THERMOCONT

TT-, TV-, TW-, TB-, TL-, TR-
TEMPERATURE TRANSMITTERS

INSTALLATION AND PROGRAMMING MANUAL

1. Edition

0408

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Thank you for choosing NIVELCO instrument
We are sure that you will be satisfied throughout its use!

1. INTRODUCTION

THERMOCONT T-500/600 series 2-wire temperature transmitters are suitable for measuring, indicating and transmitting temperature of ordinary and hazardous gases, fumes, liquids and masses. The Pt100 sensor of the unit is accommodated in normal or plastic coated stainless steel tube manufactured with different intrusion length end process connection. Intelligent electronics and HART communication provides application possibilities for the most different tasks.

2. ORDER CODES

THERMOCONT T ☐ ☐ – ☐ ☐ ☐ – ☐

TYPE	CODE
Transmitter up to 200 °C	T
Transmitter up to 600 °C	V
Transmitter up to 200 °C with plastic coated probe	W
Tx + display up to 200 °C	B
Tx + display up to 600 °C	L
Tx + display up to 200 °C with plastic coated probe	R

PROCESS CONNECTION	CODE
Wall mount	W
½" BSP	C
¾" BSP	D
½" NPT	H
M 20 x 1,5	J
1" Triclamp	L
1½" Triclamp	K
2" Triclamp	N
DN 25 pipe coupling	O
DN 40 pipe coupling	P
DN 50 pipe coupling	R
DN 50, St. St. flange + PTFE	F
2" ANSI St. St. flange + PTFE	A
1" NPT reinforced casing	S

HOUSING	CODE
Aluminium	5
Plastic	6

SENSOR	CODE
Without	0
Class A	1
Class B	2

INTRUSION	CODE
60 mm	0
160 mm	1
250 mm	2
400 mm	3
500 mm	4
1000 mm	5
1500 mm	6
2000 mm	7
2500 mm	8
3000 mm	9

OUTPUT / EX	CODE
4 … 20 mA	2
4 … 20 mA / HART	4
4 … 20 mA / EEx ia	6
4 … 20 mA / HART / EEx ia	8
4 … 20 mA / EEx d	A
4 … 20 mA / HART / EEx d	B
4 … 20 mA / EEx d ia	C
4 … 20 mA / HART / EEx d ia	D

Not all combinations possible!

Ex certified units should have aluminium housing and Ex tag in the order code
Requirement for housing position „B"; „C"; „D" i.e. other than„A; should be specified with the order (See 3.3 Dimensions)

3. TECHNICAL DATA

3.1 GENERAL DATA

TYPE			TR□-□□□-□ TW□-□□□-□	TT□-□□□-□ TB□-□□□-□	TV□-□□□-□ TL□-□□□-□ T□W-□□□-□
Range			-50 ˚C...+200 ˚		-50 ˚C...+600˚C
Probe			Pt 100 sensor in PFA coated St. St. (DIN 1.4571) tube	Pt 100 sensor in St. St. (DIN 1.4571) tube	
Maximum pressure **			2.5 MPa (25 bar) in +20 °C ; 1.6 MPa (16 bar) in +400 °C		
Output			4…20 mA / HART 4 … 20 mA limits of the output signal: 3.9 … 20.5 mA minimum loop resistance with HART R tmin = 250 ohm		
Display		Mode	6 digit LCD, symbols, engineering units, bargraph		
		Resolution	0.1 °C (0.1 °F)		0.4 °C (0.4 °F)
Accuracy	Output current	Pt100 Class A	± (0.3+ |0.0025 t |) °C		± (1.5+ |0.004 t |) °C
		Pt100 Class B	± (0.4+ |0.0055 t |) °C		± (1.5+ |0.006 t |) °C
		Temp. coefficient	± 0,02°C / °C		
	Display	Pt100 Class A	± (0.2+ |0.0025 t |) °C		± (1.5+ |0.004 t |) °C
		Pt100 Class B	± (0.35+ |0.0055 t |) °C		± (1.5+ |0.006 t |) °C
		Temp. coefficient	± 0.002 °C / °C		
Error indicaton			By current output 3.8 mA or 22 mA		
Power supply			10V…36V DC		
Output load			$R_L = (U_s – 10\ V) / 0.022\ A$, U_s = supply voltage		
Ambient temperature			- 40 °C …+70 °C with display – 25 °C …+70 °C		
Electric protection			Class III		
Ingress protection			IP 65		
Process connection and intrusion **			According to order code		
Electric connection			Through plastic cable gland: M 20 x1,5 using shielded two-wire cable with diameter: ∅ 6 …12 mm and cross section: 0,25 … 1,5 mm^2		
Housing			Powder paint coated, cast aluminium (öAlSi12) or fibre-glass reinforced plastic		Powder paint coated cast aluminium (öAlSi12)
Wetted parts **			PFA, PTFE	Stainless steel: DIN 1.4571	
Mass		with plastic housing	ca. 0.5 kg + probe 0.5 kg/m type T□W … ca. 0.9 kg		
		with aluminium housing	ca. 0.9 kg + probe 0.5 kg/m type T□W … ca. 0.5 kg		

