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Manual

TopMessage
ProfiSignal Software

TopMessage devices

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Contents:

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References:

CE

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ISO 9001

SO 9001.

Safety regulations

Please observe the following safety regulations by all means.
Thus, you protect your device and yourself as well:

- Disconnect the supply voltage before you start working at the voltage-carrying parts – there is danger to life with high voltages!
- A control voltage of as much as 36 V max. can be applied to the input terminals of the Message devices. The installation can only be made by qualified personnel as unintended touching of lines carrying a voltage of more than 40 V will result in danger to life.
- Cross voltages, that might arise between the different signal lines can also become seriously dangerous for you.
- Electronic component parts are sensitive to electrostatic charging. In order not to damage your devices, carry off from yourself possible static chargings, before you touch the circuit board or component parts. We would recommend to wear a conductive wrist band.
- Please take care that the signal lines will be connected professionally to the screw terminals.
- Only use the intended tools to open the device.
- Upon disconnection of the supply voltage the data transmission will be interrupted which can entail data losses.

1 TopMessage and TopLab

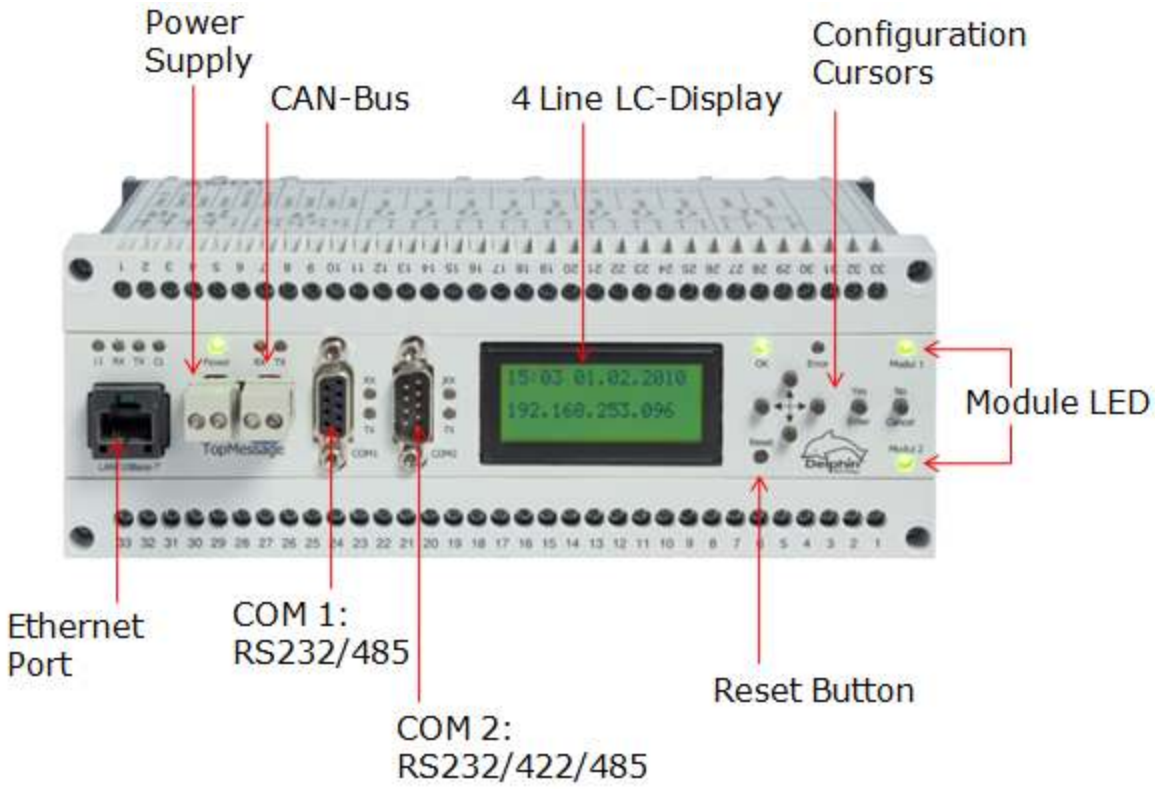
The manuals apply to TopMessage and TopLab devices. Both types of devices only differ by design and signal connections.

TopMessage Master (GBDT)
DIN rail mounting and screw terminals for sensor connection.

TopMessage Slave (Extension Unit GSLT)
DIN rail mounting and screw terminals for sensor connection.

TopLab (Master GBDT-L)
Table device with 4mm banana plugs for sensor connection.

1.1 Device overview

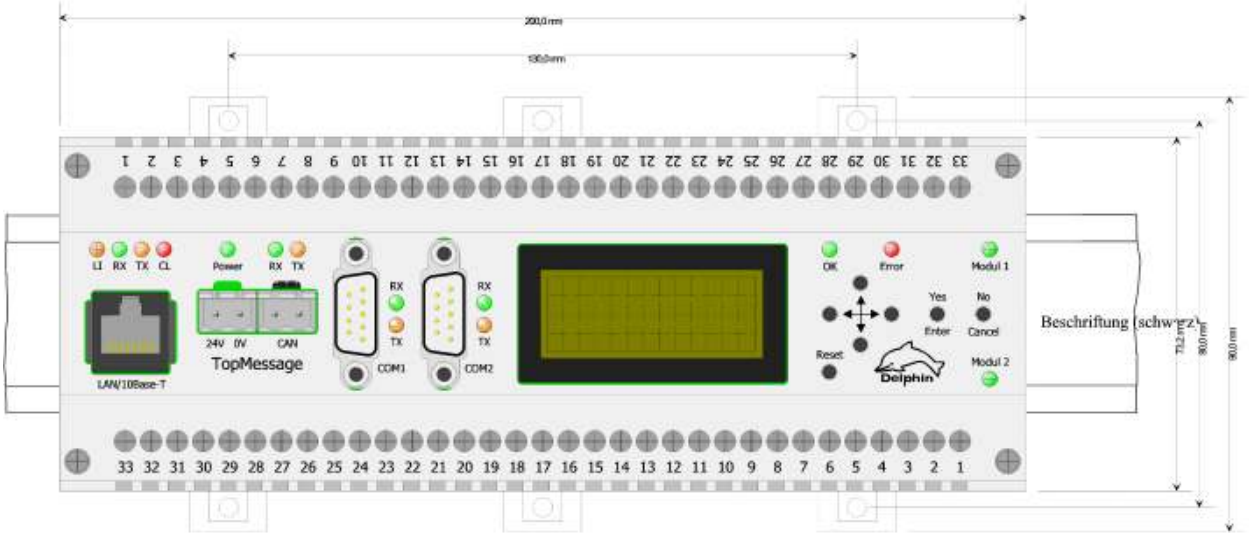


LAN-Port:	10 Base-T, for the integration to the company network and system configuration with DataService Configurator software.
Supply:	12-36 VDC, reverse voltage protection
CAN-Bus:	Internal 2-wire bus which is also used to extend the system with up to 10 slave devices (GSLT).
COM1:	SUB-D 9 Socket, supporting RS232, RS485 and optionally Profibus-DP Salve protocols
COM2:	SUB-D 9 Socket, supporting RS232, RS422 and RS485 protocols
Display:	4 line LC-Display, Display settings can be configured
Reset Button:	Press button for 1 sec. to restart the system
Cursor Buttons:	Basic configuration of the device, e.g. IP-Address settings
Module LED:	Status information of modules

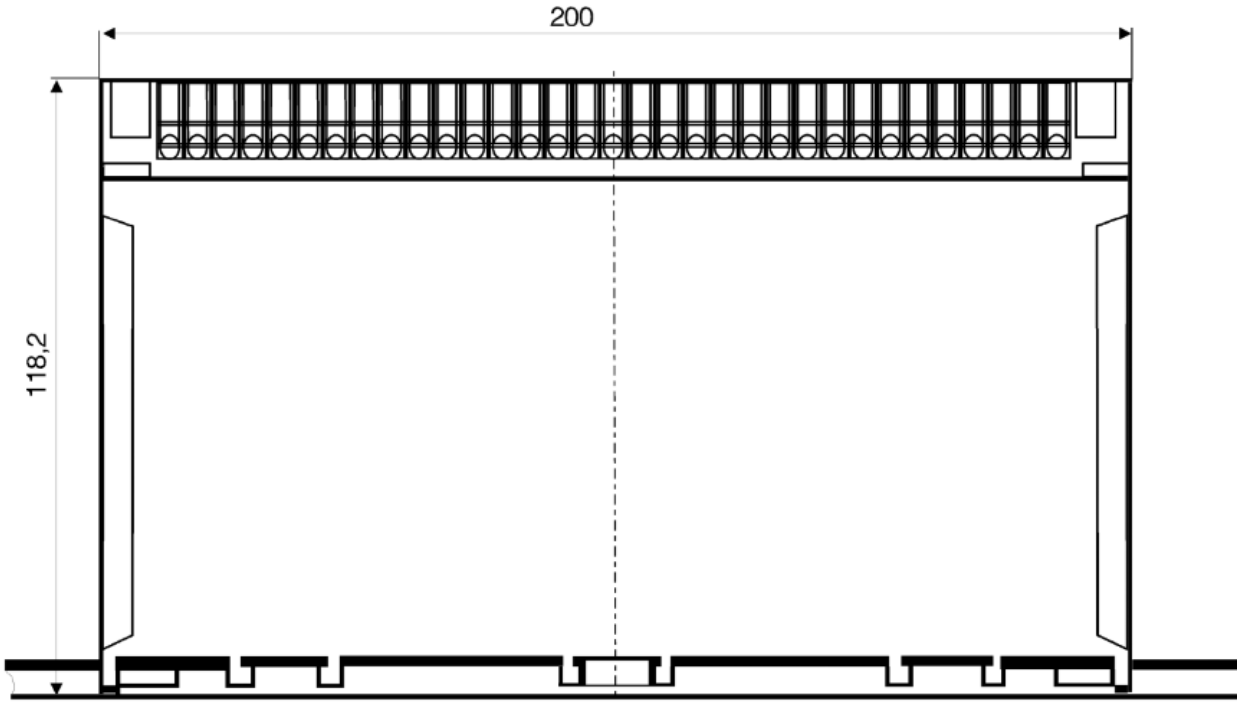
1.2 Device dimensions

Housing (WxHxD – 200x73x118 mm) for basic and extension devices.
Mounting rail DIN EN 50023 or screw fixture.

Front view:



Side view:



Detachable screw clamps, 33 clamps in 2 rows,
cable protection, connection wiring, max. 2,5mm^2

1.3 General technical data

GENERAL TECHNICAL SPECIFICATION	
Weight	1 kg
Dimensions	200 x 73 x 118 mm
Material	Plastic Housing
Humidity	80%, non Condensing
Temperature Range	-20 … 60 °C
Power Supply	12 (18) - 36 VDC external, Revers Voltage Protection
Power Consumption	10 Watt
Mounting	DIN Rail
Ethernet	10 Base-T (half/ful Duplex) / TCP/IP, UDP, ICMP
Display	4 lines, 15 characters, backlight
Real Time Clock	100 ms Resolution
Key Pad	6 keys
Number of Status LED	14
Web Server	Built-in for HMI Design
Serial Port COM 1	RS232 - 125 kBaud / RS485 - 500 kBaud
Serial Port COM 2	RS232 - 125 kBaud / RS485 - 500 kBaud / RS422
Protocols	TCP/IP, Modbus RTU (Master & Slave) , Modbus TCP (Master & Slave), GPS (NMEA), GSM Modem
Sensor Connection	Screw terminal, 2,5mm²

2 Connection to PC

2.1 Setting the IP-Address

In order to establish a direct connection between PC and the Message device the cross over cable included in the delivery is required. The configuration of the IP-Address through the cursors is explained in the following chapters.

LAN Socket: RJ45 (8pol. TP/UTP-Socket)
10Base-T (Twisted Pair, 10 Mbps)
Galvanic Isolation : 1kV

To establish a connection between the Message device and the PC the appropriate network settings (IP-Address and Subnet Mask) are very import. The IP address is valid for the master and all slaves connected via CAN-Bus. The selected IP addresses must not be occupied by other participants in the network.

If possible, use the factory-set addresses. However, please check that the IP addresses differ from each other if you operate several master devices in a network.

Each interface (LAN, COM1, COM2) requires its own IP address.

Interfaces	**Access via the menus**	**Factory setting**
Data network connection Ethernet-LAN10Base-T	Main Menu **/** Setup **/** LAN 10Base-T **/** IP address	192.168.254.xxx
Serial port COM1 RS232 or RS485	Main Menu **/** Setup **/** Serial COM1 **/** IP address	192.168.001.001
Serial port COM2 RS232 or RS485	Main Menu **/** Setup **/** Serial COM2 **/** IP address	192.168.002.002

Remark:
If you link the Message devices to an existing company's network, clarify the allocation of the IP addresses with your network administrator.

For Ethernet connection the numbers (xxx) to be selected from the range „1" to „254" („0" and „255" must not be selected by any of the devices connected to the network; these numbers cannot be set on the devices!).

2.2 Function of NetMask

The Net-Mask serves to adapt to the prevailing network and subnetwork structures, and should filter out of the current data transfer in the network the appropriate information for the master.
Default setting : 255.255.255.0

Only alter, if necessary.
Clarify the allocation of the setting with your network administrator.

3 Connect supply voltage

Plug :

LP-plug clamp 2-pin.
E. g. Wieland 8113B/2VL, order no. 25.326.3253.0

24V+	connection 1	(left)
0V / earth	connection 2	(right)

U_{IN} : 12..28 V_{AC} ±10% / 12..36 V_{DC} ±10%
$U_{IN\ MIN\ AMDT}$: 18 $V_{AC/DC}$

P_{max} : 10 Watt

Protection: internal Fuse: 2 A T

4 Serial interfaces

4.1 COM 1 - RS232/485-Interface

The interface can be used as RS232 or RS485.
Communication mode RS232 / RS485 is configured through software settings.
Baud rate : RS232 : 125 kbaud
Baud rate: max. 5 Mbaud (PROFIBUS: 6 Mbaud)
Galvanic isolation : 1kV.
9 pole Sub-D Socket, Pinout like PROFIBUS, DIN/EN/ISO 19245-1

4.1.1 COM 1 - RS232-pinout

Pin	***Bez.***	***Description***
1	Shield	Protective Ground
2	-	
3	TxD	Transmit Data
4	-	-
5	GND	Signal Ground
6	-	
7	-	
8	RxD	Receive Data
9	-	

4.1.2 COM 1 - RS485 pinout (also PROFIBUS-DP Slave)

Pin	***Designation***	***Signal***	
1		Shield	Shield, Protective Ground
2		-	
3	B/B´	RxD/TxD-P	Receive- / Transmit-Data-P
4		-	
5	C/C´	DGND	Data Ground (M5V)
6		VP	Supply Voltage -Plus (P5V)
7		-	
8	A/A´	RxD/TxD-N	Receive- /Transmit-Data-N
9		-	

4.2 COM 2 - RS232/422/485-Interface

The interface can be used as RS232.
Baud rate : RS232 : 125 kbaud
Galvanic isolation : 1kV.
Protocols : TCP/IP, firmware and customer specific
9 pole Sub-D plug, pin version acc. PC, DIN 41 652, part 1 (ISO 4902)

4.2.1 COM 2 - RS232 pinout

Pin	***Designation***	***Description***
Casing Screen	Shield, Screen	Protective Ground
1	DCD	Data Carrier Detect
2	RxD	Receive Data
3	TxD	Transmit Data
4	DTR	Data Terminal Ready
5		Signal Ground
6	DSR	Data Set Ready
7	RTS	Request to Send
8	CTS	Clear to Send
9	A1	Ring Indicator

4.2.2 COM 2 - RS422 pinout

Pin	***Designation***	***Description***
Casing Shield	Shield	Protective ground
1	RxD	Receive data, not inverted
2	RxD*	Receive data. inverted
3	TxD*	Transmit data. inverted
4	TxD	Transmit data, not inverted
5		Signal ground

4.2.3 COM 2 - RS485 pinout

Pin	*Designation*	*Description*
Casing Shield	Shield	Protective ground
1,4	D	Data not inverted
2,3	D*	Data inverted
5		Signal ground

Remark:
Pin 1 and 4 as well as 2 and 3 must be bridged

4.2.4 COM 2 - modem connection

If you wish to connect a modem via serial interface, you must use the interface COM2. It is connected with a non-crossed serial 1:1 cable (one end of the cable is a plug the other one a socket) which is usually included in the modem delivery.

5 LC-Display of the master

5.1 Function of the LC-Display

The 4 line LC display is on the master, type GBDT. The display has several functions. All settings apply also to the connected slaves, type GSLT. The LC-Display with four lines serves to enter the basic settings.

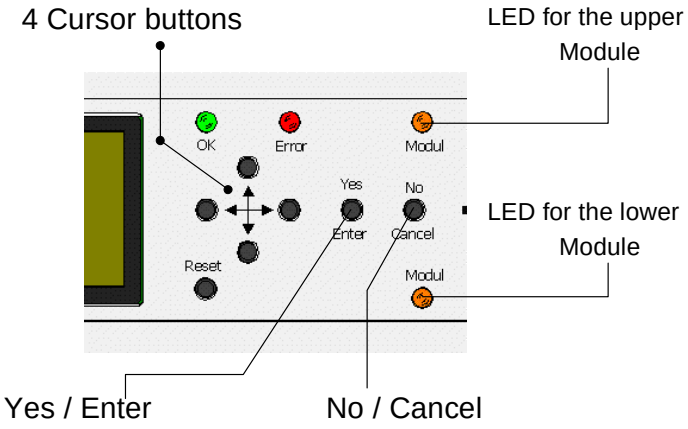
- IP-Addresses,
- Date and time,
- I/O Module numbers -addresses of the individual modules.

Also the display can be configured individually to show status readings of the device or any channel readings. In the default settings the time, date and IP-Address is shown on the display. The display will also show system message.

These and other other configuration settings can be carried out with the configuration software “TopMessage Configurator”.

5.2 Function of the operating keys

The configuration is carried out through the 4 cursor buttons and two conformation buttons (yes/no).



No-Cancel key	1.) Do not carry out entry. 2.) Upward in the menu By several pressing the main menu is reached.
Yes-Enter key	1.) Open a menu point, 2.) Confirm entry and close menu point
Cursor keys up/down, right left	1.) Navigate in the menu (up/down) 2.) Entry of numbers right/left → select decimal point up/down → select number 0..10

5.3 Setting of date and time

During normal operation an automatic time synchronization between PC and device shall be configured. The configuration of the NTP-Time Server can be done easily with the software TopMessage Configurator. However, it is also possible to change the time settings manually via the LC display.

Access to date-time-setting
Main Menu **/** Setup **/** Set Date Time
Output at LC display

```
→Setup
→Set Date Time
Change ?
09:12 26.02.2002
```

If you wish to alter the time, press the „Enter“ key now.
The marker now appears at the bottom line.
right/left → select decimal position
up/down → select number 0....X

5.4 Setting of IP-Address

Access to LAN/10base-T-setting
Main Menu / Setup **/** LAN 10Base-T **/** IP address

Output at LC display

```
→LAN/10Base-T
→IP-Address
Change ?
192.168.254.XXX
```

If you like to alter the IP-Address, press the „Enter“ key now.
The last digit will be located (underlined).
Select for xxx a number between 1 .. 254
Select for each basic device in LAN a different IP address.

5.5 Display of the measurement values

For the service, which is to say possible fault diagnosis, it is very useful, to follow up the measurement values of the individual channels on the display. Thus, faults in the sensor range can be easily discovered.

Access to modules and channels
Main Menu **/** Channels **/** Hardware-Channel **/**

```
ADGT 02/Chn 01
K2-M1-Pt100   ←
              →
  132,32 °C   ↓
```

1. line : Module type, module address/channel number in module.
2. line : Individual name of the channel (12 characters max.).
4. line : Measurement value of the channel.

Navigating between the modules and the channels
Cursor keys left/right : Navigate between the modules
Cursor keys up/down : Navigate between the channels

5.6 Module addresses allocation

5.6.1 General instructions

You find the module addresses labeled on the devices.

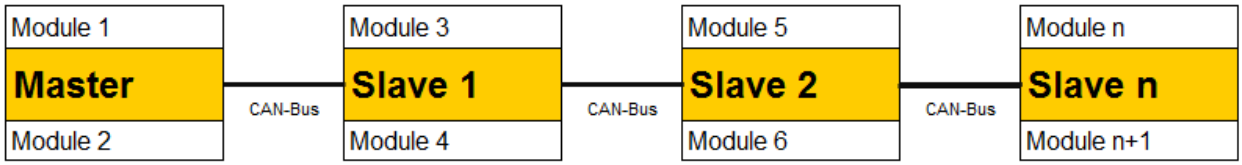
The module addresses are preset factory side.

Order of the module addresses
Each module in a basic or extension device requires an address. It is necessary in order to identify clearly the channels in the modules.
An intervention on the part of the customer will only be necessary if

- A module should be added
- A module should be removed
- A module should be replaced (in the case of faults). For the replaceable module the same module number must be allocated.

Valid module addresses : 1 to 99

In the basic device the module numbers start with 1 and 2. Afterwards the module numbers are allocated factory-preset in ascending order.



Upper module always has an uneven number, the lower module always an even number.

Inactive module
An inactive module is built in.

- a module address had not yet been allocated.
- the module address „Zero“ had been allocated.

In case a module is connected that is not yet known to the master, this module will be perceived by the master, however still left ignored (inactive module).

Active module
Only if a module address is allocated to a module, this module is active and can be configured.

Location of the terminal block, of the just selected module
Next to the terminal blocks green LEDs with the name „module“ are located. The LED with the appropriate terminal block is blinking, if the module has just been selected.

5.6.2 Allocate a module address

Access to module-address-setting
Main Menu / Setup / Modules
Output at LC display

```
→Setup
→Modules
Change ?
DIOT:    # 01
```

With the cursor keys up/down you move from module to module.

If you wish to alter the module address, press the „Enter“ key now.
The last digit is located (underlined).
right/left → select decimal point
up/down → select number 0..10

5.6.3 Mount/dismount I/O module

Warning: Please avoid static charge upon dismounting/mounting of the Message device and upon exchange of a I/O module.

Working steps (Dismount):

- Disconnect device from supply voltage.
- Remove all plug connectors from the front panel.
- Detach the 4 screws at the ends of the 2 terminal blocks. Then remove terminal blocks from device.
- Slightly impress the both locking hooks at the sides of the housing bar with a screw driver or similar and thus pull the bar with the cards out of the housing.
- The outer cards are the I/O modules. The corresponding module must now be removed and the new one plugged on.

Working steps (Mount):

- The assembly of the device must be carried out in reverse order with the following points to be observed:
- Check that all pins of the plug connector are plugged in the holes of the power supply resp. CPUT printed circuit board.
- The printed circuit boards have one direction in the housing. Use it this way that the front panel resp. central bar fits on the housing.
- Please take note that the printed circuit boards sit in the guidings upon insertion into the basic housing and are pushed into the housing until end stop.
- Before the front panel is attached to the housing the LEDs should again be aligned.
- The terminal blocks are again screwed on. Note: Special terminal blocks for the modules ADGT, ADIT, ADVT, AAST concerning cold reference junction.

Working steps (Settings after replacement of I/O module):

- Replug the plug connectors on the front and reconnect supply voltage.
- After initializing the LED should now blink „OK“. This is confirmed with the „Yes/Enter“ key as often as the main menu is reached.
- Now change to „Setup“ and confirm with „Yes/Enter“.
- Then navigate with the cursor to the submenu „Modules“ and select with „Yes/Enter“.
- Click once again with „Yes/Enter“ on the corresponding module (LED of the module is blinking and allocate a module number). Confirm with „Yes/Enter“.
- Finally press the „No/Cancel“ key as often as you will finally be out of the configuration menu.

5.6.4 Delete a module

If you intend to delete a module, proceed as follows:
Allocate the module the module address „zero“ and remove the module.

5.6.5 How to replace a module

Replacing the same type of module.

Disconnect the supply voltage and replace module.
Building in a new module into a basic or extension device has been described in the manual “B1-I/O modules”.
Reconnect supply voltage.
The new module is being recognized as inactive. Now you must allocate the same module address of the previous module to this module.

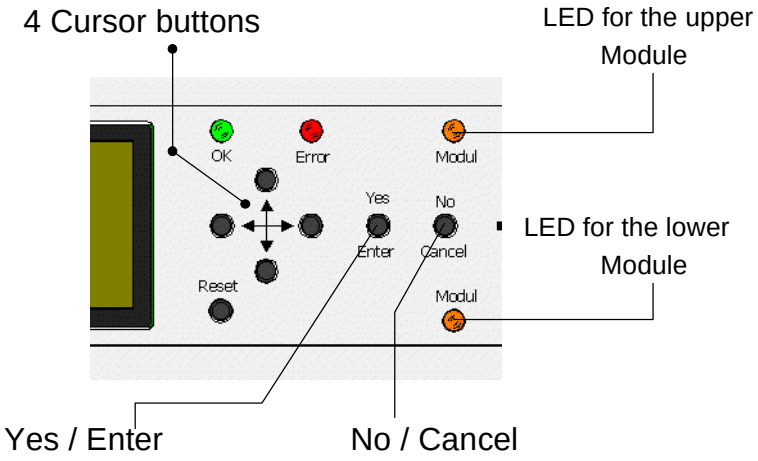
Replacing different type of module.

- In case the new module is a different type, e. g. replacing ADVT by ADIT.
- **Allocate the module the module address „zero“.**
- **Disconnect the supply voltage.**
- **Replace the module.**
- Insert the new module into the same plug-in place.
  The mounting of the modules is explained above.
- Reconnect the supply voltage.
  The new module is being recognized as inactive.
- As described earlier, now allocate the same module address.

Remark:
After changing modules and module numbers it is recommended to restart the TopMessage Configurator software. You can also use the hot key (STRG+I) or in the menu the option “reinitialize”

6 LEDs / display of error messages

The device shows its operational state via the LEDs „OK“ and „Error“.



OK-LED on	Normal operational state
OK-LED blinking	An operational message is there
ERROR-LED blinking	An error message is there

Messages are immediately displayed with current date / time and must be acknowledged by the user. Messages remain preserved also upon restart of the device and upon disconnection of the supply voltage.

6.1 List of operational messages

User: <text>	Message of a user
New Module found: YYYY (S/N: xxx)	A new I/O module had been found upon system start
Module Watchdog: Module xx dead	Module xx does no longer answer. Possible reasons: CAN-Bus terminators not plugged-in, CAN-Bus-cable faulty, GSLT without supply voltage, module faulty
Module Watchdog: Module xx alive	Module xx answers again.
Modem COM2: Max Init attempts excecded	Modem does not react / with ERROR on initialization. Check modem.
Modem COM2: DCD not set after CONNECT	Modem does not set Carrier Detect after connection set up. Check modem configuration.
Modem COM2: DCD set after Init	Modem sets Carrier Detect already after initialization. Check modem configuration.

6.2 List error messages:

Battery empty: Main Memory	Internal buffer battery is empty, measurement data are lost. Leave device at supply voltage for several hours
Battery empty: Ext. Memory	s.a.
Battery empty: Real time clock	Internal buffer battery empty, time invalid
Real time clock failure: Oscillator failure	Error of real time clock. Sequence error of an empty battery or hardware failure
Real time clock failure: Real Time invalid	Time invalid, reset clock
Real time clock failure: Switching to backup clock	Real time clock is faulty. Operation with inaccurate “emergency clock”
User: <text>	Message of a user
MEM Error: <text>	Fault of memory extension
Channel problem: <text>	A channel caused a problem concerning running time
Channel config problem: <text>	A channel ascertains a problem with its configuration
IP-Addr. conflict with MAC aa:bb:cc:dd:ee:ff	The network participant with the MAC aa:bb:cc:dd:ee:ff has the same IP address, one of the participants must be changed (consult network administrator)
MAC conflict with IP-Addr. xx.yy.zz.aa	The network participant with the IP address xx.yy.zz.aa has the same MAC, one of the participants must be changed (consult network administrator)
IP-Addr. conflict LAN – COM1	Two interfaces of the device have the same IP address. One must be changed

7 Connection of extension devices

7.1 Extension with GSLT Salve units

For the extension of a system up to 10 extension devices (slaves) can be connected to a basic device (master) via CAN-Bus. The slaves must be positioned in the near of the appropriate master, as the line length of the CAN-Bus is limited. Only the masters are connected to the data network via Ethernet.

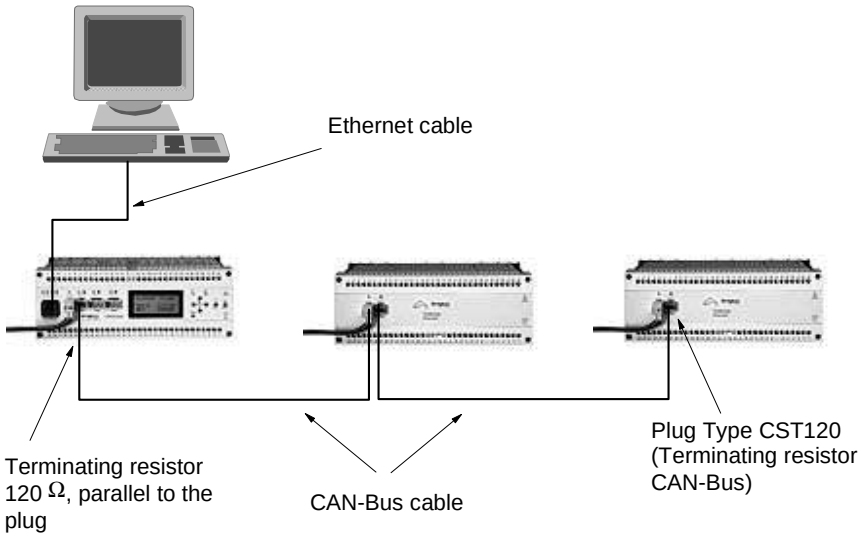
Basic device/master, Type GBDT
Extension devices/slaves, Type GSLT

The CAN-Bus serves for the internal communication between the individual modules and the CPU in the basic device. The devices, basic device (master, type GBDT) and extension devices (slaves, type GSLT) are connected via the CAN-Bus plug connectors.

7.2 CAN-Bus terminating resistors

Attach 1 piece 120 Ohm resistor at the CAN-Bus clamp on the basic device. (Included in the delivery). The CAN plug clamp CST 120 must be plugged onto the end of the bus of the last extension device. (Included in the delivery). The CAN-Bus must be terminated at the beginning and at the end by means of a 120 Ω resistor.

Maximum CAN-Bus length:
The maximum length of the CAN bus (total length of the CAN bus cables) amounts to 10 meters in the standard version (on master and one slave).
Longer CAN-Bus available on request !



Galvanic isolation : 1kV.

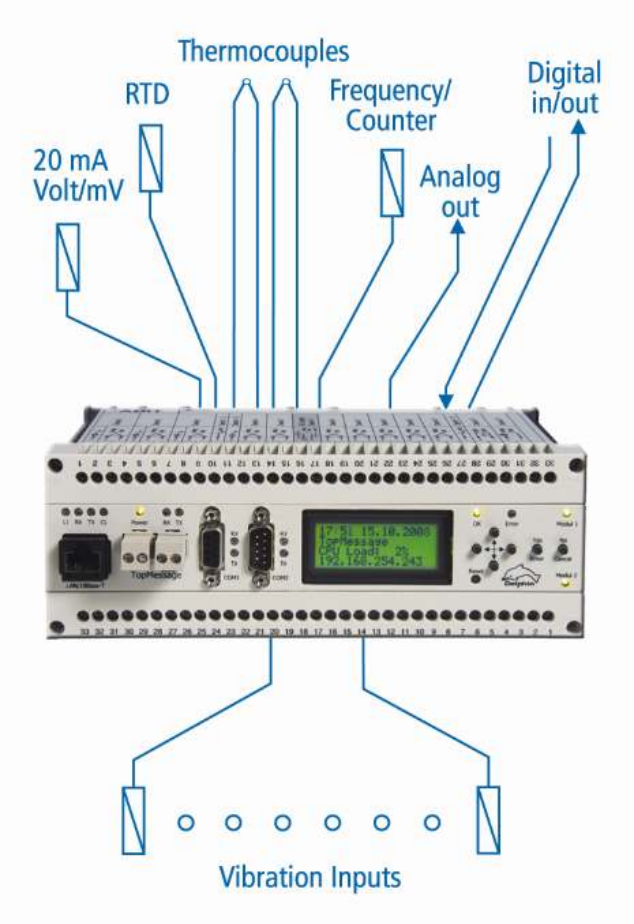
Counter plug
LP-plug clamp 2-pin : e. g. Wieland 8113B/2VL, order no. 25.326.3253.0
Connection 1 (left) CANL
Connection 2 (right) CANH

CAN-Bus cable
CAN-Bus cables with various lengths can be ordered from Delphin directly
TYPE : CKx X = length of the cable in meters

Case 1 no extension devices (slaves)
The CAN plug clamp with the 120Ω terminating resistor must be plugged onto the free plug of the CAN-Bus connection.
CAN plug clamp: CST 120
Type CST120 is included in the delivery of the basic devices.

Case 2 with extension devices (slaves)
Upon the connection of extension devices the termination must always be made on both sides of the bus.
The resistors are clamped parallel to the both lines at the 2-pin plug clamps. The resistors are included in the delivery of the basic devices.

8 Sensor connection at one glance



Input for voltage (V/mV), current (20mA), resistance thermometer (Pt100), thermocouples, frequency inputs, state inputs, switch outputs.

Neither isolating amplifiers, transformers nor signal conditioning are required.

Each input can be individually adjusted for different sensor types.

9 I/O modules

Two IO modules fit in each basic and extension device. There is a free assignment of the modules to the slots.

9.1 I/O module overview

With the following tables gives an overview of the availabel I/O-modules.

Type	Analog inputs [1]		Analog outputs		Digital inputs (with counter)	Digital outputs
ADGT	8	V/mV, 20mA, Pt100, TC, pH				
ADIT	10	V/mV, 20mA, Pt100, TC, pH	1	20mA		1
ADVT	15	V/mV, 20mA, TC, pH				
AAST	4	V/mV, 20mA, Pt100, TC, pH	4	20mA	2	2
ADFT	8	V/mV, 20mA	2	0..10V	4 (2)	4
AMDT [2]	8	V/mV, 20mA	2	0..10V	4 (2)	4
DIOT					12 (11)	16
IOIT					24	1
OTPT					1	24

1) TC = Thermocouple
2) AMDT is handled in an own manual

Typ	Sample rate (total), maximum (of each I/O module)	Sequential /parallel sampling
ADGT	60 samples/s	seq.
ADIT	600 samples/s	seq.
ADVT	600 samples/s	seq.
AAST	600 samples/s	seq.
ADFT	10.000 samples/s	par.
AMDT [1]	10.000 / 160.000 samples/s	par.

1) AMDT is handled in an own manual

9.2 Galvanic isolation

Typ	Galvanic isolation to the system and the supply	Galvanic isolation from channel to channel	permissible difference voltage from channel to channel
ADGT	750 VDC	560 VDC / 400 VAC	
ADIT	750 VDC		110 VDC
ADVT	750 VDC		110 VDC
AAST	750 VDC		110 VDC
ADFT	750 VDC		100 VDC
AMDT [1)]	750 VDC		100 VDC
DIOT	2500 VDC	2500 VAC	
IOIT	2500 VDC	2500 VAC	
OTPT	2500 VDC	2500 VAC	

1) AMDT is handled in an own manual

9.3 I/O modules – CAN-Bus

All I/O modules transfer the data though a common two-wirer-bus (CAN). This CAN-Bus can transfer 3.300 samples per second. The modules ADFT and AMDT are using an optimized transfer mechanism where 3 samples are transferred in one CAN-Bus message.

Typ	Max. total transfer rate of two-wire-bus (CAN)
ADGT, ADIT, ADVT, AAST	3300 samples/s
ADFT	10000 samples/s
AMDT [1)]	10000 samples/s

1) AMDT is handled in an own manual

Remark:
With ADFT the full load can be reached already with one I/O module. Based on technical properties only one I/O module ADFT can be installed in a system.

9.4 Common features of the I/O modules

- Scaling: Each channel can be scaled individually, so that the output appears in the desired unit, e. g. range 0..20 bar or 5..2400 l/min etc.
- Each channel can be allocated an individual measuring range
- The sample rate of analog inputs can be set for each channel.
- Protection against electro-magnetic influences.
- Any number of lower and upper limits per channel can be activated. Output can be directly processed to digital outputs (no need of host computer).
- Compensation of measurement errors of the sensors

9.5 Technical data overview

9.5.1 Technical data: ADGT / ADIT / ADVT / AAST

Analog inputs

Voltage measuring ranges :
+-156 mV to +-10 V,
Unipolar and bipolar ranges

Current measuring ranges :
0..20 mA and 4..20 mA,
External shunt resistor 10..500 Ω
2-wire transducers can be directly connected

Sample rate (total), maximum :

ADGT	60 samples/s,
ADIT, ADVT, AAST	600 samples/s

Sequential sampling, conversion time adjustable per channel

Resolution :
24 Bit (about 7 decimal digits)

Input impedance :
>1 GΩ (10 MΩ ADGT)

Accuracy (DC) :

V/mV, mA	0.01 % of measuring range
Pt100	0.1 K
Pt1000	0.01 K
Thermocouples	0.1 % of measuring range, after compensation

Thermocouples :
Cold reference junction build in.
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 up to 2320 °C , depends on the rmocouple type

Resistance thermometers :
Pt50, Pt100, Pt250, Pt500, Pt1000, Pt5000 :
2-, 3- or 4–wire circuit
Reference current circuit with 1 mA for each channel
Measuring range –270 up to 850 °C , depends on Pt-t ype

Resistance measurement :
0 … 10kΩ

pH measurement :
Temperature compensation integrated

Self calibration :
DC offset, cyclic, adjustable

Digital filter :
Low pass, 6..1000 Hz, adjusted automatically

Galvanic isolation between channels of ADGT:
560 VDC, 400 VAC

Electric strength of input :
110 V continuous

Analog outputs

Output signal :
0..20 mA, 4..20 mA, maximum shunt resistor is 650 Ω
Resolution :
16 Bit
Galvanic isolation :
750 V from channel to channel, to supply and to system
Accuracy :
+-0.05 %

Digital inputs

State inputs :
High level: 3.5..90 V / 2 mA (typ. 2.7 mA @ 5V)
Low level: 0..1.5 V / 0..1.5 mA
Galvanic isolation: 2.5 kV, Reverse voltage protection: 1 kV
Update rate: 1 kHz (1 ms)
Evaluable signal pulse duration: >1 ms
Highest continuous signal frequency: 50 Hz

Modified module: Digital Input for switching AC Voltage
High level: 18..270 V / 2 mA (typ. 2.7 mA @ 24V)
Low level: 0..12 V / 0..1.5 mA
Galvanic isolation: 2.5 kV, Reverse voltage protection: 1 kV
Update rate: 1 kHz (1 ms)
Evaluable signal pulse duration: >1 ms

Digital outputs

Switch outputs :
Switching voltage: max. 50 V DC
Switching current: max. 2.5 A DC
Recovery diode integrated
Galvanic isolation: 2.5 kV

9.5.2 Technical data: ADFT

Analog inputs

Voltage measuring ranges :
+-156 mV to +-10 V, in 7 steps, unipolar and bipolar range

Current measuring ranges :
0..20 mA and 4..20 mA, external shunt resistor 10..500 Ω

Input signal bandwith :
DC to 4000 Hz

Sample rate :
10 to 10000 Hz, in 10 steps, adjustable per channel
Channels with same sample rate are sampled in parallel

Total sample rate :
10 to 10000 samples/s for 4-channel mode
10 to 8500 samples/s for 8-channel mode

Resolution :
14 Bit (1.2 mV for measuring range +-10 V)

Anti alias filter :
Optional digital low-pass filter of 8th/4th order. Cut-off frequency adapted automatically.
For sample rates 100 to 10000 Hz.

Input impedance :
0.8 MΩ

Permissible voltage difference, channel to channel :
100 V DC in total, continuous

Input protection :
+-250 V DC

DC/AC coupling :
DC coupling adjusted ex works. Change by DIP switch inside device.

Accuracy (DC) :

Measuring range +-10V/5V/2,5V/1,25V:	+-0.1 %	o.f.s.	or	+-10mV/5mV/2.5mV/1.3mV
Measuring range +-0.625V:	+-0.2 %	o.f.s.	or	+-1.3mV
Measuring range +-0.312V:	+-0.3 %	o.f.s.	or	+-0.9mV
Measuring range +-0.156V:	+-0.4 %	o.f.s	or	+-0.6mV

Analog outputs

Output signal :
0..10 V, max. 4 mA (min. 2.5 kΩ)
Resolution :
12 Bit (2.4 mA)
Analog ground :
Clamps '-' are connected with 1 kΩ to internal analog ground point
Accuracy :
+-0.25 % of full scale, or +-25mV

Digital inputs / Counter

State inputs :
High level: 3.5 to 90 V / 2 mA (typ. 2.7 mA bei 5V)
Low level: 0 to 1.5 V / 0 to1.5 mA
Update rate: 1 kHz (1 ms)
Smallest evaluable signal pulse duration: 2.5 ms
Highest continuous signal frequency: 50 Hz
Galvanic isolation: 2.5 kV, Revers voltage protection: 1 kV

Frequency/Counter inputs :
Mode 'frequency measurement' or 'pulse count'
Frequency measurement within range 0.2 Hz to 50 kHz
Gate time from 250 to 5000 ms (in steps of 250 ms)
Pulse count within range 16 Bit or 0 to 65535

Accuracy (of frequency measurement) :
Range up to 100 Hz : +-1 % of input frequency
Range above 100 Hz : +-1 Hz

Digital outputs

Switch outputs :
Switching voltage: max. 50 V DC
Switching current: max. 2.5 A DC
Recovery diode integrated
Galvanic isolation: 2.5 kV

9.5.3 Technical data: DIOT / IOIT / OTPT

Digital inputs / Counter

State inputs :
High level: 3.5 to 90 V / 2 mA (typ. 2.7 mA bei 5V)
Low level: 0 to 1.5 V / 0 to1.5 mA
Galvanic isolation: 2.5 kV, Revers voltage protection: 1 kV
Update rate: 1 kHz (1 ms)
Evaluable signal pulse duration: >1 ms
Highest continuous signal frequency: 50 Hz

Modified module: Digital Input for switching AC Voltage
High level: 18..270 V / 2 mA (typ. 2.7 mA @ 24V)
Low level: 0..12 V / 0..1.5 mA
Galvanic isolation: 2.5 kV, Reverse voltage protection: 1 kV
Update rate: 1 kHz (1 ms)
Evaluable signal pulse duration: >1 ms

Frequency/Counter inputs :
Mode 'frequency measurement' or 'pulse count'
Max. input frequency is 30 kHz
Gate time from 1 to 6000 ms (in steps of 1 ms)
Pulse count within range 16 Bit or 0 to 65535

Accuracy (of frequency measurement) :
Range 0 to 1 kHz : +-1 Hz
Range >1 kHz to 10 kHz : +-5 Hz
Range >10 kHz to 30 kHz : +-10 Hz

Digital outputs

Switch outputs :
Switching voltage: max. 50 V DC
Switching current: max. 2.5 A DC
Recovery diode integrated
Galvanic isolation: 2.5 kV

10 I/O modules

10.1 ADGT module

See also technical data in section 9.5.1

Analog Inputs

Features :
8 analog inputs
Sample rate (total) : 60 samples/s
Channels can be configured individually for sensor type voltage (V/mV), current (20 mA) , resistance thermometer (Pt100), thermocouples, pH channels.
Differential inputs. Very high measuring accuracy. Self calibrating.
Galvanic isolation. Wire breakage monitoring.

Functions :
Scaled and linearized measured data

Available measuring ranges :
The following tables show the available measuring ranges, which can be configured by software.

Voltage measuring range :

Measuring range, unipolar	0..10	0..5	0..2.5	0..1.25	0..0.625	0..0.312	0..0.156	V
Measuring range, bipolar	+-10	+-5	+-2.5	+-1.25	+-0.625	+-0.312	+-0.156	V

Current measuring range :

Measuring range	0..20	4..20	mA
Shunt resistor	10/50/100/125/250/500	10/50/100/125/250/500	Ω

The terminating shunt resistors are to be positioned externally between the clamps '+' and '-'.

Measuring range for thermocouples :

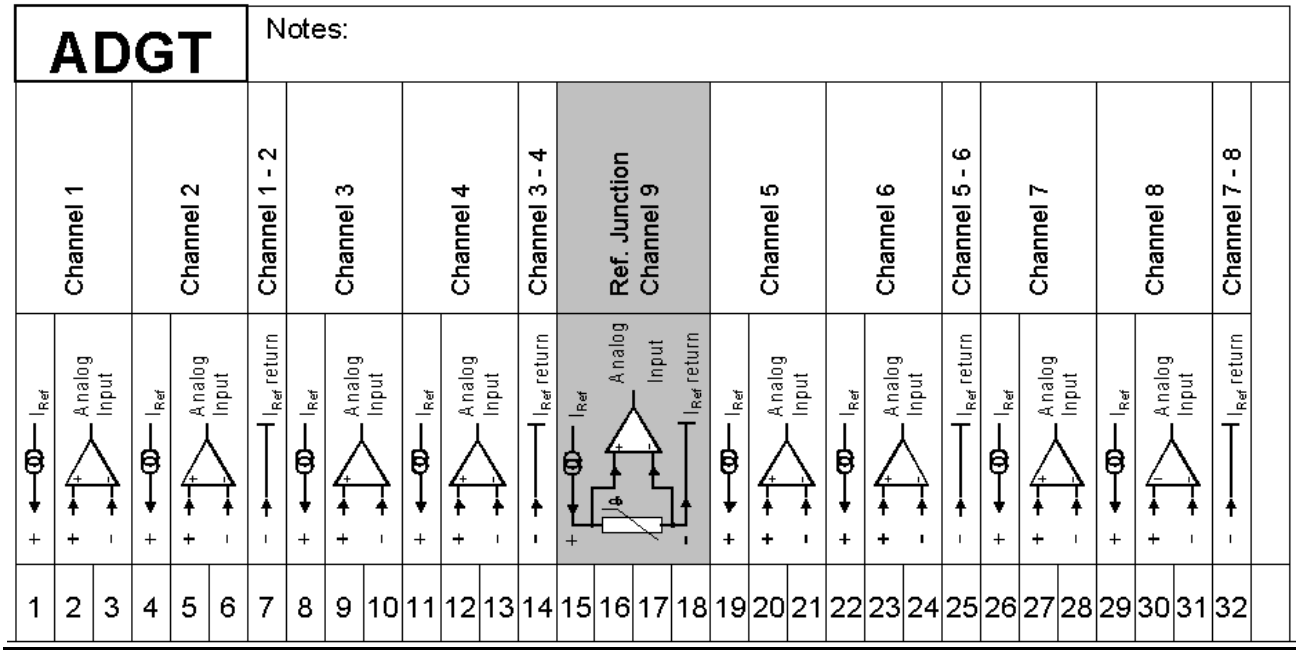
Thermocouple	Typ K NiCr-NiAl	Typ E NiCr-CuNi	Typ N NiCrSi-NiSi	Typ L Fe-CuNi	Typ J Fe-CuNi	Typ S Pt10Rh-Pt	
Measuring range	-270..1372	-270..1000	-270..1300	-200..900	-210..1200	-50..1767	℃
Thermocouple	Typ U Cu-CuNi	Typ R Pt13Rh-Pt	Typ T Cu-CuNi	Typ B Pt30Rh-Pt6Rh	Typ C W5Re-W26Re		
Measuring range	-200..600	-50..1767	-270..400	0..1800	0..2320		℃

For thermocouples the measuring range refers to cold reference junction temperature of 0℃:

Measuring range for resistance thermometers

Resistance thermometer	Pt 50/100/250/500/1000	Pt 1000	
Measuring range	-260..850	-260..270	℃

10.1.1Wiring diagram (industry)



Connection of different sensors.

See also notes on the instrumentation in section 5

Connect resistance thermometers (Pt100/1000) with 4-wire interface :

I ref +	Current reference for resistance thermometers
In +	Positive signal input
In -	Negative signal input
I ref -	Return point for current reference

Connect voltage signals (V/mV) and thermocouples :

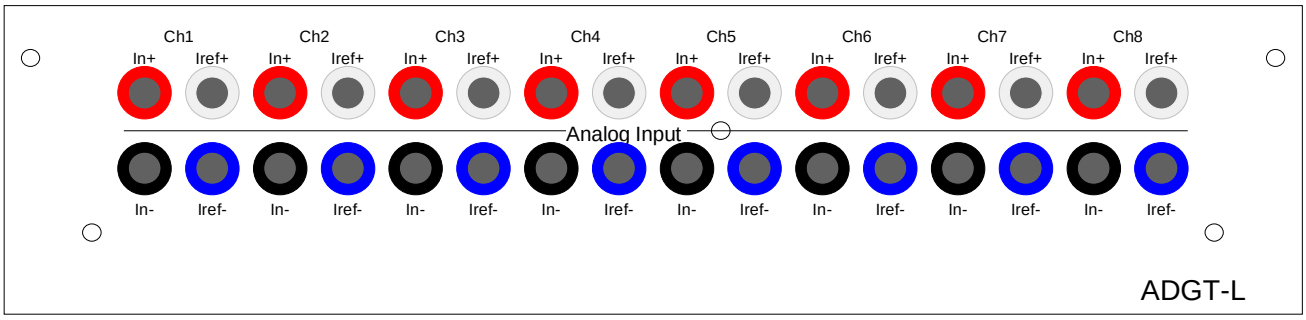
In +	Positive signal input
In -	Negative signal input

Connect current signals (0/4..20 mA) :

In +	Positive signal input
In -	Negative signal input

The terminating shunt resistors are to be positioned externally between the clamps '+' and '-'.
Resistors alternatively 10 / 50 /100 /125 / 250 / 500 Ω (0,05%).

10.1.2Wiring diagram (laboratory)



Connection information: see above.

10.2 **ADIT module**

See also technical data in section 9.5.1

Analog inputs

Features
10 analog inputs
Sample rate (total) : 800 samples/s
Channels can be configured individually for sensor type voltage (V/mV), current (20 mA) , resistance thermometer (Pt100), thermocouples, pH channels.
Galvanic isolation. Very high measuring accuracy. Self calibrating
Wire breakage monitoring.

Functions :
Scaled and linearized measured data
Alarm output to digital channels.

Available measuring ranges :
The following tables show the available measuring ranges, which can be configured by software.

Voltage measuring range :

Measuring range, unipolar	0..10	0..5	0..2.5	0..1.25	0..0.625	0..0.312	0..0.156	V
Measuring range, bipolar	+-10	+-5	+-2.5	+-1.25	+-0.625	+-0.312	+-0.156	V

Current measuring range :

Measuring range	0..20	4..20	mA
Shunt resistor	10/50/100/125/250/500	10/50/100/125/250/500	Ω

The terminating shunt resistors are to be positioned externally between the clamps '+' and '-'.

Measuring range for thermocouples :

Thermocouple	Typ K NiCr-NiAl	Typ E NiCr-CuNi	Typ N NiCrSi-NiSi	Typ L Fe-CuNi	Typ J Fe-CuNi	Typ S Pt10Rh-Pt	
Measuring range	-270..1372	-270..1000	-270..1300	-200..900	-210..1200	-50..1767	℃
Thermocouple	Typ U Cu-CuNi	Typ R Pt13Rh-Pt	Typ T Cu-CuNi	Typ B Pt30Rh-Pt6Rh	Typ C W5Re-W26Re		
Measuring range	-200..600	-50..1767	-270..400	0..1800	0..2320		℃

For thermocouples the measuring range refers to cold reference junction temperature of 0℃:

Measuring range for resistance thermometers

Resistance thermometer	Pt 50/100/250/500/1000	Pt 1000	
Measuring range	-260..850	-260..270	℃

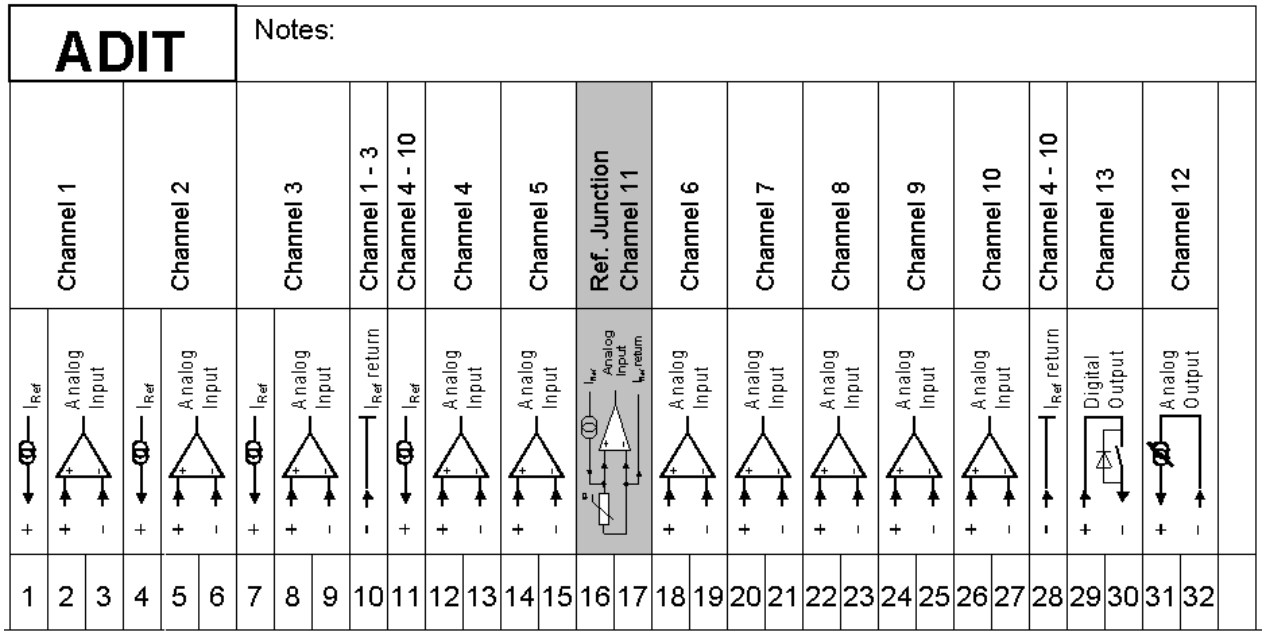
Analog output

Features
1 Analog output
Output signal 0..20 mA
16 bit resolution
Galvanically isolated

Scaling
The channels can be scaled individually. The scale data input can take place in the desired unit (e.g. range 0..20 bar or 5.2400 l/min). The output takes place as a scaled current signal.

Digital output
Switching voltage: Max.: 50V DC
Switching current: Max.: 2.5A DC
Free wheeling diode integrated
Galvanic isolation: 2.5 kV

10.2.1Wiring diagram (industry)



Connection of different sensors :

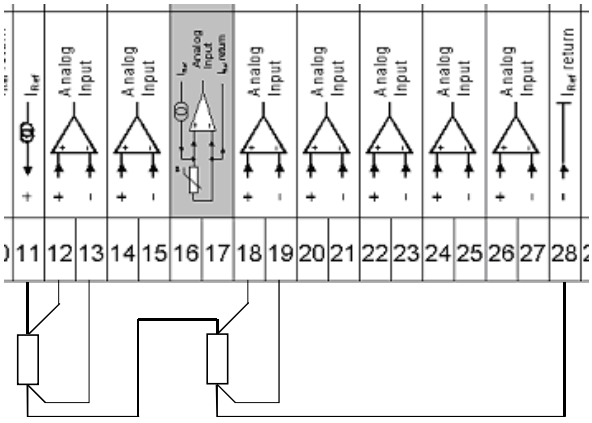
See also notes on the instrumentation in section 5

Connect resistance thermometers (Pt100/1000) with 4-wire interface :

I ref +	Current reference for resistance thermometers
In +	Positive signal input
In -	Negative signal input
I ref -	Return point for current reference

Important hint: Channels 4 to 10 are provided with a common current reference. You have to use a series connection for current path of resistance thermometers.

Example: Channels 4 and 6 connected with resistance thermometers.
Series connection of current path from clamp 11 to clamp 28.



Connect voltage signals (V/mV) and thermocouples :

In +	Positive signal input
In -	Negative signal input

Connect current signals (0/4..20 mA) :

In +	Positive signal input
In -	Negative signal input

The terminating shunt resistors are to be positioned externally between the clamps '+' and '-'. Resistors alternatively 10 / 50 /100 /125 / 250 / 500 Ω (0,05%).

Connection of actuators :

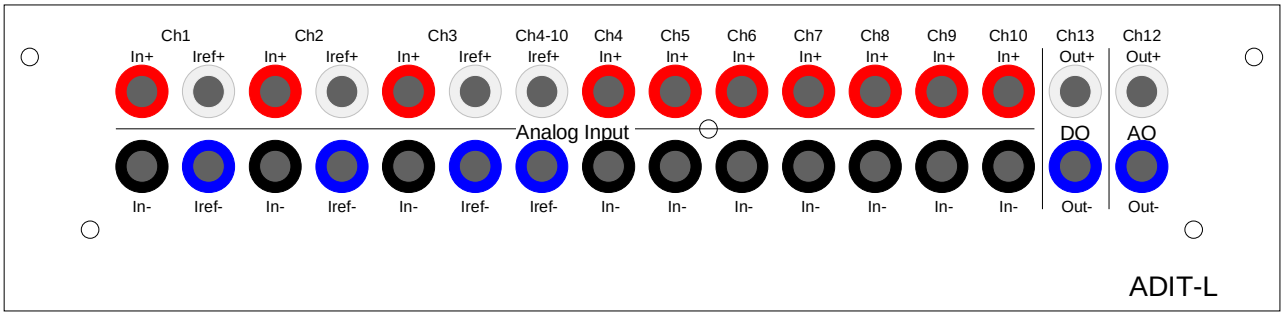
Connect actuator with digital output :

Out +	Positive signal output
Out -	Negative signal output

Connect actuator with analog output :

Out +	Positive signal output
Out -	Negative signal output

10.2.2Wiring diagram (laboratory)



Connection information: see above.

10.3 ADVT module

See also technical data in section 9.5.1

Analog inputs

Features
15 analog inputs
Sample rate (total) : 600 samples/s
Channels can be configured individually for sensor type voltage (V/mV), current (20 mA) , thermocouples, pH channels.
Galvanic isolation. Very high measuring accuracy. Self calibrating
Wire breakage monitoring.

Functions :
Scaled and linearized measured data

Available measuring ranges :
The following tables show the available measuring ranges, which can be configured by software.

Voltage measuring range :

Measuring range, unipolar	0..10	0..5	0..2.5	0..1.25	0..0.625	0..0.312	0..0.156	V
Measuring range, bipolar	+-10	+-5	+-2.5	+-1.25	+-0.625	+-0.312	+-0.156	V

Current measuring range :

Measuring range	0..20	4..20	mA
Shunt resistor	10/50/100/125/250/500	10/50/100/125/250/500	Ω

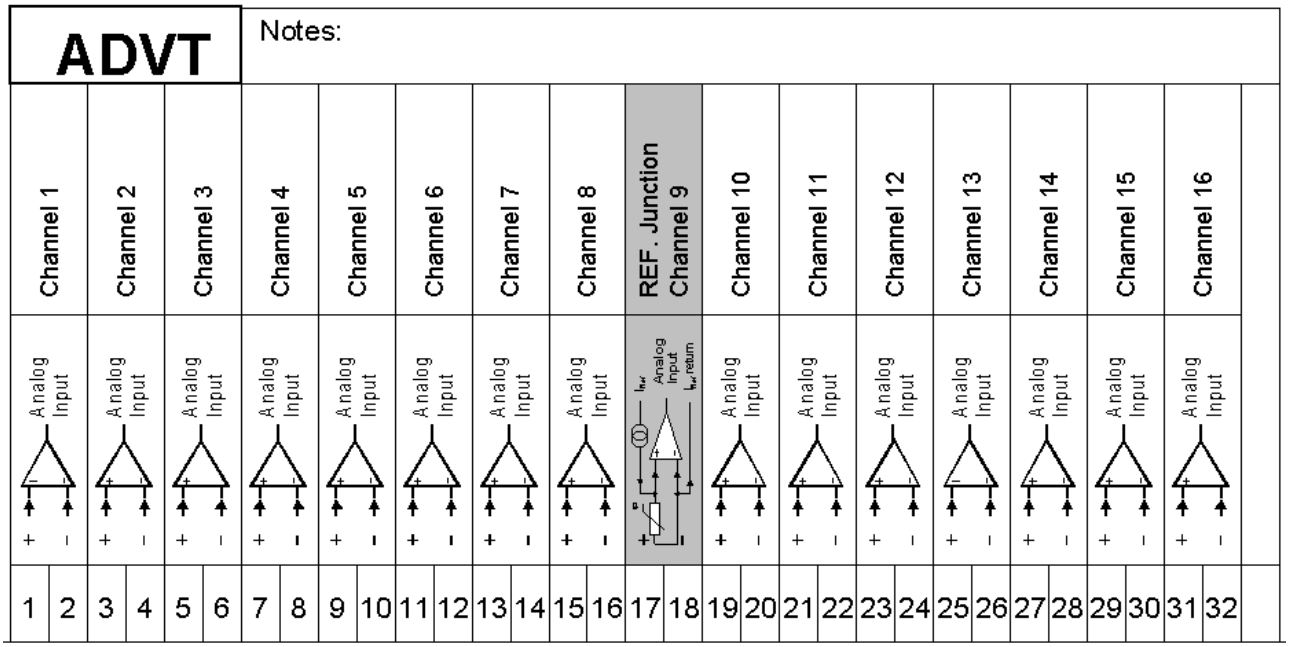
The terminating shunt resistors are to be positioned externally between the clamps '+' and '-'.

Measuring range for thermocouples :

Thermocouple	Typ K NiCr-NiAl	Typ E NiCr-CuNi	Typ N NiCrSi-NiSi	Typ L Fe-CuNi	Typ J Fe-CuNi	Typ S Pt10Rh-Pt	
Measuring range	-270..1372	-270..1000	-270..1300	-200..900	-210..1200	-50..1767	℃
Thermocouple	Typ U Cu-CuNi	Typ R Pt13Rh-Pt	Typ T Cu-CuNi	Typ B Pt30Rh-Pt6Rh	Typ C W5Re-W26Re		
Measuring range	-200..600	-50..1767	-270..400	0..1800	0..2320		℃

For thermocouples the measuring range refers to cold reference junction temperature of 0℃:

10.3.1Wiring diagram (industry)



Connection of different sensors:

See also notes on the instrumentation in section 5

Connect voltage signals (V/mV) and thermocouples :

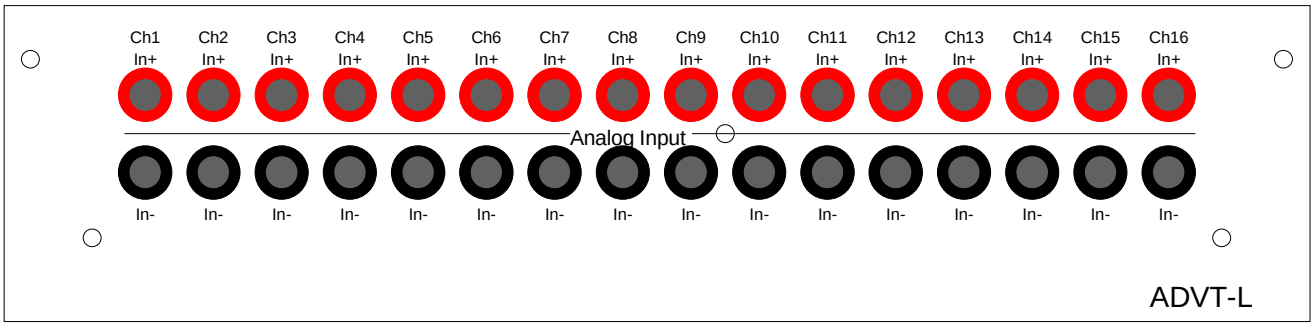
In +	Positive signal input
In -	Negative signal input

Connect current signals (0/4..20 mA) :

In +	Positive signal input
In -	Negative signal input

The terminating shunt resistors are to be positioned externally between the clamps '+' and '-'.
Resistors alternatively 10 / 50 /100 /125 / 250 / 500 Ω (0,05%).

10.3.2Wiring diagram (laboratory)



Connection information: see above.10.3.1

10.4 **AAST module**

See also technical data in section 9.5.1

Analog inputs

Features
4 analog inputs
Sample rate (total) : 600 samples/s
Channels can be configured individually for sensor type voltage (V/mV), current (20 mA) , resistance thermometer (Pt100), thermocouples, pH channels.
Galvanic isolation. Very high measuring accuracy. Self calibrating
Wire breakage monitoring.

Functions :
Scaled and linearized measured data
Alarm output to digital channels.

Available measuring ranges :
The following tables show the available measuring ranges, which can be configured by software.

Voltage measuring range :

Measuring range, unipolar	0..10	0..5	0..2.5	0..1.25	0..0.625	0..0.312	0..0.156	V
Measuring range, bipolar	+-10	+-5	+-2.5	+-1.25	+-0.625	+-0.312	+-0.156	V

Current measuring range :

Measuring range	0..20	4..20	mA
Shunt resistor	10/50/100/125/250/500	10/50/100/125/250/500	Ω

The terminating shunt resistors are to be positioned externally between the clamps '+' and '-'.

Measuring range for thermocouples :

Thermocouple	Typ K NiCr-NiAl	Typ E NiCr-CuNi	Typ N NiCrSi-NiSi	Typ L Fe-CuNi	Typ J Fe-CuNi	Typ S Pt10Rh-Pt	
Measuring range	-270..1372	-270..1000	-270..1300	-200..900	-210..1200	-50..1767	℃
Thermocouple	Typ U Cu-CuNi	Typ R Pt13Rh-Pt	Typ T Cu-CuNi	Typ B Pt30Rh-Pt6Rh	Typ C W5Re-W26Re		
Measuring range	-200..600	-50..1767	-270..400	0..1800	0..2320		℃

For thermocouples the measuring range refers to cold reference junction temperature of 0℃:

Measuring range for resistance thermometers

Resistance thermometer	Pt 50/100/250/500/1000	Pt 1000	
Measuring range	-260..850	-260..270	℃

Analog output

Features :
4 Analog output
Output signal 0..20 mA
Resolution 16 bit
Galvanic isolation

Scaling :
The channels can be scaled individually. The scale data input can take place in the desired unit (e.g. range 0..20 bar or 5.2400 l/min). The output takes place as a scaled current signal.

