

Technical Information

TMD1000 TMD1

Digital Transmitter



Application

TMD1 is used in combination with an on-site float level gauge, such as an LT float gauge. TMD1 can monitor tank data, including level and temperature, by 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 allows for easy function change and addition.

Features

- Once TMD1 is installed, aligning commands and adjusting transmission can be performed with a hand held terminal.
- The module is designed to allow selection from remote transmission output, temperature A/D conversion, level alarm, and external device operation output.
- TMD1 is capable of handling HART communication.
 - Communication with Wireless HART adapter or PLC/DCS through Ex d HART output
 - Communication with NMT539 Ex d[ia] or NRF560 Ex d through Ex d HART input
- By selecting a module, TMD1 can be connected to Endress+Hauser's existing or new tank gauge system.
- The main unit has a explosion-proof structure (Ex d IIB T4), and therefore it can be used in hazardous areas.
- TIIS explosion-proof certified
- FM explosion-proof certified





Table of contents

About this document	3	Certificates and approvals	35
Symbol	3	Ex Approval	35
Registered trademarks	5		
Functions and system configuration	6	Order information	36
NMT53x & NRF560 combination (HART communication) ..	6	Accessories	37
Combination with spot temperature device	6	Coupling	37
Combination with NMT539 Ex d[ia] (TIIS only)	7		
Combination with RCV and DRM9700 (TIIS only)	8	Documentation	38
Operating Principle	9	Operating Instructions (BA)	38
Configuration diagram	11	Safety Instructions (XA)	38
Input/Output	12		
Temperature input	12		
4 to 20 mA input	12		
Contact point input (status)	12		
HART output	13		
2-wire digital output	13		
BCD parallel output	14		
SAKURA code parallel output	14		
Optical (FFi) communication	14		
4 to 20 mA output	14		
Contact output (Alarm)	15		
External device operation	15		
Relay contact output (alarm)	15		
Allowable load impedance	15		
Standard TMD1 terminal table	16		
A - 3 H terminal table	16		
A - 2 H terminal table	17		
B - 2 H terminal table	18		
B - 3 H terminal table	19		
C H terminal table	20		
E - 1 H terminal table	21		
550 H terminal table	22		
A - 2 H Optical FFi terminal table	23		
Power supply	25		
Power consumption	25		
Cable entry	25		
Level A/D conversion	25		
Performance characteristics	26		
Performance characteristics of tank side monitor	26		
Installation	27		
Installation location	27		
Structure	28		
Installation onto a tank	31		
Environment	33		
Ambient temperature range	33		
Water-proof dust-proof structure	33		
Surge arrester	33		
Operability	34		
HHT2 (Hand Held Terminal)	34		







About this document

Symbol






Safety symbols

Symbol	Meaning
	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! 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.
	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.
	NOTE! This symbol contains information on procedures and other facts that do not result in personal injury.









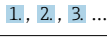






Electrical symbols

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.

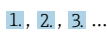


Tool symbols

Symbol	Meaning
 A0013442	Torx screwdriver
 A0011220	Flat blade screwdriver
 A0011219	Phillips screwdriver
 A0011221	Allen key
 A0011222	Open-ended wrench



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
	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

Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
	Series of steps
A, B, C, ...	Graphics
A-A, B-B, C-C, ...	Cross-sections
	Hazardous area Indicates the hazardous area
	Safe area (non-hazardous area) Indicates the non-hazardous area

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.

Registered trademarks

HART®

Registered trademark of the HART Communication Foundation, Austin, USA

Functions and system configuration

NMT53x & NRF560 combination (HART communication)

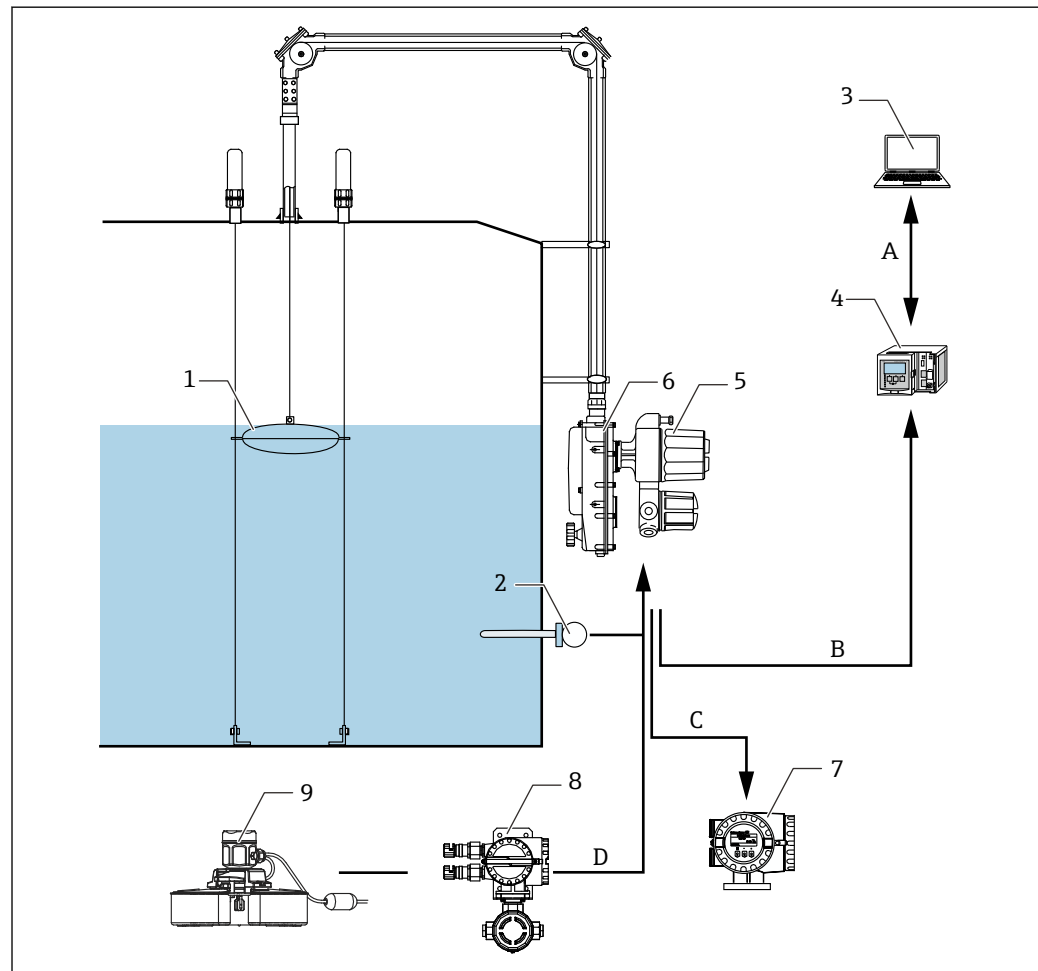
TMD1 can be connected to Promonitor NRF560 instead of DRM9700 and average temperature device Prothermo NMT53x equipped with a HART communication function. For specifications of HART devices, contact your Endress+Hauser Sales Center.

i NMT53x has two types of HART communication. Since TMD1 is Ex d (XP) type, an additional barrier is required in order to connect with NMT53x's Ex i type.

- NMT53x Ex i output (ATEX, IECEx, FM, NEPSI)
- NMT53x Ex d [ia] output (TIIS only)

Combination with spot temperature device

Using conventional communication, tank information can be selected from various input/output cards depending on the needs, and the functions can be changed and added easily with module cards.

