

**AccuProx™ Analog
Inductive Proximity Sensors****Contents**

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The Cutler-Hammer® AccuProx™ from Eaton's electrical business 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 Cutler-Hammer 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.

Approvals

- C-UL Listed
- CE



Unless otherwise noted, the products contained in this document are not designed or intended for use in human safety applications.

Introducing a Long Range, High Precision Analog Inductive

Sense Three Times Farther Than
Standard Tubular Analogs

Durable Stainless
Steel Barrel

360-Degree, Dual-Color
Output LED Indicator

Micro, Pigtail and Potted
Cable Connectivity

Product 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

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

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**.

Presenting AccuProx™ — Unmatched Analog Range in a Proven Package

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.

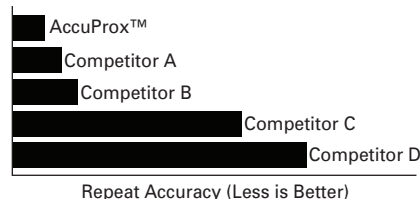
AccuProx utilizes many of the proven materials found in other Cutler-Hammer tubular sensor families. The threaded barrel and included mounting nuts are made of stainless steel, which exhibits superior corrosion and abrasion resistance versus nickel-plated brass. AccuProx also features a proprietary internal 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

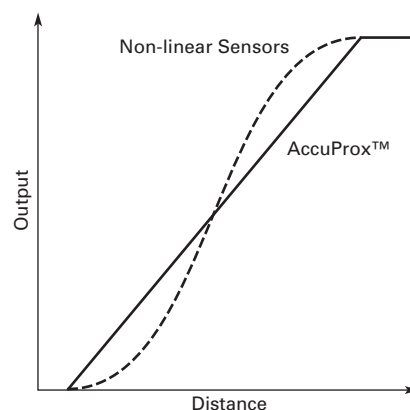
Analog inductive sensors are often used in applications that require a higher level of precision than a standard digital sensor. For example, applications such as part inspection require a sensor that can detect very small variances. AccuProx has been designed with these applications in mind.

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 below chart for a repeat accuracy comparison of AccuProx versus the competition.



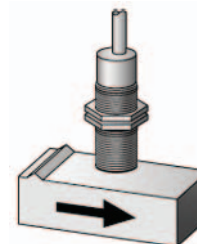
Linearity refers to the shape of the output curve. Many competitive analog sensors exhibit a wavy or "S-shaped" output curve. This means that a change in target distance may not always translate into an equivalent change in output, particularly at the innermost and outermost ranges of a non-linear analog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

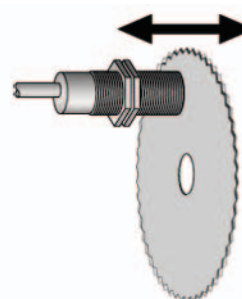
Typical Analog Applications



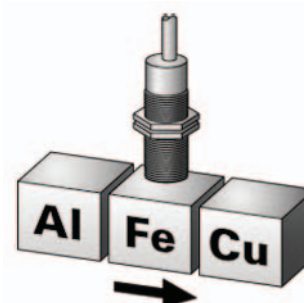
Material Imperfection or Blemish Detection



