TECHNICAL GUIDANCE

2-wire System Level Radar

TLR7400

Microwave level meter

OUTLINE

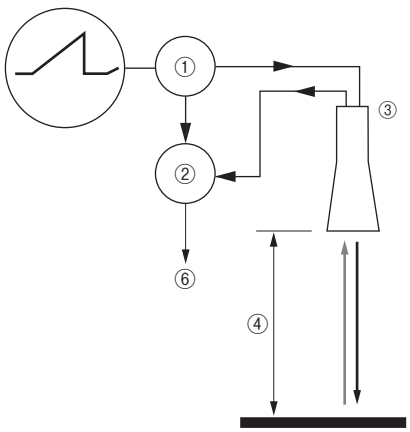
The **TLR7400** is a non-contact type continuous level meter using microwaves. This meter determines the level of a measured object by emitting microwaves and measuring the time taken for the microwaves to travel out, be reflected and return from the object.
Since the velocity of electromagnetic waves is hardly affected by temperature and pressure, meters of this type can accurately measure levels under any conditions. Measurements are also independent of the viscosity, or changes in the density and temperature of measured objects, allowing such meters to be used for a wide range of temperatures and pressures.
The 2-wire transmission system enables high-accuracy and low-cost level measurement. Inheriting the features of existing microwave level meters, the **TLR7400** is even easier to use.

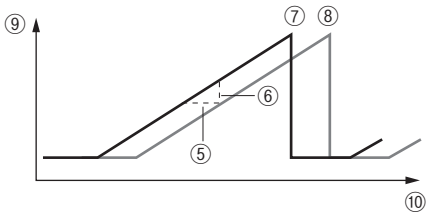
FEATURES

- ❑ Non-contact, continuous level measurement
- ❑ Low total cost achieved by 2-wire system
- ❑ Measuring various objects such as liquids and slurries
- ❑ Displaying and outputting measurements as level, ullage, volume, and mass
- ❑ PTFE drop antennas assuring high corrosion resistance
- ❑ PEEK drop antennas operable at up to 200°C
- ❑ Wide operation range: –50°C to 200°C and vacuum to 4 MPa
- ❑ High-accuracy level measurement independent of changes in temperature, pressure, or density
- ❑ Easy mounting on top of tanks
- ❑ Simple mounting thanks to the compact housing design
- ❑ Quick start with simple parameter setting
- ❑ Quick start with interactive parameter setting
- ❑ Maintenance-free with no moving parts

MEASUREMENT PRINCIPLE

Microwaves, whose frequency linearly changes in the main body, are continuously emitted from the antenna. The microwaves are reflected by the measured object and return to the antenna. Based on the frequency of the returned microwaves, the return time can be calculated. Since the propagation speed of microwaves is constant, the return time is used to calculate the distance to the measured object. The calculated distance can be displayed (output) as a level, based on the preset tank data.





① Emitted microwaves
② Received microwaves
③ Antenna
④ Distance
⑤ Time difference
⑥ Frequency difference
⑦ Emitted microwaves
⑧ Received microwaves
⑨ Frequency
⑩ Time

TOKYO KEISO CO., LTD.

TG-L2184-E01
2nd edition Jul 2022 K
1st edition Oct 2021 K

STANDARD SPECIFICATIONS

	Item	Description
Measurement	Object	Liquids, pastes, and slurries
	Method	Frequency modulated continuous wave (FMCW)
	Frequency	24 to 26 GHz (K band)
	Output	Level, distance, volume, and mass
	Range	Max. 100 m (depends on the dielectric constant of the measured objects and antenna type)
	Minimum output range	0.2 m
	Minimum dead zone	Antenna length + antenna extension length + 0.2 m (depends on the measuring conditions) Antenna length + 0.3 m (when measuring in a pipe)
Output	Output	4–20 mA DC (HART)
	Accuracy	±0.01 mA (at 20ºC) (Output accuracy is added to the accuracy of the display value.)
	Resolution	±5 µA
	Temperature drift	50 ppm/K (typical)
	Error signal	21.5 mA DC, 3.5 mA DC (selectable by parameter)
	Load resistance (max.)	R [Ω] ≦ (Supply voltage – 12 V)/21.5 mA (Standard type/Ex i)
		R [Ω] ≦ (Supply voltage – 16 V)/21.5 mA (Ex d)
Accuracy		±3 mm R. D. (less than 10 m), ±0.03%/R. D. (10 m or more)
	Standard conditions	Temperature: 15ºC to 25ºC Pressure: 0.1 MPa ±5 kPa Humidity: 60% ±15% Target: Metal plate
Resolution		1 mm
Repeatability		1 mm
Measuring conditions	Temperature of process connection	–50 to +200ºC The operating temperature range depends on the antenna types and seal materials. Refer to ANTENNA SPECIFICATIONS.
	Operating pressure	0 kPa (abs) to 4.0 MPa
	Dielectric constant	1.4 or more: Direct mode (depends on the measuring conditions and antenna types) 1.1 or more: TBF mode ※1
	Change rate (max.)	60 m/min (depends on the measuring conditions)
Instrument specifications	Ambient temperature	–40 to +80ºC (For explosionproof type, refer to EXPLOSIONPROOF SPECIFICATIONS.)
	Relative humidity	0 to 99% (no condensation)
	Storage temperature	–40 to +85ºC
	Protection class	IP66/IP68[IEC60529]
		NEMA250: NEMA type 6
	Explosionproof	ATEX explosionproof II ½ G Ex ia IIC T6...T3 Ga/Gb II ½ D Ex ia IIIC T85°C...T150°C or T85°C...T200°C Da/Db II ½ G Ex db ia IIC T6...T3 Ga/Gb II ½ D Ex ia tb IIIC T85°C...T150°C or T85°C...T200°C Da/Db
		IECEx Ex ia IIC T6...T3 Ga/Gb Ex ia IIIC T85°C...T150°C or T85°C...T200°C Da/Db Ex db ia IIC T6...T3 Ga/Gb Ex ia tb IIIC T85°C...T150°C or T85°C...T200°C Da/Db
		JPN Ex Ex ia IIC T6...T3 Ga/Gb Ex ia IIIC T85°C...T150°C or T85°C...T200°C Ga/Gb Ex db ia IIC T6...T3 Ga/Gb Ex ia tb IIIC T85°C...T150°C or T85°C...T200°C Ga/Gb
Electrical connection	Type	2-wire loop-powered system
	Power supply	Rated voltage: 24 V DC
		Voltage range: 16 to 36 V DC (Ex d), 12 to 30 V DC (Standard type, Ex i) ※2
	Cable entry	M20 × 1.5, ½″ NPT female gland
	Terminal	0.5 to 2.5 mm^2
	Cable outer diameter	7 to 12 mm
Material	Housing	Aluminum (polyester coating)
	Process connection	Stainless steel (SS316L)
	Antenna	Metal horn antenna: Stainless steel (SS316L) Drop antenna: PTFE, PEEK Antenna extension: Stainless steel (SS316L) Flange plate: PTFE
	Seal	FKM/FPM, Kalrez 6375, EPDM
	Weather protection	Stainless steel (SS316L)
Display	Display panel	LCD with backlight, 128 × 64 pixels in 64-step gray scale
		Language: English or Japanese
	Control unit	4 key buttons (Right, Enter, Up and Down)
Process connection	Thread	G1-½, 1-½″ NPT male thread
	Flange	JIS 10K 40 to 200 A
		1-½″ to 8″ ASME 150 lbs, 300 lbs

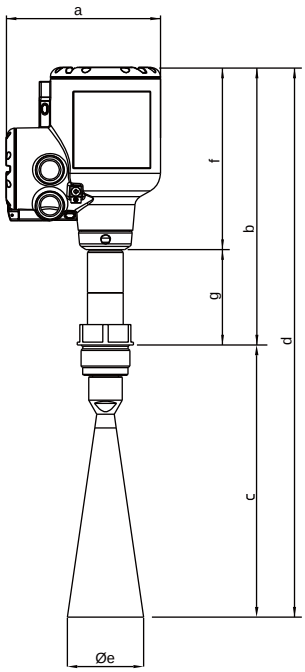
※1: The dielectric constant of measured objects may not be measured depending on the measuring conditions.
※2: Voltage supply required to output 21.5 mA