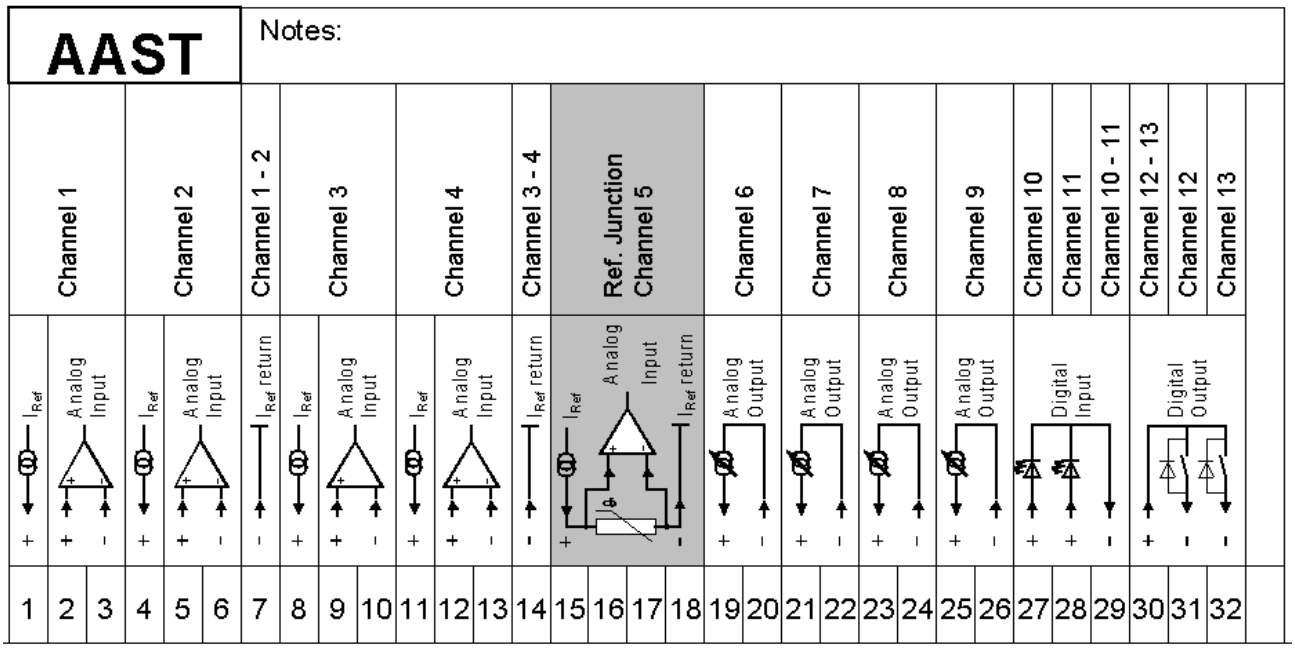
Digital inputs / Counter

Features :
2 Digital inputs
High level: 3.5 to 90 V / 2 mA (typ. 2.7 mA bei 5V)
Low level: 0 to 1.5 V / 0 to1.5 mA
Galvanic isolation: 2.5 kV
Revers voltage protection: 1 kV

Digital output

Features
2 Digital outputs
Switching voltage: max.: 50V DC
Switching current: max.: 2.5A DC
Free wheeling diode integrated
Galvanic isolation: 2.5 kV

10.4.1Wiring diagram (industry)



Connection of different sensors :

See also notes on the instrumentation in section 5

Connect resistance thermometers (Pt100/1000) with 4-wire interface :

I ref +	Current referenz for resistance thermometers
In +	Positive signal input
In -	Negative signal input
I ref -	Return point for current referenz

Connect voltage signals (V/mV) and thermocouples :

In +	Positive signal input
In -	Negative signal input

Connect current signals (0/4..20 mA) :

In +	Positive signal input
In -	Negative signal input

The terminating shunt resistors are to be positioned externally between the clamps '+' and '-'.
Resistors alternatively 10 / 50 /100 /125 / 250 / 500 Ω (0,05%).

Connect signal to digital input :

In +	Positive signal input
In -	Negative signal input

Hint: The two digital inputs have a common clamp "In -"

Connection of actuators :

Connect actuator with digital output :

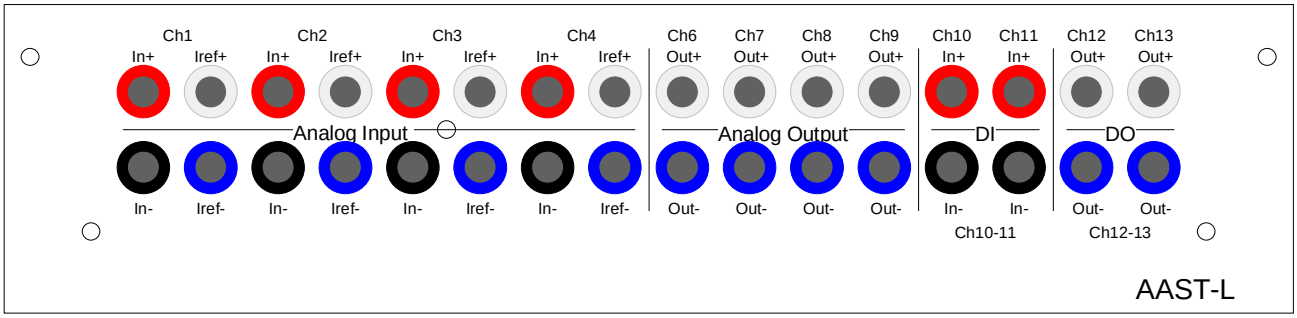
Out +	Positive signal output
Out -	Negative signal output

Hint: The two digital outputs have a common clamp "Out +"

Connect actuator with analog output :

Out +	Positive signal output
Out -	Negative signal output

10.4.2Wiring diagram (laboratory)



Connection information: see above.

10.5 ADFT module

See also technical data in section 9.5.2

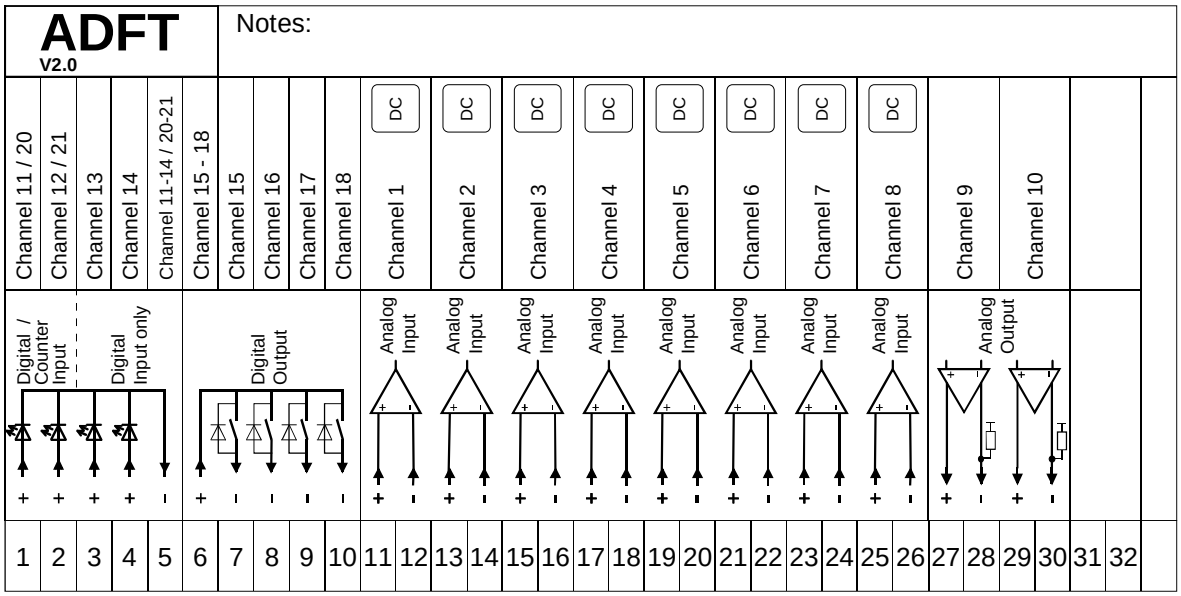
Analog inputs

Features :
The I/O module ADFT offers a higher total sample rate than the other modules (see above). The sampling is continuously and in parallel. Any of the 8 analog inputs can operate with a sample rate of 10 to 10000 Hz. Channels with identical sample rate are measured synchronously. The maximum total sample rate is 10000 samples/s.

Voltage measuring range :
+-10000 mV / +-5000mV / +-2500mV / +-1250mV / +-625mV / +-312mV / +-156mV,
alternatively also with unipolarer range

Current measuring range :
0..20mA or 4..20mA,
with terminating shunt resistors 10/50/10/125/250/500 Ω

10.5.1Wiring diagram (industry)



Connection hints :

See also technical data in section 9.5.2

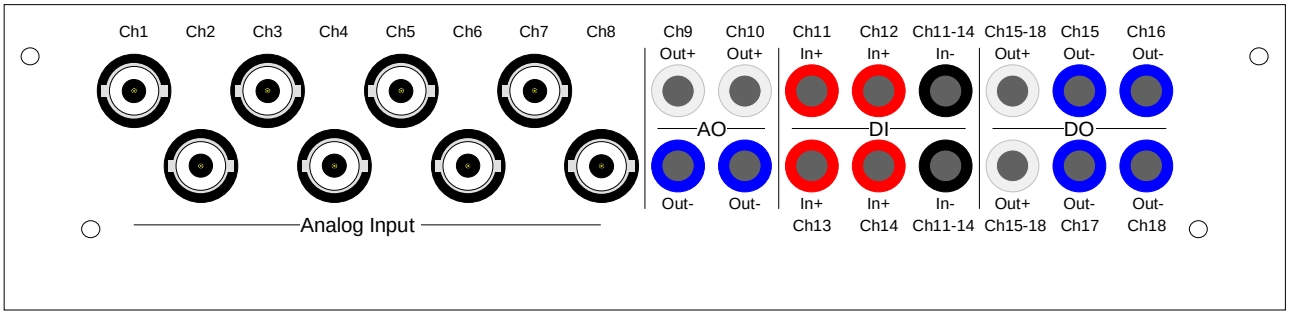
Analog inputs :
Voltage signals of max. +-10 V within frequency range of DC to 4000 Hz can be connected. Input impedance is 0.8 MΩ. Current signals (0/4..20 mA) are connected by means of terminating shunt resistor (between clamp '+' and '-'). DC coupling is preset ex works. Change by DIP switch inside device possible. Permissible channel-to-channel voltage difference is 100 V DC in total.

Analog outputs :
Output range is 0..10 V. Max. load is 4 mA (min. 2,5 kΩ)
Clamps '-' are connected with 1 kΩ to internal analog ground point.

Digital inputs / counters
Square signals (pulses) of 5 V / 12 V or 24 V can be connected.
Low level is <1.5 V. High level is >3.5 V. Common '-' clamp. Galvanic isolation.
Frequency measurement within range 0.2 Hz to 50 kHz.

Digital outputs
Switching voltage is max. 50 VDC. Switching current is max.: 2.5 ADC.
Common '+' clamp. Galvanic isolation.

10.5.2Wiring diagram (laboratory)

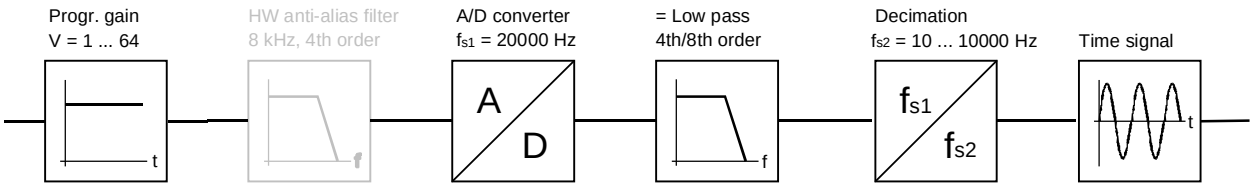


Connection information: see above.

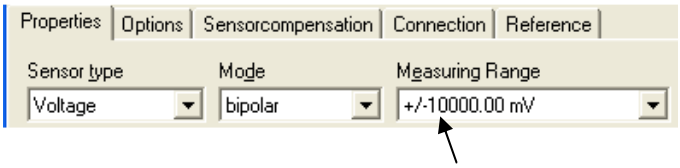
10.5.3Mode of operation

Mode of operation of analog inputs

Block diagram

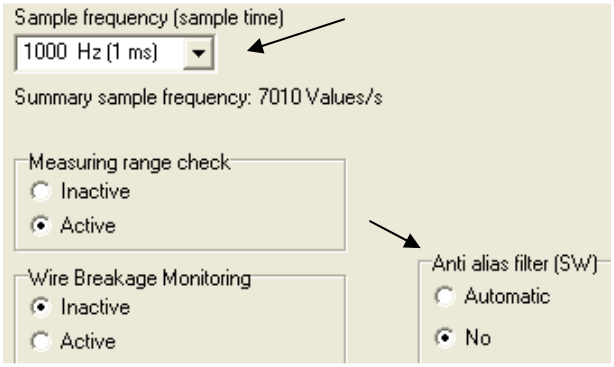


Programmable amplification
Depending on the selected measuring range +-10000mV to +-156mV the analog signal from the sensor will be 1 to 64 times amplified.



HW-Anti-Alias-Filter
There is now analog low pass filter in front of the A/D converter. The advantage is that there are no filtering effects and distortions on the time signal. However, the user should be aware of Alias effects when sample rate and analog signal frequency do not match the Shannon / Nyquist theorem.

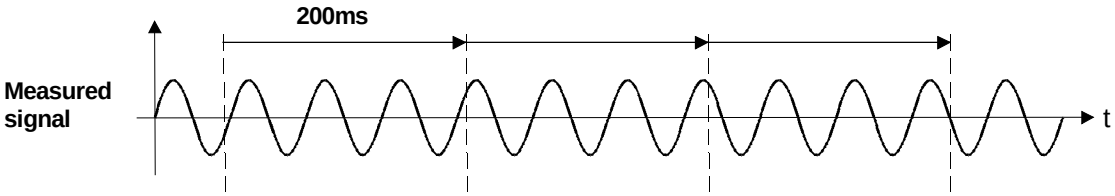
A/D-Converter
The A/D converter is sampling continuously with 20000Hz. All active inputs are sampled in parallel. The user can chose is preferred sample rate 10Hz to 10000Hz by selection it from the drop down list box. The A/D converter is then working accordingly with an internal oversampling of 2000 to 2 samples.



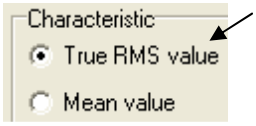
SW-Anti-Alias-Filter
If required a software anti alias filter can be activated. This digital filter has a cut-off frequency of 40% of the selected sample rate

Decimation
This describes the process of reducing the number of samples to the selected sample rate. Example: A sample rate of 1000 Hz leads to 20-time over sampling. In this case 19 of 20 samples are skipped.

Time signal
The recorded time signal will is transferred in block format. The standard block length is 200ms. With this setting 5 blocks are transferred in one second. The block length can be also configured to 100 ms (10 blocks / sec.) or to 500ms (2 blocks / sec.). With a sample rate of 1000Hz and with a block length of 200ms the system will transfer 200 samples in one block.



In the standard setting the DSP processor of the ADFT module is calculating the “True RMS value” (RMS = Root Mean Square) from each block. This value is also displayed in the DataService Configuration software. If required the user can also change the settings to “Mean Value”.



10.6 DIOT module

See also technical data in section 2.2.3

Digital inputs / counters

Features :
12 digital inputs, from that 11 with additional counters
High level: 3.5 to 90 V / 2 mA (typ. 2.7 mA bei 5V)
Low level: 0 to 1.5 V / 0 to1.5 mA
Galvanic isolation: 2.5 kV, Revers voltage protection: 1 kV

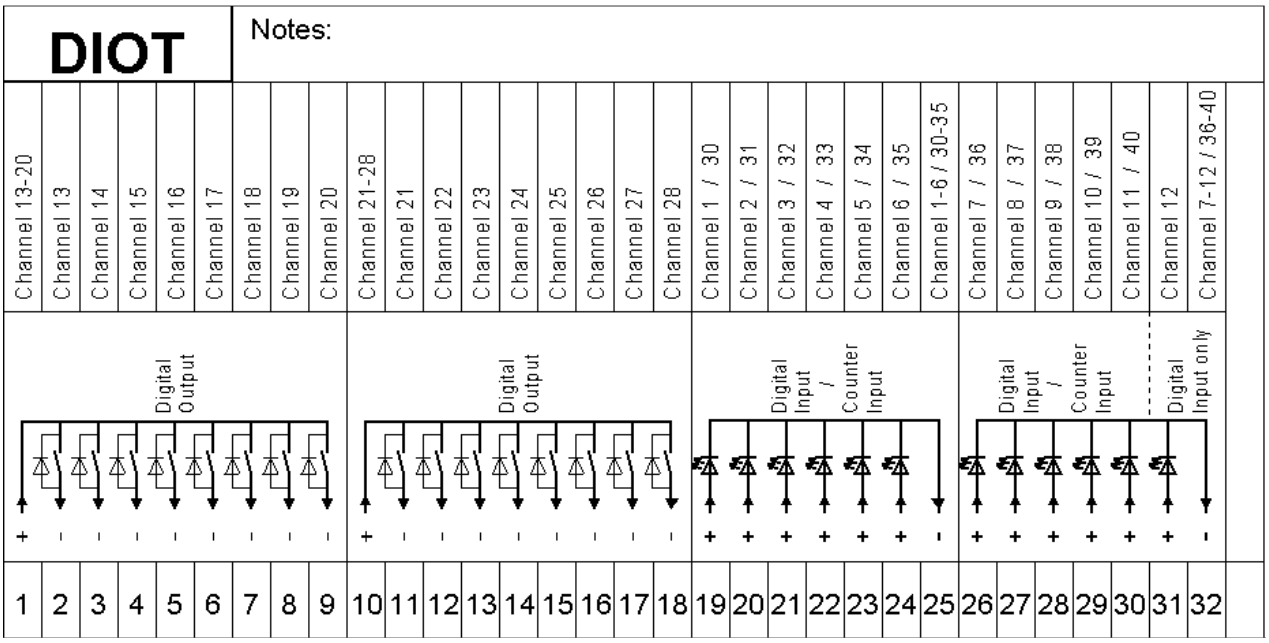
Counters :
11 channels can be configured as counter channel, frequency channel or state input channel.
Max. input frequency: 30 kHz, Counter capacity: 16 bit
Gate time (in case of frequency measurement): 1 to 6000 ms (step 1 ms)

Scaling :
Each frequency channel can be scaled individually, so that the output is shown directly in the desired unit, e.g. range, 5..2400 l/min. etc.

Digital outputs

Features
16 Digital outputs
Switching voltage: max. 50 VDC. Switching current: max.: 2.5 ADC.
Galvanic isolation: 2.5 kV, Free wheeling diode integrated

10.6.1Wiring diagram (industry)



Connection of sensors / actuators :

Connect signal to digital input :

In +	Positive signal input
In -	Negative signal input

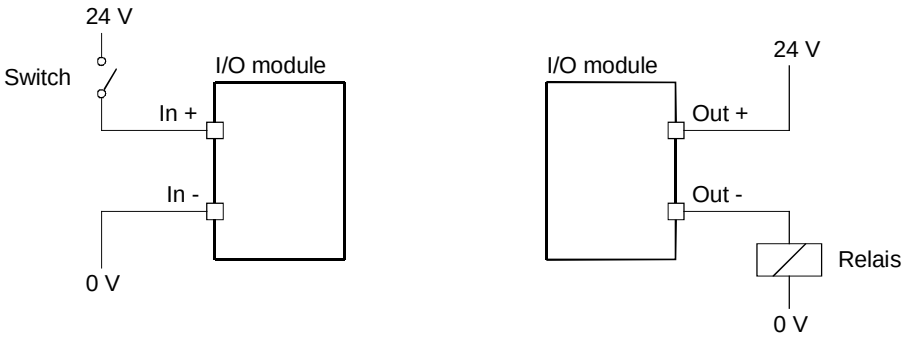
Hint: Any group of 6 digital inputs has a common clamp "In -"

Connect actuator with digital output :

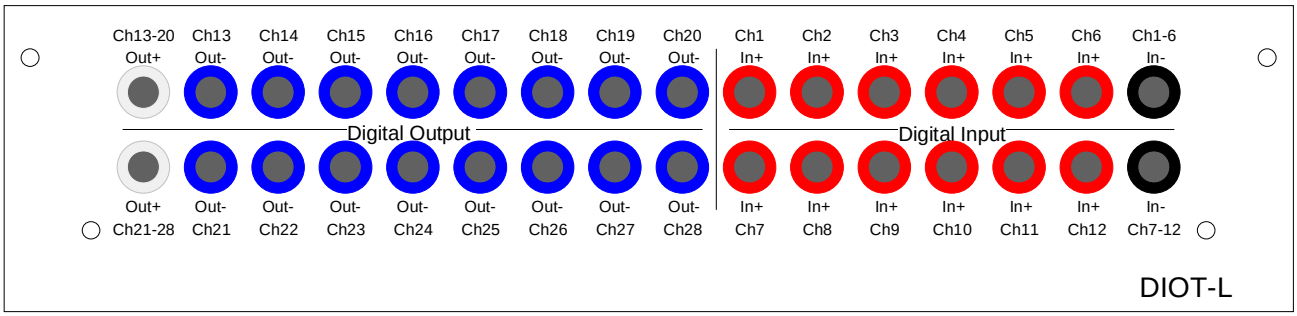
Out +	Positive signal output
Out -	Negative signal output

Hint: Each group of 8 digital outputs has a common clamp "Out +"

Connection examples :



10.6.2Wiring diagram (laboratory)



Connection information: see above.

10.7 IOIT module

See also technical data in section 2.2.3

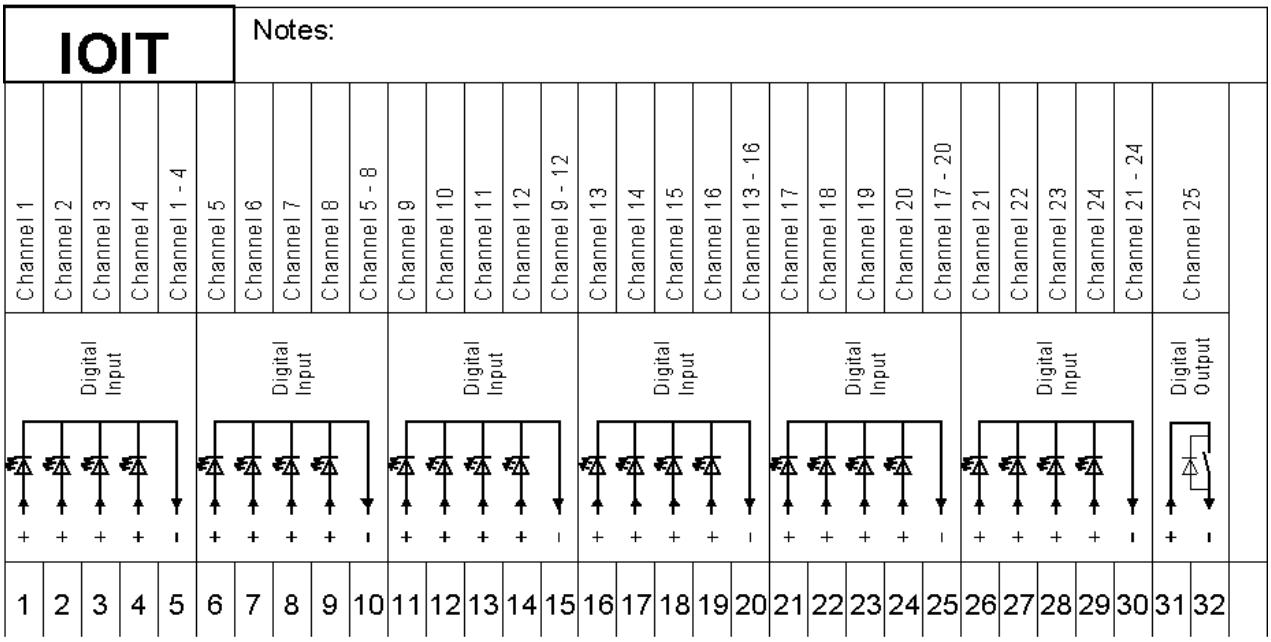
Digital inputs

Features :
24 digital inputs
High level : 3.5 to 90 V / 2 mA
Low level: 0 to 1.5 V / 0 to1.5 mA
Galvanic isolation: 2.5 kV,
Reverse voltage protection: 1 kV

Digital outputs

Features
1 Digital output
Switching voltage: max. 50 VDC. Switching current: max.: 2.5 ADC.
Galvanic isolation: 2.5 kV, Free wheeling diode integrated

10.7.1Wiring diagram (industry)



Connection of sensors / actuators :

Connect signal to digital input :

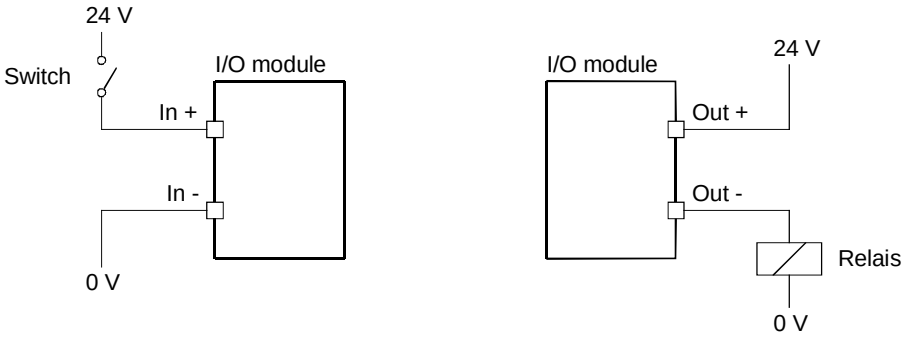
In +	Positive signal input
In -	Negative signal input

Hint: Any group of 4 digital inputs has a common clamp "In -"

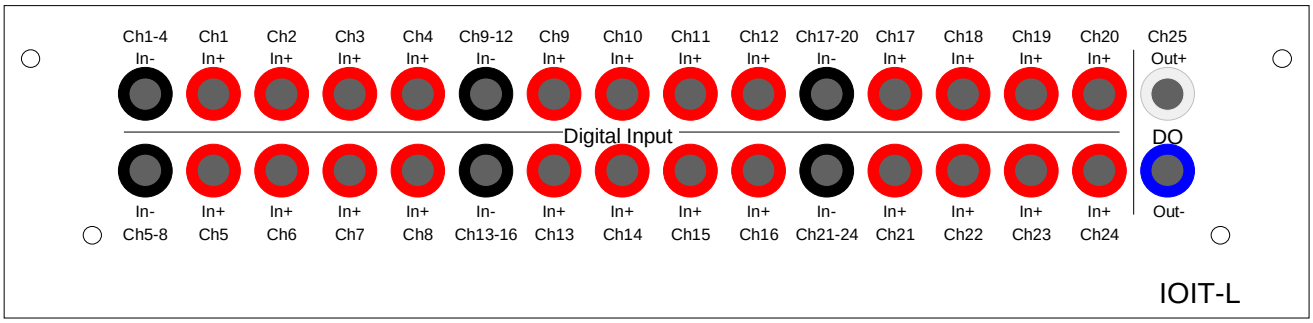
Connect actuator with digital output :

Out +	Positive signal output
Out -	Negative signal output

Connection examples :



10.7.2Wiring diagram (laboratory)



Connection information: see above.

10.8 OTPT module

See also technical data in section 2.2.3

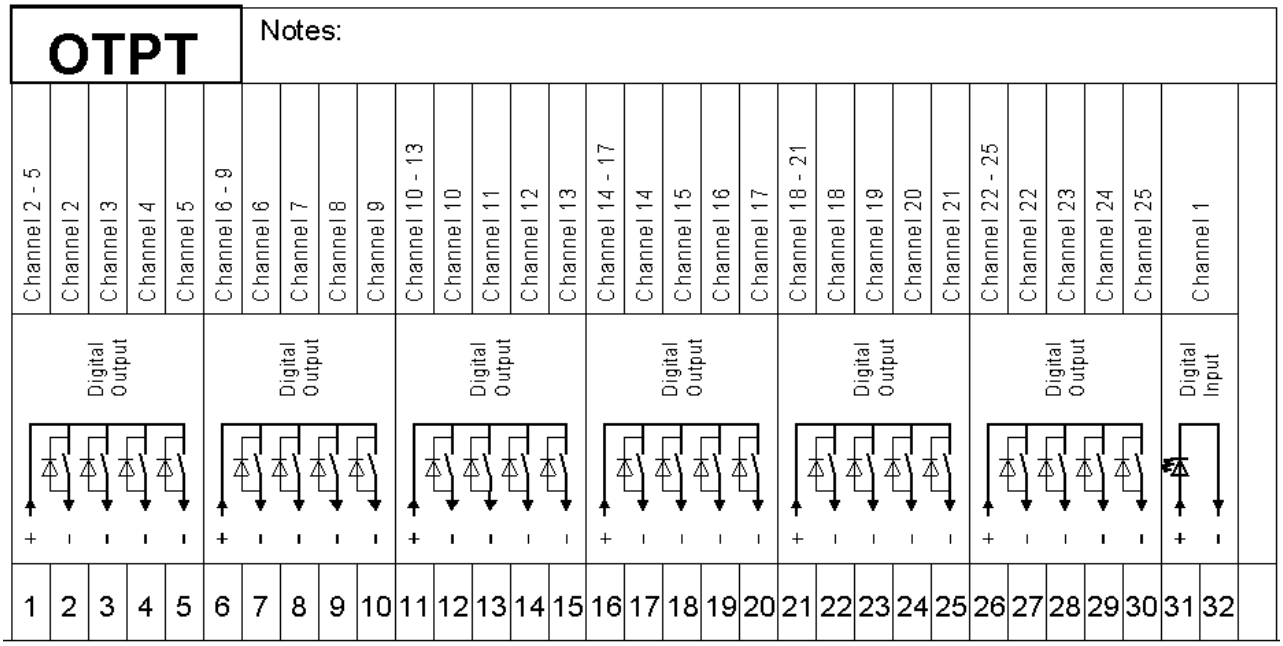
Digital inputs

Features :
1 digital input
High level : 3.5 to 90 V / 2 mA
Low level: 0 to 1.5 V / 0 to1.5 mA
Galvanic isolation: 2.5 kV,
Reverse voltage protection: 1 kV

Digital outputs

Features
24 Digital outputs
Switching voltage: max. 50 VDC. Switching current: max.: 2.5 ADC.
Galvanic isolation: 2.5 kV, Free wheeling diode integrated

10.8.1Wiring diagram (industry)



Connection of sensors / actuators:

Connect signal to digital input :

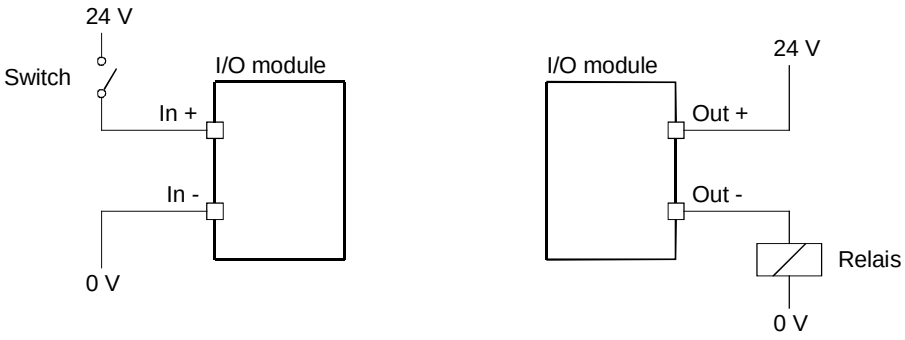
In +	Positive signal input
In -	Negative signal input

Connect actuator with digital output :

Out +	Positive signal output
Out -	Negative signal output

Hint: Each group of 4 digital outputs has a common clamp "Out +"

Connection examples :

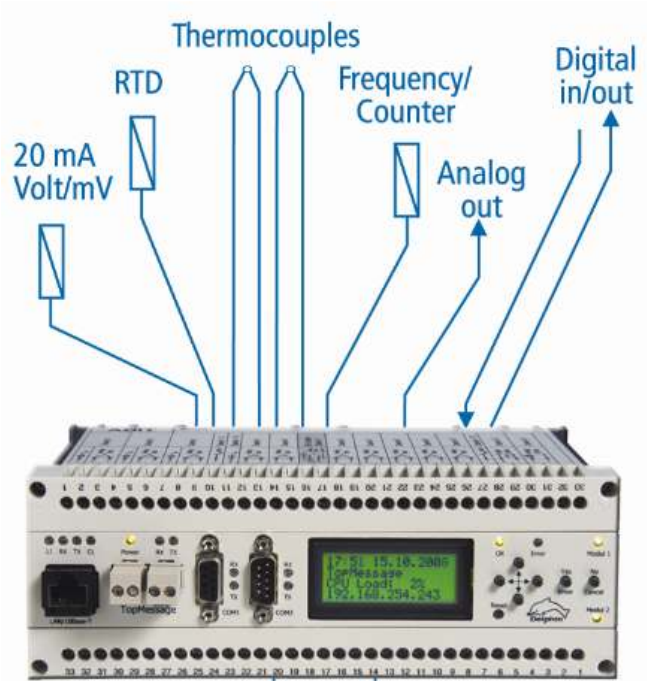


10.8.2Wiring diagram (laboratory)

- not defined -

11 Instrumentation

In this section you will learn how the individual sensor types like voltage signals (V/mV), current signals (20mA), thermocouples and resistance thermometers (Pt100) are connected to the Message devices, and what should be observed here.



Technicians, engineers and scientists need frequently systems for measurement data acquisition. The Message-Devices from Delphin are developed for this task and make the data acquisition very easy. The sensors can be directly connected to the devices and the scaling to engineering unit is performed directly by the device. Through the Ethernet interface the data can be transferred to the LAN Network and any PC for analysis. Thanks to the Message devices it is very simple to create a link between the technical process and the computer.

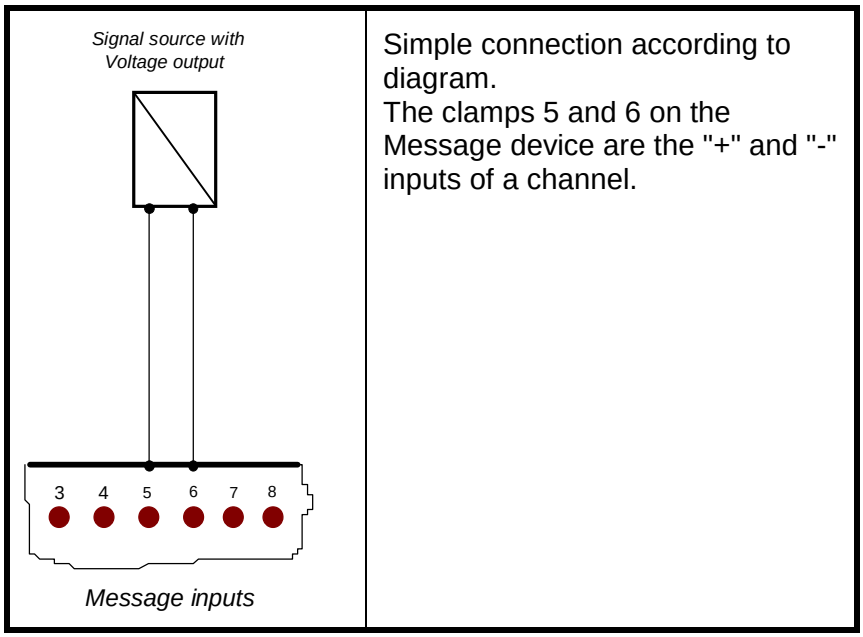
11.1 Basic terms

Galvanic isolation, galvanic decoupling
are the most important characteristics of devices for data acquisition assuring accurate measured data.
The inputs and outputs of the Message devices are galvanically isolated. Thus the dangerous earth loops will be avoided.

Potential compensation
In principle potential compensation is no longer needed with the Message devices. The permissible potential differences a listed in table in section 9.1.

11.2 Connection of voltage signals (V/mV)

Application
Serves for the data acquisition with sensors with voltage output.
The measuring ranges are mostly 0..10 V or +-10 V, also +-1 V or +-100 mV.
Voltage inputs are more sensitive to electro-magnetic noise than current inputs. (see next section)



Simple connection according to diagram.
The clamps 5 and 6 on the Message device are the "+" and "-" inputs of a channel.

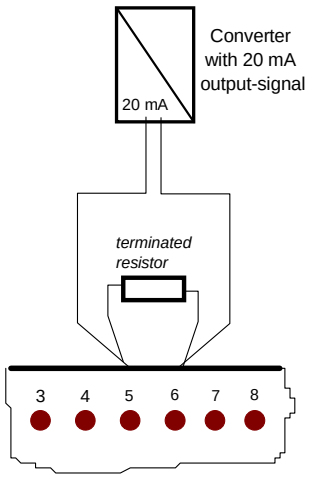
Protection against electro-magnetic noise
For high-speed measurements and the high filter frequencies thus necessary, the use of shielded cables can in some cases be required. See section 11.7.2

11.3 Connection of current signals (20 mA)

Application
Current signals are prevailing in industry due to their insensitivity to electro-magnetic noise. Nowadays, most measurement converters are equipped with current inputs.
In use are 0..20 mA and 4..20 mA. The 4..20 mA signal is especially suitable for wire breakage monitoring, since the current value will only drop below 4 mA in the case of a wire breakage.

Terminating resistor
An external terminating resistor is necessary for the Message devices, values between 50..250 Ω. The resistor will be fixed at the clamps of the Message device.
The resistance value affects the measurement accuracy proportionally. Therefore the resistors must have narrow tolerances and a small temperature coefficient.

Burden
Attention has to be paid to the burden of the measurement source when selecting the size of the terminating resistor. If several measurement devices, e.g. Message device and panel instrument, are connected to a signal source (in series), the sum of the terminating resistors must not exceed the value of the max. burden (mostly 500...1000 Ohm).



Message-inputs

When using current signals an external terminating resistor is necessary, values 50..250 Ω.

The resistor is fixed to the terminals of the Message device.

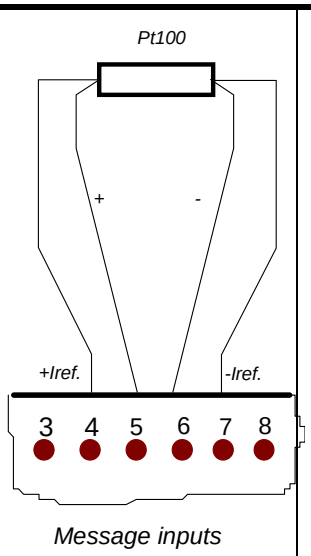
The resistance value affects the measuring accuracy proportionally. Therefore the resistors must have narrow tolerances.

11.4 Selection of temperature sensor

For temperature measurements with the Message devices, resistance thermometers (Pt100, Pt1000) and thermocouples can be used.
For the measurement range -200...+200 °C, Pt100s sh ould preferably be used. Due to the advanced miniaturization (sensor diameter: 3 mm and lower) you can achieve excellent measurement results with resistance thermometers (class A according to DIN) which are available at favorable prices.
Thermocouples prove their strength at high temperatures, small measurement points (e.g. 0,5 mm diameter and smaller) as well as in acquiring fast temperature changes

11.5 Connection resistance thermometer (Pt100)

Application :
Besides the thermocouples, the Pt100 is the sensor which is used most for temperature measurements.
The application with the Message devices is very simple. For each analog channel the current reference "I ref" is available. The current reference feeds the temperature-dependent resistance Pt100 with constant current.



This diagram shows the connection in four-wire circuitry. With the four-wire circuitry, the resistance of the cables will be eliminated. It is the most accurate way of temperature measuring.

Here the voltage drop will be measured at the terminals 5 and 6 as voltage signal which depends on the temperature.

Furthermore two or three wire circuits are possible.

Please note: "I ref -" and "In -" must not be connected with protective earth

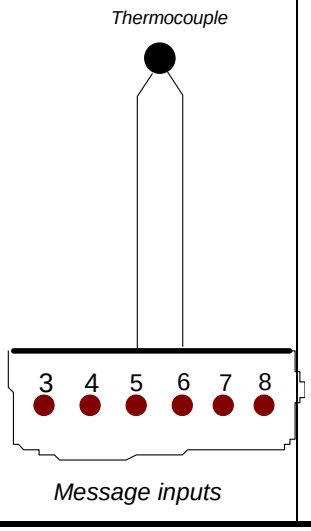
Three-Wire-Circuitry
In the three-wire circuitry the signals "I ref +" and "In +" will be combined to one cable. In this case the resistance of the measurement wirer is included to the overall resistance measurement which will increase the measurement error. With long cables the measurement error is increasing. At a length of 2 m and more, significant deviations can already be measured.

Two-Wire-Circuitry
In the two-wire circuitry the signals "I ref +", "In +" and the signals "I ref -", "In -" will be combined each to one cable. Due to this the resistance of these cables will not be compensated any more. The longer the cables the greater the measurement error. At a length of approx. 1 m and more, significant deviations can be measured.

11.6 Connection of thermocouples

Application
Thermocouples are the most important temperature transducers next to the Pt100.
Thermocouples are used for temperatures exceeding 600℃. The module ADG is available for measurements with thermocouples.

Mode of Operation
Thermocouples are active transducers. Depending on the type of thermocouple and on the temperature measurement range they will deliver a voltage value ranging from 0 to approx. 20 mV.
Thermocouples supply a difference temperature between the warm end (measurement point) and the cold end (reference point).
You will get the absolute temperature by adding the temperature of thermocouple and the temperature of the reference measurement point.
The user of the Message device can disregard it. The cold junction is installed in the Message device. The absolute temperature value will be calculated by the software.



With the Message devices, the connection of the thermocouples is very simple. The cold junction is integrated.

Temperature curves are mostly very flat. Temperatures only change very slowly. Thus a small filter value can be chosen advantageously and no measurement distortions due to electro-magnetic noise have to be considered.

The length of the thermocouple lines can be up to 100 m and more.

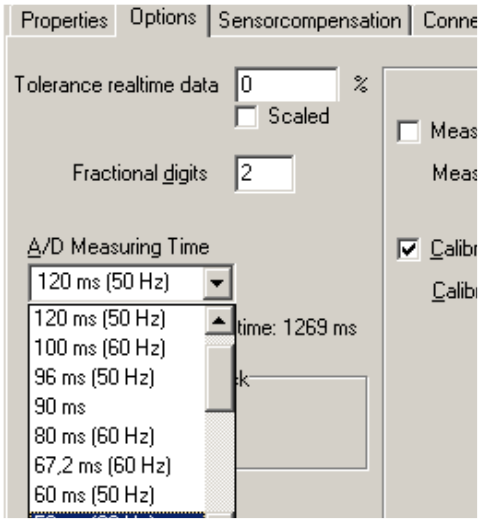
Warning :
If you use shielded thermocouples, never connect the shield (screen) to the clamps of the Message devices. The inputs are galvanically isolated.
Choose a good earth point.

11.7 Noise suppression

11.7.1 Power line interference

Power line interference will appear as noise of 50Hz or 60Hz. So result is cyclical error of measured value.

With selection of "A/D measuring time" (see section above) an internal low pass filter is adjusted.
The filter characteristic gives optimal power line noise supression for several settings.



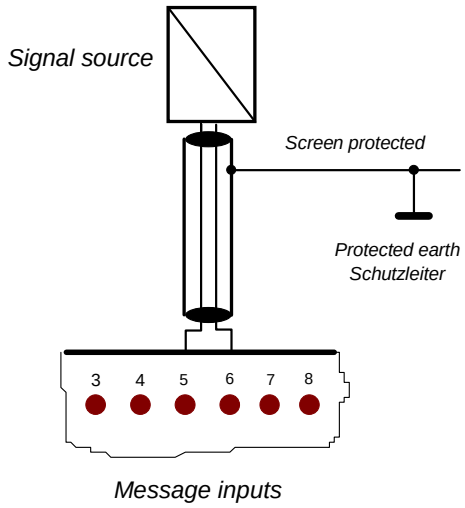
Meaning of optional Information '(60 Hz)' : This is good selection for power line noise suppression.

11.7.2 Shielded measurement cables.

Electro-magnetic influences affecting the device and the supply lines of the supply voltage are to be expected.

Electro-magnetic influences affecting the measurement cables
The influence on the measurement cables will be limited by input filters whose filter frequency will be set per software (see section above).
Shielded lines may have to be used for fast measurement which cause high filter frequencies. A shield is usually not required.

Shielded measurement cables



The channels of the Message modules are extremely robust with regard to measurement cables interference. Interference may only occur in extreme cases.

In such cases shielded lines are to be used. The shield is to be connected with the protected earth on one end.

Warning:
Never connect the shield (screen) to the terminals of the Message devices. These inputs are galvanically isolated. Select a good earth point.

12 Top/LogMessage Configurator

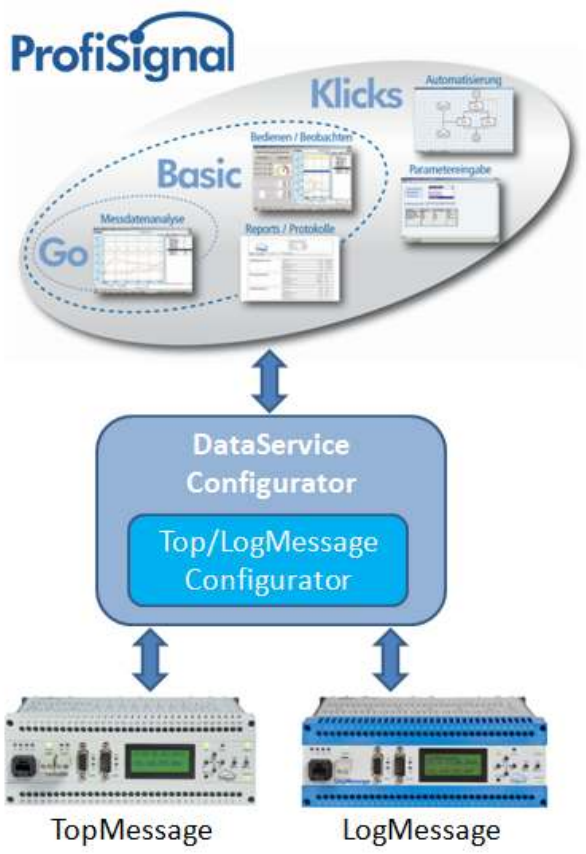
The software module „Top/LogMessage Configurator“ is the basic configuration and communication software for Message devices. You need the configuration software for:

- Device settings
- Channel configuration
- Memory configuration
- Virtual Channel configuration
- Configuration of the Serial interfaces

12.1 Software Architecture

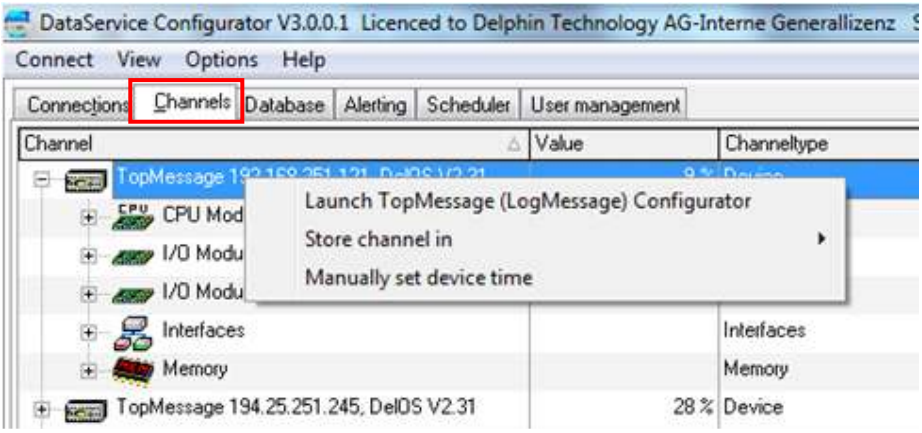
The Message devices are available with different software options of **ProfiSignal Go, Basic** and **Klicks**. With ProfiSignal you can very easily analyze measurement data, create individual HMI mimics or even configure fully automated test sequences for product testing with integrated reporting.

The main configuration software is the **DataService Configurator**. This software is required to establish a connection to the devices, configuration of databases for online archiving, scheduler events, alarm rules and the user administration. Within the software DataService Configurator the **Top/LogMessage Configurator** is launched to configure Message devices.



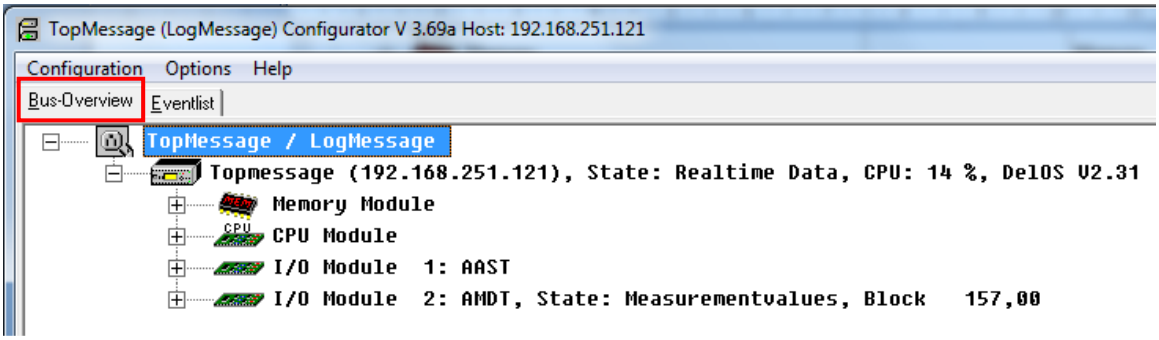
12.2 Launch Top/LogMessage Configurator

The Top/LogMessage Configurator will be started from the software DataService Configurator from the tab sheet channels.

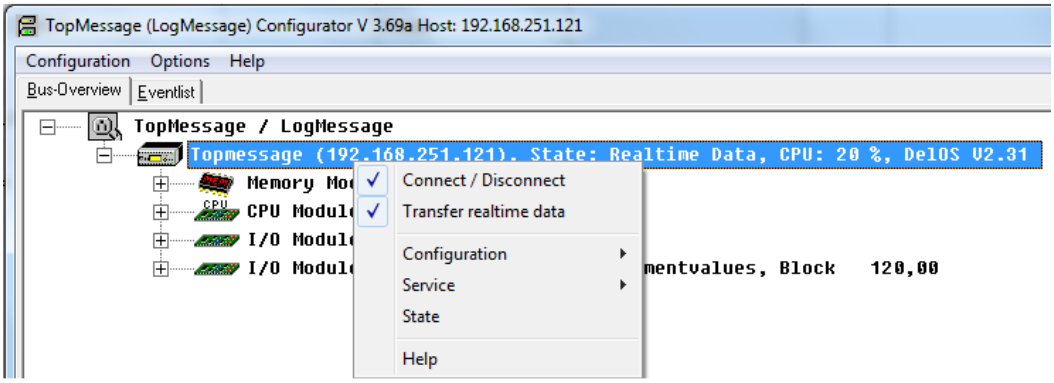


12.3 Bus overview

The actual configuration of the Message devices is carried out with the software Top/LogMessage Configurator. The Bus overview provides an overview of the different modules.

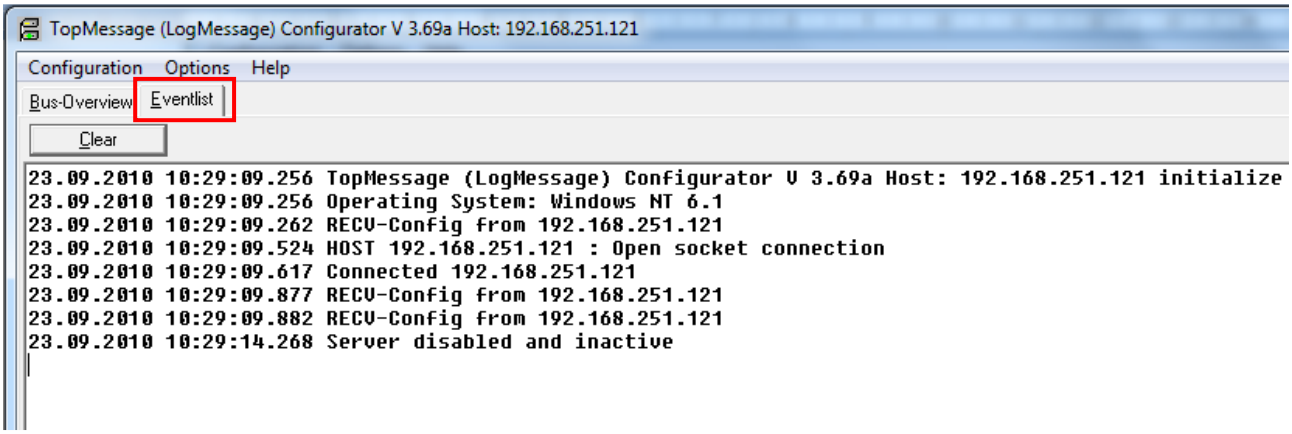


With right click on the device the configuration menu can be accessed. The configuration options will be explained in the following chapters.

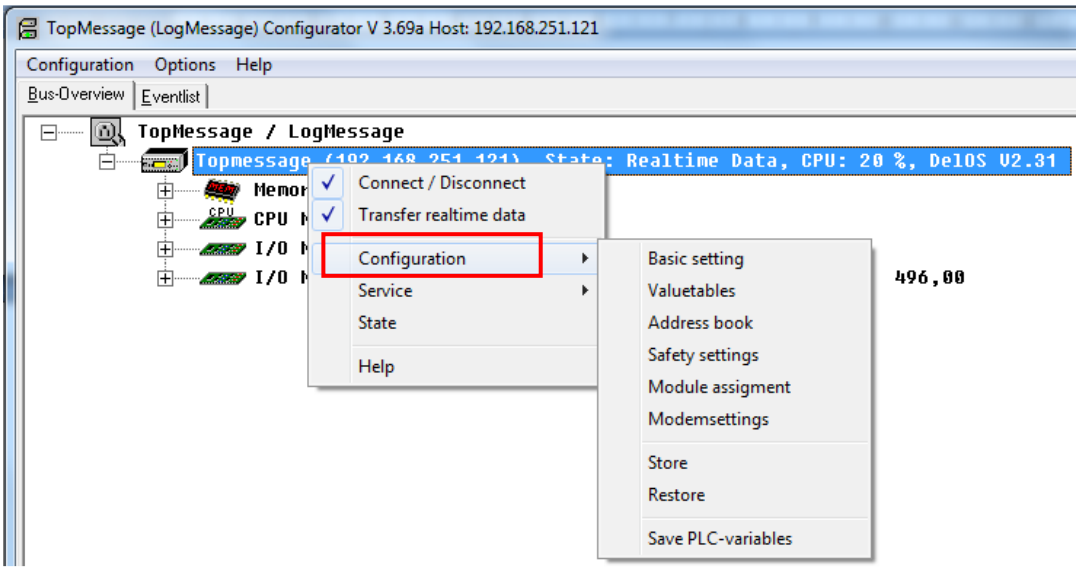


12.4 Event list

The event list records all changes made to the device. This event list will be rebuild after each reboot of the system.



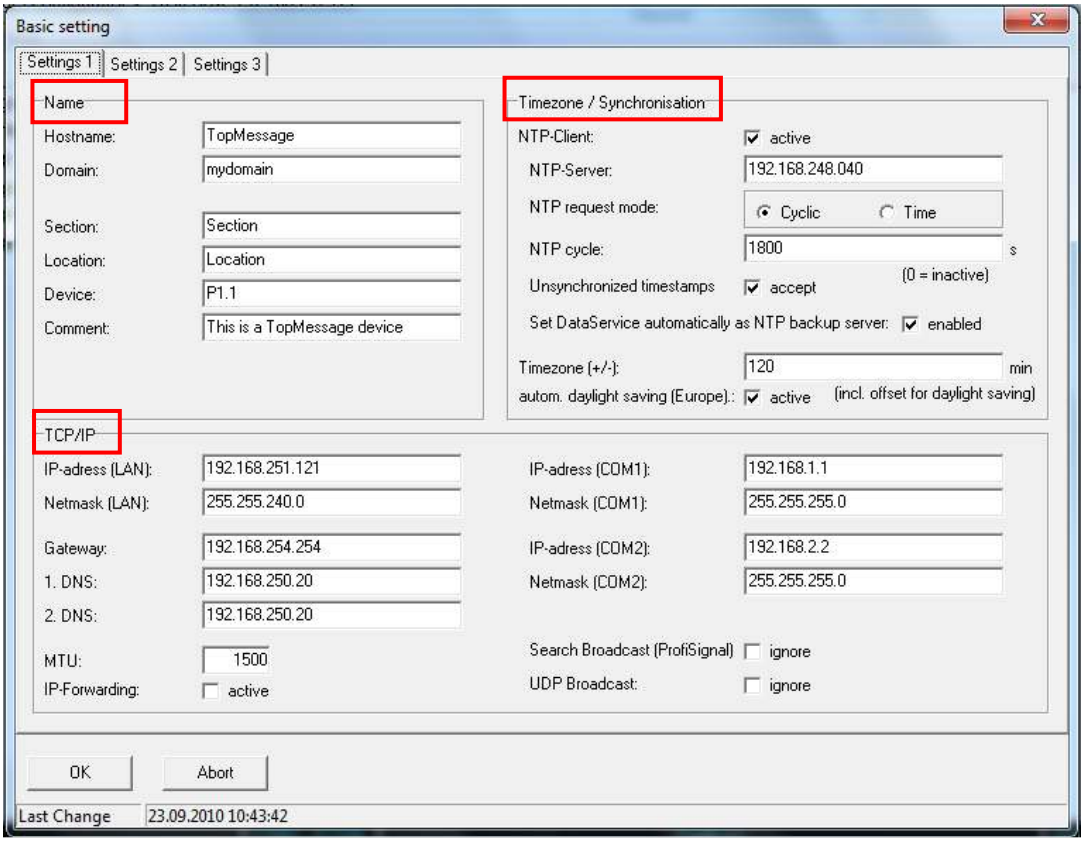
13 Device configuration & service



13.1 Configuration menu

13.1.1Basic settings 1

In the basic settings menu fundamental configurations are carried out.



Device name:

Includes the parameters „host name“ (necessary for DNS operation) and „domain“ (for E-mails). The further parameters have no effects on the communication and have a mere informative purpose.

TCP/IP:

Here the basic connection parameters for the operation within the LAN network can be configured. If the device has also been entered in DNS (device names→host names), it is also possible to work with the host name here. For this purpose the device must know at least one DNS-Server. Should the device be reachable in different subnets, a gateway must be entered. For sending Emails, the host name of the SMTP-Server is needed.

IP address
The TCP/IP protocol demands an IP address by each subscriber in the network.
The IP address runs as follows:
Example : 192.168.254.161

Note:
The number 0 and 255 are not permitted on the last part of the IP address. They also cannot be entered for Message devices.

Netmask:
The Netmask is a filter for the TCP/IP communication. Usually only devices within the same Netmask can communicate with each other. It is important that device IP addresses within one Netmask have a difference where the netmask is zero. Each device in a local network must have a different IP address, which must differ only in the last three digits.

Example:
Netmask = 255.255.255.0
IP1 = 192.168.254.13, IP2 = 192.168.254.78 ok
IP1 = 192.168.254.13, IP2 = 192.168.**253**.12 wrong, IP differs on the 3. position

Netmask = 255.255.0.0
IP1 = 192.168.254.122, IP2 = 192.168.123.3 ok
IP1 = 192.168.254.122, IP2 = 192.**2**.2.5 wrong, IP differs on the 2. position

Gateway: If inquired IP addresses are not in the range that has been declared valid through the netmask for the local network (see under „wrong“ examples), the communication can be set up via a Gateway. This is e. g. the case for all Internet inquiries. For the properties of the TCP/IP protocol the IP address of a Gateway (computer or device) which provides this function can therefore be indicated. Normally, this is a router. Of course, the IP address must be valid for the local network!

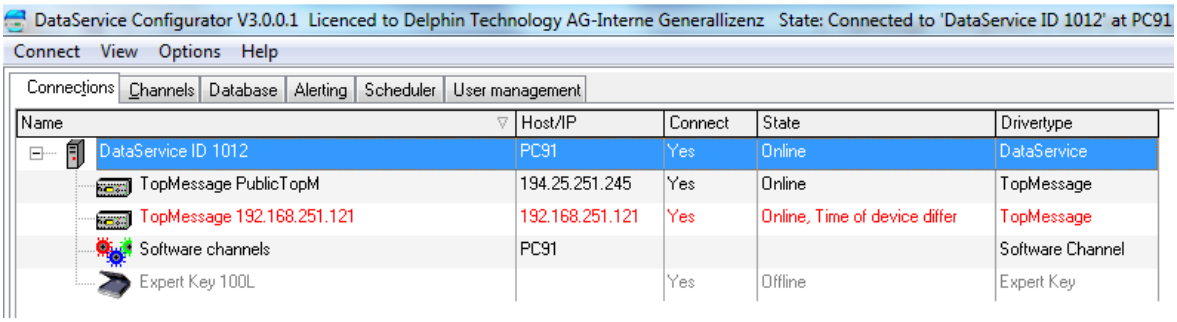
MTU:
Here the sizes of the TCP/IP package can be defined.

IP-Forwarding:
The Message device an server as a router and forward IP-addresses in the scope of GSM modem communication.

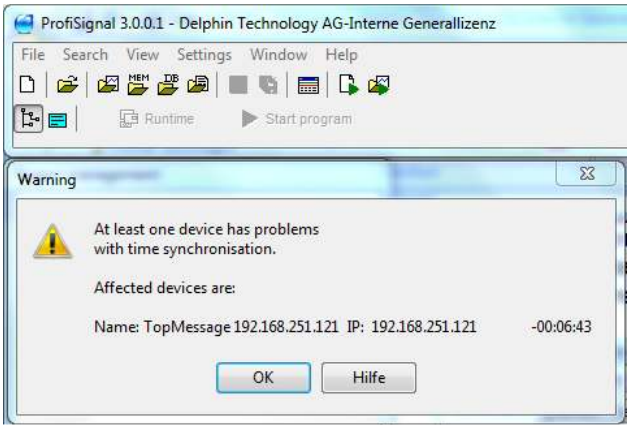
UPD Broadcast and Search Broadcast:
With deactivated broadcast function the DataService Configurator will not be able to list the device which is connected to the network. In this case other users of the Network will not be able to find the device automatically.

Timezone / Synchronisation:

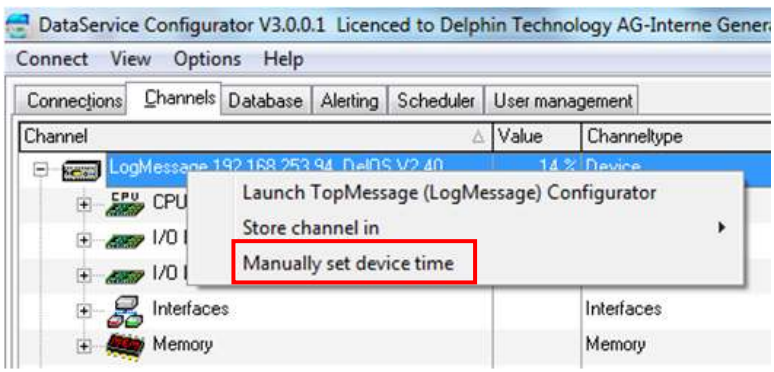
The time synchronization between PC and Message device are very important to have a synchronous data presentation on the ProfiSignal software. If time is not synchronous the following message appears in the DataService configurator.



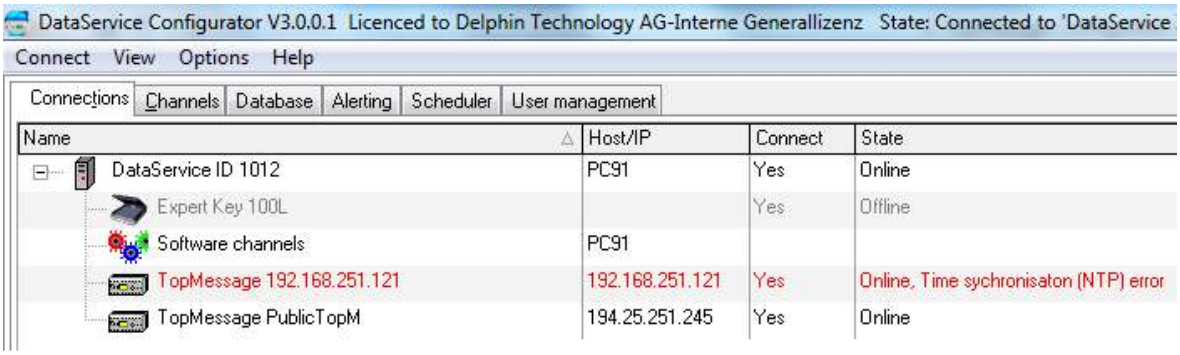
When the software ProfiSignal is started the following warning message comes up where the concerned device IP address and the time difference is reported.



When the time settings of the Message device do not instantly lead to a synchronization, you can manually synchronize the PC with the Message device through the DataService Configurator from the tab sheet channels.



NTP Client:
The check box NTP Client (NTP = Network Time Protocol) is the main control function to activate or deactivate the time synchronization between PC and Message device. If a NTP server is configured and reachable the Message device will receive the current time from this server. In the case that no NTP server is available, or cannot be reached the DataService Configurator will show the message “Online, Time synchronization (NTP) error”.



It is recommended to configure the DataService Configurator as back up NTP server.

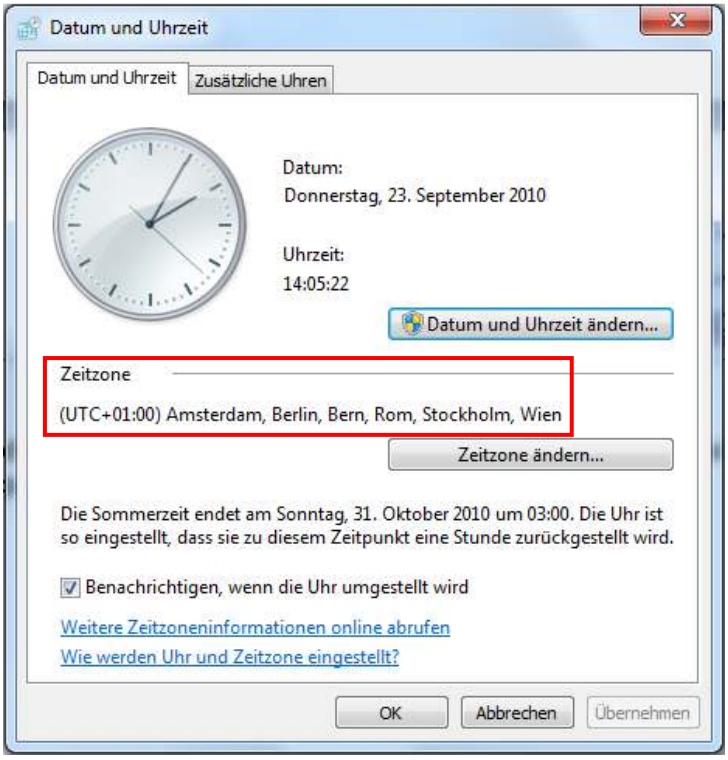
NTP Server:
Normally the PC with the ProfiSignal application and the Message devices are linked up to the overall company network. In this case it is recommended to use the global NTP time server of the company to synchronies the Message device.
You can obtain the IP address of the NTP server from your systems administrator.

NTP request mode:
In order to activate the time synchronization the request cycle time has to be defined. It is recommended to have a request cycle time of 30 minute = 1800 sec.

Accept unsynchronized time stamps:
It is recommended to activate the check box to accept unsynchronized time stamps. This has the following advantage. In some cases the NTP server is for any reason not synchronized to a time reference server. The Message device will get the information from the NTP server whether the NTP was able to synchronies himself or not. If the check boy is not activated the Message device will not consider the time of the NTPS server as trustworthy. However, if the Message device is connected to a local PC only and the PC also operates as a time server it is probably not relevant whether the NTP server of the local PC can make synchronization to a reference time server or not.

DataService automatically as backup NTP:
It is recommended to activate this check box so that the DataService Configurator can serve as a backup NTP time server in the case that the main NTP server is not reachable.

Time zone:
Here the time zone will be configured in minutes. You can find out your time zone by accessing the data and time icon on your control panel of the PC. For Germany the time zone is UTC + 1 hour.