* t = reading temperature

** No data for type T□W …

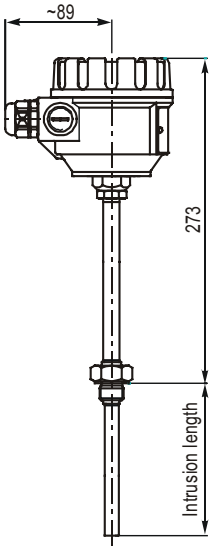
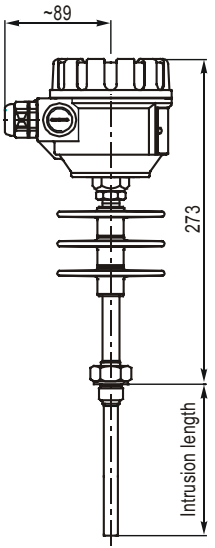
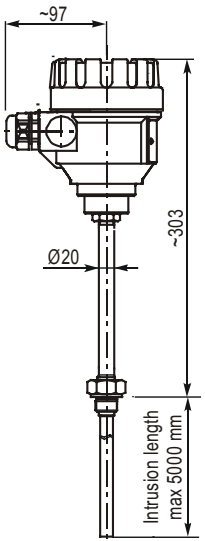
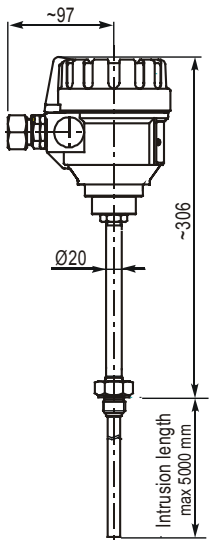
3.2 ADDITIONAL DATA FOR EX APPROVED VERSIONS

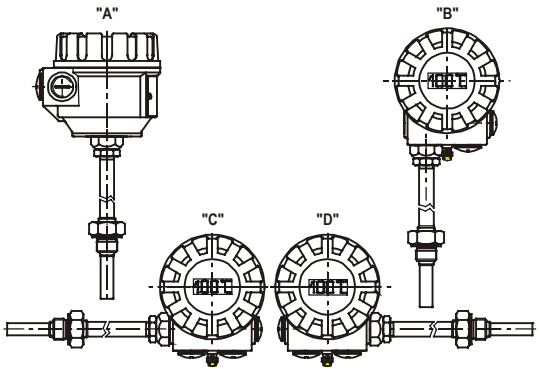
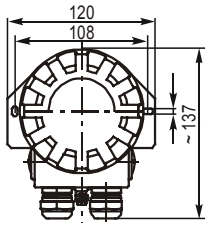
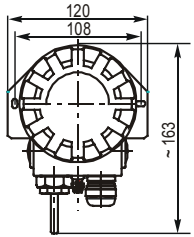
Type	T□□ – 5□□ – 6Ex T□□ – 5□□ – 8Ex	T□□ – 5□□-AEx T□□ – 5□□-BEx	T□□ – 5□□-CEx T□□ – 5□□-DEx
Protection mode	Intrinsically safe	Flame proof casing	Flame proof casing and intrinsically safe
Protection mark	⟨Ex⟩ II 1 G EEx ia IIB T6...T1 +600°C	⟨Ex⟩ II 2 G EEx d IIB T6...T1 +600°C	⟨Ex⟩ II 1/2 G EEx d ia IIB T6...T1 +600°C
Ex approved power supply data	U_{max} = 30 V I_{max} = 140 mA P_{max} = 1,0 W C_i < 20 nF L_i < 200 μH	–	U_{max} = 30 V I_{max} = 140 mA P_{max} = 1,0 W C_i < 20 nF L_i < 200 μH
Cable gland	Metal M 20 x1,5 cable diameter 6…12 mm	Metal M 20 x1,5 cable diameter: 9 … 11 mm	
Ambient temperature	– 40 °C…+70 °C with display – 25 °C…+70 °C	– 40 °C…+70 °C with display – 20 °C…+70 °C	
Housing	Paint coated aluminium		

