

An Expertise in Industrials Solutions

TNMS Magnetostrictive Level Transmitter



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INTRODUCTION

The magnetostrictive level transmitter identifies the level of liquids and solutions with high precision and reliability.

This versatile sensor is ideal for continuous level measurement of a wide range of liquids. Application ranges from petrochemical industries, marine and shipping to food and beverage production.

The sensor has a loop power supply and provides direct analog or digital output to the user interface.

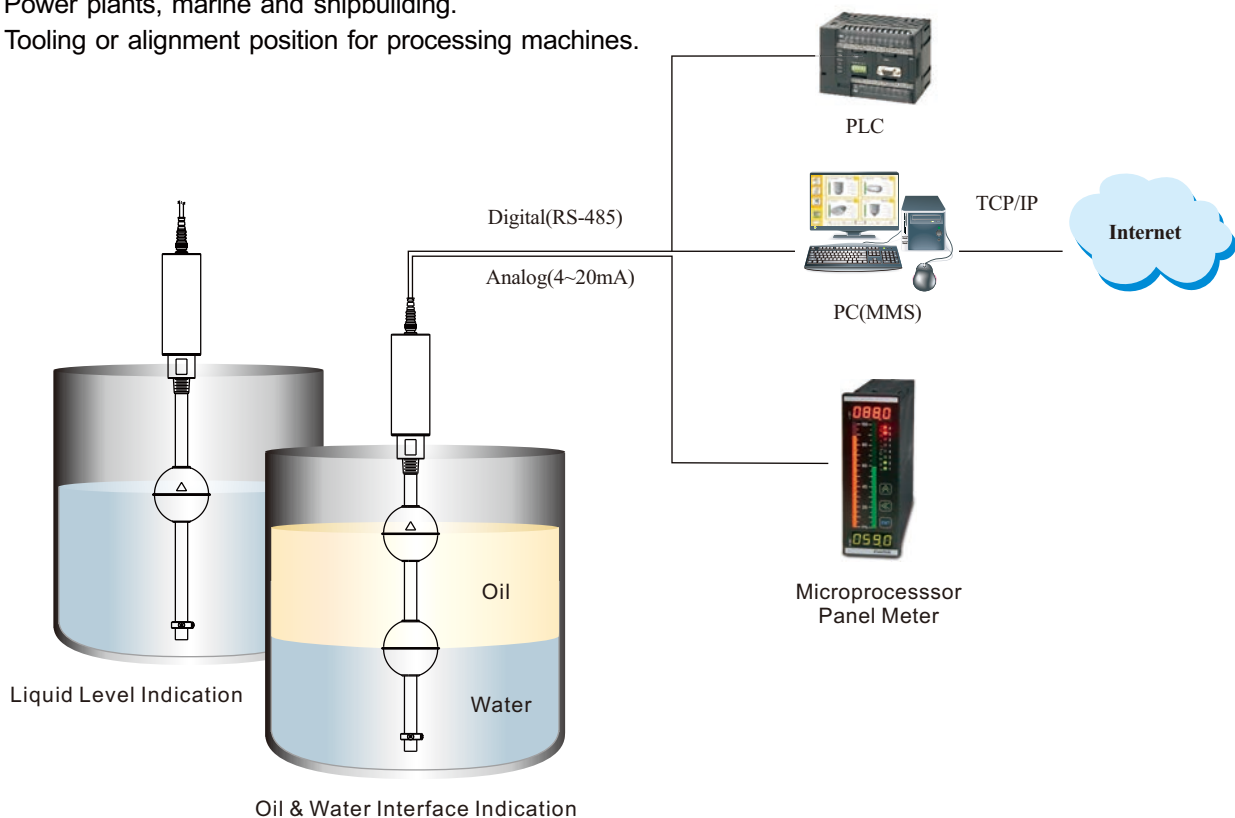
The magnetostrictive level sensor has proven itself due to its durability in a wide range of temperatures, pressures and operating conditions as well as its low maintenance nature.

FEATURES

- Absolute positioning output and no calibration required after power failure.
- Stability and reliability.
- Ease installation without calibration & maintenance.
- Prompt response time, high resolution & high accuracy.
- Durable structure, dust-proof, withstands high pressure.
- Oil/water dual level indication.
- The Max. operation temp. is 200°C.
- TMNS31, 32, 36, 37 adopted loop power structure for wire saving.
- Explosion-proof model available for hazardous environments.
- Housing of TMNS3 is IP67(Enclosure)/IP69K(Probe).
- Support HART / RS485 and 4~20mA / voltage output.

APPLICATION

- Liquefied natural gas.
- Crude oil, petroleum's and diesels.
- Chemical processing.
- Pharmaceuticals and medication.
- Food and beverages, breweries.
- Dams, water barriers, wastewater treatment.
- Power plants, marine and shipbuilding.
- Tooling or alignment position for processing machines.



OPERATING PRINCIPLE

The sensor mainly consists of magnetorestrictive wires sealed in a stem/rod and a permanent magnet sealed into a float that can move up and down the stem. Electrical current travels along the wires in the stem creating an axial magnetic field. When the float's and stem's magnetic field intersect, a torsional force is created with different height levels (see right).

