User Manual M1

Thermocouple type K, B, S, N, E, T, R, L, J



Technical features:

- red display of -1999…9999 digits (optional: green, orange or blue display)
- minimal installation depth: from 63 mm with plug-in terminal
- adjustment via factory default or directly on the sensor signal
- min-/max-value recording
- display of °C or °F possible
- display flashing at threshold exceedance or undershooting
- impedance matching
- programming interlock via access code
- protection class IP65
- plug-in screw terminal
- pc-based configuration software PM-TOOL for devices without keypad, for a simple adjustment of standard devices

Identification

STANDARD TYPES	ORDER NUMBER
Thermocouple Housing size: 96x24 mm	**M1-3TR4B.040x.570AD** **M1-3TR4B.040x.770AD**

Options – breakdown of order code:

	M	1-	3	T	R	4	B.	0	4	0	X.	7	7	0	A	D

Basic type M-Line

Installation depth
74 mm, incl. plug-in terminal: 1

Housing size
96x24x60 mm (without plug terminal): 3

Display type
Temperature: T

Display colours
Blue: B
Green: G
Red: R
Orange: Y

Number of digits
4-digit: 4

Digit height
14 mm: B

Interface
without: 0

Dimension
D physical unit

Version
A Standard
B Installation depth 63 mm only with 24 VDC supply

Setpoints
0 not setpoints

Protection class
1 without keypad, operation on the back
7 IP65 / plug-in terminal

Supply voltage
5 230 VAC
7 24 VDC galv.insulated

Measuring input
X Type K,B,S,N,E,T,R,L,J selectable

Analog output
0 without

Temperature device
4 Thermocouple

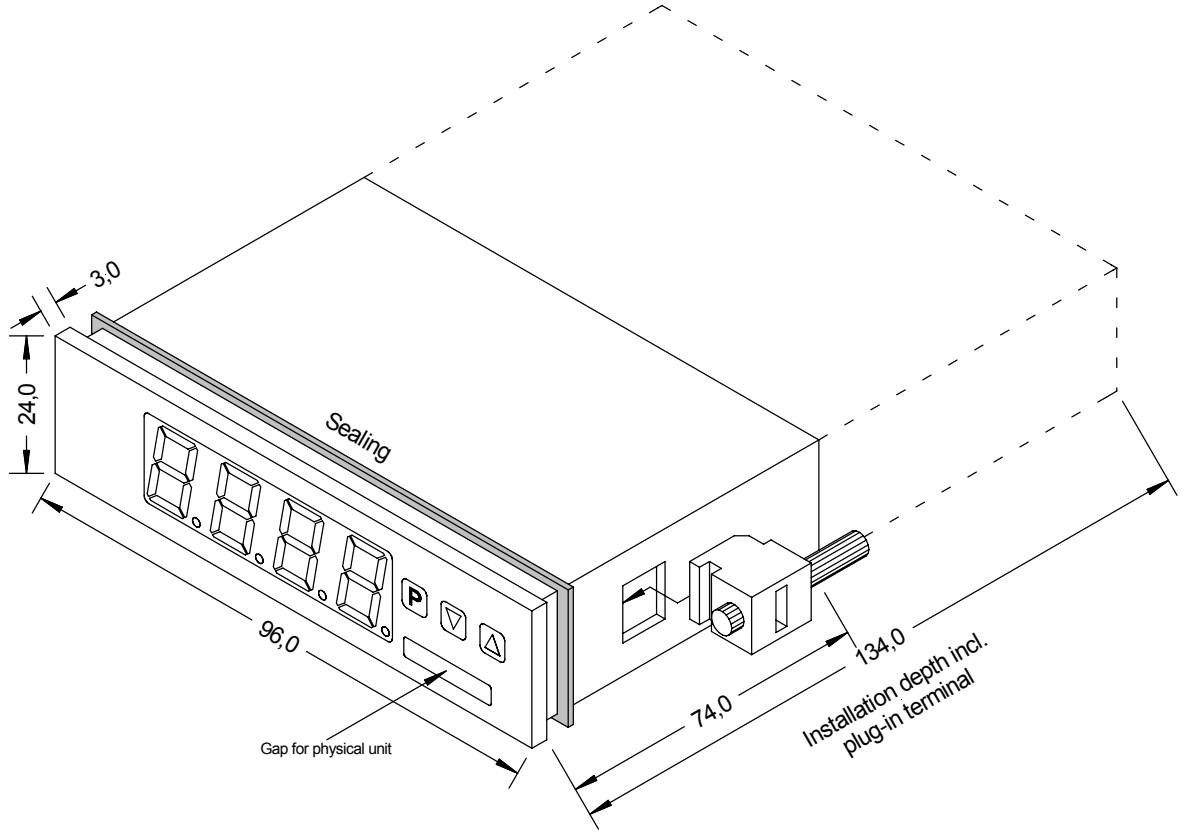
Please state physical unit by order, e.g. °F.

