HEITRONICS
Infrarot Messtechnik

TABLETOP INDICATOR
MS40T

Instruction Manual

95583204
01/01/20e

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PREFACE

Please read this instruction manual before commissioning the instrument. Keep the manual in a place accessible to all users at all times. Your comments are appreciated and may assist us in improving this manual.

All necessary settings are described in this instruction manual. Manipulations not described in the manual or expressly forbidden will jeopardize your warranty rights. Please contact the nearest subsidiary or the head office, should you encounter problems.

The manual is valid from **instrument software version 217.01.01**.

It appears by simultaneously pressing PG and ▲ (four-digit display; example: 01.01).

When accessing the inner parts of the unit and returning modules, assemblies or components, please observe the regulations according to EN 61340-5-1 and EN 61340-5-2 „protection of electrostatic sensitive devices“. Only use **ESD** packaging for transport.

Please note that we cannot accept any liability for damage caused by ESD.

ESD = **E**lectro **S**tatic **D**ischarge

RoHS-CONFORMITY

This product is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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II. Preface

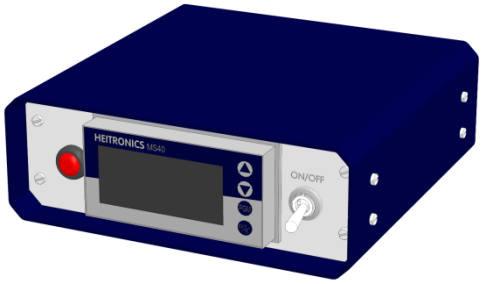
MS40T is the tabletop version of MS40, operated by mains. All functions of MS40 can be used. How to configure MS40 is to be found in MS40 instruction manual, which is attached to this manual.

III. Features

- Power supply / operating voltage (24V DC)
- Display (divided in two)
- Connection for HEITRONICS instruments with 7-pin and 12-pin plug connection
- Push button for digital input (12-pin plug)
- SUB-D-socket-outlet for connection to PC
- Looped-through current output

IV. Front panel

- MS40
- SWITCH-ON/SWITCH-OFF
- Push button



IV.1 Switch-On / Switch-Off

The switch applies and disconnects power of indicator and of connected instruments.

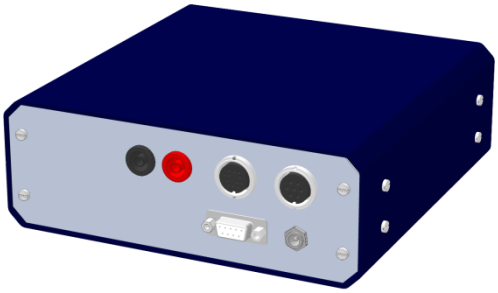
IV.2 Push button

The push button controls the digital input of the radiation thermometer connected to the 12-pin plug.

IV.3 MS40

Functions of MS40 are described in the attached manual.

V. Rear panel



- 7-pin socket-outlet
- 12-pin socket-outlet
- SUB-D-socket-outlet
- DC-socket-outlet (2.1 mm)
- Analog output (including short-circuit jumper)

V.1 7-pin socket-outlet

- Supply voltage 24V DC
- Analog input (current)

V.2 12-pin socket-outlet

- Supply voltage 24V DC
- Analog input (current)
- Digital output
- RS232

The analog input of input socket-outlets (7-pin and 12-pin) is connected to analog input 1 of MS40.

Caution!

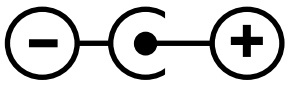
The analog input of the 7-pin socket-outlet is connected in parallel to the analog input of the 12-pin socket-outlet. Never connect a device to both socket-outlets at the same time, as this may destroy the analog inputs or outputs.

V.3 SUB-D-socket-outlet

RS232 interface as direct connection of a HEITRONICS instrument at the 12-pin socket-outlet with suitable cable assignment (see assignment).

V.4 DC-socket-outlet (2.1 mm)

Input for the 24 V supply voltage (max. 30W). Polarity is as follows:



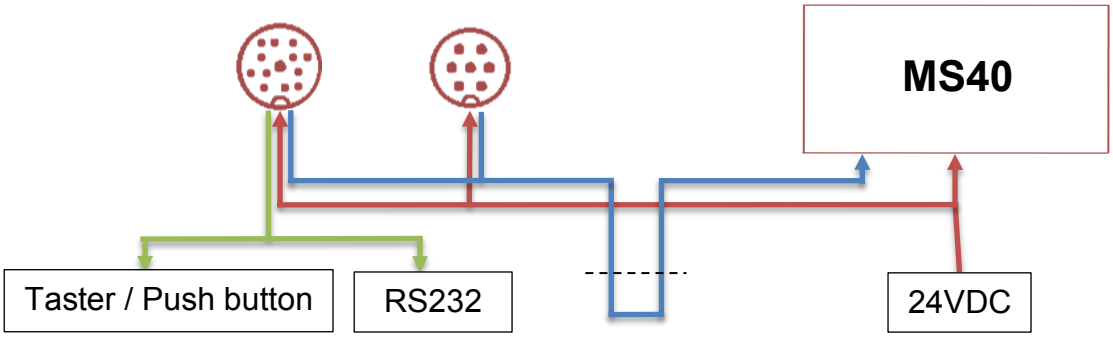
Caution!

Reversed polarity of the input voltage may lead to destruction of the connected instruments.

VI. Assignment

Function	7-pin socket-outlet	12-pin socket-outlet	SUB-D socket-outlet
Supply voltage (24V)	4	L	
Supply voltage (GND)	2	B	
Analog input + (current)	5	E	
Analog input - (current)	1	M	
DTR		F	6
CTS		A	4
RTS		H	5
RXD		J	2
TXD		G	3
COM		K	7
Digital input		C	
Digital input GND		D	

VII. Inner connection of MS40T



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Content

1.1 Description

The digital indicator shows temperatures in °C or °F and standard signals in plain text.

Inputs/outputs

The standard instrument is equipped with an analog input, two binary inputs, two relay outputs, two logic outputs as well as a voltage supply for two-wire transmitters.

Optional modules

Three extension slots can be equipped with additional inputs and outputs as well as interfaces.

Displays

The high-contrast, multi-colour LCD display for process value/text and operator prompting contains a five-digit 7-segment display (showing the value or parameter setting) and an eight-digit 16-segment display with colour change (value, parameter name, channel name, process/alarm text as max. 24 character ticker or pseudo bargraph). Four additional switch position indicators are available for binary outputs (relay or logic).

Operation

The instrument is operated and configured by four keys; an optional setup program for a PC is available. The user-friendly setup program provides additional configuration possibilities (e.g. math and logic functions, display texts).

Special functions

The instrument offers 4 configurable limit comparators and an optional math and logic module (two virtual channels).

Extensive binary functions are available for the assignment of functions to the signals of limit comparators, logic and binary inputs.

Special functions (continued)

The computation results of both math functions can be used for the different analog parameters (e.g. as value shown in the display).

Instruments with a second (optional) analog input allow the computation of differential, humidity or ratio computations by means of default formulas.

Probes

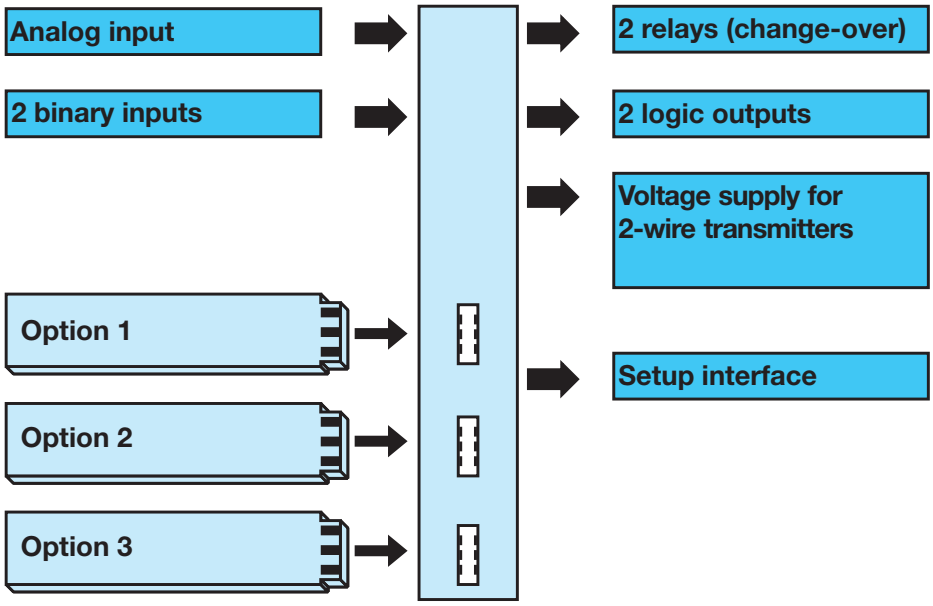
10 types of probes (RTD temperature probe, thermocouple, resistance transmitter, standard signals) and more than 20 linearisations are available for analog input configuration. Customer-specific linearisation with 10 interpolation points or by the entry of the polynomial coefficients is possible.

Interface and electrical connection

An optional interface (RS422/485 or PROFIBUS-DP) can be used for integration of the instrument in a data network.

The electrical connection is made at the back of the instrument by means of screw terminals.

Block structure



1.2 Typographical conventions

Warning signs

Danger This symbol is used when there may be **danger to personnel** if the instructions are ignored or not followed correctly!

Caution This symbol is used when there may be **damage to equipment or data** if the instructions are ignored or not followed correctly!

Caution This symbol is used where special precautionary measures are required when handling components liable to damage through electrostatic discharge.

Note signs

Note This symbol is used to draw your special attention to a remark.

Reference This symbol refers to further information in other operating manuals, chapters or sections.

✱ **Action instruction** This symbol refers to a description of an action to be performed.

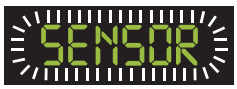
The individual steps are marked by this asterisk, e.g.:

✱ Press EXIT/F

Representation

Menu items Text referring to the setup program is shown in italics, for example: *„Display/Operation“*.

Blinking display



2.1 Type designation

(1) Basic type

701550	Digital Indicator incl. 1 analog input, 2 binary inputs, 2 relay outputs, 2 logic outputs and 1 setup interface, Front dimension 96mm x 48mm

(2) Basic type extensions

1			Basic type
			Version
	8		Standard with factory settings
	9		Programming to customer specification
			Logic outputs (2 are available as standard)
		1	0 / 12V

(3) Option slots

1.	2.	3.	Option slot	Max. number	
0	0	0	not assigned		**Please note:** **The position of the options (slot 1, 2 or 3) is freely assignable, however, the max. number must not be exceeded.**
1	1	1	Analog input 2 (universal)	1	
2	2	2	Relay (change-over)	2	
3	3	3	2 relays (n.o. make)	2	
4	4	4	Analog output	2	
5	5	5	2 binary inputs	2	
6	6	6	Solid state relay 1A	2	
7	7	7	RS422/485 interface	1	
8	8	8	PROFIBUS-DP interface	1	

(4) Voltage supply

23	AC 110—240V -15/+10%, 48—63Hz
25	AC/DC 20—30V, 48—63Hz

(5) Extra codes

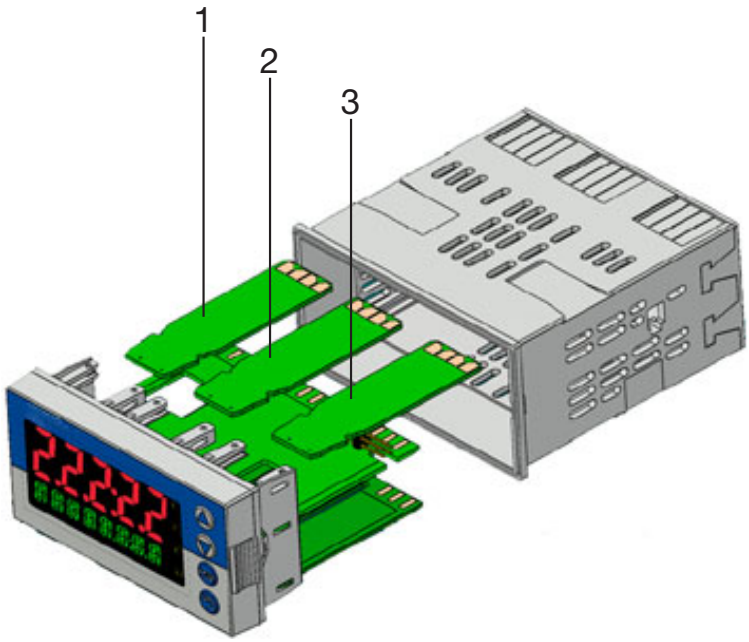
000	none
214	Math and logic module

Ordering code: **(1)** [ ] / **(2)** [ ][ ][ ] – **(3)** [ ][ ][ ] – **(4)** [ ] / **(5)** [ ]

Ordering example: **701550 / 1 8 1 – 1 4 0 – 2 3 / 0 0 0**

2 Identifying the instrument version

View of option slots



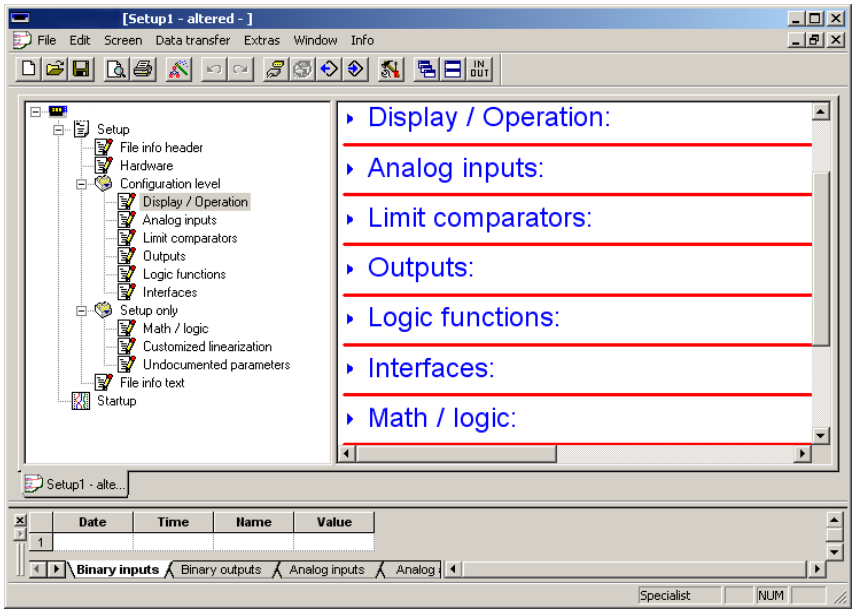
2.2 Scope of delivery

- Display instrument
- Seal
- Mounting brackets
- Operating Manual B70.1550.0 in DIN A6 format

