Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical information

Easytemp® TMR31, TMR35

Compact thermometer
Pt100, Class A. Optionally with integrated 4 to 20 mA transmitter, programmable via PC.

Application

The Easytemp® TMR31 and TMR35 compact thermometers are used to measure temperatures from -50 °C to 150 °C (-58 °F to 302 °F), or up to 200 °C (392 °F) with neck. The most common installation locations are tanks and pipes.

- TMR31 with process connections for general applications.
- TMR35 with process connections for hygienic applications.

Benefits at a glance

- 4-wire, Pt100 or PC-programmable transmitter with 4 to 20 mA output and USB (no separate energy source required)
- Configuration and visualization with ReadWin® 2000 PC operating software
- Preset measuring range
- Highly accurate sensor and electronics
- Breakdown information in event of sensor break or sensor short-circuit, adjustable as per NAMUR NE43
- GL (Germanischer Lloyd) ship building approval
- UL recognized component to UL 61010B-1
- 3-A approval for TMR35
- Small, compact design
- M12 connector with IP 66/67
- Variable insertion lengths
- Quick and easy installation and commissioning
- Compact thermometer made entirely of stainless steel (parts in contact with process: 316L)
- Platinum measuring resistor Pt100, accuracy class A (IEC 60751)

TI123R/09/en
71006018

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

Electronic recording and conversion of input signals in industrial temperature measurement.

Measuring system

The compact thermometer uses a Pt100 (Class A) sensor element for measurement. The device is available with a Pt100 4-wire connection or, optionally, with an analog, temperature-linear 4 to 20 mA output signal. A built-in transmitter in the device converts the Pt100 input signal into the 4 to 20 mA signal and can be programmed using a PC via the M12 connector. The compact thermometer has different process connections for general (TMR31) and hygienic applications (TMR35).

Input

Measuring principle

Temperature (temperature-linear transmission behavior)

Measuring range

Designation	Measuring range limits	Min. span
Pt100 as per IEC 60751	-50 to 150 °C (-58 to 302 °F) without neck -50 to 200 °C (-58 to 392 °F) with neck	10 K (18 °F)
Sensor current: ≤ 0.6 mA		

Output

Output signal

- Standard: Pt100, Class A, 4-wire
- Optional: 4 to 20 mA or 20 to 4 mA

Signal on alarm

Signal on alarm as per NAMUR NE43
- Underranging: Linear drop to 3.8 mA
- Overranging: Linear rise to 20.5 mA
- Sensor break; sensor short-circuit:
  ≤ 3.6 mA or ≥ 21.0 mA (at settings ≥ 21.0 mA, 21.5 mA output is guaranteed)

Maximum load

($U_{power\ supply}$ - 10 V) / 0.023 A (current output)

Min. current consumption

≤ 3.5 mA

Current limit

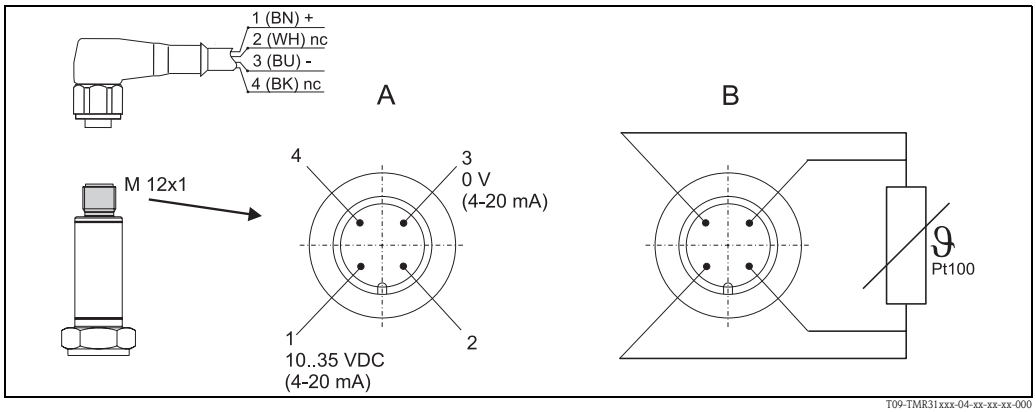
≤ 23 mA

Switch-on delay

2 s

Power supply

Electrical connection



Pos. A: with electronics, M12 plug, 4-pin
Pin 1: power supply 10 to 35 V DC; current output 4 to 20 mA (cable connection, wire color brown = BN)
Pin 2: connection of PC configuration cable - shortened pin (cable connection, wire color white = WH)
Pin 3: power supply 0 V DC; current output 4 to 20 mA (cable connection, wire color blue = BU)
Pin 4: connection of PC configuration cable - shortened pin (cable connection, wire color black = BK)

Pos. B: without electronics, Pt100, 4-wire connection

Supply voltage

U_b= 10 to 35 V DC

Residual ripple

Permitted residual ripple $U_{ss} \leq 3$ V at $U_b \geq 13$ V, $f_{max.} = 1$ kHz

Performance characteristics

Response time of electronics

1 s

Reference operating conditions

- Calibration temperature (ice bath) 0 °C (32 °F) for Pt100 sensor
- Ambient temperature 25 °C ± 5 °C (77 °F ± 9 °F) for transmitter

Maximum measured error

Electronics

0.1 K (0.18 °F) or 0.08%
% relates to the set span. The larger value applies.

Sensor (Pt100) for version without transmitter

- Tolerance class A as per IEC 60751, with operating temperature range:
  -50 to 150 °C (-58 to 302 °F) without neck
  -50 to 200 °C (-58 to 392 °F) with neck
- Maximum measured error in °C = 0.15 + 0.002 · |T|

|T| = Numerical value of the temperature in °C without regard to the leading sign.

Total deviation of electronics + sensor

0.25 K + 0.002 · |T|
With calibration and sensor transmitter matching: ≤ 0.2 K over the entire measuring range

Long-term stability of electronics

≤ 0.1 K (0.18 °F)/year or ≤ 0.05%/year
Data under reference conditions. % relates to the set span. The larger value applies.

Influence of ambient temperature (temperature drift)

- Pt100 resistance thermometer:
  T_d= ±(15 ppm/K * (full scale value of measuring range + 200) + 50 ppm/K * set measuring range) * Δ ϑ

Δ ϑ = deviation of ambient temperature from the reference operating condition.

