



## Hall-effect Position Sensors with Sealed Housing

**103SR Series**

# Hall-effect Position Sensors with Sealed Housing

The 103SR Series Hall-effect position sensor assemblies are sealed in aluminum or stainless-steel threaded housings and meet NEMA 3, 3R, 3S, 4, 4X (stainless-steel housing), 12 and 13 requirements. They respond to the magnetic field from permanent magnets or electromagnets. These rugged non-contact sensing products use versatile, reliable Hall-effect sensor ICs that are operated by a magnetic field and are designed to respond to alternating North and South Poles or to South Pole only.

103SR Series Hall-effect position sensors include digital unipolar, latching, and linear magnetic types, available in a number of sensitivities to meet a variety of customers' application requirements. The digital version of 103SR Series Hall-effect position sensors delivers stable output over -40 °C to 100 °C [-40 °F to 212 °F] temperature range with 20 mA current sinking capability, and can accept dc supply voltage from 4.5 Vdc to 24 Vdc. The linear version operates from -40 °C to 125 °C [-40 °F to 257 °F] across a supply voltage range of 4.5 Vdc to 10.5 Vdc.

The standard open-collector sinking output (digital devices) or push-pull output (linear device) of the 103SR Series Hall-effect position sensors can be easily interfaced with common electronic circuitry such as microprocessors, integrated logic, discrete transistors, and SCRs with compatible voltage specifications.

## *What makes our sensors better?*

- Honeywell magnetic sensing experience
- Robust, sealed housing
- Multiple wire types and cable options



## Features and Benefits

### *Choose the best fit option*

#### **SOLID STATE RELIABILITY**

Unlike electromechanical switches, the 103SR Series Hall-effect position sensors are not affected by contact bounce or wear. They are solid-state devices suitable for applications requiring reliable switching operations and long life.

#### **DIGITAL UNIPOLAR, LATCHING, AND LINEAR MAGNETICS**

Honeywell's 103SR Series Hall-effect position sensors offer digital unipolar, latching, and linear magnetic options specifically designed and engineered to meet a number of industrial, transportation, and consumer application requirements.

#### **ELECTRICAL CHARACTERISTICS**

The 103SR Series offers current-sinking output (digital) and push-pull output (linear/analog) options to choose from that help address a wide range of applications.

#### **MEETS INDUSTRY STANDARD REQUIREMENTS**

The rugged, sealed threaded aluminum housing of the device meets NEMA 3, 3R, 3S, 4, 4X (stainless steel only), 12, and 13 requirements allowing them to be used in various environmental conditions.

#### **LEAD WIRE GAUGE AND LENGTH OPTIONS**

Lead wires of different gauges, lengths, and insulation allows the customer to choose the best-fit option per their application's requirement.

#### **WIDE SUPPLY VOLTAGE RANGE**

The sensor operates over a wide supply voltage range from 4.5 Vdc to 24 Vdc (digital) or 4.5 Vdc to 10.5 Vdc (linear).

#### **OPERATING TEMPERATURE RANGE**

The 103SR Series Hall-effect sensors can operate over a broad operating temperature range from -40 °C to 100 °C [-40 °F to 212 °F] (digital) and from -40 °C to 125 °C [-40 °F to 257 °F] (linear). This reduces operating and installation issues and provides greater flexibility of design to engineers.

### *Protective sealed housing*

#### **RUGGED, SEALED, THREADED HOUSING**

The sensor ICs in the 103SR Series Hall-effect position sensors are potted and supplied in sealed aluminum or stainless steel housings, protecting them from dust, dirt, and liquid splashing or other harsh environmental operating conditions.

#### **ADJUSTABLE MOUNTING**

The 103SR Series Hall-effect position sensors come with threaded metal housings. When installed on a bracket, the relative position of the sensor and magnet can be easily adjusted for optimum performance. This provides the user with greater flexibility in integrating and mounting the 103SR Series Hall-effect position sensors into their system.

# 103SR Series

## Potential Applications



Honeywell Sensing and Control's internal design capabilities and customized options allow use of these Hall-effect position sensors across a number of potential industrial, transportation, and medical applications.

### INDUSTRIAL

- Position sensing
- Robotics control
- Linear or angular displacement sensing
- Speed and RPM (revolutions per minute) sensing
- Tachometer, counter pick-up
- Flow-rate sensing
- Motor and fan control



### TRANSPORTATION

- Speed and RPM (revolutions per minute) sensing
- Tachometer, counter pick-up
- Motor and fan control
- Seat position



### MEDICAL

- Motion detection in motorized medical equipment
- Position sensing in hospital beds



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**Table 1. Electrical and Magnetic Specifications - Digital Hall-effect Position Sensors (for reference only)**

Catalog Listing	Supply Voltage (Vdc)	Supply Current (mA max.) @ 25 °C [77 °F]	Output Type	Output Voltage (V max.)	Output Current (mA max.)	Magnetic Type	Magnetic Characteristics [Gauss]* and Temperature °C [°F]								
							0 °C to 70 °C [32 °F to 158 °F]			-40 °C to 100 °C [-40 °F to 212 °F]			25 °C [77 °F] Typical		
							Max. Operate Point	Min. Release Point	Min. Differential Hysteresis	Max. Operate Point	Min. Release Point	Min. Differential Hysteresis	Typ. Operate Point	Typ. Release Point	Typ. Differential Hysteresis
103SR13A-1	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-2	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-3	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-4	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-6	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-8	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-9	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-10	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-11	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-12	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-13	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-14	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR13A-16	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	475	135	40	495	200	35	350	275	75
103SR14A-1	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	-	-	-	160	5	8	85	58	27
103SR14A-2	4.5 V to 24 V	10	Sink	0.4	20	Unipolar	-	-	-	160	5	8	85	58	27
103SR17A-1	4.5 V to 24 V	10	Sink	0.4	20	Latching	180	-180	80	205	-205	35	100	-100	200
103SR17A-2	4.5 V to 24 V	10	Sink	0.4	20	Latching	180	-180	80	205	-205	35	100	-100	200
103SR18-1	4.5 V to 24 V	10	Sink	0.4	20	Latching	90	-90	40	120	-120	40	50	-50	100

\*Unipolar digital Hall-effect position sensor has a positive maximum operate point (South Pole) and a positive minimum release point. One magnetic pole (South) is required to operate and release a unipolar digital Hall-effect position sensor

Latching digital Hall-effect position sensor is guaranteed to switch on with positive (South Pole) Gauss only, and switch off with negative (North Pole) Gauss only

Ring magnets with alternating North and South Poles are usually used with latching digital Hall-effect position sensors

