APPENDICE E

Sistema Monitoraggio Acqua di Mare

Schede Tecniche della Strumentazione di Misura e del Campionatore Automatico

General Specifications

Model YTA110
Temperature Transmitter

YTA SERIES

GS 01C50B01-00E

[Style: S3]

The YTA110 is the high performance temperature transmitter that accepts Thermocouple, RTD, ohms or DC milivolts inputs and converts it to a 4 to 20 mA DC signal for transmission. The YTA110 supports either BRAIN or HART communication protocol.

The YTA110 in it standard configuration is certified by TÜV as complying with SIL2 for safety requirement.

■ FEATURES

High performance

Microprocesser-based sensing technology ensures long-term accuracy and high reliability.

High reliability

Dual-compartment housing realizes high resistance capability to harsh environments, and YTA110 has SIL2 capability for safety requirement.

Variety of sensor inputs

The type of sensor input is user-selectable from thermocouples (T/C), RTDs, ohms, or DC milivolts.

Digital communication

BRAIN or HART® communication protocol is available. The insturment configuration can be changed by the user with using the BT200 or HART communicator.

Self-diagnostics function

Continuous self-diagnostics capability ensures long-term performance and lower cost of ownership.

LCD display with bargraph

The LCD display provides both a digital readout and percent bargraph simultaneously.

■ STANDARD SPECIFICATIONS

□ PERFORMANCE SPECIFICATIONS

Accuracy
(A/D accuracy/span + D/A accuracy) or ± 0.1 % of calibrated span, whichever is greater.
See Table 1. on page 3.

Cold Junction Compensation Accuracy
(For T/C only)
± 0.5˚C (± 0.9 ˚F)

Ambient Temperature Effect (per 10 ˚C change)
± 0.1 % or ± (Temperature Coefficient /span), whichever is greater. See Table 2. for Temperature Coefficient.

Stability
RTD:
±0.1% of reading or ±0.1°C per 2 years, whichever is greater at 23±2°C.
T/C:
±0.1% of reading or ±0.1°C per year, whichever is greater at 23±2°C.

5 Year Stability
RTD:
±0.2% of reading or ±0.2°C, whichever is greater at 23±2°C.
T/sC:
±0.4% of reading or ±0.4°C, whichever is greater at 23±2°C.

RFI Effect
Tested per EN 50082-2, field intensity up to 10 V/m.

Power Supply Effect
±0.005 % of calibration span per volt

Vibration Effect
10 to 60 Hz 0.21 mm peak displacement
60 to 2000 Hz 3G

Position Effect
None

□ FUNCTIONAL SPECIFICATIONS

Input
Input type is selectable: Thermocouples, 2-, 3-, and 4-wire RTDs, ohms and DC milivolts. See Table 1. on page 3.

Span & Range Limits
See Table 1. on page 3.

Input signal source resistance (for T/C, mV)
1 kΩ or lower

Input lead wire resistance (for RTD, ohm)
10 Ω per wire or lower

Output
Two wire 4 to 20 mA DC. Output range: 3.68 mA to 20.8 mA
BRAIN or HART ® protocol is superimposed on the 4 to 20 mA signal.
Any single value from the followings can be selected as the analog output signal.
Sensor 1, Terminal Temperature.
Also, up to three of the above values can be displayed on LCD display or read via communication.

Isolation
Input/Output/GND isolated to 500 V DC

YOKOGAWA

Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Phone: 81-422-52-5690 Fax.: 81-422-52-2018

GS 01C50B01-00E

13th Edition Aug. 2006

Sensor Burnout
High (21.6 mA DC) or Low (3.6 mA DC), userselectable.

Output in Transmitter Failure
High (21.6 mA DC or more) or Low (3.2 mA DC or less).

Update Time
Approximately 0.5 seconds

Turn-on Time
Approximately 5 seconds

Damping Time Constant
Selectable from 0 to 99 seconds

Ambient Temperature Limits
Option code may affect limits.
-40 to 85 ˚C (-40 to 185 ˚F)
-30 to 80 ˚C (-22 to 176 ˚F) with Integral Indicator

Ambient Humidity Limits
5 to 100 % RH at 40 ˚C (104 ˚F)

EMC Conformity Standards CE , N200
EN61326, AS/NZS CISPR11

SIL Certification
YTA110 temperature transmitter is certified by TÜV NORD CERT GmbH in compliance with the following standards;
IEC 61508: 2000; Part1 to Part 7 Functional Safety of Electrical/electronic/programmable electronic related systems;
SIL 2 capability for single transmitter use, SIL 3 capability for dual transmitter use.

Self-calibration
The analog-to-digital measurement circuitry automatically self-calibrates for temperature update by comparing the dynamic measurement to extremely stable and accurate internal reference elements.

Self-diagnostics
Loss of input error, ambient temperature error, EEPROM error, and CPU error. Up to four error history can be stored in the memory.

Manual Output Function
The output value can be set manually.

Supply & Load Requirements

Supply Voltage
10.5 to 42 V DC for general use and flameproof type
10.5 to 32 CV DC for lightning protector (Optional code /A)
10.5 to 30 V DC for intrinsically safe, Type n, nonincendive, or non-sparking type
Minimum voltage limited at 16.4 V DC for digital communications, BRAIN and HART® protocols

Load
0 to 1335 Ω for operation
250 to 600 Ω for digital communication
See Figure 1. on page 4.

Communication Requirements

BRAIN:

Communication Distance
Up to 2 km (1.25 miles) when using CEV polyethylene-insulated PVC-sheathed cables. Communication distance varies depending on type of cable used.

Load Capacitance
0.22 μF or less

Load Inductance
3.3 mH or less

Input Impedance of communicating device
10 kΩ or more at 2.4 kHz.

HART®:

Communication Distance
Up to 1.5 km (1 mile) when using multiple twisted pair cables. Communication distance varies depending on type of cable used.

Use the following formula to determine cable length for specific applications:

$$L = \frac{65 \times 10^6}{(R \times C)} - \frac{(C_f + 10{,}000)}{C}$$

Where:
L = length in meters or feet
R = resistance in Ω (including barrier resistance)
C = cable capacitance in pF/m or pF/ft
C_f = maximum shunt capacitance of receiving devices in pF

□ PHYSICAL SPECIFICATIONS

Enclosure

Material
Low copper cast-aluminum alloy
Coating
Polyurethan resin baked finish
Color: Deep-sea moss green (Munsell 0.6GY3.1/2.0)
Degrees of Protection
IP67, NEMA4X, JIS C0920 immersion proof

Data and tag plate
SUS304 Stainless steel
Mounting
Optional mounting brackets can be used either for two-inch pipe or flat panel mounting.
Terminal Screws
M4 screws

Integral Indicator
Optional LCD digital indicator includes 5-digit numerical dispaly with ˚C, K, ˚F,˚R, % and mV, 0 to 100 % bargraph and dot-matrix display.

Weight
1.2 kg(2.6 lb) without Integral indicator and Mounting bracket. Integral indicator weights 0.2 kg(0.4 lb).

Electrical Connections
Refer to '**MODEL AND SUFFIX CODES'** on page 5.

Table 1. Sensor type, measurement range, and accuracy.

Sensor Type		Reference Standard	Measurement Range °C	Measurement Range °F	Minimum Span (Recommended)	Accuracy: Input range °C	Accuracy: Input range °F	Accuracy: A/D Accuracy °C	Accuracy: A/D Accuracy °F	Accuracy: D/A Accuracy
T/C	B	IEC584	100 to 1820	212 to 3308	25 °C (45 °F)	100 to 300	212 to 572	± 3.0	± 5.4	± 0.02% of span
						300 to 400	572 to 752	± 1.0	± 1.8	
						400 to 1820	752 to 3308	± 0.75	± 1.35	
	E		-200 to 1000	-328 to 1832		-200 to -50	-328 to -58	± 0.35	± 0.63	
						-50 to 1000	-58 to 1832	± 0.16	± 0.29	
	J		-200 to 1200	-328 to 2192		-200 to -50	-328 to -58	± 0.40	± 0.72	
						-50 to 1200	-58 to 2192	± 0.20	± 0.36	
	K		-200 to 1372	-328 to 2502		-200 to -50	-328 to -58	± 0.50	± 0.90	
						-50 to 1372	-58 to 2502	± 0.25	± 0.45	
	N		-200 to 1300	-328 to 2372		-200 to -50	-328 to -58	± 0.80	± 1.44	
						-50 to 1300	-58 to 2372	± 0.35	± 0.63	
	R		-50 to 1768	-58 to 3214		-50 to 0	-58 to 32	± 1.0	± 1.8	
						0 to 100	32 to 212	± 0.80	± 1.44	
						100 to 600	212 to 1112	± 0.60	± 1.08	
						600 to 1768	1112 to 3214	± 0.40	± 0.72	
	S		-50 to 1768	-58 to 3214		-50 to 0	-58 to 32	± 1.0	± 1.8	
						0 to 100	32 to 212	± 0.80	± 1.44	
						100 to 600	212 to 1112	± 0.60	± 1.08	
						600 to 1768	1112 to 3214	± 0.40	± 0.72	
	T		-200 to 400	-328 to 752		-200 to -50	-328 to -58	± 0.25	± 0.45	
						-50 to 400	-58 to 752	± 0.14	± 0.25	
	W3	ASTM E988	0 to 2300	32 to 4172		0 to 400	32 to 752	± 0.80	± 1.44	
						400 to 1400	752 to 2552	± 0.50	± 0.90	
						1400 to 2000	2552 to 3632	± 0.60	± 1.08	
						2000 to 2300	3632 to 4172	± 0.90	± 1.62	
	W5		0 to 2300	32 to 4172		0 to 400	32 to 752	± 0.70	± 1.26	
						400 to 1400	752 to 2552	± 0.50	± 0.90	
						1400 to 2000	2552 to 3632	± 0.70	± 1.26	
						2000 to 2300	3632 to 4172	± 0.90	± 1.62	
	L	DIN43710	-200 to 900	-328 to 1652		-200 to -50	-328 to -58	± 0.30	± 0.54	
						-50 to 900	-58 to 1652	± 0.20	± 0.36	
	U		-200 to 600	-328 to 1112		-200 to -50	-328 to -58	± 0.50	± 0.90	
						-50 to 600	-58 to 1112	± 0.25	± 0.45	
RTD	Pt100	IEC751	-200 to 850	-328 to 1562	10 °C (18 °F)	-200 to 850	-328 to 1562	± 0.14	± 0.25	
	Pt200		-200 to 850	-328 to 1562		-200 to 850	-328 to 1562	± 0.30	± 0.54	
	Pt500		-200 to 850	-328 to 1562		-200 to 850	-328 to 1562	± 0.20	± 0.36	
	JPt100	JIS C1604	-200 to 500	-328 to 932		-200 to 500	-328 to 932	± 0.16	± 0.29	
	Cu	SAMA RC21-4	-70 to 150	-94 to 302		-70 to -40	-94 to -40	± 1.35	± 2.43	
						-40 to 150	-40 to 302	± 1.0	± 1.8	
	Ni120	—	-70 to 320	-94 to 608		-70 to 320	-94 to 608	± 0.11	± 0.19	
mV		—	-10 to 100 [mV]		3 [mV]	—		±12 [μV]		
ohm			0 to 2000 [Ω]		20 [Ω]			± 0.35 [Ω]		

T01E.EPS

Total Accuracy = (A/D Accuracy / Span + D/A Accuracy) or (± 0.1% of calibrated span), whichever is greater.

For T/C input, add Cold Junction Compensation Accuracy (± 0.5 °C) to the total accuracy.

Example; when selecting Pt100 with measurement range of 0 to 200 °C.

$\frac{0.14°C}{200°C} \times 100\%$ of span +0.02% of span = 0.09% of span

Since the value is smaller than ± 0.1% of span, the total accuracy is ± 0.1%.

Table 2. Temperature Coefficient

Sensor Type		Temperature Coefficient
Thermocouples E,J,K,N,T,L,U		0.08°C + 0.02% of abs.reading
Thermocouples R,S,W3,W5		0.25°C + 0.02% of abs.reading
T/C B	100°C ≦ Reading < 300°C	1°C + 0.02% of abs.reading
	300°C ≦ Reading	0.5°C + 0.02% of abs.reading
RTD		0.08°C + 0.02% of abs.reading
mV		0.002 mV + 0.02% of abs.reading
ohm		0.1 Ω + 0.02% of abs.reading

T02E.EPS

Note1: Ambient Temperature Effect per 10°C change is ±0.1% or ±(temperature coefficient/span), whichever is greater.
Note2: The “abs.reading” on Table2 means the absolute value of the reading in °C.
Example of abs reading;
When the temperature value is 250 Kelvin, abs reading is 23.15, absolute (250−273.15).
Example of Ambient Temperature Effect;
Conditions;
1) Input Sensor: Pt100
2) Calibration Range: −100 to 100°C
3) Reading value: −50°C
Ambient Temperature Effect per 10°C;
Temperature Coefficient/Span=(0.08°C+0.02/100×|−50°C|)/{100°C−(−100°C)}= 0.00045 → 0.045%
There for, Ambient Temperature Effect is ±0.1%/10°C

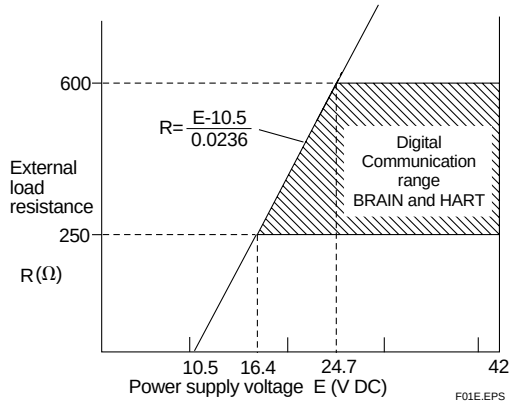


Figure 1. Relationship Between Power Supply Voltage and External Load Resistance.

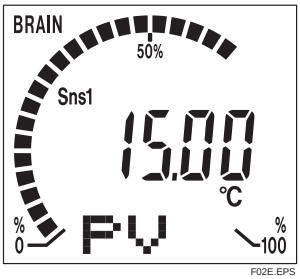


Figure 2. Integral Indicator Display Example.

■ MODEL AND SUFFIX CODES

Model	Suffix Codes	Descriptions
YTA110	·····	Temperature Transmitter
Output Signal	**-D** ·····	4 to 20mA DC with digital commnuication (BRAIN protocol)
	-E ·····	4 to 20mA DC with digital communication (HART protocol, refer to GS 1C50T1-E)
—	**A** ·····	Always A
Electrical Connection	**0** ·····	G1/2 female
	2 ·····	1/2 NPT female
	3 ·····	Pg 13.5 female
	4 ·····	M20 female
Integral Indicator	**D** ·····	with digital indicator
	N ·····	None
Mounting Bracket	**B** ····	SUS304 Stainless steel 2-inch horizontal pipe mounting *1
	D ····	SUS304 Stainless steel 2-inch vertical pipe mounting *1
	N ····	None
Optional Codes	/□	Optional Specifications

*1: For flat-panel mounting, please prepare bolts and nuts.

T03E.EPS

■ OPTIONAL SPECIFICATIONS

Item		Descriptions		Code
Lightning protector		Power supply voltage: 10.5 to 32 V DC Allowable current: Max. 6000A(1×40μs), repeating 1000A(1×40μs) 100 times		**A**
Painting	Coating change	Epoxy resin coating		**X1**
	Color change	Amplifier cover only	Munsell renotation code: N1.5 Black	**P1**
			Munsell renotation code: 7.5BG4/1.5, Jade green	**P2**
			Metallic silver	**P7**
Calibration Unit		Degree F/Degree R unit		**D2**
Output signal low-side in Transmitter failure		Output signal low-side: -5%, 3.2 mA DC or less. Sensor burnout is also set to 'LOW': -2.5%, 3.6 mA DC.		**C1**
NAMUR NE43 Compliant		Output signal limits: 3.8 mA to 20.5 mA	Failure alarm down-scale: output status at CPU failure and hardware error is -5%, 3.2 mA or less. Sensor burnout is also set to LOW: -2.5%, 3.6 mA DC.	**C2**
			Failure alarm up-scale: output status at CPU failure and hardware error is 110%, 21.6 mA or more. In this case Sensor burnout is High: 110%, 21.6 mA DC.	**C3**
Data Configuration		Description into “Descriptor” parameter of HART protocol (max. 16 characters)		**CA**
Stainless steel housing *1		Housing Material: SCS14A stainless steel (equivalent to SUS316 cast stainless steel and ASTM CF-8M)		**E1**

*1: Available with optional code A, D2, C1, KU2, CU1, FF1, FU1, and SU1.

T04E.EPS

■ OPTIONAL SPECIFICATIONS (For Explosion Protected Types)

Item	Descriptions	Code
CENELEC ATEX (KEMA)	CENELEC ATEX (KEMA) Intrinsically safe, Flameproof approval and Type n combination [Intrinsically safe approval] Applicable standard: EN 50014, EN 50020, EN 50284 Certificate: KEMA 02ATEX1026X II 1G EEx ia IIC T4,T5 Ambient Temerature: -40 to 70°C for T4, -40 to 50°C for T5 Supply/Output circuit: Ui=30V, Ii=165mA, Pi=900mW, Ci=20nF, Li=660μH Input circuit: Uo=8.6V, Io=30mA, Po=70mW, Co=3μF, Lo=20mH Electrical Connection: 1/2 NPT female and M20 female*1 [Flameproof approval] Applicable standard: EN 50014, EN 50018 Certificate: KEMA 02ATEX2155 II 2G EEx d IIC T5, T6 Ambient Temerature: -40 to 80°C for T5, -40 to 75°C for T6 Electrical Connection: 1/2 NPT female and M20 female*1 [Type n approval] Applicable standard: EN60079-15 Referential standard: IEC60079-0, IEC60079-11 II 3G EEx nL IIC T4, T5 Ambient Temperature: -40 to 70°C for T4, -40 to 50°C for T5 Supply/Output circuit: Ui=30V, Ci=20nF, Li=660μH Input circuit: Uo=8.6V, Io=30mA, Po=70mW, Co=3μF, Lo=20mH Electrical Connection: 1/2 NPT female and M20 female*1	**KU2**
Canadian Standards Association (CSA)	CSA Intrinsically safe, non-incendive and Explosionproof approval combination [Intrinsically safe/non-incendive approval] Applicable standard: C22.2 No0, C22.2 No0.4, C22.2 No25, C22.2 No94, C22.2 No142, C22.2 No157, C22.2 No213 Certificate: 172608-0001053837 Intrinsically safe for Class I, Division 1, Groups A, B, C and D; Class II, Division 1, Groups E, F and G; Class III, Division 1: Non-incendive for Class I, Division 2, Groups A, B, C and D; Class II, Division 2, Groups E, F and G; Class III, Division 1: Enclosure Type 4X Temperature Class: T4, Ambient Temperature: -40 to 60°C, Supply: Vmax=30V, Imax=165mA, Pmax=0.9W, Ci=18nF, Li=730μH Sensor input: Voc=9V, Isc=40mA, Po=0.09W, Ca=1μF, La=10mH Electrical Connection: 1/2 NPT female*1 [Explosionproof approval] Applicable standard: C22.2 No0, C22.2 No0.4, C22.2 No25, C22.2 No30, C22.2 No94, C22.2 No142, C22.2 No157, C22.2 No213, C22.2 No1010.1 Certificate: 1089576 Explosionproof Class I, Div.1, Groups B, C and D, Class II, Groups E, F and G, Class III. For Class I, Div.2 Locations “FACTORY SEALED, CONDUIT SEAL NOT REQUIRED” Enclosure Type 4X Temperature Class: T6 Ambient Temperature: -40 to 60°C Electrical Connection: 1/2 NPT female*2	**CU1**
Factory Mutual (FM)	FM Explosionproof approval Applicable standard: FM 3600, FM 3615, FM 3810, NEMA250 Explosionproof Class I, Division 1, Groups A, B, C and D; Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G. “FACTORY SEALED, CONDUIT SEAL NOT REQUIRED.” Enclosure Rating: NEMA 4X Temperature Class: T6 Ambient Temperature: -40 to 60°C (-40 to 140°F) Electrical Connection: 1/2 NPT female*2	**FF1**
	FM Intrinsically safe, non-incendive and Explosionproof approval combination [Intrinsically safe/non-incendive approval] Applicable standard: FM 3600, FM 3610, FM 3611, FM 3810 Intrinsically safe for Class I, II, III Division 1 Groups A, B, C, D, E, F and G. Non-incendive for Class I, II, Division 2 Groups A, B, C, D, F and G Class III, Division 1. Enclosure Type: 4X Temperature Class: T4 Ambient Temperature: -40 to 60°C (-40 to 140°F) Supply: Vmax=30V, Imax=165mA, Pmax=0.9W, Ci=18nF, Li=730μH Sensor: Voc=9V, Isc=40mA, Po=90Mw, Ca=1μF, La=10mH [Explosionproof approval] Applicable standard: FM 3600, FM 3615, FM 3810, NEMA250 Class I, Division 1, Groups A, B, C and D.; Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G. "FACTORY SEALD, CONDUIT SEAL NOT REQUIRED." Enclosure Ratings: NEMA4X Temperature Class: T6 Ambient Temperature: -40 to 60°C (-40 to 140°F) Electrical Connection: 1/2NPT female*2	**FU1**

T05E-1.EPS

*1 : Applicable for Electrical Connection Code 2 and 4.
*2 : Applicable for Electrical Connection Code 2.

Item	Descriptions		Code
Standards Association of Australia (SAA)	SAA Int rinsically safe, non-sparking and Flameproof approval combination [Intrinsically safe and non-sparking] Applicable standard: AS2380.1, AS2380.7, AS2380.9 Certificate: AUS Ex 3652X Ex ia IIC T4 (Tamb=70°C) IP66/67, Ex n IIC T4 (Tamb=70°C), IP66/67 Input parameters: Ui=30V, Ii=165mA, Pi=0.9W Output parameters: Uo=8.6V, Io=30mA, Po=62mW, Co=1μF [Flameproof approval] Applicable standard: AS2380.1, AS2380.2 Certificate: AUS Ex 3640 Ex d IIC T6 (Tamb=75°C) IP66/67 Electrical connection: 1/2 NPT female, Pg13.5 female and M20 female*4		SU1
Japanese Industrial Standards (TIIS)	TIIS Flameproof approval Ex ds IIC T6 X Amb. Temp.: -20 to 60°C		JF3
Attached flameproof packing adapter*3	Electrical connection: G1/2 female Applicable cable: O.D. 8.5 to 11 mm	1 pc.	G11
		2 pc.	G12

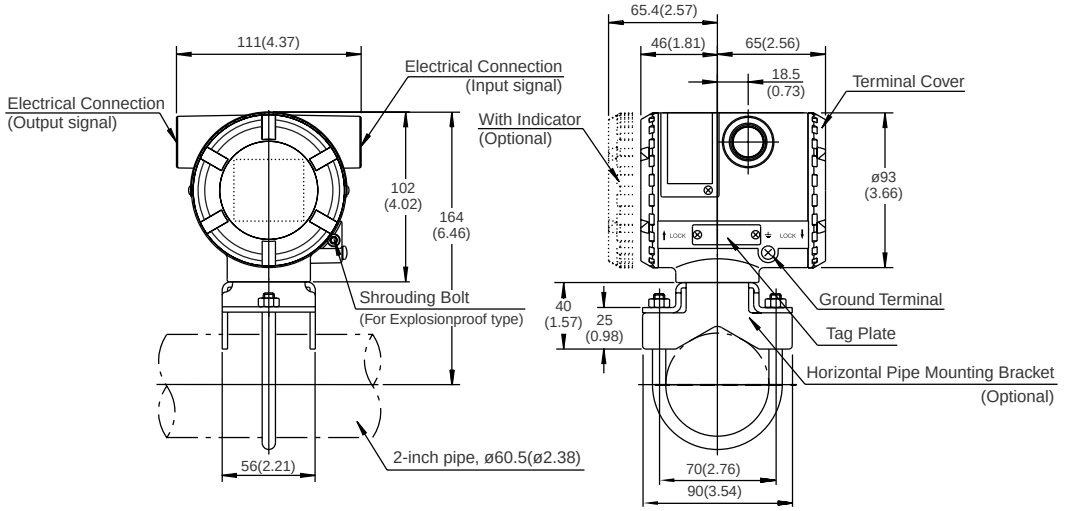
T05E-2.EPS

*3 : If cable wiring is to be used to a TIIS flameproof type transmitter, do not fail to add the YOKOGAWA-assured flameproof packing adapter.
*4 : Applicable for Electrical connection code 2, 3 and 4.

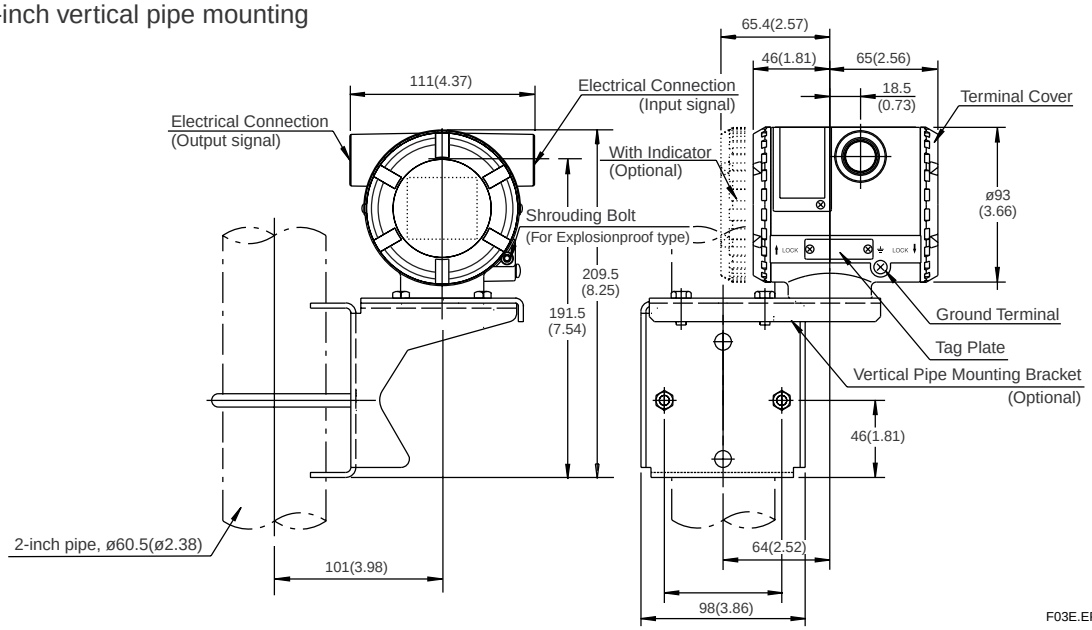
■ DIMENSIONS

Unit: mm (Approx. inch)

● 2-inch horizontal pipe mounting

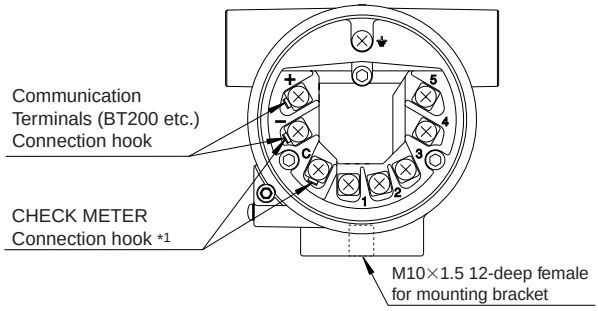


● 2-inch vertical pipe mounting



F03E.EPS

Terminals



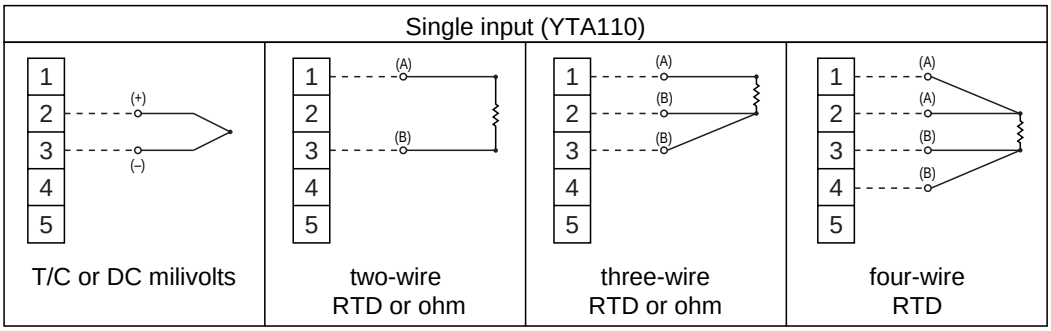
Terminal Configuration

+ / −	Power Supply and output terminal
− / C	External Indicator (ammeter) terminal *1
⏚	Ground terminal

*1: When using an external indicator or check meter, the internal resistance must be 10Ω or less. This hook is not available for Fieldbus communication type(output signal code F).

F04.EPS

Input Wiring



F05E.EPS

< Ordering Information >

Specify the following when ordering

Model, suffix codes, and optional codes

The instrument is shipped with the settings shown in Table A. Specify the following when necessary.

1. Sensor type.
   For RTD and resistance input, specify the number of wire as well.
   (Example; Pt200 3-wire system)
2. Calibration range and unit
   1) Calibration range can be specified within the measurement range shown in Table 1. on page 3.
   2) Specify one range from °C, K, °F or °R for temperature input. °F and °R are available when Optional code D2 is specified. It is not necessary to specify the unit of mV and ohm inputs, for these units automatically will be mV or Ω.
3. Tag Number
4. Other Items related with options
   /CA option allows specifying the setting Descriptor for HART protocol type at factory.
   Specify upto 16 characters to be entered in the Descriptor parameter.

Table A. Settings upon shipment.

Input sensor type	Pt100 three-wire system, or as specified
Calibration range lower limit	"0" or as specified
Calibration range upper limit	"100" or as specified
Calibration unit	"°C" or as specified
Damping time constant	2 seconds
Sensor burnout *1	High (110%, 21.6 mA DC)
Output in Transmitter failure *1	High (110%, 21.6 mA DC or more)
Integral Indicator *2	PV
Output type	Sensor 1
Tag number	As specified in order

T07E.EPS

*1: Except when Optional code C1 or C2 is specified.
*2: When Integral indicator is specified.

< Related Instruments >

Power Distributor: Refer to GS 01B04T01-02E or GS 01B04T02-00E
BRAIN TERMINAL: Refer to GS 01C00A11-00E

< Reference >

HART; Trademark of The HART Communiation Foundation. (USA)

Material Cross Reference Table

SUS304	AISI 304

T08E.EPS

General Specifications

EJX110A
Differential Pressure Transmitter

GS 01C25B01-01E

[Style: S3]

The high performance differential pressure transmitter EJX110A features single crystal silicon resonant sensor and is suitable to measure liquid, gas, or steam flow as well as liquid level, density and pressure. EJX110A outputs a 4 to 20 mA DC signal corresponding to the measured differential pressure. Its highly accurate and stable sensor can also measure the static pressure which can be shown on the integral indicator or remotely monitored via BRAIN or HART communications. Other key features include quick response, remote set-up using communications, self-diagnostics and optional status output for pressure high/low alarm. FOUNDATION Fieldbus protocol type is also available. All EJX series models in their standard configuration, with the exception of the Fieldbus type, are certified by TÜV as complying with SIL 2 for safety requirement.

■STANDARD SPECIFICATIONS

Refer to GS 01C25T02-01E for Fieldbus communication type marked with "◇."

□ SPAN AND RANGE LIMITS

Measurement Span/Range		kPa	inH_2O(/D1)	mbar(/D3)	mmH_2O(/D4)
L	Span	0.1 to 10	0.4 to 40	1 to 100	10 to 1000
	Range	–10 to 10	–40 to 40	–100 to 100	–1000 to 1000
M	Span	0.5 to 100	2 to 400	5 to 1000	50 to 10000
	Range	–100 to 100	–400 to 400	–1000 to 1000	–10000 to 10000
H	Span	2.5 to 500	10 to 2000	25 to 5000	0.025 to 5 kgf/cm^2
	Range	–500 to 500	–2000 to 2000	–5000 to 5000	–5 to 5 kgf/cm^2

T01E.EPS

□ PERFORMANCE SPECIFICATIONS

Zero-based calibrated span, linear output, wetted parts material code S and silicone oil, unless otherwise mentioned.
For Fieldbus communication type, use calibrated range instead of span in the following specifications.

Specification Conformance

EJX series ensures specification conformance to at least ±3σ.

Reference Accuracy of Calibrated Span

(includes terminal-based linearity, hysteresis, and repeatability)

Measurement span		H
Reference accuracy	X ≤ span	±0.04% of Span
	X > span	±(0.005+0.0049 URL/span)% of Span
X		70 kPa (280 inH_2O)
URL (upper range limit)		500 kPa (2000 inH_2O)

T08E.EPS

Measurement span		M
Reference accuracy	X ≤ span	±0.04% of Span
	X > span	±(0.005+0.0035 URL/span)% of Span
X		10 kPa (40 inH_2O)
URL (upper range limit)		100 kPa (400 inH_2O)

T02E.EPS

Measurement span		L
Reference accuracy	X ≤ span	±0.04% of Span
	X > span	±(0.015+0.005 URL/span)% of Span
X		2 kPa (8 inH_2O)
URL (upper range limit)		10 kPa (40 inH_2O)

T03E.EPS

Square Root Output Accuracy

The square root accuracy is a percent of flow span.

