

IMU (Inertial Measurement Unit) CAN INTERFACE

■ GENERAL DESCRIPTION

The M-G552 is a small form factor inertial measurement unit (IMU) with 6 degrees of freedom: tri-axial angular rates and linear accelerations and provides high-stability and high-precision measurement capabilities with the use of high-precision compensation technology.

The M-G552PC1 features a built-in attitude angle output function using an extended Kalman filter optimized for high-speed operation and highly accurate attitude angle (Roll/Pitch). This exceptional real time performance is achieved using our unique DSP processing architecture for efficiency, and low power consumption. The application or system level power consumption and complexity can be reduced by offloading the high-speed processing from the host system that would otherwise be necessary to achieve highly dynamic posture angle.

A variety of calibration parameters are stored in memory of the IMU, and are automatically reflected in the measurement data being sent to the application after the power of the IMU is turned on.

With Controller Area Network (CAN) interface support for host communication, the M-G552PCx reduces technical barriers for users to introduce inertial measurement and minimizes design resources to implement inertial movement analysis and control applications.

This unit is packaged in a water-proof and dust-proof metallic case. It is suitable for use in industrial and heavy duty applications.

The features of the IMU such as high stability, high precision, and small size make it easy to create and differentiate applications in various fields of industrial systems.

■ FEATURES

| Item | Specification |
|--------------------|---|
| Sensor | |
| Integrated sensor | SEIKO EPSON inertial measurement sensor Low-noise, High-stability Gyro bias instability : 1.2 °/h Angular random walk : 0.08 °/√h Initial bias error : 360 °/h (1σ)/ 4mG(1σ) 6 Degree of freedom Triple Gyroscope : ±450 °/s Tri-axis Accelerometer : ±10 G Tilt function Inclination mode : ±80 ° Euler mode: ±180 °(Pitch), ±45 °(Roll) Resolution: 0.01 °, Static :±0.2 ° (1σ), Dynamic :±0.2 ° (1σ) 16bit data resolution Calibrated stability (Bias, Scale factor, Axial alignment) |
| Interface | |
| | M-G552PC1 |
| Protocol | CANopen |
| Physical layer | ISO11898-2 (High speed CAN) |
| Frame format | CAN2.0A |
| Profile | DS-301 (Standard profile) DS-404(Device profile for measuring devices) |
| Bit rate | 1M/ 800k/ 500k/ 250k(default)/ 125k/ 50k/ 20k/ 10k bps |
| Sampling rate | 100 sps (Default) up to 200 sps (When attitude angle output enable) Max 1,000 sps (Sampling mode, When 6 dof sensor output enable) / 500sps (Sync mode, When 6 dof sensor output enable) |
| Default ID | 1d(default) to 127d |
| Environment | |
| Voltage supply | 9 V to 32 V |
| Power consumption | 33mA (VIN = 12V) |

| Item | Specification |
|-----------------------------|--|
| Operating temperature range | -30 °C to +80 °C |
| External dimension | |
| Outer packaging | Overall metallic shield case |
| Size | 65 x 60 x 30 mm ³ (Not including projection.) |
| Weight | 115 g |
| Interface connector | CAN connector: 5-pos, M12, water-proof |
| Water-proof , Dust-proof: | IP67 equivalent |
| Random vibration | 1 hour at 7.7Grms MIL-STD-810, METHOD 514.x ANNEX E, Category24 |
| Sine sweep vibration | 4 hours / axis at 10G MIL-STD-202G, METHOD 204 |
| Mechanical shock | 1,000G, Half-sine 0.5ms, once per ±each axis(6times) |
| Regulation | |
| EU | CE marking (EN61326/RoHS Directive) Class A |
| USA | FCC part15B Class A |

■ APPLICATIONS

- Motion and vibration measurement
- Platform stabilization
- Attitude detection for unmanned systems
- Vibration control and stabilization

