


TRB - PS

Temperature controller - limiter - alarm unit



Labelling	 Ex II (2) GD
Level functional safety	SIL 1
EU-type examination certificate	BVS 07 ATEX F 001
2 Pt -100 inputs	Three-wire-system
Ambient temperature range	0°C - 40°C
Analog output	4-20 mA
Nominal current	45 mA
Nominal voltage	230 V
Controller	0°C - 400°C
Limiter	0°C - 500°C
Protection degree	IP20 (AG 12 o. 14)
Type of construction	19" euro board 3HE/ 14TE o. 12TE

Safety temperature limiter

The safety temperature controller or -limiter is a comfortable compact unit for temperature control and -monitoring of electrically heated pipelines, containers, tanks, devices and for the installation in control rooms and switch areas.

The TRB-PS serves for the regulations and limitation of thermal processes, whereas the most common field of application is trace heating. It is available with different temperature ranges, which can result up to 500°C. The TRB-PS is intended for the installation in switchgear cabinets. The compact, electronic controller-/limiter unit TRB-PS is designed as standard – 19" – board. An installation cabinet is available as an option.

Controller with digital display	TRB - P . . S
Controller with digital display	TRB - PO . . S

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Warning

The installation, configuration and commissioning may only be carried out by accordingly trained persons. The local installation and safety regulations must be respected.



Reservation

We reserve the right for technical changes. Aberrations and printing errors do not constitute grounds for any claims to damages. For safety components and systems the relevants standards and regulations as well as the according instruction manual and the assembly instructions should be observed.



Installation notes

Possible ignition hazards, which result from the heating circuit to be operated and its installation situation, can only in so far be monitored and secured by the present devices, as the sensors being connected are reported reliably. As their mounting and the thereby associated correct acquisition of the safety-related important thermal situations of the device represent independantly operating factors, a final safety assessment of a heating circuit can not be implemented by the EU-type examination certificate of this device. Please also consult in this context the informations of the EN 60079-30-1 and EN 60079-30-2.

Before the device is taken into operation, the installation without device must be checked. A mix up of the connections can lead to immediate destruction of the device.

Please not the additional installation informations on page 9 under point 10



Maintenance

The operator must check the safety function in regularly (Switching off of the relay contact when the set limit temperature is exceeded). The test cycle results from the instruction of the EN 61508 and must be carried out every 5 years.

Repair

Repairs may only be carried out by the manufacturer. Alterations, which change the design of the device would lead expiry of the certificate and any warranty claim.

Read through this operating manual carefully, before you take the device into operation. Keep the operating manual at a place accessible for all users at any time.

Please support us to improve this operating manual.

We are grateful for your suggestions.

Please contact us for technical queries!

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1.0 DESCRIPTION

Characteristics

Certified STB (SIL1)
Precise regulation
Large dimensioned display
Parameterization easy to understand
Simple installation
Remote switch connection
Analogue output
Standstill monitoring



The TRB-PS provides two Pt100 inputs in three wire technology, at which appropriate temperature sensors can be operated in the potentially explosive area. The sensor inputs are individually designed for controller and limiter and independent. We supply suitable, certified Pt100 sensors in two basic designs.

Type Ex TF Pt100L as strap-on sensor with minimal dimensions of 7,4 cm x 2,1 cm x 2,1 cm. Fully encapsulated in an aluminium cabinet with a measuring temperature of up to 200°C.

Type Ex TF Pt100Ks with a sensor tip 5 mm and a length of 23 cm. Fully encapsulated in an aluminium cabinet, a stainless steel sensor tip and a measuring temperature of up to 400°C.

Both sensors are exceptionally reliable of interference voltage. For further information please refer to the product literature Pt-100Ks or Pt-100L.

The device is absolutely configurable directly on site.. The complete overview of the operating condition and all functions can be read directly off the frontplate.

The TRB-PS consists of a temperature controller and an according to the guideline 2014/34/EU certified safety temperature limiter (STL) with classification of the functional safety according to SIL 1. It offers the user an optimum of safety and reliability with the monitoring of thermal processes.

Controlling

The control unit is designed as two-point controller and asquires the temperature by means of a Pt- 100- sensor in 3-wire technique, which is

directly connected to the installation rack (optionally) of the TRB-PS . In dependence of the temperature at the sensor and the value set as desired value, the relay at the output of the controller operates. The desired value is set analogue by means of a knob of a scale at the front and is protected against unintentional adjustment with a pneumatic locking. The actual value is reported on a three digit display..

Monitoring

A variety of parameters are monitored, such as:

- Temperature and temperature undershoot
- Limiter alarm
- Sensor break/- short circuit
- Power failure and heat conductor break (optionally).

