



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



Solutions

Operating Instructions

Flowphant T DTT31, DTT35

Flow Switch

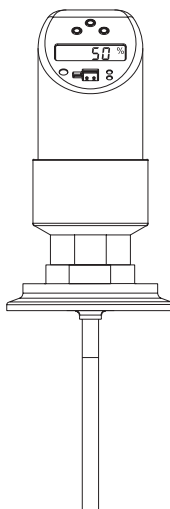
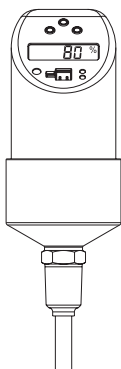


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1 Safety instructions

1.1 Designated use

The Flowphant T is a flow switch for measurement and monitoring of mass flow rates in industrial processes. The device has been safely built with state-of-the-art technology and meets the applicable requirements and EC Directives. It can, however, be a source of danger if used incorrectly or for anything other than the designated use.

1.2 Installation, commissioning and operation

Installation, electrical connection, commissioning, operation and maintenance of the measuring system must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator. The specialist must have read and understood these Operating Instructions and must follow the instructions they contain. The device may only be modified and repair work carried out if this is explicitly permitted in the Operating Instructions. Damaged devices which could be a source of danger may not be commissioned and must be labeled and identified as defective.

1.3 Operational safety

Ex-area

The Flowphant T is not approved for use in Ex-areas.

1.4 Return

The following procedures must be carried out before a device is returned to Endress+Hauser:

- Always enclose a fully completed "Declaration of Contamination" form with the device. Only then can Endress+Hauser transport and examine a returned device. A copy of the "Declaration of Contamination" can be found on the second last page of these Operating Instructions.
- Remove all fluid residues. This is particularly important if the fluid is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.



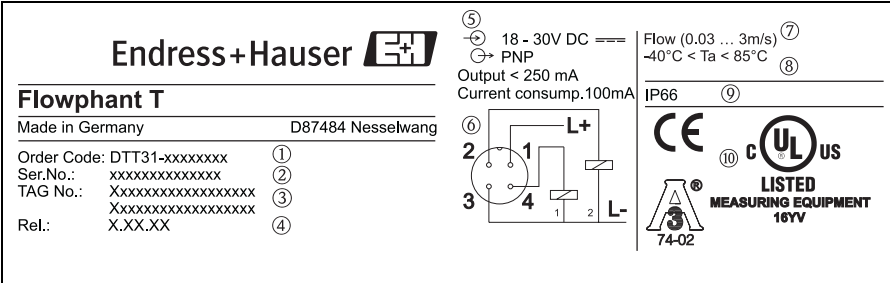
Warning!

Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.

2 Device identification

2.1 Nameplate

To identify your device, compare the complete order code and the version information on the delivery papers with the data on the nameplate.



T09-DTT31xxx-18-xx-xx-xx-000.eps

Fig. 1: Nameplate for device identification (as example)

①	Order code	⑥	Connection diagram
②	Serial number	⑦	Measuring range
③	TAG number	⑧	Ambient temperature range
④	Release number (change status)	⑨	Degree of protection
⑤	Connection values	⑩	Approvals



Note!

The release number indicates the change status of the device. A change in the last two figures does not have any affect on the compatibility – see also Section 7.

3 Installation

3.1 Incoming acceptance, storage

- Incoming acceptance:
Check the packaging and the device for damage. Check that the goods delivered are complete and nothing is missing.
- Storage:
Storage temperature -40 °C to $+85\text{ °C}$ (-40 °F to 185 °F).

3.2 Dimensions

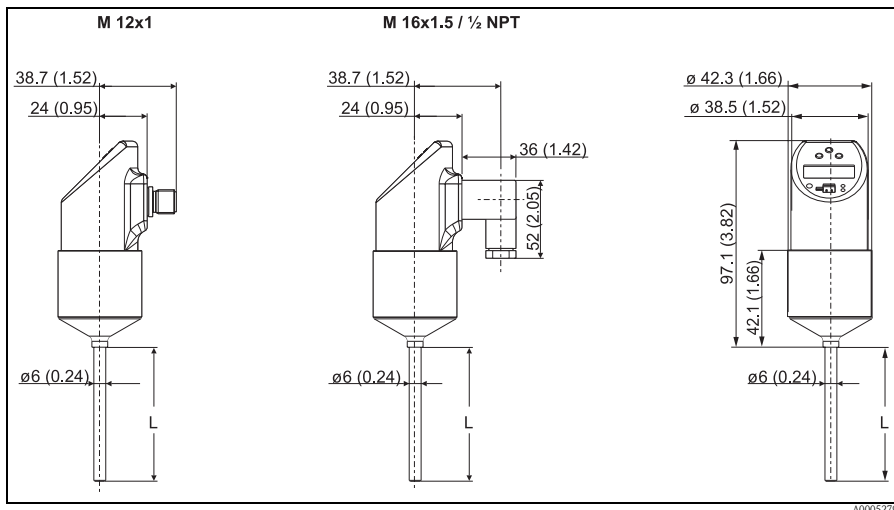


Fig. 2: Dimensions in mm (inch)

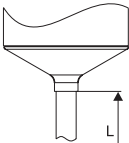
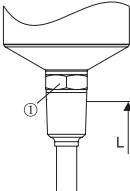
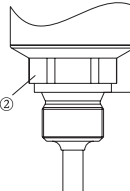
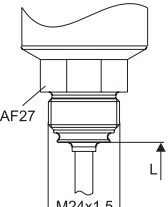
Version L with 30 and 100 mm (1.18 and 3.94 in)

M 12x1 connector as per IEC 60947-5-2

M 16x1.5 or 1/2" NPT valve plug as per DIN 43650A/ISO 4400

3.3 Process connection

The following table illustrates the versions of Flowphant T.

