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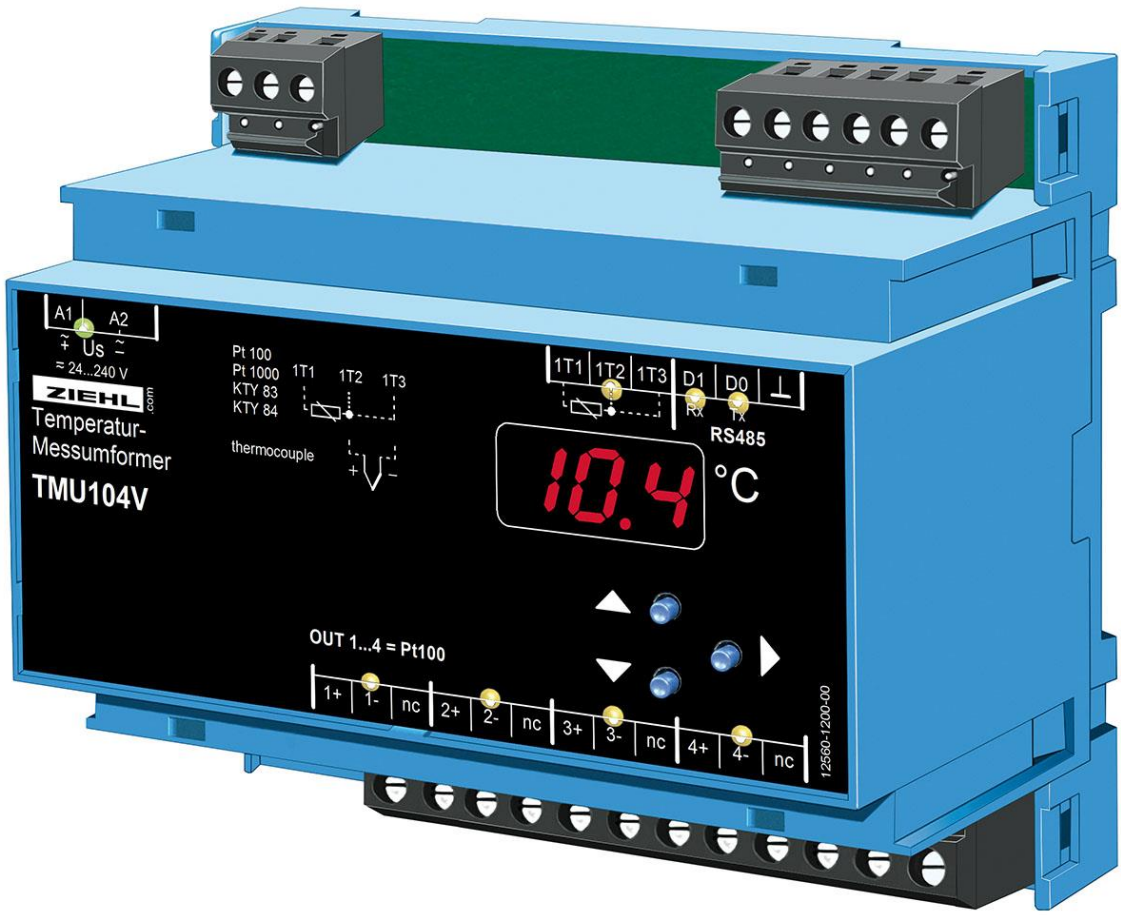
Operating Manual TMU104V

updated: 2018-11-09 / sm

- Measuring point multiplicator / Measuring-Transducer /
1 input for temperature sensors, 4 outputs Pt100

- Fourfold Pt100 simulator



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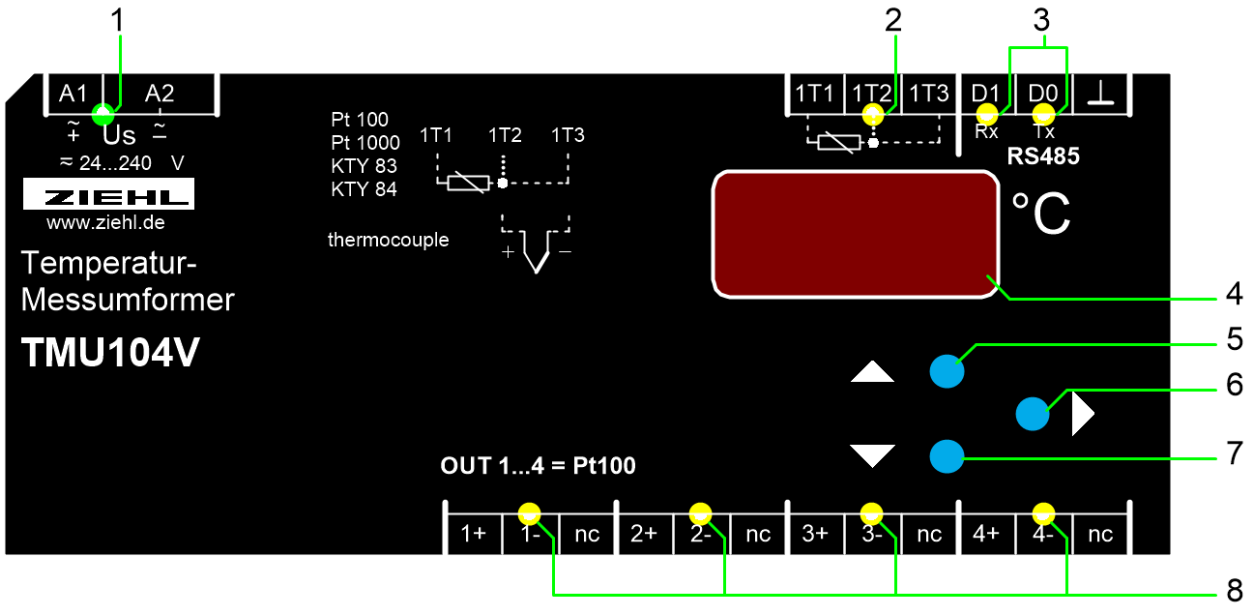
1 Display and controls



