

Operating Instruction

TMD1000 TMD1

Digital Transmitter

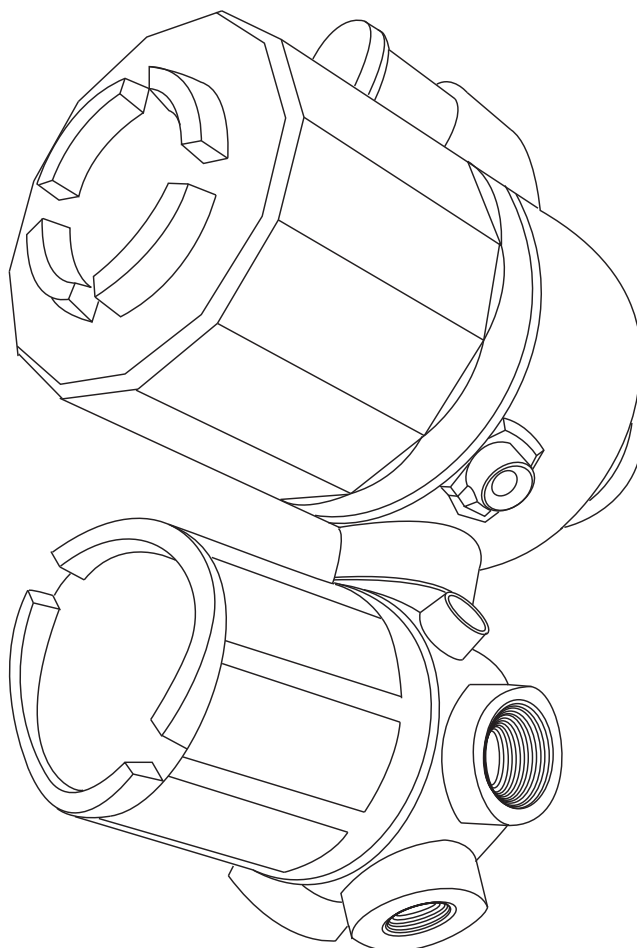


Table of contents

1	Safety instructions	3	6	Operations and device settings	24
1.1	Designated use	3	6.1	HHT2 (Hand Held Terminal)	24
1.2	Installation, commissioning, and operation	3	7	Specifications, modules and mode in HHT2	25
1.3	Product requirements	3	7.1	Basic specifications	25
1.4	Operational safety	4	7.2	Output1 specifications	25
1.5	Notes on safety conventions and symbols	4	7.3	Output 2 specifications	26
1.6	Symbols for certain types of information	4	7.4	Input specifications	27
2	Identification	5	8	Maintenance	28
2.1	Device designation	5	8.1	Exterior cleaning	28
2.2	Order information	8	8.2	Seal replacement	28
2.3	Scope of delivery	10	9	Troubleshooting	29
2.4	Registered trademarks	10	9.1	Error message	29
3	Installation	11	9.2	Error confirmation	29
3.1	Incoming acceptance, transport, storage	11	9.3	Error message table	30
3.2	Installation conditions	11	9.4	Malfunction diagnosis	30
3.3	General view (Standard)	12	9.5	Return	31
3.4	General view (Optical FFi specification)	13	9.6	Disposal	31
3.5	Installing TMD1 on float gauge (LT5)	14	9.7	Software history	31
3.6	Installation TMD and LT to tank side	16	10	Option	32
4	Cable connection	18	10.1	Modules	32
4.1	Calculation of wiring transmission distance	18	10.2	Module types	32
4.2	Wiring	21	11	Technical data	33
5	Operation settings	23			
5.1	Level adjustment operation flow	23			

1 Safety instructions

1.1 Designated use

Digital transmitter TMD1 transfers the signal relate to liquid level and liquid temperature in a tank, or the status of power outage and malfunction via an external device and also transfers all tank data to a receiver including that of the peripheral equipment by digital transmission system. TMD1 is used in combination with float level gauge LT5.

1.2 Installation, commissioning, and operation

- Mounting, electrical installation, start-up, and maintenance of the instrument may only be performed by trained personnel authorized by the operator of the facility.
- Personnel must read and understand these installation instructions before performing the procedures.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual must be observed.
- The installer must make sure that the measuring system is correctly wired according to the wiring diagrams. The measuring system must be grounded.
- Observe all law and regulations applicable and valid for your country and pertaining to the opening and repairing of electrical devices.

1.3 Product requirements

Power source

Check the voltage of the power supply before connecting it to the product. It should be the exact voltage required for proper operation of the product.

Connection to other devices

It is possible to connect to other devices explained in this instruction. Refer to each operation instruction when connecting to devices.

Ground

Do not remove earth terminal or earth wire when the power is on.

Power cable

Use a power cable specified by our company. The product should be protectively grounded before it is connected to a measurement object or an external control circuit.

1.4 Operational safety

Hazardous area

- Use the explosion proof type for measurement in areas where explosion hazards are present.
- Devices installed in areas having explosion hazards must not be opened when the power is on.
- Strict compliance with installation instructions and - ratings, as directed in this supplementary documentation, is mandatory.
- Device maintenance and repair is restricted to meet explosion proof regulations.
- Tighten the cable gland firmly.
- Devices employed in areas having explosion hazards should be installed and wired in keeping with explosion proof regulations.
- Ensure that all personnel are properly qualified.
- Observe the certification requirements as well as national and local regulations.



WARNING

Changes or modifications other than those expressly approved by Endress+Hauser are strictly prohibited. Unauthorized modifications can cause malfunction or damage, resulting in serious injury or death.

1.5 Notes on safety conventions and symbols

To highlight safety-relevant or alternative operating procedures in this manual, the following conventions have been used, each indicated by a corresponding symbol on the left.

Symbol	Meaning
 DANGER A0011189-EN	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 WARNING A0011190-EN	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 CAUTION A0011191-EN	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 NOTICE A0011192-EN	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.

1.6 Symbols for certain types of information

Symbol	Meaning
 A0011182	Allowed Indicates procedures, processes or actions that are allowed.
 A0011183	Recommendation Indicates procedures, processes or actions that are recommended.
 A0011184	Forbidden Indicates procedures, processes or actions that are forbidden.
 A0011193	Tip Indicates additional information.

2 Identification

2.1 Device designation

2.1.1 Nameplate

The following technical data are given on the instrument nameplate.

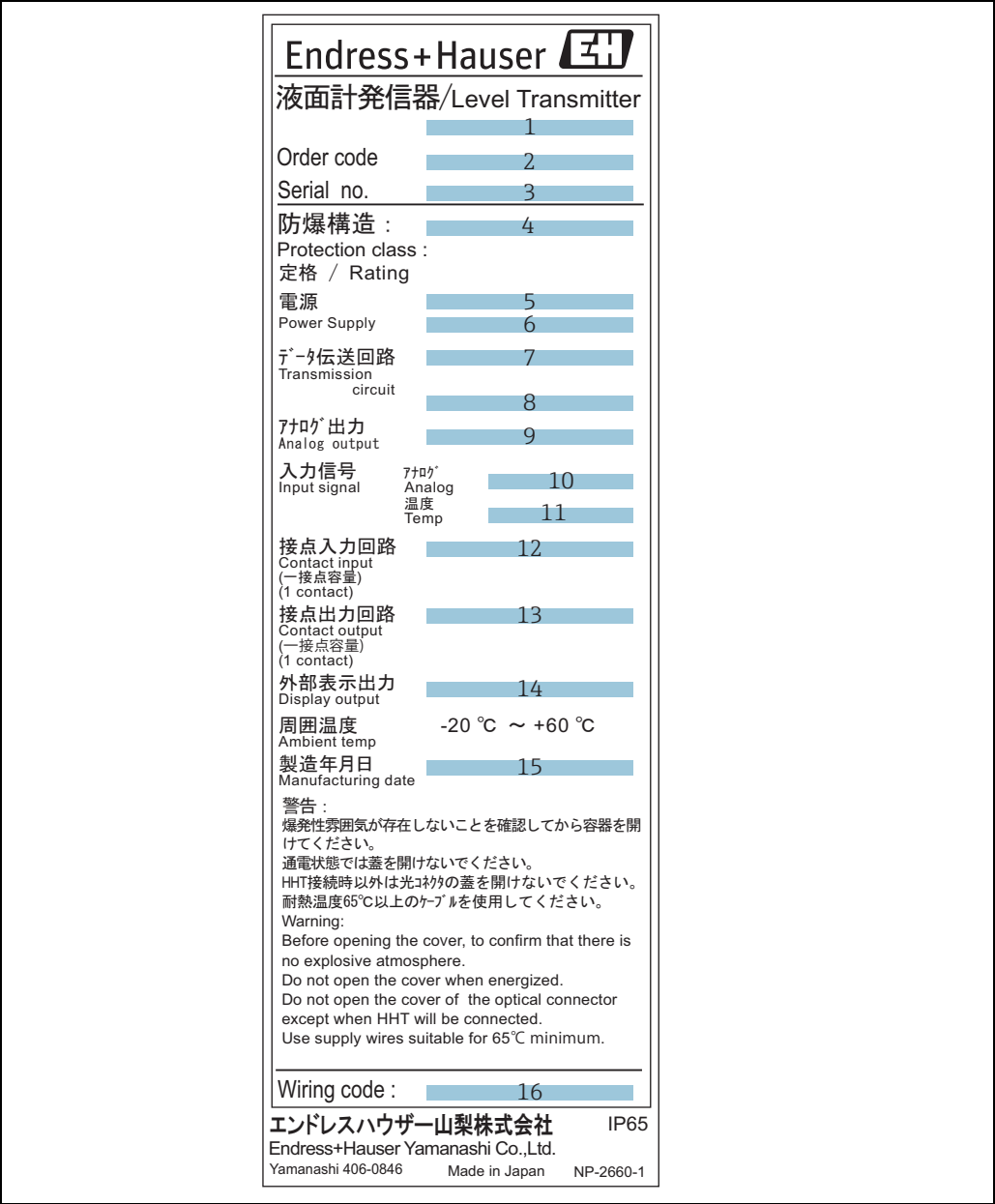


Figure 1: TMD1 nameplate

- 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 circuit
- 13. Contact output circuit
- 14. Display output
- 15. Manufacturing date
- 16. Wiring code