Influence of load

± 0.02%/100 Ω
Specifications refer to the full scale value of the measuring range.

Sensor response time

As per IEC 60751, in water flowing at 0.4 m/s (1.3 ft/s)

t_{50}	t_{90}
≤ 2.0 s	≤ 4.0 s

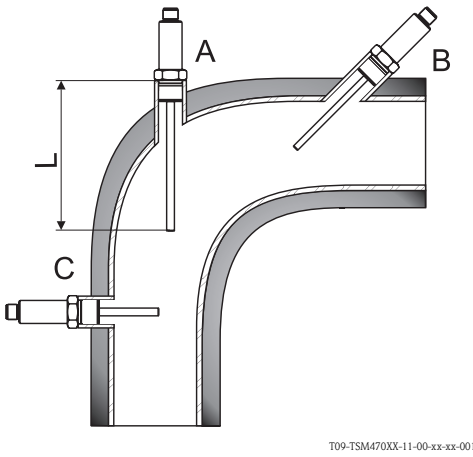
Influence of supply voltage

≤ ±0.01%/V deviation from 24 V
Specifications in percent refer to the full scale value of the measuring range.

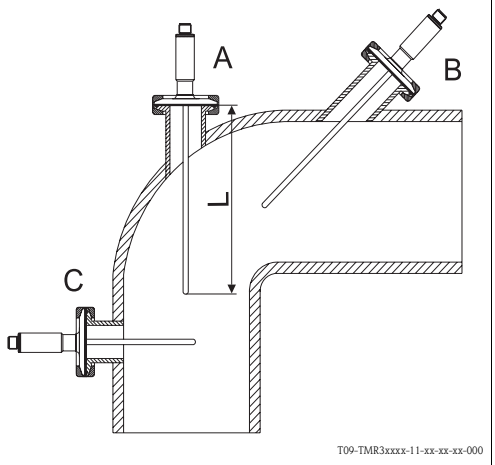
Installation conditions

Installation instructions

Mounting location



TMR31 - general applications



TMR35 - hygienic applications

Pipe installation of the compact thermometer:

- Pos. A: On angle brackets
- Pos. B: In smaller pipes, inclined
- Pos. C: Perpendicular to the direction of flow
- L = Insertion length

Note!
The insertion length of the compact thermometer can have a substantial influence on the accuracy. If the insertion length is insufficient, heat dissipation via the process connection and the container wall can cause measurement errors. To minimize errors caused by heat dissipation, a minimum insertion length of L_{min} = 50 mm (1.97") is recommended.

Environment conditions

Ambient temperature limits	-40 to +85 °C (-40 to 185 °F)
Storage temperature	-40 to +100 °C (-40 to 212 °F)
Climate class	As per IEC 60654-1, Class C
Degree of protection	IP 66/67
Shock resistance	4g / 2 to 150 Hz as per IEC 60068-2-6
Vibration resistance	Refer to 'Shock resistance'
Electromagnetic compatibility (EMC)	Interference immunity and emitted interference as per IEC 61326 and NAMUR NE21.
Condensation	Permitted

Process conditions

Process temperature limits

The electronics of the TMR31 and TMR35 must be protected from temperatures above 85 °C (185 °F) by a neck of appropriate length. TMR31 and TMR35 compact thermometers without electronics (Pt100, 4-wire) do not require a neck.

- -50 to 150 °C (-58 to 302 °F) without neck
- -50 to 200 °C (-58 to 392 °F) with neck
- -50 to 200 °C (-58 to 392 °F) without electronics

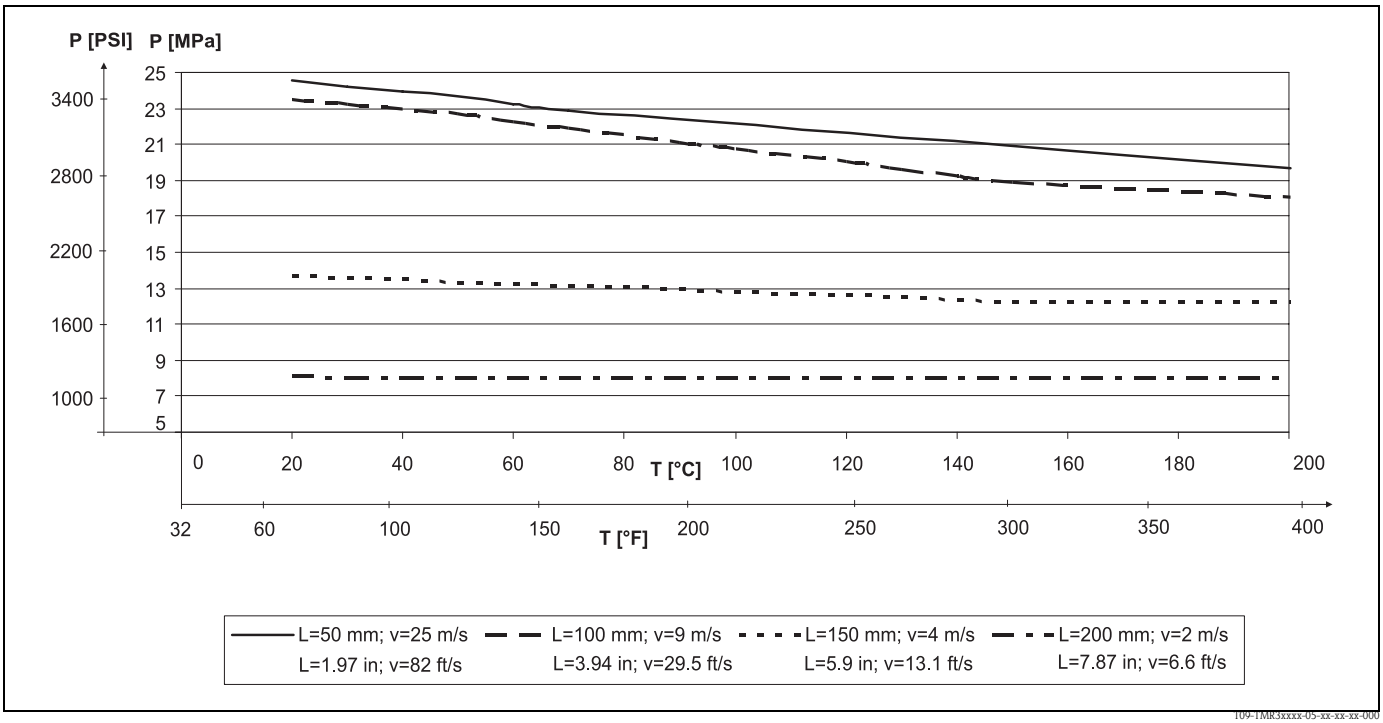
Caution!
Restrictions depending on process connection and ambient temperature:

- For installation with adjustable insertion length (welding boss with sealing taper, Order No. **51004751**; collar welding boss Order No. **51004752**; compression fitting with sealing taper, Order No. **51004753**) provide a neck with an appropriate length.