**Table 2. Electrical and Magnetic Specifications - Linear Hall-effect Position Sensor (for reference only)**

Catalog Listing	Supply Voltage (Vdc)	Supply Current (mA max.) @ 25 °C [77 °F]	Output Type	Output Voltage Span (V)	Output Current (mA max., sink or source, Vs >5 Vdc)	Magnetic Type	Magnetic Characteristics [Gauss]** and Temperature °C [°F]							
							-40 °C to 125 °C [-40 °F to 257 °F]		25 °C [77 °F]**			25 °C [77 °F]**		
							Max. Linearity	Min. Linear Measuring Range [G]	Min. Sens. [mV/G]	Typ. Sens. [mV/G]	Max. Sens. [mV/G]	Min. Null [V]	Typ. Null [V]	Max. Null [V]
103SR19A-1	4.5 V to 10.5 V	10	Push-Pull	0.4 V to Vs -0.4 V (min.); 0.2 V to Vs -0.2 V (typ.)	1	Linear	-1.5 %	±600	3.031	3.125	3.219	2.425	2.500	2.575

\*\*Refer to 103SR19A-1 engineering drawing for sensitivity and null drift vs temperature specifications

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Table 3. Absolute Maximum Ratings\*

Parameters	4.5 Vdc to 24 Vdc
Supply Voltage (Vs)**	-1.0 Vdc to 25 Vdc
Voltage Externally Applied to Output	25 Vdc max. (OFF only) -0.5 Vdc min. (ON or OFF)
Output Current	20 mA max.
Temperature Operate and Storage	-40 °C to 100 °C [-40 °F to 212 °F]

\*Absolute maximum ratings are the extreme limits that the device will withstand without damage to the device. Electrical and magnetic characteristics are not guaranteed as the maximum limits (above recommended operating conditions) are approached, nor will the device necessarily operate at absolute maximum rating

\*\*Vs is the unregulated supply voltage

## DIMENSIONAL DRAWINGS

### Unipolar Digital Hall-effect Position Sensors

Figure 1. 103SR13A-1

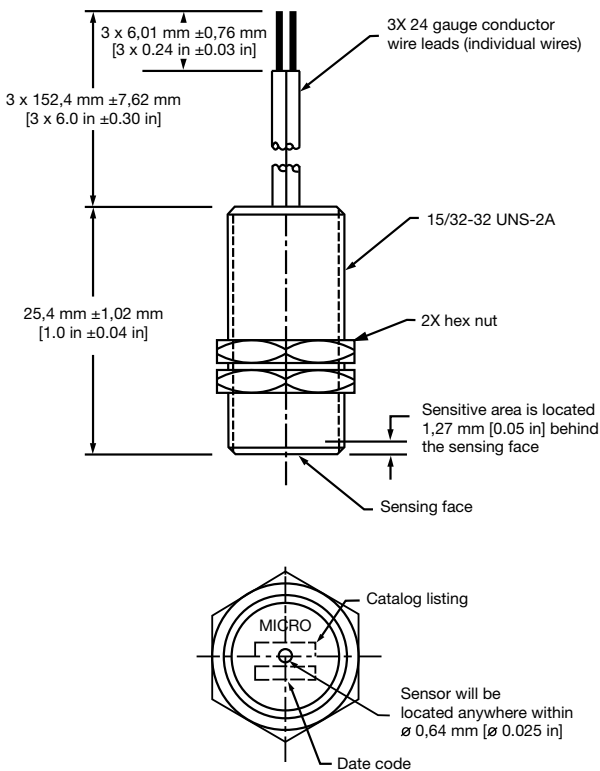
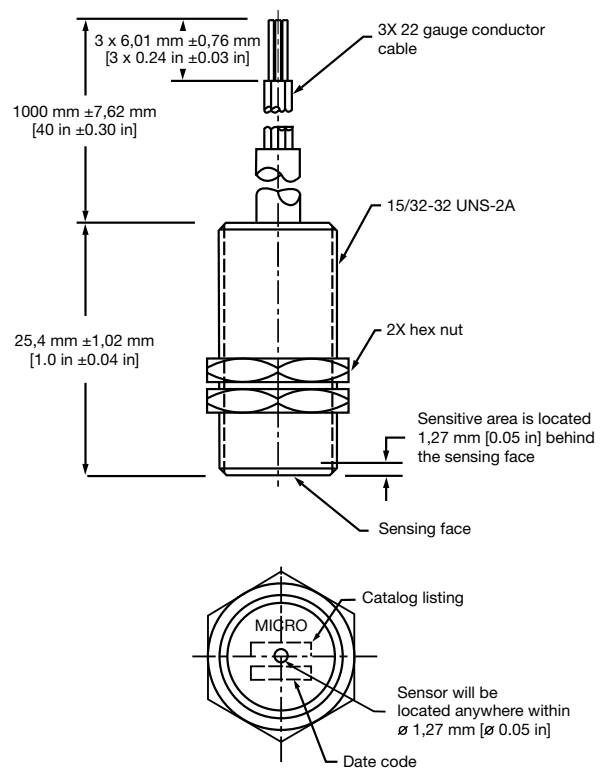


