Technical Information
TMD1000 TMD1
Digital Transmitter

Application

TMD1 is used in a combination with float level gauge (LT series).
TMD1 can monitor the tank data of level and temperature by the remote operation.
The input/output cards can be selected according to their purposes for the information between the transmitter and the receiver. Furthermore employing module cards can easily change or add functions.

Features and Benefits

- After installing TMD1, aligning level and transmission output adjustment can be performed by HHT2.
- The module design is to be able to select from remote transmission output, temperature A/D conversion, level alarm, and external device operation output.
- TMD1 can connect HART temperature sensor by HART communication.
- TMD1 can connect our existing or new tank gauge system by selecting modules.
- TMD1 is Ex-protected construction (Ex d IIB T4) and can be used in hazardous areas.
- FM approval: FM XP Cl.I Div.1 Gr.C-D, AEx d IIB T4

Endress+Hauser [EH]

People for Process Automation

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Important document information

Notes on safety conventions and symbols

Symbols for safety conventions

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.

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.

Function and system design

Combination with NMT53x and NRF560 (HART communication)

TMD1 can connect to average temperature Prothermo NMT53x which has installed HART communication and also can connect to Promonitor NRF560 instead of DRM9700.
Contact Endress+Hauser Japan for details on HART device.

ℹ️ NMT53x has two types of HART communication.
To connect to NMS53x Exi specification, a separate relay barrier is required.

1. NMT53x EX i output (ATEX, IECEx, FM, NEPSI)

2. NMT53x Ex d [ia] output only for TIIS specification

Combination with spot temperature

According to existing communication method, tank information can be selected based on the purposes by each input/output card and function can be also changed and added by a module card.

Figure 1:   TMD with spot temperature

A   *Host system communication*
B   *Digital output*
C   *Local HART (Ex d) communication*
D   *Contact input (Status)*
1.   *Float*
2.   *Spot temperature*
3.   *Browser*
4.   *Tank vision*
5.   *Digital transmitter TMD1000, TMD1*
6.   *Float level gauge LT5*
7.   *Promonitor NRF560*
8.   *Transmitter NRR261*
9.   *Oil leakage sensor NAR300*

**Combination with NMT539
Ex d [ia]**
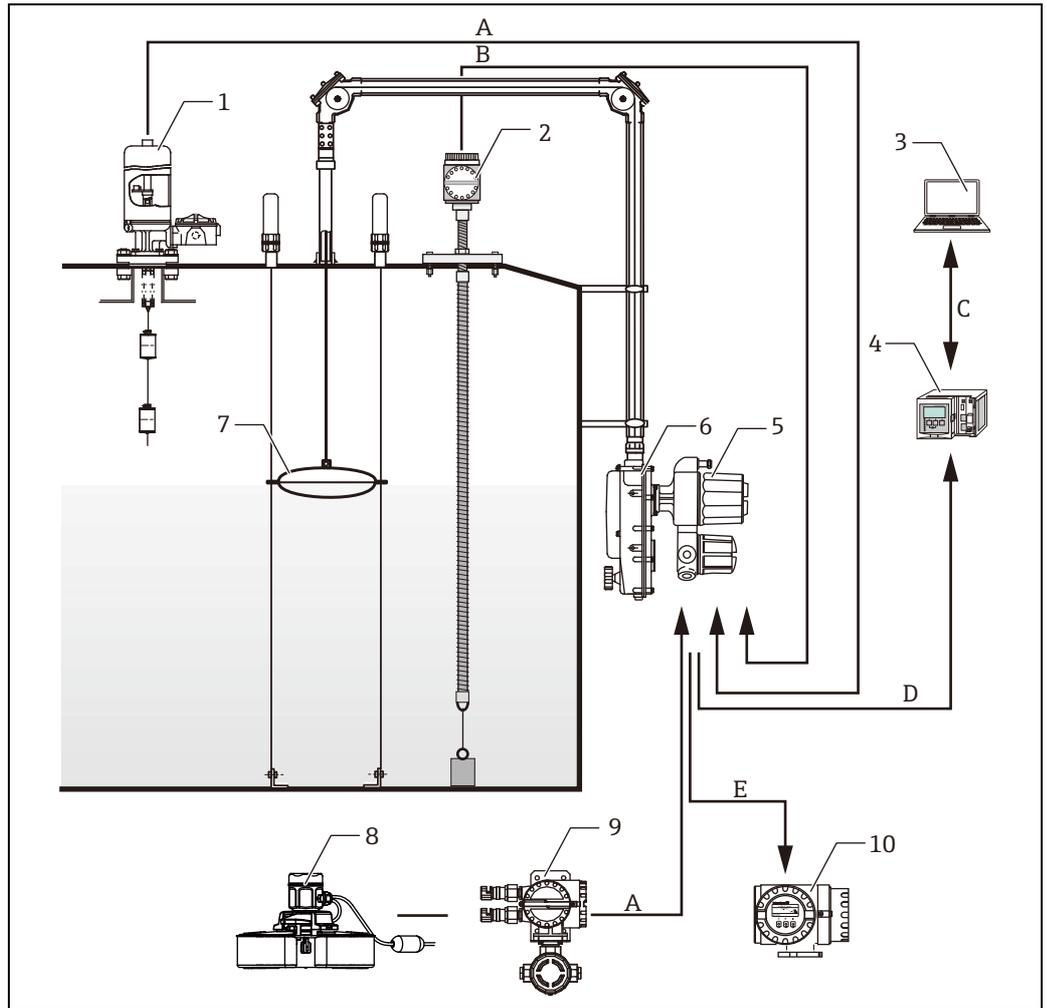
Figure 2:   Combination with NMT539 Ex d [ia]

A   Contact input (Status)
B   Local HART (Ex d) communication
C   Host system communication
D   Digital output
E   Local HART (Ex d) Communication
1.   Level switch MPC
2.   Average temperature NMT53x
3.   Browser
4.   Tank vision
5.   Digital transmitter TMD1000, TMD1
6.   Float level gauge LT5
7.   Float
8.   Oil leakage sensor NAR300
9.   Ex I/F box
10.   Transmitter NRR261
11.   Promonitor NRF560

Combination of RCV and DRM9700 only for TIIS Spec.

