



Technology Solutions

TEK-FLEX 4100B

Two-wire Loop-powered OEM TDR Level Transmitter



LEVEL



Introduction

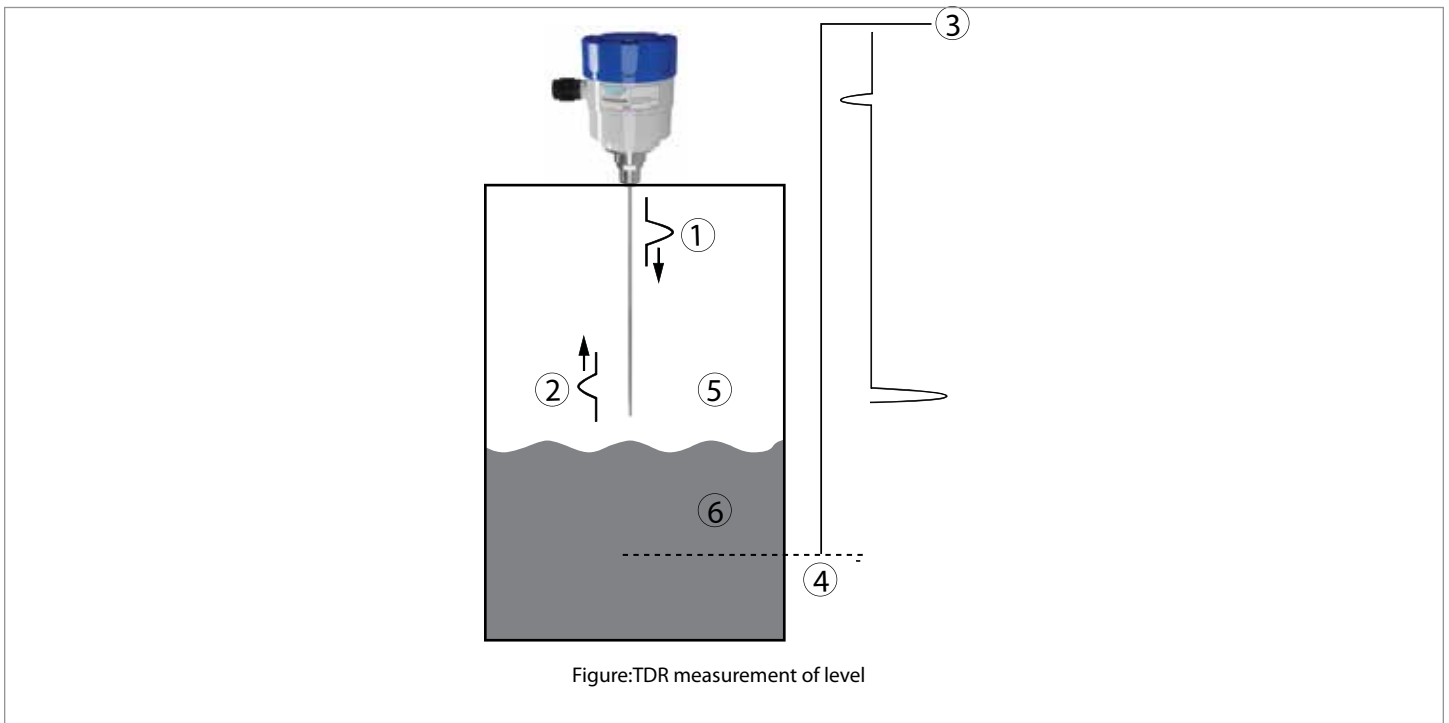
Tek-Flex 4100B is a Two-wire Loop-powered OEM TDR Level Transmitter designed for measuring distance, level, volume, and mass of liquids and solids (including pastes, slurries, powders, granulates and bulk goods etc). Its simple and compact design allows a quick 2-step installation- assembling the probe and attaching, it to the threaded connection. It's based on Time Domain Reflexometry (TDR) which is an excellent alternative to conventional level measurement techniques such as RF, capacitance, conductive, and DP transmitters. It provides a cost effective solution for applications that do not require supreme accuracy.

TDR is extremely robust technology in which the device performance is unaffected by several external factors such as dust, foam, vapour, agitated surfaces, boiling surfaces and changes in pressure, temperature, dielectric constant, or density.

