

## AccuProx Analog Sensors



## AccuProx Analog Sensors

## Product Description

The AccuProx from Eaton's Electrical Sector is a high performance analog inductive proximity sensor. The AccuProx family of analog sensors provide unmatched sensing range, linearity and resolution in an affordable and compact tubular package.

Unlike standard inductive sensors, which send an open or close signal upon target presence or absence, AccuProx analog sensors provide an electrical signal that varies in proportion to the position of the metal target within its sensing range. This makes AccuProx ideal for applications requiring precise position sensing and measurement.

The sensing performance of AccuProx sets it apart from traditional analog inductive designs. Utilizing components from the cutting-edge iProx family, AccuProx provides sensing ranges of three to four times that of typical tubular analog inductive sensors—all without compromising accuracy.

Unlike many competitive products, which are often hampered by an "S-shaped" output curve, AccuProx outputs are linear.

AccuProx has the range and precision to solve your most difficult measurement applications.

## Application Description

## Typical Applications

- Part positioning
- Distance, size and thickness measurement
- General inspection and error proofing, such as material imperfection or blemish detection
- Eccentricity or absolute angle detection
- Identification of different metals

See the Application Guide on **Page V8-T3-46** for more detail.

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## Description

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## Features

- Extended linear sensing range of up to 25 millimeters—three times longer than standard tubular analog inductive sensors
- Outputs available in current (4–20 or 0–20 mA) and voltage (0–10V)
- High output resolution and repeatability for applications requiring precision sensing performance
- Robust stainless steel barrel, shock-resistant front cap, polycarbonate end bell and impact-absorbing potting compound
- Ideal for extreme temperature or high pressure washdown environments
- High noise immunity of 20V/m prevents many problems associated with electrical noise

## Standards and Certifications

- cUL Listed
- CE



**⚠ DANGER**

**THIS SENSOR IS NOT A SAFETY DEVICE AND IS NOT INTENDED TO BE USED AS A SAFETY DEVICE. This sensor is designed only to detect and read certain data in an electronic manner and perform no use apart from that, specifically no safety-related use. This sensor product does not include self-checking redundant circuitry, and the failure of this sensor product could cause either an energized or de-energized output condition, which could result in death, serious bodily injury, or property damage.**

For the most current information on this product, visit our Web site: [www.eaton.com](http://www.eaton.com)

For Customer Service in the U.S. call 1-877-ETN CARE (386-2273), in Canada call 1-800-268-3578.  
For Application Assistance in the U.S. and Canada call 1-800-426-9184.

## Application Guide

### Presenting AccuProx— Unmatched Analog Range in a Proven Package

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Historically, analog sensors have been limited by very short sensing ranges—as little as one or two millimeters. By utilizing technology first perfected in the iProx family of digital inductive sensors, AccuProx can sense objects as far as 25 millimeters. This extended range can be achieved without making compromises often found in competitive products, such as reduced output accuracy.

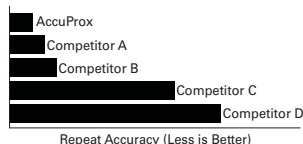
AccuProx utilizes many of the proven materials found in other tubular sensor families. The threaded barrel and included mounting nuts are made of stainless steel, which exhibits superior corrosion and abrasion resistance versus nickel-plated brass. AccuProx also features a proprietary internal potting compound that absorbs impacts and vibration while sealing out moisture. The materials used in the construction of AccuProx are time-tested and proven to work.

### High Output Accuracy

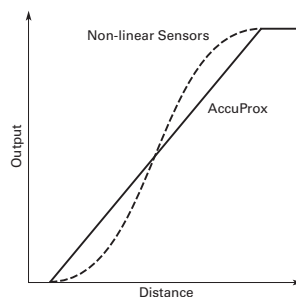
Analog inductive sensors are often used in applications that require a higher level of precision than a standard digital sensor. For example, applications such as part inspection require a sensor that can detect very small variances. AccuProx has been designed with these applications in mind.

