

INSTALLATION INSTRUCTIONS FOR THE **SMART ARC CAN** **SMART ARC CAN-ENABLED 145° POSITION SENSOR**

32354270

Issue 2

SPS SMART ARC CAN SENSOR

Introducing Honeywell's new SMART Arc CAN Position Sensor with CAN-J1939 communication protocol. The SMART Arc CAN Position Sensor is specifically designed for demanding applications in industries such as heavy-duty off-highway transportation. This sensor reports key data required to monitor and automate the movement of vehicle parts.

TARGET APPLICATIONS

The SPS Arc CAN Position Sensor is designed for construction machines like excavators, large backhoes, front- end loaders and other similar equipment to provide precise position sensing of rotating parts around a pinned joint.

Equipment manufacturers can use this sensor output in conjunction with other system kinematics to determine the exact location or angle of inclination of the vehicle attachments or implements. For the bucket example, the sensor is mounted on the fixed member, and the magnet is installed directly on the moving link from the bucket to the stick. As the moving link rotates in conjunction with the bucket, the magnet attached to the moving link will rotate, allowing for accurate position detection. These precise position measurements enable autonomous capabilities such as operator assist systems or full system autonomy.



Three active configurations to choose from:

1. SPS-A145D-WCBS0301, Baud rate at 250 KB, (Sensor-161), Defined by the 161-mm Outer Ring Magnet diameter
2. SPS-A145D-WCBS0302, Baud rate at 500 KB, (Sensor-161), Defined by the 161-mm Outer Ring Magnet diameter
3. SPS-A145D-WCBS0303, Baud rate at 250 KB, (Sensor-220), Defined by the 220-mm Outer Ring Magnet diameter

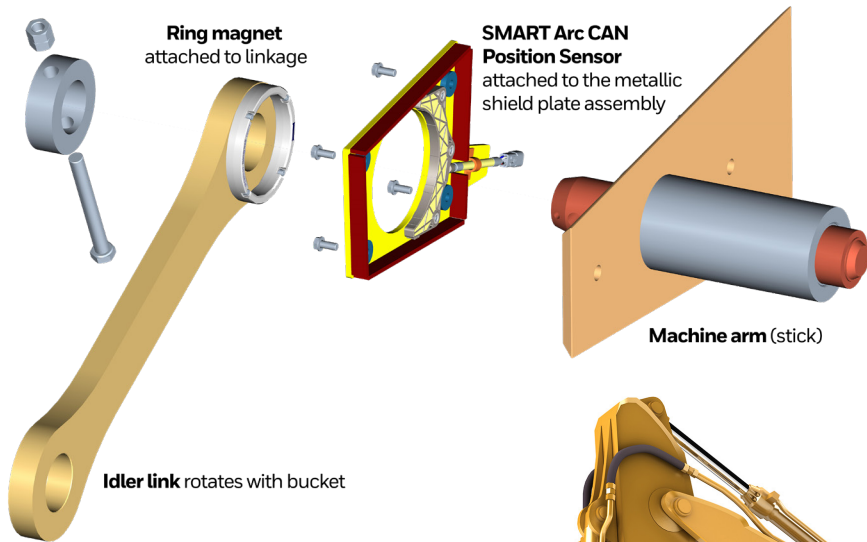
Note 1: Honeywell has developed a series of installation Jigs that can readily be downloaded from our website to help with the installation of these sensors. In the detailed instructions below a series of Jig part-numbers have been identified to help facilitate the installation of the SMART Arc CAN Sensors. [Please click here to download supporting details.](#)

Note 2: Magnet rings are supplied separately.

SMART POSITION SENSOR, 145° ARC SMART ARC CAN

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APPLICATION EXAMPLE & OVERVIEW ON EXCAVATOR



The SMART Arc CAN Position Sensor is mounted on the stick, and the ring magnet attached directly to the idler link. As the idler link rotates in conjunction with the bucket, the ring magnet rotates w.r.t. the sensor allowing for accurate position detection. The sensor is attached to the metallic shield plate which protects it from external stone and debris.



**INSTALLATION GUIDELINES SPS-A145D-WCBS0301 AND
SPS-A145D-WCBS0302 (SENSOR-161)**

⚠ CAUTION

Before any handling of the sensor, it is critical that proper ESD mitigation steps be taken. Sensor is ESD sensitive therefore all handling should be managed accordingly.

MOUNTING INFORMATION (See part number drawing)

1. Locate sensor and ring magnet in desired position.
2. Ensure that the air gap between sensor and ring magnet does not exceed what is noted in installation drawing.

TABLE 1. SPECIFICATIONS

Characteristic	Parameter
Sensor mounting screws	M6 x 1 (length = 20)
Recommended installation torque for sensor	10 Nm to 16 Nm

Sensor mounting torque must be applied gradually as per sequence below

Bush locations	Torque
A ⇨ C ⇨ B ⇨ D	Hand torque
A ⇨ C ⇨ B ⇨ D	Full torque

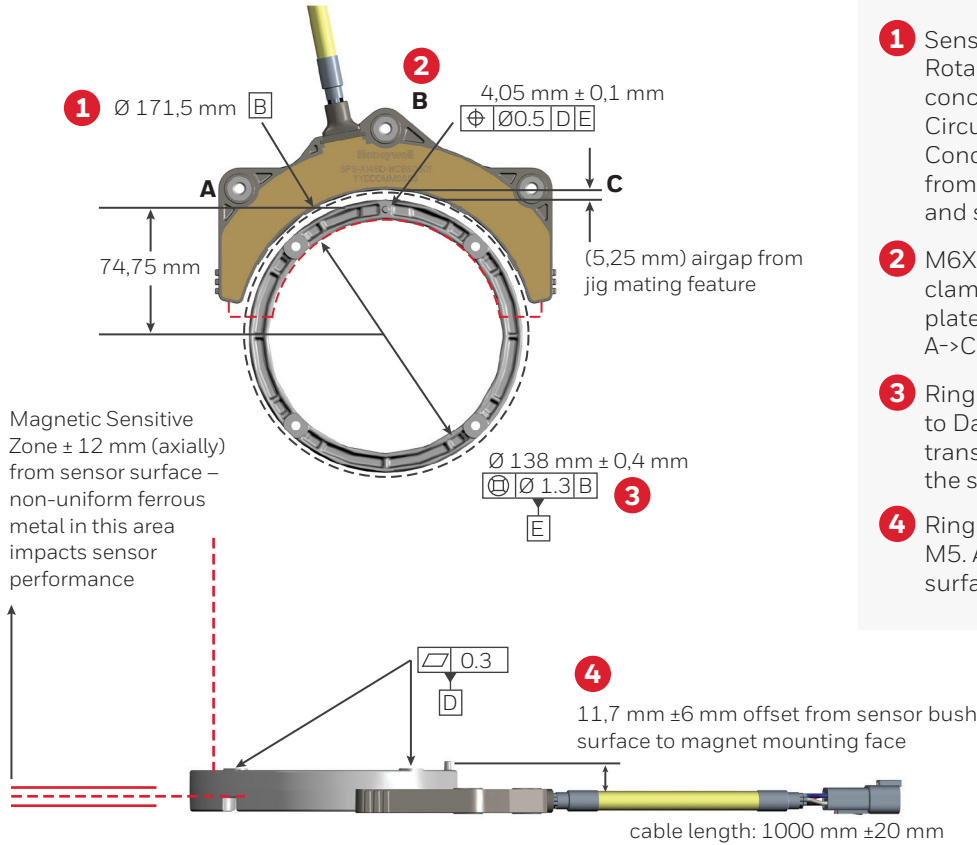
Note 1: Non-ferrous hardware should be considered when installing the sensor and ring magnet to help minimize magnetic interference.

Note 2: Sensor is to be installed with the epoxy facing up and away from the machine as shown here.

Note 3: Sensor can be installed in flipped orientation if required, this will not affect the performance of the sensor. Customer should understand that if flipped, the signal would be reversed.

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

SENSOR INSTALLATION PARAMETERS



- 1** Sensor ID is the prime Datum B Rotary Axis. Sensor axis needs to be concentric to the rotary pin axis. Circular jigs per Steps 1 and 2 of Concept 1 transfers axial reference from rotary to pin to the shield plate and shield to the sensor axis.
- 2** M6X1 Screws used for sensor clamped to mounting plate (fixed plate). Screw tightening sequence A->C->B.
- 3** Ring Magnet ID is mounted w.r.t. to Datum axis B. Circular jig transfers axial reference from pin to the sensor axis.
- 4** Ring Magnet clamped with 4 bolts M5. Axial offset between sensor bush surface to magnetic ring is 11,7mm.

1. Any non-uniform ferrous in **Red zone** ±12 mm axially will impact the sensor performance, non-linearity, or diagnostic. Magnetic-sensitive zone should be protected by a non-ferrous shield to keep out foreign ferrous objects.

Note: Please refer to step by step instruction for (Sensor-161) and Jig details in this document for guidance on mounting.

**INSTALLATION GUIDELINES FOR SPS-A145D-WCBS0303
(SENSOR-220)**

⚠ CAUTION

Before any handling of the sensor, it is critical that proper ESD mitigation steps be taken. Sensor is ESD sensitive therefore all handling should be managed accordingly.

