ABB i-bus® KNX
Analogue Input AE/S 4.1.1.3
Product Manual

Power and productivity
for a better world™

Contents

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1 General

It is becoming increasingly important to be able to control complex installations in a user-friendly manner. Sensors are used, for instance, in order to control supply air valves, exhaust air valves and air flow speeds in an air conditioning system. The heating is controlled using an outside temperature sensor. Container levels are scanned in order to obtain information about when the containers need filling. Pipeline temperatures are recorded and evaluated. Sensors to detect the presence of persons in a room are installed in order to optimize the use of energy. Monitoring and security functions rely on the data from sensors.

All of these events play a role when it comes to controlling complex installations in buildings and houses in a convenient and secure manner while minimizing energy consumption.

In making it possible to record and process four independent analogue input signals, this device can help you control your installations using ABB i-bus®.

1.1 Using the product manual

This manual provides detailed technical information on the function, installation and programming of the ABB i-bus® KNX device. The application is explained using examples.

This manual is divided into the following chapters:

Chapter 1	General
Chapter 2	Device technology
Chapter 3	Commissioning
Chapter 4	Planning and application
Chapter A	Appendix

1.1.1 Notes

Notes and safety instructions are represented as follows in this manual:

Note
Tips for usage and operation

Examples
Application examples, installation examples, programming examples

Important
These safety instructions are used as soon as there is danger of a malfunction without risk of damage or injury.

Attention
These safety instructions are used as soon as there is danger of a malfunction without risk of damage or injury.

 **Danger**
These safety instructions are used if there is a danger to life and limb with inappropriate use.

 **Danger**
These safety instructions are used if there is an extreme danger to life with inappropriate use.

1.2 Product and functional overview

The device is a modular installation device with a module width of 4 space units in Pro *M* design for installation in distribution boards. The connection to the ABB i-bus® is established using a bus connection terminal on the front side. The assignment of the physical address, as well as the setting of parameters, is carried out with Engineering Tool Software ETS.

- The device enables you to record and process four analogue input signals in accordance with DIN IEC 60381, e.g. 0…1 V, 0…5 V, 0…10 V, 1…10 V, 0…20 mA, 4…20 mA. Furthermore, PT 100 and PT 1000 sensors in 2- and 3-conductor technology, 0...1,000 ohm resistors and a selection of KTY sensors can be connected. It is also possible to adapt the device to user-defined KTY sensors by entering a characteristic curve. Floating contacts can also be connected to the device.
- The processing of the input signals is carried out in the application *Threshold measurement 4f.*
- The object values can be set for each input separately in the application. The output value can be sent as a 1-bit value, or a 1-, 2- or 4-byte value via the bus.
- Due to the flexibility allowing the measurement curve to be adapted, it is possible to mask out certain areas of the measurement curve or to even offset or correct them. Measured values can be averaged over 1, 4, 16 or 64 measurements using the *Filter* function. The output value is “smoothed” via the mean value. As one measurement is taken every second, the setting for 64 measurements per output means that the output value is sent after about 64 seconds.
- It is possible to set two thresholds per input. The thresholds each have an upper and lower limit which can be set independently. The thresholds themselves can be changed via the bus.
- There are four further calculation objects available. It is thus possible to compare two output values or calculate the arithmetic mean. The options less than, greater than, addition, subtraction and averaging are available.

Important
To ensure that all programmable functions work correctly, be sure to observe the sensor manufacturer's technical data

1.2.1 Integration in the i-bus® Tool

The device possesses an interface to the i-bus® Tool.

The i-bus® Tool can be used to change settings on the connected device.

The i-bus® Tool can be downloaded for free from our website (*www.abb.com/knx).*

ETS is not required for the i-bus® Tool. However, Falcon Runtime (version 1.6 or higher and version 1.8 or higher for Windows 7) must be installed to set up a connection between the PC and KNX.

A description of the functions can be found in the online help of the i-bus® Tool.

2 Device technology

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Analogue Input AE/S 4.1.1.3

The device is used to record analogue data. Four conventional sensors can be connected to the device. The connection to the bus is established via the bus connection terminal on the front of the device.

The device is ready for operation after connecting the bus voltage. Additional auxiliary voltage is required. The device is parameterized and programmed using ETS.

2.1 Technical data

Supply	Bus voltage	21…32 V DC
	Current consumption, bus	< 10 mA
	Mains voltage U_S	85…265 V AC, 110…240 V DC, 50/60 Hz
	Power consumption	Max. 11 W at 230 V AC
	Power consumption, mains	80/40 mA at 115/230 V AC
	Leakage loss, device	Max. 3 W at 230 V AC
Auxiliary voltage supply for the sensors	Rated voltage U_n	24 VDC
	Rated current I_n	300 mA
Connections	KNX	Via bus connection terminal, screwless
	Mains voltage	Via screw terminals
	Sensor supply	Via screw terminals
	Sensor inputs	Via screw terminals
	Screw terminals	0.2…2.5 mm^2 fine stranded 0.2…4.0 mm^2 single core
	Tightening torque	Max. 0.6 Nm
Cable length	Between sensor and device input	Max. 100 m
Operating and display elements	*Programming* button/LED	For assignment of the physical address
Protection type	IP 20	To DIN EN 60 529
Protection class	II	To DIN EN 61 140
Isolation category	Overvoltage category	III to EN 60 664-1
	Pollution degree	II to DIN EN 60 664-1
KNX safety voltage	SELV 24 V DC	

Temperature range	Operation	-5 °C…+45 °C
	Storage	-25…+55 °C
	Transport	-25…+70 °C
Ambient conditions	Maximum air humidity	93 %, no condensation allowed
Design	Modular installation device (MDRC)	Modular installation device, Pro *M*
	Dimensions	90 x 72 x 64.5 mm (H x W x D)
	Mounting width in space units	4 x 18 mm modules
	Mounting depth	64.5 mm
Mounting	On 35 mm mounting rail	To DIN EN 60 715
Installation position	Any	
Weight	0.27 kg	
Housing/color	Plastic housing, gray	
Approvals	KNX to EN 50 090-1, -2	Certification
CE mark	In accordance with the EMC guideline and low voltage guideline	

2.1.1 Inputs

Rated values	Quantity	4
	Voltage	0…1 V, 0…5 V, 0…10 V, 1…10 V
	Maximum upper limit	12 V
	Current	0...20 mA, 4...20 mA
	Maximum upper limit	25 mA
	Resistance	0…1,000 ohms PT100 2-conductor technology PT100 3-conductor technology PT1000 2-conductor technology PT1000 3-conductor technology Choice of KT/KTY 1000/2000, user-defined
	Contact	Floating
	Input resistance for voltage measurement	> 50 Mohms
	Input resistance for current measurement	260 ohms
	Permitted cable length between sensor and device input	Max. 100 m

Device type	Application	Max. number of communication objects	Max. number of group addresses	Max. number of assignments
AE/S 4.1.1.3	Threshold measurement 4f/...*	42	100	100

* … = Current version number of the application. **Please refer to the software information on our website for this purpose.**

Note

ETS and the current version of the device application are required for programming.

The current application can be found with the respective software information for download on the Internet at *www.abb.com/knx*. After import into ETS, the application appears in the *Catalogs* window under *Manufacturers/ABB/Analogue Input, 4-fold-MDRC*.

The device does not support the locking function of a KNX device in ETS. If you use a BCU code to inhibit access to all the project devices, this has no effect on this device. Data can still be read and programmed.

2.2 Resolution and accuracy and tolerances

Please note that the tolerances of the sensors which are used will need to be added to the listed values.

With sensors based on resistance measurement, it is also necessary to consider the feeder cable errors.

In the supplied state of the device, the stated accuracies will not be initially achieved. After initial commissioning, the device performs an autonomous calibration of the analogue measurement circuit. This calibration takes about an hour and is performed in the background. It is undertaken regardless of whether or not the device is parameterized and is independent of the connected sensors. The normal function of the device is not affected. After calibration has been completed, the calibration values which have been determined will be stored in the non-volatile memory. Thereafter, the device will achieve this level of accuracy every time it is switched on. If the calibration is interrupted by programming or bus failure, it will recommence every time it is restarted. The ongoing calibration is displayed in the Status byte by a 1 in bit 4.

Important
The Analogue Input has a U_n = 24 V DC output voltage to power the sensors. Make sure that the maximum output current is not exceeded.

2.2.1 Voltage signals

Sensor signal	Resolution	Accuracy at 25 °C T_U*1	Accuracy at -5…45 °C T_U*1	Accuracy at -20…70 °C T_u*1	Remark
0…1 V	200 µV	±0.2 % ±1 mV	±0.5 % ±1 mV	±0.8 % ±1 mV	
0…5 V	200 µV	±0.2 % ±1 mV	±0.5 % ±1 mV	±0.8 % ±1 mV	
0…10 V	200 µV	±0.2 % ±1 mV	±0.5 % ±1 mV	±0.8 % ±1 mV	
1…10 V	200 µV	±0.2 % ±1 mV	±0.5 % ±1 mV	±0.8 % ±1 mV	

*1 of current measured value at ambient temperature (T_U)

2.2.2 Current signals

Sensor signal	Resolution	Accuracy at 25 °C T_U*2	Accuracy at -5…45 °C T_u*2	Accuracy at -20…70 °C T_u *2	Remark
0…20 mA	2 µA	±0.2 % ±4 µA	±0.5 % ±4 µA	±0.8 % ±4 µA	
4…20 mA	2 µA	±0.2 % ±4 µA	±0.5 % ±4 µA	±0.8 % ±4 µA	

*2 of current measured value at ambient temperature (T_U)

2.2.3 Resistance signals

Sensor signal	Resolution	Accuracy at 25 °C T_U*3	Accuracy at -5…45 °C T_u *3	Accuracy at -20…70 °C T_u *3	Remark
0…1,000 ohms	0.1 ohm	±1.0 ohm	±1.5 ohms	±2 ohms	
PT100*4	0.01 ohm	±0.15 ohm	±0.2 ohm	±0.25 ohm	0.1 ohm = 0.25 °C
PT1000*4	0.1 ohm	±1.5 ohms	±2.0 ohms	±2.5 ohms	1 ohm = 0.25 °C
KT/KTY 1,000*4	1 ohm	±2.5 ohms	±3.0 ohms	±3.5 ohms	1 ohm = 0.125 °C/at 25 °C
KT/KTY 2,000*4	1 ohm	±5 ohms	±6.0 ohms	±7.0 ohms	1 ohm = 0.064 °C/at 25 °C

*3 in addition to current measured value at ambient temperature (T_U)

*4 plus feeder cable and sensor faults

PT100

The PT100 is precise and exchangeable but subject to faults in the feeder cables (cable resistance and heating of the feeder cables). A terminal resistance of just 200 milliohm causes a temperature error of 0.5 °C.

PT1000

The PT1000 responds just like the PT100, but the influences of feeder cable errors are lower by a factor of 10. Use of this sensor is preferred.

KT/KTY

The KT/KTY has a low level of accuracy, can only be exchanged under certain circumstances and can only be used for very simple applications.

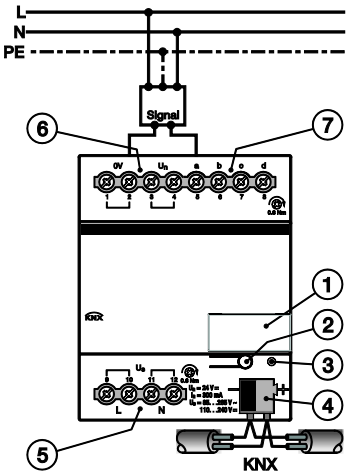
Please note that there are different tolerance classes for the sensors in the versions PT100 and PT1000.

The table indicates the individual classes:

Designation	Tolerance
DIN class A	0.15 + (0.002 x t)
1/3 DIN class B	0.10 + (0.005 x t)
1/2 DIN class B	0.15 + (0.005 x t)
DIN class B	0.30 + (0.005 x t)
2 DIN class B	0.60 + (0.005 x t)
5 DIN class B	1.50 + (0.005 x t)
t = Current temperature	

2.3 Connection schematics

Connecting sensor with an external supply



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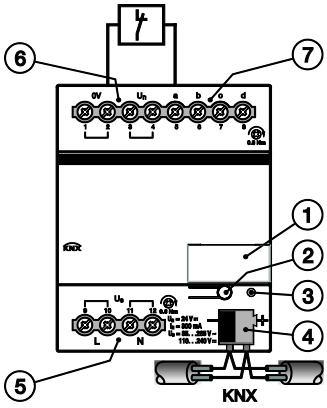
Connecting a floating contact



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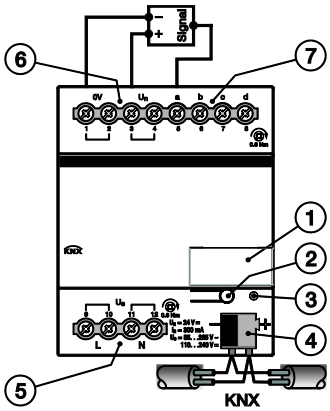
Connecting a 3-conductor sensor with its own power supply



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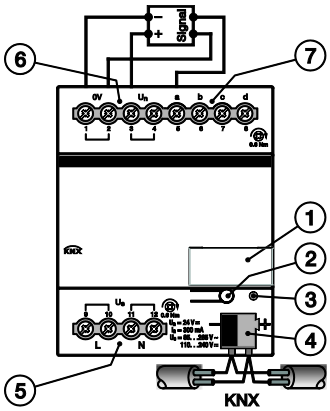
Connecting a 4-conductor sensor with its own power supply



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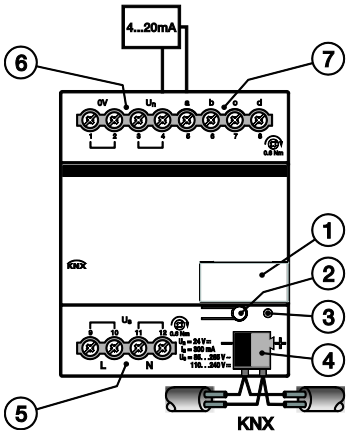
Connecting a 4…20 mA sensor



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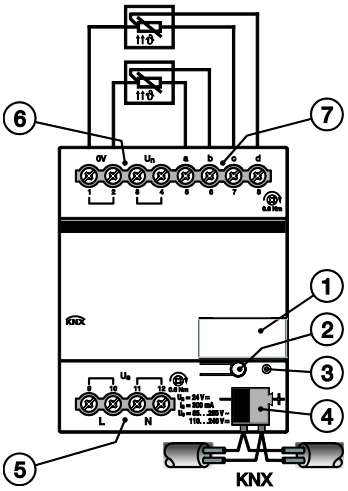
Connecting a PT100/PT1000 3-conductor temperature sensor



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1 Label carrier

2 *Programming* button

3 *Programming* LED ● (red)

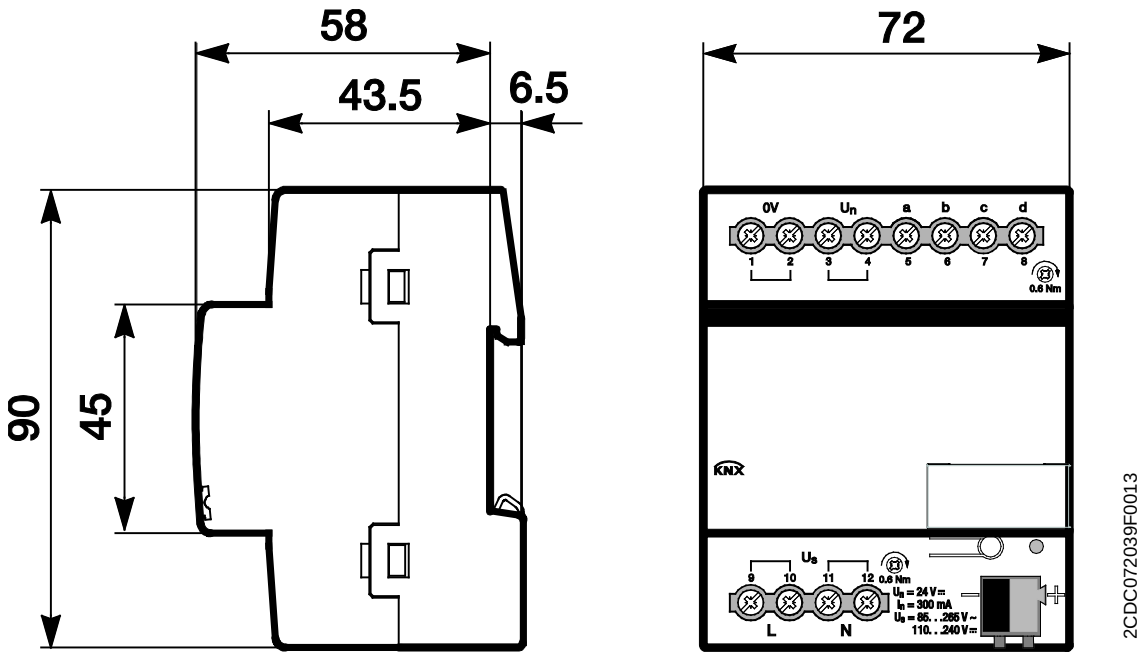
4 Bus connection terminal

5 Power supply

6 Auxiliary voltage output for sensor supply

7 Sensor input

2.4 Dimension drawing



2.5 Mounting and installation

The device is a modular installation device for quick installation in distribution boards on 35 mm mounting rails to DIN EN 60 715.

