

# Technical Information

## Temperature Switch

### Thermophant T

### TTR31, TTR35



Temperature switch for the safe measurement, monitoring and control of process temperatures

#### Application

Temperature switch for the monitoring, display and control of process temperatures in a range from -50 to 200 °C (-58 to 392 °F):

Thermophant T TTR31 – with thread connections or coupling  
Thermophant T TTR35 – for hygienic applications

- Versions for use in hygienic applications
- Electronic versions
  - one PNP switch output
  - two PNP switch outputs
  - 2 x PNP switch outputs or one PNP switch output and 4 to 20 mA output (active)

#### Benefits at a glance

This compact temperature switch impresses with the latest in technology being used:

- Integrated switching electronics for decentral and economic process monitoring and control
- High reproducibility and long-term stability
- Function check and information onsite thanks to LEDs and digital display
- Long-term stable temperature sensor made of platinum (Pt100 class A as per IEC 60751)
- High accuracy across the entire ambient temperature range and short response time
- Operation and visualization also with PC and ReadWin 2000 or FieldCare configuration software
- Upper part of housing can be rotated by 310°
- DESINA-compliant
- TTR35: 3-A marked

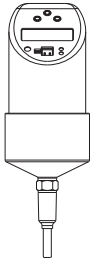
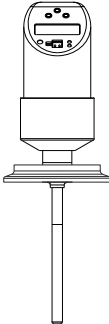
## Function and system design

### Measuring principle

Electronic recording and conversion of input signals in industrial temperature measurement. A platinum sensor located at the measuring tip changes its resistance value depending on the temperature. This resistance value is recorded electronically. The relation of the measured resistance value and temperature is defined by the international standard IEC 60751.

### Measuring system

#### Overview

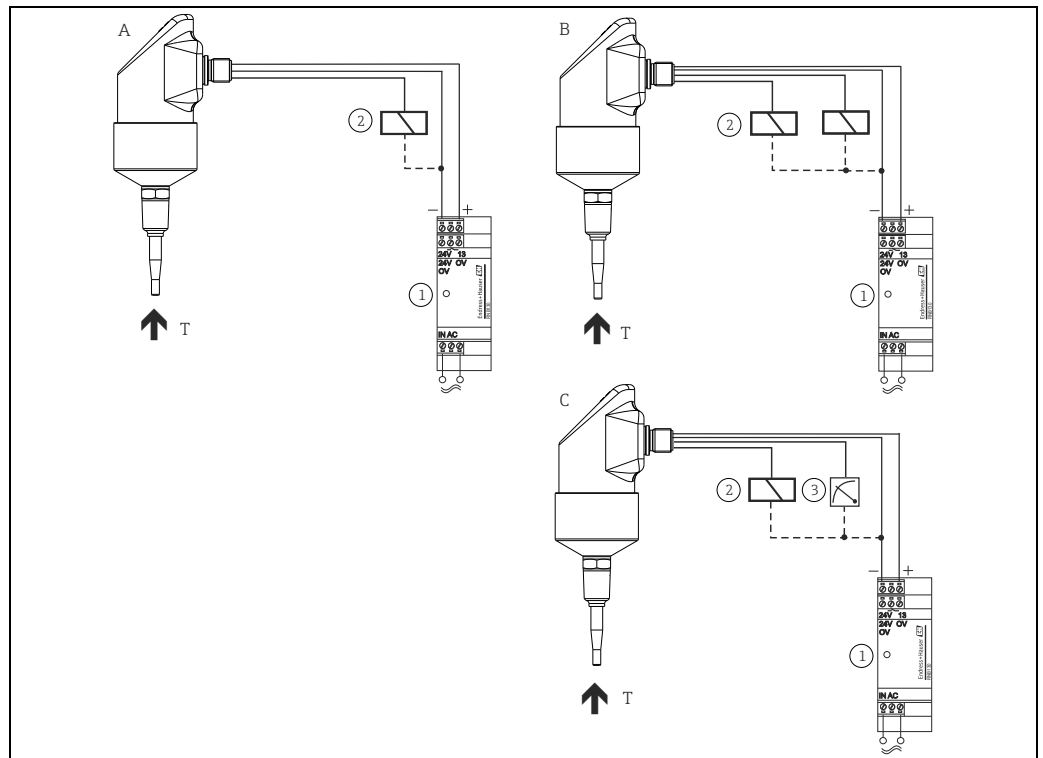
Thermophant product family	TTR31	TTR35
	 A0005276	 A0023194
Sensor element	Pt100	Pt100
Field of application	Measurement and monitoring and control of process temperatures.	Measurement and monitoring and control of process temperatures in hygienic processes.
Process connection	<ul style="list-style-type: none"> <li>▪ Coupling, sensor length <math>\geq</math> 100 mm (3.94 in)</li> <li>▪ Thread               <ul style="list-style-type: none"> <li>– G<math>\frac{1}{2}</math>" and G<math>\frac{3}{4}</math>"</li> <li>– ANSI NPT <math>\frac{1}{4}</math>" and NPT <math>\frac{1}{2}</math>"</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Hygiene               <ul style="list-style-type: none"> <li>– Conical metal-metal G<math>\frac{1}{2}</math>"</li> <li>– Clamp 1" - 1<math>\frac{1}{2}</math>", 2"</li> <li>– Varivent F, N</li> <li>– DIN 11851</li> <li>– APV inline</li> </ul> </li> </ul>
Measuring range (process temperature range)	-50 to +150 °C (-58 to +302 °F) -50 to +200 °C (-58 to +392 °F) with neck	-50 to +150 °C (-58 to +302 °F) -50 to +200 °C (-58 to +392 °F) with neck in hygienic processes

### DC voltage version

PNP switch output of electronics.

Power supply e.g. with a power supply unit.

Preferably in conjunction with programmable logic controllers (PLC) or for controlling a relay.



A: 1x PNP switch output

B: 2x PNP switch output

C: PNP switch output with additional analog output 4 to 20 mA

① Power supply unit e.g. RNB130

② Load (e.g. programmable logic controller, process control system, relay)

③ Display e.g. RIA452 or recorder e.g. Ecograph T or Minilog B (at 4 to 20 mA analog output)

#### ① Power supply "Easy Analog RNB130":

Primary switched-mode power supply for sensors. Space saving DIN rail mounting as per IEC 60715. Wide-range nominal voltage input: 100 to 240 V AC; Output: 24 V DC, max. 30 V in the event of a fault; Nominal output current: 1.5 A. Connection to monophased a.c. networks or to two phase conductors of three-phase supply networks.

#### ② Process display RIA452:

If you would like to read off the instantaneous value of the temperature not only locally, but also e.g. directly from a control room or in the PC network, then one suitable device is the process display RIA452:

Digital process display unit in 96 x 96 mm (3.78 x 3.78 in) panel mounted housing for monitoring and displaying analog measured values with pump control and batch functions. Multicoloured 7-digit 14-segment LC display with large bargraph. Configuration and visualisation via RS232 interface and ReadWin® 2000 PC operating software.