Measuring Principle

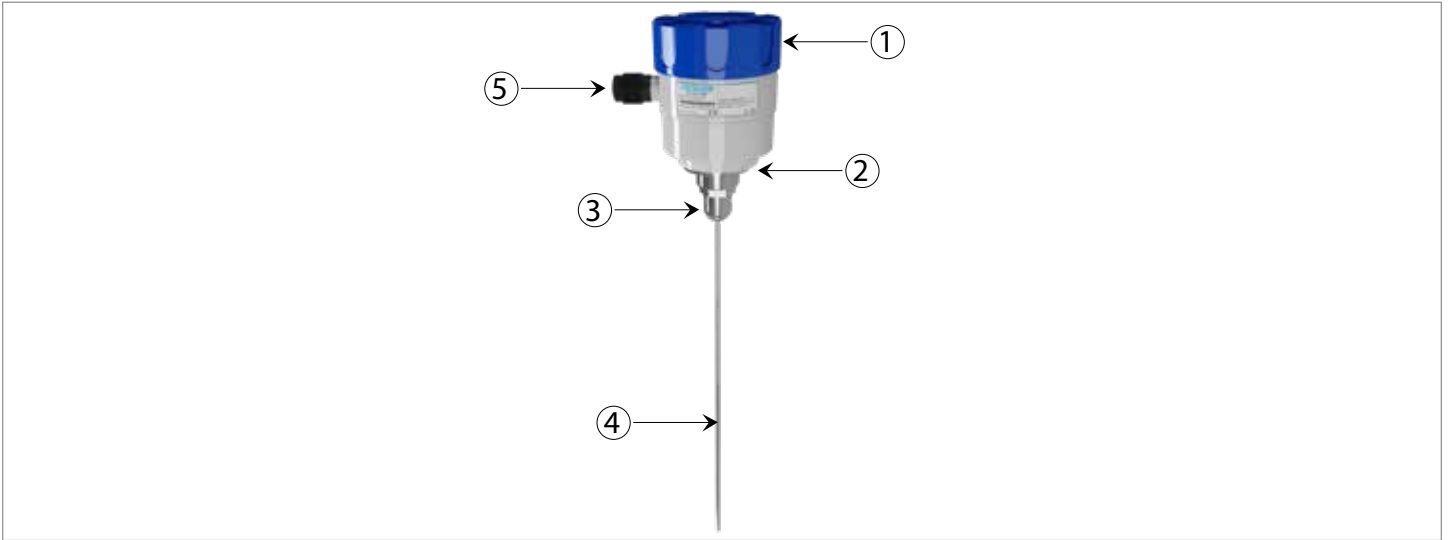
The Two-wire Loop-powered OEM TDR Level Transmitter works on proven technology of Time Domain Reflexometry (TDR).

In TDR, the meter transmits an incident signal onto the conductor and listens for its reflections. Using the values of the speed of light and half of the time lapse between the incident and reflected signals, TDR calculates the distance of the product from the top of the container. Knowing the distance, other parameters like level, mass and volume can be determined.



1. Transmitted pulses
2. Reflected pulse
3. Pulse amplitude
4. Time of flight
5. Air, $\epsilon = 1$
6. Liquid, $\epsilon \geq 1.6$. Solid, $\epsilon \geq 2.1$.

