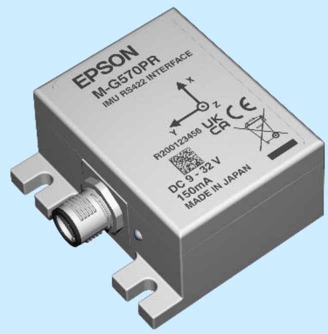
IMU (Inertial Measurement Unit): M-G570PR20

Features

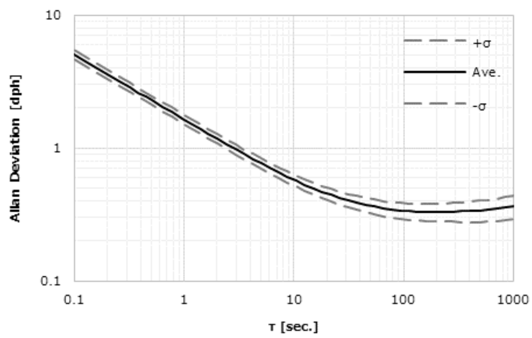
- Small Size, Lightweight : 65 x 60 x 30 mm^3, 150 g
- Low-Noise, High-Stability
  - Gyro Bias Instability : 0.5 °/h
  - Angular Random Walk : 0.04 °/$\sqrt{h}$
- Initial Bias Error : 360 °/h (1σ) / 2 mG (1σ)
- Six-degrees-of-freedom Sensor
  - Triple Axis Gyroscope : ±475 °/s
  - Triple Axis Accelerometer : ±15 G
- 16/32-bit Data Resolution
- Digital Interface : RS-422 (Full duplex, 120 Ω (Typ.) terminator included)
- Calibrated Stability (Bias, Scale Factor, Axial Alignment)
- Data Output Rate : 2k sps (Max.)
- Operating Temperature Range : -30 ℃ to +70 ℃
- Power Supply Voltage Range : 9 V to 24 V
- Power Consumption : <1W
- Waterproof and Dustproof : IP67



Application

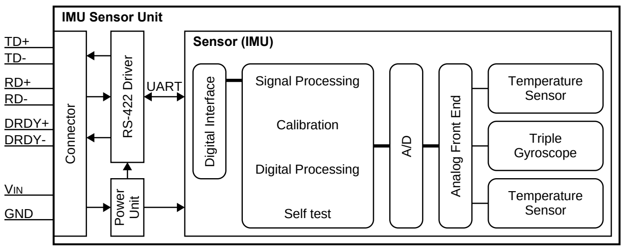
- Antenna Platform Stabilization
- Camera Gimbals
- Navigation Systems
- Vibration Control and Stabilization
- Pointing and Tracking Systems

Typical Performance Characteristic



Gyro Allan Variance Characteristic

Block Diagram



Description

The M-G570PR20 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. 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.

The M-G570PR20 is packaged in a waterproof and dust-proof metallic case supporting RS-422 interface. This ruggedized unit is suitable for industrial use that requires remote mounting, or long-distance wiring.

This product is compliant with RoHS 3 (EU Directive 2015/863)

Note: Lead is contained as per RoHS directive exemptions.

Outline Dimensions

Unit: mm

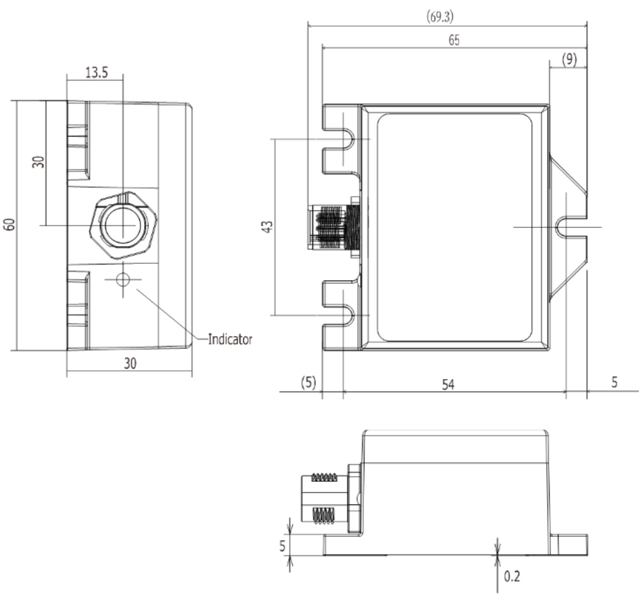


Table of Contents

List of Figures

List of Tables

Revision History

Rev. No.	Date	Page	Description
Rev. 1.0	2024/03/07	ALL	New release.
Rev. 1.1	2024/08/01	11 45	Table 1.3 Sensor Specifications (Common Items) Correction of typos (Condition of Nonlinearity) 10.4UKCA Statement Change of representative address.
Rev. 1.2	2025/3/26	Front page 11	Gyro dynamic range, ±450dps □ ±475dps Table 1.3 Sensor Specifications (Common Items) Gyro dynamic range, ±450dps □ ±475dps Nonlinearity test condition, 5G □ 1G
Rev. 1.3	2025/6/1	7	Corrected the Product Model Number typo.

Ordering Information

The product can be ordered with the following numbers. Please inquire separately about details.

Product Model Number	Product Name	Comments
X2G000211000200	M-G570PR20	This product.

Symbols

RoHS Compliant	• **Compliant with the EU RoHS directive** * About products without the Pb-Free label Product terminals are lead-free but the internal components of the product contain lead (high melting point solder lead as well as the lead contained in the glass of an electronic component are both not applicable under the EU RoHS directive).

Notice of the Document

1. Product Specifications

1.1 Absolute Maximum Ratings

Table 1.1 Absolute Maximum Ratings

Parameter	Min.	Typ.	Max.	Unit
V_{IN} to GND	-0.3	–	+32	V
Voltage on Any Pin to GND	-32	–	+32	V
Storage Temperature Range	-40	–	+85	°C
Operating Temperature Range	-30	–	+70	°C
Acceleration / Shock (Half-sine 0.5 ms)	–	–	1000	G

1.2 Recommended Operating Conditions

Table 1.2 Recommended Operating Conditions

Parameter	Term	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{IN}	V_{IN} to GND *2	9 *1	12	24	V
Port Input Voltage	V_{PORT}	RD+ / RD- to GND	–	5	–	V
Operating Temperature	T_{OPE}		-30	–	+70	°C

*1. When power supply voltage is 9 V or less, the host may not be able to communicate with this node normally even if the LED turns on.

*2. The power supply voltage must reach the recommended operating condition within 2 seconds after power is applied to this node.

1.3 Performance and Electrical Specifications

Table 1.3 Sensor Specifications (Common Items)

V_{IN} = 12 V, Ta = +25 °C, angular rate = 0 °/s, ±1 G, ±450dps unless otherwise specified

Parameter	Test Conditions / Comments	Min.	Typ.	Max.	Unit
GYRO SENSOR					
Sensitivity					
Dynamic Range		–	±475	–	°/s
Scale Factor	16 bits	-0.2%	66	+0.2%	LSB/(°/s)
	32 bits	-0.2%	66 x (2^{16})	+0.2%	
Nonlinearity (Best fit straight line)	1 σ	–	0.05	–	% of FS
Misalignment	1 σ, Axis-to-axis, Δ = 90° ideal	–	0.15	–	°
Bias					
Initial Error	1 σ, −30 °C ≤ Ta ≤ +70 °C	–	360	–	°/h
Repeatability	1 σ, Turn-on to turn-on *3	–	36	–	°/h
Bias Instability	Average	–	0.5	–	°/h
Angular Random Walk	Average	–	0.04	–	$°/\sqrt{h}$
Linear Acceleration Effect	Average	–	18	–	(°/h)/G
Noise Density	f = 10 Hz to 20 Hz	–	2.9	–	$(°/h)/\sqrt{Hz}$, rms
Frequency Property					
3 dB Bandwidth		–	189	–	Hz
ACCELEROMETERS					
Sensitivity					
Dynamic Range		–	±15	–	G
Scale Factor	16 bits	-0.1%	2	+0.1%	LSB/mG
	32 bits	-0.1%	2 x (2^{16})	+0.1%	
Nonlinearity (Best fit straight line)	1 σ, < 1 G	–	0.1	–	% of FS
Misalignment	1 σ, Axis-to-axis, Δ = 90 ° ideal	–	0.15	–	°
Bias					
Initial Error	1 σ, −30 °C ≤ Ta ≤ +70 °C	–	2	–	mG
Repeatability	1 σ, Turn-on to turn-on *3	–	2	–	mG
Bias Instability	Average	–	14	–	μG
Velocity Random Walk	Average	–	0.012	–	$(m/s)/\sqrt{h}$
Noise Density	f = 10 Hz to 20 Hz	–	29	–	$μG/\sqrt{Hz}$, rms
Frequency Property					
3 dB Bandwidth		–	333	–	Hz
TEMPERATURE SENSOR					
Scale Factor *1*2	Output = 0 @ +25 °C	–	0.00390625	–	°C/LSB

*1. This is a reference value used for internal temperature compensation. There is no guarantee that the value gives an absolute value of the internal temperature.

*2. This is the temperature scale factor for the upper 16 bits (TEMP_HIGH).

*3. Turn-on to turn-on / Day by day, estimated variation during 5 consecutive days.

NOTE:
- The values in the specifications are based on the data calibrated at the factory. The values may change according to the way the product is used.
- The Typ. values in the specifications are average values or 1σ values.
- Unless otherwise specified, the Max./Min. values in the specifications are the standard values of the calibration test of the installed device.

Table 1.4 Interface Specifications

V_{IN} = 12 V, Ta = 25 °C, unless otherwise specified

Parameter	Test Conditions	Min.	Typ.	Max.	Unit
DRIVER					
Differential Output Voltage	R_L = 120 Ω, TD- to TD+	2	2.5	–	V
	R_L = 54 Ω, TD- to TD+	1.5	2	–	V
Common Mode Output Voltage	R_L = 120 Ω	1	2.5	3	V
Output Resistance		–	120	–	Ω
Rise or Fall Time	R_L = 120 Ω	–	–	400	ns
RECEIVER					
Differential Input Voltage		-25	–	25	V
Input Resistance		–	120	–	Ω
FUNCTIONAL TIMES (Time until data is available)					
Power-On Start-Up Time *1		–	1000	5000	ms
Reset Recovery Time *1		–	1000	5000	ms
Flash Backup Time		–	–	200	ms
Initial Backup Time		–	–	200	ms
Self-test Time		–	–	200	ms
Self-test Sensor Time		–	–	10000	ms
Data Output Rate *2	DOUT_RATE = 0x00	–	–	2000	Hz
Clock Accuracy		–	–	±0.005	%

*1. Do not access the device during startup or reinitialization.

*2. Data rate and optimum filter characteristics can be changed by a command.