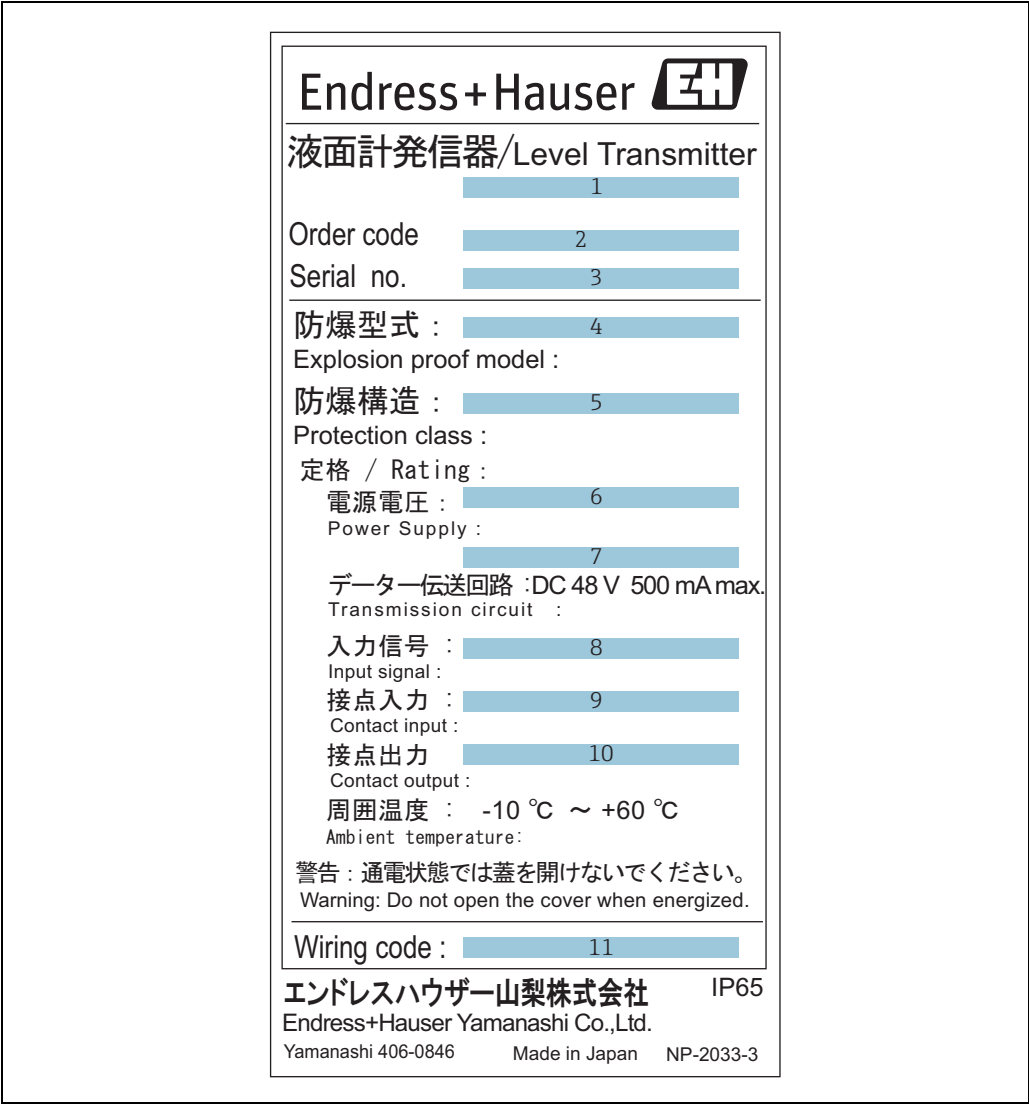


Figure 2: TMD1 with Optical FFi Specification

- 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

○

Endress+Hauser 

Digital Transmitter TMD1

1

Order code **2**

Serial no. **3**

 XP Class I, Div.1, Gp. C, D, T4
Cert. No. FM16US0252X

Ambient temperature: -20 ~ +60°C
Type 4X, IP65

Rating: **4**
Power Supply

Data communication **5**

Analog output **6**

Analog input **7**

Temp. input (RTD input) **8**

Contact input (1 contact cap.) **9**

Contact output (1 contact cap.) **10**

Display output **11**

Manufacturing date **12**

Warning:
 - Before opening the cover, to confirm that there is no explosive atmosphere.
 - Do not open the cover when energized.
 - Do not open the cover of the optical connector except when HHT will be connected.
 - Using the cable that has heat resistance more than 65°C.

 →  XA01089G
BA00427G

Wiring code : **13**

Endress+Hauser Yamanashi Co.,Ltd.
 Yamanashi 406-0846 Made in Japan NP-2682

○

Figure 3: Nameplate for FM approval

1. Required contents by a customer (e.g. Tag No.)
2. Order code
3. Serial number
4. Rating
5. Data
6. Analog output
7. Analog input
8. Temperature input
9. Contact input
10. Contact output
11. Display output
12. Manufacturing date
13. Wiring code

2.2 Order information

010	Output 1		
	0	Not selected	
	1	4-20 mA	
	2	2-way 2-wire (MDP protocol)	
	3	BCD parallel	
	4	Sakura code parallel	
	5	2-way 2-wire (MIC, BBB protocol)	
	6	2-way 2-wire (V1 protocol)	
	7	Optical FFi	
	9	Special version, TSP-no. to be spec.	
020	Function:		
	B	HART input (NMT5xx, NRF560)	
	9	Special version, TSP-no. to be spec.	
030	Approval:		
	0	Weather proof IP65	
	4	Exd IIB T4, TIIS	
	5	FM XP Cl.I Div.1 Gr.C-D, AEx d IIB T4	
040	Output 2:		
	0	Not selected	
	1	4-20 mA	
	2	4 x alarm (open collector)	
	3	Monitor DRM	
	4	2 x gauge operation command	
	5	2 x gauge operation command, 6x outer equipment operation command	
	6	8 x outer equipment operation command	
	A	4-20 mA, 4 x alarm (open collector)	
	B	4-20 mA, monitor DRM	
	C	4x alarm (open collector), monitor DRM	
	D	4-20 mA, 4 x alarm (open collector), monitor DRM	
	E	4-20 mA, 2 x gauge operation command	
	F	2 x gauge operation command, monitor DRM	
	G	4 x alarm (relay)	
	H	4-20 mA, 4 x alarm (relay)	
	J	4 x alarm (relay), monitor DRM	
	K	4-20 mA, 4 x alarm (relay), monitor DRM	
	Y	Special version, TSP-no. to be spec.	
050	Input:		
	0	Not used	
	1	4-20 mA	
	2	4 x status	
	3	1 x spot temperature Pt100/JPt100	
	4	3 x spot temperature Pt100/JPt100	
	5	Multi element average temperature	
	6	Multi spot average temperature	
	A	4-20 mA, 1 x spot temperature Pt100/JPt100	
	B	4-20 mA, 3 x point spot temperature Pt100/JPt100	
	C	4-20 mA, multi element average temperature	
	D	4-20 mA, multi spot average temperature Pt100/JPt100	
	E	4 x status, 1 x spot temperature Pt100/JPt100	
	F	4 x status, 3 x spot temperature Pt100/JPt100	
	G	4 x status, multi element average temperature	
	H	4 x status, multi spot average temperature	
	J	4-20 mA, 4 x status	
	K	4-20 mA, 4 x status, 1 x spot temperature Pt100/JPt100	
	L	4-20 mA, 4 x status, 3 x spot temperature Pt100/JPt100	
	M	4-20 mA, multi element average temperature, 4 x status	
	N	4-20 mA, multi spot average temperature, 4 x status	