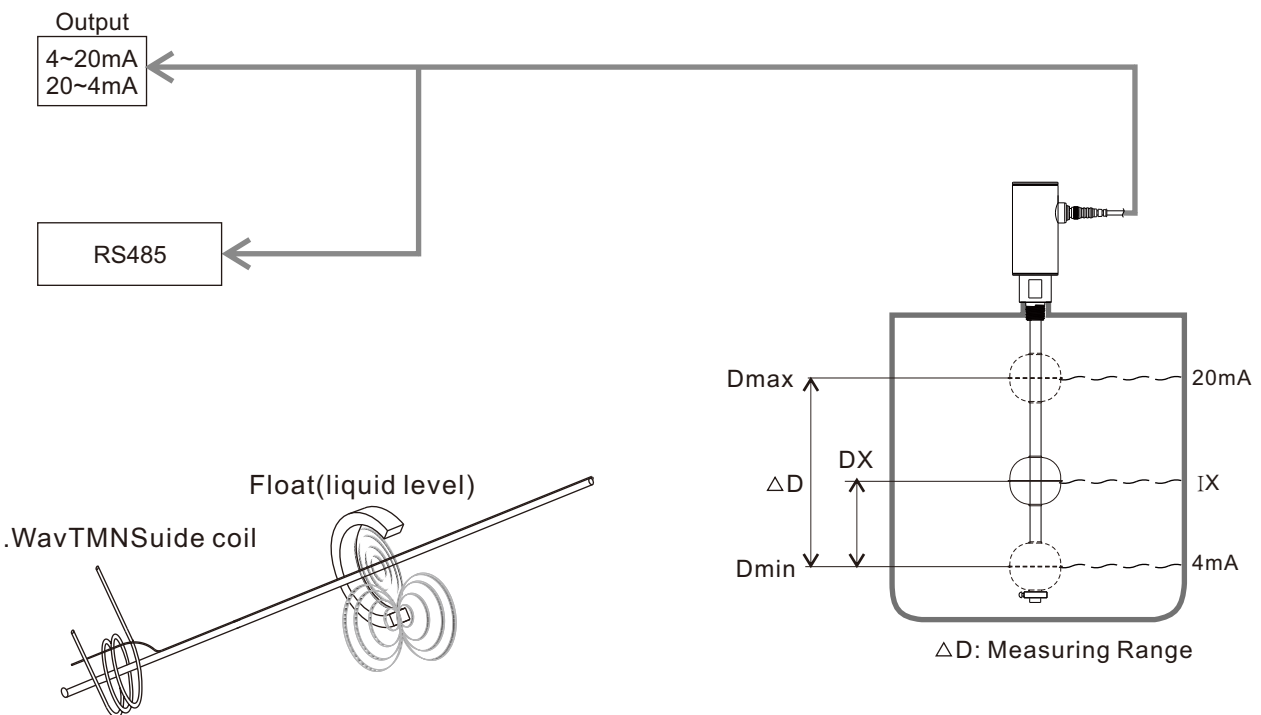
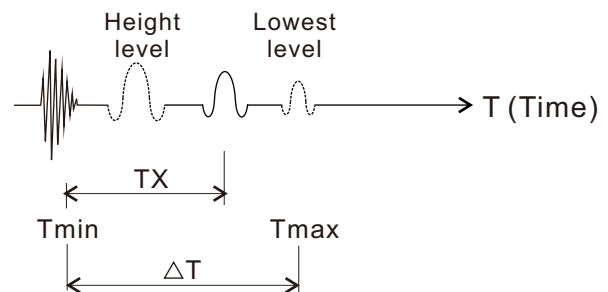
The sensor measures the liquid level (D) by calculating the elapsed time between torsional forces. Using velocity and time, distance can be calculated. This action is timely and continuous. A change in float position will be detected promptly via signal output.

CONVERSION FORMULA

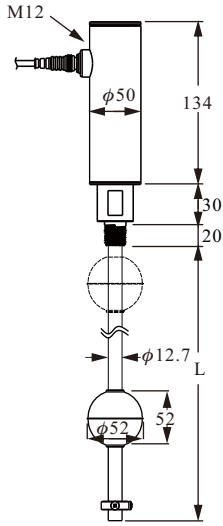
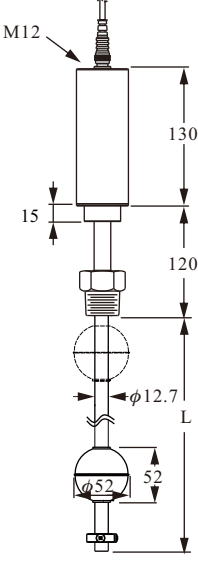
The relation of D & 4~20mA output

$$\frac{IX-4}{(20-4)mA} = \frac{DT-TX}{\Delta T} = \frac{DX}{\Delta D}$$

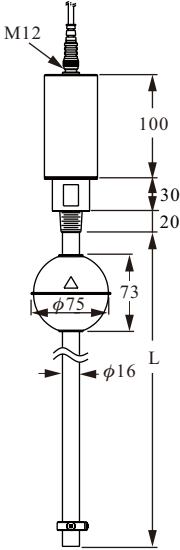
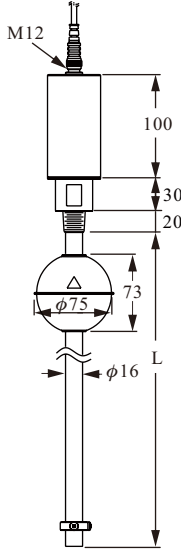
$$\Rightarrow IX = \frac{16DX}{\Delta D} + 4mA \text{ (The relative current)}$$



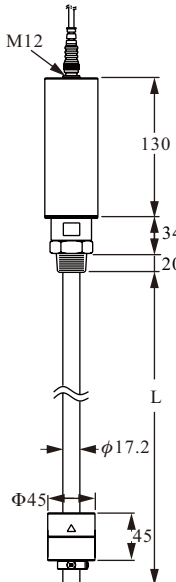
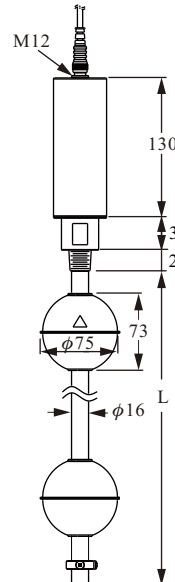
STANDARD MODEL (2 Wire)