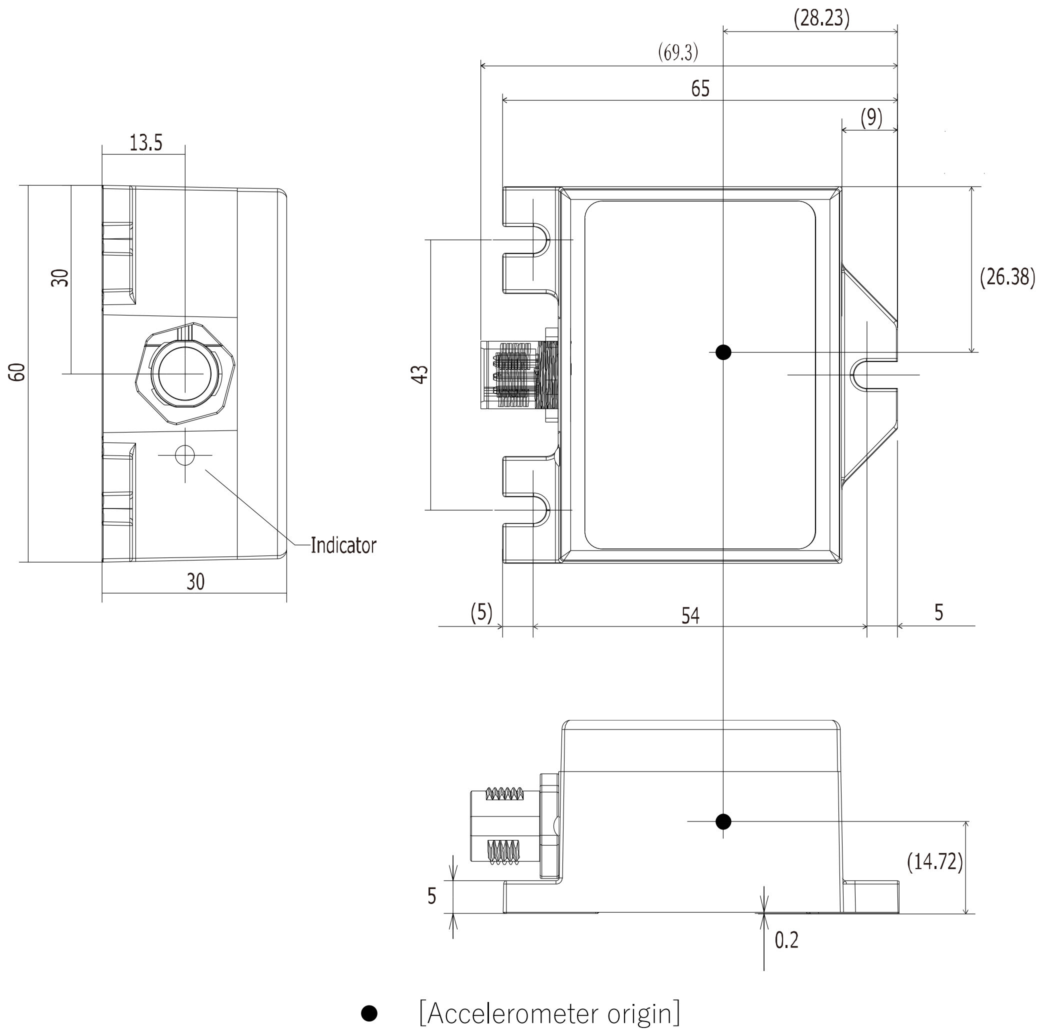
Table 1.5 Current Consumption

Ta = 25 °C, R_L = 120 Ω, unless otherwise specified; all voltages are defined with respect to ground; positive currents flow into the sensor unit.

Parameter	Term	Condition	Min.	Typ.	Max.	Unit
Standby Current	$I_{IN(ready)}$	V_{IN} = 12 V	–	60	–	mA
		V_{IN} = 24 V	–	35	–	mA
Operating Current	I_{OPE}	V_{IN} = 12 V, Tap2, 460.8 kbps, 1000 sps	–	80	–	mA
Maximum Input Current	$I_{IN(max)}$		–	–	150	mA

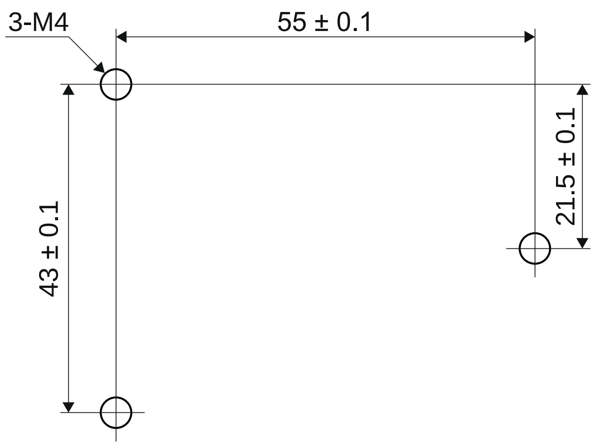
2. Mechanical Dimensions

2.1 Outline Dimensions



(Unit: mm)

Figure 2.1 Outline Dimensions



(Unit: mm)

Figure 2.2 Recommended Mounting Dimension

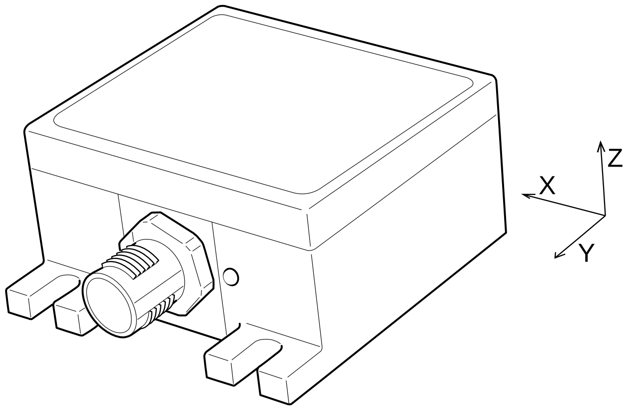


Figure 2.3 Axial Direction

2.2 Connector Specifications

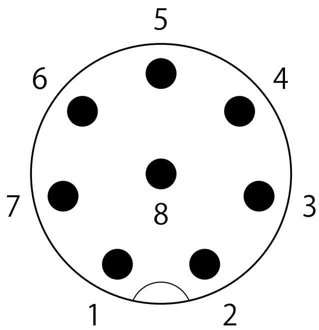


Figure 2.4 Connector Pin Layout

Table 2.1 Pin Function Description

Pin No.	Mnemonic	Type *1	Description
1	DRDY+	O	Data Ready (+) *2
2	V_{IN}	S	Power Supply (9 / 12 / 24 V)
3	GND	S	0 V
4	TD-	O	Transmit Data (-) *3
5	RD+	I	Received Data (+)
6	TD+	O	Transmit Data (+) *3
7	DRDY-	O	Data Ready (-) *2
8	RD-	I	Received Data (-)

*1. Pin Type I: Input, O: Output, I/O: Input/Output, S: Supply, N/A: Not Applicable

*2. Do not connect anything, if unused. Please refer to chapter 7.7 for details on how to use DRDY.

*3. Incorrect data may be output to "Transmit Data" until internal initialization is completed when the power is turned on.

NOTE: Please use an M12-8 pin mating female connector that corresponds to IP67 specifications.

Table 2.2 describes the connector manufacturer and the model number which is used in this product.

Table 2.2 Connector Part Number

Manufacturer	Part Number	RoHS Compliant
PHOENIX CONTACT	SACC-DSI-MS-8CON-M12-SCO SH(X)	Yes

3. Typical Performance Characteristics

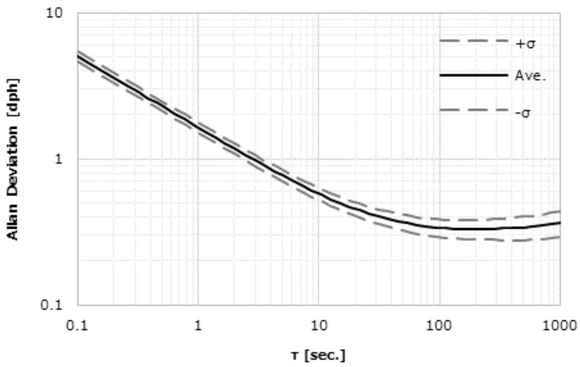


Figure 3.1 Gyro Allan Variance Characteristic

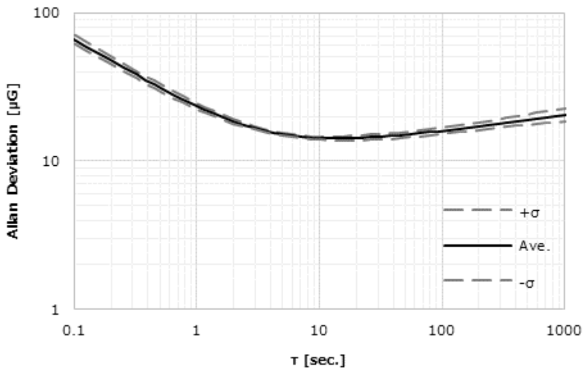


Figure 3.2 Accelerometer Allan Variance Characteristic

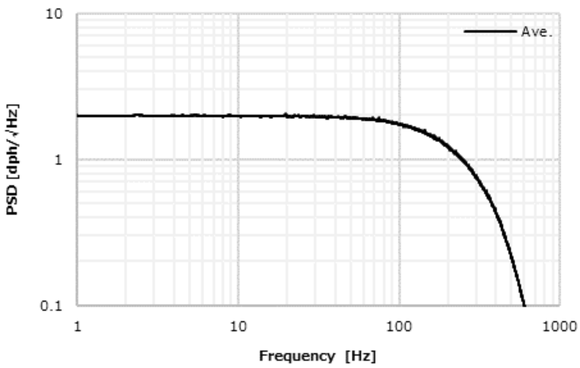


Figure 3.3 Gyro Noise Frequency Characteristic

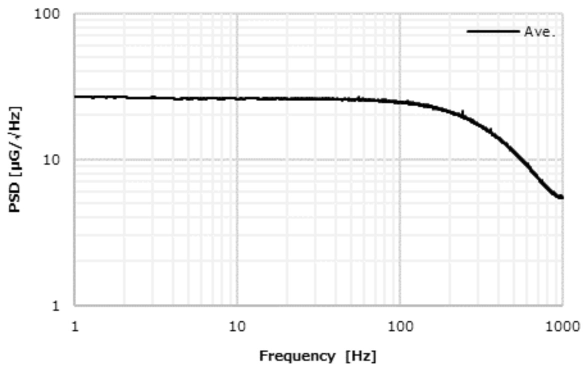


Figure 3.4 Accelerometer Noise Frequency Characteristic

The above graphs are typical examples of the product characteristics and are not guaranteed by the specification.

4. Basic Operation

4.1 Connection to Host

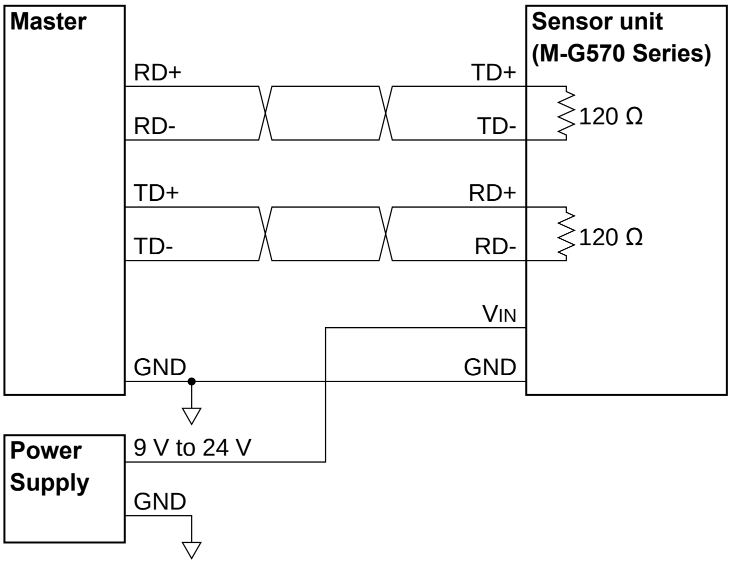


Figure 4.1 Connection Example

4.2 Precaution for Wiring and Cabling

- This product has a built-in terminator on the receiver (RD) and transmitter (TD) ports.
- It is recommended that a twisted pair cable with shielding should be used. Each signal pair should be connected to each cable pair. (e.g., RD+ and RD-)
- It is recommended that the shield should be connected to the ground at the host when a shielded cable is used.

4.3 Operation Mode

The device has the following two operation modes.

(1) Configuration mode

(2) Sampling mode

Immediately after a software reset or power-on, internal initialization starts. During the internal initialization, all the register values and states of external pins are undefined. After the internal initialization is completed, the device goes into Configuration mode. Configure various operational settings in Configuration mode [*1]. After configuration is completed, go to the Sampling mode to output the temperature, angular rate, and acceleration data. To change the operation mode, write to **MODE_CMD** (MODE_CTRL[0x02 (W0)] bit[9:8]) [*2]. When software reset is executed by writing “1” to **SOFT_RST** (GLOB_CMD[0x0A (W1)] bit[7]), internal initialization is executed and then the device goes into Configuration mode regardless of the current operation mode.

