Pressure Sensor (Stainless Steel Diaphragm)

E8AA

Pressure Sensor of Stainless Steel Construction Is Ideal for a Wide Range of Applications

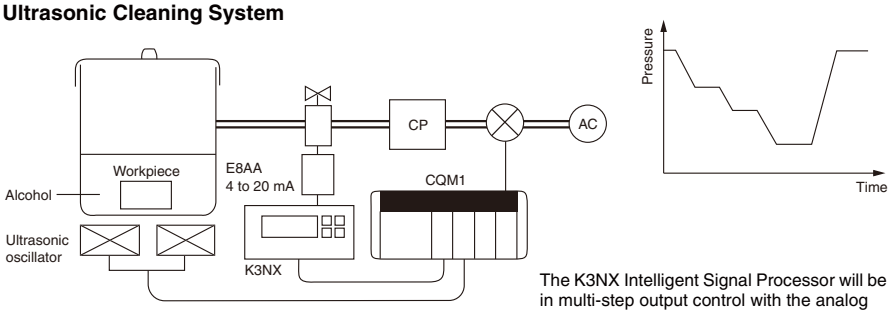
- Incorporates double diaphragms consisting of SUS316L stainless steel and silicone diaphragms that are applicable to a variety of gases and liquids.
- Two models with different pressure sensing ranges: 0 to 500 kPa and 0 to 1 MPa.
- Linear output from 4 to 20 mA with excellent linearity.
- IEC IP66 degree of protection: Washable with water.

⚠ Be sure to read *Safety Precautions* on page 4.

Application Examples

- **Semiconductor Manufacturing Equipment:** Pressure monitoring and control
- **Automatic Assembly Equipment:** Pneumatic pressure control
- **Robots:** Pneumatic pressure control
- **Production Lines:** Pneumatic pressure control
- **Industrial Material Pneumatic Transportation Systems**
- **Pressure Tank:** Pressure control
- **Tank Level Control**

Ultrasonic Cleaning System



The K3NX Intelligent Signal Processor will be in multi-step output control with the analog output of the E8AA and then the peripheral devices will be in multi-step feedback control with the CQM1 Programmable Controller.

Ordering Information

Pressure range	Output configuration	Model
0 to 500 kPa	Linear output (4 to 20 mA)	**E8AA-M05**
0 to 1 MPa		**E8AA-M10**