<p>Dimensions (Unit: mm)</p>		
Model No.	TMNS31 (Standard Model)	TMNS31 (High Temperature Model)
Application	Two-wire loop power output, for Oil/Water interface, pharmaceutical and food grade level control.	Two-wire loop power output, high process environment application.
Measuring range	50~5500mm	50~5500mm
Non-Linearity	± 0.05% F.S. or ± 1.0mm (whichever is greater)	± 0.05% F.S. or ± 1.0mm (whichever is greater)
Repeatability	± 0.004% F.S.	± 0.004% F.S.
Temp. coefficient	± 100 ppm/°C	± 150 ppm/°C
Operation pressure	30 BAR(Max.)	30 BAR(Max.)
Ambient temp.	-40°C ~ 85°C	-40°C ~ 85°C
Operation temp.	-40°C ~ 125°C	-40°C ~ 200°C
Temp. accuracy	± 1°C	± 1°C
Output	4~20mA / 2 Wire	4~20mA / 2 Wire
Maximum load (Ω)	$(VS-18) \div 0.02$ VS=Supply voltage	$(VS-18) \div 0.02$ VS=Supply voltage
Digital output	RS485 / HART 7.3(option)	RS485 / HART 7.3(option)
Power supply	18~30V	18~30V
Housing material	SUS304 (SUS316 option)	SUS304 (SUS316 option)
Connection	1/2"PT	1/2"PT
Wetted material	SUS304	SUS304
Enclosure	IP67 (enclosure)/IP69K(probe)	IP67 (enclosure)/IP69K(probe)

HIGH ACCURACY MODEL (2 Wire/4 Wire)

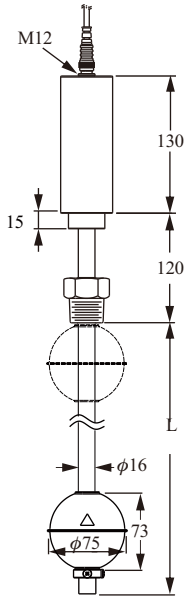
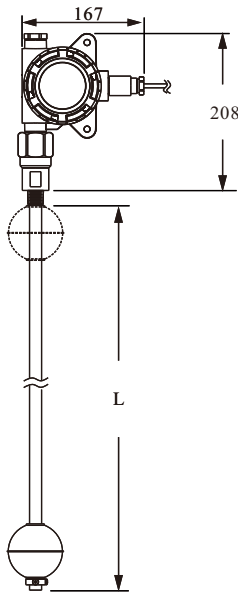
<p>Dimensions (Unit: mm)</p>		
Model No.	TMNS32 (High Accuracy Model)	TMNS34 (High Accuracy Model)
Application	Two-wire loop power output, comply with high accuracy & HART demands.	Four wire output, high speed active in low voltage 5V.
Measuring range	50~5500mm	50~5500mm
Non-Linearity	50~500mm@±100µm 501~2500mm@±0.02%F.S. 2501~5500mm@±0.04%F.S.	50~500mm@±100µm 501~2500mm@±0.02%F.S. 2501~5500mm@±0.04%F.S.
Repeatability	±0.002% F.S.	±0.002% F.S.
Temp. coefficient	±100 ppm/°C	±100 ppm/°C
Operation pressure	30 BAR(Max.)	30 BAR(Max.)
Ambient temp.	-40°C ~ 85°C	-40°C ~ 85°C
Operation temp.	-40°C ~ 125°C	-40°C ~ 125°C
Temp. accuracy	±1°C	±1°C
Output	4~20mA / 2 Wire	0~10V, 10~0V, ±10V, 0~5V, 5~0V, ±5V 4~20mA, 20~4mA, 0~20mA, 20~0mA
Maximum load (Ω)	$(VS-18) \div 0.02$ VS=Supply voltage	$(VS-5) \div 0.02$ VS=Supply voltage
Digital output	RS485, HART 7.3 (option)	RS485
Power supply	18~30V	5~30V
Housing material	SUS304 (SUS316 option)	SUS304 (SUS316 option)
Connection	1/2"PT	1/2"PT
Wetted material	SUS304	SUS304
Enclosure	IP67 (enclosure) / IP69K (probe)	IP67 (enclosure) / IP69K (probe)

EXPLOSION PROOF MODEL (2 Wire)

Dimensions (Unit: mm)		
	NEPSI PROOF No.GYB15.1889X Ex ia IIB T3~T6 PTB PROOF NO.13 ATEX 2016X Ⓢ II 1G Ex ia IIB T3~T6	NEPSI PROOF No.GYB15.1889X Ex ia IIB T3~T6 PTB PROOF NO.13 ATEX 2016X Ⓢ II 1G Ex ia IIB T3~T6
Model No.	TMNS374 (Anti-Corrosion Model)	TMNS371 (Single/dual Float Model)
Application	Two-wire loop power output, for acid/alkali corrosion liquids.	Two-wire loop power output, for single/dual level and interface measurement.
Measuring range	50~2000mm	50~5500mm
Non-Linearity	± 0.05% F.S. or ± 1.0mm (whichever is greater)	± 0.05% F.S. or ± 1.0mm (whichever is greater)
Repeatability	± 0.004% F.S.	± 0.004% F.S.
Temp. coefficient	± 100 ppm/°C	± 100 ppm/°C
Operation pressure	5 BAR(Max.)	30 BAR(Max.)
Ambient temp.	-40°C ~ 85°C	-40°C ~ 85°C
Operation temp.	-20°C ~ 80°C	-40°C ~ 125°C
Temp. accuracy	± 1°C	± 1°C
Output	4~20mA / 2 Wire	4~20mA / 2 Wire
Max load (Ω)	$(VS-18) \div 0.02$ VS=Supply voltage	$(VS-18) \div 0.02$ VS=Supply voltage
Digital output	RS485 / HART 7.3(option)	RS485 / HART 7.3(option)
Power supply	12~30V(4-wire), 18~30V(2-wire), 18~28V(Exp Lotion proof)	12~30V(4-wire), 16~30V(2-wire), 16~28V(Exp Lotion proof)
Housing material	SUS304 (SUS316 option)	SUS304 (SUS316 option)
Connection	3/4"PT	1/2"PT
Wetted material	PP	SUS304
Enclosure	IP67 (enclosure) / IP69K(probe)	IP67 (enclosure) / IP69K(probe)

