Expert Transient

HARDWARE MANUAL

Expert Transient – Installation and start-up

Delphin Technology

Contents

Delphin Technology AG

1   Introduction

Dear User,

Thank you for purchasing a device from the **Expert Transient** 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. Siehe auch "Potential differences" on page 238.

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 Win-
  dows 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:

<table>
<tr><td>⚠️</td><td>**WARNING!**</td></tr>
<tr><td colspan="2">**This symbol warns of a potential hazard which - if the safety requirements are not followed - may be fatal or cause serious physical injury.**</td></tr>
</table>

STOP **Indicates important inform-
ation.**

Info
Refers to a special option or explains an interesting fea-
ture.

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

$$C\,E$$

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

1.4 Included in delivery:

Included in delivery:
- **Expert** Transient device
- Connecting plugs for inputs and outputs and power supply
- Brackets for rail mountings
- Ethernet crossover cable
- **ProfiSignal** Software DVD
- Quick Start Guide
- Screwdriver

2 Getting started

The device is designed for use as a modular measurement, control, and monitoring device and is fitted with many settings and connection options. They are also equipped with a range of inputs and outputs, field bus interfaces, and software channels to enable the performance of monitoring, control, and regulation tasks. The device has 16 GB internal memory and can function as a stand alone independent unit. Data that has been acquired can be transferred via interfaces in runtime mode, via time-controlled events, or via the device's available interfaces.

This section outlines:

- How to set up the device.
- Which programs must be installed.
- How to establish a connection between a PC and the device.
- The settings required to acquire measurement signals from the device.

2.1 Installing programs

You need administrator rights to install the program.

Install the **ProfiSignal** CD. 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:

DataService Konfigurator

ProfiSignal

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

Info

As an alternative to the procedure described here, you can set the IP address and subnet mask used also via the **Expert Vibro Expert LoggerExpert Transient** device's display, see Network configuration via the display.

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.
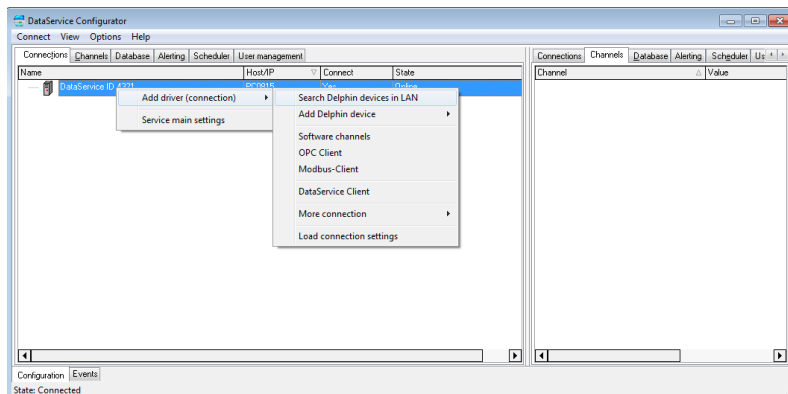
3. The device search takes place and a dialogue with the found device(s) is displayed.
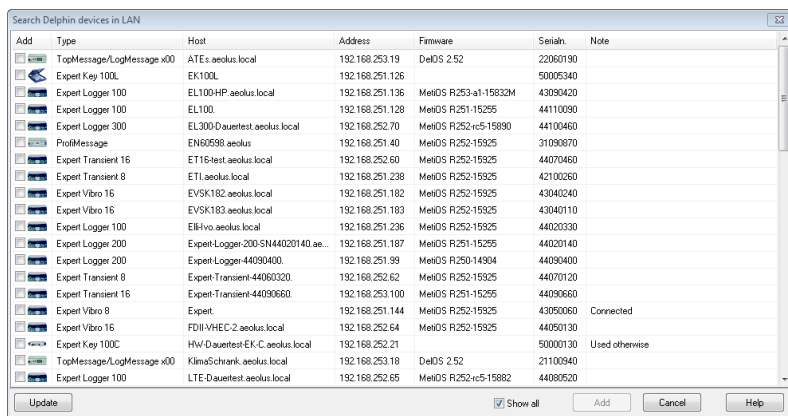
4. In the *Add* column, enable the device or devices that you want to connect to. Then click *Add*.
   If the device IP address does not correspond with that of your PC, you must first assign a different network address. If no devices are found, for example, if the scan required for searching (port 16555) 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.

Die Angaben in der Zeile DataService…, Spalte Host/IP sid der Hostname oder die IP-Adresse Ihres

6. PCs.
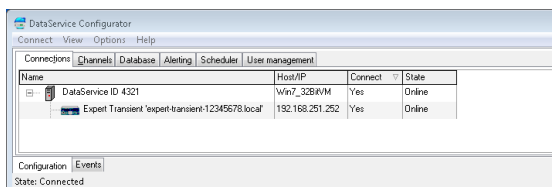
Set different network address

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:
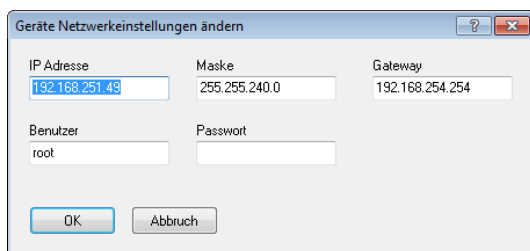
Enter a suitable IP address corresponding to your PC IP address (similar but not the same) and subnet mask. For a new device, use the *root* user, username and password are then only relevant if you have enabled User management on the device. Enter the required data and click *OK*. The settings are saved 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*.
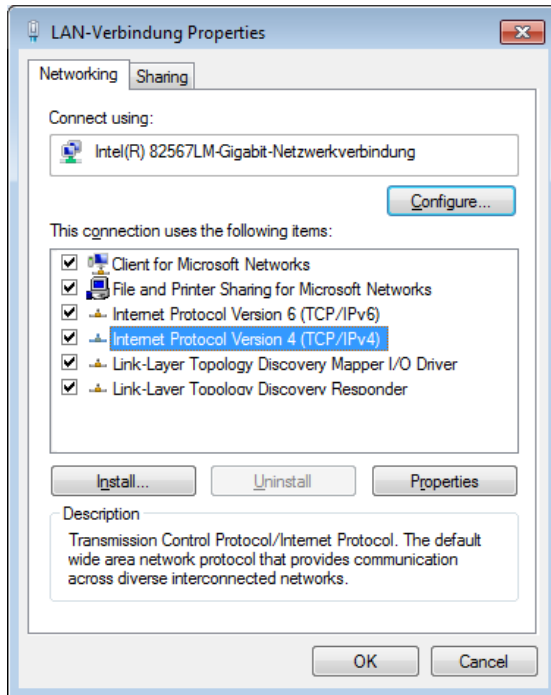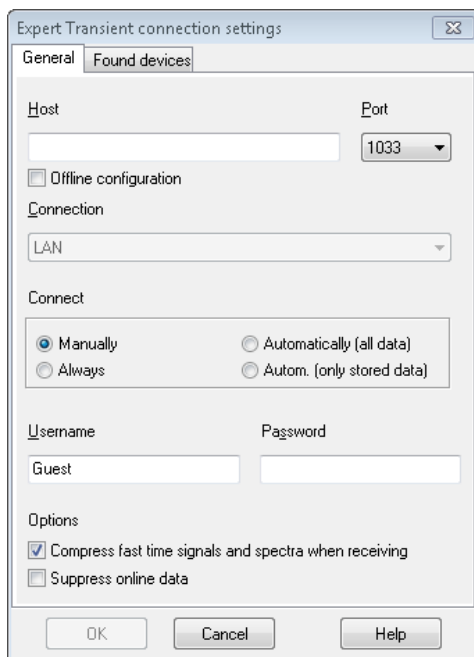
5. In the following dialogue you can either enter a fixed address for your PC or – if the PC is set to DHCP and to be used in the LAN – use the option of specifying an *Alternative configuration* for cases where the network

(server) is unavailable (recommended procedure).

Internet Protocol Version 4 (TCP/IPv4) Properties

General | Alternate Configuration

If this computer is used on more than one network, enter the alternate IP settings below.

- ○ Automatic private IP address
- ● User configured

IP address: 192 . 168 . 251 . 1

Subnet mask: 255 . 255 . 255 . 0

Default gateway: . . .

Preferred DNS server: . . .

Alternate DNS server: . . .

Preferred WINS server: . . .

Alternate WINS server: . . .

☑ Validate settings, if changed, upon exit

OK | Cancel

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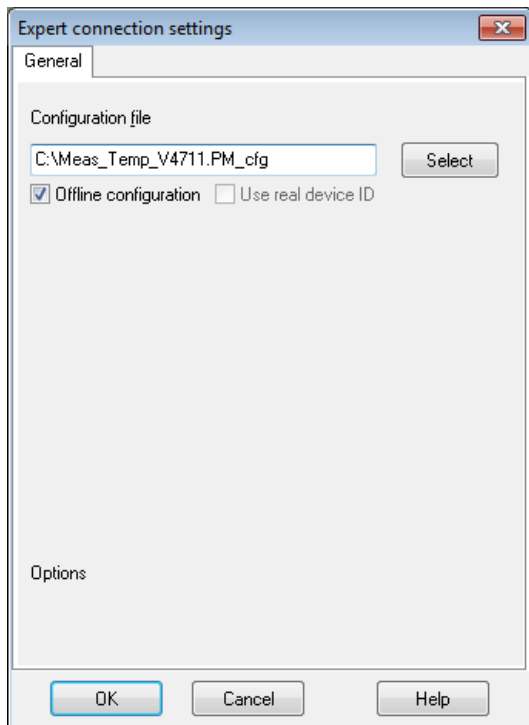
Enable *Offline configuration* and enter the path and filename, or click on *Select*, to search for the file.

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

STOP **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.
- Connect the three-pin plug to an appropriate power supply and plug it into the 'Power' socket on the device.
  - **Expert** devices: 12 … 24 VDC

The plug is non-interchangeable and polarity-protected and can be inserted into the socket in only one direction.

The next steps are:

- Installing programs
- PC connection
- Basic settings

2.4 Basic settings

The dialog is split enabling a device to be selected on the left under Connections and settings to be made on the right under ChannelsDataService Configurator.
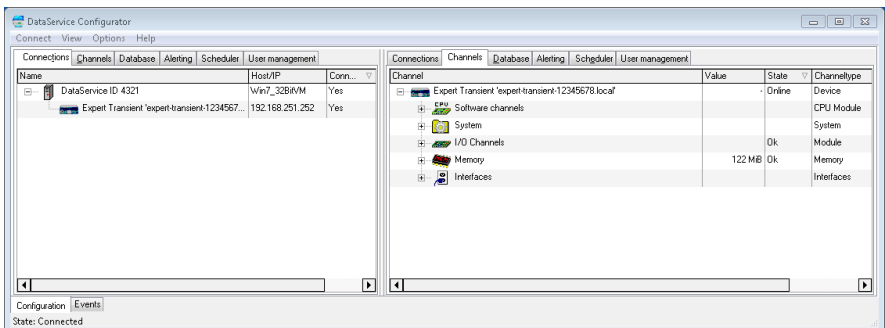
Displaying measurement data

Once a connection has been established (see the previous Section) current measurement data can then be displayed. Double click on the right side on your device and then on *I/O Channels* to open the entry and display all available channels or channel groups. The *Value* column continuously updates with new measurement data. 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* under Configuring I/O modules channels. The dialog also displays connection diagrams. Under I/O module connection terminal blocks you will find the terminal assignments for the I/O module of *LogMessage* or *ProfiMessage*.

Other settings

- Setting digital I/O
  Scaling can also be made for counter inputs. Set which signal (channel) requires output of a constant level.
- Specific settings for a device
  Options are available for system monitoring, for example CPU utilisation or available memory, and interface configurations.
- Calculation channels (subordinate channels)
  Your **Delphin** device is capable of processing data before it is saved and output. The corresponding settings are described in configuring software channels.

3 Expert Transient displays and connections
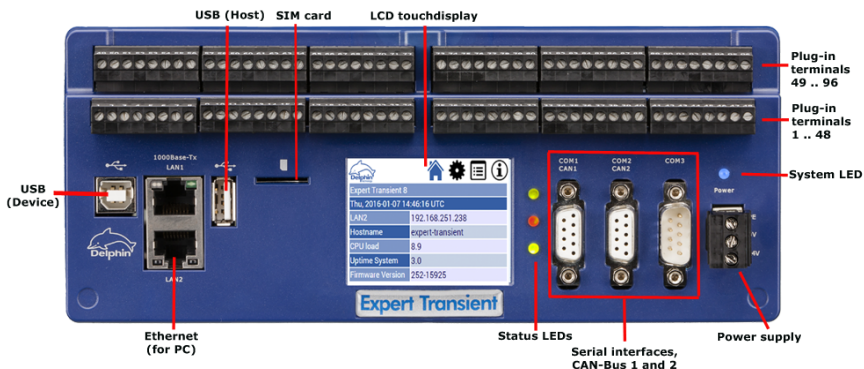
Die Beschreibung der Anzeigen und Anschlüsse finden Sie in den folgenden Abschnitten.

- Power supply
- Display and LEDs
- COM interfaces and CAN bus

3.1 Power supply

Input voltage: 12 VDC – 24 VDC ±10%

Pmax power input: 10 W

Pin assignment

Pin	Label	Description
Top	PE	Protective Earth, refer to Earthing
Middle	0V	Neutral

Pin	Label	Description
Bottom	24V	Power supply

3.2 Display, LEDs

Display

The display is touch-sensitive, so you can call up the corresponding menu items by tapping. You can also connect a mouse to the USB port and click on the menus and icons with the mouse pointer.

The interface settings are explained in Network configuration via the display, the symbols and menus are described in Configuring and operating the display.

LED indicators

Power LED

The power LED is lit permanently, when a correct power supply is connected. The LED flashes briefly every 5 seconds for approximately 0.1 s in energy saving mode.

LEDs next to the display

The LEDs next to the display indicate sign of life (LED 1) and read/write access to the memory (LED 2) by default. Configure the LED display in DataService Configurator via *System → LED*. When doing so, please note that the LEDs can be either red or green only. Therefore, leave the source for the other state at *None*.

LEDs LAN2 (PC interface)

LED	Status	Description
Left	On	Link
	blinking	Data transfer
Right	1 x blinking	10 Mbit
	2 x blinking	100 Mbit
	3 x blinking	1 GB

3.3 COM interfaces, CAN bus

COM1/2 and CAN1/2

Pin assignment 9-pole Sub-D socket

Pin	Signal	Description COM1/2 RS-485 (IEC 61158)	Description CAN1/2 (CiA DS102-1)
Housing	Shield	Shield / protective ground, refer to Earthing	
1	Shield	Shield / protective ground, refer to Earthing	
2	CANL	—	CAN bus low
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	CANH	—	CAN bus high
8	RxD/TxD-N/A	Receive/transmit data-Minus (RS-485)	—
9	—	Not connected	

No galvanic isolation between CAN1 and COM1 or CAN2 and COM2.

COM3

Pin assignment 9-pole Sub-D plug

Pin	Signal	Description COM3 DIN 41 652, part 1 (ISO 4902)
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

3.4 Sensor connection (sensor terminals)

Sensor terminals 1 to 48
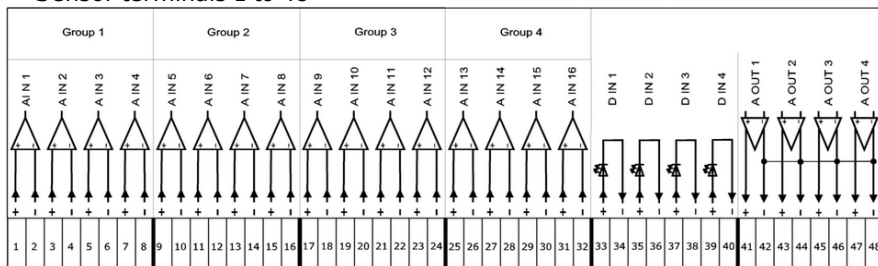
Sensor terminals 49 to 96
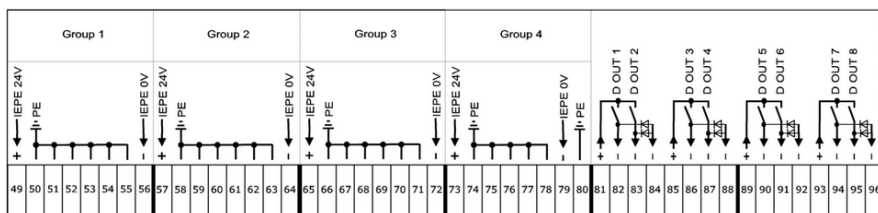
4   Configuration and operation

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.
- Configuration of the display, as well as an explanation of the display's symbols and menus, are available under Configuring and operating the display.
- Channel configuration of the various I/O modules is explained in detail under Configuring channels (sensors).

Settings and operation, which are the same for all **MetiOS** 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. Eine ausführliche Beschreibung des Programms DataService Configurator finden Sie auch im Handbuch zum DataService-Konfigurator.

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 dialog is split enabling a device to be selected on the left under Connections and settings to be made on the right under Channels. The device itself is considered a 'channel' and in the example is listed as '**Expert Vibro** 'ExpVib-SN4108…'.
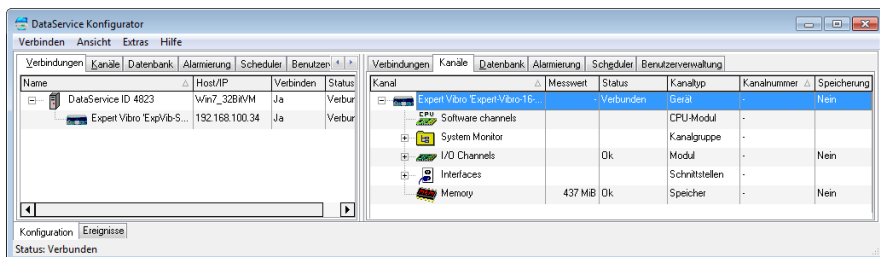
Channel configuration

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

Amendments to configurations to take immediate effect with the previous settings being overwritten. The new settings are saved to the **Expert Vibro** device's non-volatile memory 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 Configuring the network via the display

The settings that you can make in the display relate to the basic setting required to enable communication via the Ethernet interface. Additional settings are required for device operation, see Settings for Internet browser configuration or Network settings for configuration via the DataService Configurator.

After changing the *IP address* or *subnet mask* the device is then accessible only via the new address. The PC's IP address (and any subnet mask) then also requires amending to establish a connection if required.

Tap ⚙ on the display to call the network settings main view. This allows you to make the settings for the PC interface:
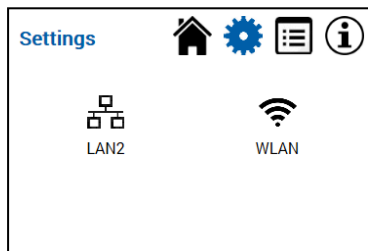
By tapping on the relevant symbol for LAN2 or WLAN, the corresponding settings dialogue will open. These are described below:
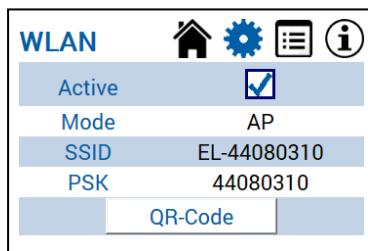
This screen gives you two action options. Under the "Active" item, you can enable or disable the WLAN module. The QR code button opens a further view, with which the "Android" mobile operating system can be set up by QR code.

Start the QR code app on your Android smartphone and align it with the displayed code. The smartphone WLAN connection will be set up according to the Expert device settings.
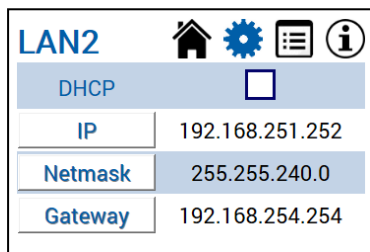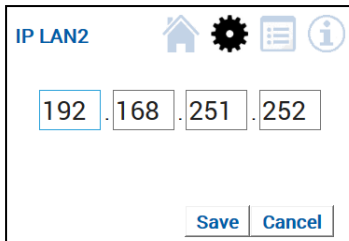
Settings
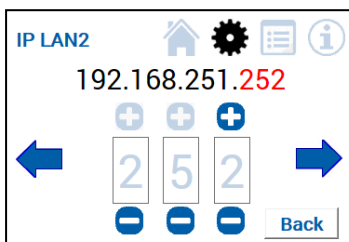
If you enable DHCP (tap on the checkbox), the device tries to obtain an IP address from the DHCP server automatically. While DHCP is enabled, no manual settings can be made for IP address, net mask, or gateway. The corresponding fields are greyed out in this case.

To change the IP address, net mask, or the gateway, please tap the corresponding button. This will take you to the following views:

IP address
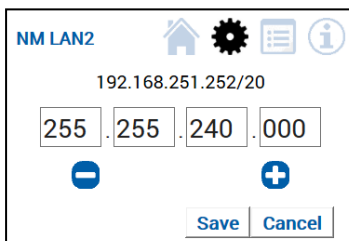
To change the IP address, please tap one of the displayed IP blocks. This takes you to a further view:

Here, by tapping '+', or '-', you can change individual figures in the red highlighted IP blocks. Using the arrows to the left or right, you can toggle between individual IP blocks.

Important: your settings are made only after clicking "Back" and then "Save". To discard changes made, please tap on "Back" and then "Cancel".

Net mask

Here, by tapping '+', or '-', you can set the desired net mask. You may set only allowed values for the net mask.

Important: your settings are made only when you click "Save". To discard changes made, please tap "Cancel".

Gateway

The views and functions for setting the gateway correspond to those for setting the IP address (see above).

Note: A gateway address is required only if connections are to be established to other networks.

4.3 Configuring and operating the display

In addition to the network configuration described in the previous Section, various additional information is available via the navigation area at the top right of the device display, which is described in this Section.

Homescreen

Tap the top ⌂ right hand corner to call up the start (home) page:

Configure the lines shown here in System → Display in DataService Configurator, see Display. Seven lines can be displayed.

Channel view

Tapping the ▤ icon takes you to a view containing the current device channel contents:

All available channels and their current values are displayed here, sorted in alphabetical order. You can scroll through this list in steps or blocks using the navigation arrows on the right-hand side. Tapping on a channel content displays the channel name and content full-screen on the display. You can return to the list view using "Back".

Information

Tap ⓘ. The device hardware and software versions, and serial numbers for example, are then shown.

4.4 Configuration via an Internet browser

The Web configuration is performed by entering the IP address (or the DNS name for networks) in the browser's address bar. Any current browser can be used. Cookies are not required for the functions and JavaScript is used only for date and time settings.

Info

To return to the main page either click the *Back* button on your browser or click *Back* right at the bottom of the respective window.

Settings via the Web interface are made in the following four sections: Configuration, Service and System. To display current status of the NTP or PTP client click on the respective link, see "NTP/PTP status" on page 34. Most of the settings made through the Web interface can also be made via the DataService Configurator.

Example: Internet browser display for a device with name "**Expert Transient**-SN12345678" and IP address 192.168.251.252.

Expert Transient 8 *"expert-transient-12345678.local"*

Firmware: **MetiOS R253, Build 16606** (ExpertTransient-MetiOS-r253-build16506-160502.tar.bz2)

Serial №: **44070120**

Current time: Thu, 2016-06-02 13:44:49 CEST

NTP status: ✔ synchronised to NTP server (192.168.248.40) at stratum 3

PTP status: ✔ Clock status : calibrated, in control

Server status: ✔ is running.

Last boot: Tue, 2016-05-17 12:34:06 CEST , Reason: PowerON

Uptime system: 16days 1h 10m 55s

LAN status: Speed: 100Mb/s; Duplex: Full; Link detected: yes;

Configuration	Show configuration table	Channel default configuration
	Live channel values	Factory default configuration

Service	System report	PuTTY
	Browser information	PROFIBUS GSD file (Bitmaps)
	Hardware test certificate	XML template network config file
		USB Networking driver (Windows XP and later)
		USB Networking driver (Windows 7 and later)

System	Update firmware MetiOS	MetiOS changelog
	Reboot	Recalibrate touch screen
	Restart server	

Home

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4.4.1   Settings

You can make network and time zone settings in this area. You can obtain NTP status or PTP status information by clicking *NTP status* or *PTP status* above this section.

4.4.1.1 NTP/PTP status

This window displays detailed information about the NTP and PTP status, for example regarding server IP, signal delay and jitter (variations). The information is for users who are familiar with the protocols involved and who wish to identify errors in timestamp transfers or time server responses.

Synchronisation requires up to 5 minutes to adjust to the time server time after the device has been switched on. The *NTP status* or *PTP status* will display invalid values during this period, for example the message 'Synchronised to unspecified at stratum 13' on the NTP.

The following is an example of the NTP status (only the beginning is shown):

Time sync status

R241 (Build 11428)

Current time: Wed, 2014-07-30 17:22:08 CEST (UTC+0200)

PTP status

Service not running

NTP status

```
synchronised to NTP server (192.168.100.2) at stratum 3
time correct to within 64 ms
polling server every 1024 s
```

NTP peers

```
     remote         refid     st t when poll reach   delay   offset  jitter
==============================================================================
*192.168.100.2  192.53.103.108  2 u  153 1024  377   0.368  -13.188   7.541

ind assid status  conf reach auth condition  last_event cnt
===========================================================
  1  4274  965a   yes   yes  none  sys.peer    sys_peer   5
```

- **Status of NTP peer 4274**

```
    associd=4274 status=965a conf, reach, sel_sys.peer, 5 events, sys_peer,
    srcadr=192.168.100.2, srcport=123, dstadr=192.168.100.28, dstport=123,
    leap=00, stratum=2, precision=-10, rootdelay=58.517, rootdisp=111.984,
    refid=192.53.103.108,
    reftime=d7838825.99b49a44  Wed, Jul 30 2014 17:05:09.600,
    rec=d7838b88.6c254309  Wed, Jul 30 2014 17:19:36.422, reach=377,
    unreach=0, hmode=3, pmode=4, hpoll=10, ppoll=10, headway=0, flash=00 ok,
    keyid=0, offset=-13.188, delay=0.368, dispersion=18.382, jitter=7.541,
    xleave=0.184,
    filtdelay=    1.42    0.37    0.72    0.76    0.38    0.90    1.02    0.26,
    filtoffset=  -2.06  -13.19  -11.21  -10.80   -4.14   -4.14   -5.60   -6.62,
    filtdisp=     0.98   16.90   32.33   40.04   47.95   55.78   63.52   71.62
```

4.4.2 Configuration

In this area you can:
- *Show configuration table* displays the current channel settings.
- You can view current values for individual channels (tracks) using *Live channel values*.
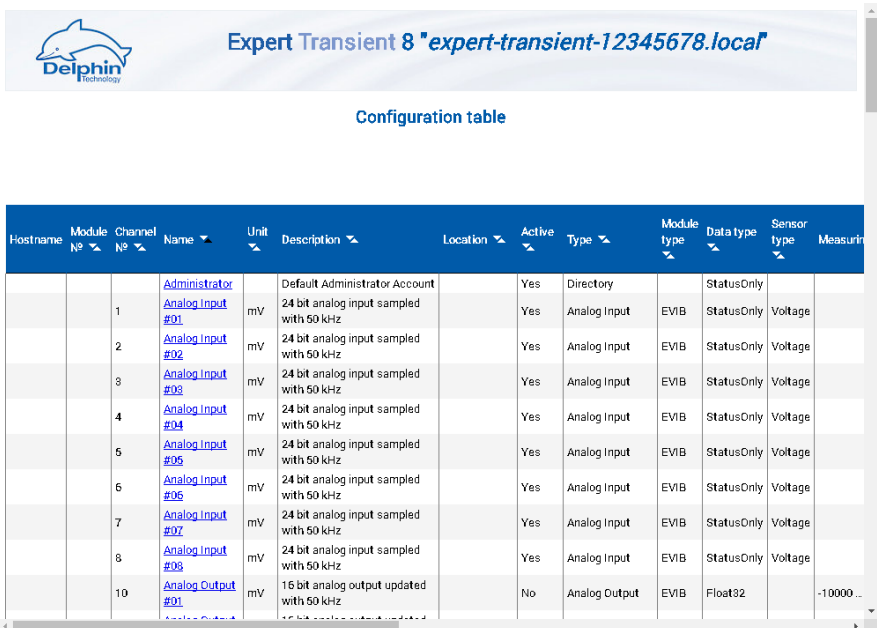
- Use *Channel default configuration* to reset all channel settings to factory set-tings. System channels and network settings are maintained.
- Use *Factory default configuration* to reset everything to factory settings, including the system channels and network settings. This then corresponds to the device's condition with the firmware at the time of delivery.

4.4.2.1 Channels overview (Show configuration table)

This window shows, in tabular form, the configurations of all the channels of the device. Each column contains detailed information such as channel name, type of module, physical unit, measurement range, or whether an invalid channel configuration exists, etc. The object ID in the penultimate column enables you to display the channel configuration as an XML file (potentially important for support purposes).

The data can be displayed only. Changing settings is not possible. To change configurations, use the DataService Configurator program.

The following figure shows a channels overview example (extract):

4.4.2.2 View current values (live channel values)

This allows you to display current values of all or a selection of channels (tracks). In the Filter area you can select the signals or values to be

displayed. Change the sorting (ascending/descending) by clicking any column header.

The following figure shows an example (extract):

4.4.2.3   Resetting configuration

Resetting the configuration to the factory setting can only be done through the Web interface.

Resetting to factory setting cannot be undone.

By clicking *Channel default configuration* all channel settings are reset to factory settings. All the channels you created will be deleted.

By clicking *Factory default configuration*, all channels and all settings are reset to factory settings, including the system channels and network set-tings. All the channels you created will be deleted. This then corresponds to the device's condition with the firmware at the time of delivery.

The process is displayed in a window:

Default configuration

R251 (Build 15244)

Creating default channel configuration…

Shutting down FRoG: Shutting down PoND:
Creating default configuration... OK
Starting PoND:
Starting FRoG:

The process ends when *Home* is displayed in the window's footer.

STOP **After resetting to factory settings all channels are then disabled and you will need to enable them again.**

4.4.3   Service

In this area you can:
- Generation of a "System report" on the facing page.
  The file is required only by **Delphin** service and support in the event that the device malfunctions.
- Display information about your browser, the settings used and the (server) settings of the device via Browser information. You can also use this dialogue to test the speed of the data transfer.
- Download *Hardware test certificate* that documents the results of the hardware test. The test is carried out after the hardware has been manufactured.
- Downloading the PuTTY terminal program (*PuTTY*) button.
- The *PROFIBUS GSD file* displays the "PROFIBUS GSD file" on the facing page for integrating the -**Expert Transient**- device into a PROFIBUS network (clicking) or saves it to a PC (context menu, Save target as). You can also download bitmaps from the device using this dialogue.
  Bitmaps are used for the graphical representation of the device in the user's PROFIBUS configuration program.
- Copy an XML network configuration template to the PC.
  This way, you can set a device's network settings to appropriate values without having to connect to the device. Specify the new settings in the file and transfer the file to a device using a USB memory stick
- Using "USB network driver" on page 39, download a driver for the USB interface for your PC operating system, which enables communication such as via Ethernet (but not at the same speed).

