

## Position Sensors Line Guide



**Precision, down the line.** Honeywell Sensing and Control (S&C) Position Sensors consist of encoders, inertial measurement units, non-contact Hall-effect rotary positions sensors, SMART position sensors, ultrasonic products, and resolvers.

**Encoders** are available in both mechanical and optical versions, and are best for potential applications requiring panel-mounted, manually-operated rotary sensing.

**Inertial Measurement Units (IMU)** are high-end position sensors with sensitive multi-axis motion control. These sensors measure the motion of the equipment onto which they are attached and deliver the data to the equipment's control module, allowing the operator to focus on other equipment functions, enabling more precise control than can be achieved by using only the human eye, thus increasing safety, stability and productivity.

**Non-Contact Hall-Effect Rotary Position Sensors** respond to the presence or to the interruption of a magnetic field, using a solid-state Hall-effect IC to sense rotary movement of the actuator shaft and then producing a proportional output. These sensors provide a 360° operating range, low torque actuation, enhanced resistance to damage from incorrect wiring and electrical noise,

wide operating angle tolerant to overtravel, and integrated reverse polarity, short circuit and EMC protection.

**SMART Position Sensors** (Superior Measurement, Accuracy, Reliability, and Thinking.) enable highly accurate motion control, improving operational efficiency and safety. They measure linear, angular, or rotary movement of a magnet attached to a moving object. Non-contact design eliminates mechanical failure mechanisms, reducing wear and tear, improving reliability and durability, and minimizing downtime. Robust in most harsh environments. Easy to install, reducing set-up costs.

**Ultrasonic Sensors** measure time delays between emitted and echo pulses, determining the sensor-to-target distance. These non-contact-based products solve the toughest sensing problems by detecting targets made of virtually any material — regardless of color, transparency, shine or opacity.

**Resolvers** provide non-contact measurement for 360° sensing, enhanced accuracy, resolution, and repeatability under severe environmental conditions. They are inherently radiation hardened and offer durable EMC (Electromagnetic Compatibility) performance.

## FEATURES

### ENCODERS

#### 510 Series.

**Features:** Mechanical encoder • High resolution of up to 36 positions • Gray code digital voltage output • Wide operating temperature range of -40 °C to 105 °C [-40 °F to 221 °F] • Mounting flexibility

**Benefits:** High resolution of up to 36 positions for applications that require high resolution. Gray code digital voltage output may eliminate the need for analog to digital converters, contributing to a more cost-effective solution. Wide operating temperature range helps minimize thermal performance issues. Horizontal or vertical mounting

terminations promote flexibility in the application. Potential applications include audio/visual equipment, smoke detectors, irrigation controls, oscilloscopes, robotics, EKG and defibrillation machines.

#### 600 Series.

**Features:** Optical encoder • Dual quadrature output generating 128 pulses per channel • Non-contact technology, with a minimum of 10 million shaft rotation:

- Digital voltage output • TTL-compatible output
- Wide operating temperature range of -40 °C to 65 °C [-40 °F to 149 °F]
- Choice of mounting terminations

**Benefits:** Non-contact technology promotes long life in the application.

Digital voltage output may eliminate the need for analog to digital converters, contributing to a more cost-effective solution. TTL-compatible output prevents triggering of false highs/lows due to ambient noise. Wide operating temperature range promotes flexibility in the applications. Designed to provide mounting flexibility. Potential applications include motor control, flow control, robotics, computer peripherals, welding equipment, portable diagnostic equipment, home healthcare respiratory equipment, surgical equipment and precision joysticks.

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**Encoders:** Our mechanical encoders have 2-bit and 4-bit graycode outputs for absolute electrical reference applications. Manually operated optical encoders output two square waves in quadrature.

**Inertial Measurement Units (IMU):** Designed to Six Sigma standards with industry-leading durability, accuracy, voltage input flexibility, and temperature performance.

**Non-Contact Hall-effect Rotary Position Sensors:** These products use a magnetically biased, Hall-effect integrated circuit to sense rotary movement of the actuator over a set operating range. Integral actuator or external actuator available.

**SMART Position Sensors:** The non-contacting technology is designed to provide enhanced product life and durability with less downtime.

**Ultrasonic Sensors:** We offer analog or digital units, plus programmable versions for tailored applications. Particularly effective detecting clear or shiny objects, or in particle-laden air and splashing liquid environments.

**Resolvers:** These rotary and angle absolute position sensors provide 360° non-contact sensing with enhanced accuracy for precise motion control. Available in standard styles and are fully customizable.