	DTT31			DTT35
	<div><div><p>A</p></div><div><p>B</p></div><div><p>C</p></div><div><p>D</p><p>T09-TTR31xxx-17-xx-xx-en-000</p></div></div>			
Field of appli- cation	Measurement and monitoring of mass flow rates			Measurement and moni- toring, mass flow rates in hygienic processes
Process con- nection	Item A Version without process connec- tion ('w'). Suit- able welding bosses and cou- pling (see section 7)	Item B Version with thread process connection ANSI 1/4" NPT (① = AF14) and 1/2" NPT (① = AF27)	Item C Version with thread process connection G 1/4 (② = AF14) and G 1/2 (② = AF27) as per ISO 228	Item D Adapter concept - ver- sion with M24x1.5 thread for adapters with process connection for hygienic processes (see section 7.1.2)
Sensor length L	Version L with 30 and 100 mm (1.18 and 3.94 in)			
Operational range	Liquids from 0.03 to 3.0 m/s (0.1 to 9.84 ft/s)			

3.4 Installation instructions

Mounting instructions:

- Any orientation
- The onsite display can be rotated electronically 180° – see section 5.1 "Onsite operation"
- The housing can be rotated up to 310°.



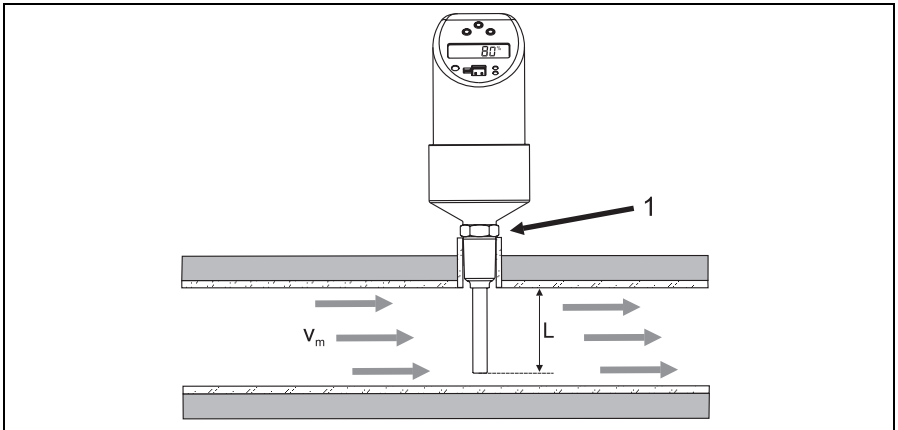
Caution!

Do not turn the device into the process connection thread at the housing. Always install the device at the hexagonal-headed bolt (→ Fig. 3, item 1). Use a suitable open-ended wrench for this task (see Table → Chap. 3.3).



Note!

For correct flow measurement, the complete sensor length must be immersed in the fully developed flow profile.



T09-DTT31xxx-11-00-xx-xx-000

Fig. 3: Installing the device (example). Sensor length L is completely immersed in the flow profile.