4.4.3.1   System report

Provides a detailed overview of the system for fault diagnosis by **Delphin** Support. Send the file to the Support team. The system report can be generated only through the Web interface.

After clicking *System report*, the device requires approximately 15 seconds to acquire all the information and record it to a ZIP file. Depending on your browser settings, the following dialog for example is then displayed to select the file save location. The file name is made up of the current date and time and the network identifier of the device.
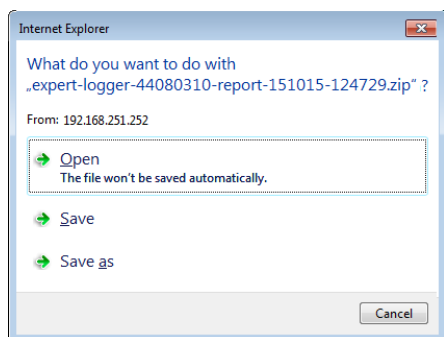
4.4.3.2   PROFIBUS GSD file

The PROFIBUS GSD file is required to configure the device in the PROFIBUS configuration software of the PROFIBUS Master.

Click *PROFIBUS GSD file* to display the GSD file in your browser. Right click and select Save as from the context menu to save the file and to enable it to be copied to a PC with your PROFIBUS configuration program.

The saved bitmaps optional for correct graphical representation of the device in the PROFIBUS configuration program.

Load the GSD file via the Web interface or copy it from the /firmware directory of the installation CD.

The following is an example of a GSD file (only the beginning is shown):

```
;=========================================================
; GSD file for Delphin Technology MetiOS Devices
; ProfiMessage / LogMessage / Expert
; Copyright (C) Delphin Technology AG 2015
; $Author: ischenk $
; $Date: 2015-05-27 10:08:02 +0200 (Mi, 27. Mai 2015) $
; $Revision: 14307 $
; $Id: DELP09b8.gsd 14307 2015-05-27 08:08:02Z ischenk $
;
;=========================================================
#Profibus_DP
;=========================================================
; General DP Key Words
;=========================================================
GSD_Revision        = 5
Vendor_Name         = "Delphin Technology AG"
Model_Name          = "MetiOS Device"
Revision            = "$Rev: 14307 $"
;Revision_number    = 1
Ident_Number=0x09b8
Info_Text                        = "ProfiMessage / Expert DPV0/DPV1/Redundancy $Id: DELP09b8.gsd 14307 2015-05-27 08:08:02Z ischenk $"
Protocol_Ident      = 0                        ; Profibus-DP
Station_Type        = 0                        ; DP-slave
FMS_supp            = 0
Hardware_Release    = "1.3.x"
Software_Release    = "2.x.x"
Implementation_Type = "VPC3+"
Bitmap_Device="DelpPM_n"
Bitmap_Diag="DelpPM_d"
Bitmap_SF="DelpPM_n"
```

4.4.3.3   XML network configuration template

The XML template allows you to set the network configuration for a device, without the device having to be connected to a PC. This is particularly helpful if you have multiple devices to configure, as you can then modify the file for each device and save it to a USB memory stick. When the USB memory stick is connected to a device, this file is read and the device obtains the settings from the file.

Method

1. Save the file to your PC (right click on the link).
2. Open the file using an editor.
3. Change entries *DefaultGateway='192.168.0.254', IPV4_ Address='192.168.0.1'* and *IPV4_NetMask='255.255.255.0'* to your required values or change *DHCP_active='false'* to *DHCP_active='true'*.
4. Save the amended file to a USB memory stick.
5. Plug the USB memory stick in to the device.
6. Switch on the device.

4.4.3.4   USB network driver

Use this menu item to download a driver for the USB port of your PC, which enables you to establish a TCP/IP connection via the USB interface, if you do not want or are unable to use the Ethernet interface.

Method

1. Save the driver that is compatible with your operating system to any directory on your PC.
2. Connect the **Delphin** device to the USB connection.
3. The subsequent driver search of Windows fails at first, so you can cancel the search.

4. Open the Windows Device Manager via Control Panel (requires administrator rights).
5. You may have to open the entry *Other devices* to see the entry for the missing driver "RNDIS/Ethernet Gadget".
6. In the context menu for the entry (right mouse button), select Update driver software.
7. In the next dialogue, specify "Browse my computer for driver software".
8. Enter the path of the directory where you have saved the USB network driver (*Search for driver software in this location*). Also specify a file if necessary.
9. If the message appears that the publisher of the driver software could not be verified, install the software all the same. It only means that the software has not been verified or signed by Microsoft.
10. Once you see the message that the driver has been installed successfully, you can use the **Delphin** device.

Connecting to the device

Enter the IP address of the device in DataService Configurator. If you are not sure about the address:

1. Open the Network and Sharing Center of your PC via Control Panel.
2. Click *Change adapter settings*.
3. Double-click "RNDIS LAN connection" or "Ethernet over USB for Expert Devices" (exact name depends on the operating system).
4. Click *Details* in the next dialogue.
5. You will find the address under *IPv4-DHCP Server*, such as *192.168.1.2*.

Refer also to .

4.4.4   System

In this area you can:

- Firmware updating using *Update firmware***MetiOS** (updating of the software within the device).
  See Update firmware.
- Displaying of the changes to the current firmware compared to the previous version using **MetiOS***changelog*.
  Adobe Acrobat Reader is required. The Acrobat Reader can be downloaded (free) from the Adobe website.
  See Updating firmware.
- Restarting the device using *Reboot*.
  This has the effect of switching the device off and on.
  See Rebooting the device.
- *Restart server* restarts the software only for data acquisition and storage or transmission.
  See Restart server.
  This is faster than a reboot (full restart) of the device.

- Recalibrate touch screen
  Calls a dialogue where you must tap the points displayed in the four corners of the screen. This improves and/or restores the accuracy of tapping text or graphics on the screen.

4.4.4.1 Update firmware

Firmware update can be performed only via the Web interface.

A firmware update is provided with every software update. Please carry out both updates to ensure software and hardware are being used with their latest versions. Errors may otherwise occur in data acquisition or configuration. The device's current firmware version is also displayed in this window.

The device's power supply must not be interrupted during the firmware update, or damage may occur to the equipment that will require repair.

Enter the file with the new firmware in the *New firmware file* input field (click *Browse* to locate the file on your PC) and then click *Start firmware update*. The firmware upgrade takes approximately 2 to 3 minutes.

Expert Transient 8 "*expert-transient-12345678.local*"

Update firmware MetiOS and reboot

Do not switch off power or reboot while updating firmware.
The device may become unusable and has to be repaired at factory!

Current Firmware: **MetiOS R253, Build 16606** (ExpertTransient-MetiOS-r253-build16606-150502.tar.bz2)
New Firmware file: [Choose file] No file choosen

[Start firmware update]

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4.4.4.2   Firmware changelog

Click *Firmware changelog* to display a PDF file containing information on how the current firmware differs from previous versions. Adobe Acrobat Reader is required. The Acrobat Reader can be downloaded cost-free from the Adobe website.

Example of a firmware changelog:

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http://www.delphin.de/

Changelog MetiOS

Firmware **Message** & **Expert** Series

General notes

- Termini used in this document:
  - "**Expert**" means **Expert** Logger x00, **Expert** Vibro, and **Expert** Transient
  - "**Message**" means **ProfiMessage**, **LogMessage** x000

⚠️ • **Message**: When updating from versions <= **R234** to >= **R236** an intermediate update to **R235** or the installation of "**Message-UpdaterPatch-r232.tar.bz2**" has to be done

- **Expert Vibro**: When updating from versions <= **R242-beta5** the device has to be set to the default channel configuration (all channel configuration will be lost!):
  Web browser → Default channel configuration

- Any device: When downgrading from >= **R247** to **any earlier version** a pre-R247 configuration should be loaded.
  Besides that: A downgrade of the firmware is *not recommended* at any time.

- R251-rc8 (Build 15xxx) – xx. October 2015

  New:
  - Support for **Expert** Logger 300
  - Applying factory settings shows new default IP address on web page.
  - Reference junctions of thermocouples can be in different temperature scales as the thermocouples (e.g. Thermocouple in "°F" and reference junction in "R")
  - **Expert**

4.4.4.3   Device restart (reboot)

Restarts the device. The process takes approximately 2 minutes. After this time, click *Back*. The power LED (System LED) on the device indicates when the device is ready.

This has the same effect as switching the device off and on.

4.4.4.4   Restart measurement data acquisition (restart server)

Clicking *Restart server* restarts the main program (application), which acquires and processes measurement data. This is faster than a Reboot (full restart) of the device.

STOP **During the restart, data is neither acquired nor stored. The network connection to the device is interrupted and re-established following the restart.**

A restart can be performed only via the Web interface.

The process is displayed in a window:

Restart

R251-15244

Application is restarting now...

Shutting down FRoG: Shutting down PoND:
Starting PoND:
Starting FRoG:

OK

The process ends when 'OK' is displayed in the window.

4.5 Configuring the Expert Transient device via the DataService Configurator

Delete this text and insert your own.

4.6 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.
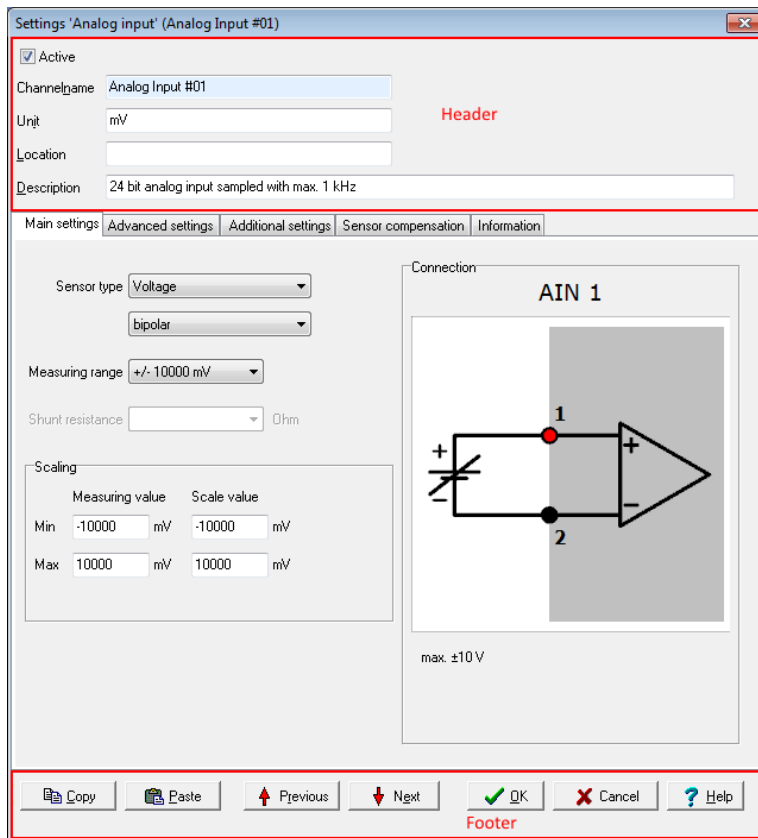
Upper section
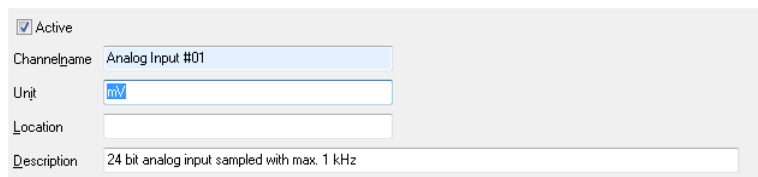
Active: Enables or disables the channel.

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

Last change: 19.10.2015 11:11:19,961

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).
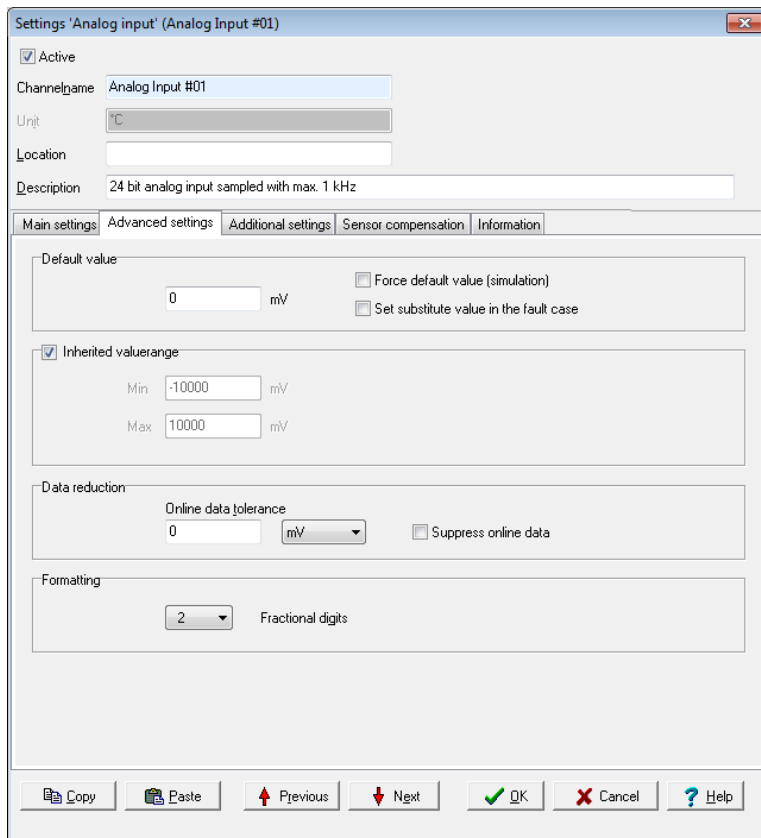
Tabs in the dialogue's main section

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.

4.6.1   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.

4.6.2 Sensor compensation tab

In this tab you can specify corrections for sensors or analogue outputs. Conversion takes place *accor*ding 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 meas-
  ured values.
- *Linear interpolation*
  Set a table for converting measured values into display values. Linear inter-
  polation 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*.

4.6.3   Information tab

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

4.6.4 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:
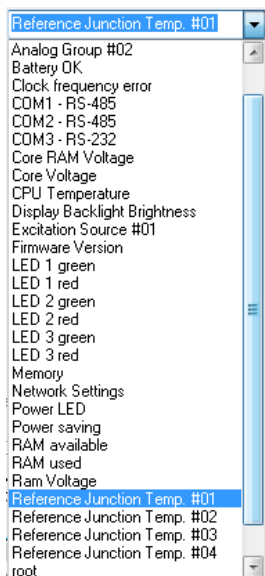
Click the required channel.
If the channel name is known, it can be input from the keyboard. The list is filtered down while letters are keyed in, which makes selection easier.

4.6.5 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.*
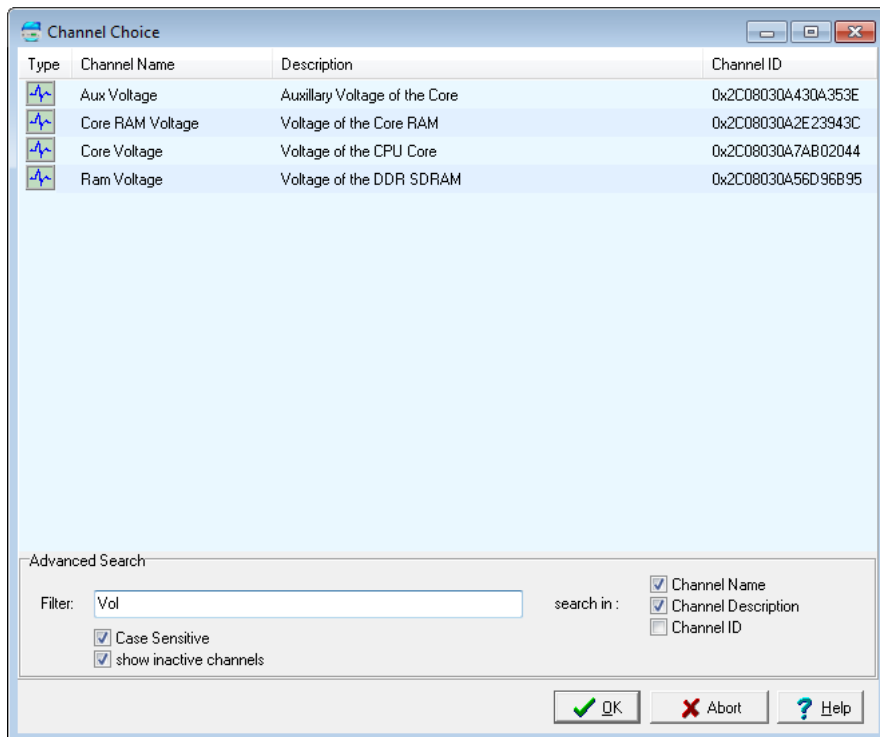
4.6.6   Trigger options

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.

4.6.7   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.
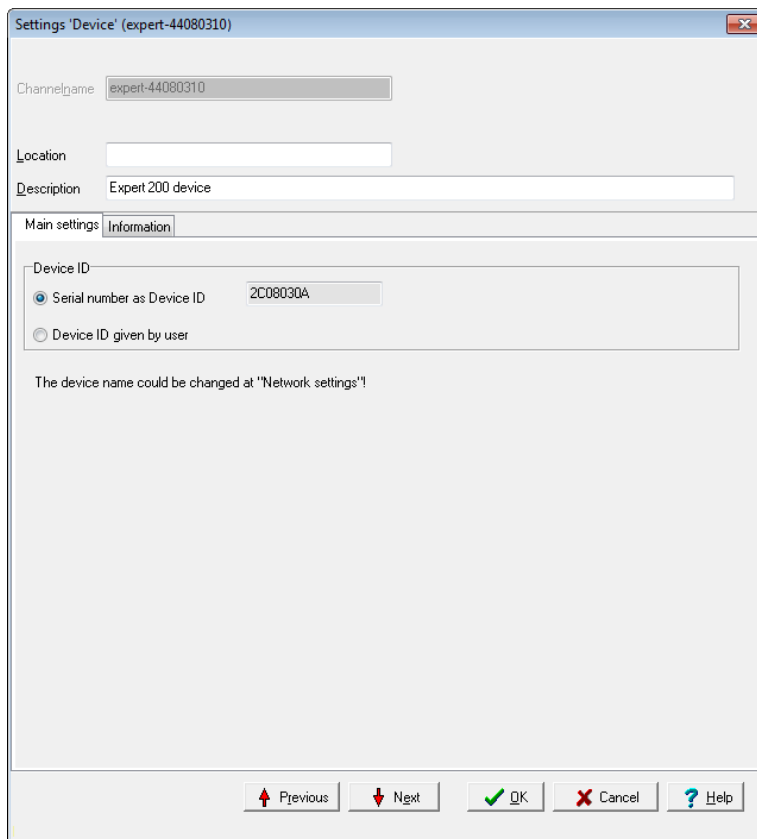
4.7 Device Properties context menu

The device's context menu allows you access to various settings, which are valid for the device as a whole and therefore also for all channels:

- Set (Device)properties, for example the device ID or location.
- Save and load configurations (you may use the configuration also in offline mode).
- Creating the network configuration

4.7.1 Configuring device properties

Open the configuration dialogue either by double clicking the device or by opening the dialogue via Properties from the context menu.

This dialogue enables users to:

- Enter information about the device's *Location* and its function (*Description*). For example, enter the location of the device or of the object from which data is being acquired.
- Changing *device ID*.

Device ID

The DataService uses device ID to uniquely identify a device and its channels. The factory setting for the device ID is its serial number.

The device ID is displayed as the main part of the *object ID* under the column with the same name in DataService. The column can be displayed via *View → Right panel → Visible channel sheet columns*.

The device ID requires amending when copying the configuration from one device to another and then running both devices together on the same DataService. Both devices would then have identical device IDs and the DataService would not be able to distinguish between them.

Method

1. Open the *Device properties* dialogue.
2. Enable *User-defined device ID*.
3. Enter a new ID (e.g. the device's "old" serial number).

The device ID is in hexadecimal format. Valid inputs include numbers from 0 to 9 and letters from 'a–f' or 'A–F' (no distinction is made between upper case and lower case letters). If a sufficient number of characters is entered, preceding zeroes are removed. A valid input changes the input font from red to black.

After amending the device ID, the connection to the device is briefly interrupted before being restored again.

Refer also to <u>Settings for all dialogues</u>

4.7.2   Saving and loading device configurations

Save configuration

Open the dialog via the device's context menu.

Enter the destination file in the file dialog. Thereafter you can enter a description of the configuration to be saved (comment). This will be displayed when you load the file.

Load configuration

Open the dialog via the device's context menu.

Select the configuration file to be loaded. You may only load configurations you have generated using the Save configuration menu. Configuration

files which you have previously saved via the device's Web interface can-not be loaded via this menu. The description saved with the file will be shown and you will be shown the various options.

Info

Not all options are available for every device.
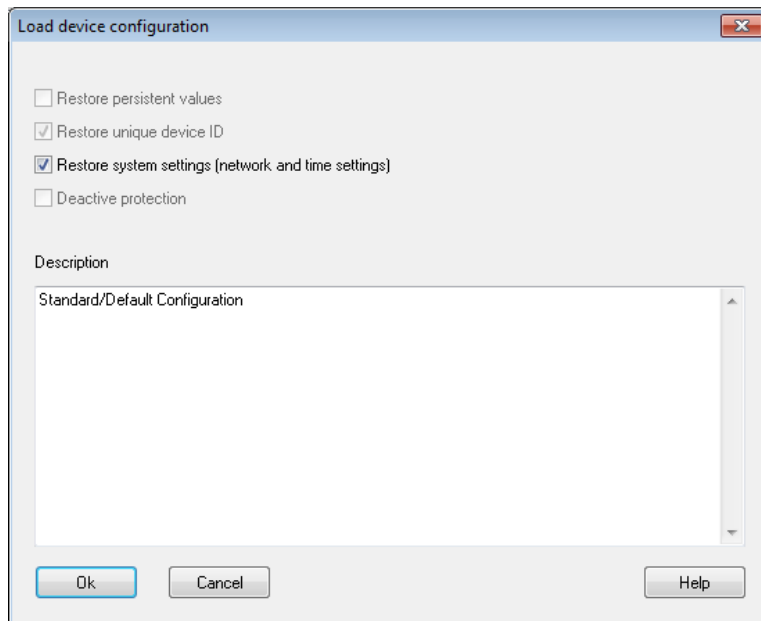
Loading channels

All configuration file channels are loaded to the device. Any existing device channel configurations will be overwritten.

Restoring persistent measurement values

The tracks marked as persistent are set to the value stored in the file. Refer to "Additional settings tab" on page 45.

Loading/restoring a unique device ID

The factory setting for the device ID is generally its serial number. This ensures that the device's channel ID is globally unique. Select this option to use an existing configuration in for example a replacement device,

without needing to adjust the channel assignment in other applications or trends. The option is selected automatically if the stored device ID corresponds to the current device ID. This option is not available if the configuration file device ID is already in use by one of the devices connected to the DataService Configurator.

Devices with the same device ID cannot be used together in the same DataService Configurator environment.

Loading global tables

All global setpoint and linearisation tables contained in the configuration file will be loaded to the device. Any existing device tables will be overwritten.

Loading system settings

All system settings (network settings, active user management, etc.) in the configuration file are loaded to the device.

If user management is enabled, you must know the passwords (from the configuration file) at next login, otherwise you will no longer be able to connect to the device.

Keep current device IP address/mask/gateway

If this option is enabled, the standard network settings are not loaded. Otherwise it could happen that a network configuration is loaded to your device, that will render your device unreachable from your IP range, or the device could receive an IP address which is already allocated to another device, causing a network conflict.

Disabling access protection during loading

Any access protection is disabled temporarily during the loading process, so that the setting in the file can be imported.

4.7.3 Creating the network configuration

Allows you to set the network configuration for a device, without the device having to be connected to a PC. This is particularly helpful if you have multiple devices to configure, as you can then modify the file for each device and save it to a USB memory stick. When the USB memory stick is connected to a device, this file is read and the device obtains the settings from the file.

Method

1. Enter the desired configuration, for example *IP address* 192.168.0.10, *Net mask* 255.255.255.0 or enable *DHCP*. No input is required for *Gateway* , the *MTU* value can be left unchanged. If in doubt ask your network administrator.
2. Save the file to a USB memory stick.
3. Plug the USB memory stick in to the (switched off) device.
4. Switch on the device.

4.8 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" on page 60.

4.8.1 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

Selection	Description	Unit
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)).

4.8.2 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.
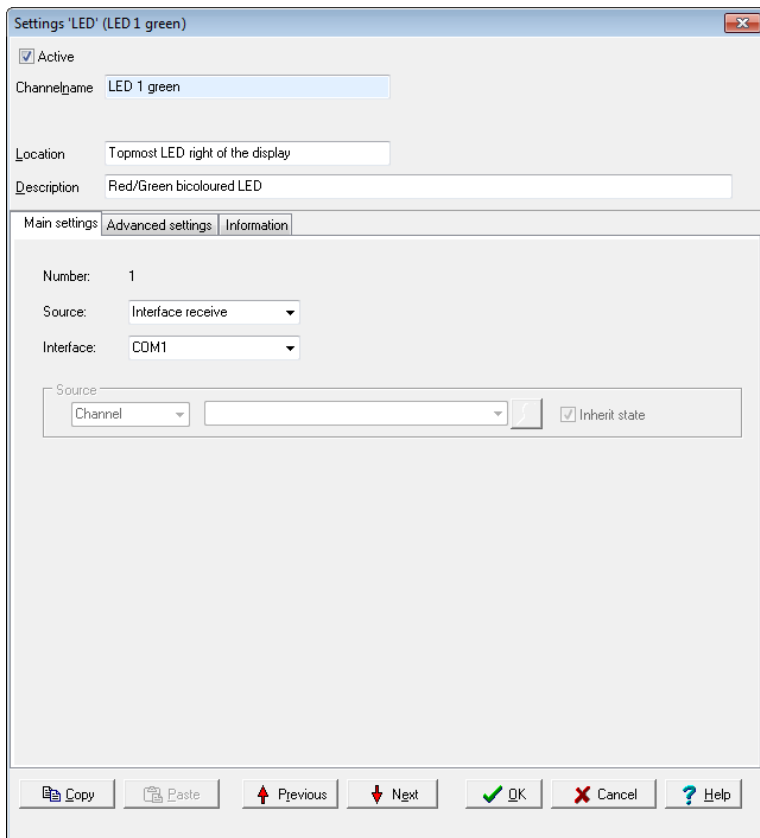
Select the desired *source* and specify for each source, whether the for example an interface or channel should send the information.

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.

4.8.3   Drives

Specify here which drives should be available for data saving.
Refer to "Device memory" on page 227.
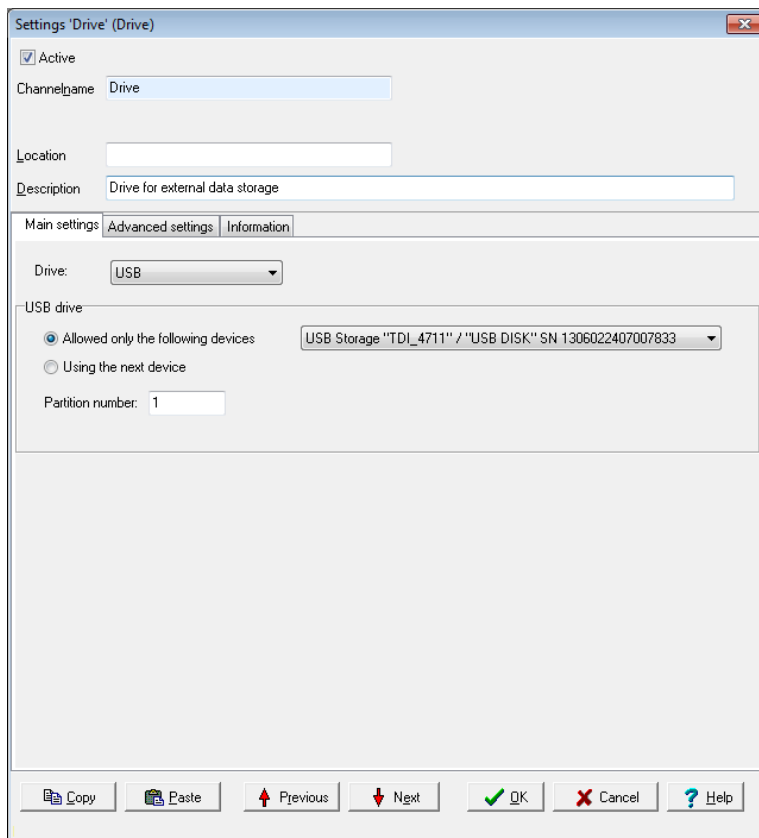
USBdrive

Once you have connected a memory, for example, a USB memory stick or a USB drive with the USB interface, the memory will be displayed as a drive and can be selected here.
Refer also to USB device.

STOP **The USB storage must be configured with the FAT32 filesystem; other file systems are not recognised.**

You can either select *Only allow following devices* and enter the device (you may add multiple drives). If the memory is formatted with multiple partitions, you can also enter the *Partition number*. Alternatively, you can select *Next available device*, and then one of the other memories will be used (if available), as soon as the current one runs out of space.

Network drive

Choose the file system or protocol for addressing the network drive.

NFS (Network File System) enables file access via a network. Choosing this means that the files are not transmitted via for example FTP, but instead you can locate and access files saved on another PC, as if they were located on the local drive.

CIFS(Common Internet File System) is based on NetBIOS over TCP/IP and SMB and offers other services such as Windows RPC and NT Domain in addition to the file functions.