## Encoders

	510 Series	600 Series
<b>Type</b>	mechanical	optical
<b>Pulse per revolution</b>	16, 9, 6, 4	128
<b>Output</b>	2- or 4-bit gray code	quadrature square wave
<b>Temperature range</b>	-40 °C to 105 °C [-40 °F to 221 °F]	-40 °C to 65 °C [-40 °F to 149 °F]
<b>Expected rotational life</b>	100k cycles	10 million rotations min.
<b>Operating speed</b>	50 rpm max.	300 rpm max.
<b>Terminals</b>	PC type C-30 type with/without bracket, B-110 type	PC type B-66, PC type C-24, cable, cable/connector



## Inertial Measurement Units (IMU)

	6DF Series
<b>Description</b>	6 Degrees of Freedom, 6-D Motion Variant
<b>Supply voltage</b>	7 V to 32 V
<b>Supply current</b>	350 mA max.
<b>Startup time</b>	700 ms typ.
<b>Output type</b>	SAEJ1939 CAN 29
<b>Operating temperature range</b>	-40 °C to 85 °C [-40 °F to 185 °F]
<b>Accelerometer</b>	2 g, 6 g
<b>Sealing</b>	IP67, IP69K
<b>Housing material</b>	aluminum
<b>Approvals/testing/qualifications</b>	EMI/EMC, ESD, mechanical and thermal shock, random vibration, humidity, salt spray, chemical compatibility, automotive grade



## Non-Contact Hall-Effect Rotary Position Sensors

### RTY Series

### RTP Series

### RPN Series

<b>Sensing range</b>	50° (±25°), 60° (±30°), 70° (±35°), 90° (±45°), 120° (±60°), 180° (±90°), 270° (±135°), 360° (±180°)	50° (±25°), 60° (±30°), 70° (±35°), 90° (±45°), 120° (±60°), 180° (±90°), 270° (±135°), 350° (±175°), 360° (±180°)	50° (±25°), 60° (±30°), 70° (±35°), 90° (±45°), 120° (±60°), 180° (±90°), 270° (±135°), 360° (±180°)
<b>Input voltage</b>	low voltage: 5 Vdc ±0.5 Vdc high voltage: 10 Vdc to 30 Vdc	low voltage: 5 Vdc ±0.5 Vdc high voltage: 10 Vdc to 30 Vdc	5 Vdc, 8 to 30 Vdc, 10 Vdc to 30 Vdc
<b>Output</b>	<ul style="list-style-type: none"> <li>low voltage: 0.5 V to 4.5 V ratiometric (standard); 4.5 V to 0.5 V ratiometric (inverted)</li> <li>high voltage: 0.5 V to 4.5 V ratiometric (standard); 4.5 V to 0.5 V ratiometric (inverted)</li> </ul>	<ul style="list-style-type: none"> <li>low voltage: 0.5 V to 4.5 V ratiometric (standard); 4.5 V to 0.5 V ratiometric (inverted)</li> <li>high voltage: 0.5 V to 4.5 V ratiometric (standard); 4.5 V to 0.5 V ratiometric (inverted)</li> </ul>	0.25 V to 4.75 V, 0.5 V to 4.5 V, 1 V to 9 V, 3 V to 5 V, 4.5 V to 0.5 V, 4.75 V to 0.25 V, 4 mA to 20 mA, 20 mA to 4 mA
<b>Input current</b>	<ul style="list-style-type: none"> <li>low voltage: 20 mA max.; during output to ground short, 25 mA max.</li> <li>high voltage: 32 mA max.; during output to ground short, 47 mA max.</li> </ul>	<ul style="list-style-type: none"> <li>low voltage: 20 mA max.; during output to ground short, 25 mA max.</li> <li>high voltage: 32 mA max.; during output to ground short, 47 mA max.</li> </ul>	20 mA max.
<b>Operating temp. range</b>	-40 °C to 125 °C [-40 °F to 257 °F]	-40 °C to 125 °C [-40 °F to 257 °F]	-40 °C to 125 °C [-40 °F to 257 °F]
<b>Termination</b>	AMP super seal	AMP super seal	AMP 1-1419168-1, AMP Superseal 282087-1, Deutsch DT04-3P
<b>Life</b>	35 M cycles	infinite	30 M cycles
<b>EMI/EMC</b>	<ul style="list-style-type: none"> <li>EMI radiated immunity: 100 V/m from 200 MHz to 1000 MHz per ISO11452-2</li> <li>EMI conducted immunity:                             <ul style="list-style-type: none"> <li>low voltage: 100 mA BCI per ISO11452-4 from 1 MHz to 200 MHz</li> <li>high voltage: 100 mA BCI per ISO11452-4 from 1 MHz to 400 MHz</li> </ul> </li> <li>EMC: exceeds CE requirements</li> </ul>	<ul style="list-style-type: none"> <li>EMI radiated immunity: 100 V/m from 200 MHz to 1000 MHz per ISO11452-2</li> <li>EMI conducted immunity:                             <ul style="list-style-type: none"> <li>low voltage: 100 mA BCI per ISO11452-4 from 1 MHz to 200 MHz</li> <li>high voltage: 100 mA BCI per ISO11452-4 from 1 MHz to 400 MHz</li> </ul> </li> <li>EMC: exceeds CE requirements</li> </ul>	EMC: 200 V/m ISO 11452-3
<b>Housing material</b>	PBT plastic	PBT plastic	PA66 plastic