Operation



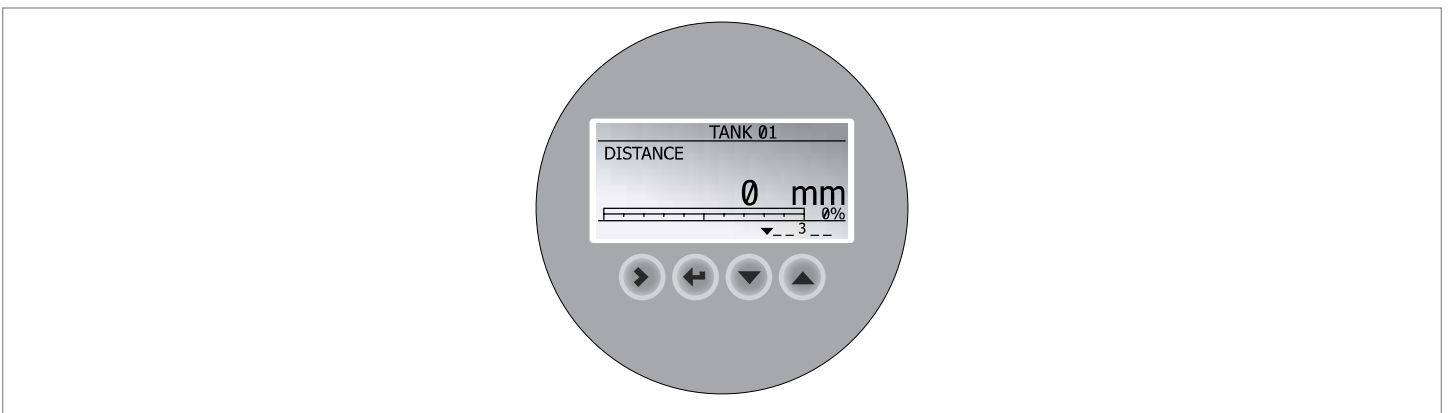
The assembly consists of

1. Aluminum housing with optional LCD display
2. Converter - rotatable and removable under process conditions
3. Threaded connection (NPT or G)
4. Cable or coaxial probe
5. 2-wire loop-powered level meter

The device transmits low-amplitude, high frequency electromagnetic pulses along a rigid or flexible electrode. The pulses propagate along the electrode towards the level surface at the speed of light. These pulses are reflected back when they hit the surface of the product being measured and are received by the receiving module.

The device measures the time taken by the pulse to travel to-and-from the product. Half of this time is equivalent to the distance from reference point to the product surface. The time is converted into an equivalent output current of 4 to 20mA. The product level from the bottom of the tank or container can be easily determined knowing the speed of light and time taken by the wave to travel the distance.

The optional LCD can be ordered along with the device or separately as an accessory. The display shows measurement data on a 128 x 64 pixel screen. The device can be configured through menu options convenient (push buttons) available on the LCD in sequential steps.



Features

- 2-wire loop powered level meter
- Suitable for continuous level measurement of liquids and solids
- Easy menu navigation without opening the casing
- Quick view display for monitoring measured values
- Stainless steel probes and process connections
- Measuring range up to 20 m/65.6' (liquids) and 10 m/32.8' (solids)
- Suitable for process temperatures up to 212°F (100°C) and pressures up to 16barg/232psig

Applications

- Distance and level measurement in tanks, collectors in various process applications
- Silo level measurement in mining and agriculture
- Volume measurement in storage tanks

Liquid Level Meter

Measures level of a wide range of fluids involving in various process applications under stated pressure and temperature condition. It's easy to install and requires no calibration. All you need is to adapt the probe length as per the application requirement (container depth, type of fluid) and execute a short configuration procedure.

Solid Level Meter

Measures level of solids (powders, granulates etc) involved in variety of applications like silos in agriculture or mining industry. It requires no calibration. Adjust the probe length and execute a short configuration procedure.

Volume Meter

It uses strapping table function in configuration menu for calculating volume from measured level. Up to 30 volume values can be predefined by using the parameters like number of steps, tank height, area of cross section and type of solid. Each step/ level indicates particular volume. For example,

Level 1 = 2 m/Volume 1 = e.g. 0.7 m³

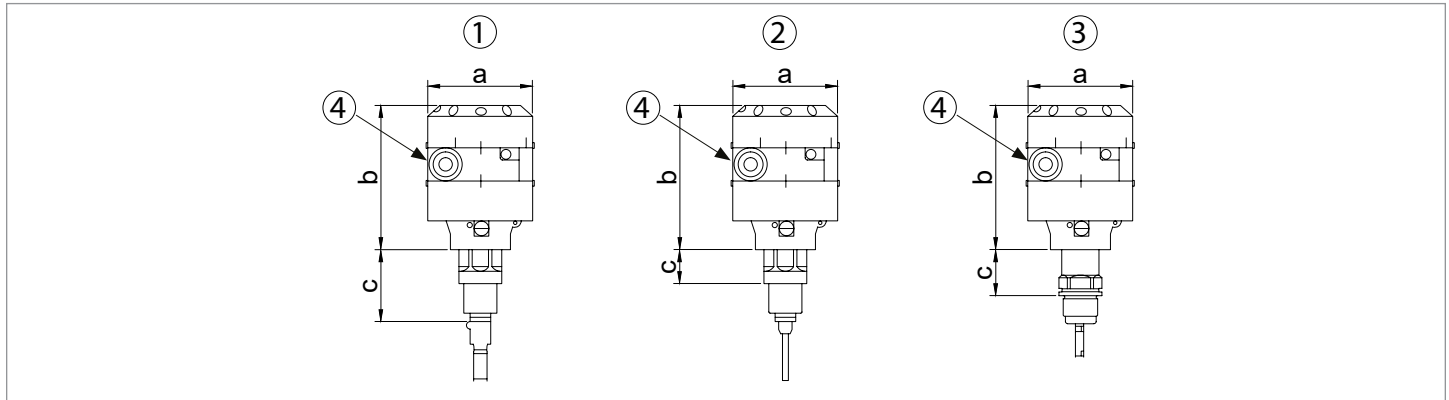
Level 2 = 10 m/Volume 2 = e.g. 5 m³

Level 3 = 20 m/Volume 3 = e.g. 17 m³

This data in strapping table entries gives accurate volume measurement.