*1. Make sure that the device is in Configuration mode when you write to the registers to configure operational settings. In Sampling mode, writing to registers is ignored except the following cases.
- Writing to **MODE_CMD** (MODE_CTRL[0x02 (W0)] bit[9:8])
- Writing to **SOFT_RST** (GLOB_CMD[0x0A (W1)] bit[7])
- Writing to **WINDOW_ID** (WIN_CTRL[0x7E (W0/W1)] bit[7:0])

*2. The following explains register notation used in this document. For example, MODE_CTRL[0x02 (W0)] bit[9:8] refers to:
- MODE_CTRL : Register Name.
- [0x02 (W0)] : First number is the Register Address, (W0) refers to Window Number “0”.
- bit[9:8] : Bits from 9 to 8 (= **MODE_CMD** bit).

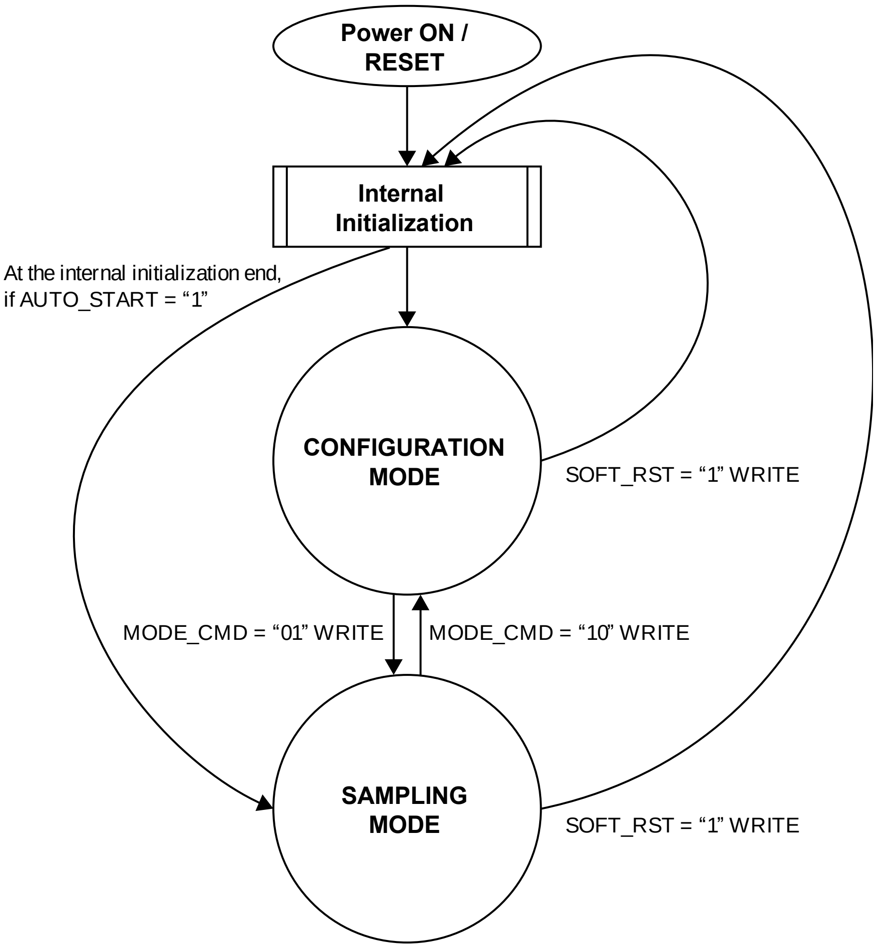


Figure 4.2 Operational State Diagram

4.4 Data Ready (DRDY) Signal

The Data Ready signal is asserted to notify the internal sampling timing to the outside, and is automatically negated just before data transmission.

The Data Ready signal is disabled by default and enabled by setting **DRDY_ON** (MSC_CTRL[0x02 (W1)] bit[2]) to "1".

The polarity of the Data Ready signal can be changed by **DRDY_POL** (MSC_CTRL[0x02 (W1)] bit[1]).

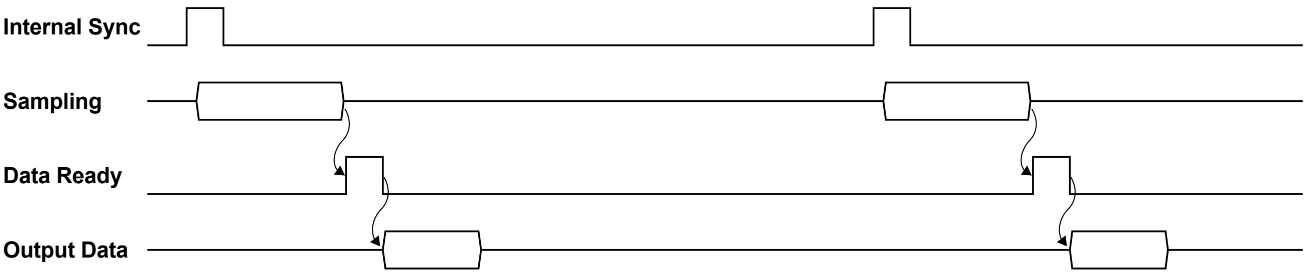


Figure 4.3 Data Ready Signal Timing

4.5 Automatic Start

The Automatic Start function, when enabled, allows the device to automatically enter Sampling Mode after completing internal initialization when power is supplied or the IMU is reset. Please refer to Figure 4.2 for the state transition.

Follow the procedures below to enable the Automatic Start function:

1. Write a “1” to **AUTO_START** (HIF_CTRL[0x08 (W1)] bit[1]).
2. Store the current register settings to the non-volatile memory by writing a "1" to **FLASH_BACKUP** (GLOB_CMD [0x0A (W1)] bit[3]). After completion of the **FLASH_BACKUP** command, confirm the results by reading **FLASH_BU_ERR** (DIAG_STAT[0x04 (W0)] bit[0]).
3. The IMU will automatically enter Sampling Mode after the power supply is cycled, or the software reset command is executed.

4.6 Filter

This device contains built-in user configurable digital filters that are applied to the sensor data. The type of filter (moving average filter or FIR Kaiser filter) and the numbers of TAPs can be set with the FILTER_CTRL[0x06 (W1)] register.

(1) Moving Average Filter

TAP setting can be N = 2, 4, 8, 16, 32, 64, or 128.
Figure 4.4 shows the characteristics of this filter.

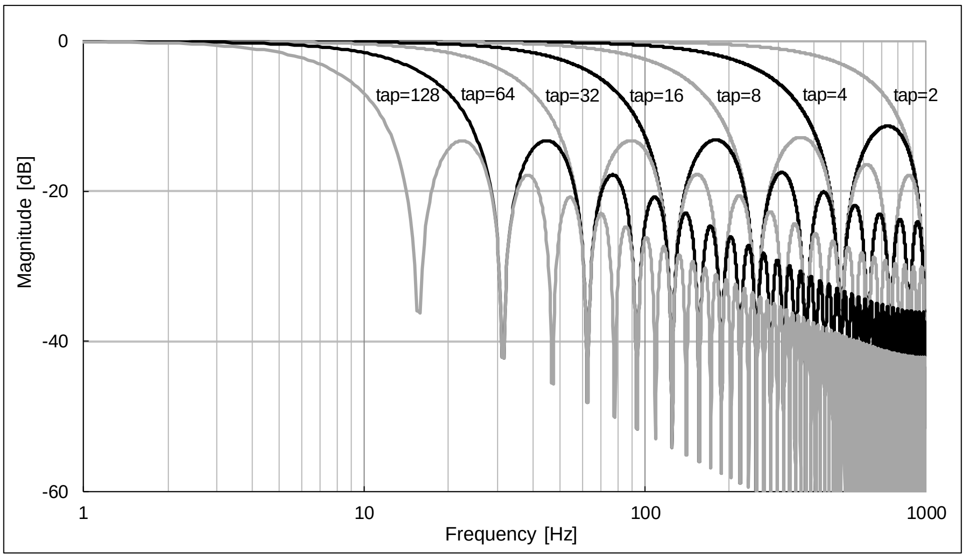


Figure 4.4 Moving Average Filter Characteristics

(2) FIR Kaiser filter

Uses Kaiser Window (parameter = 8)
TAP setting can be N = 32, 64, or 128 with cutoff frequency fc= 50, 100, 200, or 400 Hz.
Figure 4.5 and Figure 4.6 show the typical characteristics of this filter.

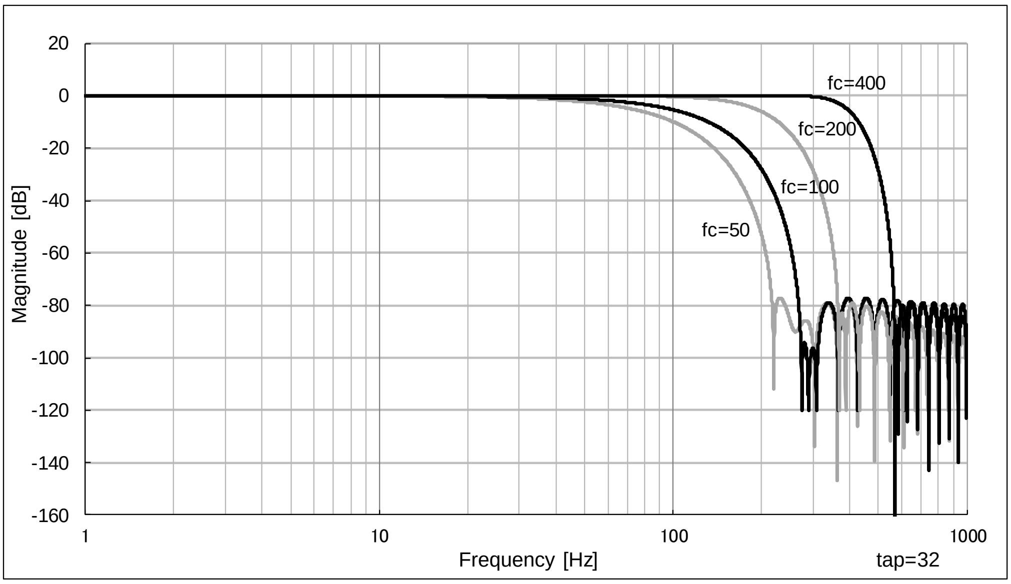


Figure 4.5 FIR Kaiser Filter Typical Characteristic 1

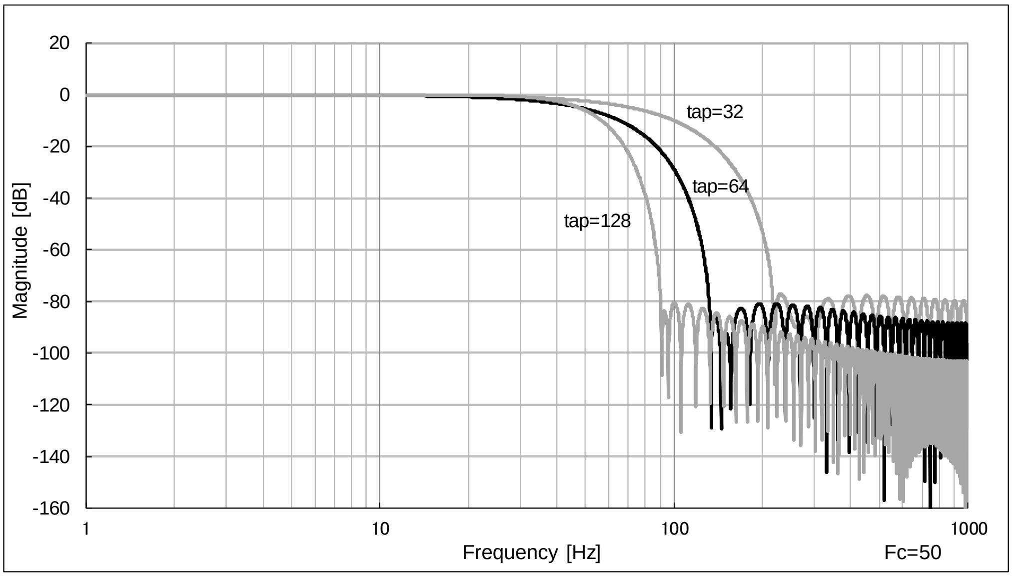


Figure 4.6 FIR Kaiser Filter Typical Characteristic 2

5. Host Interface

5.1 Serial Interface

Table 5.1 shows the supported communication settings and Figure 5.1 shows the bit format.

For the serial interface, a delimiter (1 byte) is placed at the end of each command (by the host) and response (by the IMU). In addition, for responses, the address (1 byte) specified by the command is added (by the IMU) to the beginning of the response.

