SMART ARC CAN

SMART Arc CAN Enabled 145° Position Sensor

Superior Measurement. Accurate. Reliable. Thinking.

006002

Issue 1

DESCRIPTION

The Honeywell SMART Arc CAN Position Sensor is one of the most durable, adaptable, lightweight, and non-contact position sensors available, enabling absolute position sensing with enhanced accuracy. The SMART Arc CAN Position Sensor is a new configuration type of Honeywell's SMART Arc Position Sensors.

The SMART Arc CAN Position sensor uses a ring magnet, allowing ease of integration in pinned joint applications. Communication is transmitted using industry-standard CAN J1939 connectivity. 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 sensing range of 0° to 145°. This robust arc position sensor is much more robust than typical rotary position sensors or in-cylinder sensors.

Honeywell's SMART Arc CAN Position Sensor offers an IP69K sealed package, eliminates mechanical failure mechanisms, reduces wear and tear and improves system reliability and durability.

Customization

The SMART Arc CAN Position Sensor may be customized to best meet specific application needs. Solutions may be tailored to exact specifications for improved time to market, lower total system costs and enhanced reliability.

These devices use a patented combination of an ASIC (Application-Specific Integrated Circuit) and an array of MR (magnetoresistive) sensors to accurately and reliably determine the position of the magnet in the magnet ring.

The MR array measures the output of the MR sensors mounted along the magnet's direction of travel. The output and the MR sensor sequence determine the nearest pair of MR sensors to the center of the magnet location. The output of these two MR sensors is then used to determine the position of the magnet between them.

POTENTIAL APPLICATIONS

Transportation

- Front end loader and digger/excavator boom position
- Refuse truck lift and automatic reach arm position
- Articulated vehicle steering position
- Timber harvester/processor equipment cutter arm position
- On-board loader weighing system position

Industrial

- Telescoping conveyor elevation
- Rail-road crossing arms position

Military

- Remote weapon systems elevation
- Chassis suspension systems position height

Aerospace:

- Ground-based solar panels elevation and azimuth
- Ground-based satellite dish elevation and azimuth

Medical:

- Robotically assisted surgery equipment position

FEATURES

- **Reliable, durable:** Non-contact design reduces wear and tear, improving reliability and durability, minimizing downtime
- **Rugged:** Honeywell utilizes package materials with no moving parts within the sensor, making it resistant to vibration, shock, and extreme temperatures
- **Flexible:** Air gap tolerance of 5,25 mm [0.21 in] between sensor and magnet expands application use
- **Cost effective:** Adaptable, non-contacting design allows customers to eliminate unnecessary connections for installation, reducing installation steps/time and components
- **Accurate:** 145° configuration accurately, linearity down to 0.3 %
- **Adaptable:** Electronics on board allow for flexible packaging and component compatibility with existing systems
- **Lightweight:** Lighter in weight than optical encoders
- **Self-diagnostics** feature can reduce equipment downtime by providing predictive maintenance input
- **Combined patented MR sensor and ASIC technology** provide enhanced differentiation and performance
- **IP68, IP69K sealing** allow use in many harsh applications
- **RoHS-compliant** materials meet Directive 2002/95/EC
- **Connector:** Deutsch DT06-04
- **Sensor Output:** CAN-2.0B SAE J1939

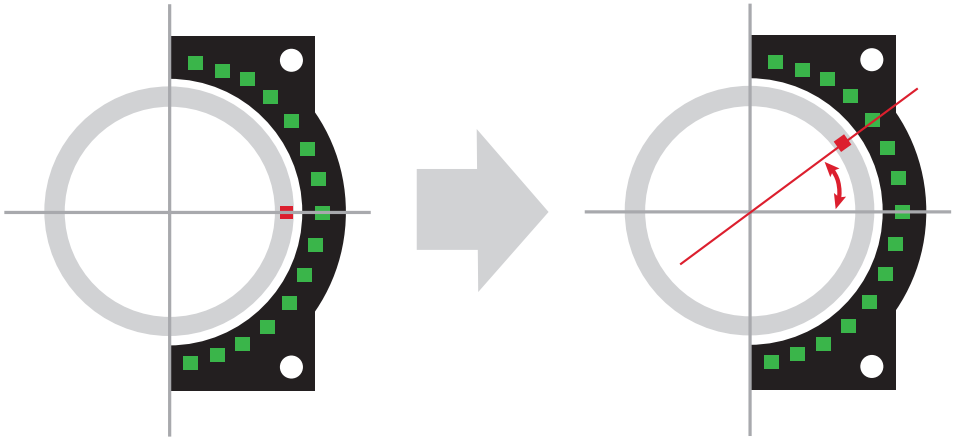
Honeywell

SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

THEORY OF OPERATION

- The bucket sensor is a two-piece design, consisting of the sensor and the magnet ring carrier.
- Theory of operation, as the magnet moves with respect to the sensor body. The position of the system can be interpreted.

