

2-Wire Level Radar TLR3000

Microwave Level Meter

GENERAL

The **TLR3000** is a non-contact type continuous level meter using microwaves. It detects a level by measuring a reciprocating time of a microwave emitted from the level meter to reflect and return from an object measured.

As the electric wave velocity is very little affected by the temperature and pressure, high-accuracy level measurement is allowed regardless of changes to the measuring conditions in a vessel.

It provides level measurement independent of density change, temperature change or viscosity of the object measured, allowing a variety of applications, ranging from low temperature to high temperature, and from vacuum to high pressure.

Use of 2-wire transmission system has realized high-accuracy and low-cost performance.

Its large clear graphic display allows you to set the data easily.

Inheriting the features of the microwave level meters, it has further improved the ease of using.



FEATURES

- ❑ Non-contact type continuous level measurement.
- ❑ Reduced total cost by the 2-wire transmission system.
- ❑ Easy operation through the wide graphic display.
- ❑ Available for a variety of applications owing to improved dynamic range.
- ❑ Available for various objects measured such as liquids and slurry.
- ❑ Capable of displaying a level, ullage, volume and mass.
- ❑ Responds to a wide range of temperature and pressure.
- ❑ High-accuracy level measurement independent of temperature, pressure, or density change

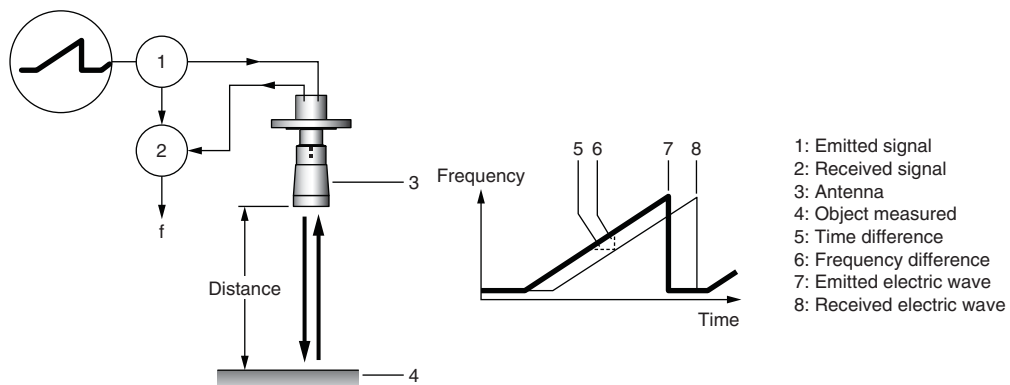
OPERATION PRINCIPLE

A microwave, whose frequency has been linearly changed inside the main body, is continuously emitted from an antenna.

The emitted microwave reflects from the object measured and is received by the antenna.

By reciprocating over the distance to the object measured, the received microwave causes a frequency difference from the emitted microwave. A reciprocating time is calculated from this frequency difference. As the microwave speed is constant, the distance to the object measured can be calculated.

The calculated distance is displayed (output) in terms of level, based on the preset tank data.



