

SMART Arc CAN Enabled 145° Position Sensor Superior Measurement. Accurate. Reliable. Thinking.



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

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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

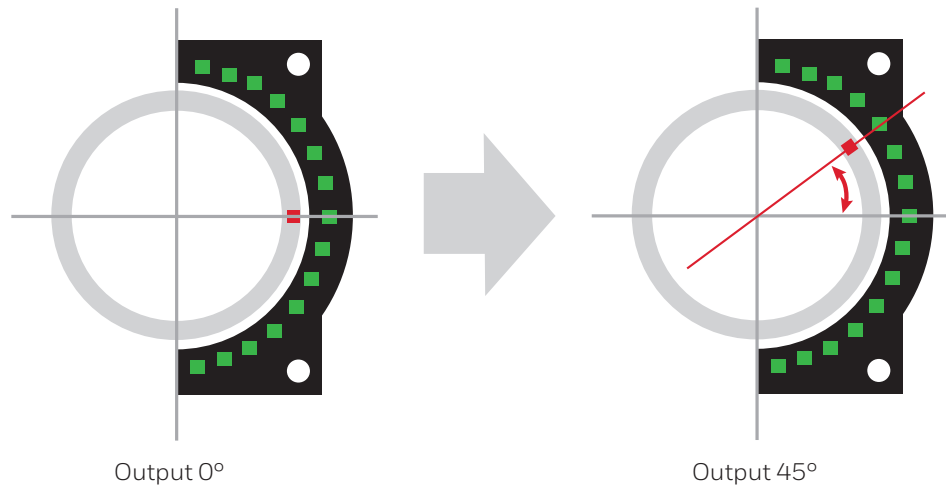


TABLE 1. SENSOR FAMILY DESIGNATION

| 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

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SENSOR SENSING RANGE

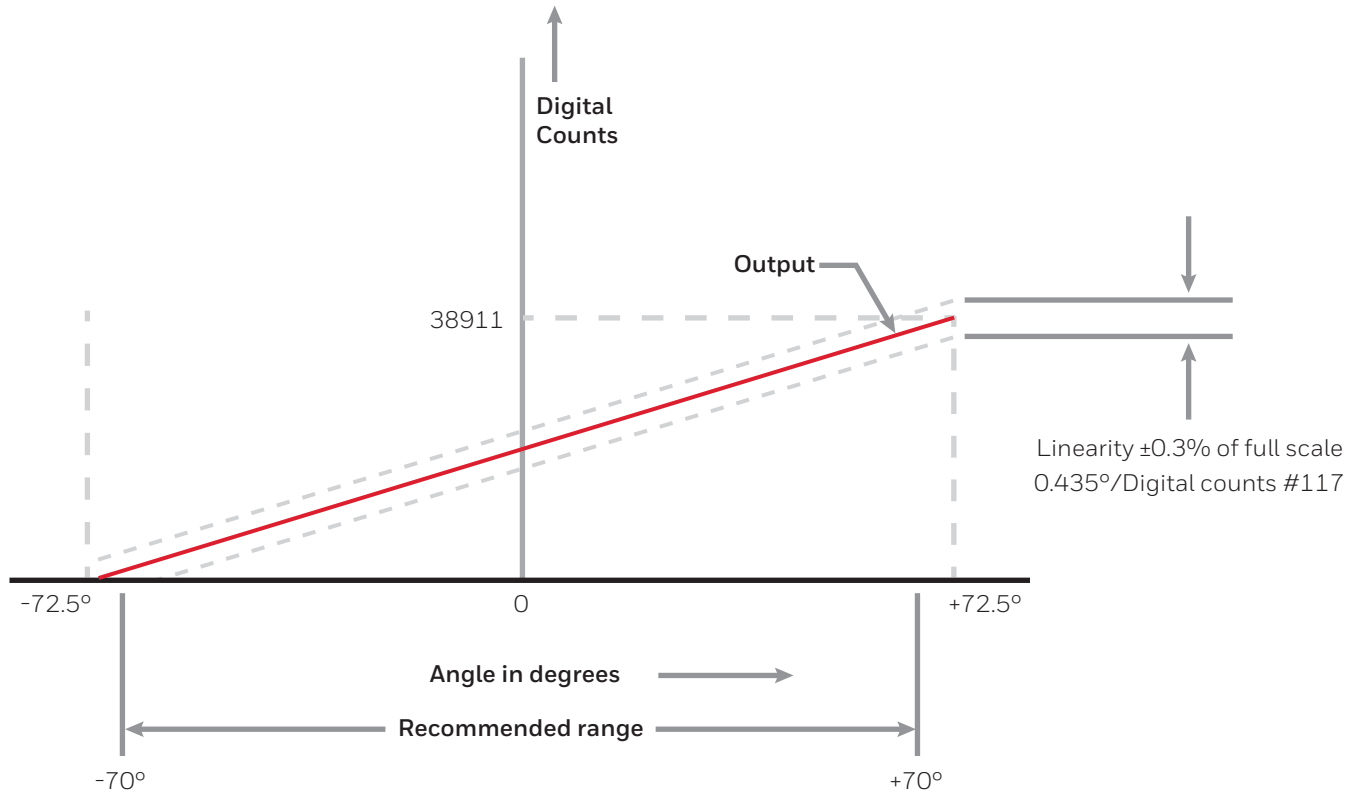


TABLE 3. SENSOR OUTPUT PERFORMANCE CHART