Operating Principles Example



Output 0°

Output 45°

TABLE 1. SENSOR FAMILY DESIGNATION

Part Number	Definition
SPS-A145D-WCBS0301, **(Sensor-161)**	Defined by the 161-mm Outer Magnet Ring Diameter
SPS-A145D-WCBS0302, **(Sensor-161)**	Defined by the 161-mm Outer Magnet Ring Diameter
SPS-A145D-WCBS0303, **(Sensor-220)**	Defined by the 220-mm Outer Magnet Ring Diameter

TABLE 2. PART NUMBER ORDER GUIDE

Sensor Part Number	CAN Baud Rate	Ring Magnet Carrier*	Ring Magnet Outer Diameter	Product Family
SPS-A145D-WCBS0301	250 kbs	SPS-MAG-017 *	161 mm	Sensor-161
SPS-A145D-WCBS0302	500 kbs	SPS-MAG-017 *	161 mm	Sensor-161
SPS-A145D-WCBS0303	250 kbs	SPS-MAG-018 *	220 mm	Sensor-220

**Note: Ring magnets sold separately*

SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

SENSOR SENSING RANGE

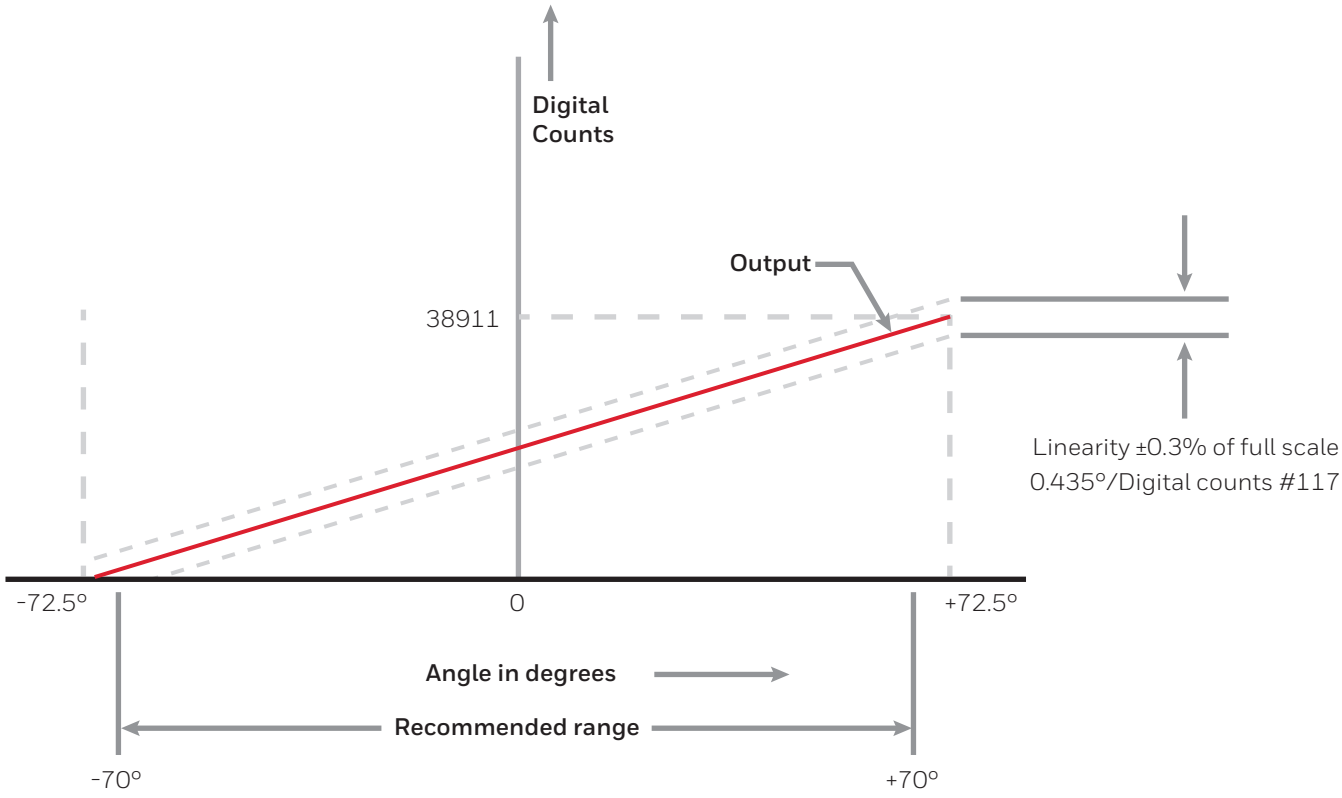


TABLE 3. SENSOR OUTPUT PERFORMANCE CHART

Parameter	Min.	Type	Max.	Unit
Measured angle	-	145	-	Degrees
Digital counts	0.0	-	38911	Numbers (#)
Sensitivity	-	268.35	-	Counts /Degree
% Linearity	-0.3	0.0	+0.3	% FS
Hysteresis	-	-	0.01	% Full scale
Repeatability	-	0.001	-	% Full Scale
Air gap (Sensor-161)	-	5.25	-	Millimeters
Air gap (Sensor-220)	-	6.75	-	Millimeters
Concentricity (Sensor-161)	-0.65	0.0	+0.65	Millimeters
Concentricity (Sensor-220)	-0.85	0.0	+0.85	Millimeters
Offset (Z)	-6.0	0.0	+6.0	Millimeters
Ring sensor magnet offset (Sensor-161)	-6.0	11.7	+6.0	Millimeters
Ring sensor magnet offset (Sensor-220)	-6.0	14.3	+6.0	Millimeters
Magnet rotary speed	-	-	10	RPM