## Non-Contact Hall-Effect Rotary Position Sensors

### HRS Series

<b>Sensing range</b>	90° ±2°, 180° ±2°
<b>Input voltage</b>	5 Vdc ±10 %
<b>Output</b>	5 % to 95 % of applied Vdd, approx. (programmable) output ratiometric to supply)
<b>Input current</b>	5 mA typ.
<b>Operating temp. range</b>	-40 °C to 85 °C [-40 °F to 185 °F]
<b>Termination</b>	solder lug, flying wire leads, cable and connector
<b>Life</b>	10 M cycles
<b>EMI/EMC</b>	EMI: 30 V/m, 10 kHz to 1000 MHz at 3 m
<b>Housing material</b>	stainless steel

# Position Sensors Line Guide



**SMART Position Sensor**  
Superior Measurement.  
Accuracy. Reliability. Thinking.

**SPS Series**  
**35 mm Analog, 75 mm Analog,**  
**225 mm Analog, Digital Linear**  
**Configurations**

**SPS Series**  
**100° and 180°**  
**Arc Configurations**

**SPS Series**  
**360° Rotary Configuration**

<b>Description</b>	Enables highly accurate motion control, improving operational efficiency and safety. Non-contact design eliminates mechanical failure mechanisms, reducing wear and tear, improving reliability and durability, and minimizing downtime. Robust in most harsh environments. Easy to install, reducing set-up costs.		
<b>Configuration</b>	linear	arc	rotary
<b>Sensing range</b>	35 mm: 0 mm to 35 mm [0 in to 1.38 in] 75 mm: 0 mm to 75 mm [0 in to 2.95 in] 225 mm: 0 mm to 225 mm [0 in to 8.86 in]	100°: 0° to 100° 180°: 0° to 180°	0° to 360°
<b>Actuator sensing location on arc</b>	N/A	100°: inside or outside 180°: inside	N/A
<b>Resolution</b>	35 mm analog: 0,04 mm [0.0016 in] 75 mm analog: 0,05 mm [0.002 in] 225 mm analog: 0,14 mm [0.0055 in] 225 mm digital: 0,0035 mm [0.000137 in]	100° inside and outside: 0.06° 180° inside: 0.11°	0.01°
<b>Supply voltage</b>	35 mm: 4.75 Vdc to 5.25 Vdc all other versions: 6 Vdc to 24 Vdc	100° inside: 6 Vdc to 24 Vdc, 18 Vdc to 40 Vdc 100° outside: 5 Vdc 180° inside: 6 Vdc to 24 Vdc, 18 Vdc to 40 Vdc	12 Vdc to 30 Vdc
<b>Supply current</b>	35 mm analog: 20 mA max. 75 mm analog: 32 mA max. 225 mm analog: 34 mA max. 225 mm digital: 88 mA max.	100° inside: 45 mA max. 100° outside: 30 mA max. 180° inside: 45 mA max.	90 mA max.
<b>Output</b>	35 mm analog: 0.55 Vdc to 4.15 Vdc 75 mm and 225 mm analog: 0 Vdc to 5 Vdc 225 mm digital: RS232 type	0.5 Vdc to 4.5 Vdc	4 mA to 20 mA
<b>Air gap (sensor to magnet actuator clearance)</b>	35 mm analog: 8,5 ±1,0 mm [0.334 ±0.039 in] all other versions: 3,0 mm ±2,5 mm [0.118 in ±0.098 in]	100° inside: 7,8 ±2,5 mm [0.307 ±0.098 in] 100° outside: 9,2 ±2,5 mm [0.36 ±0.09 in] 180° inside: 8,58 ±2,5 mm [0.338 ±0.098 in]	3,0 ±2,0 mm [0.118 ±0.079 in]
<b>Operating temperature range</b>	-40 °C to 125 °C [-40 °F to 257 °F]	-40 °C to 85 °C [-40 °F to 185 °F]	-40 °C to 85 °C [-40 °F to 185 °F]
<b>Storage temperature range</b>	-40 °C to 150 °C [-40 °F to 302 °F]	-40 °C to 150 °C [-40 °F to 302 °F]	-40 °C to 150 °C [-40 °F to 302 °F]
<b>Termination</b>	35 mm analog: TYCO Super Seal 282087-1 integral connector all other versions: 18 AWG flying leads	100° inside: 4-pin M12 connector, 18 AWG flying leads 100° outside: Ampseal 16 connector 180° inside: 4-pin M12 connector	5-pin male connector
<b>Sealing</b>	IP67, IP69K	IP67, IP69K	IP67, IP69K
<b>Radiated immunity</b>	35 mm analog: 100 V/m per ISO 11452-2 all other versions: n/a	—	—
<b>Conducted immunity</b>	35 mm analog: 100 mA BCI per ISO 11452-4 all other versions: n/a	—	—
<b>Housing material</b>	thermoplastic	thermoplastic	aluminum with powder coating
<b>Approvals</b>	CE	CE	CE

