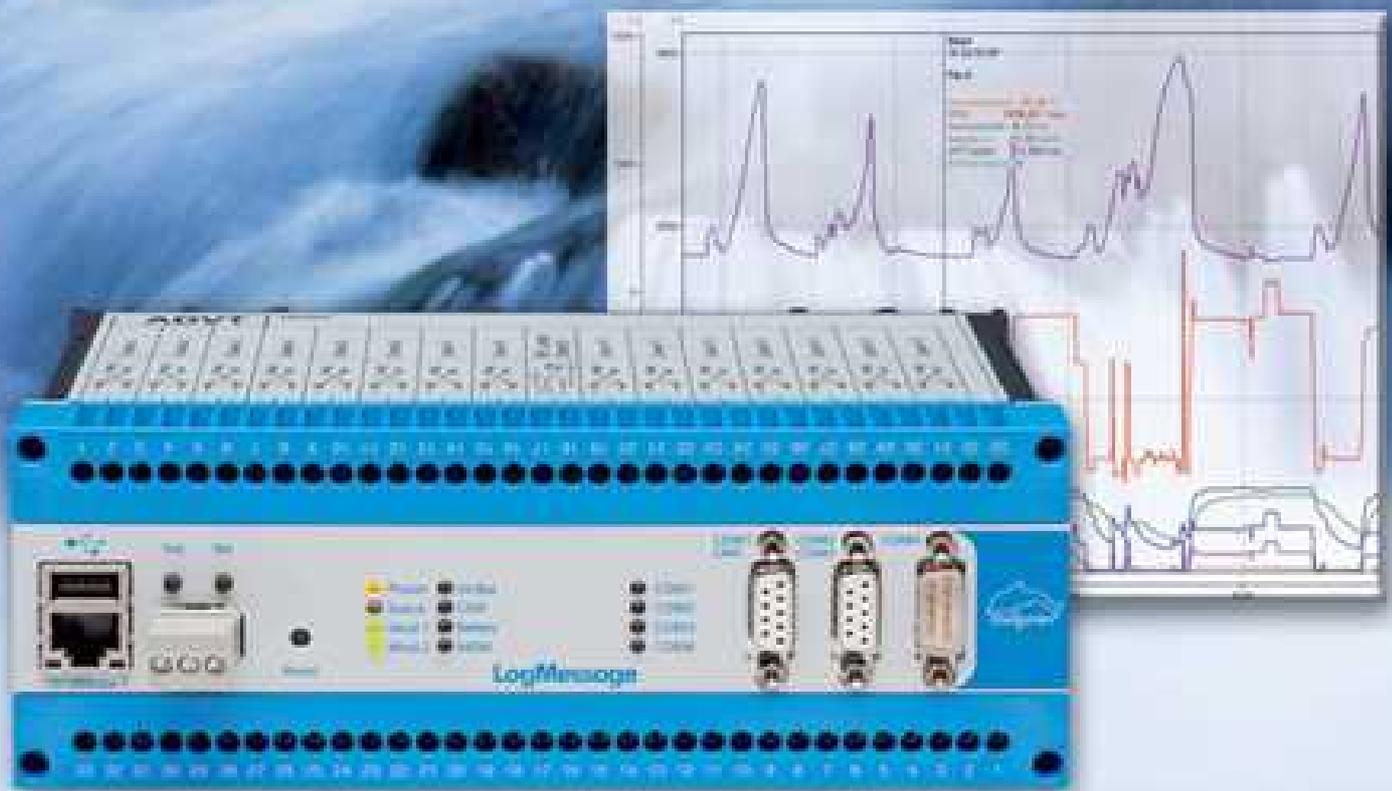


## HARDWARE MANUAL

LogMessage – Installation and start-up  
Type 1000 to 9000



Delphin Technology AG  
Lustheide 81  
51427 Bergisch Gladbach  
Germany

Phone +49 (0) 2204 97685-0  
Fax +49 (0) 2204 97685-85  
Email [info@delphin.de](mailto:info@delphin.de)  
Internet [www.delphin.com](http://www.delphin.com)



# Table of contents

	<b>LogMessage</b>	<b>1</b>
<b>1</b>	<b>Safety Advice</b> .....	<b>2</b>
<b>2</b>	<b>Introduction</b> .....	<b>3</b>
	<b>Included in delivery</b> .....	<b>4</b>
	<b>System requirements</b> .....	<b>5</b>
	<b>Symbols used in this documentation</b> .....	<b>6</b>
<b>3</b>	<b>Getting started</b> .....	<b>7</b>
	<b>Starting LogMessage</b> .....	<b>8</b>
	<b>Installing programs</b> .....	<b>9</b>
	<b>PC connection</b> .....	<b>10</b>
	<b>Basic settings</b> .....	<b>13</b>
<b>4</b>	<b>LogMessage device and connections</b> .....	<b>14</b>
	<b>Device types</b> .....	<b>15</b>
	<b>Power supply</b> .....	<b>16</b>
	<b>LED lamps, LAN, USB</b> .....	<b>17</b>
	<b>General LEDs</b> .....	<b>18</b>
	<b>COM interfaces, CAN</b> .....	<b>20</b>
	<b>I/O module connections (terminal blocks)</b> .....	<b>23</b>
	<b>I/O module installation and removal</b> .....	<b>28</b>
	<b>Internal memory card installation and upgrade</b> .....	<b>32</b>
	<b>Internal battery installation</b> .....	<b>36</b>
<b>5</b>	<b>Configuration and operation</b> .....	<b>40</b>
	<b>Overview</b> .....	<b>41</b>
	<b>Configuration via an internet browser</b> .....	<b>43</b>
	Unknown IP address?.....	43
	Settings.....	44
	Network.....	44
	Clock settings.....	46
	NTP status.....	47
	Configuration.....	47
	View channels.....	48
	Saving and loading configurations.....	48
	Default configuration.....	49
	Service .....	50
	System report.....	50
	System.....	51
	Update firmware.....	51
	Firmware changelog .....	53
	Restart main application.....	53
	Device restart (reboot).....	54

<b>Configuring a LogMessage device .....</b>	<b>55</b>
Device configuration (channel configuration).....	56
Network settings, NTP.....	58
<b>Storage Group .....</b>	<b>60</b>
<b>Data transfer to USB memory stick .....</b>	<b>64</b>
<b>Configuring I/O module channels .....</b>	<b>66</b>
Settings for all dialogs.....	66
Tables.....	70
Global linearisation tables.....	71
Global setpoint tables.....	73
I/O module.....	76
I/O module AMDT.....	78
Analog input.....	79
Voltage sensor type.....	80
Resistor sensor type.....	81
Current sensor type.....	83
Current sensor type (0/4...20 mA).....	84
Resistance thermometer sensor type.....	85
Thermocouple sensor type.....	87
Ph-probe sensor type.....	88
Digital input with counter/frequency measurement.....	89
Digital input.....	91
Analog output.....	92
Digital output .....	93
<b>Configuring interfaces .....</b>	<b>94</b>
CAN-Controller.....	94
CAN-Driver.....	96
CAN -Bus-Channel.....	96
<b>Configuring Software channels .....</b>	<b>101</b>
General settings for Software channels.....	102
Channelgroups.....	102
Edge and level triggers.....	102
Basic channel selection.....	103
Advanced channel selection.....	103
Inherit status.....	104
Advanced settings tab (software channels).....	105
Accumulator.....	106
Operating hours counter.....	106
Differentiator.....	106
FlipFlop.....	107
Limit.....	109
Impulse generator.....	111
Integrator.....	121
Linearization.....	121
Logic.....	123
Variables.....	126
Average.....	127
Pulse width modulation (PWM).....	127

	Calculation channel.....	128
	Collective fault.....	131
	Setpoint .....	132
	Statistics.....	134
	Status monitor.....	135
	Stopwatch.....	136
	System monitor.....	141
	Timer.....	141
	Trigger.....	144
	Alarmclock.....	145
	Counter.....	146
<b>6</b>	<b>Connection examples .....</b>	<b>150</b>
	<b>Connecting sensors .....</b>	<b>151</b>
	<b>Connecting actuators .....</b>	<b>155</b>
<b>7</b>	<b>Measurement technology .....</b>	<b>157</b>
	<b>Galvanic isolation .....</b>	<b>158</b>
	<b>Earthing .....</b>	<b>159</b>
	<b>Earth loops .....</b>	<b>160</b>
	<b>Shielding .....</b>	<b>162</b>
	<b>ESD protection .....</b>	<b>163</b>
	<b>Potential differences .....</b>	<b>164</b>
<b>8</b>	<b>Technical specifications .....</b>	<b>166</b>
	<b>Main device .....</b>	<b>167</b>
	<b>I/O modules .....</b>	<b>170</b>
	I/O modules: AAST, ADGT, ADIT and ADVT.....	170
	I/O modules: DIOT, IOIT and OTPT.....	173
	I/O module: ADFT.....	175
	I/O module: AMDT .....	177
<b>9</b>	<b>I/O module AMDT .....</b>	<b>178</b>
	<b>Safety advice .....</b>	<b>179</b>
	<b>Introduction .....</b>	<b>180</b>
	Included in delivery.....	180
	Symbols used in this documentation.....	181
	Project planning .....	182
	<b>Hardware .....</b>	<b>184</b>
	Connector panel (industrial).....	184
	Connector panel (laboratory).....	185
	Block circuit diagram.....	186
	Technical specifications.....	187
	Galvanic isolation.....	187
	Analog inputs.....	187
	Analog outputs.....	188
	Digital inputs.....	189
	Counter.....	189
	Digital outputs.....	190
	Attachment.....	191

AC-coupling for analog inputs.....	191
External circuits.....	192
<b>Functions .....</b>	<b>194</b>
Operating mode.....	194
Non-Continuous recording.....	194
Continuous recording.....	195
Signal simulation.....	196
Synchronizing two AMDT modules.....	199
Triggering and recording.....	204
Redundant trigger source.....	206
Time signal.....	208
Digital filter.....	208
Digital integrator.....	208
FFT analysis / frequency spectrum.....	209
Characteristics.....	209
Characteristic "Maximum value", "minimum value".....	211
Characteristic "Peak-to-peak value".....	212
Characteristic "Mean value".....	213
Characteristic "True RMS value".....	214
Characteristic "Frequency of main amplitude".....	214
Characteristic "Main amplitude".....	215
Characteristic "Phase of main amplitude".....	215
Characteristic "Amplitude of 1X/2X/3X/xX component".....	216
Characteristic "Phase of the 1X/2X/3X/xX component".....	217
Characteristic "Rotation speed".....	218
Characteristic "Maximum of vector sum".....	219
Characteristic "Mean of product".....	220
Characteristic "Frequency of main amplitude, band 1/2/3".....	221
Characteristic "Main amplitude, band 1/2/3".....	221
Characteristic "RMS value, band 1/2/3".....	223
Characteristic "Sum value".....	225
Characteristic "Remainder value".....	225
Measuring frequency or speed.....	227
Measuring the phase angle.....	229
Monitoring.....	231
<b>Configuration and operation .....</b>	<b>232</b>
Configuration using the DataService Configurator.....	232
Configuration/settings for I/O module.....	235
I/O module / measurement block counter.....	241
Configuration/settings for analog input.....	241
Configuration/settings for FFT/spectrum.....	246
Configuration/settings for characteristics.....	247
Configuration/settings for analog output.....	249
Configuration/settings for digital input.....	250
Configuration/settings for counter.....	251

	Configuration/settings for digital output.....	252
	Visualization using ProfiSignal.....	253
	Firmware update.....	254
	<b>Information on applications .....</b>	<b>256</b>
	<b>Appendix to older AMDT hardware .....</b>	<b>257</b>
<b>10</b>	<b>Appendix: .....</b>	<b>259</b>
	<b>EC declaration on conformity LogMessage .....</b>	<b>259</b>
	<b>ISO 9001 certificate .....</b>	<b>260</b>

## LogMessage

LogMessage devices are designed for use as modular measurement, control, and monitoring devices and are equipped with many settings and connection options. They are also equipped with a range of I/O modules, field bus interfaces, and software channels to enable the performance of monitoring, control, and regulation tasks. LogMessage devices have 16 GB internal memories and can function as stand alone, independent units. Acquired data can be transferred via interfaces in runtime mode, via time-controlled events, or via the device's USB ports.

Copyright © 2003-2012 Delphin Technology AG. All rights reserved.  
This document's content, especially text, images, and graphics are protected by copyright. When not otherwise stated, the copyright belongs to Delphin Technology AG, Lustheide 81, in 51427 Bergisch Gladbach, Germany.

All the trademarks and brands used in this manual refer only to the respective product or trademark holder. Delphin Technology claims no rights other than those to its own trademarks and brands.

## 1 Safety Advice



### WARNING!

**Connector terminals on I/O modules carry electrical potential from the attached sensors/actuators.**

**Before coming into contact with the connectors, ensure the power is off. There should be no voltage at the connector terminals when the attached sensors have varying potentials or earthed high potentials, e.g. when measuring the electrical current of a mains voltage phase.**

**Differences in electrical potential between two channels of a module can not be determined from the Measurement data.**

Refer to [Potential differences](#).

I/O module, memory card, battery installation installation/replacement



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

ESD damage can have varying consequences from minor deviations in data recording through to full system failure.

## 2 Introduction

Dear User,

Thank you for purchasing a device from the LogMessage series. 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.

### **Contact:**

Delphin Technology AG  
Lustheide 81

51427 Bergisch Gladbach (Refrath), Germany

Telephone: +49 2204 97685-0

Telefax: +49 2204 97685 -85

Email: [info@delphin.de](mailto:info@delphin.de)

Internet: [www.delphin.de](http://www.delphin.de)

### **Contact USA:**

Delphin Technology Corp.  
4860 Cox Road, Suite 2000

Glen Allen, VA 23660  
Virginia, USA

Telephone: +1 804 217 8391

Telefax: +1 804 747 6182

Email: [info@delphin.com](mailto:info@delphin.com)

Internet: [www.delphin.com](http://www.delphin.com)

## 2.1 Included in delivery

Included in delivery:

- LogMessage device)
- Brackets for rail mountings
- Ethernet cross-cable
- RS232 connection cable with D-SUB DB9 connectors
- CD containing ProfiSignal software
- Documentation

The devices can be equipped with various I / O modules.

Available I / O modules:

- AAST:
  - 4 analog inputs for V, mV, 20mA, Pt100, thermocouples
  - 2 digital inputs
  - 4 analog outputs 20mA
  - 2 digital outputs
- ADFT:
  - 8 analog inputs for V, mV, 20mA
  - 2 frequency or counter inputs
  - 2 digital inputs
  - 2 analog outputs 10V
  - 4 digital outputs
- ADGT V2.0:
  - 8 analog inputs for V, mV, 20mA, Pt100, thermocouples
- ADGT V3.0:
  - 8 analog inputs for V, mV, 20mA, Pt100, thermocouples
- ADIT:
  - 10 analog inputs for V, mV, 20mA, Pt100, thermocouples
  - 1 analog output 20mA
  - 1 digital output
- ADVT:
  - 15 analog inputs for V, mV, 20mA, thermocouples
- AMDT: module with DSP (enables calculation functions)
  - 8 analog inputs for V, mV, 20mA
  - 2 frequency or counter inputs
  - 2 digital inputs
  - 2 analog outputs 10V
  - 4 digital outputs
- DIOT:
  - 11 frequency or counter inputs
  - 1 digital input
  - 16 digital outputs
- IOIT:
  - 24 digital inputs
  - 1 digital output
- OTPT:
  - 1 digital input
  - 24 digital outputs

## 2.2 System requirements

The following hardware requirements are the minimum requirements to ensure problem-free operation of the **Delphin** products.

- **Operating System**  
Microsoft Windows XP 32-bit, Windows Vista, Windows 7 and Windows Server 2008 R2 in the 32-bit- or 64-bit versions,  
either the English or German versions.
- **Main memory**  
At least 1024 MB\*  
Recommended: 2 ... 3 GB for 32-bit systems, 4 ... 8 GB for 64-bit-systems
- **Monitor**  
At least 1024 x 768 pixel, fixed font size of 96 dpi (100%) resolution
- **CPU**  
A PC with at least 1.6-GHz\*  
Recommended: Systems with dual or 4-core processors from 2.5 GHz or greater
- **Hard disk**  
for **ProfiSignal-Go** at least 70 MB of free hard disk space  
for **ProfiSignal-Viewer** at least 70 MB of free hard disk space  
for **ProfiSignal-Klicks** at least 500 MB of free hard disk space  
for other **ProfiSignal--** versions at least 250 MB of free hard disk space

### 2.3 Symbols used in this documentation

To make reading of this manual easier, we have used the following symbols:



**WARNING!**

This symbol warns of a *potential* hazard which - if the safety requirements are not followed - may be fatal or cause serious physical injury.



Indicates important information.



**Info**

Refers to a special option or explains a special feature.

We use *italics* to highlight individual words within the text. *Keyboard input* is highlighted in this way. Program menus have a grey background with arrows indicating the respective sub-menus which need to be accessed: Connect → Add driver (connection) → LogMessage device. Also highlighted in grey and displayed in italics are the dialog headings, buttons, check boxes, input field names, etc. *Display status*.

This should help you to find the relevant fields and buttons or menus within the corresponding software.

#### Symbols on the device



CE symbol: The CE symbol guarantees that our products meet the requirements of relevant EU directives. Refer also to the EC Declaration of Conformity section.

## 3 Getting started

This section explains:

- The important device connections to commence work.
- The software that needs to be installed on your PC.
- How to establish a connection between a PC and the device.
- The settings required to acquire measurement signals from the device.

For detailed information refer to these sections:

- The section [Display devices and connections](#) gives an overview of all the interfaces/connections/ports and LEDs.
- The section [Configuration and operation](#) explains the different options for setting up the device for measurement tasks.
- The section on [Examples of connections](#) shows the options for connecting standard sensors and actuators and how to configure them.
- The section on [Measurement technology](#) contains general information and recommendations on using measurement technology.
- Technical data is available in the [Technical specifications](#) section.

## 3.1 Starting LogMessage

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

- Unpack the device.
- Plug the three-pinned, grey plug from the supplied AC adapter into the socket marked "Power" on the device.  
Refer also to [Display devices and connections](#). The plug is polarity-protected and can be inserted into the socket in only one way.
- Plug the supplied three-pinned grey connector for the external bus terminal in the socket marked "Ext. BUS".  
The terminal possesses a resistor that is necessary for the proper functioning of the bus system. The resistor is required even when a bus (cable) is not connected.
- Connect the power adapter into the mains socket.

The next steps are:

- [Installing programs](#)
- [PC connection](#)
- [Basic settings](#)

### 3.2 Installing programs



Administrator rights are required to install the programs.

Install the CD **ProfiSignal Go**. Please ensure that the DataService Configurator is installed as a *Program* (and not as a *Service*).

Following installation, these two desktop icons should appear:



The **DataService Configurator** from **Delphin** functions as a link between the PC and measurement hardware.

**Delphin hardware** is configured using **DataService Configurator**. **LogMessage** devices are immediately configured in the **DataService Configurator**.

The **ProfiSignal** program provides evaluation and visualisation functions for measurement data.

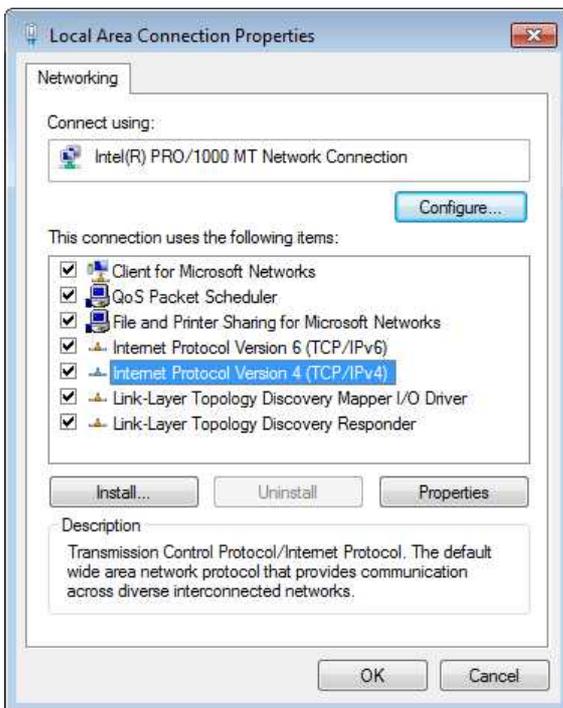
### 3.3 PC connection

#### Preparing the PC

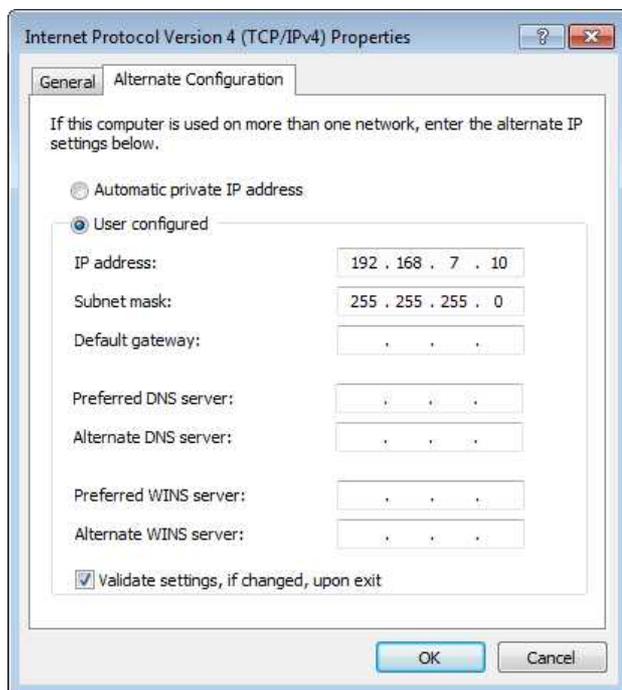
The factory setting of the IP address is printed on a sticker on the device. If the sticker is lost, the please try the IP address 192.168.251.252 (Net mask: 255.255.240.0)

To be able to establish a connection using this address, the PC must be temporarily set to a different address within the same IP segment:

1. Run the network connection dialog.
2. Depending on the operating system being used, the the dialog can be accessed from either the Windows Start button and **Network settings** or via the Control Panel, **Network and Sharing Center**.
3. Display the **Properties** of the connection to which the device is to connect (usually labelled **Local Area Connection**). In Windows Vista, click **Status** , then **Properties** .
4. Display the **Properties** for the internet protocol.



5. In the next dialog you can set either a fixed address for your PC, or - if the PC is set to DHCP and used in the LAN - use the option of an *alternate configuration* to prepare for cases where no network (server) is available (recommended).



6. Enter an address that falls within the same segment as the address of the device (refer to above example). Windows automatically adds the subnet mask.
7. Close all dialogs by clicking **OK**.

### Establishing a cable connection

- Connect the PC and the device using the supplied Ethernet cable.  
The connection between the device and PC can also be made via a network hub or switch.

### Establishing a device connection and setting an alternative network address

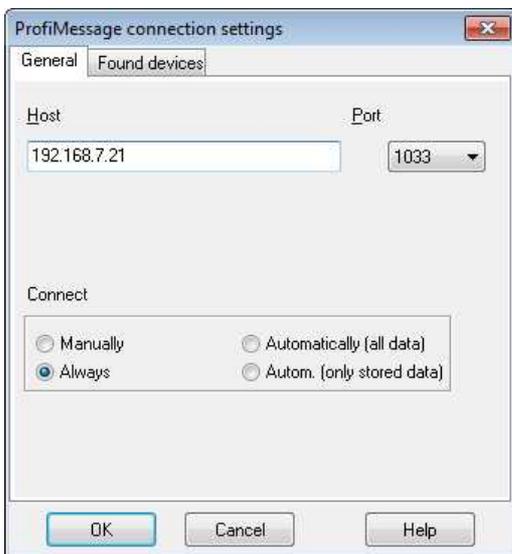
If a different IP address is required, e.g. to operate the device within a LAN, this can be performed using any internet browser. Go to the next section if a change of IP address is not required.

1. Open the internet browser and enter the address <http://192.168.7.21>.  
A connection is established to the device and the start page is displayed.
2. In the **Settings** section, click **Network**.  
This displays the network settings page.
3. Enter the address required for your network at **IP Address**. The subnet mask and gateway, or DNS and NTP server can also be entered (refer to [web browser configuration](#))
4. Click **Save** when finished to store the settings.

The LogMessage device can now be connected to your network. If the PC again requires reconnecting to the device, you may need to set it to the new IP Segment (the first group of three digits).

**Establishing a connection to the device**

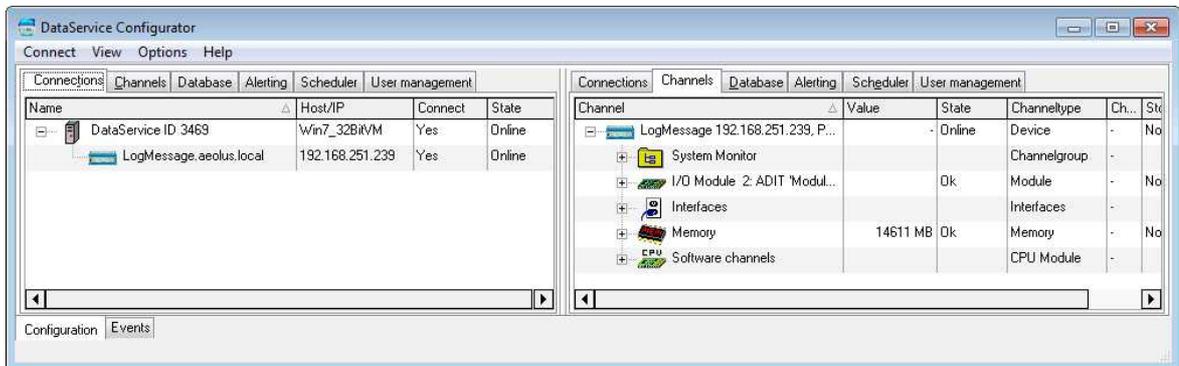
1. Start the DataService Configurator to establish a connection and to carry out configuration.  
The DataService is starts and the *Connections* tab is displayed on the left of the DataService Configurator.
2. Select *Connect* → *Add driver (connection)* → *LogMessage device*. Alternatively, a LogMessage device driver can be added by right-clicking *DataService ...*.
3. A device search is performed and a dialog displayed with the found device or devices.
4. Double-click the the address of the required device. If no device is found, use the *General* tab to manually enter the address.  
Change the port only when the Windows firewall is not being used and/or other ports have been configured within the firewall.



5. Confirm the settings with *Connect: Always* (default). Connection is then automatic when starting the DataService Configurator.  
A successful connection is then displayed with an IP address and a status. The DataService record displays the host name or the address of the PC.

### 3.4 Basic settings

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*.



#### Displaying measurement data

Once a connection has been established (refer to the [previous section](#)) current measurement data can then be displayed. Double-click on an I/O module to displays its channels. The *Value* column continuously updates with new measurement data.

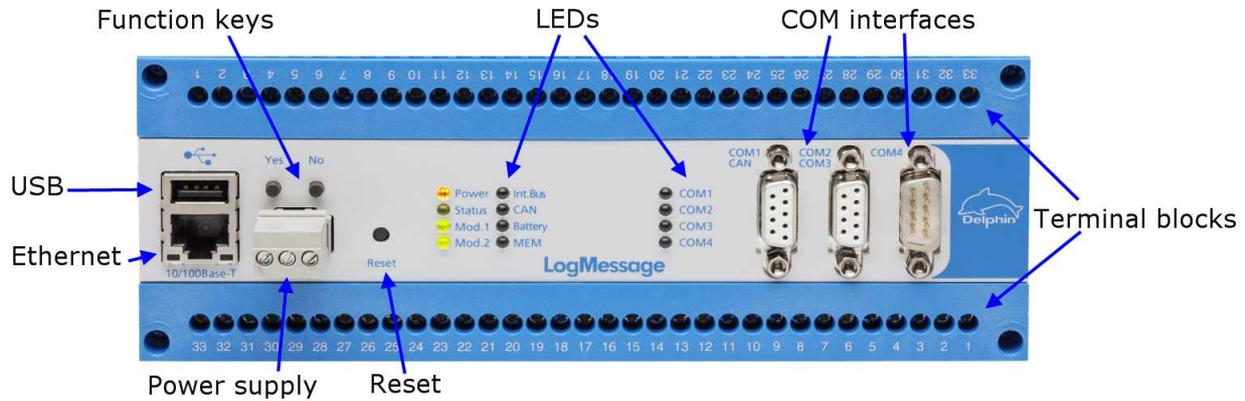
#### Displaying scaled measurement data

To convert data from the sensor into the required measurement unit requires configuration of the channel. Right click a channel to display the *Properties* dialog. A general explanation of dialogs is available under [settings for all dialogs](#) section. Special settings for different channel types (analog input, analog output) can be found in subsections of the [configuring module channels](#) section. The dialog also displays connection diagrams (refer to [I/O module connections](#)).

#### Other settings

- Setting digital I/O  
Scaling can also be made for counter inputs. Set which signal (channel) requires output of a constant level.
- Settings for data reduction, A/D measurement duration, etc.  
A number of options are available other than basic scaling, e.g. duration of an A/D conversion, the change required for a new measured value to be stored (data reduction), or how the channel is to be monitored.
- Specific settings for a device  
Options are available for system monitoring, e.g. CPU utilization or the available memory, and interface configurations.
- Calculation channels (subordinate channels)  
ProfiSignal devices are capable of processing data before it is saved and output. The corresponding settings are described in [configuring software channels](#).

## 4 LogMessage device and connections



Function keys are not currently enabled.

Connections are described in the following sections:

- [Power supply](#)
- [LEDs, LAN, USB](#)
- [General LEDs](#)
- [COM interfaces](#)
- [I/O module connections \(terminal blocks\)](#)

Also in this section:

- [I/O module installation and removal](#)
- [Internal memory card installation and upgrade](#)
- [Internal battery installation](#)

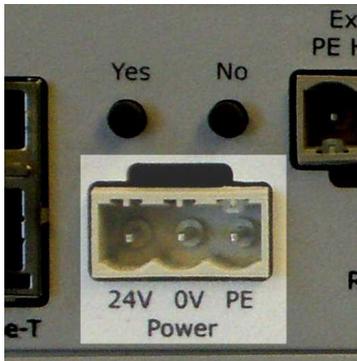
Refer also to [Device restart \(reboot\)](#)

### 4.1 Device types

Types	LM 1000	LM 2000	LM 3000	LM 4000	LM 5000
Analog inputs (mV, mA, Thermocouples)	15		15	8	
Analog inputs (mV, mA, Thermocouples, Pt100(0))		10			16
Analog outputs (mV, mA)		1		2	
Digital inputs (frequency measurements)		12 (11)	24	28 (2)	
Digital inputs (mV)		17	1	5	
Sampling rate in measurements per second	600	600	600	10000	80
Galvanic isolation AI to AI ( V DC)	110	110	110	100	650
Module 1	ADVT	DIOT	ADVT	ADFT	ADGT
Module 2		ADIT	IOIT	IOIT	ADGT

Types	LM 6000	LM 7000	LM 8000	LM 9000
Analog inputs (mV, mA, Thermocouples)	15	30	15	
Analog inputs (mV, mA, Thermocouples, Pt100(0))	10			20
Analog outputs (mV, mA)	1			2
Digital inputs (frequency measurements)			12 (11)	
Digital inputs (mV)	1		16	2
Sampling rate in measurements per second	1200	1200	600	1200
Galvanic isolation AI to AI ( V DC)	110	110	110	110
Module 1	ADVT	ADVT	ADVT	AAST
Module 2	ADIT	ADVT	DIOT	AAST

## 4.2 Power supply



Input voltage: 12 ... 28 VAC ± 10% / 12 ... 36 V DC ± 10%



### Info

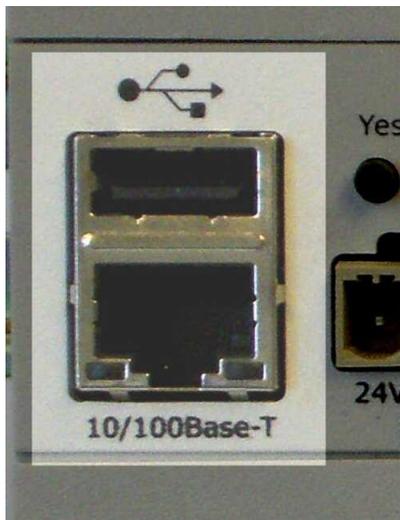
If the device is equipped with the AMDT I/O module the input voltage is 18 V<sub>AC/DC</sub>

Power input Pmax : 10 W

### Pin assignment

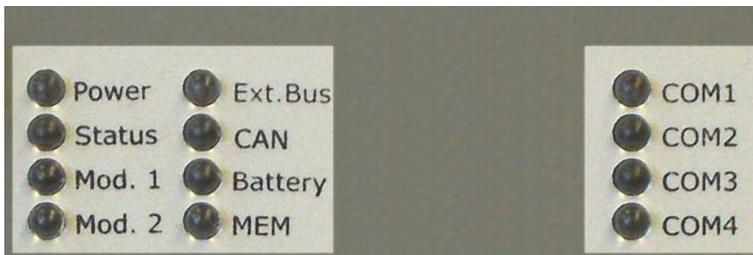
Pin	Label	Description
Left	24V	Power supply
Middle	0V	Neutral
Right	PE	Protective Earth , refer to <a href="#">ear-thing</a>

### 4.3 LED lamps, LAN, USB



LED	Status	Description
Right	Off	Not connected
	Green, non-flashing	Connected, data not being transferred
	Green, flashing	Data transfer
Left	Off	Half duplex
	Orange, non-flashing	Full duplex
	Orange, flashing	Collision

#### 4.4 General LEDs



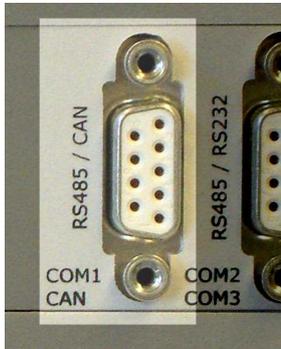
##### LED descriptions

Com-ponents	Number of LEDs	Status	Description
Power	1	green	Hardware failure, e.g. the device connected to the USB port requires too much power
		orange	Power supply OK
Status	1	red / green	Multifunctional display Flashing green: Module OK Flashing orange: Main program has ended (no data acquisition / processing)
Mod. 1	1	green	Status of I/O module  Permanent: normal functioning Slow flashing: BUS identification  For ADFT / ADMT:  Slow flashing: new firmware being saved Fast flashing: firmware being downloaded
Mod. 2	1	green	Status of I/O module
Ext. BUS	1	green	RxD
		orange	TxD
CAN	1	green	RxD
		orange	TxD
Battery	1	red	Battery failure / battery low  The battery for the clock and emergency data backup is flat and must be replaced. Refer to <a href="#">Internal battery replacement</a>
MEM	1	green	Access to the internal memory
COM1	1	green	RxD
		orange	TxD
COM2	1	green	RxD

Com-ponents	Number of LEDs	Status	Description
		orange	TxD
COM3	1	green	RxD
		orange	TxD
COM4	1	green	RxD
		orange	TxD

## 4.5 COM interfaces, CAN

### ▼ COM1/CAN



#### Pin assignment

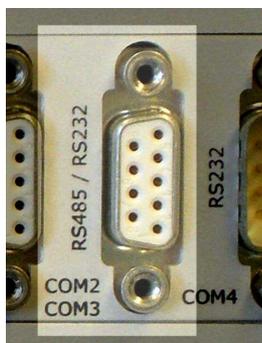
Pin	Signal	Description COM1 (RS485)	Description CAN
Housing	Shield	Shield / protective ground, refer to <a href="#">earthing</a>	
1	Shield	Shield / protective ground, refer to <a href="#">earthing</a>	
2	CANL	-	CAN-Bus Low
3	RxD/TxD-P / B	Receive/transmit data-Plus (RS485)	-
4	RTS	Control signal for repeaters (TTL)	-
5	GND / C	Data reference potential / neutral	
6	VP	Supply voltage / Plus (5V)	
7	CANH	-	CAN-Bus High
8	RxD/TxD-N / A	Receive/transmit data-Negative (RS485)	-
9	-	Not connected	



#### Info

Galvanic isolation does not exist between CAN and COM1.

▼ **COM2/COM3**



**Pin assignment**

Pin	Signal	Description COM2 (RS485)	Description COM3 (RS232)
Housing	Shield	Shield / protective ground, refer to <a href="#">earthing</a>	
1	Shield	Shield / protective ground, refer to <a href="#">earthing</a>	
2	RxD	-	Receive data (RS232)
3	RxD/TxD-P / B	Receive/transmit data-Plus (RS485)	-
4	RTS	Control signal for repeaters (TTL)	-
5	GND / C	Data reference potential / neutral	
6	VP	Supply voltage / Plus (5V)	
7	RTS	-	Request to Send (RS232)
8	RxD/TxD-N / A	Receive/transmit data-Negative (RS485)	
9	TxD		Transmit data (RS232)



**Info**

Galvanic isolation does not exist between COM2 and COM3.

▼ **COM4**



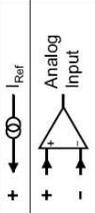
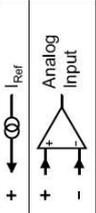
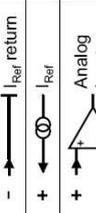
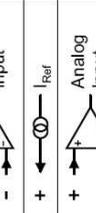
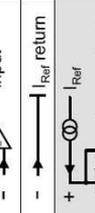
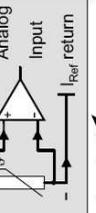
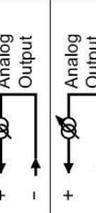
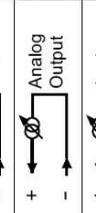
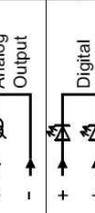
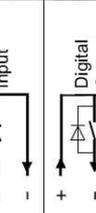
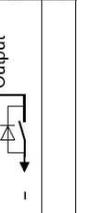
**Pin assignment**

Pin	Signal	Description
Housing	Shield	Shield / protective ground, refer to <a href="#">earthing</a>
1	DCD	Data Carrier Detect (RS232)
2	RxD	Receive Data (RS232)
3	TxD	Transmit Data (RS232)
4	DTR	Data terminal ready (RS232)
5	GND	Signal ground
6	-	Not connected
7	RTS	Request to Send (RS232)
8	CTS	Clear to Send (RS232)
9	-	Not connected

### 4.6 I/O module connections (terminal blocks)

Devices can be equipped with different modules. Below are the the wiring diagrams/terminal assignments for the various I/O modules (in alphabetical order).

▼ **AAST**

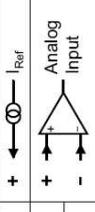
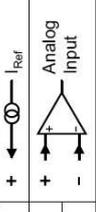
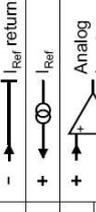
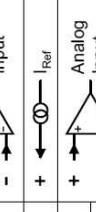
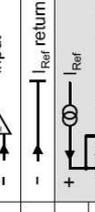
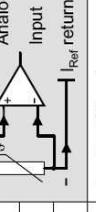
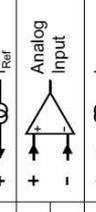
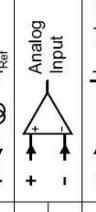
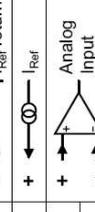
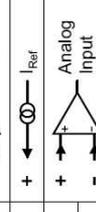
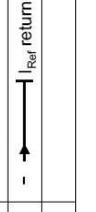
<b>AAST</b>		Notes:																																					
Channel 1			Channel 2			Channel 1 - 2		Channel 3			Channel 4			Channel 3 - 4		Ref. Junction Channel 5		Channel 6		Channel 7		Channel 8		Channel 9		Channel 10		Channel 11		Channel 10 - 11		Channel 12 - 13		Channel 12		Channel 13			
																																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33							

▼ **ADGT**



**Info**

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

<b>ADGT v2.0</b>		Notes:																																					
Channel 1			Channel 2			Channel 1 - 2		Channel 3			Channel 4			Channel 3 - 4		Ref. Junction Channel 9		Channel 5		Channel 6		Channel 5 - 6		Channel 7		Channel 8		Channel 7 - 8											
																																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33							

<b>ADGT</b> v3.0		Notes:	
Channel 1			
Channel 2			
Channel 1 - 2			
Channel 3			
Channel 4			
Channel 3 - 4			
Ref. Junction Channel 9			
Channel 5			
Channel 6			
Channel 5 - 6			
Channel 7			
Channel 8			
Channel 7 - 8			
PE			
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33			

ADIT

<b>ADIT</b>		Notes:	
Channel 1			
Channel 2			
Channel 3			
Channel 1 - 3			
Channel 4 - 10			
Channel 4			
Channel 5			
Ref. Junction Channel 11			
Channel 6			
Channel 7			
Channel 8			
Channel 9			
Channel 10			
Channel 4 - 10			
Channel 13			
Channel 12			
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33			

▼ ADVT

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

▼ AMDT and ADFT

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

ADFT and AMDT have identical terminal assignments. For technical reasons, only one ADFT module per system can be used.

DIOT

DIOT		Notes:																															
Channel 13-20	Channel 13	Channel 14	Channel 15	Channel 16	Channel 17	Channel 18	Channel 19	Channel 20	Channel 21-28	Channel 21	Channel 22	Channel 23	Channel 24	Channel 25	Channel 26	Channel 27	Channel 28	Channel 1 / 30	Channel 2 / 31	Channel 3 / 32	Channel 4 / 33	Channel 5 / 34	Channel 6 / 35	Channel 1-6 / 30-35	Channel 7 / 36	Channel 8 / 37	Channel 9 / 38	Channel 10 / 39	Channel 11 / 40	Channel 12	Channel 7-12 / 36-40		
Digital Output									Digital Output									Digital Input / Counter Input						Digital Input / Counter Input					Digital Input only				
+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	-
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	

IOIT

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

▼ OTPT

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

## 4.7 I/O module installation and removal



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



### Removal

1. Disconnect the unit from the mains voltage supply.
2. Remove all plug-in connectors from the device front.  
When replacing one module with a similar module, leave the cables attached to the terminal blocks.
3. Unscrew the four locking screws at the ends of the two terminal blocks until a distinct cracking sound is heard.  
The screws have retaining rings to prevent their complete removal.
4. Pull the two terminal blocks towards the front. Prise off if necessary using a flat screw at the sides between the terminal block and housing front (see image).



5. Use a screwdriver to lightly press the two retaining lugs at the housing sides and lever towards the front.



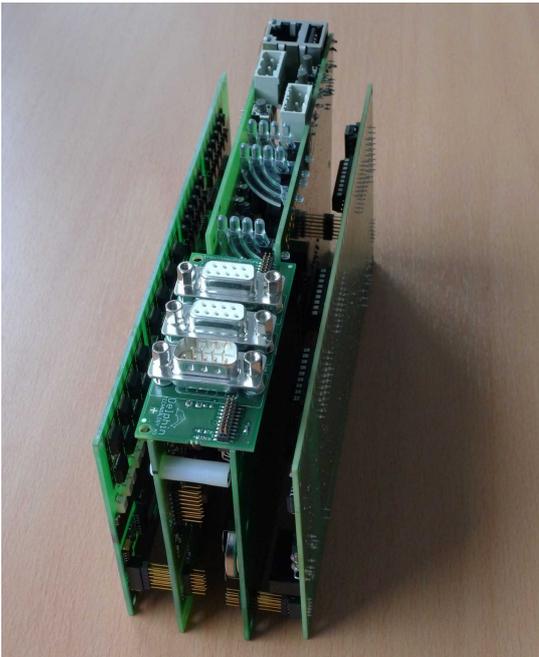
6. Carefully pull the module circuit board from the slots in the board. Be careful not to bend any pins.



## Installation

Follow the above procedures in reverse order but taking the following into account:

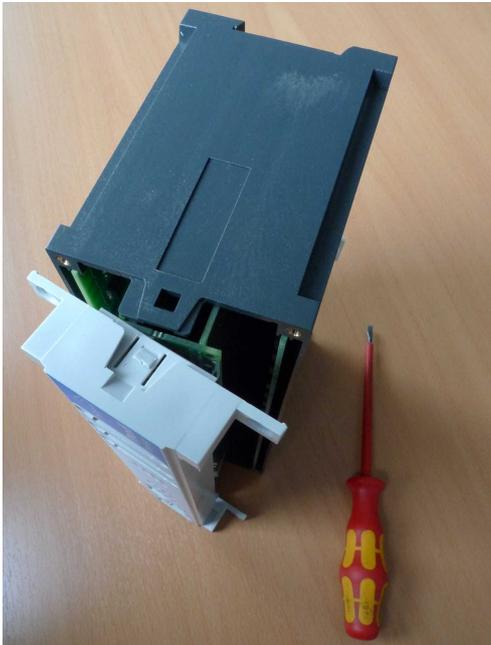
- The side of the I/O module with components must point towards the internal circuit board.
- Check that all connector pins fit into the sockets of the inner board and that the boards are aligned in parallel.



- Make sure that the boards keep within the side slots when installing them onto the base board.



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



- Do not fully tighten each screw one after the other. Lightly tighten one screw then move to the next, repeating the procedure until all screws are fully tightened.



5. Use a screwdriver to lightly press the two retaining lugs at the housing sides and lever towards the front.



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

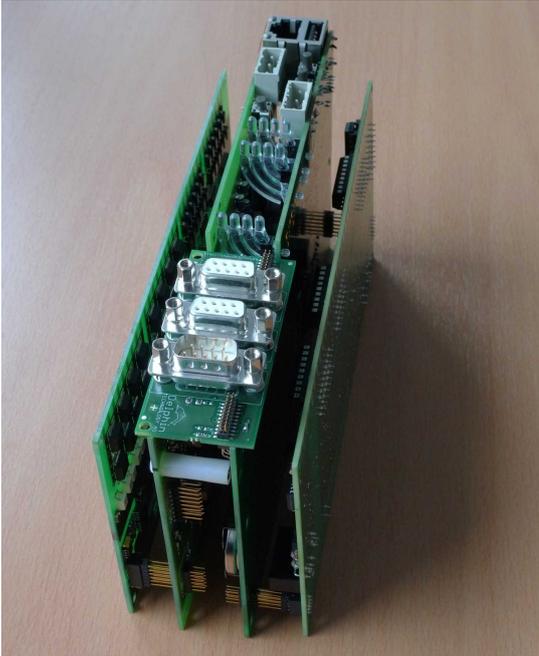


7. Push in the new memory card, with its "handle" pointing towards the board, until it stops. Use only gentle pressure and do not force. The card fits in one direction only.

## Installation

Follow the above procedures in reverse order but taking the following into account:

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



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



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



- Do not fully tighten each screw one after the other. Lightly tighten one screw then move to the next, repeating the procedure until all screws are fully tightened.

## 4.9 Internal battery installation



Electronic components are sensitive to electrostatic charge. Therefore, discharge any electrostatic before opening the device to replace the battery. We recommend wearing a wrist band (static discharge wrist band) and to carry out the work on a conductive surface.



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

### Removal

1. Disconnect the unit from the mains voltage supply.
2. Remove all connectors from the device front. Leave the cables that are attached to the terminals of the terminal blocks.
3. Unscrew the four locking screws at the ends of the two terminal blocks until a distinct cracking sound is heard.  
The screws have retaining rings to prevent their complete removal.
4. Pull the two terminal blocks towards the front. If necessary prise off using a flat screwdriver between the side of the terminal block and housing.



5. Use a screwdriver to lightly press the two retaining lugs at the housing sides and lever towards the front.

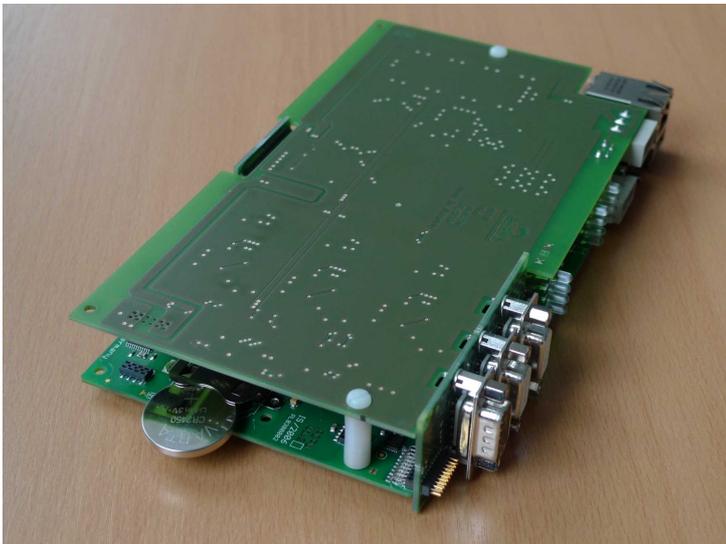


6. Remove the battery from its holder using long-nose pliers or a similar tool.

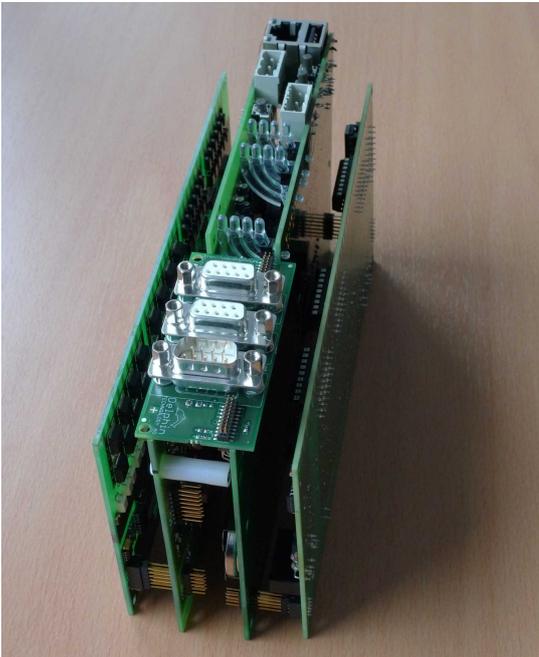
## Installation

Follow the above procedures in reverse order but taking the following into account:

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



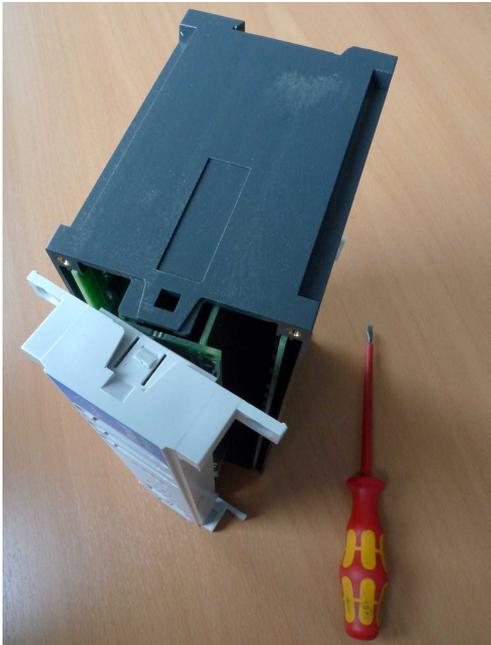
- Check that all connector pins fit into the sockets of the inner board and that the boards are in parallel alignment.



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



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



- Do not fully tighten each screw one after the other. Lightly tighten one screw then move to the next, repeating the procedure until all screws are fully tightened.

## 5 Configuration and operation

The following sections are covered here:

- The [Configuration via web browser](#) explains how to make (device) settings via an internet browser.  
The following functions are *possible* via the device's web interface: saving and loading device configurations; resetting to factory settings; firmware updating. Some basic settings are also possible, e.g. Ethernet interface or device-clock.
- Basic device settings, such as the network settings or the device ID, is described in the [Device configuration](#) section.
- The Connecting slave devices section explains the configuration process when multiple devices are being used.
- Devices are equipped with internal memories to enable configurations to be saved. The [Memory](#) section explains how this storage space can be used the space, e.g. for partitioning across different channel groups.
- The [Data transfer to USB memory stick](#) section explains how to externally back up internally stored data.
- Configuring the various I/O module-channels is described in detail in the section on [Configuring module channels](#).
- Read the [Configuring interfaces](#) section on how to use the various interfaces for connecting or exchanging data with external devices.
- The [Configuring software channels](#) section describes the various ways in which to perform calculations on the measurement data or between channels.

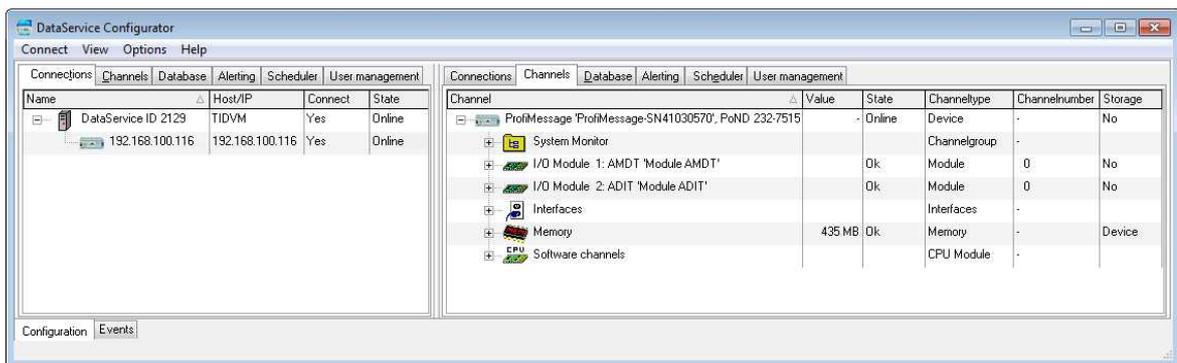
See also [Getting Started](#) , [Settings for all dialogs](#).

## 5.1 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*. Settings via the web interface are described in the [Configuration via an internet browser](#) section. The configuration of sensor and actuator connections, and the definition of calculation (software channels) takes place via the DataService Configurator and is explained in the following sections. A detailed description of DataService Configurator is available in the DataService Configurator manual.

Clicking DataService Configurator starts the DataService background program and establishes a connection to the devices (the default for the first installation is explained 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 "LogMessage '192.168.100.116 ', PoND 2.2 ...".



### Channel configuration

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

Amendments to configurations take immediate effect with the previous settings being overwritten. The new settings are saved to the LogMessage 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, i.e. 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 (+).

## 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 manual for the DataService Configurator.

## 5.2 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. Refer also to [Unknown IP address?](#)



### Info

Click **Save** after entering the settings otherwise they will not be amended within the device.

To return to the main menu either click the **Back** button on your browser or click **Back** at the bottom of the screen.

Settings via the web interface are made in the the following four areas: [Settings](#) , [Configuration](#) , [Service](#) and [System](#) . To display the current status of the NTP client click [NTP status](#) or [Clock](#) . Many of the settings made through the device web interface can also be made via the DataService Configurator. Refer to [Configuring the LogMessage device](#).

The browser display for a device with the address 192.168.100.116, the host name "LogMessage" and the domain "example.com".

### 5.2.1 Unknown IP address?

If an IP address has been amended and then forgotten, the new address can be determined via a connection to the serial interface. Requirements:

- A Null modem cable (crossover serial cable, D-SUB DB9 connector coupling to D-SUB DB9 connector coupling that is included the delivery).
- A terminal program such as Windows HyperTerminal or PuTTY.



### Info

PuTTY can be downloaded using the device's **Service** option and via the web interface (when connected).

#### Method

1. Connect the RS232 port of your PC to the [COM4](#) port of the device using the null modem cable.
2. Set your terminal program to **115200 baud transmission speed** , **8 data bits** , **no parity** and **1 stop bit** (8N1), and **No handshake**.
3. Enter the user name **root** .
4. Enter **ifconfig** .

The current IP address and subnet mask settings for the device are then shown in the second line of the output (underlined in red in the following example):

```
login: root
Last login: Tue Apr 10 15:43:16 on console
[root@pm_is:~] # ifconfig
eth0      Link encap:Ethernet  HWaddr 00:50:C2:13:88:21
          inet addr:192.168.0.134  Bcast:192.168.15.255  Mask:255.255.240.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:36  errors:0  dropped:0  overruns:0  frame:0
          TX packets:46  errors:0  dropped:0  overruns:0  carrier:0
          collisions:0  txqueuelen:1000
          RX bytes:2515 (2.4 KiB)  TX bytes:3305 (3.2 KiB)
          Interrupt:43

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:4  errors:0  dropped:0  overruns:0  frame:0
          TX packets:4  errors:0  dropped:0  overruns:0  carrier:0
          collisions:0  txqueuelen:0
          RX bytes:360 (360.0 b)  TX bytes:360 (360.0 b)
```

To change the IP address or subnet mask, you must first set your PC address to an address in the same segment and then connect the PC to the device via Ethernet. Refer to [PC Connection](#). This section also explains how to amend the device's IP address.

## 5.2.2 Settings

This section enables [network](#) and [timezone](#) settings. The [NTP status](#) is obtained by clicking [NTP status](#) above.

### 5.2.2.1 Network

This window enables network data to be input or amended. Settings are made only after clicking [Save](#).



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

## Network settings

R234-beta5-8125M

LAN Status: eth0: negotiated 100baseTx-FD, link ok

Hostname:	<input type="text" value="LogMessage"/>
Domain:	<input type="text" value="aeolus.local"/>
IP address:	<input type="text" value="192.168.251.239"/>
Subnet mask:	<input type="text" value="255.255.240.0"/>
Default Gateway:	<input type="text" value="192.168.254.254"/>
MTU:	<input type="text" value="1500"/>
DNS server 1:	<input type="text" value="192.168.248.20"/>
DNS server 2:	<input type="text" value="192.168.248.21"/>
NTP servers:	<input type="text" value="127.127.20.3"/>

The *hostname* (network name for the device), *domain* and *DNS server* 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, i.e. no German umlauts, etc., but hyphens are allowed).

Ask your network administrator whether your network requires MTU and gateway information. Otherwise, leave the **1500** default setting for *MTU*. A gateway address is required only if connections are to be established to other networks.