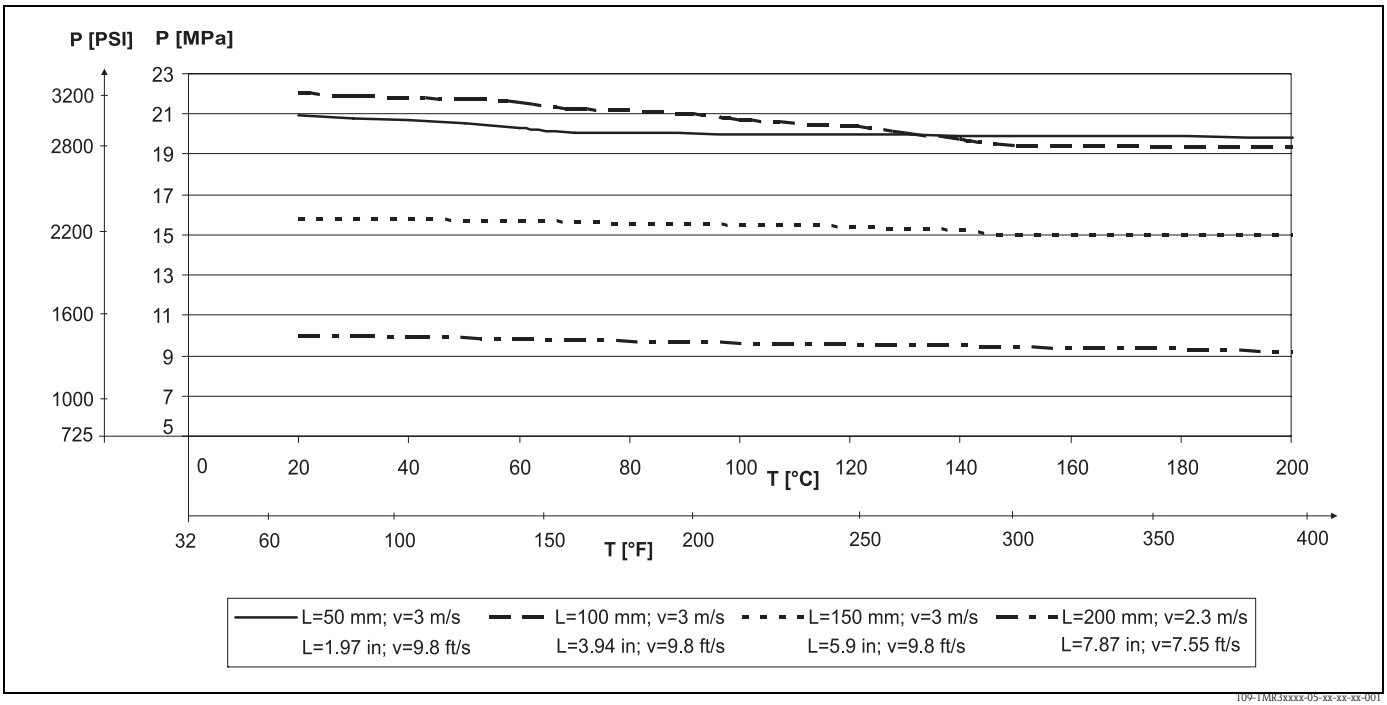
- For TMR31 with process connection:

Max. ambient temperature	Max. process temperature	
	Without neck	With neck
Up to 25 °C (77 °F)	150 °C (302 °F)	200 °C (392 °F)
Up to 40 °C (104 °F)	135 °C (275 °F)	180 °C (356 °F)
Up to 60 °C (140 °F)	120 °C (248 °F)	160 °C (320 °F)
Up to 85 °C (185 °F)	100 °C (212 °F)	133 °C (271 °F)

Process pressure limits



p/T load diagram as per DIN 43772 for air

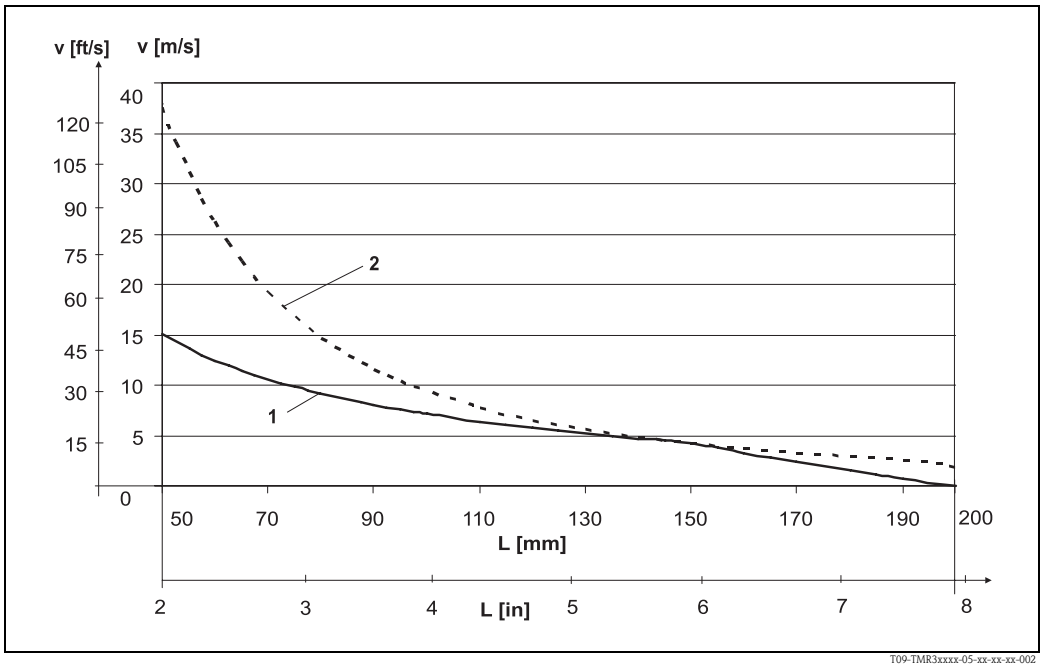


p/T load diagram as per DIN 43772 for water

Legend:
- P = Pressure in MPa (PSI)
- T = Temperature in °C (°F)
- v = Flow velocity in m/s (ft/s)
- L = Insertion length in mm (inch)

