

2-Wire transmission type TGR4500

Micro-pulse level meter

OUTLINE

TGR4500 series is a unique 2-wire continuous level-measuring instrument using micro-pulse reflection.

A micro-pulse emitted from the electronics propagates along the probe and reflects on the surface of the product. The reflected pulse propagates back along the probe to the electronics. The level can be measured by computing the time interval between emission and receipt of the pulse.

Thanks to the probe, the efficiency of the micro-pulse propagation is high and dense. Thus only low energy is required even for the measurement of low dielectric constant product. Temperature, pressure and density change will not influence the measurement. High accuracy measurement and measurement in narrow spaces are also possible.

Thanks to the 2-wire loop powered system, reduction of cable cost and installation cost are available.

FEATURES

- ☐ Micro-pulse achieves high accuracy regardless of the temperature and pressure change, vapor and dust of the tank.
- □ Density or temperature change of measuring liquid will not affect the measuring accuracy.
- □ Easy change of the basic settings and confirmation of the identifying value, with the display unit
- □ Non-moving parts guarantee maintenance-free operation.
- ☐ Thanks to the 2-wire loop powered system, reduction of cable and installation cost are possible.
- Thanks to the 2-wire loop powered system, revamp from other devices is also available easily.
- ☐The device is delivered with factory setting, and therefore no need for field calibration.

OPERATION PRINCIPLE

TGR4500 is a unique continuous level-measuring instrument based on TDR (Time Domain Reflectometry) technology.

TDR is well known technology for the detection of the reflection point of micro-pulse based on propagation time from emission to receipt of reflection pulse. A micro-pulse emitted from the electronics propagates along the rod or cable probe and reflects on the surface, where the dielectric constant differs.

The surface of a liquid is the point where the dielectric constant suddenly changes. Since reflective strength is dependent on the dielectric constant of measuring liquid, strong reflection can be obtained from a liquid with a high dielectric constant.

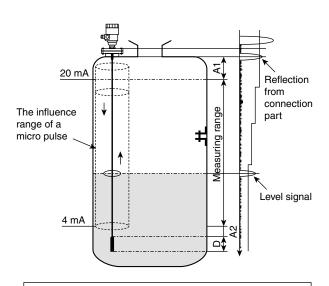
TGR4500 measures the travel time of micro-pulse from emission to receipt of reflection pulse and computes the level. The time is proportional to the traveling distance of the pulse.

The propagation speed of the micro-pulse is almost constant in the gas phase. It will remain constant regardless of temperature or pressure change of the gas phase.

The measured level by TDR is therefore very accurate.

Neither change of the temperature in a tank, pressure, and a dielectric constant, nor the dust on the surface of liquid, vapor, a bubbles etc affect the measurement.





Refer to the technical data for A1, A2, and D.

