

# Operating Manual

## Pt 100 Thermostat TR 600 with interface RS 485

### Short Description

The Pt 100 thermostat TR 600 is a temperature controller and monitors up to six Pt 100 sensors at the same time. Six switching points and six relays permit almost any combination of switching action. It also can select the highest temperature of a group of three or six sensors. Temperatures and switching states of alarms/relays are available at the interface RS 485. Programming is very variable and simple.

### Application

Due to the fact that 6 type Pt 100 sensors can be connected, the unit is especially suitable for temperature monitoring wherever up to 6 different measuring points must be monitored simultaneously:

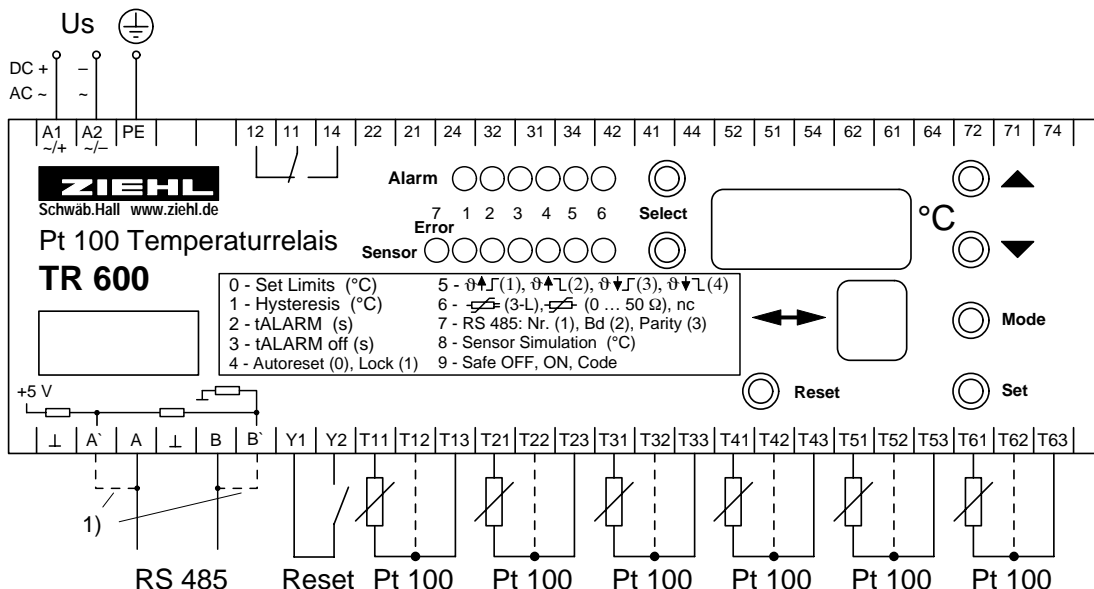
- motors and generators with simultaneous monitoring of bearings and coolant.
- transformers with additional monitoring of the core temperature also.
- power machines and plants

### Approval



USL, CNL Industrial Control Equipment 82VN

### Wiring scheme:



1) Bridge for terminating resistor

## Function overview

- Measuring and monitoring range -199 ... +800 °C
- 6 sensor inputs with 2- or 3-wire connection
- 7 relay outputs with change-over contact
  - Alarm 1 ... 6 relay K1 (11/12/14) ... K6 (61/62/64)
  - Sensor Error Relay K7 (71/72/74) monitors sensor break or sensor short circuit.
- RS 485 interface
- Universal power supplies. 2 ranges AC/DC 24-60V or AC/DC 90-240 V

