

## Installation Instructions for the HG1171 Series 6DF Inertial Measurement Unit

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### GENERAL INFORMATION

The HG1171 Series is a six degrees of freedom (6DF) inertial measurement unit (IMU) that senses rotation rate about the roll, pitch and yaw axes (X, Y and Z axes) and acceleration along the longitudinal, lateral and vertical axes (X, Y and Z axes), see Figure 1.

The HG1171 collects samples from three rotation rate sensors (gyroscopes), one for each axis, and three accelerometers, one for each axis. IMU built-in tests (BIT) are performed to ensure data integrity, ensure robustness of sensor performance and avoid erroneous data at output, see Figure 3.

Samples are filtered and compensated against temperature. The processed data is available at the CAN interface at a rate of 10 ms (100 Hz).

### INSTALLATION

- Mount the sensor using three M6 bolts in the housing mounting tabs, see Figure 2. Torque no greater than 5,4 N m [48 in lb]. Ensure the connector opening is horizontal in order to prevent fluid intrusion.
- Wire the mating cable according to Figure 3. Ensure power supply requirements according to Table 2.

Figure 1. Axes of Motion

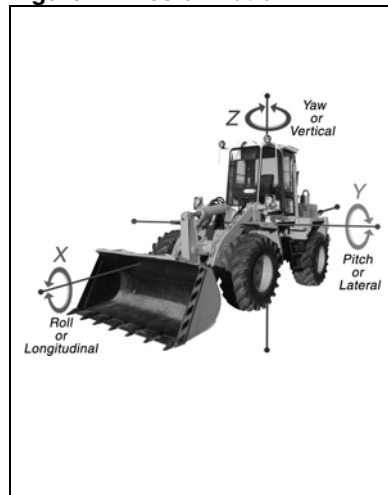


Figure 2. Mounting Dimensions For reference only: mm/[in.]

