ABB MEASUREMENT & ANALYTICS | DATA SHEET

TB84EC

4-electrode conductivity transmitter

Measurement made easy

Hazardous area rated transmitter compatible with a wide range of sensors (including TB4)

Simple smart key menu programming
- variable process display: mS/cm and mS/cm, concentration, and 6-character user-defined including percent, ppm and ppb

Two fully programmable isolated outputs
- 0 to 20 mA and 4 to 20 mA

Three fully programmable relay outputs

Eleven modes of temperature compensation
- includes three for pure water and four for specified chemicals

Adjustable damping

Hold output function
- holds all outputs or any individual output

Programmable security codes and configuration lockout

Universal power supply
- 120 to 240 V AC, 50 / 60 Hz. Voltage range is 94 to 276 V AC

NEMA 4X/IP65 housing
- cast aluminum with corrosion-resistant polyester powder coat finish

FM and CSA non-incendive agency approvals
- CE Mark

Advantage™ conductivity transmitter

The ABB TB84EC Advantage conductivity transmitter is a unique and advanced microprocessor-based instrument. Smart keys on the front panel enable local programming of all transmitter functions. Easy-to-follow instructions appear above each smart key. A secondary display clearly defines each menu option during transmitter programming. During normal operation the secondary display shows several useful parameters. This innovative, user-friendly interface provides for straightforward transmitter configuration and calibration.

Standard outputs include two isolated analog (current) outputs and three relay outputs. The analog outputs can be configured for the PV (process variable) and / or temperature. The relay outputs can be configured for the PV, temperature, diagnostics, cycle timer controller, or sensor cleaner.

The TB84EC transmitter is compatible with all ABB 4-electrode conductivity sensors. These patented sensors provide worry-free measurement by compensating for all sensor fouling that might affect sensor accuracy. The transmitter provides notification should sensor fouling become so severe as to affect accuracy. Sensor diagnostics include unique ground loop detection, fouled or dirty sensor, and other features.

The TB84EC transmitter meets current CE and NEMA 4X/IP65 requirements.

4-electrode sensor compatibility

The TB84EC transmitter accepts inputs from all ABB patented 4-electrode sensors. A menu choice during configuration makes changing from one sensor group to another easy. No jumpers or manual adjustments are required.

Group	Ranges
Cell constant A	0 to 199.9 µS/cm, 0 to 1,999 µS/cm 0 to 19.99 mS/cm, 0 to 199.9 mS/cm 0 to 1,999 mS/cm
Cell constant B	0 to 19.9 µS/cm, 0 to 199.9 µS/cm 0 to 1,999 µS/cm

Basic or advanced programming

Basic or advanced programming modes can be chosen at the time of purchase. Basic mode has configuration choices common to conductivity transmitters. Advanced mode has an expanded set of functions intended for complex applications. Separating basic and advanced modes simplifies setup and calibration activities. The added choices are:

- Toggle between basic or advanced programming mode
- Concentration transmitter:
  - 0 to 15 % sodium hydroxide (NaOH)
  - 0 to 20 % sodium chloride (NaCl)
  - 0 to 18 % hydrochloric acid (HCl)
  - 0 to 20 % sulfuric acid (H_2SO_4)
  - user-defined through a 6-point conductivity versus concentration linear curve fit where output follows concentration. Engineering units are %, ppm, ppb, and user- defined.
- Temperature compensation types:
  - 0 to 15 % sodium hydroxide (NaOH)
  - 0 to 20 % sodium chloride (NaCl)
  - 0 to 18 % hydrochloric acid (HCl)
  - 0 to 20 % sulfuric acid (H_2SO_4)
  - pure water neutral salt
  - pure water trace base
  - pure water trace acid
  - user-defined function generator
  - solution coefficient (0 to 9.99 %/°C).
- Analog pulse diagnostic output.
- Expanded relay functions and flexibility.

Concentration

The concentration configuration has four preprogrammed conductivity to concentration curves. They are:

- 0 to 15 % sodium hydroxide (NaOH)
- 0 to 20 % sodium chloride (NaCl)
- 0 to 18 % hydrochloric acid (HCl)
- 0 to 20 % sulfuric acid (H_2SO_4).