According to existing communication method, tank information can be selected based on the purposes by each input/output card and function can be also changed and added by a module card.
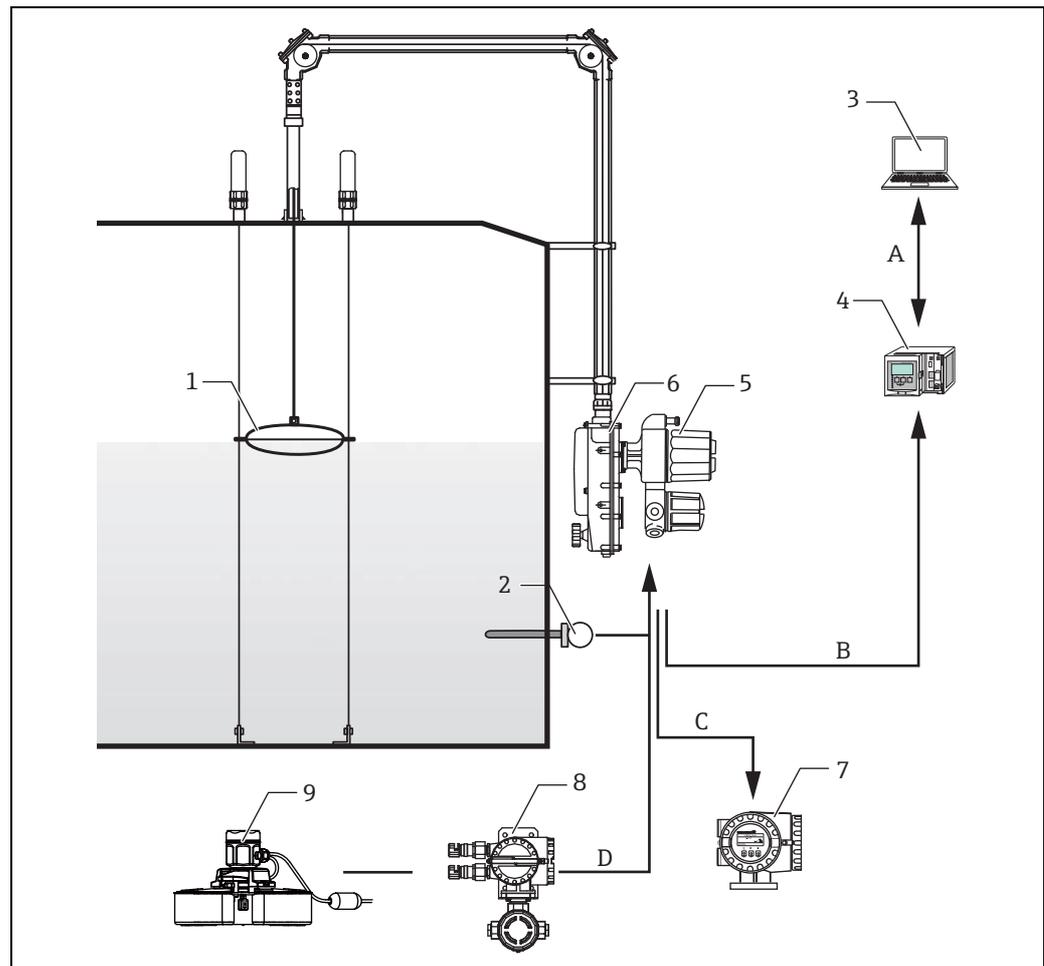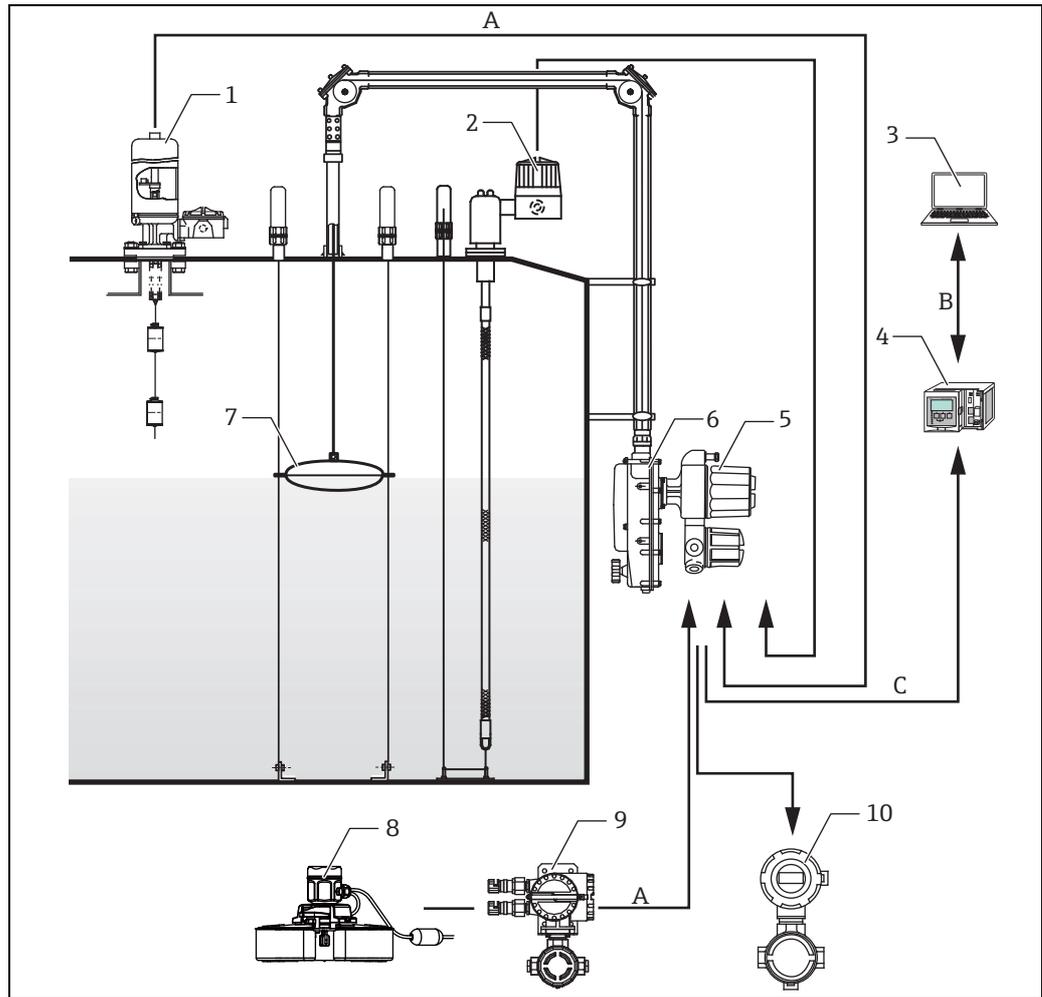

Figure 3: RCV/DRM9700 combination system configuration

A   Contact input (Status)
B   Host system communication
C   Digital output
1.   Level switch MPC
2.   Average temperature RCV
3.   Browser
4.   Tank vision
5.   Digital transmitter TMD1000, TMD1
6.   Float level gauge LT5
7.   Float
8.   Oil leakage sensor NAR300
9.   Transmitter NRR261
10.   Tank gauge monitor DRM9700

Operation principal

Detecting principal

The changing amounts of tape or wire that corresponds to the level detected by the float level gauge (LT5) are transmitted to the rotation angle inside the float level gauge and transferred to inside the transmitter by coupling of the float level gauge and the transmitter.

The level rotation change is transferred to the level encoder and digitally converted via a gear unit and timing belt.

The converted level is calculated and diagnosed by a microprocessor and the level, its alarm, and temperature element switching are digitally controlled and transmitted with other information either digitally or by analog means.
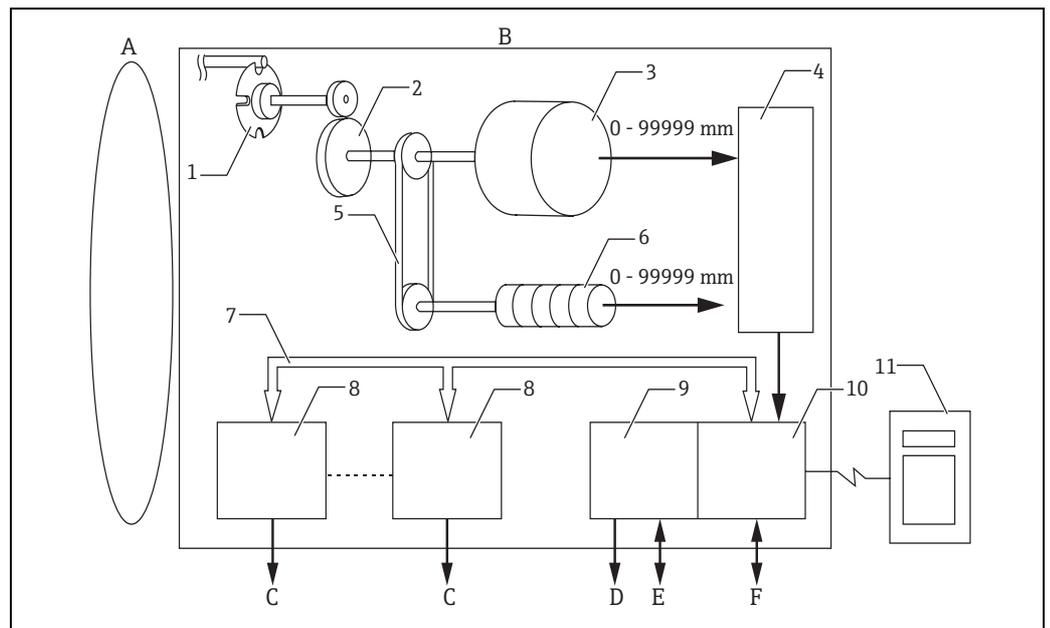
Figure 4:   Detecting configuration

A   Float level gauge LT5
B   Digital transmitter TMD1000, TMD1
C   To external device
D   Status input and alarm output
E   2-way, 2-wire communication
F   HART device
1.   Coupling (Connection with level)
2.   Gear unit
3.   Lower digit encoder
4.   Level A/D, I/F module
5.   Timing belt
6.   Upper digit encoder
7.   Buss line
8.   I/O modules
9.   Exp-module
10.   CPU module
11.   HHT2 (Hand held terminal 2)

Gear unit

The change of the tape travel distance amount that corresponds to the detected level at the float gauge is converted to a rotation angle inside the float level gauge, which is transferred to inside the transmitter by the coupling of the level gauge and the transmitter.

The gear unit adjusts the signal to be accelerated and drives level encoder.

Level encoder

Level encoder of transmitter is configured by two types of encoders which are the lower-digit and the upper digit encoders.
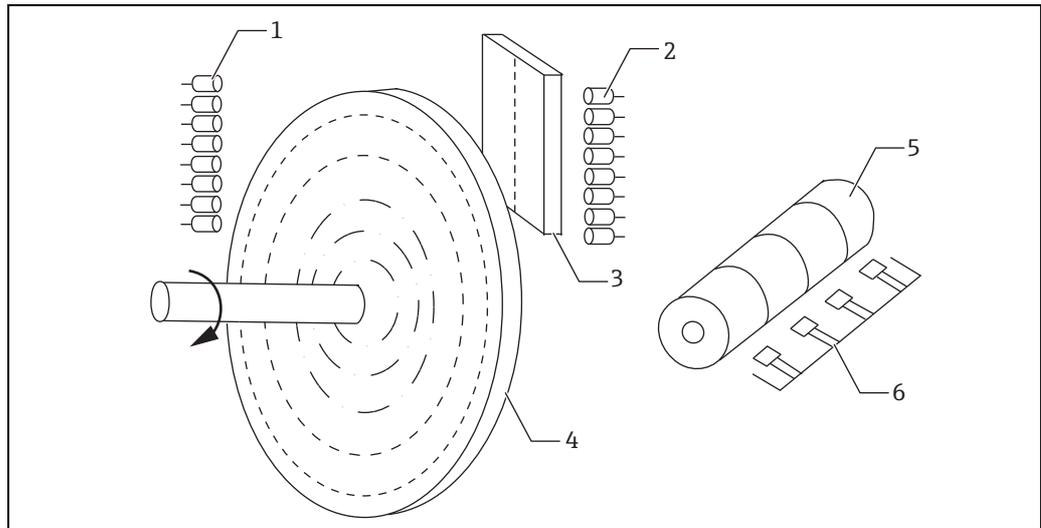
Figure 5:   Level encoder

1.   Optical transistor
2.   LED
3.   Slit
4.   Disk
5.   Counter
6.   Optical sensor

Lower digit encoder

When the patterned disc rotates, the light that has passed through the slit also passes through the patterned shaped slit, but some of it does not pass onto the disc.
The light that can pass through the patterned shaped slit is converted to an electrical signal by the light receiving element and is outputted to the microprocessor.