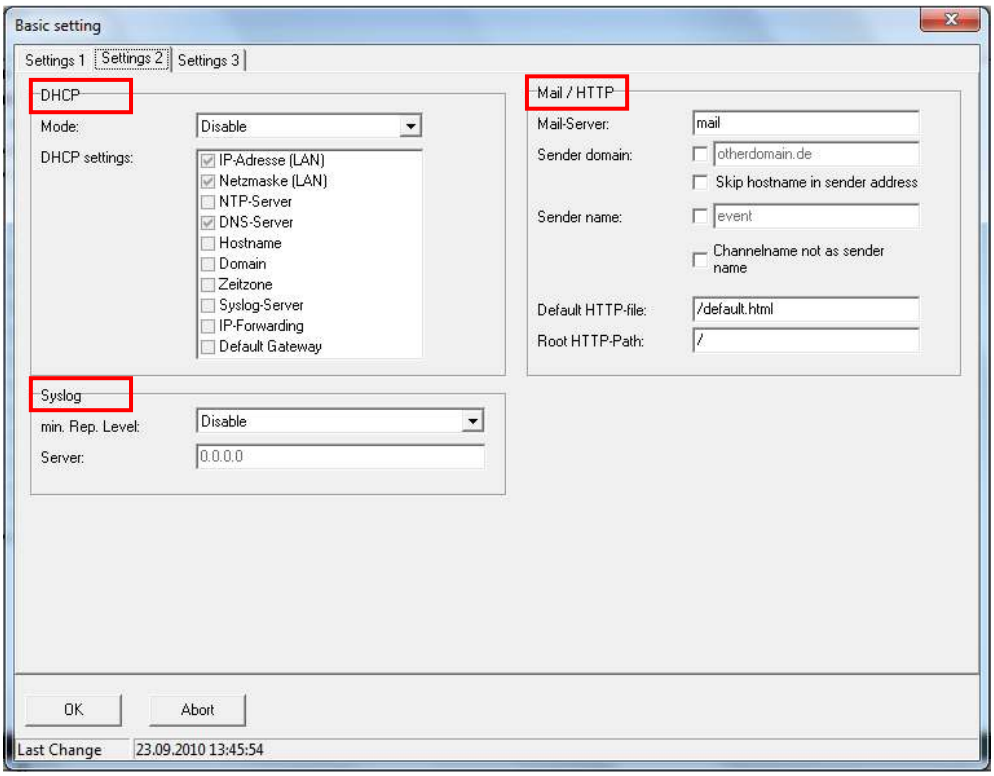


Automatic daylight saving Europe:
In Europe the time is change twice a year. The Message device can automatically anticipate the time change when the check box is activated.

Summer time : Last Sunday in March, 2 hrs AM (1 hour ahead)
Winter Time: Last Sunday in October, 3 hrs AM (1 hour back)

Remark:
The activation of day light saving settings during the summer time is causing an update of the time zone. When the time zone is configured e.g. for + 60 minutes (UTC +1 Germany) and you activate the day light saving afterwards the system will update the time zone automatically to 120 minutes when you open the dialog again. Under this specific circumstance the updated time zone is correct and the system will run correctly.

13.1.2 Basic Settings 2



DHCP:

In case your network supports „DHCP“ you can configure the Message device in the way that it will receive its IP-address dynamically and can be reached via host name in the Top/LogMessage Configurator. For this option you activate under settings 2 the mode “Boot/DHCP” (Attention: older servers might require: “native Bootp”).
Select from the following list „DHCP-settings“ the parameters that should be taken over and which are supported by your DHCP-server.
Contact your network administrator for information on DHCP-server.

Syslog:

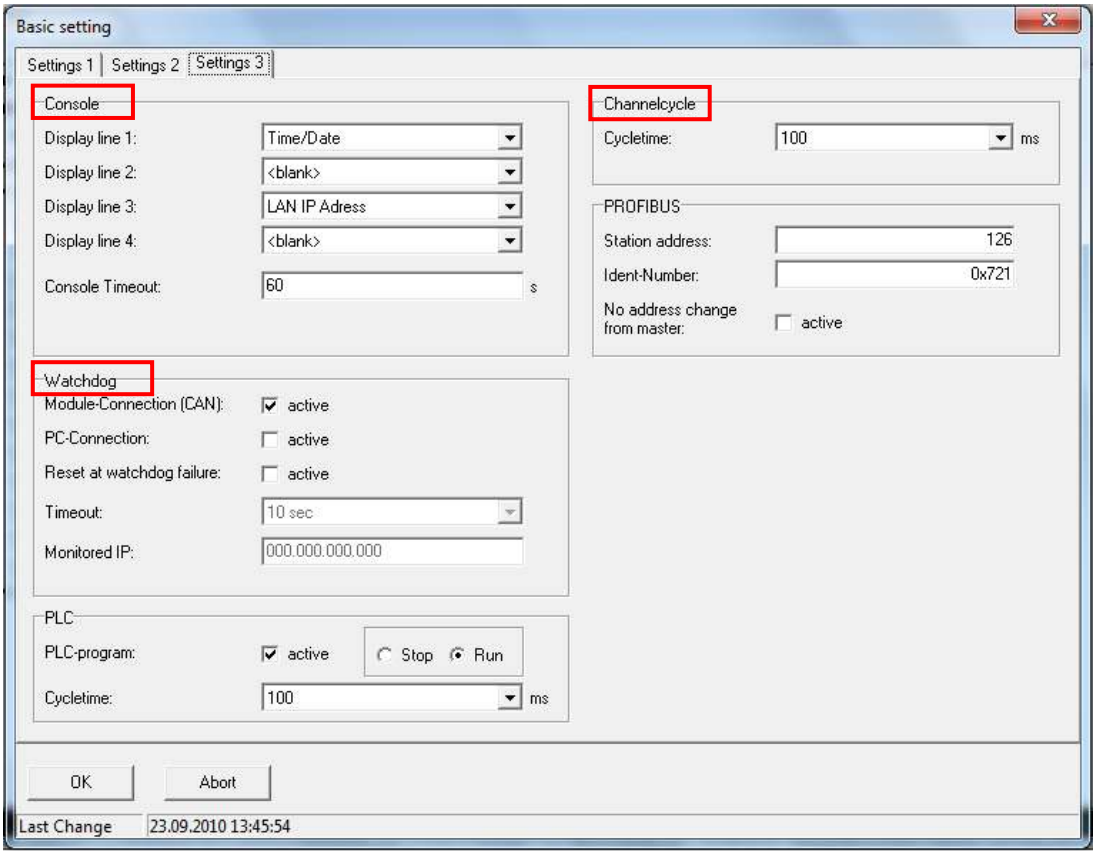
In case the system report of the Message devices should be centrally filed on a PC, enter the IP-address of PC as well as the logging level. If you select log level INFO all information will be logged. All logging information will be stored in the file DataService Config on the ProfiSignal installation directory.

Mail / HTTP:

Here the mail servers resp. the HTTP starting paths must be entered. In order to send an Email via your provider you will require the following settings:

Domain:	*Domain_of your_Poviders.de*
Sender-Domain:	*Domain_of your_Poviders.de*
Mail-Server (SMTP):	smtp. *Domain_of your_Poviders.de*
Option:	„No hostname in sender“ active

13.1.3 Basic Settings 3



Console:

Different display functions can be allocated individually to each line of the display. Display functions besides time and IP addresses for LAN (default setting) and COM 1 / 2 can also be among other measurement values of individual channels or states of the interface. Timeout console indicates the cycle in which it is being changed from the submenus in the respective main menus or back to the standard display.

Watchdog:

The module communication and the PC communication as well (together with the indicated PC) can be provided with a watchdog. In the default settings only the module communications is monitored. In order to report watchdog messages a limit channel is required.

PLC:

Activates the internal PLC resp. sets the cycle time. This function is only relevant when PLC programs are configured in the Message device.

Channel cycle:

Cycle time in which analog/digital outputs and time based virtual channels (as e.g. timer and integrator) are performed resp. are set.

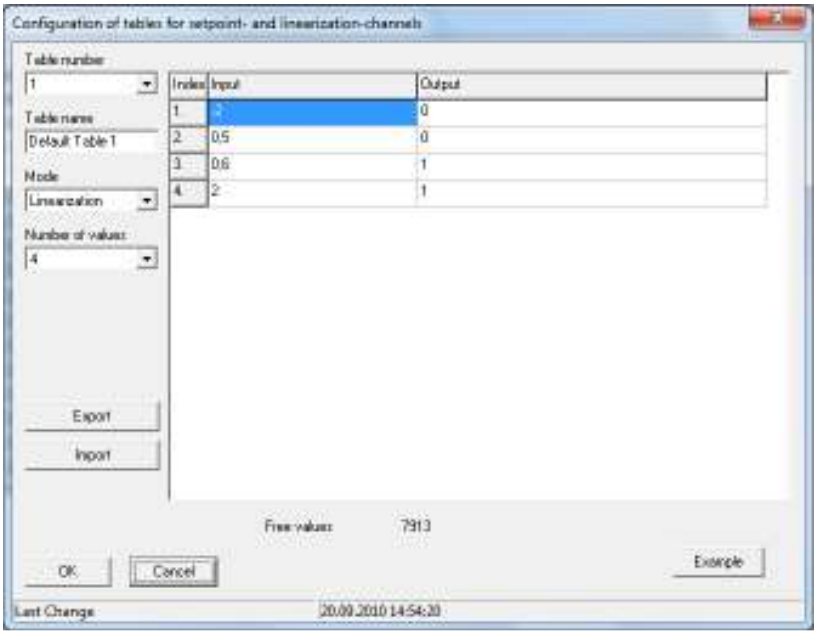
Caution:
Small cycles may lead to negative side effects (too high CPU-load or faster filling up of data memory).

Profibus:

The Message devices can be ordered with the option for Profibus-DP Slave communication. In order to use the Message device for PLC applications the station address and the indent number has to be defined. With the delivery of the device you will also receive a special GSD file.

13.1.4Value tables

Here there is the possibility to file up to 72 tables with up to 7936 values.



Three modes are available for this:

Set value curve
Indicate the values and the duration; between the values it is being interpolated.
(>is used by set point channel)

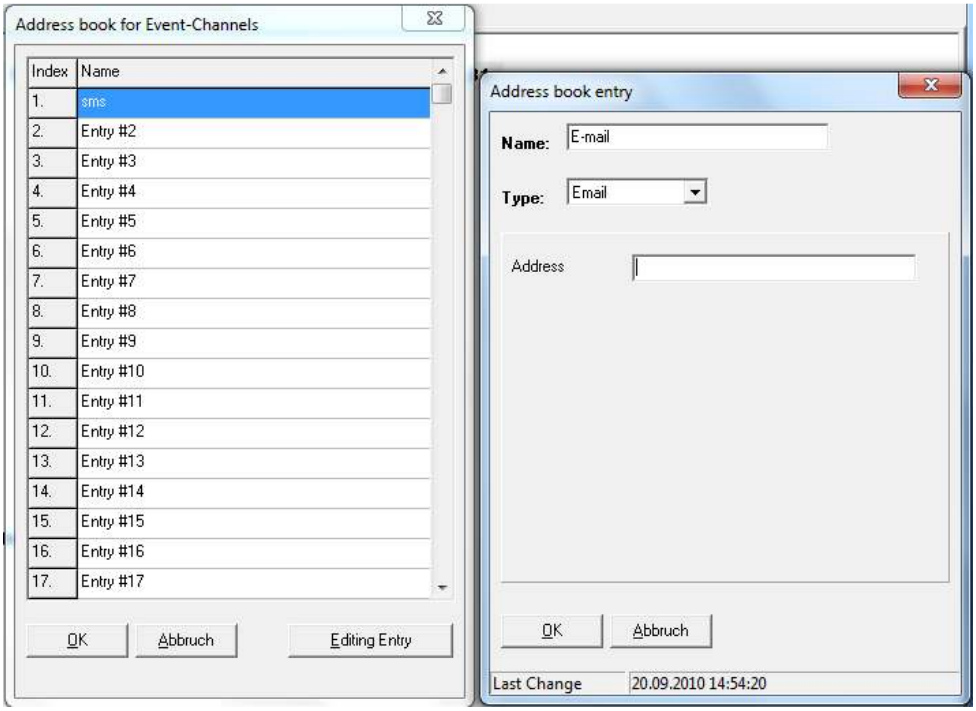
Sequential circuit
Switch up to 16 signals either time related or triggered dependent on a signal
(> is used by set point channel)

Linearization
Give your value table (input and output values) your linearization function
(>is used by linearization channel)

Besides the manual input there is also the possibility for the import/export of tables.
The configuration of the table is explained in more detail in the section “Virtual Channels”.

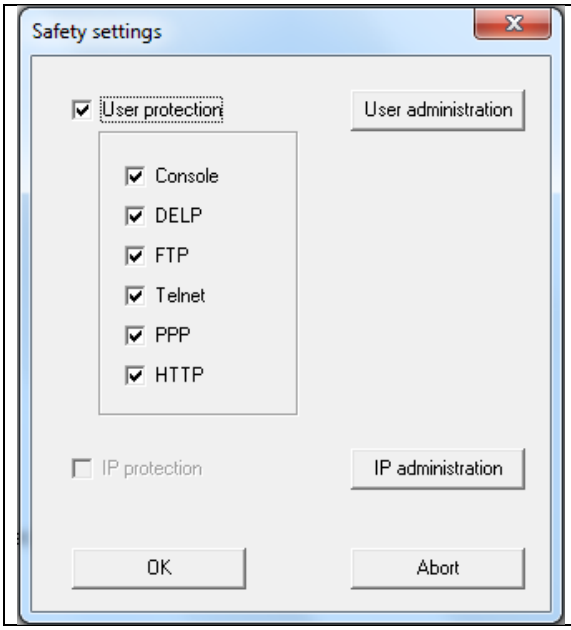
13.1.5 Address book

In the address book up to 40 „addressees“ can be filed; address book entries can cover the formats of “E-mail”, “SMS” “Datastring” and “Fax”. These entries can be used by the event channel. More details about the configuration of event channels can be found in the chapter “Virtual Channels”.



13.1.6 Safety settings

It is possible to limit the access to the Message devices through a user administration / registration and also through an IP interlock on the network level.



User protection:
In the case of activated protection a log in is required for the selected access types.

- **Console**: Console at device
- **DELP**: Top/LogMessage Configurator / real time data / channel configuration
- **FTP**: Other configuration / read out memory
- **Telnet:** System console
- **PPP**: Modem / serial connections
- **HTTP**: Browser access

IP access protection:

In the case of activated protection the device only accepts only connections of permitted IP addresses.

Install:

The user administration is switched on in the main menu „options“ by activating the option „user protection“. The user „SUPERVISOR“ is part of the default installation. In order to create other users the following administration menu is available. You can choose from 6 different user profiles.

User Profiles:

Guest: The user has access to real time data only.

User: The user has access to the internal memory and he can establish a Telnet connection.

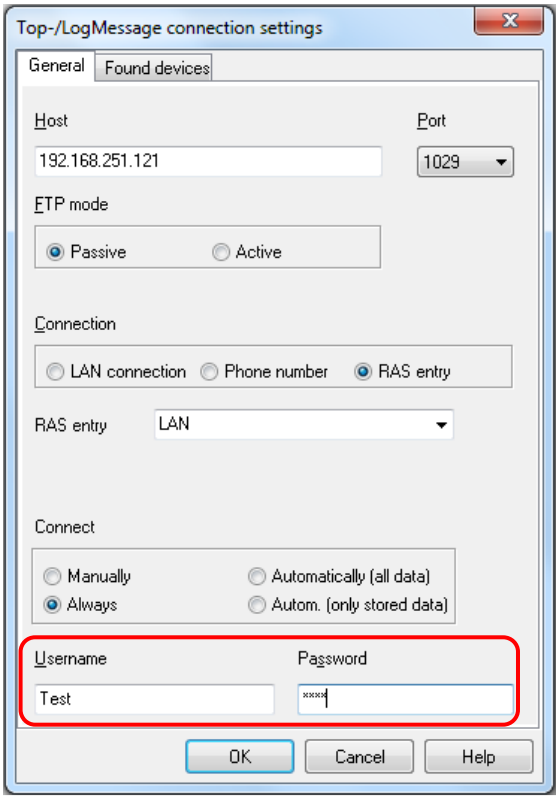
Configurator: The user can configure the devices with the Top/LogMessage Configurator as far as this is permitted by the safety settings of the devices.

Administrator: The user can operate / configure the Top/LogMessage Configurator device with the exception of the user administration completely.

Superuser: The user can operate / configure the Top/LogMessage Configurator without any restrictions.
Name: SUPERVISOR
Password SUPERVISOR

Log in

When the user administration is activated the corresponding user name and password must be included in the connection setting of the DataService Configurator. In the example a connection is established with the user “Test” and the corresponding password.



Login on Message device level:

When the password protection is activated a long in on device level is also required. If the user administration in the Top/LogMessage Configurator is deactivated or if there isn't any user logged in, the log in at the device is made with the user name „anonymous“ without password. If data should be transferred in this state, the user must be installed “anonymous” in the concerned device.

IP administration:

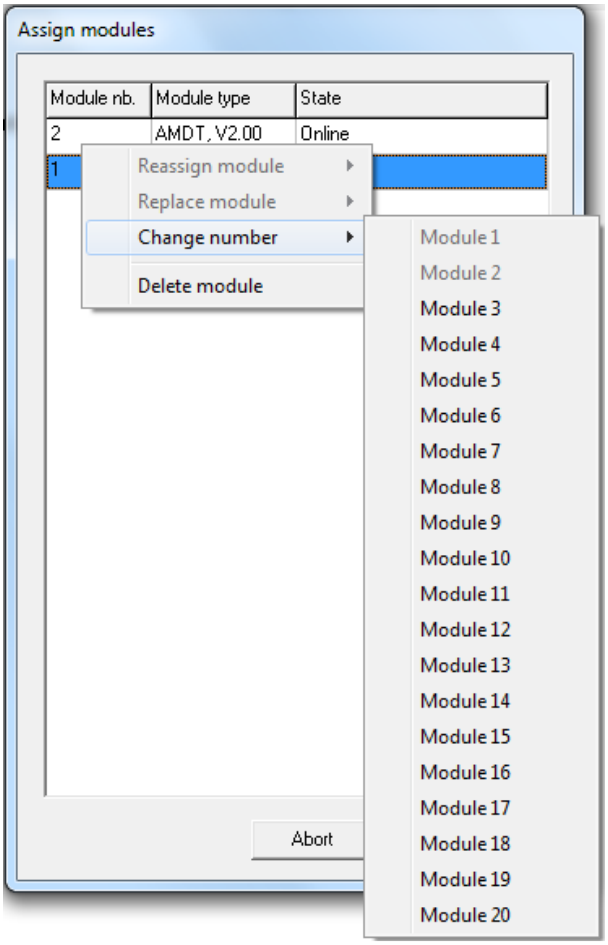
The IP addresses of the devices (e. g. PC) which should have access to the device must be entered into the IP list.

Remark:
In the case of modem or serial connection the IP address is allocated to the PC by the device. The allocated address is the incremented IP address of the selected interface. This address must be entered in the IP administration, if data com connections should be possible.

Example:
If COM2 has the IP address 192.168.2.2, the PC will be allocated the address 192.168.2.3. The address 192.168.2.3 must be added to the IP list.

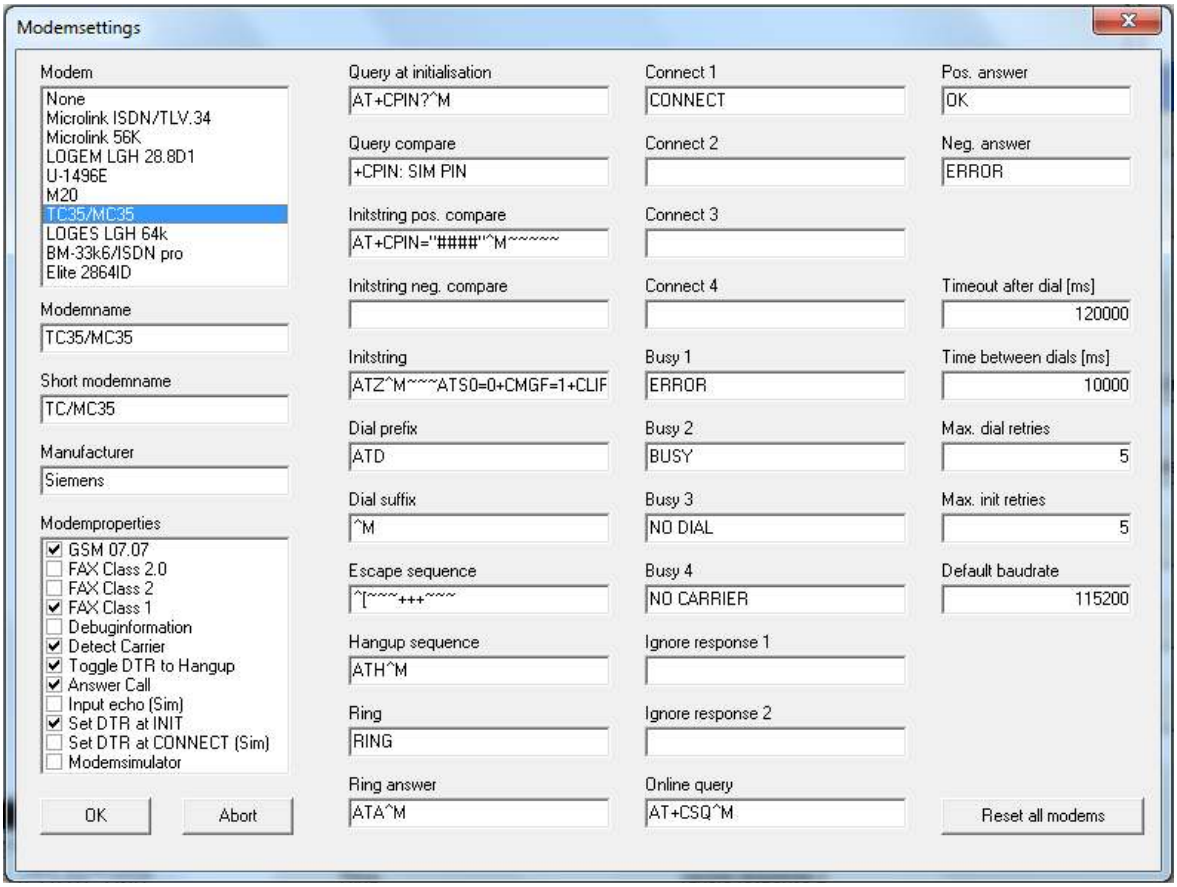
13.1.7 Module assignment

In the following configuration menu the module numbers are linked to the I/O modules. The module number is very important. Without an assigned module number it is not possible to configure the module and it is also not visible in the Bus overview in the Top/LogMessage Configurator. When a module is selected for assignment the corresponding LED on the Message devices is flashing. The flashing LED indicated which module is concerned. The module number can be obtained from the device as it is printed next to the LED. The module assignment can also be carried out through the LCD display of the Message device.



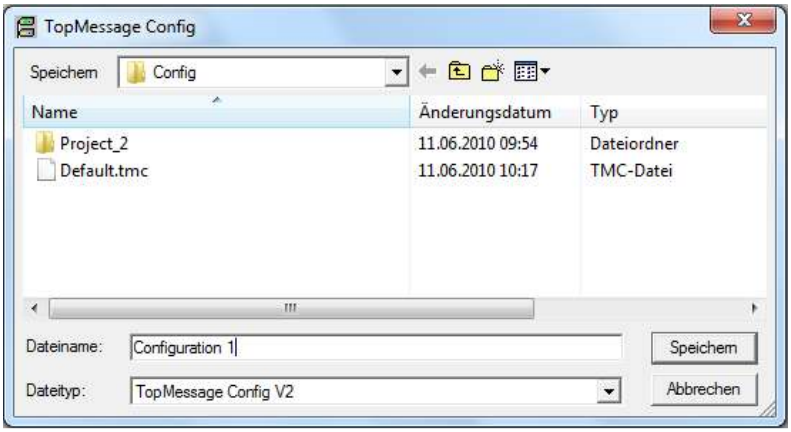
13.1.8 Modem parameter

On demand it is possible here to change the configuration of a modem or add a new type of modem. Please take the respective information from the documentation of your modem.



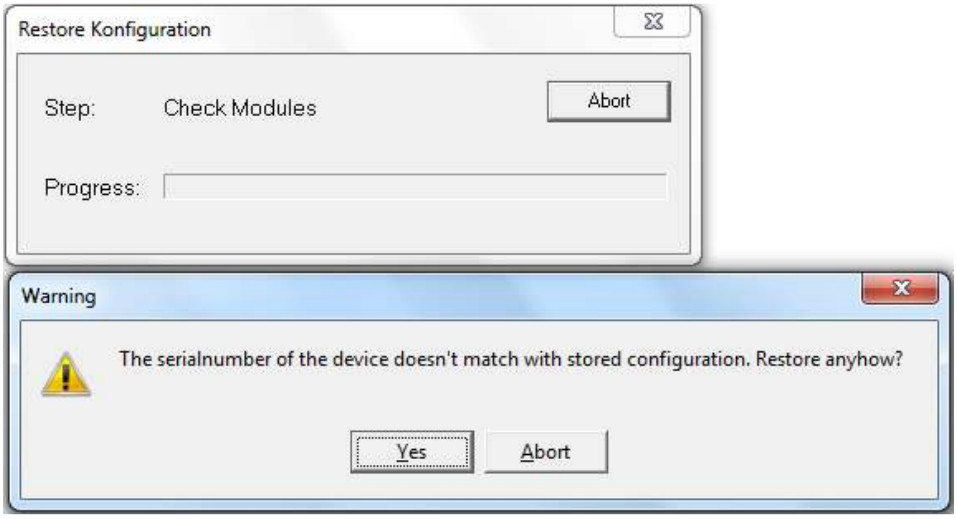
13.1.9 Store / recover configuration

Store
Indicate path and file name in the opening dialog box. Thus, several test set-ups can be quickly exchanged and recovered.

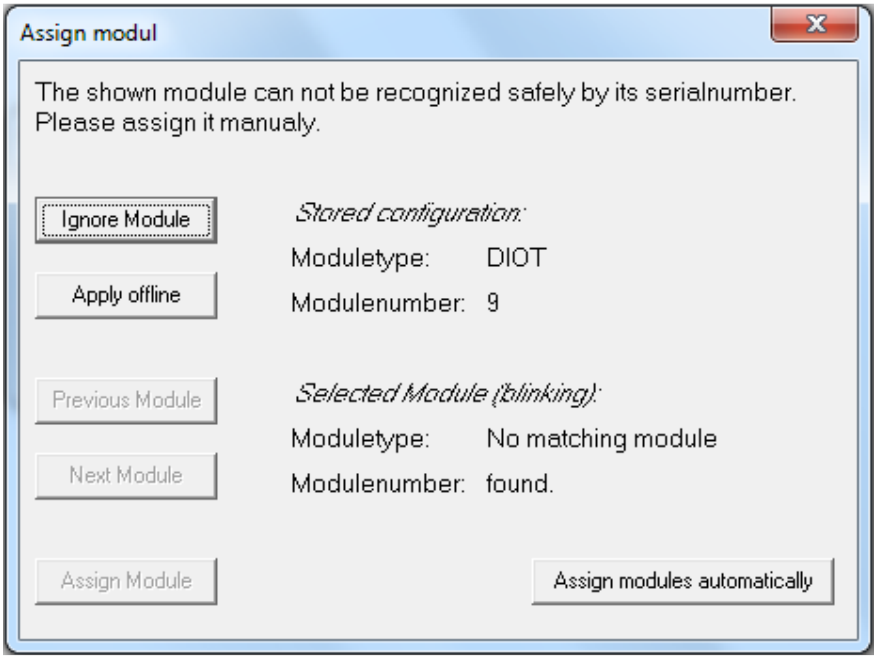


Recover
Select the file with the configuration to be recovered. Configurations can, if the hardware is matching with them, be recovered on different Message devices.

If the device is not recognized due to its series number during the plausibility checks, a corresponding warning will be issued. However, it is anytime possible to copy the configuration into a different device.



During the restore process the system is checking the serial numbers of the modules of the configuration with the serial numbers of the modules in the configuration (.tmc) file. If the serial number do not match a manual module assignment is necessary. The module assignment is carried out in the following screen.



Ignore module:
The channels of the displayed module (from the configuration file) are not recovered.

Apply offline:
The displayed module is added in the device (without appropriate physical module). The channels of the module are operable as soon as the physical module is connected.

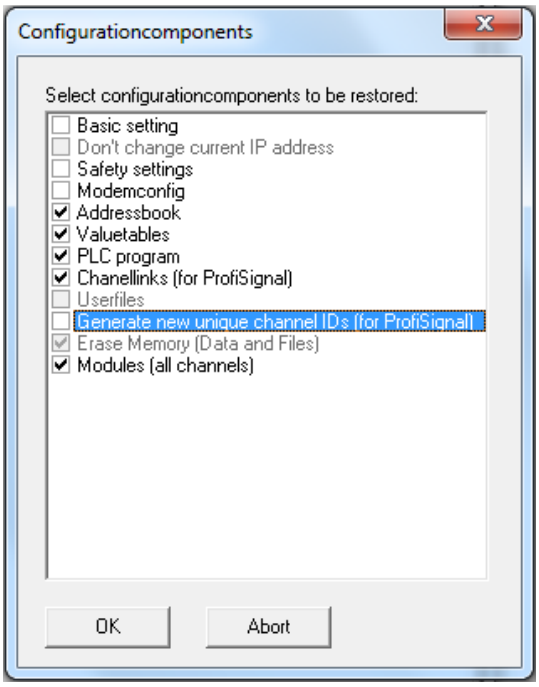
Previous module / next module:
If there are several modules of the same module type inside the device, select the appropriate module.
The “module“ –LED of the selected module is blinking during selection.

Allocate module:
The currently selected module will be allocated the displayed module of the configuration file.

Allocate modules automatically:
This function tries to allocate the modules automatically. The allocation is made according to the following rules:

1. Modules without an equivalent physical module (type) are applied „Offline“
2. Modules with the same module no. are allocated
3. The modules are allocated with ascending module no.
4. Not allocated modules (without module no.) are allocated one after the other (coincidentally !)

In the final step you can chose which parts of the configuration you would like to restore.



Basic setting:

Basic settings of the device: Interface settings, network parameters, etc.

Safety settings:

Configuration data of the IP interlock and all users established in the device.

Modem configuration:

Configuration parameters of the installed modems.

Delete supernumerary software and storage channels

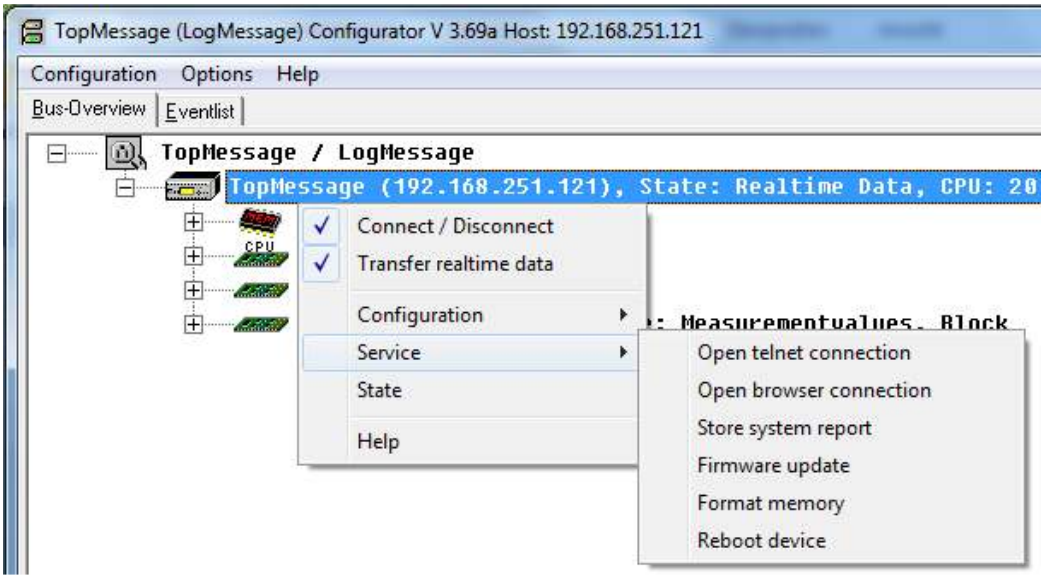
:If this option is displayed in gray, there are no supernumerary channels in the device.

I/O module x: yyy

If a module is displayed in gray, the configuration file does not contain any configuration information for this module.
(After the storage the module was added to the configuration file).

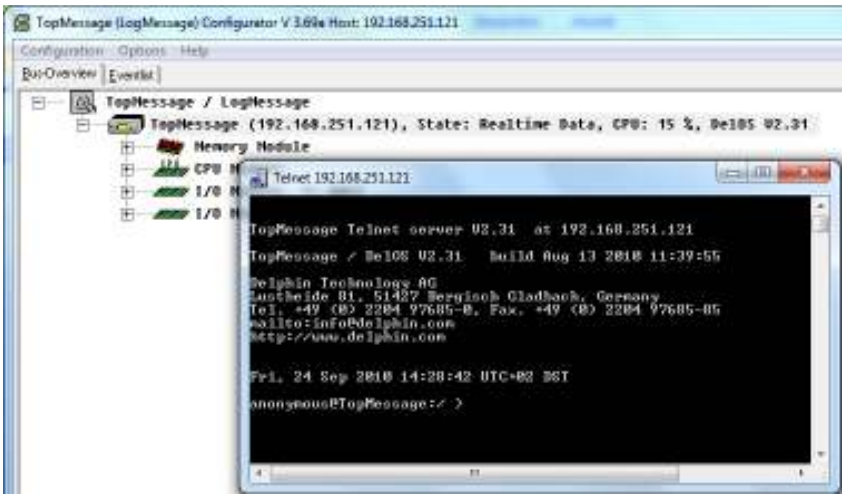
Note:
If there are changes at the module table required for the configuration recovery (module type, series no. etc.), the channels can no longer be recovered partly.

13.2 Service Menu



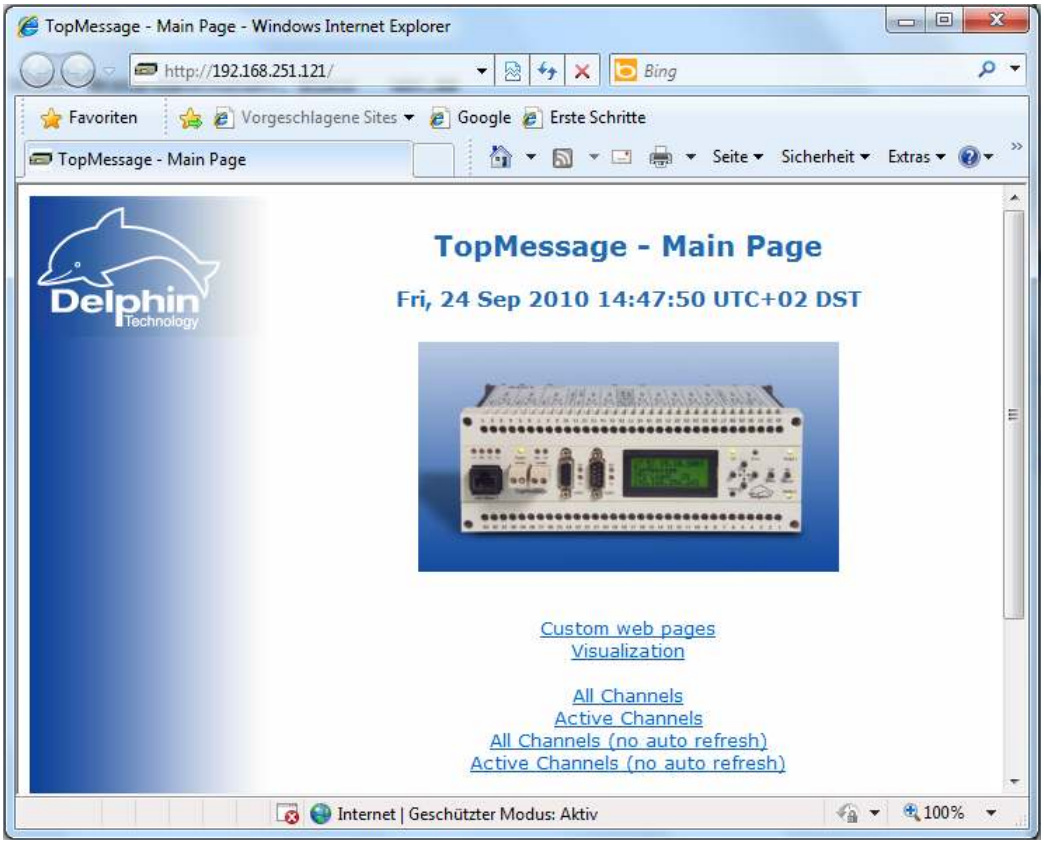
13.2.1 Open telnet connection

The function establishes a Telnet connection to the selected device. With this connection you can carry out commands via the system console of the device. This function is intended for service purposes only and must be used after hotline instructions only.
Operation error can crash the system!



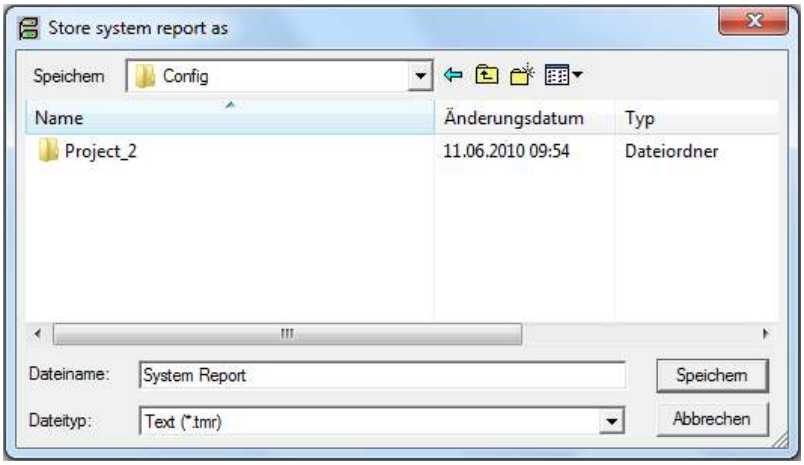
13.2.2 Browser connection

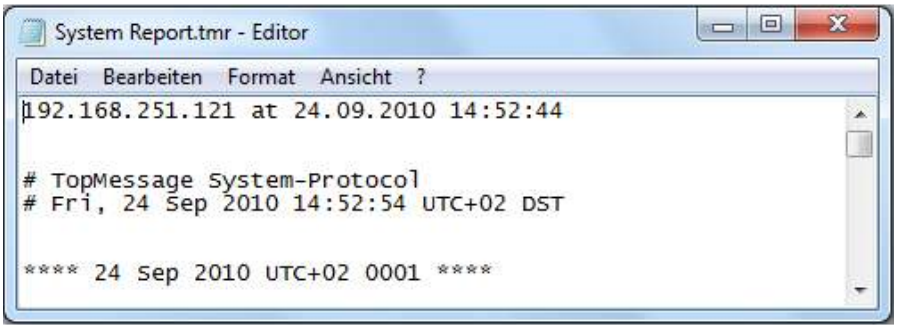
The Message devices have an inbuilt web browser. The web browser can be used to access device and channel information. It is not possible to make any configurations through the browser.



13.2.3 Generate system report

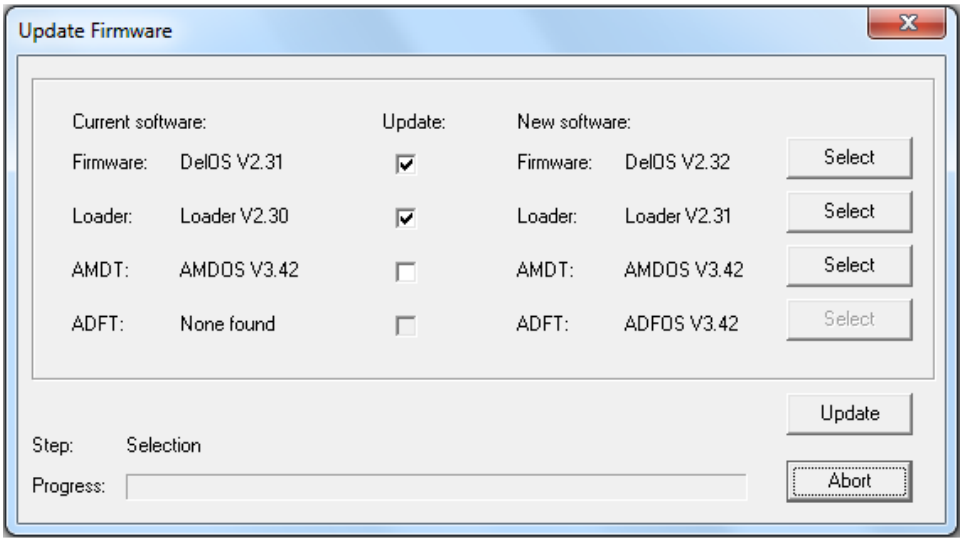
This function generates a systems report of the device and stores them for service purposes in a text file. Please perform this function before each hotline contact and have the file ready.





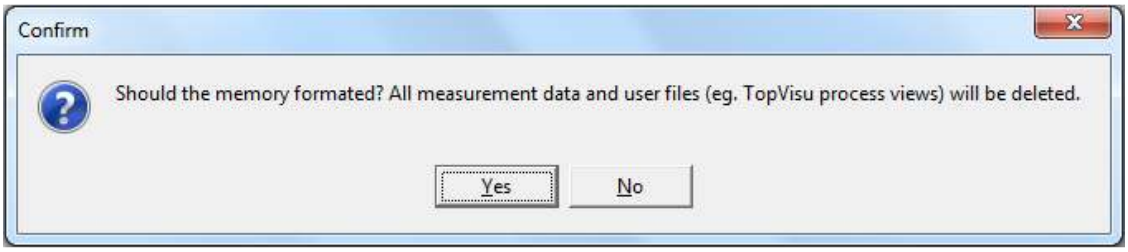
13.2.4 Update firmware

The device firmware is called DelOS. The firmware version is always tested together with the corresponding ProfiSignal version. The latest firmware is installed in the directory of ProfiSignal in the folder “Firmware”. When you receive an update of the ProfiSignal software you many carry out a firmware update. The following screen automatically indicates which parts should be updated.



13.2.5 Formats memory

With the command all data of the memory will be deleted. However the storage groups and related channels will not be deleted.

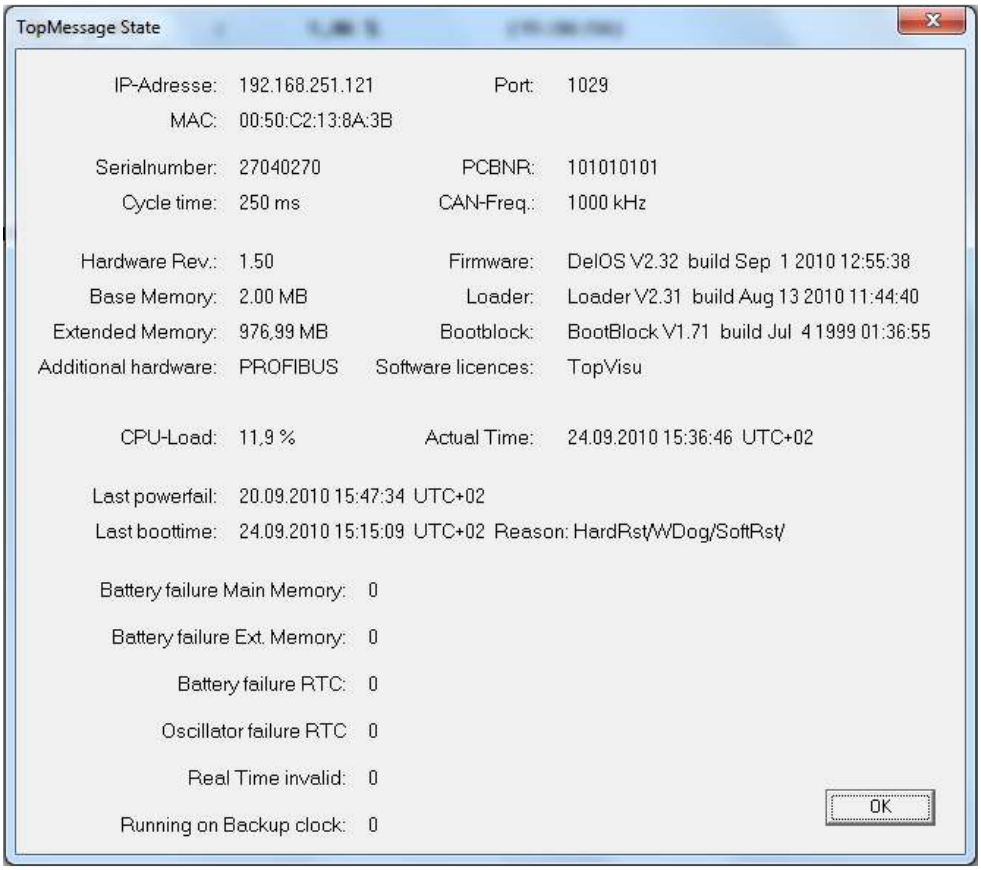


13.2.6 Reboot device

With this command the device will carry out a reboot. The report can be made also through the Rest bottom on the front panel of the Message device.

13.3 State

In the service menu “State” the general device information is indicated.

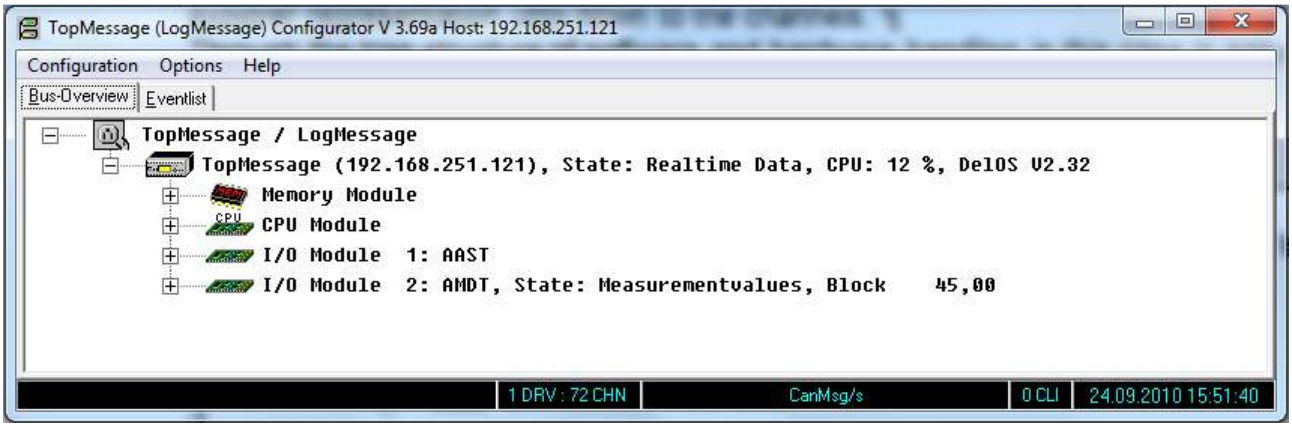


14 Channel configuration

The basic configuration of your Message devices is finally the channel configuration. Only with these configurations it is possible to process the different signal and sensor types, no matter if current, voltage or temperature sensor is required.

14.1 Bus Overview

If the connection between computer and the Message devices is established, you will have an explorer representation until down to the channels. Through the tree structure the navigation between the different levels is easy.



Interface level:
This uppermost level indicates through which interfaces (drivers) the Message devices are connected with the computer.

Device level:
Message devices and Lab devices, the IP addresses of which had been selected.

IO/ module level:
I/O modules with the hardware channels of the Message devices.

Channel level:
Channels of the individual modules.

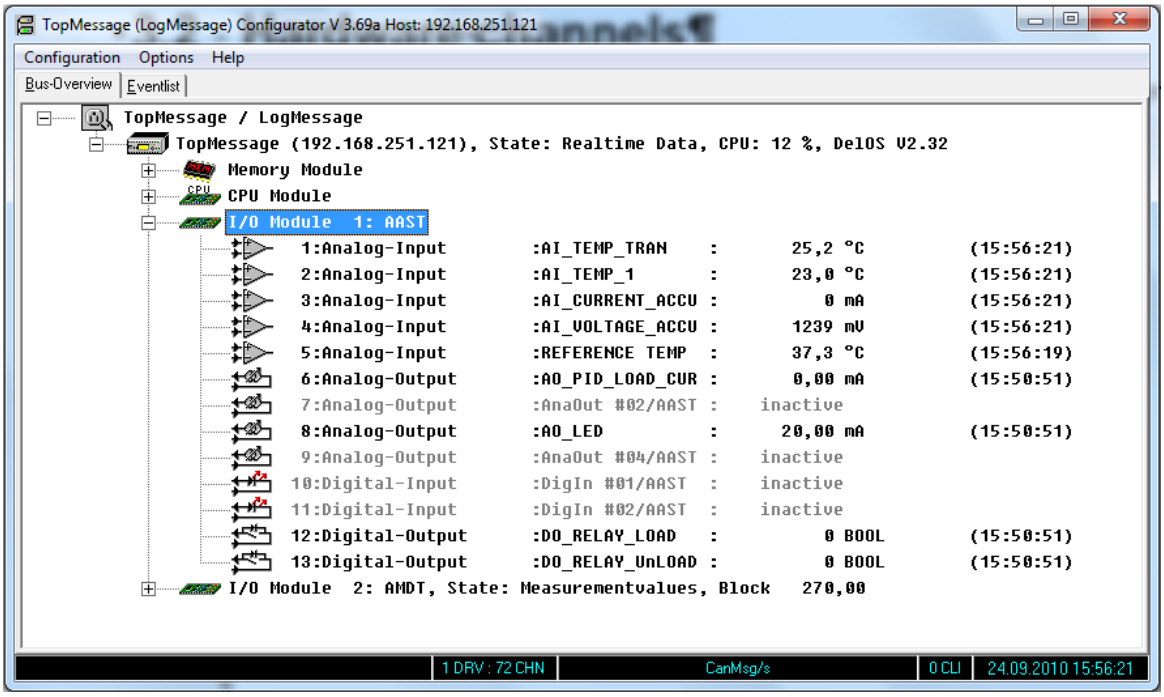
14.2 Hardware channels

Hardware channels acquire the signals on the hardware modules. The following different I/O channels on module level are available:

- Analog input
- Analog output
- Status input
- Digital output
- Frequency / Counter input
- Gate time

14.3 Channel level

In the **Explorer** view you can now open the individual modules just down to the channel level. Open and close. This occurs as known from Windows by clicking on the "+" or "-" symbol.



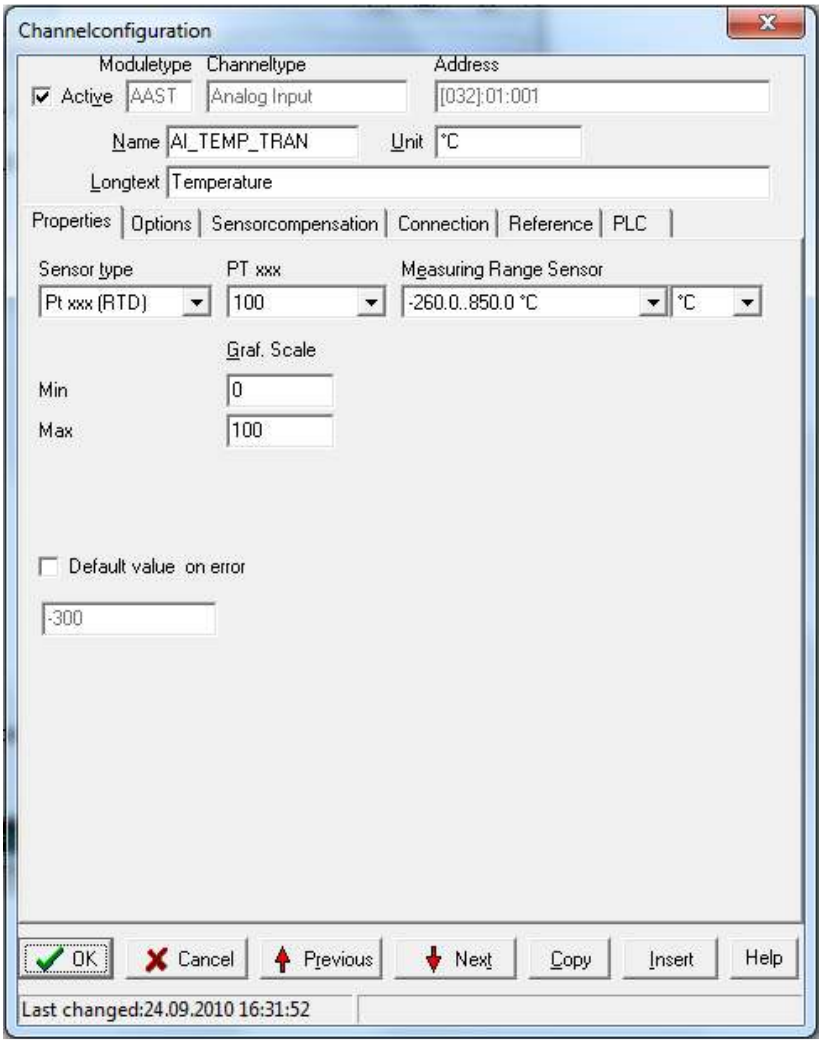
By double clicking on the individual channels you will reach the channel configuration.

It signifies from the left to the right

Channel number:	Hardware or software channel number.
Channel type:	Channel type, e. g. "analog input"
Channel name:	Name of the channel, max.16 characters
Measured data:	Scaled (actual) measured data value
Units:	Engineering units, max. 6 characters
Time stamp:	Time stamp of last measured data value

14.3.1 Open the configuration dialogues

By double click on the requested channel the dialogue **channel configuration** opens.



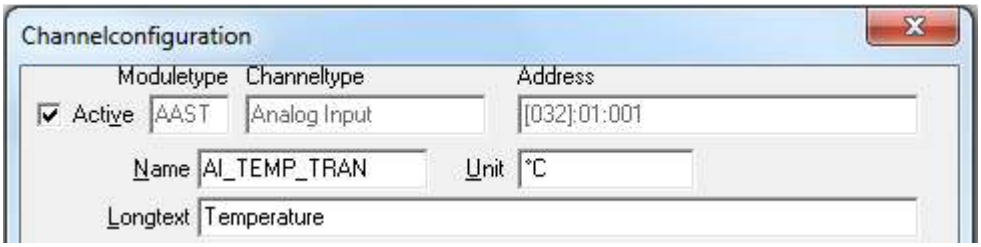
Introduction

Each channel can be configured individually. If it is not required, it can be switched off (delete tick in **active**). Once a channel has been configured, the configuration data are transmitted to the corresponding Message device. The new configuration is immediately effective. The configuration is stored in the Message device in an EEProm and is thus cannot get lost. New configuration data overwrite old ones. Switching off or resetting the Message devices does not cause the loss of the configuration.

Upon start of the Top/LogMessage Configurator the configuration will automatically be read out from the Message device. This ensures that the Message device is operated with the correct device configuration.

14.3.2 Common fields, for all channel types

Channel description



Switch: Active
This switch set the channel to active or passive mode.

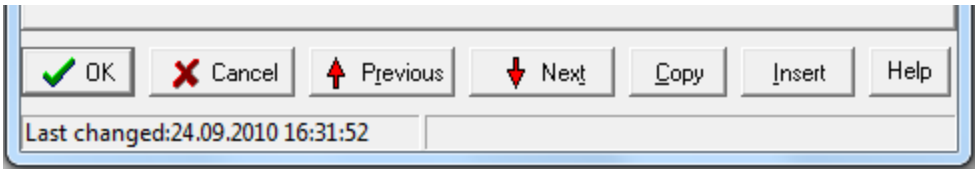
Fields: Module type, Channel type, Address
Example of address field:

[032]:01:001
:032 Channel ID
:01 I/O module number
:001 channel number

Field: Name
Input of an individual channel name, max. 16 characters max. Serves to identify the channel.
Also appears on the LC display of the Message device.

Field: Unit
Input of an individual physical unit (bar, m/min, °C).
Also appears on the LC display of the Message device.

Fields at the lower part:

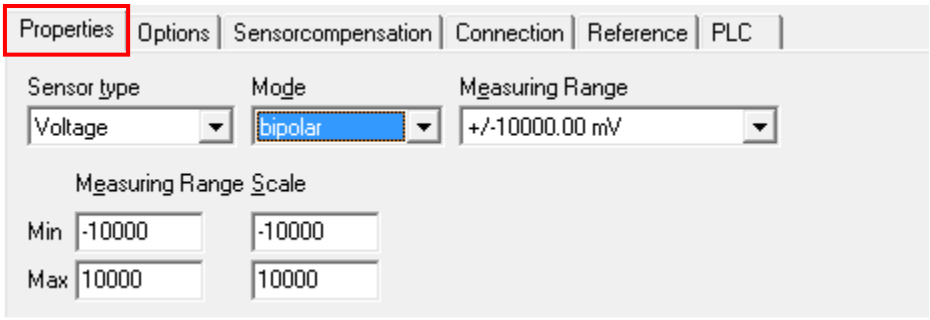


OK	Confirmation and saving of changes
Previous	One channel downward
Next	One channel upward
Copy	Put the contents of a channel into an buffer memory
Insert	Insert the contents of a channel from the buffer memory to this channel
Help	Access to device documentation and technical manuals

14.4 Configure analog inputs

By double click on the required channel in the explorer the dialog "channel configuration" opens.

14.4.1 Register “Properties”



Field: Sensor type
Select the sensor (or sensor signal) which you wish to connect to this channel. The selection possibilities are restricted by the selected I/O module type.

Field: Mode
Select "unipolar" signal range (only positve values) or "bipolar" signal range (positive/negative values).

Field: Measuring range
Serves to select a required (physical) measuring range. The list field supplies the measuring ranges available.

Field: Measuring range, Min/Max and Scale Min/max'
The two input fields "measuring range" (Min/Max) and "scale" (Min/Max) correspond with each other. The scaling refers to the range, as this is selected in the measuring range. Enter here two points of the linear sensor characteristic curve.

Examples

Measuring range	Measuring range, min./max.	Scale, min./max.
± 10 000 mV	± 10 000 mV	± 20 bar
0..10 000 mV	0..5 000 mV	0..30 bar
0..10 000 mV	0..10 000 mV	0..20 bar
± 625 mV	±100..500 mV	20..100 m/min.
0..20 mA	0..20 mA	5..30 bar
4..20 mA	4..20 mA	0..150 bar

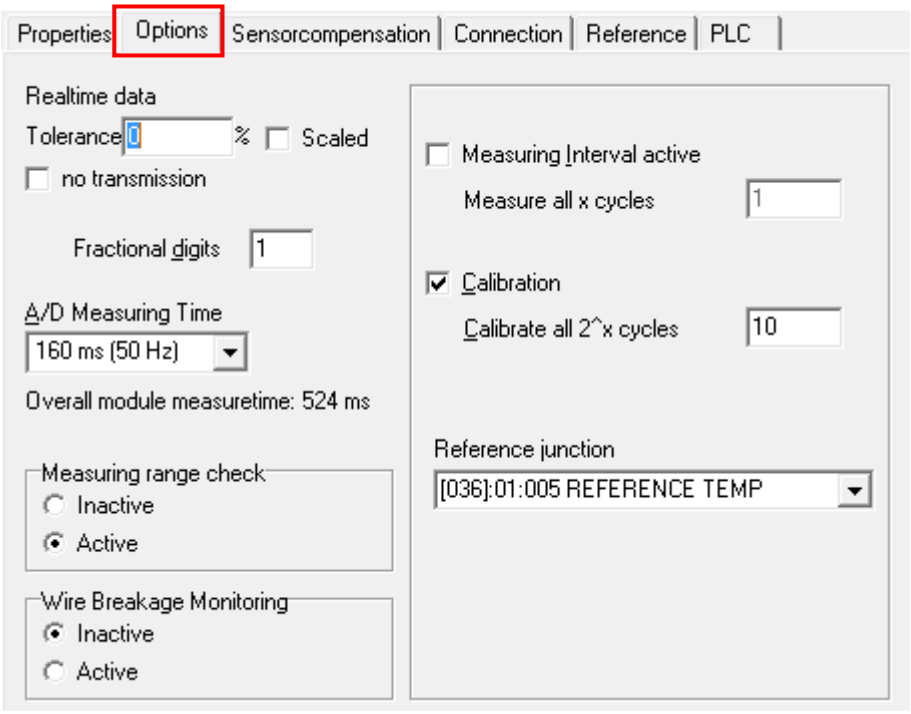
For temperature sensors scaling is preset maximum possible range, which is generally determined by the sensor. Within these limits only a scaling which corresponds to the application can be set.

Example:

Measuring range	Scale, Min/Max
-200..850 ℃ (Pt100)	0..100 ℃
-270..1372 ℃ (NiCrNi)	0..300 ℃

Hint: The computers trend graphic use the scaling min/max for the scaling (range) of the Y-axis.

14.4.2 Register “Options”



Field: Tolerance, real-time data
This input is based on the adaptive storage concept of the Message devices.
A measured value is only stored with time and date stamp if it lies outside the tolerance of the previous value. The percentage value refers to the scale (see input scaling min/max).
Optionally, press the button “scaled” and enter the absolute value.

Field: Fractional digits
Enter the requested number of the fractional digits (from 0 to 9).

Field: A/D measuring time'
Is close to the conversion time of the analog-to-digital converter. It can be adjusted for each channel individually. The real measuring cycle time is calculated from the sum of the selected values of the individual active channels. This information is valid for I/O modules with sequential sampling thus for ADGT, ADIT, ADVT, AAST.

For thermocouples please select the greatest possible A/D measuring time.

Option: Measuring rang check
Enables a permanent check of the valid measuring range.

Option: Wire break monitoring
Enables a permanent wire break monitoring.
Hint: Active wire break monitoring slows measurements down. The wire break monitoring can be monitored via a limit channel to report alarm status information.

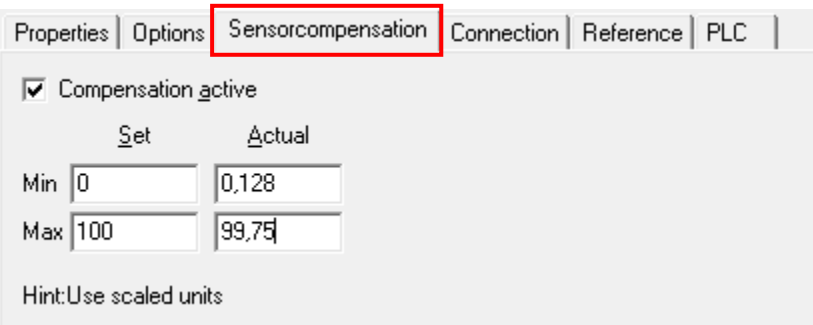
Option: Measuring interval active
Channels, where the measurement density is unproblematic, often temperature channels, can be measured with a reduced measurement density. This has advantages for the capacity utilization and also saves memory space. Enter a factor in the field "measure all x cycles" in order to reduce measuring cycle.

Option: Calibration
If you attach great importance to high measuring accuracy, the auto-calibration should be switched on. Thus, this channel calibrates automatically, e. g. upon changing of the ambient temperature. Typical setting is 10 for 2^10 = 1024 cycles.

Field: Reference junction (only for sensor type "thermocouple")
The internal temperature reference can be replaced by an external temperature reference measuring point. The external reference measuring point must be equipped with a Pt100. The temperature reference junction is preconfigured for the modules ADGT, ADIT, AAST and ADVT. Without an active temperature reference junction the thermocouple measurement is not possible.

Remark:
One analog input channel serves as cold reference junction channel for thermocouples (ADGT, ADIT, ADVT, AAST). This channel is configured ex works. This configuration must not be altered. The function of the thermocouples would then no longer be ensured.

14.4.3 Register “Sensor compensation”

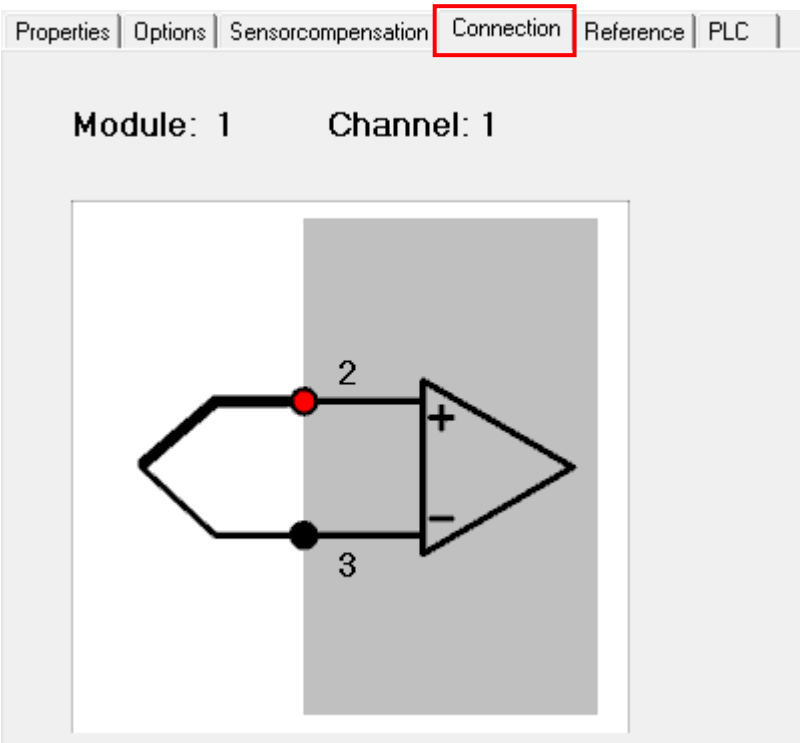


Option: Sensor compensation
The sensor compensation permits the compensation of sensor errors. For this purpose the sensor must be calibrated, i. e. the error must be known on two points of the identification line (e.g. a Pt100 at 0°and 100 ℃). The input of value s occurs in scaled units – also for temperature sensors.

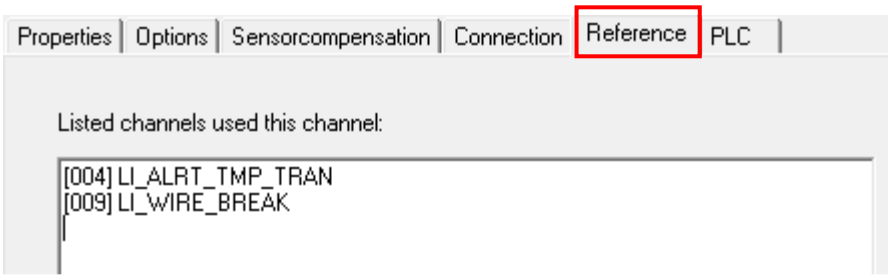
Warning
If you do not wish to use the sensor compensation, you have to remove the checkmark „Compensation active“ by all means. The sensor compensation alters the measurement values!

14.4.4 Register “Connection”

This register shows the clamps and the connection for the input signal. The drawing is depending on the selected sensor type. (Example: Thermocouple)

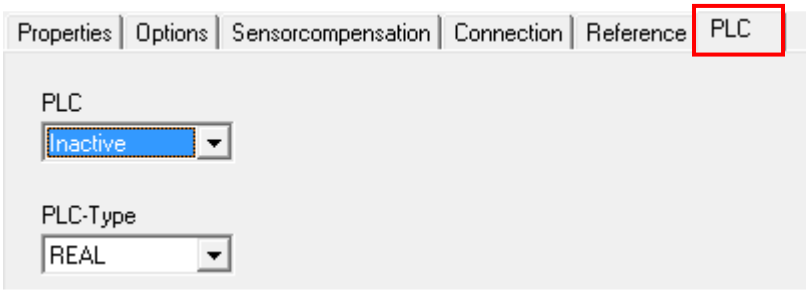


14.4.5 Register “Reference”



This register provides a list of all channels which use this channel as source channel.