Additionally, the transmitter offers the freedom to program conductivity to concentration curves via a 5-segment (6-point) function generator. This increases accuracy by enabling the programming of exact curve breakpoints. Most concentration programs force curve fitting to percent concentration values divisible by five only.

Analog outputs

The transmitter has two isolated analog outputs (AO1 and AO2). Each is user-configurable as either a 0 to 20 or a 4 to 20 mA signal. AO1 is dedicated to the PV while AO2 is configurable for either the PV or temperature. A 2-point calibration method applies to both analog outputs. This enables adjustment of the analog outputs to compensate for other devices in the loop that may not be calibrated. Entering the PV or temperature endpoints in reverse order allows for reverse-acting outputs.

A capacitive type lag, applied via the damping function, is useful in process environments where noise is present. Damping is supported for both analog outputs and the displayed PV and has a maximum value of 99.9 seconds. One damping value affects both analog outputs and the displayed PV in basic configuration. Individual damping values affect each analog output and the displayed PV in advanced configuration.

Relay outputs

The transmitter has three relay outputs available (RO1, RO2, RO3). Each is jumper selectable as either NO (normally open) or NC (normally closed). A corresponding relay icon appears on the display when a relay activates. The functionality of each relay output depends on the configuration mode. Table 1 shows the possible functionality of each relay output for basic and advanced configuration. Advanced programming offers all function choices shown in Table 1 for each of the three relay outputs.

	R01		R02		R03	
Function	**Basic**	**Adv**	**Basic**	**Adv**	**Basic**	**Adv**
High or low PV alarm	✔	✔	✔	✔	✔	✔
High or low temperature alarm (°C or °F)		✔	✔	✔	✔	✔
Diagnostics alarm		✔		✔	✔	✔
High- or low-cycle timer		✔		✔		✔
Sensor cleaner*		✔		✔		✔

* If a relay output is configured as a sensor cleaner, no other relay output can be used for this function

Table 1 Relay output functionality

High and low alarms can be chosen for the PV and temperature in either °C or °F. The diagnostic relays can be linked to sensor diagnostics, transmitter diagnostics, or all diagnostic conditions. The high- and low-cycle timer has adjustable set points, cycle time and on time. This feature works best with processes that have poor mixing or a long lag or dead time. The cycle timer enables a waiting period to see the results of chemical addition by interrupting the feed. The sensor cleaner feature provides for cycle time, on time and recovery time programming. This makes set up and operation of the transmitter with the ABB hydraulic sensor cleaner or TB18 Safe-T-Clean® sensor valve easy and troublefree.

Diagnostics

The TB84EC transmitter monitors both the sensor and the transmitter constantly. This helps to ensure reliability and accuracy. Upon detection of a diagnostic condition, the transmitter provides diagnostic notification by flashing a FAULT icon on the display and supplying a pulse on AO1 (if activated). Pressing the FAULT info smart key stops the icon from flashing and provides, on the secondary display, a short description and fault code. The FAULT icon remains on until the problem is resolved. Sensor faults that activate the diagnostic notification are:

- Fouled or dirty sensor
- Shorted or open temperature compensator
- Ground loop detection (patent pending)

The user can turn the diagnostics on or off.

Hold output

The transmitter has a hold output state that improves plant safety and process integrity during maintenance and calibration. When activated, the HOLD icon appears at the top of the display. Upon release of the hold state, the HOLD icon disappears. When the sensor cleaner option is chosen, the transmitter provides the option of holding all analog and relay outputs during the cleaning cycle. The analog outputs can be held to any preselected level. The relay outputs can be held individually to any active or inactive state. This is useful for checking and exercising any external devices connected to the transmitter.

Diagnostic pulse

The analog output is fully scalable over any conductivity or concentration range. Advanced configuration enable pulsing of AO1 during a diagnostic condition.