To ensure the operational safety, the TRB-PS provides three special functions:

Periodically switched off heating circuits are monitored regularly. (Stand-still monitoring)
With the infinitely adjustable undertemperature monitoring a descent of the process temperature below the given setpoint value can be recorded so early that the error can possibly be remedied before a damage occurs.
Overtemperature supervision with necessary switching off the heating and manual reclosing lockout of the limiter.

Overtemperature – limitation (SIL)

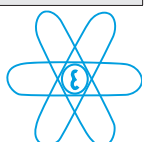
The registration of the maximum temperature results by means of a Pt-100 sensor in 3-wire technique, which is connected to the subrack of the device (optionally).

To ensure that the temperature is measured at the warmest point, the sensor must be installed at the correct hot-spot. If the admissible temperature limit is exceeded or an error (sensor break, power failure) occurs within the possible temperature range, the built-in relay switches the system to a safe operating condition without any delay. The switching off remains active until a manual approval is carried out by use of a release button at the front of the TRB-PS.

In case of a power failure, without triggering of the alarm contact, an automatic release takes place when the power supply is available again. The analogue limit value adjuster for the temperature limitation is mounted on the front. An unintentional or unauthorised adjustment of the limit value is prevented by use of a sealable transparent cover.

2.0 TECHNICAL DATA

Ambient temperature	0 °C to +540 °C	
Dimensions	19"-euroboard 100x160 mm according to DIN 41494	
Design		
Front panel (aluminium) (1 TE = 5,08 mm)	Width 12 TE	approx. 61 mm without digital display
	Width 14 TE	approx. 71 mm with digital display
	Height 3 HE	129 mm
	Length	176 mm (with front panel and connector strip)
Electrical connection	32-pole connector strip according to DIN 41612, design F	
	Pin assignment b+z (standard, connector strip 1)	
Cabinet type	32-pole connector strip according to DIN 41612, pin assignment d + z (optionally, connector strip 2)	
	Alu-installtion cabinet with terminal strips (210 x 190 mm, D x H) IP20 (optionally)	
Cabinet protection degree	19"- sub-rack according to DIN 41494	
Cabinet examination degree	IP20 / EN 60529 (when ordering the installation cabinet)	
EU-type examination certificate	BVS 07 ATEX F 001	
Identification		



Voltage regulator SRS

The TRB-PS can optionally be supplemented by a voltage regulator for power adjustment or length adjustment of trace heatings.

The planning, installation and subsequent expansion of heater circuits is substantially simplified. The voltage regulator is designed as standard 19"-board. Optionally an installation cabinet is available. The product literature for the SRS includes further details. See chapter 7.0 (application example)

2.1 CONTROLLER CIRCUIT

Measuring range	-40...200°C
	-40...300°C
	-40...400°C
Setting ranges/ Scales	0...100°C
	0...200°C
	0...300°C
	0...400°C
Desired value adjustment	Precision potentiometer lockable, angle of rotation 300°
Switching point accuracy	≤ 1 %
Switching hysteresis	≤ 1 % of full scale value
Ambient temperature influence	≤ 0,02 % per K
Linearization fault	≤ 0,1 %
Supply line measuring error	1 K for lead 3 x 1,5 mm ² , length 1,0 km
Measuring circuit monitoring	
Conductor breakage	≥ 200 Ω (dependant on measuring range*)
Cable connection	≤ 50 Ω

* For measuring ranges above 200°C the conductor breakage is 10% above the end of the measuring range.

2.2 LIMITER CIRCUIT

Setting ranges / Scales	0...200°C
	0...300°C
	0...400°C
	0...500°C
Desired value adjustment	Precision potentiometer lockable, angle of rotation 300°
Switching point accuracy	1 %, reproducible 0,2 %
Switching hysteresis	≤ 2 % des full scale value
Ambient temperature influence	≤ 0,02 % per K
Linearization fault	≤ 0,1 %
Zuleitungsmessfehler	1 K for lead 3 x 1,5 mm ² , length 1,0 km
Measuring circuit monitoring	
Conductor breakage	≥ 200 Ω (dependant on measuring range*)
Cable connection	≤ 50 Ω
Push button	b2 behind the front panel

* For measuring ranges above 300°C the conductor breakage is 10% above the end of the measuring range.

2.3 MIN. - MONITORING (UNDERTEMPERATURE)

Power failure, heat conductor break or switched off machines are not always registered by the usual protective elements like fuses and earth leakage circuit breaker. With the min. monitoring a temperature drop under a preset target value can be registered early enough, so that the error can possibly be eliminated before a damage occurs. The adjustment of the temperature switching point results at the Min. scale by use of a screw driver. If the under temperature message responds, the error indication relay switches into neutral position (alarm state). Additionally the LED's

„Min“ and „Failure“ signal the alarm status (see chapter 4.1). The temperature range identical with that of the controller circuit. To avoid triggering the Min. alarm when starting up the heating, the Min.-monitoring can be decommissioned individually with the push button b2. (see chapter 4.2.). For external switching off the heating by means of a remote switch, the Min.-monitoring is inevitably bridged. (see chapter 2.4).