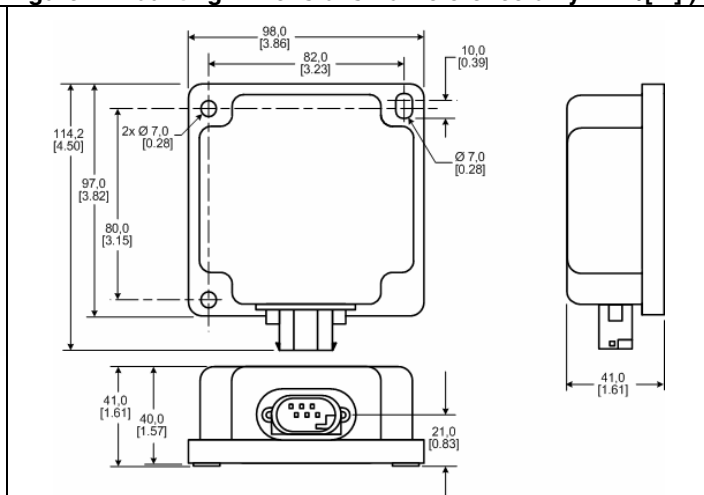


Figure 3. Pinout

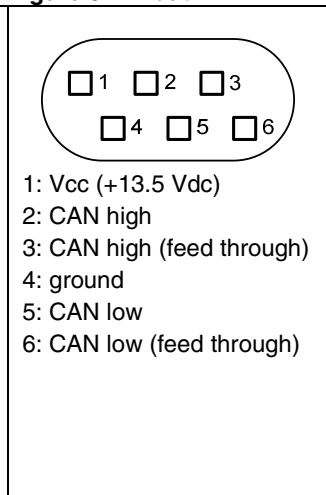


Figure 4. Sensor Block Diagram

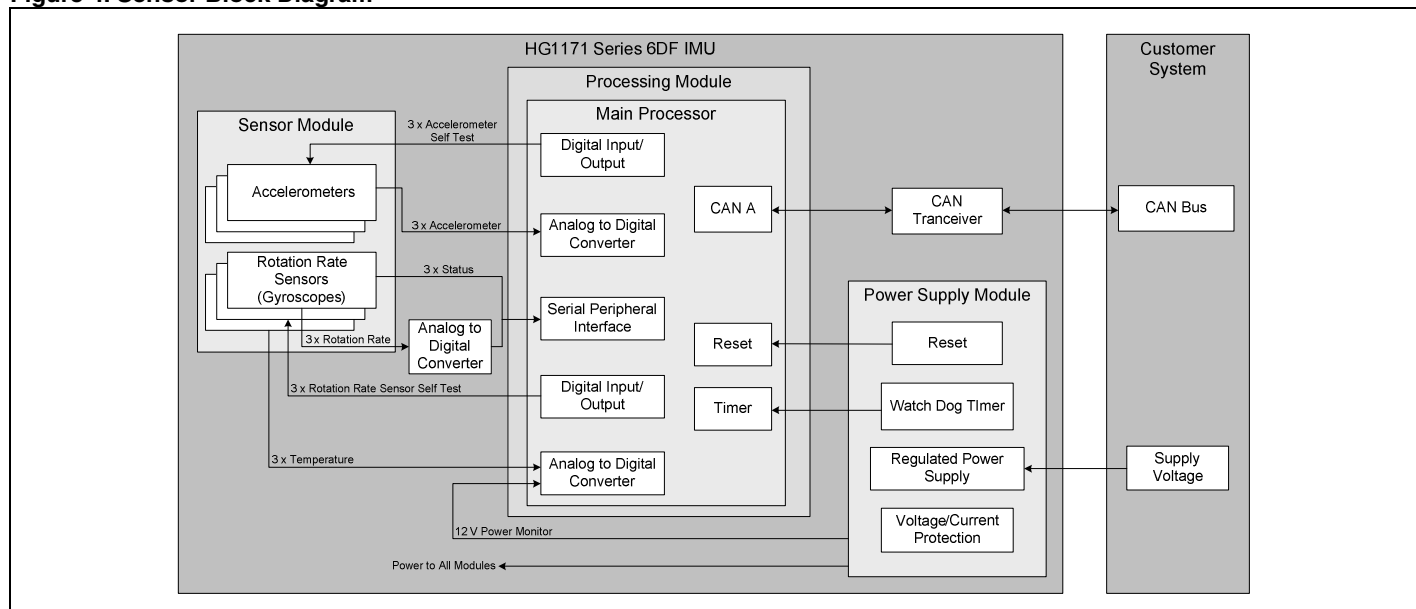


Figure 5. System Interface Block Diagram

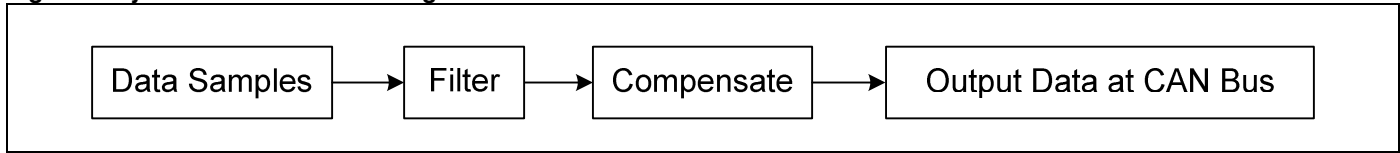


Table 1. General Specifications

Characteristic	Minimum	Typical	Maximum	Unit
Supply voltage (normal operation)	+7	+13.5	+17	V
Over voltage (output halted)	—	—	+26	V
Reverse voltage	—	—	-18	V
Supply current	—	—	+75	mA
Start up time	—	700	—	ms
Operating temperature	-40 [-40]	20 [68]	85 [185]	°C [°F]
Storage temperature	-40 [-40]	—	95 [203]	°C [°F]
Vibration (10 Hz to 1000 Hz)	—	—	3.1	g (RMS)
Shock	—	100	—	g (half sine for 6 ms)
Humidity <sup>(1)</sup>	—	—	95%	—
Sealing	IP6K2			
ESD (Electrostatic Discharge) <sup>(2)</sup>	Meets ISO 10605: - at ≤8 kV ESD protection for handling - at ≤15 kV protection for power			
Connector	AMP: 3-967-616-1, keying C mating cable harness			

**Notes:**

1. After exposure, including a condensing environment.
2. All exposed ports have low-pass filtering using trade-off methods which consider ESD protection, RF filtering and bandwidth. The ESD simulator waveform verification complies with ISO 10605 except for contact discharge rise time <1 ns and air discharge rise time ≤20 ns.

Table 2. Rotation Rate Sensor Specifications

Characteristic	Minimum	Maximum	Unit
Measurement range	-75	75	°/s
Overload range(<60 ms recovery)	-1000	1000	°/s
Sensitivity error	-4	4	%
Linearity	-1	1	%
Offset (total)	-2.5	2.5	°/s
Offset drift (over temperature range)	-1	1	°/s
Offset drift speed (t > 3 min)	-0.2	0.2	°/s/min
Noise	—	0.2	°/s
Cross axis sensitivity	—	2	%
Turn on time	—	750	ms

Table 3. Acceleration Sensor Specifications

Characteristic	Minimum	Maximum	Unit
Measurement range	-17	17	m/s <sup>2</sup>
Overload range(<60 ms recovery)	-100	100	m/s <sup>2</sup>
Sensitivity error	-5	5	%
Linearity	-4	4	%
Offset (total)	-1	1	m/s <sup>2</sup>
Offset drift (over temperature range)	-0.35	0.35	m/s <sup>2</sup>
Offset drift speed (over 60 °K interval)	-0.2	0.2	m/s <sup>2</sup> /min
Noise	—	0.1	m/s <sup>2</sup> (RMS)
Cross axis sensitivity	5	5	%
Turn on time	—	250	ms