Upper digit encoder

The upper-digit encoder consists of the counter and the optical reading part. By optically reading signs on the circle of the mechanical counter drum, the level is converted to gray code, which is a combination of ON-OFF signals, and is outputted to the microprocessor.

Configuration diagram

Block diagram
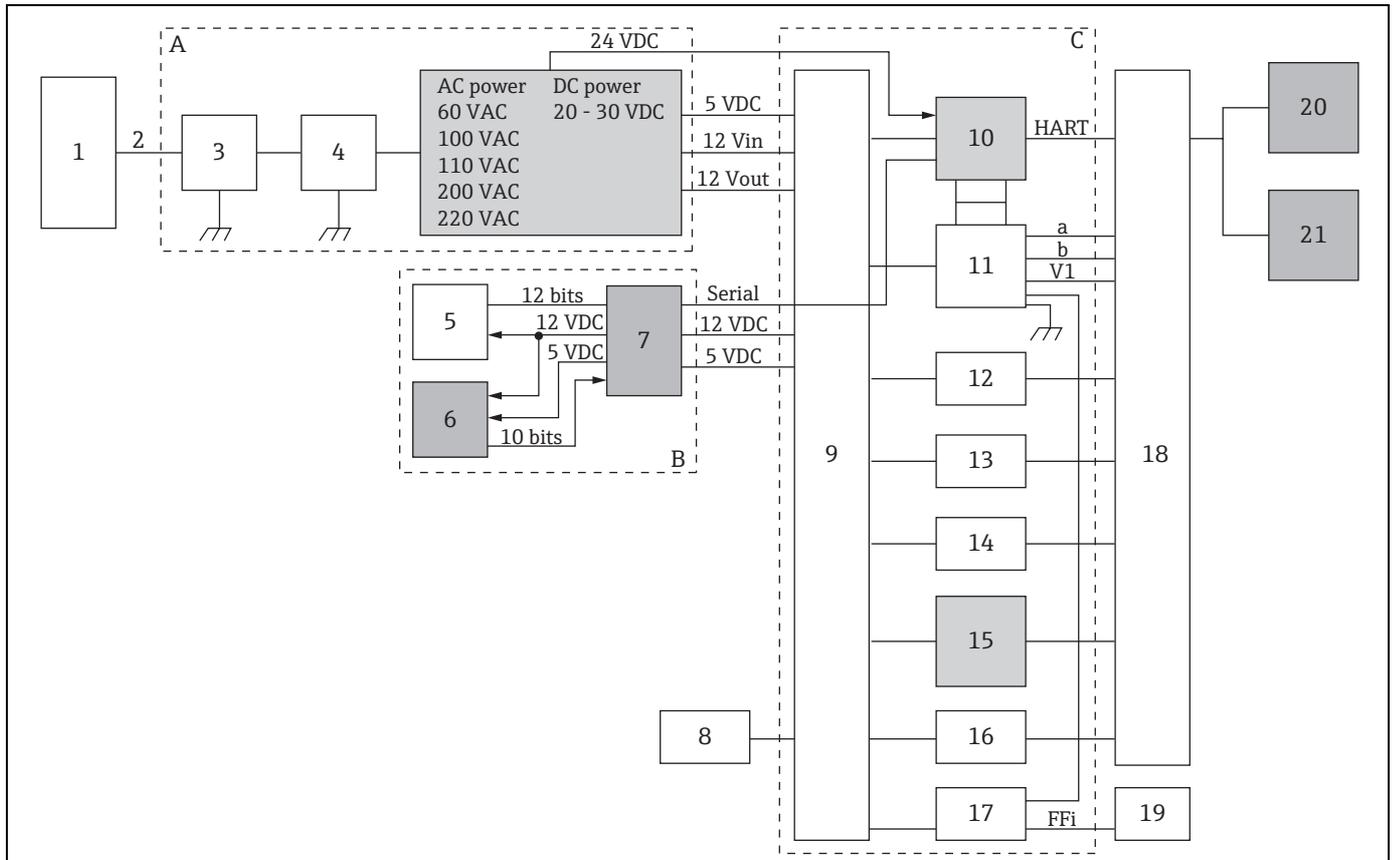
Figure 6: Block diagram

A	*Power supply*
B	*Level A/D transmitter*
C	*Microcomputer*
a	*Alarm 8 points*
b	*External status 8 points*
1.	*Terminals*
2.	*Shield for power supply*
3.	*Arrester (ARS-1)*
4.	*Noise filter*
5.	*Lower encoder*
6.	*Upper encoder (level A/D counter)*
7.	*Level A/D interface MIF-4*
8.	*HHT2 (Hand held terminal 2)*
9.	*Mother board*
10.	*CPU board (Main-CPU-B)*
11.	*Expansion board (Exp-A)*
12.	*4 to 20 mA output (DAC-1)*
13.	*DRM 9700 (DRMM-A)*
14.	*4 to 20 mA input (ADC-2)*
15.	*Temperature system (Thermo-A)*
16.	*External operation (CNT-2)*
17.	*Optical FFi communication (ODC-1)*
18.	*Terminals*
19.	*FFi optical unit*
20.	*Promonitor NRF560*
21.	*Average temperature NMT53x*

Input and output function

Temperature input

TMD1 can connect to temperature measuring device and collect temperature data inside the tank.

Average temperature Prothermo NMT53x

NMT53x is an intelligent average temperature that has an electrical housing on the top of a flexible tube fitted with temperature elements and the communication module for A/D conversion and data output in the temperature side.

TMD1 internal mdule	None (Fllowing shows prothermo NMT53x series main data)
Communication method	HART (local HART protocol) 2-way 2-wire digital serial transmission
Corresponding temperature element	Pt100 measuring temperature resitor
A/D conversion range	-200 to +235 ℃
Conversion accuracy	±0.1 ℃ or less
Resolution ability	0.01 ℃
Temperature element points	Maximum 16 points

Average temperature RCV series

TMD1 internal module	Thermo-A
Corresponding temperature element	Pt100 measuring temperature resistor
A/D conversion range	-200.9 to +240.0 ℃
Conversion accuracy	± 0.15 ℃
Resolution ability	0.1 ℃
Temperature element points	Maximum 12 points

4 to 20 mA input

TMD1 can download 4 to 20 mA output device data and output the data, adding the data on the 2-way 2-wire transmission (V1) signal.

Module	ADC-2
Input point	1 data
Data conversion accuracy	± 0.3%
Rating	4 to 20 mA
Input allowable impedance	250 Ω
Supply voltage	24 VDC
Current capacity	60 mA

Contact input (Status)

TMD1 can download external alarm device data such as for MPC series level switch or oil leak detector which has contact output and TMD1 can output the contact output as status signal to the host receiver.

Module	INT-1/Exp-A
Input point	4 points for standard (8 points for maximum)
Input rating	30 VDC, 30 mA
Circuit power	12 VDC, 4 mA /1 circuit
Circuit resistance	Maximum 100 Ω/1 wire (include contact resistance)

2-way 2-wire digital output   Digital 2-way 2-wire transfer communication, which can efficiently control data measurement for several existing tanks, is an important function in modern tank gauges. TMD1 uses V1 communication, which is Endress+Hauser's standard tank gauge protocol, and communicate across the distance of up to 6 km (loop length).

Module	Exp-A
Communication method	2-way 2-wire digital serial transmission
Level output	0 to 89,999 mm
Temperature output	-49.9 to +199.9 ℃
Contact output (alarm) (→ Tip below.)	4 points for standard (max. 8 points)
Contact input (status) (→ Tip below.)	4 points for standard (max. 8 points)
Communication address	0 to 225
Level transmission error	±0 mm
Temperature transmission error	±0.0 ℃
Response speed	Within 180ms/unit
Transmission distance	Maximum 6 km (while in use of CPEV Ø 1.2)
Circuit resistance	Maximum 120 Ω/wire
Line capacitance	0.3 μF/loop

:information_source: Select contact output (alarm) and contact input (status) as an output 2 and input function.

BCD parallel output   TMD1 can provide BCD parallel output.
In BCD output, either of collector common or emitter common can be selected.

Module	OUT-3 (collector common) OUT-4 (emitter common)
Communication method	Digital parallel transmission
Level output	Standard: 0 to 19.999 mm Special: 0 to 79.999 mm
Temperature output	-49.9 to +199.9 ℃
Number of wires	Standard: 17 bits and 1 common (total 18 lines)
Transmission output error	± 0 (both level and temperature)

Sakura code parallel output   TMD1 also can provide Sakura code parallel output.
In Sakura code parallel output, either of collector common or emitter common can be selected.