Further technical data:

Setting ranges / Scales	0...100°C/ 0...200°C/ 0...300°C/ 0...400°C
Desired value adjustment	Precision potentiometer; with screwdriver; angle of rotation 300°
Switching point accuracy	1 %, reproducible 0,2 %
Switching hysteresis	≤ 2 % of full scale value

2.4 REMOTE SWITCH CONNECTION

Via the remote switch connection all controller combinations can be switched on and off externally. This is of advantage, for example, if in the case of failure of a product pump a space heater shall be switched on automatically. With closed remote switch loop the heating is interrupted. Switched on with open contact or dependant on the position of the control buttons in the front panel. In the case of external heating cut-off the min.-monitoring is inevitably decommissioned, to avoid a response of the failure signal.

2.5 ANALOGUE OUTPUT (I) 4 – 20 mA

All control boards have a linearized, temperature analogue power output of 4 to 20 mA corresponding to the indicating range (for example 0 to +200 °C), on request also from 0 to 20 mA (for example -40°C to +200°C). At the output a temperature indicator, temperature recorder or similar can be connected. If the 4-20 mA output remains open, this is without influence on the controller.

2.6 AUTOMATIC RE-POWERON AFTER POWER FAILURE 10 - 20 SEK.

With a failure of the supply voltage 10-20 seconds after voltage return all previous functions switch on again automatically, if the limiter is not blocked by an overtemperature release. This saves the maintenance personnel from reclosing (limiter reset) each controller by hand.

2.7 FAILURE SIGNAL AT POWER FAILURE

When taking up the controller supply after the automate and/or earth leakage circuit breaker a contact of the fault signal relay can be used for supply system monitoring. This method makes an additional auxiliary contact at the automate and/or ground fault circuit interrupter unnecessary and simplifies the circuitry. Relay d3 is constructed in closed current circuit and returns to rest position in case of power failure. The electrical date of the relay must be observed.

2.8 MONITORING OF PERIODICALLY SWITCHED OFF HEATINGS

If a heating is only used occasionally (space heater) or is switched off again after the freezing period, interferences can occur during the unused period, which would only be detected next time when it is switched on again. To ensure a more balanced and also faster failure remedy, our controller units are equipped with an automatism that switches on the heating for approx. 2 minutes in 6-hour-rhythm. An error that has occurred can be detected quickly and removed that way. This monitoring requires however, that each, controller and heater circuit are kept operational. If this function is not required, please mention when the order is placed.

2.9 FAULT SIGNAL d3

The fault signal relay fundamentally responds to any functional disorder (drop in rest position). It is assembled with to volt-free changeover contacts. If a collective alarm loop is led via the closing contact, this can be bridged by means of the slide switch b3 at switched off heating, to avoid triggering a collective alarm (see chapter 4.3).

2.10 HEAT CONDUCTOR BREAK MONITORING (OPTIONALYL)

(only with power strip 2 at model TRB - PieS)

The heat conductor break monitoring makes sense wherever the interruption of a heat conductor does not inevitably lead to triggering of the isolation or earth fault monitoring (undervoltage release).

Functioning

The heat conductor current is delivered to the controller by use of 1 to 3 current transformers with a max. secondary current of 1 A and there it is compared with the adjusted minimum current of 150mA. We recommend to provide a minimum current of 300 mA. Thereby also errors in the data logging, caused by very small phase angles, do not trigger a failure signal. If the values have fallen below, the fault signal relay d3 and the LED „conductor break“ cause alarm (see chapter 4.0 LED No. 11). Also see chapter 4.3. in this context (slide switch B3 on the circuit board) and chapter 4.4 (switch S5). With this the interruption of a collective alarm loop at deenergization of individual heating circuits can possibly be avoided.

2.11 EXTERNAL SETPOINT VALUE (OPTIONALLY)

(only with power strip 2 at model TRB - PieS)

4-20 mA correspond to 0...100 % of each range of the built-in setpoint potentiometer. This input is galvanically separated from the other electrical circuits. Switching from internal setpoint value to external setpoint value by use of switch. See chapter 4.4 (switch S5).

