

GENERAL

TGR3000 series is the 2-wire system Guided Radar Gauge which can continuously measure the level using micro-pulse. The micro-pulse emitted from the electronics is propagated along rod or cable probe. So the efficiency of micro-pulse propagation is high and dense. By the micro-pulse in low energy, sufficient reflection can be obtained from the products in a low dielectric constant, and it is possible to make measurement of level and interface of fluids in low dielectric constant, of organic solvents and oils, and solids. The local indication is large and easy to see at the site as graphic display is adopted.

FEATURES

- Total cost can be reduced by the 2-wire system level meter.
 - TDR system is available for various applications.
 - Measurement in high accuracy is realized in spite of 2-wire loop powered system.
 - Easy operation with wide graphic display
 - Improvement in the dynamic range by modifying the specification of emitter.
 - Measuring objects are level, interface, liquids and solids.
 - Available for temperature and pressure in wide range.
- Measurement in high accuracy can be made without being influenced by the change in temperature, pressure and density.

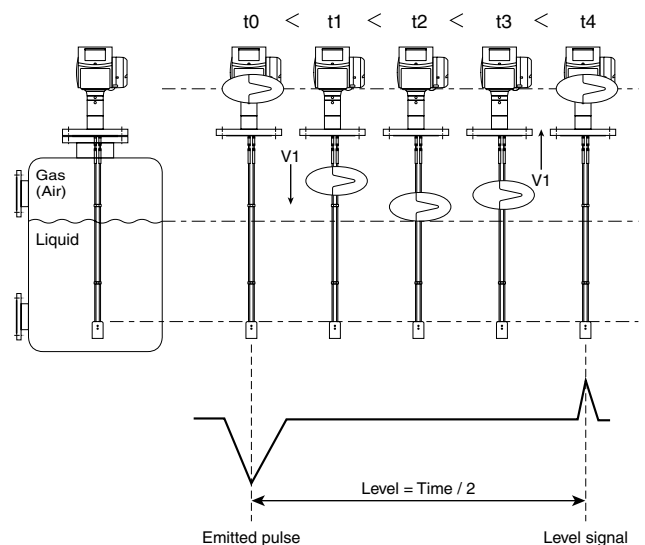


OPERATION PRINCIPLE

TGR3000 is a unique instrument based on TDR (Time Domain Reflectometry) technology, by which the level can be continuously measured. The electric wave called a micro-pulse is intermittently emitted, and the emitted micro-pulse reflects on the surface. The level is detected by the turnaround time of reflection until it comes back to a emitting point.

The micro-pulse emitted from the electronics propagates to the surface of the measuring fluids at the fixed speed along with the rod or cable called a probe and reflects at the surface of liquids or solids where the dielectric constant changes. The level is measured by this turnaround time.

The velocity at which the micro-pulse spreads is mostly fixed by about 300,000 km/sec. and is not influenced by the change in temperature or pressure. Even when these measuring conditions are changed, there is no necessity for the compensation to be made. The error over the measured level is very small, and the measurement can be made without being influenced by the change in temperature, density, dielectric constant of the fluids to be measured, and dust, vapor, bubbles etc