ANTENNA SPECIFICATIONS

	Description	
Antenna type	DN40 (1-½") metal horn antenna	
	DN50 (2") metal horn antenna	
	DN80 (3") metal horn antenna	
	DN100 (4") metal horn antenna	
	DN150 (6") metal horn antenna	
	DN200 (8") metal horn antenna	
	DN80 (3") PTFE drop antenna	
	DN100 (4") PTFE drop antenna	
	DN150 (6") PTFE drop antenna	
	DN80 (3") PEEK drop antenna	
Beam angle	DN40 (1-½") metal horn antenna: 17 degrees	
	DN50 (2") metal horn antenna: 16 degrees	
	DN80 (3") metal horn antenna: 9 degrees	
	DN100 (4") metal horn antenna: 8 degrees	
	DN150 (6") metal horn antenna: 6 degrees	
	DN200 (8") metal horn antenna: 5 degrees	
	DN80 (3") PTFE drop antenna: 8 degrees	
	DN100 (4") PTFE drop antenna: 7 degrees	
	DN150 (6") PTFE drop antenna: 4 degrees	
	DN80 (3") PEEK drop antenna: 9 degrees	
Measuring range	Max. 10 m : DN40/DN50 metal horn antenna	
	Max. 40 m : DN80/DN100 metal horn antenna	
	Max. 40 m : DN100/DN80 drop antenna	
	Max. 100 m : DN150 / DN200 metal horn antenna	
	Max. 100 m : DN150 drop antenna	
Operating temperature	Metal horn antenna	−40 to +200°C (Seal material: FKM/FPM) −20 to +200°C (Seal material: Kalrez) −50 to +150°C (Seal material: EPDM)
	PTFE drop antenna	−40 to +150°C (Seal material: FKM/FPM) −20 to +150°C (Seal material: Kalrez) −50 to +150°C (Seal material: EPDM)
	PEEK drop antenna	−40 to +200°C (Seal material: FKM/FPM) −20 to +200°C (Seal material: Kalrez) −50 to +150°C (Seal material: EPDM)
Operating pressure	0 kPa (abs) to 4.0 MPa: Metal horn antenna	
	0 kPa (abs) to 4.0 MPa: PTFE drop antenna	
	0 kPa (abs) to 4.0 MPa: PEEK drop antenna	

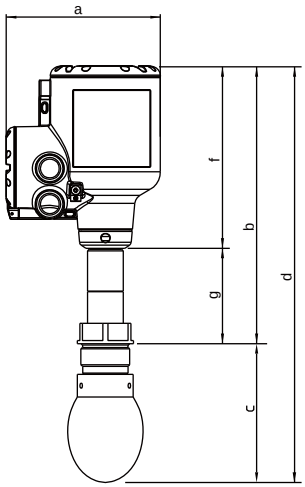
EXTERNAL DIMENSIONS

Metal horn antenna: Thread connection



Antenna type	Dimensions [mm]						
	a	b	c	d	ϕe	f	g
DN40 (1-½")	151	272	143	415	39	179	93
DN50 (2")	151	272	157	429	43	179	93
DN80 (3")	151	272	267	539	75	179	93
DN100 (4")	151	272	336	608	95	179	93
DN150 (6")	151	272	491	763	140	179	93
DN200 (8")	151	272	663	935	190	179	93

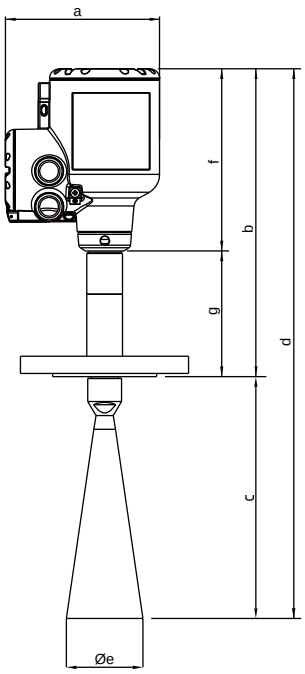
Drop antenna: Thread connection



Antenna type	Dimensions [mm]						
	a	b	c	d	ϕe	f	g
DN80 (3")	151	272	139	411	74	179	93
DN100 (4")	151	272	162	434	94	179	93
DN150 (6")	151	272	220	492	144	179	93

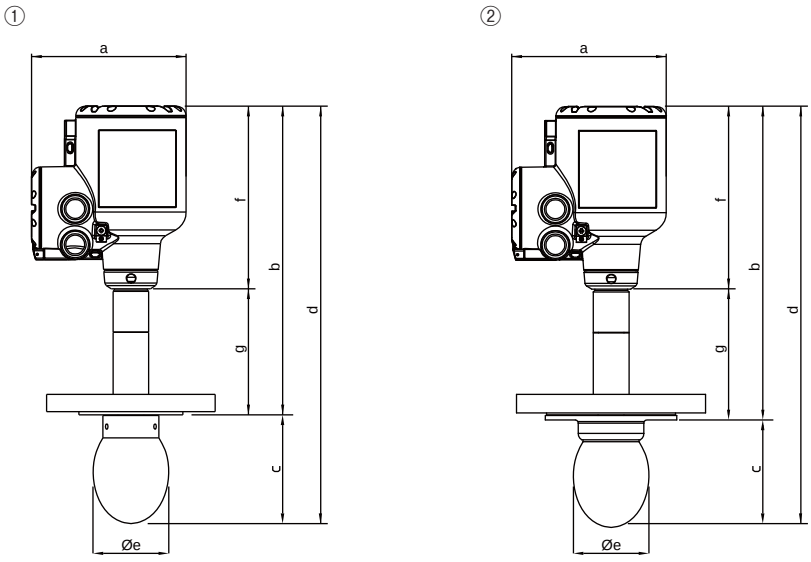
※After the process connection is completed, mount the drop antenna (thread connection type).
Make sure that the mounting conditions are appropriate.

Metal horn antenna: Flange connection



Antenna type	Dimensions [mm]						
	a	b	c	d	ϕe	f	g
DN40 (1-½")	151	302	114	416	39	179	123
DN50 (2")	151	302	127	429	43	179	123
DN80 (3")	151	302	237	539	75	179	123
DN100 (4")	151	302	306	608	95	179	123
DN150 (6")	151	302	461	763	140	179	123
DN200 (8")	151	302	633	935	190	179	123

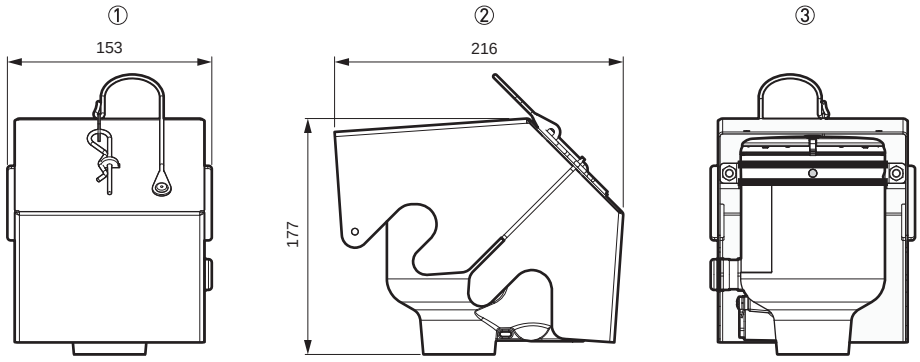
Drop antenna: Flange connection



Process connection	Antenna type	Dimensions [mm]						
		a	b	c	d	ϕe	f	g
① Standard flange connection	DN80 (3")	151	302	110	412	74	179	123
	DN100 (4")	151	302	133	435	94	179	123
	DN150 (6")	151	302	191	493	144	179	123
② Standard flange connection with flange plate※	DN80 (3")	151	307	105	412	74	179	128
	DN100 (4")	151	307	127	434	94	179	128
	DN150 (6")	151	307	186	493	144	179	128

