NIVELCO

THERMOPOINT

TM/J-500/-600/-700
Multi-point Temperature Transmitters

User's and Programming manual

6th edition

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Thank you for choosing a NIVELCO instrument!

1. INTRODUCTION

THERMOPOINT TM / J−500 / −600 / −700 series 2-wire temperature transmitters are suitable for continuous multipoint measurement, indication, and transmission of the temperature of regular and hazardous liquids, powders, and granular solids. The sensor of the instrument is built into a rigid or a flexible tube or an antistatic plastic-coated steel wire rope, depending on the measured material and insertion length. The insertion length and process connection of the instruments are as per the order code (see **chapter 2**). The device's electronics and HART® communication provide application possibilities for many different tasks.

2. ORDER CODES (NOT ALL COMBINATIONS ARE POSSIBLE!)

THERMOPOINT multipoint temperature transmitters

T □ □ – □ □ □ – □ – Ex *

VERSION	CODE
Multipoint transmitter	M
Multipoint transmitter with local LCD display	J

PROBE	PROCESS CONNECTION	CODE
Rod	1" BSP	R
	1" NPT	A
	M20x1.5	J
Cable	1½" BSP 1…30 m	K
	1½" NPT 1…30 m	E
	1½" BSP 31…50 m	N
	1½" NPT 31…50 m	L
Coated cable	1½" BSP 1…30 m	H
	1½" NPT 1…30 m	C
	1½" BSP 31…50 m	F
	1½" NPT 31…50 m	G

HOUSING	CODE
Aluminum	5
Plastic	6**
Stainless steel	7

NUMBER OF SENSORS	CODE
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

CABLE LENGTH	CODE
1 m / 31 m	1
2 m / 32 m	2
3 m / 33 m	3
4 m / 34 m	4
5 m / 35 m	5
6 m / 36 m	6
7 m / 37 m	7
8 m / 38 m	8
9 m / 39 m	9
10 m / 40 m	A
11 m / 41 m	B
12 m / 42 m	C
13 m / 43 m	D
14 m / 44 m	E
15 m / 45 m	F
16 m / 46 m	G
17 m / 47 m	H
18 m / 48 m	J
19 m / 49 m	K
20 m / 50 m	L
21 m	M
22 m	N
23 m	P
24 m	R
25 m	S
26 m	T
27 m	U
28 m	V
29 m	W
30 m	Z

OUTPUT/EX	CODE
HART®	4
HART® / Ex ia IIIC	5
HART® / Ex ia IIB	6
HART® / Ex ta/tb IIIC	8
HART® / Ex ta IIIC	9

** Ex versions are marked "Ex" right after the type designation on the label.*

*** Only standard or Ex ia version is available.*

3. TECHNICAL DATA

Type		Rigid probe version T□R, T□A, T□J-□□□-□	Flexible probe version T□K, T□E, T□N, T□L-□□□-□	Flexible, plastic-coated probe version T□H, T□C, T□F, T□G-□□□-□
Insertion length		1…4 m (3.3…13 feet)	1…50 m (3.3…164 feet)	1…50 m (3.3…164 feet)
Highest medium pressure		25 bar (2.5 MPa, 363 psi)	16 bar (1.6 MPa, 232 psi)	3 bar (0.3 MPa, 43.5 psi)
Ambient temperature (1)		With plastic housing: –30…+65 °C (–22…+149 °F) With metal housing: –30…+65 °C (–22…+149 °F) with SAP–300 display: –20…+60 °C (–4…+140 °F)		
Medium temperature (1)		–40…+105 °C (for max. 1 hour: +125 °C) [–40…+221 °F (for max. 1 hour: +257 °F)]		–40…+80 °C (for max. 1 hour: +85 °C) [–40…+176 °F (for max. 1 hour: +185 °F)]
Accuracy		–40…–10 °C ±2 °C (–40…+14 °F: ±3.6 °F); –10…+85 °C ±0.5 °C (+14…+185 °F: ±0.9 °F); +85…+125 °C ±2 °C (+185…+257 °F: ±3.6 °F)		
Resolution (digital)		0.1 °C (+0.18 °F)		
Material of wetted parts		Stainless steel: 1.4571	Stainless steel: 1.4571 + 1.4301	Stainless steel: 1.4571 + Antistatic PE-coated steel + 1.4301
Output	Analog	4…20 mA		
	Digital	4…20 mA HART® communication (minimal loop resistance: 250 Ω)		
	Display	SAP−300 LCD		
Error indication		3.9 mA or 20.5 mA		
Maximum output load		$R_{max} = (U_{Supply} – U_{Supply\ min.}) / 0.02$ A;		
Power supply (U_{Supply}) (1)		11…36 V DC (in case of HART® multi-drop: 10…36 V DC)		
Electrical protection		Class III		
Electronics housing's ingress protection		IP67		
Probe housing's ingress protection		IP68 (up to medium pressure)		IP66
Process connection		As per order codes		
Electrical connection		2× M20×1.5 plastic cable gland, cable outer diameter: Ø6…12 mm (Ø.236…Ø.472"), wire cross section: max. 1.5 mm² (AWG16)		
Housing material		Powder-coated cast aluminum (EN AC-42000), stainless steel (1.4571/Ti316) or plastic (PBT)		
Weight		1.7 kg + probe: 0.6 kg/m (3.75 lb + probe: 0.4 lb/ft)	2.9 kg + probe cable: 0.3 kg/m + weight 3 kg (6.4 lb + probe cable: 0.2 lb/ft + weight: 6.6 lb)	2.9 kg + probe cable: 0.7 kg/m (6.4 lb + probe cable: 0.5 lb/ft)

