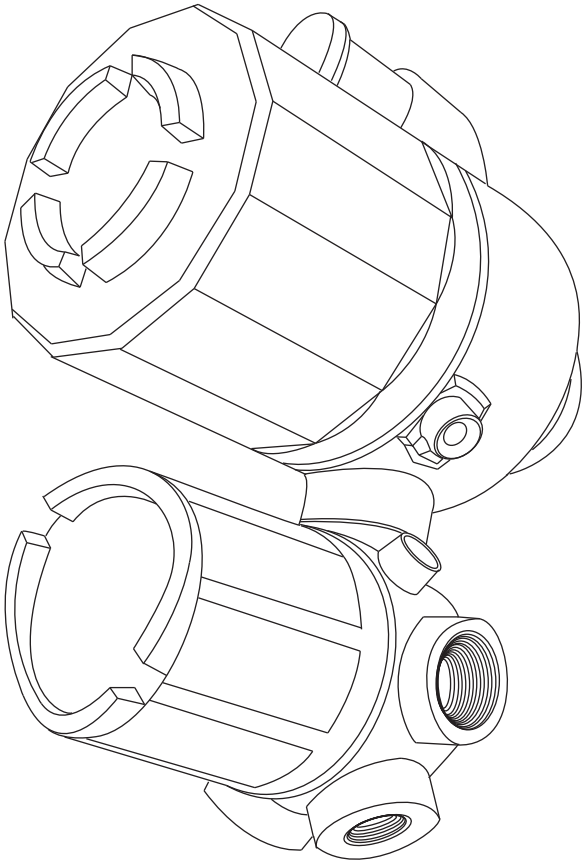
BA00427G/00/EN/03.18
71427109
2018-12-28

Operating Instructions
TMD1000 TMD1

Digital Transmitter



Endress+Hauser
People for Process Automation

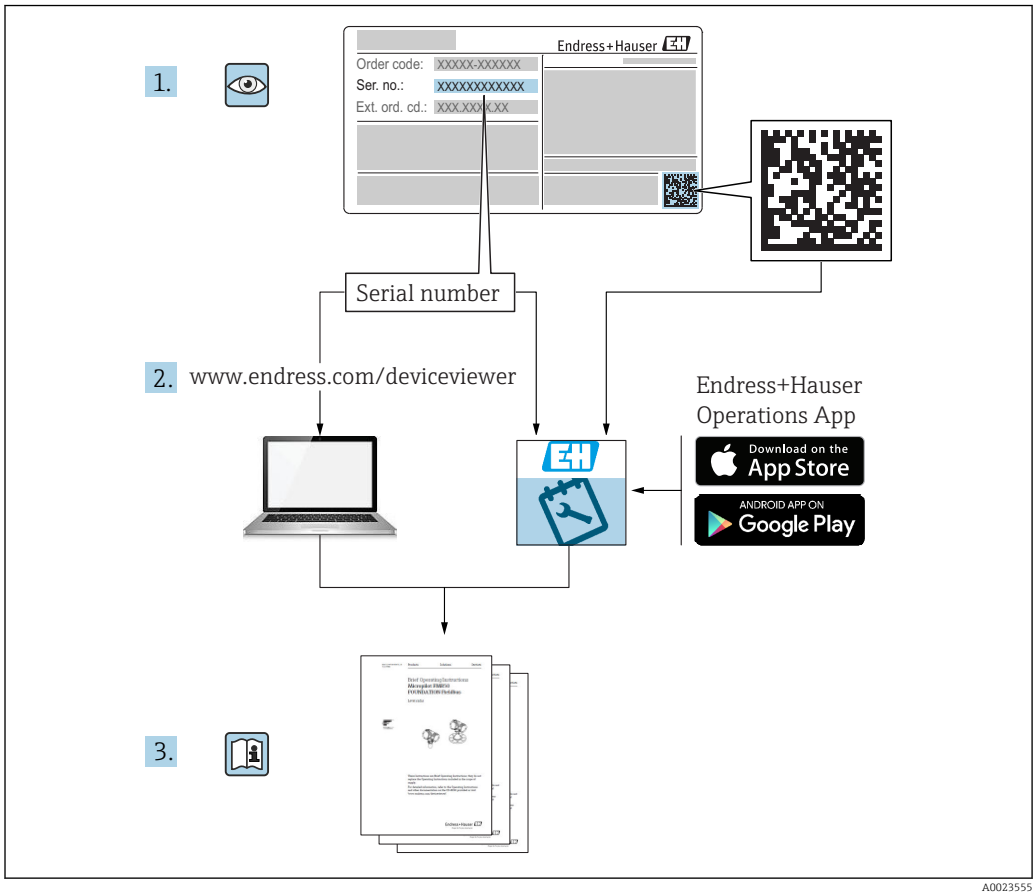

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX-XXXXXX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
A0023555

Table of contents

1 About this document

1.1 Document function

These Operating Instructions contain all the information that is required during various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbol

1.2.1 Safety symbols

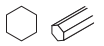
Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury, as well as a risk of fire or explosion.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in a risk of serious or fatal injury, fire or explosion.
CAUTION	**Note** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in a risk of minor or moderate injury and damages to properties.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts that do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	**Ground connection** A grounded terminal that, as far as the operator is concerned, is grounded via a grounding system.
	**Protective ground connection** A terminal that must be connected to the ground prior to establishing any other connections.
	**Equipotential connection** This connects with the grounding system at the plant.It includes equipotential line and single point ground systems, depending on the norms of each country or company.

1.2.3 Tool symbols

Symbol	Meaning
	Torx screwdriver
	Flat blade screwdriver

Symbol	Meaning
 A0011219	Phillips screwdriver
 A0011221	Allen key
 A0011222	Open-ended wrench

1.2.4 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted
	**Preferred** Procedures, processes or actions that are preferred
	**Forbidden** Procedures, processes or actions that are forbidden
	**Tip** Indicates additional information
	Reference to documentation
	Reference to page
	Reference to graphic
	Notice or individual step to be observed
1., 2., 3. ...	Series of steps
	Result of an operation or commissioning
	Help in the event of a problem
	Visual inspection
	Operation via the local display
	Operation via operating tool
	Write-protected parameter

1.2.5 Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1., 2., 3. ...	Series of steps
A, B, C, ...	Graphics
A-A, B-B, C-C, ...	Cross-sections

Symbol	Meaning
	**Hazardous area** Indicates the hazardous area
	**Safe area (non-hazardous area)** Indicates the non-hazardous area

1.2.6 Device symbol

Symbol	Meaning
	**Safety instructions** Observe the safety instructions contained in the associated Operating Instructions.
	**Temperature resistance of the connection cables** Specifies the minimum value of the temperature resistance of the connection cables.

1.3 Documentation

For an overview of the scope of the relevant Technical Documentation included with the product, refer to the following:
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer).
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate.

1.3.1 Technical Information

The Technical Information contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

Device	Technical Information
Digital Transmitter TMD1000 TMD1	TI00463G

1.3.2 Operating Instructions (BA)

The Operating Instructions contain all the information that is required during various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

The Operating Instructions also contain detailed descriptions of each parameter in the operation menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Device	Operating Instructions
Digital Transmitter TMD1000 TMD1	BA00427G BA00428G BA00429G

1.3.3 Safety Instructions (XA)

Feature 030 "Approval"	Meaning	XA
4	TIIS Exd IIB T4	XA01072G
5	FM XP Cl.I Div.1 Gr.C-D, AEx d IIB T4	XA01089G

1.4 Registered trademarks

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

2 Basic safety instructions

2.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Be specialists who are trained and have a relevant qualification for this specific function and task.
- Be authorized by the plant owner-operator.
- Be familiar with local/national regulations.
- Before starting work, read and understand the instructions in the Operating Instructions and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:
- Be instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Designated use

Application and measured materials
Depending on the version ordered, the device can also be used with potentially explosive, flammable, poisonous or oxidizing materials.

Devices that are used in hazardous areas have corresponding labels on their nameplates.

To ensure that the device remains in proper condition for the operation time:
- Only use the device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Check the nameplate to verify if the device can be put to its intended use in hazardous areas.
- If the device is not operated at an atmospheric temperature, compliance with the relevant basic conditions specified in the relevant device documentation is absolutely essential.
- Protect the device permanently against corrosion from environmental influences.
- Observe the limit values in the "Technical Information".

The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to local/national regulations.

2.4 Operational safety

Risk of injury!
- ▶ Operate the device in proper technical conditions and fail-safe conditions only.
- ▶ The plant owner-operator is responsible for interference-free operation of the device.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:
- ▶ If modifications are nevertheless required, contact your Endress+Hauser Sales Center.

Repair

To ensure continued operational safety and reliability:
- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe local/national regulations pertaining to repair of an electrical device.
- ▶ Use only original spare parts and accessories from Endress+Hauser.

Ex-area

Observe the following notes to eliminate the risk of danger to persons or the facility when the device is used in Ex-areas (e.g. explosion protection, pressure equipment safety):
- ▶ Check the model nameplate to ensure that the ordered device is explosion proof.
- ▶ Observe the specifications in the separate supplementary documentation attached to these Instructions.

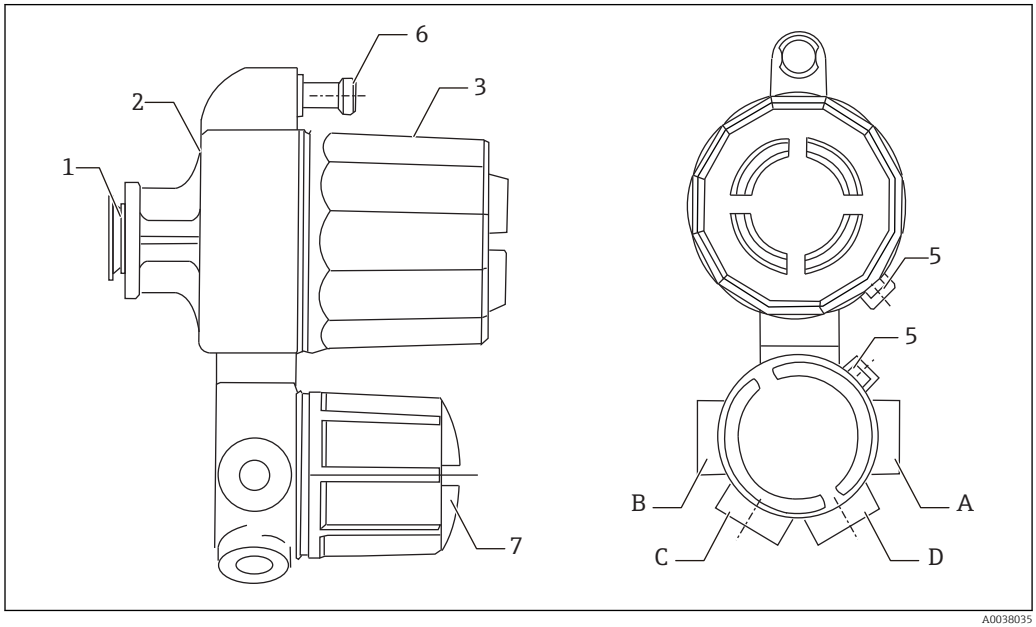
2.5 Product safety

This device was designed in accordance with GEP (Good Engineering Practice) to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. It meets the general safety standards and legal requirements.

