

OUTLINE

The TGF1100 series is a unique 2-wire continuous level-measuring instrument using TDR technology.

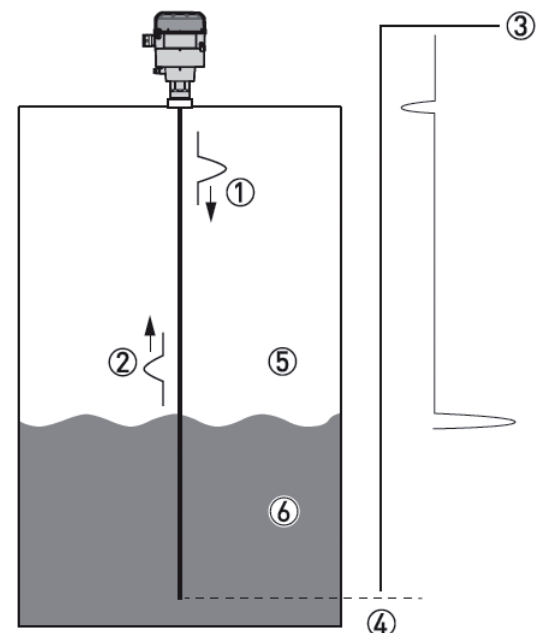
The simple and compact design suitable for tank-top installation with no moving parts has a high cost performance with the maintenance-free and low cost installation by the simple 2-wire loop powered system. This continuous level meter become applicable to wide services including various liquid and powders using by coaxial and single cable probes. The keypad operation on the front display allows easy parameter setting including zero point adjustment and measuring range. The micro pulse level meter is suitable for tank and silo inventory for liquids and powders as well as level controls of the intermediate tanks and vessels.

FEATURES

- Wide applications by TDR technology
- 2-wire loop powered system with less cable and low installation cost
- A current output is selectable from level, distance, volume or mass
- From -50°C to 100°C and from full vacuum to 1.6 MPa
- No influence from changes in temperature, pressure or density
- The probe can be cut in short on site to the application
- Start to measure with a minimum setting after installation
- Measuring Max. 20 m in liquids and 10 m in powders
- Easy mounting on top of tanks
- No moving parts and less maintenance
- Display language in English, Japanese or others and easy operation

MEASURING PRINCIPLE

This Guided Radar level meter TGF1100 has been developed from a proven technology called Time Domain Reflectometry (TDR). The device transmits intermittently low-intensity electromagnetic pulses along a rigid or flexible conductor called a coaxial probe or single cable probe. These pulses move at the speed of light. When the pulses reach the surface of the product to be measured, the pulses are reflected back to the signal converter. The device measures the time from when the pulse is transmitted to when it is received: half of this time is equivalent to the distance from the reference point of the device to the surface of the product. The time value is converted into an output current of 4 to 20 mA which corresponds to the level height. The traveling speed of the pulses is constant about 300,000 km/second same as light regardless of the changes in conditions. Therefore, dust, foam, vapor, agitated surfaces, boiling surfaces, changes in pressure, changes in temperature, changes in dielectric constant and changes in density do not have an effect on device performance.



- ① Transmitted pulse
- ② Reflected pulse
- ③ Pulse amplitude
- ④ Measuring range
- ⑤ Air : $\epsilon_r \approx 1$
- ⑥ Measured objects: $\epsilon_r > 1.6$ for coaxial probe
 $\epsilon_r > 2.1$ for single cable probe