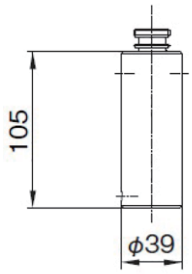
※ Only for PTFE drop antennas

Weather protection



① Front
② Left side
③ Back

Antenna extension



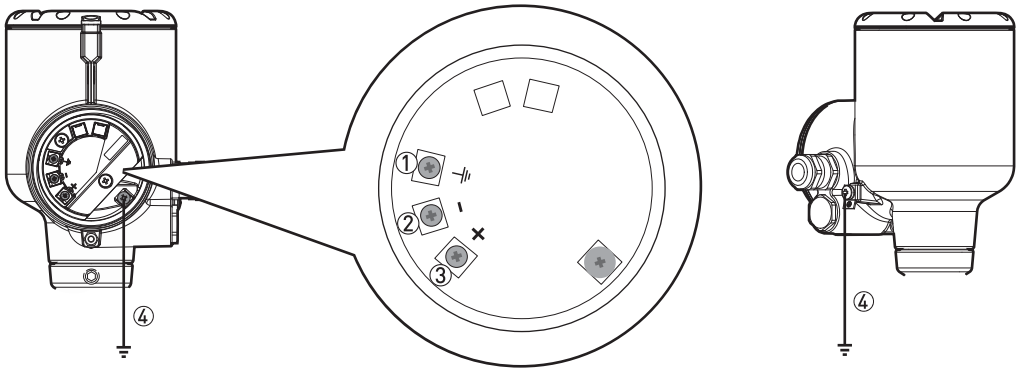
MASS

Part name		Specification	Mass [kg]
Housing		Aluminum	3.0
Antenna*1	Metal horn antenna	DN40 (1-1/2”) metal horn antenna	2.3 to 58.7
		DN50 (2”) metal horn antenna	2.3 to 58.7
		DN80 (3”) metal horn antenna	2.5 to 58.9
		DN100 (4”) metal horn antenna	2.6 to 59.0
		DN150 (6”) metal horn antenna	3.0 to 59.4
		DN200 (8”) metal horn antenna	3.7 to 60.0
	Drop antenna	DN80 (3”) PTFE drop antenna	3.1 to 59.2
		DN100 (4”) PTFE drop antenna	3.8 to 60.2
		DN150 (6”) PTFE drop antenna	7.2 to 63.6
		DN80 (3”) PEEK drop antenna	2.8 to 59.2
Antenna extension		105 mm	0.92
		210 mm	1.84
		315 mm	2.76
		420 mm	3.68
		525 mm	4.60
		630 mm	5.52
		735 mm	6.44
		840 mm	7.36
		945 mm	8.29
		1050 mm	9.20
Option			
Weather protection		Stainless steel	1.3
Flange plate		DN80 PTFE	0.3
		DN100 PTFE	0.5
		DN150 PTFE	0.7

※1: Mass of an antenna includes that of the process connection.

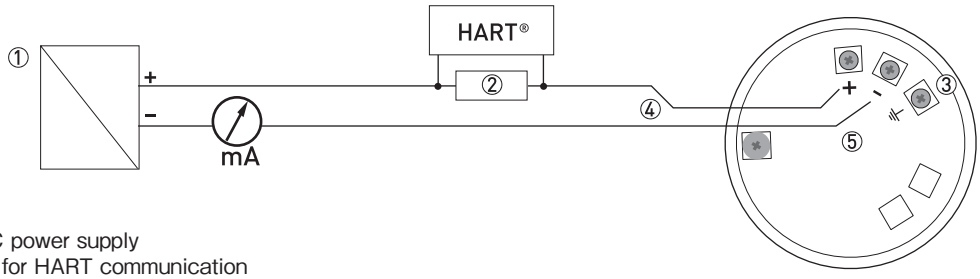
WIRING

Terminals



① Housing ground terminal (connected when the signal line is a shielded cable)
② Signal (power supply) cable (–)
③ Signal (power supply) cable (+)
④ Ground terminal (underneath the converter housing)

Wire connection



① 24 V DC power supply
② Resistor for HART communication
③ Housing ground terminal
④ Signal line
⑤ Housing wire connection board

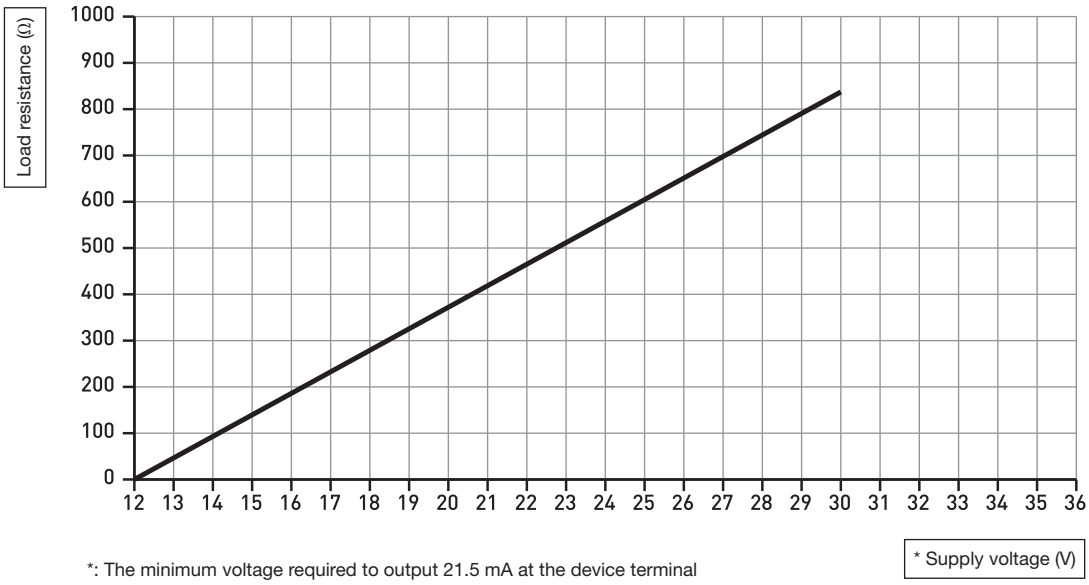
- Use stranded cable of 0.5 to 2.5 mm^2 cross section for a signal (power supply) line.
- Avoid laying a signal (power supply) line close to a power cable.
- Use a different power supply for the TLR7400 from those for other power instruments.
- Single-point ground with a shielded cable is recommended.

POWER SUPPLY

The graphs below show the minimum voltage required across a resistor in the loop.