Dimensional Drawing

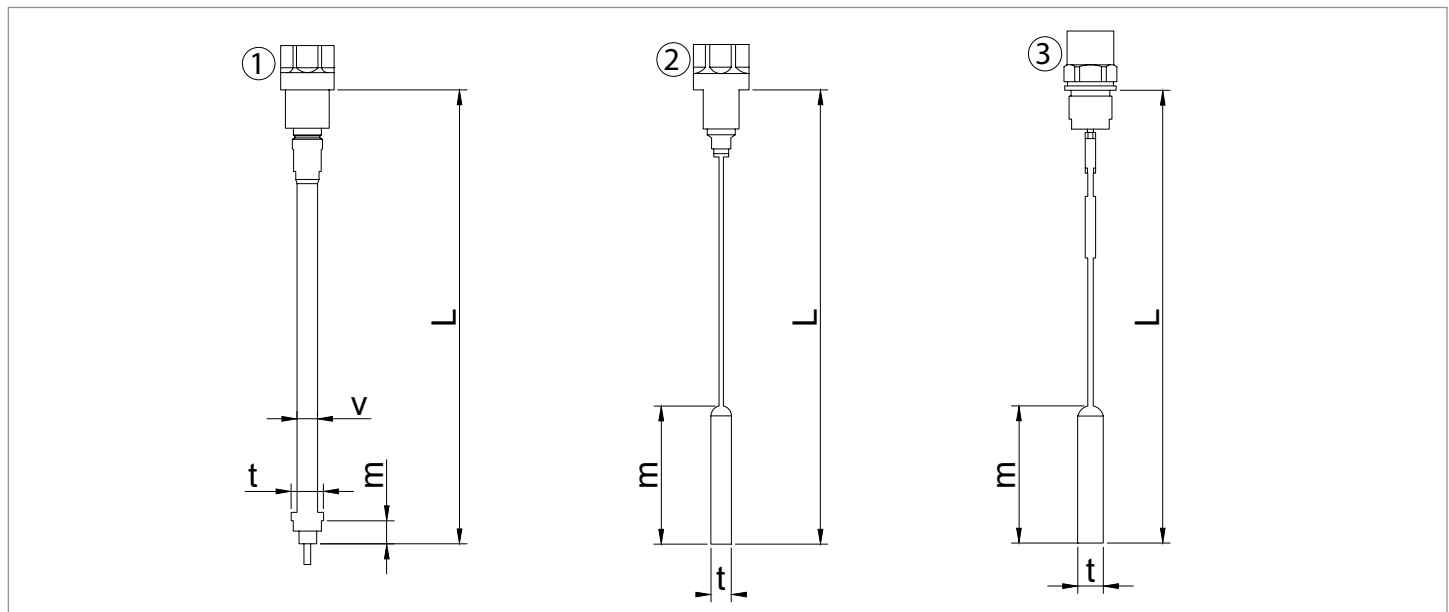
Converter



1. Converter with a coaxial probe
2. Converter with a 1/8" (Ø2mm) single cable probe
3. Converter with a 1/4" (Ø4mm) single cable probe
4. The diameter of the outer sheath of the cable must be 1/4" to 1/2" (6 to 12mm)
(cable entry size M20 × 1.5)

	Dimensions			Weights	
	Øa	b	c	Kgs	lbs
	In (mm)	In (mm)	In (mm)		
1 and 2	4"(104)	5 1/2"(141)	1 1/2"(34)	3.3	7.3
3	4"(104)	5 1/2"(141)	1 3/4"(45)	3.3	7.3

Probe



L is the total length of the probe. This includes the length of the counterweight for cable probes and the probe end cap for coaxial probes.

m is the length of the counterweight or the bottom of the probe end cap for coaxial probes

1. 1/2" (Ø14mm) coaxial probe
2. 1/8" (Ø2mm) single cable probe
3. 1/4" (Ø4mm) single cable probe