Appendix1. CANopen Messages

| COB | CAN-ID | | DLC | Data field (Byte) ^(*) | | | | | | | | Description |
|---------------------|--------|----------------------------|-----|----------------------------------|------|----------|-----|-----|---|---|---|---|
| | FC | Node-ID | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| NMT | 0000b | 0000000b | 2 | Cs | Id | | | | | | | Cs=command specifier Id=node-ID |
| SYNC | 0001b | 0000000b | 1 | Cn | | | | | | | Cn=SYNC counter | |
| | | | 0 | or | | | | | | | | |
| TIME | 0010b | 0000000b | 6 | Ms | | | Dy | | | | Dy=days Ms=milliseconds | |
| TPDO1 | 0011b | 0000001b to 1111111b | 8 | Tc | Gx | Gy | Gz | | | | | Tc=trigger counter Gx/Gy/Gz=gyro data |
| TPDO2 | 0101b | 0000001b to 1111111b | 8 | Tc | Ax | Ay | Az | | | | | Tc=trigger counter Ax/Ay/Az=accel data |
| TPDO3 ^{*2} | 0111b | 0000001b to 1111111b | 8 | Tc | Te | Reserved | | STS | | | | Tc=trigger counter Te=temperature STS= Status information |
| TPDO3 ^{*3} | 0111b | 0000001b to 1111111b | 8 | Tc | ANG1 | ANG2 | STS | | | | | Tc=trigger counter ANG1= Attitude data1 ANG2= Attitude data2 STS= Status information |
| TPDO4 | 1001b | 0000001b to 1111111b | 8 | Tc | Ms | | | Dy | | | | Tc=trigger counter Ms=time Milliseconds Dy=time of day |
| TSDO | 1011b | 0000001b to 1111111b | 8 | Cs | Pi | Ps | Pd | | | | Cs=command specifier Pi=index Ps=sub-index Pd=data | |
| RSDO | 1100b | 0000001b to 1111111b | 8 | Cs | Pi | Ps | Pd | | | | Cs=command specifier Pi=index Ps=sub-index Pd=data | |
| HB | 1110b | 0000001b to 1111111b | 1 | St | | | | | | | St=state | |

*1. Byte order is little endian

*2. When 6dof output is valid by writing [11h] to OD[2005h,00h]

*3. When attitude angle output is valid by writing [21h] to OD[2005h,00h]

