ABB MEASUREMENT & ANALYTICS | DATA SHEET

TBX5

pH, Redox (ORP) sensors with diagnostics

Measurement made easy

The most durable pH / Redox (ORP) sensors in the world

Next Step™ Solid State reference
- eliminates poisoning, pumping and plugging

Advantage™ series with solution ground rod
- permits continuous sensor diagnostics

Comprehensive selection of measuring electrodes
- sensors designed to suit all application requirements

Combination style construction
- measuring, reference and temperature elements, all in one compact body

Insertion, submersion, flow-through and hot-tap
- increases flexibility of installation

Operating temperatures up to 140 °C (284 °F)
- the highest glass temperature limit on the market

Operating pressures up to 21 bar (300 psi) and higher
- the highest pressure limit on the market

The most durable pH / Redox (ORP) sensors in the world

A well-deserved reputation for ruggedness, longevity and accuracy hallmark the TB(X)5 series pH / Redox sensors. The sensors are easily applied to most industrial measurement needs. They are renowned for their ability to outperform conventional sensors in the industries' toughest process applications.

Solid-state Next Step reference technology is the foundation for all TB(X)5 series electrodes. The totally solid inner reference chamber is charged with potassium chloride (KCl). This non- liquid reference all but eliminates poisoning, plugging and pumping problems that plague conventional liquid, slurry and gel designs.

The Next Step Advantage series incorporates a solution ground rod that enables sensor diagnostics.

All measurement functions are combined in one compact body: reference, measuring electrode, temperature sensor and ground rod. Using an integral potted cable, a completely sealed assembly is provided without in-process high impedance connections.

These advances in reference design, combined with superior glass electrode technology, result in an industrial sensor with unequalled durability and flexibility

Wide variety of sensors for most industrial applications

ABB offers a wide variety of standard sensors for most applications. These include variations in body style, measuring electrode type and shape, temperature compensator, junction type and shape and cable. Next Step Advantage sensors also allow choice of solution ground and O-ring materials.

Durable electrodes

The TB(X)5 electrode design eliminates failures due to thermal stress caused by rapid temperature excursions. Unlike other sensors that use a large inner air bubble for expansion absorption, TB(X)5 electrodes use a unique inner plunger; providing more effective protection against temperature fluctuations.

The glass contains no barium, cobalt or uranium oxides. The impedance is low enough to maintain signal integrity, yet high enough to remain chemically durable with little or no sodium ion (Na^+) error.

The electrodes are available in several measuring element types ensuring greatest process optimization.