The installation position can be selected as required.

The electrical connection is implemented using screw terminals. The connection to the bus is implemented using the supplied bus connection terminal. The terminal assignment is located on the housing.

The device is ready for operation once the mains voltage and the bus voltage have been applied.

Accessibility to the device for the purpose of operation, testing, visual inspection, maintenance and repair must be provided compliant to DIN VDE 0100-520.

Attention

The sensor manufacturer's technical data must be observed for optimum measuring or monitoring values. The same applies to the specifications with regard to equipment for lightning protection.

Commissioning requirement

In order to commission the device, a PC with ETS as well as a connection to the ABB i-bus®, e.g. via a KNX interface, is required.

The device is ready for operation after connection to the bus voltage. Additional auxiliary voltage is required.

Important

The maximum permissible current of a KNX line must not be exceeded.
During planning and installation ensure that the KNX line is correctly dimensioned.
The device features a maximum current consumption of 12 mA.

Mounting and commissioning may only be carried out by electrical specialists. The appropriate standards, guidelines, regulations and specifications for the appropriate country should be observed when planning and setting up electrical installations and security systems for intrusion and fire detection.

- Protect the device from damp, dirt and damage during transport, storage and operation.
- Only operate the device within the specified technical data!
- The device should only be operated in an enclosed housing (distribution board)!
- The voltage supply to the device must be switched off before mounting work is performed.

Danger

All poles must be disconnected when expanding or modifying the electrical connections.

Supplied state

The device is supplied with the physical address 15.15.255. The application is pre-installed. It is therefore only necessary to load group addresses and parameters during commissioning.

The complete application can be reloaded if required. Downloads may take longer after a change of application or a discharge.

Assignment of the physical address

The assignment and programming of the physical address is carried out in ETS.

The device features a *Programming* button for assignment of the physical address. The red *Programming* LED lights up after the button has been pressed. It goes off as soon as ETS has assigned the physical address or the *Programming* button is pressed again.

Download reaction

Depending on the PC which is used, the progress bar for the download may take up to one and a half minutes to appear, due to the complexity of the device.

Cleaning

The voltage supply to the device must be switched off before cleaning. If devices become dirty, they can be cleaned using a dry cloth or a cloth dampened with a soapy solution. Corrosive agents or solutions should never be used.

Maintenance

The device is maintenance-free. In the event of damage repairs should only be carried out by an authorized person, e.g. during transport and/or storage.

3 Commissioning

The *Threshold measurement 4f* application and ETS Engineering Tool Software are used to parameterize the device. The application provides the device with a comprehensive and flexible range of functions. The standard settings allow simple commissioning. The functions can be expanded if required.

3.1 Overview

The following functions can be selected for each of the four inputs:

Sensor type (type of input signal)	All conventional sensors with an output signal of 0…1 V, 0…5 V, 0…10 V, 1…10 V, 0…20 mA, 4…20 mA, 0…1,000 ohms, 2-conductor PT100s and 2- and 3-conductor PT1000s or a range of KT/KTY sensors can be connected. Furthermore, user-defined KTY sensors can be matched to the Analogue Input. Floating contacts also be processed.
Signal correction/ displacement	The sensor signal can be corrected or displaced.
Measuring range	Flexible setting option for the upper and lower measuring limits dependent on the sensor's output signal. The measuring curve can be linearly adapted between the upper and lower measuring limits.
Output value	Flexible setting options for the output value – upper and lower measuring limits dependent on the sensor's output signal.
Data types of the output value	The output value can be sent as a 1-bit value [0/1], 1-byte value [0...+255], 1-byte value [-128...+127], 2-byte value [0...+65,535], 2-byte value [-32,768...+32,767], 2-byte value (floating point) or 4-byte value (IEEE floating point).
Filtering	The output value is "smoothed" via the mean value. The mean value can be calculated over 1, 4, 16 or 64 measurements. A measurement is taken once per second.
Threshold	Two thresholds can be set, each with an upper and lower limit. The limits can be modified via the bus.
Calculation	There are four calculation objects available. It is thus possible to compare two output values or calculate the arithmetic mean. The options less than, greater than, addition, subtraction and averaging are available.

3.1.1 Conversion

For ABB i-bus® KNX devices, it is possible to adopt the parameter settings and group addresses from earlier versions of the application from ETS3.

Furthermore, conversion can be used to transfer the existing parameterization of a device to a different device.

Note
When the term "channels" is used in ETS, it always means inputs and/or outputs. To make the language of ETS generally valid for as many ABB i-bus® devices as possible, the word "channels" is used in this document.

The following applications can be fully converted:

- Threshold measurement 2f/1.0b (AE/A 2.1) to Threshold measurement 4f/1.0 (AE/S 4.1.1.3)

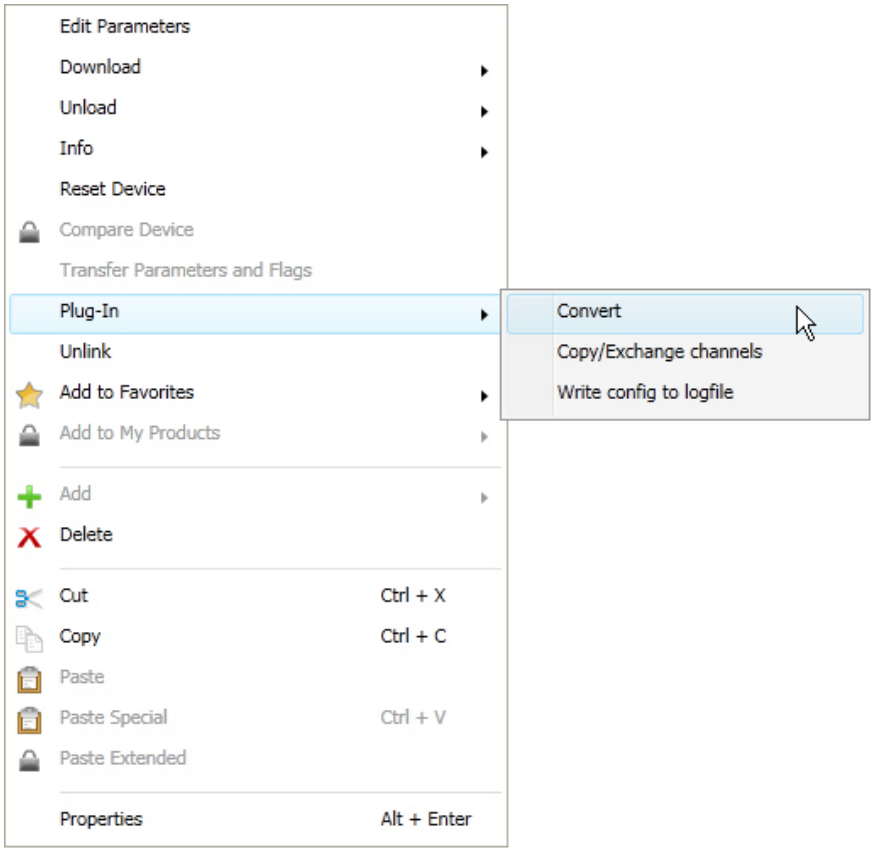
Note
If the number of channels on the target device is larger than the number of inputs/outputs of the source device, only the first inputs/outputs of the target device are written with the converted data from the source device. The remaining inputs/outputs retain or are reset to the default values. Default values for newly added parameters are set after conversion.

Inputs a and b of the AE/A 2.1 Analogue Input's application become the same inputs in the AE/S 4.1.1.3's application. Inputs c and d of the AE/S 4.1.1.3 remain unused.

The parameters *Mains frequency* and *Enable communication object "In operation", 1 bit* are not available in the AE/A 2.1 and after conversion they retain the standard values of the AE/S 4.1.1.3.

3.1.1.1 Conversion procedure

- Import the current application into ETS.
- Insert the desired device into your project.
- Perform your parameterizations and program the device.
- Right-click the product and select *Plug-in* > *Convert* in the context menu.



- Then make the desired settings in the *Convert* dialog.
- Finally, replace the physical address and delete the old device.

3.2 Parameters

The ETS Engineering Tool Software is used for parameterizing the device.

The application is in the ETS *Catalogs* window under *Manufacturers/ABB/Analogue Input, 4-fold-MDRC.*

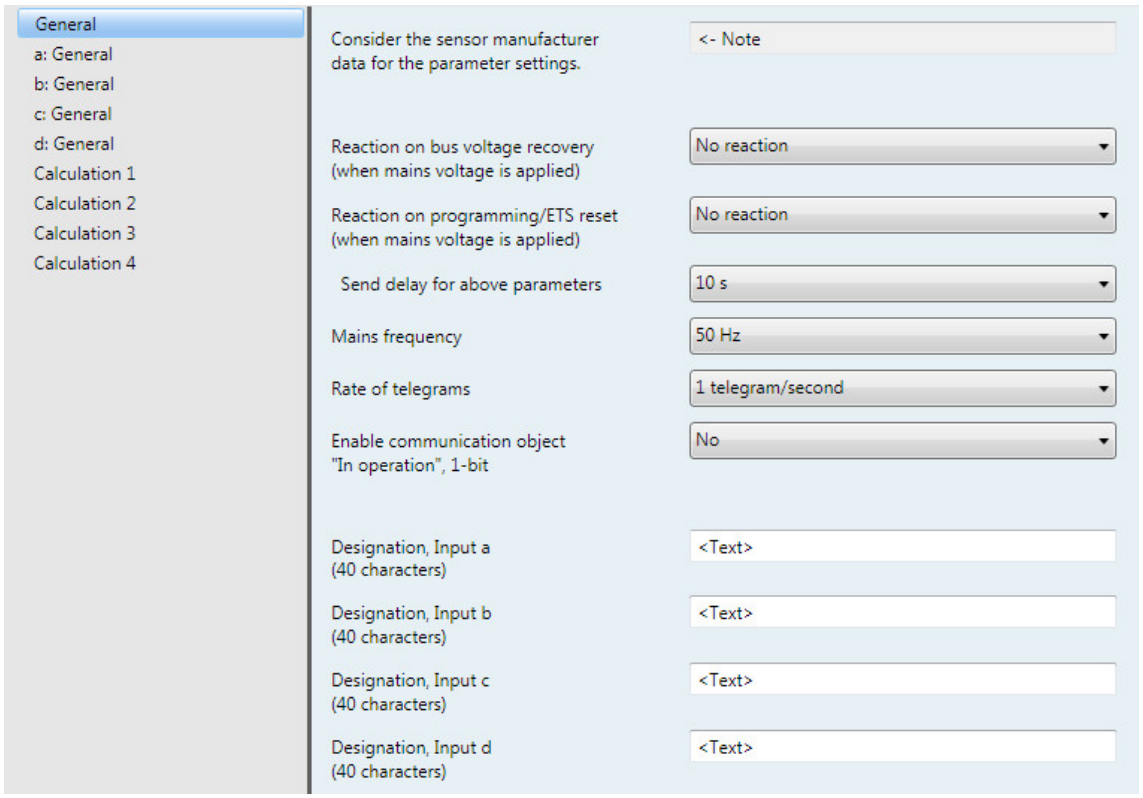
The following chapter describes the parameters of the device using the parameter windows. Parameter windows are structured dynamically so that further parameters may be enabled depending on the parameterization and the function.

The default values of the parameters are underlined, e.g.:

Options: Yes
No

3.2.1 Parameter window *General*

Higher level parameters can be set in the *General* parameter window.



Consider the sensor manufacturer for the parameter settings.

Important
The specifications of the sensor manufacturer must be observed to ensure perfect functioning of the Analogue Input. Furthermore, the manufacturer's specifications should be consulted for the parameter settings. On the connected sensors, ensure, for example, that the upper limits of 12 V with voltage signals and 25 mA with current signals are not exceeded.

Reaction on bus voltage recovery (when mains voltage is applied)

Reaction on programming/ETS reset (when mains voltage is applied)

Options: No reaction
Send object values immediately
Send object values with a delay

The parameters are used to set the reaction on bus voltage recovery/reaction on programming/ETS reset when mains voltage is applied.

- *No reaction*: No object values are sent. After bus voltage recovery, programming or ETS reset, none of the object values (output values, thresholds, calculation values, measured value out of range, In operation and Status byte) are sent on the bus, i.e. a visualization is not refreshed. The object values are sent at the earliest after the parameterized settings are sent on the bus.
- *Send object values immediately*: The object values are sent immediately. After bus voltage recovery, programming or ETS reset, the individual object values (output values, thresholds, calculation values, measured value out of range, In operation and Status byte) are sent on the bus. This ensures, for example, that visualizations display a current process map.
- *Send object values with a delay*: The object values are sent after a delay. After bus voltage recovery, programming or ETS reset, the individual object values (output values, thresholds, calculation values, measured value out of range, In operation and Status byte) are sent on the bus after a delay. Thus the process map is sent after a delay, e.g. to control the bus load in a KNX system.

The *Send delay* is set separately and applies to both the parameters *Reaction on bus voltage recovery* and *Reaction on programming/ETS reset*.

How does the device react if bus voltage recovers before the mains voltage?

As the circuit is supplied with power from the mains voltage, it cannot react to the bus voltage recovery. The circuit cannot be activated.

If the mains voltage recovers and the bus voltage is already available then the reaction after mains voltage recovery is undertaken.

How does the device react if mains voltage recovers before the bus voltage?

Case 1: Option *Send object values immediately*

The telegrams are sent immediately. As the bus voltage is still absent, no telegrams are visible. Should the bus voltage then recover, the reaction in accordance with the setting of the option for bus voltage recovery is applied.