FTP (File Transfer Protocol) is a widely used network protocol used to transfer files and manage directories (create, delete, etc.).
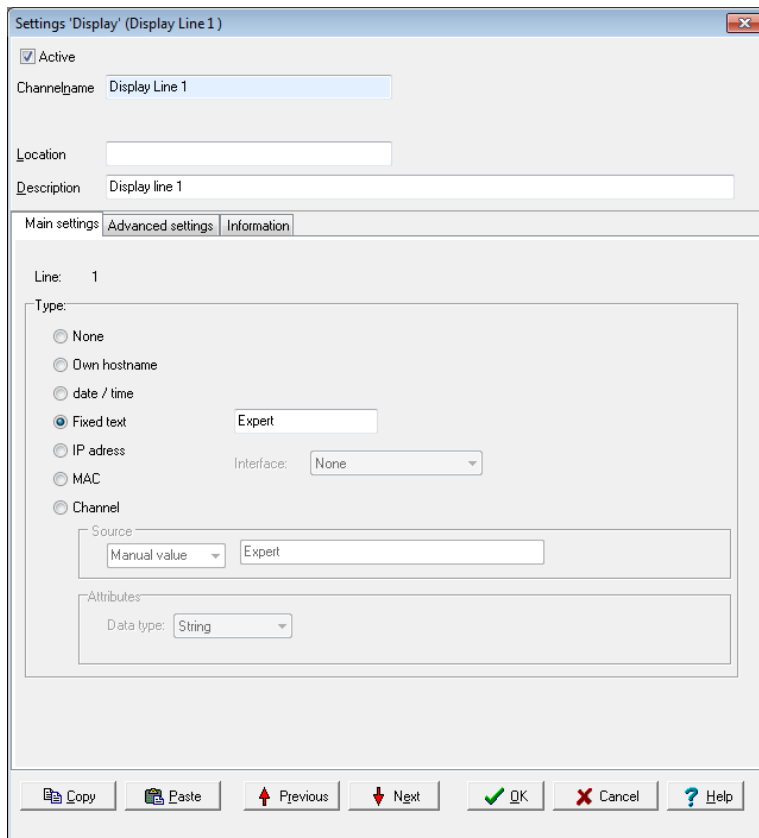
SFTP (Secure File Transfer Protocol) allows a more variable encryption of data transfer than FTP.

For all options you need to specify the *network address* and *path* for access. For NFS, also the protocol version to be used (v2 or v3). If authentication is required for other methods, you must enter the *user*. The user must be created via "Directory (User management)" on page 64.

4.8.4   Display

See also LED for the display backlight brightness.

You can configure the display home view under System → Display and the Properties context menu for each line.

Own host name

Displays the device network host name.

IP address, MAC

Select the interface for which you wish to display information. The line then displays either the IP address or MAC address (Media Access Control address) used for the interface. The MAC address identifier is defined via the (hardware) adapter and is required if the network administrator wants to assign a specific IP address to a device, as opposed to via DHCP.

Channel

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. You can use

Properties to define whether the output value is to be handled as a *String* (text) or *Float* (numeric value).

4.8.5   Directory (User management)

Using the User management, you can specify the user 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 70.

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. There is no default password for 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.
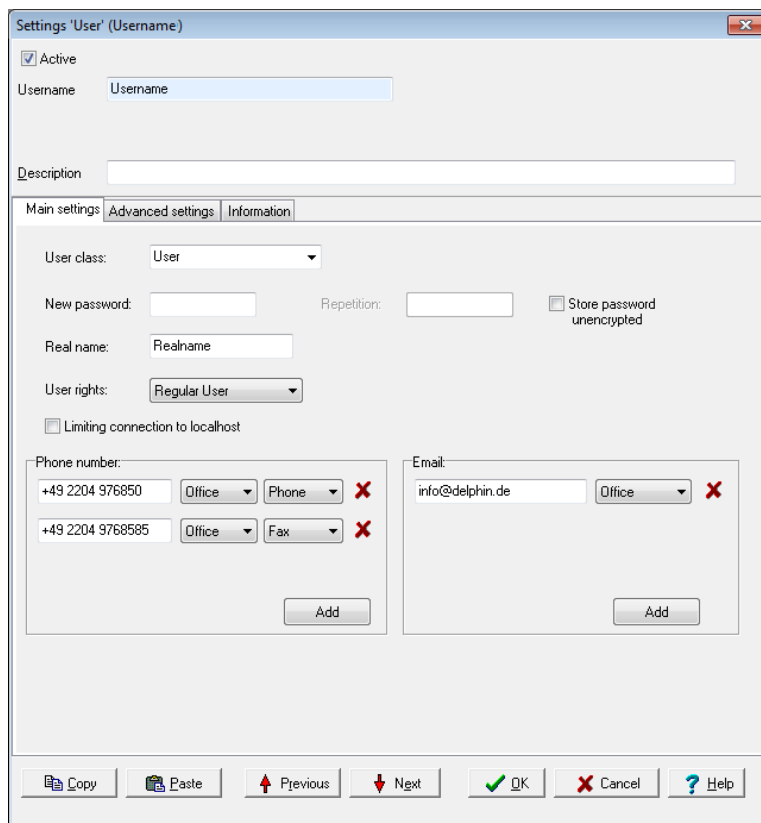
Then, specify the login name (*username*), the *user right* and the *password*. You must enter the password twice to prevent typing errors from occurring. Only once both entries are identical will the red back-

ground 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 pre-set 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.

Eingabe einer Telefonnummer

Es wird empfohlen Telefonnummern im internationalen Format nach E.123 einzugeben. Dieses Format kennzeichnet die Ländervorwahl mit einem '+'. Weiterhin kann die Nummer - zur Verbesserung der Lesbarkeit - durch Leerzeichen getrennt werden.
Beispiel: +49 2204 976850

4.8.6   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 clock 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:
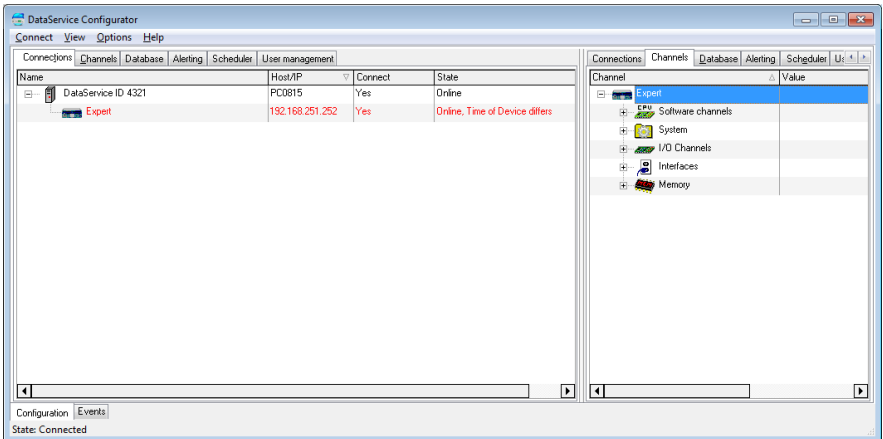
Setting the time zone

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.
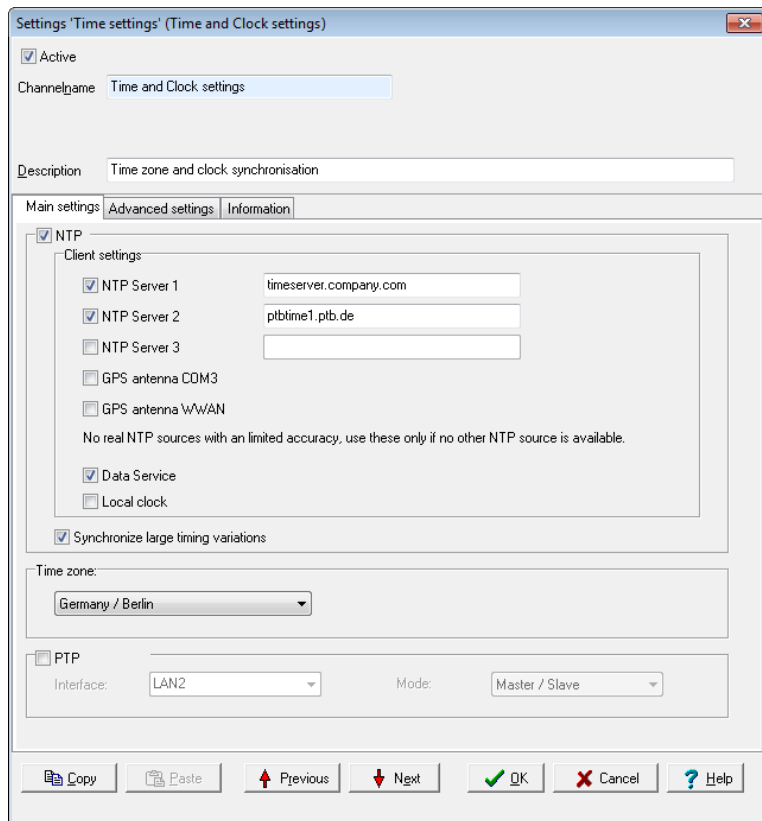
Info

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.

4.8.7   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.
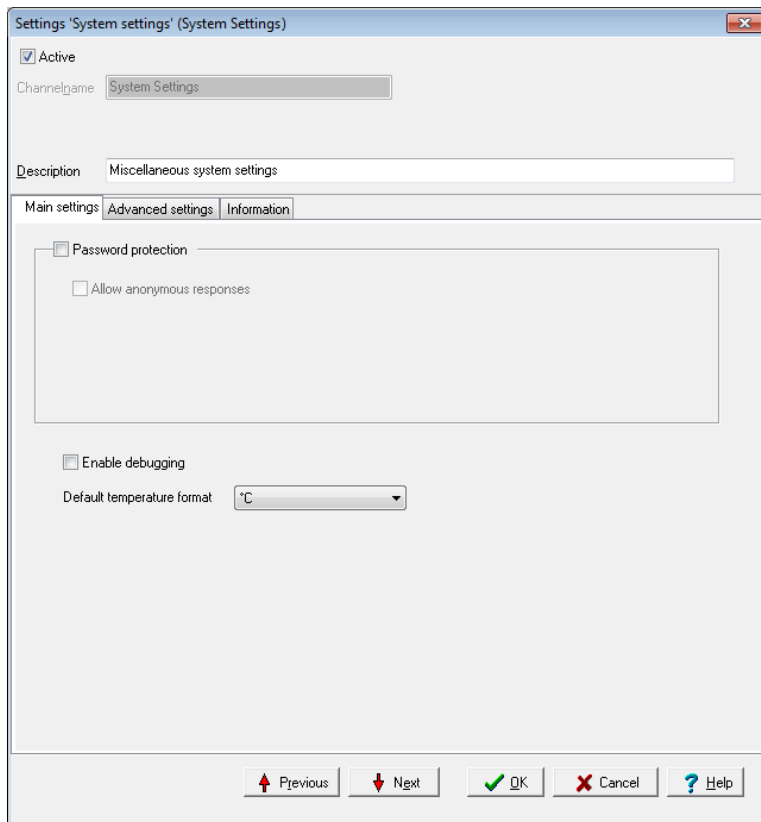
Anonymous login

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*

STOP **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.

4.8.8   Power saving

The Power Saving Properties dialog allows you to wake the device only at certain times or in response to certain events, and to enable the power saving mode at other times.
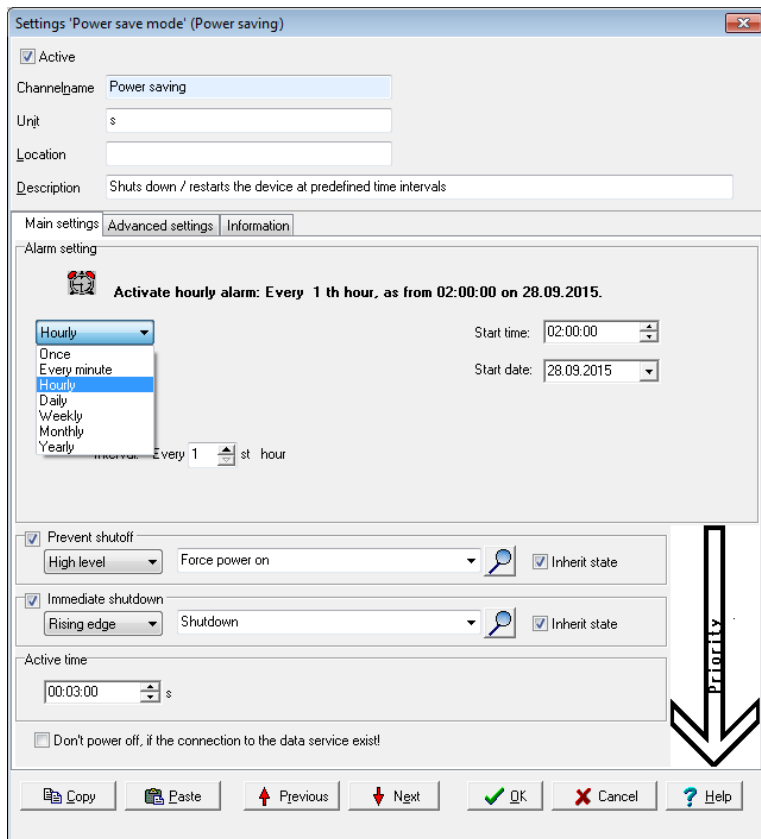
You can create further conditions to prevent shutdown or to trigger imme-
diate shutdown, see also Trigger variants edge and level.

Active time sets a minimum period for which the device operates.

To prevent shutdown from interrupting an existing DataService connection
following a signal or once the Active time duration has elapsed, you should
enable the corresponding option at the bottom of the dialog.
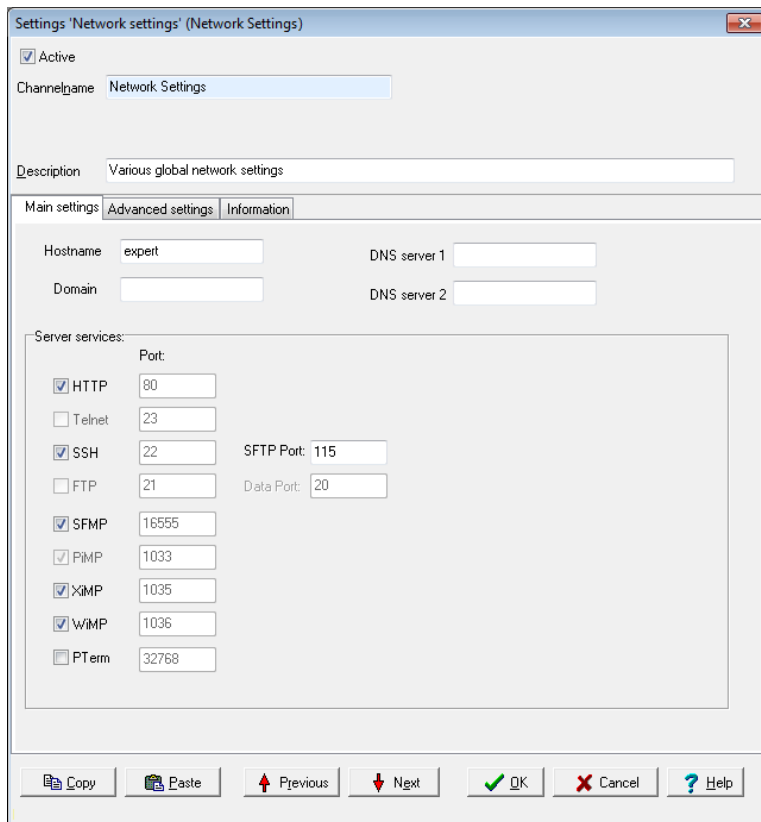
4.8.9   Network settings

Info

The "Network settings" group is by default available both in the "Sys-
tem" 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 (Connections→ Find Delphin device on 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 activated by default.

4.8.10 Mail settings

No settings possible here!

The mail servers can be created under this channel.

4.9 Configuring channels (sensors)

Configuration of software channels, interfaces (for external devices) and device memory is described in separate sections.

See also Settings for all dialogs, Overview, Galvanic isolation

The **Expert Vibro** device has the following I/O channels:

- Trigger group
- Rotation speed
- Track
    - Spectrum
    - Min/Max/PP
    - Average/RMS
    - Vector sum
    - Local min/max values
    - Sample rate
- Analogue output
- Digital input
- Digital output
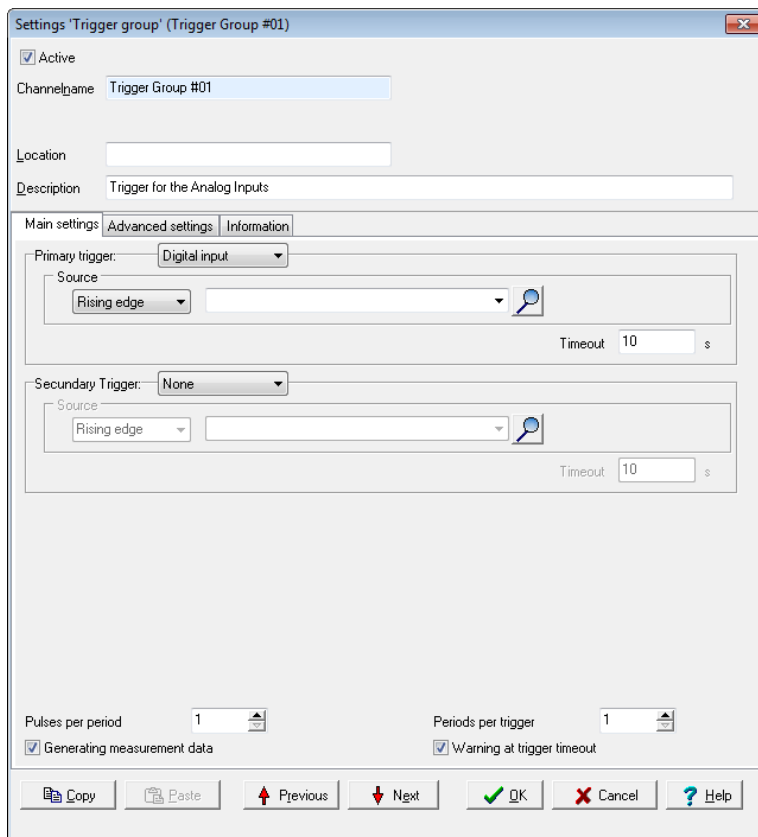
The additional inputs and outputs are shown after the Trigger group. The Trigger groups show you which analogue inputs can be synchronised via which rotation sensor.

Trigger group

4.9.1   Trigger Group

The settings for the respective trigger group have a decisive influence on how the collection and processing of data in the subordinate channels and tracks is carried out.

There are four options for trigger sources:
1. Software
   Triggering occurs during an edge change in the software channel.
2. Time
   Triggering occurs upon expiry of set time. The option is useful if you do not have any other trigger at your disposal.

3. Digital input
4. Analogue input

Specify whether the evaluation trigger should take place after a given *time* (periodically) or dependent on a channel, that is, synchronised with an analogue, digital or software channel. Track calculations are then carried over the time specified or over the period between the trigger pulses of the specified source(s).

Refer also to "Trigger options" on page 51.

If you have selected an analogue or digital trigger, you can now also select secondary triggers and/or a further trigger via the time parameter. These triggers will then become active when the time specified for the original trigger under Timeout has expired without triggering.

If you select *Analogue input* in Channel, additional options become available to you:

Threshold is the decisive value in monitoring. You can specify a *Channel* or a fixed value (*Manual value*).

Hysteresis: Hysteresis prevents the trigger being repeatedly released 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.
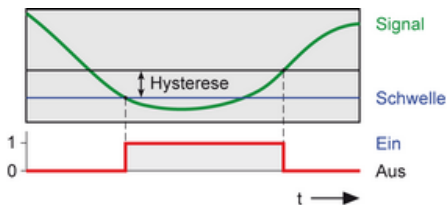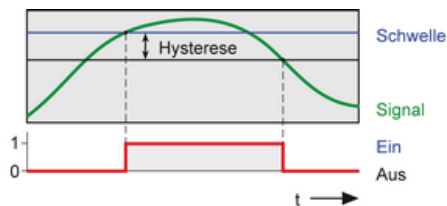
Debouncing: Enable this option in addition to the hysteresis if your signal contains brief pulses with high amplitudes. In this case, you should select a relatively large hysteresis in order to prevent trigger release. Enter the

maximum pulse duration allowed before the pulses are hidden (suppressed).

Specify under *Number of pulses per period* the number of pulses to be generated during one rotation. For example, if you use a gear with 60 teeth, enter 60 if each tooth generates a pulse.

Since triggering can work with no more than one trigger frequency of 100 Hz (100 triggers per second), you can also specify under *Number of periods per trigger* that several rotations will be required to complete a period.

Generating measurement data: When this option is enabled, all resulting measurement data is transferred, although, for example, in the DataService Configurator *channels* tab, only one measured value will be shown. If you require characteristic values only, then for example no "raw values" are written to the database. The display of individual measured values in DataService Configurator also works when this option is disabled. You only need to enable the option therefore, if you want to see a graphical representation of the route or overall result.

Warning at trigger timeout: If the option is enabled, a warning status is set when the timeout of the trigger has been reached and no further trigger has been defined. For example, if you have specified a primary and a secondary trigger, the warning will be set when the timeout of the secondary trigger has been reached.

Refer also to "Status monitoring" on page 154, "Status filter" on page 151.

4.9.2 Analogue inputs (**Expert Vibro**/**Expert Transient**)

Preconfigure the Trigger group settings for the analogue inputs, on which the group analogue inputs are dependent.
The triggering settings determine how the analogue channel signals and their dependent calculations are handled, for example, whether they are measured over a time period or a set number of rotations.
If you wish to use rotation-dependent functions, also configure the rotation channel.

Refer also to Settings for all dialogues, Galvanic isolation.

Method for analogue inputs

1. Specify the sensor type and sensor measurement range settings in the Properties context menu of the respective inputs.

2. Set how the sensor signal is to be used: Each input sends a signal that is designated a track by default. You can however define additional tracks (Track context menu). You can then assign various properties such as for example scaling, sample rate and filter to each track. You can evaluate the same sensor signal in various ways simultaneously.

3. Specify whether, and if so, which characteristic values are to be determined for a track or whether for example a spectrum is to be calculated for a track (optional settings).

4. If you calculate characteristic values or spectrum, you can create additional dependent channels for it which enable further evaluation.

Info

You can evaluate each input over several tracks, in order to use as many different filters as required to enable identification of several characteristic values (spectrum, minimum/maximum values) or different storage variants. You can save a channel configuration with its various tracks (Sub channels→ Add to library) or copy it and transfer it to other channels.

4.9.2.1 Configuring analogue inputs

The **Expert Vibro** device has only the voltage sensor type.

Preconfigure the Trigger group settings for the analogue inputs, on which the group analogue inputs are dependent.

The triggering settings determine how the analogue channel signals and their dependent calculations are handled, for example, whether they are measured over a time period or a set number of rotations.

If you wish to use rotation-dependent functions, also configure the rotation channel.

Voltage sensor type
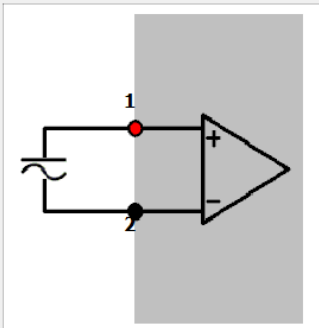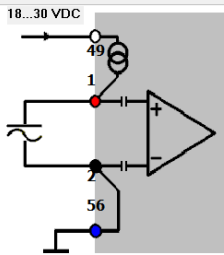
IEPE/ICP$^®$ feed

For ICP$^®$ and IEPE sensors, enable the *IEPE/ICP$^®$ feed*. Note the additional connections to be carried out (power supply), which are entered under *Connection*. This will supply the sensor with (constant) current and the signal is decoupled.
See also sensor connections, IEPE and ICP sensors

AC coupling

Enable *AC coupling*, if you wish to exclude DC components. In this case only the AC component of your signal is recorded. (For ICP$_®$ and IEPE sensors this setting is always enabled.) The DC component can also be suppressed by a track.

4.9.3   Track

Create one (or more) tracks via the context menu of an analogue input.

A track is used to limit the number of measurement values of the A/D converter (50 kHz) to a meaningful number of values for the evaluation. You can also do this in several stages, for example, by initially calculating a spectrum at a high measuring rate, from which you can identify the main frequency and then average this over several measurements.
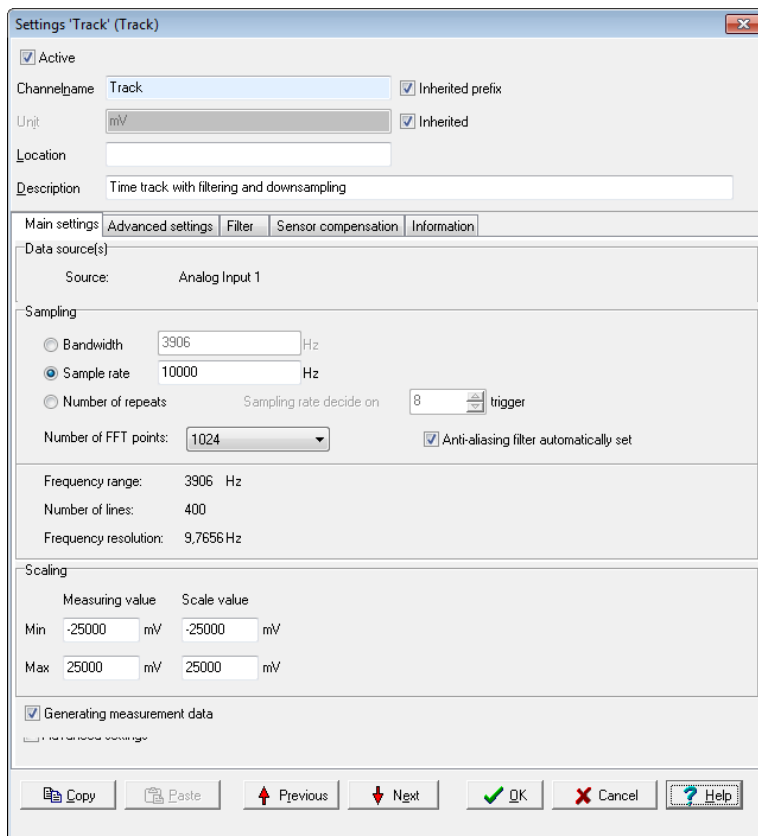
See also Settings for all dialogs, Status monitoring (software channels)

Info

To configure a track you can use the Component configuration context menu to save the configuration to file, and load it later or copy it and transfer it to another track using Replace.

4.9.3.1   Main settings tab

Sampling

Bandwidth/sample rate: Specify here either which bandwidth you require in the useful signal (the sampling frequency is then automatically calculated) or the sampling frequency to be used. In this case, the bandwidth resulting from the sampling rate is displayed. Activate automatic anti-aliasing filter, so that the required anti-aliasing filter is automatically calculated and activated (see "Filter tab" on the next page).

Number of repeats: Here the "Rotation speed" group channel is used as a trigger channel for all group channels and adapts the sampling frequency to the rotation speed. This allows you to obtain the same amount of measurement data per rotation at both high and low rotation speeds. After

activating the option, in the *Sample rate defined by* field, enter the number of trigger events over which the measurement data are to be captured. See also rotation adaptation in the *Filter* and "Trigger Group" on page 76 tabs.

Number of FFT points: Enter how many measurement data values should be available per FFT. The more points you use, the better the frequency resolution (more lines in spectrum). However, the more measurement data needed for the calculation, the less frequently it will take place.

Automatic anti-aliasing filter: Enable this option to obtain an appropriate low-pass filter automatically; also refer to "Filter tab" below.

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 additional linearisation. See software channel "Linearisation" on page 120 tab. The specified range (in the example 0 bar to 2000 bar) 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" on page 154.

Generating measurement data: When this option is enabled, all resulting measurement data is transferred, although for example in the DataService Configurator channels tab, only one measured value will be shown. If you require characteristic values only, then for example no "raw values" are written to the database. The display of individual measured values in DataService Configurator also works when this option is disabled. You only need to enable the option therefore, if you want to see a graphical representation of the route or overall result.

4.9.3.2   Filter tab

Select the required filter or mathematical function by clicking the symbol. In Integrator, you can specify double integration by clicking it twice. If you select the wrong filter or calculation, click again to deactivate the function (greyed out). Alternatively, you can select a function using *Preselect*.

In the example, high pass, bandstop (at 300 Hz) and anti-aliasing filter (AA filter, low pass) are selected.

Depending on the filter, enter the *cut-off frequency* or for the bandstop filter, the *centre frequency*. You also need to specify the *bandwidth* for the bandstop. The *order* determines the filter steepness; however, higher orders require more computation time. Also select your filter *characteristic*. The *passband ripple* resulting from the settings can be changed for some filter types and for others is displayed only (greyed out).

If you specify sample frequency over rotation in the *Main settings* tab, you will need to activate *Rotation adaptation* so that the filters can be selected as a percentage of the sample frequency, which also allows for adaptation to the rotation speed.

If you have selected on the *Main settings tab* the option *Automatic anti-aliasing filter*, a suitable low-pass filter (*AA filter*) will be activated automatically, and the settings can no longer be changed.

If you select the integrator, the high pass is automatically activated as well.
Refer also to "Validity range of integrated signals" on page 86

Checking the conversion function

Using *Conversion function* call up the window displaying the amplitude and phase responses. The function is not available if you specify sample frequency over rotation in the *Main settings* tab, because the filters have to be calculated dynamically in this case.

⊞ shows/hides the grid.

LOG switches the frequency axis between linear and logarithmic representations.

⮜ shows/hides a red cursor (underscore) under amplitude, frequency and phase information. Drag the cursor with the mouse to the desired position in order to read the values.

✋ allows you to move the curves displayed in the window.

⬚ hides the red cursor.

Reset resets the display to the standard settings.
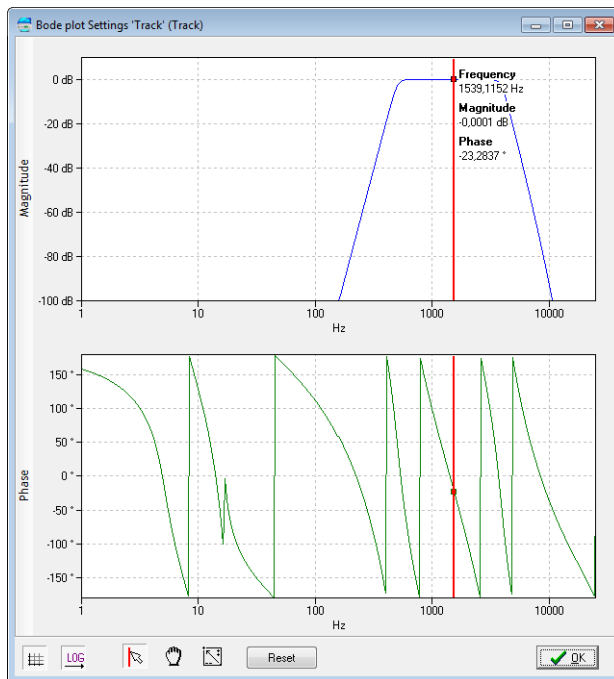
The example shows the amplitude and phase response of the above settings, the cursor is at the bandstop filter frequency.

Validity range of integrated signals

Depending on the frequency of the high-pass filter used, the output amplitudes of the integration are limited. The following diagrams show the maximum amplitudes of a sinus signal relative to the frequency of different high-passes. The diagrams include both the linear x-axis (frequency axis) and the logarithmic x-axis to achieve better readability.