TABLE 4. ENVIRONMENTAL CHARACTERISTICS

Characteristic	Parameter
Operating temperature	-40°C to 85°C [-40°F to 185°F]
Storage temperature	-55°C to 105°C [-67°F to 221°F]
Ingress protection	Pressure wash (IP69K, vacuum/pressure (IP68) All sealing test to be completed without connector immersed
Mechanical vibration	20 Grms [48 Hz to 200 Hz]
Mechanical shock	Max 100 G, Half Sine, 11 ms
Wire pull	10 lb [44.5 N] 1 min (Jacketed Cable)
Gravel bombardment	0.96 CM to 1.6 CM to check level of distraction
Chemical resistance (engine oil, diesel fuel, hydraulic oil)	Duration 24 hours immersion and 24-hour dry at room temperature
Hot dunk	10 power cycles (without connector immersion) 20 thermal cycles prior to hot dunk, duration 1 hour

SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

TABLE 5. ELECTRICAL SPECIFICATIONS

Characteristic	Min.	Nominal	Max.	Unit	Note
Supply voltage	9	12/24	36	V	–
Supply current	–	–	100	mA	–
Reverse voltage	–	–	-36	V	60 min @ 85°C
Over voltage	–	–	36	V	–
Short circuit protection	–	–	36	V	2 min. @ 85°C

EMI/EMC SPECIFICATIONS

Characteristic	Level	Standard	Note
Radiated immunity: ALSE	140 V/m, 200 MHz to 2.7 GHz	ISO 11452-2:2004	This sensor is used on earth-moving and building construction machinery; therefore, it was tested according to ISO 13766-1:2018 Earth-moving and building construction machinery standard, published in the Official Journal of the European Union (OJEU)
Radiated immunity: Stripline	100 V/m, 10 kHz to 200 MHz	ISO 11452-5:2002	
Bulk current injection	Test to 120 mA; 1 MHz to 400 MHz	ISO 11452-4:2011	
ESD: ISO packaging and handling	8 kV contact, 15 kV air	ISO 10605:2008	
Radiated emissions	150 kHz to 2.5 GHz, Class 3	CISPR 25:2016	
Radiated emissions	Broadband 30 MHz to 75 MHz, 58-48 db uV/m 75 MHz to 400 MHz, 48-59 db uV/m 400 MHz to 1000 MHz, 59 db uV/m (Quasi peak detector)	ISO 13766-1:2018	
	Narrowband 30 MHz to 75 MHz, 48-38 dB uV/m 75 MHz to 400 MHz, 38-49 dB uV/m 400 MHz to 1000 MHz, 49 dB uV/m (Average detector)		
Conducted emissions	150 kHz to 108 MHz	CISPR 25:2016	
Far field emissions	30 MHz to 230 MHz, 40 dB uV/m 230 MHz to 1000 MHz, 47 dB uV/m (Quasi peak detector)	CISPR 16-2-3:2016	
Ground noise immunity	100 Hz to 500 kHz, 0.5 V pp		
Conducted transient immunity	Pulse 1, -600 V	ISO 7637-2:2011 (ISO 13766) 24 V power test levels	
	Pulse 2a, +55 V		
	Pulse 2b, +20 V		
	Pulse 3a, -220 V		
	Pulse 3b, +220 V		
	Load dump: Pulse 5b	ISO 16750-2:2012	
	Starting profile		

SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

CONNECTOR PIN-OUT DETAILS

Mating Connector Deutsch Receptacle Part: DT06-4S

TABLE 6. CONNECTOR PINOUTS

Pinout	Wire Color	Pin out
Pin 1	Red	Power supply
Pin 2	Black	Signal ground
Pin 3	White	CAN Bus high
Pin 4	Blue	CAN Bus low

CAN MESSAGES AND COMMUNICATION

SPS-SMART Arc utilizes CAN 2.0B SAE J1939 protocol and message format to report data.

Please refer to the J1939 standard for information regarding communications and system implementation.

Security note

CAN Communication:

1. All communication which includes transmission and reception are sent decrypted.

CAN messages from SPS Sensor

Sensor are factory programmed to have a CAN address of **0xC4**.

Sensor is locked before shipment. Hence, CAN address cannot be changed. For CAN address customization, contact your sales representative.