Output accuracy is determined by the repeat accuracy, linearity, resolution and response time of the sensor.

Repeat accuracy refers to the variations in sensing distance between successive sensor operations due to component tolerances, where all operating conditions are kept the same. The repeat accuracy of an 18 millimeter, unshielded AccuProx sensor is less than 20 micrometers. See the chart below for a repeat accuracy comparison of AccuProx versus the competition.



Linearity refers to the shape of the output curve. Many competitive analog sensors exhibit a wavy or “S-shaped” output curve. This means that a change in target distance may not always translate into an equivalent change in output, particularly at the innermost and outermost ranges of a non-linear analog sensor. AccuProx features a linear output. See the diagram below for an example of AccuProx versus a non-linear competitive offering.

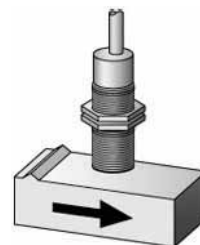


Resolution refers to the number of “steps” in the sensor output. A higher resolution is ideal because it will allow the sensor to detect smaller changes in target position.

An 18 millimeter, unshielded AccuProx features more than 350 output steps, ensuring consistent performance.

### Typical Analog Applications

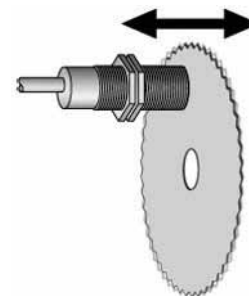
#### Material Imperfection or Blemish Detection



#### Eccentricity or Absolute Angle Detection






#### Saw Blade Deflection



## Product Selection




## AccuProx Analog Sensors

## Three-/Four-Wire Sensors

	Operating Voltage	Sensing Range <sup>①</sup>	Shielding	Connection Type	Current (0–20 mA) and Voltage (0–10V) Output <sup>②</sup> Catalog Number	Current (4–20 mA) Output Only <sup>②</sup> Catalog Number
<b>12 mm</b> 	<b>12 mm Diameter</b>					
	15–30 Vdc	0.5–4 mm	Shielded	4-pin micro DC connector	<b>E59-A12A104D01-CV</b> ☼	<b>E59-A12A104D01-C1</b> ☼
				4-pin micro DC pigtail	<b>E59-A12A104D01P-CV</b> ☼	<b>E59-A12A104D01P-C1</b> ☼
				2-meter cable	<b>E59-A12A104C02-CV</b>	<b>E59-A12A104C02-C1</b>
		1–8 mm	Unshielded	4-pin micro DC connector	<b>E59-A12C108D01-CV</b> ☼	<b>E59-A12C108D01-C1</b> ☼
				4-pin micro DC pigtail	<b>E59-A12C108D01P-CV</b> ☼	<b>E59-A12C108D01P-C1</b> ☼
				2-meter cable	<b>E59-A12C108C02-CV</b>	<b>E59-A12C108C02-C1</b>
<b>18 mm</b> 	<b>18 mm Diameter</b>					
	15–30 Vdc	1–7 mm	Shielded	4-pin micro DC connector	<b>E59-A18A107D01-CV</b> ☼	<b>E59-A18A107D01-C1</b> ☼
				4-pin micro DC pigtail	<b>E59-A18A107D01P-CV</b> ☼	<b>E59-A18A107D01P-C1</b> ☼
				2-meter cable	<b>E59-A18A107C02-CV</b>	<b>E59-A18A107C02-C1</b>
		1–15 mm	Unshielded	4-pin micro DC connector	<b>E59-A18C115D01-CV</b> ☼	<b>E59-A18C115D01-C1</b> ☼
				4-pin micro DC pigtail	<b>E59-A18C115D01P-CV</b> ☼	<b>E59-A18C115D01P-C1</b> ☼
				2-meter cable	<b>E59-A18C115C02-CV</b>	<b>E59-A18C115C02-C1</b>
<b>30 mm</b> 	<b>30 mm Diameter</b>					
	15–30 Vdc	1–12 mm	Shielded	4-pin micro DC connector	<b>E59-A30A112D01-CV</b> ☼	<b>E59-A30A112D01-C1</b> ☼
				4-pin micro DC pigtail	<b>E59-A30A112D01P-CV</b> ☼	<b>E59-A30A112D01P-C1</b> ☼
				2-meter cable	<b>E59-A30A112C02-CV</b>	<b>E59-A30A112C02-C1</b>
		1–25 mm	Unshielded	4-pin micro DC connector	<b>E59-A30C125D01-CV</b> ☼	<b>E59-A30C125D01-C1</b> ☼
				4-pin micro DC pigtail	<b>E59-A30C125D01P-CV</b> ☼	<b>E59-A30C125D01P-C1</b> ☼
				2-meter cable	<b>E59-A30C125C02-CV</b>	<b>E59-A30C125C02-C1</b>