Probes: Dimensions and Weights

Probes	Dimensions					Weights	
	L min.	L max.	m	t	v		
	In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	Kg	lb
Coaxial Ø1/2" (Ø14mm)	29"(730)①	162 1/2"(4067)②	1/2"(15)	3/4"(Ø21)	1/2"(Ø14)	0.45③	0.30③
Single cable Ø1/8"(2mm)	40"(1000)①	800"(20000)	4"(100)	1/2"(Ø14)	-	0.47	0.88
Single cable Ø1/4"(4mm)	40"(1000)①	400"(10000)	4"(100)	3/4"(Ø20)	-	1.2	2.64

(1) All the probes can be shortened on site

(2) The coaxial probe can be supplied in 6 standard lengths: 29"(730mm), 55 7/8"(1397mm), 82 1/2"(2065mm), 109 1/2"(2732mm), 136"(3400mm) or 162 1/2"(4067mm)

(3) This is the weight for each segment of the coaxial probe

Specifications

Measuring system	
Application	Level and volume measurement of liquids, pastes, powders, and granulates
Measuring principle	TDR (time domain reflectometry)
Construction	Measuring probe attached directly to a signal converter
Operating conditions	
Ambient temperature	-40 to +176°F (-40 to +80°C) Integrated LCD display: -5 to +140°F (-20 to +60°C); if the ambient temperature is not in these limits, the display switches off
Storage temperature	-60 to +185°F (-50 to +85°C)
Protection category	IP 66/67
Materials	
Housing	Polyester-coated aluminum
Cable entry	M20 x 1.5 (plastic cable gland included) or ½ NPT (without cable gland)
Electrical connections	
Power supply [terminals]	14 to 30 VDC
Current output load	$R_L (\Omega) \leq ((U_{\text{ext}} - 14 \text{ V}) / 22 \text{ mA})$
Cable entry capacity [terminals]	0.004 ²
Input and Output	
Measured Variables	Time between the emitted and received signal
Output signal	4 to 20.5 mA
Resolution	± 1 µA
Error signal options	High : 22 mA; Low: 3.6 mA Hold (frozen value)