STANDARD SPECIFICATIONS

Objects	Item	Contents
Measuring object	Measurable materials	Liquids and Slurries
	Measuring method	Frequency Modulated Continuous Wave (FMCW)
	Measured variable	Level, distance, and volume
	Minimum tank height	0.5m
	Measuring range	Max. 40m (Depending on the measuring condition)
	Blocking distance	Antenna extension length + antenna length + 0.2m
Output	Output	4 to 20mA DC (HART), NAMUR NE 43
	Accuracy	±0.01mA (at 20°C)
	Resolution	±3μA
	Temperature drift	50ppm/K (Key value)
	Error signal	22mA DC, 3.6mA DC, NAMUR NE 43 (Selected by parameter)
	Load resistance (Max.)	350ohms
Accuracy: Based on criteria condition	Liquid measurement	±3mm/R.D. (Less than 10m), ±0.03%/R.D. (10m or more)
Measuring conditions	Temperature of process connection	−40 to +200°C (Standard), (Flameproof type: Refer to EXPLOSIONPROOF SPECIFICATIONS)
	Thermal shock resistance	100°C/min
	Operating pressure	0kPa (abs) to 4MPa (Based on flange rate)
	Dielectric constant	1.5 or more (Depending on the measuring condition)
Instrument specification	Ambient temperature	−40 to +80°C (Standard), (Flameproof type: Refer to EXPLOSIONPROOF SPECIFICATIONS)
	Storage temperature	−40 to +85°C
	Protection class	IP67 (JIS C0920, equivalent to NEMA6)
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)
	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
Material	Housing	Aluminium
	Process connection	Stainless steel (SS316L): Standard Hastelloy C-22
	Horn antenna and flange	Stainless steel (SS316L): Standard Hastelloy C-22
	Seal	Viton (−40 to +200°C) Standard Kalrez 6375 (−20 to +200°C)
Display		9 lines 160 × 160 pixels in 8-step grey scale 4 buttons (Right-hand key, Enter key, Up key and Down key) Language: English or Japanese
Mass		DN80 Horn antenna: Approx. 11kg
		DN80 Long horn antenna: Approx. 12kg
		DN40 / 50 Horn antenna (Flange connection): Approx. 8kg
		DN50 Horn antenna (Thread connection): Approx. 6kg
Process connection	Thread	G1 1/2 Male thread
		1/2 Male thread
	Flange	1 1/2", 2", 3", 4", 6", 8", ANSI 150lbs, 300lbs
		40A, 50A, 80A, 100A JIS 10K

EXPLOSIONPROOF SPECIFICATIONS

ATEX (ATEX Directives 94/9/EC)
KEMA 05 ATEX 1181X
II 1G D or II 1/2 G D or II 2 G D
EEx ia IIC or EEx ia IIB or EEx ia IIA T6...T3
T65°C...T90°C IP 6X
or
II 1/2 G D or II 2 G D
EEx d[ia] IIC or EEx d[ia] IIB or EEx d[ia] IIA T6...T3
T65°C...T90°C IP 6X

Operating Conditions

(Process and ambient temperature)
The ambient temperature range and the flange temperature range, depending on the equipment category required in the area where the Transmitter is installed, are as listed in the following table:

Equipment category	Ambient temperature range	Flange temperature range
II 1 G	-20°C ... +60°C	-20°C ... +60°C
II 1/2 G	-40°C ... +85°C	-20°C ... +60°C
II 2 G	-40°C ... +85°C	-40°C ... +200°C
II 1 D, II 1/2 D, II 2 D	-40°C ... +85°C	-40°C ... +200°C

The temperature class depending on the ambient temperature and the flange temperature is for the different versions as listed in following table:

Equipment category	Max. ambient temperature	Max. flange temperature	Temperature class
II 1 G	60°C	60°C	T6
II 1/2 G	60°C	60°C	T6
	75°C	60°C	T5
	85°C	60°C	T4
II 2 G	60°C	60°C	T6
	55°C	80°C	
	75°C	75°C	
	70°C	95°C	T5
	85°C	85°C	
	80°C	110°C	T4
	75°C	135°C	
	70°C	150°C	
	65°C	180°C	T3
	60°C	200°C	

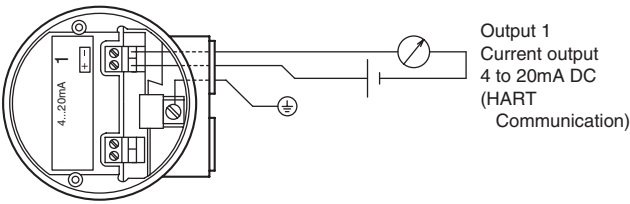
The maximum surface temperature of the electronics enclosure "T", depending on the ambient temperature and the flange temperature, is as listed in following table:

Max. ambient temperature	Max. flange temperature	Surface temperature "T"
55°C	80°C	65°C
70°C	95°C	80°C
75°C	135°C	86°C
60°C	200°C	90°C

[Intrinsically safe type]
In case of using IS type in hazardous area, observe the following matters.