Contents

1. Assembly 2
2. Electrical connection 3
3. Function and operation description 4
4. Setting up the device 5
   - 4.1. Switching on 5
   - 4.2. Standard parameterization 5
   - 4.3. Extended parameterization 7
     - 4.3.1. Min/Max value inquiry „TRST“ 7
     - 4.3.2. Flashing of display „FLAS“ 7
     - 4.3.3. Threshold values „LI-1“ to „LI-2“ 7
5. Factory settings 10
   - 5.1. Default values 10
   - 5.2. Reset to default settings 10
6. Technical data 11
7. Safety advice 13
8. Error elimination 14

1. Assembly

Please read the *Safety advice* on *page 13* before installation and keep this user manual for future reference.



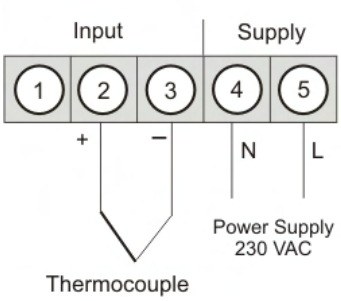
1. After removing the fixing elements, insert the device.
2. Check the seal to make sure it fits securely.
3. Click the fixing elements back into place and tighten the clamping screws by hand. Then use a screwdriver to tighten them another half a turn.

CAUTION! The torque should not exceed 0.1 Nm!

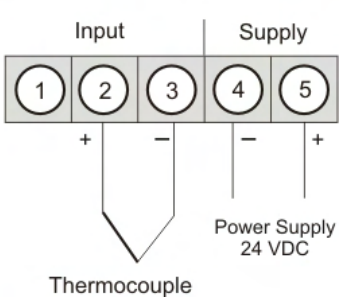
The dimension symbols can be exchanged before installation via a channel on the side!

2. Electrical connection

Type M1-3TR4B.040X.570AD with a supply of 230 VAC



Type M1-3TR4B.040X.770AD with a supply of 24 VDC



Advice:

The galvanic insulation in devices with temperature sensors that do not have a galvanic connection to an extrinsic potential, can be cancelled by an bridge from terminal 3 to 4 and thus stabilise the device against external failures.

3. Function and operation description

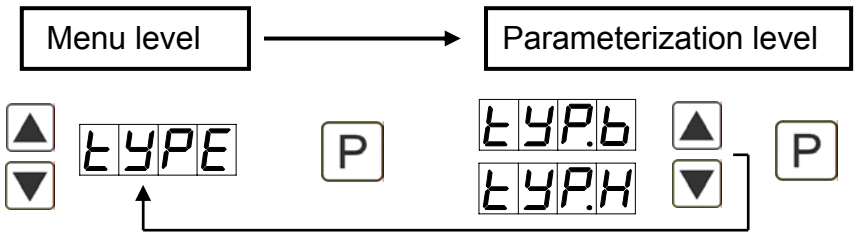
Operation
The operation is divided into two different levels.