Maximum temperatures allowed for the Ex approved units

Temperature class	T6	T5	T4	T3	T2	T1
$T_{ambient}$	60°C	70°C				
T_{medium}	80° C	95°C	130°C	195°C	295°C	440°C

3.3 DIMENSIONS

ORDINARY TYPES				EXPLOSION PROOF TYPES			
-50 °C… +200 °C		-50 °C… +600 °C		INSTRINSICALLY SAFE		FLAME PROOF CASING	
							
TR□ – □□□ – □	TW□ – □□□ – □	TV□ – □□□ – □	TL□ – □□□ – □	T□□ – 5□□ – 6Ex	T□□ – 5□□ – 8Ex	T□□ – 5□□ – AEx	T□□ – 5□□ – BEx
TT□ – □□□ – □	TB□ – □□□ – □					T□□ – 5□□ – CEx	T□□ – 5□□ – DEx

HOUSING POSITIONS	VERSION FOR WALL MOUNTING	
		
	Without sensor	With sensor
Requirement for housing position other than„A; should be specified with the order	T☐W – ☐00 – ☐	T☐W – ☐☐0 – ☐

3.4 ACCESSORIES

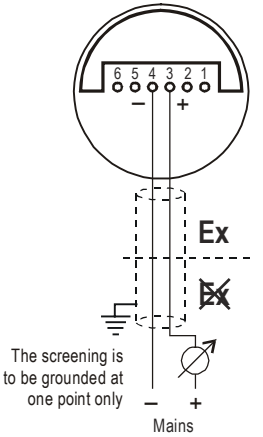
- Installation and Programming Manual
- Warranty Certificate,
- Manufacturer's Declaration,
- 2 cable glands

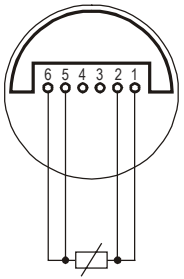
4. INSTALLATION AND ELECTRIC CONNECTION

- Place of installation should be selected so that proper place should be available for handling.
- Housing of the units with flange or threaded connection can be rotated. After installing the unit housing can be turned to reach best position for reading display.
- Device should be fastened with two nuts of M4.

4.1 WIRING

- Transmitters are used in 2-wire systems with power supply of 10 … 36 V DC. Resistance of the units in the loop depends on the voltage of the power supply.
- For wiring shielded cable suggested in the Technical Data should be used.
- After removal of the housing cover and taking out the display module (if any), the screw terminals can be accessed. Cover of the flame proof housing can be removed after unhooking the clamp.
- The unit should be grounded by the inner or outer grounding screw.
- Loop should be connected to terminal 3 (+) and 4 (-). Other terminals are for internal connection of the Pt sensor.
- The Pt100 sensor for types T☐W-☐☐☐-☐ should be wired as shown on drawing at the right.
- Switch on the unit and make necessary programming.
- After wiring and programming ensure proper sealing and closing of the cover (and fastening of the clamp with the flame proof models).





The Pt100 sensor for types T☐W-☐00-☐ should be wired as shown on drawing

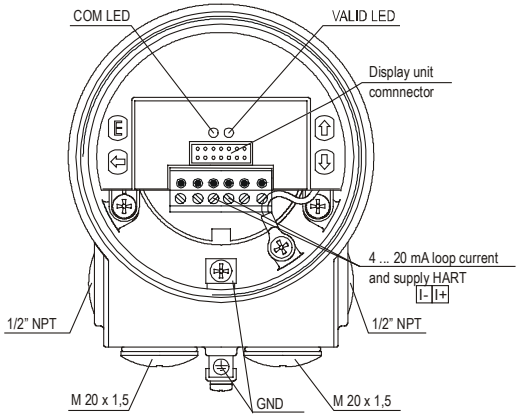
The unit may be damaged by electrostatic discharge (EDS) via its terminal, thus apply the precautions commonly used to avoid electrostatic discharge e.g. by touching a properly grounded point before removing the cover of the enclosure.

4.2 SAFETY REGULATIONS FOR THE EX APPROVED UNITS

- Intrinsically safe units should be powered by duty certified intrinsically safe [EEx ia IIB] or [EEx ia IIC] device with features as per technical data above.
- Plastic coated probes may be charged electrostatically therefore such units should only be used for measurement of conductive medium and its specific resistance must not exceed 10^4 Ωm, even under the most unfavourable conditions and at the most unfavourable place.
- The Ex device should be grounded by its grounding screw.