2.3 Accessories

Mini-CD	Mini-CD with demo setup program and PDF documents (operating manual and further documentation) Sales No.: 70/00448699
PC interface	PC interface with TTL/RS232 converter and adapter (socket connector) for setup program Sales No.: 70/00350260
USB interface	PC interface with USB/TTL converter, adapter (socket connector) and adapter (pins) Sales No.: 70/00456352
Setup program	Setup program with startup function (recording and visualisation measuring data) Sales No.: 70/00493223

Setup program (continued)



Required hardware:

- PC Pentium IV or compatible
- 256 MB RAM, 100 MB free fixed disk memory
- CD ROM drive
- free serial or USB interface

Required software:

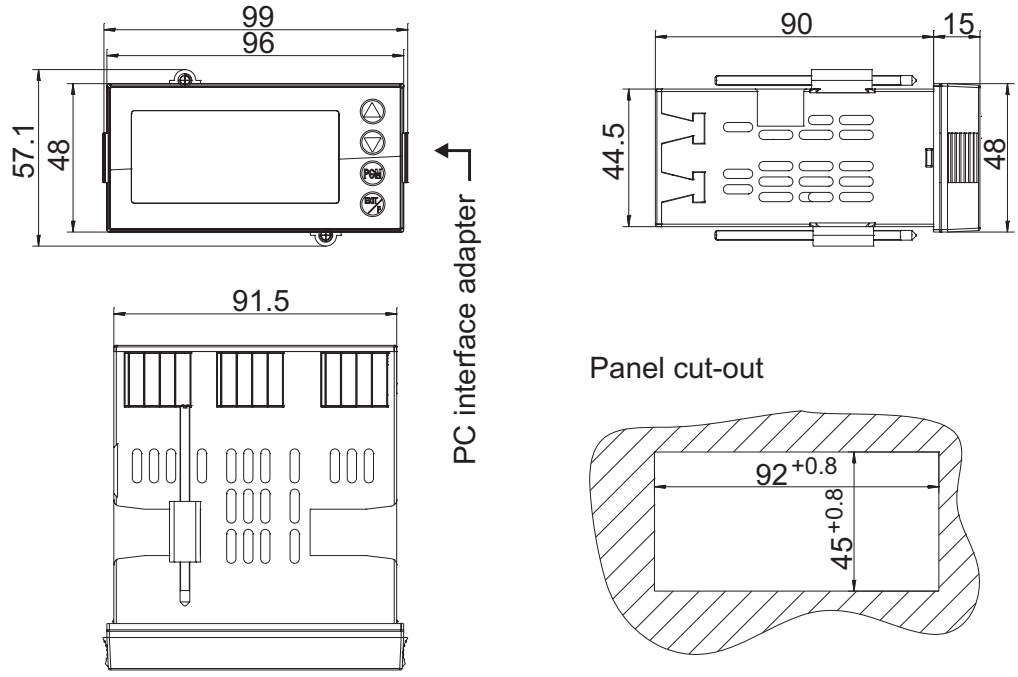
Microsoft[1] Windows 2000/XP/Vista

1. Microsoft is a registered trademark of Microsoft Corporation

3.1 Mounting site and climatic conditions

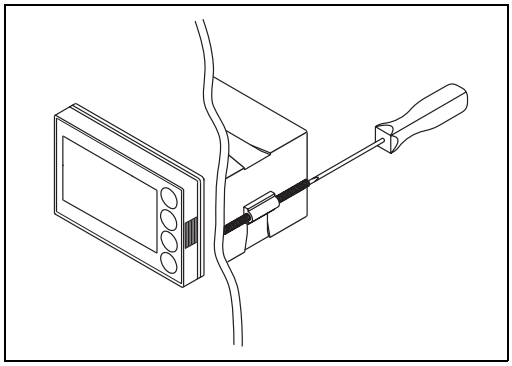
The conditions at the mounting site must meet the requirements specified in the technical data. The ambient temperature at the mounting site can range from 0...55 °C with a maximum relative humidity of ≤ 90 %.

3.2 Dimensions



3.3 Fitting in position

- Place the supplied seal on the instrument body.
- Insert the instrument from the front into the panel cut-out.
- From the panel rear, slide the mounting



brackets into the guides on the sides of the housing.
The flat faces of the mounting brackets must make contact with the housing.

* Place the mounting brackets against the panel rear, and tighten them evenly with a screwdriver.

Mounting controllers back-to-back/ next to each other

Minimum spacing of panel cut-outs		
	horizontal	vertical
without setup plug	30 mm	11 mm
with setup plug (arrow)	65 mm	11 mm

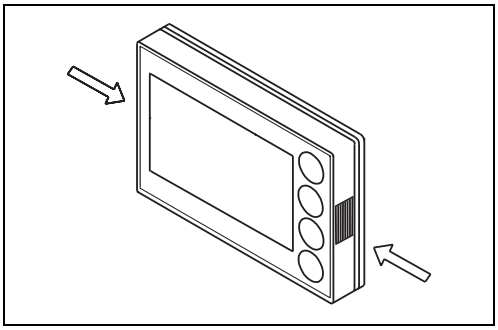
Care of the front panel

The front panel can be cleaned with commercial detergents and cleaning agents. It has a limited resistance to organic solvents (e.g. methylated spirits, white spirit, P1, xylol, etc.). Do not use high-pressure cleaning equipment.

3.4 Removing the plug-in module

The plug-in module can be removed from its housing for servicing.

* Press together the knurled surfaces on the front panel (left and right), and pull out the plug-in module.



☞ When re-inserting the plug-in module, ensure that the latches (beneath the knurled areas) engage.

4.1 Installation notes

- The choice of cable, the installation and the electrical connection of the instrument must conform to the requirements of VDE 0100 "Regulations on the Installation of Power Circuits with Nominal Voltages below 1000V" or the appropriate local regulations.
- The electrical connection must only be carried out by qualified personnel.
- The instrument shall be operated by mains protected with a branch circuitry overcurrent protection device not more than 20 Amps.
  For servicing/repairing a Disconnecting Device shall be provided to disconnect all conductors.
- The load circuit must be fused for the maximum relay current, in order to prevent the output relay contacts becoming welded in the event of a short circuit occurring at that point.
- Electromagnetic compatibility conforms to the standards and regulations cited in the technical data.

  ⇨ Chapter 10.1 „Technical data“

- Run input, output and supply cables separately and not parallel to one another.
- Sensor and interface cables should be shielded cables with twisted conductors. Do not run cables close to current-carrying components or cables. Ground the shielding on one side.
- Do not connect any additional loads to the supply terminals of the instrument.

- The instrument is not suitable for use in areas with an explosion hazard (Ex areas).

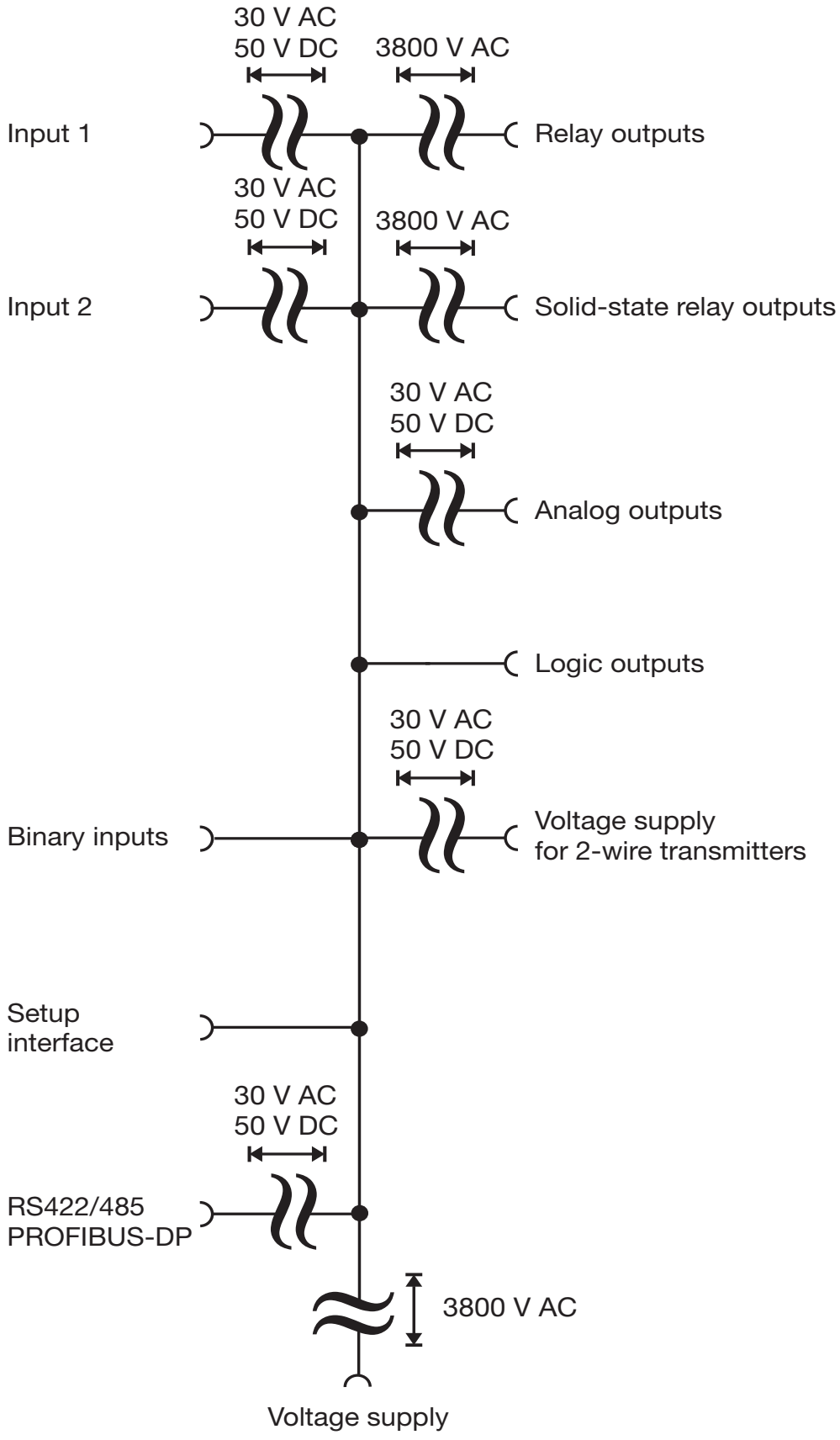
Only allow qualified personnel to carry out the electrical connection.

Identify the instrument version by means of the type code.

Installation information on conductor cross sections and core ferrules

	Minimum cross-section	**Maximum cross-section**	**Min. length of core-end ferrule**
Without core-end ferrule	0.34 mm^2	2.5 mm^2	10 mm (stripped)
Core-end ferrule without lip	0.25 mm^2	2.5 mm^2	10 mm
Core end ferrule with lip up to 1.5 mm^2	0.25 mm^2	1.5 mm^2	10 mm
Core end ferrule with lip above 1.5 mm^2	1.5 mm^2	2.5 mm^2	12 mm
Twin ferrule with lip	0.25 mm^2	1.5 mm^2	12 mm

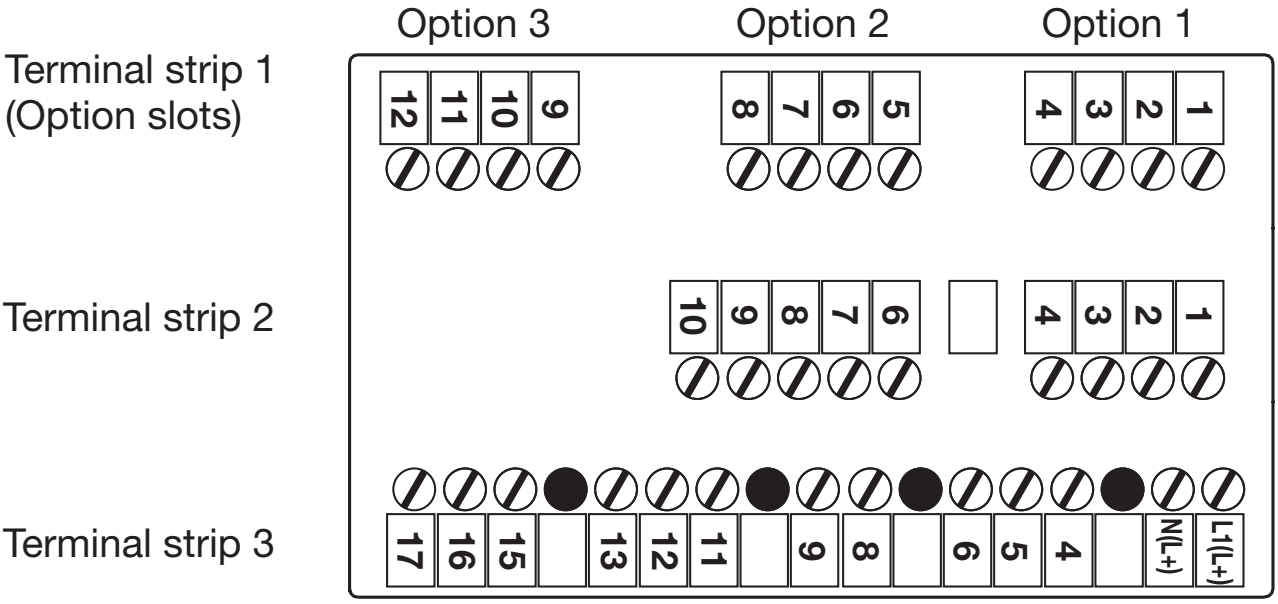
4.2 Electrical isolation



4 Electrical connection

4.3 Connection diagram

Terminal strips on the back of the instrument:



