

ABB MEASUREMENT & ANALYTICS | DATA SHEET

AX460, AX466 and AX416

Single and dual input analyzers
for pH/Redox (ORP)



Measurement made easy

More processing power,
higher performance

Cost effective

- select one or two pH/Redox (ORP) inputs or combine pH/Redox (ORP) and conductivity in one analyzer

Reduced installation cost

- easy access terminations; reduced panel space

High functionality at minimum cost

- three alarms and two fully isolated current outputs
- integral water / chemical sensor cleaner control
- integral PID controller (AX460)

Expanded monitoring and control

- add-on option board provides a total of five alarm relays and four current outputs
- service logbook providing historical data

On line assurance of reliability

- comprehensive sensor and instrument self-checking

Energy saving

- high visibility, backlit display with auto switch-off function

Reduced yearly maintenance costs

- 12 to 30 V DC option negates the need for costly safety tests

Wide range of applicability

- water and waste water treatment
- power, pure water
- semiconductors
- chemicals
- pharmaceuticals
- pulp & paper

Combined conductivity and pH

The AX416 version measures conductivity and pH with the same analyzer. The option board provides the capability to retransmit pH, conductivity and both sample temperatures. Five programmable alarms can be assigned to suit the needs of the application, enabling even the most demanding requirements to be met.



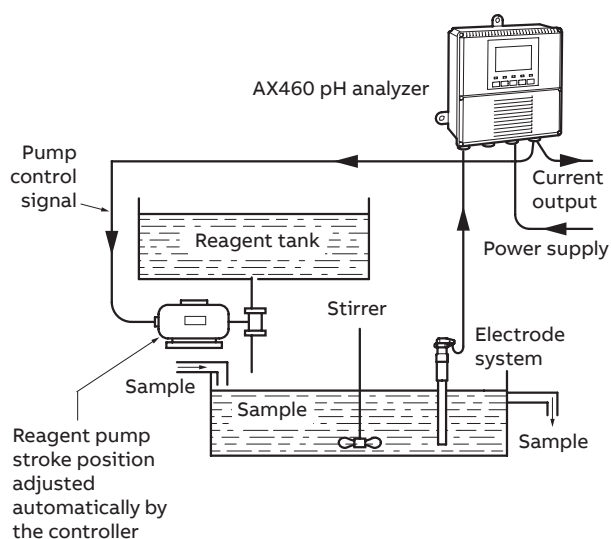
Simultaneous conductivity and pH measurement

AX460 integral P, PI and PID control

The single input AX460 analyzers incorporate three-term PID Control, offering three modes of sophisticated control: analog, pulse length (time proportional) and pulse frequency. These are supplied as standard and can be operated in direct- or reverse-acting mode, dependent upon the application.

Auto / Manual and bumpless transfer

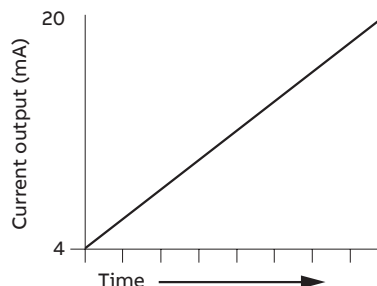
An auto / manual feature is incorporated for rapid manual access to the control functions. The controller facilitates bumpless transfer between manual and auto modes, providing the measured variable is within the proportional band and some integral action time has been programmed.



AX460 – integral P, PI, and PID control

Current output proportional control

In this case, the control signal is provided by the 4 to 20 mA output of the AX460 analyzers rather than using the alarm / control contacts. The magnitude of the current output changes in proportion to the deviation from set point. This method is used generally with motorized valves or when controlling the speed of dosing pumps with a 4 to 20 mA proportional input.