Appendix2. OBJECT DICTIONARY LIST

| Index | Sub | Function | Type | Access | Default Value | Save |
|-----------------------|----------------------|------------------------------------|-------|------------|------------------------|------|
| 1000h | 00h | Device type | U32 | const | 0002 0194h | |
| 1001h | 00h | Error register | U8 | ro | 00h | |
| 1002h | 00h | Manufacturer status register | U32 | ro | 0000 0000h | |
| 1005h | 00h | SYNC COB-ID | U32 | rw | 0000 0080h | # |
| 1006h | 00h | Communication cycle period | U32 | rw | 0000 2710h | # |
| 1008h | 00h | Manufacturer device name | VS | const | 3235 3547h | |
| 1009h | 00h | Manufacturer hardware version | VS | const | 3031 4350h | |
| 100Ah | 00h | Manufacturer software version | VS | const | 3030 2E31h(latest Rev) | |
| 1010h | 00h | highest sub-index supported | U8 | const | 01h | |
| | 01h | Save all parameters | VS | rw | 0000 0001h | |
| 1011h | 00h | highest sub-index supported | U8 | const | 01h | |
| | 01h | Restore all default parameters | VS | rw | 0000 0001h | |
| 1012h | 00h | TIME COB-ID | U32 | const | 8000 0100h | |
| 1017h | 00h | Producer heartbeat time | U16 | rw | 0000h | # |
| 1018h | 00h | highest sub-index supported | U8 | const | 01h | |
| | 01h | Vender ID | U32 | const | 0000 0000h | |
| 1019h | 00h | Synchronous counter overflow value | U8 | rw | 00h | # |
| 1200h | 00h | highest sub-index supported | U8 | const | 02h | |
| | 01h | RSDO COB-ID | U32 | ro | 0000 0600h + NID | |
| | 02h | TSDO COB-ID | U32 | ro | 0000 0580h + NID | |
| 1800h | 00h | highest sub-index supported | U8 | const | 02h | |
| | 01h | TPDO1 COB-ID | U32 | rw | 4000 0180h + NID | # |
| | 02h | TPDO1 transmission type | U8 | rw | FEh | # |
| 1801h | 00h | highest sub-index supported | U8 | const | 02h | |
| | 01h | TPDO2 COB-ID | U32 | rw | 4000 0280h + NID | # |
| | 02h | TPDO2 transmission type | U8 | ro | (FEh) | (#) |
| 1802h | 00h | highest sub-index supported | U8 | const | 02h | |
| | 01h | TPDO3 COB-ID | U32 | rw | C000 0380h + NID | # |
| | 02h | TPDO3 transmission type | U8 | rw | (FEh) | (#) |
| 1803h | 00h | highest sub-index supported | U8 | const | 02h | |
| | 01h | TPDO4 COB-ID | U32 | rw | C000 0480h + NID | # |
| | 02h | TPDO4 transmission type | U8 | ro | (FEh) | (#) |
| 1A00h | 00h | highest sub-index supported | U8 | const | 04h | |
| | 01h | TPDO1 mapping1 (Tc) | U32 | const | 2100 0010h | |
| | 02h | TPDO1 mapping2 (Gx) | U32 | const | 7130 0110h | |
| | 03h | TPDO1 mapping3 (Gy) | U32 | const | 7130 0210h | |
| | 04h | TPDO1 mapping4 (Gz) | U32 | const | 7130 0310h | |
| 1A01h | 00h | highest sub-index supported | U8 | const | 04h | |
| | 01h | TPDO2 mapping1 (Tc) | U32 | const | 2100 0010h | |
| | 02h | TPDO2 mapping2 (Ax) | U32 | const | 7130 0410h | |
| | 03h | TPDO2 mapping3 (Ay) | U32 | const | 7130 0510h | |
| | 04h | TMAP2 mapping4 (Az) | U32 | const | 7130 0610h | |
| 1A02h | 00h | highest sub-index supported | U8 | const | 04h | |
| | 01h | TPDO3 mapping1 (Tc) | U32 | const | 2100 0010h | |
| | 02h | TPDO3 mapping2 (Temp) | U32 | const | 7130 0710h (6dof) | |
| | | TPDO3 mapping2 (ANG1) | | | 7130 810h(Attitude) | |
| | 03h | TPDO3 mapping3 (Reserved) | U32 | Const | 2022 0410h(6dof) | |
| TPDO3 mapping3 (ANG2) | | 7130 0910h(Attitude) | | | | |
| 04h | TPDO3 mapping4 (STS) | U32 | const | 2022 0110h | | |
| 1A03h | 00h | highest sub-index supported | U8 | const | 03h | |
| | 01h | TPDO4 mapping1 (Tc) | U32 | const | 2100 0010h | |
| | 02h | TPDO4 mapping2 (Ms) | U32 | const | 2101 0220h | |
| | 03h | TPDO4 mapping3 (Dy) | U32 | const | 2101 0110h | |
| 1F80h | 00h | NMT Startup Mode | U32 | rw | 0000 0008h | # |
| 2000h | 00h | highest sub-index supported | U8 | const | 02h | |
| | 01h | CAN node-ID | U8 | rw | 01h | # |
| | 02h | CAN bitrate | U8 | rw | 03h | # |

