

# SWING ANGLE SENSOR

006008  
Issue 1

## RTP Series Hall-effect Swing Angle Sensor

### DESCRIPTION

The RTP Series Hall-effect **Swing Angle Sensor** is a non-contact rotary position sensor with sensing range up to 360°. The Swing Angle Sensor is an extension of Honeywell's RTP rotary position sensors.

The Swing Angle Sensor uses a magnetically biased dual die Hall-effect integrated circuit (IC) to sense rotary movement of an actuator over a set operating range. The rotation of the actuator changes the magnet's position relative to the IC. The resulting flux density change is converted to a linear output.

The non-contact sensor construction, signal conditioning and protection circuitry, are sealed in an IP69K rugged brass housing capable of withstanding pressure up to 5000KPa. The magnet is separated from the sensor body, and this combination allows over-travel of the actuator. The absence of the actuator shaft removes wear and tear on the bearings caused by radial forces. The Swing Angle Sensor is designed to meet high reliability standards.

Two independent analog outputs separated with 180° phase shift are combined to achieve a 360° sensing range. The Swing Angle Sensor low power consumption makes it ideal for low voltage applications.

### FEATURES

- **Reliable, durable:** Non-contact design reduces wear and tear, improving reliability and durability, minimizing downtime
- **Rugged:** Honeywell utilizes a brass housing with no moving parts within the sensor, making it resistant to corrosion, vibration and shock

- **Flexible:** Air gap tolerance of 2 mm between sensor and magnet
- **Cost effective:** Adaptable, non-contacting design allows customers eliminate unnecessary connections for installation, reducing installation steps/time and components
- **Adaptable:** Electronics on board allow for flexible packaging and component compatibility with existing systems
- **IP69K sealing, o-ring and brass housing** allows use in many harsh applications
- **RoHS-compliant** materials meet Directive 2002/95/EC
- **Mating connector:** AMP 776487-1
- **Sensing range:** 0° to 360°
- **Output type:** Dual Output 10 % to 90 % of VDD (Ratiometric) 270° ±5° range with 180° ± 0.2° phase shift
- **Linearity accuracy:** ±2 % or ±0.74 %FS
- **Repeatability:** ±0.2 % or ±0.074 %FS

### VALUE TO CUSTOMERS

- **Precise machine control:** Low cost sensor solution enables precise rotary position sensing, up to 360° in heavy-duty applications
- **Improved system reliability:** The absence of an actuator shaft allows over-travel in 360° sensing applications. This reduces system wear and tear. The o-ring allows for direct contact with most common transportation fluids without impact to product performance
- **Scalable robust solution:** Brass housing makes it ideal for usage in high pressure applications



### APPLICATIONS

#### Transportation

- 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 (buses, trucks)
- Tilt/trim position (boat engines, tilling equipment)

#### Industrial

- Valve control
- HVAC damper control
- Irrigation equipment pivot control

#### Military

- Chassis suspension systems position height

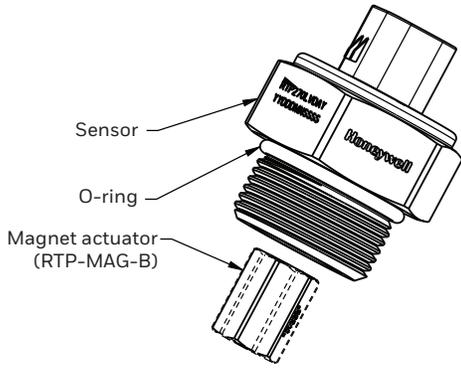


### PORTFOLIO

Honeywell offers a variety of Hall-effect rotary position for use in many applications. To view the entire product portfolio, [click here](#).