Connection diagram in the setup program

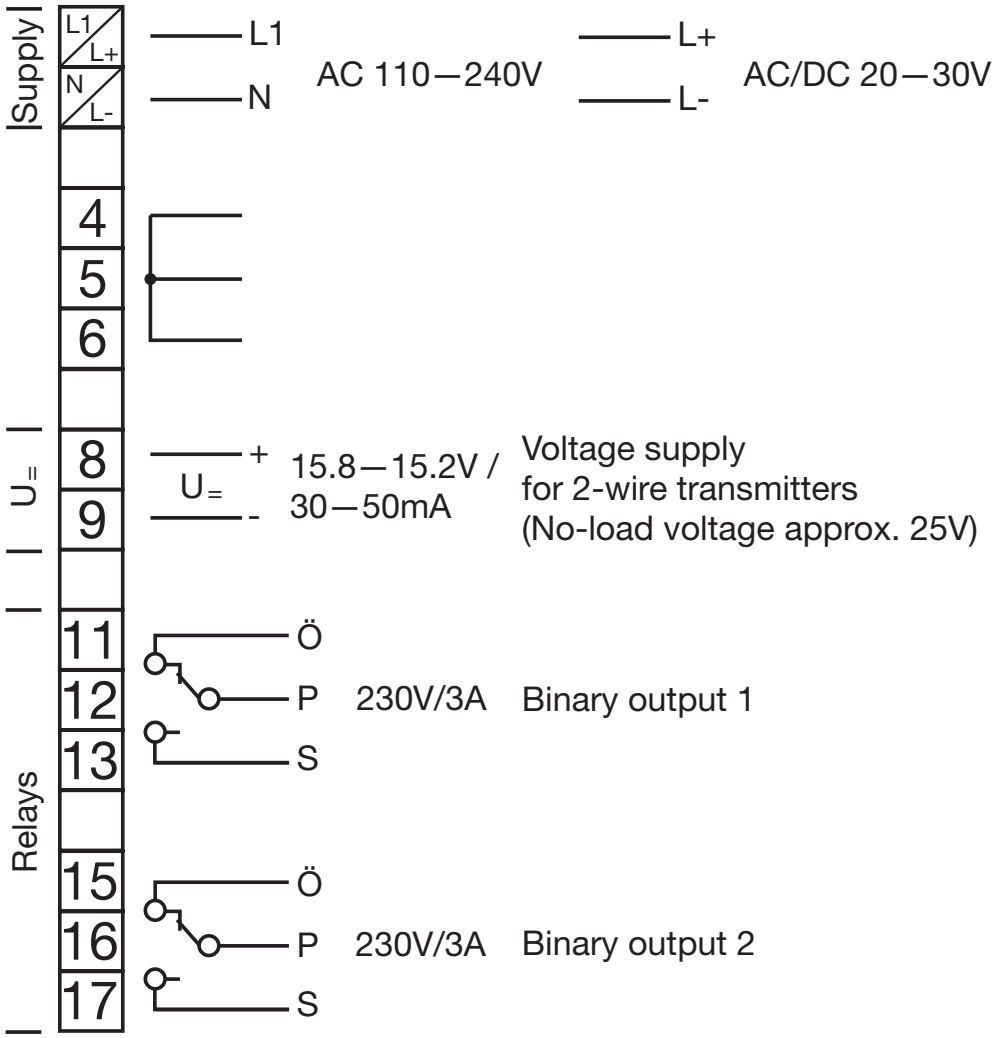
The setup program includes a graphic connection diagram subject to updates depending on the configuration or equipment.

It also allows the preparation of a list of connections containing the hardware equipment and configuration of the connections.

Connection diagram and list of connections can be printed out.

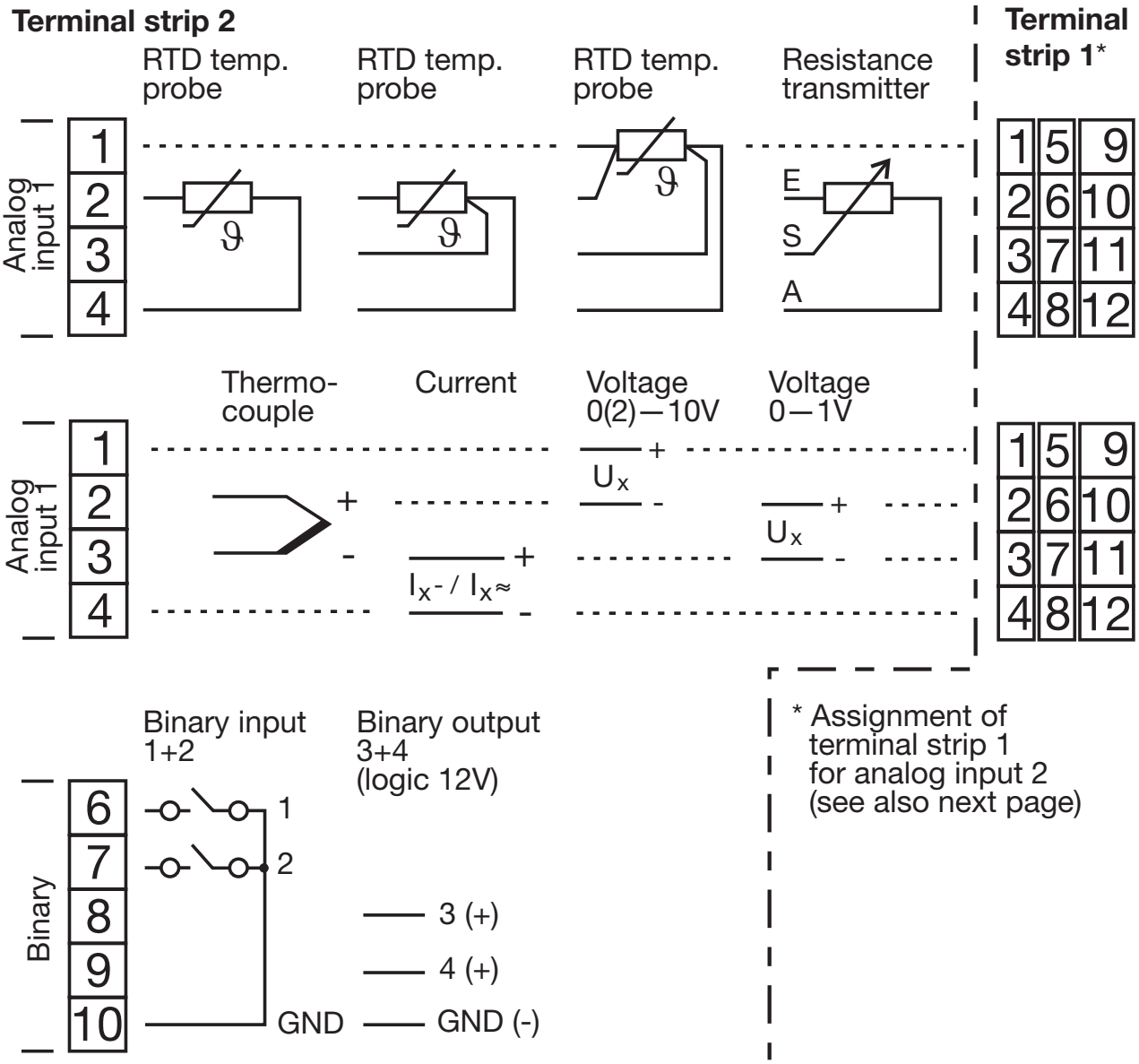
⇨ *Setup program (Extras -> Connection diagram; or via Toolbar „IN/OUT“)*

Assignment of terminal strip 3: Voltage supply and binary outputs 1+2

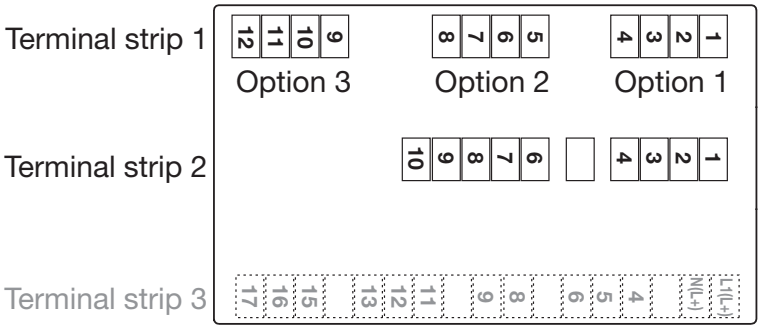


4 Electrical connection

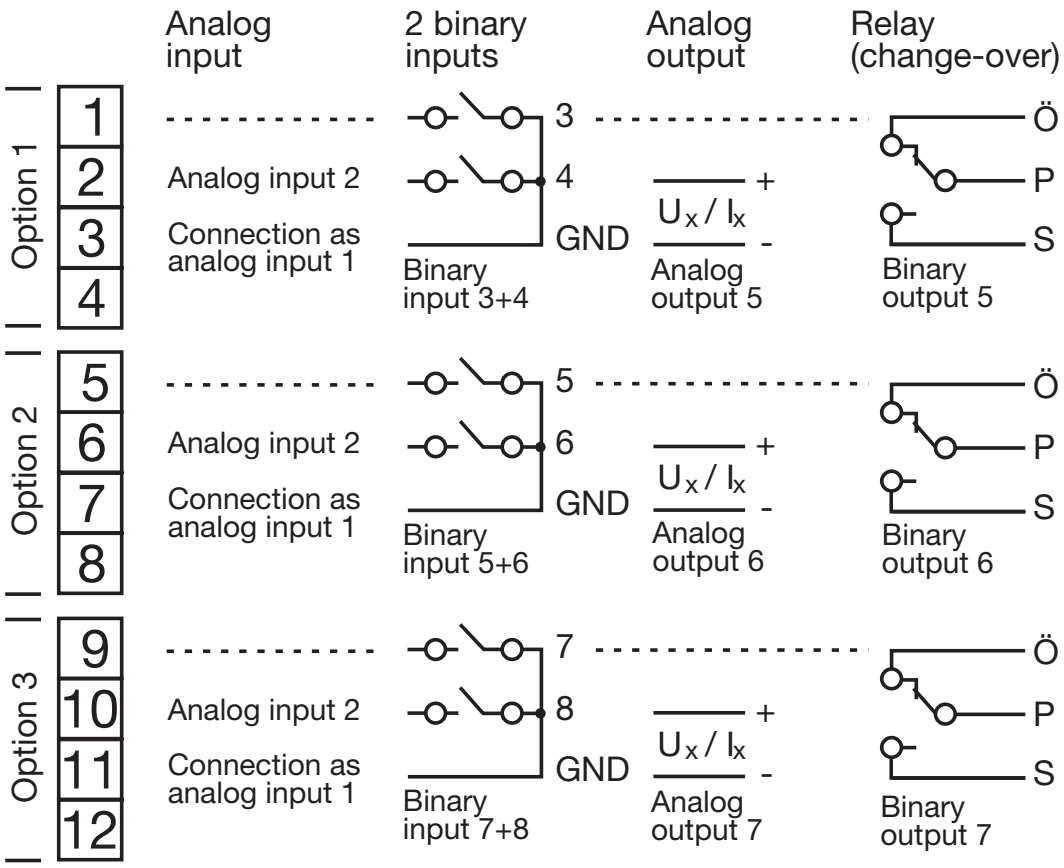
Assignment of terminal strip 2: Analog input 1, binary inputs 1+2, and binary outputs 3+4



Position of terminal strip 1 and 2 (on the back of the instrument):



Assignment of terminal strip 1 (option boards): Inputs, outputs and interfaces

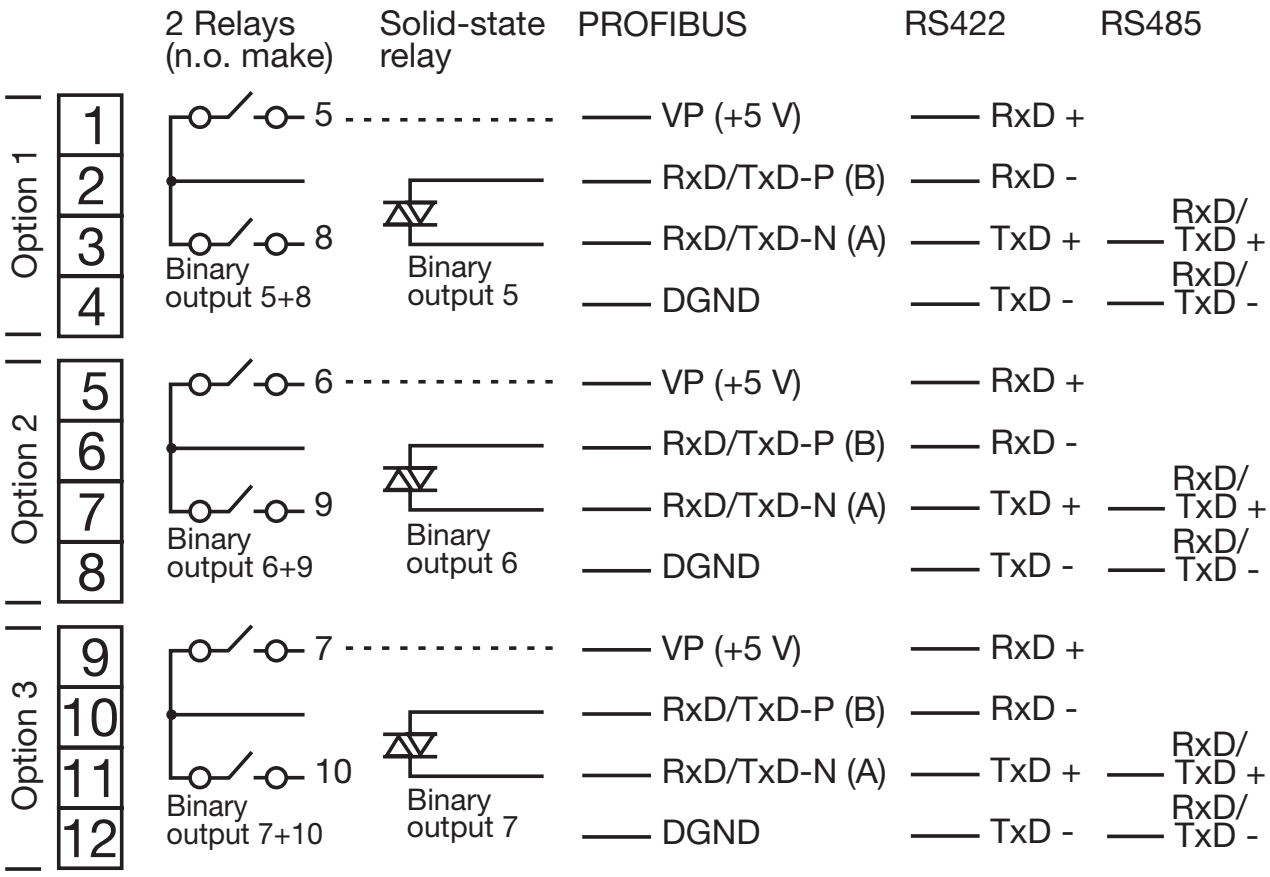


☞ The maximum number of option boards has to be taken into account (see Chapter 2.1 „Type designation“).

☞ Note numbering of the outputs (see Chapter 7.3 „Outputs „OUTPUT““).

4 Electrical connection

Assignment of terminal strip 1 (option boards) - continued: Inputs, outputs and interfaces



☞ The maximum number of option boards has to be taken into account (see Chapter 2.1 „Type designation“).