Non-explosionproof products and intrinsically safe products

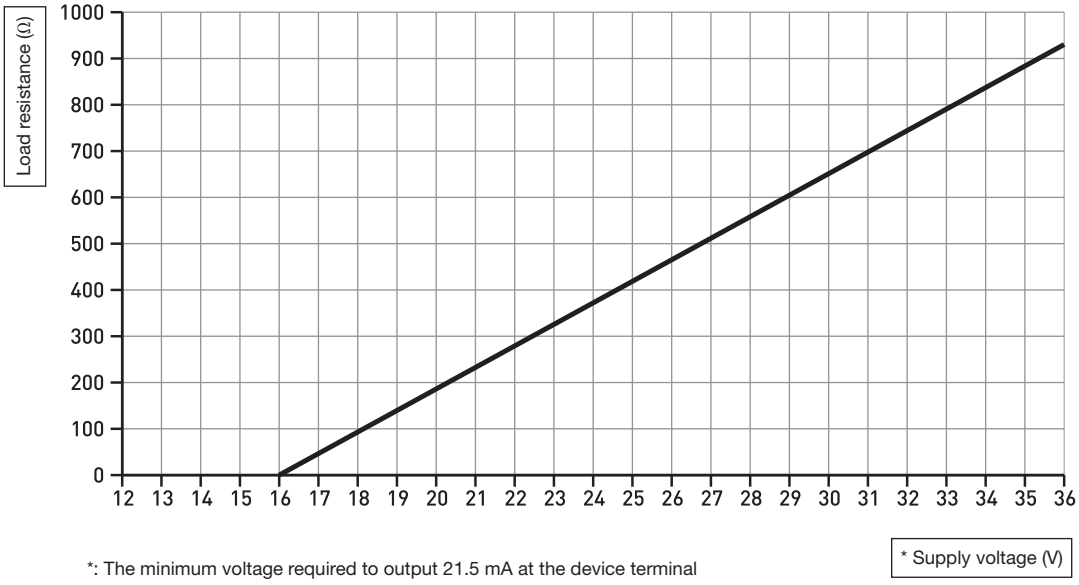
Supply voltage: 12 V to 30 V DC



*: The minimum voltage required to output 21.5 mA at the device terminal

Flameproof products

Supply voltage: 16 V to 36 V DC



*: The minimum voltage required to output 21.5 mA at the device terminal

EXPLOSIONPROOF SPECIFICATIONS

ATEX
Certification No. KIWA 19ATEX0015X

II ½ G Ex ia IIC T6...T3 Ga/Gb
II ½ D Ex ia IIIC T85°C...T150°C or T85°C...T200°C Da / Db
II ½ G Ex db ia IIC T6...T3 Ga/Gb
II ½ D Ex ia tb IIIC T85°C...T150°C or T85°C...T200°C Da / Db

EPL Ga/Gb Temperature class	EPL Da/Db Max. surface temperature	Max. ambient temperature [°C]		Max. process temperature [°C]
		Aluminium housing	Stainless steel housing	
T6	T85°C	+60	+60	+60
		+54	+51	+85
T5	T100°C	+75〔+70〕②	+75〔+68〕②	+75
		+69	+66〔+62〕②	+100
T4	T135°C	+72〔+70〕②	+67〔+59〕②	+115
		+68	+61〔+54〕②	+135
T3 ①	T200°C ①	+64	+55〔+50〕②	+150
		+58	+45〔+43〕②	+180
		+54	+38	+200

① Max. process connection temperature is +150°C, if the device has an antenna with an EPDM gasket or a PTFE Drop antenna
② Values in parentheses are for Ex db ia- or Ex ia tb- approved device.

EPL Ga/Gb Temperature class	EPL Da/Db Max. surface temperature	Min. ambient temperature [°C]		Min. process temperature [°C]
		Aluminium housing	Stainless steel housing	
All ③	All ③	–40	–40	–40
		–37	–36	–50

③ Min. process connection temperature is –20°C, if a Kalrez® 6375 gasket is used. Min. process connection temperature is –40°C, if the device has an antenna with an FKM/FPM gasket.

When using the TLR7400 as an intrinsically safe (ia) device with 4–20 mA output, circuit variables must not exceed the following values.

Ui=30 Vdc, Ii=130 mA, Pi=1 W, Ci=10 nF, Li=0 µH

When using the TLR7400 as a flameproof device, the ratings below must be observed.
U_N=36 Vdc, I_N=22 mA, U_N=250 Vac

IECEx
Certification No. IECEx KIWA 19.0009X

Ex ia IIC T6...T3 Ga/Gb
Ex ia IIIC T85°C...T150°C or T85°C...T200°C Da / Db
Ex db ia IIC T6...T3 Ga/Gb
Ex ia tb IIIC T85°C...T150°C or T85°C...T200°C Da / Db

EPL Ga/Gb Temperature class	EPL Da/Db Max. surface temperature	Max. ambient temperature [°C]		Max. process temperature [°C]
		Aluminium housing	Stainless steel housing	
T6	T85°C	+60	+60	+60
		+54	+51	+85
T5	T100°C	+75〔+70〕②	+75〔+68〕②	+75
		+69	+66〔+62〕②	+100
T4	T135°C	+72〔+70〕②	+67〔+59〕②	+115
		+68	+61〔+54〕②	+135
T3 ①	T200°C ①	+64	+55〔+50〕②	+150
		+58	+45〔+43〕②	+180
		+54	+38	+200

① Max. process connection temperature is +150°C, if the device has an antenna with an EPDM gasket or a PTFE Drop antenna

② Values in parentheses are for Ex db ia- or Ex ia tb- approved device.

EPL Ga/Gb Temperature class	EPL Da/Db Max. surface temperature	Min. ambient temperature [°C]		Min. process temperature [°C]
		Aluminium housing	Stainless steel housing	
All ③	All ③	–40	–40	–40
		–37	–36	–50

③ Min. process connection temperature is –20°C, if a Kalrez® 6375 gasket is used. Min. process connection temperature is –40°C, if the device has an antenna with an FKM/FPM gasket.

When using the TLR7400 as an intrinsically safe (ia) device with 4–20 mA output, circuit variables must not exceed the following values.

Ui=30 Vdc, Ii=130 mA, Pi=1 W, Ci=10 nF, Li=0 µH

When using the TLR7400 as a flameproof device, the ratings below must be observed.

U_N=36 Vdc, I_N=22 mA, U_N=250 Vac

JPN Ex
Certificate No. : CML19JPN2030X

Ex ia IIC T6...T3 Ga/Gb
Ex ia IIIC T85℃ ...T150℃ or T85℃ ...T200℃ Da/Db
Ex db ia IIC T6...T3 Ga/Gb
Ex ia tb IIIC T85℃ ...T150℃ or T85℃ ...T200℃ Da/Db

EPL Ga/Gb Temperature class	EPL Da/Db Max. surface temperature	Max. ambient temperature [°C]		Max. process temperature [°C]
		Aluminium housing	Stainless steel housing	
T6	T85°C	+60	+60	+60
		+54	+51	+85
T5	T100°C	+75〔+70〕②	+75〔+68〕②	+75
		+69	+66〔+62〕②	+100
T4	T135°C	+72〔+70〕②	+67〔+59〕②	+115
		+68	+61〔+54〕②	+135
T3 ①	T200°C ①	+64	+55〔+50〕②	+150
		+58	+45〔+43〕②	+180
		+54	+38	+200

① Max. process connection temperature is +150°C, if the device has an antenna with an EPDM gasket or a PTFE Drop antenna

② Values in parentheses are for Ex db ia- or Ex ia tb- approved device.

EPL Ga/Gb Temperature class	EPL Da/Db Max. surface temperature	Min. ambient temperature [°C]		Min. process temperature [°C]
		Aluminium housing	Stainless steel housing	
All ③	All ③	–40	–40	–40
		–37	–36	–50

③ Min. process connection temperature is –20°C, if a Kalrez® 6375 gasket is used. Min. process connection temperature is –40°C, if the device has an antenna with an FKM/FPM gasket.

When using the TLR7400 as an intrinsically safe (ia) device with 4–20 mA output, circuit variables must not exceed the following values.

Ui=30 Vdc, Ii=130 mA, Pi=1 W, Ci=10 nF, Li=0 µH

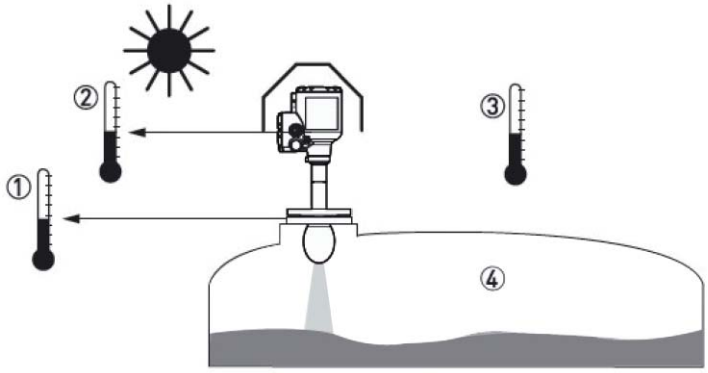
When using the TLR7400 as a flameproof device, the ratings below must be observed.