Output	Accuracy
50% or Greater	Same as reference accuracy
50% to Dropout point	$\frac{\text{Reference accuracy} \times 50}{\text{Square root output (\%)}}$

T03E.EPS

Ambient Temperature Effects per 28˚C (50˚F) Change

Capsule	Effect
H	±(0.04% Span+0.0125% URL)
M	±(0.04% Span+0.009% URL)
L	±(0.055% Span+0.09% URL)

Static Pressure Effects per 6.9 MPa (1000 psi) Change

Span Effects

L, M and H capsules
±0.075% of span

Effect on Zero

Capsule	Effect
H	±0.028% URL
M	±0.02% URL
L	±0.05% URL

Overpressure Effects

Overpressure condition: up to maximum working pressure
M and H capsules
±0.03% of URL

YOKOGAWA

Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Phone: 81-422-52-5690 Fax.: 81-422-52-2018

GS 01C25B01-01E

8th Edition Jan. 2008

● Total Probable Error (M capsule)
±0.12% of Span @1:1 to 5:1 Rangedown

Total probable error, known as a measure of the total performance of the transmitters under the condition of fixed line presurre.

$$\text{Total Probable Error} = \pm\sqrt{E_1^2+E_2^2+E_3^2}$$

E1: Reference Accuracy of Calibrated Span
E2: Ambient Temperature Effects per 28°C change
E3: Static Span Effects per 6.9 MPa change

● Total Accuracy (M capsule)
±0.12% of Span @1:1 Rangedown
±0.25% of Span @ 5:1 Rangedown

Total accuracy is a comprehensive measure of transmitter total performance, covering all major factors in actual installation, that cause errors in measurement.
As a standard measure, YOKOGAWA uses this to evaluate transmitter performance.

$$\text{Total Accuracy} = \pm\sqrt{E_1^2+E_2^2+(E_3+E_4)^2+E_5^2}$$

E1: Reference Accuracy of Calibrated Span
E2: Ambient Temperature Effects per 28°C change
E3: Static Span Effects per 6.9 MPa change
E4: Static Zero Effects per 6.9 MPa change
E5: Overpressure Effects upto overpressure 25MPa

Not only a day-to-day changes in temperature can affect the measurement and lead to unnoticed errors; fluctuaion of line pressure, incorrect operation of three/five valve manifold leading to over-pressure events, and other phenomena can have the similar result. Total Accuracy factors in such changes and errors and provides much comprehensive and practical determination of how a transmitter will perform under actual plant operation.

Stability (All normal operating condition, including overpressure effects)
M and H capsules
±0.1% of URL per 10 years

Power Supply Effects (Output signal code D and E)
±0.005 % per Volt (from 21.6 to 32 V DC, 350 Ω)

Vibration Effects
Amplifier housing code 1:
Less than 0.1% of URL when tested per the requirements of IEC60770-1 field or pipeline with high vibration level (10-60 Hz, 0.21 mm peak to peak displacement/60-2000 Hz 3 g)
Amplifier housing code 2:
Less than ±0.1% of URL when tested per the requirements of IEC60770-1 field with general application or pipeline with low vibration level (10-60 Hz 0.15mm peak to peak displacement /60-500 Hz 2g)

Mounting Position Effects
Rotation in diaphragm plane has no effect. Tilting up to 90 degree will cause zero shift up to 0.4 kPa (1.6 inH_2O) which can be corrected by the zero adjustment.

Response Time (Differential pressure) "◇"
L, M and H capsules : 90 msec
When amplifier damping is set to zero and including dead time of 45 msec (nominal)

Static Pressure Signal Range and Accuracy

(For monitoring via communication or on indicator. Includes terminal-based linearity, hysteresis, and repeatability)

Range
Upper Range Value and Lower Range Value of the statice pressure can be set in the range between 0 and Maximum Working Pressure(MWP). The upper range value must be greater than the lower range value. Minimum setting span is 0.5 MPa(73 psi). Measuring either the pressure of high pressure side or low pressure side is user-selectable.

Accuracy
Absolute Pressure
1MPa or higher : ±0.2% of span
Less than 1 MPa: ±0.2%×(1 MPa/span) of span
Gauge Pressure Reference
Gauge pressure reference is 1013 hPa (1 atm)
Note : Gauge pressure variable is based on the above fixed reference and thus subject to be affected by the change of atomospheric pressure.

□ FUNCTIONAL SPECIFICATIONS

Output "◇"
Two wire 4 to 20 mA DC output with digital communications, linear or square root programmable. BRAIN or HART FSK protocol are superimposed on the 4 to 20 mA signal.
Output range: 3.6 mA to 21.6 mA
Output limits conforming to NAMUR NE43 can be pre-set by option code C2 or C3.

Failure Alarm (Output signal code D and E)
Analog output status at CPU failure and hardware error;
Up-scale: 110%, 21.6 mA DC or more (standard)
Down-scale: −5%, 3.2 mA DC or less

Damping Time Constant (1st order)
Amplifier damping time constant is adjustable from 0.00 to 100.00 sec by software and added to response time.
Note: For BRAIN protocol type, when amplifier software damping is set to less than 0.5 sec, communication may occasionally be unavailble during the operation, especially while output changes dynamically. The default setting of damping ensures stable communication.

Update Period "◇"
Differential pressure: 45 msec
Static pressure: 360 msec

Zero Adjustment Limits
Zero can be fully elevated or suppressed, within the lower and upper range limits of the capsule.

External Zero Adjustment
External zero is continuously adjustable with 0.01% incremental resolution of span. Re-range can be done locally using the digital indicator with range-setting switch.

Integral Indicator (LCD display, optional) "◇"
5-digit numerical display, 6-digit unit display and bar graph.
The indicator is configurable to display one or up to four of the following variables periodically.;
Measured differential pressure, differential pressure in %, scaled differential pressure, measured static pressure. See also "Factory Setting."

Burst Pressure Limits
69 MPa (10,000 psi)

Self Diagnostics
CPU failure, hardware failure, configuration error, and over-range error for differential pressure, static pressure and capsule temperature.
User-configurable process high/low alarm for differential pressure and static pressure is also available, and its status can be output when optional status output is specified.

Signal Characterizer (Output signal code D and E)
User-configurable 10-segment signal characterizer for 4 to 20 mA output.

Status Output (optional, output signal code D and E)
One transistor contact output (sink type) to output the status of user configurable high/low alarm for differential pressure/static pressure.
Contact rating : 10.5 to 30 V DC, 120 mA DC max.
Refer to 'Terminal Configuration' and 'Wiring Example for Analog Output and Status Output.'

SIL Certification
EJX series transmitters except Fieldbus communication type are certified by RWTÜV Systems GmbH in compliance with the following standards;
IEC 61508: 2000; Part1 to Part 7
Functional Safety of Electrical/electronic/programmable electronic related systems; SIL 2 capability for single transmitter use, SIL 3 capability for dual transmitter use.

□ NORMAL OPERATING CONDITION

(Optional features or approval codes may affect limits.)

Ambient Temperature Limits
−40 to 85˚C (−40 to 185˚F)
−30 to 80˚C (−22 to 176˚F) with LCD display

Process Temperature Limits
−40 to 120˚C (−40 to 248˚F)

Ambient Humidity Limits
0 to 100% RH

Working Pressure Limits (Silicone oil)

Maximum Pressure Limits

L capsule	16 MPa (2300 psi)
M and H capsules	25 MPa (3600 psi)

Minimum Pressure Limit
See graph below

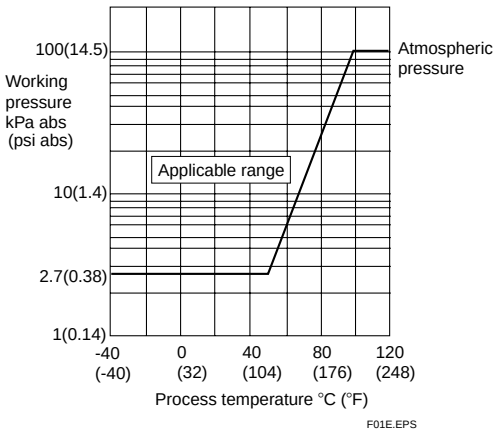


Figure 1. Working Pressure and Process Temperature

Supply & Load Requirements

(Output signal code D and E. Optional features or approval codes may affect electrical requirements.)
With 24 V DC supply, up to a 550 Ω load can be used. See graph below.

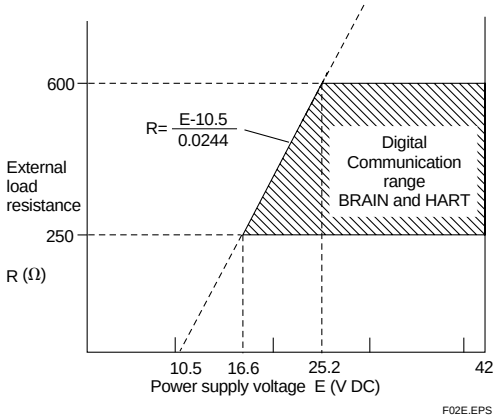


Figure 2. Relationship Between Power Supply Voltage and External Load Resistance

Supply Voltage "◇"
10.5 to 42 V DC for general use and flameproof type.
10.5 to 32 V DC for lightning protector (option code / A.)
10.5 to 30 V DC for intrinsically safe, type n, or non-incendive.
Minimum voltage limited at 16.6 V DC for digital communications, BRAIN and HART

Load (Output signal code D and E)
0 to 1290 Ω for operation
250 to 600 Ω for digital communication

Communication Requirements "◇"

(Approval codes may affect electrical requirements.)

BRAIN

Communication Distance
Up to 2 km (1.25 miles) when using CEV polyethylene-insulated PVC-sheathed cables. Communication distance varies depending on type of cable used.

Load Capacitance
0.22 μF or less

Load Inductance
3.3 mH or less

Input Impedance of communicating device
10 kΩ or more at 2.4 kHz.

HART

Communication Distance
Up to 1.5 km (1 mile) when using multiple twisted pair cables. Communication distance varies depending on type of cable used.

Use the following formula to determine cable length for specific applications:

$$L = \frac{65 \times 10^6}{(R \times C)} - \frac{(C_f + 10{,}000)}{C}$$

Where:
L = length in meters or feet
R = resistance in Ω (including barrier resistance)
C = cable capacitance in pF/m or pF/ft
C_f = maximum shunt capacitance of receiving devices in pF/m or pF/ft

EMC Conformity Standards CE , N200
EN 61326, AS/NZS CISPR11

European Pressure Equipment Directive 97/23/EC
Sound Engineering Practice (for all capsules)

With option code /PE3 (for M and H capsules)
CE 0038
Category III, Module H, Type of Equipment: Pressure Accessory-Vessel, Type of Fluid: Liquid and Gas, Group of Fluid: 1 and 2

□ PHYSICAL SPECIFICATIONS

Wetted Parts Materials

Diaphragm, Cover Flange, Process Connector, Capsule Gasket, and Vent/Drain Plug
Refer to "MODEL AND SUFFIX CODES."

Process Connector Gasket
PTFE Teflon
Fluorinated rubber for option code N2 and N3

Non-wetted Parts Materials

Bolting
ASTM-B7M carbon steel, 316 SST(ISO A4-70) stainless steel, or ASTM grade 660 stainless steel

Housing
Low copper cast aluminum alloy with polyurethane, mint-green paint (Munsell 5.6BG 3.3/2.9 or its equivalent), or ASTM CF-8M Stainless Steel

Degrees of Protection
IP67, NEMA4X, JIS C0920

Cover O-rings
Buna-N

Name plate and tag
304 SST, 316 SST (optional)

Fill Fluid
Silicone, fluorinated oil (optional)

Weight
[Installation code 7, 8 and 9]
2.8 kg (6.2 lb) without integral indicator, mounting bracket, and process connector.
Add 1.5 kg (3.3lb) for Amplifier housing code 2.

Connections
Refer to "MODEL AND SUFFIX CODES."
Process connection of cover flange: IEC61518

< Related Instruments>

Power Distributor: Refer to GS 01B04T01-02E or GS 01B04T02-02E
BRAIN TERMINAL: Refer to GS 01C00A11-00E

< Reference >

1. Teflon; Trademark of E.I. DuPont de Nemours & Co.
2. Hastelloy; Trademark of Haynes International Inc.
3. HART; Trademark of the HART Communication Foundation.
4. FOUNDATION Fieldbus; Tradmark of Fieldbus Foundation.

■ MODEL AND SUFFIX CODES

Model	Suffix Codes	Description
EJX110A	· ·	Differential pressure transmitter
Output signal	**-D** ·	4 to 20 mA DC with digital communication (BRAIN protocol)
	-E ·	4 to 20 mA DC with digital communication (HART protocol)
	-F ·	Digital communication (FOUNDATION Fieldbus protocol, refer to GS 01C25T02-01E)
Measurement span (capsule)	**L** ·	0.1 to 10 kPa (0.4 to 40 inH_2O)
	M ·	0.5 to 100 kPa (2 to 400 inH_2O)
	H ·	2.5 to 500 kPa (10 to 2000 inH_2O)
Wetted parts material *2	□ ·	Refer to "Wetted Parts Material" Table below.
Process connections	**0** ·	without process connector (Rc1/4 female on the cover flanges)
	1 ·	with Rc1/4 female process connector
	2 ·	with Rc1/2 female process connector
	3 ·	with 1/4 NPT female process connector
	4 ·	with 1/2 NPT female process connector
☆	**5** ·	without process connector (1/4 NPT female on the cover flanges)
Bolts and nuts material	**J** ·	ASTM-B7M carbon steel
	G ·	316 SST (ISO A4-70) stainless steel
	C ·	ASTM grade 660 stainless steel
Installation	**-7** ·	Vertical piping, left side high pressure, and process connection downside
	-8 ·	Horizontal piping and right side high pressure
☆	**-9** ·	Horizontal piping and left side high pressure
	-B ·	Bottom Process Connection, left side high pressure*5
Amplifier housing	**1** ·	Cast aluminum alloy
	2 ·	ASTM CF-8M stainless steel*3
Electrical connection	**0** ·	G1/2 female, one electrical connection without blind plugs
☆	**2** ·	1/2 NPT female, two electrical connections without blind plugs
	4 ·	M20 female, two electrical connections without blind plugs
	5 ·	G1/2 female, two electrical connections and a blind plug*4
	7 ·	1/2 NPT female, two electrical connections and a blind plug*4
	9 ·	M20 female, two electrical connections and a blind plug*4
	A ·	G1/2 female, two electrical connections and a SUS316 blind plug
	C ·	1/2 NPT female, two electrical connections and a SUS316 blind plug
	D ·	M20 female, two electrical connections and a SUS316 blind plug
Integral indicator	**D** ·	Digital indicator
	E ·	Digital indicator with the range setting switch*1
☆	**N** ·	None
Mounting bracket ☆	**B** ·	304 SST 2-inch pipe mounting, flat type (for horizontal piping)
	D ·	304 SST 2-inch pipe mounting, L type (for vertical piping)
	G ·	304 SST 2-inch pipe mounting (for bottom process connection type)
	J ·	316 SST 2-inch pipe mounting, flat type (for horizontal piping)
	K ·	316 SST 2-inch pipe mounting, L type (for vertical piping)
	M ·	316 SST 2-inch pipe mounting (for bottom process connection type)
	N ·	None
Optional Codes		/□ Optional specification

T04E.EPS

The "☆" marks indicate the most typical selection for each specification.

*1: Not applicable for output signal code **F**.

*2: ⚠ Users must consider the characteristics of selected wetted parts material and the influence of process fluids. The use of inappropriate materials can result in the leakage of corrosive process fluids and cause injury to personnel and/or damage to plant facilities. It is also possible that the diaphragm itself can be damaged and that material from the broken diaphragm and the fill fluid can contaminate the user's process fluids.
Be very careful with highly corrosive process fluids such as hydrochloric acid, sulfuric acid, hydrogen sulfide, sodium hypochlorite, and high-temperature steam (150°C [302°F] or above). Contact Yokogawa for detailed information of the wetted parts material.

*3: Not applicable for electrical connection code **0**, **5**, **7** and **9**.

*4: Material of a blind plug is aluminum alloy or 304 SST.

*5: Only applicable for Wetted parts material code **S**.

Table. Wetted Parts Materials

Wetted parts material code	Cover flange and process connector	Capsule	Capsule gasket	Drain/Vent plug
S #	ASTM CF-8M *1	Hastelloy C-276 *2 (Diaphragm) 316L SST (Others)	Teflon-coated 316L SST	316 SST

M04E.EPS

*1: Cast version of 316 SST. Equivalent to SCS14A.
*2: Hastelloy C-276 or ASTM N10276.
The '#'marks indicate the construction materials conform to NACE material recommendations per MR01-75. For the use of 316 SST material, there may be certain limitations for pressure and temperature. Please refer to NACE standards for details.

■OPTIONAL SPECIFICATIONS (For Explosion Protected type) "◇"

Item	Description	Code
Factory Mutual (FM)	FM Explosionproof Approval *1 Applicable Standard: FM3600, FM3615, FM3810, ANSI/NEMA 250 Explosionproof for Class I, Division 1, Groups B, C and D, Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G, in Hazardous locations, indoors and outdoors (NEMA 4X) Temperature class: T6, Amb. Temp.: –40 to 60°C (–40 to 140°F)	**FF1**
	FM Intrinsically safe Approval *1*2 Applicable Standard: FM3600, FM3610, FM3611, FM3810 Intrinsically Safe for Class I, Division 1, Groups A, B, C & D, Class II, Division 1, Groups E, F & G and Class III, Division 1, Class I, Zone 0, in Hazardous Locations, AEx ia IIC Nonincendive for Class I, Division 2, Groups A, B, C & D, Class II, Division. 2, Groups F & G, and Class III, Division 1, Class I, Zone 2, Group IIC, in Hazardous Locations Enclosure: "NEMA 4X", Temp. Class: T4, Amb. Temp.: –60 to 60°C (–75 to 140°F) Intrinsically Safe Apparatus Parameters [Groups A, B, C, D, E, F and G] Vmax=30 V, Imax=200 mA, Pmax=1 W, Ci=6 nF, Li=0 μH [Groups C, D, E, F and G] Vmax=30 V, Imax=225 mA, Pmax=1 W, Ci=6 nF, Li=0 μH	**FS1**
	Combined FF1 and FS1 *1*2	**FU1**
CENELEC ATEX	CENELEC ATEX (KEMA) Flameproof Approval *1 Applicable Standard: EN 60079-0, EN 60079-1, EN 61241-0, EN 61241-1 Certificate: KEMA 07ATEX0109 II 2G, 2D Exd IIC T4, T5, T6 Ex tD A21 IP6X T85, T100, T120 Degree of protection : IP66 and IP67 Amb. Temp. (Tamb) for gas-proof : T4 ; –50 to 75°C (–58 to 167°F), T5; –50 to 80°C (–58 to 176°F), T6; –50 to 75°C (–58 to 167°F) Max. process Temp.(Tp): T4; 120°C (248°F), T5; 100°C (212°F), T6; 85°C (185°F) Max. surface Temp. for dust-proof : T85°C (Tamb: –40 to 40°C, Tp:85°C), T100°C (Tamb: –40 to 60°C, Tp:100°C), T120°C (Tamb: –40 to 80°C, Tp:120°C)	**KF21**
	CENELEC ATEX (KEMA) Intrinsically safe Approval *1*2 Applicable Standard: EN 50014, EN 50020, EN 50284, EN 50281-1-1 Certificate: KEMA 03ATEX1544X II 1G, 1D EEx ia IIC T4 Degree of protection : IP66 and IP67 Amb. Temp.(Tamb) for gas-proof: –50 to 60°C (–58 to 140°F) Maximum Process Temp.(Tp) for gas-proof :120°C Electrical data : Ui=30 V, Ii=200 mA, Pi=0.9 W, Ci=10 nF, Li=0 mH Max. surface Temp. for dust-proof : T85°C (Tamb: –40 to 60°C, Tp:80°C), T100°C (Tamb: –40 to 60°C, Tp:100°C), T120°C (Tamb: –40 to 60°C, Tp:120°C)	**KS2**
	Combined KF21, KS2 and Type n *1*2 Type n Applicable Standard: EN 50021, EN 60529 II 3G EEx nL IIC T4, Amb. Temp.: –50 to 60°C (–50 to 140°F) Ui=30 V DC, Ci=10 nF, Li=0 mH	**KU21**

T05E.EPS

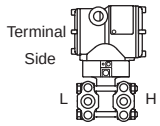
*1: Applicable for Electrical connection code **2**, **4**, **7**, **9**, **C** and **D**.
*2: Not applicable for option code **/AL**.

Item	Description	Code
Canadian Standards Association (CSA)	CSA Explosionproof Approval *1 Certificate: 1966237 Applicable Standard: C22.2 No.0, C22.2 No.0.4, C22.2 No.0.5, C22.2 No.25, C22.2 No.30, C22.2 No.94, C22.2 No.60079-0, C22.2 No.60079-1, C22.2 No.61010-1-01 Explosion-proof for Class I, Groups B, C and D. Dustignition-proof for Class II/III, Groups E, F and G. When installed in Division 2, “SEAL NOT REQUIRED” Enclosure: TYPE 4X, Temp. Code: T6...T4 Ex d IIC T6...T4 Enclosure: IP66 and IP67 Max.Process Temp.: T4;120°C(248°F), T5;100°C(212 °F), T6; 85°C(185°F) Amb.Temp.:–50 to 75°C(–58 to 167°F) for T4, –50 to 80°C(–58 to 176°F) for T5, –50 to 75°C(–58 to 167°F) for T6	**CF1**
	CSA Intrinsically safe Approval *1*3 Certificate: 1606623 [For CSA C22.2] Applicable Standard: C22.2 No.0, C22.2 No.0.4, C22.2 No.25, C22.2 No.94, C22.2 No.154, C22.2 No.213, C22.2 No.1010.1 Intrinsically Safe for Class I, Division 1, Groups A, B, C & D, Class II, Division 1, Groups E, F & G, Class III, Division 1, Nonincendive for Class I, Division 2, Groups A, B, C & D, Class II, Division 2, Groups E, F & G, Class III, Division 1 Enclosure: Type 4X, Temp. Code: T4 Amb. Temp.:–50 to 60°C(–58 to 140°F) Electrical Parameters: [Intrinsically Safe] Vmax=30V, Imax=200mA, Pmax=0.9W, Ci=10nF, Li=0 [Nonincendive] Vmax=30V, Ci=10nF, Li=0 [For CSA E60079] Applicable Standard: CAN/CSA E60079-0, CAN/CSA E60079-11, CAN/CSA E60079-15, IEC 60529:2001-02 Ex ia IIC T4, Ex nL IIC T4 Enclosure: IP66 and IP67 Amb. Temp.:–50 to 60°C(–58 to 140°F), Max. Process Temp.: 120°C(248°F) Electrical Parameters: [Ex ia] Ui=30V, Ii=200mA, Pi=0.9W, Ci=10nF, Li=0 [Ex nL] Ui=30V, Ci=10nF, Li=0	**CS1**
	Combined CF1 and CS1 *1*3	**CU1**
IECEx Scheme *4	IECEx Flameproof Approval *1 Applicable Standard: IEC 60079-0:2004, IEC60079-1:2003 Certificate: IECEx CSA 07.0008 Flameproof for Zone 1, Ex d IIC T6...T4 Enclosure: IP66 and IP67 Max.Process Temp.: T4;120°C(248°F), T5;100°C(212°F), T6; 85°C(185°F) Amb.Temp.:–50 to 75°C(–58 to 167°F) for T4, –50 to 80°C(–58 to 176°F) for T5, –50 to 75°C(–58 to 167°F) for T6	**SF2**
	IECEx Intrinsically safe, type n and Flameproof Approval *1*3 Intrinsically safe and type n Applicable Standard: IEC 60079-0:2000, IEC 60079-11:1999, IEC 60079-15:2001 Certificate: IECEx CSA 05.0005 Ex ia IIC T4, Ex nL IIC T4 Enclosure: IP66 and IP67 Amb. Temp.:–50 to 60°C(–58 to 140°F), Max. Process Temp.: 120°C(248°F) Electrical Parameters: [Ex ia] Ui=30V, Ii=200mA, Pi=0.9W, Ci=10nF, Li=0 [Ex nL] Ui=30V,Ci=10nF, Li=0 Flameproof Applicable Standard: IEC 60079-0:2004, IEC60079-1:2003 Certificate: IECEx CSA 07.0008 Flameproof for Zone 1, Ex d IIC T6...T4 Enclosure: IP66 and IP67 Max.Process Temp.: T4;120°C(248°F), T5;100°C(212°F), T6; 85°C(185°F) Amb.Temp.:–50 to 75°C(–58 to 167°F) for T4, –50 to 80°C(–58 to 176°F) for T5, –50 to 75°C(–58 to 167°F) for T6	**SU2**
Combination of approval	Combination of KU21, FU1 and CU1 *1*3	**V1U**

T05Eb.EPS

*1: Applicable for Electrical connection code **2**, **4**, **7**, **9**, **C** and **D**.
*2: Applicable for Electrical connection code **2**, **7** and **C**.
*3: Not applicable for option code /**AL**.
*4: Applicable only for Australia and New Zealand area.

■ OPTIONAL SPECIFICATIONS

Item		Description		Code
Painting	Color change	Amplifier cover only*9		P□
		Amplifier cover and terminal cover, Munsell 7.5 R4/14		PR
	Coating change	Anti-corrosion coating*1*9		X2
316 SST exterior parts		316 SST name plate, tag plate and zero-adjustment screw*11		HC
Lightning protector		Transmitter power supply voltage: 10.5 to 32 V DC (10.5 to 30 V DC for intrinsically safe type.) Allowable current: Max. 6000 A (1×40 μs), Repeating 1000 A (1×40 μs) 100 times Applicable Standards: IEC 61000-4-4, IEC 61000-4-5		A
Status output*2		Transistor output (sink type) Contact rating : 10.5 to 30 V DC, 120 mA DC(max) Low level : 0 to 2 V DC		AL
Oil-prohibited use*3		Degrease cleansing treatment		K1
		Degrease cleansing treatment and fluorinated oilfilled capsule. Operating temperature −20 to 80°C(−4 to 176°F)		K2
Oil-prohibited use with dehydrating treatment*3		Degrease cleansing and dehydrating treatment		K5
		Degrease cleansing and dehydrating treatment with fluorinated oilfilled capsule. Operating temperature −20 to 80°C(−4 to 176°F)		K6
Capsule fill fluid		Fluorinated oil filled in capsule		K3
Calibration units*4		P calibration (psi unit)	(See Table for Span and Range Limits.)	D1
		bar calibration (bar unit)		D3
		M calibration (kgf/cm^2 unit)		D4
Long vent*5		Total length: 119 mm (standard: 34 mm); Total length when combining with option code K1, K2, K5, and K6: 130 mm. Material: 316 SST		U1
Output limits and failure operation*6		Failure alarm down-scale : Output status at CPU failure and hardware error is −5%, 3.2mA DC or less.		C1
		NAMUR NE43 Compliant Output signal limits : 3.8 mA to 20.5 mA	Failure alarm down-scale : Output status at CPU failure and hardware error is −5%, 3.2 mA DC or less.	C2
			Failure alarm up-scale : Output status at CPU failure and hardware error is 110%, 21.6 mA or more.	C3
Body option*7 		Right side high pressure, without drain and vent plugs		N1
		N1 and Process connection, based on IEC61518 with female thread on both sides of cover flange, with blind kidney flanges on back.		N2
		N2, and Material certificate for cover flange, diaphragm, capsule body, and blind kidney flange		N3
Stainless steel tag plate		304SST tag plate wired onto transmitter		N4
Data configuration at factory*8		Data configuration for HART communication type	Software damping, Descriptor, Message	CA
		Data configuration for BRAIN communication type	Software damping	CB
European Pressure Equipment Directive*10		PED 97/23/EC Category III, Module H, Type of Equipment: Pressure Accessory-Vessel, Type of Fluid: Liquid and Gas, Group of Fluid: 1 and 2		PE3

T06E.EPS

*1: Not applicable with color change option.
*2 : Check terminals cannot be used when this option code is specified. Not applicable for output signal code **F** and amplifier housing code **2**.
*3: Applicable for Wetted parts material code **S**, **M**, **H** and **T**.
*4: The unit of MWP (Max. working pressure) on the name plate of a housing is the same unit as specified by option codes **D1**, **D3**, and **D4**.
*5: Applicable for vertical impulse piping type (Installation code **7**) and Wetted parts material code **S**, **H**, **M** and **T**.
*6: Applicable for output signal codes **D** and **E**. The hardware error indicates faulty amplifier or capsule.
*7: Applicable for wetted parts material code **S**, **M**, **H** and **T**; process connection codes **3**, **4**, and **5**; installation code **9**; and mounting bracket code **N**. Process connection faces on the other side of zero adjustment screw.
*8: Also see 'Ordering Information'.
*9: Not applicable for amplifier housing code **2**.
*10: Applicable for measurement span code **M** and **H**. If compliance with category III is needed, specify this option code.
*11: 316 or 316L SST. The specification is included in amplifier code **2**.

Item	Description		Code
Material certificate*1	Cover flange *2		**M01**
	Cover flange, Process connector *3		**M11**
Pressure test/ Leak test certificate*7	Test Pressure: 16 MPa(2300 psi)*4	Nitrogen(N_2) Gas*6	**T12**
	Test Pressure: 25 MPa(3600 psi)*5	Retention time: one minute	**T13**

T06Eb.EPS

*1: Material traceability certification, per EN 10204 3.1B.
*2: Applicable for process connections codes **0** and **5**.
*3: Applicable for process connections codes **1**, **2**, **3**, and **4**.
*4: Applicable for capsule code **L**.
*5: Applicable for capsule codes **M** and **H**.
*6: Pure nitrogen gas is used for oil-prohibited use (option codes **K1**, **K2**, **K5**, and **K6**).
*7: The unit on the certificate is always Pa unit regardless of selection of option code **D1**, **D3** or **D4**.

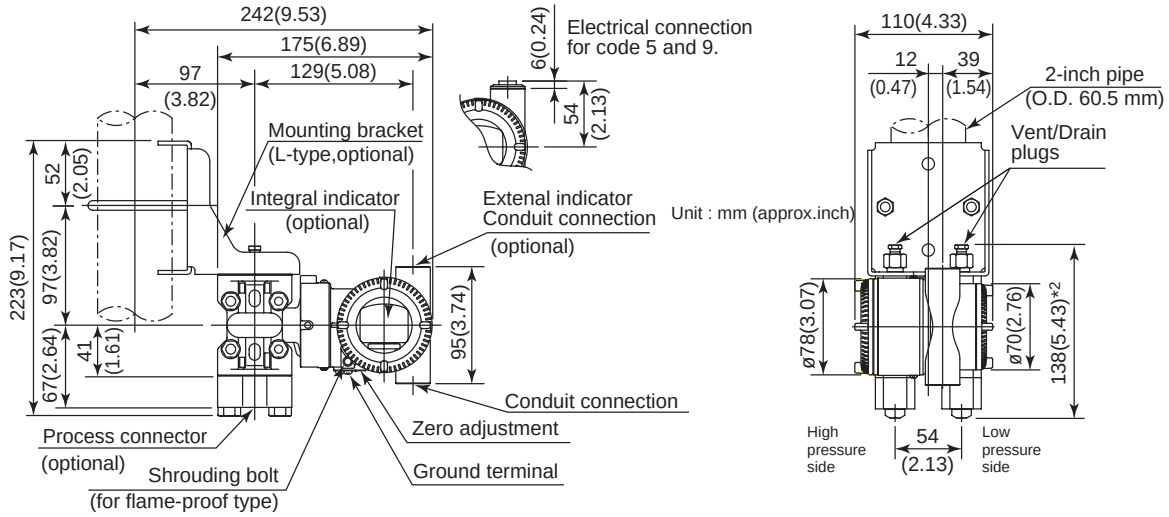
■ DIMENSIONS

● **Model EJX110A**

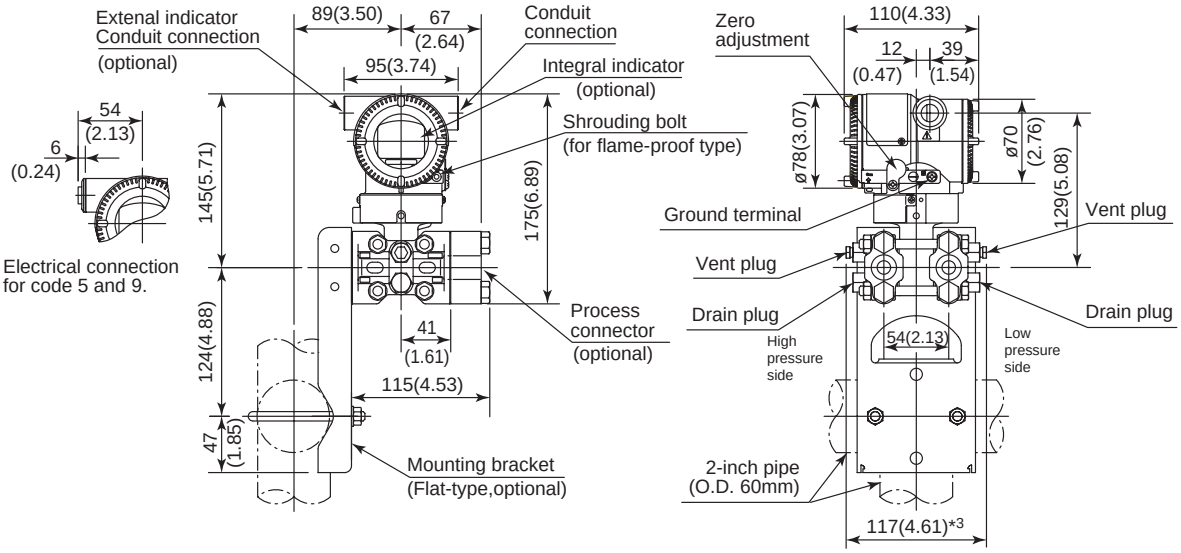
Vertical Impulse Piping Type

Process connector upside (INSTALLATION CODE '7')

Unit : mm (approx.inch)



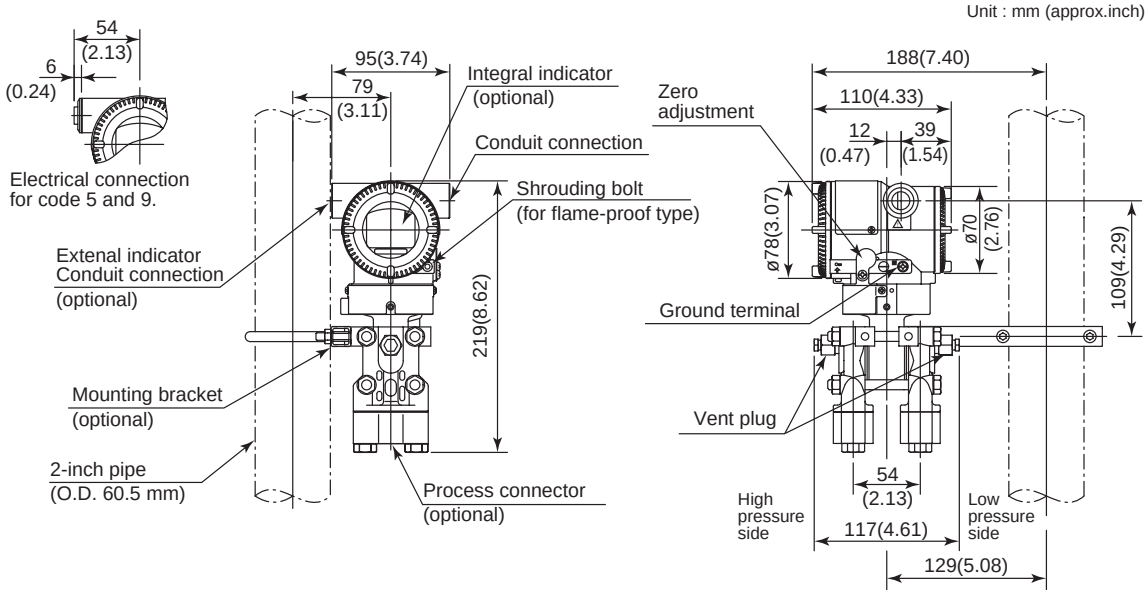
Horizontal Impulse Piping Type (INSTALLATION CODE '9') (For CODE '8', refer to the notes below.)