Module	OUT-3 (collector common) OUT-4 (emitter common)
Communication method	Digital parallel transmission
Level output	Standard: 0 to 19.999 mm Special: 0 to 39.999 mm
Temperature output	N/A
Number of wires	Standard: 17 bits and 1 common (total 18 lines)
Transmission output error	± 0 (level)

Optical (FFi) communication

Optical communication specification can be selected for use in lightning prone areas. Because optical communication can minimize external stress such as electrical noise based on its characteristics, it can send and receive data stably.

Module	ODC-1
Communication method	2-way and half dowble optical digital pulse communication (FFi protocol)
Level output	0 to 65.535 mm or ± 32767 mm (the value can be set using HHT2.)
Temperature output	-49.9 to +199.9 ℃
Main status output	Over and under tension, level A/D conversion error, level flow error
Level alarm output	H (Higher) and L (Lower) alarm, each 1 point
Displacer balance output	Balance or unbalance
External status output	4 points
TGM5 operation and operation information	Hoisting, measurement, stop
Fiber-optic for communication	Step index 100/140 μm (110/150μm is available.)

4 to 20 mA output

Regardless of host system, the transferring method simply and reliably for the host receiver has 4 to 20 mA output. 4 to 20 mA output can configure the independent system from data sending and receiving of loop control by the digital signal and can directly connect to analog bar graph of receiver.

Module	DAC-1(installable number of cards: 2 pcs.)
Communication method	4 to 20 mA output
Input points	1 data (2 data while in use of 2 cards)
Data conversion accuracy	± 0.3%
Rating	4 to 20 mA
Input allowable impedance	Within 600 Ω

Contact output (Alarm)

TMD1 is used not only for a transmitter but also for a level alarm sensor in inventory control to operate a tank yard safely. By setting conditions for level and temperature, the alarm can output with a relay contact by exceeding the allowable range (or not being able to reach the range).

Module	Exp-A
Output method	Transistor (photo coupler) contact
Output setting	Level and temperature
Output points	4 points for standard (max. 8 points)
Output rating	Open collector output by photo coupler
Collector current	30 mA
Voltage between collector and emitter	Maximum 250 VDC

External device operation output

External device operation output can operate relays by operation command from special receiver and can control an external device. Because the relay uses latching type, the contact status of relay maintains the current status.

Module	CNT-2
Output method	Relay contact
Application setting	Control for external device
Output points	8 points for standard (8 points for maximum)
Number of wire	16C (8 points)
Contact capacity	220 VDC/250 VAC, 3A, 60 W/125 VA

Relay contact output (alarm)

Module	Exp-A+CD688
Output method	Relay contact output (A contact)
Output setting	Level and temperature
Output points	4 points for standard and common is independent.
Accuracy	± 0 for level or temperature data
Output rating	100 VAC 0.5 A, 30 VDC 0.5 A

Allowable load impedance
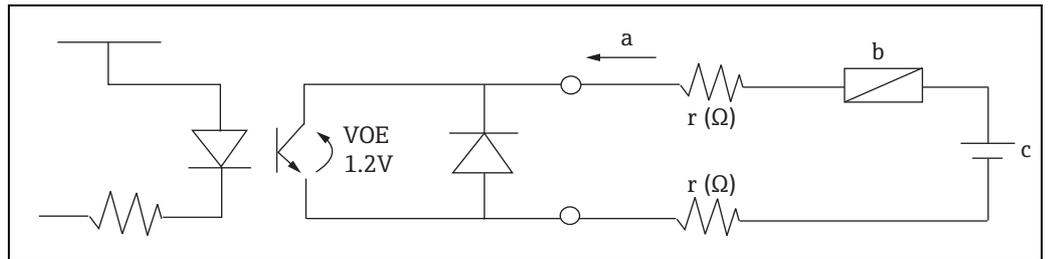
Figure 7: TMD1 and allowable load impedance of contact output circuit

a   *Maximum 30 mA*
b   *Load resistance R (Ω)/Operating current*
c   *Current E (DVC)*

In order to satisfy the following formula, define the E and R.

$$Is\ (A) \leq \frac{E\ (V) - 1.2\ (V)}{R\ (\Omega) + 2r\ (\Omega)} \leq 0.03\ (A)$$

Example: Transmission distance calculation on wiring

1. The purpose of this calculation is to calculate the following limitation between lines of resistance and capacitance amount.
   - One way resistance: Maximum 120 Ω
   - Maximum amount between lines: Maximum 0.3 μF

2. Maximum amount of cable resistance and between lines

Cable Name	Conductor Resistance (Ω/km)	Capacitance (μF/km)	Max. Transmission Distance (km)	Notes
CPEV, CPEE: Ø0.9	Max. 30	Max. 0.05	4	Calculation based on 30 Ω
KMPEV. KPEV-S KMPEE 0.9 mm²	Max. 21.5	0.05	5.58	Calculation based on 21.5 Ω
CPEV Ø12	16.5	0.05	6	Calculation based on 0.05 μF
CPEV (T) Ø0.9	Max. 30	0.06	4	Calculation based on 30 Ω
CVV2 mm² (CEE)	9.5	0.09(0.06)	3.3 (5)	Calculation based on 0.09 (0.06) μF

Specifications

Power supply	AC60, 100, 110, 200, 220V ± 10% 50/60 Hz 20-32 VDC ℹ️ DC power is not available for FFi specification. Contact Endress+Hauser representatives for special power supply.
Power consumption	AC: max. 14 W DC: max. 10 W

Cable entry

Specification	Description
0	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 the 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 the screw hole can be specified by either of A, B,C, D.)
K	4 x thread G1 EXPC-28B (The position of the 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 the 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 the screw hole can be specified by either of A, B,C, D.)
N	4 x thread G3/4 EXPC-22B (The position of the 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

Level A/D conversion	Method: Optical non-contact absolute encoder Range: 0 to 99999 mm Accuracy: ± 1 mm
Allowable ambient temperature	-20 to +60 ℃ (non-explosion proof/explosion proof) -10 to +40 ℃ (FFi specification)
Approval	Waterproof and dust-proof (IP65) Flame proof (Ex d IIB T4) Flame proof (d2G4) (FFi specification only)
Surge arrester	Supplied as standard
Weight	Approx. 10 kg
Material	Electrical housing: AC4C-T6 Cover of electrical housing: AC4C-T6 Terminal box: ADC12 Cover of electrical housing: AC4C-T6
Painting color	Blue and white

Operation condition: installation

Standard installation
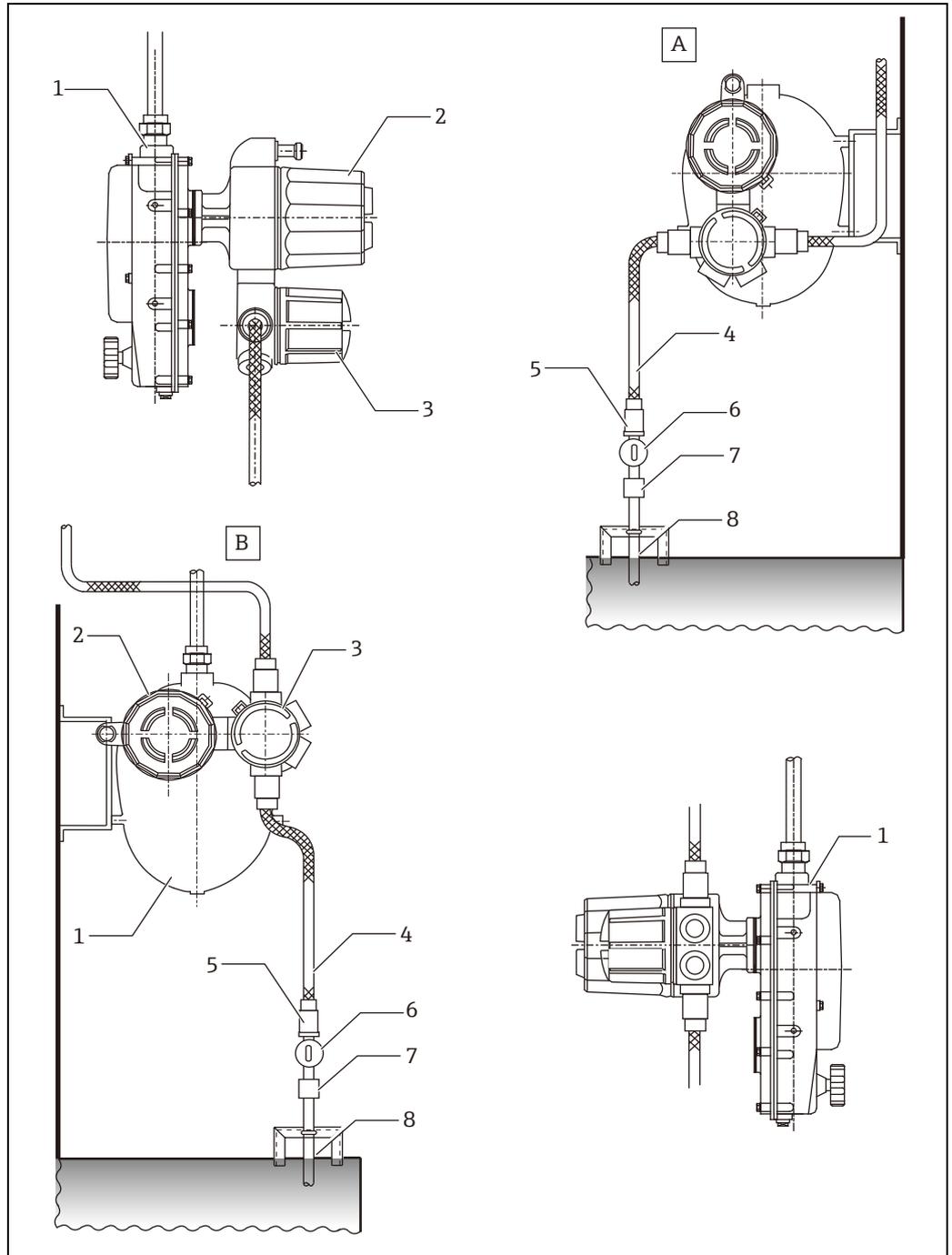
Figure 8:   Installation (Standard)