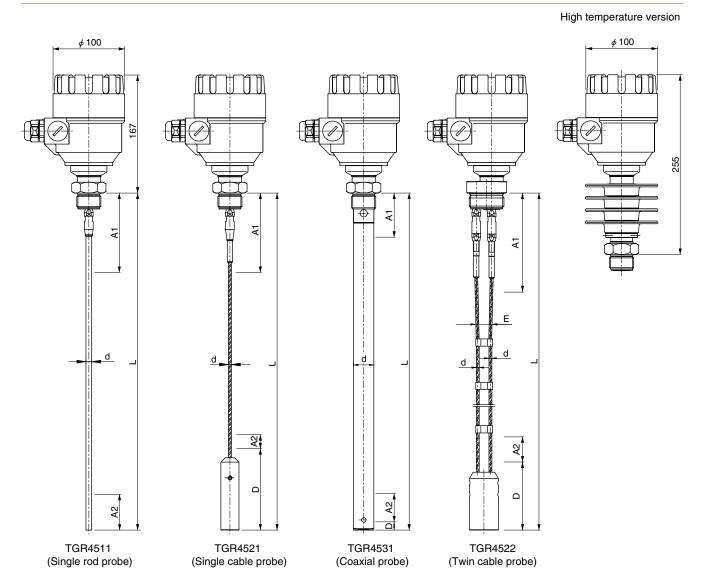
STANDARD SPECIFICATION

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	Objects	Item	Contents				
б		Measurable materials	Liquids				
Measuring object	Measuring	Measuring method	Time Domain Reflectmetry (TDR)				
leas obj	object		Level, distance, or volume				
_		Output variables Output	DC4 to 20 mA (HART)				
		Resolution	±2 µA				
		Temperature drift	±2 μΛ 0.5 μΛ/K (Key value)				
	Output		Selection of "Hold" or "DC22 mA"				
		Output when error occurs Max. load resistance	750 Ω				
		Start-up drift	After turning on a power-supply, normal directions are carried out in about 50 seconds.				
		20°C	Measurement distance < 15 m: ± 15 mm + 0.01% FS				
	Accuracy	Based on a basal condition	Measurement distance ≥ 15 m: ± 0.1% of Reading + 0.01% FS				
lug		Display	LCD dot-matrix				
isno	Display unit	0	Display item: Level, Ullage (Distance), Volume, Ullage Volume,				
ا کر کر		Controlling button	4 push button				
l e		Product temperature	Single rod, Single cable: –30 to 200°C (However, care about process connection temperature)				
cati	Measurement		Twin cable, Coaxial: –30 to 150°C (However, care about process connection temperature)				
ecifi	condition	Thermal shock resistance	100°C/min				
ds		Maximum operating pressure	4 MPa				
Electric specification of housing	Specification	Protection class	IP65 (IEC 60529 / JIS C0920)				
Ele	of instrument	Ambient temperature	-20 to 60°C (Standard type), -30 to 60°C (With out display unit)				
		Temperature of process connection	-30 to 90°C (Standard type), -30 to 200°C (High temp. version)				
		Туре	2-wire loop powered system				
	Electric connection	Power supply	Rated voltage: DC 24 V				
		Cabla	Voltage range: DC 18 to 35 V (Standard type), DC 18 to 28 V (Explosion proof type)				
		Cable	Max. 1.5 mm², Finished outer diameter: 11 mm or less				
		Cable entry	M20 x 1.5 female screw, G1/2 female screw (with adapter), 1/2NPT female screw				
	Material	Seal	FPM (Fluorine rubber)				
	Maight	Housing	Aluminium alloy				
	Weight	Aluminium housing Probe type	1.5 kg (Screwing installation, without probe) Single rod				
		,,	3 m / Ø8 mm				
		Maximum length / Probe diameter Material	Stainless steel (SS316)				
	TGR4511	Dielectric constant	er > 2.3				
	10114511	Dead zone, Non linear range	0.4 m (Upper part: A1), 0.1 m (Lower part: A2) : Refer to DIMENSIONS.				
		Process connection	G1" Male screw, 1" NPT Male screw				
		Weight	0.41 kg/m				
		Probe type	Single cable				
		Maximum length / Probe diameter (weight)	24 m / Ø4 mm / (Ø25 mm × 100 mm)				
		Material	Stainless steel (SS316), FEP coated probe				
	TGR4521	Dielectric constant	er > 2.3				
_		Dead zone, Non linear range	0.4 m (Upper part: A1), 0.1 m (Lower part: A2) : Refer to DIMENSIONS.				
atio		Process connection	G1" Male screw, 1" NPT Male screw				
Probe specification		Weight	0.12 kg/m				
sbe		Probe type	Twin cable				
age		Maximum length / Probe diameter (weight)	24 m / Ø4 mm (Ø40 mm × 80 mm)				
P		Material	Stainless steel (SS316), FEP (Spacer)				
	TGR4522	Dielectric constant	er > 1.8				
		Dead zone, Non linear range	0.3 m (Upper part: A1), 0.1 m (Lower part: A2) : Refer to DIMENSIONS.				
		Process connection	G1-1/2" Male screw, 1-1/2" NPT Male screw				
		Weight	0.24 kg/m				
		Probe type	Coaxial				
		Maximum length / Probe diameter	3 m / Ø28 mm				
		Material	Stainless steel (SS316), PTFE (Spacer)				
	TGR4531	Dielectric constant	gr > 1.5				
		Dead zone, Non linear range	0.05 m (Upper part: A1), 0.1 m (Lower part: A2) : Refer to DIMENSIONS.				
		Process connection	G1" Male screw, 1" NPT Male screw				
		Weight	1.3 kg/m				