U_N=36 Vdc, I_N=22 mA, U_N=250 Vac

NOTES ON USE

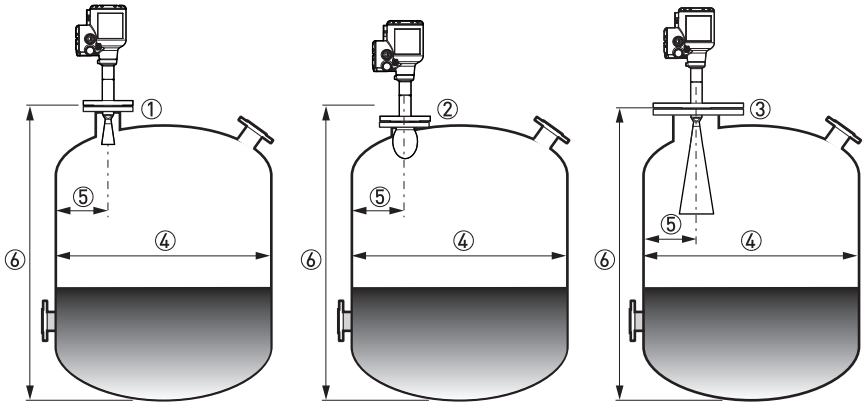
Mounting location

- Avoid direct sunshine. Use a sunshade or weather protection to keep the TLR7400 within the operating temperature range. In particular, do not expose the LCD indicator to direct sunshine. The ambient temperature must be between –40°C and +80°C.
- Do not mount the TLR7400 at a place subject to strong vibration.
- The TLR7400 has a dead zone near the sensor in which the TLR7400 cannot measure the level. This may cause difficulties. Consider the range (vertical length) of this zone when mounting the TLR7400.



① The allowable temperature range of the process connection varies depending on the antenna type and seal material.
② The temperature of the indicator must be between –20°C and +70°C.
③ The ambient temperature must be between –40°C and +80°C. Refer to EXPLOSIONPROOF SPECIFICATIONS for explosionproof types.
④ Use the TLR7400 within the specified pressure range.

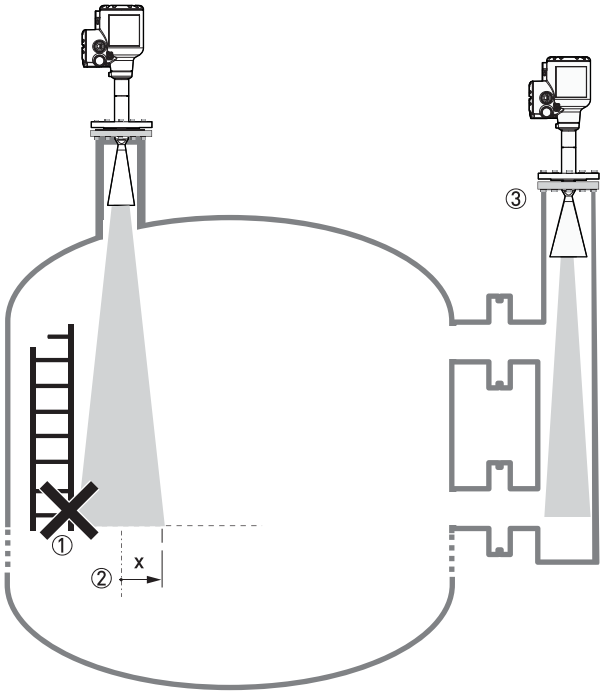
- When the TLR7400 is mounted close to the center of a tank, multiple reflections disturb measurement. Mount it closer to the tank wall (not more than a quarter of the tank diameter from the wall). For a non-cylindrical vessel such as a concrete pit, choose a mounting location where the distances to the two adjacent walls are not equal.
- Recommended mounting locations and distances from the vessel wall are shown below.
  In any case, the TLR7400 must be at least 200 mm off the tank wall.
- Ensure that walls within the emission range of microwaves are smooth.



① Mounting location for DN40 and DN50 metal horn antennas
② Mounting location for DN80 and DN100 metal horn antennas and DN80 drop antenna
③ Mounting location for DN150 and DN200 metal horn antennas and DN100 and DN150 drop antennas
④ Inner diameter of the vessel
⑤ Recommended minimum distance between the mounting location and the vessel wall for each antenna type
- DN40 and DN50 metal horn antennas : Vessel height × 1/5 (in the case of a 5 m high vessel: 5 m × 1/5 = 1 m)
- DN80 and DN100 metal horn antennas : Vessel height × 1/10 (in the case of a 5 m high vessel: 5 m × 1/10 = 0.5 m)
- DN80 drop antenna : Vessel height × 1/10 (in the case of a 5 m high vessel: 5 m × 1/10 = 0.5 m)
- DN150 and DN200 metal horn antennas : Vessel height × 1/20 (in the case of a 5 m high vessel: 5 m × 1/20 = 0.25 m)
- DN100 and DN150 drop antennas : Vessel height × 1/20 (in the case of a 5 m high vessel: 5 m × 1/20 = 0.25 m)

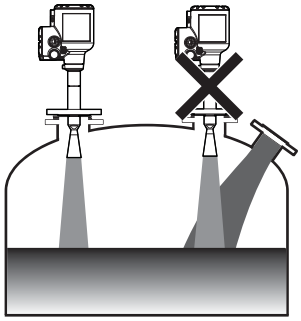
⑥ Height of the vessel

● Ensure that there are no obstacles within the emission range of microwaves.
① Obstacles include agitator, ladders, reinforcements, and heating coils.
② The emission range of microwaves varies depending on the antenna type. Refer to the table below.
③ If there is no appropriate location in the vessel, in-pipe measurement (measuring the level in a pipe) is recommended.

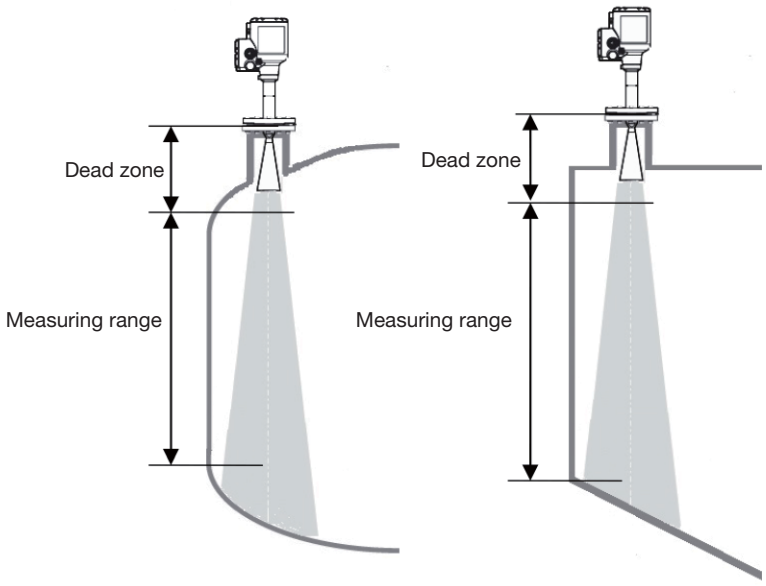


Antenna type	Beam angle	Beam range (x) mm/m
DN40 [1-1/2"] metal horn antenna	17°	150
DN50 [2"] metal horn antenna	16°	141
DN80 [3"] metal horn antenna	9°	79
DN100 [4"] metal horn antenna	8°	70
DN150 [6"] metal horn antenna	6°	53
DN200 [8"] metal horn antenna	5°	44
DN80 [3"] PTFE drop antenna	8°	70
DN100 [4"] PTFE drop antenna	7°	61
DN150 [6"] PTFE drop antenna	4°	35
DN80 [3"] PEEK drop antenna	9°	79

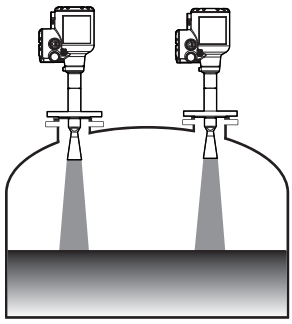
● Avoid a mounting position where any inflow of product enters the emission range of microwaves. Take appropriate measures such as changing the mounting location or the product loading method.