3.0 ELECTRICAL DATA

Current supply circuit		
Power strip 1 Pin 2 b+z, 18z	Nominal voltage	230 V ± 15%, 48-62 Hz
	Nominal current	45 mA
Fuse	80 mA slow	
Examination category	II	

Analogausgang Istwert		
Steckerleiste 1 b20 / b22	Nominal current	0-20 mA / 4-20 mA
	max. current	122 mA
	max. voltage	15,8 V

Fernschalter		
Steckerleiste 1, b20 / z20	max. current	16,3 mA
	max. voltage	5,4 V

Pt 100 input temperature controller		
Power strip 1 b30; b32; z32		
	max. current	31,1 mA
	max. voltage	7,5 V
	max. power	Characteristic line trapezoid
	Measuring current	6 mA
	Nominal voltage	1,6 V (0,3 V)

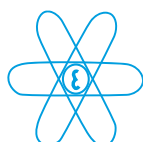
Pt 100 input temperature limiter		
Power strip 1 b28; b26; z26		
	max. current	31,1 mA
	max. voltage	7,5 V
	max. power	Kennlinie trapezförmig
	Measuring current	6 mA
	Nominal voltage	1,6 V (0,3 V)
Relay d1 (Controller)		
Power strip 1 b4; z4; z6	1 volt-free changeover contact	
	Nominal voltage	230 V
	Max. curret	4 A (3 A at $\cos\phi \geq 0,7$)
	Max. power	100 VA (no restriction at $\cos\phi \geq 0,7$)

Relay k1 (Limiter)		
Power strip 1 b26; z26; b28		
	Nominal voltage	230 V
	Max. current	4 A (3 A at $\cos\phi \geq 0,7$)
	Max. power	100 VA (no restriction at $\cos\phi \geq 0,7$)

Relay d3 min.-monitoring and wire break		
Power strip 1 b12; z10; z12		
	Nominal voltae	230 V
	Max. current	3 A (2 A at $\cos\phi \geq 0,7$)
	Max. power	100 VA (no restriction at $\cos\phi \geq 0,7$)
	Voltage drop	≤ 0,47 V (at 1 A)

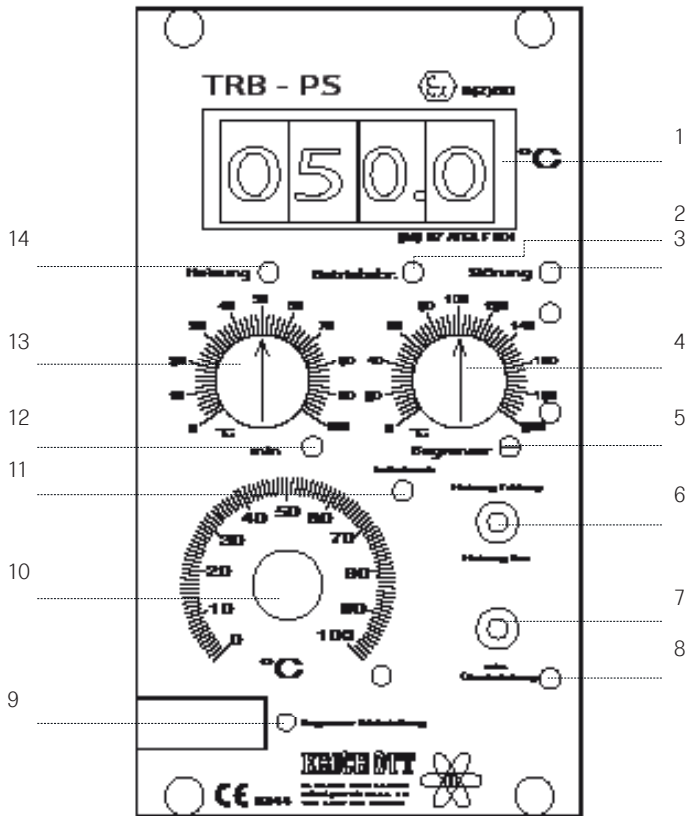
Power strip 2 (optionally)		
Safety extra-low voltage (SELV)		
PH1	z22	b22
PH2	z24	b24
PH3	z26	b26
External setpoint value 4-20 mA 5,5 V		
+	z32	
-	b32	

SIL 1 Safety integrity Level		
Parameters		
SFF	PFH	PFD
50.36%	7.88 . 10-7 1/h	1.73 . 10-2 1/h



4.0 FUNCTIONS ON THE FRONT PANEL

The various operating states are displayed by seven (without current monitoring six) LED's in different colours.



1	LED Display
2	Display operational readiness
3	Failure indication (generally)
4	Limit value adjuster limiter
5	Display limiter triggering
6	B1 combination switch heater check/ OFF
7	B2 switch Min. temperature bypass
7	Button setpoint value display (only TRB-PieS)
8	Display Min. temperature bypass
9	S1 unlock button limiter
10	Setpoint adjuster controller
11	Display wire break (optionally)
12	Display Min. temperature undershoot
13	Limit value adjuster Min. temperature
14	Display heating ON

4.1 FUNKTIONAL SIGNALLING ON THE FRONT PANEL

	Front panel text	LED	Signal meaning
2	Operational	green	Controller on voltage, no interference
14	Heating	yellow	Heating on, no interference
3+11	Wire break	red	Heat conductor disconnected
3+12	Min	red	Min.-temperature fallen below
8	Min. bypass	red	Min.-monitoring out of order
3	Interference	red	Temperature undershoot limiter circuit
			Measuring line end/break in the controller/limiter circuit
			Min. temperature undershoot
			Heat conductor interrupted (Undervoltage signal)
3+5	Limiter	red	Temperature underflow in the limiter circuit
			Measuring line end/ break in the limiter circuit
			Limiter relay not reseted

NOTE: Have all LED's gone out, either the voltage supply for the controller is interrupted or an internal defect in the controller exists.(fuse or other).

