

THERMOCONT

TT-, TV-, TW-, TB-, TL-, TR-
Temperature transmitter

User's and Programming manual
4th edition



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Thank you for purchasing a NIVELCO product.

1. INTRODUCTION

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

2. ORDER CODES (NOT ALL COMBINATIONS ARE AVAILABLE)

THERMOCONT - - *

Version	Code
Transmitter, up to +200 °C (+392 °F)	T
Transmitter, up to +600 °C (+1112 °F)	V
Transmitter, up to +200 °C (+392 °F) with plastic-coated probe	W
Transmitter with plug-in display, up to +200 °C (+392 °F)	B
Transmitter with plug-in display, up to +600 °C (+1112 °F)	L
Transmitter with plug-in display, up to +200 °C (+392 °F), PFA-coated	R

Process connection	Code
With console for wall mounting	W
½" BSP	C
¾" BSP	D
1" BSP	E
½" NPT	H
M20×1.5	J
1" TriClamp	L
1½" TriClamp	K
2" TriClamp	N
DN25 Pipe coupling (DIN 11851)	O
DN40 Pipe coupling (DIN 11851)	P
DN50 Pipe coupling (DIN 11851)	R
DN50, PN16, 1.4571 flange + PTFE lining ⁽¹⁾	F
2" ANSI, 1.4571 flange + PTFE lining ⁽¹⁾	A
1" NPT reinforced casing	S
½" NPT reinforced casing	Z
Welded stainless steel flange ⁽²⁾	U

Housing	Code
Painted aluminum	5
Fiberglass-reinforced plastic (PBT) ⁽³⁾	6

Sensor	Code
None	0
Class "A" Pt100	1
Class "B" Pt100	2

Probe length (L)	Code
60 mm (2.4")	0
160 mm (6.3")	1
250 mm (9.8")	2
400 mm (15.7")	3
500 mm (19.7")	4
1000 mm (39.4")	5
1500 mm (59.1")	6
2000 mm (78.7")	7
2500 mm (98.4")	8
3000 mm (118")	9

Output / Certificates	Code
HART	4
Ex ia G	6
Ex d G	A
HART / Ex d	B
Ex d ia G	C
HART / Ex d ia G	D

* For explosion-proof devices, the article number is followed by "Ex" on the data plate!

⁽¹⁾ Only for coated probe versions

⁽²⁾ MF□-□□-K type flanges [available from size DN15] should be ordered separately

⁽³⁾ only for +200 °C versions, not available in Ex version

Requested housing position "B"; "C"; "D" other than standard ("A"); must be specified with the order.