Figure 2. 103SR13A-2



# Hall-effect Position Sensors with Sealed Housing

## Unipolar Digital Hall-effect Position Sensors

Figure 3. 103SR13A-3

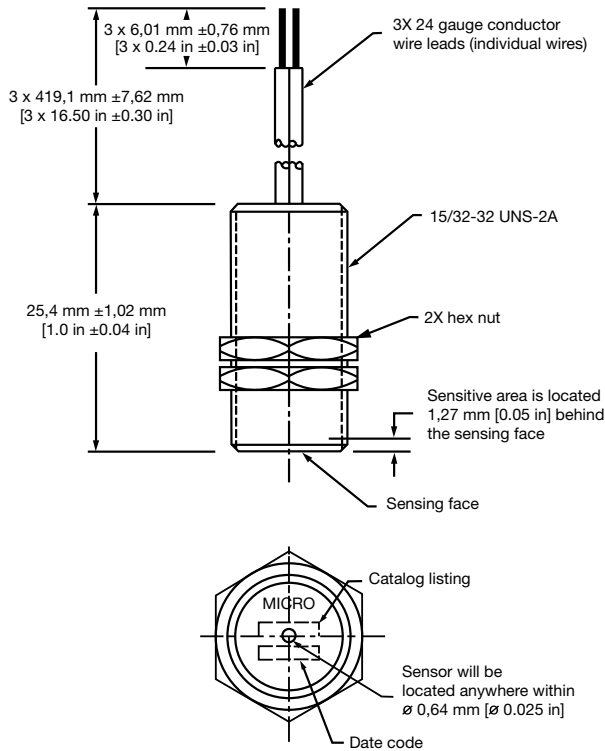


Figure 4. 103SR13A-4

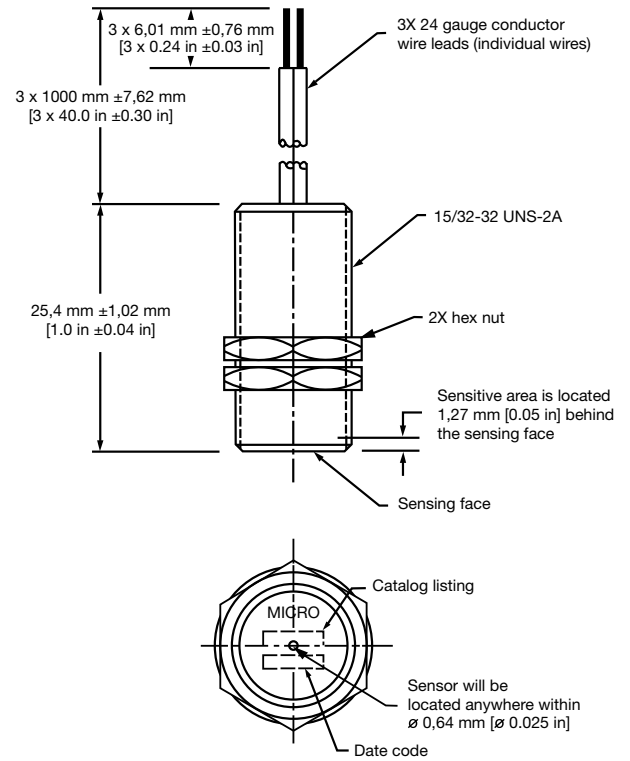


Figure 5. 103SR13A-6

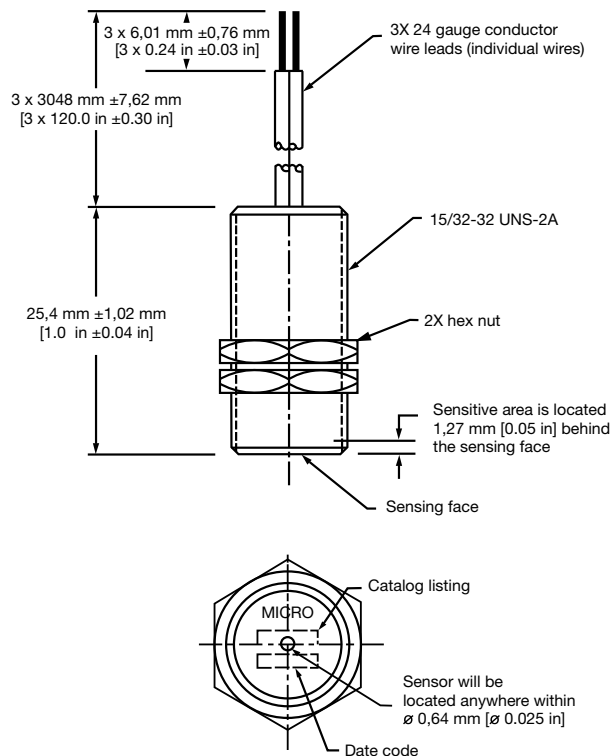
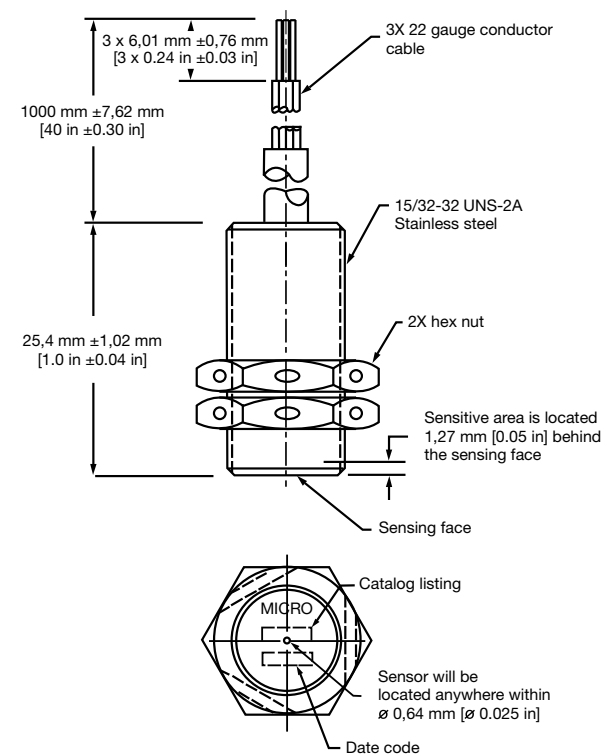


Figure 6. 103SR13A-8



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## Unipolar Digital Hall-effect Position Sensors