050										Input:
										Y Special version, TSP-no. to be spec.
060										Power Supply:
										C Loop powered
										B 20-32VDC
										5 60VAC, 50/60Hz
										1 100VAC, 50/60Hz
										2 110VAC, 50/60Hz
										3 200VAC, 50/60Hz
										4 220VAC, 50/60Hz
										9 Special version, TSP-no. to be spec.
070										Color:
										1 Blue + white
										9 Special version, TSP-no. to be spec.
080										Cable Entry:
										0 A: PF(G)1-1/2, B: PF(G)3/4, C: PF(G)1, D: PF(G)1
										H 2 x thread G1 EXPC-28B, 2 x blind plug see additional spec.
										J 3 x thread G1 EXPC-28B, 1 x blind plug see additional spec.
										K 4 x thread G1 EXPC-28B see additional spec.
										L 2 x thread G3/4 EXPC-22B, 2 x blind plug see additional spec.
										M 3 x thread G3/4 EXPC-22B, 1 x blind plug see additional spec.
										N 4 x thread G3/4 EXPC-22B see additional spec.
										P 4 x thread NPT 1
										Q 4 x thread NPT 3/4
										9 Special version, TSP-no. to be spec.
090										Communication:
										0 Not used
										2 2-way 2-wire (MIC, BBB protocol)
										3 2-way 2-wire (MDP protocol)
										4 2-way 2-wire (V1 protocol)
										A Emitter common
										B Collector common
										F Store box (Optical FFi)
										H M42 x P1.5 (Optical FFi)
										J 4-20 mA HART
										K MODBUS RS485
										9 Special version, TSP-no. to be spec.
100										Temperature Input:
										0 Not used
										1 Pt100, JIS=IEC, -50...+200°C
										2 Pt100, JIS=IEC, +70...+350°C
										3 JPt100, JIS, -50...+200°C
										4 JPt100, JIS, +70...+350°C
										5 NMT
										9 Special version, TSP-no. to be spec.
110										Application:
										3 LT11/LT12/LT31/LT32
										4 LT14/LT16/LT34/LT36
										5 LTC2230/LTC2240
										9 Special version, TSP-no. to be spec.
TMD1-										Complete product designation

2.3 Scope of delivery

It is extremely important to follow the instructions concerning the unpacking, transportation and storage of measuring instruments provided in the chapter “Incoming acceptance, transportation, storage”. The scope of delivery consists of:

- Assembled instrument
- Documents

Documents list for TMD1

Document No.	Type of documents	Descriptions
BA00427G	Operating Instructions	Installation, wiring, and maintenance
BA00428G	Module Setting/Adjustment Instructions	Installation, Operations, Adjustment, Descriptions of errors
BA00429G	HHT2 Operating Instructions	Operations, commissioning for TMD1
XA01073G	Safety Instructions	Device versions approved for use in explosion hazardous areas; nameplate specifies, which of these documents is relevant for your instrument version

2.4 Registered trademarks

HART®

Registered trademark of HART Communication Foundation, Austin, USA

3 Installation

3.1 Incoming acceptance, transport, storage

3.1.1 Incoming acceptance

Check the packing and contents for any signs of damage.

Check the shipment, and make sure that nothing is missing and that the items match your order.

3.1.2 Transport

- Follow the safety instructions and conditions of transportation for instruments in excess of 18kg (40 lbs.).
- Do not lift the measuring instrument by its housing during transportation.

3.1.3 Storage

Pack the measuring instrument so that it is protected against impacts during storage and transportation.

The original packing material provides the optimum protection for this.

The allowed storage temperature is -20°C to +60°C (-4°F to +140°F)

3.2 Installation conditions

Digital Transmitter TMD1 is designed to be installed on the rear of a level gauge and placed at outside the tank as shown below. The unit (level gauge and transmitter) is primarily employed in measurement 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.

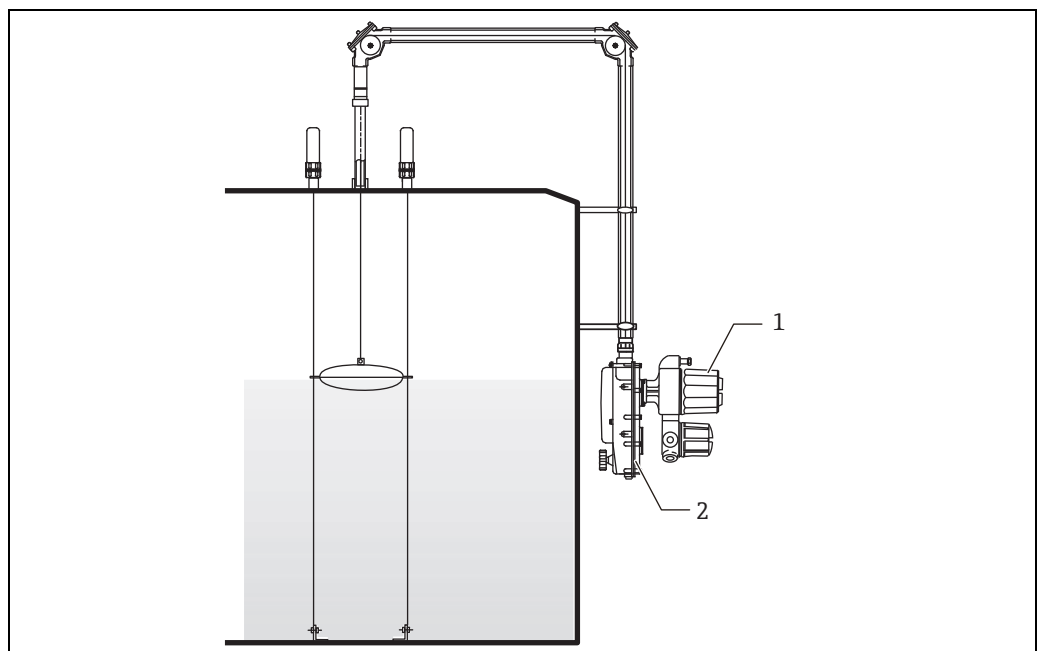


Figure 4: TMD1 installation

1. Digital transmitter TMD1
2. Float level gauge LT5

3.3 General view (Standard)

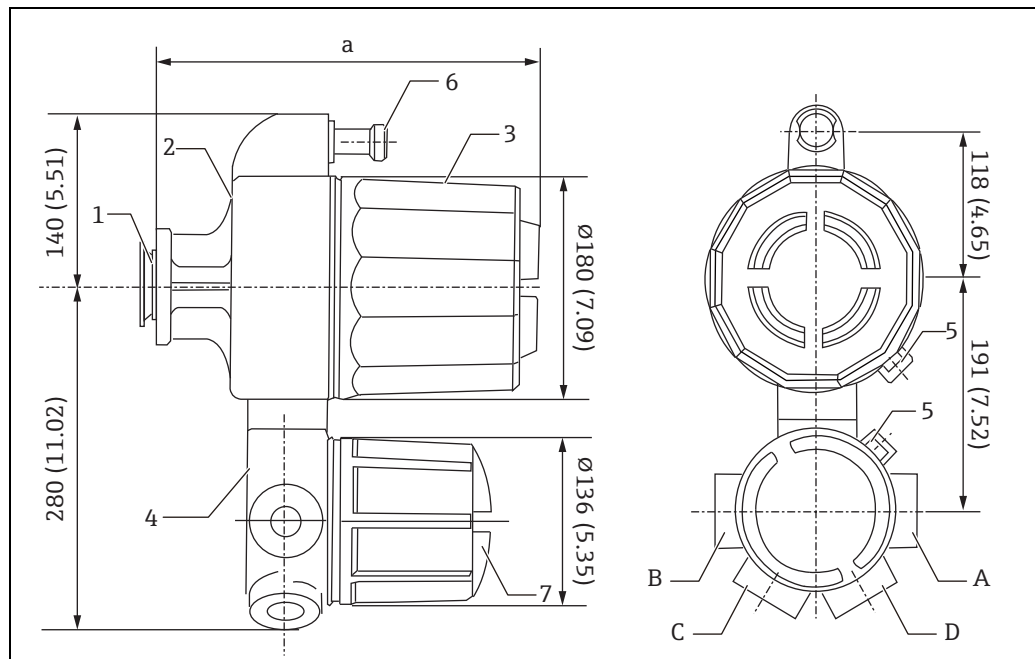


Figure 5: General view, Unit: mm (in)

- A Cable gland: position of cable entry A, B, C, D
- B Cable gland: position of cable entry A, B, C, D
- C Cable gland: position of cable entry A, B, C, D1
- D Cable gland: position of cable entry A, B, C, D
- a 325 mm (12.79 in) for all spec., excluding FM spec./335 mm (13.19 in) for FM spec.
- 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: 1)
- 6. Connection of Hand Held Terminal (HHT2)
- 7. Terminal box cover (AC4C-T6/Quantity: 1)



The position of the cable entry (optional: H, J, K, L, M, N) in order information 080 must be specified by a customer.