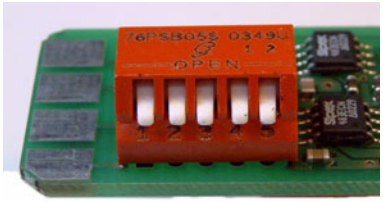
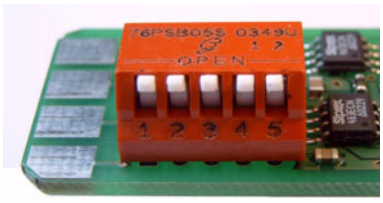
☞ Note numbering of the outputs (see Chapter 7.3 „Outputs „OUTPUT““).

4.4 Termination resistor for the RS422/485 interface

Setting resistors

To ensure fault-free operation of several instruments in a line structure, their internal termination resistors must be activated at the start and end.

* Pull plug-in module out towards the front by pressing on the knurled areas
* Using a suitable aid (e.g. ballpoint pen), press all the white switches into the same direction

Bus termination active	* Push all 5 switches down 
No bus termination (ex-factory)	* Push all 5 switches up 

* Re-insert the module into the housing

Check

* Press the PGM + ▲ keys

When checking the software version and the termination resistors activated, an additional decimal point appears behind the version number (top display).

Example of version number 01.01:
active: 01.01.
inactive: 01.01

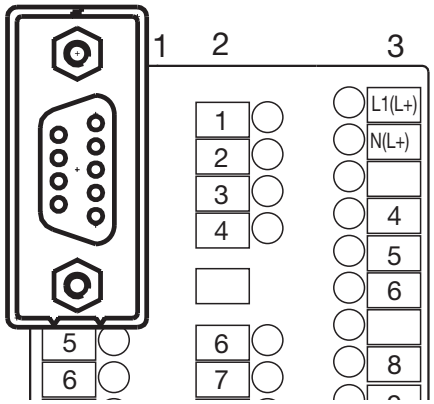
4 Electrical connection

4.5 Connection of the PROFIBUS-DP connector

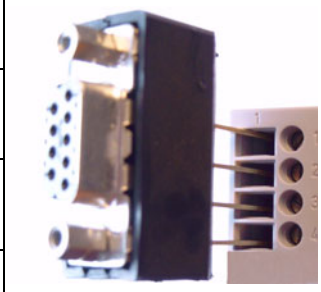
Mounting the adapter

✱ Identify option slot with the PROFIBUS-DP interface by means of the type code (in the case of pre-configured instruments)

In this example, the PROFIBUS-DP interface is in option slot 1.



Assignment of the 9 pole D-Sub socket

Pin at D-Sub socket		Pin at terminal strip 1: Signal (Example for option slot 1)	Designation
6		1: VP	Voltage supply, positive
3		2: RxD/TxD-P	Receive/Transmit data, positive
8		3: RxD/TxD-N	Receive/Transmit data, negative
5		4: DGND	Ground

To fit the D-Sub adapter, open the black housing of the adapter board; otherwise the connection screws in the instrument back are not accessible.

It is important to note that the adapter is fitted in the position shown above to ensure correct pin assignment.

5.1 Displays and controls

(1)	**7-segment display** (measured value display) five-digit, red; decimal place is configurable (automatic adjustment on display overflow)
(2)	**16-segment display** (24 character ticker, parameter name, level symbols) eight-digit, green or red; decimal place configurable
(3)	**Indication** yellow; for four switch positions of max. four outputs (display lit = ON)
(4)	**Keys**

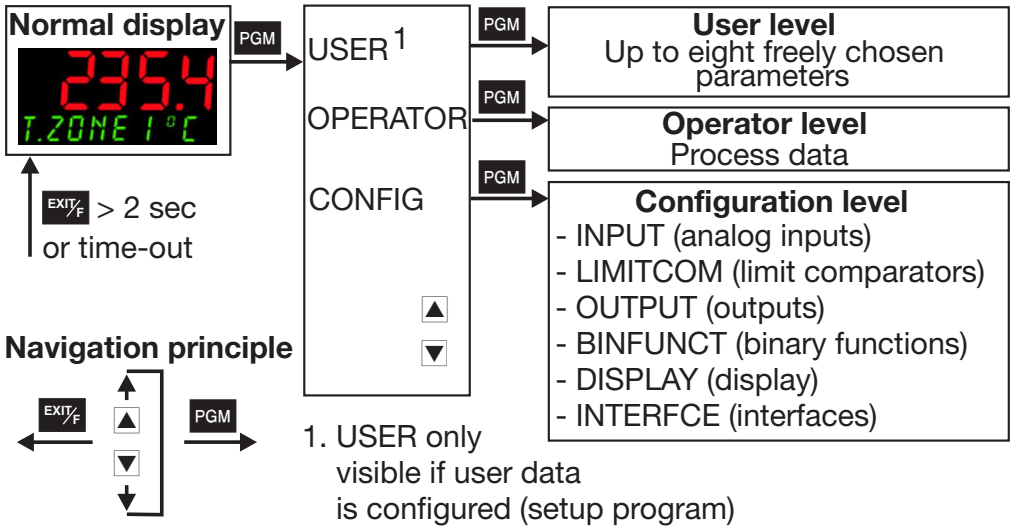
The displays are configurable.

⇨ Chapter 7.5 „Display / Operation „DISPLAY““

5 Operation

5.2 Level concept

The parameters for instrument setting are organised at different levels.



Time-out

If no key is pressed for 180 secs the instrument changes back to normal display!

⇨ Chapter 6 „Operator level“

⇨ Chapter 7 „Configuration“

⇨ *Setup program (Display/Operation -> Operation -> Operation time-out)*

User data „USER“

The setup program allows the display and editing up to 8 freely chosen parameters at this level.

⇨ *Setup program (Display/Operation -> User data -> Parameters 1...8)*

The user can assign a symbol for the representation of each parameter. Otherwise, the default symbol will appear. All letters and numbers that can be presented by a 16 segment display are permissible.

5.3 Level inhibit

Access to the individual levels can be prevented.

Code	Configuration level
0	enabled
1	inhibited

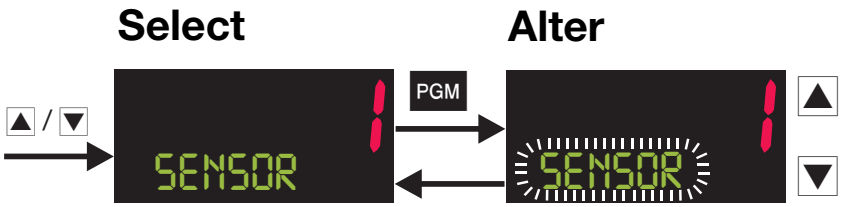
- Enter code by pressing PGM and ▼ (simultaneously for > 5 sec).
- Change code by pressing PGM (display blinks!)
- Enter code by pressing ▲ and ▼. Ex-factory: all levels enabled.
- Return to normal display by pressing EXIT/F or automatically after approx. 180 secs

The configuration level can also be inhibited via the binary function.

⇨ Chapter 7.4 „Binary functions „BINFUNCT““

5.4 Entries and operator prompting

When entries are made within the levels, the parameter symbol appears in the lower display.



* Select parameter by pressing ▲ or ▼.
* Change to the entry mode by pressing PGM (lower display blinks!)
* Alter value by pressing ▲ and ▼
  The value alters dynamically for as long as the key is kept pressed.
* Assign the value by pressing PGM or automatically after 2 secs

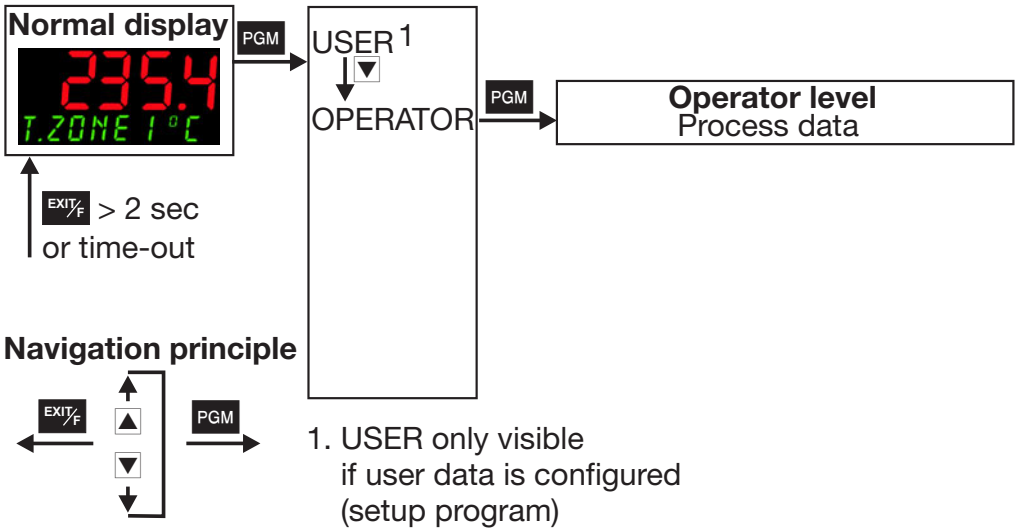
or

* Cancel the entry with EXIT/F.
  The value will be assigned.

☞ To enter digits after the decimal point, the value of system point must be set accordingly (see page 57).

For the display of measurement values of the analog inputs, the digits after the decimal point can be set separately (see page 38).

Access


Normal display
PGM
USER 1
OPERATOR
PGM
Operator level
Process data
EXIT/F > 2 sec
or time-out
Navigation principle
EXIT/F
PGM
1. USER only visible
if user data is configured
(setup program)

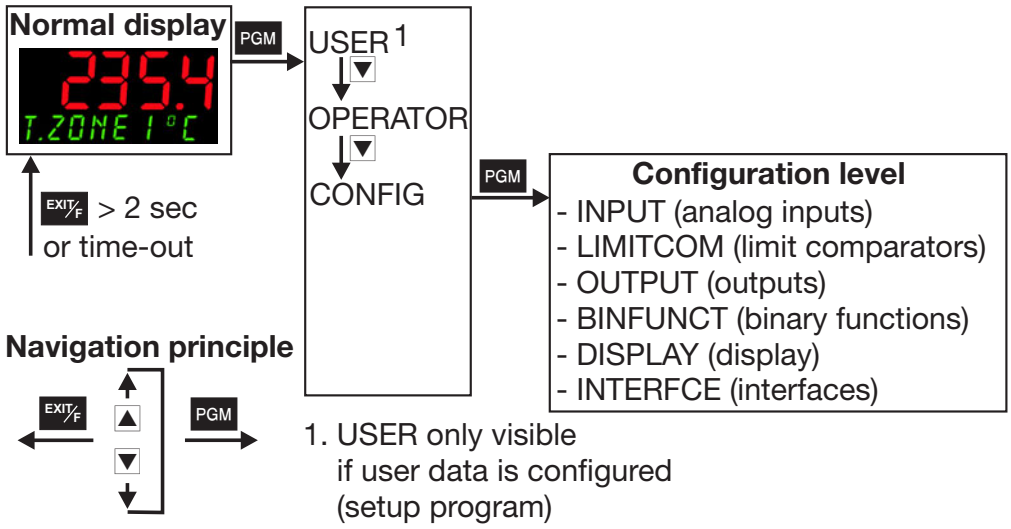
6 Operator level

Process data

Process data is shown in the operator level in accordance with the configuration.

Symbol	Meaning
INPUT1	Measured value of analog input 1
INPUT2	Measured value of analog input 2 (only if available)
MIN INP1	Minimum value for analog input 1 (only if function is activated)
MAX INP1	Maximum value for analog input 1 (only if function is activated)
HOLD1	Hold value for analog input 1 (only if function is activated)
MIN INP2	Minimum value for analog input 2 (only if analog input 2 is available and function activated)
MAX INP2	Maximum value for analog input 2 (only if analog input 2 is available and function activated)
HOLD2	Hold value for analog input 2 (only if analog input 2 is available and function activated)
MATHE1	Calculated result of mathematical formula 1 (only if mathematics module is available or if analog output 2 is available as a prerequisite for function „Humidity“, „Difference“ or „Ratio“)
MATHE2	Calculated result of mathematical formula 2 (Same conditions as with MATHE1)

Access



☞ Levels can be inhibited

⇨ Chapter 5.3 „Level inhibit“

☞ Parameters are not displayed if the equipment level does not permit the function assigned to the parameter. Example: Analog output 2 cannot be configured if no second analog output is implemented in the instrument.

☞ Some parameters can only be programmed through the set-up program. In the following tables, these are marked in the „Parameter“ column with „(Setup)“.

Analog selector

With some parameters, you can choose from a series of analog values. To provide you with an overview, this selection is listed below.

Value	Description
0	deactivated
1	analog input 1
2	analog input 2
3	*(reserved)*
4	*(reserved)*
5	math 1
6	math 2
7	*(reserved)*
8	*(reserved)*
9	*(reserved)*
10	*(reserved)*
11	analog marker
12	minimum value input 1
13	minimum value input 2
14	*(reserved)*
15	*(reserved)*
16	maximal value input 1
17	maximal value input 2
18	*(reserved)*
19	*(reserved)*
20	hold value input 1
21	hold value input 2
22	*(reserved)*
23	*(reserved)*
24	any analog value
25	internal Pt100
26	sampling cycle time

7.1 Analog inputs „INPUT“

Configuration
Analog inputs
Limit comparators
Outputs
Binary functions
Display / Operation
Interfaces

Depending on the instrument version, up to two analog inputs are available.

➔ ***INPUT1 (analog input 1)*** ➔
➔ ***INPUT2 (analog input 2)*** ➔

Sensor type

Parameter	Value/ Selection	Description
SENSOR	0	No function
	1	**RTD temperature probe in 3-wire circuit**
	2	RTD temperature probe in 2-wire circuit
	3	RTD temperature probe in 4-wire circuit
	4	Thermocouple
	5	Resistance transmitter
	7	0…20mA
	8	4 ... 20mA
	9	0…10V
	10	2…10V
	11	0 ... 1V
		Factory set on analog input 2: no function

Factory settings are shown **bold**.