### ③ Universal Graphic Data Recorder Ecograph T, Data logger Minilog B:

If you would like to read off the instantaneous value of the temperature not only locally, but also record, analyze and display it e.g. directly from a control room or in the PC network, then the following devices are suitable:

- Universal Graphic Data Manager Ecograph T  
144 x 144 mm (5.67 x 5.67 in) panel mounted housing for electronic acquisition, display, recording, analysis, remote transmission and archiving of analog and digital input signals. Multichannel data recording system with multicoloured TFT display (145 mm (5.7 in) screen size), galvanically isolated universal inputs (U, I, TC, RTD, pulse, frequency), digital inputs, transmitter power supply, limit relay, communication interfaces (USB, Ethernet, optional RS232/485), 128 MB internal memory, external SD card and USB stick. The Field Data Manager Software (FDM) supports data analysis at the PC; configuration is done via FieldCare or the integrated web server.
- Data logger Minilog B  
Battery powered measured value collector with 2 input channels for storing analog and digital values. Internal memory 128 kB for max. 84000 measured values. Configuration and visualisation via RS232 interface and ReadWin 2000 PC operating software. Optionally with telealarm function.

## Input

**Measured variable** Temperature (temperature-linear transmission behaviour)

**Measuring range**

Designation	Measuring range limits	Min. span
Pt100 as per IEC 60751	-50 to +150 °C (-58 to +302 °F) -50 to +200 °C (-58 to +392 °F) with neck	20 K (36 °F)
<ul style="list-style-type: none"> <li>■ Sensor current: ≤ 0.6 mA</li> </ul>		

## Output

**Output signal** DC voltage version: (short-circuit proof version)

- 1x PNP switch output
- 2x PNP switch outputs
- 2x PNP switch outputs or one PNP switch output and 4 to 20 mA output (active)

**Signal on alarm**

- Analog output: ≤ 3.6 mA or ≥ 21.0 mA adjustable (if setting ≥ 21.0 mA the output is > 21.5 mA)
- Switch outputs: at safety condition (switch open)

**Load** Max.  $(V_{\text{power supply}} - 6.5 \text{ V}) / 0.022 \text{ A}$  (current output)

**Range of adjustment**

- Switch output:  
Switch point (SP) and Switch-back point (RSP) in increments of 0.1 °C (0.18 °F)  
Min. distance between SP and RSP: 0.5 °C (0.8 °F)
- Analog output (if available):  
Lower range value (LRV) and upper range value (URV) can be set anywhere within the sensor range (min. measuring range 20 K (36 °F))
- Damping: can be set anywhere between 0...40 s in increments of 0.1 s
- Unit: °C, °F, K

**Switching capacity** DC voltage version:

- Switch status ON:  $I_a \leq 250 \text{ mA}$ , switch status OFF:  $I_a \leq 1 \text{ mA}$
- Switching cycles: > 10,000,000
- Voltage drop PNP: ≤ 2 V

■ Overload protection

Automatic testing of switching current; output is switched off in case of overcurrent, the switching current is tested again every 0.5 s; max. capacitance load: 14 µF for max. supply voltage (without resistive load)

Periodic disconnection from a protective circuit in event of overcurrent (f = 2 Hz) and indication of 'Warning'

**Inductive load**

To prevent electrical interference, only operate an inductive load (relays, contactors, solenoid valves) when directly connected to a protective circuit (free-wheeling diode or capacitor).

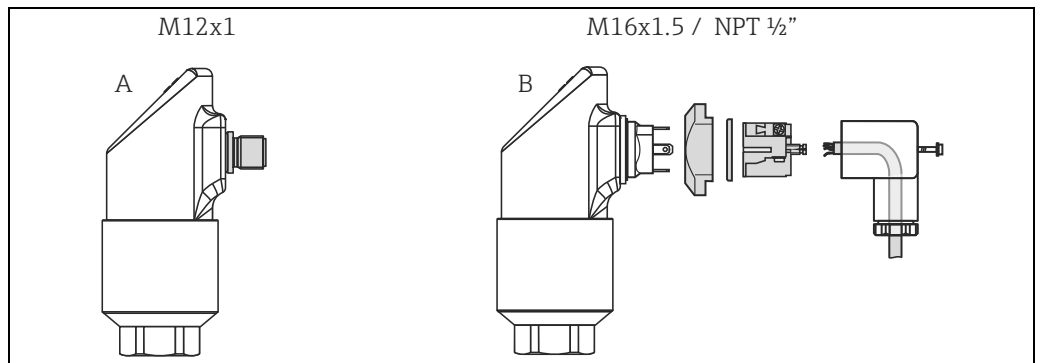
## Power supply

**Electrical connection**

**Plug connection**



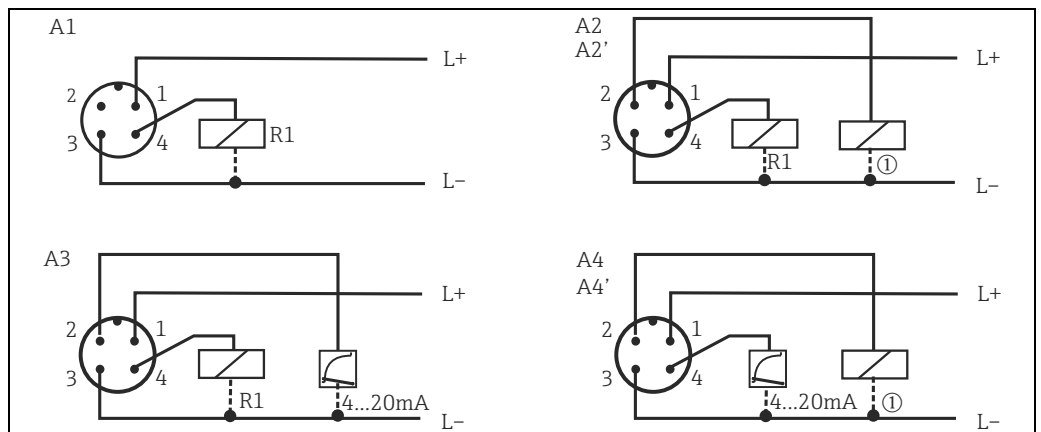
TTR35: Electrical cables must comply with 3-A standard, must be smooth, corrosion resistant and cleanable.