Menu Level
Here it is possible to navigate between the individual menu items.

Parameterization level:
The parameters stored in the menu item can be parameterized here.
Functions that can be adjusted or changed are always indicated with a flashing of the display. Adjustments made at the parameterization level should be always confirmed by pressing the **[P]** key to save them.
However, the display automatically saves all adjustments and then switches to operation mode if no further keys are pressed within 10 seconds.

Level	Button	Description
Menu level	P	Change to parameterization level with the relevant parameters
	▲ ▼	For navigation at the menu level
Parameterization level	P	To confirm the changes made at the parameterization level
	▲ ▼	To change the value or setting

Example:



Programming via configuration software PM-TOOL-MUSB6

You receive the software on CD incl. an USB-cable with a device adaptor. The connection is done via a 6-pole micromatch connector plug on the back and the PC is connected via an USB connector plug.

System requirements: PC with USB interface

Software: Windows XP, Windows Vista

4. Setting up the device

4.1. Switching on

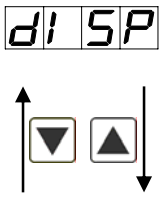
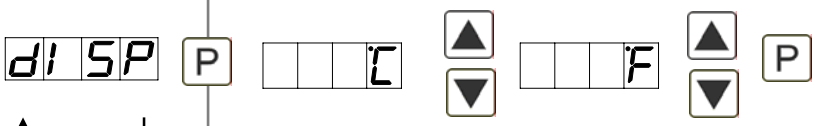
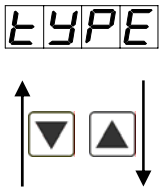
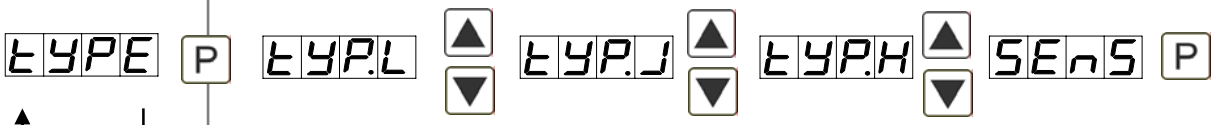
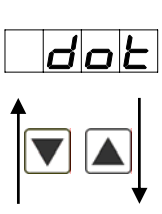
Once the installation is complete, you can start the device by applying the current loop. Check beforehand once again that all the electrical connections are correct.

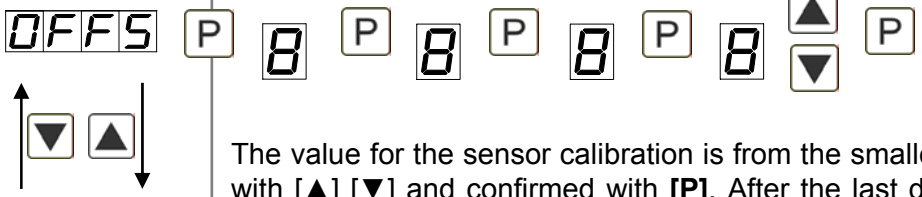
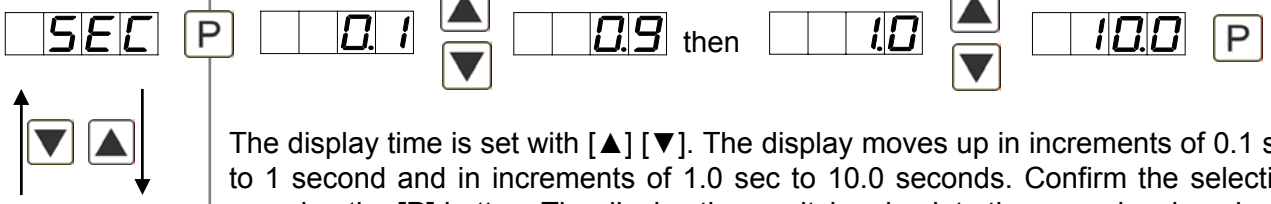
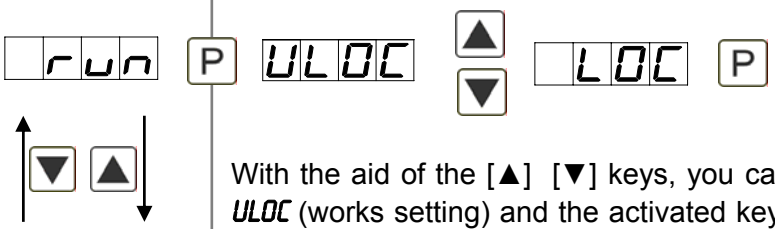
Starting sequence