Eccentricity or Absolute Angle Detection






Saw Blade Deflection



Detecting Different Metals

August 2008

Model Selection — AccuProx Analog




| | | Operating Voltage | Sensing Range ① | Shielding | Connection Type | Catalog Number | |
|--|-------------|-------------------|-----------------|--------------------------|----------------------|--|----------------------------------|
| | | | | | | Current (0 – 20 mA) and Voltage (0 – 10V) Output ② | Current (4– 20 mA) Output Only ② |
| 3/4-Wire Sensors | | | | | | | |
| 12 mm Diameter  | 15 – 30V DC | 0.5 – 4 mm | Shielded | 4-Pin Micro DC Connector | E59-A12A104D01-CV ☼ | E59-A12A104D01-C1 ☼ | |
| | | | | 4-Pin Micro DC Pigtail | E59-A12A104D01P-CV ☼ | E59-A12A104D01P-C1 ☼ | |
| | | | | 2-meter Cable | E59-A12A104C02-CV | E59-A12A104C02-C1 | |
| | | 1 – 8 mm | Unshielded | 4-Pin Micro DC Connector | E59-A12C108D01-CV ☼ | E59-A12C108D01-C1 ☼ | |
| | | | | 4-Pin Micro DC Pigtail | E59-A12C108D01P-CV ☼ | E59-A12C108D01P-C1 ☼ | |
| | | | | 2-meter Cable | E59-A12C108C02-CV | E59-A12C108C02-C1 | |
| 18 mm Diameter  | | 1 – 7 mm | Shielded | 4-Pin Micro DC Connector | E59-A18A107D01-CV ☼ | E59-A18A107D01-C1 ☼ | |
| | | | | 4-Pin Micro DC Pigtail | E59-A18A107D01P-CV ☼ | E59-A18A107D01P-C1 ☼ | |
| | | | | 2-meter Cable | E59-A18A107C02-CV | E59-A18A107C02-C1 | |
| | | 1 – 15 mm | Unshielded | 4-Pin Micro DC Connector | E59-A18C115D01-CV ☼ | E59-A18C115D01-C1 ☼ | |
| | | | | 4-Pin Micro DC Pigtail | E59-A18C115D01P-CV ☼ | E59-A18C115D01P-C1 ☼ | |
| | | | | 2-meter Cable | E59-A18C115C02-CV | E59-A18C115C02-C1 | |
| 30 mm Diameter  | | 1 – 12 mm | Shielded | 4-Pin Micro DC Connector | E59-A30A112D01-CV ☼ | E59-A30A112D01-C1 ☼ | |
| | | | | 4-Pin Micro DC Pigtail | E59-A30A112D01P-CV ☼ | E59-A30A112D01P-C1 ☼ | |
| | | | | 2-meter Cable | E59-A30A112C02-CV | E59-A30A112C02-C1 | |
| | | 1 – 25 mm | Unshielded | 4-Pin Micro DC Connector | E59-A30C125D01-CV ☼ | E59-A30C125D01-C1 ☼ | |
| | | | | 4-Pin Micro DC Pigtail | E59-A30C125D01P-CV ☼ | E59-A30C125D01P-C1 ☼ | |
| | | | | 2-meter Cable | E59-A30C125C02-CV | E59-A30C125C02-C1 | |

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 (e.g. 1 – 5V, 0 – 5V). Contact factory for details.

☼ See listing of compatible connector cables below.

Model Selection — Compatible Connector Cables ③

| | Voltage Style | Number of Pins | Gauge | Length | Catalog Number | | | Pin Configuration/Wire Colors (Face View Female Shown) |
|--|---------------|-----------------|--------|---------------|----------------|---------------|----------------|---|
| | | | | | PVC Jacket | PUR Jacket | IRR PUR Jacket | |
| Standard Cables — Micro Style | | | | | | | | |
| <div>Micro Style Straight Female</div>  | DC | 4-pin 3-wire | 22 AWG | 6.0 feet (2m) | CSDS4A3CY2202 | CSDS4A3RY2202 | — |  <div>1-Brown 2-No Wire 3-Blue 4-Black</div> |
| | DC | 4-pin 4-wire | 22 AWG | 6.0 feet (2m) | CSDS4A4CY2202 | CSDS4A4RY2202 | CSDS4A4IO2202 |  <div>1-Brown 2-White 3-Blue 4-Black</div> |

③ For a full selection of connector cables, see PG.05.05.T.E.

 Stocked product, typical order quantities guaranteed in stock.