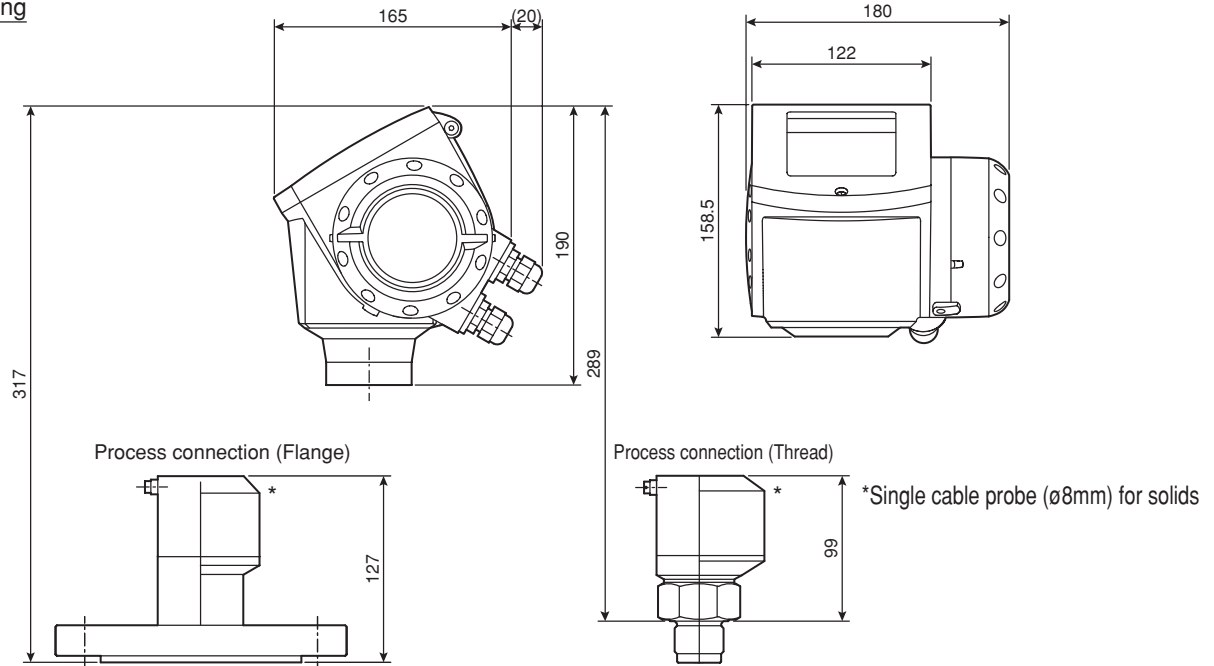


STANDARD SPECIFICATIONS

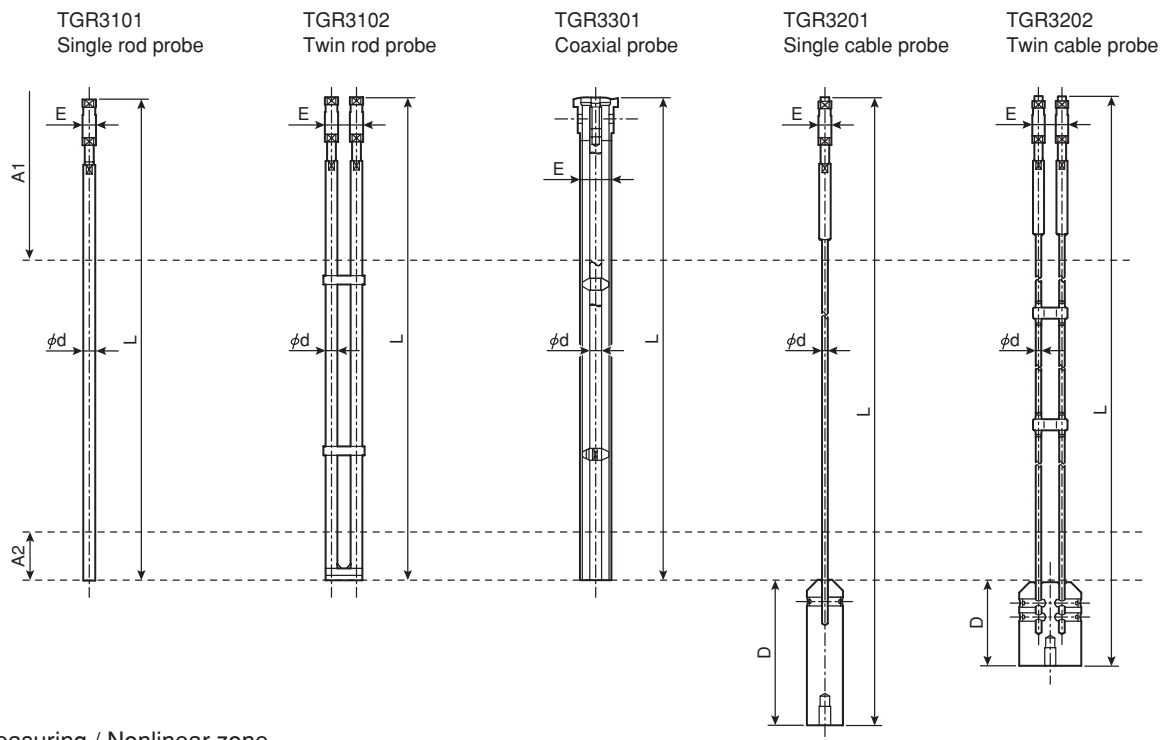
Objects	Item		Contents
Measuring object	Measurable materials		Liquids, Slurries and/or solids (Less than 5mm of the grain diameter)
	Measuring method		Time Domain Reflectometry (TDR)
	Measured variable		Level, distance, volume and/or interface
Probe type / Length (Max.)	TGR3101		Single rod probe (ϕ 8mm) / 3m
	TGR3102		Twin rod probe (ϕ 8mm) / 3m
	TGR3201		Single cable probe (ϕ 4mm: For liquid measurement) / 35m
	TGR3201		Single cable probe (ϕ 8mm: For solid measurement) / 35m
	TGR3202		Twin cable probe (ϕ 4mm) / 8m
	TGR3301		Coaxial probe (ϕ 22mm) / 3m
Output	Output 1		4 to 20mA DC (HART)
	Output 2		4 to 20mA DC
	Accuracy		± 0.01 mA (at 20°C)
	Resolution		± 2 μ A
	Temperature drift		50ppm/K (Key value)
	Error signal		22mA DC, 3.6mA DC (Selected by parameter)
Accuracy: Based on criteria condition	Load resistance (Max.)		350ohms
	Liquid measurement		± 3 mm (Less than 10m), $\pm 0.03\%$ /R.D. (More than 10m)
Measuring conditions	Interface measurement		± 10 mm (If specific conductivity not changed.)
	Temperature of process connection		-40 to +150°C(Standard), (Flameproof type: Refer to EXPLOSION PROOF SPECIFICATIONS)
	Thermal shock resistance		100°C/min
	Operating pressure		0kPa (abs) to 4MPa (Based on flange rate)
	Dielectric constant		More than 1.4 (Coaxial probe)
			More than 1.6 (Twin rod probe, Twin cable probe)
			More than 1.8 (Single rod cable, Single cable probe)
	Interface measurement		Dielectric constant of upper liquid is 1.6 to 10. Difference of dielectric constant is over 20. (Lower liquid should be bigger.)
			Thickness of interface should be over 50mm and the interface should be formed definitely.