**Honeywell**

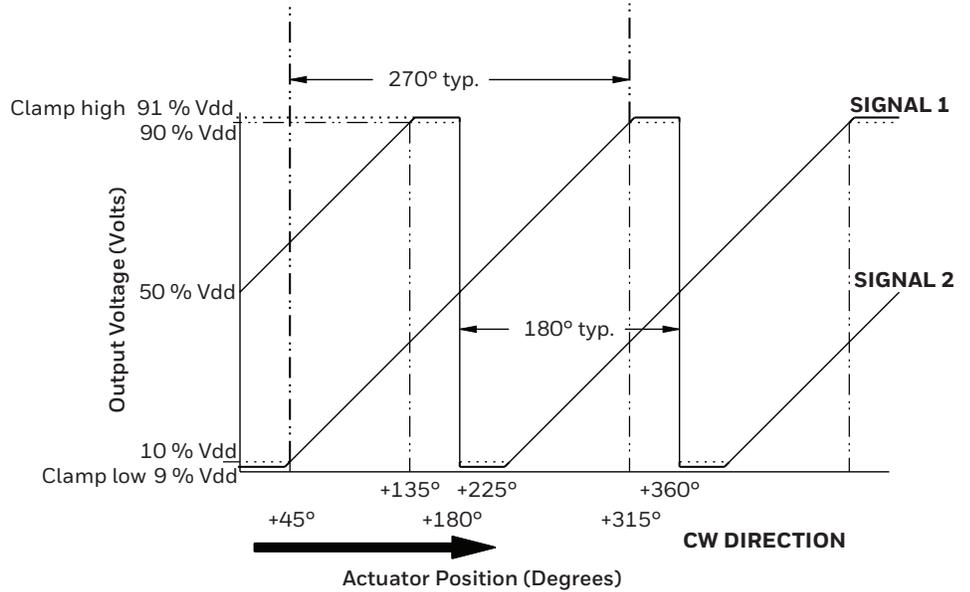
# SWING ANGLE SENSOR RTP SERIES



**Swing Angle Sensor:** Honeywell's Swing Angle Sensor belongs to the RTP Platform which is a Hall-effect Rotary Position Sensor in a two-piece construction where the magnet and sensor are packaged in two separate housings.

Both the sensor and magnet carriers are thread mounted devices. The sensor provides Dual Analog Output with 180 degrees phase shift. Each one of them independently covers a sensing range of 270°. Swing Angle Sensor can be utilized to measure 360° of travel by calculating the positional information of the two output signals.

**Figure 1. Characteristic Curve**



## HONEYWELL SWING ANGLE SENSOR TECHNOLOGY OVERVIEW

The Honeywell Angle sensors have been specifically designed for demanding applications in industries such as heavy-duty, off-highway transportation. The Hall-effect Swing Angle Sensor assists in enabling autonomous vehicle characteristics and enhances efficiency and productivity by reporting the key data required to automate and monitor movements of components.

# SWING ANGLE SENSOR RTP SERIES

## TYPICAL APPLICATION FOR SWING ANGLE SENSORS

### EXCAVATORS

One of the most versatile and heavily utilized pieces of equipment in the earth-moving arsenal is the excavator. The excavator is truly a workhorse for its owner. Available in many different sizes with many features, the excavator makes quick work of any digging, trenching, grading, loading and other types of work. Typically equipped with a large bucket for digging, these machines can be easily changed over to utilize other implements, such as claws for grabbing, rock crushers, even cutters... the list is endless.

Proper operation of such a machine requires great skill to ensure safety and efficiency. Training operators to be proficient in operating these complex machines can take many months.