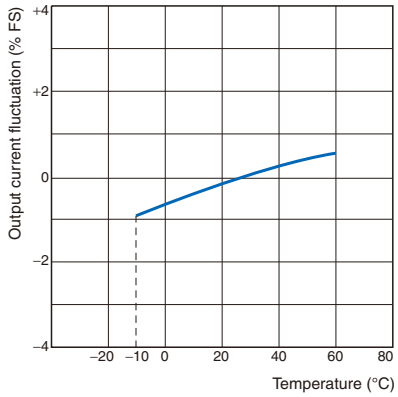
Ratings and Specifications

Item	Model	E8AA-M05	E8AA-M10
Power supply voltage		12 to 24 VDC ±10%, ripple (p-p): 5% max.	
Current consumption		40 mA max. (standard value including 20-mA output current) at rated pressure	
Pressure type		Gauge pressure	
Pressure range		0 to 500 kPa	0 to 1 MPa
Withstand pressure		980 kPa	2 MPa
Applicable material		Non-corrosive gasses, non-corrosive liquids, inert gasses	
Accuracy (linear output)		±1% FS max. with a resistive load of 150 Ω at 23°C	
Hysteresis (linear output)		±0.5% FS max.	
Linearity (linear output)		±1% FS max.	
Response time		100 ms max.	
Linear output		4 to 20 mA with a permissible resistive load of 300 Ω max.	
Ambient temperature		Operating: −10°C to 60°C (with no icing) Storage: −25°C to 70°C (with no icing)	
Ambient humidity		Operating/Storage: 35% to 95% (with no condensation)	
Temperature influence		±0.09% FS/°C max. between −10°C and 60°C	
Voltage influence		Max. output current fluctuation of ±0.5% FS at 12 VDC ±10% or 24 VDC ±10% with a ripple of 5%	
Insulation resistance		100 MΩ min. (at 500 VDC) between current carry parts and case	
Dielectric strength		1,000 VAC, 1 min	
Vibration resistance		Destruction: 10 to 500 Hz, 1.5-mm double amplitude or 100 m/s^2 for 2 hours each in X, Y, and Z directions	
Shock resistance		Destruction: 1,000 m/s^2 3 times each in X, Y, and Z directions.	
Degree of protection		IEC 60529 IP66 (excluding end of cable)	
Pressure inlet		R(PT)1/4	
Connection method		Pre-wired (standard cable length: 2 m)	
Weight (packed state)		Approx. 250 g	
Material	Pressure port and casing	SUS316	
	Diaphragm	SUS316L	
	O-ring	Fluorocarbon rubber	
Accessories		Protective cap, instruction manual	

Engineering Data (Typical)

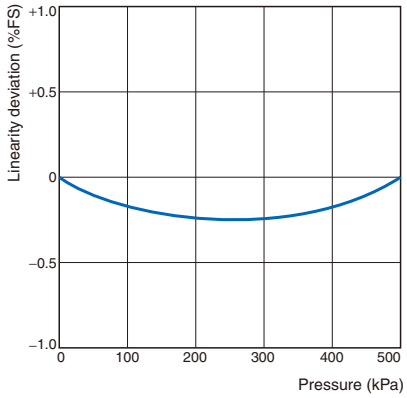
Output Current Fluctuation vs. Temperature

E8AA-M10



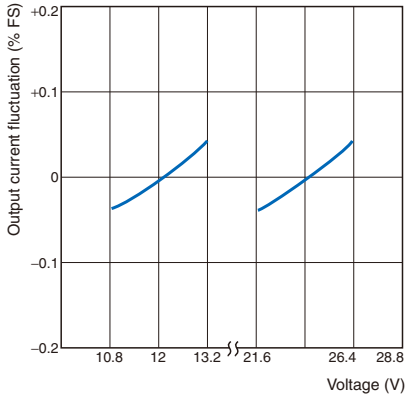
Linearity

E8AA-M05



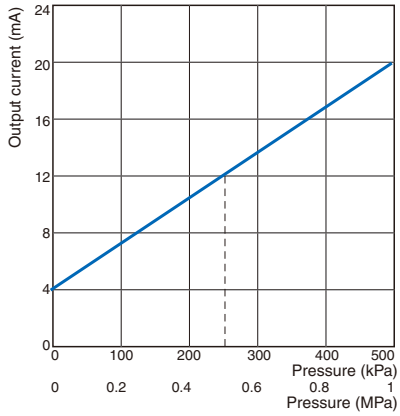
Output Current Fluctuation vs. Voltage

E8AA-M10



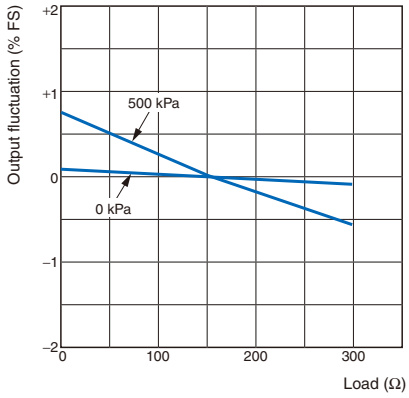
Output Current vs. Pressure

E8AA-M05 (E8AA-M10)