4 Wiring

4.1 DC voltage version with M12 connector

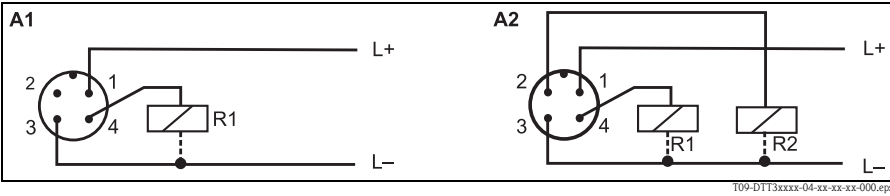


Fig. 4: Flowphant T with M12x1 connector

A1: 1x PNP switch output

A2: PNP switch outputs R1 and R2

4.2 DC voltage version with valve connector

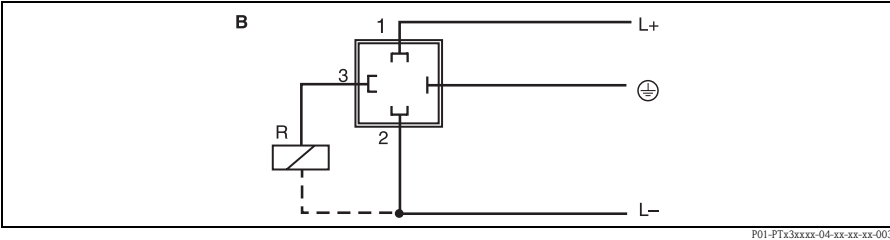


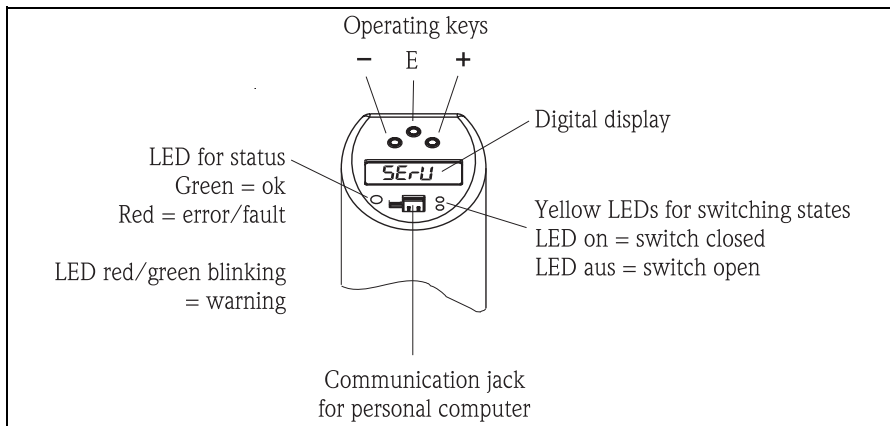
Fig. 5: Flowphant T with M 16x1.5 or 1/2" NPT valve plug

B: 1x PNP switch output

5 Operation

5.1 Onsite operation

The Flowphant T is operated by means of three keys. The digital display and the light emitting diodes (LED) support navigation in the operating menu.



T09-TTR31xxx-19-xx-xx-en-001

Fig. 6: Position of operating elements and possibilities for display

Background illumination of the digital display:

- White = OK status
- Red = alarm/error status

5.1.1 Navigating in the operating menu

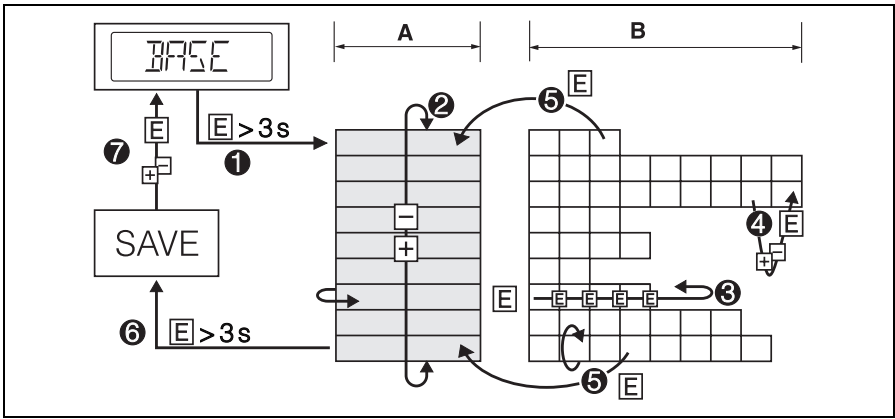


Fig. 7: Navigating in the operating menu

A Function group selection

B Function selection

① Enter the operating menu

– Press the E key for longer than 3 s

② Select the "Function group" with the + or – key

③ Select the "Function" with the E key

④ Enter or change parameters with the + or – key

– Then return to "Function" with the E key

Note: If software locking is enabled, it must be disabled before making entries or changes

⑤ Press the E key several times to return to the "Function group"

⑥ Jump back to the measuring position (Home position)

– Press the E key for longer than 3 s

⑦ Query to save data (select "YES" or "NO" with the + or – key)

– Confirm with the E key



Note!

Changes to the parameter settings only become effective if you choose ⑦ 'YES' when asked to save data.

Navigating the 'Learn' function

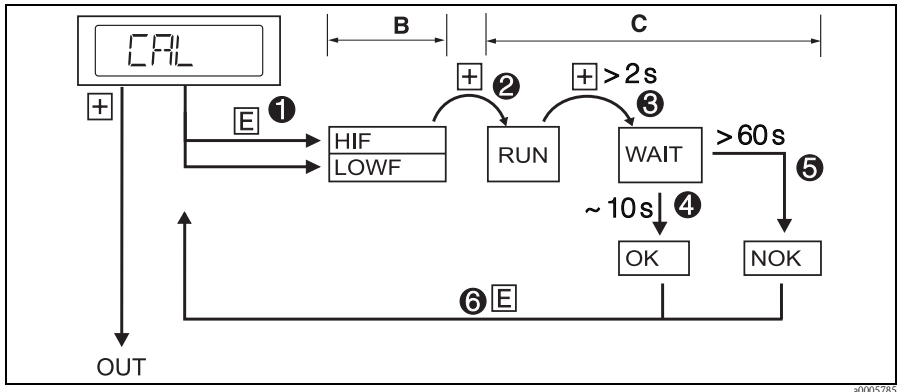


Fig. 8: Navigating the 'Learn' function using the Calibration (CAL) function group as an example

- ① Select the HIF (Learn High Flow) or LOWF (Learn Low Flow) function with the E key
- ② Select the "RUN" function with the + key, learn function is initialized
- ③ Select the "WAIT" function with the + key, press for longer than 2 s
- ④ Accept ('learn') the current measured value after approx. 10 s - "OK" appears on the display
- ⑤ If "NOK" (not OK) appears on the display after 60 s, no current measured value was set
- ⑥ Return to the CAL function group (Home position) with the E key

5.1.2 Structure of the operating menu

The structure below shows all the possible fields of the operating menu.