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DIMENSIONS



Refer to the probe specification for weight sizes.

There is a dead zone and a nonlinear zone for each probe type. These areas are dielectric constant dependent. Refer to the table below for the selection of probe for the dead zone and non-linear zone.

Non measurable / Non-linear zones

(mm)

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Dielectric constant	Zone	Single rod	Single cable	Coaxial	Twin cable
or- 40	A1	300	300	50	150
εr>40	A2	100	100	100	100
εr≤40	A1	400	400	50	300
ει <u>≥</u> 40	A2	100	100	100	100
_	D	_	Weight length + 50	10	Weight length + 50
_	φd	8	4	28	4
_	E	_	_	_	17

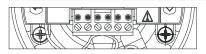
A1: Top dead zone

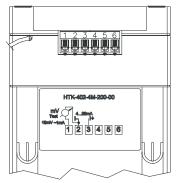
A2: Bottom non-linear zone (Measurement is possible but out of guaranteed range in accuracy.)

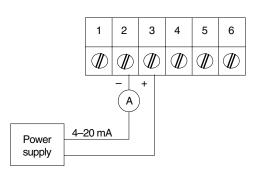
D: Non-measurable zone E: Probe distance L: Probe length (Including weight)

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ELECTRIAL CONNECTION







Terminal No.	Polarity	Description				
2	-	Current out put (DC 4 to 20 mA) Load resistance (M.750 Ω at DC 24 V)				
3	+	External source (Standard type: Max. DC 35 V) (Explosion proof type: Max. DC 28 V)				
1		Check terminal * Do not connect external cable				
4						
5		Not use				
6						

Note:Connect wires while the indicating part is being pulled up.

CAUTION FOR USING EXPLOSION PROOF TYPE

The TGR4500 has the intrinsically safe model also.

Observe the following when the intrinsically safe model is using in the hazardous area

Explosion proof specification

ATEX

II 1G Ex ia IIC T6...T3

II 1G Ex ia IIB T6...T3

(IIB is applied for the probe coated by FEP)

Temperature class	Product temperature	Ambient temperature
T6	≦ + 85°C	≦60°C
T5	≦ + 100°C	≦60°C
T4	≦ + 135°C	≦60°C
Т3	≦ + 200°C	≦60°C

Minimum ambient temperature	Minimum product temperature
−30°C	−50°C

[IS circuit rating]

Allowable supply voltage for IS circuit (Ui) = 30 V

Allowable current for IS circuit (Ii) =150 mA

Allowable electric power for IS circuit (Pi) = 1 W

Internal capacitance (Ci) = 10 nF

Internal inductance (Li) = $10 \mu H$

* The product model in ATEX certification is "Micro TREK H"

When using this model at the hazardous area as in intrinsically safe circuit, the safety barrier shall be used in the non-hazardous area in 2 line loop.

Recommended isolation barrier;

The model KFD2-STC4-Ex1 installed on DIN rail.

