Quick Start Guide

Tek-Flex 4100A

Explosion-Proof Guided Wave Radar Level Transmitter

796 Tek Drive, Crystal Lake, IL 60014 USA
+1 847 857 6076
+1 847 655 6147
www.tek-trol.com

Quick Start Guide

1. Before you begin

This guide provides basic guidelines to assist you in quickly getting started.

Installation of the transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the approvals section of the Tek-Flex 4100A Explosion-Proof Guided Wave Radar Level Transmitter reference manual for any restrictions associated with a safe installation.

Do not remove the transmitter covers in explosive environments when the circuit is live.

Make sure the transmitter is installed by qualified personnel and in accordance with applicable codes of practice.

2. Unpack

Tek-Flex 4100A Explosion-Proof Guided Wave Radar Level Transmitter

3. Dimensional Drawings

- **Signal Converter and Probe Electronics Options**

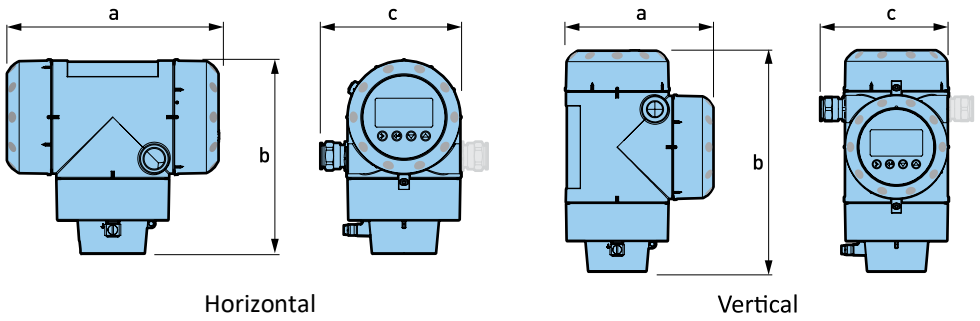


Fig 1: Compact Version

	a in (mm)		b in (mm)		c in (mm)	
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Non-Ex / Ex i / IS	7 ½"(191)	5 ¾"(147)	7"(175)	8 ¾" (218)	5"(125)	5"(125)
Optional output / Ex d / XP	10 ¼"(258)	8 ½"(210)	7"(175)	8 ¾" (218)	5"(125) [6 ⅛" (153)]	5"(125) [6 ⅛" (153)]

*Note: Use the dimension in square brackets if the device has 2 current outputs or a switch output (relay).

• Sensor Extension with Vertical Compact Version

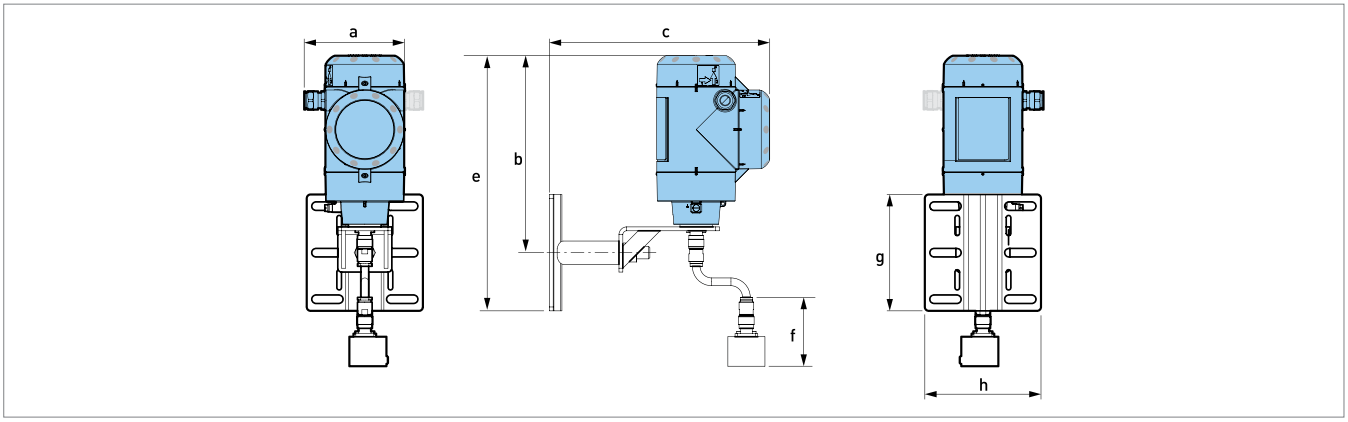


Fig 2: Vertical Sensor Extension

	a in (mm)	b in (mm)	c in (mm)	e in (mm)	f in (mm)	g in (mm)	h in (mm)
Non-Ex / Ex i / IS	5" (125)	10" (250)	11 ¼" (280.75)	13 ¼" (329)	3 ½"(89)	6" (150)	6" (150.4)
Optional output / Ex d / XP	5" (125) [6 ⅛" (153)]	10" (250)	13 ¾" (348.4)	13 ¼" (329)	3 ½"(89)	6" (150)	6" (150.4)

*Note: Use the dimension in square brackets if the device has 2 current outputs or a switch output (relay)

• Double Sensor Extension with Remote Version- Wall Bracket

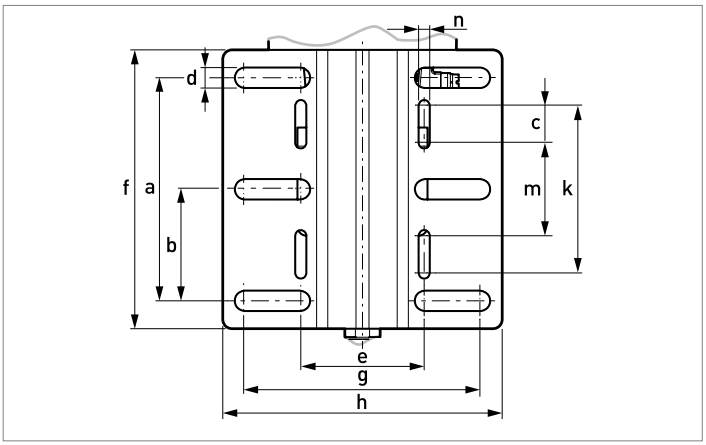


Fig 3: Wall Bracket

	a in (mm)	b in (mm)	c in (mm)	d in (mm)	e in (mm)	f in (mm)	g in (mm)	h in (mm)	k In (mm)	m in (mm)	n in (mm)
Wall Bracket	4 ¾" (120)	2 ¼" (60)	¾" (20)	3/8" (10)	2 ¾" (67.4)	6" (150)	5" (126.4)	6" (150.4)	3 ½" (90)	2" (50)	¼" (6)

*Note: Use the dimension in square brackets if the device has 2 current outputs or a switch output (relay).