Note!
These diagrams show the curve of the maximum permitted outside overpressure for the media water/water vapor and air at various inflow velocities, which here is v = 3 m/s (9.84 ft/s) for water and v = 25 m/s (82 ft/s) for air, and the maximum permitted inflow velocity.
The diagram takes into consideration both the overpressure and the pressure load from inflow, whereby a safety factor of 1.9 has been used for the flow. In each case, the lesser value for the maximum permitted pressure is specified.
The inflow velocity is also limited by the resonance velocity. The resonance is calculated at the maximum working temperature of the material, which here is 400 °C (752 °F). The resonance velocity is greater at lower temperatures. A resonance separation of 80% applies for the maximum permitted excitation frequencies.

Permitted inflow velocity depending on the insertion length



Item 1: in water

Item 2: in air

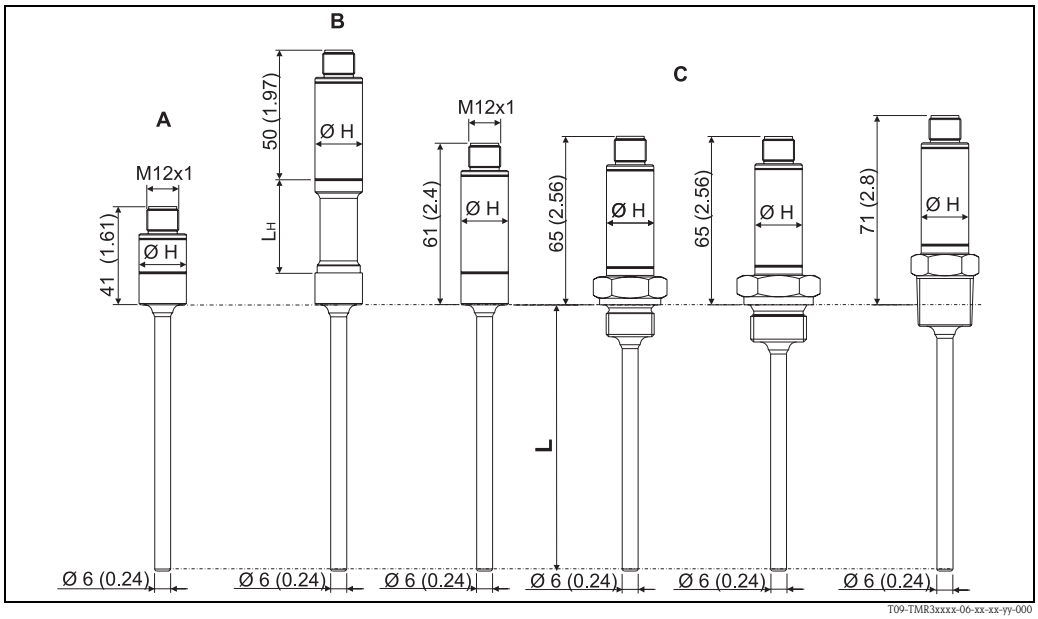
L = Insertion length in mm (inch)

v = Inflow velocity in m/s (ft/s)

Note!
The permitted inflow velocity is the minimum resonance velocity (resonance separation 80 %) and stress or buckling due to flow that would cause the thermometer or thermowell to fail or cause the safety factor to fall below 1.9. The calculation was done for the specified limit operating conditions of 200 °C (392 °F) and a process pressure of 10 MPa (1450 PSI).

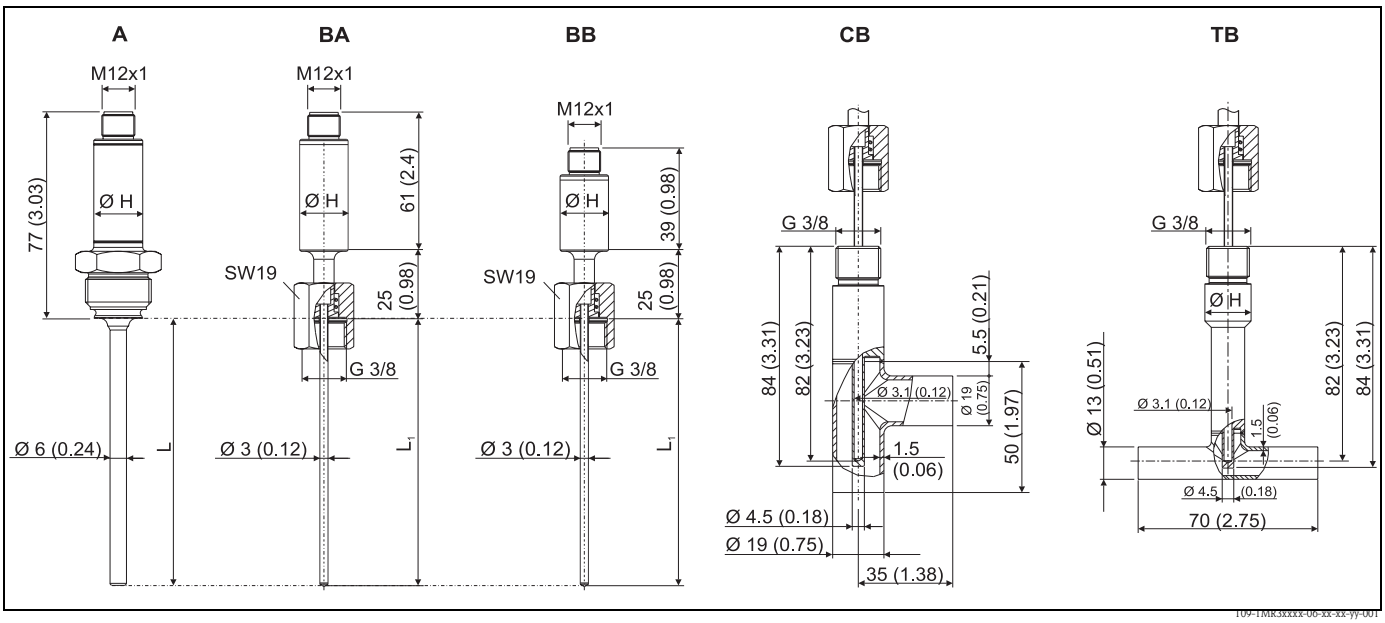
Mechanical construction

Design, dimensions



TMR31 - dimensions in mm (inch)