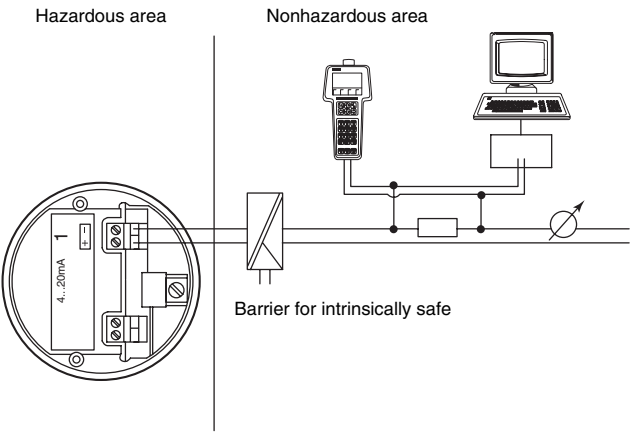
IS circuit allowable supply voltage (Ui) ≤ 30V
IS circuit allowable current (Ii) ≤ 300mA
IS circuit allowable electric power (Pi) ≤ 1W
Internal capacitance (Ci) = 30nF
Internal inductance (Li) = 200μH

WIRING DIAGRAM



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

If Used in Intrinsically Safe

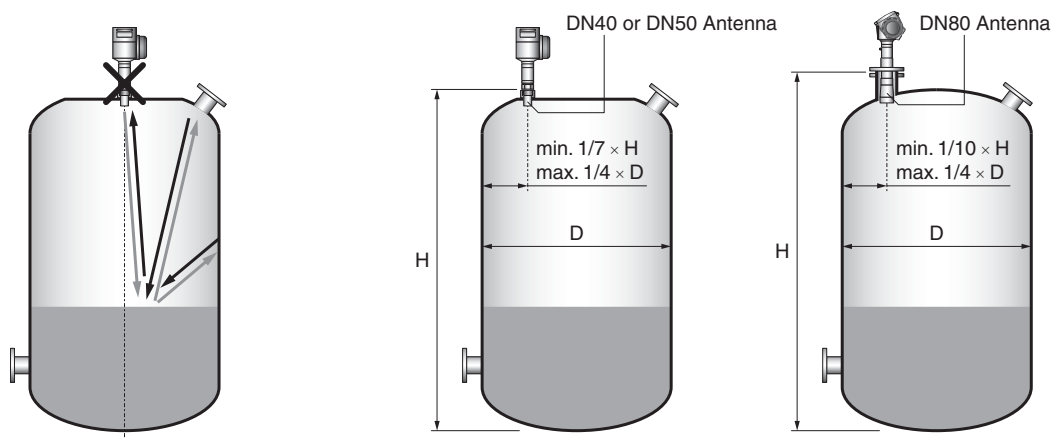


- When using TLR3000 at the hazardous area as intrinsically safe instrument, the intrinsically barrier shall be used.
- The items as mentioned in "Precautions for installation" shall be observed when used as explosionproof instrument.
- Regarding the required supply power when using insulating barrier, the specification for barrier shall be confirmed.