Figure 7. 103SR13A-9

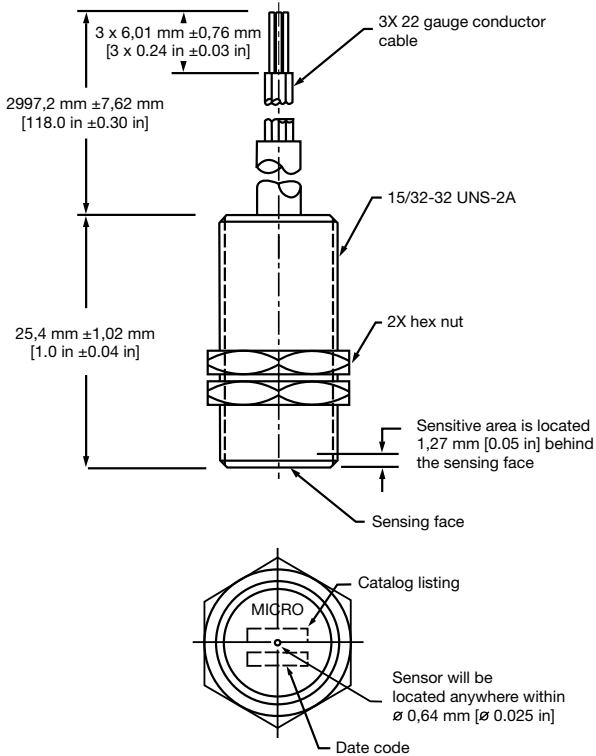


Figure 8. 103SR13A-10

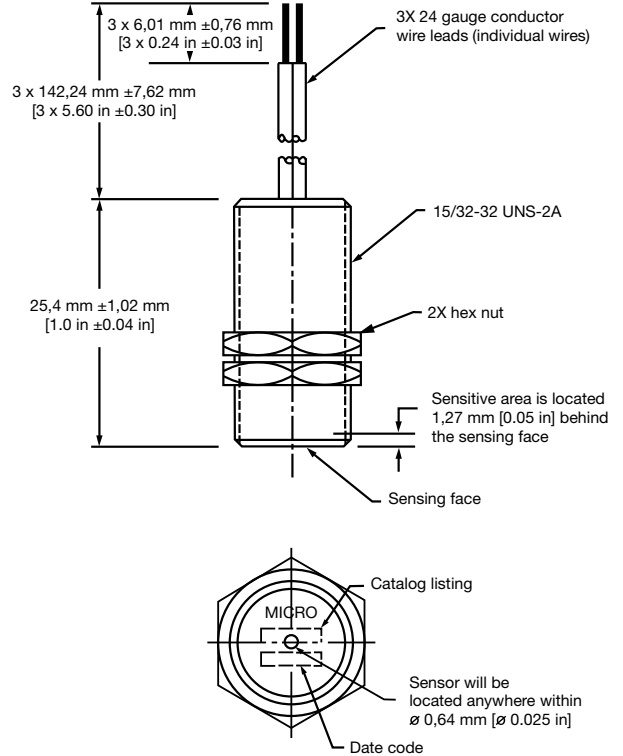


Figure 9. 103SR13A-11

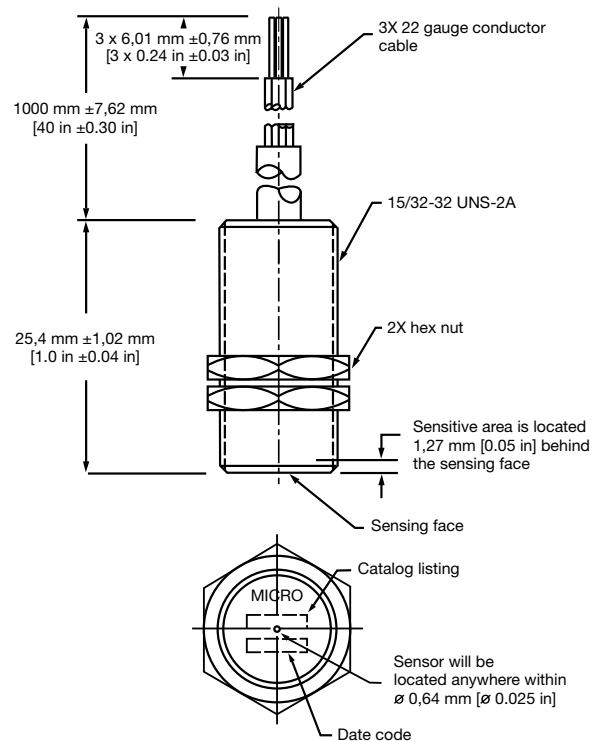
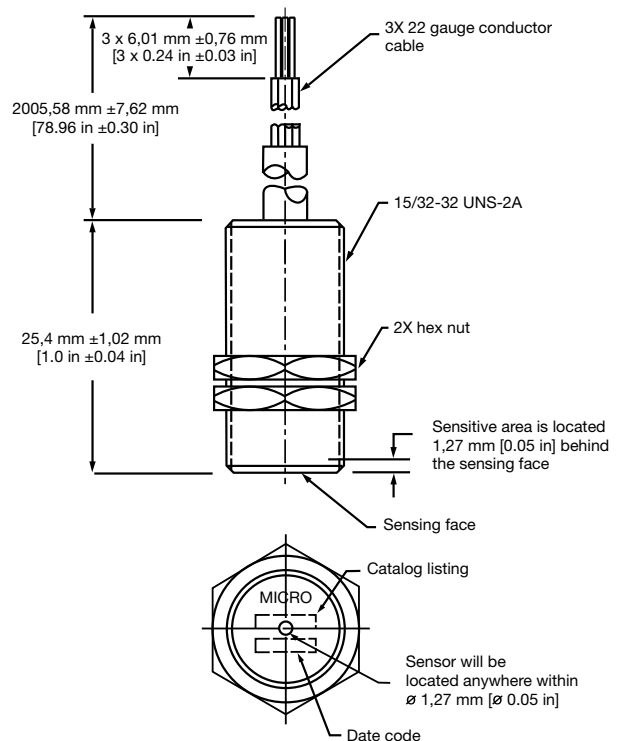