| 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 |

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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 |

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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 | | | |

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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

Sensors 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 |

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

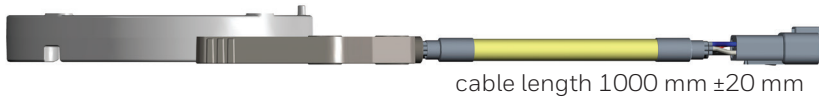
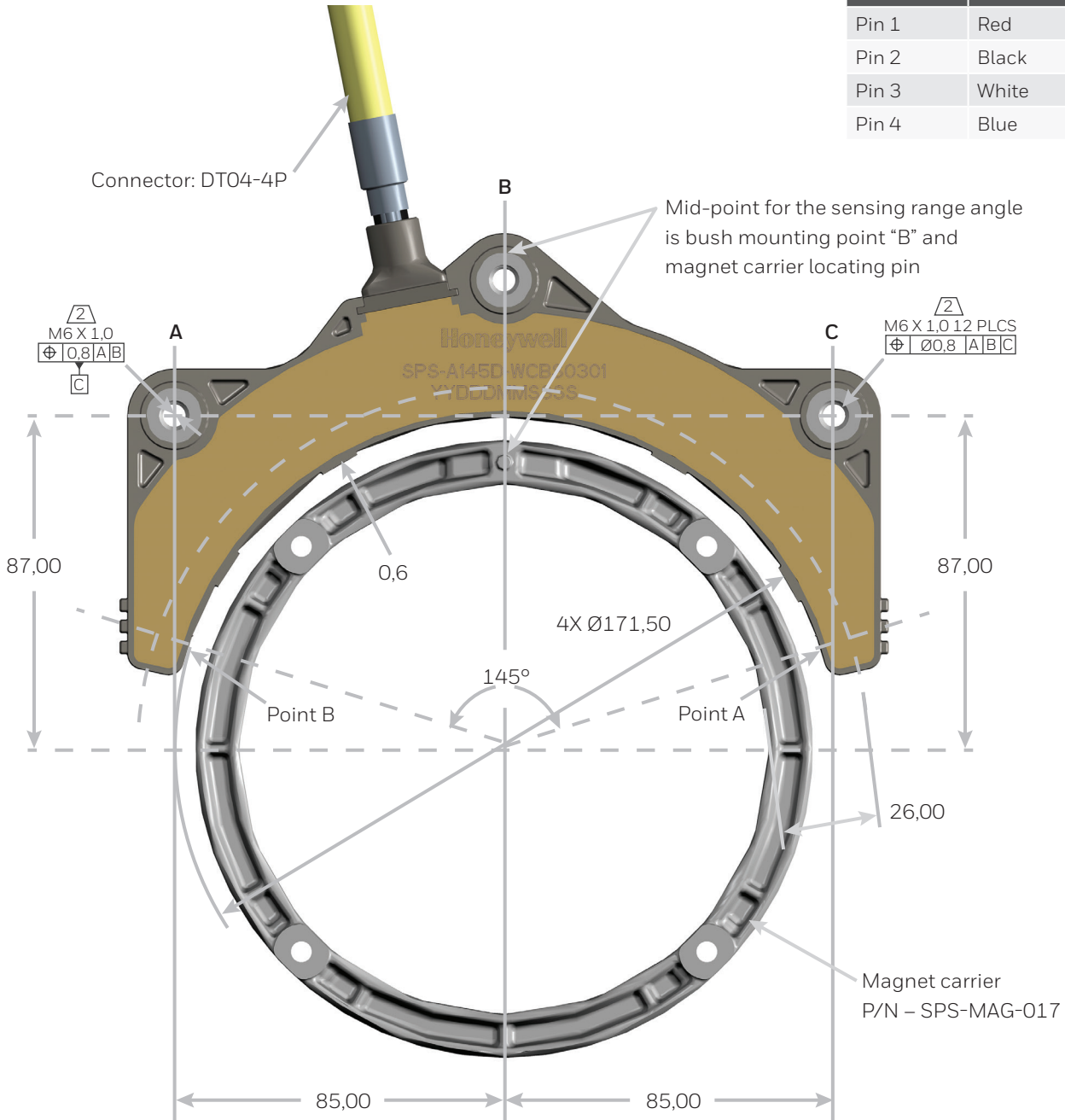