● For tanks whose bottom is not flat but dish- or cone-shaped, the measuring range is from the lower end of the dead zone to the lower end of the cylindrical part of the tank. It is not possible to measure the level precisely below the cylindrical part.

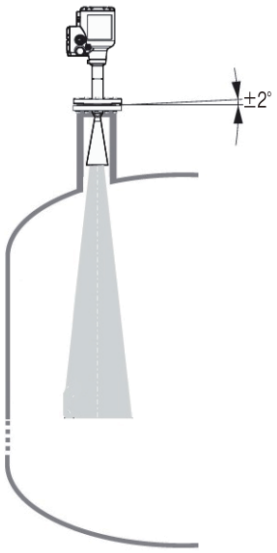


● Multiple TLR7400 units can be mounted on the same vessel. In this case, however, mount them as far as possible from each other.



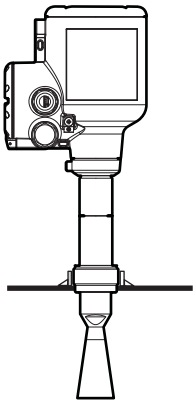
Mounting method

① The mounting flange face should not be tilted more than ±2 degrees.



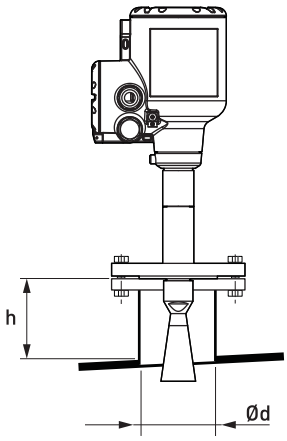
Thread mounting

● Weld a half coupling on the vessel roof. Do not screw in the thread with an excessive torque.



Flange mounting

- Insert a gasket between the flanges of the vessel and the TLR7400 and fix them all with bolts and nuts. A drop antenna with a flange plate does not need a gasket. Fix it to a flange of the vessel with bolts and nuts. Loose fastening will cause the tank atmosphere to permeate into the level meter, which may cause it to fail.
- The antenna tip should stick out from the nozzle down into the vessel. Refer to the table below for allowable maximum nozzle lengths.
- Use an antenna extension when the antenna is shorter than the nozzle. If much condensation within the antenna is expected, do not use it.
- When the nozzle diameter (ød) is larger than the nozzle length (h), antennas shorter than the nozzle can be used.

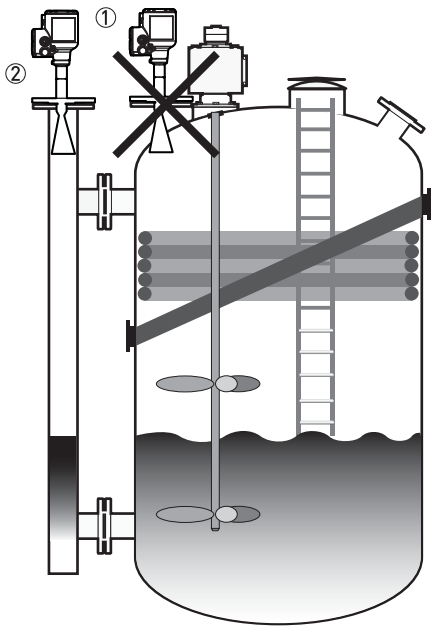


Nozzle diameter (ød)		Allowable max. nozzle length (h)	
		Metal horn antenna	Drop antenna
[mm]	[inch]	[mm]	[mm]
40	1-1/2	140※	—
50	2	150※	—
80	3	260※	60※
100	4	330※	70※
150	6	490※	100※
200	8	660※	—

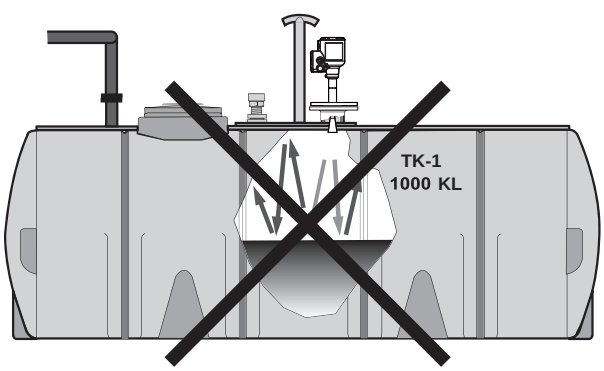
※ When an antenna extension is used, its length is added to the allowable maximum nozzle length.

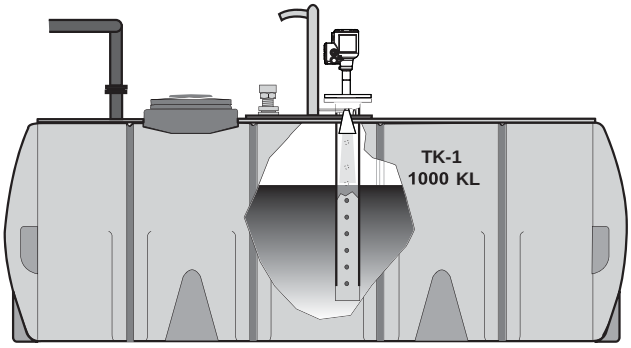
In-pipe measurement (measuring liquids in pipes)

① Do not mount the TLR7400 at a location where any obstacles are in the emission range of microwaves.
② When there are many obstacles in the tank, or heavy waving or foaming is expected, use a pipe for measuring the level.



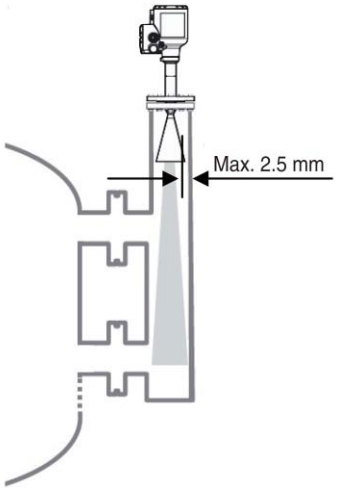
- For horizontal cylindrical vessels, use stilling well or bypass chamber for measuring the level. If it is not possible to install a pipe for measurement, mount the TLR7400 at a location 1/3 of the vessel radius off the vessel center.