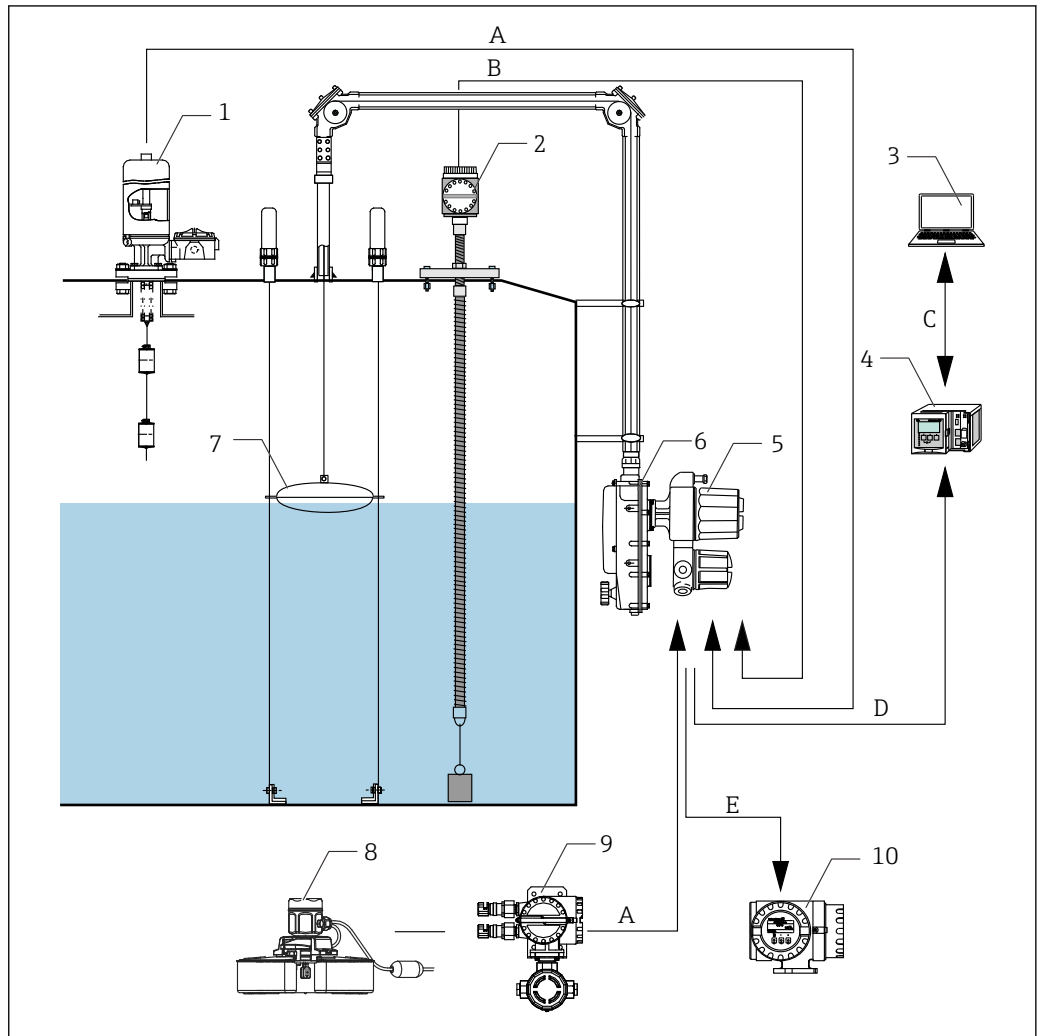


A0038054

1 Combination with spot temperature device

- A Host communication system
 B Digital output
 C Local HART (Ex d) communication
 D Contact point input (status)
 1 Float
 2 Spot temperature device
 3 Browser
 4 Tankvision
 5 Digital Transmitter TMD1000 TMD1
 6 Float Level Gauge LT5
 7 Promonitor NRF560
 8 Converter NRR261
 9 Oil Leak Detector NAR300

Combination with NMT539
Ex d[ia] (TIIS only)



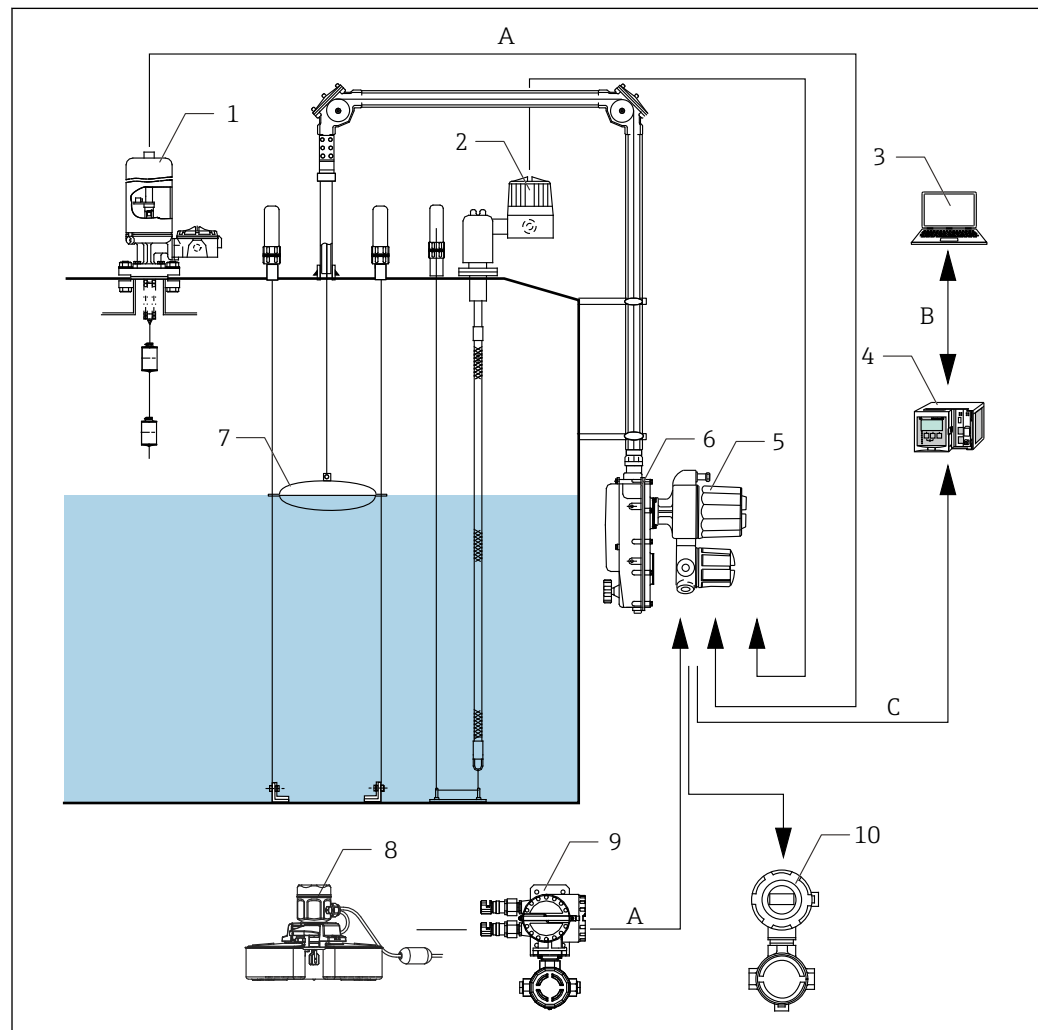
A0038055

2 HART Ex d [ia] output system configuration

- A Contact point input (status)
- B Local HART (Ex d) communication
- C Host communication system
- D Digital output
- E Local HART (Ex d) communication
- 1 Level switch MPC
- 2 Average temperature device NMT539
- 3 Browser
- 4 Tankvision
- 5 Digital Transmitter TMD1000 TMD1
- 6 Float Level Gauge LT5
- 7 Float
- 8 Oil Leak Detector NAR300
- 9 Converter NRR261
- 10 Promonitor NRF560

Combination with RCV and DRM9700 (TIIS only)

Using conventional communication, tank information can be selected from various input/output cards depending on the needs, and the functions can be changed and added easily with module cards.



A0038056

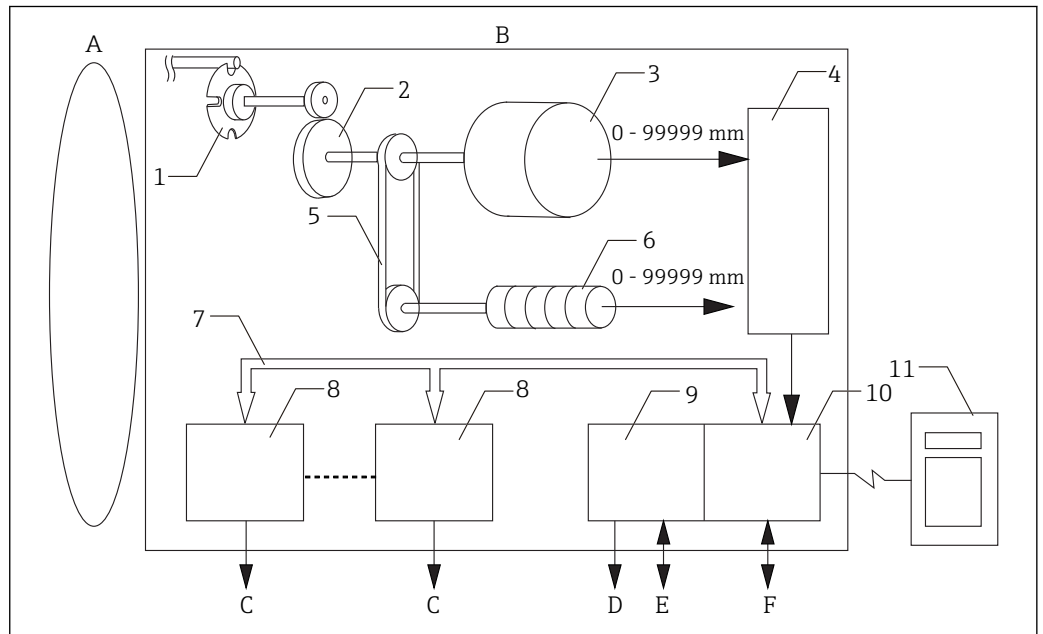
3 System configuration of RCV and DRM9700 combination

- A Contact point input (status)
- B Host communication system
- C Digital output
- D Digital output
- 1 Level switch MPC
- 2 Average temperature device RCV
- 3 Browser
- 4 Tankvision
- 5 Digital Transmitter TMD1000 TMD1
- 6 Float Level Gauge LT5
- 7 Float
- 8 Oil Leak Detector NAR300
- 9 Converter NRR261
- 10 Tank Gauge Monitor DRM9700

Operating Principle

Detection configuration

The changing amounts of tape or wire which corresponds to the level detected by a float level gauge (LT5) is converted to rotational angle and then transmitted inside the transmitter by means of coupling of the float level gauge and transmitter. The level's rotational change is transmitted to the level encoder and is digitally converted via 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 digitally or analog transmitted along with other information.