3.4 General view (Optical FFi specification)

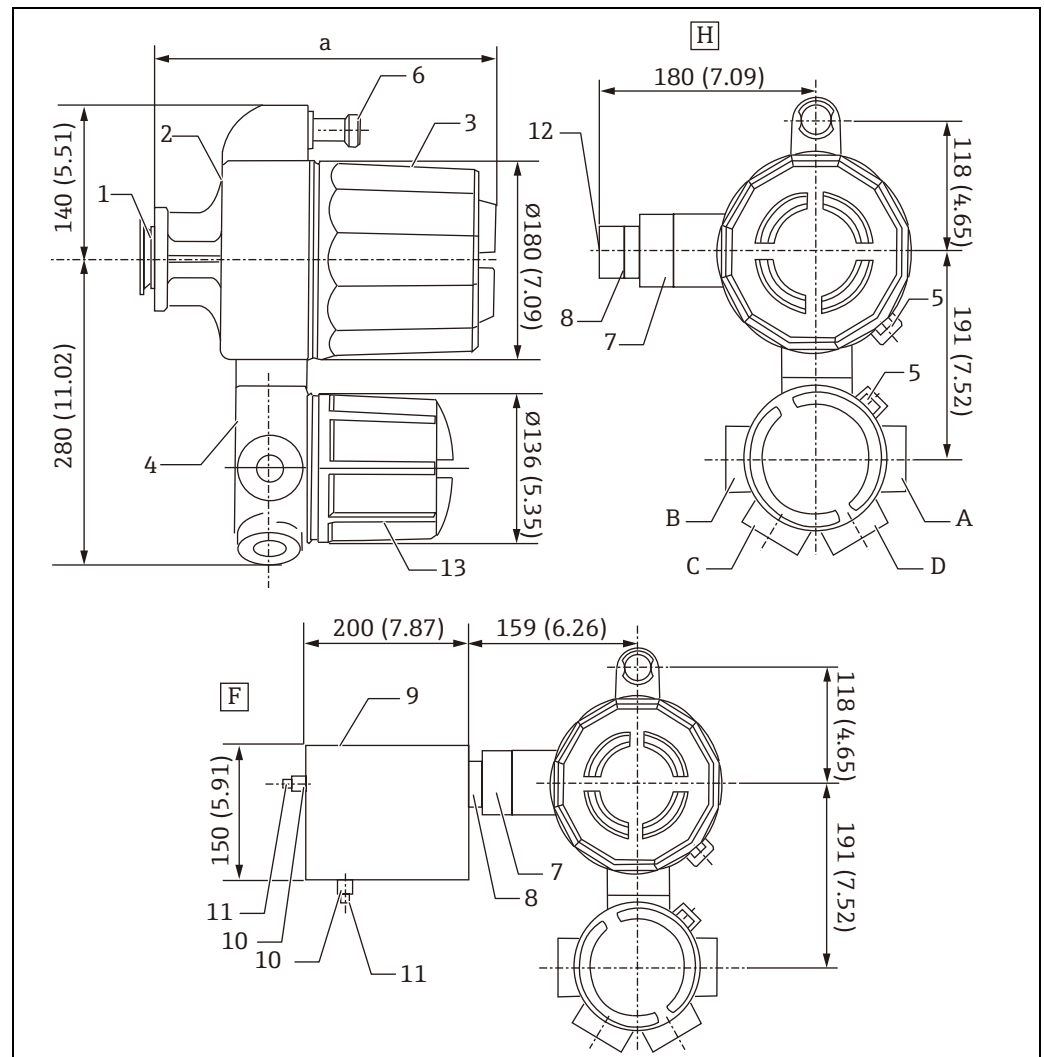


Figure 6: General view

- | | |
|---|--|
| A | Cable gland: position of cable entry A, B, C, D |
| B | Cable gland: position of cable entry A, B, C, D |
| C | Cable gland: position of cable entry A, B, C, D1 |
| D | Cable gland: position of cable entry A, B, C, D |
| F | Terminal box type |
| H | M42 x P1.5 slide coupling type |
| a | 325 mm (12.79 in) for all spec., excluding FM spec./335 mm (13.19 in) for FM spec. |

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: 1)
6. Connection of Hand Held Terminal (HHT2)
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 (Rc1/2) (Material: Ferrous casting/Quantity: 1)
11. Blind plug (Material: FCMB310/Quantity: 1)
12. FC inlet connection (M42 x P1.5/Quantity: 1)
13. Terminal box cover (AC4C-T6/Quantity: 1)

 The position of the cable entry (optional: H, J, K, L, M, N) in order information 080 must be specified by a customer.

3.5 Installing TMD1 on float gauge (LT5)

Digital transmitter TMD1 is designed to be installed on the rear of the float gauge head by using a flange.

Installation procedure

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

1. Insert the stud bolt in the rear cover of the float gauge.
2. Make sure that the coupling on TMD is secure when installing on low pressure float gauges.
 - Make sure that coupling on both TMD and float gauge is secure when installing on medium or high pressure float gauges.

This completes installation procedure.

3.5.1 Coupling installation

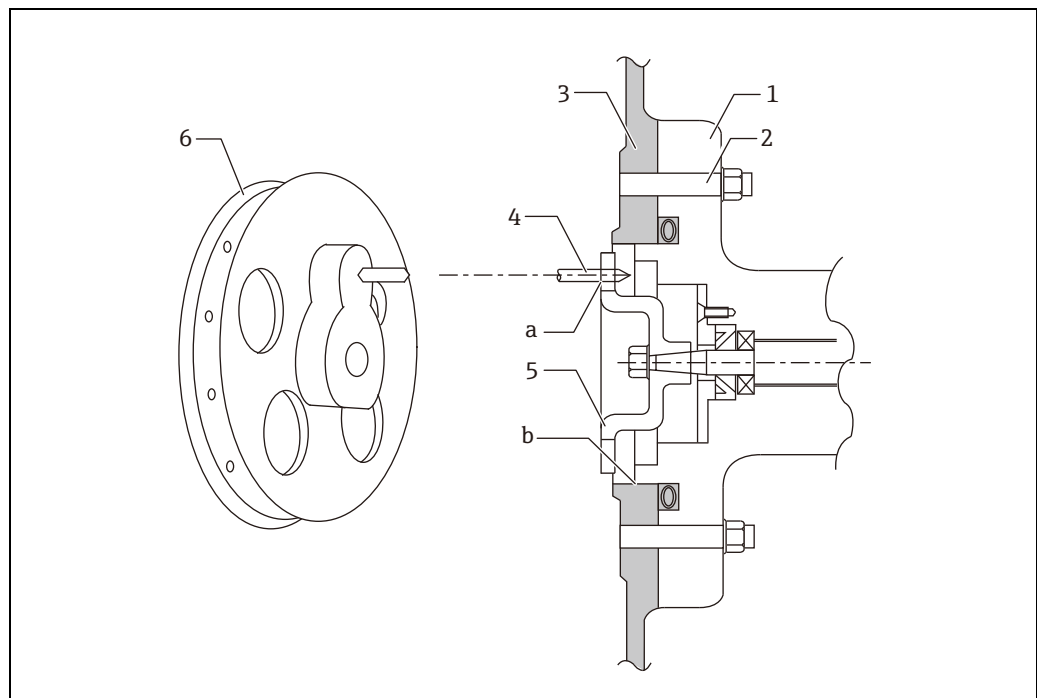


Figure 7: Coupling installation for low pressure float gauge

- a* Be careful to install this part.
b Ensure installation of this part.
1. Transmitter
 2. Stud bolt
 3. Float level gauge
 4. Sprocket pin
 5. Coupling
 6. Sprocket

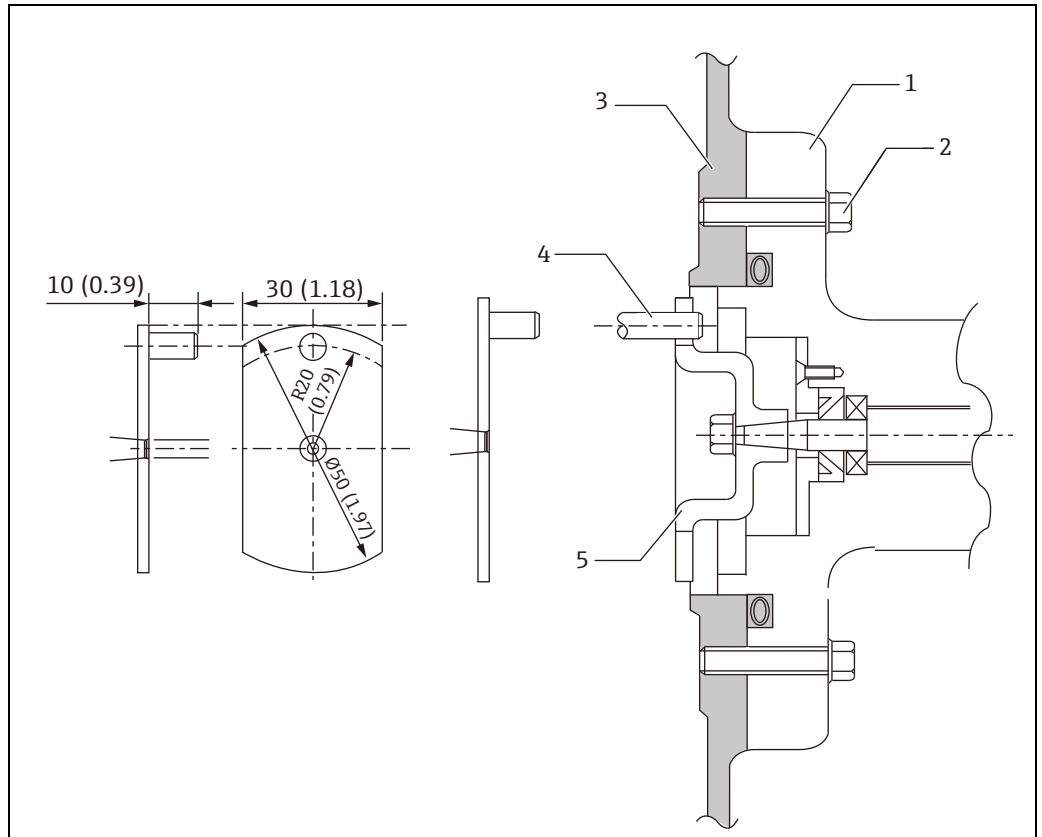


Figure 8: Coupling installation for medium and high pressure float gauge

1. Transmitter
2. Stud bolt
3. Level gauge
4. Coupling pin
5. Coupling (Transmitter)

Installation procedure

1. Remove the TMD rear cover.
 2. Install TMD in float gauge while engaging coupling groove with coupling pin.
- This completes installation procedure.