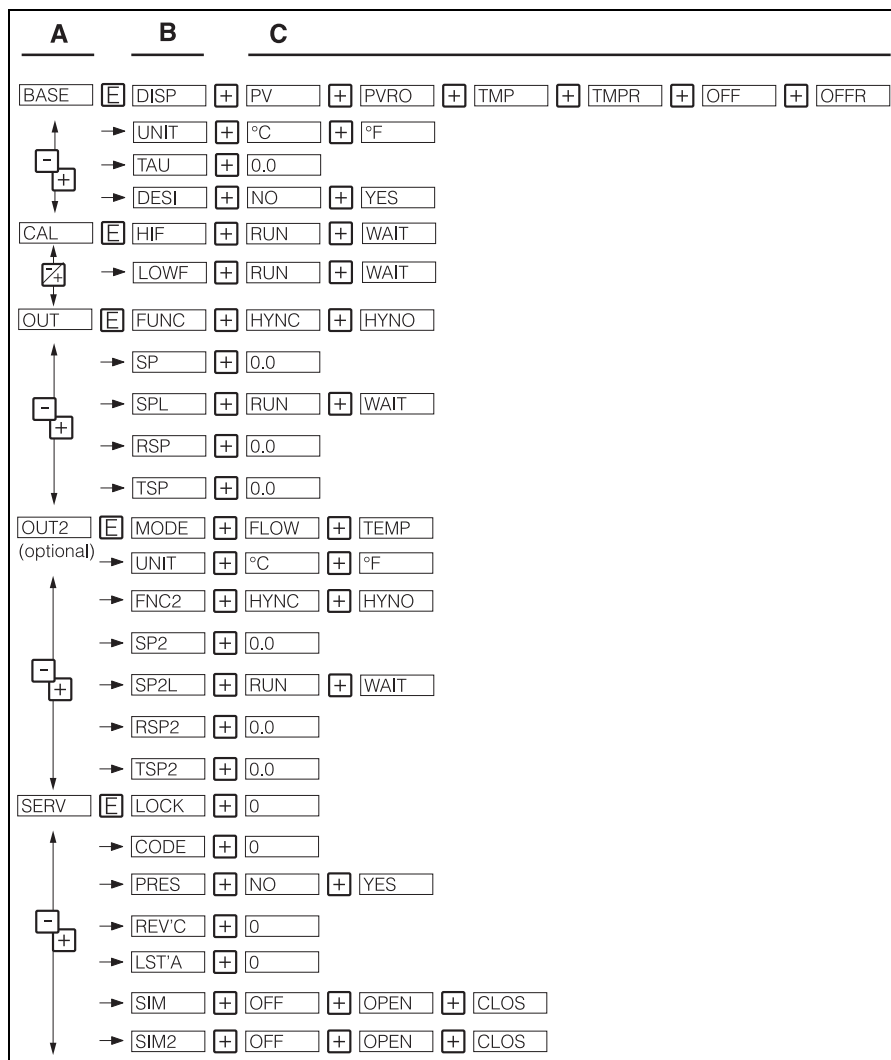






Fig. 9: Operating menu: A function groups, B functions, C settings

5.1.3 Basic settings

Menu-guided operation with the operating keys.

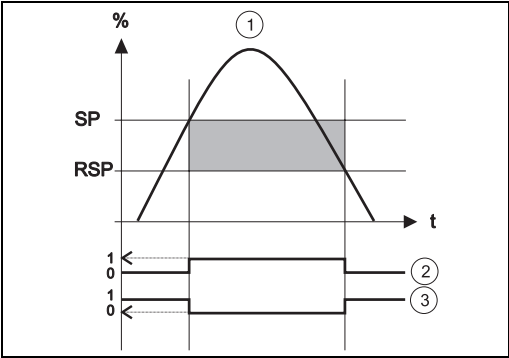
Function group	Function (display)	Description
BASE (basic func- tions)	Display (DISP)	Display assignment: OFF Display of current measured value or of configured switch point (switch 1) Display of current measured value or of configured switch point (switch 1) rotated 180° Display of current medium temperature Display of current medium temperature rotated 180° Factory setting: current measured value
	UNIT	Display medium temperature unit °C or °F Factory setting: °C  Note! Only visible if the current medium temperature is selected in the DISP mode.
	Damping (TAU)	Measured value damping with regard to display value and output: 0 (no damping) or 9 to 40 s (in increments of 1 second) Factory setting: 0 s
	DESINA (DESI) Only for 2 x PNP switch outputs	Behavior as per DESINA: The PIN of the M12 connector is assigned in accordance with the guidelines of DESINA. (DESINA = DistributEd and Standardized INstAllation technology for machine tools and manufacturing systems)
CAL (calibration)	Learn High Flow (HIF)	Setting for maximum flowrate occurring. 100% value
	Learn Low Flow (LOWF)	Setting for minimum flowrate occurring. 0% value