(1) For explosion-proof design, see section 3.1 Ex information

3.1. Ex INFORMATION

Type	T□□-□□□-6Ex	T□□-5□□-5Ex T□□-7□□-5Ex	T□□-5□□-8Ex, T□□-7□□-8Ex T□□-5□□-9Ex, T□□-7□□-9Ex	
Ex marking	Ⓔx II 1 G Ex ia IIB T6…T4 Ga	Ⓔx II 1 D Ex ia IIIC T85°C Da	Ⓔx II 1 D Ex ta IIIC T105°C Da	Ⓔx II 1/2 D Ex ta/tb IIIC T85°C Da/Db
Waiting time for opening the cover	–	–	0 minutes	30 minutes
Ex electrical limits	Use Ex ia certified power supply only! $U_i \leq 30$ V DC $I_i \leq 140$ mA $P_i \leq 1$ W $C_i \leq 15$ nF $L_i \leq 200$ µH		$U_o \leq 30$ V DC $I_o \leq 1$ A	
Power supply	U_i = 11…30 V DC (in case of HART® multi-drop: U_i = 10…30 V DC)			
Medium temperature	See section 3.1.1 Ambient and medium temperature			
Ambient temperature	See section 3.1.1, For SAP–300 display: –20…+60 °C (−4…+140 °F)			
Cable introduction	M20×1.5 cable gland		certified “Ex ta” protective gland M20×1.5	
Cable diameter	Ø7…12 mm (Ø.275…Ø.511")			
Electrical connection	Wire cross section: 0.5…1.5 mm² (AWG20…16)			

3.1.1 Ambient and medium temperature

3.1.1.1 Thermal limits of Ex ia IIB compliant models

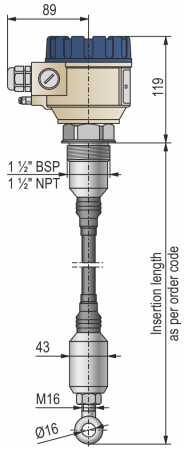
Type of enclosure and measuring pipe	Ambient temperature	Medium temperature	Temperature class
Metal enclosure with rigid or flexible measuring tube	–30…+65 °C (−22…+149 °F)	–40…+80 °C (−22…+176 °F) –40…+95 °C (−22…+203 °F) –40…+105 °C (−22…+221 °F)	T6 T5 T4
Plastic enclosure with rigid or flexible measuring tube	–20…+65 °C (−4…+149 °F)	–40…+80 °C (−22…+176 °F) –40…+95 °C (−22…+203 °F) –40…+105 °C (−22…+221 °F)	T6 T5 T4
Metal enclosure with plastic-coated flexible measuring tube	–30…+65 °C (−22…+149 °F)	–40…+80 °C (−22…+176 °F)	T6

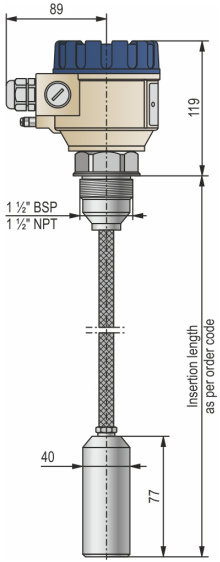
3.1.1.2 Thermal limits of Ex ta/tb IIIC, Ex ta IIIC and Ex ia IIIC compliant models

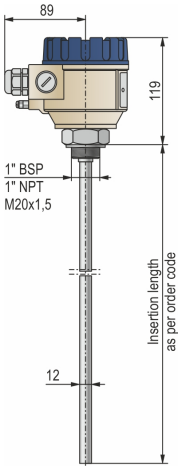
Housing position	Ambient temperature	Medium temperature	Temperature class		
			Ex ta/tb IIIC	Ex ta IIIC	Ex ia IIIC
Outside the tank	–30…+65 °C (−22…+149 °F)	–40…+80 °C (−22…+176 °F)	T85°C	T105°C	T85°C
Inside the tank	–30…+65 °C (−22…+149 °F)		–		

3.2. DIMENSIONS

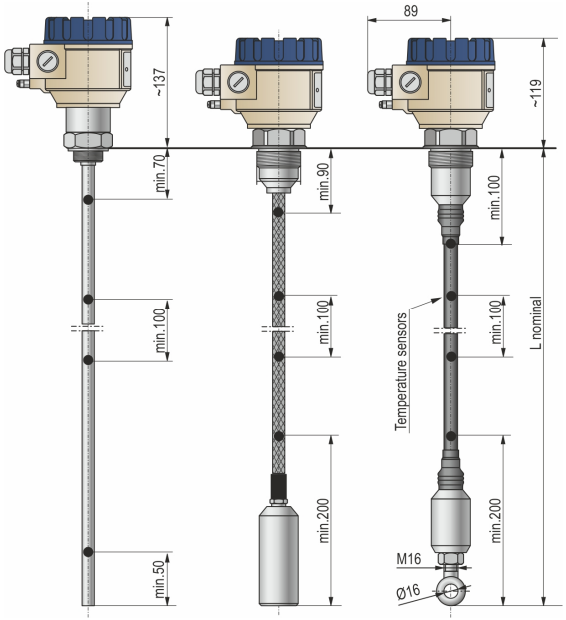
For solids	For liquids	
TDH, TDC, TDF, TDG-DDD-D	TDN, TDL, TDK, TDE-DDD-D	TDR, TDA, TDJ-DDD-D







Position of sensors



3.3. ACCESSORIES

- User's and programming manual
- Warranty Card
- EU-Declaration of Conformity
- 2× cable glands

3.4. CONDITIONS OF SAFE OPERATION

- Make sure the installation is complete with no visible defects before turning the device on.
- The device may only be used within the limitations specified in the technical specifications.
- The device must be installed in a way that the IP20 ingress protection is maintained throughout the installation!
- The metal housing of the device must be connected to the EP (equipotential) network!
- The thermal resistance of the cable insulation must correspond to the permissible ambient temperature at the place of application.
- The parameters of the sealing ring in respect of chemical and flame proofness shall be observed as specified in the instruction manual.