A0038057

4 Detection configuration

- A Float Level Gauge LT5
- B Digital Transmitter TMD1000 TMD1
- C To external devices
- D Status input / Alarm output
- E 2-way communication
- F HART device
- 1 Coupling (connected to a level gauge)
- 2 Gear unit
- 3 Low-order digit encoder
- 4 Level A/D I/F module
- 5 Timing belt
- 6 High-order digit encoder
- 7 Bus line
- 8 Various I/O modules
- 9 Exp module
- 10 CPU module
- 11 HHT2 (Hand Held Terminal)

Gear unit

Change in the tape travel distance, which the float gauge corresponds to the detecting level, is converted to rotational angle inside the float level gauge and then transmitted to inside transmitter by the coupling of level gauge and transmitter. The gear mechanism applies acceleration adjustment to this signal and runs the level encoder.

Level encoder

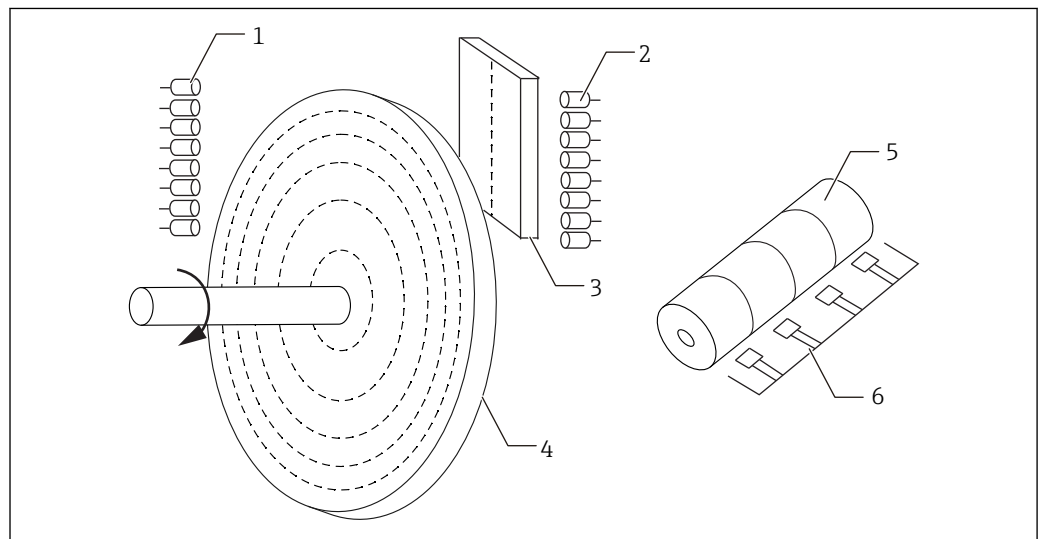
The level encoder is comprised of both a low-order digit level encoder and a high-order digit level encoder.

Low-order encoder

When the disc which contains patterns rotates, the light which has passed through the slit is either passed through along the pattern or is blocked. The light that passed through the pattern is converted to an electrical signal by the light-receiving element and then output to the microprocessor.

High-order encoder

The high-order encoder is comprised of a counter and an optic reader, and it optically reads codes along the circumference of the mechanical counter's drum. The level is converted to a gray code, which is a combination of ON and OFF signal, and then output to the microprocessor.



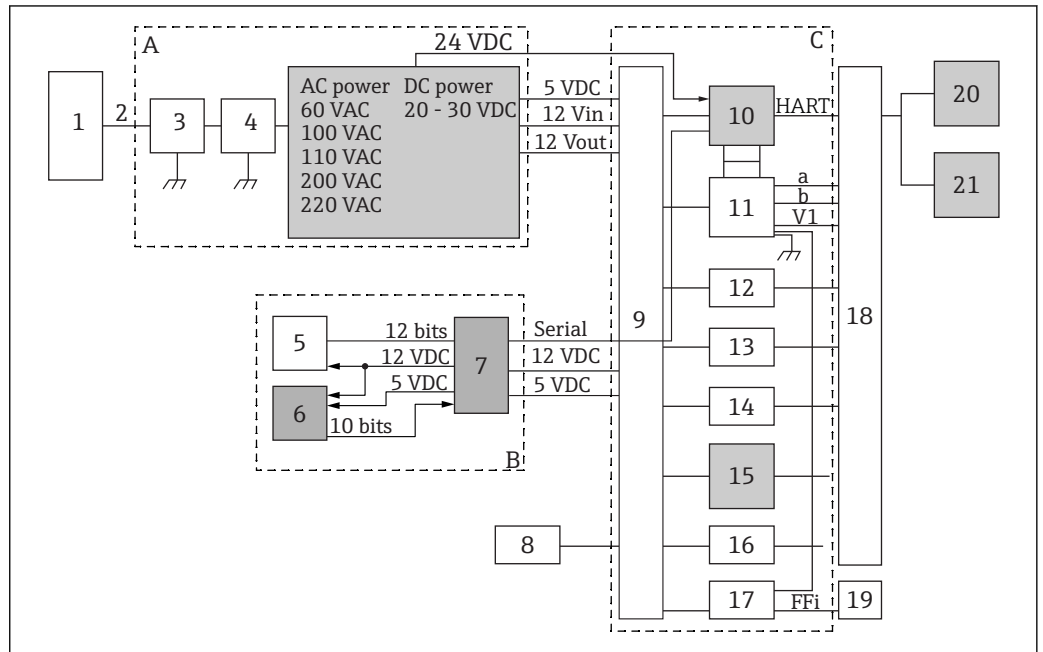
A0038058

5 Level encoder

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

Configuration diagram

Block diagram



A0038059

6 Block diagram

- A Power source
- B Level A/D converter
- C Microcomputer
- a Alarm 8 points
- b External status 8 points
- 1 Terminal area
- 2 Power supply line shield
- 3 Protector (ARS-1)
- 4 Noise filter
- 5 Low-order encoder
- 6 High-order encoder (level A/D counter)
- 7 Level A/D interface MIF-4
- 8 HHT2 (Hand Held Terminal)
- 9 Motherboard
- 10 CPU board (Main-CPU-B)
- 11 Extension 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 Terminal area
- 19 FFi optical unit
- 20 Promonitor NRF560
- 21 Average temperature device NMT53x


Input/Output

Temperature input

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

Average temperature device Prothermo NMT53x

NMT53x is an intelligent-type average temperature device in which an electrical compartment is installed on top of a flexible tube with a built-in temperature element, and a HART communication module for A/D conversion installed on the temperature device side.

 TMD1's HART output function cannot be used if TMD1 is used in HART input mode in order to connect to NMT53x or NRF560. Conversely, HART input function cannot be used if TMD1 is being used in HART output mode.

TMD1 internal module	None (the following shows Prothermo NMT539 series main unit's data)
Communication method	HART (local HART protocol) 2-wire transmission
Corresponding temperature element	Pt100 measuring temperature resistor
A/D conversion range	-200 to 235 °C (-328 to 455 °F)
Conversion accuracy	±0.1 °C (32.2 °F)
Resolution	0.01 °C (32.01 °F)
Temperature element points	Maximum 16 points

RCV series average temperature device

TMD1 internal module	Thermo-A
Corresponding temperature element	Pt100 measuring temperature resistor
A/D conversion range	-200.9 to 240 °C (-329.6 to 464 °F)
Conversion accuracy	±0.15 °C (32.27 °F)
Resolution	0.1 °C (32.2 °F)
Temperature element points	Maximum 12 points

4 to 20 mA input

TMD1 imports the external 4 to 20 mA current output device's data, and it is able to add said data to a 2-wire transmission (V1) signal and output it.

Module	ADC-2
Input points	1 data
Data conversion accuracy	±0.3 °C (32.54 °F)
Input signal	4 to 20 mA
Input resistance	250 Ω
Supply voltage	24 V DC
Current capacity	60 mA





Contact point input (status)


It imports data from external device with contact point output, such as oil leak detector or PC Series' level switch, and it can output the contact point output as a status signal to a high-order receiver.