14.4.6 Register “PLC”

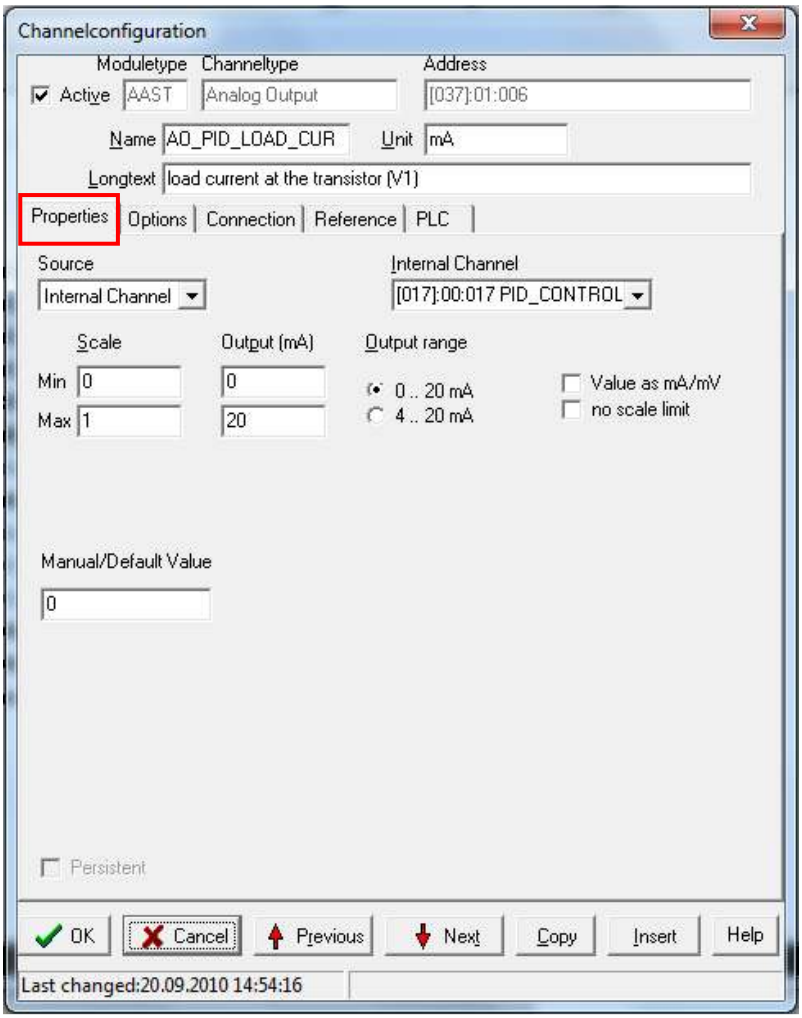


This register has no function any more.

14.5 Configuration of analog outputs

The analog outputs of AAST and ADIT module can be used to control other external devices. The analog outputs provide 0..20 mA or 4..20 mA signals. The analog output can be controlled through the ProfiSignal software or through other internal channels

14.5.1 Register “Properties”



Field: Source
Selects one of several signal sources.

- Internal channel Output is controlled by device-internal quantity
- PC Output is controlled by PC (computer, DCS)
- Manual Output is controlled by hand (this dialog)
- PLC Output is controlled by device-internal PLC process

In the example the output is controlled by device-internal PID controller channel.

Field: Internal channel
See above, field "Source"

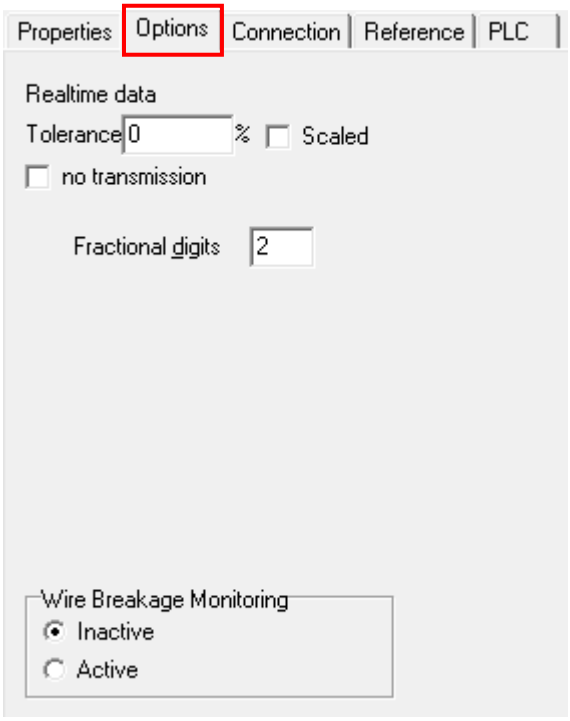
Field: Manual/Default value
Manual output value (for source 'Manual') or start value (after power-up of device)

Fields: Scale / Unit / Output
This setting defines the assignment of source and output. The show example assigns 0 to 1 of the PID controller to an output of 0..20 mA.

Option: Output range
You can select between 0..20 mA and 4..20 mA

Option: no scale limit
This configuration allows to input lager points via the ProfiSignal application then the channel actually can process.

14.5.2 Register “Options”



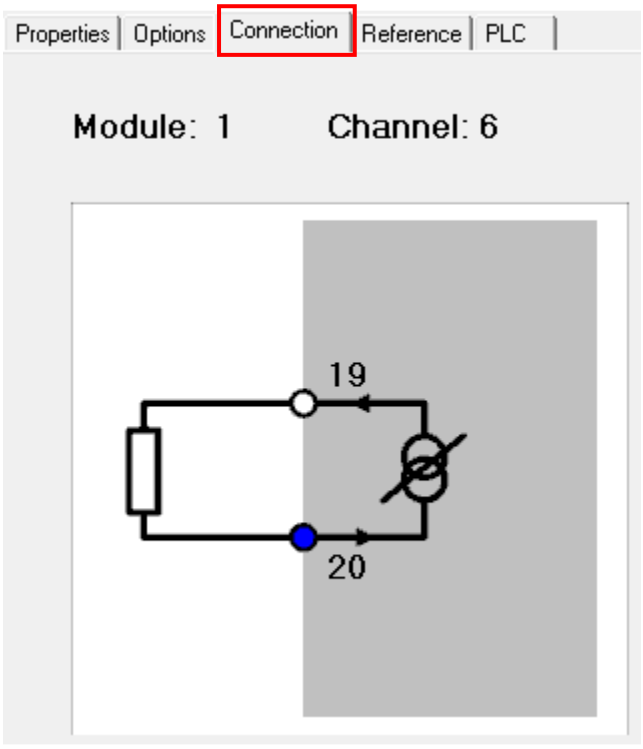
Field: Tolerance realtime data
This input is based on the adaptive storage concept of the Message devices. A measured value will only be stored with time and date stamp if this lies outside the tolerance of the previous value. The greater the tolerance the more memory space is saved. The percentage value refers to the scaling.

Field: Fractional digits
Enter the requested number of the fractional digits (0 to 9).
Option: Wire break monitoring
Enables a permanent wire break monitoring.

Hint: Active wire break monitoring slows measurements down. The wire break monitoring can be monitored via a limit channel to report alarm status information.

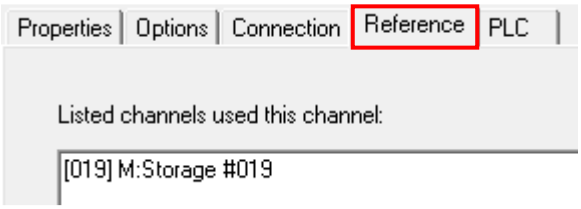
14.5.3 Register “Connection”

This register shows the clamps and the connection for the output signal.



14.5.4 Register “Reference”

This register provides a list of all channels which use this channel as source channel.

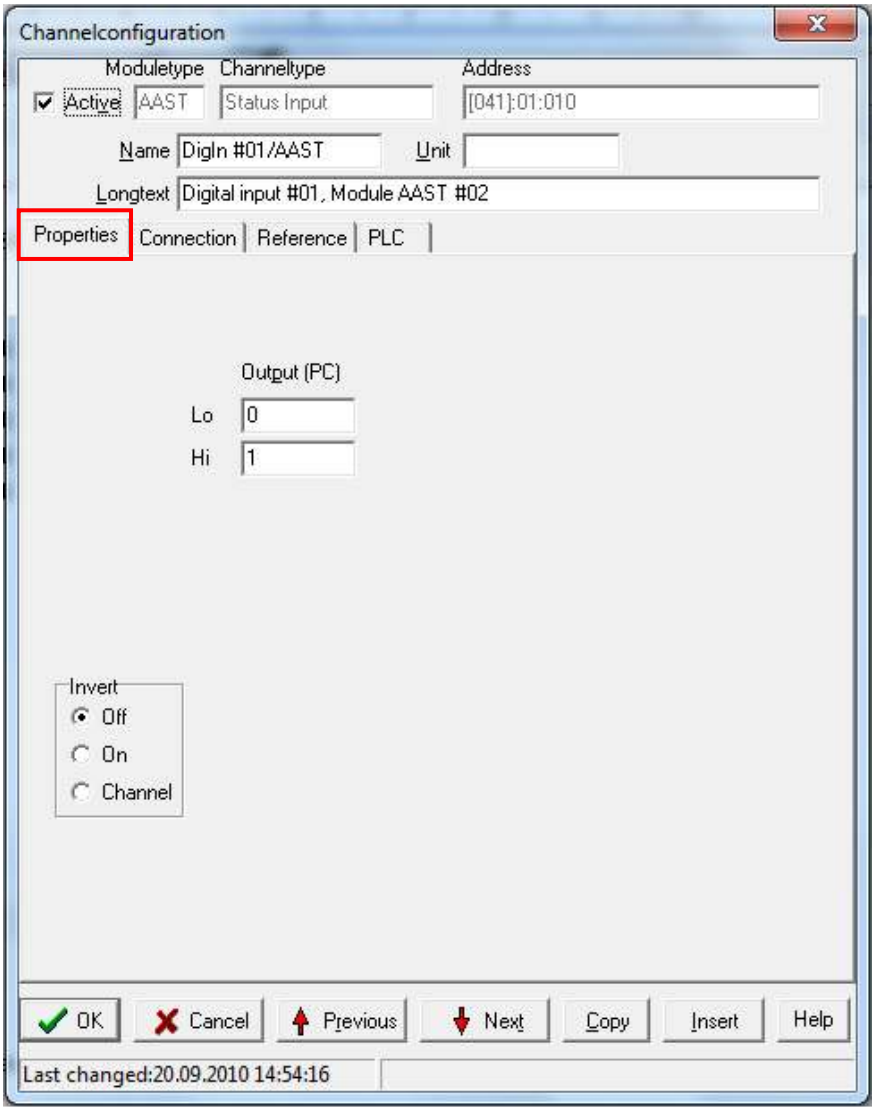


14.5.5 Register “PLC”

This register has no function any more.

14.6 Configuration of digital inputs

14.6.1 Register “Properties”



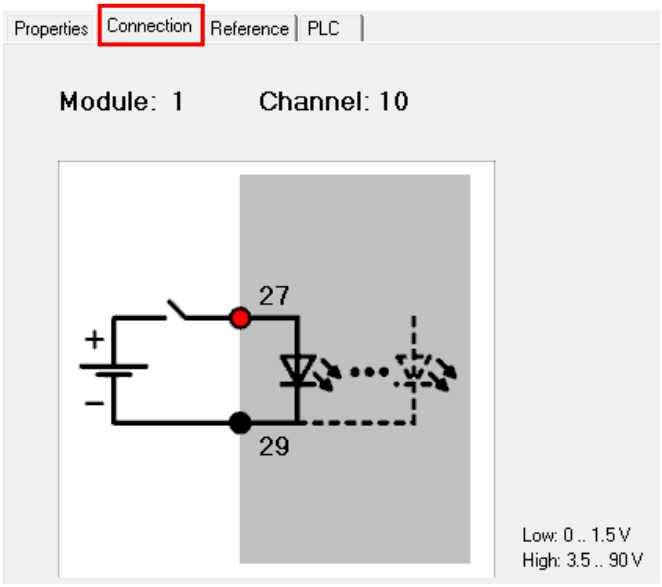
Field: Output (PC)
Low level and high level are assigned to numerical values 0 and 1.
Other values are possible. e.g. for better display representation (evaluation software).

Option: Inverting

Off	No inverting
On	Logic level low and high are changed
Channel	The inverting is controlled through an internal channel.

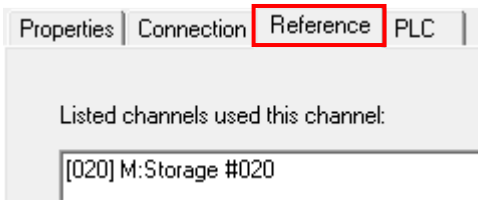
14.6.2 Register “Connection”

This register shows the clamps and the connection for the input signal.



14.6.3 Register “Reference”

This register provides a list of all channels which use this channel as source channel.

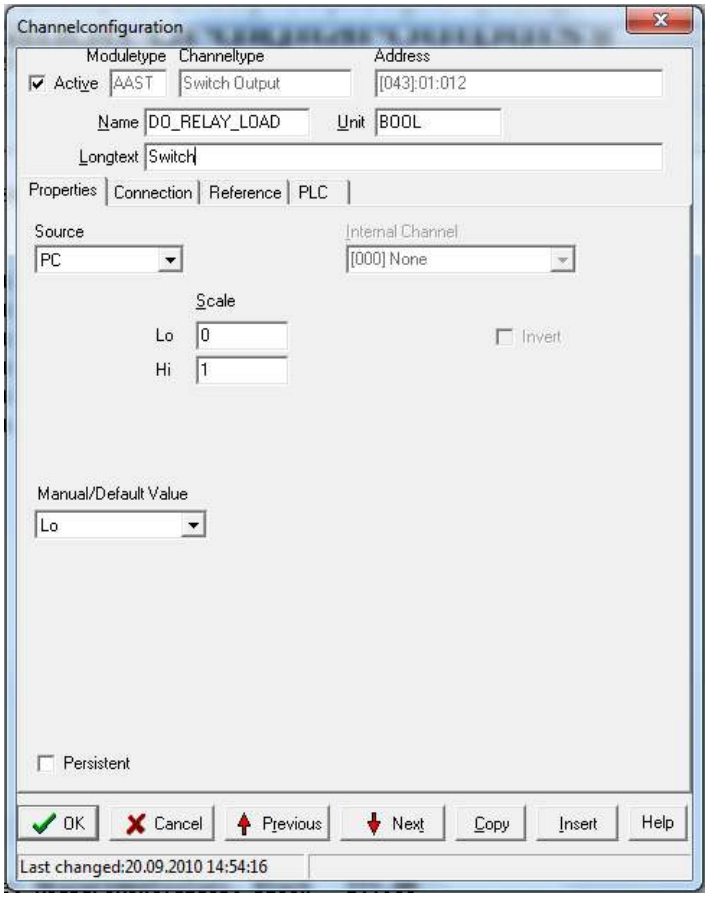


14.6.4 Register “PLC”

This register has no function any more.

14.7 Configuration of digital outputs

14.7.1 Register “Properties”



Field: Source
Selects one of several signal sources.

- Internal channel Output is controlled by device-internal channel
- PLC Output is controlled by device-internal PLC process (set point channel)
- PC Output is controlled by PC / ProfiSignal application
- Manual Output is controlled by hand (this dialog)

Field: Internal channel
See above, field "Source"

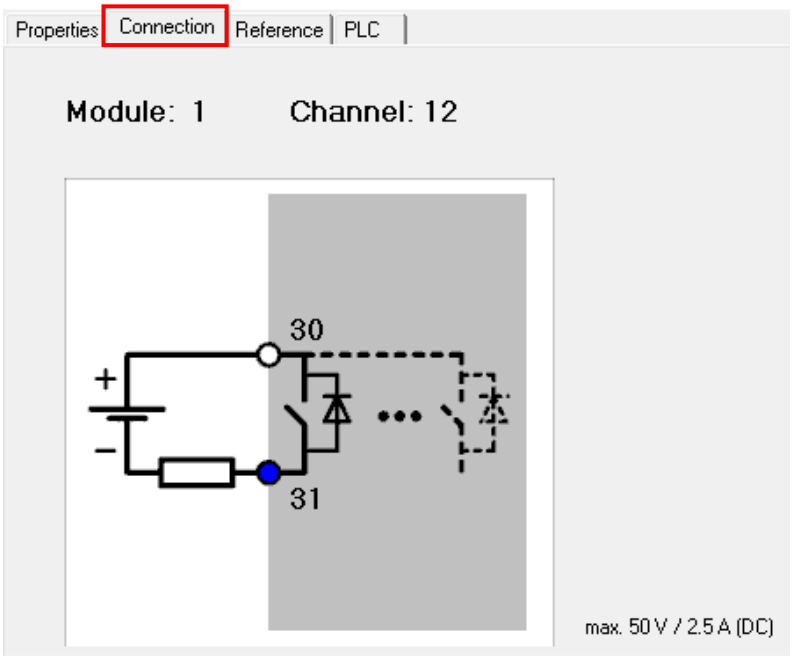
Field: Manual/Default value
Manual output value (for source 'Manual') or start value (after power-up of device)

Field: Scale
Defines the assignment of logical level low and high.

Option: Inverting
Logic level low and high level are changed.

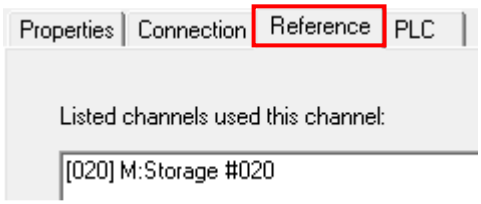
14.7.2 Register “Connection”

This register shows the clamps and the connection for the output signal.



14.7.3 Register “Reference”

This register provides a list of all channels which use this channel as source channel.



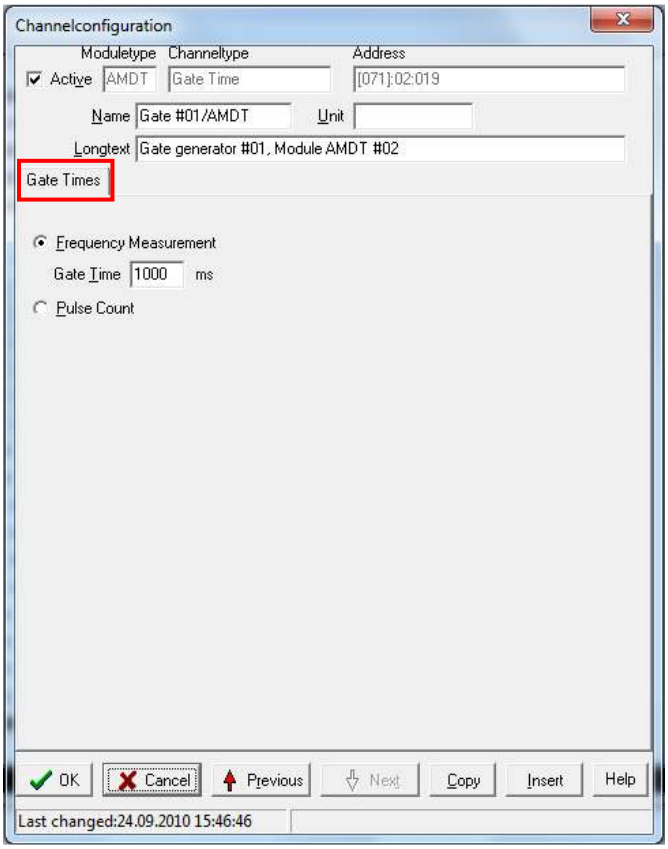
14.7.4 Register “PLC”

This register has no function any more.

14.8 Config. of frequency inputs /counters

14.8.1 Setup mode and gate time

The additional channel 'Gate time' must be configured for this purpose, first of all.
Hint: The setting is valid for all frequency/counter channels the I/O module.



Mode: Frequency measurement
During the evaluation the number of the pulses per gate time is registered. The gate time can be set in wide limits. You must take care that the pulse number which is counted during the gate time will not exceed the value of 65.535 pulses.

Mode: Pulse count
During the evaluation the current count of the pulses is registered.

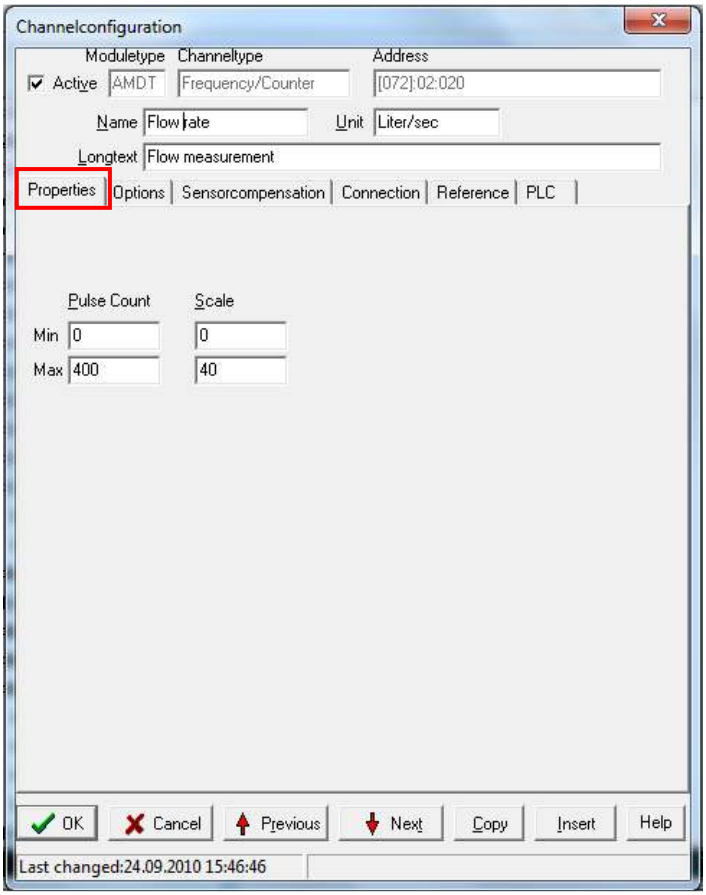
Example for frequency measurement:
Suppose you have a flow measurement with max. of 40 liter/s.
Per liter 10 pulses are generated.

Gate time	Pulses per gate time, max.	Scaled measured value, max.
1000 ms	400	40 liter/s
2000 ms	800	40 liter/s
3000 ms	1200	40 liter/s

Select higher gate time if higher resolution is desired.

14.8.2 Register “Properties”

After having defined the 'gate time' you can now configure the actual channel 'frequency'.



Fields: Pulse count and Scale

Mode 'Frequency measurement'

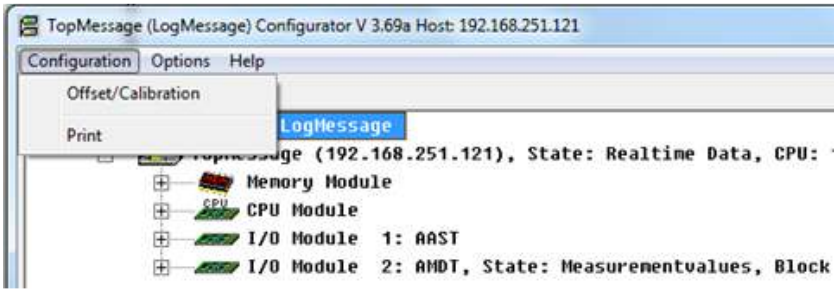
Enter assignment between 'pulses per gate time' and 'scaled measured data'.
The shown example assigned 400 pulses/s to a flow of 40 l/s.

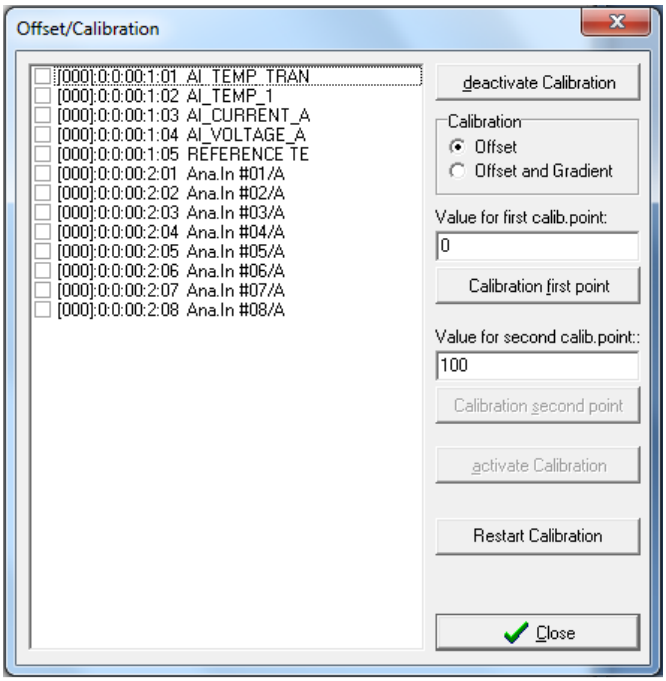
Mode 'Pulse count'

Enter assignment between 'pulse count' and 'scaled measured data'.

15 Calibration

The sensor compensation for several channels can be carried out automatically. You start the automatic sensor compensation via the main menu „configuration / offset/calibration“.





Calibration:
According to the type of calibration you require one (only offset) or two (offset and gradient) calibration points.

Activate calibration points:
The compensation points obtained during calibration will be taken over into the channel configuration of the selected channels and the sensor compensation will be activated.

Deactivate calibration:
The sensor compensation of the selected channels will be activated if necessary.

Note: Only channels without already activated sensor compensation can be calibrated.

16 Data memory

16.1 Introduction

In the basic version the Message devices include a data memory of appr. 0,5 MB. Optionally it can be extended to 1 GB for 128 Mio. records. All measurement values are provided with time and date stamp. Thus, data can be related to real time. The resolution of the time stamp is in millisec.

Adaptive storage:
Through the special design of the Message devices' data memories the data storage can be usefully adapted to your application. The adaptive storage permits a very powerful data compression so that the data according to the configuration of the data memory can be stored for a very long time. Adaptive means that a measurement value of a channel is only stored if its value deviates from its predecessor. If the measurement values are constant through a long period of time, only one measurement value is stored for this period.

Online/Offline data transmission to PC:
Through the battery buffered data memory the Message devices are at the same time data loggers. The measurement data can simultaneously be transferred to PC online and be stored in the Message devices as well.

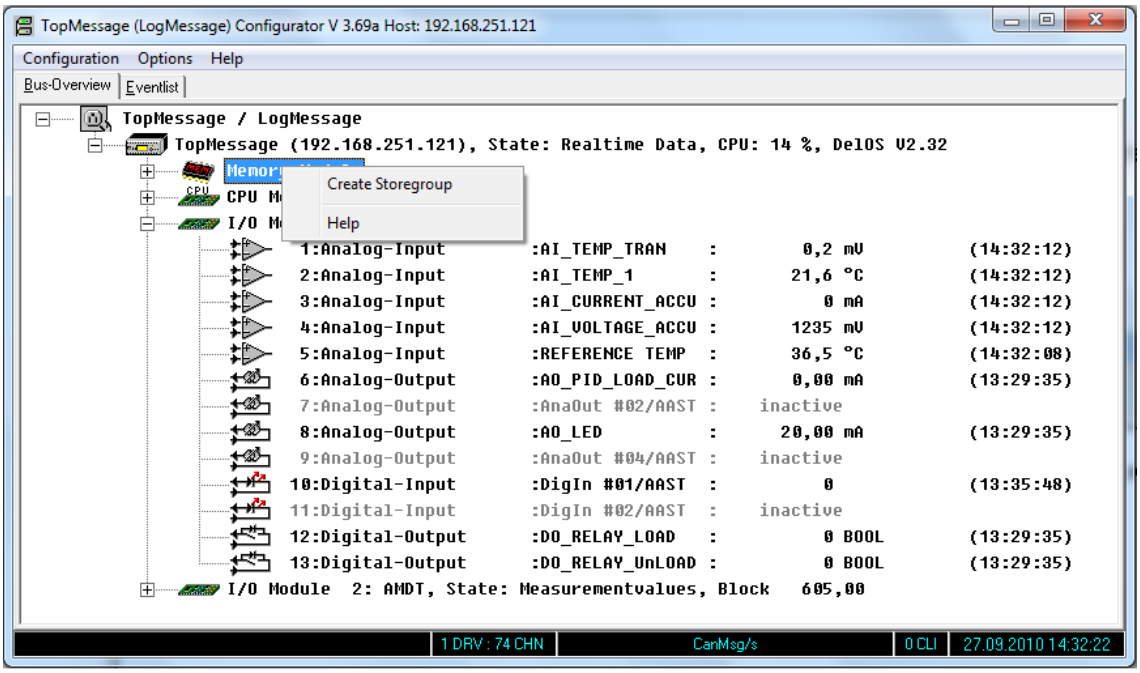
Reliable measurement data acquisition:
Through the possibility to configure redundant data storage in PC and in the Message devices measurement data acquisition is reliable.

Readout data memory:
The Top/LogMessage Configurator permits to read out the data memories of the individual Message devices and transfer the data to PC. During the data transfer from the Message device to the PC the storage process is not affected and the system keeps logging.

16.2 Configure data memory

Mark in the Memory module of the Message device. Through right mouse click on the marked Memory module a selection dialog will open.

Select “Create Storegroup”



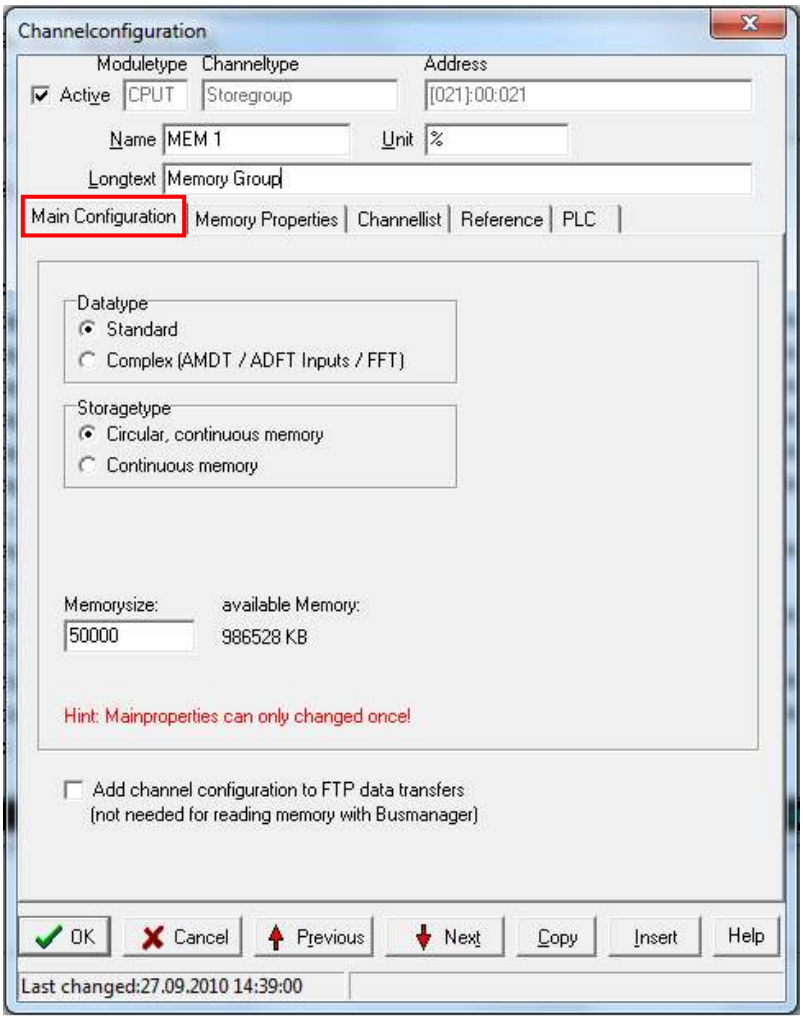
16.2.1Main configuration

Configure main configuration first in order to activate a memory group (partition).
The necessary parameters are:

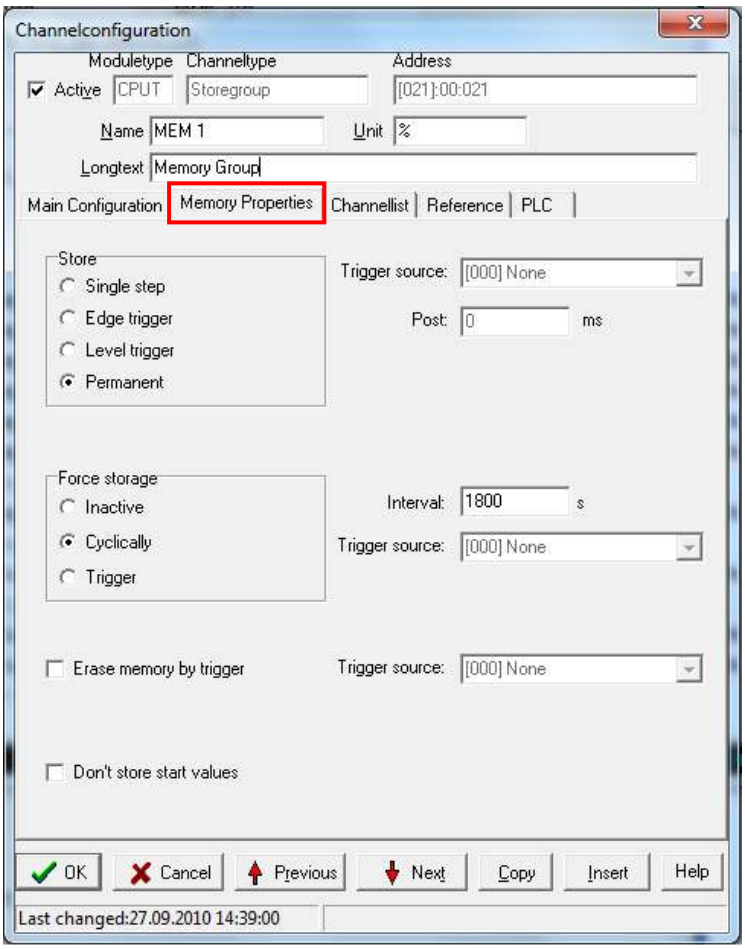
Data type: Standard normal analog, digital, calculated measurement values
Complex time signals, FFT of AMDT / ADFT module

Memory type: Circular memory:
The latest data is always available. The oldest data is erased from the memory.
Continuous memory:
All data is saved to the memory group until all storage capacity is used.
Then the data storage is stopped.

Memory size: The size of the storage group can be individually configured.
You can always see how much free storage capacity is available.



16.2.2 Memory properties



Store:

Mode: Permanent

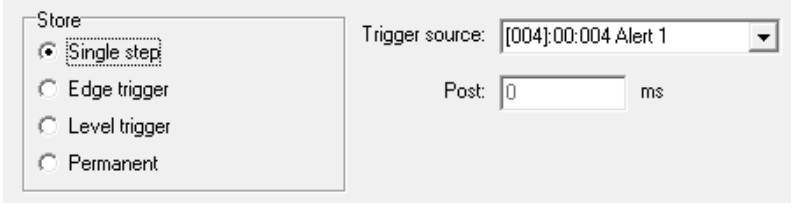
This is the default configuration. The modules permanent records all group related channels permanently.

Field: Trigger source

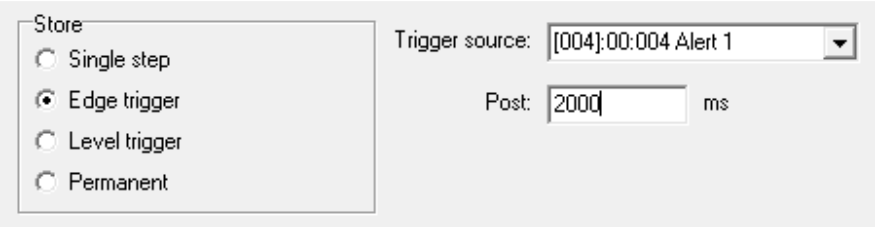
The trigger source channel allows to control the data storage depending on the status of the source channel.

Mode: single step

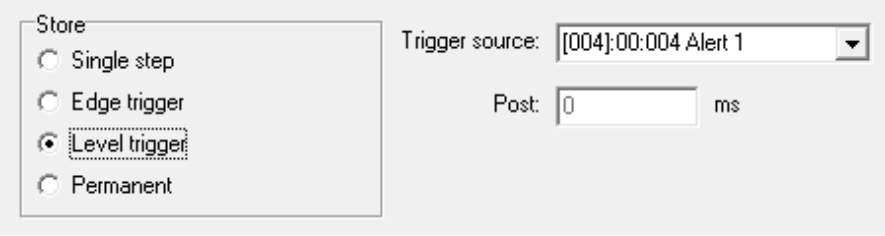
Upon start of the event exactly one value per channel is stored. These values are being synchronized to the moment of the event, so that all values have the same time stamp.



Mode: edge trigger
The data recording is started at the event of a rising edge and will run until the post time is elapsed. In this example an event post recording time of 2 seconds is configured.



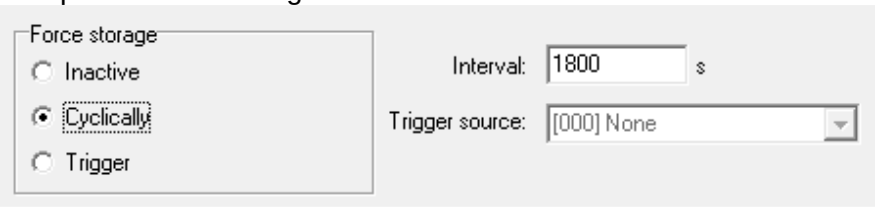
Mode: level trigger
The trigger source channel is activating the data storage. The storage group will record all data when the trigger signal is high.



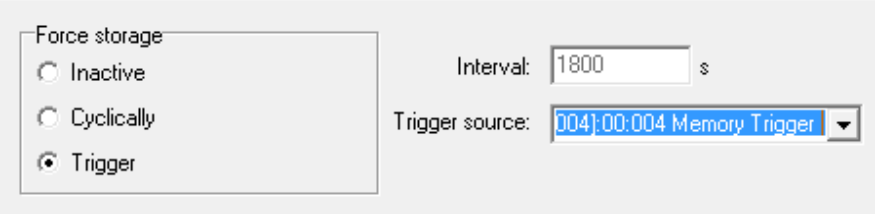
Force storage:

Mode Inactive:
This is the default configuration.

Mode cyclical:
When the cyclical storage is activated you can chose any storage interval. In this example a forced storage for all channels of the storage group is performed every 1800 sec. The time stamp will not be changed in this mode.



Mode: Trigger
The forced storage can also be activated from a trigger channels.



In this mode the raising edge is the trigger event. The settings in the storage tolerance are not considered. All channels and all values are recorded. The time stamp of the measurement values will not be changed also.

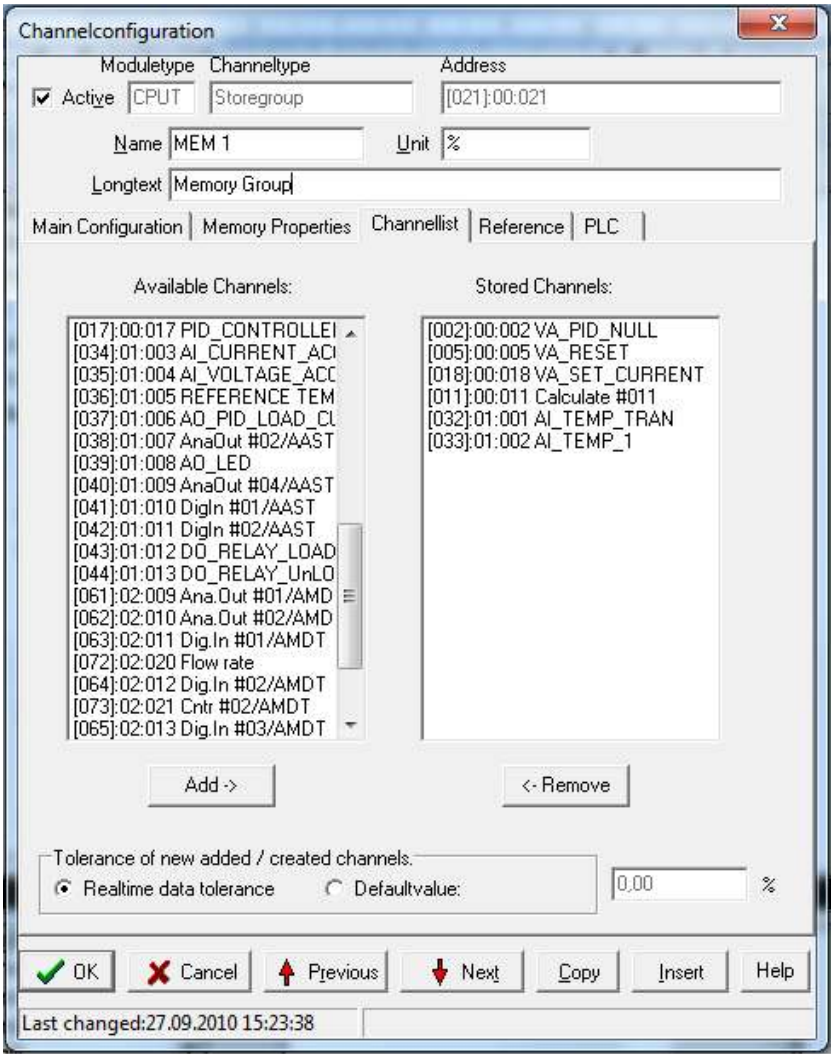
Remark:
This cycle time for forced storage events must be smaller than the cycle time (scheduler) for reading out the data memory. If the readout cycle (scheduler) is 24 h, the value in sec. must be smaller than 24 h (e. g. 12 h). If stored data are transferred to PC, for each channel at least one value must be available. If not, this channel is not visible on the trend graphics.
In the example a value of 1800 sec. has been entered. This corresponds to half an hour.

Delete memory contents triggered
If this function is activated the contents of memory can be deleted event dependent (positive edge)

Don’t store start values
If this field is active, you don’t get start values, if the system is booting (e.g. firmware update)

16.2.3 Channel list

In the tab sheet channels you can add all channels which should be stored in the memory group.



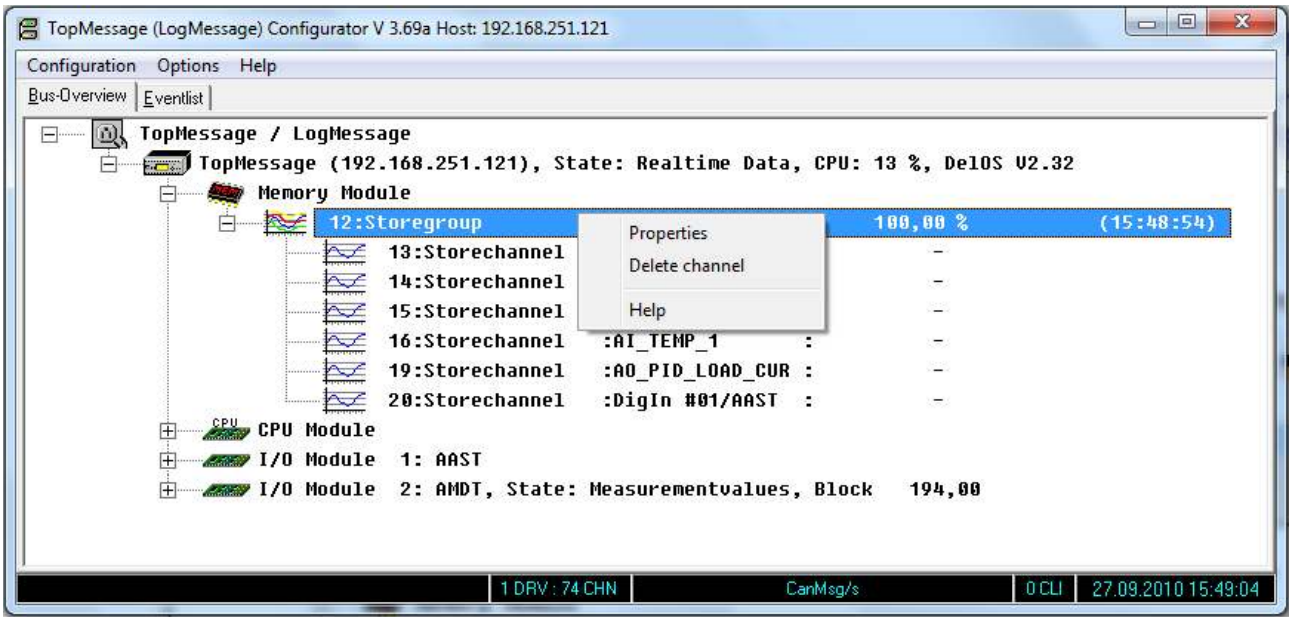
Mark the respective channel you want to store and click on the field „add“ (or simply drag it into the right field by means of the mouse). The channels will then appear on the right side („stored channels“). Analogous to this channels to be stored are erased.

Real time data tolerance
With the “tolerance of added channels” you can activate a tolerance for all channels through the „default value“ or you activate the „real time data tolerance“ for the memory channels. If you use real time data tolerance, the tolerance can be defined for each channel individually. Only if the measurement value is changing by the tolerance value, a new measurement value will be stored.

Default value
The percentage value refers to the scaled value. If you choose default value in percent the same storage tolerance to all channels of the storage group is applied.

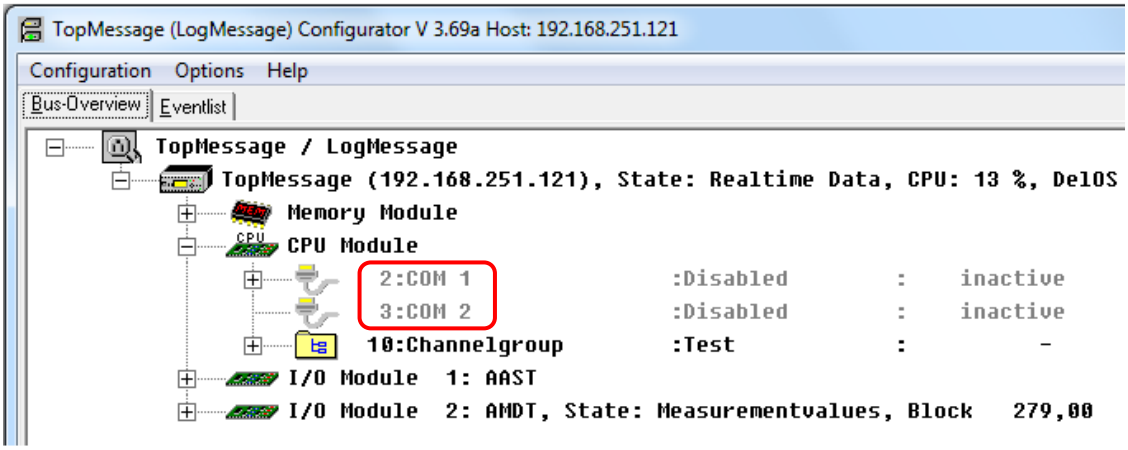
16.3 Delete data memory configuration

By clicking on the entry „delete channel“ in the context menu of the memory group the complete memory configuration will be deleted. This is useful, if you do no longer want to use the storage group of the Message device. You can also delete single channels from the storage group.

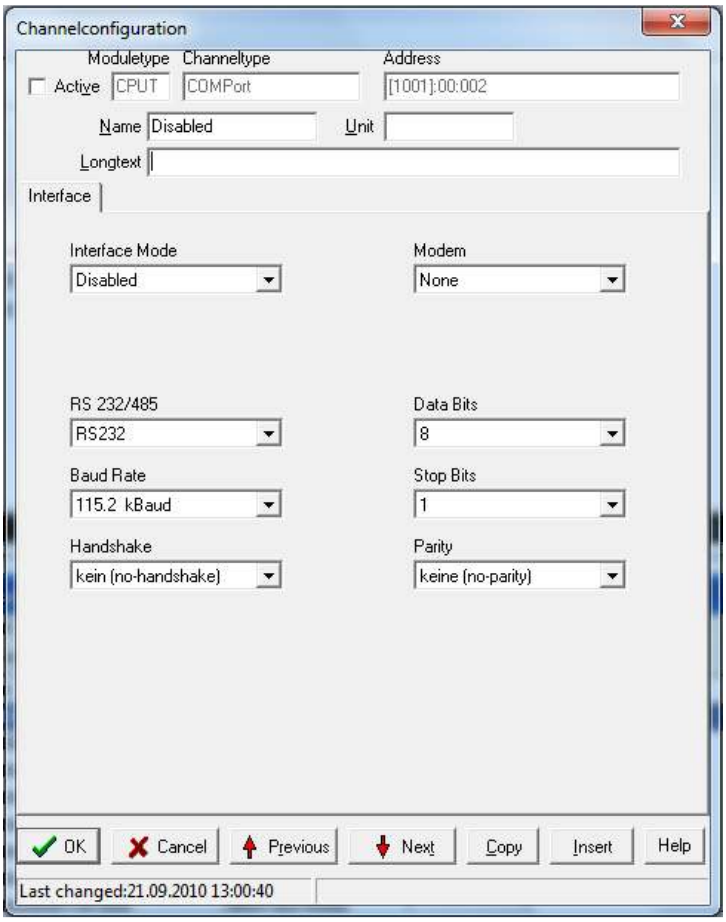


17 COM - ports

The serial interfaces of Message devices (Comports) are within the CPU module and can be configured like a channel there.



It is possible to select 23 different driver types directly besides interface parameters like Baudrate and Handshake, etc.

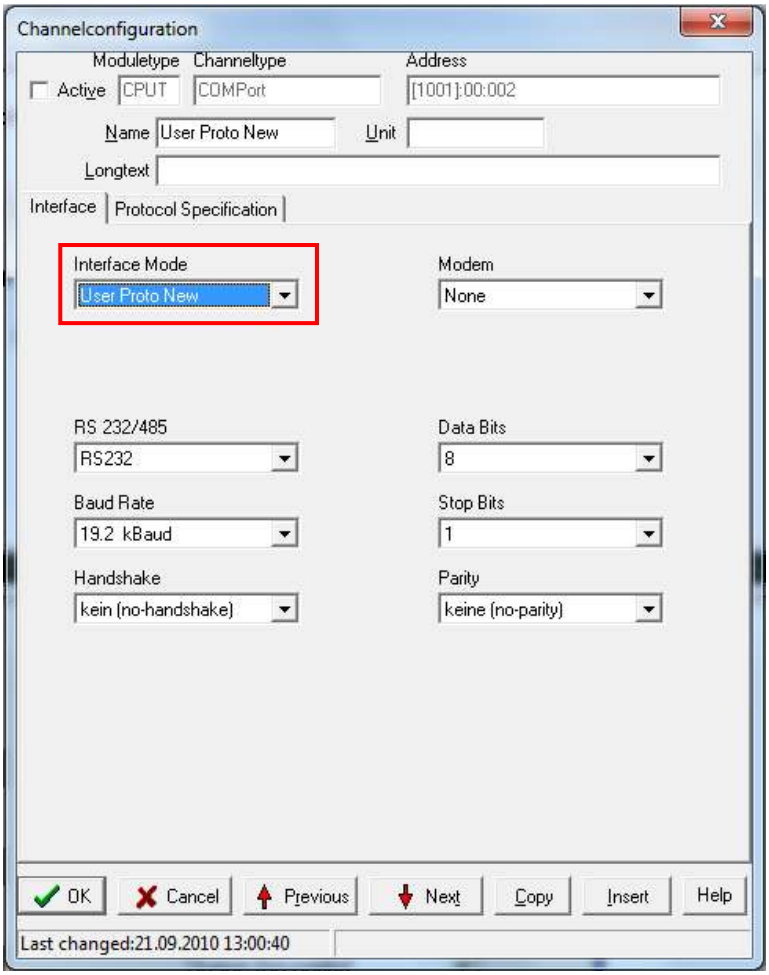


17.1.1 List of available COM port drivers

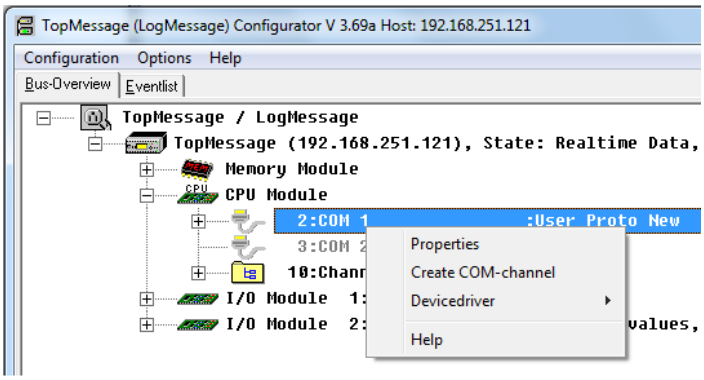
The following divers are implemented on the COM port. The Profibus-DP Slave driver is an option and has to be ordered separately.

17.2 Create COM channel

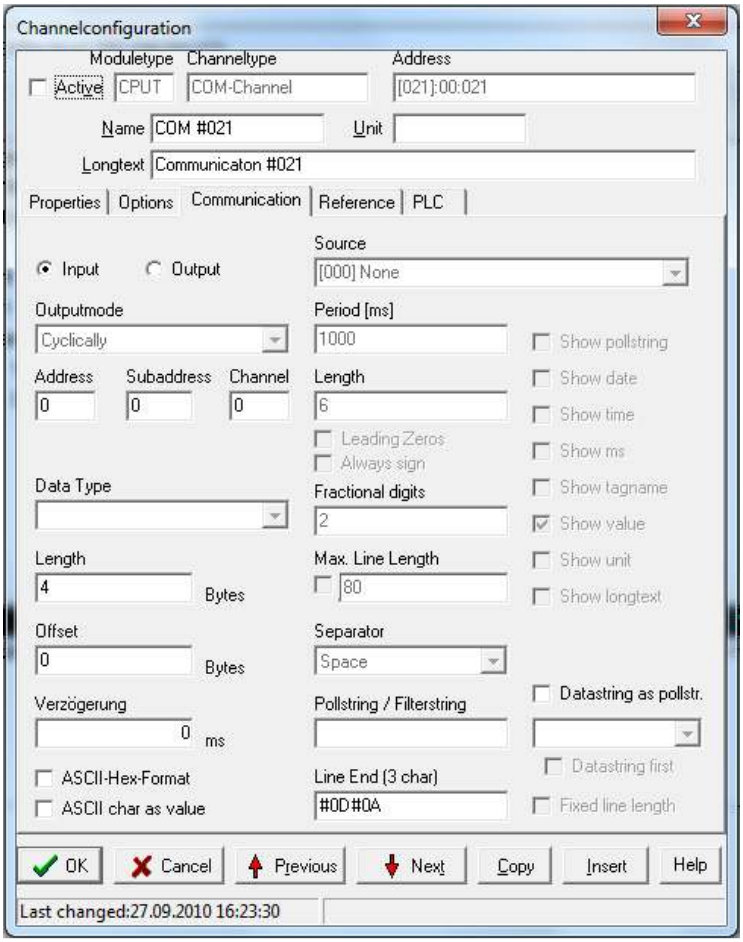
In the first step you have to select the main driver from the interface mode. In this example the driver “User Proto New” is selected.



In the next step the COM channel is created.



On COM Channel level you can now see the configuration parameters for the driver “User Proto New”. The configuration screen is depending on the driver you chose in the first place.



18 Virtual channels

Virtual channels are extended functions of the Message devices. The term virtual channels refers to a general description of many different functions which can be configured inside the Message devices. This includes functions of:

- Math
- Logic
- Alarm
- Events
- Switching
- Control

The output of the virtual channels is calculated directly online on the device CPU. It is possible to combine many virtual channels with each other to cover large and complex logic and control functions. The Message devices can cover up to 1000 channels consisting of I/O channels and virtual channels. Every virtual channel can be saved to the internal memory of the device.

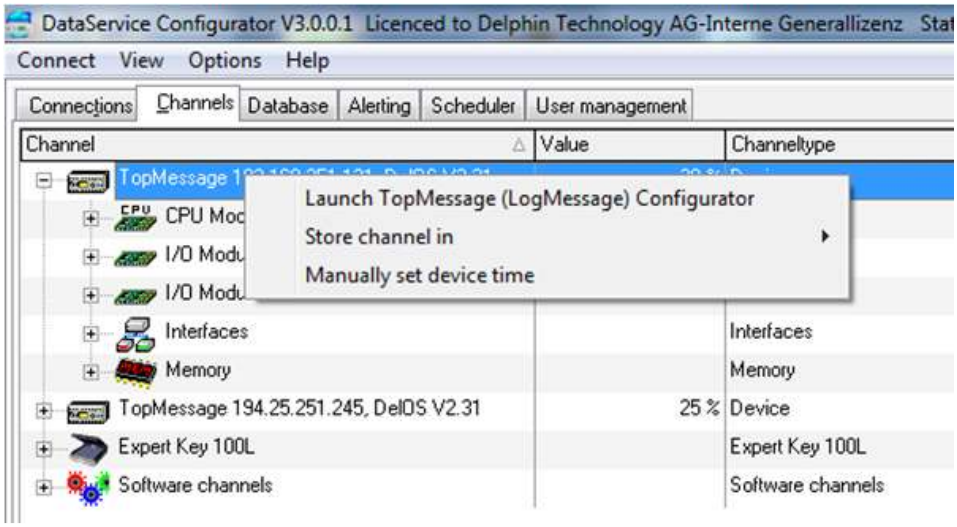
18.1 Available virtual channels

1	**Channel Group**	To organize and structure channels
2	**Average**	Average value can be calculated from any source channel. The available functions are: • time related average value, • moving average value • time related and moving average value.
3	**Calculation**	With the calculation channels calculations with the channels are made online and independently in the Message devices, e. g. temperature differences, ratios, efficiencies etc. can be realized. The results of the calculation channels can be treated like measurement channels and be used as these in the software programmes.
4	**Variable**	The Variable channel can store parameters which can be dynamically updated through the ProfiSignal Basic or Klicks applications or manually.
5	**Integrator**	A versatile configurable function for the integration / summing formation of analog signals and counting pulses. **Edge counter** The edge counter counts the edges of a source (status input). A reset source that resets the counter can be activated. Thus, each status input can be used as frequency input. **Integral** Module DIOT contains 16 Bit counter inputs. Thus, the capacity of these counter amounts to appr. 65 000 pulses. One of the functions “differentiator and integrator” serves to prevent that pulses get lost upon the overflow of the counter. The functions “integrator adaptive” and “integrator cyclical” calculate the integral. **Operating hours counter**

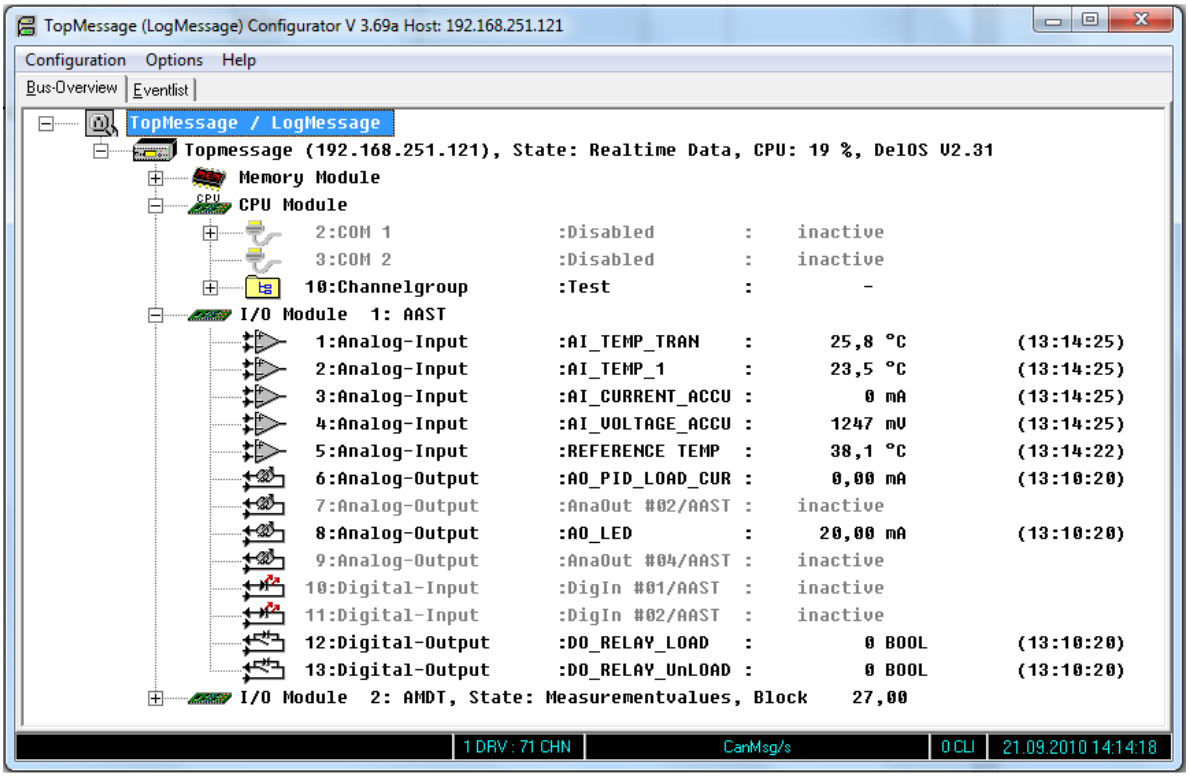
		Increases the counter permanent. **Adder**: Adds values of a source. **Stop watch**: Calculates the time between two signal edges
6	**Differentiator**	Is calculating the difference between two measurements (gradient). The time basis can be configured individual.
7	**Setpoint**	With this channel individual set point curves can be configured. This channel can also sequence the switching of up to 16 digital outputs.
8	**PID-CLC**	PID regulator channels permit the continuous regulation of a process quantity. P, I, PI and PID regulators can be selected. In addition settings like e. g. dead zone, control variable limitation etc. are possible
9	**Linearisation**	With given x-value the channel searches in the table resp. calculates (interpolated) the y-value of a discrete function.
10	**Strain-Gauge**	This channel is calculating characteristics for strain gauge inputs.
11	**Spectral-Component**	This channel provides a very specific analysis of FFT channels. This channel can only be used in combination with the AMDT module
12	**Limit**	Limit channels are used for Alarm and Event management. For each channel (analog, digital, calculation channel),.... lower and upper limit values can be established. Limit values can be used internally and externally. For the external function digital outputs can be switched (alarm functions).
13	**Logic**	Logic functions for Boolean operations.
14	**FlipFlop**	FlipFlops are use to cover control functions as they can store values and perform resets on trigger signal
15	**Timer**	Timer channels are mostly used to produce selectively edges and pulses at digital outputs. Thus you have a tool to control external installations in the required form. • Pulse duration modulator • Release delayed edges • Response delayed edges • Alarm-clock functions related to time • Pulse generator
16	**Event**	The event channel is frequently used for e-mail or SMS notification in case of alarm
17	**X-Message**	This virtual channel permits, among others per LAN connection, to import the value of a channel from a further Message Device
18	**Modbus (LAN)**	This channels allows for cross linking between two devices. Any channel of one device can be integrated to another device.

18.2 Channel summary (Explorer)

In order to configure the “virtual channels” the Top/LogMessage Configurator has to be started. The Top/LogMessage Configurator is launched from tap sheet channels of the DataService Configurator.



The Top/LogMessage Configurator software provides an overview of the device. In the Memory module the internal data storage is configured. In the CPU Module are the software channels and the 2 COM ports are configured. I/O module refers to the installed modules of the system.

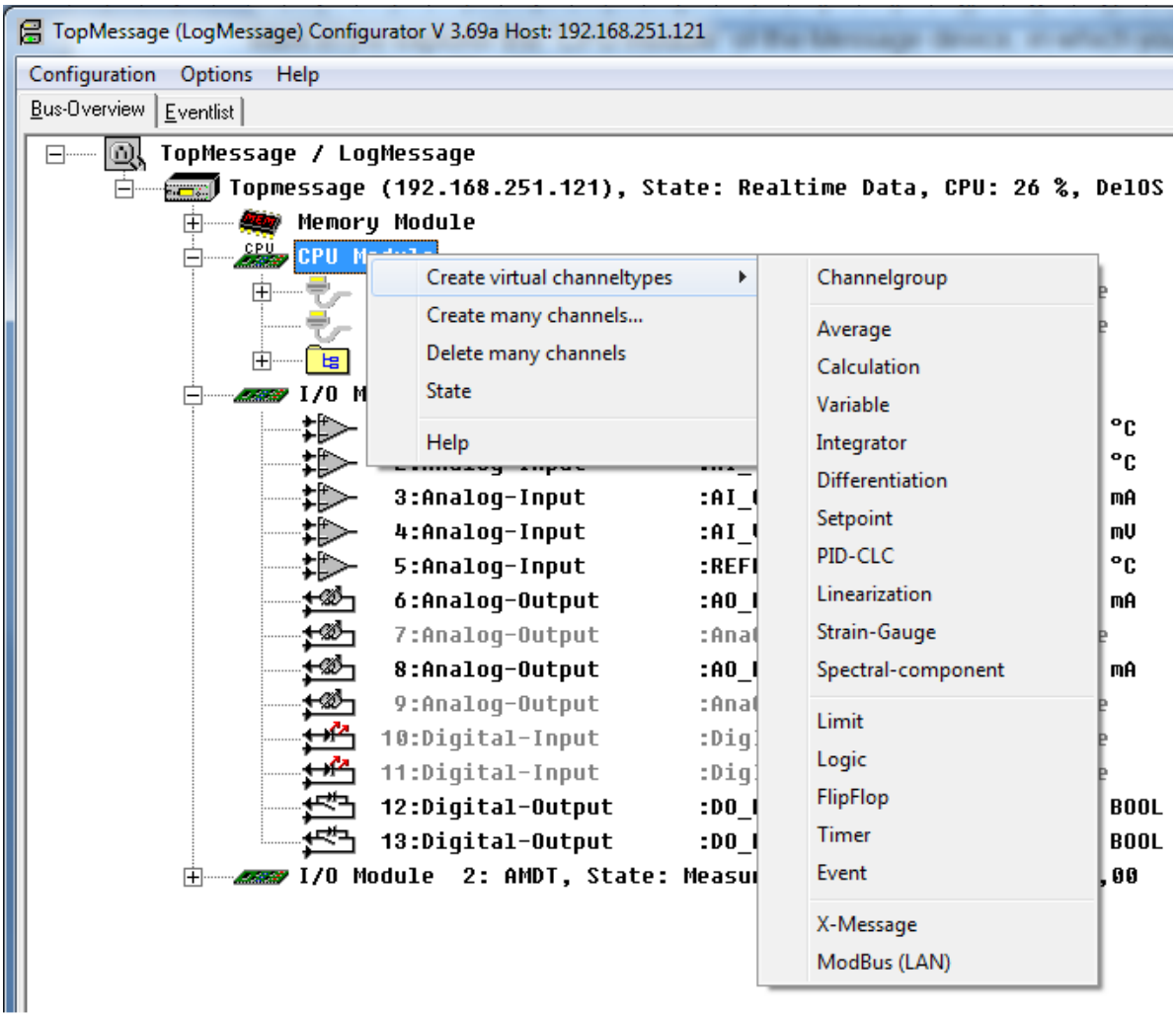


18.3 Creating virtual channel types

Mark in the explorer the “CPU module” of the Message device, in which you want to set up a virtual channel. Click with right mouse key on the marked “CPU module” and a selection dialog opens.

Select > ”Create virtual channel types”

Click on the virtual channel you want to create,
When you have created the channel in the next step the configuration is carried out.

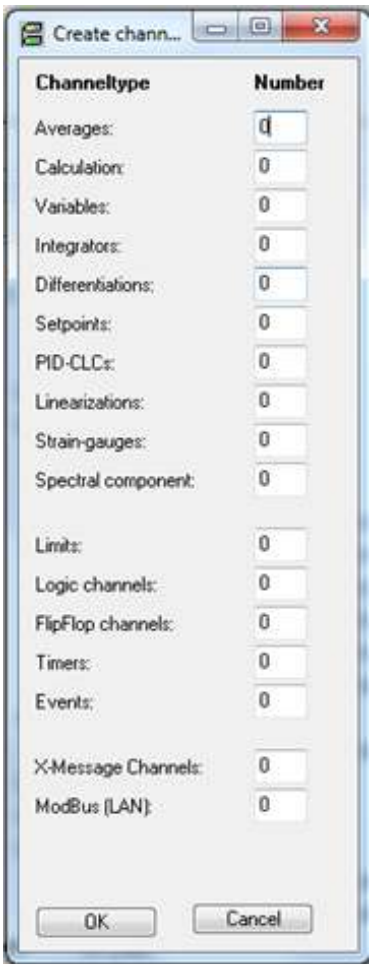


18.4 Generate several virtual channels

Mark in the explorer the “CPU module” of the Message device, in which you want to set up one or more virtual channels. Click with right mouse key on the marked “CPU module”.
A selection dialog opens.

