ABB MEASUREMENT & ANALYTICS | DATA SHEET

TB84TC

Toroidal conductivity transmitter



Measurement made easy

Hazardous area rated transmitter for use with TB404 sensors

Smart key menu programming

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

Three fully programmable relay outputs

Concentration analyzer
- Predefined and user-defined configurations

Back-lit display for easy viewing

Adjustable damping

Hold output function
- holds all outputs or any individual output

Programmable security codes and configuration lockout

Universal power supply
- 120 / 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 toroidal conductivity transmitter

The ABB TB84TC Advantage™ toroidal conductivity transmitter is a unique and advanced microprocessor- based instrument. Smart keys on the front panel provide local programming of all analyzer functions. Easy-to-follow instructions appear above each smart key. A secondary display clearly defines each menu option during programming. When the analyzer is in normal operating mode, the secondary display shows several useful parameters. This innovative, user-friendly interface provides straightforward analyzer operation, configuration and calibration.

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

The TB84TC transmitter is compatible with all ABB TB404 toroidal conductivity sensors. It automatically measures and autoranges from 400 µS/cm to 1,999 mS/cm without any configuration or jumper changes. Toroidal sensors provide accurate conductivity measurements in fouling or corrosive solutions. Encapsulating the sensor in polyether-ether ketone (PEEK) ensures the chemical resistance and durability of the sensor.

Flexible sensor mounting options include submersible, inline, ball valve insertion and high pressure ball valve insertion. Chemically resistant sensor material choices include chlorinated polyvinyl chloride (CPVC), 316 stainless steel, Kynar® and titanium.

The TB84TC transmitter meets current CE and NEMA 4X/IP65 requirements.

Toroidal sensor compatibility

The TB84TC transmitter is compatible with ABB's TB404 toroidal conductivity sensors that are designed to measure from 400 µS/cm to 1,999 mS/cm. The TB84TC transmitter autoranges automatically across this full range.

Basic or advanced programming

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

- Preprogrammed concentration analyzer:
  - Preprogrammed for 0 to 15 % sodium hydroxide (NaOH), 0 to 20 % sodium chloride (NaCl), 0 to 18 % hydrochloric acid (HCl) and 0 to 20 % sulfuric acid (H_2SO_4).
- User-defined concentration analyzer:
  - User-defined through a 6-point conductivity versus concentration linear curve fit where output follows concentration. Engineering unit choices are percent (%), parts per million (ppm), parts per billion (ppb) and user-defined.
- Temperature compensation types:
  - Manual (0.1 N KCl based)
  - Automatic configurable as:
    - standard (0.1 N KCl based)
    - user-defined solution coefficient (0 to 9.99 %/°C)
    - 0 to 15 % NaOH
    - 0 to 20 % NaCl
    - 0 to 18 % HCl
    - 0 to 20 % H_2SO_4
    - user-defined function generator
- Analog pulse diagnostic output.
- Nonlinear output:
  - User-defined through a 6-point conductivity versus desired current output that best fits the nonlinear relationship
- Expanded relay functions and flexibility

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). RELAY, followed by the corresponding relay number 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 enables 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. Each has a user-selectable deadband and time delay designed to control relay functions and prevent problems like relay chatter. The diagnostic relays are linked to all diagnostic conditions. The high- and low-cycle timer has adjustable set points, cycle time and on time. The cycle timer provides 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 analyzer with the ABB hydraulic sensor cleaner or TB18 Safe-T-Clean® sensor valve easy and trouble-free.

Diagnostics

The TB84TC 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 include, but are not limited to:

- Shorted or open temperature compensator
- PV and temperature over or under range
- Slope and offset checks

Hold output

The transmitter has a hold output state that improves plant safety and process integrity during maintenance and calibration. When activated, HOLD appears at the top of the display. Upon release of the hold state, HOLD disappears. 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. When the sensor cleaner option is chosen, the transmitter provides the option of holding all analog and relay outputs during the cleaning cycle.

