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 (H2SO4).
- 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 % H2SO4
    - 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.

<table>
<thead>
<tr>
<th>Function</th>
<th>RO1</th>
<th>RO2</th>
<th>RO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>High or low PV alarm</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>High or low temperature alarm</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>(°C or °F)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Diagnostics alarm</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>High- or low-cycle timer</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sensor cleaner*</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

* 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.

**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.

**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

**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 % H₂SO₄
Calibration

Smart key programming makes transmitter calibration accurate and efficient. Process calibration is a straightforward 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 KCl based)
- Automatic, configurable as:
  - standard (0.1N KCl based)
  - user-defined coefficient (0 to 9.99 %/°C)
  - user-defined function generator
  - 0 to 15 % NaOH
  - 0 to 20 % NaCl
  - 0 to 18 % HCl
  - 0 to 20 % H₂SO₄
**Speciation**

**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 ¼ in hubs, 3 each 15.24 mm (0.6 in) holes that accept PG9 hubs

**Size (⅝ 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.

Specification subject to change without notice
Installation

Dimensions in mm (in)

Panel-mounting

Minimum panel depth = 144.8 (5.7)

Hinge / Wall (rear) mounting

Fasteners for wall (supplied by others)

Top view

Front view
Wall (side) mounting

Pipe-mount bracket

- ¼ in flat washer (4)
- ⅜ x ⅜ in bolt (4)
- ⅝ in lock washer (4)

Fasteners for wall (supplied by others)

Wall

Pipe-mounting

Pipe-mount bracket

- ¼ in lock washer (4)
- ⅞ in flat washer (4)

Pipe

- ⅞ in nut (4)
- ⅞ in lock washer (4)
- ⅞ in flat washer (4)

Wall

Pipe

- ¼ x ¼ in bolt (4)
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

<table>
<thead>
<tr>
<th>Advantage toroidal conductivity transmitter</th>
<th>TB84</th>
<th>XX</th>
<th>X</th>
<th>0</th>
<th>0</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td></td>
<td>EC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductivity 4-electrode</td>
<td></td>
<td>EC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductivity 2-electrode</td>
<td></td>
<td>TE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toroidal conductivity</td>
<td></td>
<td>TC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programming option</td>
<td></td>
<td>1</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Basic</td>
<td></td>
<td>1</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Advanced†</td>
<td></td>
<td>2</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Reserved</td>
<td></td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Housing type</td>
<td></td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Anodized aluminum, powder coat polyester</td>
<td></td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mounting hardware</td>
<td></td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pipe</td>
<td></td>
<td>1</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hinge (for pipe or wall)</td>
<td></td>
<td>2</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Panel</td>
<td></td>
<td>3</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Wall</td>
<td></td>
<td>4</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Agency approval</td>
<td></td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>FM (Factory Mutual)</td>
<td></td>
<td>1</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CSA (Canadian Standards Association)</td>
<td></td>
<td>2</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Tag</td>
<td></td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Stainless steel (4TB5003-0007)</td>
<td></td>
<td>1</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mylar™</td>
<td></td>
<td>2</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

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