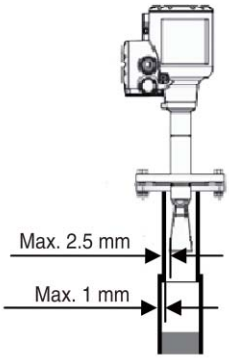




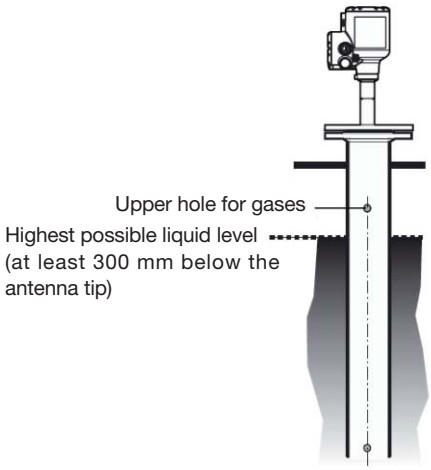
Notes for in-pipe measurement (measuring liquids in pipes)

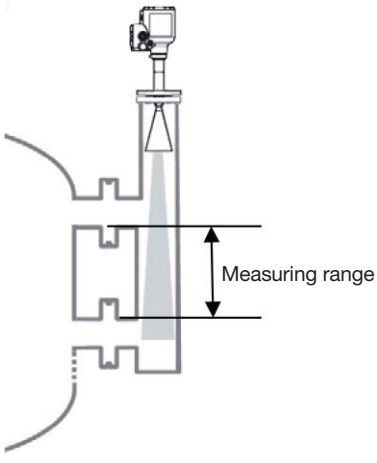
- Use a metal pipe. The inner diameter of the pipe should not be more than 5 mm larger than the outer diameter of the antenna. The roughness of the inner surface of the pipe should be 0.1 mm or less. Changes in the inner diameter of the pipe (because of joints or other reasons) should be 1 mm or less.
- Metal horn antennas are applicable to in-pipe measurement. Drop antennas cannot be used.





- To allow gases to pass, make holes on the internal pipe at the position above the highest possible liquid level. Make sure that upper holes for gases and lower holes for liquids are not clogged.
- In the case of stilling well, levels cannot be measured below the lower end.
- In the case of bypass chamber, the measuring range is between the upper and lower horizontal pipes.





ANTENNAS AND THEIR APPLICATIONS

Type of antenna		Horn antenna					
		DN40	DN50	DN80	DN100	DN150	DN200
Process connection	G1-½ male thread	○	○	×	×	×	×
	NPT1-½ male thread	○	○	×	×	×	×
	40A JIS	○	×	×	×	×	×
	50A JIS	○	○	×	×	×	×
	80A JIS	×	○	○	×	×	×
	100A JIS	×	×	○	○	○	○
	150A JIS	×	×	○	○	○	○
	200A JIS	×	×	○	○	○	○
	ASME 1-1/2"	○	×	×	×	×	×
	ASME 2"	○	○	×	×	×	×
	ASME 3"	×	○	○	×	×	×
	ASME 4"	×	×	○	○	×	×
	ASME 6"	×	×	×	○	○	×
	ASME 8"	×	×	×	×	○	○
Antenna material	Stainless steel (SS316L)	○	○	○	○	○	○
	PTFE	—	—	—	—	—	—
	PEEK	—	—	—	—	—	—
Antenna specifications	Antenna extension	Max.1050 mm	Max.1050 mm	Max.1050 mm	Max.1050 mm	Max.1050 mm	Max.1050 mm
	Flange plate (resin wet-part)	—	—	—	—	—	—
	Beam angle	17 degrees	16 degrees	9 degrees	8 degrees	6 degrees	5 degrees
	Beam range (one side)	150 mm/m	141 mm/m	79 mm/m	70 mm/m	53 mm/m	44 mm/m
Measuring conditions	Bypass chamber	○	○	○	○	○	○
	Stilling well	○	○	○	○	○	○
	Small tank	×	×	○	○	○	○
	Tank with an agitator	△	△	△	○	○	○
	Horizontal cylindrical tank	○※1 (In-pipe measurement)	○※1 (In-pipe measurement)	○※1 (In-pipe measurement)	○※1 (In-pipe measurement)	○※1 (In-pipe measurement)	○※1 (In-pipe measurement)
	Long nozzle	○	○	○	○	○	○
	High temperature	○	○	○	○	○	○
	High pressure	○	○	○	○	○	○
Measured objects	Low dielectric liquid	△	△	○	○	○	○
	High dielectric liquid	○	○	○	○	○	○
	Slurry	○	○	○	○	○	○
	Corrosive liquid	×	×	×	×	×	×
	Sticky liquid	×	×	△	△	△	△
	Volatile liquid	×	×	×	×	×	×
	Foaming liquid	○ In-pipe measurement	○ In-pipe measurement	○ In-pipe measurement	○ In-pipe measurement	○ In-pipe measurement	○ In-pipe measurement

○ : Most suitable, △ : Suitable, × : Not suitable, − : Cannot be used

※1: Measurement is possible in a pipe.

Type of antenna		Drop antenna			
		DN80		DN100	DN150
		PTFE	PEEK	PTFE	PTFE
Process connection	G1-½ male thread	○	○	○	○
	NPT1-½ male thread	○	○	○	○
	40A JIS	×	×	×	×
	50A JIS	×	×	×	×
	80A JIS	○	○	×	×
	100A JIS	○	○	○	×
	150A JIS	×	×	○	○
	200A JIS	×	×	×	○
	ASME 1-½"	×	×	×	×
	ASME 2"	×	×	×	×
	ASME 3"	○	○	×	×
	ASME 4"	○	○	○	×
	ASME 6"	○	○	○	○
	ASME 8"	○	○	○	○
Antenna material	Stainless steel (SS316L)	○※2	○	○※2	○※2
	PTFE	○	—	○	○
	PEEK	—	○	—	—
Antenna specifications	Antenna extension	Max.525 mm ※3	—	Max.525 mm ※3	Max.525 mm ※3
	Flange plate (resin wet-part)	○	—	○	○
	Beam angle	8 degrees	9 degrees	7 degrees	4 degrees
	Beam range (one side)	70 mm/m	79 mm/m	61 mm/m	35 mm/m
Measuring conditions	Bypass chamber	×	×	×	×
	Stilling well	×	×	×	×
	Small tank	○	○	○	○
	Tank with an agitator	○	○	○	○
	Horizontal cylindrical tank	×	×	×	×
	Long nozzle	△	△	△	△
	High temperature	×	○	×	×
	High pressure	○	○	○	○
Measured objects	Low dielectric liquid	○	○	○	○
	High dielectric liquid	○	○	○	○
	Slurry	○	○	○	○
	Corrosive liquid	○※4	×	○※4	○※4
	Sticky liquid	○	○	○	○
	Volatile liquid	○	○	○	○
	Foaming liquid	×	×	×	×

○ : Most suitable, △ : Suitable, × : Not suitable, − : Cannot be used

※2: The material of the wet part should be PTFE to attach a flange plate.
※3: An antenna extension is not used for antennas with a flange plate.
※4: With a flange plate

MODEL AND SPECIFICATION CODES

Model: TLR7400

Metal horn antenna

Spec. code	VFDE	4	4	W		0		2	1				0			*	*	*	0	0			Description
Fixed code		4	4	W																			
Approval					0																		Standard (Non-ex)
					1																		ATEX II ½ G Ex ia IIC T6...T3 Ga/Gb (Intrinsically safe)
					2																		ATEX II ½ G Ex db ia IIC T6...T3 Ga/Gb (Flameproof)
					K																		IECEx Ex ia IIC T6...T3 Ga/Gb (Intrinsically safe)
					L																		IECEx Ex db ia IIC T6...T3 Ga/Gb (Flameproof)
					U																		JPN Ex Ex ia IIC T6...T3 Ga/Gb (Intrinsically safe)
					W																		JPN Ex Ex db ia IIC T6...T3 Ga/Gb (Flameproof)
Fixed code						0																	Always 0
Approval 2							0																N/A
							3																NACE (MR0175 / MR0103 / ISO 15156)
Housing type/material								2															Compact type housing (aluminum)
Output									1														Two-wire system/4–20 mA passive (HART)
Cable entry/cable gland										1													M20 × 1.5/Without cable gland (Cable entry : For G1/2 female thread, select M20 × G1/2 adapter as an option.) (For JPN Ex of flameproof / dust ingnition, select the Flameproof cable gland (G1/2) as an option.)
										2													M20 × 1.5/With a plastic cable gland
										3													M20 × 1.5/With a metal cable gland
										C													½ NPT/Without cable gland
Display											0												Without display unit
											4												With a plug-in display unit
Display language												0											Without display
												1											English
												7											Japanese
Fixed code													0										Always 0
Seal material/temperature range														1									FKM/FPM/–40 to +200°C
														2									EPDM/–50 to +150°C
														3									Kalrez® 6375/–20 to +200°C
Antenna type															1								DN40 Metal horn antenna (ø39 mm)
															2								DN50 Metal horn antenna (ø43 mm)
															4								DN80 Metal horn antenna (ø75 mm)
															5								DN100 Metal horn antenna (ø95 mm)
															6								DN150 Metal horn antenna (ø140 mm)
															7								DN200 Metal horn antenna (ø190 mm)
Antenna extension																0							None
																1							105 mm
																2							210 mm
																3							315 mm
																4							420 mm
																5							525 mm
																6							630 mm (only for metal horn antennas)
																7							735 mm (only for metal horn antennas)
																8							840 mm (only for metal horn antennas)
																A							945 mm (only for metal horn antennas)
																B							1050 mm (only for metal horn antennas)
Process connection																	*	*	*				Choose from the connection table.
Fixed code																				0	0		Always 00
Accessories																						0	N/A
																						1	Weather protection ※2
Special specification																							Blank None
																							/Z For special requirements ※1