Input limits of the integrator (linear representation)
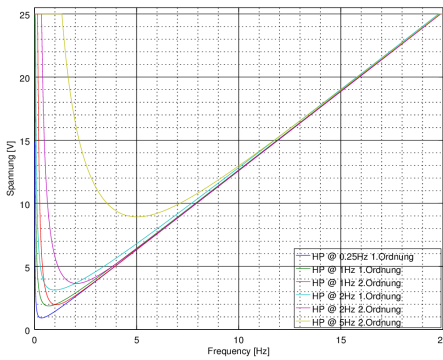
Input limits of the integrator (logarithmic representation)
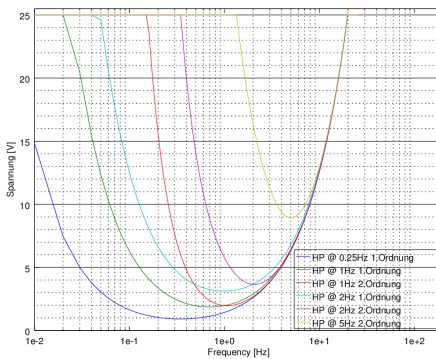
Input limits of the double integrator (linear representation)
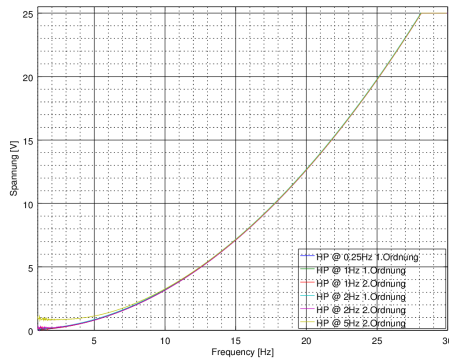
Input limits of the double integrator (logarithmic representation)
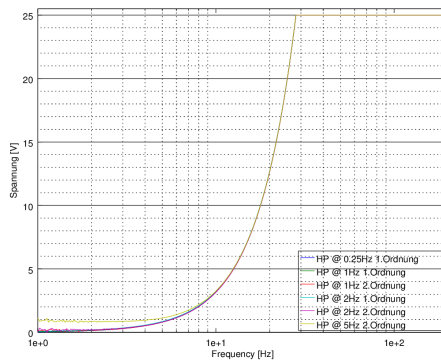
4.9.3.3   Min/Max/Peak-to-peak (PP)

This function allows you to determine the minimum (lower value on the graph), the maximum (upper value in the graph) or the peak-to-peak value (difference between minimum and maximum) for a signal. The time period over which the characteristic values are determined, is obtained from the Trigger group settings.
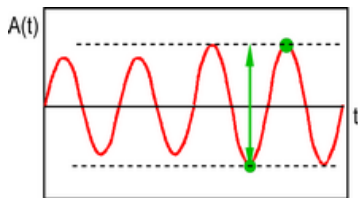
Set the desired function in the *Main settings* tab.
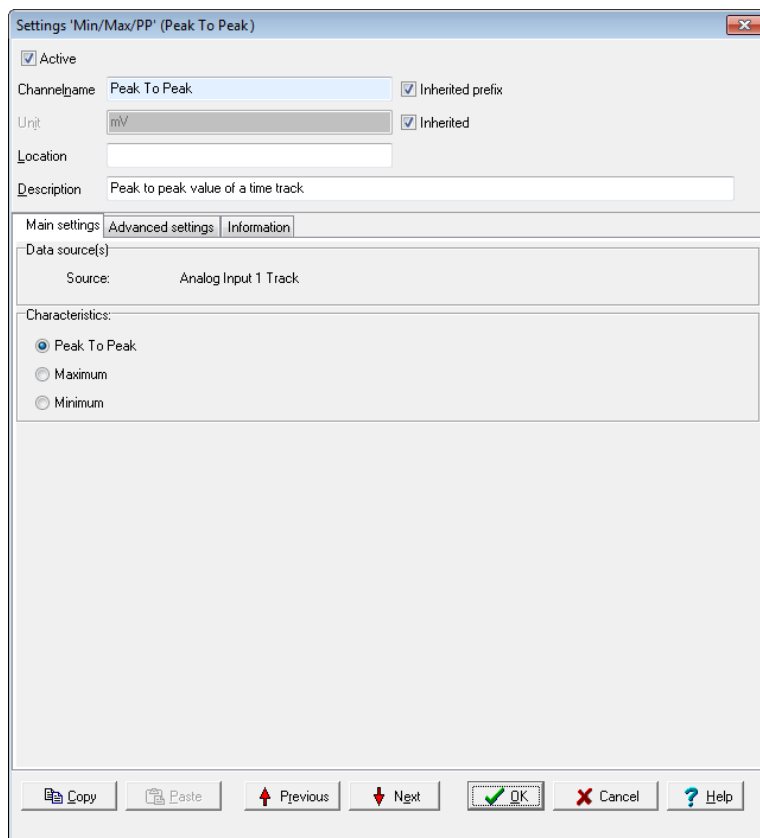
4.9.3.4   Average/RMS

This function allows you to determine the average value or the effective value (RMS). The arithmetical average is also referred to as a signal's steady or DC component. This characteristic value is also available if you

have enabled the 'AC coupling' option for the analogue input (see Con-figuring analogue inputs). You can however also enable the *RMS without DC component* option here. The time period over which the characteristic values are determined, is obtained from the Trigger group settings.

The mean is calculated using the following formula:

$$y = \frac{1}{n} * \sum_{i=0}^{n-1} x_i$$

x_i = amplitude at sampling point i

n = number of sampling values

y = arithmetic average

The effective value is calculated using the following formula:

$$y = \sqrt{\frac{1}{n} * \sum_{i=0}^{n-1} x_i^2}$$

x_i = amplitude at sampling point i

n = number of sampling values

y = true root mean square

The accuracy for TRMS calculations on sine signals depends on the number of signal periods acquired. The general rule is: Errors are <3% for more than two periods; and <1% for more than four periods. You enter the period in the Trigger group settings.

Settings 'Mean/RMS' (RMS)

☑ Active

Channel name   RMS   ☑ Inherited prefix

Unit   mV   ☑ Inherited

Location

Description   Mean value of a time track

Main settings | Advanced settings | Information

Data source(s)

    Source: Analog Input 1 Track

Characteristics:

○ Mean

◉ RMS

○ RMS without DC part

[Copy]   [Paste]   [↑ Previous]   [↓ Next]   [✓ OK]   [✗ Cancel]   [? Help]
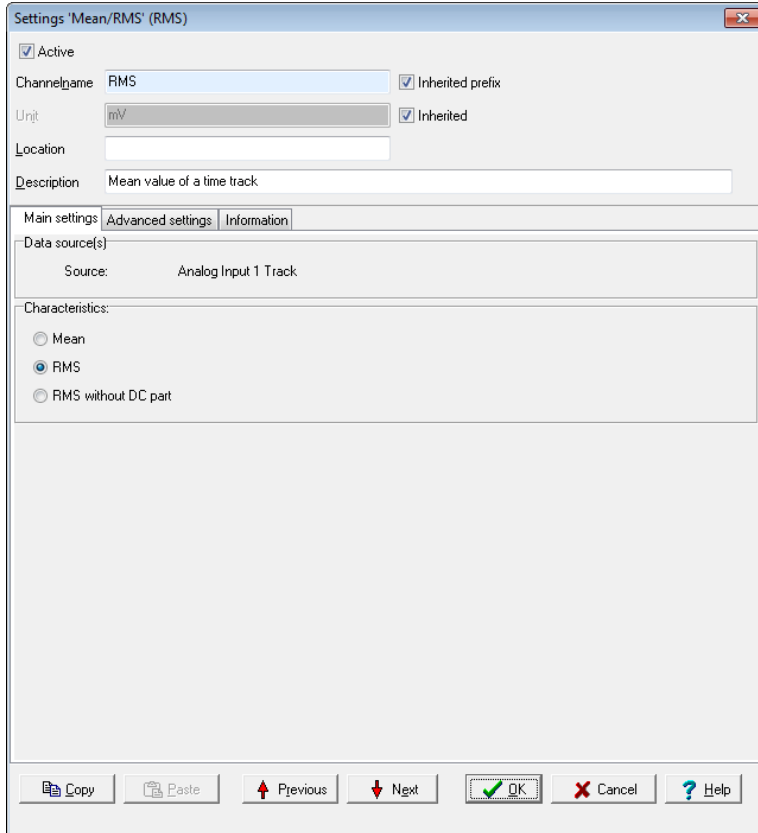
4.9.3.5   Vector sum

The function performs vectoral addition of all amplitude values from the time signals' of two channels and then determines the *maximum*. The time period over which the characteristic values are determined is obtained from the Trigger group settings.

$$z_i = \sqrt{x_i^2 + y_i^2}$$

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
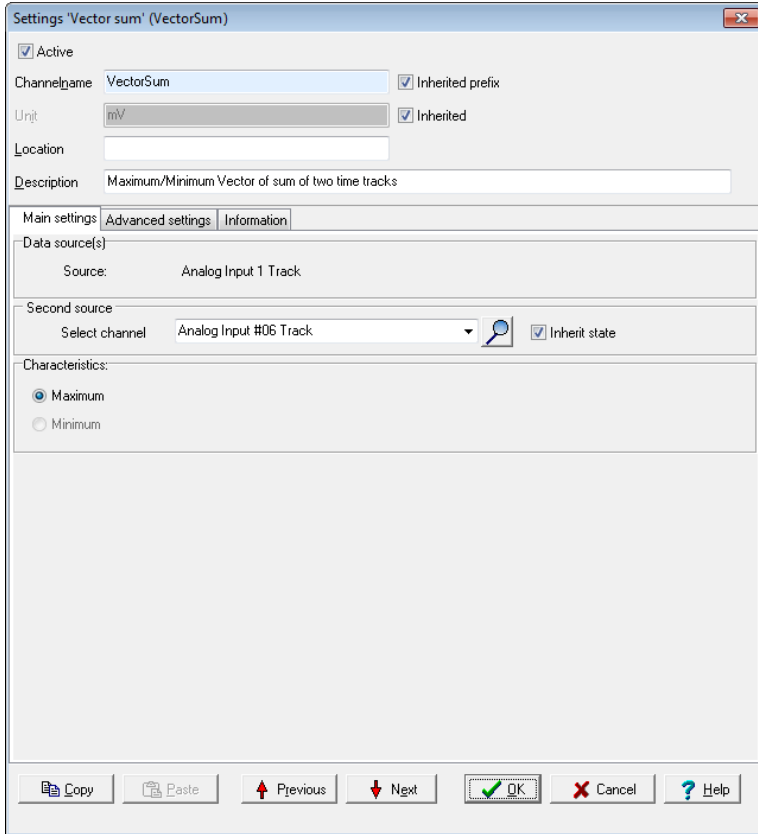
4.9.3.6   Local min/max values
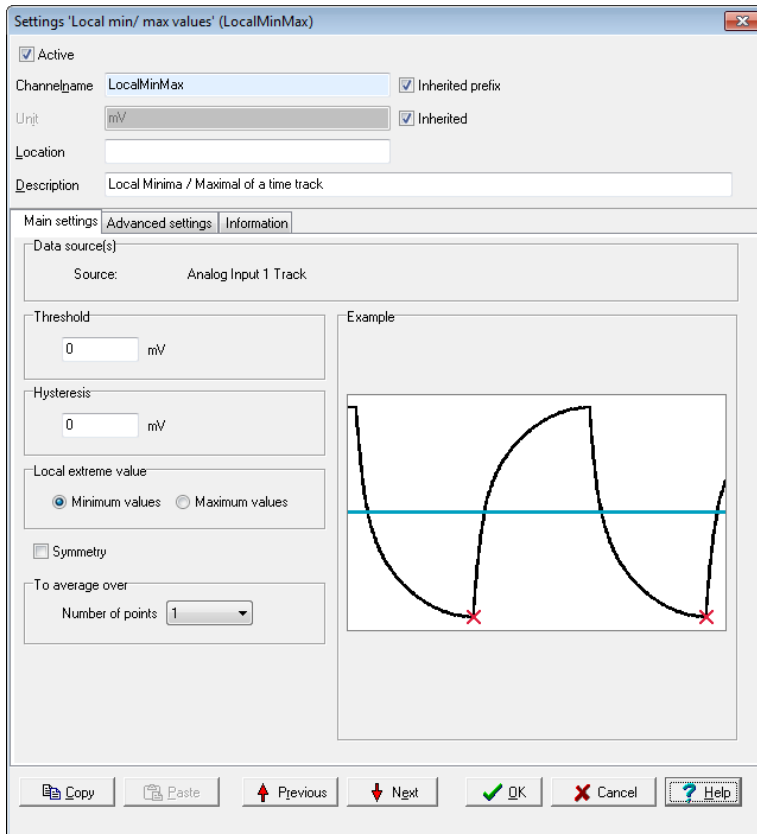
This function allows you to determine the minimum or maximum values of a signal relative to a threshold value. The time period over which the characteristic values are determined, is obtained from the "Trigger Group" on page 76 settings.

Threshold is the decisive value in determining minimum or maximum values.

Hysteresis prevents undesired values from being determined for small fluctuations around the threshold value in the monitored signal. Depending on the configuration, the hysteresis lies below the threshold (for maximum values) or above the threshold (for minimum values). See images.

Local extreme values: Specify whether minimum or maximum values are to be determined.

When using *symmetry*, it is not the minimum or maximum value that is determined, but the value right between the threshold overrun and under-run (for maximum values) or between threshold underrun and overrun (for minimum values).

Calculate average from: The minimum or maximum values determined are averaged arithmetically once again by their adjacent values.

Minimum without symmetry:
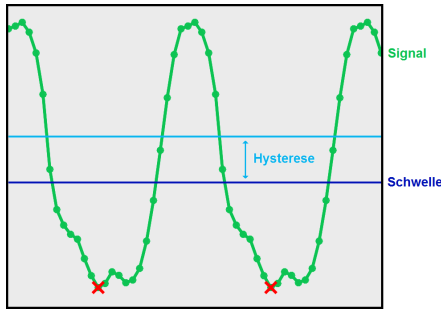
Minimum with symmetry:
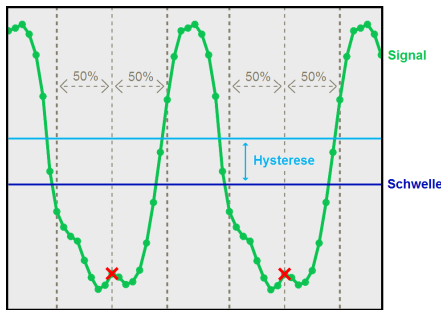
Maximum without symmetry:
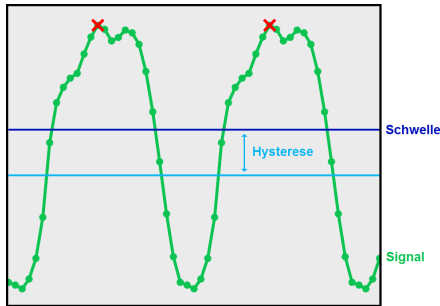
Maximum with symmetry:
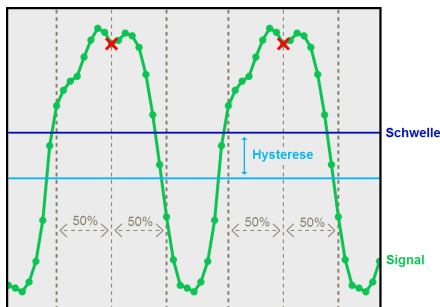
4.9.3.7 Sample rate

The function outputs the sample rate currently used in the channel. This allows you to see the frequency for the settings *bandwidth* or *rotation adaptive* that results for *sampling*.

4.9.4 Raw data track

The raw data track contains all measurement values following the A/D conversion without any further filtering.

STOP

The high A/D conversion rates used here generate a huge number of measurement values in a short amount of time.

4.9.5 Configuring digital inputs

Refer also to Settings for all dialogues, Galvanic isolation

Your device has ports that can be used only as digital inputs and ports that can be used both as inputs and as outputs. As long as you choose digital input as mode for these ports, these are identical to the pure inputs.

Method for digital inputs

1. Specify the logical level for the input (normal or inverted).
2. Indicate which replacement value is to be used if the input fails. Refer to "Additional settings tab" on page 45.
3. Sets how the input should be used: for counting or for frequency measurement.

Main settings tab
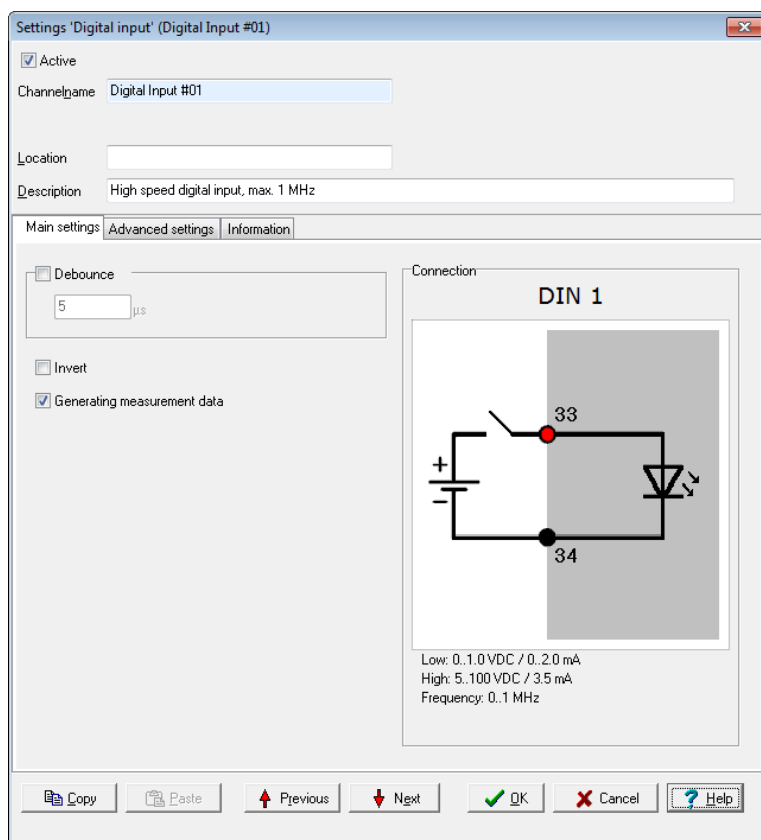
Debouncing: To hide short interference pulses, here you can specify a time period that you want to elapse before a signal is evaluated.

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

Generating measurement data: When this option is enabled, all resulting measurement data is transferred, although, for example, in the DataService Configurator *channels* tab, only one measured value will be shown. The display of individual measured values in DataService Configurator also works when this option is disabled. You only need to enable the option therefore if you want to see a graphical representation of the *route* or the overall result.

4.9.5.1   Counter (hardware)

 This channel counts the edges of a digital signal.
Refer also to "Counter" on page 163 (software).
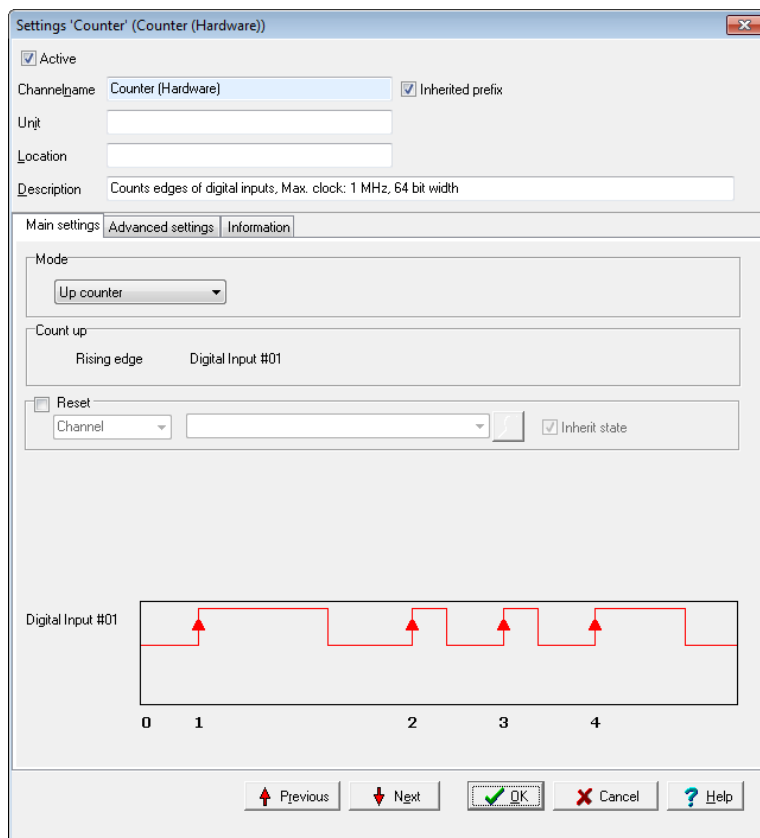
Mode

Upwards counter: Each rising edge at the input increases the counter by one.

Downwards counter: Each rising edge at the input decreases the counter by one.

Up/down counter: Each rising edge at the input increases the counter; each rising edge at the input specified for *downward count* decreases the counter.

Position counter: When the level is high at the input specified for *Direction*, each rising edge increases the counter by one, or decreases the counter by one if the level is low.

Quadrature decoder: The counter is increased by one if the signal at this input (*A*) has an edge before the signal at the input specified for *B*. Otherwise, the counter is reduced by one (signal *B* before signal *A*). Depending on the quadrature mode, the following will be evaluated (counted): only the rising edge of signal *A* (*1x*), both edges of signal *A* (*2x*), or all edges of the signals *A* and *B*.

You can use the function, for example, to determine the rotation angle at a gear via two sensors. For this purpose, the sensors must be offset by 90 degrees of a vibration (360 degrees). That is, for example, they must be aligned to the tooth and the centre between the tooth and gap and must output the distance as tooth (1) or gap (0). Use the 4x setting in the case of few teeth in order to improve the angle resolution. Note the maximum frequency of the input when dealing with many teeth or high rotation speeds.

Reset

Select an available channel via *Channel* that will reset the counter with a rising edge. In the case of *Application*, you can achieve this via DataService Configurator or a **ProfiSignal** application. But note the time delay that is created by the transmission via the interface.

Info

For activating *Persistence* in the *Additional settings* tab, e.g. in the event of power outage, the last counter reading is saved and counting resumes from this point.

4.9.5.2 Frequency

This channel determines the frequency of the signal applied.
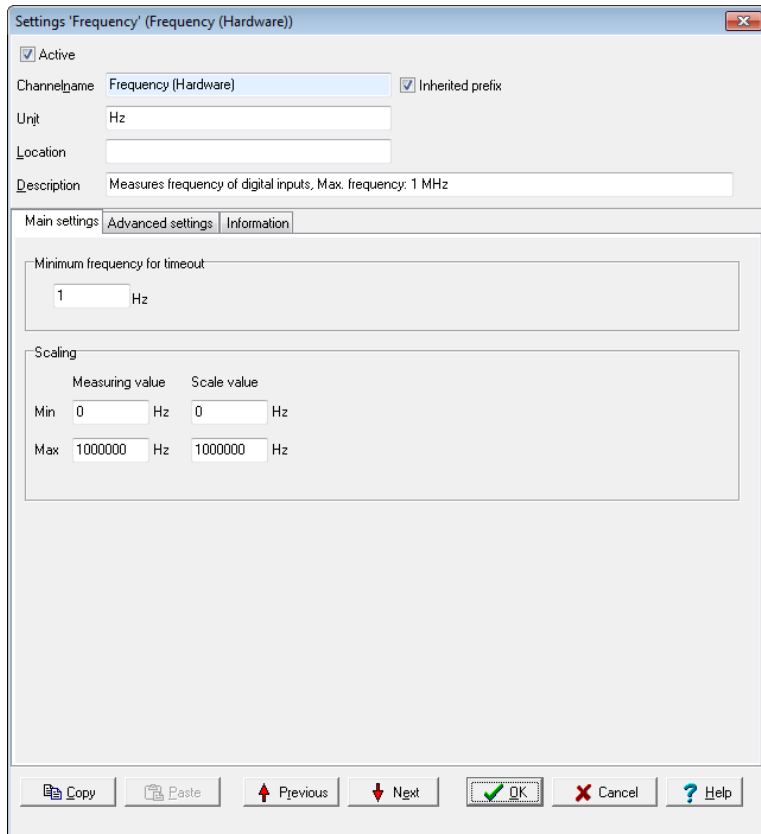
Minimum frequency range

Below this threshold, 0 is displayed and/or output. Since the measurement value fluctuates considerably in the case of few pulses per second, the default setting for the threshold is 1 Hz. But different applications may require higher thresholds.

Scaling

Enter two points from the sensor's characteristic curve, if possible, the lower (*Min*) and upper (*Max*) vertexes. For a linear characteristic, measurement values are then converted into the unit of measurement (*scale value*) from the sensor. The specified range 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 <u>Status monitoring</u>.

4.9.6   Digital outputs (**Expert Vibro** / **Expert Transient**)

Mode

You have the choice of three different settings: *Switch output*, *Fast limit value* and *PWM*. Depending on the setting, you will see further input fields.

Switch output and fast limit value mode

In *switch output* mode the output is controlled via the channel, and the response time is in the milliseconds range. In *Fast limit value* mode the output is controlled directly at Trigger group detection and the response time is in the 10 µs range.

Switch output mode:

In *switch output* mode the output is controlled via the channel, and the response time is in the milliseconds range.
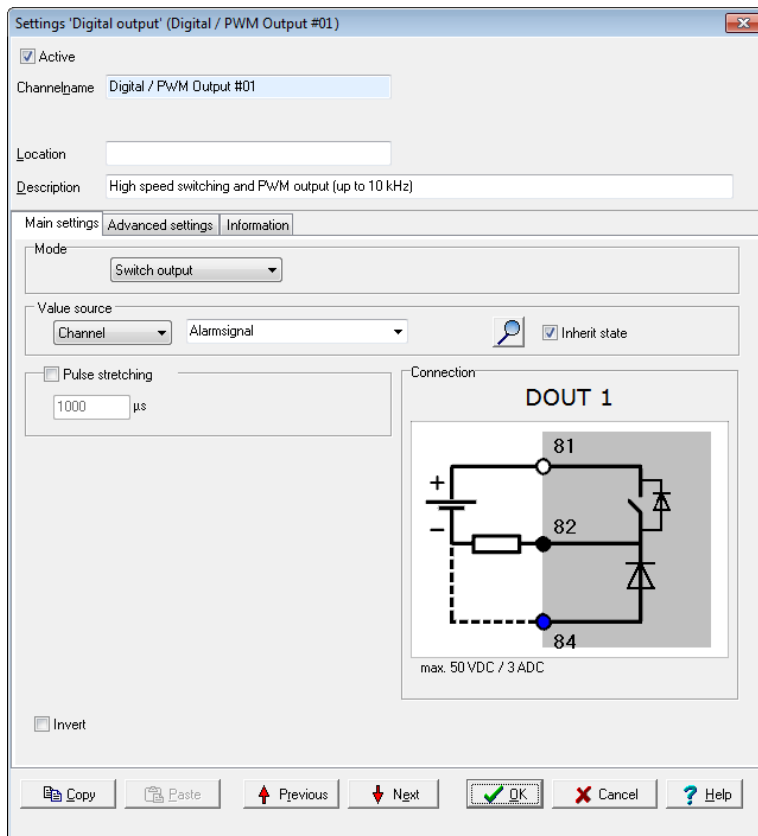
Value source: Select an available channel whose value is to be output using *Channel*, or enter a constant value (*Manual value*). Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a ProfiSignal application.

Inverted: When enabled, this option inverts a 'high' level to a 'low' level at the output (measurement signal in device) and vice versa.

Pulse stretching: With this option you can ensure that at least one output pulse of this length is output, even if the specified value source has issued a shorter duration signal.

PWM mode
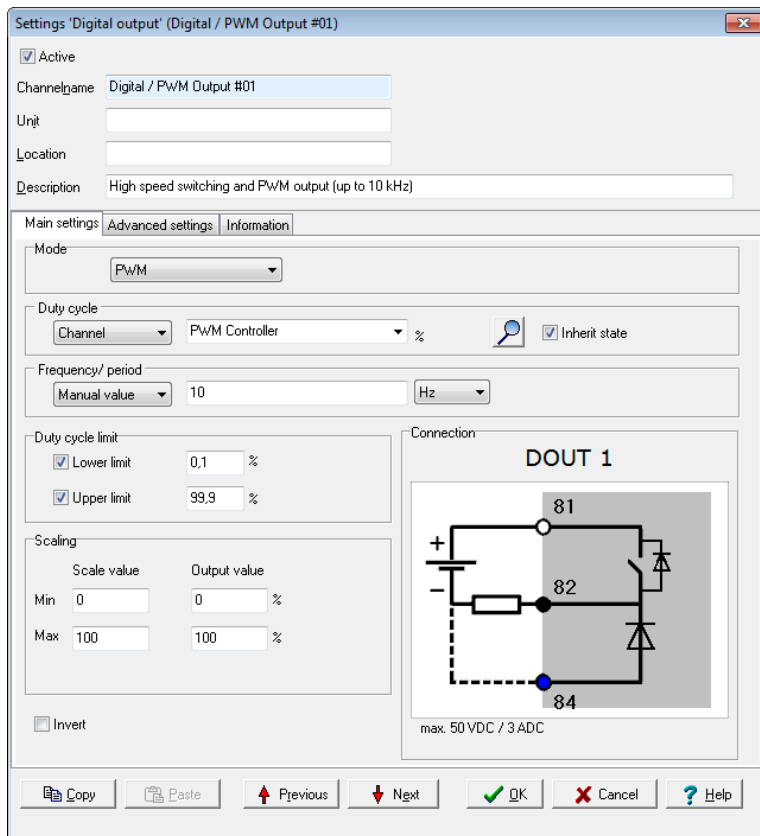
Duty cycle: Sets how the duty cycle should be controlled: Enter either a constant (*Manual value*) or select an existing channel from *Channel* whose value can be output as a scaling-dependent duty cycle. Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a ProfiSignal application. If you enter a channel, you must use a fixed value for the signal frequency.

Frequency/period: Enter a *channel* or a *manual value* (fixed frequency) for the output. If you enter a channel, you must use a fixed value for the duty cycle.

Duty cycle restriction: Enables you to set the variation limits for the duty cycle.

Scaling: Based on the scale specified here, the source signal is converted into the output value.

Inverted: When enabled, this option inverts a 'high' level to a 'low' level at the output (measurement signal in device) and vice versa.