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*

FFi optical installation
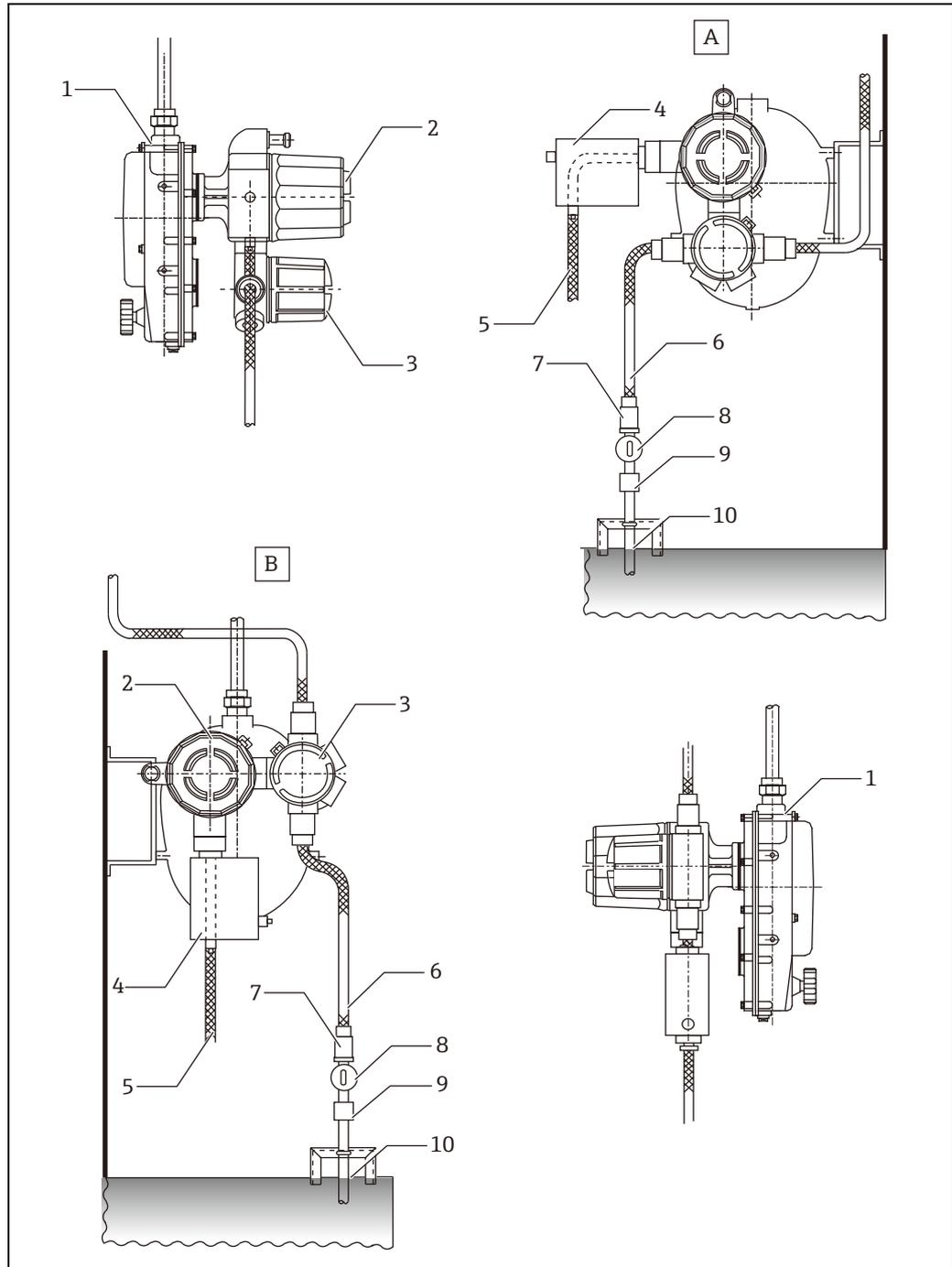
Figure 9:   Installation (FFi optical specification)

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

Tank side monitor

Tank gauge monitor DRM9700

TMD1 incorporates DRMM-A module as output 2 and can output level and temperature data to tank gauge monitor DRM9700.

TMD1 Module Name	DRMM-A
Communication Method	Single (unidirectional) way serial digital pulse 2-wire transmission
Level Display	0 to 99999 mm
Temperature Display	-49.9 to +199.9 ℃
Other Display	Gauge status
Line Resistor	Maximum 6.0 Ω (one line)
Line Capacitance	Maximum 0.4 μF (CPEV cable Ø1.2 = Max. 4km, Ø0.9 = Max. 2km)

Promonitor NRF560

The feature of Promonitor NRF560 is not for single way (unidirectional) monitor function. NRF560 sends and receives data via HART communication.

Type	Promonitor NRF560
Communication Method	HART (local HART protocol) 2-way 2-wire transmission
Level Display	0 to 99999.9 mm
Temperature Display	-49.9 to +199.9 ℃
Other Display	Gauge status (measuring status), error status

Because TMD1 has local HART communication board in Main-CPU-B supplied as standard, NRF560 and NMT53x can connect to TMD1 without adding any modules.

Operating condition: Terminal tables

Standard TMD1 terminal table

Terminal assignment and internal wiring of TMD1 vary depending on specifications. Specific cable patterns are defined according to their functions and combination of input and output. The following cable pattern are only for a partial excerpt and the patterns vary depending on their specifications.

A - 3 H

4 to 20 mA analog current output, DRM9700 output, contact alarm output, spot temperature (1 point)

Terminal No.	Signal Name	Polarity	Connector No.	Connection Board	Remarks
1	Supply Power AC /DC	+			No polarity on AC
2		-			
3					
4					
5					
6					
7	4-20 mA	+	4	DAC-1	
8		-			
9	4-20 mA Output	+	8	DAC-1	
10		-			
11	DRM9700 Output	+	5	DRMM-A	
12		-			
13					
14					
15	HART Communication	+		Main-CPU-B	Connection for NRF and NMT
16		-			
17	Alarm Output 1	+	J-3	Exp-A	
18		-			
19	Alarm Output 2	+			
20		-			
21	Alarm Output 3	+			
22		-			
23	Alarm Output 4	+			
24		-			
25	Spot Temperature Input (A)		2	Thermo-A	Simultaneous operation with NMT is prohibited.
26	Spot Temperature Input (B)				
27	Spot Temperature Input (b)				
28					
29					
30					
31					
32					
33					
34					
35					
36					

A - 2 H   **2-way 2-wire transmission, 4 to 20 mA analog current output, DRM9700 output, contact alarm output, Status input spot temperature (1 point), Level gauge operation output**

Terminal No.	Signal Name	Polarity	Connector No.	Connection Board	Remarks
1	Supply Power AC/DC	+			No polarity on AC
2		-			
3	Level Gauge Operation Output: Hoisting common				
4	Level Gauge Operation Output: Hoisting		6	CNT-2	
5	Level Gauge Operation Output: Stop common				
6	Level Gauge Operation Output: Stop				
7	2-way, 2-wire Transmission		1	Exp-A	
8					
9	4-20?A output	+	4	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	
12		-			
13	DC4-20?A input	+	7	ADC-2	
14		-			
15	HART communication	+		Main-CPU-B	Connection for NRF and NMT
16		-			
17	Alarm Output 1	+			
18		-			
19	Alarm Output 2	+			
20		-			
21	Alarm Output 3	+	J-3	Exp-A	
22		-			
23	Alarm Output 4	+			
24		-			
25	Spot Temperature Input (A)				Simultaneous operation with NMT is prohibited.
26	Spot Temperature Input (B)		2	Thermo-A	
27	Spot Temperature Input (b)				
28					
29	Status Input 1	+			
30		-			
31	Status Input 2	+			
32		-			
33	Status Input 3	+	J-4	Exp-A	
34		-			
35	Status Input 4	+			
36		-			

B - 2 H **2-way, 2-wire transmission, 4 to 20 mA analog current output, DRM9700 output, contact alarm output, average temperature/spot temperature (3 points), level gauge operation output**