Diagnostic pulse

The analog output is fully scalable over any conductivity range. Advanced configurations 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 analyzer be below 50 %, the pulse will add current; if the actual output is at or above 50 %, 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 TB84TC transmitter is compatible with Pt100, Pt1000 or 3 kΩ Balco RTD temperature compensators. The automatic temperature compensation options are:

- manual
- automatic for potassium chloride (KCl),
- user-entered coefficient in %/°C
- a user-defined function generator
- 0 to 15 % NaOH
- 0 to 20 % NaCl
- 0 to 18 % HCl,
- 0 to 20 % H_2SO_4

Calibration

Smart key programming makes transmitter calibration accurate and efficient. Process calibration is a straight-forward 2-point smart calibration with the zero-point calibration resulting in an offset adjustment and a span-point calibration resulting in a span adjustment. 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 allows manual editing or adjusting of the calibration data.

Calibration of the 0 to 20 or four to 20 mA output is provided via an easy 2-point procedure.

Programmable security code

The transmitter has a single three-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
- set point / tune
- configure

Specification

Type

Toroidal 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 TB404 toroidal conductivity sensors

Input Range

Conductivity

400 µS/cm to 1,999 mS/cm

Concentration

0.000 to 1,999 digits **(engineering units configurable)**

Display resolution

Conductivity

1 µS/cm

Concentration

0.001 digits (configurable)

Temperature

1 °C, 1 °F

Temperature compensation types

- Pt100
- Pt1000
- 3 kΩ Balco

Temperature compensation

- Manual (0.1N KCI based)
- Automatic, configurable as:
  - standard (0.1N KCI based)
  - user-defined coefficient (0 to 9.99 %/°C)
  - user-defined function generator
  - 0 to 15 % NaOH
  - 0 to 20 % NaCI
  - 0 to 18 % HCI
  - 0 to 20 % H_2SO_4

...Specification

Analog output ratings

2, completely isolated 0 to 20 and 4 to 20 mA outputs, 750 Ω max. load value, AO1 fixed to PV, AO2 configurable to either PV or temperature

AO1

Conductivity / concentration – isolated 0 to 20 and 4 to 20 mA, direct or reverse-acting, linear and nonlinear, configurable across full range

Minimum span

- Conductivity 100.0 µS/cm
- Concentration 5 % max. concentration range

Maximum span

- Conductivity 1,999 mS/cm
- Concentration 1,999 digits

AO2

Conductivity / concentration / temperature – isolated 0 to 20 and 4 to 20 mA, direct or reverse-acting, configurable across full range

Minimum span

- Conductivity 100.0 µS/cm
- Concentration 5 % max. concentration range
- Temperature 10 °C, 18 °F

Maximum span

- Conductivity 1,999 mS/cm
- Concentration 1,999 digits
- Temperature 300 °C, 540 °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.

Contact ratings (max.)

AC	100 VA, 240 V AC, 3 A
DC	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 0 to 300 °C or 32 to 572 °F
- Deadband range 0 to 10 °C or 0 to 18 °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

Conductivity

- Display ±0.1 % full scale
- Output ±0.02 mA at full scale output settings
- Temperature 1 °C

Repeatability

Conductivity

- Display ±0.5 % full scale
- Output ±0.02 mA at full scale output settings
- Temperature 1 °C
-

Maximum sensor cable length

15 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 corrosion-resistant 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

