfaces. For example, use could be limited to display (not yet implemented at this time).

If required, you can also store up to three telephone numbers and three e-mail addresses per user. Click *Add* for additional input fields. Close the dialog with *OK*.



Activate user

Only active users (*Active* at top of dialog enabled) can log in to the device.

Delete user

Selected the user to be deleted and click on *Delete channel*. The three preset Administrator, Guest and root users cannot be deleted.

Change user

Select the user to be changed. The current user details are shown in the dialog.

User rights

Select one of the five user levels: *Monitor*, *Evaluator*, *Operator*, *Configurator* or an additional *Administrator*.

Monitor

Members can, for example, display current measurement data in DataService Configurator.

Evaluator

Members can analyse measurement data and evaluate reports.

Operator

Members can operate elements and, for example, switch device outputs.

Configurator

Members can create and configure **ProfiSignal** applications.

Administrator

Members can manage users, set up password protection and make other administrative settings.

Root

Has the same rights as the Administrator, but in addition has permission to log in to the operating system console.

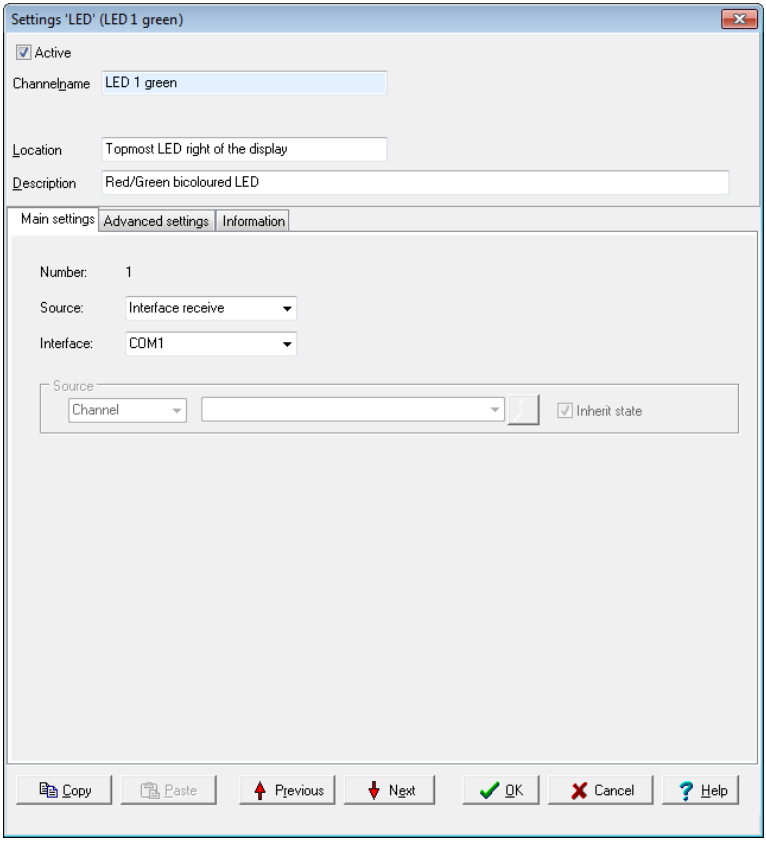


Enter a phone number

It is recommended to enter telephone numbers in international format according to E.123. This format indicates the country code with a '+'. Furthermore, the number can be separated by blanks to improve readability.
Example: +49 2204 976850

4.5.3 LED

The LED group allows you to specify the display backlight brightness and the assignment of the LEDS, for example, when and which LED illuminates red or green.



Select the desired *source* and specify for each source, whether the for example an interface or channel should send the information.

Select an available channel whose value is to be output using *Channel* in *Source*, or enter a constant value (*Manual value*). Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal**application.



Info

You can also change the Power LED assignment. However, make sure that the indication that the unit is on, can still be seen.

4.5.4 System monitoring

The system monitoring group collates individual settings, which you can generate via the System monitoring software channel. This displays system information such as CPU load or memory usage.

Available system information

Selection	Description	Unit
Total CPU usage	Display of total used processing power.	%
Application CPU usage	Display of processing power used by the main program (data acquisition and calculation).	%
System CPU usage	Display of processing power used by (operating) system.	%
Available memory	Displays how much free working memory is available.	MiB
Used memory	Displays how much working memory is in use.	MiB
System operating time	Display of time that the operating system has been working, as in the time since the device was last switched on.	Days
Application operating time	Display of time that the main program has been working, as in the time since Restart main application or switching on or Reboot of the device.	Days
Data storage used	Amount of memory already used for the data.	MiB
Free data storage	Amount of memory available for the data.	MiB
Firmware version	Device firmware version number.	—
CPU temperature	Temperature of the CPU.	°C
Core voltage	CPU core voltage, diagnostic value.	V

Selection	Description	Unit
Core RAM voltage	Internal value for diagnostics only.	V
Aux voltage	Internal value for diagnostics only.	V
Battery OK	Display whether the backup battery for the real-time clock and the SRAM is working.	—

MiB = 1024 x 1024 byte (Mebibyte, actual storage capacity); MB = 1000 x 1000 byte (Megabyte). A hard disk with 500 MB (according to the manufacturer) can therefore effectively only save 476 MiB (500,000,000/(1024 x 1024)).

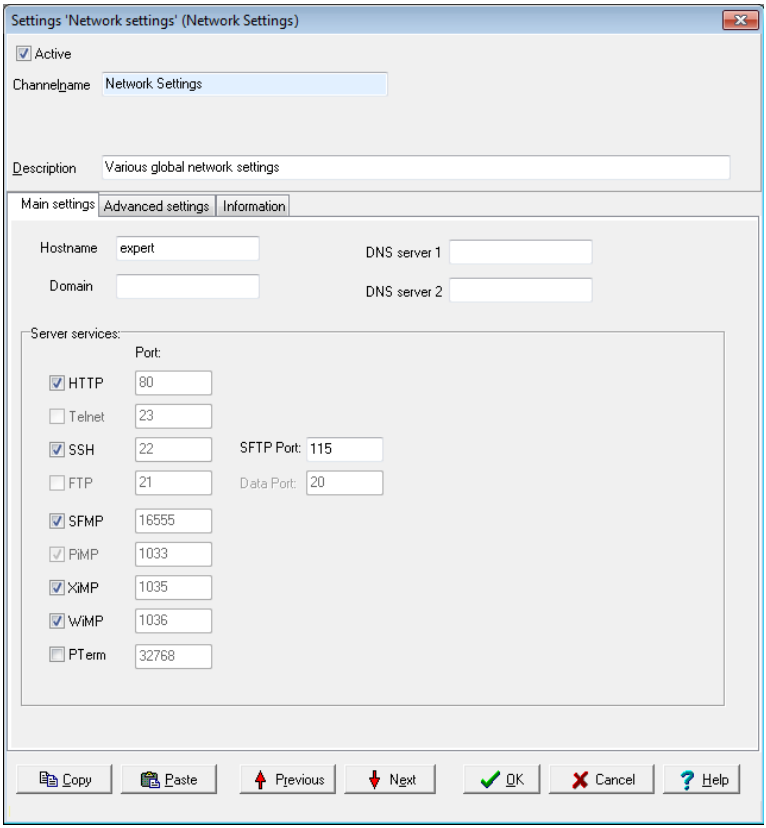
4.5.5 Network settings



Info

The "Network settings" group is by default available both in the "System" and "Interfaces" groups.

Display the dialog via the Properties context menu.



The *Hostname* (network name for the device), *domain* and *DNS server* field inputs are used to convert network names into the corresponding IP address. Leave the DNS server field empty when a DNS server is unavailable on the network.

Do not use invalid characters for network host and domain names (no underscores or special characters and only ASCII characters, as in, no German umlauts, etc., but hyphens are allowed).

Server services

Here you can see which ports are used for the various server services. The ports themselves cannot be changed. You can however deactivate services which are not required.

HTTP is required for the Web interface (for example firmware update), but can however be switched off when not required.

SSH, *Telnet* and *FTP* are required only if you wish to access a device via these services.

SFMP (Search For Message Protocol) is used to find devices (menu Connections→ search for Delphin devices in the LAN).

PiMP (PoND interchange Message Protocol) is permanently required by the DataService and cannot therefore be deactivated.

XiMP (XML interchange Message Protocol) transfers data in the same way as the DataService, except in XML format.

WiMP (Web interchange Message Protocol) is required; for example, for channel representation (Live channel values) in your Internet browser.

PTerm is used only in debug mode for Telnet transfers and is therefore not active in the default setting.

Ports

List of all ports used by **Delphin**.

Info

Please note that changing the permitted protocols can affect the functioning of the device and may completely block access to the device in combination with firewalls, managed switches etc.!

4.5.5.1 Mail settings

No settings possible here!

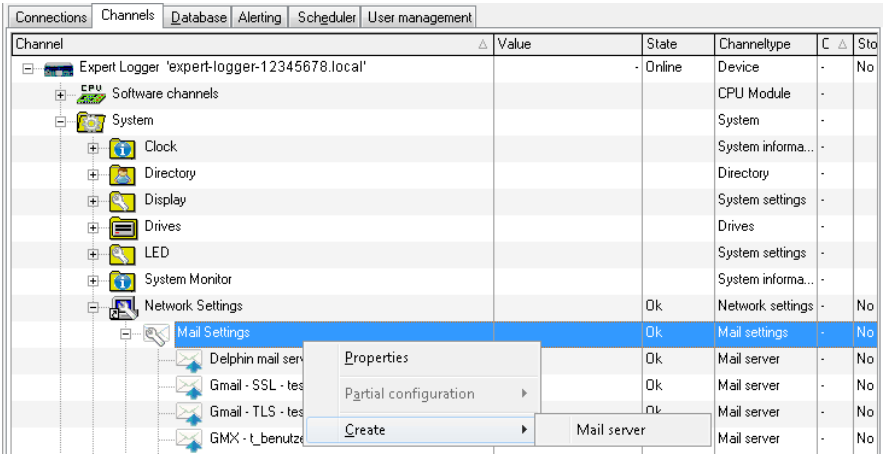
The mail servers can be created under this channel.

Mail server

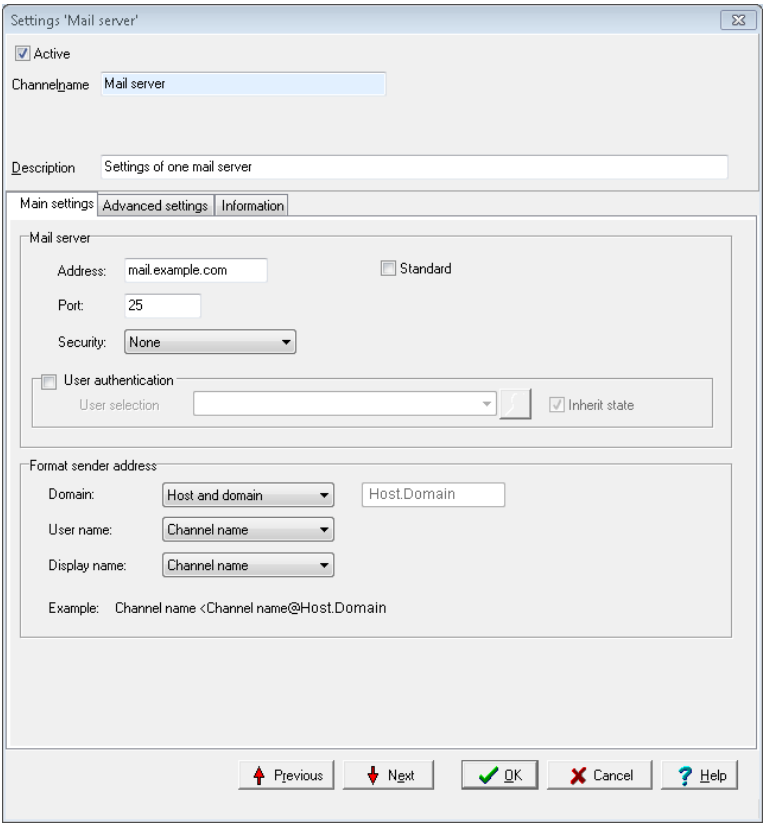
Specify a mail server for sending mails.

Info

If your mail server requires user authentication, create the necessary login data via "Directory (User management)" on page 64 before calling the mail server dialogue.



Main settings tab



Mail server: This section is used to specify the connection settings of the mail server.
Address: Enter the address of the mail server to be used.
Port: Enter the port of your SMTP server.
Security: Select the encryption protocol of the mail server. The encryption protocol for your mail server is available from your IT or e-mail provider. Please note: Public mail servers generally no longer allow unencrypted protocols.
User authentication: If the mail server requires authentication via login data, enable the check mark for user authentication. Now select the user. Please note that you have created the user in the **Directory** section of the devices before opening the mail server dialogue.
Standard: Select this check mark if the mail server is to be used as the default mail server. In the appropriate configuration dialogues, you can specify a mail server manually as well as the use of a default mail server.

Format sender address

This section is used to specify the format of the sender address to be used with the mail server. The sender address of a mail consists of two parts:
1) The actual sender address
2) The sender name displayed



Info

Many mail servers do not allow for a sender mail address to be entered that is different from the login data.

The sender address is created from the two fields Domain and Username.
Domain: Enter a user-defined domain or select the domain set under.
Username: Enter a user-defined username or select one of the predefined options.
Display name: Enter a user-defined display name or select one of the predefined options.



Info

The "Channel name" setting is resolved by the respective channel used at run time. Example: A mail server was assigned the value "Channel name" for the fields "Username" and "Display name". Its domain is "example.com". An event channel called "Time stopper" uses the previously configured mail server for sending mails. If an event occurs, an email will be sent with the sender "Time stopper <timestopper@example.com>".

Example for setting up mail servers

This guide serves to successfully implement event-driven mail sending.

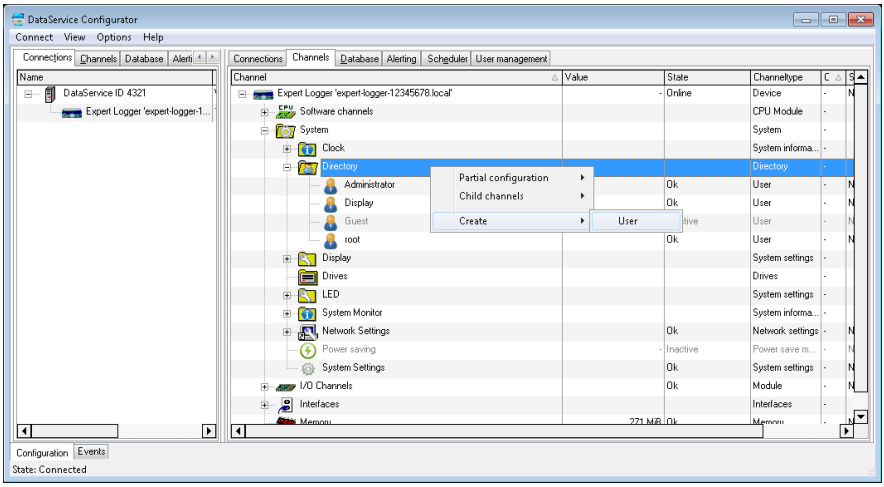
First, the following questions have to be clarified:

- What is the address data of the mail server?
- Address?
- Port
- Encryption? The following can be configured: none, TLS or SSL
- Authentication necessary on the mail server?
- What are the recipient addresses?

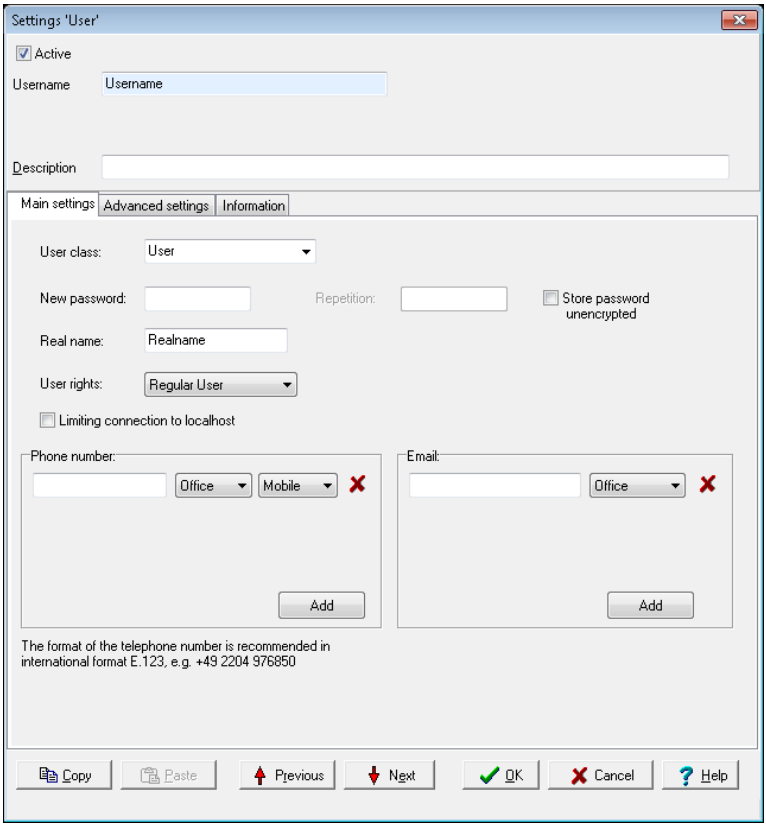
Creating the mail server in the channel structure

Before the mail server is created, check whether login data is required. If the mail server to be used requires authentication by means of login data, this must be created first. Please follow the descriptions in the**Create login data** section and then continue with **Create mail server**.
If no authentication is required, please skip the**Create login data** section and continue with the**Create mail server** section.

Creating login data

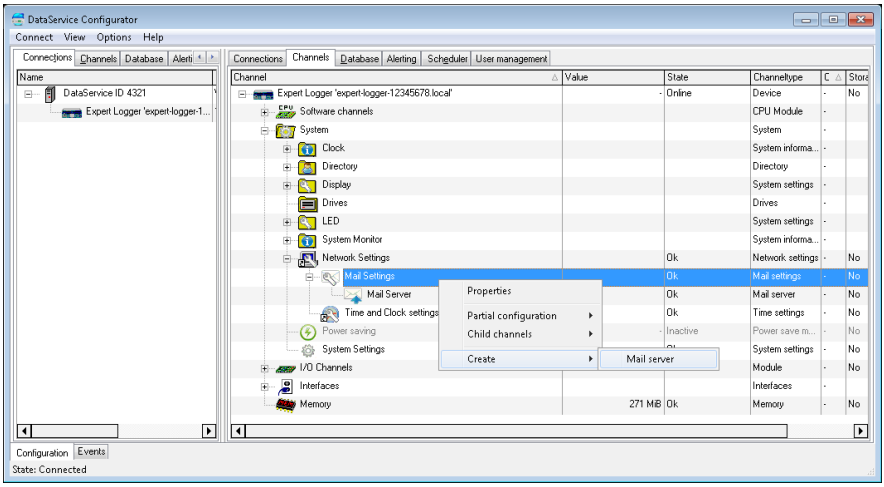


In the channel tree, open the *System* folder. Right-clicking *Directory* allows you to create a new user.

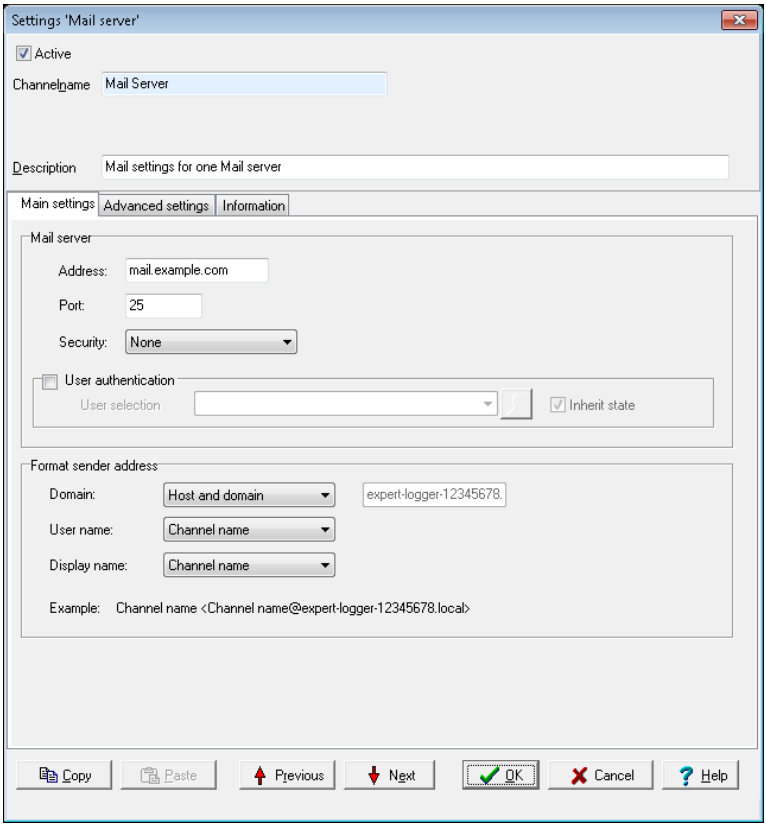


The following settings must be entered in the Basic Settings tab:
Enter the authentication login name under *Username*.
For user class, please select *Login data*.
In the fields *New Password* and *Repeat*, enter the password required for authentication.
Now confirm the dialogue by clicking *OK*.

Creating the mail server



In the channel tree, open the *System* folder, then *Network Settings* and, under it, *Mail Settings*. By right-clicking *Mail Settings*, you can create a new mail server.



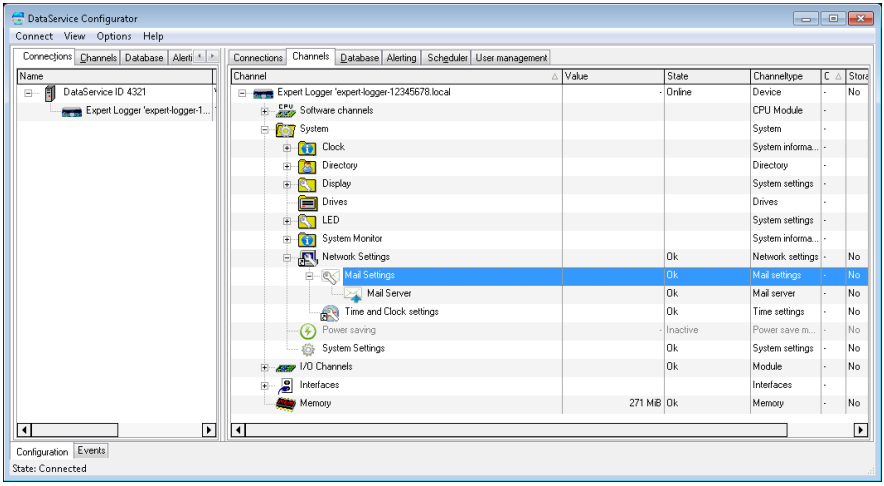
Assign a suitable channel name to the mail server. Furthermore, the following settings must be entered in the Basic Settings tab:

- Enter the mail server address in the *Address* field.
- Enter the port of the mail server in the *Port* field.
- Select the encryption that is specified by the mail server. (None, TLS or SSL)
- If user authentication is required, please check the *User authentication* box and select the user with the stored login data from the list.

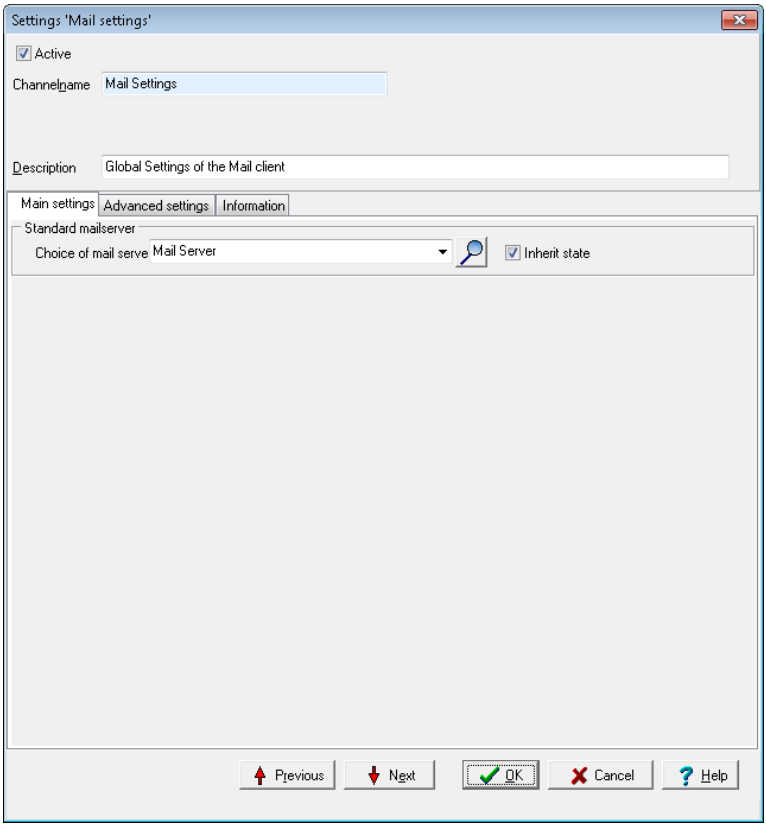
Info

The fields in the range *Format sender address* can be used to format the mail sender.
A mail address consists of two (or three) parts.
The mail address itself consists of the local part as well as the global part. These parts are connected by the '@' sign. For example, mail-address@example.com
You can manually determine the mail address by changing the fields *domain* (for the global part) and *username* (for the local part).
Furthermore, the field *Displayed name* offers the option to store a *real name*. This can be displayed in mail programs instead of the complete mail address.
Please note: Some mail servers prohibit a mail address that differs from the login name.

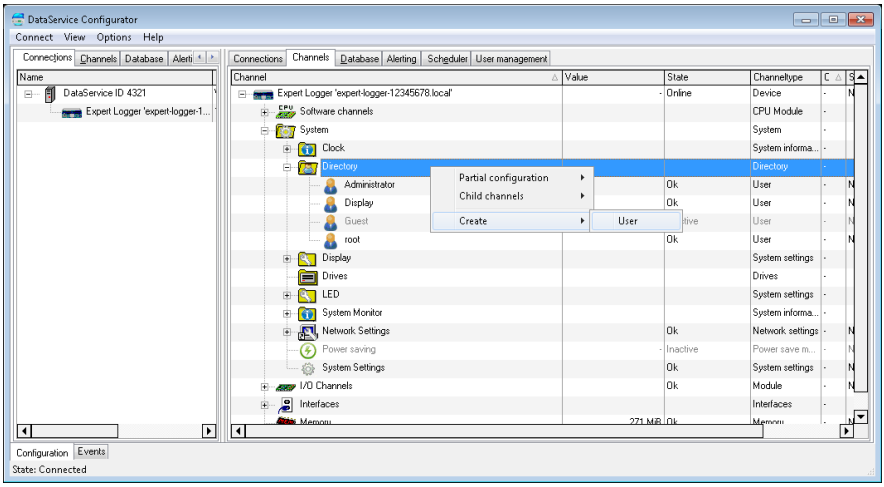
Setting the default mail server



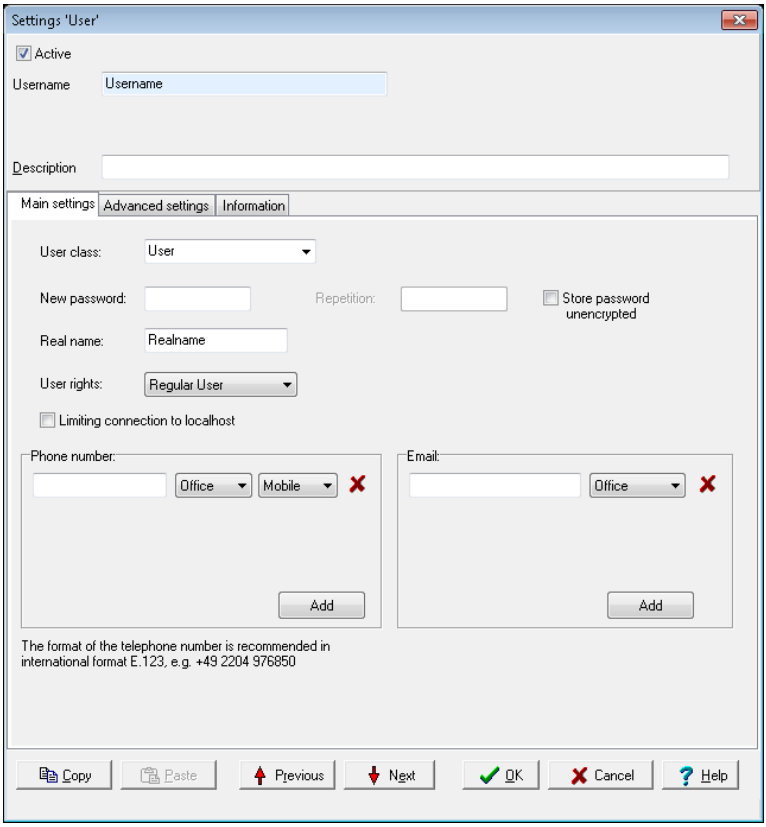
In the channel tree, open the *System* folder, then *Network Settings* and, under it, *Mail Settings*. Double-clicking *Mail Settings* opens the dialogue of the *Mail Settings*. Here, you can set a default mail server.


Settings 'Mail settings'
Active
Channelname
Mail Settings
Description
Global Settings of the Mail client
Main settings
Advanced settings
Information
Standard mailserver
Choice of mail serve
Mail Server
Inherit state
Previous
Next
OK
Cancel
Help

Creating recipients

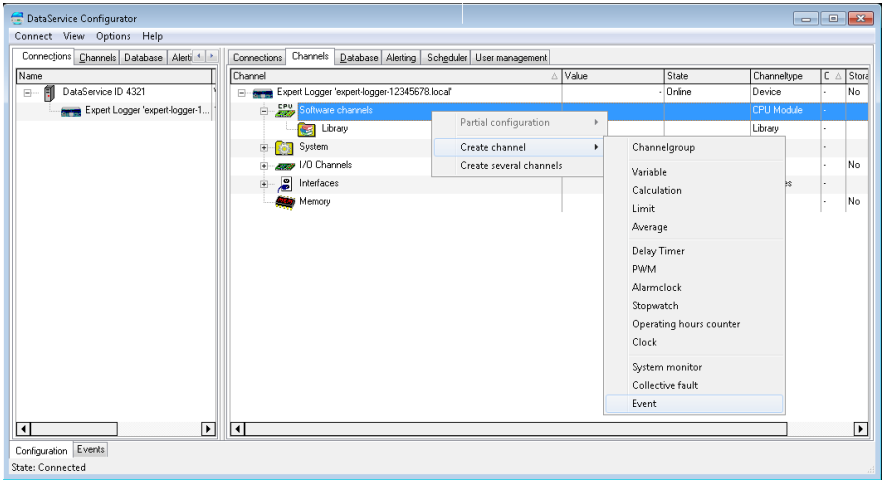


In the channel tree, open the *System* folder. Right-clicking *Directory* allows you to create a new user.

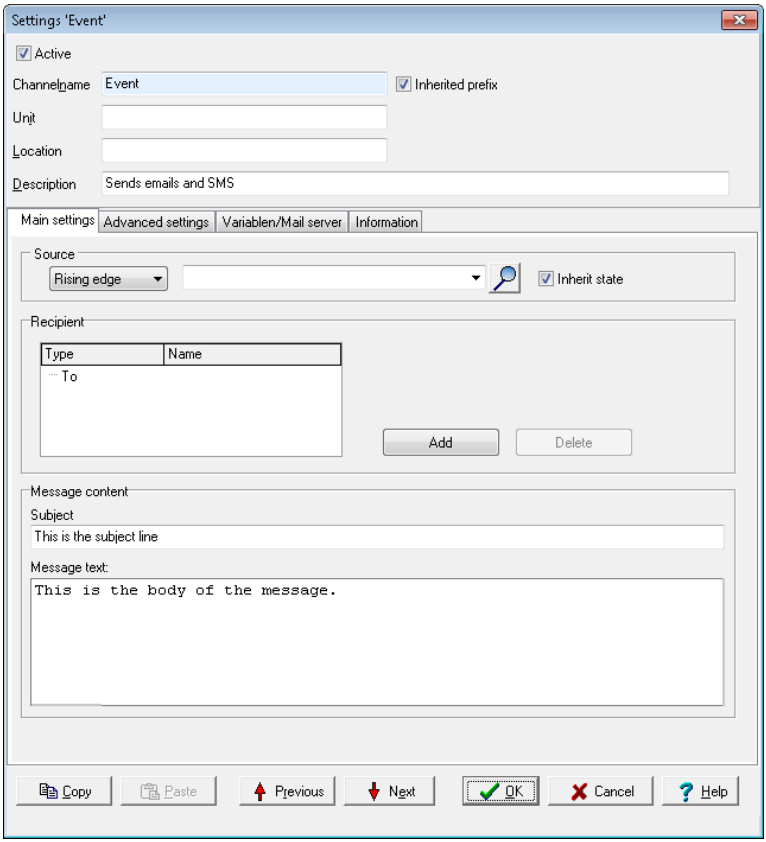


The following settings must be entered in the Basic Settings tab:
Enter the desired username under *Username*.
For user class, please select *User*.
In the *E-mail* section, enter the appropriate mail address of the user.
Now confirm the dialogue by clicking *OK*.
Repeat this step until you have created all the desired recipients.

Creating the event channel



In the channel tree, navigate to the location where you want to create the event channel. In the above example, an event channel is created below *Software channels*.



The following settings must be entered in the *Basic Settings* tab:

- Under *Source*, select the trigger of the event.
- You can add the desired mail recipients in the *Recipients* section. The *Type* is used to determine whether the receiver should be a main receiver (To), a secondary receiver (CC) or the receiver of a blind copy (BCC).
- In the *Message content* section, you can specify the subject and message content.

In the *Variables/Mail server* tab, the following settings are mandatory:

- Select whether this event channel should use the default mail server or a manually defined mail server.

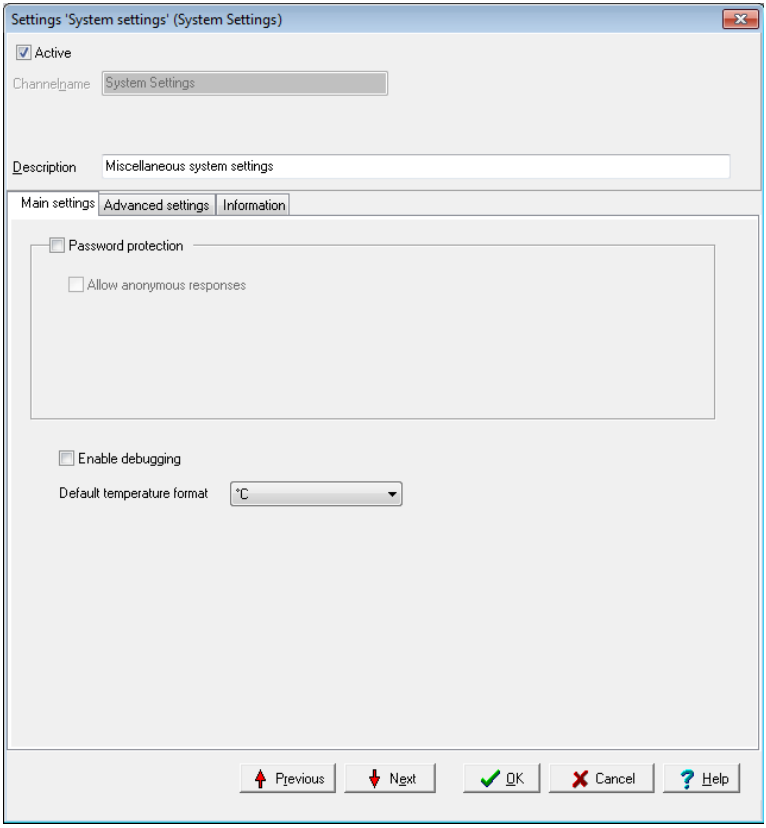
Now confirm the dialogue by clicking *OK*.
You have now configured a mail dispatch. As soon as the *source* of the event channel triggers an event, a mail is sent to the configured addressees.

4.5.5.2 Time and clock settings

The dialogue is identical to the dialogue for *System* → *Clock* → *Time and Clock Settings*, refer to "Time and clock settings" on page 60. The dialogue is found here again, for example, because the NTP servers can be reached via the Ethernet interface and the setting, therefore, could also be searched under Interfaces.

4.5.6 System Settings

This dialog allows you to enable the device's User management. Open the dialog from the context menu.
Refer also to "Directory (User management)" on page 64.



Anonymous login

This option allows device login with the "Guest" username. So that anonymous connection is possible, you must also enable the "Guest" user account and specify the rights for this account. Anonymous login via the DataService then always takes place, if either no user data for connection to a device are provided, or the user data provided are invalid.



Once User management is activated, a connection to the device can be established just by entering a valid user name and password. Ensure that you have the required login information before activating User management. Otherwise you will no longer be able to connect to your device.

Factory set login data

User: *Administrator*

Password: *SUPERVISOR*



For security reasons, change the Administrator and root passwords in the device's User management.

Enable debugging

Enable this option only when requested to by**Delphin** Support. This enables important information to be detected on the device, in the event of a fault.

Standard unit for temperature

Specifies the default unit to be applied to temperature measurements. But you can use different units for each channel. This specifies only the unit; units are not converted.

4.6 Configuring standard I/O module channels

I/O module channels denote the channels of the I/O modules. The configuration for software channels, interfaces and device memory is described in separate sections.

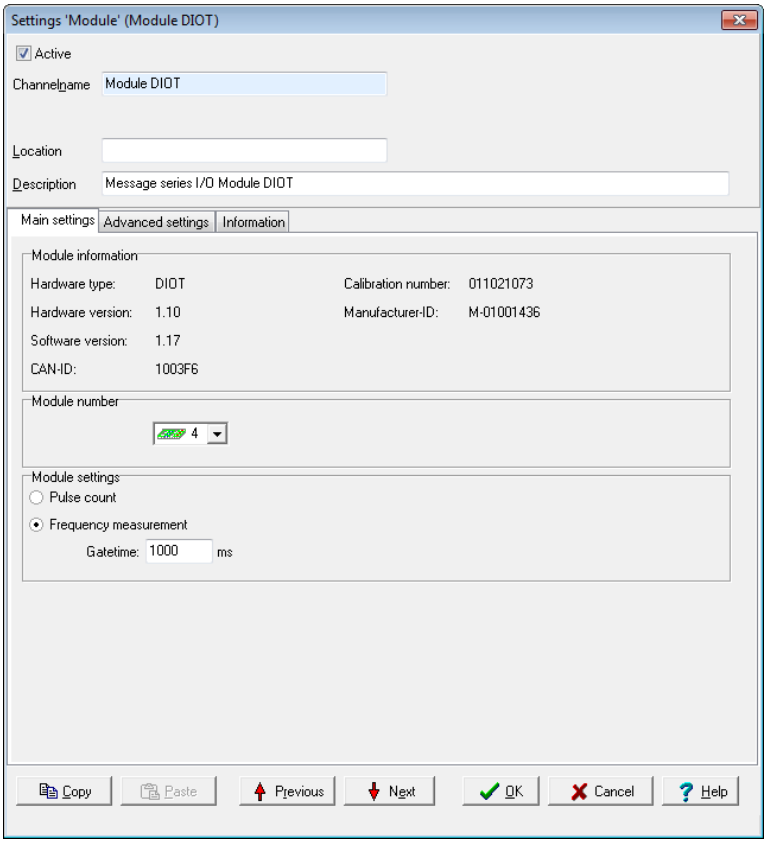
Refer also to Overview , Settings for all dialogues , Galvanic isolation, and Technical specifications

4.6.1 I/O modules

This section describes configurations at the I/O module level and how to delete a module entry. The I/O module AMDT for vibration measurement is explained in the section I/O module AMDT see also I/O module AMDT, section Configuraton.

An I/O module appears in the *Channels* tab as a  symbol. The I/O modules are available in the hardware view below the "Ext The → user-defined view lists all the I/O modules directly below the device ( ) – provided the user has not already moved the modules or channels. The user-defined view lists all the I/O modules directly below the device ( ) – provided the user has not already moved the modules or channels.

Double-click an I/O module or select Properties from the context menu to display the configuration dialogue. Use the dialogue to change the module name or set the module number (bus address) in the *Main settings* tab.



Main settings tab

Module information

This area shows the type, version and unique CAN-ID of the module.

Module number

The modules have no number, especially after loading of the factory settings. The number is important because a module can be active only when it has been assigned a unique number. Modules are displayed in numerical order in the channel view.

Give each connected module a unique number between 1 and 99. Numbers that have already been allocated are marked with the symbol. When

a number has been allocated, the module symbol is displayed next to the number.

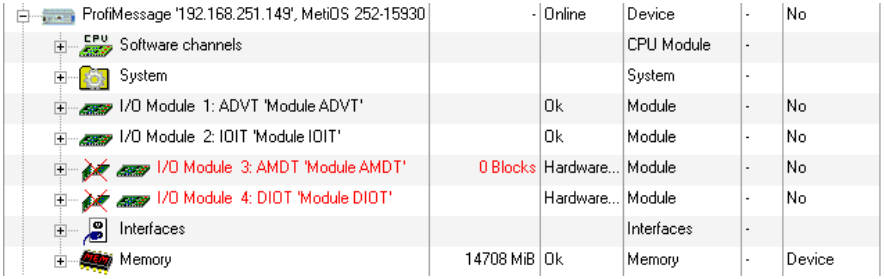
Module settings (for I/O modules DIOT and ADFT only)

These modules provide the option of using the counter inputs either as pulse counters or frequency measurements. For frequency measurements, set the period over which incoming impulses are totalled to enable the frequency to be determined. Low frequencies require a correspondingly longer time to acquire multiple vibrations, but measurement is slow for long time periods. Measurement is more dynamic for small times, but fewer vibrations are detected and measurement data fluctuates more strongly. Ensure the gate time is small enough at higher frequencies because the maximum number of pulses that can be counted is 65535.



delete module entries

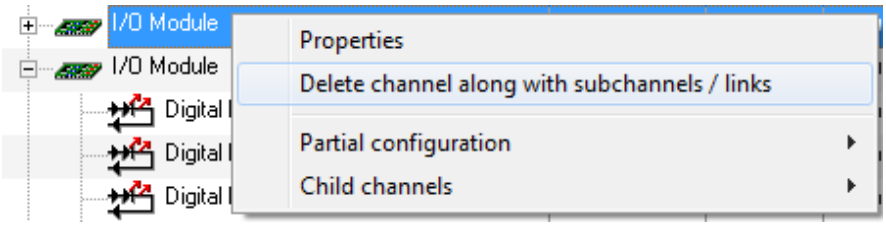
Modules can also be displayed that currently have no connection, but have been previously connected or configured. As long as they have not been deleted, they appear with the symbols  or  before the module symbol in red font. The configuration is retained and reloaded as soon as the module is reconnected.





Deleting a module entry permanently deletes the entire module configuration, including all hardware channels. Therefore, prior to deleting, back up the current configuration. Refer to save/ load configuration.

Delete the entire module entry when the module configuration is no longer required. Click *Delete channel along with subchannels/links* from the module's context menu.



4.6.2 AMDT I/O module

The AMDT I/O module for vibration measurement is discussed in a separate section.

Refer to AMDT I/O module.

Channel configuration/settings are described here: AMDT I/O module section configuration and operation.

4.6.3 Analogue input

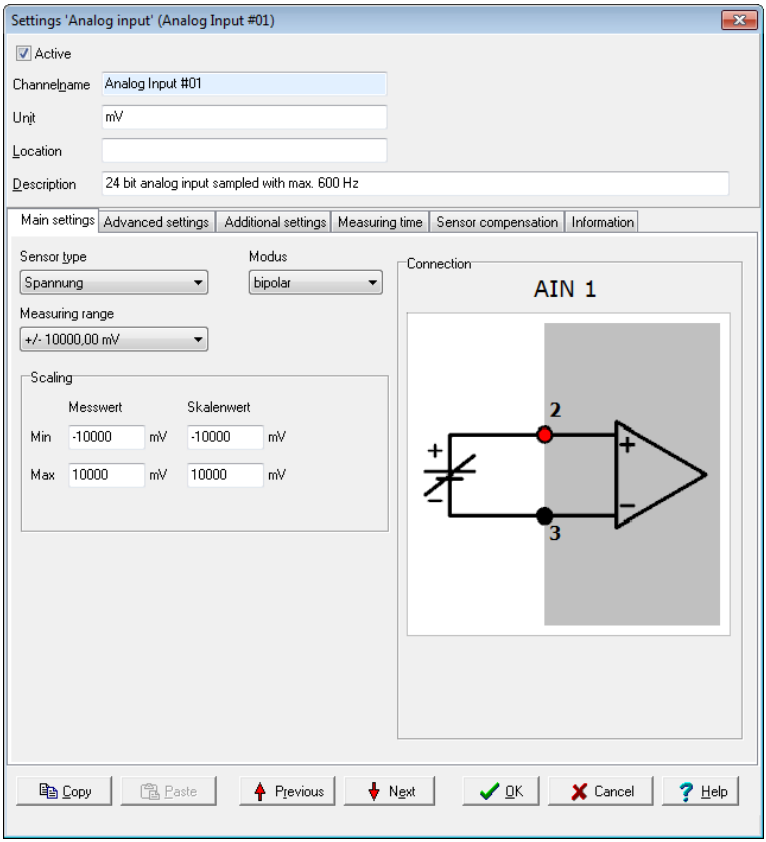
Configuration options in the *Main settings* tab of the analogue inputs dialog depend on the sensor type, and are explained in the following sections:

Refer also to "Additional settings tab" on page 52, "Sensor compensation tab" on page 54, "Information tab" on page 56.

Info

The section Examples of connections contains information on the connection of sensors, the section Metrological information contains background information on metrological practice.

4.6.3.1 Voltage sensor type



The example means: 0 mV corresponds to 0 bar, 5 V corresponds to 10 bar.

Mode

unipolar: Measuring only positive signals.

bipolar: Measuring positive and/or negative signals.

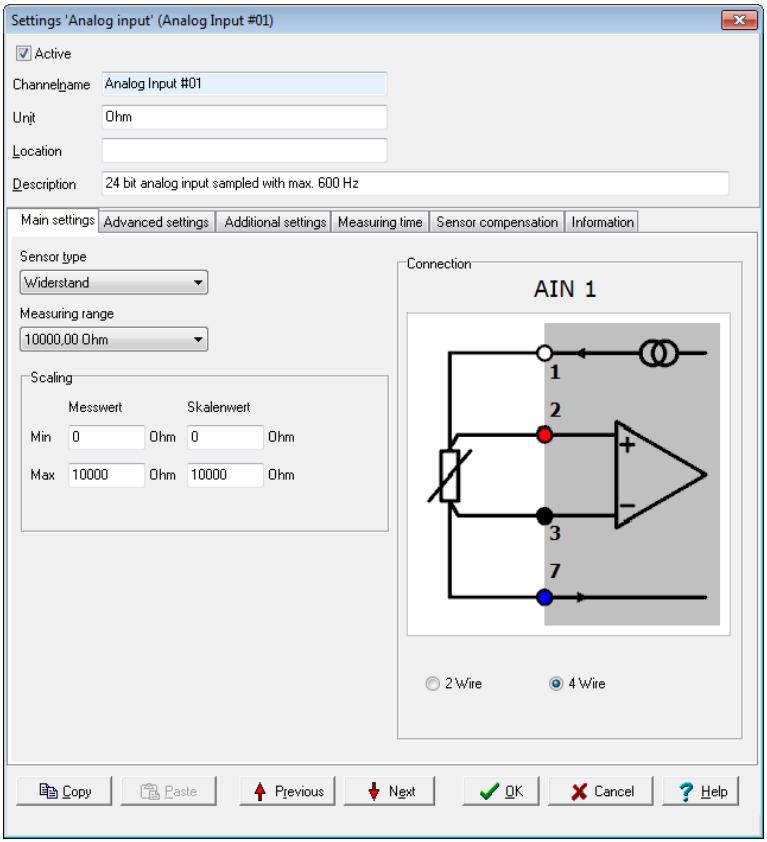
Measuring range

Select a measuring range that is equal to or greater than the signal from the sensor or signal source to prevent A/D converter overload. The channel receives the status 'Measurement range overrun/underrun' for measurements not within the range. Channel status values are available in status monitoring.

Scaling

Enter two points from the sensor's characteristic curve, if possible, the lower and upper vertexes. For a linear characteristic, measurement values are then converted into the unit of measurement (scaling) from the sensor. For non-linear characteristics, use *Sensor compensation*. Refer to tab Sensor compensation. The specified range (in the example 0bar to 10bar) is used as the default for the **ProfiSignal** graphic display area. The channel receives the status "scale range overrun" or "scale range underrun" when not within the range. Channel status values are available in the table in Status monitoring.

4.6.3.2 Resistance sensor type



The example means: 0 degrees corresponds to 0 ohms, 4000 ohms corresponds to 270 degrees.

Measuring range

Select a measuring range that is equal to or greater than the resistance from the sensor to prevent A/D converter overload. The channel receives the status 'Measurement range overrun/underrun' for measurements not within the range. Channel status values are available in status monitoring.

Scaling

Enter two points from the sensor's characteristic curve, if possible, the lower and upper vertexes. For a linear characteristic, measurement values are then converted into the unit of measurement (scaling) from the sensor. For non-linear characteristics, use *Sensor compensation*. Refer to tab Sensor compensation. The specified range (in the example 0 degrees to 270 degrees) is used as the default for the **ProfiSignal** graphic display area. The channel receives the status "scale range overrun" or "scale range underrun" when not within the range. Channel status values are available in the table in Status monitoring.

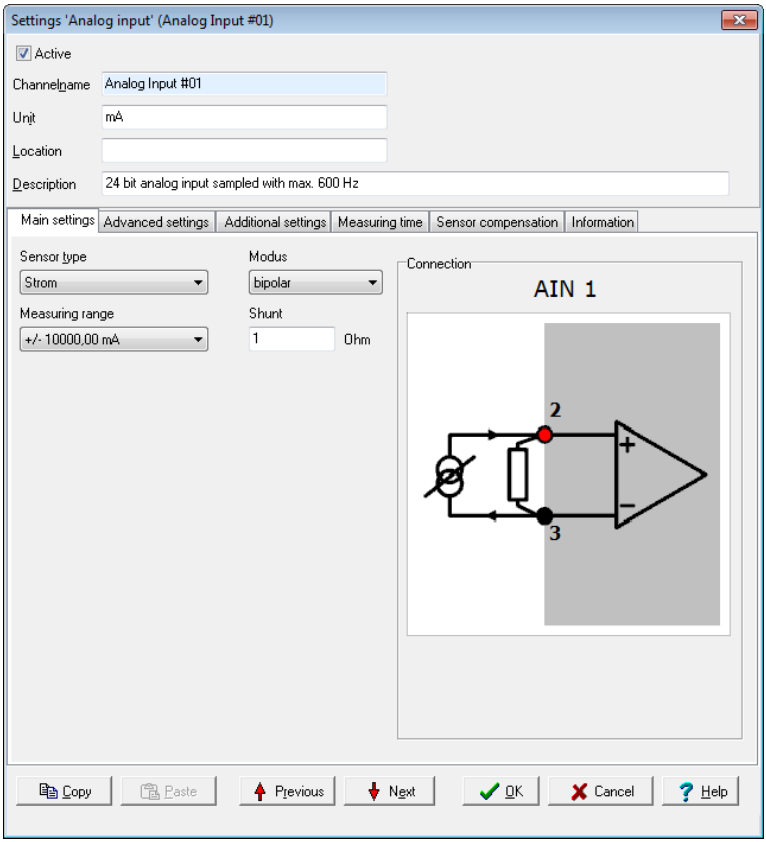
Connection

Indicate here how the sensor has been connected (the diagram displays the selected wiring):

2 Wire: The sensor is connected with only two wires. This is recommended only for very short lines and high impedance sensors otherwise the resulting voltage drop across the circuits can lead to measurement errors. Alternatively, a sensor can be used with three connections, where measurement takes place without line compensation.

4 Wire: The recommended connection method for low impedance sensors and/or longer supply lines. The loss of feed lines does not matter because the device has a high-ohm input resistance (no voltage drop on the line feed) and the voltage drop (the measurement value) can be measured directly at the sensor.

4.6.3.3 Sensor type current



Mode

unipolar: Measuring only positive currents.

bipolar: Measuring positive and/or negative currents.

Load

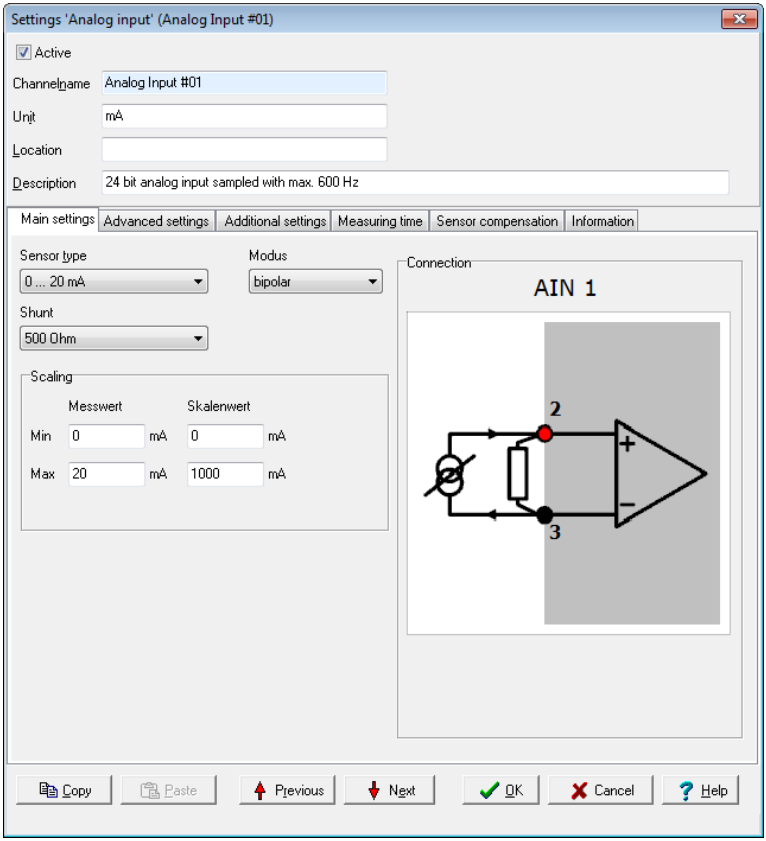
Specify the load resistor used. The load resistor also affects the maximum current range possible. When selecting the load resistor, note the power loss created at the resistor!

Current measurement is not possible without load resistance.

Measuring range

Select a measuring range that is equal to or greater than the current at the load resistor to prevent A/D converter overload. The channel receives the status 'Measurement range overrun/underrun' for measurements not within the range. Channel status values are available in the table in "Status monitoring" on page 165.

4.6.3.4 Sensor type current 0/4 mA to 20 mA



The example means: 0 mA corresponds to 0 l/h (litres per hour), 20 mA corresponds to 1000 l/h.

Mode

This setting is available only for sensor type *0 ... 20mA*. For sensor type *4 ... 20 mA* the measuring range is always unipolar.

unipolar: Measuring only positive signals.

bipolar: Measuring positive and/or negative signals.

Load

Enter the load resistance being used. **Delphin** offers various load resistances for the current measurement. Contact us to obtain a suitable resistance.

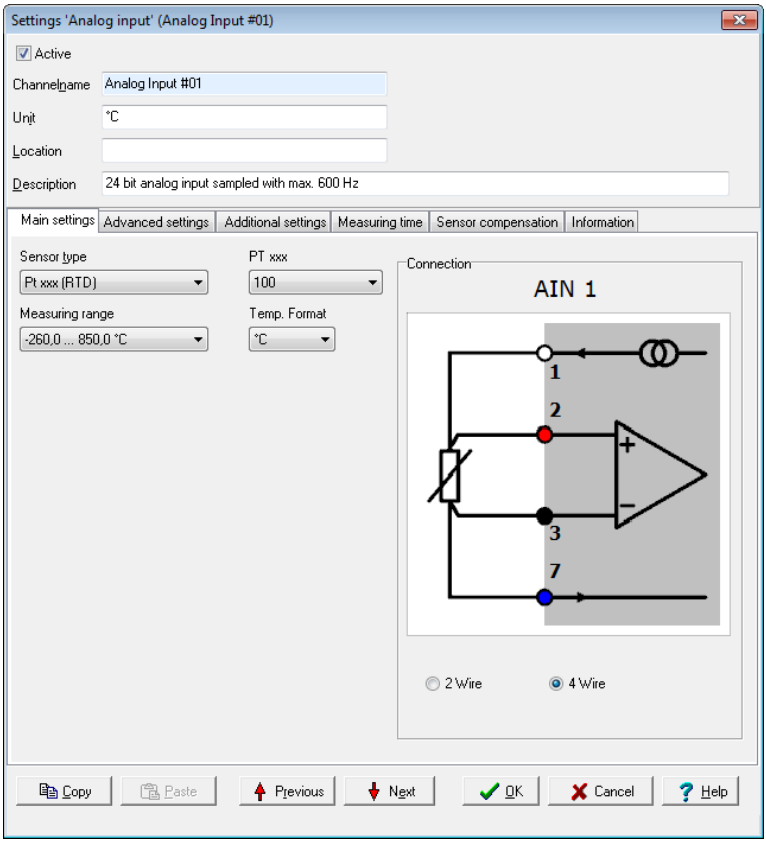


Current measurement is not possible without load resistance.

Scaling

Enter two points from the sensor's characteristic curve, if possible, the lower and upper vertexes. For a linear characteristic, measurement values are then converted into the unit of measurement (scaling) from the sensor. For non-linear characteristics, use *Sensor compensation*. Refer to tab Sensor compensation. The specified range (in the example 0 l/h to 1000 l/h) is used as the default for the **ProfiSignal** graphic display area. The channel receives the status "scale range overrun" or "scale range underrun" when not within the range. Channel status values are available in the table in Status monitoring.

4.6.3.5 Resistance thermometer sensor type



The example shows the settings for a Pt100 sensor. The settings for Nixxx sensors or PT1000 etc. are, however, similar.

Pt xxx or *Ni xxx* or *YSI400*

Select the resistance thermometer type used: *Pt100*, *Pt1000* or *Ni500* etc. The numerical values for the platinum and nickel thermometers correspond to their resistance at 0 °C.

YSI400 is a special NTC resistor mainly used in the medical field (temperature range -80 to 250 °C, resistance of 1660 ... 6400 Ω).

Measuring range

Select the measurement range being used. Depending on the sensor version only a limited range may be permissible. Refer to the sensor's technical data. The default is always the sensor's maximum possible measuring range. The channel receives the status 'Measurement range overrun/underrun' for measurements not within the range. Channel status values are available in status monitoring.

Temp. Format

Select the unit of measurement in which the temperature is to be displayed. Conversion is performed automatically within the device.

°C: Degrees Celsius

K: Kelvin

°F: Degrees Fahrenheit

R: Rankine

°R: Degrees Réaumur

Scaling

Enter the valid range for sensor signals. The specified range (in the example -260°C to +850°C) is used as the default for the display area for graphics in **ProfiSignal**. The channel receives the status "scale range overrun" or "scale range underrun" when not within the range. Channel status values are available in the table in Status monitoring.

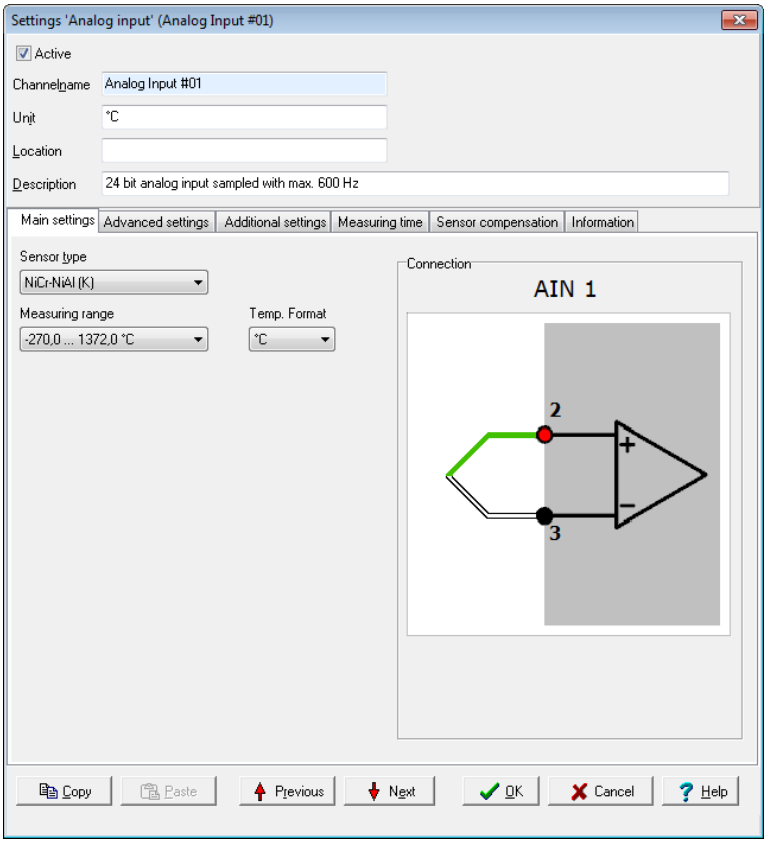
Connection

Indicate here how the sensor has been connected (the diagram displays the selected wiring):

4 Wire: The recommended connection method for low impedance sensors and/or longer supply lines. The loss of feed lines does not matter because the device has a high-ohm input resistance (no voltage drop on the line feed) and the voltage drop (the measurement value) can be measured directly at the sensor.

2 Wire, *3 Wire*: The sensor is connected with only two/three wires. This is recommended only for very short lines and high impedance sensors, because there is no line compensation, that is, the voltage drop across the circuits leads to measurement errors.

4.6.3.6 Thermocouple sensor type



The example shows the settings for a type K thermocouple (NiCr-NiAl, nickel-chrome and nickel-aluminium alloy).

Sensor type

Select your thermocouple type. The letter type and material type of the thermocouple wires are given.

Measuring range

The maximum possible sensor measuring range is pre-selected. The channel receives the status 'Measurement range overrun/underrun' for meas-

urements not within the range. Channel status values are available in status monitoring.

Temp. Format

Select the unit of measurement in which the temperature is to be displayed. Conversion is performed automatically within the device.

°C: Degrees Celsius

K: Kelvin

°F: Degrees Fahrenheit

R: Rankine

°R: Degrees Réaumur

Scaling

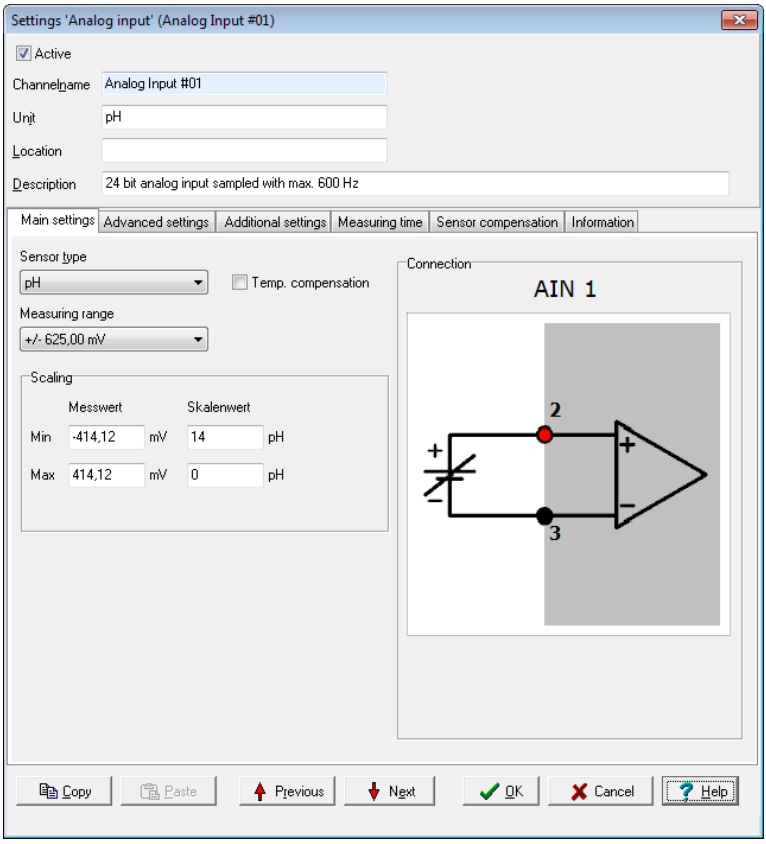
Enter the valid range for sensor signals. The specified range (in the example -270°C to +1372°C) is used as the default for the display area for graphics in **ProfiSignal**. The channel receives the status "scale range overrun" for "scale range underrun" when not within the range. Channel status values are available in the table in Status monitoring.