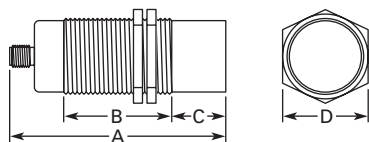
Wiring Diagrams (Pin numbers are for reference, rely on pin location when wiring)

| Style | Output(s) | Micro-Connector Models | Cable and Pigtail Models |
|--|--|------------------------|--------------------------|
| 12 mm Diameter Models Ending in -C1 ① | Current: 4 – 20 mA | | |
| 18 and 30 mm Diameter Models Ending in -C1 ① | | | |
| Models Ending in -CV | Current: 0 – 20 mA Voltage: 0 – 10V | | |

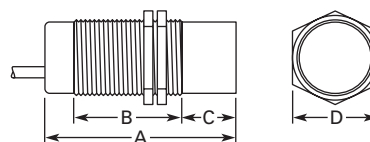
① For models ending in -C1 (current output only models), pins 2 and 4 are intentionally connected. **Note:** Do not connect outputs of -C1 models to separate loads — this sensor should only be connected to a single-output load.

Approximate Dimensions — AccuProx Analog in Inches (mm)

Micro-Connector Models



Cable and Pigtail Models



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) |

August 2008

Specifications — AccuProx Analog

| Description | 12 mm Models | | 18 mm Models | | 30 mm Models | |
|-------------|--------------|------------|--------------|------------|--------------|------------|
| | Shielded | Unshielded | Shielded | Unshielded | Shielded | Unshielded |

Performance

| | | | | | | |
|--------------------------|------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Analog Operating Range ① | 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) | | | | | |
| Temperature Drift | < ± 10% | | | | | |
| Conformity | < ± 10% | | | | | |
| Repeat Accuracy | < 25 µm ② | < 20 µm ② | < 40 µm ② | < 20 µm ② | < 50 µm ② | < 30 µm ② |
| Minimum Repeat Accuracy | < 3.0% @ max. range | < 1.1% @ max. range | < 2.2% @ max. range | < 1.2% @ max. range | < 1.2% @ max. range | < 0.8% @ 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 | | | | | |
| Resolution | 23 µm max. | 16 µm max. | 40 µm max. | 21 µm max. | 50 µm max. | 30 µm max. |

Electrical

| | | | | | | |
|--------------------------------|---------------------------------|-------|-------|-------|-------|-------|
| Style | AccuProx™ Analog, 3/4-Wire DC | | | | | |
| Operating Voltage | 15 – 30V DC | | | | | |
| Current Output Signal | 0 – 20 mA or 4 – 20 mA by model | | | | | |
| Current Output Load Resistance | 400 – 500 ohm | | | | | |
| Current Output Ripple Content | ± 40 µA max. | | | | | |
| Current Output Minimum Change | 30 µA | 20 µA | 50 µA | 28 µA | 66 µA | 40 µA |
| Voltage Output Signal ③ | 0 – 10 V | | | | | |
| Voltage Output Load Resistance | 4.7 – 5.0 kOhm (2.5 mA max.) | | | | | |
| Voltage Output Ripple Content | ± 10 mV max. | | | | | |
| Voltage Output Minimum Change | 15 mV | 10 mV | 25 mV | 14 mV | 33 mV | 20 mV |
| Burden Current | < 20 mA | | | | | |
| Output LED | Dual-color, 360° viewable | | | | | |
| Short Circuit Protection | Incorporated ④ | | | | | |
| Wire Breakage Protection | Incorporated | | | | | |
| Reverse Polarity Protection | Incorporated | | | | | |

Physical

| | | | | | | |
|----------------------|---|--|--|--|--|--|
| Size | See dimension drawings on Page 4 | | | | | |
| Enclosure Protection | NEMA 4, 4X, 6, 6P, 13 | | | | | |
| Shock | 30 g half-sine @ 11 mS | | | | | |
| Vibration | 10 – 55 Hz, 1 mm amplitude | | | | | |
| Housing Material | Stainless steel, Polycarbonate endbell, Polyphenylene sulfide front cap | | | | | |
| Termination | Micro connector Potted cable, 2 m Pigtail micro connector, 2 m | | | | | |