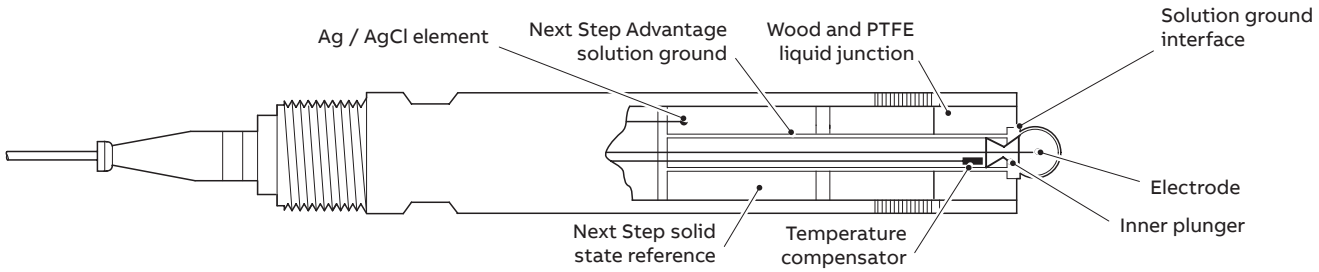


ABB TB(X)5 series sensor construction

Electrode types and ratings

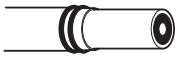
Code	Type	Description	Range	Ratings Operating temperatures °C	°F	Impedance at 25 °C (77 °F)
1	Flat glass	High density duty with heavy fouling. Electrode flush with liquid junction. Low Na^+ error.	0 to 14 pH	10 to 100	60 to 212[1]	650 MΩ
2	General-purpose glass	For light to medium duty and lower temperature applications. Not for high pH.	0 to 12 pH	0 to 100	32 to 212	200 MΩ
3	High temperature glass	Versatile and suitable for high and low pH, strong chemicals and high temperature rated cabling.	0 to 14 pH	10 to 140	50 to 284	500 MΩ
5	Redox (ORP)	Platinum (Pt) element.	0 to ±2000 mV	0 to 140	32 to 284	1 kΩ
A	Redox (ORP)	Gold (Au) element.	0 to ±2000 mV	0 to 140	32 to 284	1 kΩ
F	Fluoride / Acid	Resistant to etching by up to several percent HF and strong acids.	0 to 12 pH	10 to 80[2]	50 to 176[2]	500 MΩ
J	Coating resistant high temperature	Versatile and suitable for high and low pH, strong chemicals.	0 to 14 pH	10 to 140	50 to 284	500 MΩ

Notes. [1] 0 to 121 °C (32 to 250 °F) for sterilization cycles
[2] 50 °C (122 °F) maximum recommended for high HF concentration

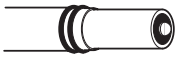
Body style

Sensor bodies are constructed of Kynar (PVDF) or Ryton (PPS). TB5 series sensors use Solid-State Next Step references. The TBX5 series denotes Next Step Advantage types with integral solution ground.

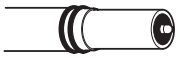
Model number			
Solid-state Next Step	**Next Step Advantage**	**Body**	**Application**
TB551	TBX551	PPS	In-line, twist-lock, submersion
TB556	TBX556	PVDF	In-line, threaded, submersion
TB557	TBX557	PVDF	Ball valve retractor, hot-tap
TB561	TBX561	PVDF	In-line, sterilizable
TB564	TBX564	PVDF	High pressure retractor, hot-tap
TB567	TBX567	PPS	In-line, high pressure



pH
Type 1 – flat glass



pH
Type 2 – general purpose glass
Type 3 – high temperature glass
Type f – fluoride / acid resistant glass
Type j – coating resistant glass



ORP
Type 5 – platinum
Type A – gold

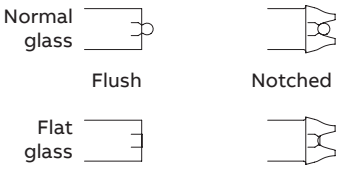
Electrode types

To promote TB(X)5 electrode process efficiency, reference junctions are available as either wood or PTFE, each also offered in flush or notched forms.

The hardwood junction is recommended for all general purpose duties particularly those requiring high resistance to coating. PTFE junctions are promoted for continuous processes over 11.0 pH or those containing known wood delignifiers such as strong caustics, bleaches and other oxidizers.

Flush junctions have no process protrusions and therefore supply excellent self-cleaning properties when used with flat glass and fitted at 90 ° in process pipelines.

Notched junctions provide an integral protection guard for normal bulb-style glasses and are especially suited for retractable and immersion sensors.



Junction styles

Sensor models and applications

Junction styles

Style	Description	Application
Flush	Flush with end of sensor	In-line, heavy fouling processes
Notched	Extends beyond junction providing electrode protection	Hot-tap (ball valve) and immersion sensors

Reference junction selection

Sensor TB(X)	Flush			Notched		
	Wood	**PTFE**	**Electrodes**	**Wood**	**PTFE**	**Electrodes**
551	✓	✓	1, 2, 3, 5, A, F, J	✗	✗	✗
556	✓	✓	1, 2, 3, 5, A, F, J	✓	✓	1, 2, 3, 5, A, F, J
557	✓	✓	1	✓	✓	1, 2, 3, 5, A, F, J
561	✓	✓	1, 2, 3, 5, A, F, J	✓	✓	1, 2, 3, 5, A, F, J
564	✓	✓	1, 2, 3, 5, A, F, J	✓	✓	1, 2, 3, 5, A, F, J
567	✓	✓	2, 3, 5, A, F, J	✗	✗	✗