5. PUTTING INTO OPERATION, PROGRAMMING

Transmitter installed and wired correctly will operate after powering according to the Manufacturer's (Default) or to the last settings. Operability is indicated by lighting of the LED **VALID**.



Unit with removed cover and without SAP-202 display module

5.1 PROGRAMMING

Adjustment of the unit to the conditions of the application will be carried out by programming parameters with the aid of the push buttons and following the procedure on the display of the SAP-202 module. Manufacturer's setting is as below:

DEFAULT

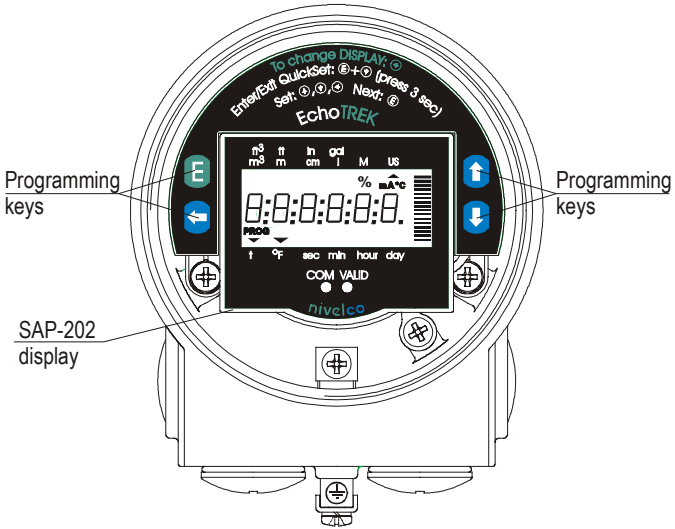
- Current output: 4 mA assigned to –50°C and 20 ma assigned to +200°C (+600°C),
- Noise suppression: 50 Hz
- Error indication: I_{out} = 3,8 mA

The THERMOCONT is fully operational without the SAP-202 display module (incorporated in types TB□-□□□, TL□-□□□ , and TR□-□□□).
It is for programming and/or displaying measurement values.

The unit will measure during programming in accordance with the parameters set previously. The new, modified parameters will only be effective after returning to the Measurement Mode

If the transmitter is left in Programming Mode by mistake, it will automatically return to Measurement Mode after 3 minutes and will operate with the parameters entered during the last completed programming.

5.1.1 Display and keys of the SAP 202 display module



Symbols on the screen

- ▼ – pointer (showing to the relevant engineering unit)
- **°C** – temperature grade Celsius
- **mA** – current output (lighting)
- **%** – display in percentage

PROG (blinking) – indicating programming

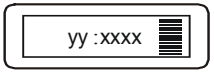
Symbols on the frame

- **M** metric system
- **US** calculation system
- **°F** temp. in Fahrenheit
- **LED indication**
- **COM** indicating HART communication
- **VALID** indicating operability

5.1.2 Steps of programming

Programming will be performed by pressing and releasing the relevant one or two keys (simultaneously).
The following description is for overview only, detailed programming is to find in 5.1.3

For entering calibration value decimal point will automatically turn up. Its position can not be changed.



y or yy — parameter address (**0, 1**, …**19**)

xxxx or xxxxx — parameter value (dcba) or calibration/measurement value

bargraph

	X	X	X	X	X
sign	–	0	0	0	0
	0	:	:	:	:
	1	9	9	9	9
	2				

OPERATION OF PROGRAMMING KEYS	OPERATION	
Ⓔ + ⓿ (for minimum 3 sec!) *	Enter or exit programming mode (Return to the Measurement mode means saving modifications of parameter value)	
⓾ + ⓫	GET VALUE – function for automatic setting. Actual/measured value will be accepted as value to be programmed. SET will be displayed for confirmation	
pressing **Keys**	while **Parameter address blinking**	while **Parameter value blinking**
Ⓔ	to select parameter address and go to parameter value	to save parameter value and return to parameter address
⓿ + ⓾	Cancel all modifications of the actual programming procedure. **CANCEL** will be displayed for warning.	Neglect modification of the parameter value (if any) and return to the parameter address **CANCEL** will be displayed
⓿ + ⓫	Reset all parameter values to the manufacturer's setting. (Default). **LOAD** will be displayed for warning	Reset to the factory value of the relevant parameter address. **LOAD** will be displayed for warning
⓿	Move blinking (changeability) of the digit to the left	
⓾ / ⓫	Modify the blinking digit (increase or decrease value, minus sign) or scroll up/down … 8, 9, " –" ,0, 1, 2, …	

Notes:

Double key pressing is indicated by "+" * **Make sure that Ⓔ would be pressed first!**