Instrument specification	Protection class		IP66 (JIS0920, Equivalent to Jet-proof)
	Ambient temperature		-40 to +80°C (Standard), (Flameproof type: Refer to EXPLOSION PROOF SPECIFICATIONS)
	Storage temperature		-40 to +85°C
Electrical connection	Type		2-wire loop powered system
	Power supply (Output 1)		Rated voltage: 24V DC
			Voltage range: 20 to 36V DC (Exd)
			14 to 30V DC (Non-Ex, Exi)
	Power supply (Output 2)		Rated voltage: 24V DC
			Voltage range: 10 to 30V DC (Non-Ex, Exd, Exi)
Material	Cable entry		M20 (with waterproof gland) G1/2 female thread 1/2 NPT female gland (Option: G1/2 waterproof cable gland)
	Terminal		0.5 to 1.5mm ²
	Housing		Aluminium
	Process connection		Stainless steel (SS316L): Standard
			Hastelloy C-22
	Probe	Single rod probe	Stainless steel (SS316L): Standard Hastelloy C-22
		Twin rod probe	Stainless steel (SS316L): Standard Hastelloy C-22
		Coaxial probe	Stainless steel (SS316L): Standard Hastelloy C-22
		Single cable probe(ϕ 4)	Stainless steel (SS316): Standard Hastelloy C-22
		Single cable probe(ϕ 8)	Stainless steel (SS316): Standard
		Twin cable probe	Stainless steel (SS316): Standard
	Seal		Viton (-40 to +150°C) Standard
			Kalrez 6375 (-20 to +150°C)
Display			9 lines 160 x 160 pixels in 8-step grey scale
			with 4 buttons (Right-hand key, Enter key, Up key and Down key)
			Language: English or Japanese
Weights	Housing		1" to 3" flange connection: 4 to 7kg
			4" to 6" flange connection: 7 to 12kg
			Thread connection: 3kg
	Probe	Single cable probe (ϕ 4mm):	0.12kg/m
		Single cable probe (ϕ 8mm):	0.41kg/m
		Twin cable probe:	0.24kg/m
		Single rod probe:	0.41kg/m
			Twin rod probe: 0.82kg/m
			Coaxial probe: 0.79kg/m