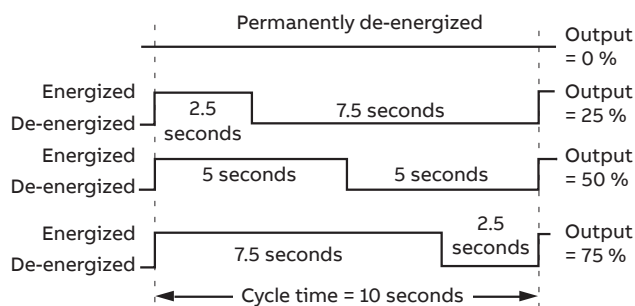


Current acting control

Time proportioning control (pulse length)

With time proportioning control, the AX460 analyzer's control signal output is in pulses, the duration of which changes in proportion to the system error. The pulses are delivered by varying the length of time that the alarm / control contact is activated.

Time proportioning control is used generally to control dosing by low-cost solenoid valves or metering pumps and is also known as pulse-length proportional or 'Mark Space' control.



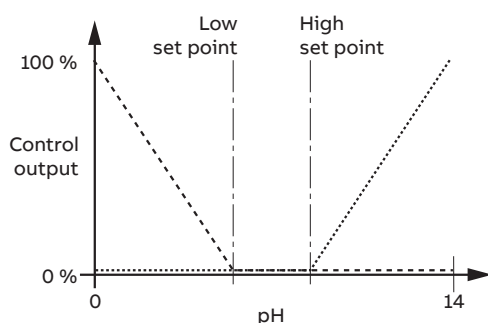
Time proportioning control

Bi-directional control

As well as single set point control for both acid and base addition, the AX460 analyzer can be configured with independent controllers.

To avoid control overlap, a minimum of 0.5 pH difference (or deadband) between the set points is essential. The difference between the set points varies depending upon the application.

Control of each set point can be configured independently as either P or PI control in this mode. The setting of proportional band or integral action can also be different for each set point.



Bi-directional control

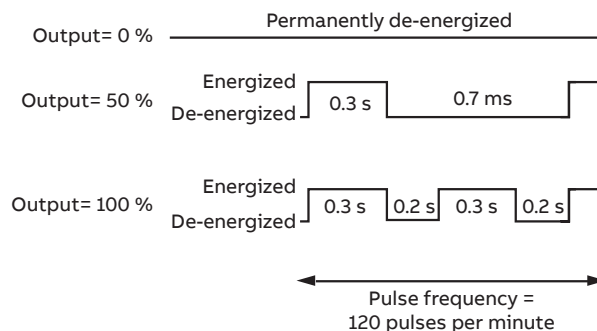
Pulse-frequency proportional control

Impulse pumps dosing chemical reagents are controlled easily by the AX460 analyzer's pulse-frequency proportional control output. In this case, the pulse length of the alarm / control contact is fixed and the frequency of the delivered pulses increases in proportion to the system error, as set by the proportional band. Diaphragm metering pumps must have a remote pulse input capability in order to utilize this function.

Pulse-frequency control in the AX460 analyzer operates by pulsing a relay on for 300ms and off for a period of time determined by the pulse frequency. The pulse frequency (PFR) is adjustable between 1 and 120 pulses per minute. The greater the difference between the measured variable and the set point the greater the pulse frequency.

Example

If the pulse frequency is set at 120 pulses per minute and the percentage output is 100 % then the pulse rate is 2 pulses per second. If the percentage output is reduced to 50 %, the pulse rate falls to one pulse per second.



Pulse-frequency proportional control

Power failure recovery

In the event of a power failure the user can configure the control mode to be Auto, Manual or Last. This optimizes control conditions on power-up to ensure rapid recovery of process control.

Specification

pH/Redox (ORP) – AX460 and AX466

Inputs

- One or two* pH or mV inputs and solution earth
- One or two* temperature sensors
- Enables connection to glass or enamel pH and reference sensors and Redox (ORP) sensors

Input resistance

- Glass $>1 \times 10^{13} \Omega$
- Reference $1 \times 10^{13} \Omega$

Range

–2 to 16 pH or –1200 to +1200 mV

Minimum span

Any 2 pH span or 100 mV

Resolution

0.01 pH

Accuracy

0.01 pH

Temperature compensation modes

- Automatic or manual Nernstian compensation
 - Range –10 to 200 °C (14 to 392 °F)
- Process solution compensation with configurable coefficient
 - Range –10 to 200 °C (14 to 392 °F)
 - adjustable –0.05 to 0.02 %/°C (–0.02 to 0.009 %/°F)