1 LED Us

- on = normal operation
- off = device not ready

2 LED Sensor input

- on = displays temperature of sensor in the digital display
- blinks = Sensor error (error code in the digital display)

3 LEDs RS485 interface

- Rx flashes briefly = Unit is receiving data via the RS485 interface
- Tx flashes briefly = Unit is transmitting data via the RS485 interface

4 Digital display (3 digits)

- Display of sensor value (°C), error codes
- Display of menu and configuration mode

5 Button Up ▲

- Press short = selection of menu item; Change into display mode (see 8.3)
- Press long (≥ 2s) = displays the max. sensor value
  Reset: press button Set ≥ 2s additionally

6 Button Set ▶

Press long (≥ 10 s) = displays the firmware version
When simulating via interface:

- Switch over to next output Pt 100 -> simulated value in (LED OUTx on)

7 Button Down ▼

- Press short = selection of menu item; Change into display mode (see 8.3)
- Press long (≥ 2s) = displays the min. sensor value
  Reset: press button Set 2s additionally

8 OUT1 … OUT4

When simulating via interface:

- Simulated value at OUTx is displayed (switch over to next with Set)

2 Factory setting

Menu item	Parameter	Factory setting value	User Data
In	In.	100	
	LA.	3-L	
BUS	bUS.	Mod	
	Adr.	1	
	bd.	9.6	
	PAr.	Evn	
	StP. *1)	1	
Code	Cod.	oFF	
	Pin.	504	
Int	Int *2)	-4.0	
Tri	tri *3)	20	
Trd	trd *3)	5	

1) from Firmware -02 *2) from Firmware -03* *3) from Firmware -04*

2.1 Factory reset

Press key Set and keep it pressed while switching on supply voltage.

⇒ After app. 2s display changes to 888 - Cod - oFF - 888

⇒ after app. 10s display ---

Device has been reset to factory settings. Release key Set.

3 Application and short description

The measuring point multiplicator TMU104V measures the temperature at a connected sensor and transduces it into 4 insulated signals Pt100 (RTD).
Via interface RS485 it can be used as a simulator for up to 4 signals Pt100.

Measuring Point Multiplicator and Transducer:
The temperature of the sensor (resistance or thermocouple), connected to the input, is available as signal Pt100 (RTD) at 4 insulated outputs.
Thus allows the connection of other sensors than Pt100 to inputs for Pt100 at other devices.
Normally only one input can be connected to a temperature sensor. With help of TMU104 up to 4 devices (controls, displays, monitoring devices) with inputs Pt100 can be connected to one sensor at the same time.

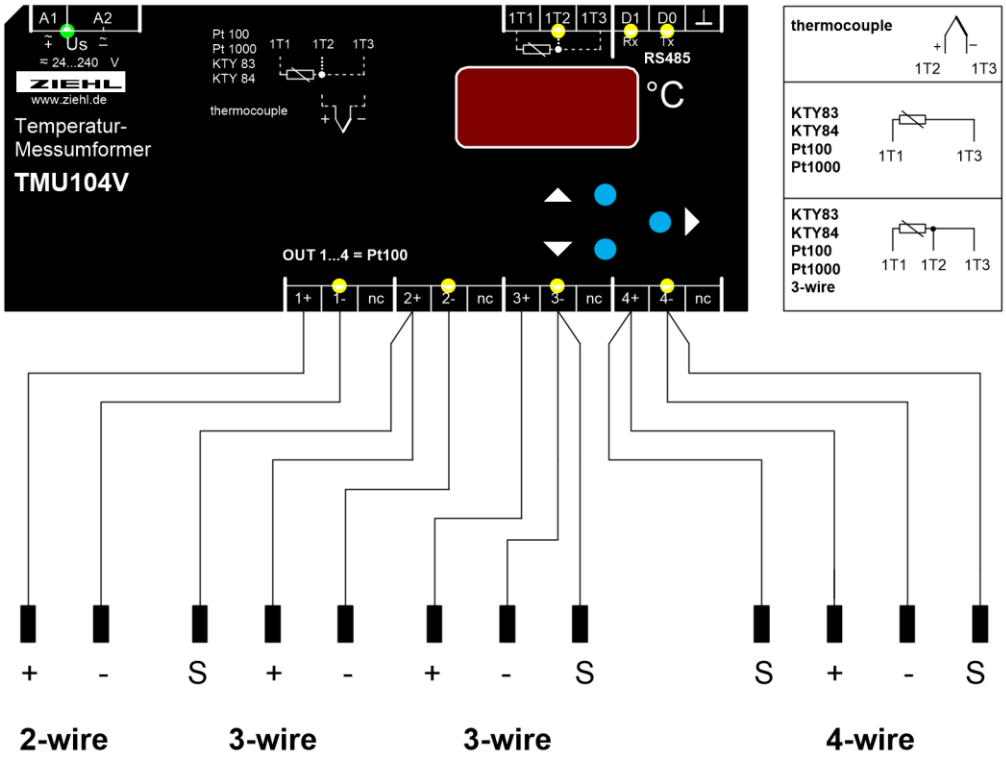
Simulator for Pt100:
Controlled via interface RS485 (protocol Modbus RTU) the TMU1004V can simulate up to 4 sensors Pt 00 (RTD). This allows the application in equipment, that makes automatic tests and calibrations at devices and installations with several inputs Pt100.