Module	Exp-A
Input points	Standard 4 points (max. 8 points)
Input rating	DC 30 V, DC 30 mA
Circuit power	DC 12 V, DC 4 mA/per circuit
Circuit resistance	Maximum 100 Ω/ 1 line (including contact point resistance)

HART output

Ex d HART output allows for communication with Wireless HART adapter or with PLC/DCS.

Output function	Local HART  It can be used as a generic HART device, but does not have a DD (FDT/DTM) that is registered with the HART Federation.
Output format	Can be selected from HART active or passive
Types of HART value output	<ul style="list-style-type: none"> ▪ PV: Level ▪ SV: Temperature ▪ TV: Status of status input 1 ▪ QV: Status of status input 2  4x relay control can be applied when SWA70 and SWG70 are used together. For details, contact your Endress+Hauser Sales Center.
Level unit	<ul style="list-style-type: none"> ▪ mm ▪ ft ▪ in  HHT2 displays level only in ISO unit (mm: millimeter). When setting up inch (in) or feet (ft) tank, manually convert the values to millimeter.
Temperature unit	<ul style="list-style-type: none"> ▪ Celsius degree (mm) ▪ Fahrenheit (ft or in)
Output current	4 mA  It is fixed to 4 mA so that it is compatible with Multidrop. Point-to-Point 4 to 20 mA cannot be used.

-  For analog 4 to 20 mA output in which HART is not superimposed, it can be used from another port (terminal) by selecting an output option of 010 or 040 specifications.
- Since TMD1 is explosion proof, note that it cannot be connected directly in an explosion-proof area when an intrinsic safety Wireless HART adapter is being used.
- Note that HART input for connecting to NMT539 or NRF560 cannot be used functionally when the HART port is used for HART output.

2-wire digital output

Digital 2-wire transmission communication, which can efficiently control measuring data for several existing tanks, is an important function in modern tank gauges. TMD1 uses V1 communication which is a tank gauge standard protocol of Endress+Hauser, and it can handle a communication distance of up to 6 km (total loop length).

Module	Exp-A
Communication method	2-way, 2-wire serial digital pulse transmission
Level output	0 to 89.999 mm
Temperature output	-49.9 to 199.9 °C (-57.82 to 391.82 °F)
Contact point output (alarm) (see Hint)	Standard 4 points (max. 8 points)
Contact point input (status) (see Hint)	Standard 4 points (max. 8 points)
Communication address	0 to 225
Level transmission error	±0 mm
Temperature transmission error	±0.0 °C
Response speed	Within 180 ms/unit
Transmission range	6 km (3.73 mi) (when using CPEVφ1.2)
Line resistor	Maximum 120 Ω/line
Line capacitance	0.3 μF/loop

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

BCD parallel output

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

Module	<ul style="list-style-type: none"> ▪ OUT-3 (collector common) ▪ OUT-4 (emitter common)
Communication method	Digital parallel transmission
Level output	<ul style="list-style-type: none"> ▪ Standard: 0 to 19.999 mm ▪ Special: 0 to 7.9999 mm
Temperature output	-49.9 to 199.9 °C (-57.82 to 391.82 °F)
Number of wires	Standard: 17 bit + 1 common (total 18 wires)
Transmission output error	± 0 (level and temperature)

SAKURA code parallel output

TMD1 is capable of handling SAKURA code parallel output. In SAKURA code parallel output, either collector common or emitter common can be selected.

Module	<ul style="list-style-type: none"> ▪ OUT-3 (collector common) ▪ OUT-4 (emitter common)
Communication method	Digital parallel transmission
Level output	<ul style="list-style-type: none"> ▪ Standard: 0 to 19.999 mm ▪ Special: 0 to 39.999 mm
Temperature output	None
Number of wires	Standard: 17 bit + 1 common (total 18 wires)
Transmission output error	± 0 (level)

Optical (FFi) communication

Optical communication specification can be selected when using in lightning prone areas. Because the optical communication's characteristics, it can minimize the external stress such as electrical noise, and it can send and receive stable data.

Module	ODC-1
Communication method	2-way and half double optical digital pulse communication (FFi protocol)
Level output	0 to 65.535 mm or ±32.767 mm (can be set with HHT2)
Temperature output	-49.9 to 199.9 °C (-57.82 to 391.82 °F)
Main status output	Over and under tension, level A/D conversion error, level flow error
Level alarm output	H (upper limit) and L (lower limit) alarm, each 1 point
Displacer balance output	Balance or unbalance
External status output	4 points
TGM5 control and operation information	Hoisting, measurement, stop
Optic fiber for communication	Step index 100/140 μm (110/150 μm is also available)

4 to 20 mA output

4 to 20 mA current output is a method for transmitting measurement data to a high-order receiver in a simple and secure way despite being a high-order system. The system can be configured independently from the loop control data transmission and receipt with digital signal, and it can be connected to an analog bar graph of a receiver, etc.

Module	DAC-1 (2 modules can be installed)
Communication method	4 to 20 mA Current outputs
Input points	1 data (2 data when using 2 modules)
Data conversion accuracy	±0.3 %

Rating	4 to 20 mA
Input allowable impedance	600 Ω

Contact output (Alarm)

TMD1 is used not only as a transmitter but also as a level alarm sensor of inventory control to operate tank yard safely. By setting conditions for measurement data such as level and temperature, the alarm can output warning with relay contact with conditions that would exceed (or not reach) the range.

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

External device operation output

External devices, such as valves, are controlled by operating relays via operation commands from a dedicated receiver. Because the relay uses a latching type, the contact status of relays is maintained even during power outages.

Module	CNT-2
Output method	Relay contact point
Output setting	External device control
Output points	Standard 6 or 8 points depending on use (max. 8 points)
Number of wires	16C (8 points)
Contact capacity	DC220 V/AC250 V, 3 A, 60 W/ 125 VA

Relay contact output (alarm)

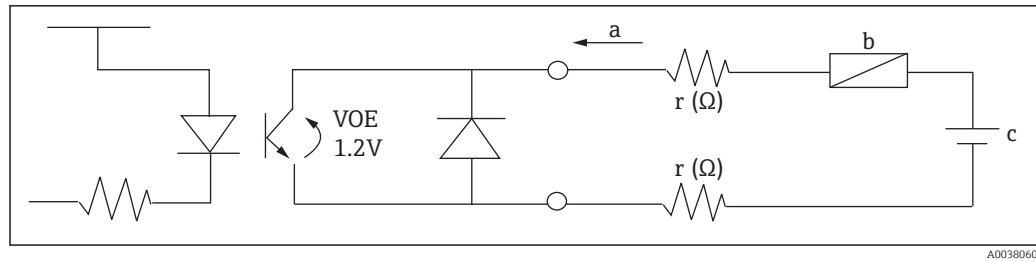
Module	Exp-A + CD688
Output method	Relay contact point output (contact point A)
Output setting	Level and temperature
Output points	Standard 4 points, independent common
Accuracy	±0 with respect to level or temperature data
Output rating	AC100 V 0.5 A, DC30 V 0.5 A

Allowable load impedance

E and R are determined so that the following equation is satisfied.

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

A0038061



7 Allowable load impedance of TMD1 and contact output circuit

a Max. 30 mA

b Load $R(\Omega)$ / Operating current I_s

Example: Transmission distance calculation on wiring

- The purpose of this calculation is to calculate the limitation between resistance and capacitance between the following lines.
 - Unidirectional resistance: Max. 120 Ω
 - Max. capacitance between lines: Max. 0.3 μF
- Maximum capacitance between lines and cable resistance (see table below)

Cable name	Conductor resistance (Ω/km)	Capacitance ($\mu\text{F}/\text{km}$)	Max. transmission distance (km)	Note
CPEV, CPEE $\varnothing 0.9$	Max. 30	Max. 0.05	4	Calculated based on 30 Ω
KMPEV, KPEV-S KMPEE0.9 mm ²	Max. 21.5	0.05	5.58	Calculated based on 21.5 Ω
CPEV $\varnothing 1.2$	16.5	0.05	6	Calculated based on 0.05 μF
CPEV (T) $\varnothing 0.9$	Max. 30	0.06	4	Calculated based on 30 Ω
CVV2 mm ² (CEE)	9.5	0.09 (0.06)	3.3 (5)	Calculated based on 0.09 (0.06) μF

Standard TMD1 terminal table

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

A - 3 H terminal table

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

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
1	Supply power AC /DC	+			AC has no polarity
2		-			
3					
4					
5					
6					
7	DC 4 to 20 mA output	+	4	DAC-1	
8		-			
9	DC 4 to 20 mA output	+	8	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
12		-			
13					
14					
15	HART communication	+		Main-CPU-B	Connection for HART input (NRF and NMT) or HART output
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-type average temperature device is prohibited.
26	Spot temperature input (B)				
27	Spot temperature input (b)				
28					
29					
30					
31					
32					
33					
34					
35					
36					