3 Product description

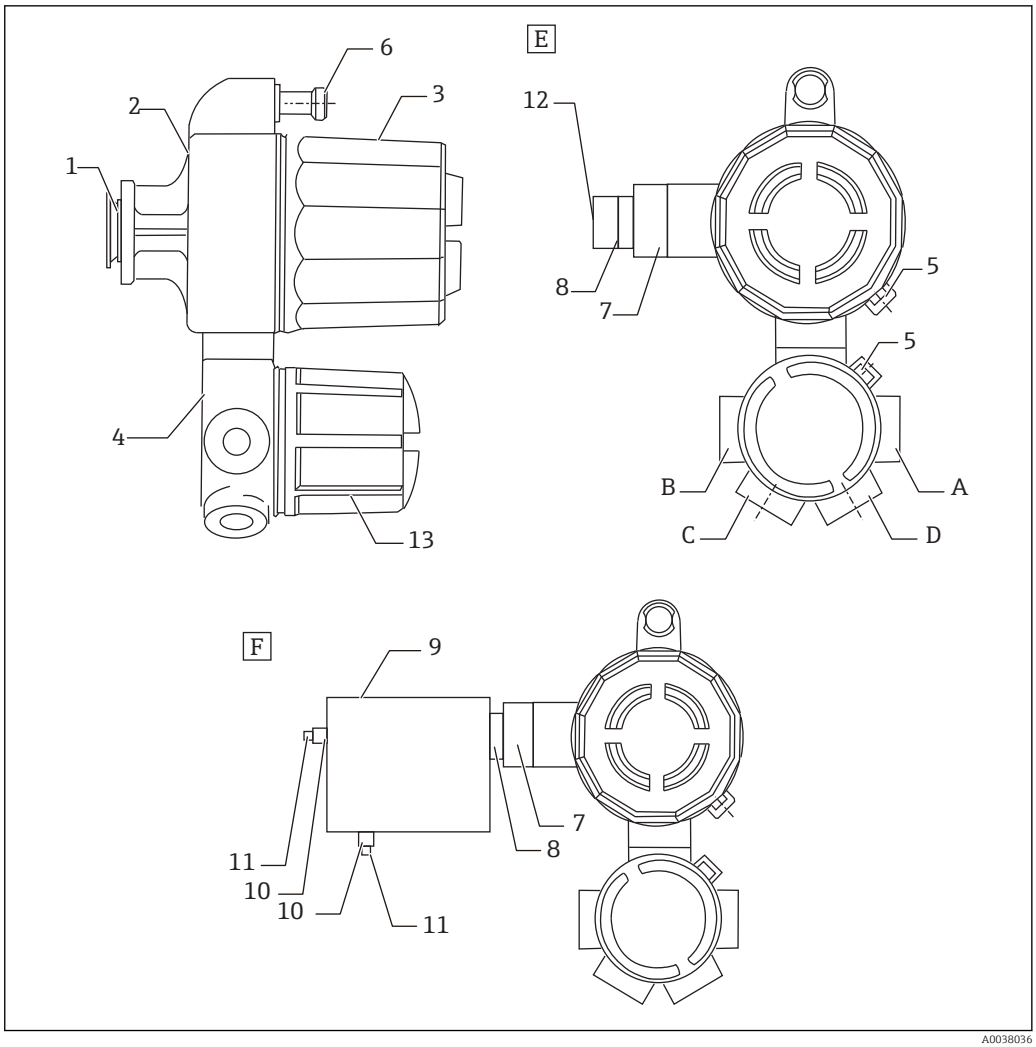
3.1 Product design

Ordering information 080 A cable gland is included with cable entry options H/J/K/L/M/. Options P/Q do not come with a cable gland.



1 *Digital transmitter TMD1000 TMD1 (Standard)*

A Cable entry position A
B Cable entry position B
C Cable entry position C
D Cable entry position D
1 Coupling (Material: ADC6/Quantity: 1)
2 Electrical housing (Material: AC4C-T6/Quantity: 1)
3 Cover of electrical housing (Material: AC4C-T6/Quantity: 1)
4 Terminal box (Material: ADC12/Quantity: 1)
5 Locking (Material: ADC6/Quantity: 2)
6 Hand-held terminal connection port (Quantity: 1)
7 Terminal box cover (AC4C-T6/Quantity: 1)



2 *Digital Transmitter TMD1000 TMD1 (Optical FFi specifications)*

A Cable entry position A
B Cable entry position B
C Cable entry position C
D Cable entry position D
E Connection box type
F M42 x P1.5 slide coupling type
1 Coupling (Material: ADC6/Quantity: 1)
2 Electrical housing (Material: AC4C-T6/Quantity: 1)
3 Cover of electrical housing (Material: AC4C-T6/Quantity: 1)
4 Terminal box (Material: ADC12/Quantity: 1)
5 Locking (Material: ADC6/Quantity: 2)
6 Hand-held terminal connection port (Quantity: 1)
7 Optical unit adapter (Material: SUS304/Quantity: 1)
8 Optical unit 6D (Quantity: 1)
9 Connection box (Material: Aluminum/Quantity: 1)
10 Lead-in cable port (Rc1/2) (Material: Ferrous casting/Quantity: 1)
11 Blind plug (Material: FCMB310/Quantity: 2)
12 FC inlet connection (M42 x P1.5/Quantity: 1)
13 Terminal box cover (AC4C-T6/Quantity: 1)

Cable gland is not included.

3.2 Technical data

Items	Descriptions
Level A/D Conversion	Method: Optical non-contact absolute encoder ▪ Range:0 to 99999 mm ▪ Accuracy: ±1 mm (0.4 in)
Power supply	AC 60, 100, 110, 200, 220 V ±10 % 50/60 Hz DC 20-32 V When ordering special specifications, contact your Endress+Hauser Sales Center.
Power consumption	▪ AC: max. 14 W ▪ DC: max. 10 W
Allowable ambient temperature	▪ −20 to 60 °C (−4 to 140 °F)(Non-explosion proof/Explosion proof) ▪ −10 to 40 °C (14 to 104 °F)(FFi Specifications)
Approval	▪ Waterproof and dust-proof IP65 / NEMA Type 4X ▪ Exd IIB T4, TIIS ▪ FM XP Cl.I Div.1 Gr.C-D, AEx d IIB T4
Cable entry	0: A: PF(G)1-1/2, B: PF(G)3/4, C: PF(G)1, D: PF(G)1 The screw position is fixed (refer to External dimension).
	H: 2 x thread G1 EXPC-28B, 2 x blind plug The screw hole position can be specified with A, B,C or D.
	J: 3 x thread G1 EXPC-28B, 1 x blind plug The screw hole position can be specified with A, B,C or D.
	K: 4 x thread G1 EXPC-28B The screw hole position can be specified with A, B,C or D.
	L: 2 x thread G3/4 EXPC-22B,2 x blind plug The screw hole position can be specified with A, B,C or D.
	M: 3 x thread G3/4 EXPC-22B,1 x blind plug The screw hole position can be specified with A, B,C or D.
	N: 4 x thread G3/4 EXPC-22B The screw hole position can be specified with A, B,C or D.
	P: 4 x thread NPT 1
	Q: 4 x thread NPT 3/4
Surge arrester	Supplied as standard
Weight	Approximately10 kg
Material	▪ Electrical housing: AC4C-T6 ▪ Electrical housing cover: AC4C-T6 ▪ Terminal box: ADC12 ▪ Terminal box cover: AC4C-T6
Color	Blue and white

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Upon receipt of the goods check the following:
- Are the order codes on the delivery note and the product label identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) enclosed?

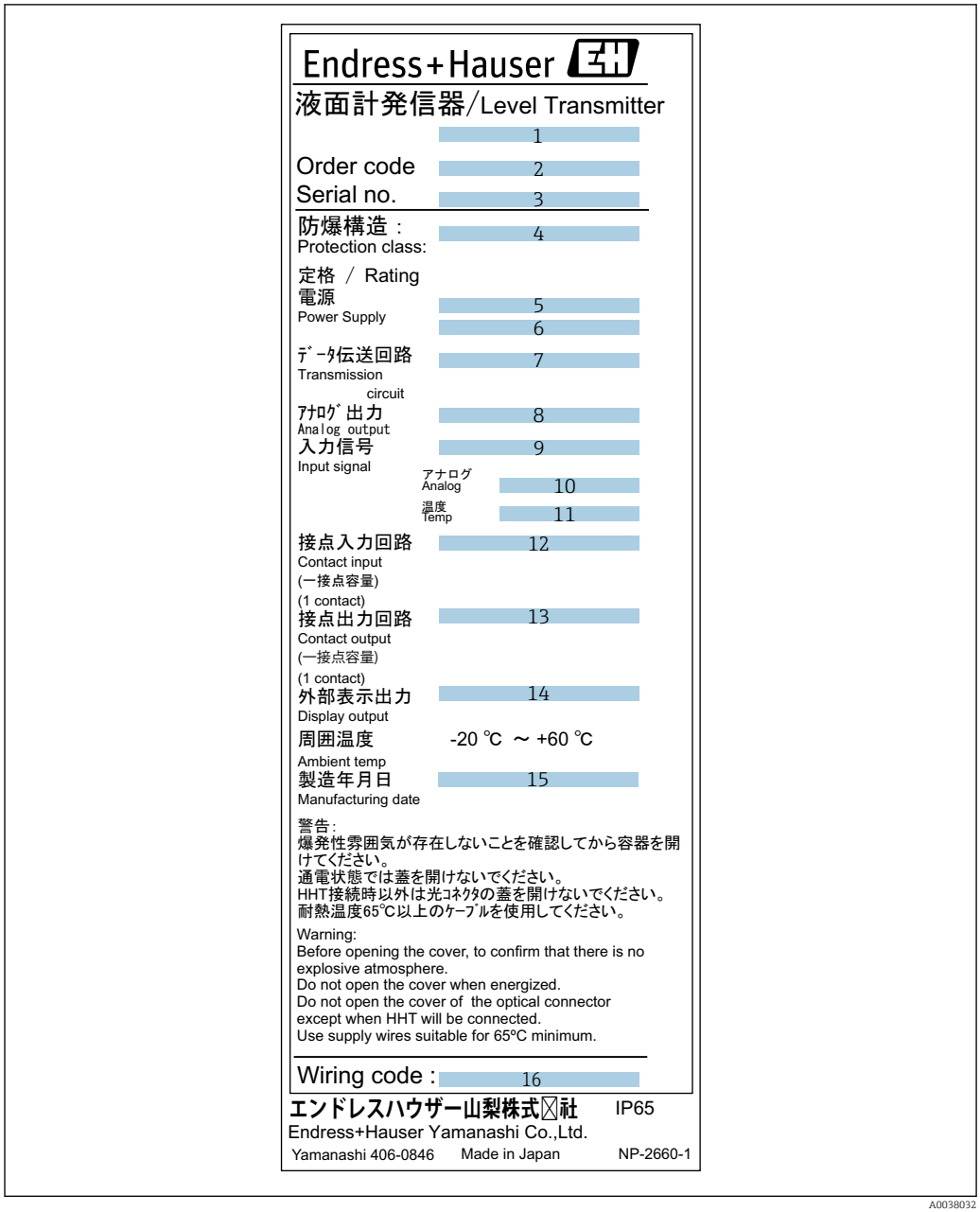
If any one of these conditions is not met, contact your Endress+Hauser Sales Center.

4.2 Product identification

The following options are available for the identification of the device:
- Nameplate
- Extended order code with a breakdown of the device features on the delivery note
- Enter serial numbers from nameplates into the *W@M Device Viewer* (www.endress.com/deviceviewer); all information on the device will be displayed.
- Enter serial numbers from nameplates into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*; all the information on the device will be displayed.