TABLE 7. CAN OUTPUT DIAGNOSTIC CHARACTERISTICS

Error	Count	FOM	Error Code
Magnet out of range	65535	0 x 03	0 x 80
Other errors	Sensor position output	0 x 03	Non-zero value

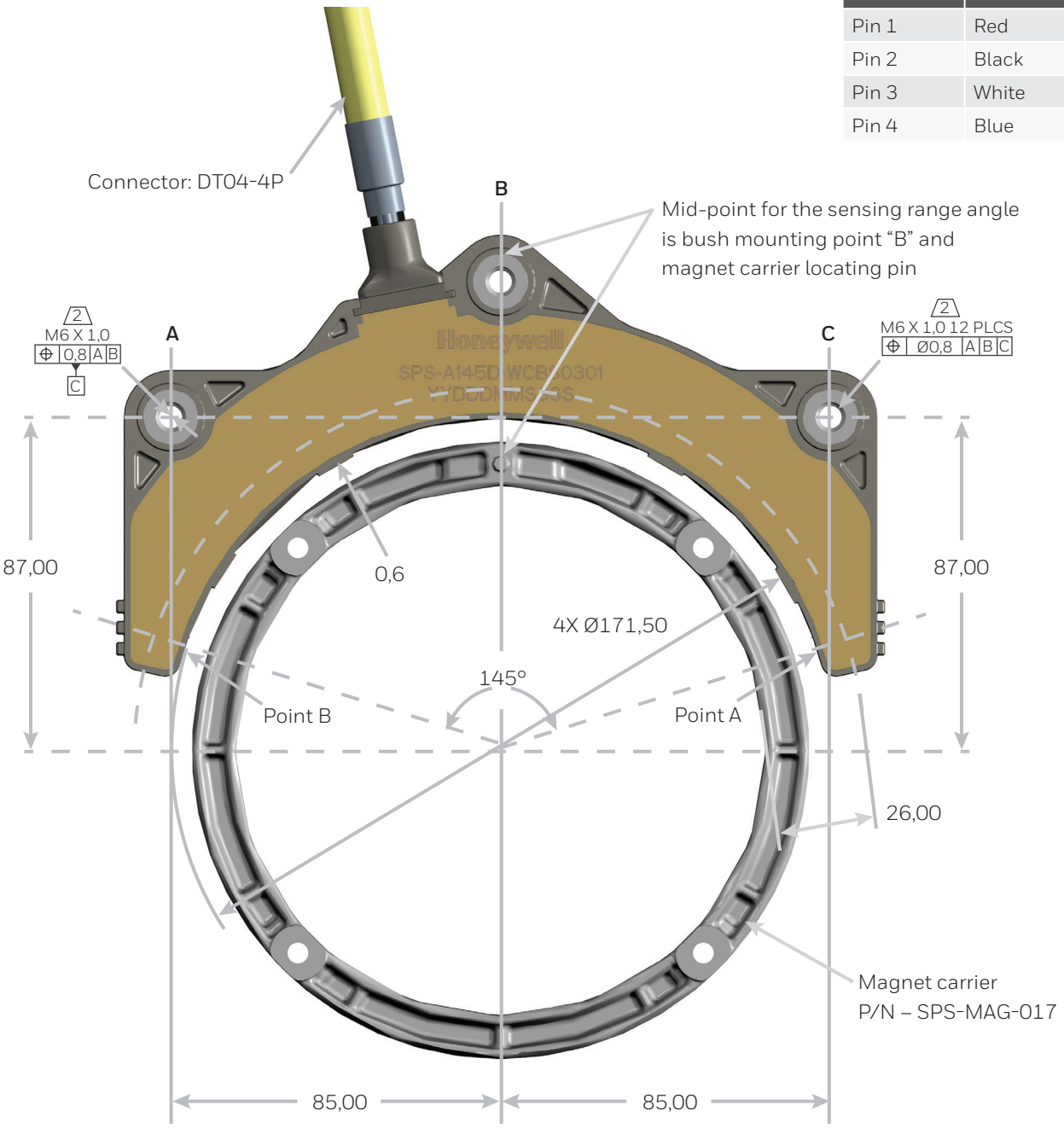
SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

DIMENSIONAL DETAILS FOR SPS-A145D-WCBS0301 AND SPS-A145D-WCBS0302 (SENSOR-161)

cable length 1000 mm ±20 mm

TABLE 8. CONNECTOR PINOUTS

Pinout	Wire Color	Pin out
Pin 1	Red	Power supply
Pin 2	Black	Signal ground
Pin 3	White	CAN Bus high
Pin 4	Blue	CAN Bus low