A - 2 H terminal table

2-way, 2-wire transmission, 4 to 20 mA analog current output, DRM9700 output, contact point alarm output, status input spot temperature device (1 point), level gauge operation output

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
1	Supply power AC/DC	+			AC has no polarity
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	DC 4 to 20 mA output	+	4	DAC-1	

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks			
10		-						
11	DRM9700 output	+	5	DRMM-A				
12		-						
13	DC4 to 20 mA input	+	7	ADC-2				
14		-						
15	HART communication	+		Main-CPU-B	Connection for HART input (NRF and NMT) or HART output			
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-type average temperature device is prohibited.
26	Spot temperature input (B)							
27	Spot 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		-						

B - 2 H terminal table

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

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks	
1	Supply power AC/DC	+			AC has no polarity	
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		

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
8		-			
9	DC 4 to 20 mA output	+	4	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	
12		-			
13	DC4 to 20 mA input	+	7	ADC-2	
14		-			
15	HART communication	+		Main-CPU-B	Connection for HART input (NRF and NMT) or HART output
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-type average temperature device is prohibited.
26	Average temperature input (b)				
27	Average temperature input (A1)/Spot 1 (A)				
28	Average temperature input (A2)/Spot 1 (B)				
29	Average temperature input (A3)/Spot 1 (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 terminal table

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

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
1	Supply power AC/DC	+			AC has no polarity
2		-			
3	Level gauge operation output: hoisting common		6	CNT-2	
4	Level gauge operation output: hoisting				
5	Level gauge operation output: stop common				

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
6	Level gauge operation output: stop				
7	2-way, 2-wire transmission	+	1	Exp-A	
8		-			
9	DC 4 to 20 mA output	+	4	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	
12		-			
13	DC 4 to 20 mA input	+	7	ADC-2	
14		-			
15	HART communication	+		Main-CPU-B	Connection for HART input (NRF and NMT) or HART output
16		-			
17	Alarm output 1	+	J-4	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-type average temperature device is prohibited.
26	Average temperature input (b)				
27	Average temperature input (A1)/Spot 1 (A)				
28	Average temperature input (A2)/Spot 1 (B)				
29	Average temperature input (A3)/Spot 1 (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)				

C H terminal table

2-way, 2-wire transmission, contact point alarm output, status input, average temperature/spot temperature devices (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 HART input (NRF and NMT) or HART output
4		-			
5					

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
6					
7	2-way, 2-wire transmission	+	1	Exp-A	
8		-			
9	Alarm output 1	+	J-3	Exp-A	
10		-			
11	Alarm output 2	+			
12		-			
13	Alarm output 3	+			
14		-			
15	Alarm output 4	+			
16		-			
17	Status input 1	+	J-4	Exp-A	
18		-			
19	Status input 2	+			
20		-			
21	Status input 3	+			
22		-			
23	Status input 4	+			
24		-			
25	Average temperature input (B)		2	Thermo-A	Simultaneous operation with NMT-type average temperature device is prohibited.
26	Average temperature input (b)				
27	Average temperature input (A1)/Spot 1 (A)				
28	Average temperature input (A2)/Spot 1 (B)				
29	Average temperature input (A3)/Spot 1 (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)				

E - 1 H terminal table

4 to 20 mA Analog current output, contact point alarm output, status input, level/average temperature or spot temperature device (3 points)

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
1	Supply power AC /DC	+			AC has no polarity
2		-			
3	HART communication	+		Main-CPU-B	Connection for HART input (NRF and NMT) or HART output
4		-			
5					
6					

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks			
7	Common		1	OUT-3 or OUT-4	Use OUT-3 for collector common Use OUT-4 for emitter common Either level or temperature output must be selected according to specifications.			
8	Level $10^0 - 2^0$ /Temperature $10^{-1} - 2^0$							
9	Level $10^0 - 2^1$ /Temperature $10^{-1} - 2^1$							
10	Level $10^0 - 2^2$ /Temperature $10^{-1} - 2^2$							
11	Level $10^0 - 2^3$ /Temperature $10^{-1} - 2^3$							
12	Level $10^1 - 2^0$ /Temperature $10^{-1} - 2^0$							
13	Level $10^1 - 2^1$ /Temperature $10^{-0} - 2^1$							
14	Level $10^1 - 2^2$ /Temperature $10^{-0} - 2^2$							
15	Level $10^0 - 2^0$ /Temperature $10^{-1} - 2^0$							
16	Level $10^2 - 2^0$ /Temperature $10^{-1} - 2^0$							
17	Level $10^2 - 2^1$ /Temperature $10^{-1} - 2^1$							
18	Level $10^2 - 2^2$ /Temperature $10^{-1} - 2^2$							
19	Level $10^2 - 2^3$ /Temperature $10^{-1} - 2^3$							
20	Level $10^3 - 2^0$ /Temperature $10^{-2} - 2^0$							
21	Level $10^3 - 2^1$ /Temperature $10^{-2} - 2^1$							
22	Level $10^3 - 2^2$ /Temperature $10^{-2} - 2^2$							
23	Level $10^3 - 2^3$ /Temperature $10^{-2} - 2^3$							
24	Level $10^4 - 2^0$ /Temperature $10^+ -$							
25	DRM-9700 output	+				5	DRMM-A	
26		-						
27	DC 4 to 20 mA output	+				4	DAC-1	
28		-						
29	Alarm output 1	+				J-3	Exp-A	
30		-						
31	Alarm output 2	+						
32		-						
33	Alarm output 3	+						
34		-						
35	Alarm output 4	+						
36		-						

550 H terminal table

2-way, 2-wire transmission, 4 to 20 mA analog current output, DRM9700 output, alarm output (relay), status input, spot temperature device (1 point), level gauge operation output

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
1	Supply power AC /DC	+			AC has no polarity
2		-			
3	Level gauge operation output: hoisting common		6	CNT-2	
4	Level gauge operation output: hoisting				
5	Level gauge operation output: stop common				

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
6	Level gauge operation output: stop				
7	2-way, 2-wire transmission	+	1	DAC-1	
8		-			
9	DC 4 to 20 mA output	+	4	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	
12		-			
13	DC4 to 20 mA input	+	7	ADC-2	
14		-			
15	HART communication	+		Main-CPU-B	Connection for HART input (NRF and NMT) or HART output HART input or output (depending on the specifications)
16		-			
17	Alarm output (relay) 1		J-3	Exp-A and CD-688	Because of 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)	A	2	Thermo-A	Simultaneous operation with NMT-type average temperature device is prohibited.
26	Average temperature input (B)	B			
27	Average temperature input (b)	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		-			

A - 2 H Optical FFi terminal table

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

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
1	Supply power AC				
2					

Terminal No.	Signal name	Polarity	Connector No.	Connection board	Remarks
3					
4					
5					
6					
7					
8					
9	DC 4 to 20 mA output	+	4	DAC-1	
10		-			
11	DRM9700 output	+	5	DRMM-A	DRMM-A board is optional.
12		-			
13	DC4 to 20 mA input	+	7	ADC-2	
14		-			
15	HART communication	+		Main-CPU-B	Connection for HART input (NRF and NMT) or HART output HART input or output (depending on the specifications)
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 (A)		2	Thermo-A	Simultaneous operation with NMT-type average temperature device 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		-			

Power supply

- 60 V_{AC}, 100 V_{AC}, 110 V_{AC}, 200 V_{AC}, 220 V_{AC} ±10 % 50/60 Hz
- 20 to 32 VDC



DC power source cannot be used with FFi specification. For special power supply, contact your Endress+Hauser Sales Center.

Power consumption

AC	Max. 14 W
DC	Max. 10 W

Cable entry

Code	Spec.
0	A: PF(G)1-1/2, B: PF(G)3/4, C: PF(G)1, D: PF(G)1 (Thread positions are fixed. See external dimensional drawing.)
H	2 x thread G1/EXPC-28B, 2x blind plug (The position of the thread hole can be specified by A, B, C, or D.)
J	3 x thread G1/EXPC-28B, 1x blind plug (The position of the thread hole can be specified by A, B, C, or D.)
K	4 x thread G1 EXPC-28B (The position of the thread hole can be specified by A, B, C, or D.)
L	2 x thread G3/4 /EXPC-22B, 2x blind plug (The position of the thread hole can be specified by A, B, C, or D.)
M	3 x thread G3/4 /EXPC-22B, 1x blind plug (The position of the thread hole can be specified by A, B, C, or D.)
N	4 x thread G3/4 EXPC-22B (The position of the thread hole can be specified by A, B, C, or D.)
P	4 x thread NPT 1
Q	4 x thread NPT 3/4

Level A/D conversion

Method	Optical non-contact absolute encoder
Capacity	0 to 99 999 mm
Accuracy	±1 mm (0.04 in)

Performance characteristics

Performance characteristics of 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-way (unidirectional) serial digital pulse 2-wire transmission
Level display	0 to 99 999 mm (0 to 3 536 in)
Temperature display	-999.9 to 999.9 °C (-1 767.8 to 1 831.8 °F)
Other display	Gauge status
Line resistor	Max. 6.0 Ω (Disconnection)
Line capacitance	Max. 0.4 μF(CPEV cable φ1.2 = max. 4 km, φ0.9 = max. 2 km)

Promonitor NRF560

Promonitor NRF560 is characterized by its ability to send and receive data via HART communication; it does not have a unidirectional on-site monitor function.