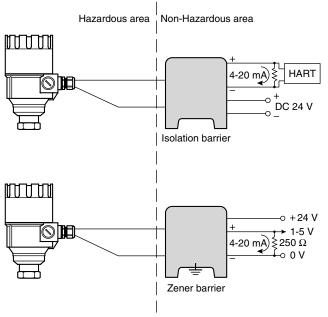
manufactured by PEPPERL + FUCHS

Recommended zener barrier;

The model MTL7087P+ installed on the DIN rail

 $\mbox{MTL7000}$ series manufactured by \mbox{MTL} instruments.

* MTL 7087P+ cannot perform HART communication from the nonhazardous area.



 The power supply requirements are subject to the specifications of isolation barriers when they are used.

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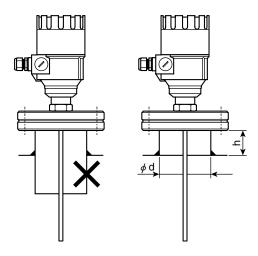
PRECAUTONS FOR INSTALLATION

• The height for the tank nozzle for mounting the instrument is preferably shorter then 100 mm.

When nozzle length is longer than 100 mm, the diameter of the nozzle (\emptyset d) shall be more than the length (h) of the nozzle.

The longer and narrow nozzle leads to wide dead zone and erroneous level reading.

Welding beat and ruggedness, on the inner surface and tip of the nozzle, shall be avoided. Do not extrude the nozzle inside tank.



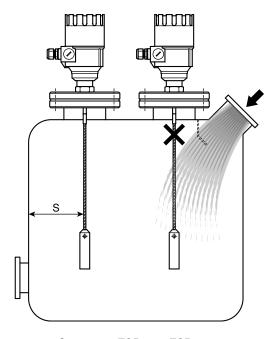
 Keep the probe at a distance from the liquid filling inside and avoid direct contact with liquid flow.

Mount the single rod or cable probe more than 300 mm away from the wall or any projections of the vessel.

Mount the twin cable probe more than 100 mm away from the wall or any projections of the vessel. The coaxial probe is free from above restrictions.

Avoid the physical of the probe with the mounting nozzle and the wall Install the cable probe at the place where it is not moved by the liquid flow or turbulence caused by agitator.

Determine the probe-mounting location where any adhesive material to tank wall will not touch the probe.



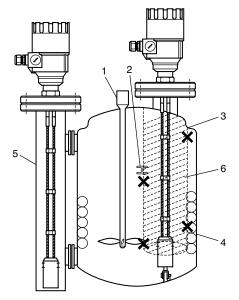
S≧300mm : TGR4511, TGR4521

S≧100mm : TGR4522

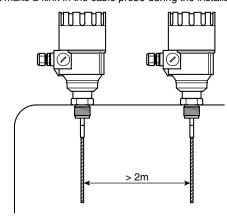
 Do not mount the probe close to the agitator blades. We recommend mounting the probe in a pipe when the tank equipped with an agitator.

Otherwise, fix the tip with a turnbuckle when the strong flow or turbulence may be caused by the agitator or the operation.

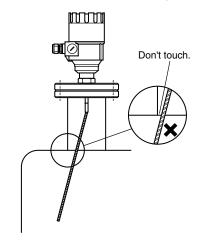
- 1. Agitator
- 2. Tank reinforcement etc.
- 3. Abrupt change of the tank inside shape such as diameter
- 4. Heating or cooling coil
- 5. External chamber
- 6. Micropulse radiation range



 When the two TGR4500 are installed in the same tank, keep a distance between them at least 2 m to avoid the interference.
 Do not make a kink in the cable probe during the installation of it.



Avoid the physical contact the probe with the mounting nozzle.
 Otherwise, the measurement would not be performed.



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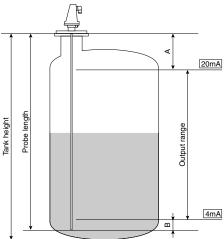
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- Do not introduce foreign materials or deposit adhesive substance inside the coaxial probe.
- Each probe has non-measurement zones both at upper and lower area, and non linear zone also. The dead zone starts from the nozzle end when the probe install onto the long nozzle. Please refer to DIMENSIONS.
- Install the sunshade for the probe head where it is exposed to the sun directly.