DIMENSIONS

Housing



Probe



Non-measuring / Nonlinear zone

(mm)						
Specific dielectric const	Zone	Single rod	Twin rod	Coaxial single cable	Single cable	Twin cable
$\epsilon r \geq 40$	A1	200	150	50	200	150
	A2	10	10	10	10	10
$\epsilon r < 40$	A1	250	200	50	250	200
	A2	50	50	50	50	50
Probe diameter	ϕd	8	8	8	4, 8	4
Length of weight	D	—	—	—	100(*1: $\phi 20$) 100(*1: $\phi 12$) 245(*1: $\phi 38$)	60(*1: $\phi 38$)
Max. Probe width	E	8	25	22	8	25

A1: Top non-measurement zone (This range cannot be measured. The right value is not outputted although it is possible to convert this zone into the current output range.)

A2: Bottom nonlinear zone (Measurement is possible but out of guaranteed range in accuracy.)

ϕd : Probe diameter D: Non-measurable zone E: Max. Probe width (Except weight) L: Probe length *1: Dia. of weight

EXPLOSION PROOF SPECIFICATIONS

ATEX (ATEX Directives 94/9/EC)
 KEMA 04 ATEX 1219X
 II 1G D or II 1/2 GD or II 2GD
 EEx ia IIC T3...T6 T65°C...107°C
 or
 II 1/2 G D or II 2 GD
 EEx d [ia] IIC T3...T6 T65°C...T107°C

OPERATING CONDITIONS

(Process and ambient temperature)

- Category II 1G (EExi)

Temperature class	Amb. temperature	Process temperature
T6	-20°C to +60°C	-20°C to +60°C

- Category II 1/2 G

Temperature class	Amb. temperature	Process temperature
T6	-40°C to +60°C	-20°C to +60°C
T5	-40°C to +75°C	-20°C to +60°C
T4	-40°C to +85°C	-20°C to +60°C

- Category 2 G

Temperature class	Amb. temperature	Process temperature
T6	-40°C to +60°C	-40°C to +60°C
	-40°C to +55°C	-40°C to +80°C
T5	-40°C to +75°C	-40°C to +75°C
	-40°C to +70°C	-40°C to +95°C
T4	-40°C to +85°C	-40°C to +130°C
T3	-40°C to +85°C	-40°C to +150°C

- Category II 1D (EExi), II 1/2D, II 2D

Amb. temperature	Process temperature
-40°C to +85°C	-40°C to +150°C

- Category II 1D, II 1/2 D, II2D

Temperature class	Amb. temperature	Surface temperature
55°C	80°C	65°C
70°C	95°C	80°C
85°C	130°C	98°C
85°C	150°C	107°C

(Pressure)

Category	Pressure range
1G, 1D, 1/2G or 1/2D	80kPa...110kPa
Others	Same as non-flameproof

(Intrinsically safe type)

In case of using IS type in hazardous area, observe the following matters.