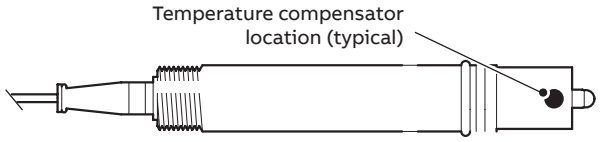
Note. ✓ = Valid selection ✗ = Invalid selection

Temperature compensation

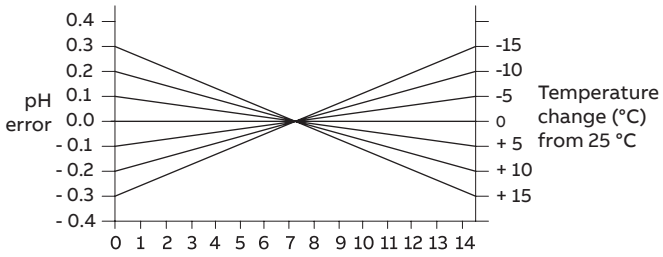
Temperature compensators enable analyzers to adjust for temperature effects on the glass pH electrode output (Nernst). Selected analyzers can also use this measurement to compensate for solution pH temperature effects.

Sensors can be ordered with integral temperature sensors or as external units.

The integral temperature compensator is available in two forms; Balco 3k and Pt100.



Integral temperature compensator



pH Error without temperature compensation

Cable options

TB(X)5 sensors offer complete flexibility of cabling options throughout the range. All cables are potted inside the sensor ensuring environmental protection.

The standard cable length for most sensors is 1.5 m (5 ft.). However, cables can be supplied as any continuous size up to 9 m (30 ft.).

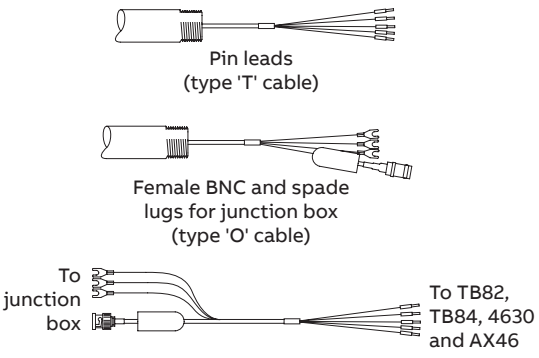
Standard accessories include junction boxes and submersion (immersion) couplers, typically used with extension cables for direct connection to ABB-TBI instruments.

Extension cables also permit distances between sensor and instrument of up to 30 m (100 ft.) without external preamplifier.

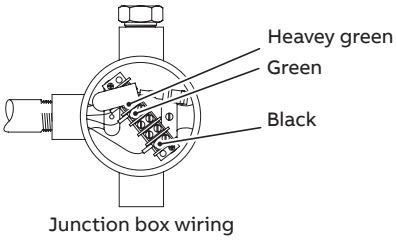
A BNC / TC to pin terminal adapter is available for connection to TB82, TB84, 4630 and AX46 series instruments.
Sensors with pin terminals are selected with code option ‘T’

Next Step Advantage sensor cables and junction box wiring (TBX5 sensors)

ORP / Redox sensors without temperature compensator

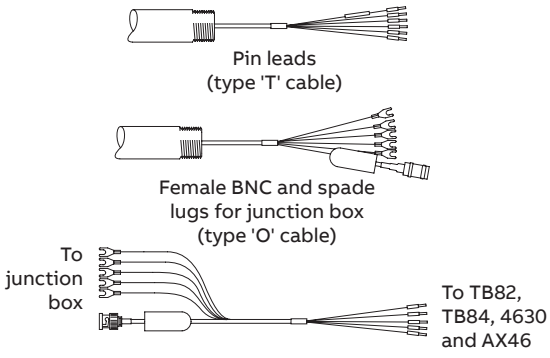


Male BNC / spade lug to pin leads extension (cable 4TB 3011-7XXX)