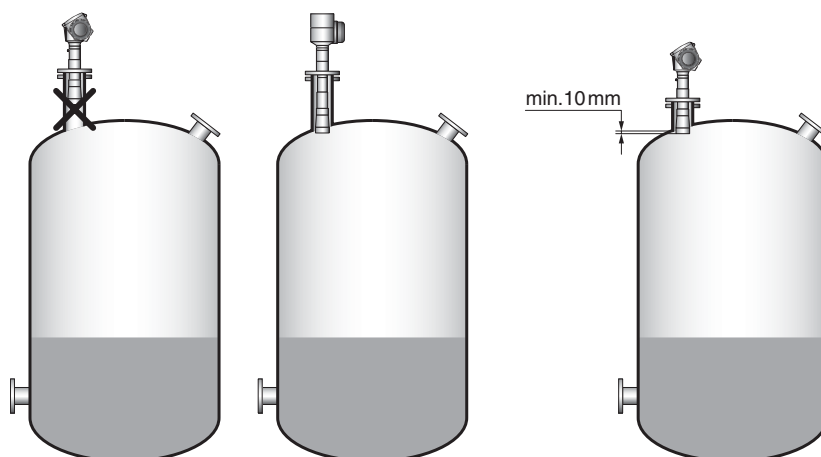
NOTES FOR MOUNTING

- Do not mount the TLR3000 close to the center of the tank because multiple reflections disable measurement. Mount it 1/4 or less of the tank diameter apart from the tank wall. When mounting to a non-circular vessel such as a concrete water tank, ensure that the walls at 2 points close to the level meter are differently distant from it.
- Mount the TLR3000 to the position away from the tank wall by 1/7 or more (DN40/DN50 horn antenna) or 1/10 or more (DN80 horn antenna) of the tank height.

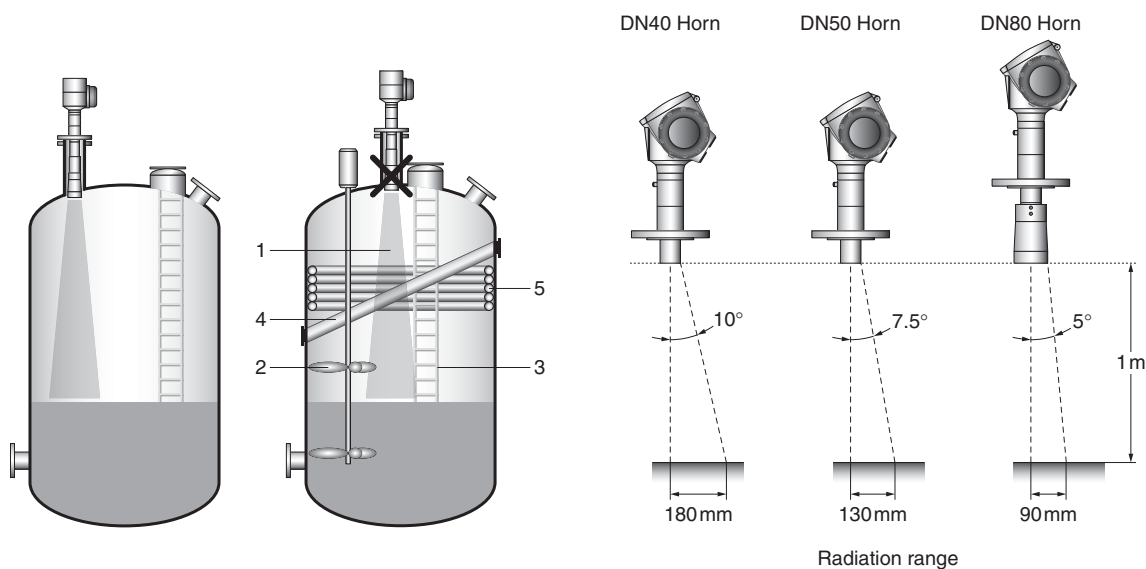
Regardless of the numerical values above, install the TLR3000 away from the tank wall at least by 150 mm or more. When installing close to the tank wall, ensure that the walls within the emission range of electric waves are flat and smooth without any unevenness.