Table 5.1 Communication Settings

Parameter	Set Value
Transfer Rate	230.4 kbps / 460.8 kbps / 921.6 kbps / 1 Mbps /1.5 Mbps / 2 Mbps
Start	1 bit
Data	8 bits
Stop	1 bit
Parity	None
Delimiter	CR (0x0D)

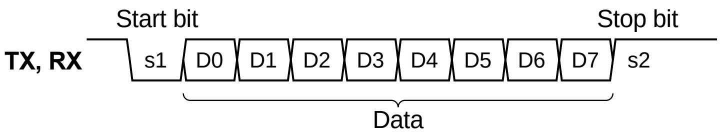


Figure 5.1 Bit Format

Table 5.2 shows the command and response communication timing.

Table 5.2 Command and Response Communication Timing

Parameter	Configuration mode		Sampling mode		Unit
	Min.	Max.	Min.	Max.	
t_{STALL} (230.4 kbps)	–	25	–	– *1	μs
t_{STALL} (460.8 kbps)	–	25	–	– *1	μs
t_{STALL} (921.6 kbps)	–	25	–	– *1	μs
t_{STALL} (1 Mbps)	–	25	–	– *1	μs
t_{STALL} (1.5 Mbps)	–	25	–	– *1	μs
t_{STALL} (2 Mbps)	–	25	–	– *1	μs
$t_{WRITERATE}$ (230.4 kbps)	350	–	350	–	μs
$t_{WRITERATE}$ (460.8 kbps)	200	–	200	–	μs
$t_{WRITERATE}$ (921.6 kbps)	125	–	125	–	μs
$t_{WRITERATE}$ (1 Mbps)	120	–	120	–	μs
$t_{WRITERATE}$ (1.5 Mbps)	100	–	100	–	μs
$t_{WRITERATE}$ (2 Mbps)	85	–	85	–	μs
$t_{READRATE}$ (230.4 kbps)	350	–	– *1	–	μs
$t_{READRATE}$ (460.8 kbps)	200	–	– *1	–	μs
$t_{READRATE}$ (921.6 kbps)	125	–	– *1	–	μs
$t_{READRATE}$ (1 Mbps)	120	–	– *1	–	μs
$t_{READRATE}$ (1.5 Mbps)	100	–	– *1	–	μs
$t_{READRATE}$ (2 Mbps)	85	–	– *1	–	μs

*1. Register reading is not supported while in Sampling mode.

5.1.1 Register Read Timing

The response to the read command, i.e., the data from the internal register, is always returned 16-bit data at a time. The register address (AD) comes at the beginning of the response, for example, 0x02 for the MODE_CTRL[0x02 (W0)] register.

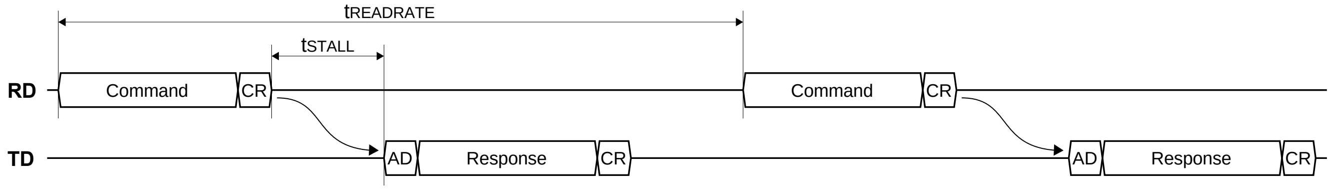


Figure 5.2 Register Read Timing

Table 5.3 Command Format (Read)

First byte								Second byte								Third byte							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	A[6:0]							XX								0x0D							

A[6:0]: Register address (even address)
XX: Don't Care
0x0D: Delimiter

Table 5.4 Response Format (Read)

First byte								Second byte								Third byte								Fourth byte							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	A[6:0]							D[15:8]								D[7:0]								0x0D							

A[6:0]: Register address (even address)
D[15:8]: Register read data (upper byte)
D[7:0]: Register read data (lower byte)
0x0D: Delimiter

5.1.2 Register Write Timing

A write command to a register will have no response. Unlike register reading, registers are written in 8-bit words.

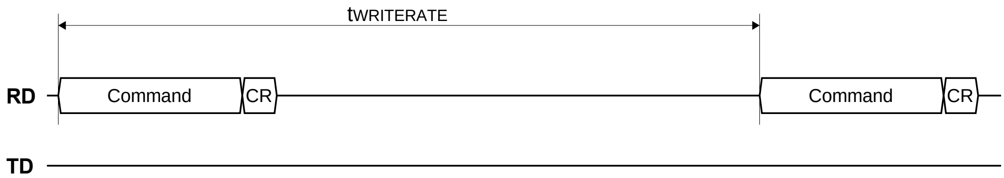


Figure 5.3 Register Write Timing

Table 5.5 Command Format (Write)

First byte								Second byte								Third byte							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
1	A[6:0]							D[7:0]								0x0D							

A[6:0]: Register address (even number or odd number)
D[7:0]: Register write data
0x0D: Delimiter

5.1.3 Sampling Mode Operation

In Sampling mode, all sensor outputs are sent automatically at the programmed output data rate. For information about the output data format, refer to *Section 5.2 Data Packet Format*. The output data is configured by register setting in BURST_CTRL1[0x0C (W1)] and BURST_CTRL2[0x0E (W1)]. The first byte (AD) of the output data is fixed at 0x80.

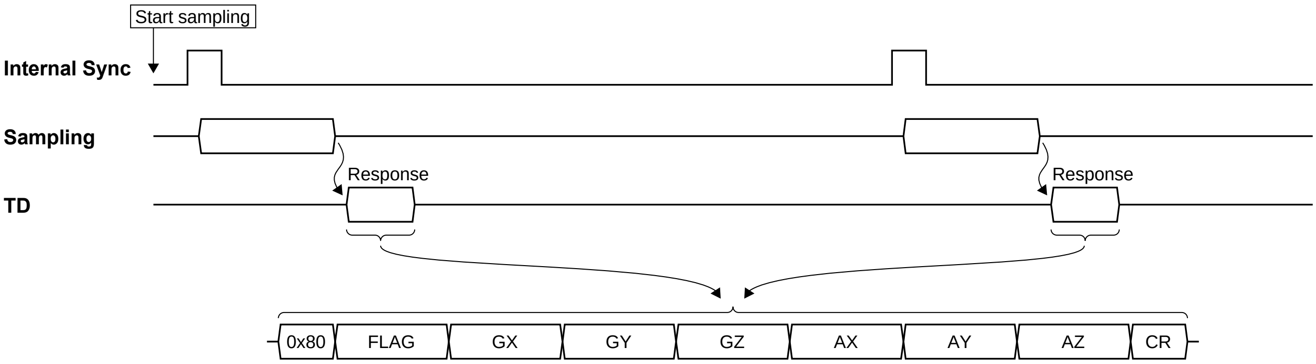


Figure 5.4 Sampling Mode Operation

5.1.4 Command Timeout

This function measures the interval between command bytes with a timer, and if about 20ms or more has passed, and clears the received data up to that point. This makes it possible to receive subsequent commands even if the following problems occur.

The device receives commands in 3-byte units with 0x0D as the delimiter from the host (see Table 5-3 and Table 5-5).

There is no problem if the command is normally received in units of 3 bytes, but if a command is received at a baud rate different from the set baud rate, or if noise is injected into the transmission line of the host interface, indefinite data of less than 3 bytes may be stored in the receive buffer. In this case, even if the next 3-byte command is received, the leading data of the 3-byte command is concatenated with the undefined data, so the command cannot be interpreted correctly. This function is for automatic recovery from this state.

5.2 Data Packet Format

The following tables show examples of the data packet format sent to the host in Sampling mode.

Table 5.6 Data Packet Format, Example: 16-bit Output

BURST_CTRL1[0x0C (W1)] = 0xF003 / BURST_CTRL2[0x0E (W1)] = 0x0000

Byte No.	Data	Mnemonic	Byte No.	Data	Mnemonic
1	0x80	AD	12	AX[15:8]	AX_HH
2	FLAG[15:8]	FLAG_H	13	AX[7:0]	AX_HL
3	FLAG[7:0]	FLAG_L	14	AY[15:8]	AY_HH
4	TEMP[15:8]	TEMP_HH	15	AY[7:0]	AY_HL
5	TEMP[7:0]	TEMP_HL	16	AZ[15:8]	AZ_HH
6	GX[15:8]	GX_HH	17	AZ[7:0]	AZ_HL
7	GX[7:0]	GX_HL	18	COUNT[15:8]	COUNT_H
8	GY[15:8]	GY_HH	19	COUNT[7:0]	COUNT_L
9	GY[7:0]	GY_HL	20	CHKSUM[15:8]	CHKSUM_H
10	GZ[15:8]	GZ_HH	21	CHKSUM[7:0]	CHKSUM_L
11	GZ[7:0]	GZ_HL	22	0x0D	CR

Table 5.7 Data Packet Format, Example: 32-bit Output

BURST_CTRL1[0x0C (W1)] = 0xF003 / BURST_CTRL2[0x0E (W1)] = 0x7000

Byte No.	Data	Mnemonic	Byte No.	Data	Mnemonic
1	0x80	AD	20	AX[31:24]	AX_HH
2	FLAG[15:8]	FLAG_H	21	AX[23:16]	AX_HL
3	FLAG[7:0]	FLAG_L	22	AX[15:8]	AX_LH
4	TEMP[31:24]	TEMP_HH	23	AX[7:0]	AX_LL
5	TEMP[23:16]	TEMP_HL	24	AY[31:24]	AY_HH
6	TEMP[15:8]	TEMP_LH	25	AY[23:16]	AY_HL
7	TEMP[7:0]	TEMP_LL	26	AY[15:8]	AY_LH
8	GX[31:24]	GX_HH	27	AY[7:0]	AY_LL
9	GX[23:16]	GX_HL	28	AZ[31:24]	AZ_HH
10	GX[15:8]	GX_LH	29	AZ[23:16]	AZ_HL
11	GX[7:0]	GX_LL	30	AZ[15:8]	AZ_LH
12	GY[31:24]	GY_HH	31	AZ[7:0]	AZ_LL
13	GY[23:16]	GY_HL	32	COUNT[15:8]	COUNT_H
14	GY[15:8]	GY_LH	33	COUNT[7:0]	COUNT_L
15	GY[7:0]	GY_LL	34	CHKSUM[15:8]	CHKSUM_H
16	GZ[31:24]	GZ_HH	35	CHKSUM[7:0]	CHKSUM_L
17	GZ[23:16]	GZ_HL	36	0x0D	CR
18	GZ[15:8]	GZ_LH			
19	GZ[7:0]	GZ_LL			

6. Sensor Data

Sensor data is sent to the host via the host interface. Each sensor data can be included in the output data packet by setting the BURST_CTRL1[0x0C (W1)] register. For information about the data packet format, see *Section 5.2 Data Packet Format*. For FLAG, refer to *Section 7.3 FLAG Register (Window 0)*.

6.1 Angular Rate Data (32 bits)

For 32-bit output, set **GYRO_BIT** (BURST_CTRL2[0x0E (W1)] bit[13]) to “1”.

GX[31:0]: Gyroscope output data (x-axis)
GY[31:0]: Gyroscope output data (y-axis)
GZ[31:0]: Gyroscope output data (z-axis)

The output data format is 32-bit two's complement. Please refer to the below formula for conversion to angular rate in degrees/second. The scale factor is (66 x 65536) [LSB/(°/s)].

G [°/s] = (1/SF) x B

SF: Scale Factor
B: Gyroscope output data (decimal)

6.2 Angular Rate Data (16 bits)

For 16-bit output, set **GYRO_BIT** (BURST_CTRL2[0x0E (W1)] bit[13]) to “0”.

GX[15:0]: Gyroscope output data (x-axis)
GY[15:0]: Gyroscope output data (y-axis)
GZ[15:0]: Gyroscope output data (z-axis)

The output data format is 16-bit two's complement. Please refer to the below formula for conversion to angular rate in degrees/second. The scale factor is 66 [LSB/(°/s)].