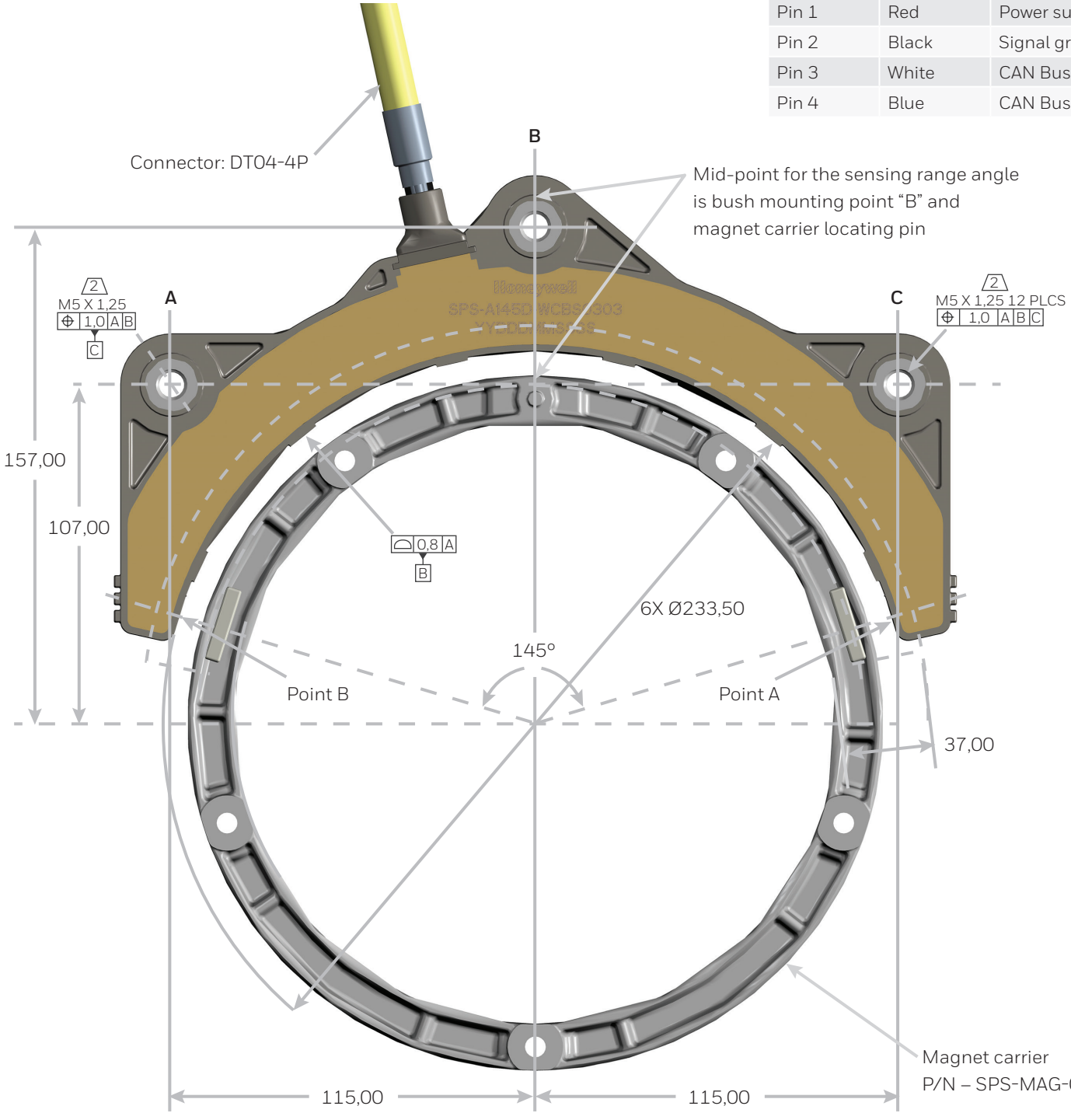
SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

DIMENSIONAL DETAILS FOR SPS-A145D-WCBS0303 (SENSOR-220)

cable length 1000 mm ±20 mm

TABLE 9. CONNECTOR PINOUTS

Pinout	Wire Color	Pin out
Pin 1	Red	Power supply
Pin 2	Black	Signal ground
Pin 3	White	CAN Bus high
Pin 4	Blue	CAN Bus low



SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

SENSOR RING MAGNET CARRIERS

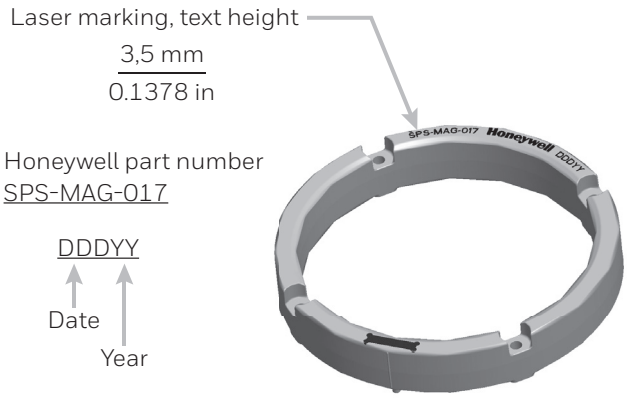
Honeywell offers two different sized Ring Magnet Carriers; they are specific for the two different sensor diameters.

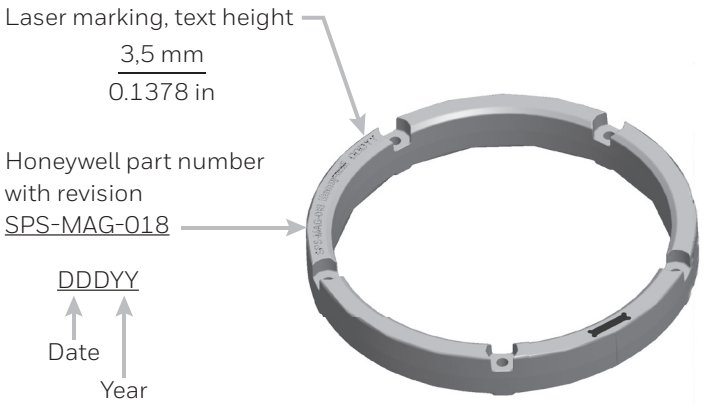
Ring Magnet Carriers are not supplied with sensor, customer will need to procure the proper carrier for their chosen sensor.