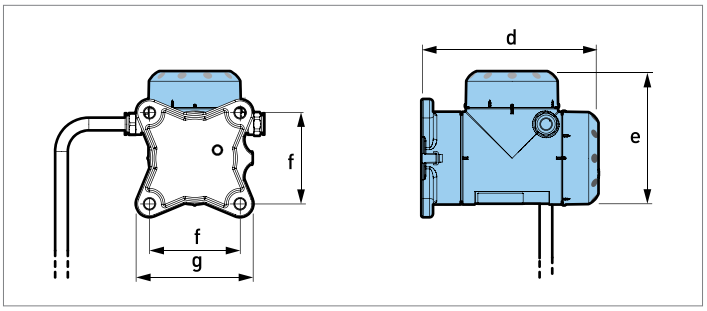


Fig 4: Remote Converter Housing

	d in (mm)	e in (mm)	f in (mm)	g in (mm)
Non-Ex / Ex i / IS	7 ¾" (195)	5 ¾" (146)	4" (100)	5 ¼" (130)
Optional output / Ex d / XP	7 ¾" (195)	5 ¾" (146)	4" (100)	5 ¼" (130)

- **Double Sensor Extension with Remote Version- Wall Bracket**

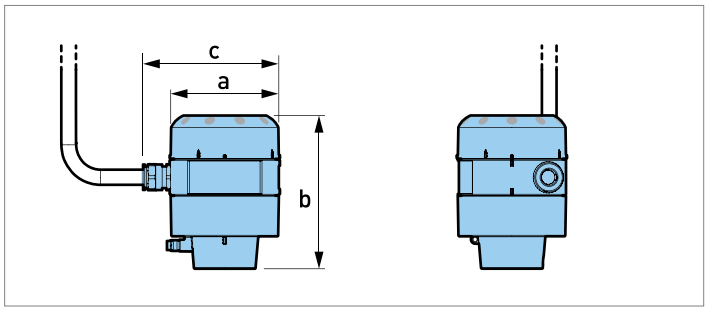


Fig 5: Probe Electronic Housing

	a in (mm)	b in (mm)	c in (mm)
Non-Ex / Ex i / IS	4 ¼" (104)	5 ¾" (142)	4" (100)
Optional output / Ex d / XP	7 ¾" (195)	5 ¾" (146)	4" (100)

- **Double Sensor extension with remote version- Probe Electronic Housing**

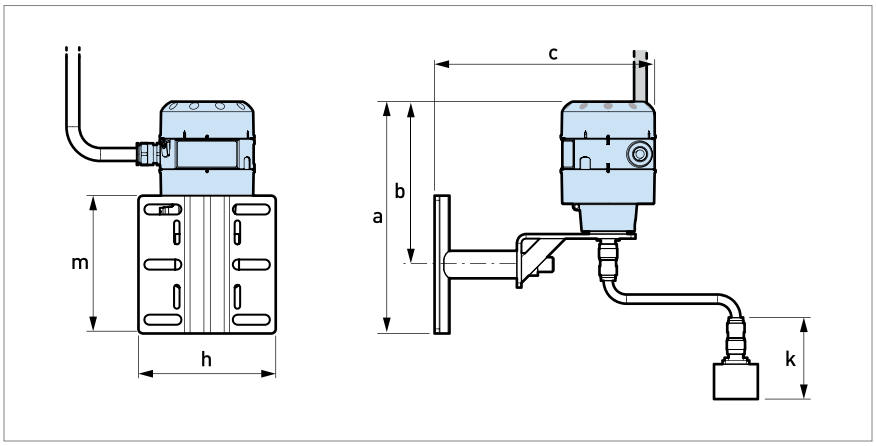


Fig 6: Double Sensor Extension-Probe Electronics Housing

	a in (mm)	b in (mm)	c in (mm)	h in (mm)	k in (mm)	m in (mm)
Probe Electronics Housing with Sensor Extension	10 1/8" (252.3)	7 1/8" (177.3)	9 ¾" (241)	6" (150.4)	3 ½" (88.9)	6" (150)

4. Probe Options

- **Single Probe**

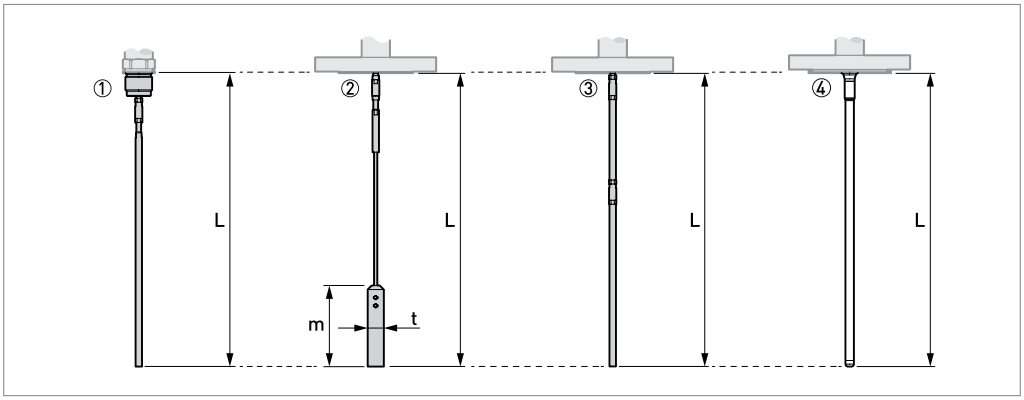


Fig 7: Single Probes

1. Single rod Ø¼" (Ø8mm)
2. Single cable Ø⅛" (Ø4mm)
3. Single rod Ø¼" (Ø8mm) (segmented version)
4. Single rod Ø⅛" (Ø8mm) with PTFE coating

Probes	L min in (mm)	L Max in (mm)	m in (mm)	t in (mm)
Single rod Ø¼" (Ø8mm)	24" (600)	160" (4000)	-	-
Single cable Ø⅛" (Ø4mm)	40" (1000)	2400" (60000)	4" (100)	¾" (20)
Single rod Ø¼" (Ø8mm) (segmented version)	24" (600)	240" (6000)	-	-
Single rod Ø⅛" (Ø8mm) with PTFE coating	24" (600)	160" (4000)	-	-

- **Probe End Options for the Ø1/8" (Ø4mm) Single Cable Probe**

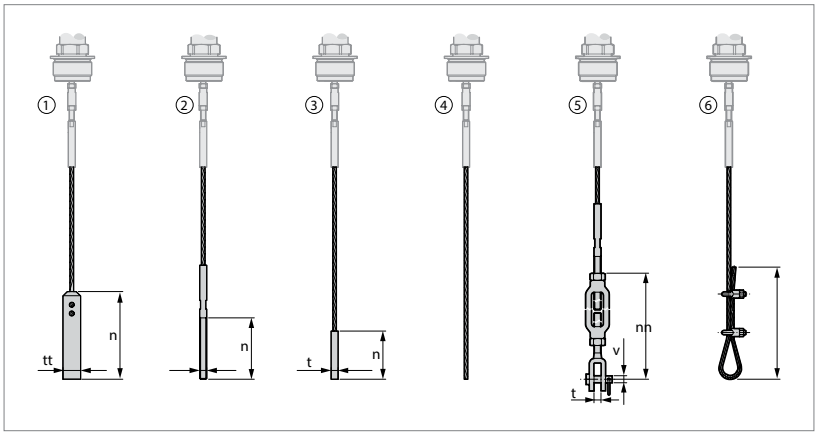


Fig 8: Probe End Options

Probe End Type	n in (mm)	t in (mm)	v in (mm)
Counterweight	4" (100)	Ø¾" (Ø20)	-
Threaded end	2 ¾" (70)	M8	-
Crimped end	2 ¼" (55)	Ø¼" (Ø8)	-
Open end	-	-	-
Turnbuckle	6 ¾" (172)	3/8" (11)	Ø¼" (Ø6)
Chuck	12" (300)	-	-

4. Display

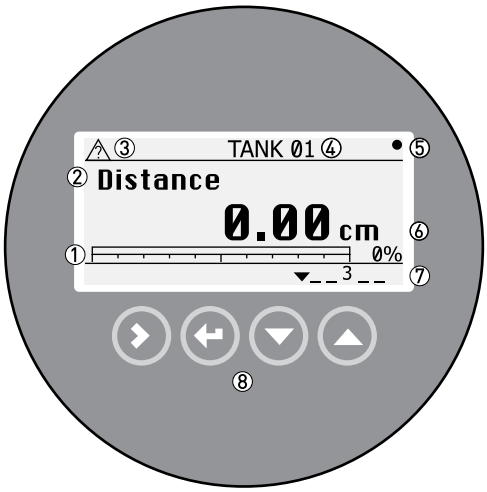


Fig 9: Local Display Screen Layout in Normal Mode

1. Current output percentage.
2. Measurement type (for example, distance).
3. Device status (NE 107 symbols).
4. Device tag name.
5. Updated measurement data (the symbol flashes each time the measurement data is updated).
6. Measurement value and units.
7. Device status (markers).
8. Keypad buttons.