CAUTION

- If the coupling groove and the pin positions are not aligned, the installation surface between LT and TMD will rise and not match with the position. Do not install the coupling using excessive force. Check coupling position and reinstall TMD, if needed.
- When the professional installation and adjustment service of Endress+Hauser are required, all procedures, including unpacking, are conducted by our service technician.

3.6 Installation TMD and LT to tank side

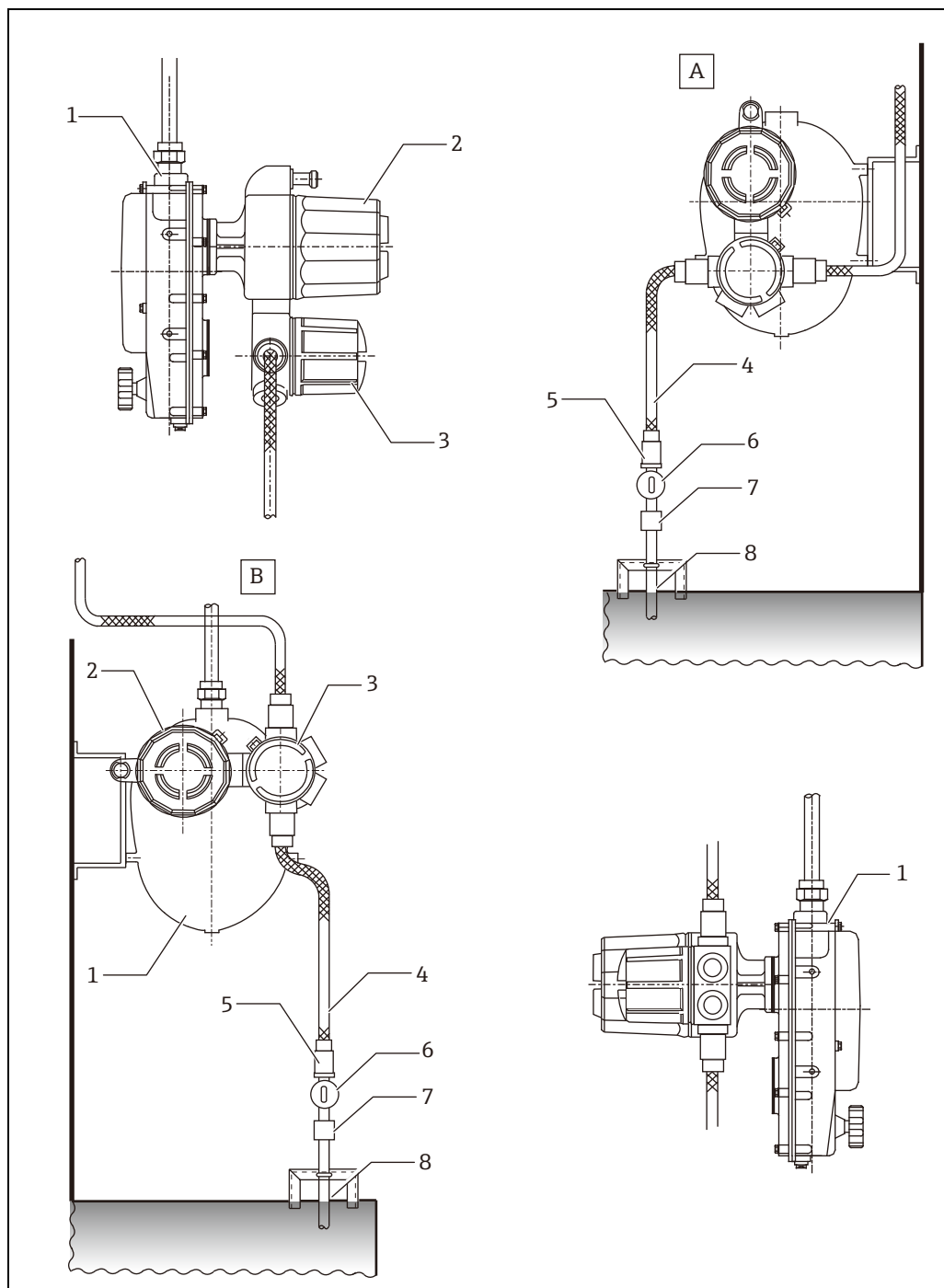


Figure 9: Tank installation (Standard)

A Standard installation

B Special installation when the flexible fitting [4] cannot be mounted in the standard position (Not recommended due to high risk of rain water).

1. Float level gauge
2. Electrical housing of TMD1
3. Terminal box of TMD1
4. Flexible fitting
5. Cable gland or cable conduit
6. Tumbler switch
7. Flexible fitting
8. Thick steel conduit tube

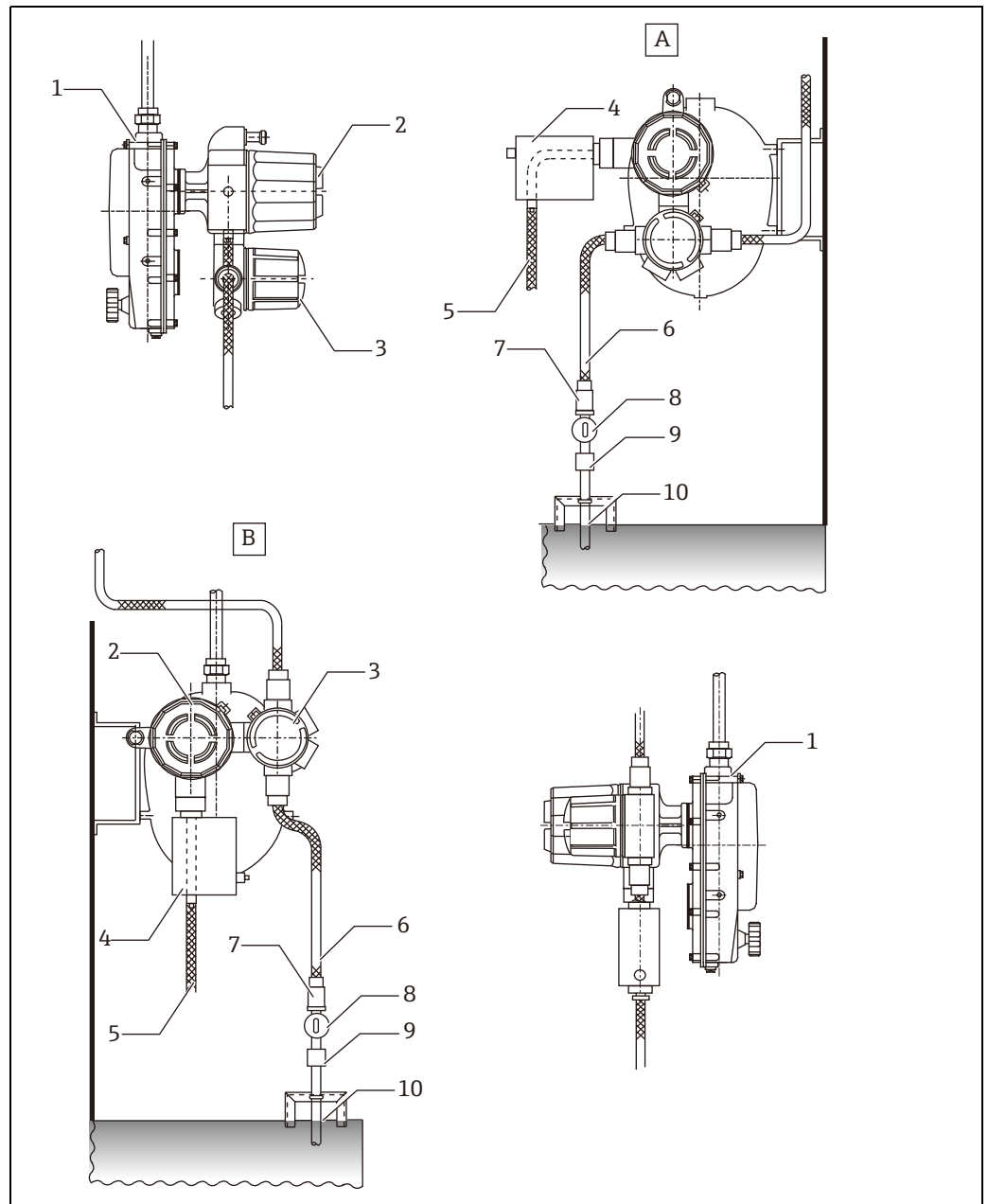


Figure 10: Tank installation (FFi Specification)

A Standard installation

B Special installation when the flexible fitting [4] cannot be mounted in the standard position (Not recommended due to high risk of rain water).