Case 2: Option *Send object values with a delay*

The reaction depends on the option for bus voltage recovery.

Option *No reaction*

The ongoing send delay is not interrupted.

Option *Send object values immediately*

The ongoing send delay is interrupted and sending is implemented immediately.

Option *Send object values with a delay*

The ongoing send delay is retriggered. Sending is undertaken after the new send delay time.

How does sending values function?

Generally, the send options of the individual sensors tend to overlap with the options that are possible for mains voltage recovery or programming.

Example
If the temperature sensor is parameterized to send cyclically every 5 seconds, it will do so after mains voltage recovery, regardless of the option selected for mains voltage recovery.

With the options in parameter *Reaction on...*, it is possible after an event (mains voltage recovery, programming and bus voltage recovery) that the complete process map of the sensor (output values and thresholds) is either sent immediately or after a defined send delay. This ensures that all relevant information is guaranteed to be sent at least once after an event (e.g. for use by a visualization system).

What is an ETS reset?

Generally an ETS reset is defined as a reset of the device via the ETS. The ETS reset is triggered in the ETS under the menu item *Commissioning* with the function *Reset device*. This stops and restarts the application.

Send delay for above parameters

Options: 5 s/10 s/20 s/30 s/60 s

The send delay time determines the time between bus voltage recovery, programming/ETS reset and the time from which the telegrams should be sent with a delay. When the device has been started, the following communication objects also send a telegram after the set delay.

- The *In Operation – General* communication object sends an In operation telegram with the value 1 or 0 (adjustable).
- The *Status byte – General* communication object sends a Status byte telegram with the current value (state). Each bit is assigned with information.

For further information see: Appendix

Note
The settings in the parameters only have an effect on the parameters *Reaction on bus voltage recovery* and *Reaction on programming/ETS reset*. If the option *No reaction* is set in each of the parameters, the selected send delay has no function. No telegrams are sent during the send delay in progress in the initialization phase. Value Read telegrams are also answered during the delay time. Incoming telegrams to the communication object, e.g. *Request output value*, are not considered here. The send delay times should be coordinated to the entire KNX system.

How does the send delay function?

The sensor inputs are evaluated and telegrams are received during the send delay. The received telegrams are processed immediately, and the object values of the outputs change immediately if necessary. However, no telegrams are sent on the bus.

If during the Send delay objects are read via the Value Read telegrams, e.g. by visualization systems, immediately thereafter the corresponding Value Respond telegrams are sent and not just after the Send delay has timed out.

After the *Send delay* has timed out, all object values to be sent are sent on the bus.

Mains frequency

Options: 50 Hz
60 Hz

This parameter defines the mains frequency.

Rate of telegrams

Options: 1/2/3/5/10/20 telegrams/second

To control the bus load, this parameter can be used to limit the rate of telegrams per second.

Example
With the setting *5 telegrams/second* a maximum of five telegrams can be sent in a second.

Enable communication object "In operation", 1-bit

Options: No
Yes

- *Yes*: The 1-bit communication object *In operation* is enabled.

  Dependent parameter:

  Send

  Options: Value 0
  Value 1

  Sending cycle time in s [1...65,535]

  Options: 1...60...65,535

  Here a time interval is set, which the communication object *In operation* uses to cyclically send a telegram.

Note
After bus voltage recovery, the communication object sends its value after the set sending and switching delay time.

Designation, Input a, b, c, d (40 characters)

Options: < Text >

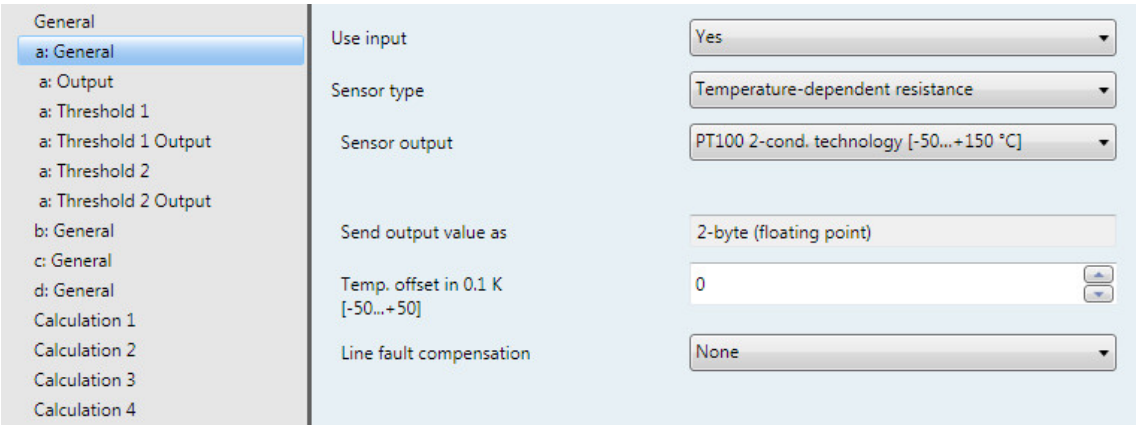
With this parameter, it is possible to enter a text of up to 40 characters in length for identification in the ETS.

Note
The text field allows you to enter information such as which function is assigned to which input. The text is purely for informative purposes and has no further function.

3.2.2 Parameter window *a: General* with sensor type: *Temperature-dependent resistance*

Setting options for sensor type *Temperature-dependent resistance*.

The specifications below also apply to parameter windows b...d: General.



Use input

Options: No
Yes

The parameter enables input a.

As a result, further parameters and communication objects become visible.

Sensor type

Options: Current/Voltage/Resistance
Temperature-dependent resistance
Floating contact scanning

The Sensor type is set with this parameter.

Selection of option *Temperature-dependent resistance*.

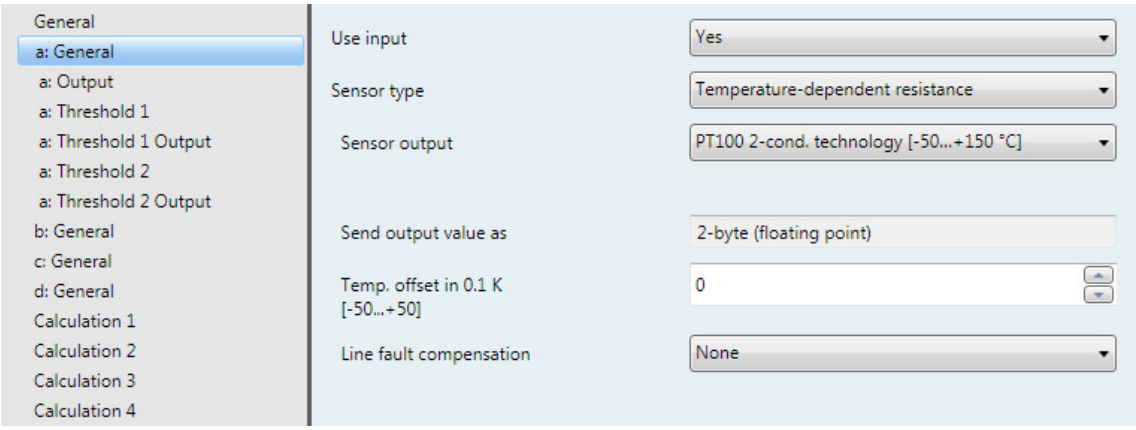
Dependent parameters:

Sensor output

Options: PT100 2-cond. technology [-50…+150 °C]
PT1000 2-cond. technology [-50…+150 °C]
PT100 3-cond. technology [-50…+150 °C]
PT1000 3-cond. technology [-50…+150 °C]
KT/KTY [-50…+150 °C]

The Sensor output is set with this parameter. The data can be found in the sensor manufacturer's technical documentation.

3.2.2.1 Sensor output parameter option: *PT100/PT1000 2-cond. technology*



Send output value as

This parameter is fixed to *2-byte (floating point)*.

What is the output value?

The Analogue Input records a sensor measured value, converts it according to the set parameters and sends it on the bus. This sent value is designated as the output value.

Temp. offset in 0.1 K
[-50...+50]

Options: -50...0...+50

A maximum offset of ± 5 K (Kelvin) can be added to the recorded temperature with this parameter.

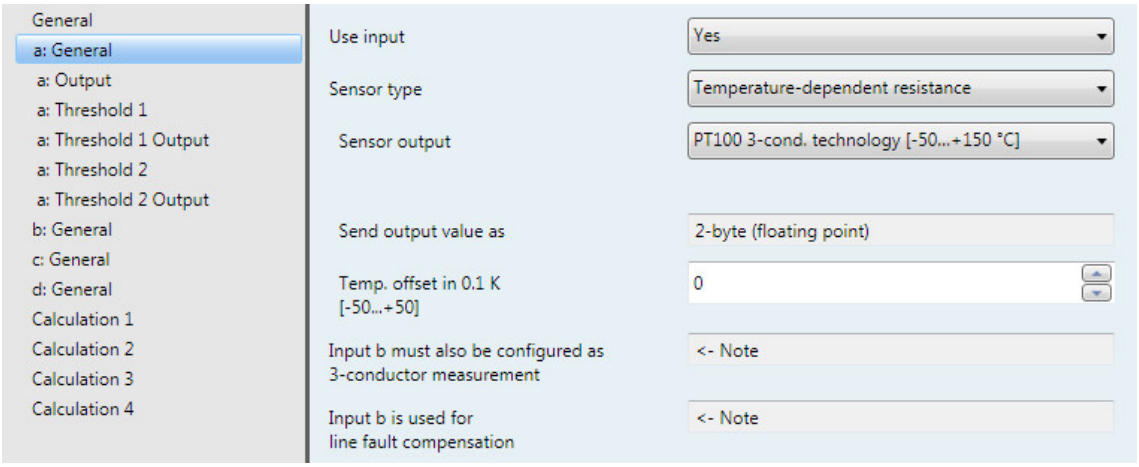
Line fault compensation

Options: None
Via cable length
Via cable resistance

This parameter is used for setting the line fault compensation.

Selection of options V*ia cable length* and V*ia cable resistance*: For a description, see Chapter Line fault compensation Via cable length, p. 34 and Chapter Line fault compensation Via cable resistance, p. 35.

3.2.2.2 Parameter option Sensor output: *PT100/PT1000 3-cond. technology*



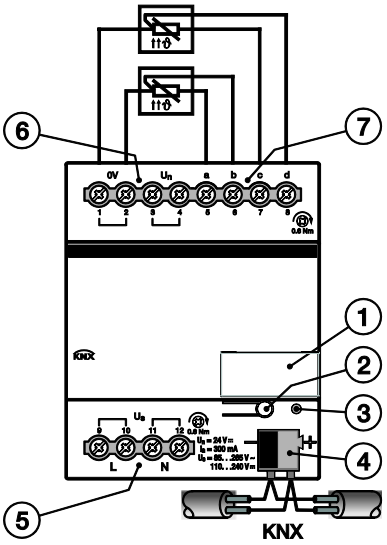
Note
For a description of the parameters, see Chapter Sensor output parameter option: PT100/PT1000 2-cond. technology, p. 29.

On selecting a 3-conductor PT100 or PT1000 the following information also appears:

Input b must also be configured as
3-conductor measurement

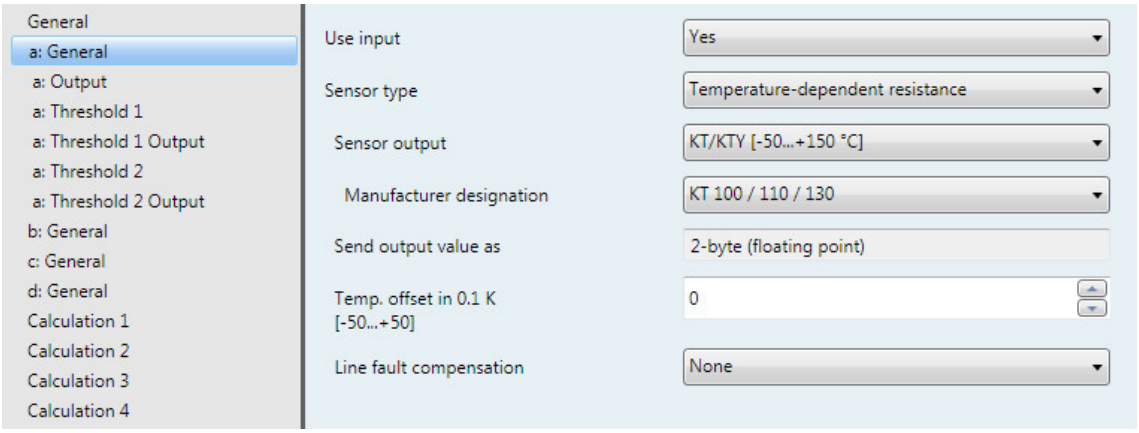
Input b is used for
line fault compensation

3-conductor connection:



Note
With the 3-conductor connection the following applies: • Input a or c always measures the measuring resistor. • Input b or d always measures the cable resistance. When a 3-conductor connection is selected, inputs b and d are visible in the communication objects. If a group address is linked to these inputs, then the measured cable resistance is transmitted. It should be noted that the temperature value must be converted with the DPT 9.001, so that the resistance value remains intact.