3. TECHNICAL DATA

3.1 General Data

			Standard version [T□, TB□]	Plastic-coated version [TR□, TW□]	Strengthened probe version [T□S, T□Z]	High-temperature version [TV□, TL□]	
Measuring Range			-50...+200 °C (-58...+392 °F), T□W: -40...+70 °C (-40...+158 °F)	-50...+200 °C (-58...+392 °F)	-50...+600 °C (-58...+1112 °F) ⁽¹⁾		
Insertion length			As per order code, up to 3000 mm (10 ft)				
Process connection			As per order code			½" / 1" NPT threaded	As per order code
Highest process pressure			25 bar (363 psi) @ +20 °C (+68 °F), 16 bar (232 psi) @ +400 °C (+752 °F)			40 bar (580 psi)	25 bar (363 psi) @ +20 °C (+68 °F), 16 bar (232 psi) @ +400 °C (+752 °F)
Material of wetted parts ⁽²⁾			1.4571 (316Ti) stainless steel	PFA / (PTFE / PVDF)		1.4571 (316Ti) stainless steel	
Probe			Class "A" or Class "B" Pt100 temperature sensor, as per order code				
Accuracy ⁽³⁾	Output current	Class "A" Pt100	± (0.3 + 0.0025 t) °C				± (1.5 + 0.004 t) °C
		Class "B" Pt100	± (0.4 + 0.0055 t) °C				± (1.5 + 0.006 t) °C
		Temperature error	± 0.02 °C / °C				
	Displayed current	Class "A" Pt100	± (0.2 + 0.0025 t) °C				± (1.5 + 0.004 t) °C
		Class "B" Pt100	± (0.35 + 0.0055 t) °C				± (1.5 + 0.006 t) °C
		Temperature error	± 0.02 °C / °C				
Supply voltage			10...36 V DC; Ex version: 12...30 V DC				
Output	Analog		4...20 mA				
	Digital communication		HART®				
	Output load		R _{max} = [(U _{Supply} - U _{Supply min.})/0.02 A], [Ω]				
	Display	type	SAP-202				
resolution		0.1 °C		0.4 °C			
Error indication			3.8 mA or 22 mA				
Ambient temperature			-40...+70 °C °C (-40...+158 °F), with display -25...+70 °C (-13...+158 °F); see "Explosion Protection, Designation, Limit Values"				
Overvoltage category			I				
Electrical protection			Class III				
Ingress protection			IP65				
Electrical connection			Plastic or metal cable gland: M20×1.5; Cable outer diameter: Ø6...12 mm (Ø.276...Ø.512"); / see "Explosion Protection, Designation, Limit Values" Wire cross section: 0.25...1.5 mm² (AWG20...16)				
Housing material			Painted aluminum or plastic (PBT)			Painted aluminum	
Weight	With aluminum housing		~0.9 kg (~2 lb) + probe: 0.5 kg/m (0.33 lb/ft) (for T□W...types: ~0.9 kg [-2 lb total])			~1.55 kg (~3.45 lb) + probe: 0.25 kg/100 mm (1.68 lb/ft)	~0.9 kg (~2 lb) + probe 0.5 kg/m (0.33 lb/ft) (for T□W ...types ~0.5 kg [-1.1 lb total])
	With plastic housing		~0.5 kg (~1.1 lb) + probe 0.5 kg/m (0.33 lb/ft) (for T□W ...types ~0.5 kg [-1.1 lb total])			-	

⁽¹⁾ With heatsink above +200 °C (+392 °F).

⁽²⁾ Not valid for T□W types.

⁽³⁾ t = measured temperature.

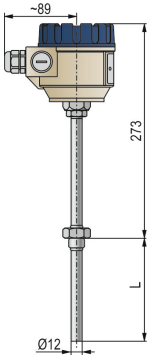
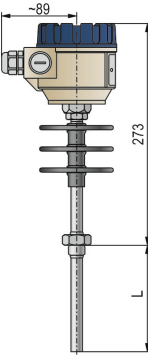
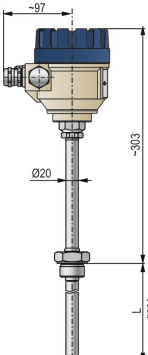
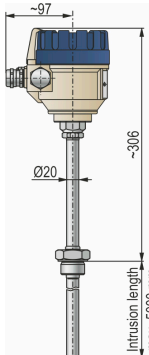
3.2 Explosion Protection, Designation, Limit Values

Type	T00-500-6 Ex T00-500-8 Ex	T00-500-A Ex T00-500-B Ex	T00-500-C Ex T00-500-D Ex
Protection mode	Intrinsically safe	Flame proof casing	Flame proof casing and intrinsically safe
Protection mark	Ⓔ II 1 G Ex ia IIB T6...T1 Ga	Ⓔ II 2 G Ex d IIB T6...T1 Gb	Ⓔ II 1/2 G Ex d ia IIB T6...T1 Ga/Gb
Ex-approved power supply data	U _{max} = 30 V I _{max} = 140 mA P _{max} = 1.0 W C _i < 14 nF L _i < 180 μH	-	U _{max} = 30 V I _{max} = 140 mA P _{max} = 1.0 W C _i < 14 nF L _i < 180 μH
Cable gland	Metal M20×1.5 cable diameter Ø6...12 mm (Ø0.236...0.47")	Metal M20×1.5 cable diameter: Ø9...11 mm (0.35...0.433")	
Ambient temperature	-40...+70 °C (-40...+158 °F), with display -25...+70 °C (-13...+158 °F)		
Housing	Paint-coated aluminum (EN AC-43100)		