STANDARD SPECIFICATION

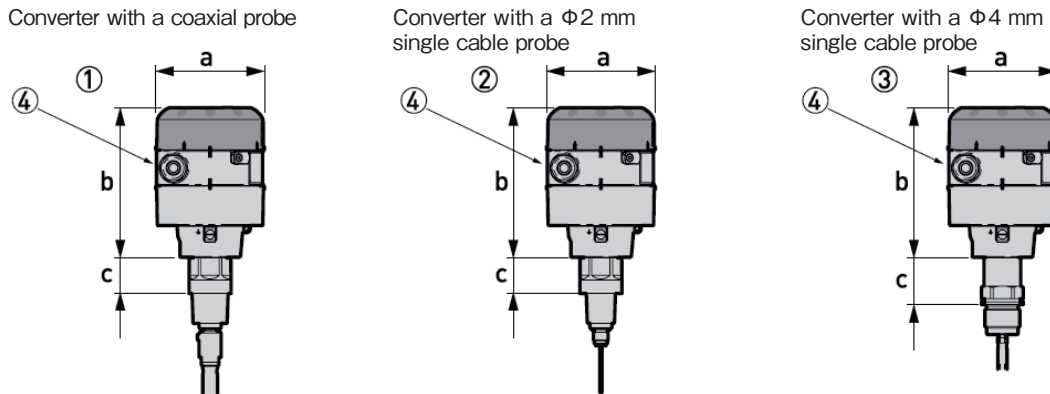
Objects	Item	Contents
Measuring objects	Measuring material	Liquids, slurries, powders, granules (5 mm or less in diameter)
	Measuring principle	Time Domain Reflectometry (TDR)
	Measuring variables	Level, distance, volume, mass
Probe type and measuring range	TGF1121	Single cable probe (Φ 2 mm) / 1 to 20 m / Liquids, slurries Single cable probe (Φ 4 mm) / 1 to 10 m / Powders, granules
	TGF1131	Coaxial probe (Φ 14 mm) / 0.73 to 4.07 m / Liquids * ¹
	Dead zone	Top : 150 mm (coaxial probe), 200 mm (single cable probe) Bottom : 50 mm (coaxial probe), 150 mm (single cable probe) Length of dead zone depends on measuring conditions. See Measuring Limits for details.
Outputs	Outputs	4 to 20 mADC or 3.8 to 20.5 mADC
	Resolution	$\pm 1 \mu A$
	Error outputs	22 mADC, 3.6 mADC, Fixed by parameter setting
	Load resistance	$R [\Omega] \leq (\text{supply voltage} - 14V) / 22\text{mA}$. The allowable load resistance depends on the supplied voltage. See Supply Voltage.
Accuracy	Accuracy	Liquid measurement : ± 20 mm (Less than 10 m), $\pm 0.2\%/R.D.$ (More than 10 m) Powder measurement : ± 40 mm
	Resolution	1 mm
	Repeatability	± 3 mm
	Max. rate of change	10 m/min. (Depending on the measuring conditions)
Measuring conditions	Temperature of process connection	$- 50$ to $+ 100^\circ\text{C}$
	Thermal shock resistance	100°C /minute
	Pressure	0kpa (abs) to 1.6Mpa
	Dielectric constant	More than 1.6 for coaxial probe More than 2.1 for single cable probe
	Max. dia. of granules	5 mm or less in diameter
Specification of instrument	Protection class	IP66 / IP67
	Ambient temperature	$- 40$ to $+ 80^\circ\text{C}$
	Display	$- 20$ to $+ 60^\circ\text{C}$
	Storage temperature	$- 50$ to $+ 85^\circ\text{C}$
Electric connection	Type	2-wire loop-powered
	Power supply	Rated voltage : 24 V DC Acceptable voltage : 14 to 30 V DC * ²
	Cable entry	M20 x 1.5 with waterproofed cable gland, 1/2" NPT female
	Cable entry capacity (Terminal)	0.5 to 1.5mm ²
Materials	Housing	Aluminum
	Process connection	Stainless steel 316L
	Probe	Single cable probe : Stainless steel 316 Coaxial probe : Stainless steel 316L
	Seal	EPDM
Process connection		G3/4" male, G1" male, 3/4" NPT male, 1" NPT male
Display	Display	LCD 128 x 64 pixels in 8-step greyscales English, Japanese or others
	Key pad	4 buttons (right, enter, up, down)
Mass	Housing including process connection	3.3kg
	Probe	Single cable probe Φ 2 mm : 0.4kg/m
		Single cable probe Φ 4 mm : 1.2.kg/m
		Coaxial probe : 0.45 kg/segment

* 1 The coaxial probe will be shipped either in 73, 140, 207, 273, 340, or 407 cm length.

* 2 See the minimum power supply voltage for an output of 22 mADC at the terminal.

DIMENSIONS AND MASS

Converter

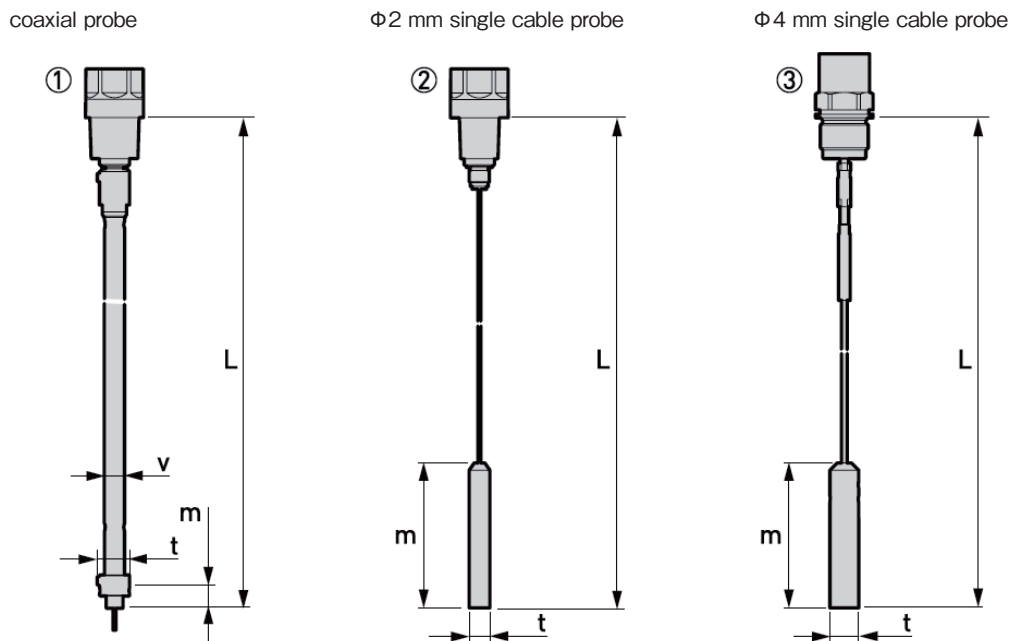


- ① Converter with a coaxial probe
- ② Converter with a $\Phi 2$ mm single cable probe
- ③ Converter with a $\Phi 4$ mm single cable probe
- ④ The diameter of the outer sheath of the cable must be 6 to 12 mm for the cable entry M20 x 1.5.