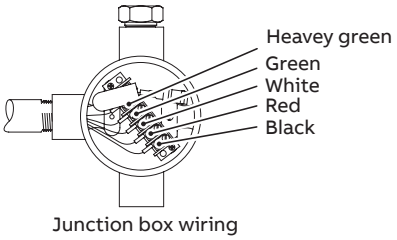


Junction box wiring (4TB5023-0088)

pH sensors with temperature compensator



Male BNC / spade lug to pin leads extension (cable 4TB 3011-7XXX)



Junction box wiring (4TB5023-0088)

Solid state and Next Step reference sensor cables and junction box wiring (TB5 models)

ORP / Redox sensors without temperature compensator

Male BNC
(type 'F' cable)

Pin leads
(type 'T' cable)

Female BNC – to sensor or junction box

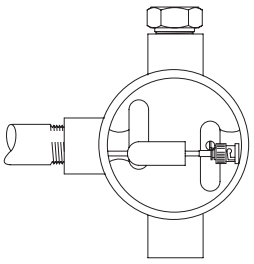
Male BNC

Extension cable
(cable 4TB3011-1XXX)

Female BNC – to sensor or junction box

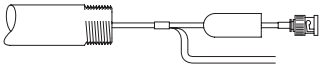
Pin leads to TB82, TB84 and AX46

Pin extension cable
(cable 4TB3011-3XXX)

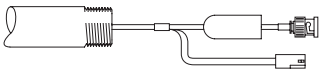


Junction box wiring
(4TB5023-0162)

pH sensors with temperature compensator

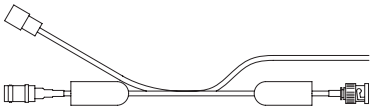


Male BNC and tinned temperature compensator leads
(type 'F' cable)



Male BNC and extension cable connector on temperature compensator leads
(type 'F' cable)

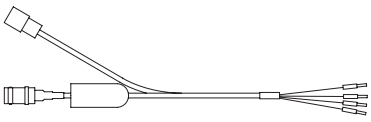
Pin leads
(type 'T' cable)



To sensor or junction box

To transmitter

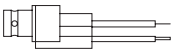
Female BNC to male BNC extension with temperature compensator connector to tinned leads
(cable 4TB 3011-2XXX)



To sensor or junction box

Pin leads to TB82, TB84, 4630 and AX46

Pin lead extension with temperature compensator connector
(cable 4TB3011-4XXX)



Female BNC to pin leads adaptor
(4TB9515-0164)

Temperature compensator extension cable connector to pin leads adaptor
(4TB9515-0277)

Note. Junction box not supplied with cable gland kit (part number: 4TB9515-0244)

TB551 and TBX551 Ryton sensors

TB(X)551 sensors are in-line flow-through or submersible (immersion), general purpose, twist-lock style sensors. The sensor body is molded from chemically resistant Ryton® (PPS).

The sensor can be adapted to 1 in. fittings by either a threaded Ryton receptacle or a twist-lock receptacle. The twist-lock receptacle is available in Kynar® (PVDF) or stainless steel.

Optional electrode guards protect the electrode in submersion (immersion) applications.

TB(X)551 Ryton sensors

Specification

Applications

In-line, flow-through, submersible (immersion)

Maximum pressure / temperature

690 kPa (100 psi) at 140 °C (284 °F)