TABLE 8. CONNECTOR PINOUTS

| 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 |



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

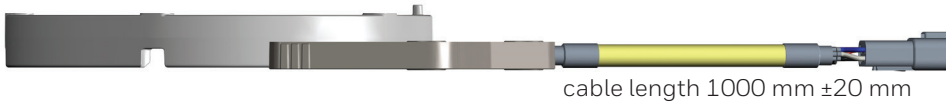
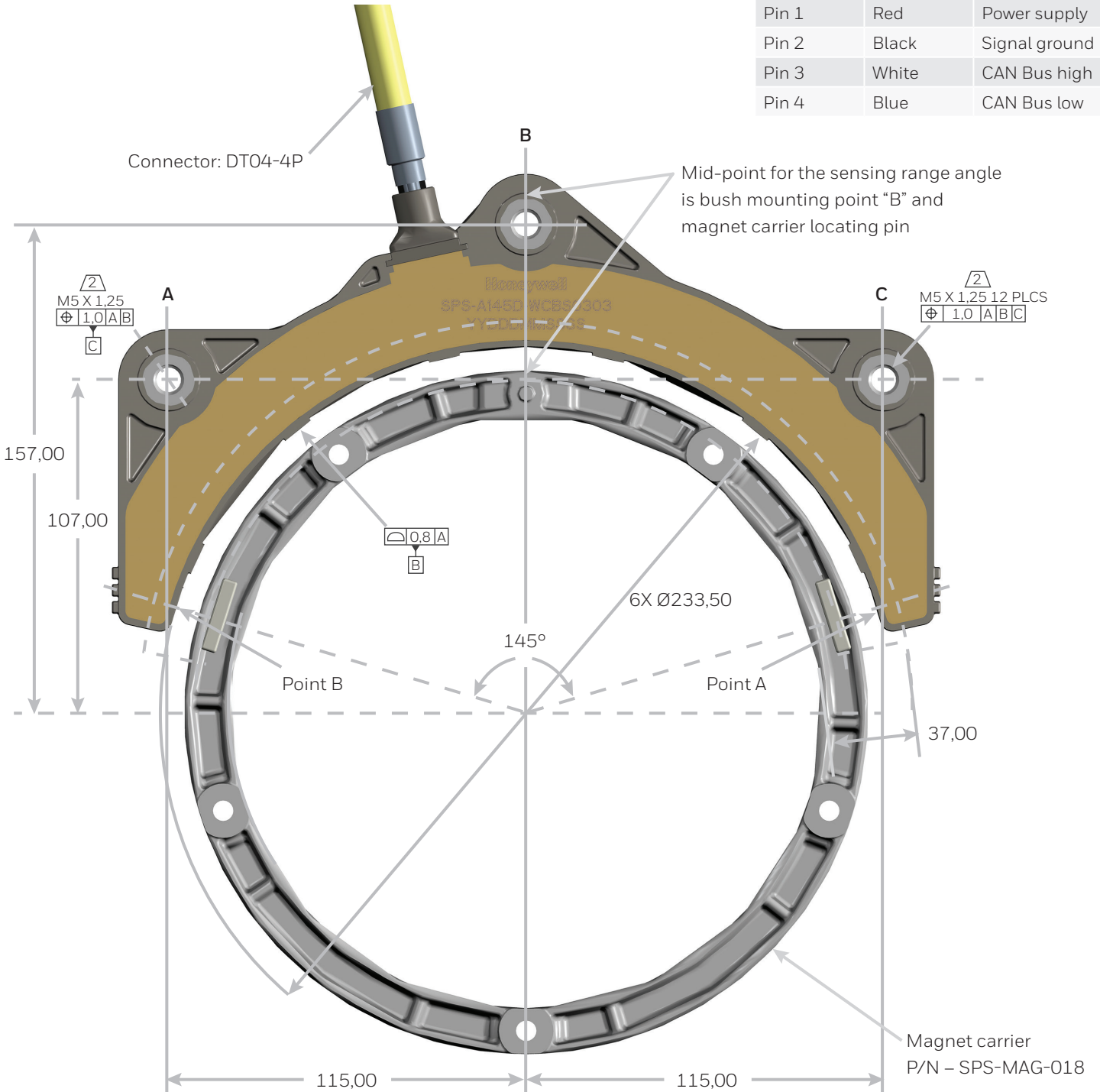