Dimensions and mass

Probe type	Dimension [mm]			Mass [Kg]
	a	b	c	
① Coaxial probe	104	141	34	3.3
② $\Phi 2$ mm single cable probe	104	141	34	3.3
③ $\Phi 4$ mm single cable probe	104	141	45	3.3

Probe

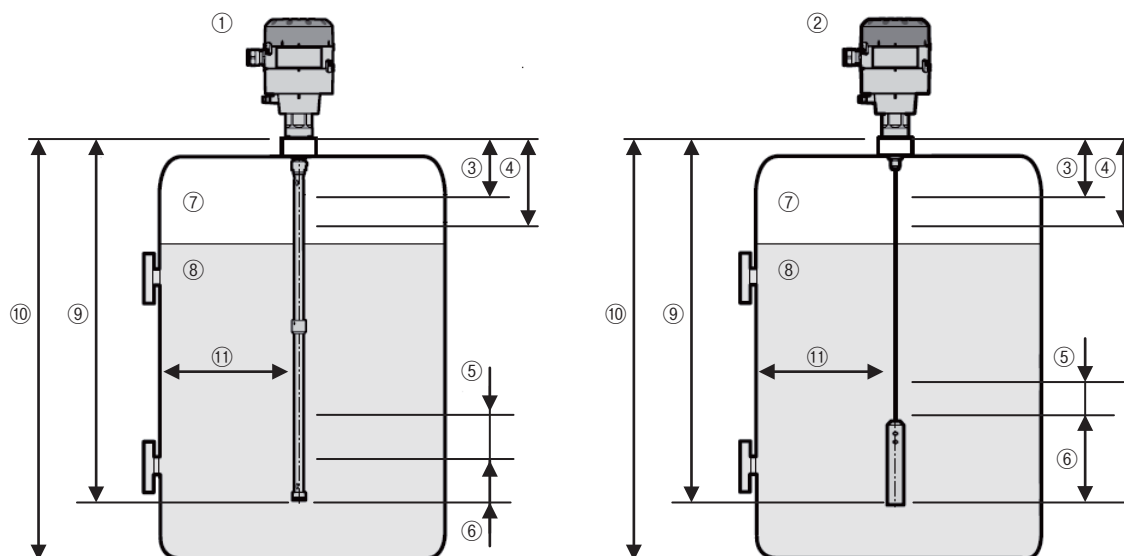


Dimensions and mass

Probe type	Dimension [mm]					Mass [Kg]
	Lmin.	Lmax.	m	t	v	
① Coaxial probe	730 ^{*1}	4,070 ^{*2}	15	$\phi 21$	$\phi 14$	0.45 ^{*3}
② $\Phi 2$ mm single cable probe	1,000 ^{*1}	20,000	100	$\phi 14$	—	0.4
③ $\Phi 4$ mm single cable probe	1,000 ^{*1}	10,000	100	$\phi 20$	—	1.2

- * 1 The probe can be cut in short on site.
- * 2 The coaxial probe can be supplied in 6 standard lengths : Approx. 730, 1400, 2070, 2730, 3400 or 4070 mm.
- * 3 This is the mass for each segment of the coaxial probe.

MEASUREMENT LIMITS



- ① Converter with coaxial probe
- ② Converter with single cable probe
- ③ Top dead zone : Top part of the probe where measurement is not possible
- ④ Top non-linearity zone :Top part of the probe with a lower accuracy
- ⑤ Bottom non-linearity zone : Bottom part of the probe with a lower accuracy
- ⑥ Bottom dead zone : Bottom part of the probe where measurement is not possible

- ⑦ Gas (Air)
- ⑧ Product
- ⑨ Probe length
- ⑩ Tank height
- ⑪ Minimum distance from the probe to a tank wall
Single cable probe : 0.3 m
Coaxial probe : 0 m

Dead zone and non-linearity zone

Dielectric constant of product (Er)	>40		≤ 40	
	Top ③	Bottom ⑥	Top ③	Bottom ⑥
① Coaxial probe	150	50	200	200
② Single cable probe	200	150	250	150

(mm)

Dielectric constant of product (Er)	>40		≤ 40	
	Top ④	Bottom ⑤	Top ④	Bottom ⑤
① Coaxial probe	300	50	350	50
② Single cable probe	450	200	500	250

(mm)

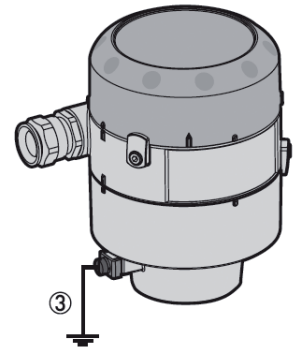
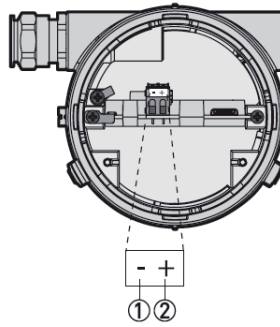
Start-up

- The start-up indication will appear approx 5 seconds after power-on.
- The measurement starts approx 30 seconds later. Further approx 10 seconds later the correct measurement starts. The necessary time to get the correct measurement depends on the measuring conditions.
- The current output becomes approximately 2.8 mA just after power-on, approx 10 seconds later 3.6 mA and after approx 30 seconds later, it becomes correct output.
- The necessary time to get the correct output depends on the measuring conditions.

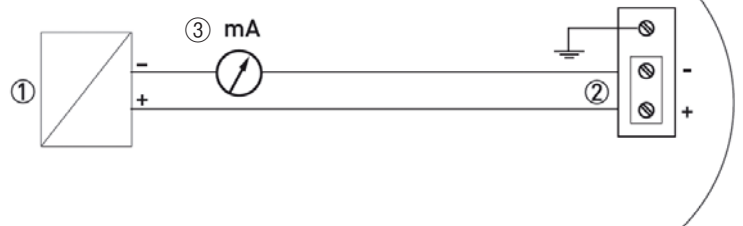
WIRING

Terminals

- ① Signal (Power) cable (-)
- ② Signal (Power) cable (+)
- ③ Grounding



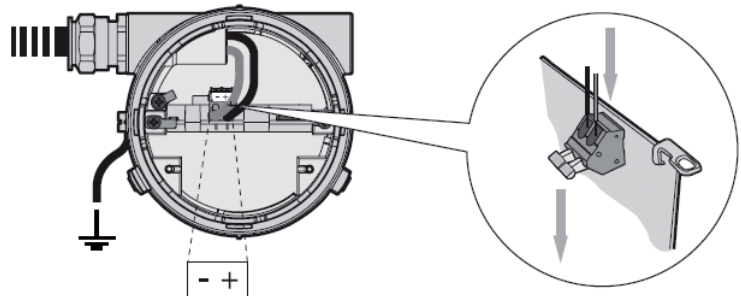
- ① : Power supply
- ② : Terminals at level meter
- ③ : Indicator or receiver



- The stranded cable with 0.5 to 1.5 mm² is recommended for the signal cable.
- Strip the sheath of cable 5 to 7 mm in length and connect the conductor directly to terminals.
- Install the signal cable apart from power lines.
- Use a separate power source from other power equipment.
- Using the shield cable is recommended.
- Grounding the level meter and tank or silo when measuring powders or granules.