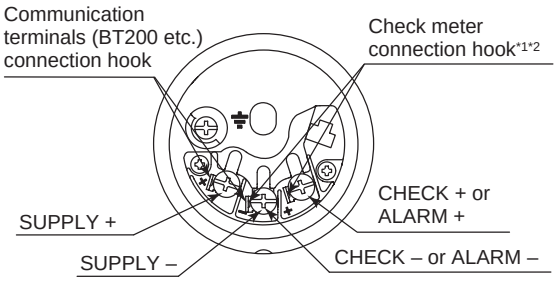
* 1: When installation code 8 is selected, high and low pressure side on above figure are reversed. (i.e. High pressure side is on the right side.)
* 2: When option code K1, K2, K5 or K6 is selected, add 15mm(0.59 inch) to the value in the figure.
* 3: When option code K1, K2, K5 or K6 is selected, add 30mm(1.18 inch) to the value in the figure.

Bottom Process Connection Type (INSTALLATION CODE 'B')

Unit : mm (approx.inch)



● Terminal Configuration



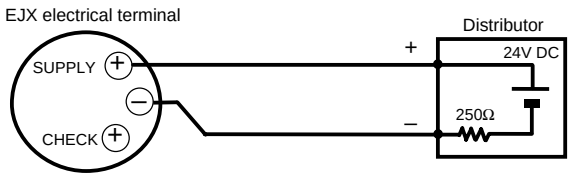
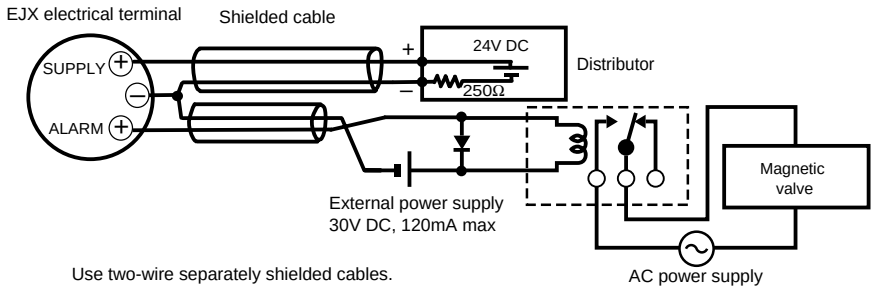
● Terminal Wiring

SUPPLY + –	Power supply and output terminal
CHECK + – or ALARM + –	External indicator (ammeter) terminal*1*2 or Status contact output terminal*2 (when /AL is specified)
⏚	Ground terminal

*1: When using an external indicator or check meter, the internal resistance must be 10 Ω or less. A check meter or indicator cannot be connected when /AL option is specified.
*2: Not available for fieldbus communication type.

F05E.EPS

● Wiring Example for Analog Output and Status Output

Connection	Description
Analog output	
Analog and status output (when /AL is specified) If shield cable is not used, communication is not possible.	

F06E.EPS

< Ordering Information > “◇”

Specify the following when ordering
1. Model, suffix codes, and option codes
2. Calibration range and units
   1) Calibration range can be specified with range value specifications up to 5 digits (excluding any decimal point) for low or high range limits within the range of -32000 to 32000. When reverse range is designated, specify Lower Range Value(LRV) as greater than Upper Range Value(URV). When square root output mode is specified, LRV must be “0 (zero) ”.
   2) Specify only one unit from the table, ‘Factory setting.’
3. Select linear or square root for output mode and display mode.
   Note: If not specified, the instrument is shipped set for linear mode.
4. Display scale and units (for transmitters equipped with the integral indicator only)
   Specify either 0 to 100 % or ‘Range and Unit’ for engineering units scale:
   Scale range can be specified with range limit specifications up to 5 digits (excluding any decimal point) for low or high range limits within the range of -32000 to 32000. Unit display consists of 6-digit, therefore, if the specified scaling unit excluding ‘/’ is longer than 6-characters , the first 6 characters will be displayed on the unit display.
5. Tag Number (if required)
   For BRAIN communication type, specify upto 16 letters. The specified letters will be written in the amplifier memory and engraved on the tag plate.
   For HART communication type, specify software tag (up to 8 letters) to be written on the amplifier memory and Tag number(up to 16 letters) to be engraved on the tag plate seperately.
6. Other factory configurations (if required)
   Specifying option code **CA** or **CB** will allow further configuration at factory. Following are configurable items and setting range.
   [/CA : For HART communication type]
   1) Descriptor(up to 16 characters)
   2) Message (up to 30 characters)
   3) Software damping in second (0.00 to 100.00)
   [/CB : For BRAIN communication type]
   1) Software damping in second (0.00 to 100.00)

< Factory Setting > “◇”

Tag number	As specified in order
Software damping *1	‘2.00 sec’ or as specified in order
Output mode	‘Linear’ unless otherwise specified in order
Calibration range lower range value	As specified in order
Calibration range upper range value	As specified in order
Calibration range unit	Selected from mmH_2O, $mmH_2O(68^\circ F)$, mmAq*2, mmWG*2, mmHg, Pa, hPa*2, kPa, MPa, mbar, bar, gf/cm^2, kgf/cm^2, inH_2O, $inH_2O(68^\circ F)$, inHg, ftH_2O, $ftH_2O(68^\circ F)$ or psi. (Only one unit can be specified.)
Display setting	Designated differential pressure value specified in order. (% or user scaled value.) Display mode 'Linear' or 'Square root' is also as specified in order.
Static pressure display range	'0 to 25 MPa' for M and H capsule and '0 to 16 MPa' for L capsule, absolute value. Measuring high pressure side.

T07E.EPS

*1: To specify these items at factory, option code **CA** or **CB** is required.
*2: Not available for HART protocol type.

General Specifications

EXA ISC

Model ISC202G, ISC202S
2-wire Inductive Conductivity Transmitter

GS 12D06A03-01E

■ General

The EXA ISC202 transmitter is a user programmable instrument for conductivity measurements in medium to highly conductive process liquids, using inductive measuring principles. It is used in combination with the Yokogawa model ISC40 inductive conductivity sensor, for concentration monitoring applications in the chemical industry and for various other conductivity applications in the food and pharmaceutical industry, the plating and metal finishing industry and pulp & paper industry. The robust chromated cast aluminium housing, makes it the ideal 2-wire transmitter for mounting directly on-site, even under tough environmental conditions.

Its 2-wire concept gives low installation costs, a safe operation and easy maintenance in the fieid. HART® communication is also available.

The ISC202 features user-selectable process dedicated temperature compensation for various (strong) acids and alkalis.

The process linearised output function and the “%”-concentration displays contribute to a highly functional inductive conductivity based concentration analyzer.

■ Features

- Process optimised temperature compensation on fit the instrument in any application.
- Extermely wide measuring range (> 6 decades) while mainteining a high resolution and accuracy using only one sensor type : 0 to 1999 mS/cm.
- Free programmable setting of the output range, including a 21-step table output to linearise the output function e.g. to % by weight.
- Programmable % by weight display indication.
- Proven simple 3-lebel operation system using YES/NO prompts where each level can separately by protected from unwanted access by a 3-digit passcode.
- Passive 2-wire system, 4 to 20 mA for easy installation at low costs and safe opreation at 24 V DC.
- HART®, PROFIBUS-PA, FOUNDATION Fieldbus H1 communications

■ Applications

- Applications where severe electrode fouling prevents the use of contacting electrodes.
- All ranges except the (ultra) pure water applications.
- Chemical processes except concentrated sulfuric, nitric, and fluoric acids.
- Slurry applications where conventional systems suffer from plugging or erosion.
- Applications where the 6-decimal rangeability is necessary for accurate process control.

YOKOGAWA
Yokogawa Electric Corporation

Yokogawa Electric Corporation
2-9-32, Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Tel.: 81-422-52-5617 Fax.: 81-422-52-6792

GS 12D06A03-01E

1st Edition Oct. 2004
2nd Edition May. 2007

■ System configuration

Refer to applicable GS for inductive conductivity sensor, fitting, terminal box, and extension cable.

Non-explosionproof System

Inductive Conductivity Senor

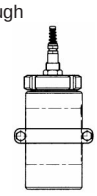
・Non-explosionproof type

ISC40G
ISC40GJ

Holders

・Immersion
ISC40FD
ISC40FDJ

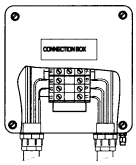
・Flow-Through
ISC40FF
ISC40FFJ



・Direct Insertion
ISC40FS
ISC40FSJ

Terminal Box

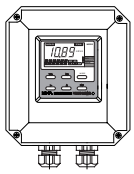
・Terminal Box
BA10, BA20



・Extension Cable
WF10, WF10J

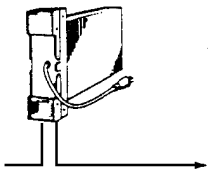
Inductive Conductivity Transmitter

・Non-explosionproof type Inductive Conductivity Transmitter
ISC202G



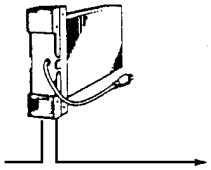
Distributor

・Dedicated Distributor for EXA PH SC ISC
PH201G



・Output 1 to 5 V DC
・Hold contact output
・Failure contact output

・General Purpose Type Distributor
SDBT, SDBS



・Output 1 to 5 V DC

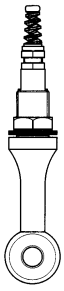
F001.EPS

Explosionproof System

Inductive Conductivity Sensor

・Explosionproof type

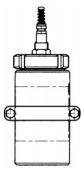
ISC40S



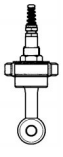
Holders

・Immersion
ISC40FD

・Flow-Through
ISC40FF

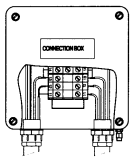


・Direct Insertion
ISC40FS



Terminal Box

・Terminal Box
BA10



・Extension Cable
WF10

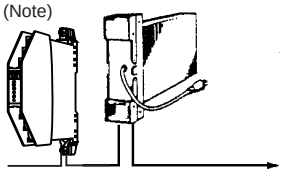
Inductive Conductivity Transmitter

・Intrinsically safe type Inductive Conductivity Transmitter ISC202S

Safety Barrier & Distributor

・Safety Barrier (Note)

・Distributor



Output

(Note) For intrinsically safe approval, use the safety barrier certified by the testing laboratories.
(BARD-400, BARD-800 are not applicable.)

F002.EPS

Measurement principle

Unlike -2 or 4- electrode conductivity systems, the ISC202 analyzes conductivity without any contact between the electrodes and process fluid. The measurement is based on the inductive coupling of 2 ring transformers (Toroids) by the liquid.

The ISC202 supplies a reference voltage (V1) at a high frequency to the “drive coil.” The core of this coil is of a highly permeable magnetic material, and a strong magnetic field is generated in the toroid.

The liquid passes through the hole in the toroid and can be considered as a “one turn” secondary winding.

The magnetic field induces a voltage (V2) in this liquid winding. The induced current thus made to flow is proportional to this voltage and the conductance of the liquid’s “one turn winding” is according to Ohm’s law.

The conductance (G = 1/R) is proportional to the specific conductivity and a constant factor that is determined by the geometry of the sensor (the length divided by surface area of the hole in the toroid) and the installation of the sensor.

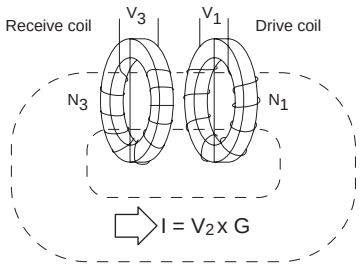
There are 2 toroids mounted in the doughnut-shaped sensor. The liquid also flows through the second toroid and therefore the liquid turn can be considered as the primary winding of the second ring transformer. The

current in the liquid will create a magnetic field in the second toroid.

The induced voltage (V3) being the result of this magnetic field can be measured as the output. The output voltage of this “receive coil” is, therefore, proportional to the specific conductivity of the process liquid.

There are 2 toroids mounted in the doughnut-shaped sensor.

Inductive conductivity measurement principle



F003.EPS

Process dedicated temperature compensation

The ISC202 features optimisation of the temperature compensation for virtually any process. From neutral salt solutions to the most concentrated acids and alkalis. From tight controlled and/or very stable processes to processes that have extreme variations in both conductivity and temperature. The ISC202’s temperature compensation can easily be adapted to meet the accuracy requirements for temperature compensation imposed by the process control targets.

Temperature compensation based on the IEC 60746-3 table for NaCl solution can be selected for standard conductivity measuremens in different processes.

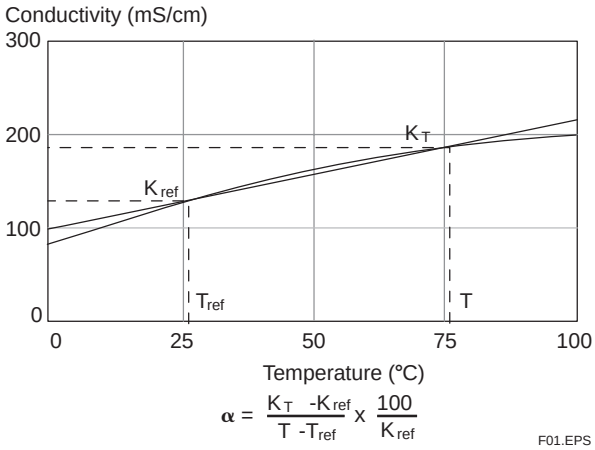
For measurements requiring accuracy such as concentration applications, the temperature compensation can be tailored to the process. This is done during commissioning of the transmitter by using the actual process solution by programming a (linear) temperature coefficient : “**α**” (see Figure 1). For processes where the temperature coefficient varies with temperature and concentration (eg Sodiumhydroxide and Sulphuric acid), matrix compensation is applied.

To further simplify transmitter set up, the matrices for several common process solutions are stored in memory. Any of these can be selected from the Service Menu of the transmitter. These include:

Sulphuric Acid	H_2SO_4	0.5 - 5.0 %,	0 - 100 °C
Sulphuric Acid	H_2SO_4	2.5 - 25.0 %,	0 - 100 °C
Hydrochloric Acid	HCl	0.5 - 5.0 %,	0 - 60 °C
Hydrochloric Acid	HCl	1.0 - 20.0 %,	0 - 60 °C
Nitric Acid	HNO_3	0.5 - 5.0 %,	0 - 80 °C
Nitric Acid	HNO_3	2.5 - 25.0 %,	0 - 80 °C
Sodium Hydroxide	NaOH	0.5 - 5.0 %,	0 - 100 °C
Sodium Hydroxide	NaOH	0.5 - 15.0 %,	0 - 100 °C

If your process in not covered by one of these selectable curves, the user can create curves specific to the process. This is done by building a simple matrix table of temprature related conductivity values. Thus the accuracy of the measurement is fine-tuned to the specific process conditions.

The matrix compensation method guaranties optimal accuracy where TC dependence from conductivity and process temperature is taken into account.



F01.EPS

Figure 1 Definition of temperature compensation factor (α)

Output signal

The standard ISC202 features a 4-20 mA current output available for recording, indication or control functions which represent:

- the measured conductivity value

In addition the following output functions are available:

- a “HOLD” function that holds the last measured process value or a fixed value during maintenance or commissioning
- a “BURN” function that gives a high, low or pulsed output at fail status
- a programmable output function that allows the user to linearise the output when used as a concentration analyzer.

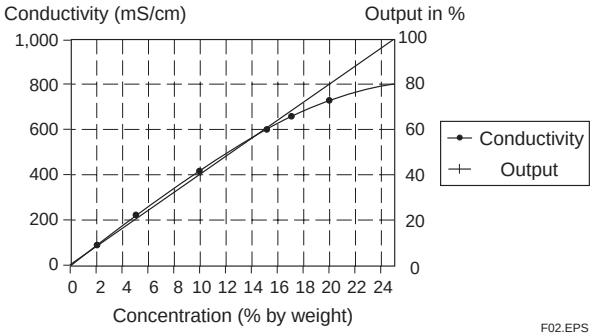


Figure 2 Linearization of output (Example: 0-25% Sulfuric acid)

Table 1 where Conductivity is converted to concentrstion (Example: 0-25% Sulfuric acid)

Code	mA	Conc.	Example	Cond.	Example
Output	4-20		% H_2SO_4		mS/cm
0	4.0		0.00		0
5	4.8		1.25		60
10	5.6		2.50		113
15	6.4		3.75		180
20	7.2		5.00		211
25	8.0		6.25		290
30	8.8		7.50		335
35	9.6		8.75		383
40	10.4		10.00		424
45	11.2		11.25		466
50	12.0		12.50		515
55	12.8		13.75		555
60	13.6		15.00		590
65	14.4		16.25		625
70	15.2		17.50		655
75	16.0		18.75		685
80	16.8		20.00		718
85	17.6		21.25		735
90	18.4		22.50		755
95	19.2		23.75		775
100	20.0		25.00		791

T01.EPS

■ Fault diagnosis - burnout function

The measurement is continuously checked for faults, giving warning of abnormal conductivity readings and cable problems. These faults are signaled by the FAIL flag and can be transmitted to the control room by a current of 21 mA, or 3.6 mA (burn). This is also available in HART communication. The fault is also signaled by a special marker field in the display, and an error code in the message display.

■ Cell constant (Installation Factor)

The ISC40 sensor is a doughnut-shaped sensor. When installing the sensor, be sure to allow the process fluid to flow through the doughnut hole and around the sensor freely.

The sensor is provided with a gasket and retaining nut. This allows " bulkhead mounting" in a tank wall or standard flange through a hole with a 27-mm diameter (A). The insertion depth is 124 mm. Using a 20-mm size wrench, the sensor can be easily mounted and aligned.

The WF10(J) Extension Cable may be used with the BA10, BA20 Terminal Box. The total length of the extension cable and the sensor cable should not exceed 50 m.

The installation factor of the ISC40 is the ratio of the measured conductivity at the sensor and the specific conductivity of the solution. The unit is cm^{-1} just as the cell constant of a contact electrode system. An installation factor unique to each sensor is indicated on the label of the sensor cable. (The nominal value is 1.88 cm^{-1}.) This factor varies depending on materials of process piping and the distance between the doughnut sensor and process piping. If the distance is less than 30 mm, sensor calibration is required before using the ISC40. From the calibration results, the ISC202 will calculate an installation factor corresponding to the installation conditions and use it for conductivity measurement.

In case where sensor calibration is difficult to be conducted, enter the manually calculated installation factor into the ISC202 following the instructions below.

-When a sensor is installed in the standard stainless steel holder, ISC40FF-S, ISC40FFJ-S:

An installation factor decreases approximately 7%. Reduce the value indicated on the label of the sensor cable by 7%, and then enter the result.

-When a sensor is installed in the standard polypropylene holder, ISC40FF-P, ISC40FFJ-P:

An installation factor increases approximately 1%. Increase the value indicated on the label of the sensor cable by 1%, and then enter the result.

-When a sensor is installed in long piping with a distance (D) between the sensor and piping, as shown in Figure 3:

The installation factor for pipe mounting (reference data when the nominal value is 1.88 cm^{-1}) is shown in Figure 3. Divide the value indicated on the label of the sensor cable by 1.88 and then multiply the quotient by the value obtained from Figure 3. Enter the result.

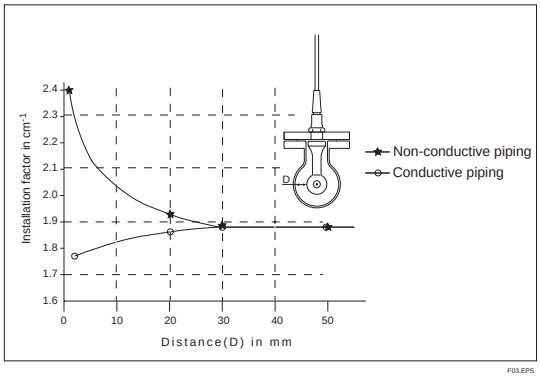
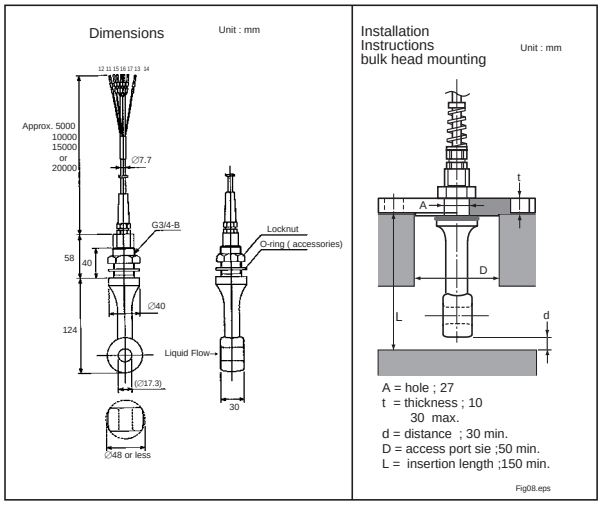


Figure 3 Installation Factor (Reference) for Pipe Mounting



(Note) Do not submerge the sensor itself in process water, as the seams between the mold and the metal of the sensor are not waterproof.

F004.EPS

Three level operation

The EXA ISC202 transmitter uses a 3-level operating system to take full advantage of the microprocessor while retaining the traditional simplicity of analog converters. Advanced functions are separated from conventional operation to avoid confusion. They can be activated as required for each individual application.

1. The normal maintenance functions are accessible through the flexible window by pushing the keys underneath.
2. Functions required to commission the instrument are hidden to discourage unauthorized tampering. The front cover is removed to reveal the commissioning menu and the hidden access key (marked*).
3. Specialised functions can be adjusted via the SERVICE menu. In this case access is by using “service codes”.

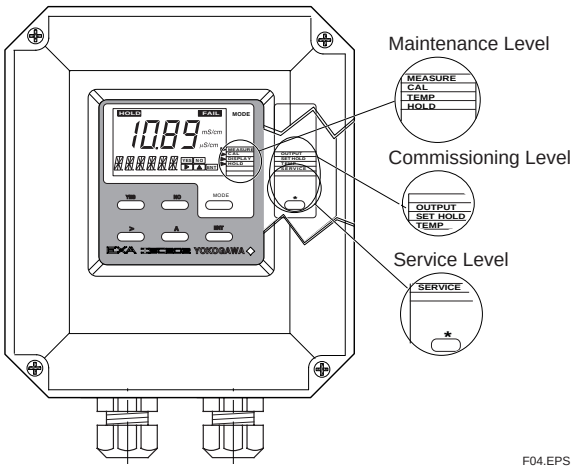


Figure 4 Three level operation

With this 3-level user-friendly approach, the instrument can be operated by anyone.

All three levels can be separately protected against unauthorised access by a password system using a three digit code.

HART Communication

One of the features of smart field devices is their ability to detect faults, either in the device electronics or in an associated sensor. Using a fieldbus system, such faults are reported in the device status byte in every message (assuming that communication is still possible!). For HART, it is still useful to follow the convention of indicating fault conditions by setting the analogue output current to a value which is recognisably beyond the normal operating range (including the small amount of linear over-range commonly allowed). If it is still alive, the current output value is set to an appropriate value with the intention that a host system should be able to set alarm thresholds just outside the normal 4 to 20 mA range, to indicate measurement out-of-range, and to set further alarm thresholds to indicate a fault condition.

DD specification and other support files

The ISC202 Device Description (DD) files are available enabling communications compatible HOST devices (and HHT for HART). Other files to support AMS, PRM and PDM are available as well.

General specifications

1. TRANSMITTER

Input specifications : Compatible with the Yokogawa inductive conductivity ISC40 series with integrated temperature sensor: Pt1000 or 30kΩ NTC.
ISC202S: use with ISC40S

Input ranges
- Conductivity : 0 to 1999 mS/cm at 25 °C (77 °F) reference temperature.
- Temperature : -20 to 140 °C (4 to 284 °F) .
- Cable length : max. 60 meters total length of fixed sensor cable + WF10(J) extension cable.
Influence of cable can be adjusted by doing an AIR CAL with the cable connected to a dry cell.

Functional specification

Accuracy (under reference conditoons):
(Output span is 0 - 100 µS/cm or more)
- Conductivity :
  Linearity : ± (0.4 %FS + 0.3 µS/cm)
  Repeatability : ± (0.4 %FS + 0.3 µS/cm)
- Temperature : ± 0.3 °C

Note on accuracy specifications: The following tolerance is added to above performance.
mA output tolerance : ± 0.02 mA of "4 - 20 mA"
- Step response : ≦ 8 seconds for 90 % (for 2 decade step).

Indicating range

Main display : 0 to 1999 mS/cm (1st compensation)
Message display : 0 to 1999 mS/cm (2nd compensation),
Temperature -20 to 140 °C (0 to 280 °F)
Concentration 0 to 100.0 %
Temperature compensation methods NaCl, T.C., Matrix
Cell constant [cm^{-1}]
Reference Temperature (°C/°F)
Software Release.

Transmission signal

Output signal : Isolated output of 4-20 mA DC. Burn up (21 mA) or Burn down (3.6 mA when HART or distributor comm. is non-used, 3.9 mA when HART or distributor comm. is used) or pulse of 21 mA to signal failure.
Hold : Outputs may be set to hold the last or a fixed value during maintenance.

Transmission range

Conductivity : Minimum span: 100 µS/cm
Maximum span: 1999 mS/cm
Setting value at 4 mA output:
≦ 90 % of setting value
at 20 mA output

Maximum load resistance :

For the ISC202G, see figure 5.
200 Ω or less with the PH201G
50 Ω or less with the SDBT
For the ISC202S, see figure 6.

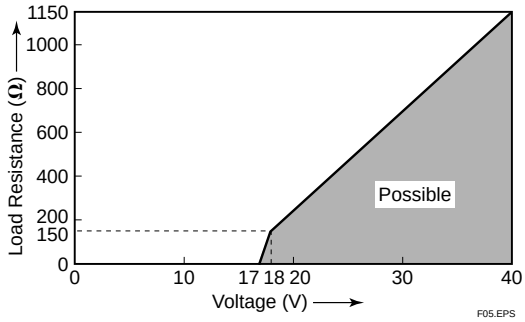


Figure 5 Supply voltage/ load diagram (ISC202G)

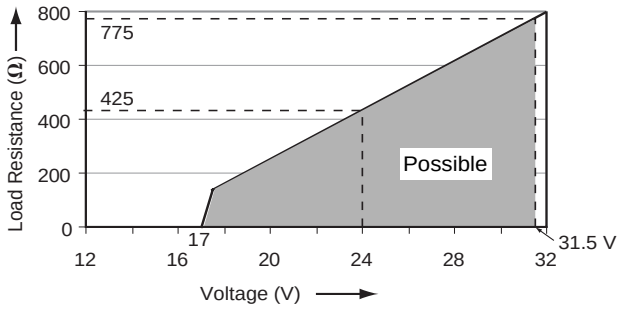


Figure 6 Supply voltage/ load diagram (ISC202S)

Environment and operational conditions

Ambient temp.	:	-10 to +55 °C (10 to 130 °F)
Storage temp.	:	-30 to +70 °C (-20 to 160 °F)
Relative humidity	:	10 to 90% RH at 40°C ambient temperature, non condensing

Temperature compensation

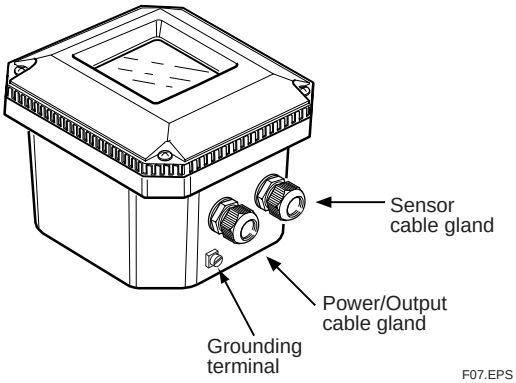
Sensor types	:	Pt1000 or 30kΩ NTC.
Automatic	:	-20 to 140 °C (0 to 280 °F)
Algorithm	:	selectable as mentioned below NaCl according to IEC 60746-3 tables. Two T.C. setting possible between 0.00 to 3.50 %/°C Matrix: user selectable/ configurable. 8 selectable for concentrated solutions, 1 free programable. Reference temperature adjustable between -20 to 140 °C (0 to 280 °F)
Sensor diagnostics	:	Abnormal temperature, abnormal conductivity values, e.g. dry cell, wiring problems.
Calibration	:	Manual, calibration Input pre-measured data (cell constant).
Weather resistant	:	IP65, NEMA 4X, Type 3S
Mounting	:	Pipe, Wall or Panel.
Dimensions	:	Refer to the appropriate external dimensions.
Weight	:	approx. 1.6 kg Mounting brackets weight approx. 0.7 kg

Logbook

: Software record of important events and diagnostic data.

Construction

Display	:	Custom liquid crystal display
- Main display	:	3 1/2 digits, 12.5 mm high, zero change included.
- Message display	:	6 alphanumeric characters, 7 mm high.
- Special fields	:	Flags for status indication : FAIL and HOLD.
- Measuring units	:	µS/cm or mS/cm
- Key prompts	:	YES, NO, >, ^, ENT, Menu pointer
- Keys	:	6 keys operated through flexible window with tactile feedback. One hidden key behind the front cover.
Power supply	:	Normal 24 V DC loop powered system, see Figure 5, 6, 7. ISC202G: 17 - 40 V DC ISC202S: 17 - 31.5 V DC
Input Isolation	:	Maximum 1000 V DC
Housing	:	
- Material	:	Cast aluminium case with chemically resistant coating, cover with flexible polycarbonate window.
- Color	:	Case : Off-white (Equivalent to Munsell 2.5Y8.4/1.2) Cover : Deepsea Moss green (Equivalent to Munsell 0.6GY3.1/ 2.0)
- Cable gland	:	2-Pg13.5



Automatic safeguard:

Return to measuring mode after 10 minutes when no keystroke.

Operation protection :

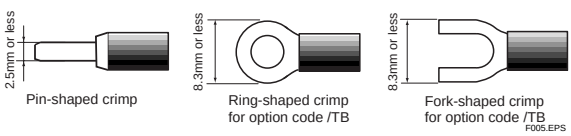
3 digital pass codes (programmable).

Data protection :

EEPROM for configuration.

Cable and terminals:

The glands will form a tight seal on cables with an outside diameter in the range of 6 to 12 mm.



Requirement of connecting with external instruments

	Terminal for pin cable terminal	Screw terminal (option /TB)
Crimp contact for cable	Pin-shaped crimp contact with sleeve insulator	Ring-shaped or fork-shaped crimp contact
Usable contact	max. 2.5 mm	Crimp contact shown as the figures under this table, which meets M3 screw
Torque for fixing	0.5 N·m or less	1.35 N·m (recommended)
Example of crimp contact*	Weidmuller Co., Ltd. made: H0.34/10, H0.5/12, H1/12, H1.5/12S	JST, Mfg. Co., Ltd. made: VD1.25-3(Ring shape), VD1.25-S3A(Fork shape)

*Note: Other crimp contact may be required , depending on core-cable diameter .

T02.eps

Regulatory compliance

EMC: conforms to EN61326 Class A
AS/NZS CISPR11

Explosionproof type

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Vmax=31.5 V, Imax=100 mA, Pmax=1.2 W, Ci=22 nF, Li=35 µH	-A
	FM Non-incendive safe Approval Applicable standard: FM3600, FM3611, FM3810 Non-incendive Safe for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Vmax=31.5 V, Ci=22 nF, Li=35 µH	-N
CENELEC ATEX	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26 Certificate: KEMA 06ATEX0222 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	-A
	CENELEC ATEX (KEMA) Type of protection "n" Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 06ATEX0223 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	-N

2.EPS

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Entity { Vmax=24 V, Imax=250 mA, Pmax=1.2 W, Ci=220 pF, Li=0 µH FISCO { Vmax=17.5 V, Imax=380 mA, Pmax=5.32 W, Ci=220pF, Li=0 µH	-P or -F
	FM Non-incendive safe Approval Applicable standard: FM3600, FM3611, FM3810 Non-incendive Safe for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Entity { Vmax=32 V, Pmax=1.2 W, Ci=220 pF, Li=0 µH FNICO { Vmax=32 V, Pmax=5.32 W, Ci=220 pF, Li=0 µH	-B or -D

FM.EPS

Note: Suffix code "-P", "-F", "-B" and "-D" of FM approval are pending.

Item	Description	Code
CENELEC ATEX Entity	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26 Certificate: KEMA 07ATEX0052 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	-P or -F
CENELEC ATEX FISCO	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26, EN60079-27 Certificate: KEMA 07ATEX0052 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	
CENELEC ATEX	**CENELEC ATEX (KEMA) Type of protection "n"** Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 07ATEX0053 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	-B or -D

ATEX.EPS

Item	Description	Code
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1 Ex ia Class I, Division 1, Groups ABCD Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ii(Imax)=100 mA, Pi(Pmax)=1.2 W, Ci=22 nF, Li=35 µH	-A
	CSA Non-incendive safe Approval or type of protection "n" Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No.61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ci=22 nF, Li=35 µH	-N
IECEx Scheme	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 06.0054X Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	-A
	IECEx Type of protection "n" Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 06.0054X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	-N

T12E.EPS

Item	Description	Code
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1 Ex ia Class I, Division 1, Groups ABCD Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Entity { Ui(Vmax)=24 V, Ii(Imax)=250 mA, Pi(Pmax)=1.2 W, Ci=220 pF, Li=0 µH FISCO { Ui(Vmax)=17.5 V, Ii(Imax)=380 mA, Pi(Pmax)=5.32 W, Ci=220 pF, Li=0 µH	-P or -F
	CSA Non-incendive safe Approval or type of protection "n" Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No. 61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Entity: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH FNICO: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH	-B or -D

CSA.EPS

Item	Description	Code
IECEx Scheme Entity	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 07.0028X Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	-P or
IECEx Scheme FISCO	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26, IEC60079-27 Certificate: IECEx KEM 07.0028X Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	-F
IECEx Scheme	**IECEx Type of protection "n"** Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 07.0028X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	-B or -D

IEC.EPS

HART® communications

Input : Two-wire system, 4-20 mA DC

Power supply : ISC202G : up to 40 volts
ISC202S : up to 31.5 volts
Note: The transmitter contains a switched power supply,drawing its energy from the 0-4 mA section of the signal. Consequently the 17 volt limit is applied at 4 mA. The characteristic of the unit is such that above about 7 mA on the output, the terminal voltage can drop to 14.5 volts without problem.