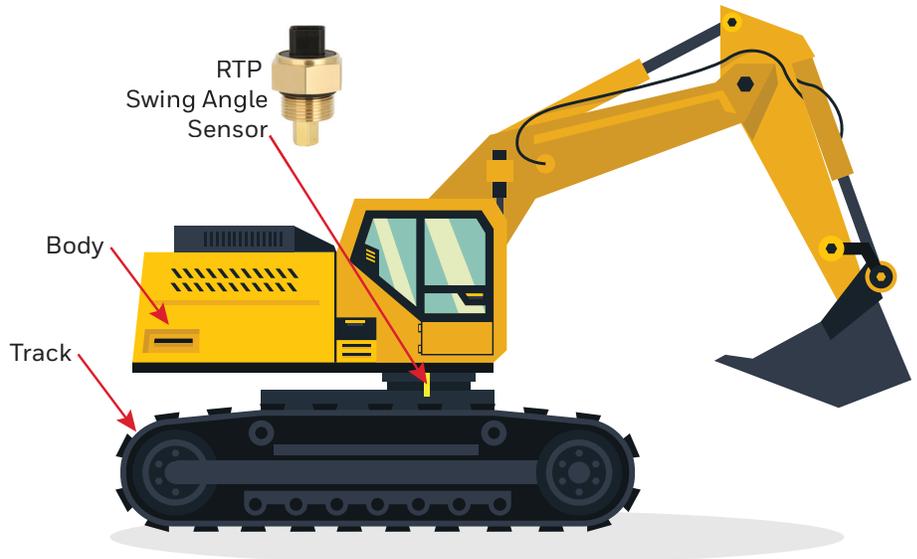
New technologies available today are tackling normally heavily skilled operator-dependant platforms and enhancing their capability. Honeywell's new line of Swing Angle Sensors products are designed to do just that. Combining the Swing Angle Sensors with the SMART Arc CAN sensor and Honeywell TARS IMU help enable full machine control.

The Honeywell Swing Angle sensor is positioned in the center of rotation on the excavator or similar machine. The sensor is thread mounted on the Chassis/Body of the machine; the separate magnet is installed on the track, or lower unit of the apparatus.

As the chassis rotates or changes location with respect to the track, the Honeywell Swing Angle Sensor will provide a full 360° of position location. Taking this reading from the Swing Angle Sensor allows the machine control system to determine the location of the chassis with respect to the track.

By knowing the exact location of the chassis, this allows systems integrators to understand the location of the Boom and Stick with respect to the track and allows for the implementation of autonomous features.

For example, once the track and body/chassis locations are established, autonomous features like Return To-Dig, Return To-Dump, E-fencing and other advanced capabilities can be implemented.



### AUTONOMOUS FEATURES EXAMPLES

**RETURN TO-DIG:** This feature improves efficiency. By programming in the location of the work area, the machine can quickly return to a state of readiness and minimize operator interaction and reduce cycle time.

**RETURN TO-DUMP:** Much like the Return To-Dig, this automated feature allows for improved efficiency. Once the parameter is established, this feature allows the machine to deposit material or dump in the same location each time. Examples include a dump truck or dirt pile.

**E-FENCE SWING:** This feature improves safety when working near traffic or in congested areas. Just use the monitor to set maximum swing angles to the left and right of the machine. When those angles are reached, motion stops, preventing contact between the machines and nearby obstacles.

**E-FENCE PROTECTION:** Once enabled, this simple feature can create invisible electronic boundaries over, under and around the machine. If any part of the machine breaches the boundaries, motion stops, protecting people and property. This is how e-fence can help to reduce risk.

# SWING ANGLE SENSOR

## RTP SERIES

**TABLE 1. ELECTRICAL CHARACTERISTICS**

CHARACTERISTIC	CONDITION
Regulated & Protected Supply Voltage (Vdd)	5 Vdc $\pm$ 0.5 Vdc
Supply Current	25 mA MAX
Supply Current (During output to ground)	30 mA MAX
Power-Up Time	20 m sec
Output	Dual output 10 % to 90 % of Vdd (Ratiometric) 270° $\pm$ 5° range. 180° $\pm$ 2° phase shift
Reverse Polarity Protection	-5.5 Vdc
Output to Ground Short Circuit Protection	Continuous
Output Load Resistance (Pull Down)	10 KOhm pull down on both outputs
EMI - Radiated Immunity	50 V/m per ISO11452-2, from 1.0 GHz TO 2.7 GHz
EMI - Connected Immunity	80 mA BCI per ISO11452-4, from 1 MHz to 400 MHz
EMI - Radiated Immunity	REF: 100 V/m per ISO11452-2, from 200 MHz to 1 GHz
EMI- Radiated Immunity (Strip Line)	REF: 100 V/m per ISO11452-2, from 10 KHz to 200 MHz
ESD	8 KV contact, 15 KV AIR, ISO10605
Conducted Emission	150 KHz to 108 MHz CISPR25 (Class 3)
Radiated Emission	150 KHz to 54 MHz CISPR25 (Class 3) 300 MHz to 1G Hz ISO13766-1 EAS BB&NB
FAR Filed Emissions	Highest internal frequency <108 MHz, CISPR16