IS circuit allowable supply voltage (U_i) $\leq 30V$

IS circuit allowable current (I_i) $\leq 300mA$

IS circuit allowable electric power (P_i) $\leq 1W$

Internal capacitance (C_i) = 30nF

Internal inductance (L_i) = 0.2mH

(TIIS)

- Ex d [ia] IIC T4 (in preparation)

Temperature class	Amb. temperature	Process temperature
T4	-20°C to +55°C	-20°C to +130°C

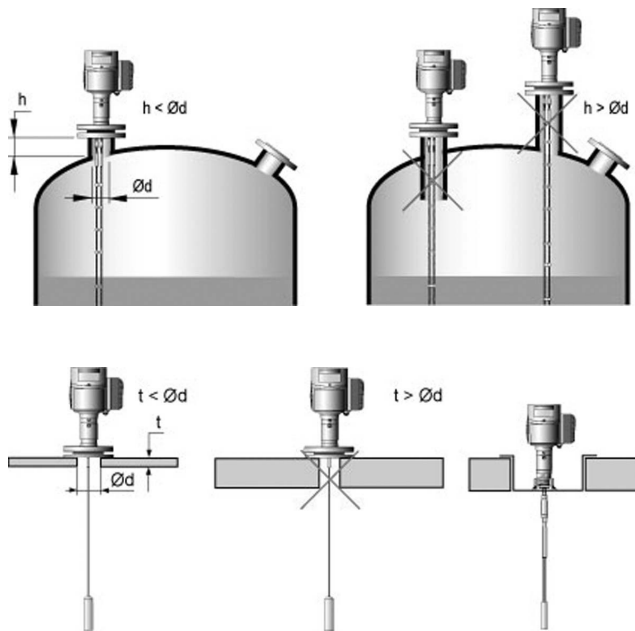
TIIS approval number: (in preparation)

PRECAUTIONS FOR INSTALLATION

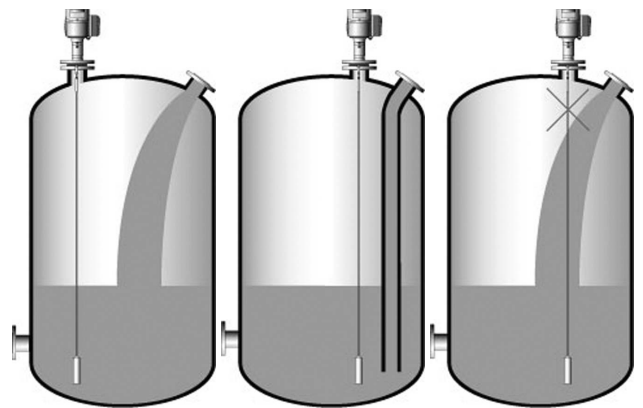
When installing a guide radar in a tank, refer to the following precautions about the fixing position and installation nozzle etc.

- Regarding the length of a nozzle to attach, make it less than 100mm. When longer than 100mm, pay attention not to make it larger than the diameter of the nozzle. If this condition is not fulfilled, the dead band length is generated from the lower end of a nozzle.
- When the fluctuation of the liquid in a tank is intense, the stabilizing processing shall be carried out to a probe point. In the tank with a stirrer, keep a probe apart enough, or fix the top in order that a probe may not be entangled in a stirrer wing. When carrying out the stabilizing processing, the measurement can not be performed at the lower part than the upper position of the processing.
- When the measurement is performed inside a pipe, a probe shall be equipped in the center of the pipe.
- The ambient temperature in the housing should be between -40°C to +80°C. Install a blind at the place where the direct sunlight hits.
- When the two guide radars are installed in the same tank, detach 1m or more to install.
- When the measurement of the adhesive fluid is made, the installation shall be made so that the adhesion may not be generated inside the nozzle.
- In case of the measurement of powder, a single cable probe shall be used, and do not fix it, making it free.
- In order to prevent a cable from slackening when using a cable probe, set a weight afloat above the tank base, or fix the weight, applying the tension.
- Consider the shape and location of a nozzle so that the probe may not touch the nozzle and tank wall.
- Separate a single probe by more than 300mm and a twin probe by more than 100mm from the wall of a tank, to install the guide radar.