Select “create many channels”.

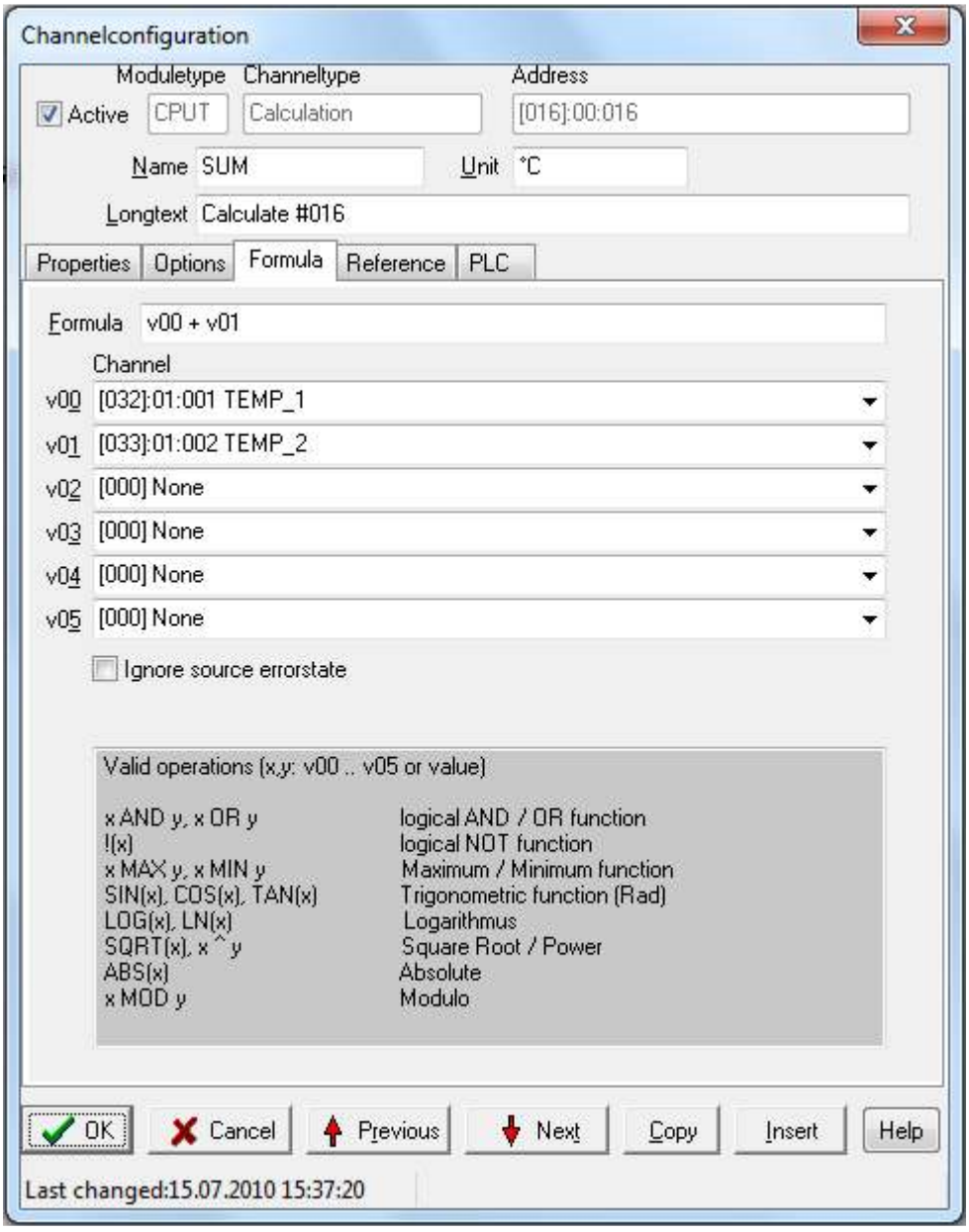
The following window appears:



Click the requested number of channels (max. 99) per channel type, which you want to set up. After clicking on “OK” the channels will be set up and the window that had been opened last will be closed.

19 Calculation channel

Mark this calculation channel.
Double click on the calculation channel.
The dialog channel configuration opens.



FORMULA: Enter the requested calculation formula here.
Tick the check box “Active” to activate the calculations.
Max. 6 variables (V00 to V05 channels) can be processed in this channel.

Ignore error state of source ignores the state of sources.

Herein signifies

Column	Value range	Function
1. position		„V“ stands for variable
2. position	0 to 1	„0“ current value, „1“ previous value
3. position	0 to 5	Max. variable possible.

For each variable a channel can be selected via the selection menu.

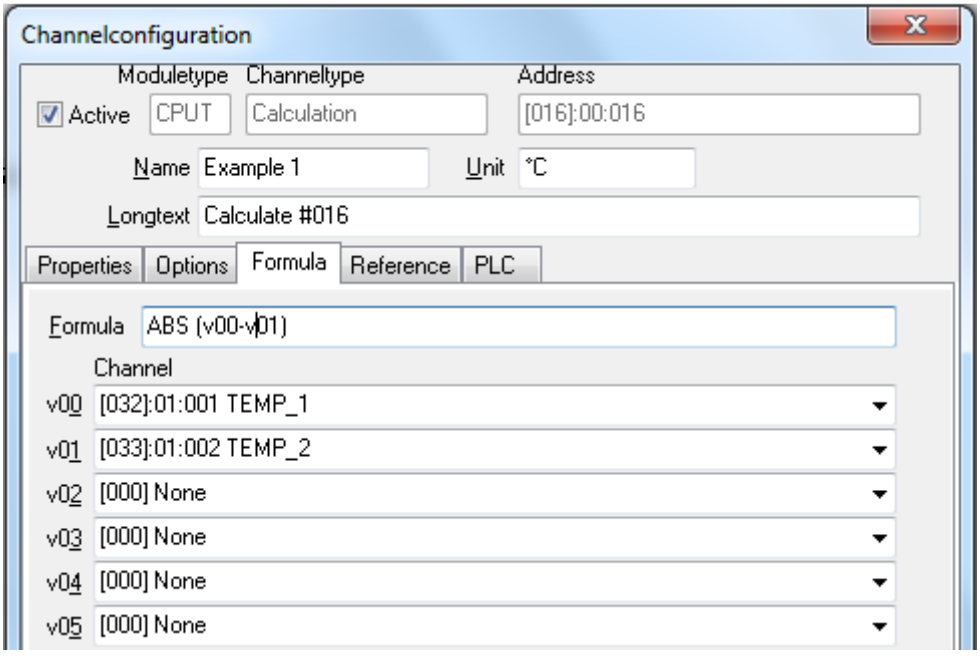
Entry in the formula
The formula can include max. 68 characters.
Constants must not be more than 9 digits; if necessary, the exponential presentation (s. b.) must be selected.
For brackets the usual mathematic rules are applied.
Point before dash calculation is valid. (AND before OR)

Constants may be written in scientific exponential spelling

„1,234“ can be written as follows:
“1,234” , “1.234” , “0.1234e1” , “123.4e-2”

General configuration example

ABS(v00-v01)



Returns the unsigned difference between two analog values, e. g. 2 temperatures

Valid Operators / Functions for a calculating formula:

Operators for Boolean Logic: (Syntax is „x OPERATOR y“) (Result 0 or 1)

<	Compares for Less
=	Compares for Equality
>	Compares for Greater
<=	Compares for Less / Equal
<>	Compares for Unequality
>=	Compares for Greater / Equal
AND	Boolean AND
OR	Boolean OR
XOR	Boolean Exclusive OR

Operators for Arithmetic Functions:

+, -, * /	Basic calculations
^	Power (x^y)
&	AND Bit Operation
|	OR Bit Operation
#	XOR Bit Opertion
>>	Shift Right
<<	Shift Left
MOD	Modulo-Function (Rest of division)
MIN	Returns smaller value
MAX	Returns greater value

Functions: (Syntax is „FUNKTION(x)“)

NOT	Boolean NOT (Alias: “!(x)”)
~	BOT Bit operation
SIN	Sinus-Function
COS	Cosinus-Function
TAN	Tangens-Function
LOG	Logarithm to Base 10
LN	Logarithm naturalis to Base e
EXP	Exponential function to Base e (e^x)
SQRT	Square Root function
ABS	Absolute value function

Constants

PI	Ludolph's Constant π = 3,1415927...
E	Euler’s Constant e = 2,7182818...

Please Note:

The operators AND, OR, XOR, MIN, MAX and MOD have to be embedded in blanks (SPACE)

Examples:

“V01 AND V02“

“V01 MOD V02“

„V01 MIN 1.234“

Nesting (Example: “(a MAX b) MIN (c MAX d)”) is possible.

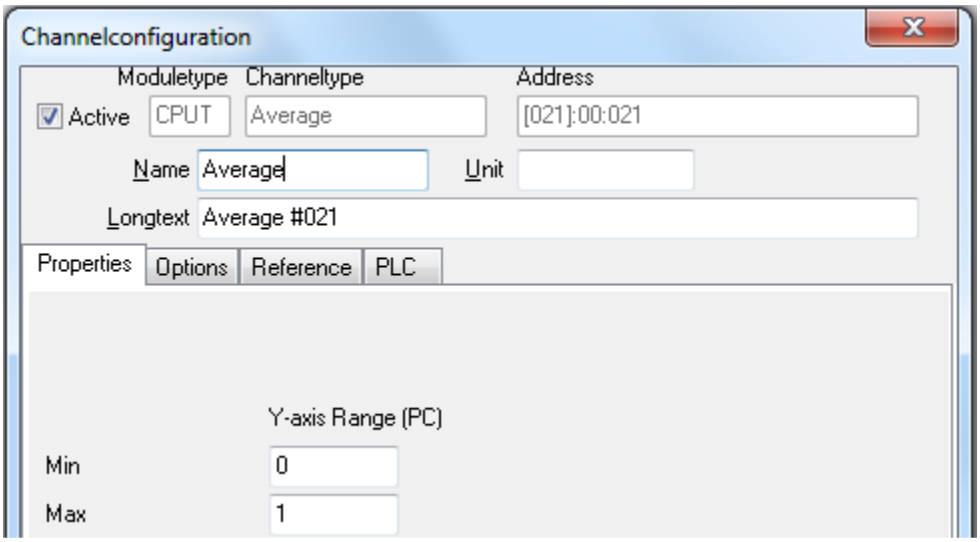
20 Average channel

With this channel it is possible to calculate an Average value e.g. from an analog input channel like temperature. In the configuration dialogue register “options” you can select the hardware channel for the averaging with the help of the pull down menu. Together with the average of a channel a smoothing of the measurement value is achieved. If the average is generated over a status input, the result will be the ratio from High to Low level

Available are: Time related average, moving average, time related and moving average

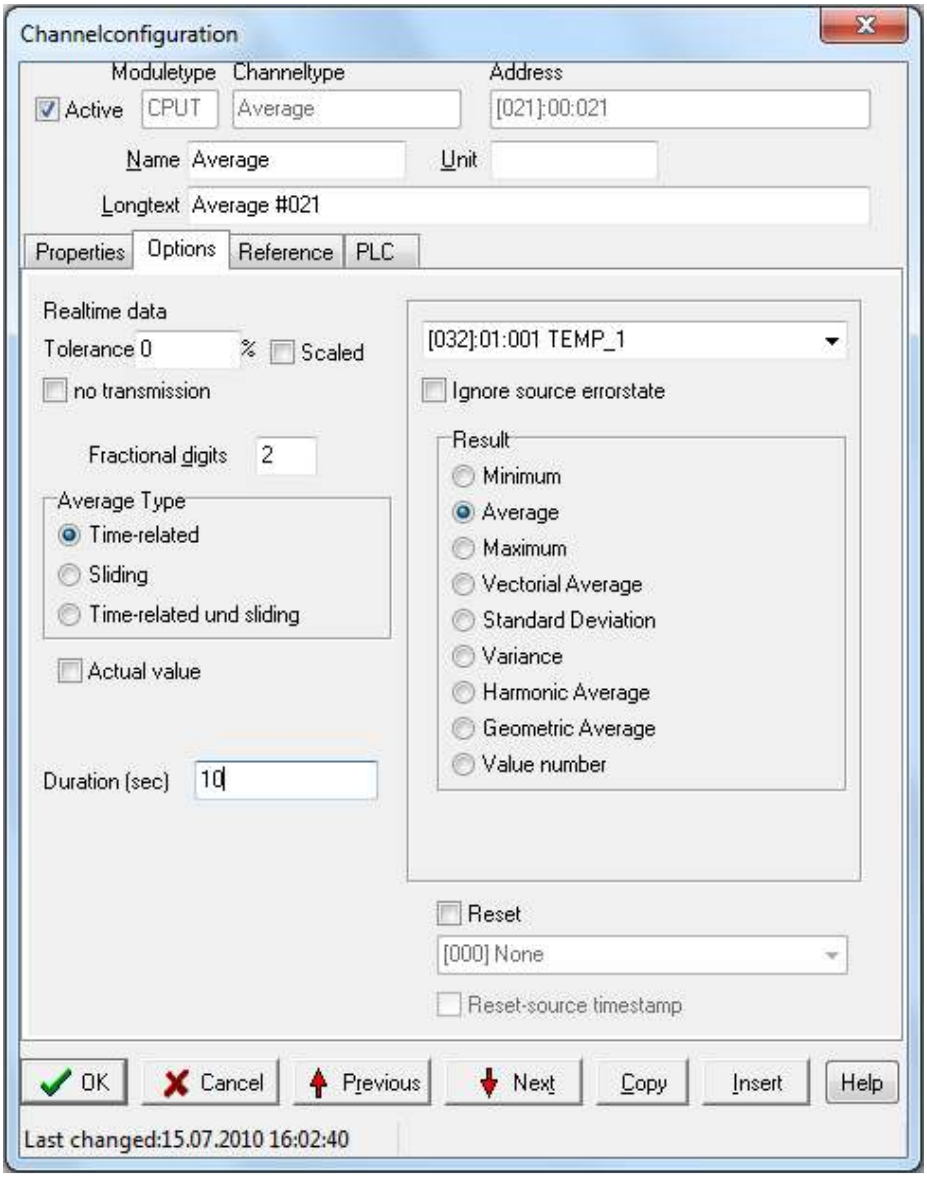
20.1 Configuration of mean channels

Open in the register “Bus summary” of the Explorer the required mean channel by double click. The dialogue channel configuration opens.



In the field **range of Y-axis (PC)** you define the range at evaluation in PC. Suppose the measurement range of the analog channel amounts to 0..100 ℃. For the average only the range 10...90℃ is of interest, thus this can be de fined here.

20.2 Mode “Time related”



Under **„reference channel“** you select the source channel, to which the averaging should refer.

Averages are computed in fixed time blocks specified in “Duration”.
The average as configured above is calculated not time synchronized.

If you require a synchronised average the „Source-Reset“ needs to be activated.
With this trigger signal the start of the blocks is defined.
If the average should be calculated in real time synchronous, use a time synchronized pulse generator as source reset. Thus the start of the blocks is synchronized with the clock hours resp. minutes or seconds. Half hour cycles will then start exactly at clock hours and half clock hours. Half clock hours are usual e. g. for the acquisition of environmental data.

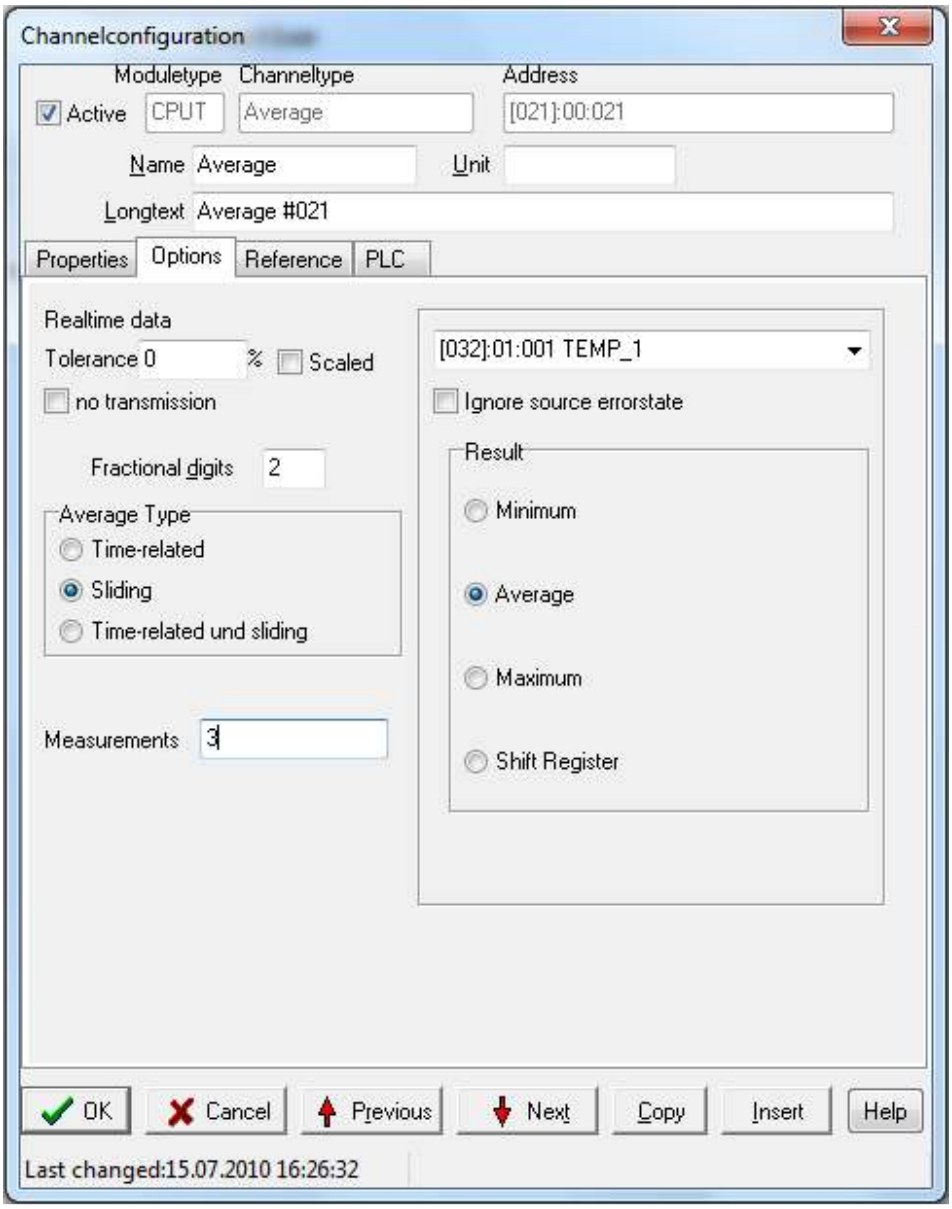
„**Memory tolerance**“ is based on the adaptive storage concept of the Message devices.
A measured value will only be stored with time and date stamp if this lies outside the tolerance of the previous value.

The greater the tolerance the more memory space is saved.

The percentage value refers to the scaling (see scaling in the register settings).
Besides the (arithmetic) averaging the following types can be adjusted furthermore:

Minimum	Smallest measurement value within interval
Maximum	Biggest measurement value within interval
Vectorial average	Averaging at unit circle (e.g. mass fow in air conditioning technology)
Standard deviation	Square root of variance (not mean deviation !)
Variance	Mean square deviation related to mean value
Harmonic average	Reciprocal of a mean calculated from reciprocal value.
Geometric average	N-th root from the product of n measurement values
Value Number	Counting number of measurement

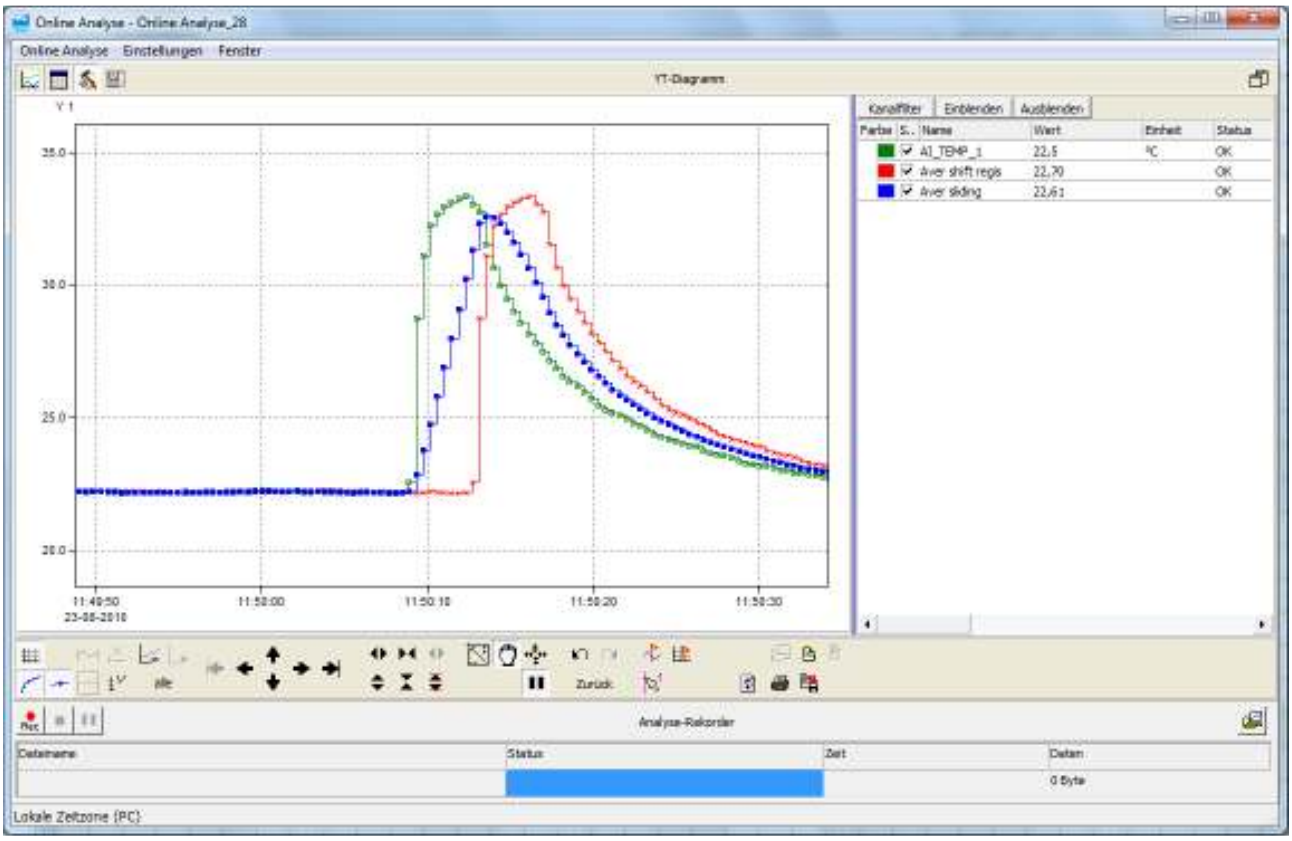
20.3 Mode „Sliding“



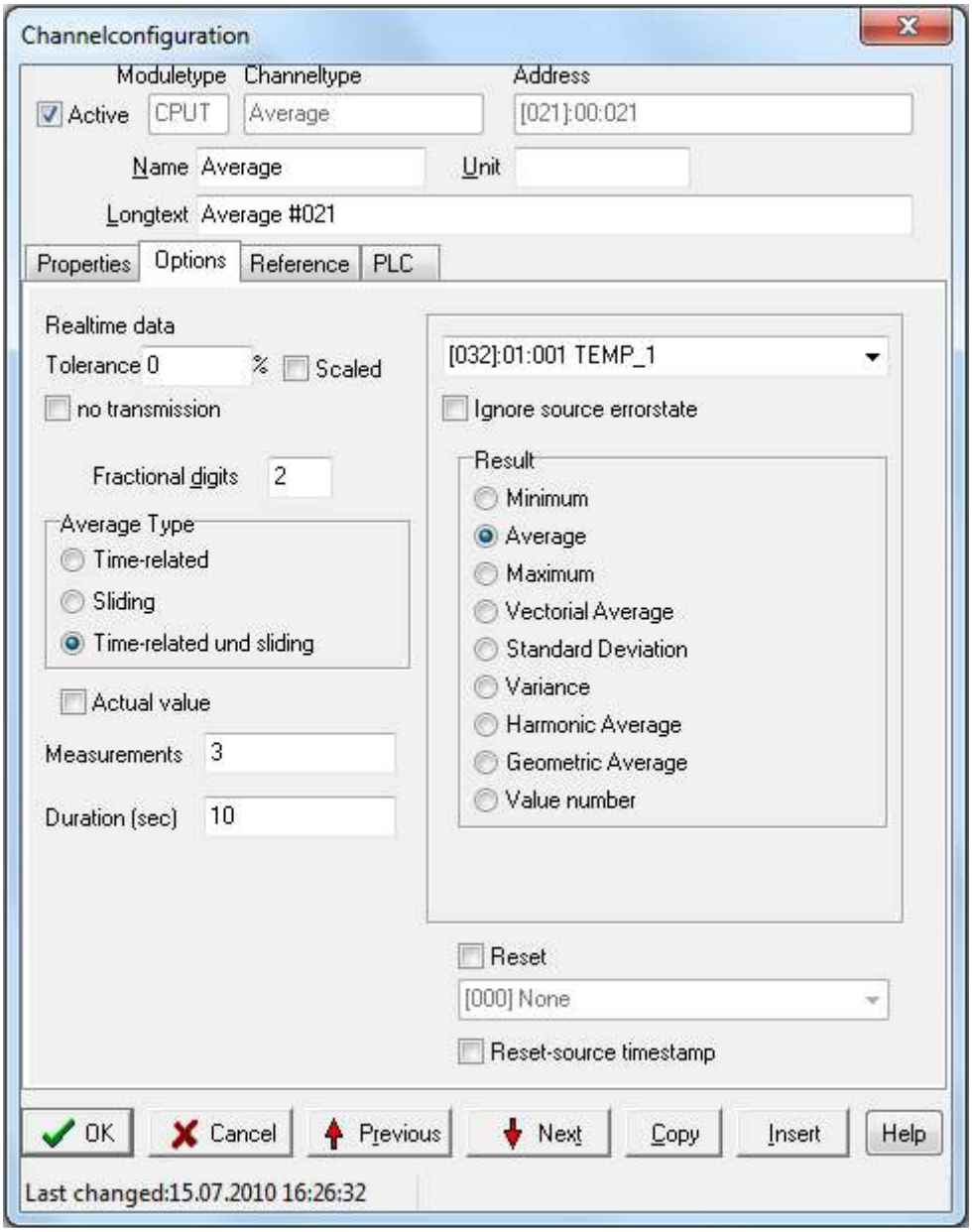
If you select moving, write in the field “measurements” the number for the moving average. The maximum value is 120.

This channel can also calculate the Minimum or maximum value over the number of defined measurements

The “Shift Register” is a special mode of the sliding average. With this mode the sliding average is calculated after “n-number of measurements” are taken. The following trend diagram shows the 3 channels: Original Measurement, Sliding Average over 10 values, Shift register channel (red curve)


Online Analyse - Online Analyse_28
Online Analyse
Einstellungen
Fenster
YT-Diagramm
Y 1
35.0
30.0
25.0
20.0
11:49:50
23-08-2010
11:50:00
11:50:10
11:50:20
11:50:30
Kanalfilter
Einblenden
Ausblenden
Farbe
S..
Name
Wert
Einheit
Status
AI_TEMP_1
22,5
°C
OK
Aver shift regis
22,70
OK
Aver sliding
22,61
OK
Zurück
Analyse-Rekorder
Dateiname
Status
Zeit
Daten
0 Byte
Lokale Zeitzone (PC)

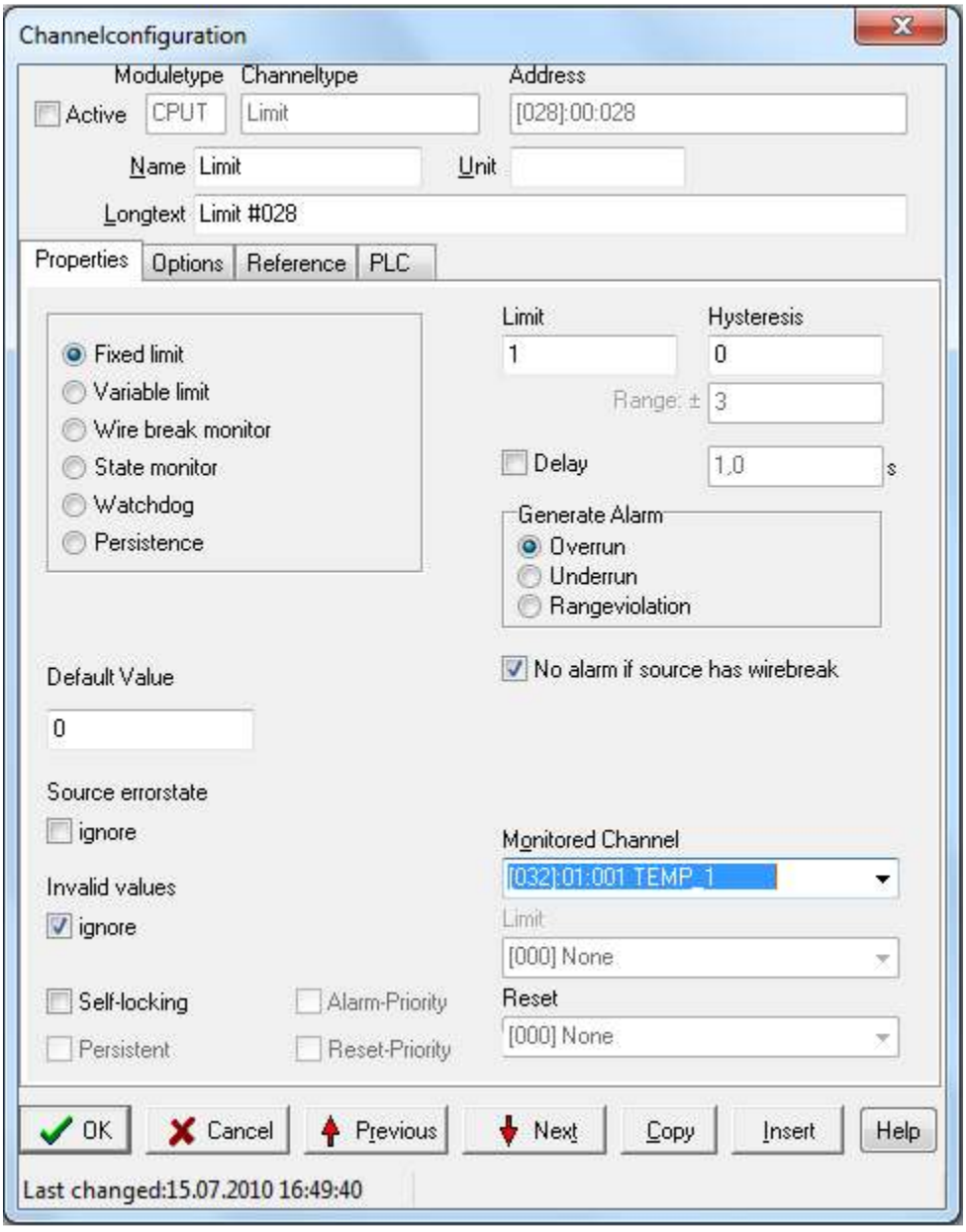
20.4 Mode „Time related and sliding



In this setting you can calculate moving averages of block averages.
E. g. 10.sec block averages are computed, which can now be inserted in a moving averaging.
The field “duration” covers the block length for the average. You can also define the block length by activating the “Reset” source channel.

21 Limit channel

For each channel a lower-bound and an upper-bound can be established. For each limit channel only one limit value can be set. If it is necessary to establish more bounds for one analog input, additional limit channels must be created.



The following setting are possible:

Fixed limit
The threshold is entered in the upper field “limit”.

Variable limit
The threshold is supplied by channel selectable from the list
(“limit” below)

Wire break monitor
Monitors the wire break on a channel

State monitor
Generates an alarm at a selected event

Watchdog
Checks the state of the communication of the Message devices (master and slave)

Persistent
The value of the output is stored and reload after each power on of the Message device

Under **“Monitored channel”** select the analog channel, to which the monitoring should be related.

In the field **“Limit”** the alarm threshold is set.
In this case is 1.

“Hysteresis” modifies the value of the reset of the alarm. If the monitored channel values pass the limit the alarm is set to high, if the hysteresis is set, before the alarm is set to low, not only the values have to be inside the limit but also they havce to be inside the limit + hysteresis

In the field **“Generate alarm”** it can be selected when the output has to be high (**overrun:** the value is higher than the limit, **underrun** the value is lower than the limit, **range violation** is when the value is outside the limit value ± range value).

No alarm if source has wire break doesn't sets a wire break of the monitored channel as alarm state.

With **Source error states ignore** the error state of the monitored channel are ignored.

With **Source invalid values ignore** the invalid values of the monitored channel are ignored.

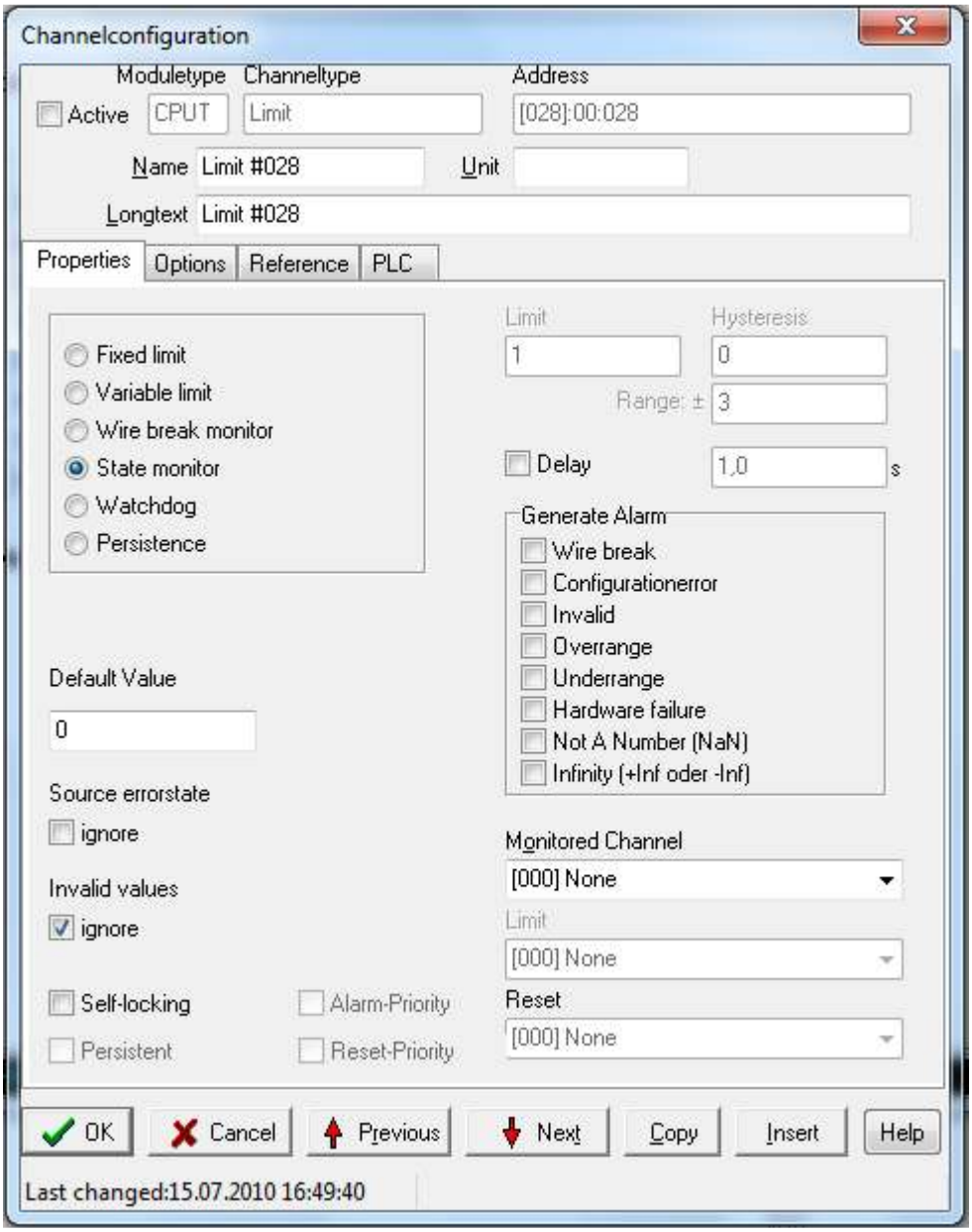
With **Self Locking** when the output is set to one it stays to one even if the limit is not pass anymore. This can be reset from the signal chosen in the reset list down.

When the **Self Locking** flag is set it is possible to choose **Alarm priority** or **Reset priority**.
The first flag allows the reset only if the alarm condition is not violated. The second flag allow the reset every time.

.

21.1 State monitor

In the mode State monitor it is possible to react on different system states.

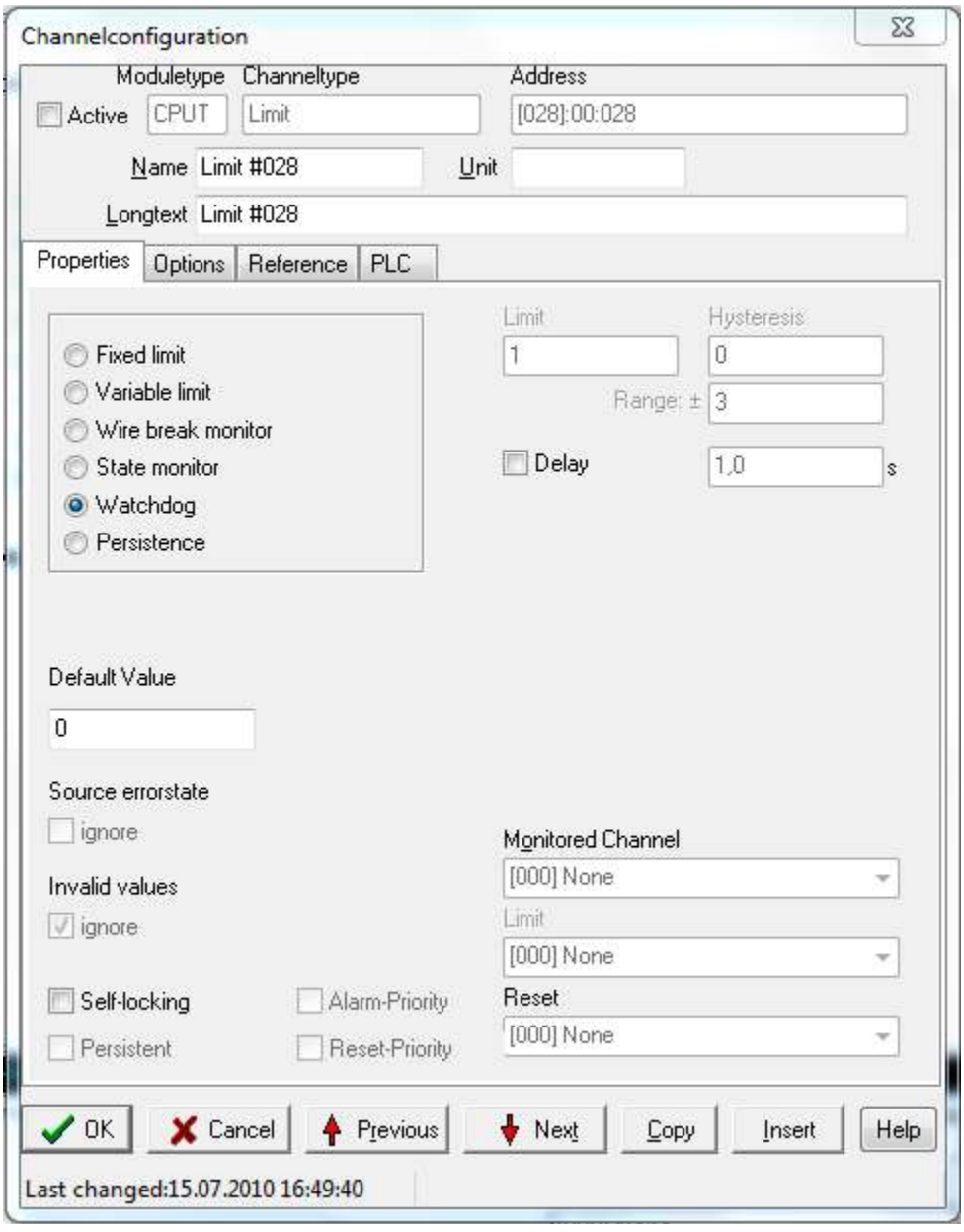


Alarm at:

Wire break	Wire break at monitored channel
Configuration error	Problem with configuration of monitored channel
Invalid value	Invalid value at monitored channel
Overrange	Overranging of the monitored channel
Underrange	Underranging of the monitored channel
Hardware failure	Hardware failure
Not a Number	The value is NaN (Calculating square root from negative values)
Infinity (+/- Inf)	Calculation Channel were division by 0

21.2 Watchdog

The Watchdog function is monitoring the communication between the units (Master – Slave) and also to the Top/LogMessage Configurator. When one communication partner is out of service an alarm is generated which could e.g. switch a digital output for annunciation.

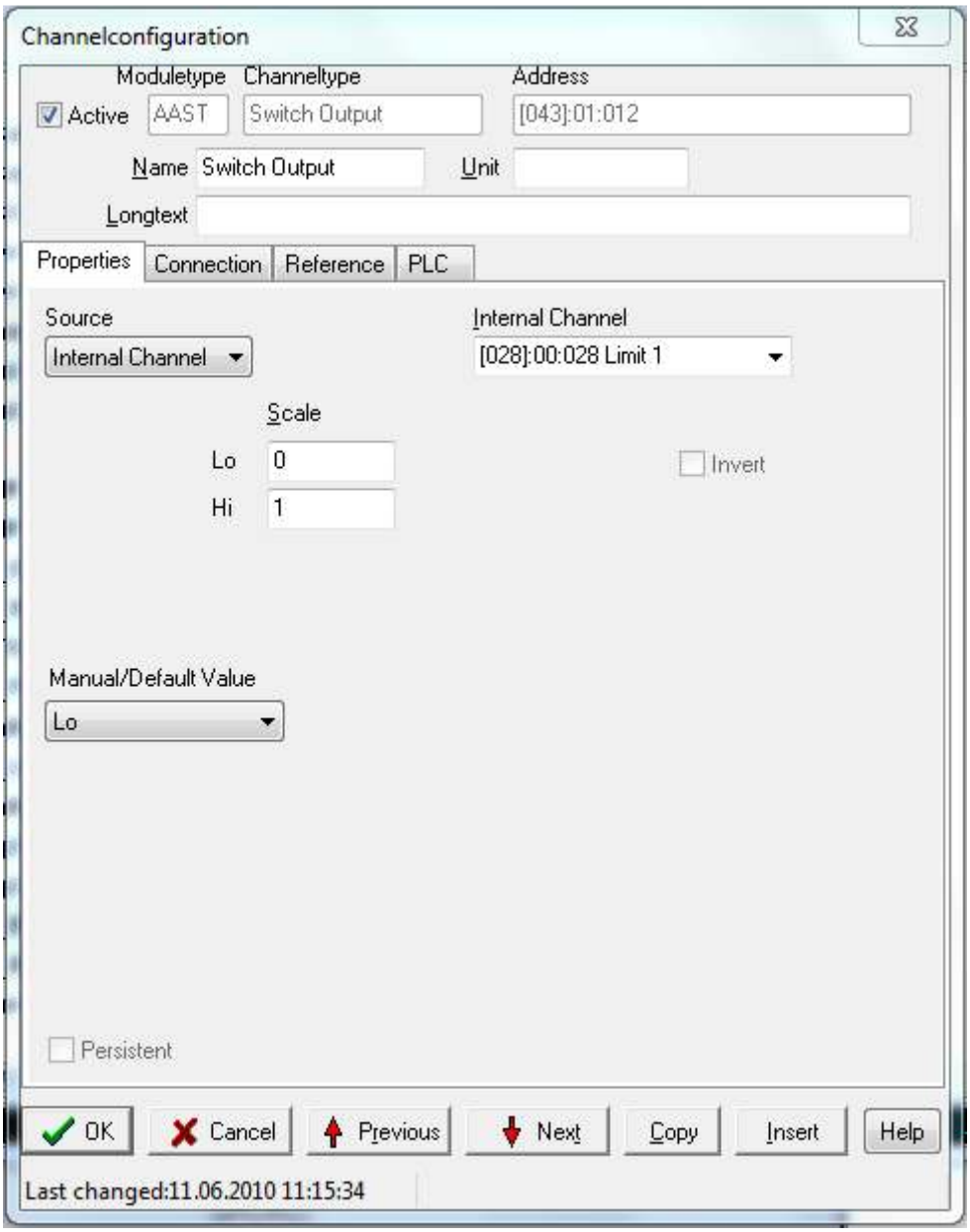


21.3 Configuration of a switch output for the limit channel

For alarm or status annunciation you can feed the status of the limit channel to a digital output channel (switch output).

The steps are as following:

1. Select the required digital output channel of our I/O module
2. Change the source channel to “Internal Channel”
3. Link the required limit channel which should switch the output to “Internal Channel”.

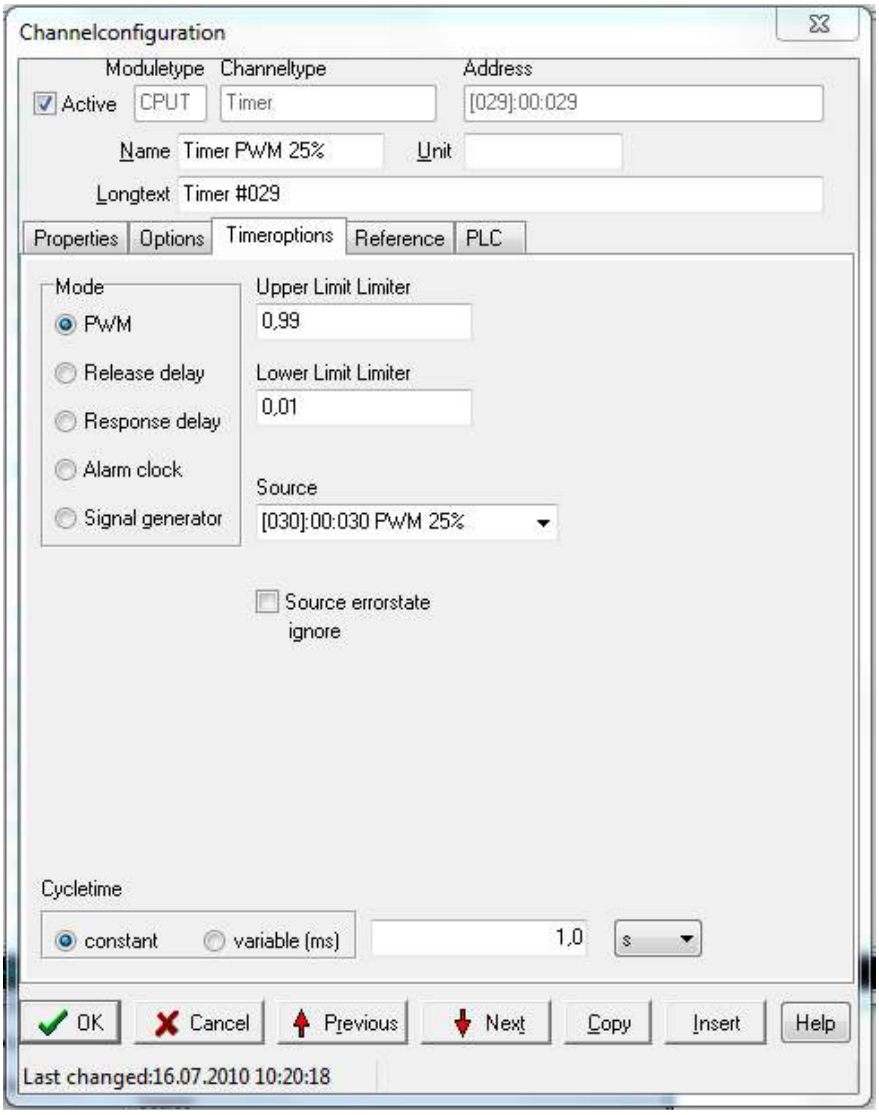


22 Timer channel

Timer channels are often used to produce selectively edges and pulses for digital outputs. With these a tool to control external device it is available.
In detail the following modes are possible:

- Pulse duration modulator
- Release delayed edges
- Response delayed edges
- Alarm-clock functions related to time
- Pulse generator

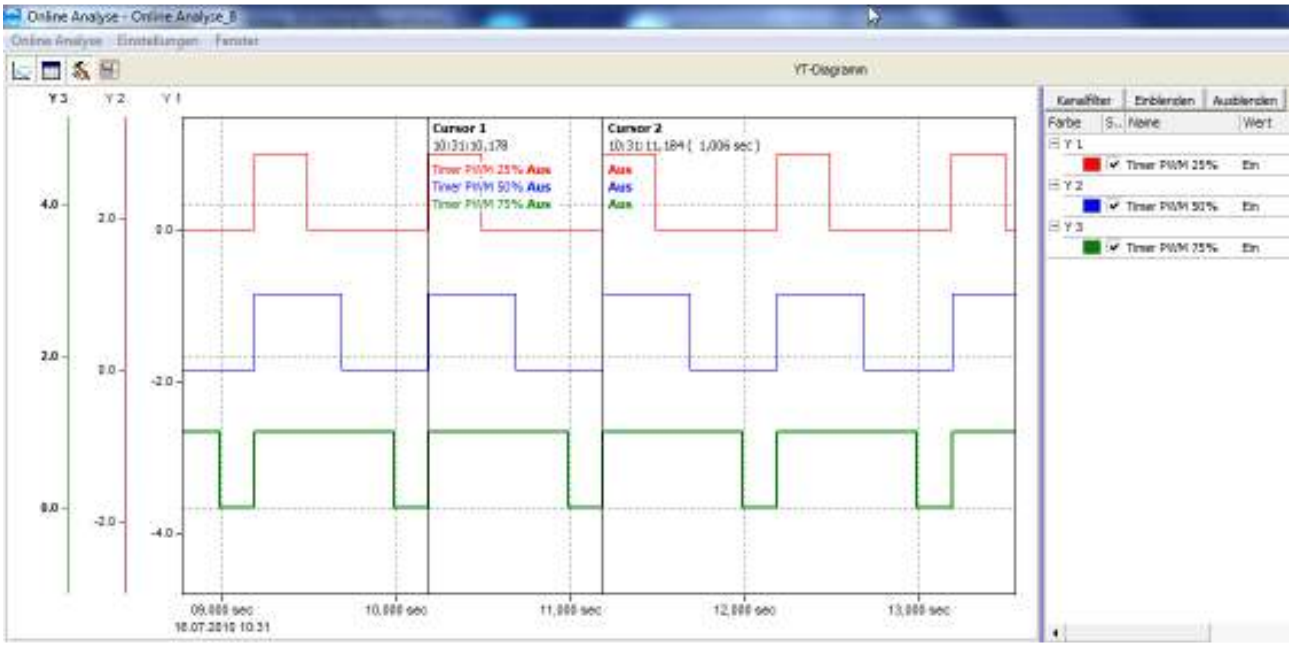
22.1 Pulse duration modulator (PWM)



The pulse duration modulator allows to control the pulse duration of the timer depending of an external input. The cycle time can be set to a constant value or it can be dynamically adjusted through another integral channel of the system.

The pulse width is dynamically adjusted depending on the set value of the source channel. The value of the source is calculated in percentage on the given time interval given by the set source lower and the upper limit.

Example:
The pulse duration will last the same percentage value of the cycle period. E.g. If the source value is 25, and the cycle time has been set on 1000 ms (1 sec), the pulse duration will amount to 25 % of 1000 ms, i.e. 250 ms



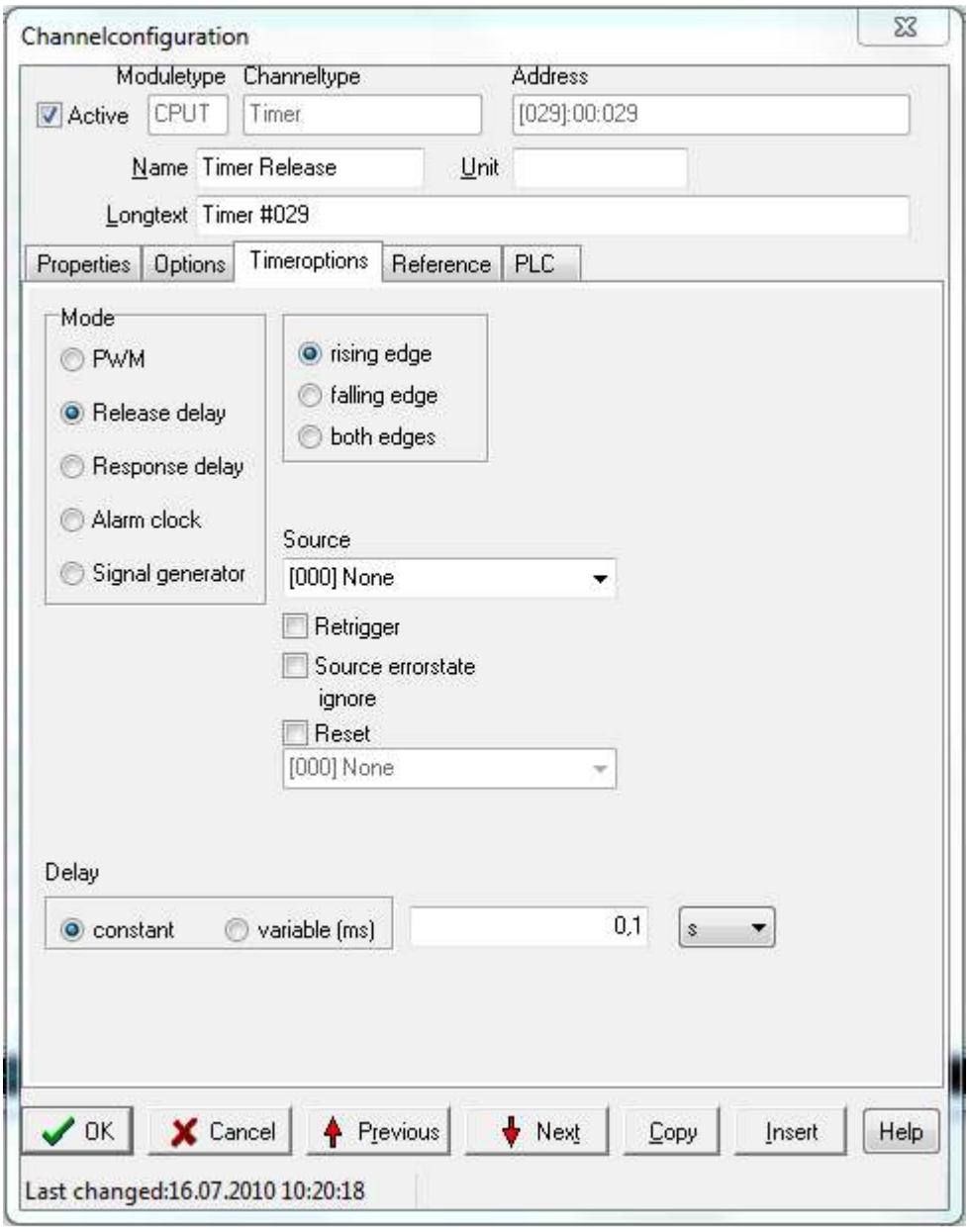
The upper and lower limit for the output assures that the pulse duration will not be less than the lower limit or more than the upper. The source channel should take values in the range of 0,01 und 0,99 only.

E.g. if the lower limiter amounts to 10%, the upper to 90% and the cycle time to 10000 ms, the corresponding limits are around 1 and 9 sec.

22.2 Release delay

It is possible to generate pulses which are triggered by a rising or falling edge of a source and are reset after the selected pulse duration.

22.2.1 Rising edge - not retriggerable



In this mode the timer is started by a rising edge (diagram 1) and is reset after the selected pulse duration. Rising edges occurred before the reset have no influence on the timer.

After the timer reset a rising edge starts the timer again.

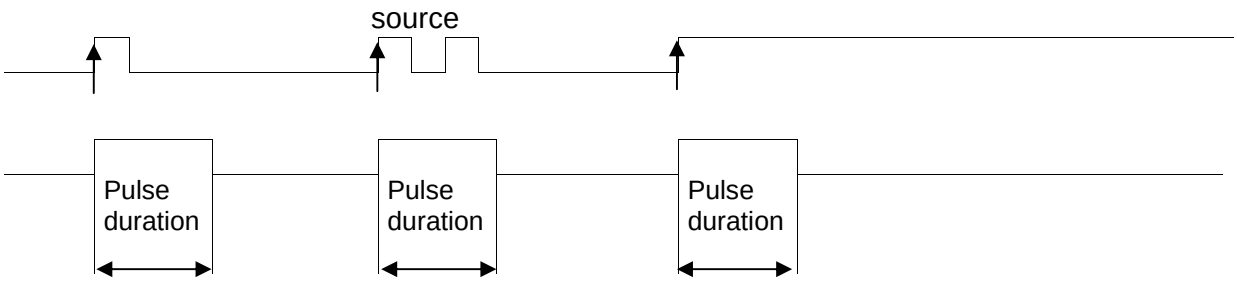


Diagram 1

22.2.2 Rising edge - retriggerable

In comparison with the not retriggerable timer the retriggerable timer can be started before a reset occurs (diagram 2).

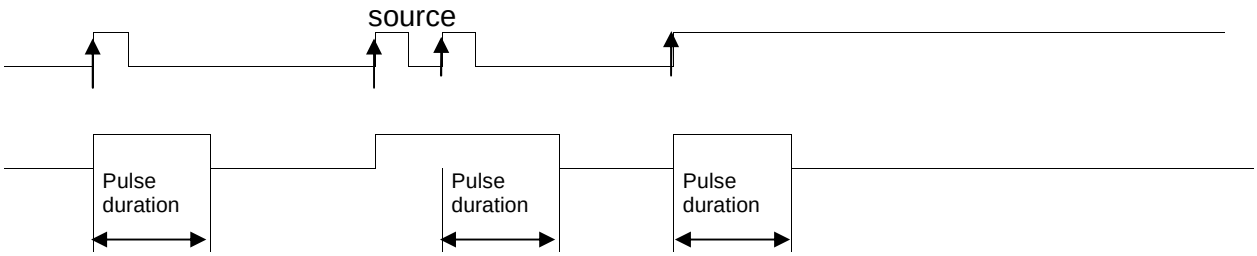


Diagram 2

22.2.3 Falling edge - not retriggerable

At a positive edge the timer is set on High (diagram 3), however it requires a negative edge in order to start the pulse. The timer will be reset after the selected pulse duration.
Positive and negative edges will be ignored before reset.

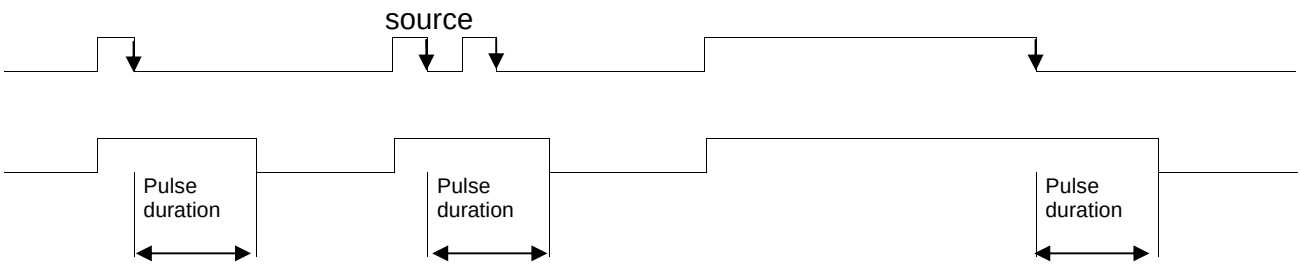


Diagram 3

22.2.4 Negative edge - retriggerable

The pulse can be started even before a reset occures. (diagram 4).

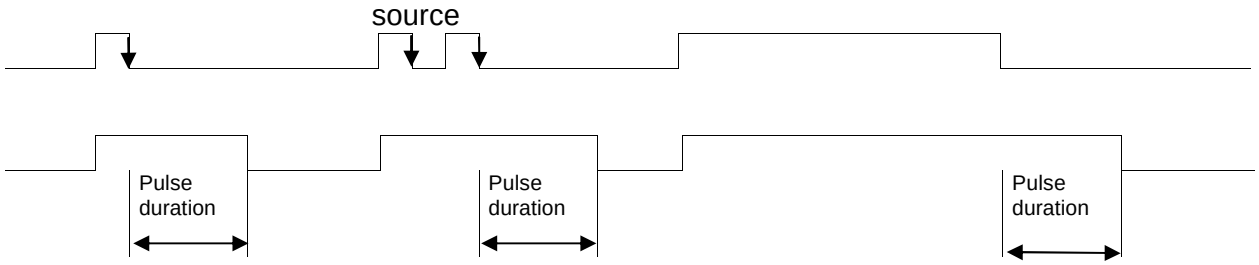
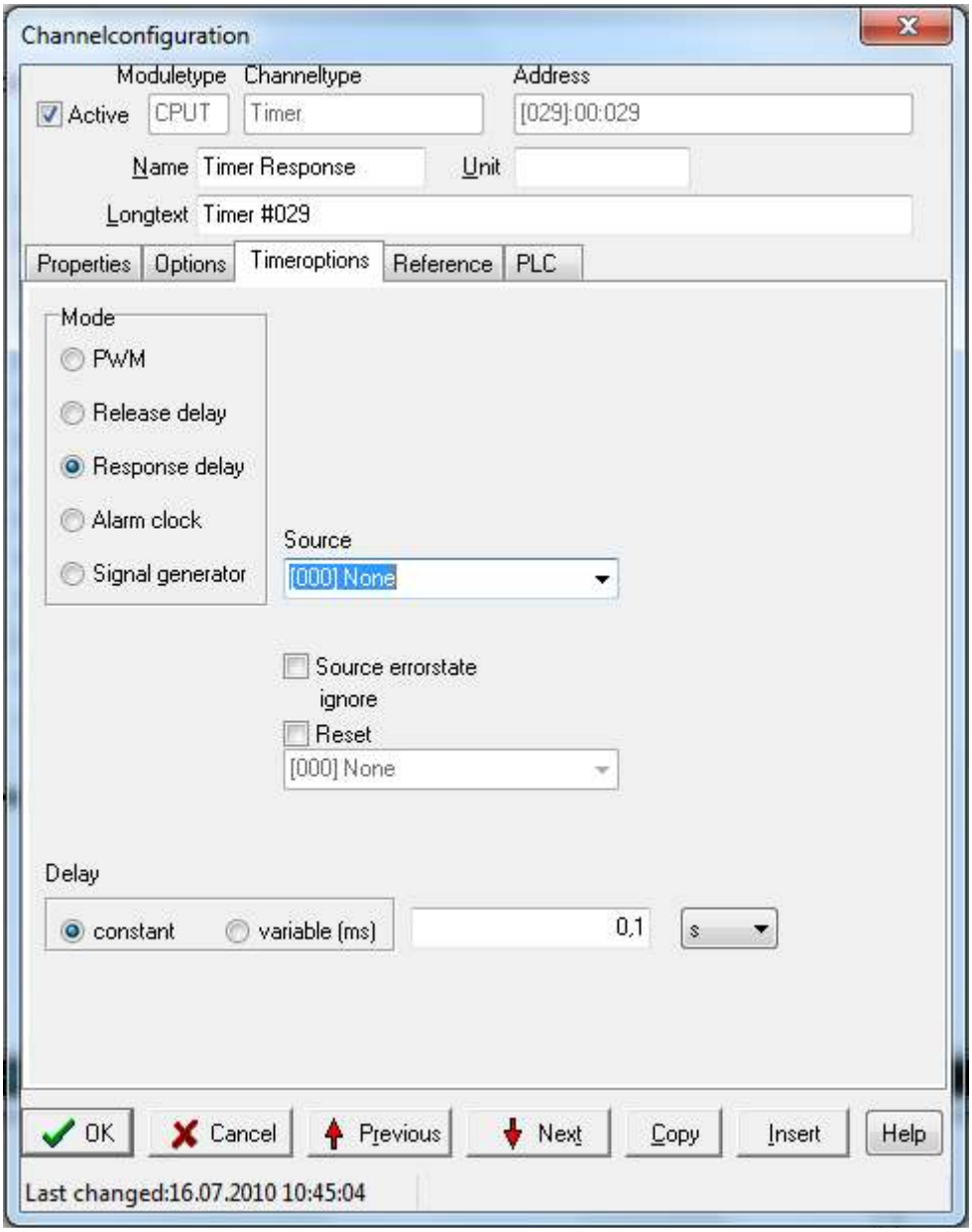


Diagram 4

22.2.5 Both edges

The mode “both edges” is the combination of the trigger signals of “positive” and “negative edge”.

22.3 Response delay



The response delay timer is triggered through a rising edge of the source channel. As you can see on diagram 5 the timer will reach the high status only when the source channel is staying high as long or longer than the delay time. To visualize this function the diagram 5 shows 3 high pulses which stay only a short time high. Due to the short high status the timer in “Response Delay” mode is not started.

The timer will be reset at the first falling edge of the source channel.