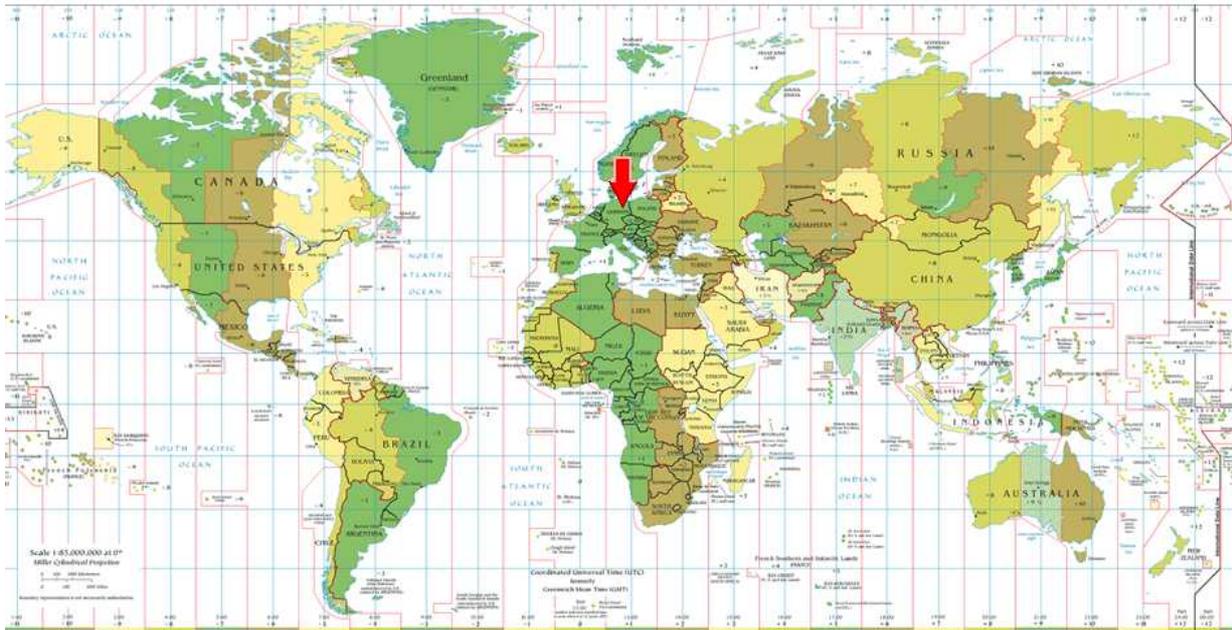
For the *NTP server* field, enter the IP address of one or more available NTP time servers (NTP: Network Time Protocol) to enable correct time settings for the device. The NTP time server can be any other network device such as a PC or another LogMessage device. The integrated Windows time server SNTP (Simple Network Time Protocol) is however not recommended due to it having insufficient information on synchronization status. The device accepts (S)NTP times but only when the (S)NTP is synchronized to an internet time server or to DCF77 or GPS and is able to provide information on the quality of synchronization. If necessary, download an NTP time server from <http://www.meinberg.de/german/sw/ntp.htm>.

### 5.2.2.2 Clock settings

Use this window to specify the timezone that the device is to use. Store the selection by clicking **Save**.

#### Clock settings

R232-7515



World map based on CIA World Factbook, Sept. 2011

Timezone: \*Germany / Berlin

Current time: **Fri, 2012-06-22 13:39:59 CEST (UTC+0200)**

Change time: 2012-06-22 13:39:59

#### NTP status

When a time server is unavailable, the date and time can be manually set. The device's internal clock then functions without synchronization to a time server.

Click **Synchronize with NTP servers now** to commence synchronization with the NTP time server specified under [Network](#).

### 5.2.2.3 NTP status

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



**Info**

NTP synchronization requires up to 5 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".

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

```

NTP status
Current time: Thu Jan 27 10:32:47 CET 2011

synchronised to NTP server (192.168.248.40) at stratum 3
time correct to within 64 ms
polling server every 1024 s

  remote          refid          st t when poll reach  delay  offset  jitter
  =====
*timeserver.aeol 192.53.103.103  2 u 190 1024 377   2.743  -1.481  0.102
LOCAL(0)         .LOCL.         12 l   7   64 377   0.000   0.000  0.001

ind assID status  conf reach auth condition  last_event cnt
=====
  1 14466 9614   yes  yes  none  sys.peer  reachable 1
  2 14467 9014   yes  yes  none  reject   reachable 1

assID=0 status=0664 leap_none, sync_ntp, 6 events, event_peer/strat_chg,
version="ntpd 4.2.4p2@1.1495 Tue Apr 1 23:30:05 UTC 2008 (1)",
processor="ppc", system="Linux/2.6.37-svni054", leap=00, stratum=3,
precision=-20, rootdelay=24.380, rootdispersion=64.124, peer=14466,
refid=192.168.248.40,
reftime=d0ebb981.9ad97a97 Thu, Jan 27 2011 10:29:37.604, poll=10,
clock=d0ebba3f.4da91f4b Thu, Jan 27 2011 10:32:47.303, state=4,
offset=-1.481, frequency=8.444, jitter=0.102, noise=0.569,
stability=0.022
    
```

### 5.2.3 Configuration

This section describes how to:

- **Save** or **Load** device settings, refer to [Saving and loading configurations](#).
- **View channels** to display the current [channel Settings](#) .
- Reset all settings (except the network and settings) to the factory settings using **Default configuration**. Refer also to [Resetting configurations](#).

### 5.2.3.1 View channels

This window shows in tabular form, configurations for all the channels from a 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 users to display the channel configuration as an XML file (potentially important for support purposes).

The data can only be displayed. Changing settings is not possible. To change configurations, use the DataService Configurator (Refer to [LogMessage device configuration](#)).

**LogMessage 2000 "pmIS.aeolus.local"**

**Channel List**  
R234-beta5-8125M

Name	Unit	Description	Location	Active	Type	Module type	Data type	Sensor type	Measuring range min	Measuring range max	Scaling min
Rs1-Out		Integration function		Yes	Integrator		Float64				
Variable2		Holds variable or constant values		Yes	Variable		Float64				
CAN		CAN bus controller, connector is "COM1/CAN"		Yes	CANInterface		StatusOnly				
Memory	MB	Channel group containing storage groups, shows free space in megabytes		Yes	MemoryGroup		Integer32				
TestSign1	%			No	Setpoint		Float64				
FftSpectrum		Spectrum of an AMDT Analog Input		Yes	TopDSPFFT	AMDT	Block				
Counter #20	Hz			Yes	TopCounterInput	AMDT	Float32	0.00	1.00	0.00 Hz	
x1		Calculates various arithmetic operations		Yes	Calculation		Float64				
Analog Input #05	mV			Yes	TopAnalogInputAMDT	AMDT	Block	Voltage	-10000.00 mV	10000.00 mV	-8000.00 mV

### 5.2.3.2 Saving and loading configurations



**Info**

The saving or loading of device configurations can only be done through the web interface.

#### Save configuration

Saves the current configuration to a (compressed) file. The file name is automatically generated from the host name, domain (refer to [network settings](#) ) and the date and time as at file creation.

## Load configuration

Loads a file that has been created with *Save configuration* and sets the device to the file's settings except for network, date and time settings.

Enter the file to loaded in *Configuration file* or click on *Search* to find the file on your PC (file extension tar.gz). Then click *Load configuration*. Loading takes about 1 minute. A message is displayed during loading and when a restart has been completed:

```
Load configuration
R224 (Build 6850)

LoadConfig $Rev: 6445 $
Unpacking file... Done.
Stopping Services...

Shutting down FRoG: [ OK ]
Shutting down PoND: [ OK ]

Done.
Copying files... Done.
Starting Services...

Starting PoND: [ OK ]
Starting FRoG: [ OK ]

Done.
```

The process is complete when "Done" is the last message displayed.

### 5.2.3.3 Default configuration



Resetting to factory setting cannot be undone. Therefore save the current configuration using *Save* (Refer to [Saving and loading configurations](#)).

By clicking *Default configuration* all settings, except for the network, date and time settings, are reset to the factory settings. The process is displayed in a window.

```
Creating default configuration...

Shutting down FRoG: [ OK ]
Shutting down PoND: [ OK ]
Creating default configuration... Done.
Starting PoND: [ OK ]
Starting FRoG: [ OK ]
```

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



After resetting to factory settings, the I/O modules are disabled and required the reassigning of a module number (refer to [I/O module](#) ).



**Info**

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

**5.2.4 Service**

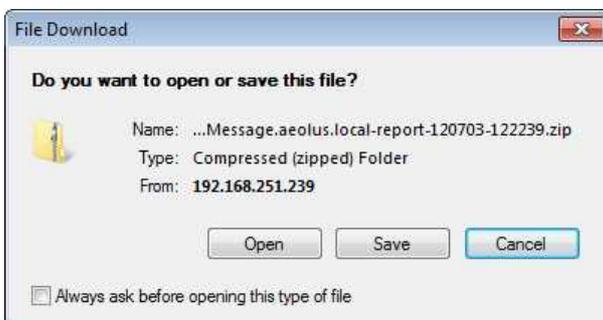
This section describes:

- Generation of a [system report](#).  
The file is required only by **Delphin's** service and support in the event that the device malfunctions.
- 
- Downloading of bitmaps from a device.  
Bitmaps are used for the graphical representation of the device in the user's PROFIBUS configuration program.
- Downloading the PuTTY terminal program ( *PuTTY* ) button.

**5.2.4.1 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 10 seconds to acquire all the information and record it to a ZIP file. The following dialog is then displayed to select the location of the saved file. The file name is made up of the current date and time and the network identifier of the device.



## 5.2.5 System

This section describes:

- Firmware updating using *Update firmware* (updating of the software within the device). Refer to [Update firmware](#).
- Displaying of the changes to the current firmware compared to the previous version using *Firmware changelog*.  
The Adobe Acrobat Reader is required. The Acrobat Reader can be downloaded cost-free from [Adobe](#).  
Refer to [Updating firmware](#).
- Restarting the device using *Reboot*.  
This has the effect of switching off and on.  
Refer to [Rebooting the device](#).
- *Restart main application* only restarts the software for data acquisition and storage or transmission.  
Refer to [Restart main application](#).  
This is faster than fully rebooting the device.

### 5.2.5.1 Update firmware



#### Info

A firmware update can be performed only via the web interface.

A firmware update is provided with every software update. Perform 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 firmware updating otherwise damage may occur to the equipment that will require repairing.

Enter the file with the new firmware in the New firmware file field on (click Search to find the file on your PC) and then click Start firmware update . The firmware upgrade takes 4 to 6 minutes.



## Update firmware and reboot

R234-beta5 (Build 8125M)



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

Current Firmware: **R234-beta5, Build 8125M** (Message-Firmware-120702-r234-beta5-build8125M.tar.bz2)

New Firmware file:

The device will reboot after the update (reboot). A message is displayed during loading and when a restart has been completed:

## Update firmware

R.224 (Build 6850)



UpdateFirmware \$Rev: 6484 \$

Stripping header... OK.  
Decompressing archive... OK.  
Unpacking updater... OK.  
Executing updater...

FirmwareUpdater \$Rev: 6433 \$  
Unpacking archive... Done.

Updating from **R224, Build 6850** (ProfiMessage-Firmware-110912-r224-build6850.tar.bz2)  
to **R225, Build 6914** (ProfiMessage-Firmware-110920-r225-build6914.tar.bz2)

Checking Kernel... Writing... Done. Verifying... Done.  
Checking RamDisk... Not provided.  
Checking U-Boot... Writing... Done. Verifying... Done.  
Stopping Services...

Shutting down FRoG: [ OK ]  
Shutting down PoND: [ OK ]  
Starting HW watchdog: [ OK ]

Copying files... Done.



**System is rebooting now. Please standby about one minute...**

The process finishes about one minute later. Then return to the home page ( Back ).

## 5.2.5.2 Firmware changelog

Click *Firmware changelog* to display a PDF file containing information on how the current firmware differs to previous versions. The Adobe Acrobat Reader is required. The Acrobat Reader can be downloaded cost-free from [Adobe](http://www.adobe.com).

Example of a firmware changelog:

Delphin Technology AG Lustheide 81 D - 51427 Bergisch Gladbach Tel: +49 (0) 2204 97685 0 Fax: +49 (0) 2204 97685 85 <a href="http://www.delphin.com/">http://www.delphin.com/</a>	<b>ProfiMessage Firmware</b>  Changelog	
--	---	--

- **R121/R221 (Build 6526) – 27. June 2011**
  - Web:
    - Fixed displaying hostname after changing hostname / domain via web interface
    - Channellist: Fixed displaying of channel names, units and descriptions with >, < or &
  - NTP synchronisation after reboot, NTP server address change or manual synchronisation faster
  - At boot time the reset reason (PowerOn, ResetButton/Watchdog, Restart or Panic) is logged and displayed on web front page
  
- **R120β/R220β (Build 6516) – 22. June 2011**
- **R119β/R219β (Build 6461) – 14. June 2011**
  - Downgrade to versions below **R118** / **R218** possible, if a compatible boot loader is detected
  - Web:
    - Warning if storage medium may prevent a software reboot
    - "Reboot", "Restart" and "Default config" now buttons instead of links
    - NTP status improved
  - Bug-fixes Setpoint and Alarm-clock
  - LEDs of I/O modules will blink when module dialog is open (Configurator > V3.1)
  - Newly connected I/O modules will appear immediately in Configurator, deleted but still connected I/O modules will re-appear
  - Updating firmware improved: Slightly faster, needs less memory
  - First implementation of Modbus TCP Client and Server
  - Serial ports COM1 and COM2 in UART mode and COM3 now working (Configurator > V3.1)

## 5.2.5.3 Restart main application

Clicking Restart main application restarts the main program. This is faster than fully rebooting the device.



During the restart, data is neither acquired nor stored. The network connection to the <% PM%> device is interrupted and the re-established following the restart.

**Info**

A start can be performed only via the web interface.

The process is displayed in a window.

**Application is restarting now...**

```
Shutting down FRoG: [ OK ]  
Shutting down PoND: [ OK ]  
Starting PoND: [ OK ]  
Starting FRoG: [ OK ]
```

**Done.**

The process ends when the "Done" message is displayed.

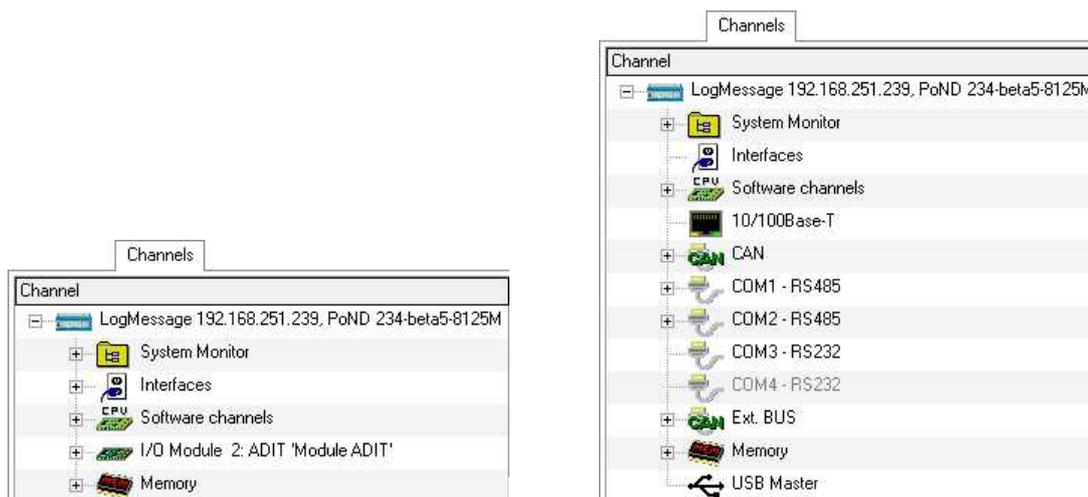
#### 5.2.5.4 Device restart (reboot)

Restarts the device. The process takes approximately 2 minutes. Then click **Back**. The LEDs on the device indicate when the device is ready (refer to [General LED](#)).

The action is equivalent to pressing the (countersunk) reset button on the front of the device or switching it off and then on again.

### 5.3 Configuring a LogMessage device

The Channels tab's top level DataService Configurator is the device level. The next level is the user-defined view (left panel) and displays the I/O modules, the interfaces, memory and the software channels. The hardware view (right panel), displays the various system interfaces, memory and software channels. The I/O modules are located in the "Ext. BUS" group.



This section explains the settings that users can make themselves. This takes place via "LogMessage '192.168.100.116'..." in the Channels tab in the DataService Configurator (see example). Use the Properties context menu to amend a device name and ID or to enter a description for the device. Use Main settings context menu to amend network and NTP settings.

Refer to [Configuring main unit](#), [Network settings](#), [NTP](#).

The explanations of other settings, refer to:

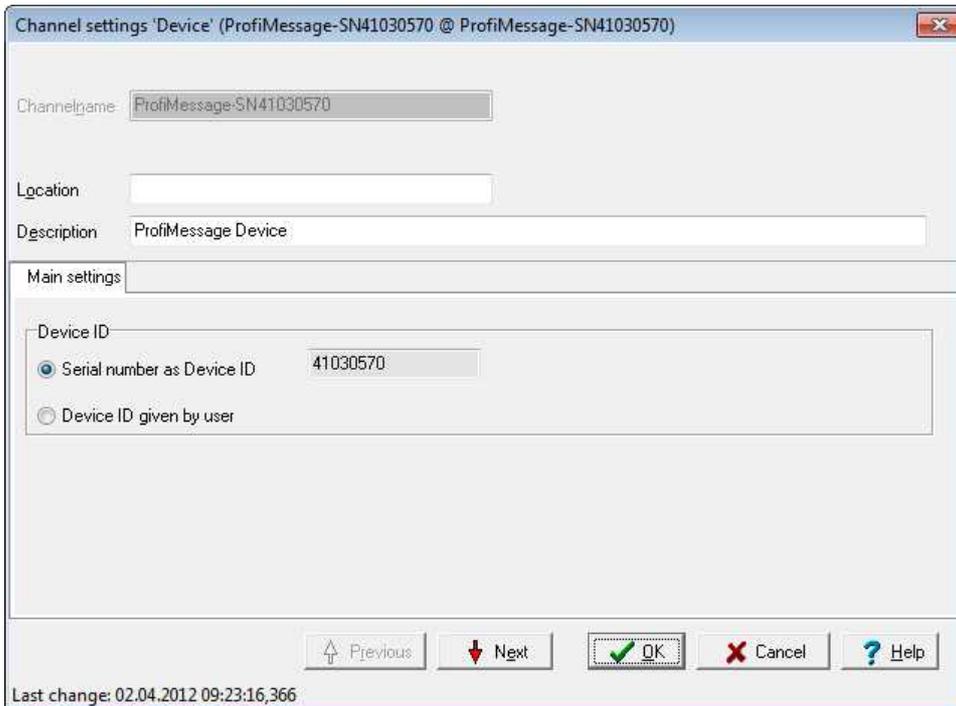
- [Memory](#) for internal memory
- [Configuring module channels](#) for I / O modules
- [Configuring interfaces](#) for CAN, COM and
- [Configuring software channels](#) for system monitoring and calculations

**Info**

For general information on configuration dialogs (including header and footer), refer to [Settings for all dialogs](#).

### 5.3.1 Device configuration (channel configuration)

Open the configuration dialog either by double clicking the device or by selecting Properties from the context menu.



This dialog 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.
- Amending *Device ID* .

#### Device ID

The DataService uses the 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 *Device ID* under the DataService's column of the same name. 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. Save the required configuration using the web interface. Refer to [Saving a configuration](#).
2. Use the web interface to load the configuration to the new device. Refer to [Loading a configuration](#).
3. Open the *Device configuration* dialog.
4. Enable *User-defined device ID*.
5. Enter a new ID (e.g. the device's " old " serial number).

The device ID is in hexadecimal format. Valid input includes numbers from 0 to 9 and letters from 'a-f' or 'A-F' (no distinction is made between upper case and lower case letters). A zero may not be entered as the first character.

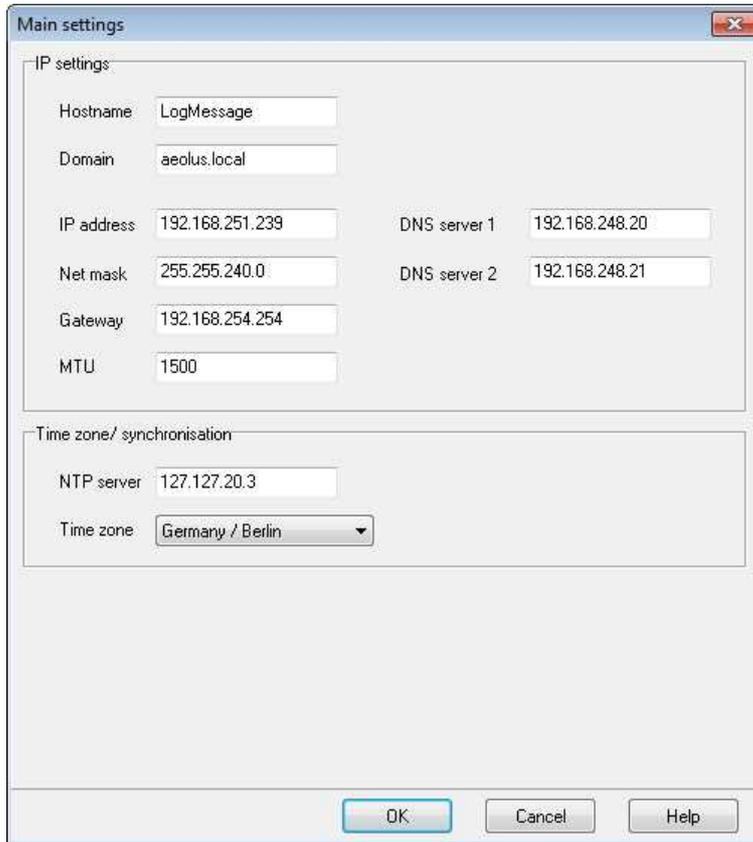
A valid input changes the input field's background color to bright green. It remains red background as long as the input is invalid or incomplete.

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

Refer also to [Settings for all dialogs](#)

### 5.3.2 Network settings, NTP

Open the Main settings dialogue via the device's context menu.





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

The Hostname (network name for the device), domain and DNS server 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, i.e. no German umlauts, etc., but hyphens are allowed).

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.

For the *NTP server* field, enter the IP address of one or more available NTP time servers (NTP: Network Time Protocol) to enable correct time settings for the device. The NTP time server can be any other network device such as a PC or another LogMessage device. The integrated Windows time server SNTP (Simple Network Time Protocol) is however not recommended due to it having insufficient information on synchronization status. The device accepts (S)NTP times but only when the (S)NTP is synchronized to an internet time server or to DCF77 or GPS and is able to provide information on the quality of synchronization. Download an NTP server from <http://www.meinberg.de/german/sw/ntp.htm> if necessary.

As of Firmware Version R233 it is possible to connect GPS clocks (e.g. Holux GR-213). For that enter the "pseudo IP address" 127.127.20.3 in the *NTP server* field. Additionally deactivate the corresponding channel (Device -> Interfaces -> COM3 RS232). When the GPS receiver has locked on valid satellite signal, after a while the NTP status will change to "synchronized to UHF radio at stratum 1".

Example of absent or incorrect time synchronization DataService Configurator:



Name	Host/IP	Connect	State
DataService ID 2129	Win7_32BitVM	Yes	Online
192.168.100.116	192.168.100.116	Yes	Online, Time of device differ



### Info

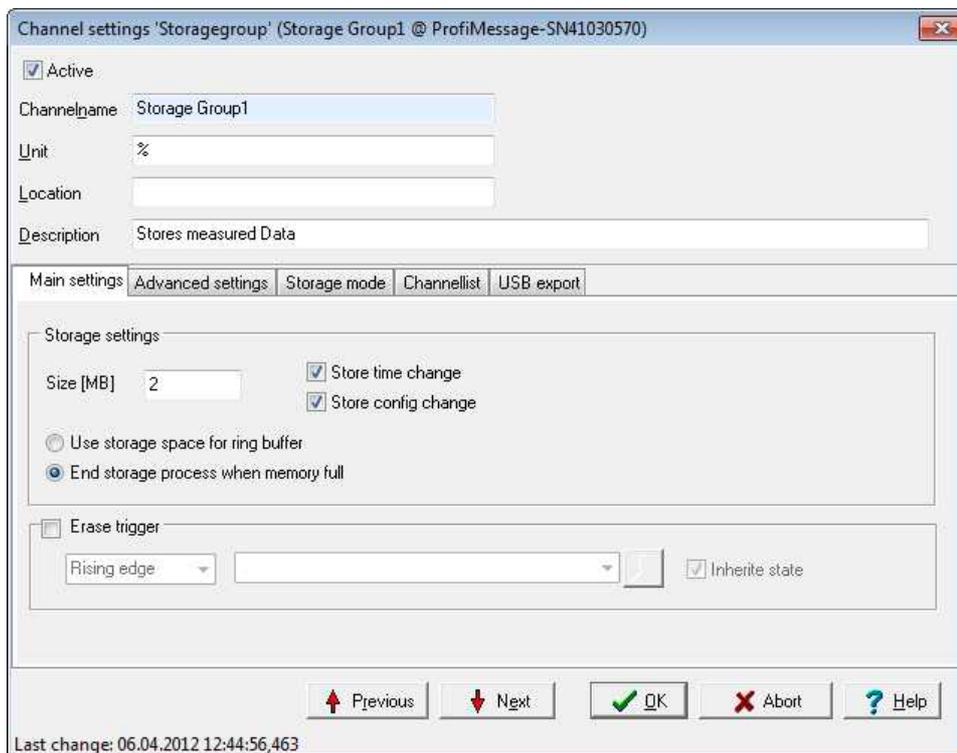
NTP synchronization requires up to 5 minutes to adjust to the NTP time server after the device has been switched on. The *NTP status* will be invalid during this period and will display the message "Synchronised to unspecified at stratum 13".

## 5.4 Storage Group

Setting subgroups within the "Memory" enables a more efficient partitioning of the memory. From the context menu select **Create channel** → **Memory groups**. Divide the available memory among these groups and use the *Channel list* tab to set how often the groups channels are to be saved.

Refer also to [Settings for all dialogs](#) , [Data transfer to USB memory stick](#).

### ▼ Memory group settings, Main settings tab



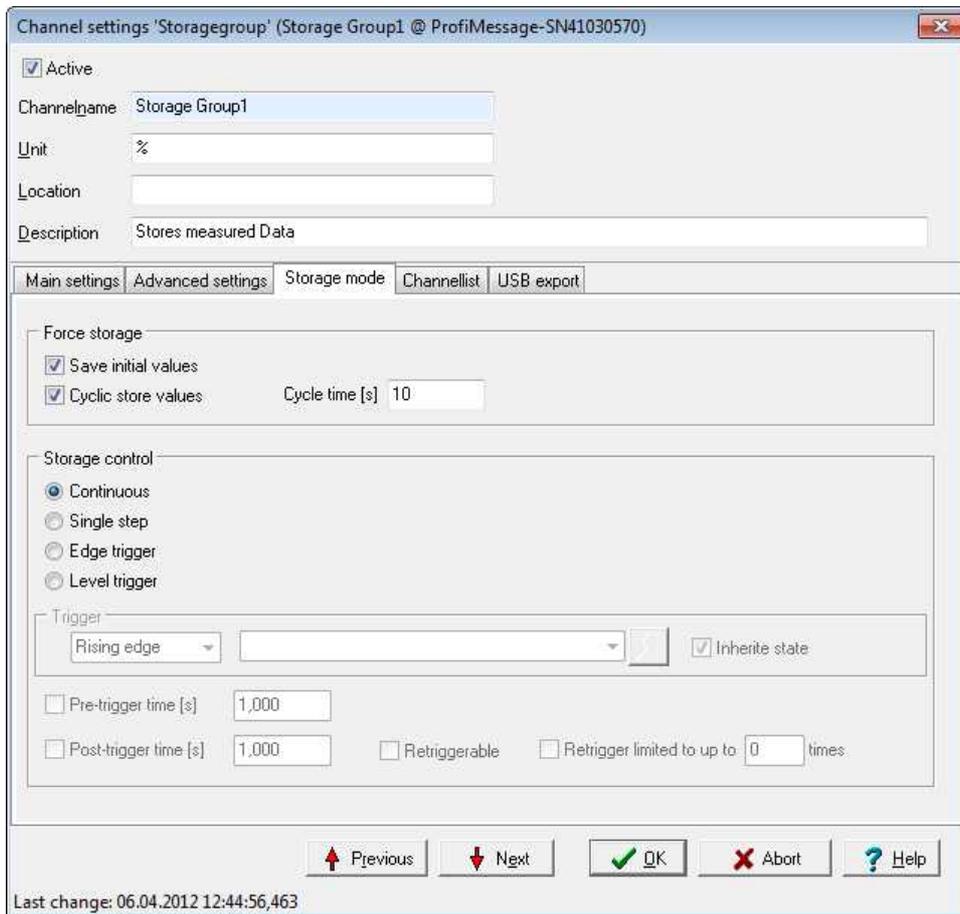
Use this tab to set the Size (amount) of memory that this group may use. The memory either can be written to until full (End storage process when memory full) or the group can be configured as a Ring buffer. As a ring buffer, the current value overwrites the oldest value when the memory is full.

An alternative to the ring buffer is the *Erase trigger* function. Enter a (digital) channel as the trigger for the deletion. A calculation channel can be used that monitors memory capacity and then deletes the memory when a specified capacity has been reached.

**Store time change** : When enabled, time changes, such as synchronizing using NTP time, triggers extra saving to the memory group from the channels in the channel list. This identifies from the data the cause of the "time mismatch".

**Store config change**: When enabled, saves changes to channel configurations in this memory group along with the time of change, version number and configuration file history in the device (.. / pm / config / channels / backup / directory).

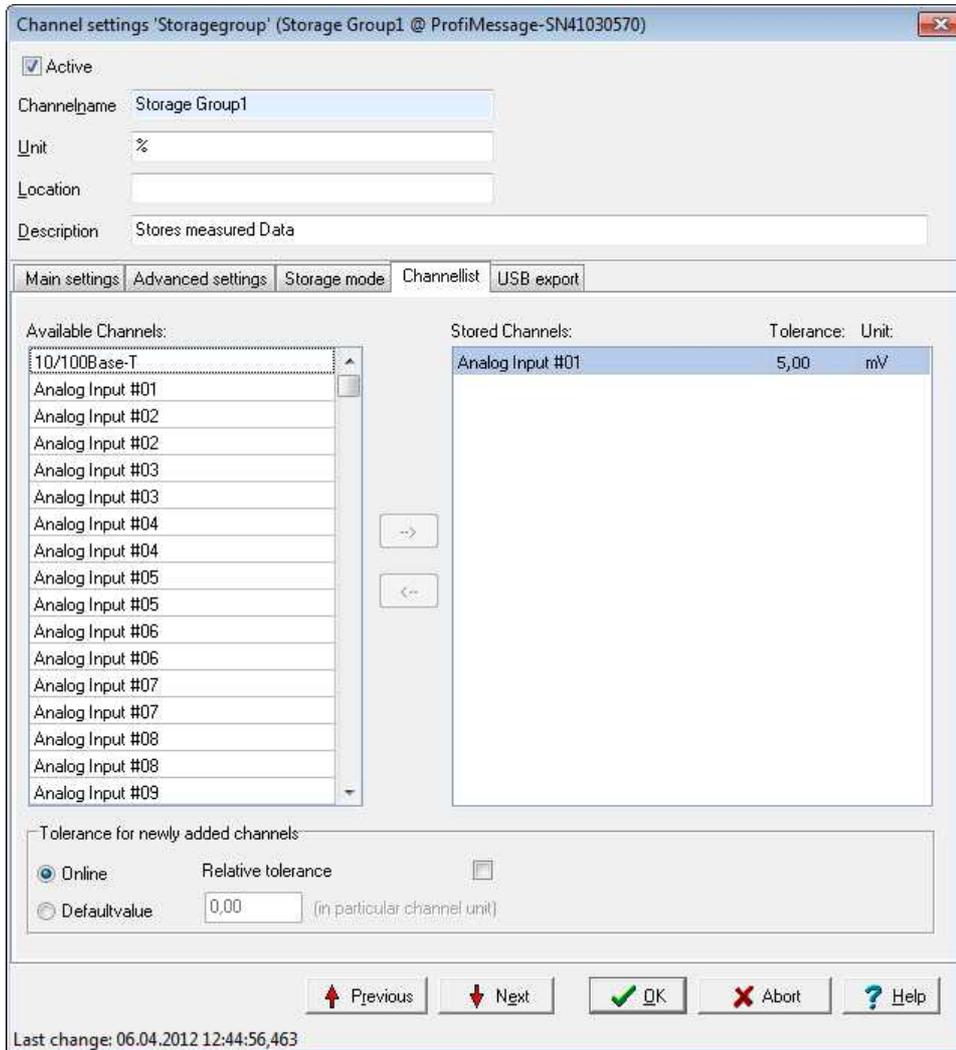
▼ Memory group settings, Storage mode tab



The following options are available:

- **Save initial 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.
- **Cycle store values:** When enabled, saving takes place at the given interval irrespective of any trigger or tolerance settings.
- **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 place 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 **post-trigger** time can be given for saving to also take place. Data is then stored within these times when a value exceeds the tolerance settings for the respective channel.

▼ Memory group settings, Channellist tab



Select the channels from which data is to be stored: Mark channel and click 

How often measurement data is saved depends on a the different settings (refer also to the **Storage mode** tab) and may also be influenced by the **Tolerance for newly added channels**:

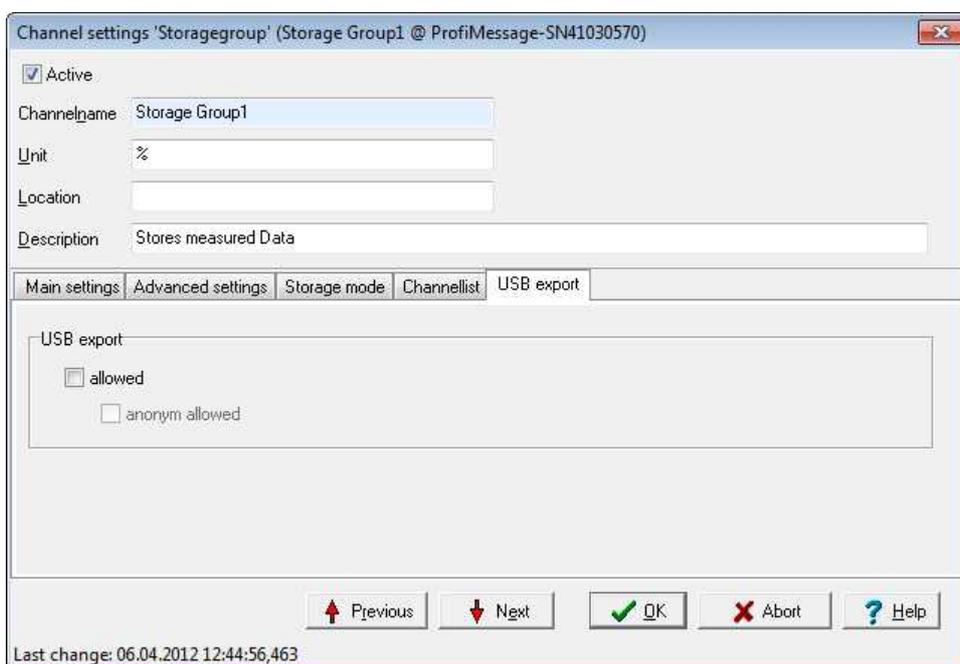
- **Online**: The tolerances given in the **Advanced settings** tab under **Data reduction** will also be used for saving. The measurement data is saved when it deviates from the previously saved data by more than the value given here. The valid value for the channel is displayed - after acquisition - in the field **Stored channels** .
- **Defaultvalue**: The value specified here is used for the channel that is to be assigned to the group. The tolerance is valid only for saving to this memory group. For everything else, such as a calculation using this channel, the valid tolerance is the one assigned to this channel. The valid value for the channel is displayed - after acquisition - in the field **Stored channels** .
- If **Relative tolerance** is enabled, data is not displayed according to the channel's unit but as a percentage based on **Conversion** in the **Main settings** tab.



**Info**

Make the *Tolerance for channels being saved* settings before clicking  . A subsequent change to the settings will be ineffective. For the change to be effective, the channel first needs to be deleted and then reinstated.

▼ **Settings for USB export**



Activate this option to export data from a memory group to a USB memory stick: allowed.

Refer also to [Data transfer to USB memory stick](#).

## 5.5 Data transfer to USB memory stick

Acquired data can be copied to a USB memory stick without the device having to be connected to a PC. There are two options for the transfer of data:

1. Data transfer without configuration
2. Data transfer with transfer type configuration

The prerequisite for both options is the capability of transferring data to a USB memory stick. Refer to [device memory](#).



### Info

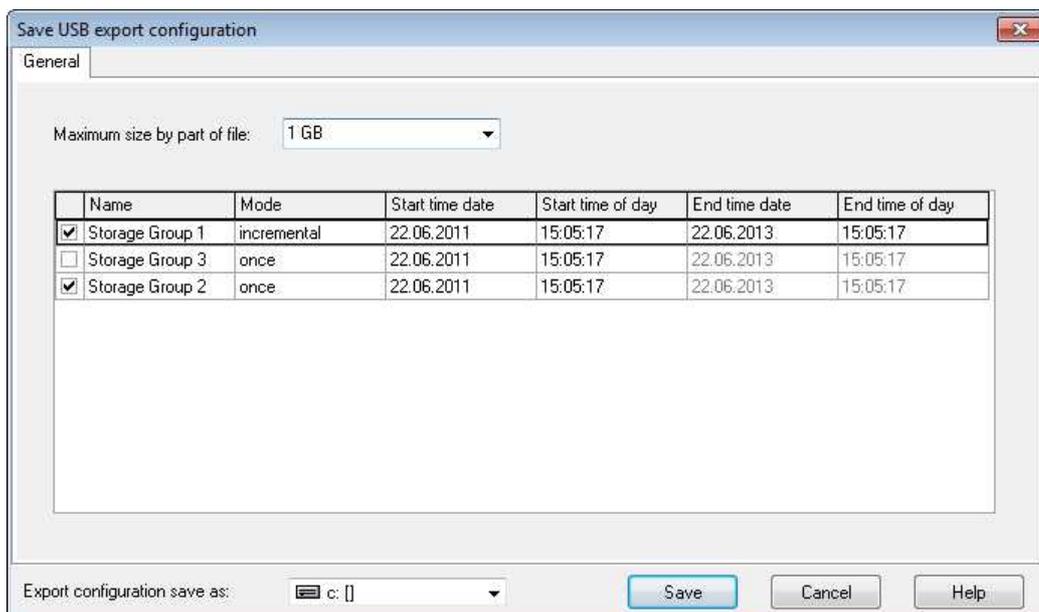
Use a FAT32-formatted USB flash drive with an LED that blinks during the data transfer.

### Data transfer without configuration

1. Plug in the USB memory stick.
2. After detection of the USB memory stick, data is transferred to the USB stick from the enabled storage groups. The transfer is complete when the USB stick's LED stops blinking.  
The data is copied and not deleted from the device!
3. Remove the USB memory stick.

### Configuring data transfer

1. Insert the USB memory stick into a PC running the DataService Configurator.
2. Open the configuration dialog from the "memory" group's Save USB export Configuration option.



3. Select the required (memory) mode:

*One-off*: Data is saved for the specified period.

*Incrementally*: Data is saved that has been acquired since the last save. Saving takes place after removal and reinsertion of the USB memory stick.

4. Enter the USB memory stick's drive (in the dialog's lower left corner).

5. Click **Save**:

The configuration file is saved in XML format to the USB memory stick.

6. Remove the USB memory stick.

When the USB stick is inserted into the device the configuration file is read and the corresponding data transferred to the USB memory. The data is only copied and not deleted from the device!

Saving ends when either:

- All data from the selected memory group(s) for the set time periods has been saved or
- The date has been saved with a time-stamp for the current time.

The transfer is complete when the USB stick's LED stops blinking. A new saving process begins only by the removal and reinsertion of the stick.

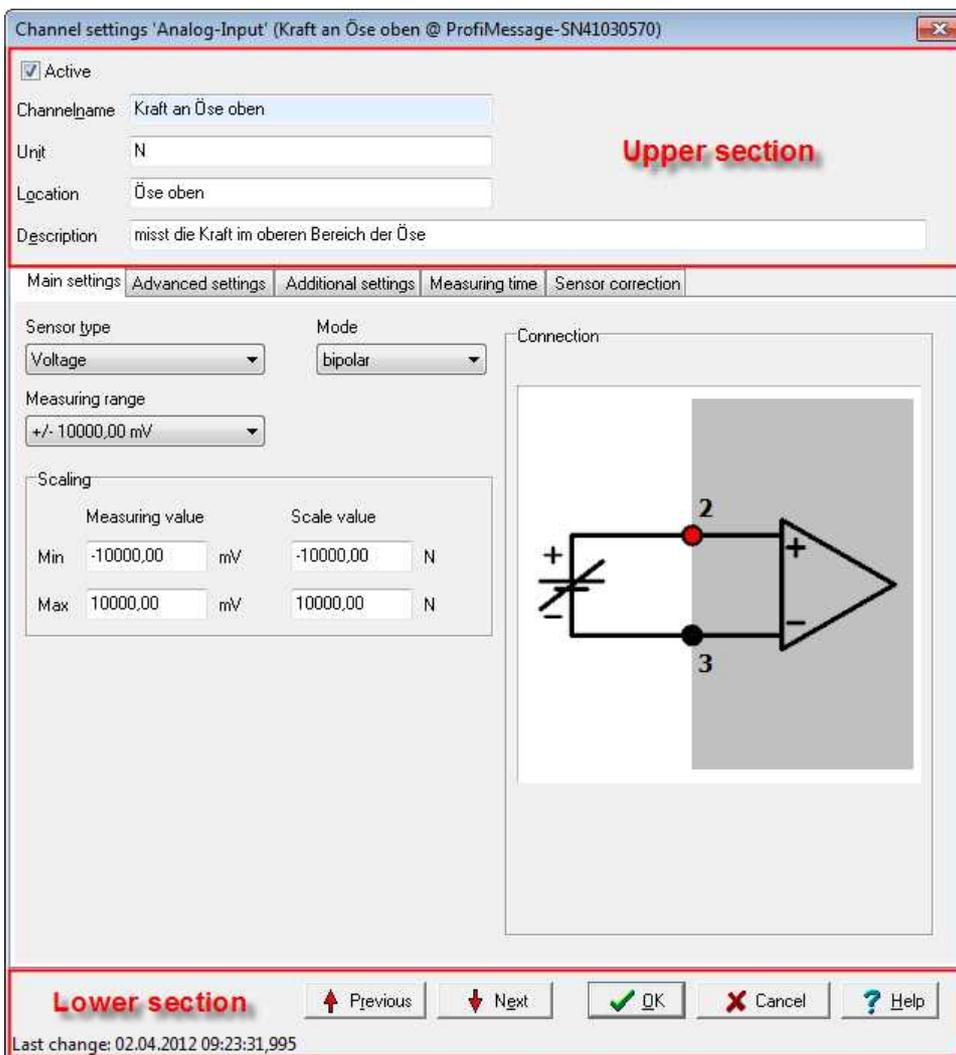
## 5.6 Configuring I/O module channels

I/O module channels refer to the channels of the of the I/O modules. The configuration for [software channels](#) , [interfaces](#) and [device memory](#) is described in separate sections.

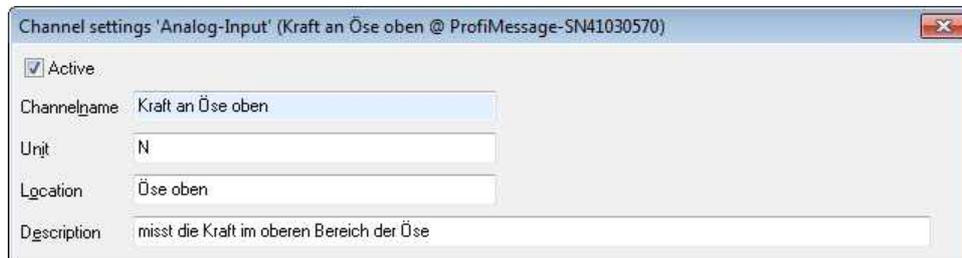
Refer also to [the overview](#) , [galvanic isolation](#), [specifications](#).

### 5.6.1 Settings for all dialogs

A configuration dialog opens after double-clicking one of the channels, e.g. from an I/O module, an interface or an interface protocol. Different tabs are displayed depending on the channel type. The data in the tabs also depends on the channel type. Many settings are similar, especially in the upper and lower sections, and can therefore be explained generally for any type of channel.



## ▼ Upper section



Channel settings: 'Analog-Input' (Kraft an Öse oben @ ProfiMessage-SN41030570)

Active

Channelname: Kraft an Öse oben

Unit: N

Location: Öse oben

Description: misst die Kraft im oberen Bereich der Öse

**Active:** Enables or disables the channel.

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

**Unit:** Enter the unit of measurement.



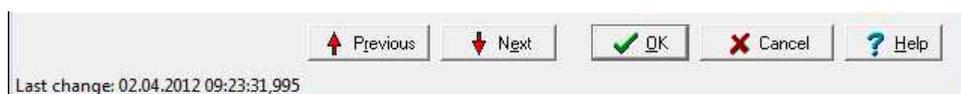
### Info

The unit for memory groups should be left at % (default). Storage capacity is always shown as a percentage.

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

**Description:** For entering a description or comment. After creating a function (software channel), a description of the function (in English) appears here.

## ▼ Lower section



↑ Previous   ↓ Next   ✓ OK   ✗ Cancel   ? Help

Last change: 02.04.2012 09:23:31,995

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

**OK:** Applies all the settings and closes the dialog.

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

**Help** : Opens the online help. The appropriate topic is displayed whenever possible.

The date and time display of the last setting change for the channel is displayed in the lower left corner (08/25/2011 in the example).

### Tabs in the dialog's main section

Depending on the type of channel, different tabs are available. Not every channel type has the following tabs:

- *Main settings*
- *Advanced settings*
- *Additional settings*
- *Measuring time*
- *Sensor correction*

The settings in the *Main settings* and *Additional settings* tabs differ according to channel type and are therefore not described here. There are also other tabs that relate to specific channels and are therefore described under these channels. The other tabs have share common settings and can be explained here.

#### ▼ **Advanced settings tab**



**Default value:** This is used in the event of a input or output failure (refer also to [status monitor](#) ). The settings depend on channel type. For example, digital inputs have only the options *Off* and *On*.

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

**Data reduction** (Not available for all channel types): A signal is fed in at the channel input, processed within the channel and then released to the channel output. The tolerance specifies the extent of change a signal value must undergo following processing before being output. In the example the processed input value is output only when it differs by more than 0.1 mA to the preceding value. The **Data reduction** function prevents the device from having to process/store superfluous data.

The tolerance value can be expressed as an absolute measurement unit or as a relative value. Refer also to the **Scaling** section of the *Main settings* tab.

**Format:** For setting data resolution.

**Persistence** (not available for all channel types): The current valid output value (refer to data reduction) is stored to a non-volatile memory. The channel uses this value following a restart or reboot. This feature is particularly important for outputs to establish a predefined state following a power failure.

▼ **Measurement time settings tab**

To set an A/D measurement cycle for analog input channels, i.e. the frequency to be used for converting an analog signal into a digital value. The smaller the frequency the more values are acquired. A short measurement cycle may however raise the signal's noise level.

Input of (50Hz) or (60Hz) achieves improved network frequency suppression via measurement cycle and via the A/D conversion's special filters.

▼ **Sensor correction tab**

To specify correction values for sensors with non-linear characteristics or to specify the correct direction for sensors with different characteristic values for positive and negative measurement directions. Conversion takes place according to scaling settings in the Main settings tab for the signal delivered by the sensor.

Sensor correction

Active

Mode

Calibration points

	Correct value (mA)	Measured value (mA)
1.	0	2,3
2.	100	103,4

**Active:** Enables sensor correction.

Mode There is a choice of modes:

- **Offset**  
An offset shifts the curve by a fixed value, i.e. the given value is added to the measurement value.
- **Offset and gradient**  
Allows a shifting of the curve and an increase in its gradient. The example above picture shows the values for a temperature measurement with calibration at 0 ° C and 100 ° C.
- **Square**  
Generates a quadratic curve through the given points to linearize the measured values.

- **Linear interpolation**

Enter a table for the conversion of 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 convert the measured values.



### Info

You can use copy and paste to transfer data from an Excel table into the dialog's table. Position the cursor in the table's top left field. 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**.

## 5.6.2 Tables

Set point tables can be created in the device for software and channel linearization tables. The tables can have two different applications:

- **Global application for multiple channels (external table)**

Global tables can be used for multi-channel data not assigned to a specific channel. They are valid only after **Global** settings have been made for **Table type** in the **Main settings** tab for this channel's software channel setpoints or linearization.

A global linearization table is created using the **Global linearization table** context menu of the device.

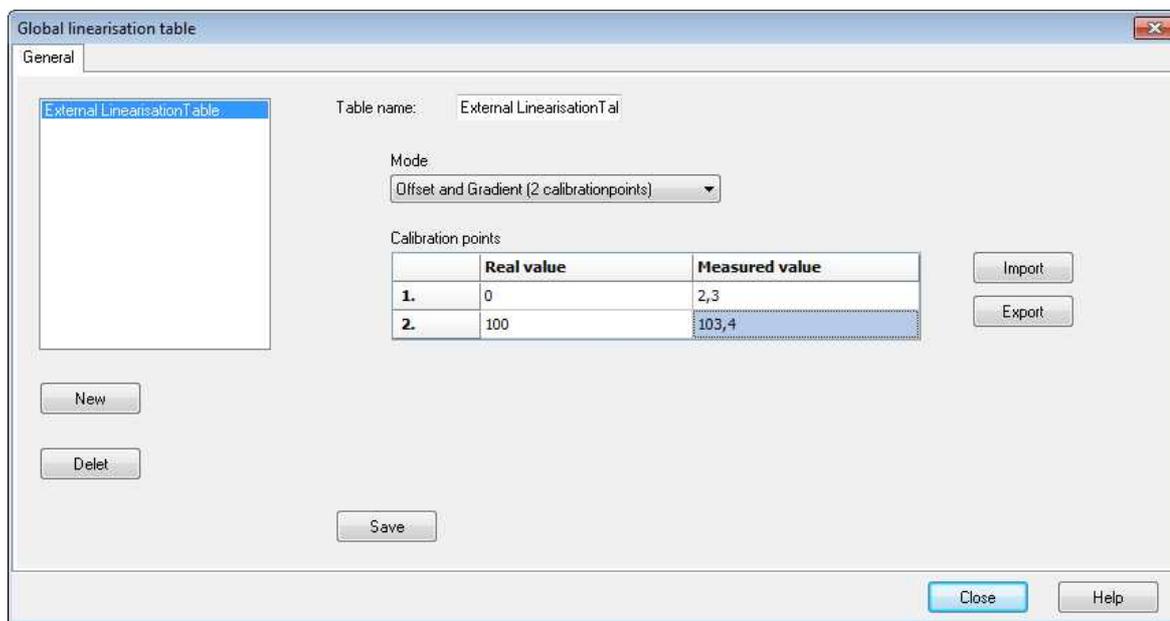
- **Local**

The validity of a local setpoint or linearization table is limited to the channel in which it is configured.

From the **Main settings** tab select the **Local** for the software channel setpoint or linearization **Table type**. Create the table in the **Table** tab that then appears.

### 5.6.2.1 Global linearisation tables

An external linearization table that can be used as a global table for multiple channels is created via the Global linearisation tables context menu of device. Refer also to [Linearization](#).



Linearization table created using the device's context menu.

#### Method

1. Click **New** to create a table.
2. Change the **Table name** if required.
3. Select the required mode.
4. Enter the point values.  
The number of values to be entered will depend on the type of linearization required (**Mode**).
5. Click **Save**.

A table can be imported as well as created: **Import**.

## Mode

There is a choice of modes

- **Offset**  
An offset shifts the curve by a fixed value, i.e. the given value is added to the measurement value.
- **Offset and Gradient**  
Allows a shifting of the curve and an increase in its gradient. The example above shows the values for a temperature measurement with calibration at 0 ° C and 100 ° C.
- **Squarely**  
Generates a quadratic curve through the given points to linearize the measured values.
- **Linear interpolation**  
Enter a table for the conversion of 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. This is then used to convert the measured values.



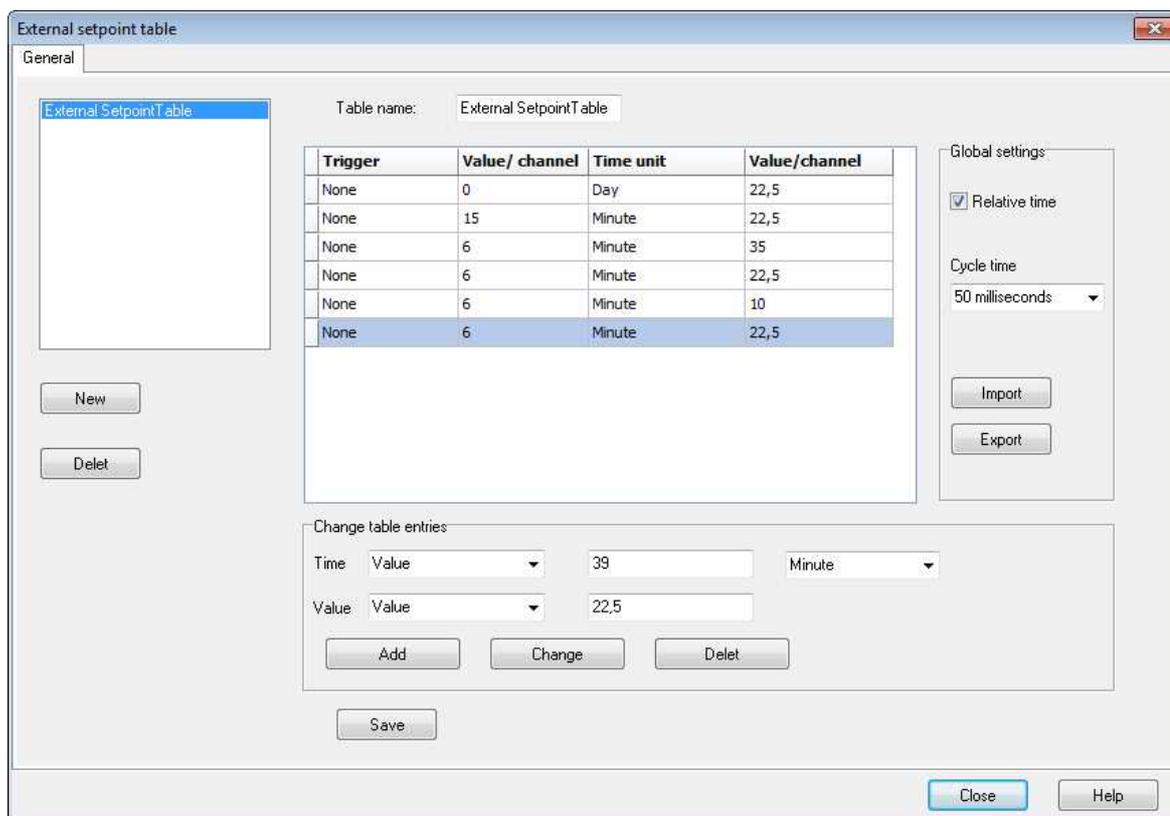
### Info

You can use copy and paste to transfer data from an Excel table into the dialog's table. Position the cursor in the table's top left field. 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**.

### 5.6.2.2 Global setpoint tables

An external setpoint table that can be used as a global table for multiple channels is created via the *Global setpoint table* context menu of device.

The setpoint table creates a conditional procedure whose points are set by value pairs made up from a period and a value. Each row of the table describes a program step for time  $t$  (fixed or variable) and value  $y$  (fixed or variable). Based on the previous value of  $y_{i-1}$ , the  $t_i$  value indicates how long will it take to achieve the  $y_i$  value. The first row defines the starting point of the track, so at least two pairs of values require entering. One variable is defined via the [setpoint channel](#) that uses the table.



Setpoint table created using the device's context menu.

## Method

1. Click **New** to create a table.
2. Change the **Table name** if required.
3. For each table row (program step) enter the time value ( **Time** ) with the unit of time and to be used and the **value** to be output.
4. Click **Add**.
5. Enter the required **Global Settings** .
6. Click **Save**.

A table can be imported as well as created: **Import**.

Numbers (constants) or variables can be used for times and values. The variables used in the tables are defined under [setpoint channel](#) (software channels). For time input, the variable may be used as a value or as a trigger:

**Variable (value)** means that the value of the variable is used as time value. **Variable (trigger)** means that the channel set for the variable 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 applied as a setpoint and the next program step is then performed. This method enables the upgrade of a basic time-controlled program to an event controlled system.

## Global settings

**Relative time** : When enabled, input times are calculated as a difference to previous time points. When disabled, time values are taken from the start (first value).

### ▼ Example of absolute and relative time input

The numerical values are fixed values and in this case refer to identical time points. The final time is 7 (the unit is not stated but might, for example, be minutes).

Point no.	Absolute	Relative
1	0	0
2	1	1
3	5	4
4	7	2

▼ **Example of a table**

In the table in the example, the value 22.5 is held for the first 15 minutes. Then, after each 6 minutes (*Relative time* setting ) the value increases to 35, then lowers to 10 via 22.5, and then increases again to 22.5. A change and therefore output of the new value takes place every 10 seconds. The change over the previous value is therefore around 0.35 for every 10 seconds.

Trigger	Value/ channel	Time unit	Value/channel
None	0	Minute	22,5
None	15	Minute	22,5
None	6	Minute	35
None	6	Minute	22,5
None	6	Minute	10
None	6	Minute	22,5

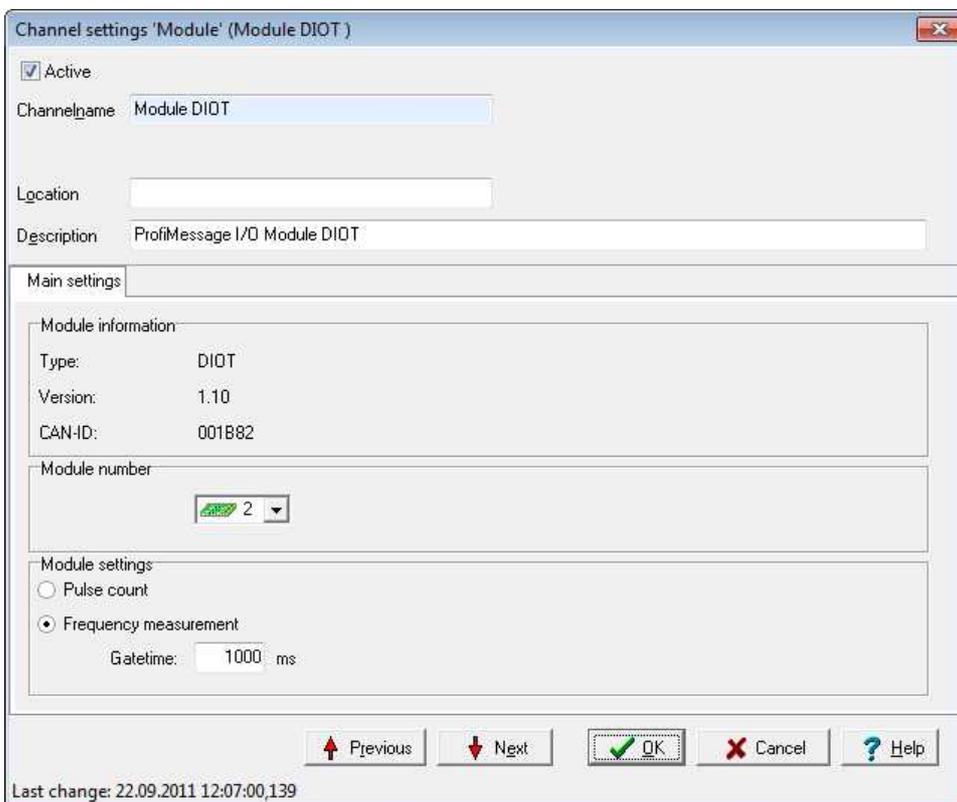
**Cycle time** : The cycle time for values to be output between two program steps. Intermediate values are linearly interpolated, i.e. calculated using a linear equation. The intervals used in the table between each program step should be multiples of the cycle time.