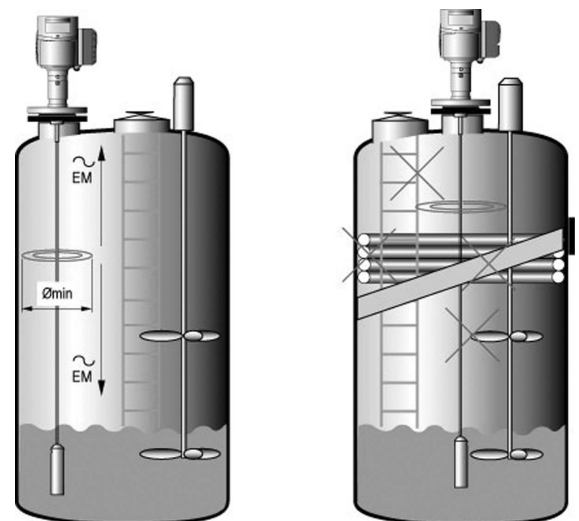
- Avoid using long and narrow nozzle. Regarding the diameter of nozzle, make it larger than the nozzle length, and do not make the projection of nozzle in a tank. When the installation of nozzle is made in a concrete tub, make the sum of the thickness of concrete and the length of nozzle not to be longer than the diameter of hole.



- The installation is to be made in the location where the object to tank does not touch probe directly. Moreover, the main stream of flow should be separated from the probe by 300mm or more.

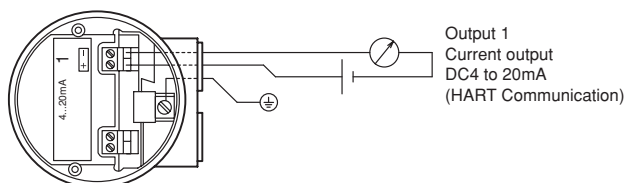


- When the obstructions such as a ladder, a heating coil etc. are in a tank, the installation of single rod and single cable probe is to be made, separated by 300mm or more from the obstruction, and twin rod and twin cable probe are to be installed, separated by 100mm or more.



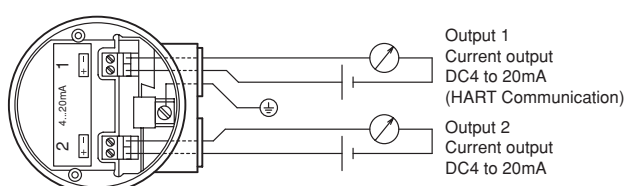
WIRING DIAGRAM

1 In case of being used by current output

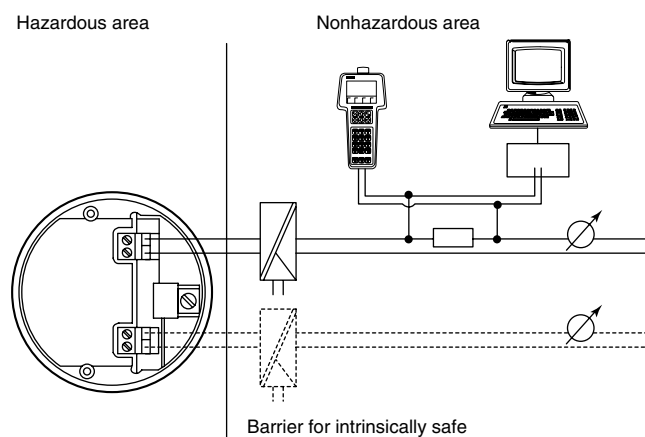


Output 1	Max. load resistance: 350Ω	
	External power supply	Exd: Max. DC36V Non-Ex, Exi: Max DC30V
Output 2	Max. load resistance: 350Ω	
	External power supply	Max. DC30V

2 In case of being used by current output



IF USED IN INTRINSICALLY SAFE



- When using TGR3000 at the hazardous area as intrinsically safe instrument, the intrinsically barrier shall be used.
- The items as mentioned in "Precautions for installation" shall be observed when used as explosion proof instrument.
- Regarding the required supply power when using insulating barrier, the specification for barrier shall be confirmed.