1. Float level gauge
2. Electrical housing of TMD1
3. Terminal box of TMD1
4. Connection box for FFi optical communication
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

3.6.1 HHT2 (Hand Held Terminal)



CAUTION Always make data setting using HHT2 during operations (conditioning setting). If conditions are not set, proper readings cannot be obtained.

4 Cable connection

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

I/O signal	Recommended cable type	Recommended cable	Remarks
Power supply	PVC, PE 600V dielectric strength voltage cable with shield or equivalent	CVV-S	Define core area based on the power consumption 20VAC.
Digital signal (2-way 2-wire transmission, DRM9700 communication)	Twisted pair cable for digital communication	CPEV KPEV	The data can be transferred in a range of up to 6km with CPEV Ø1.2 cable.
(NMT, NRF communication)	Twisted pair cable with shield for digital communication	CPEV-S KPEV-S	
I/O 4 to 20 mA	PVC or PE dielectric cable	CVV-S	
Output contact	PVC or PE dielectric cable	CVV-S	Use contact output max. voltage rating: 30DCV and contact input: 12DCV.
RCV, RCS/NC Temperature input (PT 100 Ω)	Standard control cable (conduit, flexible tube) Ω	IV Cable	Use CCV-S cable if cable conduit is not employed.
BCD, Sakura code parallel output	Multicore twisted pair cable or equivalent	CPEV-S KPEV-S	If level transmission is 19999mm, 18 cores (9 pairs) are required.

NOTICE Select cables so that TMD terminal power supply can reach to a nominal voltage of 90% or more in the following cases.

4.1 Calculation of wiring transmission distance

Calculation sample

- Calculation object is to find resistance between circuits and electrical capacity limits.
 - One-way resistance: Max. 120 Ω
 - Maximum capacity between circuits: 30 μF
- Maximum capacity of cable resistance and between circuits (see the following table).

Cables	Conductor resistance (Ω/km)	Electric capacity (μF/km)	Max. transmission distance (Km)	Remarks
CPEV, CPEE Ø0.9	Max. 30	Max. 0.05	4	Calculation based on 30 Ω
KMPEV, KPEV-S KMPEE 0.9 mm ²	Max. 21.5	0.05	5.58	Calculation based on 21.5 Ω
CPEV Ø1.2	16.5	0.05	6	Calculation based on 0.05μF
CPEV (T) Ø0.9	Max. 30	0.06	μF 4	Calculation based on 30 Ω
CVV2 mm ² (CEE)	9.5	0.09 (0.06)	3.3 (5)	Calculation based on 0.09 (0.06) μF

In case of TMD1 with 100VAC

Power supply cable data

Cross-section area	Ω/1km
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

Voltage drop calculation formula

Supply current for one transmitter: $\frac{10\text{ VA}}{100\text{ V}} = 0.1\text{ A}$

①

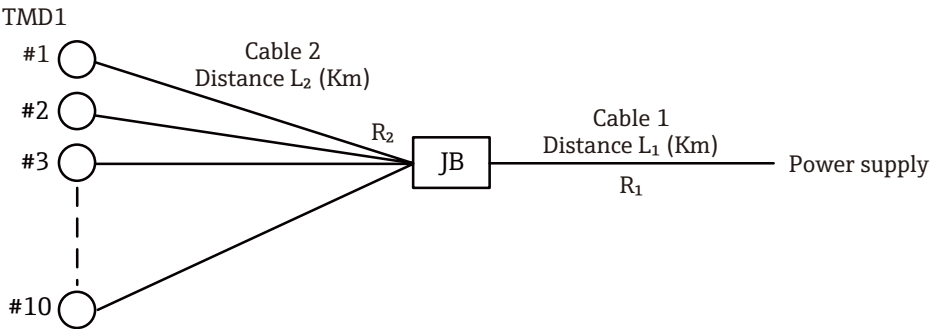
Voltage drops by cable 1:
 $10\text{ transmitters} \times 0.1\text{ A} \times R_1\text{ Ω} = 1\text{ R}_1\text{ (V)}$

②

Voltage drops by cable 2:
 $1\text{ transmitter} \times 0.1\text{ A} \times R_2\text{ Ω} = 0.1\text{ R}_2\text{ (V)}$

Maximum allowable voltage drops for cable 1 and 2:
From allowable power fluctuation of power supply -10 %
 $100\text{ (V)} \times 10\text{ \%} = 10\text{ (V)}$

The result is:
 $10\text{ (V)} > 1\text{ R}_1\text{ (V)} + 0.1\text{ R}_2\text{ (V)}$



The following table shows values outcomes when assigning the following values to the formula above.

- Cable 1 length: 100 m
- Cable 2 length: 2 km

Cable 1 Cross-section area (mm ²)	Ω/1km	Ω/2km	Cable 2 Voltage drops (V)	Cable 2 Cross-section (mm ²)	Ω/100mm	Cable 2 voltage drops (V)	Cable1 and 2 voltage drops (V)	TMD1 terminal voltage (V)	Result
1.25	14.70	29.40	29.40	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

4.2 Wiring

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

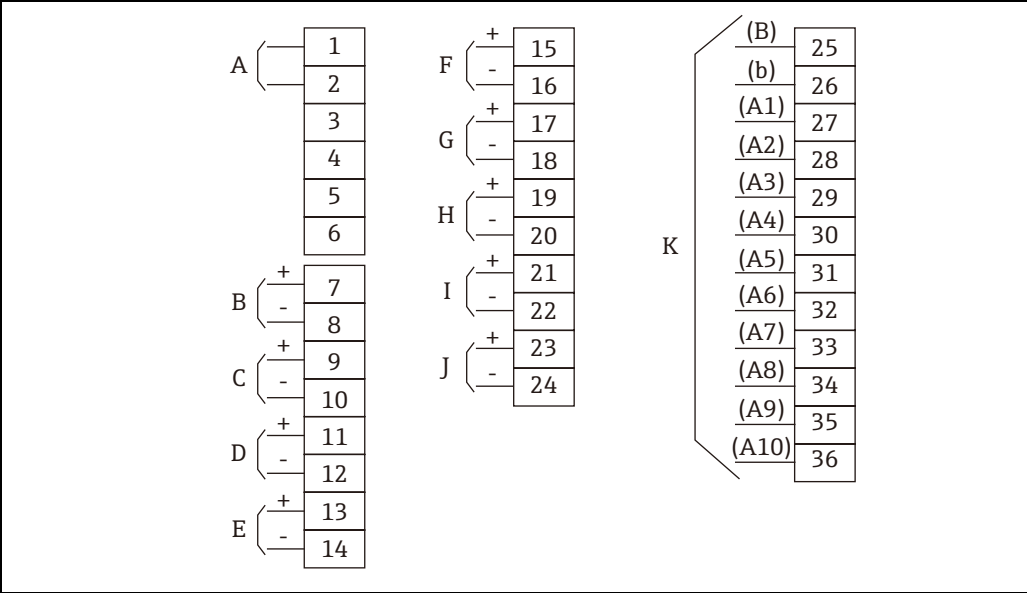


Figure 11: TMD1 Terminal table (e.g. TMD1 B-2)

- A AC power supply
- B 2-way 2-wire transmission
- C DC 4 to 20 mA output
- D DRM9700 output
- E DC 4 to 20 mA input
- F HART signal (see NOTICE.)
- G Alarm output 1
- H Alarm output 2
- I Alarm output 3
- J Alarm output 4
- K Average temperature input
- A1 Spot1
- A2 Spot1
- A3 Spot1
- A4 Spot2
- A5 Spot2
- A6 Spot2
- A7 Spot3
- A8 Spot3
- A9 Spot3

Contact switch

Operation	SW1 (Terminal No.4)	SW2 (Terminal No.5)	SW3 (Terminal No.6)
Level measurement	OFF	OFF	OFF
Hoist up	ON	OFF	OFF
Stop	OFF	ON	OFF