A: M12x1 connector  
B: M16x1.5 or NPT 1/2" valve plug

**Device connection**

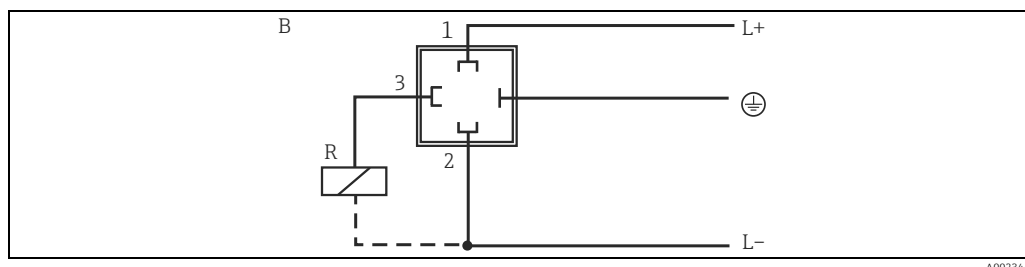
■ DC voltage version with M12x1 connector



Pos.-No.	Output setting	Order code (see chap. ordering information → 15)
A1	1x PNP switch output	TTR3x-A1A*****
A2	2x PNP switch output R1 and R2	TTR3x-A1B*****

Pos.-No.	Output setting	Order code (see chap. ordering information → 15)
A2'	2x PNP switch output R1 and ⊕ (diagnosis/break contact with adjustment "DESINA")	TTR3x-A1B*****
A3	1x PNP switch output and 1x analog output (4 to 20 mA)	TTR3x-A1C*****
A4	1x analog output (4 to 20 mA) and 1x PNP switch output ⊕ (R2)	TTR3x-A1C*****
A4'	1x analog output (4 to 20 mA) and 1x PNP switch output ⊕ (diagnosis/break contact with adjustment "DESINA")	TTR3x-A1C*****

- DC voltage version with M16x1.5 or NPT 1/2" valve plug



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Pos.-No.	Output setting	Order code (see chap. ordering information → 15)
B	1x PNP switch output	TTR3x-A2A*****; TTR3x-A3A*****

#### Supply voltage

- DC voltage version  
12...30 V DC (reverse polarity protection)

#### Current consumption

without load < 60 mA, with reverse polarity protection

#### Power supply failure

- Behaviour in case of overvoltage (> 30 V)  
The device works continuously up to 34 V DC without any damage.  
No damage is caused to the device in case of a short-term overvoltage up to 1 kV (as per EN 61000-4-5). The specific properties are no longer guaranteed if the supply voltage is exceeded
- Behaviour in case of undervoltage  
If the supply voltage drops below the minimum value, the device switches off (status as if not supplied with power = switch open).

## Performance characteristics

The percentage information in the "Performance characteristics" section refers to the sensor nominal value.

#### Reference operating conditions

As per DIN IEC 60770 or DIN IEC 61003  
T = 25 °C (77 °F), relative humidity 45 to 75%, ambient air pressure 860 to 1060 kPa (12.47 to 15.37 PSI)  
Supply voltage U = 24 V DC

<b>Maximum measured error switch point and display</b>	<b>Electronics</b> ± 0.2 K (0.36 °F)				
	<b>Sensor</b> <ul style="list-style-type: none"> <li>▪ Tolerance class A as per IEC 60751, -50 to +200 °C (-58 to +392 °F)</li> <li>▪ Maximum measured error in °C = ± 0.15 + 0.002 ·  T </li> </ul>  T  = Process temperature in °C without taking sign into account.				
	<b>Total error</b> Total error = electronics error + sensor error, e.g. for process temperatures: <ul style="list-style-type: none"> <li>▪ -50 to +75 °C (-58 to +167 °F) ≤ 0.5 K (0.9 °F)</li> <li>▪ +75 to +200 °C (+167 to +392 °F) ≤ 0.75 K (1.35 °F)</li> </ul>				
<b>Non-repeatability switch point</b>	0.1 K (0.18 °F) as per EN 61298-2 (without ambient temperature influence)				
<b>Long-term drift</b>	≤ 0.1 K (0.18 °F) per year under reference operating conditions				
<b>Sensor response time</b>	Measured as per IEC 60751, in water flowing at 0.4 m/s (1.3 ft/s)				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; width: 50%;"><math>t_{50}</math></th> <th style="text-align: center; width: 50%;"><math>t_{90}</math></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">&lt; 1.0 s</td> <td style="text-align: center;">&lt; 2.0 s</td> </tr> </tbody> </table>	$t_{50}$	$t_{90}$	< 1.0 s	< 2.0 s
$t_{50}$	$t_{90}$				
< 1.0 s	< 2.0 s				
<b>Long-term reliability</b>	Mean time between failure (MTBF) > 100 years (calculated according to "British Telecom Handbook of Reliability Data No. 5")				
<b>Influence of ambient temperature</b>	<ul style="list-style-type: none"> <li>▪ Switch output and display: ≤ 30 ppm/K</li> <li>▪ Analog output: ≤ 50 ppm/K + influence of switch output and display</li> </ul>				
<b>Switch output response time</b>	100 ms				
<b>Analog output</b>	<ul style="list-style-type: none"> <li>▪ Maximum measured error = switch point error and display error + 0.1%</li> <li>▪ Rise time <math>t_{90}</math>: ≤ 200 ms</li> <li>▪ Settling time <math>t_{99}</math>: ≤ 500 ms</li> </ul>				

## Operating conditions: Installation instructions

<b>Installation instructions</b>	<ul style="list-style-type: none"> <li>▪ Any orientation</li> <li>▪ Housing can be rotated up to 310 °</li> </ul>
<b>Orientation</b>	No restrictions, but self draining.

## Operating conditions: Environment

<b>Ambient temperature range</b>	-40...+85 °C (-40 to +185 °F)
<b>Storage temperature</b>	-40...+85 °C (-40 to +185 °F)
<b>Climate class</b>	4K4H as per DIN EN 60721-3-4

**Degree of protection** IP65 (optional IP66, depending on used connector)

**Shock resistance** 50 g as per DIN IEC 68-2-27 (11 ms)

**Vibration resistance**

- 20 g as per DIN IEC 68-2-6 (10-2000Hz)
- 4 g as per German Lloyd GL Guidelines

**Electromagnetic compatibility**

- Interference emission as per IEC 61326 Series, class B electrical equipment
- Interference immunity as per IEC 61326 Series, appendix A (industrial use) and NAMUR Recommendation NE 21