4 Overview of functions

- Measuring input Pt100 (RTD), Pt1000, KTY83 / 84 in 2- or 3-wire
- Measuring input thermocouple (types B, E, J, K, L, N, R, S, T)
- Measuring range -199…+850 °C
- 4 insulated outputs signal Pt 100 (resistance- signal), connection in 2-, 3- or 4-wire
- Digital display, 3 digits, resolution 1 °C (-19.9 … 99.9 °C: resolution 0,1 °C)
- Storing of MIN- and MAX- values
- Universal supply voltage AC/DC 24-240 V
- Interface RS485 (protocols ZIEHL and Modbus RTU)
- Housing for DIN-rail or wall-mount, 105 mm wide, mounting height 55 mm

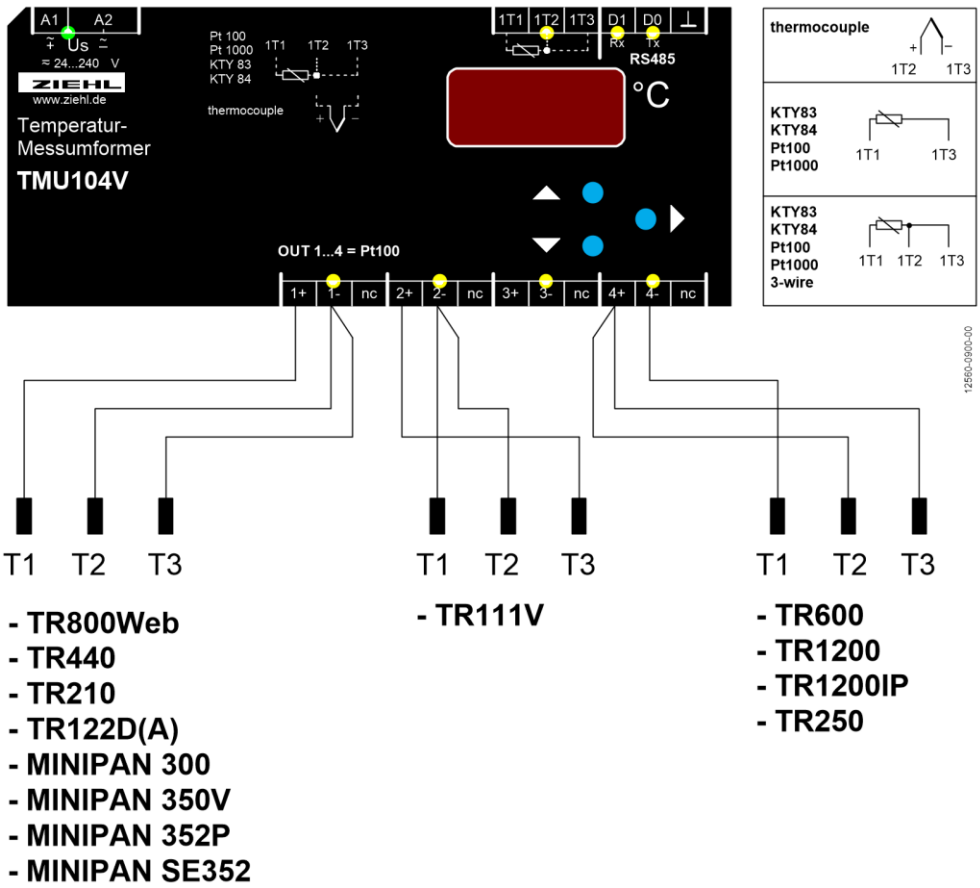
5 Connecting diagram

5.1 Outputs

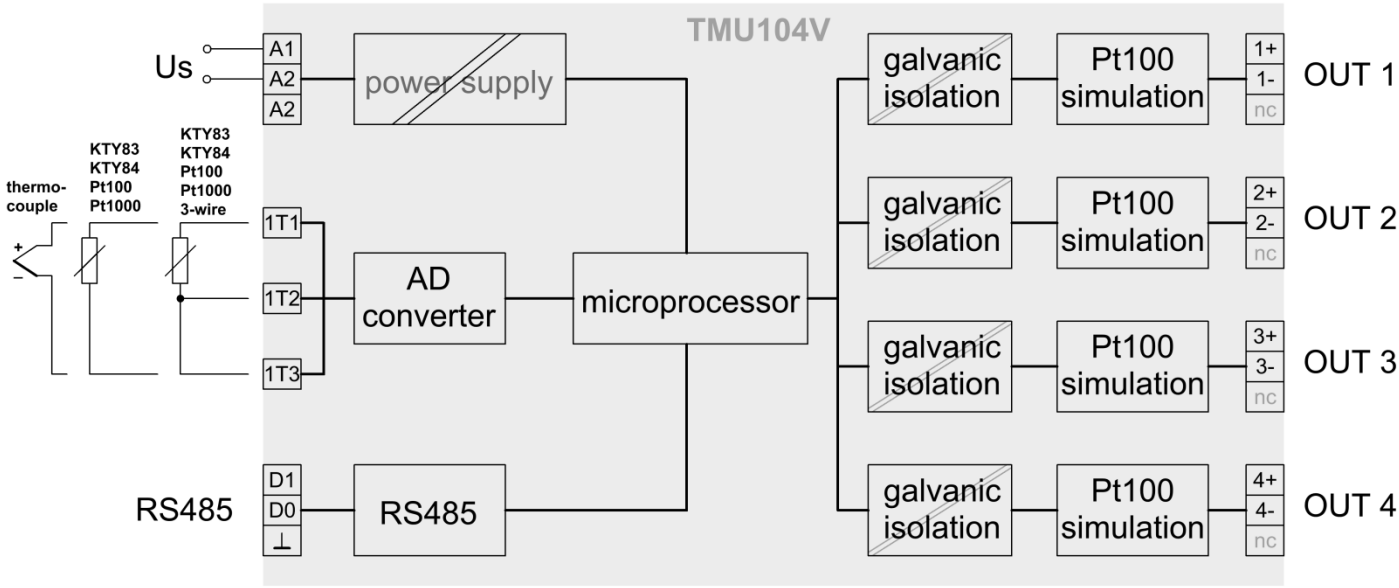


S = Sense-wire

5.2 Connection of ZIEHL equipment



6 Block diagram



7 Important notes

DANGER!
Hazardous voltage!
Will cause death or serious injury. Turn off and lock out all power supplying this device before working on this device.