Figure 10. 103SR13A-12





# Hall-effect Position Sensors with Sealed Housing

## Unipolar Digital Hall-effect Position Sensors

Figure 11. 103SR13A-13

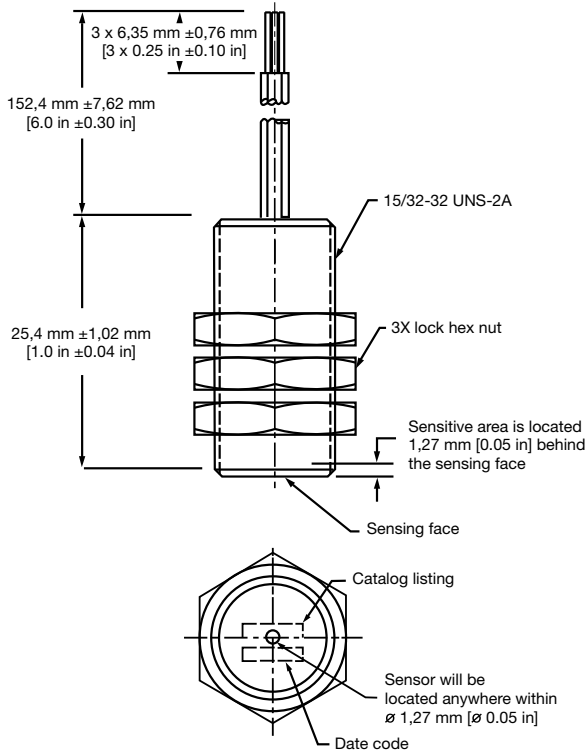


Figure 12. 103SR13A-14

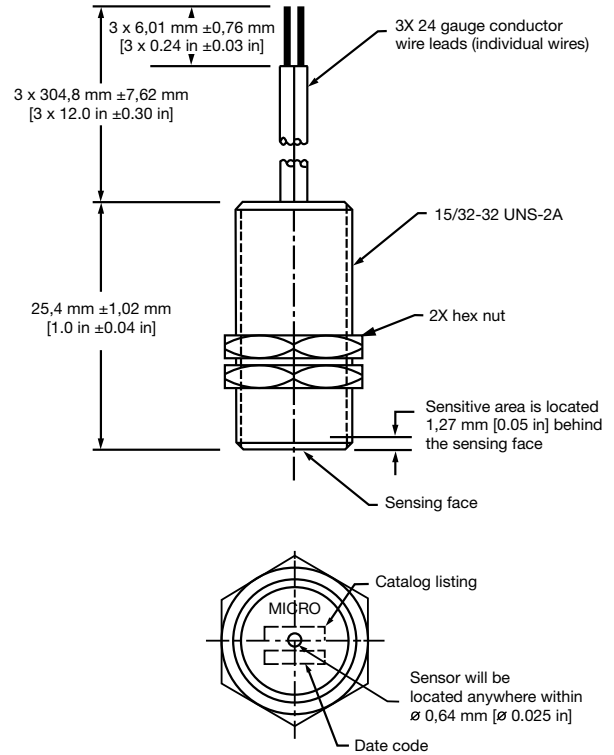


Figure 13. 103SR13A-16

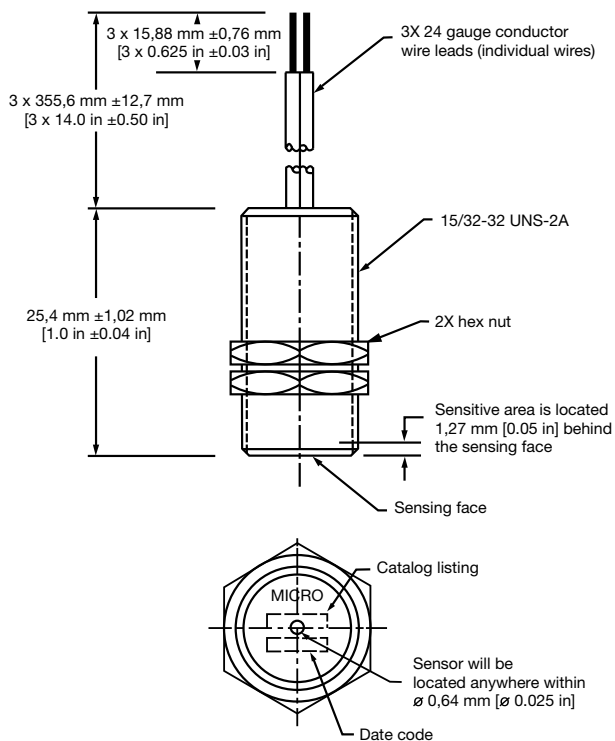
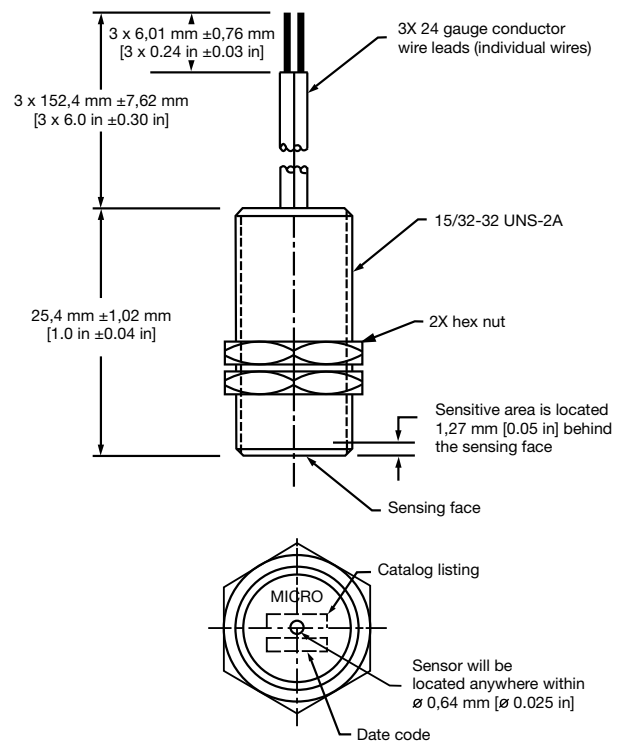


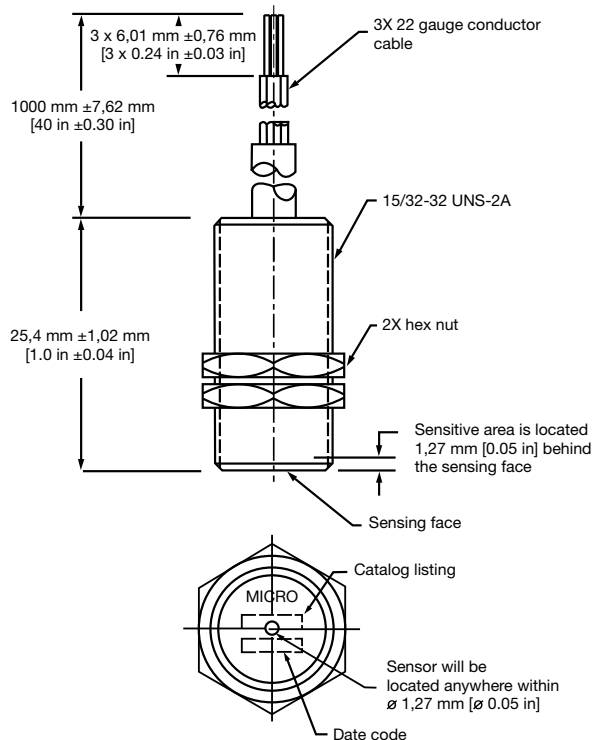
Figure 14. 103SR14A-1



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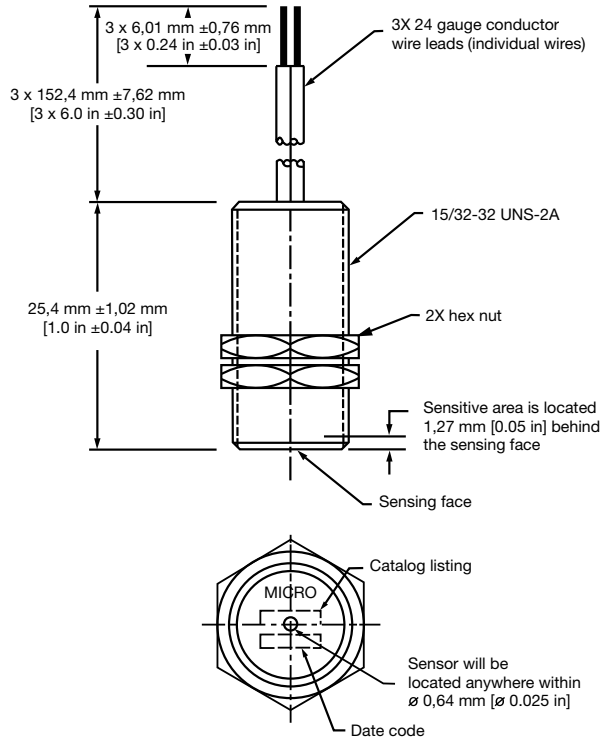
## Unipolar Digital Hall-effect Position Sensors