Table 1: Keypad Function

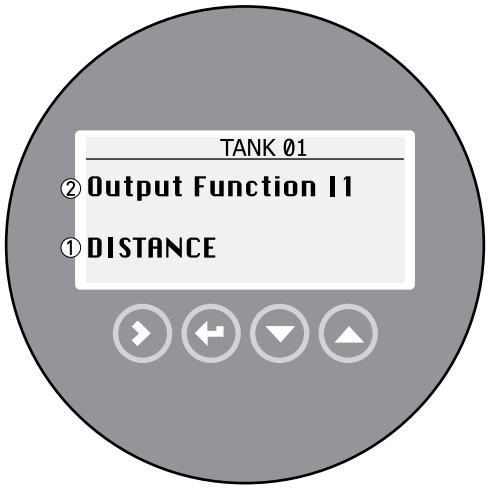
Key	Description	Standard Function	"Hot Key" Function
☞	Right	Enter configuration mode	Software versions installed on the device (converter firmware version, sensor firmware version and the HMI (device display screen) firmware version).
☞	Return / Escape	Change the measurement units	Enter Auto Setup menu and then enter the supervisor password. You can set the time, date, probe length, tank height, tank type, application type, top product data, current output function, 4mA value and 20mA value.
☞	Down	Change the measurement type	Setup summary (output function, 4mA value, 20mA value and output range). Press [>] to read the installation summary, application summary and probe summary. Press [▲]or [▼] to scroll up or down the list. Press [>] again to go back to normal mode.
☞	Up	Change the measurement type	Enter the display language menu and then enter the supervisor password. You can change the display screen language.

1. Function name
2. Configuration mode symbol
3. Menu number

Fig 10: Local Display Screen Layout in Configuration Mode

Table 2: Menu Navigation Buttons and its Function

Key	Description	Function
☞	Right	• Go down to the sub-menu level (for example, from menu 1.0.0 to sub-menu 1.1.0). • Enter the menu item.
☞	Enter or Escape	• Go up to the menu level (for example, from sub-menu 1.1.0 to menu 1.0.0). • Go to Normal mode. If you changed settings in Configuration mode, you must save or cancel your new settings.
☞	Down	• Scroll down the menu list (for example, from menu 2.0.0 to menu 1.0.0). • Scroll down the sub-menu list (for example, from sub-menu 2.2.0 to sub-menu 2.1.0).
☞	Up	• Scroll up the menu list (for example, from menu 1.0.0 to menu 2.0.0). • Scroll up the sub-menu list (for example, from sub-menu 2.1.0 to sub-menu 2.2.0).

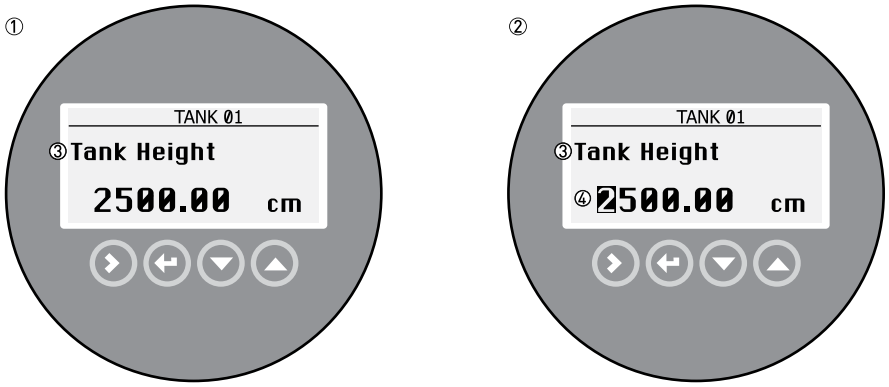


1. Parameter
2. Menu name

Fig 11: Parameter Menu

Table 3: List of Parameters

Key	Description	Function
☞	Right	• NA
☞	Enter or Escape	• Select the parameter and go back to the menu
☞	Down	• Move down the list
☞	Up	• Move up the list



1. Parameter
2. Menu number

Fig 12: Values in Menu Items

Table 4: Values in Menu and its Function

Key	Description	Function
☞	Right	• Enter the menu item and see the value stored at this time. • Enter the menu item configuration level to change the value. • Move the cursor to the next digit on the right. If the cursor is on the last digit, press [>] again to go back to the first digit.
☞	Enter or Escape	Accept the value and go back to the sub-menu.
☞	Down	Decrease the digit value.
☞	Up	Increase the digit value.

5. Power Supply

- 2-wire, Loop Powered

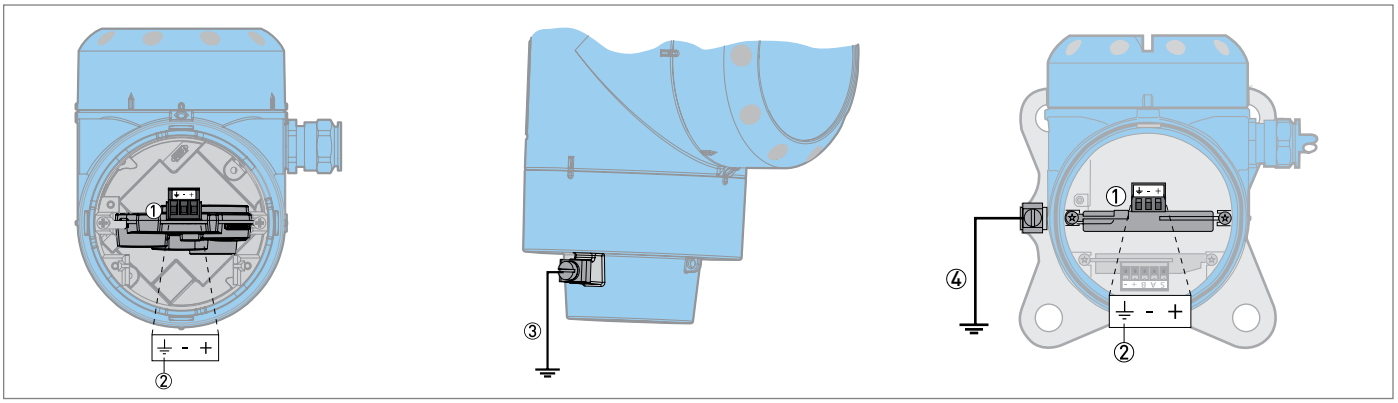
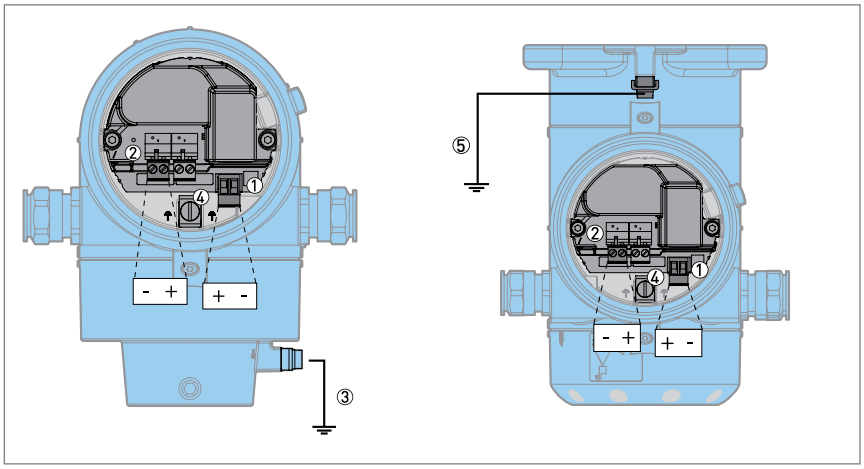