Info

Enter the compensation to be used in the *Advanced settings* tab. Refer to Settings for all dialogues.

4.6.3.7 Ph probe sensor type



This sensor type determines the pH value from the voltage of the pH probe in mV and the temperature in ° C of the reference junction via the Nernst factor.

Nernst factor = ln10 * molar gas constant * absolute temperature / Faraday constant
molar gas constant = 8.314472 in J/(mol*K),absolute temperature = temperature of the reference junction + 273.15 in K,Faraday constant = 96.4851534 in J/(mV*mol)

Sensor type

Select *pH*.

Sensor measuring range

A range of ±625 mV is sufficient for this sensor type.

Temp. compensation

Temperature compensation is determined by measuring the temperature at the measurement point in the solution to be determined. Activate compensation and configure the channel using the *Advanced settings* tab. Refer to Settings for all dialogues.

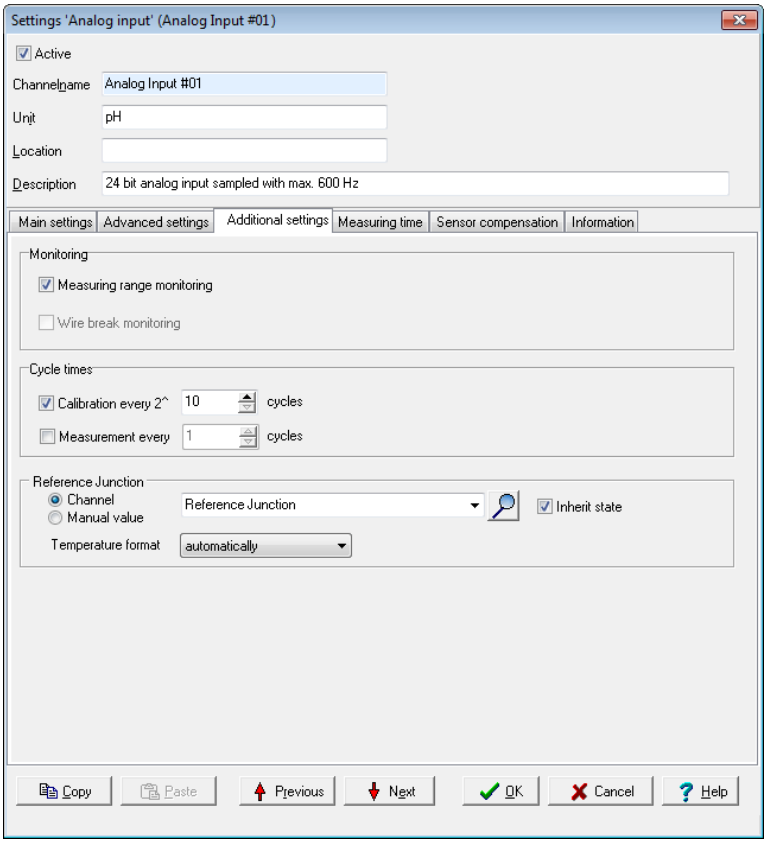
Scaling



The default scaling uses the standard measurement methods and should not be altered.

4.6.3.8 Advanced settings tab

The *Extended settings* tab is identical for all analogue input sensors but not every setting is accessible from every type of sensor.



Monitoring

Measurement range monitoring: When measurement data is not within the *Measurement range* specified in the *Main settings* tab, the channel status is set to 'Measurement range overrun/underrun'. Otherwise the status displays 'OK'. The output value of the channel is set to the maximum or minimum value of the *Scaling* value (in the *Main settings* tab). Channel status values are available in status monitoring.

Wire break monitoring: The option is useful for monitoring sensor failure in, for example, thermocouples or sensors with 4 mA–20 mA output. In the event of a failure, channel status is set to 'Wire-break'. Channel status values are available in the table in Status monitoring.

Cycle times

Calibration every 2 ^ x cycles: Offset errors require correcting from considerable ambient temperature fluctuations in long term measurement procedures. This setting determines how often this happens. A cycle is made up of the measurement of all active channels in the module (refer to *Module's overall measurement time* in the *Measurement cycle settings tab).* The default is every 1024 cycles (210). For an A/D measurement time of 100 ms for 8 active channels, any offset errors are then corrected approximately every 14 minutes.

Measurement every x cycles: The setting can be made for a measurement from a channel not to be taken in every cycle (as in all other channels), but, for example, only every 10th cycle. A cycle is made up of the measurement of all active channels in the module (refer to *Module's overall measurement time* in the *Measurement cycle settings* tab).

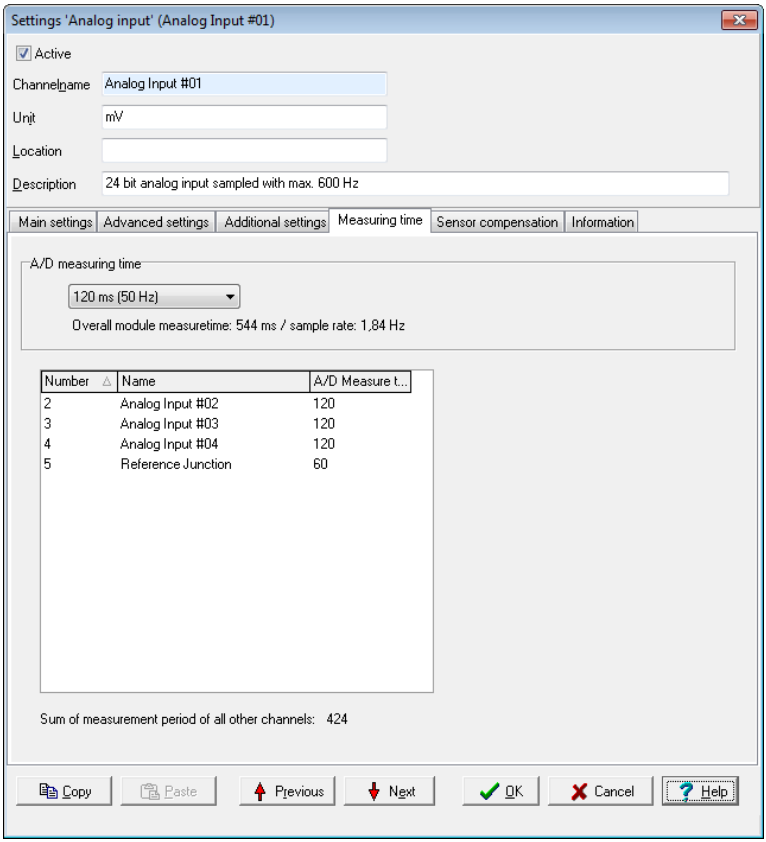
Cold junction

The setting is available for thermocouple sensor types and pH probes. Enter the *Channel* that is to be used for the thermocouple's cold junction measurement (junction between thermocouple and copper wire/-connector) or the temperature compensation for the pH probe. The default *Reference Junction* uses the measurement from the Pt100 temperature sensor at the I/O module's terminal and is practical only for the thermocouple sensor type. A different channel may also be used for when the temperature at the thermocouple to the copper wire junction remains constant, or this temperature value can be entered as a *Manual value*. *Inherit status* means that the cold junction is also applied to the current measuring point.

4.6.3.9 Measurement cycle settings tab

The following I/O modules allow for the measurement time to be set:
AAST, ADGT, ADIT and ADVT

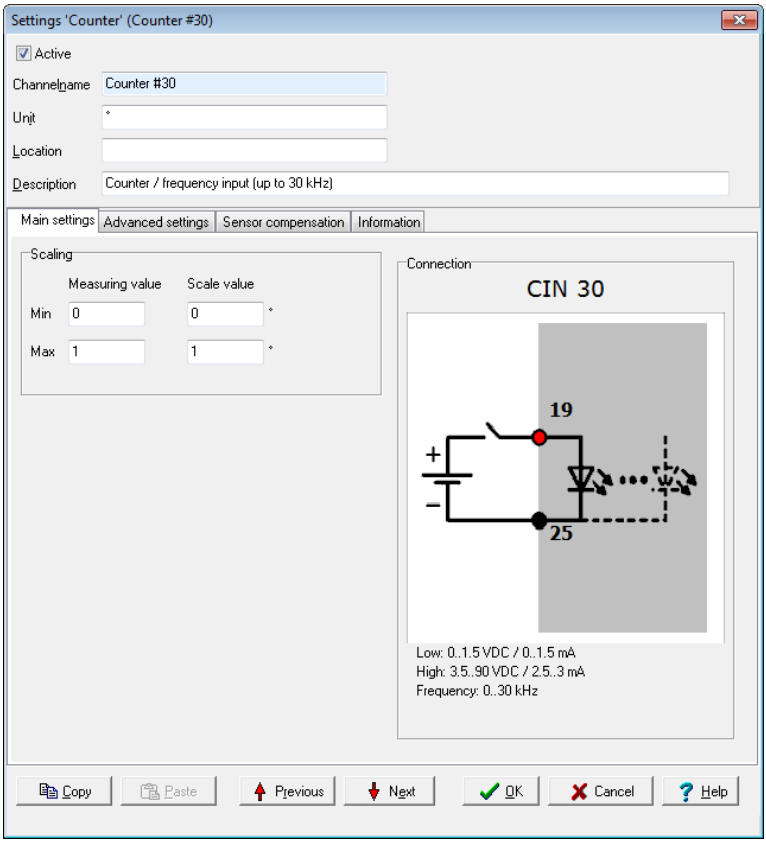
The setting can be used to suppress, for example, hum interferences generated by the mains frequency. It also affects the measurement time, that is, how long it takes before a measurement value and/or the measurement data of all channels are available. The resulting measurement time for all channels of the I/O module and/or the resulting sampling rate per channel will be displayed below your selected measurement time.



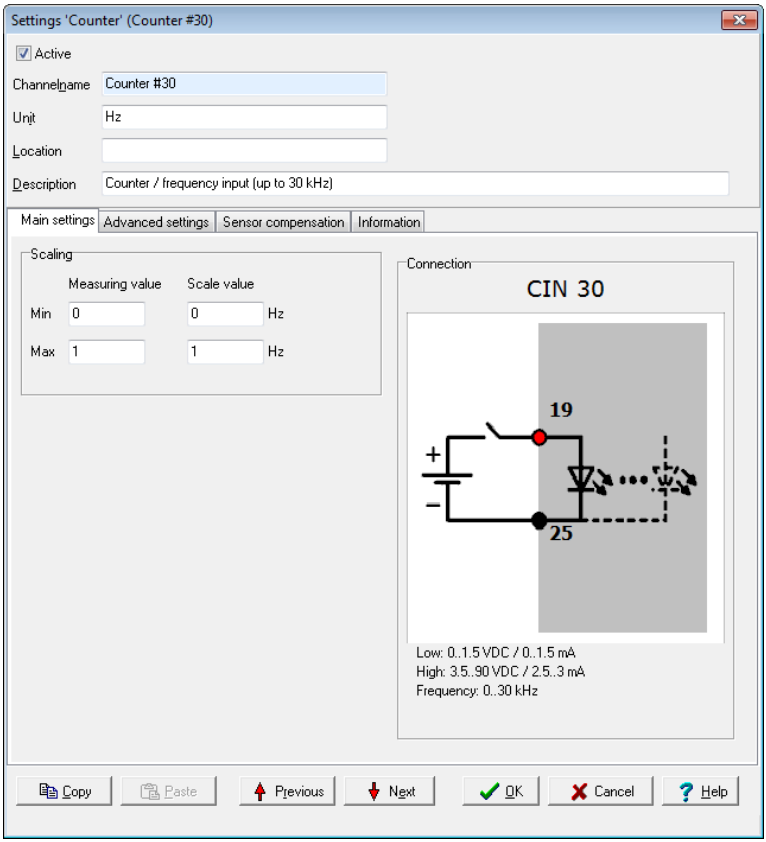
4.6.4 Digital input with counter/frequency measurement

For the modules DIOT, AMDT and ADFT, use the *Main settings* (DIOT and ADFT) or *Rotation speed measurement* (AMDT) tabs to select whether the digital inputs are to be used for counting (*pulse counting*) or *frequency measurement*. Pulse counting occurs according to a signal's falling edge. For frequency measurement, pulses are counted that occur within the gate time. The result is then converted into a frequency.
Refer also to Module, *Main settings tab*, *Module settings*, "Additional settings tab" on page 52, "Sensor compensation tab" on page 54, "Information tab" on page 56.

Pulse counting or frequency measurement settings apply to all digital inputs of an I/O module.



The example means: 0 pulses correspond to 0 degrees, 7200 pulses correspond to 3600 degrees (10 rotations).



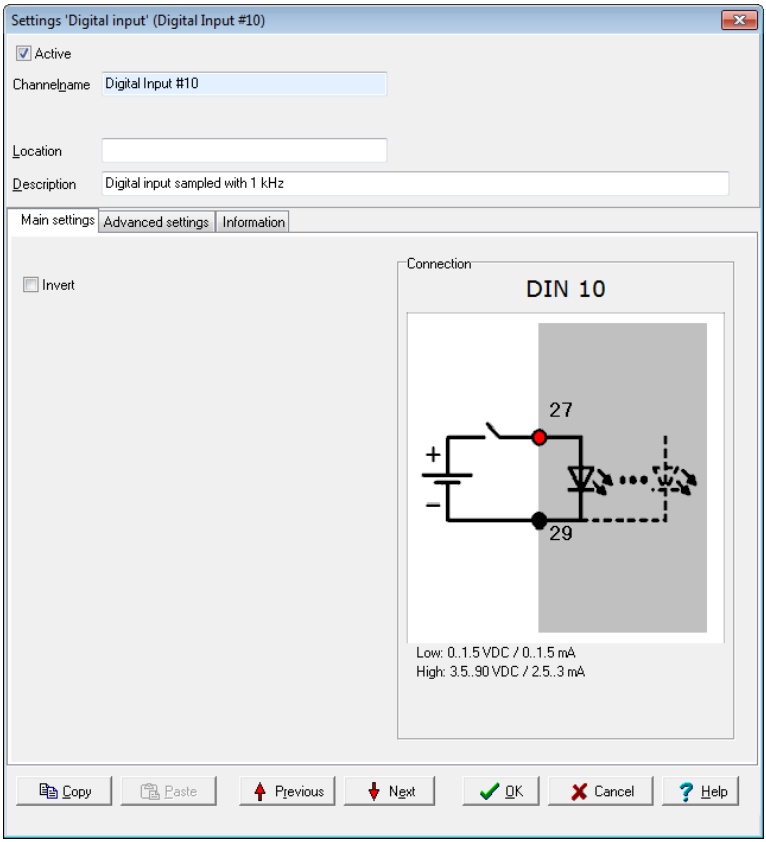
The example means: 0 pulses correspond to 0 kHz, 5000 pulses correspond (with a gate time of 100 ms) 50 kHz.

Scaling

Enter two points from the sensor's characteristic curve, if possible, the lower and upper vertexes. For a linear characteristic, measurement values are then converted into the unit of measurement (scaling) from the sensor. For non-linear characteristics, use *Sensor compensation*. Refer to tab Sensor compensation. The specified range (0 to 3600 degrees in the upper example, i.e. 10 rotations; in the lower example 0 to 50 kHz) is the default for the display area in **ProfiSignal** graphics. The channel receives the status "scale range overrun" for "scale range underrun" when not within the range. Channel status values are available in the table in Status monitoring.

4.6.5 Digital input

Refer also to "Additional settings tab" on page 52, "Information tab" on page 56.

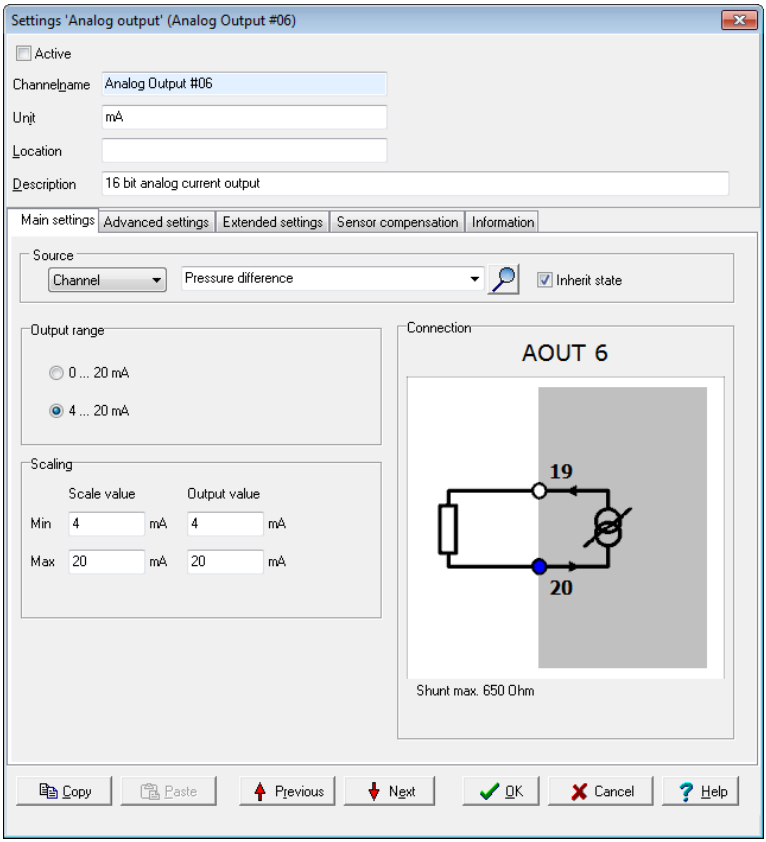


Inverted: This option inverts a 'high' level at the input to a 'low' level at the output (measurement signal in device) and vice versa.

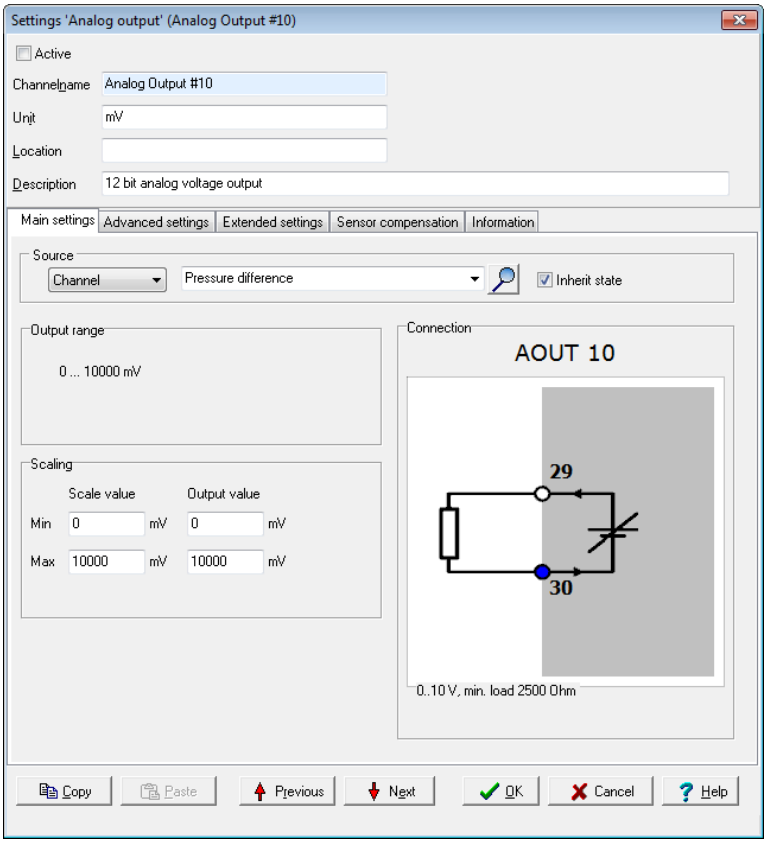
4.6.6 Analogue output

Depending on the module, either currents or voltages can be output. The *Output range* in the configuration dialogue indicates whether currents can be output in the range 0 to 20 mA or 4 to 20 mA or voltages in the range 0 to 10 V or ± 10 V.

Refer also to the Advanced settings, "Additional settings tab" on page 52, "Sensor compensation tab" on page 54, "Information tab" on page 56.



The example means: 0 bar corresponds to 4 mA, 0.5 bar corresponds to 20 mA.



The example means: 0 bar corresponds to 0 V, 0.5 bar corresponds to 10 V.

Source

Enter either a constant value (*Manual value*) or select an existing channel from *Channel*, from which the value can be output. Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal** application.

Scaling

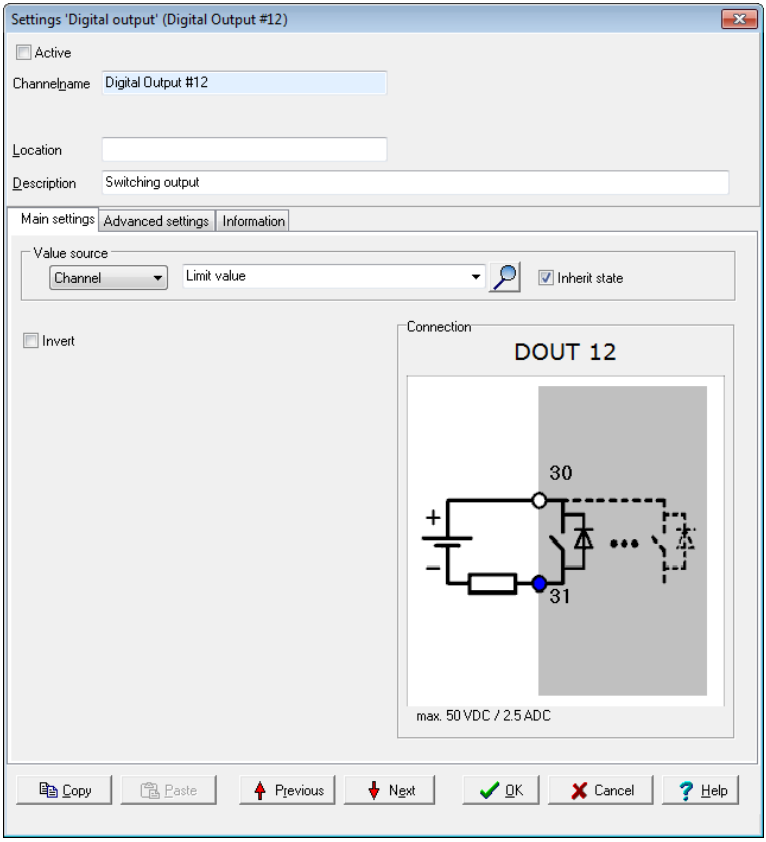
Enter two points from the sensor's characteristic curve, if possible, the lower and upper vertexes. Values from the source are then linearly converted into the range of specified output values. For non-linear characteristics, use *Sensor compensation*. Refer to tab Sensor compensation. The specified range (in the example 0 to 0.5bar) is used as

the default for the display area in graphics of **ProfiSignal**. The channel receives the status "scale range overrun" or "scale range underrun" when not within the range. Channel status values are available in the table in Status monitoring. The *Output range* defines the limits of the current or voltage output.

4.6.7 Digital output

The digital output corresponds to a switch that is either ON (the two output terminals are connected, the input is "High") or OFF (no current flow between the two output terminals, the input is "Low") An external voltage source may be necessary (see wiring diagram in the dialogue). Be aware of the maximum permitted currents and voltages for the digital output, (refer to the Technical specifications).

Refer also to "Additional settings tab" on page 52, "Information tab" on page 56.



Source

Enter either a constant value (*Manual value*) or select an existing channel from *Channel*, from which the value can be output. Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal** application.

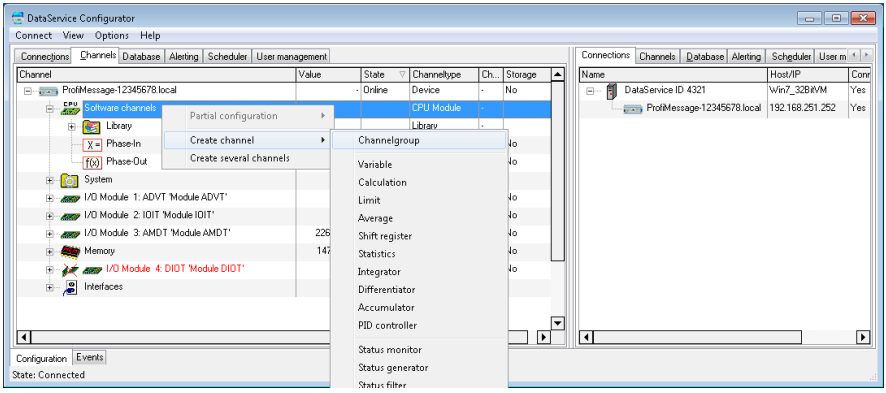
Inverted: This option inverts the "High" level for the channel into the OFF state (No current flow between the two output terminals) at the output and vice versa.

4.7 Configuring software channels

Refer also to Settings for all dialogues

Software channels are calculations or functions that are performed within the device. In previous device families from **Delphin**, such channels were also called virtual channels. Any number of channels can be created. This is a standard feature of the device.

Display the *Software channels* in the context menu (DataService tab *Channels*). You can then either create a *Channel group* (e.g. *Analogue channels* in the example) to group together created channels, or select one of the available channel operations. The context menu contains all available calculations and functions.



Alternatively, software channels can be created via the context menu of a hardware channel as *Create dependent channel.* In contrast to creation via *Software channel*, the source channel is already selected within the dialogue and the channel is (initially) located directly under the hardware channel. Following creation, the user-defined view enables channels to be moved and grouped differently.

Another option enables the linking of a channel. The original channel remains in the original position, but creates in another location an entry that is linked to this channel.

Linking channels

From the *Options* of the DataService Configurator, select *Move/link channels*. Further information is available in the manual of the *DataService Con→ figurator.→* Further information is available in the manual of the DataService Configurator.

Further configuration is similar to module channels. Specific settings for each function are explained in the sections here. General information on dialogs is available in Settings for all dialogues.

4.7.1 Adder

This software channel adds together all values from the specified source channel:

Adder = adder + new value

Reset: When enabled, the calculated sum is output only in the case of a reset event and then reset internally to zero. When not enabled, the sum is output for each new value from the source channel.
Refer also to Trigger options .

Generate intermediate values: When enabled, results are also output between reset events immediately following their calculation, (without being reset to zero).

Initial value: This enables you to indicate a start value. Select an available channel whose value will be used via*Channel*, or enter a constant value (*Manual value*). Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal**application.

4.7.2 Operating hours counter

This software channel registers the time period during which the source has an active level. When the level becomes inactive, the time period is added to the existing time period.

High level / Low level: Sets the active level of the source.



The operating hours counter retains its value even when the scale is altered.

Enable *Reset* and configure a channel and the trigger (*edge*, *level*) to reset the operating hours counter at the time the reset event occurs.
Refer also to Trigger options .

4.7.3 Differentiator

Refer also to Additional settings tab, "Information tab" on page 56.

This software channel calculates the ratio of the difference between two values from the source channel to the difference between their time stamps in relation to the time base:

$$Differenzial = \frac{(\square Wert)}{\square Zeichenstempel} * Zeitbasis$$

Time base: Enter the time base for the calculation. The default is 1000 ms.

Timeout: Enable this option if a calculation is to be performed despite a constant source signal. In this case, enter the time period after which the calculation is to be performed.

Overflow hardware counter: Takes into account the overflow of counter channels. This is useful in connection with 16-bit counter channels of DIOT, AMDT and ADFT.

Enable the *Trigger* if the calculation is to be triggered by specific events. The differential between successive trigger events is then calculated.
Refer also to Trigger options.

4.7.4 Event (Mail)

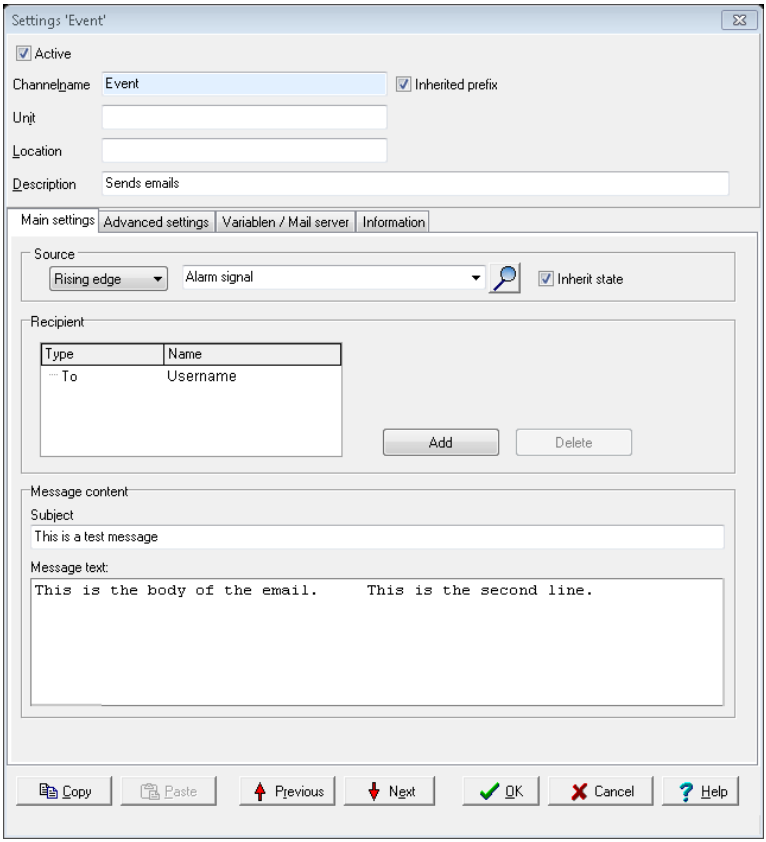
Specify an event here that, when it occurs, triggers the sending of a mail (or SMS if there is a WWAN option).



Info

Create the necessary information prior to calling the dialogue. When sending mails, create the mail server to be used and the necessary mail addresses of recipients in Directory (User management). For sending SMS, create users with registered phone numbers in Directory (User management).

Main settings tab



Info

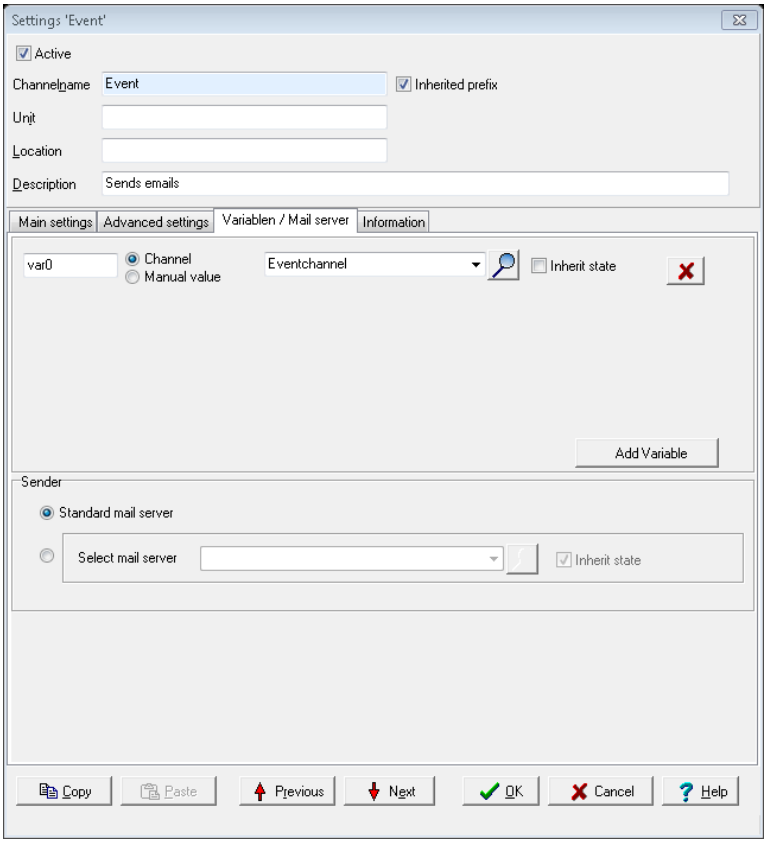
Set special variables for the message text or subject line in the dialogue of the *Variables/Mail Server* tab.

Source: Specify whether the event is to occur with a rising, falling or both edges of the channel in question.
Refer also to "Trigger options" on page 58.

Recipient: Select a recipient from the list in the Name column. Also select in the Type column how the selected user is to be notified by the event channel. Click Add for additional recipients.

Message content: Enter here the *subject line* and text of your mail/SMS (*Message text*).

Variables/Mail Server tab



Using *Add variable* you can create variables here that can be used in the subject line or message text.

Mail Server/Sender: Enter here the "Mail server" on page 71 used to send the mails.

Examples

In the network settings, you have entered *Logger01* for the *host name* and *aeolus.local* for the *domain*; the channel name is *EventVar*.

The Hostname setting uses *EventVar@Logger01.aeolus.local*.

If you entered in the free setting, for example, *test@delphin.de*, *EventVar <test@delphin.de>* will be sent, that is, the channel name is sent in addition as a name to be displayed.

Incorporate channel values in the text to be sent

To do this, switch to the *Variables/Mail server* tab and press the *Add variable* button.
A new line appears. Now name the variable and select the appropriate source channel.
To use the newly created variable in the message text, please switch back to the *Basic Settings* tab.
In the *message content*, a variable can be used according to the following scheme:
`%variablen_name.variablen_attribut%`
For `variablen_name`, please insert the previously selected variable name.
The following options are available for `variablen_attribut`:

Attribute	Displayed value
Surname	Source channel name
id	Hexadecimal ID of the source channel
value (int)	Integer value of the source channel
value (float)	(floating) comma number of the source channel
value (string)	Text value of the source channel
flags.l	Flags of the source channel

Example

For example, if you want to monitor a temperature, you can trigger an event by exceeding a limit.
Assuming an *analogue input* measures the ambient temperature by thermocouple. This analogue input is monitored by *limit channel*. This limit channel is configured to 35 °C. The limit channel serves as the source for an *event channel*. As variables in the event channel, the analogue input is configured as *var0* and the limit channel is configured as *var1*.
Below is the example configuration of the message content:

```
Die Temperaturmessung an %var0.name% meldet eine Überschreitung des Grenzwertes von %var1.value(int)%°C!
Die derzeitig gemessene Temperatur beträgt %var1.value(float)% °C.
```

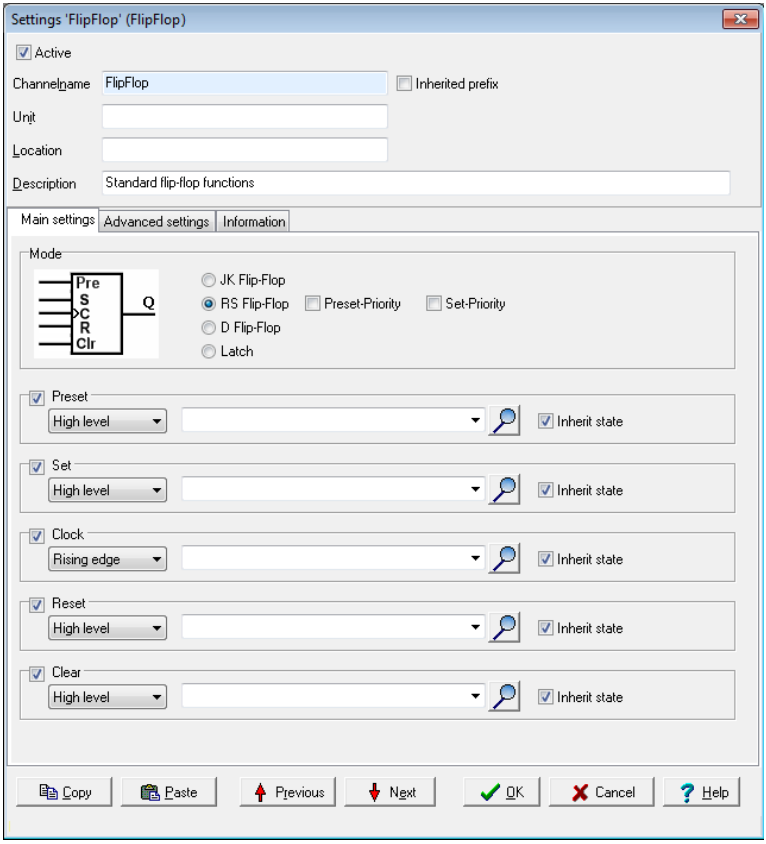
The resulting mail/SMS thus contains the following, for example:

```
Die Temperaturmessung an Analogeingang #03 - Thermoelement meldet eine Überschreitung des Grenzwertes von 35°C!
Die derzeitig gemessene Temperatur beträgt 36,565°C.
```

4.7.5 Flip-flop

This software channel functions as a hardware flip-flop.

Select the type of flip-flop in the *Mode* field. A diagram is displayed depending on the selection. Various inputs are available. Disable any unnecessary inputs.



The "Latch" mode will store any data types, for example, if the D source is an analogue channel, the flip-flop stores the analogue value.

The following tables show possible statuses.
This means: X = any level, ↑= edge, H = "high" level, L = "low" level.
Refer also to Trigger options .

JK flip-flop

Status	Y	K	C (clock)	Clr (clear)	Pre (preset)	Q
1	X	X	X	H	X	L
2	X	X	X	L	H	H
3	L	L	X	L	L	Previous status
4	H	L	↑	L	L	H
5	L	H	↑	L	L	L
6	H	H	↑	L	L	Toggle

RS flip-flop state table

Status	S	R	S + set priority	C (clock)	Clr (clear)	Pre (preset)	Q
1	X	X	X	X	H	X	L
2	X	X	X	X	L	H	H
3	H	L	X	↑	L	L	H
4	L	H	X	↑	L	L	L
5	H	H	L	↑	L	L	L
6	H	H	H	↑	L	L	H
7	L	L	X	X	L	L	Previous status

In RS flip-flop, there is the additional option of *Set priority*, i.e. the value at set input (S) has priority when R = H.

D flip-flop

Status	D	C (clock)	Clr (clear)	Pre (preset)	Q
1	X	X	H	X	L
2	X	X	L	H	H
3	H	↑	L	L	H
4	L	↑	L	L	L
5	L	L	L	L	Previous status

Latch

Status	D	C (clock)	Clr (clear)	Q
1	X	X	H	L
2	D	↑	L	D
2	D	H	L	D (transparent)
3	X	L	L	Previous status

4.7.6 Limit value

This software channel monitors the specified source channel. The result, i.e. the output signal of the limit value channel, is "High" when the specified alarm conditions are met.

The following forms of monitoring are available:

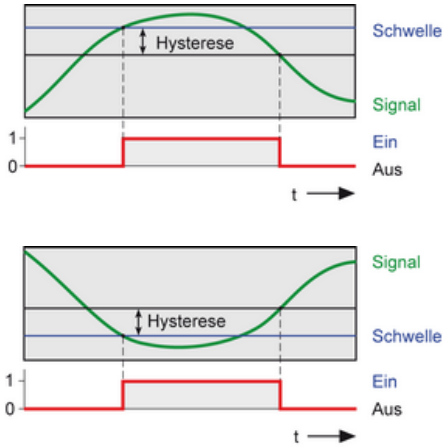
Mode	Alert when
Overrun	the value is above the specified range or above the threshold
Underrun	the value is below the specified range or below the threshold
Band monitoring	the value is outside the specified range (threshold ± bandwidth)
Band violation	the value is within the specified range (threshold ± bandwidth)
Steady condition	values change by more than the bandwidth during lag time.

In addition, you can also set no triggering for wire-breaks at the source. The setting is only for sources (sensors) which can have wire-break monitoring.

For all input, either enter a fixed value (*Manual value*) or specify a *channel* that delivers the value. It is possible to dynamically change the limit values during measurement.

Threshold is the decisive value in monitoring.

Hysteresis: Hysteresis prevents the alarm being repeatedly activated for small fluctuations around the threshold value in the monitored signal. Depending on switch direction, the hysteresis lies below the threshold (for overruns) or above the threshold (for underruns). See images. The hysteresis is especially beneficial for small (noise) signals. The *Delay* option offers an alternative.



Bandwidth: Sets the "monitoring window" for forms of monitoring: *Band violation* and *steady condition*. In *Band monitoring/violation*, the "monitoring window" is symmetrical to the threshold. The value entered acts as a subtraction to the window with *band monitoring* in positive and negative directions, and as an addition with *band violation*.

Example: Threshold = 50, bandwidth = 3 → means the range from 47 to 53 is monitored.

Delay: The alarm condition must be me during the specified time to trigger an alarm. The option is an alternative to the *Hysteresis* option and is especially suitable for suppressing false alarms for brief signal distortions with high amplitudes. Both options can be combined.

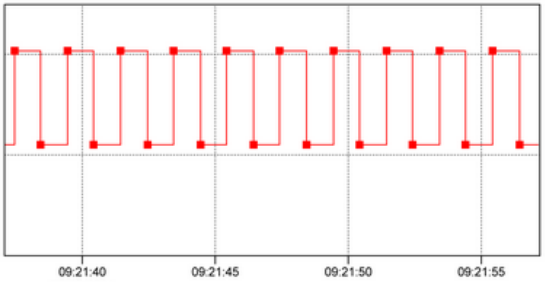
Latching: The alarm is latched (continues to alarm) even when the alarm condition is no longer met. Enabling *Latching* changes the field label in Reset trigger for latching. The alarm resets when a reset event occurs, e.g. a *rising edge* in the given channel. The *Reset priority* option causes an alarm to reset when the alarm condition is still met.

Refer also to Trigger options.

4.7.7 Pulse generator

This software channel can be used in two different modes:

- *Free running*: Continuous pulses are generated at a fixed repetition rate (*Cycle time*) and at a set *Pulse width*.



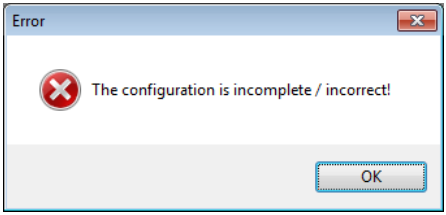
- *Synchronous*: Pulses are generated with a repetition rate based on the time. If, for instance, a *Cycle time* is set at 15 minutes, pulses are generated at 00, 15, 30 and 45 minutes of each hour. As the pulses can only be generated with an integer scaling factor, only discrete values can be selected.
  In this mode, only certain times can be selected from the list as the cycles represent integer scaling factors with respect to time.

Source: In the trigger option *Level*, the pulse generator only operates while the source is active. In the trigger option *Edge*, the pulse generator starts with the edge of the source and runs continuously or until stopped with *Reset*.

Pulse width: Sets the pulse duration, for example how long the pulse maintains a "High" level.

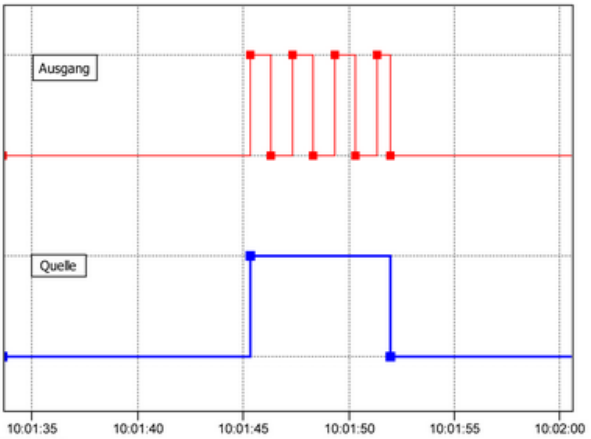
Cycle time: Sets the pulse repetition rate.

Reset: Sets the output of the pulse generator immediately (asynchronous) to "Low" level when the event occurs, unless *End of running cycle* is enabled, in which case it will go on until the current cycle is finished. If the *Level* trigger setting is selected, this signal permanently suppresses further pulses occurring at the pulse generator output (as long as the respective level is applied).
Refer also to "Trigger options" on page 58.



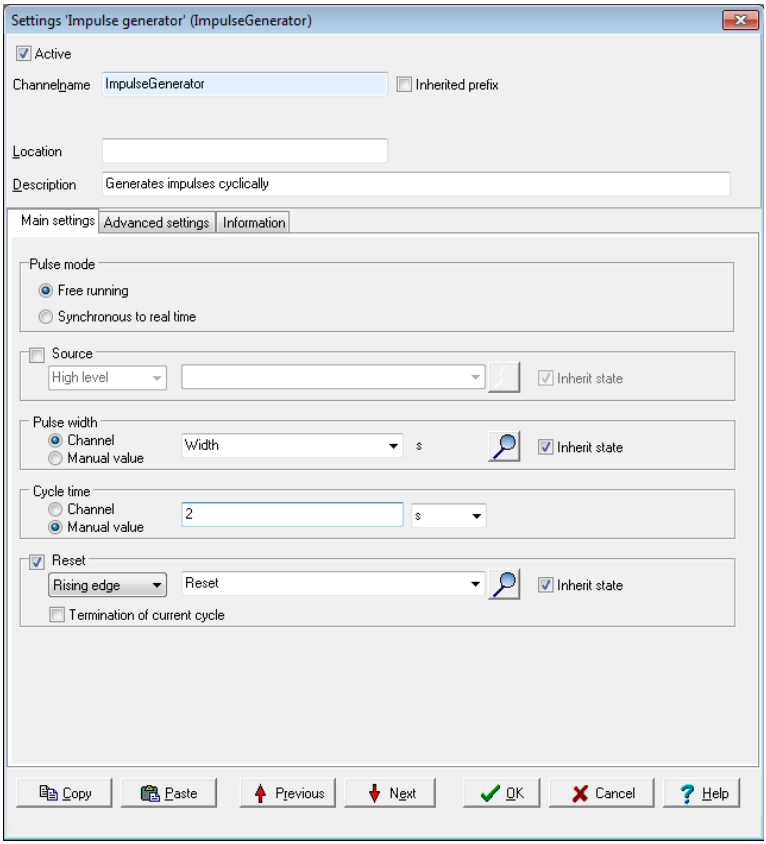
After closing the dialogue with *OK*, a validity check is performed. If the input is invalid, e.g. the pulse width is greater than the cycle time, an error message is displayed and the previous valid configuration is retained.

Examples

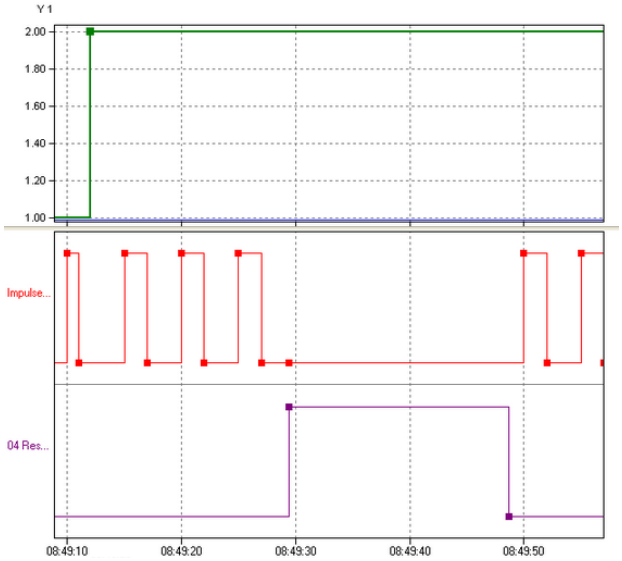


The diagram shows the release of the pulse generator (**red** curve) by the source (**blue** curve).

Example 1

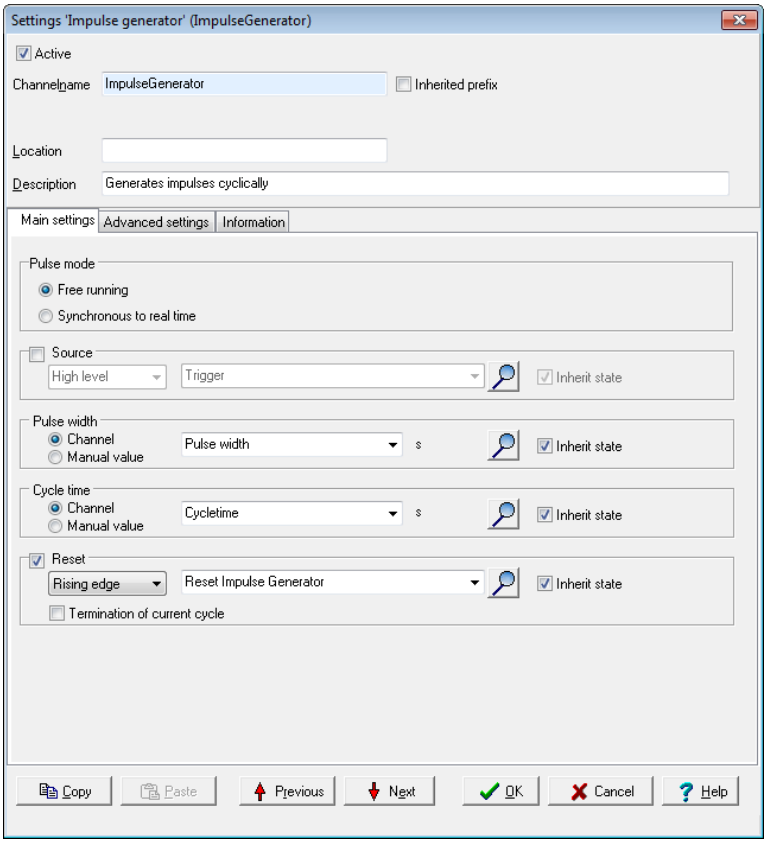


In this example, the pulse generator runs in continuous mode. The cycle time is 5 seconds. A channel has been selected for the pulse width that initially outputs the value 1 and then the value 2. The channel is not permitted to output a negative value (no negative times) nor a value greater than the cycle time, i.e. 5 in this example. Another channel is given for the reset.

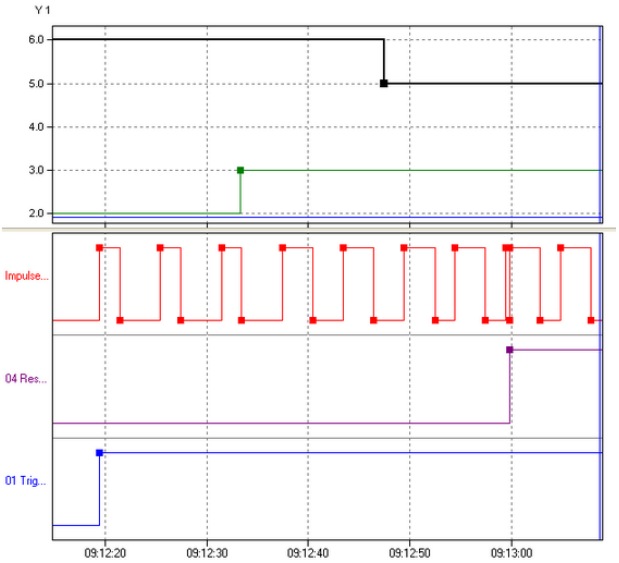


Once the pulse generator starts (**red** curve) with a pulse duration of 1 second, the pulse duration is set to 2 seconds (**green** curve). After three pulses, the reset channel (**purple** curve) gives the reset signal and the pulse generator issues no more pulses (the next pulse would be due at 8:49:30). Pulses begin again only after deleting the reset signal (level = "Low"). The cycle time indicates that the next pulse will be output at 08:49:50.

Example 2



In this example, the pulse generator runs in controlled mode. The trigger is enabled by setting *High level* ("High"). The pulse width and cycle time are set by other channels. Note that these channels may not issue negative values (no negative times) nor conflicting values such as a pulse width greater than the cycle time. Another channel is given for the reset.



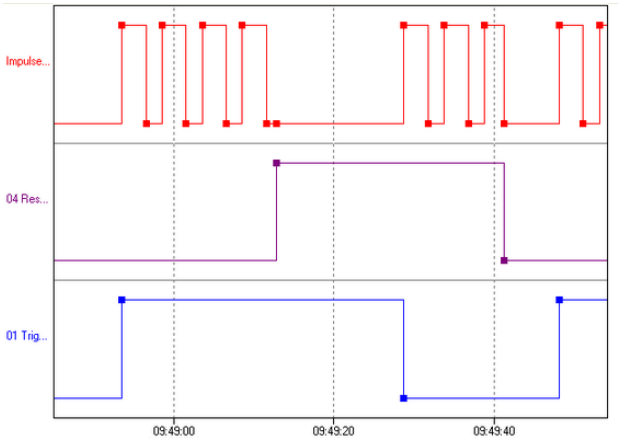
The pulse generator (**red** curve) is started by the trigger channel (**blue** curve) with a 2-second pulse duration (**green** curve) and a 6-second cycle time (**black** curve). After three pulses, the pulse duration is increased to 3 seconds (**green** curve). After another two pulses, the cycle time (**black** curve) is reduced to 5 seconds. Just before 9:13:00, a reset occurs at the rising edge of the reset channel. Because the trigger source has a "High" level, the pulse duration re-starts even though a pulse has already begun.

Example 3

The following examples illustrate the relationship between trigger signal and reset signal.

a)

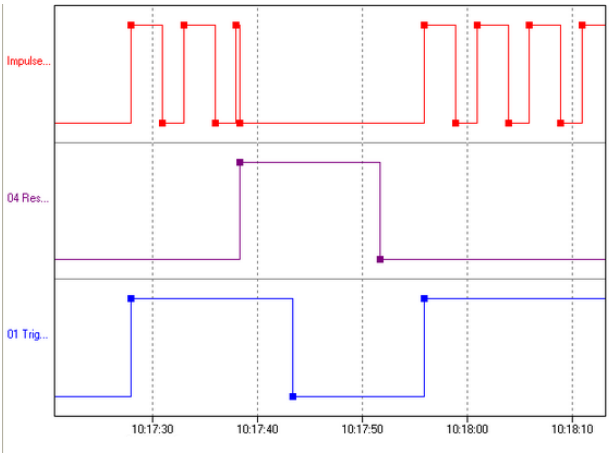
Trigger and reset are triggered by channels and are set to *Edges (both)*. Then both the signal's rising and falling edges trigger the event.



The trigger (**blue** curve) starts the pulse generator (**red** curve) with a rising edge. Then the reset (**purple** curve) is triggered with a rising edge and the pulse generator is stopped. Pulses are generated again only after the trigger gives a new start signal with a falling edge. A falling edge of the reset channel stops the pulse generator again and pulses are generated again only after the rising edge of the trigger channel.

b)

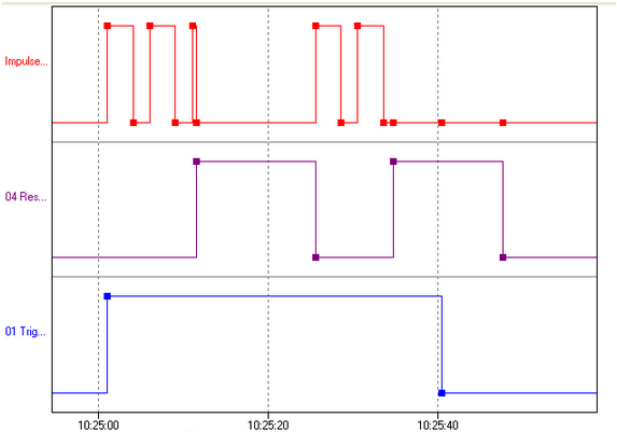
The trigger is triggered by a channel and has been set to *Edges (both)*. The reset is also triggered by a channel, but has been set to High level.



The trigger (**blue** curve) starts the pulse generator (**red** curve) with a rising edge. Then comes the reset (**purple** curve). Because the high level ("high") remains, no further pulses are generated (*Reset = High level).* Meanwhile, the trigger channel switches to a low level ("Low"). However, because the reset channel remains at a high level as before, the trigger channel's edge has no effect. The pulse generator does not re-start even when the reset channel reverts to a low level as it is only re-started with an edge in the trigger channel. The pulse generator restarts only once the trigger channel has a (rising) edge.

c)

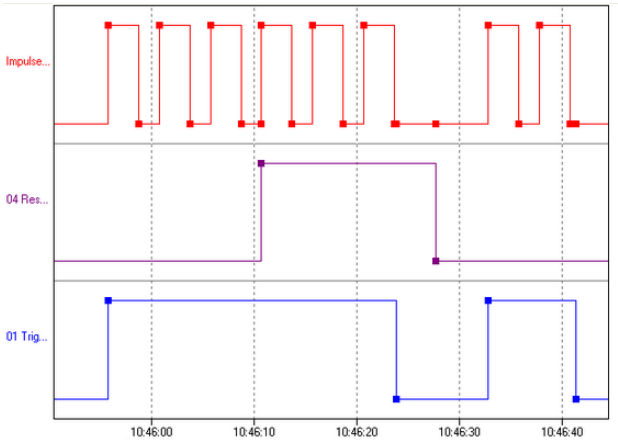
Trigger and reset are triggered by channels and are set to *Level high*.



The pulse generator (**red** curve) is started by the trigger channel (**blue** curve). When a reset signal (**purple** curve) is received, the output is set to "low" and no further pulses are generated. When the reset signal resets to "Low", the pulse generator re-starts (10:25:25) because the trigger channel remains at a high level. In the second example, no further pulses are generated because the trigger channel has meanwhile gone to "low".

d)

The trigger is triggered by a channel and has been set to *High level*. The reset is also triggered by a channel, but has been set to *Edges (both)*.



The pulse generator (**red** curve) is started by the trigger channel (**blue** curve). When a reset signal (**purple** curve) is received, the pulse counter is set to "low", but begins immediately to generate new pulses because the trigger signal remains "High" and the reset signal is generated only by the edge. The pulse generator stops only once the trigger signal also goes to "Low". The falling edge of the reset signal has no effect here as no pulses are being generated at this time.

4.7.8 Integrator

This software channel calculates the area below a curve (*Source*).

$$Integral = \sum\left(\frac{Vorgänger + aktueller Wert}{2} * \Delta Zeitstempel * \Delta Zeitbasis\right)$$

Cyclic: A new value is repeatedly obtained from the source for the given *Period* and the integral is calculated between the current and previous value. A new value is calculated for each interval and added to the running total.

Adaptive: When the source delivers a new value, the integral is calculated between this value and the previous value. The result is added to the running total.

Time unit of source: The calculated values are scaled to the source's time unit, e.g. in l/min (for litres per minute, enter 60 seconds).

Reset: When enabled, the calculated integral is output only in the case of a reset event and then reset internally to zero or the start value.
Refer also to Trigger options .

Generate intermediate values: When enabled, results are also output between reset events immediately following their calculation, (without being reset to zero).

Initial value: Specify a value with which integration is to start. Select an available channel whose current value will be used at the start via*Channel*, or enter a constant value (*Manual value*). Selecting *Application* enables the value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal**application.



Info

For activating *Persistence* in the *Additional settings tab*, each new status will be stored and, for example, integration will continue from there after a power outage. The choice for *Initial value* is then set to *Application*. When loading a configuration file, too, the last value stored is set as the initial value in this case.
Refer also to the "Additional settings tab" on page 52.

4.7.9 Channel group

Use channel groups to group related or interdependent channels. Any number of channel groups may be created. If required, a channel can be linked to more than one group (linked channels: refer to Configuring software channels).

4.7.10 Linearisation

Linearisation enables an additional conversion to be performed on a channel's values. An advantage of this feature is that the channel's original values remain available with the conversion being performed in a "new" channel.

This dialogue enables either a conversion function to be set for this channel (*Table type: local table*) or the use of a global linearisation function (*Linearisation table*) which has been set up via the *Global linearisation table* option in the device's context menu.

Refer also to Linearisation table (global), Settings for all dialogues: Sensor compensation tab.

Method

1. Select the table type.
   For external tables, select the table to be used next; for internal tables, create a table via the *Table* tab that is displayed after making your selection.
2. Select a source.
3. Set up a table if necessary (*Table* tab).

A table can be imported instead of creating a new one: *Import*.

***Mode*: You may select between various methods**

- *Offset*
  An offset shifts the curve by a fixed value, for example the given value is added to the measurement value.
- *Offset and slope*
  Allows a shifting of the curve and an increase in its slope.
- *Quadratic*
  Generates a quadratic curve through the given points to linearise the measured values.
- *Linear interpolation*
  Set a table for converting measured values into display values. Linear interpolation takes place between the given points.
- *Spline interpolation*
  An optimal fitting polynomial 3rd degree (cubic spline) is determined using spline interpolation for the given values which is then used to to convert the measured values.



Info

You can use copy and paste to transfer data from an Excel table into the dialog table. Position the cursor in the table's top left field of the first row. Extra rows are created automatically when this is permitted by the selected mode.
Click on a row and use the *Del* key to delete unwanted rows. Insert extra rows in a linear interpolation using the *Return* key.
A created table can be exported and then re-imported later: *Export* and *Import*.

Format information for export and import

To import or export a table, please note the following information.

A table file for a linearisation channel is indicated by the suffix ".tab". Furthermore, these table files are constructed according to the following scheme:

Row	Text	Description
1	Mode: X;""	Selection of the table mode
2	y1;z1	First calibration point
3	y2;z2	Second calibration point
...	...	Other calibration points

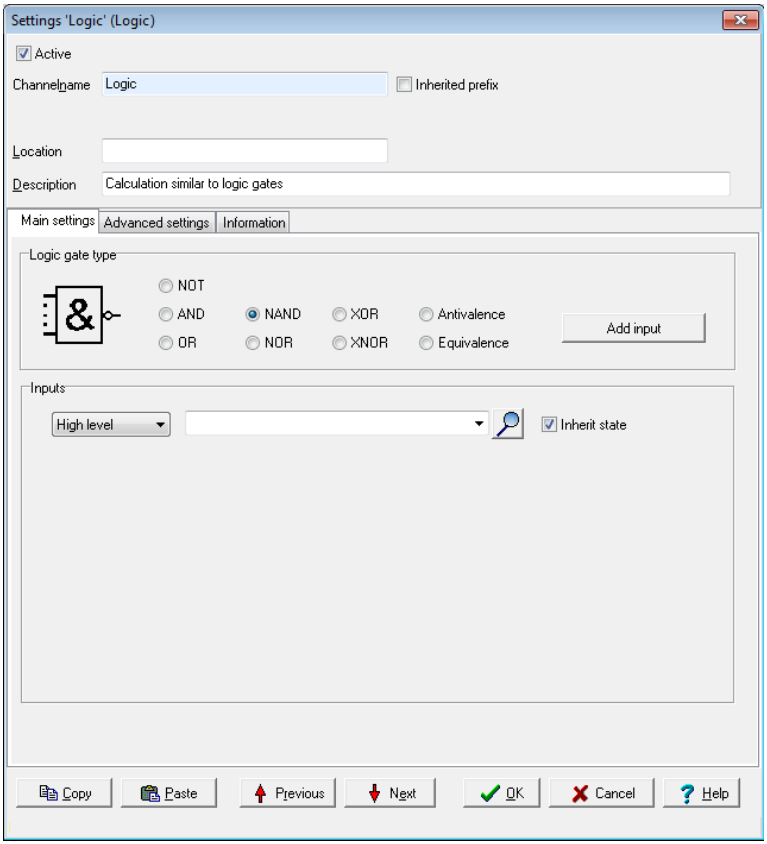
Please note: The decimal separator "," is used for the values y and z.