Function group	Function (display)	Description
OUT (Setting for the 1st output) OUT2 (Setting for the 2nd output, optional)	Switching mode (MODE)	Output switching mode for channel 2: flow or temperature Factory setting: flow
	UNIT	Temperature unit selection (°C/°F)  Note! Function only visible if switching mode (MODE) is set to temperature in the 2nd output.
	Function 1 (FUNC) Function 2 (FNC2), optional	Switch output function: hysteresis function NC contact or NO contact (see diagram)
	Switch point (SP) Switch point 2 (SP2), optional	Enter value 5 to 100% in increments of 1%. Factory setting: 50% Or optionally for SP2: Enter value -15 to 85 °C (-5 to 185 °F) in increments of 1 °C (1 °F) if the switching mode (MODE) is set to temperature. Factory setting: 55 °C (131 °F)
	Switch point learn (SPL) Switch point learn 2 (SP2L), optional	Take current flowrate as SP.
	Switch-back point (RSP) Switch-back point 2 (RSP2), optional	Enter value 0 to 95% in increments of 1%. Factory setting: 40%  Note! The value has to be at least 5% smaller than the switch point (SP or SP2). Or optionally for RSP2: Enter value -20 to 80 °C (-4 to 176 °F) in increments of 1 °C (1 °F) if the switching mode (MODE) is set to temperature. Factory setting: 50 °C (122 °F)  Note! Value has to be at least 5 °C (9 °F) smaller than switch point 2 (SP2).

Function group	Function (display)	Description
OUT and OUT2 continued	Switch point delay (TSP) Switch point delay (TSP2), optional	Can be set anywhere between 0 and 99 s in increments of 1 second. Factory setting: 0 s
SERV (Service functions)	Operating code (LOCK)	Enter the device locking code.
	Edit operating code (CODE)	Locking, only visible with valid operating code.
	Preset (PRES)	Resetting of all settings to factory settings.
	Static revision counter (REVC)	Configuration counter, incremented each time the configuration is changed.
	Device status (STAT)	
	Last error (LSTA)	Display of last error to occur.
	Simulation 1 (SIMU) Simulation 2 (SIM2), optional	Simulation switch output 1: on/off with display, optionally corresponding to switch output 2.

Functions of the switch point

- Hysteresis function
The hysteresis function enables two-point control via a hysteresis. Depending on the mass flow, the hysteresis can be set via the switch point SP and the switch-back point RSP.
- NO contact or NC contact
This switch function is freely selectable.



a0005280

Fig. 10: ① Hysteresis function, ② NO contact,
③ NC contact

SP switch point; RSP switch-back point

5.2 Operation with PC and ReadWin® 2000

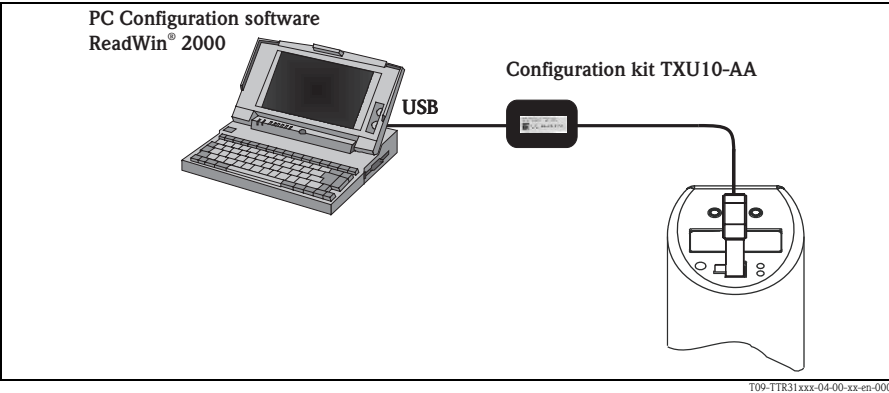


Fig. 11: Operation with PC

5.2.1 Additional operating options

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

Function group	Function (display)	Description
SERV (service functions)	Switching processes 1 Switching processes 2, optional	Number of changes in switching status for switch output 1; optionally switch output 2
INFO (device information)	TAG 1 TAG 2, optional	Tagging, 18-digit
	Order code	Order code
	Serial number	Device serial number
	Sensor serial number	Sensor serial number
	Electronics serial number	Electronics serial number
	Device revision	Display of entire revision
	Hardware revision	Hardware version
	Software revision	Software version

5.2.2 Operating Instructions for ReadWin® 2000

Comprehensive information on the ReadWin® 2000 configuration software may be found in the Operating Instructions BA137R/09/en.

6 Maintenance

Any buildup on the sensor can have a negative effect on the accuracy. For this reason, check the sensor for buildup at regular intervals.



Caution!

Make sure the process is unpressurized before you remove the device! Do not twist the device out of the process connection thread at the housing. Always use a suitable open-ended wrench for dismantling (see also → Fig. 3) (→ Chap. 3.3).

7 Accessories

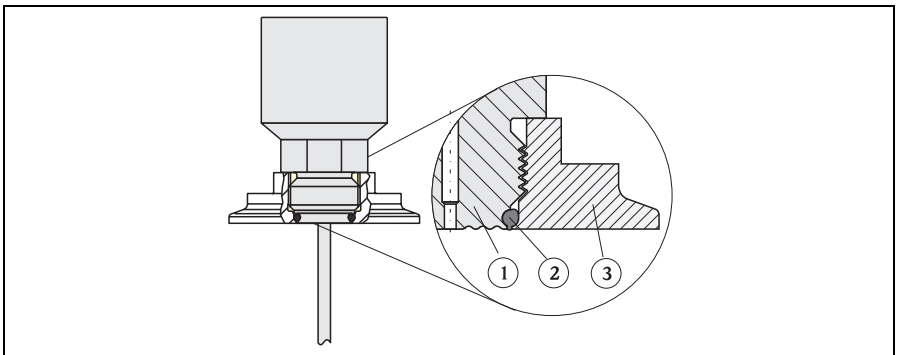
All dimensions in the drawings are given in mm (inch).