If after pressing Ⓔ blinking does not spring over from the parameter address to the parameter value this means that

- *the parameter is either a read-out type, or*
- *the secret code prevents the modification (see P19)*

If the modification of the parameter value is not accepted i.e. the parameter value keeps blinking after pressing ENTER Ⓔ,

- *the modified value is either out of the range, or*
- *the code entered is not a valid one*

5.1.3 Parameters – descriptions and programming

P0: - - - a Assignment of the (lowest) measured temperature to 4 mA

P1: - - - a Assignment of the (highest) measured temperature to 20 mA

The lowest and highest (limit) value of the temperature range is to be assigned to the 4 and 20 mA output current. This can be performed by two methods

a: manually i.e. by entering the relevant values in P0 and P1 (Make sure that values to be programmed does not exceed the range of the unit in question, the modification of the parameter value will not be accepted i.e. after pressing Ⓔ the parameter value will remain blinking and refuse to return to the address.)

The procedure to assign for instance +160°C to 4 mA in P0 is the following: press Ⓔ + ◄ to enter programming mode, go to P1 with Ⓔ, enter 160 and press Ⓔ to go back to the parameter address, finally press Ⓔ + ◄ to exit programming/return to measurement mode).

b: automatically i.e. using the GET VALUE function at being in P0 and P1. For this method the probe should be in a medium with the required (zero and high limit value) temperature. Successful setting will be indicated by the message SET displayed.

FACTORY DEFAULT: P0 -50°C

P1 +200°C or +600°C respectively

P7: - - - a Offset of characteristic

Displayed (and transmitted) temperature value can be diverted from that of measured by the sensor. This represents an offset of the characteristic so that the displayed value will be throughout the whole range in line with a - for instance - control measurement, performed by a control thermometer. Difference value should be entered here with its mathematical sign (-) if it is minus.

FACTORY DEFAULT: 0

P9: - - - a Current generator test

In this parameter the actual current output (corresponding to the measured process value) will be displayed. Pressing Ⓔ the blinking) current value can be set for any value between 3,9 and 20.5 mA. The current output has to show the same value, which can be checked by an ampere meter.

P10: - - - a Engineering unit

a	Engineering unit
0	Celsius
1	Fahrenheit

FACTORY DEFAULT: 0

P11: - c - - Noise suppression and displayed value

c	Noise supression
0	50 Hz
1	60 Hz

d	Displayed value
0	Temperature (°C or F see P10)
1	%

FACTORY DEFAULT: 0 0

P12: - - - a Error indication

Find explanation of errors in 5.2

a	Error indication
0	3.8 mA
1	22 mA

FACTORY DEFAULT: 0

P13: - - - - HART short address

THERMOCONT involved in HART multidrop usage should be addressed here. Value of parameter is described in the Manual for the Eview software supplied with the HART capable THERMOCONT.

P14: - - - - Software version

The software number of your transmitter can be viewed in this parameter.

P19: - - - - Secret code

Settings can be protected by a 4 digit number (secret code) other than 0 entered as value of this parameter. If the secret code is active the symbol PROG is lighting and the value of the parameters can only be viewed. . If there is no secret code or it is not active the symbol PROG is blinking.
For opening secret code the old code should be entered. For modifying or deleting the secret code (modifying to 0000) the new code can only be entered after opening old code. The procedure is as below: Go to P19 press Ⓔ to select parameter address and go to parameter value, enter the old code; press Ⓔ to go to address and Ⓔ again to return to value; enter new code or 0000.

FACTORY DEFAULT: 0000

5.2 *ERROR CODES*

In case of error the LED VALID will be blinking, and **Errx** message will be displayed indicating the following errors:

Error Code (x)	Error description	Causes and solutions
0	Sensor error or exceeding default range by more than 10%	Contact local agent Modify programming
1	Memory error	Contact local agent
3	Programming error: same value in P0 and P1	Modify programming

5.3 *HART COMMUNICATION*

HART capable transmitters would communicate with the Nivelco made MULTICONT interface according to the HART standard. MULTICONT provides for the powering and makes possible remote programming of the transmitters while (transmitter parameter values and) measurement data can be forwarded from the MULTICONT on RS485 line.

6. MAINTENANCE AND REPAIR

The unit does not require regular maintenance. In case of need the diaphragm might be carefully cleaned. All repairs will be carried out in the premises of the Manufacturer only.

7. STORAGE

Ambient temperature: -25 °C ...+60 °C
Relative humidity: max. 98 %

8. WARRANTY

Nivelco undertakes warranty of 2 (two) years in compliance with details described on the Warranty Certificate.