

Dual Input Analyzers for Conductivity and pH/Redox (ORP)

Models AX411, AX466 & AX416



- **Cost effective**
 - select from two input conductivity, two input pH/Redox (ORP) or combined pH/Redox (ORP) and conductivity in one instrument
- **Reduced installation cost**
 - easy access terminations and reduced panel space
- **Dual Conductivity**
 - Difference, Ratio, % Passage, % Rejection and Inferred pH calculations
- **High functionality at minimum cost**
 - three alarms and two current outputs supplied as standard
- **Add-on option card provides flexible and versatile operation**
 - maximum five alarm relays and four current outputs
- **On-line diagnostics**
 - provide assurance of performance reducing operational costs
- **Versatile power supply options**
 - 85V to 265V AC
 - 12V to 30V DC available as an option



**High specification, high performance
Conductivity and pH/Redox (ORP)
analyzers for all types of Industry**



The AX400 Series

The AX400 Series of dual input analyzers incorporate the latest technology to provide a flexible, feature-packed device that satisfies a diverse range of applications.

They are available in both wall-/pipe- and panel-mount formats. The wall-/pipe-mount version is rated to **IP66/NEMA 4X** and particular attention has been paid to the ease of connection, making installation rapid and cost-efficient.

The front of the panel-mount version is also rated **IP66/NEMA 4X**.

Dual input

There are three permutations to select from; two conductivity inputs, two pH inputs and a combined version incorporating both a conductivity and a pH input.

The **AX411 dual input conductivity** version enables the user to select a variety of options depending on the needs of the application.

It can be configured as either a conventional, two-input conductivity-measuring device, with simultaneous local display and retransmission or for calculated variables.

The software enables the input from the sensors to be used in calculations and presented in a number of formats where required. Difference, Ratio, % Passage, % Rejection and, when used with a cation resin column, Inferred pH can be displayed and retransmitted (if selected).

The pH versions incorporate five choices of recognised buffers to select from; ABB, NIST, DIN, US Tech and Merck. The option to set the buffer values manually is also available.

Standard Features

All dual input versions are supplied with two fully-isolated current outputs as standard, which can be assigned to either the measured parameter, the sample temperature or the calculated variable.

Three programmable relay set points are available which can also be assigned as required.

Innovative features such as a power saving display, a diagnostic current output option and Smart software that reconfigures automatically to the correct prompts if an option card is added retrospectively, all contribute to a low cost of ownership.

Versatile Power Supply Options

The AX400 Analyzers are supplied as standard suitable for 85 to 265V AC operation. They can also be provided for 24V AC, or 12 to 30V DC, supply and recognize automatically which of the two inputs are being used.

This reduces maintenance costs significantly by negating the need for electrical safety tests to eliminate the risk of damage due to incorrect connection of the power supply.

Advanced Function Card

An advanced function card provides an additional two current outputs and two further alarm relays which can be assigned to either measured values or sample temperature.

A real-time clock and, for pH, a logbook is also included making the full-facility versions extremely powerful and versatile.

Display

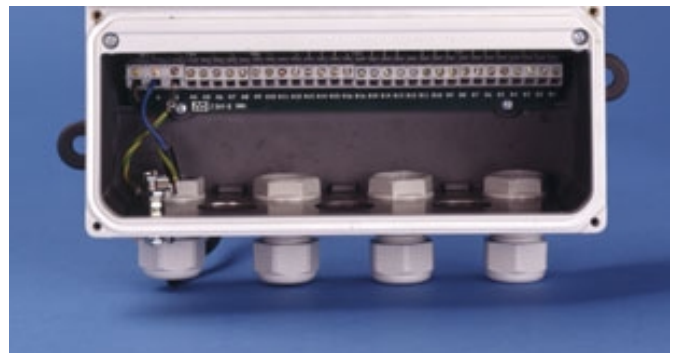
The backlit display has been designed to operate in all types of environments, to provide simultaneous readouts of both measured parameters, as well as a 16-character text giving diagnostic or computed information.