For 1 second during the switching-on process, the segment test (*8 8 8 8*) is displayed, followed by an indication of the software type and, after that, also for 1 second, the software version. After the start-up sequence, the device switches to operation/display mode.

4.2. Standard parameterization:

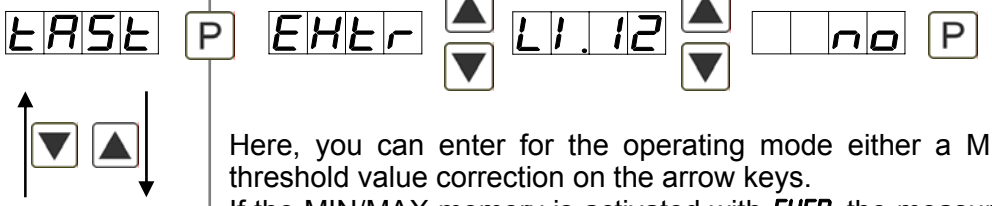
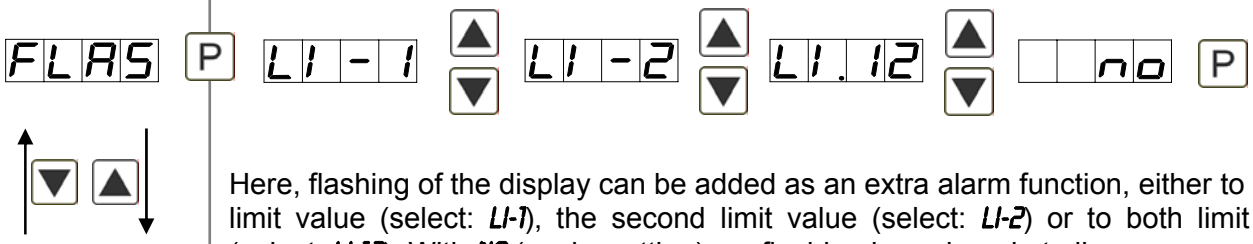
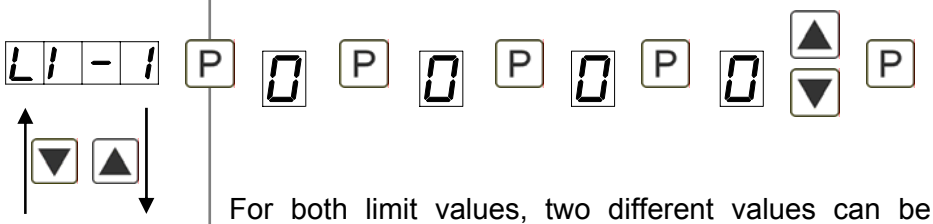
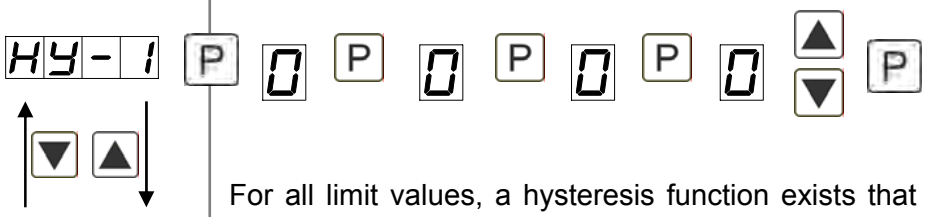
To be able to parameterize the display, press the **[P]** key in operating mode for 1 second. The display then changes to the menu level with the first menu item *TYPE*.