Ring Options

1. SPS-A145D-WCBS0301 (Sensor-161) and SPS-A145D-WCBS0302 (Sensor-161) will require **ring magnet carrier SPS-MAG-017.**
2. SPS-A145D-WCBS0303 (Sensor-220) will require **SPS-MAG-018.**

Rings are marked with the Honeywell part number. Before installation, the customer should ensure the proper ring magnet has been supplied.





Note: Non-ferrous hardware should be considered when installing the sensor and magnet to help minimize magnetic interaction.

SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

MAGNET RING MOUNTING SPECIFICATIONS FOR SPS-MAG-017

TABLE 10. SPECIFICATIONS

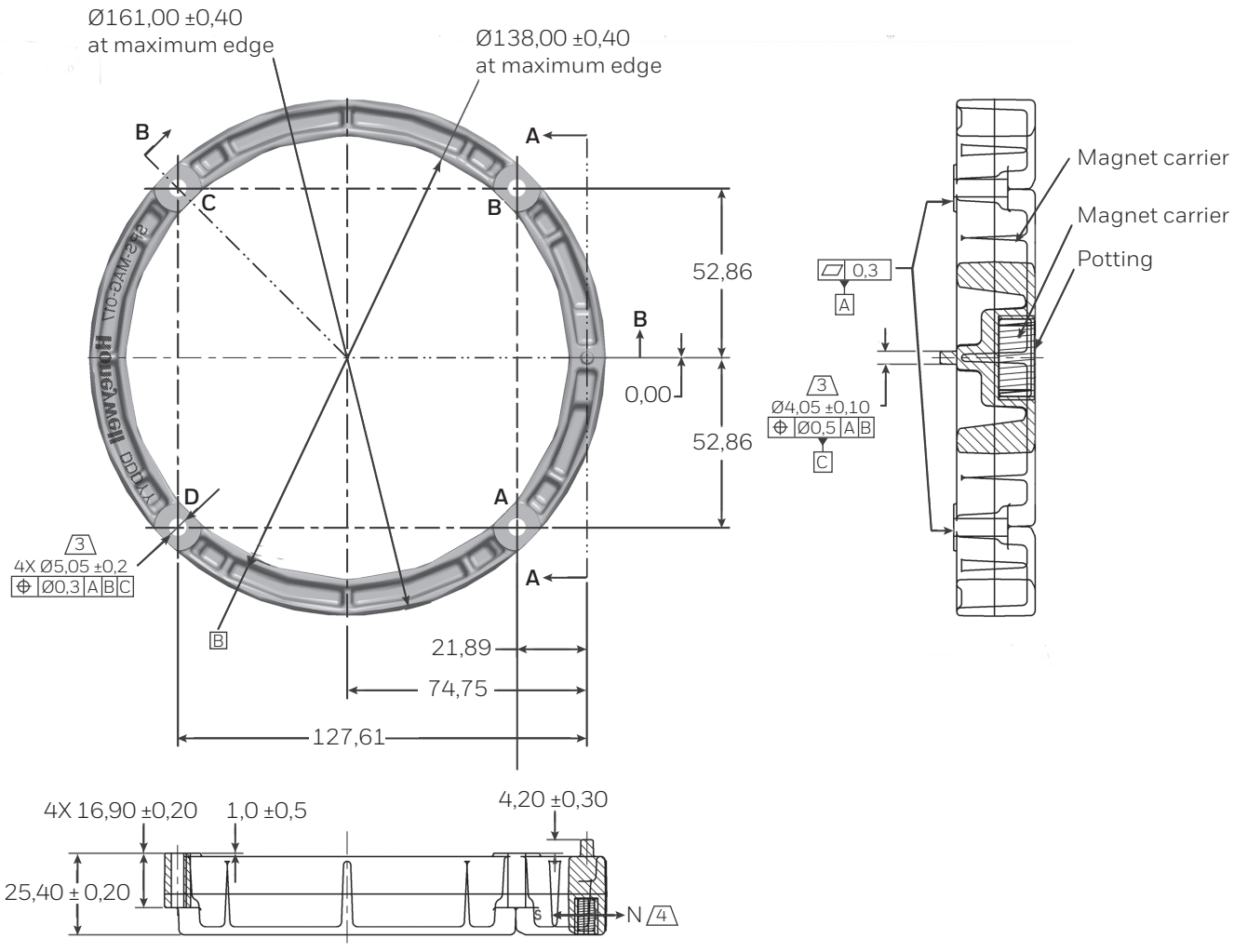
Characteristic	Parameter
Magnet carrier	Aluminum A380 with silver, powder coated
Magnet	Neodimium
Potting	Epoxy
Magnet pin locating hole	Ø 4,2 mm [Ø 0.17 in]
Mounting screws	M5 x 0,8 (length = 30) with washer (ID - 5.3)
Recommended installation torque	4,5 Nm to 6 Nm

Magnet carrier mounting torque must be applied gradually as per the sequence below

Mounting locations	*Torque*
A ⇨ C ⇨ B ⇨ D	Hand torque
A ⇨ C ⇨ B ⇨ D	Full torque

Note: Non-ferrous hardware should be considered when installing the sensor and magnet to help minimize magnetic interaction.