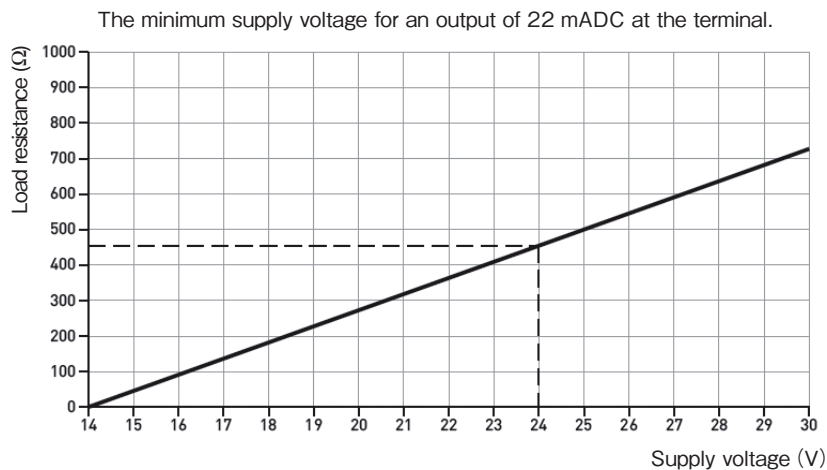
Connecting cable

- Connect the conductor by inserting it through the terminals while pushing down the claw.
- Push down the claw with your finger, not with a tool.
- Too much strength might break the claw.
- Check if the connection is secure.
- Do not put the cable between the level meter and its cover during assembling them.



Power supply

- Supply voltage : 14 to 30 VDC
- Load resistance : See the graph.



PRECAUTIONS ON INSTALLING OR USING TGF1100

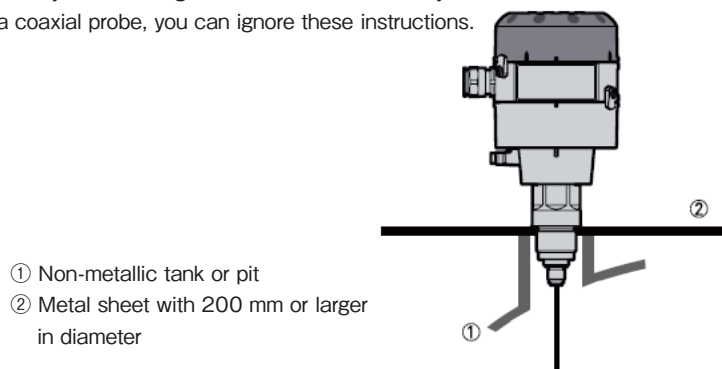
Installation

- Install it in the ambient temperature -40 to +80° C.
- Provide a sun shade or cover to avoid the direct sunshine and rain splash if the meter is exposed to them.
- Do not install the level meter in the place where a strong vibration is expected.
- Decide the installation location and height considering the dead zone (non-measurable zone) of the TGF1100. The dead zone varies by the probe to be used and operating conditions. See the section “MEASUREMENT LIMITS.”
- Screw the TGF1100 into the threaded connection with a wrench by putting it around the hexagonal part of the meter, not rotating the housing with your hand. It may be broken.

Installation on a non-metallic tank

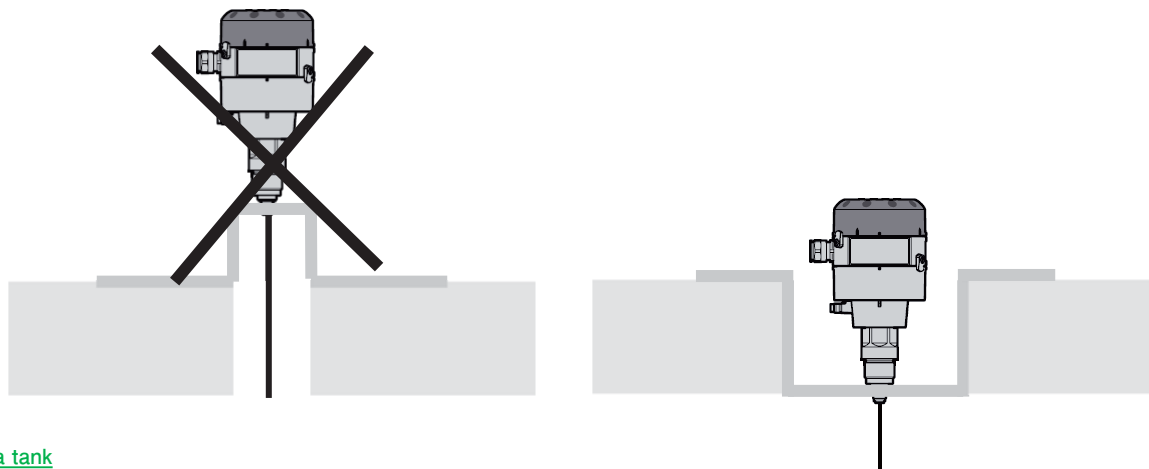
Provide a metal sheet with 200 mm or larger in diameter as a reflection plate when installing it on the non-metallic tank like FRP. Without the reflection plate the error may become larger or the measurement may be failed.