### 5.6.3 I/O module

This section describes configurations at the I/O module level and how to [delete a module entry](#).

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

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



#### **Main settings tab**

#### **Module information**

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

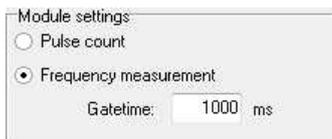
**Module number**

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

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

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

These modules have the option to use the counter inputs either as pulse counters or frequency measurements. For frequency measurements, set the period over which incoming pulses are totalled to enable the frequency to be determined. Low frequencies require a correspondingly longer time to acquire multiple vibrations, but measurement is then slow for long time periods. For short times measurement is dynamic but less vibrations are detected and measurement data fluctuates strongly. Make sure the gate time is small enough at higher frequencies because the maximum number of impulses is 65535.



**Deleting module entries**

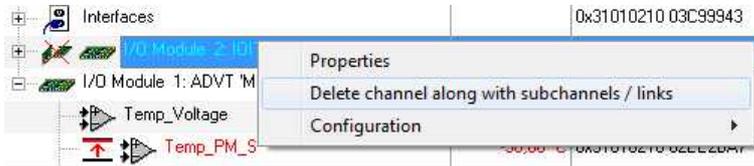
Modules can also be displayed that are currently inactive but had been previously connected or configured. As long as they have not been deleted they appear with the symbols  or  before the module symbol. The configuration is retained and reloaded as soon as the module is reconnected.

ProfitMessage 'PmZetkin.aeolus.local', PoND 233-rc5-7...		-	0x31010200 0AD630A2	Online, Time of ...
+	 I/O Module 4: AMDT 'Module AMDT'	209 Blocks	0x31010200 16B6BA36	Ok
+	  I/O Module 2: IOIT 'Module IOIT'		0x31010210 7B265D04	Hardware failure
+	 I/O Module 2: ADVT 'Module ADVT'		0x31010200 5EB1CBF7	Ok
+	  I/O Module 1: ADFT 'Module ADFT'		0x31010200 42BCA33E	Hardware failure



Deleting a module entry permanently deletes the entire module configuration including all hardware channels. Therefore, prior to deleting, back up the current configuration via the web interface. Refer to [save/ load configuration](#).

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



## 5.6.4 I/O module AMDT

The AMDT I/O module on vibration measurement is dealt with in a separate chapter. Refer to [E/A-Modul AMDT](#).

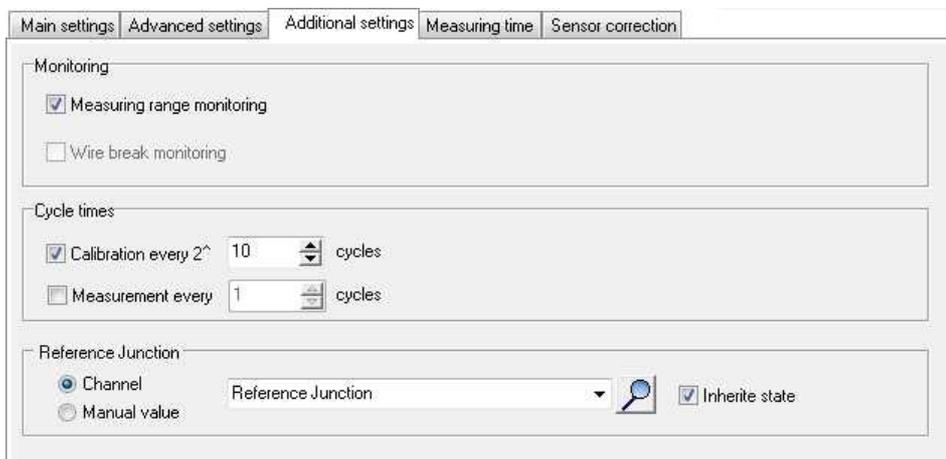
Channel configuration/settings are described here: [I/O module AMDT, Configuration and operation](#).

### 5.6.5 Analog input

Configuration options in the *Main settings* tab depend on the sensor type:

- [Voltage](#), e.g. 0 ... 10 V
- [Resistor](#)
- [Current](#), e.g. 4 ... 20 mA
- [Resistance thermometer](#), e.g. Pt 100
- [Thermocouple](#), e.g. type K NiCr-NiAl
- [pH probe](#)

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



The screenshot shows the 'Additional settings' tab with the following configuration:

- Monitoring:**
  - Measuring range monitoring
  - Wire break monitoring
- Cycle times:**
  - Calibration every 2<sup>n</sup>: 10 cycles
  - Measurement every: 1 cycle
- Reference Junction:**
  - Channel
  - Manual value
  - Reference Junction (dropdown menu)
  - Inherit state

#### Monitoring

**Measuring range monitoring:** When data is not in the *Measuring range* specified in the *Main settings* tab, the channel status is set to "measurement range overrun/underrun". The status otherwise displays "OK". The output value of the channel is set to the maximum or minimum value of the *Scaling* value (in the *Main settings* tab). Channel status values are available in the [status monitoring](#) table.

**Wire break monitoring:** The option is useful for monitoring sensor failure in, for example, thermocouples or sensors with 4 ... 20 mA output. In the event of a failure, channel status is set to "wire-break". Channel status values are available in the [status monitoring](#) table.

#### Cycle times

**Calibration every 2<sup>n</sup> x cycles:** Offset errors require correcting from ambient temperature fluctuations in long term measurement procedures. This setting determines how often this happens. A cycle is made up of the measurement of all active channels in the module (refer to *Overall module measurement time* in the *Measuring time* tab). The default is every 1024 cycles (2<sup>10</sup>). For an A/D measurement time of 100 ms for 8 active channels, any offset errors are then corrected approximately every 14 minutes.

**Measurement every x cycles:** To specify that a measurement from a channel is acquired at, for example, every 10th cycle. A cycle is made up of the measurement of all active channels in the module (refer to *Module's overall measurement time* in the *Measurement cycle settings* tab).

**Compensation**

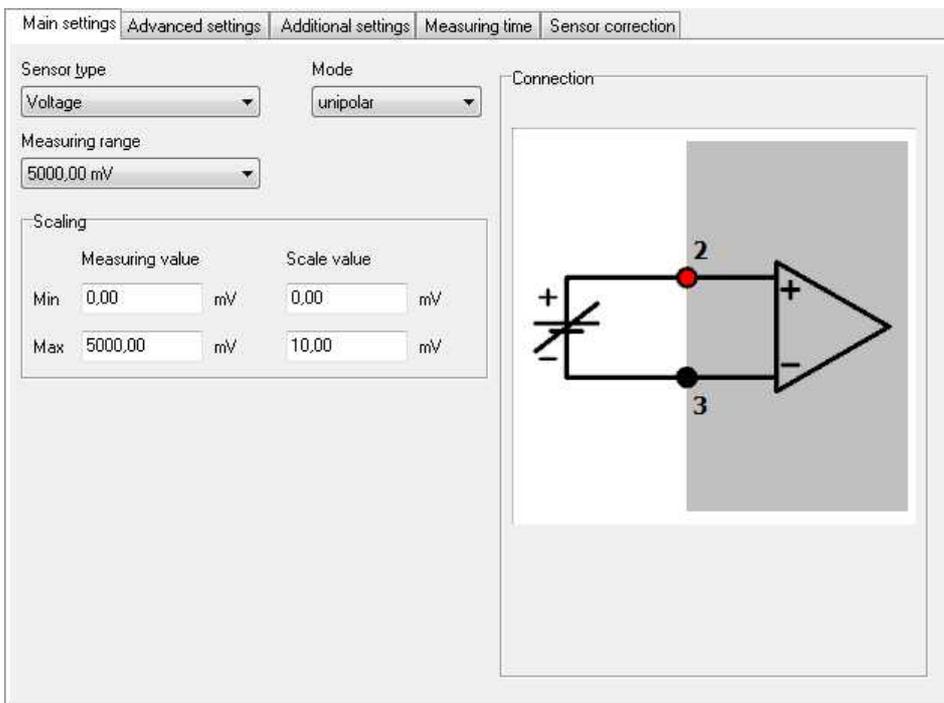
The setting is available for thermocouple sensor types and pH probes. Enter the *Channel* that is to be used for the thermocouple's cold junction measurement (junction between thermocouple and copper wire/connector) or the temperature compensation for the pH probe. The default *Reference Junction* uses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



**Info**

Refer also to [Examples of connections](#) for information on the connection of sensors and [Measurement technology](#) for background information on measurement technology in practice .

**5.6.5.1 Voltage sensor type**



Measuring value	Scale value
Min: 0.00 mV	0.00 mV
Max: 5000.00 mV	10.00 mV

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

**Mode**

*unipolar* : Measuring positive signals only.

*bipolar* : Measuring positive and / or negative signals.

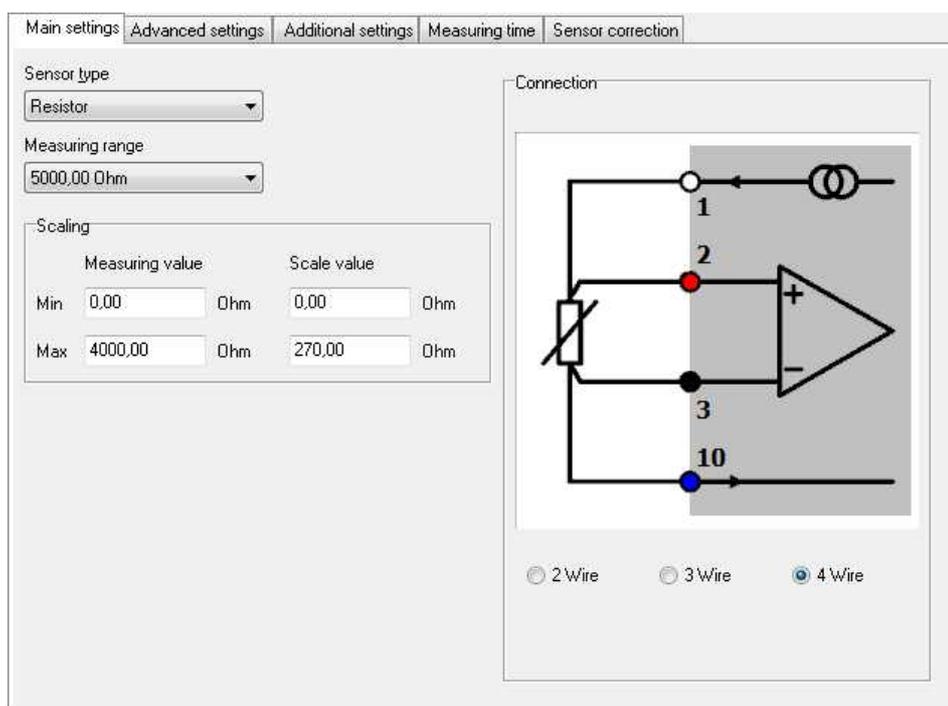
**Measuring range**

Select a measuring range that is equal to or greater than the signal from the sensor or signal source to prevent A / D converter overload. The channel receives the status "measurement range overrun/underrun" for measurements not within the range. Channel status values are available in the [status monitoring](#) table.

**Scaling**

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

**5.6.5.2 Resistor sensor type**



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

**Measuring range**

Select a measuring range that is equal to or greater than the resistance from the sensor to prevent A/D converter overload. The channel receives the status "measurement range overrun/underrun" for measurements not within the range. Channel status values are available in the [status monitoring](#) table.

## **Scaling**

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

## **Connection**

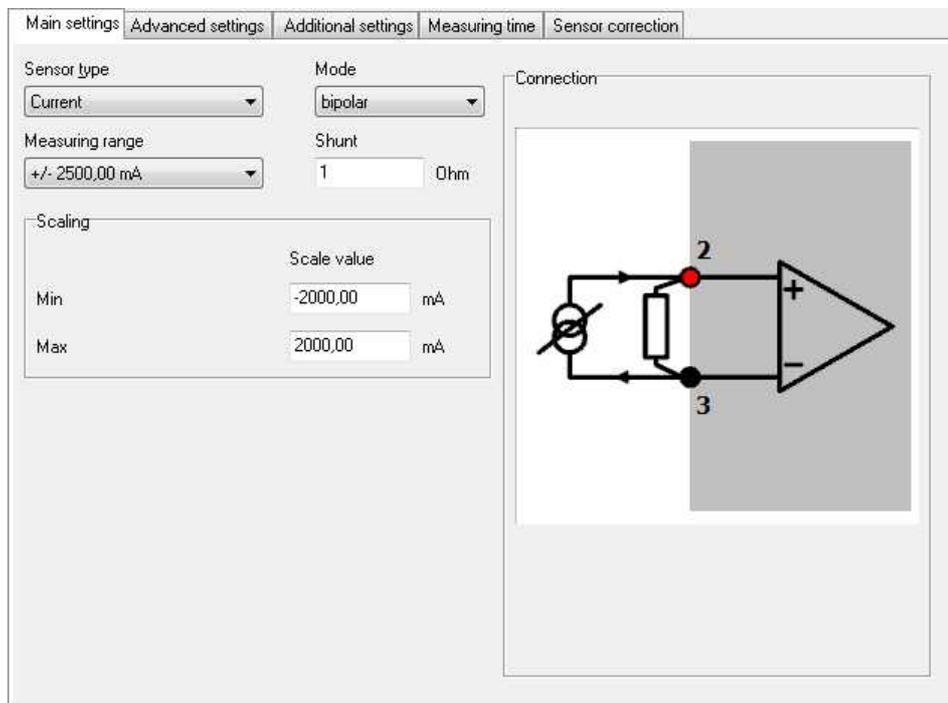
Indicate here how the sensor has been connected (the diagram displays the selected wiring):

**2 Wire** : The sensor is connected with only two wires. This is recommended only for very short lines and high impedance sensors otherwise the resulting voltage drop on the line feeds can lead to measurement errors.

**3 Wire** : The sensor is connected with three wires. Since loss occurs only on one line, a measurement error is only half as large as in two-wire connections.

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

### 5.6.5.3 Current sensor type



**Mode**

*unipolar* : Measuring positive currents only.

*bipolar* : Measuring positive and / or negative currents.

**Measuring range**

Select a measuring range that is equal to or greater than the current at the load resistor to prevent A/D converter overload. The channel receives the status "measurement range overrun/underrun" for measurements not within the range. Channel status values are available in the [status monitoring](#) table.

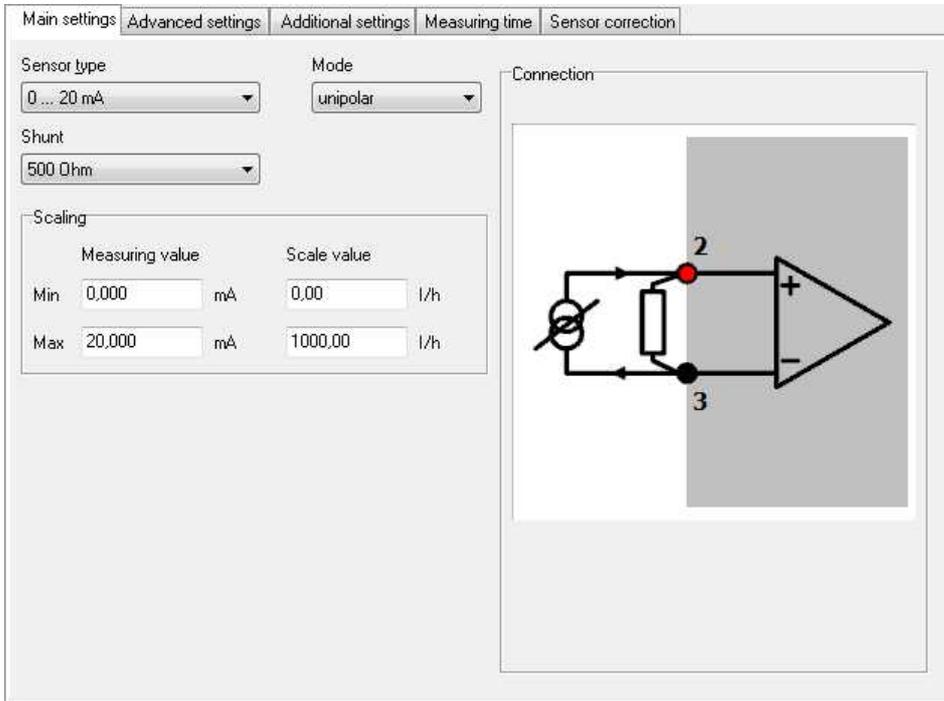


Current measurement is not possible without a load resistance.

**Scaling**

Enter the lower and upper vertexes of the sensor's characteristic curve. For non-linear characteristics use [Sensor correction](#). The specified range (in the example -2000 mA to 2000 mA) is used as the default for the display area for graphics in ProfiSignal. The channel receives the status "scale range overrun" or "scale range underrun" when not within the range. Channel status values are available in the [status monitoring](#) table.

5.6.5.4 Current sensor type (0/4...20 mA)



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

**Mode**

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

**unipolar** : Measuring positive signals only.

**bipolar** : Measuring positive and / or negative signals.

**Shunt**

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

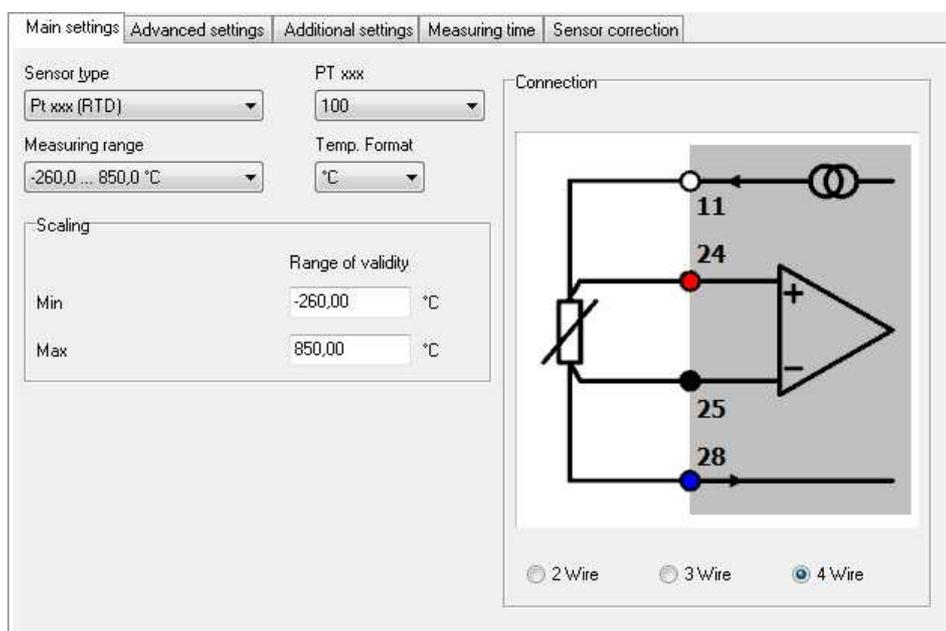


Current measurement is not possible without a load resistance.

### Scaling

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

#### 5.6.5.5 Resistance thermometer sensor type



The screenshot shows the configuration window for a resistance thermometer sensor. The 'Main settings' tab is selected. The 'Sensor type' is set to 'Pt xxx (RTD)'. The 'PT xxx' value is set to '100'. The 'Measuring range' is set to '-260,0 ... 850,0 °C'. The 'Temp. Format' is set to '°C'. The 'Scaling' section shows 'Min' as '-260,00 °C' and 'Max' as '850,00 °C'. The 'Connection' diagram shows a 4-wire circuit with terminals 11, 24, 25, and 28. The '4 Wire' option is selected at the bottom.

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

#### **Pt xxx** or **Ni xxx** or **YSI400**

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

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

#### **Measuring range**

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

**Temp. Format**

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

°C : Degrees Celsius

K: Kelvin

°F: Degrees Fahrenheit

R: Rankine

°R: Degrees Réaumur

**Scaling**

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

**Connection**

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

**2 Wire** : The sensor is connected with only two wires. This is recommended only for very short lines and high impedance sensors otherwise the resulting voltage drop across the circuits can lead to measurement errors.

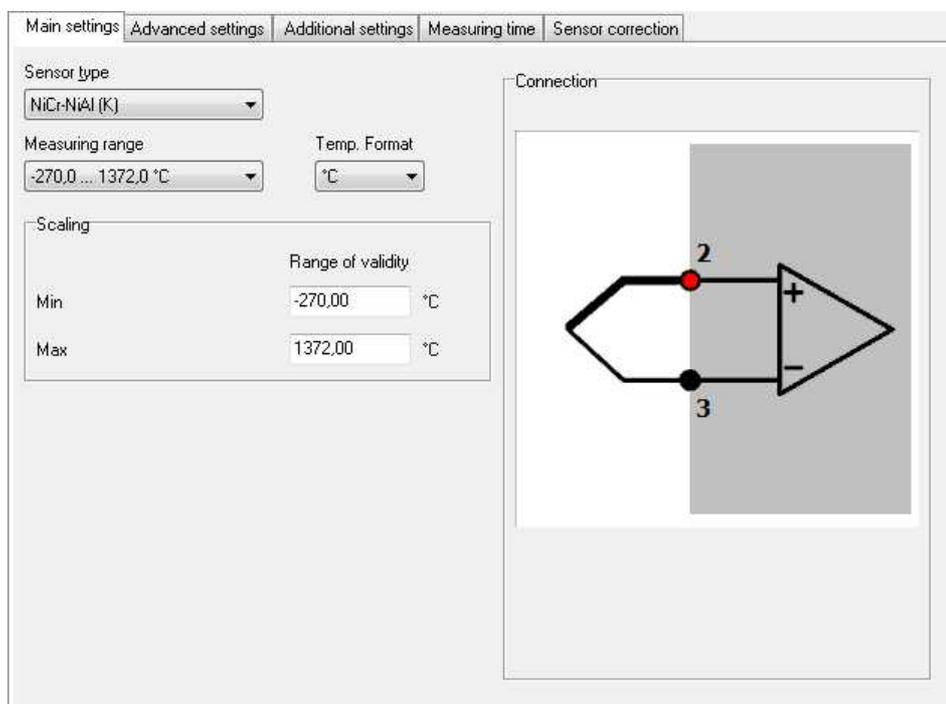
**3 Wire** : The sensor is connected with three wires. Since loss occurs only on one line, the measurement error is only half as large as in two-wire connections.

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

**Info**

No choice of wiring is available for YSI400 sensors.

### 5.6.5.6 Thermocouple sensor type



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

#### **Sensor type**

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

#### **Measuring range**

The maximum possible sensor measuring range is pre-selected. The channel receives the status "measurement range overrun/underrun" for measurements not within the range. Channel status values are available in the [status monitoring](#) table.

#### **Temp. Format**

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

**°C** : Degrees Celsius

**K**: Kelvin

**°F**: Degrees Fahrenheit

**R**: Rankine

**°R**: Degrees Réaumur

**Scaling**

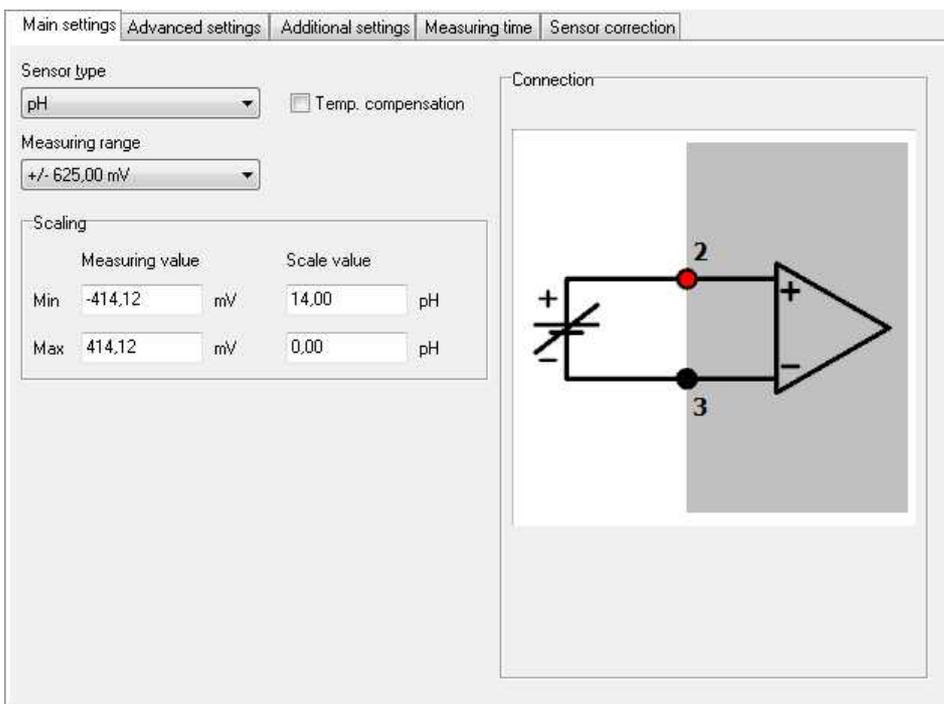
Enter the range for valid sensor signals. The specified range (in the example -270 °C to +1372 °C) is used as the default for the display area for graphics in ProfiSignal. The channel receives the status "scale range overrun" or "scale range underrun" when not within the range. Channel status values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



**Info**

Enter the compensation to be used in the *Extended settings* tab (refer to [Settings for all dialogs](#)).

**5.6.5.7 Ph-probe sensor type**



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

Nernst factor =  $\ln 10 * \text{molar gas constant} * \text{absolute temperature} / \text{Faraday constant}$   
 with molar gas constant = 8.314472 in J/(mol\*K), absolute temperature = temperature of the reference junction + 273.15 in K, Faraday constant = 96.4851534 in J/(mV\*mol)

**Sensor type**

Select *pH*.

**Measuring range**

A range of  $\pm 625$  mV is sufficient for this type of sensor.

**Temp. compensation**

Temperature compensation is determined by measuring the temperature at the measurement point in the solution to be determined. Activate compensation and configure the channel using the *Additional settings* dialog (refer to [Settings for all dialogs](#)).

**Scaling**

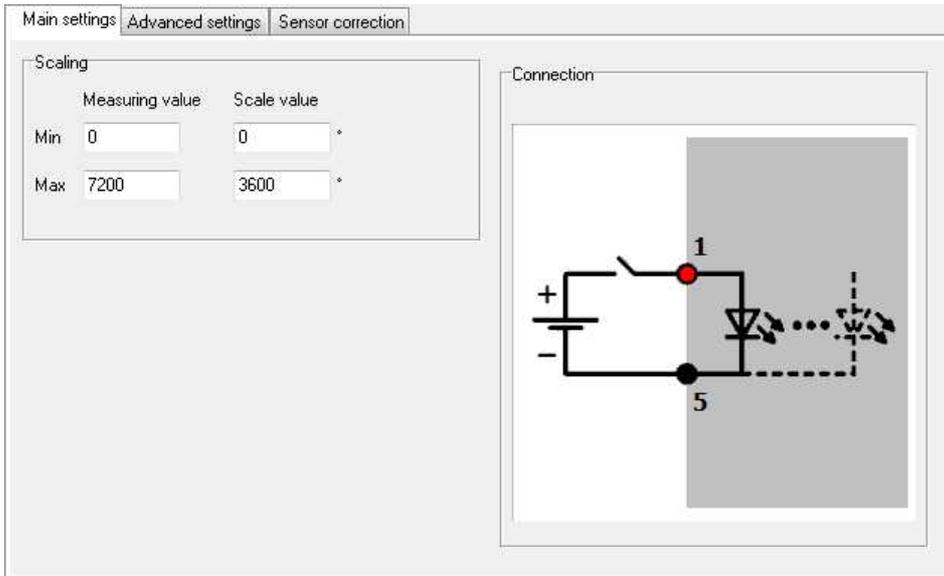
The default scaling uses the standard measurement methods and should not be altered.

**5.6.6 Digital input with counter/frequency measurement**

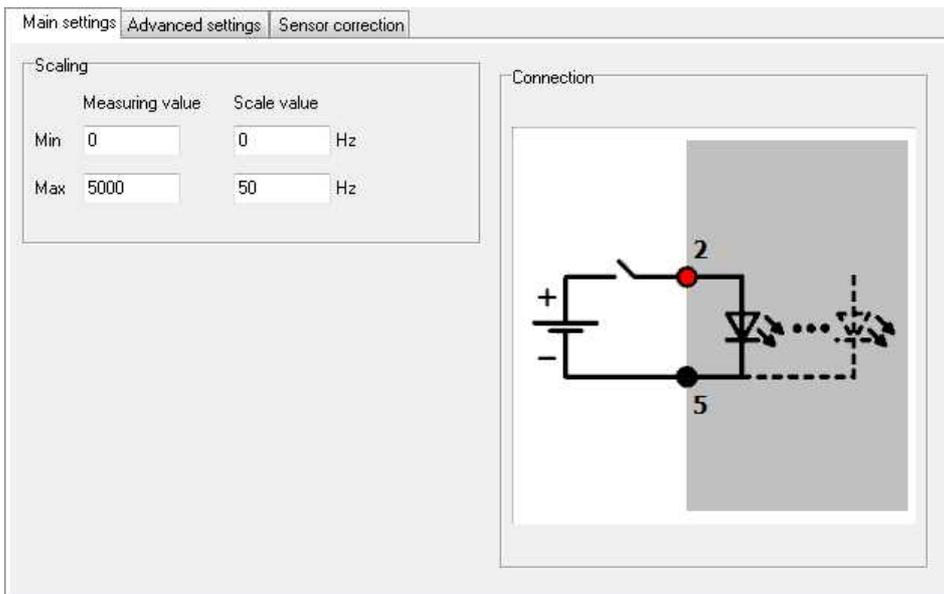
Use the *Main settings* (for DIOT and ADFT modules) or *Speed measurement* (AMDT module) tabs to select whether the digital inputs are to be used for counting (*Pulse count*) or *Frequency measurement*. Pulse counting occurs according to a signal's falling edge. For frequency measurement, pulses are counted that occur within the gate time. The result is then converted into a frequency (refer also to the [module](#) tab in the *Module settings* area of the *Main settings* tab).



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



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

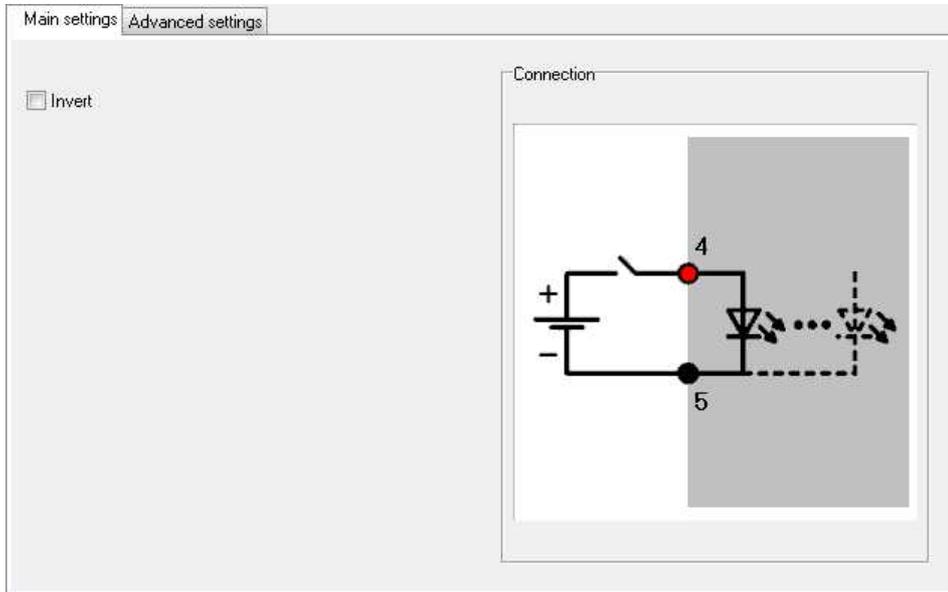


This example means: 0 pulses correspond to 0 kHz, 5000 pulses correspond (with a gate time of 100 ms) to 50 kHz.

**Scaling**

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

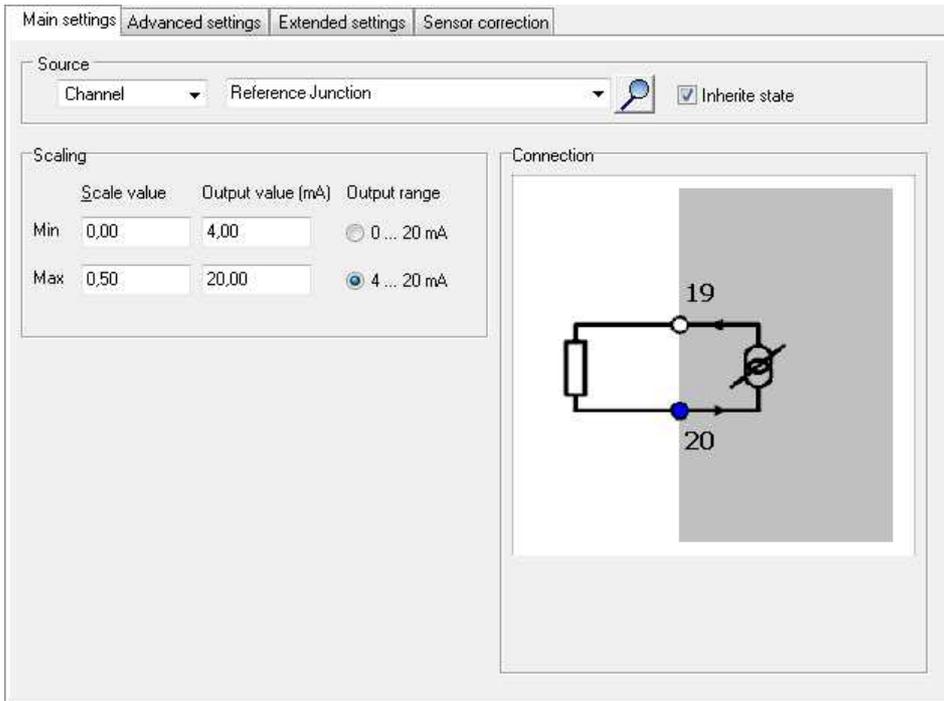
### 5.6.7 Digital input



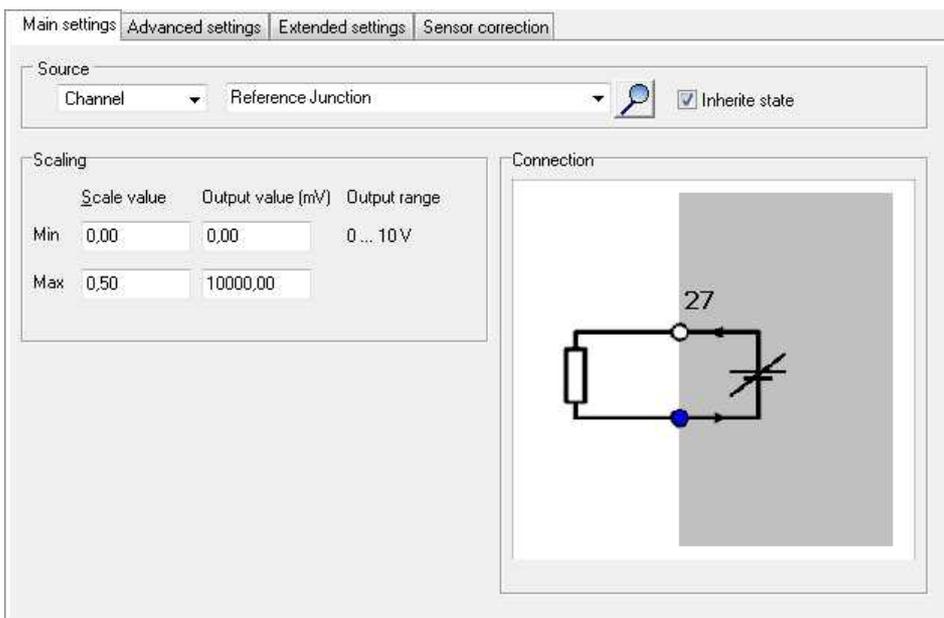
*Invert* : This option inverts a "High" level at the input to a "Low" level at the output (measurement signal in device) and vice versa.

### 5.6.8 Analog output

Depending on the module, either currents or voltages can be output. The *Output range* in the configuration dialog indicates whether currents can be output in the range 0 ... 20 mA or 4 ... 20 mA or voltages in the range 0 ... 10 V or  $\pm 10$  V.



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



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

## Source

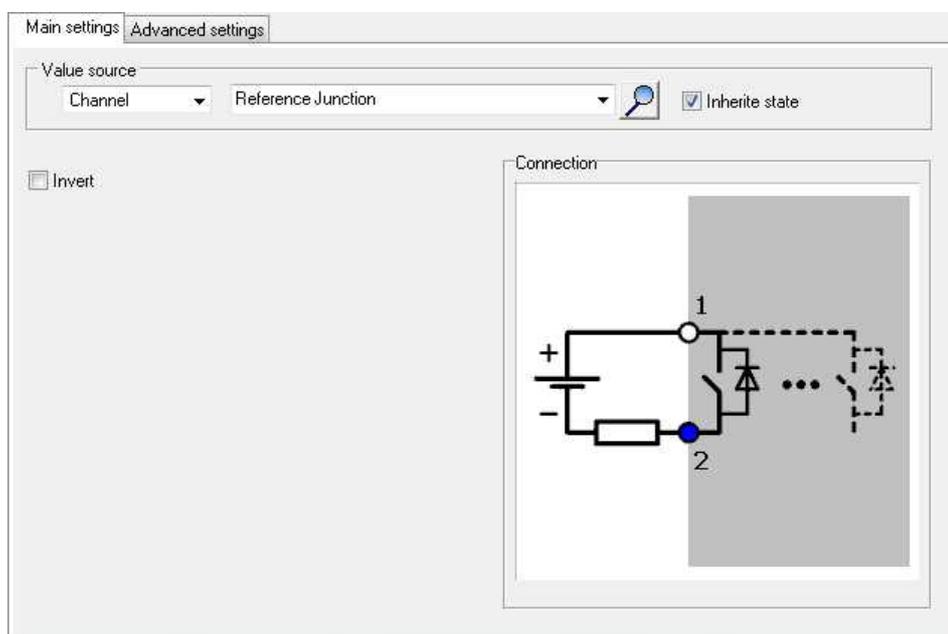
Enter either a constant value ( *Manual value* ) or use *Channel* to select an existing channel whose value is then output. Selecting *Application* enables the output value to be manually set via the *DataService Configurator* or automatically set via a ProfiSignal application.

## Scaling

Enter two points from the sensor's characteristic curve, if possible, the lower and upper vertexes. Values from the source are then linearly converted into the output range. For non-linear characteristics use [Sensor correction](#). The specified range (in the example 0 to 0.5 bar) is used as the default for the display area for graphics in ProfiSignal. The channel receives the status "scale range overrun" or "scale range underrun" when not within the range. Channel status values are available in the [status monitoring](#) table. The *Output range* defines the limits of the current or voltage output.

## 5.6.9 Digital output

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



## Source

Enter either a constant value ( *Manual value* ) or use *Channel* to select an existing channel whose value is then output. Selecting *Application* enables the output value to be manually set via the *DataService Configurator* or automatically set via a ProfiSignal application.

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

## 5.7 Configuring interfaces

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

The Ethernet and USB interface require no configuration and therefore have no configuration dialog. Configuration of the CAN-bus and COM interfaces as well as for I/O modules takes place directly from the channel view of the DataService Configurator and is described in this section.

The device has one CAN bus and four COM ports which are available as two D-SUB DB9 socket-connectors, and one D-SUB DB9 plug-connector (refer also to [display devices and connections](#)). Using the left D-SUB connector as a COM1 *and* CAN connection is possible via a special connector available from **Delphin**.

- COM1 is a RS485 port and can operate in UART mode.
- COM2 has the same properties as COM1.
- COM3 is a limited (3-wire) RS232 port in UART mode.
- COM4 is a full RS232 port in UART mode.



### Info

The DataService Configurator displays a hardware error following the activation of the COM4 port because COM4 is set internally as an interface for support / service purposes and therefore initially unavailable for use. If COM4 is required as an additional port, contact **Delphin's** support team.

### Configuring the CAN bus

- [CAN-Controller](#)
- [CAN-Driver](#)
- [CAN-Bus-Channel](#)

Refer also to [settings for all dialogs](#)

### 5.7.1 CAN-Controller

Follow these steps to run a device via the CAN interface:

1. Configuring the basic settings of the CAN-Controller (this section)
2. Creating a CAN-Driver: [CAN-Driver](#)
3. Create one (or more) [CAN-Bus-Channels](#)

The CAN interface is displayed in the *Channels* tab with the CAN-symbol . The CAN interfaces are available in the Hardware defined view under the interface entry. The User defined view lists all CAN interfaces 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 dialog. Set the baud rate and the length of the identifier in the **Main settings** tab. We recommend a unique **Channelname**. If required, amend **Description** and enter a **Location**.

### **Main settings tab**



Main settings

Baudrate: 1000.0 kBaud (CiA/DCP) ▼

### **Baudrate**

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

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

The following are guidelines for CAN interfaces:

- from 15 m: 1000 kBaud (factory device)
- up to 30 m: 500 kBaud
- up to 45 m: 333.3 kBaud
- up to 60 m: 250 kBaud
- up to 150 m: 100 kBaud

The baud rate must be the same for transmission and reception. Therefore, first determine the baud rate for the equipment to be communicated to and use this value to set the CAN interface's baud rate.

In brackets are noted the protocols, which implement that baud rate (CiA = CAN in Automation, DCP = Delphin CAN Protocol)

### **Extended ID**

A CAN system identifies data not by device addresses but by identifiers within a message. The CAN specification defines identifiers at either 11 or 29 bits in length. The setting determines which identifier length is being used.

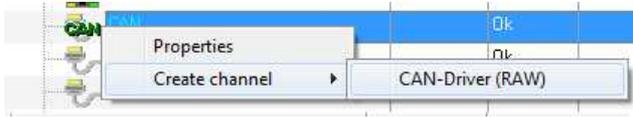
When enabled this interface can be used with either an 11-bit or 29-bit (CAN 2.0B) identifier. When not enabled, data transmission on the CAN bus is limited to an 11-bit identifier (CAN 2.0A) and no other amendments can be made via [CAN-Bus-Channels](#).

### **Refer to**

- [Pin assignment of COM interfaces](#)

### 5.7.1.1 CAN-Driver

Create a CAN-Driver via the CAN-Controller context menu: Create channel → CAN-Driver (RAW).

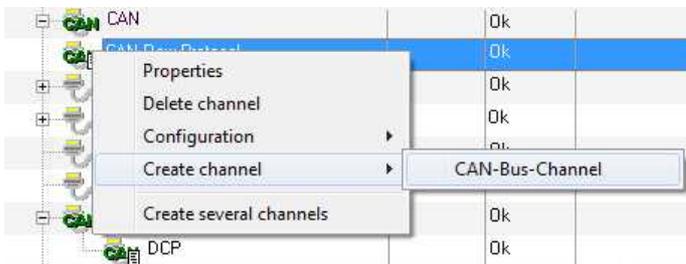


The symbol  is then displayed for the CAN driver.

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

### 5.7.1.2 CAN -Bus-Channel

A CAN-Bus-Channel is displayed with the symbol . CAN-Bus-Channels are available only when a [CAN interface](#) and [CAN-Driver](#) have been configured. To create additional channels, select Create channel → CAN-Bus-Channel from the CAN-Driver context menu (, CAN Protocol RAW).



Double-click a CAN-Bus-Channel entry or select Properties from the context menu to display the configuration dialog. The data to be entered depends on the type signal that is to be sent to or received from the CAN-Bus-User. Therefore, obtain information on the format and settings of the signal before entering data here.

Channel settings 'CAN-Bus-Channel' (Wheel speed RL @ ProfiMessage-SN41030570)

Active

Channelname: Wheel speed RL

Unit:

Location:

Description: Wheel speed rear left

Main settings | **Advanced settings** | Sensor correction

Datatype Settings

Data type: Integer | Bit length: 16 | Encoding type: Binary

Signed

Byte order: BigEndian | Word order: BigEndian

Byte pattern: Hex value 01 23, Presentation 01 23

Startposition within reference data

Byte offset: 4 (Maximum value: 6 Byte) | Bit offset: 0 | Bit offset not available

CAN ID

Extended ID (Standard: 11 bit)

ID: 300 | Mask: 7FF

Scaling

Input value	Scale value
Min: 0,00	0,00
Max: 4800,00	300,00

Use channel as output

Manual value:

Last change: 06.04.2012 15:07:29,134

## Main settings tab

### ▼ Data type settings

- **Data type**  
Specifies the data type for interpreting the payload data. *Bit length*, *Byte order* and *Word order* are set and adjusted depending on the data type input. [Startposition within reference data](#), [Scaling](#) and [Use channel as output](#) are also 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 (2'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 order* and *Word order* are adjusted according to length value. This also applies to the numeric fields in [Startposition within reference data](#).

- **Encoding type**  
Specifies the encoding type for interpreting the transmitted/received data.
  - **Byte order**  
The byte order (byte sequence) is a number, made up of several bytes, how bytes are ordered to 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://de.wikipedia.org/wiki/Byte-Reihenfolge>.
  - **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 CAN message.
- ▼ **Startposition within reference 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 of 4 means that, for example, two signals each with 2 bytes (binary-coded 16-bit integer value) would fit before the current signal and one signal 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 bytes. The byte offset is also available for this data type. Input is restricted to the valid values, and the default is 0
- ▼ **CAN ID**
- **Extended ID**  
To set whether the CAN message uses 11 bit or 29 bit for the identifier. The setting in this dialog is available only when *Extended ID* has been selected in the [CAN controller](#) dialog.
  - **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 CAN message to be received (or sent, see [Use channel as output](#)) when 7FF or 1FFFFFFF is selected for *Mask*.

- **Mask**

The filter provides the option to set the CAN bus channel to a whole group of IDs. The range of input depends on the setting in *Extended ID*. The Mask value is linked with the configured and received ID bit by bit AND. The CAN message will be 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 a Mask is not to be used.

### Example of mask settings

*ID* 0x027 = 100111 = binary, *Mask* = 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; last two digits only 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, 100110 and 100111.

### ▼ **Scaling**

If CAN users send values that require conversion, enable *Scaling* and enter *Min / Max* values to convert from the *Input value* into 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*.



#### **Info**

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 the type under *Data type* is used.

### **Scaling example**

In the above image, a conversion from 4800 (pulses) to 300 (km / h) is performed.

## ▼ Use channel as output

CAN-bus channels are configured by default as input channels, i.e. they receive data via the CAN bus. This option enables the device to send data to other CAN bus users.

Enter either a constant (*Manual value*) or select an existing channel from *Channel* whose value can be output. Selecting *Application* enables the output value to be manually set via the *DataService Configurator* or automatically set via a ProfiSignal application. The source value is converted to the type given in *Data type*.

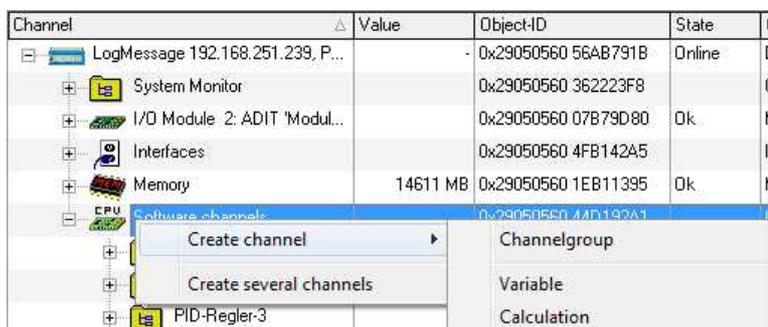
*Inherit status* (for *Channel* settings only): The status of the input channel is used but not output to the CAN-Bus.

## 5.8 Configuring Software channels

Refer also to [Settings for all dialogs](#)

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* context menu (DataServiceChannels tab). You can then either create a Channel group (e.g. *Analog 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 dialog 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 at the original position, but creates at another location an entry that is linked to this channel.

### Linking channels

From the *Options* in tab in the DataService Configurator select *Activate channel move / link*. In the User defined view (View → Right / left panel → Channel sheet options) move or link a channel by left-clicking and holding. Further information is available in the DataService Configurator manual.

The rest of the 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 dialogs](#) and [General settings for Software channels](#).

### 5.8.1 General settings for Software channels

The following sections explain some of the settings that are available in many of the configuration dialogs.

- [Channelgroups](#)
- [Edge and level triggers](#)
- [Basic channel selection](#) and [Advanced channel selection](#)
- [Inherited status](#)
- [Advanced settings tab](#)

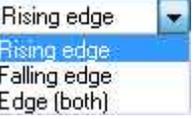
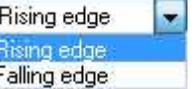
Refer also to [Tables](#).

#### 5.8.1.1 Channelgroups

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](#)).

#### 5.8.1.2 Edge and level triggers

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

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

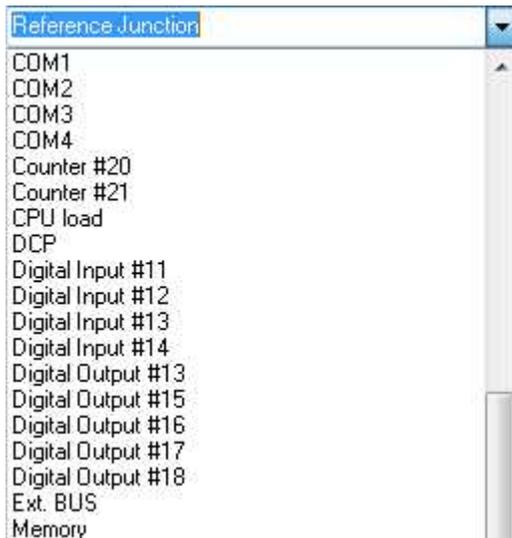
#### Explanation of options

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"

### 5.8.1.3 Basic channel selection

Many dialog require a channel to be selected as a source or a target. A basic or [advanced channel selection](#) is available.

Basic channel selection is accessed directly from the configuration dialog. All configured channels are listed by clicking the arrow on the dropdown list:



Click the required channel.

If the channel name is known it can be input from the keyboard. The list then filters according to each letter typed.

### 5.8.1.4 Advanced channel selection



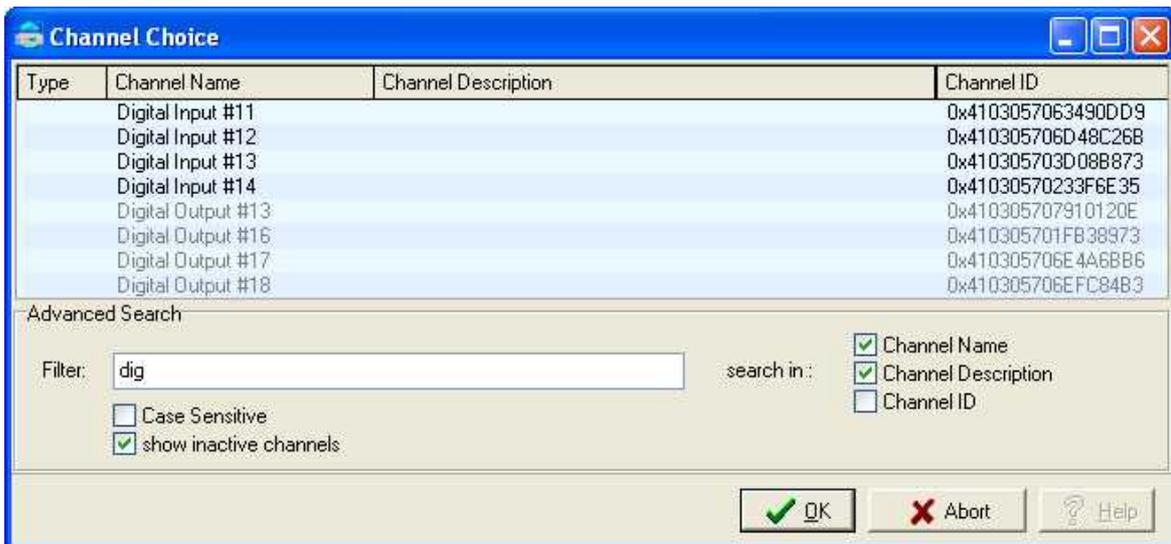
**Info**

The advanced channel selection is not yet available for Windows Vista and Windows.

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

Open the dialogue box by clicking . The channels are displayed by name, description and channel ID.

Enter filter criteria in the *Advanced search* area. The filtered channels are then displayed. Selected the required channel and click *OK*.



### 5.8.1.5 Inherit status

This option sets whether the source's status as well as its value is to be used. This can be used, for example, to prevent invalid input values from entering the process. Channel status values are available in [status monitoring](#).

**An example of inheriting:** A thermocouple wire-break is also displayed in the software channel as a wire break.

### 5.8.1.6 Advanced settings tab (software channels)

Advanced settings

Default value

0    mA     Force default value (simulation)

Data reduction

Tolerance  
0,1    mA

Format

2    Fractional digits

Persistence

Active

**Default value:** This is used in the event of a input or output failure ( refer also to [status monitor](#) ). The settings depend on channel type. For example, digital inputs only have the options Off and On.

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

**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. In the example the processed input value is output only when it differs by more than 0.1 mA to the preceding value. The **Data reduction** function enables prevents the device from having to process/store superfluous data.

As a software channel has no scale or valid range the tolerance value can only be specified in the channel's absolute unit of measurement.

**Format:** For setting data resolution.

**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 reboot. This feature is particularly important for outputs to establish a predefined state following a power failure.

### 5.8.2 Accumulator

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 a reset event and then reset internally to zero. When not enabled, the sum is output for each each new value from the source channel.

(Refer also to [Trigger options](#) ).

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

### 5.8.3 Operating hours counter

This software channel acquires the time the source has an active level. When the level becomes inactive, the time period is added to the cumulative time period.

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



#### Info

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

Enable **Reset** and configure a channel and the trigger ( **Edge**, **Level** ) to reset the hour counter.

Refer also to [Trigger options](#).

If the source has an active level when the reset signal occurs, the operating hours counter is reset to zero only after the source becomes inactive again.

### 5.8.4 Differentiator

This Software channel calculates the relationship of the difference between two values from the source channel to the difference between their time stamps based on the time base:

Differential = (  $\Delta$  Value /  $\Delta$  timestamp ) \* time base

Refer also to the [Advanced settings tab](#)

**Time base :** Enter the time base for the calculation. The default is 1 ms.

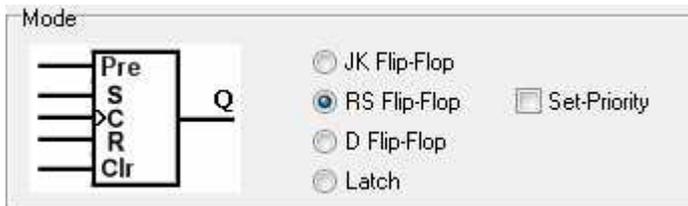
Enable **Trigger** when the calculation is to be triggered by specific events. The differential between successive trigger events is then calculated.

Refer also to [Trigger options](#).

### 5.8.5 FlipFlop

This software channel functions like a hardware flip-flop.

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



The following tables show the possible states.  
 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 (pre-set)	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

Status	S	R	S + set priority	C (clock)	Clr (clear)	Pre (pre-set)	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 state

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 state

▼ 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 state

### 5.8.6 Limit

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

The following forms of monitoring are available:

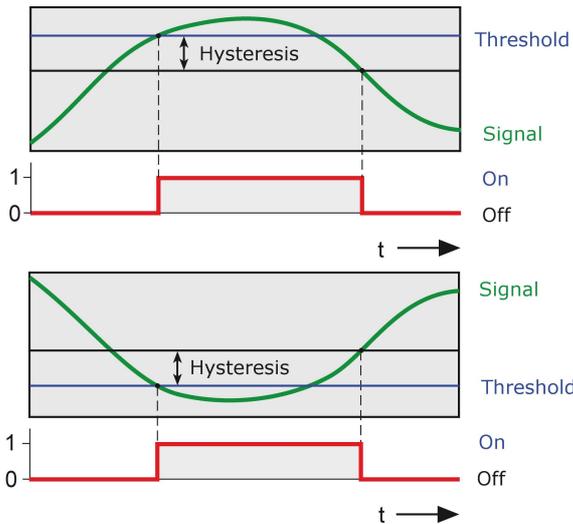
Mode	Alert when
Overrun	the value is above the specified range or above the limit/threshold
Underrun	the value is below the specified range or below the limit/threshold
Band monitoring	the value is outside the specified range (threshold ± bandwidth)
Band violation	the value is within the specified range (threshold ± bandwidth)
Steady condition	values change by more than the bandwidth during hold-up times

In addition, *no triggering for wire-breaks at the source* can also be entered. 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 change the limit value 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). Refer to the images. The hysteresis is especially beneficial for small (noise) signals. The *Delay* option offers an alternative.



**Bandwidth** : Sets the "monitoring window" for *Band violation* and *Steady condition* monitoring. In *Band violation* the "monitoring window" is symmetrical to the threshold. The value entered acts in positive and negative directions as an addition to the threshold.

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

**Hold-up:** The alarm condition must remain true during the specified time to trigger an alarm. The option is an alternative to *Hysteresis* and is especially suitable to suppress alarms for brief signal distortions with high amplitudes. Both options can be combined.