TABLE 9. CONNECTOR PINOUTS

| 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 |



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SENSOR RING MAGNET CARRIERS

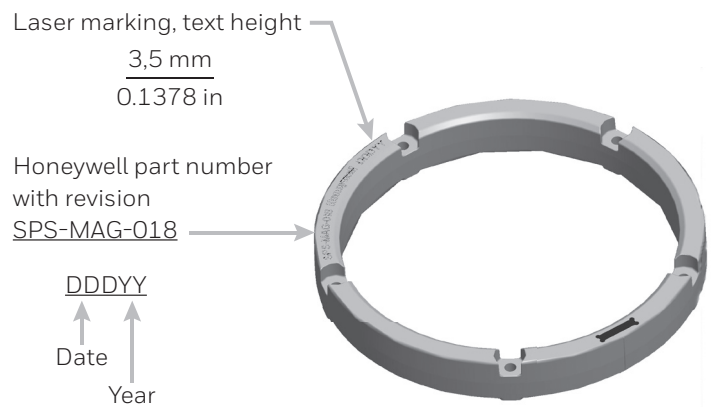
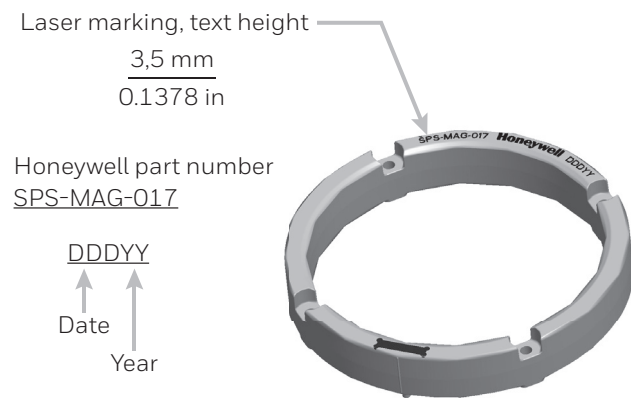
Honeywell offers two different sized Ring Magnet Carriers; they are specific for the two different sensor diameters.

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.