7.1 Adapter concept for DTT35

The process connection is an adapter and the sensor module has an adapter thread (see section 3.3, process connection). As a result, the process connection can easily be changed at a later stage.

7.1.1 Adapter change

The adapter can be changed on DTT35.



T09-TTR31xxx-17-xx-xx-xx-000

Fig. 12: Changing the adapter

- ① Sensor module with adapter thread
- ② Standard O-ring
- ③ Adapter

Please note the following when changing the adapter:

- Use a new O-ring. Diameter 15.54 x 2.62 mm (0.61 x 0.1 in).
EPDM 70 Shore material has FDA 3-A approval.
- Only fix the device (sensor module) in place with an open-ended wrench AF 27.
- Screw and unscrew the adapter with an open-ended wrench AF 27 or AF 32, depending on the process connection (see section 7.1.2: adapter versions).
The maximum torque is 80 Nm. The thread can become loose if exposed to severe strain through pressure and temperature. For this reason, the air-tightness must be checked regularly and the thread tightened if necessary.
- When changing the adapter, make sure that the sensor tube of the sensor is not damaged.



Note!

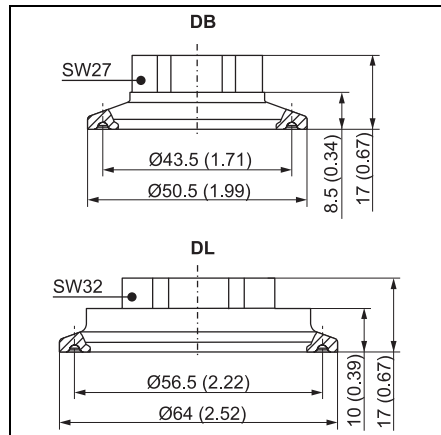
We recommend you replace the O-ring at the same intervals as you replace the other seals in your process.

7.1.2 Adapter versions

EN10204-3.1 = Material certificate (melt analysis)

DTT35: order numbers for clamp adapter versions.

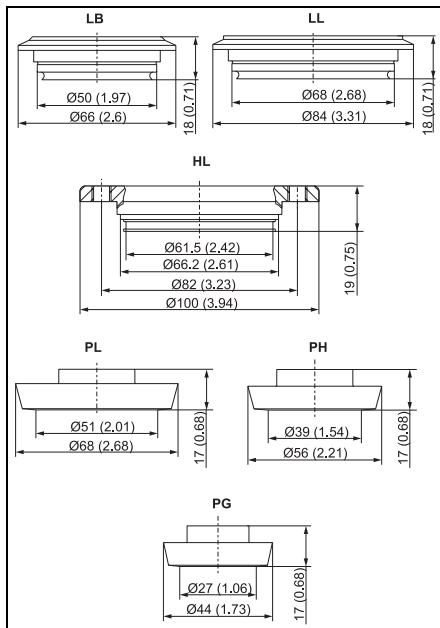
- Version DB
Without EN10204-3.1: order no. 71020524
With EN10204-3.1: order no. 51008165
- Version DL
Without EN10204-3.1: order no. 71020525
With EN10204-3.1: order no. 51008166



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

DTT35: 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

7.1.3 O-ring for adapter replacement

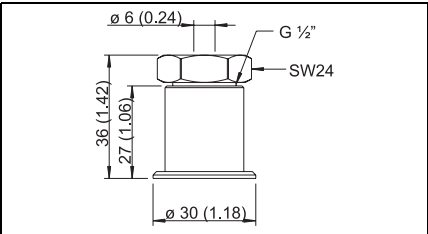
O-ring 15.54 x 2.62 mm (0.61 x 0.1 in), EPDM 70 Shore FDA, order no. 51008363

7.2 Welding bosses and coupling

7.2.1 Welding boss with sealing taper

Collar welding boss

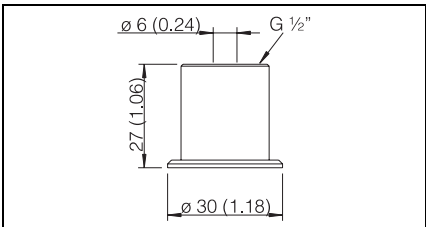
Seal, moveable coupling, material of parts in contact with process: 316L, PEEK
Order no. 51004751



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

7.2.2 Collar welding boss

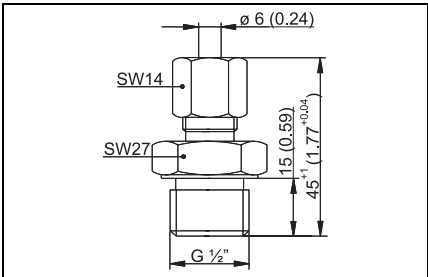
Material of parts in contact with process: 316L
Order no. 51004752