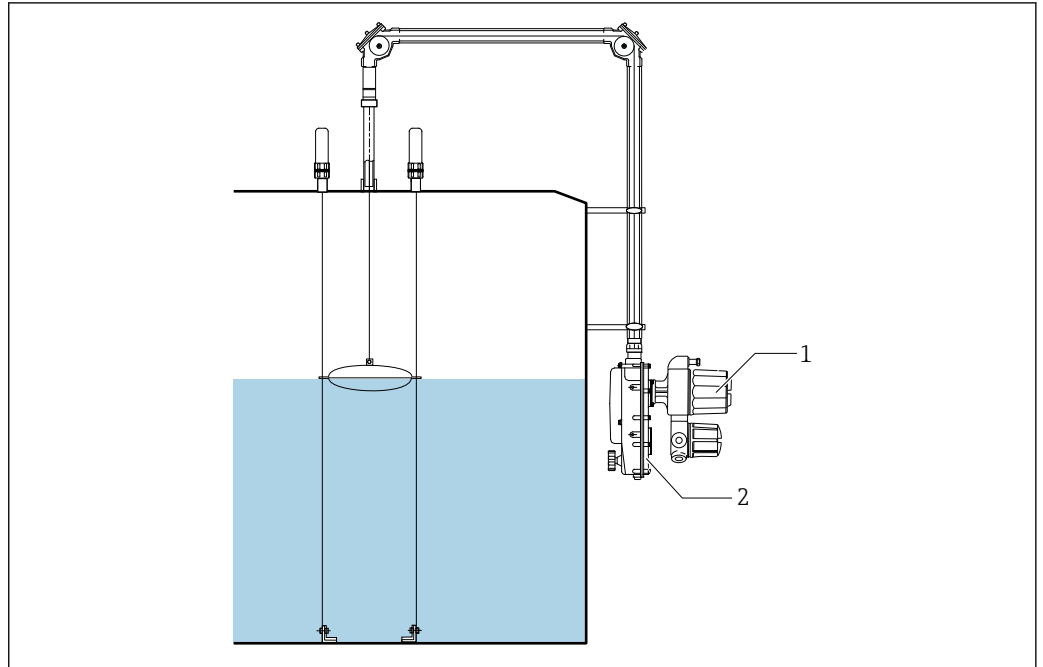
Type	Promonitor NRF560
Communication method	HART (local HART protocol) 2-wire transmission
Level display	0 to 99 999.9 mm (0 to 3 536 in)
Temperature display	-999.9 to 999.9 °C (-1 767.8 to 1 831.8 °F)
Other display	Gauge status (measuring status), error status

-  Because a standard TMD1 has a local HART communication board built into the Main CPU-B, it can connect directly to on-site monitor Promonitor NRF560 and average temperature device Prothermo NMT53x without the need to add a circuit board.
- TMD1's HART output function cannot be used if TMD1 is used in HART input mode in order to connect to NMT53x or NRF560. Conversely, HART input function cannot be used if TMD1 is being used in HART output mode.

Installation

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.



A0038037

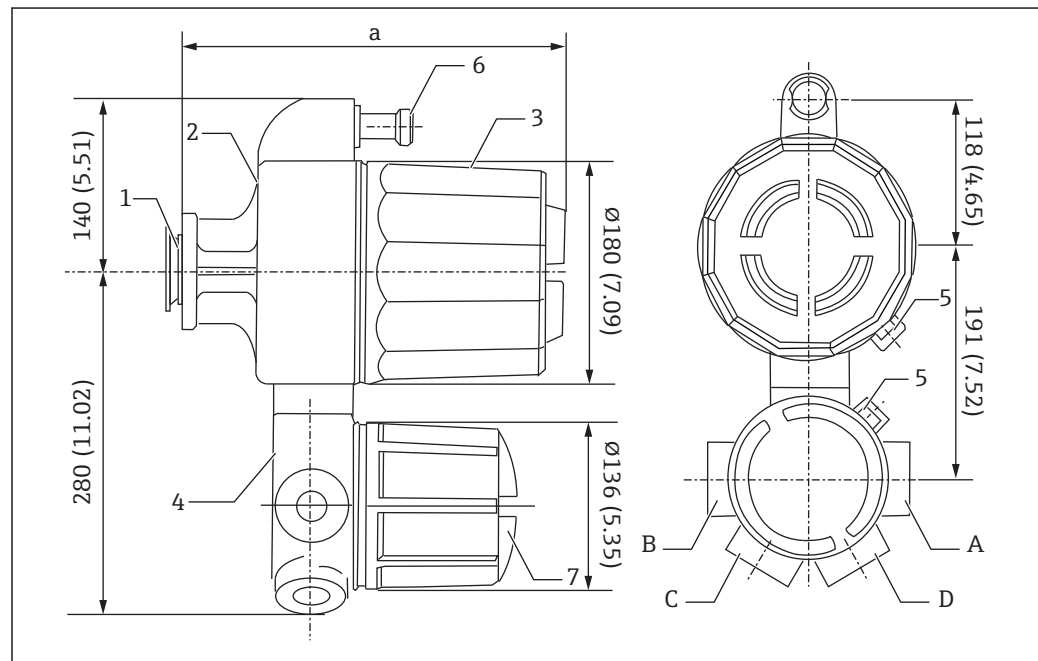
8 TMD Installation

- 1 Digital Transmitter TMD1
- 2 Float level gauge LT5

Structure

Standard size

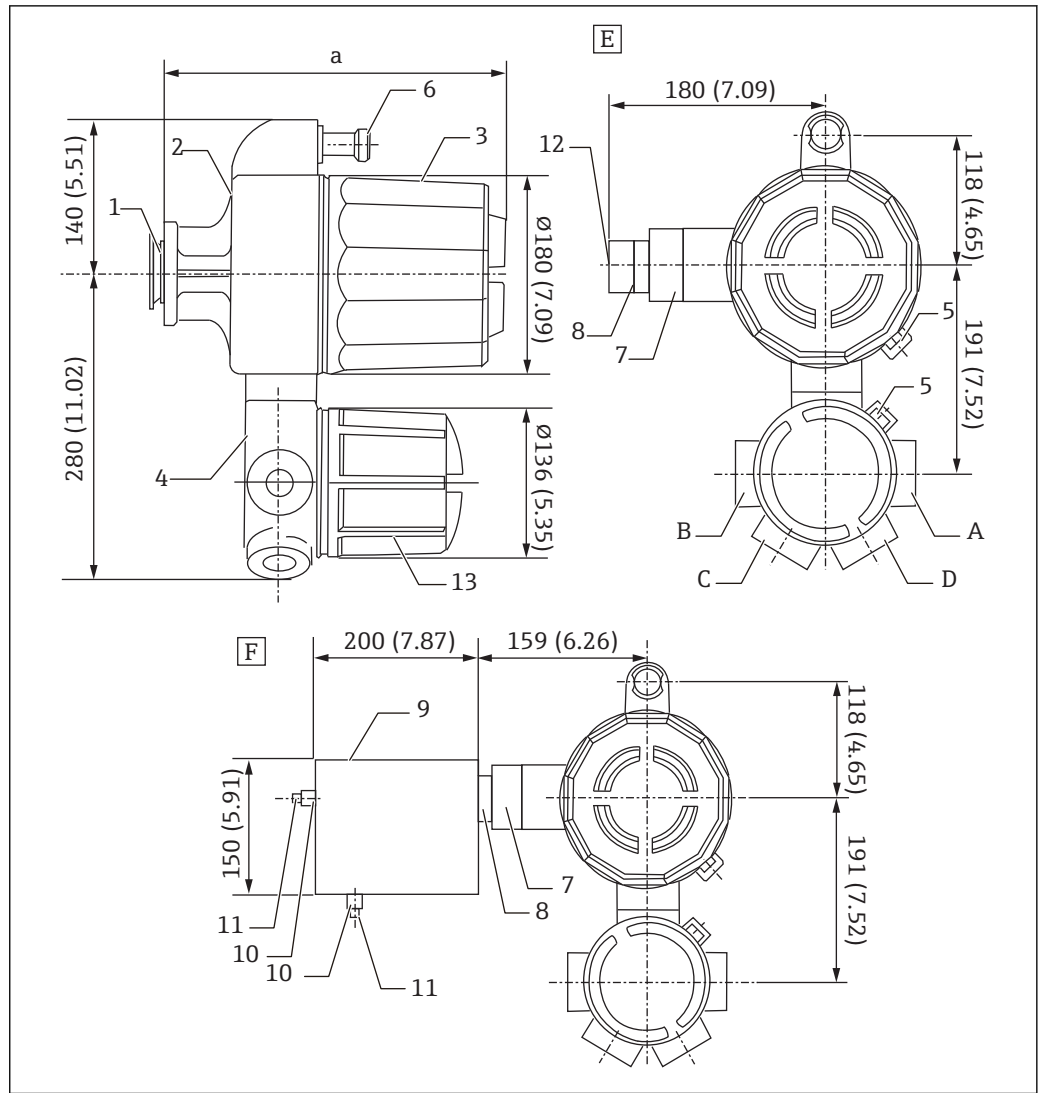
Ordering information 080 A cable gland is included with cable entry options H/J/K/L/M. In this case, the cable gland attached to the device must always be used. Options P/Q do not come with a cable gland.