EMC influence:  $\leq 0.5\%$

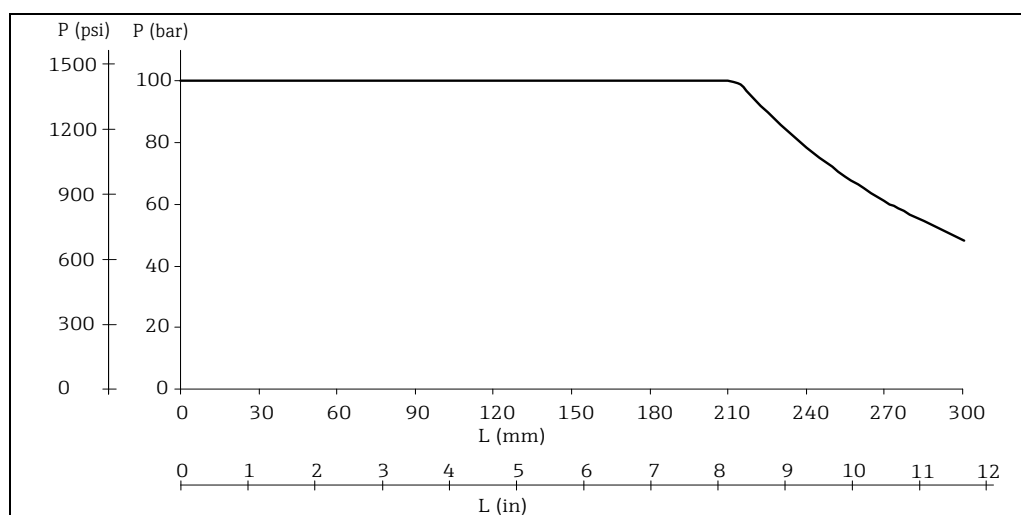
## Operating conditions: Process

**Process temperature limits** -50 to +150 °C (-58 to +302 °F) or -50 to +200 °C (-58 to +392 °F) with neck Restrictions depending on process connection and ambient temperature:

- No restriction with coupling (see Accessories, order no. **51004751, 51004753**) and neck tube length min. 20 mm (0.79 in)
- with process connection:

Max. ambient temperature	Max. process temperature
up to 25 °C (77 °F)	no restriction
up to 40 °C (104 °F)	135 °C (275 °F)
up to 60 °C (140 °F)	120 °C (248 °F)
up to 85 °C (185 °F)	100 °C (212 °F)

**Process pressure limits** Maximum permitted process pressure depending on the insertion length



Maximum permitted process pressure

$L$  = insertion length  
 $p$  = process pressure

The diagram takes into consideration not only the overpressure but also the pressure load caused by the flow, whereby a safety factor of 1.9 has been specified for operation with flow. The maximum

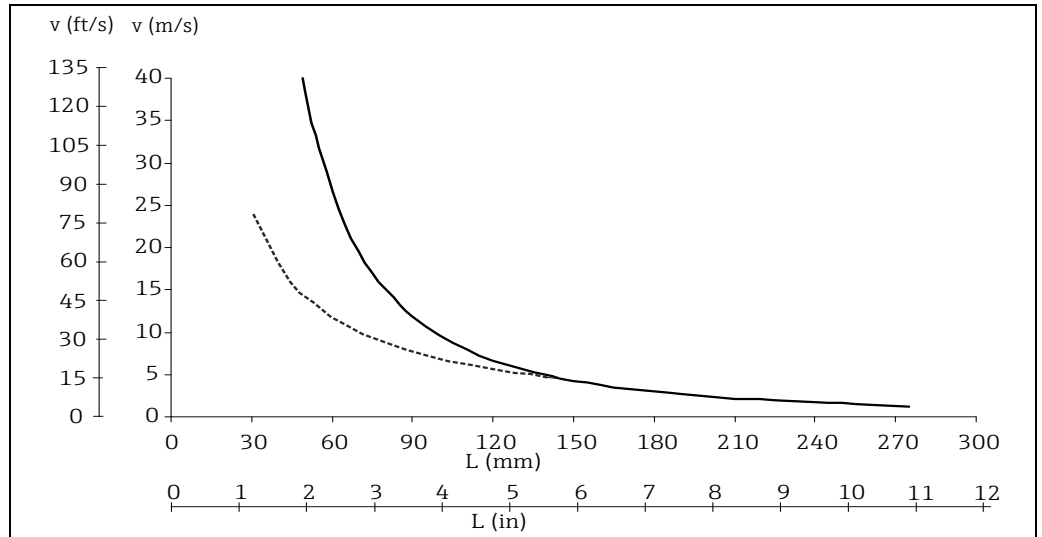


permitted static operating pressure is lower at greater insertion lengths due to the increased bending load caused by the flow. The calculation assumes the maximum permitted medium velocity for the respective insertion length (see diagram below).

**NOTICE**

The maximum process pressure for the conical metal-metal hygienic process connection (Option **MB**) is 16 bar (232 PSI)!

**Permitted flow velocity depending on the insertion length**



Permitted flow velocity

$L$  = Insertion length, during flow

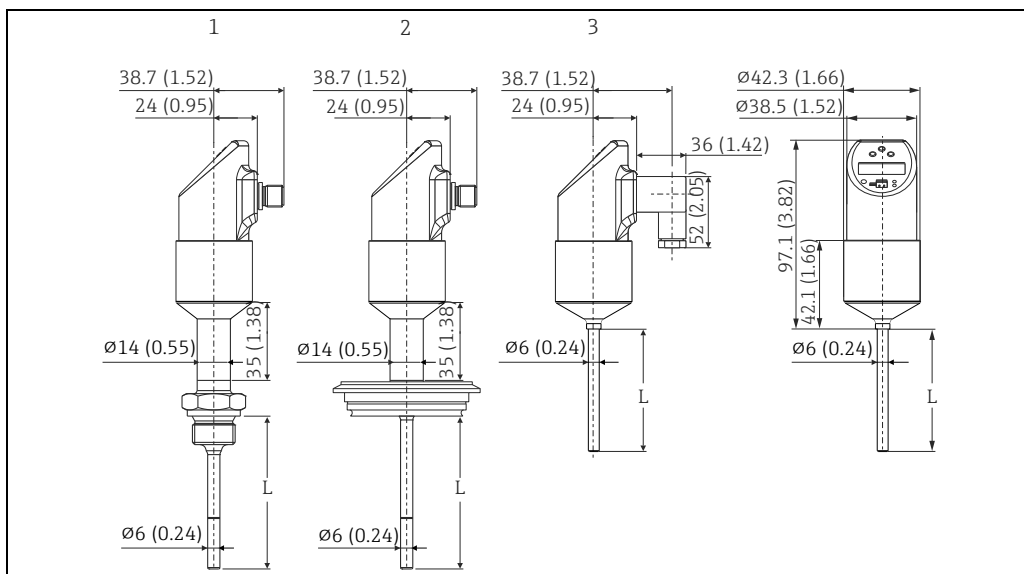
$v$  = Flow velocity

Medium: \_\_\_\_\_ air; \_\_\_\_\_ water

The permitted flow velocity is the minimum from resonance velocity (resonance distance 80%) and load or buckling caused by flow, which would lead to failure of the thermometer tube or to exceedance of the safety factor (1.9). Calculation was performed for the specified limit operating conditions of 200 °C (392 °F) and  $\leq$  100 bar (1450 PSI) process pressure.