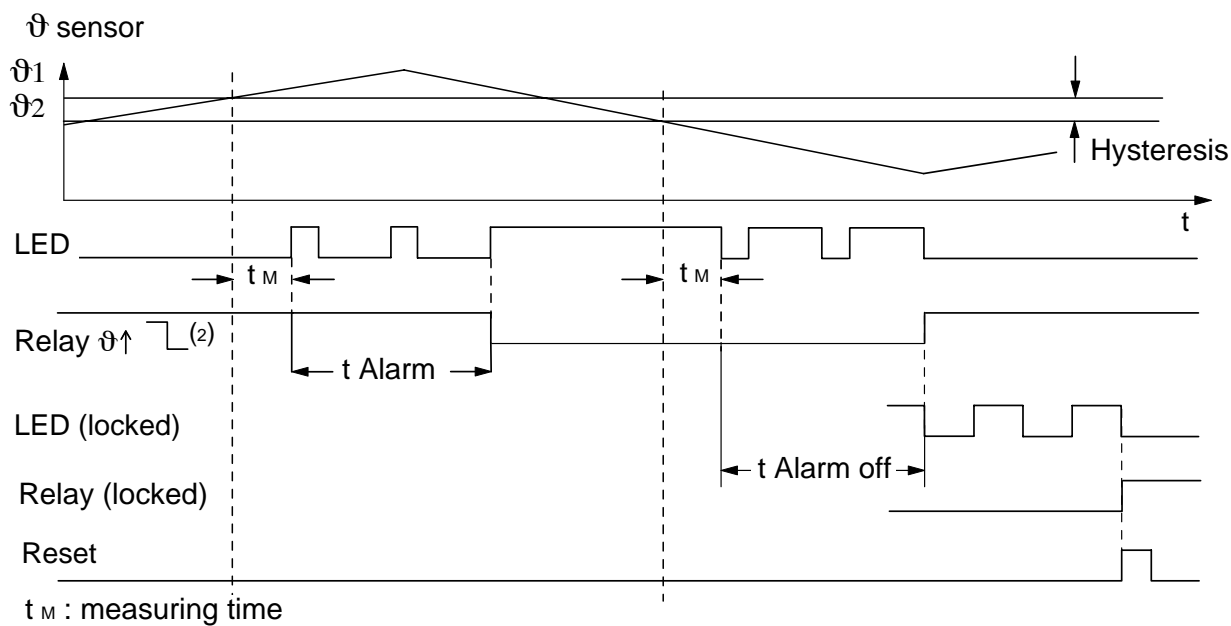
## Displays

- built-in 3 digit temperature display and 1 digit program-mode display
- LED Alarm showing state of the alarm relays
- LED Sensor Error blinking at sensor short circuit or sensor interruption.
- Stored Values of MIN- and MAX- temperature can be displayed
- "Sensor select" showing temperatures of the different sensors
- "Alarm select" showing switching points

## Attention:

Sensor-Inputs and Interface RS 485 are the same potential. Please regard.

## Function Diagram



## Table of function

Function	Key	Display
Sensor temperature	Sensor select 1 ...6	Measuring temperature of selected sensor
ϑ - MAX	Δ	Highest measured temperature
ϑ - MIN	∇	Lowest measured temperature
ϑ - MIN - MAX- Reset	Δ or ∇ + Reset	Measured temperature
Relay locked Reset	Reset	
Switching points	Alarm select 1 ...6	Adjusted limit and sensor or sensor group

## Set-up \*

Mode	Function	Alarm select (Alarm=Relay)	Sensor select	Display	SET	Factory Adjust
0	Switching Point (°C)	Relay 1...6	Sensor 1...6  group 1+2+3 group 4+5+6 group 1...6	-199°...800°C	Store	100 °C  Alarm 1 = Sensor 1  ...  Alarm 6 = Sensor 6
1	Hysteresis (K)	Relay 1...6	-	1 ...20 K	Store	3 K
2	t <sub>ALARM</sub> (s)	Relay 1...6	-	0,1 ... 20,0 s	Store	0,1 s
3	t <sub>ALARM off</sub> (s)	Relay 1...6	-	0 ... 999 s	Store	0 s
4	auto reset - locked	Relay 1...6	-	0 = auto reset 1 = locked	Store	0 = auto reset
5	Operating function Max-NO contact Max-NC contact Min-NO contact Min-NC contact	Relay 1...6 Sensor alarm (Relay K7)	-	1 = ϑ↑ ▭ 2 = ϑ↑ ▮ 3 = ϑ↓ ▭ 4 = ϑ↓ ▮	Store	2 = ϑ↑ ▮
6	Sensor connection 3-wire not connected 2-wire (Ω)	-	sensor 1...6	3-.L n.c. 0...50,6		3-.L
7	RS 485 interface	Address of unit (= 1) Baud rate (= 2) Parity bit (= 3)	- - -	0...99 4800,9600,19 200 N,O,E	Store Store Store	0 96 E
8	Sensor Simulation	-	sensor 1...6	-199°...800°C	-	
9	Code safe = off Code safe = on	-	-	500 (safe) 504 (free)	on/off/on	500