For the "Mode:" attribute, one of the following values can be entered for "X" in the diagram shown above:

Set mode	Attribute	Number of calibration points
Offset	Offset	1
Offset and slope	Gradient	2
Quadratic	Squarely	3
Linear interpolation	Linear	>= 3
Spline interpolation	Spline	>= 4

4.7.11 Logic

This software channel enables digital channels to be linked logically. Various boolean functions are available: *AND*, *OR*, *NAND*, *NOR*, *NOT*, *XOR* and *XNOR* as well as *antivalence* (XOR with more than two inputs) and *equivalence* (XNOR with more than two inputs).



Add input produces additional inputs. All inputs are linked according to the selected logic.

NOT, XOR and XNOR functions can link only one or two inputs.
Only this number of inputs can then be created.

Click  to delete an input.

Status table NOT

Input value	Output value
L	H
H	L

Status table AND

Input value A	Input value B	Output value
L	L	L
L	H	L
H	L	L
H	H	H

Status table OR

Input value A	Input value B	Output value
L	L	L
L	H	H
H	L	H
H	H	H

Status table NAND

Input value A	Input value B	Output value
L	L	H
L	H	H
H	L	H
H	H	L

Status table NOR

Input value A	Input value B	Output value
L	L	H
L	H	L
H	L	L
H	H	L

Status table XOR (exclusive OR)

Input value A	Input value B	Output value
L	L	L
L	H	H
H	L	H
H	H	L

Status table XNOR

Input value A	Input value B	Output value
L	L	H
L	H	L
H	L	L
H	H	H

Status table antivalence

The output for antivalence is then "High" if an odd number of inputs are "High" and the remaining inputs are "Low".

Input value A	Input value B	Input value C	Output value
L	L	L	L
L	L	H	H
L	H	L	H
L	H	H	L
H	L	L	H
H	L	H	L
H	H	L	L
H	H	H	L

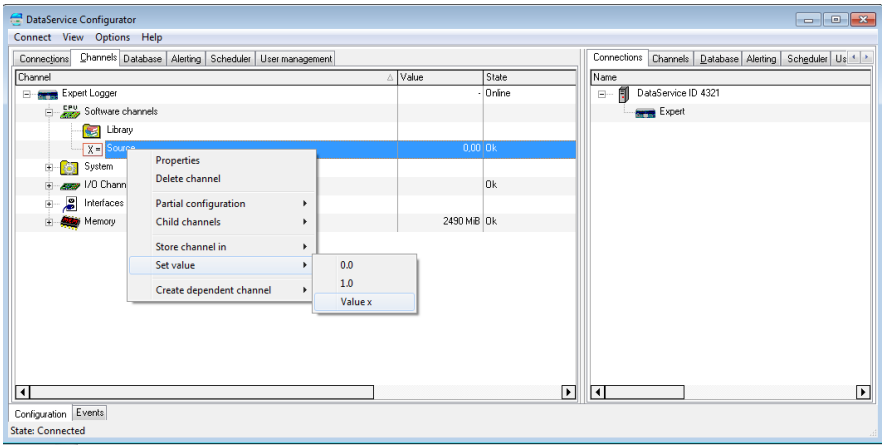
Status table equivalence

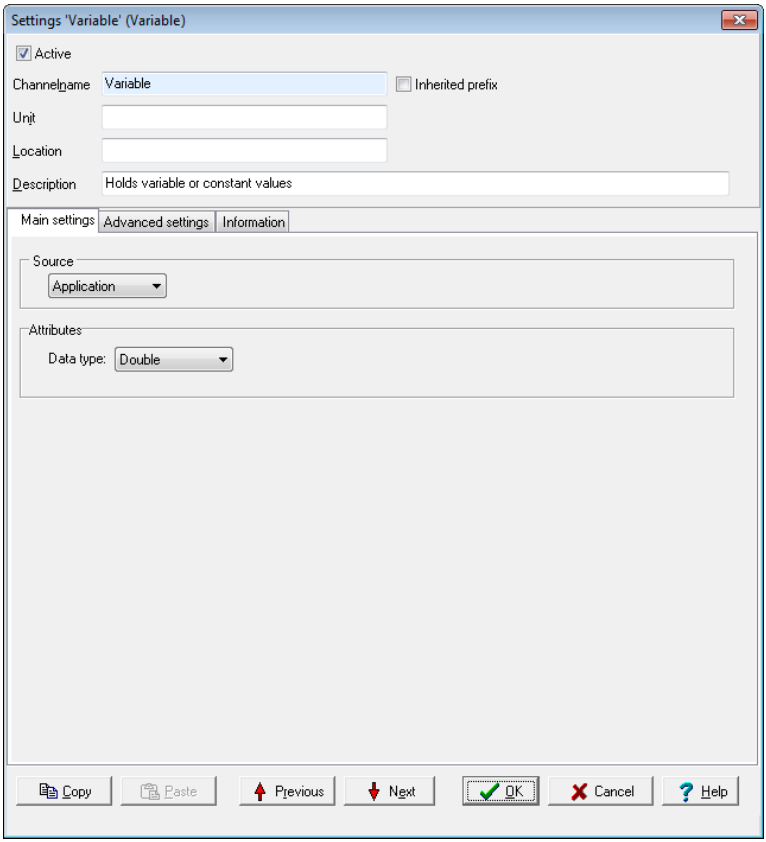
Input value A	Input value B	Input value C	Output value
L	L	L	H
L	L	H	L
L	H	L	L
L	H	H	H
H	L	L	L

Input value A	Input value B	Input value C	Output value
H	L	H	H
H	H	L	H
H	H	H	H

4.7.12 Variable

This software channel generates a variable (or constant for *Manual value*) that you can use for other channels or calculations. This provides a control option that enables either manual control over the processes in a device via the DataService Configurator or automated control via a **ProfiSignal** application. For example, you can use a marker as a reset trigger for a counter channel. It is also helpful in testing certain device or system reactions.





Source: Select an available channel whose value will be used via*Channel*, or enter a constant value (*Manual value*). Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal**application.

You can use *Properties* to define whether the output value is to be handled as a *String* (text) or as a numeric value, such as *Float* or *Double*.

4.7.13 Average

This software channel calculates the average from the source values.

Moving, arithmetic average: This arithmetic average is calculated from a configured series of values numbering from 2 to 1000 values.

Moving means that each new value from the source is stored to the data series and triggers calculation of the average from the accumulated values

and output of the result. If the number of values reaches the specified maximum, the data series is then full and a new value from the source then overwrites the oldest value.
A device reboot or a configuration change deletes all the accumulated values.

Block averaging: This option provides two methods of averaging:

- *Arithmetic average*: The arithmetic average, also called the mean, is the sum of all values of a data series divided by the number of values.
- *Vector average*: The vector average is the average for a unit circle. The method is used, for example, for mass flow rates in air conditioning engineering.

Edge triggering (only with block averaging): The configured average type is calculated at the time of the trigger event for all values of the data series that have accumulated between two trigger events. The result is output following calculation.

Level triggering (only with block averaging): When a level moves from an active to inactive state, the average is calculated from the values accumulated during the active level period.

Generate intermediate values (only with block averaging): When enabled, the results between the trigger events are immediately output after calculation (with each new source value).
Refer also to Trigger options.

4.7.14 PID controller

The PID controller channels enable the continuous control of a process variable. Available controllers are P, I, PI and PID. Additional settings are also available, e.g. dead zone, manipulated variable limit etc.

4.7.14.1 Introduction to control technology

This Section gives you an introduction to control technology in order to help you understand the PID controller.

Designations

Control loop variables

w – reference variable. Process variable setpoint or target value.

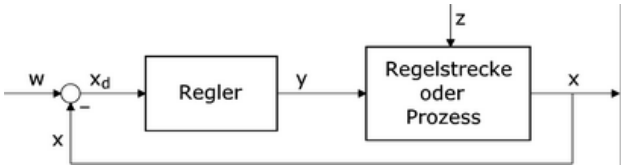
y – manipulated variable. Controller output value.

x – control variable. Process variable to be controlled. .

xd – control difference or control deviation. Xd = W –X

z – interference variable. Interference influence on process variable by process.

Control loop with controller and control paths:



Control parameter

Kp – proportional amplification. For controller P component.

Tn – reset time. For controller I component.

Tv – derivative time. For controller D component.

Typical formula for a standard PID controller:

$$y = K_p * \left(x_d + \frac{1}{T_n} * \square x_d \, dt + T_v * \frac{d x_d}{dt} \right)$$

Characteristic control system values

KS – process gain. dX/dY of a system step response.

Tu – delay time

Tg – compensation time

Tt – dead time

W – inflection point

KI – integral gain

TI – integral time

Control paths

To find a suitable controller, you must know the characteristics of the control paths to be influenced.

A control path is that part of a system between the final control element for the control quantity (the process quantity to be controlled) and the control quantity's measuring point. The final control element and the measuring element are also part of the control path.

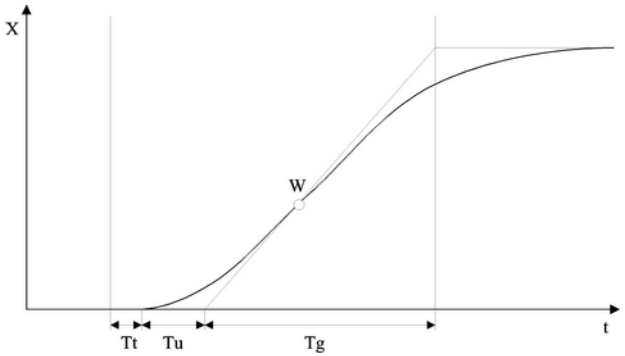
Control paths can be fundamentally divided into two categories:

- Control paths with compensation: When a control or interference variable changes, the control variable searches for a new final value (steady state). Example: Flow, temperature, etc.

- Control paths without compensation: Control paths that do not search for a final value (integrating control paths), are known as control paths without compensation. Example: Fill level.

Most control paths consist of P systems (amplification/attenuation), one or more T1 systems (lowpass) and if possible one dead time (run time). Paths with P T1 properties are called first order control paths. Control paths with multiple T1 systems correspond to nth order control paths.

Control paths with compensation have the following characteristics:

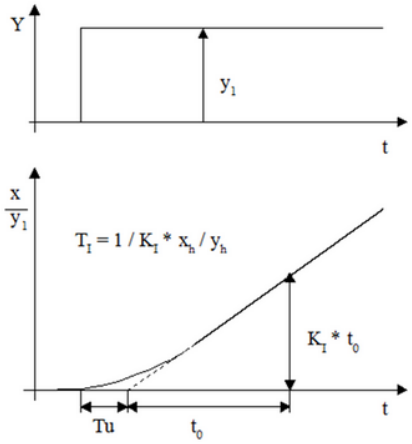


The controllability of such a control path by a PID controller can be estimated as follows:

Tg / Tu > 10: easy controllability
Tg / Tu > 6: medium controllability
Tg / Tu < 3: poor controllability

For control paths with dead time, Tg / (Tt + Tu) defines the controllability..

Step response of control path without compensation:



Continuous controller (PID)

With continuous controllers, the manipulated variable Y assumes any value within a working range.

- P controller: The P controller changes the manipulated variable immediately proportionally to the change in the control deviation.
- I controller: The I controller (integrator) assigns a particular control rate to a particular control deviation.
- PI controller: The PI controller is formed by combining a P controller with an I controller. The PI controller contains a proportional and an integral term.
- PD controller: The controller comprises a controller with a P term and a D term. The derivative element assigns a manipulated variable to a particular change rate of the control deviation.
- PID controller: The manipulated variable consists of a proportional, an integral and a derivative term.

Controller choice

Controller type Loop (with compensation)	P	I	PI	PD	PID
Pure dead time	Unusable	A little worse than PI	Setpoint and disturbance	Unusable	Unusable
Dead time and delay	Unusable	Worse than PI	A little worse than	Unusable	Setpoint and dis-

Controller type Loop (with compensation)	P	I	PI	PD	PID
1. Order			PID		turbance
Dead time and delay 2. Order	Unsuitable	Bad	Worse than PID	Bad	Setpoint and disturbance
Delay 1. Order and small dead time (delay time)	Reference	Unsuitable	Interference	Setpoint with delay time	Disturbance with delay time
Higher order	Unsuitable	Worse than PID	A little worse than PID	Unsuitable	Setpoint and disturbance
Without compensation and with delay	Setpoint (without delay)	Unusable, unstable	Disturbance (without delay)	Reference	Interference

4.7.14.2 Controller parameter settings

Various methods have been established to determine controller parameters. This introduction describes the Chien, Hrones and Reswik configuration guidelines. You can find further configuration guidelines and methods in related specialist literature.

Configuration guidelines for control paths with equalisation:

Determine the following control path characteristic values from the control path step response:

- Process gain KS
- Compensation time Tg
- Delay time TU
- For systems with dead time, the equivalent dead time Tu + Tt is used in place of the delay time Tu.

You can specify the controller parameters (reference values) according to the following table:

Controller type	Aperiodic control process (no overshoot)		Control process with approximately 20% overshoot	
Optimise:	Interference	Reference	Interference	Reference
P	K » 0.3 * Tg / Tu	K » 0.3 * Tg / Tu	K » 0.7 * Tg / Tu	K » 0.7 * Tg / Tu
PI	K » 0.6 * Tg / Tu TN » 4 * Tu	K » 0.35 * Tg / Tu TN » 1.2 * Tg	K » 0.7 * Tg / Tu TN » 2.3 * Tu	K » 0.6 * Tg / Tu TN » Tg
PD	K » 0.95 * Tg / Tu TN » 2.4 * Tu TV » 0.42 * Tu	K » 0.6 * Tg / Tu TN » Tg TV » 0.5 * Tu	K » 1.2 * Tg / Tu TN » 2 * Tu TV » 0.42 * Tu	K » 0.95 * Tg / Tu TN » 1.35* Tg TV » 0.47 * Tu

Configuration guidelines for control paths without equalisation:

Determine the following control path characteristic values from the control path step response:

- Integral gain KI
- Delay time TU

You can specify the controller parameters (reference values) according to the following table:

Controller type	K	TN	TV
P	0.5 / (KI * Tu)	–	–
PD	0.5 / (KI * Tu)	–	0.5 * Tu
PI	0.42 / (KI * Tu)	5.8 * Tu	–
PID	0.4 / (KI * Tu)	3.2 * Tu	0.8 * Tu

4.7.14.3 Configuring PID controllers

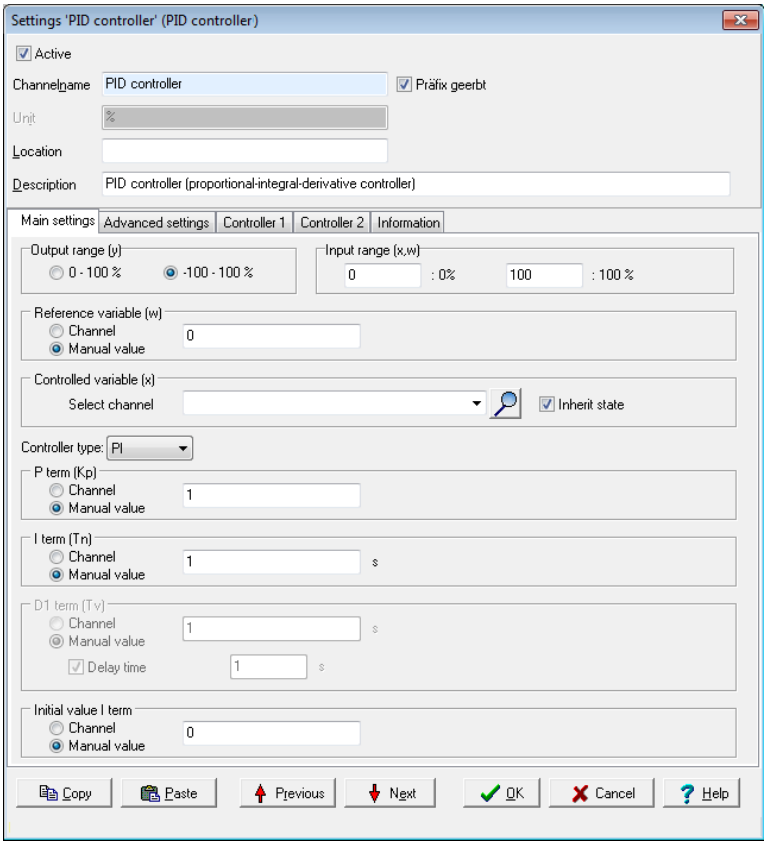
The controller is specifically configured in tabs “Main settings”, “Controller 1” and “Controller 2”.

Settings in tabs “Controller 1” and “Controller 2” are only required for specific applications.

The controller channel obtains its input values (setpoint variable ”W” and process variable “X” from two HW channels or SW channels of the device). The controller yields the manipulated variable “Y” as the output value in the preset value range 0...100% or -100..+100%. If you link the output of

the controller channel directly with an analogue output, you must enter the same scaling 0...100 % or -100...+100 %.

Main settings tab



Output range: Set the required output range for the final control element: 0...100 % or -100...+100 %.

Input range: Match the input range of the setpoint variable (w) and process variable (x) to the internal operating range of the controller. Important: The setpoint variable (w) and process variable (x) must match one another.

Setpoint variable (w): Source channel for the setpoint variable. An analogue input, a marker or the output of another controller (cascade) is normally used as the source channel. Ensure in the case of a cascade that the

master controller has a fixed output value range. Conversion may be required through a calculation channel.

Process variable (x): Source channel for the process variable. An analogue input is normally used as the source.

Controller type: Type of controller: P, PI, PID, PD or I controller

P term (Kp): The P part of the controller, i.e. the proportional gain, Kp. Alternatively to manual configuration, you can control Kp via a channel, for example, via a slider from a visualisation system.

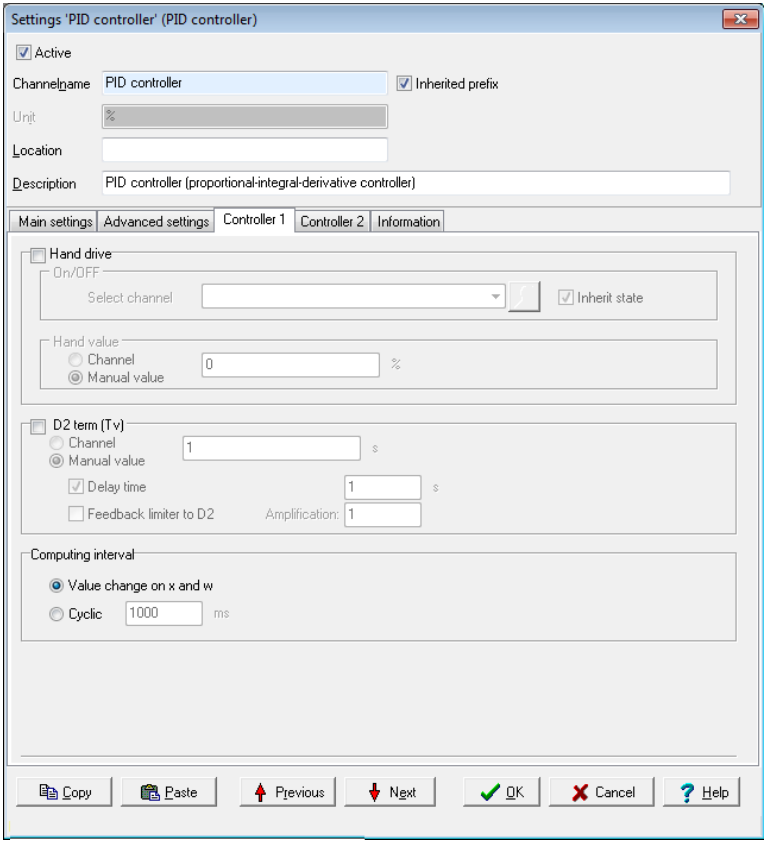
I term (Ti): The I term of the controller, i.e. the integral time, Tn. Alternatively to manual configuration, you can control Tn via a channel, for example, via a slider from a visualisation system.

D1 term (Td): The first D term of the controller, i.e. the derivative time Td. Alternatively to manual configuration, you can control Td via a channel, for example, via a slider from a visualisation system.

Delay time: By enabling this option, you can switch the first D term of the controller from difference to time delayed difference. We recommend enabling this option.

Start value I term: Depending on whether the I term is activated (see controller type), here you can choose to give the start value of the I term or the zero point of the manipulated value (y).

Controller 1 tab



Manual operation: Enable this option to switch between automatic mode and manual operation.

On/Off: Give the source channel by which the switch between automatic mode and manual operation is to occur. If a value is ≥ 1.0, the manual value (see below) will be output as manipulated variable (y).

Manual value: Give the source value which delivers the "manual value".

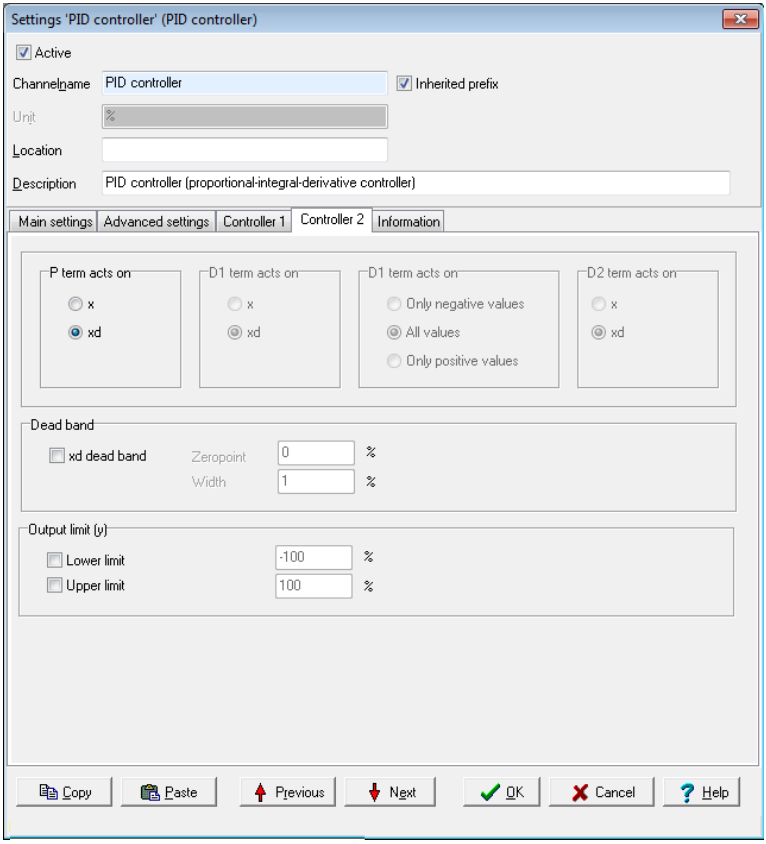
D2 term (Td): Optional second D term of controller.

Delay time: By enabling this option, you can switch the first D term of the controller from difference to time delayed difference. We recommend enabling this option.

Limiter feedback to D2: This option feedbacks the manipulated variable cut in the preceding control cycle to the second D term. Give the degree of feedback in the *Amplification* field (1.0 = full feedback).

Computing interval: Enter how the controller output is to be updated: Via a value change of the process variable (x) and setpoint variable (w) or via an adjustable time period.

Controller 2 tab



P term affects: Specify how the P term of the controller is to use the *control deviation (xd)* or immediately the *process variable (x)* as an input value.

D1 term affects: Specify how the first D term of the controller is to use the *control deviation (xd)* or immediately the *process variable (x)* as an input

value. You can also set which input values the first D term reacts to. All non-effective values are taken as 0.0.
The option is only available if the first D term operates without *Delay time*.

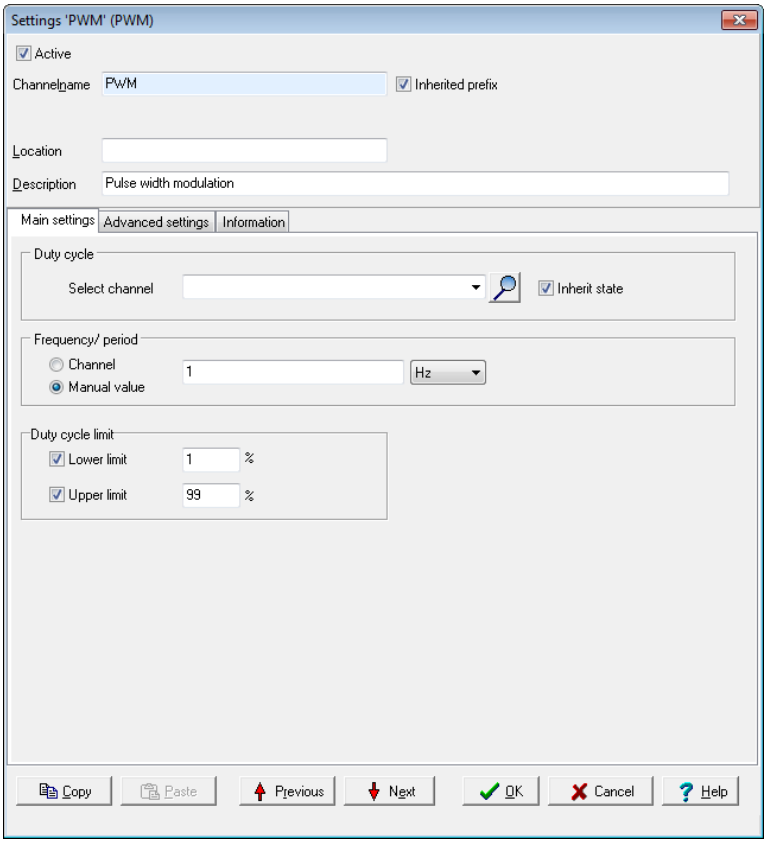
D2 term affects: Specify how the second D term of the controller is to use the *control deviation (xd)* or immediately the *process variable (x)* as an input value.

Dead zone: Activates the dead zone of the control deviation (xd). Specify the zero point of the dead zone with *Zero point*. The entry field *Width* contains the maximum deviation from the zero point of the dead zone, within which the control deviation is set to 0.0.

Output limitation: This option allows the value range of the manipulated variable to be limited to values larger than -100% or smaller than +100%. The cut term of the manipulated variable can optionally be fed back to the second D term of the controller.

4.7.15 Pulse width modulation (PWM)

This software channel generates a square signal with a variable frequency and variable pulse-pause ratio. The pulse-pause ratio is determined by the source.



Frequency/period:

Enter either a fixed frequency or time for the period of the fundamental oscillation or name a channel that provides the appropriate value.

Duty cycle restriction

Lower / upper limit: Set here the minimum and maximum values for the pulse-pause ratio.

A pulse-pause ratio of 0% means that the PWM output is permanently switched off. A pulse-pause ratio of 100% means that the PWM output is permanently switched on. The range of source values is limited to the specified range.

4.7.16 Calculation channel

This software calculates the input mathematical formula. Any number of sources can be linked within the formula. Each source is represented by a variable that can assume either a constant value or the value from the specified channel.

Method

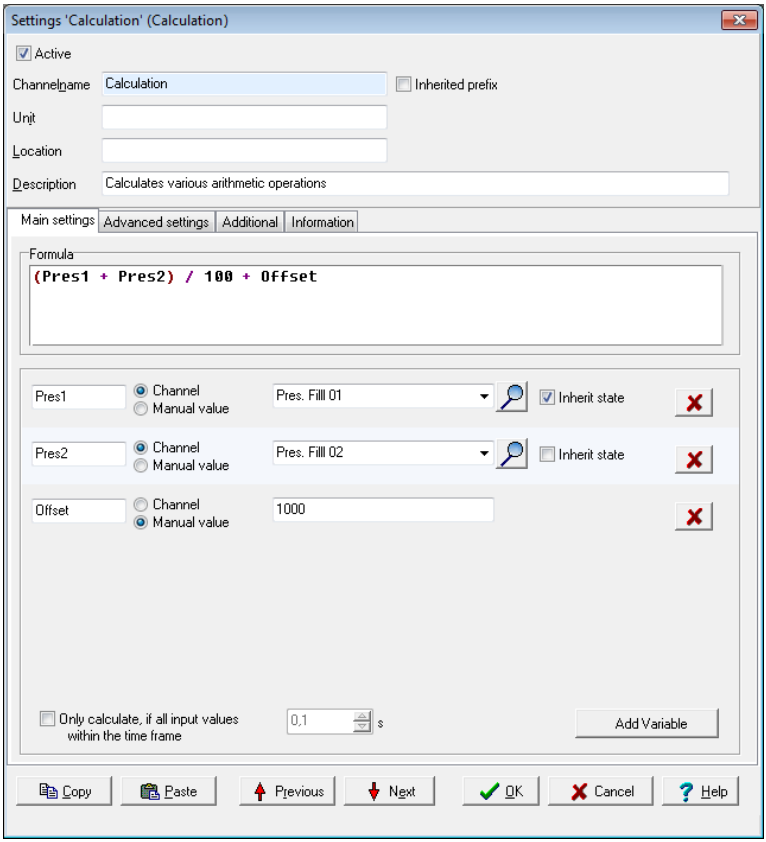
1. Set the required variables with *Add variable*.
   A variable named *var0* is created by default, but its name can be changed.
2. Set whether the variable is to have a constant value (*Manual value*) or whether the value is to be obtained from a channel (*Channel*).
3. Enter the formula expression in the field *Formula*.

Restrictions on variable names

1. The first character must be alphabetic (a...z/A...Z).
   The subsequent characters must be alphanumeric (letters a...z/A...Z or numbers 0..9) or an underscore (_).
2. Variable names must be unique (no repeat names in different channels).
3. A distinction is made between upper and lower case letters.

Input in the formula field must use the same syntax as for variable names, otherwise the formula is invalid.

Example



The example calculates the difference between two channels, divides the result by 100 and adds an offset.

Syntax for the formula field

- Operand1 operator operand2, e.g. pressure 1 - pressure2
- Operator operand, e.g. ! DigIO1
- Function(operand), e.g. sin(pressure)
- Function(operand1 , operand2), e.g. pow(pressure, 2)

Available calculation functions

Type of calculation	Function	Data types		Syntax
		Operand1	Operand2	
Basic calculations	Addition	bool, int, float	bool, int, float	Operand1 + Operand2
	Subtraction	bool, int, float	bool, int, float	Operand1 - Operand2
	Multiplication	bool, int, float	bool, int, float	Operand1 * Operand2
	Division	bool, int, float	bool, int, float	Operand1 - Operand2
Logical (boolean) operations	AND	bool, int, float	bool, int, float	Operand1 && Operand2
	OR	bool, int, float	bool, int, float	Operand1 || Operand2
	NOT	bool, int, float	—	!Operand1
Binary (bit by bit) operations	AND	bool, int	bool, int	Operand1 & Operand2
	OR	bool, int	bool, int	Operand1 | Operand2
	XOR	bool, int	bool, int	Operand1 ^ Operand2
	Negation	bool, int	—	~Operand1
	Left shift (move operand1 to the right by number of positions in operand2.)	bool, int	bool, int	Operand1 << Operand2
	Right shift (move operand1 to the right by number of positions in operand2.)	bool, int	bool, int	Operand1 >> Operand2

Type of calculation	Function	Data types		Syntax
		Operand1	Operand2	
Operations with sets	Minimum	bool, int, float	bool, int, float	Min(operand1, operand2)
	Maximum	bool, int, float	bool, int, float	Min(operand1, operand2)
Matching operations	Less than	bool, int, float, string	bool, int, float, string	Operand1 < Operand2
	Less than or equal	bool, int, float, string	bool, int, float, string	Operand1 <= Operand2
	Greater than	bool, int, float, string	bool, int, float, string	Operand1 > Operand2
	Greater than or equal	bool, int, float, string	bool, int, float, string	Operand1 >= Operand2
	Equals	bool, int, float, string	bool, int, float, string	Operand1 == Operand2
	Not equal to	bool, int, float, string	bool, int, float, string	Operand1 != Operand2
Trig. functions	Tangent	bool, int, float	—	TAN(Operand1)
	Cosine	bool, int, float	—	COS(Operand1)
	Sine	bool, int, float	—	SIN(Operand1)
Reverse trig. functions	Arctangent	bool, int, float	—	ATAN(Operand1)
	Arccosine	bool, int, float	—	ACOS(Operand1)
	Arcsine	bool, int,	—	ASIN(Oper-

Type of calculation	Function	Data types		Syntax
		Operand1	Operand2	
		float		and1)
Other operations or functions	Exponential	bool, int, float	—	EXP(Operand1)
	Power	bool, int, float	bool, int, float	POW(basis, factor) POW(Operand1, Operand2)
	Root	bool, int, float	—	SQRT(Operand1)
	Modulo	bool, int, float	bool, int, float	Operand1 % Operand2
	Absolute	bool, int, float	—	ABS(Operand1)
	Natural logarithm	bool, int, float	—	LN(Operand1)
	Logarithms (base 10)	bool, int, float	—	LOG(Operand1)
Constants	Pi	—	—	PI
	Euler e number	—	—	EX

Data types

- bool: True or false
- float: a floating point number or a fraction
- int: an integer

Constants

- Constants are considered as integers if entered without a decimal point
- Constants must be given with a decimal point and not a comma, regardless of the country setting of the computer and the DataService Configurator.

4.7.17 Batch alarms

This software channel monitors channels with boolean output signals to generate a common alarm. Its output has an ON state when one of the sources (*Monitored channels)* has an ON-state (logical OR link).

Latching: The alarm is latched (continues to alarm) even when the alarm condition is no longer met. The alarm has to be reset by a reset event. If the *Latching* option is not selected, the output for the batch alarm channel takes the state of the linked sources.

Enabling *Latching* changes *Reset trigger for latching*. The alarm resets when a reset event occurs, e.g., a rising edge in the given channel. The *Reset priority* option causes an alarm to reset when the alarm condition is still met.
Refer also to "Trigger options" on page 58.

Method

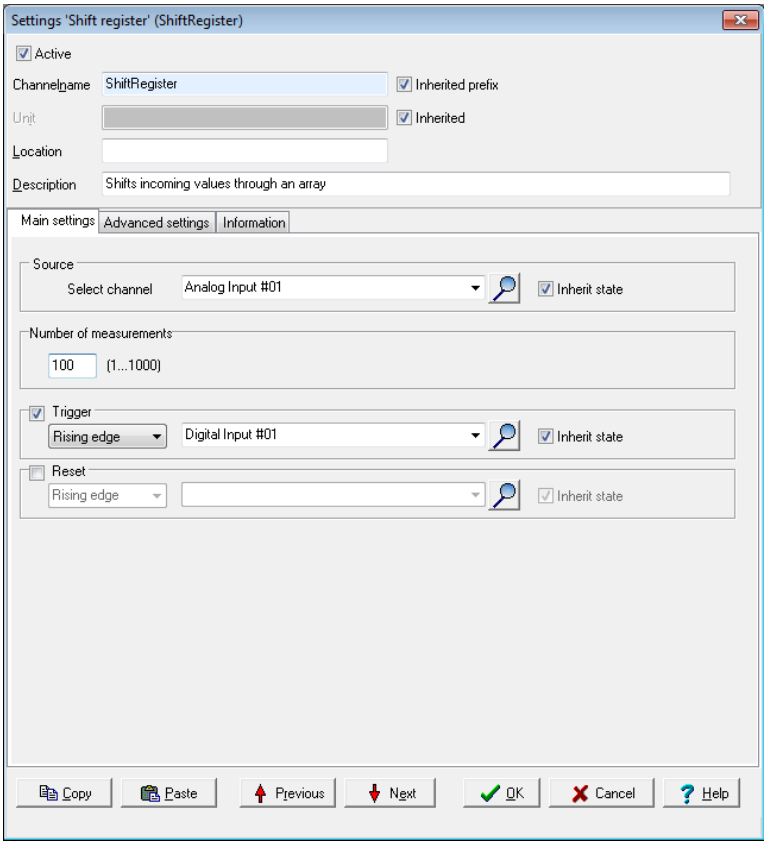
- Select one or several channels to trigger a batch alarm from the *Available channels* field and click to accept the selection.
- Select one or several channels from *Monitored channels* and click to remove the selection.

4.7.18 Shift register

The slider tab allows you to transmit values with delay.

Give the *Source* which is to be delayed and how many values (*Number of values*) the delay is to affect. An entry from *100* allows the 101 value, when there are 100 values, to cause the first read value to be output. 100 values are always "reserved".

Use the *Trigger* to establish that the delay only occurs if the trigger event occurs. *Reset* cancels the delay.
Refer also to Trigger options.



4.7.19 Setpoint

This software channel enables the device to be used as a program controller. The setpoint table creates a conditional procedure (track) with reference points set by value pairs of time and a value, which can be repeated any number of times. Each row of the table describes a program step with a *time* t (fixed or variable) and a *value* y (fixed or variable).

Refer also to Setpoint table (global), "Additional settings tab" on page 52, "Information tab" on page 56

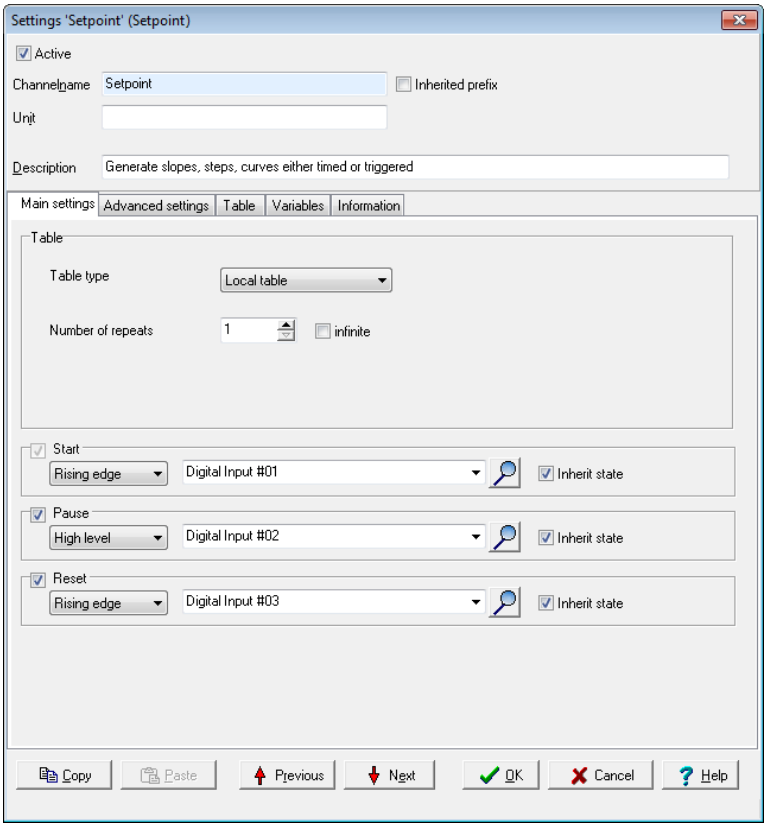


Table type: Use a global (external) table (*Global table* setting) that has been created for the device under Library (refer to Setpoint table (global)) or define a table for a specific channel (*Local table* setting). In the latter case, a *Table* tab will appear.

Number of repeats: Determine here whether and how often the program sequence will be repeated automatically. After the last repeat, the final setpoint remains in the table.

Start: The state (*Level*) or edge (*Edge*) of the specified channel starts the program execution with the specified number of repetitions. Once the repetitions have been completed, a new or active start event then sets the programmer to the beginning and restarts the program sequence.

Pause: Pauses the program's execution, i.e. the current setpoint is retained for as long as the specified channel has the set *Level*. The break pause channel has a higher priority than the start channel, i.e. the start

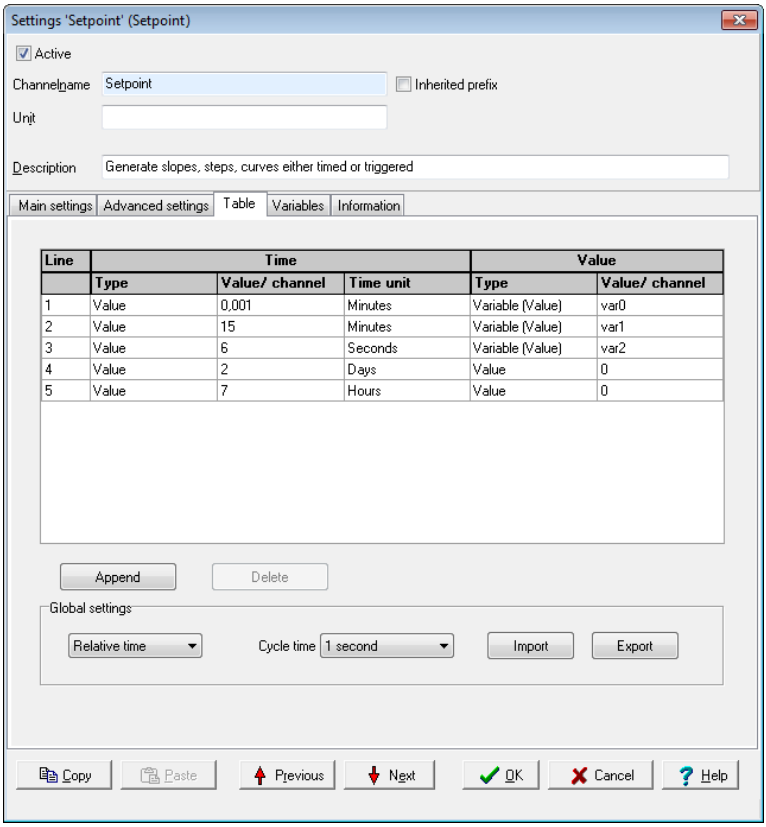
channel does not start the programmer while pause state is active.
For *Edge* settings, the setpoint is retained from the onset of the edge until the next edge. An event here is also unable to give priority to a start channel over a pause state.

Reset: A reset event from the specified channel sets the program to the beginning but does not start it. The reset channel has the highest priority, i.e. the reset condition prevents starting by a start event and cancels a pause state.

Refer also to Trigger options.

Table tab (only for local table)

The setpoint table contains the value pairs of time and value. Each row of the table describes a program step with a *time* t (fixed or variable) and a *value* y (fixed or variable). If a variable is used, it requires configuring via the *Variables* tab. This applies even when using a global setpoint table for the selected channel.



Method

1. For each table row (program step) enter the time value (Time) with the unit of time to be used and the *value* to be output. The first row defines the starting point, so at least two value pairs need to be entered.
2. Click *Add* for additional rows.
3. Enter the required *Global Settings* (valid for the entire table).

Click on a field to modify the value specified there. *Delete* removes the selected row.

A table can be imported instead of creating a new one: *Import*.

Numbers (constants) or variables can be used for times and values. The variables are defined via the *Variables* tab. For time input, the variable may be used as a value or as a trigger:
Variable (value): Means that the value of the variables is used as time

value. *Variable (trigger)* means that the channel set for the variable in the *Variables* tab is used as a trigger channel. A trigger event is a rising edge. If this trigger occurs, the value that is programmed into the program step for the trigger is assumed as a setpoint and the next program step is then started. This method enables time control of a program sequence to be expanded by an event control.

Global settings (for all rows)

Relative time: Based on the previous value y_{i-1}, the t_i value indicates how long it will take to reach the y_i value.

Absolute time: Based on the starting point (first row), the t_i value indicates how long it will take to reach the y_i value

Cycle time: The cycle time determines in which time frame the values are output between two program steps. Intermediate values are linearly interpolated, i.e. calculated using a linear equation. The intervals between program steps used in the table should be integral multiples of the cycle time.

Variables tab

The tab appears only if there are variables in the table.

Specify whether the variables used are fixed values (*Manual value*) or are to be imported from a *Channel*.

4.7.20 Statistics

This software channel enables a source to be evaluated with a range of statistical functions.

Moving minimum/maximum: This minimum or maximum is calculated from a configured series of values numbering from 2 to 1000 values.

Moving indicates that each new value from the source is stored to the data series and triggers calculation of the minimum or maximum from the accumulated values and output of the result. If the number of values reaches the specified maximum, the data series is then full and a new value from the source then overwrites the oldest value.
A device reboot or a configuration change deletes all the accumulated values.

Block evaluation: The number of values in the data series is determined by the frequency of new source values within an interval set by trigger events. A change in the specified channel produces the trigger event. Several statistical functions are available in this mode.

Edge triggering: The selected function is calculated at the time of the trigger event from the data series that has accumulated between two trigger events. After calculation, the result is output and all the accumulated values are deleted.

Level triggering: When a level moves from an active to inactive state, the selected function is applied to the values accumulated during the active level period. The result is output and the accumulated values then deleted.

Generate intermediate values: When enabled, the results between the trigger events are immediately output after calculation (with each new source value).
Refer also to Trigger options .

Definitions

- The minimum is the smallest value within the data series.
- The maximum is the greatest value within the data series.
- The variance is the mean square error relative to the mean.
- The number of measurement values are values in the block interval.
- The standard deviation is the square root of the variance (not the average deviation!).
- The True RMS is the root from the sum of the squares of the values by the number of values.
- The arithmetic mean, also called the average, is the sum of all values of a data series divided by the number of values.
- The geometric mean is the Nth root from the product of n values.
- The harmonic mean is the reciprocal from an average of reciprocals.

4.7.21 Status filter

The function allows certain status messages to be suppressed and another output to be controlled. You can pass on all status messages to a digitial output to be informed of problems, but relay only certain messages to a second digitial output, such as the actions of switching off machines etc.
Refer to Status monitoring, Status generator.

Available status functions and their meaning

Selection	Description
Wire break	Wire break in monitored channel.
Configuration error	Error in monitored channel configuration.
Invalid value	Invalid value in monitored channel.
Measuring range over-run	The measured value is outside the (positive) measuring range of the A/D converter, that is, it is too high in the positive range.
Measuring range under-	The measured value is outside the (negative) measuring range of the A/D converter, that is, it is too high in the neg-

Selection	Description
run	ative range.
Hardware error	Error in the hardware, please contact the service of **Delphin**.
Simulated value	An internally generated value for testing, for example from the PROFIBUS.
No number (NAN = Not A Number)	A calculation has not returned a valid number, for example root of negative numbers.
Infinite value (INF = infinity)	A calculation is infinite, for example division by zero.
Inactive	This is set when a channel that is output, calculated or used in any other way is not active at the start of a measurement. Thus, you can see at run time which channels are inactive.
Scale range overrun	Scaling range exceeded.
Scale range underrun	Scaling range not met.
Trigger block end	End of a trigger block (data storage).
Input value outside the (permissible) range	The source channel value cannot be processed, there is a parameter error. Check the parameters specified.
Recursion	When a channel is used for a calculation and the input signal of that channel depends on the calculation, there is a loop and thus a recursion. The **MetiOS** software recognises this; the calculation is terminated and this status is set.
Overload	An analogue or digital input or output is overloaded. For example, the power source for a Pt100 sensor may be overloaded at one input. The load resistance could be too small at one output, resulting in an excessive current.

4.7.22 Status generator

This software channel, e.g. for test purposes, can generate a certain status. You can check whether the system reacts as required.

You can trigger the status immediately (upon closing the dialogue) or via a channel (*Set status only with trigger*).
Refer also to Status filter, Status monitoring.

Available status functions and their meaning

Selection	Description
Wire break	Wire break in monitored channel.
Configuration error	Error in monitored channel configuration.
Invalid value	Invalid value in monitored channel.
Measuring range overrun	The measured value is outside the (positive) measuring range of the A/D converter, that is, it is too high in the positive range.
Measuring range underrun	The measured value is outside the (negative) measuring range of the A/D converter, that is, it is too high in the negative range.
Hardware error	Error in the hardware, please contact the service of **Delphin**.
Simulated value	An internally generated value for testing, for example from the PROFIBUS.
No number (NAN = Not A Number)	A calculation has not returned a valid number, for example root of negative numbers.
Infinite value (INF = infinity)	A calculation is infinite, for example division by zero.
Inactive	This is set when a channel that is output, calculated or used in any other way is not active at the start of a measurement. Thus, you can see at run time which channels are inactive.
Scale range overrun	Scaling range exceeded.
Scale range underrun	Scaling range not met.

Selection	Description
Trigger block end	End of a trigger block (data storage).
Input value outside the (permissible) range	The source channel value cannot be processed, there is a parameter error. Check the parameters specified.
Recursion	When a channel is used for a calculation and the input signal of that channel depends on the calculation, there is a loop and thus a recursion. The **MetiOS** software recognises this; the calculation is terminated and this status is set.
Overload	An analogue or digital input or output is overloaded. For example, the power source for a Pt100 sensor may be overloaded at one input. The load resistance could be too small at one output, resulting in an excessive current.

4.7.23 Status monitoring

This software channel monitors the source and becomes active (switches to " On") when the source assumes the specified status.
Refer also to Status filter, Status generator.

Available status functions and their meaning

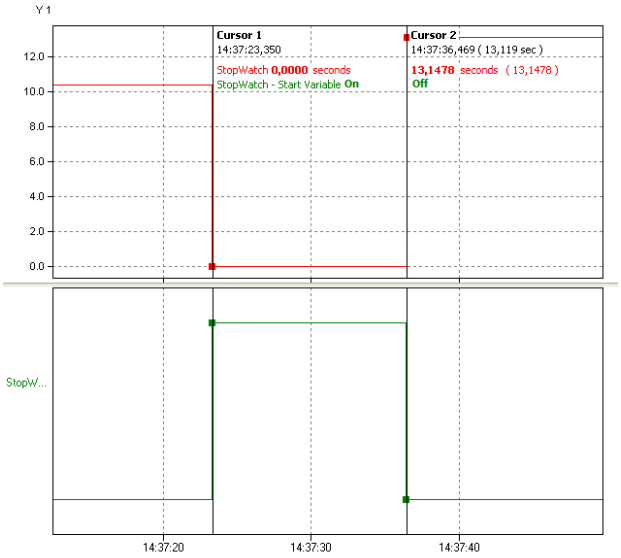
Selection	Description
Wire break	Wire break in monitored channel.
Configuration error	Error in monitored channel configuration.
Invalid value	Invalid value in monitored channel.
Measuring range overrun	The measured value is outside the (positive) measuring range of the A/D converter, that is, it is too high in the positive range.
Measuring range underrun	The measured value is outside the (negative) measuring range of the A/D converter, that is, it is too high in the negative range.
Hardware error	Error in the hardware, please contact the service of **Delphin**.
Simulated	An internally generated value for testing, for example

Selection	Description
value	from the PROFIBUS.
No number (NAN = Not A Number)	A calculation has not returned a valid number, for example root of negative numbers.
Infinite value (INF = infinity)	A calculation is infinite, for example division by zero.
Inactive	This is set when a channel that is output, calculated or used in any other way is not active at the start of a measurement. Thus, you can see at run time which channels are inactive.
Scale range overrun	Scaling range exceeded.
Scale range underrun	Scaling range not met.
Trigger block end	End of a trigger block (data storage).
Input value outside the (permissible) range	The source channel value cannot be processed, there is a parameter error. Check the parameters specified.
Recursion	When a channel is used for a calculation and the input signal of that channel depends on the calculation, there is a loop and thus a recursion. The **MetiOS** software recognises this; the calculation is terminated and this status is set.
Overload	An analogue or digital input or output is overloaded. For example, the power source for a Pt100 sensor may be overloaded at one input. The load resistance could be too small at one output, resulting in an excessive current.

4.7.24 Stopwatch

Example 1

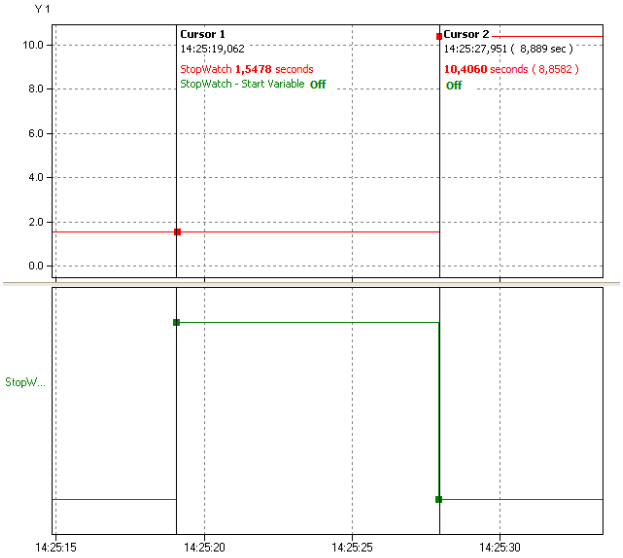
Setting: *Start /Stop* at *High level*, *Reset at start* is enabled.



The stopwatch starts (**red** curve) at a high level in the start/stop channel (**green curve**). Once the level reverts to low, recording stops. The recording time is the high level time.

Example 2

Setting: *Start/Stop* with *High level*, *Reset with start* is disabled.



The stopwatch starts (**red** curve) when a high level starts in the start/stop channel (**green curve**). The last measured value was 1.5478 seconds. Once the level reverts to low (8.8582 seconds, calculated from the beginning of the high level), recording stops. The last measured value is added to the the current "runtime". The stopwatch thus has the value of 10.4060 seconds.

4.7.25 System monitoring

This software channel displays system information such as CPU load or memory usage.

Some of the system monitoring functions are already created in the "System Monitoring" group.
Not all monitor values may be available, depending on the device version.

Available system information

Selection	Description	Unit
Total CPU usage	Display of total used processing power.	%
Application CPU usage	Display of processing power used by the main program (data acquisition and calculation).	%

Selection	Description	Unit
System CPU usage	Display of processing power used by (operating) system.	%
Available memory	Displays how much free working memory is available.	MiB
Used memory	Displays how much working memory is in use.	MiB
System operating time	Display of time that the operating system has been working, as in the time since the device was last switched on.	Days
Application operating time	Display of time that the main program has been working, as in the time since Restart main application or switching on or Reboot of the device.	Days
Data storage used	Amount of memory already used for the data.	MiB
Free data storage	Amount of memory available for the data.	MiB
Firmware version	Device firmware version number.	—
CPU temperature	Temperature of the CPU.	°C
Core voltage	CPU core voltage, diagnostic value.	V
Core RAM voltage	Internal value for diagnostics only.	V
Aux voltage	Internal value for diagnostics only.	V
Battery OK	Display whether the backup battery for the real-time clock and the SRAM is working.	—

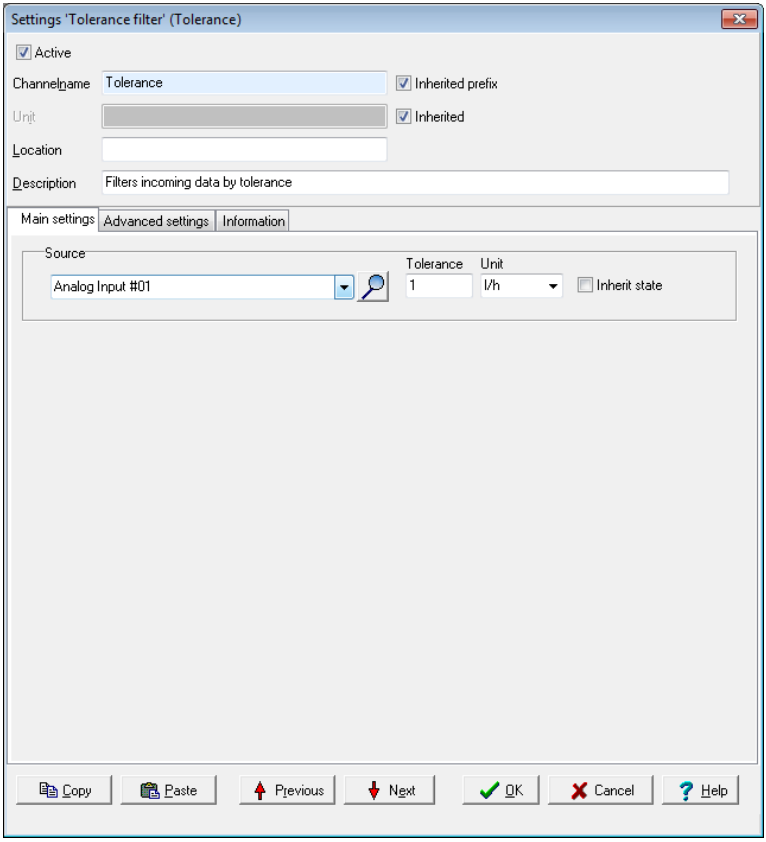
MiB = 1024 x 1024 byte (Mebibyte, actual storage capacity); MB = 1000 x 1000 byte (Megabyte). A hard disk with 500 MB (according to the manufacturer) can therefore effectively only save 476 MiB (500,000,000/(1024 x 1024)).

4.7.26 Tolerance filter

The tolerance filter enables you to hide small (interference) signals. Values are only output (relayed) if the set *tolerance* for the previously output

value is exceeded. You can reduce the number of values which are directed into a memory group.

You can specify the tolerance in the electric unit of the channel or as a percentage in relation to the signal's scaling. In the example, values are only output if they deviate from the previously output value by more than 1 mV.



4.7.27 Trigger

This software channel uses the signal of an (analogue) source to generate a logic signal for further processing. Its output is active ("On") after a trigger event (*High level* , *Low level*, *Rising edge*, *Falling edge* or *Edges (both)*). With *Every high*, every value unequal to 0 is a trigger, and with *Every low*, every value equal to 0 is a trigger.

Refer also to Trigger options.

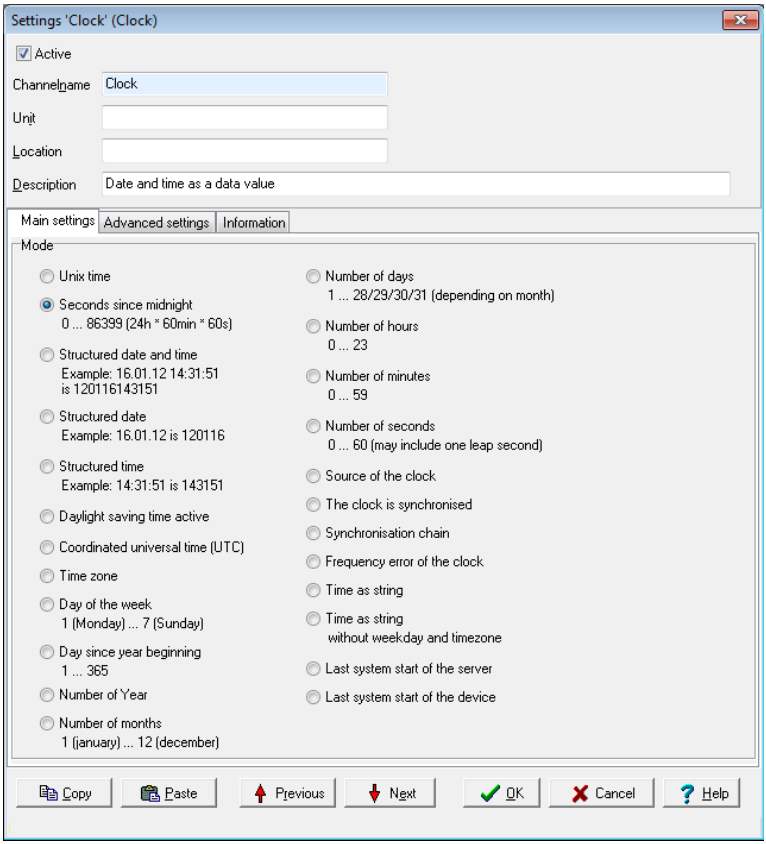
A trigger channel can be used for edge detection or recognition of a non-zero value. Another application is a trigger that is used after a limit value in order to evaluate the edge of the limit value separately.

4.7.28 Clock

This software channel allows you to define the date and clock time or their components as a channel. You can use different time systems, e.g. the time of the current time zone, the UTC or Unix time, and you can keep track of daylight saving time. Status information is also available:

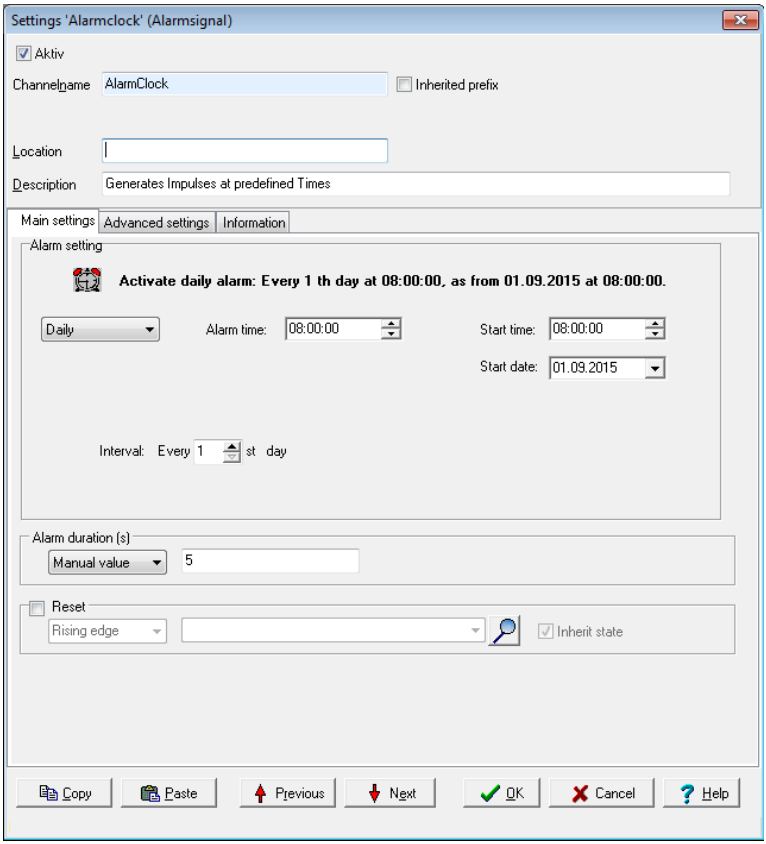
- *Source of clock* shows which reference is used.
- *The clock is synchronised* states whether the clock has or hasn't been synchronised to a reference.
- *Synchronisation chain* shows on what part of the stratum chain (stratum 2, 3 etc) the device is.
- *Frequency errors of the clock* shows the deviation of the clock stroke.

Some definitions are available in the default setting of channels in the group System.



4.7.29 Alarm clock

This software channel allows the triggering of specific events at specified times. According to the configuration, an alarm clock channel generates one-off or repeat alarms for the specified duration.



Active fields for *Alarm clock setting* depend on the repetition settings (*One off*, *Hourly* , *Daily* , *Weekly*, *Monthly* or *Annually*). Enter the times in each active field. The alarm clock response is then described in the text box above these fields. With an alarm, the output of the alarm clock's channel switches to an active state ("On").

Alarm duration: Enter either a constant value (*Manual value*) or use *Channel* to select a channel with a value which determines the alarm duration as a time in seconds.

Reset: A reset event (a trigger via *Level* or *Edge*) ends the alarm and sets the alarm clock output to the non-active state ("Off"). Alarm clock settings are not changed by a reset, i.e. a follow-up alarm may trigger during the configured time.
Refer also to Trigger options .

4.7.30 Counter

This software channel counts events.
Refer also to Trigger options .

Upward count trigger: The channel's counter is increased by one at the selected edge (*Rising edge*, *Falling edge*, *Edges (both)* or *Every high* (each value greater than 0) or *Every low*) (each value less than or equal to 0).

Downward count trigger: The channel's counter is decreased by one at the selected edge (*Rising edge*, *Falling edge*, *Edges (both)* or *Every high* (each value greater than 0) or *Every low*) (each value less than or equal to 0).

Reset trigger: The channel's counter is output and reset internally to zero at the selected edge (*Rising edge*, *Falling edge* or *Edges (both)*). When *Reset trigger* is enabled, the counter is displayed only at a reset event unless the *Generate intermediate values* option has been enabled.

Generate intermediate values: When enabled, the results are also output between the reset events immediately after their calculation (with every counter change).

Value output: The channel's counter is output with the selected edge (*Rising edge*, *Falling edge* or *Edges (both)*).