For an overview of the scope of the relevant Technical Documentation included with the product, refer to the following:
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer).
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

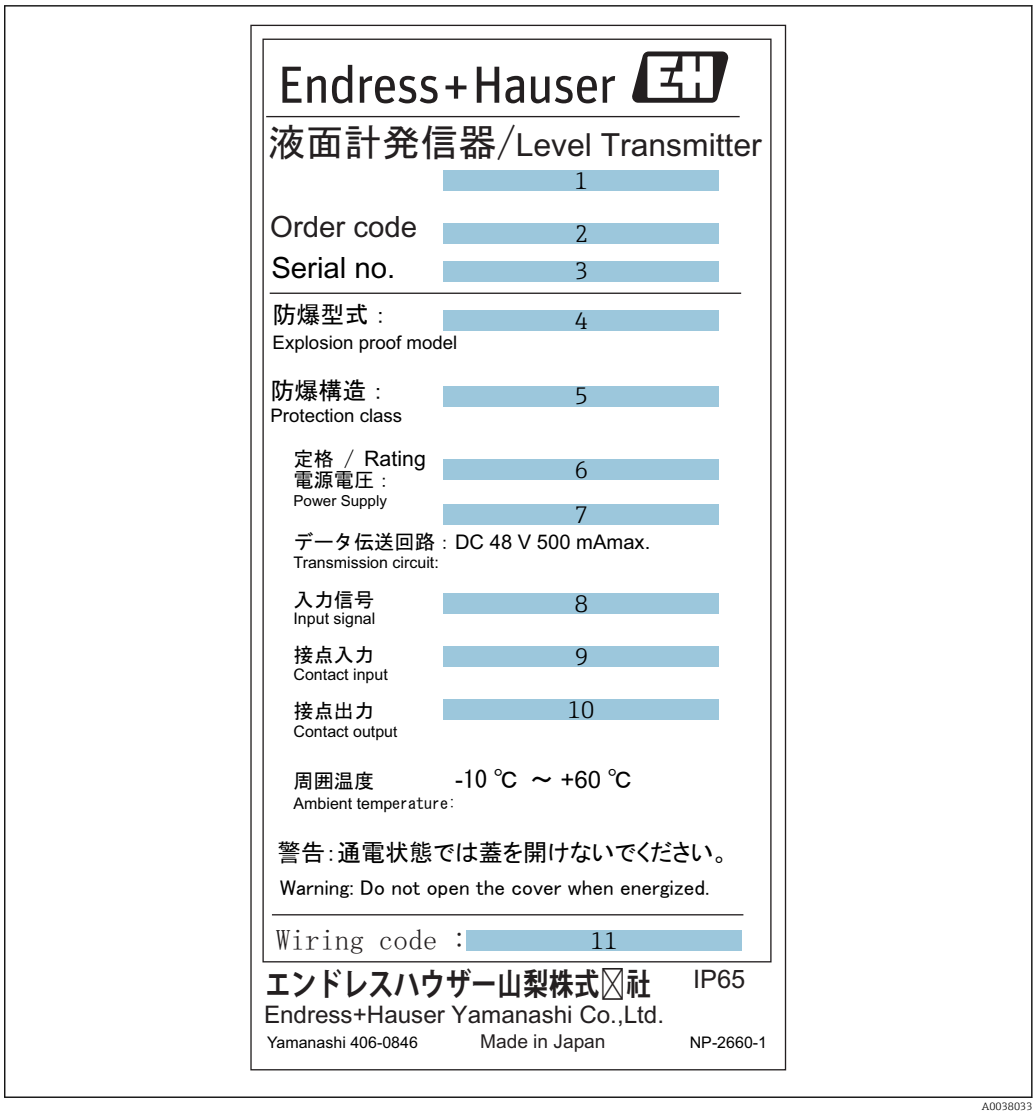
4.2.1 Nameplate



A0038032

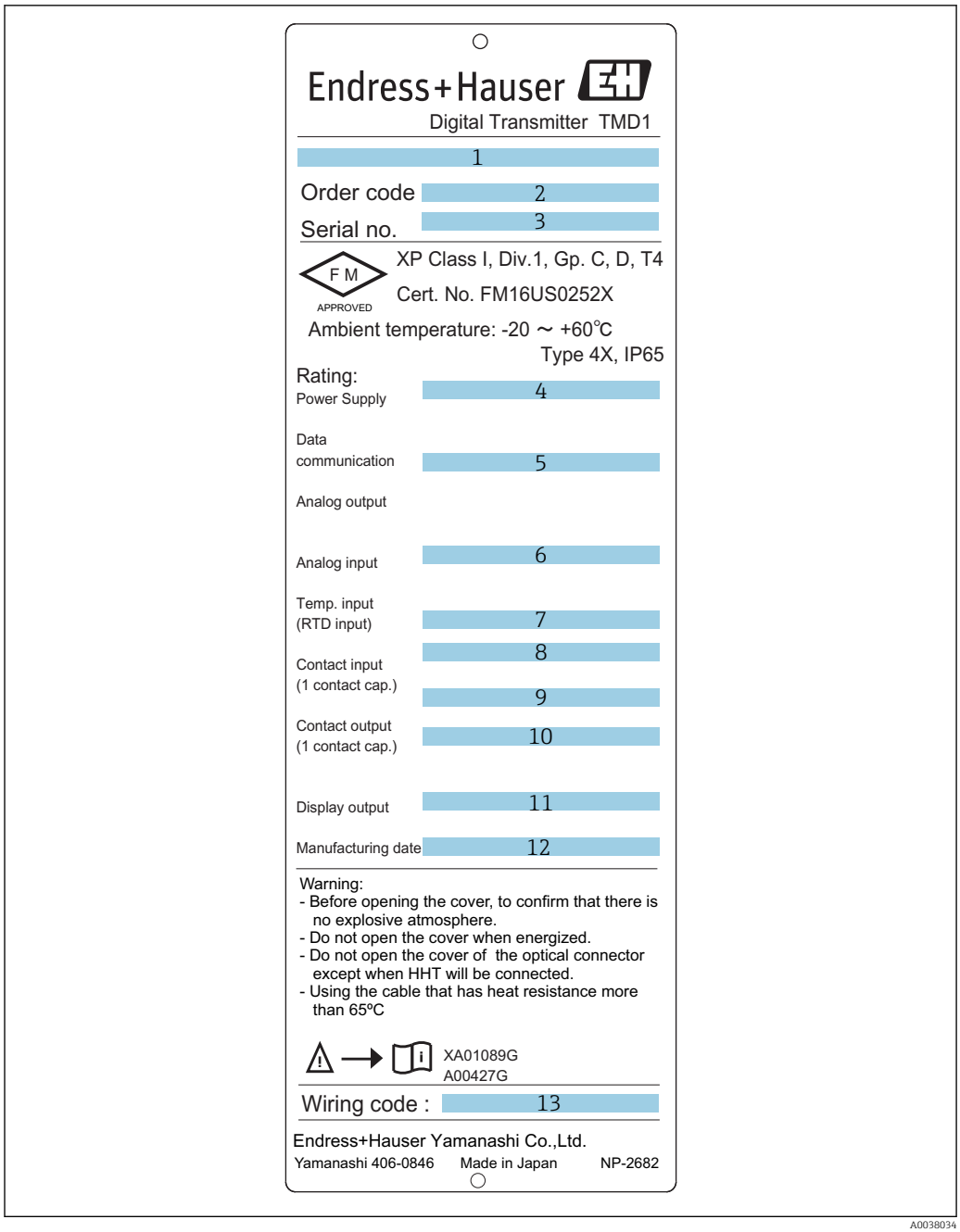
3 TMD nameplate

1 *Tag number*
2 *Order code*
3 *Serial number*
4 *Protection class*
5 *Power supply*
6 *Power consumption*
7 *Transmission circuit*
8 *Transmission circuit*
9 *Analog output*
10 *Input signal (Analog)*
11 *Input signal (Temperature)*
12 *Contact input*
13 *Contact output*
14 *Display output*
15 *Manufacturing date*
16 *Wiring code*



4 *TMD Optical FFi nameplate*

1 *Old model code*
2 *Order code*
3 *Serial number*
4 *Explosion proof model*
5 *Protection class*
6 *Power supply*
7 *Power consumption*
8 *Input signal*
9 *Contact input*
10 *Contact output*
11 *Wiring code*



5 *Nameplate for FM approval*

1 *Tag number*
2 *Order code*
3 *Serial number*
4 *Rating*
5 *Data*
6 *Analog output*
7 *Analog input*
8 *Input signal (Temperature)*
9 *Contact input*
10 *Contact output*
11 *Display output*
12 *Manufacturing date*
13 *Wiring code*

4.3 Manufacturer contact address

Endress+Hauser Yamanashi Co., Ltd.
862-1
Mitsukunugi, Sakaigawa, Fuefuki, Yamanashi, Japan
Address of the manufacturing plant: See nameplate.

4.4 Storage and transport

4.4.1 Storage conditions

- Storage temperature: −20 to +60 °C (−4 to 140 °F)
- Store the device in its original packaging.

4.4.2 Transport

NOTICE

The housing may become damaged or dislodged.
Risk of injury

- ▶ Transport the device to the measuring point in its original packaging or hold by the process connection.
- ▶ Do not fasten lifting devices (hoisting slings, lifting eyes etc.) at the housing; instead, secure it to the process connection. Take into account the center of gravity of the device in order to avoid unintended tilting.
- ▶ Comply with the safety instructions, transport conditions for devices over 18 kg (39.6 lbs) (IEC61010).

NOTICE

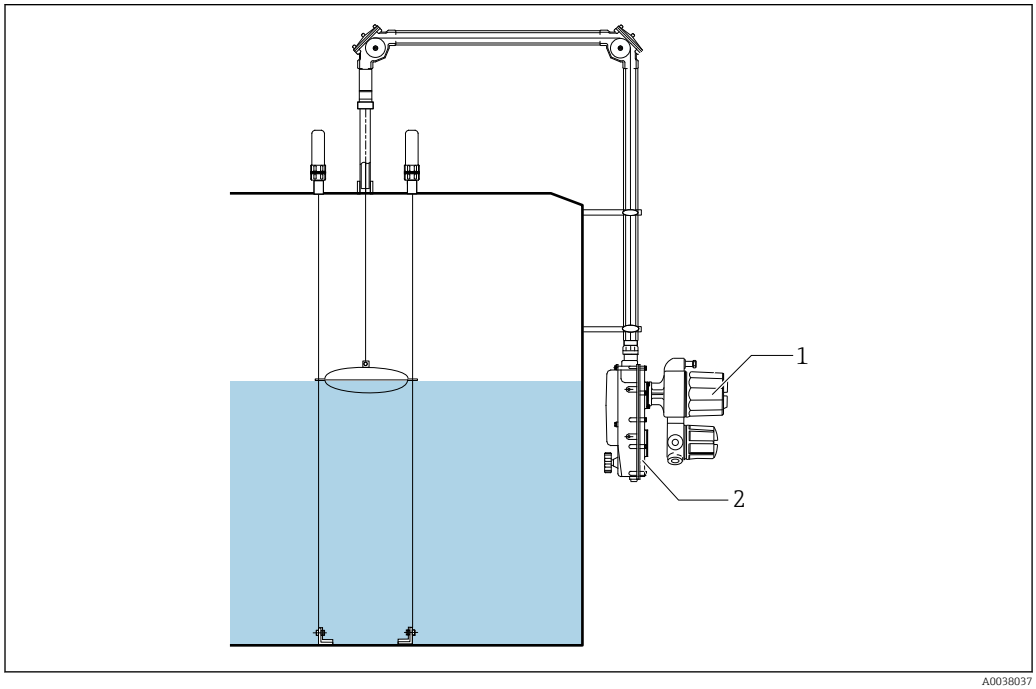
Risk of injury

- ▶ Transport the measuring device to the measuring point in its original packaging.
- ▶ Take into account the center of gravity of the device in order to avoid unintended tilting.
- ▶ Comply with the safety instructions, transport conditions for devices over 18 kg (39.6 lbs) (IEC61010).