## Mechanical construction

### Design, dimensions TTR31, TTR35

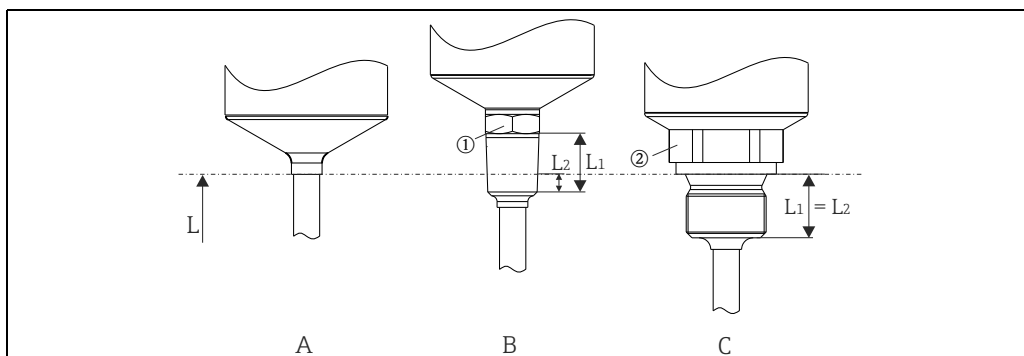


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All dimensions in mm (in)

- 1 TTR31 with neck and M12x1 connector as per IEC 60947-5-2
- 2 TTR35 with neck and M12x1 connector as per IEC 60947-5-2
- 3 M16x1.5 or NPT 1/2" valve plug as per DIN 43650A/ISO 4400
- L Insertion length

### TTR31 design, dimensions for process connections

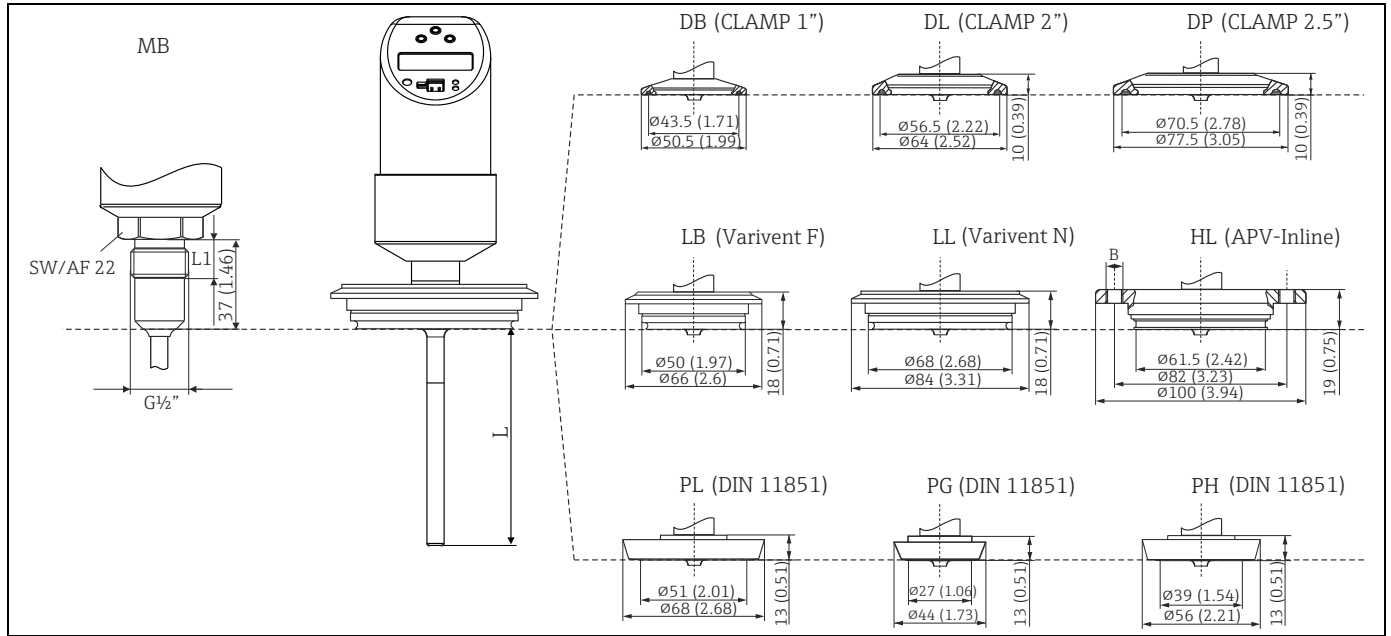


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Process connection of the device TTR31

Pos.-No.	Version TTR31	Thread length L <sub>1</sub>	Thread length L <sub>2</sub>
A	Without process connection. For suitable welding boss and coupling see 'Accessories'.	-	-
B	Thread process connection: <ul style="list-style-type: none"> <li>■ ANSI NPT 1/4" (① = AF14)</li> <li>■ ANSI NPT 1/2" (① = AF27)</li> </ul>	<ul style="list-style-type: none"> <li>■ 14.3 mm (0.56 in)</li> <li>■ 19 mm (0.75 in)</li> </ul>	<ul style="list-style-type: none"> <li>■ 5.8 mm (0.23 in)</li> <li>■ 8.1 mm (0.32 in)</li> </ul>
C	Thread process connection as per ISO 228: <ul style="list-style-type: none"> <li>■ G1/4" (② = AF14)</li> <li>■ G1/2" (② = AF27)</li> </ul>	<ul style="list-style-type: none"> <li>■ 12 mm (0.47 in)</li> <li>■ 14 mm (0.55 in)</li> </ul>	-

**TTR35 design, dimensions for process connections**



All dimensions in mm (in)

L = Insertion length

Item No.	Process connection versions TTR35
MB	Conical metal-metal for hygienic processes, G $\frac{1}{2}$ " thread. Suitable welding boss available as accessory. Thread length L <sub>1</sub> = 14 mm (0.55 in)
DB	Clamp 1"...1½" (ISO 2852) or DN 25...DN 40 (DIN 32676), 3-A marked
DL	Clamp 2" (ISO 2852) or DN 50 (DIN 32676), 3-A marked
DP	Clamp 2½" (ISO 2852), 3-A marked
LB	Varivent <sup>1)</sup> F DN25-32, PN 40, 3-A marked
LL	Varivent <sup>1)</sup> N DN40-162, PN 40, 3-A marked
HL	APV inline, DN50, PN40, 316L, (B = 6 x Ø8.6 bores + 2 x M8 thread), 3-A marked
PL	DIN 11851, DN50, PN40 (including coupling nut), 3-A marked
PG	DIN 11851, DN25, PN40 (including coupling nut), 3-A marked
PH	DIN 11851, DN40, PN40 (including coupling nut), 3-A marked