➔ ***INPUT1 (analog input 1)*** ➔
➔ ***INPUT2 (analog input 2)*** ➔

	Parameter	Value/ Selection	Description
Linearization	LINEAR	0 **1** 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	Linear **Pt100 DIN** Pt500 DIN Pt1000 DIN KTY11-6 Pt100 GOST Pt 50 GOST Cu100 Cu50 Chromel-Copel W5Re-W26Re C W3Re-W25Re D NiCr-Con E Cu-Con T Fe-Con J Cu-Con U Fe-Con L NiCr-Ni K Pt10Rh-Pt S Pt13Rh-Pt R Pt30Rh-Pt6Rh B NiCrSi-NiSi N W3Re-W26Re Customised linearization For customised linearization, a maximum of 10 knee points can be implemented, or a 4th order polynomial function programmed *(only through the setup program)*. For the „KTY11-6“ linearization, the resistance is 2kΩ at 25°C *(setting only through the setup program and with 2-wire circuit)*.
Measurement offset	OFFSET	-19999… **0**… 99999	The measurement offset is used to correct a measured value by a certain amount upward or downward. Examples: Measured value / offset / displayed value 294.7 / +0.3 / 295.0 295.3 / - 0.3 / 295.0 To enter digits after the decimal point, the value of system point must be set accordingly (see page 57). Special case: „2-wire circuit“ If the input is connected to an RTD temperature probe in 2-wire circuit, then the lead resistance is set in ohms here.

Factory settings are shown **bold**.

➔ ***INPUT1 (analog input 1)*** ➔
➔ ***INPUT2 (analog input 2)*** ➔

	Parameter	Value/ Selection	Description
Scale low point	SCAL-LOW	-19999… **0**… 99999	On transducers with standard signal and on resistance potentiometers, a display value is assigned to the physical signal (scaling). Example: 0—20mA ≙ 0—1500°C. The range of the physical signal can be 20 % wider or narrower without generating an out-of-range signal. With a standard signal and customised linearization, the display range coincides with the linearization range (range of the x values). For the above example this means: Start x = 0, End x = 20, in order that the display range goes from 0 to 1500 °C. If the range of the x values is smaller, the display range is reduced accordingly.
Scale high point	SCAL-HI	-19999… **100**… 99999	
Filter time constant	FILTER	0.0… **0.6**… 100.0	To adjust the digital input filter (time in seconds; 0.0 sec = filter off). 63 % of the alterations are acquired after 2x filter time constant (2nd order filter) at a filter time step change. When the filter time constant is large: - high damping of interference signals - slow reaction of the process value display to process value changes - low limit frequency (low-pass filter)
Fine adjustment begin value	FINEADJB	-19999… **0**… 99999	These parameters are factory- **deactivated**. *(Activation in the setup program > Non documented parameters; please contact the manufacturer.)* These values cannot be accepted by another instrument. If these values have been altered by mistake, this setting has to be canceled using the procedure described under „Customised fine tuning“. See description on page 39.
Fine adjustment end value	FINEADJE	-19999… **1**… 99999	

Factory settings are shown **bold**.

➔ ***INPUT1 (analog input 1)*** ➔
➔ ***INPUT2 (analog input 2)*** ➔

	Parameter	Value/ Selection	Description
Decimal point	DECPOINT	0 1 2 3 **7**	no digit after the decimal point one digit after the decimal point two digits after the decimal point three digits after the decimal point **System point** This setting is only valid for the display of measurement value of analog input 1 or 2! *(Adjustment in the setup program under Display/Operation -> Display -> Channel name)*
Correction value KTY at 25°C	(Setup)	0… **2000** … 4000	Resistance in ohms at 25°C/77°F for „KTY 11-6“ linearisation *Adjustment only possible in the setup program: -> Analog inputs -> Analog input 1 or 2*

Factory settings are shown **bold**.

➔ ***INPUT (analog inputs general)*** ➔

	Parameter	Value/ Selection	Description
Temperature unit Temperature unit	UNIT	**0** 1	**deg. Celsius** deg. Fahrenheit Unit for temperature values
Mains frequency Mains frequency	FREQUENC	**0** 1	**50Hz** 60Hz Adaptation of the conversion time of the input circuitry to the supply frequency
Sampling cycle time Sampling cycle time	CYCLE-t	**0** 1 2 3	**50ms** 90ms 150ms 250ms

Factory settings are shown **bold**.

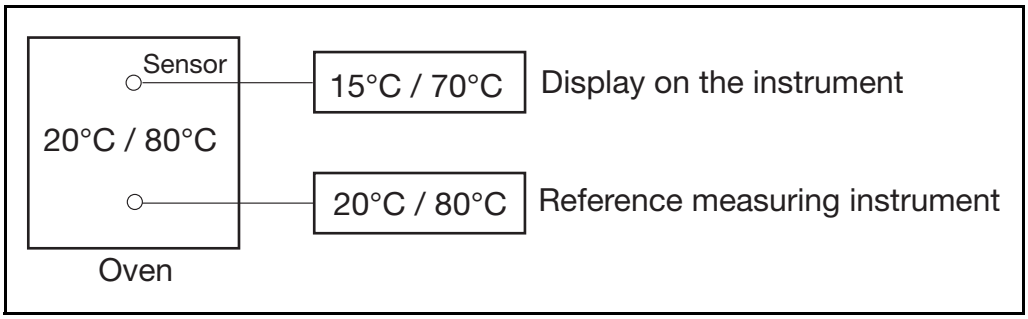
Customised fine adjustment

The customised fine adjustment is used to correct the values displayed by the instrument. This may be necessary, for example, after a system validation, if the displayed values no longer coincide with the actual values at the point where the measurement is taken.

Using a reference measuring instrument, two measured values are determined which should be as far apart as possible (start value, end value). Ensure that the measuring conditions are stable. Enter the reference value found as the start value (FINEADJB) or end value (FINEADJE) on the instrument to be tuned.

Example

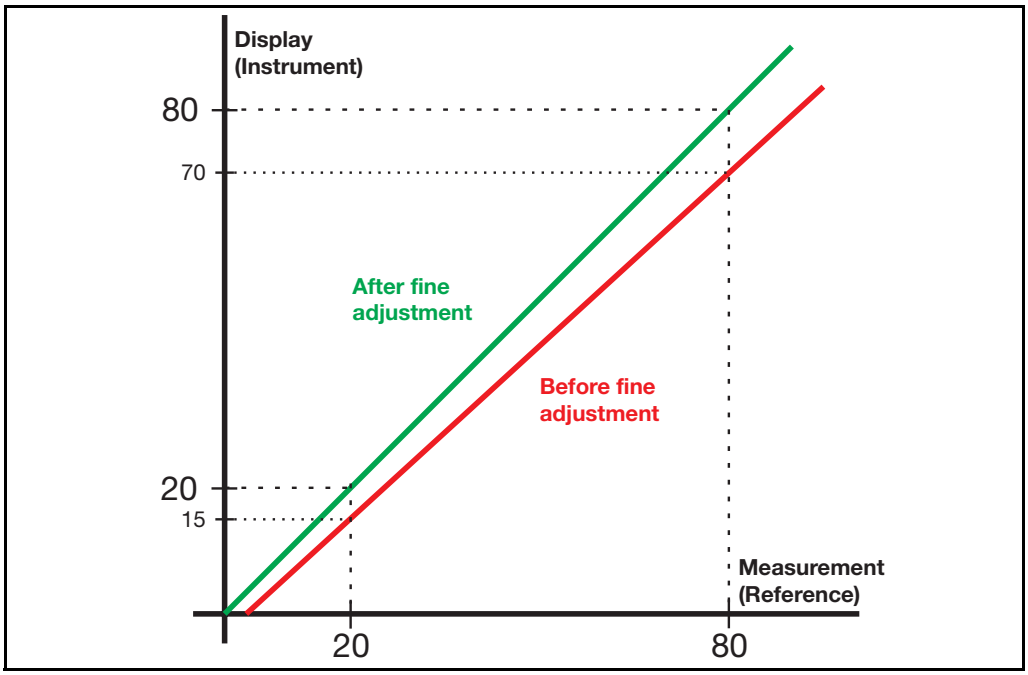
The temperature inside an oven is measured with an RTD temperature probe and displayed on an instrument. The reading on the instrument deviates from the actual temperature as a result of the sensor temperature drifting. At 20°C the instrument reads 15°C, at 80°C it shows 70°C (exaggerated example for better understanding).



Procedure:

* Step 1: The measurement carried out with the reference measuring instrument shows a constant oven temperature of 20 °C.
* Step 2: Enter value 20 as start value (FINEADJB) at the instrument.
* Step 3: The oven temperature is increased to 80 °C, the temperature is still controlled by a reference measuring instrument.
  The temperature must remain constant.
* Step 4: Enter the value 80 as end value (FINEADJE) at the instrument.

The following diagram shows the changes in the characteristic curve caused by the fine adjustment (point of intersection with the x axis as well as ascent)



Special case: Offset

If the deviation between measured value and displayed value at the low and high measuring point is identical, an offset correction is sufficient (ascent remains unchanged). In this case, fine adjustment is not required.

⇨ Measured value correction (offset), page 36

Repeated fine adjustment

Reset the fine adjustment prior to repeating it. For this purpose, program start value (FINEADJB) and end value (FINEADJE) are given the same value. This automatically sets the start value to 0 and the end value to 1.

Always check the start value and the end value prior to starting fine adjustment.
Reset the fine adjustment, if they deviate from the factory-set values 0 (FINEADJB) and 1 (FINEADJE).

7.2 Limit comparators „LIMITCOM“

Limit comparators (threshold monitors, limit contacts) can be used to monitor an input variable (process value for the limit comparator) against a fixed limit value or another variable w (setpoint value for the limit comparator). When a limit value is exceeded, a signal can be output or an internal controller function initiated.

4 limit comparators are available.

Limit comparator functions

Limit comparators can have different switching functions (lk1 to lk8). The switching differential HySt (HYSTERES) can be set and is, in all cases, symmetrical in relation to the limit value.

Hysteresis function

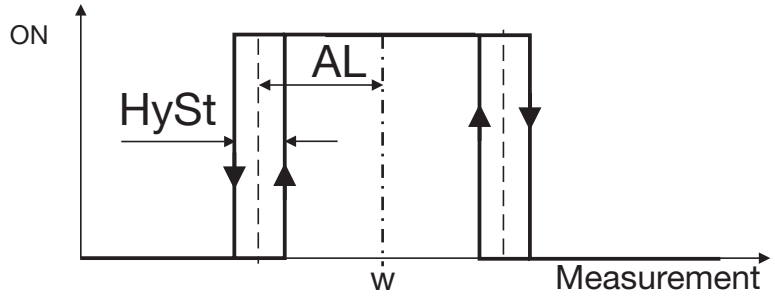
The hysteresis function (symmetrical, asymmetrical) defines the ranging of the switching differential around the limit value (adjustment in the setup program).

Limit value AL relative to setpoint value w

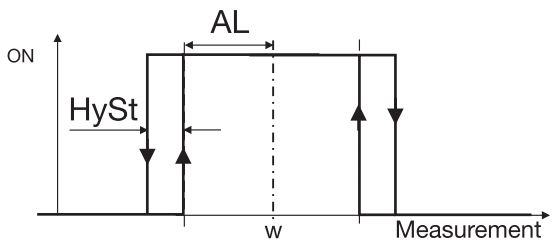
The limit comparator functions lk1 to lk6 monitor the input variable for a limit value AL (LIMVALUE) to be set, the absolute value depending on setpoint value w.

lk1

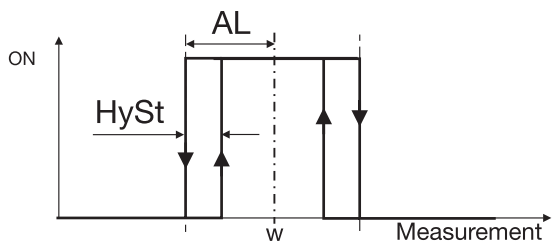
symmetrical



asymmetrical, left

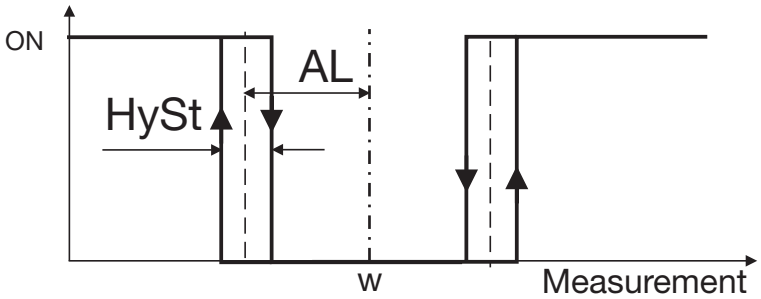


asymmetrical, right

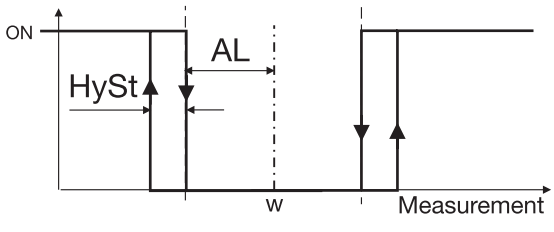


lk2

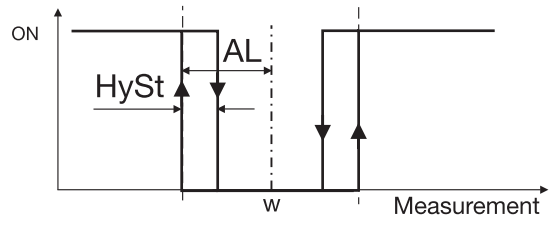
symmetrical

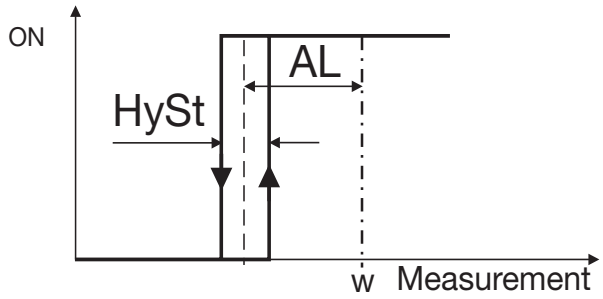
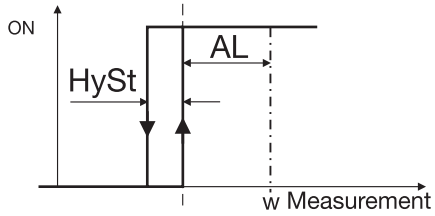
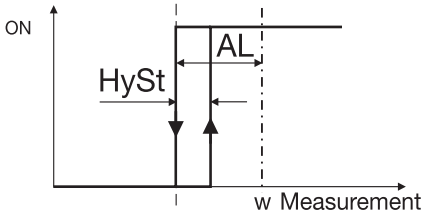
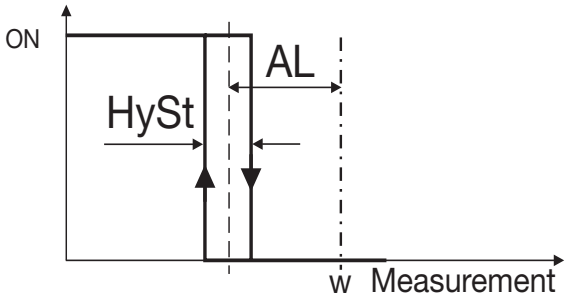
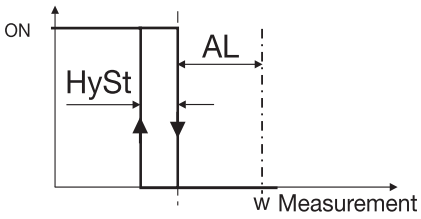
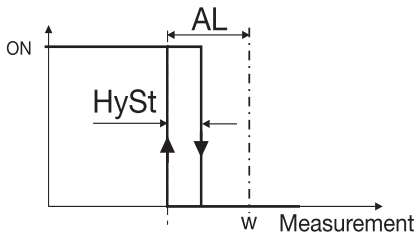


asymmetrical, left



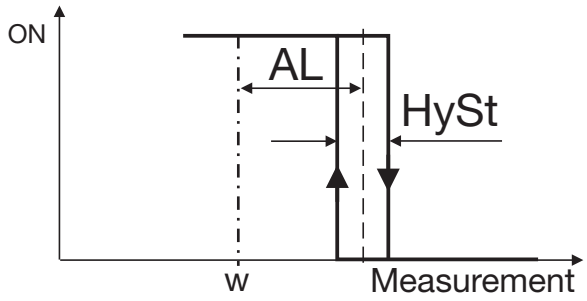
asymmetrical, right



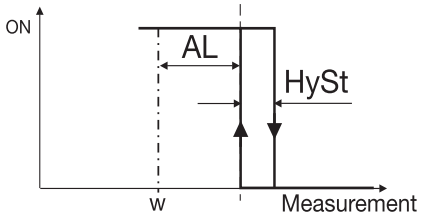
<table>
<tr><td>Ik3</td><td colspan="2">symmetrical
 