STANDARD OUTPUT RANGE

TGR4500 is delivered with current output range (4 to 20 mA) set as follows.

The probe length (means whole length including weight length) minus the length A and B is the standard setting value of output range (4 to 20 mA)



STANDARD OUTPUT RANGE TABLE CLASSIFIED BY PROBE TYPE

(mm)

Range	TGR4511/ Single Rod	TGR4521/ Single cable	TGR4522/ Twin cable				
Α	400	400	50	300			
В	100	200	100	200			
Output range	Probe length-500	Probe length-600	Probe length-150	Probe length-500			
(4 to 20 mA)	Probe length – (A+B)						

A: Upper non-measurement zone B: Lower non-measurement zone

PROBETYPE AND APPLICATION

Prob	е Туре	Single rod	Single cable	Coaxial	Twin cable
Probe lei	ngth (MAX)	3 m	24 m	3 m	24 m
Dielectri	c constant	>2.3	>2.3	>1.5	>1.8
	Low dielectric liquid			0	0
	High dielectric liquid	0	0		
Measuring object	Slurry	0	0		
	Crystallize liquid	0	0		
	Foaming liquid			0	
	Long nozzle			0	0
	Small diameter nozzle			0	0
	Small vessel			0	0
Measuring condition	Short Non measuring zone			0	
Ū	Chamber or by pass chamber measuring	0	0		
	With agitator vessel		(Fix the Probe end)	0	(Fix the Probe end)
	With obstacles vessel			0	0

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^{*} Please consult us for the output range other than mentioned above table before ordering as an optional case.

MODEL AND SPECIFICATION CODES

Model: TGR4500

TGR			-	4	0	0 -	-				/				Description	Standard
	4511						Т								Single rod probe	0
Duck - Turk	4521						Т								Single cable probe	0
Probe Type	4522			Twin cable probe			Twin cable probe									
	4531						Т								Coaxial probe	
Temperature	at I	3													Standard (-30 to +90°C)	0
process conn	nection	7					Т								High temperature version (-30 to +200°C) (ATEX Exprosion proof type: -30 to +150°C)	
		R					T								TGR4511/Single rod probe, Connection : G1"Male thread, Max. 3m	0
		Р					Т								TGR4511/Single rod probe, Connection : 1" NPT Male thread, Max. 3 m	
		K					T								TGR4521/Single cable probe, Connection : G1"Male thread, Max. 24 m	
		L					T								TGR4521/Single cable probe, Connection : 1"NPT Male thread, Max. 24 m	
Probe and pr	rocess	Т					Т								TGR4522/Twin cable probe, Connection : G1-1/2"Male thread, Max. 24 m	
connection		U					T								TGR4522/Twin cable probe, Connection : 1-1/2"NPT Male thread, Max. 24 m	
		Α	П				Т								TGR4531/Coaxial probe, Connection : G1"Male thread, Max. 3 m	
		В					Т								TGR4531/Coaxial probe, Connection : 1" NPT Male thread, Max. 3 m	
		F					Т				П				TGR4521/Single cable probe (FEP coated), Connection : G1"Male thread, Max. 24 m	
		G	П				Т								TGR4521/Single cable probe (FEP coated), Connection : 1"NPT Male thread, Max. 24 m	
Housing			-	4											Aluminium alloy	0
(Fixed code)					0	0	Т								Always 00	
Output / Eval	laaian nu					-	-	4							DC4 to 20mA (HART) Standard	0
Output / Expl	iosion pri	JOI				-	- 8	Ex							DC4 to 20mA (HART) ATEX 1G EEx ia IIC or IIB (FEP Coated Probe)	
Probe length /							Put it down in 4 digits in cm (centimeter) unit (Example: 5m →0500) *1									
Outing for only 1 - 1 - 1						/ (0		None	0						
Option for cable entry / 1							Ī	/ 1	1		With M20×G 1/2 female adapter					
Onesial										Blank	None	0				
Special														/Z	Involved *2	