MAGNET CARRIER SPECIFICATIONS FOR SPS-MAG-017



SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

MAGNET RING MOUNTING SPECIFICATIONS FOR SPS-MAG-018

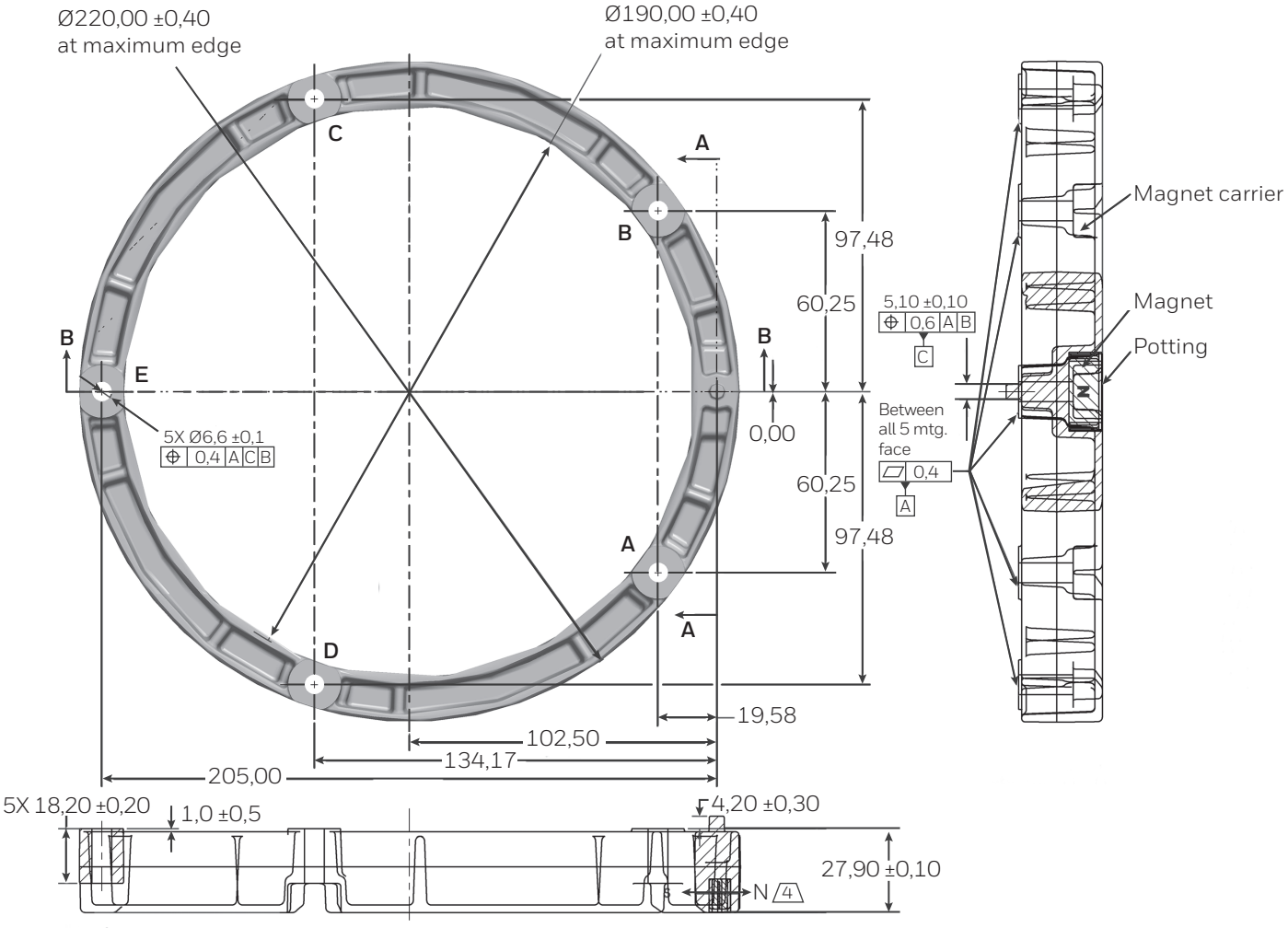
TABLE 11. SPECIFICATIONS	
Characteristic	**Parameter**
Magnet carrier	Aluminum A380 with silver, powder coated
Magnet	Neodimium
Potting	Epoxy
Magnet pin locating hole	Ø 5,2 mm [Ø 0.20 in]
Mounting screws	M6 x 1,0 (length = 35) with washer (ID - 6,4)
Recommended installation torque	8 Nm to 10,5 Nm

Magnet carrier mounting torque must be applied gradually as per the sequence below

Mounting locations	*Torque*
A ⇨ E ⇨ B ⇨ D ⇨ C	Hand torque
A ⇨ E ⇨ B ⇨ D ⇨ C	5 Nm
A ⇨ E ⇨ B ⇨ D ⇨ C	Full torque