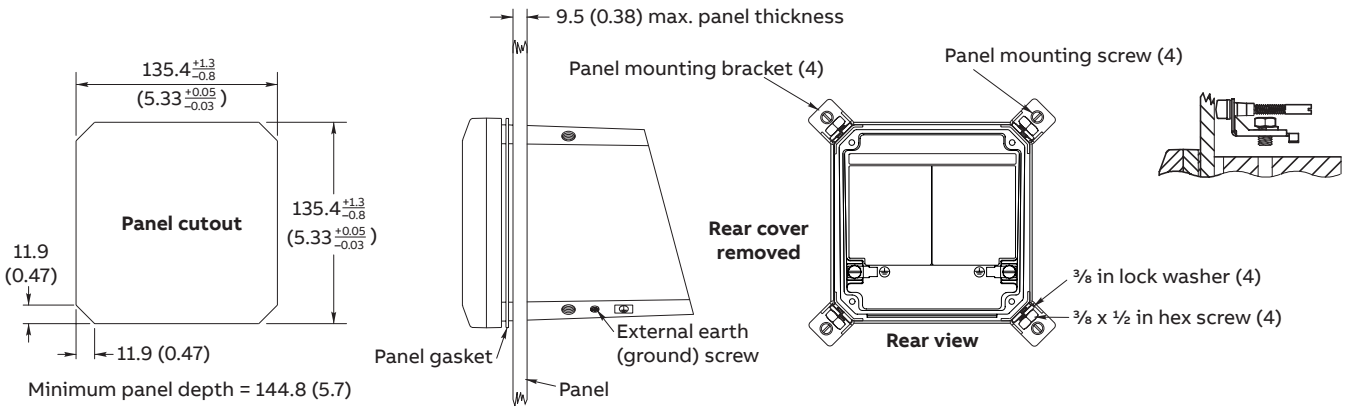
EMC requirements

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

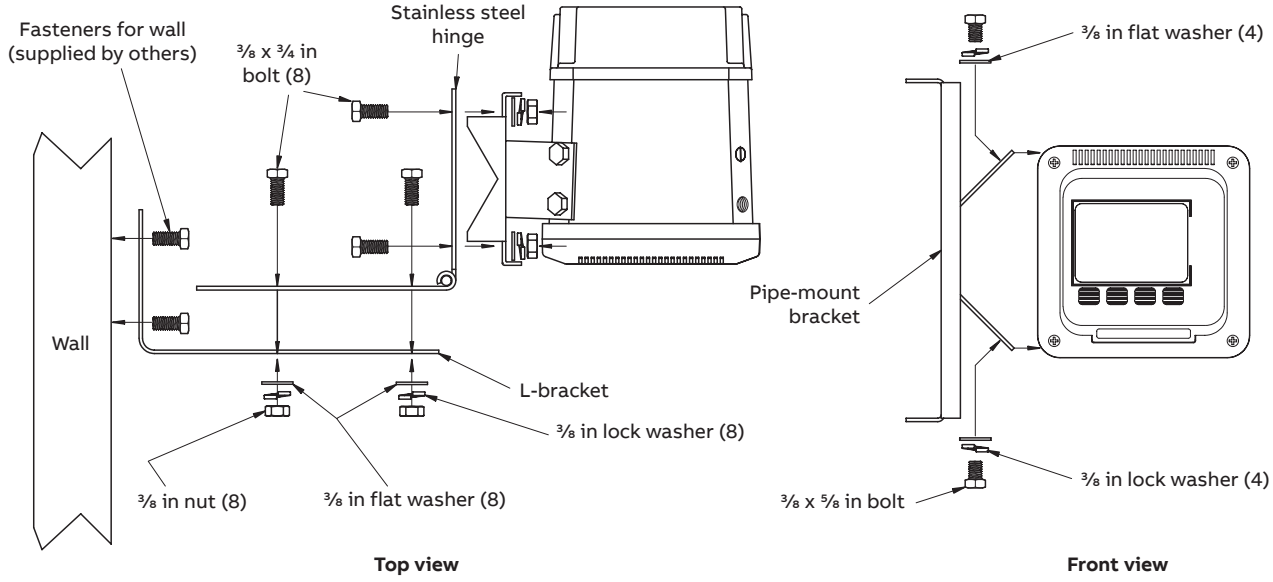
Installation

Dimensions in mm (in)