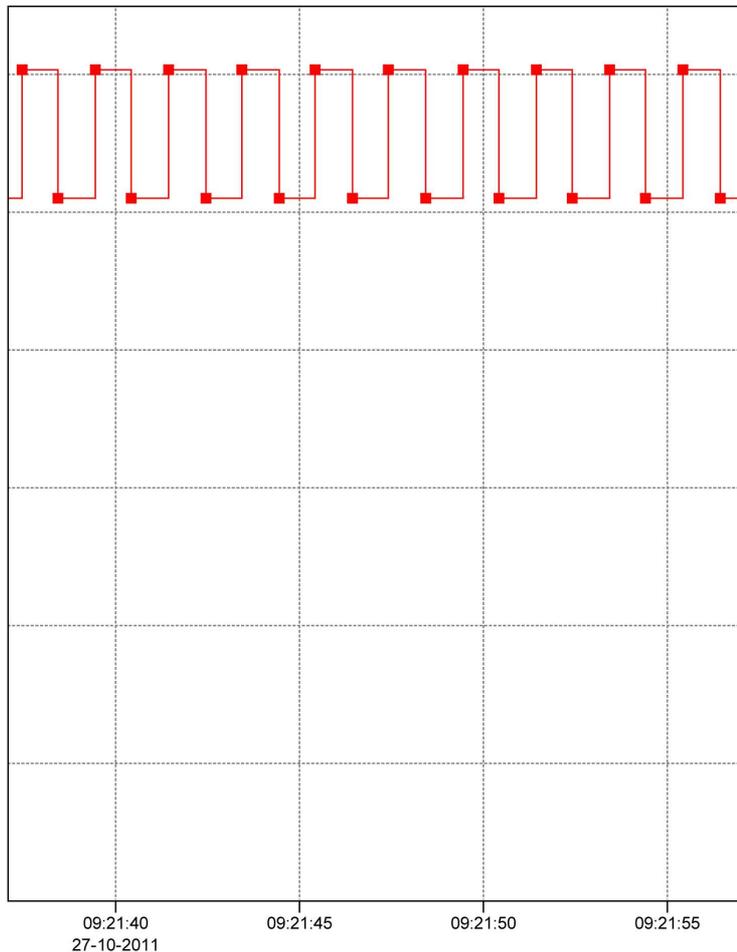
**Latching:** The alarm is latched (continues to alarm) even when the alarm condition is no longer true. Enabling *Latching* changes *Reset trigger for latching*. The alarm resets when a reset event occurs, e.g. a *Rising edge*, in the given channel. The *Reset priority* option causes an alarm to reset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

Refer also to [Trigger options](#).

### 5.8.7 Impulse generator

The software channel can be used in two different modes:

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



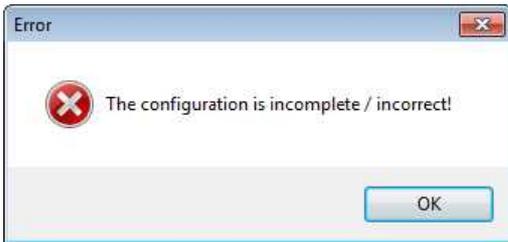
- **Synchronic to real time:** Pulses are generated at a repetition rate according to time. For example, a *Cycle time* set at 15 minutes generates pulses at 00, 15, 30 and 45 minutes of each hour. Only discrete values can be entered here because impulses are generated only at whole number ratios.

**Pulse width:** sets the pulse duration, i.e. how long the pulse maintains a "High" level.

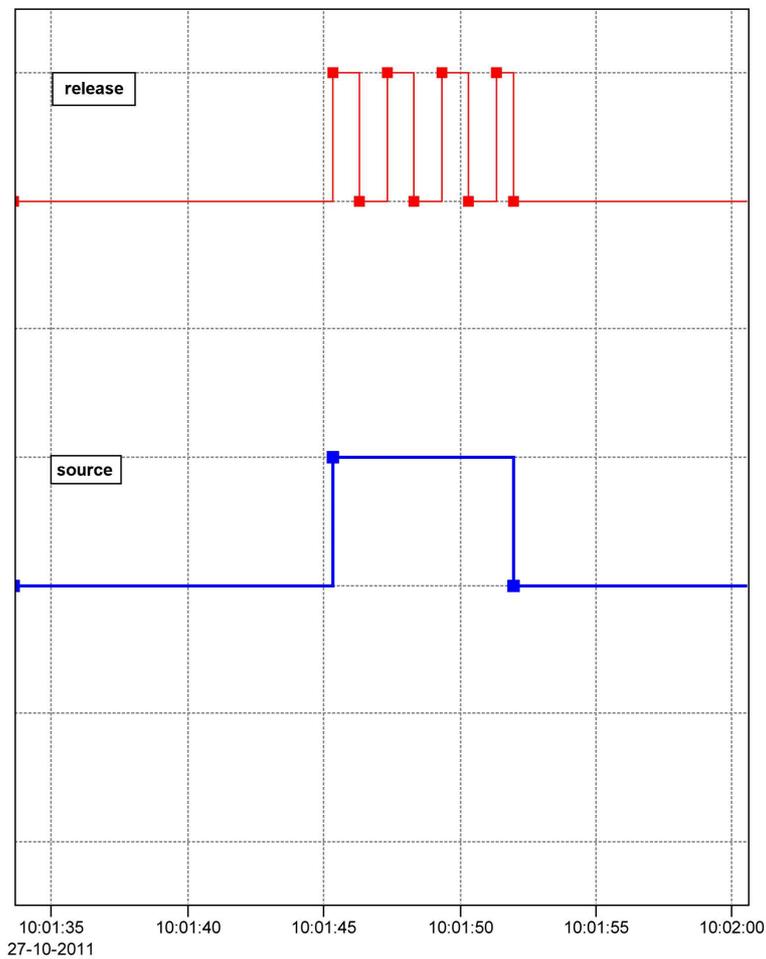
**Cycle time:** sets the pulse repetition rate.

In **Synchronic to real time** mode, only specific times can be selected from the list because the cycles must be at whole number ratios.

After closing the dialogue with **OK** a check for validity 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.



**Source:** The *Level* trigger option means that the pulse generator functions only during the source's active time, The *Edge* trigger option means that the pulse generator starts with the source's edge and runs continuously until stopped with *Reset*



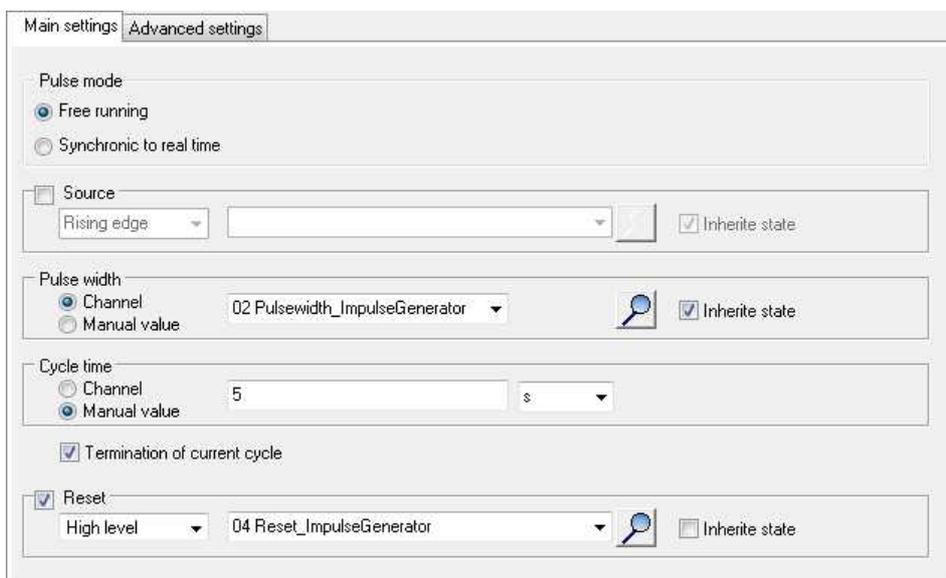
The diagram shows the release of the pulse ( **red** curve) by the source ( **blue** curve).

**Reset:** when the event occurs, immediately resets the pulse generator output to (asynchronous) "Low" level. If the *Level* trigger setting is selected, this signal permanently suppresses further pulses occurring at the pulse generator output. Refer also to [trigger options](#).

## Examples

The following are examples of possible uses for the pulse generator.

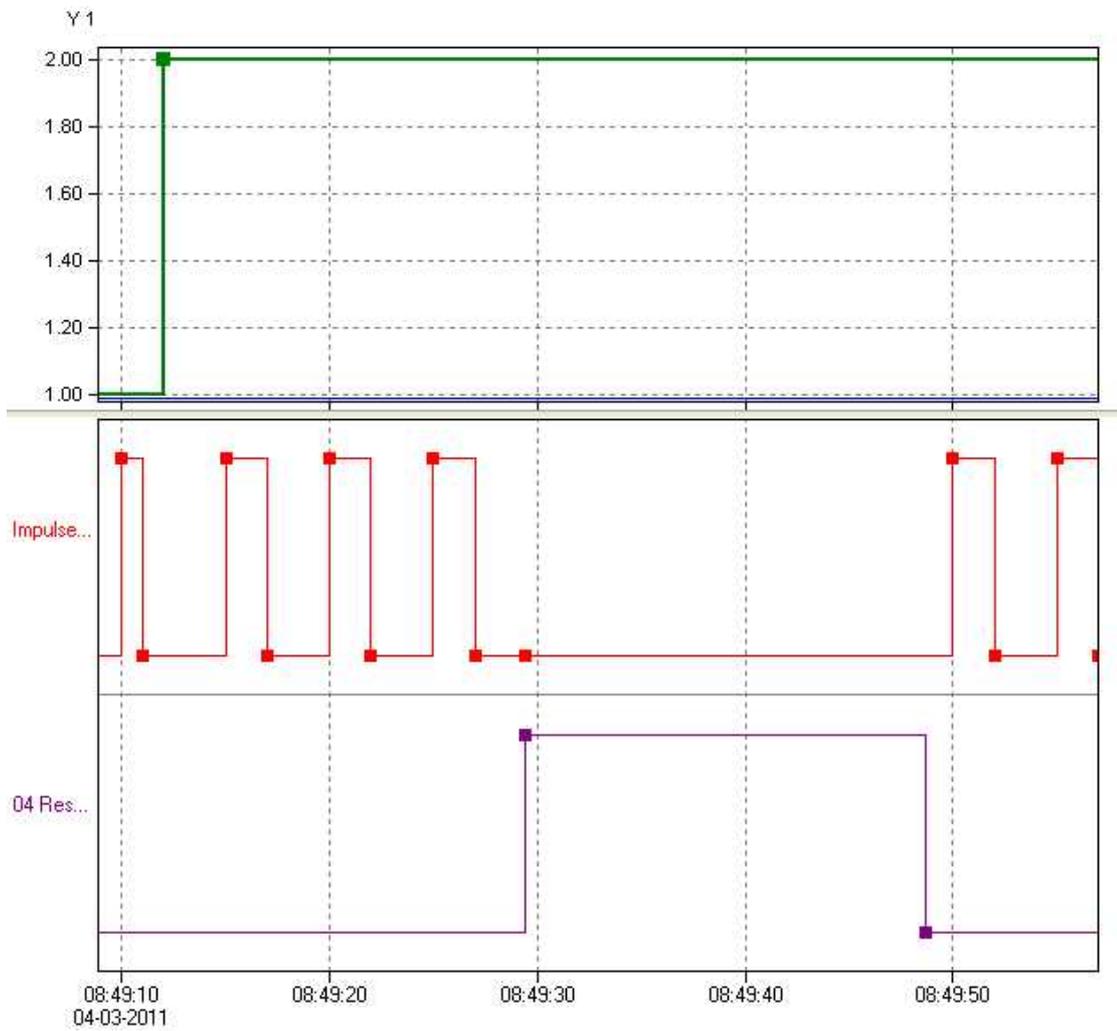
### ▼ Example 1



The screenshot shows the 'Advanced settings' tab of a pulse generator configuration window. The settings are as follows:

- Pulse mode:**  Free running,  Synchronic to real time
- Source:**  Rising edge,  Inherit state
- Pulse width:**  Channel (02 Pulsewidth\_ImpulseGenerator),  Manual value,  Inherit state
- Cycle time:**  Channel,  Manual value (5 s),  Termination of current cycle
- Reset:**  High level, 04 Reset\_ImpulseGenerator,  Inherit state

In this example the pulse generator runs in continuous mode. Cycle time = 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 sets 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**

Main settings
Advanced settings

Pulse mode

Free running

Synchronic to real time

---

Source

High level ▾

01 Trigger\_ImpulseGenerator ▾

 Inherit state

---

Pulse width

Channel

02 Pulsewidth\_ImpulseGenerator ▾

 Inherit state

Manual value

---

Cycle time

Channel

03 Cycletime\_ImpulseGenerator ▾

 Inherit state

Manual value

Termination of current cycle

---

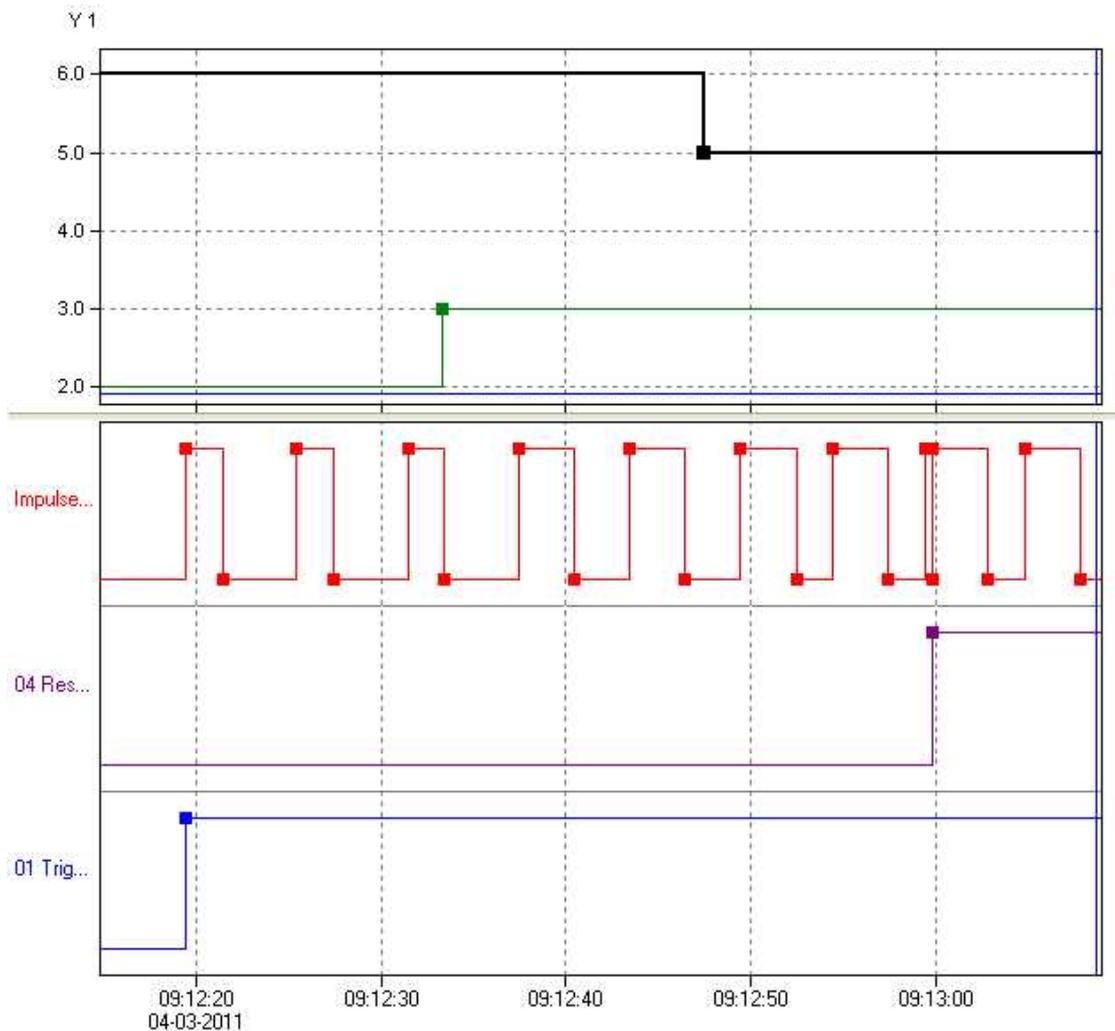
Reset

High level ▾

04 Reset\_ImpulseGenerator ▾

 Inherit state

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.



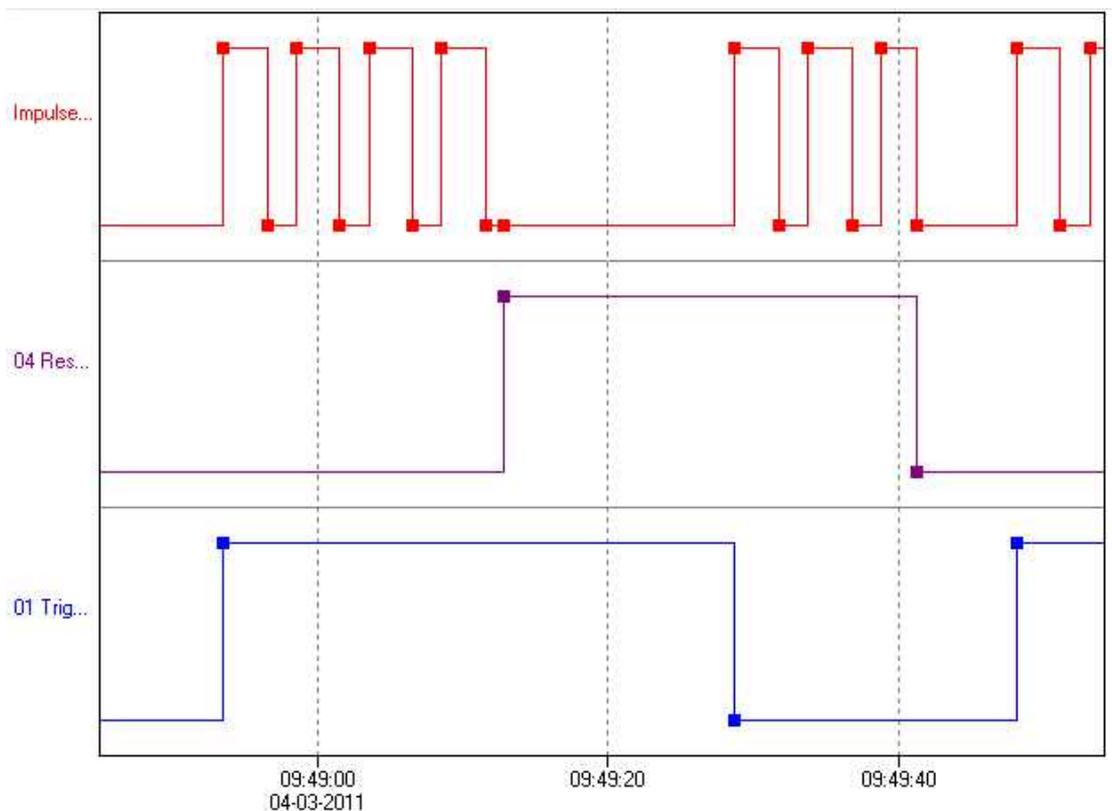
The pulse generator (**red** curve) is started by the trigger channel (**blue** curve) with a 2-second pulse duration (**green** curve) of and a 6-second cycle time (**black** curve). After three pulses, the pulse duration is increased to 3 seconds (**green** curve). After another two pulses, the cycle time (**black** curve) is reduced to 5 seconds. Just before 9:13:00 a reset takes place 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 had already begun.

▼ **Example 3**

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

**a)**

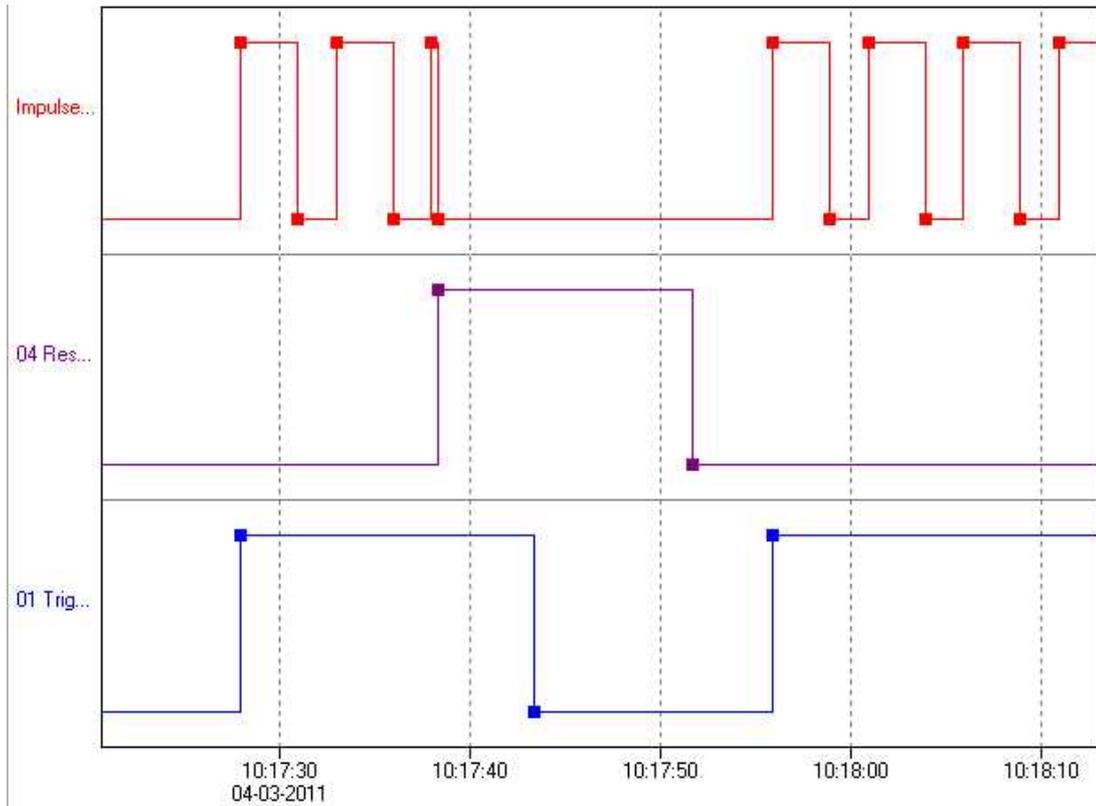
Trigger and reset are triggered by channels and are set to *Edge (both)* . Then both the signal's rising and falling edges trigger the event.



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 triggered and the pulse generator stopped. Pulses are generated again only after the trigger emits a new start signal with a falling edge. A falling edge from the reset channel re-stops the pulse generator. Pulses re-start only with a rising edge from the trigger channel.

b)

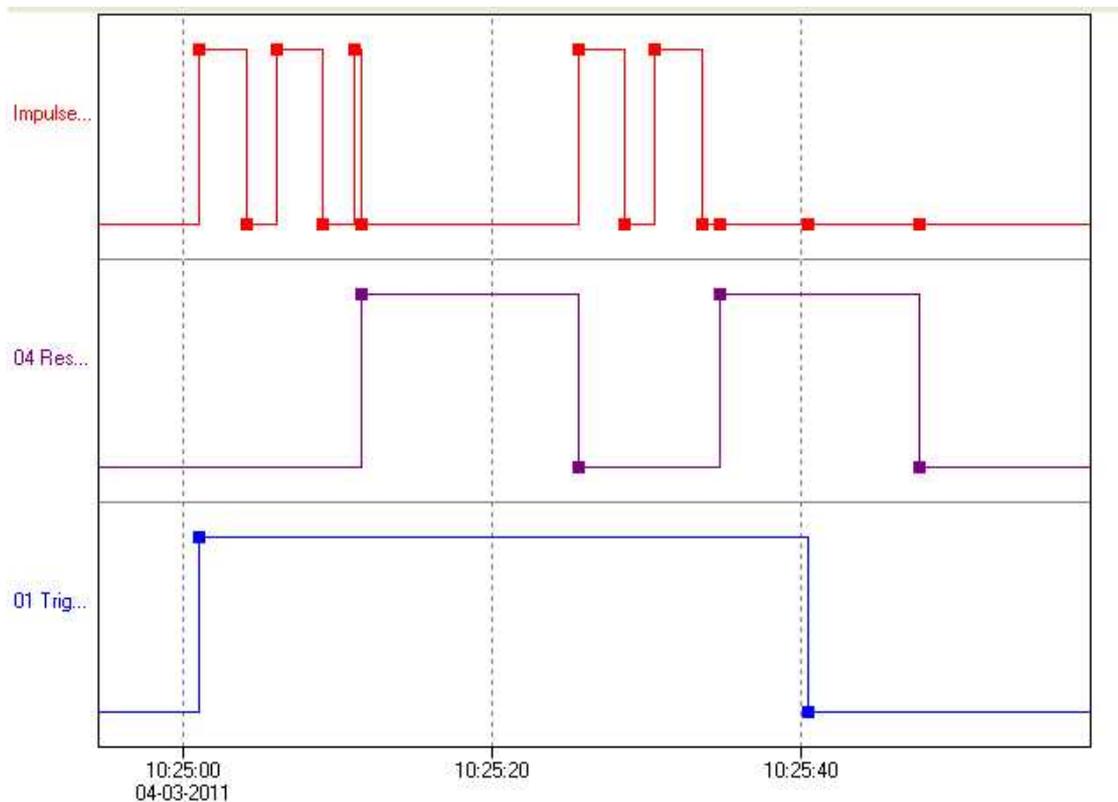
The trigger is triggered by a channel and has been set to *Edge (both)* . The reset is also triggered by a channel, but has been set to *High level*.



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, 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; a re-start takes place only with a rising edge in the trigger channel.

c)

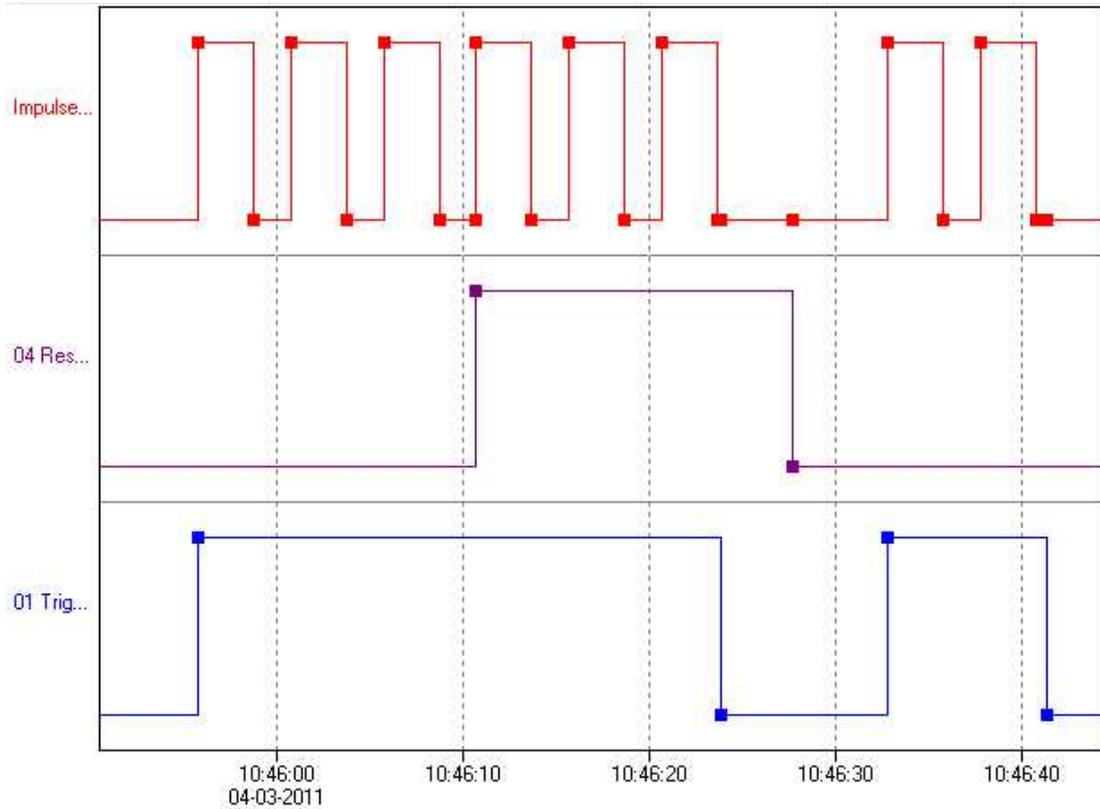
Trigger and reset are triggered by channels and are set to *High level*.



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 *Edge (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 after the trigger signal also goes to "Low". The falling edge of the reset signal has no influence here as no pulses are being generated at the time.

### 5.8.8 Integrator

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

$$\text{Integral} = \sum(((\text{previous value} + \text{current value}) / 2) * \Delta \text{ time-stamp} * \text{time-base})$$

*Cyclic* : New values are repeatedly obtained from the source for the *Period* input and the integral calculated between the current and previous values. 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 running total.

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

*Reset*: The calculated integral is output only in a reset event and then reset internally to zero.

Refer also to [Trigger options](#).

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

### 5.8.9 Linearization

Linearization 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.

The available options are identical to those for sensor compensation, which can also be performed here in addition to the required linearization. This dialog enables either the setting of only a conversion function for the channel ( *Table type: Local table* ) or the use of a global linearization function ( *Global table* ) which has been set up via the *Global linearisation table* option in the device's context menu.

See also [Tables](#) , [Global linearisation tables](#), [Settings for all dialogs: sensor compensation tab](#)

#### Method

1. Select a *table type*.  
For external tables then select a table; for an internal table, set up 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 as well as created: *Import*.

There is a choice of modes:

- **Offset**  
An offset shifts the curve by a fixed value, i.e. the given value is added to the measurement value.
- **Offset and Gradient**  
Allows a shifting of the curve and an increase in its gradient.
- **Squarely**  
Generates a quadratic curve through the given points to linearize the measured values.
- **Linear interpolation**  
Enter a table for the conversion of 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. This is then used to convert the measured values.

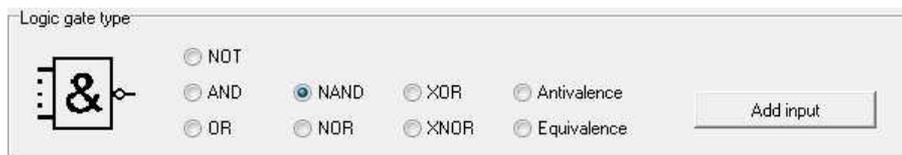


### Info

You can use copy and paste to transfer data from an Excel table into the dialog's table. Position the cursor in the table's top left field. 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**.

### 5.8.10 Logic

This software channel enables the logical linking of digital signals. 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* generates additional inputs. All inputs are linked according to the selected logic.



**Info**

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

Click  to delete an input.

▼ **Function table NOT**

Input value	Output value
L	H
H	L

▼ **Function table AND**

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

▼ Function table OR

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

▼ Function table NAND

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

▼ Function table NOR

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

▼ Functiontable XOR (exclusive OR)

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

▼ **Function table XNOR**

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

▼ **Function 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

▼ Function 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
H	L	H	H
H	H	L	H
H	H	H	H

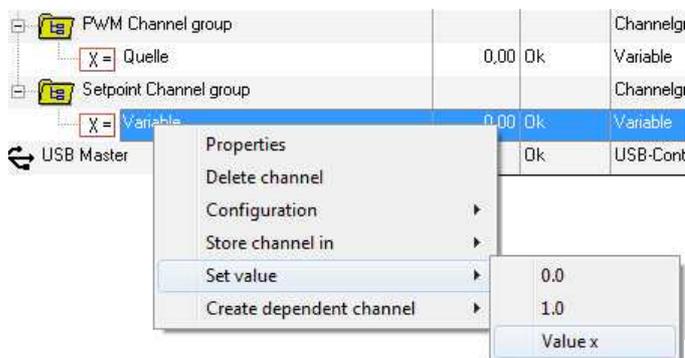
### 5.8.11 Variables

This software channel 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.

Signal flow is via a variable channel from the *DataService Configurator* or a ProfiSignal application in the direction of the device. Using channel variables differs to analog or digital outputs or COM channels set to outputs, in that access is to the device itself and not just to the connected process.

The generated variable is configured as a source for the controlling channel, e.g. as a reset trigger for a counter channel.

**Application:** This option enables variable control via the *DataService Configurator* or ProfiSignal. Set the variable to a constant value via the Variable's context menu in the *DataService Configurator* or automatically control the value via ProfiSignal.



**Manual value:** This option sets a constant value for the variable. This setting is useful during installation to test specific devices or activate system responses. Do not forget to disable the option for normal operation!

### 5.8.12 Average

This software channel calculates averages from the source values.

**Simple moving average:** This average 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 triggering calculation of the average from the accumulated values and outputting 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 mean:** The arithmetic mean, also called the average, is the sum of all values of a data series divided by the number of values.
- **Vector average:** A 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 :** The configured average type is calculated at the time of the trigger event for the data series that has accumulated between two trigger events. The result is output following calculation.

**Level triggering :** 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:** When enabled, the averages between trigger events are output immediately after calculation (after each new source value).

Refer also to [Trigger options](#).

### 5.8.13 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/ time for the period of the base wave or name a channel that provides the appropriate value.

**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.

### 5.8.14 Calculation channel

This software performs the mathematical formula that has been input. 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.

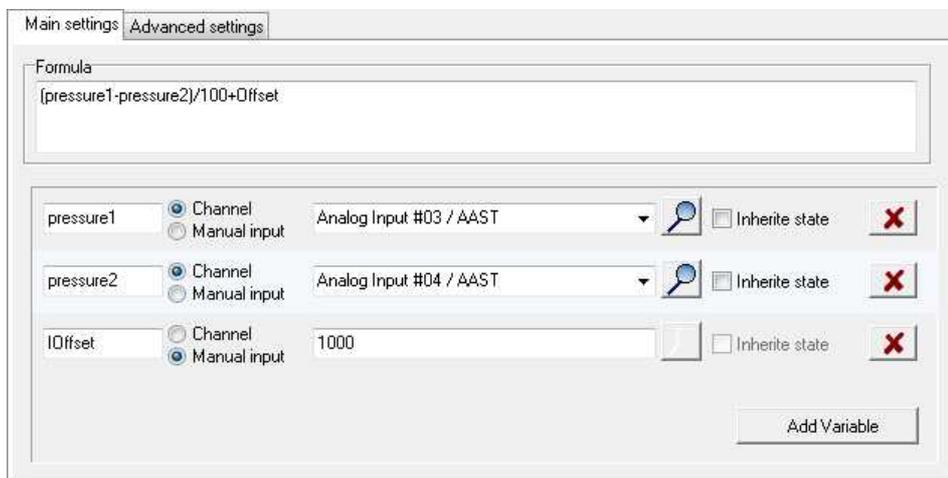
#### Method

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 input*) or whether the value is to be obtained from a channel (*Channel*).
3. Enter the formula expression in the *Formula* field.

#### Restrictions on variable names

1. The first character must be alphabetic.  
The digits 0-9 are permitted within or at the end of the name.
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 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.

#### Input for the formula field

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

▼ Available calculation functions

Type of calculation	Function	Data types		Syntax
		Operand1	Operand2	
Basic calculations	Addition	bool, int, float	bool, int, float	Operand1 + Operand2
	Subtraction	bool, int, float	bool, int, float	Operand1 - Operand2
	Multiplication	bool, int, float	bool, int, float	Operand1 * Operand2
	Division	bool, int, float	bool, int, float	Operand1 / Operand2
Logical 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 operations	AND	bool, int	bool, int	Operand1 & Operand2
	OR	bool, int	bool, int	Operand1   Operand2
	XOR	bool, int	bool, int	Operand1 ^ Operand2
	Negation	bool, int	bool, int	~Operand1
	Left-shift (Move operand1 to the left by the number of places in operand2)	bool, int	bool, int	Operand1 << Operand2
	Right-shift (Move operand1 to the right by the number of places in operand2)	bool, int	bool, int	Operand1 >> Operand2
Operations with sets	Minimum	bool, int, float	bool, int, float	MIN(operand1, operand2)
	Maximum	bool, int, float	bool, int, float	MAX(operand1, operand2)

Type of calculation	Function	Data types		Syntax
		Operand1	Operand2	
Matching operations	Less than	bool, int, float, string	bool, int, float, string	Operand1 < Operand2
	Less than or equal	bool, int, float, string	bool, int, float, string	Operand1 <= Operand2
	Greater than	bool, int, float, string	bool, int, float, string	Operand1 > Operand2
	Greater than or equal	bool, int, float, string	bool, int, float, string	Operand1 >= Operand2
	Equals	bool, int, float, string	bool, int, float, string	Operand1 == Operand2
	Not equal to	bool, int, float, string	bool, int, float, string	Operand1 != Operand2
Trig functions	Tangent	bool, int, float	-	TAN(Operand1)
	Cosine	bool, int, float	-	COS(Operand1)
	Sine	bool, int, float	-	SIN(Operand1)
Reverse trig. Functions	Arctangent	bool, int, float	-	ATAN(Operand1)
	Arccosine	bool, int, float	-	ACOS(Operand1)
	Arcsine	bool, int, float	-	ASIN(Operand1)
Other operations or functions	Exponential	bool, int, float	-	EXP(Operand1)
	Power	bool, int, float	bool, int, float	POW(basis, factor) POW(Operand1, Operand2)
	Square	bool, int, float	-	SQRT(Operand1)
	Modulo	bool, int, float	bool, int, float	Operand1 % Operand2
	Absolute	bool, int, float	-	ABS(Operand1)
	Natural logarithm	bool, int, float	-	LN(Operand1)

Type of calculation	Function	Data types		Syntax
		Operand1	Operand2	
	Logarithms (base 10)	bool, int, float	-	LOG(Operand1)

**Data types**

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

**5.8.15 Collective fault**

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

**Latching:** The alarm is latched (continues to alarm) even when the alarm condition is no longer true. A reset event is then required to reset the alarm. If the **Latching** option is not selected, the output for the batch alarm channel takes the state of the linked source.

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 true.

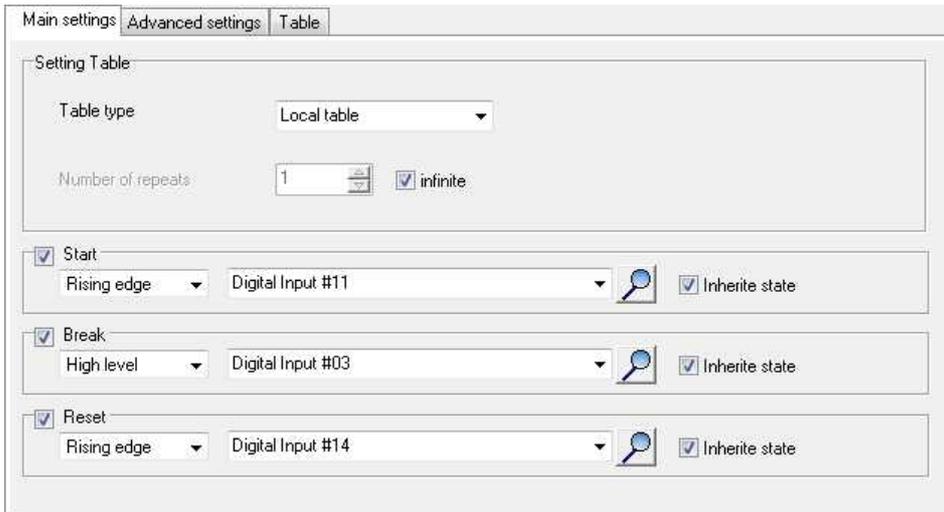
Refer also to [Trigger options](#).

**Method**

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

### 5.8.16 Setpoint

This software channel enables the device to be used as a programmer. The setpoint table enables the conditional procedures to be programmed that can be repeated as often as required.



**Table type:** Use a global Global table (*Global table* setting) that has been created for the device (refer to [Global setpoint tables](#)) or define a table for a specific channel (*Local table* setting). In the latter case, a *Table* tab will appear.

**Number of repeats:** To determine 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 at 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.

**Break:** 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.

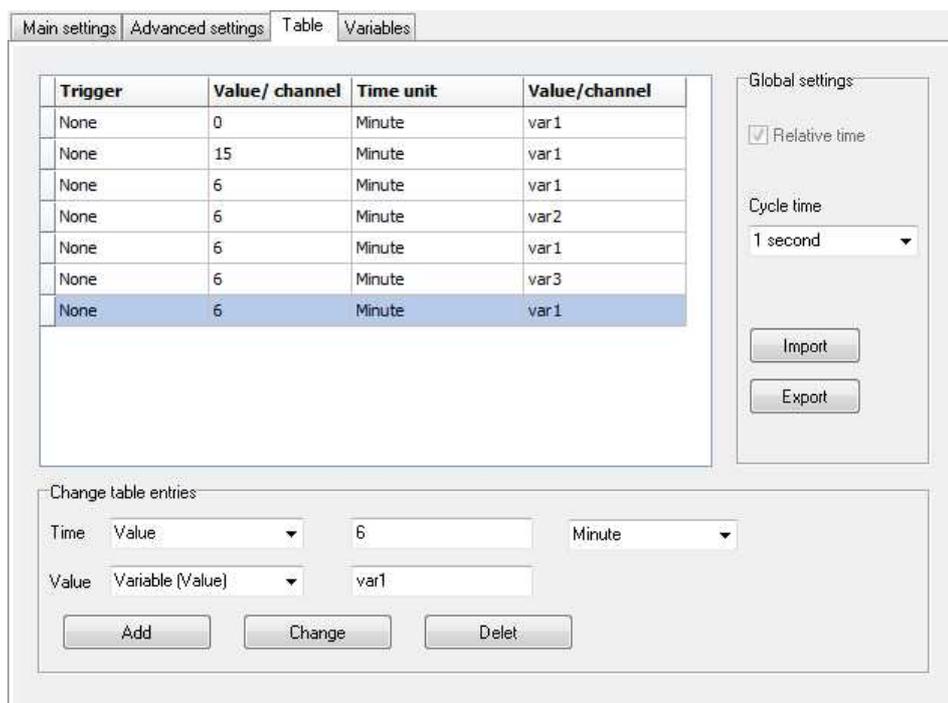
For *Edge* settings, the setpoint is retained from the arrival of the edge until the next edge. An event here is also unable to give priority to a start channel over a pause status.

**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 can override up a pause status.

Refer also to [Trigger options](#).

## Table tab

The setpoint table creates a conditional procedure whose points are set by value pairs made up from a period and a value. Each row of the table describes a program step for *time*  $t$  (fixed or variable) and *value*  $y$  (fixed or variable). Based on the previous value of  $y_{i-1}$ , the  $t_i$  value indicates how long will it take to achieve the  $y_i$  value. The first line defines the starting point of the procedure, so at least two pairs of values need to be entered. If a variable is used it requires configuring via the *Variables* tab. This applies even when using a global (external) setpoint table for the selected channel for



Trigger	Value/ channel	Time unit	Value/channel
None	0	Minute	var1
None	15	Minute	var1
None	6	Minute	var1
None	6	Minute	var2
None	6	Minute	var1
None	6	Minute	var3
None	6	Minute	var1

Global settings:

Relative time

Cycle time: 1 second

Buttons: Import, Export

Change table entries:

Time: Value (dropdown) 6 (input) Minute (dropdown)

Value: Variable (Value) (dropdown) var1 (input)

Buttons: Add, Change, Delete

## Method

1. For each table row (program step) enter the time value (*Time*) with the unit of time and to be used and the *value* to be output.
2. Click *Add*.
3. Enter the required *Global Settings*.

Select a row to change the specified values. Then click *Change*. *Delete* removes the selected row.

A table can be imported as well as created: *Import*.

Numbers (constants) or variables can be used for times and values. The variables are then 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 variable is used as time value. *Variable (trigger)* means that the channel set for the variable 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 applied as a setpoint and the next program step is then performed. This method enables the upgrade of a basic time-controlled program to an event controlled system.

**Global settings**

*Relative time*: When enabled, input times are calculated as a difference to previous time points. When disabled, time values are taken from the start (first value).

▼ **Example of absolute and relative time input**

The numerical values are fixed values and in this case refer to identical time points. The final time is 7 (the unit is not stated but might, for example, be minutes).

Point no.	Absolute	Relative
1	0	0
2	1	1
3	5	4
4	7	2

**Example**

In the table in the example, the value for var1 is held for the first 15 minutes. Then, after each 6 minutes (*Relative time* setting ) the value increases to var2, then lowers to var3 via var1, and then increases again to var1. A change and therefore output of the new value takes place every second.

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

**5.8.17 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 triggering calculation of the minimum or maximum from the accumulated values and outputting 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 calculations*: 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 creates 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 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.

Refer also to [Trigger options](#) .

### 5.8.18 Status monitor

This software channel monitors the source and becomes active (switches to " On" ) when the source contains the specified state.

#### Potential alarm functions and their meaning

Selection	Description
Alarm	Alarm for card type AMDT, range error
Wire break	Wire breakage in monitored channel
Configuration error	Error in configuring the monitored channel
Invalid	Invalid value in the monitored channel
Measuring range overrun	The measured value is above the range for the A / D converter
Measuring range underrange	The measured value is below the range for the A / D converter
Hardware failure	Error in the hardware
Simulated value	An internally generated value for testing
Not A Number (NaN)	The result of a calculation is not a valid number, e.g. a root from a negative number
Infinite value (INF)	The result of a calculation is infinity (infinity), e.g. division by zero

Selection	Description
Default value	Default value for the monitored channel
Forced value	The <i>Forced value</i> is a default value, e.g. in the event that a sensor is defective at an analog channel
Scale range over-run	The scale range has been exceeded
Scale range under-run	The scale range has underrun
General warning	An error has occurred while transferring data
End of a trigger block	End of a trigger block (data storage)
Input value out of range	The value of the source channel can not be processed. There exists a parameter error

### 5.8.19 Stopwatch

This software channel records the time between a start and a stop event. There are two methods of starting and stopping the stopwatch:

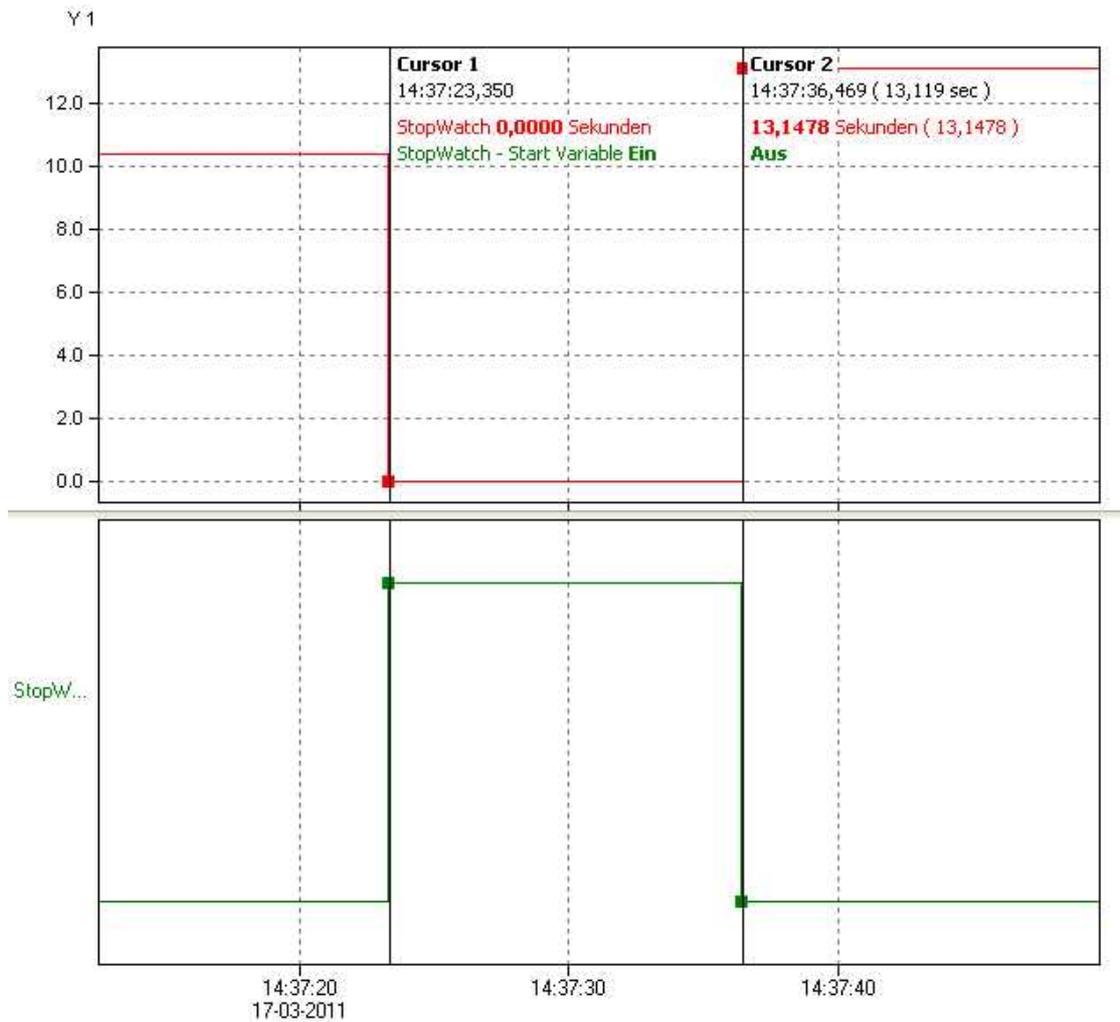
1. Starting and stopping by means of an *Edge* or *Level*.
2. Starting from one channel (*Edge* only ) and stopping from another channel (*Edge* only)

In the second example, the stopwatch can be restarted (*Retriggerable*) via a stop (*Reset*). Enabling *Reset at start* resets the stopwatch to 0 at a start (Example 1, Case 1). When not enabled the last value is retained and is added to the new interval (Example 1, Case 2). Refer also to [Trigger options](#) .

▼ Example 1

Case 1

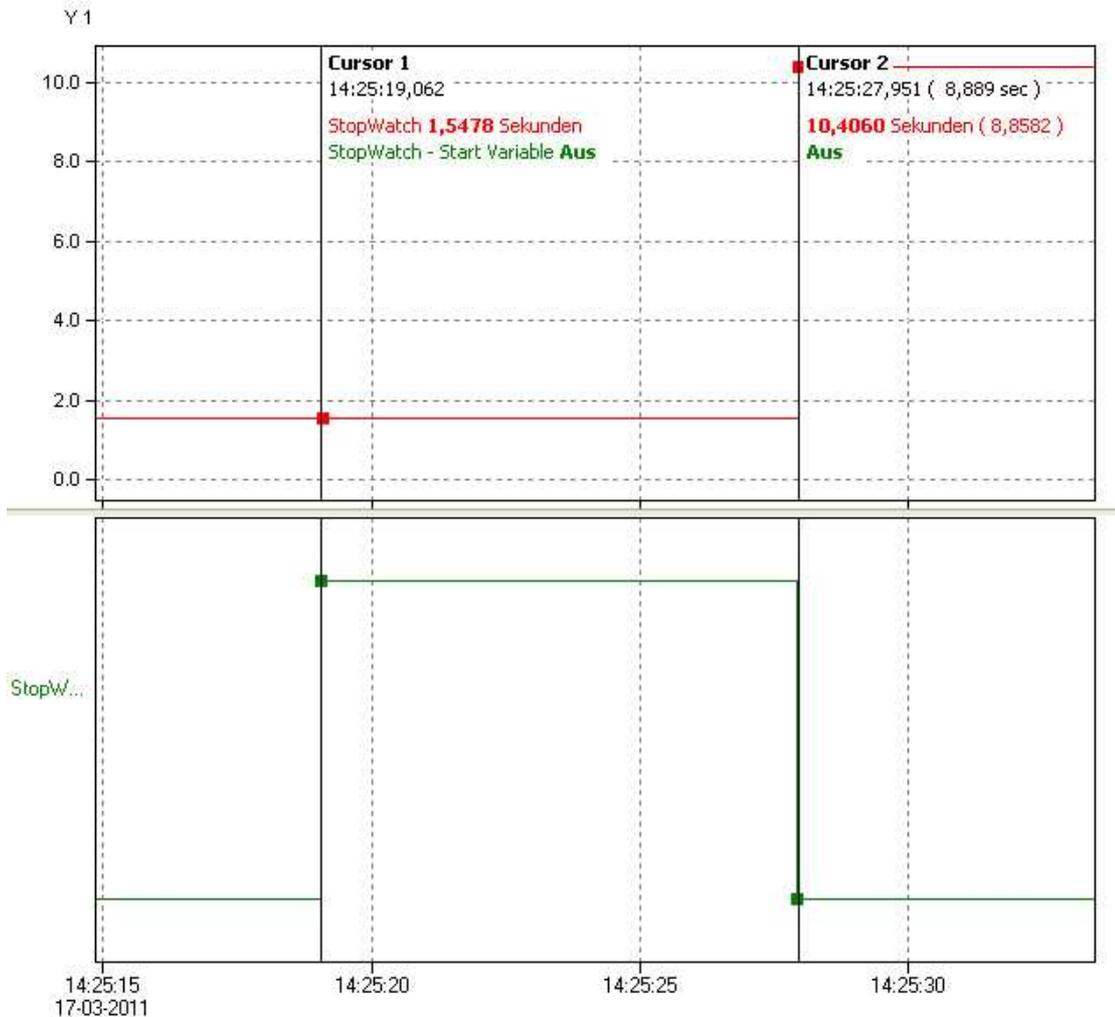
Setting: *Start / Stop* at *High level*, *Reset at start* is enabled.



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.

## Case 2

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

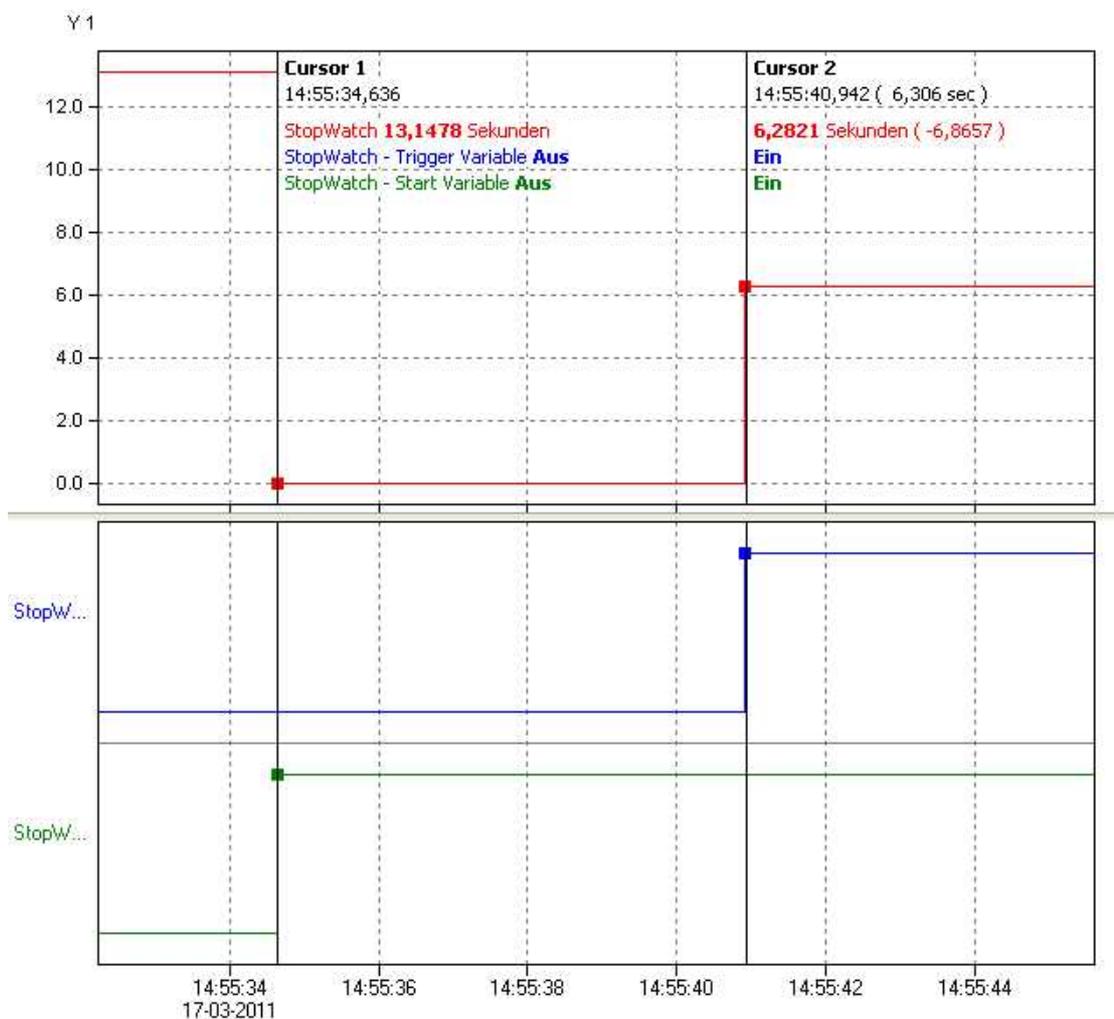


The stopwatch starts (**red** curve) at a high level in the start / stop channel (**green** curve). The last measured value was 1.5478 seconds. Once the level reverts to low (8.8582 seconds, calculated from the beginning of the high level), recording stops. The last measured value is added to the the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

▼ Example 2

**Case 1**

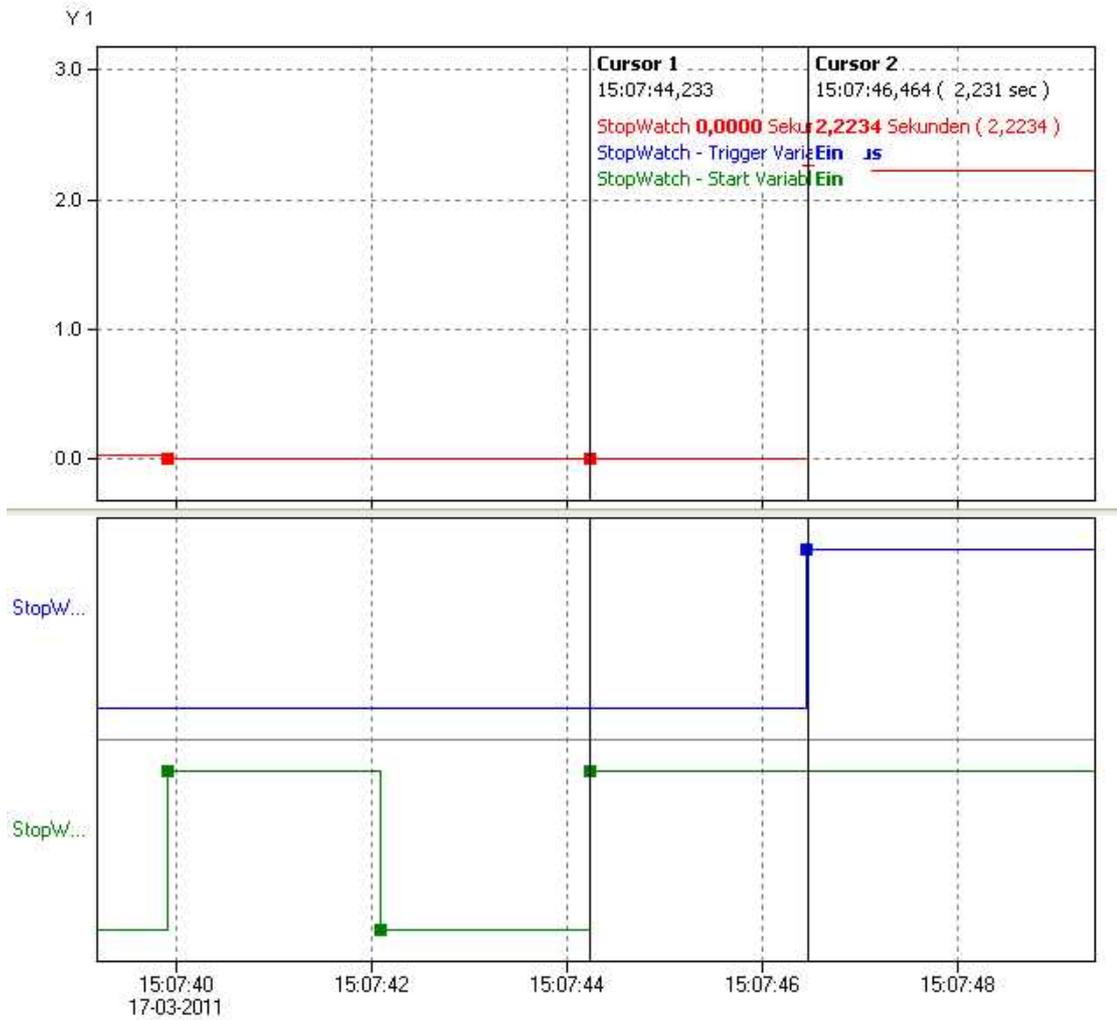
Setting: *Start at Rising edge*, *Reset at Rising edge*, *Reset at start* is enabled.