When the diagnostic pulse is active, the output is modulated for 1 second out of a 6-second repeating cycle to a configuration selectable level ranging from 1 to 100 % of span (0.16 to 16 mA for a 4 to 20 mA output or 0.20 to 20 mA for a 0 to 20 mA output). Should the actual output of the transmitter be below 12 mA, the pulse will add current; if the actual output is at or above 12 mA, it will subtract current. This provides remote notification of a problem with proper configuration of a digital control system (DCS), programmable logic controller (PLC), or chart recorder.

Temperature compensation

The TB84EC transmitter is compatible with either Pt100, 3 kΩ Balco RTD or 4.75 kΩ network, ABB proprietary negative coefficient elements. The automatic temperature compensation options are:

- manual
- automatic for potassium chloride (KCl)
- user-entered coefficient in %/°C
- 0 to 15 % sodium hydroxide (NaOH)
- 0 to 20 % sodium chloride (NaCl)
- 0 to 18 % hydrochloric acid (HCl)
- 0 to 20 % sulfuric acid (H_2SO_4)
- a user-defined function generator
- solution coefficient (0 to 99.9 %/°C)
- trace acid
- trace base
- neutral salt for pure water

Calibration

Smart key programming makes transmitter calibration accurate and efficient. Process calibration is a straight-forward 1-point smart calibration resulting in either a slope adjustment, offset adjustment, or a combination of adjustments. Selecting the reset calibration state results in the calibration defaulting to the original factory calibration. A 1-point smart temperature calibration also exists. This calibration adjusts either the temperature slope, offset, or a combination. A special edit calibration state enables manual editing or adjusting of the calibration data.

This feature is especially useful during a startup where a large number of similar loops are being set up and calibrated at the same time. Calibration of the 4 to 20 mA output is enabled via an easy 2-point procedure.

Programmable security code

The transmitter has a single 3-digit security code. Menu-selectable choices enable the security code to be applied to none or any combination of the following menu choices:

- calibrate
- output / hold
- setpoint/tune
- configure

Specification

Type
Conductivity transmitter

Input voltage
120 / 240 V AC, 50 / 60 Hz

Range
94 to 276 V AC

Installation category
II

Power consumption
17 VA max.

Input type
ABB 4-electrode conductivity sensors

Input range
Conductivity
0 to 1,999 mS/cm (sensor group dependant)
Concentration
0.000 to 1,999 digits (engineering units configurable)

Display resolution
Conductivity
0.001 µS/cm, 0.01 µS/cm, 0.1 µS/cm
(sensor group dependant)
Concentration
0.001 digits (configurable)
Temperature
1 °C, 1 °F

Temperature compensation types
Pt100, 3 kΩ Balco, 4.75 kΩ RTD

Temperature compensation
Manual
(0.1N KCI based)
Automatic, configurable as:
- Standard (0.1N KCI based)
- Coefficient (0 to 9.99 %/°C adjustable)
- 0 to 15 % NaOH
- 0 to 20 % NaCI
- 0 to 18 % HCI
- 0 to 20 % H_2SO_4
- Pure water – neutral salt
- Pure water – acid
- Pure water – base
- User-defined

Analog ouput ratings
2, completely isolated 0 to 20 mA or 4 to 20 mA outputs, 750 W max. load value, AO1 fixed to PV, AO2 configurable to either PV or temperature.

AO1
Conductivity / concentration – isolated 0 to 20 mA or 4 to 20mA, direct or reverse-acting, linear and nonlinear, configurable across full range.
Minimum span
- Sensor group A 100.0 µS/cm
- Sensor group B 10.00 µS/cm
- Concentration 5 % max. concentration range

Maximum span
- Sensor group A 1,999 mS/cm
- Sensor group B 1,999 µS/cm
- Concentration 1,999 digits

AO2
Conductivity / concentration / temperature (°C or °F) – isolated 0 to 20 mA or 4 to 20 mA, direct or reverse-acting, configurable across full range
Minimum span
- Sensor group A 100.0 µS/cm
- Sensor group B 10.00 µS/cm
- Concentration 5 % max. concentration range
- Temperature 10 °C (50 °F)

Maximum span
- Sensor group A 1,999 mS/cm
- Sensor group B 1,999 µS/cm
- Concentration 1,999 digits
- Temperature 320 °C (608 °F)

Relay outputs

Form C, SPDT relays that are jumper selectable as either normally open or normally closed. Refer to Table 1 on page 4 to see the functionality of each relay output in basic and advanced configuration.