# Position Sensors Line Guide



## Ultrasonic Sensors

### 940-F/947 Series

### 941-D Series

<b>Range type</b>	0,6 m to 3 m [2 ft to 10 ft]	0,4 m to 3,5 m [1.3 ft to 11.5 ft]
<b>Output type</b>	analog or switching	analog or switching
<b>Supply voltage</b>	19 Vdc to 30 Vdc	15 Vdc to 30 Vdc
<b>Housing style</b>	plastic M18 and M30	plastic square housing
<b>Termination type</b>	cable or connector	connector
<b>Beam angle</b>	8°	10°
<b>Response time</b>	50 ms, 90 ms	150 ms
<b>Switching frequency</b>	100 ms, 1 Hz, 8 Hz, 25 Hz	10 Hz
<b>Repeatability</b>	0.3 % or ±1 mm, 0.2 % or ±2 mm	±1 mm
<b>Software programmable</b>	no	no
<b>Teach in</b>	no	yes
<b>Remote teach in</b>	no	no
<b>Synchronization output</b>	yes	yes



## Ultrasonic Sensors

### 942 Series

### 943 Series

<b>Range type</b>	1,5 m to 3,5 m [4.9 ft to 11.5 ft]	0,2 m to 3,5 m [0.7 ft to 11.5 ft]
<b>Output type</b>	analog and switching	analog or switching
<b>Supply voltage</b>	19 Vdc to 30 Vdc	15 Vdc to 30 Vdc
<b>Housing style</b>	plastic M30	metal M12, plastic M18 and M30
<b>Termination type</b>	connector	cable or connector
<b>Beam angle</b>	8°, 10°	8°
<b>Response time</b>	100 ms	400 ms
<b>Switching frequency</b>	5 Hz to 30 Hz, 5 Hz to 8 Hz	100 ms, 250 ms, 1.2 Hz, 4.7 Hz
<b>Repeatability</b>	0.4 % or 2 mm; 0.2 % or ±1 mm	0.2 % or ±2 mm
<b>Software programmable</b>	yes	no
<b>Teach in</b>	yes	yes
<b>Remote teach in</b>	no	yes
<b>Synchronization output</b>	yes	no

## Ultrasonic Sensors



**944 Series**

**946 Series**

**948 Series**

<b>Range type</b>	0,4 m to 3,5 m [1.2 ft to 11.5 ft]	0,3 m to 6 m [0.93 ft to 19.69 ft]	0,3 m [1 ft]
<b>Output type</b>	analog and switching	analog and switching	switching
<b>Supply voltage</b>	19 Vdc to 30 Vdc	10 V to 30 V	18 Vdc to 30 Vdc
<b>Housing style</b>	plastic M18 and M30	stainless steel M30	2 pieces square plastic
<b>Termination type</b>	connector	M12 connector	cable
<b>Beam angle</b>	8°	5°	8°
<b>Response time</b>	–	21 ms, 65 ms, 145 ms, 195 ms, 285 ms, 850 ms	–
<b>Switching frequency</b>	0.8 Hz, 1 Hz, 8 Hz	–	–
<b>Repeatability</b>	0.4 % or $\pm 2$ mm	< 0.1 %	–
<b>Software programmable</b>	no	no	no
<b>Teach in</b>	yes	yes	no
<b>Remote teach in</b>	no	no	no
<b>Synchronization output</b>	no	no	no

## Resolvers



**Honeywell Hawk™ 1-Inch Series**

**Honeywell Hawk™ 3-Inch Series**

<b>Configuration</b>	fully housed	pancake (bare and simple housed), fully housed
<b>Diameter</b>	1 in	3 in
<b>Speed</b>	1X	1X; 1X and 16X
<b>Accuracy</b>	$\pm 420$ arcsec	1X: $\pm 420$ arcsec (1800 arcsec in dual speed variants) 16X: $\pm 25$ arcsec (3 V to 15 V and 800 Hz to 2500 Hz)
<b>Features</b>	transformer (360°+ mechanical) redundant	transformer (360°+ mechanical) redundant, customizable