PROBE MATERIAL / LENGTH / CONSTRUCTION

Model / Probe type		TGR3101	TGR3201		TGR3301	TGR3102	TGR3202
		Single rod	Single cable		Coaxial probe	Twin rod	Twin cable
Probe diameter		8mm	4mm	8mm	8mm	8mm	4mm
Probe length (Max.)		3m	35m	35m	3m	3m	8m
Relative conductivity		>1.8	>1.8	>1.8	>1.4	>1.6	>1.6
Process connection	G3/4, 3/4"NPT male thread	○	○		○		
	G1, 1"NPT male thread	○	○		○		
	G1 1/2, 1 1/2"NPT male thread	○	○	○	○	○	○
	Flange 40A JIS10K	○	○		○		
	Flange 50A JIS10K	○	○		○	○	○
	Flange 80A JIS10K	○	○		○	○	○
	Flange 100A JIS10K	○	○	○	○	○	○
	Flange 1 1/2" ANSI class150	○	○		○		
	Flange 2" ANSI class150	○	○		○	○	○
	Flange 3" ANSI class150	○	○		○	○	○
	Flange 4" ANSI class 150	○	○	○	○	○	○
Probe material	316SS		○	○			○
	316L SS	○			○	○	
	Hastelloy C-22	○	○		○	○	
Weight termination	w/o	○			○	○	
	φ 20 X 100mm		○				
	φ 38 X 60mm						○
	φ 38 X 245mm			○			
	φ 12 X 100mm			○			
Measuring object	Liquid of low dielectric constant				○	○	○
	Liquid of high dielectric constant	○	○		○	○	○
	Slurry	○	○				
	Crystalline liquid	○	○				
	Foamy liquid	○	○		○		
	Solids			○			
	Interface				○	○	○
Measuring condition	Long nozzle				○	○	○
	Nozzle for small connection				○	○	○
	Measurement for small tank				○	○	○
	Without Non-measurable zone				○		
	Internal chamber	○	○		○	○	○
	External chamber	○	○		○	○	○
	Tank with agitator		○*		○	○	○*
	Tank with projection things				○	○	○

*The end of the probe shall be fixed to the tank bottom.

MODEL AND SPECIFICATION CODES

Model : TGR3000

[illegible]

*1: The minimum unit of probe length is to be 1cm, and put it down in 4 digits.
For example: In case of 258 cm and 1258 cm, make them 0258 and 1258 respectively.
The numerical value less than 1cm can not be designated.
Contact factory beforehand if the length of a rod or a coaxial probe is more than 3m.

*2: When special specification is required, add a word "Z" at the end of code.
(Ask factory in advance about the possibility of production.)

STANDARD ACCESSORIES

- Parameter sheet: 1
- Instruction manual: 1

OPTION

- G1/2 watertight gland for cable entry (Symbol: WG)
- Other standard data setting (with parameter sheet) (Symbol: DS)

ORDERING INFORMATION

ORDERING INSTRUCTIONS

1. Model and spec. code
Example) Model : TGR3101
Spec. code: VF7140000000602074000000
2. Probe length
Specify the length (cm).
3. Option (if required)
Specify by the symbol referring to "OPTION".
4. Special request (if required)
Please state special requests clearly.
Consult Tokyo Keiso or representative before ordering.

Measurement

☐Level ☐Interface
Measuring range () m

Product

Name ()
Dielectric constant ϵ_r ()
Material ☐Liquid ☐Slurry ☐Powder (Less than 0.1mm) ☐Pellet (Size: mm)
Corrosivity ☐Non ☐Medium ☐Strong
Stickiness ☐Non ☐Medium ☐Strong
Crystalline ☐Non ☐Medium ☐Strong
Waving ☐Non ☐Medium ☐Strong
Foam ☐Non ☐Medium ☐Strong

Operating condition

Measuring condition ☐Outdoor use ☐Indoor use
Product temperature () °C
Ambient temperature () °C
Pressure ()
Flameproof ☐Not required ☐Required

Vessel

Shape ☐Ground tank ☐Underground tank ☐Closed pit ☐Open pit
Height ()
Diameter or width ()
Obstructive inner structures ☐No ☐Yes: ☐Agitator (Shape:) ☐Temp. sensor
☐Level switch ☐Reinforce or stay ☐Ladder ☐Others ()
Material ☐Metal () ☐Liner or coating: ☐Yes ☐No
☐Non metal ()

Installment condition

Place Distance from Tank wall () m
Distance from nozzle () m
Distance from obstruction () m
Mounting nozzle Diameter () m
Length () m

*Specification subject to change without notice

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