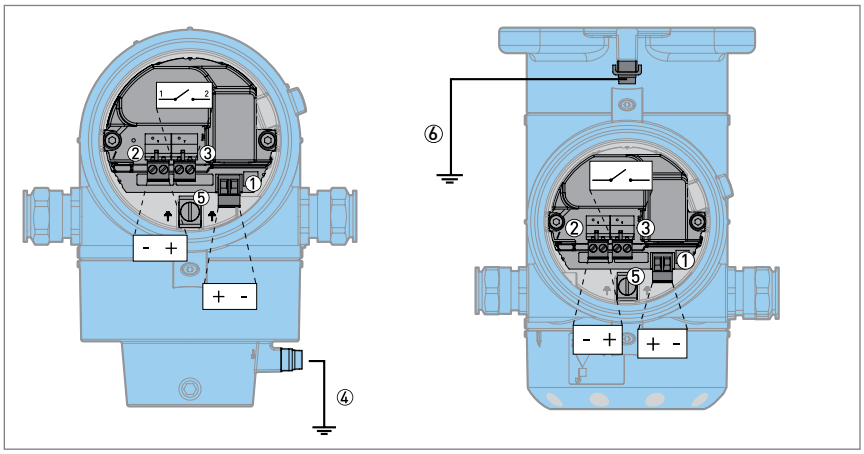
Fig 13: Electrical Installation Connection for Single Output Compact Version and remote version

1. Current output 1.
2. Grounding terminal in the housing (if the electrical cable is shielded).
3. Location of the external grounding terminal (at the bottom of the converter).
4. Location of the external grounding terminal (on the wall support).



1. Output 1: Terminals.
2. Output 2: Terminals.
3. Location of the external grounding terminal (at the bottom of the converter).
4. Grounding terminal in the housing (if the electrical cable is shielded).
5. Location of the external grounding terminal (on the wall support).

Fig 14: Electrical Installation Connection for Dual Outputs for Compact and Remote Version



1. Current output 1: Terminals.
2. Switch power supply: Terminals.
3. Switch output - relay: Terminals.
4. Location of the external grounding terminal (at the bottom of the converter).
5. Grounding terminal in the housing (if the electrical cable is shielded).
6. Location of the external grounding terminal (on the wall support).

Fig 15: Electrical Connection of Single Current Output and Single Switch Output – Relay

- **Electrical Connection for Current Output**

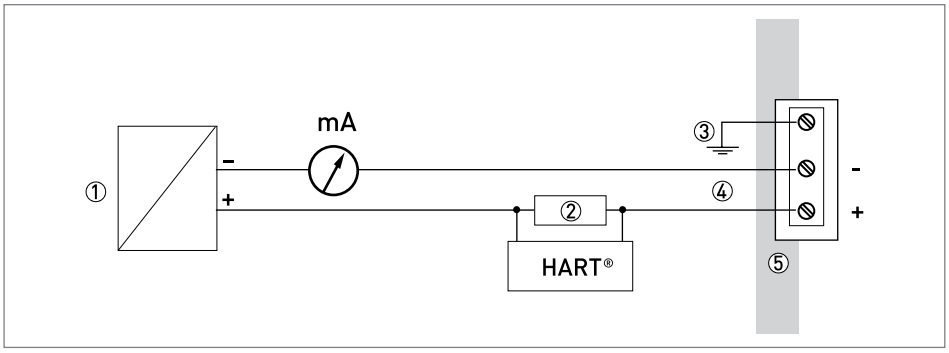
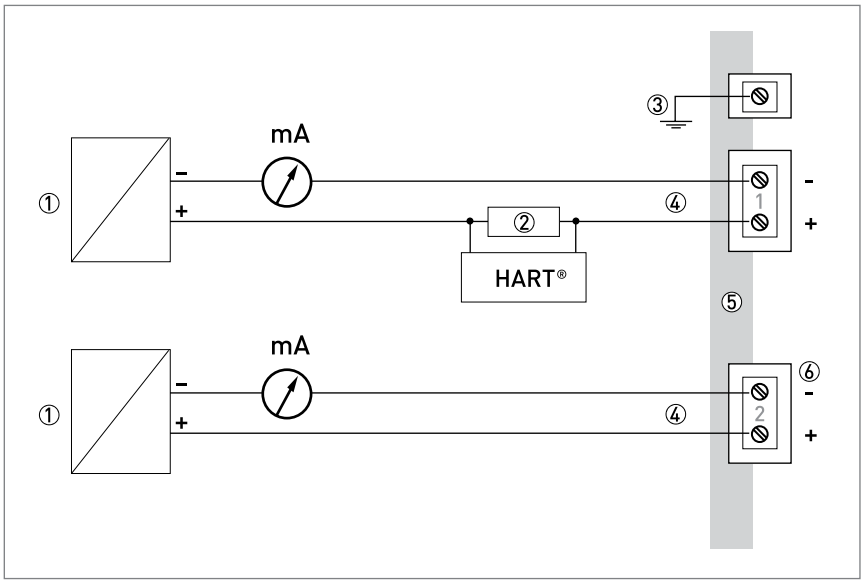


Fig 16: Electrical connections for non-Ex devices (Single Current Output)



1. Power supply.
2. Resistor for HART® communication.
3. Optional connection to the grounding terminal.
4. Output: 11.5 to 30 VDC for an output of 22mA at the terminal.
5. Device.
6. Connector for the optional second output.

Note: Use a separate power supply to power the output 2.