Ratings

Max. AC capacity values: 100 VA, 240 V AC, 3 A
Max. DC capacity values: 50 W, 24 V DC, 2 A

High and low set points (basic and advanced configuration)

Source: conductivity and concentration

- High/low/deadband Software configurable
- Delay value range 00.0 to 99.9 min

Source: temperature (°C or °F)

- High and low range –20 to 300 °C (–4 to 572 °F)
- Deadband range 0 to 10 °C (32 to 50 °F)
- Delay value range 00.0 to 99.9 min

High- or low-cycle timer (advanced configuration only)

Source: conductivity and concentration

- Turn on range Software configurable
- Cycle time range 00.0 to 99.9 min
- On time range 00.0 to 99.9 min

Sensor cleaner (advanced configuration only)

- Cycle time range 00.0 to 99.9 h
- On time range 00.0 to 99.9 min
- Recovery time range 00.0 to 99.9 min

Nonlinearity and repeatability:

Conductivity

- Display ±0.5 % of measurement range per decade
- Output ±0.02 mA at full scale output settings
- Temperature: 1 °C

Maximum sensor cable length

Sensor group A

30.5 m (100 ft)

Sensor group B

15.2 m (50 ft)

Turn on time

2 s typical, 4 s max.

Load resistance range (analog outputs)

750 Ω max.

Damping

Continuously adjustable from 00.0 to 99.9 s

Dynamic response

3 s for 90 % step change with 00.0 s damping

Mounting position effect

None

Environmental (temperature)

Operating

–20 to 60 °C (–4 to 140 °F)

Storage

–40 to 70 °C (–40 to 158 °F)

Humidity (operating and storage)

Will meet specifications to 95 % RH

Housing

NEMA 4X and IP65, anodized aluminum alloy with polyester powder coating

Conduit connection

5 total, 2 each 22.2 mm (0.875 in) holes in enclosure that accept ½ in hubs, 3 each 15.24 mm (0.6 in) holes that accept PG9 hubs

Size (½ DIN), H x W x D

144.0 x 144.0 x 171.0 mm (5.67 x 5.67 x 6.73 in)

Min. panel depth

144.8 mm (5.70 in)

Max. panel thickness

9.5 mm (0.38 in)

Panel cutout

135.4 (+1.3, –0.8) by 135.4 (+1.3, –0.8) mm
(5.33 [+0.05, –0.03] by 5.33 [+0.05, –0.03] in)

Weight

2.1 kg (4.6 lb)
3.4 kg (7.5 lb) with pipe mounting hardware

Agency certifications

CSA

- Class I, Division 2, Groups A, B, C, and D
- Class II, Division 2; Groups E, F and G
- Class III, Division 2

FM

Non-incendive:

- Class I, Division 2, Groups A, B, C, and D
- Class II, Division 2; Groups F and G
- Class III, Division 2