Temperature classification for Ex ia, d and d ia devices

Temperature class	T6	T5	T4	T3	T2	T1
T _{ambient}	+60 °C (+140 °F)	+75 °C (+167 °F)	+75 °C (+167 °F)	+70 °C (+158 °F)	+60 °C (+140 °F)	+45 °C (+113 °F)
T _{medium}	+80 °C (+176 °F)	+95 °C (+203 °F)	+120 °C (+248 °F)	+190 °C (+374 °F)	+290 °C (+554 °F)	+440 °C (+824 °F)

3.3 Dimensions

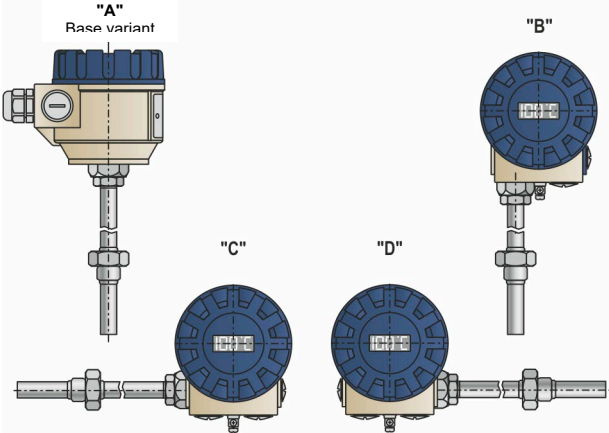
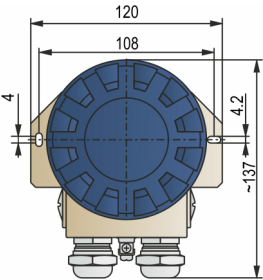
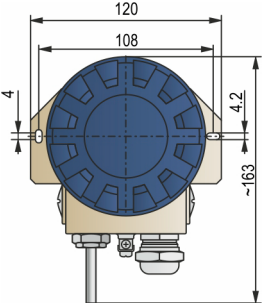
Standard version				Explosion proof version			
-50...+200 °C (-58...+392 °F)		-50...+600 °C (-58...+1112 °F)		Intrinsically safe		Flame proof casing	
							
T□□-□□□-□	T□□-□□□-□	TV□-□□□-□	TL□-□□□-□	T□□-5□□-6 Ex	T□□-5□□-8 Ex	T□□-5□□-A Ex	T□□-5□□-B Ex
T□□-□□□-□	T□□-□□□-□					T□□-5□□-C Ex	T□□-5□□-D Ex

3.4 Accessories

- Installation and Programming Manual
- Warranty Card,
- EU Declaration of Conformity,
- 2× cable glands

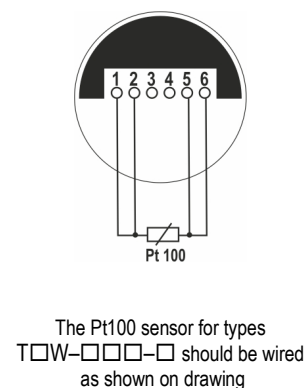
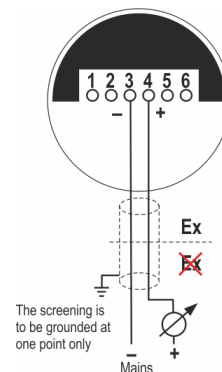
4. INSTALLATION AND ELECTRIC CONNECTION

- Place of installation should be selected so that proper place should be available for handling.
- Depending on the version, the unit is mounted with a threaded connection or a flange.
- Device should be fastened with 2× nuts of M4.

Housing positions		Version for wall mounting	
			
Requirement for housing position other than 'A': should be specified with the order		Without sensor	With sensor
T□W-□00-□		T□W-□□0-□	T□W-□□0-□

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).



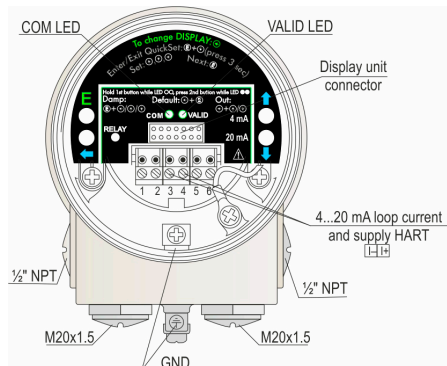
The unit may be damaged by electrostatic discharge (EDS) via its terminal, thus apply the precautions commonly used to avoid electrostatic discharge e.g. by touching a properly grounded point before removing the cover of the enclosure.