Temperature sensor

Programmable Pt100, Pt1000 or Balco 3k Ω

Calibration ranges

Check value (zero point)

0 to 14 pH

Slope

Between 40 and 105 % (low limit user configurable)

Electrode calibration modes

Calibration with auto-stability checking

- Automatic 1 or 2 point calibration selectable from:
 - ABB
 - DIN
 - Merck
 - NIST
 - US Tech
- 2 x User-defined buffer tables for manual entry, 2-point calibration or one-point process calibration

Conductivity – AX416 only

Range

Programmable 0 to 0.5 to 0 to 10,000 $\mu\text{S cm}^{-1}$ (with various cell constants)

Minimum span

10 x cell constant

Maximum span

10,000 x cell constant

Units of measure

$\mu\text{S cm}^{-1}$, $\mu\text{S m}^{-1}$, mS cm^{-1} , mS m^{-1} , $\text{M}\Omega\text{-cm}$ and TDS

Accuracy

Better than ± 0.01 % of span (0 to 100 $\mu\text{S cm}^{-1}$)

Better than ± 1 % of reading (10,000 $\mu\text{S cm}^{-1}$)

Operating temperature range

–10 to 200 °C (14 to 392 °F)

Temperature compensation

–10 to 200 °C (14 to 392 °F)

Temperature coefficient

Programmable 0 to 5 %/°C and fixed temperature compensation curves (programmable) for acids, neutral salts and ammonia

Temperature sensor

Programmable Pt100 or Pt1000

Reference temperature

25 °C (77 °F)

Display

Type

Dual 5-digit, 7-segment backlit LCD

Information

16-character, single line dot-matrix

Energy-saving function

Backlit LCD configurable as ON or Auto-Off after 60 s

Logbook**

Electronic record of major process events and calibration data

Real-time clock**

Records time for logbook and auto-manual functions

*AX466 only

**Available if option board is fitted.

Relay outputs – on/off

Number of relays

Three supplied as standard or five with option board fitted

Number of set points

Three supplied as standard or five with option board fitted

Set point adjustment

Configurable as normal or failsafe high / low or diagnostic alert

Hysteresis of reading

Programmable 0 to 5 % in 0.1 % increments

Delay

Programmable 0 to 60 s in 1 s intervals

Relay contacts

Single-pole changeover

Rating 5 A, 115 / 230 V AC, 5 A DC

Insulation

2 kV RMS contacts to earth / ground

Analog outputs

Number of current outputs (fully isolated)

Two supplied as standard or four with option board fitted

Output ranges

- 0 to 10, 0 to 20 or 4 to 20 mA
- Analog output programmable to any value between 0 and 22 mA to indicate system failure

Accuracy

± 0.25 % FSD, ± 0.5 % of reading (whichever is the greater)

Resolution

0.1 % at 10 mA, 0.05 % at 20 mA

Maximum load resistance

750 Ω at 20 mA

Configuration

Can be assigned to either measured variable or either sample temperature

Digital communications

Communications

Profibus DP (with option board fitted)

Control function – AX460 only

Controller type

P, PI, PID (configurable)

Control outputs

Output

Can be assigned a maximum of two relays, two analog outputs, or one of each

Analog

Current output control (0 to 100 %)

Time proportioning cycle time

1.0 to 300.0 s, programmable in increments of 0.1 s

Pulse frequency

1 to 120 pulses per minute, programmable in increments of 1 pulse per minute

Controller action

Reverse, direct or bi-directional (programmable)

Proportional band

0.1 to 999.9 %, programmable in increments of 0.1 %

Integral action time (Integral reset)

1 to 7200 s, programmable in increments of 1 s (0 = Off)

Derivative

0.1 to 999.9 s in increments of 0.1 s – only available for single set point control

Auto / Manual

User-programmable

Access to functions

Direct keypad access

- Measurement, maintenance, configuration, diagnostics and service functions
- Performed without external equipment or internal jumpers