Display Showing Sample Temperature Coefficient Setting

Installation

Easy access to the terminations ensures rapid and cost-effective installation. The panel-mount version has been designed to ensure that cable connection is simple and convenient and that the IP rating of the electronic section is retained when the terminal compartment cover is removed.



AX400 Termination Chamber

Dual Input Conductivity

The AX411 version is packed with options enabling it to satisfy a wide range of applications.

It can be programmed to operate as a conventional dual input analyzer, thus reducing initial expenditure, saving space and minimizing installation costs when compared to using two, single-input analyzers.

Using the power of the processor, the two conductivity measurements being made can be used to display and transmit calculated variables:

- **Difference** (input A – input B) & **Ratio** (input A/input B) – can be selected to indicate exhaustion of cation bed resin
- **% Passage & % Rejection** – for use in Reverse Osmosis applications to indicate efficiency of the process
- **Inferred pH** – a very useful feature providing a calculated pH measurement based on the conductivity being attributable to one chemical impurity. This is checked by the first conductivity input. As an example, ammonia is commonly added to correct the pH of the water and, providing there are no other impurities present, a calculated pH can be inferred. The second conductivity input is linked to an after cation measurement with a customer-programmable alarm which is used to monitor the validity of the inferred pH value.



Dual Input Conductivity Display

UPW Temperature Compensation

The AX411 offers the user ultra-pure water temperature compensation with additional temperature compensation curves for acids, ammonia and neutral salts to enable the optimum compensation for different chemical regimes. These are all user-selectable.

USP24

The AX455 is compliant with USP24 and is supplied with all necessary documentation. It is used together with the 2278/305 stainless steel conductivity cell.

Dual Input pH

The AX466 enables two continuous measurements of pH with simultaneous local display and retransmission.

The option card, which provides additional relays and retransmission outputs, enables all pH values and sample temperatures to be retransmitted simultaneously.

Buffer Tables

A choice of preprogrammed buffer values for NIST, ABB, MERCK, DIN and US Tech are stored within the processor's memory and are user-selectable.



Combination Conductivity/pH Redox (ORP) Display

Combined pH & Conductivity

The AX416 version enables pH and conductivity to be measured in the same unit. Using the option card provides the capability to retransmit pH, conductivity and both sample temperatures. Five programmable alarms, which can be assigned to suit the needs of the application, enable even the most demanding requirements to be met.

Conductivity Sensing Systems

ABB provide the widest choice of conductivity cells and sensing systems to enable the most cost-effective solution, regardless of the application. There are designs for specific applications ranging from ultra pure water to potable water, waste water and concentrated acids solutions.

From demineralization plants to potable water; to pulp and paper and demanding process liquors; ABB has the answer.

ABB cells are precision-made and do not require time consuming calibration; they are ready to go – no fuss, no effort.

Ultra Pure and Low Conductivity

The ABB series of epoxy resin and stainless steel cells are all compatible with the AX400 Series. They have been used extensively on demineralization plants, in power stations, semiconductor and large steam raising plant for more than forty years.

Flow, screw-in dip and withdrawable cell styles provide a wide choice of system configuration.

High-accuracy, guaranteed cell constants and long operational life are key features of this highly successful series, providing accurate measurements without the need for costly manual calibration.

Epoxy Cells

This unique design has proven to be extremely reliable, very durable and, on clean water applications, virtually maintenance free.

They are available in 0.1k and 1.0k cell constants. Precision manufacture guarantees the cell constant to 1% accuracy, making them interchangeable without the need for calibration.