※ Comply with safety barrier of Ex ia rating is essential for using in hazardous areas.(Refer to P.18)

EXPLOSION PROOF MODEL (2 Wire)

<p>Dimensions (Unit: mm)</p>	 <p>NEPSI PROOF No.GYB15.1889X Ex ia IIB T2~T6 PTB PROOF13 ATEX 2016X Ⓢ II 1G Ex ia IIB T3~T6</p>	 <p>NEPSI PROOF No.GYB14.1530X Ex ia IIB T3~T6Ga PTB PROOF16 ATEX 2002X Ⓢ II 1G Ex ia IIB T3~T6</p>
<p>Model No.</p>	<p>TMNS37 (Explosion-proof High Temp. Model)</p>	<p>TMNS36 (Diaplay Model)</p>
<p>Application</p>	<p>Two-wire loop power output, explosion-proof model for hazardous environment.</p>	<p>Two-wire loop power output, explosion-proof model with diaplay for hazardous environment.</p>
<p>Measuring range</p>	<p>50~5500mm</p>	<p>50~5500mm</p>
<p>Non-Linearity</p>	<p>±0.05% F.S. or ±1.0mm (whichever is greater)</p>	<p>50mm~4000mm ±1mm 4000mm~5500mm ±0.025% F.S.</p>
<p>Repeatability</p>	<p>±0.004% F.S.</p>	<p>±0.004% F.S.</p>
<p>Temp. coefficient</p>	<p>±150 ppm/°C</p>	<p>±100 ppm/°C</p>
<p>Operation pressure</p>	<p>30 BAR(Max.)</p>	<p>30 BAR(Max.)</p>
<p>Ambient temp.</p>	<p>-40°C ~ 85°C</p>	<p>-40°C ~ 85°C</p>
<p>Operation temp.</p>	<p>-40°C ~ 195°C</p>	<p>-40°C ~ 125°C</p>
<p>Temp. accuracy</p>	<p>±1°C</p>	<p>±1°C</p>
<p>Output</p>	<p>4~20mA / 2 Wire</p>	<p>4~20mA / 2 Wire</p>
<p>Max load (Ω)</p>	<p>$(VS-18) \div 0.02$ VS=Supply voltage</p>	<p>$(VS-16) \div 0.02$ VS=Supply voltage</p>
<p>Digital output</p>	<p>RS485/HART 7.3(option)</p>	<p>RS485/HART 7.3(option)</p>
<p>Power supply</p>	<p>12~30V(4-wire), 18~30V(2-wire), 18~28V(Exp Losion proof)</p>	<p>12~30V(4-wire), 16~30V(2-wire), 16~28V(Exp Losion proof)</p>
<p>Housing material</p>	<p>SUS304 (SUS316 option)</p>	<p>Aluminum</p>
<p>Connection</p>	<p>1/2"PT</p>	<p>1/2"PT</p>
<p>Wetted material</p>	<p>SUS304</p>	<p>SUS304</p>
<p>Enclosure</p>	<p>IP67 (enclosure) / IP69K(probe)</p>	<p>IP67 (enclosure) / IP69K(probe)</p>

※ Comply with safety barrier of Ex ia rating is essential for using in hazardous areas.(Refer to P.18)

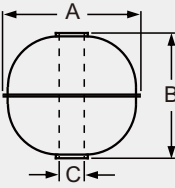
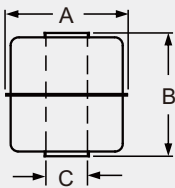
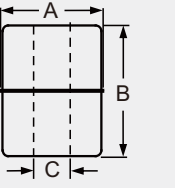
HOUSING OPTIONS

Mapping table of enclosure

TMNS31 & TMNS37 explosion-proof (2 wire)	1 Top conduit	2 Side conduit
TMNS32 & TMNS34 high accuracy series	1 Top conduit	2 Side conduit

※ Standard model cable length is 2m.

FLOAT SPECIFICATIONS

Model	Model Number	Dimensions ($\phi A \times B \times \phi C$ mm)	S.G.	Max. Pressure (kg/cm ²)	Material	Stem Size
	S5	75x73x20.5	E>0.7	30	SUS 304 / 316	$\phi 16$
	S4	52x52x15	E>0.75	30	SUS 316	$\phi 12.7$
	SD	52x52x15	E>0.9	30	SUS 316	$\phi 12.7$
	SE	75x73x20.5	E>0.9	20	SUS 304 / 316	$\phi 16$
	S3	45x55x15	E>0.7	12	SUS 316	$\phi 12.7$
	SC	45x55x15	E>0.9	12	SUS 316	$\phi 12.7$
	F3	45x45x20	E>0.65	5	PP in Grey	$\phi 18$ (coating)
	FC	45x45x20	E>0.9	5	PP in Grey	$\phi 18$ (coating)
	P3	48x45x18.5	E>0.6	5	PP in Black	$\phi 17.2$ (coating)
	PC	48x45x18.5	E>0.9	5	PP in Black	$\phi 17.2$ (coating)
	NB	48x46x15.6	E>0.5	30	NBR in Black	$\phi 12.7$
	ND	48x45x15.6	E>0.9	30	NBR in Black	$\phi 12.7$
	NC	48x46x20	E>0.5	30	NBR in Black	$\phi 16$
	NE	48x46x20	E>0.9	30	NBR in Black	$\phi 16$

※ S.G(E):specific gravity

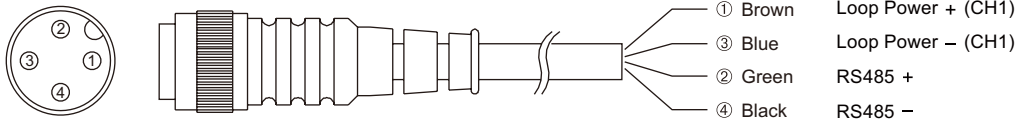
WIRING

When RS485(ModBus)is applied,Loop power only as power.