## **INERTIAL MEASUREMENT UNIT (IMU) 6 Degrees of Freedom Inertial Measurement Unit, 6-D Motion Variant, 6DF Series.**

**Features:** Designed to Six Sigma standards • Industry-leading durability • Industry-leading accuracy • Eases integration • 6-dimensional motion sensing • Industry-leading voltage input flexibility (7 V to 32 V) • Industry-leading application expertise • Industry-leading customization • Automotive-grade qualified • Industry-leading temperature performance • Long-term stability • No calibration needed

**Benefits:** Six Sigma standards provide the highest level of product quality, performance, and consistency. Aluminum housing, corrosion-resistance, chemical compatibility, IP67 and IP69k ratings, wide operating temperature range EMI (electromagnetic interference) and EMC (electromagnetic compatibility) provide industry-leading durability. Industry-leading accuracy provides highly accurate 6-dimensional rotation and acceleration outputs. SAEJ1939 CAN 29 bit identifier communication output, IP67 and IP69k ratings, wide voltage range (7 V to 32 V), Deutsch connector, chemical compatibility eases integration. 6-dimensional motion sensing provides key equipment operating data, frees the operator to focus on equipment functions, enables precise control, increases accuracy, safety, stability, and operator productivity. Industry-leading voltage input flexibility (7 V to 32 V) allows customers to purchase only one catalog listing, allows the IMU to accommodate voltage fluctuation, and provides reverse polarity protection. Honeywell's application engineers are available to provide troubleshooting and product design assistance. For Transportation applications with high volumes over 500 units per year, Honeywell will consider offering customers a choice of any CAN protocol. Industry-leading temperature performance provided by a temperature sensor placed within each rotation rate sensor within the IMU provides a temperature value to the processing module where the data samples are filtered and compensated. Long-term stability minimizes system calibration needs, maximizes system

performance, and helps support system uptime. Large batches of the IMU are calibrated to a flat surface, providing calibration consistency between units and eliminating the customer's need to calibrate the IMU.

## **NON-CONTACT HALL-EFFECT POSITION SENSORS RTY Series.**

**Features:** True, non-contact operation • Expected life: 35 M cycles • Solid-state Hall-effect technology • Rugged IP69K-sealed package with integral connector • Automotive-grade EMI/EMC testing, integrated reverse polarity, and short circuit • Industry-standard AMP termination, 32 mm mounting pitch, North American and European pinout styles, and compact package • Eight operating ranges up to 360°

**Benefits:** Non-contact sensing in harsh transportation and industrial applications at a competitive cost. 35 M cycle product life provides long life in the application. Solid-state, Hall-effect technology provides non-contact operation, long service life, low torque actuation and reduces worn-out mechanisms. IP69K sealing and integral connector allows for use in harsh environments. EMI/EMC testing, reverse polarity and short circuit provide protection against installation errors and frequencies in the environment. Industry-standard termination, mounting pitch and pinout provide drop-in replacement for existing applications. Choice of sensing ranges provides flexibility in multiple applications, allowing OEMs the range of travel needed for the application. Potential transportation applications include position and movement detection (pedals, throttles, gear shift, levers, steering, linkages, and hitches) on trucks, buses, off-road vehicles, industrial/construction/agricultural vehicles and equipment, cranes); suspension displacement/kneeling on buses, trucks; tilt/trim position on boat engines, tilling equipment), as well as industrial valve, HVAC damper control, and irrigation pivot control.

## **RTP Series.**

**Features:** True, non-contact operation • Expected life: infinite rotation • Solid-

state Hall-effect technology • Rugged IP69K-sealed package • Automotive-grade EMI/EMC testing, integrated reverse polarity, and short circuit protection • Industry-standard AMP termination, 32 mm mounting pitch, North American or European pinout styles, and compact package • Nine operating ranges to 360°

**Benefits:** Non-contact sensing in harsh transportation and industrial applications at a competitive cost. Absence of an actuator shaft removes the wear and tear on the bearings caused by radial forces. IP69K sealing provides durability in most harsh environments. Tolerant to over-travel and allows use in most common applications. Available versions cover an input voltage range of 4.5 Vdc to 30 Vdc. Potential transportation applications include position and movement detection (pedals, throttles, gear shift, levers, steering, linkages, and hitches) in trucks, buses, off-road vehicles, cranes, and industrial/construction/agricultural vehicles and equipment; suspension/kneeling position in buses and trucks); tilt/trim position in boat engines and tilling equipment. Potential industrial applications include valve, HVAC damper, and irrigation equipment pivot control.

