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THE POWER OF **CONNECTED**

Installation Instructions for the
Transportation Attitude Reference System (TARS Series)
Ruggedized Inertial Measurement Unit (IMU)

Issue B
32332897

1.0 GENERAL INFORMATION

Honeywell's Transportation Attitude Reference System (TARS) Ruggedized Inertial Measurement Unit (IMU) is designed to provide motion sensing through six degrees of freedom and reporting of angular rate, acceleration, and attitude data through a CAN J1939 interface. It is packaged for harsh environments and demanding applications.

2.0 CALIBRATION

TARS-IMU devices are aligned to a flat surface and calibrated on an aerospace-grade rate table providing consistency between units and eliminating the customer's need to calibrate the IMU.

3.0 INSTALLATION

Mount the sensor using the three mounting holes and three M8 bolts. The mounting tabs accommodate various bolt head styles such as hex, socket head cap, and hex flange bolt head. Torque to 20 Nm ±2 Nm.

• Mating connector: AMPSEAL 16 Series; 776487-1 for 18-16 AWG conductors or 776524-1 for 20-18 AWG conductors
• Mounting direction: +Z

Sensing and Internet of Things

4.0 SPECIFICATIONS

Table 1. Sensor Specifications

Characteristic	Min.	Typ.	Max.	Unit
Gyroscope 3 axis performance				
Angular rate range[1]	-245	–	+245	deg/s
Angular rate resolution	–	7.8125	–	mdps
In-run bias stability	–	1	–	mdps
Rate noise density	–	0.004	–	deg/s/sqrt Hz
Offset (0°C to 50°C)	-0.8	–	+0.8	deg/s
Offset (-40°C to 85°C)	-1.6	–	+1.6	deg/s
Accelerator 3 axis performance				
Acceleration range[1]	-78.48	–	+78.48	m/s^2
Acceleration resolution	–	0.01	–	m/s^2
In-run bias stability	–	50	–	µg
Acceleration noise density	–	65	–	µg/sqrt Hz
Offset (0°C to 50°C)	–	±0.05	–	m/s^2
Offset (-40°C to 85°C)	–	±0.15	–	m/s^2
Attitude (pitch and roll) performance				
Range[1]	-85	–	+85	deg
Resolution	–	0.058	–	deg
Static error (0°C to 50°C)	–	±0.3	–	deg
Static error (-40°C to 85°C)	–	±0.9	–	deg
Translational acceleration error	–	±0.5	–	deg
Centripetal acceleration error	–	±0.5	–	deg

[1] Sensors are calibrated in the following ranges: ±60 deg/s for gyroscope angular rate, ±9.81 m/s^2 for acceleration, and ±30 deg for pitch and roll. Calibrated ranges can be extended to maximums shown with deviation to performance specifications.

- Pitch and roll outputs per PGN61481 (Axes marking on the housing is Z-down convention required for pitch and roll outputs per J1939.)
- Acceleration outputs per PGN61485 (Acceleration data is outputted per Z-up convention required by J1939.)
- Angular rate outputs per PGN61482 (Angular rate data is outputted per Z-down convention required by J1939.)

Table 2. Electrical Specifications • TARS–LCASS Catalog Listing

Characteristic	Min.	Nominal	Max.	Unit
Supply voltage	4.5	5	5.5	V
Supply current	–	–	100	mA
Start–up time	500	–	2000	ms
Short circuit protection	CAN output shorted to supply voltage or ground without damage			
Open circuit protection	Single-line interruption and multiple-line interruption			
Reset response	Automatic after voltage dropout			
CAN output characteristics per SAE J1939				
CAN Bus data rate	–	250	–	kBaud
Signal update rate	–	–	100	Hz

Table 3. Electrical Specifications • TARS-HCASS Catalog Listing

Characteristic	Min.	Nominal	Max.	Unit
Supply voltage	9	14/28	36	V
Supply current	–	–	100	mA
Reverse voltage	–	–	-36	V
Overvoltage	–	–	36	V
Start-up time	500	–	2000	ms
Short circuit protection	CAN output shorted to supply voltage or ground without damage			
Open circuit protection	Single-line interruption and multiple-line interruption			
Reset response	Automatic after voltage dropout			
CAN output characteristics per SAE J1939				
CAN Bus data rate	–	250	–	kBaud
Signal update rate	–	–	100	Hz

Table 4. Environmental Specifications[1]