Fig 17: Electrical connections for non-Ex devices (Dual Current Output)

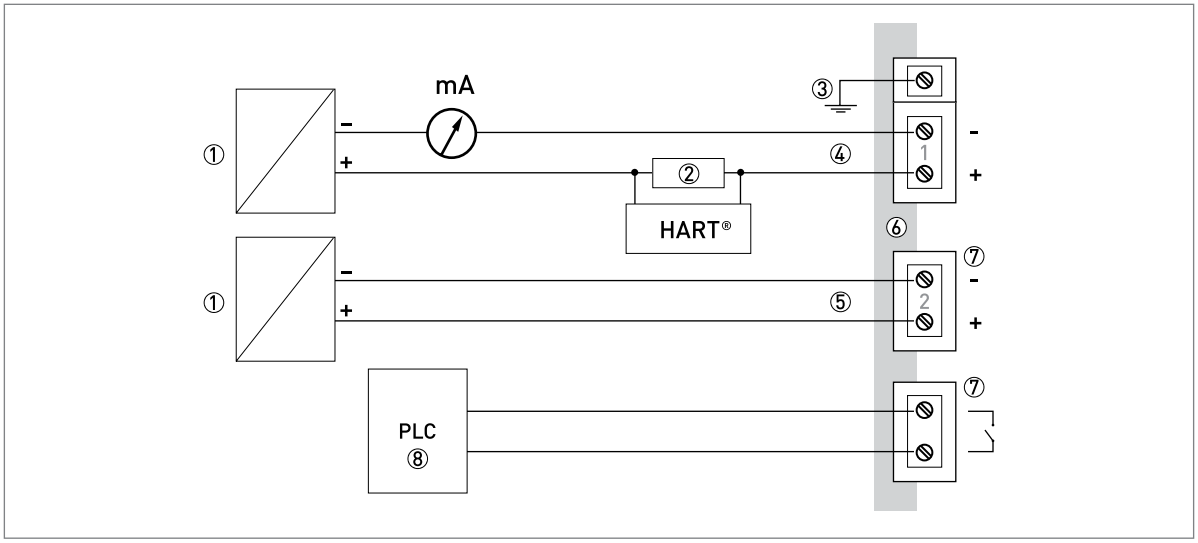
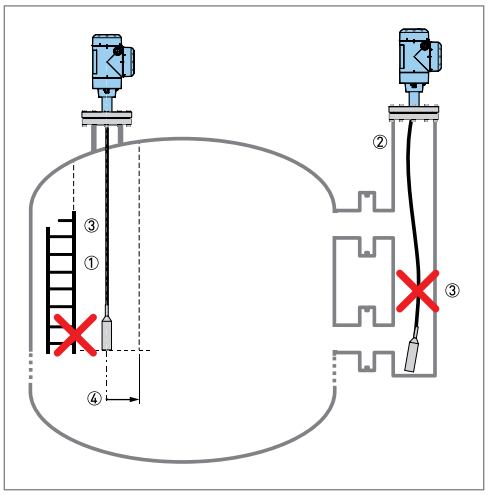


Fig 18: Electrical connections for non-Ex devices (Single current output and Single switch output - relay)

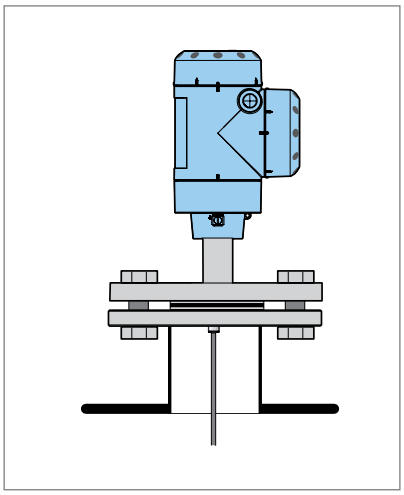
1. Power supply.
2. Resistor for HART® communication.
3. Optional connection to the grounding terminal.
4. Output: 11.5 to 30 VDC for an output of 22mA at the terminal.
5. Switch power supply (2): 11.5 to 34 VDC / 30mA.
6. Device.
7. Connector for the switch output – relay.
8. PLC (for example).

6. Installation

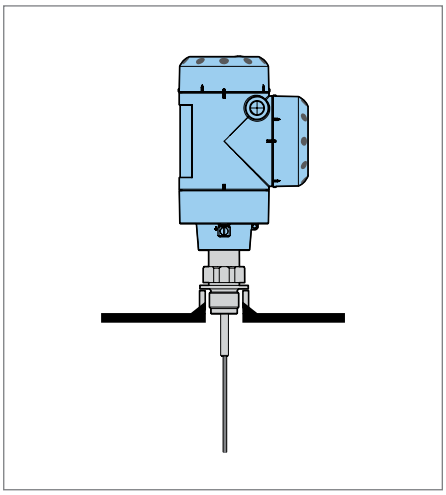
- **For Liquid**



- **Flange Connection**



- **Threaded Connection**



- **Installation of Cable Probe in the Tank**

1. Wind cable probes should not be less than 20" (500mm) in diameter.

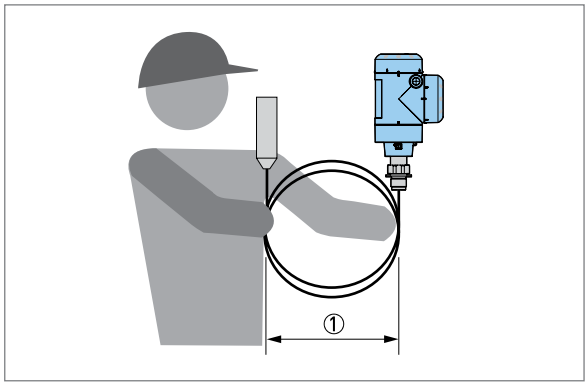


Fig 19: Wind Cable Probes and Electrical Cables

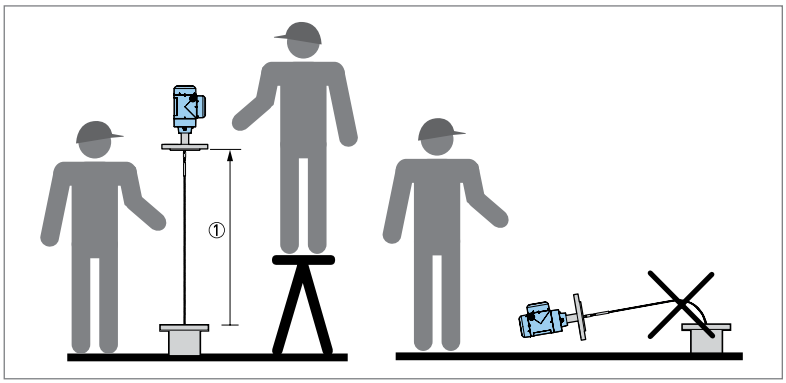
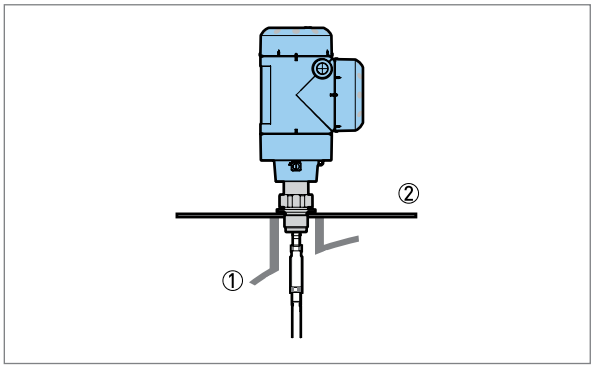