G [°/s] = (1/SF) x B

SF: Scale Factor
B: Gyroscope output data (decimal)

6.3 Acceleration Data (32 bits)

For 32-bit output, set **ACCL_BIT** (BURST_CTRL2[0x0E (W1)] bit [12]) to “1”.

AX[31:0]: Accelerometer output data (x-axis)
AY[31:0]: Accelerometer output data (y-axis)
AZ[31:0]: Accelerometer output data (z-axis)

The output data format is 32-bit two's complement. Please refer to the below formula for conversion to linear acceleration in milli-G. The scale factor is (2 x 65536) [LSB/mG].

A [mG] = (1/SF) x C

SF: Scale Factor
C: Accelerometer output data (decimal)

6.4 Acceleration Data (16 bits)

For 16-bit output, set the **ACCL_BIT** (BURST_CTRL2[0x0E (W1)] bit [12]) to “0”.

AX[15:0]: Accelerometer output data (x-axis)
AY[15:0]: Accelerometer output data (y-axis)
AZ[15:0]: Accelerometer output data (z-axis)

The output data format is 16-bit two's complement. Please refer to the below formula for conversion to linear acceleration in milli-G. The scale factor is 2 [LSB/mG].

A [mG] = (1/SF) x C

SF: Scale Factor
C: Accelerometer output data (decimal)

6.5 Temperature Data (32 bits)

For 32-bit output, set **TEMP_BIT** (BURST_CTRL2[0x0E (W1)] bit[14]) to “1”.

TEMP[31:0]: Temperature sensor output data

The output data format is 32-bit two's complement. Please refer to the below formula for conversion to temperature in centigrade. The scale factor is +(0.00390625/65536) [°C/LSB]. The output data value at 25 [°C] is 0.

T [°C] = SF x E + 25

SF: Scale Factor
E: Temperature sensor output data (decimal)

6.6 Temperature Data (16 bits)

For 16-bit output, set **TEMP_BIT** (BURST_CTRL2[0x0E (W1)] bit[14]) to “0”.

TEMP[15:0]: Temperature sensor output data

The output data format is 16-bit two's complement. Please refer to the below formula for conversion to temperature in centigrade. The scale factor is +0.00390625 [°C/LSB]. The output data value at 25 [°C] is 0.

T [°C] = SF x E + 25

SF: Scale Factor
E: Temperature sensor output data (decimal)

6.7 Sampling Count Value

COUNT[15:0]: Sampling count

The sampling count value shows the count value based on the internal sampling timing. The time unit for the sampling count value is 500 [µs/count]. The accuracy is based on the built-in crystal oscillator.

The increase in the sampling count value is determined by the ratio of the internal sampling rate (fixed to 2k sps) and the data output rate (**DOUT_RATE** (SMPL_CTRL[0x04 (W1)] bit[15:8])), and is expressed by the following formula.

Sampling count value increment = 2000 [Hz] / DOUT_RATE

Therefore, when the data output rate is 1000 sps, the number of increase in sampling count value is 2000 / 1000 = 2. The actual sampling count values are 2, 4, 6, ..., 0xFFFE, 0, 2, ...

6.8 Checksum

CHKSUM [15:0]: Checksum data

The target data range of the checksum is from after the sensor data address (AD = 0x80) sent to the host to before the delimiter (CR = 0x0D). The checksum calculation method is to simply add the target data in 16-bit units and add the lower 16 bits of the result as a checksum immediately before the delimiter (CR = 0x0D).

For example, when BURST_CTRL1[0x0C (W1)] = 0xB001 / BURST_CTRL2[0x0E (W1)] = 0x0000 is set and the response data is “0000 0005 000B FFFF 0018 FFF9 09D2”, the sum is “209F2”. The checksum will be “09F2”.

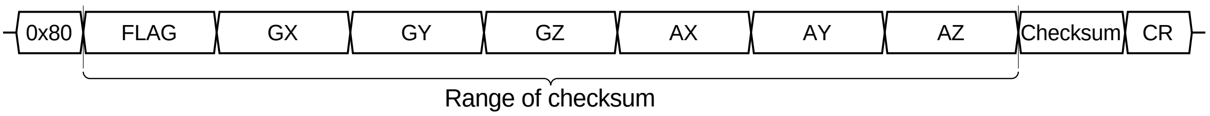


Figure 6.1 Checksum

For 32-bit data output, the 32-bit data GX[31: 0] is divided into two 16-bit data GX[31:16] and GX[15: 0] and added.

7. User Registers

A host device (for example, a microcontroller) can control the IMU by accessing the control registers inside the device.

The registers in this device are accessed using a WINDOW method. The prescribed window number is first written to **WINDOW_ID** (WIN_CTRL[0x7E (W0/W1)] bit[7:0]), then the desired register address can be accessed. The WIN_CTRL[0x7E (W0/W1)] register can always be accessed without needing to set the window number.

During the Power-On Start-Up Time or the Reset Recovery Time specified in Table 1.4 Interface Specifications, all the register values are undefined because internal initialization is in progress. Ensure to wait until this time has elapsed before the IMU registers can be accessed.

For information about the initial values of the control registers after internal initialization is finished, see the “Default” column in Table 7.1.

Make sure that the IMU is in Configuration mode before writing to registers. In Sampling mode, writing to registers is ignored except for the following cases.

- Writing to **MODE_CMD** (MODE_CTRL[0x02 (W0)] bit[9:8])
- Writing to **SOFT_RST** (GLOB_CMD[0x0A (W1)] bit[7])
- Writing to **WINDOW_ID** (WIN_CTRL[0x7E (W0/W1)] bit[7:0])

While in Sampling mode, register read access is not supported. Otherwise, the sampling data transmitted will be corrupted by the response data from the register read.

Each register is 16-bit wide, and one address is assigned to every 8 bits. Registers are read in 16-bit words and are written in 8-bit words. The byte order of each 16-bit register is little endian, but the byte order of the 16-bit data transferred over the digital interface is big endian.

Table 7.1 shows the register map, and Section7.1 through Section 7.18 describes the registers in detail.

The “-” sign in the register assignment table in Section 7.1 through Section 7.18 means “reserved”.

Write a “0” to reserved bits during a write operation.

During a read operation, a reserved bit can return either “0” or “1” (don’t care).

Writing to a read-only register is prohibited.

NOTE: The explanation of the register notation, for example, MODE_CTRL[0x02 (W0)] bit[9:8] is as follows:

- MODE_CTRL: Register name.
- [0x02 (W0)]: First number is the Register Address, (W0) means Window Number “0”.
- bit[9:8]: Bits 9 to 8.

Table 7.1 Register Map

Name	Window ID	Address	R/W	Flash Backup *1	Default	Function
MODE_CTRL	0	0x03, 0x02	R/W	–	0x0400	Operation mode control
DIAG_STAT	0	0x04	R	–	0x0000	Diagnostic result
FLAG	0	0x06	R	–	0x0000	Error flag
HARD_ERR	0	0x08	R	–	0x0000	Hardware error
OVERRANGE	0	0x0C	R	–	0x0000	Overrange
ID	0	0x4C	R	–	0x5345	ID read function
MSC_CTRL	1	0x03, 0x02	R/W	✓	0x0002	Other control
SMPL_CTRL	1	0x05, 0x04	R/W	✓	0x0100	Sampling control
FILTER_CTRL	1	0x07, 0x06	R/W	✓	0x0001	Filter control
HIF_CTRL	1	0x09, 0x08	R/W	✓	0x0001	Host interface control
GLOB_CMD	1	0x0B, 0x0A	R/W	–	0x0000	System control
BURST_CTRL1	1	0x0D, 0x0C	R/W	✓	0xB000	Burst control 1
BURST_CTRL2	1	0x0F, 0x0E	R/W	✓	0x3000	Burst control 2
POL_CTRL	1	0x11, 0x10	R/W	✓	0x0000	Polarity control
PROD_ID1	1	0x6A	R	–	0x3547	Product ID
PROD_ID2	1	0x6C	R	–	0x3037	Product ID
PROD_ID3	1	0x6E	R	–	0x5250	Product ID
PROD_ID4	1	0x70	R	–	0x3032	Product ID
VERSION *2	1	0x72	R	–	0x4410	Version
SERIAL_NUM1	1	0x74	R	–	0xFFFF *3	Serial Number
SERIAL_NUM2	1	0x76	R	–	0xFFFF *3	Serial Number
SERIAL_NUM3	1	0x78	R	–	0xFFFF *3	Serial Number
SERIAL_NUM4	1	0x7A	R	–	0xFFFF *3	Serial Number
WIN_CTRL	0, 1	0x7F, 0x7E	R/W	–	0x0000	Register window control

*1. The ✓ mark indicates that the register contents can be stored in the non-volatile memory for the automatic start function. The flash backup command stores the current register settings, and the initial backup command restores the stored values to the factory-set initial values (refer to *Section 4.5 Automatic Start*).
*2. The version is subject to change without notice.
*3 The serial number is unique for each individual.

7.1 MODE_CTRL Register (Window 0)

Addr (Hex)	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	R/W
0x03	-					**MODE _STAT**	**MODE_CMD**		**R/W** *1

Addr (Hex)	bit 7	• • •	bit 0	R/W
0x02	-			-

*1) Only **MODE_STAT** is read-only.

bit[10] **MODE_STAT**
This read-only status bit shows the current operation mode.

1: Configuration mode
0: Sampling mode

bit[9:8] **MODE_CMD**
Executes commands related to the operation mode.

01: Go to Sampling mode. After the mode transition is completed, the bits automatically go back to “00”.
10: Go to Configuration mode. After the mode transition is completed, the bits automatically go back to “00”.
11: (Not used)
00: (Not used)

7.2 DIAG_STAT Register (Window 0)

Addr (Hex)	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	R/W
0x05	**-**	**ST_ERR (GX)**	**ST_ERR (GY)**	**ST_ERR (GZ)**	**ST_ERR (ACCL)**	**SET_ERR**	**-**		**R**

Addr (Hex)	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	R/W
0x04	**-**	**RAM_ERR**	**ROM_ERR**	**HRX_OVF**	**HTX_OVF**	**-**	**FLASH _ERR**	**FLASH _BU_ERR**	**R**

NOTE: Reading this register clears all bits to “0”. At the same time, **EA** (FLAG[0x06 (W0)] bit[0]) is also cleared.

bit[14:11] ST_ERR

Shows the results of the self-test executed by **SELF_TEST_SENSOR** (MSC_CTRL[0x02 (W1)] bit[10]).

1: Error occurred
0: No error occurred

bit[10] SET_ERR

Shows that an invalid combination of **DOUT_RATE** (SMPL_CTRL[0x04 (W1)] bit [15:8]) and **FILTER_SET** (FILTER_CTRL[0x06 (W1)] bit[4:0]) is set. Refer to Table 7.2, Valid Combinations of Data Output Rate and Filter Settings.

1: Error occurred
0: No error occurred

bit[6] RAM_ERR

Shows the result of the RAM check at startup.

1: Error occurred
0: No error occurred

bit[5] ROM_ERR

Shows the result of the ROM check at startup and self-test.

1: Error occurred
0: No error occurred

bit[4] HRX_OVF

Shows that a host receive overflow is detected when the device receives too many commands in a short period of time.

1: Error occurred
0: No error occurred

bit[3] HTX_OVF

Shows that a host transmit overflow is detected when the data transmission rate is faster than the baud rate.

1: Error occurred
0: No error occurred

bit[1] FLASH_ERR

Shows the result of the non-volatile memory check at startup and self-test.

1: Error occurred
0: No error occurred

bit[0] FLASH_BU_ERR

Shows the result of the non-volatile memory operation executed by **FLASH_BACKUP** or **INITIAL_BACKUP** (GLOB_CMD[0x0A (W1)] bit[3], bit[4]).

1: Error occurred
0: No error occurred

7.3 FLAG Register (Window 0)

Addr (Hex)	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	R/W
0x07	**-**							**OVR**	**R**

Addr (Hex)	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	R/W
0x06	**HERR**	**-**						**EA**	**R**

bit[8] **OVR**
Indicates if one or more overrange flags in the OVERRANGE[0x0C (W0)] register have been set (an overrange error has occurred).

1: Error occurred
0: No error occurred

bit[7] **HERR**
Indicates if the sensor error flag in the HARD_ERR[0x08 (W0)] register has been set (a sensor error has occurred).