5 Installation

5.1 Installation location

Digital Transmitter TMD1 is designed to be installed on the rear of a level gauge and placed outside the tank as shown below. This equipment (level gauge and transmitter) is primarily employed in measuring level, particularly for crude or other oil in refineries and storage tanks. Other applications may include acid, alkaline fluid and fat products in chemical industry storage tanks.



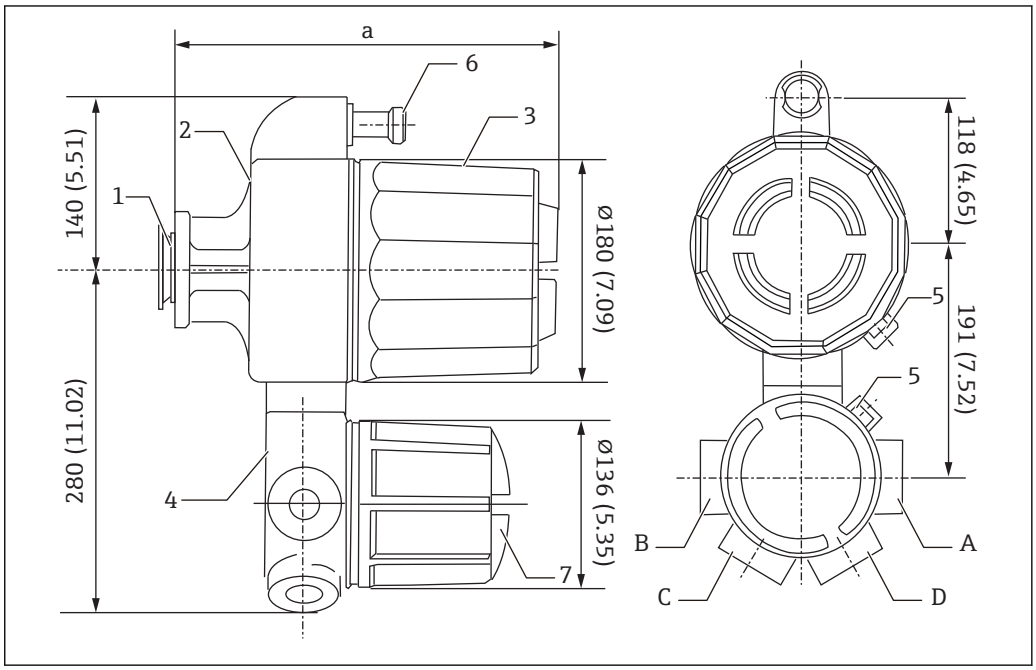
6 TMD Installation

1 Digital Transmitter TMD1
2 Float level gauge LT5

5.2 Structure

5.2.1 Standard size

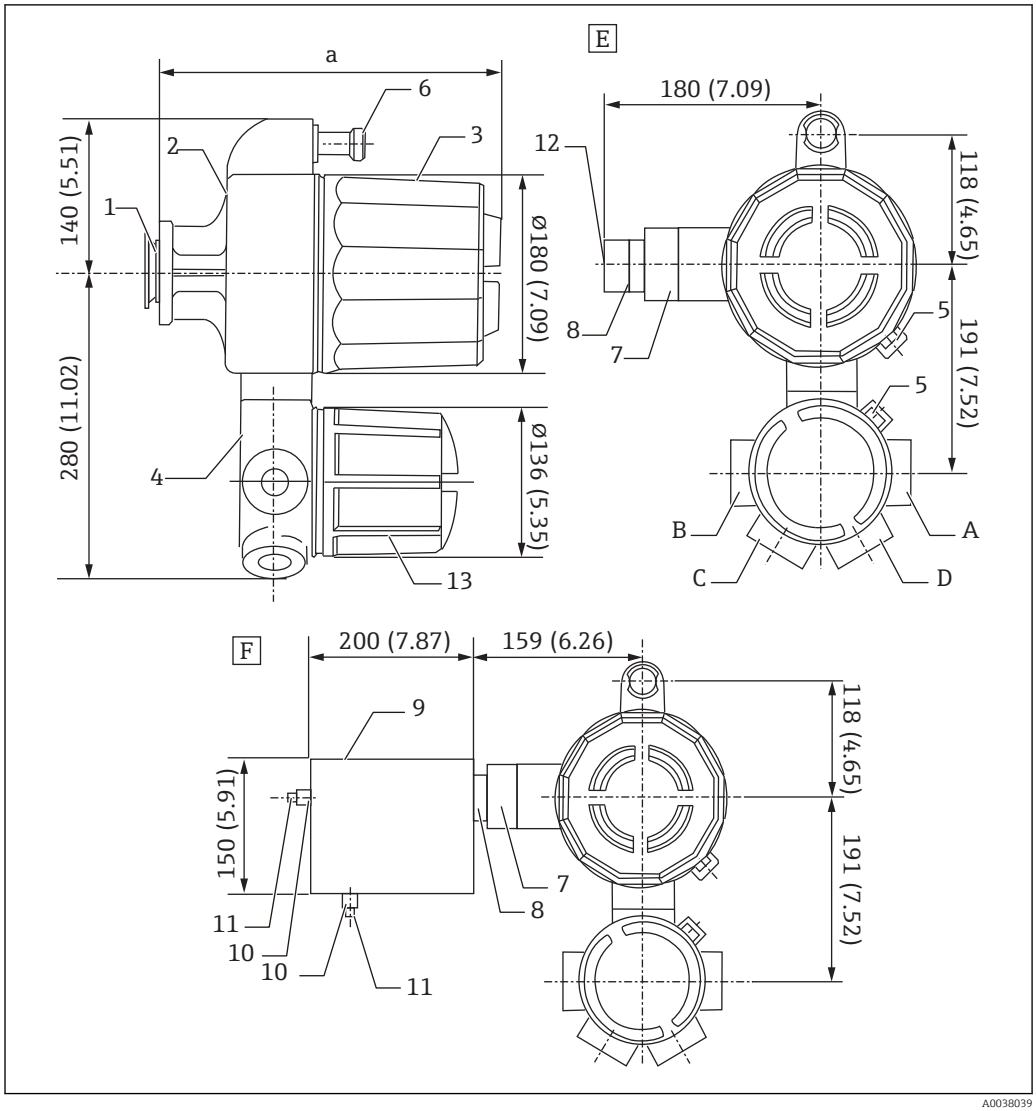
Ordering information 080 A cable gland is included with cable entry options H/J/K/L/M. In this case, the cable gland attached to the device must always be used. Options P/Q do not come with a cable gland.



7 *TMD1 size (Standard) Unit: mm (in)*

A Cable entry position A
B Cable entry position B
C Cable entry position C
D Cable entry position D
a 325 mm (12.79 in)(Non-FM specifications) / 335 mm (13.19 in)(FM specifications)
1 Coupling (Material: ADC6/Quantity: 1)
2 Electrical housing (Material: AC4C-T6/Quantity: 1)
3 Cover of electrical housing (Material: AC4C-T6/Quantity: 1)
4 Terminal box (Material: ADC12/Quantity: 1)
5 Locking (Material: ADC6/Quantity: 2)
6 Hand-held terminal connection port (Quantity: 1)
7 Terminal box cover (AC4C-T6/Quantity: 1)

5.2.2 Size of Optical FFi specifications



8 TMD1 size (FFi specifications) Unit: mm (in)

A Cable entry position A
B Cable entry position B
C Cable entry position C
D Cable entry position D
E Connection box type
F M42 x P1.5 slide coupling type
a 325 mm (12.79 in)(Non-FM specifications) / 335 mm (13.19 in)(FM specifications)
1 Coupling (Material: ADC6/Quantity: 1)
2 Electrical housing (Material: AC4C-T6/Quantity: 1)
3 Cover of electrical housing (Material: AC4C-T6/Quantity: 1)
4 Terminal box (Material: ADC12/Quantity: 1)
5 Locking (Material: ADC6/Quantity: 2)
6 Hand-held terminal connection port (Quantity: 1)
7 Optical unit adapter (Material: SUS304/Quantity: 1)
8 Optical unit 6D (Quantity: 1)
9 Connection box (Material: Aluminum/Quantity: 1)
10 Lead-in cable port (Rc1/2) (Material: Ferrous casting/Quantity: 1)
11 Blind plug (Material: FCMB310/Quantity: 2)
12 FC inlet connection (M42 x P1.5/Quantity: 1)
13 Terminal box cover (AC4C-T6/Quantity: 1)

Cable gland is not included.

5.3 Installing TMD1 on a float gauge

Digital transmitter TMD1 is designed to be installed on the rear of Float Gauge LT Series using a flange.

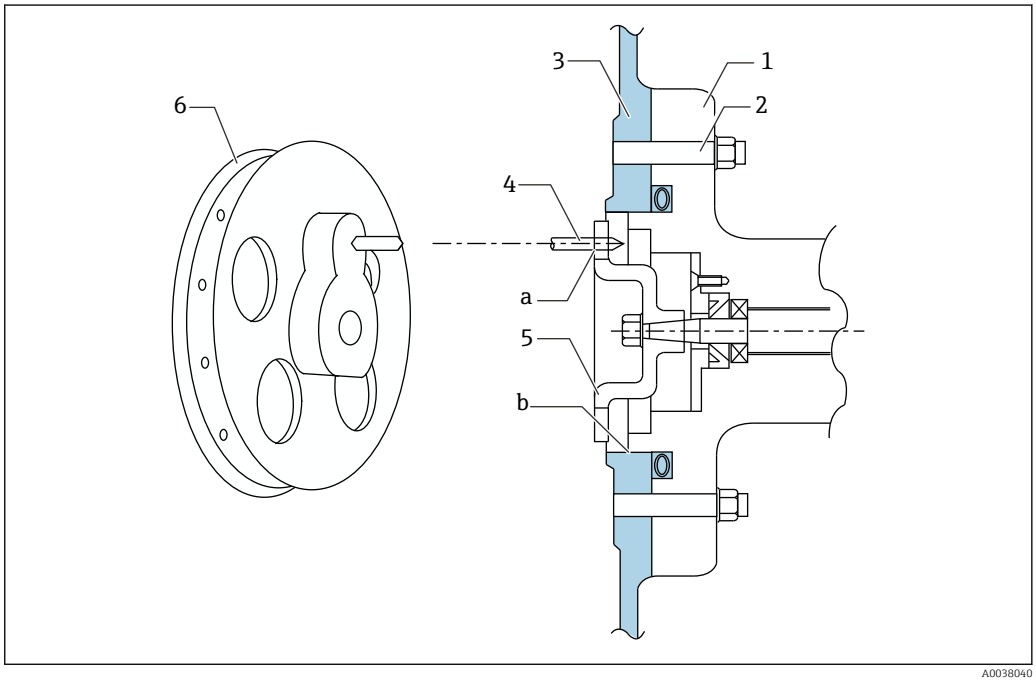
Stud bolt, nut, washer and coupling are supplied with TMD1 in a plastic bag.

5.3.1 Low-pressure coupling installation

Installation procedure

1. Insert the stud bolt in the rear cover of the float gauge.
2. Make sure that the coupling on TMD1 is secure when installing on low-pressure float gauges.

This completes the installation procedure.



9 *Coupling installation for low-pressure float gauge*

1 *Transmitter*
2 *Stud bolt*
3 *Float level gauge*
4 *Sprocket pin*
5 *Coupling*
6 *Sprocket*

- a: Pay attention to this installation.
- b: Ensure that this installation is secure.