Features

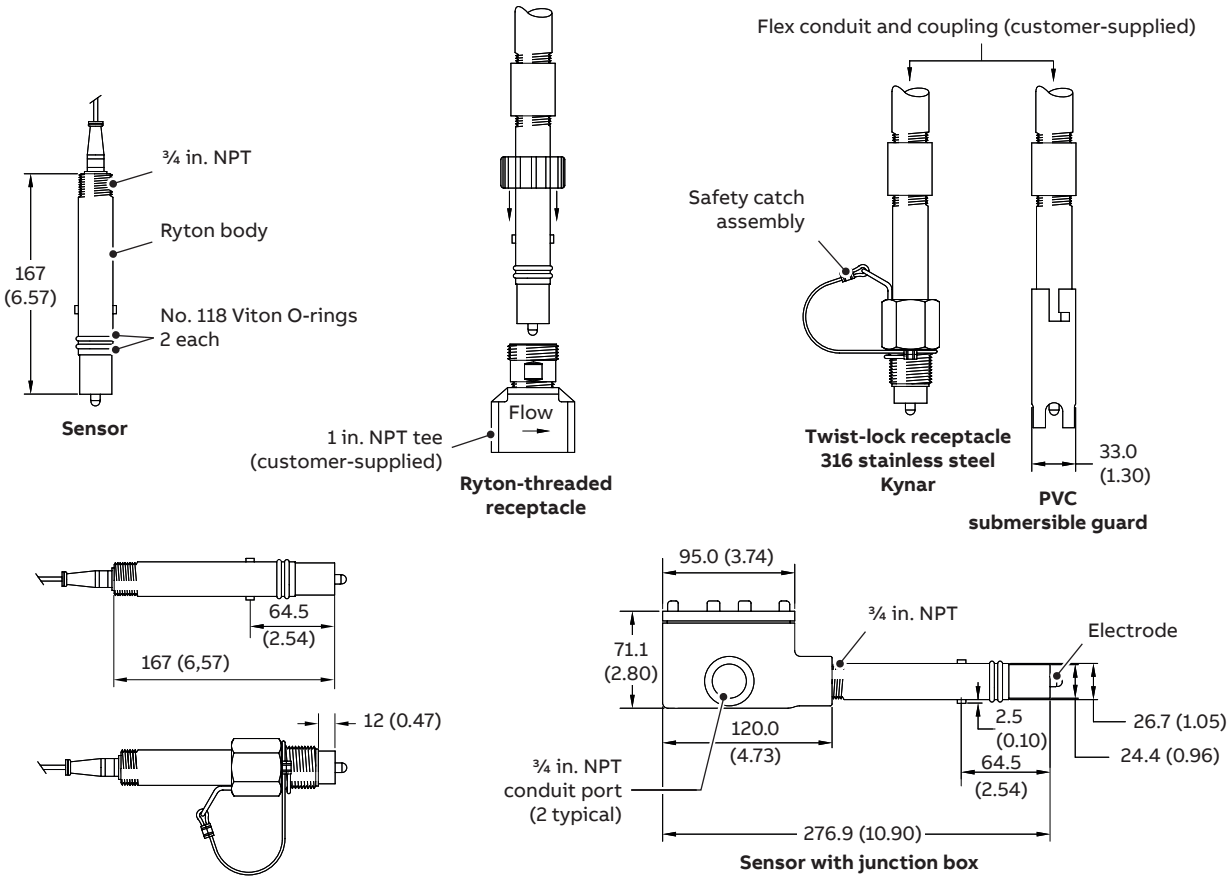
Low cost, universal type.
Adapter for twist-lock, or threaded-cap, insertion

Material

Body	Ryton (polyphenylene sulphide)
Junction	Wood or PTFE
Junction types	Flush

Overall dimensions – TB(X)551

Dimensions in mm (in.)



Ordering information – TB551

Standard solid-state sensors – no solution ground rod **Next Step in-line, twist-lock, immersion (submersible) Ryton body pH / ORP sensor assembly** **(690 kPa [100 psi] at 140 °C [284 °F])**	**TB551**	**X**	**X**	**X**	**X**	**X**	**X**	**X X**
Measuring electrode								
Flat glass (10 to 100 °C, 0 to 14 pH) for high particulates with flow at 90 °		1						
Glass, pH (0 to 100 °C, 0 to 12 pH)		2						
High temperature glass (5 to 140 °C, 0 to 14 pH)		3						
Platinum, Redox (ORP)		5						
Gold, Redox (ORP)		A						
Glass, pH, fluoride-resistant (10 to 80 °C, 0 to 12 pH)		F						
Coat-resistant glass / high temperature (5 to 140 °C, 0 to 14 pH)		J						
Integral thermocompensation								
None			0					
3 kΩ Tinned leads [2]			1					
3 kΩ Extension cable connector [2]			2					
Pt100 Tinned leads [2, 3]			3					
Pt100 Extension cable connector [2, 3]			4					
Liquid junction								
Wood, flush				1				
PTFE, flush				3				
PTFE, recessed				4				
Wood, flush, Next Step reference				A				
PTFE, flush, Next Step reference				B				
Solution ground rod material			N/A					
O-ring material			N/A					
Body style								
Ryton body					0			
Accessory hardware								
None						0		
Stainless steel, twist-lock receptacle (4TB5205-0118)						2		
Kynar (PVDF), twist-lock receptacle (4TB5205-0119)						3		
PVC, submersible guard (4TB5205-0120)						4		
Ryton (PPS), threaded receptacle (4TB9515-0120)						6		
Units of measure, integral sensor cable [5]								
BNC connector, feet							F	
Tinned / Pin leads, feet [1]							T	
Use when JB (below) is selected [6, 7]							0	
Length, integral sensor cable								
1 ft. (0.3 m) 30 ft. (8.8 m) enter length (in 5 ft. increments) (available in increments of 5 in. (12.7 cm) to 30 in. (76.2 cm).								– –
With junction box [6, 7]								J B
Less junction box [6, 7]								J S