## Compatible Connector Cables

## Standard Cables ③

	Voltage Style	Number of Pins	Gauge	Length	Pin Configuration/Wire Colors (Face View Female Shown)	PVC Jacket Catalog Number	PUR Jacket Catalog Number
<b>Micro-Style Straight Female</b> 	<b>Micro-Style, Straight Female</b>						
	DC	4-pin, 3-wire	22 AWG	6.0 ft (2m)	 1-Brown 2-No Wire 3-Blue 4-Black	<b>CSDS4A3CY2202</b>	<b>CSDS4A3RY2202</b>
	DC	4-pin, 4-wire	22 AWG	6.0 ft (2m)	 1-Brown 2-White 3-Blue 4-Black	<b>CSDS4A4CY2202</b>	<b>CSDS4A4RY2202</b>

## Notes

☼ See listing of compatible connector cables above.

① Published range data is based on a 1 mm thick square target made of Type FE 360 steel per ISO Standard 630.

② Models available in custom output configurations (for example, 1–5V, 0–5V). Contact factory for details.

③ For a full selection of connector cables, see **Tab 10, section 10.1**.

## Technical Data and Specifications

## AccuProx Analog Sensors

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Description	12 mm Models		18 mm Models		30 mm Models	
	Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded
<b>Performance</b>						
Analog operating range <sup>①</sup>	0.5–4 mm	1–8 mm	1–7 mm	1–15 mm	1–12 mm	1–25 mm
Temperature range	–40° to 158°F (–40° to 70°C)	–40° to 158°F (–40° to 70°C)	–40° to 158°F (–40° to 70°C)	–40° to 158°F (–40° to 70°C)	–40° to 158°F (–40° to 70°C)	–40° to 158°F (–40° to 70°C)
Temperature drift	≤± 10%	≤± 10%	≤± 10%	≤± 10%	≤± 10%	≤± 10%
Conformity	≤± 10%	≤± 10%	≤± 10%	≤± 10%	≤± 10%	≤± 10%
Repeat accuracy	<25 µm <sup>②</sup>	<20 µm <sup>②</sup>	<40 µm <sup>②</sup>	<20 µm <sup>②</sup>	<50 µm <sup>②</sup>	<30 µm <sup>②</sup>
Minimum repeat accuracy	<3.0% at max. range	<1.1% at max. range	<2.2% at max. range	<1.2% at max. range	<1.2% at max. range	<0.8% at max. range
Recovery time	<1.0 ms	<1.1 ms	<1.5 ms	<2.0 ms	<2.0 ms	<3.0 ms
Response time	200 Hz	100 Hz	200 Hz	100 Hz	140 Hz	100 Hz
Linearity tolerance	≤± 1.0% of full scale	≤± 1.0% of full scale	≤± 1.0% of full scale	≤± 1.0% of full scale	≤± 1.0% of full scale	≤± 1.0% of full scale
Resolution	23 µm max.	16 µm max.	40 µm max.	21 µm max.	50 µm max.	30 µm max.
<b>Electrical</b>						
Style	AccuProx Analog, three-/four-wire DC	AccuProx Analog, three-/four-wire DC	AccuProx Analog, three-/four-wire DC	AccuProx Analog, three-/four-wire DC	AccuProx Analog, three-/four-wire DC	AccuProx Analog, three-/four-wire DC
Operating voltage	15–30 Vdc	15–30 Vdc	15–30 Vdc	15–30 Vdc	15–30 Vdc	15–30 Vdc
Current output signal	0–20 mA or 4–20 mA by model	0–20 mA or 4–20 mA by model	0–20 mA or 4–20 mA by model	0–20 mA or 4–20 mA by model	0–20 mA or 4–20 mA by model	0–20 mA or 4–20 mA by model