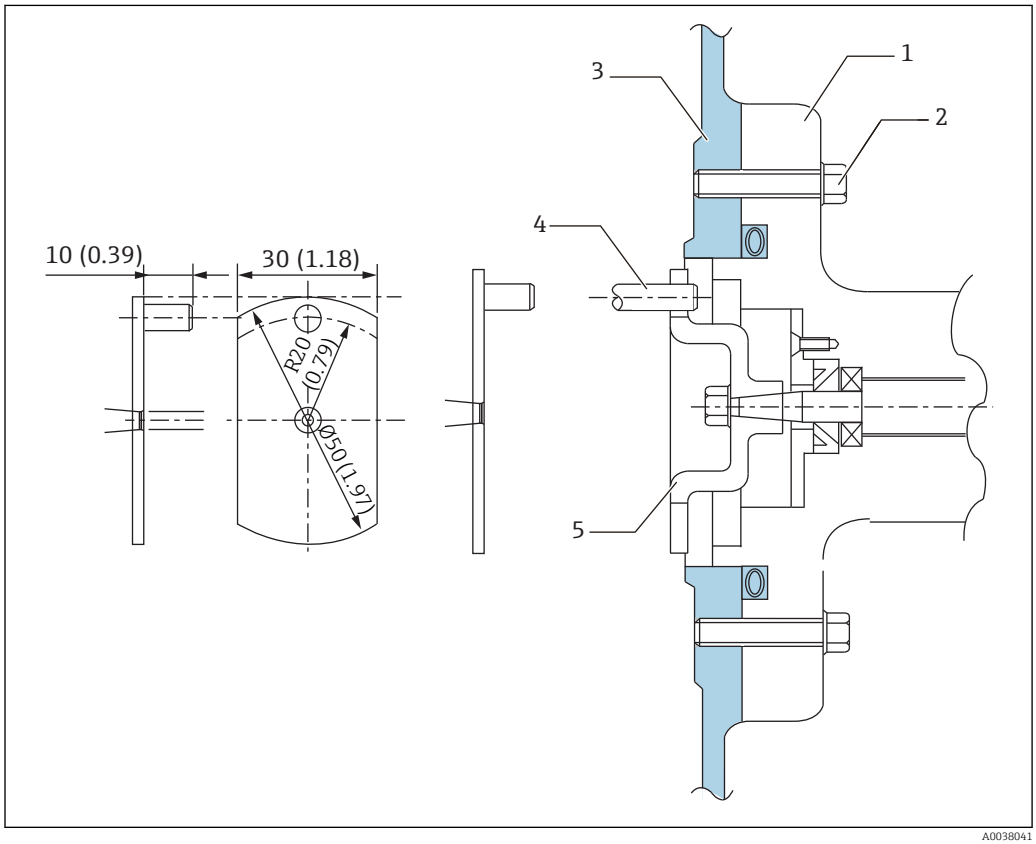
5.3.2 Coupling installation for medium- and high-pressure float gauge

Installation procedure

1. Remove the TMD1 rear cover.
2. Install TMD1 onto a float gauge while aligning the coupling groove with coupling pin.
   ↳ If the coupling groove and the pin positions are not aligned, the installation surface will rise and not match with the position. Do not install the coupling using excessive force. Check the coupling position and reinstall TMD1, if needed.

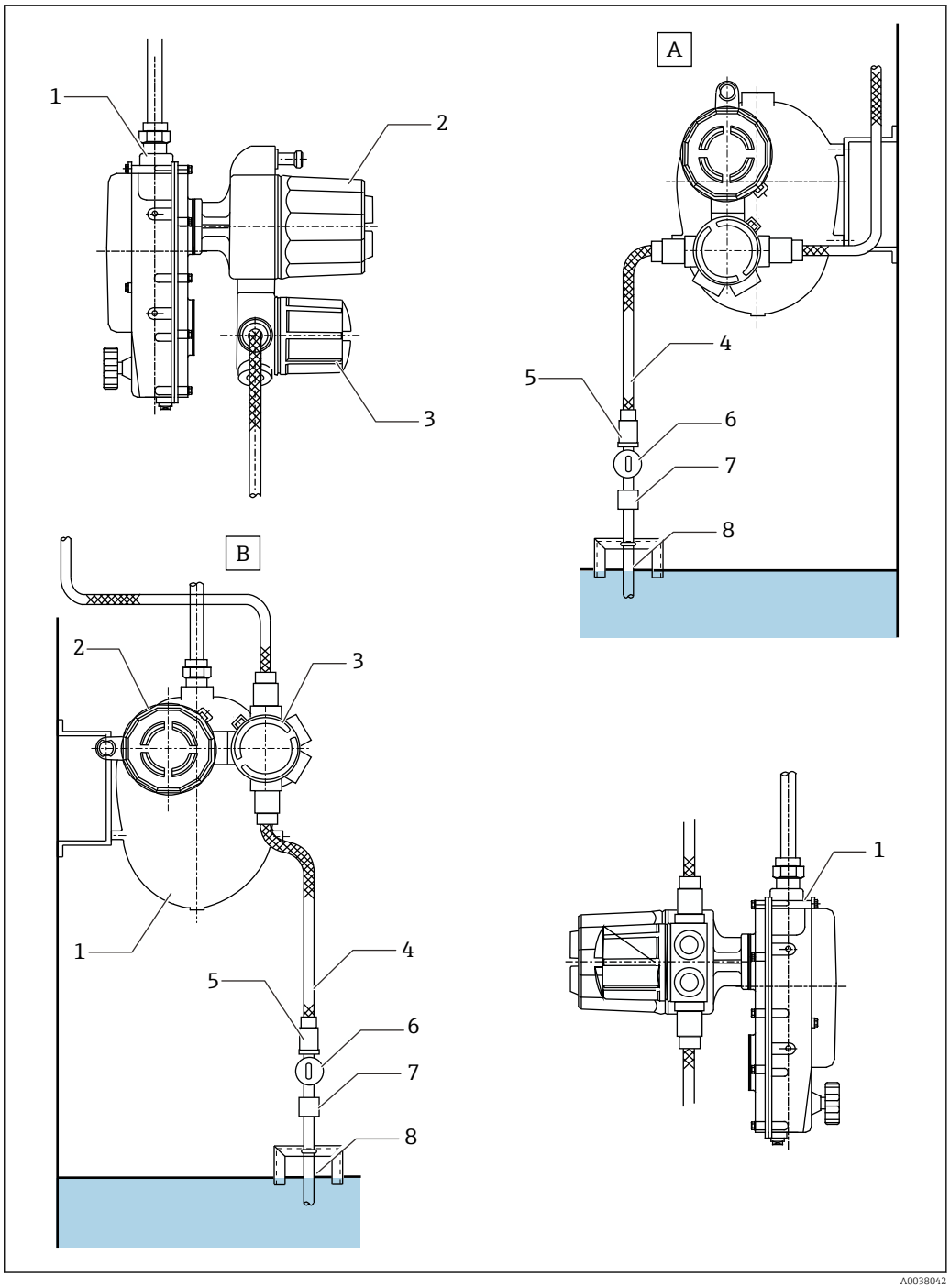
This completes the installation procedure.

When the professional installation and adjustment services of Endress+Hauser are required, all procedures, including unpacking, are conducted by our service technicians.



10 *Coupling installation for medium- and high-pressure float gauge*

5.4 Installation onto a tank

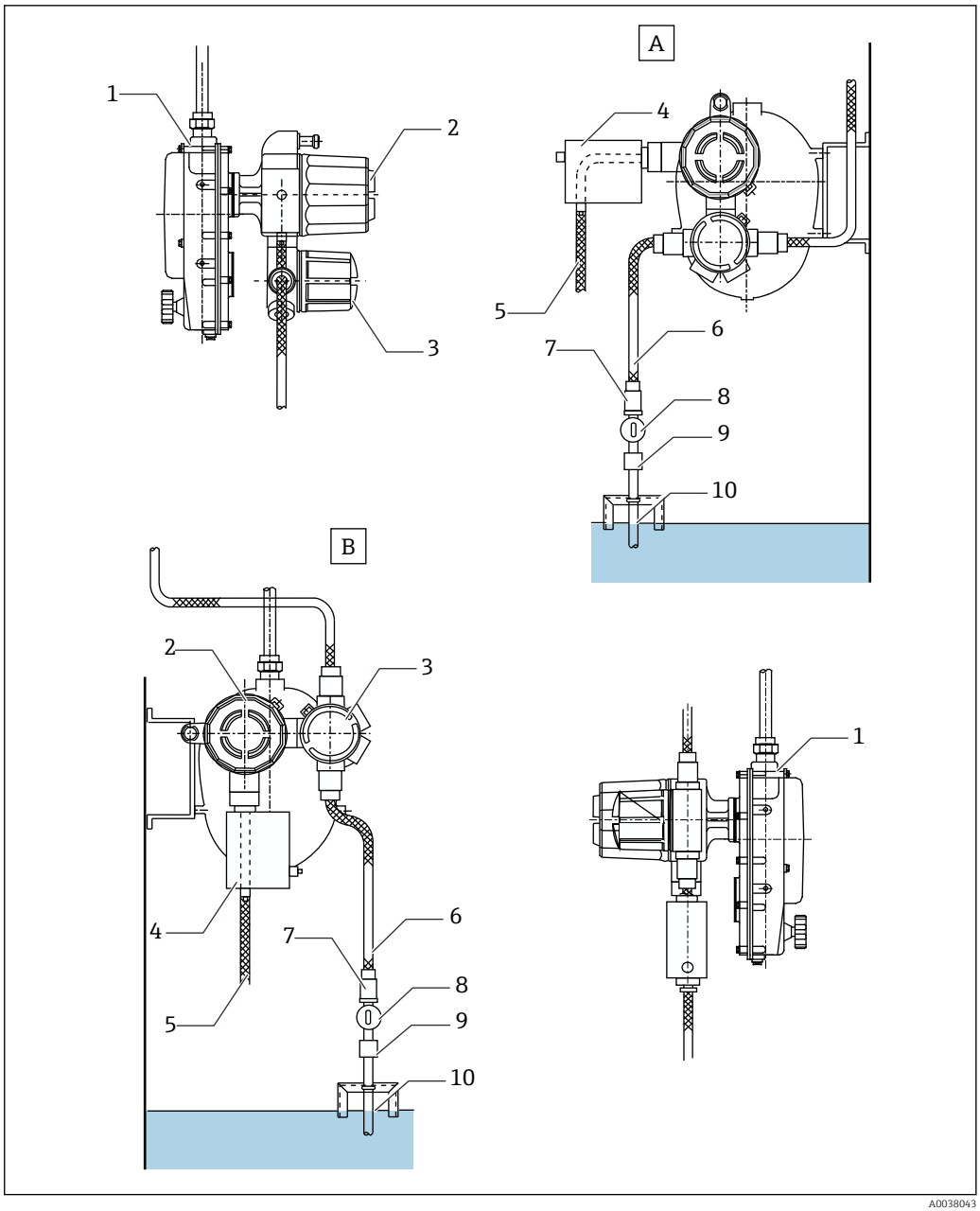


11 *Installation (Standard)*

A Standard installation
B Special installation (See notes)
1 Float level gauge
2 TMD1 electric lid
3 TMD1 terminal box
4 Flexible fitting
5 Cable gland or cable conduit

6 Tumbler switch
7 Flexible fitting
8 Thick steel conduit tube

B in the drawing shows an installation that requires wire routing. This is not recommended as it is prone to letting in rain water through the cable entry.