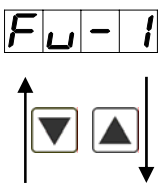
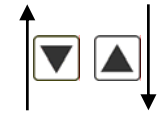
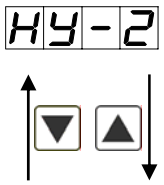
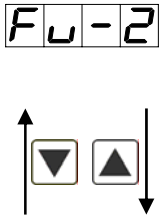
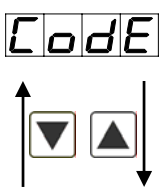
Menu level	Parameterization level
	**Type of temperature measurement,** *DISP:*  The temperature can be displayed in °C or in °F. Confirm the selection with **[P]** and the display switches back to menu level.
	**Selection of the thermocouple,** *TYPE:*  As input versions there are 9 thermocouple types (L, J, K, B, S, N, E, T, R) to choose from. Set the end value from the smallest to the highest digit with [▲] [▼] and confirm each digit with **[P]**.
	**Setting the decimal point,** *OFFS*: The decimal point on the display and the physical unit can be moved with [▲] [▼]. If e.g. temperature measurement in °C is selected, then you can choose between 0°C and 0.0°C in the parameterization level. Confirm with **[P]**, the display then switches back to the menu level again.

Menu level	Parameterization level
	**Impedance matching, *DOT*:** The value for the sensor calibration is from the smallest to the highest digit selectable with [▲] [▼] and confirmed with **[P]**. After the last digit the display switches back to the menu level again. The value calibration for a temperature measurement in °C can be adjusted between -20.0 and +20.0 and in °F between -36.0 and +36.0. If the type of the measurement is changed later, then the value is rounded.
	**Setting the display time, *SEC*:** The display time is set with [▲] [▼]. The display moves up in increments of 0.1 sec up to 1 second and in increments of 1.0 sec to 10.0 seconds. Confirm the selection by pressing the **[P]** button. The display then switches back to the menu level again.
	**Activation / deactivation of the programming lock and completion of the standard parameterization, *RUN*:** With the aid of the [▲] [▼] keys, you can choose between the deactivated key lock *ULOC* (works setting) and the activated key lock *LOC*. Make the selection with **[P]**. After this, the display confirms the settings with **"- - - -"**, and automatically switches to operating mode. If *LOC* was selected, the keyboard is locked. To get back into the menu level, you must press **[P]** for 3 seconds in operating mode. You must now enter the *CODE* (works setting *1 2 3 4*) that appears using the [▲] [▼] keys plus **[P]** to unlock the keyboard. *FAIL* appears if the input is wrong.