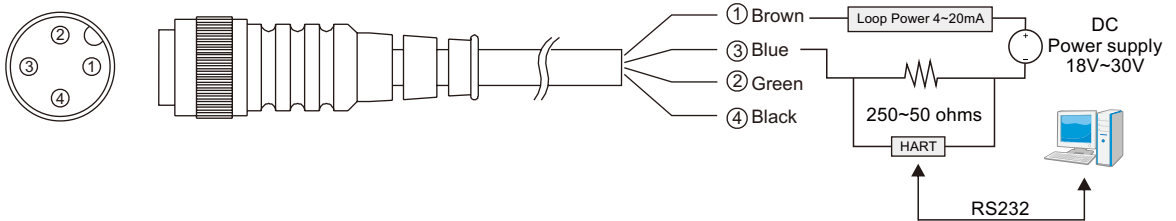
TMNS32/TMNS37

1. Single / Double float +RS485

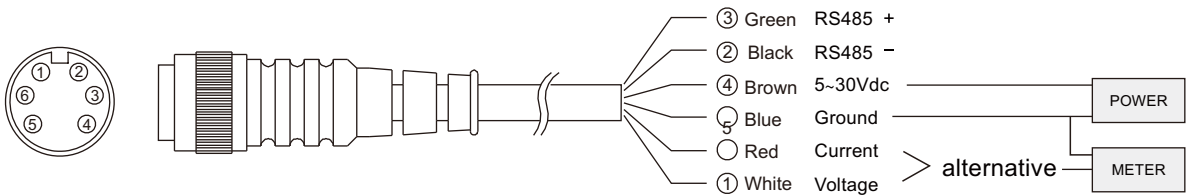
Loop Power 24Vdc ± 10%



2. Single / Double float +HART

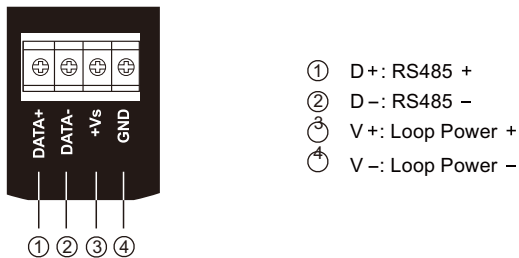


TMNS34:



※The voltage or current is only alternative.

TMNS36:



CUSTOMIZED STEM LENGTHS ARE AVAILABLE

Note the difference between ordered length and actual measurable stem length below.

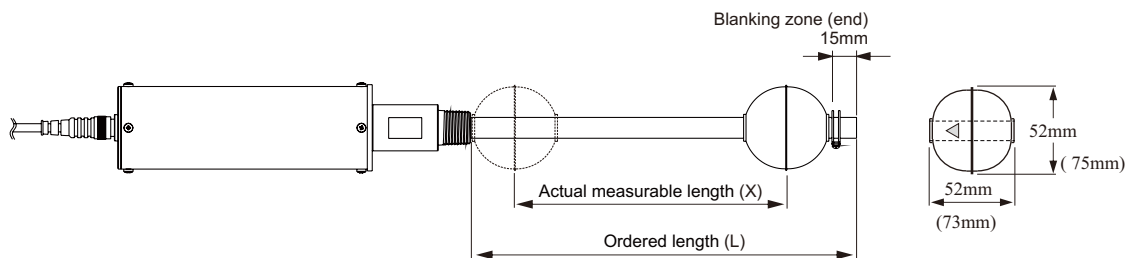
(2M below) = Actual measurable length (X) = Ordered length (L) - 52mm - 15mm, adopted stem $\phi 12.7$

(2M above) = Actual measurable length (X) = Ordered length (L) - 73mm - 15mm, adopted stem $\phi 16$

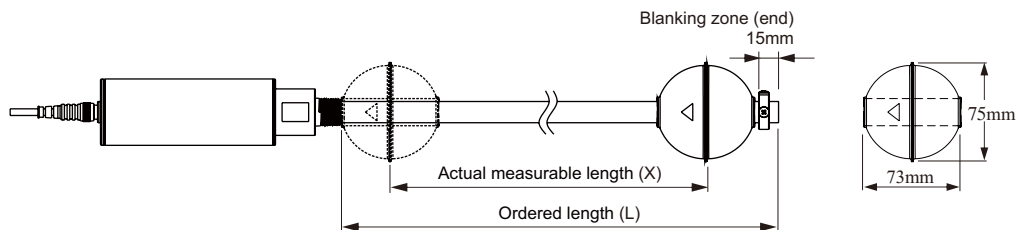
(2M below) = Ordered length (L) = Actual measurable length (X) + 52mm - 15mm, adopted stem $\phi 12.7$

(2M above) = Ordered length (L) = Actual measurable length (X) + 73mm - 15mm, adopted stem $\phi 16$