Item No.	TMR31 version
A	Short sleeve (without built-in electronics)
B	With neck; L_H = neck length 35 mm or 50 mm (1.38" or 1.97")
C	Different process connection variants (see Process connection)
L	Insertion length L variable from 30 to 600 mm (1.18" to 23.6")
Ø H	Sleeve diameter 18 mm (0.71")



TMR35 - dimensions in mm (inch)

Item No.	TMR35 version
A	Version with adapter concept for process connection
BA	Insertion length L_1 = 38 mm (1.5")
BB	Insertion length L_1 = 83 mm (3.27") - in the grafic is the version with short sleeve (without built-in electronics
CB	Thermowell version corner piece DN15, insertion length = 83 mm (3.27")
TB	Thermowell version T-piece DN10, insertion length = 83 mm (3.27")
L	Insertion length L variable from 30 to 600 mm (1.18" to 23.6")
Ø H	Sleeve diameter 18 mm (0.71")

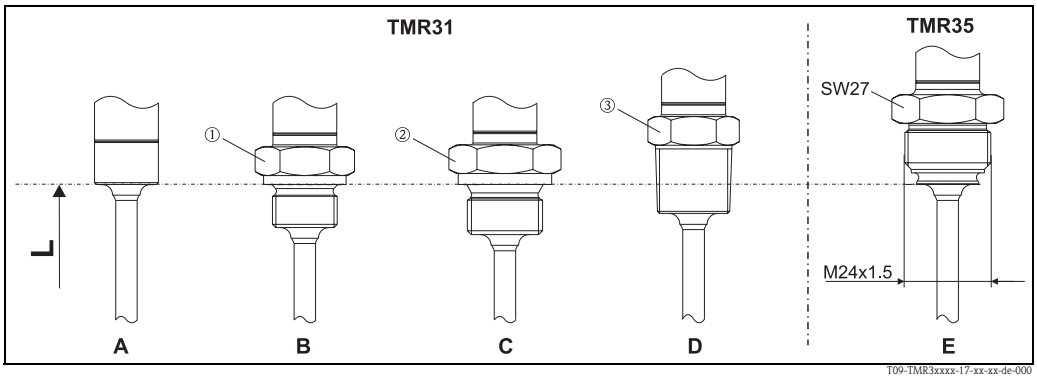
Weight

Version with L = 100 mm (3.94")	Weight
TMR31 with G½, ISO 228 process connection	116 g (4.1 oz)
TMR35 with ISO2852 DN25-38, with clamp process connection adapter (DB) 1 to 1½"	305 g (10.76 oz)

Material

- Transmitter housing: SS 304
- Parts in contact with process and process connection: SS 316L, $R_a \leq 0.8$ µm (31.5 µinch). Optionally for TMR35 $R_a \leq 0.4$ µm (15.74 µinch), electro-polished.

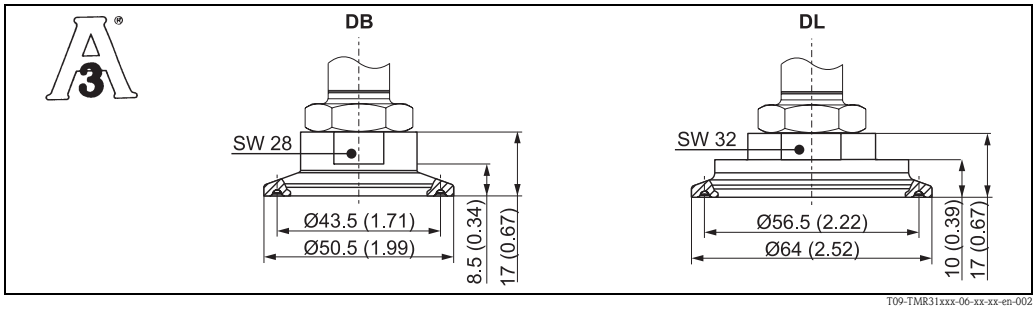
Process connection



Item No.	Version (L = insertion length)
A	Version without process connection. Refer to "Accessories" for matching welding bosses and compression fittings.
B	Version with metric thread process connection M14x1.5 (① = SW19) and M18x1.5 (① = SW24).
C	Version with inch thread process connection, cylindrical, G ¼ (② = SW19) and G ½ (② = SW27) as per ISO 228.
D	Version with inch thread process connection, conical, ANSI ¼" NPT (③ = SW19) and ½" NPT (③ = SW27), BSPT R ½" (③ = SW22).
E	Adapter concept - version with M24x1.5 thread for adapters with process connection for hygienic processes.

Note!
A sealing ring (Cu) is included in the scope of delivery of the versions with process connection.