MOUNTING INFORMATION (See part number drawing)

1. Locate sensor and ring magnet in desired position.
2. Ensure that the air gap between sensor and ring magnet does not exceed that noted in installation drawing.

TABLE 2. SPECIFICATIONS

Characteristic	Parameter
Sensor mounting screws	M8 x 1.25 (length = 20)
Recommended installation torque for sensor	23 Nm to 37 Nm

Sensor mounting torque must be applied gradually as per sequence below

Mounting locations	Torque
A ⇄ C ⇄ B	Hand torque
A ⇄ C ⇄ B	5 Nm
A ⇄ C ⇄ B	15 Nm
A ⇄ C ⇄ B	Full torque

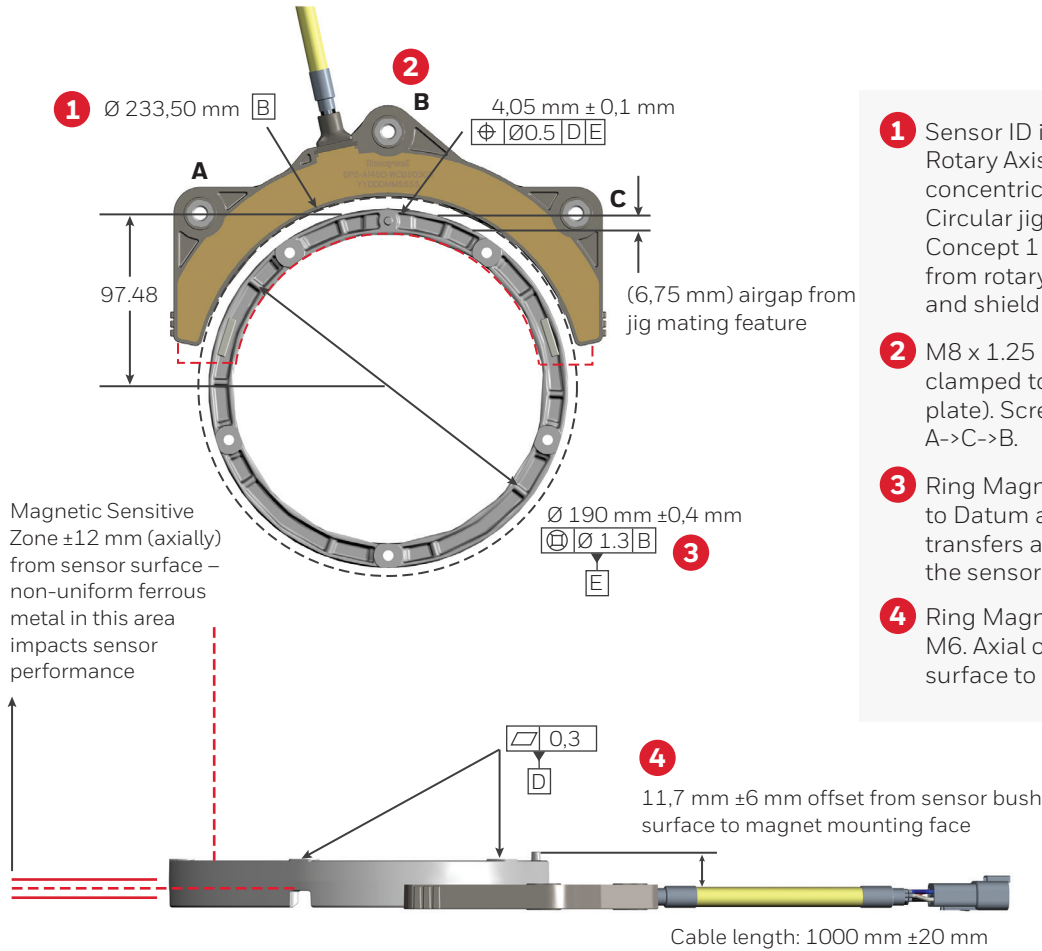
Note 1: Non-ferrous hardware should be considered when installing the sensor and ring magnet to help minimize magnetic interference.

Note 2: Sensor is to be installed with the epoxy facing up and away from the machine as shown here.

Note 3: Sensor can be installed in flipped orientation if required. This will not affect the performance of the sensor. Customer should understand that if flipped, the signal would be reversed.

**INSTALLATION GUIDELINES FOR SPS-A145D-WCBS0303
(SENSOR-220)**

SENSOR INSTALLATION PARAMETERS



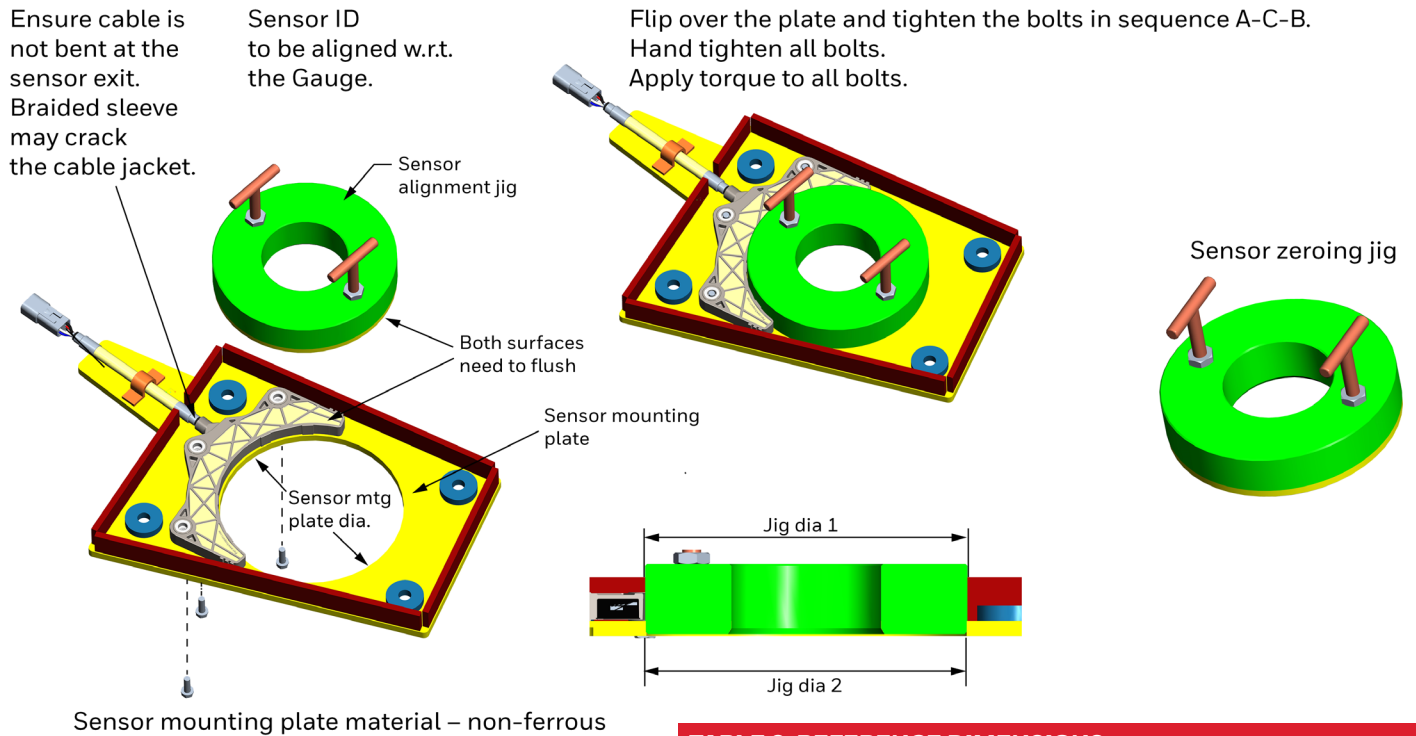
- 1 Sensor ID is the prime Datum B Rotary Axis. Sensor axis needs to be concentric to the rotary pin axis. Circular jigs per Steps 1 and 2 of Concept 1 transfers axial reference from rotary to pin to the shield plate and shield to the sensor axis.
- 2 M8 x 1.25 Screws used for sensor clamped to mounting plate (fixed plate). Screw tightening sequence A->C->B.
- 3 Ring Magnet ID is mounted w.r.t. to Datum axis B. Circular jig transfers axial reference from pin to the sensor axis.
- 4 Ring Magnet clamped with 5 bolts M6. Axial offset between sensor bush surface to magnetic ring is 11,7mm.

1. Any non-uniform ferrous in **Red zone** ± 12 mm axially will impact the sensor performance, non-linearity, or diagnostic. Magnetic-sensitive zone should be protected by a non-ferrous shield to keep out foreign ferrous objects.

Note: Refer to step by step instruction for (Sensor-220) and Jig details in this document for guidance on mounting.

INSTALLATION GUIDELINES

Step 1 – Installation of the sensor to the metallic shield plate.