\* return within 30 s without any button pushed

## Remarks

- **LED's Alarm**

off: temperature below switching point  
on: temperature beyond switching point  
blinking 1x on 4x off: alarm-relay delay time  $t_{ALARM}$  is running  
blinking 4x on 1x off: alarm-relay delay time  $t_{ALARM}$  off is running  
blinking 1x on 1x off: relay locked, ready for reset  
Alarm-relay can be resetted with reset-push-button or external contact closed Y1, Y2.  
A closed contact or short-circuit at terminals Y1-Y2 means no auto reset function.

- **Operating Delay Time – Measuring Time  $t_M$**

The operating delay time of the relay depends on the number of connected sensors and the measuring function. With continuous change of temperature the measuring time  $t_M$  is about 1,5 s. With abrupt change of temperature the measuring time  $t_M$  is about 3 ... 4 s (for example by simulation of temperature changes in mode 8). With sensor short circuit or sensor interruption the measuring time  $t_M$  increases to 6...8 s.

- **Relay locked active (Mode 4 = "1")**

In this mode the relay can switch on when all the following parameters are fulfilled:  
- the temperature decreases below the switching back limit  
- the alarm relay delay-time  $t_{ALARM}$  off has overrun  
- a reset signal Y1,Y2 (reset push-button or external closed contact) is done or the mains (supply voltage) is switched off an on.  
In the ready for reset status the alarm-LED will be blinking 1x on 1x off.

- **2-wire technique line resistance compensation**

To compensate the line resistance short-circuit the wires nearby the sensor and measure the line resistance. Settings see mode 6.

We recommend using 2 or bettering 3 wires for each sensor. With 2-wire connection and a common line for all signals, all sensor-measuring currents will be added on the common line. Thus the value of the compensation line resistance  $R_K$  must be calculated as follows:

$R_K = (n+1) \times RL/2$  (RL = line resistance of two wires, n = number of sensors)

- **Sensor Simulation**

If no button is pushed within 15 minutes the relay automatically returns in the normal function mode.

## Installation - Putting into operation

**Attention! Do not plug in or remove terminals with device alive**

**When installing the device into a cabinet, please observe the max. admissible temperature. Care for both, sufficient clearance to other devices or sources of heat or enough forced draught.**

**Before switching on make sure that the operational voltage  $U_s$  of the type-plate and the mains voltage are the same.**

### **Mounting and connection:**

- mount on 35 mm mounting rail according to DIN 50 022
- wall-mount with 3 x screws M4 (option)
- connecting wires refer to the wiring diagram to prevent miss-operation and malfunction.
- apply mains voltage to terminals A1 and A2 (DC A1=+, A2=-, also connect PE)

### **ATTENTION!**

#### **Connecting temperature sensors Pt 100**

Temperature sensors must be connected to the plug-in terminals T11, T12, T13 etc. To ensure proper operation this plug-in terminals have gold-plated contacts. Do not use these plugs for other terminals.

#### **Universal power supply**

The TR 600 universal power supply works within the ranges AC/DC 24-60V or AC/DC 90-240 V. Before switching on make sure, that the operational voltage  $U_s$  of the type-plate and the mains voltage are the same.

## Trouble-shooting and remedies

- **LED Sensor Error**

The LED sensor error indicates a failure at a sensor and the sensor-LED blinks. The sensor alarm relay K7 has switched. Refer to operation mode 5. Also see analogue output.

- **Reset to factory adjust**

When pushing the buttons "Reset" and "Set" simultaneously > 5 s all programmed parameters will be set back to factory adjust. Code save must be off. If code save is on, see mode 9.