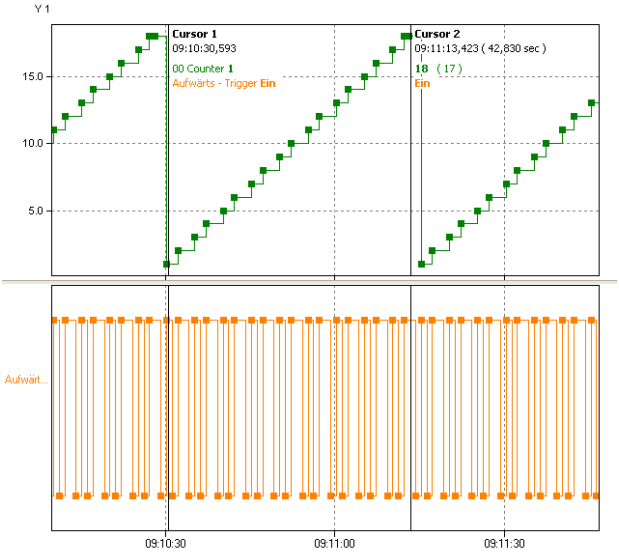
Initial value: Specify a value with which integration is to start. Select an available channel whose current value will be used at the start via*Channel*, or enter a constant value (*Manual value*). Selecting *Application* enables the value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal**application.



Info

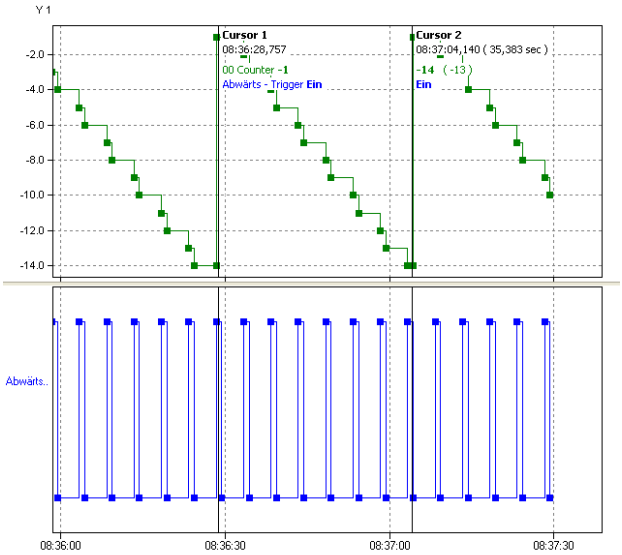
If you activate *Persistence* in the *Additional settings tab*, each new counter status will be stored and, for example, will continue counting from there after a power outage. The choice for *Initial value* is then set to *Application*. When loading a configuration file, too, the last value stored is set as the initial value in this case.
Refer also to the "Additional settings tab" on page 52.

Example of upwards counter



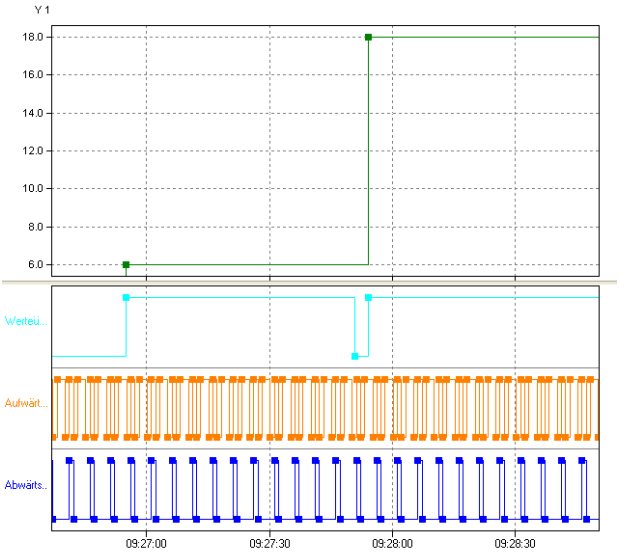
The counter (**green** curve) increases by one for each rising edge from the source channel (**orange** curve) until the reset trigger becomes active. The *Generate intermediate values* option is enabled, so all new counter readings are output immediately.

Example for downwards counter



The counter (**green** curve) decreases by one for each edge from the source channel (**orange curve) until the reset trigger becomes active.** The *Generate intermediate values* option is enabled, so all new counter readings are output immediately.

Example of value transfer

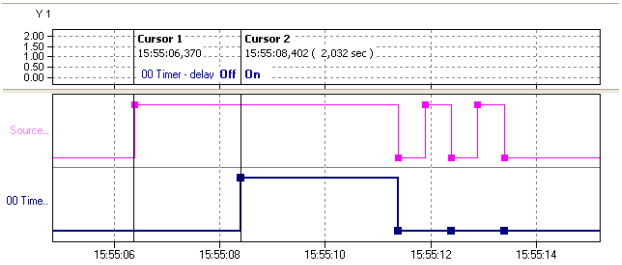


During the period of value transfer (**light blue** curve), the counter value is output. The option *Generate intermediate values* is disabled, so no intermediate values are output.

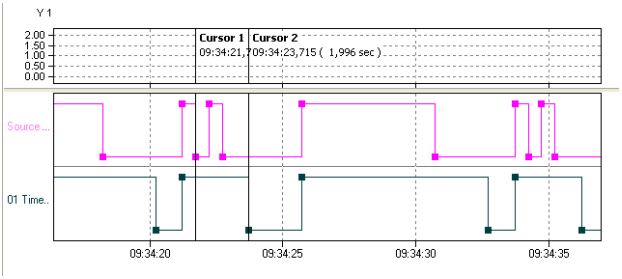
4.7.31 Time delay

This software channel allows you to change the time of (digital) source signals. This permits, for example, new trigger time points to be created for a subsequent channel or defined signals to be generated for outputting to the process. A *Pickup delay* mode temporally compresses the source signal and a *Dropout delay* temporally expands a signal.

Pickup delay: The timer channel starts the delay time when the source changes to the active state (*High level* or *Low level* trigger). At the end of the delay time, the timer output switches into an active state ("On") so long as the source retains the active state. If source's active state is shorter than the delay time, no reaction takes place with the timer output.



Dropout delay: The output of the timer channel becomes active ("On") when the source switches to an active state (*High level* or *Low level* trigger) or edge triggering (*Rising edge*, *Falling edge* or *Edges (both)* triggers). The same edge or the switch of the source from active back to inactive starts the delay time. At the end of the delay time, the timer's output becomes active ("Off").



The image shows the signal of a dropout delay with level triggering (Low level).

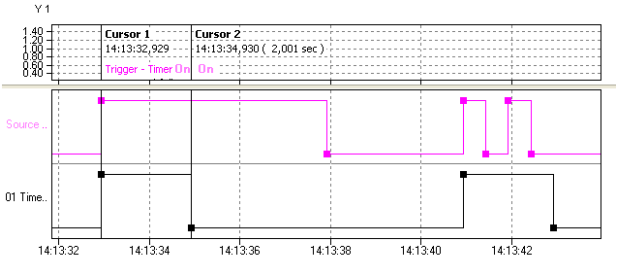
Retriggerable: This option enables a restart of the delay time via other source trigger events during the delay time.

Source: Specify the delay channel here and which level or which edge is to be delayed.

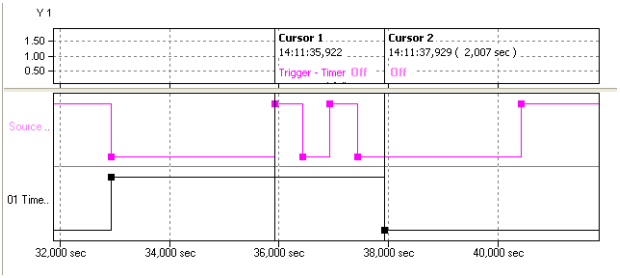
Reset: A reset event (a trigger via *Level* or *Edge*) ends the delay time and puts the timer output into a non-active state ("Off"). The reset channel has a higher priority than the *source*. This enables a reset state to block the timer function.

Delay: Enter either a constant value (*Manual value*) or use *Channel* to select an existing channel with a value that determines the delay time in seconds.

Example for dropout delay

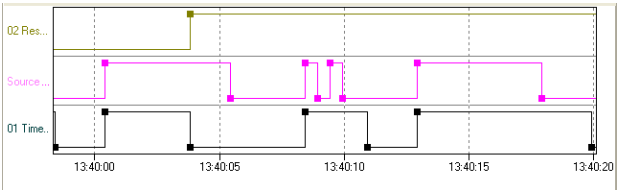


The source (**purple** curve) triggers with a rising edge. The delay is 2 seconds. Retriggerable is not enabled.

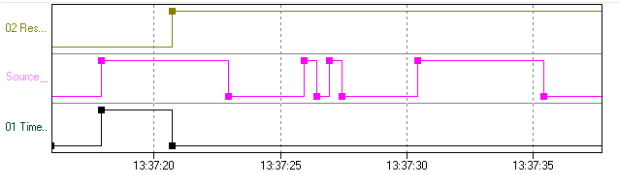


The source (**purple** curve) triggers with a *falling edge*. The delay is 7 seconds. *Retriggerable* is not enabled.

Examples for reset



The source (**purple** curve) triggers with a *rising edge.* The delay is controlled via a channel. *Retriggerable* is not enabled. Reset (**green** curve) occurs at a *Rising edge.*



The source (**purple** Triggers curve) triggers with a *Rising edge* . The delay time is controlled via a channel. *Retriggerable* is not active. Reset (**green** Curve) occurs at a *High level.* The timer (**black** curve) is then blocked for the duration of the reset signal.

4.8 Configuring interfaces

The device is equipped with multiple interfaces to enable communication with external devices. These interfaces enable connection to other PCs, PLCs, other third party equipment and sensors for data import or export.

Ethernet, CAN bus and COM interfaces are configured as with channels, from the channel view of the DataService Configurator. The configuration is described in this section.

Refer also to "Network settings" on page 69, "Settings for all dialogues" on page 50

Configuring the ethernet interface for Modbus TCP

- TCP/IP services
- Modbus TCP server
- Modbus TCP client
- Modbus channel

Configuring the CAN bus interface

- CAN connection
- CAN protocol
- CAN bus channel

Configuring the COM interfaces

- COM connection
- PROFIBUS protocol
- PROFIBUS channel
- PROFIBUS logger protocol
- Modbus RTU protocol
- Modbus RTU master
- Modbus RTU slave

- User-defined protocol
- User-defined input channel
- User-defined output channel

Configuring LAN/WLAN/WWAN interfaces

- LAN connection
- WLAN connection (option)
- WWAN connection (option)

USB interfaces

- USB Device
- USB Host (interface for USB memory)

4.8.1 TCP/IP services

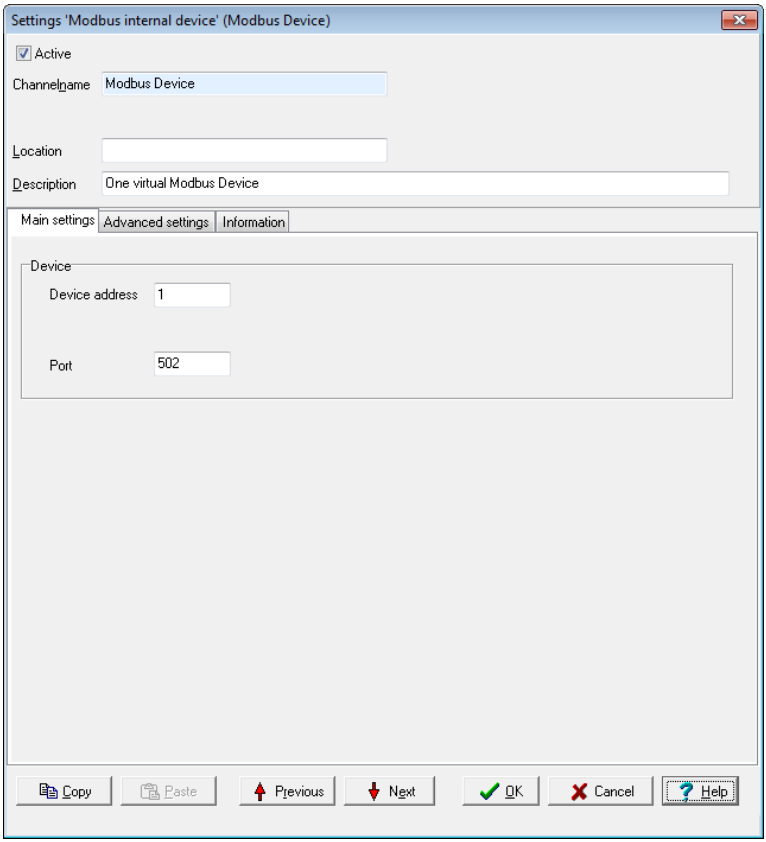
You can configure an ethernet connection to enable you to connect the device to a Modbus system (Modbus TCP).

Refer also to "LAN" on page 224 if you wish to set up a DHCP server.

4.8.1.1 Modbus Device (Server)

To create a Modbus channel, use the context menu for the Modbus protocol (, Modbus RTU slave): *Modbus internal device.* To open the configurations dialogue, double click menu item *Modbus Device* or select Properties from the context menu. You can use the dialogue to set the name, location and description under which the device is to function in the Modbus network. Give the device's address settings here for the Modbus network.

Main settings tab



Device

- *Device address*
  Sets the address for the device (slave).

The Port setting cannot be changed.

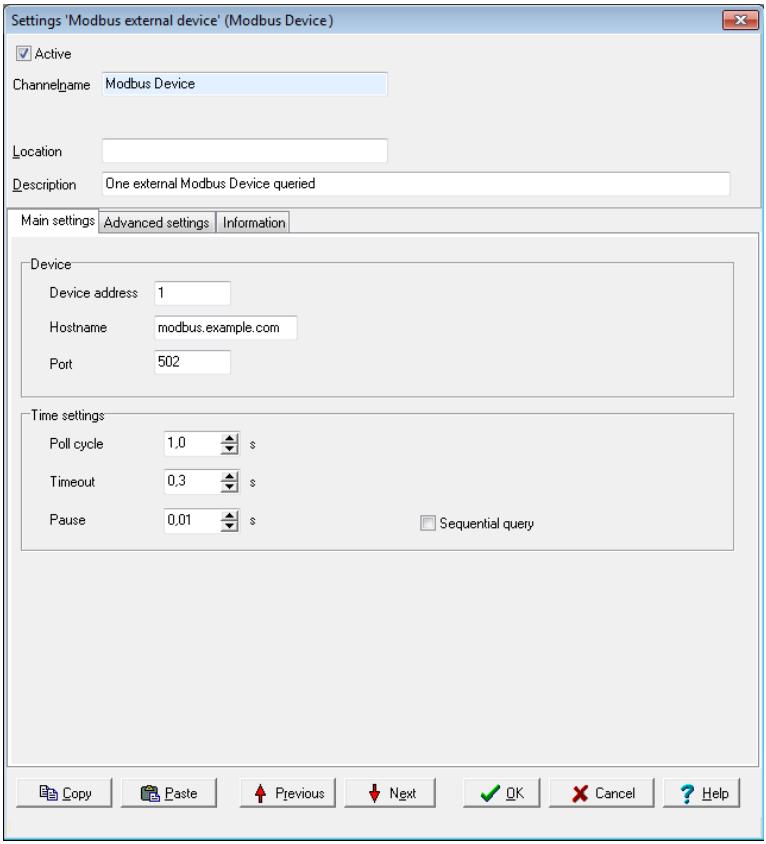
The  symbol is displayed following configuration. Then create and configure the required Modbus channels (signals).

4.8.1.2 Modbus Device (Client)

Use the context menu of the Modbus protocol (, Modbus RTU Master) to create a Modbus device: *Modbus external device*. To open the configurations dialogue, double click menu item *Modbus Device* or select Properties from the context menu. Use the dialogue to enter a name, location

and description for the external device. Set the device's (own) address in the Modbus network and the parameters for querying Modbus users.

Main settings tab



Device

- *Device address*
  Sets the address for the master.

Settings for *Host name* and *Port* cannot be changed.

Time setting

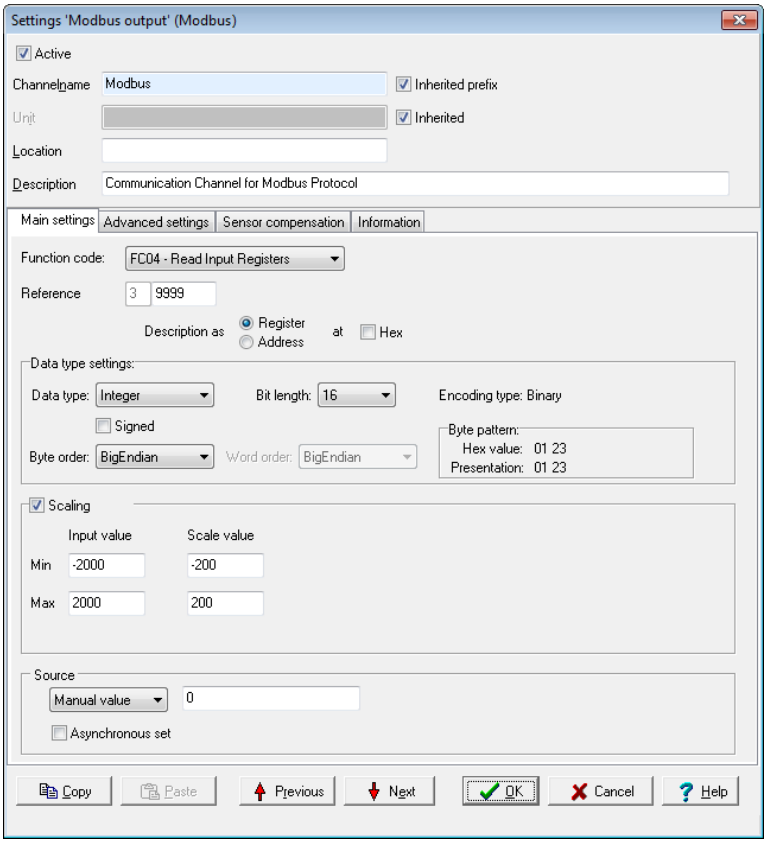
- *Poll cycle*
  Sets the the time for cyclical querying of data. Existing Modbus users are (re)-queried once the set time expires. The time must be long enough in relation to the *pause* time and the number of channels (users), or you will receive an error message when closing the dialogue. The values entered will then not be saved.
- *Timeout*
  Sets the maximum permissible time between a request and a response before an error status is shown. In the event of an error, a "wire-break" status is displayed (refer also to the table in Status monitoring). The time must be short enough in relation to the time for the *Poll cycle* or you will receive an error message when closing the dialogue. The values entered will then not be saved.
- *Pause*
  Sets the waiting time for a query from more than one channel within a poll cycle. The time must be short enough for all channels to be queried within the time entered under *Poll cycle* or you will receive an error message when closing the dialogue. The values entered will then not be saved.
- *Sequential query*
  If you enable this option, only one request telegram will be generated for sequential Modbus addresses instead of a separate request telegram for each address.

The  symbol is displayed following configuration. Then create and configure the required Modbus channels (signals).

4.8.1.3 Modbus channel

Depending on whether you want to output or read a signal, select *Create channel*→ *Modbus* output or Modbus *input*. A Modbus input channel is identified by  and a Modbus output channel by . Refer also to Settings for all dialogues.

Main settings tab



Function code: Select what is to be read (input) or written (output). Only permitted data will be available, for example FC01 to FC04 for the inputs and FC05/06 as well as FC15/16 for the outputs. The setting influences the values that can be configured in Data type settings.

Reference: The number in front of the input field indicates the memory page and thus the tab type.
Input is made in decimal form by default, and is restricted to valid values. Using *Show as* you can specify whether the input is to be used *as an* Address or *as a Tab* , and whether it should follow decimal or hexadecimal (Hex) notation.

Data type settings

These settings are dependent on the *Function code* inputs and also on whether the channel is an input or output.

- *Data type*
  Specifies the data type for interpreting the transmitted payload data. *Bit length, Byte order* and *Word order* are set and adjusted in relation to the adopted setting. *Start position in payload data*, Scaling and Use channel as output are also set according to the data type.
- *Signed*
  Sets whether the integer data type is to be interpreted as signed or unsigned. An 8-bit value would then be in the range -128 to 127 (two's complement) or 0 to 255. Floating values are always interpreted as signed. Bit-values make no distinction between signed and unsigned.
- *Bit length*
  Sets the bit lengths for integer and floating data types. *Byte sequence* and *Word sequence* are adjusted according to length value. This also applies to the numeric fields in the St*art position in data.*
- *Encoding type*
  Displays the encoding type used for interpreting the transmitted payload data.
- *Byte sequence*
  The byte order (byte sequence) is a number, made up of several bytes, that sets how bytes are ordered for the address. BigEndian, also known as Motorola format, orders the most significant byte to the lowest address. LittleEndian, also known as Intel format, orders the least significant byte to the lowest address. Refer also to http://en.wikipedia.org/wiki/Endianness.
- *Word order*
  Like the byte order, word order orders word data (1 word = 2 bytes = 16 bits) to addresses. In addition to determining byte order, a different word ordering may be necessary.
- *Byte pattern* (input channels only)
  To display the different byte and word order combinations, a hex value (a random number in the example) is shown with the resulting byte pattern of a message.

Scaling

If a Modbus user sends values that require conversion, enable *Scaling* and enter Min / Max values to convert from the Input *value* to the Scale value.

If the Use channel as output option is used, scaling takes place in the opposite direction: Enter the range from the source data in *Scale* value and the range for the output signal in *Output value*.



Without scaling, the channel's *Data type* is used When scaling is enabled, the floating data type is always used for the channel. This also applies when the channel is used as an output: When scaling is enabled, the channel must have the floating data type, otherwise you have to use the type under *Data type*.

Scaling example

In the above image, a conversion takes place from 2000 (integer value) to 200 (°C), i.e. it returns a decimal point despite transmission of an integer (whole number).

Using the channel as output

If you create a Modbus channel as an output, you can send data from the **Delphin** device to other Modbus users.

Enter the data for the message to be sent in a similar way to a Modbus input. You must also enter the *Source* (of the signal).

Enter either a constant for the *Source* (*Manual value*) or select *Channel* and an existing channel in the device for which a value is to be output. Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal** application. The source type is converted to the type given in *Data type* (refer also to Scaling).

Inherit status (for Channel settings only): The status of the input channel is used, but not output to the CAN bus.

Set asynchronous: When this option is enabled the output value transmits as soon as the value changes, that is, in real-time. Otherwise a new value is transmitted with the next cycle.

4.8.2 CAN connection

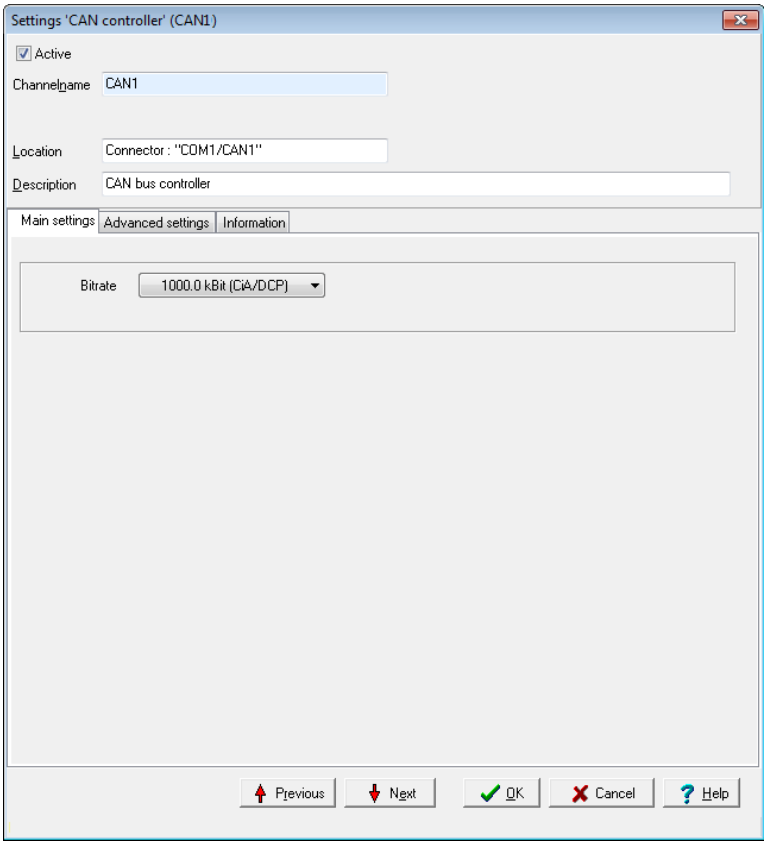
Follow these steps to run a device or sensor via the CAN interface (both the reading and output of signals is possible):

1. Configuring the basic settings of the CAN connection (this section)
2. Creating the channel for CAN protocol: CAN protocol
3. Create one (or several) CAN bus channels

The CAN connection is displayed in the *Channels* tab with the CAN-symbol . The CAN connection is available in the user-defined channel view under the interface entry. The hardware channel view lists the CAN connection directly below the device as long as the user has not already moved the modules or channels.

Double-click a CAN entry or select *Properties* from the context menu to display the configuration dialogue. Set the baud rate and the length of the identifier in the Main settings tab. We recommend giving a unique *Channel name*, amending the *Description* and, if necessary, entering a *Location*.

Main settings tab



Bit rate

The bit rate states the number of characters transferred per second. Selection depends on the properties of the connected devices and the cable length between the devices:

For longer lines, a lower baud rate should be selected to achieve error-free communication.

The following are valid for CAN connections.

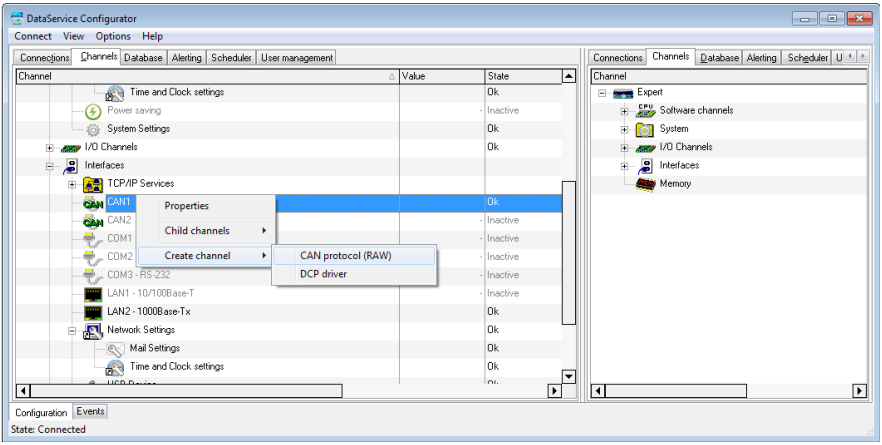
- from 15 m: 1000 kBit (standard setting)
- up to 20 m: 500 kBit
- up to 45 m: 333.3 kBit
- up to 60 m: 250 kBit
- up to 150m: 100 kBit

The bit rate must be the same for transmission and reception. Therefore, determine firstly the bit rate for the equipment communicated with and use this value to set the CAN connection's bit rate.

The detail in brackets shows for which protocol this bit rate is available (CiA = CAN in automation, DCP = **Delphin** CAN protocol).

4.8.2.1 CAN protocol

Create a channel for the CAN protocol via the context menu *Create channel* → *CAN protocol (RAW)* of the CAN connection.

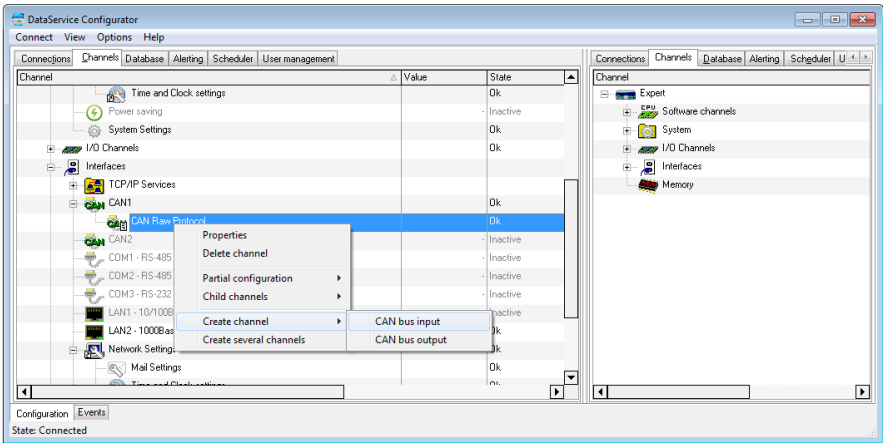


The  symbol is then displayed for the CAN protocol.

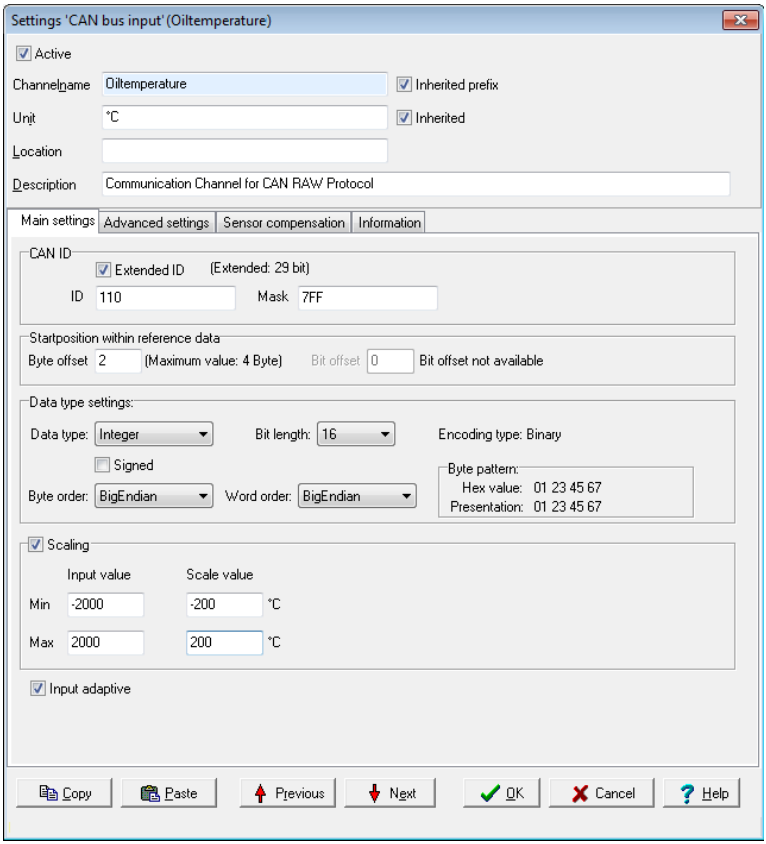
Double-click the CAN protocol or select Properties from the context menu to display the configuration dialogue. Use the dialogue to enter a name, location and description for the CAN protocol.

4.8.2.2 CAN bus channel

A CAN bus input channel is identified by  and a CAN bus output signal by . CAN-bus channels are available only when a CAN connection and CAN protocol have been configured. Select Create channel → CAN bus input or CAN bus output in the CAN protocol context menu (, CAN RAW protocol), to create channels.



Double-click a CAN bus channel entry or select Properties from the context menu to display the configuration dialogue. The data to be entered depends on the type signal that is to be sent to or received from the CAN-bus user. (Refer to Using channel as an output). Therefore, obtain information on the format and settings of the signal before entering data here. Refer also to Settings for all dialogues.



Main settings tab

CAN ID

- *Extended ID*
  Set whether the CAN message uses 11 bit or 29 bit for the identifier.
- *ID*
  ID Enter a hexadecimal value for an ID either with 11 bit (hex value of between 1 and 7FF) or 29 bit (between 1 and 1FFFFFFF). Input is restricted to the valid values.
  The entry directly sets the identifier for message to be received (or sent, see Use channel as output) when 7FF or 1FFFFFFF is selected for *Filter*.
- *Mask*
  The mask functions as a filter and provides the option of setting the CAN bus channel to a whole group of IDs. The range of input depends on the setting

in *Extended ID* . The filter value is linked with the configured and received ID bit by bit AND. The message is evaluated when the configured and received ID have the same value, otherwise it will be ignored. An identifier group is established when the bits that are to be ignored during evaluation are set to 0. Enter *7FF* or *1FFFFFFF* when you do not want to use a mask for filtering.

Example for mask settings

ID = 0x027 = 100111 = binary, *Filter* = 0x24 = 100100 binary (numbers with 0x are in hexadecimal format); bit by bit AND operation results in 100100 in binary. The first four digits of the link and ID are identical; and only the last two digits are 0 and 1. CAN messages are then received with IDs that begin with 1001 (binary) and end with either two zeroes or two ones, i.e. all messages with the (binary) IDs 100100, 100101, 100 110 and 100111.

Start position in payload data

- *Byte offset*
  The length of the payload data, i.e. the size of the data field (DATA) of a CAN message, is limited to a maximum of 8 bytes. This allows multiple signals to be transmitted within a CAN message as long as not all the 8 bytes per signal are being used (this would only be the case with a binary-coded 64-bit floating value). Enter the starting byte for this signal's payload data In the example, the value 2 means that, for example, one signal with 2 bytes (binary-coded 16-bit integer value) would fit before the current signal and two signals behind it.
  The maximum possible value of the offset is derived from the bit length of the data type and is displayed to the right of the numeric field. Input is restricted to the valid values, and the default is 0
- *Bit offset*
  This field is available only for the bit data type and binary encoding. The payload bit in this data type can be between the 0 and seventh byte position. Byte offset is also available for this data type. Input is restricted to the valid values, and the default is 0

Data type settings

- *Data type*
  Specifies the data type for interpreting the transmitted payload data. *Bit length, Byte order* and *Word order* are set and adjusted in relation to the adopted setting. Start position in payload data, Scaling and Use channel as output are also set according to the data type.
- *Signed*
  Sets whether the integer data type is to be interpreted as signed or unsigned. An 8-bit value would then be in the range -128 to 127 (two's complement) or 0 to 255. Floating values are always interpreted as signed. Bit-values make no distinction between signed and unsigned.

- *Bit length*
  Sets the bit lengths for integer and floating data types. *Byte sequence* and *Word sequence* are adjusted according to length value. This also applies to the numeric fields in the Start position in data.
- *Encoding type*
  Displays the encoding type used for interpreting the transmitted payload data.
- *Byte sequence*
  The byte order (byte sequence) is a number, made up of several bytes, that sets how bytes are ordered for the address. BigEndian, also known as Motorola format, orders the most significant byte to the lowest address. LittleEndian, also known as Intel format, orders the least significant byte to the lowest address. Refer also to http://en.wikipedia.org/wiki/Endianness.
- *Word order*
  Like the byte order, word order orders word data (1 word = 2 bytes = 16 bits) to addresses. In addition to determining byte order, a different word ordering may be necessary.
- *Byte pattern*
  To display the different byte and word order combinations, a hex value (a random number in the example) is shown with the resulting byte pattern of a message.

Scaling

If a CAB user sends values that require conversion, enable *Scaling* and enter *Min / Max* values to convert from the *Input value* to the Scale value .

If the Use channel as output option is used, scaling takes place in the opposite direction: Enter the range from the source data in *Scale* value and the range for the output signal in *Output value*.



Without scaling, the channel's *Data type* is used. When scaling is enabled, the floating data type is always used for the channel. This also applies when the channel is used as an output: When scaling is enabled, the channel must have the floating data type, otherwise you have to use the type under Data type.

Scaling example

In the above image, a conversion takes place from 2000 (integer value) to 200 (°C), i.e. it returns a decimal point despite transmission of an integer (whole number).

Using the channel as output

If you create a CAN bus channel as an output, you can send data from the **Expert VibroExpert Logger** device to other CAN bus users.

Enter the data for the message to be sent in a similar way to a CAN bus input. There is no *mask* avaialble here as for an input, so the (signal) *source* has to be entered.

Enter either a constant for the *Source* (*Manual value*) or select *Channel* and an existing channel in the device for which a value is to be output. Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal** application. The source type is converted to the type given in *Data type* (refer also to Scaling).

Inherit status (for *Channel* settings only): The status of the input channel is used, but not output to the CAN bus.

4.8.3 COM connection

Follow these steps to run a device via the COM interface (serial, Modbus RTU or PROFIBUS):

- Select the interface mode of the COM connection (this section).
- Set the communication parameters for the selected COM connection.

To use the connection for PROFIBUS, the following settings must be adopted:

- Configure the PROFIBUS protocol.
- Create one (or several) channels: PROFIBUS channel.

To use the Modbus RTU connection, the following settings must be adopted:

- Configure the Modbus RTU protocol.
- Create a Modbus RTU master or a Modbus RTU slave.
- Create one (or several) channels: Modbus channel.

Alternatively, you can set a protocol yourself - the user-defined protocol:

- Configure the user-defined protocol.
- Create one (or several) input channels.
- Create one (or several) output channels.

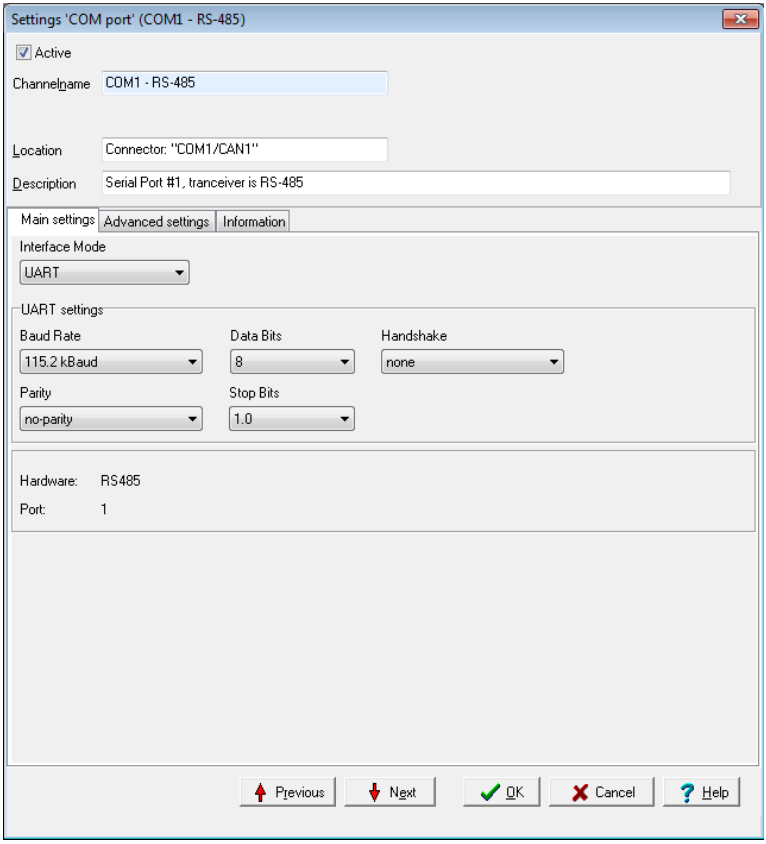
To use the connection as a logger for PROFIBUS data telegrams, the following settings must be adopted:

- Configure the PROFIBUS logger protocol.
- Create one (or several) PROFIBUS logger pairs.
- Create one (or several) input channels.

The COM connection is indicated in the *Channels* tab with the COM symbol . The COM connection is available in the channel view under the interface entry.

Double-click a COM entry or select Properties from the context menu to display the configuration dialogue. We recommend giving a unique channel name, amending the *Description* and, if necessary, entering a *Location*.

Main settings tab



Interface mode

You might not make a choice for some COM interfaces, depending on the device, as there is only one setting available. Otherwise, select whether the connection is for PROFIBUS devices (selection *PROFIBUS* or *PROFIBUS logger*) or you want to give settings freely for other protocols (Modbus, user-defined)(selection *UART*). Additional fields are displayed depending on your selection, e.g. to set interface parameters such as baud rate, number of data bits, or parity. You can also create a channel with

PROFIBUS protocol via the context menu. However, only PROFIBUS settings can be chosen afterwards.



PROFIBUS communication is limited to fixed communication parameters. Therefore, the interface mode cannot be changed after the protocol has been created, i.e. the channel only functions as PROFIBUS.

A change of the interface mode is only possible after protocol is deleted.

UART settings

- *Baud rate*
  The baud rate states the number of characters transferred per second. Selection depends on the properties of the connected devices and the cable length between the devices: For longer lines, a lower baud rate should be selected to achieve error-free communication. Usually a maximum 20 m are permitted for a RS232 connection.
- *Data bits*
  Sets how many bits can be used for a data transmission, whereby the default setting is 8.
- *Handshake*
  Sets how the data flow is controlled. You can choose between *none* (without control), *Xon/Xoff* (software handshake) and *RTS/CTS* (hardware handshake), whereby the default setting is *none*.
- *Parity*
  Sets whether a parity bit accompanies a transmission and how it is determined. The default setting is *none*.
- *Stop bits*
  Sets the number of stop bits, which are the default setting.

Displayed information

Below the UART settings are the connection properties (*Hardware*: *RS485* or *RS232* / *Port*: *1* ... *3*).

PROFIBUS settings



Delphin devices are set to address 126 via the web interface in factory mode or after configuration reset (default configuration). This address is a placeholder and does not exist in the PROFIBUS network.

PROFIBUS address

Slave address: Enter the address configured in PROFIBUS master for the device (1 to 125).

Displayed information

The connection properties (*Hardware* and *Port*) are displayed below the PROFIBUS settings.

The symbol  is then displayed for the channel following configuration. Then create and configure the required PROFIBUS channels (Signals).

PROFIBUS logger settings

PROFIBUS baud rate

Baud rate: Enter the baud rate of the connected PROFIBUS network here.

Displayed information

The connection properties (*Hardware* and *Port*) are displayed below the PROFIBUS settings.

The symbol  is then displayed for the channel following configuration. Then create and configure the required PROFIBUS logger protocol.

Other settings are described in the following sections:

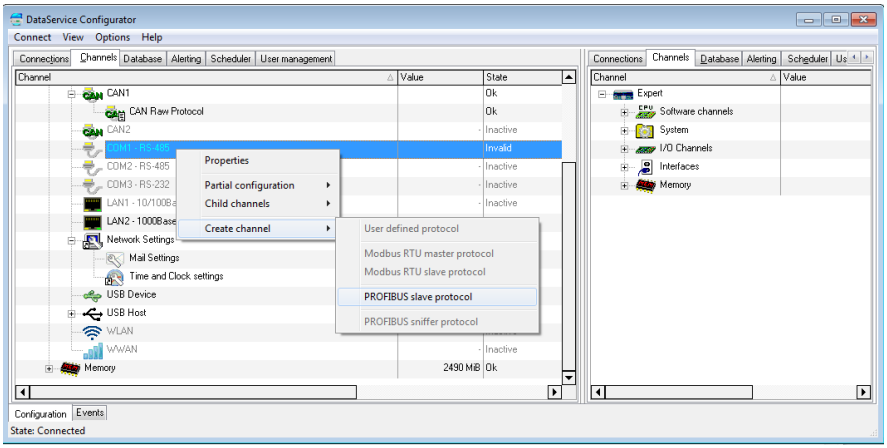
- PROFIBUS protocol
- PROFIBUS channel
- PROFIBUS logger protocol
- PROFIBUS logger pair
- Modbus RTU protocol
- Modbus RTU master
- Modbus RTU slave
- Modbus RTU channel
- User-defined protocol
- User-defined input channel
- User-defined output channel

4.8.3.1 PROFIBUS protocol



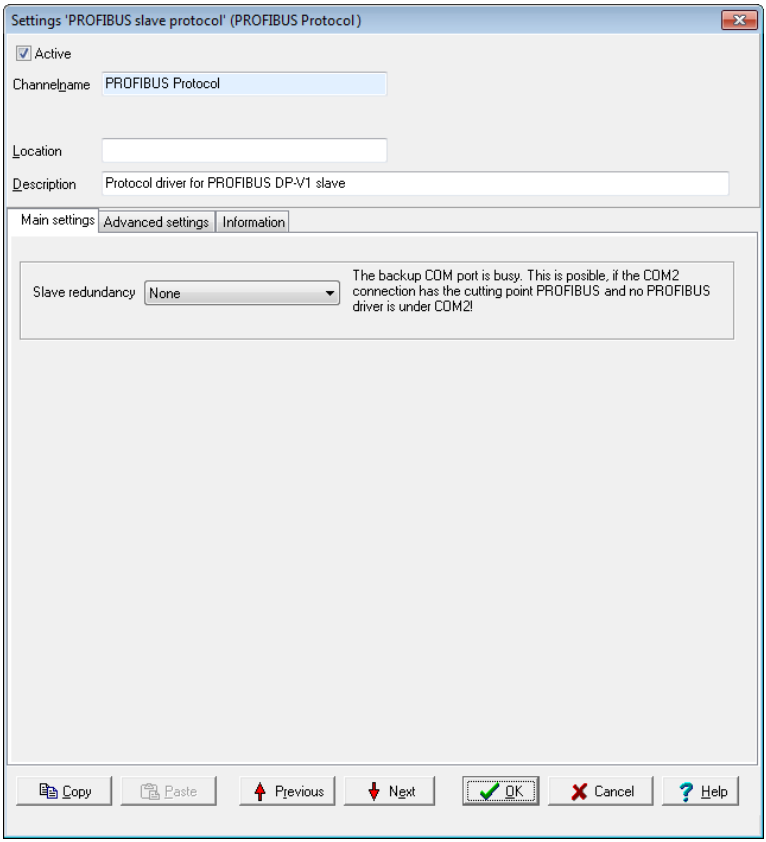
You must run the COM connection in the *PROFIBUS* interface mode and set the PROFIBUS address there (see COM connection).

Create the PROFIBUS protocol channel via the context menu of the COM connection: *Create channel* → *PROFIBUS protocol*.



We recommend giving a unique *Channel name*, amending the *Description* and, if necessary, entering the *Location*.

Main settings tab



Use *Slave redundancy* to set up a redundant PROFIBUS interface. The interface is used only when the intended interface (COM1) fails.

- Select *None* if redundancy is not required.
- Select *PNO_2212_V1.2* to set up a redundant PROFIBUS interface.
  A redundant PROFIBUS interface can be configured with this setting in accordance with the procedure described in PNO Document No. 2212 V1.2 of November 2004 from the German PROFIBUS User Organization (PNO).
- The *Custom1* or *Custom2* option is reserved for customer-specific enhancements.

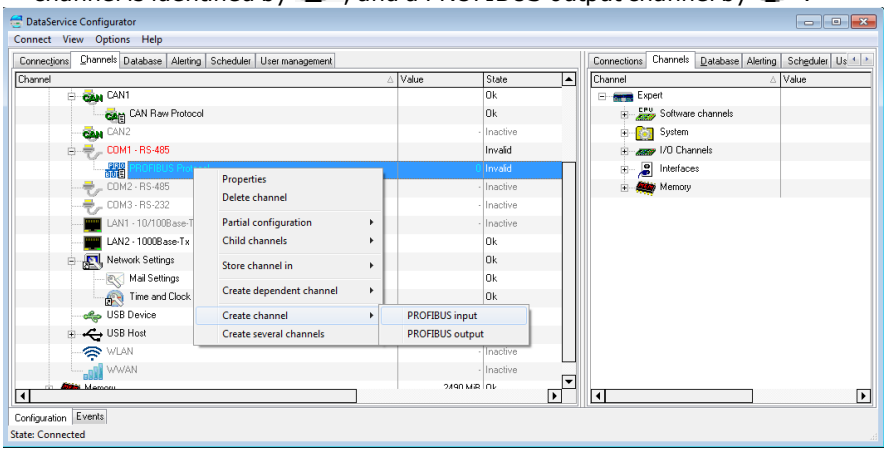
After selecting *Slave redundancy*, *Backup COM-Port* shows that the COM2 interface is used for backups.

Slave redundancy can be selected only when a second interface is available for backup operations. A second interface must run in PROFIBUS mode. However, no PROFIBUS protocol is allowed to be configured to this connection. The dialogue notifies of any incorrect settings.

The symbol is then displayed for the channel following configuration. Then create and configure the required PROFIBUS channels (Signals).

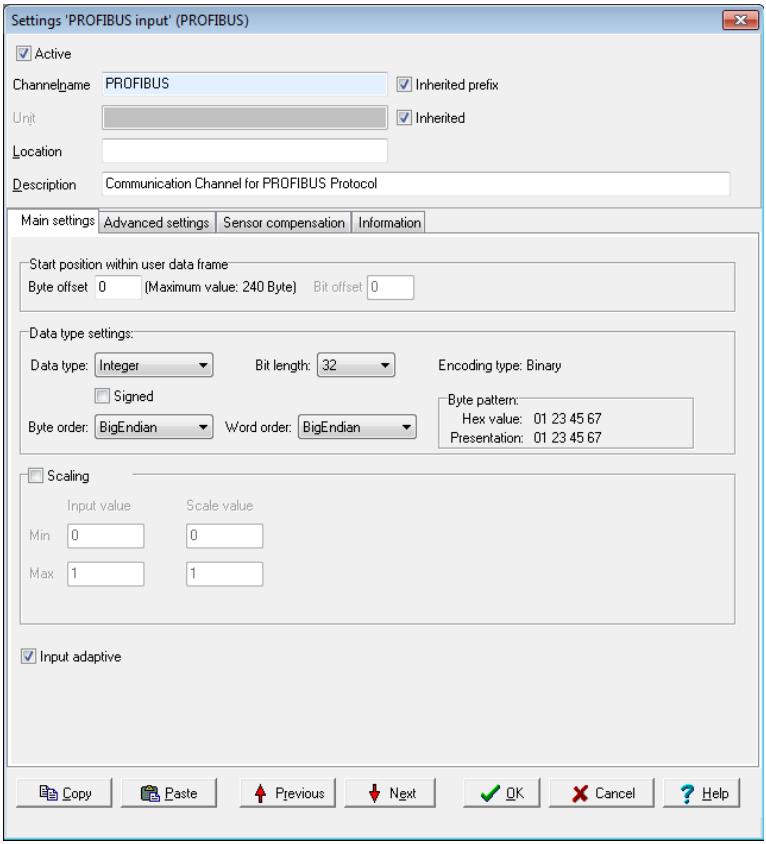
4.8.3.2 PROFIBUS channel

Creating PROFIBUS channels requires creation of a COM connection in the *PROFIBUS* interface mode and of a PROFIBUS protocol (subchannel). Select *Create channel* → *PROFIBUS input* or *PROFIBUS output* from the context menu of the PROFIBUS protocol (, PROFIBUS protocol) in order to create channels for your PROFIBUS signals. A PROFIBUS input channel is identified by , and a PROFIBUS output channel by .



Double-click a PROFIBUS channel or select Properties from the context menu to display the configuration dialogue. The data to be entered depends on the signal type that is to be sent to or received from the PROFIBUS user. (Refer toUsing channel as an output). Therefore, obtain information on the format and settings of relevant PROFIBUS signals before entering data here.
Refer also to Settings for all dialogues.

Main settings tab



Start position in payload data

- *Byte offset*
  The length of the payload data, i.e. the size of the data field (DU) of a PROFIBUS message, is limited to a maximum of 244 bytes. This enables multiple signals to be transmitted within a message. Enter the starting byte for this signal's payload data
  The maximum possible value of the offset is derived from the bit length of the data type and is displayed to the right of the numeric field. Input is restricted to the valid values, and the default is 0



When configuring the Profibus master, it receives information on the number of I/O channels from its slave, and hence also from the PROFIBUS slave. At run time, i.e. when data exchange is taking place, the master sends the I/O configuration to the slave. If the configured byte offset in the **Delphin** device is greater than the I/O addresses of the transmitted master configuration, the **Delphin** device shows a configuration error in the channel status.

- *Bit offset*
  This field is available only for the bit data type and binary encoding. The payload bit in this data type can be between the 0 and seventh byte position. Byte offset is also available for this data type. Input is restricted to the valid values, and the default is 0

Data type settings

- *Data type*
  Specifies the data type for interpreting the transmitted payload data. *Bit length, Byte order* and *Word order* are set and adjusted in relation to the adopted setting. The Start position in data and Scaling are set according to data type.
- *Signed*
  Sets whether the integer data type is to be interpreted as signed or unsigned. An 8-bit value would then be in the range -128 to 127 (two's complement) or 0 to 255. Floating values are always interpreted as signed. Bit-values make no distinction between signed and unsigned.
- *Bit length*
  Sets the bit lengths for integer and floating data types. Byte sequence and Word sequence are adjusted according to length value. This also applies to the numeric fields in the Start position in data.
- *Encoding type*
  Displays the encoding type used for interpreting the transmitted payload data.
- *Byte sequence*
  The byte order (byte sequence) is a number, made up of several bytes, that sets how bytes are ordered for the address. BigEndian, also known as Motorola format, orders the most significant byte to the lowest address. LittleEndian, also known as Intel format, orders the least significant byte to the lowest address. Refer also to http://en.wikipedia.org/wiki/Endianness.
- *Word order*
  Like the byte order, word order orders word data (1 word = 2 bytes = 16 bits) to addresses. In addition to determining byte order, a different word ordering may be necessary.
- *Byte pattern*
  To display the different byte and word order combinations, a hex value (a random number in the example) is shown with the resulting byte pattern of a message.

Scaling

If a PROFIBUS master sends values that require conversion, enable *Scaling* and enter *Min / Max* values to convert from the *Input value* to the Scale value .

If the Use channel as output option is used, scaling takes place in the opposite direction: Enter the range from the source data in *Scale* value and the range for the output signal in *Output value*.



Without scaling, the channel's data type is that entered under *Data type*. When scaling is enabled, the floating data type is always used for the channel.
This also applies when the channel is used as an output: When scaling is enabled, the channel must have the floating *data type*, otherwise you have to use the type under Data type.

Scaling example

In the above image, a conversion takes place from 2000 (integer value) to 200 (°C), i.e. it returns a decimal point despite transmission of an integer (whole number).

Using the channel as output

If you create a PROFIBUS channel as an output, you can send data from the **Delphin** device to other PROFIBUS users.

Enter the data for the message to be sent in a similar way to a PROFIBUS input. You must also enter the *Source* (of the signal).

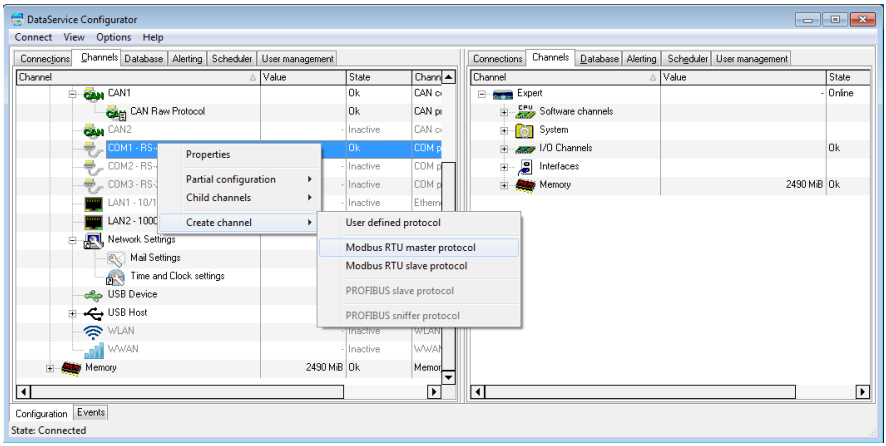
Enter either a constant for the *Source* (*Manual value*) or select *Channel* and an existing channel in the device for which a value is to be output. Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal** application. The source type is converted to the type given in *Data type* (refer also to Scaling).

Inherit status (for *Channel* settings only): The status of the input channel is used, but not output to the PROFIBUS itself.

4.8.3.3 Modbus RTU Slave/Master

Use the *Main settings* tab to enter the general settings for the interface (baud rate, number of data bits etc.) for the relevant COM interface. Refer to COM interface, UART settings.

Use the context menu of the COM connection to create the protocol for Modbus: *Create channel* → *Modbus RTU master/slave protocol*.



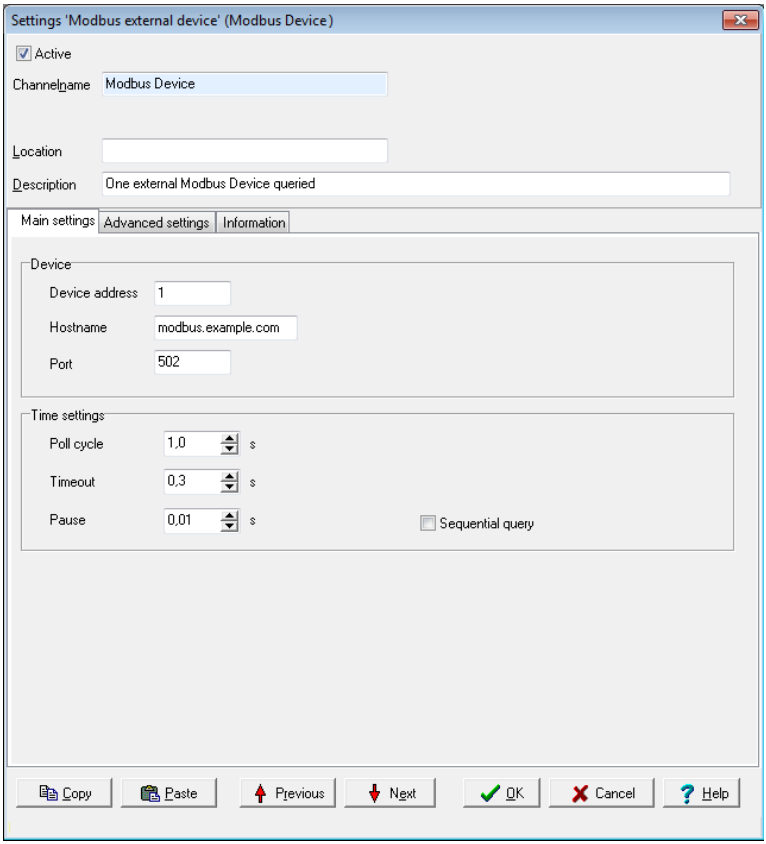
We recommend giving a unique *Channel name*, amending the *Description* and, if necessary, entering a Location.

Following configuration, the Mod symbol is displayed for a Modbus RTU master and for a Modbus RTU slave. Then create and configure the required channels for the Modbus master and/or Modbus slave.

Modbus Device (Master)

Use the context menu of the Modbus protocol (Mod, Modbus RTU Master) to create a Modbus device: *Modbus external device*. To open the configurations dialogue, double click menu item *Modbus Device* or select Properties from the context menu. Use the dialogue to enter a name, location and description for the external device. Set the device's (own) address in the Modbus network and the parameters for querying Modbus users.

Main settings tab



Device

- *Device address*
  Sets the address for the master.

Settings for *Host name* and *Port* cannot be changed.

Time setting

- *Poll cycle*
  Sets the the time for cyclical querying of data. Existing Modbus users are (re)-queried once the set time expires. The time must be long enough in relation to the *pause* time and the number of channels (users), or you will receive an error message when closing the dialogue. The values entered will then not be saved.

- *Timeout*
  Sets the maximum permissible time between a request and a response before an error status is shown. In the event of an error, a "wire-break" status is displayed (refer also to the table in Status monitoring). The time must be short enough in relation to the time for the *Poll cycle* or you will receive an error message when closing the dialogue. The values entered will then not be saved.
- *Pause*
  Sets the waiting time for a query from more than one channel within a poll cycle. The time must be short enough for all channels to be queried within the time entered under *Poll cycle* or you will receive an error message when closing the dialogue. The values entered will then not be saved.
- *Sequential query*
  If you enable this option, only one request telegram will be generated for sequential Modbus addresses instead of a separate request telegram for each address.

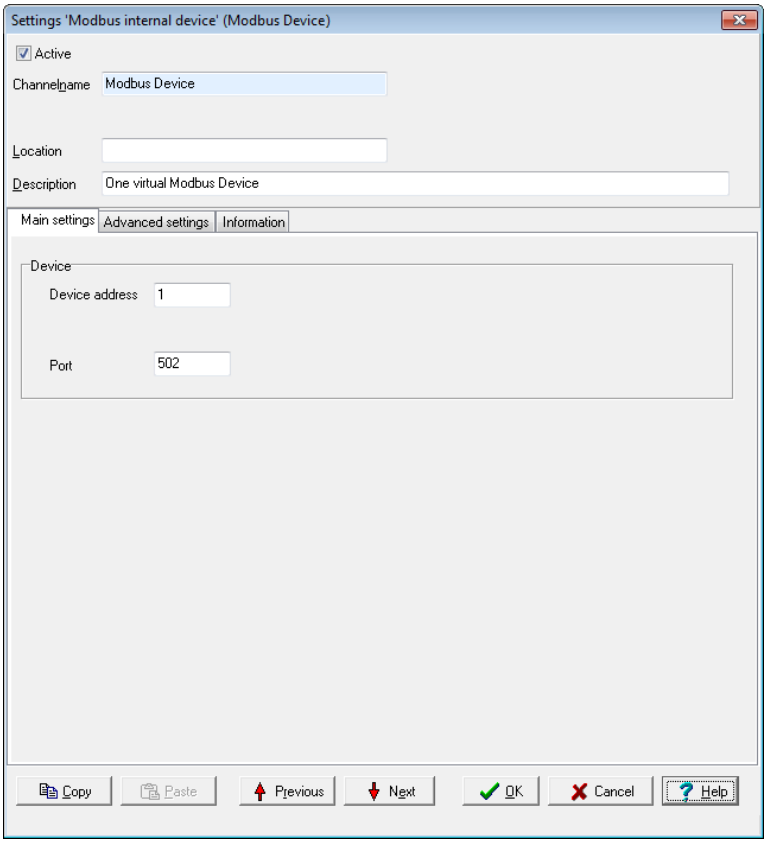
The 

symbol is displayed following configuration. Then create and configure the required Modbus channels (signals).

Modbus Device (Slave)

To create a Modbus channel, use the context menu for the Modbus protocol (, Modbus RTU slave): *Modbus internal device.* To open the configurations dialogue, double click menu item *Modbus Device* or select Properties from the context menu. You can use the dialogue to set the name, location and description under which the device is to function in the Modbus network. Give the device's address settings here for the Modbus network.

Main settings tab



Device

- *Device address*
  Sets the address for the device (slave).

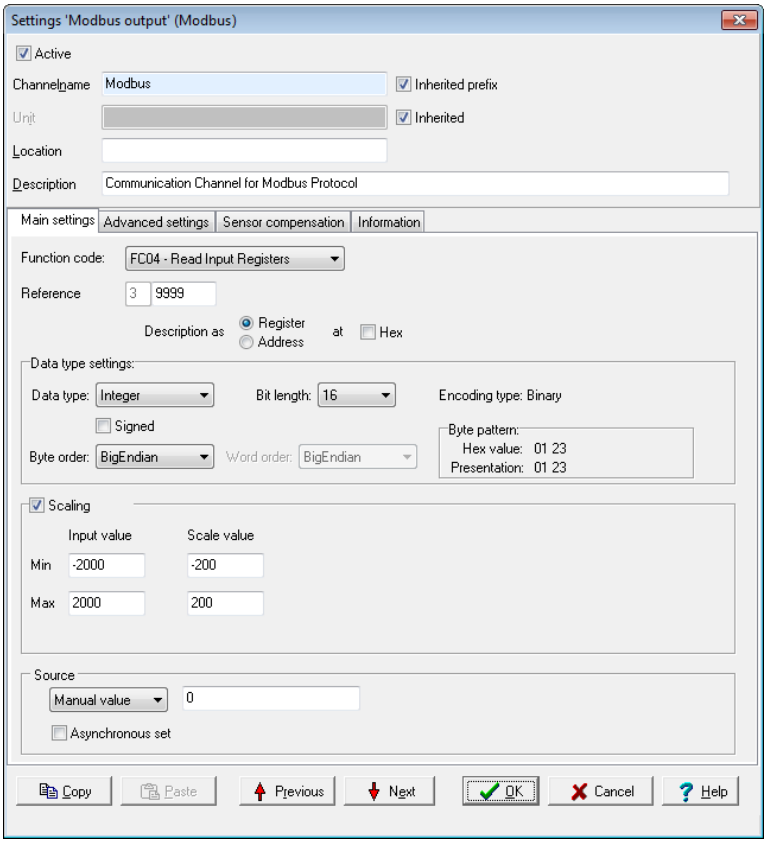
The Port setting cannot be changed.

The  symbol is displayed following configuration. Then create and configure the required Modbus channels (signals).

Modbus channel

Depending on whether you want to output or read a signal, select *Create channel*→ *Modbus* output or Modbus input. A Modbus input channel is identified by  and a Modbus output channel by . Refer also to Settings for all dialogues.

Main settings tab



Function code: Select what is to be read (input) or written (output). Only permitted data will be available, for example FC01 to FC04 for the inputs and FC05/06 as well as FC15/16 for the outputs. The setting influences the values that can be configured in Data type settings.