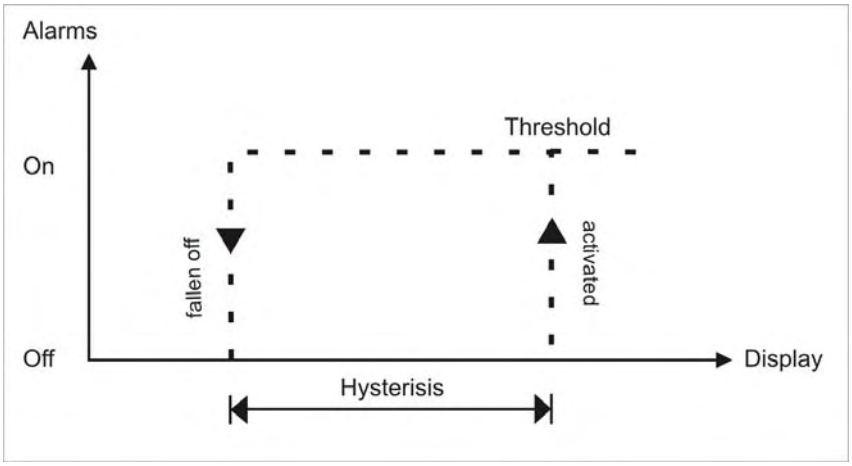
4.3. Extended parameterization

By pressing the [▲] & [▼] buttons during standard parameterization for one second, the display switches to the extended parameterization mode. Operation is the same as in standard parameterization.

Menu level	Parameterization level
	**4.3.1. MIN/MAX value inquiry - Assignment of key functions,** *TAST:* Here, you can enter for the operating mode either a MIN/MAX value inquiry or a threshold value correction on the arrow keys. If the MIN/MAX memory is activated with ***EHER***, the measured MIN/MAX values will be saved during operation and can be called up via the arrow keys **[▲] [▼]**. The values are lost if the device is restarted. If the threshold value correction *LI.1* is selected, the limit values can be changed during operation without hindering the operating procedure. If *NO* is parameterized, the arrow keys **[▼] [▲]** have no function in operating mode.
	**4.3.2. Flashing of display,** *FLAS:* Here, flashing of the display can be added as an extra alarm function, either to the first limit value (select: *LI-1*), the second limit value (select: *LI-2*) or to both limit values (select: *LI-12*). With *NO* (works setting), no flashing is assigned at all.
	**4.3.3. Limit values / Limits,** *LI-1:* For both limit values, two different values can be parameterized. With this, the parameters for each limit value are called up one after the other.
	**Hysteresis for limit values,** *HY-1:* For all limit values, a hysteresis function exists that reacts according to the settings (threshold exceedance / threshold undercut).

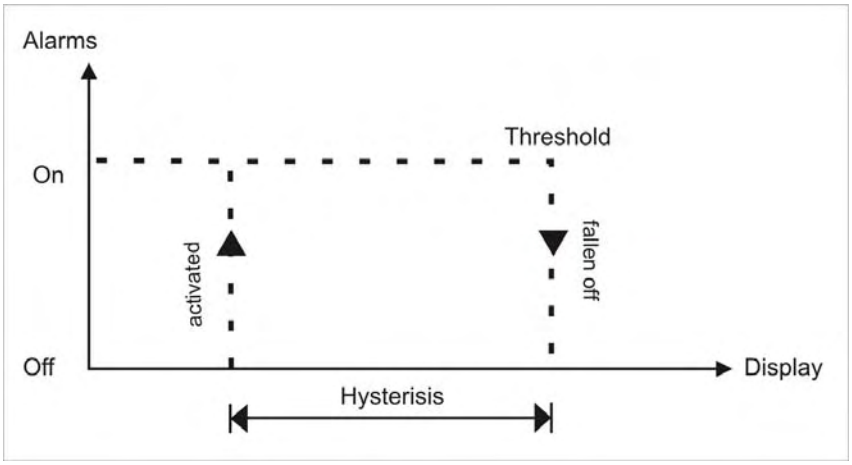
Menu level	Parameterization level
	**Function if display falls below / exceeds limit value,** *FU-1:* The limit value undercut can be selected with ***LOUU*** (LOW = lower limit value) and limit value exceedance can be selected with ***HIGH*** (HIGH = upper limit value). If e.g. limit value 1 is on a switching threshold of 100 and occupied with function „*HIGH*“, the alarm will be activated by reaching the threshold. If the limit value is allocated to „*LOW*“, an alarm will be activated by undercut of the threshold.
	**Limit value /Limits,** *LI-2:*  For both limit values, two different values can be parameterized. With this, the parameters for each limit value are called up one after the other.
	**Hysteresis for limit values,** *HY-2:*  For all limit values, a hysteresis function exists that reacts according to the settings (threshold exceedance / threshold undercut).
	**Function if display falls below / exceeds limit value,** *FU-2:*  To indicate if the value falls below the lower limit value, ***LOUU*** can be selected (LOW = lower limit value) and if it goes above the upper limit value, ***HIGH*** can be selected (HIGH = upper limit value). LOW corresponds to the quiescent current principle and HIGH to the operating current principle.
	**Setting the code,** *CODE:* With this setting, it is possible to select an individual code (works setting *1 2 3 4*) for locking the keyboard. To lock/release the key, proceed according to menu item ***RUN***.