Sensor mounting plate material – non-ferrous

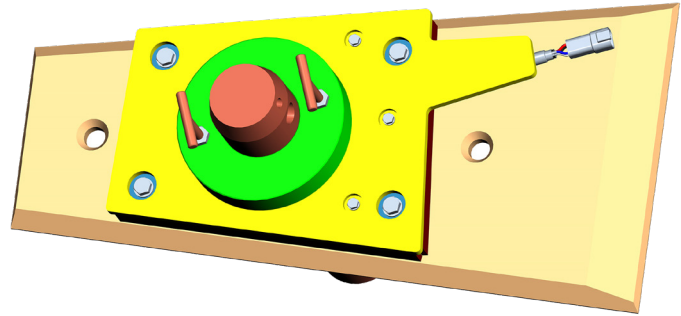
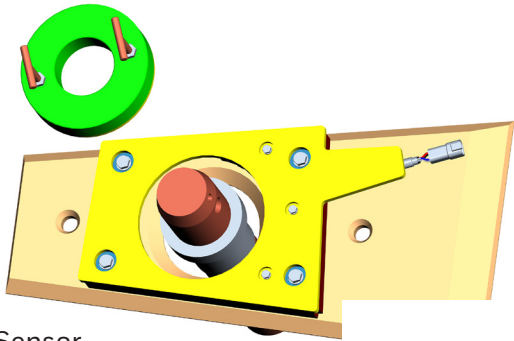
TABLE 3. REFERENCE DIMENSIONS		
Characteristic	Sensor 161	Sensor 220
Sensor mounting plate diameter	170 mm +0,1/-0 mm [6.69 in +0.004/-0 in]	231,8 mm +0,1/-0 mm [9.13 in +0.004/-0 in]
Jig dia 1	171,5 mm ±0,1 mm [6.75 in ±0.004 in]	233,5 mm ±0,15 mm [9.19 in ±0.006 in]
Jig dia 2	170 mm +0/-0,1 mm [6.69 in +0/-0.004 in]	231,8 mm +0/-0,1 mm [9.13 in +0/-0.004 in]

Alignment jig 32354413-001, diagram, for SPS-A145D-WCBS0301 & SPS-A145D-WCBS0302 (Sensor-161) available for download from Honeywell Website.

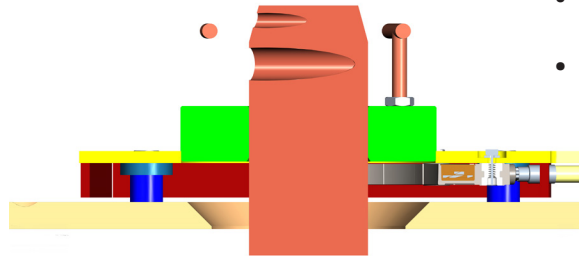
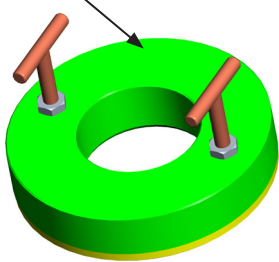
Alignment jig 32354415-001 diagram, for SPS-A145D-WCBS0303 (Sensor-220) available for download from Honeywell Website.

Step 2 – Installation of the sensor plate assembly on arm

Stick Assembly



Sensor zeroing jig

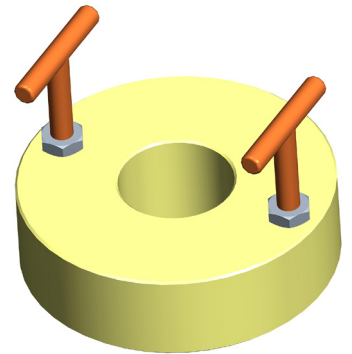
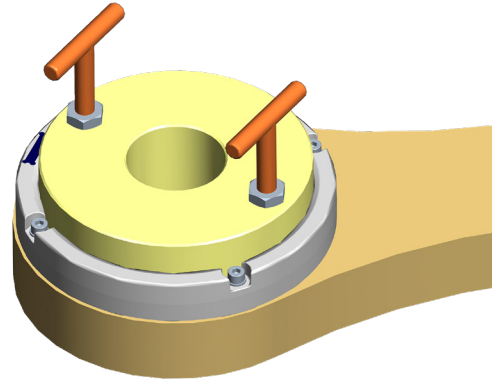
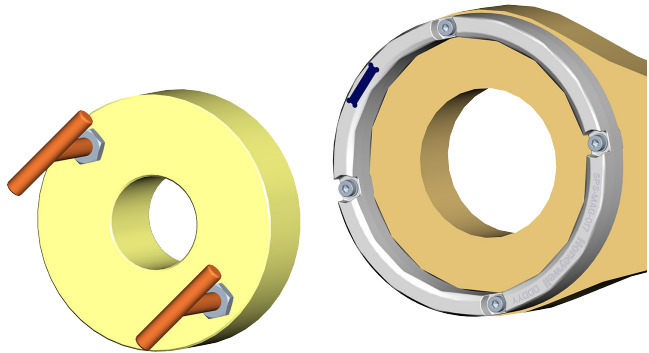


- Install gauge on the pin joint
- Mounting plate inner diameter to be aligned with the gauge
- Clamp the mounting plate to the stick assembly

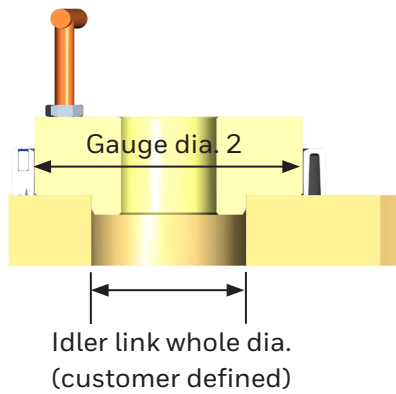
Alignment jig 32354413-001, diagram, for SPS-A145D-WCBS0301 & SPS-A145D-WCBS0302 (Sensor-161) available for download from Honeywell Website.

Alignment jig 32354415-001 diagram, for SPS-A145D-WCBS0303 (Sensor-220) available for download from Honeywell Website.

Step 3 – Installation of ring magnet on idler link



- Install gauge 3 on the idler link
- Idler link inner diameter to be aligned w.r.t the gauge
- Clamp the ring magnet to the idler link

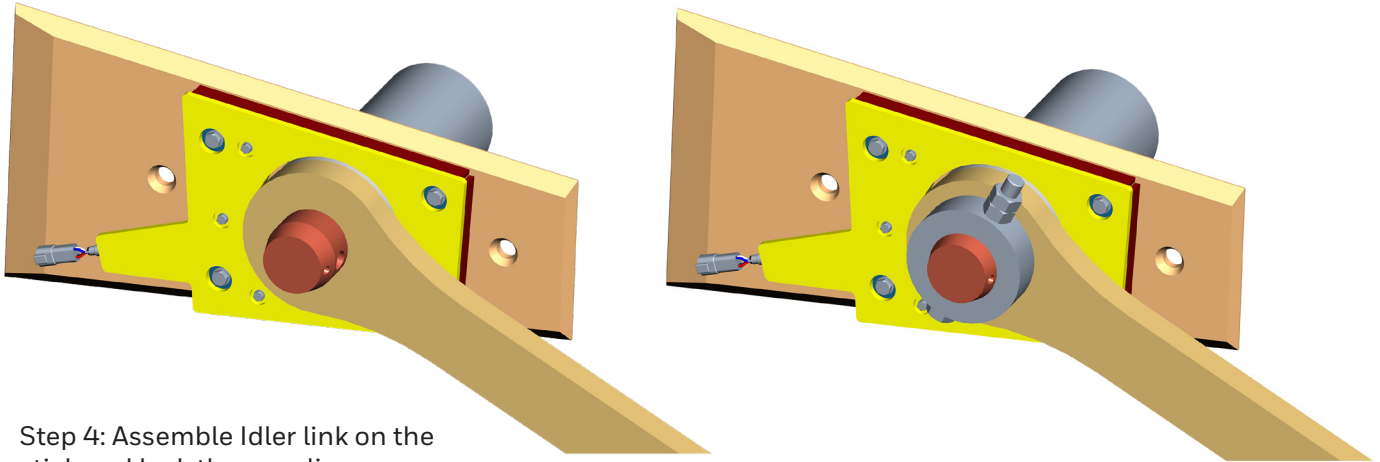


Alignment jig 32354414-001 diagram, for SPS-A145D-WCBS0301 & SPS-A145D-WCBS0302 (Sensor-161) available for download from Honeywell Website.

Alignment jig 32354416-001 diagram, for SPS-A145D-WCBS0303 (Sensor-220) available for download from Honeywell Website.