Furthermore, they are completely unaffected by any metal pipework to which they are connected and operate over 0 to 100°C (32 to 212°F) and 6 bar (88 lb/in.) pressure

Stainless Steel Cells

The stainless steel systems are available in screw-in, flow and withdrawable versions. Cell constants of 0.01k, 0.05k and 0.1k provide accurate performance over the range 0 to 1000 $\mu\text{S}/\text{cm}$ and operate over 0 to 100°C (32 to 212°F) and 10 bar (145 lb/in²) pressure.

For USP24 requirements, hygienic-fitting stainless steel cells with appropriate certification are available to meet this specific requirement and are fully compliant with the regulations.



Wall-mount Version

Resin Columns

To provide before-and-after cation column conductivity measurement, ABB manufactures resin columns which can be supplied as stand-alone devices, or supplied on backplates with change-over valves and two or three columns, depending on the requirement.

This technique is also used as a means of validating the inferred pH measurement.



Panel-mount Version

pH Sensors & Systems

ABB offers the widest choice of sensors and sensor systems, from a simple combination electrode to high-pressure, high-temperature sensors.

This unrivalled capability combined with the AX400 provides solutions for the most demanding applications.

AP100 Series

An established series; integrating glass reference and temperature sensors within one glass-coupled polypropylene body. Available in flow, insertion, dip and submersible configurations, this rugged sensor is used widely in the potable and waste water industries. Water-wash option for on-line cleaning reduces maintenance and improves performance on applications where coating of the glass is a problem.

There are two choices of pH glass; one for general purpose applications and the unique low resistance glass to overcome the difficulty of measurement in cold water applications. Detachable cable connections make for rapid and easy installation.

AP200 Series

Designed primarily for industrial process applications to meet the demands of high temperature, high pressure applications. The all-in-one 12mm (0.47 in.) glass sensor provides reliable long-life service in demanding solutions. The detachable cable makes replacing the sensor very easy and foolproof.

Ryton flow and dip systems are available and on-line cleaning, using water, or an acid clean, is optional.

AP300 Series

A rugged and versatile economically-priced series of sensors designed to operate in less demanding industrial process applications such as rinse waters and waste waters.

Available in Ryton and PVDF materials, they offer an economical alternative in less aggressive applications. They are supplied with an integral connection cable and adapters are available to fit them directly into pipelines.

Alternatively, they can be used as a dip system by fitting a dip tube to the threaded top of the sensor.

TB55/56/57 Series

Completing the range, the exceptional performance of this series underlines the total capability on offer from ABB.

Where other sensors fail due to the demands of the application, the TB5 series provides the answer.

High temperatures, high pressures, alkaline solutions and, where durability is key to overcoming the problem, the TB5 range provides the solution.

Retractable, flow and dip systems are available with a choice of glass-electrode formulations and, together with the unique wooden-junction reference-electrode, the TB5 Series overcomes the difficulty of pH measurement in arduous, heavy duty applications.



Comprehensive Range of pH Sensors

Specification

Conductivity

Range

Programmable 0 to 0.5 to 0 to 10000 $\mu\text{S}/\text{cm}$
(with various cell constants)

Units of measure

$\mu\text{S}/\text{cm}$, $\mu\text{S}/\text{m}$, mS/cm , mS/m , $\text{M}\Omega\text{-cm}$ and TDS

Accuracy

Better than $\pm 1\%$ of reading

Operating temperature range

-10 to 150°C (14 to 302°F)

Temperature compensation

-10 to 150°C (14 to 302°F)

Temperature coefficient

Programmable 0 to $5\%/^\circ\text{C}$ and fixed temperature compensation curves (programmable) for acids, neutral salts and ammonia

Temperature sensor

Programmable Pt100 /Pt1000

Reference Temperature

25°C (77°F)

pH /Redox (ORP)

Range

-2 to 16pH or -1200 to $+1200\text{mV}$

Minimum range

2pH span or 100mV

Resolution

0.01pH

Accuracy

0.01pH

Temperature compensation

-10 to 150°C (14 to 302°F)