Terminal No.	Signal No.	Polarity	Connector No.	Connection Board	Remarks
1	Supply Power AC/DC	+			No polarity on AC
2		-			
3	Level Gauge Operation Output: Hoisting common		6	CNT-2	
4	Level Gauge Operation Output: Hoisting				
5	Level Gauge Operation Output: Stop common				
6	Level Gauge Operation Output: Stop				
7	2-way 2-wire Transmission	+	1	Exp-A	
8		-			
9	4-20 mA output	+	4	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	
12		-			
13	4-20 mA input	+	7	ADC-2	
14		-			
15	HART communication	+		Main-CPU-B	Connection for NRF and NMT
16		-			
17	Alarm Output 1	+	J-3	Exp-A	
18		-			
19	Alarm Output 2	+			
20		-			
21	Alarm Output 3	+			
22		-			
23	Alarm Output 4	+			
24		-			
25	Average Temperature Input (B)		2	Thermo-A	Simultaneous operation with NMT is prohibited
26	Average Temperature Input (b)				
27	Average Temperature Input (A1)/Spot (A)				
28	Average Temperature Input (A2)/Spot (B)				
29	Average Temperature Input (A3)/Spot (b)				
30	Average Temperature Input (A4)/Spot 2 (A)				
31	Average Temperature Input (A5)/Spot 2 (B)				
32	Average Temperature Input (A6)/Spot 2(b)				
33	Average Temperature Input (A7)/Spot 3 (A)				
34	Average Temperature Input (A8)/Spot 3 (B)				
35	Average Temperature Input (A9)/Spot 3 (b)				
36	Average Temperature Input (A10)				

B - 3 H **2-way, 2-wire transmission, 4 to 20 mA analog current output, DRM9700 output, contact alarm output, average temperature/spot temperature (3 points), level gauge operation output**

Terminal No.	Terminal Name	Polarity	Connector No.	Connection Board	Remarks
1	Supply Power AC/DC	+			No polarity on AC
2		-			
3	Level gauge operation output: Hoisting common				
4	Level gauge operation output: Hoisting		6	CNT-2	
5	Level gauge operation output: Stop common				
6	Level gauge operation output: Stop				
7	2-way, 2-wire Transmission	+	1	Exp-A	
8		-			
9	4-20 mA Output	+	4	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	
12		-			
13	4-20 mA Input	+	7	ADC-2	
14		-			
15	HART Communication	+		Main-CPU-B	Connection for NRF and NMT
16		-			
17	Status Input 1	+			
18		-			
19	Status Input 2	+			
20		-	J-4	Exp-A	
21	Status Input 3	+			
22		-			
23	Status Input 4	+			
24		-			
25	Average Temperature Input (B)				
26	Average Temperature Input (b)				
27	Average Temperature Input (A1)/ Spot1 (A)				
28	Average Temperature Input (A2)/ Spot1 (B)				
29	Average Temperature Input (A3)/ Spot1 (b)				
30	Average Temperature Input (A4)/ Spot2 (A)		2	Thermo-A	Simultaneous operation with NMT is prohibited.
31	Average Temperature Input (A5)/ Spot2 (B)				
32	Average Temperature Input (A6)/ Spot2 (b)				
33	Average Temperature Input (A7)/ Spot3 (A)				
34	Average Temperature Input (A8)/ Spot 3 (B)				
35	Average Temperature Input (A9)/ Spot 3 (b)				
36	Average Temperature Input (A10)				

C H   **2-way, 2-wire transmission, contact alarm output, status Input, average temperature/spot temperature, 3 points**

Terminal No.	Signal Name	Polarity	Connector No.	Connection Board	Remarks
1	Supply Power AC/DC	+			
2		-			
3	HART Communication	+		Main-CPU-B	Connection for NRF and NMT
4		-			
5					
6					
7	2-way, 2-wire Transmission	+	1	Exp-A	
8		-			
9	Alarm Output 1	+			
10		-			
11	Alarm Output 2	+			
12		-	J-3	Exp-A	
13	Alarm Output 3	+			
14		-			
15	Alarm Output 4	+			
16		-			
17	Status Input 1	+			
18		-			
19	Status Input 2	+			
20		-	J-4	Exp-A	
21	Status Input 3	+			
22		-			
23	Status Input 4	+			
24		-			
25	Average Temperature Input (B)				
26	Average Temperature Input (b)				
27	Average Temperature Input (A1)/Spot 1 (A)				
28	Average Temperature Input (A2)/Spot 2 (B)				
29	Average Temperature Input (A3) Spot 2 (b)				
30	Average Temperature Input (A4)/Spot 2 (A)		2	Thermo-A	Simultaneous operation with NMT is prohibited.
31	Average Temperature Input (A5)/Spot 2 (B)				
32	Average Temperature Input (A6)/Spot 2 (b)				
33	Average Temperature Input (A7)/Spot 3 (A)				
34	Average Temperature Input (A8)/Spot 3 (B)				
35	Average Temperature Input (A9)/Spot 3 (b)				
36	Average Temperature Input (A10)				

E - 1 H   **4 to 20 mA analog current output, contact alarm output, status input, level/average temperature or spot temperature, 3 points**

Terminal No.	Signal Name	Polarity	Connector No.	Connection Board	Remarks
1	Power Supply AC/DC	+			No polarity on AC
2		-			
3	HART Communication	+		Main-CPU-B	
4		-			
5					
6					
7	Common				
8	Level 10^0 -2^0/Temp.10^{-1} -2^0				
9	Level 10^0 -2^1/Temp.10^{-1} -2^1				
10	Level 10^0 -2^2/Temp.10^{-1} -2^2				
11	Level 10^0 -2^3/Temp.10^{-1} -2^3				
12	Level 10^1 -2^0/Temp.10^0 -2^0				
13	Level 10^1-2^1/Temp.10^0 -2^1				In case of collector common, use OUT-3.
14	Level 10^1 -2^2/Temp.10^0 -2^2				
15	Level 10^1 -2^3/Temp.10^0 -2^3		1	OUT-3 or OUT-4	In case of emitter common, use OUT-4.
16	Level 10^2 -2^0/Temp.10^1 -2^0				
17	Level 10^2 -2^1/Temp.10^1 -2^1				
18	Level 10^2 -2^2/Temp.10^1 -2^2				Either level or temperature output must be selected according to specifications.
19	Level 10^2 -2^3/Temp.10^1 -2^3				
20	Level 10^3 -2^0/Temp.10^2 -2^0				
21	Level 10^3 -2^1/Temp.10^2 -2^1				
22	Level 10^3 -2^2/Temp.10^2 -2^2				
23	Level 10^3 -2^3/Temp.10^2 -2^3				
24	Level 10^4 -2^0/Temp.+,-				
25	DRM-9700 Output	+	5	DRMM-A	
26		-			
27	4-20 mA Output	+	4	DAC-1	
28		-			
29	Alarm Output 1	+			
30		-			
31	Alarm Output 2	+			
32		-	J-3	Exp-A	
33	Alarm Output 3	+			
34		-			
35	Alarm Output 4	+			
36		-			

550 H   **2-way, 2-wire Transmission, 4 to 20 mA analog current output, DRM9700 output, contact alarm output (relay), status input, spot temperature (1 point) level gauge operation output**

Terminal No.	Signal Name	Polarity	Connector No.	Connection Board	Remarks
1	Supply Power AC/DC	+			No polarity on AC
2		-			
3	Level gauge operation output: Hoisting common				
4	Level gauge operation output: Hoisting		6	CNT-2	
5	Level gauge operation output: Stop common				
6	Level gauge operation output: Stop				
7	2-way, 2-wire Transmission	+	1	Exp-A	
8		-			
9	4-20 mA output	+	4	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	
12		-			
13	4-20 mA input	+	7	ADC-2	
14		-			
15	HART Communication	+		Main-CPU-B	Connection for NRF and NMT
16		-			
17	Alarm output(Relay) 1				
18					
19	Alarm output(Relay) 2				
20			J -3	Exp-A CD-688	Because of the mechanical relay for alarm output, CD-688 module is supplied.
21	Alarm output(Relay)3				
22					
23	Alarm output(Relay) 4				
24					
25	Average Temperature Input (A)	A			
26	Average Temperature Input (B)	B	2	Thermo-A	Simultaneous operation with NMT is prohibited.
27	Average Temperature Input (b)	b			
28					
29	Status Input 1	+			
30		-			
31	Status Input 2	+			
32		-	J-4	Exp-A	
33	Status Input 3	+			
34		-			
35	Status Input 4	+			
36		-			

A-2 H optical FFi **4 to 20 mA analog current output, DRM9700 output, Contact alarm output, Spot temperature (1 point)**

Terminal No.	Signal Name	Polarity	Connector No.	Connection Board	Remarks
1	Supply Power AC				
2					
3					
4					
5					
6					
7					
8					
9	DC4 - 20 mA output	+	4	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	DRMM-A board is an option.
12		-			
13	4-20 mA input	+	7	ADC-2	
14		-			
15	HART Communication	+		Main-CPU-B	Connection for NRF and NMT
16		-			
17	Alarm Output (Relay) 1	+	J -3	Exp-A CD-688	Because of the mechanical relay for alarm output, CD-688 module is supplied.
18		-			
19	Alarm Output (Relay) 2	+			
20		-			
21	Alarm Output (Relay) 3	+			
22		-			
23	Alarm Output (Relay) 4	+			
24		-			
25	Average Temperature Input (A)		2	Thermo-A	Simultaneous operation with NMT is prohibited.
26	Average Temperature Input (B)				
27	Average Temperature Input (b)				
28					
29	Status Input 1	+	J-4	Exp-A	
30		-			
31	Status Input 2	+			
32		-			
33	Status Input 3	+			
34		-			
35	Status Input 4	+			
36		-			