4.10 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.
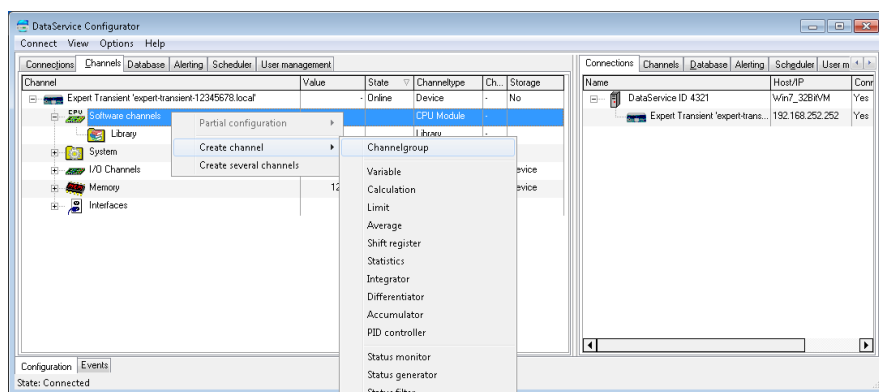
Alternatively, software channels can be created via the context menu of a hardware channel as *Create dependent channel.* In contrast to creation via *Software channel*, the source channel is already selected within the dialogue and the channel is (initially) located directly under the hardware channel. 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 chan-nels*. Further information is available in the manual of the DataService Con-figurator. Weitere Informationen dazu finden Sie im Handbuch zum DataService-Konfigurator.

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.

4.10.1 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.

4.10.2 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 .

4.10.3 Differentiator

Refer also to Additional settings tab, "Information tab" on page 49.

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:

$$Differenzial = \frac{(\Box Wert)}{\Box Zeichens\,tempel} * Zeitbasis$$

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.

4.10.4 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
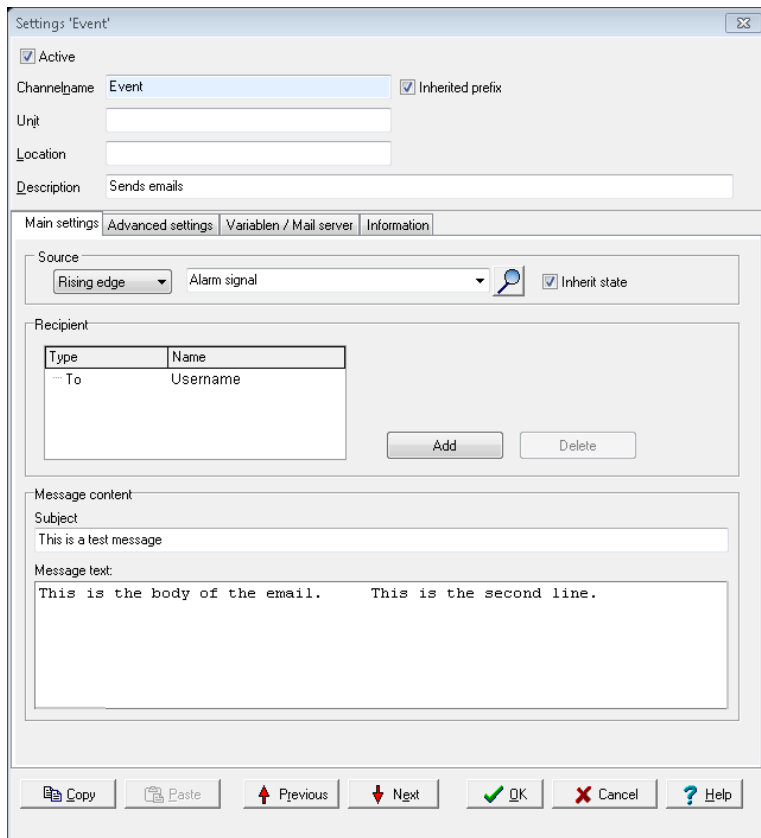
Info

Set special variables for the message text or subject line in the dialogue of the *Variables/Mail Server* tab.
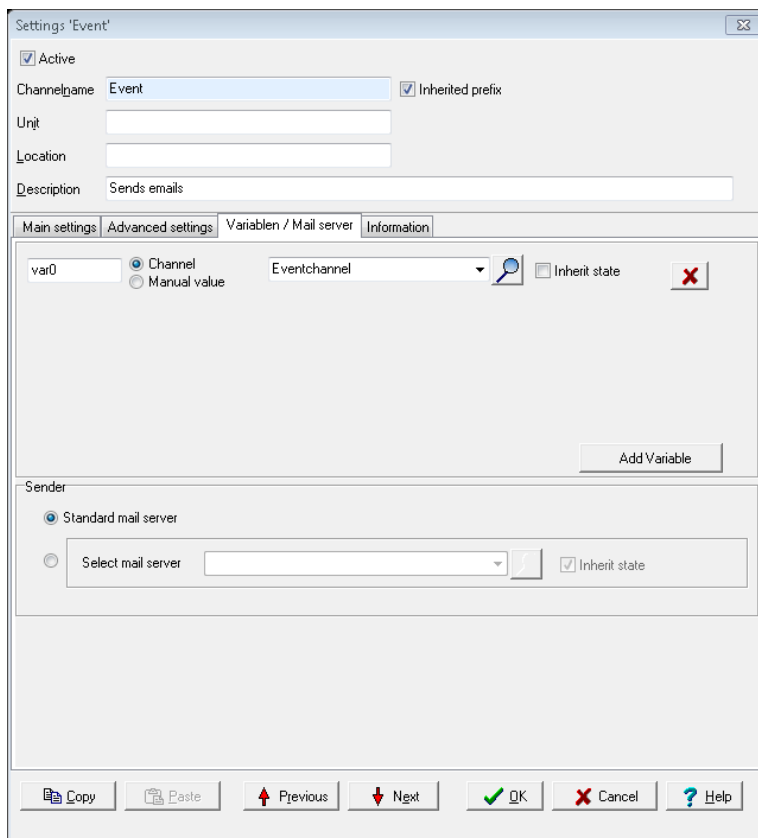
Source: Specify whether the event is to occur with a rising, falling or both edges of the channel in question.
Refer also to .

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 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.

4.10.5 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.
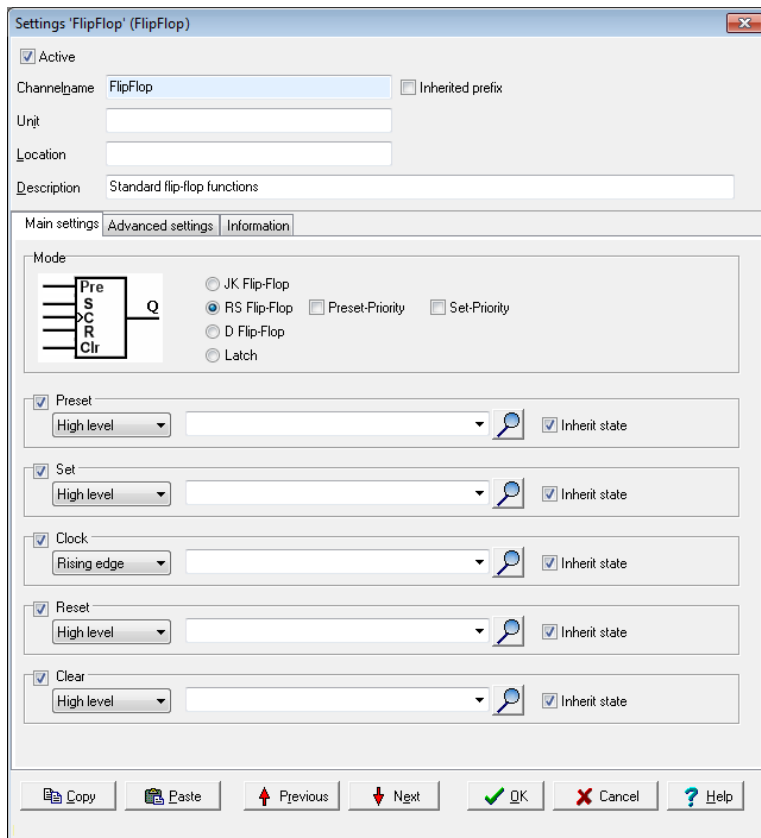
The "Latch" mode will store any data types, for example, if the D source is an analogue channel, the flip-flop stores the analogue value.

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

4.10.6 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.
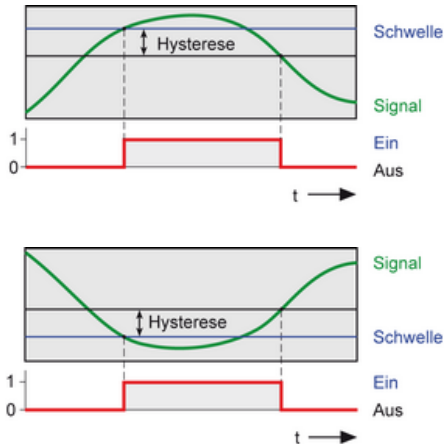
Bandwidth: Sets the "monitoring window" for forms of monitoring: *Band violation* and *steady condition*. In *Band monitoring/violation*, the "monitoring window" is symmetrical to the threshold. The value entered acts as a subtraction to the window with *band monitoring* in positive and negative directions, 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 .

4.10.7 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*.
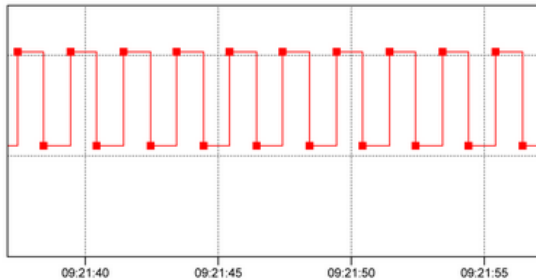
- *Synchronous*: Pulses are generated with a repetition rate based on the time. If, for instance, a *Cycle time* is set at 15 minutes, pulses are generated at 00, 15, 30 and 45 minutes of each hour. As the pulses can only be generated with an integer scaling factor, only discrete values can be selected.
  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 51.
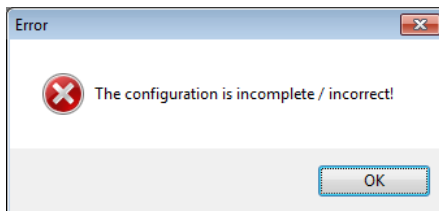
After closing the dialogue with OK , a validity check is performed. If the input is invalid, e.g. the pulse width is greater than the cycle time, an error message is displayed and the previous valid configuration is retained.

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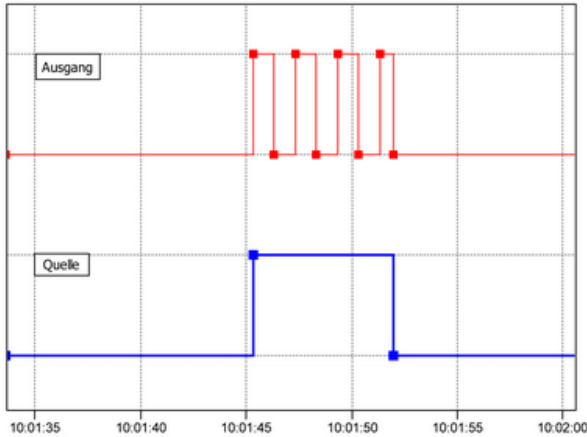
The diagram shows the release of the pulse generator (**red** curve) by the source (**blue** curve).

Example 1
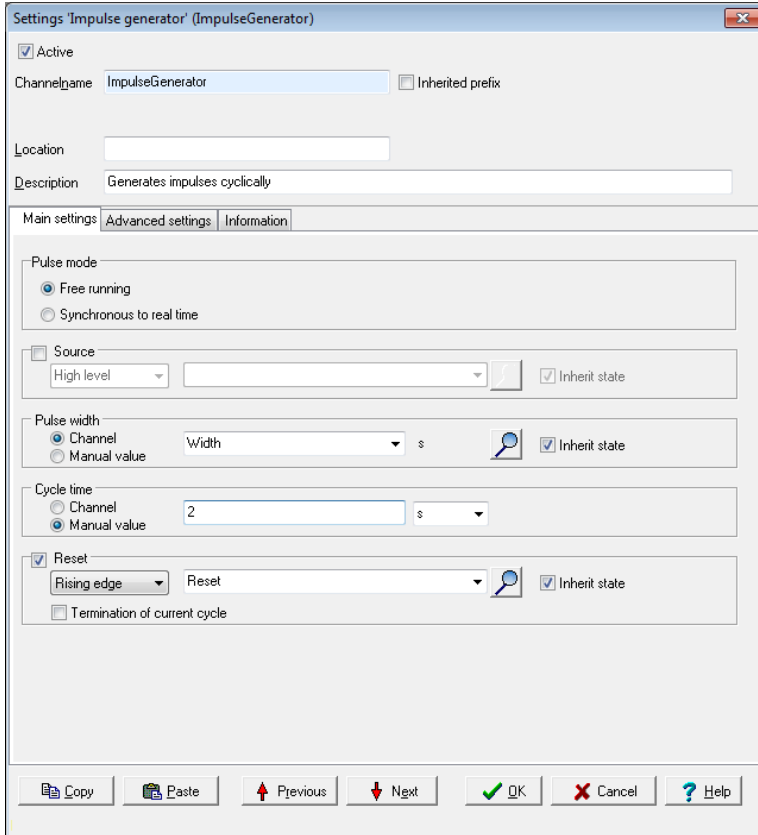
In this example, the pulse generator runs in continuous mode. The cycle time is 5 seconds. A channel has been selected for the pulse width that initially outputs the value 1 and then the value 2. The channel is not permitted to output a negative value (no negative times) nor a value greater than the cycle time, i.e. 5 in this example. Another channel is given for the reset.
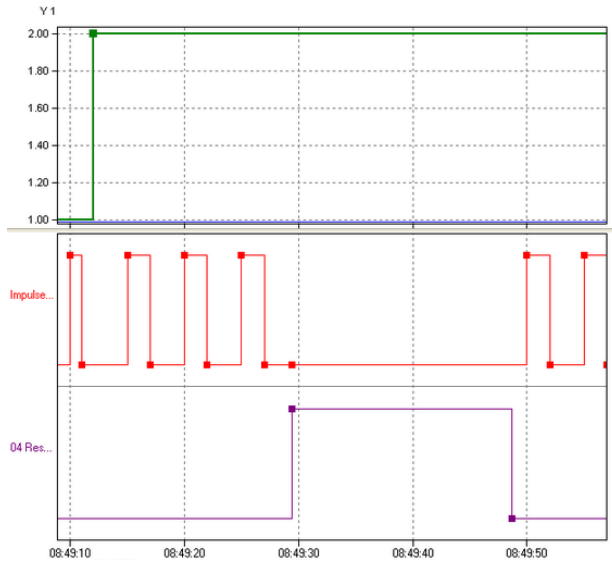
Once the pulse generator starts (**red** curve) with a pulse duration of 1 second, the pulse duration is set to 2 seconds (**green** curve). After three pulses, the reset channel (**purple** curve) gives the reset signal and the pulse generator issues no more pulses (the next pulse would be due at 8:49:30). 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
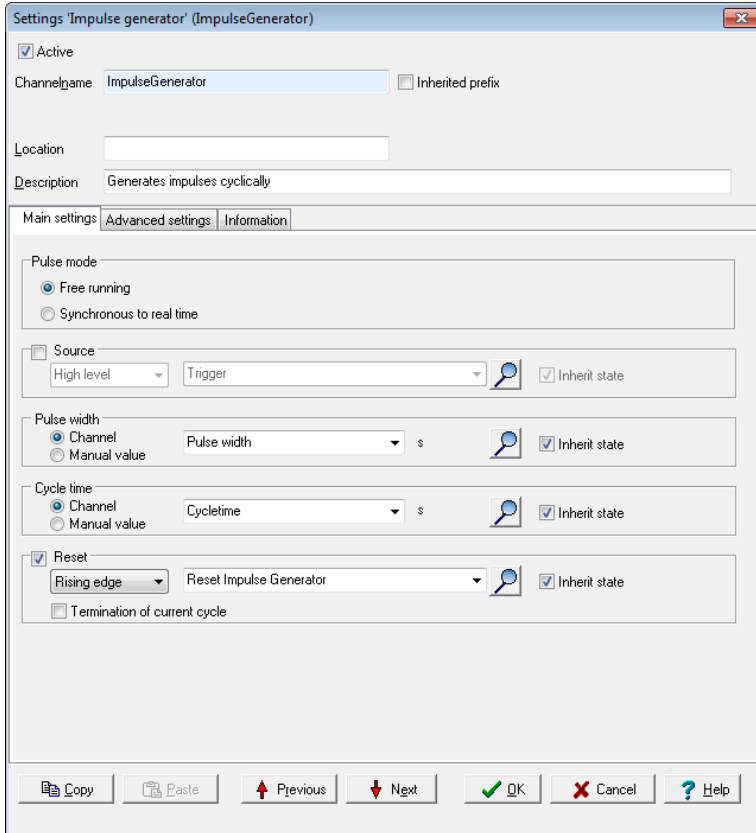
In this example, the pulse generator runs in controlled mode. The trigger is enabled by setting *High level* ("High"). The pulse width and cycle time are set by other channels. Note that these channels may not issue negative values (no negative times) nor conflicting values such as a pulse width greater than the cycle time. Another channel is given for the reset.
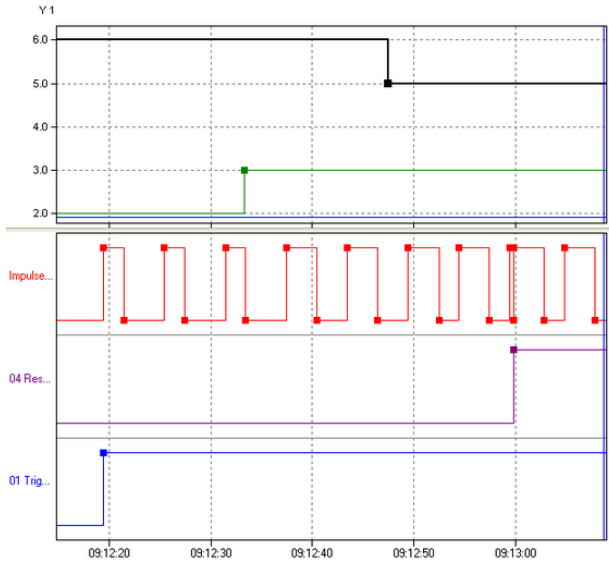
The pulse generator (**red** curve) is started by the trigger channel (**blue** curve) with a 2-second pulse duration (**green** curve) and a 6-second cycle time (**black** curve). After three pulses, the pulse duration is increased to 3 seconds (**green** curve). After another two pulses, the cycle 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.
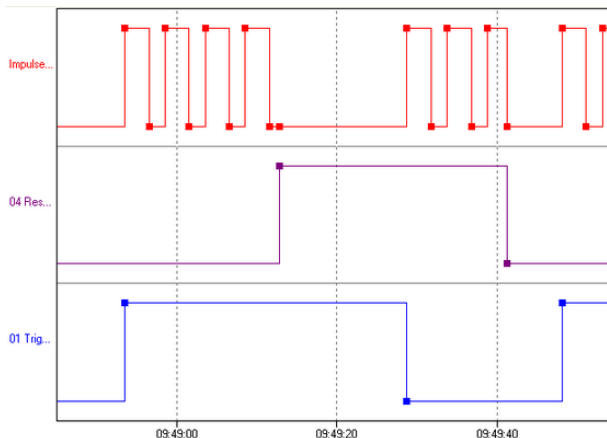
The trigger (**blue** curve) starts the pulse generator (**red** curve) with a rising edge. Then the reset (**purple** curve) is triggered with a rising edge and the pulse generator is stopped. Pulses are generated again only after the trigger gives a new start signal with a falling edge. A falling edge 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.
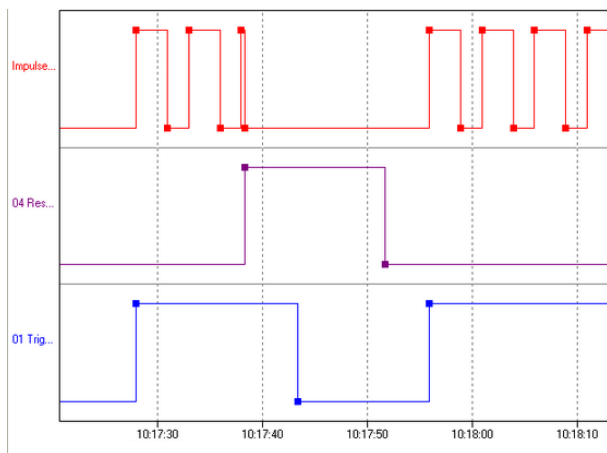
The trigger (**blue** curve) starts the pulse generator (**red** curve) with a rising edge. Then comes the reset (**purple** curve). Because the high level ("high") remains, no further pulses are generated (*Reset = High level*). Meanwhile, the trigger channel switches to a low level ("Low"). However, 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*.
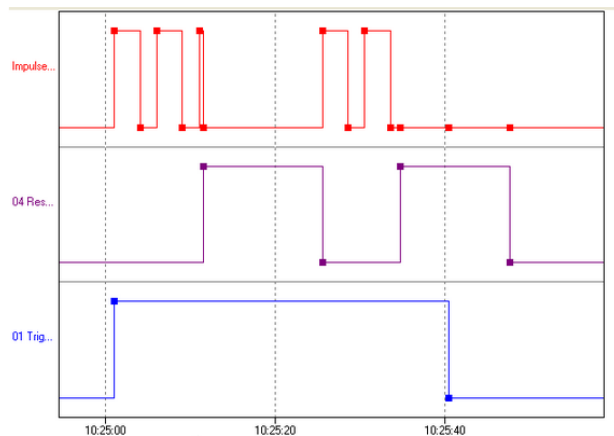
The pulse generator (**red** curve) is started by the trigger channel (**blue** curve). When a reset signal (**purple** curve) is received, the output is set to "low" and no further pulses are generated. When the reset signal resets to "Low", the pulse generator re-starts (10:25:25) because the trigger 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)*.
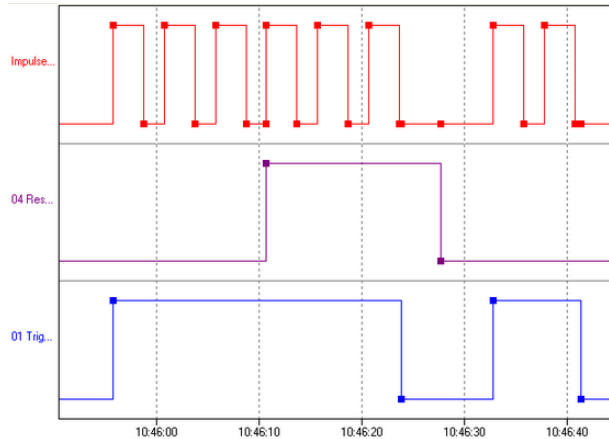
The pulse generator (**red** curve) is started by the trigger channel (**blue** curve). When a reset signal (**purple** curve) is received, the pulse counter is set to "low", but begins immediately to generate new pulses because the trigger signal remains "High" and the reset signal is generated only 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.

4.10.8 Integrator

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

$$Integral = \Sigma\left(\frac{Vorg\ddot{a}nger + aktueller\,Wert}{2} * \Box Zeitstempel * \Box Zeitbasis\right)$$

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 45.

4.10.9 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).

4.10.10 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 a table type.
    For external tables, then select a table; for an internal table, create a table via the *Table* tab that is then displayed.
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: 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*.

Formathinweise für Export und Import

Zum Importieren oder Exportieren einer Tabelle beachten Sie bitte folgende Hinweise.

Eine Tabellendatei für einen Linearisierungskanal ist durch die Endung ".tab" gekennzeichnet. Weiterhin sind diese Tabellendateien nach folgendem Schema aufgebaut:

Zeile	Text	Description
1	Mode:X;""	Auswahl des Tabellenmodus
2	y1;z1	Erster Kalibrierpunkt
3	y2;z2	Zweiter Kalibrierpunkt
…	…	Weitere Kalibrierpunkte

Bitte beachten: Für die Werte y und z wird der Dezimalseparator "," verwendet.

Für das Attribut "Mode:" ist für "X" im oben dargestellten Schema einer der folgenden Werte eintragbar:

Eingestellter Modus	Attribut	Anzahl von Kalibrierpunkten
Offset	Offset	1
Offset and slope	Gradient	2
Quadratic	Squarely	3
Linear inter-polation	Linear	>=3
Spline inter-polation	Spline	>=4

4.10.11 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).
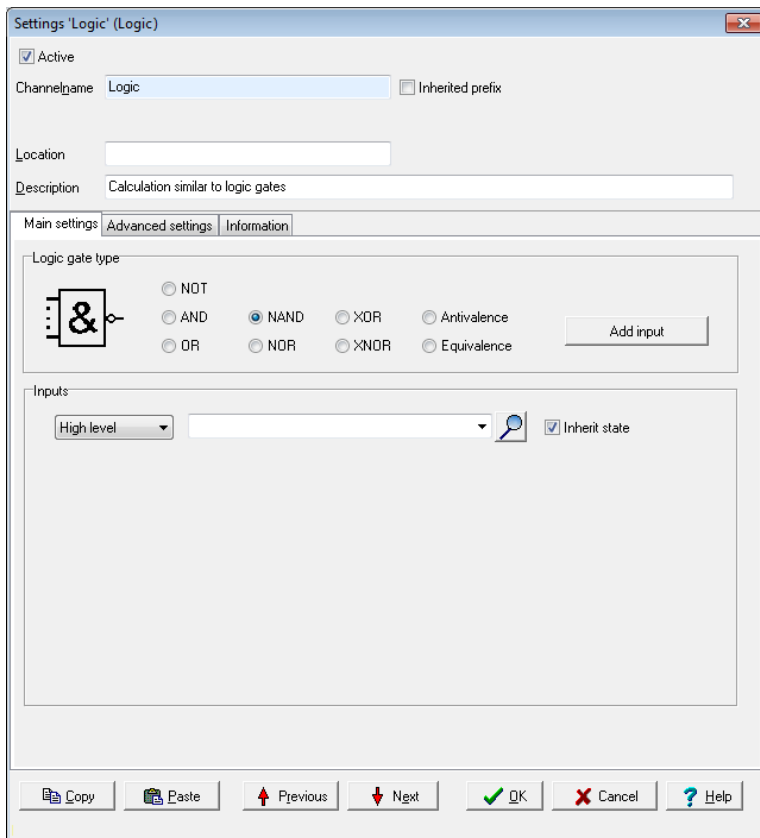
Add input produces additional inputs. All inputs are linked according to the selected logic.

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

Click ![x] 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
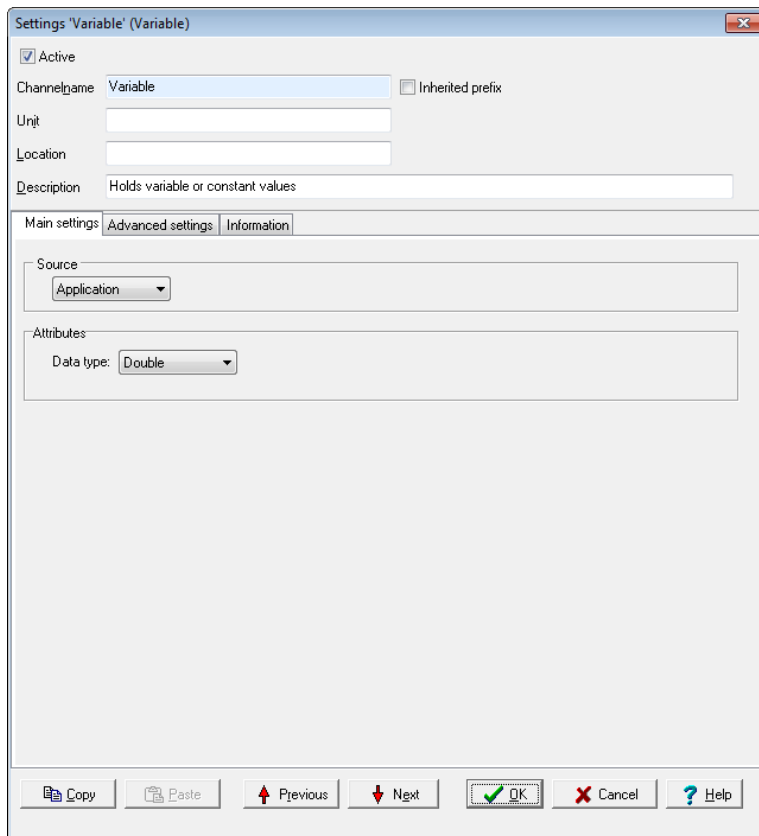
Input value A	Input value B	Input value C	Output value
L	L	L	H
L	L	H	L
L	H	L	L
L	H	H	H
H	L	L	L

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

4.10.12 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.
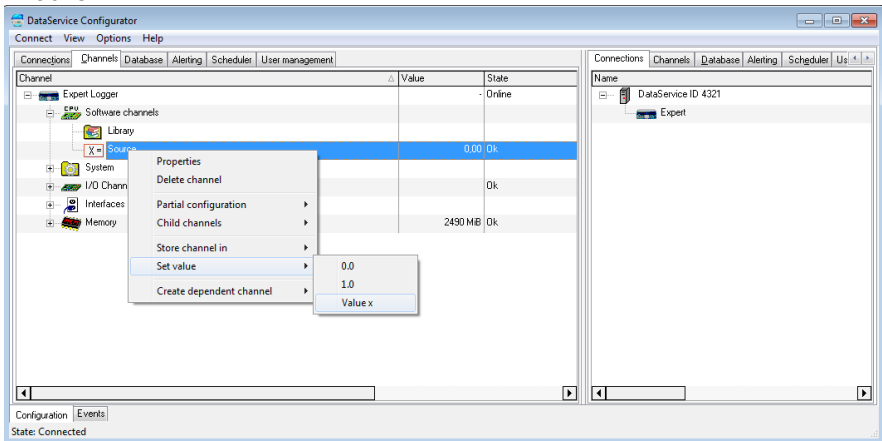
Source: Select an available channel whose value will be used via *Channel*, or enter a constant value (*Manual value*). Selecting *Application* enables the output value to be manually set via the DataService Configurator or automatically set via a **ProfiSignal** application.

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*.

4.10.13 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.

4.10.14 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.