Reference: The number in front of the input field indicates the memory page and thus the tab type.
Input is made in decimal form by default, and is restricted to valid values. Using *Show as* you can specify whether the input is to be used *as an* Address or *as a Tab* , and whether it should follow decimal or hexadecimal (Hex) notation.

Data type settings

These settings are dependent on the *Function code* inputs and also on whether the channel is an input or output.

- *Data type*
  Specifies the data type for interpreting the transmitted payload data. *Bit length*, *Byte order* and *Word order* are set and adjusted in relation to the adopted setting. *Start position in payload data*, Scaling and Use channel as output are also set according to the data type.
- *Signed*
  Sets whether the integer data type is to be interpreted as signed or unsigned. An 8-bit value would then be in the range -128 to 127 (two's complement) or 0 to 255. Floating values are always interpreted as signed. Bit-values make no distinction between signed and unsigned.
- *Bit length*
  Sets the bit lengths for integer and floating data types. *Byte sequence* and *Word sequence* are adjusted according to length value. This also applies to the numeric fields in the St*art position in data.*
- *Encoding type*
  Displays the encoding type used for interpreting the transmitted payload data.
- *Byte sequence*
  The byte order (byte sequence) is a number, made up of several bytes, that sets how bytes are ordered for the address. BigEndian, also known as Motorola format, orders the most significant byte to the lowest address. LittleEndian, also known as Intel format, orders the least significant byte to the lowest address. Refer also to http://en.wikipedia.org/wiki/Endianness.
- *Word order*
  Like the byte order, word order orders word data (1 word = 2 bytes = 16 bits) to addresses. In addition to determining byte order, a different word ordering may be necessary.
- *Byte pattern* (input channels only)
  To display the different byte and word order combinations, a hex value (a random number in the example) is shown with the resulting byte pattern of a message.

Scaling

If a Modbus user sends values that require conversion, enable *Scaling* and enter Min / Max values to convert from the Input *value* to the Scale value.

If the Use channel as output option is used, scaling takes place in the opposite direction: Enter the range from the source data in *Scale* value and the range for the output signal in *Output value*.



Without scaling, the channel's *Data type* is used When scaling is enabled, the floating data type is always used for the channel. This also applies when the channel is used as an output: When scaling is enabled, the channel must have the floating data type, otherwise you have to use the type under *Data type*.

Scaling example

In the above image, a conversion takes place from 2000 (integer value) to 200 (°C), i.e. it returns a decimal point despite transmission of an integer (whole number).

Using the channel as output

If you create a Modbus channel as an output, you can send data from the **Delphin** device to other Modbus users.

Enter the data for the message to be sent in a similar way to a Modbus input. You must also enter the *Source* (of the signal).

Enter either a constant for the *Source* (*Manual value*) or select *Channel* and an existing channel in the device for which a value is to be output. Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal** application. The source type is converted to the type given in *Data type* (refer also to Scaling).

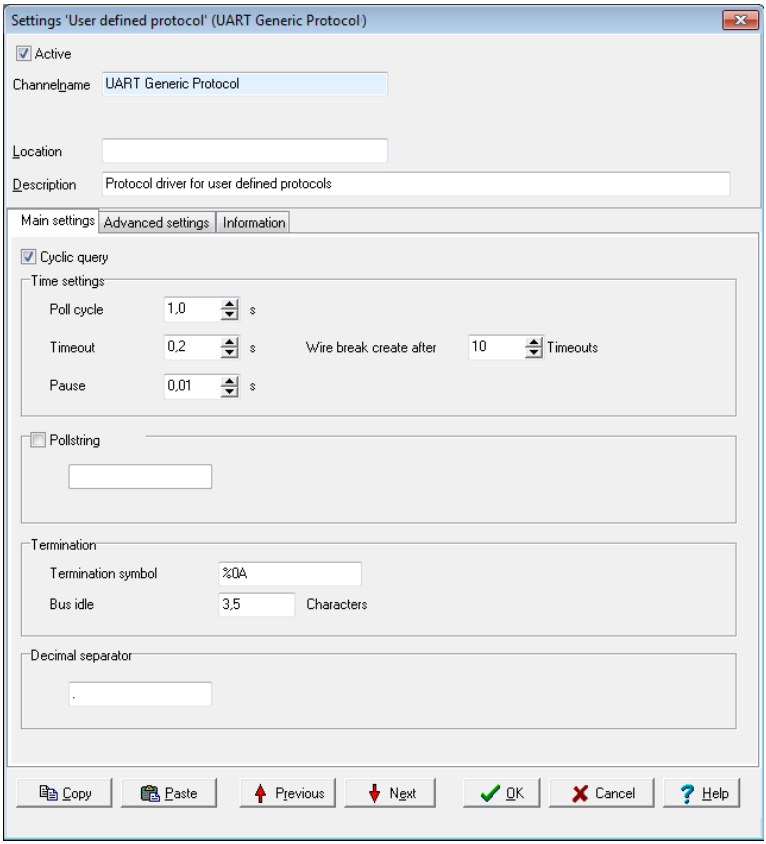
Inherit status (for Channel settings only): The status of the input channel is used, but not output to the CAN bus.

Set asynchronous: When this option is enabled the output value transmits as soon as the value changes, that is, in real-time. Otherwise a new value is transmitted with the next cycle.

4.8.3.4 User-defined protocol

We recommend giving a unique *Channel name*, amending the *Description* and, if necessary, entering a *Location*. The *Main settings* tab is described in the following and then how input and output channels are created.

Main settings tab



This tab is enables you to make settings that apply to all channels (inputs and outputs) of the interface. It is also possible to create separate settings for each channel which differ to the general setting for poll string and poll cycle and/or output time. Termination settings only apply for all input and output channels.

Cyclic query: General settings on whether data is to be cyclically queried for all input channels and/or sent for all output channels. Do not enable the option if you wish to create the settings per channel.

Time setting

- *Poll cycle*
  Sets the the time for cyclical querying of data. The current user is (re)-queried after this time has elapsed. The time must be long enough in relation to the *Pause* time and the number of channels (participants) or you will receive

an error message when closing the dialogue. The values entered will then not be saved.

- *Timeout*
  Sets the maximum permissible time between a request and a response before an error status is shown. In the event of an error, a "wire break" status is displayed according to the number of timeouts set with *Produce wire break after*. Refer also to the table in Status monitoring. The time must be short enough in relation to the time for the *Poll cycle* or you will receive an error message when closing the dialogue. The values entered will then not be saved.
- *Pause*
  Sets the waiting time for a query from more than one channel within a poll cycle. The time must be short enough for all channels to be queried within the time entered under *Poll cycle* or you will receive an error message when closing the dialogue. The values entered will then not be saved.

Poll string

Enter here a character string for all output channels which is to be output and which prompts the user to send its data if this is required. If you require data from several channels with different poll strings, do not enable the option here, but enter instead the poll string separately for each relevant input channel.

Enter the string as text. ASCII characters that cannot be entered directly, e.g. carriage return (CR) or line feed (LF), can be entered using % and the ASCII value in hexadecimal format: Enter CR as %0D and LF as %0A.

Termination

This setting applies to input and output channels for the interface and cannot be changed for a specific channel. The entries for *termination symbol* and *transmission pause* are, however, used simultaneously. For example, an input message is considered ended after either the *Termination symbol* and/or a pause larger than the time given in *transmission pause*.

- *Termination symbol*
  One or more ASCII characters that indicate the end of a message. If the characters cannot be sent, or if you do not enter any characters, the *transmission pause* will be used for end recognition.
  Enter the characters as text. ASCII characters that cannot be entered directly, e.g. carriage return (CR) or line feed (LF), can be entered using % and the ASCII value in hexadecimal format: Enter CR as %0D and LF as %0A.
  You can enter only one end sequence. Multiple end sequences are not possible.
- *Transmission pause*

Enter the pause length in “character times” (time duration for transmission of a character via interface) after which a message should be considered as ended.

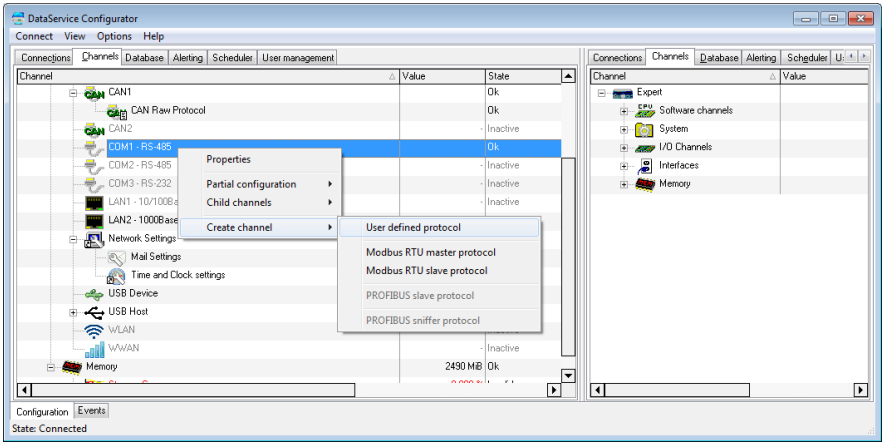
Decimal separator

Enter the decimal separator here for the transmission of numerics. The character will be used for all channels which transmit numerics.

Creating user-defined protocol

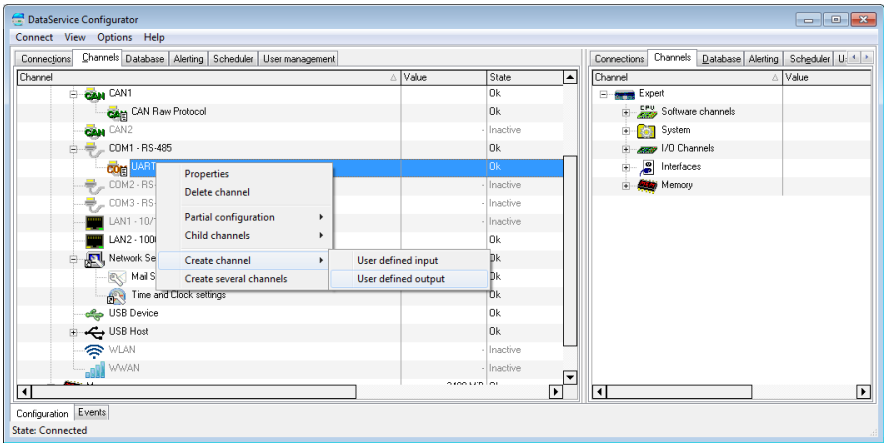
Use the *Main settings* tab to enter the general settings for the interface (baud rate, number of data bits etc.) for the relevant COM interface. Refer to COM interface, UART settings.

Create the user-defined protocol via the COM interface's context menu: *Create channel* → *User-defined protocol*.



User-defined output channel

Create an output channel via the the context menu for UART Generic Protocol:



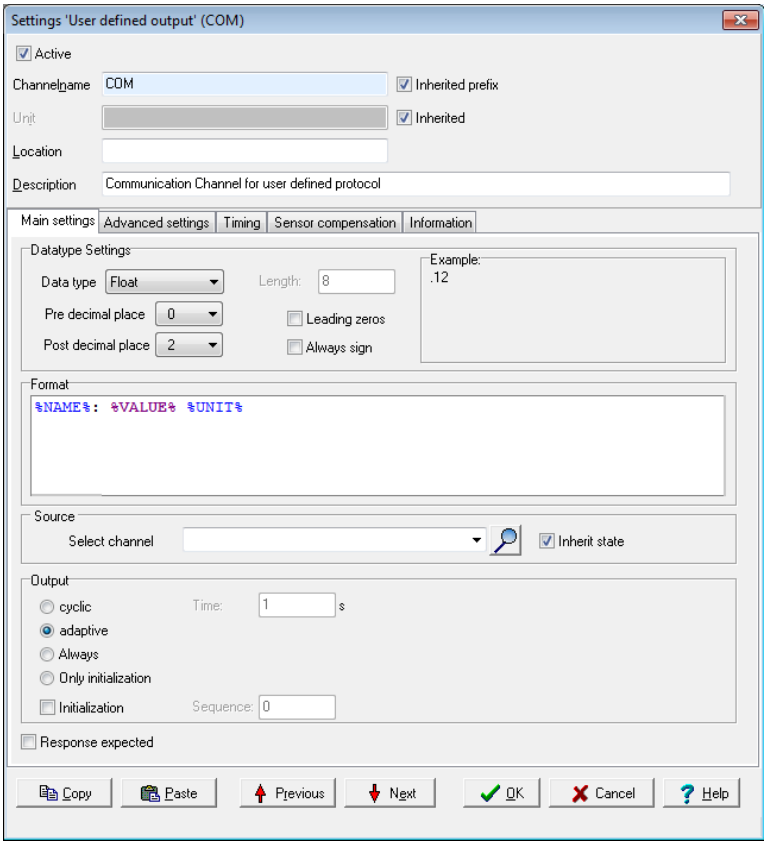
The main settings for user-defined input channels are given using two tabs:

1. Main settings tab
   Contains settings for the data type, data source and output frequency.
2. Time settings tab
   Enables customized settings for transmission time in case you need to use extra pauses for a message, e.g. to send an initialisation to a device that then needs time to perform the initialisation.

The other tabs contain standard settings. Refer also to Settings for all dialogues.

Main settings tab

Set how a value is to be output in the *Main settings* tab.



Data type settings

Output is always as an ASCII string. However, you can set the format of the value to be output using the data type setting.

- *Data type*
  Sets the data type for the signal that is to be used. The value for other entries depends on the settings here. For example, the *integer* data type has no decimal places, but can be output with post-decimal places, which are then always zeroes.
  For the *string* data type, enter its *length*.
- *Pre-decimal places*
  Sets the number of decimal places before the decimal point/separator. The decimal separator is output only when at least one post-decimal place is output.

- *Leading zeroes*
  Sets whether the pre-decimal places are to include leading zeroes when the number has fewer decimal places. This means that the same number of characters are always sent.
- *Post-decimal places*
  Sets the number of pos-decimal places to be output.
- *Always sign*
  Ensures that positive as well as negative signs are always sent. The sign does not count as a pre-decimal place.
- *Example*
  Displays the formatting of an imaginary number according to the settings made.

Format

Sets what is to be sent, e.g. value and unit for the channel. Do not delete the required placeholders, including % signs. You can send only one channel (value), but any number of placeholders for other information, e.g. for outputting the current date and time. You can also enter text instead of placeholders, e.g. text to be sent for initialisation. For example, by using the initialisation string "Measure:Volt:DC" you can switch a multimeter to DC measurement.

To send output channel data, use the following placeholders:
%VALUE%: Channel value.
%STATUS%: Channel status.
%UNIT%: Channel unit.
%NAME%: Output channel name.
%DESCRIPTION%: Output channel description.
%LOCATION%: Output channel location.
%ID%: Output channel ID.

To send source channel data, use the following placeholders:
%UNITSOURCE%: Source channel unit.
%NAMESOURCE%: Source channel name.
%DESCRIPTIONSOURCE%: Source channel description.
%LOCATIONSOURCE%: Source channel location.
%IDSOURCE%: Channel ID for the source channel.

The following general placeholders are available for you to use:
:%DATETIME%: Current date and time.
%HOUR%: Current time.
%MINUTE%: Current minute.
%SECOND%: Current seconds.
%YEAR2%: Current year as 2 digits.
%YEAR4%: Current year as 4 digits.

%MONTH%: Current month.
%DAY%: Current day.

To output ASCII special characters, the following placeholders are also available:
%NUL%: 00 in hexadecimal format.
%SOH%: 01 in hexadecimal format.
%STX%: 02 in hexadecimal format.
%ETX%: 03 in hexadecimal format.
%EOT%: 04 in hexadecimal format.
%ENQ%:05 in hexadecimal format.
%ACK%:06 in hexadecimal format.
%BEL%:07 in hexadecimal format.
%BS%: 08 in hexadecimal format.
%TAB%: 09 in hexadecimal format.
%LF%: 0A in hexadecimal format.
%VT%: 0B in hexadecimal format.
%FF%: 0C in hexadecimal format.
%CR%: 0D in hexadecimal format.
%SO%: 0E in hexadecimal format.
%SI%: 0F in hexadecimal format.
%DLE%: 10 in hexadecimal format.
%DC1%: 11 in hexadecimal format.
%DC2%: 12 in hexadecimal format.
%DC3%: 13 in hexadecimal format.
%DC4%: 14 in hexadecimal format.
%NAK%: 15 in hexadecimal format.
%SYN%: 16 in hexadecimal format.
%ETB%: 17 in hexadecimal format.
%CAN%: 18 in hexadecimal format.
%EM%: 19 in hexadecimal format.
%SUB%: 1A in hexadecimal format.
%ESC%: 1B in hexadecimal format.
%FS%: 1C in hexadecimal format.
%GS%: 1D in hexadecimal format.
%RS%: 1E in hexadecimal format.
%US%: 1F in hexadecimal format.

Source

Select a channel for which the value is to be output. Enter the %STATUS% placeholder in the *Format* field so that you can inherit and hence output the status of the source channel.

Output

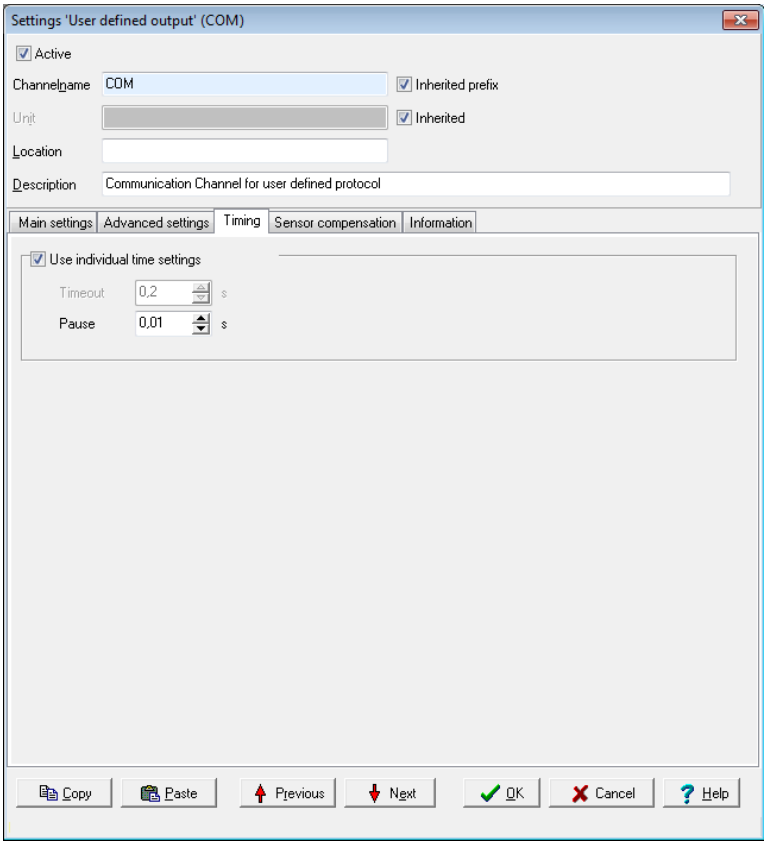
- *Cyclic*
  Here you can set how often it is sent. The next value is sent after the time given here has elapsed.
- *Adaptive*
  This option means that a new value is sent only when the value to be sent has changed.
- *Never*
  This option is intended for sending of an initialisation in conjunction with the next option. The string entered in the *Format* field is then sent only once for initialisation and never cyclically or adaptively.
- *Initialisation*
  This option enables you to set initialisation strings, for example, "Measure:Volt:DC" to switch a multimeter to DC measurement. If you have to send more than one sequence, enter a number via *Sequence* to determine whether the string entered in the *Format* field is to be sent first (*Sequence = 1*) or second (Sequence = 2) and so on. Use the *Time settings* tab to set a pause after sending an initialisation sequence in order to give the device time to process the instruction.

Response expected

Enable this option so that the next output takes place only when the user has responded to the previous transmission with a string. The response string itself is not evaluated. Only reception is awaited. If the response contains relevant information, you must define an input channel and then have the response evaluated.

Time settings tab

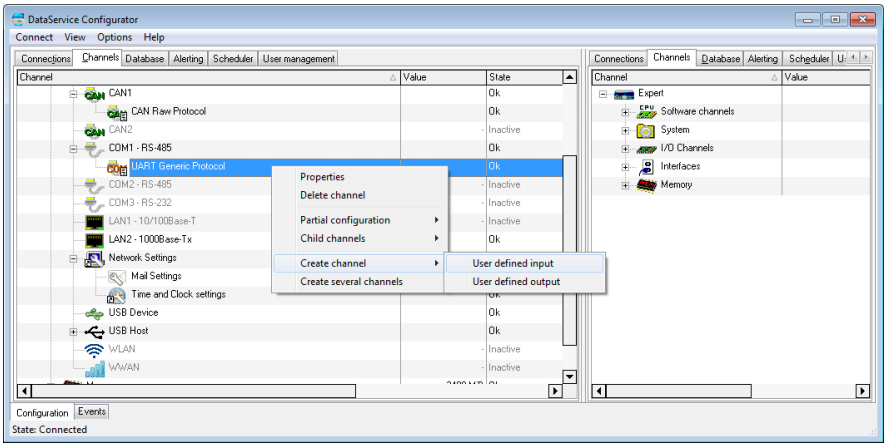
Use the *Time settings* tab if you need to use extra pauses for a message, e.g. to send initialisation to a device that then needs time to perform the initialisation.



Enable *Use custom time settings* and enter the required pause time, e.g. for when an initialisation string is sent (refer to *output*: Never). Pause times aren't necessary in all other cases because sending takes place either cyclically or adaptively.

User-defined input channel

Create an input channel via the the context menu for UART Generic Protocol:



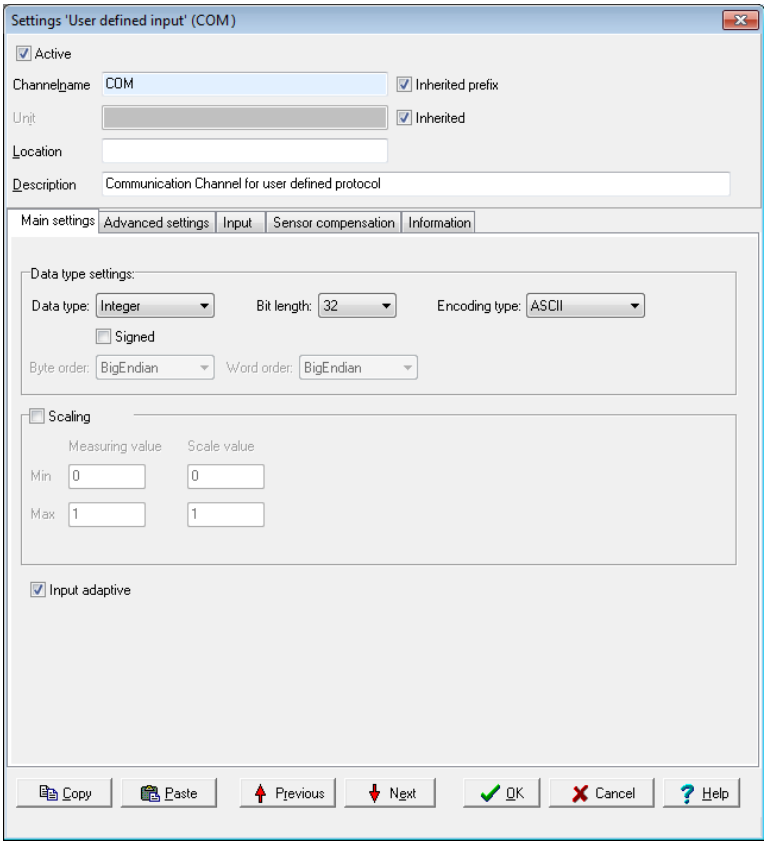
Main settings for user-defined input channels are given using the two tabs:

1. Main settings tab
   Contains settings for the data type and the scaling of received data.
2. Input tab
   Contains settings for receiving frequency, poll string and decoding (filtering) of received data.

The other tabs contain standard settings. Refer also to Settings for all dialogues.

Main settings tab

Use this tab to set how received (user) data is to be converted into a measurement value. Use the *Input* tab if not all the characters/bytes sent are to be converted (by setting filter and offset).



Data type settings

- *Data type*
  Specifies the data type for interpreting the transmitted payload data. *Bit length*, *Byte order* and *Word order* are set and adjusted in relation to the adopted setting.
- *Signed*
  Sets whether the integer data type is to be interpreted as signed or unsigned. An 8-bit value would then be in the range -128 to 127 (two's complement) or 0 to 255. Floating values are always interpreted as signed. Bit-values make no distinction between signed and unsigned.
- *Bit length*
  Sets the bit lengths for integer and floating data types. *Byte sequence* and *Word sequence* are adjusted according to length value. This also applies to the numeric fields in the Start position in data.

- *Encoding type*
  Displays the encoding type used for interpreting the transmitted payload data. *Binary* (the received bytes are interpreted as binary data), *ASCII* (ASCII characters, i.e. text) or *ASCIIHex* (the received ASCII characters are interpreted as hexadecimals pairs). The data is converted into the given data type after being received.
- *Byte sequence*
  The byte order (byte sequence) is a number, made up of several bytes, that sets how bytes are ordered for the address. BigEndian, also known as Motorola format, orders the most significant byte to the lowest address. LittleEndian, also known as Intel format, orders the least significant byte to the lowest address.
  Refer also to http://en.wikipedia.org/wiki/Endianness.
- *Word order*
  Like the byte order, word order orders word data (1 word = 2 bytes = 16 bits) to addresses. In addition to determining byte order, a different word ordering may be necessary.
- *Byte pattern*
  To display the different byte and word order combinations, a hex value (a random number in the example) is shown with the resulting byte pattern of a message.

Scaling

If the sent values require conversion, enable *Scaling* and enter *Min / Max* values to convert from the *Measurement value* into the *Scale value*.



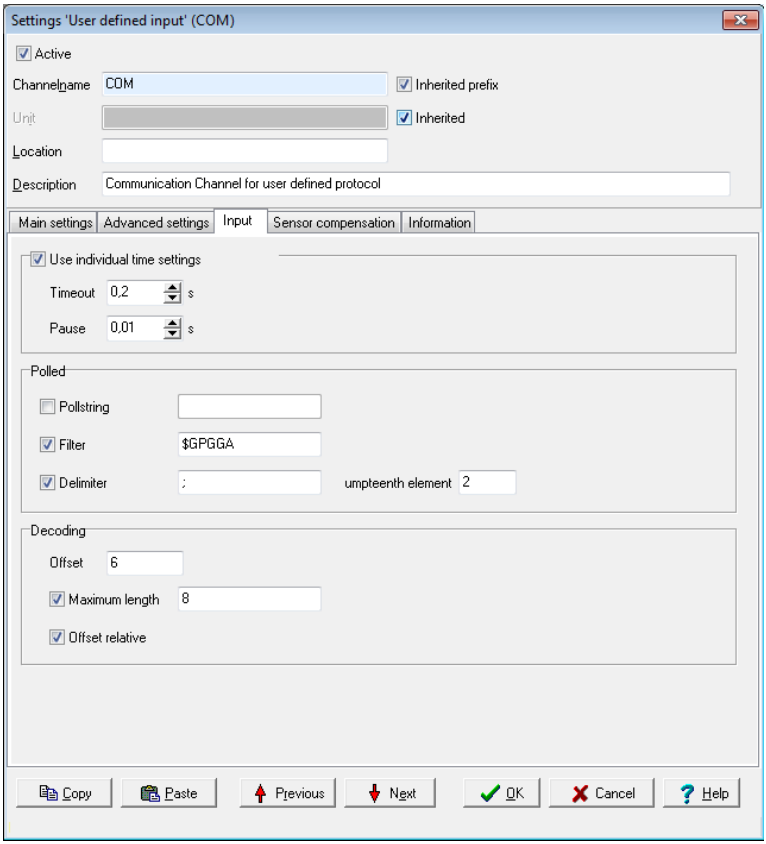
Without scaling, the channel's *Data type* is used When scaling is enabled, the floating data type is always used for the channel.

Scaling example

In the above image, a conversion takes place from 2000 (integer value) to 200 (°C), i.e. it returns a decimal point despite transmission of an integer (whole number).

Input tab

Use this tab to set how often data should/must be received, whether data output needs to be "prompted" and, if necessary, how data is to be extracted from a string.



Custom time settings

Only activate the setting if you require different settings for this channel. Otherwise, general settings are used. Refer to User-defined protocol.

- *Timeout*
  Sets the maximum permissible time that may elapse between a query (*poll string*) and its response, or between two sequential responses (without poll string) before an error status is given. In the event of an error, a "wire-break" status is displayed (refer also to the table in Status monitoring).
- *Pause*
  Sets the waiting time between two queries using a poll string. The poll string is resent once this time has elapsed.

Polled

- *Poll string*
  The string entered here will be sent to the user according to the time frame defined using *Pause*. This is required when a user sends a response (a value) only after he has been "prompted". Leave the field empty if the user doesn't require prompting to send.
  Enter the string as text. ASCII characters that cannot be entered directly, e.g. carriage return (CR) or line feed (LF), can be entered using % and the ASCII value in hexadecimal format: Enter CR as %0D and LF as %0A.
- *Filter*
  If the user sends multiple responses (messages or comments), you can use a filter to retrieve the responses you require in this channel. Enter the message's beginning, e.g. *$GPGGA*.
- *Delimiter*
  If the filtered message contains multiple elements, use this delimiter to determine how these elements are separated and which element (*n'th element*) is to be used for this channel.

Decoding

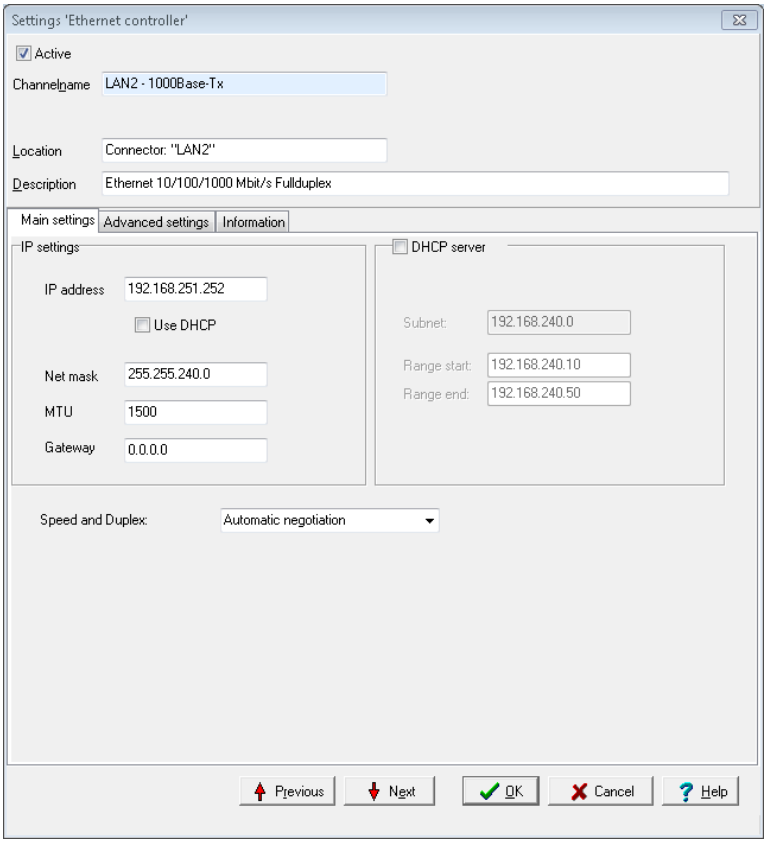
- *Offset*
  Truncates the first character of the message as set under *Polled*. This means the message is evaluated from this offset. You can set the offset from the absolute beginning of the message (default) or relative to the first character with the *Filter*(*Offset relative to filter*).
- *Maximum length*
  Evaluates the message only up to the character given here. All other characters are ignored.

4.8.4 LAN

This window enables network data to be input or amended. Changes to settings are only adopted after clicking *Save* .



After changing the *IP address* or *net mask*, the device is then only accessible via the new address. The PC's IP address (and any subnet mask) then also requires amending to establish a connection if required.



IP settings

Activate DHCP (*Use DHCP*) so that the device can obtain an IP address automatically from a DHCP server in the network. If no DHCP server is available in the network, enter a (strong) IP address and (sub) net mask or use *DHCP Server* on the right-hand side to let the device work as a DHCP server in the network.

Ask your network administrator whether your network requires MTU and gateway information. Otherwise, leave the default setting of *1500* for *MTU*. A gateway address is required only if connections are to be established to other networks.

What Ethernet address to enter on the device?

Case 1: You are setting up a local network between your PC and your measurement device

You may require an Ethernet cross cable if you want to connect only the PC and the device. But most PCs today do not need a cross cable any longer; the interface is automatically reconfigured accordingly. If you use an Ethernet hub or Ethernet switch, connect the PC and devices to it (regular Ethernet cables).
Then, set the addresses on the devices. For example, assign the IP address 192.168.100.1 to your PC and the following addresses 192.168.100.2, 192.168.100.3, etc. to the **Delphin** devices. The address ranges 192.168.xxx.xxx are set aside for such internal networks, which is why they do not conflict with addresses on the Internet, even when your PC uses another Internet access.

Case 2: Your PC is connected to an Ethernet network, and your **Delphin** device is to be connected to the same network

Contact your system administrator to obtain an Ethernet address, which you then set on the device.

DHCP Server

Use this function to set up a DHCP server that assigns to all devices on the network (*Subnet*) a valid IP address. Enter a start and end address for the range of addresses to be made available.

Example

Start: *192.168.240.10*, *End*: *192.168.240.50*. With this setting, addresses from 10 to 50 can be assigned, that is, 41 users can receive addresses automatically.
The first three groups of digits must be identical for the start and end. The maximum range possible goes from 1 to 255.



The settings for *IP address* and *Net mask* (subnet mask) on the left-hand side must match the settings for the *DHCP Server*, for example, identical digits in the first three groups of digits of the IP addresses.
The *IP address* must be outside the range specified for the *DHCP Server*.

Speed and duplex

Generally, you should use *Auto negotiation*. This way, the adapters or Ethernet switches involved will negotiate appropriate settings.

Problems may occur during auto negotiation in rare cases that interrupt the transfer, because an attempt is made over and over again to find optimal settings. In such cases, make the setting dependent, for example,

on the Ethernet switch to which the **Delphin** device is connected. For managed switches, the speed can be fixed there too, which means that no more negotiation will be necessary.

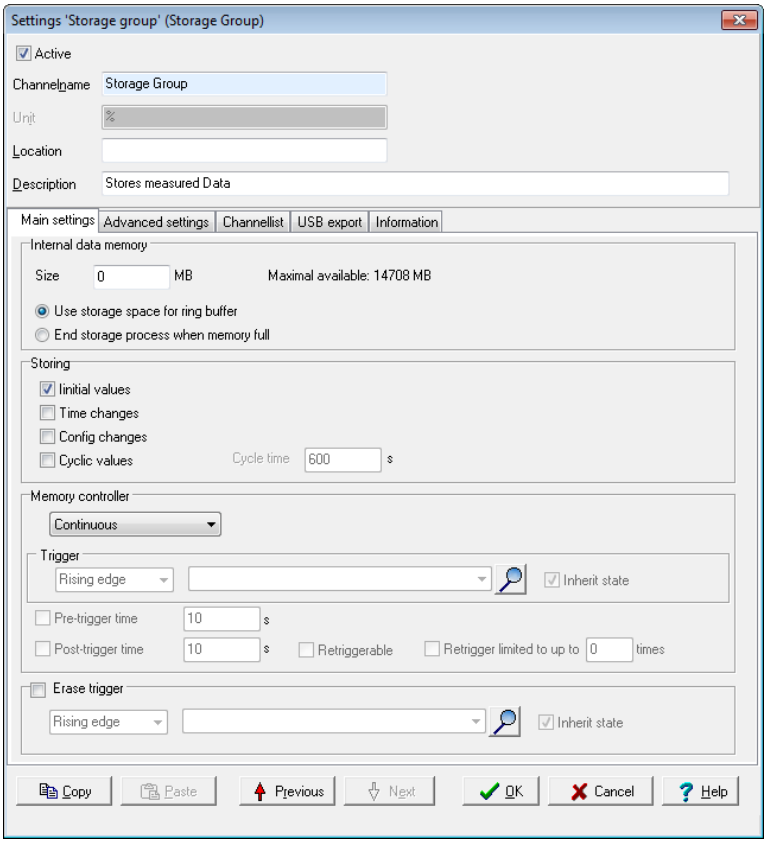
4.9 Device memory

Setting subgroups within the "Memory" group enables more efficient partitioning of memory. From the context menu, select Create channel → Memory group. Divide the available memory among these groups and use the *Channel list* tab in the configuration dialogue of the memory group to set how often the group's channels are to be saved. Via the *External memory backup* tab, you can set whether and where the captured data is to be stored (backup to external medium).

Using the context menu Read memory content, you can also transfer to your PC the data of individual or all channels of this memory group at any time for any length of time, for example, to the default directory of **ProfiSignal** (ProfiSignal\Data). The data can also be converted to the ASCII format.

Refer also to "Settings for all dialogues" on page 50, "Additional settings tab" on page 52, "Information tab" on page 56, "Tolerance filter" on page 169, USB device (Host).

4.9.1 Main settings tab



Use this tab to set the *Size* (amount) of memory that this group may use. The memory can either be written to until full (*End storage process when memory full*) or the group can be configured as a *Ring buffer*. As a ring buffer, the current value overwrites the oldest value when the memory is full. This means that the oldest values are deleted to make room for new ones.

An alternative to the ring buffer is the *Delete trigger function*. Enter a (digital) channel as the trigger for deletion. A calculated channel can be used that monitors memory capacity and then deletes the memory when a specified capacity has been reached.

Save

- *Start values*: When enabled, the current values from all channels in the channel list are saved when the memory group starts. The storage group starts by activation in this dialogue or following the switching on/rebooting of the device and active storage group.
- *Time change*: When enabled, time changes, such as synchronising using NTP time, triggers extra saving to the memory group from the channels in the channel list. This helps identify the cause of a "time mismatch" of data.
- *Configuration changes*: When enabled, it saves changes to the channel configuration in this memory group along with the time of change, the version number and the configuration file history in the device (/pm/-config/channels/backup/).
- *Saving values cyclically*: When enabled, saving takes place at the given interval irrespective of any trigger or tolerance settings.

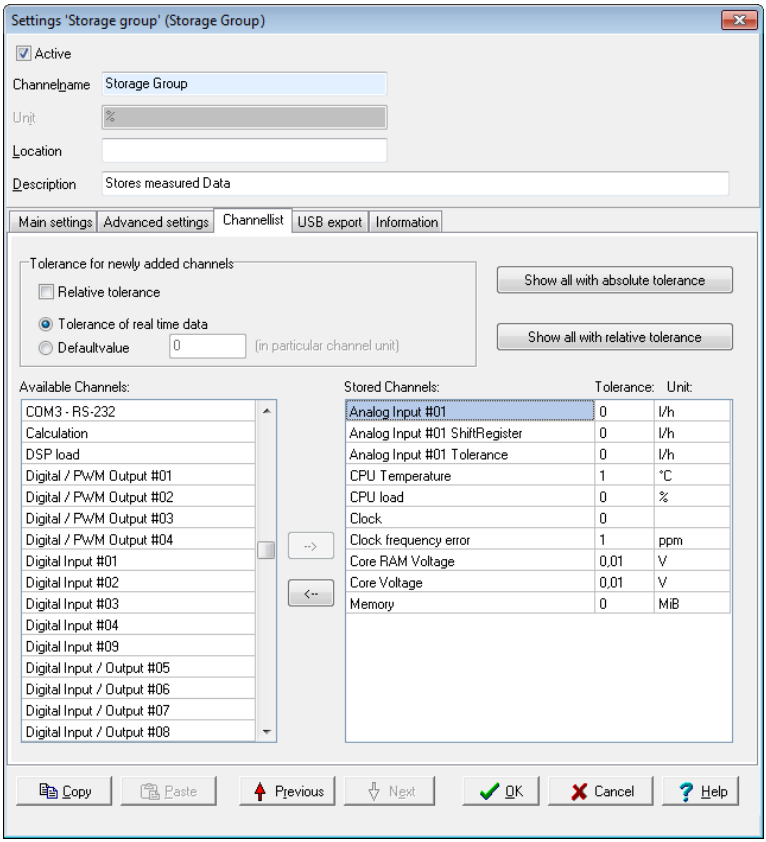
Memory control

- *Continuous*: The current value is saved when a tolerance is exceeded depending on the tolerance settings for the channel in the channel list .
- *Single step*: Functions as for the edge trigger, but without pre-or post-trigger times.
- *Edge trigger*: Saving takes places with a change (edge) in a (digital) signal.
- *Level trigger*: Measurement data is saved as long as the given level remains active.

For *Edge trigger* and *Level trigger* options, an additional *pre-trigger* and/or *post-trigger* time before and/or after the trigger event can be specified for saving to take place. Data is then stored at these times when a value exceeds the tolerance settings for a particular channel.

Retriggerable: Use this option to set a new wait period for the post-trigger time if a new trigger occurs during the post-trigger trime. The number of times this may happen is specified via *Retrigger limited to*.

4.9.2 Channel list tab



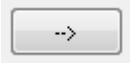
In this dialogue, you select the channels that are to be saved in this memory group.

How often measurement data is saved depends on the various settings (refer also to the *Main settings* tab) and may also be influenced by the *Tolerance for new channels*:

- *Real-time data tolerance*: The tolerances given for the channel in the *Additional settings* tab under *Data reduction* are also used for saving. The measurement value is saved when it differs from the previously saved measurement value by more than the value given there. The effective value for the channel is displayed in the field *Saved channels* once it is adopted.
- *Default value*: The value specified here is used for the channel that is to be assigned to the group. The tolerance only applies for saving to this memory

group. For everything else, such as a calculation using this channel, the effective tolerance value is the one given in the channel. The effective value for the channel is displayed in the field *Saved channels* once it is adopted.

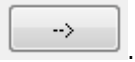
- If *Relative tolerance* is enabled, data is not displayed according to the channel's unit, but as a percentage based on the channel's range given in the *Main settings* tab for *Conversion*.

Finally, select the channels from which values are to be stored: Mark the channel and click 

.



Info

Adopt the settings under *Tolerance for newly added channels* before clicking 

. A subsequent change to the settings will have no effect. For the change to be effective, the channel first needs to be deleted and then reinstated.

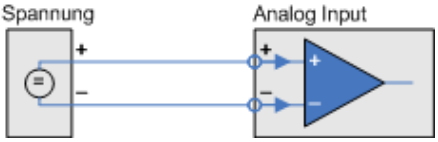
5 Connection examples

This Section shows you connection examples of typical sensors and actuators. It explains the available connection options and how to configure your sensors and actuators.

5.1 Connecting sensors

Measuring voltage at analogue input

Sensors with voltage signal can be directly connected.



The largest measurement range is ± 10V bipolar or 10 V unipolar.
The smallest range is ± 156mV bipolar and 156 mV unipolar.

Measuring 20 mA current at analogue input

For sensors with current signals you must connect what is known as a load resistor to the device input terminals. Suitable resistors are available as accessories.



The load resistor must be a maximum of 500 Ω.

Measuring temperatures with a thermocouple at analogue input

Thermocouples can be directly connected. Use the configuration dialogue to set the type (J, K, T, R, etc.).



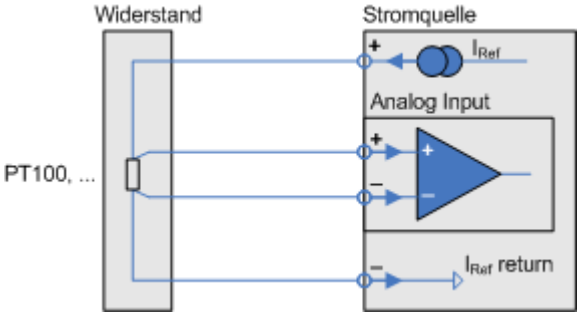
Info

Cold junction compensation required for the thermocouple is integrated into the device. Enter the compensation channel as the *Reference Junction* in the *Advanced settings* tab (for the same I/O module).

Measuring temperatures / resistances at analogue input

Connect resistor or temperature probes with 4-wire technology when possible. This connection method provides the best results since current path and measuring circuit are separate. Measurement current in 2- or 3-wire connectors flows through both, or one, measurement lines. Voltage drops on the measuring line can therefore distort readings.

Several constant-power sources are available within the device to supply power.



These sources deliver 1 mA.
They can measure resistance values of up to 10 kΩ.

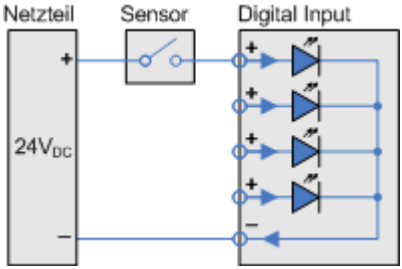
Sensor at a digital input

Digital inputs have two variants:

- Input for level (detection)
- Inputs for frequency measurement or counting

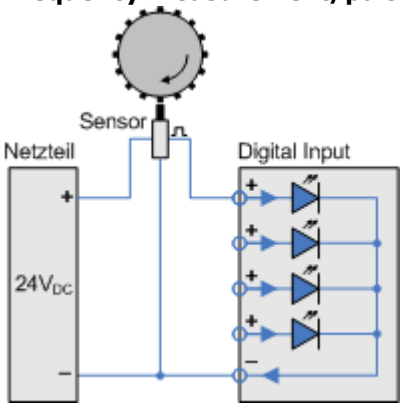
Not every input can be used for both functions.

Level detection



The I/O modules AAST, ADFT, AMDT, DIOT, and IOIT OTPT have digital inputs for level detection.
For reliable detection, the input signal must have a "low" level ranging from 0 ... 1.5 V, a "high" level ranging from 3.5 ... 90 V and a minimum pulse width of 1 ms. A maximum of 50 signal changes per second (maximum signal frequency) can be recorded.

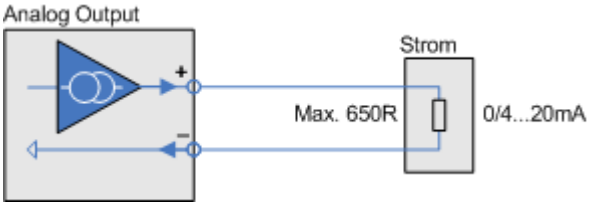
Frequency measurement/pulse counting



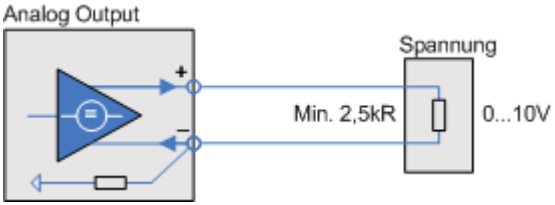
The I/O modules ADFT, and AMDT DIOT have digital inputs for frequency measurement/pulse counting.
For reliable detection, the input signal must have a "low" level ranging from 0 ... 1.5 V and a "high" level ranging from 3.5 ... 90 V. The maximum measurable signal frequencies are 50 kHz for the ADFT and AMDT module and 30 kHz for the DIOT module.

5.2 Connecting actuators

Actuator at an analogue output



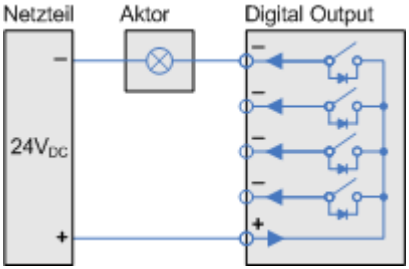
The I/O modules AAST and ADIT have power sources as analogue outputs.
The maximum permissible load resistance of the actuator is 650 Ω.



The I/O modules ADFT and AMDT have power sources as analogue outputs.
The minimum permissible load resistance of the actuator is 2.5 kΩ.

Actuator at a digital output, resistive load

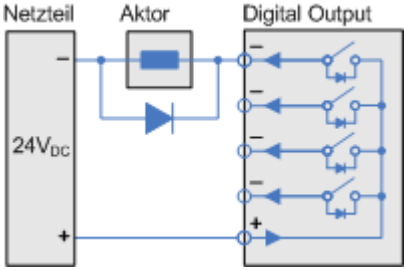
To connect an actuator at a digital output requires an external supply voltage of between 5 VDC and 50 VDC (24 V in the examples).



The maximum switching voltage is 50 V and the maximum switching current is 2.5 A.

Actuator at a digital output, inductive load

To connect an actuator at a digital output requires an external supply voltage of between 5 VDC and 50 VDC (24 V in the examples).



The maximum switching voltage is 50 V and the maximum switching current is 2.5 A.
To protect the output's electronic switches we recommend switching to recovery diodes in parallel with inductive loads.

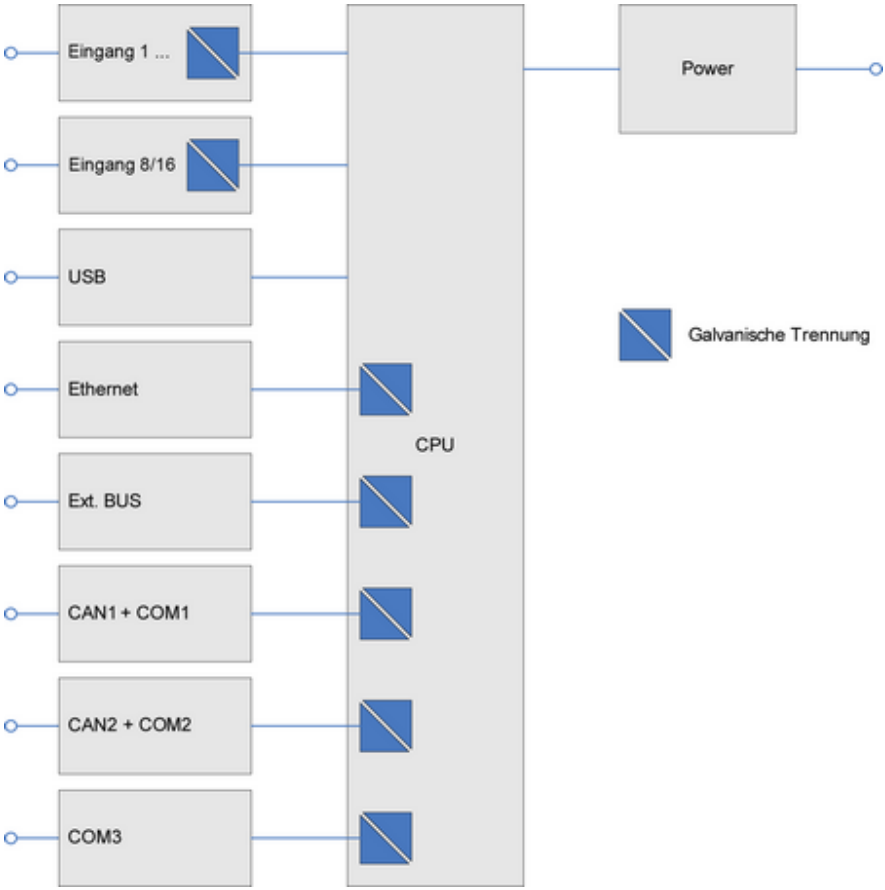
6 Measurement technology notes

This Section contains general information and recommendations on using measurement technology.

6.1 Galvanic isolation

Each of the devices' inputs, the Ethernet, external BUS (where available), CAN1 and COM1, CAN2 and COM2 and COM3 interfaces, are all galvanically isolated from the central unit (CPU and power) as well as from each other. The CAN1 and COM1 or CAN2 and COM2 ports are not galvanically isolated from each other. For system reasons, the USB interface is not isolated.

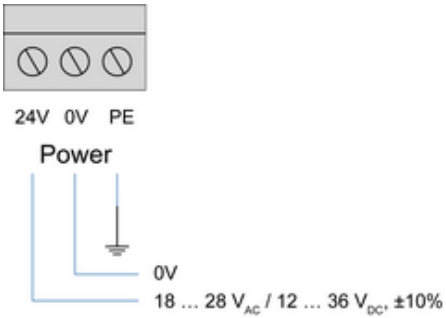
The diagram shows the individual galvanic isolating properties of the devices. The **Expert Logger** does not have external BUS, so two Ethernet interfaces are available.



See also Shielding.

6.2 Earthing

The PE terminal for the power supply is the ground terminal for the device. This terminal is internally connected to the metal housings of the USB/LAN and COM ports but has no connection to the 0V terminal(s).



Connect the PE terminal with a ≥ 2.5mm2 cable to the protective earth of your power supply.

Refer also to Shielding, Galvanic isolation.

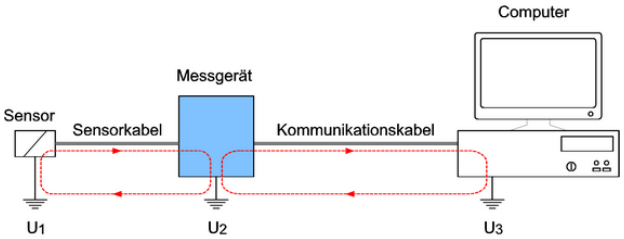
6.3 Earth loops

By linking sensor, measurement device, and computer, connections then exist between different ground points. Unless the individual devices are connected to protective earth, this electro conductive connection creates an electrical circuit between the devices. The result is what is known as an earth or ground loop (shown red in the example).

This can have the following effects:

- In practice the earthing points U1 to U3 shown in the graph do not necessarily possess equal potential. Constant or changing potential differences can occur between the earthing points due to the earthing plan and wiring. Compensating currents then occur in the sensor and communication circuits.
- Interference in the sensor or communication circuits, for example through electromagnetic fields, enable parasitic currents to occur within the circuit.

Compensation and parasitic currents lead to interference or noise voltage at the input of the measuring instrument and thus constant or shifting errors in measurement.





Prevent earth loops.

Sensor—measurement device earth loop

Galvanic isolation of the inputs to the central device, means earth loops via the sensor circuit as shown in the example, can not occur within the device . Earth loops can however occur between the sensors of different channels of a module.

To avoid such loops, we recommend the use of earth-free sensors or signal sources.
See also Potential differences.

Measuring device—computer earth loop

Most of the device's interfaces are galvanically isolated towards each other and towards the central device. The earth loop through the communication circuit as shown in the example does not occur with this device.

Use these interfaces to connect the device to PCs, PLCs or to other manufacturers' equipment.
See also Galvanic isolation.

6.4 Shielding

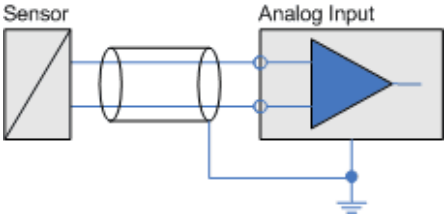
Measurement signals can be disrupted by the occurrence of magnetic and electric fields in the measuring circuits, for example generated by neighbouring current-carrying circuits. Shielded cables should therefore always be used for sensor circuitry and kept at least 50 cm away from other current-carrying circuits.

The smaller the sensor signal and/or the higher the sensor impedance, the more important good shielding becomes for a low noise, accurate reading.

To prevent earth loops, earth the shield on one side of the circuit only (see example).

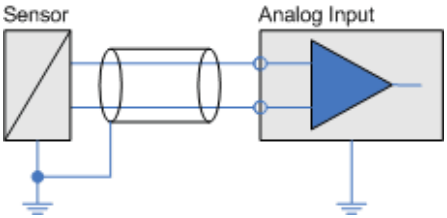
a) Sensors without earth

Earthing of the shield is in this case one-sided and directly at the device (PE connection on the power supply).
See also Earthing.



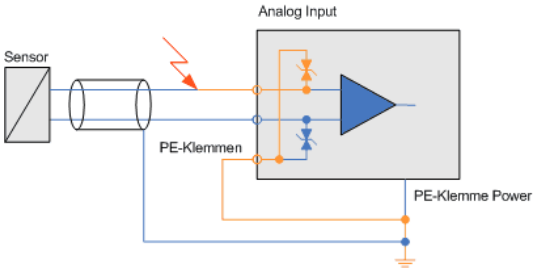
b) Sensors with earthing

When the use of earth-free sensors is not possible, earth the shield only or attach it to the sensor's earth potential (see example).
See also Potential differences.



6.5 ESD protection

The **Expert VibroExpert Logger** device and the ADGT 3.0 module have earth terminals specifically for ESD protection (ESD, ElectroStatic Discharge) **o**f the inputs.

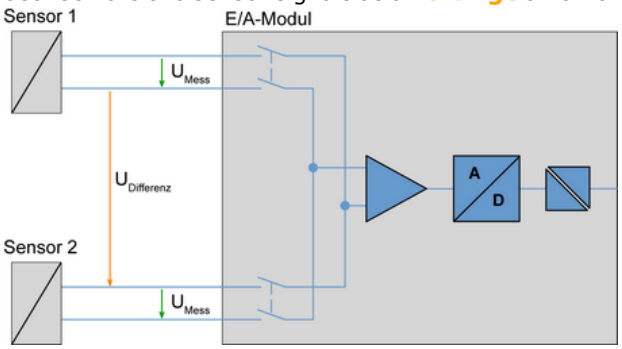


Connect this with PE labelled terminal(s) via a ≥2.5 mm2 cable to the protective earth of your power supply.
See also Earthing.

Discharge static before coming into contact with the connecting terminals. Simply touch a housing with protective earth, or the PE terminal. Inputs can be damaged if static is not discharged.

6.6 Potential differences

Potential differences can, in principle, always occur between reference potentials of multiple-sensor measurement signals that are connected to the analogue inputs of an I/O module. The following figure shows the sensor signals as **green** arrows and U mess, and the potential difference between the two sensor signals as an **orange** arrow and U Difference.



The reference potential of a measurement circuit of an analogue input for a device occurs by a change of channel of the sensors' different reference potentials. Depending on the input circuit of the various device inputs, the difference voltage U Difference between certain channels, may not exceed specified maximum values. These are the 'Permissible differential voltages from channel to channel' specified in the Technical specifications.



WARNING!

Connecting terminals carry electrical potential from the attached sensors/actuators.

Before coming into contact with the connections, ensure the power is off. Check for any voltages at the connecting terminals when the attached sensors have varying degrees of electrical potential or when they have high electrical potentials with earthing, for example, when measuring electrical current for a mains voltage phase.

Differences in electrical potential between two channels of a module can not be determined from the measurement data.



Info

If the connected sensors have different potentials and high currents are expected in the event of a short circuit between the sensor potentials, take measures to protect the device and the measurement installation from subsequent damage.

7 Technical specifications

7.1 Main device

General information

Weight, approx.	1 kg
Dimensions	200 x 73 x 120 mm
Material	Plastic housing
Humidity	20 ... 80%, non-condensing
Temperature range	-20–50 °C
Supply 1)	12–28 V AC ±10% or 12–36 V DC ±10%
Power input, approx.	10 W
Mounting	Rail 35 mm according to DIN EN 60715 or screw fixing
Processor	400 MHz PowerPC with integrated FPU
ROM	8 MB of solid state FlashROM
SRAM	0.5 MB, battery-backed
DRAM	128 MB of DDR
Real-time clock	Resolution of 100 ms, battery-backed
Backup battery	CR2450 lithium battery, backup time of at least 10 years
Web server	Basic configuration, firmware upgrade, configuration loading and saving

1) The ADFT module requires a minimum 18 V AC/DC supply

Ethernet interface

Ethernet standards	10/100Base-T (half and full duplex), auto-negotiation
Protocols	TCP/IP, UDP, ICMP, HTTP, SMTP, NTP Modbus TCP Client/Server

Connector	RJ45 (8-pin connector TP)
Galvanic isol-ation	1.5 kVeff

USB interface

Interface type	USB master
Transmission speed	USB 1.0 Full Speed (USB 1.1 compatible)
Power for external devices	5 V max. 500 mA (High Power)
Connector	USB connector type A

External bus (Ext. BUS)

Interface type	CAN 2.0B, ISO 11898-1, ISO 11898-2
Baud rate	max. 1 Mbaud
Connector	LP-3-pin terminal block (e.g. Wieland type 8113B/3VL)
Galvanic isolation	1 kV

COM1:

Interface type	RS-485 interface
Baud rate	max. 12 Mbaud
Connector	9-pin D-SUB connector, pin assignment according to IEC 61158
Galvanic isolation	1 kV (no isolation to CAN)
Features	Built-in PROFIBUS controller hardware 1) DP V1 slave, also redundant according to PNO document No. 2.212 V1.2

1) The identification number for **ProfiMessage**, as allocated by the German PROFIBUS User Organization (PNO), is 0x09B8. Further information can be found in the GSD file. Refer to PROFIBUS GSD file and PROFIBUS protocol.

CAN (CAN bus)

Interface type	CAN 2.0B, ISO 11898-1, ISO 11898-2

Baud rate	max. 1 Mbaud
Connector	9-pin D-SUB connector, pin assignment according to CiA DS102-1 (pin 2 and pin 7)
Galvanic isolation	1 kV (no isolation to COM1)

COM2:

Interface type	RS-485 interface
Baud rate	max. 12 Mbaud
Connector	9-pin D-SUB connector, pin assignment according to IEC 61158
Galvanic isolation	1 kV (no isolation to COM3)
Features	Built-in PROFIBUS controller hardware 1) DP V1 slave, also redundant according to PNO document No. 2.212 V1.2

1) The identification number for **ProfiMessage**, as allocated by the German PROFIBUS User Organization (PNO), is 0x09B8. Further information can be found in the GSD file. Refer to PROFIBUS GSD file and PROFIBUS protocol.