1: Error occurred
0: No error occurred

bit[0] **EA**
Indicates if one or more error flags in the DIAG_STAT[0x04 (W0)] register have been set (a diagnostic error has occurred).

1: Error occurred
0: No error occurred

7.4 HARD_ERR Register (Window 0)

Addr (Hex)	bit 15	• • •	bit 8	R/W
0x09	**-**			**-**

Addr (Hex)	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	R/W
0x08	**-**					**SNS_ERR**			**R**

NOTE: Reading this register clears all bits to “0”. At the same time, **HERR** (FLAG[0x06 (W0)] bit[7]) is also cleared.

bit[2:0] **SNS_ERR**
Indicates whether an error has occurred in an internal sensor.

Other than 000: Error occurred
000: No error occurred

7.5 OVERRANGE Register (Window 0)

Addr (Hex)	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	R/W
0x0D	**-**		**OVR (GX)**	**OVR (GY)**	**OVR (GZ)**	**OVR (AX)**	**OVR (AY)**	**OVR (AZ)**	**R**

Addr (Hex)	bit 7	• • •	bit 0	R/W
0x0C	**-**			**-**

NOTE: Reading this register clears all bits to “0”. At the same time, the **OVR** (FLAG[0x06 (W0)] bit[8]) is also cleared.

bit[13:8] OVR
Each bit indicates whether the output value of the gyroscope (G*) / accelerometer (A*) sensor axis has exceeded the sensing range or not.

1: Overrange occurred
0: No error occurred

7.6 ID Register (Window 0)

Addr (Hex)	bit 15	• • •	bit 0	R/W
0x4C	**ID**			**R**

bit[15:0] ID
This register returns the value “0x5345” when read.

7.7 MSC_CTRL Register (Window 1)

Addr (Hex)	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	R/W
0x03	**-**				**SELF _TEST**	**SELF_TEST _SENSOR**	**-**		**R/W**

Addr (Hex)	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	R/W
0x02	**-**					**DRDY_ON**	**DRDY _POL**	**-**	**R/W**

bit[11] SELF_TEST
Write “1” to execute the self-test to check if the device is working properly except for the gyroscope and accelerometer. The read value of the bit is “1” during the test and “0” after the test is completed. After writing “1” to this bit, wait until this bit goes back to “0” and then read the FLAG[0x06 (W0)] register to check the results.

bit[10] SELF_TEST_SENSOR
Write “1” to execute the self-test of the sensors to check if the gyroscope and accelerometer are working properly. The read value of the bit is “1” during the test and “0” after the test is completed. After writing “1” to this bit, wait until this bit goes back to “0” and then read the FLAG[0x06 (W0)] register to check the results.

The self-test using **SELF_TEST_SENSOR** should be executed at a stationary condition without vibration.

bit[2] DRDY_ON
Enables or disables the DRDY pin to output the Data Ready signal.

1: Enable
0: Disable

bit[1] DRDY_POL
Sets the polarity of the Data Ready signal when **DRDY_ON** above is enabled.

1: Active High
0: Active Low

7.8 SMPL_CTRL Register (Window 1)

Addr (Hex)	bit 15	• • •	bit 8	R/W
0x05	**DOUT_RATE**			**R/W**

Addr (Hex)	bit 7	• • •	bit 0	R/W
0x04	**-**			**-**

bit[15:8] DOUT_RATE

Specifies the data output rate.

The following lists the data output rate option with the recommended number of TAPs for the moving average filter.

0x00: 2000 sps TAP ≥ 0
0x01: 1000 sps TAP ≥ 2
0x02: 500 sps TAP ≥ 4
0x03: 250 sps TAP ≥ 8
0x04: 125 sps TAP ≥ 16
0x05: 62.5 sps TAP ≥ 32
0x06: 31.25 sps TAP ≥ 64
0x07: 15.625 sps TAP = 128
0x08: 400 sps TAP ≥ 8
0x09: 200 sps TAP ≥ 16
0x0A: 100 sps TAP ≥ 32
0x0B: 80 sps TAP ≥ 32
0x0C: 50 sps TAP ≥ 64
0x0D: 40 sps TAP ≥ 64
0x0E: 25 sps TAP = 128
0x0F: 20 sps TAP = 128

For combinations of **DOUT_RATE** (SMPL_CTRL[0x04 (W1)] bit[15:8]) and **FILTER_SEL** (FILTER_CTRL[0x06 (W1)] bit[4:0]) that can be set, refer to Table 7.2, Valid Combinations of Data Output Rate and Filter Settings. If the setting is invalid, **SET_ERR** (DIAG_STAT[0x04 (W0)] bit [10]) is set, and the fixed error value “0x7EF0” is output as the sensor data (GX, GY, GZ, AX, AY, AZ).

7.9 FILTER_CTRL Register (Window 1)

Addr (Hex)	bit 15	• • •	bit 8	R/W
0x07	**-**			**-**

Addr (Hex)	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	R/W
0x06	**-**			**FILTER_SEL**					**R/W**

bit[4:0] FILTER_SEL

Specifies the type of filter and TAP setting.
For the FIR Kaiser filter, these bits also select the cutoff frequency fc in Hz.

00000: Moving average filter TAP = 0
00001: Moving average filter TAP = 2
00010: Moving average filter TAP = 4
00011: Moving average filter TAP = 8
00100: Moving average filter TAP = 16
00101: Moving average filter TAP = 32
00110: Moving average filter TAP = 64
00111: Moving average filter TAP = 128
01000: FIR Kaiser filter (parameter = 8) TAP = 32 and fc = 50
01001: FIR Kaiser filter (parameter = 8) TAP = 32 and fc = 100
01010: FIR Kaiser filter (parameter = 8) TAP = 32 and fc = 200
01011: FIR Kaiser filter (parameter = 8) TAP = 32 and fc = 400
01100: FIR Kaiser filter (parameter = 8) TAP = 64 and fc = 50
01101: FIR Kaiser filter (parameter = 8) TAP = 64 and fc = 100

01110: FIR Kaiser filter (parameter = 8) TAP = 64 and fc = 200
01111: FIR Kaiser filter (parameter = 8) TAP = 64 and fc = 400
10000: FIR Kaiser filter (parameter = 8) TAP = 128 and fc = 50
10001: FIR Kaiser filter (parameter = 8) TAP = 128 and fc = 100
10010: FIR Kaiser filter (parameter = 8) TAP = 128 and fc = 200
10011: FIR Kaiser filter (parameter = 8) TAP = 128 and fc = 400
10100–11111: Unused

For combinations of **DOUT_RATE** (SMPL_CTRL[0x04 (W1)] bit[15:8]) and **FILTER_SEL** (FILTER_CTRL[0x06 (W1)] bit[4:0]) that can be set, refer to Table 7.2, Valid Combinations of Data Output Rate and Filter Settings. If the setting is invalid, **SET_ERR** (DIAG_STAT[0x04 (W0)] bit [10]) is set, and the fixed error value “0x7EF0” is output as the sensor data (GX, GY, GZ, AX, AY, AZ).

Table 7.2 Valid Combinations of Data Output Rate and Filter Settings

		Filter setting																			
		Moving average filter								FIR Kaiser filter											
		TAP = 0	TAP = 2	TAP = 4	TAP = 8	TAP = 16	TAP = 32	TAP = 64	TAP = 128	TAP = 32, fc = 50	TAP = 32, fc = 100	TAP = 32, fc = 200	TAP = 32, fc = 400	TAP = 64, fc = 50	TAP = 64, fc = 100	TAP = 64, fc = 200	TAP = 64, fc = 400	TAP = 128, fc = 50	TAP = 128, fc = 100	TAP = 128, fc = 200	TAP = 128, fc = 400
Data output rate setting	**2000**	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	1000	–	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	500	–	–	OK	OK	OK	OK	OK	OK	OK	OK	OK	–	OK	OK	OK	–	OK	OK	OK	–
	400	–	–	–	OK	OK	OK	OK	OK	OK	OK	OK	–	OK	OK	OK	–	OK	OK	OK	–
	250	–	–	–	OK	OK	OK	OK	OK	OK	OK	–	–	OK	OK	–	–	OK	OK	–	–
	200	–	–	–	–	OK	OK	OK	OK	OK	OK	–	–	OK	OK	–	–	OK	OK	–	–
	125	–	–	–	–	OK	OK	OK	OK	OK	–	–	–	OK	–	–	–	OK	–	–	–
	100	–	–	–	–	–	OK	OK	OK	OK	–	–	–	OK	–	–	–	OK	–	–	–
	80	–	–	–	–	–	OK	OK	OK	–	–	–	–	–	–	–	–	–	–	–	–
	62.5	–	–	–	–	–	OK	OK	OK	–	–	–	–	–	–	–	–	–	–	–	–
	50	–	–	–	–	–	–	OK	OK	–	–	–	–	–	–	–	–	–	–	–	–
	40	–	–	–	–	–	–	OK	OK	–	–	–	–	–	–	–	–	–	–	–	–
	31.25	–	–	–	–	–	–	OK	OK	–	–	–	–	–	–	–	–	–	–	–	–
	25	–	–	–	–	–	–	–	OK	–	–	–	–	–	–	–	–	–	–	–	–
	20	–	–	–	–	–	–	–	OK	–	–	–	–	–	–	–	–	–	–	–	–
	15.625	–	–	–	–	–	–	–	OK	–	–	–	–	–	–	–	–	–	–	–	–

OK = Supported, – = Invalid

7.10 HIF_CTRL Register (Window 1)

Addr (Hex)	bit 15	• • •	bit 8	R/W
0x09	**BAUD _RATE**			**R/W**

Addr (Hex)	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	R/W
0x08	**-**						**AUTO _START**	**-**	**R/W**

bit[15:8] BAUD_RATE

Specifies the baud rate of the RS-422 interface.

0x00: 460.8 kbps
0x01: 230.4 kbps
0x02: 921.6 kbps
0x03: 1000 kbps
0x04: 1500 kbps
0x05: 2000 kbps

NOTE: The baud rate change using **BAUD_RATE** takes effect immediately after the write access is completed.

bit[1] **AUTO_START**
Enables or disables the Auto Start function.

1: Enable
0: Disable

When **AUTO_START** is enabled, the device automatically starts sending sampling data after power-on or after issuing a software reset. To enable this function, after setting this bit to “1”, write “1” to **FLASH_BACKUP** (GLOB_CMD[0x0A (W1)] bit[3]) to save the current register settings to the non-volatile memory.

7.11 GLOB_CMD Register (Window 1)

Addr (Hex)	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	R/W
0x0B			**-**			**NOT _READY**	**-**		**R**

Addr (Hex)	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	R/W
0x0A	**SOFT_RST**	**-**		**INITIAL _BACKUP**	**FLASH _BACKUP**		**-**		**R/W**

bit[10] **NOT_READY**
Indicates whether the IMU is currently ready. Immediately after power on, this bit is “1” and becomes “0” when the IMU is ready. After power on, wait until the Power-On Start-Up Time has elapsed and confirm that this bit is “0” before starting sensor measurement. This bit is read-only.

1: Not ready
0: Ready

bit[7] **SOFT_RST**
Write “1” to execute software reset. Access registers after the Reset Recovery Time has elapsed.

bit[4] **INITIAL_BACKUP**
Write “1” to set the non-volatile memory for the registers with ✓ in the “Flash Backup” column in Table 7.1 to the factory default value. After the execution is completed, the bit automatically goes back to “0”. After confirming this bit goes back to “0”, check the result in **FLASH_BU_ERR** (DIAG_STAT[0x04 (W0)] bit[0]). The values saved in the non-volatile memory are reflected in the “Flash Backup” target registers after power on or a software reset.

bit[3] **FLASH_BACKUP**
Write “1” to save the current values of the control registers with ✓ in the “Flash Backup” column of Table 7.1 to the non-volatile memory. After the execution is completed, the bit automatically goes back to “0”. After confirming this bit goes back to “0”, check the result in **FLASH_BU_ERR** (DIAG_STAT[0x04 (W0)] bit[0]). The values saved in the non-volatile memory are reflected in the “Flash Backup” target registers after power on or a software reset.