TABLE 4. REFERENCE DIMENSIONS		
Characteristic	Sensor 161	Sensor 220
Idler pin diameter	79,95 mm ±0,05 mm [6.69 in]	89,95 mm ±0,05 mm [9.13 mm]
Idler link hole diameter	80 mm ±0,1 mm [3.15 in ±0.004 in]	90 mm ±0,1 mm [3.54 in ±0.004 in]
Gauge diameter 1	79,9 mm +0/-0,1 mm [3.145 in +0/-0.004 in]	89,9 mm +0/-0,1 mm [3.539 in +0/-0.004 in]
Gauge diameter 2	137,6 mm +0/-0,1 mm [5.42 in +0/-0.004 in]	189,6 mm +0/-0,1 mm [7.46 in +0/-0.004 in]

Step 4 – Installation of the idler link assembly



Step 4: Assemble Idler link on the stick and lock the coupling

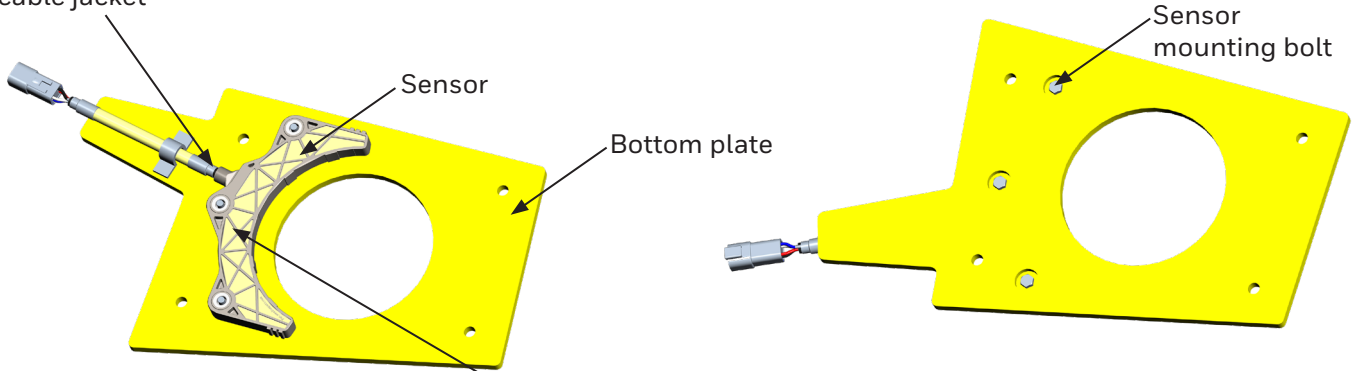
- Slide idler link onto pin.
- Install outer collar to pin.
- Fasten outer collar nut & bolt to lock idler link in place.

INSTALLATION GUIDELINES • CONCEPT 2

Step 1 – Installation of the sensor to the bottom mounting plate

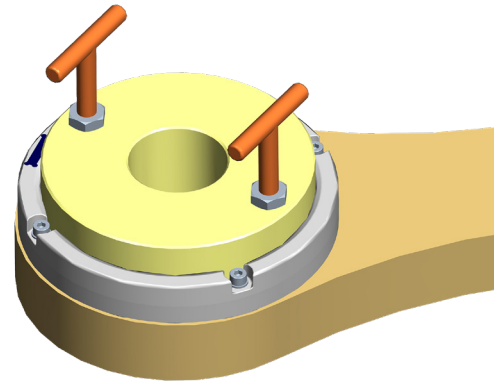
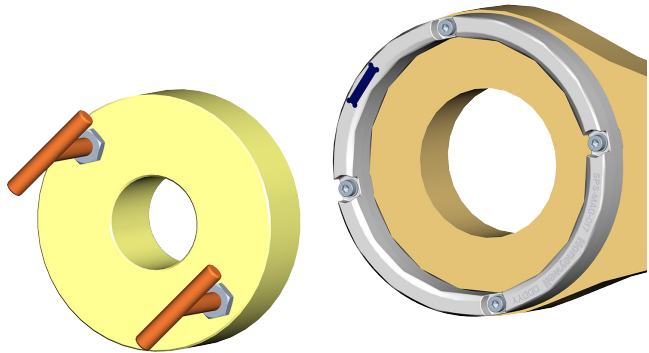
Ensure cable is not bent
at sensor exit.
Braided sleeve may crack
the cable jacket

Tighten the bolts in sequence A-C-B.
Apply torque to all bolts.

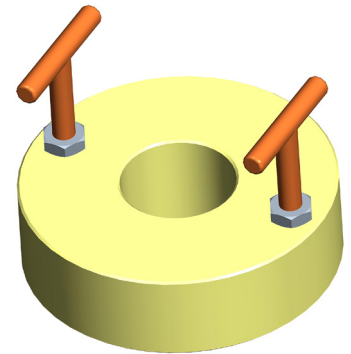
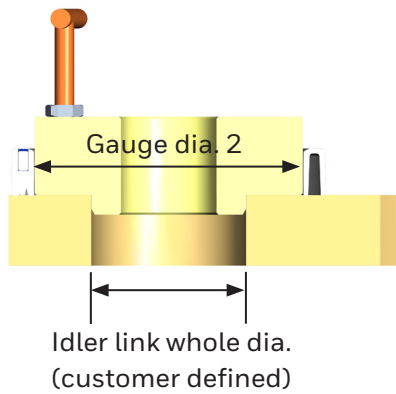


Sensor can be flipped either epoxy side up or down as
both sides are covered by plates.

Step 2 – Installation of ring magnet on idler link



- Install gauge 3 on the idler link
- Idler link inner diameter to be aligned w.r.t the gauge
- Clamp the ring magnet to the idler link



Alignment jig 32354414-001 diagram, for SPS-A145D-WCBS0301 & SPS-A145D-WCBS0302 (Sensor-161) available for download from Honeywell Website.

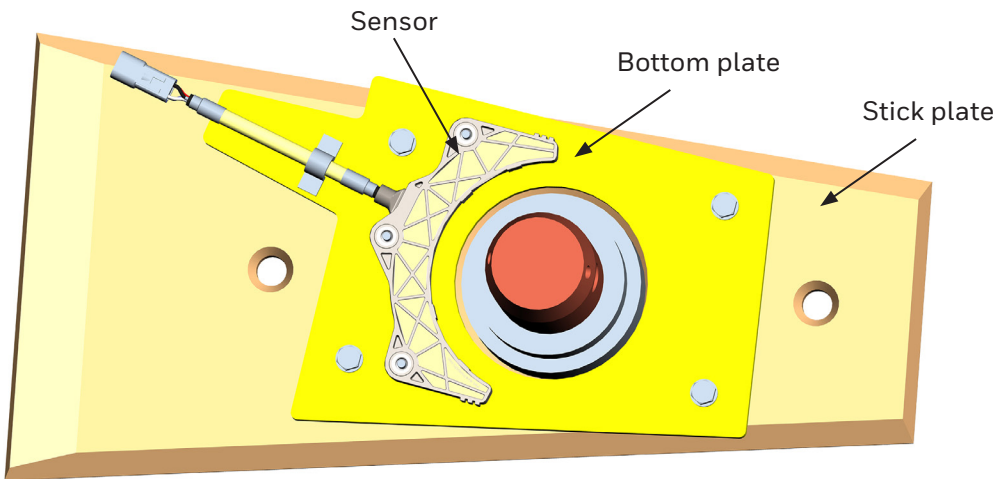
Alignment jig 32354416-001 diagram, for SPS-A145D-WCBS0303 (Sensor-220) available for download from Honeywell Website.

TABLE 5. REFERENCE DIMENSIONS

Characteristic	Sensor 161	Sensor 220
Idler pin diameter	79,95 mm ±0,05 mm [6.69 in]	89,95 mm ±0,05 mm [9.13 mm]
Idler link hole diameter	80 mm ±0,1 mm [3.15 in ±0.004 in]	90 mm ±0,1 mm [3.54 in ±0.004 in]
Gauge diameter 1	79,9 mm ±0,1 mm [3.145 in ±0.004 in]	89,9 mm ±0,1 mm [3.539 in ±0.004 in]
Gauge diameter 2	137,6 mm ±0,1 mm [5.42 in ±0.004 in]	189,6 mm ±0,1 mm [7.46 in ±0.004 in]