Functional principle of the set points



Limit value exceedance "HIGH"

By limit value exceedance the alarm S1-S2 is off below the threshold and on on reaching the threshold.



Limit value undercut "LOW"

By limit value undercut the alarm S1-S2 is on below the threshold and switched off on reaching the threshold.

Alarms / optical setpoint display

An activated set point can be optically indicated by flashing of the 7-segment display.

Functional principle of the alarms	
Alarm	Deactivated, display value
Threshold	Threshold/limit value for switch over
Hysteresis	Width of the window between the thresholds
Function	Limit value exceedance / limit value undercut

5. Factory settings

5.1. Default values

Parameter	Menu items				Default
tYPE	tYP.L	to	tYP.r		tYP.L
dISP	°C	or	°F		°C
dot	0	to	0.0°C		0.0
OFFS	-20.0	to	20.0		000.0
SEC	0.1	to	10.0		01.0
run	ULOC	LOC			ULOC
tASt	no	EHtr	LI.12		no
FLAS	no	LI-1	LI-2		no
LI-1	-999	to	9999		020.0
HY-1	0000	to	9999		000.0
Fu-1	Louu	HI 9H			HI 9H
LI-2	-999	to	9999		030.0
HY-2	0000	to	9999	LI 12	000.0
Fu-2	Louu	HI 9H			HI 9H
CodE	0000	to	9999		1234

5.2. Reset to default values

To return the unit to a **defined basic state**, a reset can be carried out to the default values.

The following procedure should be used:

- Switch off the power supply
- Press button [**P**]
- Switch on voltage supply and press **[P]**-button until „- - - -“ is shown in the display.

With reset, the default values of the program table are loaded and used for subsequent operation. This puts the unit back to the state in which it was supplied.

Caution! All application-related data are lost.

6. Technical data

Housing			
Dimensions			
96x24	96x24x60 mm (BxHxT)		
	96x24x74 mm (BxHxT) including plug-in terminal		
Panel cut-out			
96x24	$92.0^{+0.8}$ x $22.2^{+0.3}$ mm		
Insulation thickness	up to 3 mm		
Fixing	snap-in screw element		
Material	PC Polycarbonate, black, UL94V-0		
Sealing material	EPDM, 65 Shore, black		
Protection class	standard IP65 (front), IP00 (back side)		
Weight	approx. 200 g		
Connection	plug-in terminal; wire cross section up to 2.5 mm^2		
Display			
Digit height	14 mm		
Segment colour	red		
Display range	-1999 bis 9999		
Setpoints	optical display flashing		
Overflow	horizontal bars at the top		
Underflow	horizontal bars at the bottom		
Display time	0.1 to 10.0 seconds		
Input	**Measuring range**	**Measuring fault** (at 1 sec measuring time)	**Digit**
Typ L (Fe-CuNi alter Typ)	-200…900 °C	2K	±1
Typ J (Fe-CuNi)	-210…1200 °C	2K	±1
Typ K (NiCr-NiAL)	-270…1372 °C	2K	±1
Typ B (Pt30Rh-Pt6Rh)	80…1820 °C	2K	±1
Typ S (Pt10Rh-Pt)	-50…1768 °C	2K	±1
Typ N (NiCrSi-NiSi)	-270…1300 °C	2K	±1
Typ E (NiCr-CuNi)	-270…1000 °C	2K	±1
Typ T (Cu-Cu-Ni)	-270…400 °C	2K	±1
Typ R (Pt13Rh-Pt)	-50…1768 °C	2K	±1
Characteristic line failure	< ±1K		
Reference junction	Semiconductor sensor		