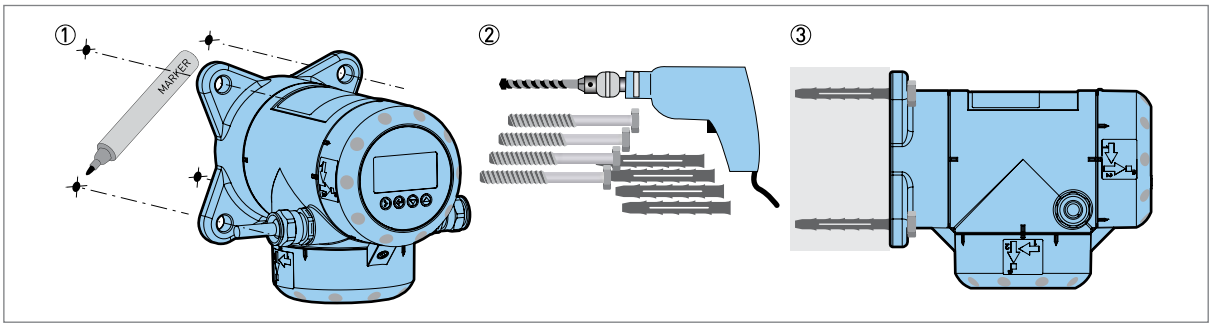
Fig 20: Installation of devices with cable probes

- **Pits and Non-Conductive Tanks**

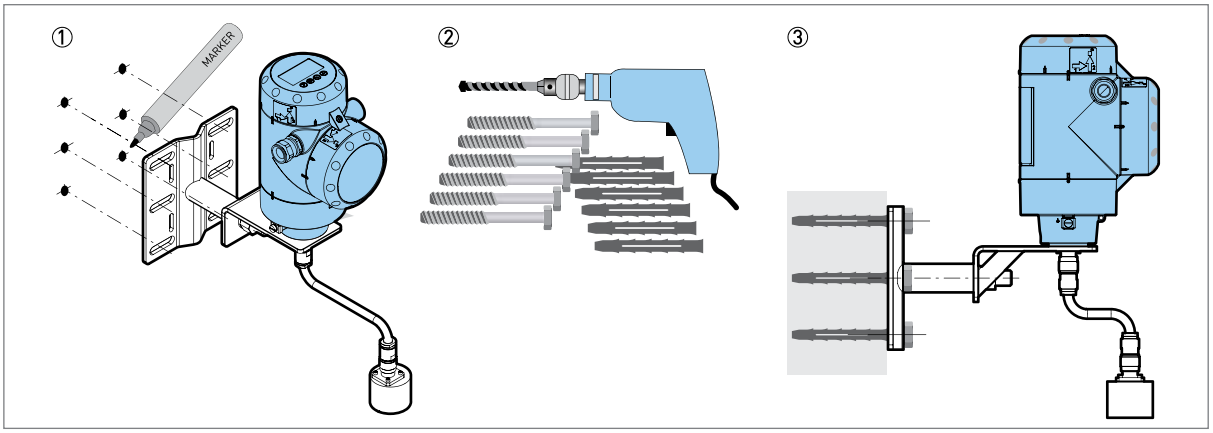


1. Non-metallic (plastic) tank or pit
2. Metal sheet, Ø ≥8"(200mm).

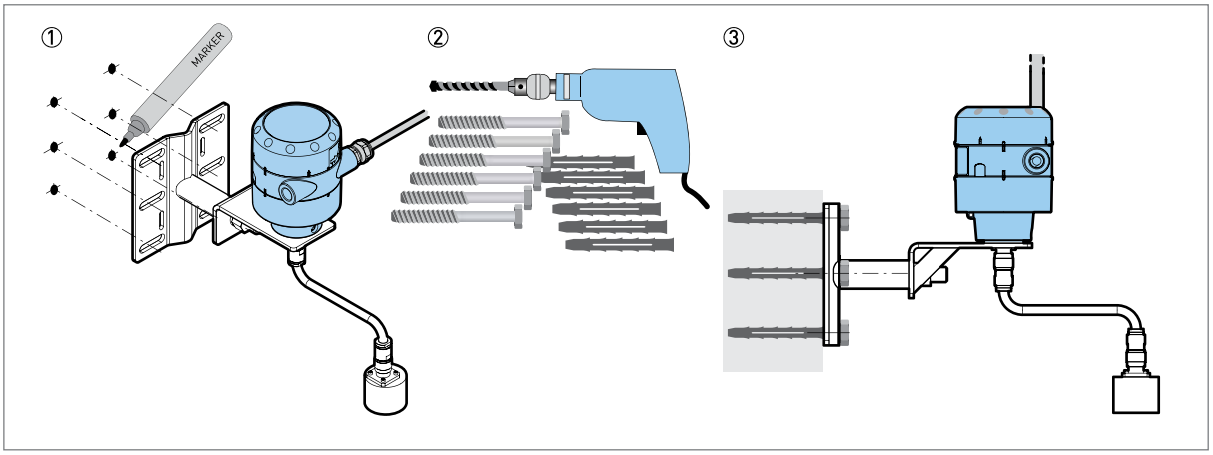
- **Wall Support for Remote Version**



- **Wall Support with Sensor Extension 1**



- **Wall Support with Sensor Extension 2**



7. Maintenance

- **Periodic Maintenance**

  No maintenance is required in normal conditions. Only the manufacturer can repair the device and replace the components. If necessary, maintenance must be done by approved personnel (the manufacturer or personnel approved by the manufacturer).

- **Device Cleaning Instructions**

  The device cleaning instructions are as follow:
  - o Keep the thread clean in the terminal compartment cover.
  - o If dirt collects on the device, clean it with a damp cloth.

7. Troubleshooting

- ***Status and Error Message***

  Device Status

  Diagnostic Menu (Configuration mode or Supervisor menu) supplies more data. This includes internal voltages, the loop current, and the reset counter. You can see this data on the device display screen and in the DTM.

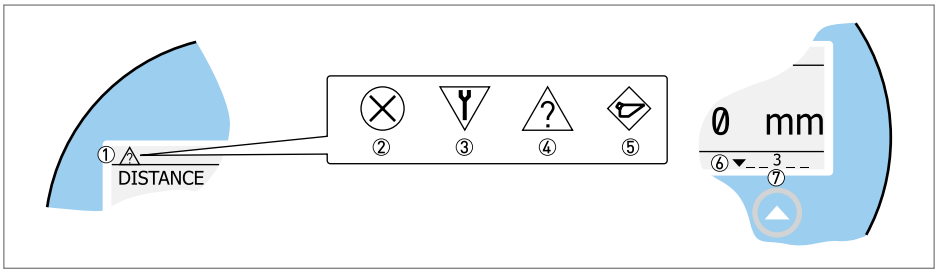


Fig 21: Status Markers

1. Device status (NAMUR NE 107 symbols)
2. Symbol: Failure
3. Symbol: Function check
4. Symbol: Out of specification
5. Symbol: Maintenance
6. Status Marker Line (marker 3 is shown)
7. A number is shown when the status marker is on

Table 5: Types of error message

Device Status	Type of error	Description
Failure	Error	The current output goes to the error signal value set in the menu Output Range I1 if an error message is shown in history. For more data about the menu, refer to the function description.
Out of specification	Warning	If a warning message is shown, there is no such effect on the output value.
Maintenance		

Symbol shown	Status	Description	Status marker shown	Error code (Type)	Possible errors
⊗	Failure	The device does not operate properly, and the fault message remains on. The user cannot remove the "Failure" message from the Normal mode screen.	1	101 (Error)	Current Output Drift
			3	102 (Error)	Temperature Out of Range
			1	103 (Error)	Converter EEPROM
			1	103 (Error)	Converter RAM
			1	103 (Error)	Converter ROM
			1	104 (Error)	Converter Voltage
			2	200 (Error)	Reference Lost
			2	202 (Error)	Peak Lost (Level Lost)
			3	203 (Error)	Sensor Processing Failure
			2	204 (Error)	Overfill
			3	205 (Error)	Internal Communication
			1	206 (Error)	No Probe detected
			1	207 (Error)	Sensor EEPROM
			1	207 (Error)	Sensor RAM
			1	207 (Error)	Sensor ROM
			1	208 (Error)	Oscillator Frequency
			3	209 (Error)	Sensor Not compatible
			2, 4	210 (Error)	Empty
				211 (Error)	Sensor Hardware Failure
			4	214 (Error)	Interface Measurement Failure
			1	501 (Error)	Optional Output Failure
	Function check	The device operates correctly, but the measured value is incorrect. It is a temporary error message. This symbol is shown when the user configures the device with the DTM or a HART® Communicator.	—	—	—