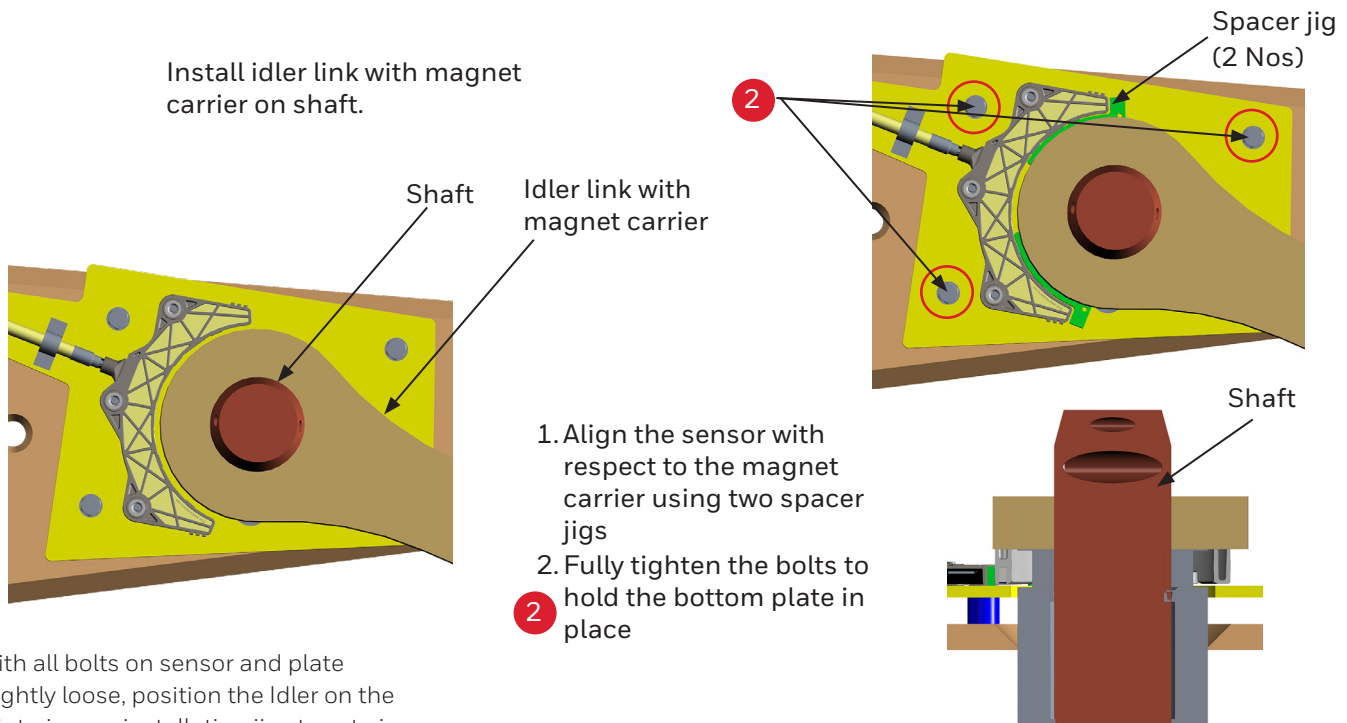
Step 3 – Installation of bottom plate on the stick plate

- Install the bottom plate and sensor assembly on the stick
- Do not fully tighten the bolts



Position sensor and plate on stick and finger tighten the bolts. Keep the bolts loose to allow sensor alignment and adjustment using jigs to ensure proper air gap is maintained.

Step 4 – Align sensor w.r.t magnet

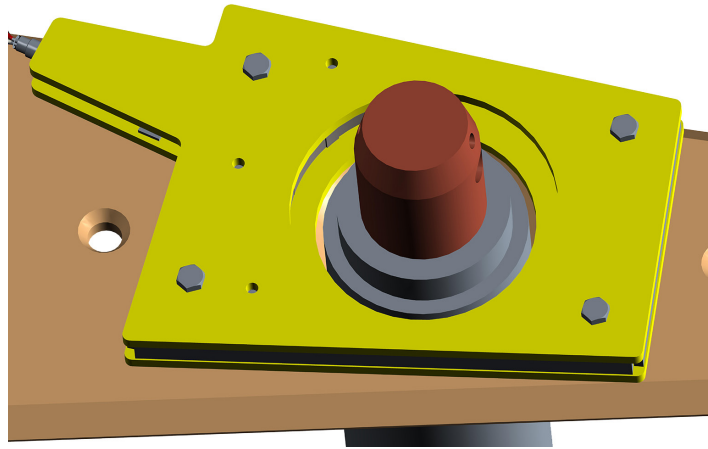


With all bolts on sensor and plate slightly loose, position the Idler on the joint pin, use installation jigs to set air gap between ring magnet and sensor. Fasten all bolts on sensor and plate to proper torque settings. Lastly remove the alignment jig.

Alignment jig 32354520-001 diagram, for SPS-A145D-WCBS0301 & SPS-A145D-WCBS0302 (Sensor-161) available for download from Honeywell Website.

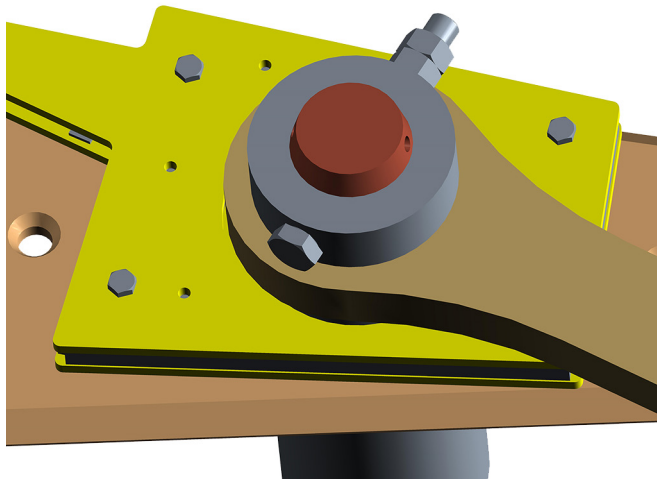
Alignment jig 32354521-001 diagram, for SPS-A145D-WCBS0303 (Sensor-220) available for download from Honeywell Website.

Step 5 – Installation of top plate



- Remove the idler link
- Install the top plate using bolts

Step 5 – Installation of idler link assembly



- Install idler link and lock the coupling

SENSOR RING MAGNET CARRIERS

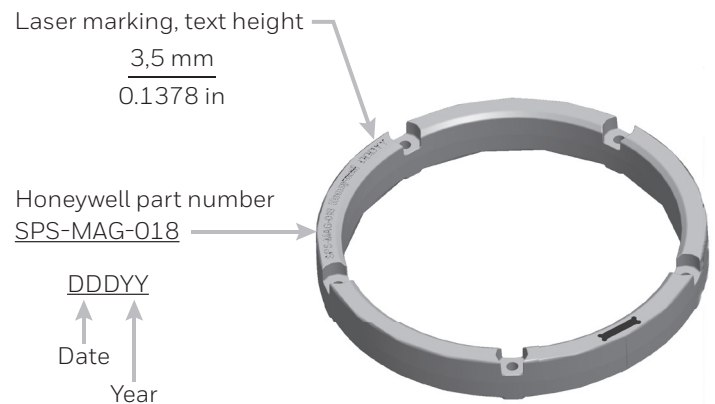
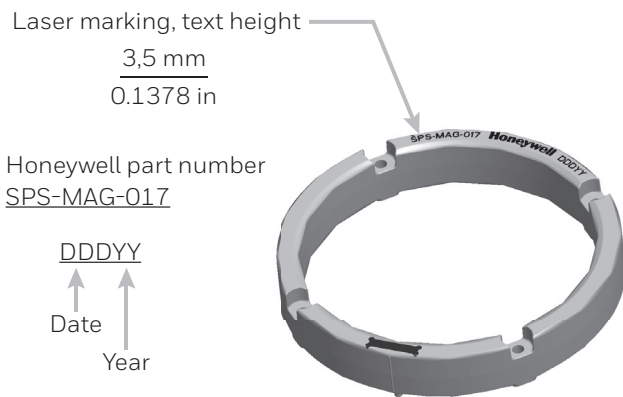
Honeywell offers two different size ring magnets; they are specific for the two different sensor diameters.

Magnet carriers are not supplied with sensor, customer shall procure the proper carrier for their chosen sensor.

Ring Options

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

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



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

RING MAGNET MOUNTING SPECIFICATIONS FOR SPS-MAG-017
(FOR PAIRING WITH SENSOR-161)

TABLE 6. SPECIFICATIONS

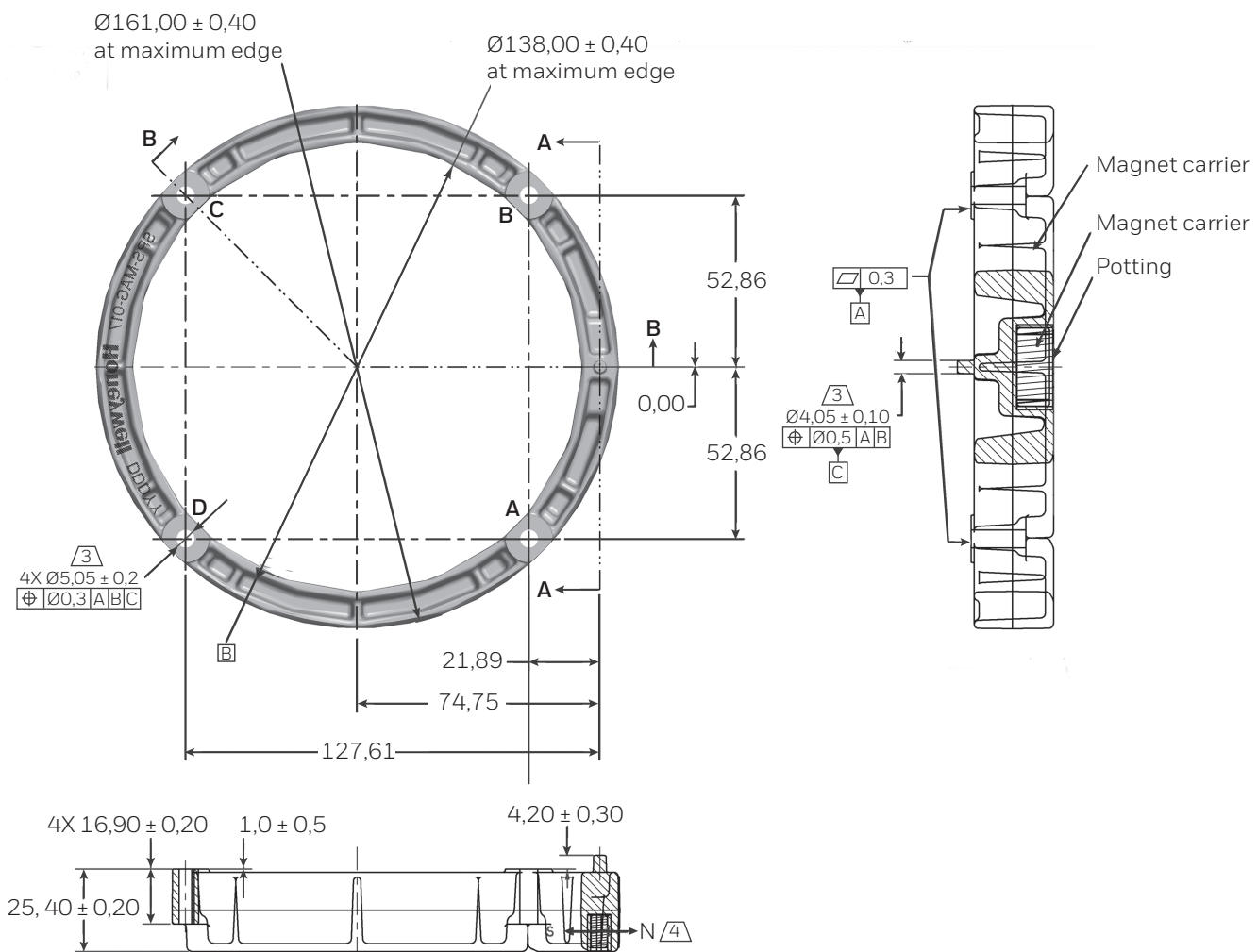
Characteristic	Parameter
Magnet carrier	Aluminum A380 with silver, powder coated
Magnet	Neodimium
Potting	Epoxy
Magnet pin locating hole	Ø 4,2 mm [Ø 0.17 in]
Mounting screws	M5 x 0,8 (length = 30) with washer (ID - 5.3)
Recommended installation torque	4,5 Nm to 6 Nm