| Index | Sub | Function | Type | Access | Default Value | Save |
|-------|-----|-----------------------------|------|-------------------|---------------|------|
| 2001h | 00h | Sensor sample rate | U8 | rw | 0Ah | # |
| 2005h | 00h | Apply parameters | U8 | rw | 10h | # |
| 2020h | 00h | highest sub-index supported | U8 | const | 1Bh | |
| | 01h | Inc / Euler select | U8 | rw | 00h | # |
| | 02h | Reference attitude | U8 | rw | 00h | # |
| | 03h | Motion profile | U8 | rw | 00h | # |
| 2100h | 00h | Trigger counter | U16 | rw | 0000h | |
| 2101h | 00h | highest sub-index supported | U8 | const | 02h | |
| | 01h | Time of day | U16 | ro | indefinite | |
| | 02h | Time difference | U32 | ro | indefinite | |
| 6110h | 00h | highest sub-index supported | U8 | const | 0Ah | |
| | 01h | AI sensor type 1 | U16 | ro | 28A1h | |
| | 02h | AI sensor type 2 | U16 | ro | 28A1h | |
| | 03h | AI sensor type 3 | U16 | ro | 28A1h | |
| | 04h | AI sensor type 4 | U16 | ro | 2905h | |
| | 05h | AI sensor type 5 | U16 | ro | 2905h | |
| | 06h | AI sensor type 6 | U16 | ro | 2905h | |
| | 07h | AI sensor type 7 | U16 | ro | 0064h | |
| | 08h | AI sensor type 8 | U16 | ro | 28A1h | |
| | 09h | AI sensor type 9 | U16 | ro | 28A1h | |
| 6131h | 00h | highest sub-index supported | U8 | const | 0Ah | |
| | 01h | AI physical unit PV 1 | U32 | ro | 0041 0300h | |
| | 02h | AI physical unit PV 2 | U32 | ro | 0041 0300h | |
| | 03h | AI physical unit PV 3 | U32 | ro | 0041 0300h | |
| | 04h | AI physical unit PV 4 | U32 | ro | FDF1 0000h | |
| | 05h | AI physical unit PV 5 | U32 | ro | FDF1 0000h | |
| | 06h | AI physical unit PV 6 | U32 | ro | FDF1 0000h | |
| | 07h | AI physical unit PV 7 | U32 | ro | 002D 0000h | |
| | 08h | AI physical unit PV 8 | U32 | ro | 0h | |
| | 09h | AI physical unit PV 9 | U32 | ro | 0h | |
| 61A0h | 00h | highest sub-index supported | U8 | const | 0Ah | |
| | 01h | AI filter type 1 | U8 | const | 02h | |
| | 02h | AI filter type 2 | U8 | const | 02h | |
| | 03h | AI filter type 3 | U8 | const | 02h | |
| | 04h | AI filter type 4 | U8 | const | 02h | |
| | 05h | AI filter type 5 | U8 | const | 02h | |
| | 06h | AI filter type 6 | U8 | const | 02h | |
| | 07h | AI filter type 7 | U8 | const | 02h | |
| | 08h | AI filter type 8 | U8 | const | 02h | |
| | 09h | AI filter type 9 | U8 | const | 02h | |
| 61A1h | 00h | highest sub-index supported | U8 | const | 0Ah | |
| | 01h | AI filter tap constant 1 | U8 | rw ⁽¹⁾ | 08h | # |
| | 02h | AI filter tap constant 2 | U8 | ro | 08h | |
| | 03h | AI filter tap constant 3 | U8 | ro | 08h | |
| | 04h | AI filter tap constant 4 | U8 | ro | 08h | |
| | 05h | AI filter tap constant 5 | U8 | ro | 08h | |
| | 06h | AI filter tap constant 6 | U8 | ro | 08h | |
| | 07h | AI filter tap constant 7 | U8 | ro | 08h | |
| | 08h | AI filter tap constant 8 | U8 | ro | 08h | |
| | 09h | AI filter tap constant 9 | U8 | ro | 08h | |
| 7130h | 00h | highest sub-index supported | U8 | const | 0Ah | |
| | 01h | AI input PV 1 | I16 | ro | indefinite | |
| | 02h | AI input PV 2 | I16 | ro | indefinite | |
| | 03h | AI input PV 3 | I16 | ro | indefinite | |
| | 04h | AI input PV 4 | I16 | ro | indefinite | |
| | 05h | AI input PV 5 | I16 | ro | indefinite | |
| | 06h | AI input PV 6 | I16 | ro | indefinite | |

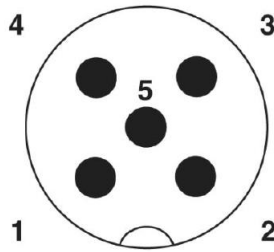
| Index | Sub | Function | Type | Access | Default Value | Save |
|-------|-----|----------------|------|--------|---------------|------|
| | 07h | AI input PV 7 | I16 | ro | indefinite | |
| | 08h | AI input PV 8 | I16 | ro | indefinite | |
| | 09h | AI input PV 9 | I16 | ro | indefinite | |
| | 0Ah | AI input PV 10 | I16 | ro | indefinite | |

*1 When OD[61A1h,01h] is set, the same value is set from OD[61A1h,02h] to OD[61A1h,0Ah] automatically.