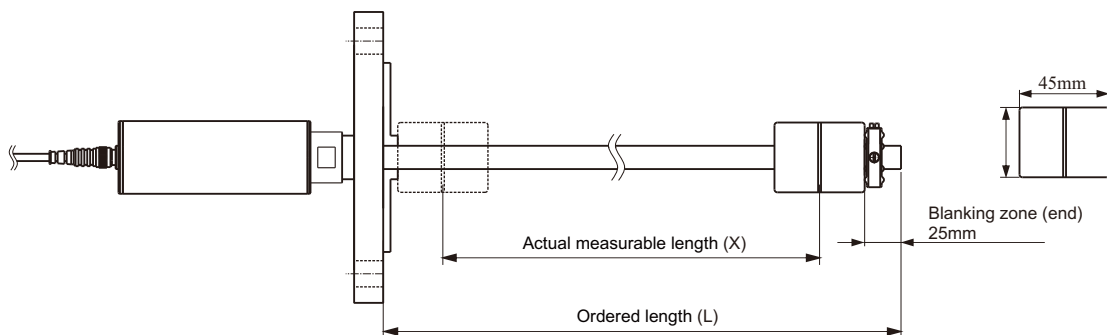
Below 2M, stem $\phi 12.7$



Above 2M, stem $\phi 16$



Below 2M, stem $\phi 12.7$, with PP coating to $\phi 17.2$

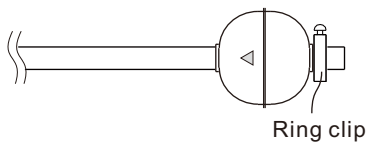


INSTALLATION

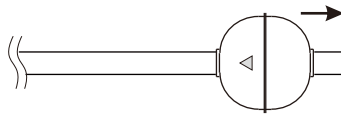
1. Loop power 24Vdc \pm 10%
2. The product is calibrated before shipment and should be sufficient to meet user needs.
3. Do not bend the stem, put pressure on it or force it in any manner.
4. For best results, use the included float only.
5. When the mounting hole is large enough, guide the stem and float through the hole to install.
6. If the hole is NOT large enough, remove float, install the stem and assemble float from inside the container.
7. When assembling the float onto the stem, the float's direction mark should face the housing.
8. Ensure the float stopper is fixed firmly.
9. If the stem is bent and can not work, it needs to be returned to the factory for calibration.
11. Bubble wrap/foam packaging is necessary to ensure safety during transportation.
12. Unnecessary opening of housing may affect accuracy.

Removing the float

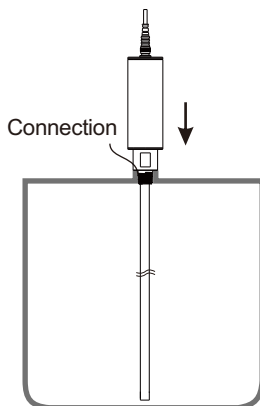
Step 1:
Loosen the stopper at stem end



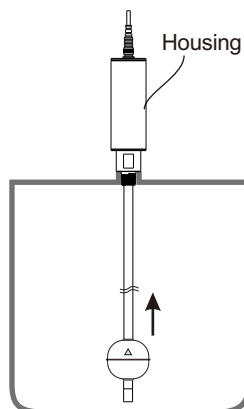
Step 2:
Take off the float



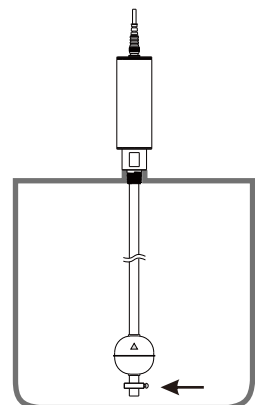
Step 3:
Install the sensor onto the tank,
and tighten the connection



Step 4:
Assemble the float onto the stem
and tighten the connection the
housing. Note the direction of float



Step 5:
Firmly fasten the stopper



MODEL NUMBER / ORDER CODE COMPARISON TABLE

Model Number	Order Code
TMNS31 Standard Type	TMNSX10000-A1
TMNS31 High Temperature Type	TMNSX10200-A1
TMNS32/34 High Accuracy Type	TMNSX20000-A1
TMNS32/34 High Accuracy & Temperature Type	TMNSX20200-A1
TMNS374 Anti-Corrosion Type	TMNSX1001B-B1
TMNS371 Ex- Proof Type	TMNSX1001B-A1
TMNS37A Ex- Proof High Temperature Type	TMNSX1021B-A1
TMNS36 Display Type	TMNSX3001B-A1
TMNS36 High Temperature Display Type	TMNSX3021B-A1

ORDER INFORMATION

TMNSX ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝

④ **Version**

- 1: 132mm (TMNS31/TMNS37)
- 2: 97mm (TMNS32/TMNS34)
- 3: Display type (TMNS36)

⑤ ⑥ **Model**

- 00: Standard
- 02: Hi-temperation

⑦ ⑧ **Certification**

- 00: None
- 1B: ATEX-Exia
- 7B: NEPSI-Exia

⑨ ⑩ **Sensor Type**

- A1: Probe type
- B1: Anti-Corrosion probe type

Connection

⑪ ⑫

Flange item
AI : 3A AK:
JIS-FF AN:
ANSI-RF AS:
DIN-FF

⑬ ⑭

A5: 1/2"
A7: 3/4"
A8: 1"
B1: 1-1/2"
B2: 2"
B4: 2-1/2"
D7: DN20
D8: DN25
D9: DN32
E1: DN40
E2: DN50
E3: DN65

⑮ ⑯

01: PT male
03: PF male
07: NPT male
40: 5 kg/cm²
42: 10 kg/cm²
48: 150 Lbs
49: 300 Lbs
57: PN10
58: PN16

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TMNSX

⑰⑱ Probe diameter

- 1G: $\phi 9.5\text{mm}$
- 2A: $\phi 12.7\text{mm}$
- 2C: $\phi 16.0\text{mm}$
- 2D: $\phi 17.2\text{mm}$

⑲⑳ Probe material

- MA: SUS 304
- MB: SUS 316
- MC: SUS 316L
- 18: PP

㉑㉒ Float 1

- | | |
|-------------------------|--------------------------|
| 00: None | P3: 48*45*18.5(S.G>0.6) |
| S3: 45*55*15(S.G>0.65) | PC: 48*45*18.5(S.G>0.9) |
| SC: 45*55*15(S.G>0.9) | NC: 48*46*20(S.G>0.5) |
| S4: 52*52*15(S.G>0.55) | NE: 48*46*20(S.G>0.9) |
| SD: 52*52*15(S.G>0.9) | S5: 75*73*20(S.G>0.65) |
| NB: 48*46*15.6(S.G>0.5) | SE: 75*73*20.5(S.G>0.9) |
| ND: 48*46*15.6(S.G>0.9) | NC: 48*46*20(S.G>0.5) |
| F3: 45*45*20(S.G>0.65) | A1: 32*69*10.9(S.G>0.75) |
| FC: 45*45*20(S.G>0.9) | AA: 32*69*10.9(S.G>0.9) |