## **RPN Series.**

**Features:** Solid-state Hall-effect technology • Expected life: 30 M cycles • Eight sensing ranges up to 360° • Reverse polarity, short circuit and EMC protection • Choice of operating ranges, outputs, and levers • IP67- or IP69K-sealed package with integral connector

**Benefits:** Long service life, low torque actuation, and reduced mechanism wear-out. Enhanced resistance to damage from incorrect wiring and electrical noise. Wide choice of sensing ranges provides range of travel for most applications; tolerant to overtravel. Output choices provide flexibility of use within the application. Sealed package with integral connector provides enhanced durability. May be used in potential Transportation applications to detect pedals, throttles, gear shift levers, linkages, suspension and hitches in trucks, offroad vehicles, cranes and construction/agricultural/industrial equipment.

## HRS Series.

**Features:** Solid-state Hall-effect technology

- 10 M cycle product life (typical)
- Choice of termination types
- Voltage output allows direct connection to the control system
- Choice of anti-rotation locating pins
- Rotary potentiometer package form factor

**Benefits:** Long service life. Low torque actuation. Enhanced performance in harsh environments, especially those with vibration, shock and extreme temperatures. Reduced mechanical wear concerns. 10 M cycle product life (typical) promotes extended life in the application. Choice of termination types contributes to design flexibility in the application. Voltage output can reduce external circuitry and overall system complexity, lowering overall installation cost to the customer. Choice of anti-rotation locating pins limits rotation of the device in the application, preventing over-travel on levers and throttles. Designed to provide direct replacement for potentiometers, often allowing drop-in conversion to Hall-effect technology. Potential applications include position and movement detection in off-road vehicles and construction/agricultural equipment gear shifters, joysticks, throttles, pedals, hitches, bucket/loaders, steering, auto-pilot/drive-by-wire system feedback, material handling, industrial vehicle attachments, robotic arms and valve actuators.

## SMART POSITION SENSORS

### SPS Series.

**Features:** • Linear, arc and rotary configurations • Reliable, durable • Easy to install • Rugged • Flexible • Cost effective • Accurate • Adaptable • Lightweight • Simplifies design-in • Self-diagnostics feature • Combined patented MR sensor and ASIC technology • IP67 and IP69K sealing • RoHS compliant

**Benefits:** Variety of configurations provide application flexibility. Non-contact design reduces wear and tear, improving reliability and durability, and minimizing downtime. Easy to install, takes four simple steps vs up to 14 steps some competitive products require, simplifying installation and reducing set-up costs. Because there are no moving parts within

the sensor, Honeywell utilizes unique packaging materials that make the sensor more resistant to vibration, shock, and extreme temperatures. Air gap of up to 8,5 mm  $\pm$  1,0 mm [0.334 in  $\pm$  0.039 in] between sensor and magnet and variety of available output options (analog standard and other RS232-type baud rates) expand application opportunities. Adaptable, non-contacting design allows customers to eliminate unnecessary connections for installation, thereby reducing installation steps, installation time, and components. Electronics on board allow for flexible packaging and component compatibility with existing systems. Lighter in weight than LVDT (Linear Variable Differential Transformer) technology. High shock and vibration resistance allows for use in a wide variety of tough applications. Combined patented MR sensor and ASIC technology provides enhanced differentiation and performance. IP67 and IP69K sealing allow use in many harsh applications. RoHS-compliant materials meet Directive 2002/95/EC. Potential applications include valve position, material handling, plastic molding, cutting and slitting, wafer handling, CNC machines, passenger bus level position, truck-mounted crane outrigger position, heavy equipment attachment position, hydraulic cylinders, gear shift position in engine transmissions, aerial work lift platform position, rail-road crossing arms position, remote weapon systems elevation, ground-based solar panels elevation and azimuth, robotically-assisted surgery equipment position, steering and articulation angle, boom arm detection, solar panes and wind turbines.

## ULTRASONIC SENSORS

### 940-F/947 Series.

**Features:** Maximum scan ranges from 0,6 m to 3,0 m [1.96 ft to 19.68 ft] • Plastic housing M18 (for 0,6 [1.96 ft] and 1,5 m [4.92 ft] models), M30 (for 3,5 m [11.48 ft] models) • Chemical-resistant epoxy heads • High sealing IP67 • Pre-leaded 2,0 m [78.75 in] or M12 connector models • Synchronizing/hold input • Adjustment by potentiometer • Micro-processor controlled • Temperature compensation

**Benefits:** Easy to use. Provide unprecedented ultrasonic power in a very small package. Provide one switching output (PNP or NPN open collector). Powerful ultrasonic beam detects even targets with bad ultrasonic characteristics (angled, soft, absorbent, and pulverulent). M18 or M30 package allows mounting in narrow places. Adjustment is simply performed by a potentiometer. The high-sealing IP67, plastic housing, and the epoxy head provide enhanced resistance in aggressive environments like food and beverage or raw materials processing factories. Other potential applications include bottle counting, food processing machinery, filling machinery, crop handling machinery, and ground flatness detection for vehicles.