12 *Installation (FFi Specification)*

A Standard installation
B Special installation (See notes)
1 Float level gauge
2 TMD1 electric lid
3 TMD1 terminal box
4 Connection box
5 Flexible fitting for optical fiber
6 Flexible fitting
7 Cable gland or cable conduit
8 Tumbler switch
9 Flexible fitting
10 Thick steel conduit tube

B in the drawing shows an installation that requires wire routing. This is not recommended as it is prone to letting in rain water through the cable entry.

6 Electrical connection

6.1 Cable connection

For TMD cable connections, the terminal configuration and internal wiring vary depending on specifications. Be sure to confirm delivery specifications to prevent incorrect wiring.

Select a cable so that the power supply voltage at the terminal of TMD1 is at least 90% of nominal voltage.

Input signal	Recommended cable type	Recommended cable	Remarks
Power supply	PVC, PE 600V dielectric strength voltage cable with shield or equivalent	CVV-S	For power consumption, determine the core area based on 20 VA.
Digital signal (2-way, 2-wire transmission, DRM9700 communication)	Digital communication twisted pair cable	CPEV KPEV	With CPEV φ 1.2 mm (0.047 in), up to 6 km can be transmitted.
(NMT, NRF communication)	Digital communication shield twisted pair cable	CPEV-S KPEV-S	
4 to 20 mA Inputs and outputs	PVC or PE dielectric cable	CVV-S	
Contact output	PVC or PE dielectric cable	CVV-S	The maximum rated voltage for contact output is DC 30 V, and it is 12 V for contact input.
RCV, RCS/NC Temperature input (Pt 100 Ω)	Standard control cable (conduit, flexible tube)	IV Cable	Use cw-s cable if a conduit is not used.
BCD, Sakura code parallel output	Multicore twisted pair cable or equivalent	CPEV-S KPEV-S	For level transmission 19 999 mm, 18 cores are required and the number of pairs is 9P.

6.2 Calculation of wiring transmission distance

Calculation example

- The purpose of this calculation is to calculate the following limitation between lines of resistance and capacitance amount.
  Resistance in one direction: Maximum 120Ω
  Maximum amount between lines: Maximum 0.3 μF
- Maximum amount of cable resistance and between lines (See table below)

Cable Name	Conductor Resistance (Ω/km)	Capacitance (μF/km)	Max. Transmission Distance (km)	Note
CPEV, CPEE Ø 0.9 mm (0.035 in)	Max. 30	Max. 0.05	4	Calculate based on 30 Ω
KMPEV. KPEV-S KMPEE 0.9 mm^2	Max. 21.5	0.05	5.58	Calculate based on 21.5 Ω
CPEV Ø 1.2 mm (0.047 in)	16.5	0.05	6	Calculate based on 0.05 0.05 μF
CPEV (T) Ø 0.9 mm (0.035 in)	Max. 30	0.06	4	Calculate based on 30 Ω
CVV2 mm2 (CEE)	9.5	0.09 (0.06)	3.3 (5)	Calculate based on 0.09 (0.06) 0.09 μF (0.06) μF

6.2.1 TMD1 with AC 100 V specifications

Voltage drop equation

Current supply to one transmitter: $\frac{10\,VA}{100\,V} = 0.1\,A$

- Voltage drop by cable 1
  10 transmitters x 0.1 A x $R_1\Omega = 1R_1$ (V)
- Voltage drop by cable 2
  1 transmitter x 0.1 A x $R_2\Omega = 0.1R_2$ (V)

The allowed maximum voltage drop by both cables due to allowed power supply voltage fluctuation −10 % is:

100 (V) x 10 % = 10 (V)

Therefore,

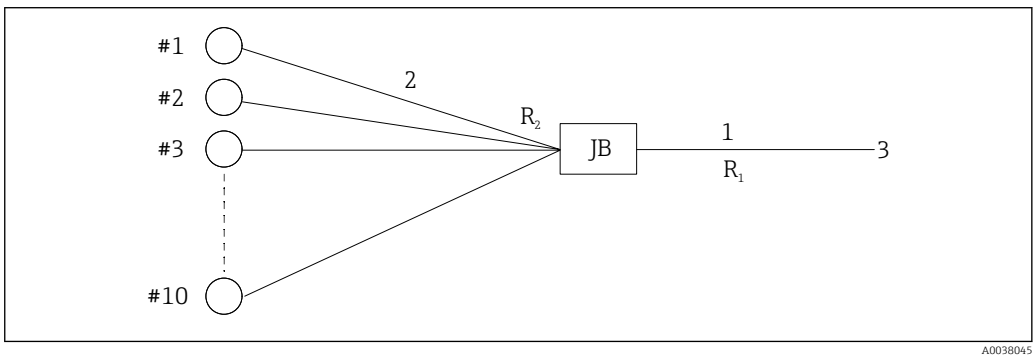
10 (V) > $1R_1$ (V) + $0.1R_2$ (V)

Power supply cable data

Cross-section area	Resistance/1 km
1.25 mm^2	14.7 Ω
2.0 mm^2	9.7 Ω
3.5 mm^2	5.3 Ω
5.5 mm^2	3.4 Ω
8 mm^2	2.3 Ω
14 mm^2	1.3 Ω

The table shows value outcomes when the following values are substituted into the following equation:

- Cable 1 length: 100 m (328.08 ft)
- Cable 2 length: 2 km (1.24 mi)



13 Voltage of TMD1 power cable

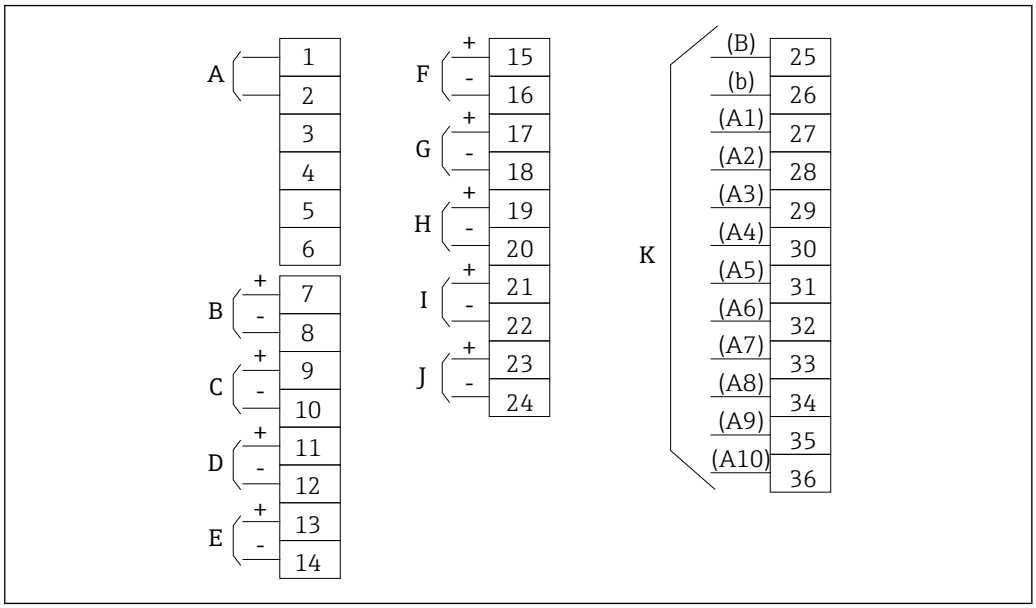
1 Cable 1 distance L_1 (km)
2 Cable 2 distance L_2 (km)
3 Power supply

Voltage and resistance of cables 1 and 2

Cable 1 cross-section area (mm^2)	Ω /1 km	Ω /2 km	Cable 1 voltage drop (V)	Cable 2 cross-section area (mm_2)	Ω /100 mm	Cable 2 voltage drop (V)	Cables 1 and 2 voltage drop (V)	TMD1 terminal voltage (V)	Result
1.25	14.7	29.4	29.4	1.25	2.94	0.294	29.694	70.306	NG
2.00	9.50	19.00	19.00				19.294	80.706	NG
3.50	5.30	10.60	10.60				10.894	89.106	NG
5.50	3.40	6.80	6.80				7.094	92.906	OK
8.00	2.30	4.60	4.60				4.894	95.106	OK
14.00	1.30	2.60	2.60				2.894	97.106	OK
1.25	14.70	29.40	29.40	2	1.9	0.19	29.59	70.41	NG
2.00	9.50	19.00	19.00				19.19	80.81	NG
3.50	5.30	10.60	10.60				10.79	89.21	NG
5.50	3.40	6.80	6.80				6.99	93.01	OK
8.00	2.30	4.60	4.60				4.79	95.21	OK
14.00	1.30	2.60	2.60				2.79	97.21	OK
1.25	14.70	29.40	29.40	3.5	1.06	0.106	29.506	70.494	NG
2.00	9.50	19.00	19.00				19.106	80.894	NG
3.50	5.30	10.60	10.60				10.706	89.294	NG
5.50	3.40	6.80	6.80				6.906	93.094	OK
8.00	2.30	4.60	4.60				4.706	95.294	OK
14.00	1.30	2.60	2.60				2.706	97.294	OK
1.25	14.70	29.40	29.40	5.5	0.68	0.068	29.468	70.532	NG
2.00	9.50	19.00	19.00				19.068	80.932	NG
3.50	5.30	10.60	10.60				10.668	89.332	NG
5.50	3.40	6.80	6.80				6.868	93.132	OK
8.00	2.30	4.60	4.60				4.668	95.332	OK
14.00	1.30	2.60	2.60				2.668	97.332	OK
1.25	14.70	29.40	29.40	8	0.46	0.046	29.446	70.554	NG
2.00	9.50	19.00	19.00				19.046	80.954	NG
3.50	5.30	10.60	10.60				10.646	89.354	NG
5.50	3.40	6.80	6.80				6.846	93.154	OK
8.00	2.30	4.60	4.60				4.646	95.354	OK
14.00	1.30	2.60	2.60				2.646	97.354	OK
1.25	14.70	29.40	29.40	14	0.26	0.026	29.426	70.574	NG
2.00	9.50	19.00	19.00				19.026	80.974	NG
3.50	5.30	10.60	10.60				10.626	89.374	NG
5.50	3.40	6.80	6.80				6.826	93.174	OK
8.00	2.30	4.60	4.60				4.626	95.374	OK
14.00	1.30	2.60	2.60				2.626	97.374	OK

6.3 Wiring

The following is a typical TMD1 terminal connection diagram. For wiring cables, refer to delivery specifications.