4.2 CONTACT SWITCHES ON THE FRONT PANEL

Push button B1

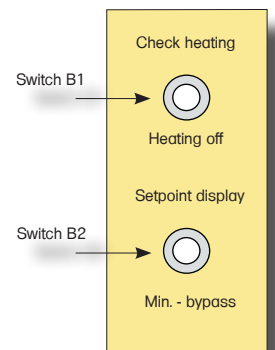
With the upper setting the heating is switched on manually for examination (power control). This has the advantage, that a calibrated setpoint value must not be changed for the heating examination. At the same time the LED's are checked with this setting. In the lower setting the heating is switched off and the Min. monitoring (undertemperature) is set out of order.

Push button B2

With the upper setting the actual value and the setpoint value can be changed on the TRB -PieS. The lower setting makes it possible to bridge the Min. monitoring individually, for example during the heat-up phase.

Limiter reset S1

The reset of the limiter relay K1 results by use of tools at the button placed behind the front panel. The limiter can thus be put into operation again after a triggering and after the elimination of the causal.

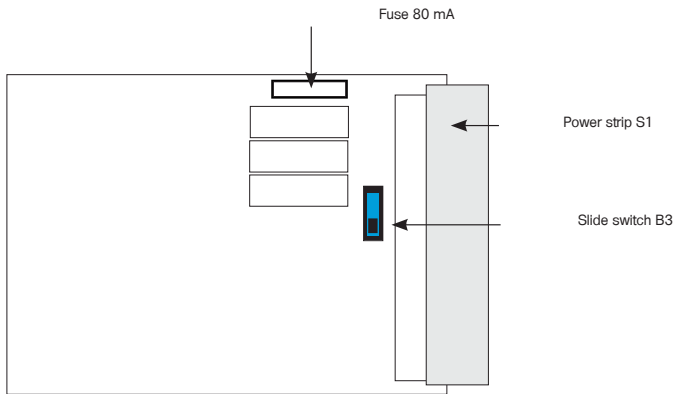


4.3 SLIDE SWITCH B3 ON THE CIRCUIT BOARD

With the slide switch on the circuit board (next to power strip) a make-contact of the central fault signal relay can be bridged. With this the interruption of a collective alarm loop when switching off individual heating circuits can possibly be avoided.

Representation of the switch settings (view from power strip):

To the left	The second make-contact of d3 is bridged
To the right	Make-contact open



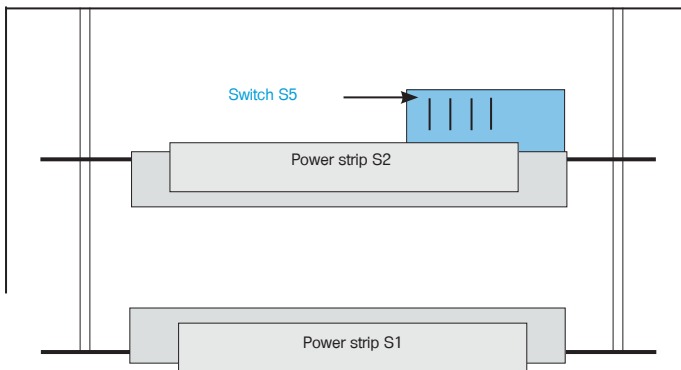
Euro-size board 19" motherboard

4.4 SWITCH S5 (for external setpoint value input)

With the switches S5.1 to S5.3 on the upper circuit board the individual phases of the setpoint value monitoring can be switched. With the switch S5.4 can be switched between external and internal setpoint control. With the button B2 (see chapter 4.2 Contact switches on the front panel) the setpoint can be switched to the display.

	Current monitoring			Setpoint value
	S 5.1	S 5.2	S 5.3	S.5.4
OFF	Phase 3 On	Phase 2 On	Phase 1 On	Internal
ON	Phase 3 Off	Phase 2 Off	Phase 1 Off	External

Screen shell



5.1 SERIAL NUMBER

With the continuous serial number the in-house quality management can determine month and year of production in case of repair. Each device is individually tested and a separate inspection sheet is made out. The serial number can be found on the back of the front panel, see chapter 12.0.