⚠	Out of specification	The measured value may be unstable if the operating conditions do not agree with the device specification.	4	(Warning)	Peak Lost
			4	(Warning)	Overfill
			4	(Warning)	Empty
			4	(Warning)	Temperature out of range
⚠	Maintenance	The device does not operate correctly because of poor environmental conditions. This symbol shows if the measured value is correct, but maintenance is required after a short period.	5	(Warning)	Snapshot Invalid
			4	(Warning)	Flange Lost
			4	(Warning)	Reference Position Outside Range
			4	(Warning)	Audio Signal Offset Outside Range
			3	(Warning)	Temperature <-35°C / -31°F (1)
			3	(Warning)	Temperature >+75°C / +167°F(1)
—	—	—	6	(Warning)	Probe End Analysis Not Valid

*Note: 1. The device display screen does not operate at this temperature. If an "Out of specification" status symbol is shown, refer to Diagnostic Menu (Configuration mode or Supervisor menu) for more data. For data on errors, error records and error codes, refer to the error handling section.

Error Handling

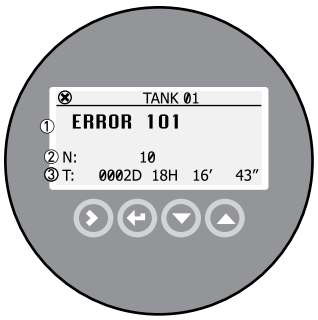


Fig 22: Error Record Data

1. Error code.
2. Number of times the error occurred.
3. Time since the last error record (for example: 2 days, 18 hours, 16 minutes, and 43 seconds).

Procedure for find an Error Record:

- Press [>] and [▲] to enter configuration mode from normal mode.
- Press [>], 9 × [▲] and [>] to go to History menu.
- Press [>] to look at errors recorded by the device. Press [▲]or [▼] for the selection of an error.
- The error record gives the number of times the error occurred and the time of the last error message.

Note: The time of the error occurred is measured in Days (D), Hours (H), Minutes ('), and Seconds ("). It includes the time when the device is powered. The error is saved in the memory of the device when it is powered off. The counter starts when the device is powered again.

Table 6: Description of Errors and Corrective Actions

Hardware Test	Description	Normal Operating Range	Full Range	Cause	Corrective Action
Functioning time	It shows the time in hours that the device is powered.	—	—	—	For information only.
Reset counter	It shows the number of times that the device starts again.				
Reset counter	It shows the number of times that the device starts again.	—	—	—	For information only.
Temperature, converter	It shows the temperature (in °C) of the converter board.	-40 to +80°C	-50 to +85°C	See error 102 in the table that follows.	See error 102 in the table that follows.
Loop current	It shows the current output of the device (in mA).	4 to 20mA	—	—	—
Voltage 5.3V	Voltage transmitted to the sensor board	5.2 to 5.6V	5.2 to 5.6V	—	If the device senses a hardware error, give this data to your supplier.
Voltage on capacitors	Voltage transmitted to the capacitor on the converter board	10 to19V	10 to19V	—	If the device senses a hardware error, give this data to your supplier.
Voltage 3.3V	Voltage transmitted to the sensor board and the converter board	3.2 to 3.5V	3.2 to 3.5V	—	If the device senses a hardware error, give this data to your supplier.
Amplitude, reference pulse	Absolute amplitude of the reference signal converted to a digital sample.	1000 to 5000	0 to 6000	—	If the device senses a hardware error, give this data to your supplier.
Amplitude, flange pulse	Absolute amplitude of the flange signal converted to a digital sample.	0 to 1000	0 to 1000	—	If the device senses a hardware error, give this data to your supplier.
Amplitude, level pulse	Absolute amplitude of the level signal converted to a digital sample.	0 to 1000	0 to 1000	—	If the device senses a hardware error, give this data to your supplier.
Amplitude, interface pulse	Absolute amplitude of the interface signal converted to a digital sample.	0 to1000	0 to1000	—	If the device senses a hardware error, give this data to your supplier.
Amplitude, probe end pulse	Absolute amplitude of the probe end signal converted to a digital sample.	0 to 1000	0 to 1000	—	This is not applicable to this version of the device.

Table 7: Description of Errors and Corrective Actions

Error code	Error Message	Status marker shown	Cause	Corrective action
Back End Errors				
100	Device reset	1	Device detected an internal error.	Record the data that is in Diagnostic Menu (Configuration mode / Supervisor menu). Contact your supplier.
101	Current output drift	1	Current output is not calibrated.	Contact your supplier to get the calibration procedure.
102	Temperature out of range	1	Hardware error.	Replace the device.
		3	Ambient temperature is beyond the given range that causes loss or corruption of data.	Measure the ambient temperature. Please power off the device until the ambient temperature is in the given range. If the temperature continues to fluctuate, ensure that there is insulation around the signal converter.
103	Converter memory failure	1	Device's hardware is defective.	Replace the signal converter.
104	Converter voltage failure	1	Device's hardware is defective.	Replace the signal converter.
Sensor Errors				
200	Reference pulse lost	2	Reference amplitude is less than reference threshold. This fault could occur because the device hardware is defective.	Contact your supplier and ensure the electronics are still correctly functioning. Check your installation has ESD protection.
201	Sensor voltage failure	1	Device's hardware is defective.	Please check the power supply at the device terminals. Ensure the voltage values are in the specified limits in Diagnostic Menu (Configuration mode or Supervisor menu). If the voltage is correct, replace the signal converter.
203	Level lost error	2, 4	Device cannot find the product surface. The measurement stops at the last measured value.	Measure the level of the contents in the tank using another method of measurement. Fill the tank until the product level is in the measurement range if the tank is empty or the level is below the end of the probe. If the tank is full (the level is in the blocking distance), remove the tank contents until the level is in the measuring range. If the product was lost and the tank was neither full nor empty, wait for the device to re-find the level.
		2, 4	Device cannot find the level and the probe end return signals.	

				If the device has to measure a product with εr, refer to the level signal value in the menu Threshold Level and adjust the level of threshold. If the product has a low dielectric constant (εr<1.6) and the device is in "Automatic" measurement mode, refer to the probe end signal value in the menu Probe End Threshold and adjust the probe end threshold. For more data, refer to Thresholds and interference signals.
				Ensure the signal converter is correctly attached to the probe.
204	Overfill error	2, 4	Level is in the blocking distance. There is a risk if the product will overflow and/or cover the device.	Remove some of the product, until the level is below the blocking distance.
205	Internal Communication	3	Device's hardware or software is defective. The converter cannot transmit or receive signals from the probe electronics.	Please power off the device. Ensure the signal cable is connected to the terminal, and the screw connection is tight. Powered the device. If the problem continues, replace the signal converter.
206	No sensor detected	2	Device's hardware is defective.	Replace the signal converter.
207	Sensor memory failure	1	Device's hardware is defective.	Replace the signal converter.
208	Oscillator Frequency	1	Device's hardware is defective.	Replace the signal converter.
209	Sensor not compatible	1	Software version of the sensor is not compatible with the software version of the signal converter.	Go to menu Identification in Configuration mode. Record the version numbers of the device software given in menu. Give this data to your supplier.
		1	Defective wiring.	
210	Empty	2, 4	Level is in the bottom dead zone. There is a risk that the tank is empty.	Add some of the product until the level is above the bottom dead zone.
211	Sensor Hardware Failure	1	Device's hardware is defective.	Replace the probe. For more data, refer to How to turn or remove the signal converter.