Transmission Signal : Isolated output of 4 to 20 mA DC. Maximum load 425Ω at 24 VDC Burn to signal failure acc. NAMUR Recommendation NE43 (18.01.1994)

Operating range : 3.9 to 21 mA

Communication : HART®, 1200 Baud, FSK modulated on 4 to 20 mA signal

Configuration : Local with 6 keys

Software : Firmware based on Yokogawa stack.

Hardware : Yokogawa HART Modem F9197UB

Other Control systems : Yokogawa PRM, Rosemount AMS, Siemens PDM

Hand Terminal : Rosemount HHT 275/375

Output span :

-Conductivity : min 0.01 µS/cm,max.1999 mS/cm. (max 90% zero suppression)

- Resistivity : min 0.001kΩ·cm, max.999 MΩ·cm. (max 90% zero suppression)
The instrument is user programmable for linear or non-linear conductivity ranges.

Cable specification: 0.5 mm diameter or 24 AWG over maximum length of 1500 m

DD specification : The ISC202 Device Description is available enabling communications with the Handheld communicator and compatible devices.

PROFIBUS-PA communications

Input signal: Digital
Supply voltage: 9 to 32 V DC
Operating current: 26.0 mA
Operating values: According to IEC 1158-2
Bus connection: Fieldbus interface based on IEC 1158-2 according to FISCO-Model
Power supply: Power supply is achieved dependant on the application by means of segment coupler
Data transfer: According to PROFIBUS- PA profile class B based on EN 50170 and DIN 19245 part 4
GSD file: The actual file can be downloaded from www.profibus.com
Configuration: Local with 6 keys
Software: Firmware based on Siemens DPC31 stack.
Hardware: PC- or PCMCIA-interfaces from Siemens
Other control: Siemens PDM systems
Electrical connection: Terminals acc. to IEC 1158-2
Fieldbus-cable-types: Twisted and shielded two wire cable according to recommendation based on IEC 1158-2
Cable diameter: 6 to 12 mm (0.24 to 0.47 inch)

FOUNDATION Fieldbus H1 communications

Input signal: Digital
Supply voltage: 9 to 32 V DC
Operating current: 26.0 mA (base current)
Operating values: According to IEC 1158-2
Bus connection: Fieldbus interface based on IEC 1158-2 according to FISCO-Model
Power supply: Power supply is achieved dependant on the application by means of segment coupler
Data transfer: FF Specification Rev. 1.4, Basic device
Function blocks: 3xAI, Transducer, Resource
Files: Actual file can be downloaded from our homepage
Configuration: Local with 6 keys,
Software: National Instruments, NI-FBUS configurator
Hardware: FBUS-interfaces from National Instruments (AT-FBUS and PCMCIA FBUS)
Other control systems: Yokogawa PRM, DMT

2. DISTRIBUTOR: PH201G (Style B)

The PH201G supplies drive power to 2-wire transmitter. The PH201G receives a 4-20 mA DC current signal from the transmitter, and converts the signal to a 1-5 V DC voltage signal. Simultaneously, it also receives a digital signal superimposed on the 4-20 mA DC current signal, and provides as outputs a hold-contact signal and a fail-contact signal. In addition, the PH201G has a built-in current regulator so that it will not supply an excess current even if the circuit or the power supply cable on the transmitter shorts.

<Input/Output Signal Specifications>

Number of input points
(Number of transmitter units connectable) : 1 point
Output signal : 1 to 5 V DC (2 points)
Load resistance : 2k Ω or less (1 to 5 V DC Output)
Isolation system : Loop isolation type
Between input and output is not isolated
Between input/output and power supply is Isolated

<Mounting / Form>

Mounting method : Indoor rack mounting
Connection method : External signal connection
: M4 screw terminal connection
Power supply / Ground connection :
100V : JIS C8303 ground type 2 plug connection or M4 screw terminal connection (option:/TB)
220V : CEE 7VII (European electrical device standard) plug connection
Cable length : 300 mm
External dimensions
: 180H x 48W x 300D mm
Weight : Approx. 1.7 kg (Including rack and case)

<Standard Specifications>

Accuracy : ±0.2% of span
Transmitter supply voltage :
: 26.5 ± 1.5 V DC
Maximum current and power consumption
24V DC : Approx. 4.8 W
100V AC : Approx. 7 VA
220V AC : Approx. 11VA
Insulation resistance
Between I/O terminals and ground pin
: 100 M Ω / 500 V DC
Between power supply pins and ground pin
: 100 M Ω / 500 V DC

<Operating Specifications>

Ambient temperature
: 0 to 50 °C
Ambient humidity : 5 to 90% RH (Non-condensing)
Power supply : Dual use AC/DC
100V : DC power 20 to 130 V, no polarity
AC power 80 to 138 V, 47 to 63 Hz
220V : DC power 120 to 340 V, no polarity
AC power 138 to 264 V, 47 to 63 Hz

<Contact Output>

Contact rating : 250 V AC, maximum 100 VA
220 V DC, maximum 50 W
Hold contact output : N.C. 1 contact, Normally energized
Contact closes when power is off or during maintenance.
Failure contact output
: N.C. 1 contact, Normally energized
Contact closes when power is off or during failure.

■ Model and suffix codes

1. 2-wire Inductive conductivity transmitter (Non-explosionproof type)

[Style: S2]

Model	Suffix Code		Option Code	Description
ISC202G	·····		·····	2-wire Inductive conductivity transmitter
Type	-A		·····	mA with HART
	-P		·····	Profibus
	-F		·····	FF
Language		-J	·····	Japanese
		-E	·····	English
Option	Mounting Hardware		/U	Pipe, wall mounting bracket (Stainless steel)
			/PM	Panel Mounting bracket(Stainless steel)
	Hood		/H	Hood for sun protection (Carbon steel)
			/H2	Hood for sun protection (Stainless steel)
	Tag Plate		/SCT	Stainless steel tag plate
	Conduit Adapter		/AFTG	G1/2
			/ANSI	1/2NPT
			/TB	Screw terminal (*1)
			/X1	Epoxy baked finish (*2)

(*1) It can be specified when the suffix code -A is selected.

(*2) The housing is coated with epoxy resin.

T03.EPS

2. 2-wire Inductive conductivity transmitter (Explosionproof type)

[Style: S2]

Model	Suffix Code		Option Code	Description
ISC202S	·····		·····	2-wire Inductive conductivity transmitter
Type	-A		·····	Intrinsic safe mA with HART
	-P		·····	Intrinsic safe Profibus (Note)
	-F		·····	Intrinsic safe FF (Note)
	-B		·····	Non-incendive FF (*2) (Note)
	-N		·····	Non-incendive mA (*2)
	-D		·····	Non-incendive Profibus (*2) (Note)
Language		-J	·····	Japanese
		-E	·····	English
Option	Mounting Hardware		/U	Pipe, wall mounting bracket (Stainless steel)
			/PM	Panel Mounting bracket(Stainless steel)
	Hood		/H	Hood for sun protection (Carbon steel)
			/H2	Hood for sun protection (Stainless steel)
	Tag Plate		/SCT	Stainless steel tag plate
	Conduit Adapter		/AFTG	G1/2
			/ANSI	1/2NPT
			/X1	Epoxy baked finish (*1)

(*1) The housing is coated with epoxy resin.

T03s.EPS

(*2) When the instrument with Suffix Code "-B, -N, -D" is used, take measures so that the display window is not exposed to direct sunlight.

Note: Suffix code "-P", "-F", "-B" and "-D" of FM approval are pending.

3. Dedicated distributor

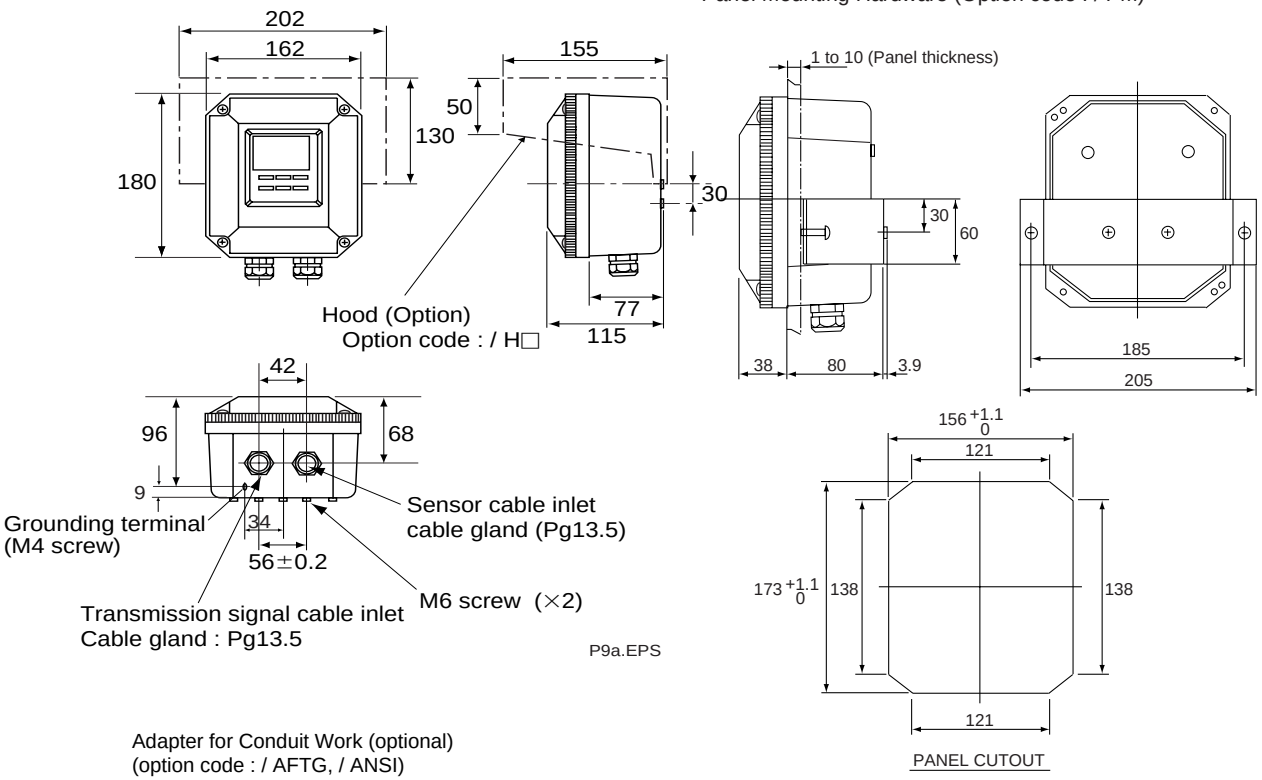
Model	Suffix Code		Option Code	Description
PH201G	·····		·····	Distributor
Power Supply	–A1		·····	100V AC
	–A2		·····	220V AC
——		∗B	·····	Style B
Option			/TB	Terminal for Power connection

T04.EPS

■ Dimensions

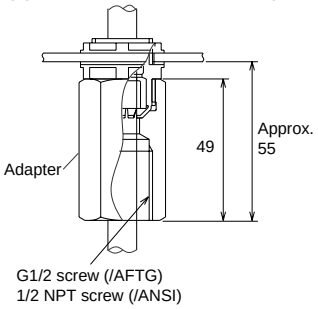
Unit : mm

Inductive Conductivity Transmitter

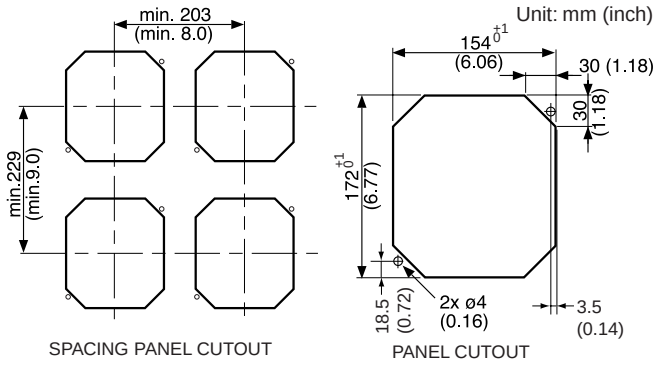


Panel Mounting Hardware (Option code : / PM)

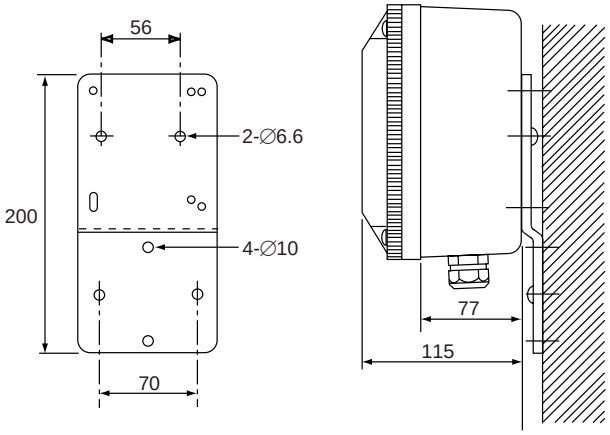
Adapter for Conduit Work (optional)
(option code : / AFTG, / ANSI)

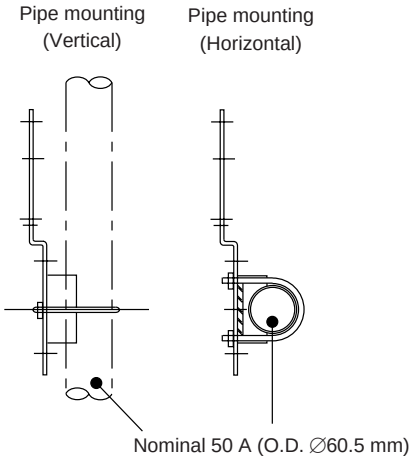


Panel Mounting when using two (2) self-taping screws



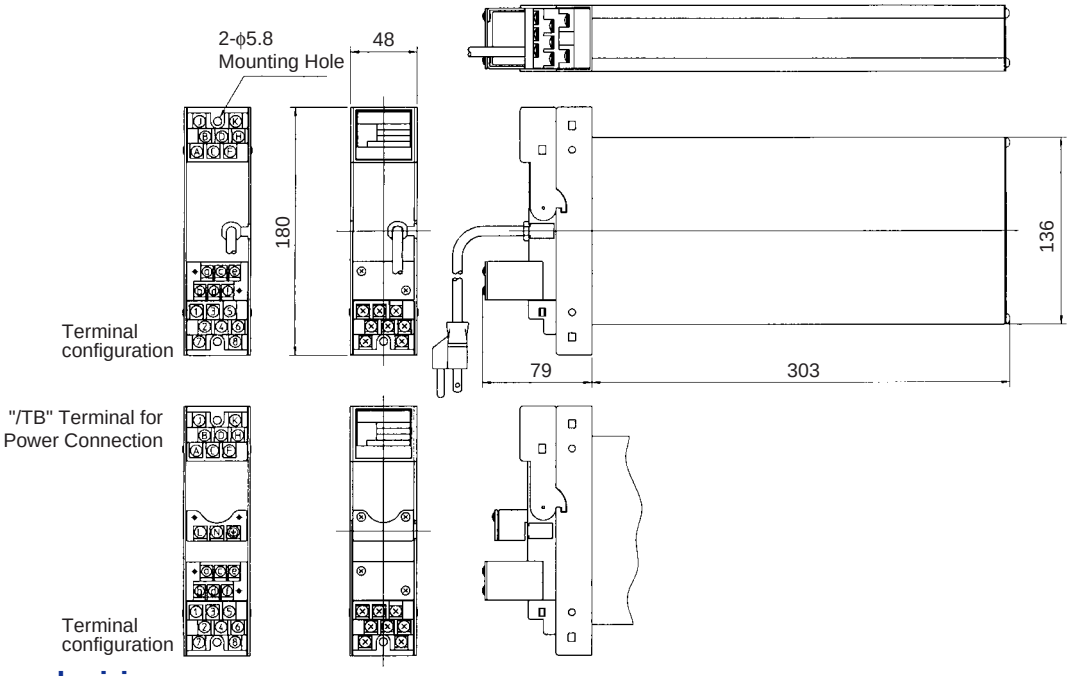
Pipe / Wall Mounting (Option code : / U)





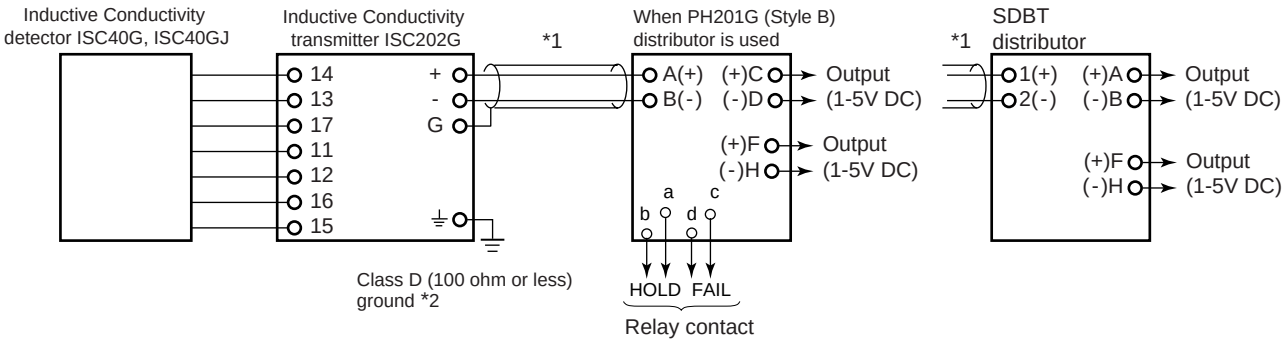
PH201G Distributor (Style B)

Unit : mm



External wiring

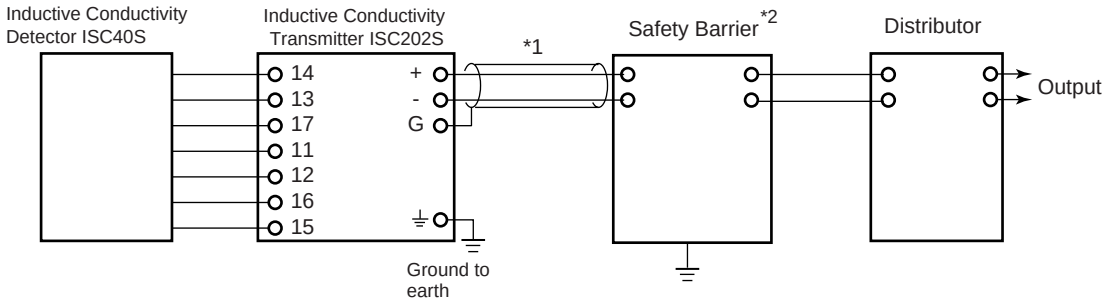
Non-explosionproof System



*1 Use two-wire cable with OD (Outside Diameter) of 6 to 12 mm
Make sure distributor voltage does not drop below minimum for ISC202G
*2 Ground ISC202G (Class D ground: 100 ohm or less)

F006.eps

Explosionproof System



*1 Use two-wire cable with OD (Outside Diameter) of 6 to 12 mm.
*2 For intrinsically safe approval, use the safety barrier certified by the testing laboratories.
In case of non-incendive type (ISC202S-B, -N, -D), the safety barrier is not neccessary.

F007-1.eps

Inquiry Specifications for 2-wire Inductive Conductivity Transmitter System

Make inquiries by filling in related boxes with checks (✔) and writing in the underlined parts.

1. General Items

Name of your company: _____

Person in charge: _____ Belongs to: _____ (Phone No. _____)

Name of plant: _____

Measuring point: _____

Purpose of use: ☐ Indication ☐ Record ☐ Alarm ☐ Control

Power supply to Distributor: _____ V AC

2. Measuring Conditions

(1) Liquid temperature: _____ to _____ , Normal _____ [˚C]

(2) Liquid pressure: _____ to _____ , Normal _____ [kPa]

(3) Flow rate: _____ to _____ , Normal _____ [l / min.]

(4) Flow speed: _____ to _____ , Normal _____ [m / s]

(5) Slurry or fouling components: ☐ No ☐ Yes

(6) Name of measuring liquid: _____

(7) Components of measuring liquid: _____

(8) Others: _____

3. Installing Location

(1) Ambient temperature: _____

(2) Installing location: ☐ Outdoors ☐ Indoors _____

(3) Others: _____

4. Specification Requirements

(1) Measuring range: ☐ _____

(2) Transmission output: ☐ 4 to 20mA DC ☐ HART® ☐ PROFIBUS-PA ☐ FOUNDATION Fieldbus H1

(3) Type of transmission output: ☐ Linear ☐ Non-linear

(4) System configuration selection: ☐ Sensor ☐ Holder ☐ Transmitter ☐ Terminal box ☐ Extension cable

(5) Detector mounting: ☐ Immersion ☐ Flow-through ☐ Direct insersion

(6) Sensor cable length: _____m

(7) Extension cable length: _____m

(8) Others: _____

General Specifications

EXA PH

Model PH202G, PH202S, PH202SJ
2-Wire Type pH/ORP (Redox) Transmitter

GS 12B07D02-E

GENERAL

Flexibility, low maintenance and low installation costs are among the benefits of the EXA PH202 pH/ORP transmitter. Designed to meet the exacting requirements of measuring pH and ORP in the modern industrial environment, it contains many features to ensure peak precision whatever the application.

This 2-wire (loop powered) transmitter is housed in a robust IP65 field mountable case. HART® communication is also available. The need for expensive cabling is minimized. The famous EXA sensor diagnostics are enhanced by an improved impedance check, and the addition of a logbook feature. Calibration history is available in the display, and is used to store important configuration, calibration and diagnostic data. Prediction of sensor failure is possible by reference to the logbook.

Microprocessor-aided calibration uses internal buffer tables and stability checking to ensure maximum accuracy with minimum effort. Process temperature compensation enhances accuracy in applications where the influence of temperature is seen in process pH changes. pH and ORP or rH measurements can be made simultaneously when an appropriate sensor combination is used.

FEATURES

- Universal pH/ORP
- Possible to input high impedance reference electrode
- On-line sensor checking
- Process temperature compensation
- Differential input amplifier with equipotential screening
- Freely configurable ITP, slope and asymmetry
- Easy to use EXA control panel
- Password protection for all levels of software
- HART®, PROFIBUS-PA, FOUNDATION Fieldbus H1 communications

YOKOGAWA
Yokogawa Electric Corporation

Yokogawa Electric Corporation
2-9-32, Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Tel.: 81-422-52-5617 Fax.: 81-422-52-6792

GS 12B07D02-E

1st Edition Jan. 2000
7th Edition May. 2007

ACCURATE pH MEASUREMENT

1. Electrode selection

In order to make precise pH/ORP measurements, there are a number of pre-requisites. Special attention should be paid to the choice of the sensors to ensure compatibility with the chemical composition of the process fluid. The speed of response required, the solids content and the flow rate of the fluid are also contributory factors. The GS12B07B02 -E general specifications cover the choice of sensors.

2. Signal processing (pH/ORP)

With the correct sensor configuration, the PH202 can measure pH and ORP.

3. High performance transmitter

The PH202 provides excellent noise rejection, minimizing the stray signals that can affect industrial pH measurements. Earth loop currents in damp and damaged cabling are eliminated by the equipotential screening. It offers a simple and effective process temperature compensation in addition to the usual compensation to the Nernst equation.

4. Maintenance

It is important that the system be well maintained to make precise pH/ORP measurement. The electrodes must be properly cleaned and regularly calibrated. Yokogawa on-line cleaning systems may be used where there is significant fouling of the sensors. Other influences from the electrode holders can be less obvious, but important none the less. Well designed fittings make it easy to provide the routine maintenance needed for best accuracy. Flow-through submersion, suspension and float types of holders are available.

HART COMMUNICATION

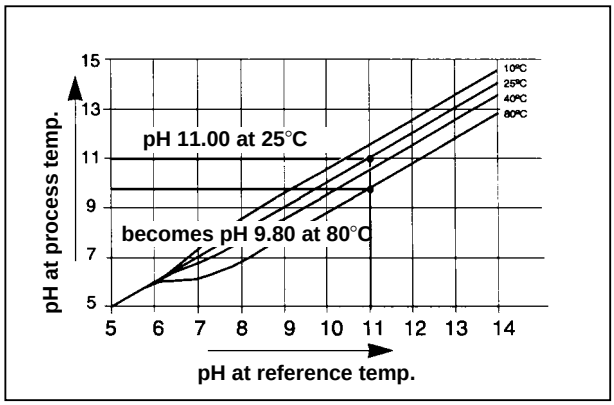
One of the features of smart field devices is their ability to detect faults, either in the device electronics or in an associated sensor. Using a fieldbus system, such faults are reported in the device status byte in every message (assuming that communication is still possible!). For HART, it is still useful to follow the convention of indicating fault conditions by setting the analogue output current to a value which is recognizably beyond the normal operating range (including the small amount of linear over-range commonly allowed). If it is still alive, the current output value is set to an appropriate value with the intention that a host system should be able to set alarm thresholds just outside the normal 4 to 20 mA range, to indicate measurement out-of-range, and to set further alarm thresholds to indicate a fault condition.

DD specification and other support files

The PH202 Device Description (DD) files are available enabling communications compatible HOST devices (and HHT for HART). Other files to support AMS, PRM and PDM are available as well.

PROCESS TEMPERATURE COMPENSATION

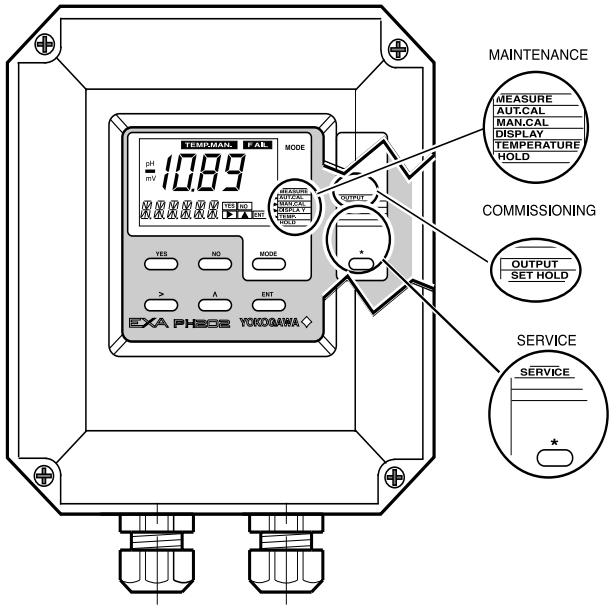
The figure below shows the strong change in pH with temperature, caused by the dissociation constant of water changing. This effectively shifts the neutral point from pH7. In order to reliably control the pH of solutions it is necessary to compensate for the changes. The PH202 transmitter has a simple-to-operate system of process temperature compensation to provide optimum accuracy and best control. An application where this is particularly important is in the measurement of alkalized boiler feed water.



F2.EPS

3-LEVEL OPERATION

The PH202 transmitter uses a 3-level operating system to take full advantage of the microprocessor while retaining the traditional simplicity of a 2-wire transmitter. Advanced functions are separated from conventional operation to avoid confusion. They can be activated as required for each individual application.



MAINTENANCE level

The normal maintenance functions are accessible through the flexible window by pushing the keys underneath.

Use : Normal operation and checking
How : Simple operation by dialog through the closed front cover
Example : Calibration with buffers

COMMISSIONING level

Functions required to commission the instrument are hidden to discourage unauthorized tampering. The front cover is removed to reveal the commissioning menu and the hidden access key (marked ∗).

Use : For normal commissioning
How : Removal of the front cover reveals the access key and second menu
Example : Selecting a measuring range

SERVICE level

Specialized functions can be adjusted via the SERVICE menu. In this case access is by using “service codes”.

Use : Only for specialist functions
How : Through special coded entries
Example : Process temperature compensation

With this 3-level user-friendly approach, the instrument can be operated by anyone. Commissioning is straight-forward and needs no calibration equipment compared to analog instruments. Specialist functions available via access codes are invisible during normal operation. All three levels can be separately protected against unauthorized access by a password system using a three digit code.

SENSOR CHECKING

1. On-line checks

Real-time sensor checking in the 2-wire transmitter is one of the most important features of the EXA PH202 transmitter. By special circuitry on the input board an alternating voltage is applied to the liquid earth pin and the sensors. The impedance of the measuring electrode (pH-glass or ORP-metal electrode) and reference electrode are independently measured. The measured values are compared to limiting values.

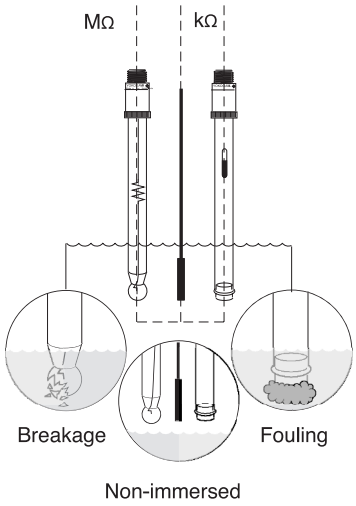
2. Faults

The pH-sensor is checked for low impedance to detect breakage of the bulb and for high impedance to detect an open circuit.

The Redox sensor is checked for high impedance to detect an open circuit.

The reference electrode is also checked for high impedance to detect fouling of the diaphragm, poisoning of the reference liquid or non immersion of the sensors.

These faults can be transmitted to the control room or remote panel by a discrete current output of 21 mA or 3.6 mA when HART or distributor comm. is non-used, 3.9 mA when HART or distributor comm. is used over the 2-wire connection. The fault is also flagged on the display by a special marker field and an error code in the message display.



3. Off-line checks

During calibration of a pH measuring system, the response of the sensors is measured and checked. Sensitivity and drift are calculated and checked. During calibration of an ORP measuring system, the drift of the sensors is calculated and checked. If any of these are outside the limits, an error is signaled.

The comprehensive combination of on-line and off-line checking monitors all key aspects of the measurement to give an early warning, if the reading is faulty.

GENERAL SPECIFICATIONS

1. Transmitter

Input specifications : Dual high impedance inputs (greater than10^{12} Ω) with provision for liquid earth connection. Suitable for inputs from glass or enamel pH & reference sensors and ORP metal electrodes.

Input ranges :
- pH : –2 to 16 pH
- ORP : –1500 to 1500 mV
- rH : 0 to 55 rH
- Temperature : –30 to 140°C (-20 to 300°F)
  8.55kΩ NTC sensor : –10 to 120 °C (10 to 250°F)
  for 10kΩ PTC sensor : –20 to 140 °C (0 to 300°F)
  (Measuring range may also be limited by the specification of the used sensor.)

Output ranges :
- pH : min. 1 pH max. 20 pH
- ORP : min. span 100 mV max. span 3000 mV
- rH : min. 2 rH max. 55 rH
- Temperature : min. 25 °C max. 200 °C
  (for 8.55kΩ NTC sensor max. 120 °C)

Output signal :

4-20 mA DC loop powered, isolated from input.

With the possibility of 21 mA “FAIL” signal (burn up) and 3.6 mA (burn down when HART or distributor comm. is non-used), 3.9 mA (burn down when HART or distributor comm. is used).

Temperature compensation:

• Range : –30 °C to 140 °C (-20 to 300 °F)
(for 8.55kΩ sensor –10 °C to 120 °C)

Sensor types: Pt100, Pt1000, 3kΩ PTC, 5.1kΩ PTC, 8.55kΩ NTC, 350Ω PTC, 6.8kΩ PTC, 10k Ω PTC

Automatic or manual compensation to Nernst equation.

Process compensation by configurable coefficient.

Adjustable ITP (Iso-thermal point of intersection).

Calibration :

Semi-automatic, using tables in transmitter for pH 4, 7 & 9 buffer solutions, or using user-defined tables, with automatic check of measurement stability.

Manual, using standard sample, by correcting reading to value of standard.

Calibration by slope and asymmetry potential setting. (IEC746-2)

Logbook :

Software record of important events and diagnostic data. Available through HART link, with diagnostic information available in the display.

Serial communication:

Bi-directional digital communication superimposed on the 4-20 mA signal.

Display : Custom liquid crystal display, with a main display of 3 1/2 digits 12.5 mm high.

Message display of 6 alphanumeric characters, 7 mm high.

Warning flags and units (pH and mV).

Power supply : Nominal 24 volt DC loop powered system.

PH202G: 17 to 40 V, see Fig. 1.
PH202S: 17 to 31.5 V, see Fig. 2.

Maximum load resistance:

For the PH202G, see Fig. 1.

200Ω or less with the PH201G

50Ω or less with the SDBT

For the PH202S, see Fig. 2.

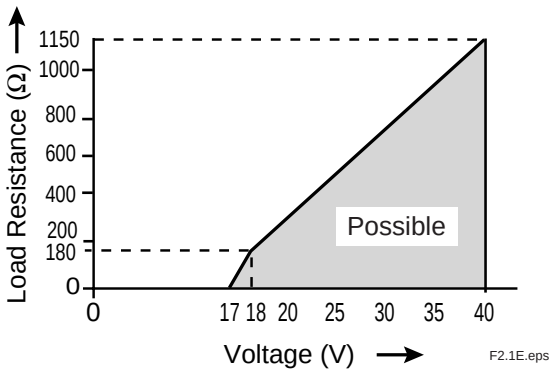


Fig.1 Supply voltage/ load diagram for the PH202G

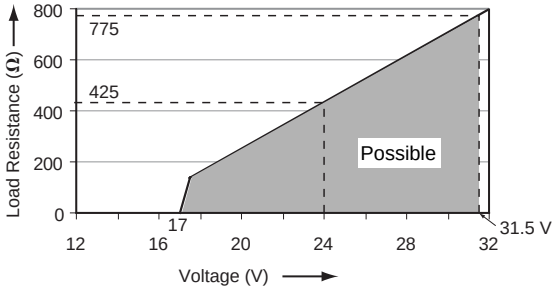


Fig.2 Supply voltage/ load diagram for the PH202S

For the PH202SJ

175Ω or less with the PH201G

25Ω or less with the SDBT

For PH202SJ allowable load resistance should be determined by the following equation.