If you have a device with a coaxial probe, you can ignore these instructions.



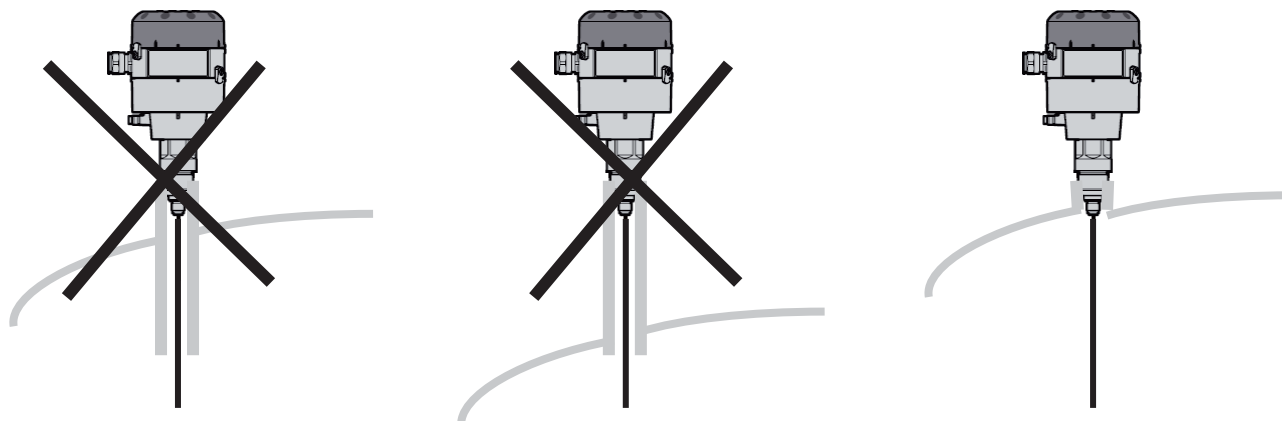
Mounting on a pit or underground tank

Do not install the level meter directly on the thick concrete roof. Make a recess on the roof to install the metal plate and install the level meter on it. See below.



Installing on a tank

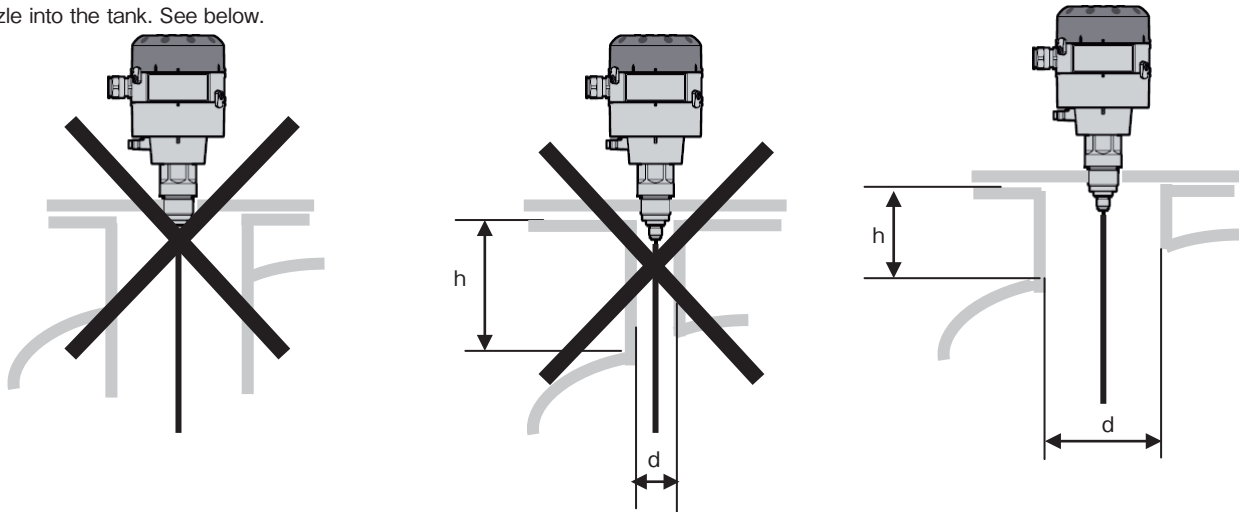
Install the TGF1100 on the threaded connection (socket) which is fixed on the roof of a tank. Do not make a nozzle longer nor protrude it into the inside of tank. See below.



Installing on a nozzle

Installation on the treaded connection (socket) is recommended. When installing it on the treaded connection (socket) on a flange with nozzle. Avoid a longer nozzle. The diameter of nozzle must be bigger or at least same as the height of nozzle: Nozzle diameter "d" \geq nozzle height "h".

If this condition is not satisfied, a correct measurement cannot be expected or much longer dead zone is needed. Do not protrude the nozzle into the tank. See below.