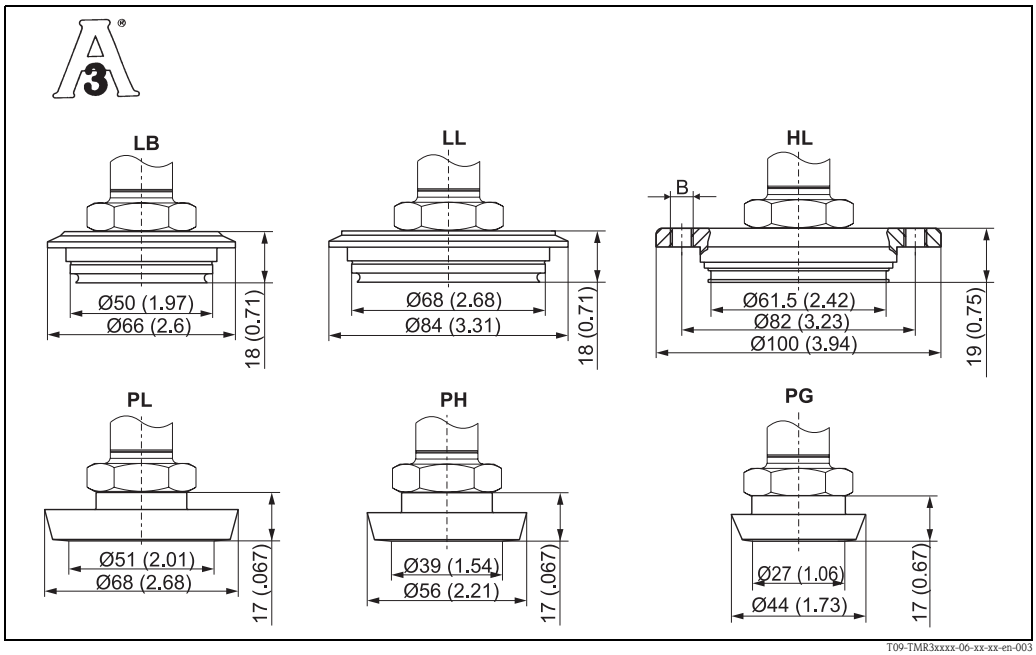
Adapters for clamp connections



Process connection versions (adapters)
DB: clamp 1" to 1½" (ISO 2852) or DN 25 to DN 40 (DIN 32676)
DL: clamp 2" (ISO 2852) or DN 50 (DIN 32676)

Also refer to the "Ordering information" section
All dimensions in mm (inch).

Adapters for hygienic connections



Process connection versions (adapters)
LB: Varivent F pipe DN 25-32, PN 40
LL: Varivent N pipe DN 40-162, PN 40
HL: APV inline, DN 50, PN 40, 316L, (B = 6 x Ø8.6 (0.34") bores + 2 x M8 thread)
PL: DIN 11851, DN 50, PN 40 (including cap-nut)
PH: DIN 11851, DN 40, PN 40 (including cap-nut)
PG: DIN 11851, DN 25, PN 40 (including cap-nut)

Also refer to the "Ordering information" section
All dimensions in mm (inch).

Human interface

Display elements

No display elements are present directly on the device.
The measured value and other displays can be called up using the ReadWin® 2000 PC software.

Operating elements

No operating elements are present directly on the display. The temperature transmitter is configured by remote operation, without an additional power supply using the ReadWin® 2000 PC software.

Remote operation

Configuration
Configuration kit TXU10-BA with PC operating program (ReadWin® 2000).

Interface
PC interface: TTL/USB connecting cable with plug connector.

Configurable parameters
Measurement dimension (°C/°F), Measuring range, failsafe mode, output signal (4 to 20 mA / 20 to 4 mA), offset, tag name (8 characters), output simulation, sensor transmitter matching.

Certificates and approvals

CE mark

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.

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA) can be supplied by your E+H Sales Center on request. All explosion protection data are given in separate Ex documentation which is also available upon request.

Hygiene standard

The TMR35 compact thermometer fulfills the requirements of Sanitary Standard No. 74-02. Endress+Hauser confirms this by applying the 3-A symbol.

Note!
Does not apply for process connection options **MB**: 'Conical metal-to-metal' and **R1**: 'Spring-loaded cap-nut'

GL

Ship building approval (Germanischer Lloyd)

Other standards and guidelines

- IEC 60529:
  Degree of protection provided by housing (IP code)
- IEC 61010:
  Safety requirements for electrical equipment for measurement, control and laboratory use
- IEC 61326:
  Electromagnetic compatibility (EMC requirements)
- NAMUR
  Standards working group for measurement and control technology in the chemical industry

UL

UL recognized component to UL 61010B-1

Note!
The UL applies only for the compact thermometers TMR31, TMR35 with electronics and 4 to 20 mA output signal.

Ordering information

Product structure

Easytemp® TMR31 compact thermometer
Pt100/4-wire compact thermometer, Cl. A, PC-programmable, M12 connector, 4 to 20 mA analog output 4-wire, failsafe mode as per NAMUR NE43, process connection for general applications.

	Approval:											
	A	Version for non-hazardous areas										
		Electrical connection:										
		1	Plug M12, IP66/67									
			Output; Measuring range:									
			A	4 to 20 mA; 0 to 100 °C (32 to 212 °F)								
			B	4 to 20 mA; 0 to 150 °C (32 to 302 °F)								
			C	4 to 20 mA; -50 to 100 °C (-58 to 212 °F)								
			D	4 to 20 mA; -50 to 150 °C (-58 to 302 °F)								
			E	4 to 20 mA; -50 to 200 °C (-58 to 392 °F)								
			X	4 to 20 mA; to be specified								
			1	Pt100, DIN class A, 4-wire								
				Neck; measuring range:								
				A	without							
				B	35 mm (1.38")							
				C	50 mm (1.97")							
					Process Connection:							
					AA	Compr. fitting, 316L, L ≥ 100 mm (3.94") Insertion length						
					AB	Thread ANSI ¼ NPT, 316L						
					AC	Thread ANSI ½ NPT, 316L						
					BA	Thread ISO228 G¼, 316L						
					BB	Thread ISO228 G½, 316L						
					JA	Thread BSPT R½, JIS 0203, 316L						
					MA	Thread M14 x 1.5, 316L						
					MB	Thread M18 x 1.5, 316L						
						Insertion Length L; Diameter D:						
						AB	50 mm; 6 mm (1.97"; 0.24")					
						AC	100 mm; 6 mm (3.94"; 0.24")					
						AD	120 mm; 6 mm (4.72"; 0.24")					
						AE	150 mm; 6 mm (5.9"; 0.24")					
						AG	200 mm; 6 mm (7.87"; 0.24")					
						AH	250 mm; 6 mm (9.84"; 0.24")					
						AJ	300 mm; 6 mm (11.81"; 0.24")					
						AX	... mm; 6 mm (30 to 300 mm) / ..."; 0.24" (1.81" to 11.81")					
						BA	20 mm; 4 mm (0.79"; 0.16")					
						BX	... mm; 6 mm (300 to 600 mm) / ..."; 0.24" (11.81" to 23.62")					
								Material; surface roughness:				
								1	316L, $R_a \leq 0.8$ µm (31.5 µinch)			
									Material certificate:			
									A	Without material certificate		
									B	EN10204-3.1 cast analysis, short form		
									C	EN10204-3.1 cast analysis, long form		
									D	EN10204-3.1 cast analysis + R, short form		
									E	EN10204-3.1 cast analysis + R, long form		
										Works Calibration:		
										A	without	
										B	2-points 0 °C; 1x variable -20 to 150 °C (-4 to 302 °F)	
										C	3-points 0 °C; 2x variable -20 to 150 °C (-4 to 302 °F)	
											Version:	
											A	Standard
											K	Standard model, North American region
TMR31-	**A**	**1**					**1**				⇒ **Order code**	

Easytemp® TMR35 compact thermometer
Pt100/4-wire compact thermometer, Cl. A, PC-programmable, M12 connector, 4 to 20 mA analog output 4-wire, failsafe mode as per NAMUR NE43, hygienic applications. Conforms to 3-A 74-02 with process connections DB, DL, HL, LB, LL, PG, PH, PL.