COM3

Interface type	RS-232 interface
Baud rate	max. 5 Mbaud
Connector	9-pin Sub-D connector, three pins used
Galvanic isolation	1 kV (no isolation to COM2)

COM4:

Interface type	RS-232 interface
Baud rate	max. 5 Mbaud
Connector	9-pin D-SUB connector, pin assignment according to DIN 41 652, part 1 (ISO 4902) (such as PC connector assignment)
Galvanic isolation	1 kV

7.2 I/O modules: AAST, ADGT, ADIT and ADVT

Analogue inputs

Number of inputs	AAST: 4 ADGT: 8 ADIT: 10 ADVT: 15
Connections	Terminals, max. diameter 2.5 mm2
Voltage measuring ranges	± 156 mV to ± 10 V (bipolar) and +156 mV to +10 V (unipolar)
Current measurement ranges	± 20 mA, 0 ... 20 mA and 4 ... 20 mA Current measurement requires a load resistance of 10 ... 500 Ω
Sampling rate	AAST, ADIT and ADVT: Max. of 600 measurements/s ADGT: Max. 60 measurements/s Sequential sampling, A/D measurement time for each channel individually adjustable
Resolution	24 bits (about 7 decimal digits)
Input impedance	> 1 GΩ, with ADGT > 10 MΩ
Measurement error (DC)	Voltage/current: ±0.01 % of measurement range/end value Pt100: ±0.1 K Pt1000 ±0.1 K Thermocouples: ±0.1% of end value following compensation
Thermocouples	Built-in cold junction, external optional NiCr-NiAl (K), NiCr-CuNi (E), NiCrSi-NiSi (N), Fe-CuNi (L), Fe-CuNi (J), Pt10Rh-Pt (S), Cu-CuNi (U), Pt13Rh-Pt (R), Cu-CuNi (T), Pt30Rh-Pt6Rh (B), W5Re-W26Re (C) Measuring ranges -270 °C ... 2320 °C, depending on thermocouple
Resistance probe/thermometer	Pt50 to Pt5000, Ni50 to Ni5000, YSI400 2-wire, 3-wire and 4-wire connection 1 mA reference current Measuring range -270 °C ... 850 °C

Resistance measurement	0 ... 10 kΩ
pH measurement	Integrated temperature compensation
Self-calibration	DC offset, cyclical; frequency adjustable
Digital filter	Low pass 6 ... 1000 Hz. The cut-off frequency is automatically adjusted to the sampling rate.
Potential isolation of main device	750V DC
Dielectric withstand voltage of the channel	110 V
Permissible differential voltage from channel to channel	ADGT V2.0: 400V DC ADGT V3.0: 650V DC AAST, ADIT and ADVT: 110 V

Analogue outputs

Number of outputs	AAST: 4 ADIT: 1
Output signal	0 / 4 ... 20 mA, maximum load resistance 650 Ω
Resolution	16 bit
Signal error	±0.05%
Potential isolation	750 V from channel to channel and to main device

Digital inputs for level detection

Number of inputs	AAST: 2
High level	3,5 ... 90 V / 2 mA (typ. 2,7 mA at 5 V)
Low level	0 ... 1.5 V / 0 ... 1.5 mA
Refresh rate	1 kHz (1 ms)
Minimum pulse width that can be evaluated	1 ms
Maximum signal frequency	50 Hz
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

Digital outputs

Number of outputs	AAST: 2 ADIT: 1
Switching voltage	max. 50V DC
Switching current	max. 2.5A DC
Flyback diode	Integrated
Potential isolation	2.5 kV

7.3 I/O modules: DIOT, IOIT and OTPT

Digital inputs for level detection

Number of inputs	DIOT: 12, including 11 for frequency measurement/pulse counting IOIT: 24 OTPT: 1
High level	3,5 … 90 V / 2 mA (typ. 2,7 mA at 5 V)
Low level	0 … 1.5 V / 0 … 1.5 mA
Refresh rate	1 kHz (1 ms)
Minimum pulse width that can be evaluated	1 ms
Maximum signal frequency	50 Hz
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

Digital inputs for frequency measurement/pulse counting

Number of inputs	DIOT: 11
High level	3,5 … 90 V / 2 mA (typ. 2,7 mA at 5 V)
Low level	0 … 1.5 V / 0 … 1.5 mA
Gate time	1 ms ... 6000 ms, adjustable in increments of 1 ms
Frequency measurement	0 … 30 kHz
Measurement error	0… 1 kHz: ±1 Hz >1 … 10 kHz: ±5 Hz >10… 30 kHz: ±10 Hz

Counter width	16 bit
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

Digital outputs

Number of outputs	DIOT: 16 IOIT: 1 OTPT: 24
Switching voltage	max. 50V DC
Switching current	max. 2.5A DC
Flyback diode	Integrated
Potential isolation	2.5 kV

7.4 ADFT I/O module

Analogue inputs

Number of inputs	8
Connections	Terminals, max. diameter 2.5 mm2
Voltage measuring ranges	±156 mV to ±10 V
Current measurement ranges	± 20 mA, 0 ... 20 mA and 4 ... 20 mA Current measurement requires a load resistance of 10 ... 500 Ω
Measurement frequency range (-3 dB)	0 … 4000 Hz
Sampling rate	10 ... 5000 Hz, in 10 stages, individually adjustable for each channel. Channels with the same sampling rate can be sampled simultaneously.
Sampling rate	10 ... 8000 measurements/s
Resolution	14 bits (approx. 1.2 mV in the 10 V range)
AC/DC coupling	DC coupling preset, switching via DIP switch in the device.
Input impedance	0.8 MΩ
Measurement error (DC)	Measurement ±0.1 % from uni-

	range ±1.25 V to ±10 V:	polar measurement range
	Measuring range ± 0.625 V:	±0.2 % from unipolar measurement range
	Measuring range ± 0.312 V:	±0.2 % from unipolar measurement range
	Measuring range ± 0.156 V:	±0.4 % from unipolar measurement range
Anti-aliasing filter	Optional digital low-pass filter 6. Order for sampling rates of 100 to 5000 Hz. The cut-off frequency is automatically adjusted to the sampling rate.	
Dielectric withstand voltage of the channel	± 250V DC	
Permissible differential voltage from channel to channel	100V DC	

Analogue outputs

Number of outputs	2
Output signal	0 … 10 V / 0 … 4 mA
Resolution	12 bits (approx. 2.4 mV)
Signal error	± 0.25% of output range or ± 25 mV
Earth reference	Terminals "–" are connected with 1 kΩ to the internal analogue ground

Digital inputs for level detection

Number of inputs	4, including 2 for frequency measurement/pulse counting
High level	3,5 … 90 V / 2 mA (typ. 2,7 mA at 5 V)
Low level	0 … 1.5 V / 0 … 1.5 mA
Refresh rate	1 kHz (1 ms)

Minimum pulse width that can be evaluated	2.5 ms
Maximum signal frequency	50 Hz
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

Digital inputs for frequency measurement/pulse counting

Number of inputs	2
High level	3,5 … 90 V / 2 mA (typ. 2,7 mA at 5 V)
Low level	0 … 1.5 V / 0 … 1.5 mA
Gate time	250 ms ... 5000 ms, adjustable in increments of 250 ms
Frequency measurement	0.2 Hz … 50 kHz
Measurement error	0.2 Hz … 100 Hz:± 1% of the input frequency >100 Hz: ±1 Hz
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

Digital outputs

Number of outputs	4
Switching voltage	max. 50V DC
Switching current	max. 2.5A DC
Flyback diode	Integrated
Potential isolation	2.5 kV

7.5 AMDT I/O module

The AMDT I/O module for vibration measurement is discussed in a separate section.

Refer to AMDT I/O module. Technical specifications are available here: AMDT I/O module technical specifications.

8 AMDT I/O module

This section of the documentation describes using and configuring the AMDT I/O module.

The AMDT I/O module has been designed for vibration measurement. The I/O module utilises a DSP (digital signal processor). The processor's firmware (= software in the I/O module) enables many functions for signal processing.

The documentation is provided under the following headings for optimum overview:

- Hardware
- Function
- Configuration and operation

The relevant subjects can be reader independently under their individual sections. Select only the section you require.

The content is based on the following version:

- **ProfiSignal**-CD: V3.1.4
- Device firmware: V232
- AMDT board: V2.0x
- AMDT firmware: V3.58

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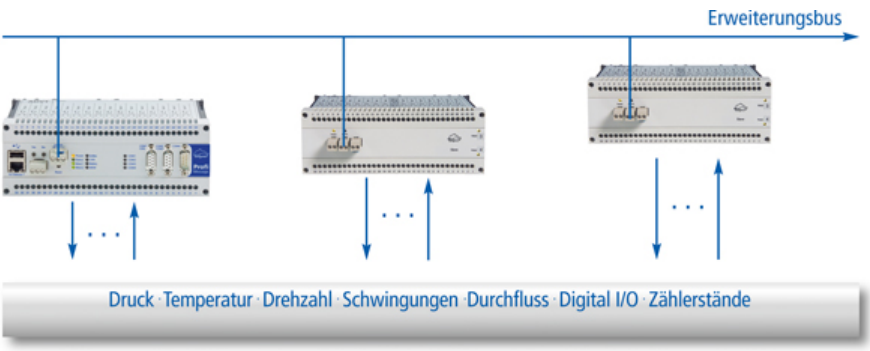
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8.1 Hardware

This section explains how to set up a system with several devices. It includes the connection and block diagrams as well as the technical data of the AMDT module.

8.1.1 Project planning and design

The **LogMessageProfiMessage** system is made up of a base device and optional extension devices (the graphic shows a **ProfiMessage** system). A **LogMessage** device cannot be extended.



Each installed I/O module communicates with a CPU via an expansion bus. The AMDT I/O module provides the fastest sampling and transfer rates. Specific conditions need to be taken into account when planning a system.

Rules for hardware setup

- One AMDT I/O module can be installed in any one slot. Full function is available. When setting parameters, take into account the maximum transfer rate of 10000 measurement values/s.
- Two AMDT I/O modules can be installed in any of the available slots. Ensure adequate ventilation when both AMDT I/O modules are installed in the base device. Full function no longer available. Both AMDT modules can continuously transmit characteristic values, but only one AMDT can continuously transmit time signals or frequency spectra.
- Two synchronised AMDT I/O modules can be installed in any of the available slots. Synchronization requires additional wiring and occupies digital-input/output 4. Ensure adequate ventilation when both AMDT I/O modules are installed in the base device. Synchronization is available only in the "batch recoding" operating mode. Both AMDT modules can transfer time signals, frequency spectra and characteristic values continuously and synchronized. Refer here to section Synchronizing two AMDT modules.
- There or more AMDT I/O modules cannot be installed.

Rules concerning the number of useable analogue inputs

- Using a digital high- or band-pass filter limits the number of analogue filters (depending on board version) to 1 ... 4. An overview is available in the section on digital filters.
- Using a digital integrator limits analogue inputs (depending on board version) to 1 ... 4. An overview is available in the section on integrators.
- The application "Measuring vibrations using acceleration sensors" (using a digital band pass filter and integrator) limits the number of analogue inputs

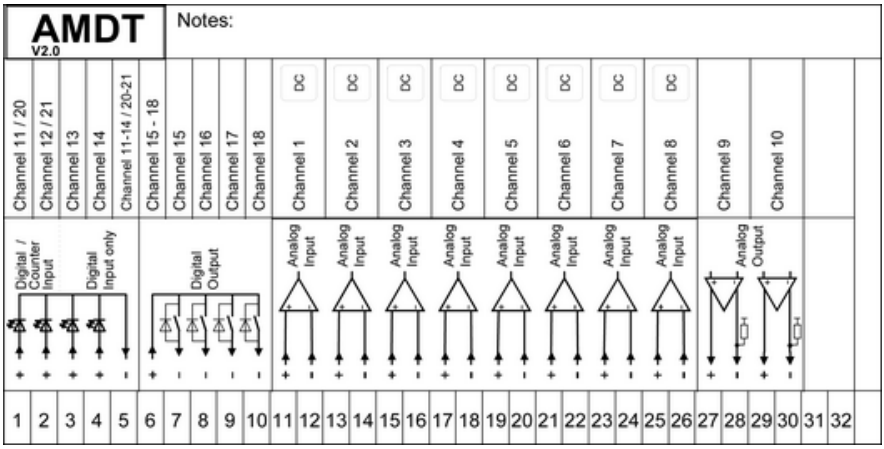
(depending on board version) to 1 ... 4. Details on this application are available in the "Applications using AMDT" manual.

- The application "Bearing diagnostics using envelope spectrum" (using digital demodulation filter) limits (depending on board version) analogue inputs to 1 ... 4. Details on this application are available in the "Applications using AMDT" manual.

Rules concerning phase measurement

- Be aware of the following when using phases to evaluate characteristic values in rotating machinery: Phase measurement can be used only for low rotation speeds (typ. < 500 rpm). Acquisition of 1 to 10 signal periods within a time signal block is normal. Refer here to the sections on Main vibration phase and Phase of 1X/2X/3X/xX vibration.

8.1.2 Connector panel (industrial)



Information on connections

Refer to Technical specifications.

Analogue inputs

Voltage signals from a max. of ±10 V in a frequency range DC ... 8000 Hz can be connected. Input resistance is 0.8 MΩ. Current signals from 0/4 ... 20 mA are processed using terminating resistors (to be wired between the '+' and '-' connectors).

DC coupling is factory set. Switching is possible using a DIP switch within the module.

The permitted total voltage difference between channels is 100 VDC.

Analogue outputs

Output range is 0 … 10 V, max. load is 4 mA (min. 2.5 kΩ).

The '-' connector is connected at 1 kΩ to the internal analogue earth point.

Digital inputs / counters

Square signals/pulses from 5 V / 12 V or 24 V can be connected.

Low-level is <1.5 V; high-level is > 3.5 V; common '-' connector, potential isolation.

Frequency measurement for signals from 0.2 Hz to 30 kHz.

Digital outputs

Switching voltage at a max. of 50 VDC. Switching current at a max.: 2.5 ADC.

Common '+' connector. Potential isolation.

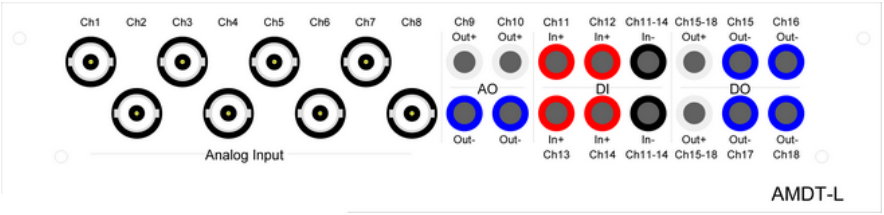
Shielded cabling

The I/O module enables measurement in the signal range DC … 8 kHz. This requires the use of shielded (single-sided shielding connected to protective earth) or twisted pair cables.

Sensors

Information on connecting special sensors is available in the "Applications using AMDT" manual.

8.1.3 Connector panel (laboratory)

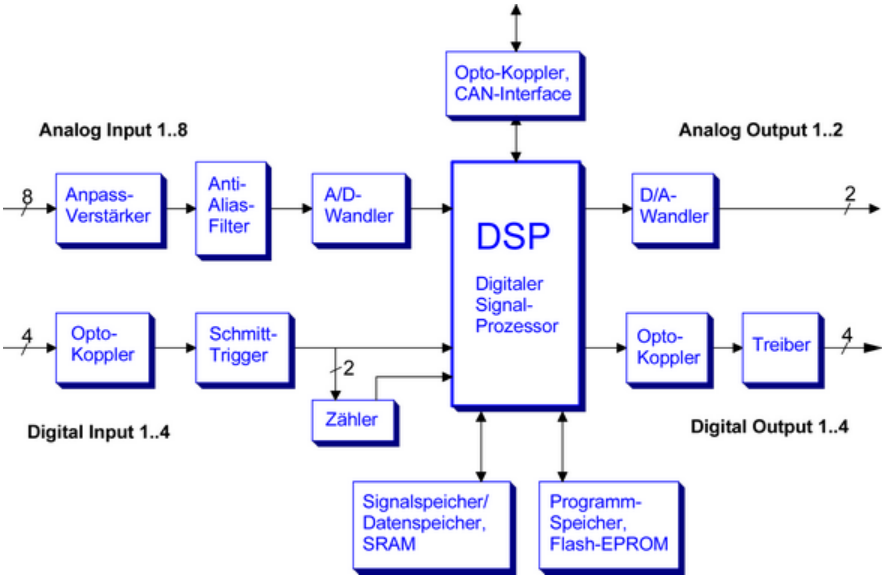


Information on connections

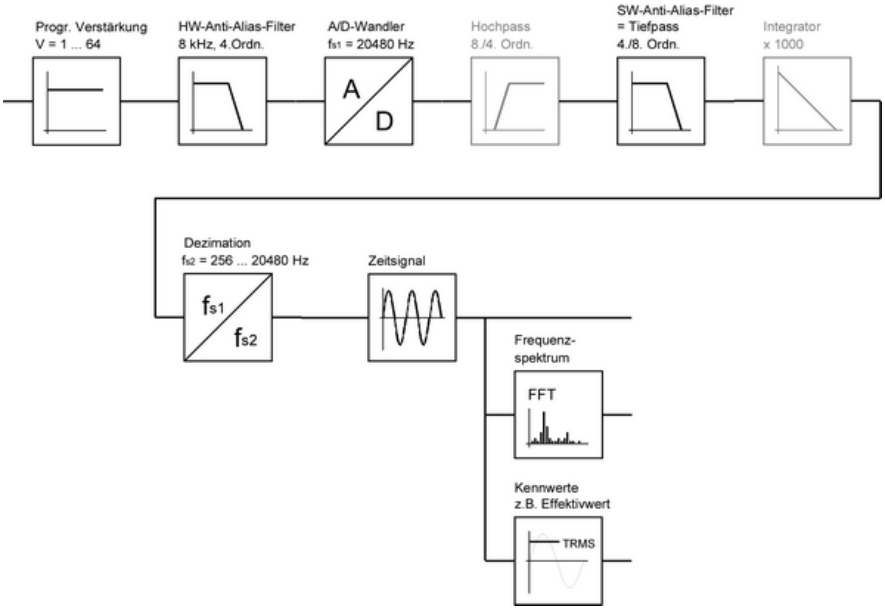
Refer to Connector panel (industry).

8.1.4 Block diagrams

Block diagram for hardware



Block diagram for an analogue input signal



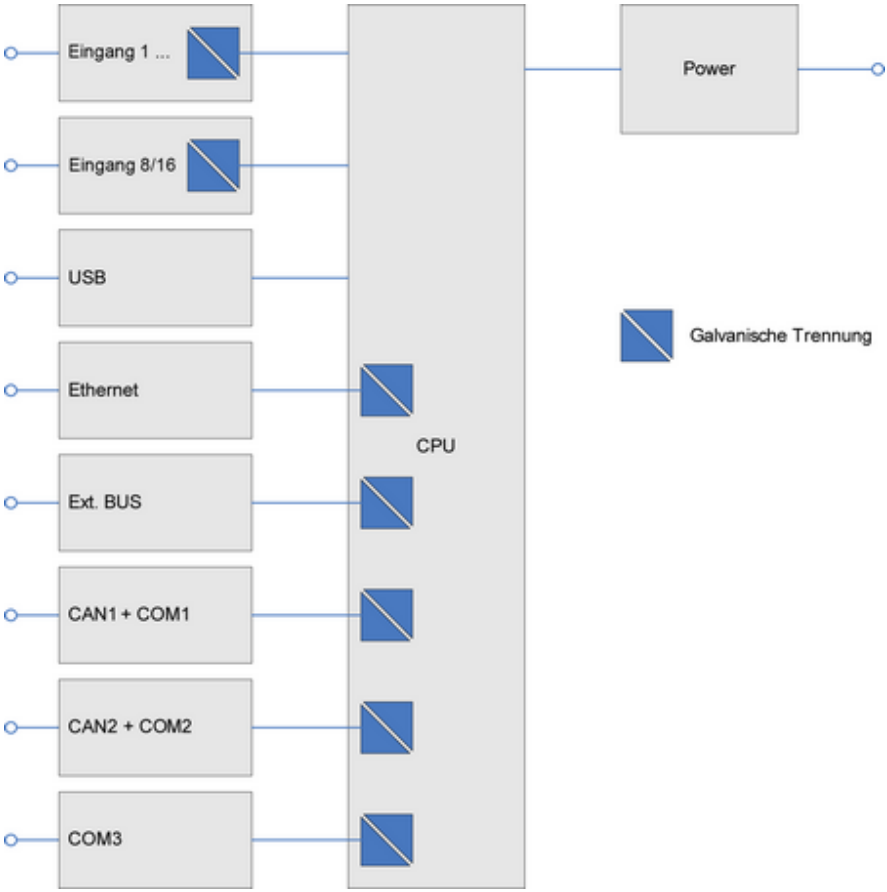
8.1.5 Technical specifications

Specifications may change as part of ongoing technical developments.

8.1.5.1 Galvanic isolation

Each of the devices' inputs, the Ethernet, external BUS (where available), CAN1 and COM1, CAN2 and COM2 and COM3 interfaces, are all galvanically isolated from the central unit (CPU and power) as well as from each other. The CAN1 and COM1 or CAN2 and COM2 ports are not galvanically isolated from each other. For system reasons, the USB interface is not isolated.

The diagram shows the individual galvanic isolating properties of the devices. The **Expert Logger** does not have external BUS, so two Ethernet interfaces are available.



See also Shielding.

8.1.5.2 Analogue inputs

Properties

8 Analogue inputs. Resolution 14 bit Differential inputs. Impedance 0.8 MW.
A potential difference totalling up to 100 V is permitted between the differential inputs ('-' connector). Input protection to ±250 V.

Sampling frequency

Real synchronous/parallel sampling.

- Batch sampling: A max. sampling frequency of 20480Hz for 8 channels. This gives a total sampling rate of approx. 160000 measurement values/s.
- Continuous sampling: A max. sampling frequency of 1024/2048/4096 Hz for 8/4/2 channels. This gives a total sampling rate of approx. 8000 measurement values/s.

Signal bandwidth / Anti-aliasing filter (HW)

Signal bandwidth is DC to 8kHz ±0.8kHz.

Transfer rate for measurement data

Max. 10000 measurement values/s.

Measurement ranges

Seven voltage measurement ranges are available:

Measurement range	V	±10	±5	±2.5	±1.25	±0.625	±0.312	±0.156
Resolution	mV	1.2	0.6	0.3	0.15	0.08	0.04	0.02

0/4 ... 20 mA signals can be converted to voltage signals using terminating resistors of, for example, 50/100/250 Ω. Resistors are to be externally attached between the '+' and '-' connectors.

Precision

DC precision is factory set using calibration and adjustment. Basic precision is ±0.1 to ±0.4 % of the (unipolar) measurement range.

Measurement range	V	±10	±5	±2.5	±1.25	±0.625	±0.312	±0.156

DC precision	mV	±10	±5	±2.5	±1.3	±1.3	±0.9	±0.6
	%	0.1	0.1	0.1	0.1	0.2	0.3	0.4

For 0/4 to 20 mA signals, terminating resistors need to be used that have an accuracy greater than 0.1 %.

AC coupling

The differential input is factory set as DC-coupled. Switching to AC coupling is possible using DIP switches on the signal conditioning board. The DC part of a signal is eliminated through a HW-filter. Cut-off frequency is around ca. 4 Hz.

The DC part of a signal can also be eliminated through a SW-filter (i.e.- through the DSP).

Scaling / sensor compensation

Channels can be individually scaled. Scaling takes place in the required unit (e.g. ± 100 µm for distance/clearance sensors or ±50 g for acceleration sensors). Zero offset/correction and amplification adjustment can be performed using sensor compensation.

Anti-aliasing filter (SW)

The (SW) anti-aliasing filter's frequency limit is set automatically at 40 % of the sampling frequency setting. This filter is optional. It is a digital deep pass of the 8th or 4th order with Butterworth characteristic.

Application

Analogue inputs deliver continuous or event-triggered recording of vibration signals or of signals requiring rapid sampling.

8.1.5.3 Analogue outputs

Properties

2 analogue outputs. Voltage range 0 to 10 V. Resolution 12 bit and 2.4 mV.
Board V2.0x: Output range restricted to 0.3 V to 9.7 V.
Board V2.1x: Output range 0 to 10 V.
Max. load of 4 mA at min. 2.5 kΩ.

Refresh rate

Determined by source channel (e.g. set-point channel).

Typical rates are 0 to 10 Hz. Dependent on DSP load.

Precision

DC precision is factory set using calibration and adjustment.

Basic precision is ±0.25 % of the output range, i.e. ±25 mV.

Scaling

Channels can be individually scaled. Scaling takes place in the required unit (e.g. 0 to 100 µm for distance/proximity sensors or 0 to 50 g for acceleration sensors)

Application

Analogue outputs are used as monitors for specific measurement data (e.g. rotation speed or vibration amplitude). Also as signal generators (z. B. set-point ramp).

8.1.5.4 Digital inputs

Properties

4 digital inputs. Potential isolation up to 2.5 kV. Polarity prtection up to 1 kV.
Low level 0 … 1.5 V/ 0 ... 1.5 mA. High level 3.5 ... 90 V / 3 mA.

Refresh rate

Digital inputs are sampled at 1 kHz (1 ms). The minimum pulse width of a signal that can be analysed is 1 ms. Recommended pulse width is >2.5 ms. Maximum continuous signal frequency is 50 Hz.

Application

Digital inputs are used as trigger sources with simultaneous frequency or rotation speed (for rotating machinery) measurement and phasing (reference) acquisition are simultaneously carried out.

8.1.5.5 Counter

Properties

2 or 4 digital inputs (see above) are each equipped with 16-bit counters. Choice of pulse counting in the 0 to 65535 range, or frequency measurement in the 0.2 Hz to 30 kHz range. Automatic switching of measurement mode at 100 Hz

Refresh rate

Counters are sampled at 4 Hz (250 ms). The minimum pulse width of a signal that can be analysed is 0.02 ms. Recommended pulse width is >0.1 ms.

Frequency measurement precision

Basic accuracy is ±1 % of the input frequency up to 100 Hz and ±1 Hz above 100 Hz.

Application

Digital inputs are used as trigger sources with simultaneous frequency or rotation speed (for rotating machinery) measurement and phasing (reference) acquisition are simultaneously carried out.

8.1.5.6 Digital outputs

Properties

4 digital outputs. Galvanic isolation up to 2.5 kV. Switching voltage at max. 50V DC. Switching current max. 2.5A DC. Protector diode integrated. Flyback diode external.

Refresh rate

Determined by source channel (e.g. timer channel). Typical range 0 … 10 Hz; dependent on DSP load.

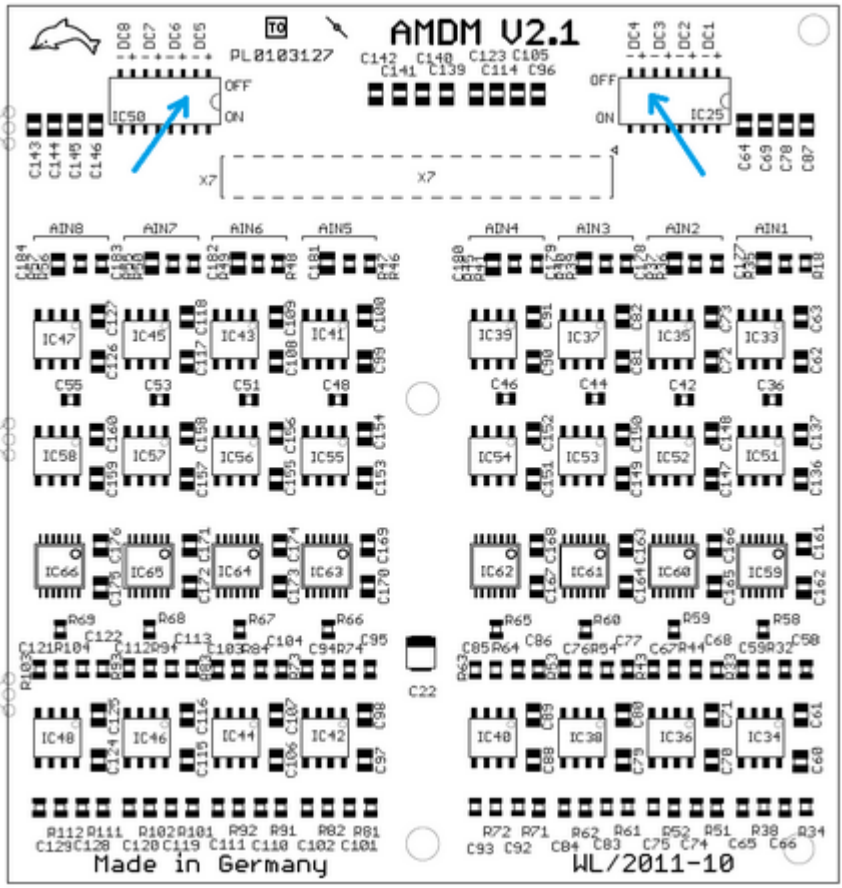
Application

The digital outputs report warnings or alarms (e.g. generated via limit values for vibration characteristic values). Signals are also delivered for process control.

8.1.6 Appendix

8.1.6.1 AC coupling for analogue inputs

An analogue input's DC coupling can be switched to AC coupling via two DIP switches on the signal conditioning board.



Two switches require activating. Analogue input 1 is located on the right.

Switch position	Function
OFF (up)	AC coupling
ON (down)	DC coupling

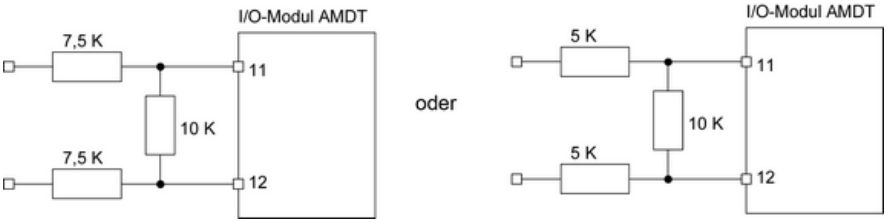
AC coupling is based on 0.1 µF (50 V) serial capacitors – these provide a high-pass cut-off frequency of 4 Hz.

8.1.6.2 External switching

The following includes examples of external switching.

External divider for analogue inputs and measurement range ±25 V or ±20 V

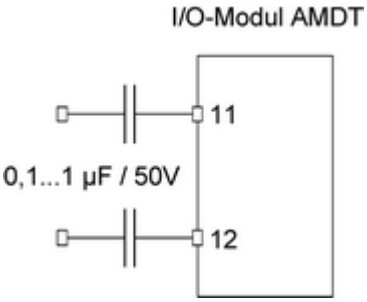
An extended measurement range of ±25 V or ±20 V can be achieved with a symmetrical external resistor divider. The recommended wiring appears as follows:



The resistor accuracy class should be (depending on requirements) 0.1% to 1%. Input impedance is reduced here to 25 or 20 kΩ. Measuring point scaling must be increased using the DataService Configurator PC software by the factor 2.5 or 2.0.

External AC coupling

AC coupling can be achieved with symmetrical capacitors. The recommended wiring appears as follows:

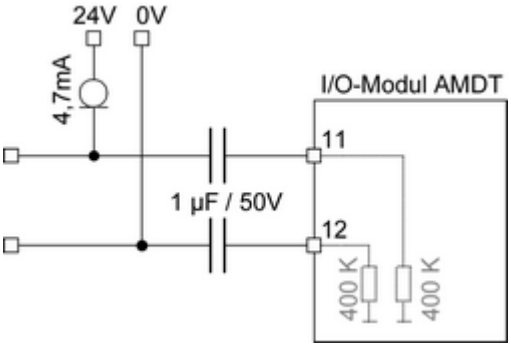


Non-polarized capacitors must be used. The input high-pass has a cut-off frequency of 4 … 0.4 Hz.

External AC coupling is useful for mobile systems. For fixed installations, refer to AC coupling for analogue inputs.

External power supply for ICP® / IEPE acceleration sensors

Basic feed and coupling of measurement signals can be achieved with three components. The recommended wiring appears as follows:



The sensor is powered through a constant current diode. An external source of 24V DC is required. The dynamic signal undergoes capacitive separation from the static DC operating point voltage. The capacitors and the AMDT input resistors form a symmetrical high-pass with a cut-off frequency of 0.4 Hz.

8.2 Function

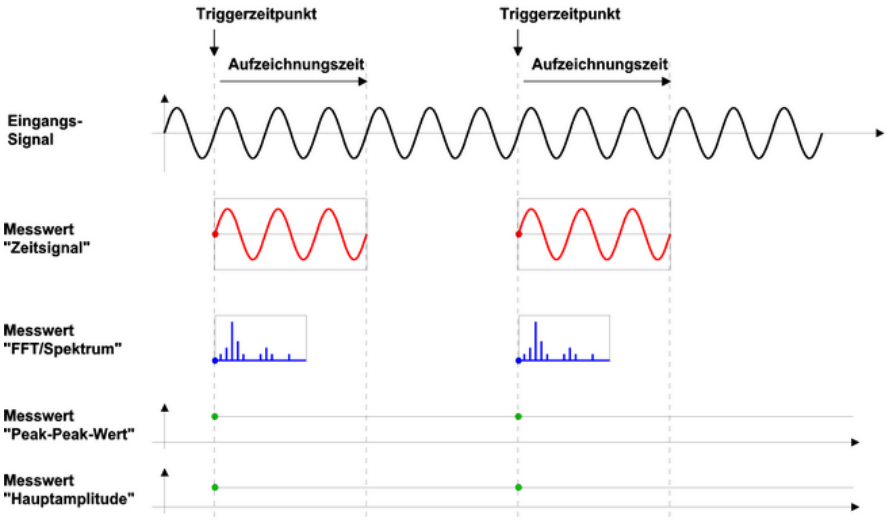
This section explains the various functionalities. It contains the respective characteristics and setting options of the AMDT module.

8.2.1 Operating mode

8.2.1.1 Batch recording

Batch recording is the preset operating mode for the I/O module. Recording, analysis and measurement data transfer takes place in chronological sequence. The DSP is then on standby for the next trigger event.

Signal sampling can take place at up to 20.48kHz, parallel across 8 channels.



The above graphic represents the generation of measurement data in relation to common triggers. The transmission of the measurement data is time delayed.

The timing of the entire cycle depends primarily on the user configuration. The main factors here are as follows:

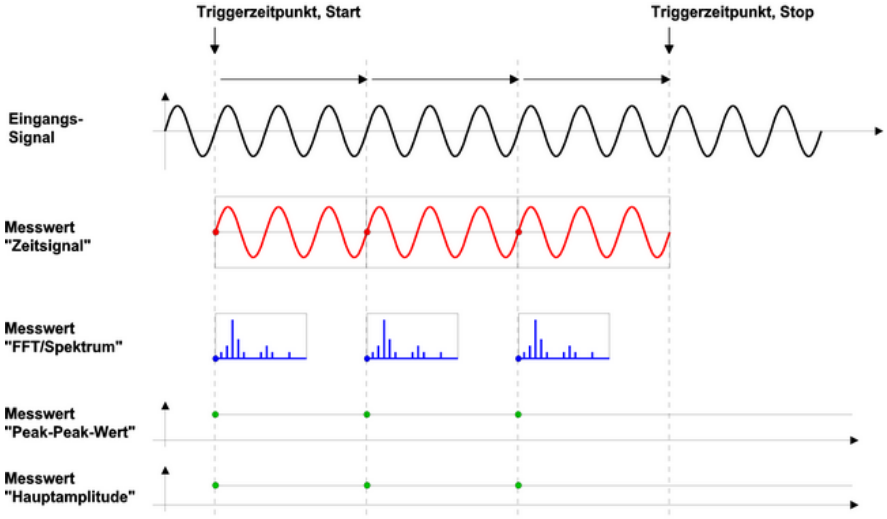
- Recording time
  Determined by the quotient of the "number of samples" and the "sampling frequency." Example: 1024 / 2560 Hz = 400 ms.
- Analysis time
  Determined by the number of active analogue channels and the computation time required for digital filtering, FFT analysis, characteristic value computation and monitoring. Example: approx. 10 ms/channel for a 1024-point FFT.
- Measurement data transmission time
  Determined by the number of selected 'active' channels "analogue input" and "FFT/spectrum". The transmission rate of approximately 10000 measurement values/s or 100ms for 1024 measurement values.

8.2.1.2 Continuous recording

The the I/O module runs continuously in this operating mode. Recording, evaluation and measurement data transmission take place by DSP continuously and simultaneously.

The maximum sampling frequency depends on the volume of measurement data that is to be simultaneously transmitted. The sampling fre-

quency is typically 1kHz parallel for 8 analogue channels with simultaneous transmission of time signals and some characteristic values.



The above graphic represents the generation of measurement data in relation to common triggers. The transmission of the measurement data is time delayed.

The max. sampling frequency is limited to the continuous measurement data transmission of maximum roughly 10000 samples/s and to the power of the DSP. Depending on the user configuration, the following rates can be achieved:

Transmitted measurement data			No. of parallel or active channels		
Time signal[1)]	FFT/Spectrum[2)]	Characteristic values[3)]	8	4	2
X	—	X	1024 Hz	2048 Hz	4096 Hz
—	X	X	2560 Hz	5120 Hz	10240 Hz
—	—	X	5120 Hz	10240 Hz	20480 Hz

1) Time signal block, each with 1024 samples

[2] FFT with 1024 samples or 400 lines

[3] 3 characteristic values from the time range and 3 characteristic values from the frequency range

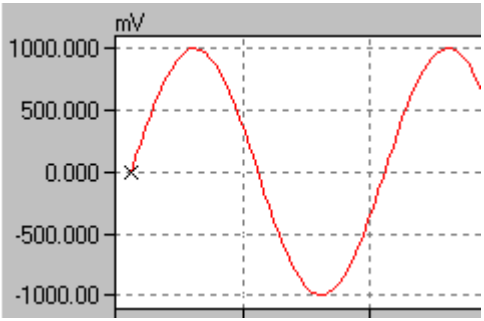
8.2.1.3 Signal simulation

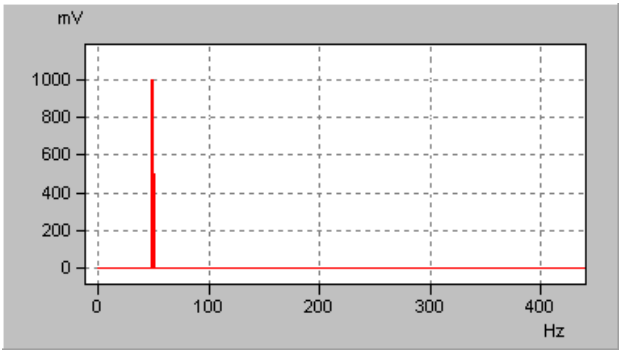
In signal simulation, the signals measured by analogue input 1 ... 8 are discarded and replaced by demo signals computed by the DSP. This operating mode enables users to perform test runs without having to actually connect signals. A choice of signals and modulation types are available.

Signal 1

Description: Harmonic signal
Channel 1 ... 8: Sine, 1000 mVpp, 50 Hz

Time signal and frequency spectrum:

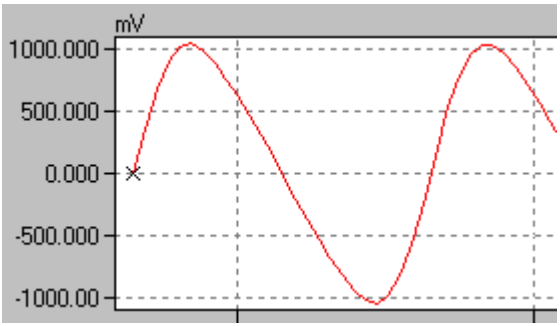


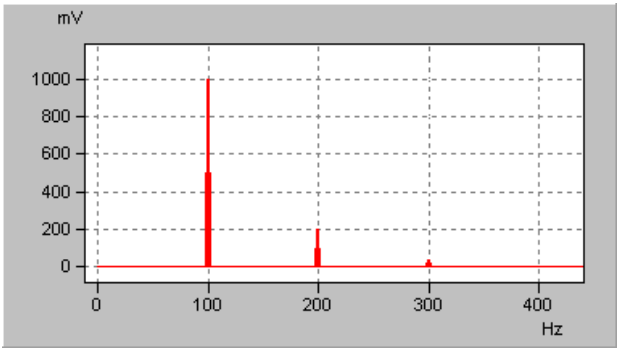


Signal 2

Description: Signal with three frequency components
Channel 1 Sine with 3 components, 1000 mVpp, 100 Hz / 200 mVpp, 200

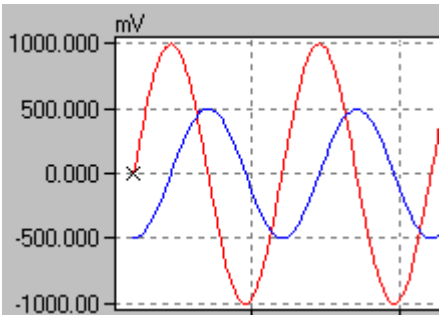
Hz / 40 mVpp, 300 Hz
Channel 2 ... 8 with 2 ... 8-fold amplitude
Time signal and frequency spectrum:





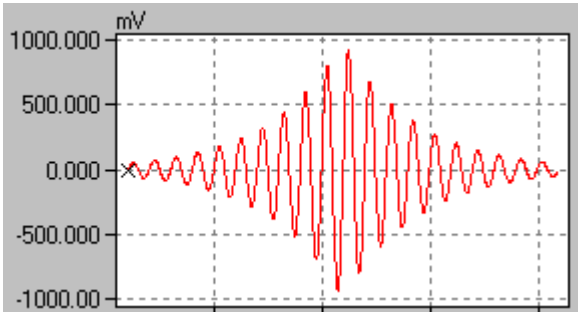
Signal 3

Description: Signals with paired phase shifts
Channel 1/3/5/7: Sine, 1000 mVpp, 50 Hz, 0°
Channel 2/4/6/8: Sine, 500 mVpp, 50 Hz, -90 °
Time signal:



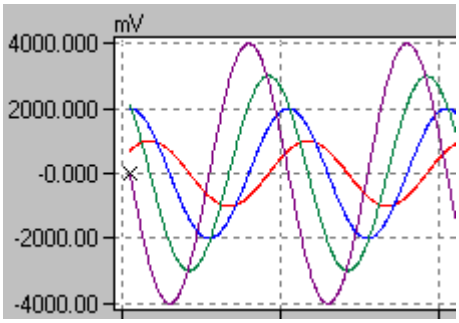
Signal 4

Description: Signal with transient progression
Channel 1 ... 8: Sinus, emerging/fading, 1000 mVpp, 50 Hz
Time signal:



Signal 5

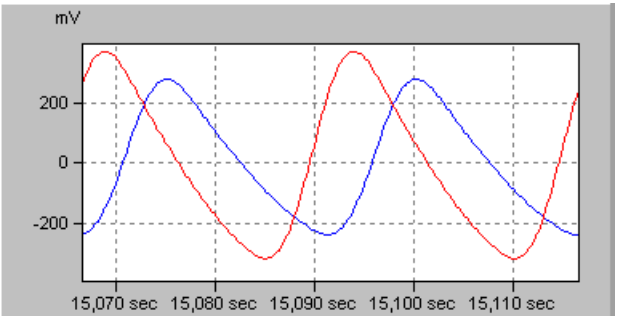
Description: Signals with increasing phase shift
Channel 1: Sine, 1000 mVpp, 10 Hz, 45 °
Channel 2 … 8 with phase 90 … 360° and 2 … 8-fold amplitude
Time signal:

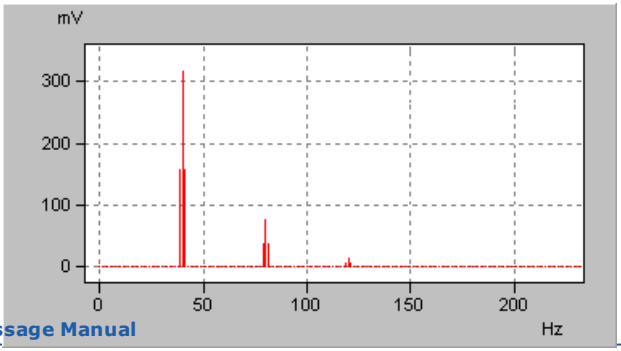


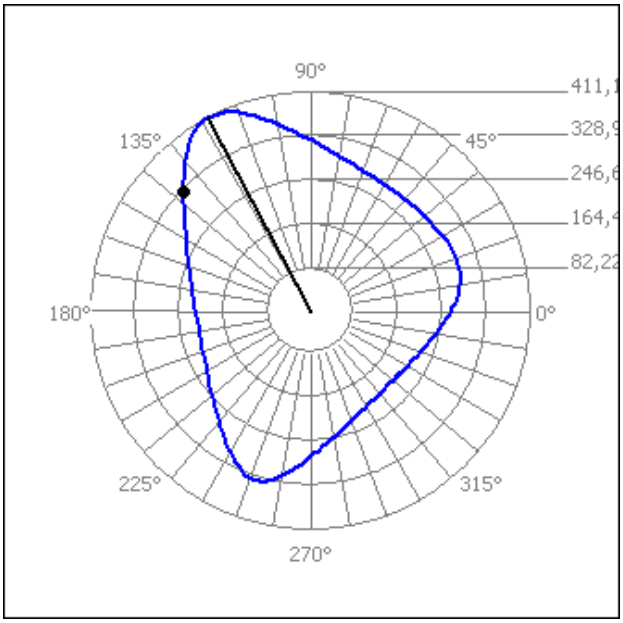
Signal 6

Description: Signals with frequency components and paired phase shifts appropriate to the "shaft vibration" application
Channel 1/3/5/7: Sine with 3 components, 320 mVpp, 40 Hz, 30° / 80 mVpp, 80 Hz, 40° / 16 mVpp, 120 Hz, 50°
Channel 2/4/6/8: Sinus with 3 components, 240 mVpp, 40 Hz, 300° / 60 mVpp, 80 Hz, 220° / 12 mVpp, 120 Hz, 140°
Each channel with an amplitude offset of -7000 mV

Time signal, frequency spectrum and orbit:

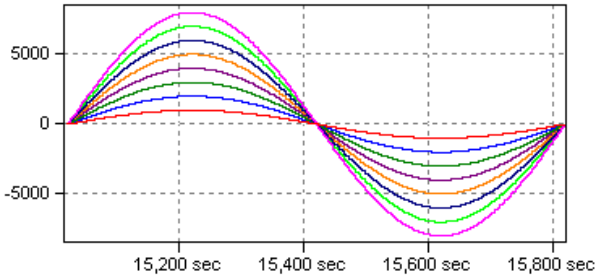






Signal 7

Description: Signals with low frequency
Channel 1: Sine 1000 mVpp, 1.25 Hz
Channel 2 … 8: same signal with 2- to 8-fold amplitude
Time signal:



Modulation

Optional modulation varies the demo signal from measurement to measurement.

Modulation 1: Modulation of amplitude, +50 % to -50 %, for 32 measurements

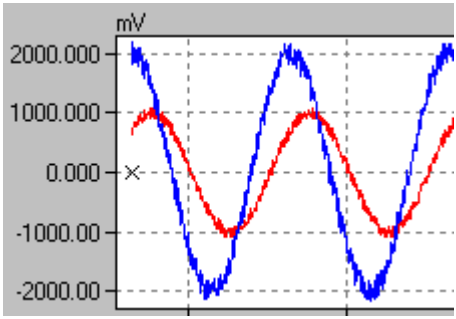
Modulation 2: Modulation of frequency , +50 % to -50 %, for 32 measurements

Modulation 3: Modulation of phase, +45 to -45 , for 32 measurements

Modulation 4: Modulation of offset , +1000 mV to -1000 mV, for 32 measurements

Modulation 5: Noise in the range of ±5 % of amplitude

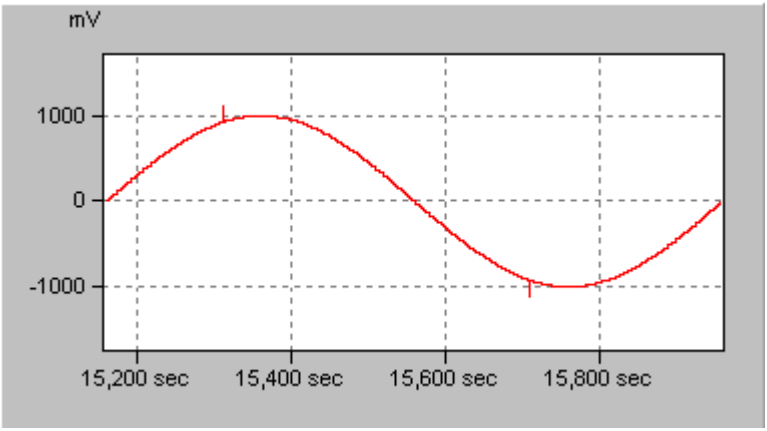
Example:



Modulation 6

Two anomalies of ±20 % of amplitude at position 3/16 and 11/16 of signal duration.

Example:



8.2.1.4 Synchronising two AMDT modules

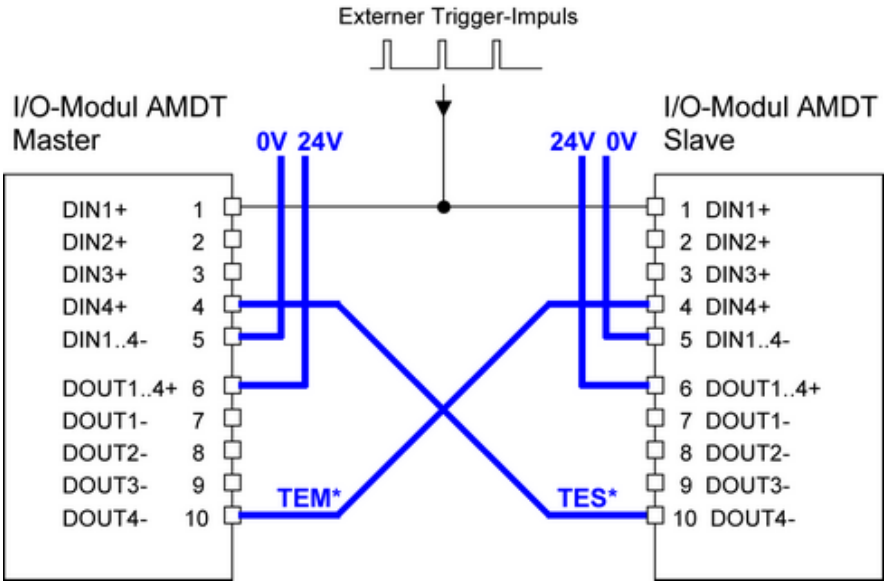
Synchronisation enables 8 + 8 = 16 analogue signals (almost) to be simultaneously triggered and sampled. Synchronization is available only in the "batch recoding" operating mode.

User example:
Synchronisation of vibration measurement from 8 + 4 = 12 analogue signals. 8 analogue inputs are assigned to a master and 4 analogue inputs to a slave. Periodic external trigger pulse (from a rotating shaft). Connected to digital input 1 of master and slave.

Additional wiring

Synchronisation requires additional wiring. Digital input 4 and digital output 4 are connected diagonally. The feed voltage and reference mass should also be connected at the same time.

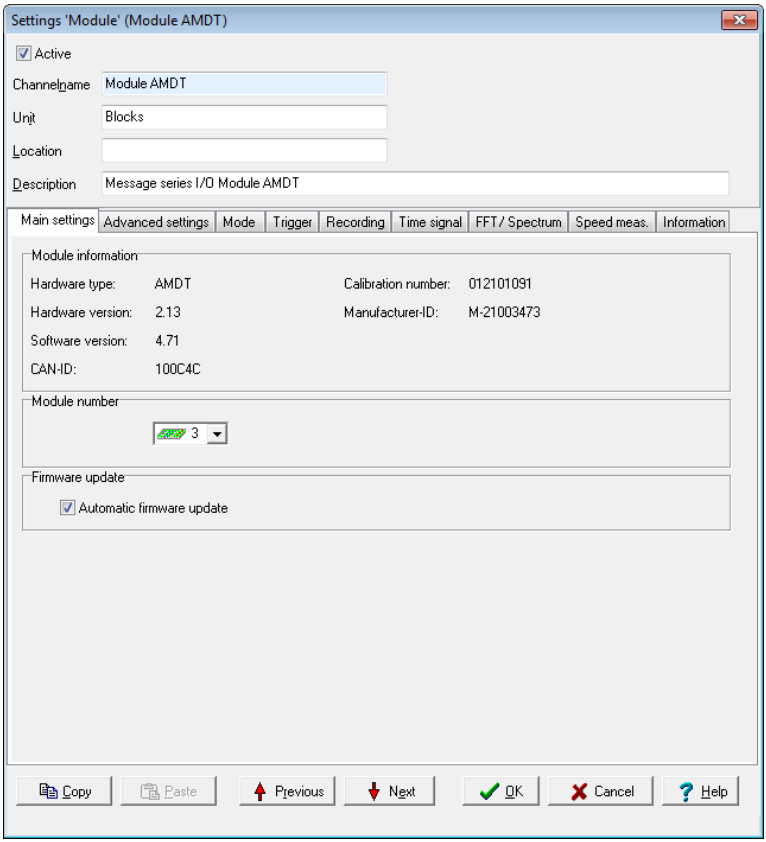
Wiring as user example:



The connections in **blue are** are always required.

Configuration/settings

Operating mode settings are as follows:

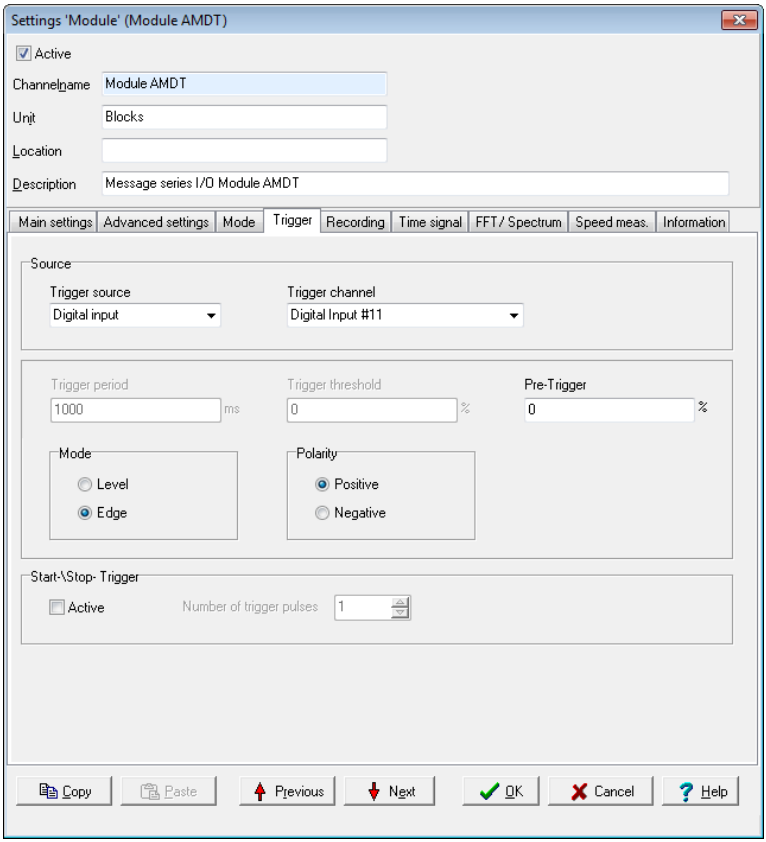


One AMDT I/O module is configured as “master”, and the other as “slave".

Overview of possible trigger settings:

External trigger signal	Master, Trigger source	Slave, Trigger source
Digital signal, wired to master and slave	Digital input	Digital input
Digital signal, wired only to master	Digital input	Master
Analogue signal, wired only to master	Analogue input	Master
None	Time period	Master

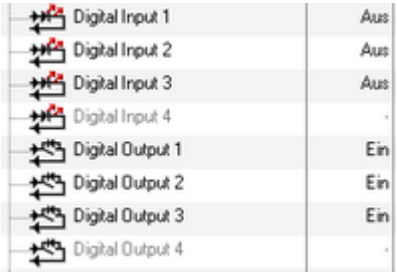
Configuration/setting for triggering is as follows:



Master and slave settings are identical.

Setting guidelines

1. Digital input 4 and digital output 4 are used internally for synchronisation. Both channels should be set to *inactive*. The *Source value* should be set to manual value for digital output 4.

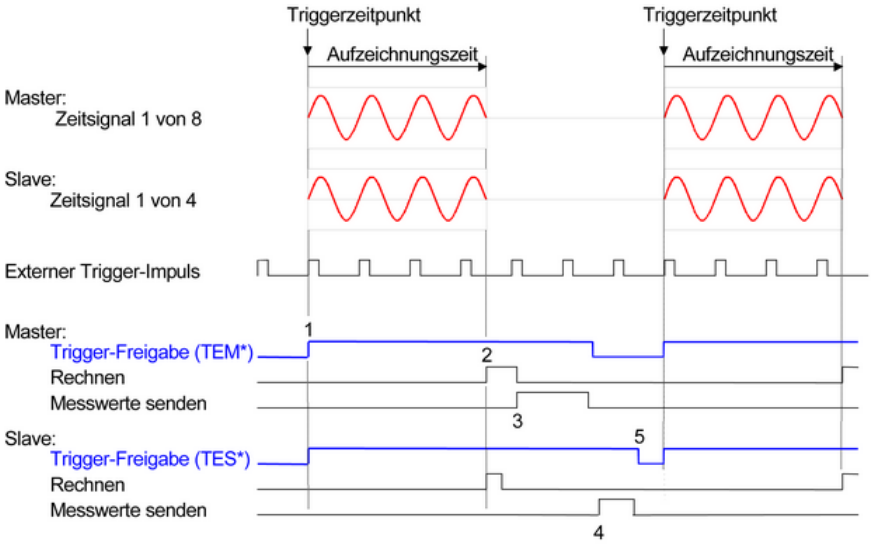


2. The configuration to the "master" must be manually changed only after configuration to the "slave" is manually changed so that the handshake stays in step.
3. If no external trigger signal is used, the time period (with the master) must be set larger than the natural cycle (recording time + computing time + 2 x measurement data transmission time) so that the handshake stays in step. See timing diagram.

Procedure

The outcome of synchronisation: Triggering takes place (almost) simultaneously Measurement data (time signal/frequency spectrum) are transmitted consecutively.

Timing diagram as user example



1 Synchrone Triggerung, Beginn der Aufzeichnung
2 Beginn der Auswertung (FFT-Analyse, Kennwert-Berechnung, etc.)
3 Master sendet Messwerte (Zeitsignal, Frequenzspektrum)
4 Slave sendet Messwerte (Zeitsignal, Frequenzspektrum)
5 Master und Slave sind bereit für nächste Triggerung

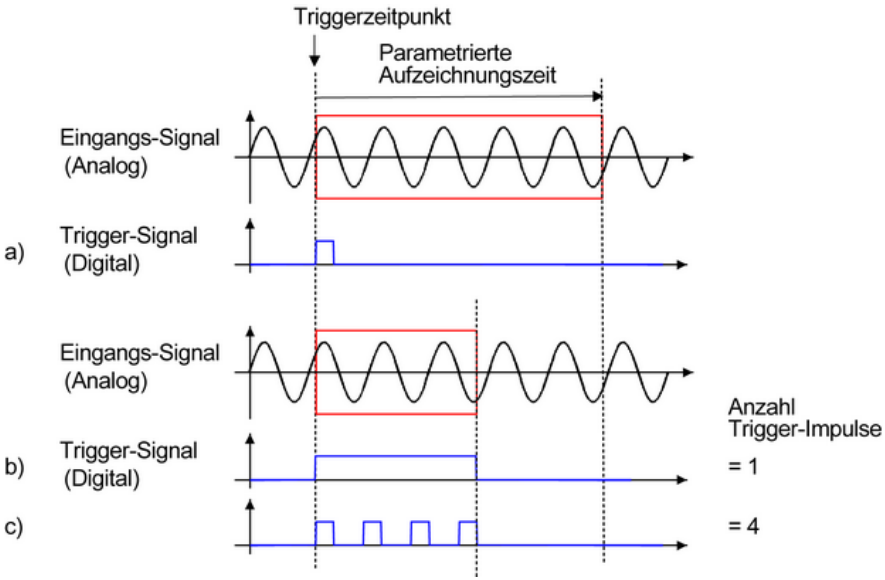
8.2.2 Triggering and recording

Properties

- Software trigger via time interval, periodically within the range 1 ms to 60 s.
- Hardware trigger via analogue input or digital input
- Trigger threshold, edge, and polarity adjustable
- Batch recording at a sampling frequency in the range of 256 Hz to 20480 Hz (for 1 to 8 channels)
- Continuous recording at a sampling frequency in the range of 256 Hz to 1024 / 2048 / 4096 kHz (for 8/4/2 channels)
- Recording depth of max. 8192 or 4096 samples for each channel, max. 8 synchronous channels
- Pre-trigger in the range of 0 to 100% of recording depth
- Start-stop trigger function for externally determined recording depth

Hardware trigger operating modes

The trigger signal is best received from one of the four digital inputs. One of the eight analogue inputs may alternatively be used with a preset threshold.



Note on above diagram:
In example a) the trigger signal starts recording. Recording stops when the recording time parameter has been reached (refer to the next section).
In Examples b) and c), the trigger signal controls starting and stopping of the recording – irrespective of the trigger pulse parameter. In the event that the stop trigger does not occur, recording is limited to the recording time parameter (refer to next section).

Recording parameters

A vibration signal is recorded with respect to the time signal according to three parameters: sampling frequency, number of samples and recording time. A frequency spectrum is determined according to the parameters: frequency range, number of lines and frequency resolution.

Parameters are closely related to each other. The following table provides an overview:

Parameter		Symbol	Calculation	Example
Sample rate	Sample rate	fs	—	2560 Hz
Number of samples	Number of samples	ns	—	2048
Recording	Recording	tr	tr = ns / fs	2048 / 2560 Hz

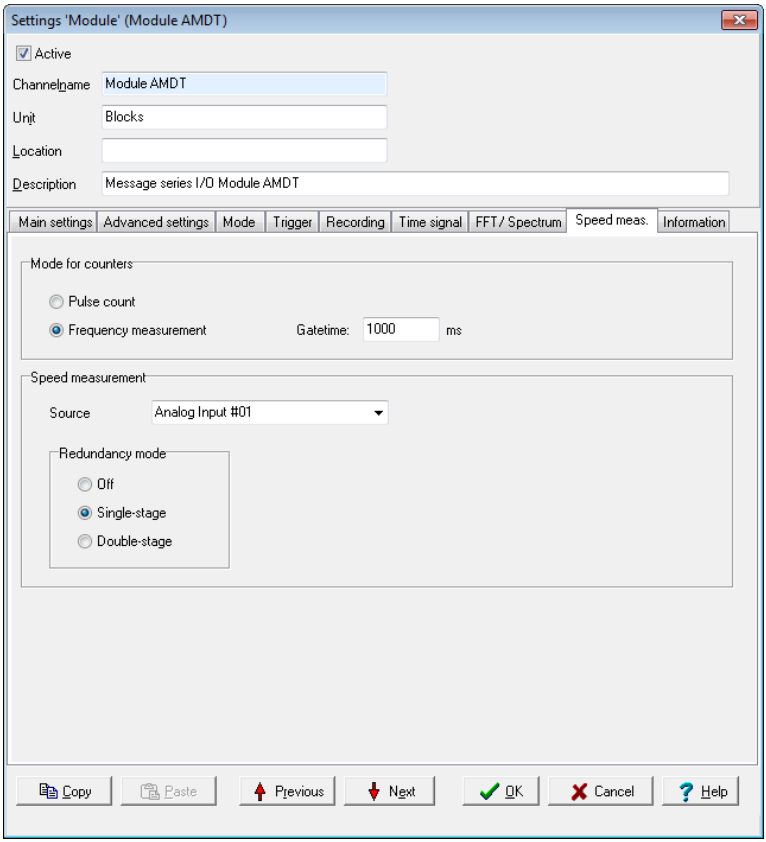
Parameter		Symbol	Calculation	Example
time	time			= 800 ms
Frequency range	Frequency range	fra	fra = fs / 2.56	2560 / 2.56 = 1000 Hz
Number of lines	Number of lines	nli	nli = ns / 2.56	2048 / 2.56 = 800
Frequency resolution	Frequency resolution	fre	fre = fs / ns	2560 Hz/ 2048 = 1.25 Hz

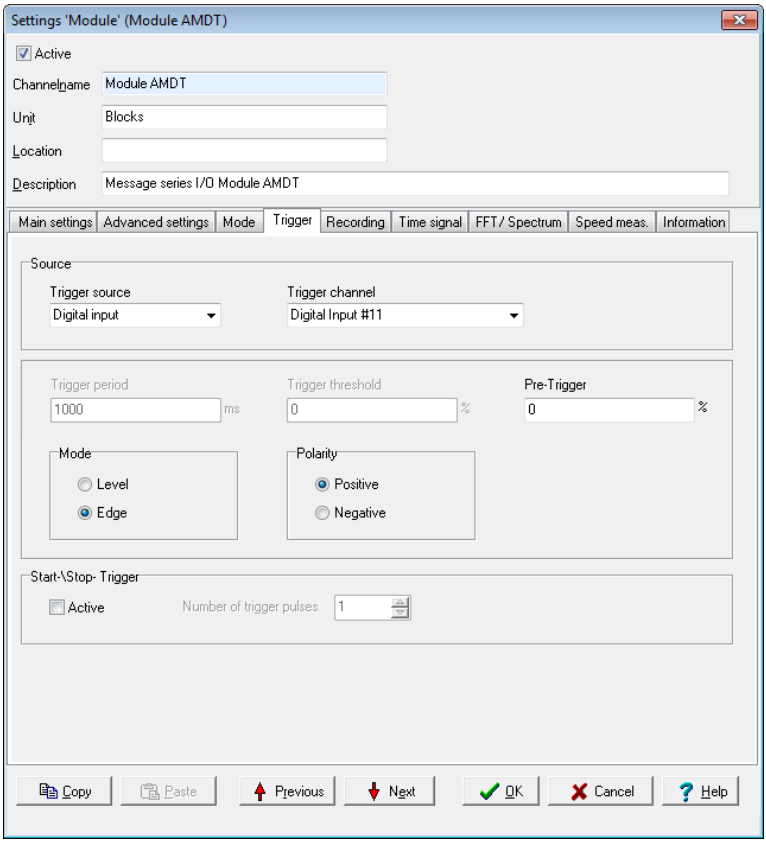
8.2.2.1 Redundant trigger source

When triggering takes place via an external digital signal, the trigger source can be automatically switched in the event of a trigger signal failure. There are two options:

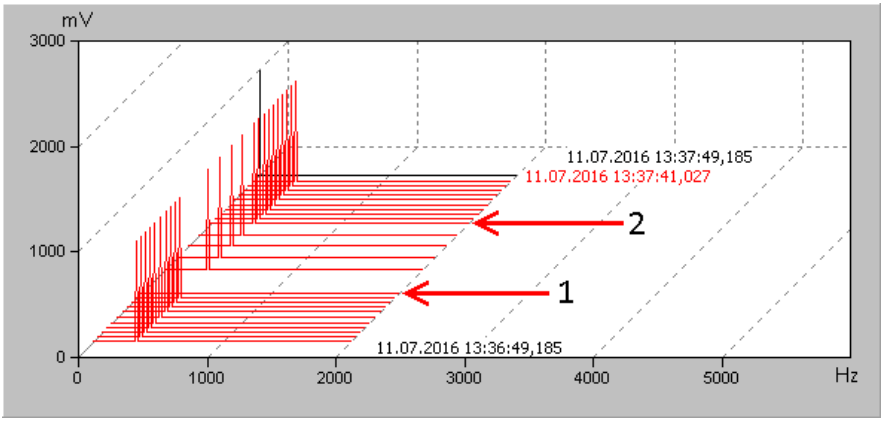
- 1-level redundancy
  There is a switch to the time-period trigger if a trigger signal on digital-input fails.
- 2-level redundancy
  There is a switch to the trigger signal on digital input 2 if the trigger signal on digital input 1 fails. If digital-input 2 also fails, there is a switch to the time period trigger.