</td></tr>
<tr><td></td><td>asymmetrical, left
 
</td><td>asymmetrical, right
 
</td></tr>
<tr><td>Ik4</td><td colspan="2">symmetrical
 
</td></tr>
<tr><td></td><td>asymmetrical, left
 
</td><td>asymmetrical, right
 
</td></tr>
</table>

lk5

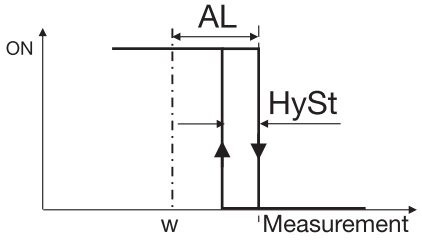
symmetrical



asymmetrical, left

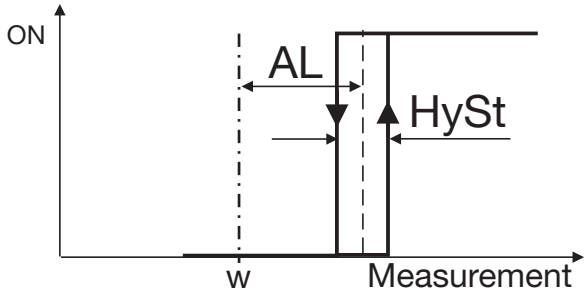


asymmetrical, right

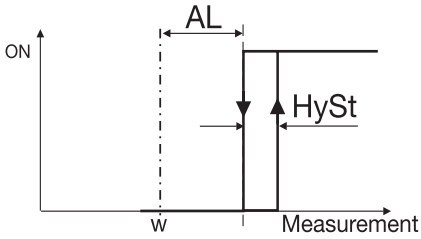


lk6

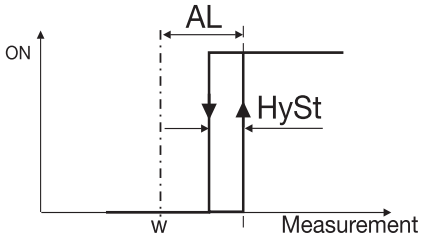
symmetrical



asymmetrical, left



asymmetrical, right



Example of a variable setpoint value

The measurement is monitored (analog input 1). The setpoint value w default value is manually entered via a potentiometer connected to analog input 2. For this, analog input 2 is selected as setpoint value (LCSETVAL).

Fixed limit value AL

In the case of the limit comparator functions lk7 and lk8, the measurement is monitored with respect to a fixed limit value AL (LIMVALUE).

<table>
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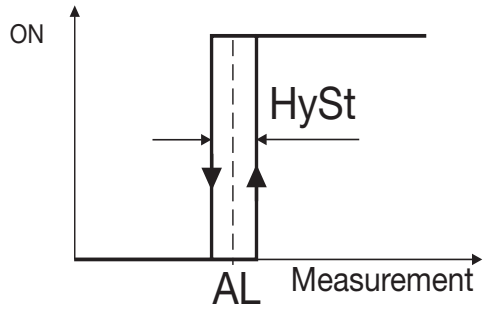
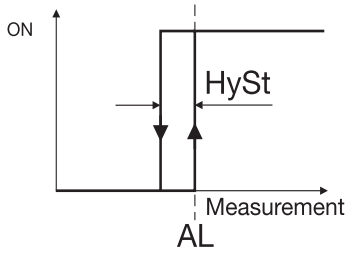
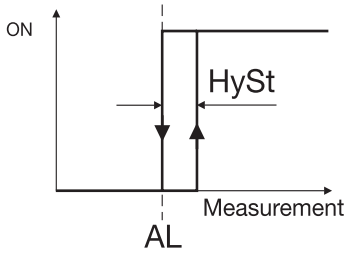
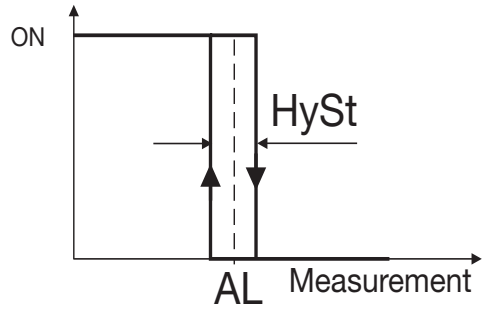
 
</td></tr>
<tr><td>asymmetrical, left
 
</td><td>asymmetrical, right
 
</td></tr>
<tr><td rowspan="2">lk8</td><td colspan="2">symmetrical
 
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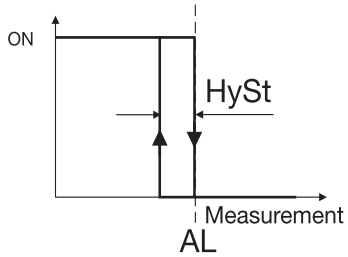
<tr><td>asymmetrical, left
 
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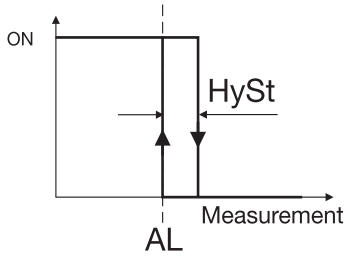
 
</td></tr>
</table>

➔ LIMITC 1 (limit comparator 1) ➔
➔ LIMITC 2 (limit comparator 2) ➔
➔ LIMITC 3 (limit comparator 3) ➔
➔ LIMITC 4 (limit comparator 4) ➔

	Parameter	Value/ Selection	Description
Function	FUNCTION	**0** 1 2 3 4 5 6 7 8	**no function** lk1 lk2 lk3 lk4 lk5 lk6 lk7 lk8
Limit value	LIMVALUE	-19999… **0**… 99999	Limit value to be monitored (see limit comparator functions lk1...lk8: limit value AL)
Hysteresis	HYSTERES	0…**1**… 99999	Switching differential in respect to the limit value (see limit comparator functions lk1...lk8: hysteresis HySt)
Fixed limit comparator setpoint value	FIXLCVAL	-19999… **0**… 99999	A fixed setpoint value can be set for the limit comparator (lk1...lk6). The limit comparator setpoint value LCSETVAL must be deactivated for the fixed setpoint value to be active.
Action/ Range response	ACT-RESP	**0** 1 2 3	**absolute/off** relative/off absolute/on relative/on Defines the switching action of the limit comparator and the switch status for an overrange or underrange (signal at „Out of Range“). See description on page 49.
Switch-on delay	ON DELAY	**0**…9999	Delays the switch-on edge by a definable time period (time in seconds).
Switch-off delay	OFFDELAY	**0**…9999	Delays the switch-off edge by a definable time period (time in seconds).

Factory settings are shown **bold**.

➔ LIMITC 1 (limit comparator 1) ➔
➔ LIMITC 2 (limit comparator 2) ➔
➔ LIMITC 3 (limit comparator 3) ➔
➔ LIMITC 4 (limit comparator 4) ➔

	Parameter	Value/ Selection	Description
Acknowledgement	ACKNOWL	**0** 1 2	**no acknowledgement** acknowledgement only possible with the limit comparator inactive acknowledgement always possible For setting with acknowledgement, the limit comparator is latching, which means, it remains „ON“ even when the switch-on condition is no longer present. The limit comparator must be reset by pressing the (▼ + EXIT/F) keys or a binary signal.
Pulse time	PULSE-t	**0**…9999	The limit comparator resets automatically after an adjustable time period (time in seconds).
Limit comparator actual value	LCACTVAL	(analog selector) **Analog input 1**	Input variable for limit comparator (see limit comparator functions lk1...lk8: Measurement) ⇨ „Analog selector“, page 34
Limit comparator setpoint value	LCSETVAL	(analog selector) **deactivated**	Setpoint value for limit comparator (see limit comparator functions lk1...lk6: setpoint value w) ⇨ „Analog selector“, page 34 When LCSETVAL is deactivated, parameter FIXLCVAL can be used to enter a fixed default setpoint value.
Hysteresis function	(Setup)	**symmetrical** asymmetrical left asymmetrical right	Switching differential ranging around the limit value *Adjustment only possible in the setup program:* *-> Limit comparators -> 1 ... 4*

Factory settings are shown **bold**.

Switching action

Switching action means: limit comparator reaction to a limit value or setpoint value change as well as to Power ON.

„absolute“ switching action:

At the time of the change, the limit comparator reacts according to its function.

„relative“ switching action:

Following Power ON, the limit comparator remains in its „OFF“ switch position, even if the process value is within the switch-on range.

If the setpoint value or the limit value is altered while the limit comparator is in its „OFF“ position, which leads to the actual value now being in the switch-on range, the limit comparator still remains in the „OFF“ switch position.

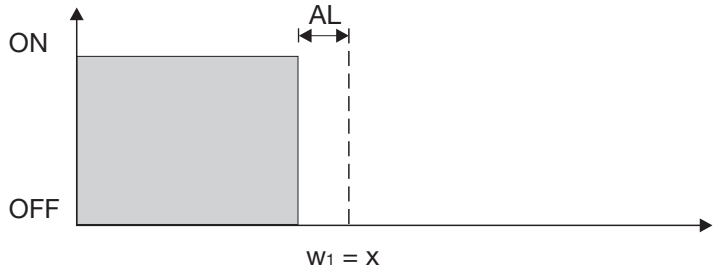
The limit comparator will only resume operation according to its function when the process value is outside of the switch-on range. In other words: it remains „OFF“ until the process value has again reached the switch-on range.

See the following example:

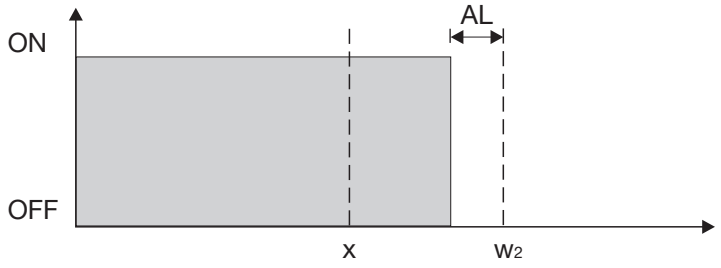
Example of the switching action „relative“:

Monitoring the actual value x with function lk4, change of setpoint value $w_1 \rightarrow w_2$

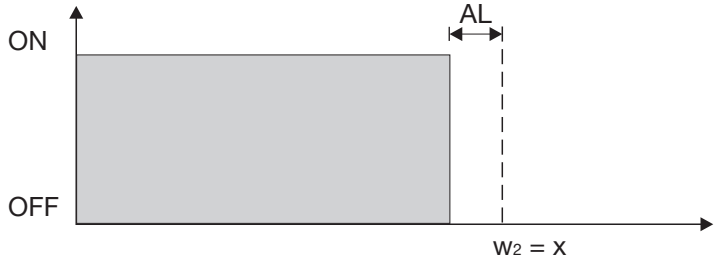
a) Start situation:
Limit comparator „OFF“, as actual value x not in the switch-on range (grey area).



b) Situation at the time of the setpoint value change:
Limit comparator remains „OFF“, although the actual value is now in the switch-on range.



c) Actual value has left the switch-on range:
Limit comparator operates according to its function again, which means it remains „OFF“ until the actual value has reached the switch-on range again.



7.3 Outputs „OUTPUT“

Configuration
Analog inputs
Limit comparators
Outputs
Binary functions
Display / Operation
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Configuration of the instrument outputs is subdivided into analog outputs (OUTANALG; max. 2) and binary outputs (OUTLOGIC; max. 10). Binary outputs are relays, solid-state relays and logic outputs. Display and numbering of the outputs depends on the assignment of the option slots.

The switching states of the binary outputs 1...4 are shown in the display (K1…K4).

Numbering of the outputs

Standard for all instrument versions:
(Binary) output 1 = relay
(Binary) output 2 = relay
(Binary) output 3 = logic output
(Binary) output 4 = logic output

Extended numbering of the option slots:

Option slot	**Plug-in board with 1 analog output**	**Plug-in board with 1 binary output (relay or solid-state relay)**	**Plug-in board with 2 binary outputs (2 relays)**
Option 1	Output 5	Output 5	Output 5+8
Option 2	Output 6	Output 6	Output 6+9
Option 3	Output 7	Output 7	Output 7+10

➔ *OUTLOGIC (binary outputs)* ➔

	Parameter	Value/ Selection	Description
Binary output 1	OUTPUT 1	**0** 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	**no function** Binary input 1 Binary input 2 Binary input 3 Binary input 4 Binary input 5 Binary input 6 Binary input 7 Binary input 8 Limit comparator 1 Limit comparator 2 Limit comparator 3 Limit comparator 4 Logic formula 1 Logic formula 2 Binary marker *(reserved)* *(reserved)* *(reserved)*
...	...		
Binary output 10	OUTPUT10		
Inversion	(Setup)	active **inactive**	Function inverted Function not inverted Inversion also affects function „Deactivated“, i. e. the output is always activated! *Adjustment only possible in the setup program: -> Outputs -> Binary outputs*

Factory settings are shown **bold**.