Characteristic	Parameter
Operating temperature	-40°C to 85°C [40 °F to 185°F]
Storage temperature[2]	-40°C to 105°C [40°F to 221°F]
Housing	PBT thermoplastic
Random vibration	10 hours at 25 Grms per MIL-STD-810, Method 514.7, Procedure I, Annex D, Category 20, 5 Hz to 500 Hz (flat spectrum)
Mechanical shock	50 g 11 ms half-sine, 3 each direction, 18 total, pulse per MIL-STD-202, Method 213
Chemical compatibility	Diesel fuel, hydraulic oil, ethylene glycol, motor oil, brake fluid, urea nitrogen, liquid lime, NPK fertilizer, ammonium hydroxide, alkaline degreaser, transmission oil, power steering fluid, and axle oil
Moisture resistance	Per MIL-STD-202, Method 106 (10 cycles, 24 hours/cycle)
Thermal shock	250 cycles, -40°C to 85°C, 73 min dwell
Salt spray	5 % salt solution, 96 hours
Ingress protection	IP67, IP69K (DIN40050-1993) with mating connector installed
RoHS	Compliant
REACH	Compliant
UV rating	Housing material meets outdoor suitability requirements per UL746C F1 rating

[1] For environmental conditions not covered by product specification, consult with Honeywell Engineering.
[2] In installed condition; otherwise, maximum storage temperature is 85°C [185°F].
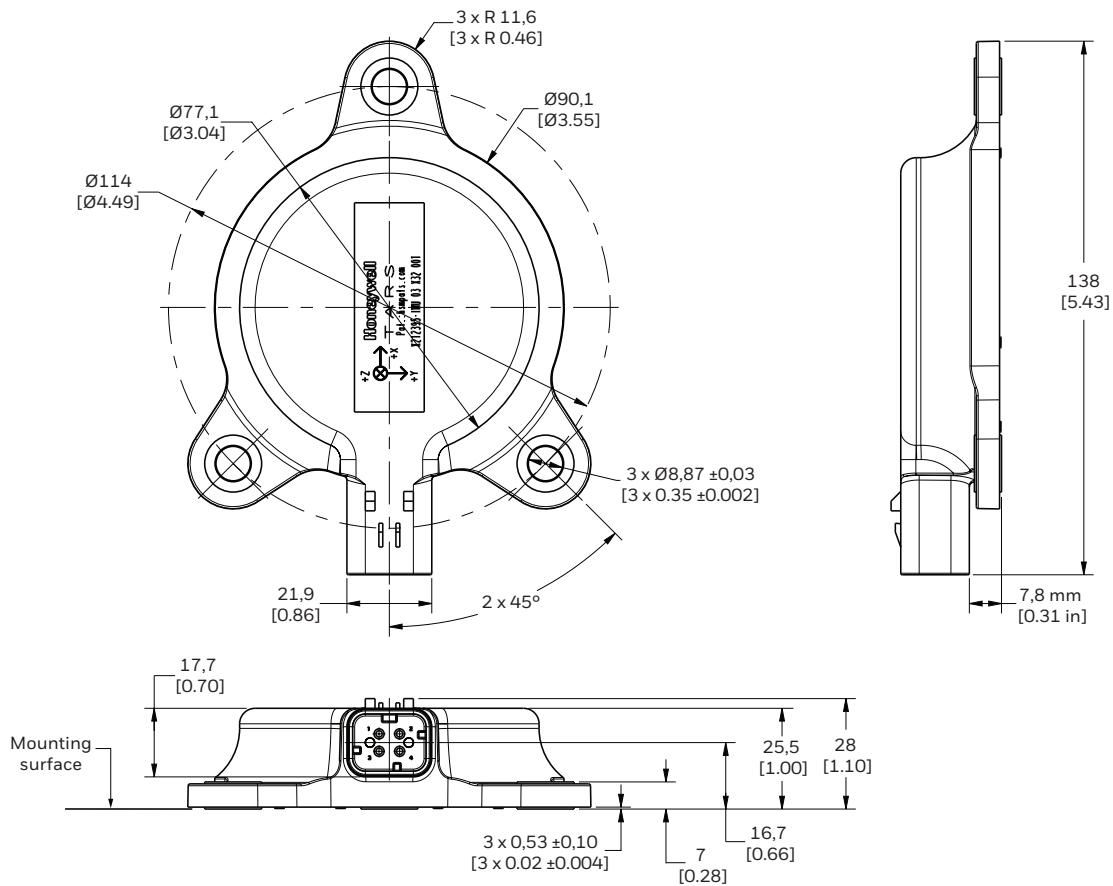
Table 5. EMC Specifications

Characteristic	Standard	Test Level, Frequency
Radiated immunity	ISO 11452-2	125 V/m, 400 MHz to 2.5 GHz
Bulk current injection	ISO 11452-4: 2011	125 mA, 1 MHz to 400 MHz
Radiated emission	ISO 13766	30 MHz to 1 GHz
Mutual coupling	ISO 7637-3	Test pulse A, Test pulse B (-80 V, 80 V)
ESD direct contact discharge	ISO 10605	±8 kV
ESD air discharge	ISO 10605	±15 kV