Sensor cleaning function

Configurable cleaning action relay contact

- Continuous
- Pulse in 1 s on and off times

Frequency

5 minutes to 24 hours, programmable in 15 minute increments up to 1 hour then in 1 hour increments for 1 to 24 hours

Duration

15 s to 10 minutes, programmable in 15 s increments up to 1 minute then in 1 minute increments up to 10 minutes

Recovery period

30 s to 5 minutes, programmable in 30 s increments

...Specification

Mechanical data

Wall- / Pipe-mount versions

- IP65 (not evaluated under UL certification)
- Dimensions 192 mm high x 230 mm wide x 94 mm deep (7.56 in. high x 9.06 in. wide x 3.7 in. deep)
- Weight 1 kg (2.2 lb.)

Panel-mount versions

- IP65 (front only)
- Dimensions 96 mm x 96 mm x 162 mm deep (3.78 in. x 3.78 in. x 6.38 in. deep)
- Weight 0.6 kg (1.32 lb.)

Cable entry types

- | | |
|----------------|---|
| Standard | 5 or 7 x M20 cable glands |
| North American | 7 x knockouts suitable for ½ in. Hubble gland |

Power supply

Voltage requirements

- 100 to 240 V AC, 50 / 60 Hz (90 V min. to 264 V max. AC)
- 12 to 30 V DC

Power consumption

10 W

Insulation

Mains to earth (line to ground) 2 kV RMS

Environmental data

Operating temperature limits

–20 to 55 °C (–4 to 131 °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

Approvals, certification and safety

Safety approval

UL

CE mark

Covers EMC & LV Directives
(including latest version EN 61010)

General safety

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

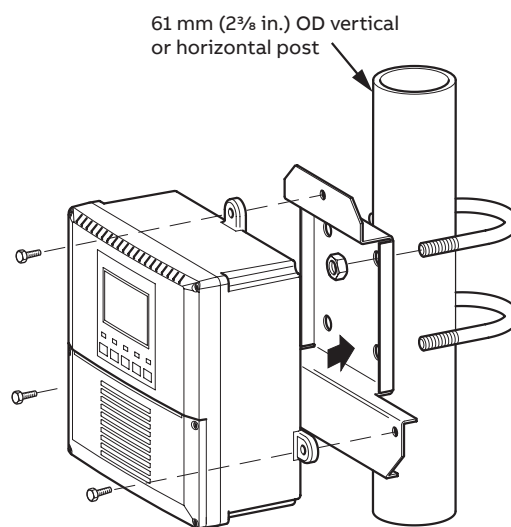
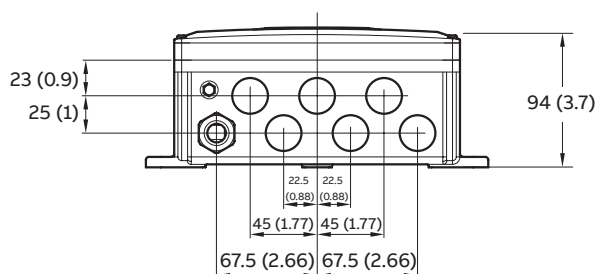
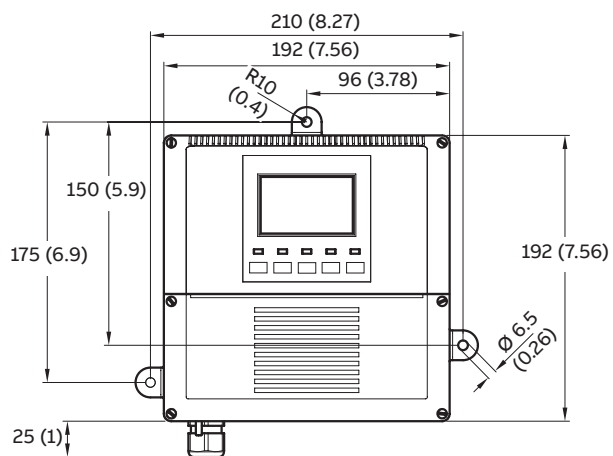
Languages

Languages configurable:

- English
- French
- German
- Italian
- Spanish

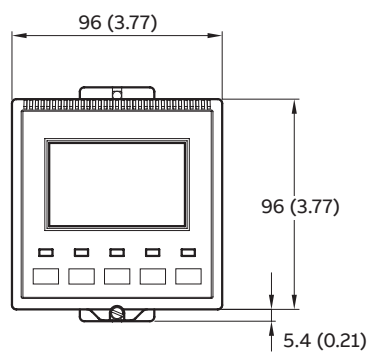
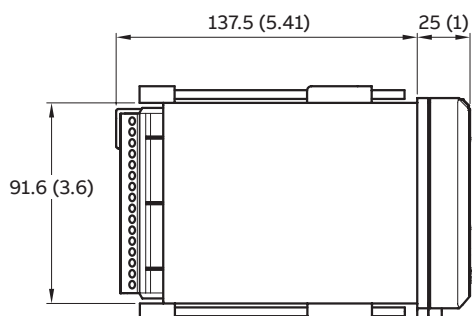
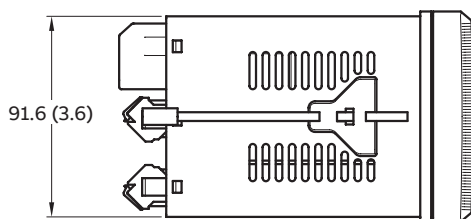
Overall dimensions

Dimensions in mm (in.)