㉓㉔ Float 2

- 00: None
- SC: 45*55*15(E>0.9)
- SD: 52*52*15(E>0.9)
- ND: 48*46*15.6(E>0.9)
- FC: 45*45*20(E>0.9)
- PC: 48*45*18.5(E>0.9)
- NE: 48*46*20(E>0.9)
- SE: 75*73*20.5(E>0.9)
- AA: 32*69*10.9(E>0.9)

(Next page)



④⑤⑥⑦⑧⑨⑩⑪⑫⑬⑭⑮⑯⑰⑱⑲⑳㉑㉒㉓㉔㉕㉖㉗㉘㉙㉚㉛㉜㉝

TMNSX
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㉕ Digital output 1

- 0: None
- A: 4~20mA F: 5V-0V
- B: 20~4mA G: 0V-10V
- C: 0mA-20mA H: 10V-0V
- D: 20mA-0mA I : -5V-5V
- E: 0V-5V J: -10V-10V

㉖ Digital output 2

- 0: None
- B: RS-485
- C: RS485 (RS485 with temperture x 1pcs)
- D: RS485 (RS485 with temperture x 5pcs)
- E: HART
- F: HART 7.3 with temperture sensor x 1pcs)
- H: 4~20mA
- I : 20~4mA

㉗ Housing

- A: Top conduit
- B: Side conduit

㉘ Response time

- A: 16 Hz
- B: 500 Hz

㉙ Material and surface roughness

- 0: None
- A: Ra < 0.3
- B: Ra < 0.5
- C: Ra < 0.8

㉚ ㉛ ㉜ ㉝ Length

Code	Probe Length
0050~5500	50~5500mm

TX10 ISOLATED SAFETY BARRIER

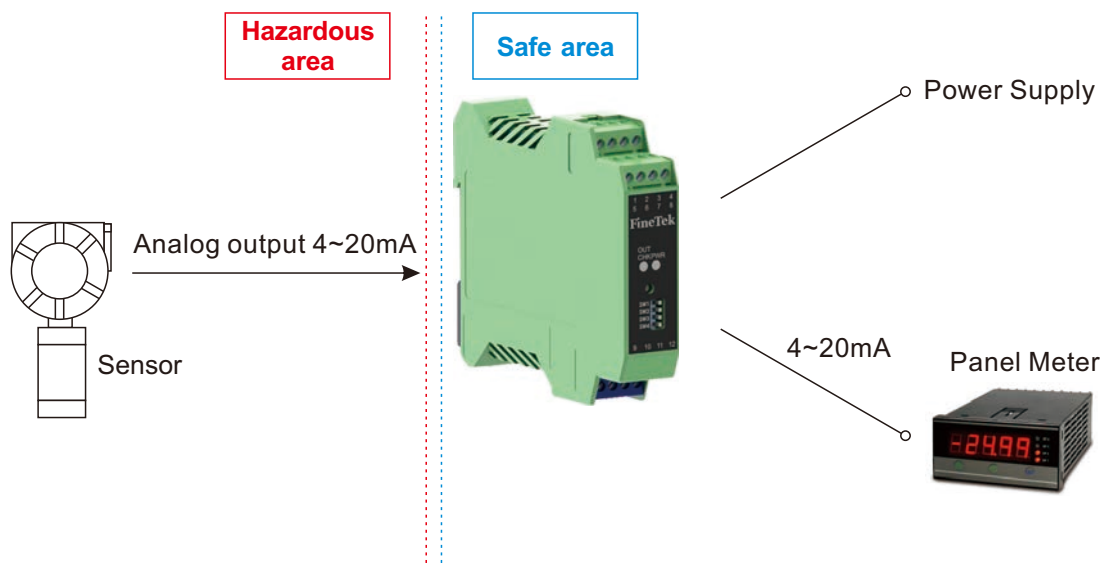
OPERATING PRINCIPLE

Isolated safety barrier provides power supply to transmitters located in hazardous zone and transmit isolated supply current signal to safe zone. Max. input 0~20mA which can be transformed to different analog outputs, such as 0~20mA / 4~20mA / 0~5V / 0~10V.

FEATURES

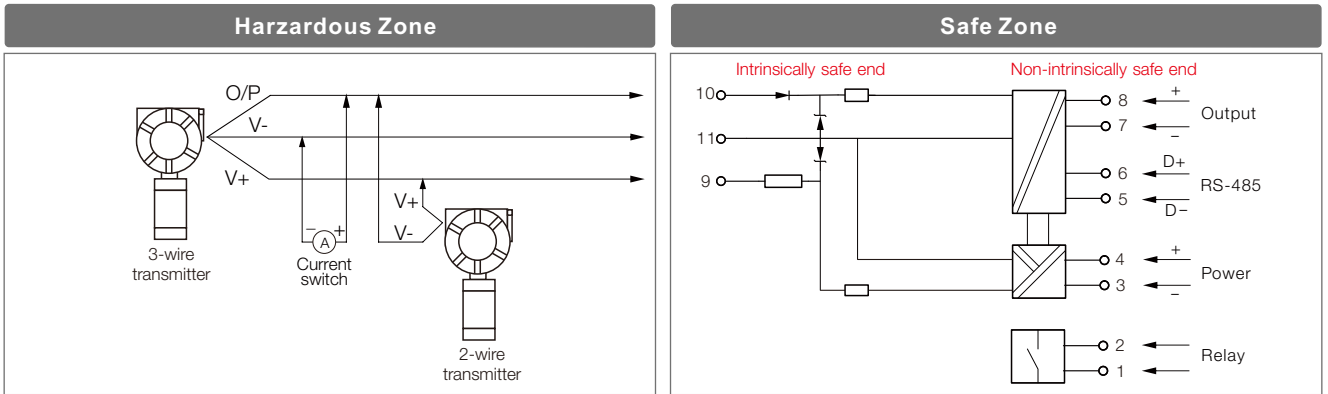
- 1 current input port to connect with continuous current or current output products. Applicable for use in hazardous zone.
- 3 output ports - relay output, current output, and RS-485.
- LED indicator, user friendly.
- DIP switch for function selection.
- In house programming per customers' criteria.
- Self-test function for system function monitoring.
- Setting relay output as alarm for optional external sensing unit connection.
- Optional RS-485 interface enables easy system configuration & supply current data retrieve.
- Product design complies with explosion proof standard.
- 2 dual-color LEDs
 - ▶ PWR LED: Green - Normal
Red - Abnormal
 - ▶ OUT/CHK LED: Yellow - Relay activated
Red (Flash) - Input current abnormal