Temperature drift	100 ppm / K
Measuring time	0.1…10.0 seconds
Measuring principle	U/F-conversion
Resolution	0.1°C or 0.1°F
Power pack	230 VAC +/- 10 % max. 6 VA 24 VDC +/- 10 % max. 1 VA
Memory	EEPROM
Data life	≥ 100 years
Ambient conditions	
Working temperature	0…60°C
Storing temperature	-20…80°C
Weathering resistance	relative humidity 0-85% on years average without dew
EMV	EN 61326
CE-sign	Conformity to directive 2004/108/EG
Safety standard	According to low voltage directive 2006/95/EG EN 61010; EN 60664-1

7. Safety advice

Please read the following safety advice and the assembly *chapter 1* before installation and keep it for future reference.

Proper use

The **M1-device** is designed for the evaluation and display of sensor signals.



Danger! Careless use or improper operation can result in personal injury and/or damage to the equipment.

Control of the device

The panel meters are checked before dispatch and sent out in perfect condition. Should there be any visible damage, we recommend close examination of the packaging. Please inform the supplier immediately of any damage.

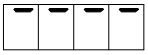
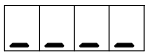
Installation

The **M1-device** must be installed by a suitably **qualified specialist** (e.g. with a qualification in industrial electronics).

Notes on installation

- There must be no magnetic or electric fields in the vicinity of the device, e.g. due to transformers, mobile phones or electrostatic discharge.
- The **fuse rating** of the supply voltage should not exceed a value of **6A N.B. fuse**.
- Do not install **inductive consumers** (relays, solenoid valves etc.) near the device and **suppress** any interference with the aid of RC spark extinguishing combinations or free-wheeling diodes.
- Keep input, output and supply lines separate from one another and do not lay them parallel with each other. Position “go” and “return lines” next to one another. Where possible use twisted pair. So, you receive best measuring results.
- Screen off and twist sensor lines. Do not lay current-carrying lines in the vicinity. Connect the **screening on one side** on a suitable potential equaliser (normally signal ground).
- The device is not suitable for installation in areas where there is a risk of explosion.
- Any electrical connection deviating from the connection diagram can endanger human life and/or can destroy the equipment.
- The terminal area of the devices is part of the service. Here electrostatic discharge needs to be avoided. Attention! High voltages can cause dangerous body currents.
- Galvanic insulated potentials within one complex need to be placed on a appropriate point (normally earth or machines ground). So, a lower disturbance sensibility against impacted energy can be reached and dangerous potentials, that can occur on long lines or due to faulty wiring, can be avoided.

8. Error elimination

	Error description	Measures
1.	The unit permanently indicates overflow. 	• The input has a very high measurement, check the measuring circuit. • The input is open
2.	The unit permanently shows underflow. 	• The input has a very low measurement, check the measuring circuit . • The input is open.
3.	The word "*HELP*" lights up in the 7-segment display.	• The unit has found an error in the configuration memory. Perform a reset on the default values and re-configure the unit according to your application.
4.	Program numbers for parameterising of the input are not accessible.	• Programming lock is activated • Enter correct code
5.	"*ERRT*" lights up in the 7-segment display	• Please contact the manufacturer if errors of this kind occur.
6.	The device does not react as expected.	• If you are not sure if the device has been parameterised before, then follow the steps as written in *chapter 5.2.* and set it back to its delivery status.
7.	Temperature value is instable.	• Check the possibility to cancel the galvanic insulation and therewith divert failures, as described in chapter 2 „Electric connection“. First make sure that a possible metallic sensor body is separated from the sensor element.