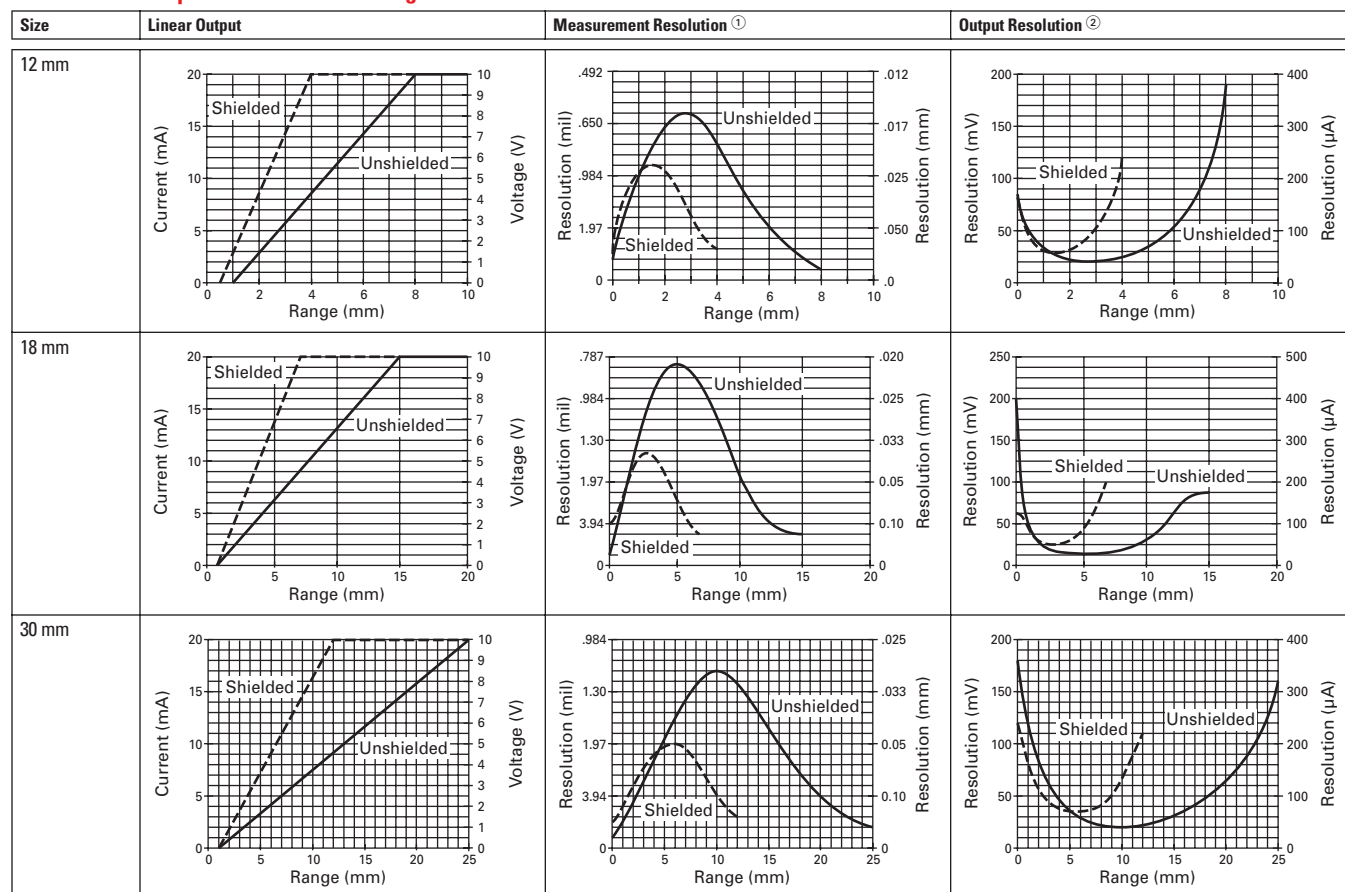
① Published range data is based on a 1 mm thick square target made of Type FE 360 steel per ISO Standard 630.

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.

Performance Graphs — AccuProx Analog



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.