3.2.2.3 Parameter option Sensor output*: KT/KTY [-50…+150 °C]*



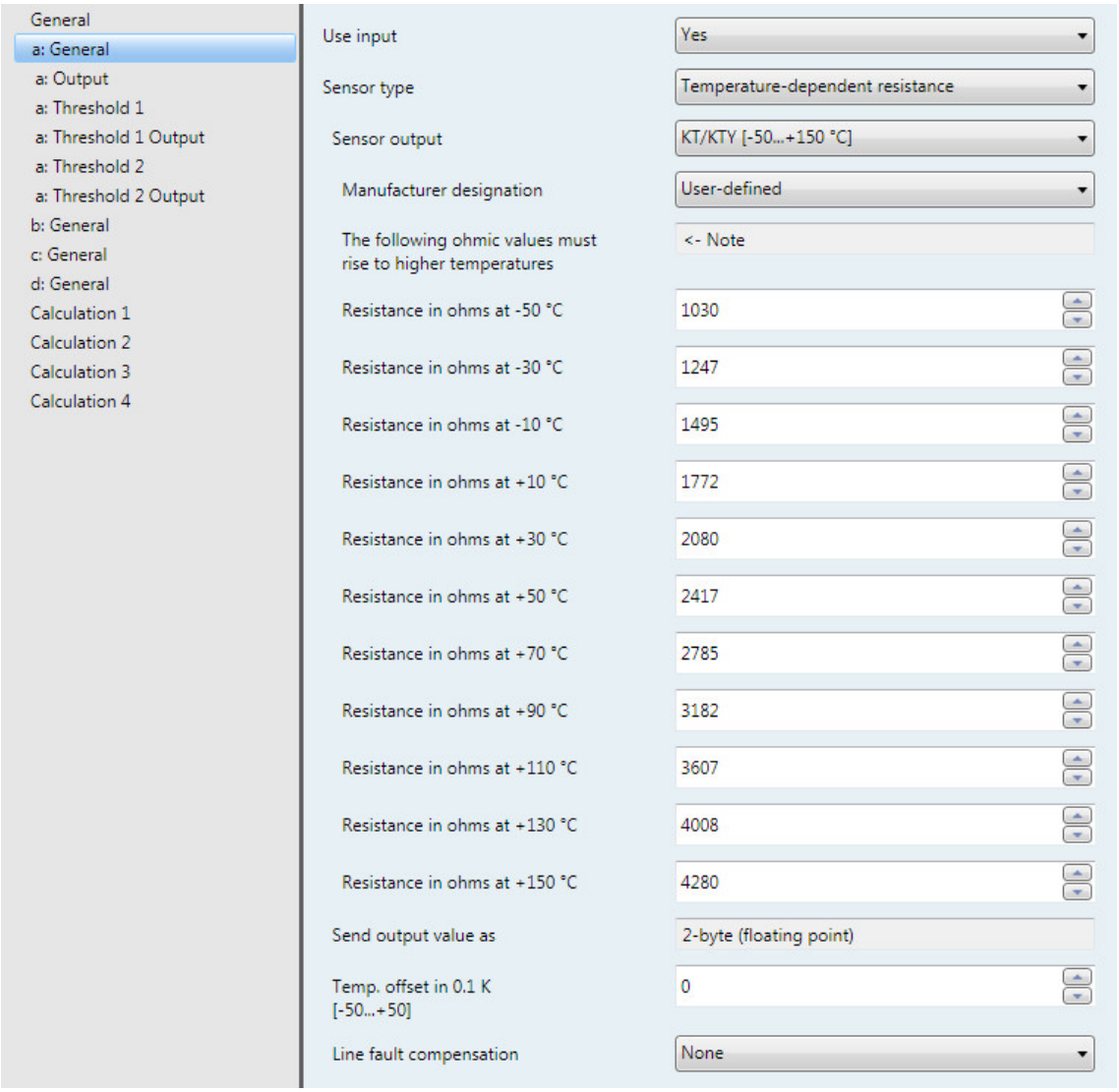
Manufacturer designation

Options:
<u>KT 100 / 110 / 130</u>
KT 210 / 230
KTY 10-5 / 11-5 / 13-5
KTY 10-6 / 10-62 / 11-6 / 13-6 / 16-6 / 19-6
KTY 10-7 / 11-7 / 13-7
KTY 21-5 / 23-5
KTY 21-6 / 23-6
KTY 21-7 / 23-7
KTY 81-110 / 81-120 / 81-150
KTY 82-110 / 82-120 / 82-150
KTY 81-121 / 82-121
KTY 81-122 / 82-122
KTY 81-151 / 82-151
KTY 81-152 / 82-152
KTY 81-210 / 81-220 / 81-250
KTY 82-210 / 82-220 / 82-250
KTY 81-221 / 82-221
KTY 81-222 / 82-222
KTY 81-251 / 82-251
KTY 81-252 / 82-252
KTY 83-110 / 83-120 / 83-150
KTY 83-121
KTY 83-122
KTY 83-151
User-defined

For selection of a predefined KTY sensor

Note
If a KTY sensor which is not in the list is used, the option *User-defined* can be used to enter its characteristic, see following page.

User-defined



The following ohmic values must rise to higher temperatures

<- Note

To ensure correct functioning of the Analogue Input with respect to the user-defined entries, the ohm (resistance) values as visible for the preset values must be in ascending order.

An incorrect entry can lead to unrealistic output values!

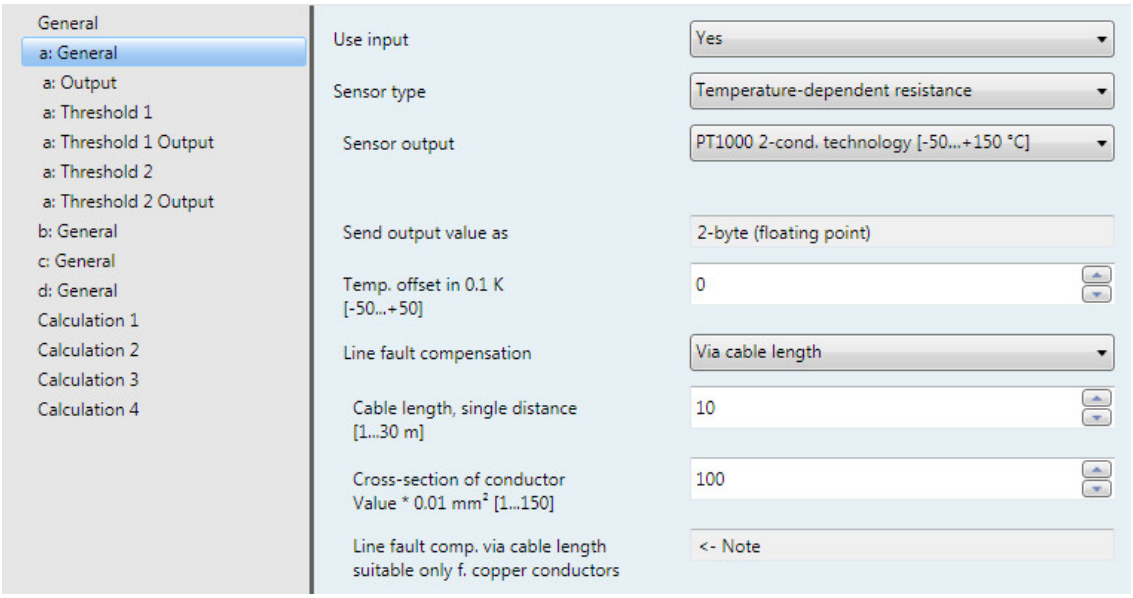
Resistance in ohms at -50…+150 °C

Options: 0…1,030…4,280…5,600

A resistance characteristic can be entered via these 11 parameters. The data can be found in the sensor manufacturer's technical documentation.

Note
The description of the parameters *Send output value as, Temperature offset* and *Line fault compensation* can be found in Parameter window a: General with sensor type: Temperature-dependent resistance.

3.2.2.4 Line fault compensation *Via cable length*



Cable length, single distance [1...30 m]

Options: 1...<u>10</u>...30

For setting the single cable length of the connected temperature sensor.

Important
The maximum cable length permitted between the sensor and device input is 30 m.

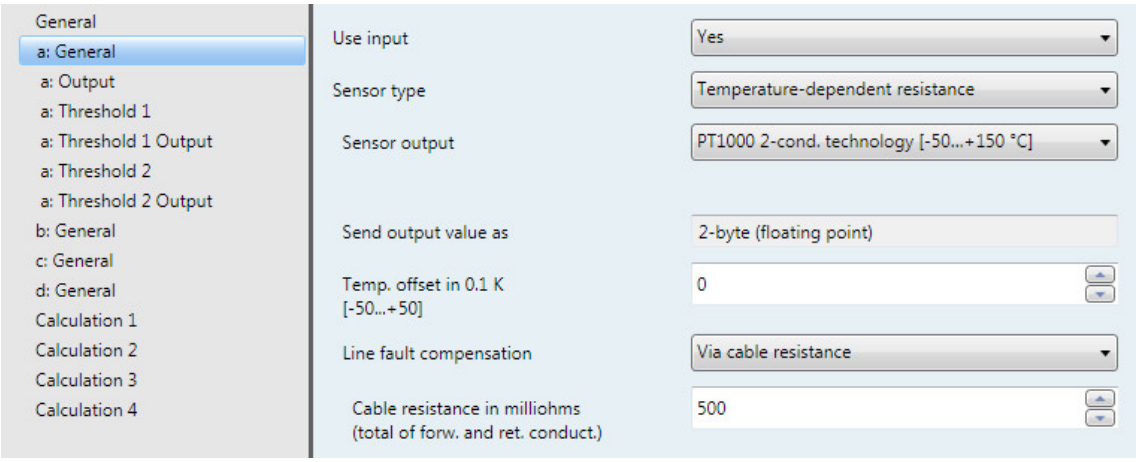
Cross-section of conductor Value * 0.01 mm² [1...150]

Options: 1...<u>100</u>...150 (150 = 1.5 mm²)

The cross-section of the conductor to which the temperature sensor is connected is entered using this parameter.

Important
Line fault compensation via cable length is only suitable for copper conductors.

3.2.2.5 Line fault compensation V*ia cable resistance*



Cable resistance in milliohms
(total of forw. and ret. conduct.)

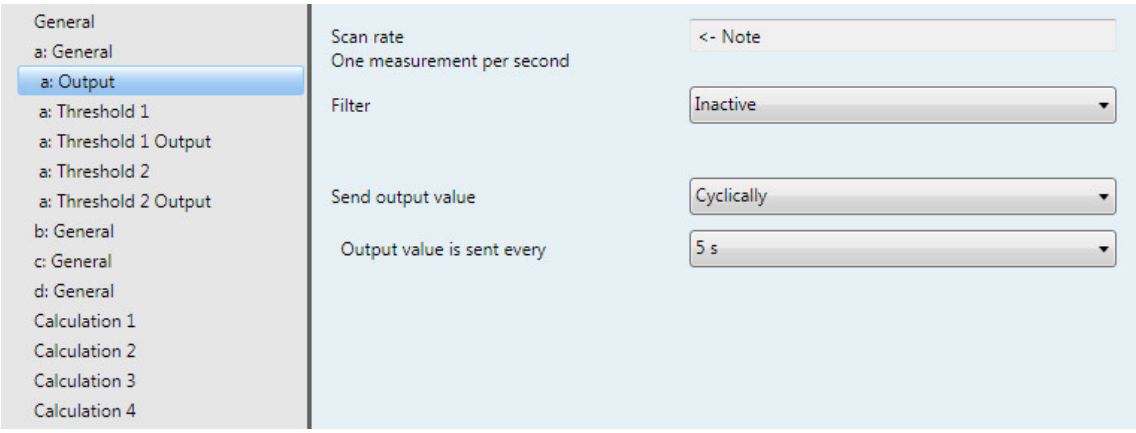
Options: 0...<u>500</u>...10,000

Using this parameter the level of cable resistance of the connected temperature sensor is set.

Important
In order to correctly measure the cable resistance, the conductors must be shorted together at the end of the cable and should not be connected to the Analogue Input.

3.2.2.6 Parameter window *a: Output*

This parameter window is enabled if the parameter *Use input* has been set to *Yes* in Parameter window a: General with sensor type: Temperature-dependent resistance, p. 28.



Scan rate

The sensor signal of input is measured once per second.

Filter

Options: Inactive
Low (mean value over 4 measurements)
Medium (mean value over 16 measurements)
High (mean value over 64 measurements)

This parameter is used for setting a filter (floating mean value filter). This can be used to set the output value as a mean value using three different options.

- *Inactive*: Filter is not active
- *Low*: Mean output value over 4 measurements
- *Medium*: Mean output value over 16 measurements
- *High*: Mean output value over 64 measurements

Important
By use of the filter the output value is “smoothed” via the mean value and is available for further processing. The filter thus has immediate effects on the thresholds and calculation values. The higher the degree of the filtering applied, the smoother the result. This means that the changes to the output values become slower. Example: An erratic change of the sensor signal with the setting *Medium* will take 16 seconds until the output value is through.

Send output value

Options: On request
On change
Cyclically
On change and cyclically

This parameter defines how the output value should be sent.

- *On request:* The output value is sent on request.

The *Request output value – Input a* communication object appears.

As soon as a 1 is received at this communication object, the current output value is sent once to the communication object *Output value – Input a*.

- *On change*: The output value is sent when a change occurs.
- *Cyclically*: The output value is sent cyclically.
- *On change and cyclically*: The output value is sent cyclically when a change occurs.

Selection of options *On change, Cyclically* and *On change and cyclically*:

Dependent parameters:

Output value is sent every

Options: 5/10/30 s
1/5/10/30 min
1/6/12/24 h

The interval for cyclical sending is set with this additional parameter.

Output value is sent from a change of [x 0.1 °C]

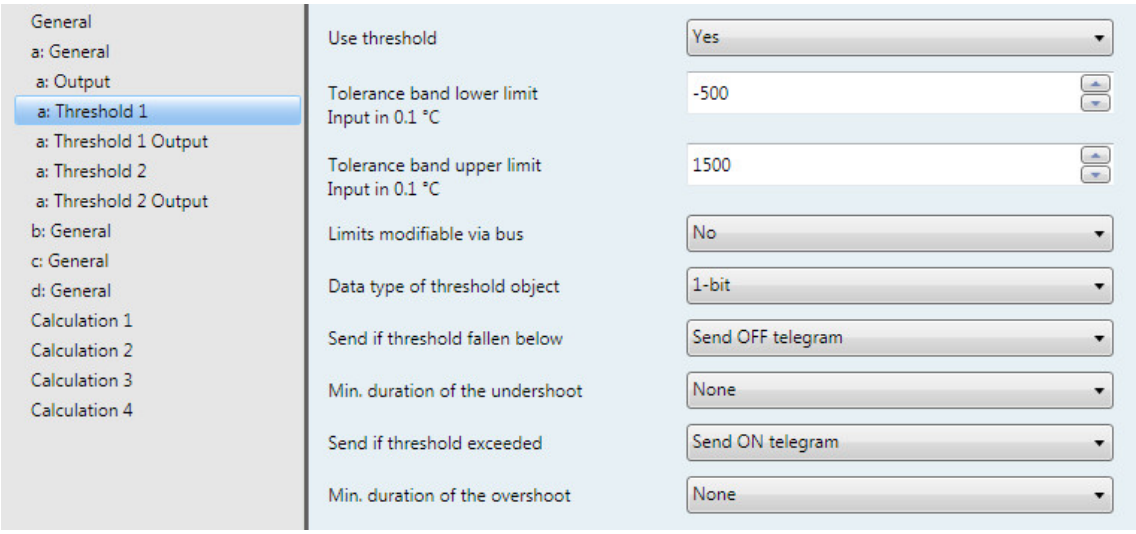
Options: 1…10...200

This parameter defines from which temperature change the output value should be sent.

- *10*: The output value is sent after a change of 1 °C.

3.2.2.7 Parameter window *a: Threshold 1*

The details in the following also apply to *a: Threshold 2.*



Use threshold

Options: No
Yes

This parameter defines if threshold 1 should be used. If *Yes* is selected, the communication object *Threshold – Input a Threshold 1* appears.

Tolerance band lower limit
Input in 0.1 °C

Options: -500…1500

Tolerance band upper limit
Input in 0.1 °C

Options: -500…1500

The upper and lower limits of the tolerance band are set via these two parameters.

The entry is made in steps of 0.1 °C, i.e. an entry of 1500 means 150 °C.

For further information see: Appendix

Limits modifiable via bus

Options: No
Yes

This parameter specifies whether the limits can be changed via the bus.

- *Yes:* The following communication objects appear:

  Modify – Input a Threshold 1 lower limit

  Modify – Input a Threshold 1 upper limit.

Important
The value formats of these communication objects are the same as the format set in parameter window *a: General,* under the parameter *Send output value as* (see Parameter window a: General with sensor type: Temperature-dependent resistance, p. 28).

Data type of threshold object

Options: 1-bit
1-byte [0...+255]

Selection of option *1-bit:*

Dependent parameters:

Send if threshold fallen below

Options: Do not send telegram
Send ON telegram
Send OFF telegram

Send if threshold exceeded

Options: Do not send telegram
Send ON telegram
Send OFF telegram

- *Do not send telegram:* There is no reaction.
- *Send ON telegram:* A telegram with the value 1 is sent.
- *Send OFF telegram:* A telegram with the value 0 is sent.

Min. duration of the undershoot

Min. duration of the overshoot

Options: None
5/10/30 s
1/5/10/30 min
1/6/12/24 h

- *None*: the threshold is sent directly.

With the further time options, a minimum duration can be selected. If the send condition reverts during the minimum duration, no telegrams are sent.