When used with BARD-800:

$$\text{Allowable load resistance } (\Omega) = \frac{V-18.5}{0.022} - R$$

When used with BARD-400:

$$\text{Allowable load resistance } (\Omega) = \frac{V-19}{0.022} - R$$

V: Minimum output voltage of power supply (distributor)
R: Internal resistance of power supply (distributor)

Note: Maximum load resistance depending on distributor used should be as follows.
(PH201G) + (BARD-800): 175 Ω
(SDBT) + (BARD-800): 25 Ω

Performance : (The specifications are expressed with simulated inputs.)

pH- Linearity : ± 0.01 pH
• Repeatability : ± 0.01 pH
• Accuracy : ± 0.01 pH
ORP- Linearity : ± 1 mV
• Repeatability : ± 1 mV
• Accuracy : ± 1 mV
Temperature with Pt1000, 3kΩ PTC, 5.1kΩ PTC, 8.55kΩ NTC, 350Ω PTC, 6.8kΩ PTC, 10kΩ PTC
• Linearity : ± 0.3 °C
• Repeatability : ± 0.1 °C
• Accuracy : ± 0.3 °C
Temperature with Pt100
• Linearity : ± 0.4 °C
• Repeatability : ± 0.1 °C
• Accuracy : ± 0.4 °C
Note: The following tolerance is added to above performance.
mA output tolerance: ± 0.02 mA of “4 - 20 mA”

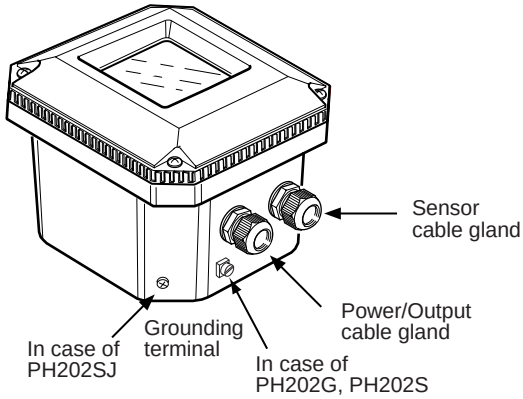
Ambient operating temperature: –10 to + 55 °C

Storage temperature: –30 to +70 °C

Humidity : 10 to 90% RH (Non-condensing)

Housing :

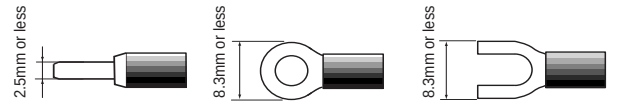
Case: Cast aluminum case with chemically resistant coating
Cover: Polycarbonate window.
Case color: Off-white (Equivalent to Munsell 2.5Y8.4/1.2)
Cover color: Deep sea Moss green (Equivalent to Munsell 0.6GY3.1/2.0)



Cable and terminals :

The PH202 is equipped with terminals suitable for the connection of finished cables in the size: 0.13 to 2.5 mm (26 to 14 AWG)

Cable entry: 2 cable glands 1/2NPT. The cable glands will form a tight seal on cables with an outside diameter in the range of 6 to 12 mm (0.24 to 0.47 inches).



Pin-shaped terminal | Ring-shaped terminal for option code /TB. | Fork-shaped terminal for option code /TB.

F3.7.EPS

Requirement of connecting with external instruments

	Terminal for pin cable terminal	Screw terminal (option /TB)
Crimp contact for cable	Pin-shaped crimp contact with sleeve insulator	Ring-shaped or fork-shaped crimp contact
Usable contact	max. 2.5 mm	Crimp contact shown as the figures see upper this table, for M3 screw
Torque for fixing	0.5 N·m or less	1.35 N·m (recommended)
Example of crimp contact*	Weidmuller Co., Ltd. make: H0.34/10, H0.5/12, H1/12, H1.5/12S	JST, Mfg. Co., Ltd. make: VD1.25-3 (Ring shape), VD1.25-S3A (Fork shape)

*Note: Other crimp contact may be required , depending on core-cable diameter .

T3.2E.eps

Construction :

Weather resistant to IP65, NEMA 4X and Type 3S standards

Mounting :

Pipe, wall or panel mounting, using optional hardware

Weight : Approx. 1.6 kg

Data protection :

EEPROM for configuration and logbook, and lithium cell for clock.

Automatic safeguard :

Return to measuring mode when no safe guard keystroke is made for 10 min.

Operation protection :

3-digit programmable password.

Sensor impedance checking :

Independent impedance check on measuring and reference sensor elements, with temperature compensation.
Display of sensor impedance on message line of display.
FAIL flag in event of “out of limits” impedance, and the possibility of 21 mA or 3.6 mA when HART comm. is non-used (3.9 mA when HART comm. is used) error signal.

Signal processing (pH/ORP):

The PH202 can measure pH or ORP. Using the FU20 allows simultaneous measurement and display of pH and ORP. It also allows display and out put of pH.

Regulatory compliance of PH202G and PH202S

EMC: conforms to EN61326 Class A, AS/NZS CISPR11

PH202S Intrinsically safe type

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Vmax=31.5 V, Imax=100 mA, Pmax=1.2 W, Ci=22 nF, Li=35 µH	**-U**
IECEx	**IECEx Intrinsically safe (see Note)**	
CENELEC ATEX	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020, EN60079-26 Certificate: KEMA 06ATEX0218 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	**-E**
IECEx	**IECEx Intrinsically safe (see Note)**	
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.61010-1 Ex ia Class I, Division 1, Groups ABCD, Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ii(Imax)=100 mA, Pi(Pmax)=1.2 W, Ci=22 nF, Li=35 µH	**-C**
IECEx	**IECEx Intrinsically safe (see Note)**	

(Note) IECEx Scheme	**IECEx Intrinsically safe** Applicable standard: IEC60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 06.0052X Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	

T1E.EPS

Type of protection “n” or Non-incendive of PH202S

Item	Description	Code
Factory Mutual (FM)	**FM Non-incendive safe Approval** Applicable standard: FM3600, FM3611, FM3810 Non-incendive for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Vmax=31.5 V, Ci=22 nF, Li=35 µH	-N
CENELEC ATEX	**CENELEC ATEX (KEMA) Type of protection "n"** Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 06ATEX0219 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	
Canadian Standards Association (CSA)	**CSA Non-incendive safe Approval or type of protection "n"** Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No.61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ci=22 nF, Li=35 µH	
IECEx Scheme	**IECEx Type of protection "n"** Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 06.0052X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	

T2.EPS

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Entity { Vmax=24 V, Imax=250 mA, Pmax=1.2 W, Ci=220 pF, Li=0 µH FISCO { Vmax=17.5 V, Imax=380 mA, Pmax=5.32 W, Ci=220 pF, Li=0 µH	-P or -F
	FM Non-incendive safe Approval Applicable standard: FM3600, FM3611, FM3810 Non-incendive Safe for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Entity { Vmax=32 V, Pmax=1.2 W, Ci=220 pF, Li=0 µH FNICO { Vmax=32 V, Pmax=5.32 W, Ci=220 pF, Li=0 µH	-B or -D

FM.EPS

Note: Suffix code "-P", "-F", "-B" and "-D" of FM approval are pending.

Item	Description	Code
CENELEC ATEX Entity	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26 Certificate: KEMA 07ATEX0048 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	-P or
CENELEC ATEX FISCO	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26, EN60079-27 Certificate: KEMA 07ATEX0048 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	-F
CENELEC ATEX	**CENELEC ATEX (KEMA) Type of protection "n"** Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 07ATEX0049 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	-B or -D

ATEX.EPS

Item	Description	Code
IECEx Scheme Entity	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 07.0026X Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	-P or
IECEx Scheme FISCO	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26, IEC60079-27 Certificate: IECEx KEM 07.0026X Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	-F
IECEx Scheme	**IECEx Type of protection "n"** Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 07.0026X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	-B or -D

IEC.EPS

Item	Description	Code
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1 Ex ia Class I, Division 1, Groups ABCD Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Entity { Ui(Vmax)=24 V, Ii(Imax)=250 mA, Pi(Pmax)=1.2 W, Ci=220 pF, Li=0 µH FISCO { Ui(Vmax)=17.5 V, Ii(Imax)=380 mA, Pi(Pmax)=5.32 W, Ci=220 pF, Li=0 µH	-P or -F
	CSA Non-incendive safe Approval or type of protection "n" Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No. 61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Entity: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH FNICO: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH	-B or -D

CSA.EPS

PH202SJ TIIS Intrinsically safe type

Electrical:

Safety Barrier Used	Construction, Explosion /Ignition Groups	Safety Barrier Rating
BARD-800	i3aG4	Vm=DC 31.5 V Im=DC 29.2 mA Pm=0.92 W
BARD-400	i3aG4	Vm=DC 31.5 V Im=DC 35 mA Pm=1.1 W

T5e.eps

Environmental:

Altitude: 1000 m max.
Ambient temperature: –10 to +55°C for sensor and transmitter
Humidity: 45 to 85% RH
Location: Zones 0, 1 and 2 hazardous locations, with safety barrier.

Wiring between PH202SJ and safety barrier:

Safety Barrier	Maximum Allowable Inductance	Maximum Allowable Capacitance
BARD-800	2.2 mH	35 nF
BARD-400	2.2 mH	35 nF

T6e.eps

Sample oxidation-reduction potential: Within ± 2 V

Connection is required between common terminal (3) of safety barrier and common terminal of distributor (power supply). Failure to connect may cause errors on 4-20 mA signal due to characteristics of safety barrier. When BARD-800/400 safety barrier is used, be sure to prevent large current from flowing into the safety barrier in order to avoid possible fuse blowing.

Yokogawa's distributors, Models PH201G and SDBT, have a current limiter function and are best suited for use with the PH202SJ.

HART® communications

Input : Two-wire system, 4-20 mA DC
Power supply : PH202G : up to 40 volts
PH202S ,SJ: up to 31.5 volts
Note: The transmitter contains a switched power supply,drawing its energy from the 0-4 mA section of the signal. Consequently the 17 volt limit is applied at 4 mA. The characteristic of the unit is such that above about 7 mA on the output, the terminal voltage can drop to 14.5 volts without problem.
Transmission : Isolated output of 4 to 20 mA DC.
Signal : Maximum load 425Ω at 24 VDC
Burn to signal failure acc. NAMUR Recommendation NE43 (18.01.1994)
Operating range : 3.9 to 21mA
Communication : HART®, 1200 Baud, FSK modulated on 4 to 20 mA signal
Configuration : Local with 6 keys
Software : Firmware based on Yokogawa stack.
Hardware : Yokogawa HART Modem F9197UB
Other Control systems : Yokogawa PRM, Rosemount AMS, Siemens PDM
Hand Terminal : Rosemount HHT 275/375
Output span :
- pH : min 1 pH, max 20 pH.
(max 90% zero suppression)
: The instrument is user programmable for linear or non-linear pH ranges.
Cable specification: 0.5 mm diameter or 24 AWG over maximum length of 1500 m
DD specification : The PH202 Device Description is available enabling communications with the Handheld communicator and compatible devices.

PROFIBUS-PA communications

Input signal: Digital
Supply voltage: 9 to 32 V DC
Operating current: 26.0 mA
Operating values: According to IEC 1158-2
Bus connection: Fieldbus interface based on IEC 1158-2 according to FISCO-Model
Power supply: Power supply is achieved dependant on the application by means of segment coupler
Data transfer: According to PROFIBUS- PA profile class B based on EN 50170 and DIN 19245 part 4
GSD file: The actual file can be downloaded from www.profibus.com
Configuration: Local with 6 keys
Software: Firmware based on Siemens DPC31 stack.
Hardware: PC- or PCMCIA-interfaces from Siemens
Other control: Siemens PDM systems
Electrical connection: Terminals acc. to IEC 1158-2
Fieldbus-cable-types: Twisted and shielded two wire cable according to recommendation based on IEC 1158-2
Cable diameter: 6 to 12 mm (0.24 to 0.47 inch)

FOUNDATION Fieldbus H1 communications

Input signal: Digital
Supply voltage: 9 to 32 V DC
Operating current: 26.0 mA (base current)
Operating values: According to IEC 1158-2
Bus connection: Fieldbus interface based on IEC 1158-2 according to FISCO-Model
Power supply: Power supply is achieved dependant on the application by means of segment coupler
Data transfer: FF Specification Rev. 1.4, Basic device
Function blocks: 3xAI, Transducer, Resource
Files: Actual file can be downloaded from our homepage
Configuration: Local with 6 keys,
Software: National Instruments, NI-FBUS configurator
Hardware: FBUS-interfaces from National Instruments (AT-FBUS and PCMCIA FBUS)
Other control systems: Yokogawa PRM, DMT

2. Dedicated Distributor PH201G (Style B)

This distributor, designed exclusively for use with these pH transmitter, supplies drive power to the 2-wire transmitter while simultaneously receiving 4 to 20 mA DC current signal from the transmitter and converting it to 1 to 5 V DC voltage signal; it also simultaneously receives a digital signal superimposed on 4 to 20 mA DC signal, and provides contact outputs during hold, failure, and/or cleaning.

A current limiter function is built into this unit so it can continue to operate properly even with a short circuit on the transmitter side.

<Input/Output Signal Specifications>

Number of input points (Number of transmitter units connectable): 1 point
Output signal: 1 to 5 V DC (2 points)
Load resistance : 2 kΩ or less (1 to 5 V DC Output)
Isolation system : Loop isolation type

<Mounting /Form>

Mounting method : Indoor rack mounting
Connection method :
External signal connection : M4 screw terminal connection
Power supply / Ground connection :
100V : JIS C8303 ground type 2 plug connection
220V : CEE 7VII (European electrical device standard) plug connection
Cable length : 300 mm
External dimensions : 180H x 48W x 300D mm
Weight : Approx. 1.7 kg (Including rack and case)

<Standard Specifications>

Accuracy : ±0.2 % of span
Transmitter supply voltage : 26.5 ± 1.5 V DC
Maximum current and power consumption
24 V DC : Approx. 4.8 W
100 V AC : Approx. 7 VA

220 V AC : Approx. 11 VA
Insulation resistance
Between I/O terminals and ground pin : 100 MΩ / 500 V DC
Between power supply pins and ground pin : 100 MΩ / 500 V DC

<Operating Specifications>

Ambient temperature : 0 to 50°C
Ambient humidity : 5 to 90 % RH (Non-condensing)
Power supply : Dual use AC/DC
100 V : DC power 20 to 130 V, no polarity
AC power 80 to 138 V, 47 to 63 Hz
220 V : DC power 120 to 340 V, no polarity
AC power 138 to 264 V, 47 to 63 Hz

<Contact Output>

Contact rating : 250 V AC, maximum 100 VA
220 V DC, maximum 50 VA
Hold contact output : N.C. 1 contact, Normally energized
Contact closes when power is off or during maintenance.
Failure contact output : N.C. 1 contact, Normally energized
Contact closes when power is off or during failure.
Cleaning contact output : 1 contact, Close during cleaning only
Used as drive contact for solenoid valve for cleaning.

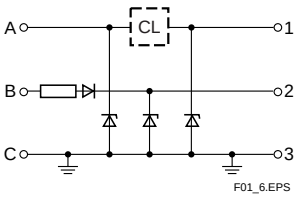
3. Safety Barrier BARD-800 (for PH202SJ)

The BARD-800 intrinsic safety (IS) barrier, connected to intrinsic safety devices installed in a hazardous area, configure an IS system in such a way that electric currents and voltages delivered from a safe area into a hazardous area can be limited to prevent energy generated in the IS circuit from igniting specified explosive gases.

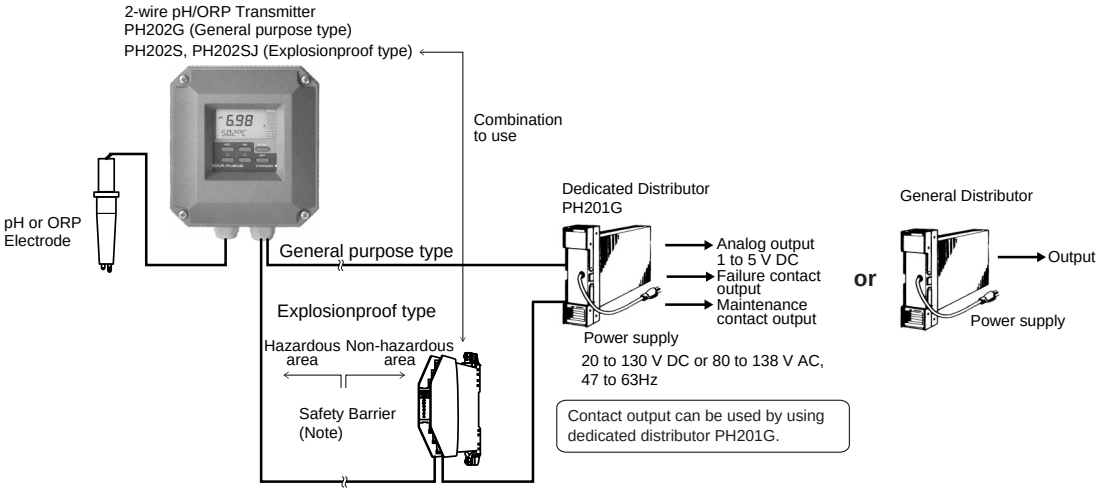
<Standard Specifications>

Type: Zener barrier
Use: 4 to 20 mA DC signal
Intrinsic safety class and certificate number:
Construction Grade; i3aG5 (certified by TIIS, No. 55577)
Intrinsic safety ratings:
Vmax (Uo): 31.5 V
Icc (Io): 29.2 mA
Pmax (Po): 0.92 W
Cext (Co): 42 nF
Lext (Lo): 4.2 mH
VM (Um): 250 V AC/DC
Leakage current: 10 μA at 28 V
Internal voltage drop:
139Ω × Io + 0.9 V, 4.16 V at 23.6 mA
Maximum impressed voltage: 31.0 V
Rated current of internal fuse: 50 mA
Working temperature range: -10 to 50°C
Storage temperature range: -40 to 90°C
Humidty range: 5 to 95% RH (no condensation)
Installation location: Nonhazardous area (indoors)
Grounding: Grounding resistance of 10Ω or less (equivalent to Japanese Industrial Standard Class A)
Housing: Material; Polycarbonate, Color; Light green
Weight:160 g

Schematic Diagram



System Configuration Example



(Note) For intrinsically safe approval, use the safety barrier certified by the testing laboratories.
Use the safety barrier designed for the communications when PH201G distributor is used.
Use BARD-800/400 when PH202SJ is used.

MODEL AND SUFFIX CODES

1. 2-Wire pH/ORP Transmitter (Non-explosionproof type)

[Style : S3]

Model	Suffix Code	Option Code	Description
PH202G	·····	·····	2-Wire pH/ORP Transmitter (*1)
Type	**-E**	·····	mA with HART (For other regions)
	-C	·····	mA with HART (Canada type)
	-U	·····	mA with HART (North America type)
	-P	·····	Profibus
	-F	·····	FF
Language	**-J**	·····	Japanese
	-E	·····	English
Option	Mounting Hardware	**/U**	Pipe, wall mounting bracket (Stainless steel)
		/PM	Panel mounting bracket (Stainless steel)
	Hood	**/H**	Hood for sun protection (Carbon steel)
		/H2	Hood for sun protection (Stainless steel)
	Tag Plate	**/SCT**	Stainless steel tag plate
	Conduit Adapter	**/AFTG**	G 1/2
		/ANSI	1/2 NPT
		/TB	Screw terminal (*2)
		/X1	Epoxy baked finish (*3)

(*1) The PH202G can be also used as ORP transmitter. (Setting can be made in the field.)

T8-1.eps

(*2) It can be specified when the suffix code "-E" or "-C" or "-U" is selected.

(*3) The housing is coated with epoxy resin.

2. 2-Wire pH/ORP Transmitter (Explosionproof type)

[Style : S2]

Model	Suffix Code	Option Code	Description
PH202S	·····	·····	2-Wire pH/ORP Transmitter (*1)
Type	**-E**	·····	Intrinsic safe mA with HART (ATEX)
	-C	·····	Intrinsic safe mA with HART (CSA)
	-U	·····	Intrinsic safe mA with HART (FM)
	-P	·····	Intrinsic safe Profibus (Note)
	-F	·····	Intrinsic safe FF (Note)
	-B	·····	Non-incendive FF (*3) (Note)
	-N	·····	Non-incendive mA with HART (*3)
	-D	·····	Non-incendive Profibus (*3) (Note)
Language	**-J**	·····	Japanese
	-E	·····	English
Option	Mounting Hardware	**/U**	Pipe, wall mounting bracket (Stainless steel)
		/PM	Panel mounting bracket (Stainless steel)
	Hood	**/H**	Hood for sun protection (Carbon steel)
		/H2	Hood for sun protection (Stainless steel)
	Tag Plate	**/SCT**	Stainless steel tag plate
	Conduit Adapter	**/AFTG**	G 1/2
		/ANSI	1/2 NPT
		/X1	Epoxy baked finish (*2)

(*1) The PH202S can be also used as ORP transmitter. (Setting can be made in the field.)

T8-11.eps

(*2) The housing is coated with epoxy resin.

(*3) When the instrument with Suffix Code "-B,-N,-D" is used, take measures so that the display window is not exposed to direct sunlight.

Note: Suffix code "-P", "-F", "-B" and "-D" of FM approval are pending.

3. 2-Wire pH/ORP Transmitter (TIIS Explosionproof type) [Style : S2]

Model	Suffix Code	Option Code	Description
PH202SJ	·····	·····	Intrinsically safe type transmitter (*1)
Type	**-1**	·····	TIIS Certification (*5)
Language	**-J**	·····	Japanese
	-E	·····	English
Option	Mounting Hardware	**/U**	Pipe, wall mounting bracket (Stainless steel)
		/PM	Panel mounting bracket (Stainless steel)
	Hood	**/H**	Hood for sun protection (Carbon steel)
		/H2	Hood for sun protection (Stainless steel)
	Tag Plate	**/SCT**	Stainless steel tag plate
	Conduit Adapter	**/AFTG**	G 1/2
		/ANSI	1/2 NPT
		/TB	Screw terminal
		/SPS	Teflon coated SUS steel screws (resistance to salt corrosion) (*2)
		/X1	Epoxy baked finish (*3)
		/PAC	Cable gland for separate type detector (*4)

PH202SJ is available only for Japan, South Korea , Taiwan, China, and Russia.

(*1) The PH202SJ can be also used as ORP transmitter. (Setting can be made in the field.)

T8-12.eps

(*2) The SUS screws with teflon coating are used at the four corners of the cover.

(*3) The housing is coated with epoxy resin.

(*4) Cable gland for separate type pH detector (pH sensor, reference sensor and temperature element are not integrated) "/PAC" contains the items on the following table.

Item	Qty.	Description
1) Packing with 4 holes	1	Use in case of applying separate type pH detector (pH sensor, reference sensor and temperature element are not integrated.)
2) Plug (black)	2	For plugging the unused holes of Packing with 4 holes
3) Plug (Semi-transparent)	1	For plugging the unused holes of Packing with 4 holes

Note: The above items may also be necessary when using detectors other than YOKOGAWA-made ones.

When using this packing, be careful to ensure that it is well enough sealed to be waterproof. When separate type pH detector (pH sensor, reference sensor and temperature element are not integrated) is used, use packing with 4 holes. Plug the unused holes in the packing with the black plugs.

(*5) "TIIS Certification" as a certified explosion approval from the Technology Institution of Industrial Safety.

4. Distributor (Dedicated EXA Series)

Model	Suffix Code	Option Code	Dscription
PH201G	·····	·····	Distributor
Power Supply	**-A1**	·····	100 V AC
	-A2	·····	220 V AC
——	***B**	·····	Style B
Option		**/TB**	Terminal for Power connection

T8-2.eps

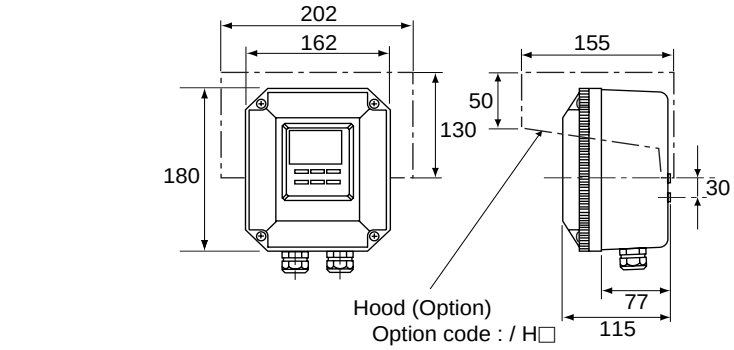
5. Safety Barrier BARD-800 for PH202SJ only

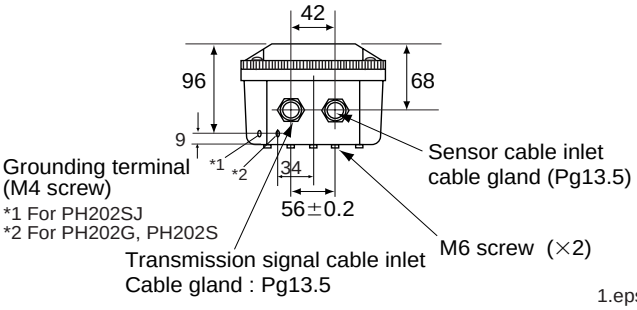
Model	Suffix Codes	Description
BARD	·····	Safety barrier
Use	-8 ·····	For use with a 4 to 20 mA signal
Type	00 ·····	Zener barrier
Style code	*A ···	Style A

T01.EPS

DIMENSIONS

pH/ORP Transmitter

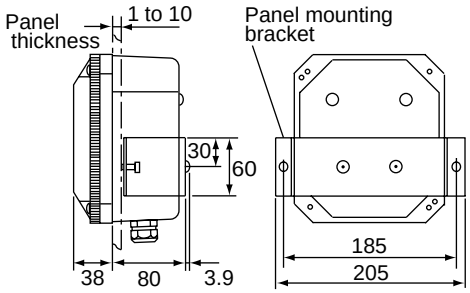


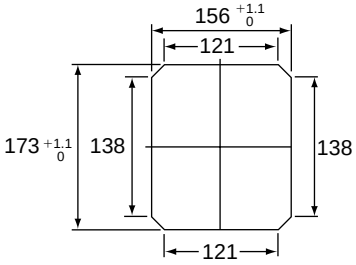


1.eps

Panel Mounting (Option code : /PM)

Unit : mm

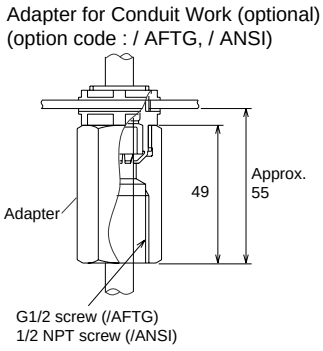




PANEL CUTOUT

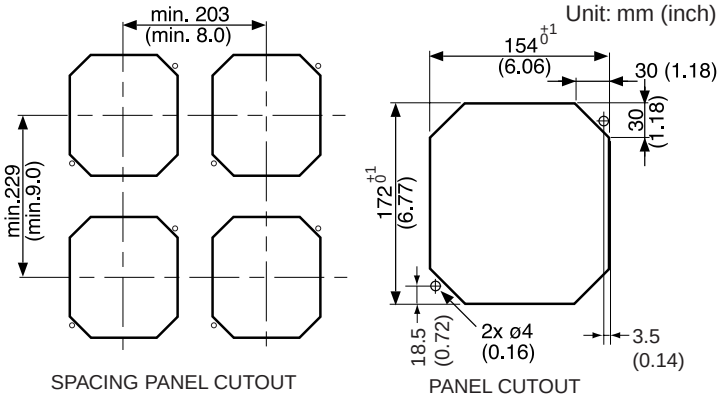
5.eps

Conduit Adapter (Option)

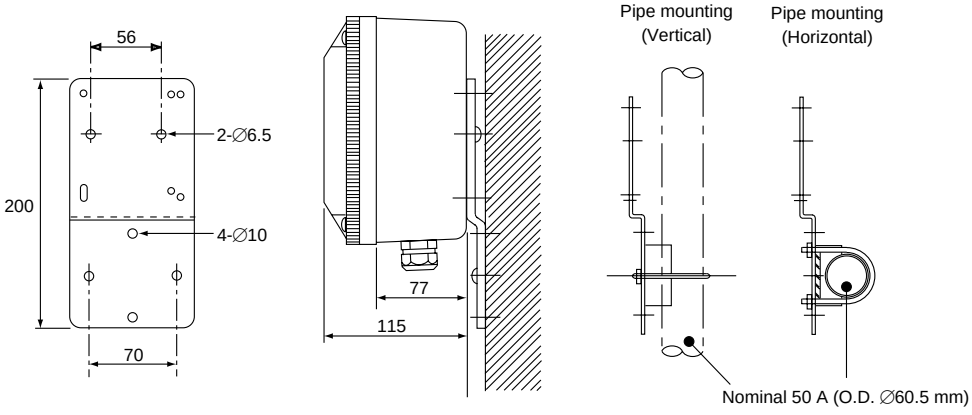


Panel Mounting when using two (2) self-taping screws

Unit: mm (inch)



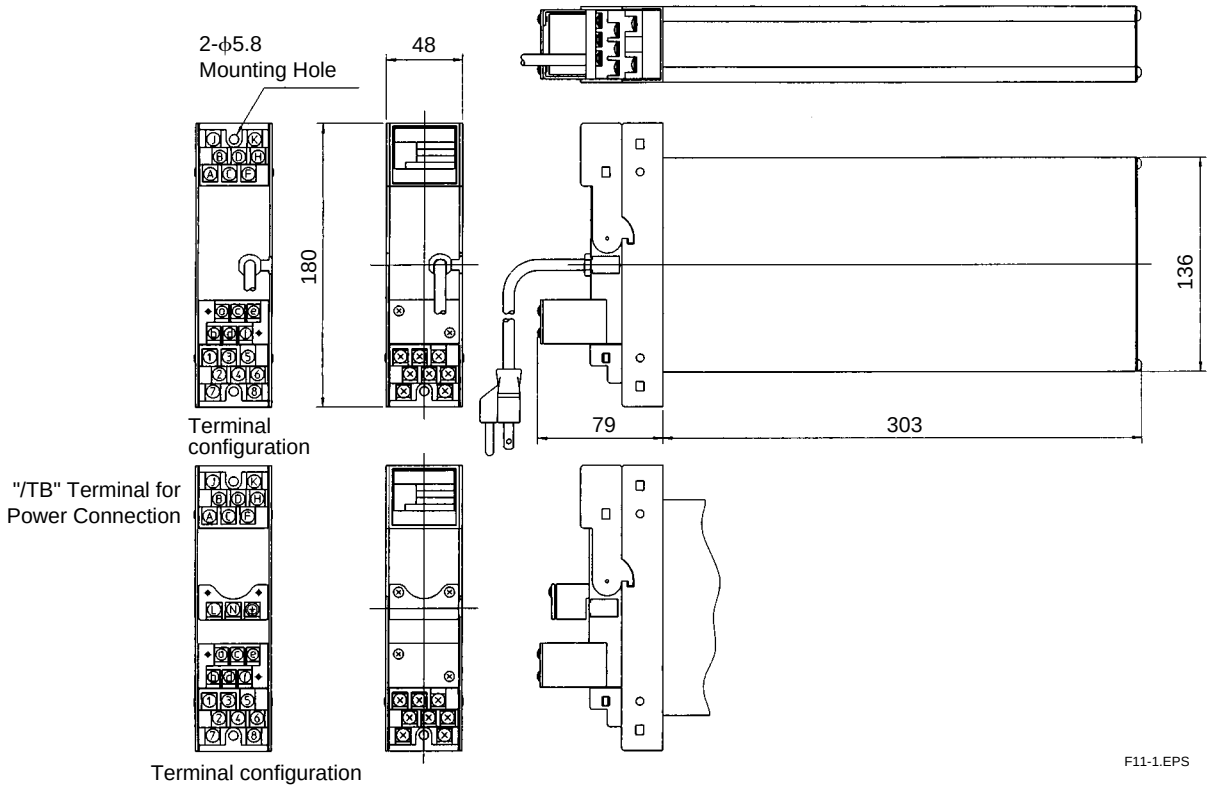
Pipe/Wall Mounting (Option code : /U)



4.eps

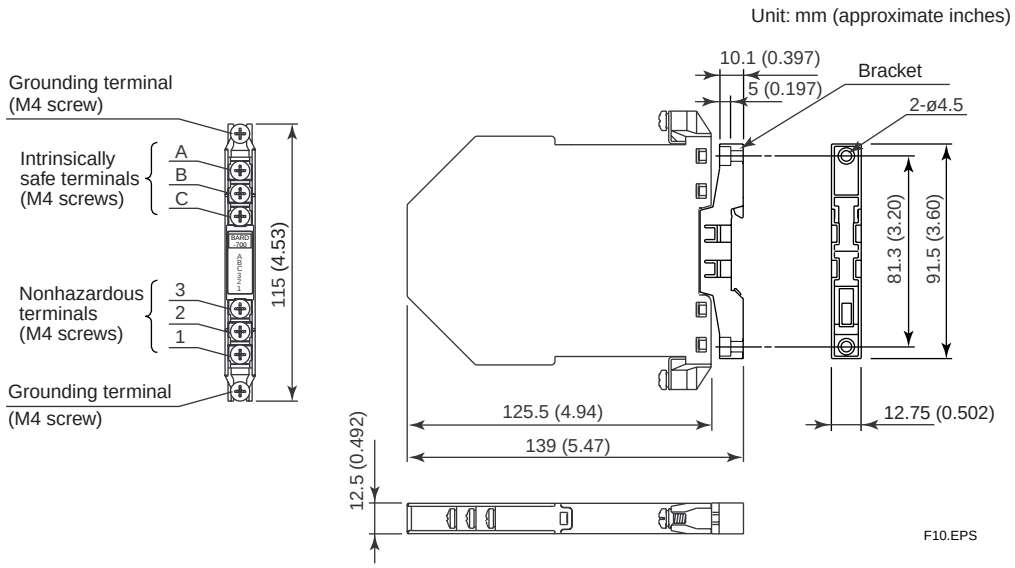
PH201G Dedicated Distributor (Style B)

Unit : mm



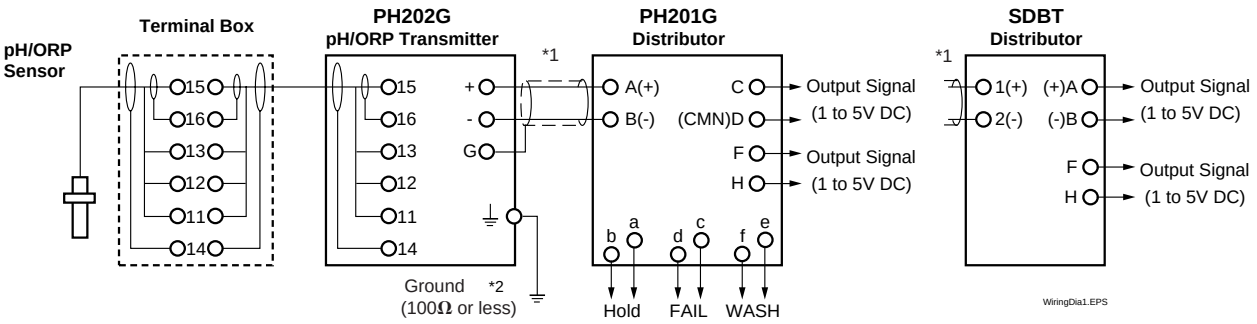
Safety Barrier BARD-800

Unit: mm (approximate inches)



WIRING DIAGRAMS

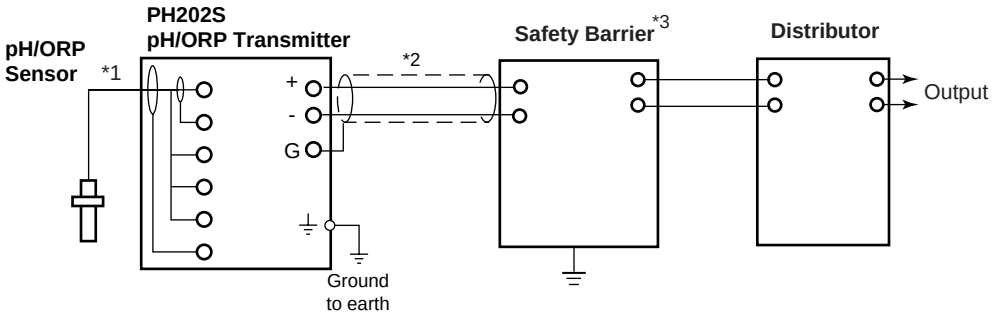
Example of Non-Explosionproof System



*1: Use a 2-conductor shielded cable with an outside diameter of 6 to 12 mm. Shield must be connected to internal terminal G of transmitter and left unconnected at the other side.