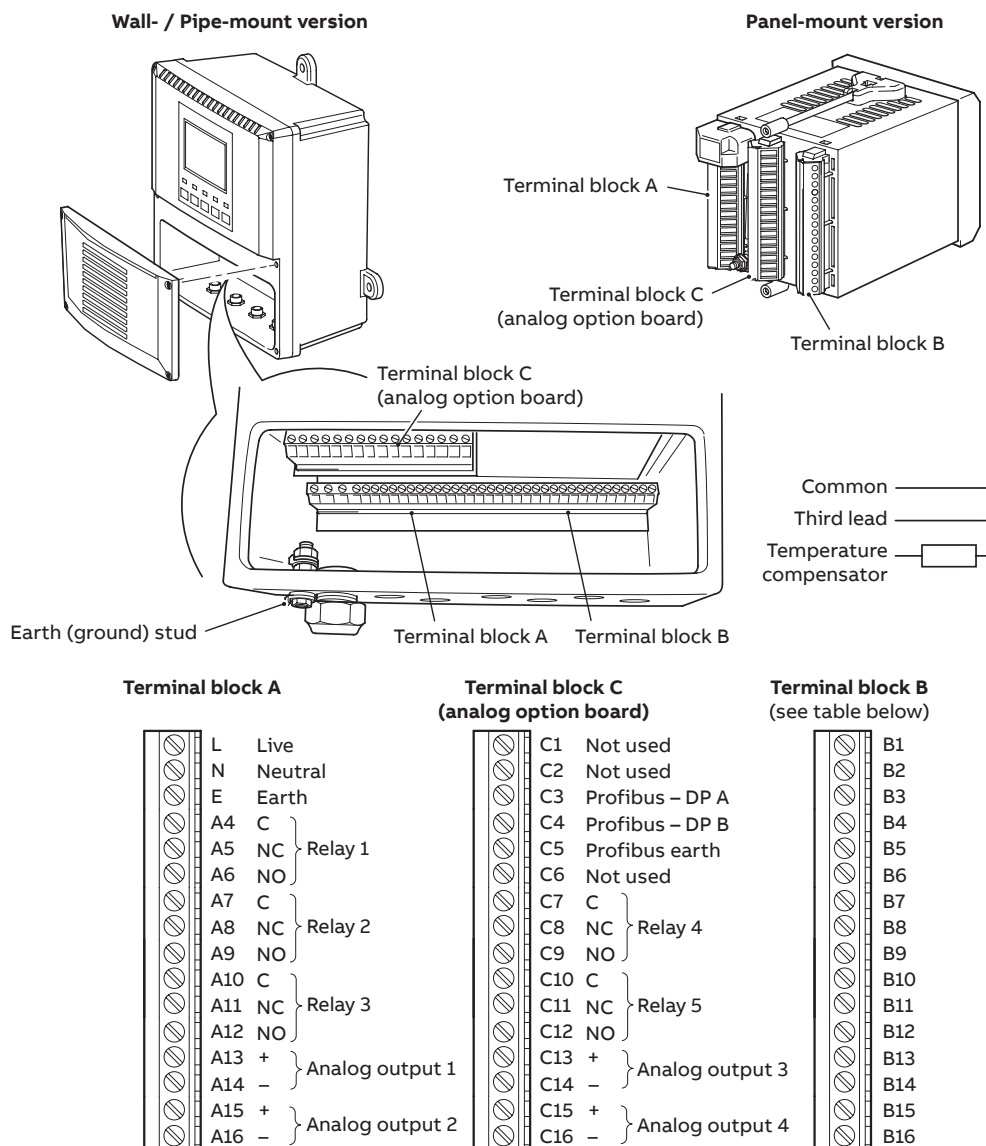
Pipe-mount detail

Wall- / Pipe-mount version



Panel-mount version

Electrical connections



Terminal block B					
Sensor B	Sensor A	pH/Redox (ORP) without solution earth‡	pH/Redox (ORP) with solution earth‡	Conductivity	
1	9	Temperature compensator common* Link 1 & 2 / 9 & 10**	Temperature compensator common* Link 1 & 2 / 9 & 10**	Temperature compensator common	Link 1 & 2 / 9 & 10**
2	10	Temperature compensator third lead*	Temperature compensator third lead*	Temperature compensator third lead	
3	11	Temperature compensator*	Temperature compensator*	Temperature compensator	
4	12	Not applicable	Reference electrode	Screen	
5	13	Not used	Not used	Cell (cell electrode)	
6	14	Reference electrode	Solution earth‡	Cell (earth electrode)	
7	15	Screen*	Screen*	Not used	
8	16	Glass / Metal electrode	Glass / Metal electrode	Not used	

*If fitted.

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

‡Solution earth also referred to as ground rod.

Ordering information

Single and dual input analyzers for pH/Redox (ORP) and conductivity models AX460, AX466 and AX416	AX4	X	X	X	X	X	0	X
First process variable (PV1)								
Conductivity 0 to 10,000 $\mu\text{S cm}^{-1}$ for 2-electrode sensors	1							
Conductivity 0 to 1,999 mS cm^{-1} for 4-electrode sensors	3							
Conductivity USP<645> for 2-electrode sensors	5							
pH/Redox (ORP)	6							
Dissolved oxygen	8							
Second process variable (PV2)*								
No second process variable – select for PID control of PV1	0							
Conductivity 0 to 10,000 $\mu\text{S cm}^{-1}$ for 2-electrode sensors	1							
Conductivity 0 to 1,999 mS cm^{-1} for 4-electrode sensors**	3							
Conductivity USP<645> for 2-electrode sensors	5							
pH/Redox (ORP)	6							
Dissolved oxygen	8							
Enclosure types								
Wall-mount IP65, general								
Wall-mount – cable glands fitted			1					
Pipe-mount			2					
Wall-mount IP65, North American								
Wall-mount			6					
Pipe-mount			7					
Panel-mount, universal								
Panel-mount**			5					
Advanced functions and communications								
Basic (2 current outputs + 3 relays)					0			
Advanced (4 current outputs + 5 relays + logbook)					1			
Profibus DP, basic (2 current outputs + 3 relays)**					2			
Profibus DP, advanced (4 current outputs + 5 relays + logbook)**					3			
Power supply								
100 to 240 V AC 50 / 60 Hz						0		
12 to 30 V DC						1		
Reserved							0	
Manual								
English								1
French								2
Italian								3
German								4
Spanish								5

* When ordering units with a second process variable (PV2) the code digit for PV2 in the order code number must be equal to, or greater than, the code digit for PV1 (for example, AX416 is permissible, AX461 is not permissible).

** Profibus DP is not available in panel-mount housing when 0 to 1,999 mS/cm is selected as the second process variable (PV2).