Selection of option *1-byte [0...+255]:*

Dependent parameters:

Send if threshold fallen below [0...+255]

Options: 0...255

Send if threshold exceeded [0...+255]

Options: 0...255

A value of 0 to 255 can be entered in single steps.

Min. duration of the undershoot

Min. duration of the overshoot

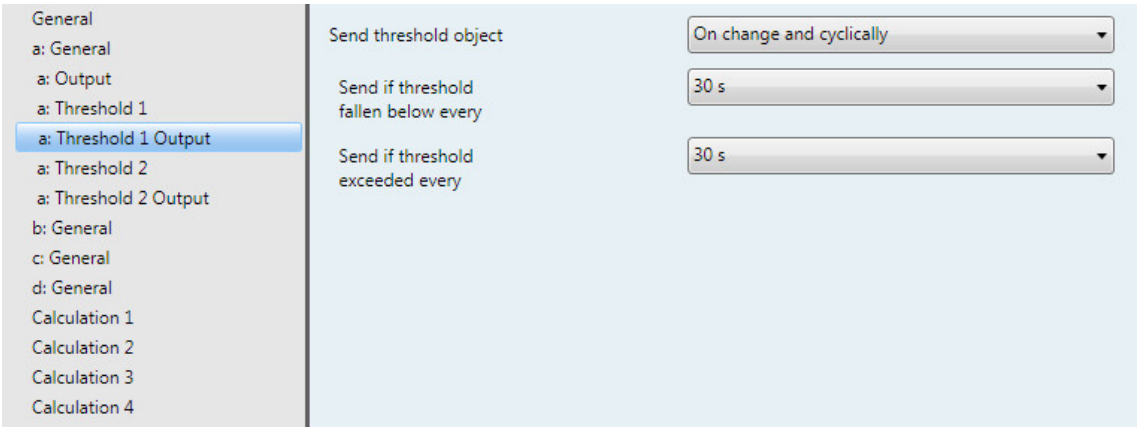
Options: None
5/10/30 s
1/5/10/30 min
1/6/12/24 h

- *None*: the threshold is sent directly.

With the further time options, a minimum duration can be selected. If the send condition reverts during the minimum duration, no telegram is sent.

3.2.2.8 Parameter window *a: Threshold 1 Output*

The details in the following also apply to *a: Threshold 2 Output.*



Send threshold object

Options: On change
<u>On change and cyclically</u>

This parameter is used to specify the send behavior of the threshold object.

- *On change*: The threshold object is sent when a change occurs.
- *On change and cyclically:* The threshold object is sent cyclically when a change occurs. The threshold object is sent cyclically until the value falls below or exceeds the other limit.

  Dependent parameters:

  Send if threshold fallen below every

  Send if threshold exceeded every

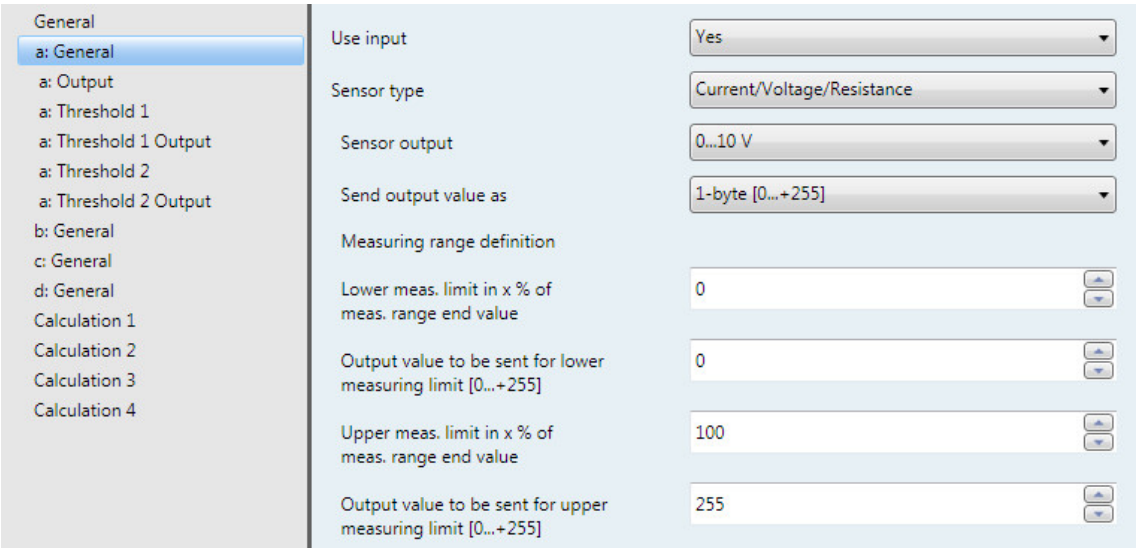
  Options: 5/10/<u>30 s</u>
  1/5/10/30 min
  1/6/12/24 h

  These two parameters are used to define the point to which cyclical sending should take place after an undershoot of the lower limit or an overshoot of the upper limit.

3.2.3 Parameter window *a: General* with sensor type: *Current/Voltage/Resistance*

Setting options with sensor type *Current/Voltage/Resistance*.

The specifications below also apply to parameter windows *b...d: General*.



Use input

Options: No
Yes

The parameter enables input a.

As a result, further parameters and communication objects become visible.

Sensor type

Options: Current/Voltage/Resistance
Temperature-dependent resistance
Floating contact scanning

The Sensor type is set with this parameter.

Selection of option *Current/Voltage/Resistance*

Dependent parameters:

Sensor output

Options:
0…1 V
0…5 V
0…10 V
1…10 V
0…20 mA
4…20 mA
0…1,000 ohms

With this parameter the input range of the connected sensor is set to the *Sensor output*.

Send output value as

Options:
1-byte [0...+255]
1-byte [-128...+127]
2-byte [0...+65,535]
2-byte [-32,768…+32,767]
2-byte (floating point)
4-byte (IEEE floating point)

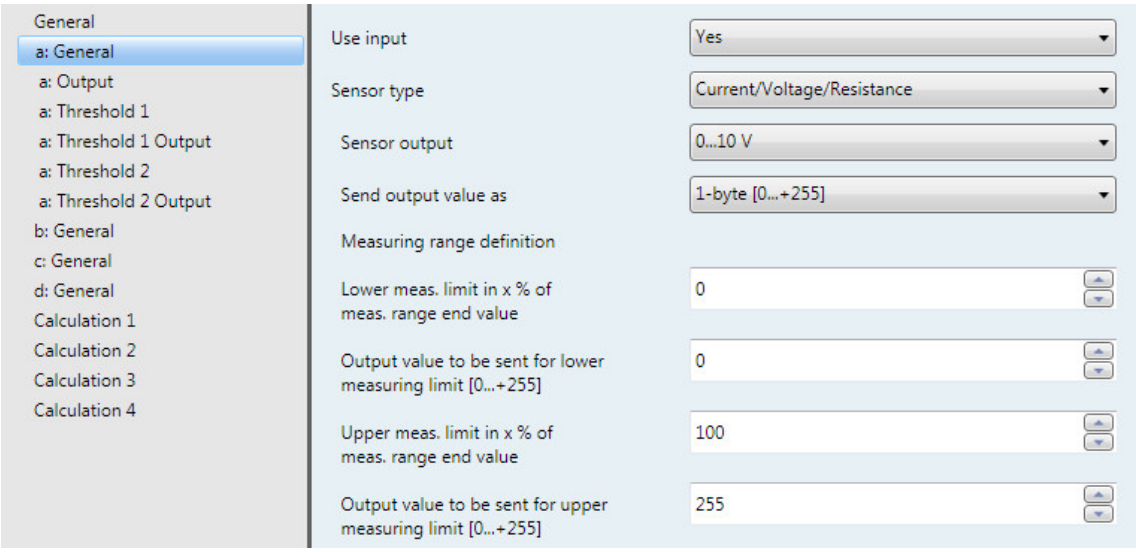
This parameter defines in which format the *Output value* should be sent.

If the option *2-byte (floating point)* or *4-byte (IEEE floating point)* is set, a further parameter will also appear at the bottom of the parameter window.

What is the output value?

The Analogue Input records a sensor measured value, converts it according to the set parameters and sends it on the bus. This sent value is designated as the output value.

Measuring range definition



The following four parameters are dependent on the parameter *Send output value as*.

The preset values change dependent on the selected option. With the options *2-byte (floating point)* or *4-byte (IEEE floating point)* the additional *Factor* parameter appears.

The following description is an example for all adjustable options.

Lower meas. limit in x % of meas. range end value

Options: 0...100

Upper meas. limit in x % of meas. range end value

Options: 0...100

Using both of these parameters the lower and upper measuring limits in x % of the measuring range end value are set. If the set upper and lower measuring limits are exceeded or not achieved, the communication object *Measured value out of range – Input a* sends a 1. If the measured value is back between the limits, the communication object sends a 0.

What is the measuring range end value?

The measuring range end value is used to define the maximum voltage, current, resistance value or temperature value which is set in the *Sensor output* parameter, e.g. a sensor with signal output from 0...10 V has a measuring range end value of 10 V.

Output value to be sent for lower measuring limit [0...+255]

Options: 0...255

Output value to be sent for upper measuring limit [0...+255]

Options: 0...255

Using both these parameters the Output values to be sent for upper and lower measuring limits [0...+255] are set. The measuring curve between the upper and lower measuring limits is linear.

What is the measuring limit?

Using the measuring limit, you define up to which set values the Analogue Input is to evaluate the signal of the connected sensor. Both an upper and a lower measuring limit can be set.

Example
A sensor with a measuring range of 0...1,000 ohms is connected, but the measuring curve should only be evaluated between 10 and 90 % (100...900 ohms). In this case the measuring limits are between 100 and 900 ohms.

Selection of option *2-byte (floating point)* for parameter *Send output value as*:

Dependent parameter:

Factor for the output values and thresholds

Options: 0.01
0.1
1
10
100

Selection of option *4-byte (IEEE floating point)* for parameter *Send output value as*:

Dependent parameter:

Factor for the output values and thresholds

Options: 0.000001
0.00001
0.0001
0.001
0.01
0.1
1
10
100
1,000
10,000
100,000
1,000,000

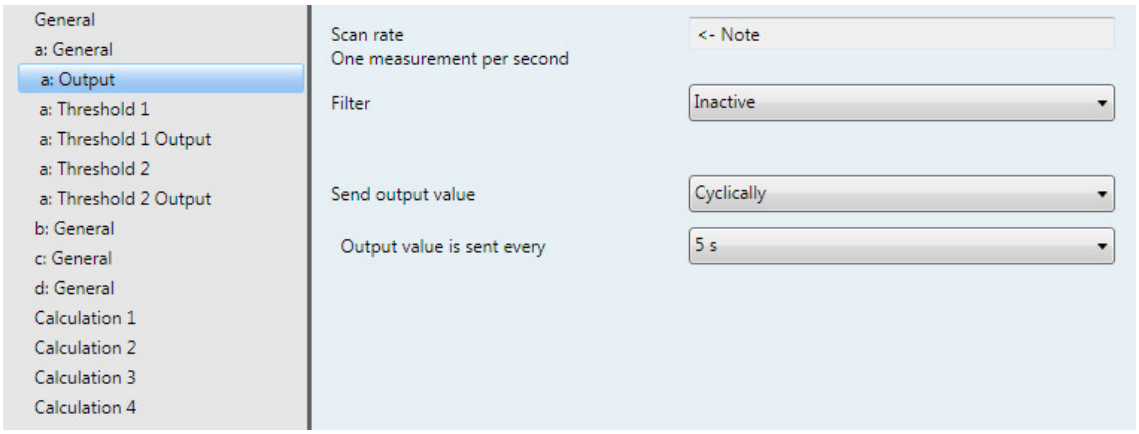
Using this parameter the factors for the output values and thresholds are set.

Example
Option *1*: The output value is transferred 1:1.

By entering a factor, units can be converted, i.e. the output value corresponds to the output value to be sent multiplied by the set factor.

3.2.3.1 Parameter window *a: Output*

This parameter window is enabled if the parameter *Use input* has been set to *Yes* in Parameter window a: General with sensor type: Current/Voltage/Resistance, p. 42.



Scan rate

The sensor signal of input is measured once per second.

Filter

Options: Inactive
Low (mean value over 4 measurements)
Medium (mean value over 16 measurements)
High (mean value over 64 measurements)

This parameter is used for setting a filter (floating mean value filter). This can be used to set the output value as a mean value using three different options.

- *Inactive*: Filter is not active
- *Low*: Mean output value over 4 measurements
- *Medium*: Mean output value over 16 measurements
- *High*: Mean output value over 64 measurements

Important
By use of the filter the output value is “smoothed” via the mean value and is available for further processing. The filter thus has immediate effects on the thresholds and calculation values. The higher the degree of the filtering applied, the smoother the result. This means that the changes to the output values become slower. Example: An erratic change of the sensor signal with the setting *Medium* will take 16 seconds until the output value is through.

Send output value

Options: On request
On change
Cyclically
On change and cyclically

This parameter defines how the output value should be sent.

- *On request:* The output value is sent on request.

The *Request output value – Input a* communication object appears.

As soon as a 1 is received at this communication object, the current output value is sent once to the communication object *Output value – Input a*.

- *On change*: The output value is sent when a change occurs.
- *Cyclically*: The output value is sent cyclically.
- *On change and cyclically*: The output value is sent cyclically when a change occurs.

Selection of options *On change, Cyclically* and *On change and cyclically*:

Dependent parameters:

Output value is sent every

Options: 5/10/30 s
1/5/10/30 min
1/6/12/24 h

The interval for cyclical sending is set with this additional parameter.

**Output value is sent from a x %
change in the output range**

Options: 1…10...200

Using this parameter you define from which percentage change of the output range the output value is to be sent.

With option 2 the output value is sent from a 2 % change in the output range.

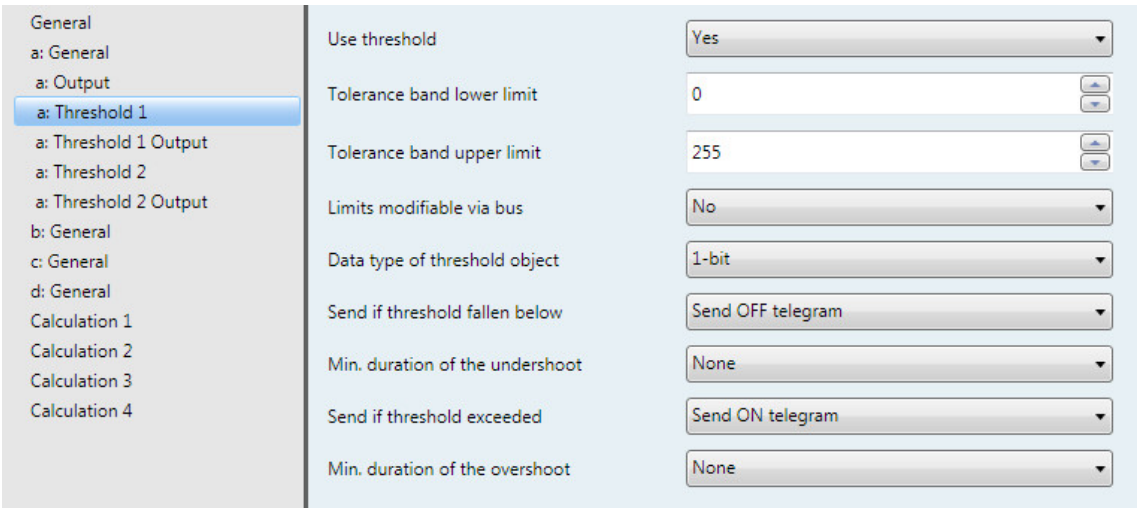
What is the output range?