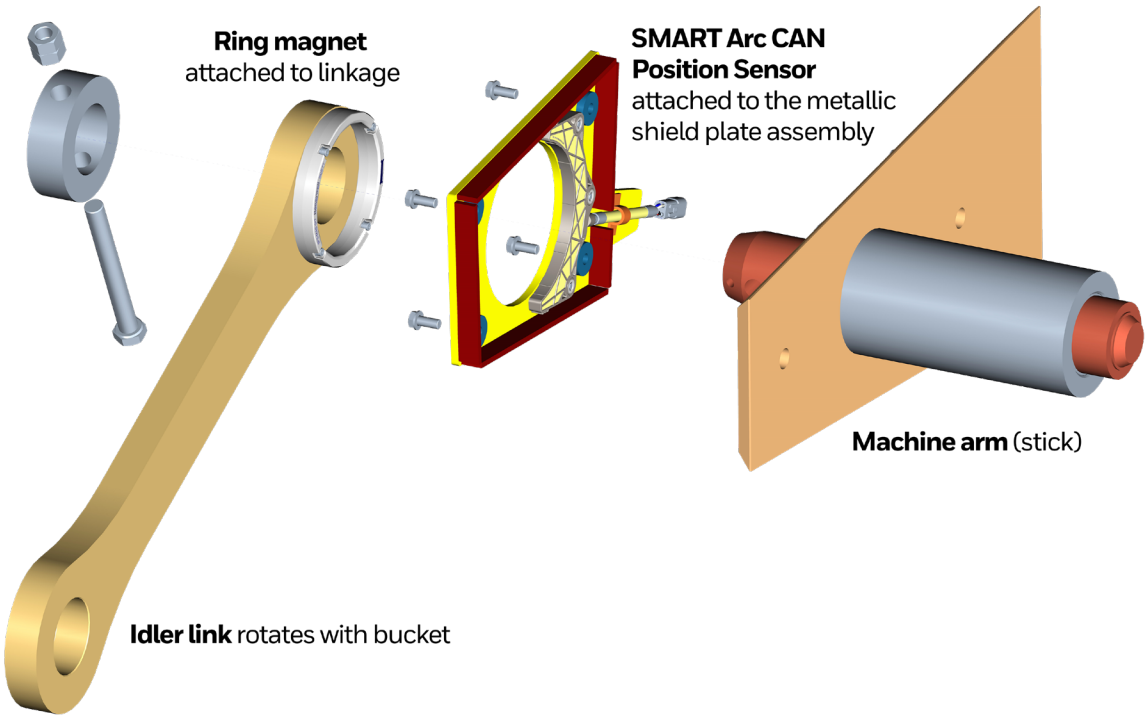
Note: Non-ferrous hardware should be considered when installing the sensor and magnet to help minimize magnetic interaction.

MAGNET CARRIER SPECIFICATIONS FOR SPS-MAG-018

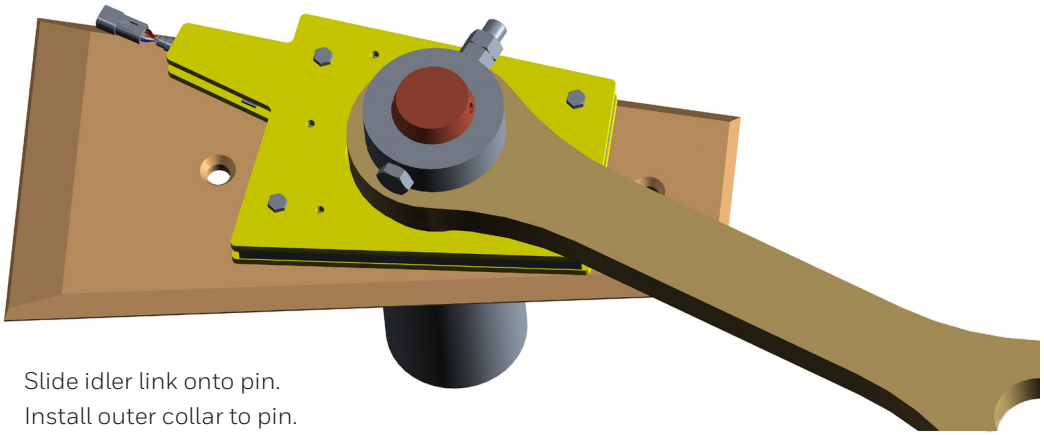


SMART ARC CAN ENABLED 145° POSITION SENSOR
SMART ARC – CAN

APPLICATION EXAMPLE AND OVERVIEW



SENSOR, RING AND IDLER INSTALLED ON STICK



- Slide idler link onto pin.
- Install outer collar to pin.
- Fasten outer collar nut & bolt to lock idler link in place.

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgment 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 that Honeywell, in its sole discretion, finds defective. **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
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.

⚠ WARNING
PERSONAL INJURY

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

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

Honeywell

FOR MORE INFORMATION

Honeywell Advanced Sensing Technologies services its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing or the nearest Authorized Distributor, visit our website or call:

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

Honeywell
Advanced Sensing Technologies
830 East Arapaho Road
Richardson, TX 75081
sps.honeywell.com/ast

Powell®

Visit us at www.powell.com

Email us at honeywellinfo@powell.com

Call us at 800-235-7880

006002-1-EN | 1 | 09/21