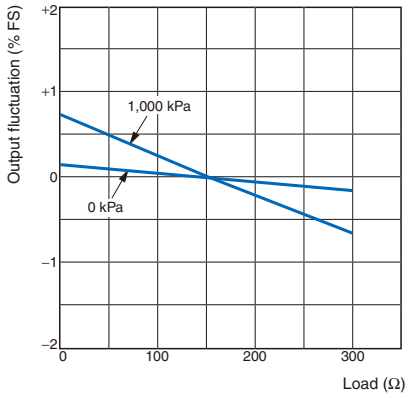


Output Current vs. Load

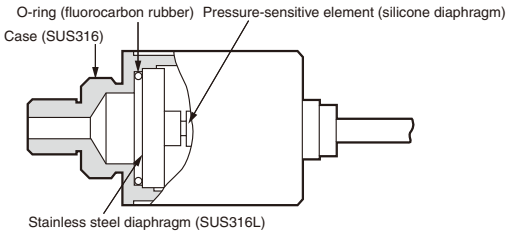
E8AA-M05



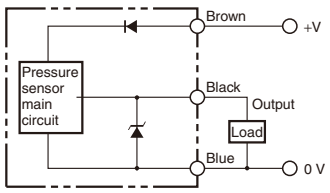
E8AA-M10



Nomenclature



I/O Circuit Diagram



Safety Precautions

⚠ WARNING

This product is not designed or rated for ensuring safety of persons. Do not use it for such purposes.

Precautions for Correct Use

Do not use the product in atmospheres or environments that exceed product ratings.

Mounting

- The cable is in a hollow pipe in order to keep the pressure inside the Sensor the same as the atmospheric pressure. If the pipe is clogged, the accuracy of the Sensor may be lowered.
- Do not bend or impose a heavy weight on the output cable.
- Make sure that the tip of the output cable is open and not clogged with dust or water.
- If the diaphragms are damaged, the Unit will not operate properly. Do not insert a screwdriver or steel wire into the interior of the pressure-sensitive parts.
- The characteristics of the Unit will change if foreign material is stuck to the stainless steel diaphragm.
- The mounting screw for the pressure inlet is a PT1/4 taper screw. Do not use any other type of screw.
- Apply sealing tape to the PT1/4 screw part so that there will be no pressure leakage.
- The most suitable wrench is 22 mm in size.
- Do not apply a tightening torque higher than 49 N·m.
- Do not use the E8AA for applications in which the E8AA comes into direct contact with medical or food products.

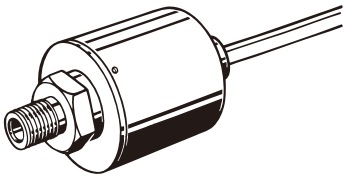
Wiring

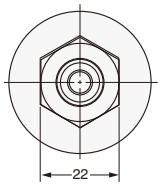
- If it is necessary to cut the output cable, make sure that the tip of the hollow pipe is not clogged.

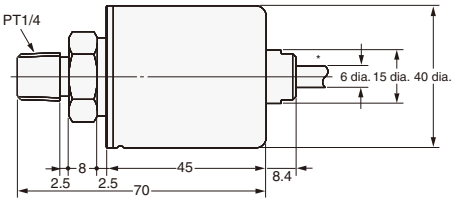
Dimensions

(Unit: mm)

E8AA-M05
E8AA-M10





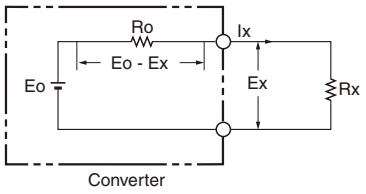


* 6-dia. vinyl-insulated round cable (in hollow pipe) with 3 conductors,
(Conductor cross-section: 0.3 mm^2, Insulator diameter: 1.5 mm); Standard length: 2 m

Output Impedance

1. Measuring the Output Impedance of Voltage Output Models

Figure 1



Ro : Output impedance
Rx : Load resistance
Eo : Output voltage (terminals open)
Ex : Output voltage (with load Zx connected)
Ix : Load current (with load Zx connected)

In Figure 1, the current (Ix) that flows when the load resistance (Rx) is connected is calculated as follows:

$$Ix = \frac{Ex}{Rx} = \frac{Eo - Ex}{R0} \quad \text{.....(1)}$$

The output impedance (Ro) in Equation (1) is calculated as follows:

$$Ro = Rx \left(\frac{Eo - Ex}{Ex} \right) \text{.....(2)}$$

The voltage (Eo) is measured when the output is open, followed by the voltage (Ex) when a load resistance (for example, the minimum value of the permitted load resistance of a transducer) is connected. The measured values Eo and Ex and the connected load resistance (Rx) are inserted into Equation 2 to calculate the output impedance (Ro) of the transducer.