Current output load resistance	400–500 ohms	400–500 ohms	400–500 ohms	400–500 ohms	400–500 ohms	400–500 ohms
Current output ripple content	± 40 µA max.	± 40 µA max.	± 40 µA max.	± 40 µA max.	± 40 µA max.	± 40 µA max.
Current output minimum change	30 µA	20 µA	50 µA	28 µA	66 µA	40 µA
Voltage output signal <sup>③</sup>	0–10V	0–10V	0–10V	0–10V	0–10V	0–10V
Voltage output load resistance	4.7–5.0 kohm (2.5 mA max.)	4.7–5.0 kohm (2.5 mA max.)	4.7–5.0 kohm (2.5 mA max.)	4.7–5.0 kohm (2.5 mA max.)	4.7–5.0 kohm (2.5 mA max.)	4.7–5.0 kohm (2.5 mA max.)
Voltage output ripple content	± 10 mV max.	± 10 mV max.	± 10 mV max.	± 10 mV max.	± 10 mV max.	± 10 mV max.
Voltage output minimum change	15 mV	10 mV	25 mV	14 mV	33 mV	20 mV
Burden current	<20 mA	<20 mA	<20 mA	<20 mA	<20 mA	<20 mA
Output LED	Dual-color, 360° viewable	Dual-color, 360° viewable	Dual-color, 360° viewable	Dual-color, 360° viewable	Dual-color, 360° viewable	Dual-color, 360° viewable
Short circuit protection	Incorporated <sup>④</sup>	Incorporated <sup>④</sup>	Incorporated <sup>④</sup>	Incorporated <sup>④</sup>	Incorporated <sup>④</sup>	Incorporated <sup>④</sup>
Wire breakage protection	Incorporated	Incorporated	Incorporated	Incorporated	Incorporated	Incorporated
Reverse polarity protection	Incorporated	Incorporated	Incorporated	Incorporated	Incorporated	Incorporated
<b>Physical</b>						
Size	See Dimensions on <b>Page V8-T3-50</b> .					
Enclosure protection	NEMA 4, 4X, 6, 6P, 13	NEMA 4, 4X, 6, 6P, 13	NEMA 4, 4X, 6, 6P, 13	NEMA 4, 4X, 6, 6P, 13	NEMA 4, 4X, 6, 6P, 13	NEMA 4, 4X, 6, 6P, 13
Shock	30g half-sine at 11 ms	30g half-sine at 11 ms	30g half-sine at 11 ms	30g half-sine at 11 ms	30g half-sine at 11 ms	30g half-sine at 11 ms
Vibration	10–55 Hz, 1 mm amplitude	10–55 Hz, 1 mm amplitude	10–55 Hz, 1 mm amplitude	10–55 Hz, 1 mm amplitude	10–55 Hz, 1 mm amplitude	10–55 Hz, 1 mm amplitude
Housing material	Stainless steel, polycarbonate end bell, polyphenylene sulfide front cap	Stainless steel, polycarbonate end bell, polyphenylene sulfide front cap	Stainless steel, polycarbonate end bell, polyphenylene sulfide front cap	Stainless steel, polycarbonate end bell, polyphenylene sulfide front cap	Stainless steel, polycarbonate end bell, polyphenylene sulfide front cap	Stainless steel, polycarbonate end bell, polyphenylene sulfide front cap
Termination	Micro-connector, potted cable, 2m; Pigtail, micro-connector, 2m	Micro-connector, potted cable, 2m; Pigtail, micro-connector, 2m	Micro-connector, potted cable, 2m; Pigtail, micro-connector, 2m	Micro-connector, potted cable, 2m; Pigtail, micro-connector, 2m	Micro-connector, potted cable, 2m; Pigtail, micro-connector, 2m	Micro-connector, potted cable, 2m; Pigtail, micro-connector, 2m