4.2 Safety regulations for the Ex approved units

- Intrinsically safe units should be powered by duty-certified intrinsically safe [Ex ia IIB] or [Ex ia IIC] devices with features as per the 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 $10^4 \Omega m$, even under the most unfavorable conditions and at the most unfavorable place.
- The Ex device should be grounded by its grounding screw.
- The insulation of the cable must be heat resistant to the permissible ambient temperature (+75 °C [+167 °F]) at the place of application.
- Devices with 'd' class protection mode must be used with a 'd' class certified cable gland.
- In case of Ex II 1 G Ex ia IIB T6...T1 Ga protected equipment version with metallic enclosure, the aluminum contents of enclosure exceeds the limit, thus the equipment must be protected against impact and friction effects.
- The material of plastic enclosure in case of Ex ia versions may be electrostatically charged. The cleaning of the enclosure permitted only with humid cloth.

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. The manufacturer's setting is as below:

DEFAULT

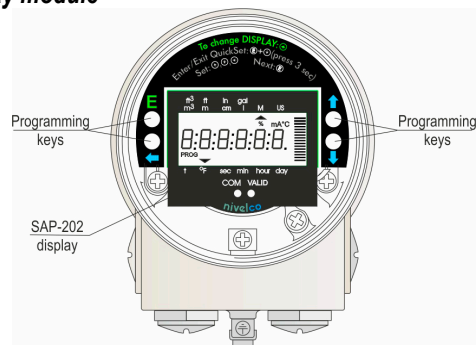
- Current output: 4 mA assigned to $-50\text{ }^{\circ}\text{C}$ ($-58\text{ }^{\circ}\text{F}$) and 20 mA assigned to $+200\text{ }^{\circ}\text{C}$ / $+600\text{ }^{\circ}\text{C}$ ($+392\text{ }^{\circ}\text{F}$ / $+1112\text{ }^{\circ}\text{F}$),
- Noise suppression: 50 Hz
- Error indication: $I_{out} = 3.8\text{ mA}$

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 by 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

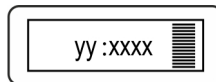


5.1.2 Steps of Programming

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 be found in 5.1.3

For entering the calibration value decimal point will automatically turn up. Its position cannot be changed.



- y or yy parameter address (0, 1, ...19)
- xxxx or xxxxx parameter value (dcba) or calibration/measurement value
- bar graph

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

Operation of programming keys	operation	
Ⓔ + ⬅ (for minimum 3 s!) *	Enter or exit programming mode (Return to the Measurement mode means saving modifications of parameter value)	
⬆ + ⬇	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 the Parameter address blinking	while the Parameter value blinking
Ⓔ	to select the parameter address and go to the parameter value	to save the parameter value and return to the parameter address
⬅ + ⬆	Cancel all modifications of the actual programming procedure. CANCEL will be displayed as a warning.	Neglect modification of the parameter value (if any) and return to the parameter address CANCEL will be displayed
⬅ + ⬇	Reset all parameter values to the manufacturer's setting. (Default). LOAD will be displayed for a warning	Reset to the factory value of the relevant parameter address. LOAD will be displayed as warning
⬅	Move the blinking (changeability) of the digit to the left	
⬆ / ⬇	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 E the parameter value will remain blinking and refuse to return to the address.)

The procedure to assign for instance +160 °C (+320 °F) to 4 mA in P0 is the following: press E + $\leftarrow$ to enter programming mode, go to P1 with E , enter 160 and press E to go back to the parameter address, finally press E + $\leftarrow$ 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 (-58 °F)

P1 +200 °C (+392 °F) or +600 °C (+1112 °F) 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 E 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 suppression
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 EView2 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 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.

7. STORAGE

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

tbj524en25p04

January 2025

NIVELCO reserves the right to change anything in this manual without notice.