Appendix3. CONNECTOR SPECIFICATIONS

Connector specification

| | |
|--------------|-----------------------------|
| Model number | SACC-DSI-MS-5CON-M12-SCO SH |
| Manufacturer | PHOENIX CONTACT |



Terminal Layout

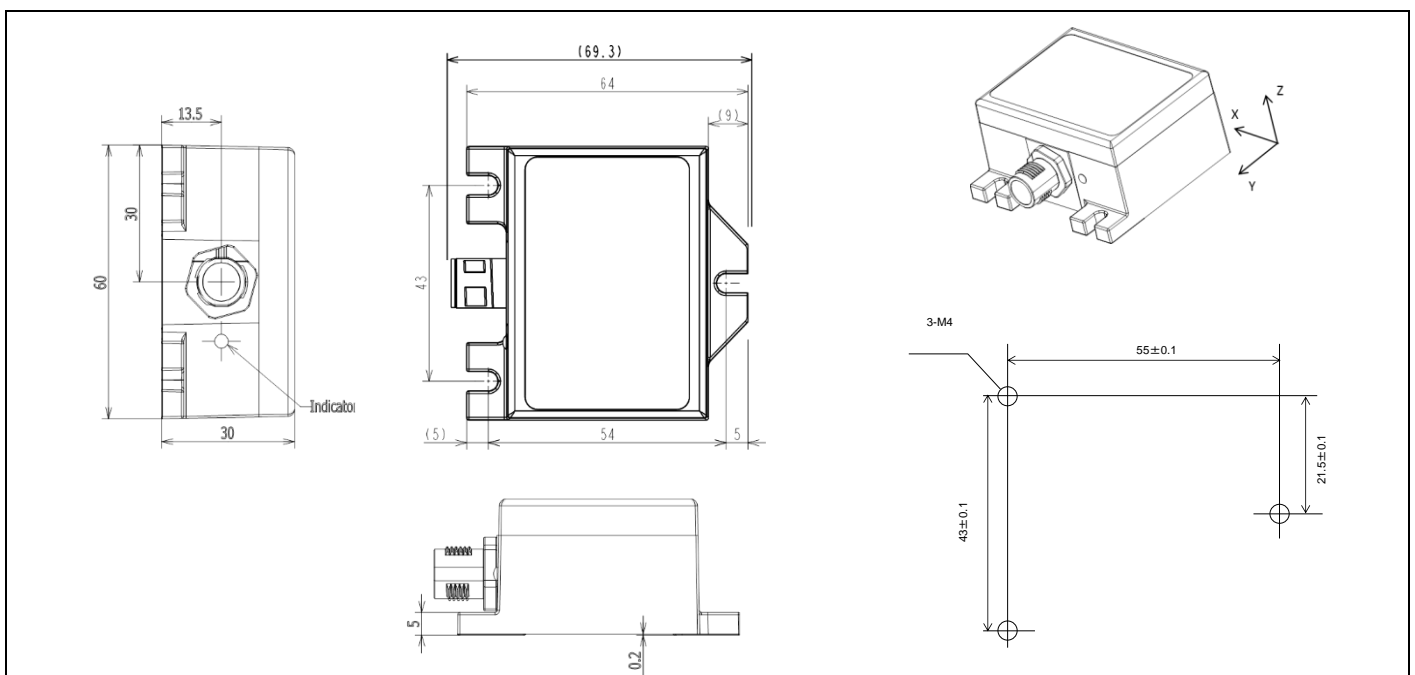
Terminal Function

| No | Pin Name | I/O | Description |
|----|----------|-----|-------------------------------|
| 1 | CAN_SHLD | - | CAN shield (*1) |
| 2 | CAN_V+ | I | External power supply (9-32V) |
| 3 | CAN_GND | - | Ground |
| 4 | CAN_H | I/O | CAN H bus line |
| 5 | CAN_L | I/O | CAN L bus line |

Notice: This unit should be connected to a connector that satisfies at least the IP67 water and dust proof specification.

(*1) CAN_SHLD is connected to the case.

OUTLINE DIMENSION



Outline Dimensions (millimeters)

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