## Notes

① Published range data is based on a 1 mm thick square target made of Type FE 360 steel per ISO Standard 630.

② The sensor achieves its maximum repeat accuracy after warming up for a period of at least one hour.

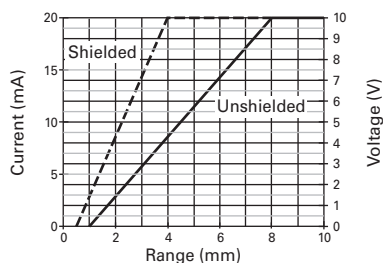
③ Voltage outputs available on models ending in **-CV**.

④ Continuous short-circuits can exceed power dissipation ratings and cause eventual destruction.

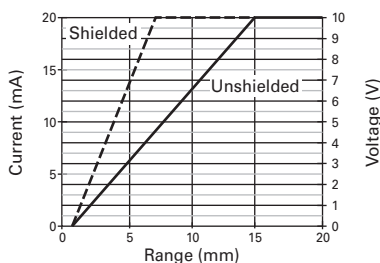
### AccuProx Analog Performance Graphs

#### Linear Output

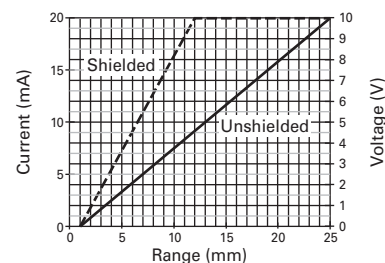
##### 12 mm



##### 18 mm

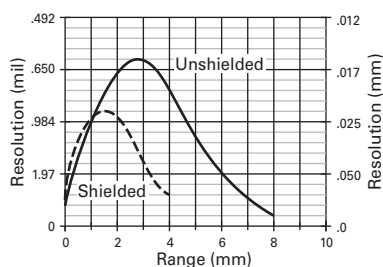


##### 30 mm

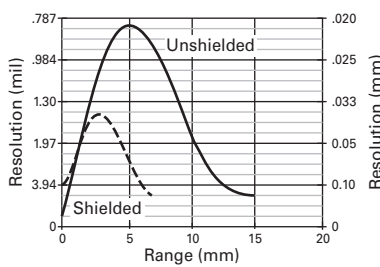


#### Measurement Resolution <sup>①</sup>

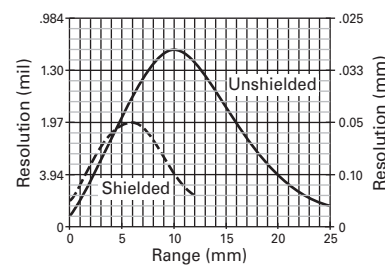
##### 12 mm



##### 18 mm

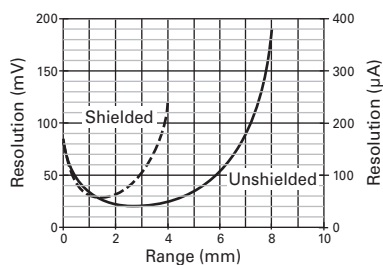


##### 30 mm

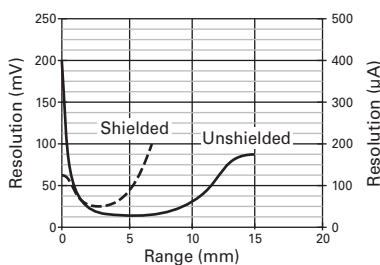


#### Output Resolution <sup>②</sup>

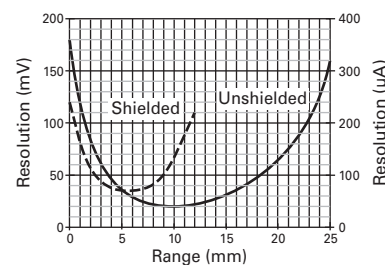
##### 12 mm



##### 18 mm



##### 30 mm



#### Notes

- ① Measurement resolution is the sensor's ability to detect a change in target position. The measurement resolution is the finest at the highest point in the curve.
- ② Output resolution is the change in output signal relative to target position. The minimum change in output resolution is defined by the lowest point in the curve.

## Wiring Diagrams

Pin numbers are for reference, rely on pin location when wiring.

### AccuProx Analog Sensors

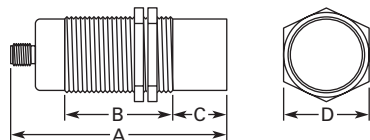