To use the equipment flawless and safe, transport and store properly, install and start professionally and operate as directed.
Only let persons work with the equipment who are familiar with installation, start and use and who have appropriate qualification corresponding to their function. They must observe the contents of the instructions manual, the information which are written on the equipment and the relevant security instructions for the setting up and the use of electrical units.

The equipment are built according to DIN / EN and checked and leave the plant according to security in perfect condition. If, in any case the information in the instructions manual is not sufficient, please contact our company or the responsible representative.
Instead of the industrial norms and regulations written in this instructions manual valid for Europe, you must observe out of their geographical scope the valid and relevant regulations of the corresponding country.

Universal power supply.
The device universal power supply works within the range AC/DC 24-240 V.
Before switching on make sure, that the rated supply voltage Us of the type- plate and the mains voltage are the same.

A circuit-breaker or switch must be situated within easy reach of the unit and fused. Installation excess current protection should be ≤ 10 A.

8 Installation

The unit can be installed as follows:

- Installation in switchgear cabinet on 35 mm mounting rail according to EN 60715 for protection against fire, external environmental conditions and mechanical effects.
- With screws M4 for installation on walls or panel. (additional latch is not included in delivery)
- Connection according to connection plan or type plate.

Failure to comply with the information in this instruction manual will not guarantee the function of the device.

9 Putting into operation

9.1 General instructions for operation

The decimal point of the last digit shows the operating mode the device is in.

9.2 Display mode

- Decimal point off (display value of measuring input)

9.3 Menu mode

- Decimal point on
- menu mode, select the menu items

Button Up / Down	Press short:	Selection of menu item; Change into display mode
Button Set	Press short:	Change into parameter setting mode

9.4 Parameter setting mode

- Decimal point blinking

Button Up / Down	Press short/long:	Adjustment of parameter value (slow/fast)
Button Set	Press short:	Storage of setting and choice of next parameter. Change into menu mode after the last parameter

9.5 Tips for operation

- When the right decimal point in the 7 segment display is on, the display mode has been left, and the menu items can be chosen with up/down (menu mode).
- When the right decimal point blinks, you are in the parameter setting mode and can change the setting with up/down.
- In Parameter setting mode:
  - Long pressing on up/down speeds up the changes in the display.
  - Pressing button up and down at the same time sets values to zero.
- With reset (press set/reset for 2s) the display mode can be reached from every position (exception: simulation) of the parameter setting mode (the last selected value in is being stored).
  The same happens when 30s no key has been pressed ((exception: simulation -> 15 minutes).

9.6 Switch on device

Switch on supply voltage,

⇒ All LEDs and displays are on. TMU104V is ready after app. 1 s.

9.7 Configure the sensor input

Starting from the display mode:

⇒ Return into the display mode by pressing Set key ≥ 2s

⇒ If no entry is made for 30 s, the device also returns to the display mode.

	• Press Down key
	⇒ Display In .
	• Press Set key
	• Set sensor type using the Up / Down key 100. … tht.
	• Press Set key
	• Set line resistance with keys Up / Down (Pt100, Pt1000, KTY83, KTY84 only) 3-L. => 3-wire sensor 0.0. … 99.9. => 2-wire sensor, set value of resistance from device to sensor and back
	• Press Set key
	⇒ Exit the menu item
	• Move to the previous/next menu item with the Up and Down keys

9.8 Configure the RS485 interface

The following parameters are significant:

Protocol	bUS.	Mod. Modbus-Protocol 485. RS485 Protocol
Device address	Adr.	Device address, - can be set from 1 to 247 (Modbus-Protocol) - can be set from 0 to 99 (Ziehl RS485 Protocol)
Baud rate	bd.	Baud rate 4800 4.8. , 9600 9.6. or 19200 19.2.
Parity	PAr.	Parity bit: Evn. , odd. , no. (even, odd, none)
Stop	StP.	Stop bit: 1. / 2. (1 / 2) *(-> from Firmware -02)*

Adjustment process:
Select the menu item with the Up/Down key until …

⇒ Display bUS.
• Press Set key
• Set the desired protocol using the Up and Down keys ⇒ Mod. / 485.
• Press Set key
⇒ Display Adr. / 1. (address / value) flash alternately
• Set the desired address using the Up and Down keys
• Press Set key
⇒ Display bd. / 9.6. (baud rate / value) flash alternately
• Set the desired baud rate using the Up and Down keys
• Press Set key
⇒ Display PAr. / Evn. (parity / value) flash alternately
• Set the desired value with the Up and Down keys
• Press Set key *(-> from Firmware -02)*
⇒ Display StP. / 1. (stop bit / value) flash alternately
• Set the desired value with the Up and Down keys
• Press Set key
⇒ Exit the menu item
• Move to the previous/next menu item with the Up and Down keys

For more information on the Modbus configuration and programming please go to www.ziehl.de.