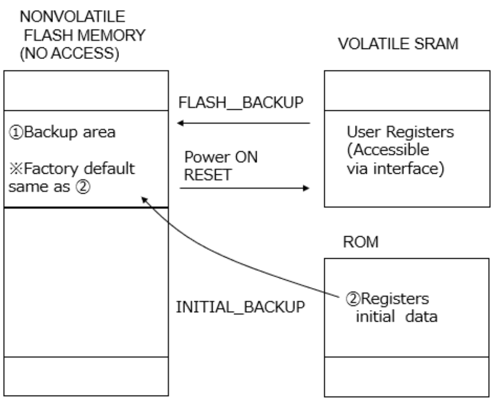


Figure 7.1 SRAM and Flash Memory Diagram

7.12 BURST_CTRL1 Register (Window 1)

Addr (Hex)	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	R/W
0x0D	**FLAG _OUT**	**TEMP _OUT**	**GYRO _OUT**	**ACCL _OUT**	**-**				**R/W**

Addr (Hex)	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	R/W
0x0C	**-**						**COUNT _OUT**	**CHKSM _OUT**	**R/W**

bit[15] **FLAG_OUT**
Enables or disables the output of the FLAG register.

1: Enable
0: Disable

bit[14] **TEMP_OUT**
Enables or disables the output of temperature sensor data.

1: Enable
0: Disable

bit[13] **GYRO_OUT**
Enables or disables the output of gyroscope data.

1: Enable
0: Disable

bit[12] **ACCL_OUT**
Enables or disables the output of accelerometer data.

1: Enable
0: Disable

bit[1] **COUNT_OUT**
Enables or disables the output of sampling count value.

1: Enable
0: Disable

bit[0] **CHKSM_OUT**
Enables or disables the output of checksum.

1: Enable
0: Disable

7.13 BURST_CTRL2 Register (Window 1)

Addr (Hex)	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	R/W
0x0F	**-**	**TEMP _BIT**	**GYRO _BIT**	**ACCL _BIT**	**-**				**R/W**

Addr (Hex)	bit 7	• • •	bit 0	R/W
0x0E	**-**			**-**

bit[14] **TEMP_BIT**
Selects the bit length of the temperature sensor output data.

1: 32 bits
0: 16 bits

bit[13] **GYRO_BIT**
Selects the bit length of the gyroscope output data.

1: 32 bits
0: 16 bits

bit[12] **ACCL_BIT**
Selects the bit length of the accelerometer output data.

1: 32 bits
0: 16 bits

7.14 POL_CTRL Register (Window 1)

Addr (Hex)	bit 15	• • •	bit 8	R/W
0x11	**-**			**-**

Addr (Hex)	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	R/W
0x10	**-**	**POL_CTRL (GX)**	**POL_CTRL (GY)**	**POL_CTRL (GZ)**	**POL_CTRL (AX)**	**POL_CTRL (AY)**	**POL_CTRL (AZ)**	**-**	**R/W**

bit[6:1] **POL_CTRL**
Specifies whether to invert the output values of angular velocity and acceleration data.

1: Inverted
0: Not inverted

7.15 PROD_ID Register (Window 1)

Addr (Hex)	bit 15	• • •	bit 0	R/W
0x6A	**PROD_ID1**			**R**
0x6C	**PROD_ID2**			**R**
0x6E	**PROD_ID3**			**R**
0x70	**PROD_ID4**			**R**

bit[15:0] **PROD_IDx**
These registers return the product model number represented in ASCII code.

PROD_ID1: 0x3547 “5G”
PROD_ID2: 0x3037 “07”
PROD_ID3: 0x5250 “RP”
PROD_ID4: 0x3032 “02”

7.16 VERSION Register (Window 1)

Addr (Hex)	bit 15	• • •	bit 0	R/W
0x72	**VERSION**			**R**

bit[15:0] **VERSION**
This register returns the Firmware Version.

7.17 SERIAL_NUM Register (Window 1)

Addr (Hex)	bit 15	• • •	bit 0	R/W
0x74	**SERIAL_NUM1**			**R**
0x76	**SERIAL_NUM2**			**R**
0x78	**SERIAL_NUM3**			**R**
0x7A	**SERIAL_NUM4**			**R**

bit[15:0] **SERIAL_NUMx**
These registers return the serial number represented in ASCII code.
For example, if the Serial Number is 01234567 then the return value is:
SERIAL_NUM1: 0x3130

SERIAL_NUM2: 0x3332
SERIAL_NUM3: 0x3534
SERIAL_NUM4: 0x3736

7.18 WIN_CTRL Register (Window 0, 1)

Addr (Hex)	bit 15	• • •	bit 8	R/W
0x7F		**-**		**-**

Addr (Hex)	bit 7	• • •	bit 0	R/W
0x7E		**WINDOW_ID**		**R/W**

bit[7:0] **WINDOW_ID**
Select the desired register window by writing the window number to this register.

0x00: Window 0
0x01: Window 1
0x02–0xFF: Unused

8. Sample Program Flow

The following describes the recommended procedures for operating this device.

8.1 Power-on Sequence

The following shows a power-on sequence:

(1) Power-on.

(2) Wait 1000 ms.

(3) Wait until the NOT_READY bit goes to 0. NOT_READY is GLOB_CMD[0x0A (W1)]'s bit[10].

```
TXdata = {0xFE, 0x01, 0x0d}                    /* WINDOW = 1 */
TXdata = {0x0A, 0x00, 0x0d}                    /* GLOB_CMD read command */
RXdata = {0x0A, MSByte, LSByte, 0x0d}          /* get response */
```

Confirm the NOT_READY bit.
When NOT_READY becomes 0, this step ends. Otherwise, please repeat (3).

(4) Confirm the ROM_ERR, RAM_ERR, and FLASH_ERR bits. ROM_ERR, RAM_ERR, and FLASH_ERR are DIAG_STAT[0x04 (W0)]'s bit[5], bit[6], and bit[1].

```
TXdata = {0xFE, 0x00, 0x0d}                    /* WINDOW = 0 */
TXdata = {0x04, 0x00, 0x0d}                    /* DIAG_STAT read command */
RXdata = {0x04, MSByte, LSByte, 0x0d}          /* get response */
```

Confirm if ROM_ERR and RAM_ERR are 0.

(5) Confirm the SNS_ERR bits. SNS_ERR is HARD_ERR[0x08 (W0)]'s bit[2:0].

```
TXdata = {0xFE, 0x00, 0x0d}.                   /* WINDOW = 0 */
TXdata = {0x08, 0x00, 0x0d}.                   /* HARD_ERR read command */
RXdata = {0x08, MSByte, LSByte, 0x0d}.         /* get response */
```

Confirm if SNS_ERR is 000.

If ROM_ERR is 0, RAM_ERR is 0, FLASH_ERR is 0, and SNS_ERR is 000, the IMU is operating normally. Otherwise, the IMU is faulty.

8.2 Register Read and Write

[Read Example]

To read a 16-bit data from a register (addr = 0x02 / WINDOW = 0).

```
TXdata = {0xFE, 0x00, 0x0d}                    /* WINDOW = 0 */
TXdata = {0x02, 0x00, 0x0d}                    /* command */
RXdata = {0x02, 0x04, 0x00, 0x0d}              /* response */
```

0x04 in 2nd byte of RXdata indicates that the device is in Configuration mode.
0x00 in 3rd byte of RXdata is Reserved.
Please note that read data unit is 16 bits, and Most Significant Byte first.

[Write Example]

To write an 8-bit data into a register (addr = 0x03 / WINDOW = 0).

```
TXdata = {0xFE, 0x00, 0x0d}                    /* WINDOW = 0 */
TXdata = {0x83, 0x01, 0x0d}                    /* command */
RXdata = w/o response
```

By sending this command, the IMU enters Sampling mode.
Please note that write data unit is 8 bits.

8.3 Sampling Data

[Sample Flow 1]

(1) Power-on sequence. Please refer to *Section 8.1*.

(2) Configure Sampling mode.

```
TXdata = {0xFE, 0x01, 0x0d}    /* WINDOW = 1 */
TXdata = {0x85, 0x02, 0x0d}    /* 500 sps */
TXdata = {0x86, 0x02, 0x0d}    /* Moving average TAP = 4 */
TXdata = {0x8C, 0x02, 0x0d}    /* COUNT = on, CHECKSUM = off */
TXdata = {0x8D, 0xF0, 0x0d}    /* FLAG = on, TEMP = on, GYRO = on, ACCL = on */
TXdata = {0x8F, 0x70, 0x0d}    /* TEMP = 32 bits, GYRO = 32 bits, ACCL = 32 bits */
TXdata = {0xFE, 0x00, 0x0d}    /* WINDOW = 0 */
TXdata = {0x83, 0x01, 0x0d}    /* move to Sampling mode */
```

(3) Receive sampling data.

(a) Read data.

```
RXdata = {0x80, FLAG_H,    FLAG_L,
                TEMP_HH,   TEMP_HL,   TEMP_LH,   TEMP_LL,
                GX_HH,     GX_HL,     GX_LH,     GX_LL,
                GY_HH,     GY_HL,     GY_LH,     GY_LL,
                GZ_HH,     GZ_HL,     GZ_LH,     GZ_LL,
                AX_HH,     AX_HL,     AX_LH,     AX_LL,
                AY_HH,     AY_HL,     AY_LH,     AY_LL,
                AZ_HH,     AZ_HL,     AZ_LH,     AZ_LL,
                COUNT_H,   COUNT_L,   0x0d}
```

(b) Repeat (a).

(4) Exit Sampling mode.

```
TXdata = {0x83, 0x02, 0x0d}    /* return to Configuration mode */
```

[Sample Flow 2]

To read upper 16 bits of temperature, gyroscope, and accelerometer data.

(1) Power-on sequence. Please refer to *Section 8.1*.

(2) Configure Sampling mode.

```
TXdata = {0xFE, 0x01, 0x0d}    /* WINDOW = 1 */
TXdata = {0x85, 0x01, 0x0d}    /* 1000 sps */
TXdata = {0x86, 0x01, 0x0d}    /* Moving average TAP = 2 */
TXdata = {0x8C, 0x02, 0x0d}    /* COUNT = on, CHECKSUM = off */
TXdata = {0x8D, 0xF0, 0x0d}    /* FLAG = on, TEMP = on, GYRO = on, ACCL = on */
TXdata = {0x8F, 0x00, 0x0d}    /* TEMP = 16 bits, GYRO = 16 bits, ACCL = 16 bits */
TXdata = {0xFE, 0x00, 0x0d}    /* WINDOW = 0 */
TXdata = {0x83, 0x01, 0x0d}    /* move to Sampling mode */
```

(3) Receive sampling data.

(a) Read data.

```
RXdata = {0x80, FLAG_H,    FLAG_L,
                TEMP_HH,   TEMP_HL,
                GX_HH,     GX_HL,
                GY_HH,     GY_HL,
                GZ_HH,     GZ_HL,
                AX_HH,     AX_HL,
                AY_HH,     AY_HL,
                AZ_HH,     AZ_HL,
                COUNT_H,   COUNT_L,   0x0d}
```

(b) Repeat (a).

(4) Exit Sampling mode.

```
TXdata = {0x83, 0x02, 0x0d}    /* return to Configuration mode */
```

[Notes]

Please note that read data unit is 16 bits, and Most Significant Byte first.
Please note that write data unit is 8 bits.

8.4 Software Reset

The following shows a software reset execution procedure:

(1) Power-on sequence. Please refer to *Section 8.1*.

(2) Issue a software reset.

(a) Send the software reset command.
TXdata = {0xFE, 0x01, 0x0d} /* WINDOW = 1 */
TXdata = {0x8A, 0x80, 0x0d} /* Software reset command */

(b) Wait 1000 ms.

8.5 Flash Backup

The following shows a flash backup execution procedure:

(1) Power-on sequence. Please refer to *Section 8.1*.

(2) Execute flash backup.

(a) Send the flash backup command.
TXdata = {0xFE, 0x01, 0x0d} /* WINDOW = 1 */
TXdata = {0x8A, 0x08, 0x0d} /* Flash backup command */

(b) Wait until the flash backup has finished.
Wait until the FLASH_BACKUP bit goes to 0. FLASH_BACKUP is GLOB_CMD[0x0A (W1)]'s bit[3].
TXdata = {0x0A, 0x00, 0x0d} /* GLOB_CMD read command */
RXdata = {0x0A, MSByte, LSByte, 0x0d} /* get response */
Confirm the FLASH_BACKUP bit.
When FLASH_BACKUP becomes 0, this step ends. Otherwise, repeat (b).