^{*1 :} For example, the probe length of 153 cm is designated as 0153

STANDARD ACCESSORIES

• Instruction manual: 1

OPTION

 Data setting other than standard output range not mentioned above (with parameter sheet) [Symbol: DS]

DATA SETTING METHODS AFTER DELIVERY

TGR4500 can do the setting change of the basic parameter by display unit.

But in the some parameter (Volume table etc.) can not be changed by the display unit.

When need to change the parameter which can not be changed with the display unit after delivery, it is necessary to change in the setting in the following way.

Method 1 : Send it back to Tokyo Keiso and recalibration will be done by Tokyo Keiso as fare – paying services.

Method 2 : Recalibrate it by customers using following equipment and software.

Personal computers Windows 98 or Windows 2000
 HART converter, communication software PC-Star2

ORDERING INSTRUCTIONS

Specify the following when ordering:

1. Model and specification code

Example: Model TGR4511

Specification code: BR-400-4 / 0153 / 0

2. Probe length

Specify the length in centimeter (cm)

The length can not be specified as small as 1 mm unit.)

- 3. Option features (if required)
- 4. Special requests (if required)

Please state special requests clearly

Consult Tokyo Keiso or representative for the availability before ordering.

- HART communication tool (Option)
- HART Converter
- PC-Star 2 Software (CD-ROM disk×1)

These devices are delivered as a separate packing from the Micro-Pulse level meter.

Please specify the name of the devices and quantity at ordering.

Barriers (Option)

• Recommended isolation barrier :

Type: KFD2-STC4-Ex1 (DIN rail installation)

• Zener barrier : Type : MTL7087P+ (DIN rail installation)

When the TGR4500 is used at the hazardous area as intrinsically safe circuit, the safety barriershall be installed at the non-hazardous area.

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^{*2 :} Add [/Z] at the end of code for special request not mentioned above table and describe your requirements. You are kindly request to consult Tokyo Keiso or representative for your requirements before ordering.

ORDERING INFORMATION

Measuremen	t conditions								
	Measuring range : () m								
Measured flu	<u>id</u>								
	Name	()							
	Dielectric constant	εr ()							
	Material	□Liquid	□Slurry						
	Corrosiveness	□No	□Medium	□Strong					
	Stickiness	□No	□Medium	□Strong					
	Crystallization	□No	□Medium	□Strong					
	Waving	□No	□Medium	☐Strong					
	Foaming	□No	□Medium	□Strong					
	Liquid separation into layer	□No	□Yes						
Vessel									
	Shape	☐Closed tank ☐Flat roo	of tank □Cone	roof tank ☐ Dome roof tank					
		☐ Cylindrical tank horizont	al installation	☐Open tank ☐Closed pit ☐Open pit					
	Height	()							
	Diameter or width	()							
	Obstructive inner structures	□ Agitator □ No □ Yes	(Shape :)					
		☐ Temperature sensors	Level switches	□ Reinforce or stay					
		□Ladder □Others ()						
	Material	□Metal () □	Coating □Yes	□No					
		□ Resin □ Concre	te □Otl	hers					
	Temperature in the vessel	(°C)							
	Pressure in the vessel	()							
Installation co	onditions								
	Place	Distance from Tank wall	() mm					
		Distance from liquid filling	inlet () mm					
		Distance from obstructions	s () mm					
	Mounting nozzle	Diameter	() mm					
		Nozzle length	() mm					
Others									
	Measuring condition	□ Outdoor use □ Indoor	use						
	Ambient temperature	(°C)							
	Explosion proof	□Not required □Required (Intrinsically safety)							

*Specification is subject to change without notice.



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