- **No parameter set-up possible - Code save on**

Code save protects the relay against not allowed manipulations. With code save on no programmed parameters can be changed. The factory code is 504 and cannot be changed by the user. See set-up mode 9.

- **Failure display "E 0", Sensor error relay K7 switching**

Operation failure. Switch off the supply voltage and restart. When the failure is still going on, the relay should be replaced and send to the factory.

- **Failure display "E 1" or "E 2", Sensor error relay K7 switching**

EEPROM parameter failure. Check all programmed parameters and set-up new when necessary. Switch off the supply voltage and restart again. When the failure is still going on, the relay should be replaced and send to the factory.

- **Sensor Alarm Relay K7**

Sensor alarm relay K7 with operating function 2 = NC-contact releases at any failure and signals an interruption of power-supply.

ATTENTION! . There is a short alarm-signal of K7 when switching-on the supply-voltage.

Sensor alarm relay K7 with operating function 1 = NO-contact picks up at any failure.

ATTENTION: There is no alarm-signal of K7 if interruption of power supply occurs.

See set-up mode 5.

In case of any other malfunctions, replace device and send it in together with a description of the occurred malfunction.

## Technical data

Rated supply voltage $U_s$ : Tolerance DC-supply Tolerance AC-supply	AC/DC 24 – 60 V (see lateral type plate) DC 20 - 81 V (0,85 x 24V...1,35 x 60V) AC 20 - 66 V (0,85 x 24V...1,1 x 60V)
Rated supply voltage $U_s$ : Tolerance DC-supply Tolerance AC-supply Power consumption Frequency	AC/DC 90 – 240 V (see lateral type plate) DC 81 - 297 V (0,9 x 90V...1,35 x 220V) AC 76 - 264 V (0,85 x 90V...1,1 x 240V) < 8 VA 0 / 50 / 60 Hz
Relay output: Switching voltage Switching current Switching power $\cos \varphi = 1$ max. 48 W at DC 24 V Derating factor $\cos \varphi = 0,7$ UL electrical ratings:	1 change-over (CO) contact max. AC 415 V max. 5 A max. 1250 VA (ohmic load)  0,5 3 A Resistive, 240 VAC C300/Q300
Rated operational current $I_e$ : AC15  DC13	$I_e = 1,5 \text{ A } U_e = 400 \text{ V}$ $I_e = 3 \text{ A } U_e = 250 \text{ V}$ $I_e = 2 \text{ A } U_e = 24 \text{ V}$ $I_e = 0,2 \text{ A } U_e = 125 \text{ V}$ $I_e = 0,1 \text{ A } U_e = 250 \text{ V}$
Recommended fuse for contacts Expected life mechanical Expected life electrical	T 3,15 A (gL) $3 \times 10^7$ operations $1 \times 10^6$ operations with AC 250 V / 5 A $2 \times 10^6$ operations with AC 250 V / 3 A $2 \times 10^7$ operations with AC 250 V / 1 A
Insulation: Test voltage between supply voltage $U_s$ , protected earth, relay contacts and against sensors/ RS485	VDE 0660 / VDE 0160 VDE 0110 / AC 415 V / I Gr.C 2000 V DC
Sensor connection : Measuring accuracy Sensor current 3-wire sensor 2-wire sensor Measuring delay time $t_M$	6 x Pt 100 acc. to DIN 43760 / IEC 751 $\pm 0,5 \%$ of value $\pm 1$ Digit $\leq 2 \text{ mA}$ Pt 100 + $R_L = \text{max. } 490 \Omega$ $R_L = 0 \dots 50,6 \Omega$ adjustable <1,5 s (normal operation, depends on number of connected sensors)
Switch points: Relay operating function	6 , digital adjustable standard = closed circuit current principle (NC) option = operating current (NO)

### Temperature alarm:

Temperature range $\vartheta_1 \dots \vartheta_6$	-199 ... +800 °C
Hysteresis	1 ... 20 K
(Release) delay time $t_{ALARM}$	0,1 ... 99,9 s
(Pick-up) delay time $t_{ALARM\ off}$	0 ... 999 s

### Max. Ambient Temperature:

Operating Temperature	-20 °C to +65 °C
UL 508 Ambient Temperature	-20 °C to +55 °C
Storage Temperature	-20 °C to +70 °C
	no condensation permitted