4.10.14.1 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:
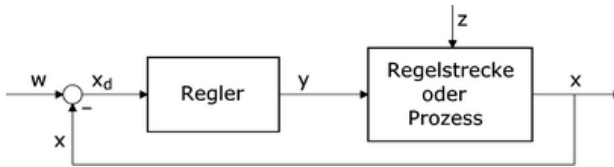
Control parameter

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:

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

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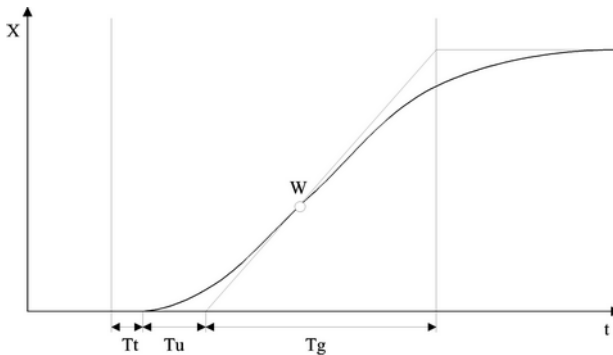
The controllability of such a control path by a PID controller can be estimated as follows:

        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:

$$T_I = 1 / K_I * x_h / y_h$$

$$K_I * t_0$$
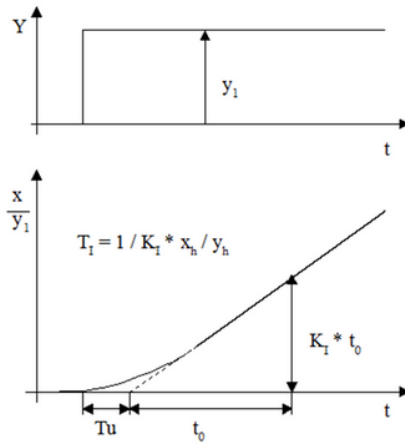
Continuous controller (PID)

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

4.10.14.2 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

4.10.14.3 Configuring PID controllers
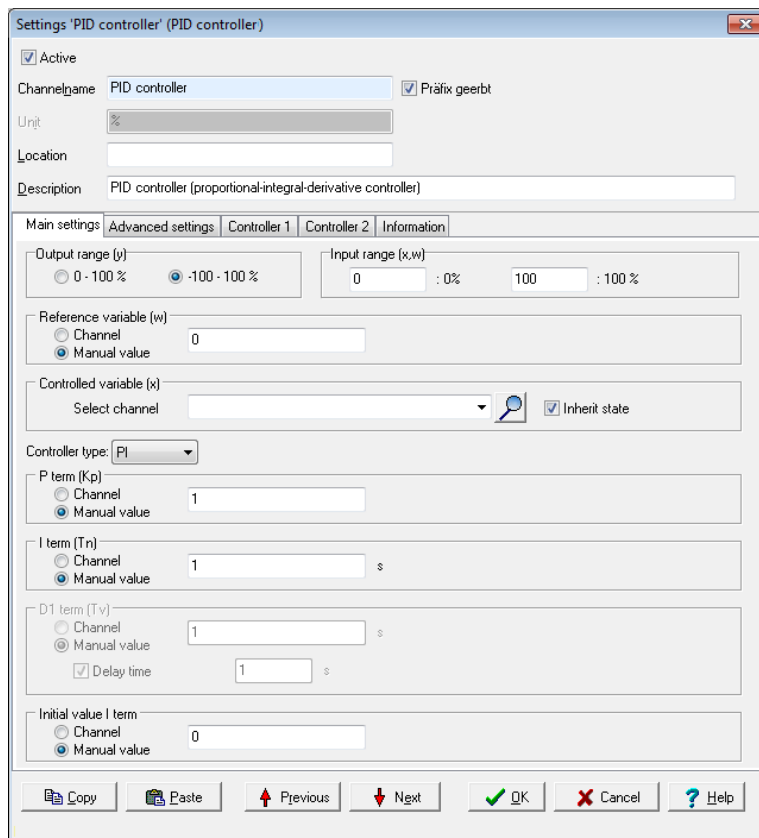
The controller is specifically configured in tabs "Main settings", "Controller 1" and "Controller 2".

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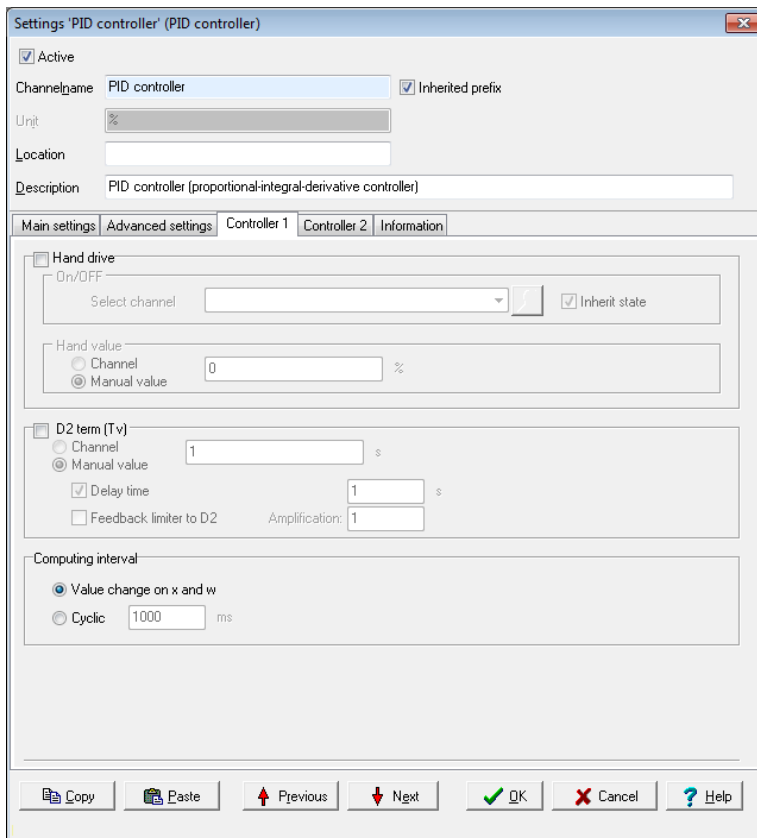
I term (Ti): The I term of the controller, i.e. the integral time, Tn. Alternatively to manual configuration, you can control Tn via a channel, for example, via a slider from a visualisation system.

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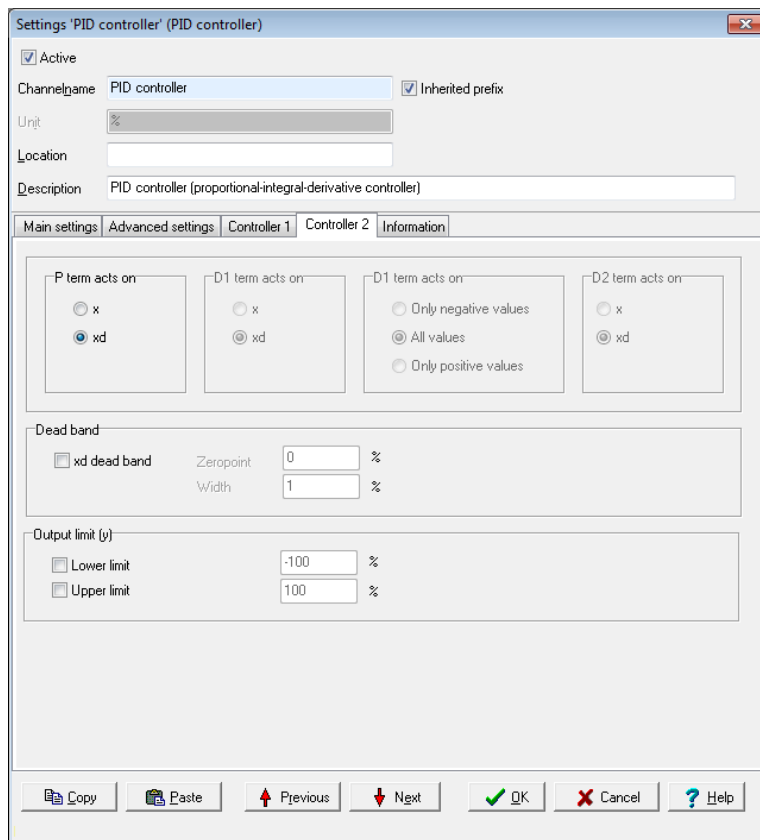
D2 term (Td): Optional second D term of controller.

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.

4.10.15 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.

4.10.16 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 cal-culation	Function	Data types		Syntax
		Operand1	**Operand2**	
Basic cal-culations	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) oper-ations	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 pos-itions in oper-and2.)	bool, int	bool, int	Operand1 << Operand2
	Right shift (move operand1 to the right by number of pos-itions in oper-and2.)	bool, int	bool, int	Operand1 >> Operand2

Type of cal-culation	Function	Data types		Syntax
		Operand1	Operand2	
Operations with sets	Minimum	bool, int, float	bool, int, float	Min(oper-and1, oper-and2)
	Maximum	bool, int, float	bool, int, float	Min(oper-and1, oper-and2)
Matching oper-ations	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(Oper-and1)
	Cosine	bool, int, float	—	COS(Oper-and1)
	Sine	bool, int, float	—	SIN(Oper-and1)
Reverse trig. functions	Arctangent	bool, int, float	—	ATAN(Oper-and1)
	Arccosine	bool, int, float	—	ACOS(Oper-and1)
	Arcsine	bool, int,	—	ASIN(Oper-

Type of cal-culation	Function	Data types		Syntax
		Operand1	Operand2	
		float		and1)
Other oper-ations or func-tions	Exponential	bool, int, float	—	EXP(Oper-and1)
	Power	bool, int, float	bool, int, float	POW(basis, factor) POW(Oper-and1, Oper-and2)
	Root	bool, int, float	—	SQRT(Oper-and1)
	Modulo	bool, int, float	bool, int, float	Operand1 % Operand2
	Absolute	bool, int, float	—	ABS(Oper-and1)
	Natural log-arithm	bool, int, float	—	LN(Oper-and1)
	Logarithms (base 10)	bool, int, float	—	LOG(Oper-and1)
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.

4.10.17 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 51.

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.

4.10.18 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.

4.10.19 Setpoint

This software channel enables the device to be used as a program con-
troller. The setpoint table creates a conditional procedure (track) with ref-
erence 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
45, "Information tab" on page 49

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.

Settings 'Setpoint' (Setpoint)

☑ Active

Channelname: Setpoint   ☐ Inherited prefix

Unit:

Description: Generate slopes, steps, curves either timed or triggered

Main settings | Advanced settings | **Table** | Variables | Information

Line	Time			Value	
	Type	Value/ channel	Time unit	Type	Value/ channel
1	Value	0,001	Minutes	Variable (Value)	var0
2	Value	15	Minutes	Variable (Value)	var1
3	Value	6	Seconds	Variable (Value)	var2
4	Value	2	Days	Value	0
5	Value	7	Hours	Value	0

[Append]   [Delete]

Global settings

[Relative time ▼]   Cycle time [1 second ▼]   [Import]   [Export]

[Copy] [Paste] [↑ Previous] [↓ Next] [✓ OK] [✗ Cancel] [? Help]

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*.

4.10.20 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.

4.10.21 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.

4.10.22 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 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-run	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.

4.10.23 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 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-run	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 = infin- ity)	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 meas- urement. 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 sig- nal of that channel depends on the calculation, there is a loop and thus a recursion. The **MetiOS** software recog- nises 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.

4.10.24 Stopwatch

Example 1

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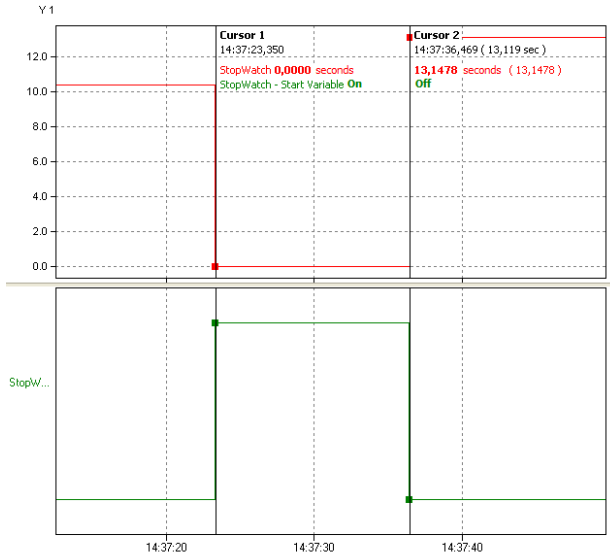
The stopwatch starts (**red** curve) at a high level in the start/stop channel (**green curve**). Once the level reverts to low, recording stops. The recording time is the high level time.

Example 2

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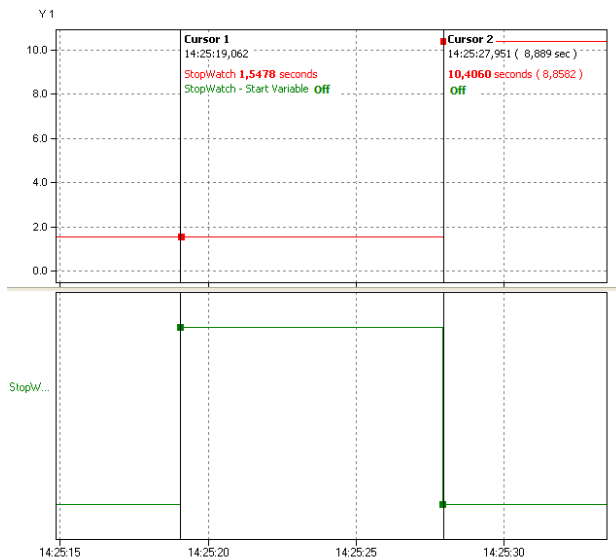
The stopwatch starts (**red** curve) when a high level starts in the start/stop channel (**green curve**). The last measured value was 1.5478 seconds. Once the level reverts to low (8.8582 seconds, calculated from the beginning of the high level), recording stops. The last measured value is added to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

4.10.25 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)).

4.10.26 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.
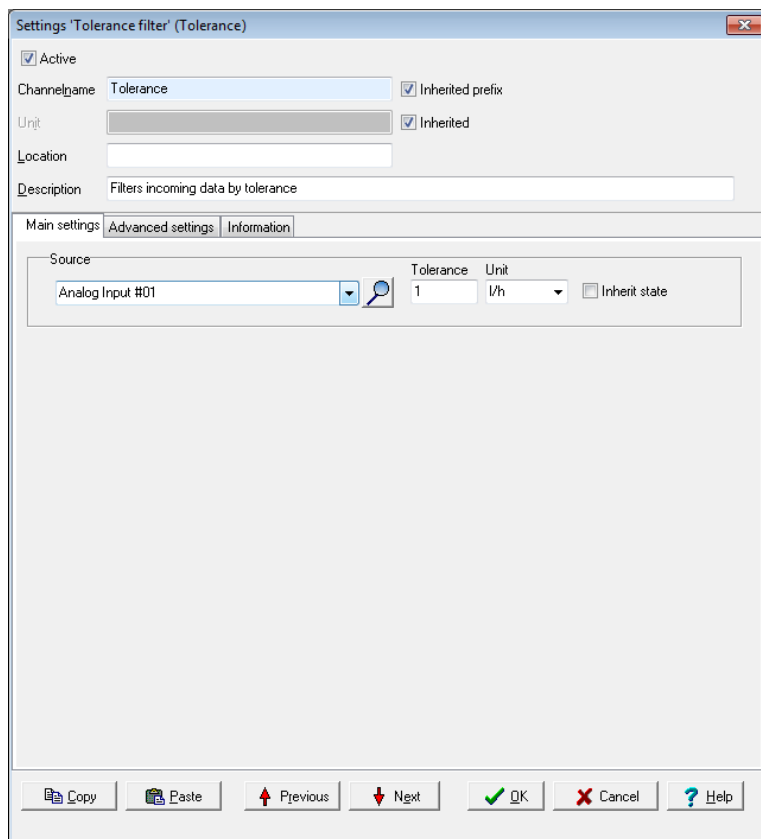
4.10.27 Trigger

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.

4.10.28 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.

Settings 'Clock' (Clock)

☑ Active

Channelname   Clock

Unit

Location

Description   Date and time as a data value

Main settings | Advanced settings | Information

Mode

○ Unix time

◉ Seconds since midnight
   0 ... 86399 (24h * 60min * 60s)

○ Structured date and time
   Example: 16.01.12 14:31:51
   is 120116143151

○ Structured date
   Example: 16.01.12 is 120116

○ Structured time
   Example: 14:31:51 is 143151

○ Daylight saving time active

○ Coordinated universal time (UTC)

○ Time zone

○ Day of the week
   1 (Monday) ... 7 (Sunday)

○ Day since year beginning
   1 ... 365

○ Number of Year

○ Number of months
   1 (january) ... 12 (december)

○ Number of days
   1 ... 28/29/30/31 (depending on month)

○ Number of hours
   0 ... 23

○ Number of minutes
   0 ... 59

○ Number of seconds
   0 ... 60 (may include one leap second)

○ Source of the clock

○ The clock is synchronised

○ Synchronisation chain

○ Frequency error of the clock

○ Time as string

○ Time as string
   without weekday and timezone

○ Last system start of the server

○ Last system start of the device

[Copy] [Paste] [↑ Previous] [↓ Next] [✓ OK] [✗ Cancel] [? Help]

4.10.29 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 .

4.10.30 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 auto-
matically 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 45.

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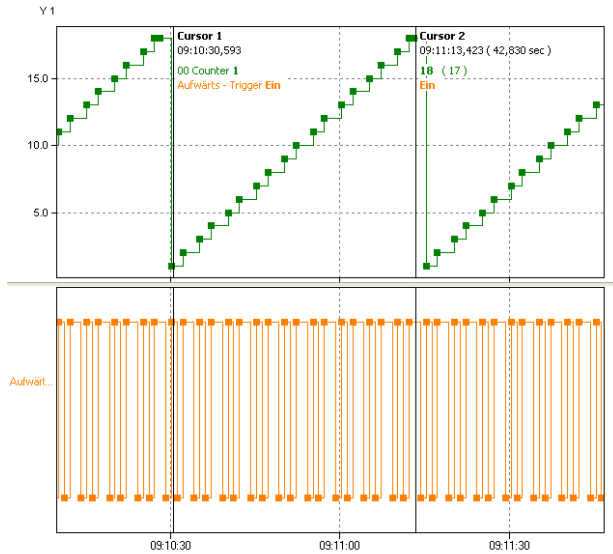
The counter (**green** curve) increases by one for each rising edge from the source channel (**orange** curve) until the reset trigger becomes active. The *Generate intermediate values* option is enabled, so all new counter readings are output immediately.

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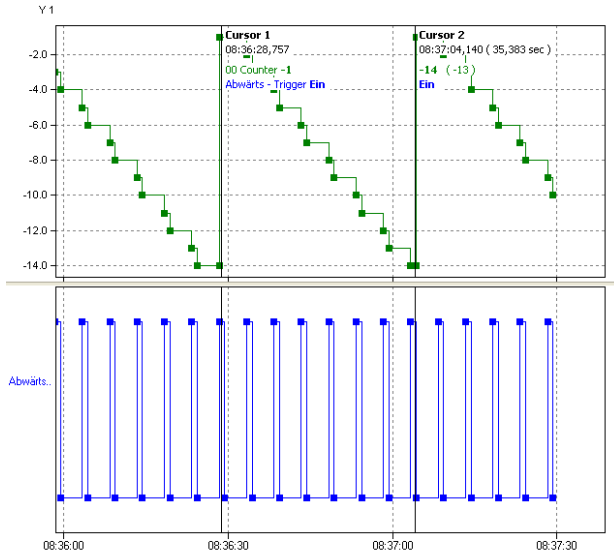
The counter (**green** curve) decreases by one for each edge from the source channel (**orange curve) until the reset trigger becomes active.** The *Generate intermediate values* option is enabled, so all new counter readings are output immediately.

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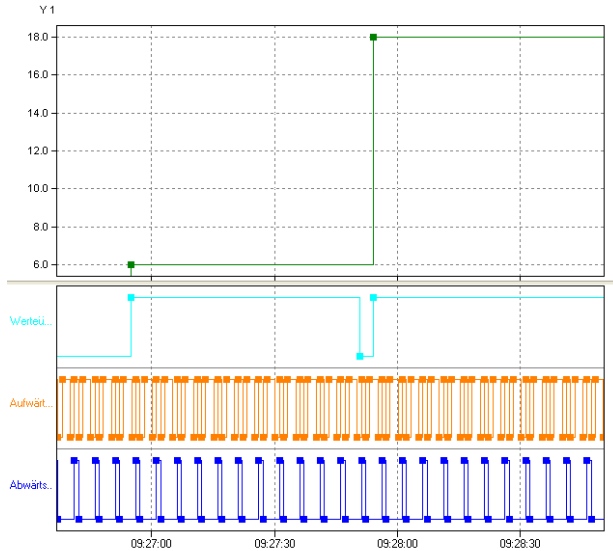
During the period of value transfer (**light blue** curve), the counter value is output. The option *Generate intermediate values* is disabled, so no intermediate values are output.

4.10.31 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.
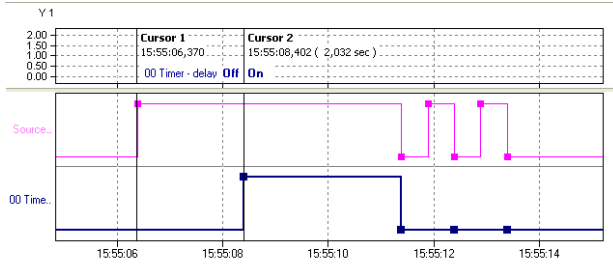
Dropout delay: The output of the timer channel becomes active ("On") when the source switches to an active state (*High level* or *Low level* trigger) or edge triggering (*Rising edge*, *Falling edge* or *Edges (both)* triggers). The same edge or the switch of the source from active back to inactive starts the delay time. At the end of the delay time, the timer's output becomes active ("Off").
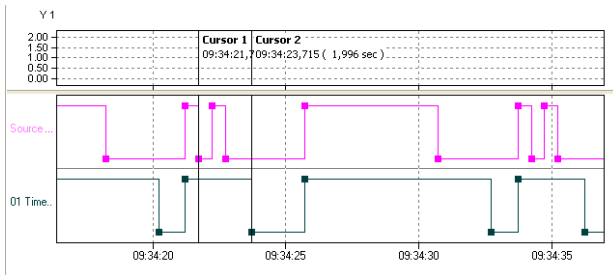
The image shows the signal of a dropout delay with level triggering (Low level).

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
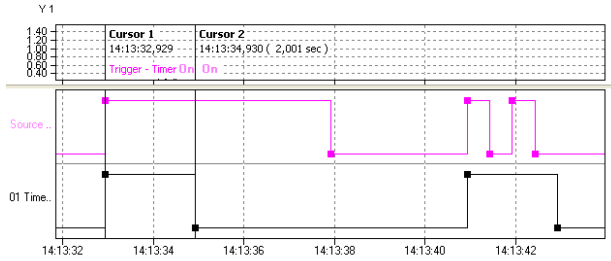
The source (**purple** curve) triggers with a rising edge. The delay is 2 seconds. Retriggerable is not enabled.
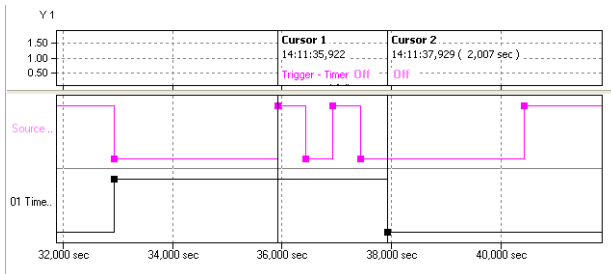
The source (**purple** curve) triggers with a *falling edge*. The delay is 7 seconds. *Retriggerable* is not enabled.

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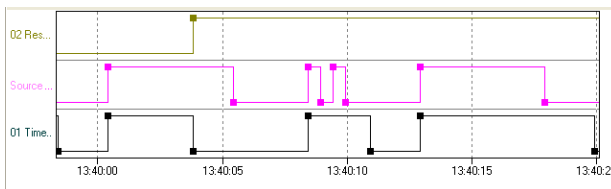
The source (**purple** curve) triggers with a *rising edge.* The delay is controlled via a channel. *Retriggerable* is not enabled. Reset (**green** curve) occurs at a *Rising edge.*
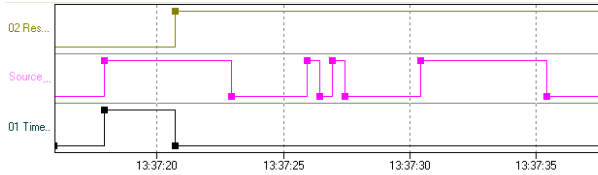
The source (**purple** Triggers curve) triggers with a *Rising edge* . The delay time is controlled via a channel. *Retriggerable* is not active. Reset (**green** Curve) occurs at a *High level.* The timer (**black** curve) is then blocked for the duration of the reset signal.

4.11 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 73, "Settings for all dialogues" on page 43

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)

4.11.1 TCP/IP services

You can configure an ethernet connection to enable you to connect the device to a Modbus system (Modbus TCP).
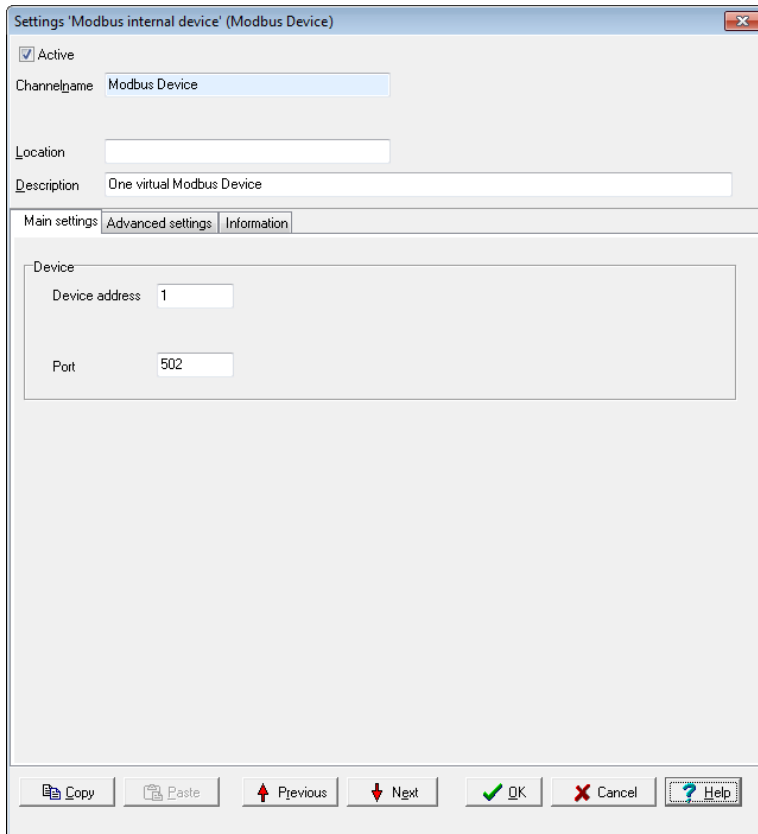
Refer also to "LAN" on page 217 if you wish to set up a DHCP server.

4.11.1.1 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 ![Mod] symbol is displayed following configuration. Then create and configure the required Modbus channels (signals).

4.11.1.2 Modbus Device (Client)

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

4.11.1.3 Modbus channel

Depending on whether you want to output or read a signal, select *Create channel→ Modbus* output or Modb*us inp*ut. A Modbus input channel is identified by ![icon] 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.

4.11.2   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
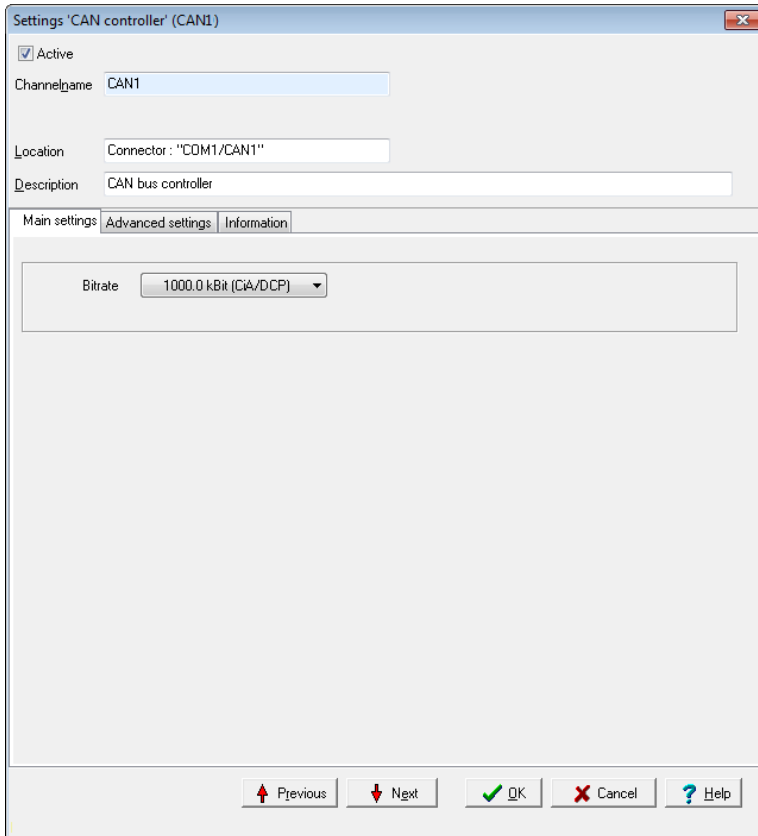
Bit rate

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).

4.11.2.1 CAN protocol

Create a channel for the CAN protocol via the context menu *Create channel → CAN protocol (RAW)* of the CAN connection.
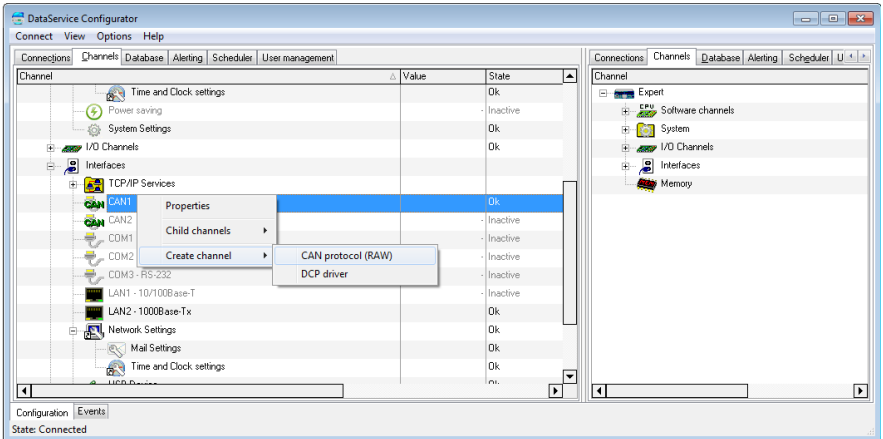
The symbol is then displayed for the CAN protocol.