*2: Transmitter must be grounded using external terminal: for general purpose version ground resistance of PH202G should not exceed 100Ω (Japanese Class D grounding).

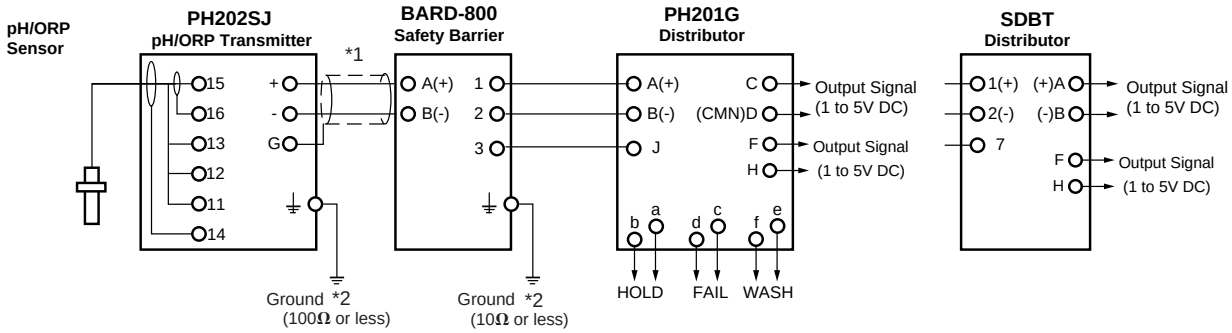
Example of Explosionproof System



*1: This cable is specified by the additional code of a pH sensor, or a sensor cable.

*2: Use two-wire cable with OD (Outside Diameter) of 6 to 12 mm.

*3: For intrinsically safe approval, use the safety barrier certified by the testing laboratories. In case of non-incendive type (PH202S-B, -N, -D), the safety barrier is not neccessary.



*1: Use a 2-conductor shielded cable with an outside diameter of 6 to 12 mm. Shield must be connected to internal terminal G of transmitter and left unconnected at the other side.

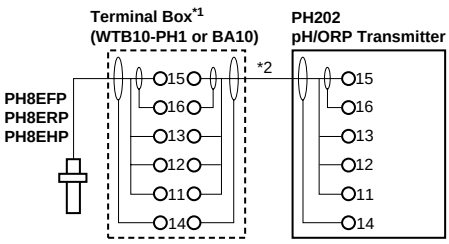
*2: Transmitter must be grounded using external terminal: for intrinsically safe version ground resistance of PH202SJ should be 100Ω or less (Japanese Class D grounding). For safety barrier ground resistance should not exceed 10Ω (Japanese Class A grounding).

CAUTION

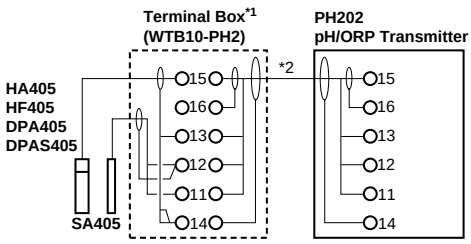
Grounding wire connection for PH202SJ is different from that for PH200S. When installing PH202SJ as a replacement for PH200S, grounding wire must be reconnected as above.

Wiring Example for Electrode

General pH electrode

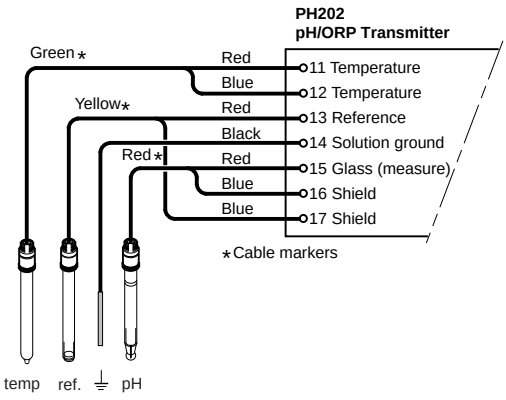


Special pH electrode

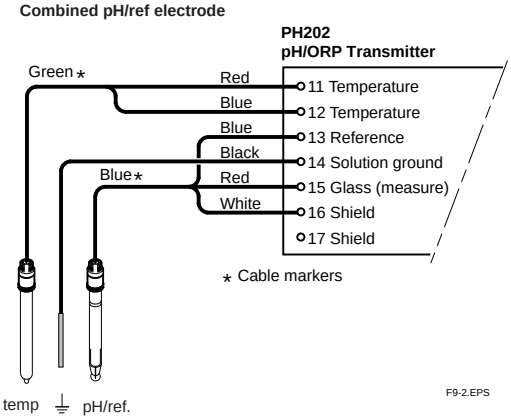


Note : Both "SE(14)" terminals of the pH detector is connected to the "SE(14)" terminal of the PH202. Nothing is connected to the "S(16)" terminal of the PH202.

Separate electrodes pH/Ref electrode

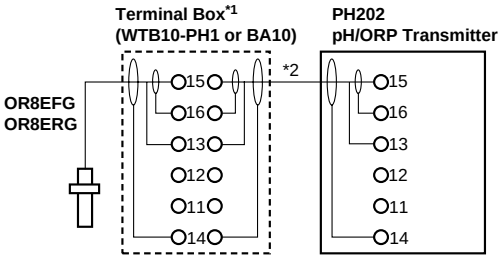


Combined pH/ref electrode

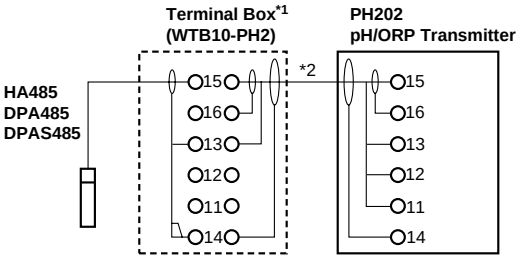


*1 Terminal box is used only where pH/ORP transmitter is installed remotely from electrodes (normally not needed).
*2 This cable is specified in the option code for the terminal box (WTB10), or extension cable (WF10).

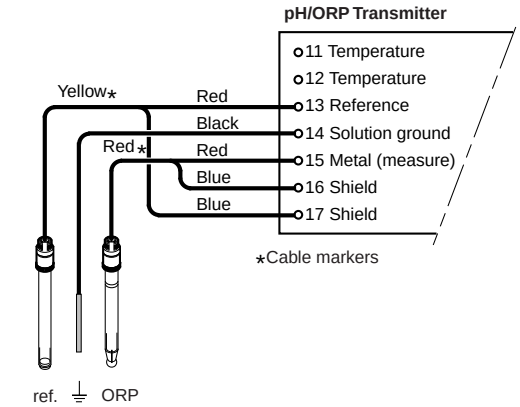
General ORP electrode



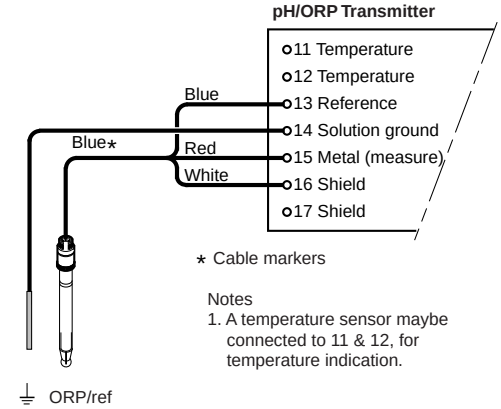
Special ORP electrode



Separate electrodes ORP/Ref electrode



Combined ORP/Ref electrode



Notes
1. A temperature sensor maybe connected to 11 & 12, for temperature indication.

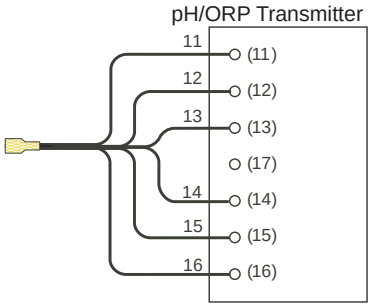
*1 Terminal box is used only where pH/ORP transmitter is installed remotely from electrodes (normally not needed).
*2 This cable is specified in the option code for the terminal box (WTB10), or extension cable (WF10).

F9-2-1.EPS

Wiring of the PH20/FU20

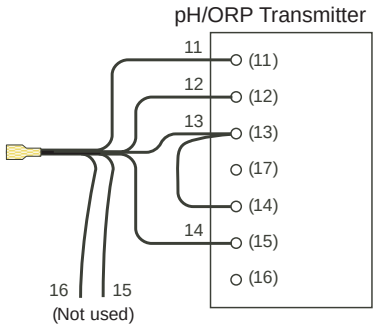
pH (& ORP) WIRING DIAGRAM

Conventional pH (& ORP) wiring
Connect the PH20 or FU20 to the EXA or EXAxt PH analyzer as shown. With this configuration, it is possible to measure ORP (or rH) at the same time.



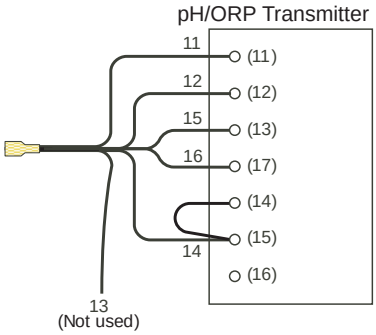
ORP WIRING DIAGRAM with normal reference

Wiring for ORP measurement with normal reference
Connect the PH20 or FU20 to the EXAPH analyzer as shown.



ORP WIRING DIAGRAM with pH sensor as reference

Wiring for ORP measurement with pH reference
Connect the PH20 or FU20 to the EXA Glass PH analyzer as shown.



To connect the other sensor systems, follow the general pattern of the terminal connections as listed below:

11 & 12	Temperature compensation resistor input	(= T1 and T2)
13	Input no. 2 (normally the reference element)	= RE
17	Screen (shield) for input no. 2	
14	Liquid earth (solution ground) connection	= SE or LE
15	Input no. 1 (normally the measuring element)	= GE
16	Screen (shield) for input no. 1	= S or G

Inquiry Specifications Sheet for 2-Wire pH/ORP (Redox) Transmitter System

Make inquiries by placing checkmarks (✔) in the pertinent boxes and filling in the blanks.

1. General

Company name;_____

Contact person ; _____Section;_____Department;_____

Plant name ; _____

Measurement location ;_____

Purpose of use ; ☐ Indication, ☐ Record, ☐ Alarm, ☐ Control

Power supply ; _____V AC_____Hz

2. Measurement Conditions

(1) Process temperature ; _____to_____ Normally _____ [°C]

(2) Process pressure ; _____Normally _____ [kPa]

(3) Flow rate ; _____Normally _____ [l/min]

(4) Flow speed ; _____Normally_____[m/sec]

(5) Slurry or contaminants, ☐ No, ☐ Yes

(6) Name of process fluid ; _____

(7) Composition of process fluid ; _____

(8) Others ; _____

3. Installation Site

(1) Ambient temperature ; _____

(2) Installation location, ☐ Outdoors, ☐ Indoors_____

(3) Others ;_____

4. User Requirements

(1) Measuring range ; ☐ pH 0 to 14 ☐_____

(2) Transmission output ; ☐ 4 to 20 mA DC ☐ HART® ☐ PROFIBUS-PA ☐ FOUNDATION Fieldbus H1

(3) System configuration selection ; ☐ Electrode, ☐ Holder, ☐ pH/ORP Transmitter, ☐ Cleaning system, ☐ Terminal box, ☐ Accessories, ☐ Safety Barrier

(4) Electrode cable length; ☐ 3m ☐ 5m ☐ 7m ☐ 10m ☐ 15m ☐ 20m ☐_____m

(5) Electrode operating pressure; ☐ 10 kPa or less, ☐ Greater than 10 kPa

(6) Type of holder ; ☐ Guide pipe, ☐ Submersion, ☐ Flow-through, ☐ Suspension, ☐ Angled floating ball, ☐ Vertical floating ball

(7) Cleaning method ; ☐ No cleaning, ☐ Ultrasonic cleaning, ☐ Jet cleaning, ☐ Brush cleaning

(8) Sample temperature ; ☐ –5 to 105°C ☐ –5 to 100°C ☐ –5 to 80°C

(9) Others ;_____

General Specifications

Model DO202G, DO202S
2-wire Dissolved Oxygen Transmitter

EXA

CE

GS 12J05C01-01E

Flexibility, reliability and low maintenance are among the benefits provided by the EXA DO202 2-wire Dissolved Oxygen transmitter. Designed to meet the exacting requirements of Dissolved Oxygen analysis in the modern industrial environment, it contains many features to ensure the best precision whatever the application.

The DO202 is housed in a rugged IP65 enclosure and is a loop powered 2-wire transmitter to combine safe and simple wiring, installation and commissioning with the advanced functionality of the YOKOGAWA EXA microprocessor analyzer family.

The DO202 is a SMART transmitter. Digital communication is done either through HART® protocol superimposed on the 4- 20 mA current or completely digital through Fieldbus communication: Fieldbus Foundation.

This SMART functionality allows the transmission of up to four process variables, information stored in the logbook, diagnostic data and remote configuration of the analyzer.

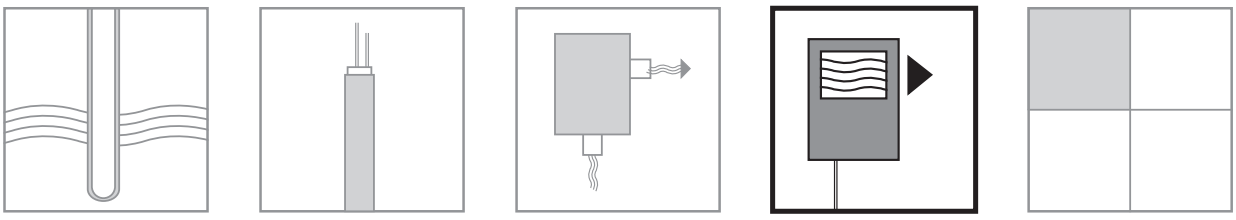
Yokogawa has developed drivers for PC configuration and maintenance software for different platforms like PRM, AMS and Pactware. The necessary drivers for PACTWARE can be downloaded free of charge from the website www.yokogawa.com/eu

The DO202 transmitter is a universal Dissolved Oxygen Transmitter that accepts both galvanic sensors like DO30 and Polarographic sensors like OXYGOLD and OXYFERM that are used primarily in the Biotech industries. In combination with the OXYGOLD G the analyzer can accurately measure concentrations down to 1 ppb (µg/L).

For high precision the DO202 offers automatic temperature compensation for both % saturation and ppm/ppb measurements; manual salinity compensation for analysis in saline water and manual pressure compensation for accurate analysis at high elevations or in reactors with high static pressure like production fermenters.

Features
- Universal input accepts Galvanic and Polarographic sensors and various temperature compensating elements (Pt1000, 22k NTC)
- HART® communication standard with 4-20 mA loop powered model
- Fieldbus models for Foundation Fieldbus
- PROFIBUS models for PROFIBUS-PA
- Wide measuring range including ppb, ppm and % saturation
- Certification for hazardous area (ATEX, IECEx, FM, CSA)
- Recommended sensors model DO30(G) , PB30, OXYFERM, OXYGOLD (for ppb measurement)
- Intrinsically safe version <Ex> II 1G Ex ia IIC T4/T6.
- Automatic temperature compensation from 0ºC up to 100ºC

System Configuration



Sensors | Cables | Fittings | Transmitters | Accessories

YOKOGAWA
Yokogawa Electric Corporation

Yokogawa Electric Corporation
2-9-32, Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Tel.: 81-422-52-5617 Fax.: 81-422-52-6792

GS 12J05C01-01E

1st Edition May.08,2007

General Specifications

Common specifications for all models

A. Input specifications

: The DO202 accepts output from membrane covered Dissolved Oxygen sensors These sensors can be Galvanic type, where the sensor generates its own driving voltage or Polarographic type, where the sensor uses external driving voltage from the transmitter. The input range is 0-50 µA for Galvanic sensors and 0- 1 µA for Polarographic sensors. For temperature compensation the DO202 accepts Pt1000 RTD (DO30 sensor) and 22k NTC elements (OXYFERM and OXYGOLD sensors).

B. Measuring range

- Dissolved Oxygen
  : 0 - 50 ppm (mg Oxygen per kg water); 0 - 1999 ppb (mg Oxygen per 1000 kg water) and 0 - 600 % Saturation of Air in Water.
- Temperature : -20 to 150ºC (-4 to 302ºF).

C. Temperature compensation

: Automatic using Pt1000 or 22k NTC or manual. Range 0 - 100ºC. (32 to 212 ºF)

D. Calibration : Semi-automatic one or two point calibration in air or in water using solubility tables of ISO 5814. The influence of pressure and salinity is taken into account when these specifications are entered. Also a two point manual calibration is possible.

E. Logbook : Software record of important events and diagnostic data. Available through digital communication.

F. Transmission Signals

: Isolated output of 4-20 mA DC, Burn up (21 mA) or Burn dwon (3.6 mA when HART comm. non-used, 3.9 mA when HART comm. used) or pulse of 21 mA to signal failure.

G. Display : Custom liquid crystal display, with a main display of 3 1/2 digits 12.5 mm high. Message display of 6 alphanumeric characters, 7 mm high.

H. Power supply : Nominal 24 volt DC loop powered system

DO202G-A : up to 40 volts
DO202S-A, -N : up to 31.5 volts
DO202G/S-F, -P: 9-24, 9-17.5 (FISCO) VDC / 26.0 mA
DO202S-B, -D : 9-32 VDC / 26.0 mA

Note: The transmitter contains a switched power supply. The transmitter requires a minimum power voltage in order to work correctly, which is dependant on the load. Please refer to figures 2-1 and 2-2 for the correct power supply.

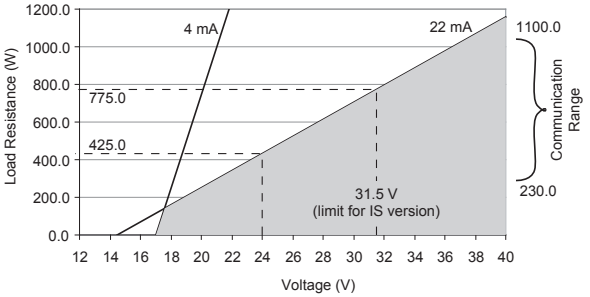


Figure 2-1. Supply voltage/ load diagram

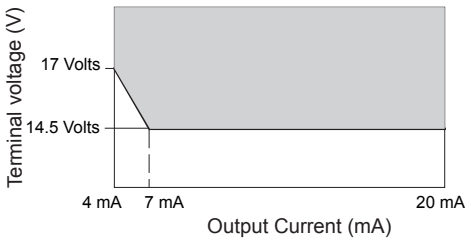


Figure 2-2. Minimum terminal voltage at the DO202

I. Input isolation : 1000 VDC

J. Shipping details

Package size : W x H x H, 290 x 300 x 290 mm (11.5 x 11.8 x 11.5 inch)
Packed weight : approx. 2.5 kg (5lb)

Performance specifications

A. Performance in ppm mode

- Linearity : ±0.05 ppm or ±0.8% FS, whichever is greater
- Repeatability : ±0.05 ppm or ±0.8% FS, whichever is greater
- Accuracy : ±0.05 ppm or ±0.8% FS, whichever is greater

B. Performance in ppb mode

- Linearity : ±1 ppb or ±0.8% FS, whichever is greater
- Repeatability : ±1 ppb or ±0.8% FS, whichever is greater
- Accuracy : ±1 ppb or ±0.8% FS, whichever is greater

C. Performance in Temperature

- Linearity : ±0.3ºC
- Repeatability : ±0.1ºC
- Accuracy : ±0.3ºC

Note on performance specifications:

The specifications are at reference temperature and with simulated inputs, because the DO202 can be used with many different sensors with their unique characteristics.
The following tolerance is added to above performance.
mA output tolerance : ± 0.02 mA of "4 - 20 mA"

D. Ambient temperature
: Operating temperature -10 to 55ºC (10 to 130ºF)
; Storage temperature -30 to 70ºC (-20 to 160ºF)

E. Humidity : 10 to 90 % RH, non-condensing

F. Housing : Cast aluminum housing with chemically resistant coating, cover with flexible polycarbonate window. Case color is off-white with moss green cover. Cable entry is through two polyamide cable glands. Cable glands are provides for wiring up to 2.5 mm.

G. Environmental protection
: IP65, NEMA 4X, Type 3S.

H. Mounting : Pipe, wall or panel mounting using optional hardware.

I. Data protection
: EEPROM for configuration;
Lithium battery for clock.

J. Watchdog timer
: checks microprocessor functionality.

K. Autoreturn : The transmitter returns into measuring mode automatically when no keystroke is made for 10 minutes.

L. Password protection
: All three levels can be protected by a user programmable 3 digit password

M. Regulatory compliance
: conforms to EN61326 Class A, AS/NZS CISPR11

N. Explosionproof type

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Vmax=31.5 V, Imax=100 mA, Pmax=1.2 W, Ci=22 nF, Li=35 µH	**-A**
	FM Non-incendive safe Approval Applicable standard: FM3600, FM3611, FM3810 Non-incendive Safe for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Vmax=31.5 V, Ci=22 nF, Li=35 µH	**-N**
CENELEC ATEX	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26 Certificate: KEMA 06ATEX0224 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	**-A**
	CENELEC ATEX (KEMA) Type of protection "n" Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 06ATEX0225 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	**-N**

2.EPS

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Entity { Vmax=24 V, Imax=250 mA, Pmax=1.2 W, Ci=220 pF, Li=0 µH FISCO { Vmax=17.5 V, Imax=380 mA, Pmax=5.32 W, Ci=220 pF, Li=0 µH	**-P** **or** **-F**
	FM Non-incendive safe Approval Applicable standard: FM3600, FM3611, FM3810 Non-incendive Safe for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Entity { Vmax=32 V, Pmax=1.2 W, Ci=220 pF, Li=0 µH FNICO { Vmax=32 V, Pmax=5.32 W, Ci=220 pF, Li=0 µH	**-B** **or** **-D**

FM Approval is pending.

FM.EPS

Note: Suffix code "-P", "-F", "-B" and "-D" of FM approval are pending.

Item	Description	Code
CENELEC ATEX Entity	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26 Certificate: KEMA 07ATEX0054 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	**-P** **or**
CENELEC ATEX FISCO	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26, EN60079-27 Certificate: KEMA 07ATEX0054 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	**-F**
CENELEC ATEX	**CENELEC ATEX (KEMA) Type of protection "n"** Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 07ATEX0055 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	**-B** **or** **-D**

ATEX.EPS

Item	Description	Code
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1 Ex ia Class I, Division 1, Groups ABCD Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ii(Imax)=100 mA, Pi(Pmax)=1.2 W, Ci=22 nF, Li=35 µH	**-A**
	CSA Non-incendive safe Approval or type of protection "n" Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No.61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ci=22 nF, Li=35 µH	**-N**
IECEx Scheme	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 06.0055X Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	**-A**
	IECEx Type of protection "n" Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 06.0055X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	**-N**

T12E.EPS

Item	Description	Code
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1 Ex ia Class I, Division 1, Groups ABCD Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Entity { Ui(Vmax)=24 V, Ii(Imax)=250 mA, Pi(Pmax)=1.2 W, Ci=220 pF, Li=0 µH FISCO { Ui(Vmax)=17.5 V, Ii(Imax)=380 mA, Pi(Pmax)=5.32 W, Ci=220 pF, Li=0 µH	-P or -F
	CSA Non-incendive safe Approval or type of protection "n" Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No.61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Entity: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH FNICO: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH	-B or -D

CSA.EPS

Item	Description	Code
IECEx Scheme Entity	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 07.0029X Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	-P or
IECEx Scheme FISCO	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26, IEC60079-27 Certificate: IECEx KEM 07.0029X Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	-F
IECEx Scheme	**IECEx Type of protection "n"** Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 07.0029X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	-B or -D

IEC.EPS

mA-HART® communication

A. Input : Two wire system 4-20 mA

B. Power supply : Nominal 24 volt DC loop powered system.

DO202G : up to 40 volts

DO202S : up to 31.5 volts

Note: The transmitter contains a switched power supply, drawing its energy from the 0-4 mA section of the signal. Consequently the 17 volt limit is applied at 4 mA. The characteristic of the unit is such that above about 7 mA on the output, the terminal voltage can drop to 14.5 volts without problem. (see figure 2-2)

C. Transmission: Isolated output of 4 to 20 mA DC.

D. Signal: Maximum load 425Ω at 24 VDC. (see figure 2-1)
Burn to signal failure acc. NAMUR Recommendation NE43 (18.01.1994)

E. Operating range : 3.9 to 21mA

F. Communication
: HART®, 1200 Baud, FSK modulated on 4 to 20 mA signal

G. Configuration : Local with 6 keys

H. Software : Firmware based on Yokogawa stack.

I. Hardware : Yokogawa HART® Modem F9197UB

J. Hand Terminal : Rosemount HHT 275/375

K. Other control systems:
Yokogawa PRM, Rosemount AMS, Siemens PDM

L. Output span : There are three output modes in which the output span can be freely selected: ppm (mg Oxygen per kg of water): 0 - 50 ppm with minimum span of 1 ppm; ppb (mg Oxygen per 1000 kg of water): 0 - 1999 ppb with minimum span of 25 ppb and % Saturation: 0 - 600 % with minimum span of 10 %

M. Cable specification
: 0.5 mm diameter or 24 AWG over maximum length of 1500 m

N. DD specification
: The DO202 Device Description is available enabling communications with the Handheld communicator and compatible devices.

PROFIBUS-PA communications

A. Input signal: Digital

B. Supply voltage: 9 to 32 V DC

C. Operating current: 26.0 mA

D. Operating values: According to IEC 1158-2

E. Bus connection
:Fieldbus interface based on IEC1158-2 according to FISCO-Model

F. Power supply: Power supply is achieved dependant on the application by means of segment coupler

G. Data transfer: According to PROFIBUS- PA profile class B based on EN 50170 and DIN 19245 part 4

H. GSD file: The actual file can be downloaded from www.profibus.com Configuration: Local with 6 keys

I. Software: Firmware based on Siemens DPC31 stack.

J. Hardware: PC- or PCMCIA-interfaces from Siemens

K. Other control: Siemens PDM systems

L. Electrical connection: Terminals acc. to IEC 1158-2

M. Fieldbus-cable-types: Twisted and shielded two wire cable according to recommendation based on IEC 1158-2 Cable diameter: 6 to 12 mm (0.24 to 0.47 inch)

FOUNDATION FIELDBUS H1 communications

A. Input signal : Digital

B. Supply voltage: 9-32 V DC

C. Operating current: 26.0 mA (base current)

D. Operating values: According to IEC 1158-2

E. Bus connection
: Fieldbus interface based on IEC 1158-2
according to FISCO model

F. Power supply: Power supply is achieved dependant on application by means of segment coupler

G. Data transfer : FF specification Rev. 1.4 Basic device

H. Function blocks: 3 x AI, Transducer, Resource

I. Files : Actual file cCan be downloaded from our homepage

J. Configuration: locally with 6 keys

K. Software : National Instruments: NI-FBUS configurator

L. Hardware : F-BUS interfaces from National Instruments (AT-FBUS, PCMIA-FBUS)

M. Other control systems
: YOKOGAWA PRM, DTM

Operating Principles

The DO202 is designed to operate with membrane covered Dissolved Oxygen sensors. The sensor consists of a Cathode and an Anode. The membrane is stretched over the Cathode and the Oxygen molecules that diffuse from the process through the membrane to the cathode are oxidized by the cathode and converted into hydroxyl ions. (OH-)

The current associated with this oxidation process is measured by the DO202 and converted in an output signal. This sensor current is proportional to the concentration of dissolved Oxygen in the process and dependent on the diffusion rate through the membrane.

This constant depends on the surface area of the cathode, on the type of membrane and on the thickness of the membrane and is therefore different for different types of sensors.

The voltage between Cathode and Anode is generated in two different ways and this determines the type of measurement:

1) **Polarographic measurement**
Here the two electrodes are both made of a noble metal and an external DC voltage is applied to the electrodes. This voltage is approximately 675 mV. This polarization voltage is adjustable in DO202 to enable measurement with other membrane covered polarographic sensors.

2) **Galvanic measurement**
Here the cathode is made of a noble metal and the anode is made of a non-noble metal like lead. The galvanic voltage
generated by this asymmetric set of electrodes is the driving force for the oxidation reaction.

Example: DO30 : Galvanic membrane covered DO sensor. The membrane is made of 50 micron TFA and the sensitivity is approximately 3.75 µA in air saturated water.

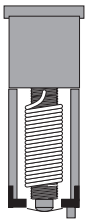


Figure 1: Galvanic DO sensor

Display functions and ranges
The display continuously gives you all necessary information at a glance. The process values are shown in easy readable programmable units. Either mg/l, % saturation or ppm can be chosen.

The user-interface is simplified to a basic set of 6 keys accessible through the flexible window cover. It uses a simple step by step, question and answer style to communicate with the operator by giving messages on the second line of the display and indicating which keys are to be pressed in the display.

Calibration
The DO202 can be calibrated for the sensor characteristics in various ways and the choice is a matter of convenience for the user.

1. **Air Calibration**
The calibration in this mode is done with calibration gas. The most important calibration gas is ambient air. In air the sensitivity of the sensor is calibrated. In this mode the zero current of the sensor can also calibrated using nitrogen as test gas. Most DO sensors require a very long time to reach their ZERO voltage and therefore it is recommended not to perform ZERO calibration, but only zero check.

2. **Water (H_2O) Calibration**
In this mode, calibration is done in water. The sensitivity of the sensor is calibrated with air saturated water. This saturation is done by blowing air in the water through a diffuser. The ZERO calibration in this H_2O CAL mode is done by dissolving sodiumbisulfite in the water. (Approximately 2 wt%). This sodiumbisulfite will remove all Oxygen from the water.

3. **Manual Calibration**
Sometimes it is more convenient to perform a grab sample calibration. In this mode there are also two calibration points: SENS for the calibration of the sensitivity of the sensor. (This is a calibration point at high DO levels, for example in aerated water. Then table values can be used from ISO 5814.) And ZERO for the calibration of the zero current of the sensor. For this measurement normally a lab measurement is used as reference value in the ppb range of the sample.

Salinity Compensation
ISO 5814 also describes the influence of salt in water on the solubility of air in water. This is an important parameter for the calibration of the DO sensor. The solubility decreases approximately 0,05 ppm with every ppt of salts. In the Automatic calibration mode the solubility tables of ISO 5814 are stored in memory and used to calibrate the sensitivity of the sensor. If the salinity (expressed in grams of salts per kg of water) is entered in the DO202, then accurate calibration is also achieved in salt water samples.

If this salinity compensation is not applied, then errors result in sensitivity calculations and in % saturation readings.

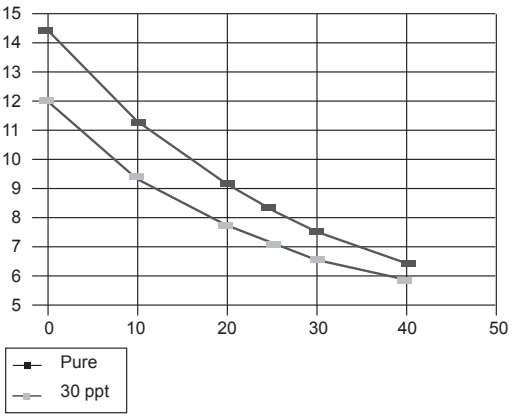


Figure 2: Solubility of air in water in ppm as function of temperature and salinity.

Temperature Compensation

Temperature has a high influence on the sensitivity of the DO sensor and on the solubility of air in water. The first temperature effect is determined by the type of membrane in the DO sensor and may vary per sensor. DO30, OXYGOLD and OXYFERM sensors follow the same membrane characteristics that are programmed in DO202.

The second influence is defined in ISO 5814 and these characteristics are also programmed in DO202 to guarantee accurate measurement within the measuring range of the instrument.