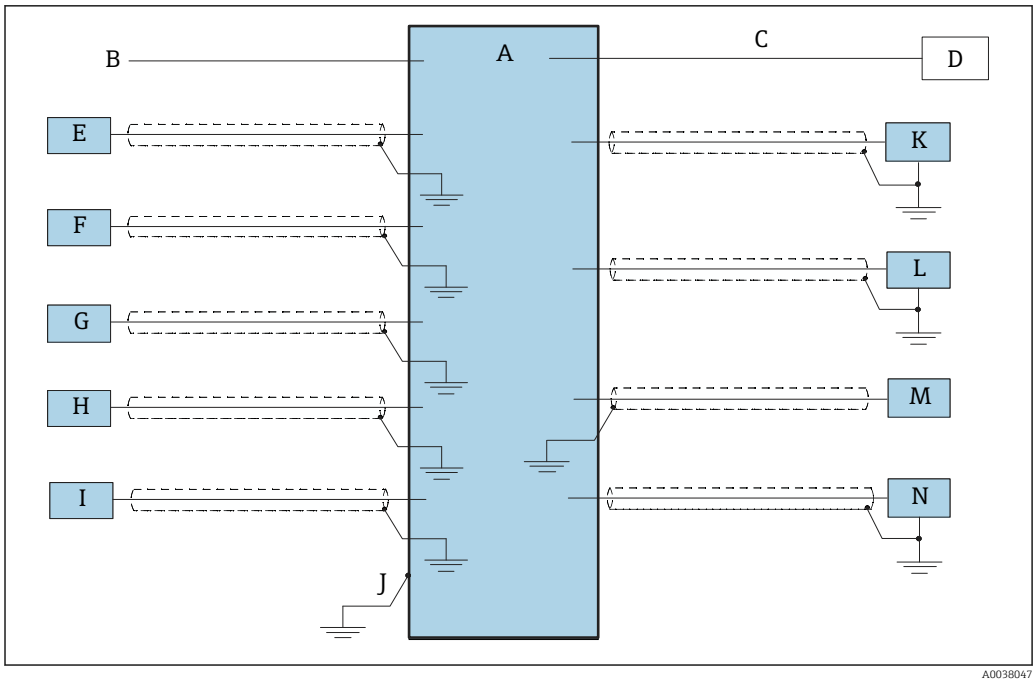
14 *TMD1 Terminal table (e.g. TMD1 B-2)*

A AC power supply
B 2-way, 2-wire transmission
C DC 4 to 20 mA output
D DRM-9700 output
E DC 4 to 20 mA output
F HART signal (see Notes)
G Alarm output 1
H Alarm output 2
I Alarm output 3
J Alarm output 4
K Average temperature input
A1 Spot 1
A2 Spot 1
A3 Spot 1
A4 Spot 2
A5 Spot 2
A6 Spot 2
A7 Spot 3
A8 Spot 3
A9 Spot 3

Contact switch

Descriptions	SW1 (Terminal No.4)	SW2 (Terminal No.5)	SW3 (Terminal No.6)
Level measurement	OFF	OFF	OFF
Hoisting	ON	OFF	OFF
Stop	OFF	ON	OFF

Temperature input connection may be either HART signal or RTD input. Both connection types cannot be utilized at the same time.



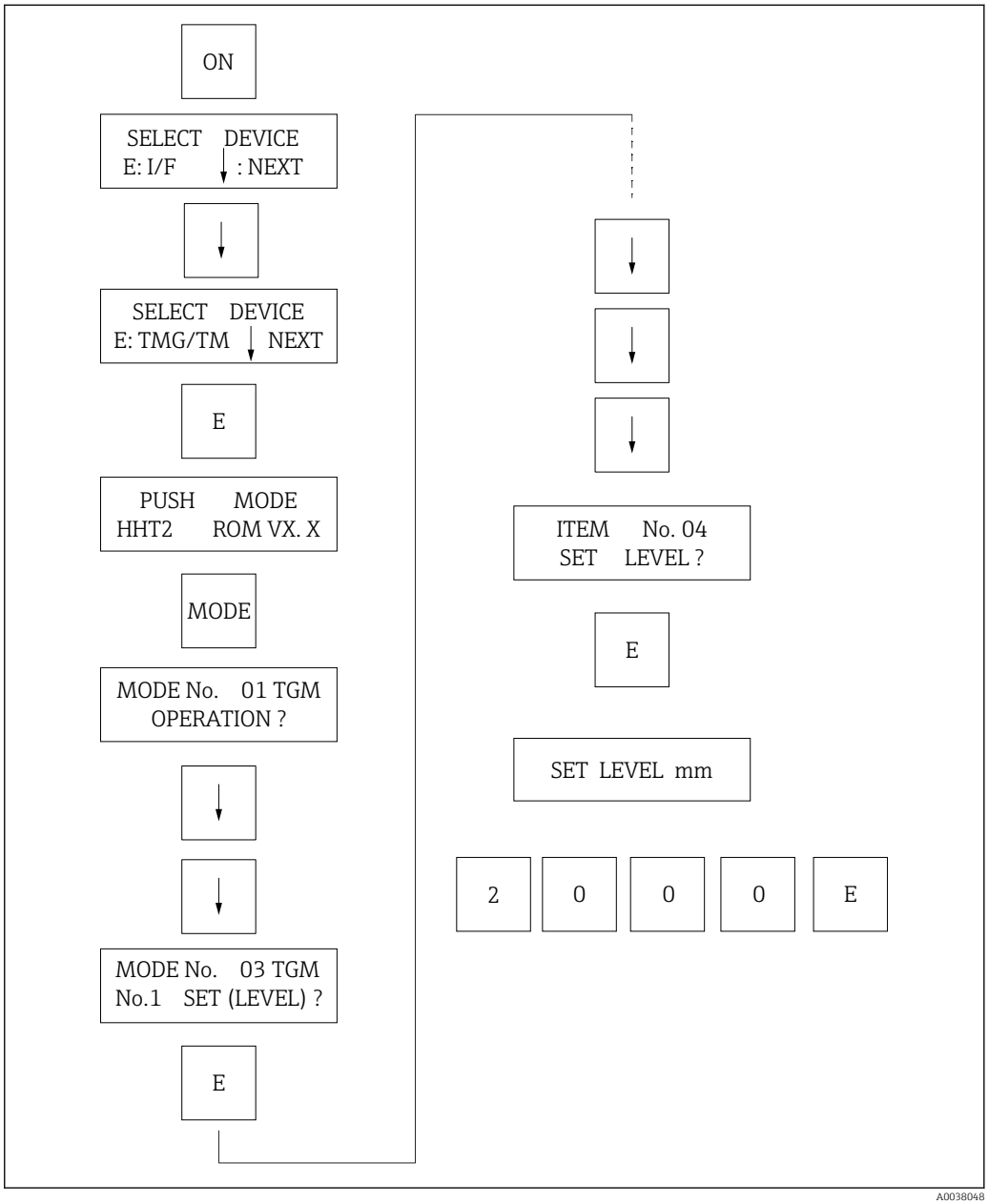
15 *Grounding wires for units and shield cables*

A TMD1 terminal box
B Power supply
C 2-way, 2-wire communication
D Receiver
E Temperature device NMT53x
F Promonitor NRF560
G Temperature device RCV/RCS
H Contact input
I DC 4 to 20 mA input
J Installing TMD1 exterior to a tank
K Contact output
L DC 4 to 20 mA output
M DRM9700 communication
N BCD/Sakura code communication

7 Operability

Prepare HHT2 (Hand Held Terminal) Operation and Setting Instructions for calibration. After wiring check, confirm power-supply voltage (differs depending on specifications) and turn the power on. Do not turn off power, except for adjustment and maintenance.

7.1 Level adjustment operation flow



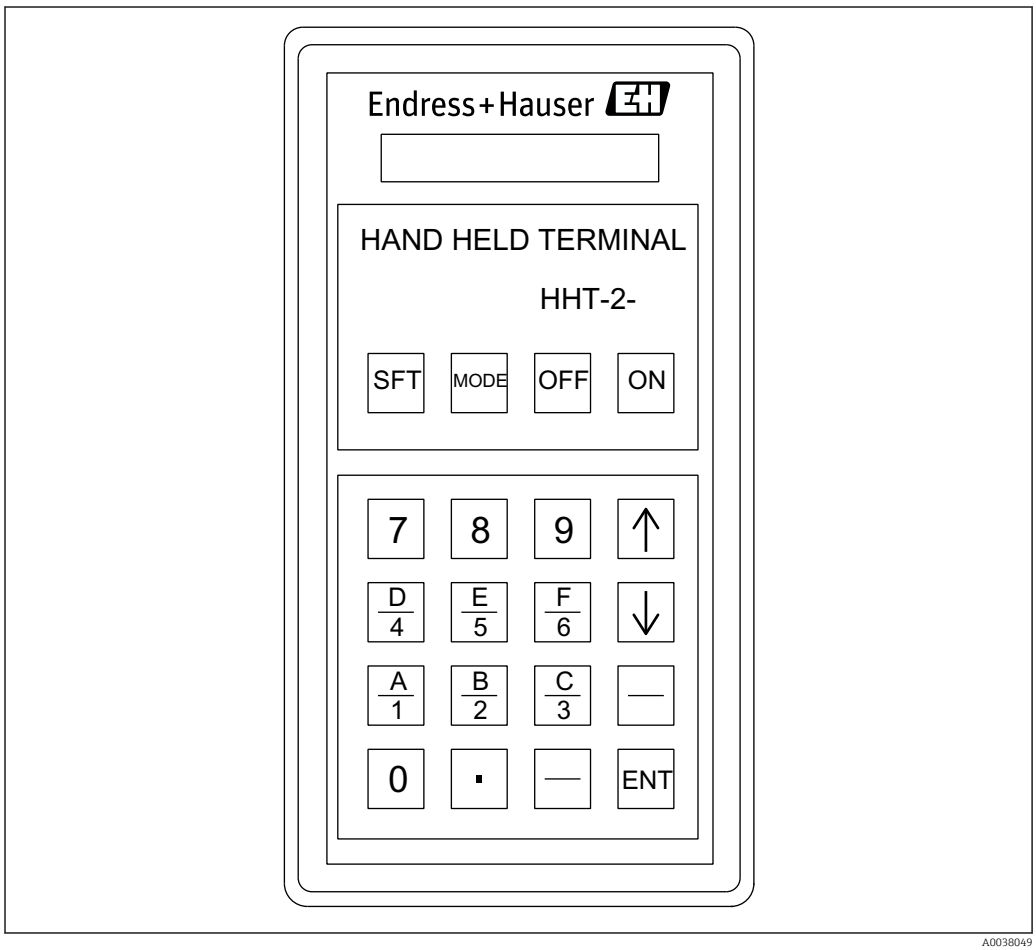
Using numerical keys, input the designated level (mm) (e.g. 2000 (mm)).

8 Operation

8.1 HHT2 (Hand Held Terminal)

The TMD1 series operation, settings and adjustments are easily done using the convenient Hand Held Terminal.

- TMD1 with HART input specification requires the latest HHT2 software version (HHT V5.8 or later).
- Always take care when using explosion-proof products in hazardous areas.