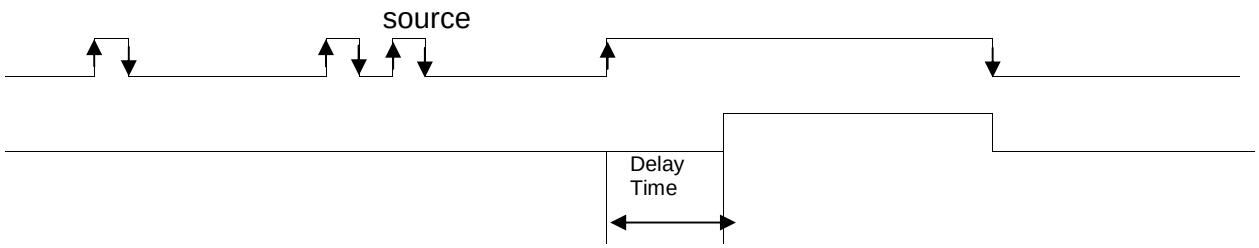
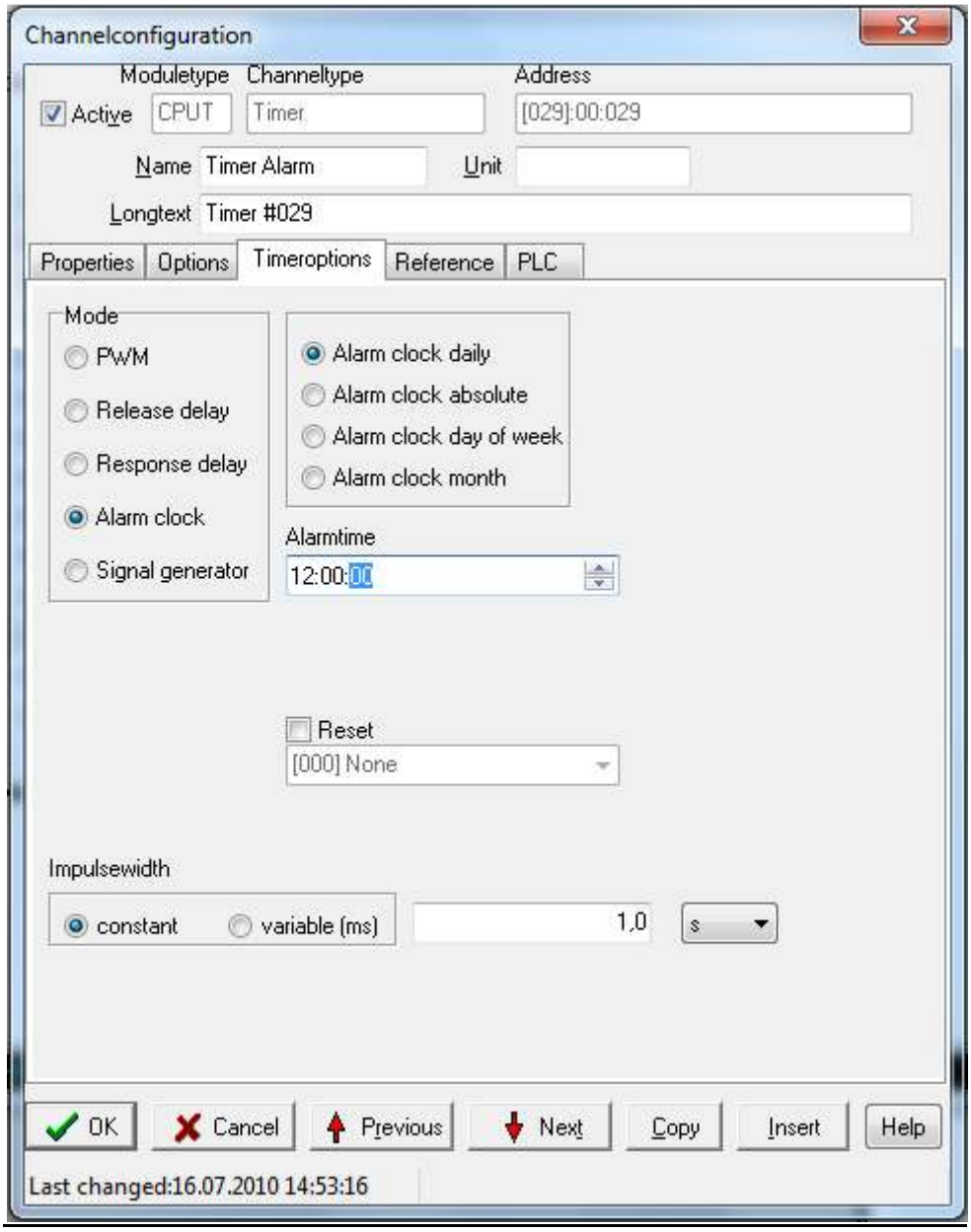


Diagram 5

22.4 Alarm clock

Four types of alarm-clock channels are available

22.4.1 Daily alarm clock



The alarm-clock will be set on High each day at the selected time and be reset after the selected pulse width (diagram 6)

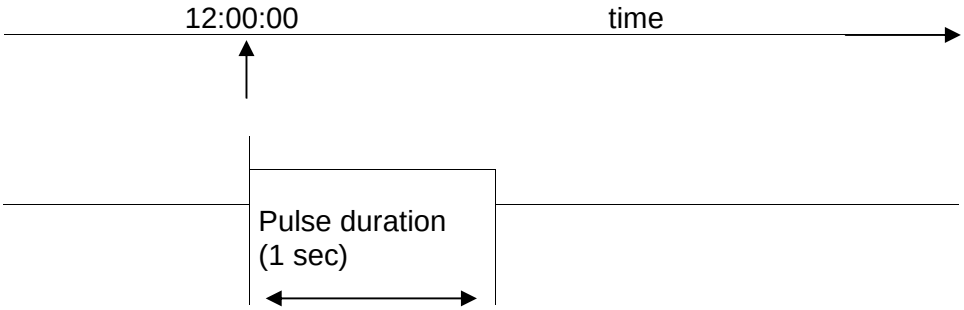
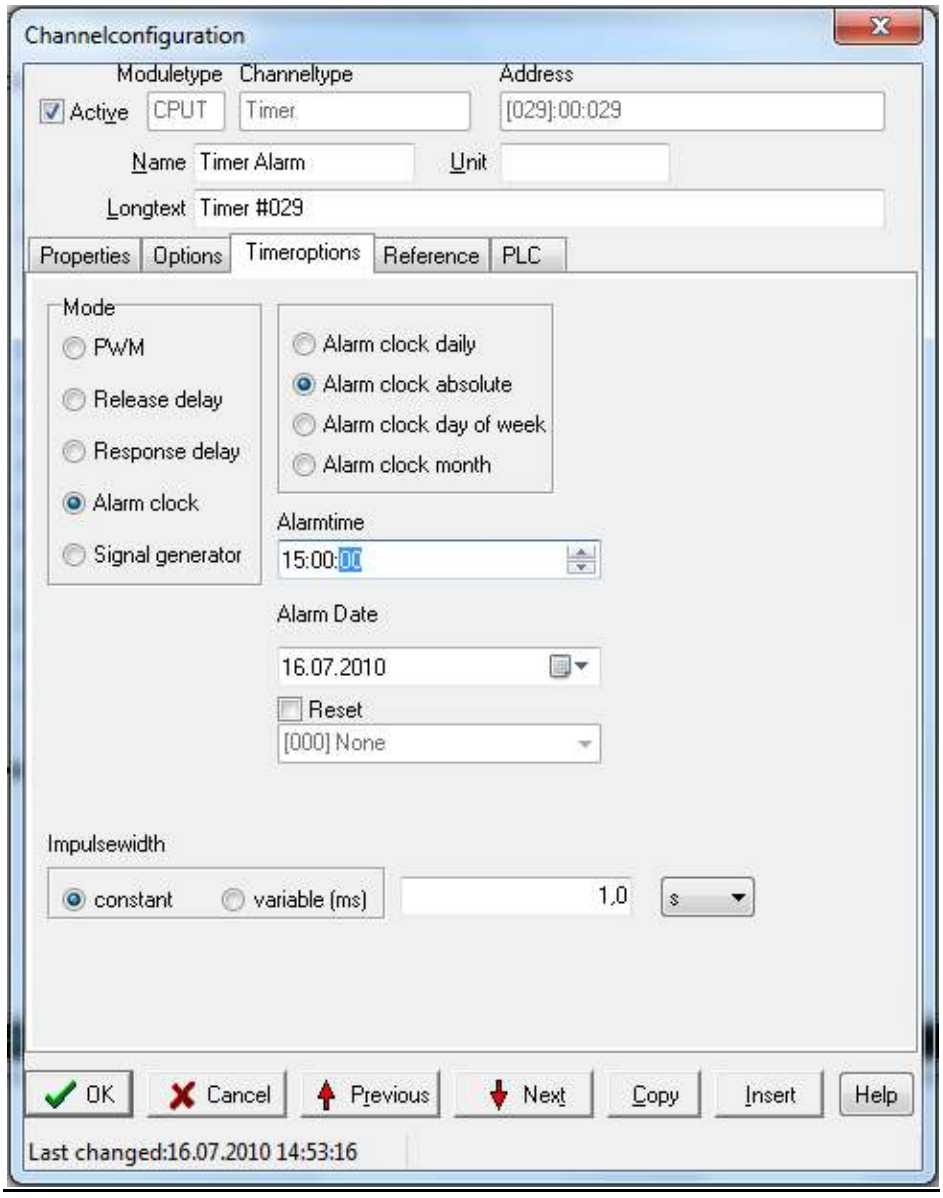


Diagram 6

22.4.2 Absolute alarm clock



Only once on the specified day the alarm-clock will be set to High and be reset after the pulse duration (diagram 7).

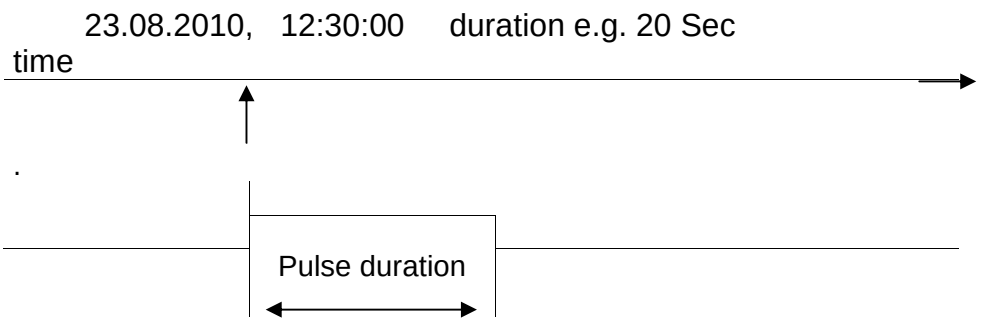


Diagram 7

22.4.3 Alarm clock - weekday

Every week at the selected weekday the alarm-clock will be set on High at the selected time and be reset after the pulse duration (diagram 8)

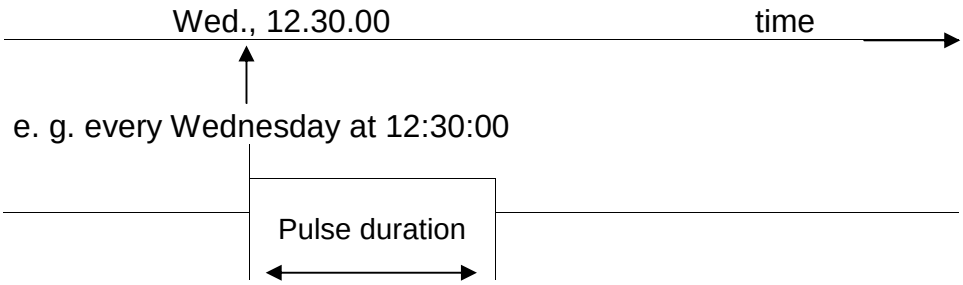


Diagram 8

22.4.4 Alarm clock - month

Every month at the selected day of the month the alarm-clock will be set on High at the selected time and be reset after the pulse duration (diagram 9)

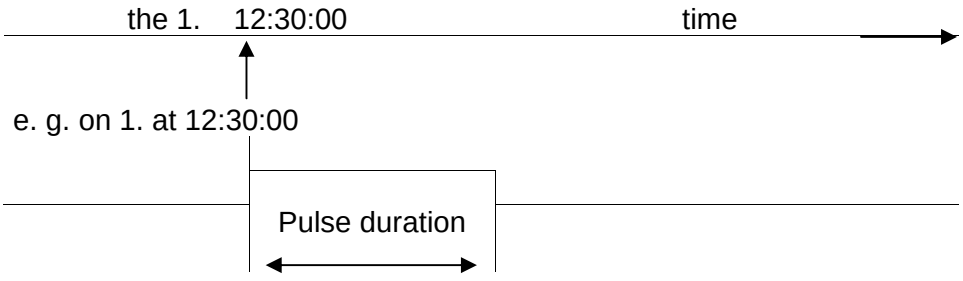


Diagram 9

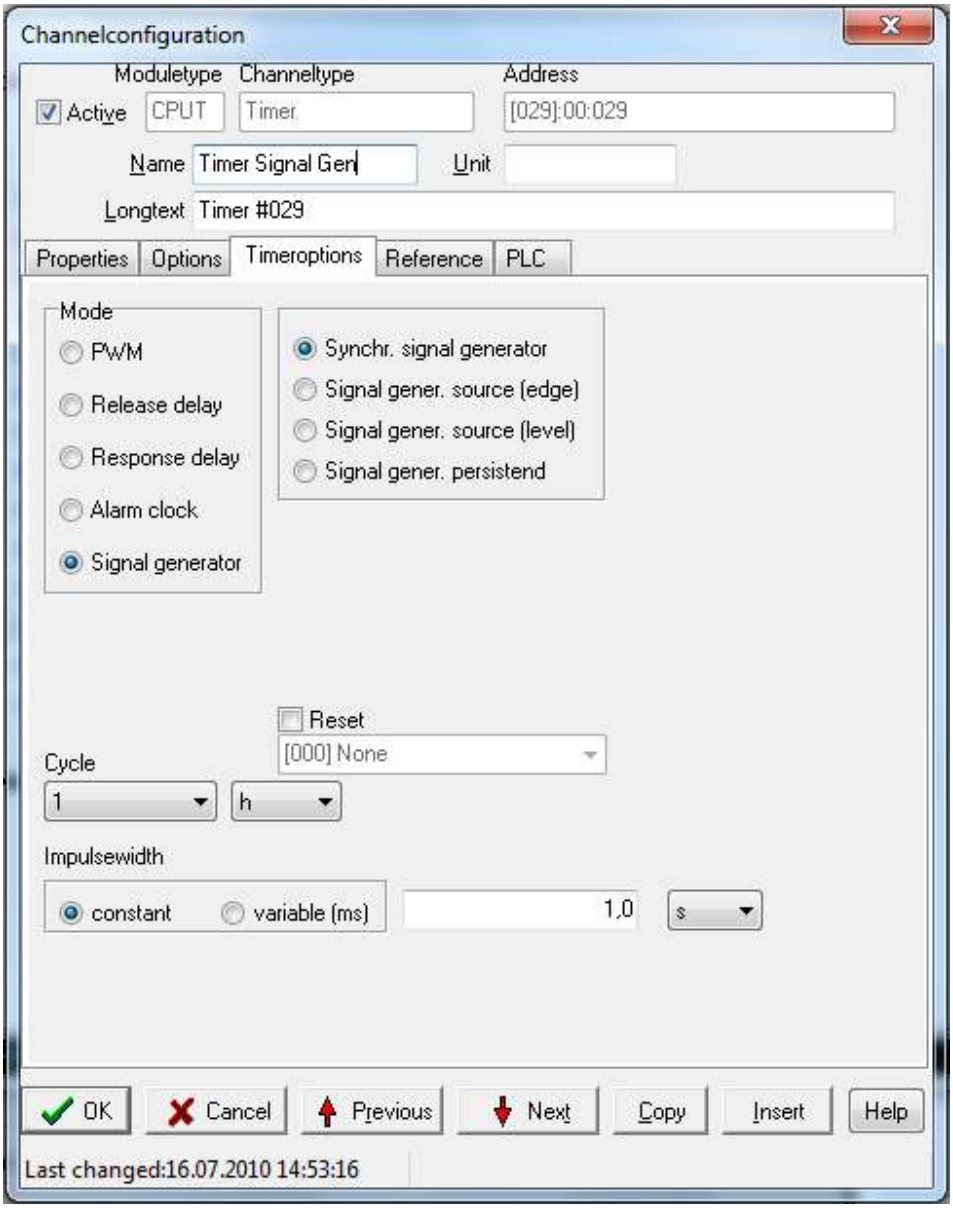
22.5 Signal generator

With the signal generator real time synchronized pulses and also real time independent pulses can be generated. It is also possible to generate pulses synchronously with another source channel.

22.5.1 Time synchronized signal generator

It is possible to generate real time synchronous pulses in the following units:

- seconds
- minutes
- hours



The time synchronized, related to seconds pulse generator has the following functions:
Real time synchronization, i. e. one minute has a defined number of pulses.

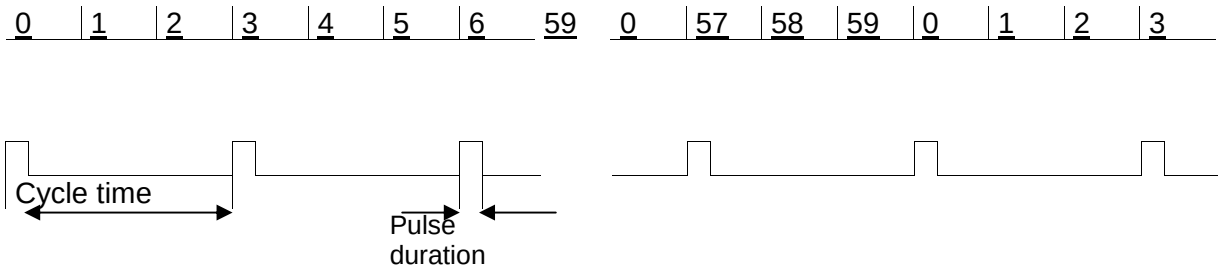


Diagram 10

If the real time clock in the device is set, the pulse generator automatically adjusts to the change and keeps on running real time synchronous.

22.5.2 Signal generator source (edge)

The first pulse is triggered by a positive edge of the source.

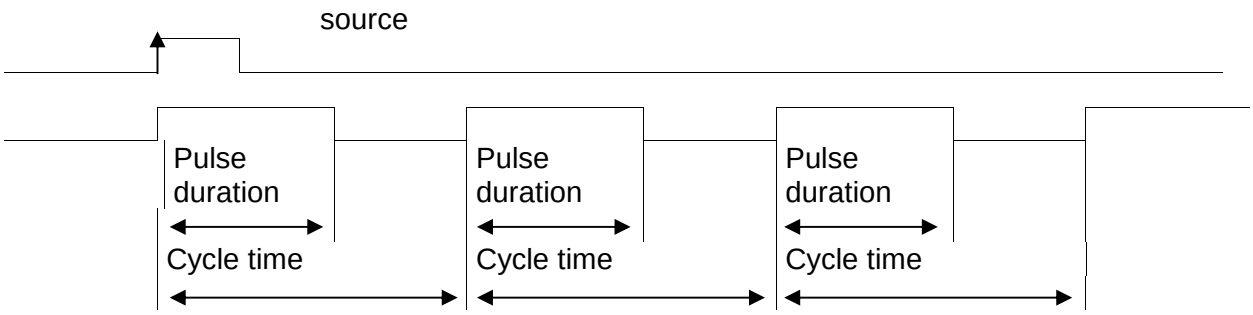


Diagram 11

22.5.3 Signal generator source (level)

Pulses are only generated with active source.

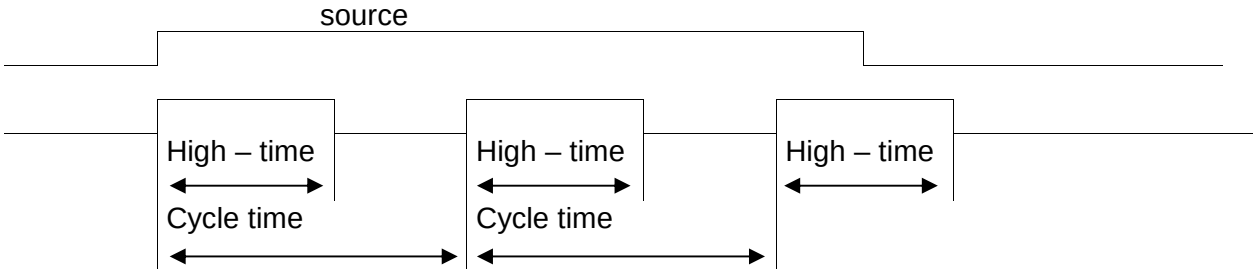


Diagram 12

22.5.4 Signal generator persistend

Pulse are generated independent of the source**.**

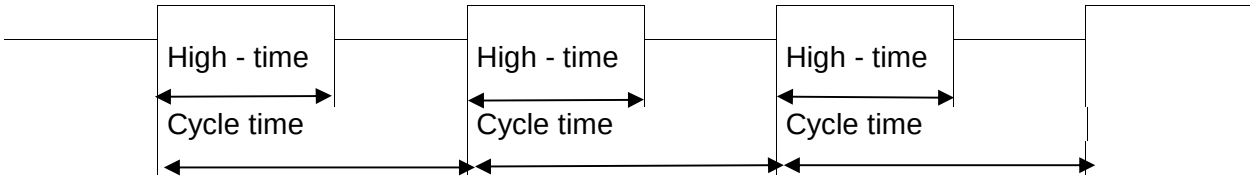


Diagram 13

23 Integrator

Edge counter
The edge counter counts the edges of a source (status input).
The type of edge can be positive or negative. A reset source can be activated to reset the counter.
Each status input (Digital Input) can also be used as counter input.

Integral
Module DIOT has two 16 bit counter inputs. The AADST and AMDZ modules also have counter inputs. The maximal number that this counter is able to reach is 65 535. The function “differentiator + integrator” can be used to prevent the overflow of the counter and pulses loss. In this mode the integral of a source is also done.

Operating hours counter
Increments the counter value each hour.

Adder
Adds the values of a source

Stop watch
Calculates the elapsed time between two pulses.

NOTE:
The measurement value of the integrator channel, (as displayed in the Top/LogMessage Configurator) is a type float and has a 7.5 digits precision. Internally the Message device it is calculating with data type double. Due to this fact rounding errors arise within the Top/LogMessage Configurator display.

23.1 Edge counter

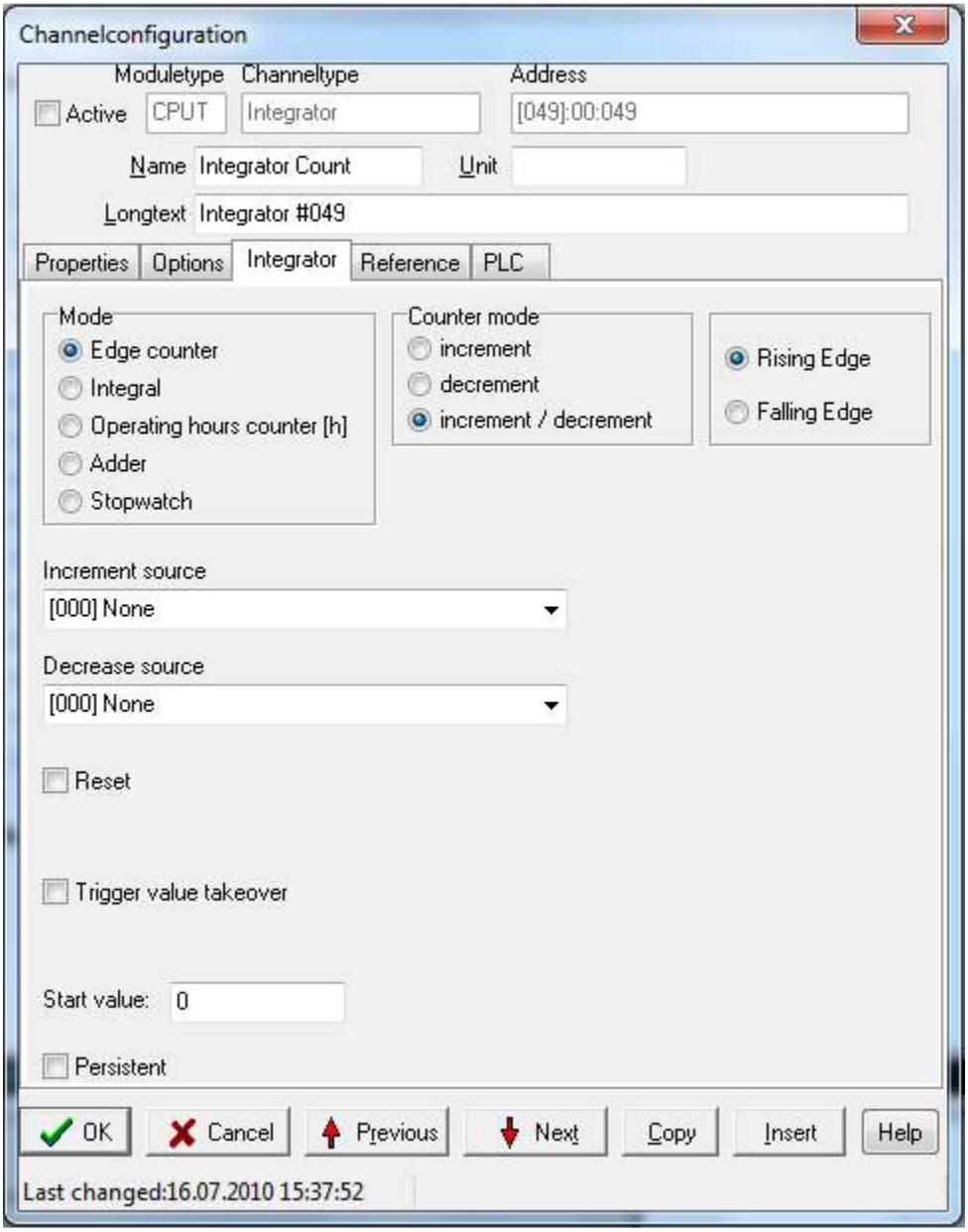
The edge counter counts the edges of a source (status input).
The type of edge can be positive or negative.

A reset source can be activated to reset the counter. If this source is a timer channel, i. e. a constant reset time is set, the result will be the pulses frequency.

Each status input can also be used as frequency input. (E.g. 24 channels of the module IOIT)

Remark:
The display value on the Top/LogMessage Configurator of the integrator channel has the data format float with an accuracy of 7,5 digits. The Device is internally calculating with the data format Double. This may causes some rounding errors on the display value.

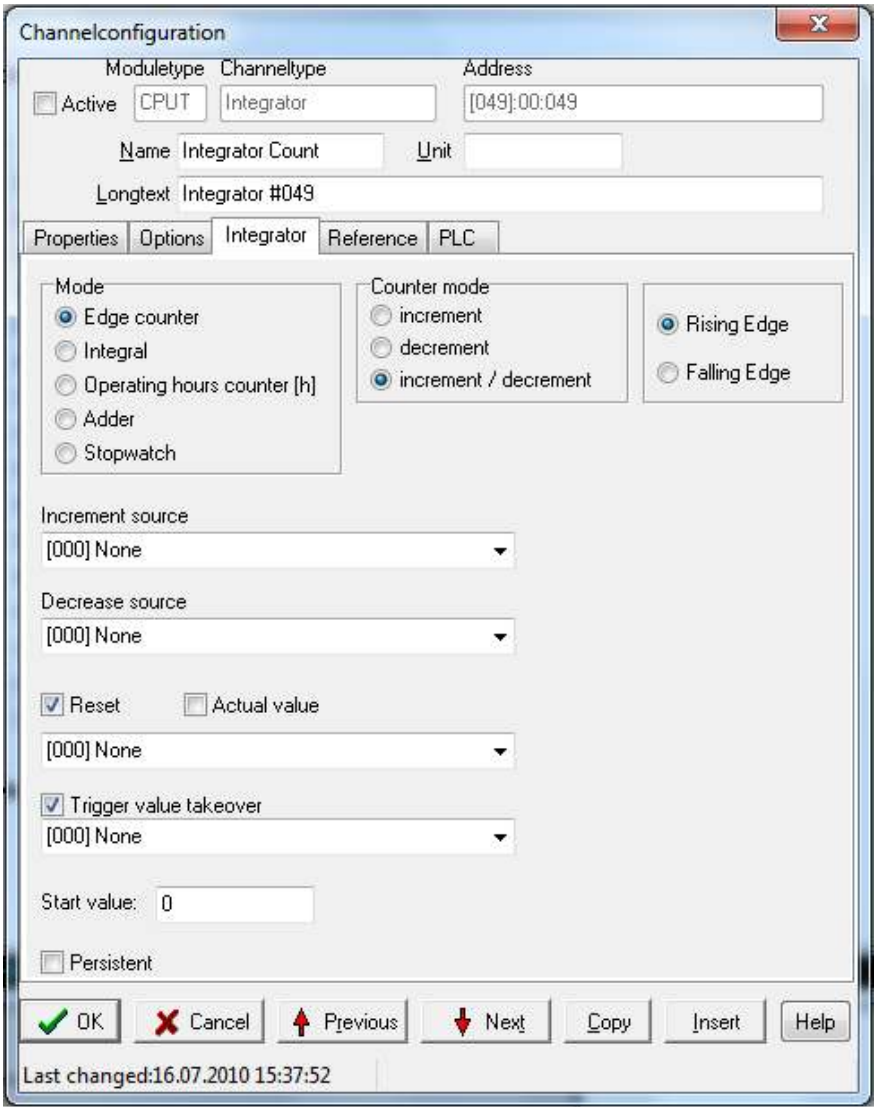
23.1.1 Counter mode



In the mode edge counter, signals can be counted easily (increasing and decreasing) or can be combined (increase/decrease). In each case the source of the increase (decrease) must be selected and the type of edge (positive or negative) must be configured.

23.1.2 Reset

With the Reset source the counter can be reset. If this source is a timer channel, i.e. a constant time interval is generated the result of edge counter channel will be the frequency of the pulses.



Actual Value
The “Actual value” function can only be activated in the “Reset” mode. If it is active, the channel will display online new values. If it is inactive, the channel will count internally, and will display the result only when it is reset.

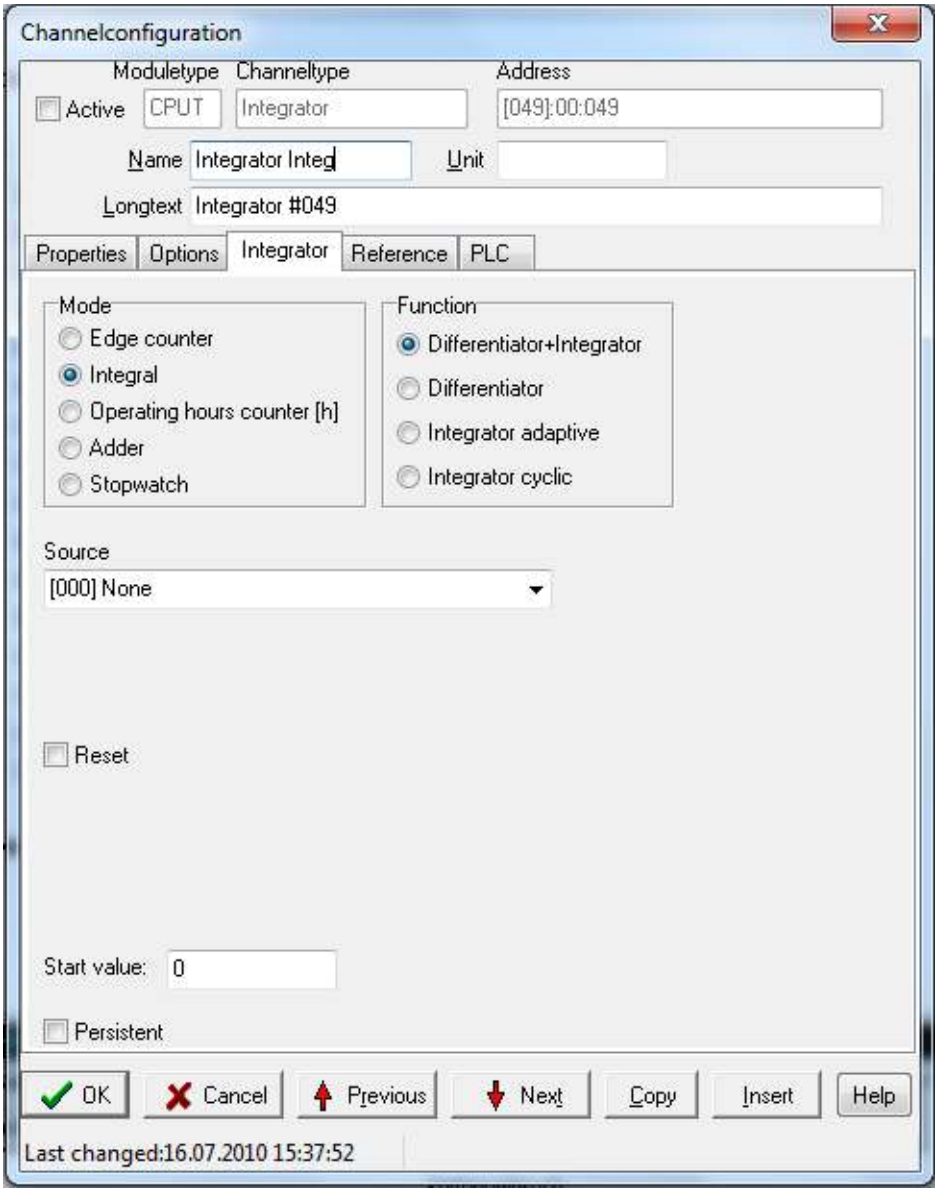
Persistent
When the “Persistent“ flag is set the result of the channel is stored and even after a power loss is retrieved after restart.

Trigger Value takeover
With this function you can have a separate trigger channel to update the reading of the integrator channel.

23.2 Integral

23.2.1 Differentiator + Integrator

Module DIOT has six 16 Bit counter inputs. The capacity of these counter amounts to 65.535 pulses. The “differentiator + integrator” channel is used to prevent pulses loss due to counter overflow. In this mode the differences between the current value and the last value of the hardware counter are added.



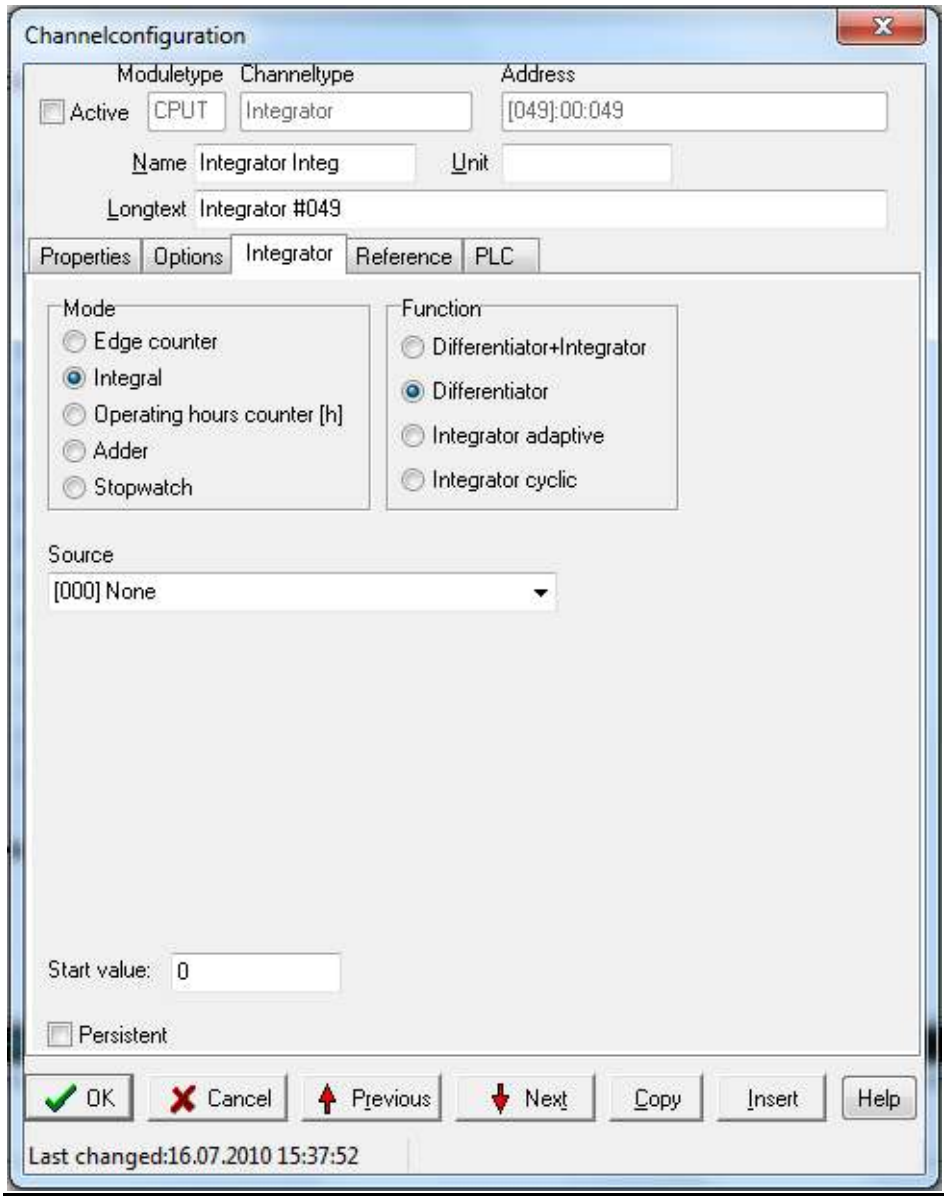
Example 1:

Source: 104 110 115 115 120 130 150 150 160.....65530 10 100

Channel: 0 6 11 11 16 26 46 46 56.....65426 65441 65531

23.2.2 Differentiator

Calculates the differences between the previous and the actual measurement value of the selected source channel.



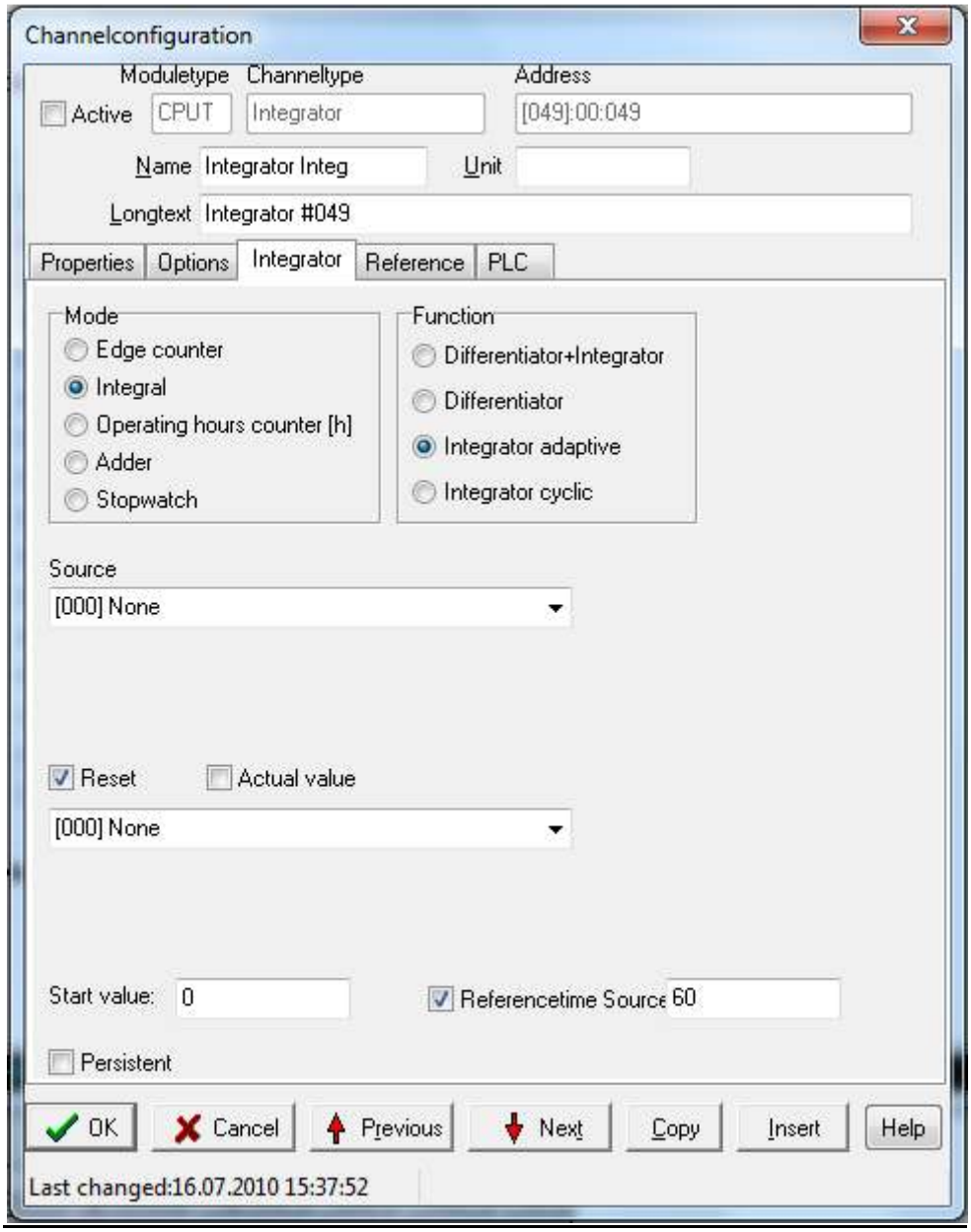
Example 2:

Source: *4 10 15 15 20 30 50 50 60 ... 65530 10 100*

Channel: *0 6 5 0 5 10 20 0 10 ... 10 15 90*

23.2.3 Integrator adaptive

The integrator will calculate the integral of a source, if the value of the source has changed.



In case the source reset is active, the integrator will return the value before reset (e.g. hourly values, daily values). It is recommended to use the time synchronized pulse generator (timer) as source reset for sec. and min. values. For the hourly, daily, weekly and monthly values the modus “Adder“ is recommended.

“Actual Value” can only be selected when the “Reset” is activated. The channel will update the reading after every integration step. If “Actual Value” is not selected the system will integrate internal but show no updated reading on the screen. It will show the final value after reset.

Reference source is the reference time of the unit of the source in sec. (see examples).

Example 1
Be the unit of the source litre/sec., the reference time should amount to 1 sec. and the source should supply permanently 1. If 1 sec. is integrated, the result will be 1 litre.

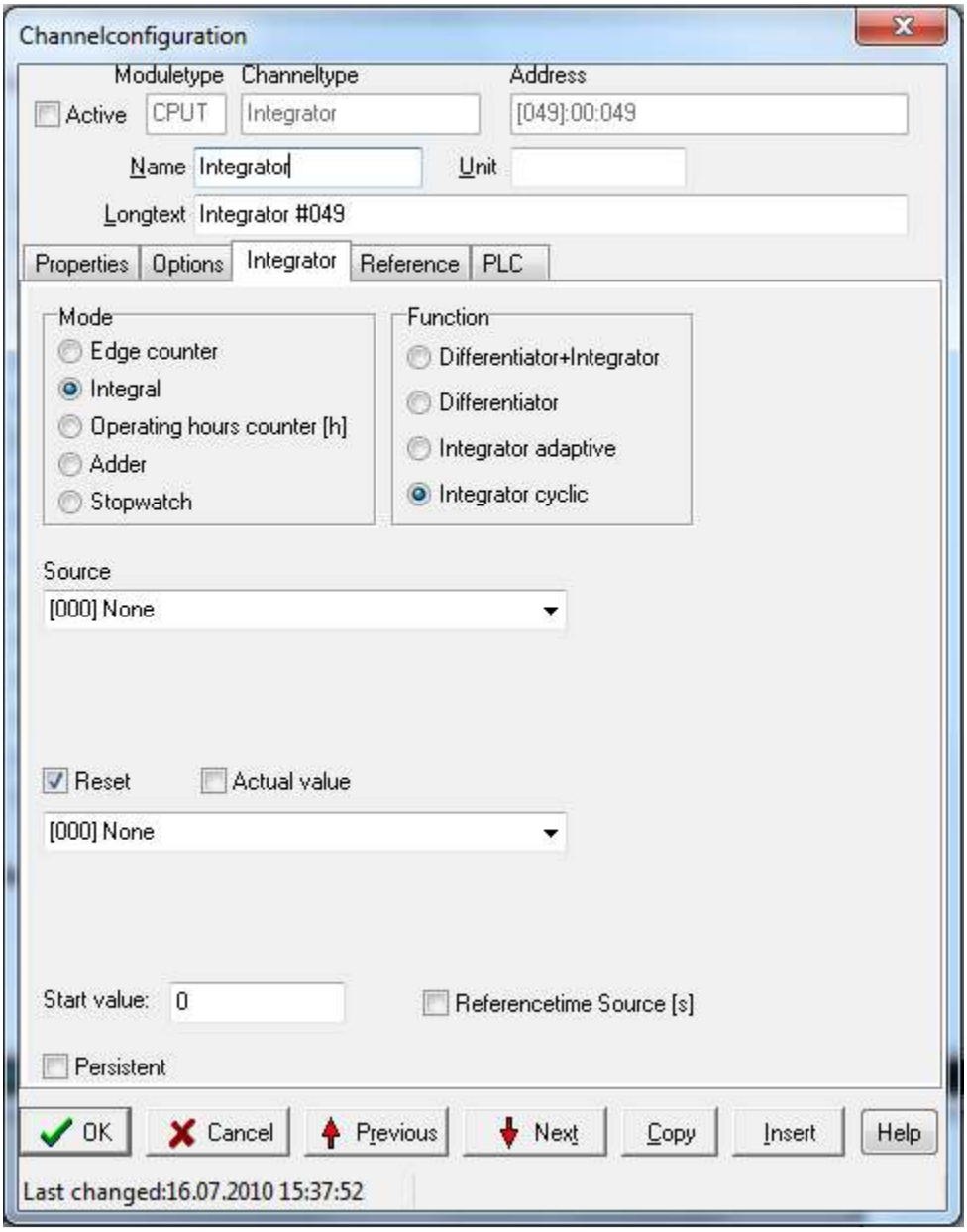
Example 2
Be the unit of the source litre/min., the reference time should amount to 60 sec. and the source should supply permanently 1. If 1 min. is integrated, the result will be 1 litre.

Example 3
Be the unit of the source litre/hour, the reference time should amount to 3600 sec. and the source should supply permanently 1. If 1 hour is integrated, the result will be 1 litre.

The “Present value” function can only be activated in the “Reset” mode. If it is active, the channel will supply the result after each integration step. If it is inactive, the channel will integrate internally, however, will supply the result, if it is reset.

23.2.4 Integrator cyclic

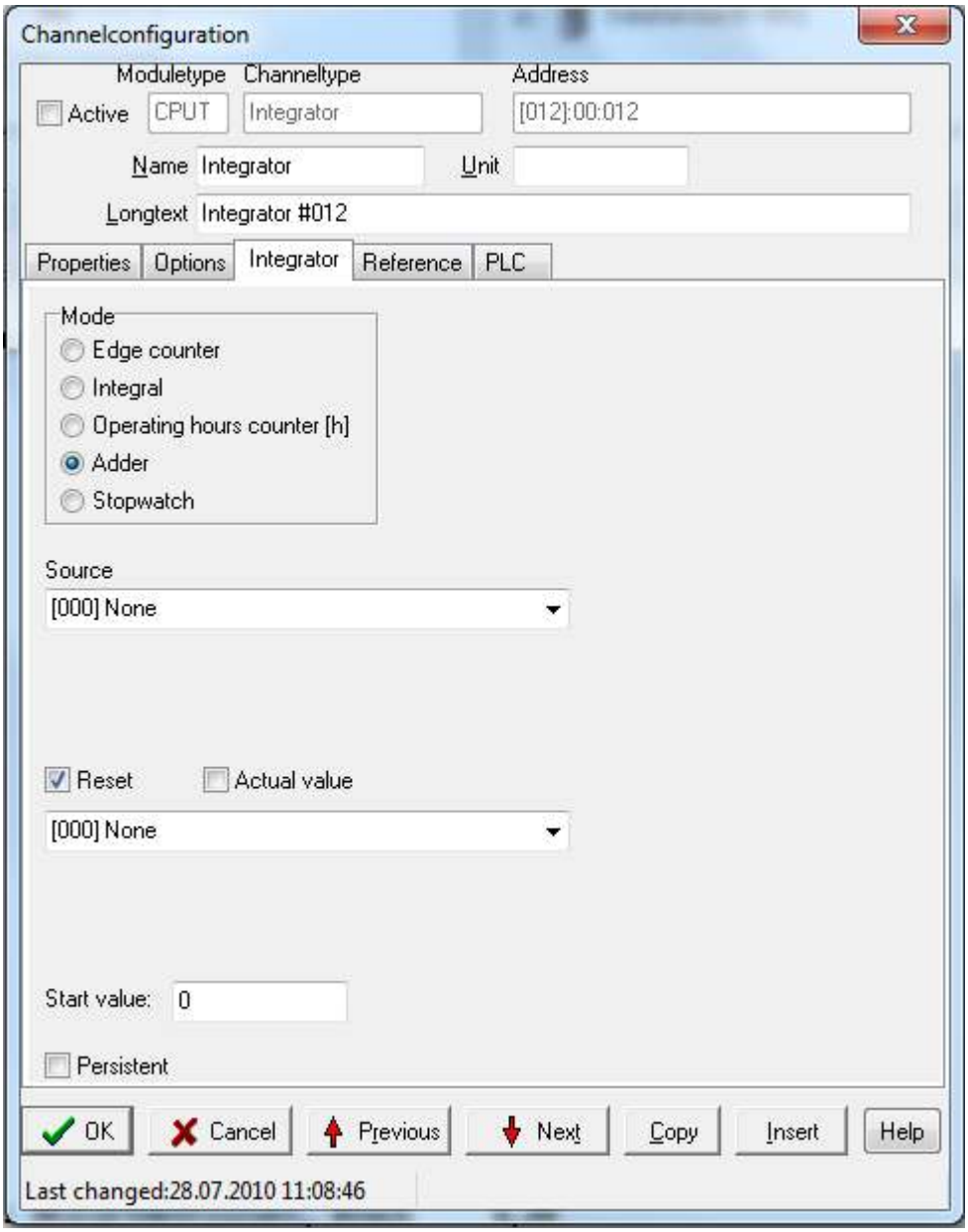
If a source changes slowly or never, it is likely that the integrator will calculate faulty results. For this type of source channels, it is recommended to use the “integrator cyclic“.



If “Reset” is active the integrator calculates the integral of the source every time.

If “start with edge“ is active the integral will only be calculated after the first positive edge of the source.

23.3 Adder



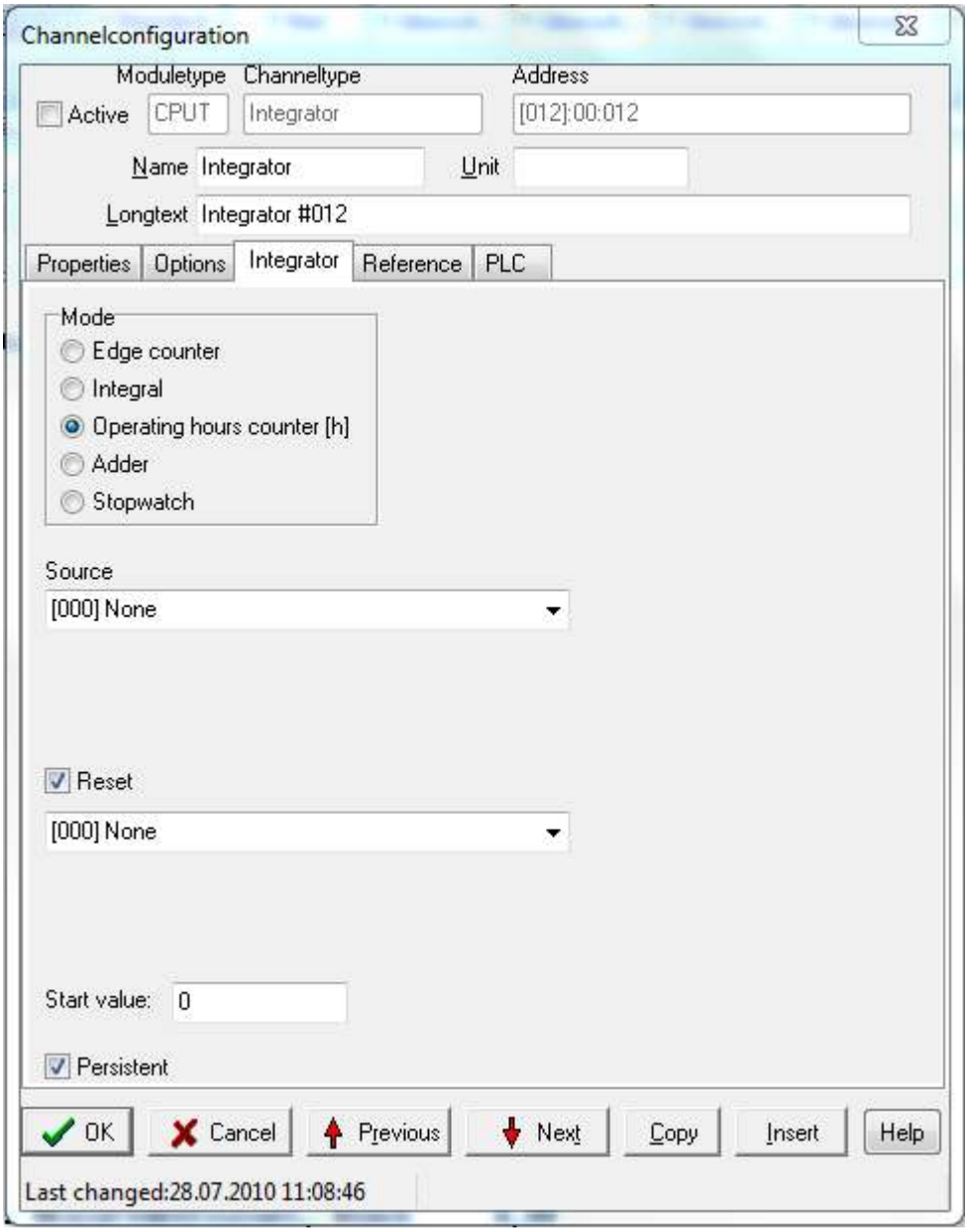
As upon integrating the amount of the complete integral is considerably higher than the part to be added, which is added with each change of the source resp. with each transit, it is recommended to avoid the rounding error, which is to say to sum up second values or minute values of the triggered “integrator adaptive” or the triggered “integrator cyclic”.

By that the summer adds the next part of the integral only when the source has changed. It is thus reached that bigger parts are summed up, so that errors that might arise upon adding of a very small to a considerably bigger number (several decades) are avoided.

Hourly, daily, weekly, and monthly values can be gained by triggering the adder through the corresponding pulse generator (timer) resp. alarm clock. As source for the hour adder the (triggered) sec. and min. integrator resp. „integrator permanently“ can be taken. On the other hand the hour adder can serve as source for the day adder etc..

The “Present value” function can only be activated in the “Reset” mode. If it is active, the channel will supply the result after each integration step. If it is inactive, the channel will integrate internally, however, will supply the result, if it is reset.

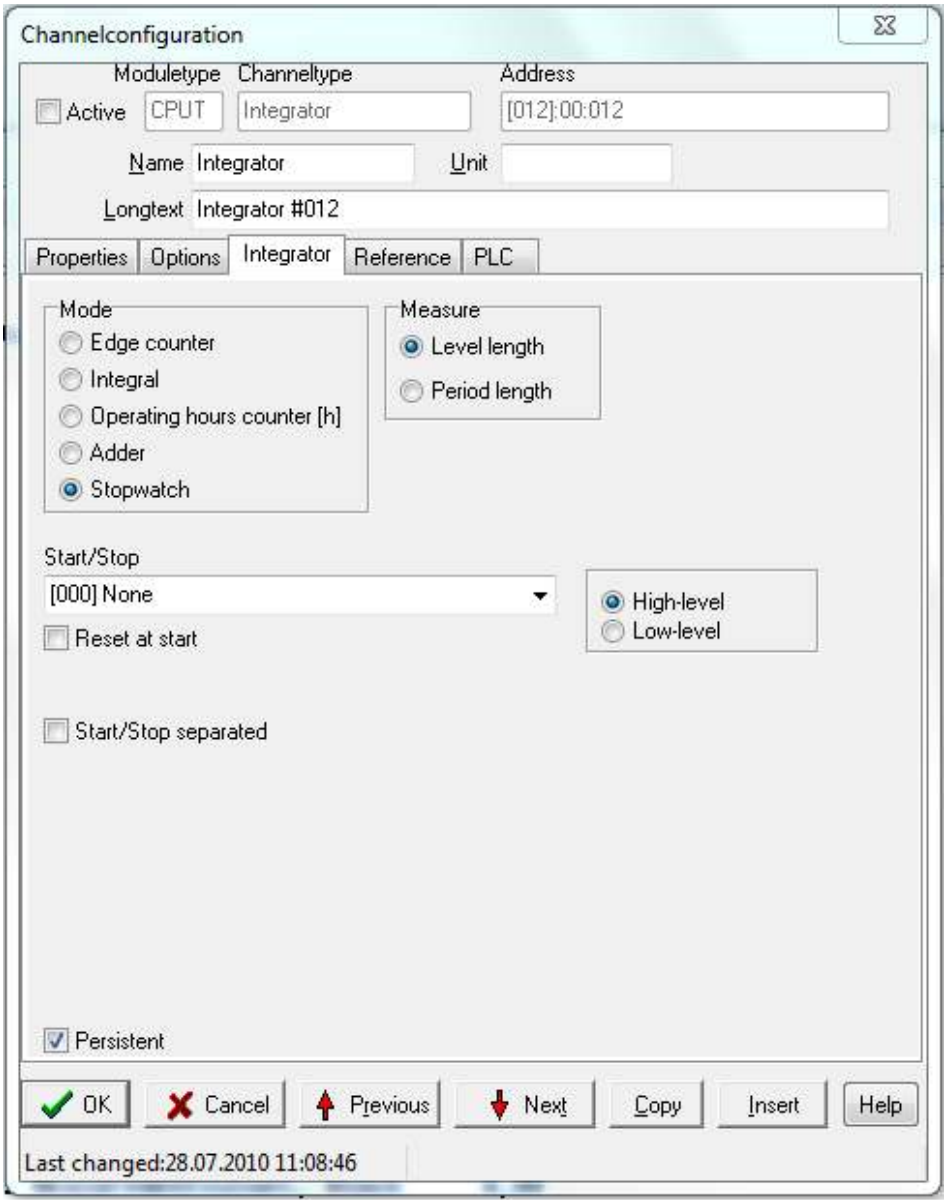
23.4 Operation hours counter



Is the source 1 hour on High, the operation hours counter calculates 1. When you record short time periods (e.g. minutes) it is recommended to change the display to more decimal place to see the readings.

In the case of the active “Reset” function, the operation hours counter will be set on 0 at each rising edge of the “Reset source” channel.

23.5 Stop watch



The difference in time between two signal edges (optionally from one or two signal sources) can be calculated in this mode. The resolution is in milliseconds, the error < 100ms.
Furthermore there is the possibility to calculate the pulse duration of a signal.

Level Length: Will calculate how long the source channel is staying high or low.
Period Length: Will calculate the time between two rising or falling edges.
Reset at start: Sets the measurement value at start to “0“.
Retrigger: Restarts the stop watch with a start edge. This function is only available when Start and Stop pulse are coming from separate source channels.

24 Set point channel

The set point generator allows to generate **set point curves**. The set point curves can be used internally and externally. Externally the set point courses can be put on analog outputs so that external devices like regulators etc. can be controlled. Internally it is possible to integrate the set point courses in many other functions. Set point courses can be shown to the operator on the screen (like other channels).

Sequence controls
With these up to 16 digital outputs can be switched time dependent and dependent on other conditions (sequence controls).

24.1 Configure set point channels

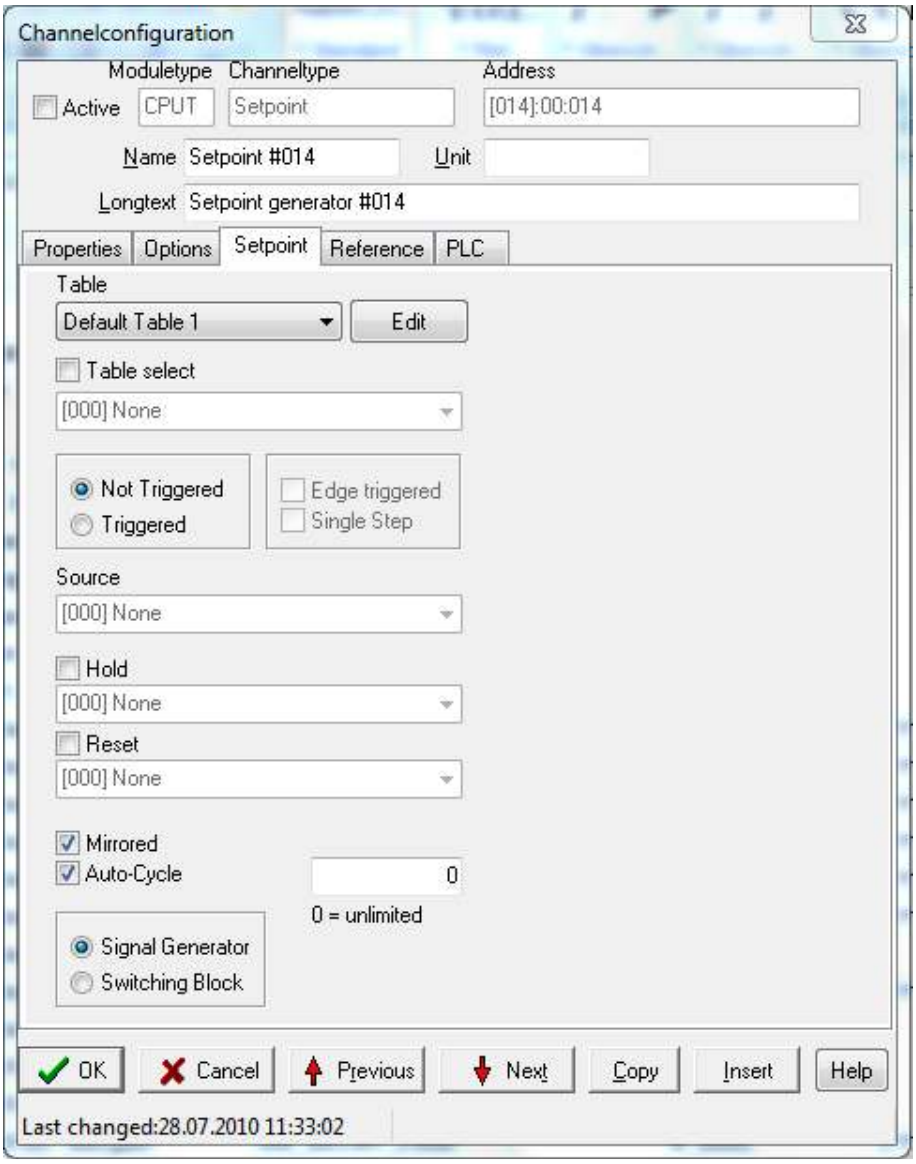
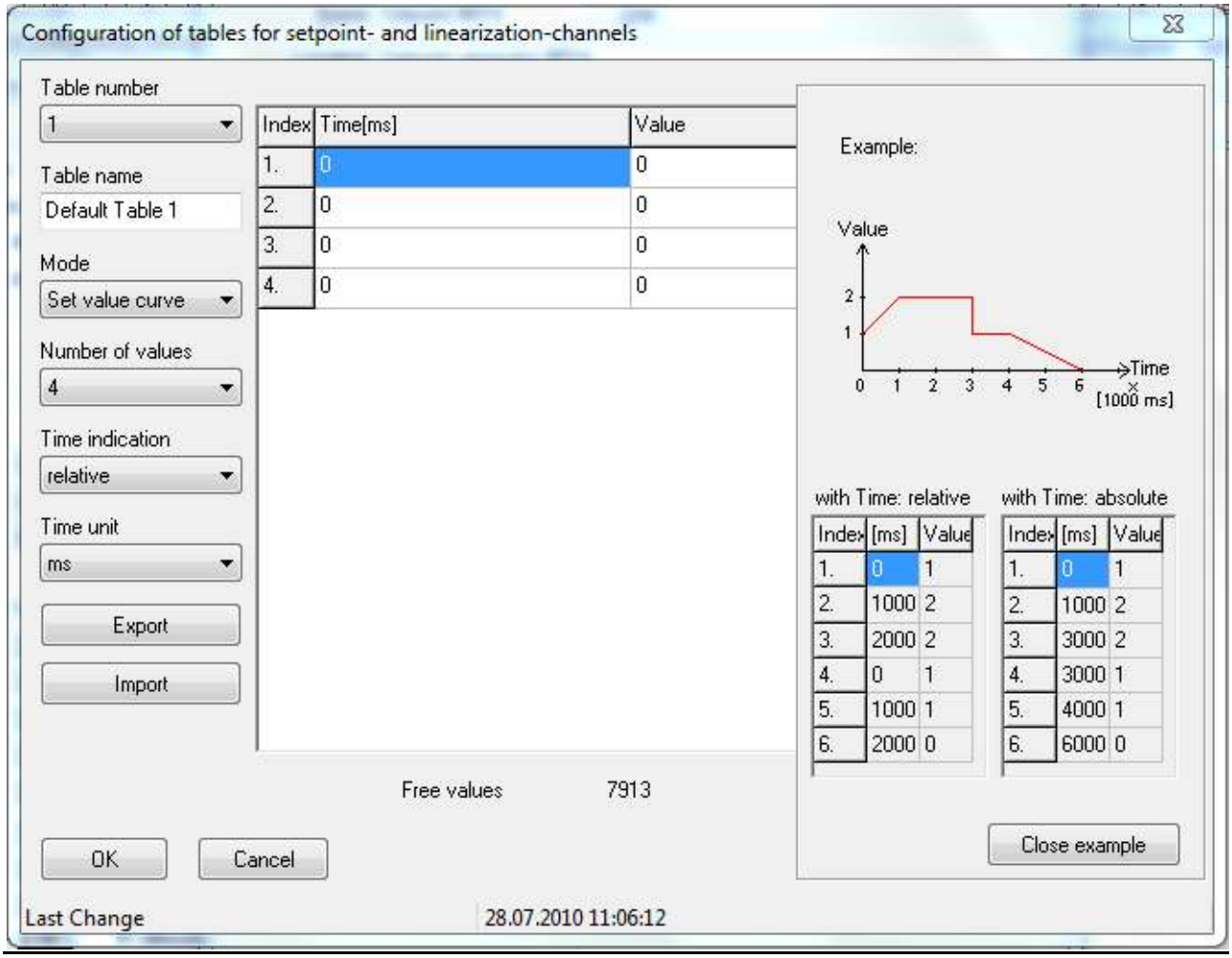


Table number
You can configure max. 72 set point curves. Each set point curve has its own value table. Through the „table number“ one of the 72 set point curves is selected. However you can also select the table automatically through an internal channel of the device. For this you need to activate “table select” and the table number of this channel will automatically load this corresponding set point table . This is practical if you want to play different set point tables depending on the control or test you are performing.

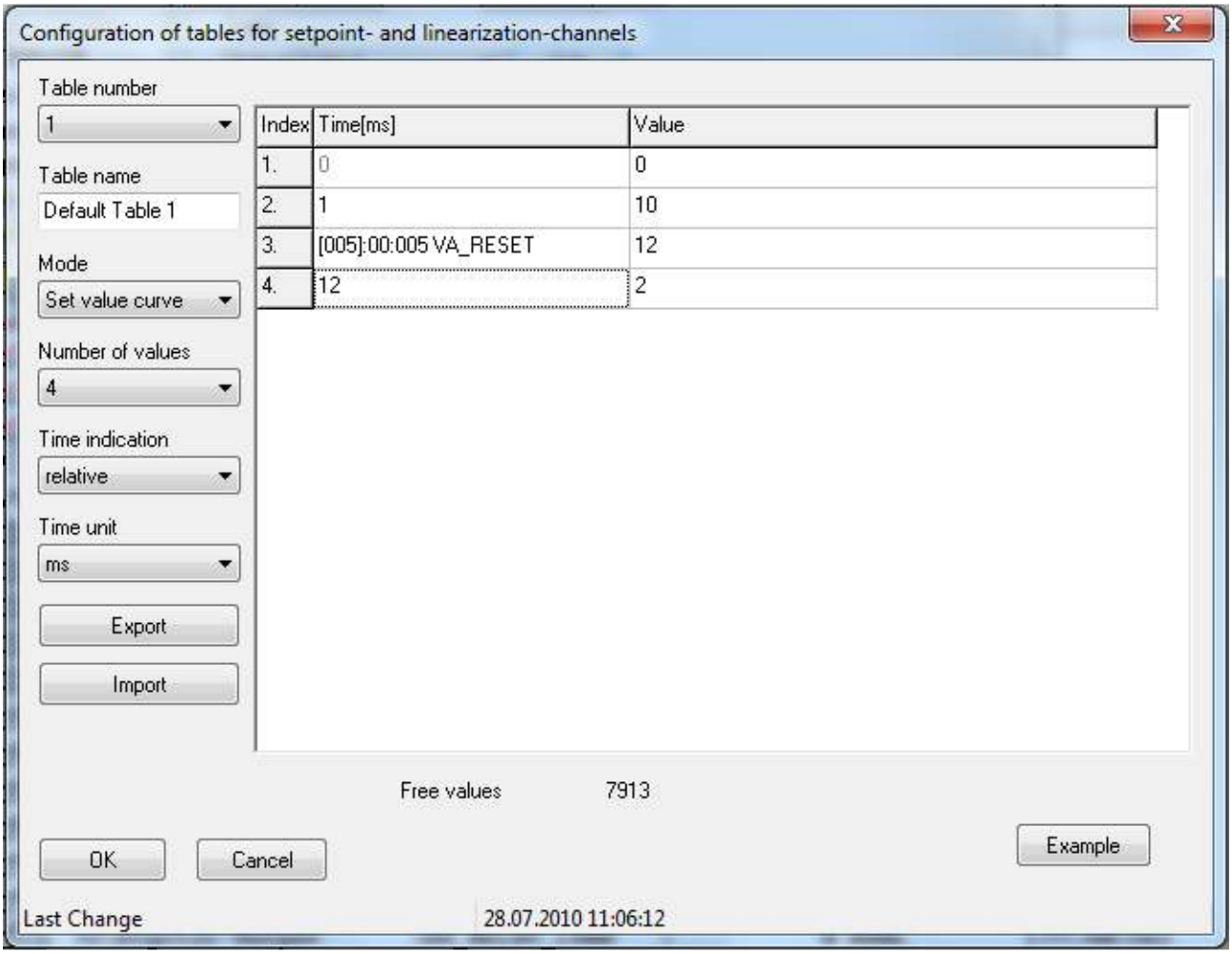
Input of set point table values

- Click on icon “EDIT” in the configuration dialog.
- Enter name of table (not necessarily required).
- Select “set point curve” as mode.
- Define number of values.
- Select relative or absolute indication of time.
  (See. „example“ in table configuration).
- Adjust the required unit of time duration
  (Millisec., sec., minutes or hours).
- Enter values and time duration.
- Press „OK“.