**Table 4. IMU to Customer System: Yaw Rate and Lateral Acceleration Definition**

Message 0x130	Bit	Bit Position	Description
Rolling counter	8	0	increments the counter for every message sent, rolls from 255 to 0
Signal state for lateral acceleration	2	8	indicates if acceleration data is valid
Signal state for yaw rate	2	10	indicates if yaw rate data is valid
Signal state for temperature	2	12	indicates if temperature data is valid
Vehicle dynamic lateral acceleration	10	22-31	digital filtered rate signal
Vehicle dynamic yaw rate	14	34-47	digital filtered acceleration signal
<Unused>	24	13-21, 32-33, 48-65	—

**Table 5. IMU to Customer System: Roll Rate and Longitudinal Acceleration Definition**

Message 0x131	Bit	Bit Position	Description
Rolling counter	8	0	increments the counter for every message sent, rolls from 255 to 0
Signal state for longitudinal acceleration	2	8	indicates if acceleration data is valid
Signal state for roll rate	2	10	indicates if roll rate data is valid
Vehicle dynamic longitudinal acceleration	10	22-31	digital filtered rate signal
Vehicle dynamic roll rate	14	34-47	digital filtered acceleration signal
Error information	16	48-63	error information
<Unused>	12	12-21, 32-33	—

**Table 6. Message 0x131 Errors**

Number of Bits	Bit Position	Error Description
1	48	<reserved>
1	49	phase locked loop
1	50	yaw rotation rate
1	51	roll rotation rate
1	52	pitch rotation rate
1	53	lateral acceleration
1	54	longitudinal acceleration
1	55	vertical acceleration
1	56	CAN bus off
1	57	CAN functionality
1	58	watch dog timer
1	59	software
1	60	serial peripheral interface
1	61	internal analog to digital
1	62	external analog to digital
1	63	battery voltage

**Table 7. IMU to Customer System: Pitch Rate and Vertical Acceleration Definition**

Message 0x132	Bit	Bit Position	Description
Rolling counter	8	0	increments the counter for every message sent, rolls from 255 to 0
Signal state for vertical acceleration	2	8	indicates if acceleration data is valid
Signal state for pitch rate	2	10	indicates if pitch rate data is valid
Vehicle dynamic vertical acceleration	10	22-31	digital filtered rate signal
Vehicle dynamic pitch rate	14	34-47	digital filtered acceleration signal
<Unused>	26	12-21, 48-63	—

**Table 8. IMU to Customer System: Serial Number Definition**

Message 0x025	Bit	Bit Position	Description
Module serial number	16	16-31	—
Software version number	16	32-47	—
Hardware version number	16	48-63	—
<Unused>	16	0-15	—

**Table 9. Signal State Definition**

Bit X	Bit X+1	Signal State	Description
0	0	valid	signal in specification
0	1	invalid	signal not accurate, fault detected
1	0	unused	unused combination
1	1	self test status	self test active

**Table 10. Interface Definition (CAN Protocol 2.0 A or B at 500k baud rate.)**

CAN Message	Message Identifier	Data Length	Description
Sensor data (lateral acceleration and yaw rate)	0x130	8 bytes	IMU to system
Sensor data (longitudinal acceleration and roll rate)	0x131	8 bytes	IMU to system
Sensor data (vertical acceleration and pitch rate)	0x132	8 bytes	IMU to system
Serial number, software version number, hardware version number	0x25	8 bytes	IMU to system (on request)
Error status	0x26	6 bytes	IMU to system (on request)

**Table 11. Software Resolution for Rotation Rates and Accelerations**

Bit Position	Number of Bits	Numerical Format	Low Significant Bit	Measurement Range	Value Range (Hex)
<b>Vehicle Dynamic Rates</b>					
34-47	14	unsigned value	0.0183 deg/s	+74.914 deg/s	0x3000
—	—	—	—	0 deg/s	0x2002
—	—	—	—	-75 deg/s	0x1000
<b>Vehicle Dynamic Lateral and Longitudinal Acceleration</b>					
22-31	10	unsigned value	0.0480 m/s <sup>2</sup>	+16.997 m/s <sup>2</sup>	0x362
—	—	—	—	0 m/s <sup>2</sup>	0x200
—	—	—	—	-16.900 m/s <sup>2</sup>	0x9F
<b>Vehicle Dynamic Vertical Acceleration</b>					
22-31	10	unsigned value	0.0480m/s <sup>2</sup>	+16.997 m/s <sup>2</sup>	0x362
—	—	—	—	0 m/s <sup>2</sup>	0x200
—	—	—	—	-16.900 m/s <sup>2</sup>	0x9F

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