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

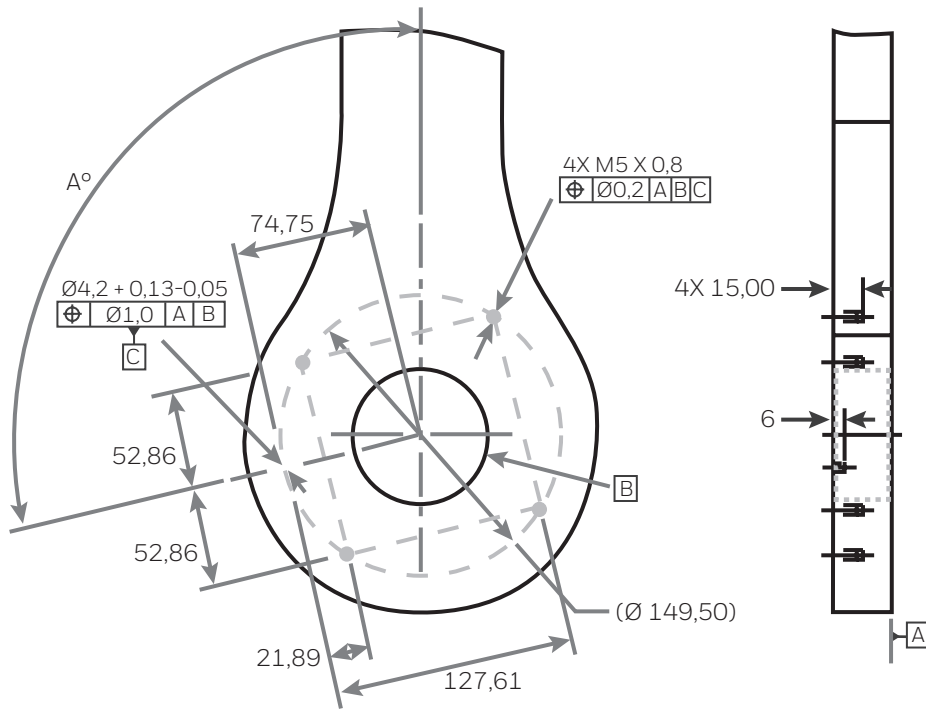
Mounting locations	Torque
A ⇒ C ⇒ B ⇒ D	Hand torque
A ⇒ C ⇒ B ⇒ D	Full torque

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



IDLER LINK MOUNTING DETAILS SPS-MAG-017 (FOR PAIRING WITH SENSOR-161)



Scale 2:5

Idler link – magnet carrier mounting dimensions

A° – angle will vary between sensor B Hex variants

RING MAGNET MOUNTING SPECIFICATIONS FOR SPS-MAG-018
(FOR PAIRING WITH SENSOR-220)

TABLE 7. SPECIFICATIONS

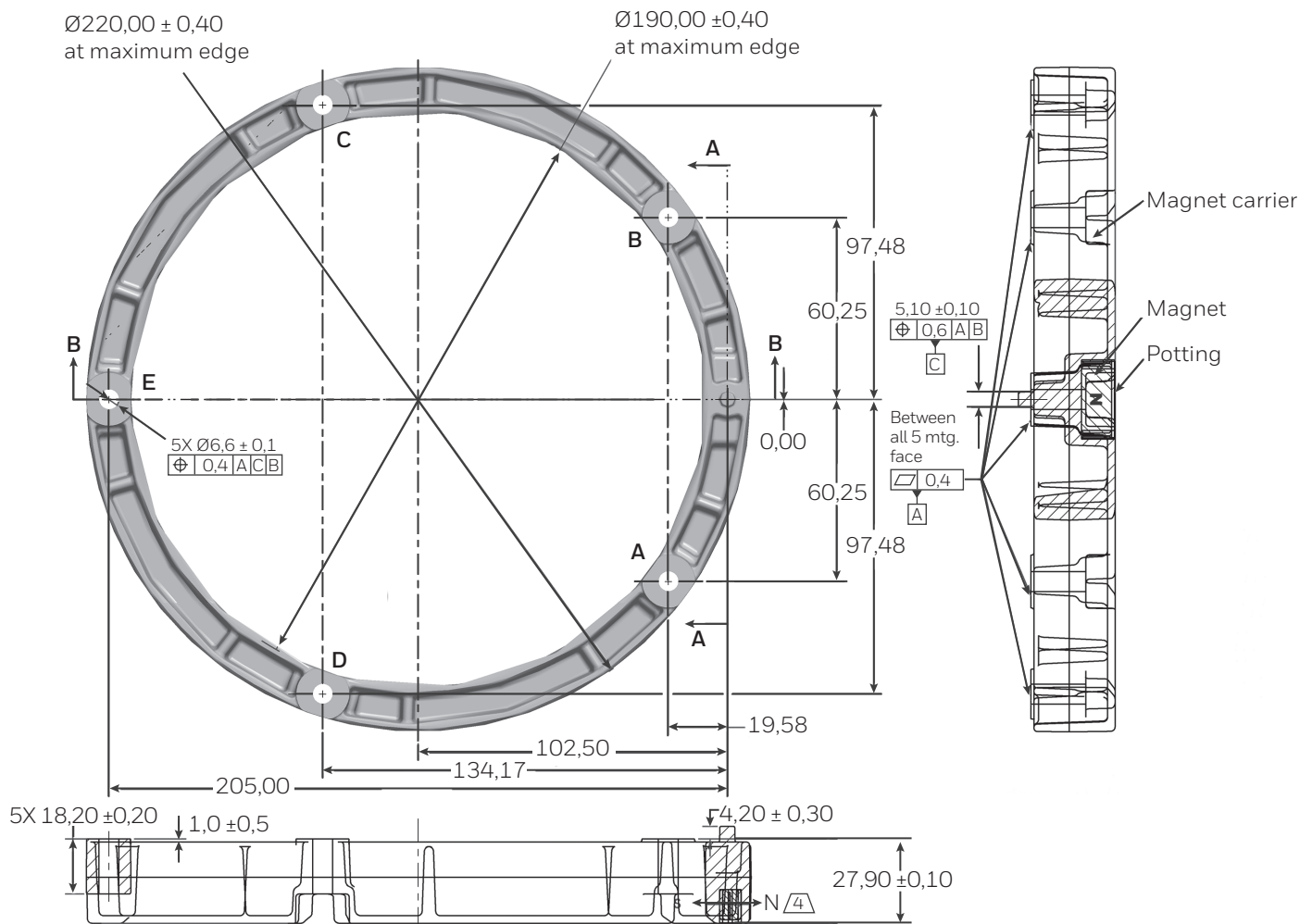
Characteristic	Parameter
Magnet carrier	Aluminum A380 with silver, powder coated
Magnet	Neodimium
Potting	Epoxy
Magnet pin locating hole	Ø 5,2 mm [Ø 0.20 in]
Mounting screws	M6 x 1,0 (length = 35) with washer (ID - 6,4)
Recommended installation torque	8 Nm to 10,5 Nm