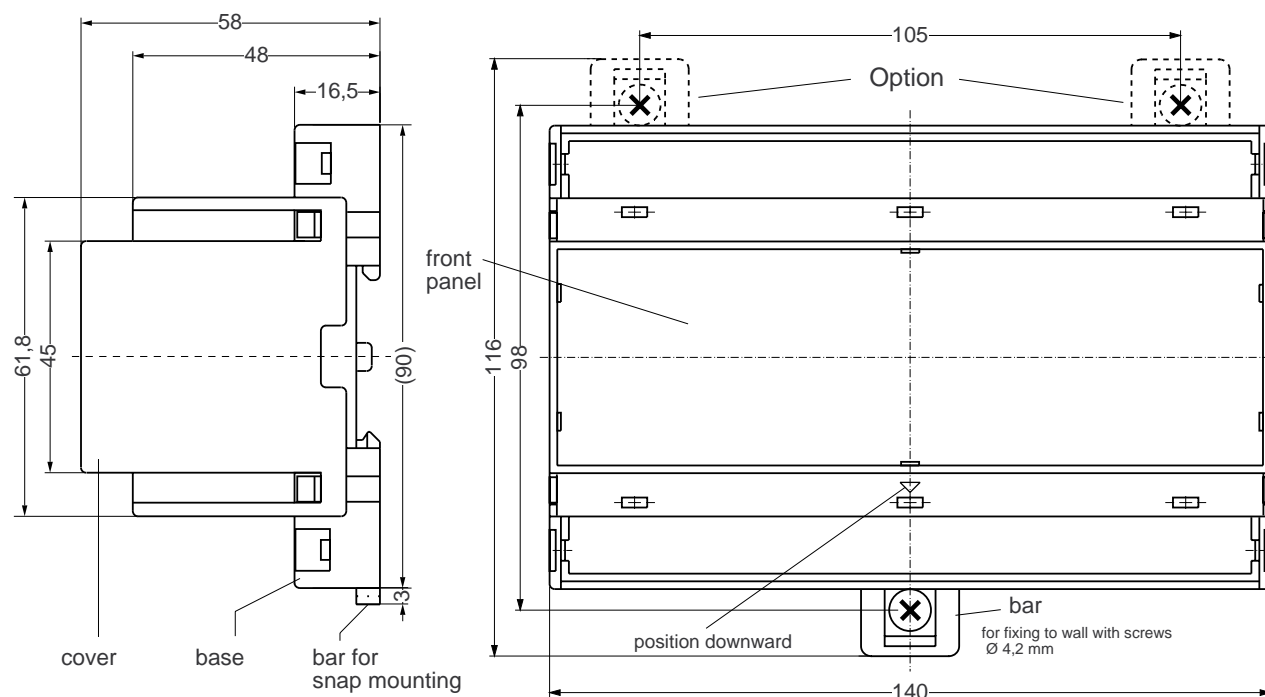
### RS 485 interface:

Address of unit	0. 99
Baud rate	4800, 9600, 19200 Baud
Parity	N, O, E (no, uneven, even)

### Housing:

Dimensions (H x W x D)	Type V8 140 x 90 x 58 mm
Line connection solid wire	each 1 x 1,5 mm <sup>2</sup>
Stranded wire with insulated ferrules	each 1 x 1,0 mm <sup>2</sup>
Torque	0,5 Nm (3,6 lb.in)
Protection class housing	IP 31
Protection class terminals	IP 20
Fitting position	any
Mounting	Snap mounting on 35 mm standard rail DIN EN 50022 or M4 screws
Weight	app. 350 gr.