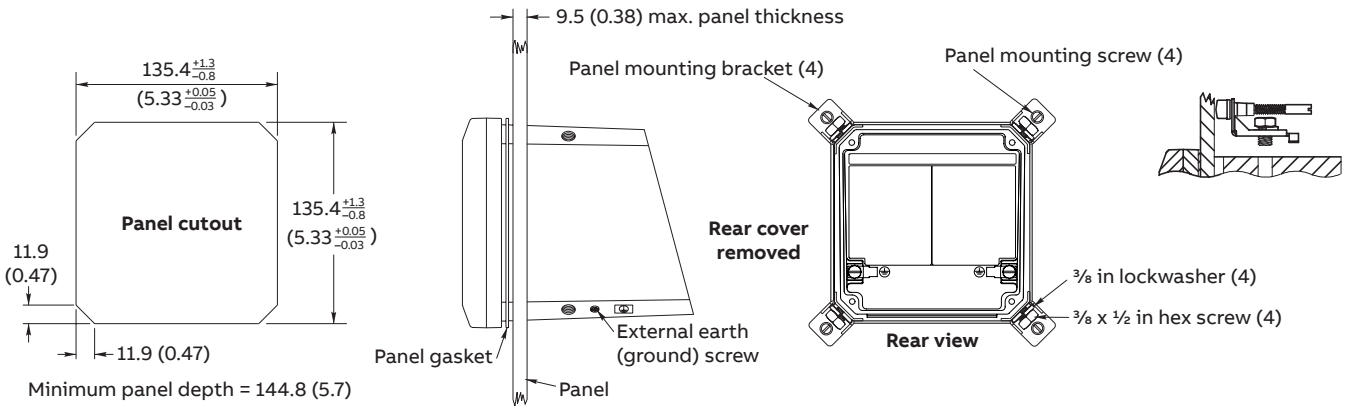
EMC requirements

CE Certified – complies with all applicable European Community product requirements, specifically those required to display the CE markings on the product nameplate.

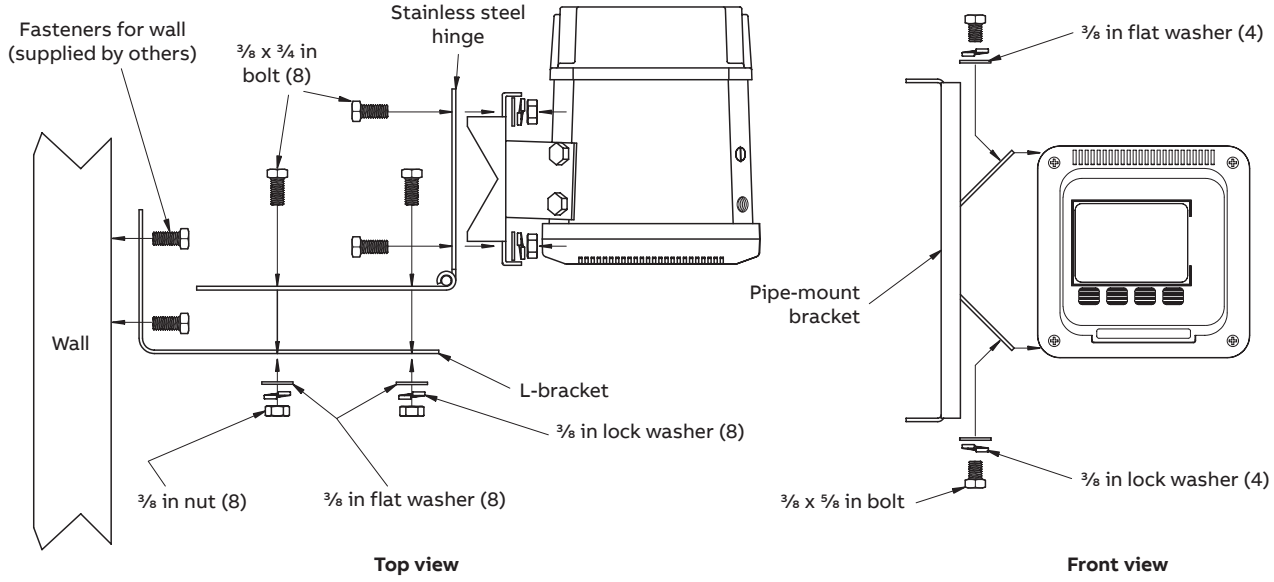
Installation

Dimensions in mm (in)