With a rising edge in the start-channel (**green** curve) the stopwatch starts (**red** curve). Because *Reset at start* is enabled, the stopwatch begins at 0. The rising edge of the reset channel (**blue** curve) stops the stopwatch. The recording time is the time between the two edges (6.2821 seconds).

**Case 2**

Setting: Start at Rising edge, Reset at Rising edge, Reset at start is enabled and Ret-riggerable is enabled.



With the first rising edge of the start channel (**green** curve) the stopwatch starts (**red** curve). Because *Reset at start* is enabled, the stopwatch begins at 0. The second rising edge of the start channel resets the timer back to 0. The rising edge of the reset channel (**blue** curve) stops the stopwatch. The recording time is the time between the the start channel's final edge and the edge of the reset channel (2.2234 seconds).

### 5.8.20 System monitor

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.

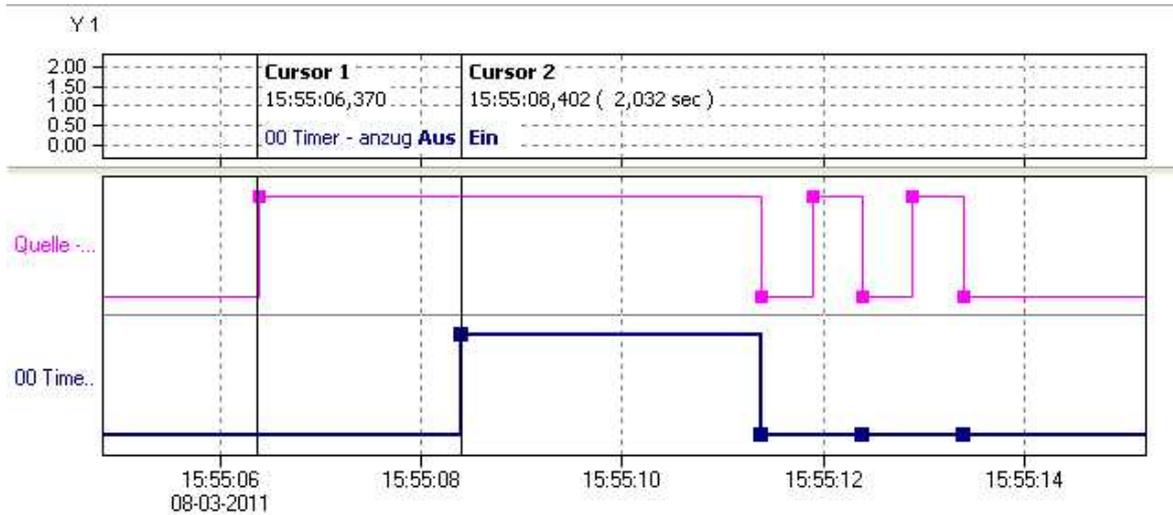
#### Optional system information

Selection	Description	Unit
CPU usage	Displays the overall CPU usage.	%
CPU usage application	Displays the main program's CPU usage (data acquisition and calculation).	%
CPU Usage system	Displays the (operating) system's CPU usage.	%
Free memory	Displays the amount of free memory available.	MB
Used memory	Displays the amount of used memory.	MB
Up time system	Displays how long the operating system has been working, i.e. the time that the device has been on since the last reset.	Days
Up time application	Displays the time that the main program has been running, i.e. the period following a <a href="#">Reset main application</a> or from a switching on of the device or from a <a href="#">Reboot</a> of the device.	Days

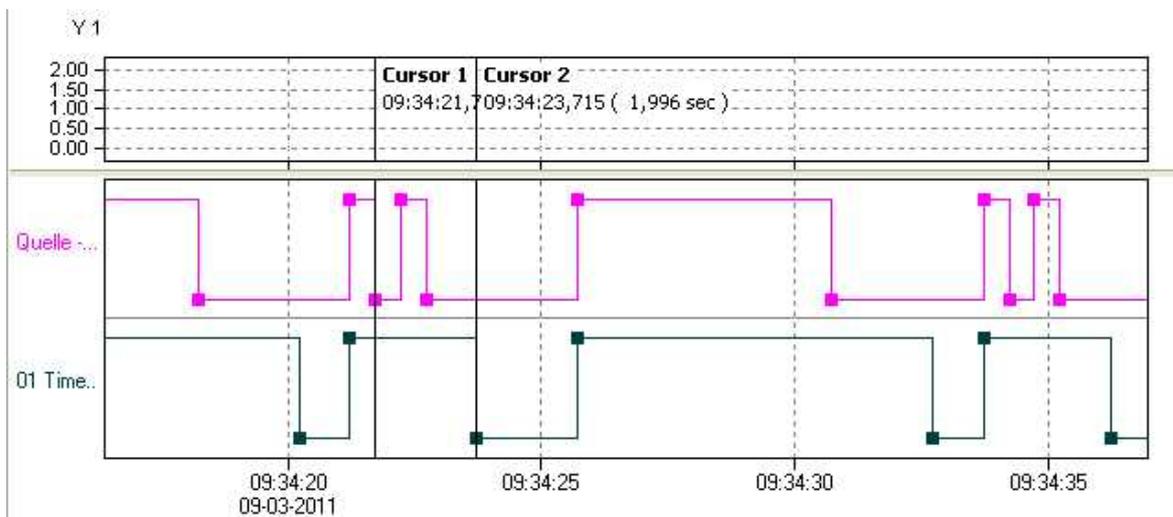
### 5.8.21 Timer

This software channel enables the changing of source signal times. This permits, for example, new trigger times to be created for a subsequent channel or defined signals to be generated for outputting to the process. A *Response delay* mode temporally compresses the signal source and a *Release delay* temporally expands a signal.

**Response delay:** The timer channel starts the delay at the source's change to an active state (*High level* or *Low level* trigger). After the delay, the timer output switches into an active state ("On") for as long as the source retains an active state. If source's active state is shorter than the delay, no reaction takes place at the timer output.



**Release 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 *Edge (both)* triggers). The same edge or a source change from active to inactive starts the delay. After the delay, the timer's output becomes active ("Off").



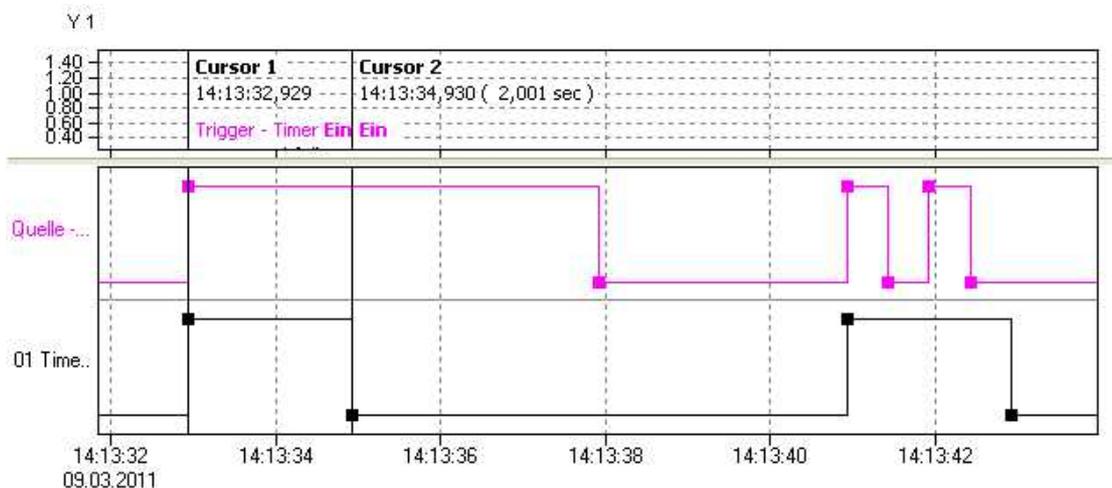
The image shows the signal of a dropout delay with level triggering.

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

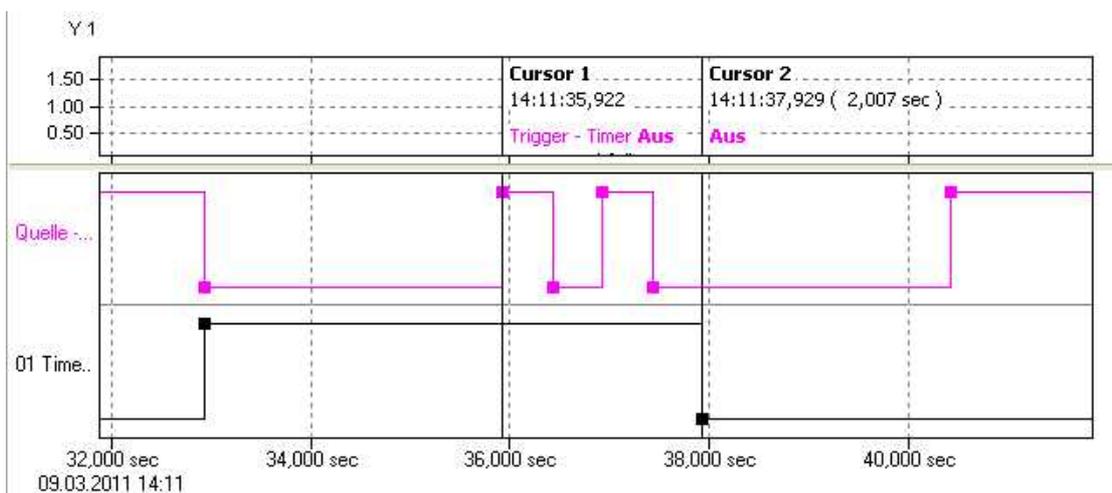
**Delay (s):** Enter either a constant value (*Manual value*) or use *Channel* to select an existing channel whose value determines the delay as a time in seconds.

**Reset:** A reset event (a trigger via *Level* or *Edge*) ends the delay time and sets the timer output in 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.

▼ Example of a dropout delay

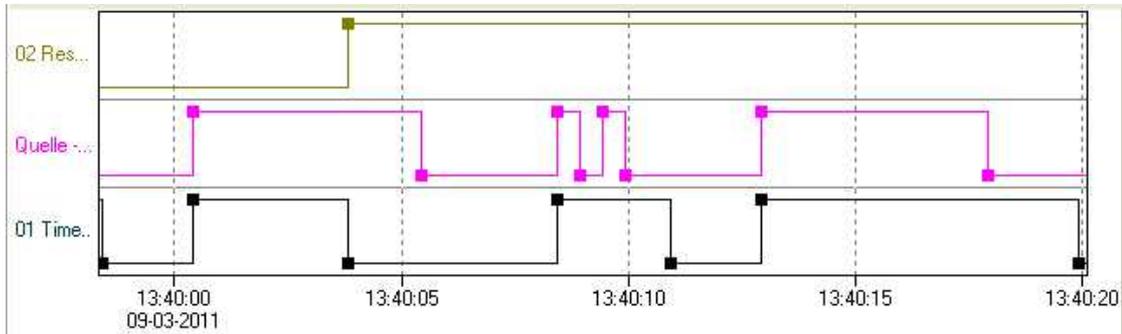


The source (purple curve) triggers with a *rising edge*. The delay is 2 seconds, *Retriggerable* is not enabled.

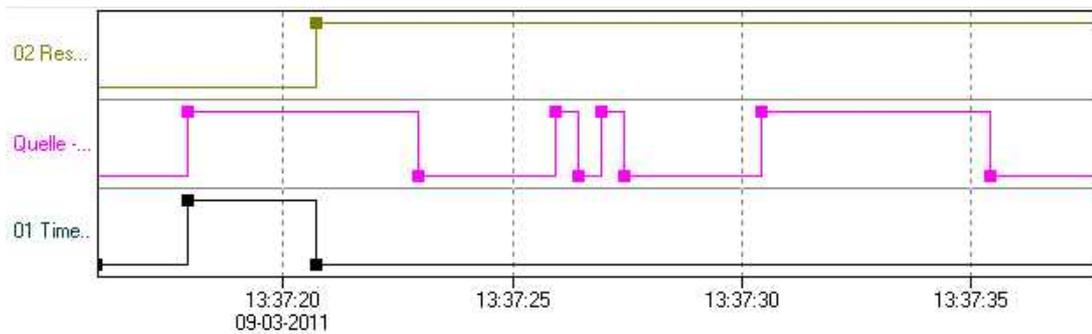


The source (purple curve) triggers with a *falling edge*. The delay is 7 seconds, *Retriggerable* is not enabled.

▼ Example of a reset



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



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

### 5.8.22 Trigger

This software channel uses the signal source to generate a logic signal for further processing. Its output is active ("On") after a trigger event (trigger *High level*, *Low level*, *Rising edge*, *Falling edge* or *Edge (both)*).

A trigger channel can be used for edge detection or recognition of a non-zero numeric value.

### 5.8.23 Alarmclock

This software channel allows the triggering of specific events at specified times. Depending on the configuration, an alarm clock channel can generate one-off or repeat alarms for the specified duration.

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

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

*Reset*: A reset event (a trigger via *Level* or *Edge*) ends the alarm duration and sets the alarm clock output in a 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](#).

### 5.8.24 Counter

This software channel counts events.

**Count up trigger:** The channel's counter is increased by one at the selected edge (*Rising edge*, *Falling edge* or *Edge (both)*).

**Count down trigger:** The channel's counter is decreased by one at the selected edge (*Rising edge*, *Falling edge* or *Edge (both)*).

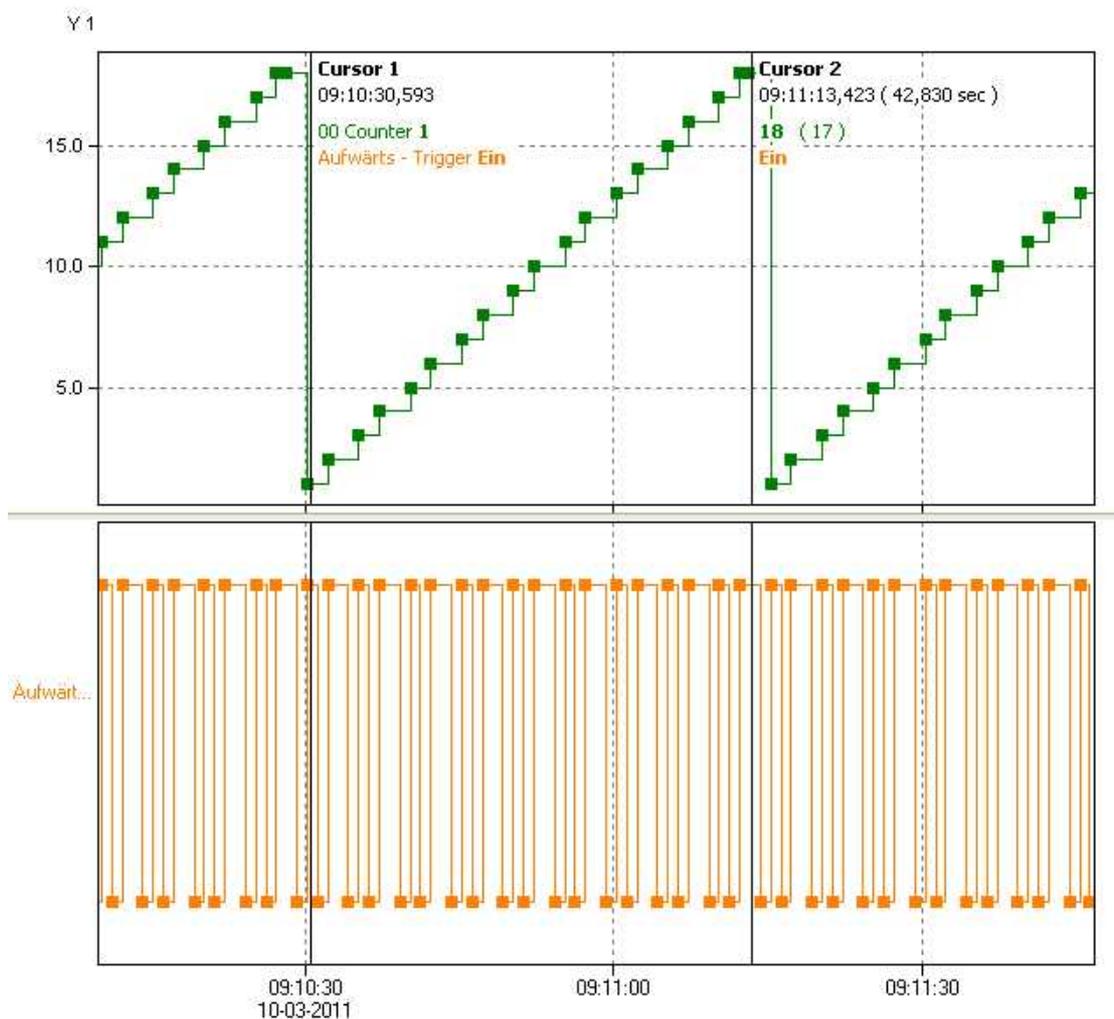
**Reset trigger:** The channel's counter is output and reset internally to zero at the selected edge (*Rising edge*, *Falling edge* or *Edge (both)*). When enabled *Reset trigger* the counter is displayed only at a reset event unless the *Generate intermediate values* option has been enabled.

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

**Output update trigger:** The channel's counter is output at the selected edge (*Rising edge*, *Falling edge* or *Edge (both)*).

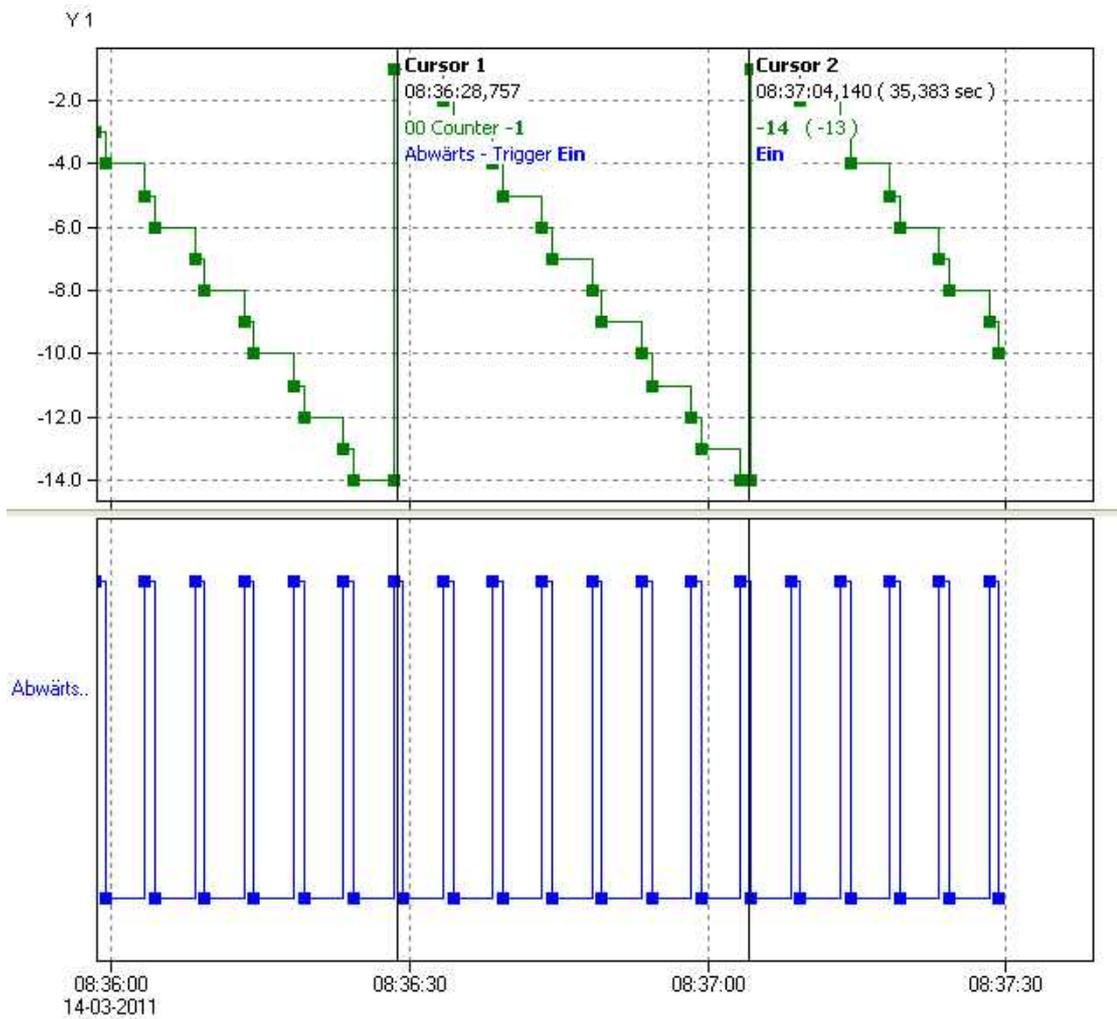
Refer also to [Trigger options](#).

▼ Example of counting up



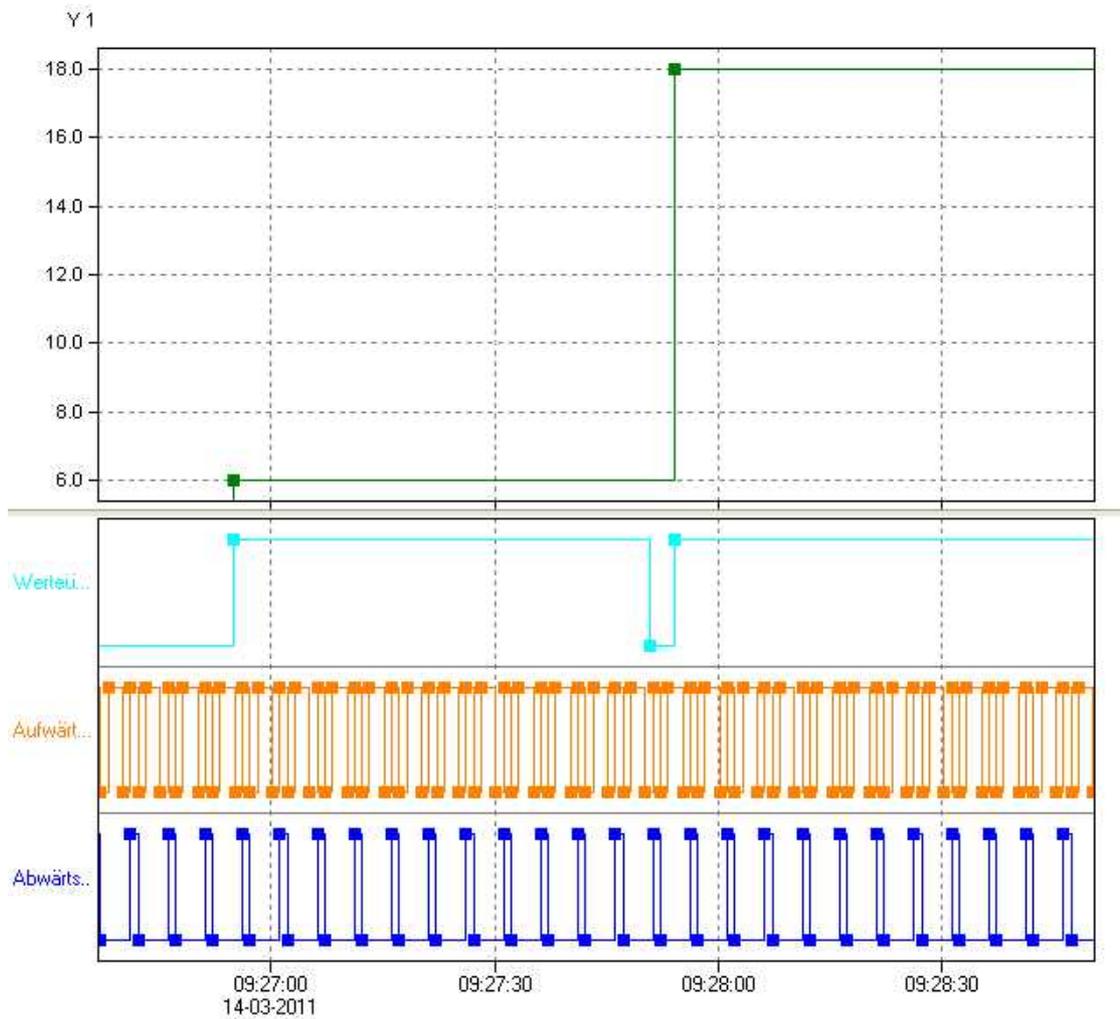
The counter (**green** curve) increases by one for each edge from the source channel (**orange** curve) until the reset trigger becomes active. The Generate intermediate values option is enabled so all new counter states are output immediately.

▼ Example of counting down



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 states are output immediately.

▼ Example of outputting a value



At the time of value output (light blue curve) the counter is output. The option *Generate intermediate values* is disabled so no intermediate values are output.

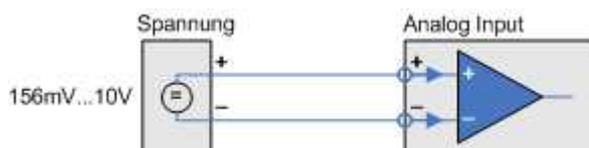
## 6 Connection examples

This section gives examples of typical sensor and actuator connections. It explains the available connection options that exist and how sensors and actuators are configured.

## 6.1 Connecting sensors

### ▼ Measuring voltages at an analog input

Sensors with voltage signals can be connected directly.



#### Info

The largest measurement range is  $\pm 10$  V bipolar or 10 V unipolar.  
The smallest range is  $\pm 156$  mV bipolar and 156 mV unipolar.

### ▼ 20 mA current measurement at an analog input

Sensors with current signals require connection of a load resistor at the device's input terminals. Resistors are available as accessories.



#### Info

The load resistance must be between  $10 \Omega$  and  $500 \Omega$ .

▼ **Measuring temperatures with a thermocouple at an analog input**

Thermocouples can be directly connected. Use the configuration dialog to set the type (J, K, T, R, etc.).



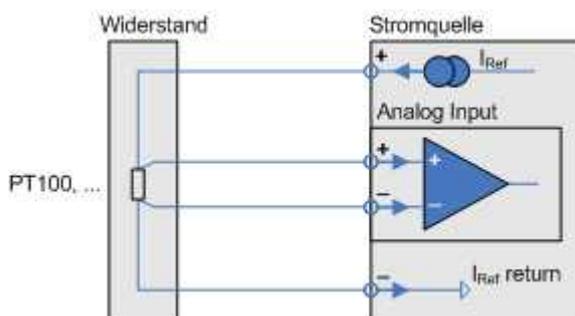
**Info**

The compensation required for the thermocouple is integrated into the device. Enter the compensation channel as the *Reference Junction* in the *Extended settings* tab (for the same I / O module).

▼ **Measuring temperatures / resistances at an analog input**

Connect resistor or temperature probes with 4-wire technology when possible. This connection method provides the best results since current path and measuring circuit are separate. Measurement current in 2- or 3-wire connectors flows through both, or one, measurement lines. Voltage drops on the measuring line can therefore distort readings.

Several constant-power sources are available within the device to supply power.



**Info**

These sources deliver 1 mA. they can measure resistance values of up to 10kΩ.

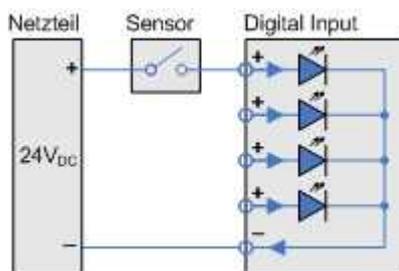
▼ **Sensor at a digital input**

Digital inputs have two variants:

- Input for level (recognition)
- Inputs for frequency measurement or counting

Not every input is usable for both functions.

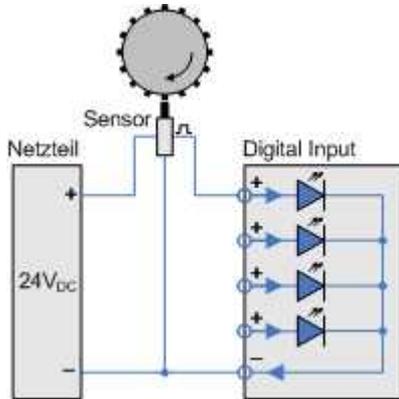
**Level detection**



**Info**

The I / O modules AAST, ADFT, AMDT, DIOT, and IOIT OTPT have digital inputs for level detection. For reliable detection the input signal must have a "low" level ranging from 0 ... 1.5 V, a "high" level ranging from 3.5 ... 90 V and a minimum pulse width of 1 ms. A maximum of 50 signal changes per second (maximum signal frequency) can be recorded.

Frequency measurement/ pulse counting

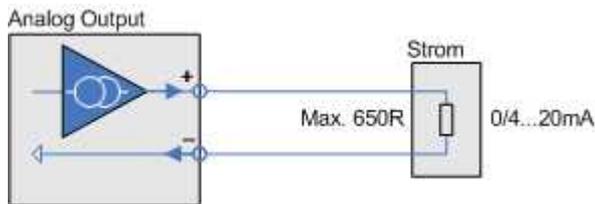


**Info**

The I / O modules ADFT, and AMDT DIOT have digital inputs for frequency measurement / pulse counting. For reliable detection the input signal must have a "low" level ranging from 0 ... 1.5V and a "high" level ranging from 3.5 ... 90V. The maximum measurable signal frequencies are 50 kHz for the ADFT and AMDT module and 30 kHz for the DIOT module.

## 6.2 Connecting actuators

### ▼ Actuator at an analog output



#### Info

The I / O modules AAST and ADIT have power sources as analog outputs.  
The maximum permissible load resistance of the actuator is 650Ω.

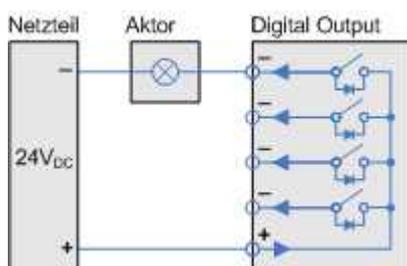


#### Info

The I / O modules ADFT and AMDT have power sources as analog outputs.  
The minimum permissible load resistance of the actuator is 2.5kΩ.

### ▼ Actuator at a digital output, resistive load

To connect an actuator at a digital output requires an external supply voltage of between 5 and 50V<sub>DC</sub> (24 V in the examples).



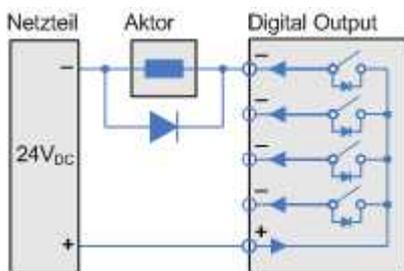


**Info**

The maximum switching voltage is 50V and a maximum switching current of 2.5A.

▼ **Actuator at a digital output, inductive load**

To connect an actuator at a digital output requires an external supply voltage of between 5 and 50V<sub>DC</sub> (24 V in the examples).



**Info**

The maximum switching voltage is 50 V, and a maximum switching current of 2.5 A.  
To protect the output's electronic switches we recommend switching to recovery diodes in parallel with inductive loads.

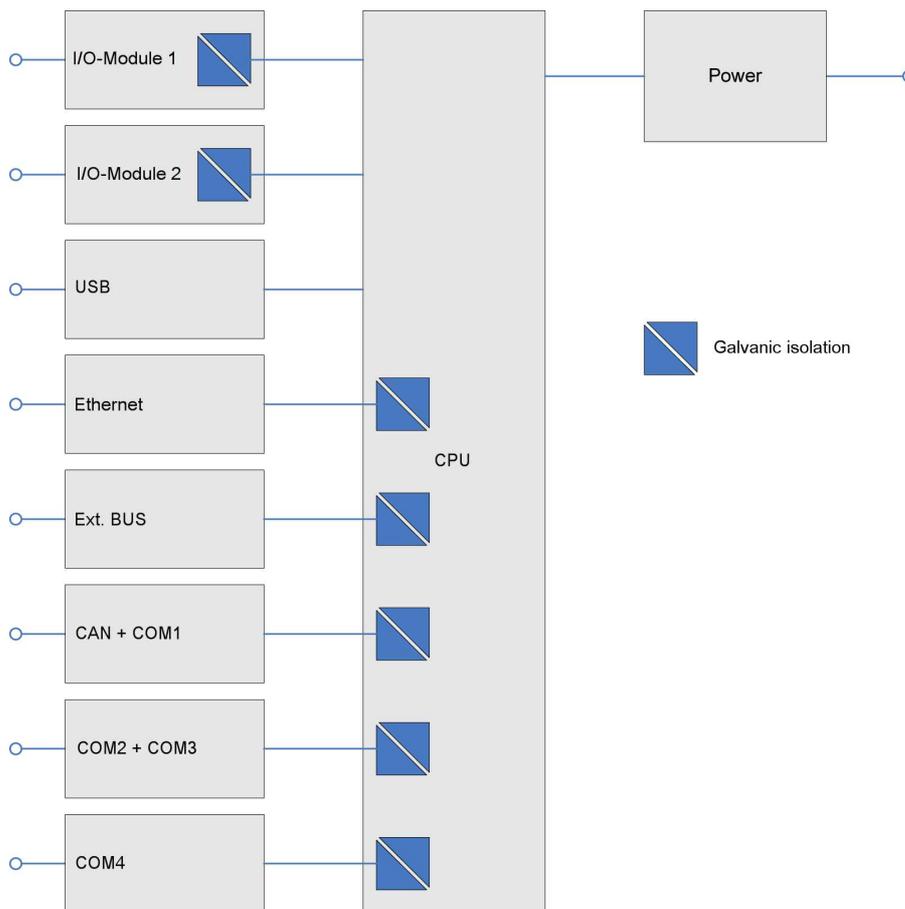
## 7 Measurement technology

The section contains general information and recommendations on using measurement technology.

### 7.1 Galvanic isolation

A device's I/O modules, interfaces, Ethernet, Ext. BUS, CAN, COM1, COM2, COM3 and COM4 are all galvanically isolated from the central unit (CPU and power) as well as from each other. The CAN ports and COM1 are not isolated from each other and nor is COM2 to COM3. For system reasons, the USB interface is not isolated.

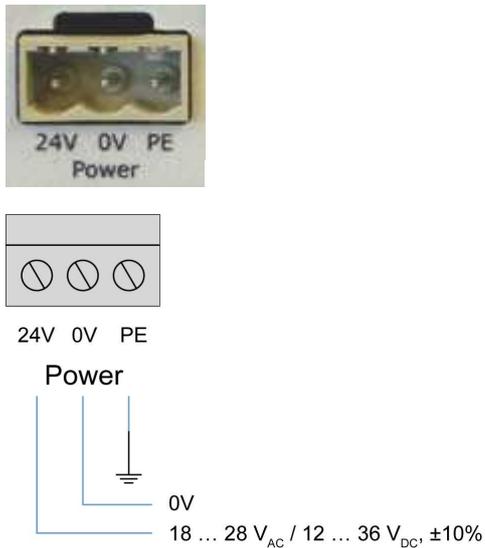
The diagram shows the individual galvanic isolating properties of the device.



Refer also to [shielding](#).

## 7.2 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 0 V terminal(s).



Connect the PE terminal with a  $\geq 2.5 \text{ mm}^2$  cable to the protective earth of your power supply.

Refer also to [Shielding](#) , [Galvanic isolation](#).

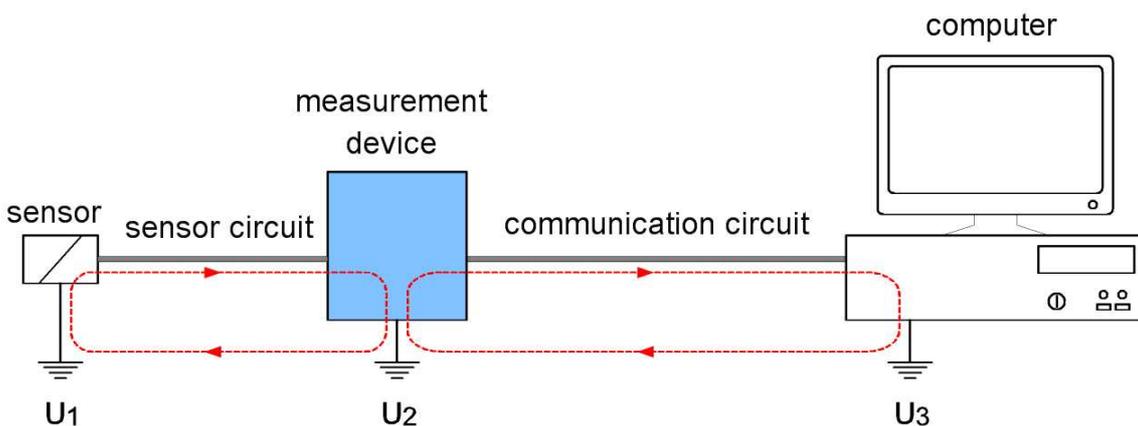
### 7.3 Earth loops

When linking a sensor, measurement device, and computer together then establishes connections 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 a so called earth or ground loop (shown red in the example).

This can have the following effects:

- In practice the earthing points U1 ... U3 shown in the example 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, e.g. 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 creating constant or fluctuating measurement errors.



Prevent earth loops!

#### Earth loop between sensor—measurement device

Galvanic isolation of the I / O modules 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.

Refer also to [potential differences](#).

## **Earth loop between measuring device—computer**

Most of the device's interfaces are galvanically isolated to each other and to the central device. The earth loop in the communication circuit, as shown in the example, does not occur with the device.

Use these interfaces to connect the device to PCs, PLCs or to the equipment from other manufacturers.

Refer also [galvanic isolation](#).

## 7.4 Shielding

Measurement signals can be disrupted by the occurrence of magnetic and electric fields across the measuring circuits, e.g. 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.

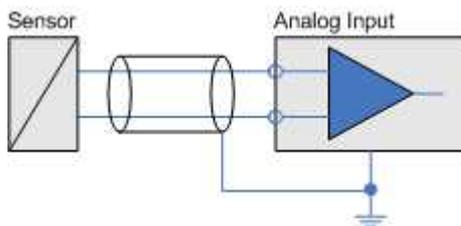
The smaller the sensor signal and/or the higher the sensor impedance, the more important is good shielding for low noise, accurate readings.

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).

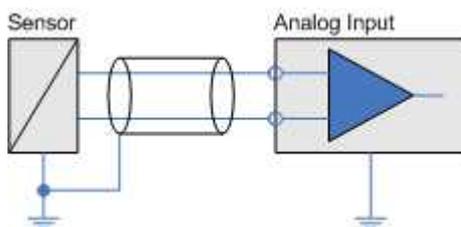
Refer also to [earthing](#).



### b) Sensors with earthing

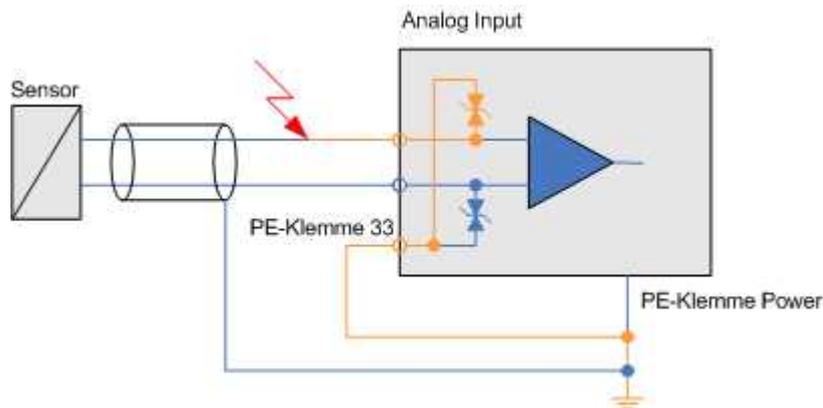
When the use of earth-free sensors is not possible, earth the shield only or attach it to the sensor's earth potential (see example).

Refer also to [potential differences](#).



## 7.5 ESD protection

The ADGT 3.0 module has an earth terminal specifically for ESD protection (ESD, **E**lectro-**S**tatic **D**ischarge ) of the inputs.



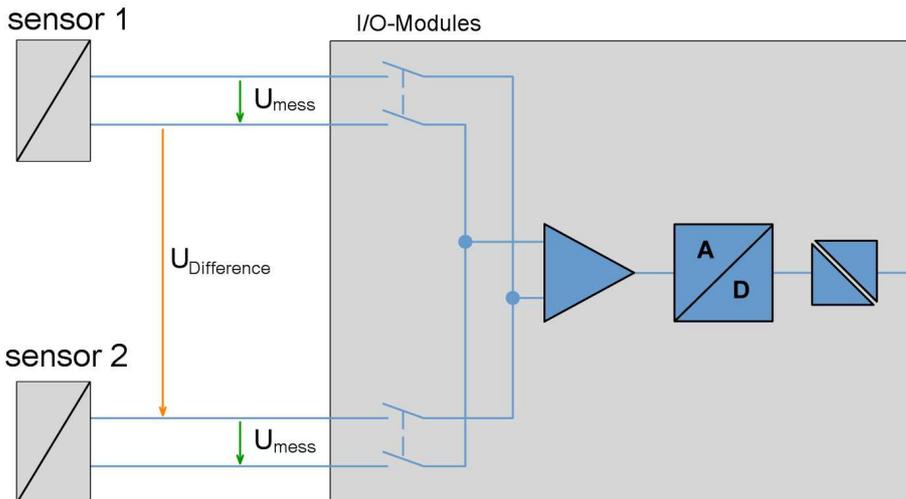
Connect this with the PE labelled terminal (33) via a  $\geq 2.5 \text{ mm}^2$  cable to the protective earth of your power supply.  
Refer also to [earthing](#).



The other modules do not have ESD protection. Therefore, discharge static before coming into contact with the I / O modules. Simply touch a housing with protective earth, the earth contact of the mains socket, or a radiator or water pipe. Modules can be damaged if static is not discharged.

## 7.6 Potential differences

Potential differences can, in principle, always occur between reference potentials of multiple-sensor signals that are connected to the analog inputs of a I/O module. The following figure shows the sensor signals as **green** arrows and  $U_{\text{mess}}$ , and the potential difference between the two sensor signals as an **orange** arrow and  $U_{\text{Difference}}$ .



The reference potential of a measurement circuit of an analog input for a device occurs by a change of channel of the sensors' different reference potentials. Depending on the input circuit of the various I / O modules of a device, the difference voltage  $U_{\text{Difference}}$  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!

**Connector terminals on I/O modules carry electrical potential from the attached sensors/actuators.**

**Before coming into contact with the connectors, ensure the power is off. There should be no voltage at the connector terminals when the attached sensors have varying potentials or earthed high potentials, e.g. when measuring the electrical current of 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.

## 8 Technical specifications

- [Main device](#)
- [AAST, ADGT, ADIT and ADVT](#)
- [ADFT](#)
- [DIOT, IOIT and OTPT](#)

## 8.1 Main device

Weight, approx.	1 kg
Dimensions	200 x 73 x 120 mm
Material	Plastic housing
Humidity	20 ... 80%, non-condensing
Temperature range	-20 ... 60 ° C
Supply <sup>1)</sup>	12 ... 28 V <sub>AC</sub> ± 10% or 12 ... 36 V <sub>DC</sub> ± 10%
Power input, approx.	10 W
Mounting	Rail 35 mm according to DIN EN 60715 or screw fixing
Processor	400 MHz PowerPC with integrated FPU
ROM	8 MB of solid state FlashROM
SRAM	0.5 MB, battery-backed
DRAM	128 MB of DDR
Real-time clock	Resolution of 100 ms, battery-backed
Backup battery	CR2450 lithium battery, backup time of at least 10 years
Web Server	Basic configuration, firmware upgrade, loading and saving configuration

<sup>1)</sup> The AMDT module requires a supply of at least 18 V<sub>AC/DC</sub>

### ▼ Ethernet interface

Ethernet standards	10/100Base-T (half and full duplex), autonegotiation
Protocols	TCP/IP, UDP, ICMP, HTTP, SMTP, NTP Modbus TCP Client/Server
Connector	RJ45 (8-pin connector TP)
Galvanic isolation	1.5 kV <sub>eff</sub>

▼ **USB interface**

Interface Type	USB master
Transmission speed	USB 2.0 Full Speed(USB 1.1 compatible)
Power for external devices	5 V max. 500 mA (High Power)
Connector	USB type A

▼ **External bus (Ext. Bus)**

Interface Type	CAN bus
Baudrate	max. 1 Mbaud
Connector	LP-3-pin terminal block (e.g. Wieland type 8113B/3VL)
Galvanic isolation	1 kV

▼ **COM1**

Interface Type	RS485 interface
Baudrate	max. 12 Mbaud
Connector	9-pin D-SUB connector, pin assignment to IEC 61158 / EN19245 T1
Galvanic isolation	1 kV (no isolation to CAN)
Features	

▼ **CAN (CAN bus)**

Baudrate	max. 1 Mbaud
Connector	9-pin D-SUB connector, pin assignment according to CiA DS102-1 (pin 2 and pin 7)
Galvanic isolation	1 kV (no isolation to COM1)

▼ COM2

Interface Type	RS485 interface
Baudrate	max. 12 Mbaud
Connector	9-pin D-SUB connector, pin assignment to IEC 61158 / EN19245 T1
Galvanic isolation	1 kV (no isolation to COM3)
Features	

▼ COM3

Interface Type	RS232 interface
Baudrate	max. 5 Mbaud
Connector	9-pin D-SUB connector, 3 pins used
Galvanic isolation	1 kV (no isolation to COM2)

▼ COM4

Interface Type	RS232 interface
Baudrate	max. 5 Mbaud
Connector	9-pin D-SUB connector, pin assignment according to DIN 41 652, part 1 (ISO 4902) (such as PC connector assignment)
Galvanic isolation	1 kV

## 8.2 I/O modules

### 8.2.1 I/O modules: AAST, ADGT, ADIT and ADVT

▼ Analog inputs

Number of inputs	AAST: 4 ADGT: 8 ADIT: 10 ADVT: 15
Connections	Terminals, max. diameter 2.5 mm <sup>2</sup>
Voltage measuring ranges	± 156 mV to ± 10V (bipolar) and +156 mV to +10 V (unipolar)
Current range	± 20 mA, 0 ... 20 mA and 4 ... 20 mA Current measurement requires a load resistance of 10 ... 500 Ω
Sampling rate	AAST, ADIT and ADVT: Max. of 600 measurements / s ADGT: Max. 60 measurements / s Sequential sampling, A / D measurement time for each channel individually adjustable
Resolution	24 bits (about 7 decimal digits)
Input impedance	> 1 GΩ at ADGT > 10 M
Measurement error (DC)	Voltage / current: ±0.01% of measurement range / end value Pt100: ±0.1 K Pt1000: ±0.1 K Thermocouples: ±0.1% of end value following compensation
Thermocouples	Built in cold junction built-in, external optional NiCr-NiAl (K), NiCr-CuNi (E), NiCrSi-NiSi (N), Fe-CuNi (L), Fe-CuNi (J), Pt10Rh-Pt (S), Cu-CuNi (U), Pt13Rh-Pt (R), Cu-CuNi (T), Pt30Rh-Pt6Rh (B), W5Re-W26Re (C) Measuring range -270 ° C ... 2320 ° C depending on thermocouple

Resistance probe / thermometer	Pt50 to Pt5000, Ni50 to Ni5000, YSI400 2-wire, 3-wire and 4-wire 1 mA reference current Measuring range -270 ° C ... 850 ° C
Resistance measurement	0 ... 10 kΩ
pH measurement	Integrated temperature compensation
Self-calibration	DC offset, cyclical, frequency adjustable
Digital filter	Low pass 6 ... 1000 Hz. The cut-off frequency is automatically adjusted to the sampling rate.
Potential isolation of main device	750 V DC.
Dielectric withstand voltage of the channel	110 V
Permissible differential voltages from channel to channel	ADGT V2.0: 400 V <sub>DC</sub> ADGT V3.0: 650 V <sub>DC</sub> AAST, ADIT and ADVT: 110 V

▼ Analog outputs

Number of outputs	AAST: 4 ADIT: 1
Output signal:	0 / 4 ... 20 mA, maximum load resistance 650 Ω
Resolution	16 bit
Signal error	±0.05%
Potential isolation	750 V from channel to channel and main device

▼ **Digital inputs for level detection**

Number of inputs	AAST: 2
High level	3.5 ... 90 V / 2 mA (typ. 2.7 mA at 5 V)
Low level	0 ... 1.5 V / 0 ... 1.5 mA
Refresh rate	1 kHz (1 ms)
Minimum pulse width that can be evaluated	1 ms
Maximum signal frequency	50 Hz
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

▼ **Digital outputs**

Number of outputs	AAST: 2 ADIT: 1
Switching voltage	max. 50 V <sub>DC</sub>
Switching current	max. 2.5 A <sub>DC</sub>
Inverse diode	Integrated
Potential isolation	2.5 kV

### 8.2.2 I/O modules: DIOT, IOIT and OTPT

▼ Digital inputs for level detection

Number of inputs	DIOT: 12, including 11 for frequency measurement / pulse counting IOIT: 24 OTPT: 1
High level	3.5 ... 90 V / 2 mA (typ. 2.7 mA at 5 V)
Low level	0 ... 1.5 V / 0 ... 1.5 mA
Refresh rate	1 kHz (1 ms)
Minimum pulse width that can be evaluated	1 ms
Maximum signal frequency	50 Hz
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

▼ Digital inputs for frequency measurement / pulse counting

Number of inputs	DIOT: 11
High level	3.5 ... 90 V / 2 mA (typ. 2.7 mA at 5 V)
Low level	0 ... 1.5 V / 0 ... 1.5 mA
Gate time	1 ms ... 6000 ms, adjustable in increments of 1
Frequency measurement	0 ... 30 kHz.
Measurement error	0 ... 1 kHz: $\pm 1$ Hz >1 ... 10 kHz: $\pm 5$ Hz >10 ... 30 kHz: $\pm 10$ Hz
Counter width	16 bit
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

▼ Digital outputs

Number of outputs	DIOT: 16 IOIT: 1 OTPT: 24
Switching voltage	max. 50 V <sub>DC</sub>
Switching current	max. 2.5 A <sub>DC</sub>
Inverse diode	Integrated
Potential isolation	2.5 kV

### 8.2.3 I/O module: ADFT

▼ Analog inputs

Number of inputs	8								
Connections	Terminals, max. diameter 2.5 mm <sup>2</sup>								
Voltage measuring ranges	±156 mV to ±10 V								
Current range	± 20 mA, 0 ... 20 mA and 4 ... 20 mA Current measurement requires a load resistance of 10 ... 500 Ω								
Measurement frequency range (-3 dB)	0 ... 4000 Hz.								
Sampling rate	10 ... 10000 Hz, in 10 stages, individually adjustable for each channel  Channels with the same sampling rate can be sampled simultaneously								
Sampling rate	10 ... 8500 measurements / s  10 ... 10 000 measurements / s using only the analog inputs 1 ... 4								
Resolution	14 bits (approx. 1.2 mV in the 10V range)								
AC / DC coupling	DC coupling preset, switching via DIP switch on the device.								
Input impedance	0.8 MΩ								
Measurement error (DC)	<table border="0"> <tr> <td>Measurement range ±1.25 V to ±10 V</td> <td>±0.1% from unipolar measurement range</td> </tr> <tr> <td>Measuring range ± 0.625 V:</td> <td>±0.2% from unipolar measurement range</td> </tr> <tr> <td>Measuring range ± 0.312 V:</td> <td>±0.2% from unipolar measurement range</td> </tr> <tr> <td>Measuring range ± 0.156 V:</td> <td>±0.4% from unipolar measurement range</td> </tr> </table>	Measurement range ±1.25 V to ±10 V	±0.1% from unipolar measurement range	Measuring range ± 0.625 V:	±0.2% from unipolar measurement range	Measuring range ± 0.312 V:	±0.2% from unipolar measurement range	Measuring range ± 0.156 V:	±0.4% from unipolar measurement range
Measurement range ±1.25 V to ±10 V	±0.1% from unipolar measurement range								
Measuring range ± 0.625 V:	±0.2% from unipolar measurement range								
Measuring range ± 0.312 V:	±0.2% from unipolar measurement range								
Measuring range ± 0.156 V:	±0.4% from unipolar measurement range								
Anti-aliasing filter	Optional digital low-pass filter 8./4. Order for sampling 100-10000 measurements / s. The cut-off frequency is automatically adjusted to the sampling rate.								
Dielectric withstand voltage of the channel	±250 V <sub>DC</sub>								
Permissible differential voltages from channel to channel	100 V DC.								

▼ Analog outputs

Number of outputs	2
Output signal	0 ... 10 V / 0 ... 4 mA
Resolution	12 bits (approx. 2.4 mV)
Signal error	± 0.25% of output range or ± 25 mV
Earth reference	Terminals "-" are connected with 1 kOhm to the internal analog ground

▼ Digital inputs for level detection

Number of inputs	4, including 2 for frequency measurement / pulse counting
High level	3.5 ... 90 V / 2 mA (typ. 2.7 mA at 5 V)
Low level	0 ... 1.5 V / 0 ... 1.5 mA
Refresh rate	1 kHz (1 ms)
Minimum pulse width that can be evaluated	2.5 ms
Maximum signal frequency	50 Hz
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

▼ Digital inputs for frequency measurement / pulse counting

Number of inputs	2
High level	3.5 ... 90 V / 2 mA (typ. 2.7 mA at 5 V)
Low level	0 ... 1.5 V / 0 ... 1.5 mA
Gate time	250 ms ... 5000 ms, adjustable in increments of 250
Frequency measurement	0.2 Hz ... 50 kHz
Measurement error	0.2 Hz ... 100 Hz ± 1% of the input frequency >100 Hz: ±1 Hz
Potential isolation	2.5 kV
Reverse polarity protection	1 kV

## ▼ Digital outputs

Number of outputs	4
Switching voltage	max. 50 V <sub>DC</sub>
Switching current	max. 2.5 A <sub>DC</sub>
Inverse diode	Integrated
Potential isolation	2.5 kV

**8.2.4 I/O module: AMDT**

The AMDT I/O module on vibration measurement is dealt with in a separate chapter.

Refer to [E/A-Modul AMDT](#).

Technical data is available in the [I/O module AMDT, Technical specifications](#) section.

## 9 I/O module AMDT

This section of the documentation describes using and configuring the I/O module AMDT.

The I/O module AMDT has been designed for vibration measurement technology. The efficiency is reached by a DSP (Digital Signal Processor). The processor's firmware (i.e. software within the I/O module) provides many signal processing functions.

The documentation is provided under the following headings:

- Hardware
- [Functions](#)
- [Configuration and operation](#)

Each section can be read independently. Just select the section you require.

The content is based on this consistent state-of-the-art :

- ProfiSignal-CD: V3.1.4
- Device firmware: V232
- AMDT board: V2.0
- AMDT firmware: 3.58

Copyright © 2003-2011 Delphin Technology AG. All rights reserved.

This document's content, especially text, images, and graphics are protected by copyright. When not otherwise stated, the copyright belongs to Delphin Technology AG, Lustheide 81, in 51427 Bergisch Gladbach, Germany.

All the trademarks and brands used in this manual refer only to the respective product or trademark holder. Delphin Technology claims no rights other than those to its own trademarks and brands.

## 9.1 Safety advice

Use only the power supply connector delivered, or a power supply with protective insulation, to power the LogMessage device.



### WARNING!

**Sensors / signals without potential isolation and which have a high-voltage potential, e.g. current measurement in the phase instead of neutral conductor of the mains voltage, produce voltage also at the device's connectors.**

**In such cases, check for voltage at the connectors before coming into contact with them.**

**The device's I/O modules are potentially isolated to each other and to other components within the device. Potential differences greater than 750V can therefore not occur (potential difference cannot be detected from measurement data).**

### Replacing/exchanging I/O modules



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

## 9.2 Introduction

Dear User,

Thank you for purchasing the I/O module AMDT. With this module 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, engineers or similarly qualified persons wishing to install the I/O module AMDT into a 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.

### Contact:

Delphin Technology AG  
Lustheide 81

51427 Bergisch Gladbach (Refrath), Germany

Telephone: +49 2204 97685-0  
Telefax: +49 2204 97685 -85

Email: [info@delphin.de](mailto:info@delphin.de)  
Internet: [www.delphin.de](http://www.delphin.de)

### Contact USA:

Delphin Technology Corp.  
4860 Cox Road, Suite 2000

Glen Allen, VA 23660  
Virginia, USA

Telephone: +1 804 217 8391  
Telefax: +1 804 747 6182

Email: [info@delphin.com](mailto:info@delphin.com)  
Internet: [www.delphin.com](http://www.delphin.com)

### 9.2.1 Included in delivery

The I/O module AMDT is usually pre-installed with delivery of the LogMessage device. Devices can be equipped with various I/O modules. An existing I/O module may therefore be exchanged for an I/O module AMDT.

Included in delivery:

- A device configured to individual customer requirements with pre-installed or separate I/O module AMDT
- CD containing software
- Documentation

### 9.2.2 Symbols used in this documentation

To make reading of this manual easier, we have used the following symbols:

	<b>WARNING!</b>
<p>This symbol warns of a <i>potential</i> hazard which - if the safety requirements are not followed - may be fatal or cause serious physical injury.</p>	

	Indicates important information.
---	----------------------------------

	<b>Info</b> Refers to a special option or explains a special feature.
---	--

We use *italics* to highlight individual words within the text. *Keyboard input* is highlighted in this way. Program menus have a grey background with arrows indicating the respective sub-menu which need to be accessed: Connect → Add driver (connection) → LogMessage device . Also highlighted in grey and displayed in italics are the dialog headings, buttons, check boxes, input field names, etc. *Display status*.