Note:
If the time indication has the setting “absolute”, it is required that the time values are increasing with every line. The system allow to input smaller values than the previous one. If you do so the following error message appears: “Invalid value in line (number), column 1“.

When the time indication is set to “relative” the system also allows to define the time basis through a another internal source channel. When the source is bigger than 0, the set value channel assumes the corresponding value. That gives you the ability to dynamically control the time basis on the set point curve.



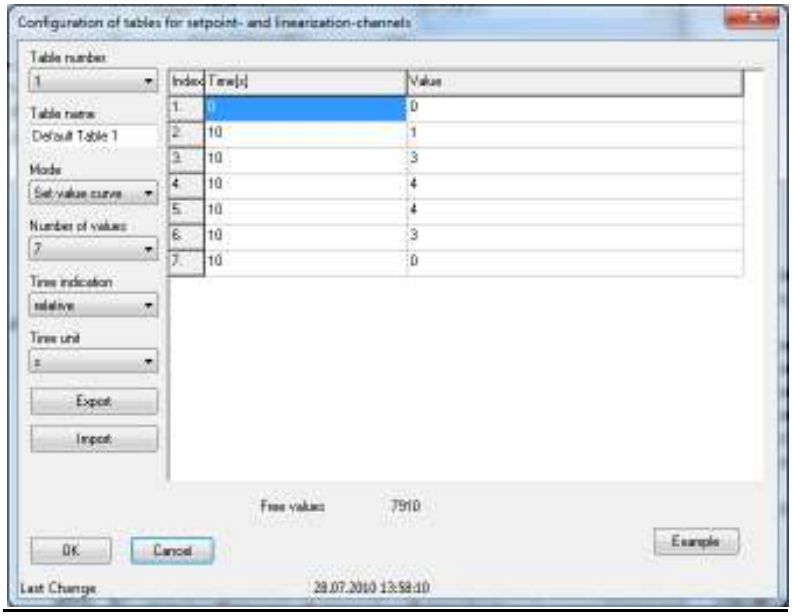
The table can be stored in ASCII format clicking “Export“ with a tabular separator between the columns “time“ and “value“.

Such table can e.g. be loaded by EXCEL. With “Import“ a table generated in e.g. EXCEL can be load into the device.

7922 free storage locations are provided in 72 different tables.
The number of free locations is shown under the table (“Free table vales”)

24.2 Signal generator

There are different settings available to start and reset and the signal generator channel. In the following the different configuration options will be explained.



24.2.1 Auto cycle – not triggered

The set value curve is being generated continuously and independently from the source immediately after the Message device is powered up.

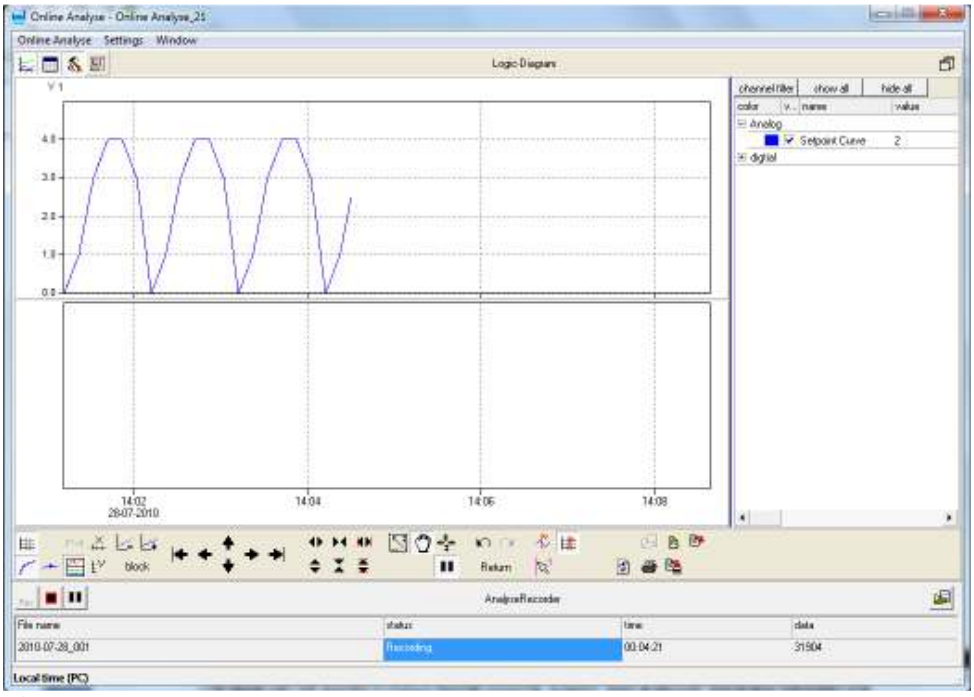
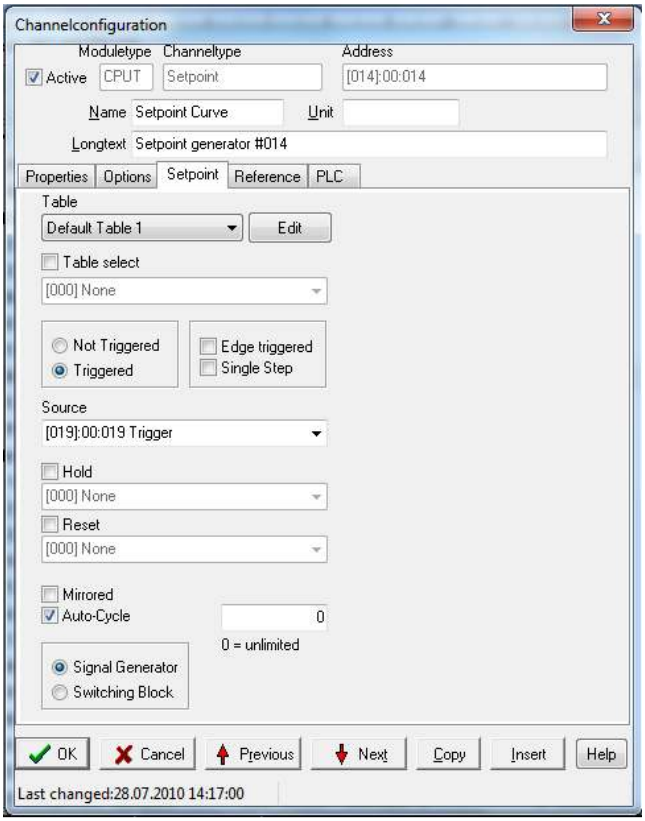


Diagram 1

24.2.2 Auto cycle – triggered

When the trigger channel is high the set point curve will be started. The set point curve will also start to play when the device is powered up and the source channel is already high.



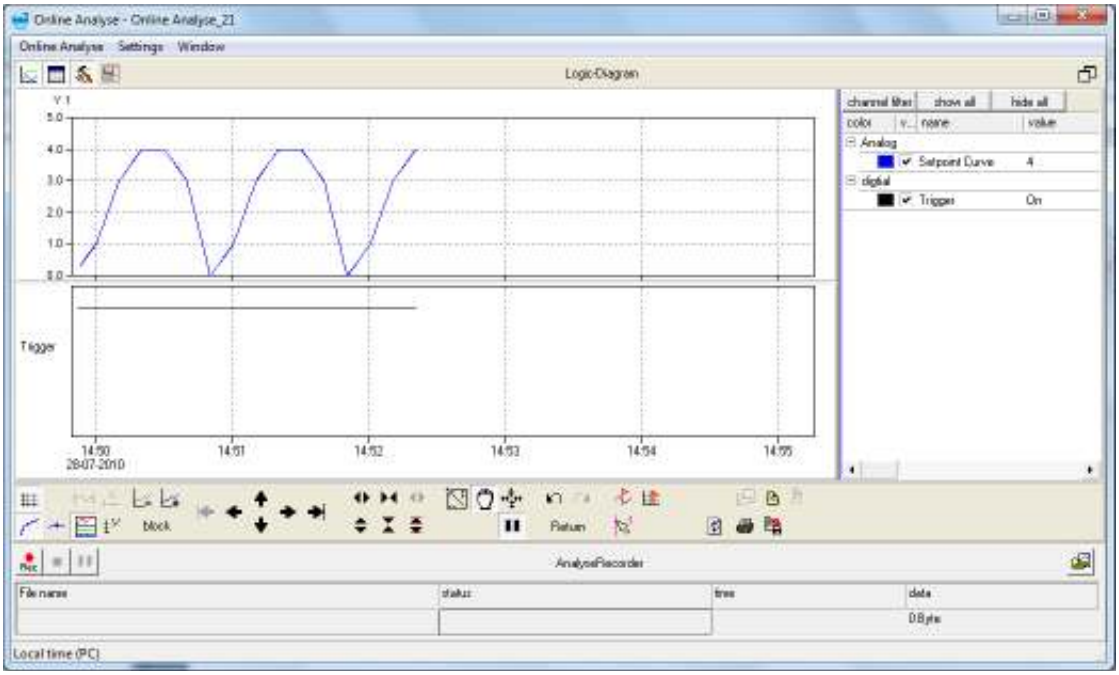
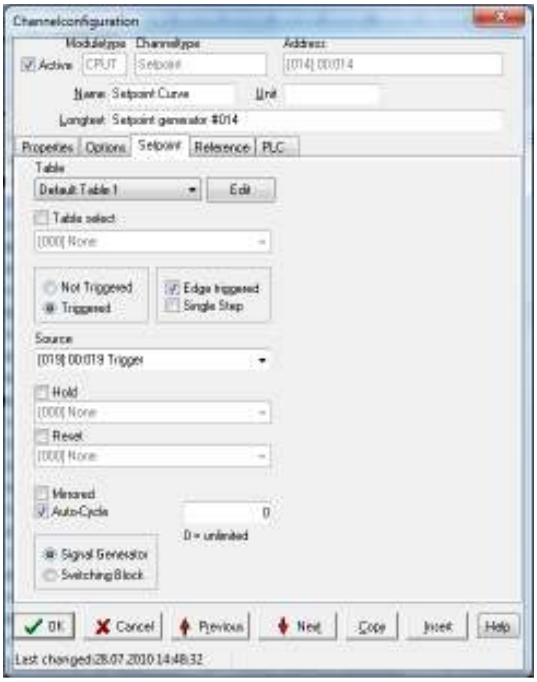


Diagram 2

24.2.3 Auto cycle – edge triggered

When the check box “Edge Triggered” is activated the set point curve will only start if the trigger channel has an rising edge.



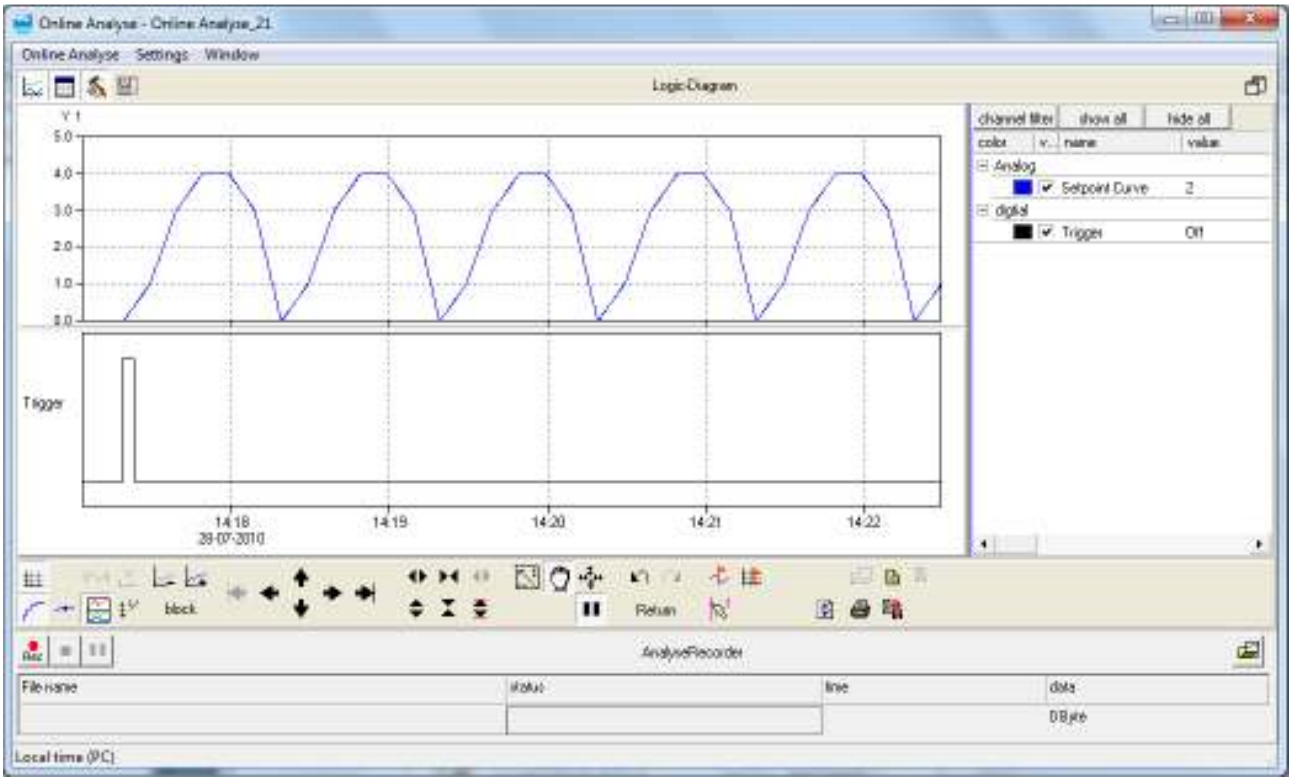
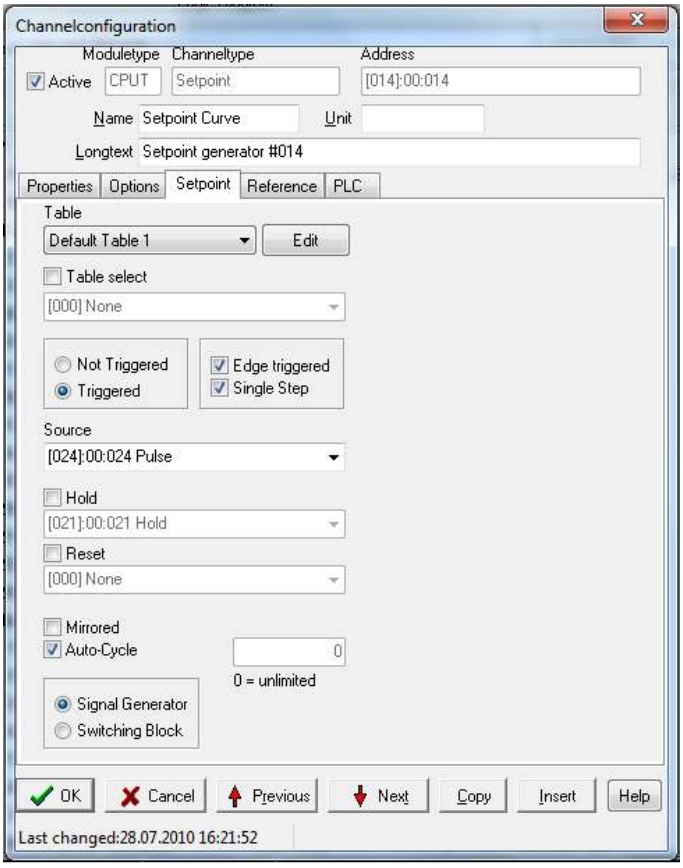


Diagram 3

24.2.4 Auto cycle – edge triggered + single step

With the function “single step” the set point curve is played back in steps. Whenever the source channel is rising to high the next step of the curve is running. Here in this example the source channel is a timer with a 15 sec pulse cycle time.



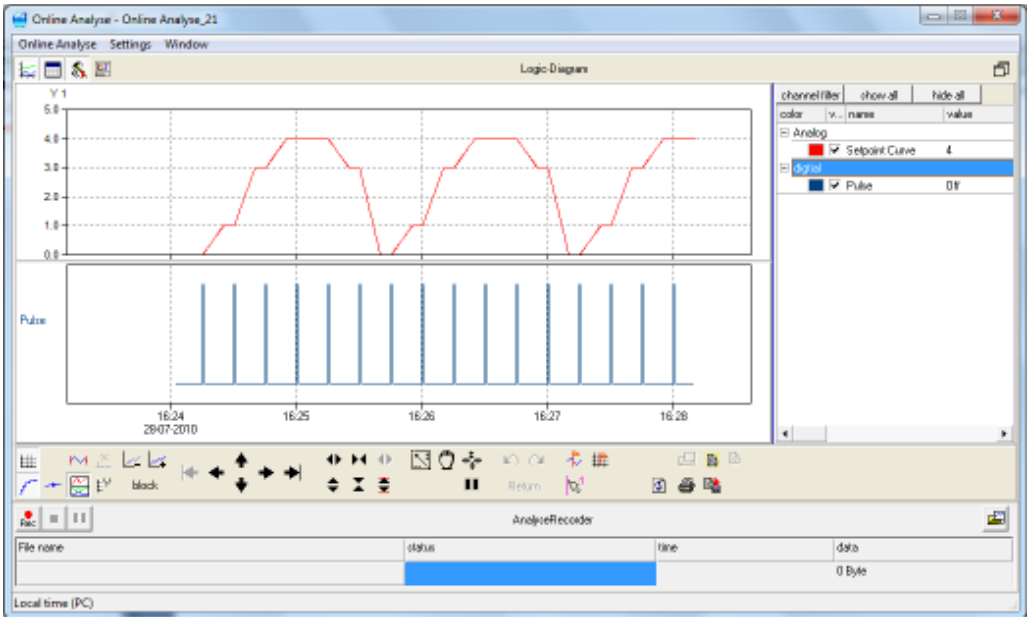
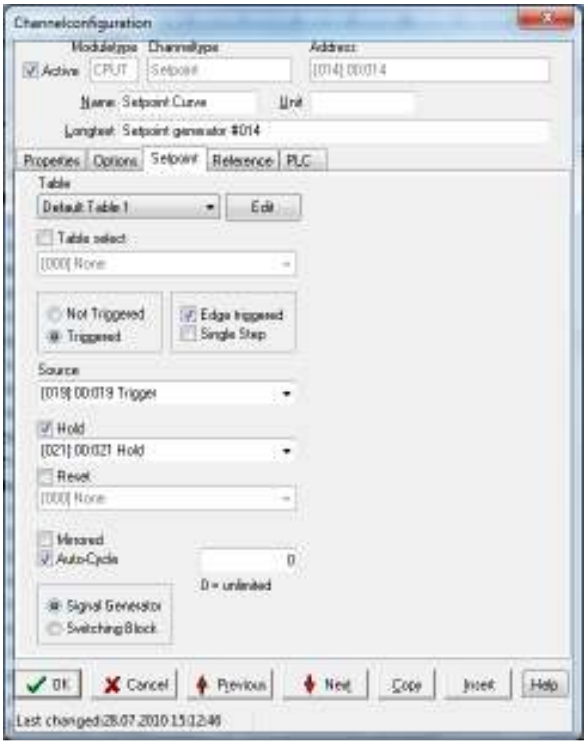


Diagram 4

24.2.5 Auto cycle – edge triggered + hold trigger

The set point curve can be stopped with a separate “Hold” trigger channel. When the hold trigger channel is high the set point curve is stopped and will restart when the hold trigger is back to low.



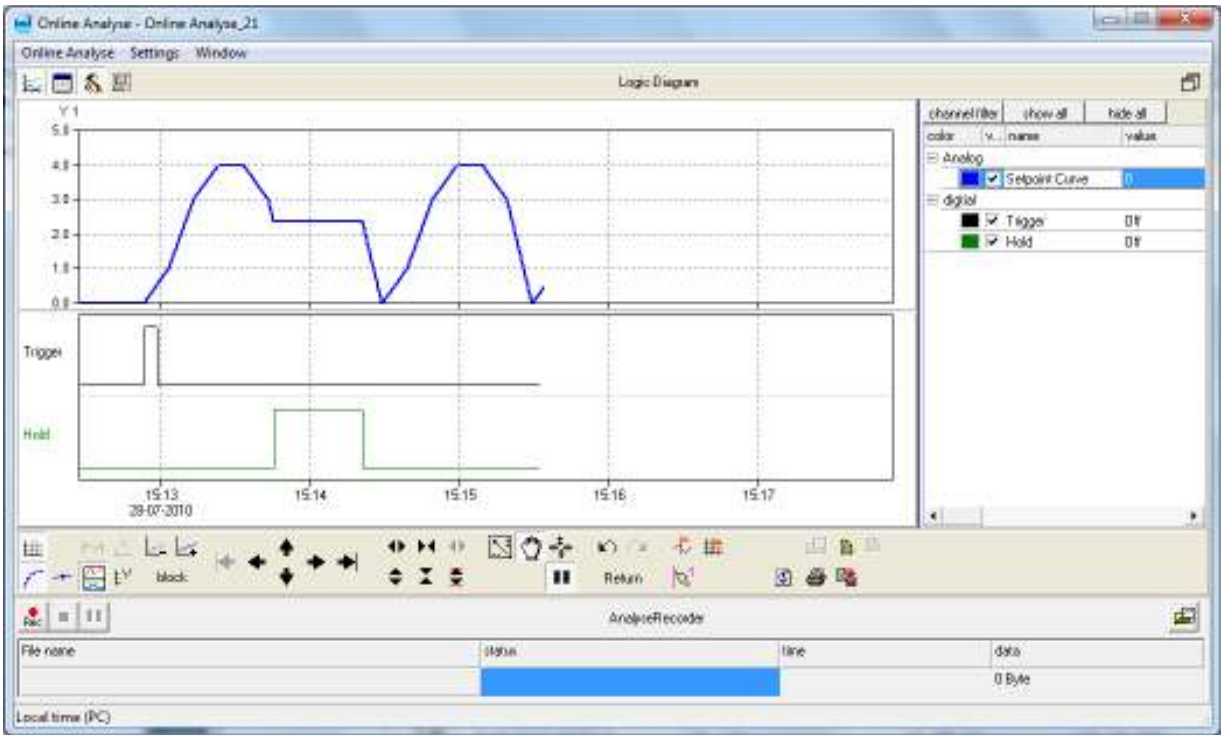


Diagram 5

24.2.6 Mirrored function

With the mirror function the set point curve will be played in mirror mode.

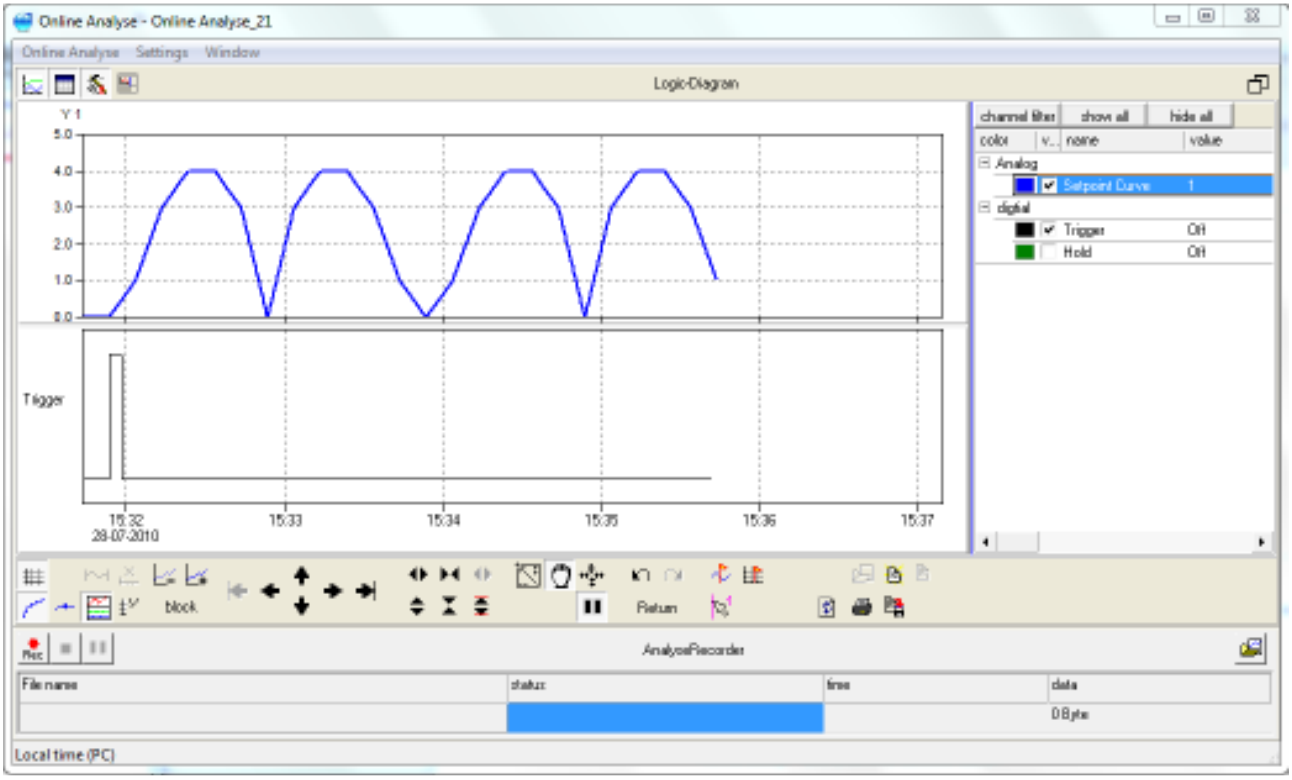
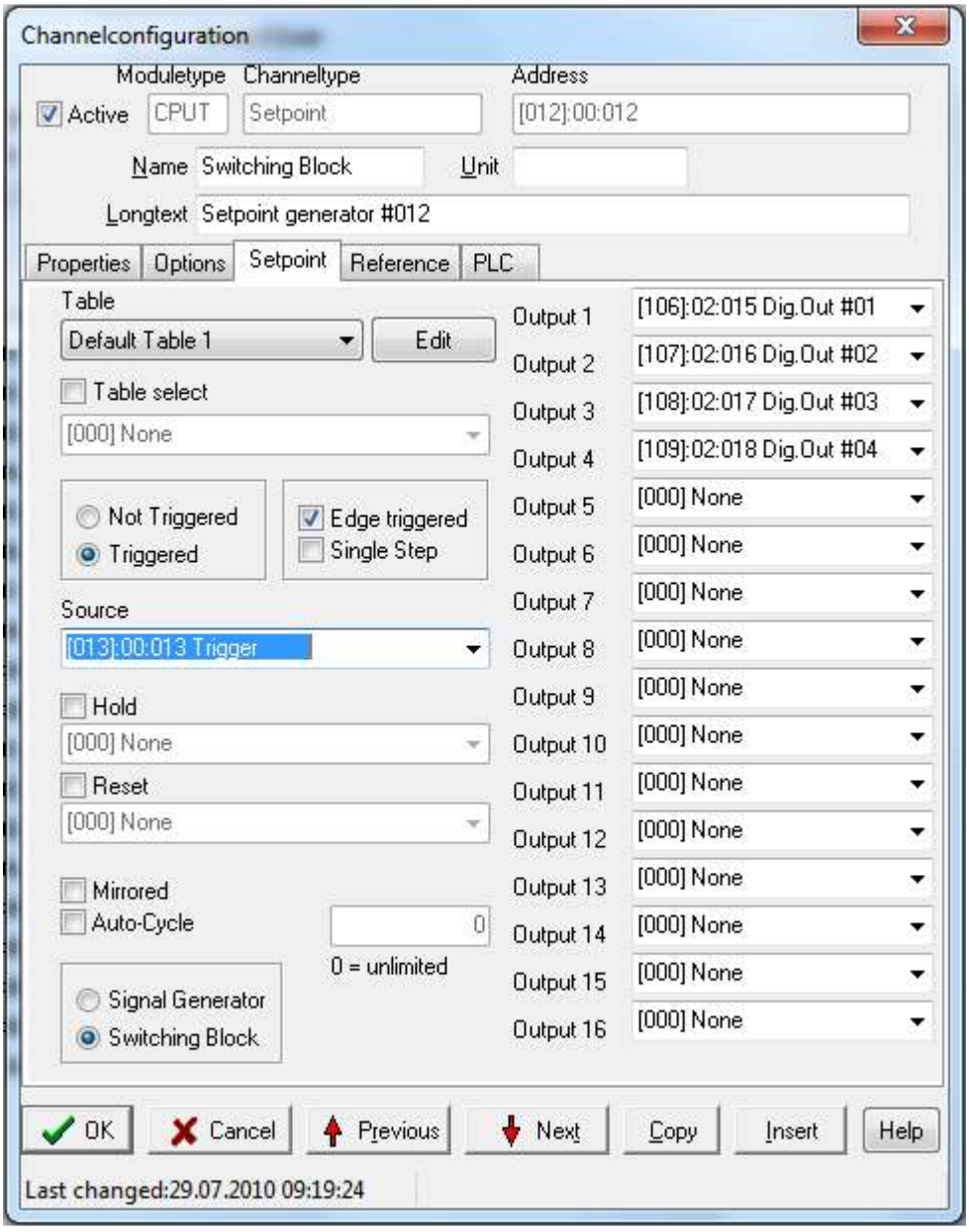


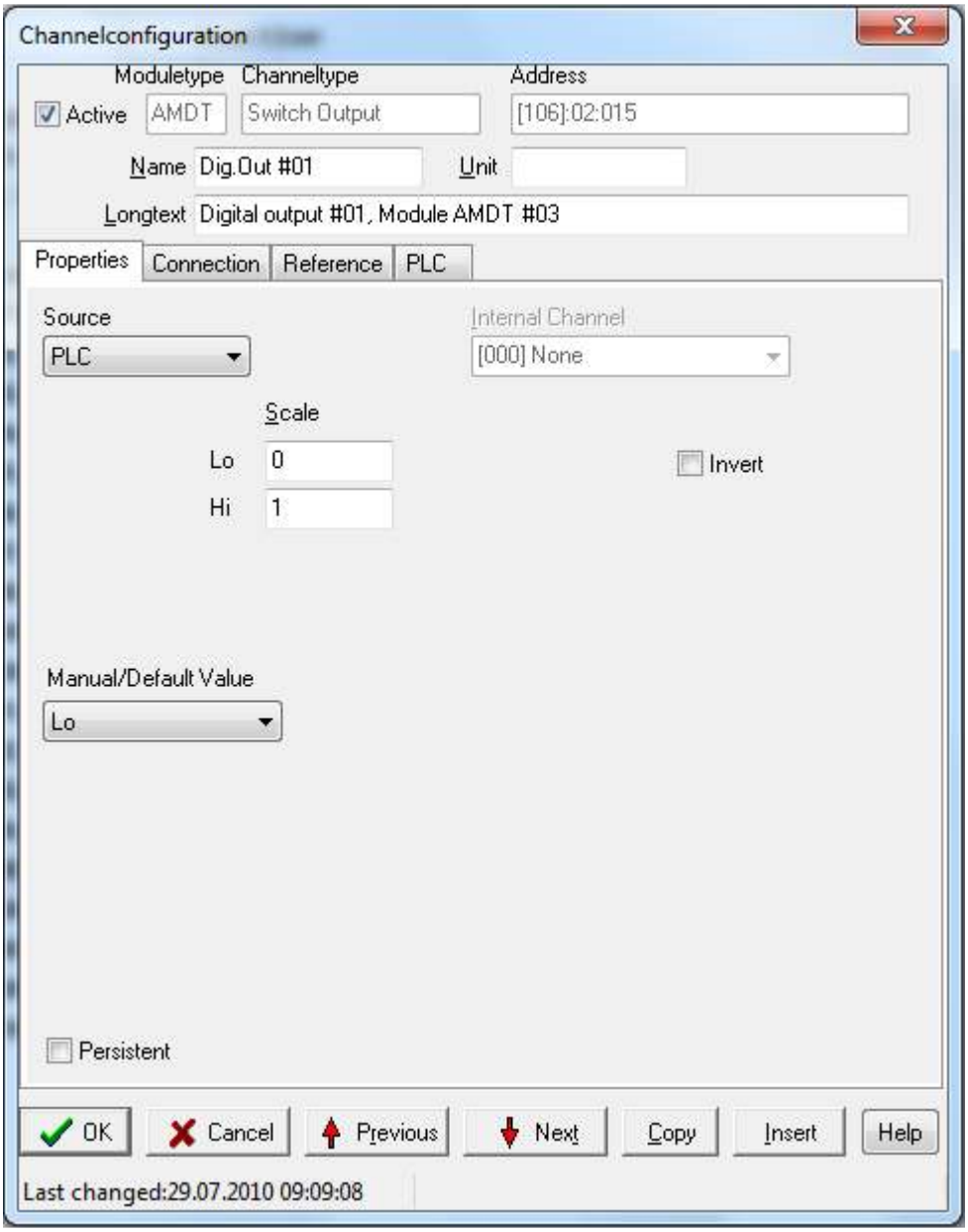
Diagram 6

24.3 Switching block mechanism

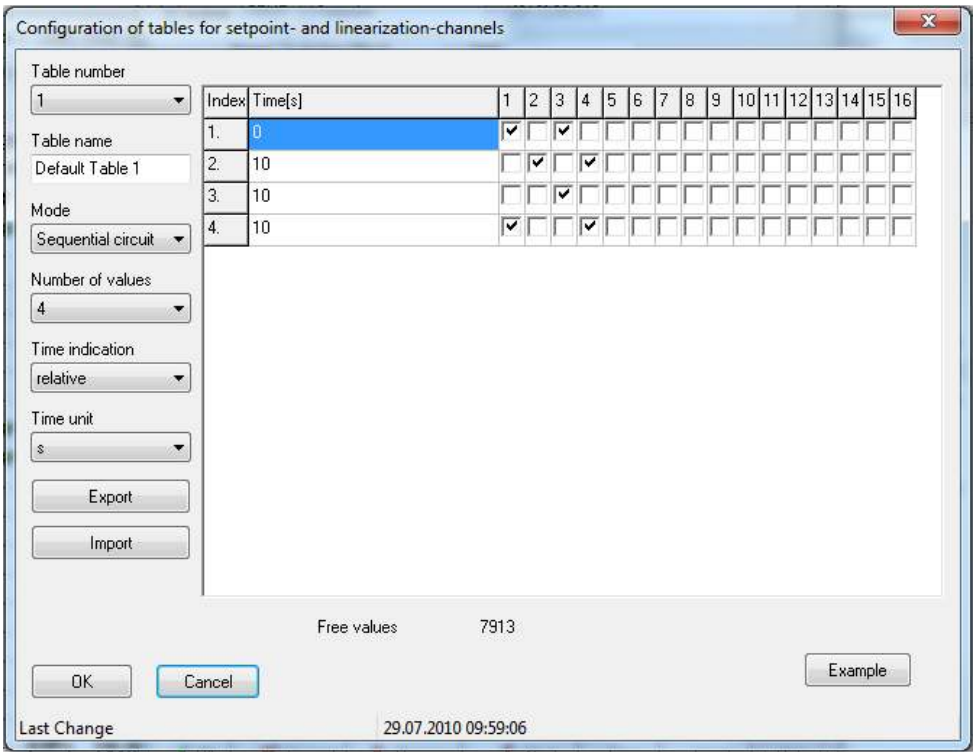
In the mode “Switching Block” up to 16 adjustable outputs are controlled corresponding to the Bit pattern (set and reset).



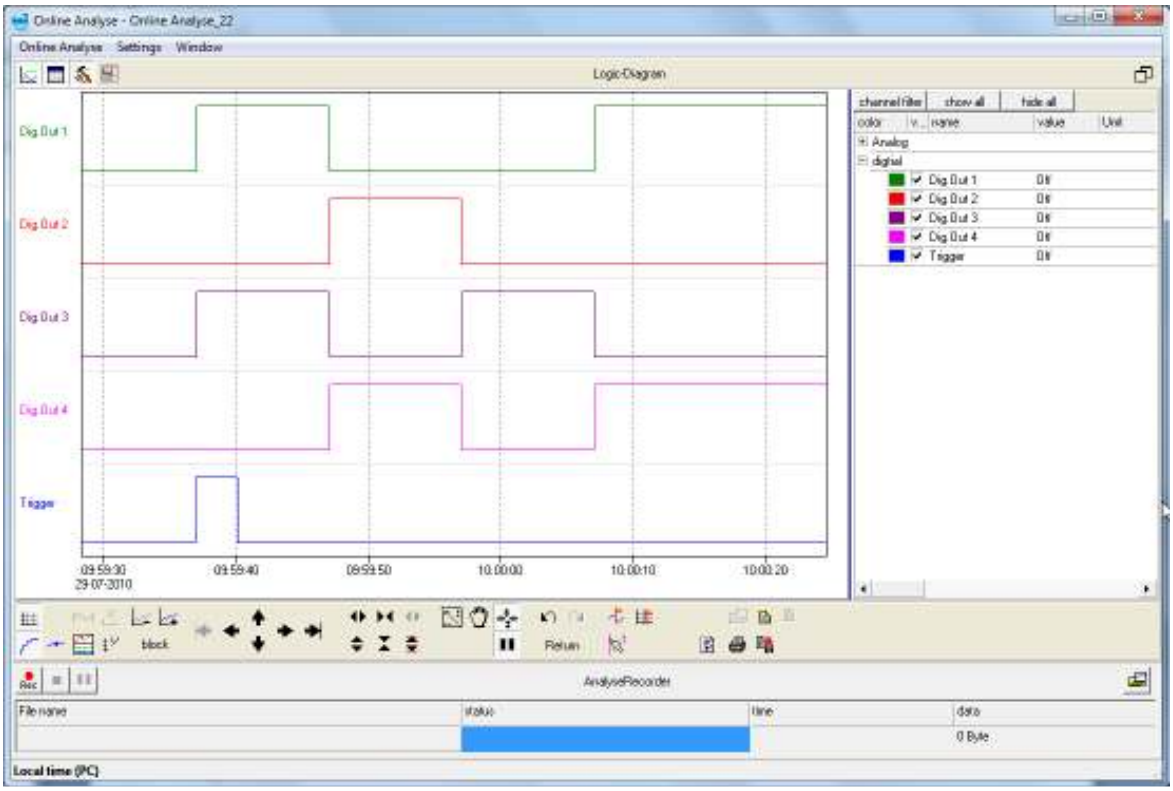
Remark:
In order to set a digital output for the “Switching Mode”, the channel configuration of the digital output should be set „PLC“. Only one switching channel should be linked to one digital output. If there is more than one snitching channel related to one digital output an error message “Config Error” occurs.



In order to configure a Bit pattern the table mode should be changed to “Sequential circuit“.

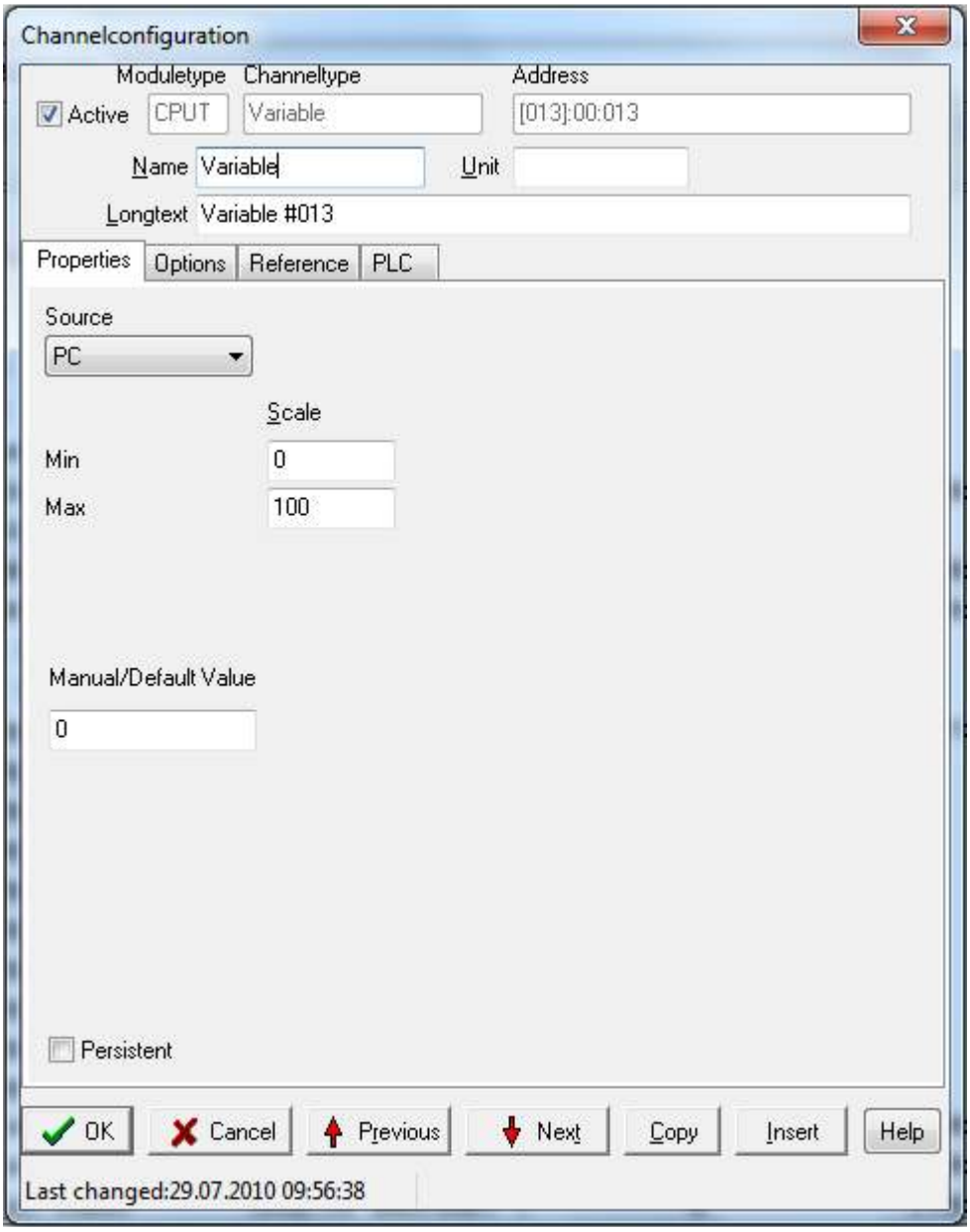


The following diagram shows the switching status of the 4 digital outputs according to the Bit pattern configured above. A trigger source is used to start the switching.



25 Variable

Variable channels are required if you want to feed parameters from ProfiSignal applications into the Message device. The variable channel is storing the parameters which can be used as input for other virtual channels also.

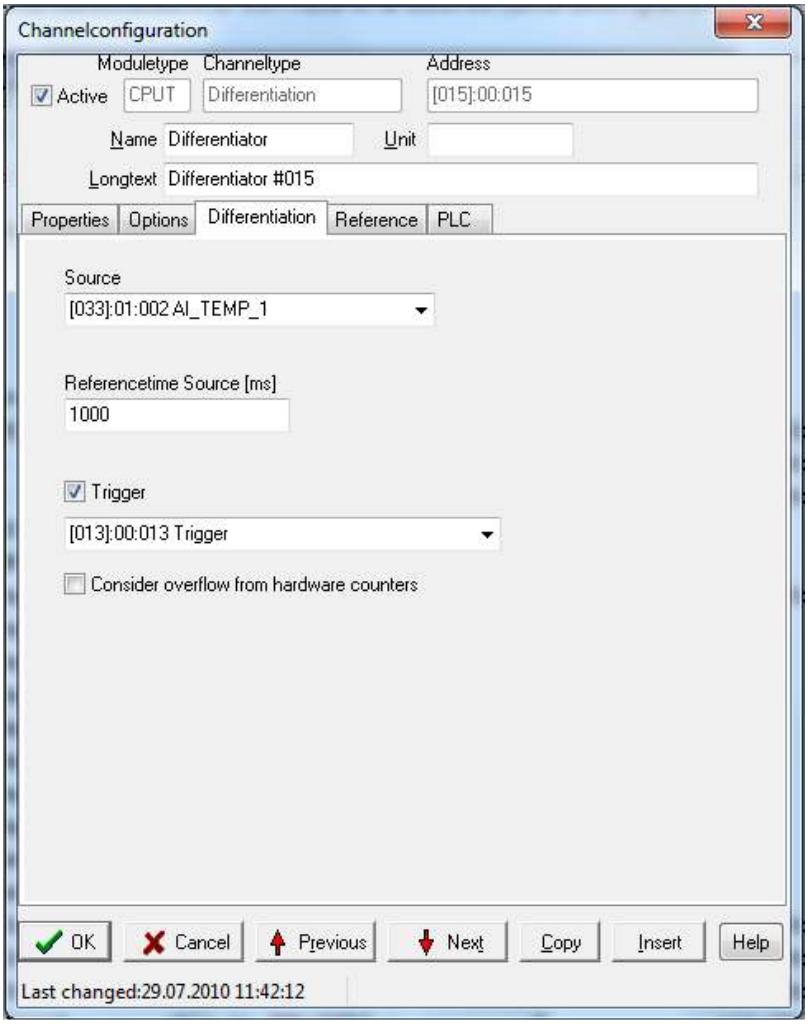


There are three different functions settings available

PC	This function is required to link the channel to ProfiSignal applications and to feed parameters from the application to this channel.
PLC	no function
Manual	With this function a constant value can be stored in the variable channel

26 Differentiator

The differentiator channel calculates the derivate of a source (alteration per time).



If a source has measurement unit “quantity“ and is derived, the unit of the differentiator channel will be “quantity/time“. This is exactly the opposite of integrating.
The unit is entered in the field “time basis-source (ms)“.

Example 1: *If 1000 ms are set under “time basis-source (ms)“, the unit will be “quantity/sec.“*

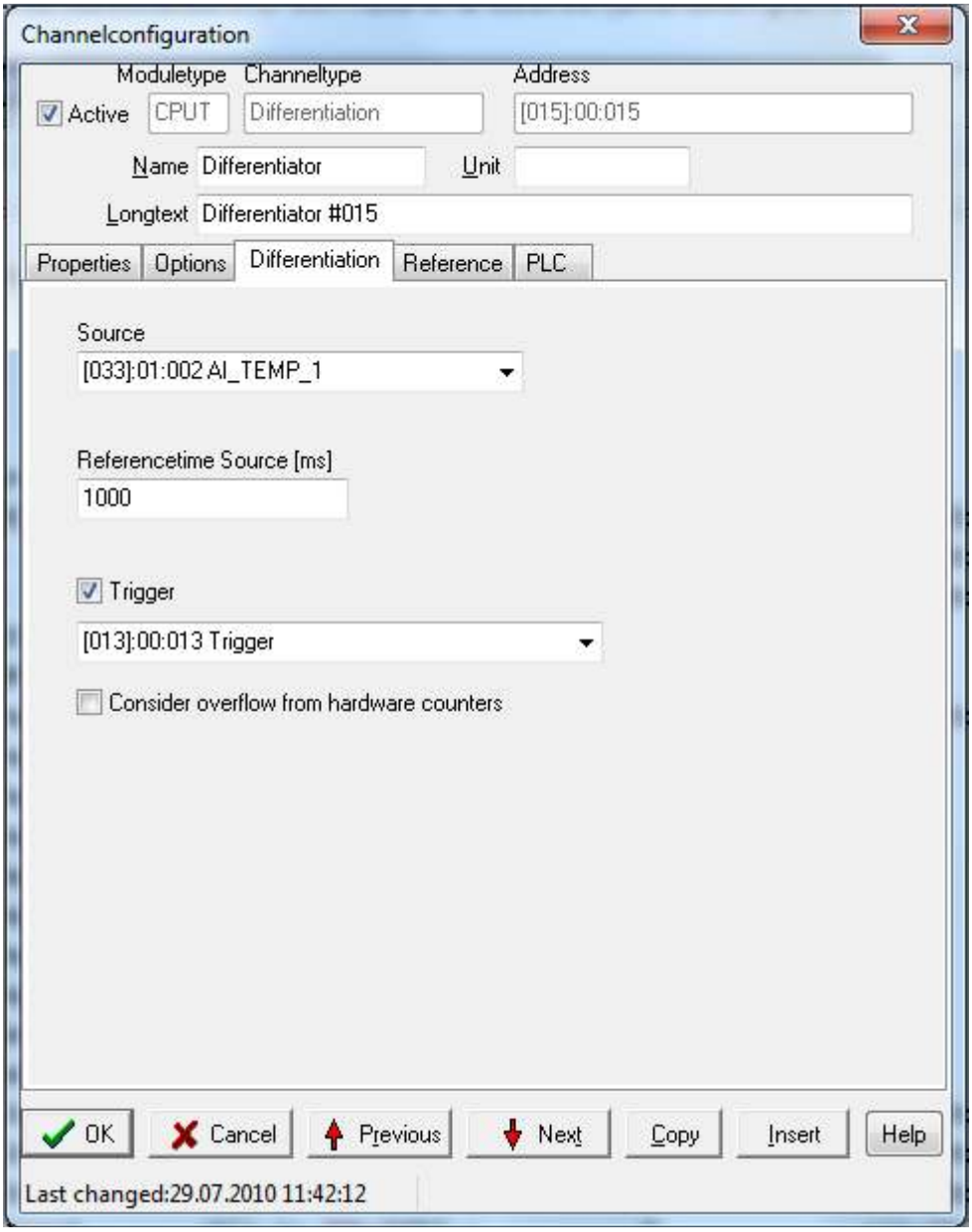
Example 2: *If 60000 ms are set under “time basis-source (ms)“, the unit will be “quantity/min.“*

Example 3:*If 3600000 ms are set under “time basis-source (ms)“, the unit will be “quantity/hour.“*

If the trigger is not active the value will be derived only when the source has changed.
If the trigger is active the value will be derived every positive edge of the selected trigger source.

27 Linearization channel

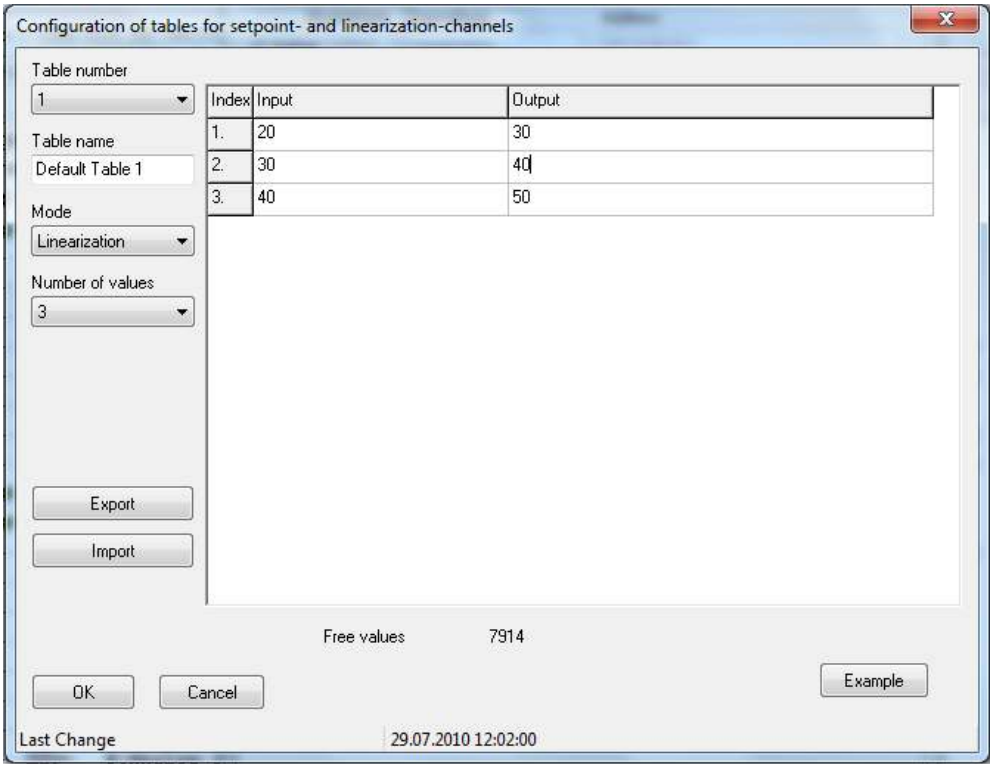
The linearization channel uses the linearization table. This table stores values in pairs of INPUT values and OUTPUT values.



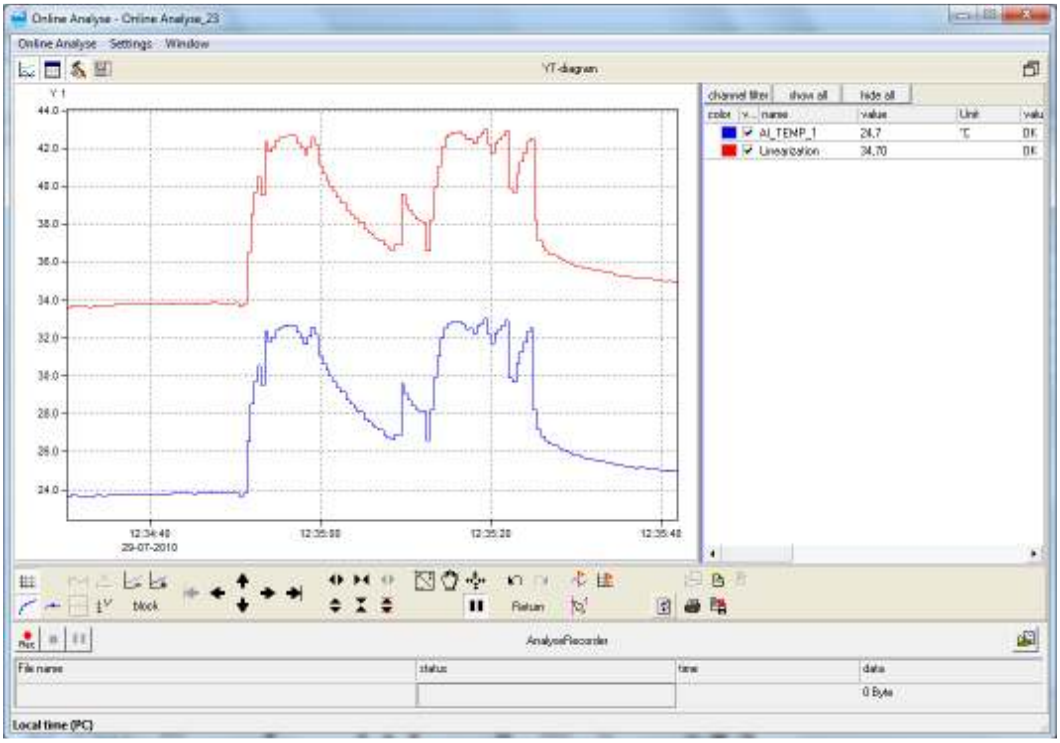
The input of the values is similar to the set point channel. It is important to choose the modus “linearization”.

The input values provided by the source channel are converted to the corresponding output values.

Example 1: The linearization table is shifting an input value by 10℃. The input channel (source channel) is AI_TEMP_1 and a value of 20℃ is conver ted to an output value of 30℃.

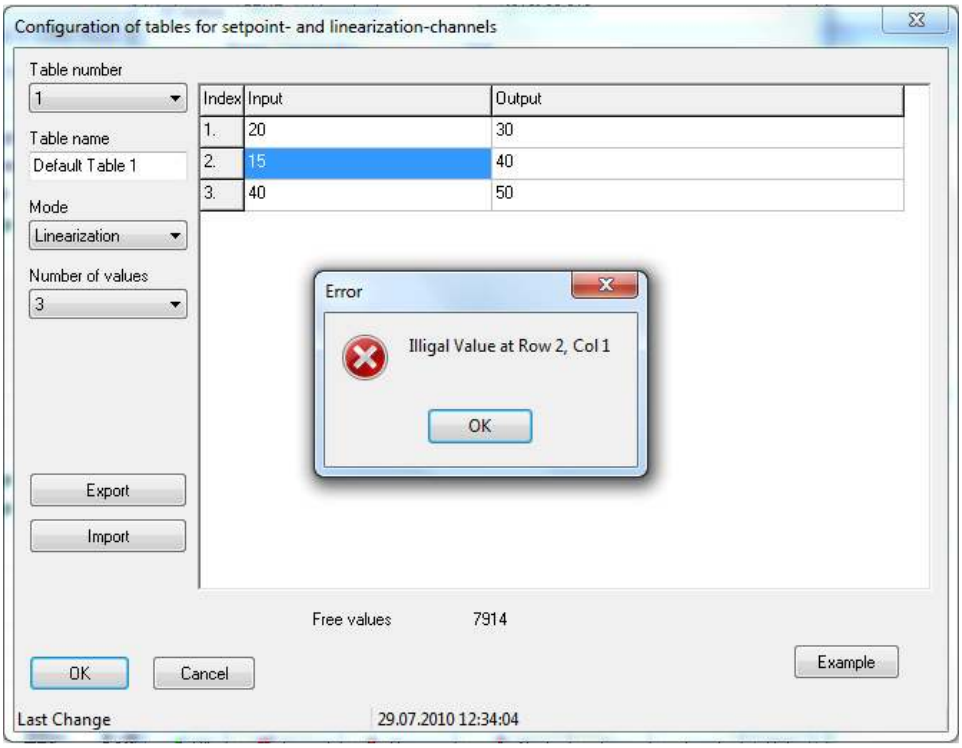


If the source channel has an INPUT value in-between the values specified in the table the OUTPUT value will be interpolated.



Remark:
Each subsequent input value in the table should be larger than the previous one (strictly monotone rising function), so that the channel is operating correctly. With wrong values on the input column the message appears “Illegal value at row (number), column 1“.

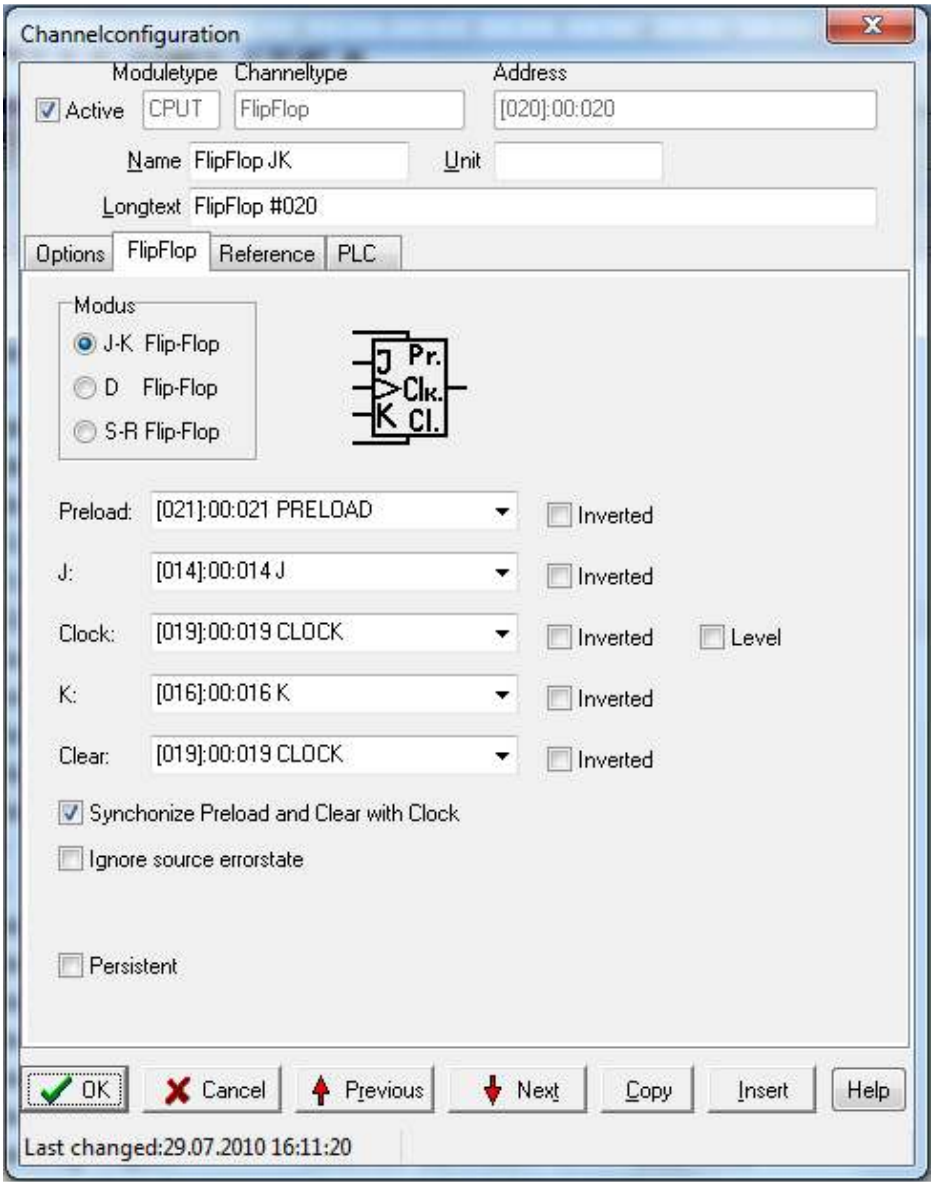
If the source supplies a value which is smaller than the first or bigger than the last input value of the table, the result will be the first resp. the last output value and the channel be declared invalid.



28 FlipFlop

When the error states of the signal inputs should not be processed, activate **ignore error state of source** (valid for all FlipFlop types).

28.1 JK FlipFlop



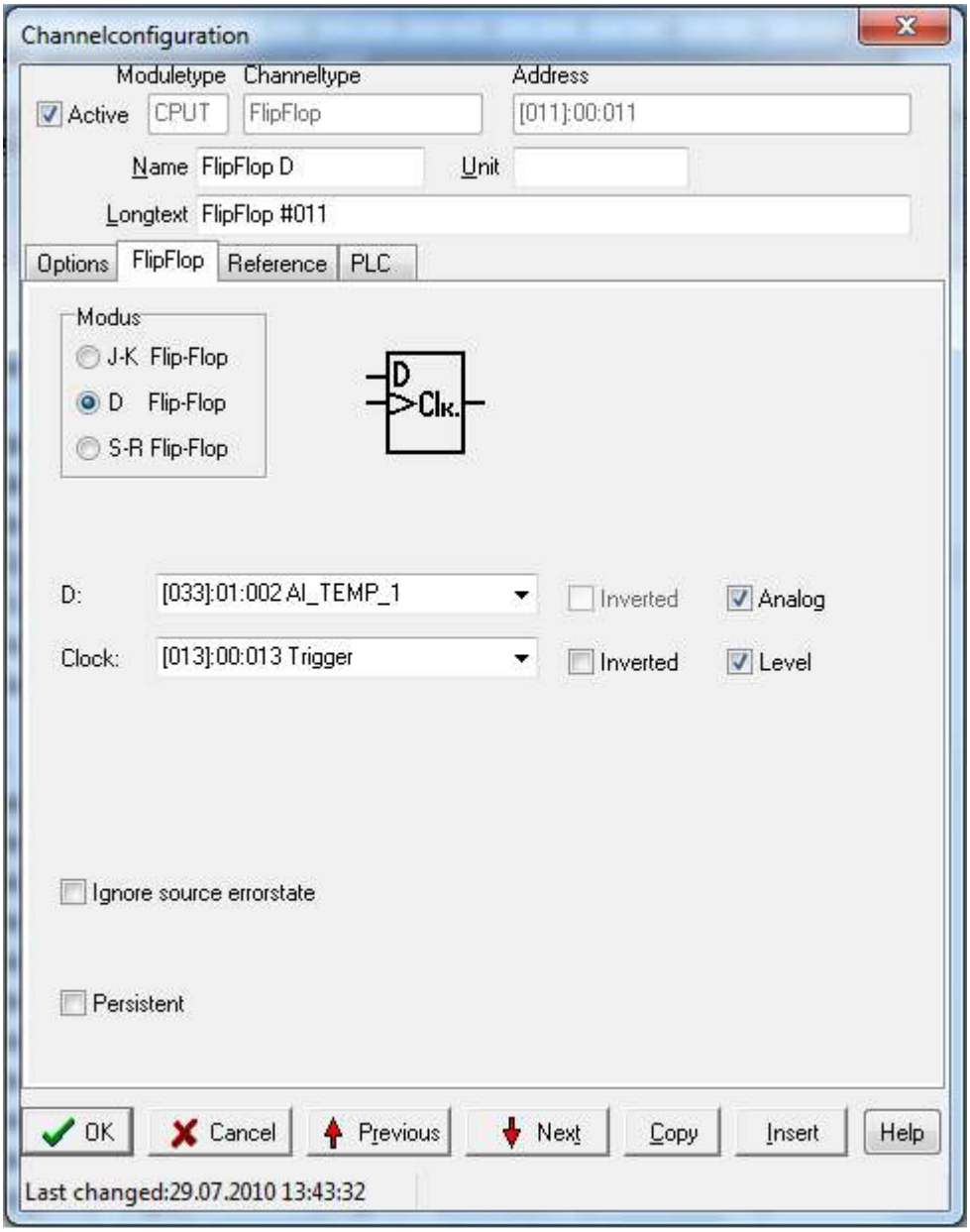
Signal inputs J and K: reset the FlipFlop with next clock edge, resp. with next active level

Preload / Clear : Presetting for the FlipFlop (priority on Clear); can be synchronized with clock

Persistent Recent state is recovered upon restart

Level Switches the clock from edge to level operation

28.2 D FlipFlop



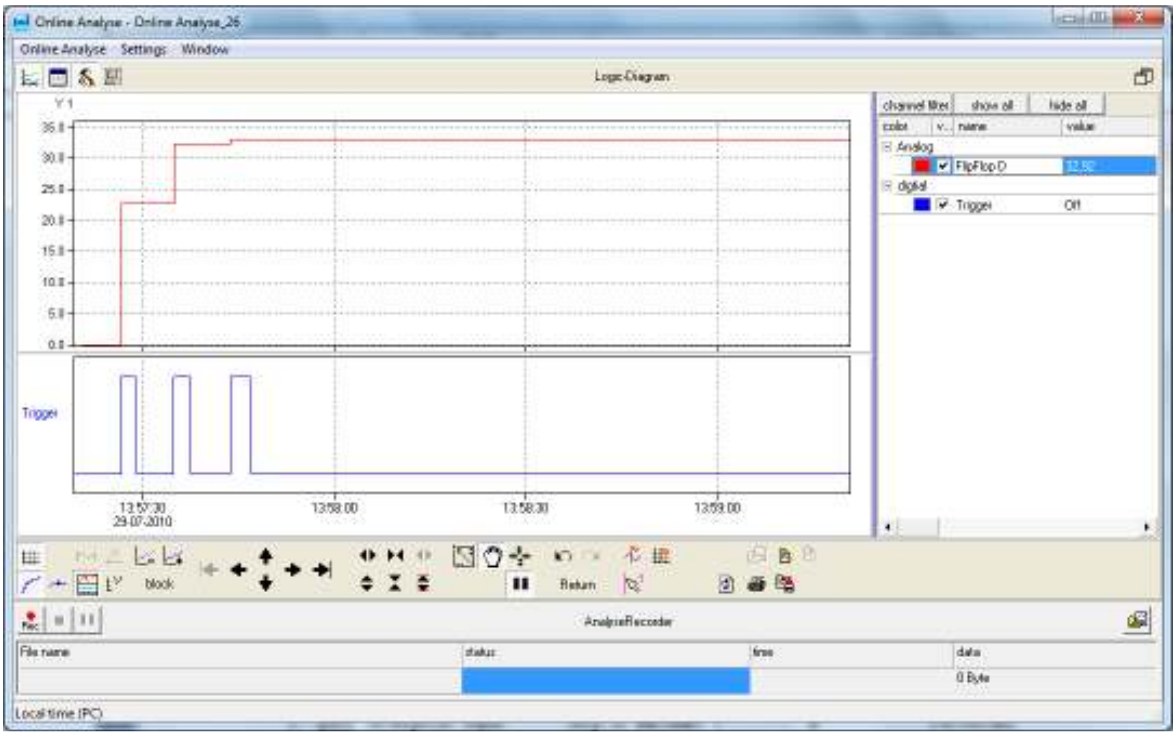
Signal input D sets the FlipFlop with next clock edge, resp. next active level

Analog Takes the (analog) value of signal input D

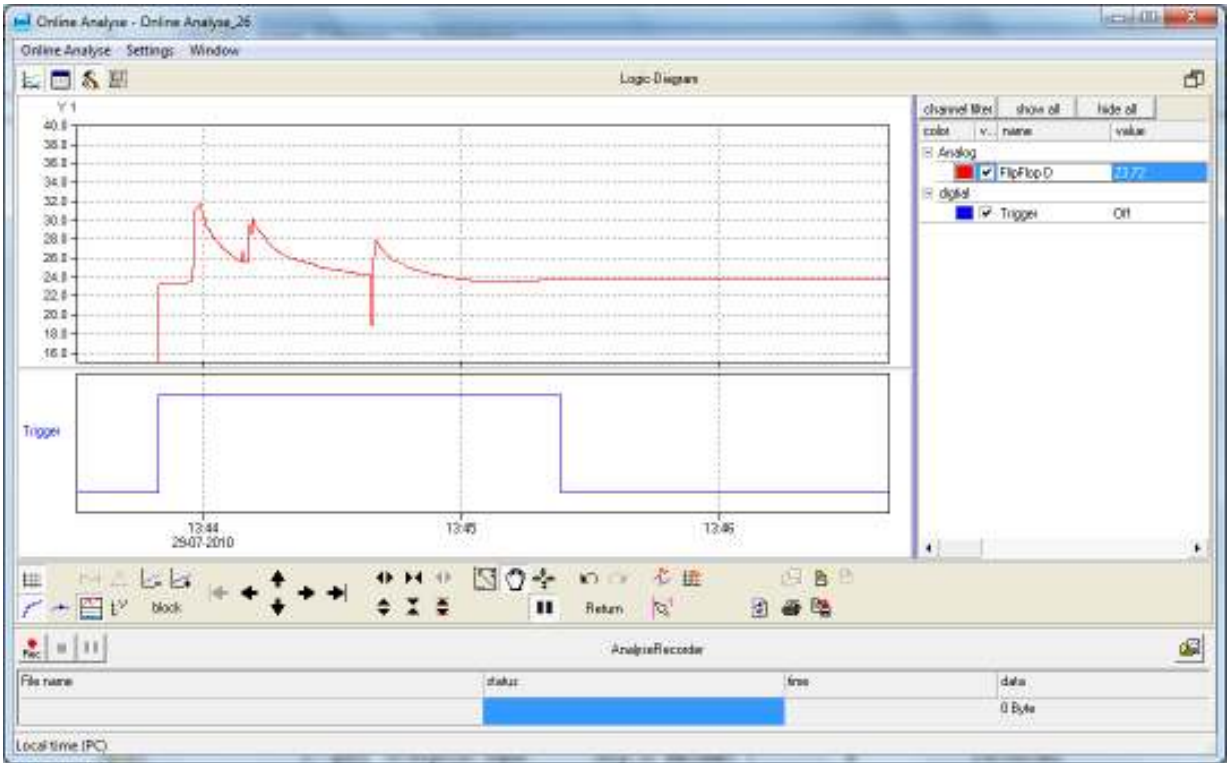
Clock The clock signal is the trigger channel to update the Flip Flop with the value of the analog input at an rising edge. The clock signal can also be configured in level mode. In this case the Flip Flop will be updated when the clock signal is going from high to low.