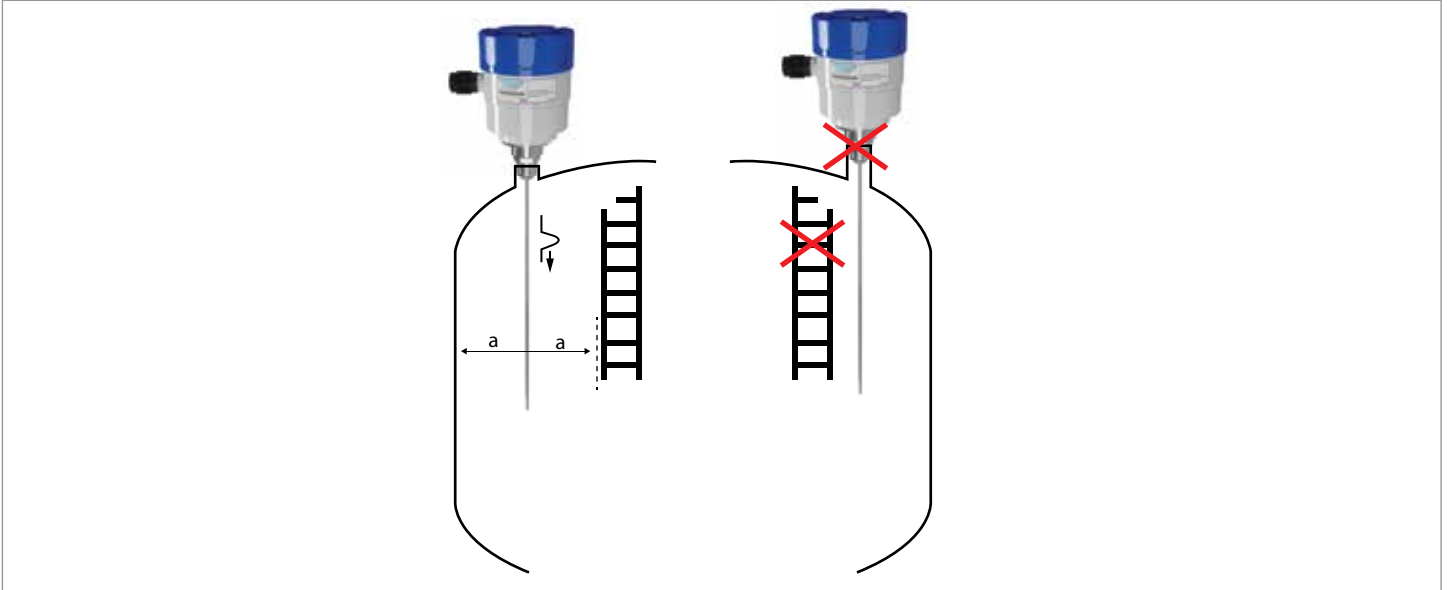
Display and user interface			
User Interface options	LCD display (128 × 64 pixels in 8-step greyscale with 4-button keypad)		
Languages	9 languages are available: English, German, French, Italian, Spanish, Portuguese, Japanese, Chinese (Mandarin) and Russian		
Materials			
CE	This device fulfils the statutory requirements of the EC directives . The manufacturer certifies successful testing of the product by applying the CE mark.		
Vibration resistance	EN 60068-2-27, -29, -34		
EMC	Electromagnetic Compatibility Directive 2004/108/EC in conjunction with EN 61326-1 [2006]. The device agrees with this standard if: the device has a coaxial probe or the device has a single probe that is installed in a metallic tank.		
Probe options			
	Segmented coaxial 1/2"(Ø14mm)	Single cable 0.006 1/8"(Ø2mm)	Single cable 1/4"(Ø4mm)
Measuring system			
Application	Level measurement of liquids		Level measurement of solids
Measuring range	0.73 to 4.067 m/ 2.4 to 13.3ft (1)	1 to 20 m/ 3.3 to 65.6ft	1 to 10 m/ 3.3 to 32.8ft
Dead zone	This depends on the type of probe.		
Measuring accuracy			
Accuracy	±1/2" (±10 mm), when distance ≤ 10 m / 33ft; ±0.1% of measured distance, when distance > 10 m / 33ft		±3/4"(±20mm)
Resolution	1/16"(1mm)		
Repeatability	±3/4"(±20mm)		
Maximum rate of change at 4 mA	10 m/min or 32.8'/min		
Operating conditions			
Temperature	-60 to +212°F / -50 to +100°C		
Pressure	-1 to 16 barg/-14.5 to 232 psig		
Viscosity	≤500 mPa.s	10000 mPa.s	n/a
Dielectric constant	≥1.6	≥ 2.1	≥2.1
Materials			
Probe	Stainless steel (1.4404 /316)	Stainless steel (1.4401/316)	Stainless steel (1.4401/316)
Gasket (process seal)	EPDM		
Process connection	Stainless steel (1.4404 /316)		
Process connections			
Thread	G ¾ to 1A; ¾ to 1 NPT		

Installation

The Tek-Flex 4100B has threaded connections for easy mounting of the probe on a tank roof or a nozzle using flanges. Ensure that the transmitter is mounted with adequate service space for easy access to service technicians. Determine the probe length. Adjust the middle segments and bottom segment accordingly.

1/8"(Ø2mm) Single Cable Probe (Liquid)

These probes are intended for distance and level measurement of liquids, slurries and pastes.



Cable probe: Minimum distance from metallic walls and other metal objects $a \geq 12"$ (300mm)

Coaxial cable (Low viscosity Liquid)