→ OUTANALG (analog outputs) → Output 5 →
→ Output 6 →
→ Output 7 →

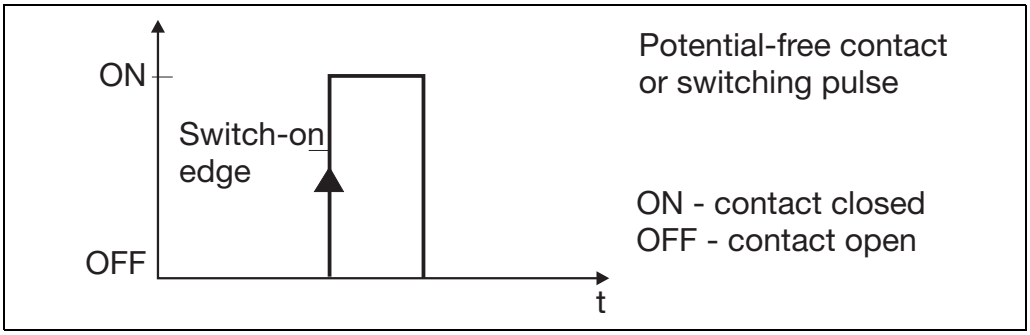
	Parameter	Value/ Selection	Description
Function	FUNCTION	(analog selector) **deactivated**	Function of the output ⇨ „Analog selector“, page 34
Type of signal	SIGNAL	0 1 **2** 3	0...10V 2...10V **0...20mA** 4...20mA Physical output signal
Range error	RANG ERR	**0**...101	Output signal (in % of the value range) for an overrange or underrange. 101=last output signal
Scale low point	SCAL-LOW	-19999... **0**... 99999	A value range of the output variable is assigned to a physical output signal. The ex-factory setting corresponds to an output variable with a value range of 0...100. Example: Via an analog output (0 … 20mA), a temperature ranging between 150 … 500°C is to be output. i.e.: 150 … 500°C ≙ 0 … 20mA Scale low point: 150 / Scale high point: 500
Scale high point	SCAL-HI	-19999... **100**... 99999	
Offset	(Setup)	-19999... **0**... 99999	The offset is used to correct the output signal by a certain amount upwards or downwards. Examples: Original value / Offset / Output value 294.7 / +0.3 / 295.0 295.3 / - 0.3 / 295.0 To enter digits after the decimal point, the value of system point must be set accordingly (see page 57). *Adjustment only possible in the setup program:* *-> Outputs -> Analog outputs*

Factory settings are shown **bold**.

7.4 Binary functions „BINFUNCT“

Binary signals of binary inputs, limit comparators and logics can be assigned functions.

Switching action



The following binary functions react to switch-on edges:

- Acknowledge limit comparator
- Reset min/max value
- Tare function
- Reset tare function
- Go to the next scroll parameter

All remaining binary functions react to switch-on or switch-off states.

	Parameter	Value/ Selection	Description
Binary input 1	B-FUNCT1	**0** 1 2 3 4 5 6 7 8 9 10 11	**no function** Key inhibit Level inhibit Display off (keys inactive) Acknowledge limit comparator Hold function Reset min/max value Tare function Reset tare function Text display Go to the next scroll parameter Colour change Level inhibit: The configuration level is inhibited. Tare function: The tare function is used to zero the display value of the analog inputs and values (math) derived from these inputs. The function is reset after Power ON. Text display: With the binary function active, a configurable text appears on the lower display: This text can be uniquely defined *(only through the setup program)*.
...			
Binary input 8	B-FUNCT8		
Limit comparator 1	LCFUNCT1		
...			
Limit comparator 4	LCFUNCT4		
Logic 1	L-FUNCT1		
Logic 2	L-FUNCT2		

Factory settings are shown **bold**.

Further functions via setup program

Several binary functions can be combined with each other in the setup program. The text display can be configured as an information or as an alarm text (with colour change).

No information or alarm texts are shown when the instrument is in the USER, OPERATOR or CONFIGURATION level.

7 Configuration

7.5 Display / Operation „DISPLAY“

Configuration
Analog inputs
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The values to be shown, the type of presentation (e.g. text, pseudo bargraph) and the display settings (e.g. colour, brightness) can be configured under this menu item.

Furthermore, start delay after Power ON, operation time-out, level inhibit and function key assignment can be defined here.

	Parameter	Value/ Selection	Description
Display 1 (upper display)	DISPLAY1	(analog selector) **Analog input 1**	Display value for the upper display ⇨ „Analog selector“, page 34
Display 2 (lower display)	DISPLAY2	(analog selector) **deactivated**	Display value for the lower display ⇨ „Analog selector“, page 34
Display type (lower display)	DISPTYPE	**0** 1 2 3 4	**Value** Channel name Process display text Unit and value display Pseudo bargraph display Channel name (max. 8 characters), process display text (max. 24 characters), unit (max. 2 characters) as well as bargraph scaling can only be entered through the setup program. For better legibility we recommend the exclusive use of capitals, numbers as well as the following special characters: ° % / \ ( ) + - < > _ | , Enter a space at the end of text comprising more than 8 and less than 24 characters.
Display colour (lower display)	COLOUR	**0** 1	**green** red

Factory settings are shown **bold**.

	Parameter	Value/ Selection	Description
Ticker time (ticker)	TICKER-t	**0** 1 2 3 4 5 6 7 8 9 10	**100ms (fast ticker)** 200ms 300ms 400ms 500ms 600ms 700ms 800ms 900ms 1000ms 1100ms (slow ticker)
Decimal point (system point)	DECPOINT	**0** 1 2 3	**no digit after the decimal point** one digit after the decimal point two digits after the decimal point three digits after the decimal point If the value to be displayed cannot be shown including the programmed decimal point, the number of digits after the decimal point are automatically reduced. If subsequently the measured value contains less digits, the reading appears with the decimal point as programmed.
Brightness	BRIGNESS	**0**…5	(bright) 0...5 (dark)
Time-out	TIMEOUT	0…**180**…255	Time period in seconds, after which the instrument automatically returns to normal display if no key is pressed.
Start delay time	START-t	**0**…3600	Start delay time in seconds after Power ON
Min/max mode	MIN-MAX	**0** 1 2 3	**Min/max mode inactive** Min/max mode active for analog input 1 Min/max mode active for analog input 2 Min/max mode active for analog input 1 and 2
Hold (Value)	(Setup)	**active** not active	Hold mode for analog input 1 or 2 With the hold mode active, the current measurement can be saved with function key „F“ or the binary function. The saved value can be shown in display 1 or 2 as well as in the scroll mode. *Adjustment only possible in the setup program:* *-> Display/Operation -> Display -> Min-Max/ Hold*

Factory settings are shown **bold**.

	Parameter	Value/ Selection	Description
Scroll time	SCROLL-t	**0**…255	Scroll mode change-over time in seconds; **0 = scroll mode inactive** 255 = scroll mode stop With the scroll mode active, keys ▲ and ▼ can be used to select the next or the previous scroll parameter. If the scroll mode was stopped, further actions are only possible with this key. *Adjustment of the scroll parameters only possible in the setup program:* *-> Display/Operation -> Display > Scroll mode* The parameter names are shown in the lower display. Example: INPUT1 = Channel name, analog input 1 MIN INP1 = Min. value, analog input 1 MAX INP1 = Max. value, analog input 1 HOLD1 = Hold value, analog input 1
Function key „F“	F-KEY	**0** 1 2 3 4 5 6	no function Apply hold value Tare function Reset tare function Reset min.-max value Scroll mode stop LK acknowledgement Keep the function key pressed for at least 2 seconds to ensure that the function will be performed.
Level inhibit	(Setup)	**none** Configura-tion level	Access to the configuration level can be inhibited. The setting is independent of binary function „Level inhibit“. *Setting in the setup program:* *-> Display/Operation -> Operation* See also Chapter 5.3 „Level inhibit“.

Factory settings are shown **bold**.

	Parameter	Value/ Selection	Description
Bargraph scaling	(Setup)	-19999 ... **0** ... +99999 -19999 ...**100**... +99999	Scaling start Scaling end *Adjustment only possible in the setup program:* *-> Display/Operation -> Display > Lower display*
Channel name	(Setup)	**INPUT1** **INPUT2** **MATHE1** **MATHE2** xxxx xxx.x xx.xx x.xxx **System point**	Channel name for analog input 1 Channel name for analog input 2 Channel name for math 1 Channel name for math 2 no digit after the decimal point one digit after the decimal point two digits after the decimal point three digits after the decimal point **Digit after the decimal point as system point** Individual channel names (max. 8 characters) can be allocated for the analog inputs and math functions. The decimal point of the values of the analog inputs can be defined different to that of the system point. *Adjustment only possible in the setup program:* *-> Display/Operation -> Display > Channel name* (The setting at the instrument is made in the menu for analog input, parameter „DECPOINT“.)
User data	(Setup)		A maximum of eight parameters from the configuration level can be defined to be available in the user level of the instrument. The parameter name (max. 8 characters) can be user-defined. Without a user-defined entry, the name programmed in the instrument will appear. *Adjustment only possible in the setup program:* *-> Display/Operation -> User data*

Factory settings are shown **bold**.

7 Configuration

7.6 Interfaces „INTERFCE“

Configuration
Analog inputs
Limit comparators
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Interfaces

The interface parameters for the RS422/485 or PROFIBUS-DP interface have to be configured in order to communicate with PCs, bus systems and peripheral devices.

→ RS422485 (Modbus) →

	Parameter	Value/ Selection	Description
Protocol	PROTOCOL	**0** 1	**Modbus** Modbus integer
Baud rate	BAUD RATE	**0** 1 2	**9600 bps** 19200 bps 38400 bps
Data format	DFORMAT	**0** 1 2 3	**8 data bits, 1 stop bit, no parity** 8 data bits, 1 stop bit, odd parity 8 data bits, 1 stop bit, even parity 8 data bits, 2 stop bits, no parity
Device address	ADDRESS	0…**1**… 255	Address in data network
Min. response time	(Setup)	**0**…500	Time period in milli-seconds that elapses between the request of a device in the data network and the response of the display instrument. *Adjustment only possible in the setup program:* *-> Interfaces -> RS422/RS485*

Factory settings are shown **bold**.

→ ***PROFIBUS (PROFIBUS-DP)*** →

	Parameter	Value/ Selection	Description
Protocol	PROTOCOL	0 **1** 2	Intel **Motorola** Intel integer
Device address	ADDRESS	0…**125**…255	Address in data network
Analog marker (analog value)	ANA-VAL	-19999…**0**…99999	Analog value
Binary marker (binary value)	BIN-VAL	**0**…255	Binary value

Factory settings are shown **bold**.

⇨ For further information, please refer to the separate interface descriptions:

- B70.1550.2.0 (Modbus)
- B70.1550.2.3 (PROFIBUS-DP)

7 Configuration

8.1 Math and logic module

Prerequisite: The „Math“ extra code must be enabled.

⇨ *Setup program (Extras -> Enable extra codes)*

The *Setup program* can be used to carry out two mathematical calculations or logical combinations of various signals and process variables from the controller. The formula is created by means of a formula editor.

⇨ *Setup program (Math/Logic)*

With math formulae, the calculated result is presented through the two signals „Math 1“ and „Math 2“ of the analog selector. With logic formulae, the result of the logical combinations is available through the signals „Logic 1“ and „Logic 2“ of the binary selector when configuring the binary functions.

⇨ Chapter 7.4 „Binary functions „BINFUNCT““

Entering formulae

- The string of characters in the formula consists of ASCII characters. It can have a maximum length of 60 characters.
- The formula can only be entered in the setup program.
- Formulae can be freely entered according to the standard mathematical rules.
- In the string of characters of the formula, spaces can be inserted as required. Spaces are not permitted within function designations, variables names and constants.

8 Extra codes

8.2 Difference, humidity or ratio calculation

The controller can be configured through the *Setup program* such that a difference, humidity or ratio calculation is carried out by means of a default formula. Analog input 2 must be available. The functions need not be enabled.

⇨ *Setup program (Math/Logic)*

Difference

The difference of the measurements is formed from analog input 1 (E1) and analog input 2 (E2).

Difference: E1-E2

Humidity

The relative humidity is determined by means of a psychrometric humidity sensor, through the mathematical combination of the wet bulb and dry bulb temperature.

Relative humidity: (E1, E2)

E1 - dry bulb temperature via analog input 1
E2 - wet bulb temperature via analog input 2

Ratio

The math module forms the ratio of the measurements from analog input (E1) and analog input 2 (E2).

Ratio: E1/E2

Result

The result is under „Math 1“ or „Math 2“ and can be used as analog value for various parameters.

⇨ Analog selector, Page 34

9 Retrofitting of modules

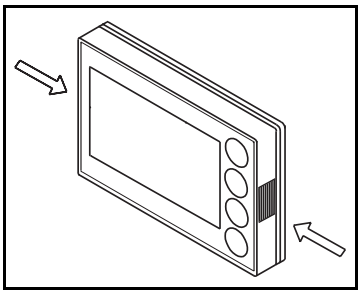
Safety notes

Only qualified personnel are permitted to carry out module retrofits.

Risk of damage to the modules by electrostatic discharge. For this reason, avoid electrostatic charge during fitting and removal. Carry out retrofitting on a grounded workbench.

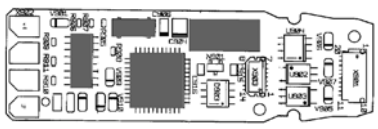
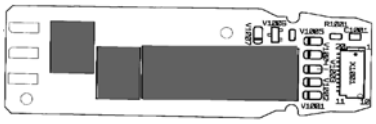
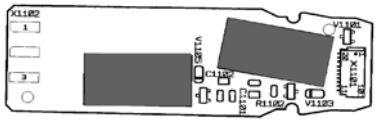
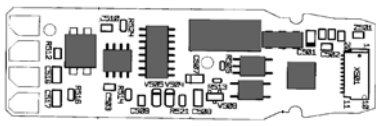
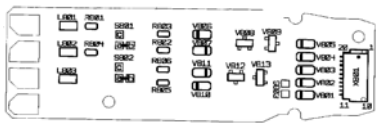
Removing the controller module

* Press together the knurled surfaces on the front panel (left and right), and pull out the controller module.