Manual user-programmable

Temperature sensor

Programmable Pt100, Pt1000 & Balco $3\text{k}\Omega$

Display

Type

Dual 5-digit, 7-segment backlit LCD

Information

16-character, single line dot-matrix

Environmental Data

Operating temperature limits

-20 to 65°C (-4 to 149°F)

Storage temperature limits

-25 to 75°C (-13 to 167°F)

Operating humidity limits

Up to 95%RH non condensing

EMC

Emissions and immunity

Meets requirements of:

EN61326 (for an industrial environment)

EN50081-2

EN50082-2

Analog Retransmission

Number of signals

Two, fully-isolated outputs supplied as standard

Four, fully-isolated outputs when ordered with option card

Output current

0 to 10mA , 0 to 20mA or 4 to 20mA

Analog output programmable to any value between 0 and 22mA to indicate system failure

Accuracy

$\pm 0.25\%$ FSD, $\pm 5\%$ of reading

Resolution

0.1% at 10mA 0.05% at 20mA

Maximum load resistance

750Ω at 20mA

Configuration

Can be assigned to either measured variable or either sample temperature

Relay Outputs

Number of relays

- Three, supplied as standard
- Five, when ordered with option card

Set point adjustment

- Fully programmable

Hysteresis

- Programmable 0 to 5% in 0.1% increments

Delay

- Programmable 0 to 60s in 1s intervals

Relay contacts

- Single-pole changeover
- Rating 5A, 115/230V AC, 5A DC

Insulation

- 2kv RMS contacts to earth/ground

Power supply

Voltage requirements

- 85 to 265V AC 50/60 Hz
- 24V AC or 12 to 30V DC (optional)

Power consumption

- <10VA

Insulation

- Mains to earth (line to ground) 2kV RMS

Safety

General safety

- EN61010-1
- Overvoltage Class II on inputs and outputs
- Pollution category 2

Hazardous area approvals

- | | |
|--------------------------------------|---------|
| ATEX Type n | Pending |
| FM non-incendive Class I Division 2 | Pending |
| CSA non-incendive Class I Division 2 | Pending |