**TABLE 2. ENVIRONMENTAL CHARACTERISTICS**

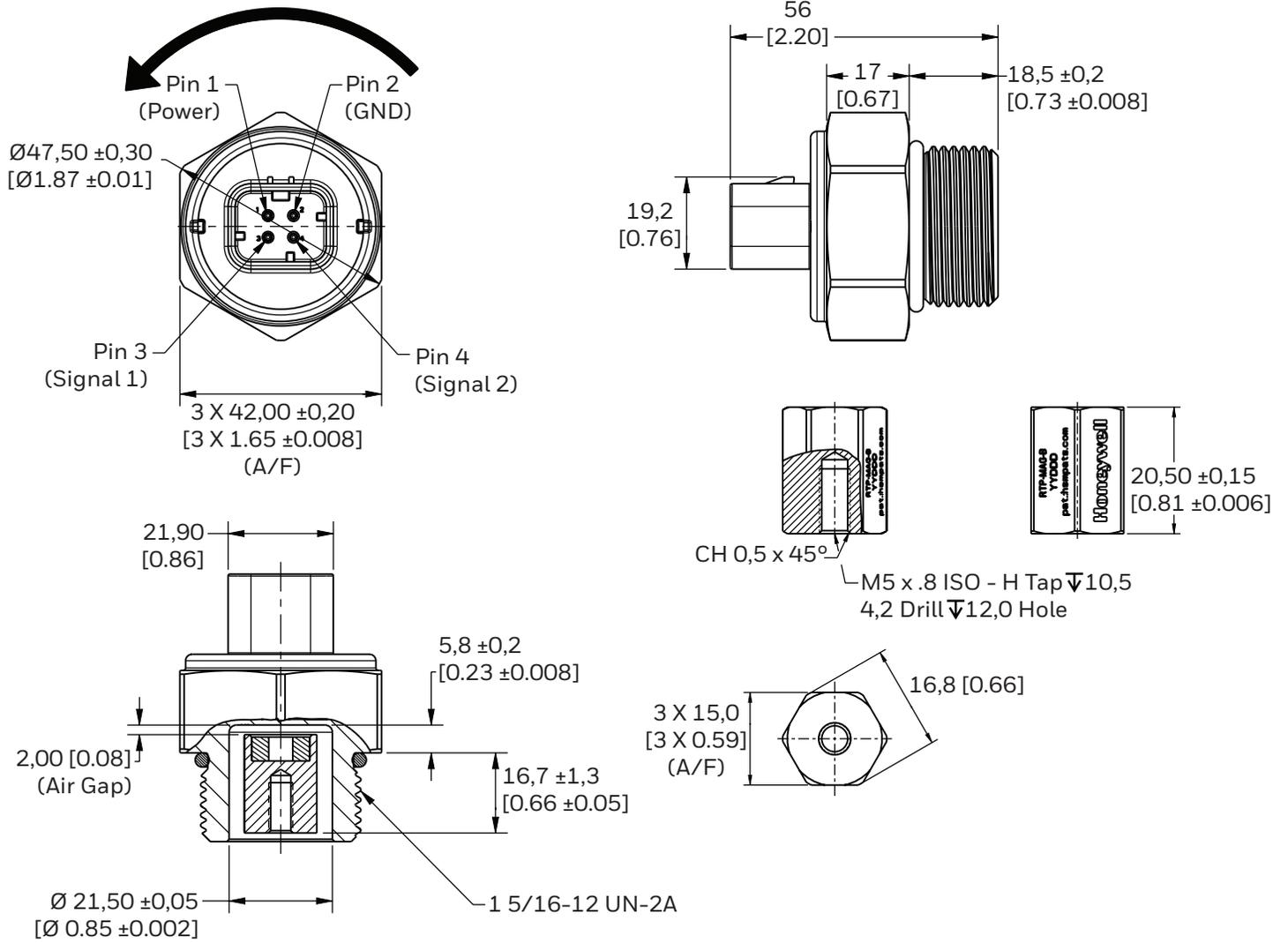
CHARACTERISTIC	CONDITION
Operating Temperature	-40°C to 105°C
Ingress Protection	IP69K (DIN40050-1993) with mating connector installed
Salt Spray	96 hours for sensor and actuator as per ASTM B117
Media Compatibility	Diesel fuel, coolant, urea, engine oil, hydraulic oil, washer solvents, (alkaline degreaser), grease tri-sodium phosphate
Mechanical Vibration	15.32 Grms random, 6 hours per Orthogonal Plane, 18 hours in total
Thermal Cycle	100 cycles, -40°C to 105°C, dwell: 60-Min
Proof Pressure	5000 KPa