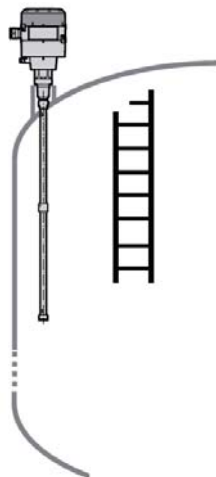
Coaxial probe

Usage

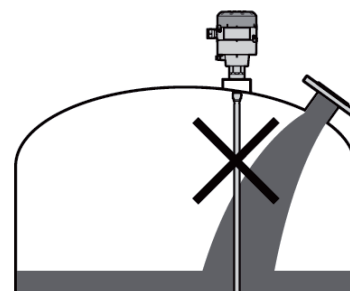
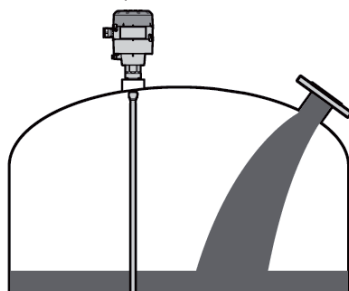
Use the coaxial probe for the liquids less than 500 mPa·s or equal in viscosity as a rule. This type can measure the level or a distance to the surface for tanks with smaller diameter or internal obstacles.

Precautions on using the level meter with a coaxial probe

- This type has no restriction of the distance from tank wall or internal obstacles to the probe.
- Do not put any foreign objects into the pipe of coaxial probe or do not adhere anything on the pipe.
- Make the product get in or out of the pipe of coaxial probe freely.
- The probe can be supported or fixed at the intermediate section. However do not bend it.



- Do not install the probe near to a product inlet.



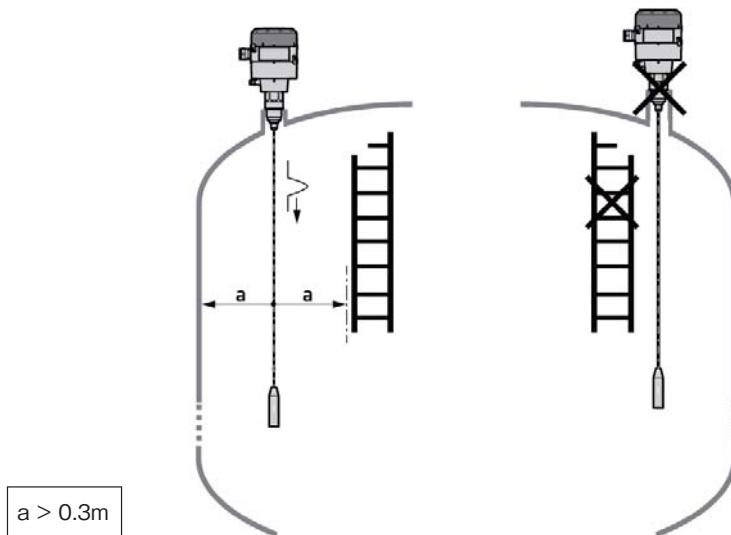
Single cable probe Φ 2 mm

Usage

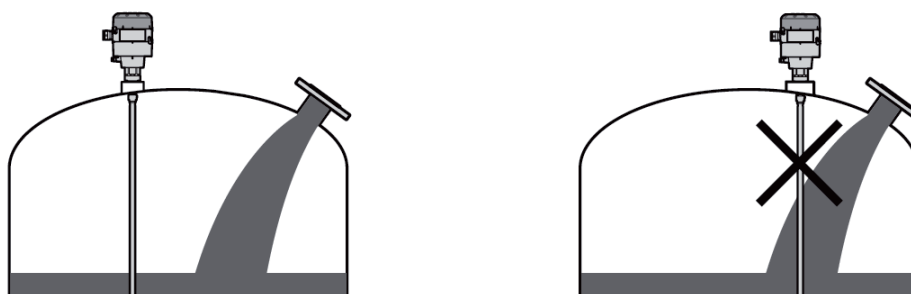
Use the single cable probe Φ 2 mm for the liquids less than 10,000 mPa·s or equal in viscosity as a rule. This type can measure the level or a distance to the surface of liquids or slurries.

Precautions on using the level meter with a single cable probe Φ 2 mm

- Keep at least a distance 0.3 m from the probe to a tank wall or internal obstacles.
- Locate a counter weight above the bottom of tank. Do not make any slack of the cable or fix the counter weight bottom of the tank with traction of the cable.
- If the fluid in the tank is turbulent, fix the tip of probe to avoid the sway. Do not make the probe get involved into the blades of agitator. Place the probe a distance from the agitator or fix the tip of probe inside tank.
- Fix the probe only at the bottom of it if required so. If you fix the probe at the intermediate point, you cannot measure the level under that point.
- Design the nozzle or installation location to keep a distance from the probe to the nozzle or to the wall of tank. See below.



- Do not install the probe near to a product inlet.



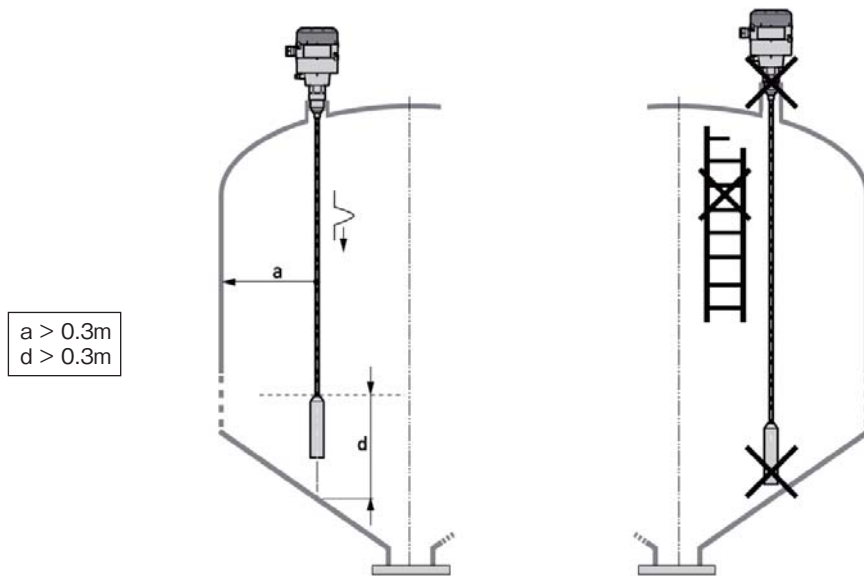
Single cable probe Φ 4 mm

Usage

The level meter with a single cable probe Φ 4 mm is used to measure the level or distance to the surface of the powders or granules with the maximum 5 mm in diameter.