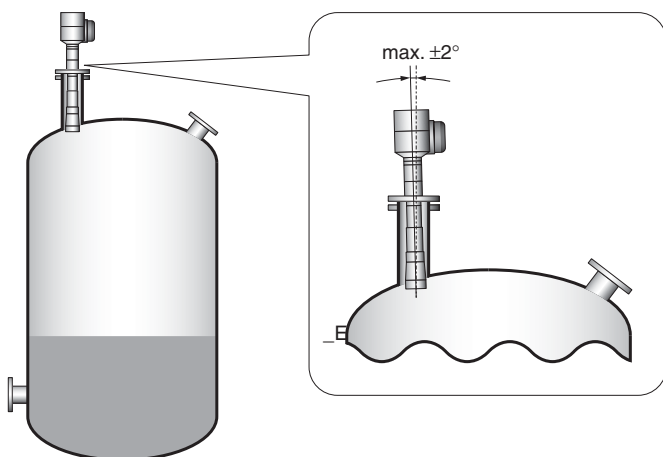
- The nose of the antenna should be extended into the vessel by 10 mm or more from the nozzle.



- Mount the TLR3000 to the position where no stream of product loading enters the emission range of electric waves. Ensure that there are no obstacles within the emission range of electric waves (1), such as a stirrer (2), ladder (3), reinforcement (4) and heating coil (5).

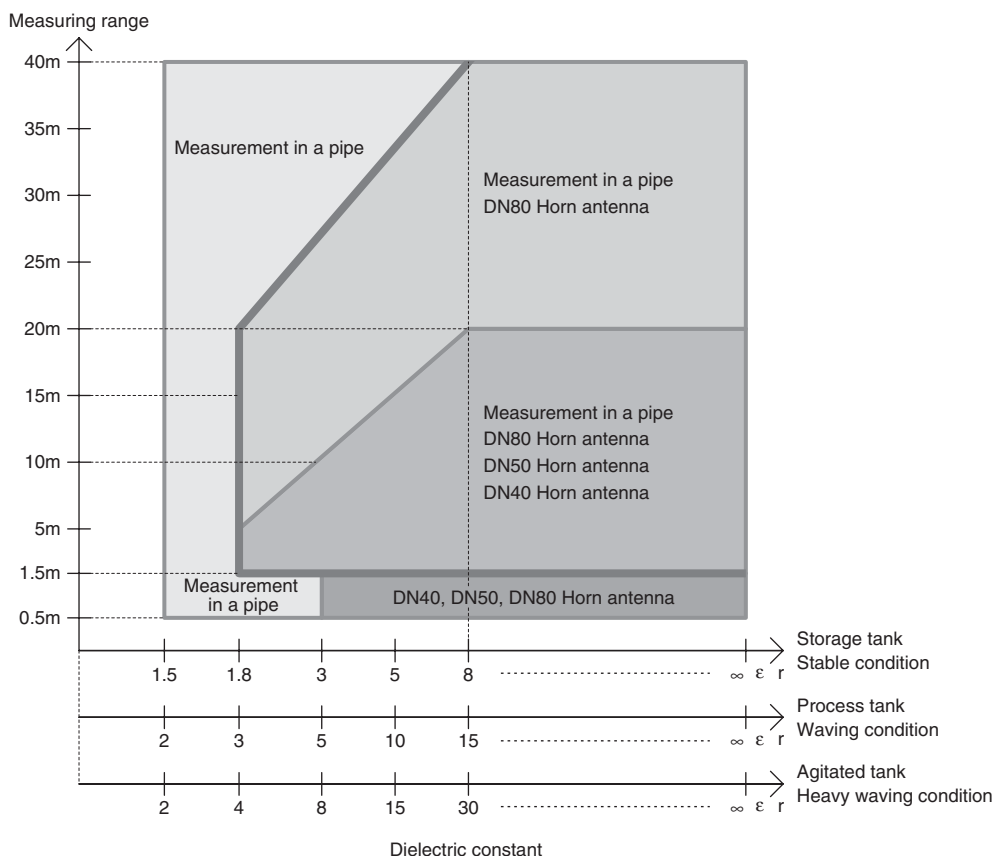


- The inclination of the mounting seat should be within ± 2 degrees.