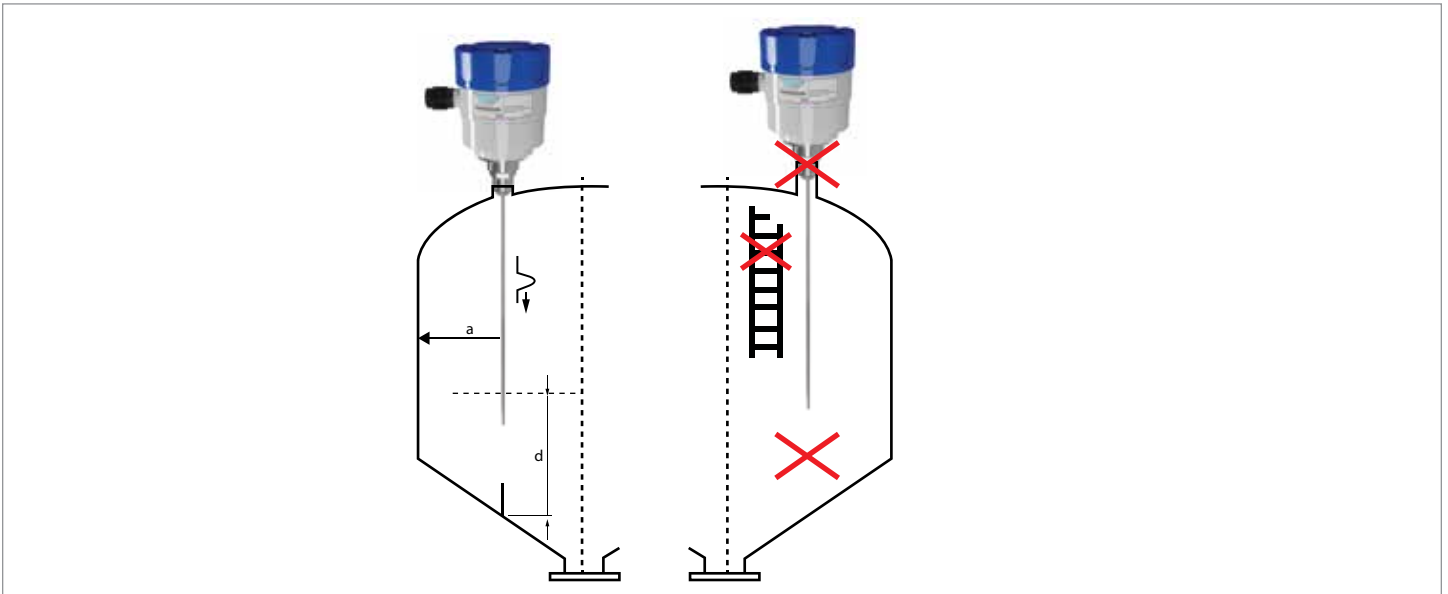
These probes are intended for distance and level measurements of the liquids with viscosity less than 500 mPa.s. These are suitable to install in closed tanks as well as open pits.



Cable probe: Minimum distance from metallic walls and other metal objects

1/4"(Ø4mm) Single Cable Probe (Solid)

These probes are intended for distance and level measurement of powders and granulate.



Installation recommendations for solids

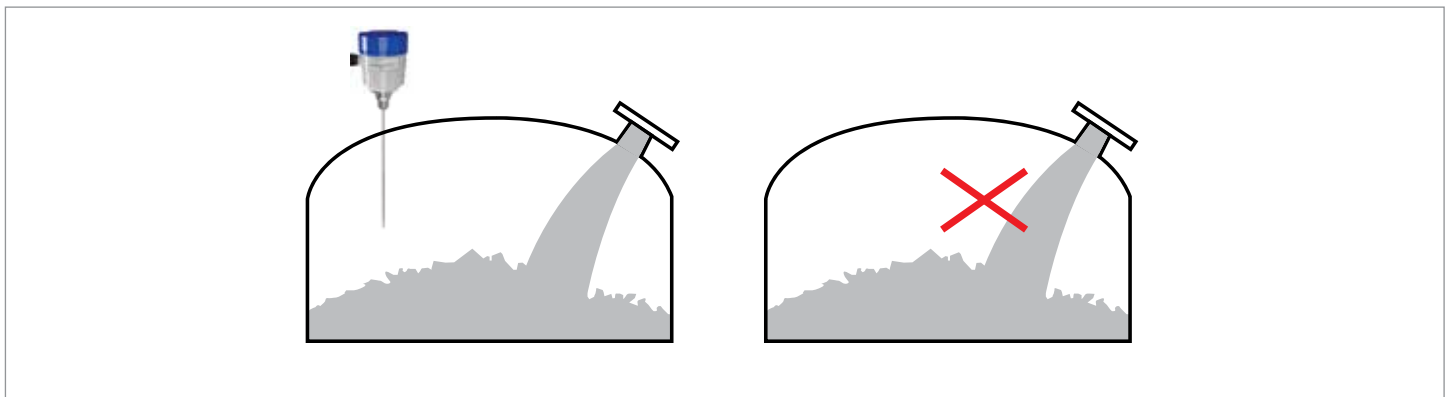
$a \geq 12"$ (300mm)

$d \geq 12"$ (300mm)