1) Varivent® process connections are suitable for installation in VARINLINE® housing connection flanges

**Weight** approx. 300 g (10.6 oz), depends on sensor length and process connection

**Material**

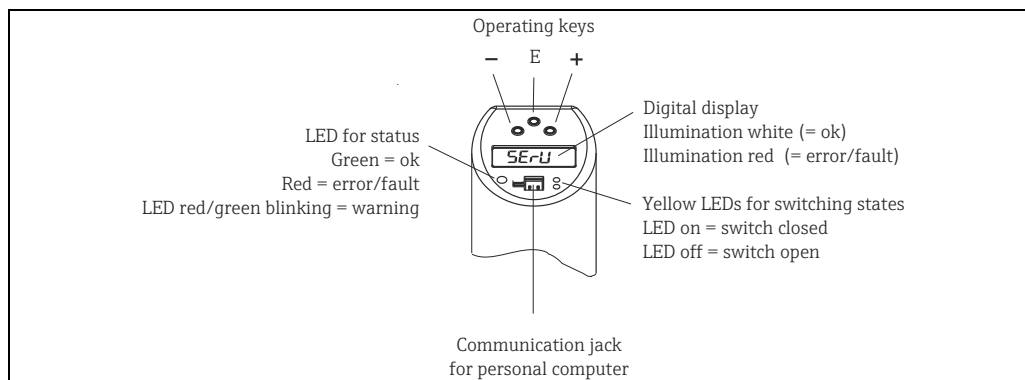
- Process connection: AISI 316L  
Surfaces in contact with process in hygienic version with surface quality R<sub>a</sub> ≤ 0.8 µm (31.5 µin)  
Coupling nut: AISI 304
- Housing: AISI 316L, with surface quality R<sub>a</sub> ≤ 0.8 µm (31.5 µin)  
O ring between housing and sensor modul: EPDM
- Electrical connection:  
M12 connector: exterior AISI 316L, interior polyamide (PA)  
Valve plug: outer polyamide (PA)  
M12 connector: exterior 316L  
Cable outer covering: polyurethane (PUR)  
O ring between electrical connection and housing: FKM

- Display:  
Polycarbonate PC-FR (Lexan®)  
Seal between display and housing: SEBS THERMOPLAST K®
- Keys: Polycarbonate PC-FR (Lexan®)

## Human interface

### Operating elements

Position of display and operating elements



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### On-site operation

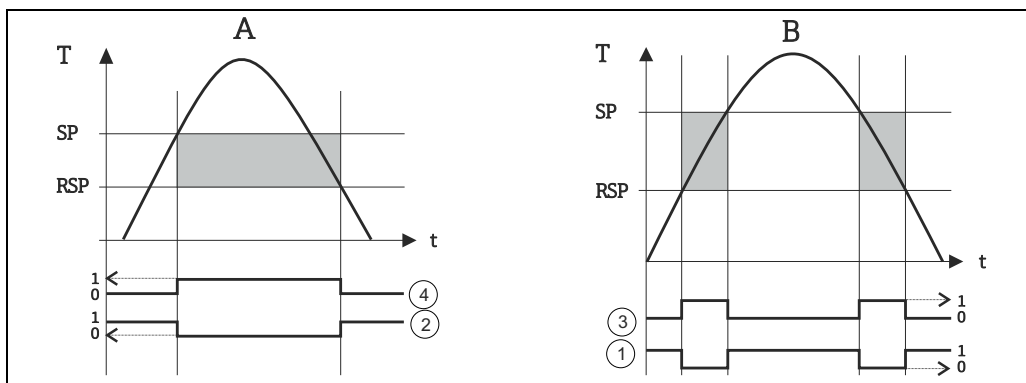
Menu-guided operation using operating keys.

Function group	Operating options
BFSE (basic functions)	Unit selection: °C, °F, K
	Zero point, offset (automatic and manual)
	Damping display value, output signal: anywhere between 0...40 s (in increments of 0.1 s)
	Display: – Display of measured value or of configured switch point – Rotation of display by 180° – Switching off of display
	Behaviour according to DESINA: The PIN assignment of the M12 connector is in accordance with the guidelines of DESINA (DESINA = distributed and standardized installation technology for machine tools and manufacturing systems)

Function group	Operating options
$OUT$ (configuration of 1st output) and $OUT2$ (configuration of 2nd output, only for corresponding electronics version)	Output function: – Hysteresis or window function – NC contact or NO contact (See next diagram) – Analog output 4...20 mA
	Switch point: – Input value – Acceptance of applied value Switch point anywhere between 0.5...100 % URL (in increments of 0.1 %)
	Switch-back point: – Input value – Acceptance of applied value Switch-back point anywhere between 0...99.5 % URL (in increments of 0.1 %)
	Delay of switch point and switch-back point: can be set anywhere between 0...99 s (in increments of 0.1 s)
$URV$ (configuration of analog output, only for corresponding electronic version)	Lower Range Value (LRV) and Upper Range Value (URV) of analog output: – Input value – Acceptance of applied value
	Setting of error current: choice of $\leq 3.6$ mA / $\geq 21.0$ mA / last current value
$SERV$ (service functions)	Resetting of all settings to factory settings
	Setting of locking code
	Security locking
	Static Revision Counter, incremented each time the configuration is changed
	Display of last error to occur
	Switch output 1, switch output 2 and analog output simulation
	Display of max. measured temperature value
	Display of min. measured temperature value

### Switch point functions

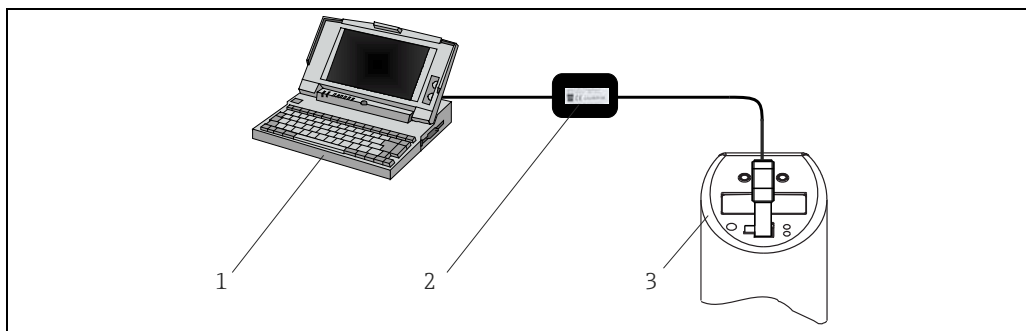
- Hysteresis function  
 The hysteresis function enables two-point control via a hysteresis. Depending on the temperature T, the hysteresis can be set via the switch point SP and the switch-back point RSP.
- Window function  
 The window function enables the setting of a process window.
- NO contact or NC contact  
 This switch function is freely selectable.
- Delay times for switch point SP and switch-back point can be set in increments of 1 s. By this means undesirable temperature peaks of short duration or of high frequency can be filtered out.