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

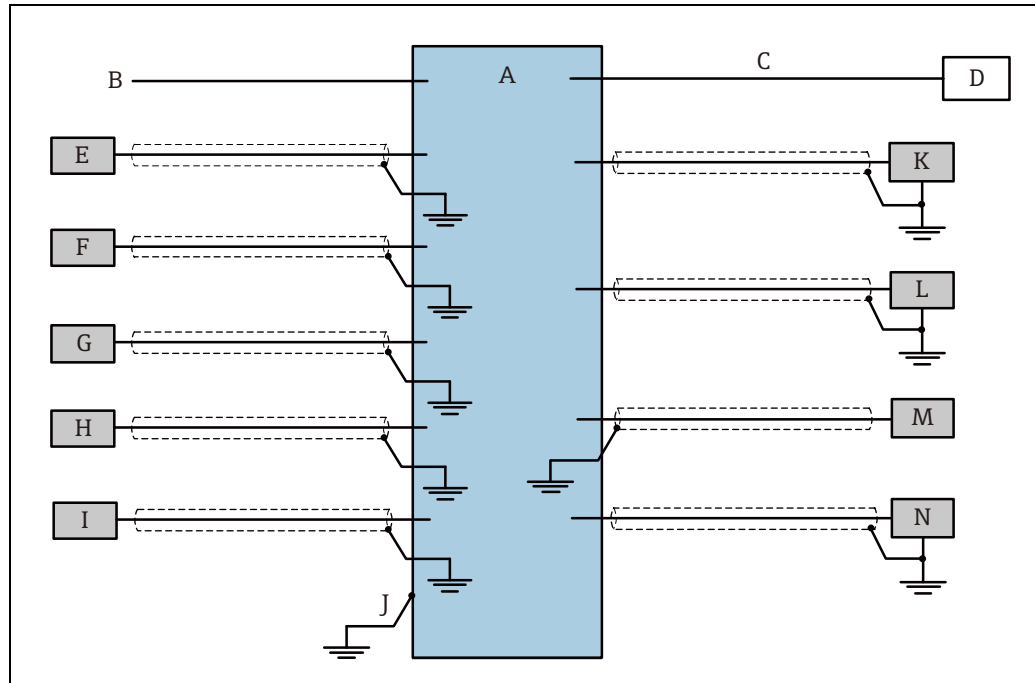


Figure 12: Grounding wires for units and shield cables

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

5 Operation settings

NOTICE

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

5.1 Level adjustment operation flow

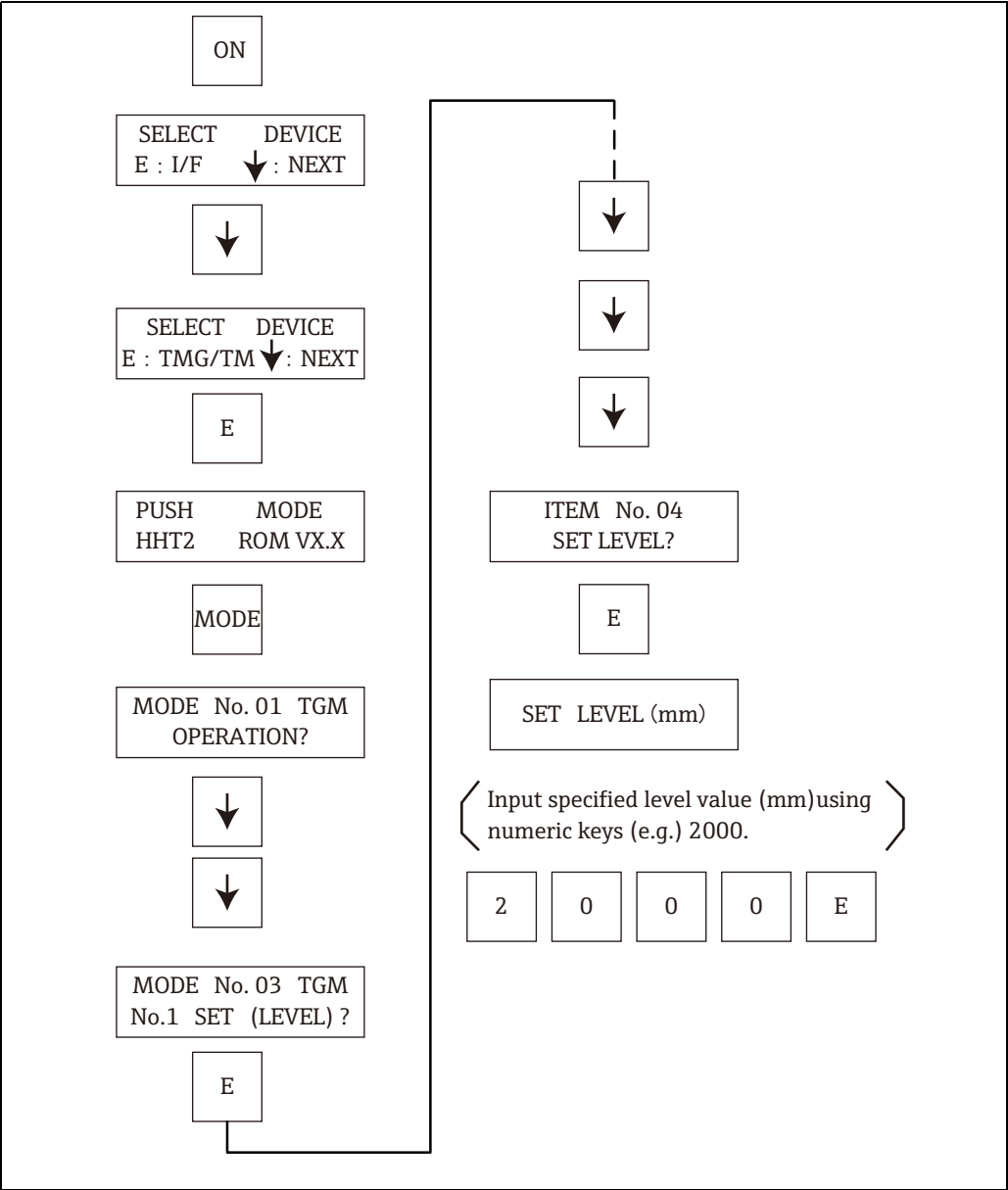


Figure 13: Flow chart

6 Operations and device settings

6.1 HHT2 (Hand Held Terminal)

The TMD1 series operation, settings, and adjustments are easily done using the convenient Hand Held Terminal (HHT2).

NOTICE

- TMD1s with HART input specification require the latest HHT2 software version (HHT V5.8 or later).
- Always take care when using explosion proof products in hazardous areas.

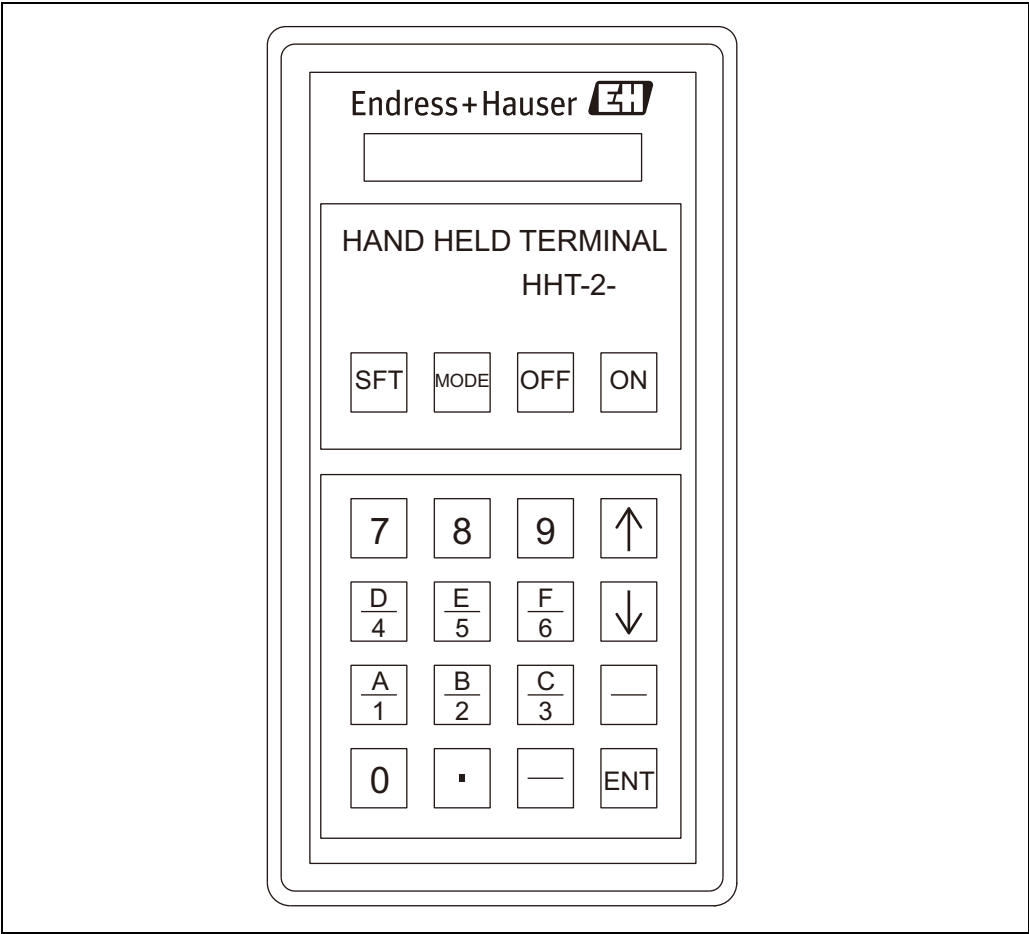


Figure 14: HHT2 (Hand Held Terminal)

7 Specifications, modules and mode in HHT2

7.1 Basic specifications

Function	Description	Mode No.
Basic operations	Check all positions and names of installed board.	MODE00
	Memory address setting/memory data display	
	Error status display	MODE02
	Data display	
	Level adjustment	MODE03

7.2 Output1 specifications

Function	Spec.	Description	Module	Mode No.
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		
	5	2-way 2-wire (MIC, BBB protocol)	Exp-A	MODE13
	6	2-way 2-wire (V1 protocol)	Exp-A	MODE13
	7	Optical FFi	ODC-1	MODE15