Mechanical Data

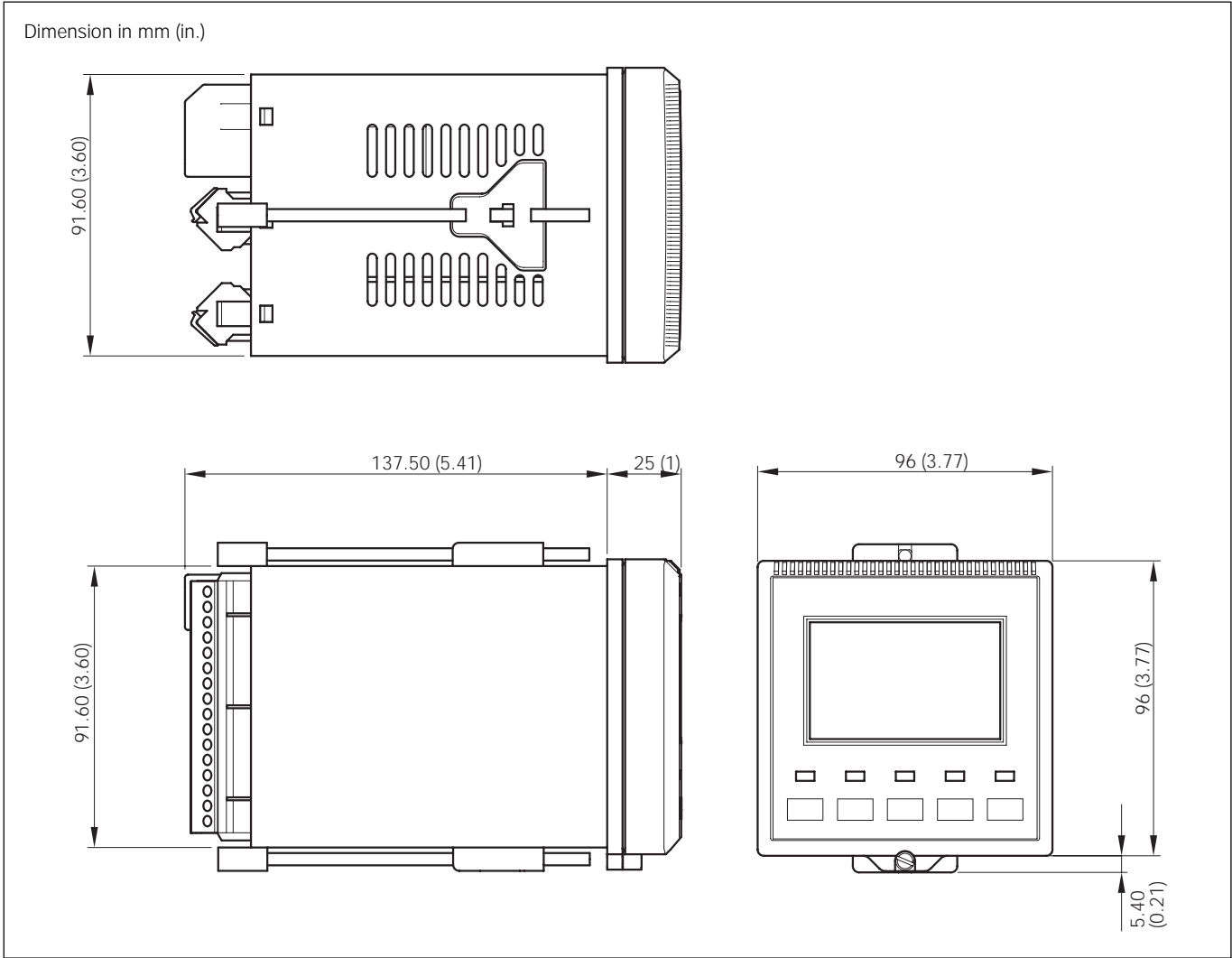
Panel-mount versions

- IP66/NEMA4X
- Dimensions 192mm high x 230mm wide x 94mm deep
(7.56 in. high x 9.06 in. wide x 3.7 in. deep)
- Weight 1kg (2.2 lb)