9.9 Sensor simulation

Simulation of temperatures at the outputs OUT1 … OUT4, individually or all at same time
After 15 minutes without pressing a key, the device automatically switches back to the display mode.
Select the menu item with the Up/Down key until …

	⇒ Display SI .
	• Press Set key
	• Set the desired output (OUT1 … OUT4) with the Up and Down keys o-1. / o-2. / o-3. or o-4. (ALL. for all outputs together, from Firmware version -02)
	• Press Set key
	• Set the desired temperature using the Up and Down keys
	• Press Set key
	⇒ Exit the menu item
	• Move to the previous/next menu item with the Up and Down keys

9.10 Code lock

Here, the set parameters can be protected by activating a code block. The device acknowledges an incorrect entry with Err (flashes three times).
Select the menu item with the Up/Down key until …

	⇒ Display Cod.
	• Press Set key
	⇒ Display Pin. / 0. (pin / pin code) flash alternately
	• Use the Up and Down keys to set the saved pin code **(factory setting is 504.)**
	• Press Set key
	• Set the desired code lock using the Up and Down keys: ○ oFF. off, all parameters can be changed ○ on . on, no parameter can be changed
	• Press Set key
	⇒ Display Pin. / 504. (pin / pin code) flash alternately
	• Set new pin code with the Up and Down keys if desired (caution: write down the pin code)
	• Press Set key
	⇒ Code lock on, Display on flashes three times ⇒ Code lock off, Display oFF flashes three times
	⇒ Exit the menu item
	• Move to the previous/next menu item with the Up and Down keys

9.11 Info menu

Read-out of data on the device.
Select the menu item with the Up/Down key until …

	⇒ Display `InF.`
	• Press Set key
	⇒ Display the Firmware version of device, `Fnr.` / `-00.` (Firmware / Version) flash alternately
	• Press Set key
	⇒ Display the serial number of device, `Snr.` / `123.` (serial number in passing through figures)
	• Press Set key
	⇒ Display the operating hours of device `h .` / `123.` (operating hours in passing through figures)
	• Press Set key
	⇒ Display the error memory of device, `Err.` / `-.` (no errors saved) `Err.` / `1.23.` (1 digit = number of error, 2 + 3 digit = count of errors)
	Delete error memory?
	Yes: Press Down key until display `dEL.` / `YES.` ⇒ Press Set key -> `YES.` flashes -> deleted error memory **No:** Press Set key
	• Move to the previous/next menu item with the Up and Down keys

9.12 Possible indications in display

In display mode:

EEE	-EE		Over range / under range
Er1	Er2		Short-circuit / Interruption in 1T1/1T2/1T3
Er3	Er4		Internal device fault

In Menu mode / parameter setting mode:

In.			**Sensor input**
	100		Pt100
	1.0		Pt1000
	83		KTY83
	84		KTY84
		LA	Line resistance
		3-L	3 wire
		0 ... 99.9	2 wire, specify the total line resistance 0 … 99,9Ω
	thb		Type B thermocouple
	thE		Type E thermocouple
	thJ		Type J thermocouple
	thK		Type K thermocouple
	thL		Type L thermocouple
	thn		Type N thermocouple
	thr		Type R thermocouple
	thS		Type S thermocouple
	tht		Type T thermocouple