The output range is determined by the setting options for the upper and lower measuring limits. The difference between the upper and lower measuring limits forms the output range.

Example
If the lower measuring limit of the sensor (0...1,000 ohms) is set to 10 % (100 ohms) and the upper measuring limit to 90 % (900 ohms), the output range is (900 ohms - 100 ohms) = 800 ohms. 2 % of 800 ohms = 16 ohms.

3.2.3.2 Parameter window *a: Threshold 1*

The details in the following also apply to *b: Threshold 2 Output*.



Use threshold

Options: No
Yes

This parameter defines if threshold 1 should be used. If *Yes* is selected, the communication object *Threshold – Input a Threshold 1* appears.

Tolerance band lower limit

Tolerance band upper limit

Options: Dependent on parameter *Send output value as* in Parameter window a: General with sensor type: Current/Voltage/Resistance

The upper and lower limits of the tolerance band are set via these two parameters.

For further information see: Appendix

Note
Depending on the setting of the parameter *Send output value as* in parameter window *a General*, different limit values are preselected (see Parameter window a: General with sensor type: Current/Voltage/Resistance, p. 42).

Limits modifiable via bus

Options: No
Yes

This parameter specifies whether the limits can be changed via the bus.

- *Yes:* The following communication objects appear:

  Modify – Input a Threshold 1 lower limit

  Modify – Input a Threshold 1 upper limit.

Important
The value formats of these communication objects are the same as the format set in parameter window *a: General,* under the parameter *Send output value as* (see Parameter window a: General with sensor type: Current/Voltage/Resistance, p. 42). The value must be sent in the same format as the output value of the input.

Data type of threshold object

Options: 1-bit
1-byte [0...+255]

Selection of option *1-bit:*

Dependent parameters:

Send if threshold fallen below

Options: Do not send telegram
Send ON telegram
Send OFF telegram

Send if threshold exceeded

Options: Do not send telegram
Send ON telegram
Send OFF telegram

- *Do not send telegram:* There is no reaction.
- *Send ON telegram:* A telegram with the value 1 is sent.
- *Send OFF telegram:* A telegram with the value 0 is sent.

Min. duration of the undershoot

Min. duration of the overshoot

Options: None
5/10/30 s
1/5/10/30 min
1/6/12/24 h

- *None*: the threshold is sent directly.

With the further time options, a minimum duration can be selected. If the send condition reverts during the minimum duration, no telegrams are sent.

Selection of option *1-byte [0...+255]:*

Dependent parameters:

Send if threshold fallen below [0...+255]

Options: 0...255

Send if threshold exceeded [0...+255]

Options: 0...255

A value of 0 to 255 can be entered in single steps.

Min. duration of the undershoot

Min. duration of the overshoot

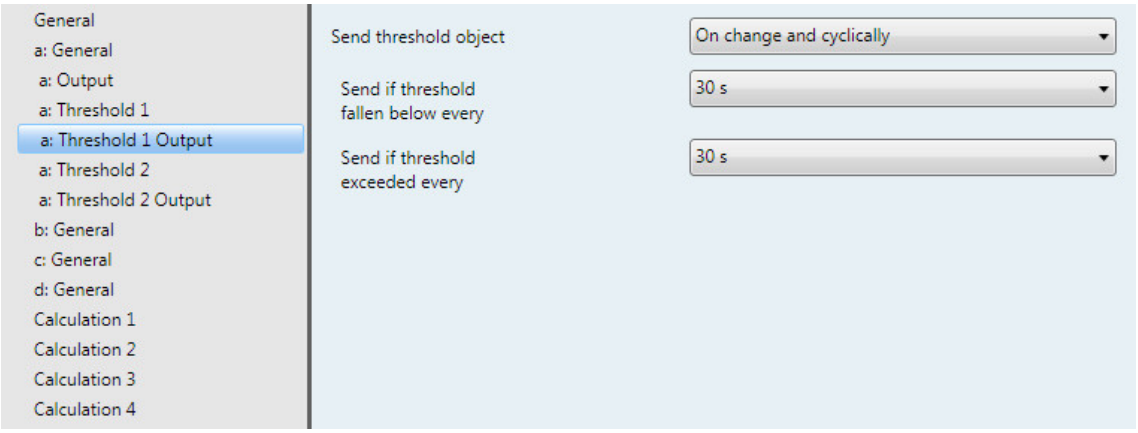
Options: None
5/10/30 s
1/5/10/30 min
1/6/12/24 h

- *None*: the threshold is sent directly.

With the further time options, a minimum duration can be selected. If the send condition reverts during the minimum duration, no telegram is sent.

3.2.3.3 Parameter window *a: Threshold 1 Output*

The details in the following also apply to *a: Threshold 2 Output.*



Send threshold object

Options: On change
<u>On change and cyclically</u>

This parameter is used to specify the send behavior of the threshold object.

- *On change*: The threshold object is sent when a change occurs.
- *On change and cyclically:* The threshold object is sent cyclically when a change occurs. The threshold object is sent cyclically until the value falls below or exceeds the other limit.

  Dependent parameters:

  Send if threshold fallen below every

  Send if threshold exceeded every

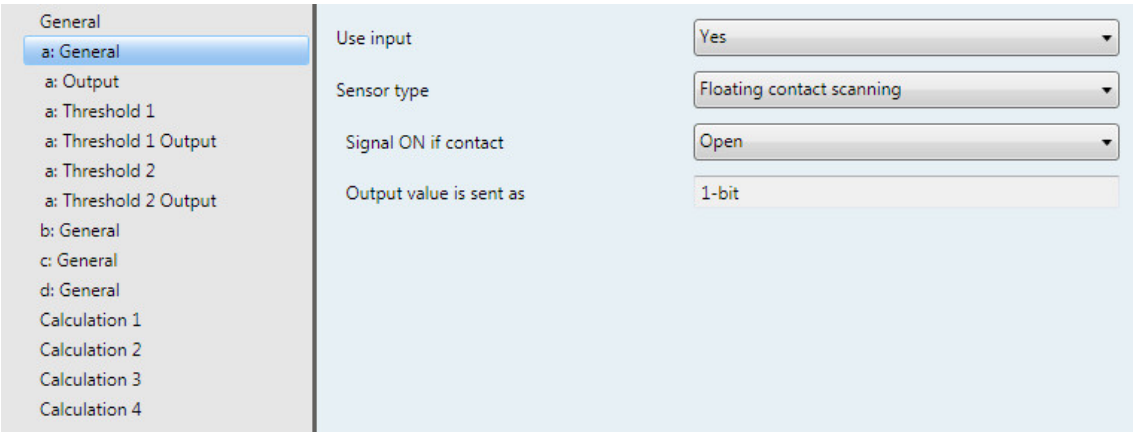
  Options: 5/10/<u>30 s</u>
  1/5/10/30 min
  1/6/12/24 h

  These two parameters are used to define the point to which cyclical sending should take place after an undershoot of the lower limit or an overshoot of the upper limit.

3.2.4 Parameter window *a: General* with sensor type: *Floating contact scanning*

Setting options with sensor type *Floating contact scanning*.

The specifications below also apply to parameter windows *b...d: General*.



Use input

Options: No
Yes

The parameter enables input a.

As a result, further parameters and communication objects become visible.

Sensor type

Options: Current/Voltage/Resistance
Temperature-dependent resistance
Floating contact scanning

The Sensor type is set with this parameter.

Selection of option *Floating contact scanning*:

Dependent parameters:

Signal ON if contact

Options: Closed
Open

With this parameter the contact is set with an ON signal.

- *Closed*: The contact is closed with an ON signal.
- *Open:* The contact is opened with an ON signal.

Output value is sent as

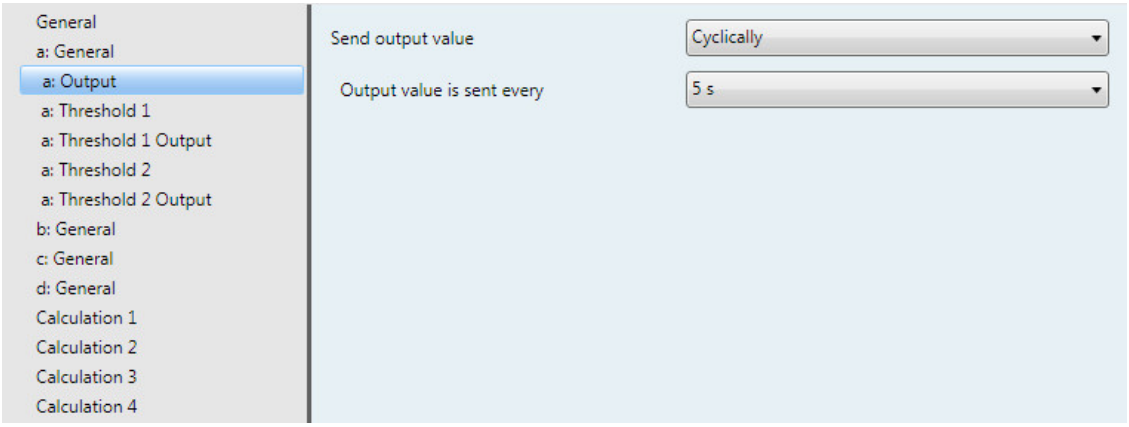
This parameter preset to 1-bit.

Bit value 0 = Signal OFF

Bit value 1 = Signal ON

3.2.4.1 Parameter window *a: Output*

This parameter window is enabled if the parameter *Use input* has been set to *Yes* in Parameter window a: General with sensor type: Floating contact scanning, p. 53.



Send output value

Options: On request
On change
Cyclically
On change and cyclically

This parameter defines how the output value should be sent.

- *On request:* The output value is sent on request.

The *Request output value – Input a* communication object appears.

As soon as a 1 is received at this communication object, the current output value is sent once to the communication object *Output value – Input a*.

- *On change*: The output value is sent when a change occurs.
- *Cyclically*: The output value is sent cyclically.
- *On change and cyclically*: The output value is sent cyclically when a change occurs.

Selection of options *On change, cyclically* and *On change and cyclically*:

Dependent parameters:

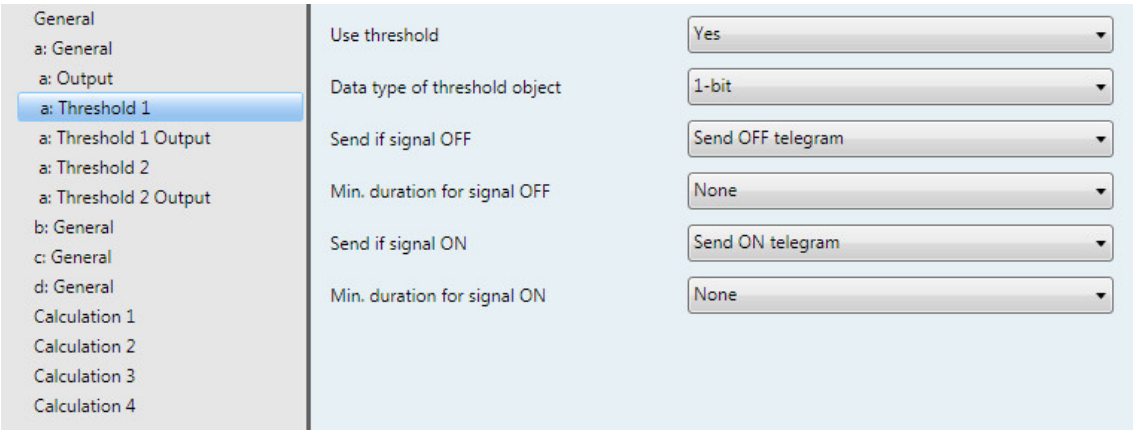
Output value is sent every

Options: 5/10/30 s
1/5/10/30 min
1/6/12/24 h

The interval for cyclical sending is set with this additional parameter.

3.2.4.2 Parameter window *a: Threshold 1*

The details in the following also apply to *b: Threshold 2 Output*.



Use threshold

Options: No
Yes

This parameter defines if threshold 1 should be used. If *Yes* is selected, the communication object *Threshold – Input a Threshold 1* appears.

Data type of threshold object

Options: 1-bit
1-byte [0...+255]

Selection of option *1-bit:*

Dependent parameters:

Send if signal OFF

Options: Do not send telegram
Send ON telegram
Send OFF telegram

Send if signal ON

Options: Do not send telegram
Send ON telegram
Send OFF telegram

- *Do not send telegram:* There is no reaction.
- *Send ON telegram:* A telegram with the value 1 is sent.
- *Send OFF telegram:* A telegram with the value 0 is sent.

Min. duration for signal OFF

Min. duration for signal ON

Options: None
5/10/30 s
1/5/10/30 min
1/6/12/24 h

- *None:* the threshold is sent directly.

With the further time options, a minimum duration can be selected. If the send condition reverts during the minimum duration, no telegram is sent.

Selection of option *1-byte [0...+255]:*

Dependent parameters:

Send if signal OFF [0...+255]

Options: 0...255

Send if signal ON [0...+255]

Options: 0...255

A value of 0 to 255 can be entered in single steps.

Min. duration for signal OFF

Min. duration for signal ON

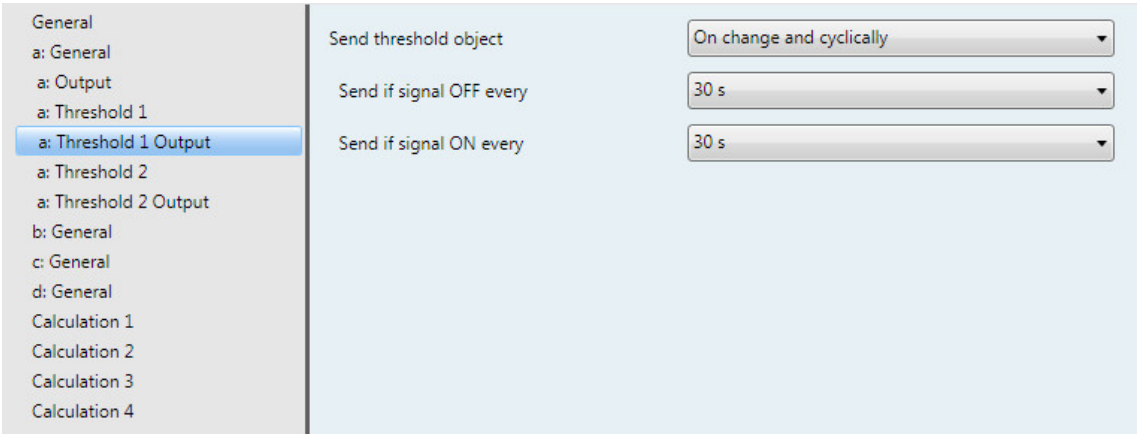
Options: None
5/10/30 s
1/5/10/30 min
1/6/12/24 h

- *None:* the threshold is sent directly.

With the further time options, a minimum duration can be selected. If the send condition reverts during the minimum duration, no telegram is sent.

3.2.4.3 Parameter window *a: Threshold 1 Output*

The details in the following also apply to *a: Threshold 2 Output.*



Send threshold object

Options: On change
On change and cyclically

This parameter is used to specify the send behavior of the threshold object.