(c) Confirm the result.
Confirm the FLASH_BU_ERR bit. FLASH_BU_ERR is DIAG_STAT[0x04 (W0)]'s bit[0].
TXdata = {0xFE, 0x00, 0x0d} /* WINDOW = 0 */
TXdata = {0x04, 0x00, 0x0d} /* DIAG_STAT read command */
RXdata = {0x04, MSByte, LSByte, 0x0d} /* get response */
Confirm if FLASH_BU_ERR is 0.
If FLASH_BU_ERR is 0, the backup has finished successfully. Otherwise, an error has occurred.

8.6 Initial Backup

The following shows an initial backup execution procedure:

(1) Power-on sequence. Please refer to *Section 8.1*.

(2) Execute initial backup.

(a) Send the initial backup command.
TXdata = {0xFE, 0x01, 0x0d} /* WINDOW = 1 */
TXdata = {0x8A, 0x10, 0x0d} /* Initial backup command */

(b) Wait until the initial backup has finished.
Wait until the INITIAL_BACKUP bit goes to 0. INITIAL_BACKUP is GLOB_CMD[0x0A (W1)]'s bit[4].
TXdata = {0x0A, 0x00, 0x0d} /* GLOB_CMD read command */
RXdata = {0x0A, MSByte, LSByte, 0x0d} /* get response */
Confirm the INITIAL_BACKUP bit.
When INITIAL_BACKUP becomes 0, this step ends. Otherwise, repeat (b).

(c) Confirm the result.
Confirm the FLASH_BU_ERR bit. FLASH_BU_ERR is DIAG_STAT[0x04 (W0)]'s bit[0].
TXdata = {0xFE, 0x00, 0x0d} /* WINDOW = 0 */
TXdata = {0x04, 0x00, 0x0d} /* DIAG_STAT read command */
RXdata = {0x04, MSByte, LSByte, 0x0d} /* get response */
Confirm if FLASH_BU_ERR is 0.
If FLASH_BU_ERR is 0, the backup has finished successfully. Otherwise, an error has occurred.

(d) Issue a software reset. Please refer to *Section 8.4*.

8.7 Self-test

The following shows a self-test execution procedure:

(1) Power-on sequence. Please refer to *Section 8.1*.

(2) Execute self-test.

(a) Send the self-test command.
TXdata = {0xFE, 0x01, 0x0d} /* WINDOW = 1 */
TXdata = {0x83, 0x08, 0x0d} /* Self-test command */

(b) Wait until the self-test has finished.
Wait until the SELF_TEST bit goes to 0. SELF_TEST is MSC_CTRL[0x02 (W1)]'s bit[11].
TXdata = {0x02, 0x00, 0x0d} /* MSC_CTRL read command */
RXdata = {0x02, MSByte, LSByte, 0x0d} /* get response */
Confirm the SELF_TEST bit.
When SELF_TEST becomes 0, this step ends. Otherwise, repeat (b).

(c) Confirm the result.
(c-1) Confirm the ROM_ERR and FLASH_ERR bits. ROM_ERR and FLASH_ERR are DIAG_STAT[0x04 (W0)]'s bit[5] and bit[1].
TXdata = {0xFE, 0x00, 0x0d}. /* WINDOW = 0 */
TXdata = {0x04, 0x00, 0x0d}. /* DIAG_STAT read command */
RXdata = {0x04, MSByte, LSByte, 0x0d}. /* get response */
Confirm if ROM_ERR and FLASH_ERR are 0.

(c-2) Confirm the SNS_ERR bits. SNS_ERR is HARD_ERR[0x08(W0)]'s bit[2:0].
TXdata = {0xFE, 0x00, 0x0d}. /* WINDOW = 0 */
TXdata = {0x08, 0x00, 0x0d}. /* HARD_ERR read command */
RXdata = {0x08, MSByte, LSByte, 0x0d}. /* get response */
Confirm if SNS_ERR is 000.

If ROM_ERR is 0, FLASH_ERR is 0, and SNS_ERR is 000, the IMU is operating normally. Otherwise, the IMU is faulty.

8.8 Self-test Sensor

The following shows a sensor test execution procedure:

(1) Power-on sequence. Please refer to *Section 8.1*.

(2) Execute sensor test.

(a) Send the self-test sensor command.
TXdata = {0xFE, 0x01, 0x0d} /* WINDOW = 1 */
TXdata = {0x83, 0x04, 0x0d} /* Self-test sensor command */

* The self-test sensor command should be executed at a stationary condition without vibration.

(b) Wait until the self-test sensor has finished.
Wait until the SELF_TEST_SENSOR bit goes to 0. SELF_TEST_SENSOR is MSC_CTRL[0x02 (W1)]'s bit[10].
TXdata = {0x02, 0x00, 0x0d} /* MSC_CTRL read command */
RXdata = {0x02, MSByte, LSByte, 0x0d} /* get response */
Confirm the SELF_TEST_SENSOR bit.
When SELF_TEST_SENSOR becomes 0, this step ends. Otherwise, repeat (b).

(c) Confirm the result.
(c-1) Confirm the ST_ERR bits. ST_ERR is DIAG_STAT[0x04 (W0)]'s bit[14:11].
TXdata = {0xFE, 0x00, 0x0d}. /* WINDOW = 0 */
TXdata = {0x04, 0x00, 0x0d}. /* DIAG_STAT read command */
RXdata = {0x04, MSByte, LSByte, 0x0d}. /* get response */
Confirm if ST_ERR is 0000.

(c-2) Confirm the SNS_ERR bits. SNS_ERR is HARD_ERR[0x08(W0)]'s bit[2:0].
TXdata = {0xFE, 0x00, 0x0d}. /* WINDOW = 0 */
TXdata = {0x08, 0x00, 0x0d}. /* HARD_ERR read command */
RXdata = {0x08, MSByte, LSByte, 0x0d}. /* get response */
Confirm if SNS_ERR is 000.

If ST_ERR is 0000 and SNS_ERR is 000, the test has finished successfully. Otherwise, an error has occurred.

8.9 Search Baud Rate

The following shows the procedure to search the lost baud rate:

(1) Power-on sequence. Please refer to *Section 8.1*.
(2) Set the baud rate on the host side to 460800baud.
(3) Send ID read command.

```
TXdata = {0x4C, 0x00, 0x0d}                 /* ID read command */
```

If the following response is received, the search has finished. Otherwise, proceed to next step.

```
RXdata = {0x02, 0x53, 0x45, 0x0d}           /* get response */
```

(4) Set the baud rate on the host side to another baud rate. For example, 230400baud.
Repeat step (3) to step (4) while changing the baud rate on the host side.

9. Handling Notes

9.1 Cautions for Use

- When you attach the product to a housing, equipment, jig, or tool, make sure you attach it properly so that no mechanical stress is added to create a distortion such as a warp or twist. In addition, tighten the screws firmly but not too firmly because the mount of the product may break. Use screw locking techniques as necessary.
- When you set up the product, make sure the equipment, jigs, tools, and workers maintain a good ground in order not to generate high voltage leakage. If you add overcurrent or static electricity to the product, the product may be damaged permanently.
- When you install the product, make sure metallic or other conductors do not enter the product. Otherwise, malfunction or damage of the product may result.
- If excessive shock is added to the product when, for example, the product falls, the quality of the product may be degraded. Make sure the product does not fall when you handle it.
- Before you start using the product, test it in the actual equipment under the actual operating environment.
- Since the product has capacitors inside, inrush current will occur during power-on. Evaluate in the actual environment in order to check the effect of the supply voltage drop by inrush current in the system.
- If water enters the product, malfunction or damage of the product may result. If the product can be exposed to water, the system must have a waterproof structure. We do not guarantee the operation of the product when the product is exposed to condensation, dust, oil, corrosive gas (salt, acid, alkaline, or the like), or direct sunlight.
- This product is not designed to be radiation resistant.
- Never use this product if the operating condition is over the absolute maximum rating. If you do, the characteristics of the product may never recover.
- If the product is exposed to excessive exogenous noise or the like, degradation of the precision, malfunction, or damage of the product may result. The system needs to be designed so that the noise itself is suppressed or the system is immune to the noise.
- Mechanical vibration or shock, continuous mechanical stress, rapid temperature change, or the like may cause cracks or disconnections at the various connecting parts.
- Take sufficient safety measure for the equipment this product is built into.
- This product is not intended for general use by the consumer but instead for engineering design. For the customer, please consider it safely with the proper use.
- This product is not designed to be used in the equipment that demands extremely high reliability and where its failure may threaten human life or property (for example, aerospace equipment, submarine repeater, nuclear power control equipment, life support equipment, medical equipment, transportation control equipment, etc.). Therefore, Seiko Epson Corporation will not be liable for any damages caused by the use of the product for those applications.
- Do not alter or disassemble the product.
- The casing of this product is electrically conductive. When the product is connected or mounted to the circuit board, ensure the board substrate or board wiring pattern does not short-circuit or contact to the case.

9.2 Cautions for Storage

- Do not add shock or vibration to the packing box. Do not spill water over the packing box. Do not store or use the product in the environment where dew condensation occurs due to rapid temperature change.
- To suppress the characteristic change by prolonged storage, it is recommended to maintain the environment at normal temperature and normal humidity. Normal temperature: +5 °C to +35 °C Normal humidity: 45% RH to 85% RH (JIS Z 8703).
- Do not store the product in a location subject to High Temperature, high humidity, under direct sunlight, corrosive gas or dust.
- Do not put mechanical stress on the product while it is stored.

9.3 Other Cautions

- When you connect the socket to the header of this product, make sure you do not insert the header in the reverse orientation. If you do, the IMU may be damaged permanently. In addition, if you attach the product to the equipment, etc. using connection harness, connect the connection harness to the product first, and then attach it to the equipment, etc.
- The gloss marks derived from the adhesive material may have appeared on the casing surface of the product, but it does not affect the function and quality of the product.
- The Parting line as a result of die cast manufacturing process may have appeared on the casing surface of the product, but it is not an abnormality.
- Please take care not to tamper with or accidently disturb the assembly screw on the surface where the serial number is printed when attaching and detaching the product to the system. We do not guarantee the performance and the quality of the product in case the assembly screw is manipulated.

9.4 Limited Warranty

- The product warranty period is one year from the date of shipment.
- If a defect due to a quality failure of the product is found during the warranty period, we will promptly provide a replacement.

10. Standards and Approvals

The following standards are applied only to the unit that are so labeled. (EMC is tested using the EPSON power supplies.)

10.1 NOTICE

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
The connection of a non-shielded interface cable to this product will invalidate the EMC standards of the device.
You are cautioned that changes or modifications not expressly approved by Seiko Epson Corporation could void your authority to operate the equipment.

10.2 CE Statement

This product conforms to the following Directives and Norms,

Directive 2014/30/EU:
EN61326-1 Class A

Directive 2011/65/EU:
EN IEC 63000:2018

Representative information,
Epson Europe Electronics GmbH
Riesstrasse 15
80992 Munich
Germany

10.3 RoHS & WEEE

The crossed out wheeled bin label that can be found on your product indicates that this product should not be disposed of via the normal household waste stream. To prevent possible harm to the environment or human health please separate this product from other waste streams to ensure that it can be recycled in an environmentally sound manner. For more details on available collection facilities please contact your local government office or the retailer where you purchased this product.

AEEE Yönetmeliğine Uygundur.

Обладнання відповідає вимогам Технічного регламенту обмеження використання деяких небезпечних речовин в електричному та електронному обладнанні

10.4 UKCA Statement

This product conforms to the following Directives and Norms,

Directive 2014/30/EU
BS EN 61326-1 Class A

Directive 2011/65/EU:
EN IEC 63000:2018
Representative information,
Epson (UK) Ltd.Westside
Floor 3&4, The Clarendon Works,
37-39 Clarendon Road, Watford WD17 1JA,
United Kingdom

10.5 FCC Compliance Statement for American users

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

10.6 Industry ICES Compliance Statement for Canadian users

CAN ICES-3(A)/NMB-3(A)

11. Contact

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Product Information on www server
https://global.epson.com/products_and_drivers/sensing_system/