5.0 TYPE CODE

TRB - P

1	2	3	4	5	6	7

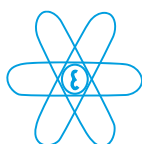
1	-	standard
	O	without display
2	-	standard
	i	current monitoring (not for SIL devices)
	ie	external setpoint value input and current monitoring
3	-	standard
	ax	intrinsically safe PT-100 input (see brochure TRB PaxS)
4	-	no safety temperature limiter or old appliance
	S	safety temperature limiter (SIL 1)
5	-	controller temperature range 0 - 100 °C (standard)
	2	controller temperature range 0 - 200 °C
	3	controller temperature range 0 - 300 °C
	4	controller temperature range 0 - 400 °C
6	-	limiter temperature range 0 - 200 °C (standard)
	3	limiter temperature range 0 - 300 °C
	4	limiter temperature range 0 - 400 °C
	5	limiter temperature range 0 - 500 °C
	-	standard
7	AG 14	14 TE for devices with display
	AG 12	12 TE for devices without display
	AG x	any desired width for 19" boards

Example:

Device without display, with external setpoint value input, without intrinsically safe Pt100- input, with safety temperature limiter, temperature range of the controller 0-200 °C, temperature range of the limiter 0-300 °C, standard cabinet size:

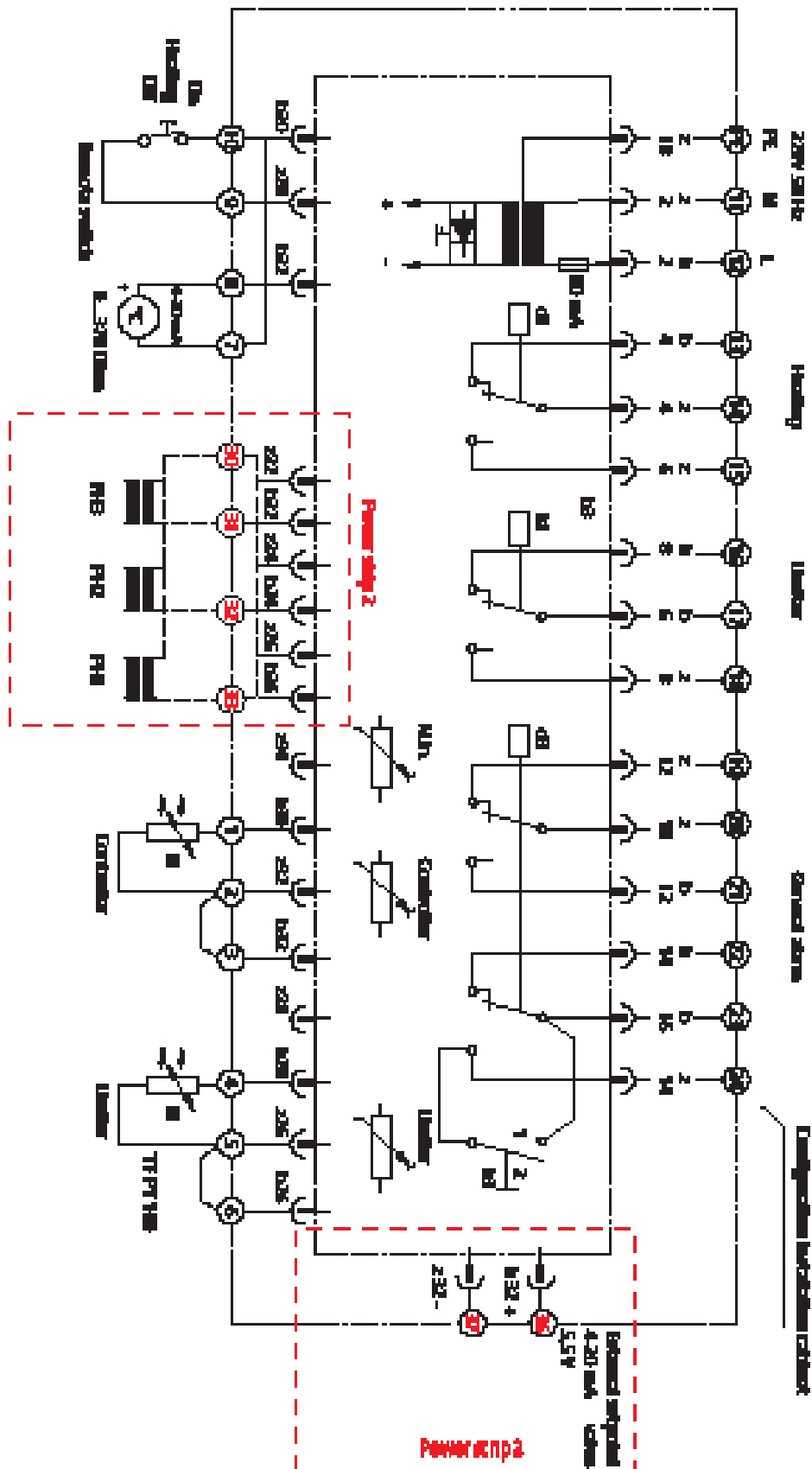
TRB - P

0	ie		S	2	3	
1	2	3	4	5	6	7



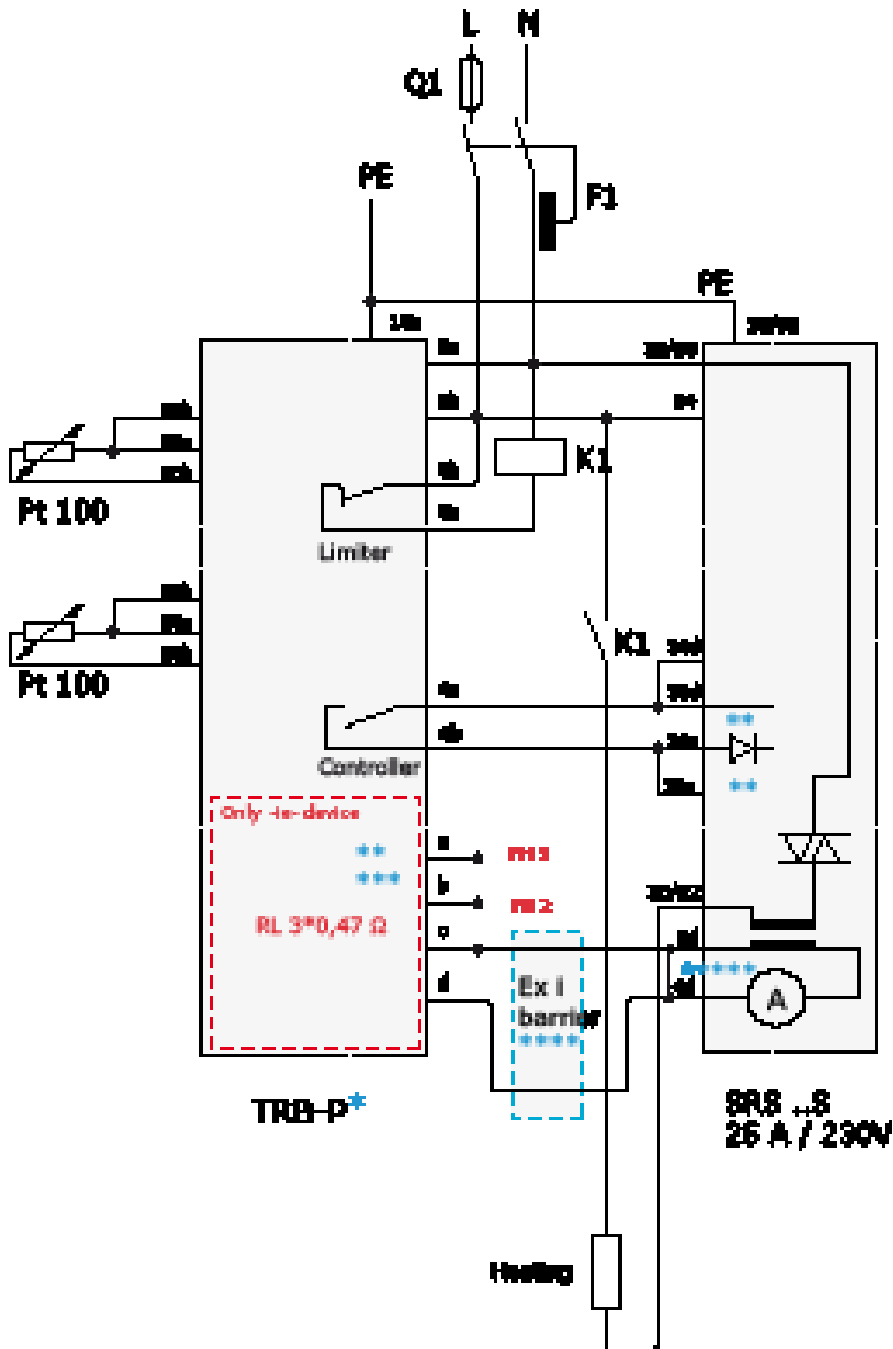
6.0 CIRCUIT DIAGRAM

Depending on the model the power strin 2 is in existence. The terminals on the cabinet are mounted according to the type of device. See price-list for scope of delivery.