Configuration examples:


Settings 'Module' (Module AMDT)
Active
Channelname
Module AMDT
Unit
Blocks
Location
Description
Message series I/O Module AMDT
Main settings
Advanced settings
Mode
Trigger
Recording
Time signal
FFT / Spectrum
Speed meas.
Information
Mode for counters
Pulse count
Frequency measurement
Gatetime:
1000
ms
Speed measurement
Source
Analog Input #01
Redundancy mode
Off
Single-stage
Double-stage
Copy
Paste
Previous
Next
OK
Cancel
Help



Function and visualisation example:



Note on above diagram: A frequency spectrum is measured here approximately every 3 seconds. If the external trigger signal fails, measurement is triggered with a time period of 6 s. Event 1 marks the failure of the trigger signal from digital input 1. Event 2 marks recovery of the trigger signal.

8.2.3 Time signal

Every vibration signal recorded is initially saved to the buffer of the I/O module. The "analogue input" channel delivers a block of measurement data (e.g. 2048 amplitude values over time). This block is referred to as a time signal.

Properties

- 128 to 8192 samples, sampled synchronously/in parallel at 256 Hz to 20480 kHz
- Variable pre/post history and/or trigger point
- Digital filters, integrators etc. can be used
- Data compression can be used for transmission and storage.

8.2.3.1 Digital filter

Properties

- Choice of filter type: low-pass, band-pass, high-pass or demodulation filter
- Filter orders of 2 … 8, preset Butterworth characteristic
- Adjustable cut-off frequency in the range 1 Hz … 10 kHz
- Adjustable filters for each channel

Application

High-frequency interferences are filtered out of the acquired signal. Or only the desired frequency range is filtered out for analysis.

Restrictions

The digital filters are also subject to these restrictions if applicable:

- Board V2.00 to V2.12
  For 1 ... 4 analogue inputs: all filters available, max. order is 8.
  For 5 ... 8 analogue inputs: only low-pass is available, max. order is 4.
- Board V2.13 and higher
  For 1 ... 8 analogue inputs: all filters available, max. order is 6.

8.2.3.2 Digital integrator

Properties

- Numerical integration of the recorded vibration signal
- Fixed scaling factor preset at 1000.

Application

For measurements using acceleration sensors, a vibration velocity signal (unit m/s2) is converted into a vibration speed signal (unit mm/s). Refer to the "Applications using AMDT" manual.

Restrictions

The digital integrator is also subject to these restrictions:

- Board V2.00 to V2.12
  For 1 ... 4 analogue inputs: Integrator available
  For 5 ... 8 analogue inputs: Integrator not available
- Board V2.13 and higher
  For 1 ... 8 analogue inputs: Integrator available



When digital integration is enabled, measurement-range checking or wire-break monitoring will not take place.

8.2.4 FFT analysis/frequency spectrum

Vibration signal recordings are initially saved to a buffer within the I/O module. Options are available to then perform an FFT analysis or to compute a frequency spectrum. Each analogue input channel is provided with an additional “FFT/spectrum” channel. This delivers a block of measurement data (e.g. 800 amplitude values concerning frequency).

Properties

- An "FFT/spectrum" channel can be created separately (for each analogue input).
- FFT algorithms for 1024, 2048, or 4096 points or with 400, 800, or 1600 lines.
- Frequency range, number of lines and frequency resolution can be set.
- Standard window functions 'Hanning', 'Flat Top', etc. can be chosen.
- Data compression can be used for transmission and storage.

Scaling

"FFT/spectrum" channels can be individually scaled. Scaling takes place in the required unit (e.g. ± 100 µm for distance/clearance sensors or ±50 g for acceleration sensors).

Application

Analysis of characteristic frequencies and their amplitudes for a measured vibration signal.

8.2.5 Characteristic values

Vibration signal recordings are initially saved to a buffer within the I/O module. Options are available to then perform an FFT analysis or to compute a frequency spectrum. It is then possible to calculate various characteristic vibration values from the vibration signal and/or the frequency spectrum.

One or more additional characteristic value channels are available for each analogue input channel. These then deliver characteristic values for vibration data (e.g. root mean square, a spectrum's peak amplitude etc.).

Properties

- 1 to 30 characteristic value channels can be set up/created separately (for each analogue input)
- Simple configuration using selection lists
- Automatic assigning to source channel

Characteristic values

No.	Characteristic value	Type	Note
1	Peak-to-peak value	T	Difference between maximum and minimum
2	Artihm. Average	T	or DC component
3	True root mean	T	—

No.	Characteristic value	Type	Note
	square (TRMS)		
4	Frequency of the main vibration	F	Frequency of the spectrum's peak amplitude
5	Amplitude of the main vibration	F	Spectrum's peak amplitude
6	Rotation speed	T	Frequency/rotation speed
7	Phase of the main vibration	T, F	—
8	Amplitude of the 1X vibration	F	Amplitude of the single rotational and synchronous vibration components
9	Phase of the 1X vibration	T, F	Phase of the single rotational and synchronous vibration components
10	Amplitude of the 2X vibration	F	Amplitude of the double rotational and synchronous vibration components
11	Phase of the 2X vibration	T, F	Phase of the double rotational and synchronous vibration components
12	Maximum vect. sum	T, 2	Maximum sum of vectorial values of two signals (at an order of 90°)
13	"Artihm. average of product"	T, 2	"Artihm. average of the product of two signals
14	Frequency of maximum line, band 1	F	Frequency of the peak amplitude for preset frequency band 1
15	Amplitude of maximum line, band 1	F	Peak amplitude for preset frequency band 1
16	RMS value, band 1	F	RMS value for preset frequency band 1
17	Frequency of maximum line, band 2	F	Frequency of the peak amplitude for preset frequency band 2

No.	Characteristic value	Type	Note
18	Amplitude of maximum line, band 2	F	Peak amplitude for preset frequency band 2
19	RMS value, band 2	F	RMS value for preset frequency band 2
20	Frequency of maximum line, band 3	F	Frequency of the peak amplitude for preset frequency band 3
21	Amplitude of maximum line, band 3	F	Peak amplitude for preset frequency band 3
22	RMS value, band 3	F	RMS value for preset frequency band 3
23	Maximum value	T	Maximum/largest value
24	Minimum value	T	Minimum/smallest value
25	Amplitude of the 3X vibration	F	Amplitude of the triple rotational and synchronous vibration components
26	Phase of the 3X vibration	T, F	Phase of the triple rotational and synchronous vibration components
27	Amplitude of the xX vibration	F	Amplitude of x-fold rotational and synchronous vibration components
28	Phase of the xX vibration	T, F	Phase of the x-fold rotational and synchronous vibration components
29	Total value	F	Weighted sum for all lines of a frequency spectrum.
30	Residual value	F	Weighted sum for all lines of a frequency spectrum, excluding the lines of harmonic components

Type: T = determined from time signal, F = determined from frequency spectrum, 2 = determined from 2 source channels

Scaling

Scaling automatically taken from source channel (for amplitude values) or appropriately preset (for frequencies or phase angles).

Application

Analysis of characteristic values of a vibration signal – for time and frequency ranges. For example, determining the root mean square of a vibration signal or the peak amplitude of a spectrum.

Mathematical definition

Mathematical definitions for all the available characteristic values are listed in the following sections.

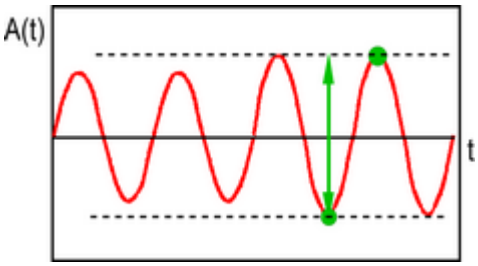
8.2.5.1 "Maximum value", "minimum value" characteristic values

Maximum value

The DSP determines (finds) the maximum value (or highest positive value) of the time signal and delivers the amplitude value.

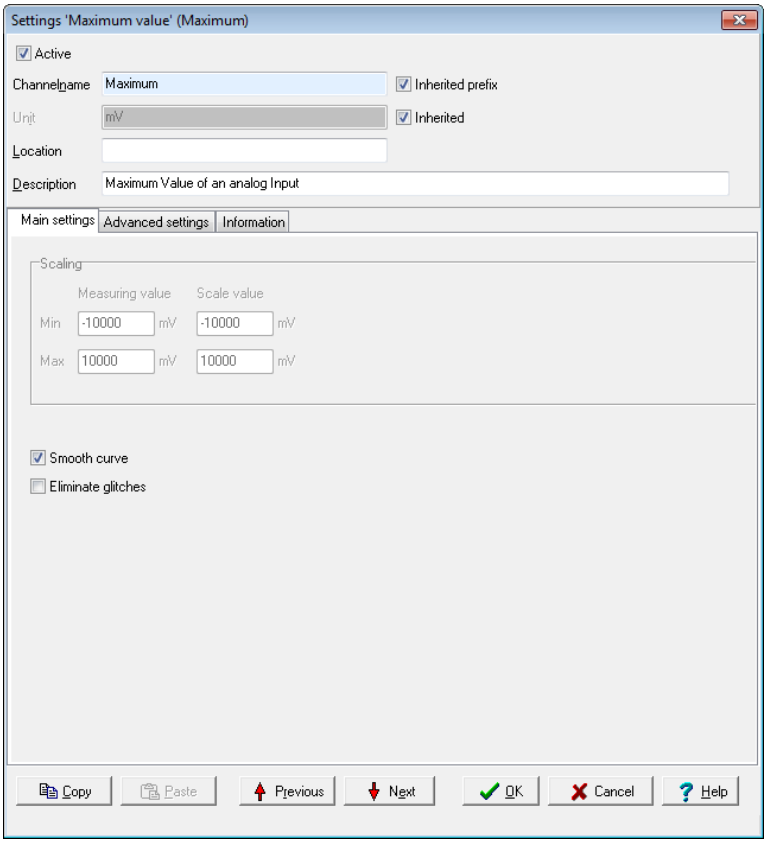
Minimum value

The DSP determines (finds) the minimum value (or lowest negative value) of the time signal and delivers the amplitude value.



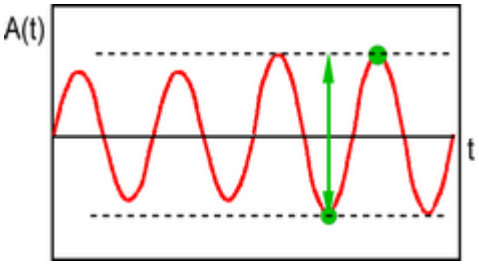
*Smooth curve / Discard anomalies*plating

Smooth curves prior to determining characteristic values may be applicable to periodic signals that have noise or distortions. These two settings are available in the *Options* tab:



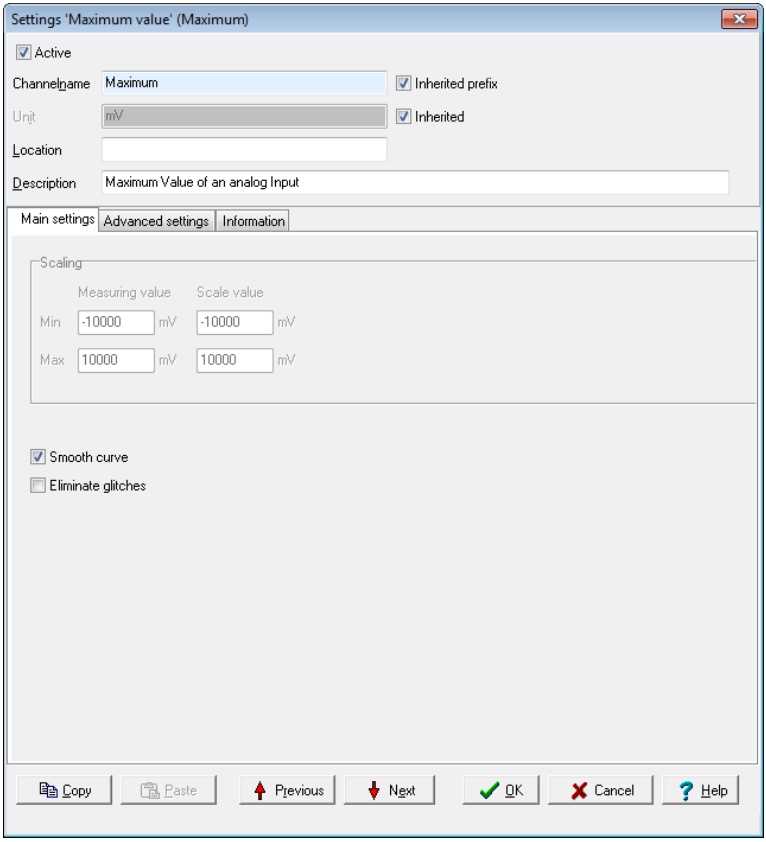
8.2.5.2 Peak-to-peak characteristic value

The DSP calculates the peak-to-peak value of the time signal, i.e. the difference between the most positive and most negative amplitude values.



Options *Smooth curve*/*Discard anomalies*

Smooth curves prior to determining characteristic values may be applicable to periodic signals that have noise or distortions. These two settings are available in the *Options* tab:



8.2.5.3 "Artihm. Average"

The DSP calculates the arithmetical average of the time signal.

$$y = \frac{1}{n} * \sum_{i=0}^{n-1} x_i$$

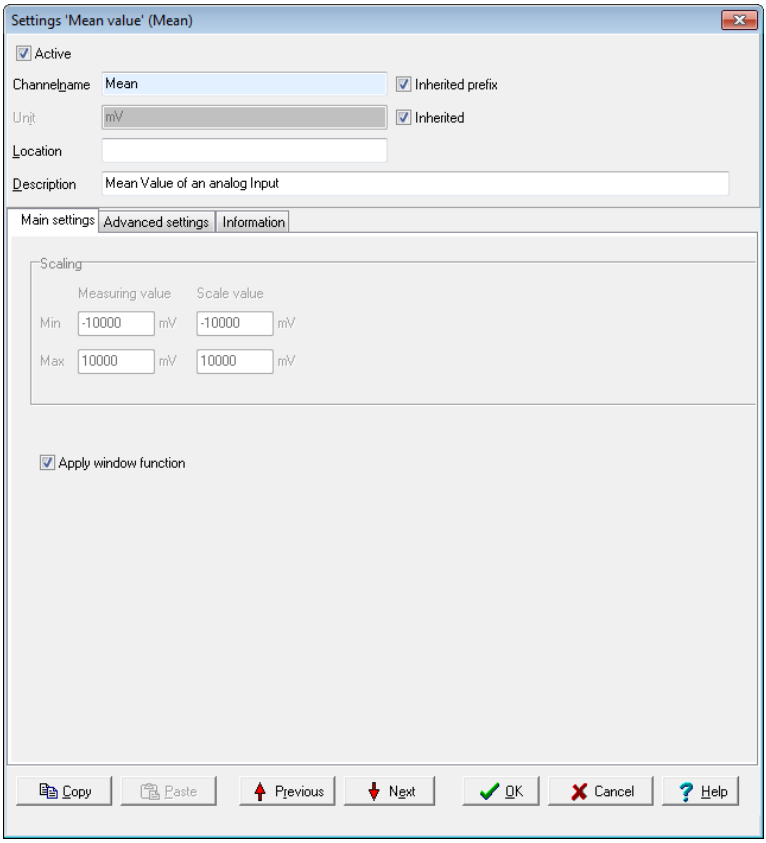
x_i = amplitude at sampling point i

n = number of sampling values

y = arithmetic average

The arithmetical average is also referred to as a signal's steady or DC component. This characteristic value is available even when the "without steady component" option is enabled for an analogue input (see configuration/settings for analogue input).

Using window function



Select this option to calm measurement data for a static vibration. A weighting is then applied prior to the arithmetic average being calculated. The signal's periphery is weighted lower and its middle higher.

8.2.5.4 "True Root mean square (TRMS)"characteristic value

The DSP calculates the root mean square of the time signal.

$$y = \sqrt{\frac{1}{T} * \int_0^T x^2(t) * dt}$$

x(t) = amplitude at time t

T = recording time

y=True root mean square (TRMS)

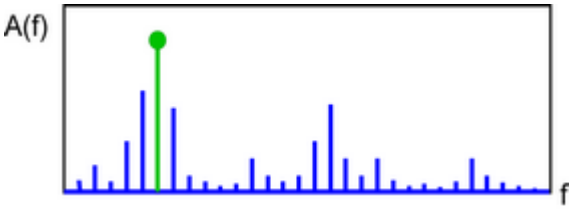
Discretization enables a good approximation to the above formula.

For 1 ... 8 analogue inputs: Integrator available

The accuracy for TRMS calculations on sine signals depends on the number of signal periods acquired. General rule: Errors are <3% for more than 2 periods; Errors are <1% for more than 4 periods.

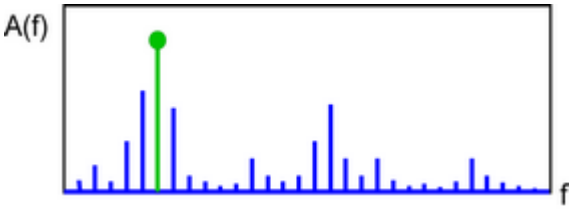
8.2.5.5 "Frequency of main vibration" characteristic value

The DSP determines (finds) the largest amplitude in the frequency spectrum and delivers the frequency of this line.



8.2.5.6 "Amplitude of the main vibration" characteristic value

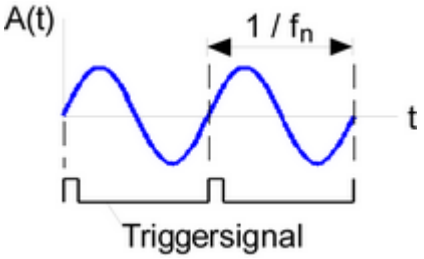
The DSP determines (finds) the largest amplitude in the frequency spectrum and provides the value of the amplitude for this line.



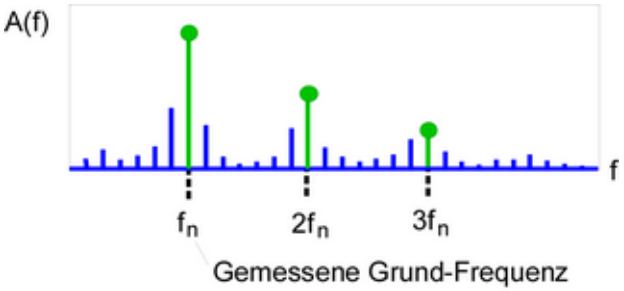
8.2.5.7 "Phase of main vibration" characteristic value

Phase angle measurement is useful only for low frequencies/rotation speeds. The evaluation procedure (see below) shows why. Further information on phase angle definition and on measurement precision etc. is available under Measuring the phase angle.
This characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/-counter (e.g. the square wave pulse of a rotating shaft). This signal delivers a stable base frequency fn as well as a phase reference or trigger signal.

The DSP normalizes the time signal (internally, hidden) to an integral multiple of the basic frequency fn.



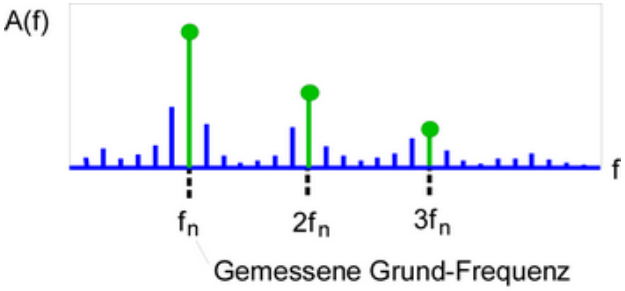
Using the frequency spectrum associated with the line index fn, the DSP determines the line/vibration component's phase angle 0 … 360°.



8.2.5.8 "Amplitude of the 1X/2X/3X/xX vibration" characteristic value

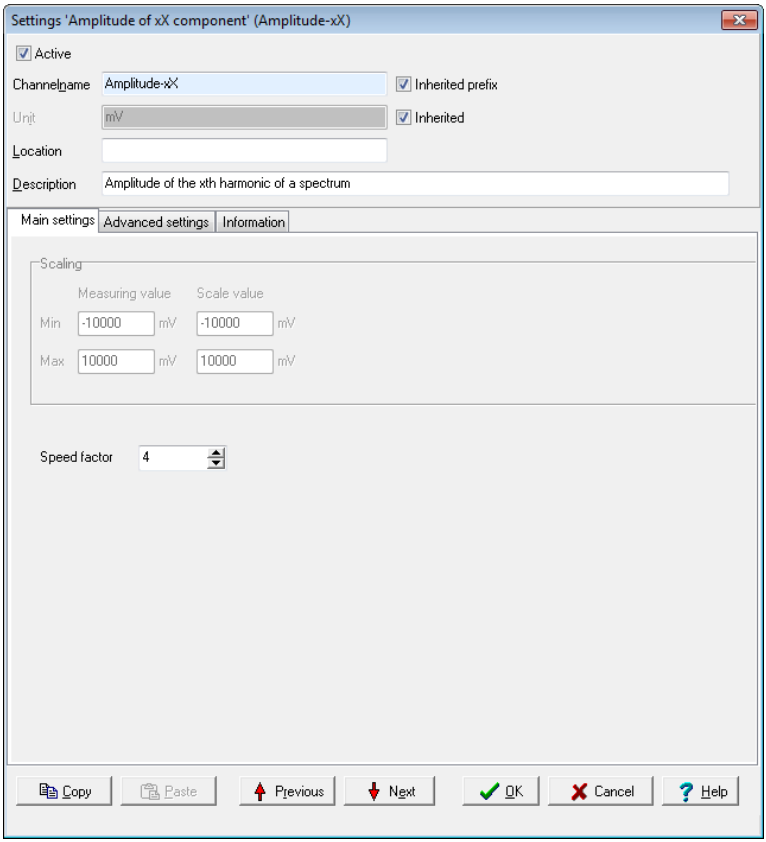
This characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/-counter. This signal delivers the stable basic frequency fn.

Using the frequency spectrum for the line index fn/2fn/3fn/xfn, the DSP determines the amplitude of this line/vibration component.



Acquisition of an accurate fn via the digital frequency input is essential, as is the highest possible resolution for the frequency spectrum. In the event of deviations between the measured frequency and frequency spectrum's line index, evaluation of the next line takes place.

Only freely definable components (amplitude of xX vibration) can be set in the range 0 … 100 x fn. The corresponding configuration dialogue (*Main settings* tab) has a "Rotation speed factor" field:

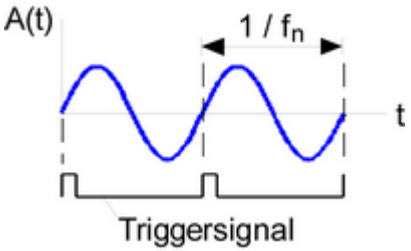


8.2.5.9 "Phase of the 1X/2X/3X/xX vibration" characteristic value

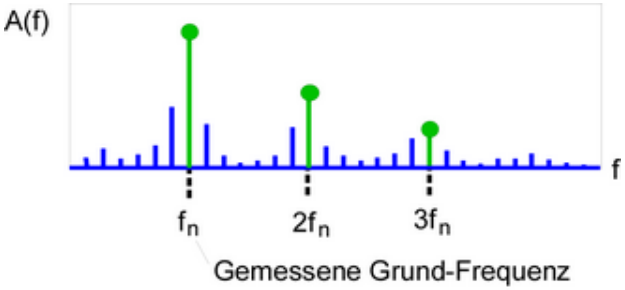


Phase angle measurement is useful only for low frequencies/rotation speeds. The evaluation procedure (see below) shows why. Further information on phase angle definition and on measurement precision etc. is available under Measuring the phase angle.
This characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/-counter (e.g. the square wave pulse of a rotating shaft). This signal delivers a stable base frequency fn as well as a phase reference or trigger signal.

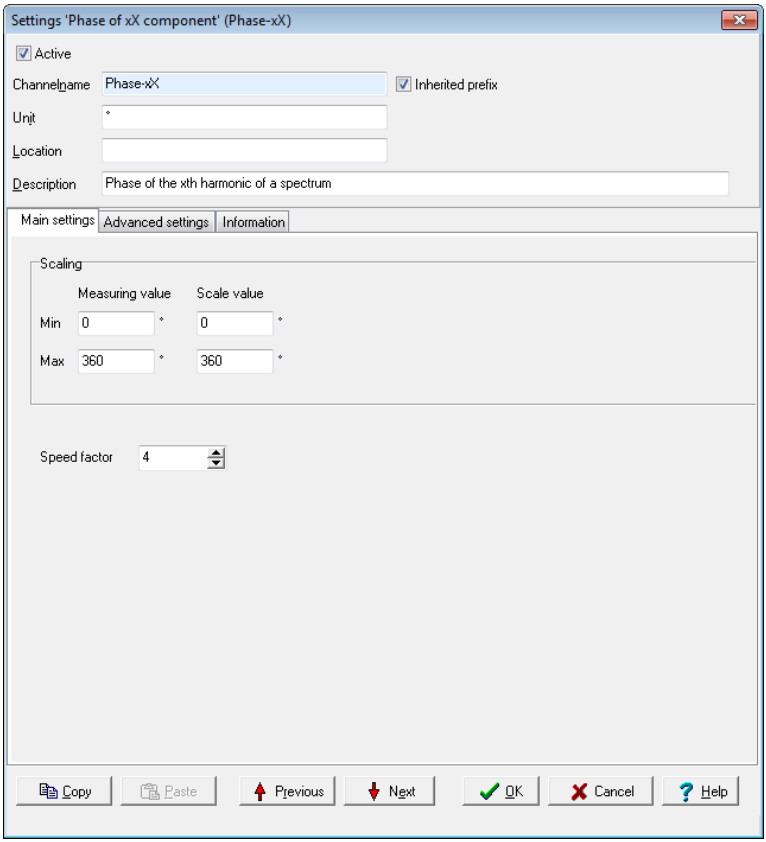
The DSP normalizes the time signal (internally, hidden) to an integral multiple of the basic frequency fn.



Using the frequency spectrum for the line index fn/2fn/3fn/xfn, the DSP determines the 0 ... 360° phasing of this line or vibration component.

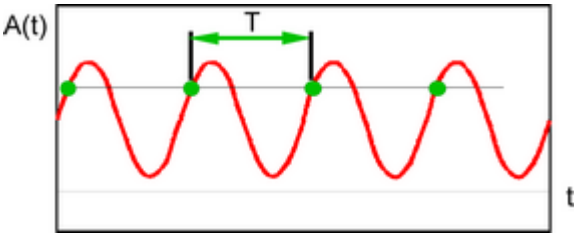


Only freely definable components (phase of xX vibration) can be set in the range 0 … 100 * fn. The corresponding configuration dialogue (*Main settings* tab) has a "Rotation speed factor" field:



8.2.5.10 "Rotation speed"

The DSP determines (finds and counts) the number of signal periods in the time signal. From this, the DSP determines the signal frequency (f = 1 / T) or rotation speed (n = 60 * f). Edge and threshold values can be set.

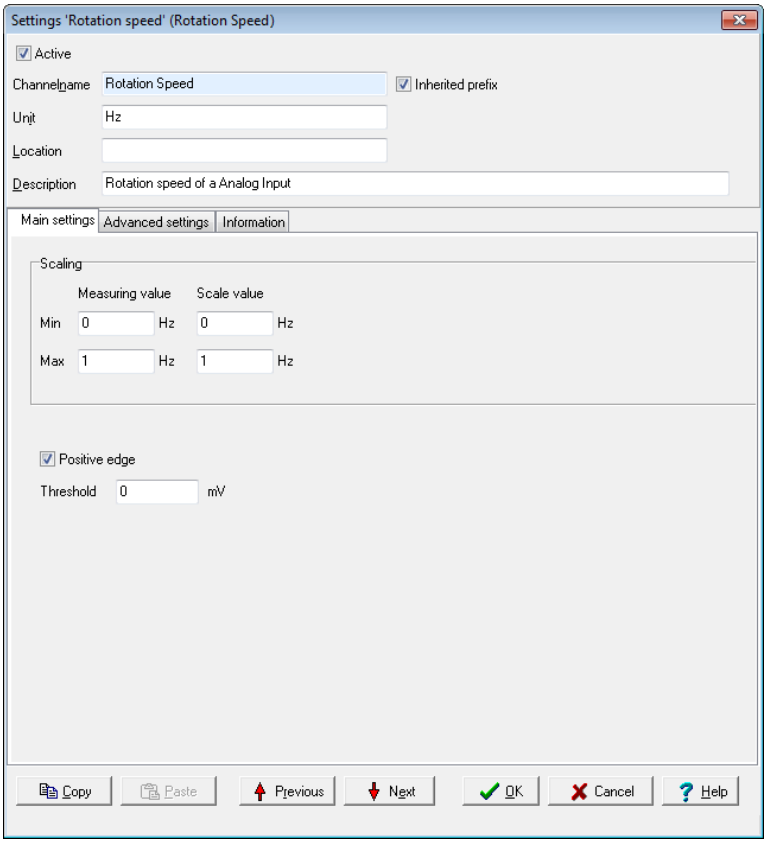


This frequency measurement has upper and lower frequency limits – frequencies outside this range cannot be clearly determined (i.e. have insufficient accuracy). The following table provides an overview as an example:

Sample rate fs	Number of samples ns	Lower limit	Upper limit
10240 Hz	2048	10 Hz	1024 Hz
2560 Hz	2048	22.5 Hz	256 Hz
512 Hz	2048	0,5 Hz	51 Hz

Frequencies can be measured between the lower limit at 2*fs/ns and the upper limit at fs/10 for selected parameters (recording parameters). The measurement value equals 0 beyond these limits.

Below is the corresponding configuration dialogue (*Main settings* tab):



8.2.5.11 "Maximum vect. sum" characteristic value

The DSP performs vectoral addition of all amplitude values from the time signals of two consecutive channels (e.g. analogue input 1 and 2) and then determines the maximum. The characteristic value must be set for the first of the two consecutive channels.

$z_i = \sqrt{x_i^2 + y_i^2}$

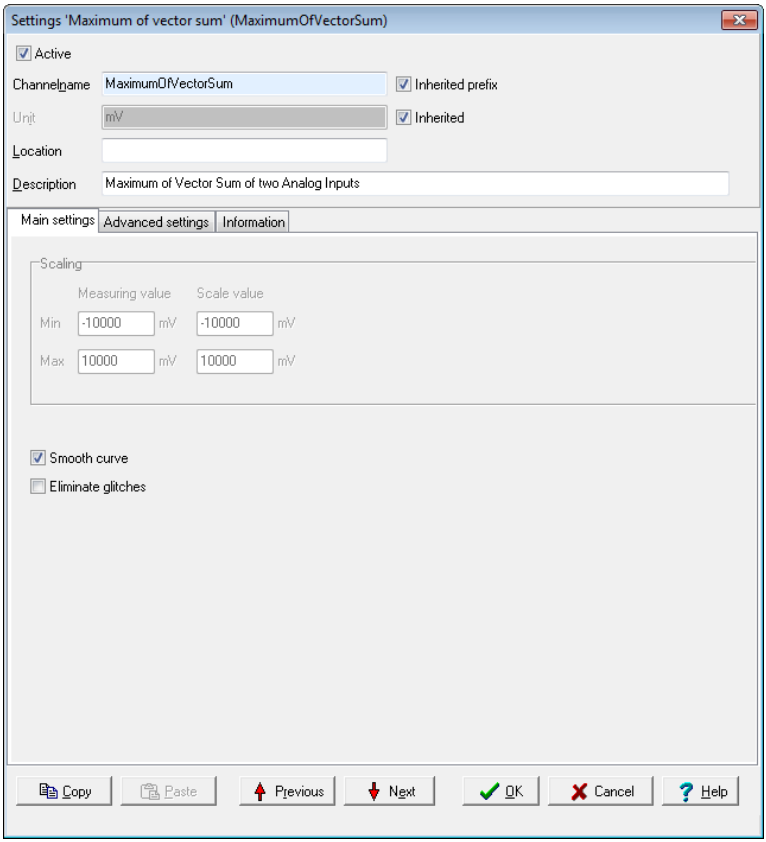
x_i = amplitude at sampling point i, first channel

y_i = amplitude at sampling point i, second channel

z_i = vector sum at sampling point i

Options *Smooth curve*/*Discard anomalies*

Smooth curves prior to determining characteristic values may be applicable to periodic signals that have noise or distortions. These two settings are available in the *Options* tab:



8.2.5.12 "Artihm. average of product"

The DSP performs multiplication of all amplitude values from the time signals of two consecutive channels (e.g. analogue input 1 and 2) and then determines the arithmetical average. The characteristic value must be set for the first of the two consecutive channels.

$x_i = a_i * b_i$

a_i = amplitude at sampling point i, first channel

b_i = amplitude at sampling point i, second channel

x_i = product at sampling point i

$$y = \frac{1}{n} * \sum_{i=0}^{n-1} x_i$$

x_i = amplitude at sampling point i

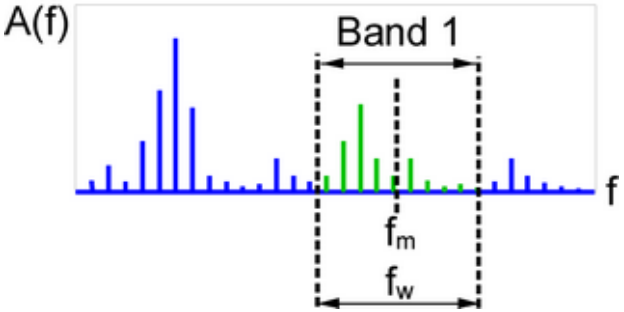
n = number of sampling values

y = arithmetic average

In the case of "electrical power measurement", this characteristic value corresponds to the measured variable P (= active power) for current and voltage input variables.

8.2.5.13 "Frequency of maximum line, band 1/2/3" characteristic value

The DSP determines (finds) the largest amplitude within a limited frequency band of the frequency spectrum and delivers the frequency of this line. The frequency band is determined via the middle fm and the width fw. The frequency band can be fixed or adapted to rotation speed.

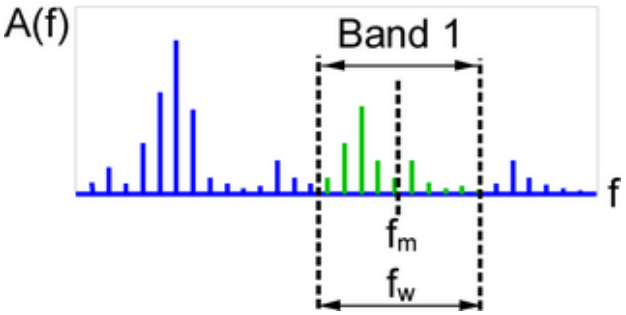


Refer also to Amplitude of maximum line, band1/2/3

8.2.5.14 "Amplitude of maximum line, band 1/2/3" characteristic value

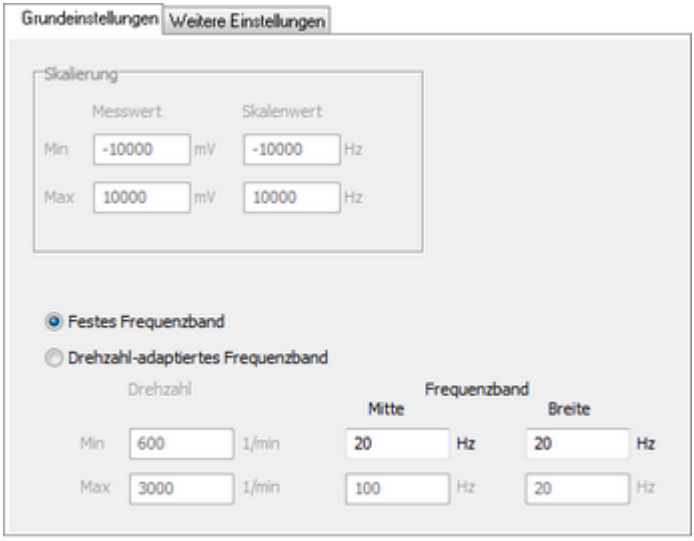
The DSP determines (finds) the largest amplitude within a limited frequency band of the frequency spectrum and provides the amplitude of this line. The frequency band is determined via the middle fm and the width fw. The frequency band can be fixed or adapted to rotation speed.

In the mode "frequency band adapted to rotation speed", this characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/counter (e.g. the pulse of a rotating shaft). This signal provides the basic frequency fn.

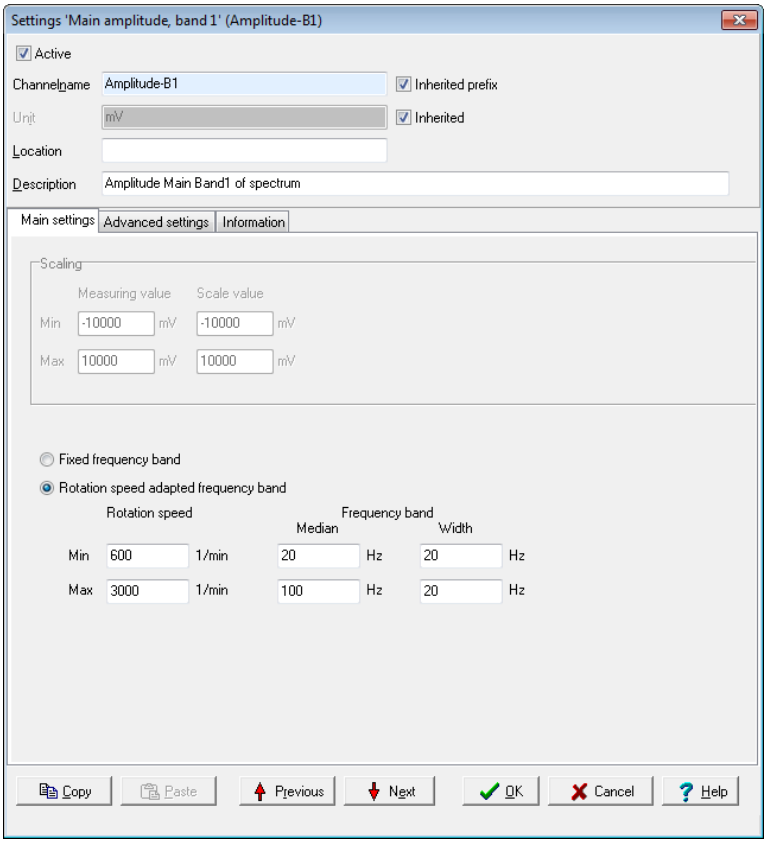


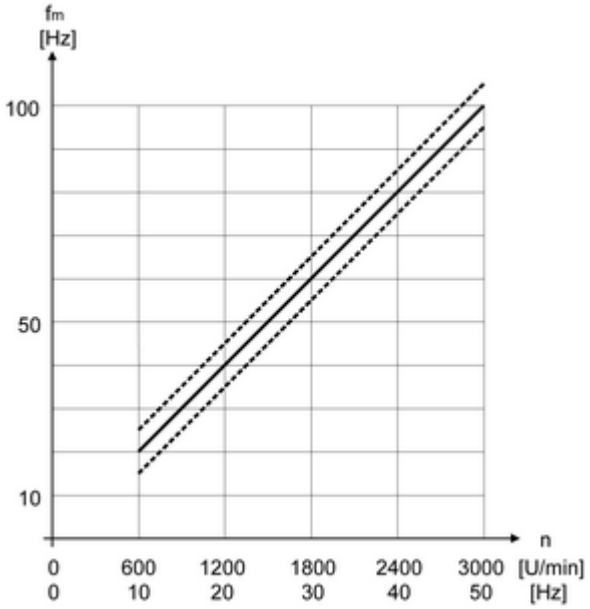
Below is the corresponding configuration dialogue (*Main settings* tab):

Example 1: *Fixed frequency band*. The characteristic value provides the largest amplitude of the frequency spectrum within the band 100±5Hz or 95 to 105 Hz.



Example 2: *Frequency band adapted to rotation speed*. Dual synchronous shaft vibration is monitored in a system with a rotating shaft. The frequency band midpoint is shifted proportionally and automatically from 20 to 100 Hz for an operating rotation speed from 600 to 3000 rev/min (10 to 50 Hz). The width of the frequency band is ±5 Hz.


Settings 'Main amplitude, band 1' (Amplitude-B1)
Active
Channelname
Amplitude-B1
Inherited prefix
Unit
mV
Inherited
Location
Description
Amplitude Main Band1 of spectrum
Main settings
Advanced settings
Information
Scaling
Measuring value
Scale value
Min
-10000
mV
-10000
mV
Max
10000
mV
10000
mV
Fixed frequency band
Rotation speed adapted frequency band
Rotation speed
Frequency band
Median
Width
Min
600
1/min
20
Hz
20
Hz
Max
3000
1/min
100
Hz
20
Hz
Copy
Paste
Previous
Next
OK
Cancel
Help



8.2.5.15 "RMS value, band 1/2/3" characteristic value

The DSP determines (calculates) the RMS value (root mean square) using all the lines within a narrow frequency band of the frequency spectrum. The frequency band is determined via the middle fm and the width fw. The frequency band can be fixed or adapted to rotation speed.

$$y = \sqrt{\frac{1}{n} * \prod_{i=k}^{i=m} x_i^2}$$

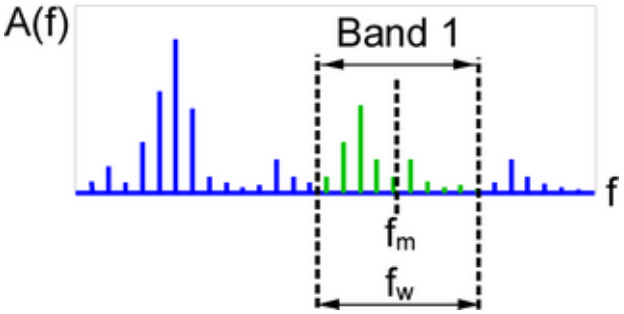
x_i = amplitude of line i in the frequency band

n = number of lines in the frequency band

k = index of lines with the smallest frequency in the frequency band

k = index of lines with the greatest frequency in the frequency band

y = calculated RMS value



The following formula is also available (*Alternative formula*):

$$y = \sqrt{\frac{1}{2} * \square_{i=k}^{i=m} x_i^2}$$

Refer also to "Amplitude of maximum line, band 1/2/3" characteristic value

Note

It is recommended that the frequency band be set so that the left and right limits are lie between the spectral lines. Each spectral line will then clearly lie within or without.

$$k \square \frac{\left(f_m - \frac{1}{2} f_w\right)}{a}$$

$$m \square \frac{\left(f_m + \frac{1}{2} f_w\right)}{a}$$

n=m-k+1

a = frequency resolution

Example

A sampling frequency of 2560 Hz and 4096 samples delivers a frequency spectrum with 1600 lines and a frequency resolution of 0.625 Hz. A frequency band midpoint of 100 Hz and a width of 6 Hz are set. This results in values for k, m and n are:

$$k \square \frac{\left(100 - \frac{1}{2} * 6\right)}{0,625}$$

$$k \square 155,2$$

$$k \cong 156$$

$$m \square \frac{\left(100 + \frac{1}{2} * 6\right)}{0,625}$$

$$m \square 164,8$$

$$m \cong 164$$

8.2.5.16 "Total" characteristic value

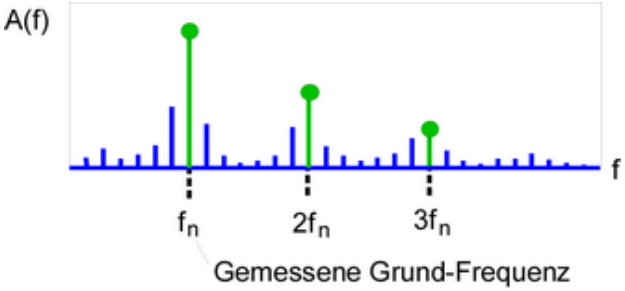
The DSP determines (calculates) a weighted sum for all quadratic lines of a frequency spectrum.

$$y = \sqrt{\frac{1}{2} * \sum_{i=0}^{n-1} x_i^2}$$

x_i = amplitude of line i in the frequency spectrum

n = number of lines in the frequency spectrum

y = total value



For a single ideal line (sine wave), the total value and effective value match.

8.2.5.17 "Residual value"

The DSP determines (calculates) a weighted sum of all quadratic lines of the frequency spectrum, excluding the three harmonic components and, when applicable, a freely definable component of choice.

This characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/-counter (e.g. the pulse from a rotating shaft). This signal provides the basic frequency fn.

$$y = \sqrt{\frac{1}{2} * \left(\sum_{i=0}^{n-1} x_i^2 - \sum_{i=j-1}^{j+1} x_i^2 - \sum_{i=k-1}^{k+1} x_i^2 - \sum_{i=l-1}^{l+1} x_i^2 - \sum_{i=m-1}^{m+1} x_i^2 \right)}$$

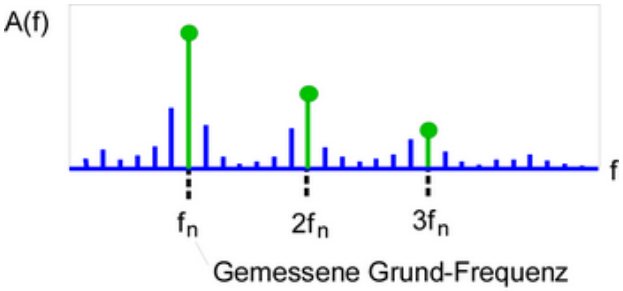
x_i = amplitude of line i in the frequency spectrum

n = number of lines in the frequency spectrum

j/k/l = index of lines at $f_n / 2f_n / 3f_n$

m= index of the line at xf_n

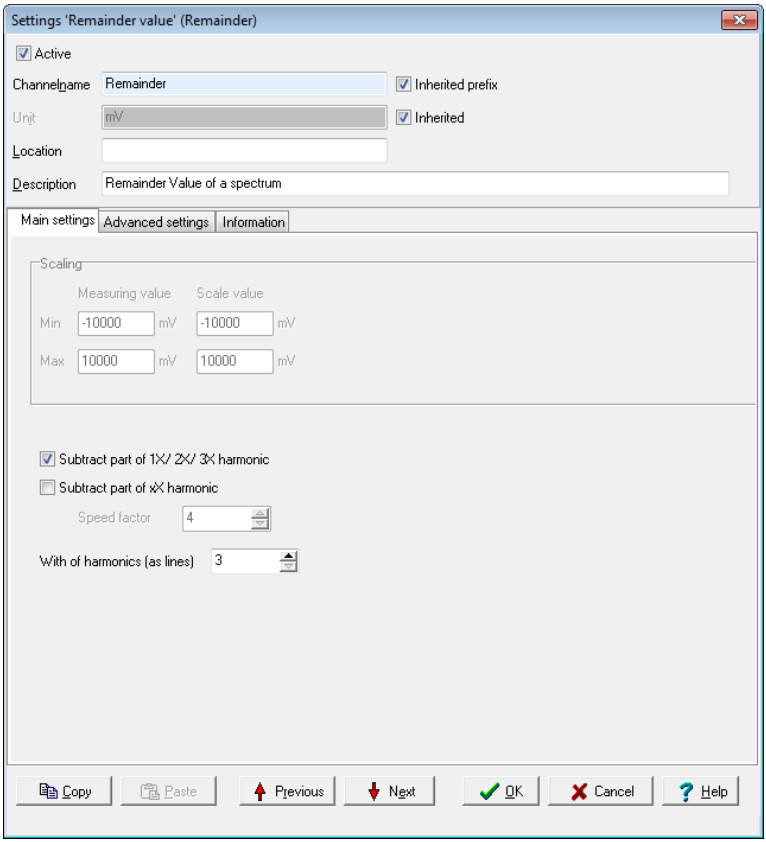
y = residual value



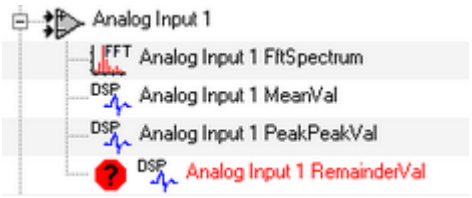
Acquisition of an accurate fn via the digital frequency input is essential, as is the highest possible resolution for the frequency spectrum. In the event of deviations between the measured frequency and frequency spectrum's line index, evaluation of the next line takes place.

The three harmonic components and the freely definable components can be processed as required. These components are each calculated using three lines in the above formula. 1/3/5 lines are configurable.

Below is the corresponding configuration dialogue (*Main settings* tab):



The characteristic value cannot be generated without a rotation pulse. The DataService Configurator then displays an error:



8.2.6 Frequency and rotation speed measurement

Measuring of current frequencies/rotation speed on rotating equipment and determining the rotation speed as additional information for the frequency spectrum.

Properties

- Frequency measurement via 2 free-running counters (16 bit)
- Connected to digital input 1/2
- Signal frequency from 0.2 Hz to 30 kHz
- Frequency measurement or pulse counting operating modes
- Gate times for frequency measurement within the range 250 ¼ 5000 ms

Operating mode

Settings are made for both counter channels for operating mode frequency measurement or pulse counting and gate time.

Frequency measurement

The appropriate measuring process is automatically selected. The time interval of registered pulses is measured in the range 0.2 to 100 Hz (or 12 ¼ 6000 rpm) range. In the >100 to 30 kHz range, the number of pulses are measured per gate time.

A gate time setting of 1000 ms is recommended. The table shows the values for 1 pulse/rotation, a gate time of 1000 ms and a sampling frequency of 1000 Hz:

Frequency in Hz	Rotation speed in rpm	Pulse interval in ms	evaluated periods
0.2	12	5000	1
0.5	30	2000	1
1	60	1000	1
2	120 ...	500 ...	2
5	300 ...	200 ...	5
10	600	100	10
20	1200	50	20
50	3000	20	50
100	6000	10	100
200 ...	12000	5	200 ...
500 ...	30000	2	500 ...

Frequency in Hz	Rotation speed in rpm	Pulse interval in ms	evaluated periods
1000	60000	1	1000
2000	—	0.5	2000
5000	—	0.2	5000
10000	—	0.1	10000
20000	—	0.05	20000
30000	—	0.033	30000

The following applies to the range >100 to 30 kHz: Lower gate times enable measurement data to be updated faster. Higher gate times provide higher resolution/measurement precision.

Gate time in milliseconds	Resolution in Hz
5000	0.2
2000	0.5
1000	1
500 ...	2
250	4

8.2.7 Measuring of phase angle

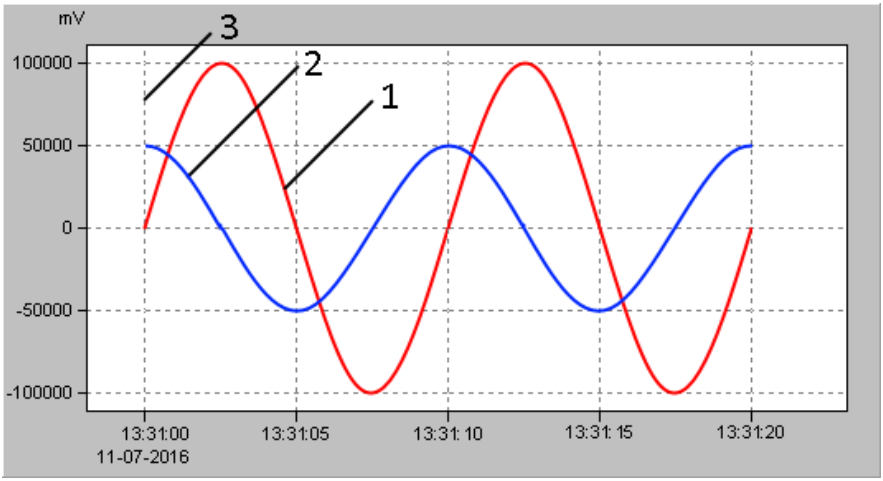


Phase angle measurement is useful only for low frequencies/rotation speeds. The evaluation procedure (see below) shows why. See also Phase of main vibration or Phase of 1X/2X/3X/xX vibration.

Phase angle definition

The phase angle definition corresponds to a sine definition associated with a trigger point. Conversion to a cosine definition is explained below.

The following example has two signals. Two signal periods are acquired. Signal 1 has a phase angle of 0 degrees. Signal 2 has a phase angle of 90 degrees. Mark 3 shows the trigger point.



Measurement accuracy

Measurement accuracy is determined by acquisition of the fn basic frequency via the digital frequency input.

Select the settings *Sampling frequency* and *Number of samples* to enable acquisition of more than one but less than ten signal periods in a time signal block. This achieves an accuracy of ±1 ... 5 degrees for the phase angle.

The following table is for a frequency spectrum with 2048 and 4096 lines.

Acquired signal periods	>1	2	5	10	20
Measurement deviation phase angle	±1 degrees	±2 degrees	±3 degrees	±5 degrees	±10 degrees

The rule of thumb for a measurement deviation of ±5 degrees:

$$f_m = 1 \square 10 * \frac{f_s}{n}$$

f_m = main frequency of the input signal

f_s =Sample rate

n=Number of samples

Examples

Sample rate	2560	2560 Hz	1280 Hz

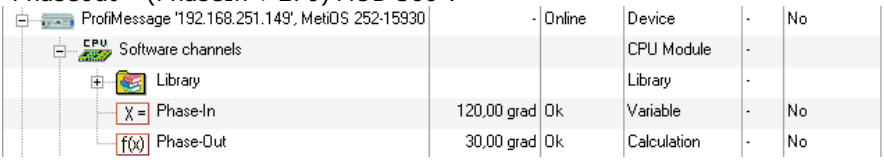
	Hz		
Number of samples	2048	4096	4096
Input signal range for a measurement deviation of ±5 degrees	1.25 to 25 Hz	0.625 to 12.5 Hz	0.3125 to 6.25 Hz

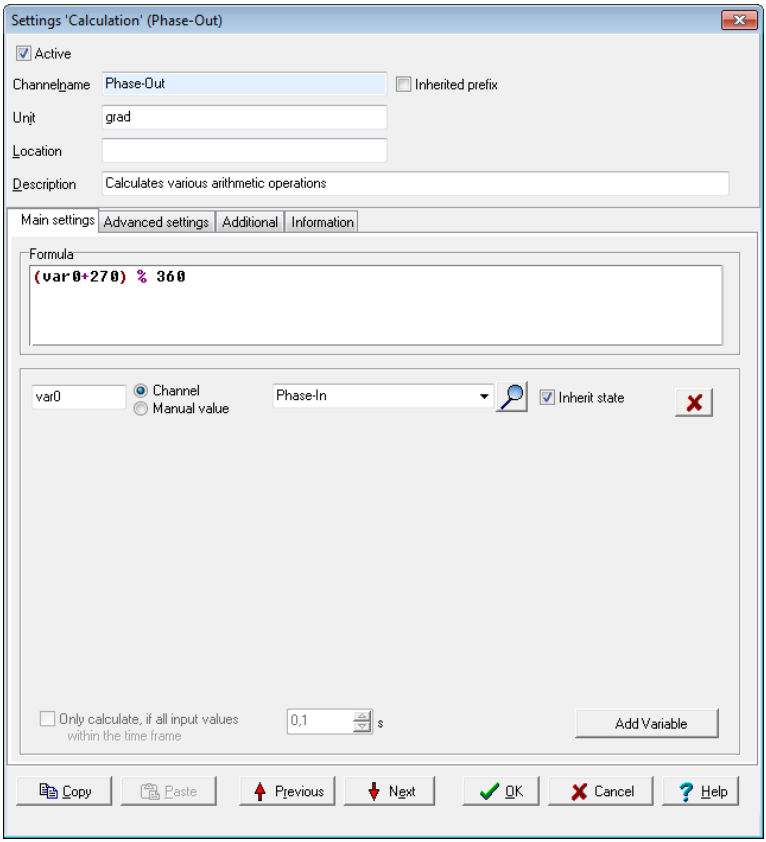
Converting a sine definition to a cosine definition

The phase angle is given in the range 0 ... 360 degrees. The following table shows a comparison between sine and cosine definitions:

Sine	0	30	60	90	120 ...	150 ...	180 ...
Cosine	270 ...	300 ...	330	360/0	30	60	90
Sine	210	240	270 ...	300 ...	330	360	degrees
Cosine	120 ...	150 ...	180 ...	210	240	270 ...	degrees

Conversion takes place via a calculation channel using the formula "Phaseout = (PhaseIn + 270) MOD 360".





8.2.8 Monitoring

The "threshold value" software channel of the base device monitors characteristic values against threshold values. Threshold channels can be logically linked and output to digital outputs. In the same way, functions can be integrated into the monitoring, such as averaging, computations or time procedures.

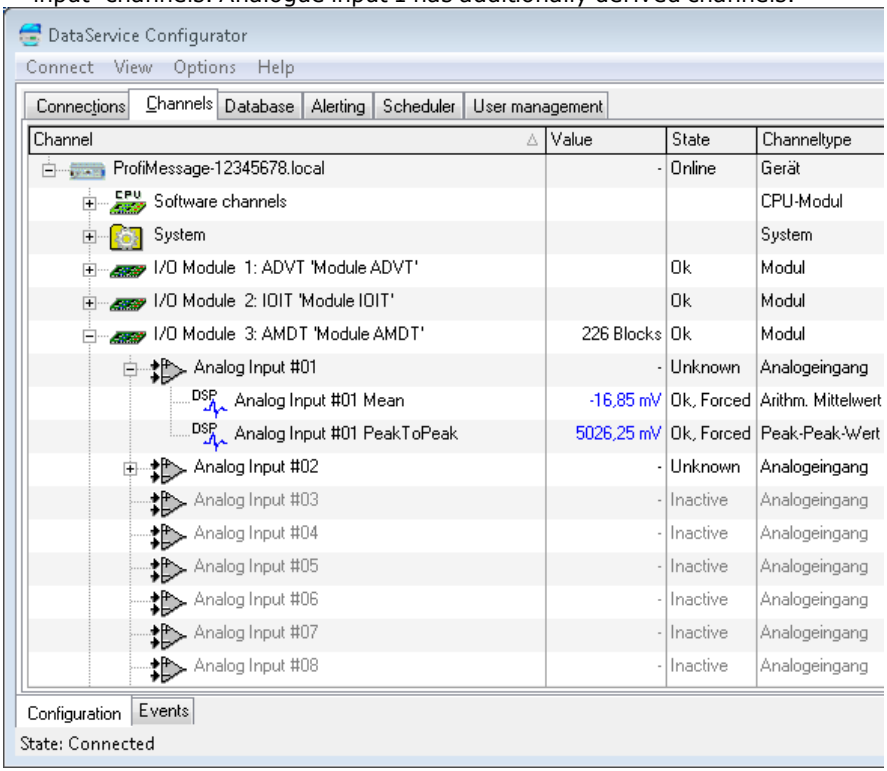
Refer to the section on software channels in the device manual.

8.3 Configuration and operation

This section explains how to configure and operate an AMDT module.

8.3.1 Configuration with DataService Configurator

The program DataService Configurator gives a hierarchical display of a system's connected components. The following image shows 8 "analogue input" channels. Analogue input 1 has additionally derived channels.



The 'Analogue Input x' channel delivers time signals (as blocks of measurement data). The value shown here is the maximum value of the time signal.

The 'Analogue Input x FftSpectrum' channel produces a frequency spectrum (as a block of measurement data). The value shown here corresponds to the spectrum's highest amplitude.

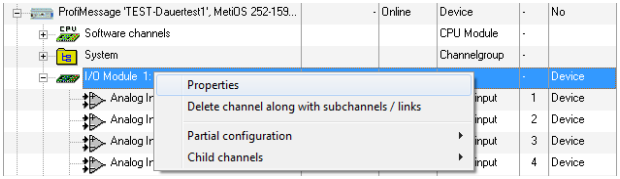
The following image shows all the other channels from the AMDT I/O module: 2 analogue outputs, 2 counters, 4 digital inputs and 4 digital outputs. The two counters belong to the first two digital inputs.

Analog Input #01	2,75 mV	Ok	Analog input	1	Device
Analog Input #02	3,36 mV	Ok	Analog input	2	Device
Analog Input #03	-	Inactive	Analog input	3	Device
Analog Input #04	-	Inactive	Analog input	4	Device
Analog Input #05	-	Inactive	Analog input	5	Device
Analog Input #06	-	Inactive	Analog input	6	Device
Analog Input #07	-	Inactive	Analog input	7	Device
Analog Input #08	-	Inactive	Analog input	8	Device
Analog Output #09	12,21 %	Ok	Analog output	9	Device
Analog Output #10	12,21 %	Ok	Analog output	10	Device
Digital Input #11	Off	Ok	Digital input	11	Device
Digital Input #12	Off	Ok	Digital input	12	Device
Digital Input #13	Off	Ok	Digital input	13	Device
Digital Input #14	Off	Ok	Digital input	14	Device
Digital Output #15	-	Inactive	Digital output	15	Device
Digital Output #16	-	Inactive	Digital output	16	Device
Digital Output #17	-	Inactive	Digital output	17	Device
Digital Output #18	-	Inactive	Digital output	18	Device
Counter #20	0,00 Hz	Ok	Counter	20	Device
Counter #21	0,00 Hz	Ok	Counter	21	Device

Overall function is organized according to channels. As a rule, each channel delivers one measurement value. Channels can be added or deleted.

Configuring/setting the entire I/O module

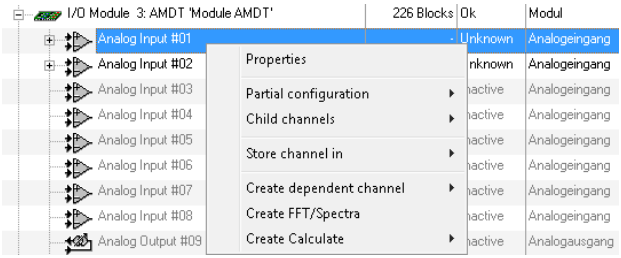
Open the configuration dialogue via the context menu (right-click) or double-click an I/O module.



The dialogue is described in Configuration/settings for I/O module.

Configuring/setting single channels

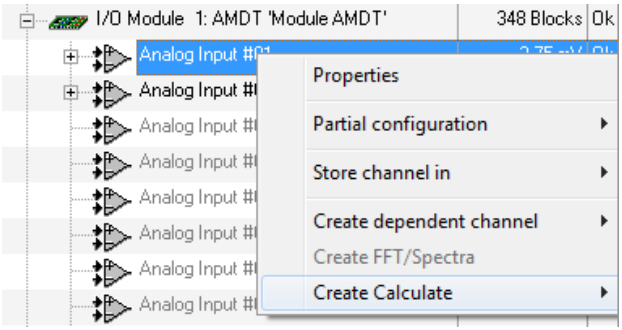
Open the configuration dialogue via the context menu (right-click) or double-click a channel.



The dialogue is described in Configuration/settings for analogue input.

Adding/deleting an FFT/spectrum or characteristic value channel

Add channels using the analogue input's context menu (right-click). Delete a channel using that channel's context menu.