Switch point functions

- A Hysteresis function
- B Window function
- ① Window - NC contact
- ② Hysteresis - NC contact
- ③ Window - NO contact
- ④ Hysteresis - NO contact
- SP Switch point
- RSP Switch-back point

Remote operation with PC



Operation, visualization and maintenance with PC and configuration software.

- Item 1: PC with configuration software ReadWin 2000 or FieldCare
- Item 2: Configuration kit TXU10-AA or FXA291 (see "Accessories")
- Item 3: Temperature switch

In addition to the operating options listed in the previous "Onsite operation" section, the ReadWin 2000 or FieldCare configuration software provides further information on the Thermophant T:

Function group	Description
SERVICE	Number of switch changes
	Device status/error
INFO	Tag number
	Order code
	Limit switch serial number
	Electronics serial number
	Hardware version
	Software version
	Device version

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## Certificates and approvals

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<b>CE-Mark</b>	The device meets the legal requirements of the EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.
<b>Other standards and guidelines</b>	<ul style="list-style-type: none"> <li>▪ IEC 60529: Degree of protection by housing (IP code)</li> <li>▪ IEC 61010-1: Safety requirements for electrical measurement, control and laboratory instrumentation.</li> <li>▪ IEC 61326-series: Electrical equipment for measurement, control and laboratory use - EMC requirements.</li> <li>▪ NAMUR: User association of automation technology in process industries (<a href="http://www.namur.de">www.namur.de</a>)</li> <li>▪ NEMA: Standardization association for the electrical industry in North America.</li> </ul>
<b>Hygiene standard</b>	The TTR35 temperature switch meets the requirements of Sanitary Standard no. 74-06. Endress+Hauser confirms this by applying the 3-A symbol (depends on the selected process connection).
<b>UL listed for Canada and USA</b>	The device was examined by Underwriters Laboratories Inc. (UL) in accordance with the standards UL 61010B-1 and CSA C22.2 No. 1010.1-92 and listed under the number E225237 UL.

## Ordering information

Detailed ordering information is available from the following sources:


- In the **Product Configurator** on the Endress+Hauser website:  
[www.endress.com](http://www.endress.com) → Select country → Products → Select device → Device support: Configure your selected product
- From your Endress+Hauser Sales Center:  
[www.endress.com/worldwide](http://www.endress.com/worldwide)



### Product Configurator - the tool for individual product configuration:

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

## Questionnaire

<b>Questionnaire Endress+Hauser Thermophant T TTR31/TTR35</b> <b>Customer specific setup / Kundenspezifische Einstellung</b>	
<b>Unit / Einheit</b>	( ) °C      ( ) °F
<b>Ausgang 1 / Output 1</b>	
Type:	
( ) 1=Fenster Öffner / Window normally closed	
( ) 2=Hysterese Öffner / Hysteresis normally closed	
( ) 3=Fenster Schließer / Window normally open	
( ) 4= <b>Hysterese Schließer / Hysteresis normally open</b>	
SP1:	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Typ -50...150°C: -49.5...150 °C (-57.1...302 °F), <b>45.0 °C (113.0 °F)</b> Typ -50...200°C: -49.5...200 °C (-57.1...392 °F), <b>45.0 °C (113.0 °F)</b>
RSP1:	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> RSP ≤ (SP -0.5 °C) (RSP ≤ (SP -0.8 °F)), <b>44.5 °C (112.1 °F)</b>
<b>Ausgang 2 (nur wenn vorhanden) / Output 2 (only if available)</b>	
Type:	
( ) 1 = Fenster Öffner / Window normally closed	
( ) 2 = Hysterese Öffner / Hysteresis normally closed	
( ) 3 = Fenster Schließer / Window normally open	
( ) 4 = <b>Hysterese Schließer / Hysteresis normally open</b>	
( ) 5 = 4...20 mA (nur wenn vorhanden / only if available)	
SP2:	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Typ -50...150 °C: -49.5...150 °C (-57.1...302 °F), <b>55.0 °C (131.0 °F)</b> Typ -50...200 °C: -49.5...200 °C (-57.1...392 °F), <b>55.0 °C (131.0 °F)</b>
RSP2:	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> RSP ≤ (SP -0.5 °C) (RSP ≤ (SP -0.8 °F)), <b>54.5 °C (130.1 °F)</b>
<b>Analogausgang (nur wenn Ausgang 2 = 4...20 mA) / Analog output (only if output 2 = 4...20 mA)</b>	
Messbereich Anfang: Range low scale:	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Typ -50...150 °C: -50...130 °C (-58...266 °F), <b>0.0 °C (32.0 °F)</b> Typ -50...200 °C: -50...180 °C (-58...356 °F), <b>0.0 °C (32.0 °F)</b> (min. Spanne / min. span: 20 K)
Messbereich Ende: Range high scale:	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Typ -50...150 °C: -30...150 °C (-22...302 °F), <b>150 °C (302 °F)</b> Typ -50...200 °C: -30...200 °C (-22...392 °F), <b>150 °C (302 °F)</b>
Fehlverhalten / Failure mode:	( ) ≤ 3.6 mA      ( ) ≥ 21.0 mA
<b>TAG (2 x 18 Zeichen / characters)</b>	
<input type="text"/>	
<input type="text"/>	
Werkseinstellung fett gedruckt Factory setting in bold	<b>Endress+Hauser</b>  People for Process Automation

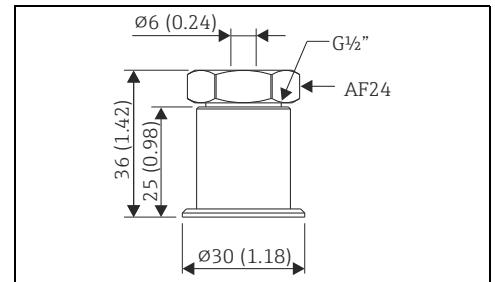


## Accessories

All dimensions in mm (inches).  
 EN10204-3.1 = Material certificate (melt analysis)

### Welding boss with sealing taper for TTR31

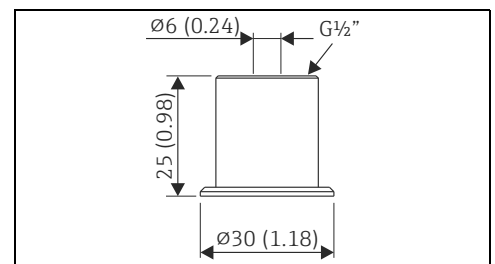
Collar welding boss moveable with sealing taper and pressure screw; material of parts in contact with the process: 316L, PEEK  
 max. process pressure 10 bar (145 PSI)  
 Order number: 51004751