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.

4.11.2.2 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.
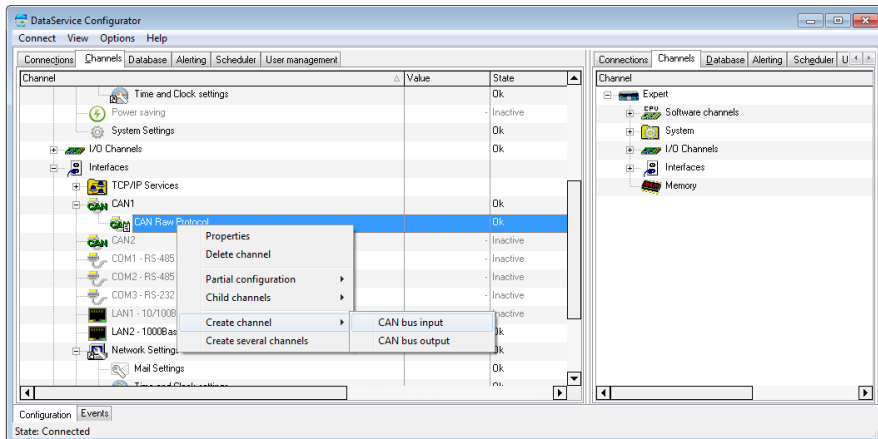
Double-click a CAN bus channel entry or select Properties from the context menu to display the configuration dialogue. The data to be entered depends on the type signal that is to be sent to or received from the CAN-bus user. (Refer to Using channel as an output). Therefore, obtain information on the 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.

4.11.3 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.
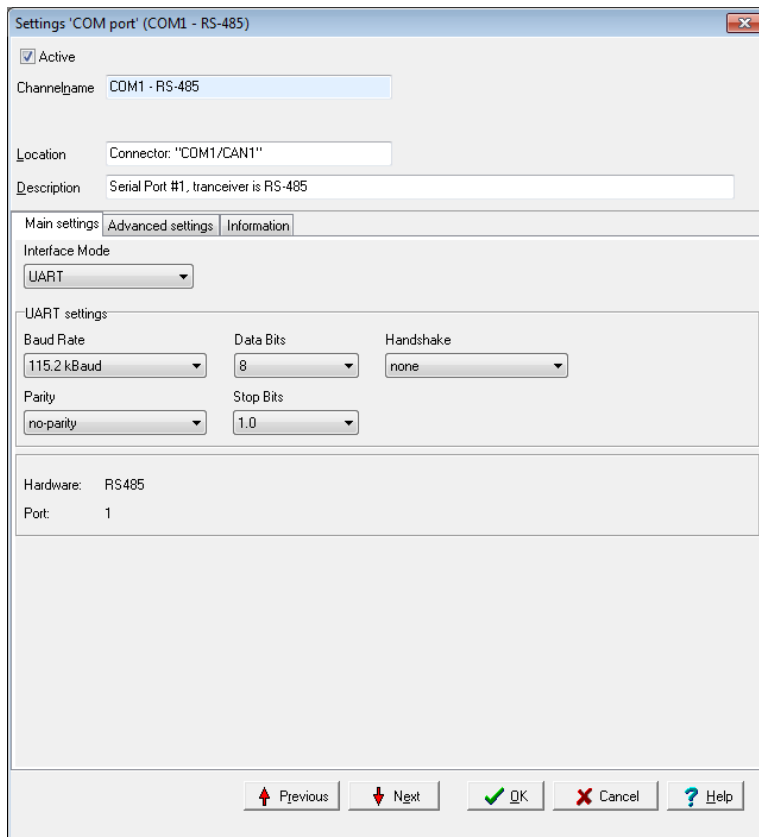
To use the connection as a logger for PROFIBUS data telegrams, the following settings must be adopted:

- 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 set-tings can be chosen afterwards.

PROFIBUS communication is limited to fixed communication para-meters. 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. Selec-tion 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 hand-shake), whereby the default setting is *none*.
- *Parity*
  Sets whether a parity bit accompanies a transmission and how it is determ-ined. 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
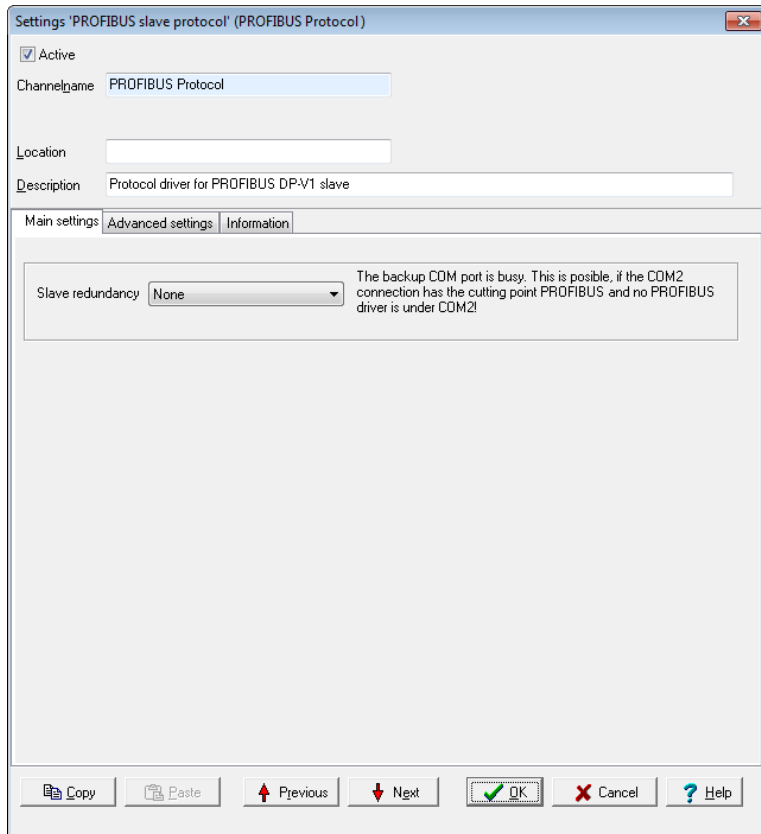- User-defined output channel

4.11.3.1 PROFIBUS protocol

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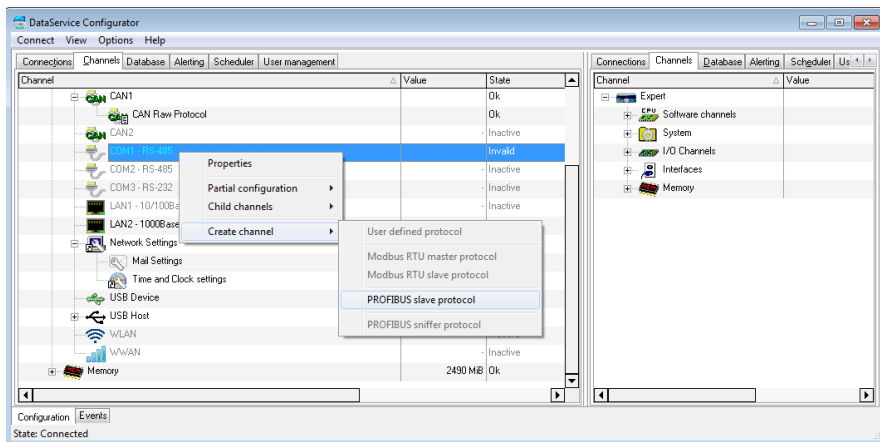
We recommend giving a unique *Channel name*, amending the *Description* and, if necessary, entering the *Location*.

Main settings tab

Settings 'PROFIBUS slave protocol' (PROFIBUS Protocol)

☑ Active

Channel name   PROFIBUS Protocol

Location

Description   Protocol driver for PROFIBUS DP-V1 slave

| Main settings | Advanced settings | Information |

Slave redundancy   None

The backup COM port is busy. This is posible, if the COM2 connection has the cutting point PROFIBUS and no PROFIBUS driver is under COM2!

Copy   Paste   ↑ Previous   ↓ Next   ✓ OK   ✗ Cancel   ? Help

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).

4.11.3.2 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 .
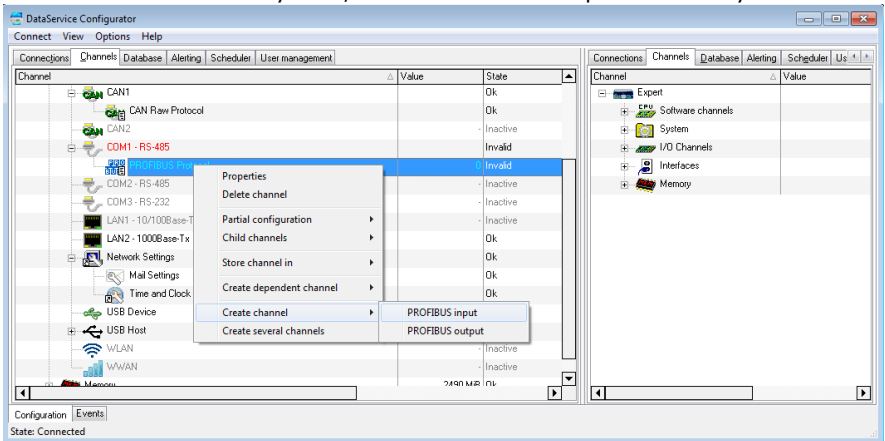
Double-click a PROFIBUS channel or select Properties from the context menu to display the configuration dialogue. The data to be entered depends on the signal type that is to be sent to or received from the PROFIBUS user. (Refer to Using channel as an output). Therefore, obtain information on the format 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.
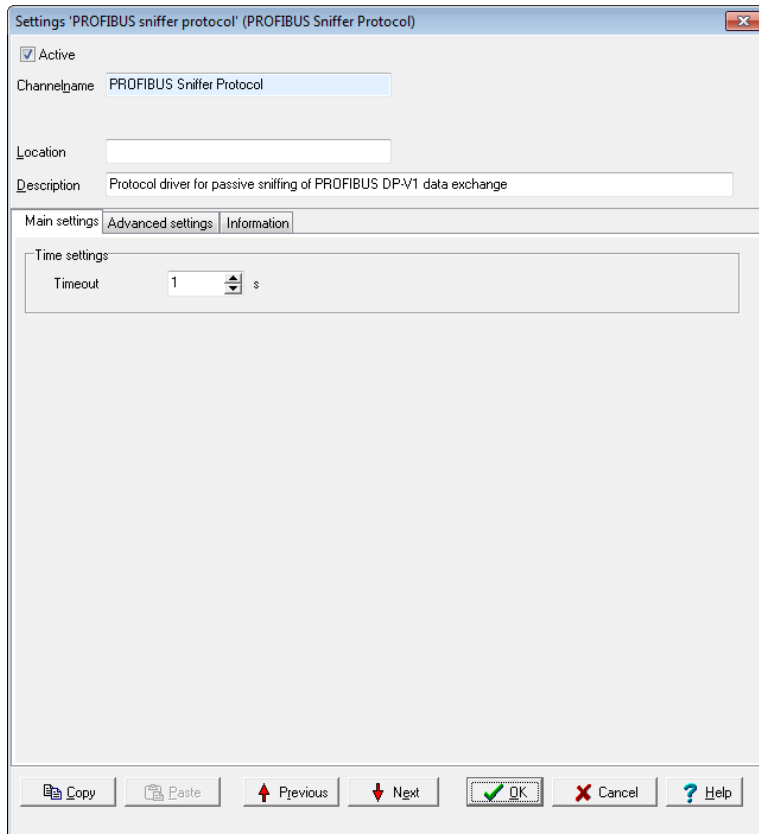
4.11.3.3 PROFIBUS logger protocol

You must run the COM connection in the *PROFIBUS logger*interface mode and set the PROFIBUS baud rate (see COM connection).

Create the PROFIBUS logger protocol channel via the context menu of the COM connection: *Create channel → PROFIBUS logger protocol*.
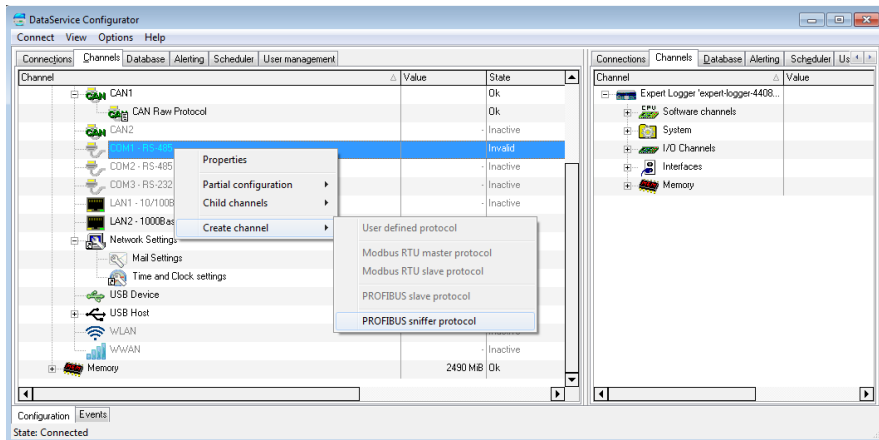
We recommend giving a unique *Channel name*, amending the *Description* and, if necessary, entering the *Location*.
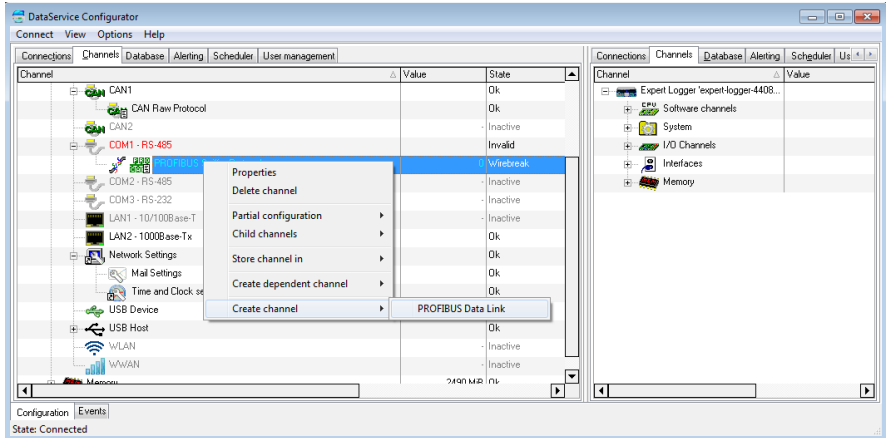
Main settings tab

You can also specify with *Timeout* how much time should lapse before timeout of PROFIBUS communication is recognised.

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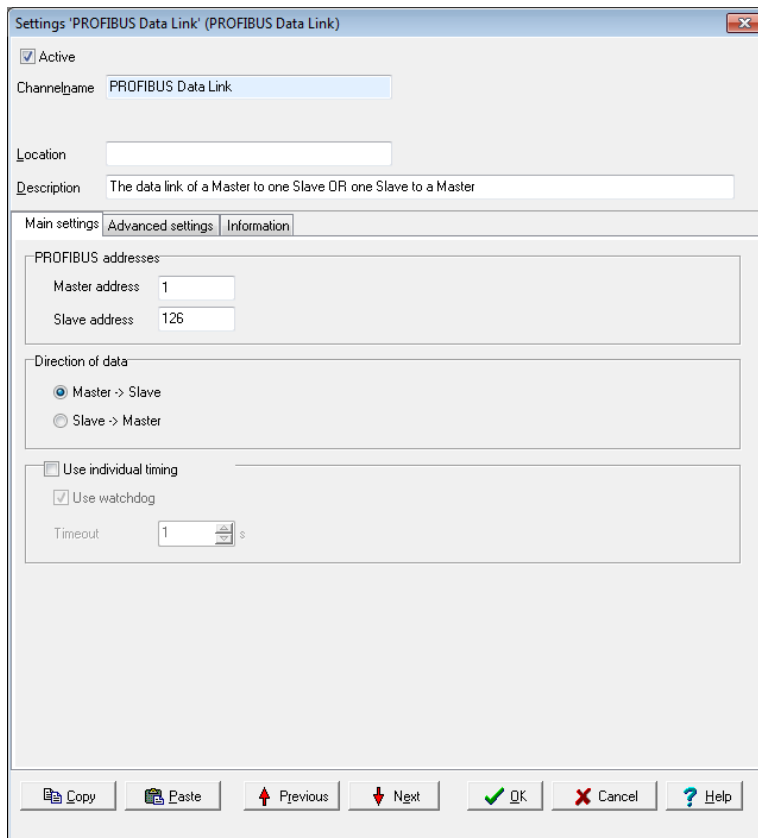
4.11.3.4 PROFIBUS logger pair

Creating PROFIBUS pairs requires creation of a COM connection in the *PROFIBUS logger* interface mode and of a PROFIBUS logger protocol (subchannel). Select *Create channel* → *PROFIBUS logger device* from the context menu of the PROFIBUS protocol (▨▨▨, PROFIBUS logger) in order to create pairs for your PROFIBUS communication partner.

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

Main settings tab

PROFIBUS addresses

- *Master address*
  Gives the address of the PROFIBUS master.
- *Slave address*
  Gives the address of the PROFIBUS slave.

Data direction

Gives the communication direction of the PROFIBUS telegrams to be copied between master and slave.

Custom time settings

Sets the maximum permissible time between two copied telegrams 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 symbol is then displayed for the channel following configuration. Then create and configure the required PROFIBUS channels (Signals).

4.11.3.5 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*.
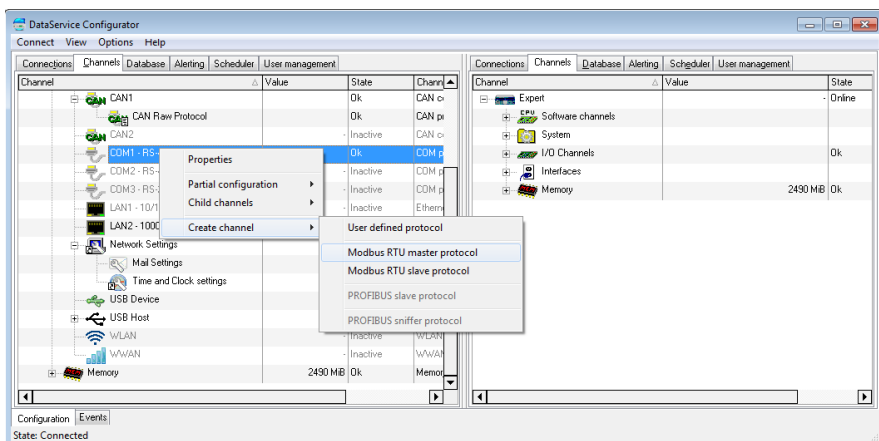
We recommend giving a unique *Channel name*, amending the *Description* and, if necessary, entering a Location.
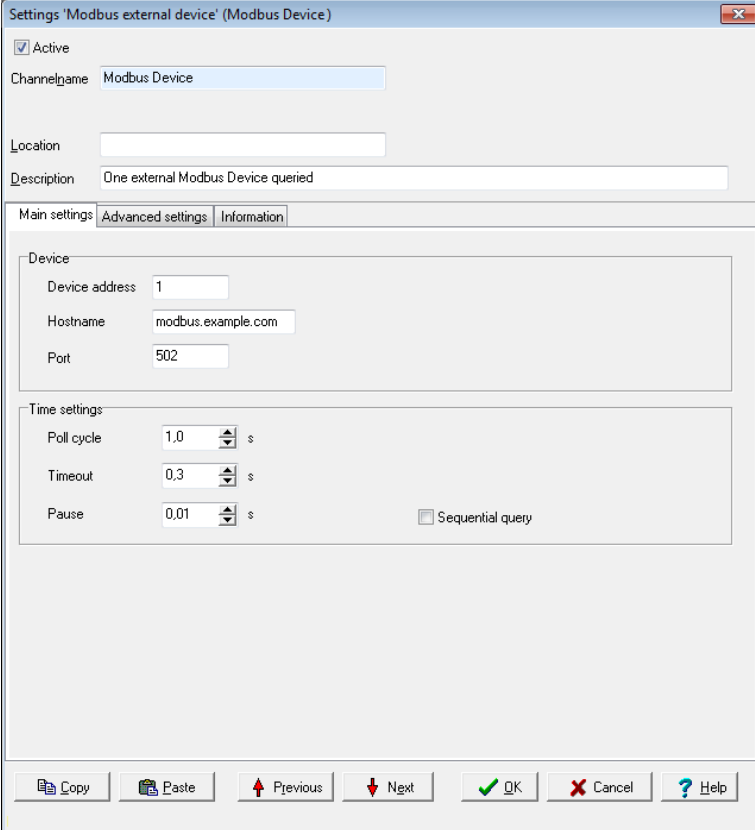
Following configuration, the symbol is displayed for a Modbus RTU master and for a Modbus RTU slave. Then create and configure the required channels for the Modbus master and/or Modbus slave.

Modbus Device (Master)

Use the context menu of the Modbus protocol (, 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

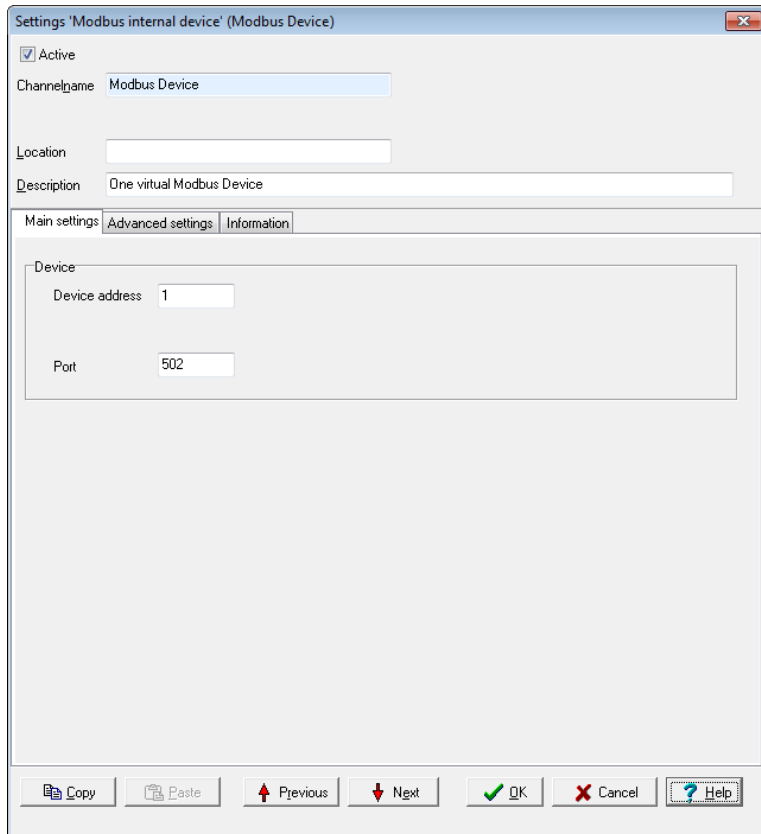an error message when closing the dialogue. The values entered will then not be saved.

- *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 **Mod** 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 ![Mod] 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 Mod*bus inp*ut. A Modbus input channel is identified by ![icon] 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.

4.11.3.6 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*.
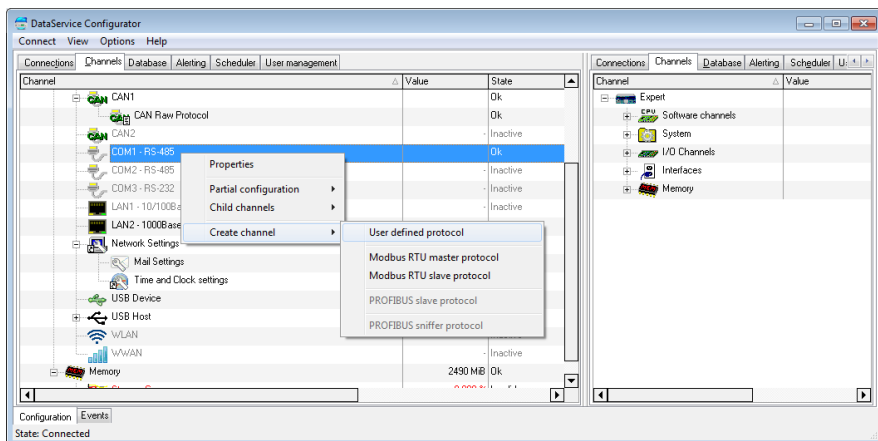
User-defined output channel

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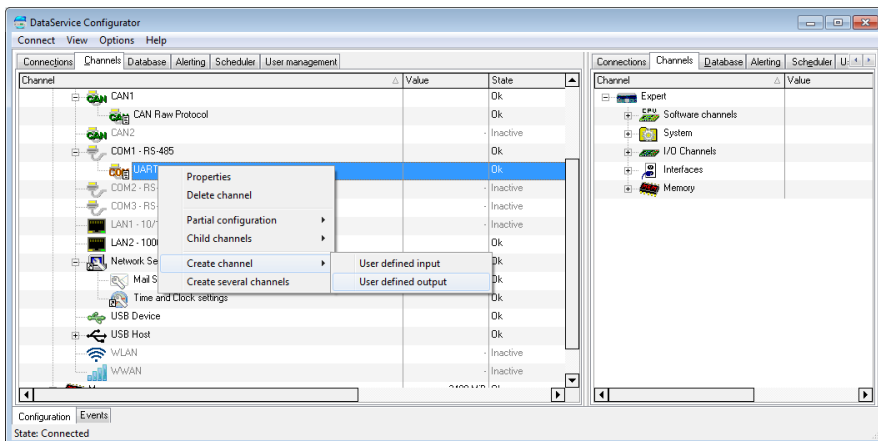   Contains settings for the data type, data source and output frequency.
2. Time settings tab
   Enables customized settings for transmission time in case you need to use extra pauses for a message, e.g. to send an initialisation to a device that then needs time to perform the initialisation.

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.
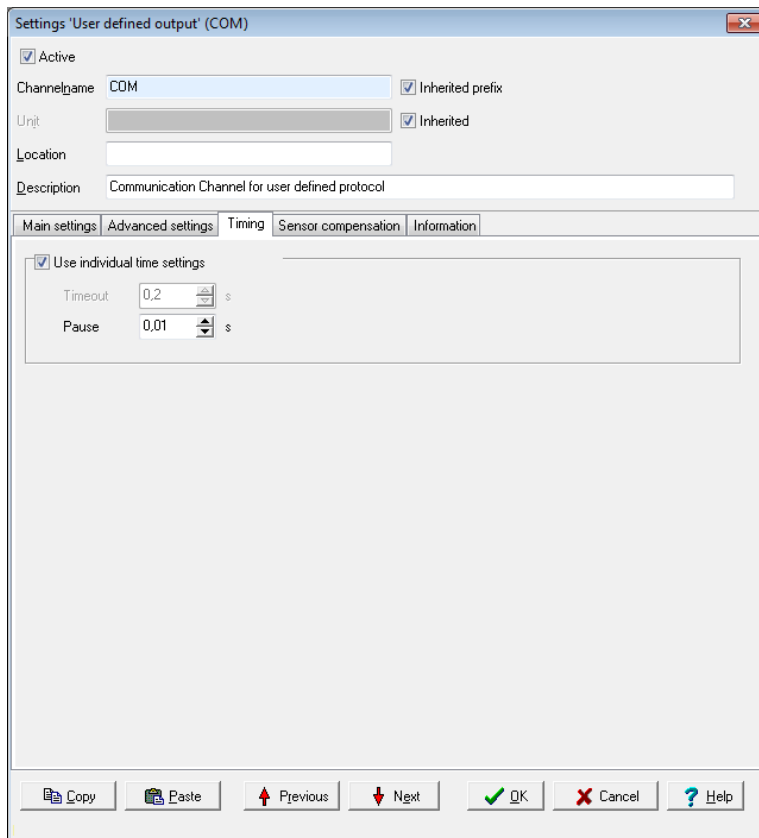
Output

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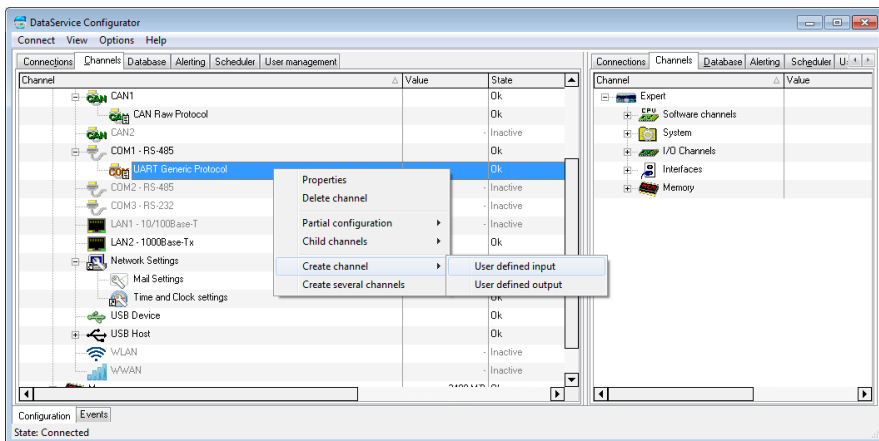
Main settings for user-defined input channels are given using the two tabs:

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.

4.11.4 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.

STOP
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.
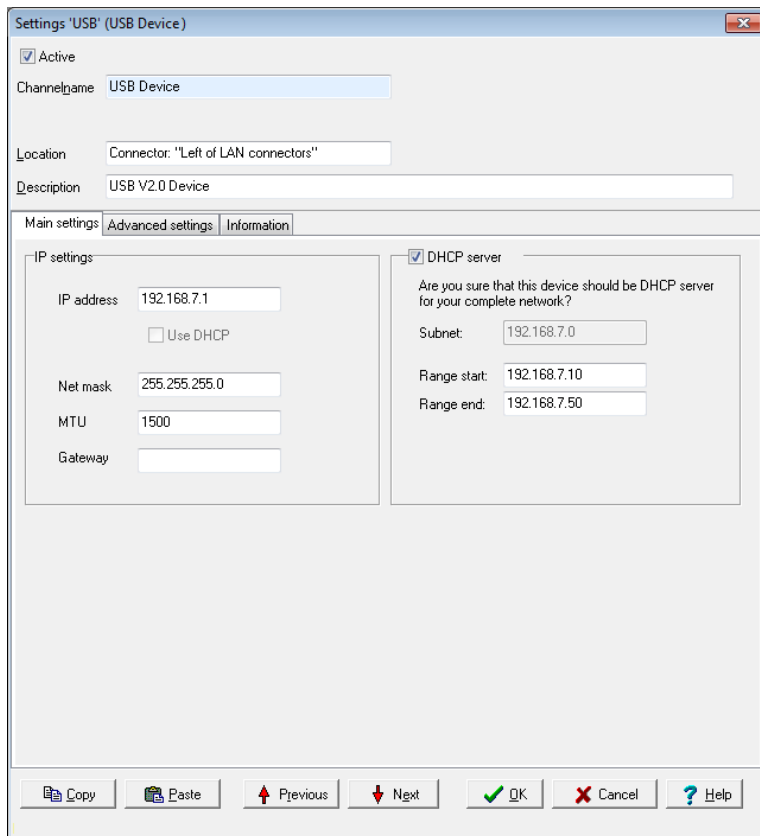
4.11.5 USB device

Firstly, download the driver for the USB interface of your PC: either from the **Delphin** website or from your device (refer to USB Network Driver).