T09-TSM470BX-06-09-00-en-000

7.2.3 Coupling with sealing taper

G 1/2" process connection
Seal, moveable coupling, material of parts in contact with process: 316L
Order no. 51004753



T09-TSM470AX-06-09-00-en-001

7.3 Electrical connection

7.3.1 Plug-in jack; connecting cable

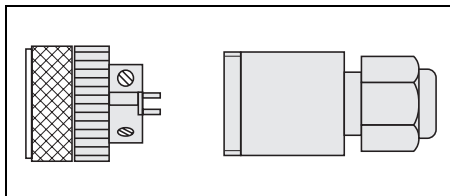
M 12x1 plug-in jack; straight

Connection to M 12x1 housing connector

Material: grip body PA, coupling nut CuZn, nickel-plated

Degree of protection (connected): IP 67

Order no. 52006263



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

M 12x1 plug-in jack; elbowed

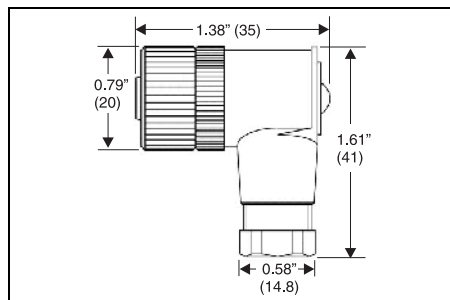
Connection to M 12x1 housing connector

Material: grip body PBT/PA,

Coupling nut GD-Zn, nickel-plated

Degree of protection (connected): IP 67

Order no. 51006327



T09-TTR3xxx-06-09-xx-en-000

PVC cable, 4 x 0.34 mm² with M12 socket,

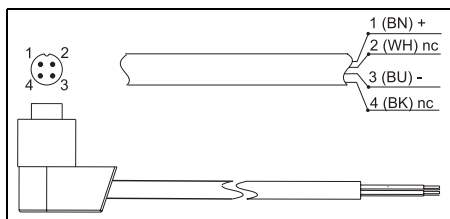
elbowed, screw plug, length 5 m

(16.4 ft) degree of protection: IP 67

Order no. 51005148

Core colors:

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



T09-TMR31xxx-00-00-xx-xx-001

PVC cable, 4 x 0.34 mm² with M12 socket,

with LED, elbowed, 316L screw plug,

length 5 m (16.4 ft), especially for hygiene

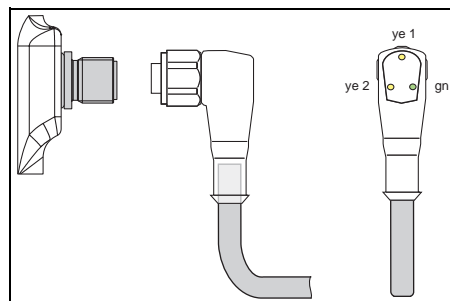
applications, degree of protection

(connected): IP 69K

Order no. 52018763

Display:

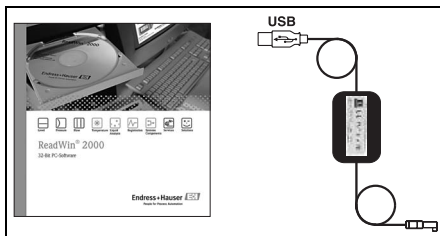
- gn: device operational
- ye1: switch status 1
- ye2: switch status 2



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

7.4 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
- ReadWin® 2000 can be downloaded free of charge directly from the internet at the following address:
www.endress.com/readwin



T09-TTR31xxx-00-00-xx-xx-000

8 Troubleshooting

8.1 Error messages and warning messages

If an error in the device occurs, the color of the status LED changes from green to red and the background illumination of the digital display changes from white to red. A status LED flashing red and green signals a warning. The display shows:

- E-code for errors
In the event of an error message, the measured value is uncertain.
- W-code for warnings
In the event of a warning, the measured value is reliable.

Code	Explanation
E011	Device configuration faulty
E012	Error in measurement or underrange/overrange
E013	Error at heating resistor
E015	Error in EEPROM
E019	Power supply has undervoltage/overvoltage
E020	Error in Flash
E021	Internal memory error
E022	USB power supply
E027	Characteristic does not suit medium

Code	Explanation
W107	Simulation active
W202	Flow outside the sensor range
W209	Device starts
W210	Configuration modified
W212	Sensor signal outside the permitted range

Code	Explanation
W250	Number of switch cycles exceeded
W260	Value for High Flow (HIF) and Low Flow (LOWF) faulty
W270	Short-circuit and overload at output 1
W280	Short-circuit and overload at output 2

8.2 Repair

A repair is not planned.

8.3 Disposal

Please pay particular attention to the local disposal regulations of your country. When disposing, ensure that the materials of the device components are separated and processed accordingly.

8.4 Change status (release)

The release number on the nameplate and in the Operating Instructions indicates the change status of the device: XX.YY.ZZ (example 01.02.01).

XX	Change in the main version. Compatibility no longer provided. Device and Operating Instructions change.
YY	Change in functionality and operation. Compatibility provided. Operating Instructions change.
ZZ	Troubleshooting and internal modifications. Operating Instructions do not change.