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Style	Output(s)	Micro-Connector Models	Cable and Pigtail Models
12 mm diameter models ending in <b>-C1</b> <sup>①</sup>	Current: 4–20 mA		
18 and 30 mm diameter models ending in <b>-C1</b> <sup>①</sup>			
Models ending in <b>-CV</b>	Current: 0–20 mA Voltage: 0–10V		

## Dimensions

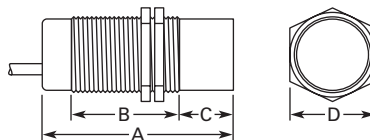
Approximate Dimensions in Inches (mm)

### Micro-Connector Models



Size	Shielding	A	B	C	D
12 mm	Shielded	3.05 (77.5)	1.98 (50.3)	0.02 (0.50)	0.67 (17)
	Unshielded	3.05 (77.5)	1.64 (41.6)	0.36 (9)	0.67 (17)
18 mm	Shielded	2.73 (69.3)	2.00 (50.9)	0.02 (0.50)	0.94 (24)
	Unshielded	2.73 (69.3)	1.47 (37.4)	0.55 (14)	0.94 (24)
30 mm	Shielded	2.92 (74.1)	2.13 (54.1)	0.03 (0.75)	1.41 (36)
	Unshielded	2.92 (74.1)	1.41 (35.8)	0.75 (19)	1.41 (36)

### Cable and Pigtail Models



Size	Shielding	A	B	C	D
12 mm	Shielded	2.46 (62.4)	1.98 (50.3)	0.02 (0.5)	0.67 (17)
	Unshielded	2.46 (62.4)	1.64 (41.6)	0.36 (9)	0.67 (17)
18 mm	Shielded	2.54 (64.5)	2.00 (50.9)	0.02 (0.5)	0.94 (24)
	Unshielded	2.54 (64.5)	1.47 (37.4)	0.55 (14)	0.94 (24)
30 mm	Shielded	2.74 (69.6)	2.13 (54.1)	0.03 (0.75)	1.41 (36)
	Unshielded	2.74 (69.6)	1.41 (35.8)	0.75 (19)	1.41 (36)

### Note

- <sup>①</sup> For models ending in **-C1** (current output only models), pins 2 and 4 are intentionally connected.  
Do not connect outputs of **-C1** models to separate loads—this sensor should only be connected to a single-output load.