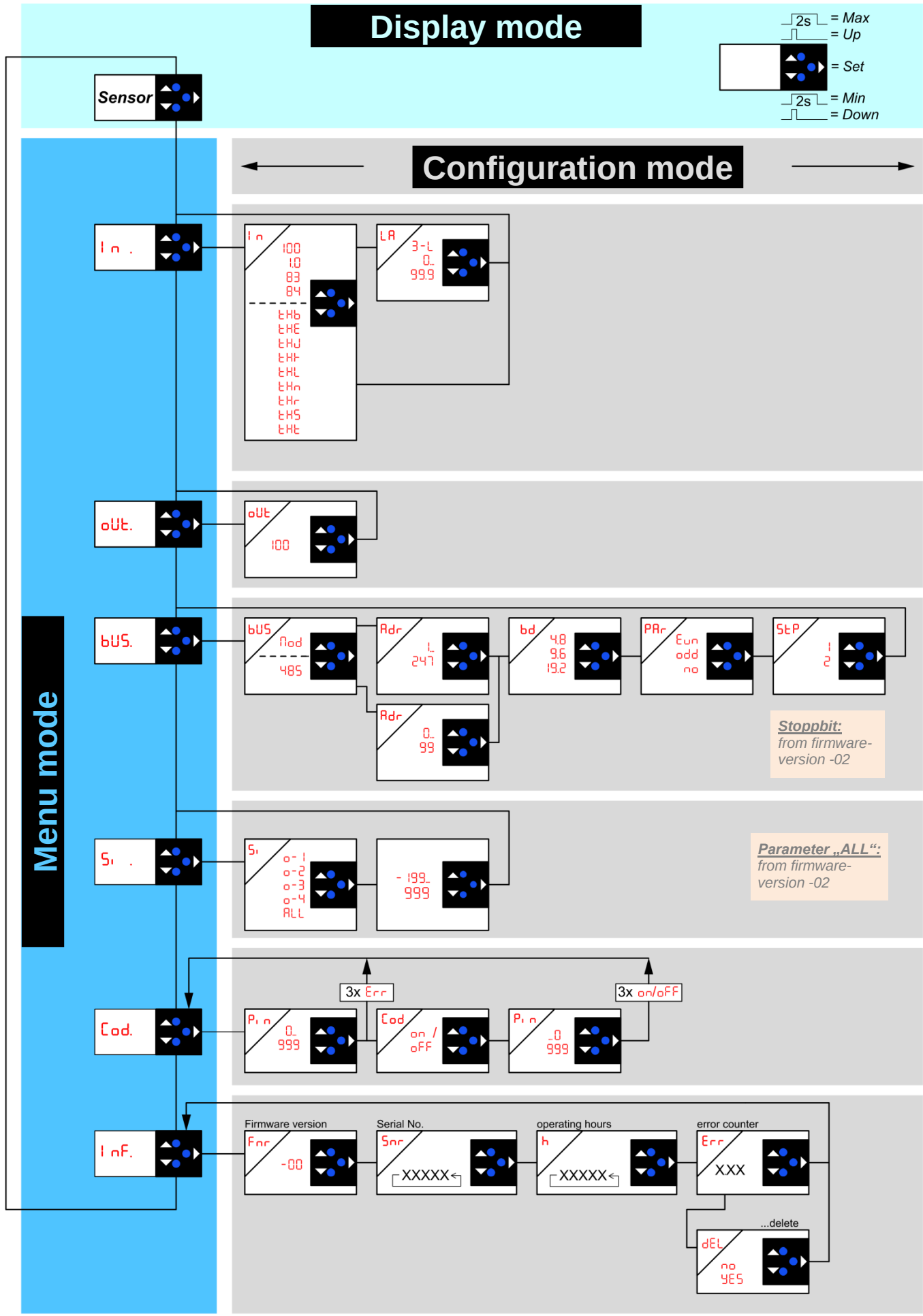
oUt.			**sensor output**
	100		Pt100

bUS.			**RS485 interface**
	Mod		Modbus protocol
	485		Ziehl RS485 protocol
		Adr	Device address ->
		1 ... 247	-> Modbus: 1 … 247
		0 ... 99	-> Ziehl RS485 protocol: 0 … 99
	bd		Baud rate ->
		4.8	-> 4800 bd
		9.6	-> 9600 bd
		19.2	-> 19200 bd
	PAr		Parity ->
		Evn	-> Even
		odd	-> odd
		no	-> no
	StP		Stop bit ->
		1 / 2	-> 1 / 2 Stop bits *(from Firmware Version -02)*

Si.			**Simulation sensor output**
	o-1 ... o-4		Out 1 … Out 4 (o-1 … o-4)
	ALL		All together *(from Firmware Version -02)*

Cod.			**Code lock**
	Pin		Code pin

Inf.			**Info about device**
	Fnr		Firmware version
	Snr		Serial number
	h		Operating hours
	Err		Saved errors
		dEL	-> delete


Display mode
2s = Max
= Up
= Set
2s = Min
= Down
Sensor
Configuration mode
Menu mode
In .
oUt.
bUS.
Si .
Cod.
Inf.
Stoppbit:
from firmware-version -02
Parameter „ALL“:
from firmware-version -02
3x Err
3x on/oFF
Firmware version
Serial No.
operating hours
error counter
...delete

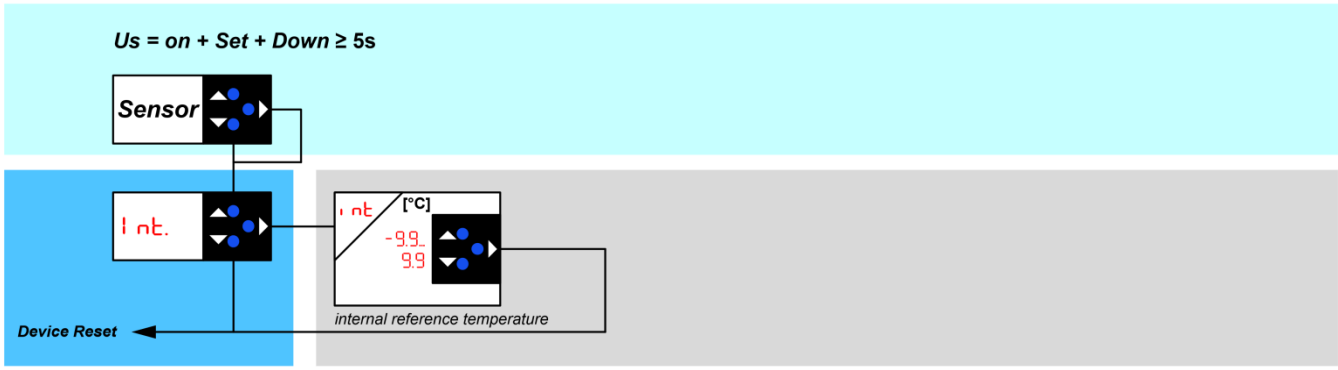
Additional function from firmware version -03:

Connection from thermocouples:

- Parameter to correct the internal reference temperature of thermocouples

Checking and setting of parameters:

- switch off control voltage supply
- press and keep pressed the Down (▼) and the Set (►) key
- switch on control voltage supply
- wait at least 5s until tri appears in the display



Additional function from firmware version -04:

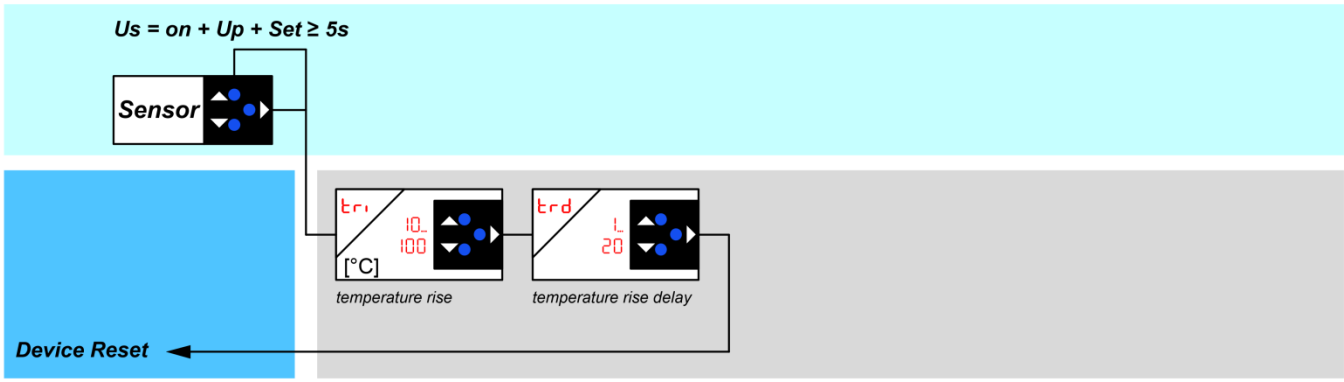
Hiding of interference and short temperature rises.