WARNING!

- Intrinsically safe devices may only be operated from an approved circuit that complies with the technical data.
- Devices protected against dust ignition may only be operated on a circuit with the specified technical data.
- In "Ex ta / tb IIIC" protection mode, after disconnecting the device, the device cover may only be removed after waiting at least 30 minutes!
- The device may contain partially static-charged plastic components! The presence of an electrostatic charge poses a risk of spark and ignition. Therefore, electrostatic charges must be prevented entirely in potentially explosive (Ex) environments!
  - Avoid friction on plastic surfaces!
  - Do not clean the appliance and the connecting cable dry! Use a damp cloth or such.
- The aluminum content of the metal die-cast housing exceeds the threshold, therefore, it requires impact and friction protection in hazardous (Ex) environments!

3.5. MAINTENANCE AND REPAIR, STORAGE CONDITIONS

The device does not require regular maintenance. The warranty card contains the terms and conditions.
Before returning the device for repairs, it must be cleaned thoroughly. The parts in contact with the medium may contain harmful substances; therefore, they must be decontaminated. Our official form (Returned Equipment Handling Form) must be filled and enclosed in the parcel. Download it from our website www.nivelco.com. The device must be sent back with a declaration of decontamination. A statement must be provided in the declaration that the decontamination process was successfully completed and that the device is clean from any hazardous substances.

Storage conditions:

Ambient temperature:	–25…+60 °C (–13…+140 °F)
Relative humidity:	max. 98%

4. INSTALLATION AND WIRING

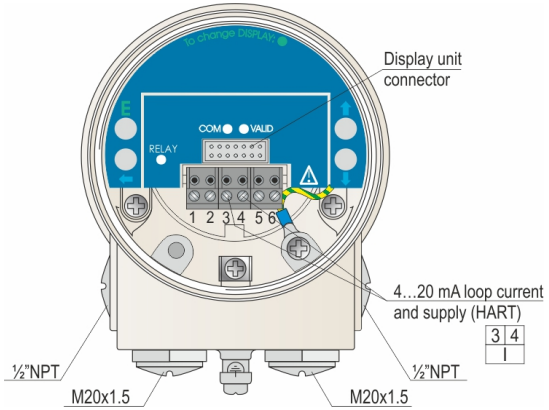
During the installation, the following instructions must be considered:

- Depending on the thermal characteristics of the measured material the sensor must be installed proper distance from the silo wall,
- Depending on the cross section of the silo several sensors should be installed,
- If the measured medium is granular solids, check the structural data of the silo's roof, and if necessary, stress needs to be relieved from the structure.

The place of installation must be selected so that it provides adequate space and easy access for installation, calibration and monitoring.
The instruments can be equipped with a flange or a threaded process connection according.
The housing of the instrument can be rotated. After the installation, turn the housing to the best position for easy reading.

4.1. WIRING

- The transmitter is designed to operate in 2-wire systems with 11…36 V DC power supply voltage.
- The internal resistance of the devices between the transmitter and the power supply unit depends on the power supply's voltage.
- The wiring must be shielded.
- The terminal screws can be accessed after removing the housing cover and the display module (if there is one).
- The unit must be grounded by its grounding screw.
- The unit must be connected via the #3(–) and #4(+) terminals.
- Programming can be performed after the device is powered on.
- After wiring and programming the device, make sure to close the cover and check if it seals properly.



The instrument may be damaged by electrostatic discharge (ESD) via its terminals; therefore, apply the precautions commonly used to avoid electrostatic discharge, e. g., touch a properly grounded point before removing the cover of the enclosure.

5. COMMISSIONING AND PROGRAMMING

TM□-□□□, TJ□-□□□ instruments can be adjusted and programmed with the SAP-300 display unit.
Without the SAP-300m, the following LED signs are possible:

- **VALID** Indicates the readiness of the unit. If it is continuously on, the input signal is stabilized. If it is blinking, the input signal is changing.

- **COM** Indicates digital (HART) communication. During remote programming, the LED is continuously on.

When the SAP-300 display is present, it covers the LEDs; their functions are taken over by the display. In its default state, the SAP display shows the table of the measured temperature values (see **chapter 5.1**).
Programming is supported by a text-based menu. Navigation is done by using the Ⓔ / ⊕ / ⊖ / ⊖ buttons.
The instrument can operate without the SAP-300 module as well. Programming can be done only by using SAP-300 display module locally or by HART (REMOTE PROGRAMMING) communication system remotely.

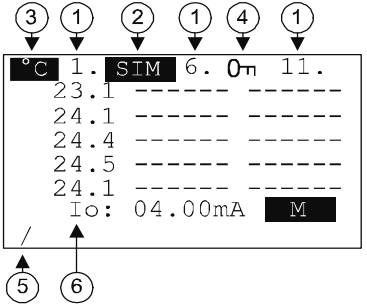
The SAP-300 is a 64x128 dot-matrix LCD display, which can be plugged into the transmitter. (The unit is universal, it can be used in other NIVELCO devices, provided that the system software supports SAP-300.)

Warning!

The SAP-300 module is based on LCD technology! Make sure it is not exposed to continuous heat or direct sunlight to avoid damaging the unit. If the instrument cannot be protected against direct sunlight or temperatures that are beyond the standard operating temperature range of the SAP-300, remove the SAP display in the instrument.

5.1. DISPLAYING MEASUREMENTS WITH THE SAP-300 DISPLAY MODULE

Legend:



1. Measured temperature values. From top to bottom, from left to right in increasing order. The instrument can handle up to 15 sensors. The six horizontal lines indicate the absence of the sensor or a sensor error. The #1 sensor is the closest to the electronic housing; the following sensors are marked with a number in increasing order. The last number belongs to the sensor at the bottom. The current measured temperature value appears inverted on the display. The displayed inverse temperature value is refreshed on the display once every second.