Then use the USB device interface (see **Delphin** device displays and connections) in order to connect the device with your PC. The driver simulates an Ethernet interface with the USB interface of your PC. It is therefore recommended, in the *USB device properties* dialogue, to keep the setting *DHCP Server* enabled (default setting), because the PC is assigned automatically a suitable address for this USB interface from the device. The default settings of the dialogue by themselves allow for easy communications.

STOP **The address used for the *IP address* must not be within the range specified for *DHCP Server*.**

With a subnet mask of *255.255.255.0* (default setting for *Net mask*), the address ranges for *DHCP Server* (*Start/End range*) and the *IP address* for *IP settings* must match, that is, the first three groups of digits must be identical.

If you do not want to use the DHCP server, you must set appropriate IP addresses both at the USB interface of your PC (via the Network and Sharing Center) and in this dialogue.

Ignore the setting for *MTU* at *1400* (default). An input for *Gateway* is not required.

4.11.6   USB device (host, such as memory)

USB flash drive

You can use the USB connection to write data to (local) storage, by connecting a USB memory stick or USB hard drive.

STOP **The USB storage must be configured with the FAT32 filesystem; other file systems are not recognised.**

Once you have connected the storage, in DataService Configurator (Channels tab) in Interfaces→ USB host an entry appears with the data carrier name.

Then, under System → Drives enter a drive and create or modify a memory group that this data carrier can write to.

Refer also to "Drives" on page 60, "Device memory" on page 227 for **Expert** devices .

USB serial converter

You can also use the USB connection to connect a USB serial converter.
After connecting the converter, the DataService Configurator (USB host tab), under Interfaces→ USB host, displays an entry showing the designation of the converter.
Below the converter – as well as under **Interfaces** – a new COM interface is created automatically with the standard designation "USB COM". You can use this as Modbus RTU or as a User-defined protocol.
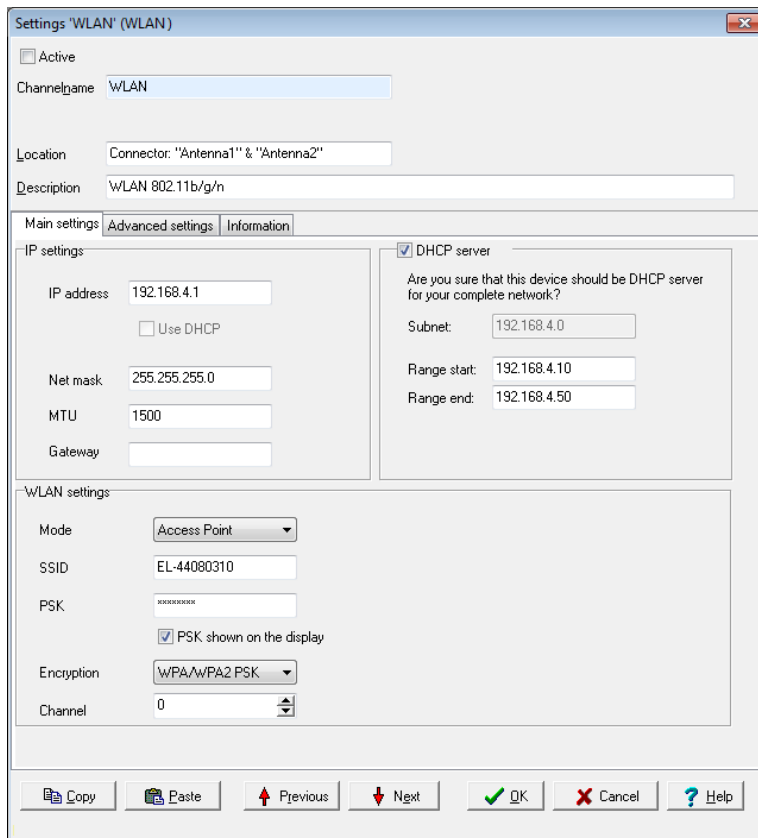
4.11.7 WLAN (option)

If the option is not available with your device, enter the data here for the WLAN connection.

To establish a WLAN connection, you must screw the antennas supplied onto the connections at the front. Use both antennas to maximise the transmission rate (speed). You will only obtain half the speed possible if you use only one antenna.

There are three connection options:

1. *Client*
   This method is recommended if there is an access point (router) that the **Delphin** device can log into.
2. *Ad hoc network*
   An ad hoc network allows you to establish a connection between a PC and the device. We do not recommend using this option unless necessary.
3. *Access Point*
   The **Delphin** device functions as an access point with this option and other devices (PCs) can log into the device. In this case, you can also use the device as a DHCP server that will assign appropriate IP addresses to the other devices.

Client

Use *DHCP* as the access point then generally assigns addresses . Then give the *SSID* of your access point, the password (*PSK*, Preshared Key), the *encryption* (mostly WPA2) and the *channel*.

Ad hoc

With an ad hoc connection, you have to firstly set up your PC for connection.

PC setup

1. Open the *Network connections* window via Windows' Start Menu and Settings.
2. Right click "Wireless Network Connection" and select Properties.
3. Find the *Wireless Networks* tab.
4. Create the network for the **Delphin** device: Click *Add* and specify the name of the network (network name, SSID) in the following dialogue, e.g. *DelphinDevice*.
5. Enable the option *Connect even if the network is not broadcasting* in the *Association* tab.
6. Select the option *This is a computer-to-computer ad hoc network*. Wireless access points are not used.
7. We recommend setting an encryption for the network, even though the less secure WEP is only possible with ad hoc networks: Enter *Open* with network authentication and *WEP* for data encryption.
8. Enter the network key which you have given to the **Delphin** device.
9. Go to the *Connection* tab and activate *Connect automatically when this network is in range*.
10. Close the dialogue with *OK*.
    The network should now appear in the list of networks and should be listed *automatically* behind the network name CX22.
11. Go the the *General tab, select* Internet Protocol (TCP/IP) *in the list and click* Properties.
12. Activate *Obtain an IP address automatically* and *Obtain DNS server address automatically* in the following dialogue.
13. Close all dialogues to the wireless connection by clicking *OK* and *Close*.

Preparing **Delphin** device

Use *DHCP* and establish the *SSID* of your access points, e.g. *DelphinDevice*. Then set the password (*PSK*, Preshared Key), the *encryption* (WEP) and the *channel*.

Creating a connection via WLAN and ad hoc network

1. Start up the PC on which a connection is to be created.
2. Right click on the symbol for WLAN, which is displayed in the information panel of the Windows task list and select View available wireless networks.

3. Check that the PC is connected to the name given above under network name (SSID).

Access Point

Specify the IP address and net mask to be used by the **Delphin** device. Then set the *SSID* , the password (*PSK*, Preshared Key), the *encryption* (mostly WPA2) and the *channel* which the **Delphin** device is to use.

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.
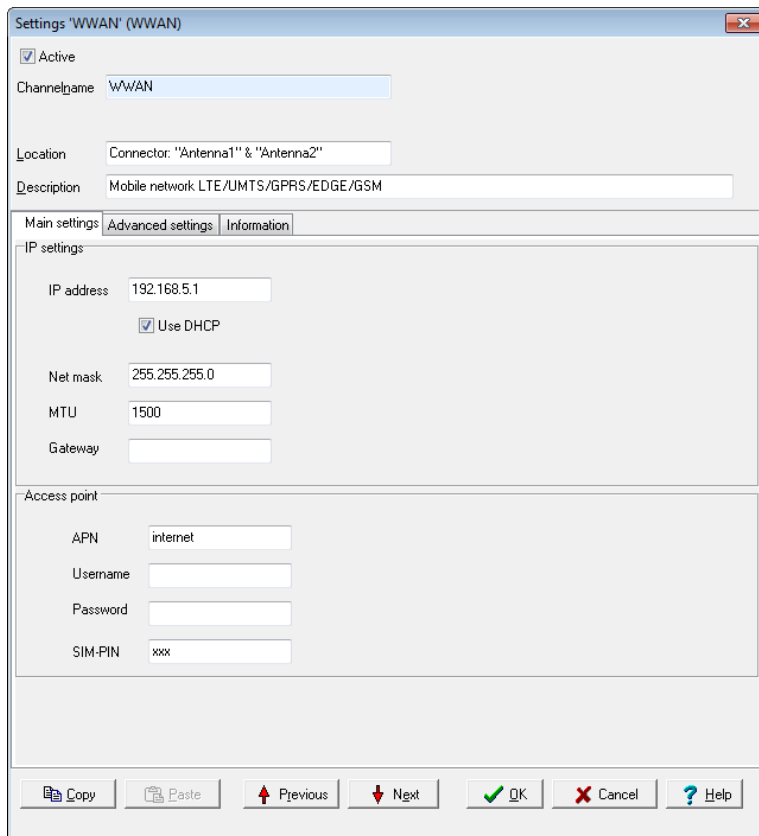
4.11.8 WWAN (option)

If the option is not available with your device, enter the data here for the WWAN connection.

STOP

To establish a WWAN connection, you must screw the antenna(s) supplied onto the connections "MAIN" and "AUX". The "AUX" connection is needed only if you wish to use LTE with a maximum of bandwidth and transmission speed. Otherwise, connecting one antenna to "MAIN" will suffice.
Also plug the SIM card of your provider into the slot above the antenna connections. The card's cut-off corner must face left, as indicated by the symbol above the slot.

In the case of *APN*, give the identifier for your provider, the *user*, *password* and the PIN number of your SIM card (*SIM PIN*). As for the address settings, leave the default setting *Use DHCP* as is in order to obtain the address from your provider.
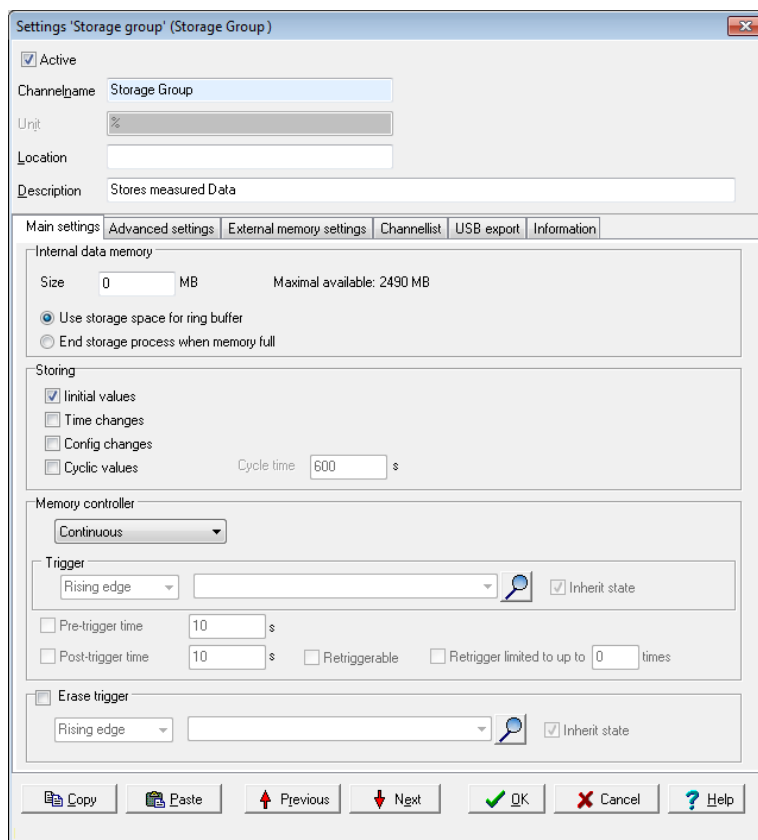
4.12 Device memory

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 43, "Additional settings tab" on page 45, "Information tab" on page 49, "Tolerance filter" on page 158, "USB device (host, such as memory)" on page 221.

4.12.1 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*.

4.12.2 External memory backup tab

First create an external memory (USB or network drive) via "Drives" on page 60 that you can then use further in this dialogue.
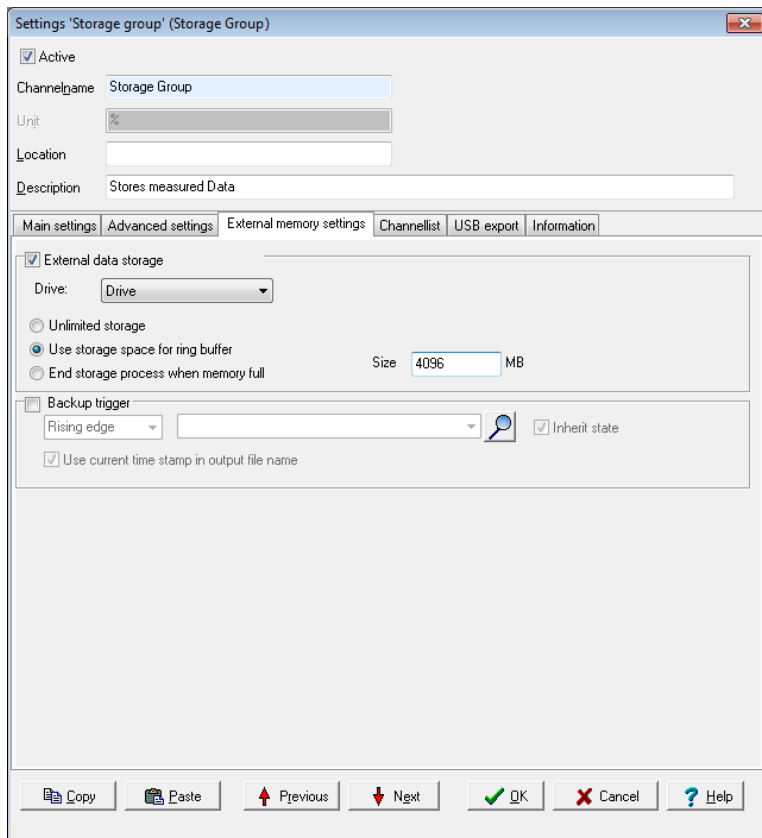
The storage space configured on the *Main settings tab* is divided into 1% increments for recording purposes. Every time another percent is filled with data, the file is closed and a new one is started. Once a file is closed, it is copied to the external memory specified here. The copying process occurs only once.

Unlimited memory: At this time, only this setting is available, a requirement that a network drive generally meets. In the case of small USB memories, note the maximum space available and change the data carrier in time.

STOP   **Do not switch out a USB memory while the write process is in progress.**

Info

Use a USB flash drive with an LED that blinks during the data transfer.

Backup trigger: With a backup trigger you can transfer to an external memory a file that has not reached the 1% limit and has therefore not been closed yet automatically. This way, *all* data, including the most current, will be available.

Opening saved files

The files are initially created in a binary format and also copied in this format. The file extension of the respective data file is .ExternalDataStorage-xml. Double-click one of these files to call the file converter that was set up during the installation. The file is then converted to the **ProfiSignal**-readable format with the file extension .hds and opened in **ProfiSignal**.

4.12.3 Channel list tab
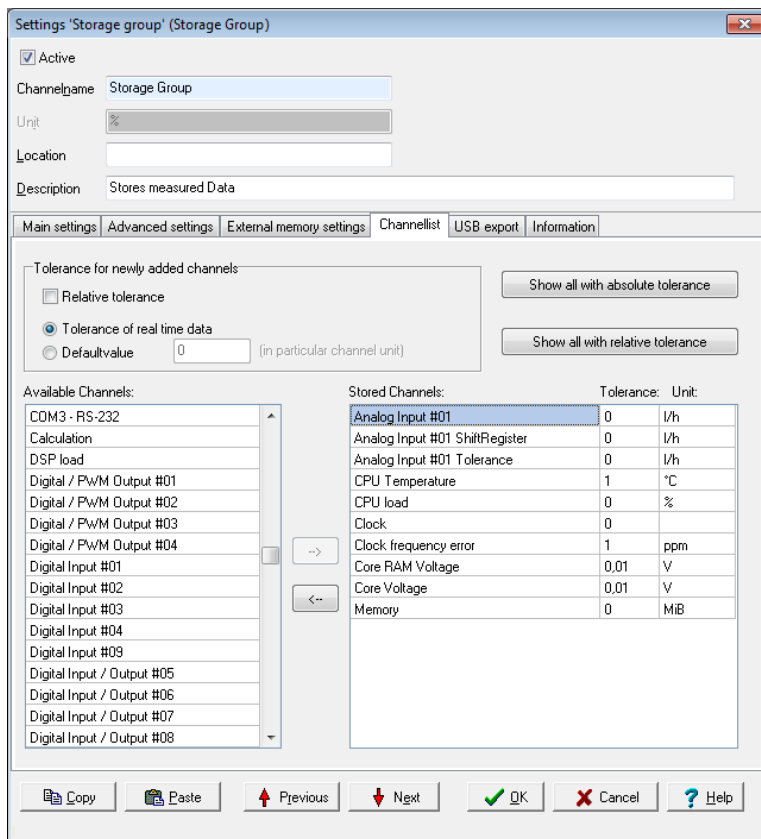
In this dialogue, you select the channels that are to be saved in this memory group.
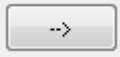
How often measurement data is saved depends on the various settings (refer also to the *Main settings* tab) and may also be influenced by the *Tolerance for new channels*:

- *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   Measurement technology notes

This Section contains general information and recommendations on using measurement technology.

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.
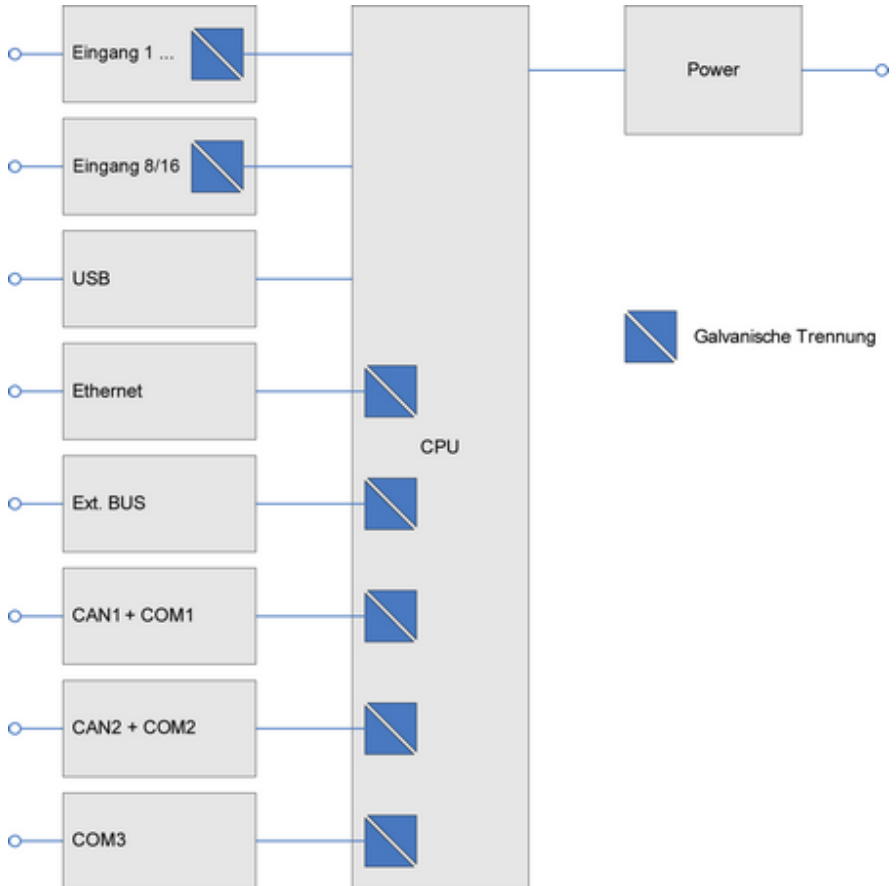
See also Shielding.

5.2 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.

5.3 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.
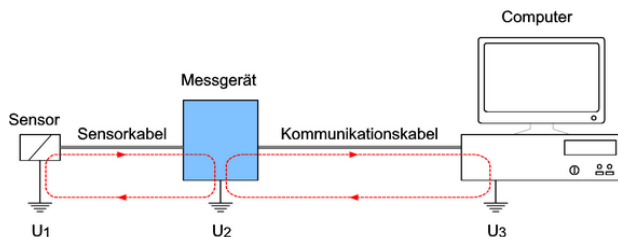
STOP **Prevent earth loops.**

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.

5.4 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).
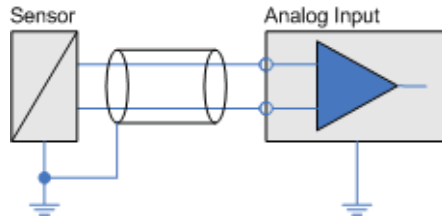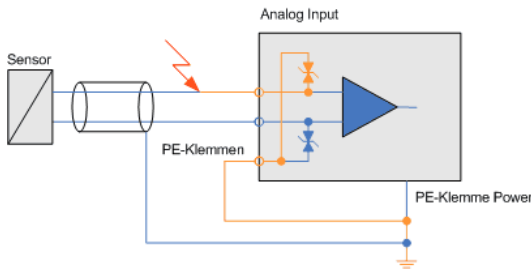See also Earthing.
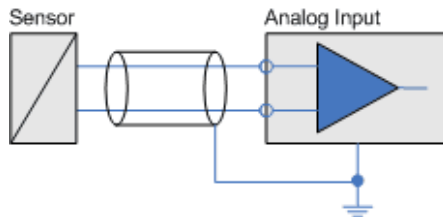
b) Sensors with earthing

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.

5.5 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.

5.6 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 $_{Difference}$.
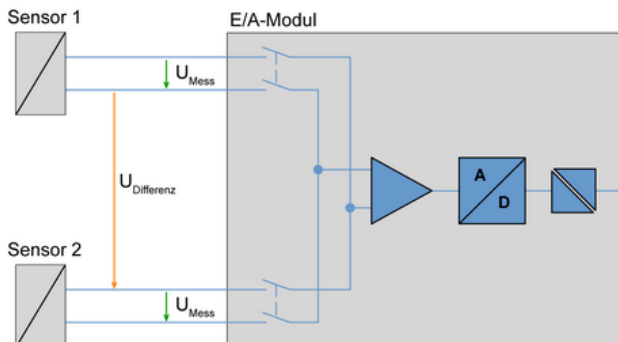
The reference potential of a measurement circuit of an analogue input for a device occurs by a change of channel of the sensors' different reference potentials. Depending on the input circuit of the various device inputs, the difference voltage $U_{Difference}$ between certain channels, may not exceed 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.

6 Technical specifications Expert Transient 8/16

Device type	8	16
Analog inputs	**8**	**16**
Sampling rate, set by channel	20 Hz … 50 kHz	
Signal bandwidth	DC … 20 kHz	
Analog anti-aliasing filter	TBD kHz/TBD order	
Measurement range	±25 V	
Signal conditioning, software switchable	None, AC coupling, IEPE	
Cut-off frequency high-pass AC coupling	0.01 Hz	
Resolution	24 bit	
Input impedance	4 MΩ	
Dielectric strength (tolerable overvoltage)	±100 VDC	
Galvanic isolation against PE/against other channel	±400 VDC	
Voltage, current precision	TBD% of measurement range end value	
Digital inputs (with counter/frequency measurement)	**4**	**4**
Grouping	none	
Level	low	0 … 1 V
	high	5 … 100 VDC@3.5 mA
Debouncing	1 … 60000 µs	
Digital input	Max. edge change	32000 / s
Frequency/counter function	Measurement range	0.2 Hz … 1 MHz
	Precision	0.01% of measurement value
	Resolution of frequency inputs	32-bit, time resolution 250 ns
	Minimum pulse width	500 ns
	Counter width	64 bit
	Quadrature decoder, optional reset	Yes
Galvanic isolation	Input to system/other channels/PE	±400 VDC
Digital outputs (also PWM)	**8**	**8**
Grouping	2 per group	
Electrical values	Max. switching voltage/-current	50 V/2.5 A
	On-state resistance (Rds on)	0.11 Ω
	Maximum power loss (P	2.5 W

Device type	8	16
	tot)	
PWM	PWM basic frequency	5 Hz … 10 kHz
	Duty cycle/resolution	1:1000
Galvanic isolation	Output to system/other channels/PE	±400 VDC
	Output-to-output same group	No
Analog outputs	**4**	**4**
Grouping	4 per group	
Resolution	16 bit	
Max. output rate	50 Hz	
Output ranges, software switchable	0 … 10 V/ ±10 V/0 … 20 mA/4 … 20 mA/±20 mA	
Current output	Output impedance	TBD MΩ
	Max. load	650 Ω
	Wire break monitoring	Yes
Voltage output	Output impedance	TBD Ω
	Min. load	650 Ω
	Short-circuit proof	Yes
	Overload monitoring	Yes
Galvanic isolation	Output to output	No
	Output to system/other channels/PE	±400 VDC
PE terminals	**TBD**	**TBD**

Software channels
Calculation channel
Limit value
…

Data storage	
Internal data storage, size/measurement values	2 … 14 GB / approx. 30 million measurement values per GB
External data storage	USB, NFS, CIFS, (S)FTP

Interfaces	
Mechanical version COM 1/COM 2	RS485, 9-pin Sub-D socket, DIN EN ISO 19245-1
Mechanical version COM 3	RS232, 9-pin Sub-D connector
LAN	1 x 1000Base-TX / 1 x 100Base-T
WLAN (optional, alternative for	802.11b/g/n

Interfaces	
WWAN)	
WWAN (optional, alternative for WLAN)	UMTS, LTE max. 100 MB (configuration, real-time data, e-mail)
	GSM, EDGE, GPRS (SMS)
USB device	2.0 Low-/Full-/High-Speed
USB host	2.0 Low-/Full-/High-Speed
CAN 2.0	2 x
PROFIBUS	2 x, max. 12 MB

Protocols	
PROFIBUS	DPV1 Slave
	Passive sniffer
RS 232/485	Modbus RTU
	SCPI
	ASCII
CAN	CAN Raw
	Delphin CAN Protocol
TCP/IP	Modbus TCP
	OPC UA Server

General technical information	
Dimensions/weight	210 mm x 80 mm x 125 mm/750 g
Mounting	Mounting rail DIN EN 60715 or screw fastening
Signal connections	Pluggable screw terminals
	96 terminals in 2 series
	Conductor cross-section max. 1.5 mm²
Temperature range	-20 … 50°C
Supply voltage	12 … 24 VDC / ± 10%
Power input normal operation	max. 10 W
Power input sleep mode	5 mW @ 12 V, 10 mW @ 24 V
Backup battery	Lithium battery 3V Varta CR-2450
	Lifespan: 10 years

Display	
Type	LC display
Resolution	320 × 240 pixels
Colour depth	18 bit
Touch	Resistive

Display	
Backlight	Brightness adjustable

LEDs	
3 LEDs red/green	Function customer-programmable
Power LED blue/red	Identification/voltage OK/undervoltage/overvoltage
Ethernet	Link, speed, traffic

7 Appendix

7.1 ISO 9001 certificate

Lloyd's Register
LRQA

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

Delphin Technology AG
Lustheide 81, 51427 Bergisch Gladbach
Germany

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standards:

ISO 9001:2008

The Quality Management System is applicable to:

Development, manufacture and service of dataloggers,
monitoring and measurement data acquisition systems,
including associated software.

Approval
Certificate No: KLN 0201756

Original Approval:	27 June 1996
Current Certificate:	01 July 2014
Certificate Expiry:	30 June 2017

Issued by: Lloyd's Register Quality Assurance GmbH
For and on behalf of: Lloyd's Register Quality Assurance Limited

UKAS
MANAGEMENT
SYSTEMS
001

This document is subject to the provision here below.
For and on behalf of Hiramford, Middlemarch Office Village, Siskin Drive, Coventry, CV3 4FJ, United Kingdom
This approval is carried out in accordance with the LRQA assessment and certification procedures and monitored by LRQA.
The use of the UKAS Accreditation Mark indicates Accreditation in respect of those activities covered by the Accreditation Certificate Number 001
Macro Revision 13

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7.2 EC declaration on conformity

EG-Konformitätserklärung
EC-Declaration of Conformity

Hersteller / *Manufacturer*:	Delphin Technology AG
Anschrift / *Address*:	Lustheide 81 51427 Bergisch Gladbach, Deutschland / Germany Tel.: +49(0)2204/97685-0 Fax.: +49(0)2204/97685-85
Kontaktperson / *Contact*:	Claudia Göbel Vorstandsvorsitzende / *CEO*
Produkt / *Product*:	**Expert Series** Expert Logger (100/200/300) Expert Transient / Vibro (8/16)

Hiermit erklären wir, dass die oben genannten Produkte in ihrer Konzeption und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den grundlegenden Sicherheits- und Gesundheitsanforderungen der unten genannten EG-Richtlinien entsprechen. Bei einer mit uns nicht abgestimmten Änderung der Geräte verliert diese Erklärung ihre Gültigkeit.

Hereby we explain that those corresponds to above designated products in its conception and design as well as in circulation the execution the fundamental safety and health requirements of the European Community Directive mentioned below brought by us. In the case of a change of these products not coordinated with us this explanation loses its validity.

2004/108/EG	Richtlinie des Europäischen Parlaments und des Rates vom 15. Dezember 2004 zur Angleichung der Rechtsvorschriften der Mitgliedsstaaten über die elektromagnetische Verträglichkeit.
2004/108/EC	*Directive of the European parliament and the council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility.*

Angewandte Spezifikationen / *references to the specifications*:

EN 61010-1:2010	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte – Teil 1: Allgemeine Anforderungen *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements*
EN 61326-1:2012	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen – Teil 1: Allgemeine Anforderungen *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*
EN 300328 V1.8.1	Elektromagnetische Verträglichkeit und Funkspektrumangelegenheiten (ERM) - Breitband-Übertragungssysteme - Datenübertragungsgeräte, die im 2,4 GHz-ISM-Band arbeiten und Bandspreiz-Modulationstechniken verwenden; Harmonisierte EN, die wesentliche Anforderungen nach Artikel 3.2 der R&TTE-Richtlinie enthält. *Electromagnetic compatibility and Radio spectrum Matters (ERM) - Wideband transmission systems - Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive.*

07.08.2015   Claudia Göbel
Datum / *Date*   Name / *Name*

Unterschrift / *Sign*

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