Operating condition: Operation

HHT2

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

NOTICE

- HART input specification settings for TMD necessitates the latest HHT2 software version (HHT2 V5.8 or later).
- Always use ex-proof products in hazardous areas.
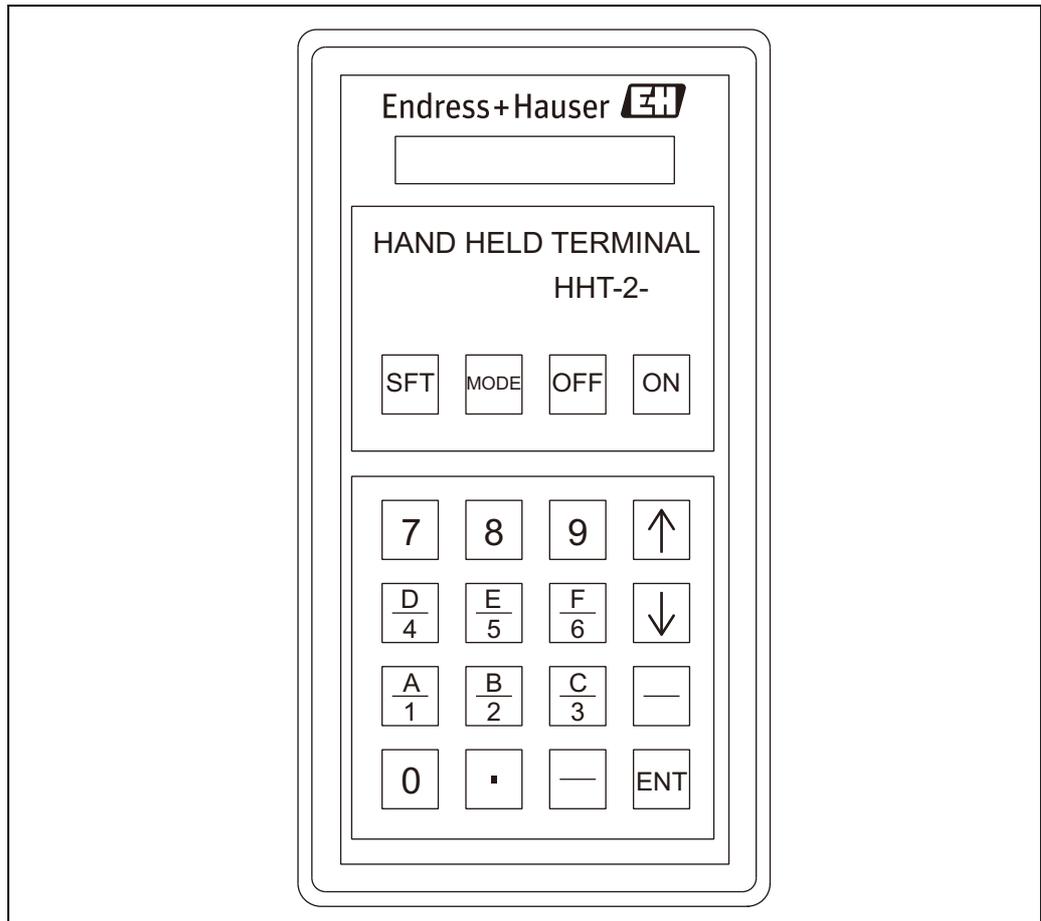
Figure 10: HHT2 (Hand Held Terminal)

External dimensions

Standard drawing

Figure 11: Standard drawing, Unit: mm (in)

A   Cable gland: position of the cable entry A, B, C, D
B   Cable gland: position of the cable entry A, B, C, D
C   Cable gland: position of the cable entry A, B, C, D1
D   Cable gland: position of the 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.

FFi specifications
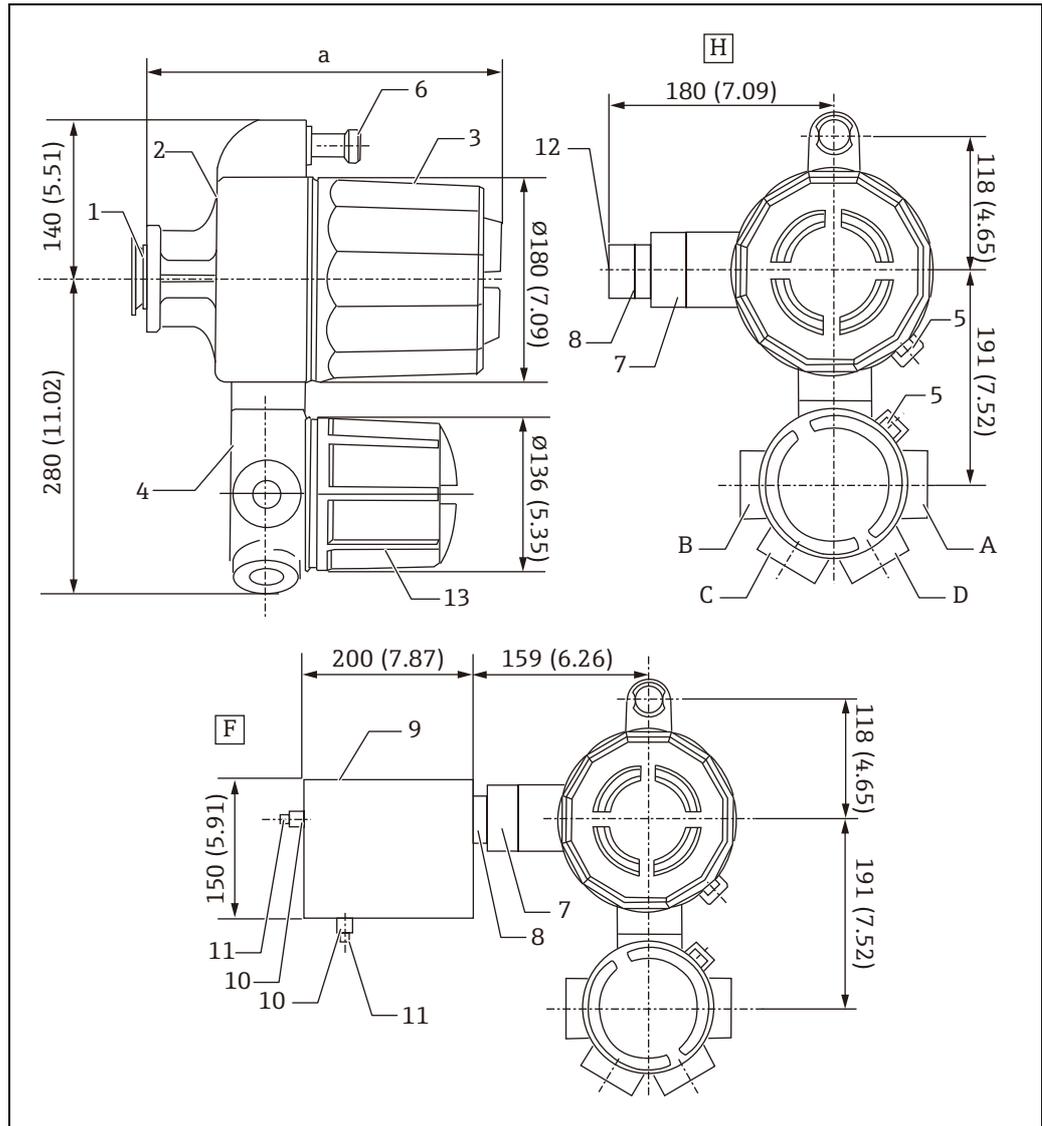
Figure 12: FFi drawing, Unit: mm (in)

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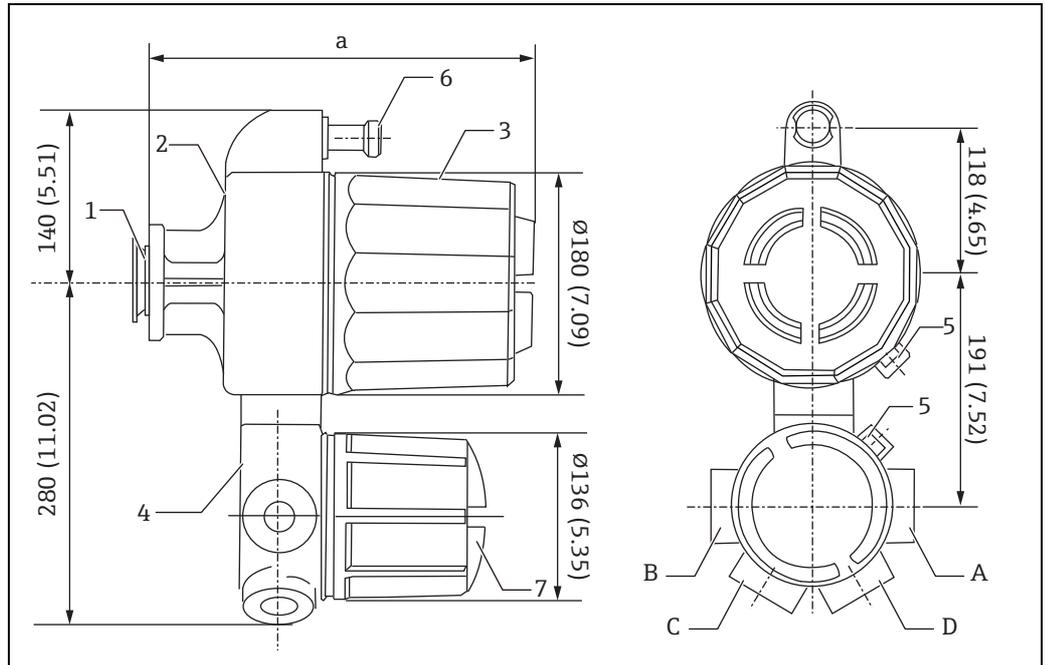*B*   Cable gland: position of the cable entry A, B, C, D
C   Cable gland: position of the cable entry A, B, C, D1
D   Cable gland: position of the cable entry A, B, C, D
F   Terminal box type
H   M42 x P1.5 slide coupling type
a   325 mm (12.79 in) for all spec., excluding FM spec./335 mm (13.19 in)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

ℹ The position of the cable gland is fixed as shown above.