2. Simulation. When the simulation sign is displayed, the output shows the values of the simulation and not the actual measured values.

3. Unit of the measured values.

4. Menu Lock. If the key symbol is visible, the unit is protected with a password. When entering the menu, the instrument asks for the password. If the REM message is shown, the instrument is in remote programming mode, and the menu cannot be accessed.

5. **Source of transmitted PV (Primary Value)** (see 5.3.1.1.)

AVG>	PV is the average of the measured temperature values.
MAX>	PV is the maximal value of the measured temperature values. The number of the first sensor measuring the maximum temperature is in the 8th cell between brackets.
MIN>	PV is the minimal value of the measured temperature values. The number of the first sensor measuring the minimum temperature is in the 8th cell between brackets.
<01>	PV is the measured temperature value of a particular sensor. The number of the selected sensor is between the <> marks.

6. **The calculated value of the output current.** After the unit, the inverted sign shows the current output mode:

M	Manual mode (see 5.3.2.1.)
E!	Analog transmission; reacts to a programmed failure condition if an upper or lower fault current is programmed (see 0)
H	HART address, which is not 0, so 4 mA overwrites the output current (see 5.3.3)

Any errors during measurement are shown in the lower part of the display.

7. **The average of measured values.**

8. **The maximum of the measured values and place (first occurrence) of the maximal value.**

Information screens

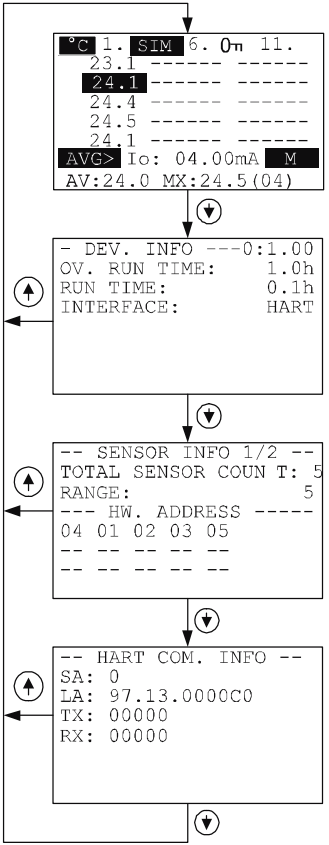
Press the ⓓ button to cycle between information screens.

1. General information (DEV. INFO): overall running time (OV. RUN TIME), uptime since power on (RUN TIME), type of interface (INTERFACE).
2. Sensor information: number of temperature sensors in the probe (TOTAL SENSOR COUNT), number of the sensor with the highest number (RANGE).
3. HART communication information: short address, manufacturer ID, device type code, Rx-Tx message counters – for debugging.

Information screens switch back to the main screen after 30 seconds.

Press the ⓤ button to get back to the main screen at any time.

Press the Ⓔ button on any of the screens to open the menu. Exiting the menu will always invoke the main screen.



5.2. PROGRAMMING WITH THE SAP−300 DISPLAY MODULE

When entering the menu, the device copies the current parameter set, and all changes are made in this duplicate. The instrument keeps measuring and transmitting values in accordance with the current (and intact) parameter set while programming. After exiting the menu, the instrument replaces the original parameters with the new parameter set and starts measuring in accordance with the new parameters. This means that pressing the E button after changing the parameters does not immediately make the new parameters effective!

Pressing the Ⓔ button to enter the menu. Press the Ⓔ button to exit the menu.

If the device is left in programming mode, it will automatically return to measuring mode, and all changes will be unsaved after 30 minutes. If the SAP−300 is removed, the instrument will immediately exit from the menu, and all changes will be discarded.

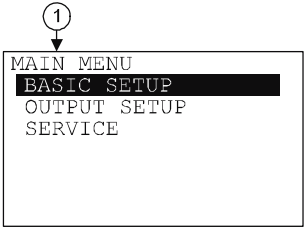
Programming the device with the SAP−300 (manual programming) and HART (remote mode) at the same time is not possible. However, the measured values can be read through HART at any time.

5.2.1 Components of the programming interface

The parameters of the instrument are grouped by their functions. The programming interface consists of lists, dialog windows, editing and report windows.

Lists

Navigate between the lines of lists by pressing the Ⓤ / Ⓓ buttons. Pressing the Ⓔ button activates the list item under the cursor. The cursor is the inverted line under which the items are cycled. Exit from a list by pressing the Ⓛ button.



Menu list

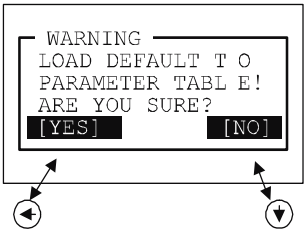
The menu list is a special list. Its characteristic is that upon selecting an item will invoke a sub-list. The menu header (1) helps navigate the menu.

Enter the menu by pressing the E button. Navigate between the menu items by pressing the Ⓤ / Ⓓ buttons. Enter Ⓔ to the selected menu by pressing the E button. The selected list item is marked with inverse color.

Exit from a sub-menu with the Ⓛ button. Press the Ⓛ button in the main menu to exit programming mode, and the instrument will return to measuring mode.

Dialog window

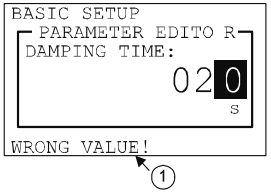
The system sends messages or warnings using dialog windows. They can usually be acknowledged by pressing the button, or the choice between two options is offered, usually YES (Ⓛ button) and NO (Ⓓ button). In some cases, a parameter has to be changed to correct an error!



Edit windows

Edit windows are used for modifying numeric parameter values. The selected character can be changed using the ⊕ / ⊖ buttons. The cursor can be moved to the left using the ⊖ button.