Persistent Recent state is recovered upon restart

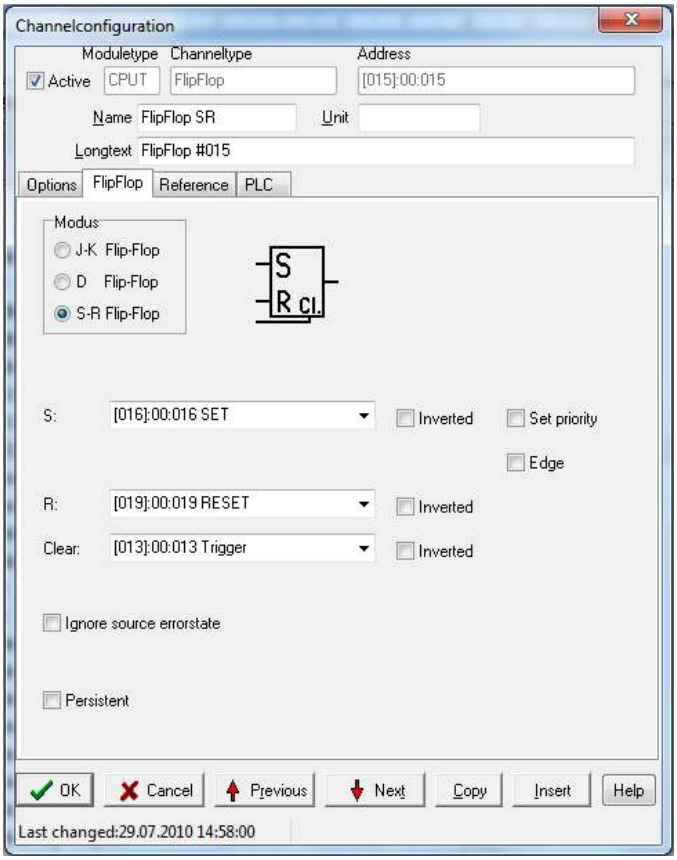
Without activated level mode: Every rising edge of the clock signal will update the Flip Flop.



With activated level mode: The Flip Flop will be permanently updated when the clock signal is high and will also save the last value when the clock signal is falling.



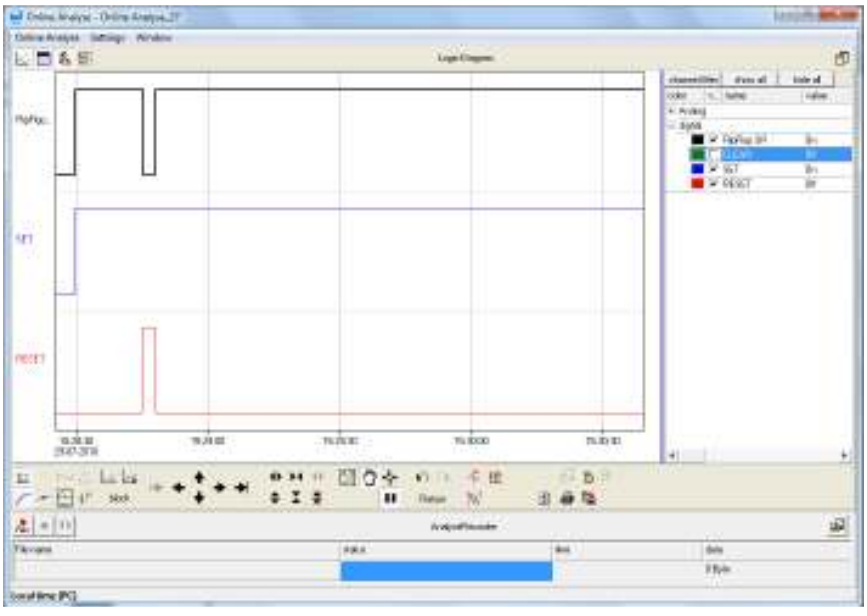
28.3 SR FlipFlop



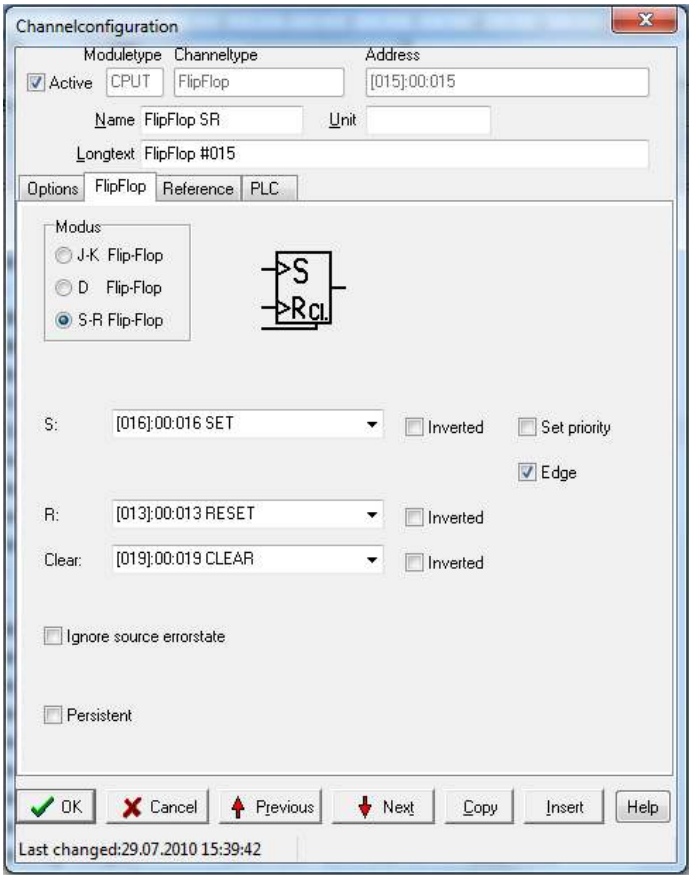
Signal inputs S Is setting the Flip Flop to high

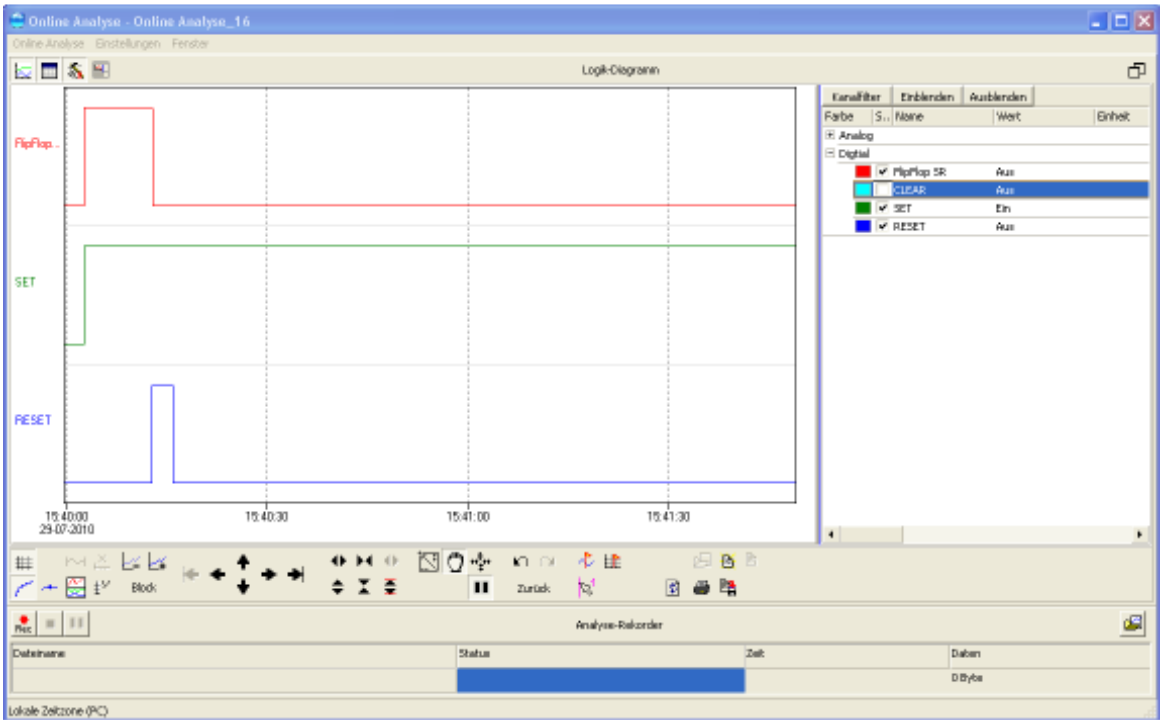
Signal inputs R Will reset the Flop Flop to low for the reset time period. The Flip Flop is going back to high provide the Set channel (S) is still high

Persistent The last state is recovered after restart

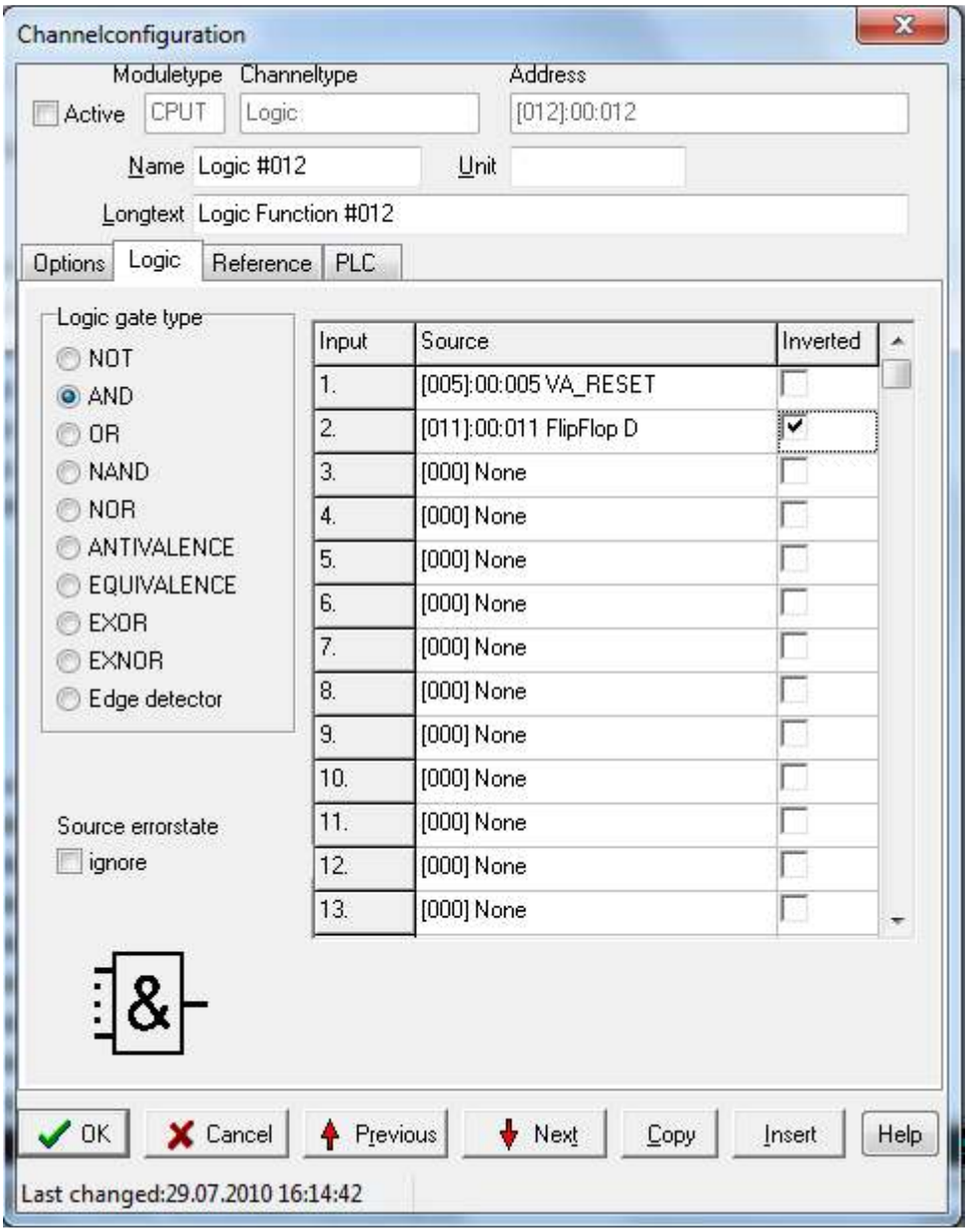


When the check box “Edge is activated the Flip Flop will be resetet to low even of the set channel (S) is still high.





29 Logic channel



The logic channel offers the possibility of linking digital signals easily.

Simply select one of the indicated logic operator and the inputs (max. 32). It is also possible to negate the input signal by checking of the button “inverted”.

For simple Boolean calculations it is recommended to use the logic channel rather than the calculation channel, because the calculation channel requires more processor performance than the logic channel.

Ignore error state of the source must be selected, if invalid or error states should not be acquired by the logic channel.

30 PID regulators

PID regulator channels allow the control of a process quantity. P, I, PI and PID controllers can be selected. Other settings like e. g. dead zone, control variable limitation etc. are also possible.

30.1 Introduction to control engineering

This chapter will give you an introduction to control engineering in order to understand the PID regulator.

30.1.1 Conventions

Y – Control signal = Start value of the controller
X – Control quantity = Process quantity to be controlled
W – Set value = Target value of process quantity.
Z – Interference quantity = Interfering influence from the process to the process quantity
Xd – Deviation = W – X
K_S – Path system gain = $\Delta X / \Delta Y$ of a path step response
Tu – Delay time
Tg – Recovery time
Tt – Dead time
W – Inflection point
K_I – Integral-action coefficient
T_I – Integration time

30.1.2 Control path

In order to find an appropriate controller, it is necessary to know the properties of the control path to be influenced.

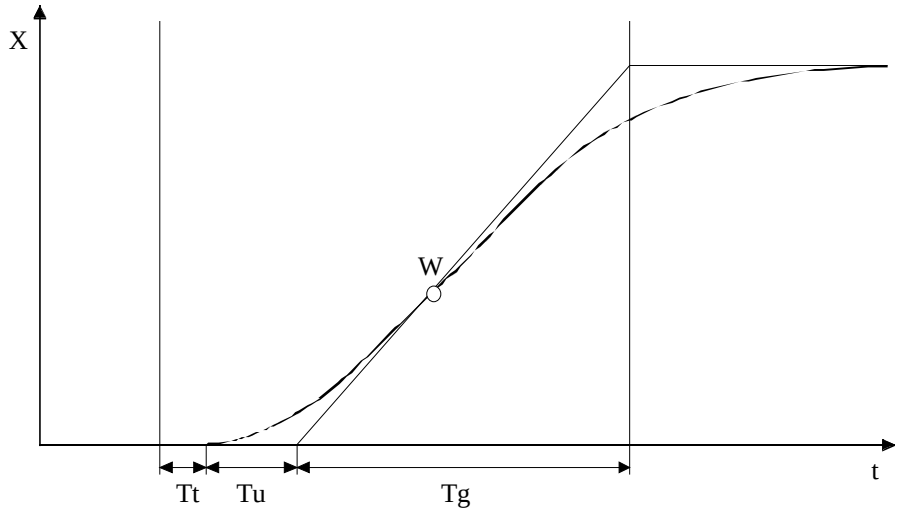
The control path is the part of a plant which is between the final control element and the measuring point of the control quantity. The final control element and the measuring element are also part of the control path.

Basically, control paths can be divided into two categories:

- Control paths with compensation: After a change of the control or interference variable the control variable strives for a new final value (steady state). E. g. flow 2, temperature etc.

- Control paths without compensation: Control paths not striving for a final value (integrating control paths) are called control paths without compensation. E. g. liquid level

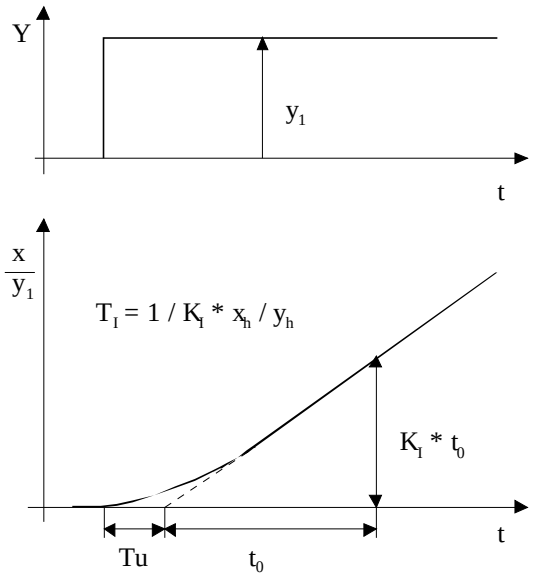
Most control paths consist of P systems (amplification/attenuation), one or more T1-systems (lowpass) and if possible one dead time (run time). Paths with P-T1 response are called control paths of 1st order. Control paths with several T1-systems respectivly control paths n. order. Control paths with compensation of this kind have the following characteristic step response:



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

Tg / Tu > 10 : well controllable
Tg / Tu ≈ 6 : medium controllable
Tg / Tu < 3 : difficult controllable

For control paths with dead time, Tg / (Tt + Tu) defines the controllability.
Step response of a control path without compensation:



30.1.3 Continuous-action controllers (PID)

In the case of continuous-action controllers the control variable Y assumes any value within a control range.

- P-controller: changes the control variable without delay proportionally to the change of the controlled signal.
- I-controller: (Integrator) allocates a certain control speed to a certain control difference.
- PI-controller: includes a proportional and an integrating part.
- PD-controller: This regulator consists from a P-controller and a D-element. The D-element allocates a certain modification speed of the control difference to a control variable.
- PID-regulator: The control variable consists from a proportional, an integral and a differential part.

Controller selection:

Regulator Path (with compensation)	P	I	PI	PD	PID
Pure dead time	Unsuitable	Somewhat worse than PI	**Reference and interference**	Unsuitable	Unsuitable
Dead time and delay 1. order	Unsuitable	Worse than PI	Somewhat worse than PID	Unsuitable	**Reference and interference**
Dead time and delay 2. order	Unsuitable	Bad	Worse than PID	Bad	**Reference and interference**
Delay 1. order and small dead time (delay time)	**Reference**	Unsuitable	**Interference**	**Reference with delay time**	**Interference with delay time**
Higher order	Unsuitable	Worse than PID	Somewhat worse than PID	Unsuitable	**Reference and interference**
Without compensation and with delay	**Reference (without delay**)	Unsuitable, instable	**Interference (without delay)**	**Reference**	**Interference**

30.2 Adjustment of the regulator characteristics

Different standards have been established for the choice of the controller characteristics. This part describes the adjustment standards by Chien, Hrones and Reswik. Please read more adjustment standards and rules from the relative technical literature.

30.2.1 Adjustment rules for control paths with compensation:

From the step response of the control path define the following characteristics of the control path:

- Path system gain K_S
- Recovery time Tg
- Delay time Tu
- For paths with dead time, instead of the delay time Tu, the virtual dead time Tu + Tt

The controller characteristics (only reference values) can be calculated according to the following table:

Controller	Aperiodic control characteristic (without overshoot)		Control characteristic with appr. 20% overshoot	
Optimization for:	Interference	Reference	Interference	Reference
P	K ≈ 0,3 * Tg / Tu	K ≈ 0,3 * Tg / Tu	K ≈ 0,7 * Tg / Tu	K ≈ 0,7 * Tg / Tu
PI	K ≈ 0,6 * Tg / Tu Tn ≈ 4 * Tu	K ≈ 0,35 * Tg / Tu Tn ≈ 1,2 * Tg	K ≈ 0,7 * Tg / Tu Tn ≈ 2,3 * Tu	K ≈ 0,6 * Tg / Tu Tn ≈ Tg
PID	K ≈ 0,95 * Tg / Tu Tn ≈ 2,4 * Tu Tv ≈ 0,42 * Tu	K ≈ 0,6 * Tg / Tu Tn ≈ Tg Tv ≈ 0,5 * Tu	K ≈ 1,2 * Tg / Tu Tn ≈ 2 * Tu Tv ≈ 0,42 * Tu	K ≈ 0,95 * Tg / Tu Tn ≈ 1,35*Tg Tv ≈ 0,47 * Tu

Note:
As further adjustment standard in the automatic determination of the regulator characteristics (see chapter) the T-sum rule has been implemented.

30.2.2 Adjustment rules for control paths without compensation:

From the step response of the control path define the following characteristics of the control path:

- Integral-action coefficient K_I
- Delay time Tu
-

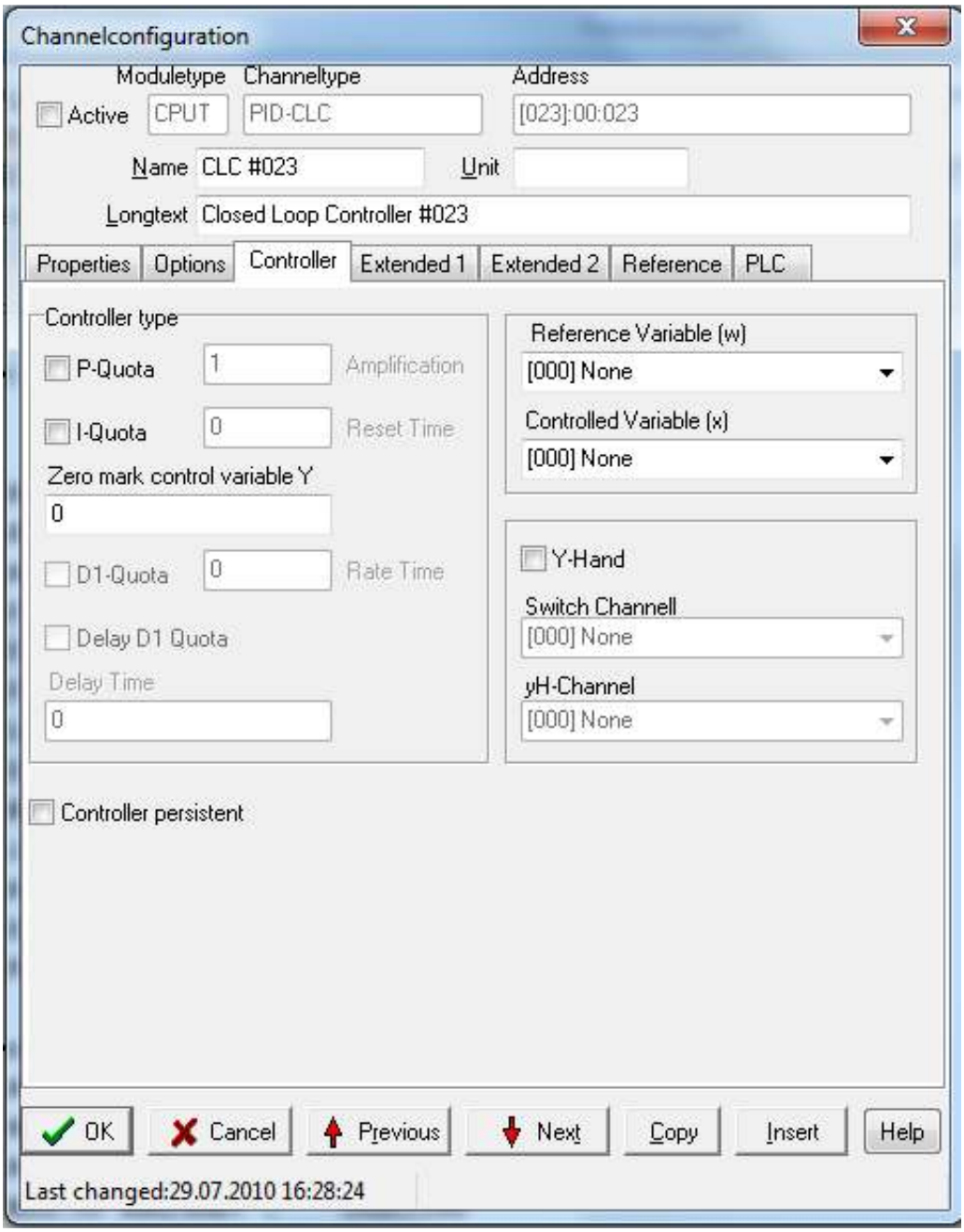
The controller characteristics (only reference values) can be calculated according to the following table:

Controller	K	Tn	Tv
P	0,5 / (K_I * Tu)		
PD	0,5 / (K_I * Tu)		0,5 * Tu
PI	0,42 / (K_I * Tu)	5,8 * Tu	
PID	0,4 / (K_I * Tu)	3,2 * Tu	0,8 * Tu

30.3 Configure PID controllers

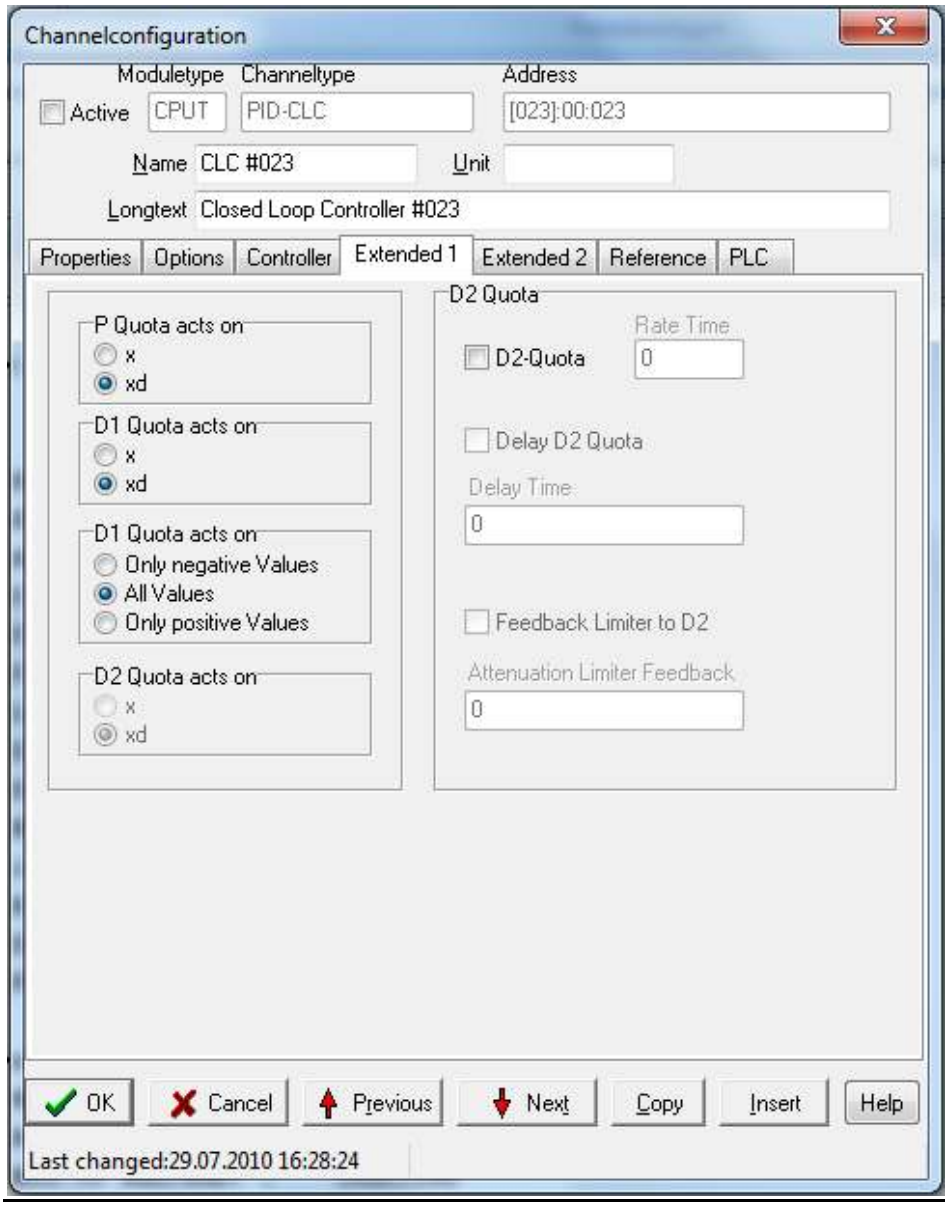
The specific setting of the controller channel is made in the register cards “Controller“, ”Extended1“ and “Extended2“.
Settings in the tab “Extended1“ and “Extended2“ are only required for special applications.
The controller channel receives its input values (set value “W“ and control variable “X“) from 2 physical or virtual channels of the device. The controller channel gives as output value the control variable “Y“ in the defined value range 0,0 – 1,0. If the output of the controller channel is directly linked with an analog output, there 0,0 – 1,0 as scaling will also have to be entered.

30.3.1 Tab “Controller”



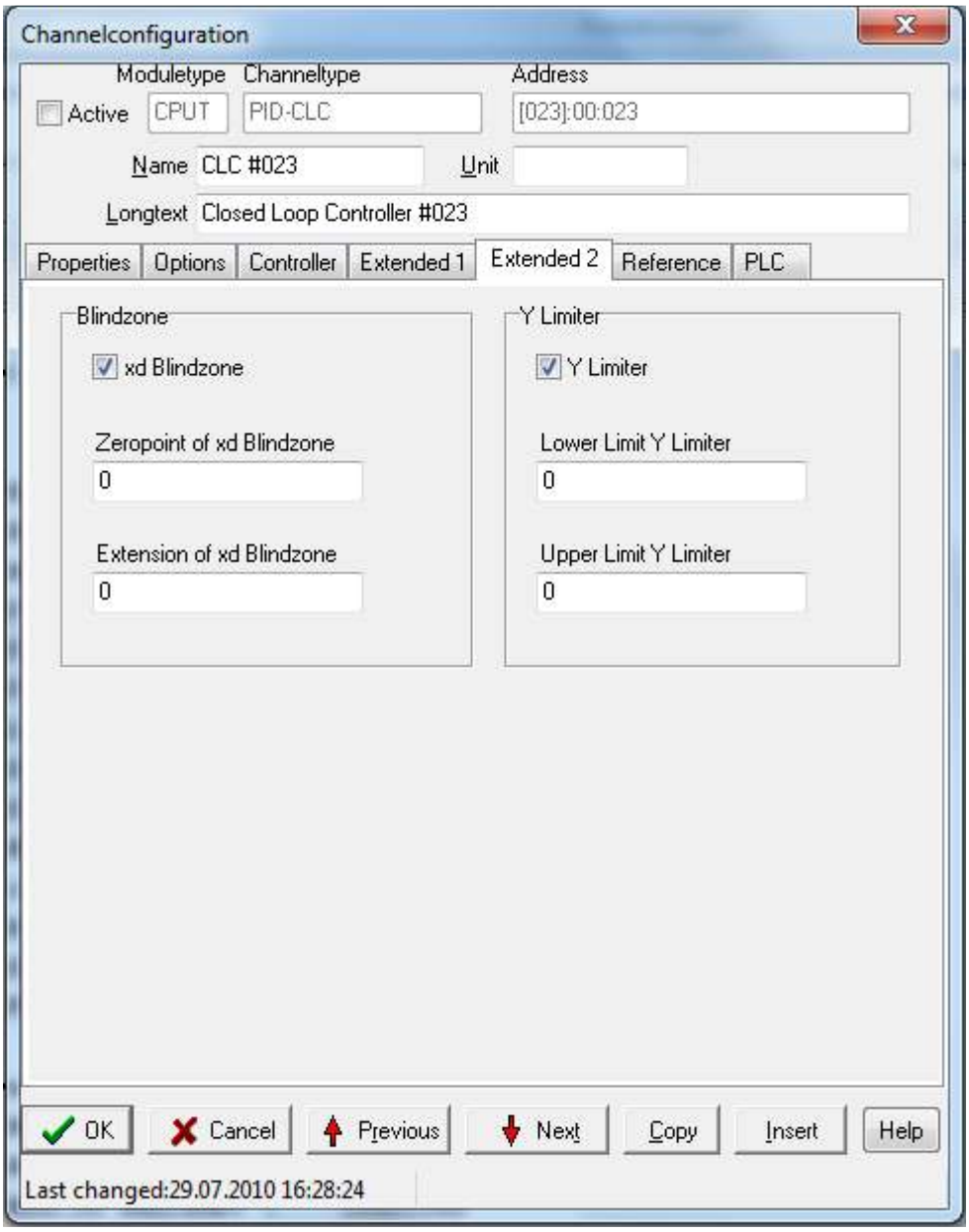
- Reference variable (W): Indication of the source channel for the reference variable. Normally an analog input, a marker, or an output of a different regulator (cascade) can be used as source channel. In case of a cascade take care that the reference regulator has a fixed output value range of 0,0 – 1,0 , if necessary, a conversion by means of a calculation channel is required.
- Control variable (X): Indication of the source channel for the control variable. Usually an analog input can be used as source.
- Y-hand: By activating this option the optional manual switching of the controller is activated. This allow to change the output value of the controller to a value from another channel.
- Switch channel: Indication of the source channel for the activation of the controller manual switching. If there is a value of >= 1,0 at the switch channel, the value of the yH channel is output as control signal (Y)
- YH channel: Indication of the source channel for the “manual value“ of the regulator.
- P quota: By activating this option the P quota of the controller is activated. In the input field “gain“ the gain factor (K) of the regulator must be entered.
- I quota: By activating this option the I quota of the regulator is activated. In the input field „reset time“ the reset time (Tn) of the regulator must be indicated in seconds.
- Initial value I term / zero point control variable Y: When the I quota is activated the initial value of the I quota (Y(0) = I(0) * K) or the zero point of the control variable (0,0 – 1,0) can be set.
- D1 quota: By activating this option the 1. D quota of the regulator is activated. In the input field “rate time” the rate time (Tv) of the regulator in seconds must be indicated.
- Delay D1 quota: By activating this option it is possible to set the 1. D quota to a delayed difference calculation. The delay time must be indicated in seconds in the input field “1. delay time“.
- Controller persistent: For optimizing reasons the control variable of the regulator is only recalculated with a change of the control variable. By activating this option the control variable is calculated upon each request of the control variable through a linked channel (output), even if there is no change in the control variable. The use of this option is not recommended.

30.3.2 Tab “Extended 1”



- P / D1 / D2 quota acts on: These options define, if the respective controller component processes the control difference „xd“ (according to the possibly calculated „dead zone“) or directly the control variable „x“ as input value.
- D1 quota acts on: Through this option it is defined on which input values the 1. D quota reacts. All non acting values are processed as 0,0. This option is only available, if 1. D quota does not work as “delayed D quota”.
- D2 quota / delay D2 quota: Analog to the 1. D quota the 2. D quota can be configured.
- Feedback Limiter to D2: By activating this option the control variable that has been cut off in the previous control cycle is reduced to the 2. D quota. In the input field “Attenuation Limiter Feedback“ the degree of the feedback must be entered (1,0 = complete reducing).

30.3.3 Tab “Extended 2”

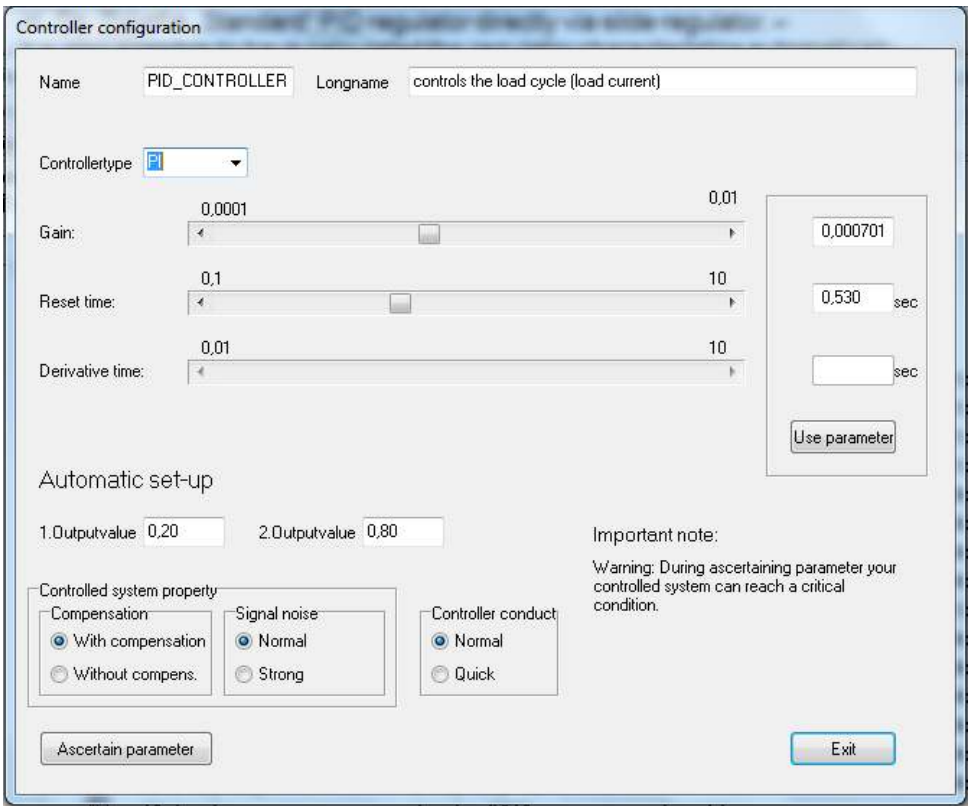


- xd Dead zone: By activating this option the dead zone of the control difference is activated. In the input field „Zero point of the xd dead zone“ the zero point of the dead zone must be indicated. In the input field „Extension of the xd dead zone“ the maximum deviation from the zero point of the dead zone, within which the control deviation is set to 0,0, must be entered.
- Y Limiter: This option permits the restriction of the value range of the control variable. The cut off quota of the control variable can optionally be reduced to the 2. D term. The limits of the control variable must be entered in the input fields (0,0 – 1,0).

30.4 „Real time“ configuration and automatic calculation of the regulator characteristics

Alternatively to the above standard configuration it is possible to alter the regulator characteristics (K, Tn, Tv) of a „Standard“ PID regulator directly via slide regulator.
It is also possible to have calculated the regulator characteristics automatically.
The requirement for using this alternative configuration is a PID regulator channel without delayed 1. D quota and without using the extended options.
Call of the alternative configuration:

After marking the PID regulator channel in the Explorer view it is possible to call in the context menu (right mouseclick) the option “Paramet setting”.



30.4.1 Manual change of parameters

- Regulator type: In this selection list the regulator type can be indicated (P, I, PI, PD and PID). The selection „inactive“ switches off the PID regulator channel. If the selection „Ext.“ is displayed, an option of the regulator channel which is inadmissible for this configuration dialogue illegal option will be activated.
- Slide regulators K / Tn / Tv: By positioning of the slide regulators the corresponding regulator parameters will be directly altered.
- Input fields: The regulator parameters can optionally be changed in the input fields. The changed values are imported by pressing the button „Import“ from the regulator. The scalings of the slide regulators are if necessary adapted to the new parameters.

30.4.2 Automatic calculation of the regulator characteristics

By analysis of the step response of the control path the regulator characteristics will be automatically calculated.

Paths with compensation:
After calculation of the system gain (K_S) and the cumulative time constant (T_Σ) the parameter K, Tn and Ty will be calculated after the T sum rule in dependence upon the regulator type.

Note:
The T sum rule is only suitable for paths with s-form step response.

For the following path definition is T_Σ :

$$F_S(p) = K_S \frac{(1+T_{D,1}p)(1+T_{D,2}p)\cdots(1+T_{D,m}p)}{(1+T_1p)(1+T_2p)\cdots(1+T_np)} e^{-pT_t}$$

$$T_\Sigma = T_1 + T_2 + \cdots + T_n - T_{D,1} - T_{D,2} - \cdots - T_{D,m} + T_t$$

The following table includes the setting rules after T sum:

	Regulator	Regulator parameter		
		K_R	**T_N**	**T_V**
Normal setting	**P**	$1/K_S$	-	-
	PD	$1/K_S$	-	$0{,}33\ T_\Sigma$
	PI	$0{,}5/K_S$	$0{,}5\ T_\Sigma$	-
	PID	$1/K_S$	$0{,}66\ T_\Sigma$	$0{,}167\ T_\Sigma$
Fast setting	**PI**	$1/K_S$	$0{,}7\ T_\Sigma$	-
	PID	$2/K_S$	$0{,}8\ T_\Sigma$	$0{,}194\ T_\Sigma$

Fast setting is only suitable for P-T_1 and P-T_2 similar control paths

Paths without compensation:
After the calculation of the integral-action coefficient K_I and the delay time Tu the parameters K, Tn and Tv after Chien, Hrones and Reswik are determined.
(see **error! Source of reference could not be found)**

Procedure of the automatic calculation of the regulator characteristic:

After the start the 2. control variable, the 1. control variable and once again the 2. control variable are put on the control path in succession. After reaching the steady state (paths with compensation) resp. a constant slope (paths without compensation) after each step, the next step is put on the control path. After the end of the 3. step the regulator characteristics are determined from the calculated path parameters.
Should the control path get into critical state during the automatic calculation, this can be stopped any time.

Options:

- 1. control variable: Here the 1. control variable must be indicated (0,0 – 1,0). The 1. control variable is predetermined for control paths without compensation (0,0).
- 2. Control variable: Here the 2. control variable must be indicated (0,0 – 1,0). The 2. control variable must deviate at least 0,25 from the 1. control variable.
- Compensation: Indication about the response of the control path: With or without compensation.
- Signal noise: Indication about the signal noise of the measurement data acquisition. If the automatic calculation with the setting „normal“ does not recognize the steady point or puts the next step too early on the control path (steady point has not yet been reached), the automatic calculation with the setting „strong“ can be repeated.
- Control response: Here the required control response must be selected. The setting “fast” causes a reduced transient time together with a stronger overshoot of the control variable.
- Calculate parameters: The automatic calculation is started. During this operation the current control variable is permanently displayed.

For the automatic calculation an adequate measurement cycle for the control variable must be set. A possible active tolerance must be deactivated during the automatic calculation (0%).
e. g. no sampling in ms grid with a slow temperature control path.

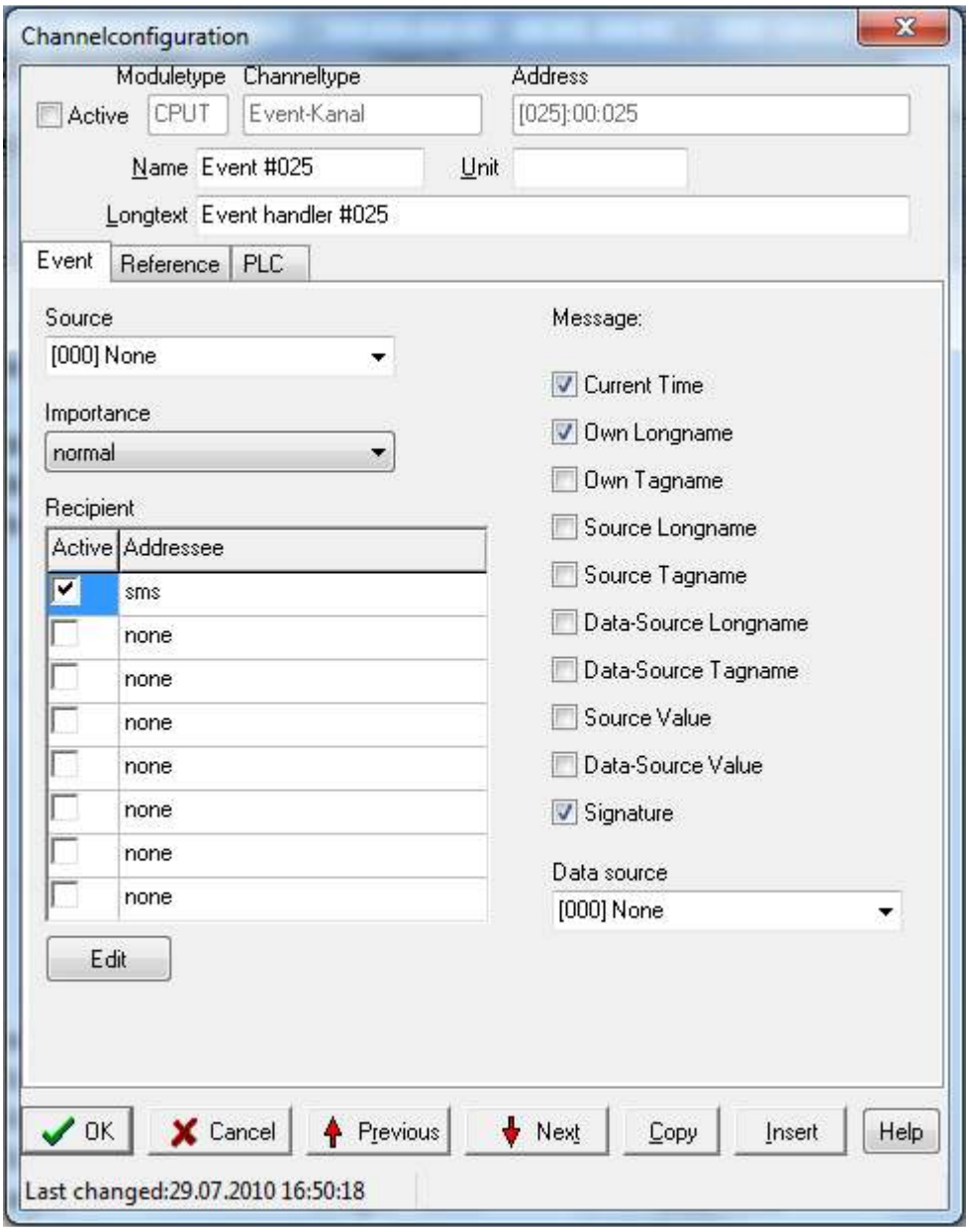
During the automatic calculation all fault variables should be eliminated as far as possible or should be very low.
e. g. locking of the drain in a liquid level control path.

Important notes:

The **suitability of your control path** for calculation of the regulator characteristics by means of path step responses presented here, is to be taken from the corresponding **technical literature**.
It is basically possible, that the complete production plant gets into **critical state** during the automatic calculation caused by interactions.
If you should not be sure whether your control path / production plant gets into critical state, **do not** use the automatic calculation of the regulator characteristics !

31 Event channel

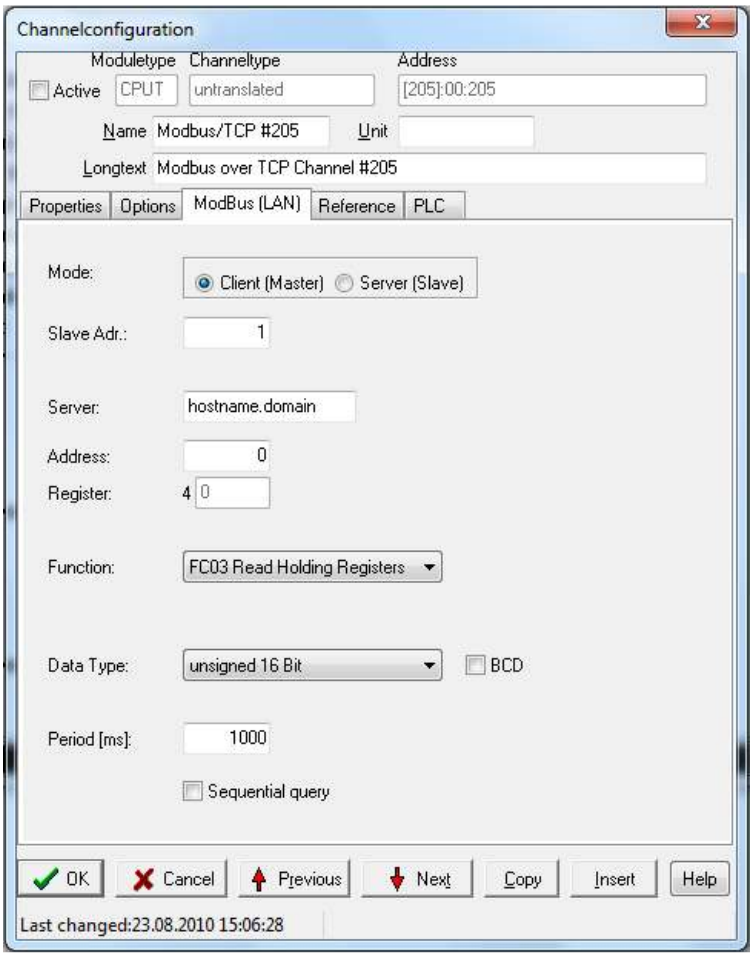
The event channel can send messages to a recipient caused by a trigger event. This recipient is stored in an address book. Depending on the configuration the system can send E-mail or SMS-Messages .



The message text can be individually configured from the channel names, long texts of the event channel and its source channel to build meaningful short messages.

32 Modbus LAN (TCP)

The Modbus LAN channels are interface channels to exchange data between other communication partners who support the Modbus TCP protocol. Modbus TCP communication partners could be another PC, Message device, a sensor or any other third party device.



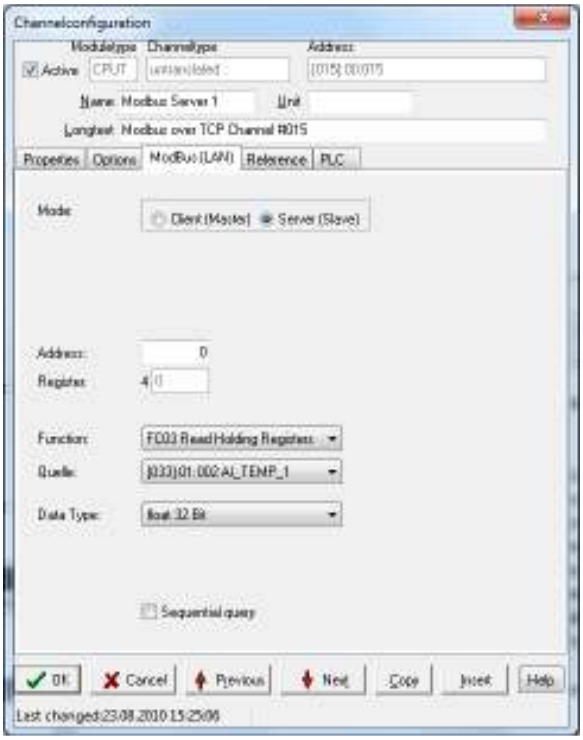
Basics about the Modbus TCP communication:
One communication partner should be the Modbus Server. All other communication partners are configures as Modbus Clients. The data flow between the devices is not independent of the Server or Client configuration. Every communication partner can send data to the server or read data from the server. The data flow is configured through the function code settings.

The configuration parameters are compliant to the Modbus standards.
The following example shows the principle of the communication settings. In this exercise two Message Devices are used.

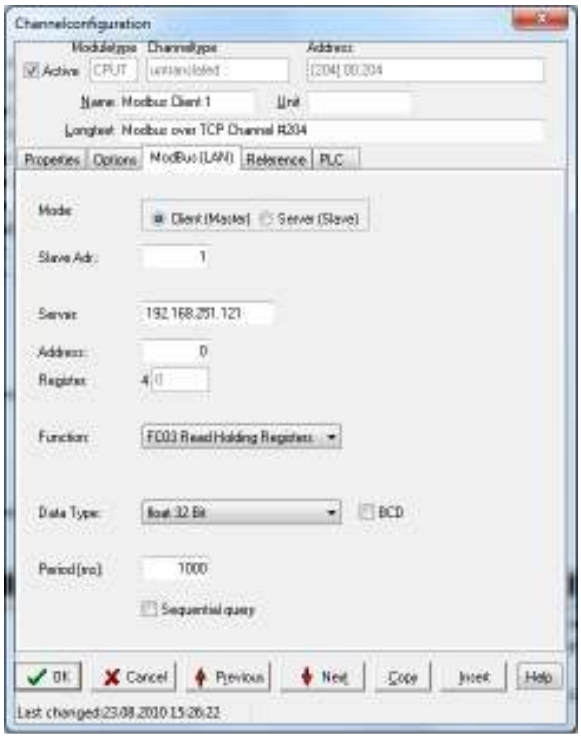
32.1 Configuration examples

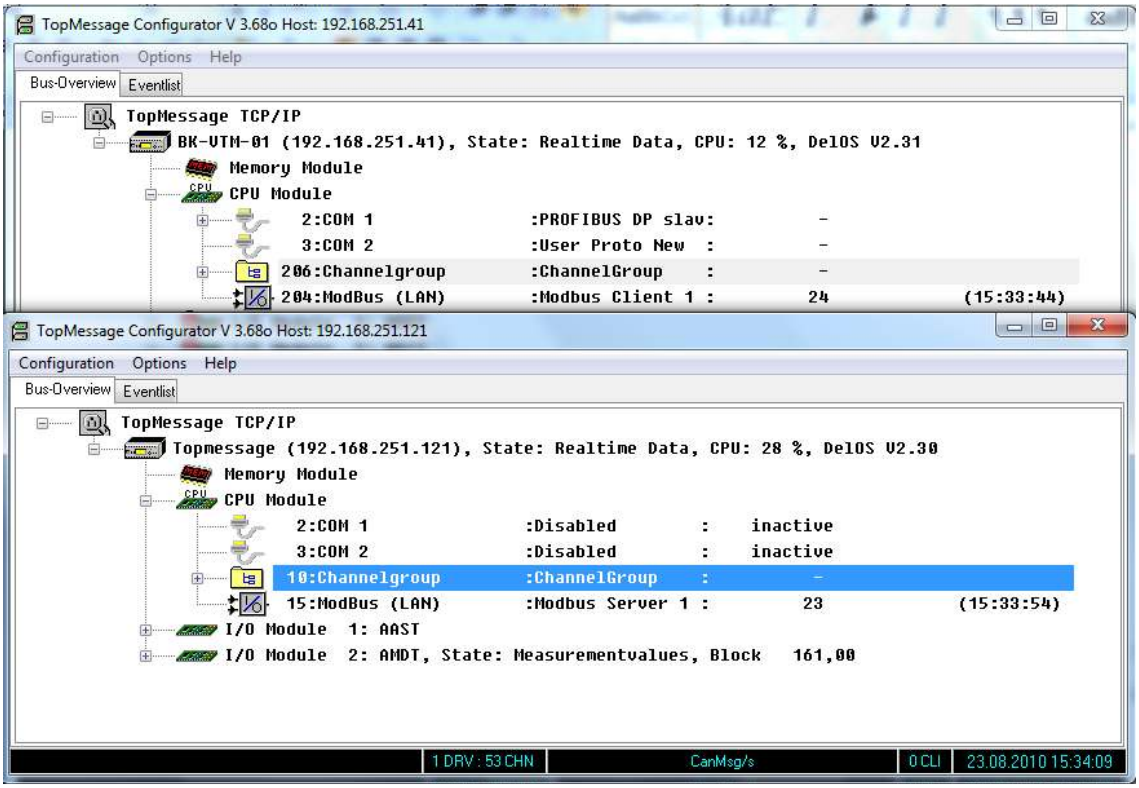
Case 1: Server (192.168.251.121) is providing an analog value (temperature)
Client (IP 192.128.251.41) is reading the value from the server.

SERVER



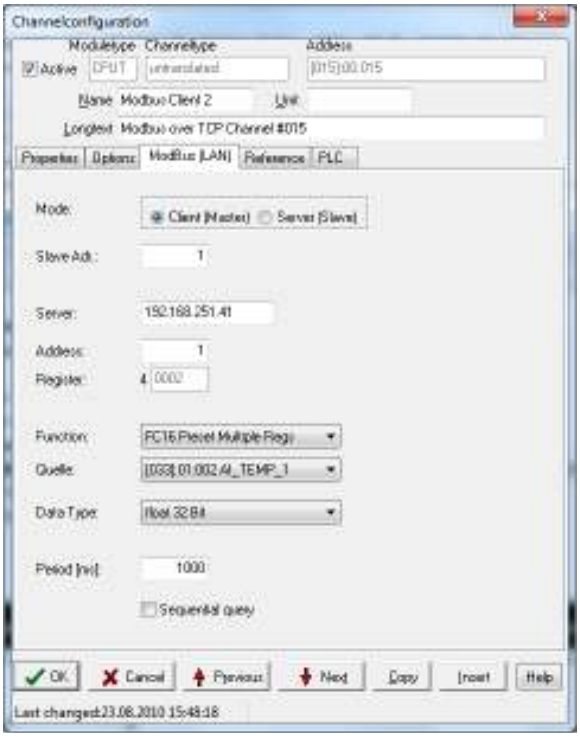
CLIENT



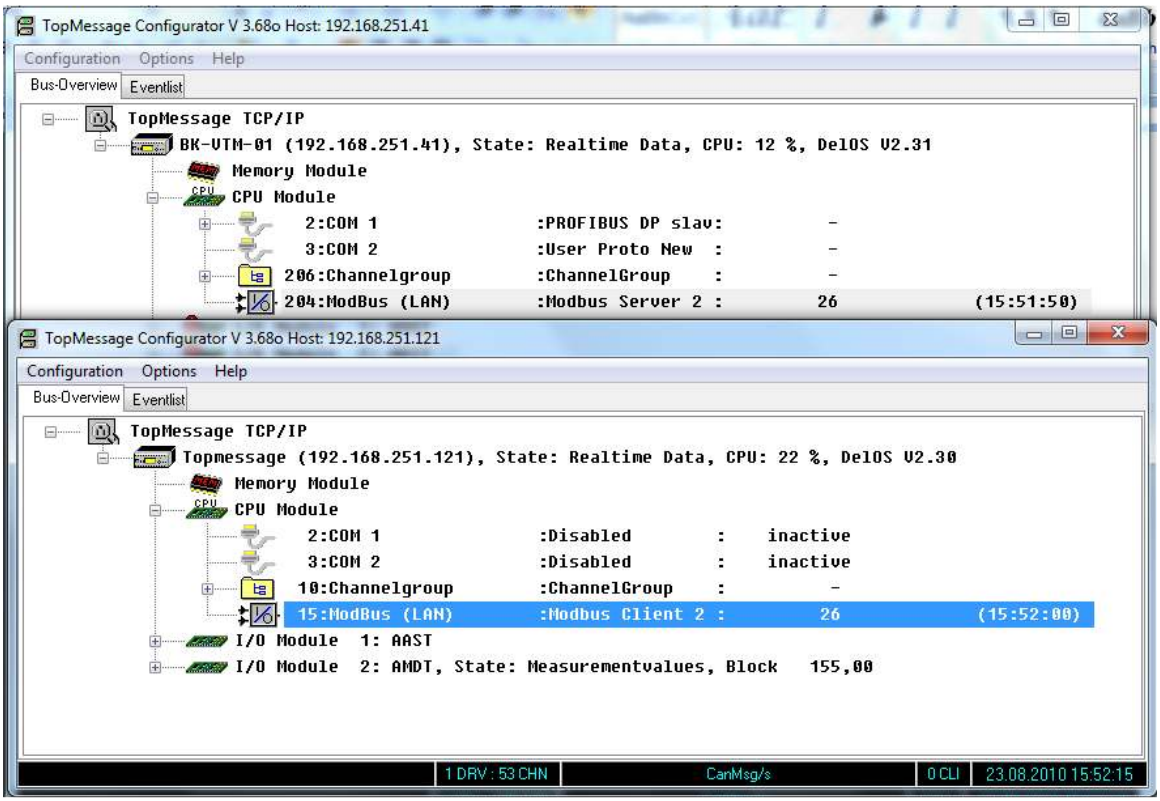


Case 2: Client (IP 192.168.251.121) is providing an analog value (temperature) to the Server with IP 192.128.251.41

CLIENT



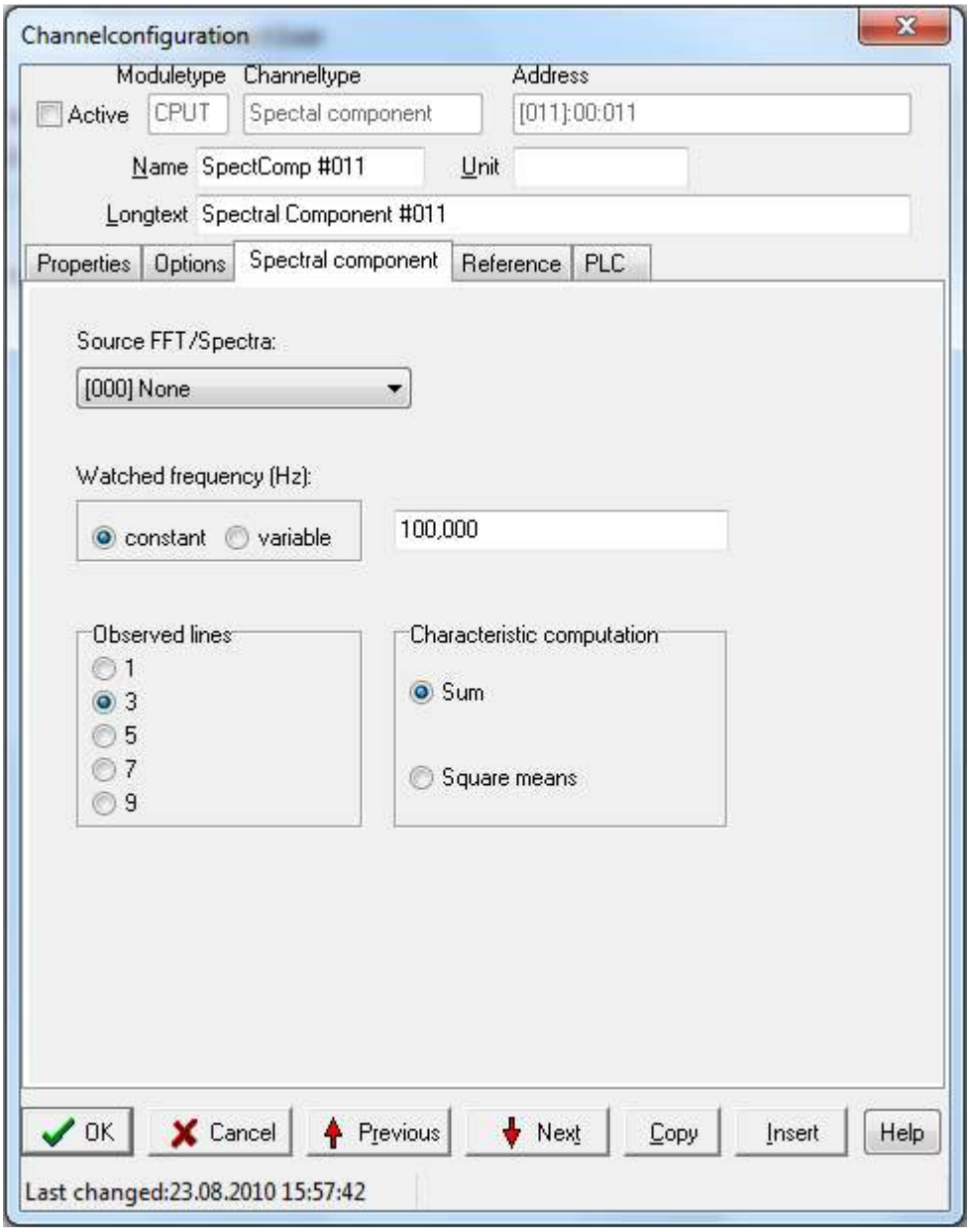
SERVER



33 Spectral-component

The analysis of Spectral components is only available in combination with the AMDT module. The FFT-characteristics channel must be configured on the AMDT module in the first place.

This virtual channel was developed to enable very specific FFT-spectrum analysis. The user can select and analyse a very small section of the spectrum (up to 9 FFT lines) around a “Watched Frequency”.



34X-Message

With an X-Message channel you can link channels from one Message device to another Message device. To configure the X-Message channel the IP address of the other Message device and the channel ID are required. The Channel-ID can be seen on the channel configuration dialog.