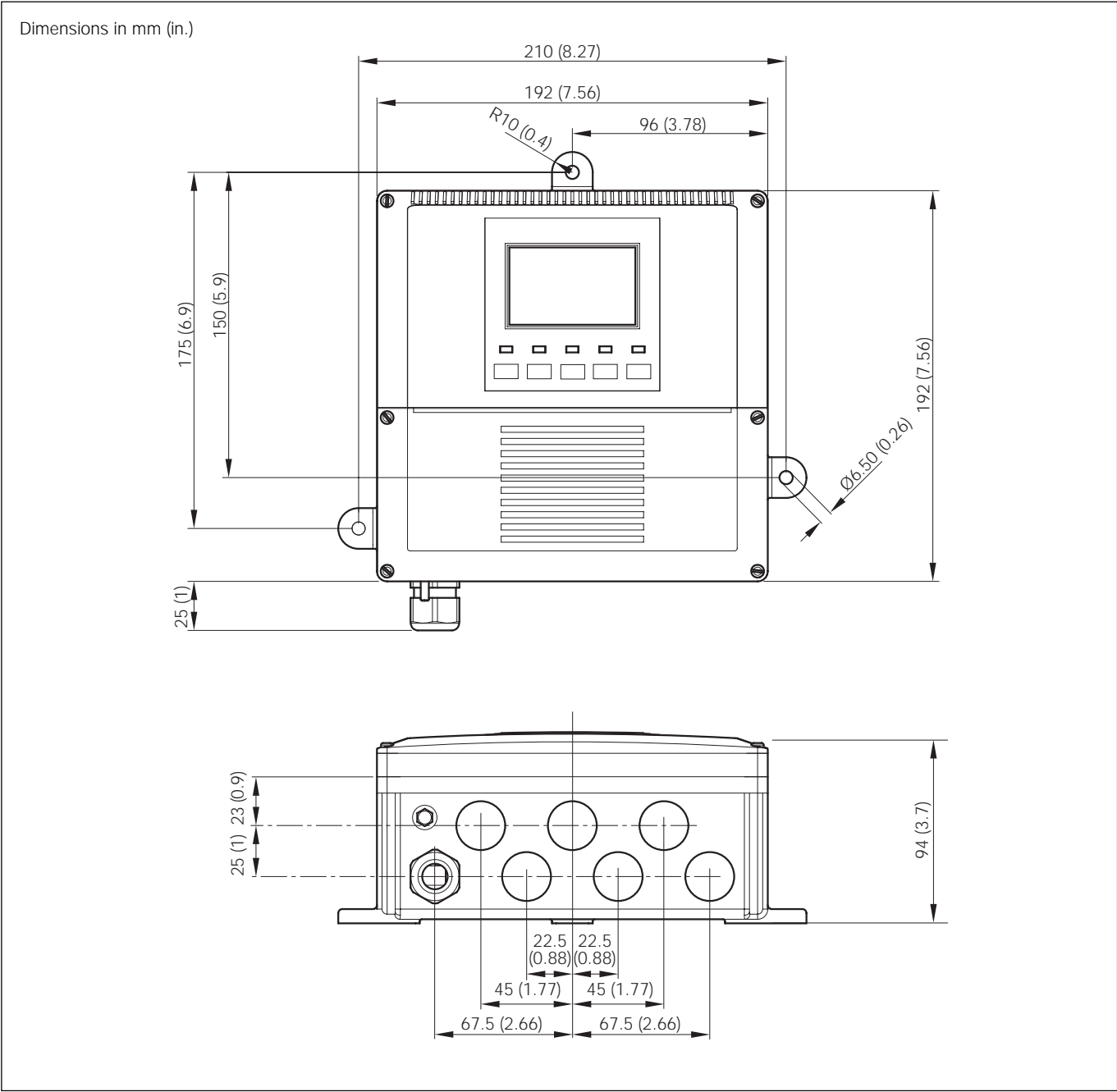
Panel-mount versions

- IP66/NEMA4X (front only)
- Dimensions 96mm x 96mm x 162mm deep
(3.78 in. x 3.78 in. x 6.38 in. deep)
- Weight 0.6kg (13.2 lb)