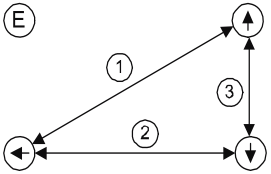
The direction of the cursor movement through the digits is right to left and the items wrap around. Changed values can be validated by pressing the E button. The software checks if the entered value is valid; exiting the edit window is only possible if the entered value is valid. If the entered value cannot be interpreted, the software sends an error message in the bottom line (1) of the display.



Edit windows – button combinations

The following button combinations are available in the edit window:

1. Reverting the parameters to the previously saved value (⊖ + ⊕, pressed for 3 secs.).
2. Restoring default parameters (⊖ + ⊖, pressed for 3 secs.).
3. Inserting the currently measured value to the edit window (⊕ + ⊖, pressed for 3 secs.). Only for certain parameters!



5.2.2 Menu structure

Main menu

BASIC SETUP	Parameter group of the basic measurement parameters
OUTPUT SETUP	Parameter group of the output parameters
SERVICE	Service functions, calibration, test and simulation

5.3. DESCRIPTION OF PROGRAMMABLE FEATURES

5.3.1 Basic measurement settings

5.3.1.1 Source of transmitted PV (Primary Value)

Parameter: P01: a

Menu path: BASIC SETUP / DAMPING TIME

Default value:	AVERAGE

Description: The selected value will be the basis for the analog and the digital (HART) transmitted Primary Value.

- AVERAGE
- SELECTED SENSOR
- MAXIMUM
- MINIMUM

All sensor data can be queried digitally, but the transmitted Primary Value can be selected in this parameter.

5.3.1.2 Temperature measurement units

Parameter: P02: a

Menu path: BASIC SETUP / UNIT / TEMPERATURE UNIT

Default value:	°C

Description: Unit of the temperature measurement

- °C
- °F

5.3.1.3 Damping time

Parameter: P20

Menu path: BASIC SETUP / DAMPING TIME

Default value:	0 sec

Description: Damping time is used to damp the unwanted fluctuations of the output and the display.
If the measured temperature changes rapidly the new value will settle within 1% accuracy after this set time.

5.3.2 Analog output

5.3.2.1 Output current mode

Parameter: P12: b

Menu path: OUTPUT SETUP / ANALOG OUTPUT / CURRENT MODE

Default value:	AUTO

Description: Transmission mode of the current output [AUTO, MANUAL]

- AUTO The output current is calculated from the Primary Value (P01: a), output is active.
- MANUAL The output current is fixed at a constant (set) value. In this mode the setting of the error current is irrelevant. The set (current) value overwrites the 4 mA output of HART multidrop mode!

5.3.2.2 Output current value 4 mA

Parameter: P10

Menu path: OUTPUT SETUP / ANALOG OUTPUT / 4 mA VALUE

Default value:	–10 (°C)

Description: Transmitted value is assigned to 4 mA output current.
The transmitted value is in accordance to the Primary Value (P01: a). Depending on the settings, the change in the measured value and the output current can either be directly (normal) or inversely (inverse operation) proportional.

5.3.2.3 Output current value 20 mA

Parameter: P11

Menu path: OUTPUT SETUP / ANALOG OUTPUT / 20 mA VALUE

Default value:	+85 (°C)

Description: Transmitted value is assigned to 20 mA output current.
The transmitted value is in accordance to the Primary Value (P01: a). The change in the measured value and the output current can be directly (normal) or inversely (inverse operation) proportional.

5.3.2.4 Output current error mode

Parameter: P12: a

Menu path: OUTPUT SETUP / ANALOG OUTPUT / ERROR MODE

Default value:	20.5 mA

Description: Error indication on the current output.

- OFF Error indication is OFF. The device transmits in accordance to the last calculation.
- 3.9 mA in case of error, the output current gets 3.9 mA.
- 20.5 mA in case of error, the output current gets 20.5 mA.

Warning! This error indication will be active as long as the failure is fixed or otherwise resolved! Manual mode and HART mode overwrite the error current.

5.3.2.5 Fixed output current

Parameter: P08

Menu path: OUTPUT SETUP / ANALOG OUTPUT / MANUAL VALUE

Default value:	4 mA

Description: Parameter for setting the fixed output current.

The values entered here must be between 3.9 and 20.5. The output current will take the entered value and analogue transmission will be suspended. The set (current) value overrides the 4 mA output of HART multidrop mode. (See 5.3.2.1)

5.3.3 Digital output

HART short address

Parameter: P19

Menu path: OUTPUT SETUP / SERIAL OUTPUT / ADDRESS

Default value:	01

Description: HART short address

The short address can be set between 0 and 15. If there is only one device, the short address can be 0, and this case the device transmits 4…20 mA on its output. In Multidrop (if there is more than one device) mode, the short address must be other than zero, and the output current is fixed at 4 mA. The fixed 4 mA output can be overridden as described in **chapter 5.3.2.5.**

5.3.4 Service functions

5.3.4.1 Security codes

User security code

Parameter: --
Menu path: SERVICE / SECURITY / USER LOCK
Description: Setting or unlocking the user security code.
The device can be protected against unauthorized programming with a 4-digit PIN code. If either of the digits differs from 0 the code is active. If zero is specified, the secret code will be deleted!
If the code is active, it will have to be entered when entering the menu.

Service code

Parameter: --
Menu path: SERVICE / SECURITY / SERVICE LOCK
Description: Setting the service code (for trained personnel only!)

5.3.4.2 Loop current test

Parameter: P80
Menu path: SERVICE / OUTPUT TEST / ANALOG OUTPUT
Description: Loop current test (mA)
When editing this parameter, the currently measured value will be shown on the display and sent to the output. In test mode, values between 3.9 and 20.5 mA can be entered into this parameter. The output current will be set to the entered value. The current measured on the output must be equal to the set value.
In test mode, a dialog window will appear about the fixed output current until it is dismissed by pressing the Ⓔ button.