Table 6. Installation Specifications

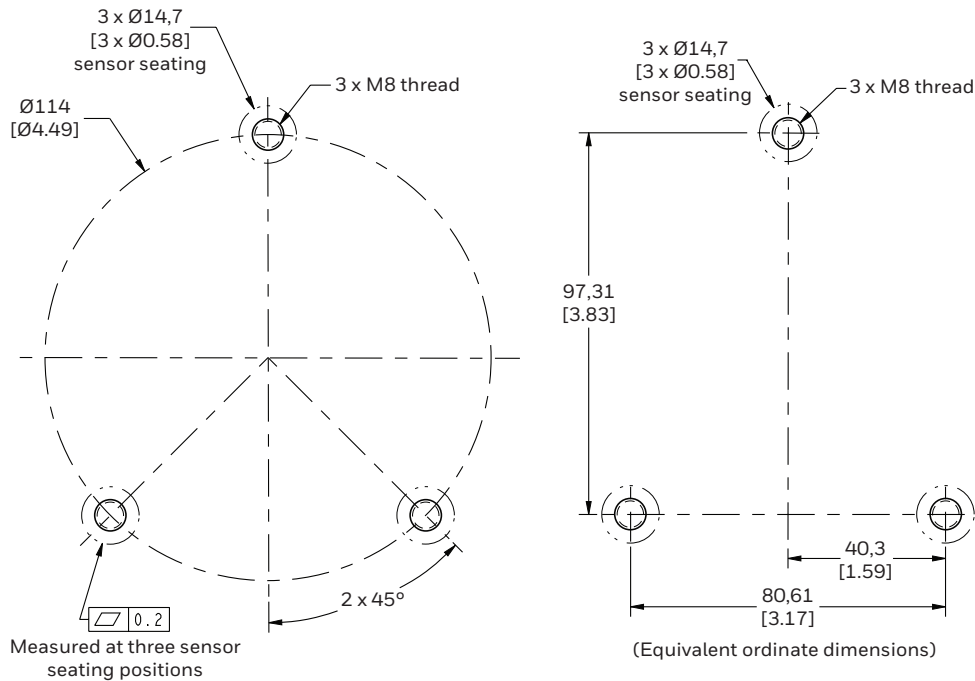| Characteristic	Parameter
Mating connector	AMPSEAL 16 Series; 776487-1 for 18-16 AWG conductors or 776524-1 for 20-18 AWG conductors
CAN termination	120 Ohm termination resistor, not included in TARS-IMU unit
Weight	170 g approx.
Mounting direction	+Z
Mounting bolt	M8, installation torque 20 Nm ±2 Nm

5.0 DIMENSIONS (For reference only: mm/[in])

Body

5.0 DIMENSIONS (Continued)

Mounting Holes

3 x Ø14,7
[3 x Ø0.58]
sensor seating

3 x M8 thread

Ø114
[Ø4.49]

2 x 45°

☐ 0.2

Measured at three sensor
seating positions

3 x Ø14,7
[3 x Ø0.58]
sensor seating

3 x M8 thread

97,31
[3.83]

40,3
[1.59]

80,61
[3.17]

(Equivalent ordinate dimensions)

Pinout

Pin 1
Pin 2
Pin 3
Pin 4

Connector Termination

Pin	Description
1	dc power
2	CAN high
3	Ground
4	CAN low

Marking Information

+Z
+X
+Y

Honeywell
T A R S
Pat.:hsmpats.com
TARS-HCASS 04 X32 001
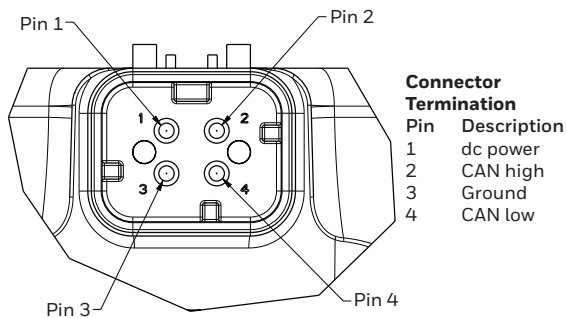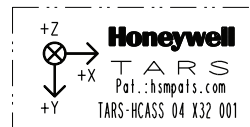
Where
04 Product configuration code
X32 Date code, where:
   X: Year code for 2016, Y for 2017, Z for 2018, A for 2019, etc.
   32: Week of final test
001 is a consecutive number, different for each product

6.0 CAN MESSAGES AND COMMUNICATION

TARS-IMU utilizes CAN J1939 protocol and message format to report data. Please refer to J1939 specification and standards for information regarding communication and implementing CAN J1939 systems.