Figure 15. 103SR14A-2



## Latching Digital Hall-effect Position Sensors

Figure 16. 103SR17A-1



## Latching Digital Hall-effect Position Sensors

Figure 17. 103SR17A-2

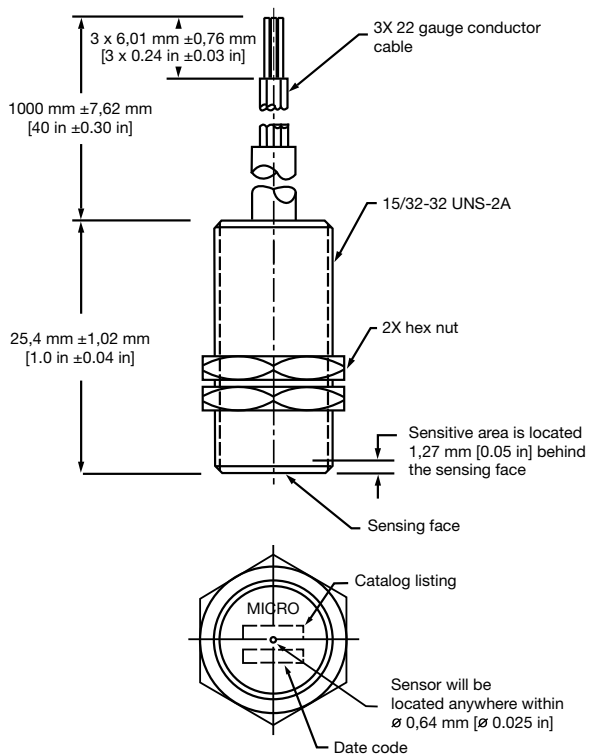
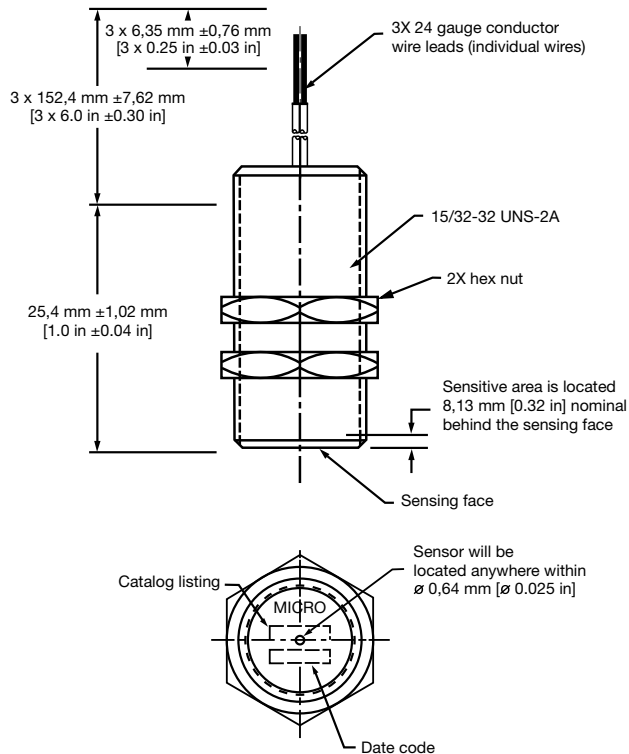


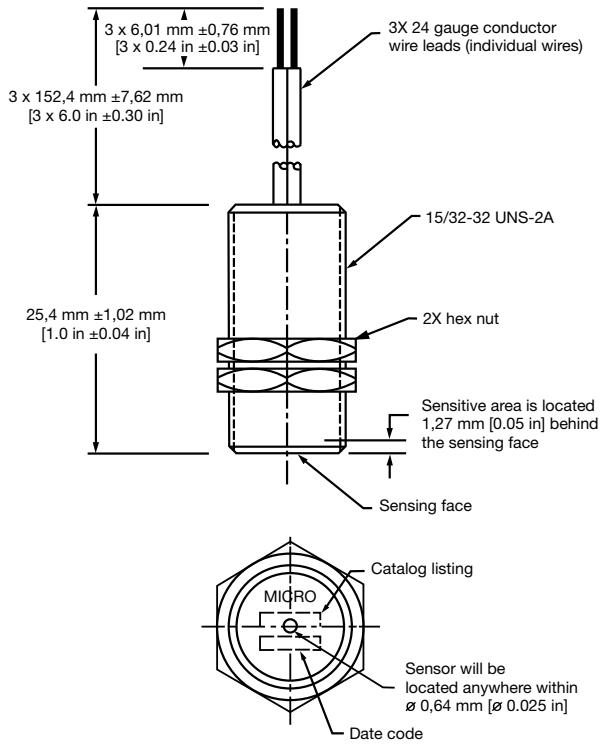
Figure 18. 103SR18-1



# Hall-effect Position Sensors with Sealed Housing

## Unipolar Ratiometric/Analog Hall-effect Position Sensors

Figure 19. 103SR19A-1

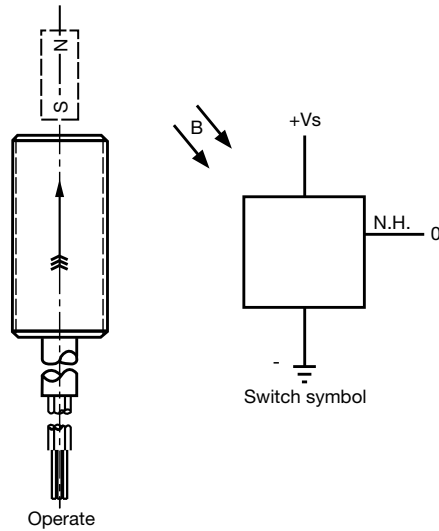


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## OPERATING MODE

Figure 20. Unipolar Digital Hall-effect Position Sensors

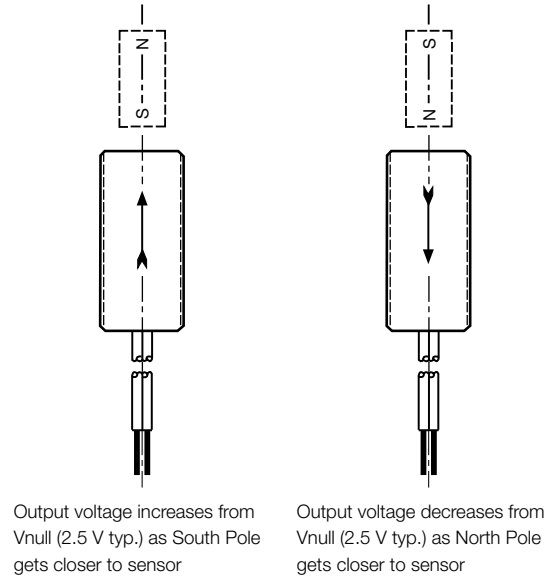
103SR13A-1, 103SR13A-2, 103SR13A-3, 103SR13A-4, 103SR13A-6, 103SR13A-8, 103SR13A-9, 103SR13A-10, 103SR13A-11, 103SR13A-12, 103SR13A-13, 103SR13A-14, 103SR13A-16, 103SR14A-1, 103SR14A-2



Note: Flux entering to the South Pole of the magnet will operate the sensor when magnet is positioned as shown in above drawing. This assumes the convention that the direction of the external flux of a magnet is from the North to the South Pole of the magnet

Figure 21. Unipolar Ratiometric/Analog Hall-effect Position Sensors

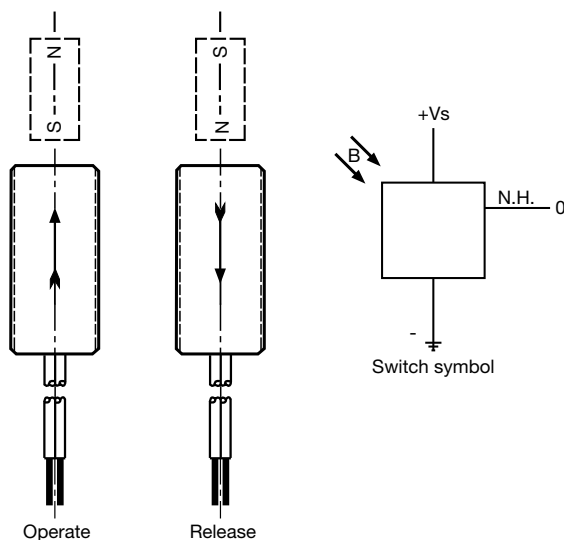
103SR19A-1



Note: In the above drawing the magnet field direction is defined as follows:  
 (+) Positive Gauss represents the South Pole of the magnet facing the sensing the area  
 (-) Negative Gauss represents the North Pole of the magnet facing the sensing the area