Precautions on using the level meter with a single cable probe Φ 4 mm

- Install the probe for the powders and granules while the silo is empty. Fix the level meter without any slack of probe.
- Design the threaded connection (socket) and the nozzle or decide the installation location so that the probe does not touch the wall of tank, socket or nozzle.
- Keep the minimum distance 0.3 m from the counter weight and probe to the wall.
- Fix the level meter to keep the counter weight at least 0.3 m above the bottom of silo.
- Do not adhere anything on the threaded connection (nozzle) or inside of nozzle when the product is adherent.
- Install the probe as far as possible from the internal obstacles to avoid the probe is entangled with them. The probe moves without fixing it.



- Do not install the probe near to a product inlet.



Installation in standpipes (Stilling wells and bypass chambers)

Usage

Use a standpipe if the level meter is installed near the internal obstacles, agitators or product inlet.

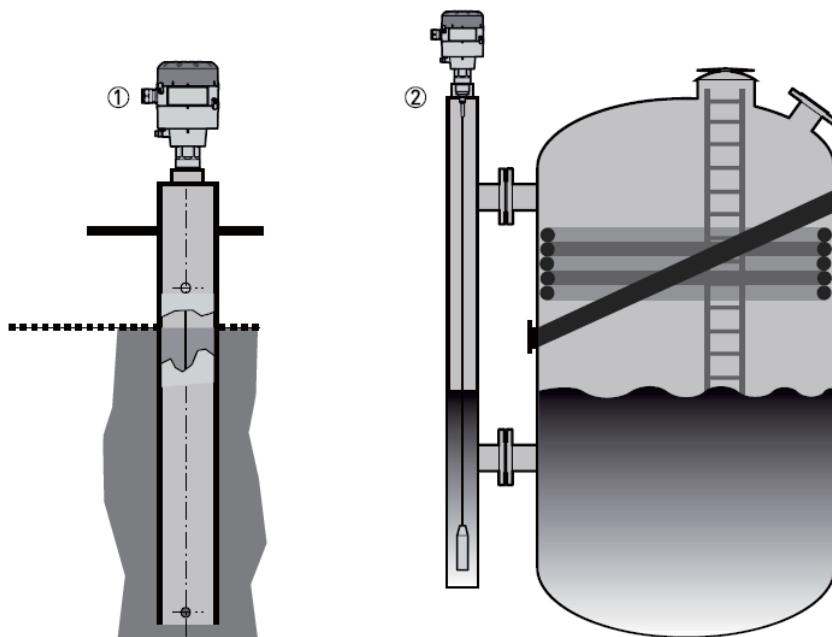
The standpipe can also reduce the influence from the foams or bubbles by installing it internally as a stilling well or externally as a bypass chamber.

Requirements for the stand pipe (Stilling well or bypass chamber)

- The pipe must be metallic or electrically-conductive.
- The pipe must be straight. The inside surface must be smooth with its roughness less than 0.1 mm.
- There must be no sudden changes in internal diameter greater than 1 mm.
- The Internal stilling well must have a vent hole at the higher point than the maximum liquid level.
- The Internal stilling well must have enough gap between the counter weight and the inside of the pipe to make the liquids go through easily.

Precautions on using the stand pipe (Stilling well or bypass chamber)

- Place the probe in the center of the stand pipe.
- The span of the bypass chamber must cover the maximum and minimum liquid levels: One nozzle must be higher than the max. level and another lower than the min. level.
- The liquids and gases must move smoothly to inside and outside the pipes.
- The corrosion or adherence by fluids inside pipe is not allowed.
- Do not let any foreign objects into the pipe.
- The lower zone than bottom of internal stilling well cannot be measured.



- ① Internal pipe (stilling well)
- ② External pipe (bypass chamber)

PROCEDURES FROM ASSEMBLING TO MEASURING

The probes of TGF1100 are delivered in following lengths:

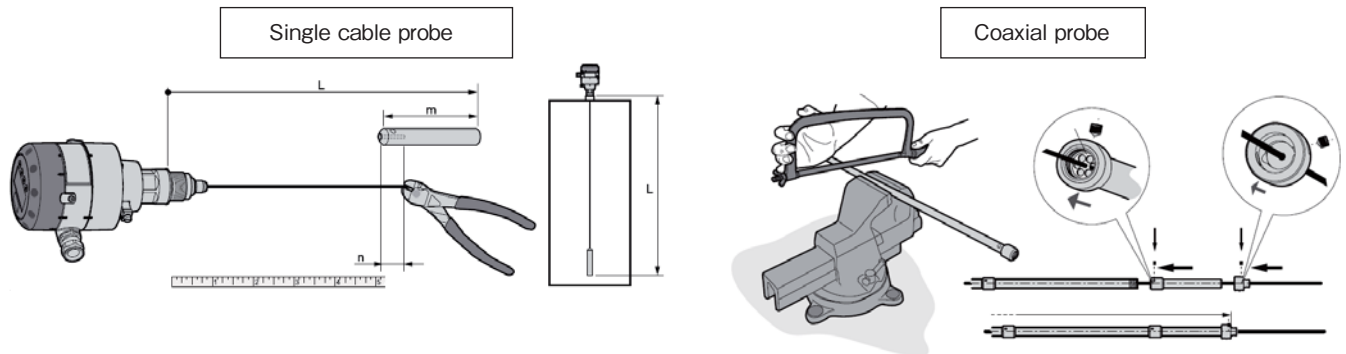
Single cable probe Φ 2 mm : 20 m

Single cable probe Φ 4 mm : 10 m

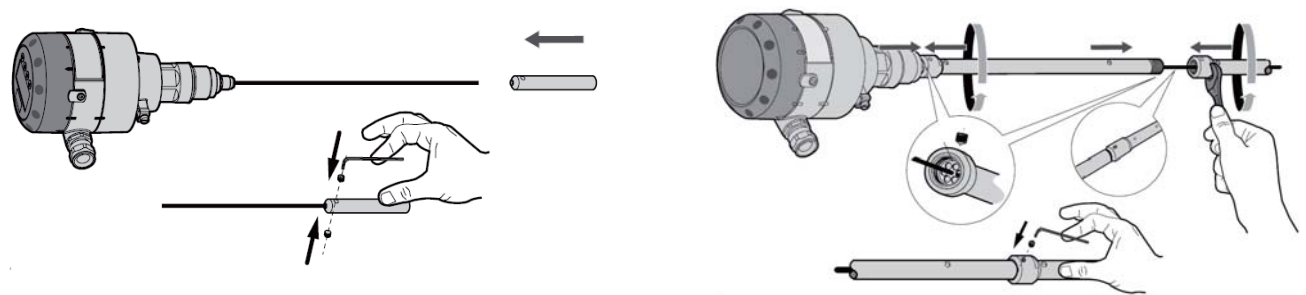
Coaxial probe : Several segments as per specified

Cut and assemble the probe before installing it on the tanks as follows. However, see the instruction manual for detail explanations on cutting and assembling.

· Adjust the probe length to the tank height



· Assemble the probe

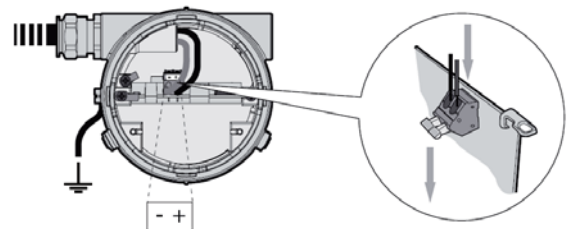


· Installing the level meter on the tank

Follow the precautions on installation

· Connecting cable

Open the cover to connect the cable.



· Closing the cover and switching on the power

The start-up indication will appear approx 5 seconds after power-on.
The indication and output will start several tens of seconds later.

· Setting parameters

Setting parameters are carried out on the display of the level meter.

Following parameters need to be set before measuring the level.

- Length of probe
- Position at 4 mA output
- Position at 20 mA output

The correct measurement starts after this setting.



Button	Function
	Normal mode : Enter the configuration mode Configuration mode : Move the cursor to the right
	Normal mode : Change the measurement units Configuration mode : Enter, move to the upper layer
	Normal mode : Change the measurement name Configuration mode : Decrease value or change parameter
	Normal mode : Change the measurement name Configuration mode : Increase value or change parameter

APPLICATION TABLE FOR PROBE SELECTION

Probe type	Coaxial probe φ 14mm	Single cable probe φ 2mm	Single cable probe φ 4mm
Max. measuring range	4m	20m	10m
Measuring objects			
Measuring material	Liquids	Liquids, Slurries	Powders, Granules
Dielectric constant	>1.6	>2.1	>2.1
Liquids less than 10,000 mPa · s or equal in viscosity *1	×	○	—
Liquids less than 500 mPa · s or equal in viscosity *1	○	○	—
Powders	—	—	○
Granules (Less than 5 mm in diameter)	—	—	○
Installation method and place			
Storage tank	○	○	×
Silo	×	×	○
Bypass chamber	○	○	—
Stilling well	○	○	—

* 1 A general guidance to select the probe

○ : Suitable, × : Not suitable, — : Not applicable

MODEL AND SPECIFICATION CODES

Specification codes	Description										
VF25	4	1								0	Always 4
Fixed code	4										Aluminum alloy
Housing material		1									Stainless steel 316, Single cable probe φ 2 mm, Counter weight φ 14 mm x 100 mm, 20 m, for liquids
Probe type/ Weight shape/ Probe material/ Probe length	TGF1121	3									Stainless steel 316, Single cable probe φ 4 mm, Counter weight φ 20 mm x 100 mm, 10 m, for powders and granules
		6									
TGF1131	A										Stainless steel 316L, Coaxial probe φ 14 mm, 1 segment (probe length max. 73 cm)
	B										Stainless steel 316L, Coaxial probe φ 14 mm, 2 segments (probe length max. 140 cm)
	C										Stainless steel 316L, Coaxial probe φ 14 mm, 3 segments (probe length max. 207 cm)
	D										Stainless steel 316L, Coaxial probe φ 14 mm, 4 segments (probe length max. 273 cm)
	E										Stainless steel 316L, Coaxial probe φ 14 mm, 5 segments (probe length max. 340 cm)
	F										
Process connection	2										G3/4" Male (ISO228)
	3										G1" Male (ISO228)
	5										3/4" NPT Male
	6										1" NPT Male
Cable entry	1										M20 x 1.5 with water proof plug
	2										1/2" NPT
Display unit	1										Without display unit
	2										With display unit
Display language	0										Without display
	1										English
	7										Japanese
Fixed code										0	Always 0

STANDARD ACCESSORIES

- A sheet of setting data
- An instruction manual
- A tool to open the cover

ORDERING INSTRUCTIONS

Specify the following when ordering for example:

Model code : TGF1121

Specification code : VF254133121

Single cable probe φ 2 mm with G1" male

* Specification is subject to change without notice.


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