### 941-D Series.

**Features:** Limit switch-style sensor

- Maximum scan range is 3,5 m [11.48 ft]
- Plastic housing
- Teach in
- Sealing to IP67
- M12 connector, 5 pin
- Visual indication
- Four output options; analog (0 Vdc to 10 Vdc and 4 mA to 20 mA) and 2 PNP or 2 NPN switching outputs
- Synchronizing/hold input
- Two switch point adjustment via teach-in sequence
- Temperature compensation
- Easy installation
- Competitively priced
- Not affected by dust, light, and color
- CE and UL/CSA approved

**Benefits:** Provides all high-end sensor features in a limit switch-style housing. Longer scanning distance than inductive technology. Up to 3500 mm scanning distance with significantly reduced dead zones. Hysteresis adjustment and Microsoft® Windows® function are available, making this sensor an excellent replacement for more expensive devices. 32 mm thickness allows installation even if the space in potential application is reduced. Meets demanding application requirements including presence detection, applications with restricted space, slitter and rewinder machines, cranes, and loop control.

### 942 Series.

**Features:** Four models with scan ranges from 0,9 m to 3,0 m [2.95 ft to 9.84 ft]

- Stainless steel M30 heads, IP65
- Plastic



control box with screw terminals, IP40

- Synchronizing/hold input
- Ultrasonic beam power (sensitivity) adjustable by switch
- Four switching outputs, open collector PNP: set points 1 and 2, adjustable by coded wheels; underrange (target close), overrange (target far or absent)
- NO/NC adjustable by switch
- Two analog outputs (4 mA to 20 mA and 0 Vdc to 10 Vdc)
- Temperature compensation
- Most versatile sensors of product range
- May be mounted in remote or difficult locations

**Benefits:** Control box is mountable on DIN rail and houses all the adjustments. Adjustment can be performed in a matter of seconds via the coding wheels and switches on the front panel of the control box. Advanced programming is done on a PC, connected with the RS-232 link. The software (under Microsoft® Windows®) provides a very easy man-machine interface with extended possibilities: digital signal processing parameters, cycle time, slope, etc. Potential applications include loop control, tank level measurement (liquids, crops, etc.), reel diameter measurement, and tire manufacturing.

### 943 Series.

**Features:** Remote teach-in/auto-tuning Windows and hysteresis mode

- Scanning distances with minimized dead zone and extended maximum ranges from 60 mm to 3500 mm [2.4 in to 137.7 in]
- Two switching outputs (each can be either NO or NC) or analog outputs (either voltage, 0 Vdc to 10 Vdc or current 4 mA to 20 mA) are available
- Temperature compensation
- Connector (M12, 5 pin) or cable version available
- Plastic M18 or M30 (depending on the scanning ranges) with IP67

**Benefits:** Remote teach-in/auto-tuning of the switching or analog outputs. High power, small package, high sealing and chemical resistance. Can be located where space is at a premium. Ideal for potential industrial applications including reel diameter measurement, tank level measurement, presence absence of a person or object, loop control, product height measurement, and tire manufacturing.

### 944 Series.

**Features:** Eight models with scan ranges from 0,35 m to 3,5 m [1.14 ft to 11.48 ft]

- Auto-tuning by one switch
- Slope direction selection
- NO/NC selection
- Two switching outputs (open collector PNP)
- Analog output (4 mA to 20 mA or 0 Vdc to 10 Vdc)
- Temperature compensation
- M12 five-pin connector
- M12 female connector included
- Plastic M30 housing, IP67

**Benefits:** Provides fullest range of functions in a complete package. Solves an even wider range of applications due to its very simple programming by auto-tuning. High power, small package, high sealing, chemical resistance. Potential applications include loop control, product height measurement, tank level measurement, reel diameter measurement, and tire manufacturing.

### 946 Series.

**Features:** Scan ranges from 0,3 m to 6,0 m [0.93 ft to 19.68 ft]

- Auto-tuning by four positions plug
- Independent/Windows® output choice (switching output models)
- Stainless steel M30 housing, IP65
- Two switching outputs, open collector PNP
- Temperature compensation
- M12 four-pin connector
- Connector cable 2,0 m [78.75 in] included

**Benefits:** Provides a compromise between easy usage and advanced features. Adjustment is easily done by auto-tuning. By inserting a plug with four positions, one can program the sensor in a matter of seconds; the parameters are stored in a non-volatile memory (EEPROM). Potential applications include loop control, product height measurement, tank level measurement, reel diameter measurement, and tire manufacturing.