9 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)


Size of Optical FFi specifications



A0038039

10 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.

Weight

10 kg (22 lb)

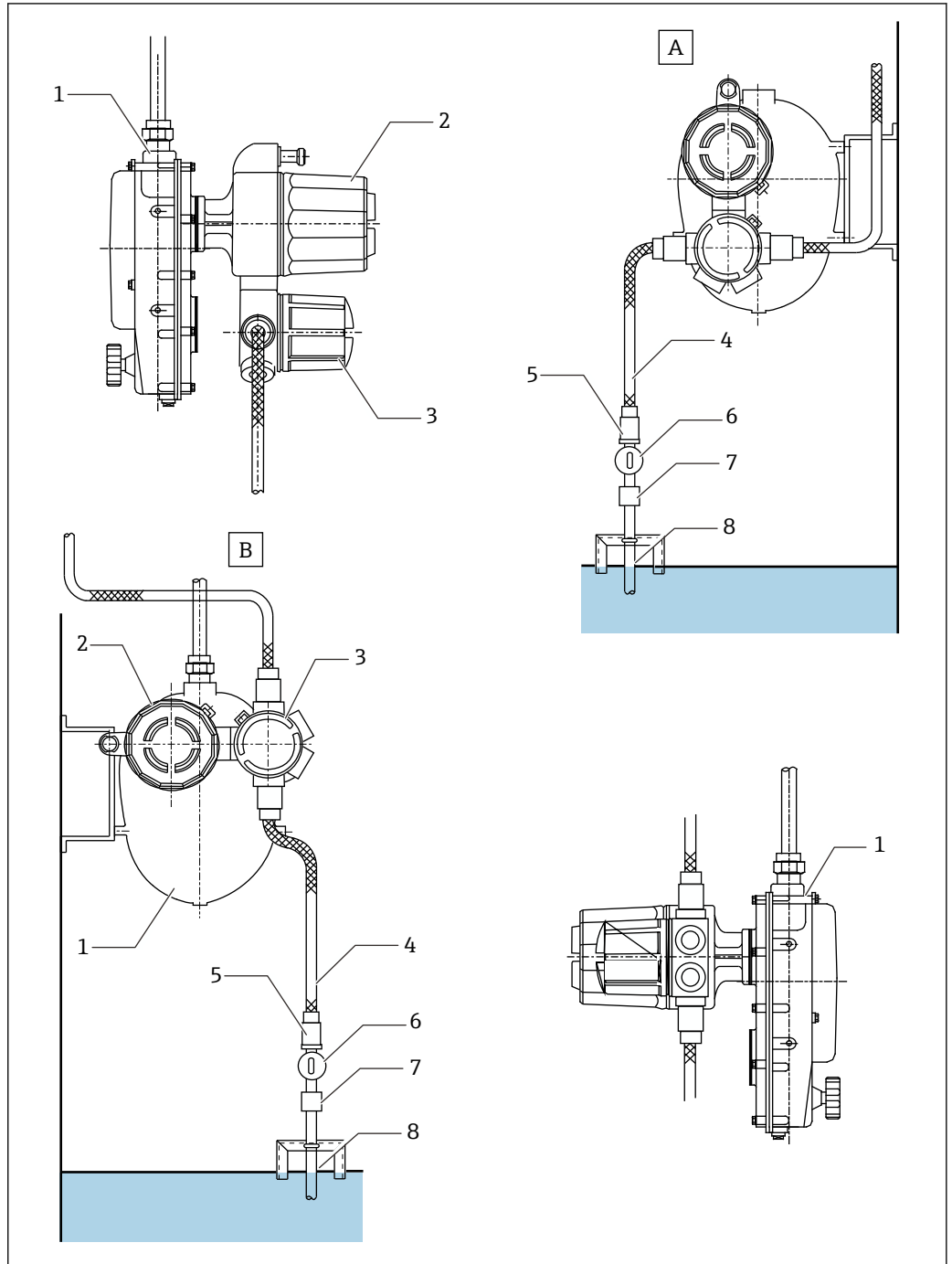
Material

- Electrical housing: AC4C-T6
- Electrical housing cover: AC4C-T6
- Terminal box: ADC12
- Terminal box cover: AC4C-T6

Color

Blue and white

Installation onto a tank

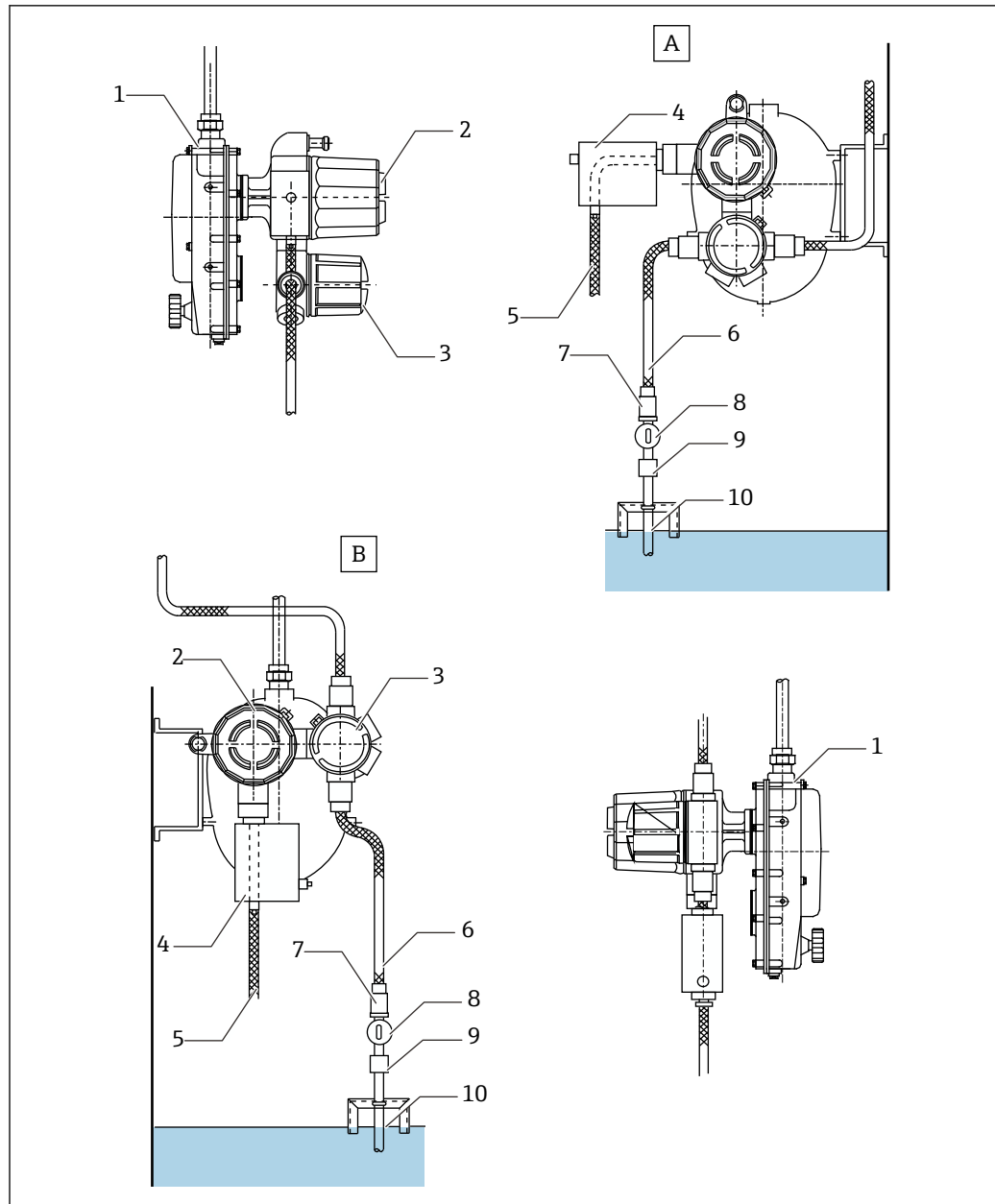


A0038042

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

i 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.