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MAGNET RING MOUNTING SPECIFICATIONS FOR SPS-MAG-017

TABLE 10. SPECIFICATIONS

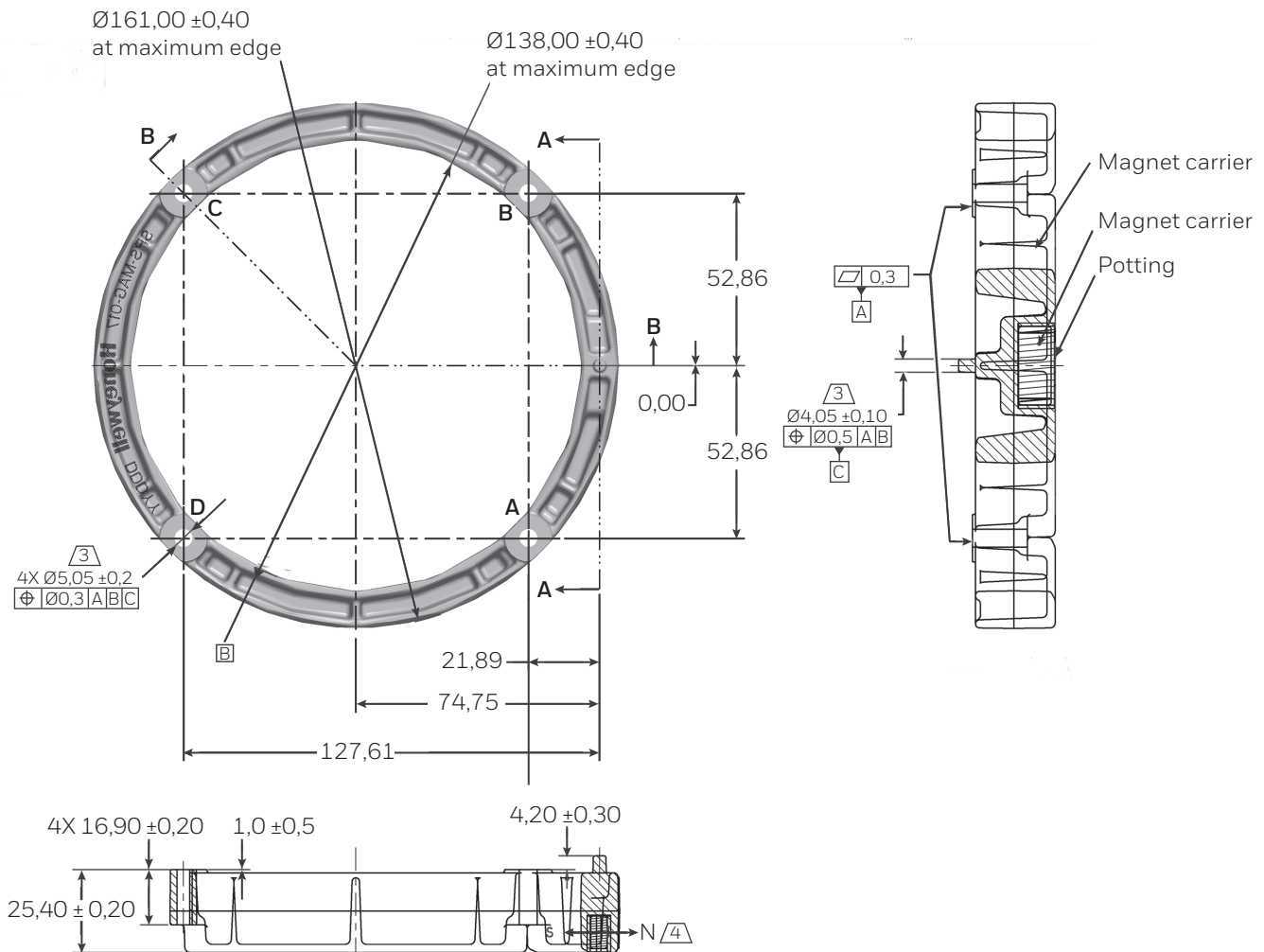
| Characteristic | Parameter |
|---------------------------------|---|
| Magnet carrier | Aluminum A380 with silver, powder coated |
| Magnet | Neodimium |
| Potting | Epoxy |
| Magnet pin locating hole | Ø 4,2 mm [Ø 0.17 in] |
| Mounting screws | M5 x 0,8 (length = 30) with washer (ID - 5.3) |
| Recommended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