### Design V8 Dimensions in mm





## Data structure for serial transmission of data with interface RS 485

Transmission format:	ASCII	
Baud rate:	9600 (default)	4800, 9600, 19200
Data:	8 bit	
Stop bit:	1	
Parity:	even (default)	even, odd, no

### 1. Master requests data from TR 600

Master sends <start><address of unit><read-command><mode><BCC><CR><LF>:

Start-of message	s (ASCII)	
	S (ASCII)	
	STX (0x2)	1 Byte
Address of unit	01 .. 99 (ASCII)	2 Byte
Read-command	r (ASCII)	
	R (ASCII)	1 Byte
Data Mode	0 .. 9 (ASCII)	1 Byte
Block check	exor of all transmitted bytes	3 Byte
Carriage Return	CR (0xd)	1 Byte
Line Feed	LF (0xa)	1 Byte

**10 Byte**

### 2. TR 600 sends the requested data

TR sends <start><type of unit><address of unit><mode><data><BCC><CR><LF>:

Start of message	s (ASCII)	(Start-sign same as start sign at data request)
	S (ASCII)	
	STX (0x2)	1 Byte
Data:		
Type of unit	TR600 (ASCII)	5 Byte (+ separated by ",")
Address of unit	00 .. 99 (ASCII)	2 Byte (+ separated by ",")
Mode of data	0 .. 9 (ASCII)	1 Byte (+ separated by ",")
Temperature sensor 1	-199 .. +800 (ASCII)	* 1 4 Byte (+ separated by ",")
Temperature sensor 2	-199 .. +800 (ASCII)	* 1 4 Byte (+ separated by ",")
Temperature sensor 3	-199 .. +800 (ASCII)	* 1 4 Byte (+ separated by ",")
Temperature sensor 4	-199 .. +800 (ASCII)	* 1 4 Byte (+ separated by ",")
Temperature sensor 5	-199 .. +800 (ASCII)	* 1 4 Byte (+ separated by ",")
Temperature sensor 6	-199 .. +800 (ASCII)	* 1 4 Byte (+ separated by ",")
Alarm 1	0 .. 1 (ASCII)	1 Byte (+ separated by ",")
Alarm 2	0 .. 1 (ASCII)	1 Byte (+ separated by ",")
Alarm 3	0 .. 1 (ASCII)	1 Byte (+ separated by ",")
Alarm 4	0 .. 1 (ASCII)	1 Byte (+ separated by ",")
Alarm 5	0 .. 1 (ASCII)	1 Byte (+ separated by ",")
Alarm 6	0 .. 1 (ASCII)	1 Byte (+ separated by ",")
Alarm 7	0 .. 1 (ASCII)	1 Byte (+ separated by ",")
Internal error	00 .. 99 (ASCII)	2 Byte (+ separated by ",")
Block check	exor of all transmitted bytes	3 Byte
Carriage Return	CR (0xd)	1 Byte
Line Feed	LF (0xa)	1 Byte

**64 Byte**

With default-address of unit "0", the TR 600 transmits a complete set of data every 3s (start-sign <STX>).

\* 1 Sensor not connected, data "+980"

Sensor short circuit, data "-999"

Sensor interruption, data "+999"

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Z.Nr. : 1120 0752.2

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Type : TR 600

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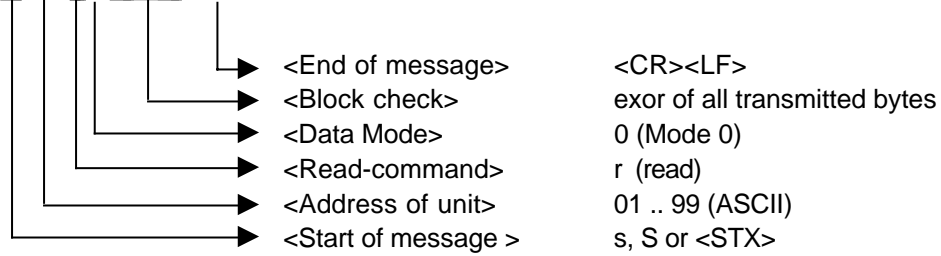
Subject to technical modifications

EA -Nr. : 1116.2

**Example:**

Data requested from TR 600

**s01r0048\r\n**



Block sum: s (115) exor 0 (48) exor 1 (49) exor r (114) exor 0 (48) **= 048**

The values in brackets correspond with the ASCII-code of the sign.

TR 600 answers

**sTR600;01;0;+154;-055;+268;+999;+980;-999;1;0;0;1;0;0;1;02;119\r\n**