A0020709-EN

### Collar welding boss for TTR31

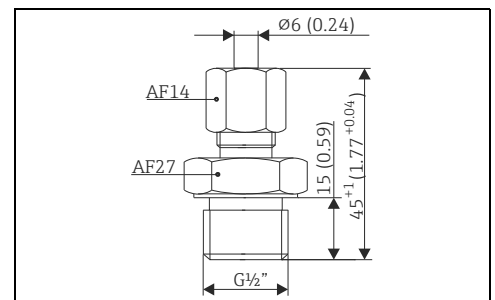
Material of parts in contact with process: 316L  
 Order number: 51004752



A0020710

### Coupling for TTR31

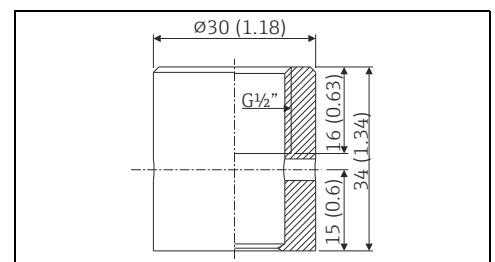
moveable coupling, G1/2" process connection, coupling and parts in contact with process: 316L  
 Order number: 51004753



A0020174-EN

### Welding boss with sealing taper (metal-metal) for TTR35

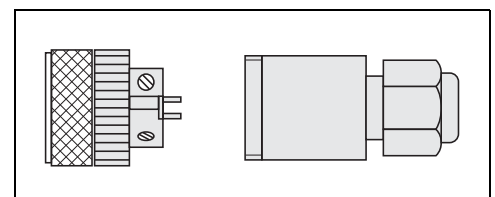
Welding boss for G1/2" thread  
 Seal, metal-metal,  
 Material of parts in contact with process: 316L/1.4435  
 Max. process pressure 16 bar (232 PSI)  
 Order number: 60021387



A0006621

### Coupling

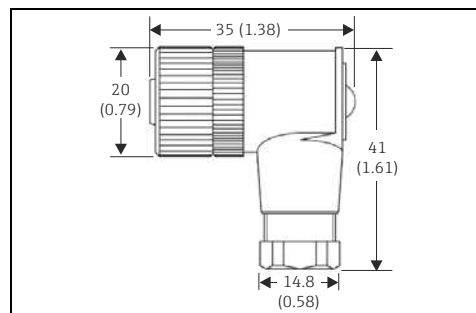
Coupling M12x1 for simple user installable assembly of the connecting cable; straight connection to M12x1 housing connector  
 Order number: 52006263



P01-PMP13xxx-00-xx-00-xx-003

**Coupling**

Coupling M12x1 for simple user installable assembly of the connecting cable; elbowed; connection to M12x1 housing connector IP67, PG7  
Order number: 51006327



A0020722

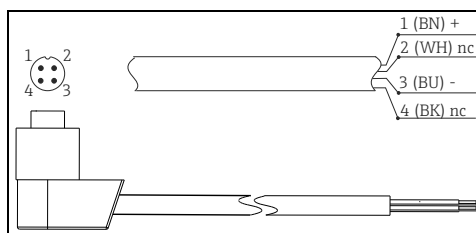
**Connecting cable (pre-assembled)**

PVC cable, 4 x 0.34 mm<sup>2</sup> (22 AWG) with M12x1 coupling, elbowed, screw plug, length 5 m (16.4 ft), IP67

Order number: 51005148

Core colours:

- 1 = BN brown
- 2 = WH white
- 3 = BU blue
- 4 = BK black



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**Connecting cable with LED**

PVC cable, 4 x 0.34 mm<sup>2</sup> (22 AWG) with M12x1 coupling, with LED, elbowed, 316L screw plug, length 5 m (16.4 ft), specially for hygiene applications, IP 69K

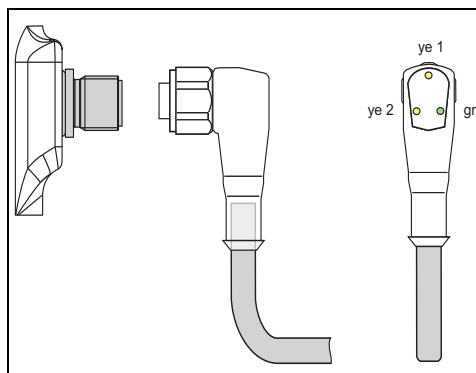
Order number: 52018763

Display:

- gn: device operational
- ye1: switch status 1
- ye2: switch status 2



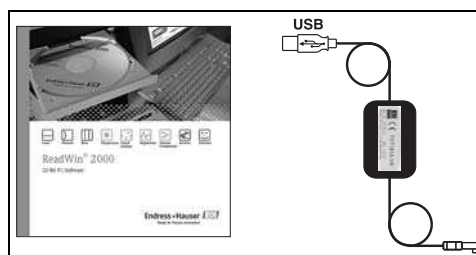
Not for use at devices with "4 to 20 mA analog output" option!



T09-TTR31xxx-00-00-xx-xx-001

**Configuration kit**

- Configuration kit for PC-programmable transmitters - ReadWin 2000 setup program and interface cable for PCs with USB port. Adapter for transmitters with 4-pole post connector.  
Order code: **TXU10-AA**
- Configuration kit "Commubox FXA291" with interface cable for PCs with USB port. Intrinsically safe CDI interface (Endress+Hauser Common Data Interface) for transmitters with 4-pole post connector. Suitable device configuration tool is e.g. FieldCare.  
Order code: **FXA291**



A0008067

**Configuration software**

- ReadWin 2000 and FieldCare 'Device Setup' can be downloaded free of charge directly from the internet at the following addresses:

[www.endress.com/readwin](http://www.endress.com/readwin)

[www.products.endress.com/fieldcare](http://www.products.endress.com/fieldcare)

For the order of the FieldCare 'Device Setup' software please ask your Endress+Hauser sales organization.

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**Power supply**

- Power supply Easy Analog RNB130 by Endress+Hauser with nominal output current  $I_N = 1.5 \text{ A}$ . Details see Technical information **TI120R/09/en**.
- Process display RIA452 by Endress+Hauser with transmitter power supply, max. output current  $I = 250 \text{ mA}$ . Details see Technical information **TI113R/09/en**.

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## Documentation

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**Technical information**

- Easy Analog RNB130: TI120R/09/en
- Process display RIA452: TI113R/09/en
- Universal Data Manager Ecograph T: TI01079R/09/en
- Data logger Minilog B: TI089R/09/en

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**Operating Instructions**

- Thermophant T TTR31 / TTR35 temperature switch: BA00229R/09/en
- Configuration software ReadWin 2000: BA137R/09/en
- Configuration software FieldCare: BA027S/04/c4

[www.addresses.endress.com](http://www.addresses.endress.com)

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