This should help you to find the relevant fields and buttons or menus within the corresponding software.

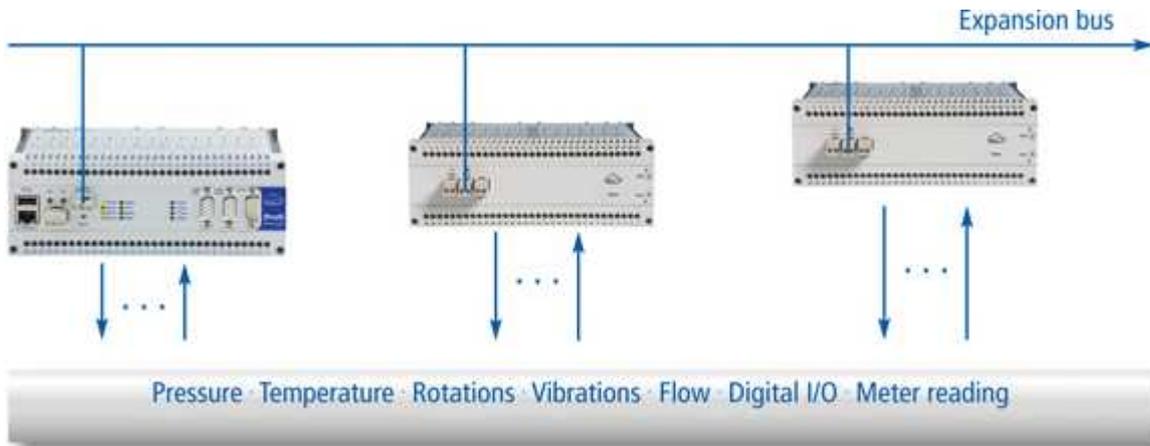
#### Symbols on the device



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

## 9.2.3 Project planning

LogMessage systems are made up of a base device and optional extension devices (the graphic shows a LogMessage system).



Each installed I/O module communicates with a CPU via an expansion bus. The I/O module AMDT is equipped with the fastest sampling and transfer rates. Specific conditions need to be taken into account when planning a system.

### Regulations according hardware set up

- One I/O module AMDT can be installed in any one slot. Full functioning is then available. When setting parameters, take into account the maximum transfer rate of 10,000 samples/s.
- Two I/O modules AMDT can be installed in any of the available slots. Ensure adequate ventilation when both I/O module AMDTs are installed in the base device. Full functioning capability is however no longer available. Both AMDT modules can continuously transmit characteristic values but only one AMDT can continuously transmit time signals or frequency spectrums or both.
- Two synchronized I/O modules AMDTs can be installed in any of the available slots. Synchronization requires additional wiring and occupies digital input 4 and digital output 4. Ensure adequate ventilation when both I/O modules AMDT are installed in the base device. Synchronization is available only in the "non-continuous recording" operating mode. Both AMDT modules can transfer time signals, frequency spectrums and characteristic values continuously and synchronized. Refer here to the section on [synchronizing two AMDT modules](#).
- Three or more I/O modules AMDT can not be installed.

### Regulations according number of usable analog inputs

- Using a digital high pass filter or band pass filter can be limited to 1..4 analog inputs - depending on board revision. An overview is available in the section [digital filters](#).
- Using a digital integrator can be limited to 1..4 analog inputs - depending on board revision. An overview is available in the section [Integrator](#).
- The application "Vibration severity measurement with acceleration sensors" (using a digital band pass filter and an integrator) can be limited to 1..4 analog inputs - depending on board revision. Details on this application are described in the manual "Applications with AMDT".
- The application "Bearing diagnostics with envelope spectrum" (using a digital demodulation filter) can be limited to 1..4 analog inputs - depending on board revision. Details on this application are described in the manual "Applications with AMDT".

### Regulations according phase measurement

Be aware of the following when using phase characteristic in rotating machinery: Phase measurement can be used only for low rotation speed (typ. < 500 RPM). Acquisition of 1 to 10 signal periods within a time signal block is significant. Refer here to the sections on [characteristic phase of main amplitude](#) and [characteristic phase of 1X/2X/3X/xX component](#).



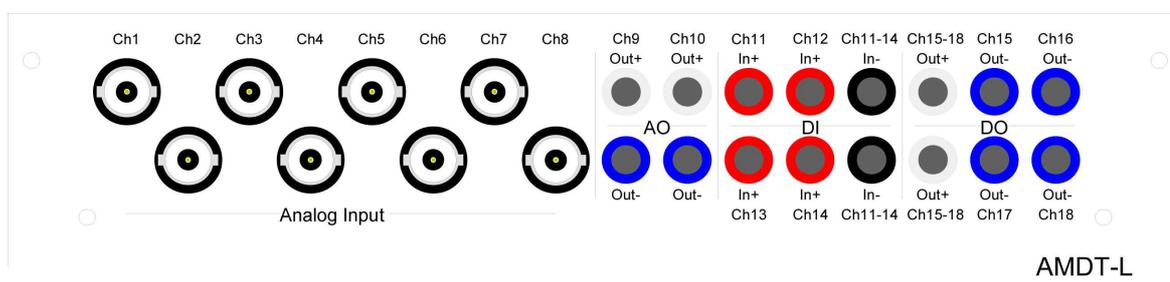
**Shielded cabling**

The I/O module enables measurement in the signal range DC to 8 kHz. This requires the use of shielded (single-sided shielding connected to protective earth) or twisted pair cables.

**Sensors**

Information on connecting special sensors are available in the manual "Applications with AMDT".

**9.3.2 Connector panel (laboratory)**

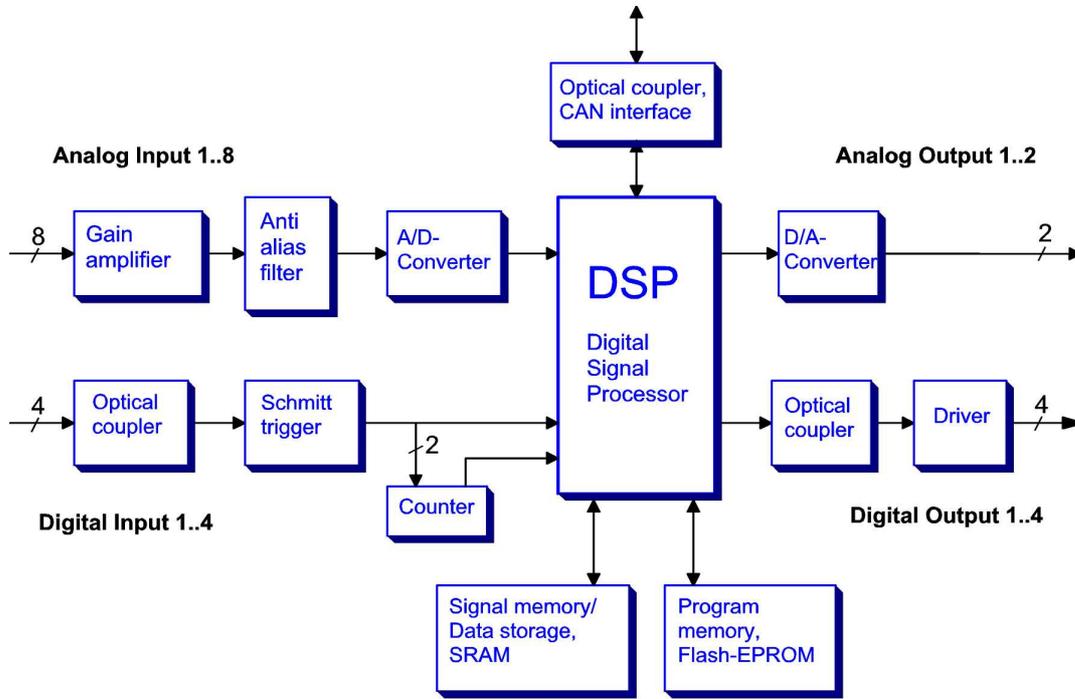


**Information on connections**

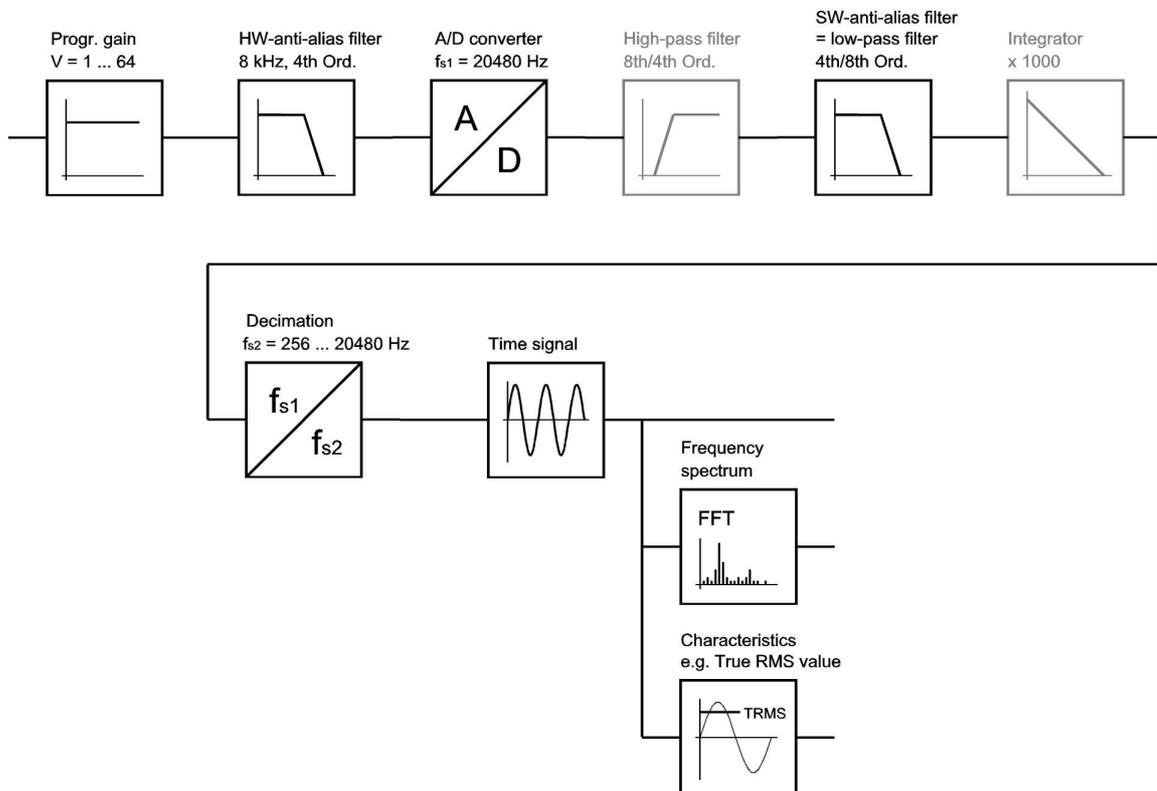
Refer to [connector panel \(industry\)](#).

### 9.3.3 Block circuit diagram

Block circuit diagram for hardware



Block circuit diagram for an analog input signal



### 9.3.4 Technical specifications

Specifications may change as part of ongoing technical developments.

#### 9.3.4.1 Galvanic isolation

The complete analog set up (analog inputs 1 ... 8 and analog outputs 1 ... 2) is galvanically isolated to the rest of the system.

Each digital input/output is galvanically isolated to the rest of the system.

The CAN-Bus interface (Ext. BUS, communication with base device or main CPU) is likewise galvanically isolated.

#### 9.3.4.2 Analog inputs

##### Properties

8 Analog inputs. 14-bit resolution. Differential inputs. 0,8 MΩ impedance.  
A potential difference totalling 100V is permitted between the differential inputs ('+' connector). Input protection to ±250 V.

##### Sampling frequency

Real synchronous/parallel sampling.

- Non-continuous sampling: A max. sampling frequency of 20480 Hz for 8 channels gives a total sampling rate of about 160000 samples/s.
- Continuous sampling: A max. sampling frequency of 1024/2048/4096 Hz for 8/4/2 channels gives a total sampling rate of about 8000 samples/s.

##### Signal bandwidth / Anti-Alias-Filter (HW)

Signal bandwidth is : DC to 8 kHz ±0,8 kHz.

##### Transfer rate for measurement data

A max. 10000 samples/s

##### Measurement range

Seven voltage measurement ranges are available:

Measurement range	V	<b>±10</b>	±5	±2.5	±1.25	±0.625	±0.312	±0.156
Resolution	mV	<b>1.2</b>	0.6	0.3	0.15	0.08	0.04	0.02

0/4 ... 20 mA signals can be converted to voltage signals using terminating resistors of, for example, 50/100/250 Ω. Resistors are to be externally attached between the '+' and '-' connectors.

**Accuracy**

DC-accuracy is factory set using calibration and adjustment. Basic accuracy is  $\pm 0.1$  to  $\pm 0.4$  % of the (unipolar) measurement range.

Measurement range	V	<b><math>\pm 10</math></b>	$\pm 5$	$\pm 2.5$	$\pm 1.25$	$\pm 0.625$	$\pm 0.312$	$\pm 0.156$
DC accuracy	mV	<b><math>\pm 10</math></b>	$\pm 5$	$\pm 2.5$	$\pm 1.3$	$\pm 1.3$	$\pm 0.9$	$\pm 0.6$
	%	<b>0.1</b>	0.1	0.1	0.1	0.2	0.3	0.4

For 0/4 ... 20 mA signals, terminating resistors need to be used that have an accuracy greater than 0.1 %.

**AC-coupling**

The differential input is factory set as DC-coupled. Switching to AC-coupling is possible using a DIP switch on the signal conditioning board. The DC part of a signal is eliminated through a HW-filter. Cut-off frequency is around 4 Hz.

The DC part of a signal can also be eliminated through a SW-filter (i.e. through a DSP).

**Scaling / sensor compensation**

Channels can be individually scaled. Scaling takes place in the required unit (e.g.  $\pm 100 \mu\text{m}$  for displacement sensors or  $\pm 50 \text{ g}$  for acceleration sensors). Zero offset correction and amplification correction can be performed using sensor correction.

**Anti-Alias-Filter (SW)**

The (SW) Anti-Alias-Filter's frequency limit is set automatically at 40 % of the sampling frequency setting. This filter is optional. It is a digital deep pass of the 8th to 4th order with Butterworth characteristic.

**Application**

Analog inputs deliver continuous or event-triggered recording of vibration/wave signals or of signals requiring rapid sampling.

**9.3.4.3 Analog outputs**

**Properties**

2 analog outputs. Voltage range of 0 to 10 V. Resolution of 12 bit and/or 2.4 mV.  
 Board V2.0.x : Output range restricted to 0.3 V to 9.7 V.  
 Board V2.1.x : Output range is 0 to 10 V.  
 Max. load of 4 mA at min. 2.5 k $\Omega$ .

**Refresh rate**

Determined by source channel (e.g. set-point channel).  
 Typical rates are 0 ... 10 Hz. Dependent on DSP load.

**Accuracy**

DC-accuracy is factory set using calibration and adjustment.  
Basic precision is  $\pm 0,25$  % of the output range, i.e.  $\pm 25$  mV.

**Scaling**

Channels can be individually scaled. Scaling takes place in the required unit (e.g. 0 to 100  $\mu\text{m}$  for distance/clearance sensors or 0 to 50 g for velocity sensors)

**Application**

Analog outputs are used as monitors for specific measurement data (e.g. speed or vibration amplitude). Also as signal generators (z. B. set-point ramp).

**9.3.4.4 Digital inputs****Properties**

4 digital inputs. Galvanic isolation up to 2.5 kV. Reverse polarity protection up to 1 kV.  
Low-level 0 ... 1.5 V / 0 ... 1.5 mA. High-level 3.5 ... 90 V / 3 mA.

**Refresh rate**

Digital inputs are sampled at 1 kHz (1 ms). The minimum signal pulse width is 1 ms. Recommended pulse width is  $>2.5$  ms.  
Maximum continuous signal frequency is 50 Hz.

**Application**

Digital inputs are used as trigger sources with simultaneous frequency or rotation speed measurement and phase measurement.

**9.3.4.5 Counter****Properties**

2 or 4 digital inputs (see above) are each equipped with 16-bit counters. Choice of pulse counting in the 0 to 65535 range, or frequency measurement in the 0.2 Hz to 30 kHz range.  
Automatic switching of measurement mode at 100 Hz

**Refresh rate**

Counters are sampled at 4 Hz (250 ms). The minimum evaluable pulse width of a signal is 0.02 ms. Recommended pulse width is  $>0.1$  ms.

**Frequency measurement precision**

Basic accuracy is  $\pm 1$  % of the input frequency up to 100 Hz and  $\pm 1$  Hz above 100 Hz.

**Application**

Digital inputs are used as trigger sources with simultaneous rotation speed measurement and phase measurement.

## 9.3.4.6 Digital outputs

### Properties

4 digital outputs. Galvanic isolation up to 2.5 kV. Switching voltage max. 50 V<sub>DC</sub>. Switching current max. 2.5 A<sub>DC</sub>. Integrated protection diode. Recovery diode external.

### Refresh rate

Determined by source channel (e.g. timer channel). Typical range 0 ... 10 Hz; dependent on DSP load.

### Application

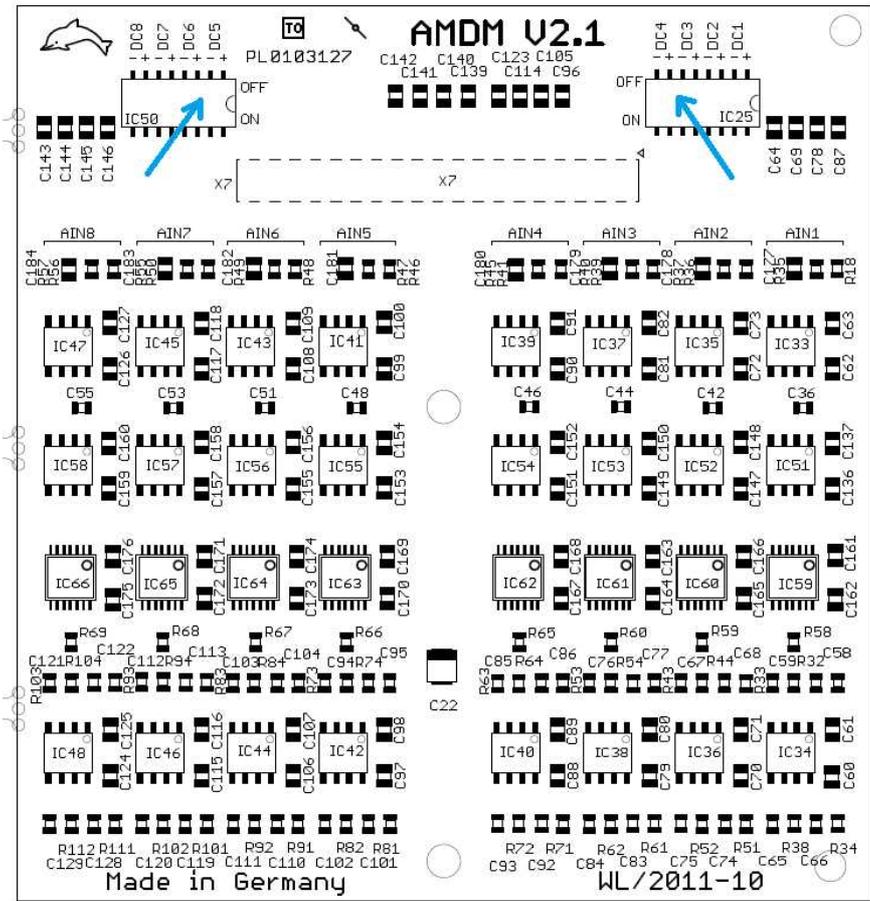
The digital outputs report warnings or alarms (e.g. generated by limits on vibration characteristics). Signals are also delivered for process control.

### 9.3.5 Attachment

- [Setting AC-coupling for analog inputs](#)
- [External switching](#)

#### 9.3.5.1 AC-coupling for analog inputs

An analog input's DC-coupling can be switched to AC-coupling via two DIP switches on the signal conditioning board.



Two switches require activating. Analog input 1 is located on the right.

Switch position	Function
OFF (up)	AC-coupling
ON (down)	DC-coupling

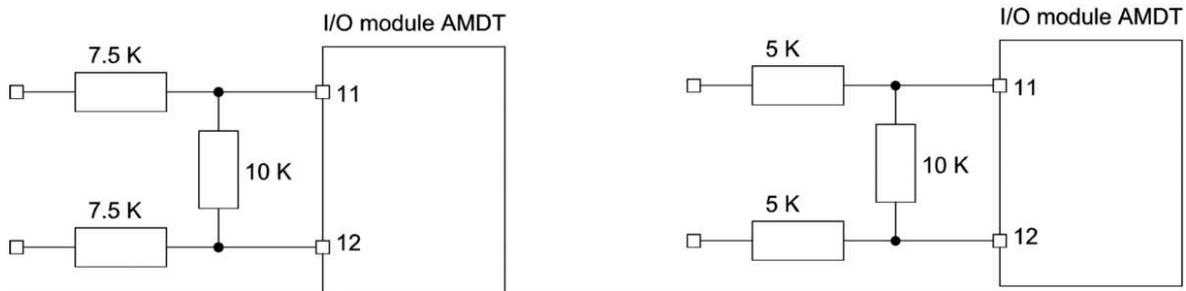
AC-coupling is based on 0.1 µF (50 V) serial capacitors – these provide a high-pass cut-off frequency of 4 Hz.

**9.3.5.2 External circuits**

The following includes examples of external circuits.

**External divider for analog inputs and measurement range  $\pm 25\text{ V}$  or  $\pm 20\text{ V}$**

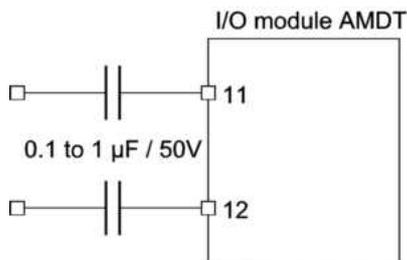
An extended measurement range of  $\pm 25\text{ V}$  or  $\pm 20\text{ V}$  can be achieved with a symmetrical external resistor divider. The recommended wiring appears as follows:



The resistor accuracy class should be (depending on requirements) 0.1 % to 1 %. Input impedance reduces here to 25 or 20 k $\Omega$ . Measuring point scaling must be performed using the DataService Configurator program to raise the factor to 2.5 or 2.0.

**External AC-coupling**

AC-coupling can be achieved with symmetrical capacitors. The recommended wiring appears as follows:

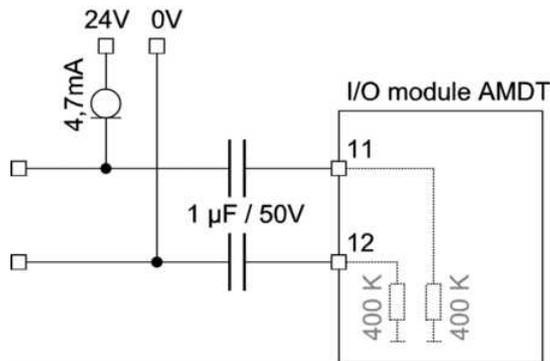


Non-polarized capacitors must be used. The input high-pass has a cut-off frequency of 4 ... 0.4 Hz.

External AC-coupling is useful for mobile systems. For fixed installations, refer to [AC-coupling for analog inputs](#).

**External supply for ICP acceleration sensors**

Basic supply and coupling of measurement signals can be achieved with three components. The recommended wiring appears as follows:



The sensor is supplied through a constant current diode. An external source of 24 V<sub>DC</sub> is required. The dynamic signal undergoes capacitive separation from the static DC operating point voltage. The capacitors and the AMDT input resistors form a symmetrical high-pass with a Cut-off frequency of 0.4 Hz.

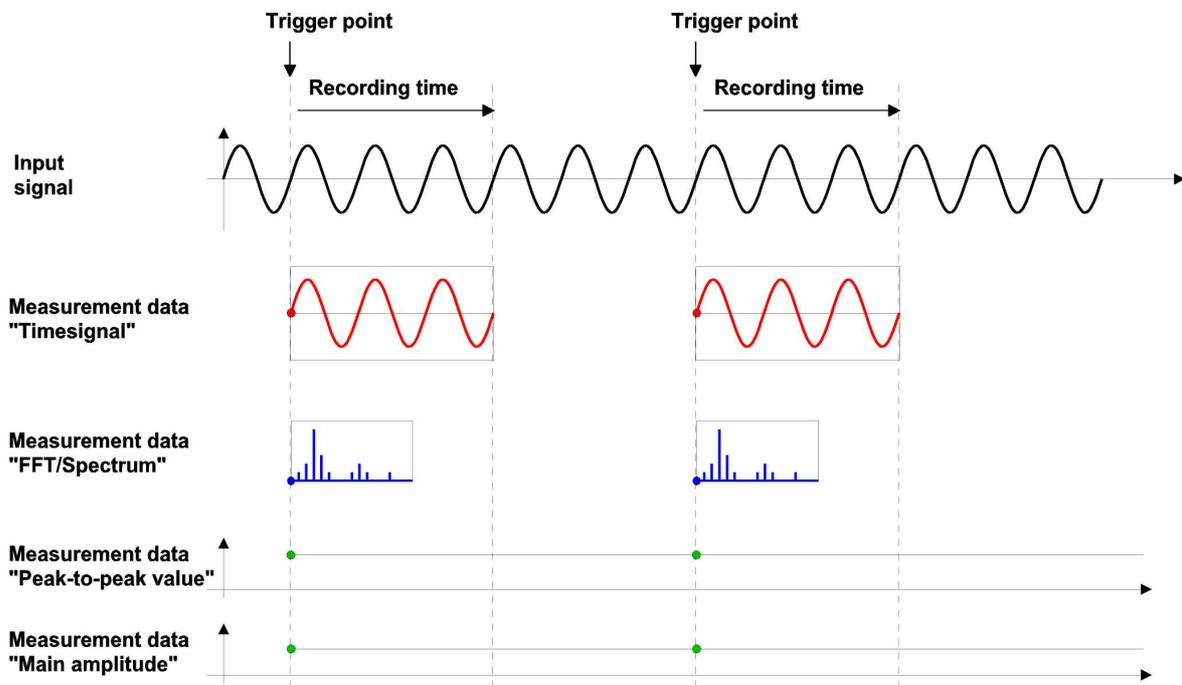
## 9.4 Functions

### 9.4.1 Operating mode

#### 9.4.1.1 Non-Continuous recording

This is the preset operating mode for the I/O module. Recording, evaluation and measurement data transfer takes place in sequence, one after the other. The DSP is then on standby for the next trigger event.

Signal sampling can take place at up to 20.48 kHz, parallel across 8 channels.



The above graphic represents the generation of measurement data associated with common triggers. The transmission of the measurement data is time delayed.

The timing of the entire cycle depends primarily on the user configuration. The main factors here are:

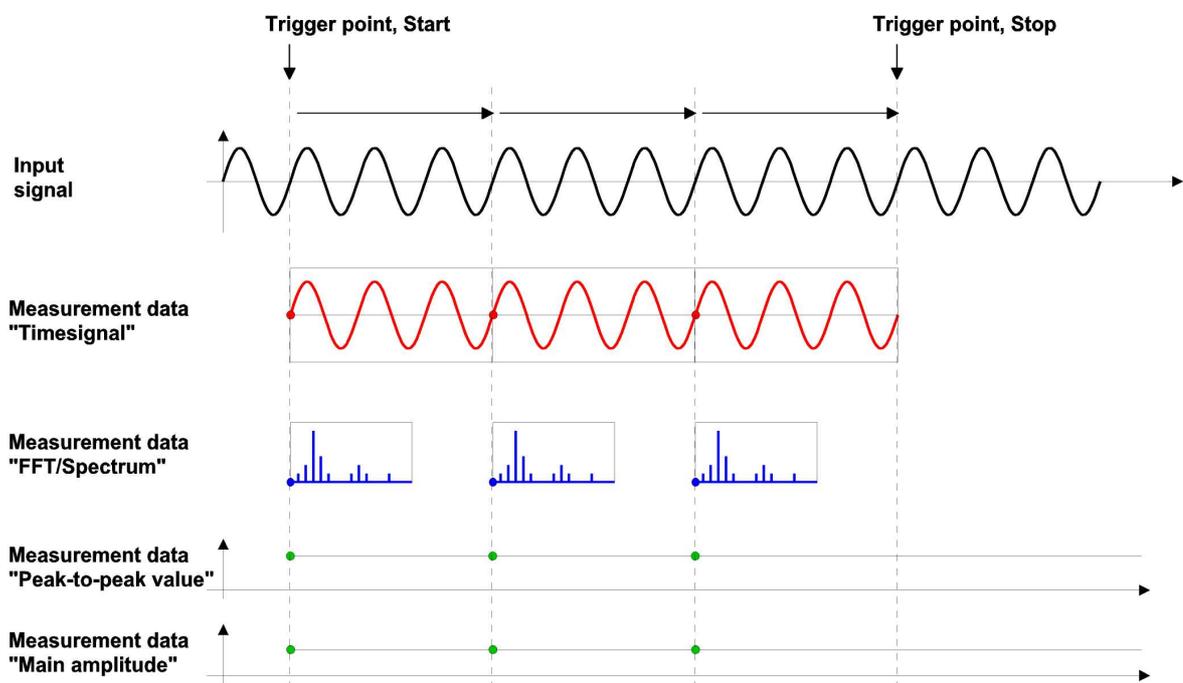
- Recording time  
Determined by the quotient of the "number of samples" and the "sampling frequency".  
Example:  $1024 / 2560 \text{ Hz} = 400 \text{ ms}$ .
- Evaluation time  
Determined by the number of active channels "analog input" and the computation time required for digital filtering, for FFT analysis, and for calculation of characteristic.  
Example: about  $10 \text{ ms/channel}$  for a 1024-point FFT.

- Measurement data transmission time  
Determined by the number of selected 'active' channels – specifically for channels "analog input" and "FFT/spectrum". Transmission rate is about 10000 samples/s. Or about 100 ms for any 1024 samples.

### 9.4.1.2 Continuous recording

The the I/O module runs continuously in this operating mode. Recording, evaluation and measurement data transmission take place by the DSP continuously and simultaneously.

The max. sampling frequency depends on the amount of measurement data that is to be simultaneously transmitted. The sampling frequency is typically 1 kHz parallel on 8 analog inputs with simultaneous transmission of time signals and some characteristic values.



The above graphic represents the generation of measurement data associated with common triggers. The transmission of the measurement data is time delayed.

The maximum sampling frequency is limited to max. 10000 samples/s of continuous measurement data transmission, and to the performance of the DSP. Depending on the user configuration, the following rates can be achieved:

Transmitted measurement data			No. of parallel or active channels		
Time signal <sup>1)</sup>	FFT/Spectrum <sup>2)</sup>	Characteristic values <sup>3)</sup>	8	4	2
X		X	1024 Hz	2048 Hz	4096 Hz
	X	X	2560 Hz	5120 Hz	10240 Hz

Transmitted measurement data			No. of parallel or active channels		
		X	5120 Hz	10240 Hz	20480 kHz

- 1) Time signal block, each with 1024 samples
- 2) FFT with 1024 samples or 400 lines
- 3) 3 characteristic values from the time range and 3 characteristic values from the frequency range

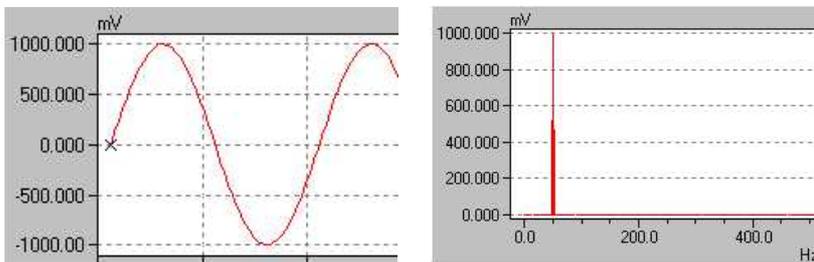
### 9.4.1.3 Signal simulation

In signal simulation, the signals measured by analog-input 1 ... 8 are discarded and replaced by demo signals computed by the DSP. This operating mode enables users to perform test runs without having to actually connect signals. A choice of signals and modulation types are available.

#### Signal 1

Description: Harmonic signal  
 Channel 1 ... 8: Sinus, 1000 mVpp, 50 Hz

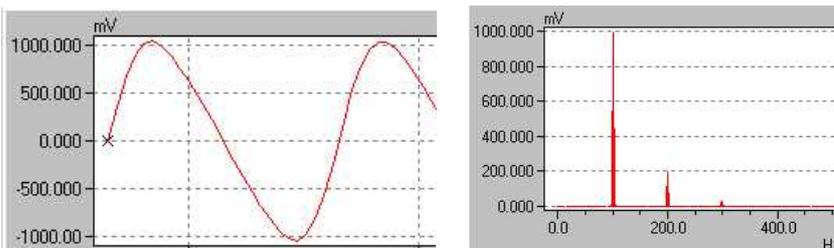
Time signal and frequency spectrum :



#### Signal 2

Description: Signal with three frequency components  
 Channel 1: Sinus with 3 components, 1000 mVpp, 100 Hz / 200 mVpp, 200 Hz / 40 mVpp, 300 Hz  
 Channel 2 ... 8 with 2 ... 8-times amplitude

Time signal and frequency spectrum :



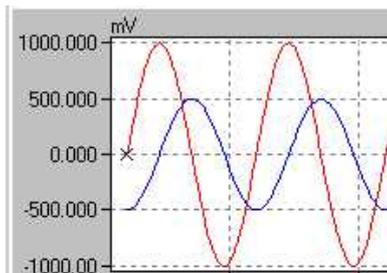
**Signal 3**

Description: Signals with paired phase shifts

Channel 1/3/5/7: Sinus, 1000 mVpp, 50 Hz, 0°

Channel 2/4/6/8: Sinus, 500 mVpp, 50 Hz, -90°

Time signal:

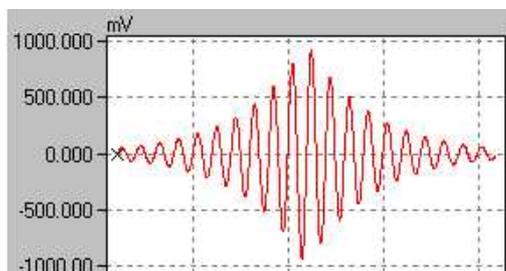


**Signal 4**

Description: Signal with transient progression

Channel 1 ... 8: Sinus, emerging/fading, 1000 mVpp, 50 Hz

Time signal:



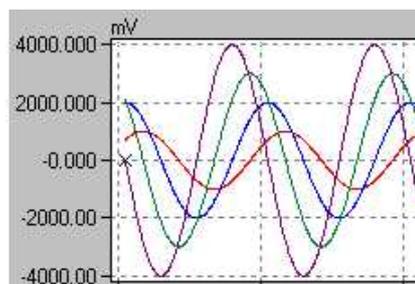
**Signal 5**

Description: Signals with increasing phase shift

Channel 1: Sinus, 1000 mVpp, 10 Hz, 45°

Channel 2 ... 8 with phase 90 ... 360° and 2 ... 8-times amplitude

Time signal:



**Signal 6**

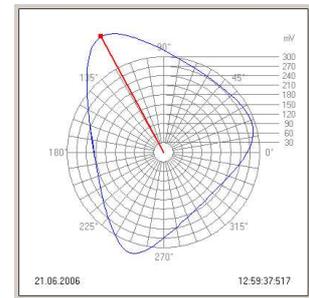
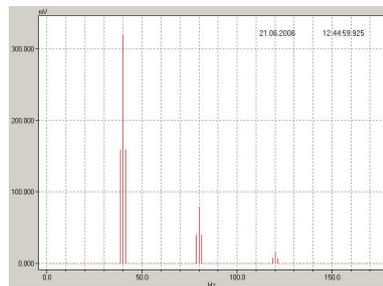
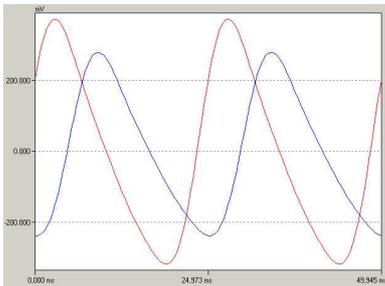
Description: Signals with frequency components and paired phase shifts appropriate to the "shaft vibration" application

Channel 1/3/5/7: Sinus with 3 components, 320 mVpp, 40 Hz, 30° / 80 mVpp, 80 Hz, 40° / 16 mVpp, 120 Hz, 50°

Channel 2/4/6/8: Sinus with 3 components, 240 mVpp, 40 Hz, 300° / 60 mVpp, 80 Hz, 220° / 12 mVpp, 120 Hz, 140°

Each channel with an amplitude-offset of -7000 mV

Time signal, frequency spectrum and orbit :



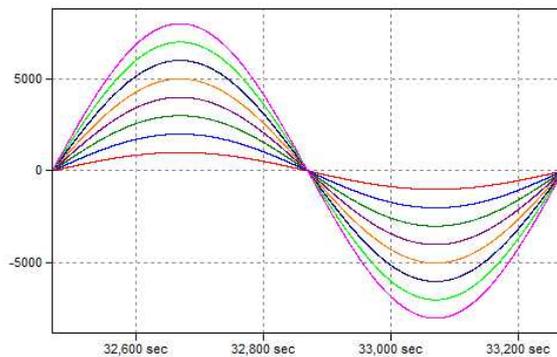
**Signal 7**

Description: Signals with low frequency

Channel 1: Sinus, 1000 mVpp, 1.25 Hz

Channel 2 ... 8: same signal with 2- to 8-times amplitude

Time signal:



**Modulation**

Optional modulation varies the demo signal from measurement to measurement.

**Modulation 1**

Modulation of amplitude, +50 % to -50 %, for 32 measurements

**Modulation 2**

Modulation of frequency , +50 % to -50 %, for 32 measurements

**Modulation 3**

Modulation of phase, +45 to -45 , for 32 measurements

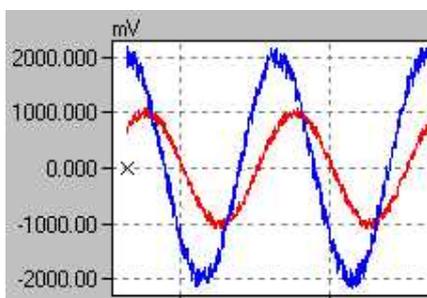
**Modulation 4**

Modulation of offset , +1000 mV to -1000 mV, for 32 measurements

**Modulation 5**

Noise in the range of  $\pm 5\%$  of amplitude

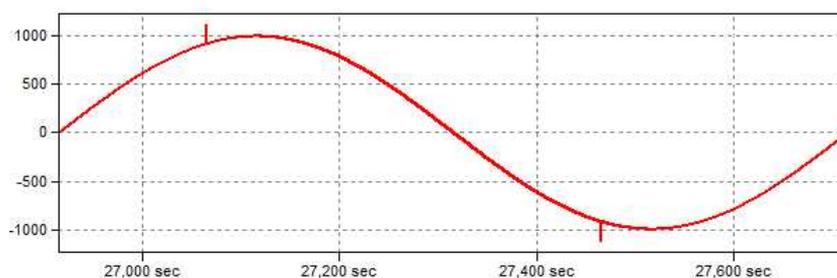
Example:



**Modulation 6**

Two anomalies of  $\pm 20\%$  of amplitude at position 3/16 and 11/16 of signal duration.

Example:



**9.4.1.4 Synchronizing two AMDT modules**

Synchronization enables  $8 + 8 = 16$  analog signals to be simultaneously triggered and sampled. Synchronization is available only in the "non-continuous recording" operating mode.

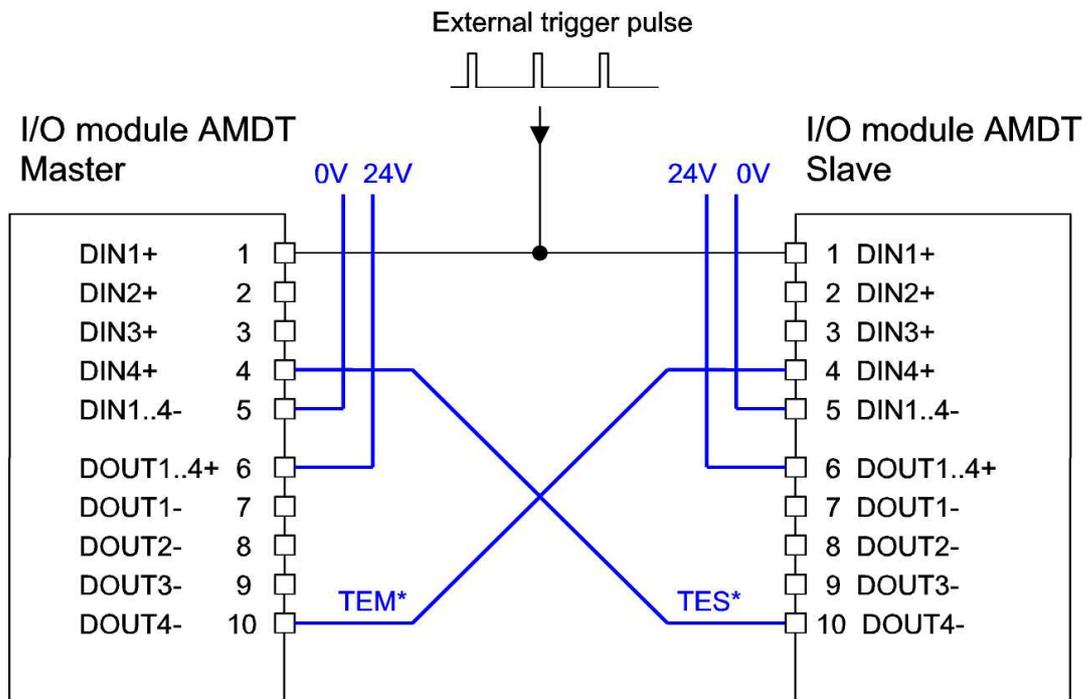
Application example as here described:

Synchronization of vibration measurement from  $8 + 4 = 12$  analog signals. 8 analog inputs are assigned to a master and 4 analog inputs to a slave. Periodic external trigger pulses (from a rotating shaft). Connected to digital input 1 on master and slave.

**Additional wiring**

Synchronization requires additional wiring. Digital input 4 and digital output 4 is connected diagonally. Feed voltage and reference mass are also to be connected.

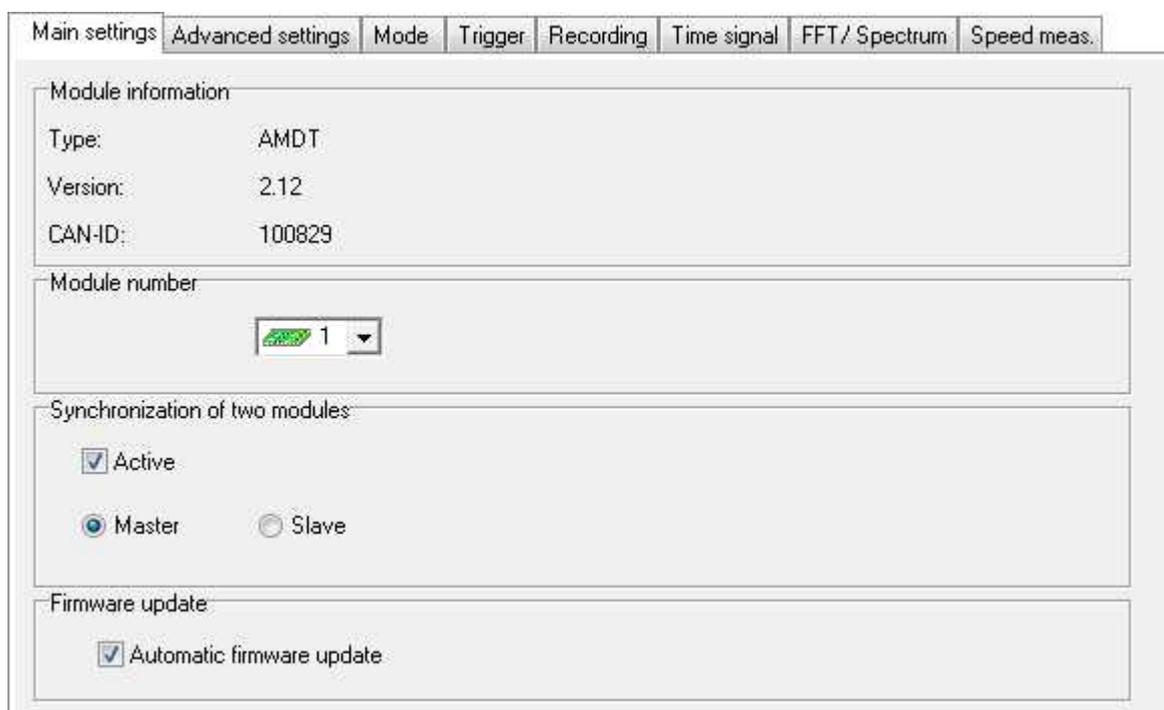
Wiring for the application example:



The connections in **blue** are always essential.

## Configuration/Settings

Settings for the operating mode is as follows:



The screenshot shows a configuration window with several tabs: Main settings, Advanced settings, Mode, Trigger, Recording, Time signal, FFT / Spectrum, and Speed meas. The 'Main settings' tab is active. It contains four sections:

- Module information:** Type: AMDT, Version: 2.12, CAN-ID: 100829.
- Module number:** A dropdown menu showing '1'.
- Synchronization of two modules:** A checked checkbox for 'Active', and radio buttons for 'Master' (selected) and 'Slave'.
- Firmware update:** A checked checkbox for 'Automatic firmware update'.

One I/O module AMDT is configured as "Master", the other as "Slave".

Overview of possible trigger settings:

External trigger signal	Master, Trigger source	Slave, Trigger source
None	Time period	Master
Analog signal, wired only at master	Analog input	Master
Digital signal, wired at master and slave	Digital input	Digital input
Digital signal, wired only at master	Digital input	Master

Settings for triggering is as follows:

Main settings	Advanced settings	Mode	Trigger	Recording	Time signal	FFT/ Spectrum	Speed meas.
Source							
Trigger source		Trigger channel					
Digital input		Digital Input #11					
Trigger period		Trigger threshold		Pre-Trigger			
1000 ms		0,00 %		0 %			
Mode			Polarity				
<input type="radio"/> Level <input checked="" type="radio"/> Edge			<input checked="" type="radio"/> Positive <input type="radio"/> Negative				
Start-Stop- Trigger							
<input type="checkbox"/> Active		Number of trigger pulses: 1					

Master and slave settings are identical.

## Rules for settings

1. Digital input 4 and digital output 4 are used internally for synchronization. Both channels should be set to *inactive*. Set *Value source* to *Manual value* for digital output 4.

	Digital Input 1	Off
	Digital Input 2	Off
	Digital Input 3	Off
	Digital Input 4	-
	Digital Output 1	On
	Digital Output 2	On
	Digital Output 3	On
	Digital Output 4	-

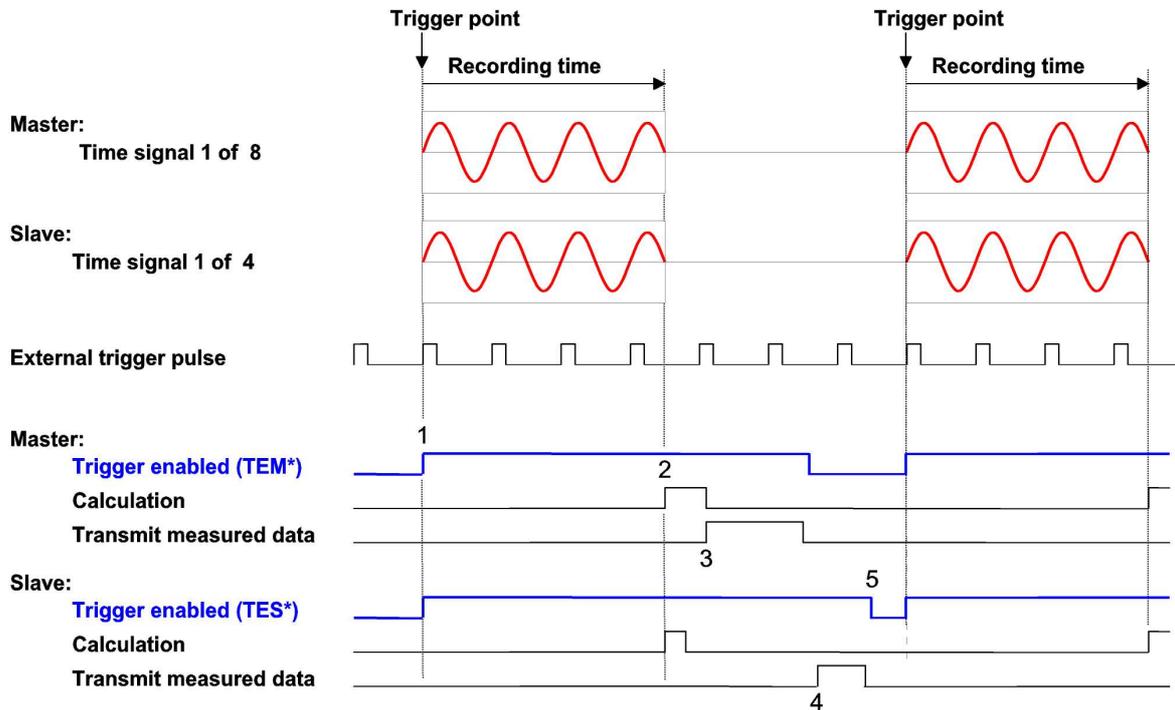
2. Manual configuration amendments to a "slave" require subsequent amendments to the "master" to avoid the handshake becoming incompatible.

3. If no external Trigger signal is used, the time period (of "master") must be set higher than the natural cycle (Recording time + Calculation time + 2 x Measured data transmit time) to avoid the handshake becoming incompatible. See timing diagram.

## Procedure

The outcome of synchronization: Triggering takes place (almost) simultaneously. Measurement data (time signal / frequency spectrum) are transmitted one after the other

Timing diagram for the application example:



- 1 Synchronous trigger, Start of recording/aquisition
- 2 Start of evaluation (FFT analysis, calculation of characteristics, etc.)
- 3 Master transmits measured data (time signal, frequency spectrum)
- 4 Slave transmits measured data (time signal, frequencyspectrum)
- 5 Master and Slave ara ready for next triaqer

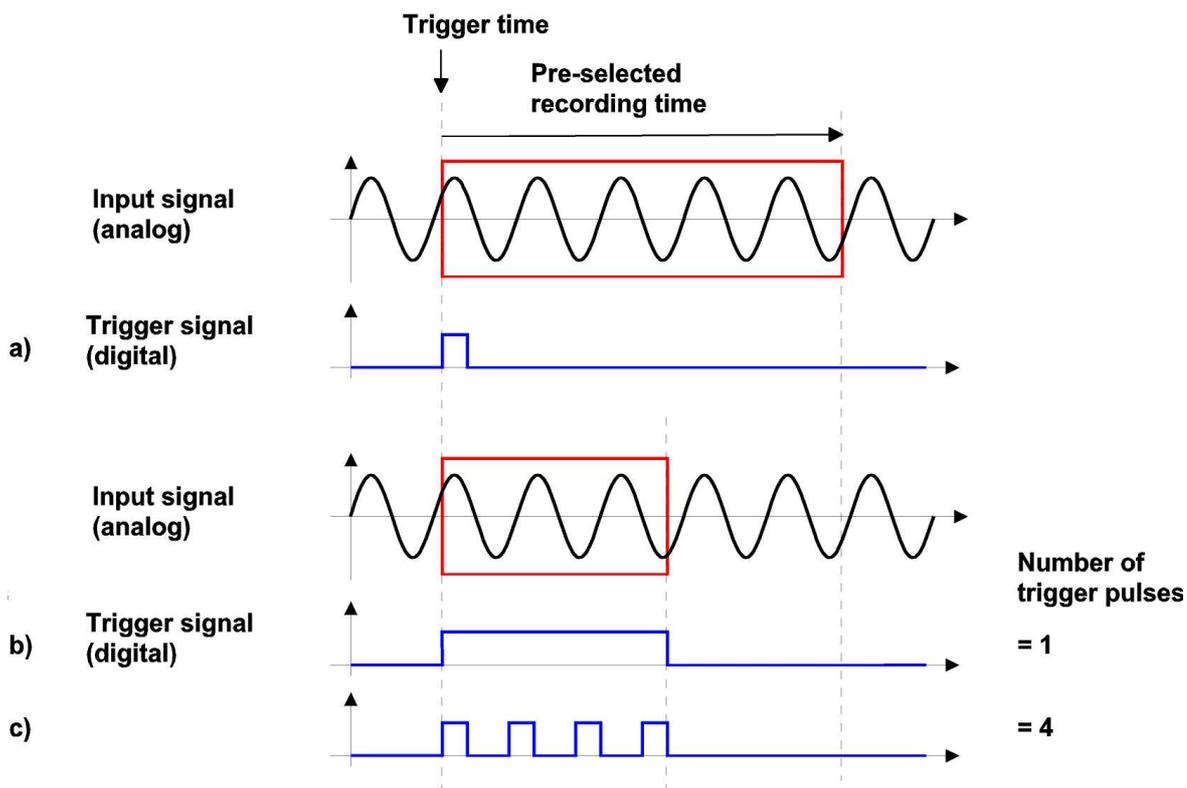
## 9.4.2 Triggering and recording

### Properties

- Software-trigger via time interval, periodic within the range 1ms .. 60s
- Hardware trigger via analog input or digital input
- Trigger threshold, edge, polarization adjustable
- Non-continuous recording at a sampling frequency in the range 256 Hz .. 20480 Hz (for 1 to 8 channels)
- Continuous recording at a sampling frequency in the range 256 Hz ..1024 / 2048 / 4096 Hz (for 8 / 4 / 2 channels)
- Recording depth of max. 8192 or 4096 samples for each channel, max. 8 synchronous channels
- Pre-trigger in the range 0..100% of recording depth
- Start stop trigger function for externally determined recording depth

### Hardware trigger operating mode

The trigger signal is preferably received from one of the four digital inputs. One of the eight analog channels may alternatively be used with a preset threshold.



Comment to illustration above:

In example a) the trigger signal starts recording. Recording stops when the recording-time parameter for has been reached (refer to the next section).

In Examples b) and (c) the trigger controls starting and stopping of the recording – irrespective of the trigger-pulse parameter. In the event that the stop trigger does not occur, recording is limited to the recording-time parameter (refer to next section).

### Recording parameters

A vibration/wave signal, associated with a time signal, is recorded according to three parameters: sampling frequency, number of samples, and recording time. A frequency spectrum is determined according to the parameters: frequency range, number of lines, frequency resolution.

Parameters are related to each other and their settings therefore influence one another. The following table provides an overview:

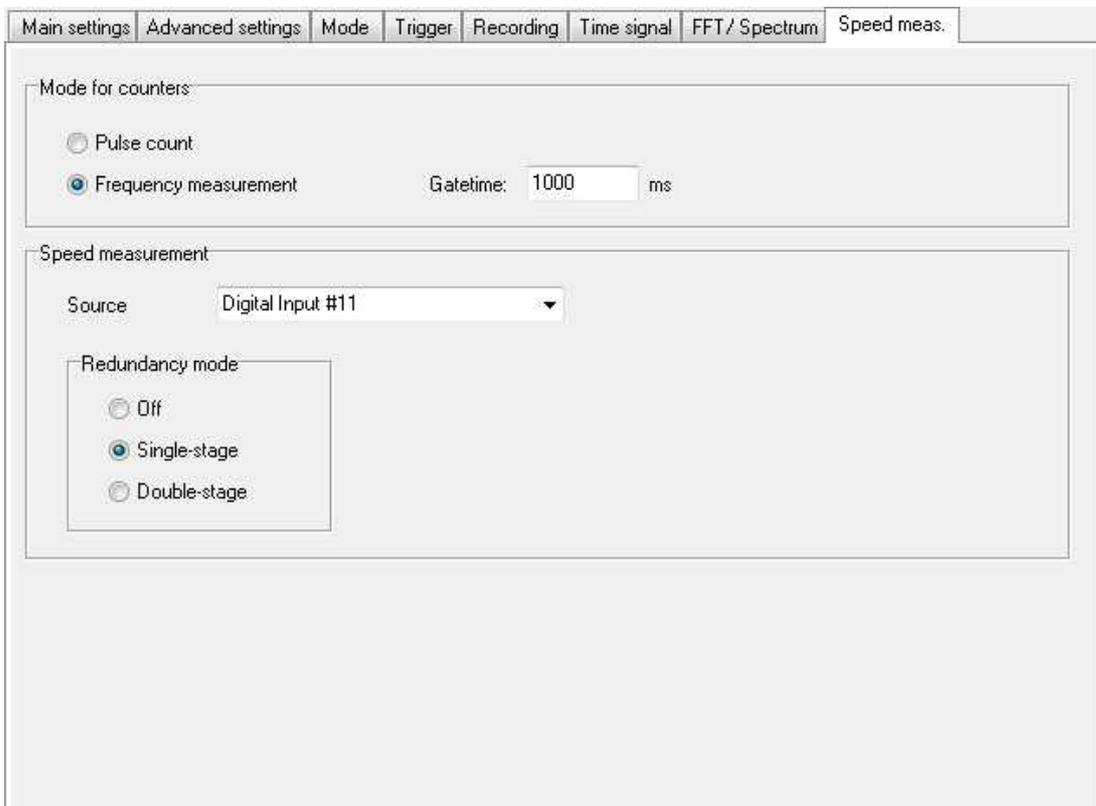
Parameter	Symbol	Calculation	Example
Sample rate	fs		2560 Hz
Number of samples	ns		2048
Recording time	tr	$tr = ns / fs$	$2048 / 2560 \text{ Hz} = 800 \text{ ms}$
Frequency range	fra	$fra = fs / 2.56$	$2560 / 2.56 = 1000 \text{ Hz}$
Number of lines	nli	$nli = ns / 2.56$	$2048 / 2.56 = 800$
Frequency resolution	fre	$fre = fs / ns$	$2560 \text{ Hz} / 2048 = 1.25 \text{ Hz}$

### 9.4.2.1 Redundant trigger source

When triggering takes place via an external digital signal, the trigger source can be automatically switched in the event of a trigger signal failure. There are two variants:

- Single-stage redundancy  
The failure of a trigger signal on digital-input 1 switches to the time-period trigger.
- Double-stage redundancy  
The failure of a trigger signal on digital-input 1 switches to the trigger signal on digital-input 2. If digital-input 2 also fails, the signal is switched to the time-period signal.