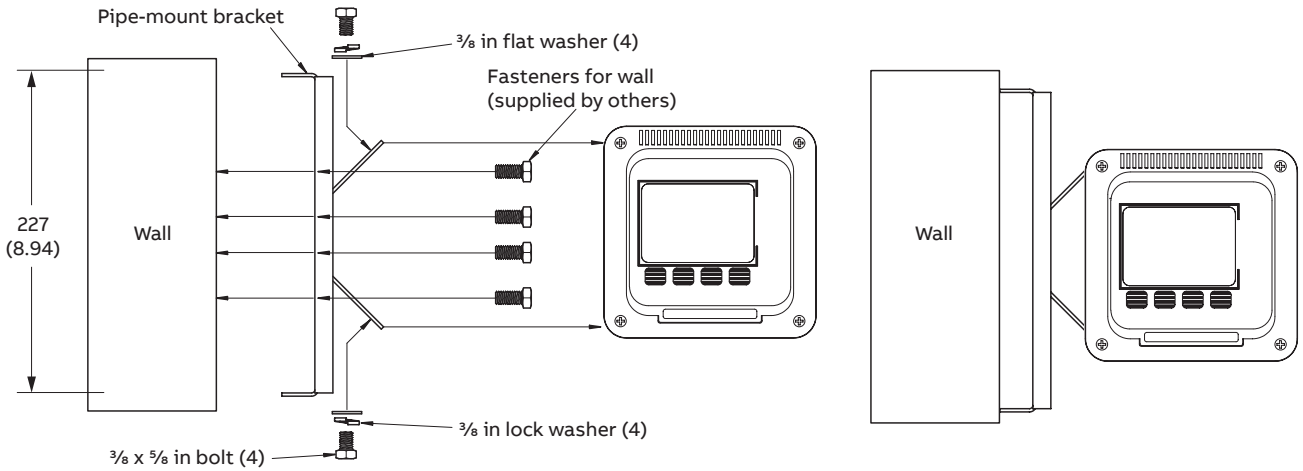
Panel-mounting



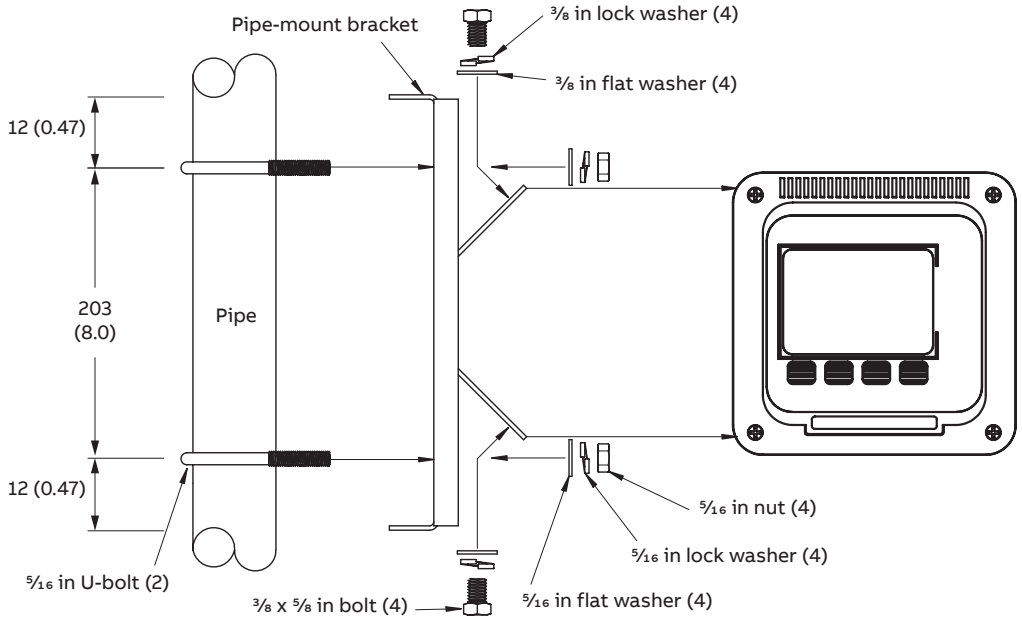
Hinge / Wall (rear) mounting



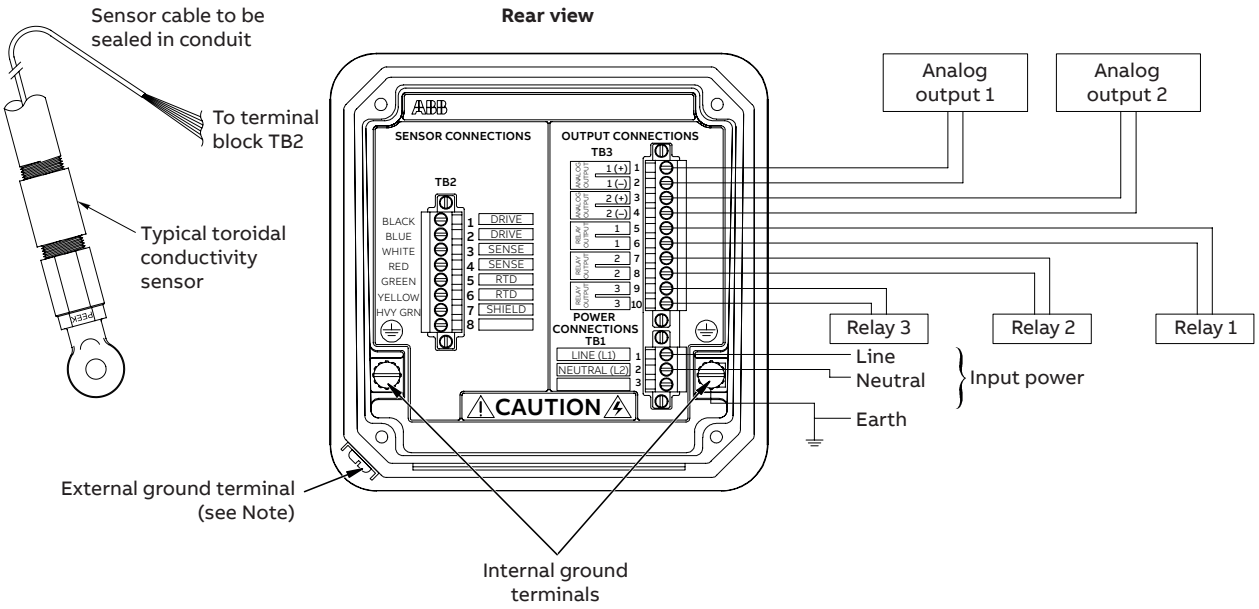
Wall (side) mounting



Pipe-mounting



Electrical connections



Note. To avoid interference, connect the transmitter enclosure to earth (ground) using a large area conductor (ground strap) ensuring resistance is less than 0.2 Ω.

Ordering information

Advantage toroidal conductivity transmitter[1]	**TB84**	**XX**	**X**	**0**	**0**	**0**	**X**	**X**	**X**
Input									
Conductivity 4-electrode[2]		EC							
Conductivity 2-electrode[2]		TE							
Toroidal conductivity[2]		TC							
Programming option									
Basic			1						
Advanced[3]			2						
Reserved									
For future use				0					
Reserved									
For future use					0				
Housing type									
Anodized aluminum, powder coat polyester						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/TB84TC-EN, DS/TB84EC-EN and DS/TB84TE-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 PG9)	4TB9515-0198

Acknowledgements

- Mylar is a registered trademark of Dupont Teijin Films

Sales

Service

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