Approval:

A	Version for non-hazardous areas

Electrical connection:

1	Plug M12, IP66/67

Output; Measuring range:

A	4 to 20 mA; 0 to 100 °C (32 to 212 °F)
B	4 to 20 mA; 0 to 150 °C (32 to 302 °F)
C	4 to 20 mA; -50 to 100 °C (-58 to 212 °F)
D	4 to 20 mA; -50 to 150 °C (-58 to 302 °F)
E	4 to 20 mA; -50 to 200 °C (-58 to 392 °F)
X	4 to 20 mA; to be specified
1	Pt100, DIN class A, 4-wire

Neck:

A	without
B	35 mm (1.38")

Process Connection:

DB	Clamp ISO2852 DN25 to 38, 1 to 1½", 316L, 3-A
DL	Clamp ISO2852 DN40 to 51, 2", 316L, 3-A
HL	APV-Inline DN50 PN40, 316L, 3-A
LB	Varivent F pipe DN25 to 32, PN40, 316L, 3-A
LL	Varivent N pipe DN40 to 162, PN40, 316L, 3-A
MB	Conical metal-to-metal G½A, 316L
PG	DIN11851 DN25, PN40, 316L, 3-A
PH	DIN11851 DN40, PN40, 316L, 3-A
PL	DIN11851 DN50, PN40, 316L, 3-A
R1	Spring-loaded cap-nut for mounting in the thermowell G3/8"

Insertion Length L; Diameter D:

AA	30 mm; 6 mm (1.18"; 0.24")
AB	50 mm; 6 mm (1.97"; 0.24")
AC	100 mm; 6 mm (3.94"; 0.24")
AE	150 mm; 6 mm (5.9"; 0.24")
AG	200 mm; 6 mm (7.87"; 0.24")
AX	... mm; 6 mm (30 to 300 mm) / ..."; 0.24", (1.18" to 11.81")
BA	38 mm; 3 mm (1.5"; 0.12")
BB	83 mm; 3 mm (3.27"; 0.12")
BX	... mm; 6 mm (300 to 600 mm) / ..."; 0.24", (11.81" to 23.62")
CB	DN15, L = 82 mm; 3 mm, (3.23"; 0.12") corner piece
TB	DN10, L = 82 mm; 3 mm, (3.23"; 0.12") T-piece

Material; surface roughness:

1	316L, $R_a \leq 0.8$ µm (31.5 µinch)
2	316L, $R_a \leq 0.4$ µm (15.74 µinch)
3	316L, $R_a \leq 0.4$ µm (15.74 µinch), electro-polished

Material certificate:

A	Without
B	EN10204-3.1 cast analysis, short form
C	EN10204-3.1 cast analysis, long form
D	EN10204-3.1 cast analysis + R, short form
E	EN10204-3.1 cast analysis + R, long form

Works Calibration:

A	without
B	2-points 0 °C; 1x variable -20 to 150 °C (-4 to 302 °F)
C	3-points 0 °C; 2x variable -20 to 150 °C (-4 to 302 °F)

Version:

A	Standard
K	Standard model, North American region

TMR35-	**A**	**1**									⇒ **Order code**

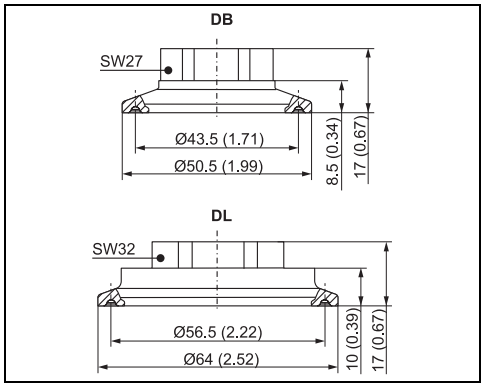
Accessories

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

Clamp adapter

Order numbers for clamp adapter versions.

- Version DB
  Without EN10204-3.1: order no. 71020524
  With EN10204-3.1: order no. 51008165
- Version DL
  Without EN10204-3.1: order no. 71020525
  With EN10204-3.1: order no. 51008166

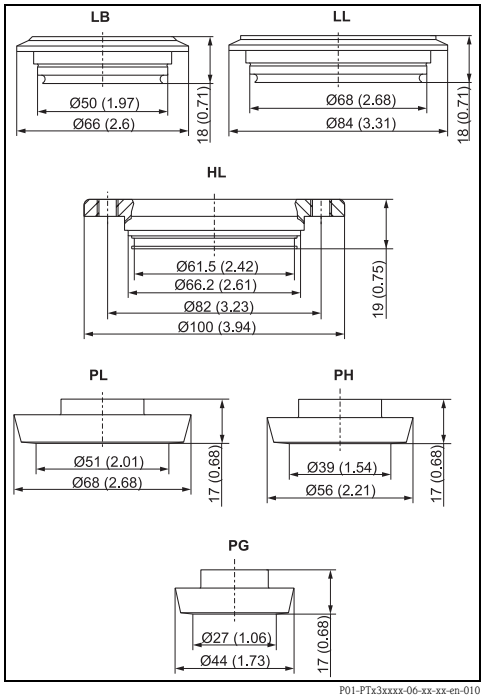


P01-PTx3xxxx-06-xx-xx-en-009

Hygiene adapter

Order numbers for hygiene adapter versions.