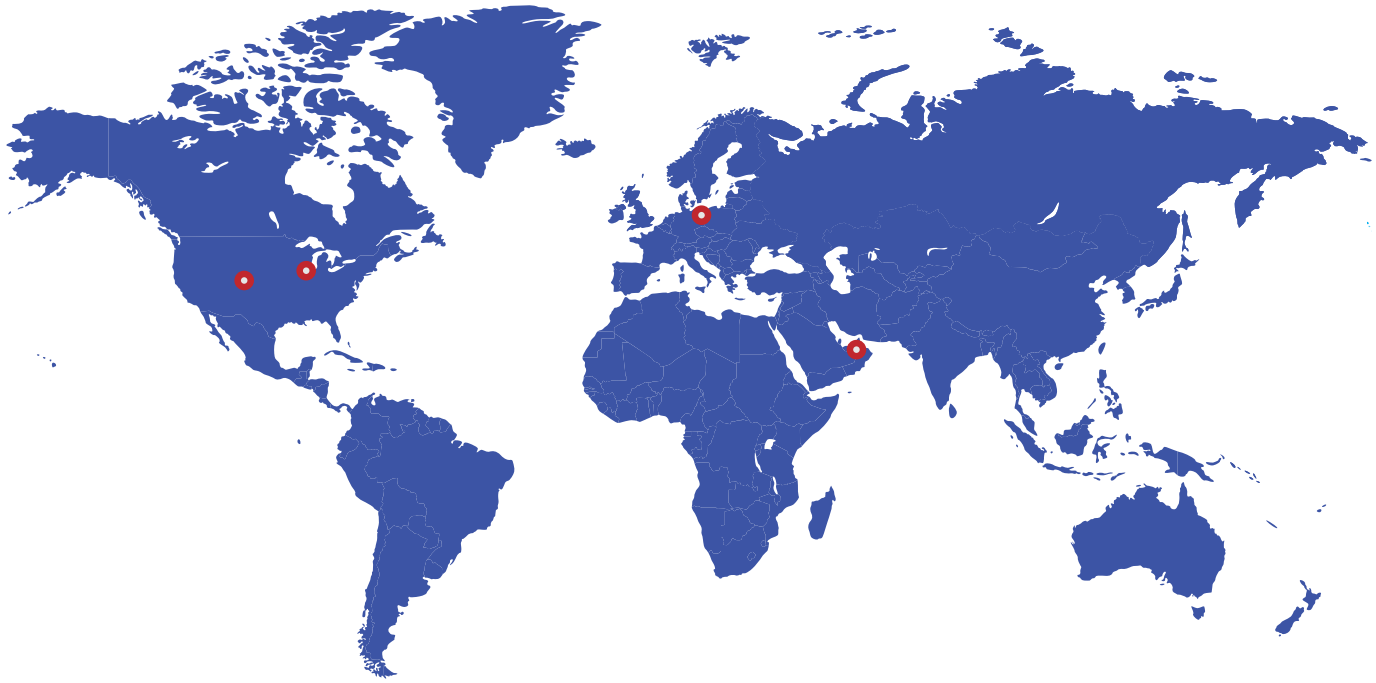
214	Interface Measurement Failure	4	Device cannot find the interface. The measurement stops at the last measured value. The interface is in the measuring range.	If the product was lost and the tank is neither full nor empty, wait for the device to re-find the level. If the device has to measure a product with a small difference between the dielectric constant (εr) of the top product and the bottom product, refer to the interface signal value in menu Interface Threshold and then adjust the interface threshold.
				Ensure the signal converter is correctly attached to the probe.
		4	Device cannot find the interface. The measurement stops at the last measured value. The interface is in the top dead zone.	Remove the contents from the tank until the interface is in the measurement range.
		4	Device cannot find the interface. The measurement stops at the last measured value. There is no interface, or the layer is less than 2”(50mm).	If there is no top product in the tank, fill the tank until the top product layer is more than 2"(50mm).
		4	Device cannot find the interface. The measurement stops at the last measured value. The tank is empty, or the interface is at the bottom dead zone.	If the tank is empty or the level is below the end of the probe, fill the tank until product level is in the measurement range.
501	Optional Output Failure	1	Current output is not calibrated.	Contact your supplier and get the calibration procedure.
		1	Hardware error.	Replace the device.
Maintenance (Status Signal)				
—	Snapshot Invalid	5	The "static" snapshot data stored in the device does not agree with the installation. If you change the device configuration (probe length etc.), this message will be shown. The recorded "static" snapshot data will not be used by the device while this error message is shown. (1)	Do the Auto Setup procedure again.

—	Flange Lost	4	The signal converter cannot find the probe below the flange. Is the signal converter attached to the process connection.	Ensure the signal converter is attached to the process connection. If this status does not change, contact your supplier.
—	Reference Position Outside Range	4	Device's hardware is defective. (1)	Replace the signal converter.
—	Audio Signal Offset Outside Range	4	Device's hardware is defective. (1)	Replace the signal converter.
—	Temperature <--31°F (-35°C) 2	3	Ambient temperature is less than -31°F (-35°C). This temperature is near to the minimum limit for device operation. (1)	Measure the ambient temperature. If the temperature does not stay in the correct range, make sure that there is insulation around the signal converter.
—	Temperature > +167°F (+75°C).	3	Ambient temperature is more than +167°F (+75°C). This temperature is close to the maximum limit for device operation. (1)	Measure the ambient temperature. Please powered off the device until the ambient temperature is in the given range. If the temperature continues to fluctuate, ensure that there is insulation around the signal converter.
Other Warnings				
—	Probe End Analysis Not Valid	6	Warning to decrease the probe length, and if it is not the same as the value used in the device settings (menu Probe Length). The device will not use the recorded probe length calculation while this error message is shown.	Do the Auto Setup procedure again.
			Warning is shown if the value set at this time in the menu Epsilon R Gas is different from the dielectric constant of the gas in the tank. The device will not use the recorded probe length calculation while this error message is shown.	

***Note**

1. This error message does not have an effect on the current output signal.
2. The device display screen does not operate at this temperature.

TEKTROL
Technology Solutions



Tek-Trol LLC

796 Tek Drive Crystal Lake, IL
60014, USA
Sales: +1 847-857-6076

Tek-DPro Flow Solutions

PO Box 121 Windsor, Colorado
80550, USA
Sales: +1 847-857-6076

Tek-Trol Solutions BV

Florijnstraat 18, 4879 AH
Etten-Leur, Netherlands
Sales: +31 76-2031908

Tek-Trol Middle East FZE

SAIF Zone, Y1-067, PO BOX No.
21125, Sharjah, UAE
Sales: +971-6526-8344

Support: +1 847-857-6076 | Email: tektrol@tek-trol.com | www.tek-trol.com

Tek-Flex 4100A