**TABLE 3. ACTIVE LISTING**

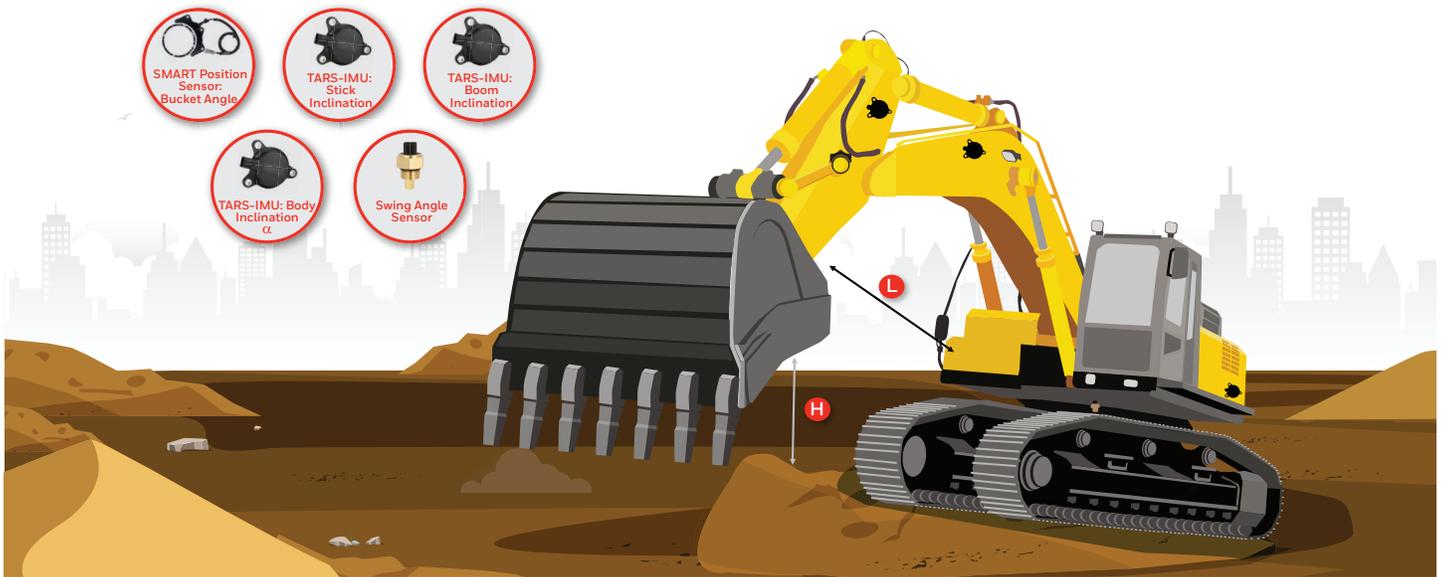
PART NUMBER	DESCRIPTION
RTP270LVDA	Honeywell Swing Angle Sensor
RTP-MAG-B	Magnet Actuator (not supplied with sensor, to be ordered separately)

# SWING ANGLE SENSOR RTP SERIES

Figure 2. Dimensional Drawing



# SWING ANGLE SENSOR RTP SERIES



## AUTONOMOUS SENSING SUITE - EXCAVATOR APPLICATION

### INCREASE PRODUCTIVITY & EFFICIENCY

The primary goal is to create a more productive and safer machine that can be efficiently operated by workers with minimal experience. For example, once the track and body/chassis locations are established, autonomous features like return-to-dig, return-to-dump, e-fencing and other advanced capabilities can be implemented.