5.3.4.3 Temperature simulation

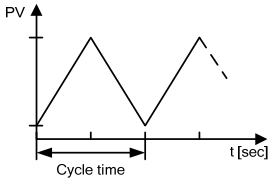
This function helps the user to check the outputs and the connected processing units
After finished editing the settings, the unit must be returned into Measurement mode to start the simulation.

Temperature simulation mode

Parameter: P84: a
Menu path: SERVICE / TEMP. SIMULATION / MODE

Default value:	0

Description: Simulation mode:

OFF	No PV simulation	
FIX VALUE	Simulation value is according to the sum of the bottom value of the simulation and the number of the sensor	
TRIANGLE WAVE	The simulated value changes linearly between the set low and high values with an adjustable cycle time	 PV: Primary Value
SQUARE WAVE	The simulated value jumps between the set low and high values within an adjustable cycle period	

Temperature simulation cycle

Parameter:	P85		
Menu path:	SERVICE / TEMP. SIMULATION / TIME	Default value:	60 sec
Description:	Cycle period of the simulation		

Bottom value of the Temperature simulation

Parameter:	P86		
Menu path:	SERVICE / TEMP. SIMULATION / BOTTOM VALUE	Default value:	–10 °C
Description:	Lowest value of the simulation		

Upper value of the Temperature simulation

Parameter:	P87		
Menu path:	SERVICE / TEMP. SIMULATION / UPPER VALUE	Default value:	85 °C
Description:	Highest value of the simulation		

5.3.4.4 Load default values

Parameter: --
Menu path: SERVICE / DEFAULTS / LOAD DEFAULT
Description: This command loads all default values of the instrument.
After loading the default values, the parameters can be freely changed, but the changes do not take effect until the user exits programming mode and returns to measurement mode. Before loading the default values, the device asks for confirmation. By loading the default values, all customized values will be lost!

5.3.4.5 Restart

Parameter: --
Menu path: SERVICE / RESTART
Description: Restarts the instrument (Cold boot) (Reloads parameters from the non-volatile memory)

5.4. RS485 COMMUNICATION VIA MULTICONT PROCESS CONTROLLER

5.4.1 Remote data query via HART® protocol

Knowing the HART commands of the transmitters, there is a possibility to query the data of the connected transmitters with the help of USER RS485 interface of MultiCONT process controller (the MultiCONT acts as a bridge). This can be done the following way:

- the MASTER inserts the HART frame to the data field of the HART frame, which is sent to the transmitters by the MultiCONT,
- the MultiCONT unpacks the HART frame (received from the MASTER) and sends it to the transmitter,
- the MultiCONT packs the HART answer of the transmitter and sends it to the MASTER in the data field of the HART frame.

The detailed description of remote programming can be found in the *"USER RS485 protocol for MultiCONT"* programming manual.

Designations: contents of the PA, SD and AD fields: see details in chapter 6.1. Command Structure*

MASTER → MultiCONT (request)

Index: list number of the transmitter.

PA	SD	AD	CD=241 (F1h)	BC=2h	CSD=232 (E8h)	Index=0	FCS(XOR)

In case of 'Index≠0' Index error will be sent in the answer!

MultiCONT → MASTER (answer)

PA	SD	AD	CD=241(F1h)	BC=48(30h)	Status S(0) and S(1)	DATA D(0)…D(45)	FCS(XOR)

The status bytes are described in details in chapter 6.1.1.*

The content of the DATA field:

BYTE NUMBER	NAME	DATA TYPE	NOTE
0…3	MultiCONT status	Bit32	
4	**CSD:** sub-command code	Unsigned 8	CSD = 232(E8h)
5	**Index:** list number of the transmitter	Unsigned 8	Index = 0…Dn-1 (see 6.2.5.7. chapter)*
6	Number of sensors in a probe (1…15)	Unsigned 8	
7	Dimension (Unit of measurement)	Unsigned 8	°C = 32(20h) or °F=33(21h)
8…37	Sensor temperatures ×10, S1…S15 in order	Signed int 16	
38…39	Transmitted Primary Value (PV) ×10	Signed int 16	(MAX, MIN, SELECTED SENSOR, AVG)
40…42	Date of last transmitter refresh	Date*	
43…45	Time of last transmitter refresh	Time*	

** This chapter is in the "Description of the USER RS485 protocol for MultiCONT" programming manual.*

5.4.2 Remote data query with MODBUS protocol

Knowing the HART commands of the transmitters, there is a possibility to query the data of the connected transmitters with the help of USER RS485 interface of MultiCONT process controller (the MultiCONT acts as a bridge). This can be done the following way:

- the MASTER inserts the MODBUS frame to the data field of the HART frame, which is sent to the transmitters by the MultiCONT,
- the MultiCONT unpacks the HART frame (received from the MASTER) and sends it to the transmitter,
- the MultiCONT packs the HART answer of the transmitter and sends it to the MASTER in the data field of the Modbus frame.

The detailed description of remote programming can be found in the *"USER RS485 protocol for MultiCONT"* programming manual.
Designations: ADDR, FNC and BCNT fields: see details in chapter 6.1. Command Structure*

MASTER → MultiCONT (request)

ADDR	FNC=03h	START	QUANTITY		CRC	
		7000h+N*0040h+00…14h	HI=00h	LO=01h…16h	HI	LO

N=0…Dn-1, where Dn is the number of the HART devices (see: Table of system variables 0012h address)*

MultiCONT → MASTER (answer)

ADDR	FNC=03h	BCNT(byte number)	DATA bytes in the read address	CRC	
			B(0)...B(BCNT-1)	HI	LO

BYTE NUMBER	NAME	DATA TYPE	NOTE
7000h	Number of sensors in a probe (1…15)	Unsigned 16	
7001h	Dimension (unit of measurement)	Unsigned 16	°C or °F
7002h	S1 Sensor temperature×10	Signed Int 16	
7003h	S2 Sensor temperature×10	Signed Int 16	
⋮	Sn Sensor temperature ×10	Signed Int 16	
700Fh	S14 Sensor temperature ×10	Signed Int 16	
7010h	S15 Sensor temperature ×10	Signed Int 16	
7011h	Transmitted Primary Value (PV) ×10	Signed Int 16	(MAX, MIN, SELECTED SENSOR, AVG)
7012h	Date of last table refresh	Date*	
7014h	Time of last table refresh	Time*	

* This chapter is in the *"Description of the USER RS485 protocol for MultiCONT"* programming manual.