8.5 Release history

Date	Device rel.	Device and software no. (Firmware/software)	Changes	Operating Instructions
02.2006	01.00.00	01.00.00	Original firmware	BA218r/09/en (71022235)

9 Technical data

9.1 Power supply

Supply voltage

- DC voltage version 18 to 30 V DC

Current consumption

- < 100 mA (open-circuit operation) at 24 V DC, max. 150 mA (open-circuit operation); with reverse polarity protection

Power supply failure

- Behavior in case of overvoltage (> 30 V)

The device factory 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). If the supply voltage is exceeded, the properties specified are no longer guaranteed.

- Behavior 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).

9.2 Output

Switching capacity

- 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: $\leq 2 \text{ V}$
- Overload protection

Automatic load testing of switching current; output is switched off in event of overcurrent, the switching current is tested again every 0.5 s; max. capacitance load: 14 μF for max. supply voltage (without resistive load); periodical protective disconnection in event of overcurrent ($f = 2 \text{ Hz}$) and 'Warning' display.

Signal on alarm

- Switch outputs: with safe status (switch open)

9.3 Operating conditions

- Any orientation
- Top housing section can be rotated 310°

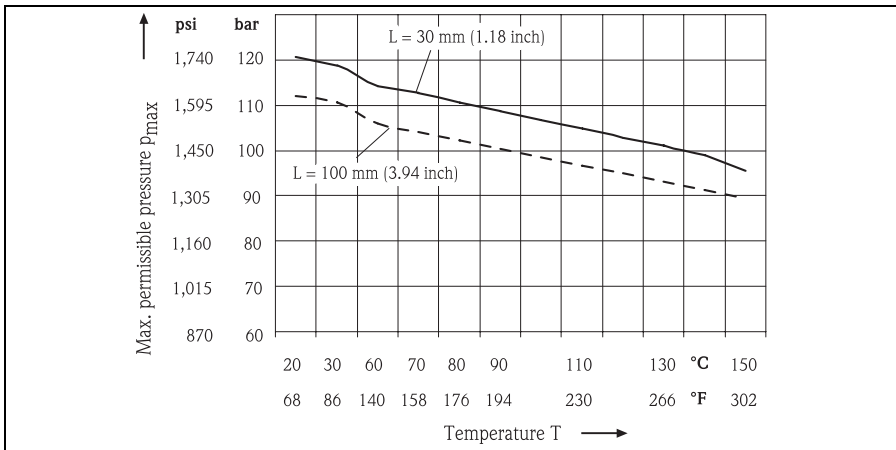
Operating conditions: Environment

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

- Degree of protection
With M 16x1.5 or ½" NPT valve plug: IP 65
With M 12x1 connector: IP 66
- 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 guidelines of German Lloyd GL
- Electromagnetic compatibility
Interference emission as per IEC 61326, class B equipment
Interference immunity as per IEC 61326, Appendix A (industry) and NAMUR Recommendation NE21; EMC influence: ≤ 0.5 %

Operating conditions: Process

- Process flow limits
Liquids: 0 to 3.0 m/s (0 to 9.84 ft/s)
- Process temperature limits
-20 to 85 °C (-4 to 185 °F)
- Process pressure limits
p/T load diagram as per DIN 43763 or Dittrich/Kohler (or as per ASME/ANSI PTC 19.3



A0005432-EN

Fig. 13: p/T load diagram

L = insertion length

v_w = water fluid velocity = 3 m/s (9.84 ft/s)

10 Dangerous Goods sheet

Declaration of Contamination
Erklärung zur Kontamination



Because of legal regulations and for the safety of our employees and operating equipment, we need the "declaration of contamination", with your signature, before your order can be handled. Please make absolutely sure to include it with the shipping documents, or - even better - attach it to the outside of the packaging.
Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination", bevor Ihr Auftrag bearbeitet werden kann. Legen Sie diese unbedingt den Versandpapieren bei oder bringen Sie sie idealerweise außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp







Serial number
Seriennummer

Process data/ Prozessdaten

Temperature / Temperatur [°C] Pressure / Druck [Pa]

Conductivity / Leitfähigkeit [S] Viscosity / Viskosität [mm²/s]

Medium and warnings
Warnhinweise zum Medium

	Medium /concentration Medium /Konzentration	Identification CAS No.	 flammable entzündlich	 toxic giftig	 corrosive ätzend	 harmful/ irritant gesundheitsschädlich/ reizend	 other * sonstiges*	 harmless unbedenklich
Process medium Medium im Prozess								
Medium for process cleaning Medium zur Prozessreinigung								
Returned part cleaned with Medium zur Endreinigung								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv
Please tick should one of the above be applicable, include security sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Reason for return / Grund zur Rücksendung

Company data / Angaben zum Absender

Company / Firma

Contact person / Ansprechpartner

Address / Adresse

Department / Abteilung

Phone number/ Telefon

Fax / E-Mail

Your order No. / Ihre Auftragsnr.

We hereby certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free from any residues in dangerous quantities.
Hiermit bestätigen wir, dass die zurückgesandten Teile sorgfältig gereinigt wurden, und nach unserem Wissen frei von Rückständen in gefährbringender Menge sind.

(place, date / Ort, Datum)

(Company stamp and legally binding signature)
(Firmenstempel und rechtsverbindliche Unterschrift)

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