#### Configuration example:



The screenshot shows a software configuration window with several tabs: Main settings, Advanced settings, Mode, Trigger, Recording, Time signal, FFT / Spectrum, and Speed meas. The 'Speed meas.' tab is active. It contains the following settings:

- Mode for counters:**
  - Pulse count
  - Frequency measurement
- Gatetime:** 1000 ms
- Speed measurement:**
  - Source:** Digital Input #11
  - Redundancy mode:**
    - Off
    - Single-stage
    - Double-stage

Main settings | Advanced settings | Mode | **Trigger** | Recording | Time signal | FFT / Spectrum | Speed meas.

Source

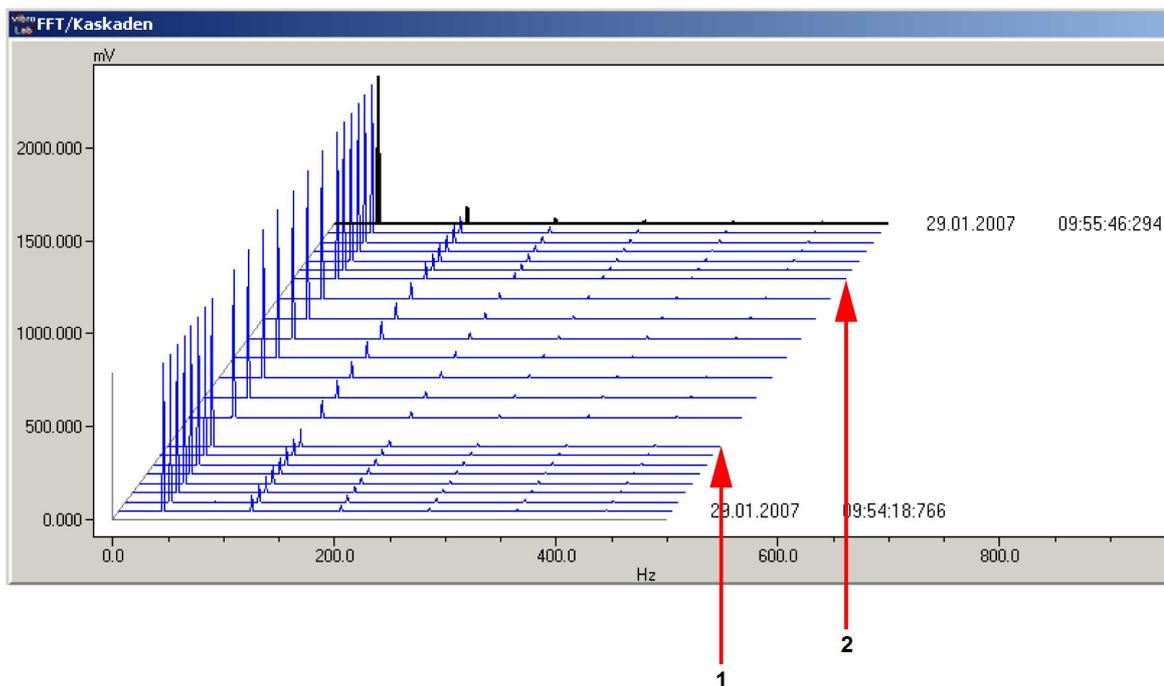
Trigger source: Digital input  
Trigger channel: Digital Input #1

Trigger period: 6000 ms  
Trigger threshold: 0.00 %  
Pre-Trigger: 0 %

Mode:  Level  Edge  
Polarity:  Positive  Negative

Start/Stop- Trigger:  Active  
Number of trigger pulses: 1

**Function and visualisation example:**



**Comment to illustration above:**

A frequency spectrum is measured here every 3 seconds. If the external trigger signal fails, measurement is triggered at a time period of 6 s. Event 1 marks the Failure of trigger signal of Digital input 1. Event 2 marks the recovery of the trigger signal.

### 9.4.3 Time signal

Any acquired vibration signal is initially saved to a buffer within the I/O module. The "analog input" channel delivers a block of measured data (e.g. 2048 amplitude values over time). This block is referred to as a "time signal".

#### Properties

- 128 to 8192 samples, synchronous/parallel sampled at 256 to 20480 Hz
- Variable pre/post history and/or triggers
- Digital filters, integrators etc. can be used
- Data compression can be used for transmission

#### 9.4.3.1 Digital filter

##### Properties

- Choice of filter type: low-pass, band-pass, high-pass or demodulation filter
- Filter order of 2 ... 8, preset Butterworth characteristic
- Adjustable cut-off frequency in the range 1 Hz ... 10 kHz
- Adjustable filters for each channel

##### Application

High-frequency distortions are filtered out of the signal to be recorded; the signal is filtered for only the frequency range required.

##### Restrictions

The digital filter is defeated if necessary by this limitations:

Board V2.0 to V2.1.2 :

With 1..4 used analog inputs : All filters available. Max. order is 8.

With 5..8 used analog inputs : Only Low-pass filter available. Max. order is 4.

From board V2.1.3 :

With 1..8 used analog inputs : All filters available. Max order is 6.

#### 9.4.3.2 Digital integrator

##### Properties

- Numerical integration of the acquired vibration signal
- Fixed scaling factor preset at 1000.

##### Application

For measurements using acceleration sensors, a signal ( $\text{m/s}^2$  unit) is converted into a velocity signal ( $\text{mm/s}$  unit). Refer to the "Applications with AMDT" manual.

### Restrictions

The integrator is defeated if necessary by this limitations:

Board V2.0 to V2.1.2 :

With 1..4 used analog inputs : Integrator available

With 5..8 used analog inputs : Integrator not available

From board V2.1.3 :

With 1..8 used analog inputs : Integrator available



#### Info

When digital integration is enabled, measurement range checking or wire-break monitoring will not take place.

### 9.4.4 FFT analysis / frequency spectrum

Any acquired vibration signal is initially saved to a buffer within the I/O module. Options are available to then perform an FFT-analysis or to compute a frequency spectrum. Each analog-input channel is provided with an additional FFT/spectrum channel. That delivers a block measured data (e.g. 800 amplitude values concerning frequency).

#### Properties

- An FFT/spectrum channel can be separately set up/created (for each analog input)
- FFT algorithms for 1024, 2048, or 4096 points or with 400, 800, or 1600 lines
- Frequency range, number of lines and frequency resolution can be set
- Standard window functions 'Hanning', 'Flat Top', etc. optional
- Data compression available for for data recording and transmission

#### Scaling

Each FFT/spectrum channel can be individually scaled. Scaling takes place in the required unit (e.g.  $\pm 100 \mu\text{m}$  for displacement sensors or  $\pm 50 \text{ g}$  for acceleration sensors)

#### Application

Analysis of characteristic frequencies and their amplitudes for a measured vibration signal.

### 9.4.5 Characteristics

Any acquired vibration signal is initially saved to a buffer within the I/O module. Options are available to then perform an FFT-analysis or to compute a frequency spectrum. It is then possible to calculate various characteristic from the vibration signal and/or the frequency spectrum.

One or more additional characteristic channels are available for each analog-input channel. These then deliver characteristic values (e.g. root mean square, a spectrum's peak amplitude etc.).

**Properties**

- 1 to 30 characteristic-value channels can be separately set up/created (for each analog input)
- Simple configuration using selection lists
- Automatic assigning to source channel

**Characteristic values**

No.	Characteristic value	Type	Note
1	Peak-to-peak value	T	Difference between maximum and minimum
2	Mean value	T	or DC component
3	True RMS value	T	
4	Frequency of the main amplitude	F	Frequency of the main amplitude within spectrum
5	Main amplitude	F	Main amplitude within spectrum
6	Rotation speed	T	Frequency/Rotational speed
7	Phase of main amplitude	T, F	
8	Amplitude of 1X component	F	Amplitude of the speed synchronous vibration component
9	Phase of 1X component	T, F	Phase of the speed synchronous vibration component
10	Amplitude of 2X component	F	Amplitude of the double speed synchronous vibration component
11	Phase of 2X component	T, F	Phase of the double speed synchronous vibration component
12	Maximum of vector sum	T, 2	Maximum of vector sum of two signals (at an order of 90°)
13	Mean of product	T, 2	Mean of product of two signals
14	Frequency of main amplitude, band 1	F	Frequency of main amplitude for preset frequency band 1
15	Main amplitude, band 1	F	Main amplitude for preset frequency band 1
16	RMS value, band 1	F	RMS value for preset frequency band 1
17	Frequency of main amplitude, band 2	F	Frequency of main amplitude in preset frequency band 2
18	Main amplitude, band 2	F	Main amplitude for preset frequency band 2
19	RMS value, band 2	F	RMS value for preset frequency band 2
20	Frequency of main amplitude, band 3	F	Frequency of main amplitude in preset frequency band 3
21	Main amplitude, band 3	F	Main amplitude for preset frequency band 3
22	RMS value, band 3	F	RMS value for preset frequency band 3

No.	Characteristic value	Type	Note
23	Maximum value	T	Most positive value
24	Minimum value	T	Most negative value
25	Amplitude of 3X component	F	Amplitude of triple speed synchronous vibration component
26	Phase of 3X component	T, F	Phase of triple speed synchronous vibration component
27	Amplitude of xX component	F	Amplitude of multiple-x speed synchronous vibration component
28	Phase of xX component	T, F	Phase of multiple-x speed synchronous vibration component
29	Sum value	F	Weighted sum of all lines of frequency spectrum
30	Remainder value	F	Weighted sum of all lines of frequency spectrum minus the lines of the harmonic components

Type: T = determined from time signal, F = determined from frequency spectrum, 2 = determined from 2 source channels

### Scaling

Scaling is automatically taken from source channel (in case of amplitude) or appropriate preset (in case of frequency or phase angle)

### Application

Analysis of characteristic values for a vibration signal – for time domain and for frequency domain. For example, determining the root mean square of a vibration signal or the peak amplitude of a spectrum.

### Mathematical definition

Mathematical definitions for all the available characteristic values are listed in the following sections.

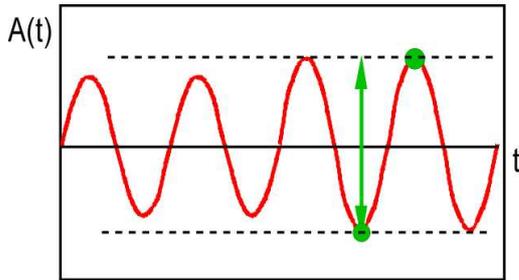
#### 9.4.5.1 Characteristic "Maximum value", "minimum value"

##### Maximum value

The DSP determines (finds) the maximum value (or most positive value) of the time signal. And then delivers the amplitude value.

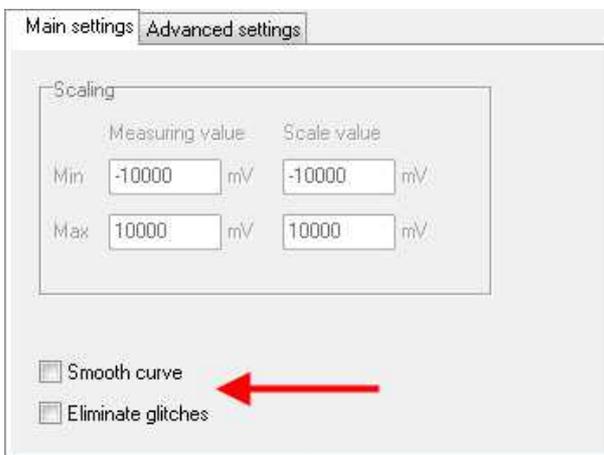
##### Minimum value

The DSP determines (finds) the minimum value (or most negative value) of the time signal. And then delivers the amplitude value.



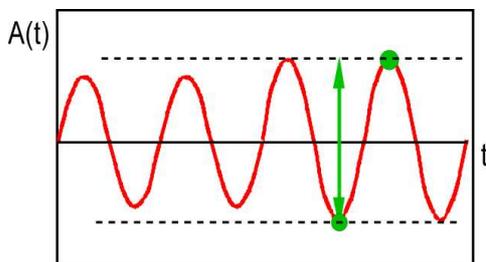
**Smooth curve / Eliminate glitches**

It might be necessary to smooth curves prior to determining characteristic values when noise or distortions occur within the periodic signals. The appropriate settings are available in the *Options* tab:



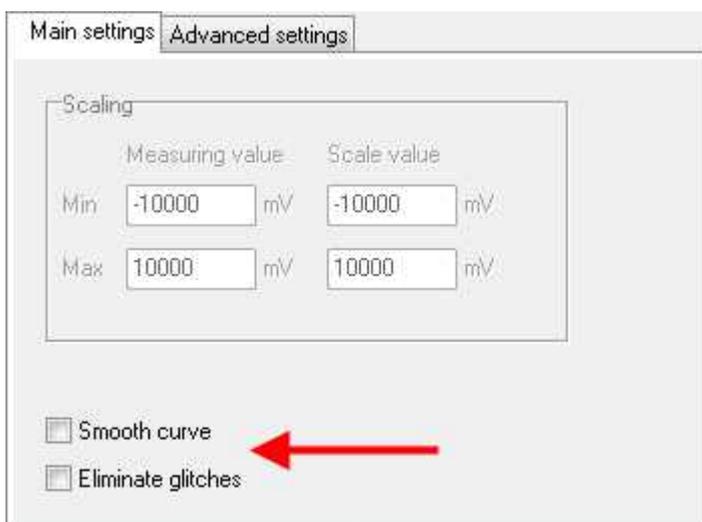
**9.4.5.2 Characteristic "Peak-to-peak value"**

The DSP calculates the peak-to-peak value of the time signal, i.e. the difference between the most positive and most negative amplitude values.



**Options Smooth curve / Eliminate glitches**

It might be necessary to smooth curves prior to determining characteristic values when noise or distortions occur within the periodic signals. The appropriate settings are available in the Options tab:



### 9.4.5.3 Characteristic "Mean value"

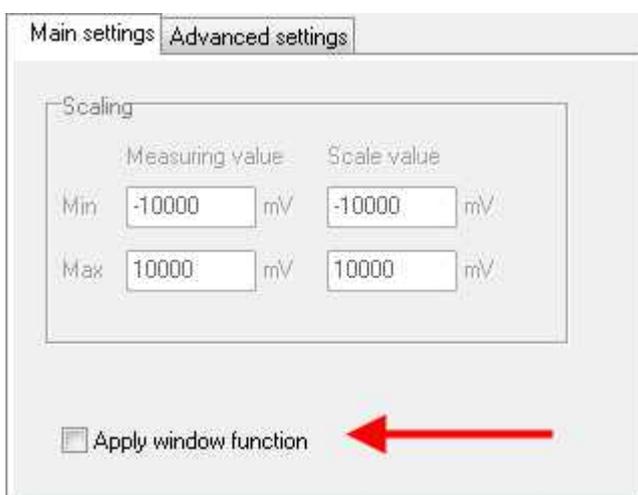
The DSP calculates the arithmetical average of the time signal.

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

with  $x_i$  = Amplitude of point  $i$   
 $n$  = Number of points  
 $y$  = Mean value

The arithmetical average is also referred to as a signal's steady or DC component. This characteristic value is available even when the option "Without DC-part" is enabled for an analog input (see [configuration/settings for an analog input](#)).

#### **Apply window function option**



Select this option to calm measurement data for a static vibration/wave. A weighting is then applied prior to the arithmetic average being calculated. A low weighting is given to the signal's periphery and a higher weighting to its middle.

**9.4.5.4 Characteristic "True RMS value"**

The DSP calculates the root mean square of the time signal.

$$y = \sqrt{\frac{1}{T} * \int_0^T x^2(t) * dt}$$

with  $x(t)$  = Amplitude of time  $t$   
 $T$  = Recording time  
 $y$  = True RMS value

Discretization enables a good approximation to the above exact formula.

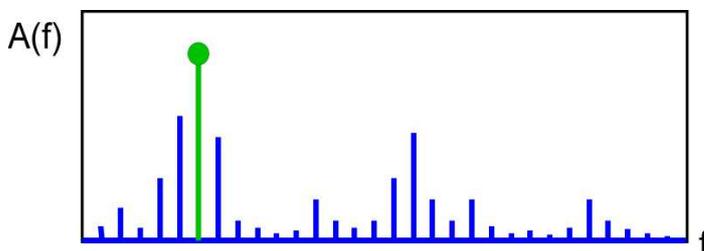


**Info**

The accuracy of TRMS calculations on sine signals depends on the number of signal periods acquired. The rule of thumb: Errors are <3% for more than 2 periods; Errors are <1% for more than 4 periods.

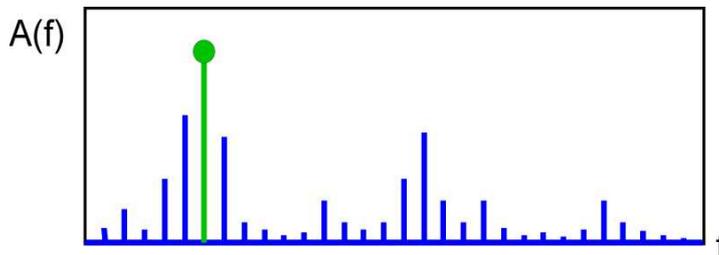
**9.4.5.5 Characteristic "Frequency of main amplitude"**

The DSP determines (finds) largest amplitude within the frequency spectrum and delivers the frequency of this line.



### 9.4.5.6 Characteristic "Main amplitude"

The DSP determines (finds) the highest amplitude in the frequency spectrum and delivers of the amplitude for this line.



### 9.4.5.7 Characteristic "Phase of main amplitude"

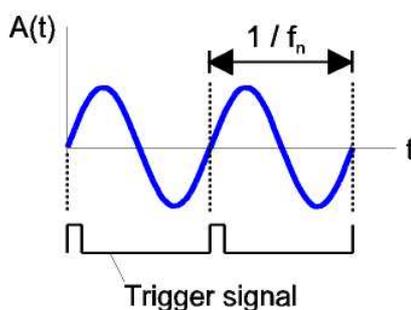


Phase angle measurement is useful only for low frequencies/rotations. The computation procedure (see below) shows why. Further information on phase angle definition and on measurement precision etc. is available under [measuring the phase angle](#).

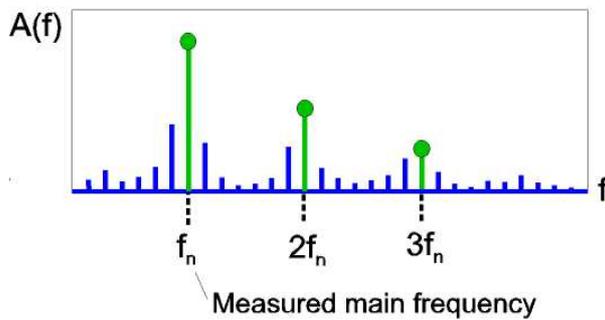


This characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/counter (e.g. the square wave pulse of a rotating shaft). This signal delivers a stable base frequency  $f_n$  as well as a phase reference or trigger signal.

The DSP normalizes the time signal (internally, hidden) to an integral multiple of the basic frequency  $f_n$ .



Using the frequency spectrum associated with the line index  $f_n$ , the DSP determines the line/vibration component's phase angle 0 ... 360°.

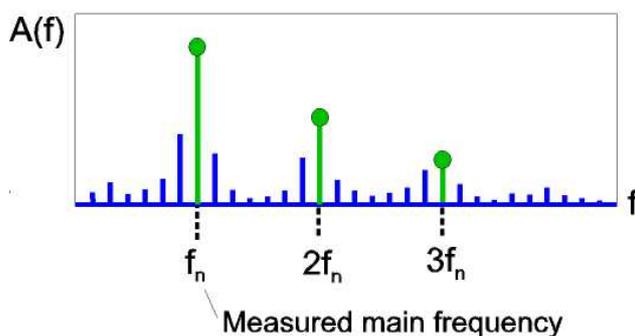


#### 9.4.5.8 Characteristic "Amplitude of 1X/2X/3X/xX component"



This characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/counter (e.g. the square wave pulse of a rotating shaft). This signal delivers a stable base frequency  $f_n$  as well as a phase reference or trigger signal.

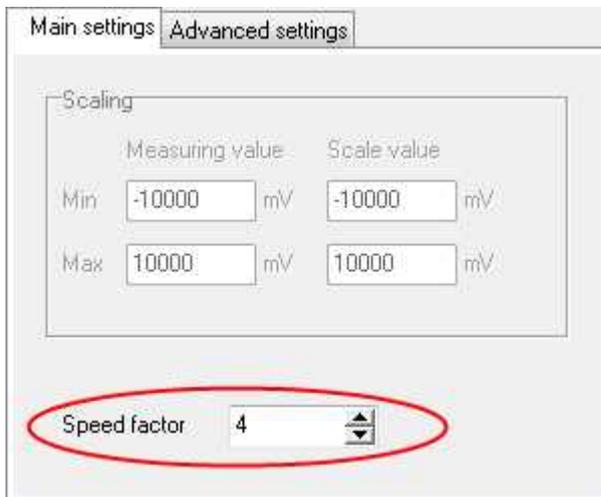
Using the frequency spectrum for the line index  $f_n / 2f_n / 3f_n / xf_n$ , the DSP determines the amplitude of this line/vibration component.



#### Info

Acquisition of an accurate  $f_n$  via the frequency input is essential, as is the highest possible resolution for the frequency spectrum. In the event of deviations between the measured frequency and frequency spectrum's line index, evaluation then takes place of the next line.

Only the free-definable component (Amplitude of  $xX$  component) can be set in the range  $0 \dots 100 \times f_n$ . See Below the corresponding configuration dialog (Tab *Main settings*) with the field "Speed factor":



#### 9.4.5.9 Characteristic "Phase of the 1X/2X/3X/xX component"

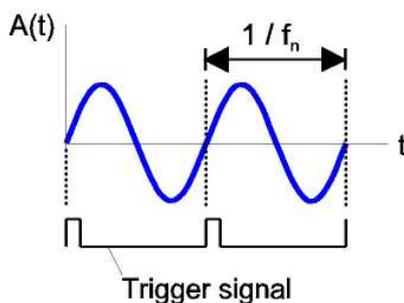


Phase angle measurement is useful only for low frequencies/rotations. The computation procedure (see below) shows why. Further information on phase angle definition and on measurement precision etc. is available under [measuring the phase angle](#).

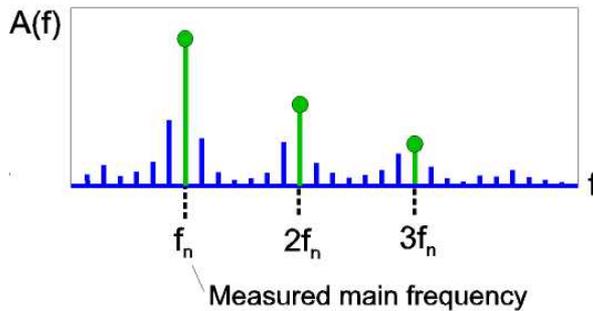


This characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/counter (e.g. the square wave pulse of a rotating shaft). This signal delivers a stable base frequency  $f_n$ .

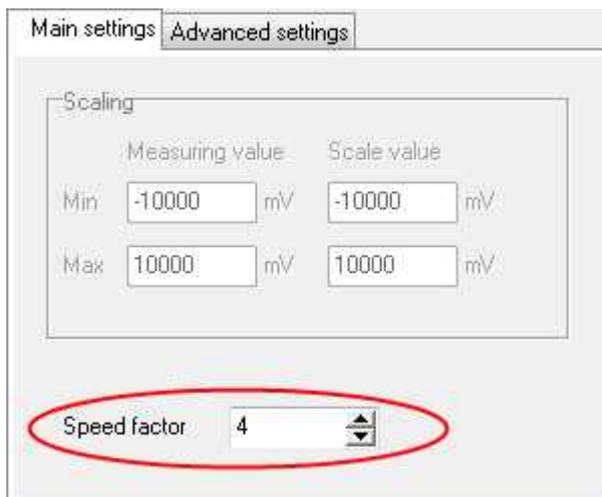
The DSP normalizes the time signal (internally, hidden) to an integral multiple of the basic frequency  $f_n$ .



Using the frequency spectrum for the line index  $f_n / 2f_n / 3f_n / xf_n$ , the DSP determines the  $0 \dots 360^\circ$  phasing for this line/vibration component.

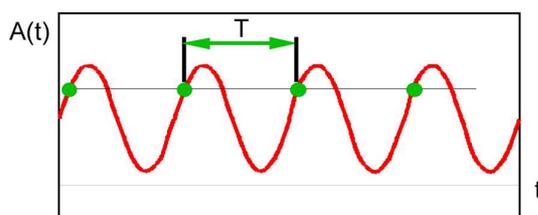


Only the free-definable component (Phase of xX component) can be set in the range  $0 \dots 100 \times f_n$ . See Below is the corresponding configuration dialog (Tab *Main settings*) with the field "Speed factor":



#### 9.4.5.10 Characteristic "Rotation speed"

The DSP determines (finds and counts) the number of signal periods in the time signal. From this, the DSP determines the signal frequency ( $f = 1 / T$ ) or rotation ( $n = 60 * f$ ). Edge and threshold values can be set.

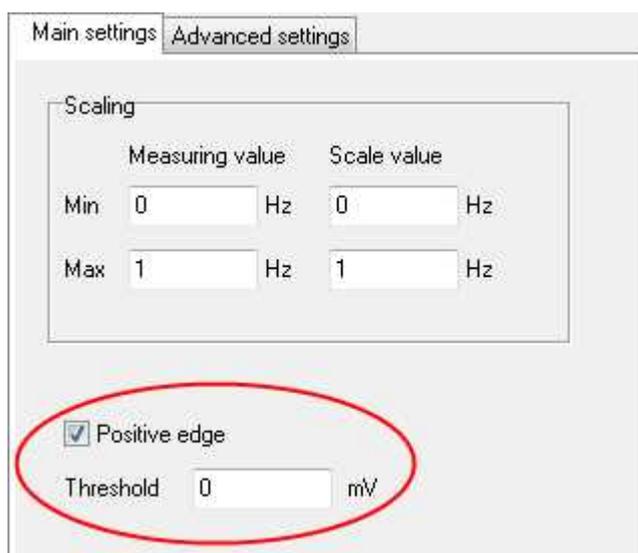


A frequency measurement has upper and lower frequency limits – frequencies outside this range can be not conclusive (i.e. have insufficient accuracy). The following table provides an overview:

Sampling frequency fs	Number of samples ns	Lower limit	Upper limit
10240 Hz	2048	10 Hz	1024 Hz
2560 Hz	2048	2.5 Hz	256 Hz
512 Hz	2048	0.5 Hz	51 Hz

Frequencies can be measured between the lower limit at  $2 \cdot fs/ns$  and the upper limit at  $fs/10$  for selected parameters (recording parameters). The measurement value equals 0 beyond these limits.

Below is the corresponding configuration dialog (Main settings) tab:



#### 9.4.5.11 Characteristic "Maximum of vector sum"

The DSP performs vectorial addition of all amplitude values from the time signals of two neighboring channels (e.g. analog inputs 1/2, 3/4, ...) and then determines the maximum value.

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

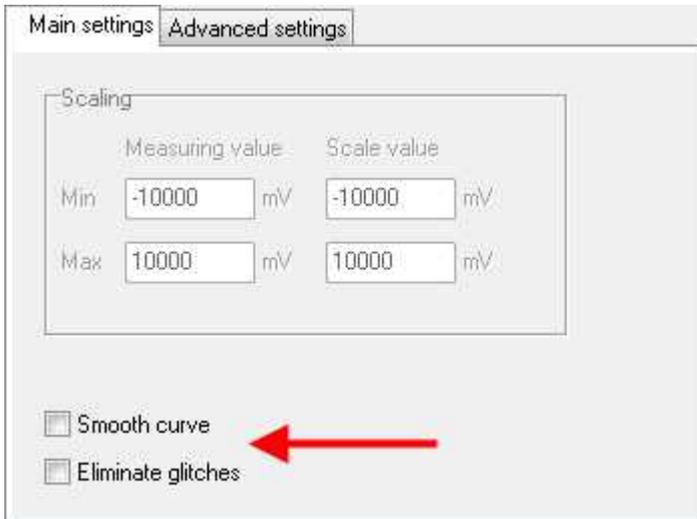
with  $x_i$  = Amplitude of point  $i$ , first channel

$y_i$  = Amplitude of point  $i$ , second channel

$z_i$  = Vector sum of point  $i$

**Options** *Smooth curve / Eliminate glitches*

Smooth curves prior to determining characteristic values may be applicable to periodic signals that have noise or distortions. These two settings are available in the *Options* tab:



**9.4.5.12 Characteristic "Mean of product"**

The DSP multiplies all amplitude values from two time signals of two neighboring channels (e.g. analog inputs 1/2, 3/4, ...) and then determines the mean value.

$$x_i = a_i * b_i$$

with  $a_i$  = Amplitude of point  $i$ , first channel  
 $b_i$  = Amplitude of point  $i$ , second channel  
 $x_i$  = Product of point  $i$

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

with  $x_i$  = Amplitude(product) of point  $i$   
 $n$  = Number of points  
 $y$  = Mean value

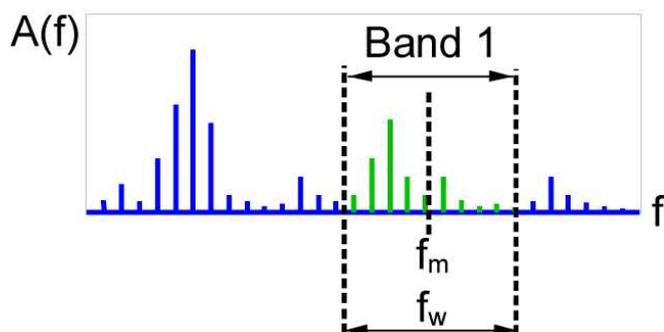


**Info**

For the "Electrical power measuring" application, this characteristic value corresponds to the P unit of measurement (= active power) for current and voltage input values.

**9.4.5.13 Characteristic "Frequency of main amplitude, band 1/2/3"**

The DSP determines (finds) main amplitude, within a small frequency band, from the frequency spectrum, and delivers the frequency of this line. The frequency band is determined by middle of band  $f_m$  and band width  $f_w$ . The frequency band can be fixed or adapted to speed.



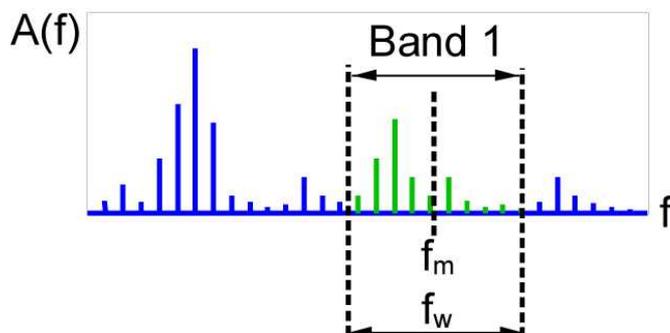
Refer also to [amplitude of maximum line, band1/2/3](#)

**9.4.5.14 Characteristic "Main amplitude, band 1/2/3"**

The DSP determines (finds) the main amplitude, within a small frequency band, from the frequency spectrum, and delivers the amplitude of this line. The frequency band is determined by band middle  $f_m$  and band width  $f_w$ . The frequency band can be fixed or adapted to rotations.

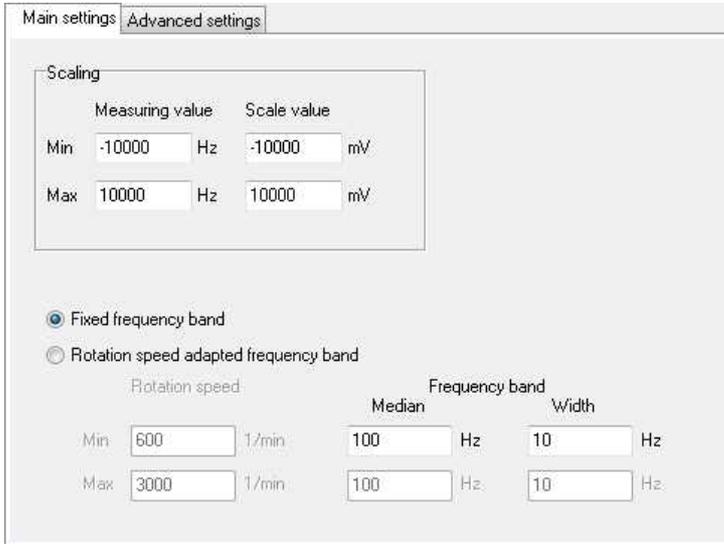


This characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/counter (e.g. the square wave pulse of a rotating shaft). This signal delivers a stable base frequency  $f_n$ .



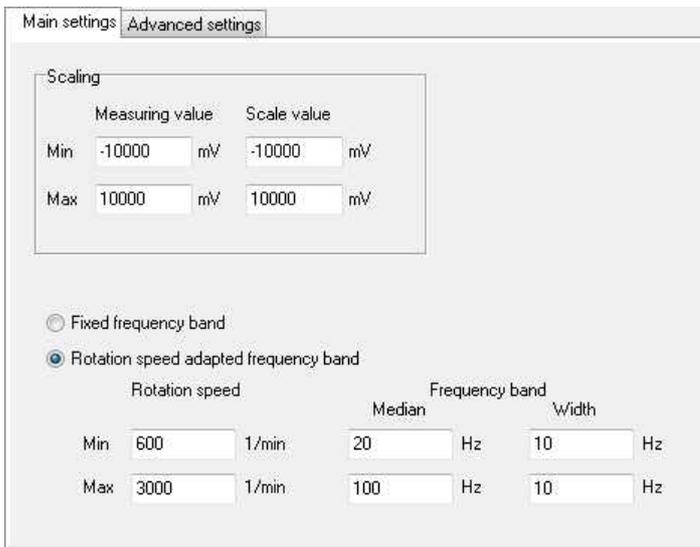
Below is the corresponding configuration dialog (*Main settings*) tab:

Example 1: *Fixed frequency band*. The characteristic value delivers the frequency spectrum's largest amplitude within the band 100±5 Hz or 95 to 105 Hz

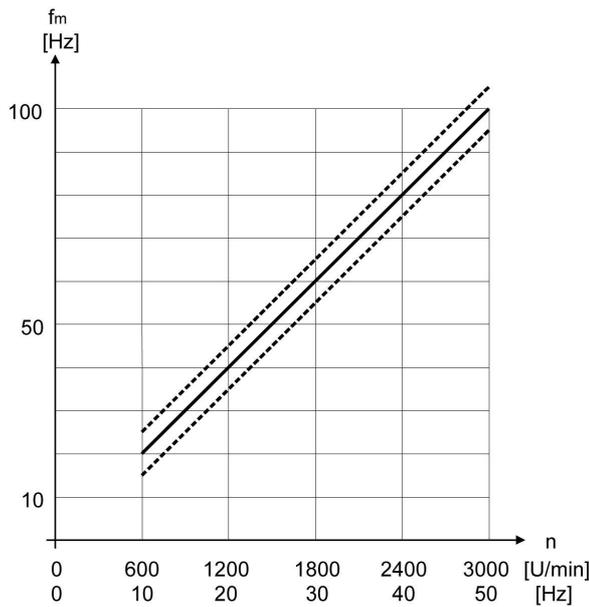


Main settings		Advanced settings	
Scaling			
	Measuring value		Scale value
Min	-10000 Hz	-10000	mV
Max	10000 Hz	10000	mV
<input checked="" type="radio"/> Fixed frequency band <input type="radio"/> Rotation speed adapted frequency band			
	Rotation speed	Frequency band	
		Median	Width
Min	600 1/min	100 Hz	10 Hz
Max	3000 1/min	100 Hz	10 Hz

Example 2: *Frequency band adapted to rotation*. Monitoring of the dual synchronous shaft vibration in a machine with a rotating shaft. The frequency band midpoint is shifted proportionally and automatically from 20 to 100 Hz for operating rotations from 600 to 3000 rev/min (10 to 50 Hz). The width of the frequency band is ±5 Hz.



Main settings		Advanced settings	
Scaling			
	Measuring value		Scale value
Min	-10000 mV	-10000	mV
Max	10000 mV	10000	mV
<input type="radio"/> Fixed frequency band <input checked="" type="radio"/> Rotation speed adapted frequency band			
	Rotation speed	Frequency band	
		Median	Width
Min	600 1/min	20 Hz	10 Hz
Max	3000 1/min	100 Hz	10 Hz



**9.4.5.15 Characteristic "RMS value, band 1/2/3"**

The DSP determines (calculates) the RMS value (root mean square) using all the lines within a specific frequency band of the frequency spectrum. The frequency band is determined via the  $f_m$  middle and  $f_w$  width. The frequency band can be fixed or adapted to rotations.

$$y = \sqrt{\frac{1}{n} * \sum_{i=k}^{i=m} X_i^2}$$

with

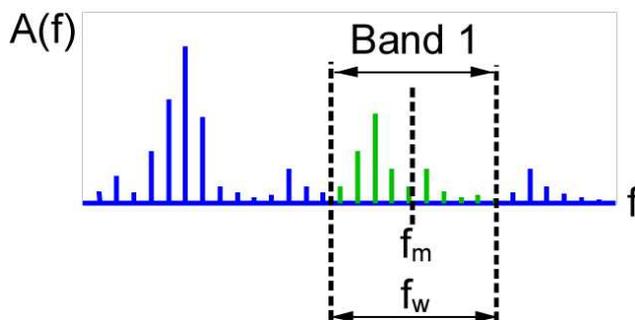
$x_i$  = Amplitude of line  $i$  within frequency band

$n$  = Number of lines within frequency band

$k$  = Index of line with lowest frequency within frequency band

$m$  = Index of line with highest frequency within frequency band

$y$  = Calculated RMS value



The following formula is also available (*Alternative formula*):

$$y = \sqrt{\frac{1}{2} * \sum_{i=k}^{i=m} X_i^2}$$

Refer also to ["Amplitude of maximum line, band 1/2/3" characteristic value](#)

**Hint**

It is recommended that the frequency band is set so that the left and right limits are located between the spectral lines. Each spectral line will then clearly lie within or without.

$$k \geq (f_m - \frac{1}{2}f_w) \div a \qquad m \leq (f_m + \frac{1}{2}f_w) \div a \qquad n = m - k + 1$$

with  
a = Frequency resolution

**Example**

A sampling frequency of 2560 Hz and 4096 samples delivers a frequency spectrum with 1600 lines and a frequency resolution of 0.625 Hz. A frequency band midpoint of 100 Hz and a width of 6 Hz. This results in values for k, m and n of:

$$\begin{array}{lll} k \geq (100 - \frac{1}{2}6) \div 0,625 & m \leq (100 + \frac{1}{2}6) \div 0,625 & \\ k \geq 155,2 & m \leq 164,8 & \\ k = 156 & m = 164 & n = 164 - 156 + 1 = 9 \end{array}$$

**9.4.5.16 Characteristic "Sum value"**

The DSP determines (calculates) a weighted sum for all lines of a frequency spectrum.

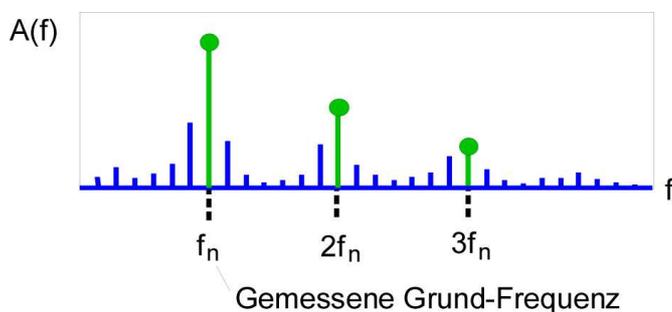
$$y = \sqrt{\frac{1}{2} * \sum_{i=0}^{n-1} x_i^2}$$

with

$x_i$  = Amplitude of line  $i$  of frequency spectrum

$n$  = Number of lines in frequency spectrum

$y$  = Sum value





**Info**

For a single ideal line (sine wave), there is agreement between Sum value and True RMS value.

**9.4.5.17 Characteristic "Remainder value"**

The DSP determines (calculates) a weighted sum of all quadratic lines of the a frequency spectrum excluding the three harmonic components and, when applicable, a component of choice.



This characteristic value can be determined only when a cyclical digital pulse is connected to a digital input/counter (e.g. the square wave pulse of a rotating shaft). This signal delivers a stable base frequency  $f_n$ .

$$y = \sqrt{\frac{1}{2} * \left( \sum_{i=0}^{n-1} x_i^2 - \sum_{i=j-1}^{j+1} x_i^2 - \sum_{i=k-1}^{k+1} x_i^2 - \sum_{i=l-1}^{l+1} x_i^2 - \sum_{i=m-1}^{m+1} x_i^2 \right)}$$

with

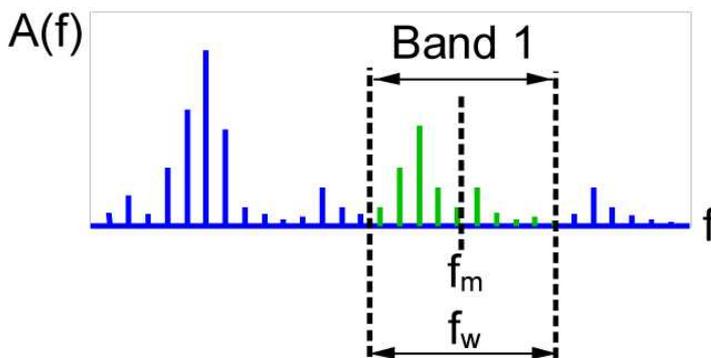
$x_i$  = Amplitude of line  $i$  of frequency spectrum

$n$  = Number of lines of frequency spectrum

$j/k/l$  = Index of line of  $f_n / 2f_n / 3f_n$

$m$  = Index of line of  $xf_n$

$y$  = Remainder value

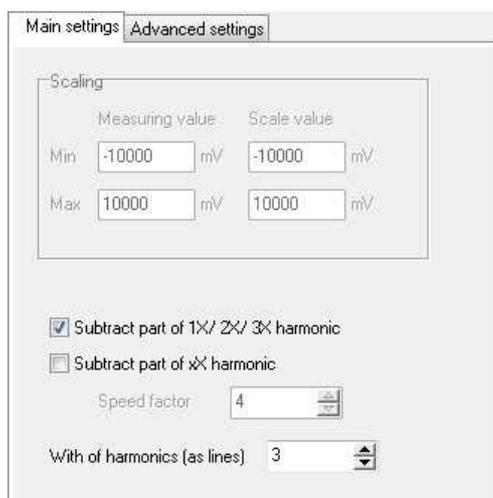


**Info**

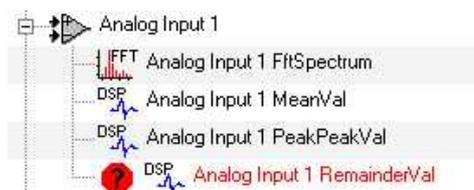
Acquisition of an accurate  $f_n$  via the frequency input is essential, as is the highest possible resolution for the frequency spectrum. In the event of deviations between the measured frequency and frequency spectrum's line index, evaluation then takes place of the next line.

The three harmonic components and the components of choice can be processed as required. These components are each calculated using three lines in the above formula. Settings are 1/3/5 lines.

Below is the corresponding configuration dialog (Main settings) tab:



The characteristic value can not be generated without an rotation pulse. The DataService-Configurator then displays an error:



## 9.4.6 Measuring frequency or speed

Measuring of frequency or rotation speed of rotating equipment provides the determining of speed as additional information for the frequency spectrum.

### Properties

- Frequency measurement via 2 free running counters (16-bit)
- Connected to digital-input 1/2
- Signal frequency of 0.2 Hz to 30 kHz
- Frequency measurement or pulse counting operating modes
- Frequency measurement gate time within the 250 ... 5000 ms range

### Operating mode

Settings are made jointly for both counter channels for operating mode (frequency measurement mode or pulse counting) and gate time.

### Frequency measurement

The appropriate measuring process is automatically selected. The interval of registered pulses are measured in the 0.2 to 100 Hz (or 12 ... 6000 rev/min) range. In the >100 Hz to 30 kHz range, the number of pulses are measured per gate time.

A gate time setting of 1000 ms is recommended. The table shows the values for 1 pulse/rotation, a gate time of 1000 ms and a sampling frequency of 1000 Hz:

Frequency in Hz	Rotation in rev/min	Pulse inter- val in ms	Evaluated periods
0.2	12	5000	1
0.5	30	2000	1
1	60	1000	1
2	120	500	2
5	300	200	5
10	600	100	10
20	1200	50	20
50	3000	20	50
100	6000	10	100
200	12000	5	200
500	30000	2	500
1000	60000	1	1000
2000		0.5	2000
5000		0.2	5000
10000		0.1	10000
20000		0.05	20000
30000		0.033	30000

The following applies to the >100 to 30 kHz range: Lower gate times enable faster measurement data updates. Higher gate times provide higher resolution/measurement precision.

Gate time in ms	Resolution in Hz
5000	0.2
2000	0.5
1000	1
500	2
250	4

### 9.4.7 Measuring the phase angle

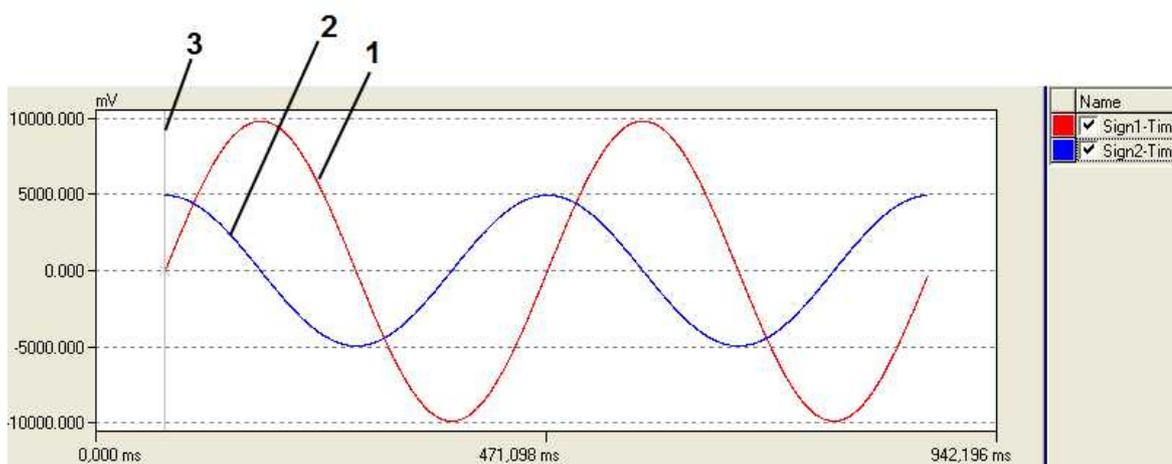


Phase angle measurement is useable only for machinery with low frequency/speed. The evaluation procedure shows why. Refer also to characteristics [phase for the main amplitude](#) or [phase for the 1X/2X/3X/xX component](#).

#### Defining the phase angle

The phase angle definition corresponds to a sine definition associated with a trigger point. Conversion to a cosine definition is explained below.

The following example has two signals. Two signal periods are acquired. Signal 1 has a phase angle of 0 deg. Signal 2 has a phase angle of 90 deg. Mark 3 shows the trigger point.



#### Measurement accuracy

Measurement accuracy is determined by acquisition of the  $f_n$  basic frequency via the digital frequency input.

Select the settings *Sampling frequency* and *Number of samples*, to enable acquisition of more than one but less than ten signal periods in a time signal block. This achieves an accuracy of  $\pm 1 \dots 5$  degrees for the phase angle.

The following table is for a frequency spectrum with 2048 and 4096 lines.

Acquired signal periods	>1	2	5	10	20
Measurement deviation phase angle	$\pm 1$ deg.	$\pm 2$ deg.	$\pm 3$ deg.	$\pm 5$ deg.	$\pm 10$ deg.

The rule of thumb for a measurement deviation of ±5 degrees:

$$f_{in} = 1..10 * \frac{f_s}{n}$$

mit

$f_{in}$  = Main frequency of input signal

$f_s$  = Sample rate

$n$  = Number of points

**Examples**

Sample rate	2560 Hz	2560 Hz	1280 Hz
Number of samples	2048	4096	4096
Input signal range for a measurement accuracy of ±5 degrees	1.25 to 25 Hz	0.625 to 12.5 Hz	0.3125 to 6.25 Hz

**Converting a sine definition to a cosine definition**

The phase angle is given in the range 0 ... 360 degrees. The following table shows a comparison between sine and cosine definitions:

Sinus	0	30	60	90	120	150	180
Cosinus	270	300	330	360/ 0	30	60	90
Sinus	210	240	270	300	330	360	deg.
Cosinus	120	150	180	210	240	270	deg.

Conversion takes place via a calculation channel using the formula "PhaseOut = (PhaseIn + 270) MOD 360".



<input checked="" type="checkbox"/> Active
Channelname: Phase-Out
Unit: Degrees
Location:
Description: Calculates various arithmetic operations
Main settings   <b>Advanced settings</b>
Formula: [var0+270]%360
var0: <input checked="" type="radio"/> Channel <input type="radio"/> Manual input      Phase-In

### 9.4.8 Monitoring

The "Limit" software channel monitors characteristic values against threshold values. Limit channels can be logically linked and given to digital outputs. In the same way, functions can be integrated into the monitoring such as averaging, computations or time procedures.

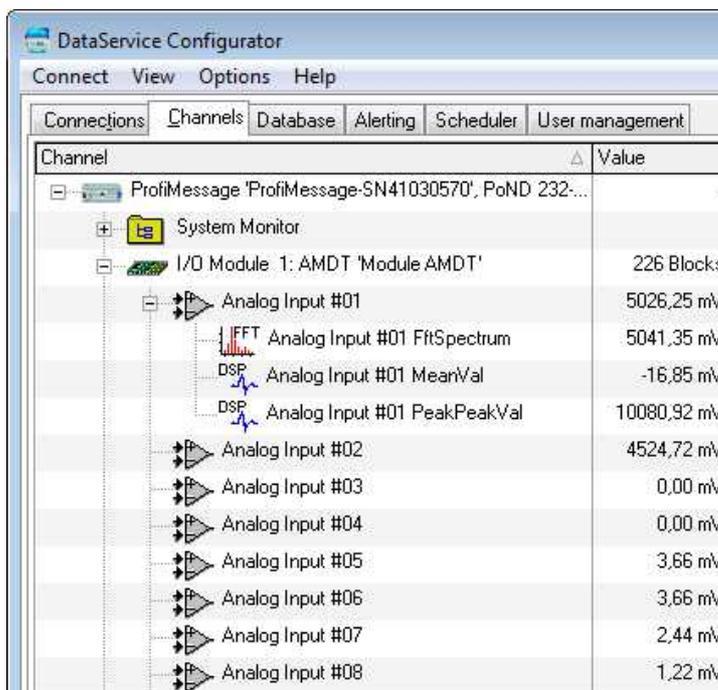
Refer to the sections on software channels in the device manual.

## 9.5 Configuration and operation

- [Configuration using the DataService Configurator](#)
- [Visualisation using ProfiSignal](#)
- [Firmware update](#)

### 9.5.1 Configuration using the DataService Configurator

The DataService Configurator gives a hierarchical portrayal of a system's connected components. The following image shows 8 "analog input" channels. Analog input 1 has additional derived channels.



The "Analog Input x" channel deliver the time signal (as block of measured data). The value shown here is the maximum value of the time signal.

The "Analog Input x FftSpectrum" channel delivers a frequency spectrum (as a block of measured data). The value shown here corresponds to the spectrum's peak amplitude.

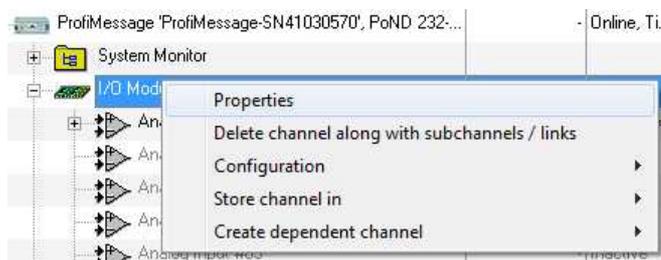
The following image shows the other channels from the I/O module AMDT: 2 analog outputs, 2 counters, 4 digital inputs and 4 digital outputs. The two counters belong to the first two digital inputs.

	Analog Output 1	13,8 %
	Analog Output 2	13,8 %
	Counter 1	0,00 Hz
	Counter 2	0,00 Hz
	Digital Input 1	Off
	Digital Input 2	Off
	Digital Input 3	Off
	Digital Input 4	-
	Digital Output 1	-
	Digital Output 2	-
	Digital Output 3	-
	Digital Output 4	-

Overall functioning is organized according to channels. As a rule, each channel delivers one measurement value. Channels can be added or deleted.

### Configuring/setting the entire I/O module

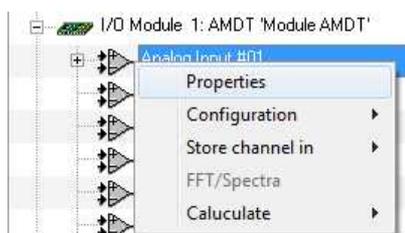
Open the configuration dialog via the context menu (right-click) or double-clicking an I/O module.



The dialog is described in [configuring/setting the I/O module](#).

### Configuring/setting single channels

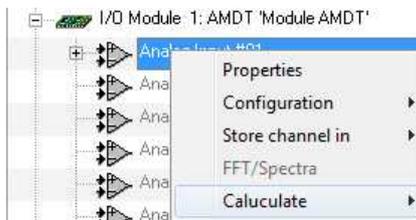
Open the configuration dialog via the context menu (right-click) or double-clicking a channel.



The dialog is described in [configuring/setting an analog input](#).

## Adding/deleting an FFT/spectrum or characteristic value channel

Add channels using the analog input's context menu (right-click). Delete a channel using that channel's context menu

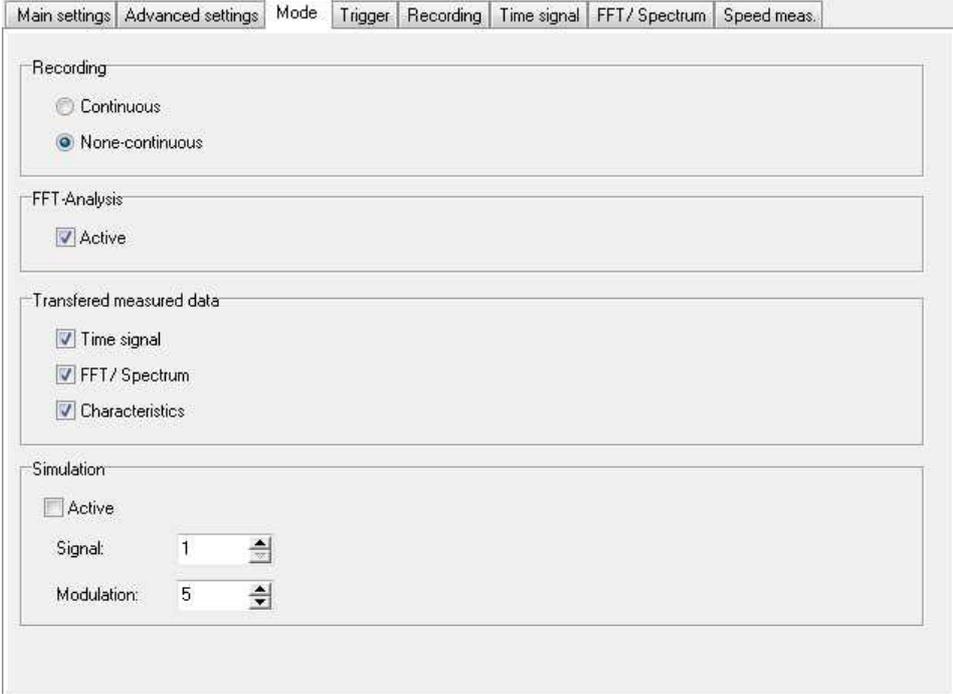


The dialog is described in [configuring/setting an FFT/spectrum](#).

### 9.5.1.1 Configuration/settings for I/O module

I/O module settings take place for all analog inputs. The most important settings are on the tabs: *Operating mode*, *Triggering* and *Recording*.

#### ▼ Operating mode tab



The screenshot shows the 'Mode' tab in the LogMessage software. The 'Recording' section has two radio buttons: 'Continuous' and 'None-continuous', with 'None-continuous' selected. The 'FFT-Analysis' section has a checked 'Active' checkbox. The 'Transferred measured data' section has three checked checkboxes: 'Time signal', 'FFT / Spectrum', and 'Characteristics'. The 'Simulation' section has an unchecked 'Active' checkbox, a 'Signal' dropdown set to 1, and a 'Modulation' dropdown set to 5.

#### Recording

To set the main mode of operating:

**Non-continuous:** Recording, evaluation and measurement data transfer takes place in chronological sequence. Refer to [Non-continuous recording](#).

**Continuous:** Recording, evaluation and measurement data transfer takes place in parallel. Refer to [Continuous recording](#).

#### FFT analysis

To enable/disable internal FFT analysis. This setting affects the settings options available on the *Recording* tab.

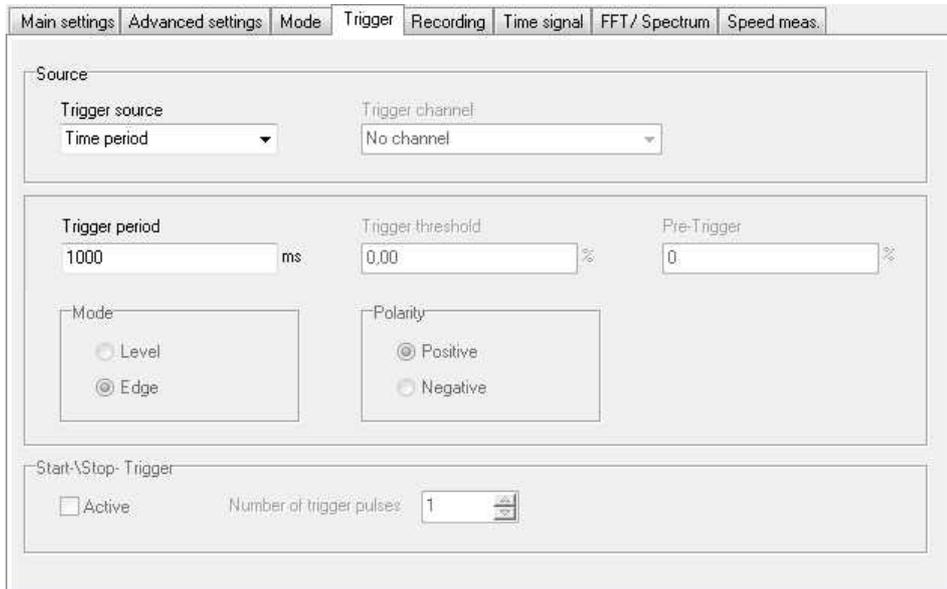
#### Transmitted measurement data

To globally set which of the three measurement data types are to be transmitted, irrespective of whether the corresponding channels have been created and are active.