Notes.

1 For direct connection to APA592, TB82, TB84, 4630 / 35 and AX46 transmitters or other supplier devices, using terminal blocks.

2 Not available for Redox (ORP) electrodes (codes 5 & A).

3 Not available for fluoride-resistant electrodes (code F). Compatible with APA592, TB82, TB84, 4630 / 35 and AX46 instruments.

4 Kalrez® O-rings only for solution ground sleeve.
External O-rings are Viton.

5 There are two options to connect to a transmitter using terminal blocks:
- Option 1 – use BNC / TC to PIN adapter with conduit fitting or BNC / TC to PIN adapter. In either case temperature compensator code must be 2 or 4.
- Option 2 – select T in integral cable code, not designed for use with extension cables or junction box.

6 TB551: junction box mounted on sensor.
Cable length approximately 102 mm (4 in.). Requires extension cable.

7 TB(X)551: when selecting JB or JS, cable length is approximately 102 mm (4 in.). Requires extension cable. If junction box is ordered separately and longer cable lengths are required, enter length under code for integral cable.

Ordering information – TBX551

Sensors for self-checking – with solution ground rod **TBX551** **Next Step Advantage, in-line, twist-lock, submersible (immersion)** [1] **Ryton body pH / ORP sensor assembly (690 kPa [100 psi] at 140 °C [284 °F])**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X X**
Measuring electrode									
Flat glass (10 to 100 °C, 0 to 14 pH) for high particulates with flow at 90 °	1								
Glass, pH (0 to 100 °C, 0 to 12 pH)	2								
High temperature glass (5 to 140 °C, 0 to 14 pH)	3								
Platinum, Redox (ORP)	5								
Gold, Redox (ORP)	A								
Glass, pH, fluoride-resistant (10 to 80 °C, 0 to 12 pH)	F								
Coat-resistant glass / high temperature (5 to 140 °C, 0 to 14 pH)	J								
Integral thermocompensation									
None		0							
3kΩ Tinned leads [2]		1							
Pt100 Tinned leads [2, 3]		3							
Liquid junction									
Wood, flush			1						
PTFE, flush			3						
Wood, flush, Next Step reference			A						
PTFE, flush, Next Step reference			B						
Solution ground rod material									
316 stainless steel				1					
Titanium				2					
Hastelloy® B2				3					
O-ring material									
Viton					1				
EPDM					2				
Silicone					3				
Kalrez					4				
Body style									
Ryton body						0			
Accessory hardware									
None							0		
Stainless steel, twist-lock receptacle (4TB5205-0118)							2		
Kynar (PVDF), twist-lock receptacle (4TB5205-0119)							3		
PVC, submersible guard (4TB5205-0120)							4		
Ryton (PPS), threaded receptacle (4TB9515-0120)							6		
Units of measure, integral sensor cable [5]									
Tinned / Pin leads, feet [1]								T	
Use when JB (below) is selected [6, 7]								0	
Length, integral sensor cable									
1 ft. (0.3m) 30 ft. (8.8 m) enter length (in 5 ft. increments) (available in increments of 5 in. (12.7 cm) to 30 in. (76.2 cm).									– –
With junction box [6, 7]									J B
Less junction box [6, 7]									J S

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