Figure 22. Latching Digital Hall-effect Position Sensors

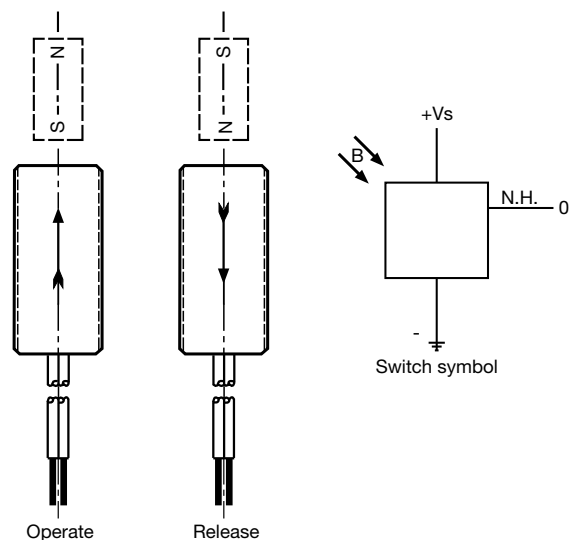
103SR17A-1, 103SR17A-2



Note: Flux entering to the South Pole of the magnet will operate the sensor when magnet is positioned as shown in the above drawing. This assumes the convention that the direction of the external flux of a magnet is from the North to the South Pole of the magnet. Latching devices requires both South and North Poles in order to ensure sensors operate and release respectively

Figure 23. Latching Digital Hall-effect Position Sensors

103SR18-1



Note: Flux entering to the South Pole of the magnet will operate the sensor when magnet is positioned as shown in the above drawing. This assumes the convention that the direction of the external flux of a magnet is from the North to the South Pole of the magnet. Latching devices requires both South and North Poles in order to ensure sensors operate and release respectively

# Hall-effect Position Sensors with Sealed Housing

## TROUBLESHOOTING

If sensor does not operate, follow these steps:

1. Assure wiring is correct. Load must be connected.
2. Measure supply voltage across red (+) and black (-) leads to verify presence of proper voltage.
3. Connect positive voltmeter lead to green, white, or brown (output) lead, and negative voltmeter lead to black (ground).

Table 4. With magnet removed (or North Pole present), reading should be:

Catalog Listing	Voltage Reading
103SR13A-1	Vs
103SR14A-1	Vs
103SR17A-1*	Vs

Table 5. When magnet (South Pole) moves toward sensor face (beyond operating point), output should change state and read:

Catalog Listing	Voltage Reading
103SR13A-1	0.4 V max.
103SR14A-1	0.4 V max.
103SR17A-1*	0.4 V max.

\*North magnetic pole must be present to ensure device is OFF due to bipolar magnetic operation

## LEADWIRE COLOR CODE

Table 6. Leadwire Color Code - Stranded

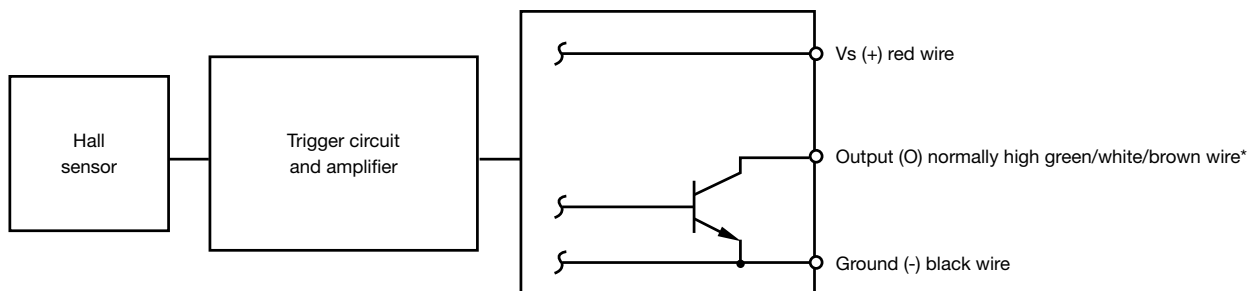
Catalog Listing	Color	Description
103SR13A-1, 103SR13A-2, 103SR13A-3, 103SR13A-4, 103SR13A-6, 103SR13A-10, 103SR13A-13, 103SR13A-14, 103SR13A-16, 103SR14A-1, 103SR17A-1, 103SR18-1, 103SR19A-1	Red	Vs (+)
	Black	Ground (-)
	Green	Output (digital or linear)

Table 7. Leadwire Color Code - Cable

Catalog Listing	Color	Description
103SR13A-8, 103SR13A-12, 103SR14A-2, 103SR17A-2	Red	Vs (+)
	Black	Ground (-)
	White (Type 2)	Output (digital)
103SR13A-9, 103SR13A-11	Red	Vs (+)
	Black	Ground (-)
	Brown (Type 3)	Output (digital)

## BLOCK DIAGRAM

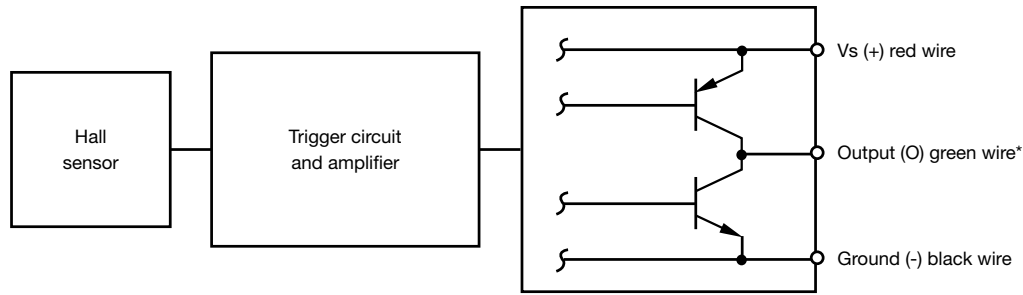
Figure 24. Digital Hall-effect Position Sensors: Current Sinking Output



\*Refer Table 6 and Table 7 for output wire color

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Figure 25. Linear Hall-effect Position Sensors: Push-Pull (Sink Source) Output



\*Refer Table 6 and Table 7 for output wire color

## INTERFACING SENSING AND CONTROL HALL-EFFECT SENSORS

The schematics shown are typical of the outputs with which Honeywell Sensing and Control Hall-effect position sensors can be interfaced. Values shown are representative only.

### Current-Sinking outputs

Current flows through load into sensor. Output terminal is open collector. In the un-operated condition ( $I_L = 0$ ), the output voltage is normally high.