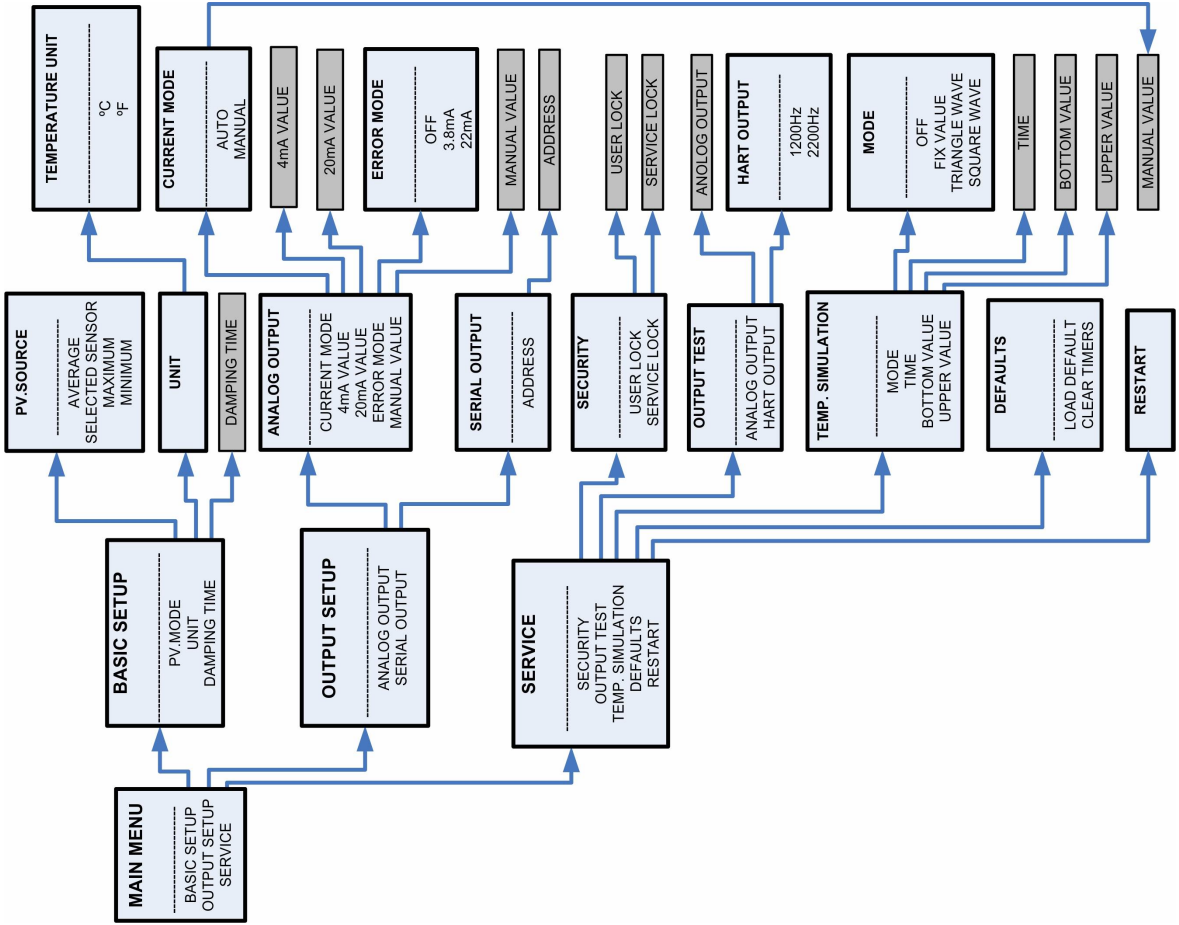
5.4.2.1 Example of data query with MODBUS protocol