6.1 CAN J1939 Device Identification

The ID is a 4-byte value to identify the message being transmitted.

- All J1939 messages are Ext CAN
- All messages have default priority
  0 (lowest) <= priority <= 0x7 (highest)
- PDU formats < 0xF0 are peer to peer
  PDU Specific is filled with destination address
- PDU formats >= 0xF0 are broadcast
  PDU Specific further defines the message format
- PDU formats = 0xFF are global broadcast
- All J1939 messages end with the sending address in the last byte

Table 7. J1939 ID Format

Extended					PDU		SA
Ext CAN	Reserved	Priority	Reserved	Data Page	PDU Format	PDU Specific	Source Address
1 Bit	2 Bits	3 Bits	1 Bit	1 Bit	8 Bits	8 Bits	8 Bits
1 Byte					1 Byte	1 Byte	1 Byte

7.0 TARS-IMU SPECIFIC MESSAGES

The TARS-IMU transmits three messages every 10 ms (100 Hz).

7.1 PGN 61481 (0xF029) Pitch and Roll Angles (°) Broadcast Data

Table 8. PGN 61481 Details

Pitch Angle			Roll Angle			Status	Latency
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte
0x00	0x00	0x7D	0x00	0x00	0x7D	0x00	0x0A
BL	BM	BH	BL	BM	BH		

$uint32 = B_H * 2^{16} + B_M * 2^8 + B_L$

$Angle (°) = (uint32 - 8192000) / 32768$

7.2 PGN 61481 Status

The status byte is comprised of compensation status and MEMS status for each value.

Table 9. PGN 61481 Status

Pitch		Roll	
Comp	Status	Comp	Status
00b	00b	00b	00b

All status definitions are defined as:
00b = Fully Functional
01b = Degraded
10b = Error
11b = Not Available
e.g., 0xCF029E2, 0x00, 0x00, 0x7D, 0x00, 0x00, 0x7D, 0x00, 0x05

Transmit 0° on both pitch and roll with priority 3, fully functional MEMS and compensation with 5 ms latency from address 0xE2.

7.3 PGN 61482 (0xF02A) Gyro (°/s) Broadcast Data

Table 10. PGN 61482 Details

Pitch Rate		Roll Rate		Yaw Rate		Status	Latency
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte
0x00	0x7D	0x00	0x7D	0x00	0x7D	0x00	0x0A
BL	BH	BL	BH	BL	BH		

$uint16 = B_H * 2^8 + B_L$

$Rotation\ Rate (°/s) = (uint16 - 32000) / 128$

7.4 PGN 61482 Status

The status byte is comprised of status for each value measure.

Table 11. PGN 61482 Status

Status			Unused
Pitch	**Roll**	**Yaw**	–
00b	00b	00b	00b

All status definitions are defined as:
00b = Fully Functional
01b = Degraded
10b = Error
11b = Not Available
e.g., 0xCF02AE2, 0x00, 0x7D, 0x00, 0x7D, 0x00, 0x7D, 0x00, 0x05

Transmit 0°/s pitch rate, roll rate, and yaw rate with priority 3, fully functional MEMS with 5 ms latency from address 0xE2.

7.5 PGN 61485 (0xF02D) Accelerometer Broadcast Data

Table 12. PGN 61485 Details

Lateral		Longitudinal		Vertical		Status	Latency
1 Byte	**1 Byte**	**1 Byte**	**1 Byte**	**1 Byte**	**1 Byte**	**1 Byte**	**1 Byte**
0x00	0x7D	0x00	0x7D	0x00	0x7D	0x00	0x0A
BL	BH	BL	BH	BL	BH		

$uint16 = B_H*2^8 + B_L$
Acceleration Rate (m/s^2) = (uint16 – 32000) / 100

The status byte is comprised of status for each value measure.

Table 13. PGN 61485 Status

Status			Unused
Lateral	**Longitudinal**	**Vertical**	–
00b	00b	00b	00b

All status definitions are defined as:
00b = Fully Functional
01b = Degraded
10b = Error
11b = Not Available
e.g., 0xCF02DE2, 0x00, 0x7D, 0x00, 0x7D, 0xD5, 0x80, 0x00, 0x05

Transmit 0 m/s² on lateral and longitudinal acceleration, and +1 g (9.80665 m/s^2) on vertical acceleration with priority 3, fully functional MEMS with 5 ms latency from address 0xE2.

⚠ 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
IMPROPER INSTALLATION

- Consult with local safety agencies and their requirements when designing a machine-control link, interface, and all control elements that affect safety.
- Strictly adhere to all installation instructions.

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

WARRANTY/REMEDY

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