- When installing multiple TLR3000s for an identical vessel, space them out as far as possible.
- For a cylindrical horizontal tank, mount onto an inner or outer cylinder to measure inside the pipe.
- When measuring inside the pipe, manufacture it with metal. Ensure that a difference between the inner diameter of the pipe and the outer diameter of the antenna is within 5 mm. The surface roughness of the pipe inner figure should be 0.1 mm or less. A fluctuation of the pipe inner diameter should be 1 mm or less.
- If the temperature of the housing rises due to the direct sunshine, install a sunshade to use within operating temperature range.

ANTENNA SELECTION



MODEL AND SPECIFICATION CODES

Model: TLR3000

Spec. code	VF70	4																4 0 0 0 0 0 0			Description	Standard
Fixed code		4																			Always 4	
Authorization		0																			Standard (Non-Ex)	○
		2																			ATEX Flameproof version (Intrinsically safe)	
		3																			ATEX Flameproof version (Pressure tight)	
		J																			TIIS (in preparation)	
Process connection and Antenna material		0																			Stainless steel (SS316L)	○
		1																			Hastelloy-C22	
Antenna type		0																			DN40 Horn antenna (ø39mm)	
		1																			DN50 Horn antenna (ø43mm)	
		2																			DN80 Horn antenna (ø75mm)	○
		3																			DN80 Long horn antaeae (ø75mm)	
Antenna extension (For DN80 Long horn antenna)		0																			Non	○
		1																			105mm	
		2																			210mm	
		3																			315mm	
		4																			420mm	
		5																			525mm	
		6																			630mm	
		7																			735mm	
		8																			840mm	
		A																			945mm	
	B																			1050mm		
Seal / temperature range		0																			Viton / -40°C....+200°C *1	○
		1																			Kalretz6375 / -20°C /.....+200°C *1	
Process connection: G male thread		0																			Other than G thread	○
		3																			G1 1/2 male thread	
Process connection: ANSI flange or NPT male thread		0																			Other than ANSI flange or NPT thread	○
		3																			1 1/2 NPT male thread	
		5																			1" 1/2 150 lb RF ANSI B16.5	
		6																			1" 1/2 300 lb RF ANSI B16.5	
		7																			2" 150 lb RF ANSI B16.5	
		8																			2" 300 lb RF ANSI B16.5	
		A																			3" 150 lb RF ANSI B16.5	
		B																			3" 300 lb RF ANSI B16.5	
		C																			4" 150 lb RF ANSI B16.5	
		D																			4" 300 lb RF ANSI B16.5	
	E																			6" 150 lb RF ANSI B16.5		
	F																			8" 150 lb RF ANSI B16.5		
Process connection: JIS flange		0																			Other than JIS flange	
		5																			40AJIS10K RF	
		6																			50AJIS10K RF	
		7																			80AJIS10K RF	○
		8																			100AJIS10K RF	
Output		0																			4 to 20mA × 1 output (HART)	○
Cable entry		0																			M20 (With waterproof gland)	
		1																			1/2NPT female thread	
		2																			G1/2 female thread	○
		Y																			G1/2 with flameproof packing adapter (TIIS)	
Housing option		0																			Non	○
		2																			Sunshade	
Display		0																			Non	
		1																			English	
		7																			Japanese	○
Fixed code																	4 0 0 0 0 0 0				Always 400000	
Special																			(Blank)		Non	○
		/Z																			with special request *2	

*1: This is a temperature range for the general type.

For the explosionproof type, see Explosionproof specifications.

*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 INSTRUCTIONS

1. Model and spec. code
Example) Model : TLR3100
Spec. code: VF704002000070200400000
2. Option (if required)
Specify by the symbol referring to "OPTION".
3. Special request (if required)
Please state special requests clearly.
Consult Tokyo Keiso or representative before ordering.

ORDERING INFORMATION

Measurement

Measuring range The distance from the mounting nozzle to the minimum level () m
 The distance from the mounting nozzle to the maximum level () m

Product

Name ()
 Dielectric constant ϵ_r ()
 Material ☐ Liquid ☐ Slurry
 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 () m
 Diameter or width () m
 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 is subject to change without notice.

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