### 948 Series.

**Features:** Sensing distance up to 300 mm [12 in]

- Four output configurations: NO PNP, NO NPN, NC PNP, NC NPN
- Switching frequency of 150 Hz
- 2 m [78.8 in] cable
- IP67 sealing
- Compact size

**Benefits:** Easy to install in limited space applications. Thru-scan detection

regardless of the object material for enhanced detection. Non-contact distance sensing for use in non-invasive measurement. Reduced sensitivity to light intensity/reflectivity/opacity of target for enhanced flexibility and certainty of measurement. Detects over a much longer distance than other detection methods reducing the need for close proximity to the target. Presence absence, tank-fill level and diameter measurement provides a robust and flexible measurement method. Potential applications include food and beverage, rapid presence/absence detection, bottle counting, and loop control.

## RESOLVERS

### Honeywell Hawk™ 1-Inch Series.

**Features:** Non-contact magnetic technology

- Fully-housed configuration with bearing/shaft
- Small outer diameter of 1 inch
- Single speed operation (1 magnetic pole pair)
- Excitation voltage range of 2 V to 15 V
- Excitation frequency range of 2000 Hz to 5000 Hz
- Transformation ratio of 0.45 or 1.0
- Accuracy of  $\pm 420$  arcsec
- Operating temperature range of -50.8 °C to 93.3 °C [-60 °F to 200 °F]
- Meets multiple military/aerospace specifications: DO-160D, MIL-STD-202G, MIL-STD-810G, MIL-STD-81963B, MIL-STD-461F; complies with space outgassing requirement SP-R0022

**Benefits:** Non-contact magnetic technology eliminates mechanical contact, reducing wear and improving reliability and durability by enhancing operation in harsh environments (performance is not affected by sand, dust or water). Small outer diameter of 1 inch allows for use in size-restricted applications. Single speed operation (1 magnetic pole pair) allows for cost-effective angle resolution over a 360°+ range. Wide voltage range allows customers to standardize on a resolver that meets their excitation voltage needs, simplifying sourcing and delivery, and saving time. Frequency range provides a wide variety of choices with which to power the device. Transformation ratios offer customers two choices, increasing flexibility of use within the application.

Accuracy enables precise motion control of weapon systems and space positioning devices. Wide operating temperature range allows for use in harsh environments and meets standard military and space application requirements. Product delivery up to 1.5 times faster than many competitive products. Customization due to Honeywell's manufacturing process. Global support due to Honeywell's worldwide presence. Engineering expertise due to Honeywell's 30+ years' experience providing accurate, reliable, and durable resolvers for the aerospace and defense industries. Potential applications include providing absolute position feedback of the azimuth and/or elevation angular planes for military electro-optical systems, fire control systems, gimbals, infrared systems, ordnance delivery and test equipment, as well as satellite, space station, space vehicle solar panel array and antennae positioning for optimum function.

### **Honeywell Hawk™ 3-Inch Series.**

**Features:** Single and dual speed operation (1 and/or 16 magnetic pole pairs) • Multiple configurations (pancake bare and pancake simple housed, fully housed) with rotary transformers • Operating temperature range of -50.8 °C to 93.3 °C [-60 °F to 200 °F] • Accuracy of ±420 arcsec (1X), ±25 arcsec (16X) • Excitation frequency range of 800 Hz to 5000 Hz • Excitation voltage range of 3 V to 15 V • Transformation ratio of 0.25 or 1.0 • Shock of 50 g, 11 ms • Vibration of 15 g, 10 Hz to 2000 Hz • Non-contact magnetic technology • Endurance testing to MIL-hdbk-218 (6.2) (1200 hr at 1150 rpm) • Meets multiple military/aerospace specifications: DO-160D, MIL-STD-202G, MIL-STD-810G, MIL-STD-81963B, MIL-STD-461F; complies with space outgassing requirement SP-R0022, product delivery, customizable, global support, engineering expertise.

Potential applications include defense electro-optical and fire control systems, gimbals position and infrared feedback, aerospace space vehicle solar panels and antennae positioning, medical oncology equipment positioning, and industrial CNC/precision tooling.

**Warranty.** Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. **The foregoing is buyer's sole remedy and is in lieu of all warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

For more information about Sensing and Control products, visit [sensing.honeywell.com](http://sensing.honeywell.com) or call +1-815-235-6847 or 1-800-537-6945; email inquiries to [info.sc@honeywell.com](mailto:info.sc@honeywell.com)

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### **⚠ 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 document is for reference only. DO NOT USE this document as product installation information.
- Complete installation, operation and maintenance information is provided in the instructions supplied with each product.

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

# Honeywell