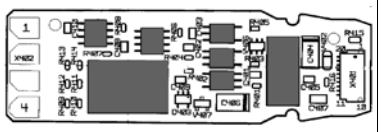
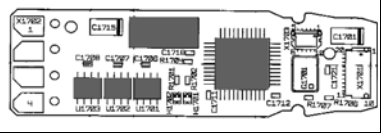


Identifying the module

* Identify the module by the sales number pasted on the packaging

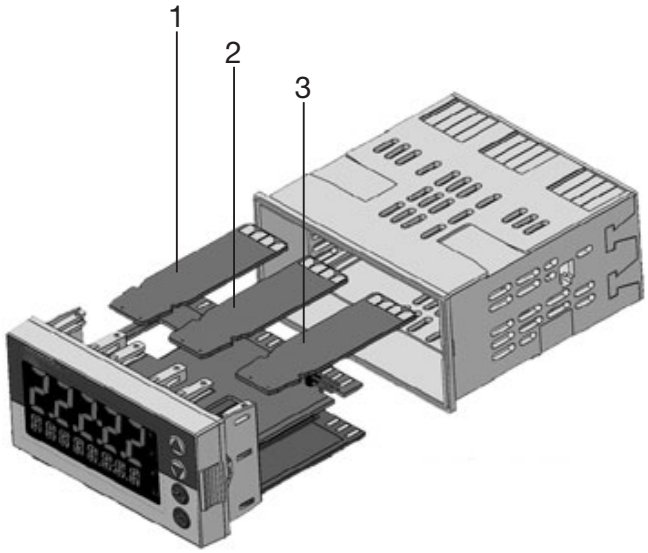
Modules	Code	Sales No.	View of boards
Analog input 2	1	70/00442785	
1 relay (changeover)	2	70/00442786	
2 relays (make, N/O)	3	70/00442787	
1 analog output	4	70/00442788	
2 binary inputs	5	70/00442789	

9 Retrofitting of modules

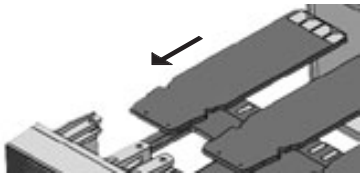
Modules	Code	Sales No.	View of boards
1 solid-state relay 230V/1A	6	70/00442790	
Interface RS422/485	7	70/00442782	
PROFIBUS-DP	8	70/00442791	

Retrofitting of modules

✱ Select slot for the option



✱ Push the module into the slot until the plug connector engages



✱ Push the module into the housing until the lugs engage in their slots

10.1 Technical data

Thermocouple input

Designation		Measuring range	Measuring accuracy[1,3]	Ambient temperature error
Fe-Con „L“		-200 to +900°C	≤ 0.25 %	100 ppm/K
Fe-Con „J“	EN 60584	-200 to +1200°C	≤ 0.25 %	100 ppm/K
Cu-Con „U“		-200 to +600°C	≤ 0.25 %	100 ppm/K
Cu-Con „T“	EN 60584	-200 to +400°C	≤ 0.25 %	100 ppm/K
NiCr-Ni „K“	EN 60584	-200 to +1372°C	≤ 0.25 %	100 ppm/K
NiCr-Con „E“	EN 60584	-200 to +1000°C	≤ 0.25 %	100 ppm/K
NiCrSi-NiSi „N“	EN 60584	-100 to +1300°C	≤ 0.25 %	100 ppm/K
Pt10Rh-Pt „S“	EN 60584	0 to +1768°C	≤ 0.25 %	100 ppm/K
Pt13Rh-Pt „R“	EN 60584	0 to +1768°C	≤ 0.25 %	100 ppm/K
Pt30Rh-Pt6Rh „B“	EN 60584	0 to +1820°C	≤ 0.25 % [2]	100 ppm/K
W5Re-W26Re „C“		0 to +2320°C	≤ 0.25 %	100 ppm/K
W3Re-W25Re „D“		0 to +2495°C	≤ 0.25 %	100 ppm/K
W3Re-W26Re		0 to +2400°C	≤ 0.25 %	100 ppm/K
Chromel-Copel	GOST R 8.585-2001	-200 to +800°C	≤ 0.25 %	100 ppm/K
Cold junction		Pt 100 internal		

[1] incl. measuring accuracy at the cold junction
[2] in the range from 300…1820°C

RTD temperature probe input

Designation		Connection circuit	Measuring range	Measuring accuracy[3]		Ambient temperature error
				3-/4-wire	2-wire	
Pt100	DIN EN 60751	2-wire/3-wire/ 4-wire	-200 to +850°C	≤ 0.05%	≤ 0.4%	50 ppm/K
Pt500	DIN EN 60751	2-wire/3-wire/ 4-wire	-200 to +850°C	≤ 0.2%	≤ 0.4%	100 ppm/K
Pt1000	DIN EN 60751	2-wire/3-wire/ 4-wire	-200 to +850°C	≤ 0.1%	≤ 0.2%	50 ppm/K
Pt50	GOST 6651-94	2-wire/3-wire/ 4-wire	-200 to +850°C	≤ 0.1%	≤ 0.8%	50 ppm/K
Pt100	GOST 6651-94	2-wire/3-wire/ 4-wire	-200 to +850°C	≤ 0.05%	≤ 0.4%	50 ppm/K
Cu50	GOST 6651-94	2-wire/3-wire/ 4-wire	-50 to +200°C	≤ 0.2%	≤ 1.6%	50 ppm/K
Cu100	GOST 6651-94	2-wire/3-wire/ 4-wire	-50 to +200°C	≤ 0.1%	≤ 0.8%	50 ppm/K
KTY11-6		2-wire	-50 to +150°C	–	≤ 2.0%	50 ppm/K

[3] The accuracy refers to the max. measurement range span. The linearization accuracy is reduced with short spans.

10 Appendix

RTD temperature probe input (continued)

Sensor lead resistance	max. 30Ω per lead for 3-wire/4-wire circuit
Measuring current	approx. 250µA
Lead compensation	Not required for 3-wire and 4-wire circuit. For a 2-wire circuit, the lead resistance can be compensated in the software by correcting the actual value.

Standard signals input

Designation	**Measuring range**	**Measuring accuracy[3]**	**Ambient temperature error**
Voltage	0(2)—10V 0—1V Input resistance R_{IN} > 100kΩ	≤ 0.05% ≤ 0.05%	100ppm/K 100ppm/K
Current	0(4)—20mA Voltage drop ≤ 1.5V	≤ 0.05%	100ppm/K
Resistance transmitter	min. 100Ω, max. 4kΩ	± 4Ω	100ppm/K

[3] The accuracy refers to the max. measurement range span. The linearization accuracy is reduced with short spans.

Binary inputs

Floating contacts	open = inactive; short-circuited to GND = active

Measuring circuit monitoring

In the event of a fault, the outputs change to defined statuses (configurable).

Sensor		**Measuring overrange / underrange**	**Probe or lead short-circuit**	**Probe or lead break**
Thermocouple		•	-	•
RTD temperature probe		•	•	•
Voltage	2—10V	•	•	•
	0—10V	•	-	-
	0—1V	•	-	-
Current	4—20mA	•	•	•
	0—20mA	•	-	-
Resistance transmitter		-	-	•

• = detected - = not detected

Outputs

Relay (change-over) Contact rating Contact life	5A at 230VAC resistive load 350,000 operations at rated load/750,000 operations at 1A
Relay (changeover (option)) Contact rating Contact life	8A at 230VAC resistive load 100,000 operations at rated load/350,000 operations at 3A
Relay (n.o. make (option)) Contact rating Contact life	3A at 230VAC resistive load 350,000 operations at rated load/900,000 operations at 1A
Logic output	0/12V / 25mA max. (sum of all output currents)
Solid-state relay (option) Contact rating Protection circuitry	1A at 230V Varistor
Voltage (option) Output signals Load resistance Accuracy	0—10V / 2—10V $R_{Load} \geq 500\Omega$ $\leq 0.5\%$
Current (option) Output signals Load resistance Accuracy	0—20mA / 4—20mA $R_{Load} \leq 500\Omega$ $\leq 0.5\%$
Voltage supply for 2-wire transmitter	electrically isolated, not stabilised 15.8—15.2V / 30—50mA (no-load voltage approx. 25V)

A/D converter

Resolution	dynamic up to 16 Bit
Sampling cycle time	50ms, 90ms, 150ms, 250ms (configurable)

Display

Type	LCD with background lighting
Display 1	7-segment display, 18mm high, 5 digits, color: red
Function of display 1	measurement display and parameter setting
Display 2	16-segment display, 7mm high, 8 digits, color: red/green (switchable)
Function of display 2	24-character running text display (alarms), display of measurements or parameter names
Display 3	4 switching status indicators (K1 to K4), 3mm high

10 Appendix

Electrical data

<table>
<tr><td>Supply voltage (switch-mode PSU)</td><td>AC 110—240V -15/+10%, 48—63Hz
AC/DC 20—30V, 48—63Hz</td></tr>
<tr><td>Electrical safety</td><td>acc. to EN 61010, part 1
Overvoltage category III, pollution degree 2</td></tr>
<tr><td>Power consumption</td><td>max. 13VA</td></tr>
<tr><td>Data backup</td><td>EEPROM</td></tr>
<tr><td>Electrical connection</td><td>at the back via screw terminals,
conductor cross section up to max. 2.5mm^2
with core-end ferrule (length: 10mm)

Installation information on conductor cross-sections and core-end ferrules
<table>
<tr><th></th><th>min. cross-section</th><th>max. cross-section</th><th>Min. length of core-end ferrule</th></tr>
<tr><td>Without core-end ferrule</td><td>0.34mm^2</td><td>2.5mm^2</td><td>10mm (stripped)</td></tr>
<tr><td>Core-end ferrule without lip</td><td>0.25mm</td><td>2.5mm^2</td><td>10mm</td></tr>
<tr><td>Core end ferrule with lip up to 1.5mm2</td><td>0.25mm^2</td><td>1.5mm^2</td><td>10mm</td></tr>
<tr><td>Core end ferrule with lip above 1.5mm2</td><td>1.5mm^2</td><td>2.5mm^2</td><td>12mm</td></tr>
<tr><td>Twin ferrule with lip</td><td>0.25mm^2</td><td>1.5mm^2</td><td>12mm</td></tr>
</table></td></tr>
<tr><td>Electromagnetic compatibility
Interference emission
Interference immunity</td><td>EN 61326-1

Class B
meeting industrial requirements</td></tr>
</table>

Housing

Housing type	Plastic housing for panel mounting acc. to IEC 61554
Depth behind panel	90 mm
Ambient/storage temperature range	0 to 55 °C / -30 to +70 °C
Climatic conditions	rel. humidity ≤ 90% annual average, no condensation
Operating position	horizontal
Enclosure protection	acc. to EN 60529, front IP 65, back IP20
Weight (fully equipped)	approx. 380 g

Interface

Modbus

Interface type	RS 422/RS 485
Protocol	Modbus, Modbus-integer
Baud rate	9600, 19200, 38400
Device address	0 - 255
Max. number of nodes	32

PROFIBUS-DP

Device address	0 - 255

Approvals/approval marks

Approval mark	Testing agency	Certificate/ certification number	Test basis	valid for
c UL us	Underwriters Laboratories	E 201387	UL 61010-1 CAN/CSA-C22.2 No. 61010-1	MS40 Type 701550/...

10 Appendix

10.2 Alarm messages

Display	Cause	Fault remedy (test/repair/replace)
-19999 (blinking!)	Underrange for the value being displayed.	Is the medium being measured within the range (too hot? too cold?) Check probe for break and probe short-circuit. Check the probe connection and the terminals. Check cable.
99999 (blinking!)	Overrange for the value being displayed.	
all displays on	Watchdog or power ON trigger initialization (reset).	Replace unit if initialization takes longer than 5s.
PROF-ERR	PROFIBUS error	Can be suppressed by setting the PROFIBUS address to "0".
OPT-ERR	Hardware configuration error	Check which option boards are installed in the slots.

Overrange / underrange covers the following events:

- Probe break or short-circuit
- Measured value outside the probe measuring range
- Display overflow

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GARANTIEBEDINGUNGEN

Die HEITRONICS Infrarot Messtechnik GmbH (nachfolgend HEITRONICS genannt) haftet unter Ausschluss weitergehender Ansprüche für Mängel an den von ihr gelieferten Infrarot-Strahlungsthermometern und deren Zubehör, und zwar für die Dauer von 24 Monaten nach Maßgabe folgender Bedingungen:
1. Die Mängelhaftung erstreckt sich ausschließlich auf kostenlosen Ersatz fehlerhafter Teile im Hause HEITRONICS.
Die Mängelhaftung bezieht sich insbesondere nicht auf natürliche Abnutzung und nicht auf Schäden, die auf unsachgemäßer Bedienung oder Beanspruchung oder sonstigen von HEITRONICS nicht verschuldeten Umständen beruhen. Die Mängelhaftung gilt nicht für Batterien.
Das Gerät ist in der Originalverpackung frachtfrei an HEITRONICS zu senden. Kosten für Steuern, Gebühren und Zölle trägt der Versender. Transportschäden gehen zu Lasten des Versenders.
2. Die Frist für die Mängelhaftung beginnt mit dem Tage des Geräteversandes aus dem Hause HEITRONICS.
3. Etwa auftretende Mängel sind HEITRONICS unverzüglich zu melden, um weitergehende Auswirkungen möglichst zu vermeiden.
4. Ersetzte Teile gehen in das Eigentum von HEITRONICS über. Für Ersatzteile leistet HEITRONICS bis zum Ablauf der für den ursprünglichen Liefergegenstand geltenden Frist in der vorgenannten Weise Gewähr.
5. Alleiniger Gerichtsstand für alle sich aus der Mängelhaftung ergebenden Streitigkeiten ist Wiesbaden, Deutschland.

IX. WARRANTY CONDITIONS

Temperature measuring equipment delivered by HEITRONICS Infrarot Messtechnik GmbH (hereinafter referred to as HEITRONICS) is warranted against defects, excluding consequential liability, notably for a period of 24 months subject to the following conditions:
1. Warranty is limited to the free replacement of defective parts at its works.
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The device must be returned to HEITRONICS in original packing, carriage paid. Costs for taxes, fees and customs duties are to be paid by sender. Shipping damage is borne by the sender.
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3. Information concerning eventually encountered defects has to be forwarded to HEITRONICS immediately to preclude possible consequential damage.
4. Replaced parts or components are returned to the property of HEITRONICS. Replacements are warranted on the conditions mentioned above until the expiration of the warranty period for the originally delivered equipment.
5. Jurisdiction for any legal dispute arising from this warranty shall be limited to the Court District of Wiesbaden, Germany.

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L'appareil doit être retourné à HEITRONICS dans son emballage d'origine, port payé. L'expéditeur paye pour les frais des impôts, des taxes et des droits de douane. Dommages de transport sont à la charge de l'expéditeur.
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5. Pour tous litiges qui pourraient naître de l'application de la garantie, la seule juridiction compétente sera celle de Wiesbaden, R.F.A.

X. Service

HEITRONICS INFRAROT MESSTECHNIK GmbH
IRM SERVICE

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