Figure 26. Interface Circuit - ac Load

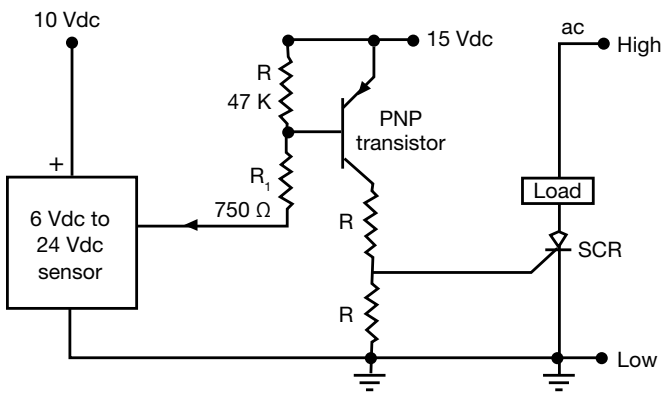


Figure 27. Interface Circuit - dc Load 50 mA

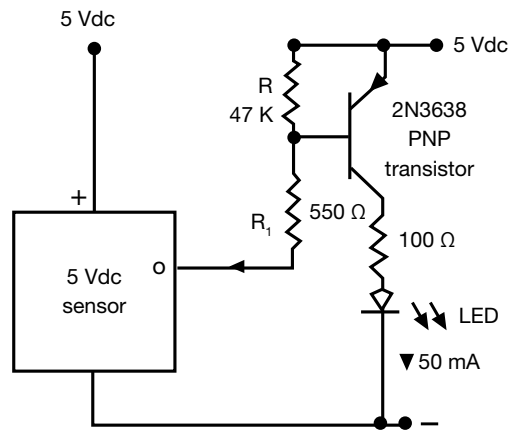


Figure 28. Interface Circuit - dc Load 150 mA

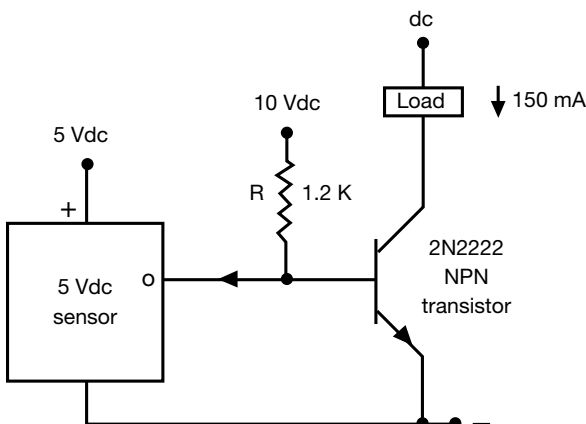
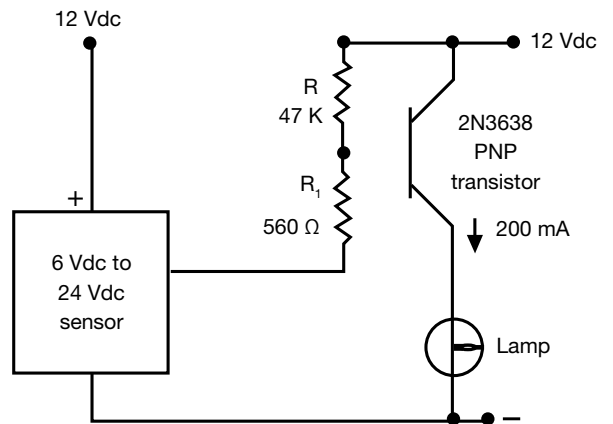



Figure 29. Interface Circuit - dc Load 200 mA





# Hall-effect Position Sensors with Sealed Housing

## Order Guide (Measurements for reference only)

Image	Catalog Listing	Description	Cable/ Leadwire Type*	Magnetic Characteristics	Cable Length
	103SR13A-1	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 1	Unipolar	152 mm [6.0 in]
	103SR13A-2	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 2	Unipolar	1000 mm [40.0 in]
	103SR13A-3	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 1	Unipolar	419 mm [16.5 in]
	103SR13A-4	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 1	Unipolar	1000 mm [40.0 in]
	103SR13A-6	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 1	Unipolar	3048 mm [120.0 in]
	103SR13A-8	Sealed, 15/32-32 UNS-2A in cylindrical <b>stainless steel</b> housing; two hex nuts	Type 2	Unipolar	1000 mm [40.0 in]
	103SR13A-9	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 3	Unipolar	2997 mm [118.0 in]
	103SR13A-10	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 2	Unipolar	142 mm [5.6 in]
	103SR13A-11	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 3	Unipolar	1000 mm [40.0 in]
	103SR13A-12	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 2	Unipolar	2006 mm [79 in]
	103SR13A-13	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; three hex nuts	Type 1	Unipolar	152 mm [6.0 in]
	103SR13A-14	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 1	Unipolar	305 mm [12.0 in]
	103SR13A-16	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 1	Unipolar	356 mm [14.0 in]
	103SR14A-1	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 1	Unipolar	152 mm [6.0 in]
	103SR14A-2	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 2	Unipolar	1000 mm [40.0 in]
	103SR17A-1	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 1	Latching	152 mm [6.0 in]
	103SR17A-2	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 2	Latching	1000 mm [40.0 in]
	103SR18-1	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 4	Latching	152 mm [6.0 in]
	103SR19A-1	Sealed, 15/32-32 UNS-2A cylindrical aluminum threaded housing; two hex nuts	Type 1	Linear	152 mm [6.0 in]

\*Cable/Leadwire type

Type 1 - 24 gauge stranded, irradiated polyethylene insulated

Type 2 - 22 gauge PVC insulated conductor with black molded PVC jacket

Type 3 - 22 gauge insulated conductors with yellow thermoplastic polyurethane jacket

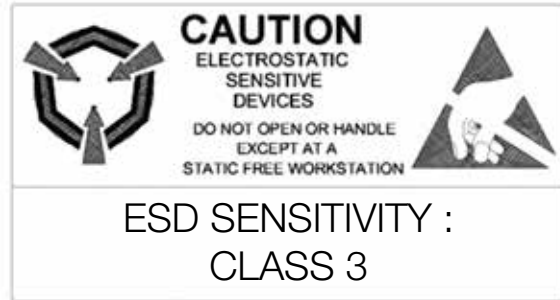
Type 4 - 24 gauge irradiated polyethylene

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## ADDITIONAL INFORMATION

The following associated literature is available on the Honeywell website at [sensing.honeywell.com](http://sensing.honeywell.com):

- Product line guide
- Product range guide
- Product installation instructions
- Application Notes:
  - Sensors and Switches in Front Loaders
  - Sensors and Switches in Mobile Cranes
  - Blood Recovery System
- Technical Notes:
  - Solid-State Sensors Glossary of Terms
  - Interpreting Operating Characteristics for Solid-State Sensors



### **⚠ WARNING** **PERSONAL INJURY**

**DO NOT USE** these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

### **⚠ WARNING** **MISUSE OF DOCUMENTATION**

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

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To learn more about Honeywell's sensing and control products, call **+1-815-235-6847** or **1-800-537-6945**, visit **sensing.honeywell.com**, or email inquiries to **info.sc@honeywell.com**

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