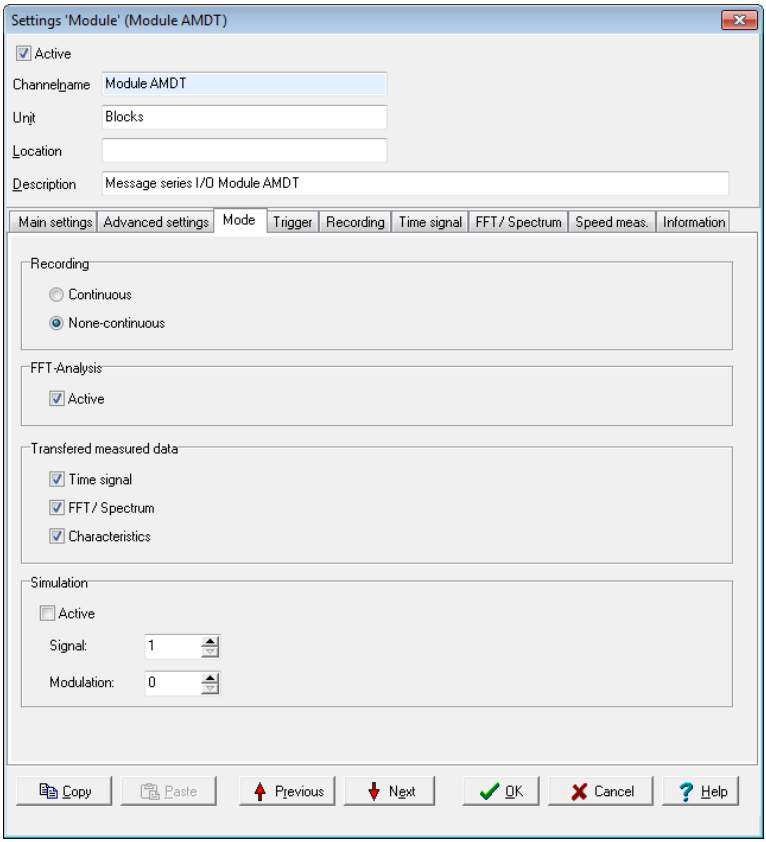


The dialogue is described in Configuration/settings for FFT/spectrum.

8.3.1.1 Configuration/settings for I/O module

I/O module settings are simultaneously effective for all analogue inputs. The most important settings are on the tabs: *Operating mode, Triggering* and *Recording.*

Operating mode tab



Recording

Choose the setting for the main operating mode:

Batch: Recording, analysis and measurement data transfer takes place in chronological sequence. Refer to the section Batch recording.

Continuous: Recording, evaluation and measurement data transfer takes place in parallel. Refer to the section Continuous recording.

FFT analysis

To enable/disable internal FFT analysis. This setting affects the options available on the *Recording* tab.

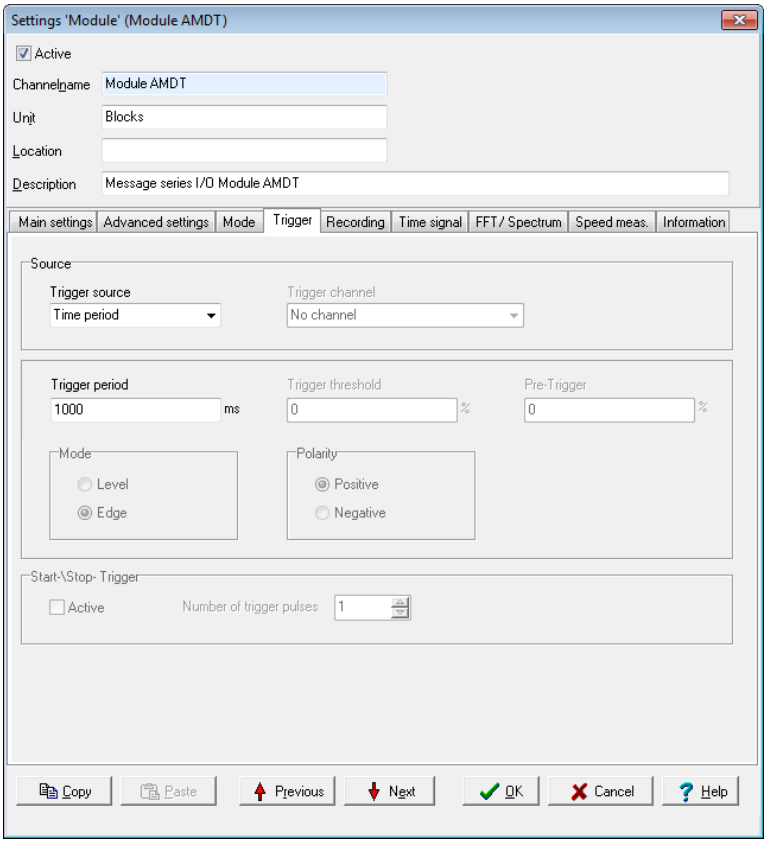
Transmitted measurement data

To globally set which of the three measurement data types are to be transmitted, irrespective of whether the corresponding channels have been created and are active.

Simulation

To enable signal simulation. Refer also to the section Signal simulation.

Triggering tab



Trigger source

A trigger event starts recording (i.e. signal acquisition). Select from four trigger-source options:

- Time period
  The I/O module's internal time counter is used to generate periodical trigger events.
- Analogue input
  The trigger source is one of the module's eight analogue inputs.
- Digital input
  The trigger source is one of the module's four digital inputs.
- Master
  The trigger source is a second AMDT I/O module. Refer to Synchronizing a second AMDT.

Trigger channel

Selects the triggering channel. This is always one of the I/O module's own channels.

Trigger period

To set a time period, between two trigger events, in the range 1 ms ... 60 s range.

Note: A short time period can extend the actual period when the total time is greater for recording, evaluation and data transmission.

Trigger threshold

For analogue input triggering, it sets the threshold value at ±0 ... 100% of the input measuring range.

Pre-Trigger

This option is available only for the *batch* operating mode.

For triggering via analogue or digital input, it sets the amount of signal pre-history as 0...100% of recording depth (i.e. signal length).

Mode and polarity

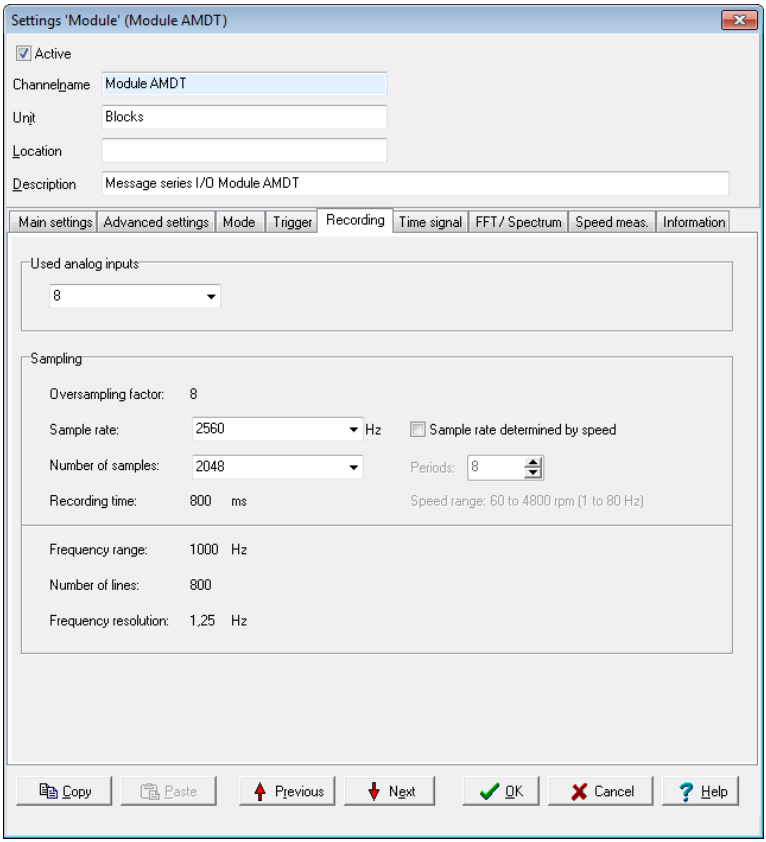
Sets the type of resolution. Analogue input: Over-run or under-run of the threshold/limit value. Digital input: For logical 1 or logical 0.

Start-stop trigger and number of trigger pulses

This option is available only for the *batch* operating mode.

This option dynamically controls the recording signal length for analogue or digital input triggering. Refer to the section Triggering and recording.

Recording tab



Analogue inputs used

Operation can reduce the number of analogue inputs from 8 to 4/2/1. This reduces the time for evaluation and for measurement data transmission, or increases the trigger rate. Some functions are available only for settings of ≤4 channels. Refer also to the section Project planning

.



This setting takes priority over the analogue inputs marked as active.

Sample rate

Sets the sampling frequency in the 256 Hz to 20480 Hz range. The setting is applied to all selected analogue inputs. The *Operating mode* settings affect the options that are available here.

Number of samples

The number of samples is set (i.e. measurement values) in the 128 to 8192 range for a time signal. The setting is applied to all selected analogue inputs. The *Operating mode* settings affect the options that are available here.

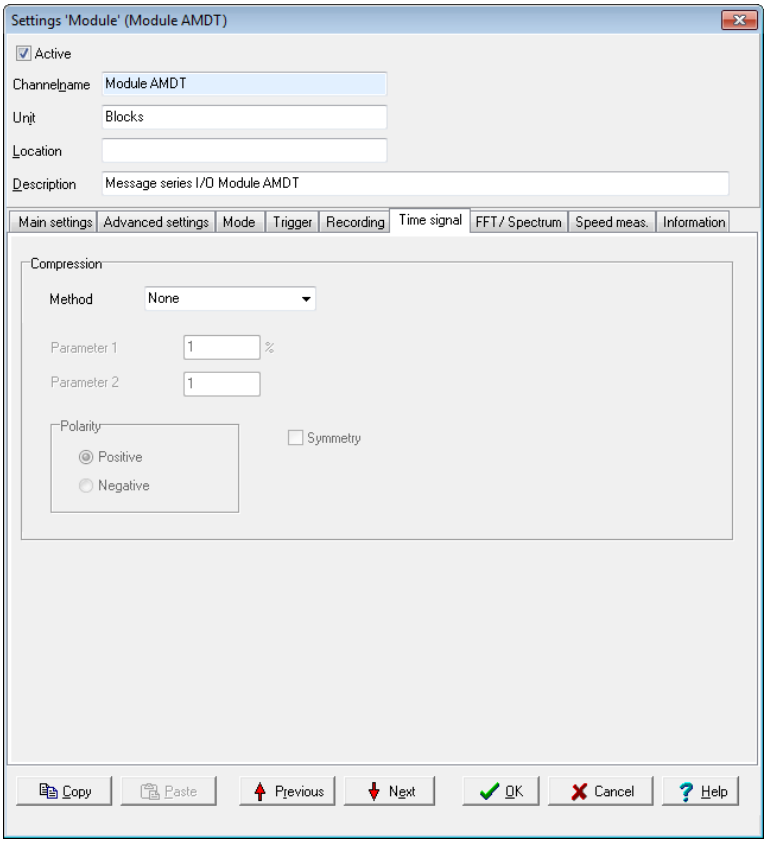
Recording time

Information about the time signal. It is determined from the sampling frequency and the number of samples and then displayed here.

Frequency range/number of lines/frequency resolution

Information about the frequency spectrum. It is determined from the sampling frequency and number of samples and then displayed here.

Time signal tab



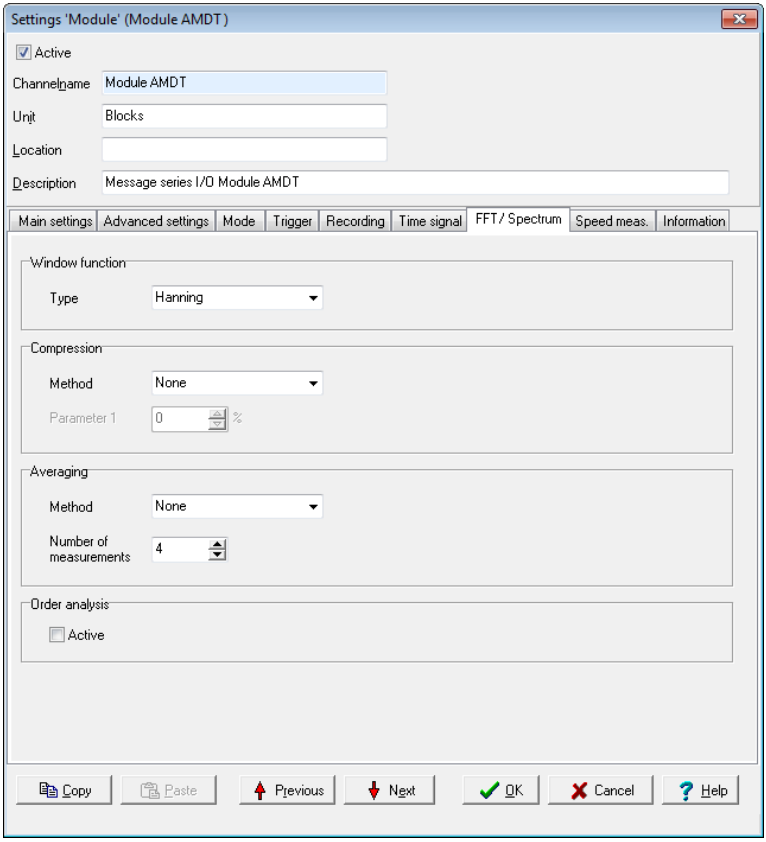
Compression

Time signals can be compressed prior to transmission. This can reduce transmission speed and increase storage capacity in the data logger memory. Select the required *Method*:

- None
  The time signal is transmitted without compression
- Log. compression (µ-law)
  Amplitude values undergo logarithmic compression, whereby the compression factor is 2:1. The amplitude error following decompression is ±2% max.
- Delta coding
  Amplitude values are transmitted as absolute (for minor changes) or relative (as differences). The compression factor ranges between 2:1 and 1:1. No compression/decompression loss.

- Minimum/maximum
  valuesThe time signal is reduced to the local maximum or minimum. More information is available in the "Applications using AMDT" manual (see section “Generator air-gap monitoring”).

FFT/Spectrum tab



Window function

Enables a weighting function for the time signal. The weighting is applied prior to running the FFT analysis. Options are "Hanning" (recommended for high frequency precision) or "Flat Top” (recommended for high amplitude precision).

Compression

Frequency spectrums can be compressed prior to transmission. This can reduce transmission speed and increase storage capacity in the data logger memory. Select the required *Method*:

- None
  The frequency spectrum is transmitted without compression.
- Log. compression (µ-law)
  Amplitude values undergo logarithmic compression, whereby the compression factor is 2:1. The amplitude error following decompression is ±2% max.

Averaging

A frequency spectrum can be averaged within the device via measurement cycles n = 2 ... 32.

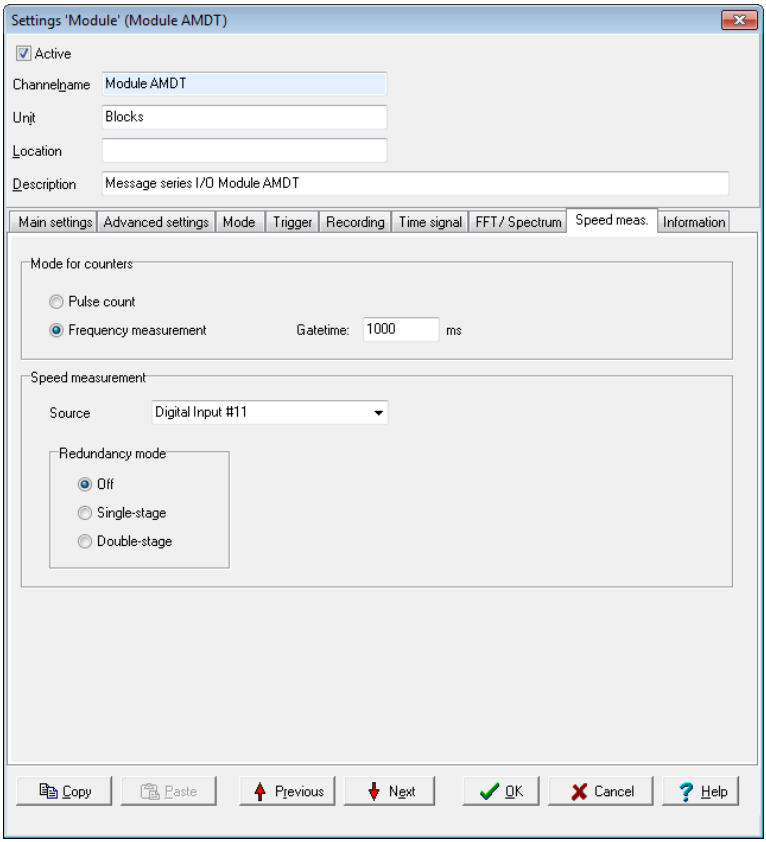
The *intermediate block values* setting transmits a frequency spectrum of the corresponding averaging level (1, 2, 3, ..., n) for each measurement.

The *End block value* setting transmits a frequency spectrum of the corresponding averaging level only after n measurements.

Order analysis

When order analysis is enabled, the evaluation software (e.g., **ProfiSignal**) will be informed that the measured frequency spectrum is to be displayed as an order spectrum. The spectrum is then normalised to the measured rotation speed. This requires that rotation-pulse is connected and frequency measurement is activated.

Rotation measurement tab



Counter mode

Both counters are assigned directly to the first two digital inputs.

Two modes are possible:

- Pulse counting
- Frequency measurement

Settings are simultaneously effective for both counters. *Pulse counting* is consecutive (16-bit = 65536) and reset is not possible. *Frequency measurement* takes place automatically in Hz. More information is available in the section Frequency and rotation speed measurement

Rotation speed measurement, source

Sets one of the digital or analogue inputs as the source for measuring rotation speed to which the FFT analysis is assigned. Key word: Rotation speed stamp for frequency spectrum and order analysis.

Digital input 1 or 2 should be used as the setting when frequency measurement takes place via one of these inputs.

Redundancy mode

Two rotation speed sensors and two digital inputs can be operated to achieve redundancy. Refer here to Redundant trigger source.

8.3.1.2 I/O module status/measurement block counter

Measurement data is recorded, evaluated and transmitted according to the I/O module settings and trigger events.

The DataService Configurator program displays a counter for the number of recorded measurement data blocks, as status information for the AMDT I/O module.

I/O Module 1: AMDT 'Module AMDT'	540 Blocks	Ok	Module	-	Device
Analog Input #01	3,05 mV	Ok	Analog input	1	Device
Analog Input #02	3,05 mV	Ok	Analog input	2	Device
Analog Input #03	-	Inactive	Analog input	3	Device
Analog Input #04	-	Inactive	Analog input	4	Device
Analog Input #05	-	Inactive	Analog input	5	Device

8.3.1.3 Configuring/settings for an analogue input

Refer also to the technical specifications for analogue inputs.

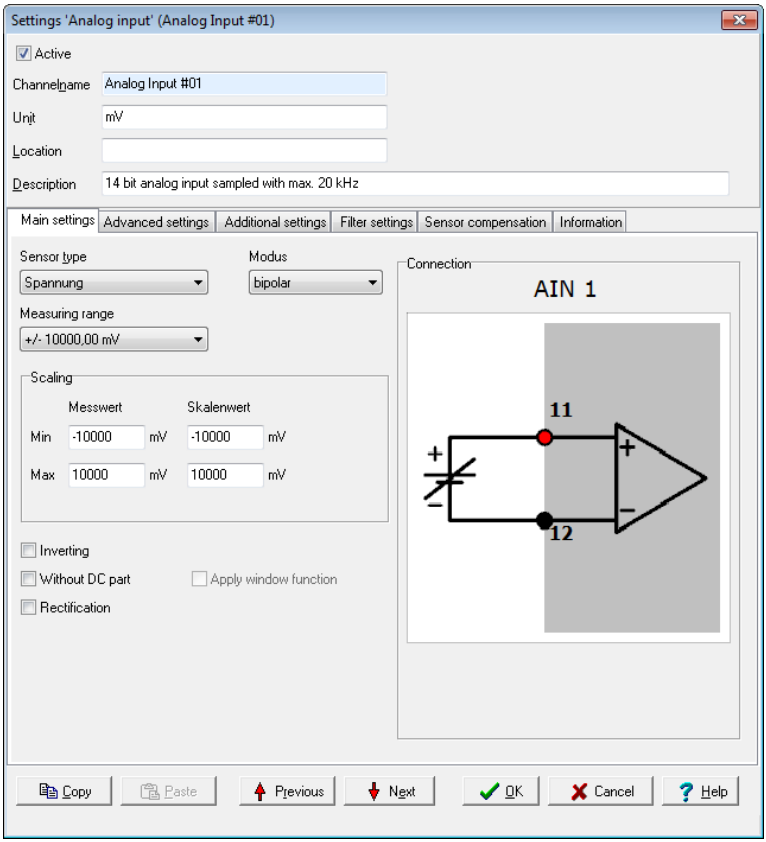
Active

Activating this channel transmits the time signal as a measurement data block following each triggering. Unrequired channels should be deactivated.



Additional settings for all "analogue input" channels can be found in the time signal tab for the I/O module. Refer to section Configuration/settings for I/O module.

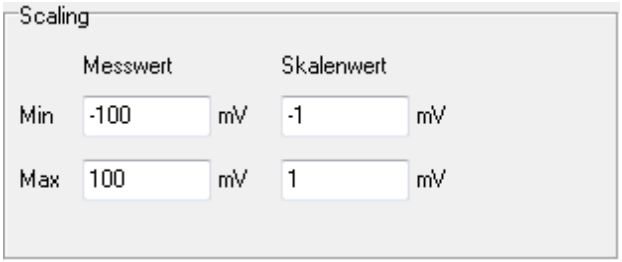
Main settings tab



Sensor type/Mode/Measurement range

Defining the input measurement range. *Sensor type* enables selection between a voltage and current interface. *Mode* enables selection between a bipolar and unipolar measurement range. *Measurement range* enables selection of one of 7 possible measurement ranges from ±10000mV to ±156mV.

Scaling/Unit



The four *scaling* fields contain scaling as a choice of 2 points of a linear allocation.

Example: Enter the unit g and the following *scaling* values for acceleration sensors with a sensitivity of 100mV/g:

Inversion

Activates signal inversion. Takes place following recording and prior to evaluation.

Without steady component

Eliminates a signal's steady component (also known as: DC component). Takes place following recording and prior to evaluation. The steady component is still available as a measurement value (arithmetic average characteristic value).

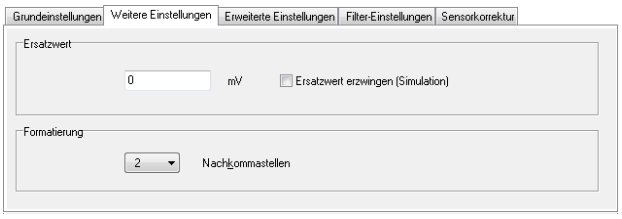
Using window function

Select this option to calm measurement data for a static vibration. Weighting is then applied prior to the arithmetic average being calculated. The signal's periphery is weighted lower and its middle higher.

Rectification

Activates signal rectification. Takes place following recording and prior to evaluation.

Additional settings tab



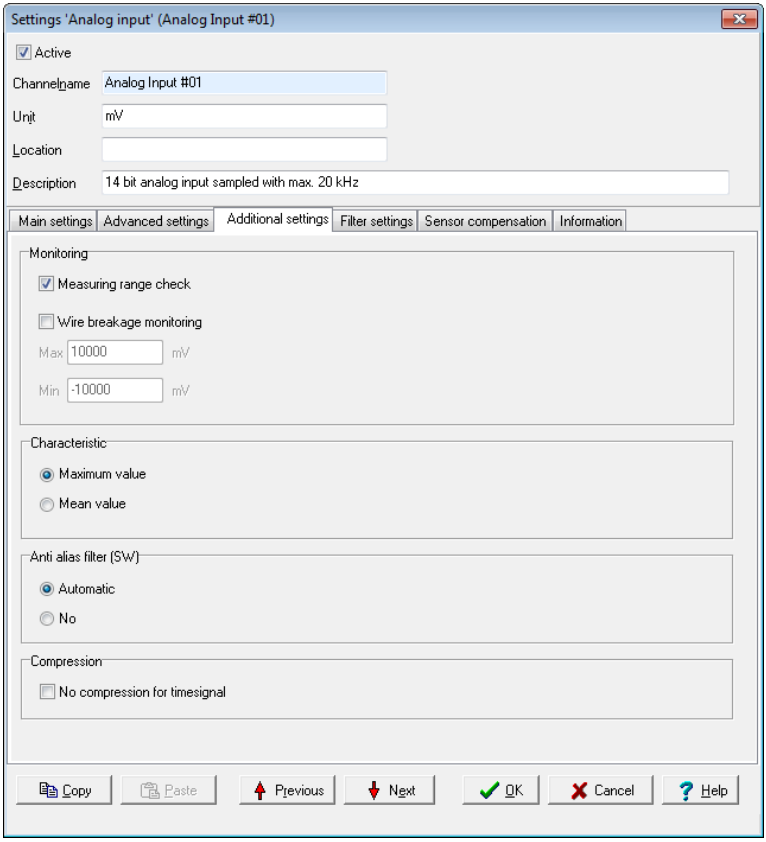
Replacement value

The value set here is transmitted as a measurement value when a normal measurement value is missing.

Format

The required number of decimal places for the measurement value is set, e.g. for display in the program DataService Configurator.

Advanced settings tab



Measurement range check

This option monitors whether the input signal remains within the voltage range (e.g. ±10 V).

Wire break monitoring

This option monitors whether the arithmetical average (DC component) of the input signal remains within the set voltage range.

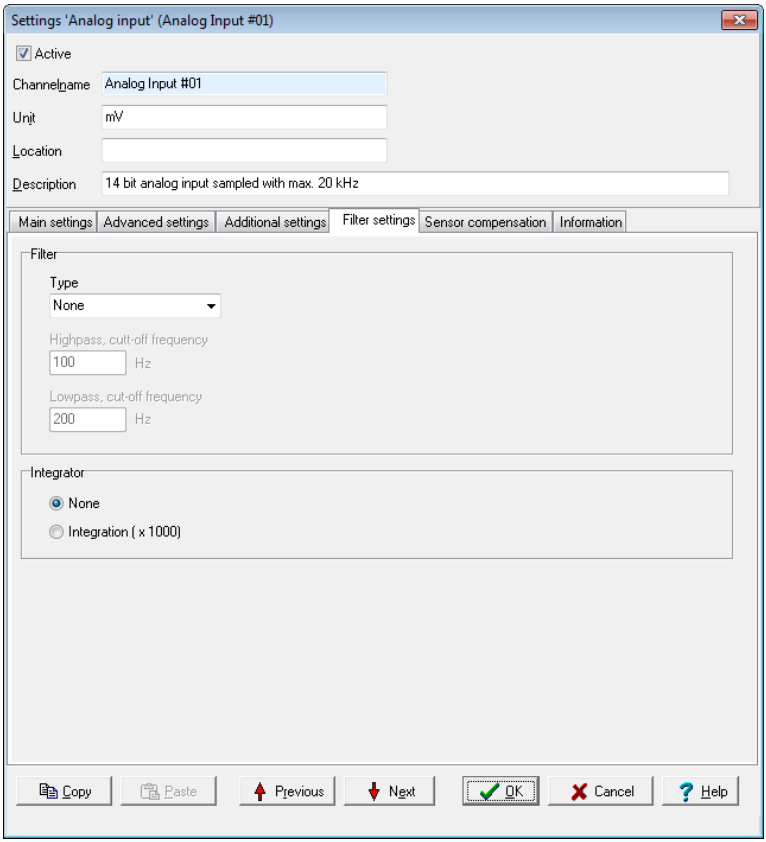
Anti-aliasing filter (SW)

The anti-aliasing filter software is a digital low-pass with a cut-off frequency around 40 % of the set sampling frequency. Select *automatic* to work with FFT analysis.

Compression

The I/O module can be set to compress measurement data for transmission of all active analogue inputs. Refer to the *time signal* tab in section Configuration/settings for I/O module. This option enables individual analogue inputs to be excluded from such compression.

Filter settings tab



Filter

Activates digital filtering of the time signal. Options are low-pass, band-pass or high-pass filters. A Butterworth characteristic is preset. Filter order is automatically set internally. Cut-off frequencies can be set at the 1 Hz to 10000 Hz range.



Using a digital high- or band-pass filter limits the number of analogue filters (depending on board version) to 1 … 4. An overview is available in the section on digital filters.

Integrator

Activates numerical integration of the time signal. The scaling factor is fixed at a preset value of 1000.

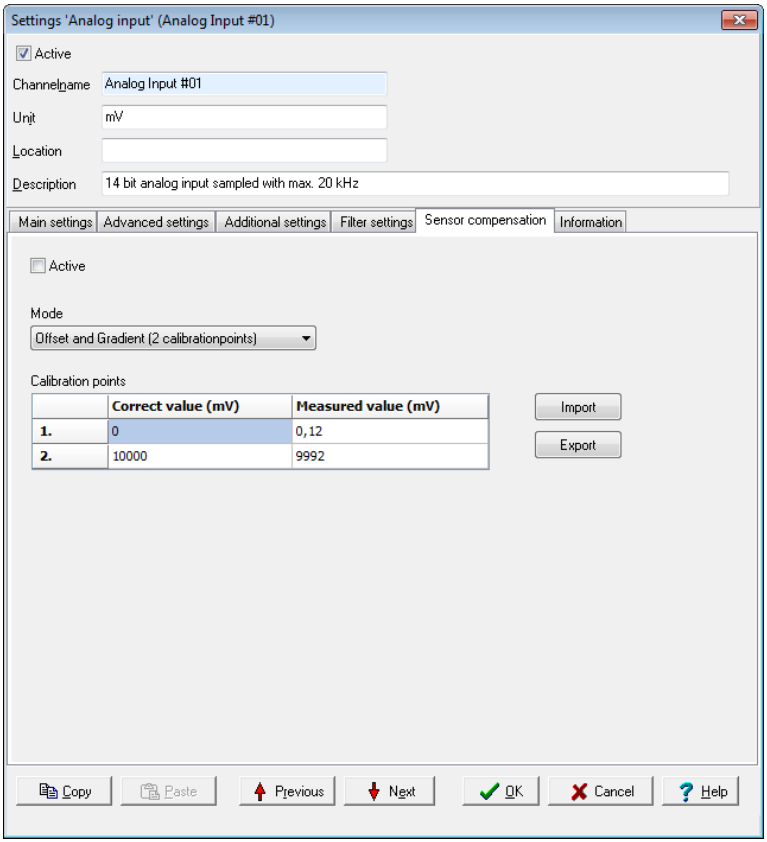
Examples of application:

For measurements using acceleration sensors, a vibration velocity signal (unit m/s2) is converted into a vibration speed signal (unit mm/s). Refer to the "Applications using AMDT" manual.



Using a digital integrator limits analogue inputs (depending on board version) to 1 ... 4. An overview is available in the section on integrators.

Sensor compensation tab

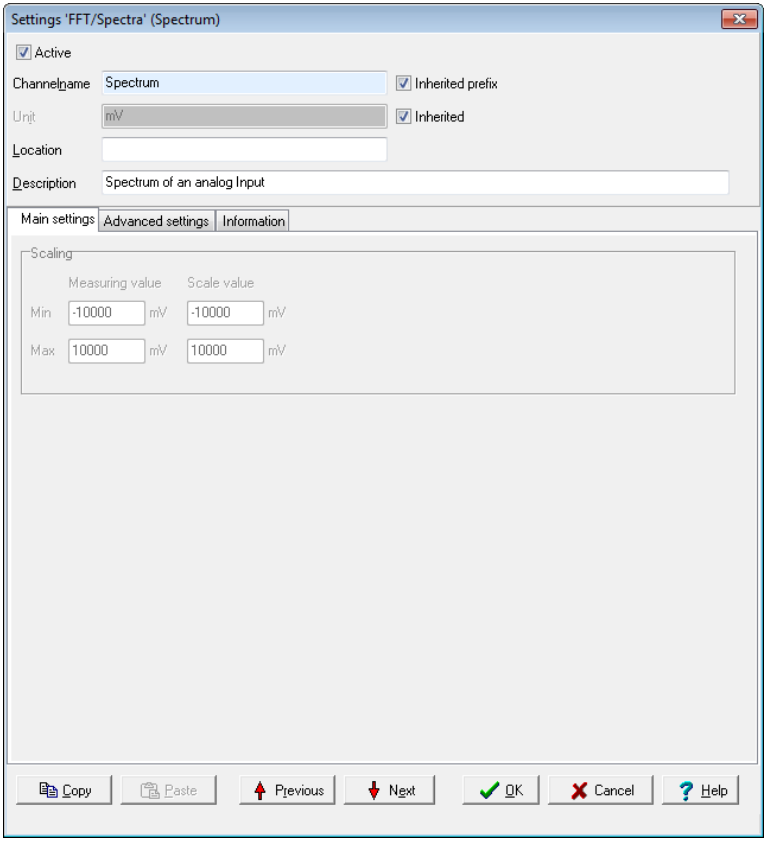


Mode/Calibration points

With active sensor compensation, compensation of zero point and amplification are performed. A simple variance analysis is used. Input is required of two points from the linear characteristic curve.

8.3.1.4 Configuration/settings for FFT/spectrum

Main settings tab



Active

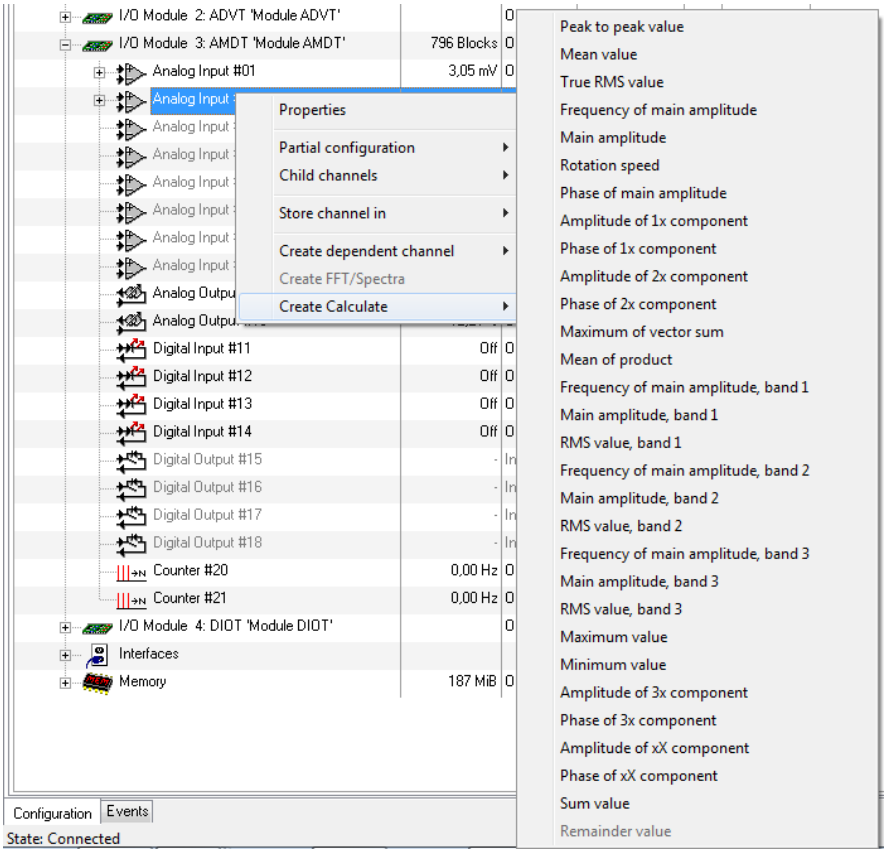
Activating this channel transmits a frequency spectrum as measurement data, following each triggering. Unrequired channels should be deactivated.

Scaling

The "FFT/spectrum" channel is derived from one of the analogue input channels and therefore inherits its scaling. The effective scaling is grayed-out here.

8.3.1.5 Configuration/settings for characteristic value

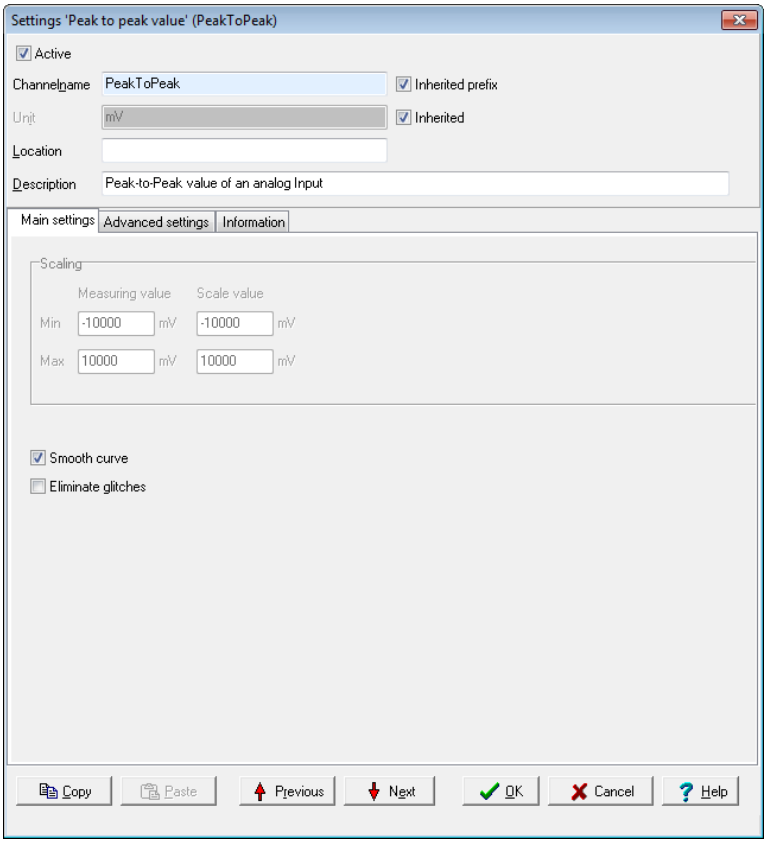
To add a characteristic value, click the source analogue input and right-click to display the required context menu – refer to image below. To delete, use the channel's context menu.



Refer also to characteristic values for technical specifications of particular characteristic values.

Main settings tab

Here is an example of a "peak-to-peak" characteristic value:



Active

Activating this channel transmits the selected vibration/wave characteristic value as measurement data following each triggering.

Measurement range/Scaling/Unit

The "Characteristic value" channel is derived from one of the analogue input channels and therefore inherits its scaling. The effective scaling is grayed-out here. Exceptions are those characteristic values that deliver frequency or phase measurements. Scaling is then preset to Hz or ° (degrees).

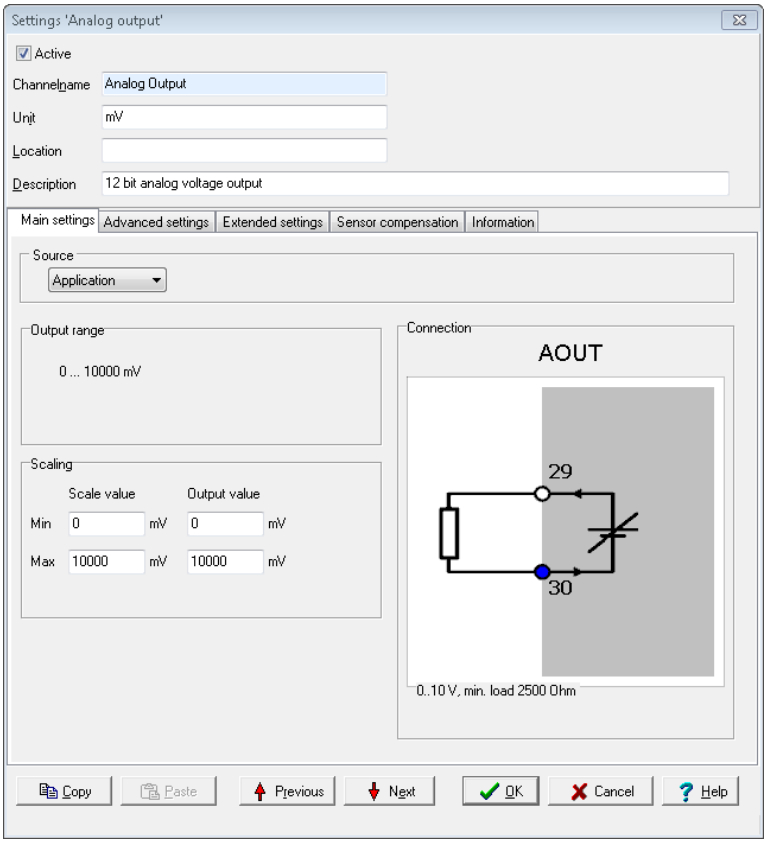
Refer also to Characteristic values for additional settings options.

8.3.1.6 Configuring/setting for analogue output

Refer also to the technical specifications for analogue outputs.

Output is always in the range 0 ... 10 V.

Main settings tab



Source

Source selects from various signal sources:

- *Application*: Output data is controlled via a **ProfiSignal** application.
- *Channel*: Output data is controlled via a DataService channel.
- *Manual value*: Output is entered and determined manually.

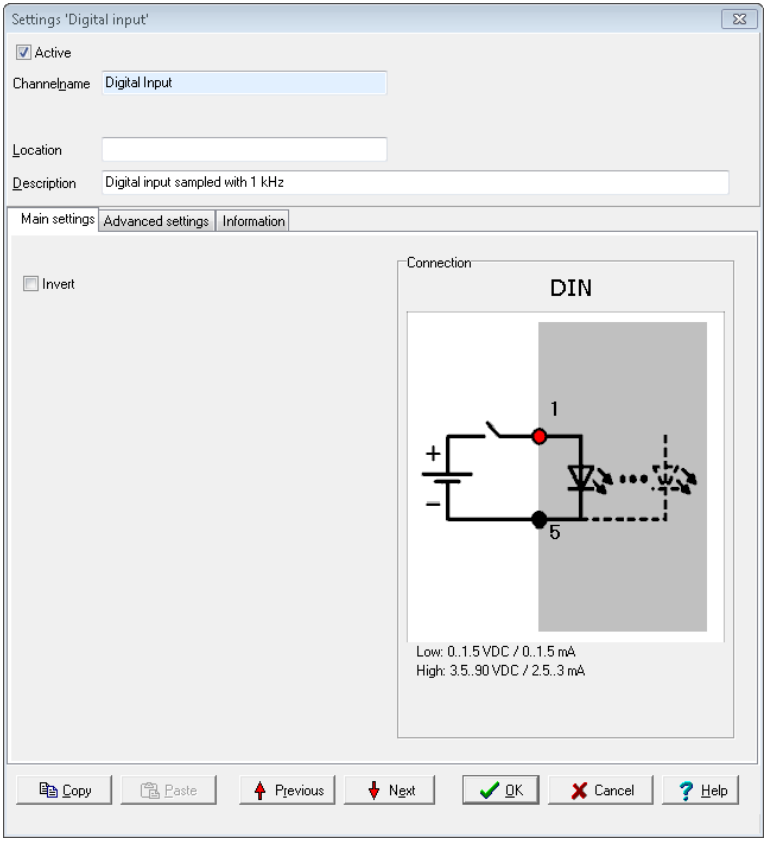
Scaling

Defines the physical basis for the output unit of measurement. In the example 0 ... 100 is assigned the output value 0 ... 10 V.

8.3.1.7 Configuration/settings for digital input

Refer also to the technical specifications of digital outputs.

Main settings tab



Inversion

Activates logical inversion.

8.3.1.8 Configuration/settings for counter

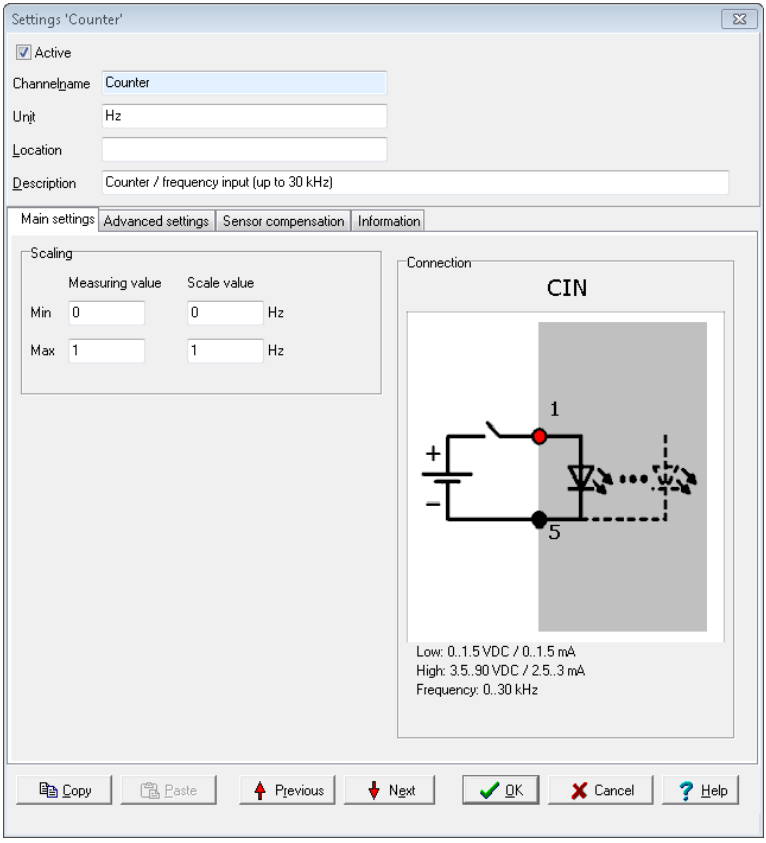
Refer also to the technical specifications for the counter and the section on Measuring frequency and rotation speed.

The (measuring frequency or counting pulses) mode is set in the *Rotation speed measurement* tab. Refer to configuration/settings for I/O module.

Unit

The preset unit for frequency measuring is Hz. Enter the required unit here.

Main settings tab



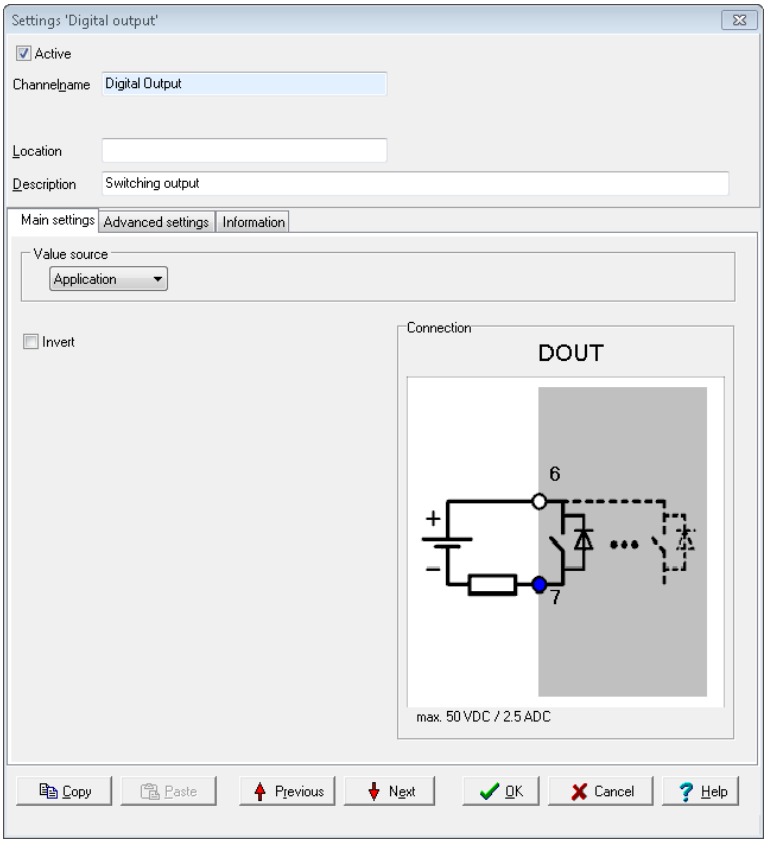
Scaling

The conversion factor setting is given here for the required unit of measurement. It's given as a choice of 2 points of a linear allocation.

8.3.1.9 Configuration/settings for digital output

Refer also to technical specifications for digital outputs.

Main settings tab



Source

Source selects from various signal sources:

- *Application*: Output data is controlled via a **ProfiSignal** application.
- *Channel*: Output data is controlled via a DataService channel.
- *Manual* value: Output is entered and determined manually.

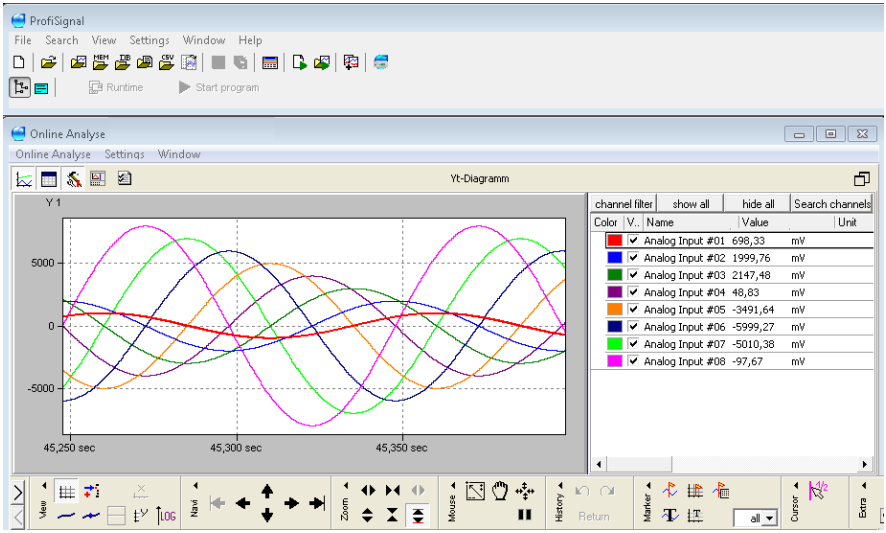
Inversion

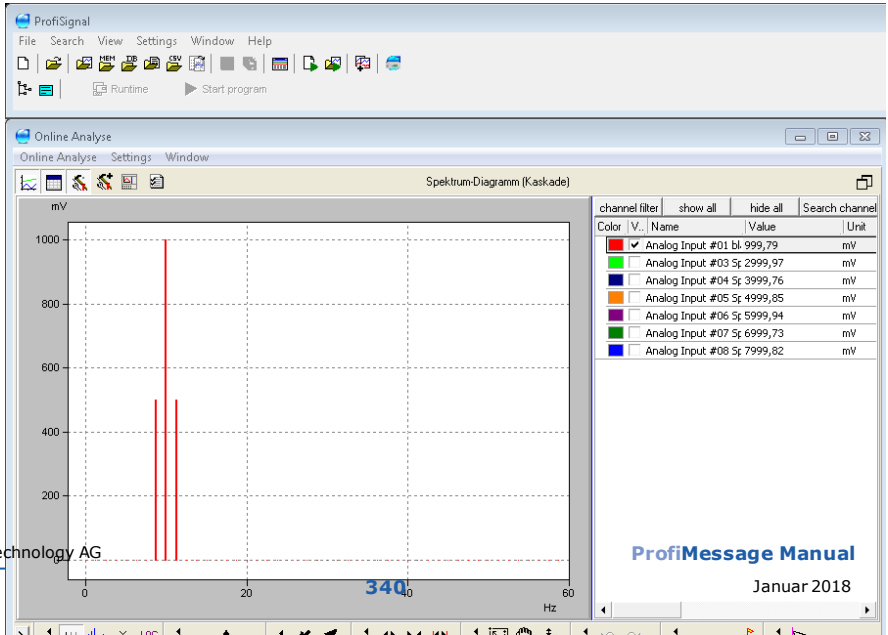
Activates logical inversion.

8.3.2 Visualisation using **ProfiSignal**

The **ProfiSignal**software is a complete solution for use in the area of data logging, analysis and visualisation. It supersedes former products, for example, VibroLab, BasisPaket or Process visualisation.

The following images show examples of a time signal diagram and a frequency spectrum diagram:





8.3.3 Update firmware

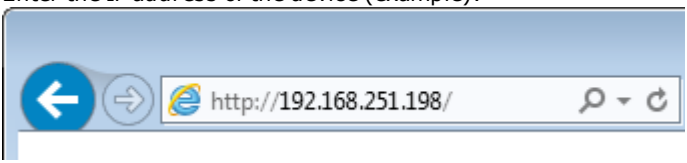
Firmware for the AMDT I/O module is included in the device firmware. Firmware updates take place via the device's ethernet interface and any internet browser. Refer to the sections on firmware updates in the device manual.



The device's power supply must not be interrupted during the firmware update, or damage may occur to the equipment that will require repair.

Method

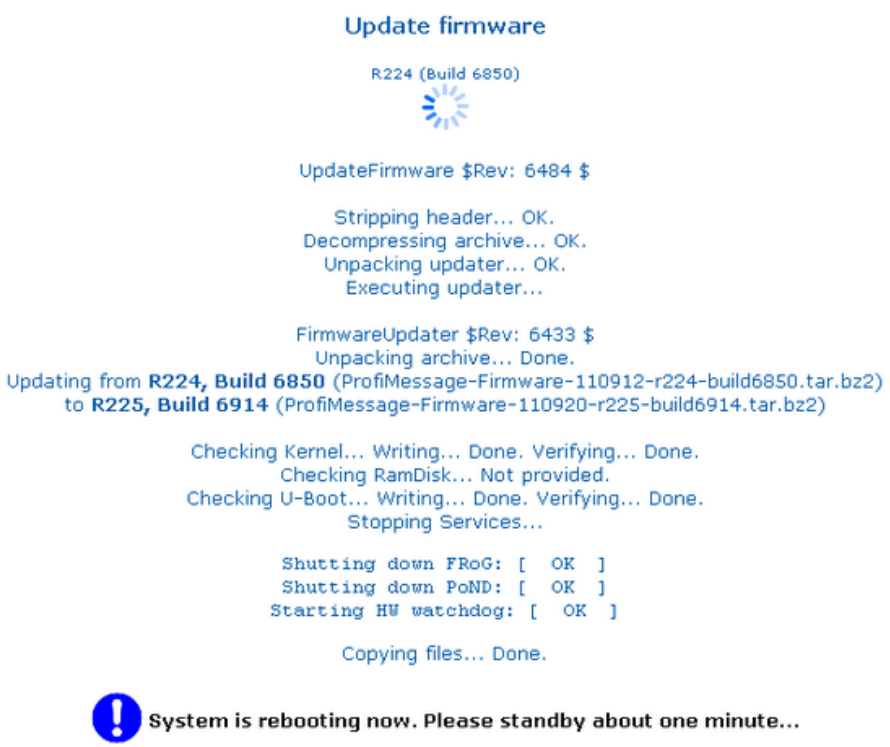
- Open your internet browser.
- Enter the IP address of the device (example):



- Click *Update firmware.*
- Enter the file with the new firmware in the *New firmware file* field (click *Search* to find the file on your PC).
- Then click *Start firmware update.*

The firmware upgrade takes 4 to 6 minutes.

The device will reboot (restart) after the update. A message is displayed during loading and when a restart has been completed:



The process finishes about one minute later. Then return to the home page (*Back*).

8.4 Information on applications

The "Applications using AMDT" manual contains information on typical industrial applications. It includes information on the fundamentals of applications, advice on connections, examples of configurations, and much more.

The manual deals with the following subjects:

- Measurement of absolute bearing vibration
- Measurement of relative shaft vibration
- Generator air gap monitoring

8.5 Information on older AMDT hardware

This appendix explains the features and differences of older hardware versions. AMDT board versions V1.0 to V1.2 were manufactured and supplied

from 2000 to 2005.

Analogue inputs

	AMDT V1.0 ... 1.2	AMDT V2.0
Measurement ranges	±10 V, alternatively ±25 V or ±2.5 V adjustable via jumpers	±10 V, ±5 V, ±2.5 V, ±1.25 V, ±625 mV, ±312 mV, ±156 mV, adjustable via software
Coupling	DC coupling	Preset DC-coupling, choice of AC-coupling via DIP switch
Max. sampling frequency	25 kHz	20.48 kHz
Oversampling	No	Yes
Anti-aliasing filter	Set by hardware (SMDs), possible to replace the signal conditioning board	Automatically adapts, with digital filter (DSP)
Potential isolation	A potential difference totalling ±2.5 V is permitted between the differential inputs ('-' connector).	A potential difference totalling up to 100 V is permitted between the differential inputs ('-' connector).
Input protection	up to 25 V	to ±250 V

Digital inputs

	AMDT V1.0 ... 1.2	AMDT V2.0
Input hysteresis	No	Yes
Input current, type	8 mA	3 mA
Updating	Coupled to analogue inputs (trigger)	Independent
Counter		
Frequency measurement	0.1 Hz to 100 MHz	0.2 Hz to 30 kHz
Measurement procedure	Pre-parameterised	Automatic

	AMDT V1.0 ... 1.2	AMDT V2.0
Updating	Coupled to analogue inputs (trigger)	Independent

Analogue outputs

	AMDT V1.0 ... 1.2	AMDT V2.0
Output range	±10 V	0 – 10 V
Updating	Coupled to analogue inputs (trigger)	Independent
Digital outputs		
Updating	Coupled to analogue inputs (trigger)	Independent

Other

	AMDT V1.0 ... 1.2	AMDT V2.0
Supply voltage	24 V	12 or 24 V

Digital filter

	AMDT V1.0 ... 1.2	AMDT V2.0
Availability	Low-pass/high-pass/band-pass for analogue input 1 ... 8	Low-pass for analogue input 1 ... 8, High-pass/band-pass for analogue input 1 ... 4
Filter order	Adjustable, 2/4/6/8	Automatically optimised , 4 or 8
Filter procedure	Batch or continuous	Always continuous

Digital integrator

	AMDT V1.0 ... 1.2	AMDT V2.0
Availability	Basic integrator for analogue input 1... 8	Basic integrator for analogue input 1... 4
Integrator procedure	Batch or continuous	Always continuous

Measuring phases

	AMDT V1.0 ... 1.2	AMDT V2.0
Availability	No	Yes for low rotation speeds, via time-zoom procedure

Envelope spectrum (for roller-bearing diagnostics)

	AMDT V1.0 ... 1.2	AMDT V2.0
Availability	Yes, via sequential mode	Yes, for analogue input 1 ... 4

9 Data transfer to USB memory stick

Acquired data saved to the device memory during operation can be copied to a USB memory stick without having to connect the device to a PC. There are two options for the transfer of data:

1. Data transfer without configuration
2. Data transfer with type of transfer configured on the device

The prerequisite for both options is the capability of transferring data to a USB memory stick. See Device memory.



The USB storage must be configured with the FAT32 filesystem; other file systems are not recognised.



Info

Use a USB flash drive with an LED that blinks during the data transfer.

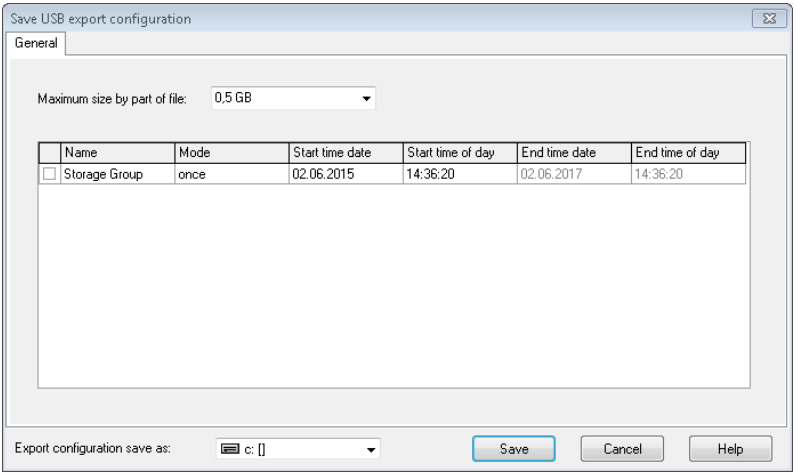
Data transfer without configuration

1. Plug in the USB memory stick.
2. After detection of the USB memory stick, data is transferred to the USB stick from the enabled storage groups. The transfer is complete when the USB stick's LED stops blinking.
   The data is copied only and is not deleted from the device.
3. Remove the USB memory stick.

Configuring data transfer

1. Insert the USB memory stick into a PC running the DataService Configurator program.

2. Open the configuration dialogue from the 'Memory' group's Save USB export Configuration context menu.



3. Select the required (memory) mode:
   One-off: Data is saved for the specified period.
   Incrementally: All newly data acquired since the last save is saved. Saving takes place after removal and reinsertion of the USB memory stick.
4. Enter the USB memory stick's drive (in the dialog's lower left corner).
5. Click *Save.*
   The configuration file is saved in XML format to the USB memory stick.
6. Eject the USB memory stick.

When the USB memory stick is inserted into the device the XML configuration file is read and the corresponding data transferred to the USB memory stick. The data is copied only and is not deleted from the device.

Saving ends when either:

- all data from the selected memory group(s) for the set time periods has been saved in full
  or
- the date has been saved with a time-stamp of the current time.

The data transfer is complete when the USB stick's LED stops blinking. A new saving process begins only on removal and reinsertion of the stick.

10 Appendix

10.1 ISO 9001 certificate

Lloyd's Register LRQA

Zertifikat

Hiermit wird bescheinigt, dass das Managementsystem von:

Delphin Technology AG

Lustheide 81, 51427 Bergisch Gladbach, Deutschland

durch Lloyd's Register Quality Assurance geprüft und bewertet wurde und den folgenden Normen entspricht:

ISO 9001:2015

P.G. Cornelissen

Ausgestellt von: Lloyd's Register Deutschland GmbH für und im Auftrag von: Lloyd's Register Quality Assurance Ltd

Bestehendes Zertifikat: 01. Juli 2017
Dieses Zertifikat ist gültig bis: 30. Juni 2020
Zertifikat-Nr.: 10019410

Erstmalige Zulassung:
ISO 9001 – 27. Juni 1996

Gültigkeits-Nr.: ISO 9001 – 0017728

Das Managementsystem ist anwendbar für:

Entwicklung, Herstellung und Wartung von Datenloggern, Monitoring- und Messdatenerfassungssystemen, einschließlich zugehöriger Software.

UKAS MANAGEMENT SYSTEMS
001

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Ausgestellt von: Lloyd's Register Deutschland GmbH, Adolf-Grimme-Allee 3 50829 Köln Germany für und im Auftrag von: Lloyd's Register Quality Assurance Ltd, 1 Trinity Park, Bickenhill Lane, Birmingham B37 7ES, United Kingdom

10.2 EC declaration on conformity

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EG-Konformitätserklärung

nach der Richtlinie: 2004/108/EG (Elektromagnetische Verträglichkeit)
nach der Richtlinie: 2006/95/EG (Niederspannungsrichtlinie)

Wir erklären, dass das nachstehend beschriebene Produkt,

Produktbezeichnung Message Series
Typ oder Modell Top-/ProfiMessage inkl. der Einbaumodule
ADIT, ADVT, ADGT, AAST, AMDT, ADFT, IOIT, OTPT, DIOT

den technischen Bestimmungen, einschließlich deren zum Zeitpunkt der Erklärung geltenden Änderungen, entsprechen.

Folgende Normen/Richtlinien wurden angewandt:

EN 61 326-1:2006	- Elektrische Mess-, Steuer-, Regel- und Laborgeräte-EMV Anforderungen
EN 55011:2007 + A2:2007	- ISM Geräte - Störaussendung
EN 61010-1:2001	- Gerätesicherheit

Anschrift des Herstellers:

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Diese Erklärung ist unter eigener Verantwortung des Herstellers und falls erforderlich, seines autorisierten Repräsentanten ausgestellt worden.

Kontaktperson:
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Bergisch Gladbach, den 08.02.2017

Delphin Technology AG

CLAUDIA ZIMMER
(VORSTANDSVORSITZENDE)

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