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

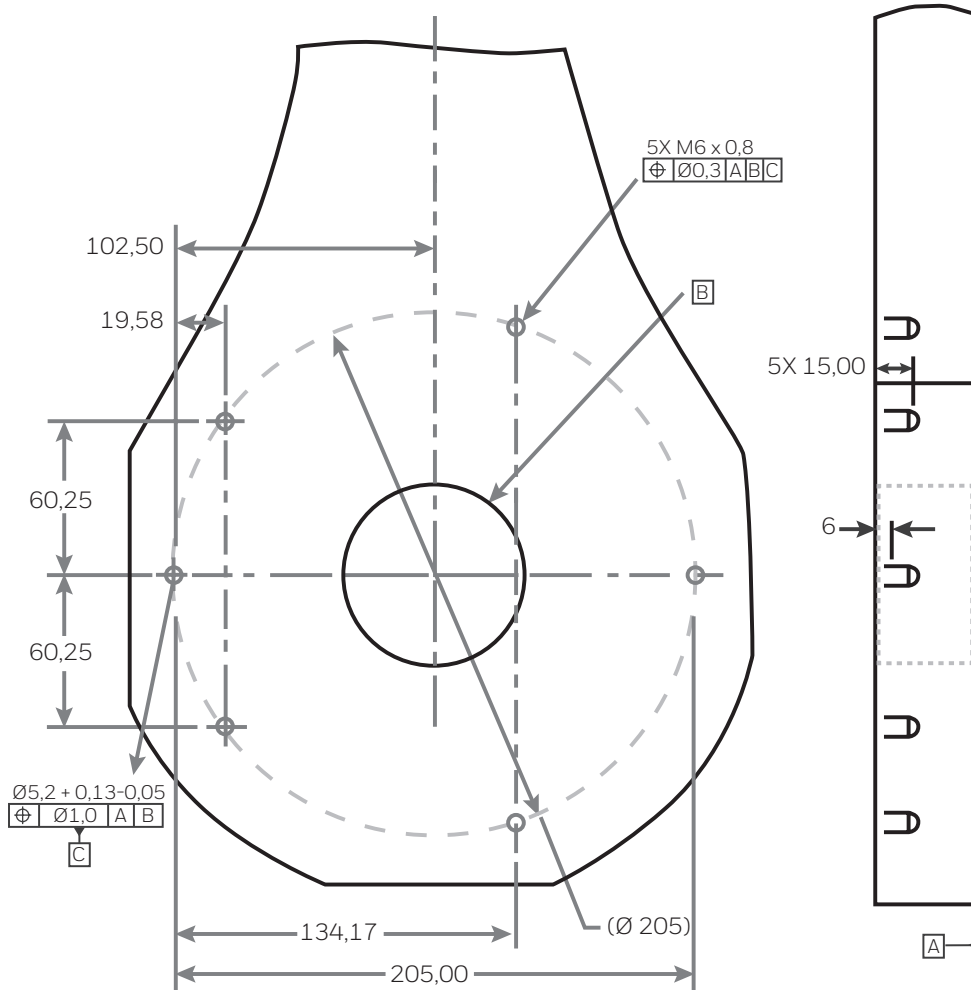
Mounting locations	Torque
A ⇒ E ⇒ B ⇒ D ⇒ C	Hand torque
A ⇒ E ⇒ B ⇒ D ⇒ C	5 Nm
A ⇒ E ⇒ B ⇒ D ⇒ C	Full torque

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

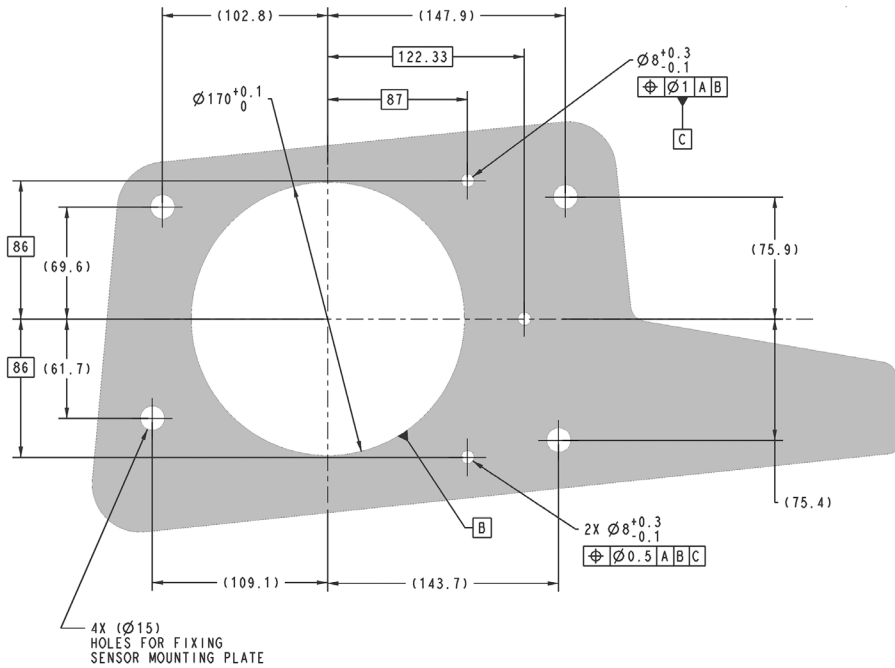


IDLER LINK MOUNTING DETAILS SPS-MAG-018 (FOR PAIRING WITH SENSOR-220)



Idler link – magnet carrier mounting dimensions

SENSOR MOUNTING PLATE/COVER FOR SPS-A145D-WCBS0301 & SPS-A145D-WCBS0302
(FOR PAIRING WITH SENSOR-161)



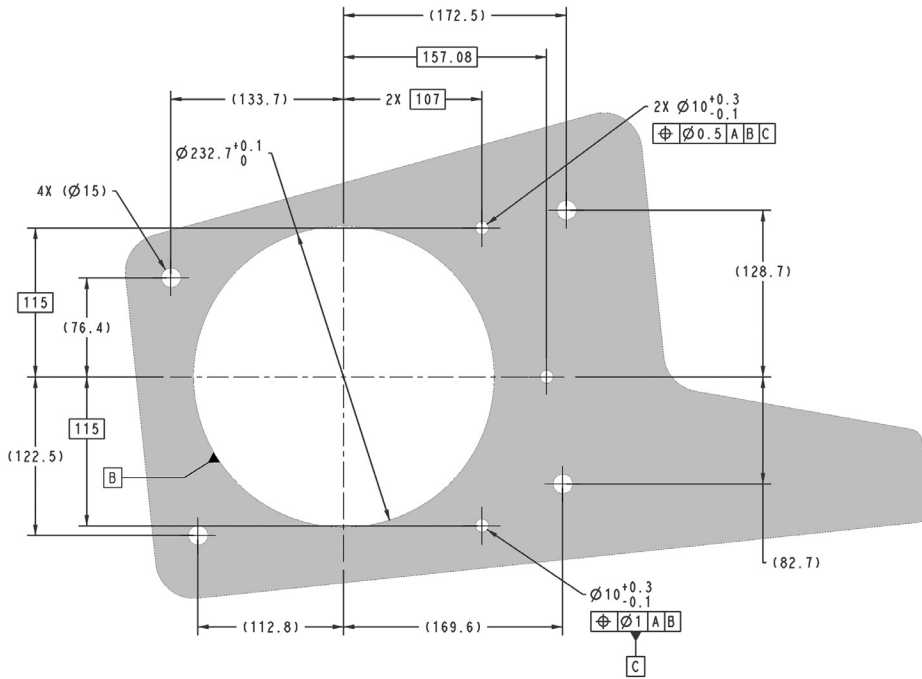
Recommended minimum thickness of 6,3 mm [0.25 in] for mounting plate, to help mitigate issues with deflection and vibration.

Non-ferrous mounting plate: Dimensions are for reference only; final designs will vary as customers modify the actual plate for optimal fit in their applications.

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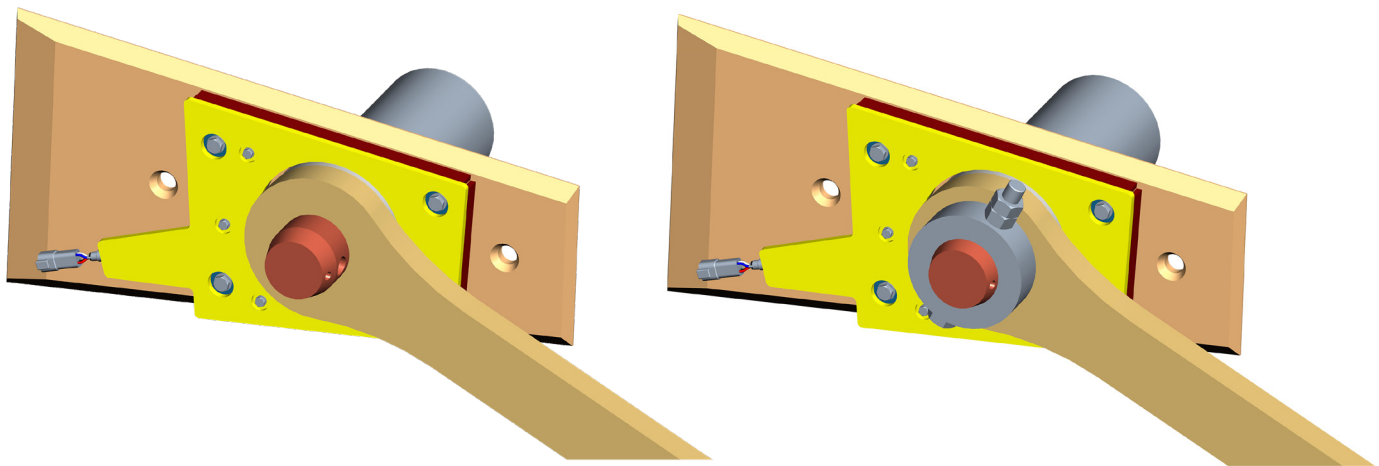
SENSOR MOUNTING PLATE/COVER FOR SPS-A145D-WCBS0303 (FOR PAIRING WITH SENSOR-220)



Recommended minimum thickness of 6.3 mm [0.25 in] for mounting plate, to help mitigate issues with deflection and vibration.