### SOLUTION: HONEYWELL SENSOR SUITE

Installation of the Honeywell Swing Angle Sensor on the chassis and track, along with the SMART Arc CAN on the bucket, can be coupled with TARS-IMUs on the boom, stick and body of the excavator. The data from these sensors are used to determine the position of the bucket tip. The resulting calculation feeds the guidance system to inform the operator. Or in autonomous systems, the data is used to drive the hydraulic system and moving parts to the specified position for trenching. Auto-assisted excavation effectively reduces the requirements for highly skilled operators and reduces project cost caused by rework.

The purpose of the five-sensor fusion calculation is to calculate the space position L and H of the bucket tip in real time.

Honeywell Swing Angle Sensor's capabilities can be extended to help include other technologies as highlighted in the Honeywell Sensor Suite. Coupling the Swing Angle Sensor along with a SMART Arc CAN sensor for bucket position and Honeywell TARS sensors for Inclination, helps create a smart excavator.

OEMs can utilize this sensor suite to create a SMART excavator that can enhance the performance of the machine.

### COMMON COMPONENTS FOR AUTONOMOUS SENSING SUITE

**Swing Angle Sensor:** Honeywell's Swing Angle Sensor provides swivel position for the excavators. The thread-mounted sensor is designed to be installed onto a swivel directly by withstanding the burst pressure of the hydraulic as it is IP69K sealed, tolerant to high vibration/shock and high tightening torque

**TARS-IMU:** The Transportation Attitude Reference System is a packaged sensor array designed to report vehicle angular rate, acceleration and attitude data for demanding applications in industries such as heavy-duty, off-highway transportation. The TARS-IMU enables autonomous vehicle characteristics and enhances efficiency and productivity by reporting key data required to automate

and monitor movements of vehicle systems and components. The sensor fusion algorithm may be customized for specific vehicle applications via on-board firmware, allowing movement data to be filtered for extraneous environment and vehicle movements.

**SMART Sensors:** The Honeywell SMART Arc CAN Position Sensor is one of the most durable, adaptable, lightweight and non-contact position sensors available. It enables absolute position sensing with enhanced accuracy. This simple, robust, arc position sensor offers an IP69K sealed package, eliminating mechanical failure mechanisms, reducing wear and tear, improving reliability and durability and minimizing downtime.

The SMART Arc CAN Position Sensor is a non-contact sensing solution, providing highly accurate motion control, and improving operation efficiency and safety. This Honeywell position sensor utilizes magnetoresistive technology to detect the position of a magnet relative to the sensor in one of two available sizes, within a range of: 0° to 145°

## ADDITIONAL MATERIALS

The following associated literature is available at [sps.honeywell.com/ast](https://sps.honeywell.com/ast):

- Product range guide
- Installation drawings

## NOTICE PRELIMINARY DOCUMENTATION

The information contained in this document is preliminary and for reference only. Preliminary means that the product described has not been or is currently being formally tested. Specifications are subject to change without notice. Reliance on the information contained herein is at the reader's own risk.

## FOR MORE INFORMATION

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USA/Canada	+1 302 613 4491
Latin America	+1 305 805 8188
Europe	+44 1344 238258
Japan	+81 (0) 3-6730-7152
Singapore	+65 6355 2828
Greater China	+86 4006396841

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**The foregoing is buyer's sole remedy and is in lieu of all other 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 Honeywell may provide application assistance personally, through our literature and the Honeywell web site, it is buyer's sole responsibility 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 writing. However, Honeywell assumes no responsibility for its use.

## 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.

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

## Honeywell Advanced Sensing Technologies

830 East Arapaho Road  
Richardson, TX 75081  
[sps.honeywell.com/ast](https://sps.honeywell.com/ast)