- *On change*: The threshold object is sent when a change occurs.
- *On change and cyclically:* The threshold object is sent cyclically when a change occurs. The threshold object is sent cyclically until the value falls below or exceeds the other limit.

  Dependent parameters:

  Send if signal OFF every

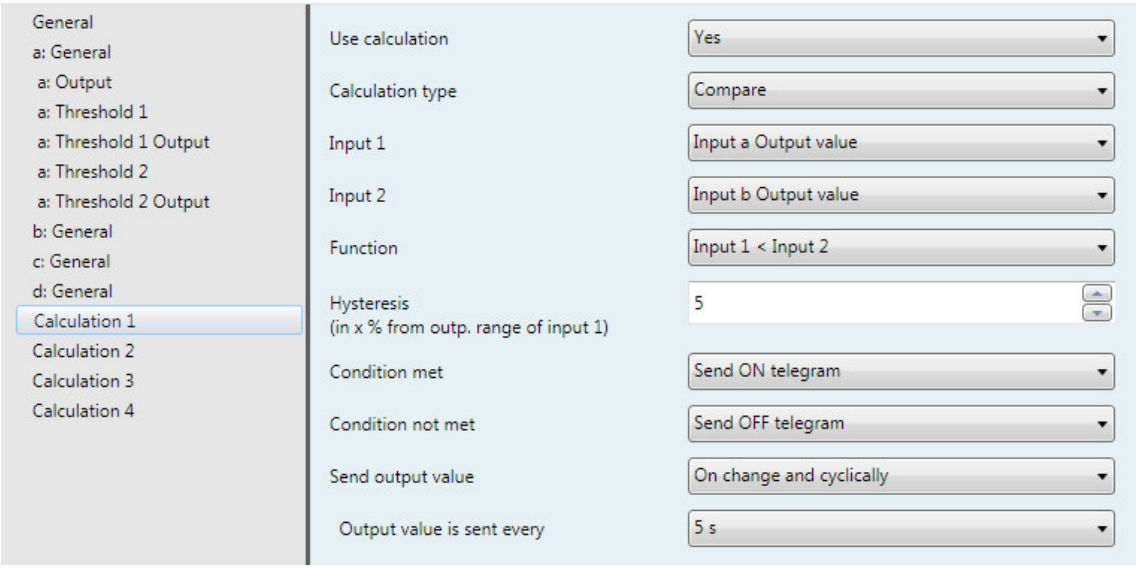
  Send if signal ON every

  Options: 5/10/30 s
  1/5/10/30 min
  1/6/12/24 h

  These two parameters are used to define the point at which cyclical sending should take place after an undershoot of the lower limit or an overshoot of the upper limit.

3.2.5 Parameter window *Calculation 1* – Calculation type: *Compare*

The specifications below also apply to the parameter windows *Calculation 2, 3 and 4*.



Use calculation

Options: No
Yes

This parameter is used to determine if *Calculation 1* is to be used.

- With the selection Yes the communication object *Send output value – Calculation 1* appears.

Calculation type

Options: Compare
Arithmetic

The calculation type is set with this parameter.

- *Compare*: Comparison of two output values
- *Arithmetic:* Arithmetic logic of two output values

Input 1

Options: Input a Output value
Input b Output value
Input c Output value
Input d Output value

Input 2

Options: Input a Output value
Input b Output value
Input c Output value
Input d Output value

With both these parameters the inputs 1 and 2 are assigned the comparative object values.

Function

Options: Input 1 < Input 2
Input 1 > Input 2
Input 1 = Input 2

Using this parameter, one of three selectable comparative functions is defined. Input 1 less than input 2, input 1 greater than input 2 or input 1 equal to input 2.

Hysteresis
(in x % from outp. range of input 1)

Options: 1...5...100

With the setting for this parameter the hysteresis band is defined dependent on the output range of input 1.

Condition met

Options: Do not send telegram
Send ON telegram
Send OFF telegram

Condition not met

Options: Do not send telegram
Send ON telegram
Send OFF telegram

Using both these parameters, the telegrams which are to be sent when the comparative function is met (condition) or not met are defined. The telegram is sent on the bus via the communication object *Send output value – Calculation 1*.

Send output value

Options: On change
On change and cyclically

This parameter defines how the output value should be sent.

- *On change*: The output value is sent when a change occurs.
- *On change and cyclically*: The output value is sent cyclically when a change occurs.

  Dependent parameter:

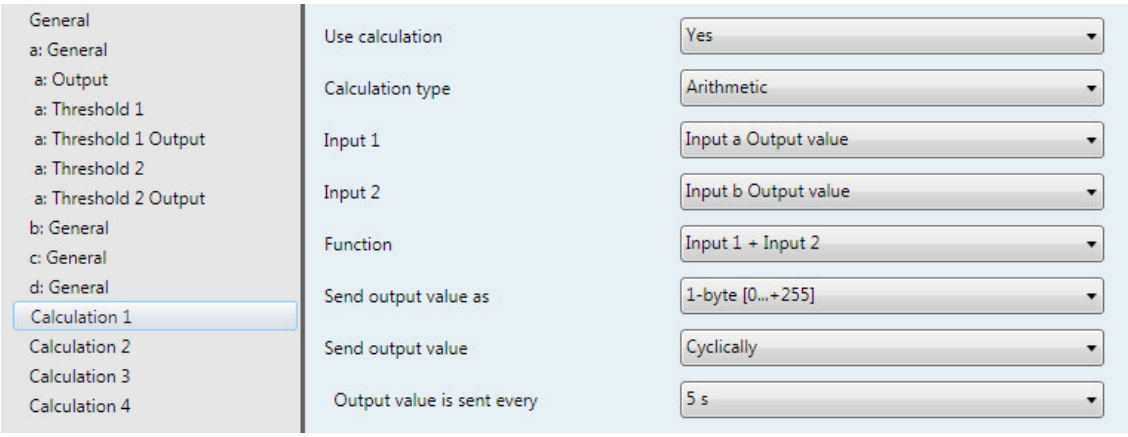
  Output value is sent every

  Options: 5/10/30 s
  1/5/10/30 min
  1/6/12/24 h

  The interval for cyclical sending is set with this additional parameter.

3.2.6 *Parameter window Calculation 1* – Calculation type: *Arithmetic*

The specifications in the following also apply to the parameter windows *Calculation 2, 3* and *4*.



Use calculation

Options: No
Yes

This parameter is used to determine if Calculation 1 is to be used.

- With the selection *Yes* the communication object *Send output value – Calculation 1* appears.

Calculation type

Options: Compare
Arithmetic

The calculation type is set with this parameter.

- *Compare*: Comparison of two output values
- *Arithmetic:* Arithmetic logic of two output values

Input 1

Options: Input a Output value
Input b Output value
Input c Output value
Input d Output value

Input 2

Options: Input a Output value
Input b Output value
Input c Output value
Input d Output value

With both these parameters the inputs 1 and 2 are assigned the comparative object values.

Function

Options: Input 1 + Input 2
Input 1 - Input 2
Arithmetic mean value

- *Input 1 + Input 2*: Input 1 and input 2 are added.
- *Input 1 - Input 2*: Input 2 is subtracted from input 1.
- *Arithmetic mean value:* The arithmetic mean value is calculated between input 1 and input 2.

Send output value as

Options: 1-byte [0...+255]
1-byte [-128...+127]
2-byte [0...+65,535]
2-byte [-32,768…+32,767]
2-byte (floating point)
4-byte (IEEE floating point)

This parameter defines in which format the *Output value* should be sent.

Important
The setting assumes that the result of the calculation matches the set format. Otherwise the result is capped. In order to guarantee full interoperability to other KNX devices, only a data type should be selected for the output which according to KONNEX is permissible for the calculated physical value!

Send output value

Options: On change
Cyclically
On change and cyclically

This parameter defines how the output value should be sent.

- *On change*: The output value is sent when a change occurs.
- *Cyclically:* The output value is sent cyclically.
- *On change and cyclically*: The output value is sent cyclically when a change occurs.

Selection of option *On change and cyclically*:

Dependent parameters:

Output value is sent every

Options: 5/10/30 s
1/5/10/30 min
1/6/12/24 h

The interval for cyclical sending is set with this additional parameter.

**Output value is sent from a x %
change in the output range, Input 1**

Options: 1...2...100

Using this parameter, you define from which percentage change of the output range of input 1 the Output value calculation x is to be sent.

With option 2, the output value is sent from a 2 % change of the output value calculation x.

Important
The output range of a PT100 sensor on Input a is -50…+150 °C. This means that the output range is 200 °C, 2% of which is 4 °C, i.e. with a change of ±4 °C the Output value calculation x is sent.

3.3 Communication objects

3.3.1 Summary of communication objects

No.	Function	Name	Data Point Type (DPT)	Length	Flags				
					C	R	W	T	U
0	Output value	Input a	Variable	Variable	x	x		x	
1	Request output value	Input a	1.009	1-bit	x		x		
2	Measured value out of range	Input a	1.001	1-bit	x		x		
3	Threshold	Input a Threshold 1	Variable	Variable	x	x		x	
4	Modify	Input a Threshold 1 lower limit	Variable	Variable	x	x		x	
5	Modify	Input a Threshold 1 upper limit	Variable	Variable	x	x		x	
6	Threshold	Input a Threshold 2	Variable	Variable	x	x		x	
7	Modify	Input a Threshold 2 lower limit	Variable	Variable	x	x		x	
8	Modify	Input a Threshold 2 upper limit	Variable	Variable	x	x		x	
9	Output value	Input b	Variable	Variable	x	x		x	
10	Request output value	Input b	1.009	1-bit	x		x		
11	Measured value out of range	Input b	1.001	1-bit	x		x		
12	Threshold	Input b Threshold 1	Variable	Variable	x	x		x	
13	Modify	Input b Threshold 1 lower limit	Variable	Variable	x	x		x	
14	Modify	Input b Threshold 1 upper limit	Variable	Variable	x	x		x	
15	Threshold	Input b Threshold 2	Variable	Variable	x	x		x	
16	Modify	Input b Threshold 2 lower limit	Variable	Variable	x	x		x	
17	Modify	Input b Threshold 2 upper limit	Variable	Variable	x	x		x	
18	Output value	Input c	Variable	Variable	x	x		x	
19	Request output value	Input c	1.009	1-bit	x		x		
20	Measured value out of range	Input c	1.001	1-bit	x		x		
21	Threshold	Input c Threshold 1	Variable	Variable	x	x		x	
22	Modify	Input c Threshold 1 lower limit	Variable	Variable	x	x		x	
23	Modify	Input c Threshold 1 upper limit	Variable	Variable	x	x		x	
24	Threshold	Input c Threshold 2	Variable	Variable	x	x		x	
25	Modify	Input c Threshold 2 lower limit	Variable	Variable	x	x		x	
26	Modify	Input c Threshold 2 upper limit	Variable	Variable	x	x		x	

No.	Function	Name	Data Point Type (DPT)	Length	Flags				
					C	R	W	T	U
27	Output value	Input d	Variable	Variable	x	x		x	
28	Request output value	Input d	1.009	1-bit	x		x		
29	Measured value out of range	Input d	1.001	1-bit	x		x		
30	Threshold	Input d Threshold 1	Variable	Variable	x	x		x	
31	Modify	Input d Threshold 1 lower limit	Variable	Variable	x	x		x	
32	Modify	Input d Threshold 1 upper limit	Variable	Variable	x	x		x	
33	Threshold	Input d Threshold 2	Variable	Variable	x	x		x	
34	Modify	Input d Threshold 2 lower limit	Variable	Variable	x	x		x	
35	Modify	Input d Threshold 2 upper limit	Variable	Variable	x	x		x	
36	Send output value	Calculation 1	Variable	1-bit	x			x	
37	Send output value	Calculation 2	Variable	1-bit	x			x	
38	Send output value	Calculation 3	Variable	1-bit	x			x	
39	Send output value	Calculation 4	Variable	1-bit	x			x	
40	In operation	General	1.003	1-bit	x	x		x	
41	Status byte	General	-	1 byte	x	x		x	

3.3.2 Communication objects *Input a*

No.	Function	Object name	Data type	Flags
0	**Output value**	**Input a**	**Variable** **DPT variable**	**C, R, T**

This communication object is used to send the output value to the bus.

The following values can be sent:

1-bit value [0/1]	DPT	1.001
1-byte value [0...+255]	DPT	5.010
1-byte value [-128...+127]	DPT	6.010
2-byte value [0...+65,535]	DPT	7.001
2-byte value [-32,768...+32,767]	DPT	8.001
2 byte value (floating point)	DPT	9.001
4-byte value (IEEE floating point)	DPT	14.068

What is sent at an undershoot or overshoot of 10 %?

Up to an overshoot of 10 % the measured value is shown and sent. This applies to both the upper and lower limits. Furthermore, the measured value continues to be sent as a *Measured value +10 %*.

The following must be observed, particularly with the lower limit:

This only applies if the lower limit is different from 0. If the lower limit is 0, it is not possible to determine an undershoot.

No.	Function	Object name	Data type	Flags
1	**Request output value**	**Input a**	**1-bit** **DPT 1.009**	**C, W**

This communication object appears if the output value *On request* is to be sent

If a 1 is received at this communication object, the current output value is sent once from the communication object *Output value – Input a*.

2	Measured value out of range	Input a	1-bit DPT 1.001	C, W

Telegram value: 1 = Measured value out of range
0 = Measured value in range

The communication object can be used to check the plausibility of the sensor, e.g. wire breakage at 1–10 V or at 4–20 mA. The check is carried out after each measurement.

Example
A wind sensor with a sensor signal of 4...20 mA and a measuring range of 0…40 m/s is connected to the Analogue Input. Output range is 16 mA (20...4 mA)

Upper measuring limit:

The communication object *Measured value outside range* is sent when the upper measuring limit is exceeded by 5 %, i.e. 16.8 mA (16 mA + 5 %).

Lower measuring limit:

The communication object *Measured value out of range* is sent when the lower measuring limit is undershot by 5 %, i.e. 3.8 mA (4 mA - 5 %).

When is the value of the communication object sent?

Measured value out of range is sent if the measured value exceeds the lower or upper limit by more than 5 %.

The following must be observed, particularly with the lower limit:

This only applies if the lower limit is different from 0. If the lower limit is 0, it is not possible to determine an undershoot.

Behavior with PT100 or PT1000?

The following applies with the calculation of the maximum and minimum output values with the PT100/1000:

The lowest measurable resistance with the PT100 is about 80 ohms (with the PT1000 800 ohms) and corresponds to about -50 °C.

The highest measurable resistance with the PT100 is about 157 ohms (with the PT1000 1,570 ohms) and corresponds to about +150 °C.

Important
The programmable feeder line resistance is subtracted from the measured resistance. Thereafter, a programmable temperature offset is added. Depending on the programming of the feeder line resistances and the temperature offset, different minimum and maximum values result. If the sensor goes open circuit, the highest possible positive temperature value in °C is sent. If the sensor goes short circuit, the lowest possible negative temperature value in °C is sent. The sent temperature values are dependent, for example, on the temperature sensor used, on line faults, ambient temperatures, etc.

Behavior with a floating contact?

The communication object has no function with the selection.