7.0 SAMPLE OF APPLICATION

SRS... with
Contact cc



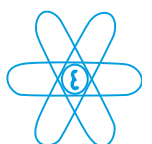
* for Ex- construction ...d instead of ...b

**

Pin assignment of the current transformer input				
	Power strip 2			Power strip 1
	STB (SIL) BVS 07 ATEX F001	STB (SIL) + [Ex ib] IIC ZELM 03 ATEX 0140	old appliances*** [Ex ib] IIC Zelm 03 ATEX 0140	not Ex***
a	22b	22d	8d	22z
b	24b	24d	10d	24z
c	26b	26d	12d	24b
d	22z, 24z, 26z	22z, 24z, 26z	8d, 10d, 12d	28z, 30z

*** bridge a-c for 1-phase-operation (only with TRB- P. VDE)

**** only for Ex i devices (TRB-P.ax..)



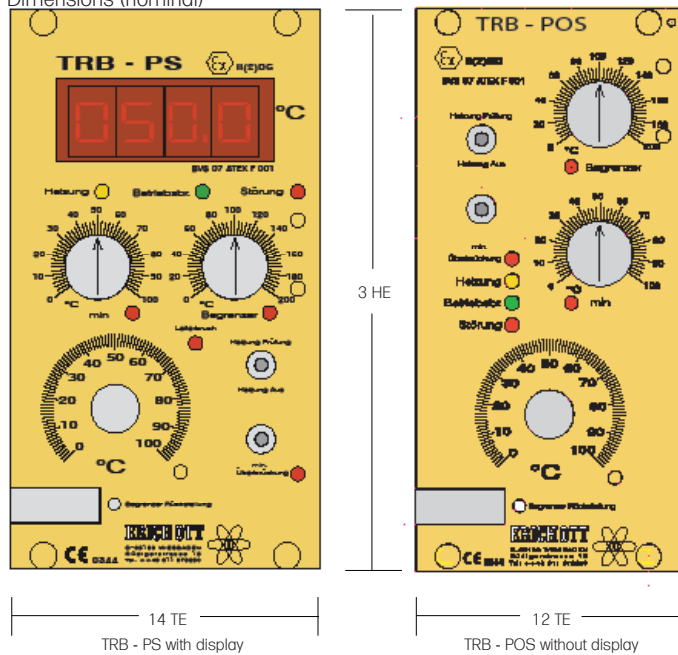
8.0 OVERVIEW OF ALL AVAILABLE DEVICES

	Availability	Type of ignition protection	Safety temperature limiter (SIL 1)	PT 100 3- wire with cable break/fault	Actual value output controller 4-20 mA	Ext. setpoint control controller 4-20 mA	Current monitoring 1/3 phase	Display	Configuration power strip 1	2. power strip	Configuration power strip 2
TRB- P	X	nicht Ex		X	X			X	b/z		
TRB - PO	X	nicht Ex		X	X				b/z		
TRB- P S	X	Ex II 2 GD	X	X	X			X	b/z		
TRB- PO S	X	Ex II 2 GD	X	X	X				b/z		
TRB - Pie S	X	Ex II 2 GD	X	X	X	X	X	X	b/z	X	b/z
TRB - POie S	X	Ex II 2 GD	X	X	X	X	X		b/z	X	b/z
TRB- P axS	X	Ex II 2 GD [Ex ib] IIC	X	X	X			X	d/z		
TRB- PO axS	X	Ex II 2 GD [Ex ib] IIC	X	X	X				d/z		
TRB- PieaxS	X	Ex II 2 GD [Ex ib] IIC	X	X	X	X	X	X	d/z	X	d/z
TRB-POieaxS	X	Ex II 2 GD [Ex ib] IIC	X	X	X	X	X		d/z	X	d/z
TRB-Pax	Substitute	EEx ib IIC		X	X			X	d/z		
TRB-POax	Substitute	EEx ib IIC		X	X				d/z		
TRB-Piax	Substitute	EEx ib IIC		X	X		X	X	d/z	X	d/z
TRB-POiax	Substitute	EEx ib IIC		X	X		X		d/z	X	d/z

**** only for TRB-P. devices without current monitoring

9.0 DIMENSIONS

Dimensions (nominal)



10.0 INSTALLATION

Installation site

The device shall be installed and used so that a secure function is not interrupted by electro-magnetic influences. Depending on the installation site it is advised to implement an adequate lightning protection concept. The categorization of at least LPZ 2 according to EN 62305-4 for the switchboard is recommended. The corresponding junctions of the protective zones must be ensured by according overvoltage protection systems.

Compensation circuits and interference suppressions

PE-conductors and N-conductors must be routed separately from the switchboard. If this connection is disconnected in the switchboard, the isolation value must be $\geq 0,5$ kV and checked.

Setpoint adjustments

Set the Min.-setpoint adjuster in accordance with the respective process. The Min.- setpoint adjusters should however be set with a value minimum 5 K below the setpoint temperature of the controller.

Limiter setting

To meet the requirements of the EN 60079-7 the limiter setting must be secured by use of the sealing screws at the limiter access cover, so that an adjustment during operation is not possible subsequently.

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