SCHEMATIC DIAGRAM

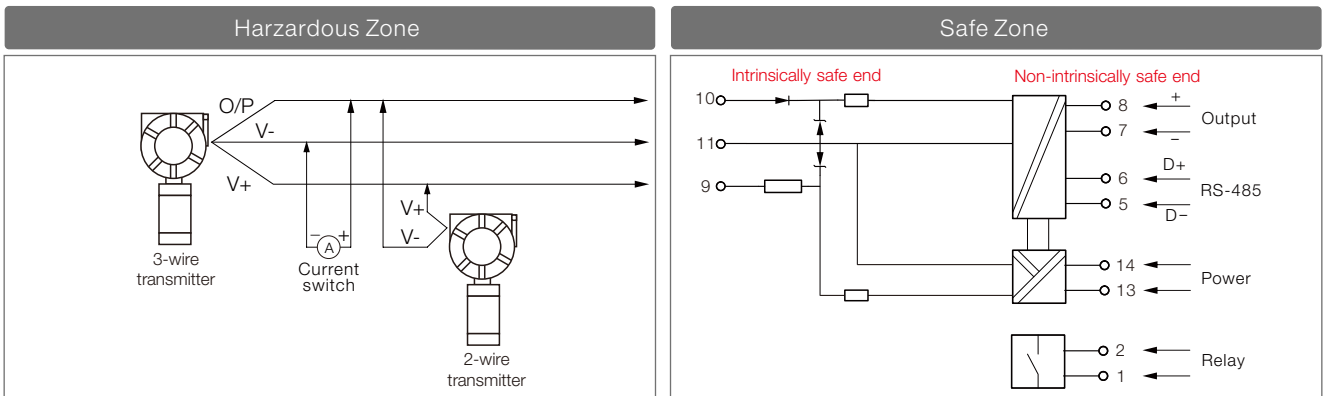


WIRING

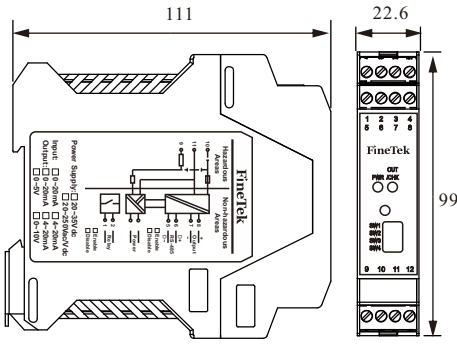
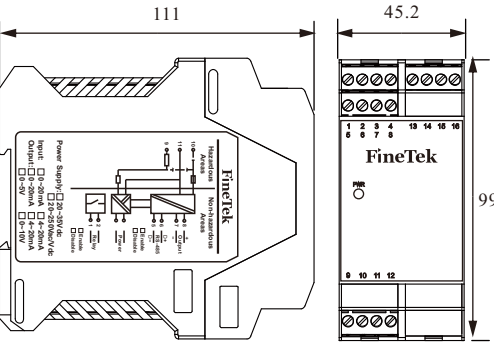
TX100R



TX101F



SPECIFICATION

<p>Dimensions (Unit: mm)</p>		
Model No.	TX100R	TX101F
Supply voltage	20~35 Vdc	20~250 Vdc/Vac, 50/60 Hz
Power supply protection	Power supply reverse protection	Non-directionality input
Current consumption	< 100 mA @24 V, Load 20mA	< 200 mA @24 V, Load 20mA
Hazardous Zone		
Input	0~20/4~20	
Open loop supply voltage	< 28 Vdc	
Distribution supply voltage	> 15 Vdc (Load 20 mA)	
Safe Zone		
Output	Current: 0~20/4~20 mA Load resistance: <550 ohm or Voltage: 0~5/0~10V Load resistance: <20k ohm	
Response time	< 5 ms	
Accuracy	0.1 % F.S., 0.5% @ <0.3V (20°C)	
Temp. coefficient	< 100 ppm/°C	
Isolation	2500Vac : Current leakage < 1mA : 1min. 1. Intrinsic end & Non-Intrinsic end 2. Non-Intrinsic end power supply & output	
Ambient temp.	-20~60 °C	
Applicable zone	Zone 0, Zone 1, Zone 2, IIA, IIB, IIC T4~T6	
External equipments	2-Wire transmitter 3-Wire transmitter Current output transmitter	

MODEL NUMBER / ORDER CODE COMPARISON TABLE

ORDER INFORMATION

Model Number	Order Code
TX100R	TXX1017BB
TX101F	TXX1007BC

TXX 1 ⁰⁵ ⁰⁶ 7 B - ⁰⁹ A ¹¹ ¹² ¹³

⑤ ⑥ Model

- 00: Standard(W45.2×H113.6×D99)
- 01: Economic(W22.6×H113.6×D99)

⑨ Power supply

- B: 20~35 Vdc
- C: 20~250 Vdc/Vac

⑪ Output 1

- A: 4~20 mA
- B: 0~20 mA
- C: 0~5 V
- D: 0~10 V

⑫ Output 2

- 0: None
- A: RS485

⑬ Output 3

- 0: None
- C: Relay

Level Measurement Expert

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