#### Simulation

To enable signal simulation. Refer also to [signal simulation](#).

▼ **Triggering tab**



**Trigger source**

A trigger event starts recording (i.e. signal acquisition). Select from four trigger-source options:

- Time period  
The I/O module's internal time counter is used to generate periodical trigger events.
- Analog input  
The trigger source is one of the I/O module's eight analog inputs.
- Digital input  
The trigger source is one of the module's four digital inputs.
- Master  
The trigger source is a second I/O module AMDT. Refer to [synchronizing a second AMDT](#).

**Trigger channel**

Selects the triggering channel. This is always one of the I/O module's own channels.

**Trigger period**

To set a time period, between two trigger events, in the 1 ms ... 60 s range.

Note: A short time period can extend the actual period when the total time is greater for recording, evaluation and data transmission.

**Trigger threshold**

For analog-input triggering, sets the threshold value at  $\pm 0 \dots 100\%$  of the input measuring range.

## Pre-Trigger

This option is available only for the *Non-continuous* operating mode.

For triggering via analog input or digital input, sets the amount of signal pre-history as 0..100% of recording depth (i.e. signal length).

## Mode and polarity

Sets the type of triggering. Analog input: With over-run or under-run of the threshold/limit value. Digital input: With logical 1 or logical 0.

## Start-Stop trigger and number of trigger pulses

This option is available only for the *Non-continuous* operating mode.

This option dynamically controls the recording signal length for analog or digital input triggering. Refer to [triggering and recording](#).

### ▼ Recording tab

Main settings	Advanced settings	Mode	Trigger	Recording	Time signal	FFT/ Spectrum	Speed meas.
Used analog inputs							
8							
Sampling							
Oversampling factor:	8						
Sample rate:	2560						Hz
Number of samples:	2048						
Recording time:	800 ms						
Frequency range:	1000 Hz						
Number of lines:	800						
Frequency resolution:	1,25 Hz						

## Used analog inputs

Operation can reduce the number of analog inputs from 8 to 4 / 2 / 1. This reduces the time for evaluation and for measurement data transmission, or increases the trigger rate. Some functions are available only for settings of  $\leq 4$  channels. Refer also to [project planning](#).



This is setting takes priority over the analog inputs marked as *Active*.

**Sample rate**

Sets the sampling frequency in the 256 Hz to 20480 Hz range. The setting is applied to all selected analog inputs. The *Operating mode* affects the options that are available here.

**Number of samples**

The number of samples (i.e. measurement values) in the 128 to 8192 range for a time signal. The setting is applied to all selected analog inputs. The *Operating mode* affects the options that are available here.

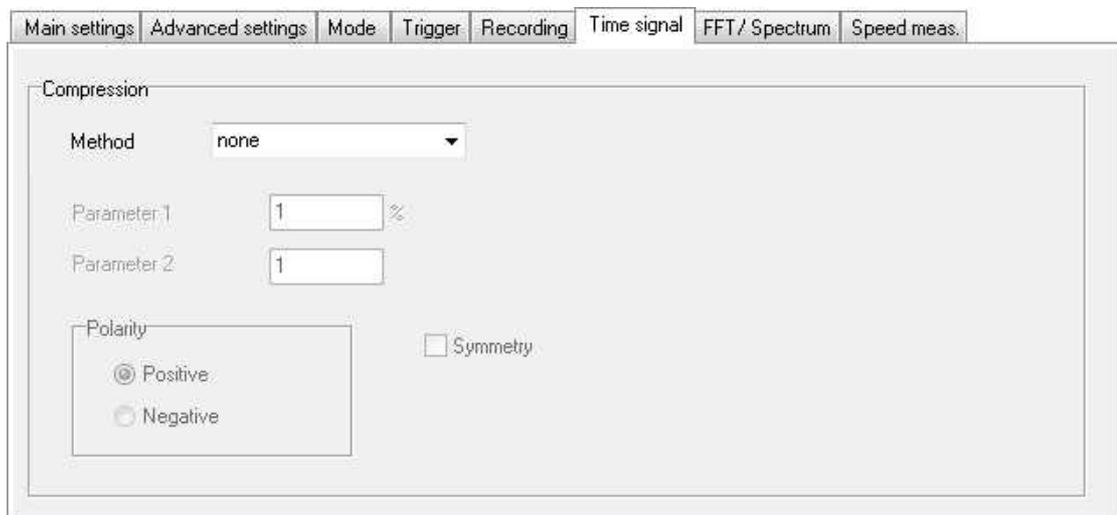
**Recording time**

Information about the time signal. It is determined from the sampling frequency and number of samples and then displayed here.

**Frequency range/ number of lines / frequency resolution**

Information about the frequency spectrum. It is determined from the sampling frequency and number of samples and then displayed here.

▼ **Time signal tab**



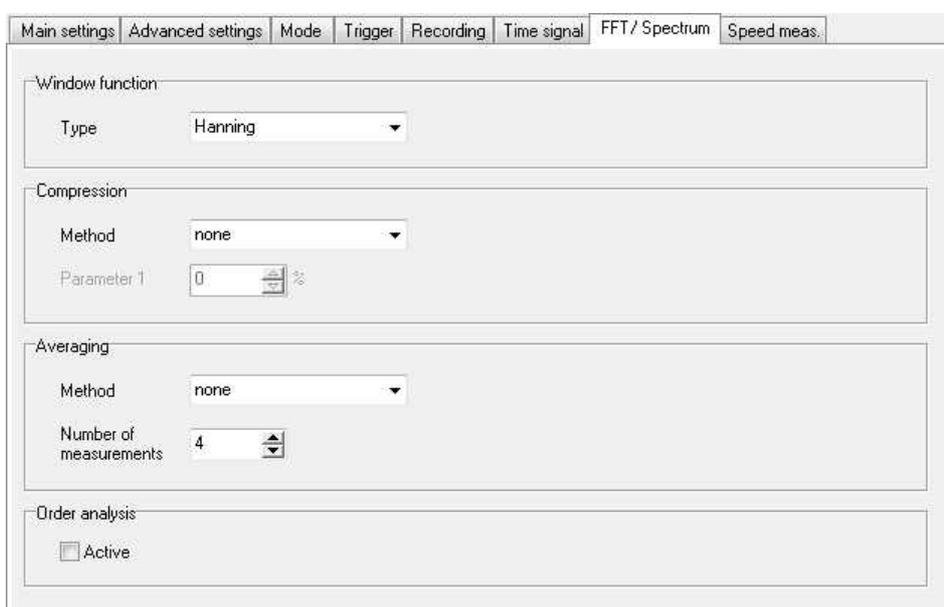
**Compression**

Time signals can be compressed prior to transmission. This can reduce transmission speed and increase storage capacity in the data logger memory. Select the required *Method*:

- None  
The time signal is transmitted without compression
- Log. compression ( $\mu$ -Law)  
Amplitude values undergo logarithmic compression; the compression fact equals 2:1. Amplitude error following decompression is  $\pm 2$  % max.

- Delta coding  
Amplitude values are transmitted as absolute (for minor changes) or relative (as differences). The compression factor ranges between 2:1 and 1:1. No compression/decompression loss.
- Minimum-/Maximum values  
The time signal is reduced to the local maximum or minimum. More information is available in the "Applications with AMDT" manual (in the generator/air-gap section).

▼ **FFT/Spectrum tab**



The screenshot shows the 'FFT/Spectrum' tab in the LogMessage software. The interface includes several sections for configuration:

- Window function:** A dropdown menu for 'Type' is set to 'Hanning'.
- Compression:** A dropdown menu for 'Method' is set to 'none', and a numeric input for 'Parameter 1' is set to '0'.
- Averaging:** A dropdown menu for 'Method' is set to 'none', and a numeric input for 'Number of measurements' is set to '4'.
- Order analysis:** A checkbox labeled 'Active' is currently unchecked.

### Window function

Enables a weighting function for the time signal. The weighting is applied prior to running the FFT analysis. Options are "Hanning" (recommended for high frequency precision) or "Flat Top" (recommended for amplitude precision).

### Compression

Frequency spectrums can be compressed prior to transmission. This can reduce transmission speed and increase storage capacity in the data logger memory. Select the required *Method*:

- None  
The frequency spectrum is transmitted without compression
- Log. compression ( $\mu$ -Law)  
Amplitude values undergo logarithmic compression; the compression factor equals 2:1. Amplitude error following decompression is  $\pm 2$  % max.

**Averaging**

A frequency spectrum can be averaged within the device via measurement cycles  $n = 2 \dots 32$ .

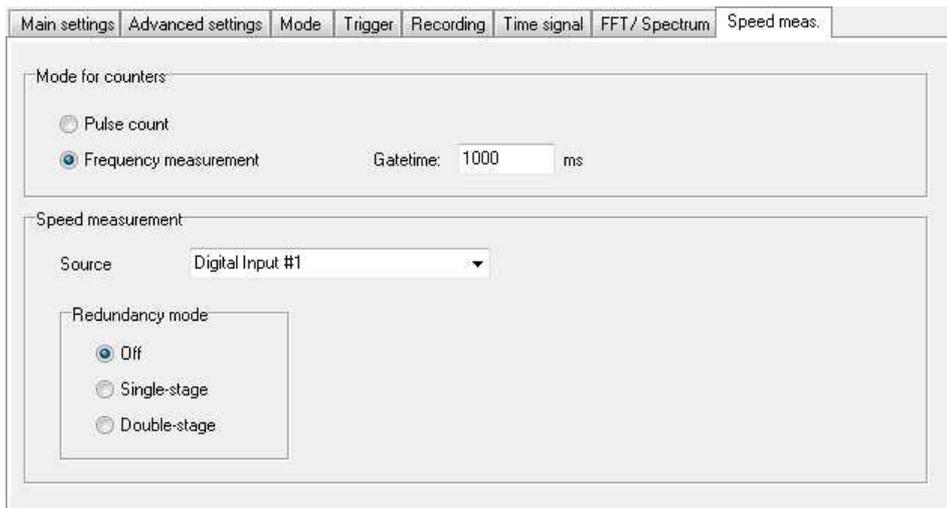
The *Intermediate block values* transmits a frequency spectrum corresponding at averaging level (1, 2, 3, ..., n) for each measurement.

The *End block value* transmits a frequency spectrum at a corresponding averaging level only after n measurements.

**Order analysis**

When order analysis is enabled, the evaluation software (e.g. ProfiSignal) will be informed that the measured frequency spectrum is to be portrayed as an order spectrum. The spectrum is then normalized to the measured rotation. This requires that a rotation-pulse is connected and a frequency measurement is activated.

▼ **Speed measurement tab**



**Counter mode**

Both counters are assigned directly to first two digital inputs.

Two modes are possible:

- Pulse counting
- Frequency measurement

Settings are made simultaneously to *both* counters. *Pulse counting* is consecutive (16-bit = 65536) and reset is not possible. *Frequency measurement* takes place automatically in Hz. More information is available in [measuring frequency or speed](#).

**Speed measurement, Source**

Sets one of the digital or analog inputs as source for measuring speed to which the FFT analysis is assigned. Key word: Rotation speed stamp to frequency spectrum and order analysis.

Set to digital-input 1 or 2 when the frequency measurement is taking place via one of these inputs.

**Redundancy mode**

Two speed pulse sensors and two digital inputs can be operated creating the possibility of redundancy. Refer here to [redundant trigger source](#).

**9.5.1.2 I/O module / measurement block counter**

Measurement data undergoes evaluation and transmission depending on I/O module settings and trigger events.

The DataService Configurator displays a counter for the number of recorded measurement-data blocks, as status information for the I/O module AMDT.

I/O Modul 1: AMDT 'Module AMDT'		428 Blocks
+	Analog Input 1	45,17 mV
+	Analog Input 2	41,75 mV
-	Analog Input 3	34,18 mV

**9.5.1.3 Configuration/settings for analog input**

Refer also to the technical specifications for [analog inputs](#).

**Active**

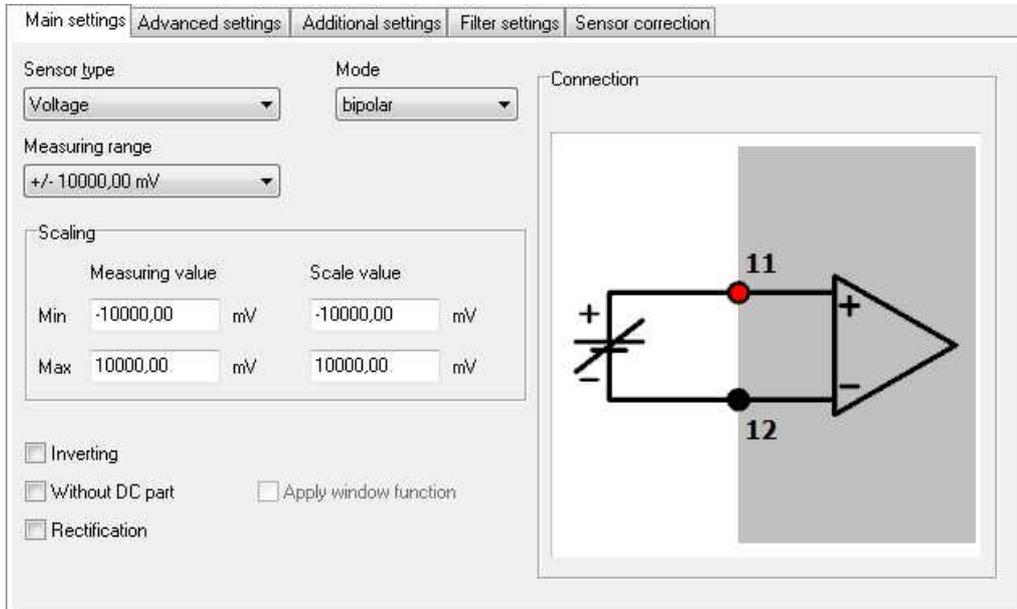
Activating this channel transmits the time signal as a measurement data block following each triggering. Non-required channels should be deactivated.



**Info**

The *Time signal* tab of the I/O module includes more settings with affects to all analog-input channels. See section [Configuring/setting an I/O module](#).

▼ Main settings tab



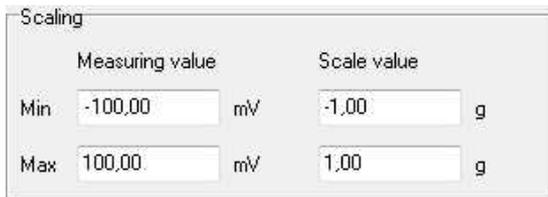
**Sensor type / Mode / Measuring range**

Defining the input measuring range. *Sensor type* enables selection between a volt and current interface. *Mode* enables selection between a bipolar and unipolar measuring range. *Measuring range* selects one of 7 possible measuring ranges from ±10000 mV to ±156 mV.

**Scaling / Unit**

The four *Scaling* fields contain scaling as a choice of two points of a linear ordering.

Example: Enter the unit **g** and the following *Scaling* values for a velocity sensor with a sensitivity of 100 mV/g:



**Inversion**

Activates signal inversion. Takes place following recording and prior to evaluation.

**Without DC part**

Eliminates a signal's DC part. Takes place following recording and prior to evaluation. The DC part is still made available as a measurement value (arithmetical average characteristic value).

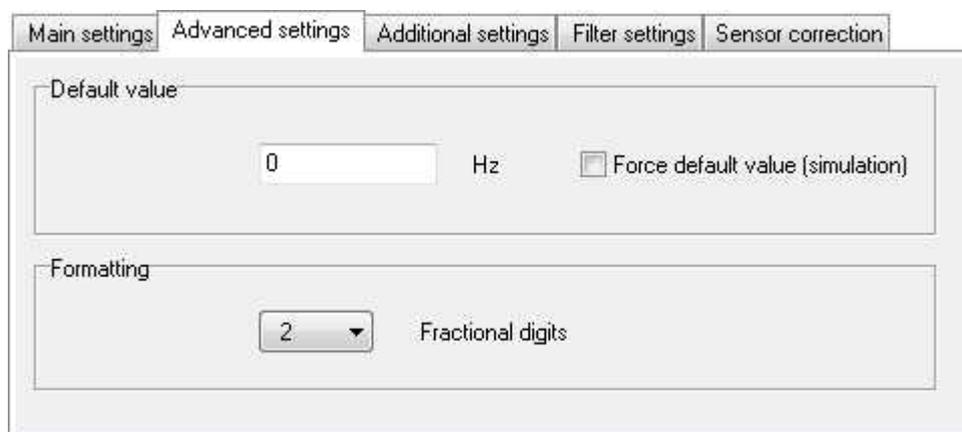
### Apply window function

Select this option to calm measurement data for a static vibration. A weighting is then applied prior to the arithmetic average being calculated. The signal's periphery is weighted lower and its middle higher.

### Rectification

Activates signal rectification. Takes place following recording and prior to evaluation.

#### ▼ Advanced settings tab



The screenshot shows the 'Advanced settings' tab selected among five tabs: 'Main settings', 'Advanced settings', 'Additional settings', 'Filter settings', and 'Sensor correction'. The 'Advanced settings' panel contains two sections: 'Default value' and 'Formatting'. In the 'Default value' section, there is a text input field containing '0', followed by the unit 'Hz', and a checkbox labeled 'Force default value (simulation)' which is currently unchecked. In the 'Formatting' section, there is a dropdown menu showing the number '2' and the label 'Fractional digits'.

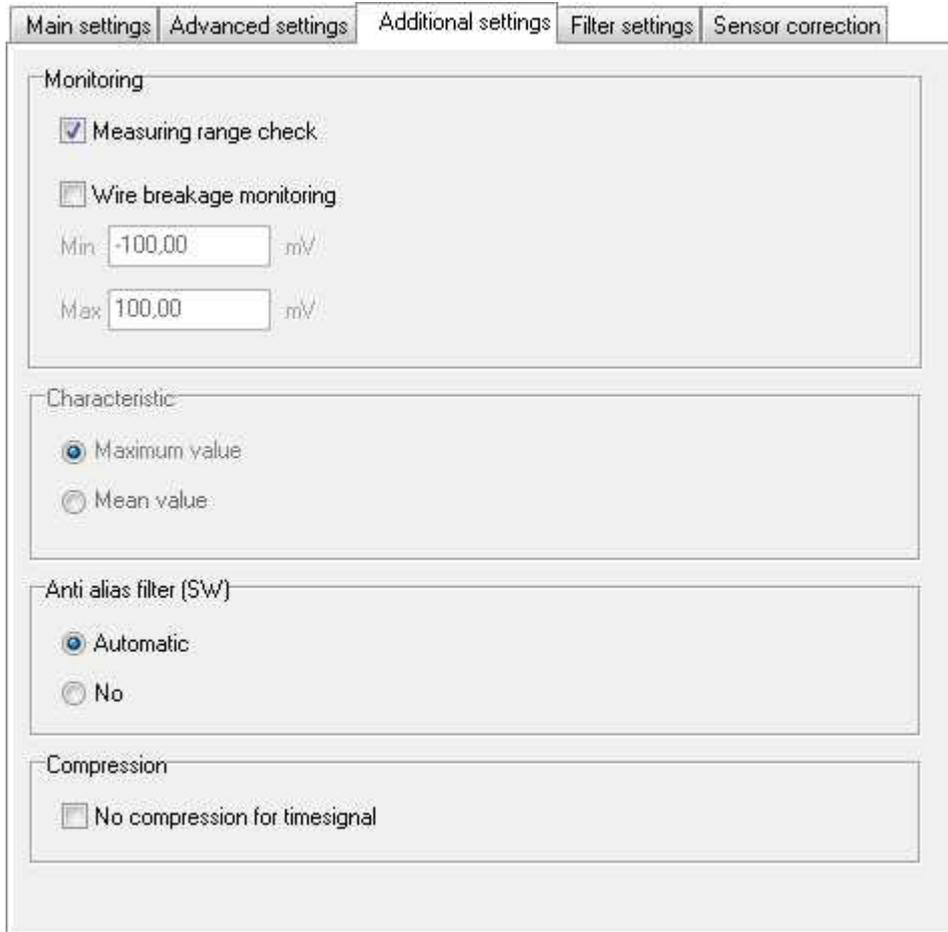
### Default value

The value set here is transmitted as a measurement value when a normal measurement value is missing.

### Formatting

The required number of decimal places for the measurement value is set, e.g. for display in the DataService Configurator.

▼ **Additional settings tab**



**Measuring range check**

Monitors whether the input signal remains within the physical voltage range (e.g. ±10 V)

**Wire break monitoring**

Monitors whether the arithmetical average (DC component) of the input signal remains within the preset voltage range.

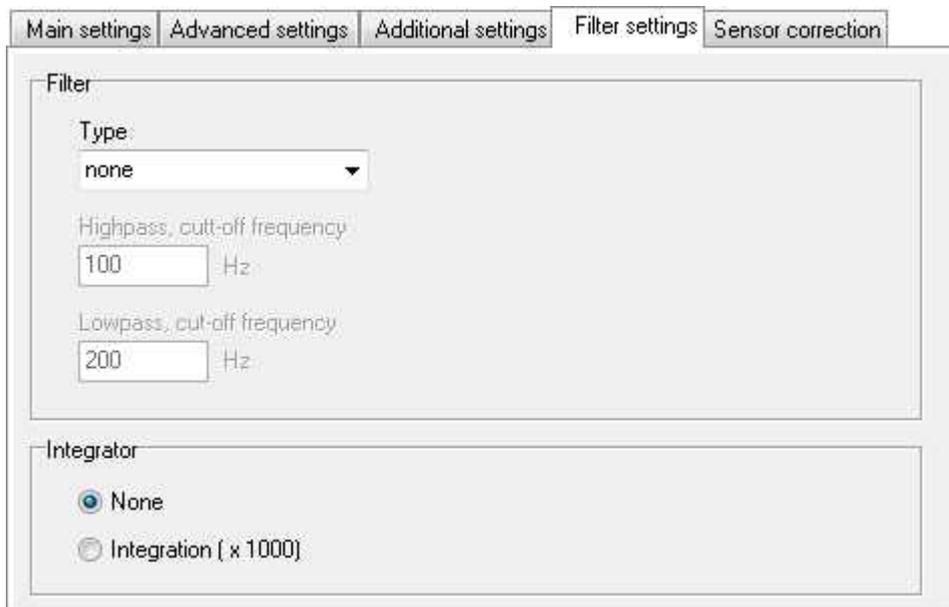
**Anti-Alias-Filter (SW)**

The software-Anti-Alias-Filter is a digital low-pass whose cut-off frequency is around 40 % of the set sampling frequency. Select the *Automatic*, to work with the FFT analysis.

**Compression**

The I/O module can be set to compress measurement data for transmission of all active analog inputs. Refer to the *time signal* tab in [configuring/setting an I/O module](#). This option enables individual analog inputs to be excluded from such compression.

▼ **Filter settings tab**



**Filter**

Activates digital filtering of the time signal. Options are low-pass, band-pass or high-pass filters. A Butterworth characteristic is preset. Filter order is automatically set internally. Cut-off frequencies can be set at the 1Hz to 10000 Hz range.



Using a digital high pass filter or band pass filter can be limited to 1..4 analog inputs - depending on board revision. An overview is available in the section [digital filters](#).

**Integrator**

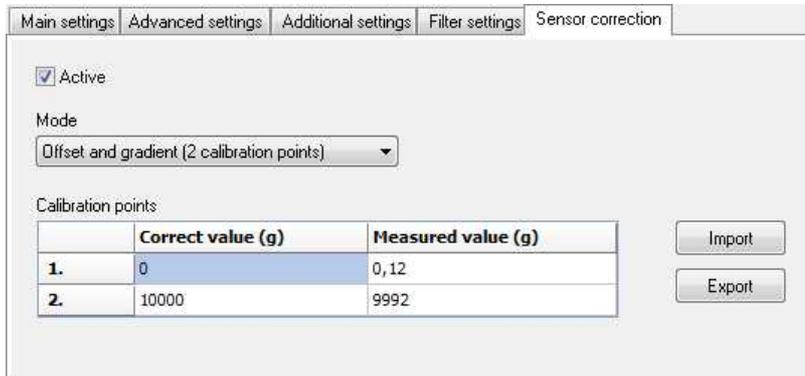
Activates numerical integration of the time signal. The scaling factor is fixed at a pre-set value of 1000.

Example: For measurements using velocity sensors, a vibration/wave velocity signal (m/s<sup>2</sup> unit) is converted into a vibration speed signal (mm/s unit). Refer to the "Applications with AMDT" manual.



Using a digital integrator can be limited to 1..4 analog inputs - depending on board revision. An overview is available in the section [Integrator](#).

▼ **Sensor correction tab**



The screenshot shows the 'Sensor correction' tab with the following settings:

- Active
- Mode: Offset and gradient (2 calibration points)
- Calibration points table:

	Correct value (g)	Measured value (g)
1.	0	0,12
2.	10000	9992

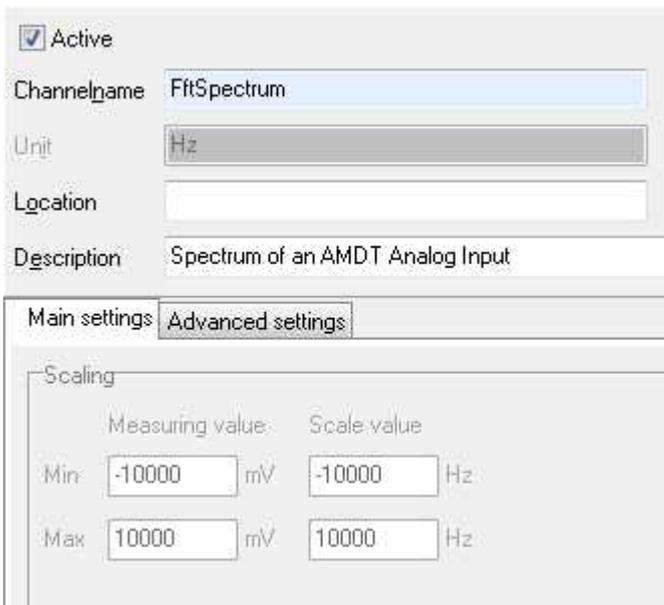
Buttons for 'Import' and 'Export' are visible to the right of the table.

**Mode / Calibration points**

Performs correction for offset and gain. A simple variance analysis is used. Input is required of two points from the linear characteristic curve.

**9.5.1.4 Configuration/settings for FFT/spectrum**

**Main settings tab**



The screenshot shows the 'Main settings' tab with the following configuration:

- Active
- Channelname: FftSpectrum
- Unit: Hz
- Location: (empty field)
- Description: Spectrum of an AMDT Analog Input

Below the main settings, the 'Advanced settings' tab is active, showing a 'Scaling' section:

	Measuring value	Scale value
Min	-10000 mV	-10000 Hz
Max	10000 mV	10000 Hz

**Active**

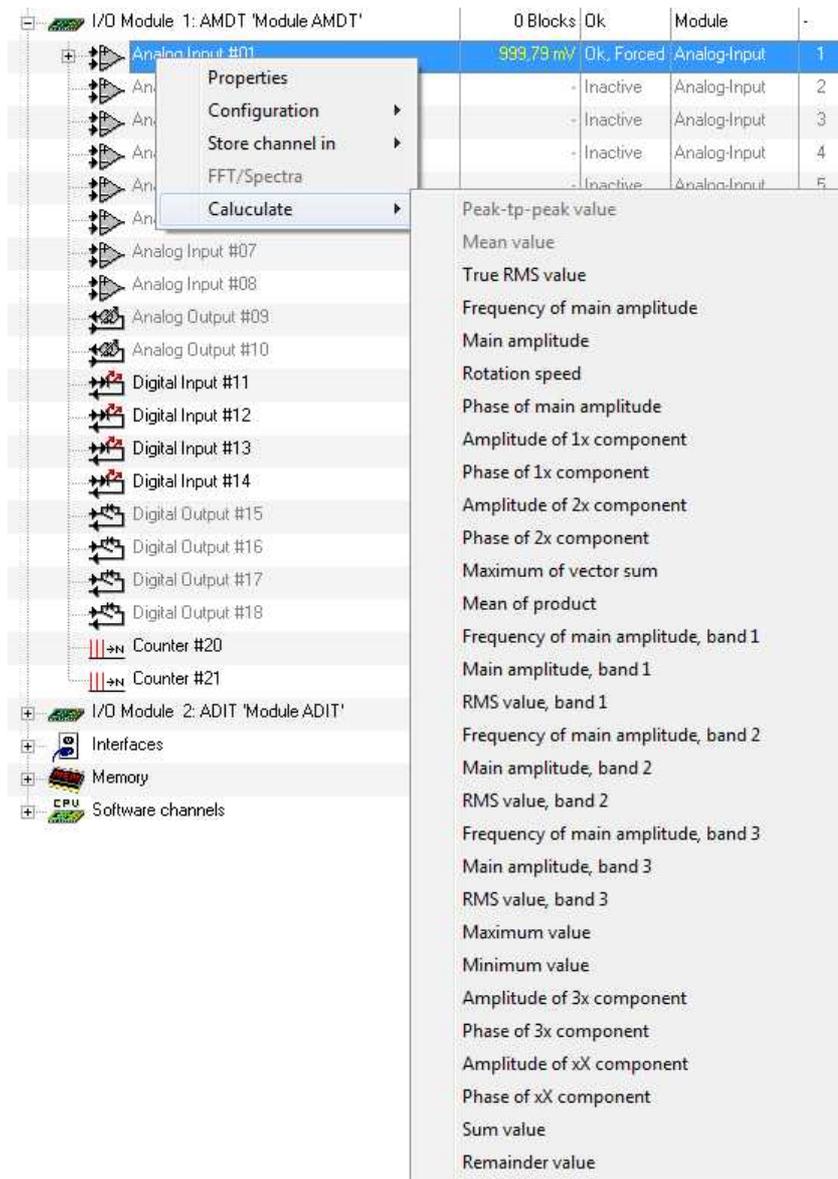
Activating this channel transmits a frequency spectrum as measurement data following each triggering. Unrequired channels should be deactivated.

**Scaling**

The "FFT/spectrum" channel is derived from one of the analog-input channels and therefore inherits its scaling. The *effective* scaling is grayed-out here.

### 9.5.1.5 Configuration/settings for characteristics

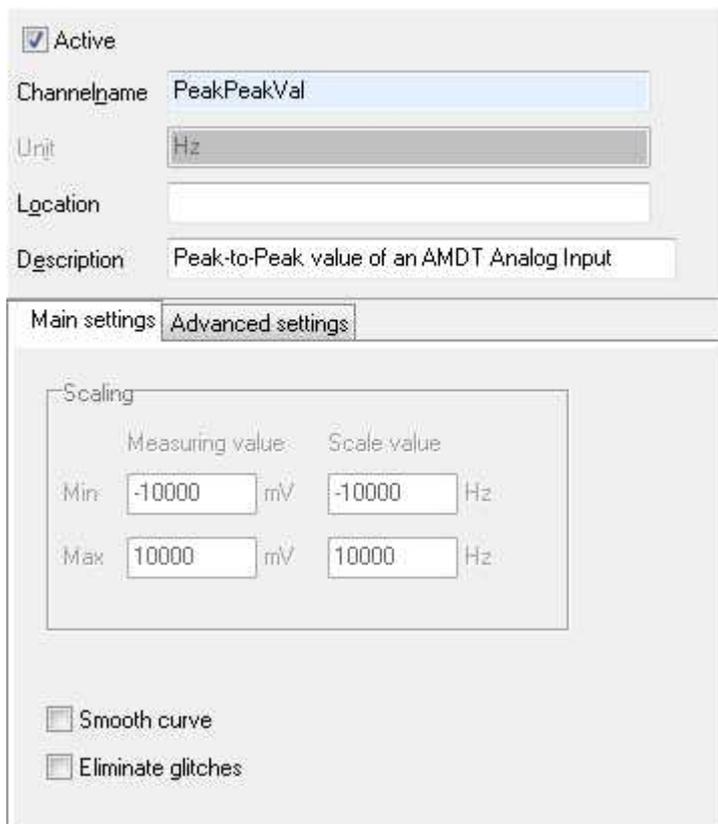
To add a characteristic-value, click on the source analog-input and right-click to display the required context menu – refer to image below. To delete, use the channel's context menu.



Technical specifications for each characteristic : see section [characteristics](#)

**Main settings tab**

Here characteristic "Peak-to-peak value" as example:



Active  
 Channelname: PeakPeakVal  
 Unit: Hz  
 Location:  
 Description: Peak-to-Peak value of an AMDT Analog Input

Main settings | **Advanced settings**

Scaling

	Measuring value	Scale value
Min	-10000 mV	-10000 Hz
Max	10000 mV	10000 Hz

Smooth curve  
 Eliminate glitches

**Active**

Activating this channel transmits the selected vibration/wave characteristic value as measurement data following each triggering.

**Measurement range /Scaling / Unit**

The "Characteristic value" channel is derived from one of the analog-input channels and therefore inherits its scaling. The *effective* scaling is grayed-out here. Exceptions are those characteristic values that deliver frequency or phase measurements. Scaling is then preset to Hz or ° (degrees).

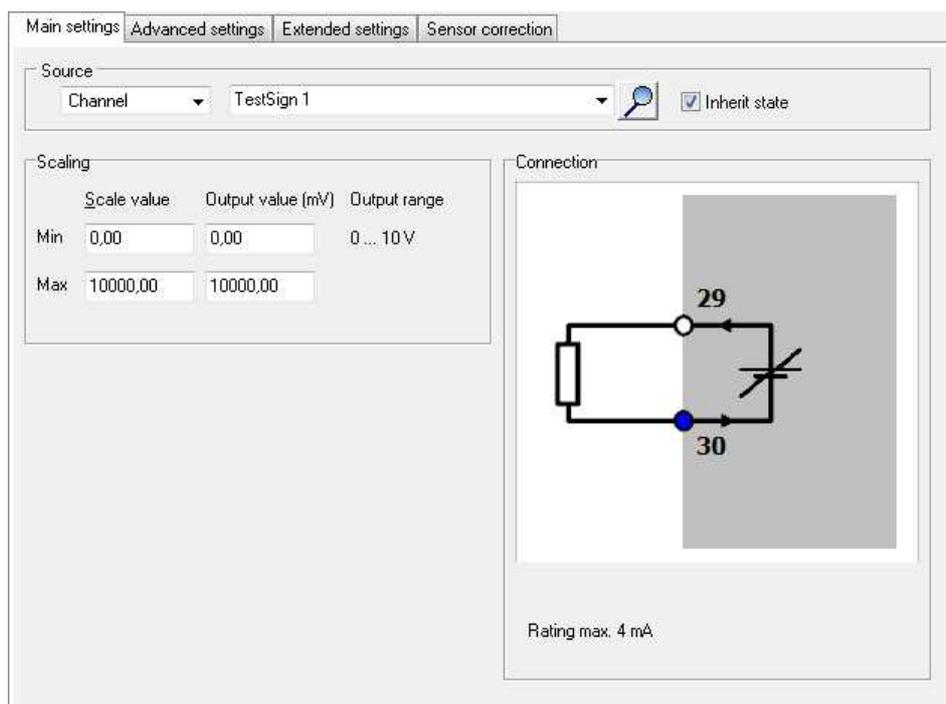
More setting options : see section [characteristics](#).

### 9.5.1.6 Configuration/settings for analog output

Refer also to the technical specifications for [analog outputs](#).

Output is always in the range 0 ... 10 V.

#### ▼ Main settings tab



#### Source

**Source** selects from various signal sources:

- **Application**: Output data is controlled via a ProfiSignal application.
- **Channel**: Output data is controlled via a DataService channel.
- **Manual value**: Output is set manually.

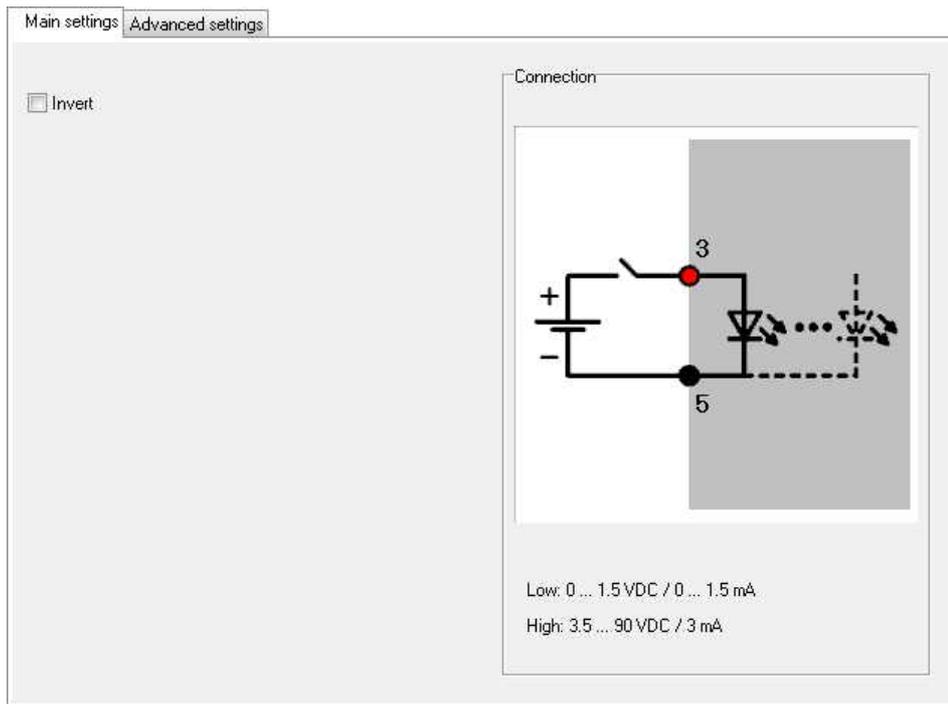
#### Scaling

Defines the physical basis for the output unit of measurement. In the example 0 ... 100 % is assigned the output value 0 ... 10 V.

## 9.5.1.7 Configuration/settings for digital input

Refer also to the technical specifications for [digital outputs](#).

### ▼ Main settings tab



### Inversion

Activates logical inversion.

### 9.5.1.8 Configuration/settings for counter

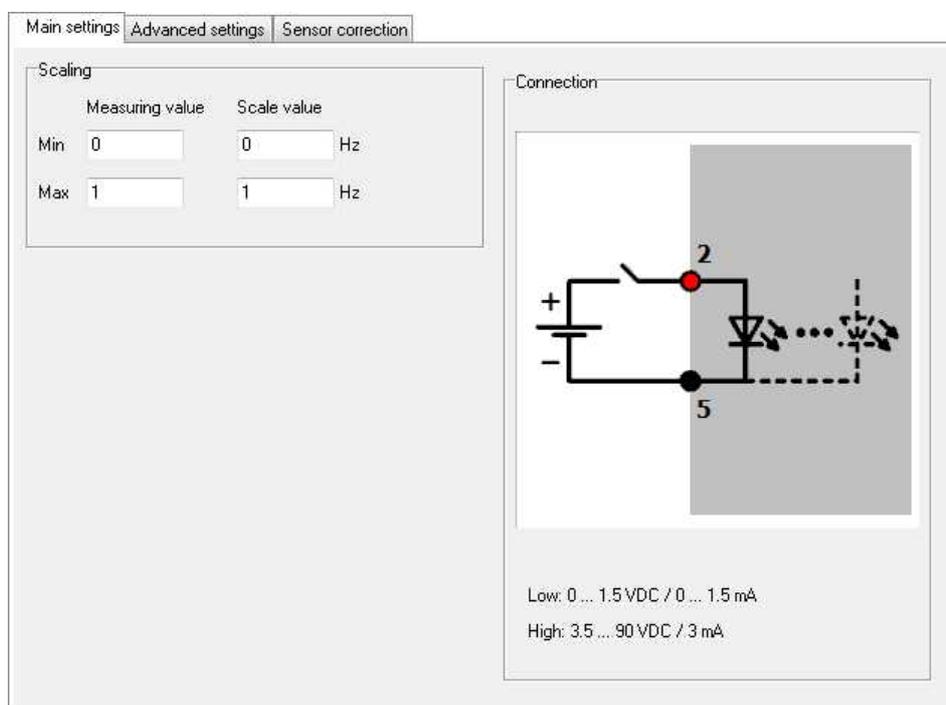
Refer also to the technical specifications for the [counter](#) and the section on [measuring frequency and rotation](#).

The (measuring frequency or counting pulses) mode is set under the *Measuring rotation* tab. Refer to [configuring/setting an I/O module](#).

#### Unit

The preselected unit for frequency measurement is **Hz** . Enter here the desired unit.

#### ▼ Main settings tab



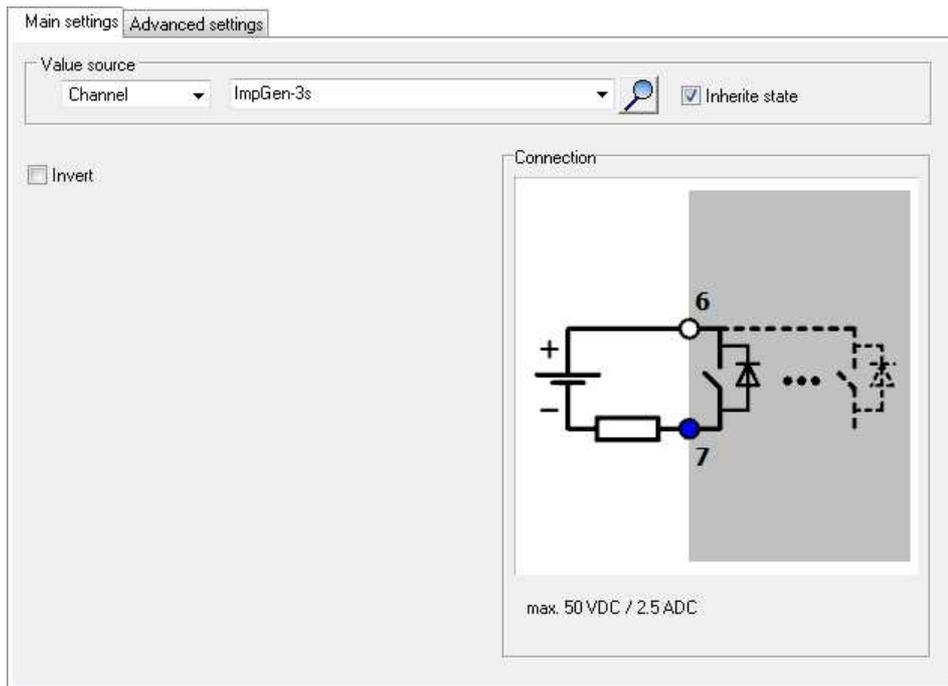
#### Scaling

Sets conversion factor for the measurement. As a choice of two points of a linear ordering.

### 9.5.1.9 Configuration/settings for digital output

Refer also to the technical specifications for [digital outputs](#).

▼ **Main settings tab**



**Source**

**Source** selects from various signal sources:

- **Application:** Output data is controlled via a ProfiSignal application.
- **Channel:** Output data is controlled via a DataService channel.
- **Manual value:** Output is set manually.

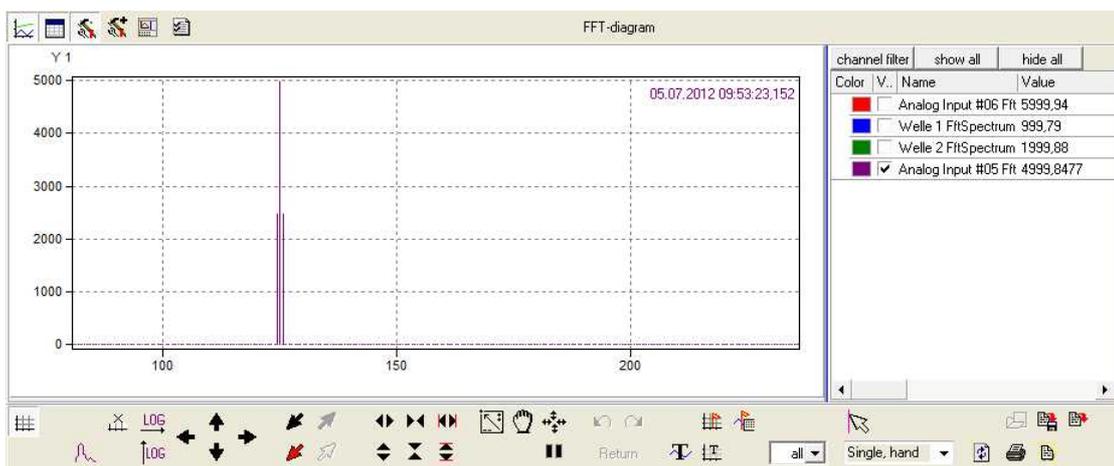
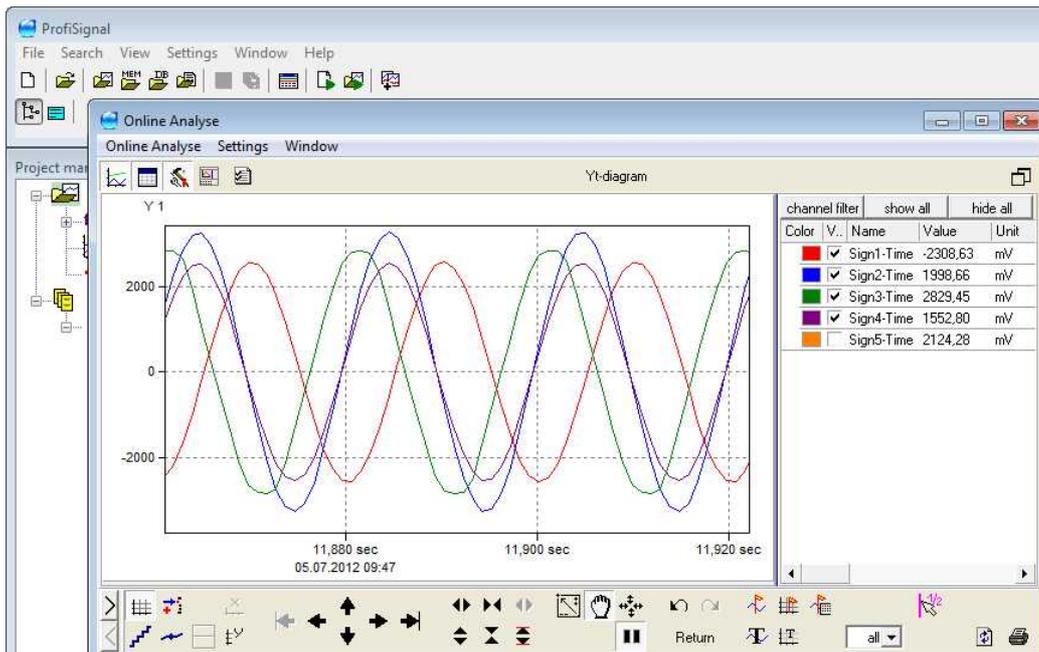
**Inverted**

Activates logical inversion.

### 9.5.2 Visualization using ProfiSignal

ProfiSignal is a complete system for applications for measurement data acquisition, analysis and visualization. It replaces former products, e.g. VibroLab, BasisPaket or Process visualisation.

The following images show examples of a diagram with some time signals and a diagram with a frequency spektrum :



### 9.5.3 Firmware update

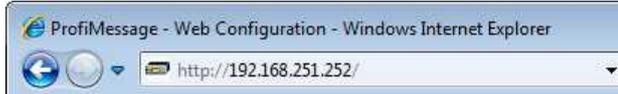
Firmware for the I/O module AMDT is included in the device firmware. Firmware updates take place via the device's Ethernet interface and any internet browser. Refer to the sections on firmware update in the device manual.



The device's power supply must not be interrupted during firmware updating otherwise damage may occur to the equipment that will require repairing.

**Method**

- Open your internet browser
- Enter the IP address of your device (example):



- Click *Update firmware*.
- Enter the file with the new firmware in the *New firmware file* field on (click *Search* to find the file on your PC).
- The click *Start firmware update*.

The firmware upgrade takes 4 to 6 minutes.



## ProfiMessage "ProfiMessage.example.com"

Update firmware and reboot

R221 (Build 6526)





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

Current Firmware: **R221, Build 6526** (ProfiMessage-Firmware-110627-r221-build6526.tar.bz2)

New Firmware file:

The device will reboot after the update (reboot). A message is displayed during loading and when a restart has been completed:

### Update firmware

R224 (Build 6850)



UpdateFirmware \$Rev: 6484 \$

Stripping header... OK.  
Decompressing archive... OK.  
Unpacking updater... OK.  
Executing updater...

FirmwareUpdater \$Rev: 6433 \$

Unpacking archive... Done.

Updating from **R224, Build 6850** (ProfiMessage-Firmware-110912-r224-build6850.tar.bz2)  
to **R225, Build 6914** (ProfiMessage-Firmware-110920-r225-build6914.tar.bz2)

Checking Kernel... Writing... Done. Verifying... Done.  
Checking RamDisk... Not provided.  
Checking U-Boot... Writing... Done. Verifying... Done.  
Stopping Services...

Shutting down FROG: [ OK ]  
Shutting down PoND: [ OK ]  
Starting HW watchdog: [ OK ]

Copying files... Done.



**System is rebooting now. Please standby about one minute...**

The process finishes about one minute later. Then return to the home page ( [Back](#) ).

## 9.6 Information on applications

The "Applications with AMDT" manual contains information on typical industrial applications. It includes information on the fundamentals of applications, advice on connections, examples of configurations, and much more.

The main sections are :

- Measurement of absolute bearing vibration
- Measurement of relative shaft vibration
- Air gap monitoring

## 9.7 Appendix to older AMDT hardware

This appendix explains features and differences to older hardware. AMDT boards V1.0 to V1.2 were manufactured and supplied from 2000 to 2005.

	AMDT V1.0 to 1.2	AMDT V2.0
<b>Analog inputs</b>		
Measurement range	$\pm 10$ V, alternatively $\pm 25$ V or $\pm 2,5$ V adjustable via jumpers	$\pm 10$ V, $\pm 5$ V, $\pm 2,5$ V, $\pm 1,25$ V, $\pm 625$ mV, $\pm 312$ mV, $\pm 156$ mV, adjustable via software
Coupling	DC-coupling	Preset DC-coupling, choice of AC-coupling via DIP switch
Max. sampling frequency	25 kHz	20.48 kHz
Oversampling	No	Yes
Anti-aliasing filter	Set by hardware (SMDs), possible to replace the signal conditioning board	Automatically adapts, with digital filter (DSP)
Potential isolation	A potential difference totalling 2.5 V is permitted between the differential inputs ('-' connector)	A potential difference totalling 100 V is permitted between the differential inputs ('-' connector).
Input protection	to 25 V	to $\pm 250$ V
<b>Digital inputs</b>		
Input hysteresis	No	Yes
Input current, type	8 mA	3 mA
Updating	Coupled to analog inputs (trigger)	Independent
<b>Counter</b>		
Frequency measurement	0.1 Hz to 100 kHz	0.2 Hz to 30 kHz
Measurement procedure	Pre-parameterized	automatic
Updating	Coupled to analog inputs (trigger)	Independent
<b>Analog outputs</b>		
Output range	$\pm 10$ V	0 ... 10 V
Updating	Coupled to analog inputs (trigger)	Independent
<b>Digital outputs</b>		
Updating	Coupled to analog inputs (trigger)	Independent
<b>Other</b>		

Power supply	24 V	12 or 24 V
<b>Digital filter</b>		
Availability	Low-pass/high-pass/band-pass for analog-input 1 ... 8	Low-pass for analog-input 1 ... 8, high-pass/band-pass for analog-input 1 ... 4
Filter order	Adjustable, 2/4/6/8	Automatically optimized , 4 or 8
Filter procedure	Non-continuous or continuous	Always continuous
<b>Digital integrator</b>		
Availability	basic integrator for analog-input 1 ... 8	Basic integrator for analog-input 1 ¼ 4
Integrator procedure	Non-continuous or continuous	Always continuous
<b>Measuring phase</b>		
Availability	No	Yes for low rotations, via time-zoom procedure
<b>Envelope spectrum (for roller-bearing diagnostics)</b>		
Availability	Yes, via sequential mode	Yes, for analog-input 1 ¼ 4

## 10 Appendix:

### 10.1 EC declaration on conformity LogMessage

#### EC declaration on conformity

According to the directive: 2004/108/EC (electromagnetic compatibility)  
 According to the directive: 2006/95/EC (low voltage legislation)

We declare that the below product,

Product name	Message Series
Type or model	LogMessage

corresponds to the technical requirements and to any amendments to these that are valid as at the date of the declaration.

The following standards/regulations have been applied:

<b>EN 61 326-1:2006</b>	EMC requirements for electrical measurement & control technology and laboratory equipment
<b>EN 55011:2007 + A2:2007</b>	ISM devices - electromagnetic interference
<b>EN 61010-1:2001</b>	Equipment safety

Manufacturer's address:

Delphin Technology AG  
 Lustheide 81  
 51427 Bergisch Gladbach - Refrath, Germany  
 Tel: ++ 49 (0)2204 97685-0  
 Fax: ++ 49 (0)2204 97685-85  
 E-Mail: info@delphin.de

This declaration is issued under the sole responsibility of the manufacturer and, where required, its authorised representatives.

Contact person:

Claudia Göbel  
 Tel: ++ 49 (0)2204 97685-0  
 Fax: ++ 49 (0)2204 97685-85

Bergisch Gladbach, 29.06.2012

Delphin Technology AG



CLAUDIA GÖBEL

(chairwoman of the board of management)

Delphin Technology AG • Lustheide 81 • 51427 Bergisch Gladbach • Deutschland  
 Vorsitzender des Aufsichtsrats: Dipl.-Ing. Peter Renner • Vorstand: Claudia Göbel (Vorsitzende), Frank Ringsdorf  
 Sitz der Gesellschaft: Bergisch Gladbach • HRB 47544 • DE121973939 • St.-Nr. 204/5712/1886 • WEEE-Reg.-Nr. DE 78054880  
 Raiffeisenbank Kürten-Odenthal Kto. 5648017 BLZ 370 691 25 • IBAN DE39 3706 9125 0005 6480 17 BIC GENODED1RKO  
 Postbank Köln Kto. 229566-504 BLZ 370 100 50 • Kreissparkasse Köln Kto. 320/000117 BLZ 370 502 99  
 Konformitätserklärung ProfiMessage\_CG2012.docx

10.2 ISO 9001 certificate



**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: 1 July 2011

Certificate Expiry: 30 June 2014

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



This document is subject to the provision on the reverse.  
71 Fenchurch Street, London EC3M 4BS, United Kingdom, registration number 1879370  
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  
March Revision 13

# Index

## - A -

Adder 106  
 Advanced channel selection 103  
 Advanced settings (software channels) 105  
 Advanced settings tab 68  
 Alarm clock 145  
 Analog input 79  
 Analog output 92  
 Average 127

## - B -

Basic channel selection 103  
 Basic device configuration 56  
 Basic Settings 13  
 Batch alarms 131

## - C -

Calculation channel 128  
 CAN interface  
     Configuration 94  
 CE symbol 6  
 Channel configuration (LogMessage) 55  
 Channel configuration (overview) 41  
 Channel groups 102  
 Channel selection  
     Advanced 103  
     Basic 103  
 Clock settings 46  
 COM interfaces  
     Configuration 94  
     Wiring 20  
 Compensation 79  
 Configuration  
     via an internet browser 43  
 Configuring a LogMessage device 56  
 Configuring main unit 56  
 Counter 146  
 Current sensor type 83  
 Current sensor type (0/4..20 mA) 84

## - D -

Data reduction 105  
 Data transfer to USB 64  
 Default configuration 49  
 Default value 105  
 Deleting module entries 76  
 Device 14  
 Device Configuration (LogMessage) 55  
 Device connections 14  
 Device ID 56  
 Device memory 60  
 Dialog footer (explanation) 66  
 Dialog for main settings, sensor compensation 69  
 Dialog header (explanation) 66  
 Differentiator 106  
 Digital input 91  
     with counter function 89  
     with frequency measurement 89  
 Digital output 93

## - E -

Earth loops 160  
 Earthing 159  
 Edge trigger 102  
 ESD protection 163  
 Establishing a connection to the device 10  
 Ethernet interface 94  
 Examples  
     Connecting actuators 155  
     Connecting sensors 151  
 Explorer view 55  
 External linearization tables 71  
 External setpoint tables 73

## - F -

Firmware changelog 53  
 FlipFlop 107  
 Format 105

## - G -

Galvanic isolation 158  
 Gateway 44, 58  
 Getting started 7

## - I -

I/O module replacement 28  
 I/O modules  
     Terminal assignment 23  
 Identify an unknown IP address 43  
 Included in delivery: 4  
 Inherit status 104  
 Install programs 9  
 Integrator 121  
 Internal battery replacement 36  
 IP address 44, 58  
 ISO 9001 certificate 260

## - K -

Keys 14

## - L -

Lamps 17  
 LAN LEDs 17  
 LED lamps 17  
 LEDs 18  
 Level trigger 102  
 Limit value 109  
 Linearization 121  
 Linearization tables 70  
 Load configuration 48  
 Load resistor 84  
 Logic 123

## - M -

Markers 126  
 Measurement range monitoring 79  
 Memory 60  
 Memory card installation and upgrade 32  
 Module information 76  
 Module layout 23  
 Module number 76  
 Module replacement 28  
 Module settings 76

## - N -

Network 44, 58

Network settings 10, 44, 58  
 Ni xxx 85  
 NTP 46, 58  
 NTP status 47

## - O -

Operating hours counter 106

## - P -

Persistence 105  
 Potential differences 164  
 Power input 16  
 Power Supply 16  
 Power supply: 16  
 Pt xxx 85  
 Pulse generator 111  
 Pulse width modulation (PWM) 127  
 PWM 127

## - Q -

Quick Start 7

## - R -

Reboot 54  
 Reboot device 54  
 Replacement  
     Battery 36  
     I/O module 28  
     Memory card 32  
 Reset 14  
 Reset button 54  
 Resistance sensor type 81  
 Resistance thermometer sensor type 85  
 Restart main application 53

## - S -

Safety Advice 2  
 Save configuration 48  
 Set point tables 70  
 Setpoint (software channel) 132  
 Setting network address 10  
 Settings for all dialogs 66  
 Settings for USB export 63

Shielding	162
Software	9
Software channels	101
Statistics	134
Status monitoring	135
Stopwatch	136
Subnet mask	44, 58
Symbols in this document	6
Symbols used in this documentation	6
System monitoring	141
System report	50
System requirements	5

## - T -

Tables	70
Technical specifications	166
Main device	167
Temperature formats	85, 87
Terminal	43
Terminal block configuration	23
Thermocouple sensor type	87
Timer	141
Trigger (software channel)	144
Trigger variants	102

## - U -

Unknown IP address?	43
Update Firmware	51
Updating firmware	53
USB	17
USB Memory Stick	64

## - V -

View channels	48
Voltage sensor type	80

## - W -

Web configuration	43
Wire break monitoring	79