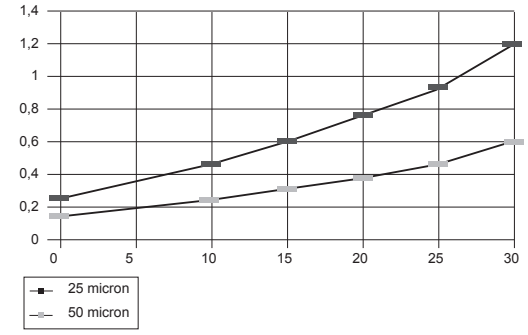


Figure 3: Sensitivity of DO30 sensor in µA as function of temperature and membrane thickness

Pressure Compensation

The solubility of air in water is proportional to the pressure according to Henri's law. This pressure function is important for calibration of the DO sensors. The pressure influences the solubility in two ways:

1. **Barometric pressure**
   The barometric pressure varies with weather conditions and with altitude. Especially the altitude is an important variable that must be taken into account for accurate calibration. Examples can be found in ISO 5814. If the pressure is known, then this value can be entered in the DO202.
   If the altitude is known, then it is best to calibrate using the manual calibration mode using the ISO 5814 tables found in the Instruction Manual.
2. **Static pressure**
   If the DO sensor is mounted near the bottom of a production ferment or and the calibration is done while the water in the fermenter is aerated, then the static pressure must be entered in the DO202 to achieve accurate sensitivity calculations in the DO202.

Output Signals

The basic DO202 transmitter offers HART® communication superimposed on the 4- 20 mA loop powered 2-wire line. The 4-20 mA can be scaled freely within the measuring range of the analyzer between 0- 600% of saturation and 0- 50 ppm oxygen and 0- 1999 ppb.

Through HART® the user has access to the other process variables:

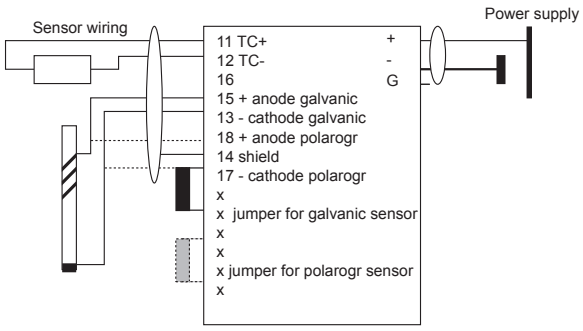
PV: User selected process value: ppm, ppb or % saturation
SV: Temperature
TV: % Saturation
QV: sensor current

Each of these process variables can be decoded into current output or contact output through the HIM: Hart Interface Module. Yokogawa offers standard a HIM with two 0- 20 or 4- 20 mA outputs and three contact outputs with 24 VDC power supply.

Full communication with the DO202 can be done through various brands of HART® Handheld terminals (HHT) or through Pactware. This program and the Yokogawa DTM library can be downloaded from YOKOGAWA or PACTWARE WEB sites free of charge by Yokogawa customers. Yokogawa recommends the use of MH-02 modem for HART®-RS232 conversion.

The Fieldbus Foundation model offers full digital communication between DO202 and the HOST computer. DO202 has passed the interoperability tests and is in addition tested with CENTUM and DELTA-V distributed control systems. For full information we refer to the WEB sites of the Fieldbus Foundation.

Wiring



Model and Suffix codes

[Style: S2]

Model	Suffix Code	Option Code	Description
DO202G	--------	----------	2-wire Dissolved oxygen transmitter
Type	-A	----------	mA with HART
	-P	----------	Profibus
	-F	----------	FF
Language	-E	----------	English
	-J	----------	Japanese
Options			
Mounting Hardware		/U	Pipe, Wall mounting bracket (Stainless steel)
		/PM	Panel mounting bracket (Stainless steel)
Hood		/H	Hood for sun protection (Carbon steel)
		/H2	Hood for sun protection (Stainless steel)
Tag Plate		/SCT	Stainless steel tag plate
Conduit Adapter		/AFTG	G 1/2
		/ANSI	1/2NPT
		/TB	Screw terminal (*1)
		/X1	Epoxy baked finish (*2)

*1 It can be specified when the suffix code -A is selected.
*2 The housing is coated with epoxy resin.

[Style: S2]

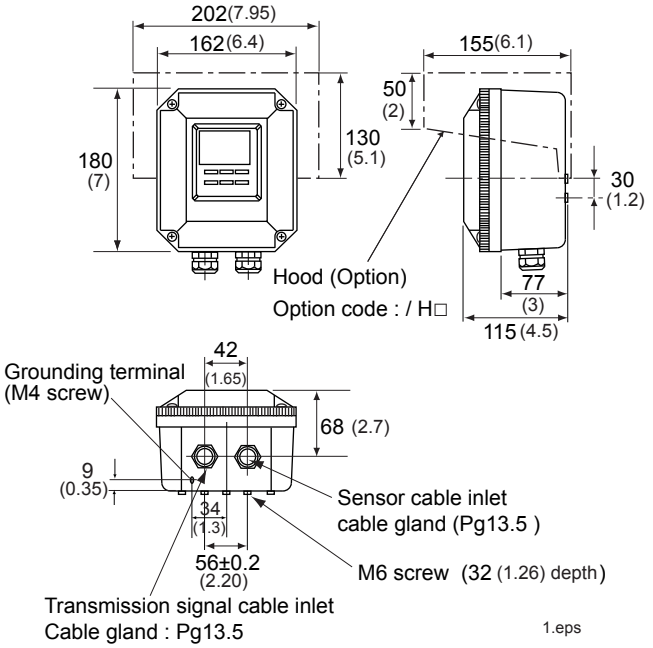
Model	Suffix Code	Option Code	Description
DO202S	--------	----------	2-wire Dissolved oxygen transmitter
Type	-A	----------	Intrinsically safe mA with HART
	-P	----------	Intrinsically safe Profibus (Note)
	-F	----------	Intrinsically safe FF (Note)
	-B	----------	Non Incendive FF (*2) (Note)
	-N	----------	Non Incendive mA with HART(*2)
	-D	----------	Non-Incendive Profibus (*2) (Note)
Language	-E	----------	English
	-J	----------	Japanese
Options			
Mounting Hardware		/U	Pipe, Wall mounting bracket (Stainless steel)
		/PM	Panel mounting bracket (Stainless steel)
Hood		/H	Hood for sun protection (Carbon steel)
		/H2	Hood for sun protection (Stainless steel)
Tag Plate		/SCT	Stainless steel tag plate
Conduit Adapter		/AFTG	G 1/2
		/ANSI	1/2NPT
		/X1	Epoxy baked finish (*1)

*1 The housing is coated with epoxy resin.
*2 When the instrument with Suffix Code "-B,-N,-D" is used, take measures so that the display window is not exposed to direct sunlight.
Note: Suffix code "-P", "-F", "-B" and "-D" of FM approval are pending.

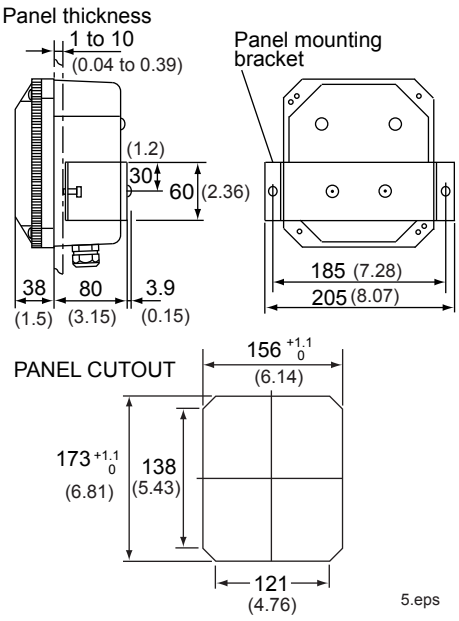
Dimensions and mounting

Unit: mm (inch)

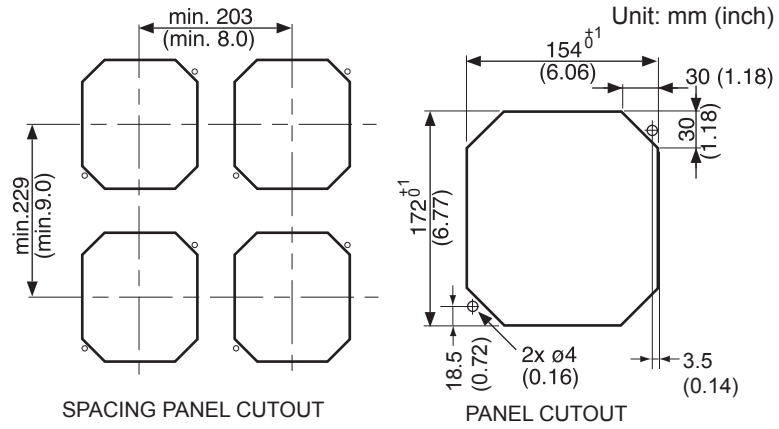
DO Transmitter



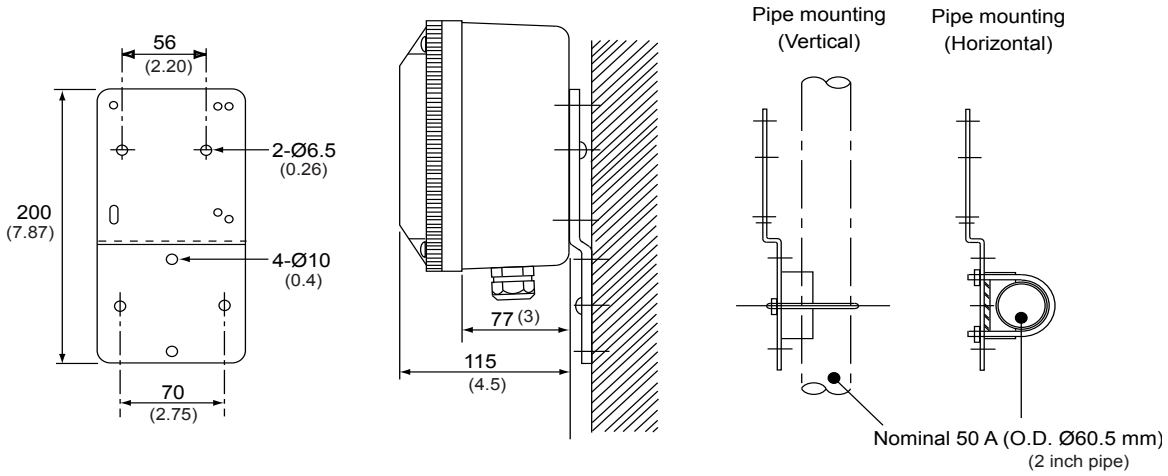
Panel Mounting (Option code: /PM)



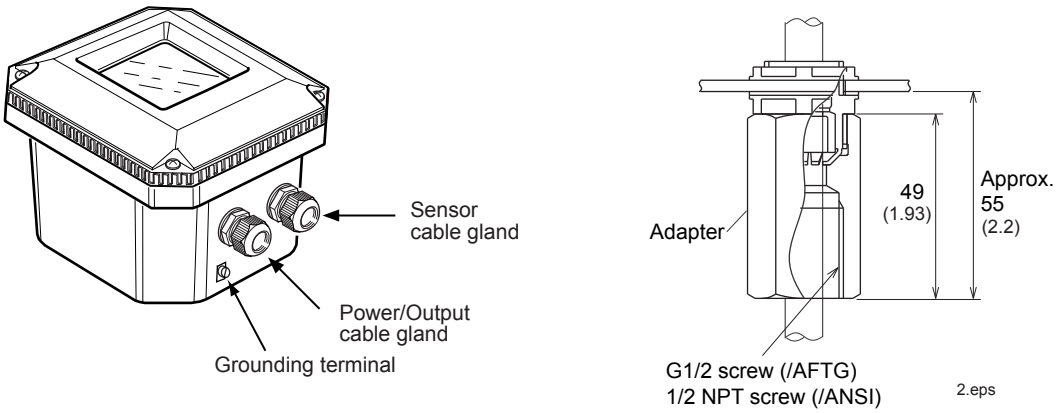
Panel Mounting using two self-tapping screws Unit: mm (inch)



Pipe/Wall Mounting (Option code: /U)



Transmitter Housing and Conduit Adapter (Option code: /AFTG, /ANSI)



Inquiry Specifications Sheet for DO202 Dissolved Oxygen Analyzer

For inquiries on the Yokogawa dissolved oxygen analyzer, please tick (✔) the appropriate box (☐) and write down the relevant information in the blanks.

1. General

Name of your firm : _____
Person in charge : _____ Department :_____ (Phone No. _____)
Name of plant : _____
Measuring point : _____
Purpose of use : ☐ Indication ☐ Recording ☐ Alarm ☐ Control

2. Measurement Conditions

(1) Liquid temperature :_____to_____,normal_____[°C]
(2) Liquid pressure :_____to_____,normal_____[kPa]
(3) Flow speed :_____to_____,normal_____[m/s]
(4) Name of liquid to be measured : _____
(5) Components of liquid to be measured :_____
(6) Other conditions : _____

3. Installation Site

(1) Ambient temperature :_____
(2) Location : ☐ Outdoors ☐ Indoors _____
(3) Other information : _____

4. Requirements

(1) Measurement range : ☐ 0 to 50 mg/l ☐ _____
(2) Transmission output : ☐ 4 to 20 mA DC ☐ HART® ☐ PROFIBUS-PA ☐ FOUNDATION Fieldbus
(3) System component selection : ☐ Sensor ☐ Holder ☐ Converter ☐ Cleaning system ☐ Calibration set ☐ Parts set for maintenance ☐ Terminal Box
(4) Length of sensor cable : ☐ 3 m ☐ 5 m ☐ 10 m ☐ 15 m ☐ 20 m
(5) Type of holder : ☐ Guide pipe ☐ Submersion ☐ Floating ball ☐ Suspension
(6) Cleaning method : ☐ No cleaning ☐ Jet cleaning
(7) Other requirements :_____

TO BE COMPLETED BY SUPPLIER

SUPPLIER DOCUMENT INFORMATION	
Purchase Order No. H0319810-0194	Issued For: ☐ Information ☒ Approval ☐ Final (No Certification Required) ☐ Certified ☐ As Built
Material Requisition No. ITAT-AK-PI-774041-ER	
Supplier Reference No. 2820-D05	
Document No. ITAT-AKZ-00-IM-774-9F-8002 2	AK VDRS Doc Type No. BH38
Document Title ~~Supplier's Standard Document Register~~ OPERATING / MAINTENANCE INSTRUCTIONS CHLORINE ANALYSERS	
Tag No(s). ITAT31-AIT-92101-04A ITAT31-AIT-92101-04B ITAT61-AIT-97501-01	

TO BE COMPLETED BY AK

AKER KVAERNER REVIEW STATUS	
Acceptance of this document by AK does not relieve Supplier of responsibility for accuracy of dimensions and strict compliance with the Purchase Order.	
Checked by: TGP	Date: 22-Feb-2007
☐ Approved (A)	☐ Information only (I)
☐ Approved as Noted (B)	☐ Disapproved (D)
☐ Approved as Certified (C)	☐ Void (V)
☒ Approved as Final (F) (Certification Not Required)	
☐ Superseded (S) by:	
Date Rec'd: 06-FEB-2007	Seq/Rev: 022-2

ORIGINAL

This manual complies with the following model numbers:

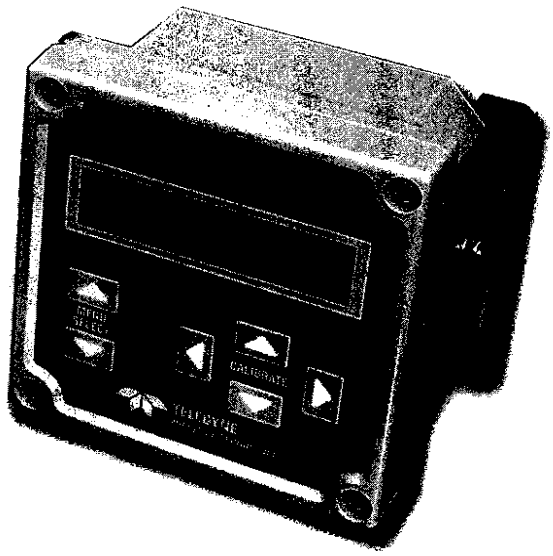
LXT-230-PH/MA-OR-MA-UM-F2
Probe: PHS17-T23-CBL-T-EG-75-2005157.Y1I-1000096
Probe: LXTS17-LXT230-CBL-T-EG-75K-2005167-OTK.EPR-1000096
Flange: FL2150FF-075FNPT-T1

SEPARATE MANUAL FOR pH + ORP SENSORS + FLANGE?

TELEDYNE
ANALYTICAL INSTRUMENTS

Model LXT-230 Transmitter

Installation and Operating Manual
for
pH and ORP



Teledyne Analytical Instruments
16830 Chestnut Street • City of Industry, CA 91748
888-789-8168 • ask_tai@teledyne.com • www.teledyne-ai.com

TABLE OF CONTENTS

UNPACKING THE INSTRUMENT

Your Teledyne instrument has been carefully packaged to protect it from damage during shipment and dry storage. Upon receipt please follow the procedure outlined below.

1. Before unpacking, inspect the condition of the shipping container to verify proper handling by the carrier. If damage is noted, save the shipping container as proof of mishandling for the carrier.

2. Check the contents of the shipping container with the items and quantities shown on the packing list. Immediately report any discrepancies to TAI.

3. Save the original packing material until you are satisfied with the contents. In the event the transmitter must be returned to TAI, the packing material will allow you to properly ship it to TAI.

4. Familiarize yourself with the instrument before installation, and follow proper installation and wiring procedures.

1.0 GENERAL DESCRIPTION

Teledyne's Model LXT-230 is a microprocessor-based two-wire transmitter for process control of pH, ORP and Specific Ion. Incorporating microprocessor technology, the LXT-230 provides the following features:

1.1 Membrane Switches

Calibrations can be performed via membrane switches located on the front cover, removing the need to open the NEMA 4X enclosure and exposing components to the environment. No potentiometric adjustments are required.

1.2 Digital Display

A 32-character Supertwist alphanumeric liquid crystal display (LCD) is used to display data menus. The two rows of 16 characters can be adjusted to different contrast intensities for easy viewing.

1.3 Automatic Buffer Calibration

Allows buffer points to be defined upon initialization of the transmitter so that no adjustments are required for future buffer calibrations.

1.4 Back To Factory Calibration

Allows the transmitter to be returned to a predetermined factory calibration. The default parameters are zero electrode offset at 7.00pH or 0.00mV ORP and the ideal Nernstian slope for the appropriate measurement.

1.5 Current Output

A standard LXT-230 transmitter is provided with a 4-20 mA current output transmitted on the same 24-vdc power wiring. The current output may be expanded to any range within the transmitter's full operating range (see specifications). For customer controllers that are not capable of reverse acting control, the LXT-230 allows the current output to be reversed; for example, a 4-20 mA output for a range of 0-14 pH can be reversed to 14-0 pH.

1.6 Temperature Conversion

This standard feature allows the temperature displays to be presented in Celsius or

Fahrenheit. A toggle function in the Temperature Calibration Menu allows this selection to be performed in the field.

1.7 PID Output (Optional)

An optional PID output is available and provides a 4-20 mA, three-mode control signal to a transducer or a final control element. Proportional band is adjustable from 0.1 to 1,000%. Reset and Rate are adjustable from 0.00 to 100 repeats per minute and 0.00 to 1,000 minutes, respectively.

1.8 Dual Input (Optional)

An optional second input can be provided for pH, ORP, Dissolved Oxygen or Specific Ion. This input can be used as a second analysis or as specific compensation for the primary input. Temperature compensation for the secondary input (channel 2) is provided through the primary input (channel 1).

1.9 Dual Output (Optional)

The standard LXT-230 is provided with a single output; however, the dual output option provides a second output in either a 4-20 mA regenerated or a 4-20 mA PID format. Outputs can be defined in pH, ORP, Specific Ion, Dissolved Oxygen or Temperature. The second output is fully isolated from the inputs and the primary output and is "floating" so it can have either a positive or negative common.

1.10 Three Outputs (Optional)

Because temperature is an input on the primary channel, TAI has made it available as a third 4-20 mA output. The third output for the LXT-230 can only be a temperature output.

1.11 Optional Software

To enhance the capability of the LXT-230, other software options are available.

Among the options are:

1.11.1 Security Access

Allows only authorized personnel entry to calibration modes.

1.11.2 Differential Output

Provides an output expressed as the difference between two inputs.

1.11.3 Ratio Output

Provides an output expressed as the ratio of two inputs. This is applicable to percent rejection in some applications.

1.11.4 Averaged Outputs

1. Provides an output expressed as the average of two inputs.
2. Provides a field selectable time average (2 to 32 seconds).

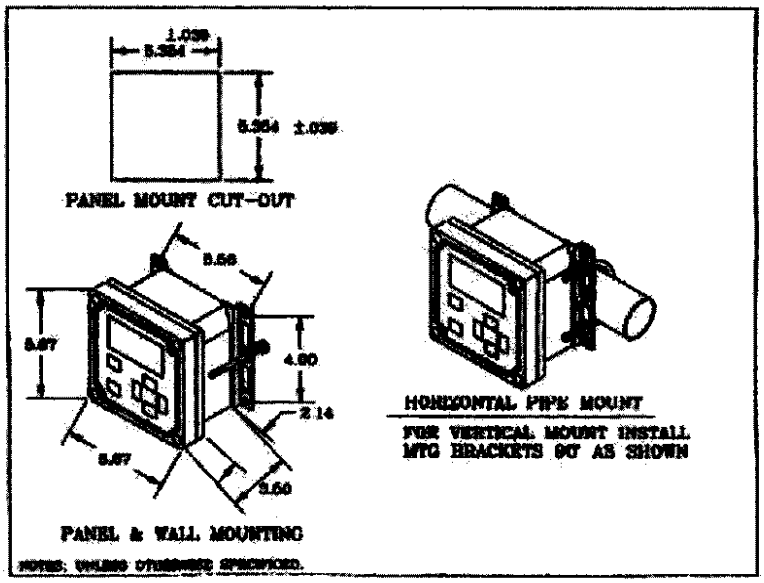
1.12 Identification

The full model number, as found on the packing slip, is a list of alphanumeric characters used to designate certain features of the transmitter. See section 10.0 (Table 1) for the list of designators used for the LXT-230.

2.0 INSTALLATION

2.1 Mounting

Three typical installation configurations are available for the LXT-230 transmitter: universal mounting, handrail mounting, and panel mounting configurations. The universal mounting configuration allows the LXT-230 to be mounted on a wall or a 2" pipe stand. U-bolts may be ordered separately for pipe stand mounting.



2.2 Power Wiring

The LXT-230 transmitter requires a nominal 24-vdc voltage source. With zero loop impedance, the minimum voltage requirement is 13.5 vdc. The maximum voltage limit is 50 vdc. Maximum loop impedance at 24 vdc is 525 ohms for the 4-20 mA compliance. Impedance levels higher than 525 ohms will require additional dc voltage.

When connecting the power wires, it is important to observe the polarity. Although no damage to the LXT-230 will result from polarity reversal, the LXT-230 will not function.

CAUTION
Do NOT apply 110 vac to the 24-vdc wiring terminals. Damage to the instrument will result!

Multiple channel transmitters can have each channel powered by separate power supplies, or they can be powered by one power supply.

2.3 Sensor Wiring

A conditioned input is required from the sensor or electrode to the LXT-230 transmitter for proper operation. In cases where S10 and S17 sensors are not used, a signal conditioning module is available and can be mounted inside the LXT-230 enclosure.

If preferred, the signal conditioner can be mounted remotely within a separate NEMA 4X enclosure. When used without an S10 or S17 sensor, signal conditioners for the LXT-230 do not provide temperature compensation. In these cases, a separate temperature sensing element is required for input to the temperature compensation circuitry.

3.0 FAMILIARIZATION

This section will provide an overview of the front panel key functions and the display menus for a single channel pH and ORP transmitter. Multiple channel transmitters will have the same menus.

3.1 Key Functions

Cursor positions or numeric adjustments are performed by pressing the appropriate keypad. The LXT-230 uses an "underline" cursor in each of the menus. Holding down the keypad will automatically scroll the cursor or numeric values. Please note that simultaneous pressure on both vertical keys or any combination of keys other than the two horizontal CALIBRATE keys is **not** recommended.

3.1.1 Menu Selection Keys

The MENU SELECTION keys are used to change the display menu and move the cursor vertically. Any menu can be accessed by the use of the appropriate up or down MENU SELECTION key, advancing the screen to the desired menu. These keys are also used to exit the calibration mode and save calibration data.

3.1.2 Calibrate Keys

The *horizontal* CALIBRATE keys are used to enter the calibrate mode and move the cursor horizontally. To enter the calibrate mode, both horizontal CALIBRATE keys must be pressed simultaneously. Once in the calibrate mode, the cursor can be positioned by pressing the individual right-hand or left-hand CALIBRATE keys.

The *vertical* CALIBRATE keys are used to perform numeric adjustments to displayed values. To use these keys, the LXT-230 must be in the calibrate mode. Pressing the upper CALIBRATE key will increase the value; pressing the lower CALIBRATE key will decrease the value.

To exit the calibrate mode, press either of the MENU SELECTION keys.

3.2 Display Menus and Screens

When the LXT-230 is first powered, the Copyright Display will appear for a few seconds, then the LXT-230 will display the Main Menu.

S/N 1234	V 2.01
(C) ECD	2002

The Copyright Display provides the software "version" number and the software serial number. TAI will require this information if software updates are to be performed. To access any of the menus listed below, press the desired MENU SELECTION key.

3.2.1 Contrast Menu

Display contrast can be adjusted to allow for variations of ambient lighting. The Contrast Menu is the same for all LXT-230 transmitters and is the uppermost screen. To access this menu from the Main Menu, press the upper MENU SELECTION key.

Contrast	20

3.2.2 Main Menu

This menu appears after the Copyright Display when power is first applied to the LXT-230. The Main Menu displays the measured process variable, temperature, and the current output in percent of full-scale. While in this menu, the current output can be adjusted and locked in a manual mode to provide an undisturbed output during buffer calibrations.

pH	7.00
_50.0%	25.0°C

ORP	-500.0 mV
_25.0%	25.0°C

3.2.3 Electrode Diagnostic Screen

As an informational screen only, this display provides diagnostic data pertaining to the electrode. The top line displays the real-time (active) absolute millivolt value (mVa) the electrode is generating, not compensated for temperature variations. The bottom line displays the electrode isopotential from the last calibration. The isopotential (electrode offset) is the value at which the electrode output is zero millivolts. A perfect pH electrode will indicate an isopotential of 7.00 pH. Replace the electrode if the isopotential is less than 6.00 pH or greater than 8.00 pH.

Input	.0 mVa
0 mVa	7.00

Input	-500.0 mVa
0 mVa	.0 mVa

A perfect ORP electrode will indicate an isopotential of 86 mV @ 25°C. Replace the electrode if the isopotential is less than 36 mV or greater than 136 mV @ 25°C.
This information is extremely helpful in determining the diagnostic status of a pH or ORP electrode. In conjunction with regular calibrations, the Electrode Diagnostic Screen provides valuable information to track electrode performance.

3.2.4 Electrode Standardization Menu

Provides the means with which to perform a one-point calibration (standardization) or the first point of a two-point calibration. For pH this point is typically 7.00 pH and ORP this point is typically 0.00 mV.

1 pH	7.00
Cal	.0 mV/pH

1 ORP	.0 mV
Cal	.0 mVa

Before entering the calibrate mode, the menu provides historical data from the last calibration. The top line displays the buffer, or calibration point, at which the last calibration was performed. The bottom line displays the temperature compensated mV value the electrode generated at the buffer point. Please note that temperature compensation is not performed for ORP. When in the calibrate mode, the bottom line displays the real-time, or active, millivolt value.

3.2.5 Electrode Span Menu

Provides the means to perform the span calibration, or the second point of a two-point calibration. Before entering the calibrate mode, the menu provides historical data from the last calibration.

2 pH	.00
Cal	-59.1 mV/pH

2 ORP	.0 mV
Cal	1.000 mV / ORP

The top line displays the buffer, or calibration point, at which the last calibration was performed. For pH transmitters, the bottom line displays the electrode slope, or efficiency, in millivolts per pH (mV/pH). ORP transmitters express efficiency in absolute millivolts per millivolt (mVa/mV). When in the calibrate mode, the bottom line displays the real-time, or active, millivolt slope value.

3.2.6 Output Calibration Menu

Current output ranges are adjusted in this menu. The top line defines the 4 mA point, while the bottom line defines the 20 mA point. Between these points, the output current is linear with respect to the sensor input. By reversing the signs, the European convention or the Thermodynamic (American) convention can be defined.

_4 mA	.00
20 mA	14.00

_4 mA -1000.0 mV
20 mA 1000.0 mV

3.2.7 Temperature Calibration Menu

This Menu has two calibrate functions. It is used to adjust or trim the temperature compensation for variations in the sensing element. This menu can also provide a manual temperature input for the process. The top line displays the temperature offset value. The bottom line displays the adjusted temperature value.

Trim °C	.0
Unit	24.3°C

Second, the menu is used to change the units of display to either Celsius or Fahrenheit. The change is performed as a toggle function and changes the displayed units on all screens or menus where temperature is displayed to the desired unit of measurement.

4.0 SENTINEL DIAGNOSTICS

The basic menu structure of the LXT-230 transmitter is architecturally the same as the LXT-230 pH, ORP and PION, with the only variable being the diagnostic information on the main and special diagnostic menus. The critical path to your process measurement is via the TAI sensor/electrode.

Under perfect conditions, the electro-chemical interface between the electrode's internal reference cell (the **measurement standard**) and the **liquid junction** (bridge between the internal electrolyte and the wet process) should be in balance (stable **potential** values). However, a dominant failure mechanism of an **Electro-Chemical** (pH, ORP, PION) **Reference Half Cell** is insidious process contamination impacting that balance (electrode internal chemistry).

Contamination from the wet process will eventually migrate through the electrode's inner structure eventually changing Electro-Chemical balances via oxidation/reduction of the metal/metal salts and gels.

4.1 Diagnostic set up and configuration menus

4.1.1 Main Menu

The degree to which the intrusive process chemicals degrades the "insitu" electrode is graphically depicted on the right side of the LXT-230 main process screen as a vertically expanding diagnostic bar, culminating in a flashing pre-pHault alert. This pre pHault Alert warns the user of a pending chemical alteration of the Electro-Chemical Reference Measurement Cell prior to the actual measurement error, hence the designation, "Pre-pHault."

pH	7.00
_50.0%	25.0°C

ORP	100.0 mV
25.0%	25.0°C

4.1.2 SENTINEL DIAGNOSTIC SCREEN

The lower section of this (split screen – over under) menu will indicate default mV values as set by the factory; the default value will be 60mV in all cases. This value is Nurnstian in that it signifies one decade change in 4 molar reference gel. The transmitter has been designed so that the customer can input other mV values based on individual experience that may differ from the default mV number.

Ref	25.2 mV
Limit	30.0 mV

To change the "LIMIT" values, enter the CALIBRATE MODE by simultaneously pressing the two horizontal CALIBRATE keys; observe the cursor move to the right allowing LIMIT value change. Once in CAL MODE, the cursor can be moved to different digit placements, then, using the vertical key, the LIMIT value can be decreased or increased based on process demands.

NOTE:
This value responds to contamination of the secondary electrolyte chamber with a Nurnstian response (log 10 System)

To file the input, with the microprocessor, exit the calibrate mode by pressing either menu selection key. The upper half of the split screen menu displays absolute reference potential (±2 millivolts) directly from the electrode via the diagnostic signal co conditioner located in the sensor. This half of the menu is "read only" and cannot be accessed.

It is this half of the menu where you will observe the state of the electrode's performance in terms of process relates aging.

The mV LIMIT value, as set in by the user or TAI at time of shipment, may require adjustment from process to process due to major chemical changes that would introduce new electrolyte contaminants thereby impacting the rate of reference contamination in the electrode.

After the desired mV values are set into the DIAGNOSTIC CALIBRATION SCREEN, further electrode "INSITU" diagnostic information can be obtained by scrolling to the main process menu where VISUAL electrode diagnostic information is displayed as a cursor/growing black vertical bar. As process intrusion threatens the electrode's internal balance, the bar correspondingly grows in height (it will
eventually flash as a **final pre-pHault alert**).

The user can toggle between the main process screen and the dedicated diagnostic screen where specific, real time DIAGNOSTIC engineering data can be obtained. There is also an option (at time of purchase) to add a 4-20mA output card for the transmission of this "INSITU" diagnostic engineering data.

5.0 MAINTENANCE

If service of the internal components is required, always turn off the power to the instrument.

5.1 Cleaning

Cleaning the front panel can be performed with a detergent and water. DO NOT USE ACETONE, ACID OR CAUSTIC SOLUTIONS ON THE ENCLOSURE SURFACE. If the enclosure cover must be removed, it is wise to clean and inspect the gasket seal. If the seal is damaged, replace the gasket. Always keep the gasket lightly lubricated with a silicone grease.

5.2 Replacement of the Microprocessor

Contact factory.

6.0 CALIBRATION

6.1 Manual Output Mode

To perform calibrations without interfering with control or recorder functions, the LXT-230 incorporates a manual output mode. The current output is set to the desired level and saved until changed or released from the manual mode.

NOTE: Prior to any calibration the LXT-230 transmitter should be placed into the manual mode.

Procedure:

1. If not at the Main Menu, press the appropriate MENU SELECTION key to reach the Main Menu.
2. Press both horizontal CALIBRATE keys simultaneously to enter the calibrate mode and observe the "M" appear in front of the % current output value; The current output is now locked in the manual mode.
3. Using the horizontal CALIBRATE keys, position the cursor under the digit to be adjusted.
4. Increase or decrease the value by pressing the appropriate vertical CALIBRATE key.
5. When the desired value is reached, exit the calibrate mode by pressing either MENU SELECTION key. The current output will be held at the filed value.

pH	7.00
M24.3%	25.0°C

ORP	-500.0 mV
M 55.0%	25.0°C

To release manual output:

1. Return to the Main Menu by pressing the appropriate MENU SELECTION key.
2. Observe that the "M" appears in front of the % current output value. The "M" signifies that the output is being held at the displayed value.
3. Press the left-hand CALIBRATE key and observe the "M" disappear, releasing the LXT-230 from the manual output mode. The % output value will return to the real-time current output.