		HART Transmitter														
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
Number of sensors in a probe (1…15)	Unsigned 16	0x7001	0x7041	0x7081	0x70C1	0x7101	0x7141	0x7181	0x71C1	0x7201	0x7241	0x7281	0x72C1	0x7301	0x7341	0x7381
Dimension	Unsigned 16	0x7002	0x7042	0x7082	0x70C2	0x7102	0x7142	0x7182	0x71C2	0x7202	0x7242	0x7282	0x72C2	0x7302	0x7342	0x7382
S1 Sensor temperature x10	Signed Int 16	0x7003	0x7043	0x7083	0x70C3	0x7103	0x7143	0x7183	0x71C3	0x7203	0x7243	0x7283	0x72C3	0x7303	0x7343	0x7383
S2 Sensor temperature x10		0x7004	0x7044	0x7084	0x70C4	0x7104	0x7144	0x7184	0x71C4	0x7204	0x7244	0x7284	0x72C4	0x7304	0x7344	0x7384
S3 Sensor temperature x10		0x7005	0x7045	0x7085	0x70C5	0x7105	0x7145	0x7185	0x71C5	0x7205	0x7245	0x7285	0x72C5	0x7305	0x7345	0x7385
S4 Sensor temperature x10		0x7006	0x7046	0x7086	0x70C6	0x7106	0x7146	0x7186	0x71C6	0x7206	0x7246	0x7286	0x72C6	0x7306	0x7346	0x7386
S5 Sensor temperature x10		0x7007	0x7047	0x7087	0x70C7	0x7107	0x7147	0x7187	0x71C7	0x7207	0x7247	0x7287	0x72C7	0x7307	0x7347	0x7387
S6 Sensor temperature x10		0x7008	0x7048	0x7088	0x70C8	0x7108	0x7148	0x7188	0x71C8	0x7208	0x7248	0x7288	0x72C8	0x7308	0x7348	0x7388
S7 Sensor temperature x10		0x7009	0x7049	0x7089	0x70C9	0x7109	0x7149	0x7189	0x71C9	0x7209	0x7249	0x7289	0x72C9	0x7309	0x7349	0x7389
S8 Sensor temperature x10		0x700A	0x704A	0x708A	0x70CA	0x710A	0x714A	0x718A	0x71CA	0x720A	0x724A	0x728A	0x72CA	0x730A	0x734A	0x738A
S9 Sensor temperature x10		0x700B	0x704B	0x708B	0x70CB	0x710B	0x714B	0x718B	0x71CB	0x720B	0x724B	0x728B	0x72CB	0x730B	0x734B	0x738B
S10 Sensor temperature x10		0x700C	0x704C	0x708C	0x70CC	0x710C	0x714C	0x718C	0x71CC	0x720C	0x724C	0x728C	0x72CC	0x730C	0x734C	0x738C
S11 Sensor temperature x10		0x700D	0x704D	0x708D	0x70CD	0x710D	0x714D	0x718D	0x71CD	0x720D	0x724D	0x728D	0x72CD	0x730D	0x734D	0x738D
S12 Sensor temperature x10		0x700E	0x704E	0x708E	0x70CE	0x710E	0x714E	0x718E	0x71CE	0x720E	0x724E	0x728E	0x72CE	0x730E	0x734E	0x738E
S13 Sensor temperature x10		0x700F	0x704F	0x708F	0x70CF	0x710F	0x714F	0x718F	0x71CF	0x720F	0x724F	0x728F	0x72CF	0x730F	0x734F	0x738F
S14 Sensor temperature x10		0x7010	0x7050	0x7090	0x70D0	0x7110	0x7150	0x7190	0x71D0	0x7210	0x7250	0x7290	0x72D0	0x7310	0x7350	0x7390
S15 Sensor temperature x10		0x7011	0x7051	0x7091	0x70D1	0x7111	0x7151	0x7191	0x71D1	0x7211	0x7251	0x7291	0x72D1	0x7311	0x7351	0x7391
Transmitted Primary Value (PV) x10		0x7012	0x7052	0x7092	0x70D2	0x7112	0x7152	0x7192	0x71D2	0x7212	0x7252	0x7292	0x72D2	0x7312	0x7352	0x7392
Date of last transmitter refresh	Date*	0x7013	0x7053	0x7093	0x70D3	0x7113	0x7153	0x7193	0x71D3	0x7213	0x7253	0x7293	0x72D3	0x7313	0x7353	0x7393
Time of last transmitter refresh	Time*	0x7014	0x7054	0x7094	0x70D4	0x7114	0x7154	0x7194	0x71D4	0x7214	0x7254	0x7294	0x72D4	0x7314	0x7354	0x7394

6. ERROR CODES

Message on the screen	Error description	Procedure
MEMORY ERROR	Memory error in the electronics	Contact the dealership!
NO INPUT SIGNAL	Hardware error	Contact the dealership!
EE COM. ERROR	Hardware error	Contact the dealership!
MATH. OVERLOAD	Display overflow	Check the settings!
SENSOR NOT FOUND	Hardware error	Contact the dealership!
SENS. ZERO ADDR.	Hardware error	Contact the dealership!
SENS. MULT. ADDR.	Hardware error	Contact the dealership!
SENS. MISS. ADDR.	Hardware error	Contact the dealership!
SENS. SHORT CIRC.	Hardware error	Contact the dealership!
EE CHK ERROR	Parameter checksum error.	Restart the device in the SERVICE / RESTART menu (or switch the device off/on) and check/repeat programming! If none of that helps, contact the dealership.
INTEGRITY ERROR	Parameter consistency error. (Automatically fixed internal error.)	Restart the device in the SERVICE / RESTART menu (or switch the device off/on) and check/repeat programming! If none of that helps, contact the dealership.
AC COM. ERROR	Hardware error	Contact the dealership!

7. MENU MAP


MAIN MENU
BASIC SETUP
OUTPUT SETUP
SERVICE
BASIC SETUP
PV.MODE
UNIT
DAMPING TIME
OUTPUT SETUP
ANALOG OUTPUT
SERIAL OUTPUT
SERVICE
SECURITY
OUTPUT TEST
TEMP. SIMULATION
DEFAULTS
RESTART
PV.SOURCE
AVERAGE
SELECTED SENSOR
MAXIMUM
MINIMUM
UNIT
DAMPING TIME
ANALOG OUTPUT
CURRENT MODE
4mA VALUE
20mA VALUE
ERROR MODE
MANUAL VALUE
SERIAL OUTPUT
ADDRESS
SECURITY
USER LOCK
SERVICE LOCK
OUTPUT TEST
ANALOG OUTPUT
HART OUTPUT
TEMP. SIMULATION
MODE
TIME
BOTTOM VALUE
UPPER VALUE
DEFAULTS
LOAD DEFAULT
CLEAR TIMERS
RESTART
TEMPERATURE UNIT
°C
°F
CURRENT MODE
AUTO
MANUAL
4mA VALUE
20mA VALUE
ERROR MODE
OFF
3.8mA
22mA
MANUAL VALUE
ADDRESS
USER LOCK
SERVICE LOCK
ANOLOG OUTPUT
HART OUTPUT
1200Hz
2200Hz
MODE
OFF
FIX VALUE
TRIANGLE WAVE
SQUARE WAVE
TIME
BOTTOM VALUE
UPPER VALUE
MANUAL VALUE

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tmh555en2106p
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