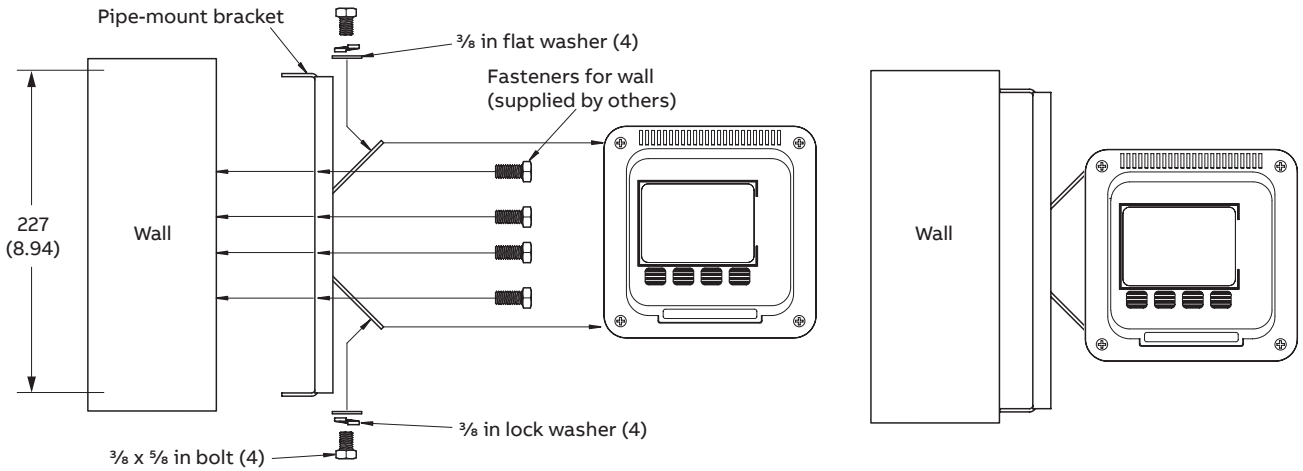
Panel-mounting



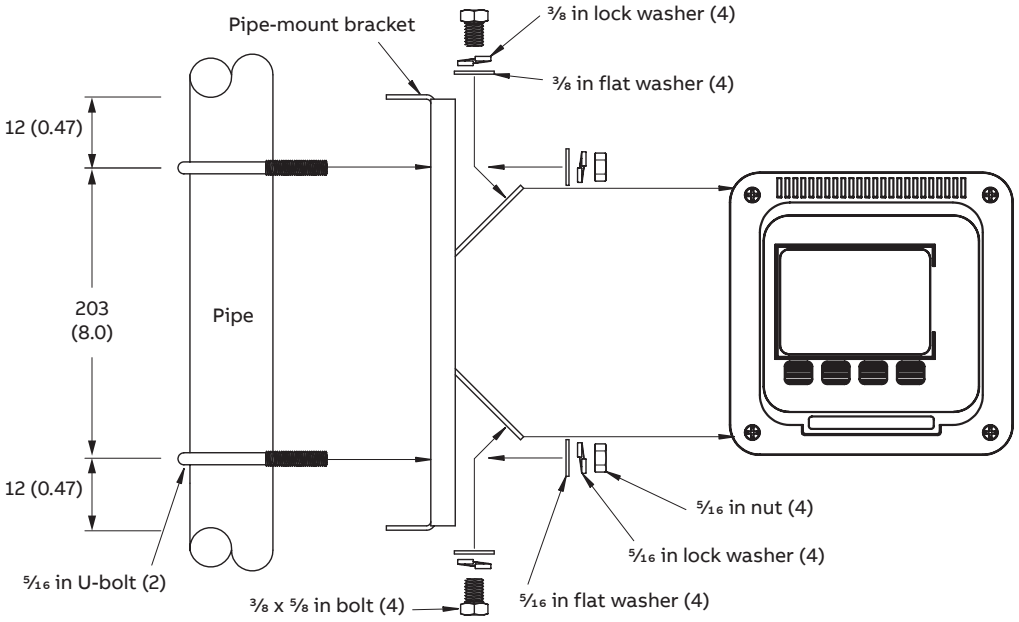
Hinge / Wall (rear) mounting



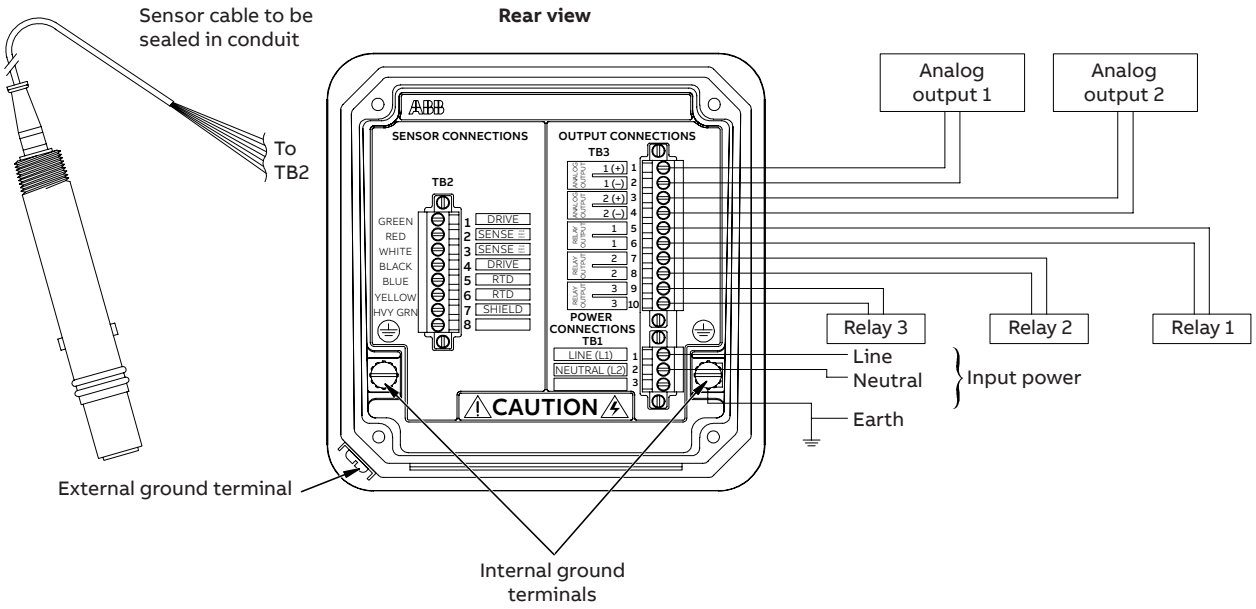
Wall (side) mounting



Pipe-mounting



Electrical connections



Ordering information

Advantage 4-electrode conductivity transmitter[1]	**TB84**	**XX**	**X**	**0**	**0**	**0**	**X**	**X**	**X**
Input									
4-electrode conductivity[2]		EC							
2-electrode conductivity[2]		TE							
Toroidal conductivity[2]		TC							
Programming option[1]									
Basic			1						
Advanced[3]			2						
Reserved									
For future use				0					
Reserved									
For future use					0				
Housing type									
Powder-coated aluminum						0			
Mounting hardware									
None							0		
Pipe							1		
Hinge (for pipe or wall)							2		
Panel							3		
Wall							4		
Agency approval									
None								0	
FM (Factory Mutual)								1	
CSA (Canadian Standards Association)								2	
Tag									
None									0
Stainless steel (4TB5003-0007)									1
Mylar™									2

Notes.

1 One instruction manual included. Additional copy, part number OI/TB84TC-EN, OI/TB84EC-EN or OI/TB84TE-EN

2 Cable grip available separately, part number 4TB9515-0165

3 See product data sheets (DS/TB84EC-EN, DS/TB84TE-EN and DS/TB84TC-EN) for details of advanced programming options

Installation accessories

Panel-mounting kit	4TB9515-0123
Pipe-mounting kit	4TB9515-0124
Hinge-mounting kit	4TB9515-0125
Wall-mounting kit	4TB9515-0156
Cable grip for ½ in hubs	4TB9515-0165
Cable grip for PG9 hubs	4TB9515-0191
Complete cable grip kit (2 each ½ in and 3 each PG3)	4TB9515-0198

Acknowledgements

- Mylar is a registered trademark of Dupont Teijin Films

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