HHT2 external dimensions

Figure 13: HHT2 (Hand Held Terminal 2) external dimensions, Unit: mm (in)

ℹ️ HHT2 for TMD1 is not supplied with TMD1.Order HHT2 separately if needed.

Certificates and approvals

Ex approval
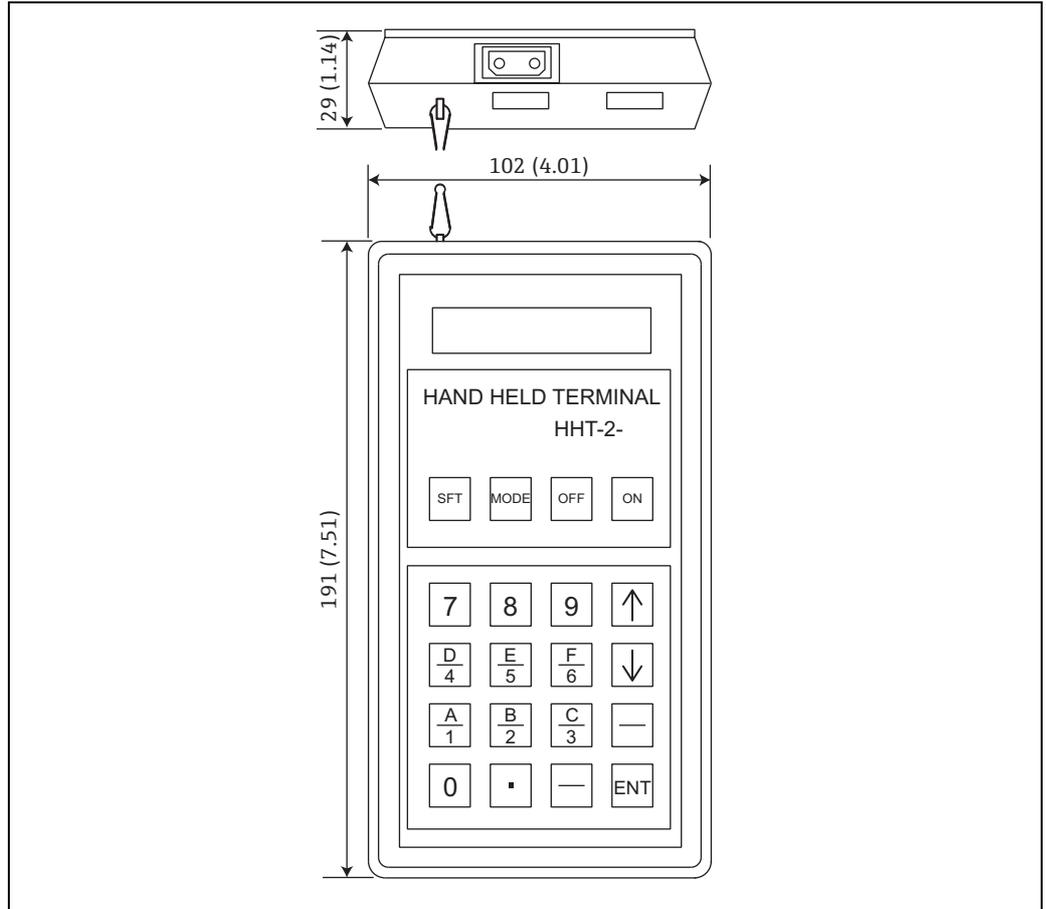TIIS: Ex d IIB T4
d2G4: Optical FFi specification
FM XP Cl.I Div.1 Gr.C-D, AEx d IIB T4

Order information

TMD1

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 sta mAtus, 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 ℃
								2	Pt100, JIS=IEC, +70...+350 ℃
								3	JPt100, JIS, -50...+200 ℃
								4	JPt100, JIS, +70...+350 ℃
								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.

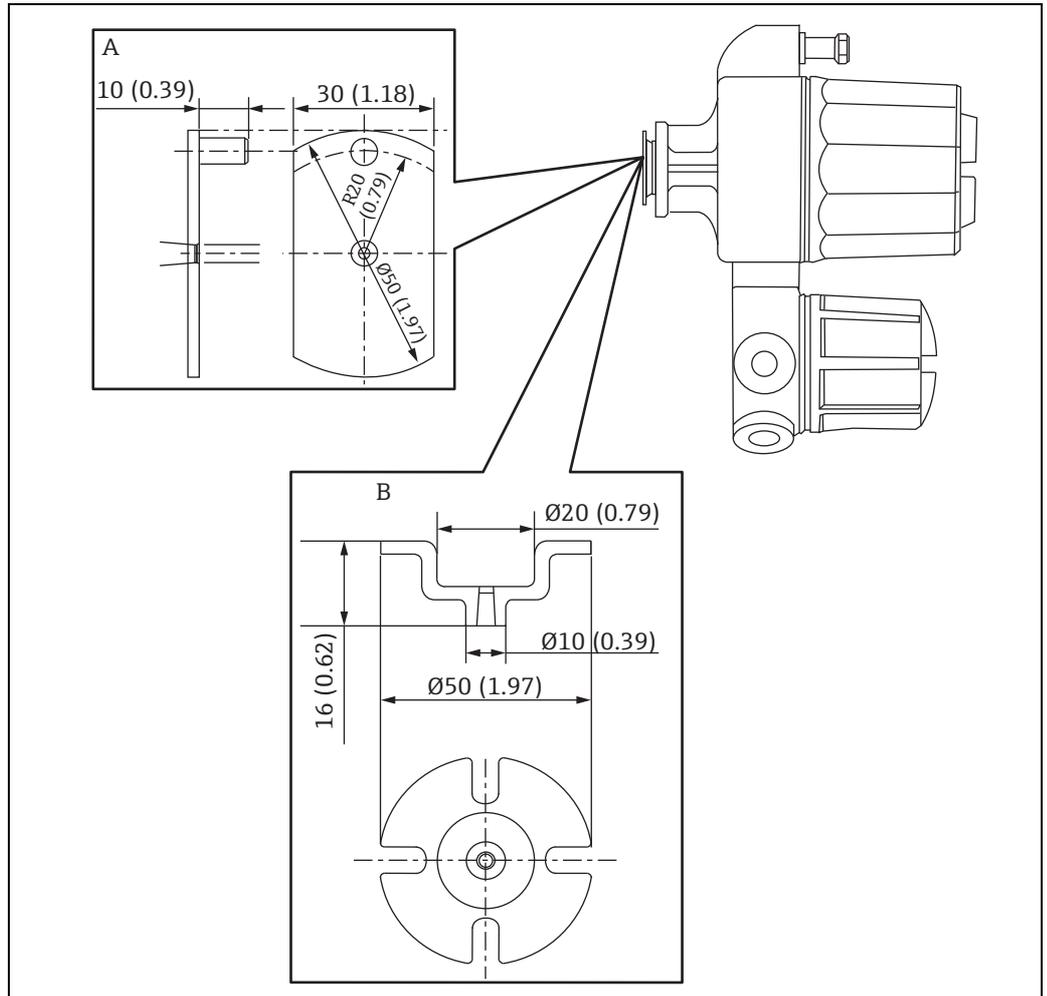| TMD1-											Complete product designation

Accessories

Coupling

Figure 14: Coupling, Unit: mm (in)

A   Coupling for medium and high pressure (when ordering float level gauge for medium or high pressure, the couplings are supplied in the kit.)
B   Coupling for connection of float level gauge

O-ring and stud bolt are supplied as standard to connect to float level gauge.

Supplementary documentation

Technical information	**TI01005G** Prothermo NMT53x **TI01167G** Float level gauge LT5
Operating instructions	**BA00427G** Digital transmitter TMD1, TMD1000 (Operation) **BA00428G** Digital transmitter TMD1, TMD1000 (Module) **BA00429G** Digital transmitter TMD1, TMD1000 (HHT2)
Safety instructions	**XA01072G-A for TIIS** Digital Transmitter TMD1, TMD1000 **XA01089G-A for FM** Digital Transmitter TMD1, TMD1000

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