Overall Dimensions



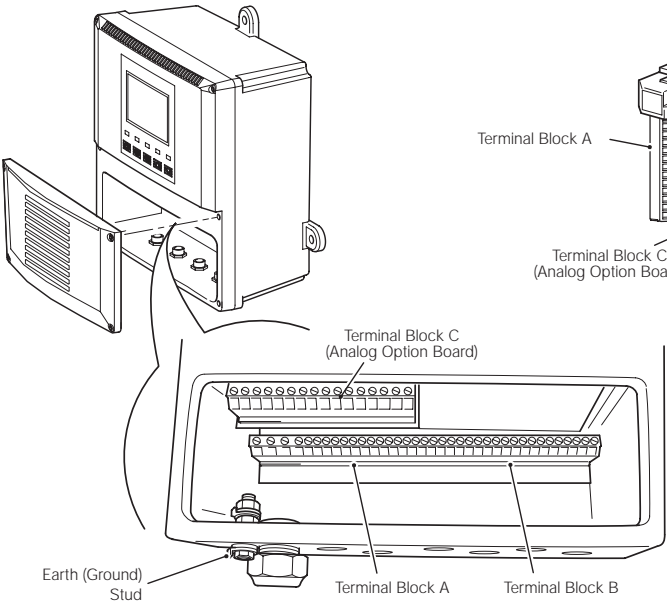
Panel-mount Version



Wall-/Pipe-mount Version

Electrical Connections

Wall-/Pipe-mount Instrument



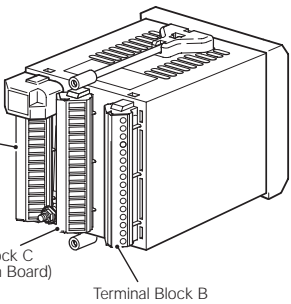
Terminal Block C (Analog Option Board)

Earth (Ground) Stud

Terminal Block A

Terminal Block B

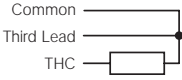
Panel-mount Instrument



Terminal Block A

Terminal Block C (Analog Option Board)

Terminal Block B



Common

Third Lead

THC

Terminal block A

	L	Live
	N	Neutral
	E	Earth
	A4	C
	A5	NC
	A6	NO
	A7	C
	A8	NC
	A9	NO
	A10	C
	A11	NC
	A12	NO
	A13	+
	A14	-
	A15	+
	A16	-

Relay 1

Relay 2

Relay 3

Analog output 1

Analog output 2

Terminal Block C (Analog Option Board)

	C1
	C2
	C3
	C4
	C5
	C6
	Earth
	C7
	C
	C8
	NC
	C9
	NO
	C10
	C
	C11
	NC
	C12
	NO
	C13
	+
	C14
	-
	C15
	+
	C16
	-

Relay 4

Relay 5

Analog output 3

Analog output 4

Terminal Block B (see table below)

	B1
	B2
	B3
	B4
	B5
	B6
	B7
	B8
	B9
	B10
	B11
	B12
	B13
	B14
	B15
	B16

Terminal Block B		Conductivity	pH/Redox (ORP) without Solution Earth	pH/Redox (ORP) with Solution Earth
Sensor B	Sensor A			
1	9	THC common, Link 1 & 2 / 9 & 10**	THC common*, Link 1 & 2 / 9 & 10**	THC common*, Link 1 & 2 / 9 & 10**
2	10	THC third lead	THC third lead*	THC third lead*
3	11	THC	THC*	THC*
4	12	Screen	N/A	Reference Electrode
5	13	Cell (Cell Electrode)	Not used	Not used
6	14	Cell (Earth Electrode)	Reference Electrode	Solution Earth†
7	15	Not used	Screen*	Screen*
8	16	Not used	Glass/Metal Electrode	Glass/Metal Electrode

*If fitted.

**When a 2-wire Pt100, Pt1000 or BALCO temperature compensator is fitted.

†Solution Earth also referred to as Ground Rod.

THC = Temperature compensator.

Ordering Information

Dual Input Analyzers for pH and Conductivity Models AX411, AX416 & AX466						AX4	X	X	X	X	X	0	X
First Process Variable (PV1)*													
Conductivity							1						
USP24 Conductivity							5						
pH/Redox (ORP)							6						
Second Process Variable (PV2)*													
Availability depends on Primary Variable													
Conductivity								1					
USP24 Conductivity								5					
pH/Redox (ORP)								6					
Enclosure Types													
European types													
Wall – cable glands fitted									1				
Wall – complete with pipe-mount bracket									2				
Panel									5				
N. American types													
Wall									6				
Pipe									7				
Panel									8				
Advanced Functions													
Basic (2 current outputs + 3 relays)										0			
Advanced (2 additional current outputs + 2 additional relays + Real-time clock)										1			
Power Supply													
85 to 265V AC 45 to 65Hz											0		
24V AC / 12 to 30V DC (auto-selection)											1		
Reserved													
Manual													
English													1
French													2
Italian													3
German													4
Spanish													5

* Conductivity must be selected for PV1 when a combined conductivity and pH/Redox (ORP) version is required.

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