7.3 Output 2 specifications

Function	Spec.	Description	Module	Mode No.
Output 2	A	4 to 20 mA	DAC-1	MODE11, 12
		4 x alarm (open collector)	Exp-A	MODE06
	B	4 to 20 mA	DAC-1	MODE11, 12
		Monitor DRM	DRMM-A	
	C	4x alarm (open collector)	Exp-A	MODE06
		Monitor DRM	DRMM-A	
	D	4-20 mA	DAC-1	MODE11, 12
		4 x alarm (open collector)	Exp-A	MODE06
		Monitor DRM	DRMM-A	
	E	4-20 mA	DAC-1	MODE11, 12
		2 x gauge operation command	CNT-2	MODE01
	F	2 x gauge operation command	DRMM-A	
		Monitor DRM	CNT-2	MODE01
	G	4 x alarm (relay)	Exp-A + CD688	MODE06
	H	4-20 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	4-20 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 gauge operation command	CNT-2	MODE01
	5	2 x gauge operation command	CNT-2	MODE01
		6x outer equipment operation command		
	6	8 x outer equipment operation command	CNT-2	MODE01

7.4 Input specifications

Function	Spec.	Description	Module	Mode No.
Input	A	4-20 mA	ADC-2	MODE14
		1 x spot temperature Pt100/JPt100	Thermo-A	MODE07
	B	4-20 mA	ADC-2	MODE14
		3 x point spot temperature Pt100/JPt100	Thermo-A	MODE08
	C	4-20 mA	ADC-2	MODE14
		Multi element aver mAage temperature	Thermo-A	MODE09
	D	4-20 mA	ADC-2	MODE14
		Multi spot average temperature Pt100/JPt100	Thermo-A	MODE10
	E	4 x status	INT-1/Exp-A	
		1 x spot temperature Pt100/JPt100	Thermo-A	MODE07
	F	4 x status	INT-1/Exp-A	
		3 x spot temperature Pt100/JPt100	Thermo-A	MODE08
	G	4 x status	INT-1/Exp-A	
		Multi element average temperature	Thermo-A	MODE09
	H	4 x status	INT-1/Exp-A	
		Multi spot average temperature	Thermo-A	MODE10
	J	4-20 mA	ADC-2	MODE14
		4 x status	INT-1/Exp-A	
	K	4-20 mA	ADC-2	MODE14
		4 x status	Thermo-A	MODE07
		1 x spot temperature Pt100/JPt100	INT-1/Exp-A	
	L	4-20 mA	ADC-2	MODE14
		4 x status	Thermo-A	MODE08
		3 x spot temperature Pt100/JPt100	INT-1/Exp-A	
	M	4-20 mA	ADC-2	MODE14
		Multi element average temperature	Thermo-A	MODE09
		4 x status	INT-1/2, Exp-A	
	N	4-20 mA	ADC-2	MODE14
		Multi spot average temperature	Thermo-A	MODE10
		4 x status	INT-1/Exp-A	
	1	4-20 mA	ADC-2	MODE14
	2	4 x status	INT-1/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	Multi spot average temperature	Thermo-A	MODE10

8 Maintenance

TMD requires no special maintenance.

8.1 Exterior cleaning

When cleaning the exterior of TMD, always use cleaning agents which will not cause corrosion or other damage to the housing and its surface seals.

8.2 Seal replacement

The TMD process seal may need replacing periodically, and more frequently in extreme climates. The period between changes will depend on cleaning frequency, temperature of target material (liquid) and cleaning temperature.

9 Troubleshooting

9.1 Error message

Error message can be confirmed at the error code display MODE02 TIME13 of HTT2.

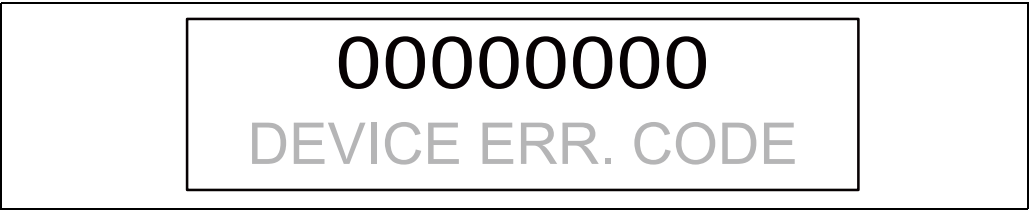


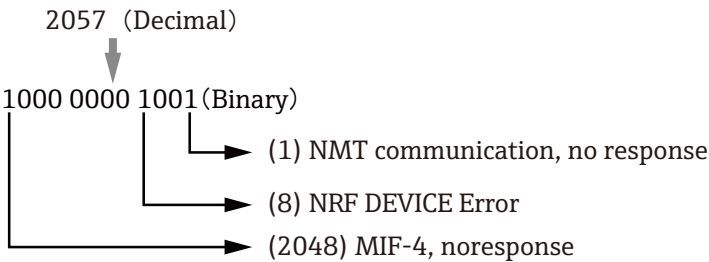
Figure 15: Error Message

 The all generated error values are converted into decimals, then shown in the error code display screen.

9.2 Error confirmation

Confirmation procedure 1

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



Confirmation procedure 2

Subtract large numbers in descending order from each error code (decimal) in 2057 (decimal), and confirm the error description corresponding to error code in "9.3 Error message table".

2057 -	4096	:	Unable to subtract	→	0000 0000 0000 0000
2057 -	2048	=	9 (Error arose in error code 2048.)	→	0000 1000 0000 0000
9 -	8	=	1 (Error arose in error code 8.)	→	0000 0000 0000 1000
	1		(Error arose in error code 1.)	→	0000 0000 0000 0001
				→	Error code

9.3 Error message table

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 code
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
4096	0001 0000 0000 0000	Temperature system	Element trouble	Open, short

9.4 Malfunction diagnosis

Conditions	Causes
Off-line of 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 (level encoder or level A/D I/F malfunction)
No change in level data	Looseness between level gauge and coupling
	Looseness of gear set screw on gear unit
	Misaligning of shaft gear and internal panel gear
Abnormal output 1 data	Data is not set appropriately.
Abnormal output 2 data	Data is not set appropriately.
Abnormal input data	Data is not set appropriately.

9.5 Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong measuring device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium. To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material

9.6 Disposal

Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

9.7 Software history

Main CPU-B

Software version/date	Software changes	Documentation changes
V1.10/2008.09	Original versions	BA1007N
V1.11/2009.05	Valve control	-
V1.12/2010.08	V1 NMT data	BA01007G
V1.13/2017.09	Update the Tankvision level value to correspond to the float level	BA00427G

10 Option

10.1 Modules

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

10.2 Module types

Name	Functions	Size	Number of terminals for standard use	Remakes
Main CPU - B	CPU module	A	6	Be sure to install this module.
Exp - A	2-way 2-wire digital pulse Contact output (alarm) 4 points Contact input (status) 4 points	A	2 8 8	Transistor output
Thermo - A	Average temperature Spot temperature	A	12 3	For average and sport temperatures
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	DC 4 to 20 mA Analog signal input	C	2	Available for use with 2-wire transmission board only
INT - 2	Status input	C	16	Available for use with 2-wire transmission board only (max. 8 points)
INT - 1	Status input	C	8	Available for use with 2-wire transmission board only (max. 4 points)
DRMM- A	DRM communication	C	2	
ODC-1	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	Standard 4 points Mechanical relay output

11 Technical data

Items	Descriptions
Level A/D conversion	Method: Optical non-contact absolute encoder Range: 0 to 99999 mm Accuracy: ± 1 mm
Power supply	AC 60, 100, 110, 200, 220V ± 10 50/60 Hz DC 20 to 32V When ordering special specifications, contact Endress+Hauser representatives.
Power consumption	AC: max. 14 W DC: max. 10 W
Allowable ambient temperature	-20 to +60 °C (-4 to 140 °F) (Ex type) -10 to +40 °C (-14 to 104 °F) (Non Ex type)
Approval	Weather proof: IP65 Flame proof: Ex d IIB T4
Cable Entry	O: A: PF(G)1-1/2, B: PF(G)3/4, C: PF(G)1, D: PF(G)1 (Screw position is fixed (refer to External dimension.))
	H: 2 x thread G1 EXPC-28B, 2 x blind plug (The position of screw hole can be specified by either of A, B,C, D.)
	J: 3 x thread G1 EXPC-28B, 1 x blind plug (The position of screw hole can be specified by either of A, B,C, D.)
	K: 4 x thread G1 EXPC-28B (The position of screw hole can be specified by either of A, B,C, D.)
	L: 2 x thread G3/4 EXPC-22B, 2 x blind plug (The position of screw hole can be specified by either of A, B,C, D.)
	M: 3 x thread G3/4 EXPC-22B, 1 x blind plug (The position of screw hole can be specified by either of A, B,C, D.)
	N: 4 x thread G3/4 EXPC-22B (The position of screw hole can be specified by either of A, B,C, D.)
	P: 4 x thread NPT 1
	Q: 4 x thread NPT 3/4
Arrester	Standard equipment
Weight	Approximately 10kg
Material	Electrical housing: AC4C-T6 Cover of electrical housing: AC4C-T6 Terminal box: ADC12 Cover of electrical housing: AC4C-T6
Color	Blue and white

www.addresses.endress.com

For more Endress+Hauser product please visit: www.ainstru.com
Mail: Sales@ainstru.com