16 *HHT2 (Hand Held Terminal)*

8.2 Specifications, modules and mode in HHT2

8.2.1 Basic specifications

Functions	Descriptions	Mode
Basic operations	Check all positions and names of installed board	MODE00
	Memory address setting / Memory address setting / Memory data display	
	Error status display	MODE02
	Data display	
	Level adjustment	MODE03

8.2.2 Output 1 specifications

Functions	Specifications	Descriptions	Module	Mode
Output 1	1	4 to 20 mA	DAC-1	MODE11
	2	2-way, 2-wire (MDP protocol)	Exp-A	MODE13
	3	BCD parallel	OUT-3/4	MODE05
	4	Sakura code parallel		MODE13
	5	2-way, 2-wire digital communication (MIC, BBB protocol)	Exp-A	MODE13
	6	2-way, 2-wire (V1 protocol)	Exp-A	MODE13
	7	Optical FFi	ODC-1	MODE15

8.2.3 Output 2 specifications

Functions	Specifications	Descriptions	Module	Mode
Output 2	A	4 to 20 mA	DAC-1	MODE11, MODE12
		4 x alarm (open collector)	Exp-A	MODE06
	B	4 to 20 mA	DAC-1	MODE11, MODE12
		Monitor DRM	DRMM-A	
	C	4 x alarm (open collector)	Exp-A	MODE06
		Monitor DRM	DRMM-A	
	D	4 to 20 mA	DAC-1	MODE11, MODE12
		4 x alarm (open collector)	Exp-A	MODE06
		Monitor DRM	DRMM-A	
	E	4 to 20 mA	DAC-1	MODE11, 12
		2 x operation command	CNT-2	MODE01
	F	2 x operation command	DRMM-A	
		Monitor DRM	CNT-2	MODE01
	G	4 x alarm (relay)	Exp-A + CD688	MODE06

Functions	Specifications	Descriptions	Module	Mode
	H	4 to 20 mA	DAC-1	MODE11, 12
		4 x alarm (relay)	Exp-A + CD688	MODE06
	J	4 x alarm (relay)	Exp-A + CD688	MODE06
		Monitor DRM	DRMM-A	
	K	4 to 20 mA	DAC-1	MODE11, 12
		4 x alarm (relay)	Exp-A + CD688	MODE06
		Monitor DRM	DRMM-A	
	1	4 to 20 mA	DAC-1	MODE11, 12
	2	4 x alarm (open collector)	Exp-A	MODE06
	3	Monitor DRM	DRMM-A	
	4	2 x operation command	CNT-2	MODE01
	5	2 x operation command	CNT-2	MODE01
		6 x external device operation command		
	6	8 x external device operation command	CNT-2	MODE01

8.2.4 Input specifications

Functions	Specifications	Descriptions	Module	Mode
Input	A	4 to 20 mA	ADC-2	MODE14
		1 x spot temperature Pt100/JPt100	Thermo-A	MODE07
	B	4 to 20 mA Analog input	ADC-2	MODE14
		3 x spot temperature Pt100/JPt100	Thermo-A	MODE08
	C	4 to 20 mA Analog input	ADC-2	MODE14
		Multi-element average temperature	Thermo-A	MODE09
	D	4 to 20 mA Analog input	ADC-2	MODE14
		Single element average temperature Pt100/ JPt100	Thermo-A	MODE10
	E	4 x status	Exp-A	
		1 x spot temperature Pt100/JPt100	Thermo-A	MODE07
	F	4 x status	Exp-A	
		3 x spot temperature Pt100/JPt100	Thermo-A	MODE08
	G	4 x status	Exp-A	
		Multi-element average temperature	Thermo-A	MODE09
	H	4 x status	Exp-A	
		Single element average temperature	Thermo-A	MODE10
	J	4 to 20 mA	ADC-2	MODE14
		4 x status	Exp-A	
	K	4 to 20 mA	ADC-2	MODE14
		4 x status	Thermo-A	MODE07
		1 x spot temperature Pt100/JPt100	Exp-A	

Functions	Specifications	Descriptions	Module	Mode
	L	4 to 20 mA	ADC-2	MODE14
		4 x status	Thermo-A	MODE08
		3 x spot temperature Pt100/JPt100	Exp-A	
	M	4 to 20 mA	ADC-2	MODE14
		Multi-element average temperature	Thermo-A	MODE09
		4 x status	Exp-A	
	N	4 to 20 mA	ADC-2	MODE14
		Single element average temperature	Thermo-A	MODE10
		4 x status	Exp-A	
	1	4 to 20 mA	ADC-2	MODE14
	2	4 x status	Exp-A	
	3	1 x spot temperature Pt100/JPt100	Thermo-A	MODE07
	4	3 x spot temperature Pt100/JPt100	Thermo-A	MODE08
	5	Multi-element average temperature	Thermo-A	MODE09
	6	Single element average temperature	Thermo-A	MODE10

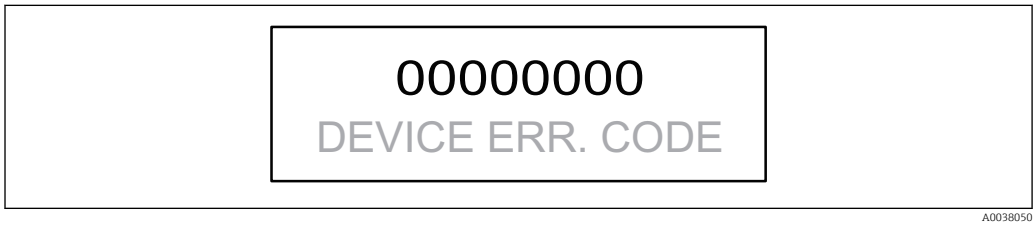
9 Diagnostics and troubleshooting

9.1 General troubleshooting

9.1.1 Error message

Error message can be confirmed on the error code display MODE02, ITEM13 of HTT2.

All generated error bit values that are converted into decimal form appear on the error code display screen.

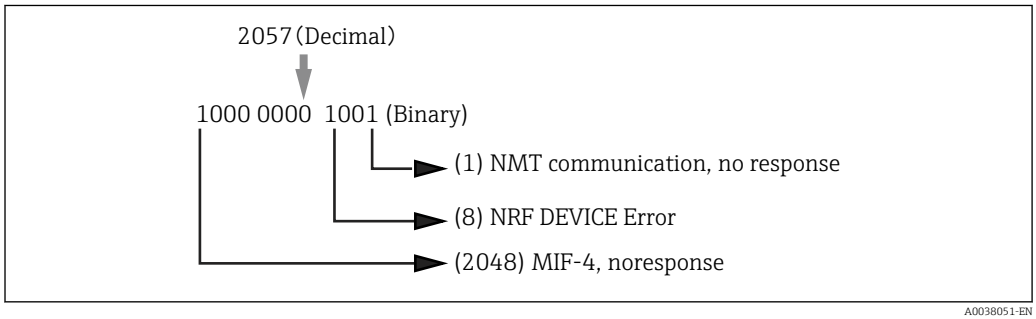


17 Error message

9.1.2 Error confirmation

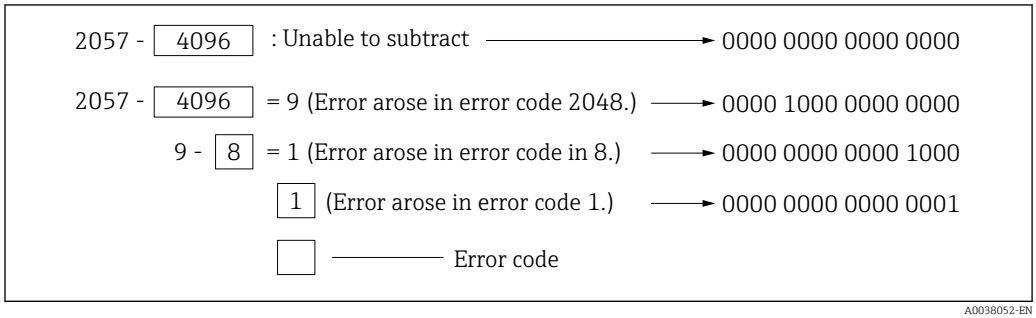
Confirmation procedure 1

When the decimal shown is 2057, this value is converted into binary as follows. The generated binary error code represents descriptions for each error.



Confirmation procedure 2

Subtract the large numbers in each error code (decimal) from 2057 (decimal) in descending order, and confirm the error description corresponding to the error code in the "Error message table" below.



9.1.3 Error message list

Error codes	Displays	Items	Error descriptions	Causes
1	0000 0000 0000 0001	HART Communication	NMT communication	No response
2	0000 0000 0000 0010		NMT device	Error codes
4	0000 0000 0000 0100		NRF COMM	
8	0000 0000 0000 1000		NRF Device	
256	0000 0001 0000 0000	EEROM	EEROM	Inaccessible
8192	0010 0000 0000 0000		SRAM	
512	0000 0010 0000 0000	System	External 12V	Disconnection
1024	0000 0100 0000 0000		Internal 12V	Disconnection
2048	0000 1000 0000 0000		MIF-4	No response or other
4096	0001 0000 0000 0000	Temperature system	Element trouble	Open, short

9.1.4 Malfunction diagnosis

Conditions	Causes
Off-line communication between HHT2 and TMD	TMD main power is off. (Power switch is off, internal fuse breakage or disconnection of internal power cable)
Abnormal level data	Level encoder circuit malfunction (the encoder itself or level A/D I/F)
No change in level data	Looseness between level gauge and coupling
	Looseness of gear set screw on gear unit
	Misalignment of main shaft gear and internal panel gear
Abnormal output 1 data	Data are not set properly.
Abnormal output 2 data	Data are not set properly.
Abnormal input data	Data are not set properly.

9.2 Firmware history

Date	Software version	Modifications	Relevant documentation (TMD1)	
			Operating Instructions	Technical Information
09.2008	V1.10	Original version	BA1007N	TI024N
05.2009	V1.11	Change in valve control	BA1007N	TI024N
08.2010	V1.12	Chane in V1 NMT data	BA01007G	TI00024G
02.2014	V1.13	Change in ullage flag ON & 90 m flag ON & minimum 900000 processing	BA00427G	TI00024G
07.2014	V1.14	Minor updates Updated Tankvision Tankvision level value to correspond to the float level	BA00427G	TI00024G
12.2017	V1.16	HART output (for demo)	BA00427G	TI00024G
12.2018	V1.17	HART output	BA00427G	TI00024G

10 Maintenance

10.1 Maintenance work

No special maintenance work is required.

10.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

10.1.2 Seal replacement

The TMD process seal must be replaced periodically, especially when a molded seal (sterile structure) is used. The period between changes will depend on cleaning frequency, temperature of target material (liquid) and cleaning temperature.

10.2 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

11 Repair

11.1 General information on repairs

11.1.1 Repair concept

The Endress+Hauser repair concept assumes that the devices have a modular design and that repairs can be done by the Endress+Hauser Service Department or specially trained customers.

Spare parts are included in appropriate kits. They contain the related replacement instructions.

For more information on service and spare parts, contact the Endress+Hauser Service Department.

11.1.2 Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel or by the Endress+Hauser Service Department.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- When ordering a spare part, note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, perform the specified routine test on the device.
- Only the Endress+Hauser Service Department may convert a certified device into a different certified variant.
- Document all repair work and conversions.

11.2 Spare parts

Some interchangeable device components are listed on an overview label on the connection compartment cover.

The spare part overview label contains the following information:
- A list of the most important spare parts for the device, including their ordering information
- The URL for the *W@M Device Viewer* (www.endress.com/deviceviewer):
  All the spare parts for the device, along with the order code, are listed here so that they can be ordered. If available, users can also download the associated Installation Instructions.

11.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

Your Endress+Hauser Sales Center can provide detailed information on the services.

11.4 Return

The device must be returned if it is in need of repair or a factory calibration, or if the wrong device has been delivered or ordered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that have come into contact with measured materials.

To ensure safe, swift and professional device returns, refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at http://www.endress.com/support/return-material.

11.5 Disposal

Observe the following notes during disposal:
- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

12 Accessories

12.1 Device-specific accessories

12.1.1 Module

TMD1 is available in variety option modules. By installing modules as necessary, various customer specification requests may be built and filled economically.

12.1.2 Module types

Name	Functions	Size	Number of terminals for standard use	Remarks
Main CPU - B	CPU module	A	6	Be sure to install one module.
Exp - A	2-way, 2-wire serial digital pulse transmission Contact output (alarm) 4 points Contact input (status) 4 points	A	2 8 8	Transistor output
Thermo - A	Average temperature device Spot temperature device	A	12 3	For average and spot temperature devices
DAC - 1	4 to 20 mA Analog output	C	2	2 modules are available to install.
OUT- 3/4	BCD parallel output	B	18	OUT-3: Collector common OUT-4: Emitter common
ADC - 2	4 to 20 mA Analog signal input	C	2	Available only for use with a 2-wire transmission board
DRMM- A	DRM communication	C	2	
ODC-1N	Optical communication (2-way, half-duplex transmission) Optical digital pulse	C	0	
CNT-2	External operation device output	B	16	Max. 8 points
CD-688	Alarm contact output	C	8	4 points for standard (max. 8 points) Mechanical relay output

Index

Symbols

C

D

E

P

R

W

www.addresses.endress.com

Endress+Hauser

People for Process Automation