※1: Special requirements not included in the above coding system should be designated by adding "/Z" at the end of the code. Consult us for the availability of such requirements before ordering.
※2: Select awning when installing in a place exposed to direct sunshine or heavy wind and rain.

Drop antenna

Spec. code	VFDE	4	4	W		0		2	1				0				*	*	*	0	0			Description
Fixed code		4	4	W																				
Approval					0																			Standard (Non-ex)
					1																			ATEX II ½ G Ex ia IIC T6...T3 Ga/Gb (Intrinsically safe)
					2																			ATEX II ½ G Ex db ia IIC T6...T3 Ga/Gb (Flameproof)
					K																			IECEx Ex ia IIC T6...T3 Ga/Gb (Intrinsically safe)
					L																			IECEx Ex db ia IIC T6...T3 Ga/Gb (Flameproof)
					U																			JPN Ex Ex ia IIC T6...T3 Ga/Gb (Intrinsically safe)
					W																			JPN Ex Ex db ia IIC T6...T3 Ga/Gb (Flameproof)
Fixed code						0																		Always 0
Approval 2							0																	N/A
							3																	NACE (MR0175 / MR0103 / ISO 15156)
Housing type/material								2																Compact type housing (aluminum)
Output									1															Two-wire system/4–20 mA passive (HART)
Cable entry/cable gland										1														M20 × 1.5/Without cable gland (Cable entry : For G1/2 female thread, select M20 × G1/2 adapter as an option.) (For JPN Ex of flameproof / dust ingnition, select the Flameproof cable gland (G1/2) as an option.)
										2														M20 × 1.5/With a plastic cable gland
										3														M20 × 1.5/With a metal cable gland
										C														½ NPT/Without cable gland
Display											0													Without display unit
											4													With a plug-in display unit
Display language												0												Without display
												1												English
												7												Japanese
Fixed code													0											Always 0
Seal material/temperature range/pressure range														1										FKM/FPM/–40 to +200°C/0 kPa (abs) to 4 MPa
														2										EPDM/–50 to +150°C/0 kPa (abs) to 4 MPa
														3										Kalrez® 6375/–20 to +200°C/0 kPa (abs) to 4 MPa
Antenna type															E									DN80 PTFE Drop antenna (ø74 mm) Max.150°C
															F									DN100 PTFE Drop antenna (ø94 mm) Max.150°C
															G									DN150 PTFE Drop antenna (ø144mm) Max.150°C
															K									DN80 PEEK Drop antenna (ø74 mm) Max.200°C
Antenna extension/flange plate																0								None
																1								105 mm
																2								210 mm
																3								315 mm
																4								420 mm
																5								525 mm
																D								PTFE flange plate *Only for PTFE drop antennas
Process connection																	*	*	*					Choose from the connection table.
Fixed code																				0	0			Always 00
Accessories																						0		N/A
																						1		Weather protection ※2
Special specification																							Blank	N/A
																							/Z	For special requirements ※1

※1: Special requirements not included in the above coding system should be designated by adding "/Z" at the end of the code. Consult us for the availability of such requirements before ordering.
※2: Select awning when installing in a place exposed to direct sunshine or heavy wind and rain.

Process connection

JIS flange connection

G	U	P	40A JIS 10K RF
H	U	P	50A JIS 10K RF
L	U	P	80A JIS 10K RF
M	U	P	100A JIS 10K RF
P	U	P	150A JIS 10K RF
R	U	P	200A JIS 10K RF

Thread connection

G	P	0	G 1-½ A
G	A	0	1-½ NPT

ASME flange connection

G	1	A	1" ½ 150 lb RF
G	2	A	1" ½ 300 lb RF
H	1	A	2" 150 lb RF
H	2	A	2" 300 lb RF
L	1	A	3" 150 lb RF
L	2	A	3" 300 lb RF
M	1	A	4" 150 lb RF
M	2	A	4" 300 lb RF
P	1	A	6" 150 lb RF
P	2	A	6" 300 lb RF
R	1	A	8" 150 lb RF
R	2	A	8" 300 lb RF

STANDARD ACCESSORIES

- Parameter sheet : 1
- Instruction manual : 1
- Magnet for setting parameters : 1
- Tool for opening the converter cover : 1
- Tool for removing the display : 1

OPTIONS

- M20 × G1/2 female adapter: [GA]
- Flameproof cable gland (G1/2): [DG]
  Note : Service temperature -40°C to +80°C
- Individual data setting of output ranges: [DS]

ORDERING INFORMATION

Measurement

Measuring range
Distance from the process connection to the lowest level ( ) m
Distance from the process connection to the highest level ( ) m

Measured object

Name	( )		
Dielectric constant (ε r)	( )		
Fluid	☐ Liquid	☐ Slurry	
Corrosivity	☐ No	☐ Medium	☐ Strong
Adhesiveness	☐ No	☐ Medium	☐ Strong
Crystallinity	☐ No	☐ Medium	☐ Strong
Waving	☐ No	☐ Medium	☐ Strong
Foaming	☐ No	☐ Medium	☐ Strong

Operation conditions

Measuring location	☐ Outdoor ☐ Indoor
Fluid temperature	( ) °C
Ambient temperature	( ) °C
Pressure	( ) MPa
Explosionproof	☐ Non-hazardous area ☐ Hazardous area

Vessel conditions

Shape	☐ Ground tank ☐ Underground tank ☐ Closed pit ☐ Others
Height	( )
Diameter or width	( )
Inner structure	☐ N/A ☐ Yes: ☐ Agitator (shape:) ☐ Thermometer ☐ Level switch ☐ Reinforcement ☐ Ladder ☐ Others
Material	☐ Metal ( ) Coating: ☐ Yes ☐ N/A ☐ Others

Installation conditions

Location	Distance from tank wall	( ) m
	Distance from inlet	( ) m
	Distance from obstacle	( ) m
Mounting nozzle	Nozzle diameter	( ) mm
	Nozzle height	( ) mm

ORDERING INSTRUCTIONS

1. Model and specification code
   Example Model: TLR7400
   Specification code: VFDE44W0002114701401UP001
2. Option (specified only when necessary)
   Refer to “OPTIONS” and specify any with respective codes.
3. Special requirements (specified only when necessary)
   If you have any special requirements, let us know separately from the model and specification code.
   Consult us for the availability of such requirements before ordering.
4. Intrinsically safe specification
   This model needs a barrier.
5. Flameproof specification
   This model needs a flameproof cable gland.

* Specification is subject to change without notice.

TOKYO KEISO CO., LTD.
Head Office : Shiba Toho Building, 1-7-24 Shibakoen, Minato-ku, Tokyo 105-8558
Tel : +81-3-3431-1625 (KEY) ; Fax : +81-3-3433-4922
e-mail : overseas.sales@tokyokeiso.co.jp ; URL : http://www.tokyokeiso.co.jp