No.	Function	Object name	Data type	Flags
3	**Threshold**	**Input a Threshold 1**	**Variable** **DPT variable**	**C, R, T**
As soon as the set threshold is exceeded or fallen below, it is possible to send the following values: 1-bit value [0/1] DPT 1.001 1-byte value [0...+255] DPT 5.010 The object value depends on the parameter *Data type of threshold object* (1-bit, 1-byte). The parameter can be found in the parameter window *a: Threshold 1*.				
4…5	**Modify**	**Input a Threshold 1 lower limit** **Input a Threshold 1 upper limit**	**Variable** **DPT variable**	**C, R, T**
The upper and lower limits of threshold 1 can be changed via the bus. The data type of these communication objects depends on the set data type of the communication object *Output value – Input a*. **Important** The lower limit should be selected to be lower than the upper limit.				
6	**See communication object 3**	**Input a Threshold 2**		
7…8	**See communication objects 4 and 5**	**Input a Threshold 2 lower limit** **Input a Threshold 2 upper limit**		

3.3.3 Communication objects *Input b, c and d*

No.	Function	Object name	Data type	Flags
9…17	**See communication objects 0...8**	**Input b**		
18…26	**See communication objects 0...8**	**Input c**		
27…35	**See communication objects 0...8**	**Input d**		

Note

With the 3-conductor connection the following applies:

- Input a or c always measures the measuring resistor.
- Input b or d always measures the cable resistance.

When a 3-conductor connection is selected, inputs b and d are visible in the communication objects. If a group address is linked to these inputs, then the measured cable resistance is transmitted. It should be noted that the temperature value must be converted with the DPT 9.001, so that the resistance value remains intact.

3.3.4 Communication objects *Calculation 1*

No.	Function	Object name	Data type	Flags
36	**Send output value**	**Calculation 1**	**1-bit** **DPT variable**	**C, T**

The result of calculation 1 is sent with this communication object.
Depending on the calculation type which has been selected, the following values are sent:

1-bit value [0/1]	DPT	1.001
1-byte value [0...+255]	DPT	5.010
1-byte value [-128...+127]	DPT	6.010
2-byte value [0...+65,535]	DPT	7.001
2-byte value [-32,768...+32,767]	DPT	8.001
2 byte value (floating point)	DPT	9.001
4-byte value (IEEE floating point)	DPT	14.068

Important

In order to guarantee full interoperability to other KNX devices, only a data type should be selected for the output which according to KONNEX is permissible for the calculated physical value!

3.3.5 Communication objects *Calculation 2, 3, and 4*

No.	Function	Object name	Data type	Flags
37	**See communication object 36**	**Calculation 2**		
38	**See communication object 36**	**Calculation 3**		
39	**See communication object 36**	**Calculation 4**		

3.3.6 Communication objects *General*

No.	Function	Object name	Data type	Flags
40	**In operation**	**General**	**1-bit** **DPT 1.003**	**C, R, T**
This communication object appears if, in the Parameter window *General*, p. 23, *Enable communication object "In operation", 1-bit* has been selected and set to *Value 0* or *Value 1.* A 0 or a 1 is sent cyclically on the bus depending on the setting.				
41	**Status byte**	**General**	**1 byte** **DPT none**	**C, R, T**

The status byte reflects the current state of the Analogue Input.

Different states are indicated here, e.g.

- Status Input a – Measured value out of range
- Status Input a – Measured value out of range and self calibration

Bit sequence: 76543210

Bit 7: Not assigned always 0

Bit 6: Mains voltage failure:
0: Mains available
1: Mains voltage failure, no measured values

Bit 5: Not assigned always 0

Bit 4: Status of internal calibration
0: Calibration completed
1: Calibration running

Bit 3: Status Input d Measured value out of range
0: In range
1: Out of range

Bit 2: Status Input c Measured value out of range
0: In range
1: Out of range

Bit 1: Status Input b Measured value out of range
0: In range
1: Out of range

Bit 0: Status Input a Measured value out of range
0: In range
1: Out of range

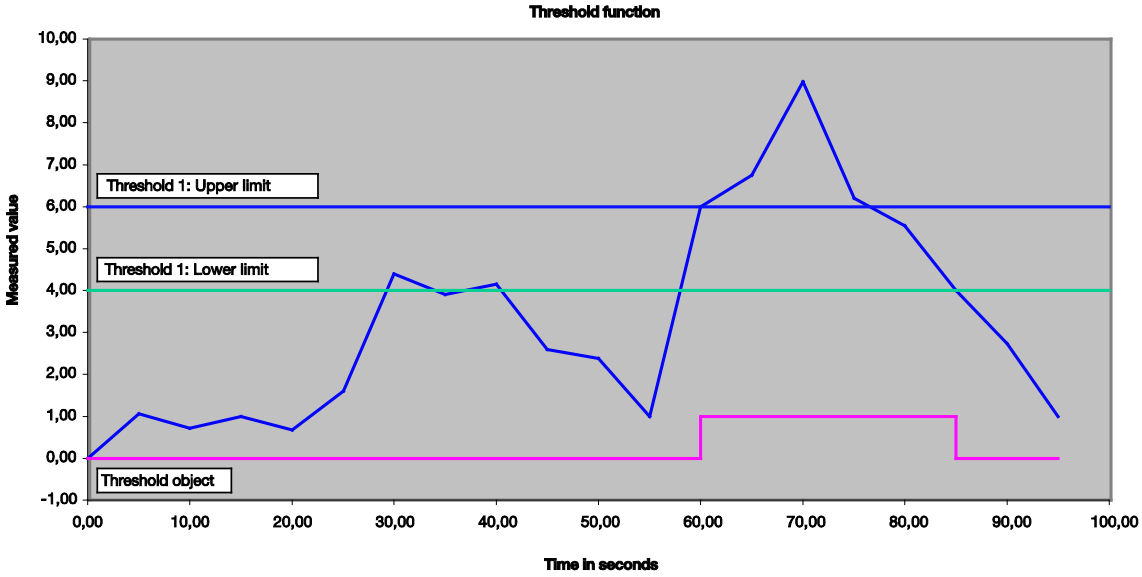
The value of the communication object is sent when a change occurs or can be read out via a Value Read command. The value of the communication object is sent automatically once after the device has started after the set send delay.

For further information see: Value table of communication object Status byte – General

4 Planning and application

4.1 Description of the Threshold function

How does the threshold function work?



Settings

- Communication object *Threshold* is set to a 1-bit value.
- An OFF telegram is sent with an undershoot of the threshold, and an ON telegram is sent with an overshoot of the threshold.

In the example diagram above, it can be seen that the measured value begins "somewhere", in this example with a 0 value. The communication object for *Threshold 1* has the value 0 and is sent cyclically as per application settings.

As long as the measured value does not exceed the upper limit of threshold 1, the communication object *Threshold* will remain at value 0.

As soon as the measured value exceeds the upper limit of threshold 1, the communication object *Threshold* will change value to 1.

The communication object *Threshold 1* will remain 1 until the measured value falls back below the lower limit of threshold 1.

A Appendix

A.1 Scope of delivery

The device is supplied together with the following components. Please check the items received using the following list:

- 1 (one) AE/S 4.1.1.3 Analogue Input, 4-fold, MDRC
- 1 (one) set of installation and operating instructions
- 1 (one) bus connection terminal (red/black)

A.2 Value table of communication object *Status byte – General*

Bit No.		7	6	5	4	3	2	1	0
8-bit value	Hexadecimal	Not assigned	Mains voltage failure	Not assigned	Status of internal calibration	Status Input d	Status Input c	Status Input b	Status Input a
0	00								
1	01								■
2	02							■	
3	03							■	■
4	04						■		
5	05						■		■
6	06						■	■	
7	07						■	■	■
8	08					■			
9	09					■			■
10	0A					■		■	
11	0B					■		■	■
12	0C					■	■		
13	0D					■	■		■
14	0E					■	■	■	
15	0F					■	■	■	■
16	10				■				
17	11				■				■
18	12				■			■	
19	13				■			■	■
20	14				■		■		
21	15				■		■		■
22	16				■		■	■	
23	17				■		■	■	■
24	18				■	■			
25	19				■	■			■
26	1A				■	■		■	
27	1B				■	■		■	■
28	1C				■	■	■		
29	1D				■	■	■		■
30	1E				■	■	■	■	
31	1F				■	■	■	■	■
32	20								
33	21								■
34	22							■	
35	23							■	■
36	24						■		
37	25						■		■
38	26						■	■	
39	27						■	■	■
40	28					■			
41	29					■			■
42	2A					■		■	
43	2B					■		■	■
44	2C					■	■		
45	2D					■	■		■
46	2E					■	■	■	
47	2F					■	■	■	■
48	30				■				
49	31				■				■
50	32				■			■	
51	33				■			■	■
52	34				■		■		
53	35				■		■		■
54	36				■		■	■	
55	37				■		■	■	■
56	38				■	■			
57	39				■	■			■
58	3A				■	■		■	
59	3B				■	■		■	■
60	3C				■	■	■		
61	3D				■	■	■		■
62	3E				■	■	■	■	
63	3F				■	■	■	■	■
64	40		■						
65	41		■						■
66	42		■					■	
67	43		■					■	■
68	44		■				■		
69	45		■				■		■
70	46		■				■	■	
71	47		■				■	■	■
72	48		■			■			
73	49		■			■			■
74	4A		■			■		■	
75	4B		■			■		■	■
76	4C		■			■	■		
77	4D		■			■	■		■
78	4E		■			■	■	■	
79	4F		■			■	■	■	■
80	50		■		■				
81	51		■		■				■
82	52		■		■			■	
83	53		■		■			■	■
84	54		■		■		■		
85	55		■		■		■		■

Bit No.		7	6	5	4	3	2	1	0
8-bit value	Hexadecimal	Not assigned	Mains voltage failure	Not assigned	Status of internal calibration	Status Input d	Status Input c	Status Input b	Status Input a
86	56		■		■		■	■	
87	57		■		■		■	■	■
88	58		■		■	■			
89	59		■		■	■			■
90	5A		■		■	■		■	
91	5B		■		■	■		■	■
92	5C		■		■	■	■		
93	5D		■		■	■	■		■
94	5E		■		■	■	■	■	
95	5F		■		■	■	■	■	■
96	60		■						
97	61		■						■
98	62		■					■	
99	63		■					■	■
100	64		■				■		
101	65		■				■		■
102	66		■				■	■	
103	67		■				■	■	■
104	68		■			■			
105	69		■			■			■
106	6A		■			■		■	
107	6B		■			■		■	■
108	6C		■			■	■		
109	6D		■			■	■		■
110	6E		■			■	■	■	
111	6F		■			■	■	■	■
112	70		■		■				
113	71		■		■				■
114	72		■		■			■	
115	73		■		■			■	■
116	74		■		■		■		
117	75		■		■		■		■
118	76		■		■		■	■	
119	77		■		■		■	■	■
120	78		■		■	■			
121	79		■		■	■			■
122	7A		■		■	■		■	
123	7B		■		■	■		■	■
124	7C		■		■	■	■		
125	7D		■		■	■	■		■
126	7E		■		■	■	■	■	
127	7F		■		■	■	■	■	■
128	80								
129	81								■
130	82							■	
131	83							■	■
132	84						■		
133	85						■		■
134	86						■	■	
135	87						■	■	■
136	88					■			
137	89					■			■
138	8A					■		■	
139	8B					■		■	■
140	8C					■	■		
141	8D					■	■		■
142	8E					■	■	■	
143	8F					■	■	■	■
144	90				■				
145	91				■				■
146	92				■			■	
147	93				■			■	■
148	94				■		■		
149	95				■		■		■
150	96				■		■	■	
151	97				■		■	■	■
152	98				■	■			
153	99				■	■			■
154	9A				■	■		■	
155	9B				■	■		■	■
156	9C				■	■	■		
157	9D				■	■	■		■
158	9E				■	■	■	■	
159	9F				■	■	■	■	■
160	A0								
161	A1								■
162	A2							■	
163	A3							■	■
164	A4						■		
165	A5						■		■
166	A6						■	■	
167	A7						■	■	■
168	A8					■			
169	A9					■			■
170	AA					■		■	
171	AB					■		■	■

Bit No.		7	6	5	4	3	2	1	0
8-bit value	Hexadecimal	Not assigned	Mains voltage failure	Not assigned	Status of internal calibration	Status Input d	Status Input c	Status Input b	Status Input a
172	AC					■	■		
173	AD					■	■		■
174	AE					■	■	■	
175	AF					■	■	■	■
176	B0				■				
177	B1				■				■
178	B2				■			■	
179	B3				■			■	■
180	B4				■		■		
181	B5				■		■		■
182	B6				■		■	■	
183	B7				■		■	■	■
184	B8				■	■			
185	B9				■	■			■
186	BA				■	■		■	
187	BB				■	■		■	■
188	BC				■	■	■		
189	BD				■	■	■		■
190	BE				■	■	■	■	
191	BF				■	■	■	■	■
192	C0		■						
193	C1		■						■
194	C2		■					■	
195	C3		■					■	■
196	C4		■				■		
197	C5		■				■		■
198	C6		■				■	■	
199	C7		■				■	■	■
200	C8		■			■			
201	C9		■			■			■
202	CA		■			■		■	
203	CB		■			■		■	■
204	CC		■			■	■		
205	CD		■			■	■		■
206	CE		■			■	■	■	
207	CF		■			■	■	■	■
208	D0		■		■				
209	D1		■		■				■
210	D2		■		■			■	
211	D3		■		■			■	■
212	D4		■		■		■		
213	D5		■		■		■		■
214	D6		■		■		■	■	
215	D7		■		■		■	■	■
216	D8		■		■	■			
217	D9		■		■	■			■
218	DA		■		■	■		■	
219	DB		■		■	■		■	■
220	DC		■		■	■	■		
221	DD		■		■	■	■		■
222	DE		■		■	■	■	■	
223	DF		■		■	■	■	■	■
224	E0		■						
225	E1		■						■
226	E2		■					■	
227	E3		■					■	■
228	E4		■				■		
229	E5		■				■		■
230	E6		■				■	■	
231	E7		■				■	■	■
232	E8		■			■			
233	E9		■			■			■
234	EA		■			■		■	
235	EB		■			■		■	■
236	EC		■			■	■		
237	ED		■			■	■		■
238	EE		■			■	■	■	
239	EF		■			■	■	■	■
240	F0		■		■				
241	F1		■		■				■
242	F2		■		■			■	
243	F3		■		■			■	■
244	F4		■		■		■		
245	F5		■		■		■		■
246	F6		■		■		■	■	
247	F7		■		■		■	■	■
248	F8		■		■	■			
249	F9		■		■	■			■
250	FA		■		■	■		■	
251	FB		■		■	■		■	■
252	FC		■		■	■	■		
253	FD		■		■	■	■		■
254	FE		■		■	■	■	■	
255	FF		■		■	■	■	■	■

Empty = Value 0
■ = Value 1, applicable

A.3 Conversion between °C and °F

No.:	°C	°F
1	-50	-58
2	-40	-40
3	-30	-22
4	-17.8	**0**
5	-20	-4
6	-10	+14
7	**0**	+32
8	+10	+50
9	+20	+68
10	+30	+86
11	+50	+122
12	+60	+140
13	+70	+158
14	+80	+176
15	+90	+194
16	+100	+212
17	+110	+230
18	+120	+248
19	+130	+266
20	+140	+284
21	+150	+302

Conversion formula

Celsius to Fahrenheit

Temperature in °F = ((T °Celsius x 9) / 5) + 32

Fahrenheit to Celsius

Temperature in °C = (T °Fahrenheit - 32) x 5 / 9

A.4 Order details

Short description	Designation	Order No.	bbn 40 16779 EAN	Weight 1 pc. [kg]	Packaging [pcs.]
AE/S 4.1.1.3	Analogue Input, 4-fold, MDRC	2CDG110190R0011	**929295**	0.27	1

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