Parameters:

- temperature rise (tri): the height of the temperature rise, who delay evaluation
- temperature rise delay (trd): number of measurements after the measured value is accept

Checking and setting of parameters:

- switch off control voltage supply
- press and keep pressed the Up (▲) and the Set (►) key
- switch on control voltage supply
- wait at least 5s until tri appears in the display



Display the firmware version:	**Info Menü**

11 Error search and measures

Er 1 or Er2 appears in the display	
Cause	Sensor short-circuit or sensor interruption in the temperature sensor
Remedy	Check temperature sensor to see if electrically okay and correctly connected

Er3 or Er4 appears in the display	
Cause	Internal device fault
Remedy	Switch device off and then back on. If the error continues to appear, send the device to the factory for inspection

Er8 or Er9 appears in the error memory (info menu)	
Cause	Communication error in RS485
Remedy	Normally no problem, if number of errors increases (while communicating via RS485) within a short time -> review parameters of interface and connection cables.

The device cannot be programmed (configured)	
Cause	Code lock
Remedy	The code block provides protection against unauthorized manipulation on the device. When the code block is active, the parameters cannot be changed. The pin can be set by the user. <u>Pin code unknown? -> perform a code reset::</u> • While switching on the control voltage, keep the "Set" key pressed for 2 s ⇒ The display changes 888 - Cod - oFF - 888 . • Release the Set key • Code block is switched off, Pin code is back to default setting 504

Displayed temperature does not match the sensor temperature	
Cause	• temperature sensor is incorrectly connected • False sensor settings
Remedy	• Check the Pt 100 sensor connection (see connection diagram) • Check the sensor settings (3-wire or 2-wire with specification of the line resistance –> Resistance of outgoing and return line)

12 Technical data

Rated supply voltage Us:	AC/DC 24 – 240 V	0/50/60 Hz
Tolerance	DC 20,4 - 297 V	AC 20 - 264 V
Power consumption	< 2,5 W	< 7 VA

Sensor input 1T1/1T2/1T3

Pt100, Pt1000 according to EN 60751:

Sensor	Measuring range [°C]		Short circuit [Ω]	Break [Ω]	Sensor resistance + line resistance [Ω]
	min.	max.	<	>	max.
Pt100	-199	860	15	400	500
Pt1000	-199	860	150	4000	4100
KTY83	-55	175	150	4000	4100
KTY84	-40	150	150	4000	4100

Tolerance	±0,2 % of measured value ±0,5 K (KTY ±5 K)
Sensor current	≤0,6 mA
Temperature drift	<0,04°C/K
Measuring time 2 wire connection	≤ 330 ms
Measuring time 3 wire connection	≤ 440 ms

Thermocouples according to EN 60 584, DIN 43 710:

Type	Measuring range [°C] min.	max.	Precision
B	0	1820	T > 300°C ±2°C
E	-270	1000	±1°C
J	-210	1200	±1°C
K	-200	1372	±2°C
L	-200	900	±1°C
N	-270	1300	±2°C
R	-50	1770	±2°C
S	-50	1770	±2°C
T	-270	400	±1°C

Temperature drift	< 0,01 % / K
Measuring error of the sensor wire	+0,25 µV / Ω
Reference junction	±5 °C (after warmup-time of 15 minutes)
Measuring time	≤ 440 ms

Sensor output OUT 1 … OUT 4

Type	Pt100 according to EN 60751	
Reaction time to sensor input	< 10ms	
range of sensor current	200 µA … 5 mA	
Type of connection	2-, 3-, 4- wire	
Tolerance	< 200 Ω = ±0,2 % of simulated value	
	> 200 Ω = ±0,5 % of simulated value	

Test conditions

EN 61010-1

Rated impulse voltage	4000 V	
Overvoltage category	III	
Contamination level	2	
Rated insulation voltage Ui	300 V	
On-time	100 %	
Galvanic insulation / Test-voltage	Us – OUT1…4, Input, RS485	DC 3820 V
	OUT1…4 – Output, RS485	DC 1000 V
	OUT1 – OUT2 – OUT3 – OUT4	DC 1000 V
No galvanic insulation	Input – RS485	

EMC-tests	EN 61326-1
Burst	EN 61000-4-4 +/-4 kV Pulse 5/50 ns, f = 5 kHz, t = 15 ms, T = 300 ms
SURGE	IEC 61000-4-5 +/-1 kV Impulse 1,2/50 µs (8/20 µs)
discharge of static electricity	IEC 61000-4-2 +/-4 kV contact, +/- 8kV air