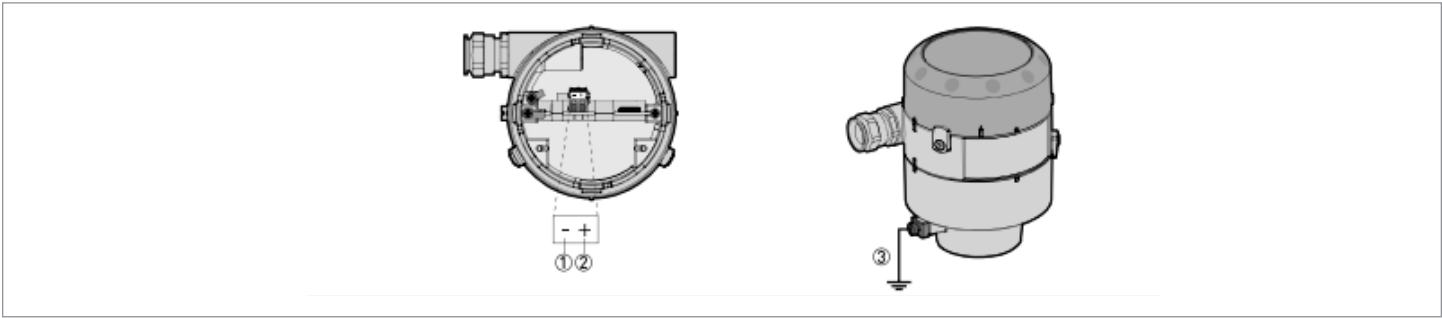
Mounting Recommendations

Carefully consider the tank conditions while fixing the probe mounting position.

- Select a position where the influence of disturbing objects is the minimum.
- Install the probe when silo or tank is empty.
- Avoid mounting the probe near inlet pipes or heating coils.
- Avoid bending the probe.
- Anchor the probe at the bottom of the tank in case of turbulent tanks. This prevents the probe from hitting the tank walls or other objects in the tank.

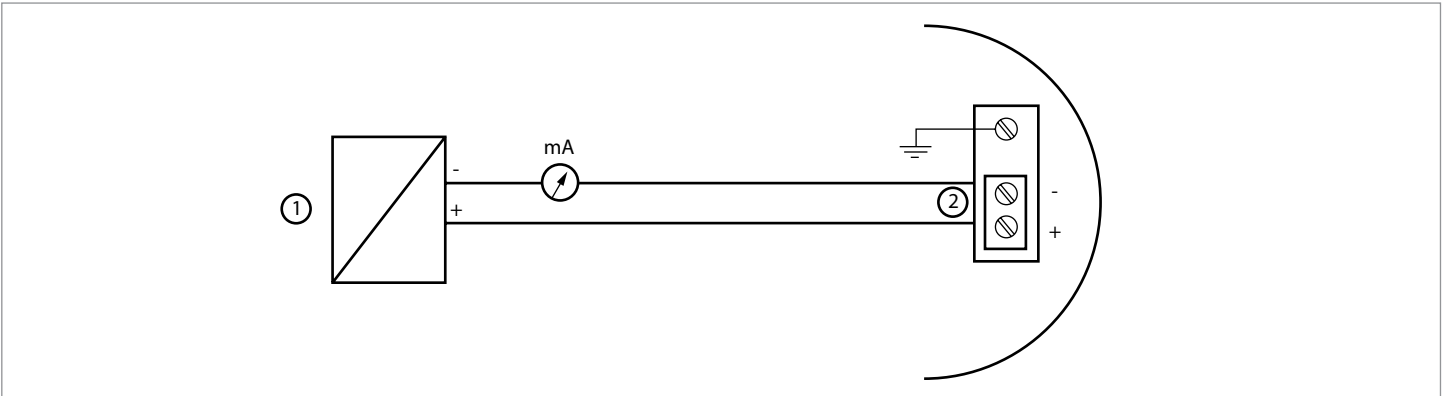


Do not install the probe near to a product inlet



Terminals for electrical installation

- Current output -
- Current output +
- Grounding terminal between the process connection and the converter



Electrical schematic

Power supply
Input: 14 to 30 VDC

Model Chart

Example	Tek-Flex 4100B	3	1	1	XXXX	N	Tek-Flex 4100B-3-1-1-XXXX-N
Series	1						Two-Wire Loop-Powered TDR Level Meter
Process Connection		1 2 3					¾" NPT 1-½" NPT 1" NPT
Probe Type			1 2				Coaxial Probe (10' Max.) 2mm Wire Probe (60' Max. length)
Electrical				1			Two ½" NPT
Probe Length					XXXX		Probe Length in Inches
Display						N LCD	No Display Programming Display