Non-ferrous mounting plate: Dimensions are for reference only; final designs will vary as customers modify the actual plate for optimal fit in their applications.

INSTALLATION OF IDLER LINK ASSEMBLY EXAMPLE



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

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

Sensor alignment jig 3D renderings available for download from Honeywell Website.

TIPS AND GUIDES FOR OPTIMAL PERFORMANCE

To optimize performance, it is most critical that the installation of the sensor and ring magnet be properly aligned. Any variability in the installation could lead to possible system error. Some considerations:

1. Develop a strategy for mounting sensor:
 - a. Honeywell recommends the customer considers utilizing jigs and fixture to help with alignment and installation.
 - b. Honeywell will provide several renderings of jigs and fixtures that customer can download and modify to better fit their needs.
2. Look for possible ferrous interference within the sensing range
 - a. Recommend using non-ferrous mounting plates and hardware for installation.
 - b. Ensure sensor and ring magnet are well distanced from known ferrous items.
3. Check for concentricity.
 - a. Performance will vary if the installation has any variability in concentricity.
4. Check pin and joint for stability.
 - a. Excessive wear of joint could lead to increase error.
 - b. For optimal performance, the pin joint should run as true as possible.
5. Check for overall flatness of mounting plate.
 - a. The sensor cannot withstand more than 1mm of flatness error.
6. Check tolerance stack-up.
7. If problems persist, contact Honeywell for additional application assistance.

TABLE 8. 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			

CONNECTOR PIN-OUT DETAILS

Mating Connector Deutsch Receptacle Part: DT06-4S



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

CAN MESSAGES AND COMMUNICATION

SMART Arc CAN 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**.

Sensors are locked when shipped. The CAN address cannot be changed.

TABLE 10 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

5.0 CAN MESSAGES AND COMMUNICATION

SMART Arc CAN utilizes CAN J1939 protocol and message format to report data. Please refer to the J1939 standard for information regarding communications and system implementation. Sensor data broadcast rate of default 5 ms, default 250/500 Kbps, 29-bit extended identifiers and 8-byte transmit and receive.

5.1 CAN J1939 DEVICE IDENTIFICATION

The ID is a 4-byte value that identifies the message being transmitted. The J1939 Protocol Data Unit (PDU) 29-Bit Identifier (CAN Extended Format) definition does not include the following three CAN Data Frame Bits: Start of Frame (SOF), Substitute Remote Request (SRR), and Identifier Extension Bit (IDE), as these bits are controlled entirely by ISO 11898-1. The J1939 PDU is comprised of a 29-bit identifier (see Table 11): Priority (P), Data Page (DP and EDP), PDU Format (PF), PDU Specific (PS), and Source Address (SA). Additionally, the PDU may also include a 0-8-byte data field that changes in length and definition based upon the message.

TABLE 11. 29-BIT IDENTIFIER (J1939 FRAME FORMAT)

FIELD	PRIORITY (P)	EDP	DP	PDU FORMAT (PF)								PDU SPECIFIC (PS)								SOURCE ADDRESS (SA)									
# Bits	3	1	1	8								8								8									
Bit ID Position	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

6.0 SMART ARC CAN-SPECIFIC MESSAGES

The SMART Arc CAN transmits broadcast data as configured by the signal update rate..

6.1 PGN 65363 (0xFF53) ANGULAR DATA

TABLE 12. PGN 65363 PDU

FRAME FORMAT	29-BIT ID						DATA (8 BYTES)								
Field	P	EDP	DP	PF	PS	SA	Angular Data			Unused			Status	Err Code	
# Bits	4	0	0	8	8	8	8	8	8	8	8	8	8	8	8
CAN Message	0x10			0xFF	0x53	0xC4	0x00	0x98	0x00	0x00	0x00	0x00	0x00	0x00	0x00
							BL	BH							

UINT16 = B_H * 2⁸ + B_L
 Angular data (deg) = (UINT16) / (145/38912)
 e.g., 0x10FF53C4, 0x00, 0x98, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
 Transmit 145 deg on angular data with priority 4, fully functional from address 0xC4.

6.1.1 PGN 65363 STATUS

The status byte is comprised angular data status.

TABLE 13. PGN 65363 STATUS

TYPE	UNUSED		UNUSED		UNUSED		ANGULAR DATA	
# Bits	2		2		2		2	
Bit ID Position	7	6	5	4	3	2	1	0
CAN Message	00b		00b		00b		00b	

All status definitions are defined as:
 00b = Fully Functional
 01b = Unused
 10b = Unused
 11b = Error
 Note: If any one of the sensor errors (described below in next section) is set, FOM is set to error status.

6.1.2 PGN 65363 ERROR CODE

The error code is comprised internal sensor error details.

TABLE 14. PGN 65363 ERROR CODE

TYPE	MAGNET OUT OF RANGE	SYNC LOSS	AUTO BAUD	DATA INVALID	UART ERROR	TIMEOUT	WDT ERROR	SW ERROR
# Bits	1	1	1	1	1	1	1	1
Bit ID Position	7	6	5	4	3	2	1	0

1 = Error, 0 = No error

TABLE 15. ERROR CODE DESCRIPTION

ERROR	DESCRIPTION	RECOVERABLE
Magnet out of range	Magnet is not in place	Yes
Sync loss	ASIC data bytes which are of 2 bytes are not trackable (Byte interchange)	No
Auto baud	ASIC communication baud rate is incorrect	Yes
Data invalid	ASIC data is out of range	Yes
UART error	ASIC communication error	Yes
Time out	ASIC is unable to output data	Yes
WDT error	Watchdog reset	No
SW error	Internal error like stack error	No

Note: As sensor errors are stored as history of errors, on power reset the errors are copied from non-volatile memory and reflects on Sensor Error code bits and on FOM where it is non recoverable. However, in the next power cycles Angular data will be transmitted with FOM as Error and Error code getting set.

6.2 PGN 65242 SOFTWARE IDENTIFICATION

TABLE 16. PGN 65242 PDU

FRAME FORMAT	29-BIT ID						DATA (8 BYTES)								
	P	EDP	DP	PF	PS	SA	Length	Week No	Year No	Ver-sion	Unused				
# Bits	6	0	0	8	8	8	8	8	8	8	8	8	8	8	8
CAN Message	0x18		0xFE	0xDA	0xC4	0x03	0x1E	0x13	0x0A	0x00	0x00	0x00	0x00	0x00	0x00

PGN 65242 is transmitted on J1939 PGN 65252 request message with source specific address. Responds with the default priority for the PGN requested with any priority.

Length indicates total no of bytes useful in the CAN packet other than 1st byte which is 3, Week No: 30, Year No: 19 (2019), Version: 10 (1.0)

6.3 PGN 60928 ADDRESS CLAIM

TABLE 17. PGN 60928 PDU

FRAME FORMAT	29-BIT ID						DATA (8 BYTES)							
Field	P	EDP	DP	PF	PS	SA	J1939 NAME							
# Bits	6	0	0	8	8	8	8	8	8	8	8	8	8	8
CAN Message	0x18		0xEE	0xFF	0xC4	0x03	0x1E	0x13	0x0A	0x00	0x00	0x00	0x00	0x00

A NAME is a 64-bit identifier for a CA and is composed of 10 fields. The values for 6 of these fields are derived from assignment lists managed by the J1939 committee. The remaining 4 values are either derived from characteristics of the network and vehicle architecture or under direct control of the manufacturer.

TABLE 18. PGN 60928 NAME

TYPE	ARBITRARY ADDRESS CAPABLE	INDUSTRY GROUP	VEHICLE SYSTEM INSTANCE	VEHICLE SYSTEM	RESERVED	FUNCTION	FUNCTION INSTANCE	ECU INSTANCE	MANUFACTURER CODE	IDENTITY NUMBER
# Bits	1	3	4	7	1	8	5	3	11	21
Byte No	8		7		6	5		4/3	2/1	
CAN Message	1	3	0	0	0	145	0	0	347	xxx (Derived from DUT Serial No)

The CAN messaging format is in INTEL format. The NAME field is implemented as per J1939-81 section Address Claimed/ Cannot Claim.

SMART-ARC-CAN starts with default source address 196 (0xC4).

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