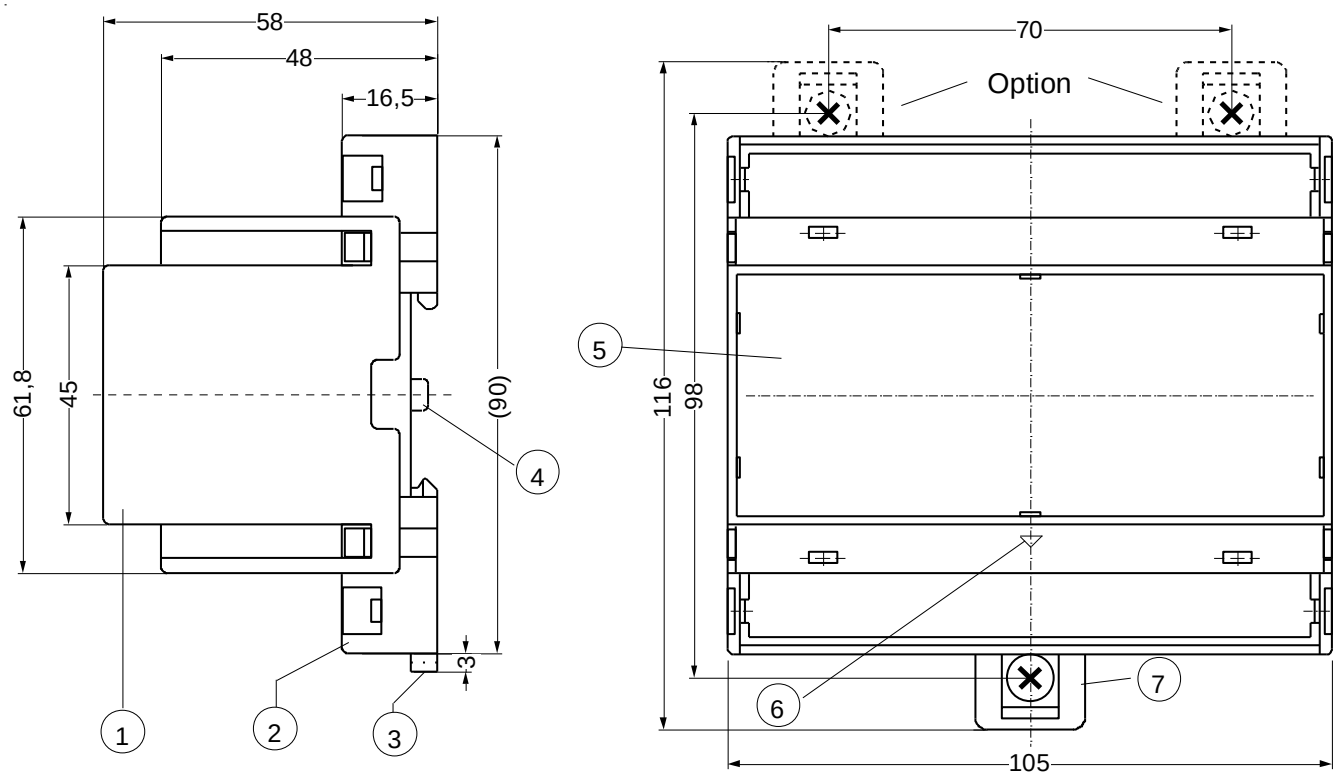
Environmental conditions	
Ambient temperature range	-20 °C ... +65 °C
Storage temperature range	-20 °C …+70 °C
Altitude	up to 2000 m
Climatic conditions	5-85% rel. humidity, no condensation
External wiring temperature range	-5 °C …+70 °C
Vibration resistance EN 60068-2-6	2…25 Hz ±1,6 mm

Housing	Design V6, switchgear mounting
Mounting height	55 mm
Width	6 TE
Dimensions (width x height x depth) (B x H x T)	105 x 90 x 58 mm
Wire connection, one wire	each 1 x 0,14 mm^2 – 2,5 mm^2
Stranded wire with insulated ferrules	each 1 x 0,14 mm^2 – 1,5 mm^2
Strip length	min. 8 mm
Torque	0,5 Nm (3,6 lb.in)
Protection class housing	IP 30
Protection class terminal	IP 20
Installation	Snap mounting on mounting rail 35 mm according to EN 60 715 or with screws M 4
Weight	approx. 200 g

Subject to technical changes

13 Housing Design V6

Dimensions in mm



1 Cover
2 Base
3 Bar for snap mounting
4 Latch for sealing
5 Front panel
6 Position downward
7 For fixing to wall with screws, Ø 4.2 mm

14 Appendix

14.1 Ziehl RS485 protocol

Transmission format:	ASCII	
Baud rat:	9600 (Default)	4800, 9600, 19200
Data:	8	
Stop bit:	1 (Default)	*from firmware -02: adjustable 1, 2*
Parity:	even (Default)	even, odd, no

1. Master requests data from TMU104V

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. TMU104V sends the requested data

TMU104V sends <start><Type of unit><address of unit><mode><data><BCC><CR><LF>:

Start of message	s (ASCII) S (ASCII) STX (0x2)	*(Start-sign same as start sign at data request)*	*1 Byte*
Data:			
Type of unit	TMU104V (ASCII)		*7 Byte (+ separated by ";")*
Address of unit	00 .. 99 (ASCII)		*2 Byte (+ separated by ";")*
Mode of data	0 .. 9 (ASCII)		*1 Byte (+ separated by ";")*
Sensor value	-199,9 .. +850,0 (ASCII)	***1**	*6 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*
			29 Byte

With default-address of unit "0", the TMU104V transmits a complete set of data every 3s (start-sign <STX>)

***1 Sensor short circuit, data "-999,9"**
Sensor interruption, data "+999,9"

14.2 Example

Data requested from TMU104V

s	01	r	0	048	\r\n

End of message	<CR><LF>
Block check	exor of all transmitted bytes
Data mode	0 (Mode 0)
Read-command	r (read)
Address of unit	01 (01 .. 99 (ASCII))
Start of message	s (s, S or <STX>)

Block check: 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.

TMU104V answers

s	TMU104V;	01;	0;	+033,9;	00;	088	\r\n

End of message	<CR><LF>
Block check	
Internal error	
Sensor value	
Data mode	
Address of unit	
Type of unit	
Start of message	

14.3 Modbus

Information's for Modbus-configuration and programming you find here: www.ziehl.de