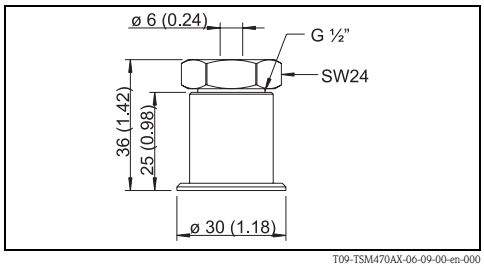
- Version LB: order no. 51008170
- Version LL: order no. 51008171
- Version HL: order no. 51007718
- Version PG
  With EN10204-3.1: order no. 71007023
  Coupling nut: order no. 71007021
- Version PH
  Without EN10204-3.1: order no. 71020526
  With EN10204-3.1: order no. 51008167
  Coupling nut: order no. 51009524
- Version PL
  Without EN10204-3.1: order no. 71020528
  With EN10204-3.1: order no. 51008169
  Coupling nut: order no. 51009525



P01-PTx3xxxx-06-xx-xx-en-010

Welding boss with sealing taper

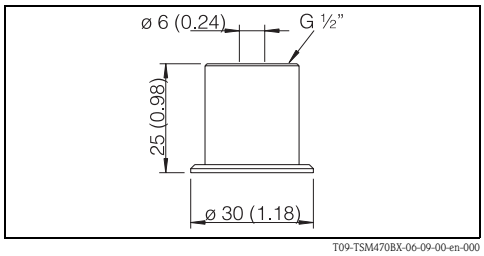
Collar welding boss
Seal, moveable compression fitting, material of parts in contact with process: 316L, PEEK
Order no. 51004751



T09-TSM470AX-06-09-00-en-000

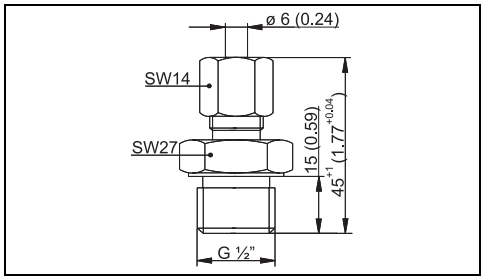
Collar welding boss

Material of parts in contact with process: 316L
Order no. 51004752



Compression fitting with sealing taper

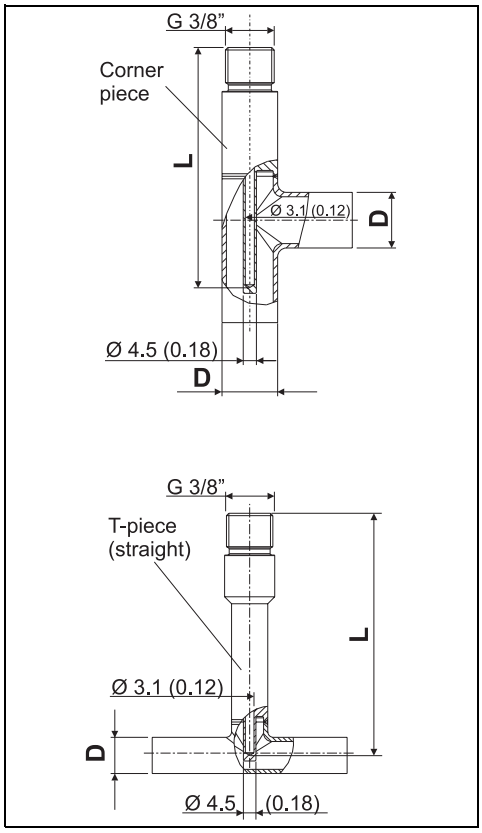
G ½" process connection
Seal, moveable compression fitting, material of parts in contact with process: 316L
Order no. 51004753



Weld-in pipe + thermowell TMR35F

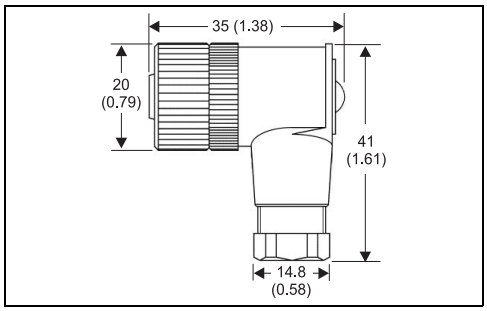
Product structure

	Connection thermometer:							
	R1	Thread 3/8"						
		Process connection (D):						
		A	DN10, PN25, DIN 11865-A					
		B	DN15, PN25, DIN 11865-A					
		C	DN20, PN25, DIN 11865-A					
		D	DN25, PN25, DIN 11865-A					
		E	DN8, PN25, DIN 11865-A					
		F	DN13, PN25, DIN 11865-B					
			Form:					
			1	Corner piece				
			2	T piece straight				
				Thermowell length (L); ∅:				
				A	38 mm; 4,5 mm (1.5"; 0.18")			
				B	83 mm; 4,5 mm (3.27"; 0.18")			
					Material:			
					1	1.4435/316 L		
						Material certificate:		
						1	not needed	
						2	EN 10204 short form	
						3	EN 10204	
							Test report:	
							A	not needed
TMR35F-	**R1**				**1**		**A**	⇒ **order code**



Elbow plug

Elbow plug
4-pole M12 connector for customized cable construction, elbowed, IP67, PG7
Order number: 51006327



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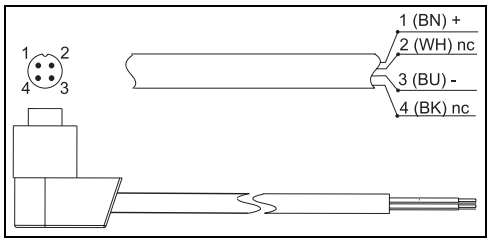
Cable

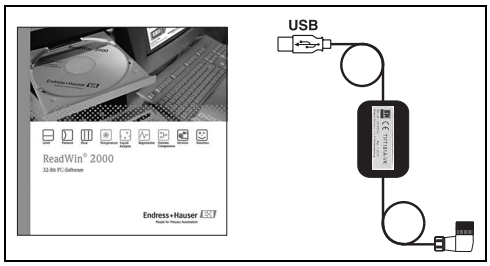
Cable M12x1, L = 5 m (16.4 ft)
Order number: 51005148



T09-TMR31xXX-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 compact thermometer with M12x1 thread + 4-pin plug
  Order code: TXU10-BA
- ReadWin® 2000 can be downloaded free of charge on the Internet at the following address:
  www.endress.com/readwin



T09-TMR31xxx-00-00-xx-xx-000

Documentation

❑Operating manual "Easytemp® TMR31, TMR35" (BA215R/09/a3)

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