6.2 Contrast Adjustment

Procedure:

1. Press the upper MENU SELECTION key to reach the Contrast Menu (upper most menu).
2. Press both horizontal CALIBRATE keys simultaneously to enter the calibrate mode. Observe the cursor move to the last digit.
3. Using the horizontal CALIBRATE keys, position the cursor under the digit to be adjusted.
4. Increase or decrease the value by pressing the appropriate vertical CALIBRATE key.
5. To file the contrast value and exit the calibrate mode, press either MENU SELECTION key.

6.3 One-Point Buffer Calibration (Standardize)

Because all pH and ORP electrodes experience minor variations, buffer calibrations are necessary before installing the electrodes in service. Also, occasional calibrations are necessary to compensate for electrode degradation while in service. For measurement specifics, refer to the pH/ORP sensor manual.

Procedure:

1. Press the appropriate MENU SELECTION key to reach the Electrode Standardization Menu and locate the cursor under the "1" as illustrated in section 3.2.4.
2. For diagnostic reasons note the pH and mV values from the prior calibration.
3. Clean the electrode and insert the sensor into the desired buffer.
4. Press both horizontal CALIBRATE keys simultaneously to enter the calibrate mode. Observe the diagnostic value on the bottom line change from historical data to a real-time value and that the term "CAL" has disappeared.

1 pH 7.00 -3.2 mV@25	1 ORP .0 mV 85.9 mVa

5. To change the buffer point, position the cursor under the desired digit using the left-hand CALIBRATE key.
6. Increase or decrease the value by pressing the appropriate vertical CALIBRATE key.
7. Wait for the real-time mV value to stabilize.
8. To file the calibration and exit the calibrate mode, press either MENU SELECTION key.

6.4 Two-Point Buffer Calibration (Span)

When first installing an electrode, a two-point buffer calibration should be used to compensate for electrode slope variations or efficiency.

Procedure:

1. Perform a one-point calibration as outlined in section 5.3.
2. Press the appropriate MENU SELECTION key to reach the Electrode Span Menu and locate the cursor under the "2" as illustrated in section 3.2.5.
3. For diagnostic reasons note the pH and mV values from the prior calibration.
4. Press both horizontal CALIBRATE keys simultaneously to enter the calibrate mode. Observe the diagnostic value on the bottom line becomes a real-time value and that the term "CAL" has disappeared.

2 pH 4.00 -58.2 mV/pH	2 ORP 180.0 mV .980 mV/ORP

5. To change the buffer point, position the cursor under the desired digit using the left-hand CALIBRATE key.
6. Increase or decrease the value by pressing the appropriate vertical CALIBRATE key.
7. Wait for the real-time mV value to stabilize.
8. To file the calibration and exit the calibrate mode, press either MENU SELECTION key.

A perfect electrode slope (efficiency) is -59.1 mV/pH and ORP is 1mV/mV. If the value falls below -50.0 mV/pH or ORP .9 mV/mV, the electrode should be serviced or replaced.

IMPORTANT

If a flashing asterisk appears during or after calibration, the electrode may require service, or the buffer solution may be contaminated. Refer to section 5.6 for details.

NOTE:

Comparing the millivolt values before and after the calibration provides a valuable

diagnostic tool in determining the degradation of the electrode. Large differences between calibrations may indicate coating or damage to the measurement half-cell.

6.5 Calibration Using a Grab Sample as a Standard

The LXT-230 allows easy standardization to a grab sample value by placing the process value into the first calibration point.

Procedure:

1. Record the pH value of the process when the sample is extracted.
2. Record the pH value of the grab sample.
3. Calculate the difference between the two values as follows:
4. Immediately before making the calibration adjustment, note the current pH value on the display and add the pH differential to the current value. This "total adjusted" value is entered as the buffer value.

6.6 Calibration Error Detection & Electrode Operational Guidelines

If the slope calibration performed in section 5.4 is not within the predetermined limits of the instrument, a flashing asterisk (*) will appear. The presence of the asterisk indicates a potential calibration problem. In general, if the asterisk appears, the integrity of the electrode, the buffer solutions or the handling procedure should be questioned. See the pH/ORP sensor manual for specifics on the electrode.

6.7 Back-to-Factory Calibration

This feature allows the LXT-230 to be reset to "ideal electrode" (Nernst equation) for electrode potentials. According to the Nernst equation, an ideal pH electrode has a zero isopotential at 7.00 pH and a slope of -59.16 mV per pH unit, an ORP electrode has an ideal slope of 1 mV per ORP. This feature is useful in providing a reliable starting point if the LXT-230 has been mis-calibrated.

IMPORTANT: Ideal instrumentation calibration does not imply ideal system calibration.

The following procedure for returning the LXT-230 to factory calibration can be used for both standardize and span calibrations.

Procedure at the Standardization Menu:

1. Position the cursor under the "C" in "Cal."
2. Press both horizontal CALIBRATE keys simultaneously and observe the cursor briefly move to the right. The default setting is complete.
3. This procedure is required at BOTH of the calibration points.

2 pH .00 Cal -59.1 mV/ph	2 ORP .0 mV Cal 1.000 mV/ORP
1 pH 7.00 Cal 0 mV@25	1 ORP .0 mV Cal .0 mVa

6.8 Output Calibration

The Output Calibration Menu is used to define the 4-20 mA range for the measurement. To change or expand the 4-20 mA range, use the following procedure.

Procedure:

1. Press the appropriate MENU SELECTION key to reach the Output Calibration Menu.
2. Position the cursor on the top line to change the 4 mA point or the bottom line to change the 20 mA point.
3. Press both horizontal CALIBRATE keys simultaneously to enter the calibrate mode.
4. To change the value, position the cursor under the desired digit using the left-hand CALIBRATE key.
5. Increase or decrease the value by pressing the appropriate vertical CALIBRATE key.
6. When the desired value is reached, file the calibration and exit the calibrate mode by pressing either MENU SELECTION key.

6.9 Temperature Calibration - Trim Adjustment

When the process demands a tighter tolerance than ±3°C the LXT-230 allows adjustment, or trim, of the temperature compensation element. This adjustment only compensates for deviations in the RTD input (as a sensor input standardize or zero adjustment).

Procedure for trim adjust:

1. Begin with the temperature sensing element (located in the sensor) in a solution of known temperature. If the temperature is not known, insert a precision thermometer in the same solution and allow it time to stabilize.
2. Press the appropriate MENU SELECTION key to reach the Temperature Calibration Menu.
3. Position the cursor on the top line.
4. Press both horizontal CALIBRATE keys simultaneously to enter the calibrate mode. Observe the cursor move under the last digit.
5. Position the cursor under the desired digit using the left-hand CALIBRATE key.
6. Dial in the difference between the displayed temperature and the actual temperature.

NOTE
Make temperature adjustments slowly to allow time for the bottom line of the display to update. This can take 5 to 7 seconds.

7. When the desired temperature value is reached, file the calibration and exit the calibrate mode by pressing either MENU SELECTION key. The value on the top line expresses the temperature error or deviation between the RTD and the precision thermometer. The value on the bottom line expresses the real-time process temperature.

6.10 Temperature Units Calibration - Celsius/Fahrenheit Conversion

The Temperature Calibration Menu is also used to change the units of display to either Celsius or Fahrenheit. The change is performed as a toggle function and changes the displayed units to the desired unit of measurement on all screens or menus where temperature is displayed.

The following procedure describes how to use this feature.

Procedure:

1. Press the appropriate MENU SELECTION key to reach the Temperature Calibration Menu.
2. Position the cursor on the bottom line under the "U" in Unit.
3. Press both horizontal CALIBRATE keys simultaneously. Observe the unit of measurement change.

4. To toggle back to the first unit of measurement, press the CALIBRATE keys again.

Trim °C	.0
Unit	25.0°C

Trim °F	.0
Unit	77.0°F

7.0 LXT-230 MODEL NUMBER DESIGNATORS

Channel 1 Input & Output

LXT-230-PH/MA	pH
LXT-230-OR/MA	ORP
LXT-230-PION/MA	Specific Ion *(see note 1)*

Note 1: For PION, the model number will reflect the ion being measured; for example, Ca for calcium, Fl for fluoride, etc.

Channel 2 Input

PH	pH
OR	ORP
PION	Specific Ion *(see note 1)*
DO	Dissolved Oxygen

Channel 2 Output

MA	4-20 mA, standard
PID	4-20 mA, 3-mode PID control
TMP1	4-20 mA, Temperature (adjustable -100° to +200°C)

Channel 3 Output

TMP1	Only output available on this channel.

Mounting Hardware

UM	Universal mounting plate
PM	Panel mounting hardware
HM	Handrail mounting plate (including 2" hardware)

Other Options

KSx	Keyboard Security Code (x = level of security. See Security Code Option)
F2	Output is the function of two inputs: ratio, differential, average.
SPH	Specific pH (TC for NH3 in condensate)
PA	Signal conditioner is mounted inside the transmitter enclosure
SC	Signal conditioner is mounted through the side of the enclosure
ZPR	Hazardous area Z-purge
AV	Field selectable time average (2 to 32 seconds)

Typical Example

LXT-230-OR/MA-PM - LXT-230 transmitter for use with an ORP sensor.

8.0 TROUBLESHOOTING GUIDE

Symptom	*Possible Causes*	*Suggested Actions*
The LCD does not display.	No power to the instrument.	Check power supply to be sure the correct voltage is being supplied to the transmitter. (13.5 to 50 VDC) Check polarity of transmitter wiring.
	Contrast level is set too low.	Set contrast level to a higher value. Because the contrast menu is always the top menu, it can be reached by pressing the upper MENU SELECTION key at least 12 times. Enter the calibrate mode and increase the value.
	Sensor or signal conditioner has a short that draws too much power from the transmitter.	Check the sensor for proper operation. To verify, disconnect all sensor wires and cycle power off, then on.
The pH fluctuates from minimum scale to full-scale, or the pH is locked at high or low scale.	The slope calibration is mis-calibrated. Typically the transmitter is calibrated with no slope (0 mV/pH).	Check buffers to make sure they are the correct values. Use the Back-to-Factory calibration feature on the Electrode Span Menu, then perform a buffer calibration. Check the electrode and sensor for proper operation.
	Wrong temperature correction has been calibrated in the temperature trim.	Examine the temperature and the Temperature Calibration Menu. Adjust trim as required.
The pH or ORP reading short spans.	The transmitter may have been mis-calibrated.	Check buffers to make sure they are the correct values. Use the Back-to-Factory calibration feature on the

		Electrode Span Menu, then perform a buffer calibration. Check the sensor and electrode for proper operation.
	Wrong temperature correction has been calibrated in the temperature trim.	Examine the temperature and the Temperature Calibration Menu. Adjust trim as required.
LCD turns black.	Power to the transmitter dropped below the minimum required voltage for a fraction of a second (gray-out). Typically caused by a voltage transient.	Cycle power off for approximately 10 seconds, and then on again.

APPENDIX A - SPECIFICATIONS

MEASUREMENT RANGE

pH: 0.00 to 14.00, fully expandable and reversible, standard. -2.00 to 14.00 pH, optional.

ORP: +1000 to -1000 mV, fully expandable and reversible, standard.

OUTPUT 4-20 mA or 20-4 mA, linear and expandable. Up to a maximum of 3 outputs.

POWER REQUIREMENTS (with zero loop impedance)

Recommended	24 vdc
Maximum	50 vdc
Minimum	13.5 vdc

MAXIMUM LOOP IMPEDANCE (@ 24 vdc)

525 ohms for 4-20 mA compliance on primary (channel 1) output; approximately 800 ohms on secondary outputs

OPERATING TEMPERATURE

-4°F to +158°F (-20°C to +70°C)

DISPLAY

Menu driven, 32 character alpha-numeric, Supertwist LCD. The main menu simultaneously displays (1) process identity (2) process value (and engineering units), (3) percent output, (4) temperature in °C or °F.

ENCLOSURE

NEMA 4X, weatherproof

SHIPPING WEIGHT

Standard LXT-230: 2 lbs (0.91 kgs)

ACCURACY

± 0.10% of full scale

LINEARITY

± 0.05% of full scale

SENSITIVITY

± 1.0 mV

STABILITY

± 0.2% per year @ 0°C to 70°C

RESPONSE TIME

1 second to reach 90% of the change.

REPEATABILITY

± 1.0 mV

TEMPERATURE COMPENSATION

pH: Automatic, -30°C to +140°C, RTD. Accuracy within ±0.1°C over a 0°C - 100°C span.

Specific pH compensation temperature correction) is available. Consult the factory.

ORP: Not used for compensation; however, temperature is displayed. Accuracy within ±0.1°C over a 0°C-100°C span.

50/60 Hz NOISE REJECTION

Greater than 70 db

INPUT/OUTPUT ISOLATION

Maximum 300 volts between process input and any 4-20 mA output (single and multiple channel outputs). No isolation between inputs on multiple channel units.

CALIBRATION

Auto Buffer Calibration

Allows the definition of two buffer points, saved in memory, during the initial start-up. This will allow subsequent standardize and span buffer calibrations with only 2 keystrokes.

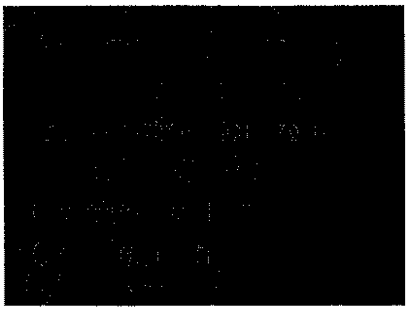
Back-to-Factory Calibration (Factory Restart)

With 2 keystrokes, allows the technician to return the transmitter to a zero electrode offset (asymmetry potential) and to an ideal Nernstian slope (1.000 mV per ORP unit).

Temperature Trim
Allows for compensation for any differences in RTDs by programming the offset into the transmitter.

Temperature Display
Temperature can be field configured to display in OC or OF.

Display Contrast
Fully adjustable for ambient lighting conditions



Addendum for Model LXT-230 Controller for Conductivity

Q003252 **C.O. 94479**

The instruction manual included with your analysis system from Teledyne Analytical Instruments describes the standard features of the system. Refer to the manual for information regarding all standard features of the model that you have selected.

In addition, your specific system has been designed according to the needs that you specified at the time of purchase. The information contained in this addendum addresses those needs and supersedes any conflicting instructions and descriptions in the standard instruction manual.

*NOTE: **All drawings that relate to your system are at the rear of this manual.***

Overview

Your Model LXT-230 transmitter is configured for chlorine output range of 0 to 0.5mg/L. The transmitter is configured with an optional temperature output of 4-20mA. The ORP and pH sensors are in titanium housing materials. A titanium flange is included for each sensor. The cable length for this instrument is 10 meters.

Theory

The device is primarily a pH compensated, ORP system. Devices that measure ORP of a fluid are referred to as oxidation/reduction potential or redox probes. In a redox probe, a noble metal such as platinum is used as one electrode. The platinum electrode is exposed to the process fluid. Oxidizing agents present in the process fluid change the electrode's electrical potential (i.e. create a voltage). The typical ORP compares this voltage to a constant-voltage reference electrode. The typical reference electrode is surrounded by electrolyte solution and separated from the process fluid by a semi-permeable barrier. The comparative measurement of these two voltages is displayed as millivolts or concentration in mg/L.

A problem with any ORP sensor is that it indiscriminately measures all oxidation/reduction potential in the fluid. Hydronium ion (H+) or that component of a liquid that lowers pH (i.e. increases acidity) is a reducing agent. As such the ORP sensor would normally add this activity to that of the free chlorine. If the pH level stayed constant, you could simply calculate its effect and deduct this number from the

total (CI2 and H+) value to arrive at the desired free chlorine value. Since most processes have a varying pH, another method must be utilized.

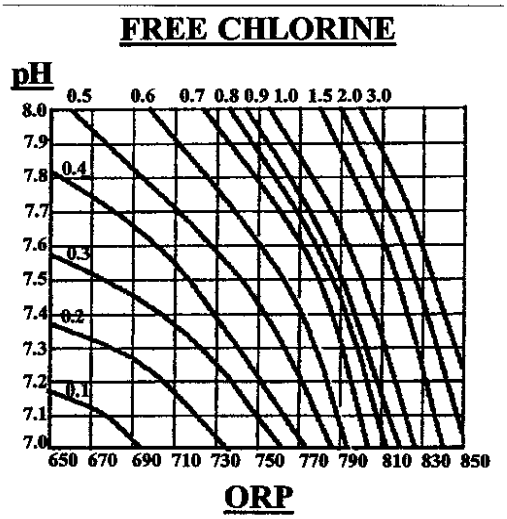
This system has incorporated a pH sensing element and an ORP sensing element allowing the T23 transmitter through the software to compensate for the changes to the chlorine reading caused by pH. The Chlorine value is calculated by the T23 and is displayed in PPM. The range of the instrument is defined as follows:

pH	7.0 to 8.0
ORP	650 to 850 mV
Chlorine	.1 to 3 PPM
	.1 to 10 PPM optional

Calibration

(Please refer to the T23 pH and ORP manual for the calibration procedure)

The ORP and the pH channels are calibrated individually with the final calibration checked by comparison against a grab sample. Any errors are then removed by standardizing using the values obtained from the following graph.



For example, if the grab sample determined the value of the chlorine to be 0.5 PPM and the pH was 7.7 then, from the graph the ORP can be seen to be 710 mV. This value would then be entered as the new standardize value.

The specified hardware will measure the total "FREE" Chlorine which consists of HOCl and OCl; it will not measure the total "residual" Chlorine which consists of "total free Chlorine + complexed Chlorine". This is because the ORP electrode does not respond to complexed Chlorine.

Spare Parts

Qty	Part Number	Description
1	2005157.EPR	**pH Electrode cartridge** 0 to 13 pH, Peek body, Teflon junction, ruggedized hemi bulb, Na2SO4 in gel, 215 psi, Na resistant, don't use for low pH, Toluene or organic solvent applications, steam sterilizable, not position sensitive, -5° to +130°C. With EPR (Ethylene Propylene) O-Ring seals
1	2005167.OTEPR	**ORP electrode Cartridge** Platinum Band, No Glass, PEEK body, Ammonium Nitrate reference (80°C) With EPR (Ethylene Propylene) O-Ring seals

NOTE: ***Orders for replacement parts should include the part number (if available) and the model and serial number of the instrument for which the parts are intended.***

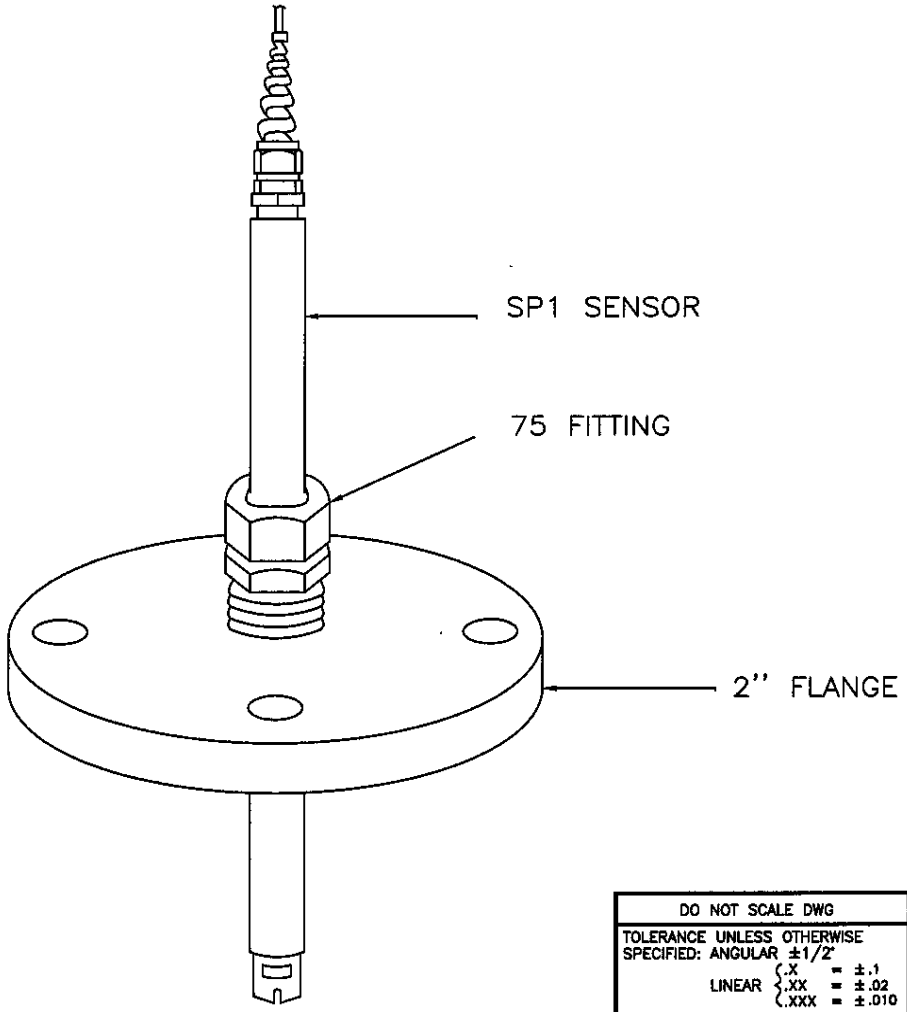
Orders should be sent to:

TELEDYNE INSTRUMENTS
ANALYTICAL INSTRUMENTS
A Teledyne Technologies Company
16830 Chestnut Street
City of Industry, CA 91748-1020
Phone (626) 961-9221 or (626) 934-1500
Fax (626) 961-2538 or (626) 934-1651
or your local representative

Project Engineer _____ Date _____

NOTES: UNLESS OTHERWISE SPECIFIED.

REVISIONS				
REV	DESCRIPTION	DATE	APP.	REV. BY
0	Initial Release			--



DO NOT SCALE DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED: ANGULAR ±1/2'
LINEAR .X = ±.1, .XX = ±.02, .XXX = ±.010

TELEDYNE INSTRUMENTS
Analytical Instruments
A Teledyne Technologies Company
City of Industry, California, 91748, USA

S/	SIGNATURES	DATE
N/	DRFT: K. MURALI	11/07/06
I/	CHK:	
P/	APPR:	
O/	ENGR: Tom Chernals.	
F/	C.O.: 094479	
REFERENCE	CAD I.D. BSK110706-3-0	

TITLE
SP1 SENSOR W/FLANGE
GENERIC

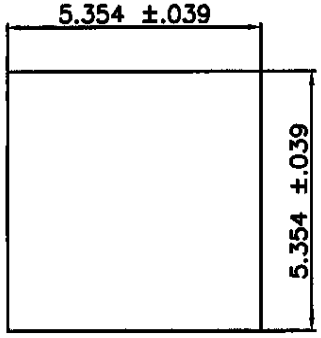
SCALE NONE
SIM NONE
SHEET 1 OF 1

MATL.

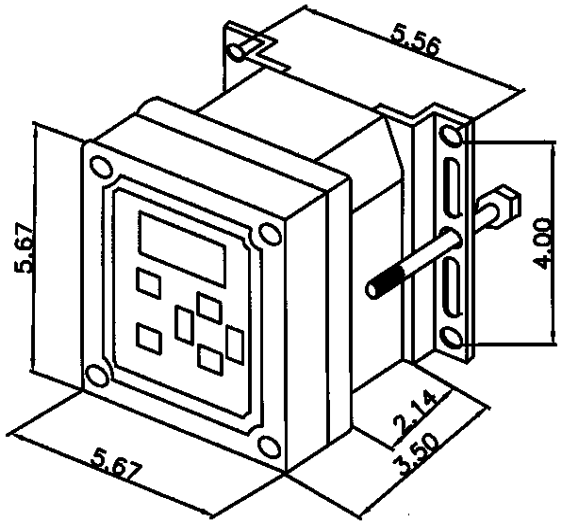
DWG NO. **BSK-**110706-3
REV 0

NOTES: UNLESS OTHERWISE SPECIFIED.

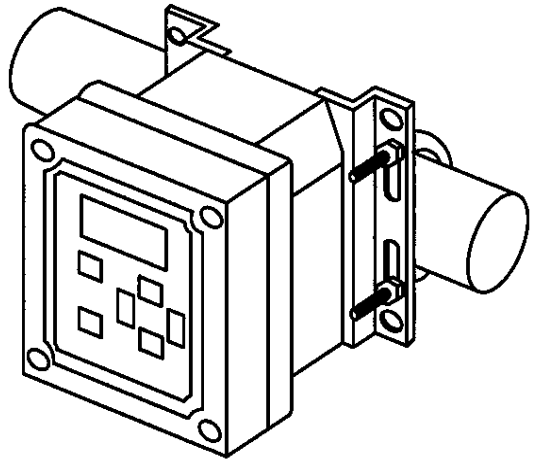
REVISIONS				
REV	DESCRIPTION	DATE	APP.	REV. BY
0	Initial Release			--



PANEL MOUNT CUT–OUT



PANEL & WALL MOUNTING



HORIZONTAL PIPE MOUNT

FOR VERTICAL MOUNT INSTALL
MTG BRACKETS 90° AS SHOWN

DO NOT SCALE DWG		THIS DRAWING IS THE PROPERTY OF TELEDYNE INSTRUMENTS AND CONTAINS CONFIDENTIAL INFORMATION. IT IS NOT TO BE COPIED, REPRODUCED OR USED WITHOUT WRITTEN PERMISSION.
TOLERANCE UNLESS OTHERWISE SPECIFIED: ANGULAR ±1/2° LINEAR .X = ±.1, .XX = ±.02, .XXX = ±.010		TELEDYNE INSTRUMENTS *Analytical Instruments* A Teledyne Technologies Company City of Industry, California, 91748, USA
S/	SIGNATURES	DATE
N/	DRFT: K. MURALI	11/07/06
I/	CHK:	
P/	APPR:	
O/	ENGR: Tom Chernak.	
F/	C.O.: 094479	
REFERENCE	CAD I.D. BSK110706-1-0	

TITLE: APPLICATION DWG, LXT230 DIM & MOUNTING GENERIC

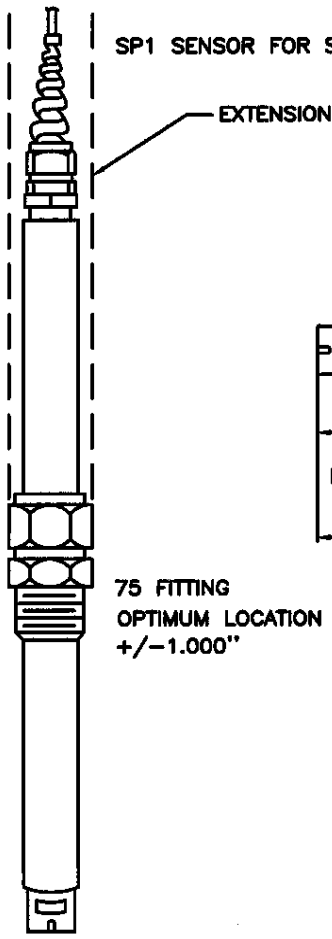
SCALE NONE | SIM NONE | SHEET 1 OF 1

MATL.

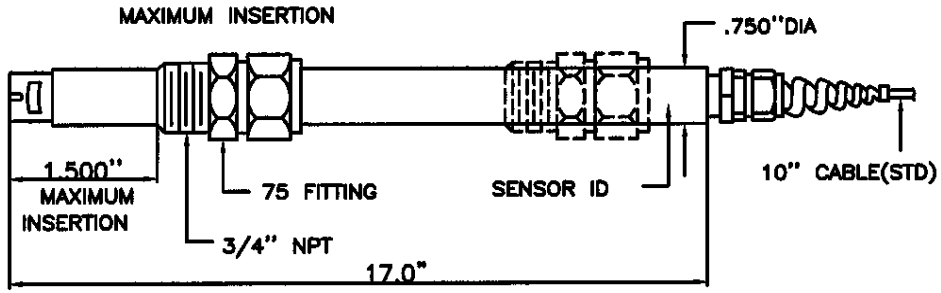
DWG NO. **BSK**-110706-1 REV 0

NOTES: UNLESS OTHERWISE SPECIFIED.

REVISIONS				
REV	DESCRIPTION	DATE	APP.	REV. BY
0	Initial Release			--



SP1 SENSOR FOR INSERTION



DO NOT SCALE DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED: ANGULAR ±1/2'
LINEAR .X = ±.1, .XX = ±.02, .XXX = ±.010

TELEDYNE INSTRUMENTS
Analytical Instruments
A Teledyne Technologies Company
City of Industry, California, 91748, USA

	SIGNATURES	DATE
S/		
N/	DRFT: K. MURALI	11/07/06
I/	CHK:	
P/	APPR:	
O/	ENGR: Tom Chernole.	
F/	C.O.: 094479	
REFERENCE	CAD I.D. BSK110706-4-0	

TITLE: INSERTION & SUBMERSION DIMENSIONS (GENERIC) SP1 SENSOR

SCALE NONE
SIM NONE
SHEET 1 OF 1

MATL.

DWG NO. **BSK-**110706-4

REV 0

Isco Product Data

Isco 6712FR Fiberglass Refrigerated Sampler

The 6712FR is a sequential or composite refrigerated sampler designed for indoor or outdoor applications where rugged, corrosion-resistant construction is required.The extensive range of programming modes lets you select the most suitable routine for your application. Programming is fast and simple, with on-line help just a key stroke away.

The environmentally-sealed 6712 controller delivers maximum accuracy and easily handles all of your sampling applications, including:

- wastewater effluent
- stormwater monitoring
- CSO monitoring
- permit compliance
- pretreatment complience

In the Standard Programming Mode, the controller walks you through the sampling sequence step-by-step, allowing you to choose all parameters specific to your application. Selecting the Extended Programming Mode lets you enter more complex programs.

Factory installed options

An optional built-in telephone modem lets you change programs and download data remotely, from a touch-tone phone. It also has dial-out alarm features.

For automatic documentation of sample storage temperature, specify the 6712FR with optional temperature sensor. With this thermally ballasted sensor, the 6712 controller can log compartment temperatures at programmable intervals with 0.1°C precision.

Versatile, Tough, and Reliable

Isco FR samplers feature a corrosion-proof refrigerator cabinet molded from polyester resin fiberglass and supported by a stainless steel frame. A UV-resistant gel coat provides a smooth, non-porous finish for added protection and easy cleaning.

The 6712FR uses thick, foamed-in-place insulation to keep samples preserved at the EPA-recommended 39°F (4°C). An automatically controlled, built-in heater ensures that samples won't freeze, even when ambient temperatures drop to -20°F (-29°C). Coolant is environmentally safe R134a. Durable powder-coated epoxy, phenolic paint, and polyester tubing, protect refrigeration components against corrosion.

The 6712FR provides long service life in corrosive environments, and can be used outdoors without an enclosure.

Specifications

Isco 6712FR	
Size (HxWxD):	49.3 x 26 x 26 inches (125 x 66 x 66 cm)
Weight:	Dry, 160 lbs (73 kg)
Bottle configurations:	24 1-liter PP or 350-ml glass 24 ProPak 1-liter disposable sample bags 12 2.5-liter wedge PE 8 2-liter PE or 1.8-liter glass. 2 2-gallon (7.5-liter) PE or 2.5-gallon (9.4-liter) glass 1 2.5-gallon (9.4 liter) PE or glass 1 4-gallon (15-liter) PE 1 5.5-gallon (21-liter) PE or 5 gallon (19 liter) glass
Refrigerator Body	Fiberglass reinforced plastic with UV-resistant gel coat
Power Requirements:	120 VAC, 60 Hz; or 240 VAC, 50 Hz (specify)
Pump	
Intake suction tubing:	
Length	3 to 99 feet (1 to 30 m)
Material	Vinyl or Teflon
Inside dimension	3/8 inch (1 cm)
Pump tubing life:	Typically 1,000,000 pump counts
Maximum lift:	28 feet (8.5 m)
Typical Repeatability	±5 ml or ±5% of the average volume in a set
Typical line velocity at Head height: of	
3 ft. (0.9 m)	3.0 ft./s (0.91 m/s)
10 ft. (3.1 m)	2.9 ft./s (0.87 m/s)
15 ft. (4.6 m)	2.7 ft./s (0.83 m/s)
Liquid presence detector:	Non-wetted, non-conductive sensor detects when liquid sample reaches the pump to automatically compensate for changes in head heights.

Controller	
Weight:	13 lbs. (5.9 kg)
Size (HxWxD)	10.3 x 12.5 x 10 inches (26 x 31.7 x 25.4 cm)
Operational temperature:	32° to 120°F (0° to 49°C)
Enclosure rating:	NEMA 4X, 6 (IP67)
Program memory:	Non-volatile ROM
Flow meter signal input:	5 to 15 volt DC pulse or 25 millisecond isolated contact closure.
Number of composite samples:	Programmable from 1 to 999 samples.
Clock Accuracy:	1 minute per month, typical, for real time clock
Software	
Sample frequency:	1 minute to 99 hours 59 minutes, in 1 minute increments. Non-uniform times in minutes or clock times 1 to 9,999 flow pulses
Sampling modes:	Uniform time, non-uniform time, flow, random interval event. (Flow mode is controlled by external flow meter pulses.)
Programmable sample volumes:	10 to 9,990 ml in 1 ml increments
Sample retries:	If no sample is detected, up to 3 attempts; user selectable
Rinse cycles:	Automatic rinsing of suction line up to 3 rinses for each sample collection
Program storage:	5 sampling programs
Sampling Stop/Resume:	Up to 24 real time/date sample stop/resume commands
Controller diagnostics:	Tests for RAM, ROM, pump, display, and distributor

Ordering Information

***Note**: Bottle configuration, suction line, and strainer must be ordered separately. Many options and accessories are available for 6712 Samplers; see separate literature for 700 Series Modules and other components to expand your monitoring capabilities.*

Description	Part No.
6712FR Refrigerated Sampler, 120VAC 60Hz Includes controller, distributor arm, instruction manual, pocket guide.	68-6710-072
6712FR Refrigerated Sampler, 230VAC 50Hz includes controller, distribution arm instruction manual, pocket guide.	68-6710-073
6712FR with temperature logging, 120VAC 60Hz As above, with internal temperature sensor	68-6710-144
6712FR with temperature logging, 230VAC 50Hz As above, with internal temperature sensor	68-6710-145

The 6712 Controller is also an SDI-12 data logger, and has many optional capabilities. Please contact Isco or your Isco distributor for more information.

Water is life. Protect it.

Teledyne Isco, Inc.

4200 Superior Street
Lincoln NE 68504 USA
Phone: (402) 464-0231
USA and Canada: (800) 228-4373
Fax: (402) 465-3022
E-Mail: iscoinfo@teledyne.com
Internet: www.isco.com