2. Measuring the Output Impedance of Current Output Models

In Figure 2, the voltage (Ex) of the output terminals when the load resistance (Rx) is connected is calculated as follows:

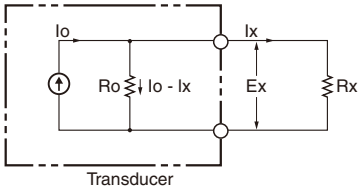
$$Ex = IxRx = (Io - Ix)\,Ro \quad \text{.....(3)}$$

The output impedance in Equation (3) is calculated as follows:

$$Ro = Rx \left(\frac{Ix}{Io - Ix} \right) \text{.....(4)}$$

Here, the current (Io) is measured with the output short-circuited.

Figure 2



Ro : Output impedance
Rx : Load resistance
Io : Output current (output terminal short-circuited)
Ix : Output current (with load Rx connected)
Ex : Output voltage (with load Rx connected)

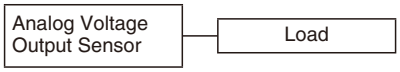
Next, the output current (Ix) is measured when a load resistance (for example, the maximum value of the permitted load resistance of a transducer) is connected. The measured values Io and Ix and the value of the connected load resistance (Rx) are inserted into Equation 4, and the output impedance (Ro) of the transducer is calculated. The output impedance of the transducer introduced here is the value for normal operation.

3. Desirable Output Impedance

In general, it is best to make the output impedance of a voltage output transducer as small as possible, i.e., as close to 0 W as possible, to minimize the effects of load fluctuations on the transducer.
For a current output transducer, the opposite is true: the higher the impedance (the closer to infinite impedance), the better.

4. Example of Calculation Using Impedance

$$\text{Error in analog voltage output} = \left(1 - \frac{Rx}{Ro + Rx} \right) \times 100\%$$



Ro = 100Ω Rx =1 kΩ or higher

Rx	Error
1kΩ	Approximately 10%
10Ω	Approximately 1%

General Precautions

For precautions on individual products, refer to the *Safety Precautions* in the individual product information.

⚠ WARNING

These products cannot be used in safety devices for presses or other safety devices used to protect human life. These products are designed for use in applications for sensing workpieces and workers that do not affect safety.

Precautions for Safe Use

Withstand Pressure

Do not apply a pressure higher than the rated withstand pressure. Applying a pressure higher than this may cause damage.

Operating Environment

Do not use the products in an environment where there are explosive or inflammable gases.

Power Supply Voltage

Do not use a voltage that exceeds the power supply voltage range. Using a voltage that exceeds the range may cause burning.

Load Short-circuiting

Do not short-circuit the load. Doing so may cause explosion or burning.

Incorrect Wiring

Be sure that the power supply polarity and other wiring is correct. Incorrect wiring may cause explosion or burning.

Precautions for Correct Use

- When using a Sensor that supports non-corrosive gas as the applicable fluid, use an air filter to remove moisture and oil from the gas.
- Do not insert any wire or other object into the pressure port. Doing so may damage the pressure elements and cause a malfunction.
- Do not use the Sensor alongside high-voltage lines or power lines.
- Mount the Sensor so that it is not subject to ultrasonic vibration.
- Do not apply a tensile force higher than 30 N to the cable or connector.
- The cable can be extended to a maximum of 10 m. For details, see the output impedance section on the previous page.

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