M-G552PC1

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■ 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 deg/hr
		Angular random walk : 0.08 deg/$\sqrt{}$hr
		Initial bias error : 0.1 deg/s (1σ)/ 4mG(1σ)
		6 Degree of freedom
		Triple Gyroscope : ±450 deg/s
		Tri-axis Accelerometer : ±10 G
		Tilt function
		Inclination mode : ±80deg
		Euler mode: ±180deg(Pitch), ±45deg(Roll)
		Resolution: 0.01deg , Static :±0.2deg (1σ), Dynamic :±0.2deg (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 to 32 V
	Power consumption	33mA (VIN = 12V)

Item		Specification
	Operating temperature range	-30 to +80 °C
External dimension		
	Outer packaging	Overall metallic shield case
	Size	65 x 60 x 30mm (Not including projection.)
	Weight	115g
	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 FC	CAN-ID Node-ID	DLC	Data field (Byte) [*1] 1	2	3	4	5	6	7	8	Description
NMT	0000b	0000000b	2	Cs	Id							Cs=command specifier Id=node-ID
SYNC	0001b	0000000b	1	Cn								Cn=SYNC counter
							or					
			0									
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) TPDO3 mapping2 (ANG1)	U32	const	7130 0710h (6dof) 7130 810h(Attitude)	
	03h	TPDO3 mapping3 (Reserved) TPDO3 mapping3 (ANG2)	U32	Const	2022 0410h(6dof) 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	#

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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	
	0Ah	AI sensor type 10	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	
	0Ah	AI physical unit PV 10	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	
	0Ah	AI filter type 10	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	
	0Ah	AI filter tap constant 10	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	
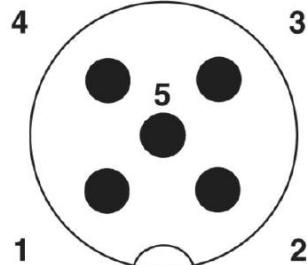
Index	Sub	Function	Type	Access	Default Value	Save
	07h	AI input PV 7	I16	ro	indefinite	
	08h	AI input PV 8	I16	ro	indefinite	
	09h	AI input PV 9	I16	ro	indefinite	
	0Ah	AI input PV 10	I16	ro	indefinite	

[*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
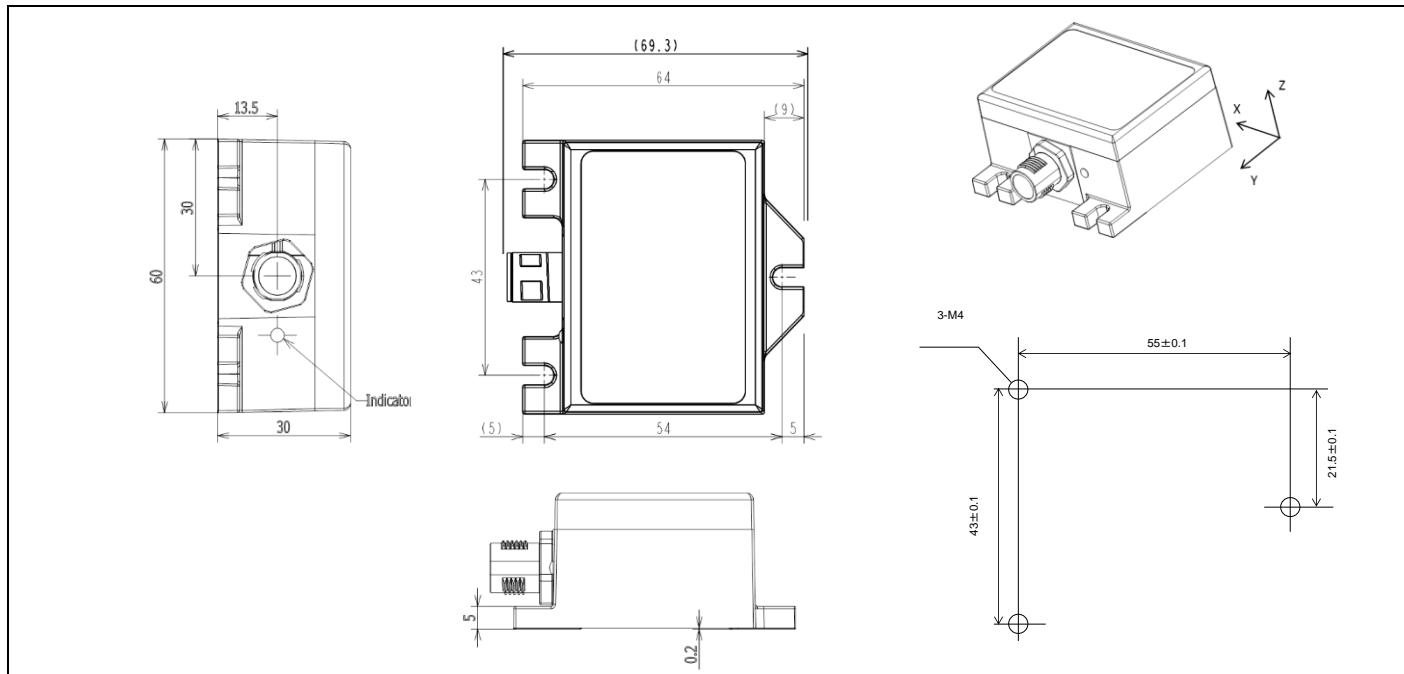
Terminal Function

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)