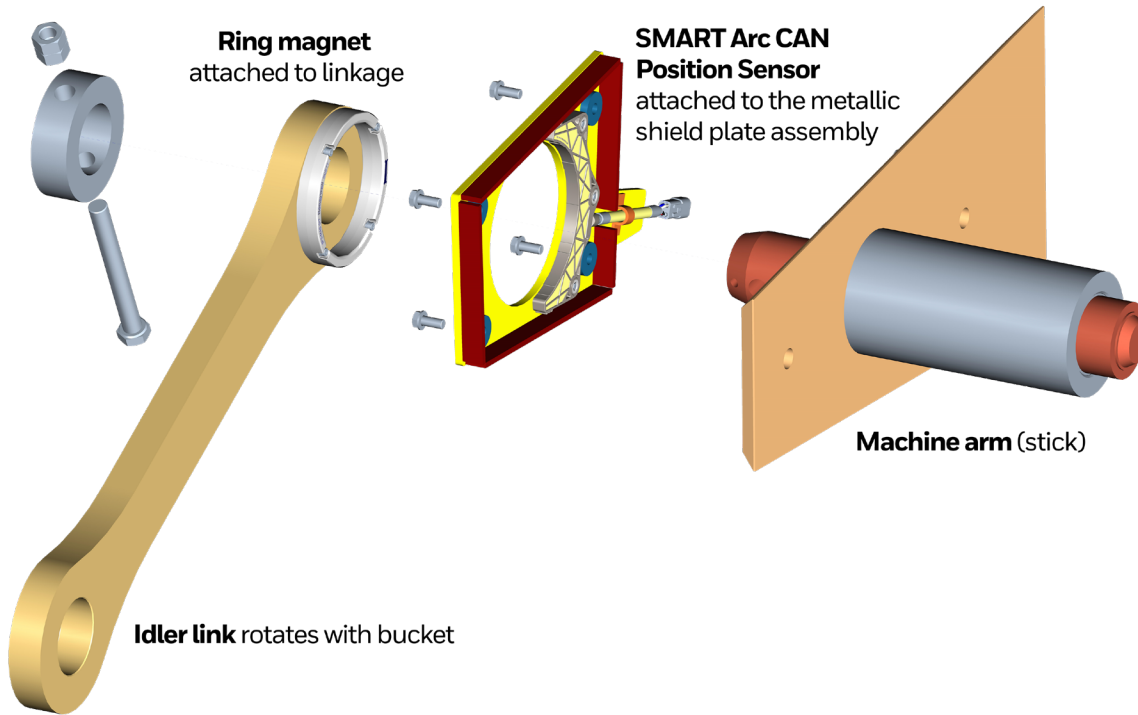
MAGNET CARRIER SPECIFICATIONS FOR SPS-MAG-017



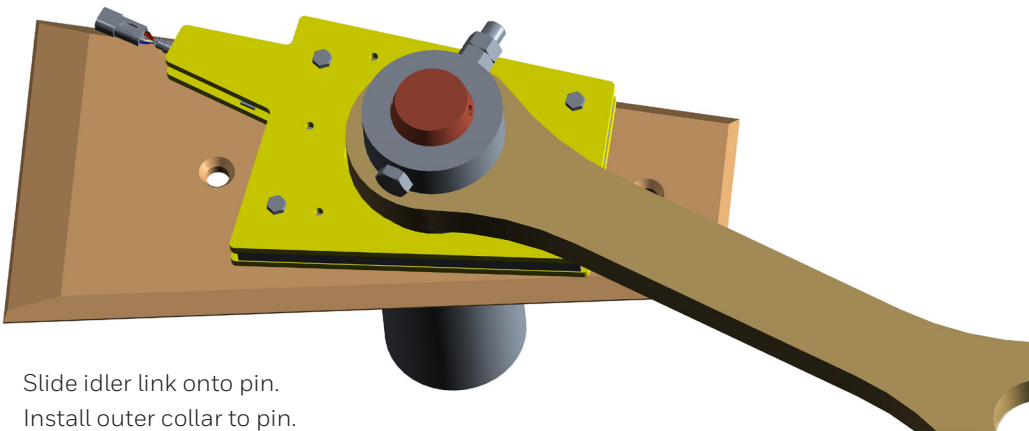
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APPLICATION EXAMPLE AND OVERVIEW



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.