A0038043

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

i 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.

Environment

Ambient temperature range	Non-explosion proof/ Explosion proof	-20 to 60 °C (-4 to 140 °F)
	FFi Specifications	-10 to 40 °C (14 to 104 °F)
Water-proof dust-proof structure	IP65 / NEMA Type 4X	
Surge arrester	Supplied as standard	

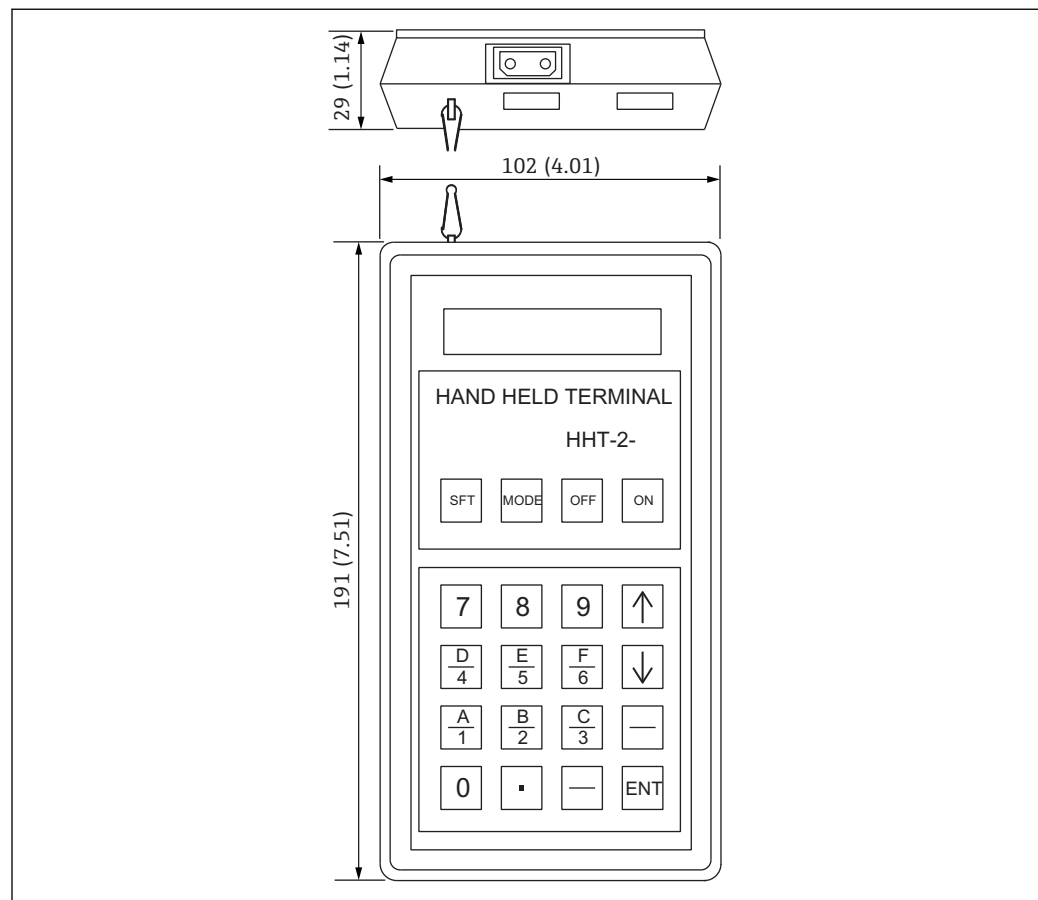
Operability


HHT2 (Hand Held Terminal)

HHT2 is TIIS explosion-proof certified. HHT2 can be used by confirming, with a detector, that there are no explosive elements (gas, liquid, powder) in the atmosphere. The operation, setting, and adjustment of the TMD1 Series can be done easily with HHT2 Ver. 5.5 or later (Hand Held Terminal).

Note that the HHT2 (Hand Held Terminal) for operating TMD1 does not come with the TMD1 main unit. It must be ordered separately for purchase.

- i
 - TMD1 with HART input specifications requires the latest HHT2 software (HHT2 Ver. 5.8 or later).
 - HHT2 is TIIS explosion-proof certified. HHT2 can be used by confirming, with a detector, that there are no explosive elements (gas, liquid, powder) in the atmosphere.
 - Handle explosion-proof products with care in hazardous areas.



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

A0038062

Certificates and approvals



Currently available certificates and approvals can be called up via the product configurator.

Ex Approval

TMD1

- TIIS Ex d IIB T4
- TIIS d2G4 (FFi specifications only)
- FM XP Cl.I Div.1 Gr.C-D, AEx d IIB T4

HHT2

TIIS i2G3

The devices are certified for use in hazardous areas, and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.



The separate documentation, "Safety Instructions" (XA), containing all the relevant explosion protection data is available from your Endress+Hauser Sales Center.

Order information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your nearest Endress+Hauser sales organization: www.addresses.endress.com



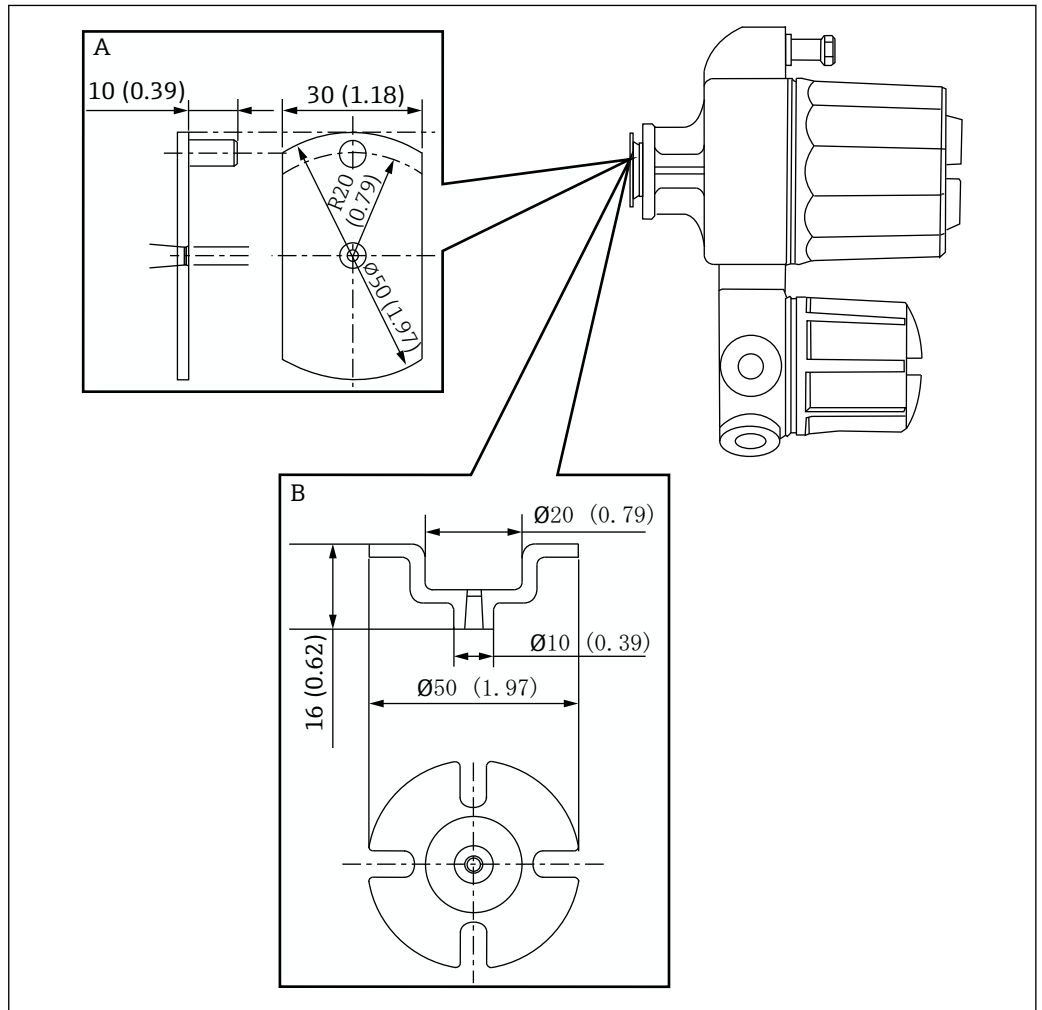
Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Coupling

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



A0038063

14 Coupling Unit: mm (in)

- A Comes as an additional attachment for connection to medium- and high-pressure float gauges
- B Coupling for level gauge connection

Documentation

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.

They also contain detailed information on the parameters in the operation menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Measuring device	Operating Instructions
Digital Transmitter TMD1000 TMD1	BA00427G BA00428G BA00429G

Safety Instructions (XA)

Specification code 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

www.addresses.endress.com
