A342VD1/A542VR1
A352AD1/A552AR1
Quick Connection Guide
(Device connection)

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Revision History

Rev. No.	Date	Page	Description
20220323	2022/03/23	ALL	New release.

1. Introduction

To use A342/A542 or A352/A552, the sensor needs to be connected to your host system (MCU board, PC, etc.). This document supports the device connection. Refer to the Quick Connection Guide (data communication) for data communication with the sensor and refer to the Vibration Logger Software Manual when using the Epson logger software.

The target models for this document are shown in Table 1.1. M-A552AC series are not covered in this document.

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Table 1.1 Target Models and Notation

Model name	Notation
M-A342VD1	A342
M-A352AD1	A352
M-A542VR1	A542
M-A552AR1	A552

2. Device Connection

2.1. Case 1: A342 or A352 Connection to MCU (Micro Controller Unit) Board via UART/SPI

The following explains how to connect the A342 or A352 to an MCU board (e.g., Raspberry Pi) as Case 1. Figure 2.1 shows a connection configuration example to the A342 or A352 end. In this connection example, the power supply to the sensor needs to be considered by customers, either from the MCU board or by preparing a DC power supply.

A variety of electrical noises may affect the measurement quality. If abnormal signal components are detected, or when measuring minute vibrations, etc., consider the countermeasures shown in Table 2.1. Length of the harness connection to the MCU board should preferably be as short as possible. Particularly in the SPI case, the length of the harness should be less than 10 cm (remember that SPI is a protocol used for IC-to-IC communication on the same board).

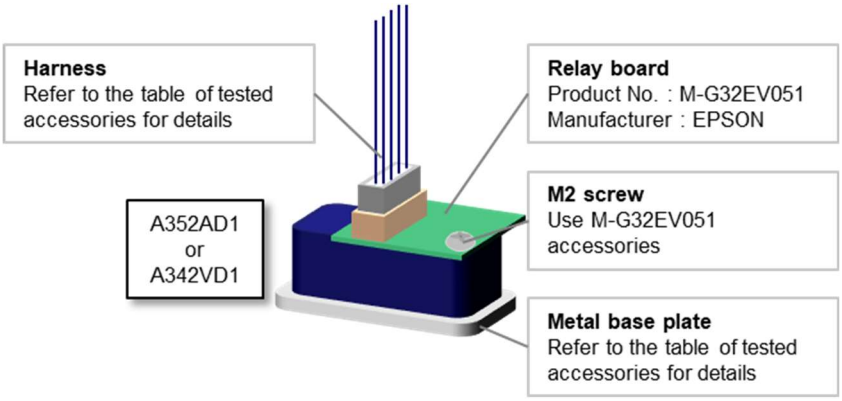

Figure 2.1 Connection Configuration Example to A352/A342 End (Case 1)

Table 2.1 Noise Countermeasure Examples

Measures	Effects
Attch the metal base plate with M2 screws	Electrical noise reduction
Use a battery or a linear power supply for supplying the power.	Power supply noise reduction

Table 2.2 shows a list of tested accessories. Accessories marked "Required" in the table are required to be used. Accessories listed as "Optional" are to be prepared when necessary. Please contact us for EPSON accessories or prepare other manufacturer's accessories by customers. A harness and a metal base plate shall be designed and fabricated by customers.

Table 2.2 Tested Accessories for Case 1

Accessories Tested (product number / manufacturer)	Use Cases / Remarks
Relay Board for EPSON Accelerometer / IMU Product No.: M-G32EV051 Manufacturer: EPSON	**Required** ・ For connecting the sensor output pins with a pin header (CN3) on the relay board. ・ Recommended when measuring minute vibrations.
Signal harness Socket Product No.: DF20A-20DS-1C Manufacturer: HIROSE ELECTRIC Crimped Terminals, Suitable Wires Refer to the Hirose Electric Co., Ltd. website for details.	**Required** ・ A harness for connection to the host system via M-G32EV051. ・ Sockets, crimp terminals, and wires are required to fabricate the harness.
Metal Base Plate	**Optional** ・ Co-tightening the sensor with M-G32EV051 or M-G32EV041 stabilizes the frame GND level and reduces the influence of electrical noises. ・ Use conductive material for fabrication. ・ Use the M2 screws supplied with M-G32EV051 or M-G32EV041.

2.2. Case 2: A342 or A352 Connection to USB Port (UART to USB connection)

The following explains how to connect the A342 or A352 to a USB port as Case 2. It assumes that the sensor output is acquired for evaluation with Epson Logger Software or the like. Figure 2.2 shows an evaluation system configuration example.

The power supply to the sensor in this configuration is either a USB bus power supply or a self-powered by a USB Hub. In this case, power supply to the sensor can be the USB bus power or the self-powered. A variety of electrical noises may affect the vibration measurement. If abnormal signal components are detected, or when measuring minute vibrations, etc., consider the countermeasures shown in Table 2.3.

The A342 and A352 are designed to be installed in a customer's cabinet. Therefore, there is no dust-proof and waterproof property, and no EMC countermeasures are provided. When measuring outdoors or in locations close to equipment that generates electromagnetic waves (e.g., high power motors), consider possible influences in your measurements.

For long-term measurement, it is recommended that customers prepare their own housing or use the A542/A552.

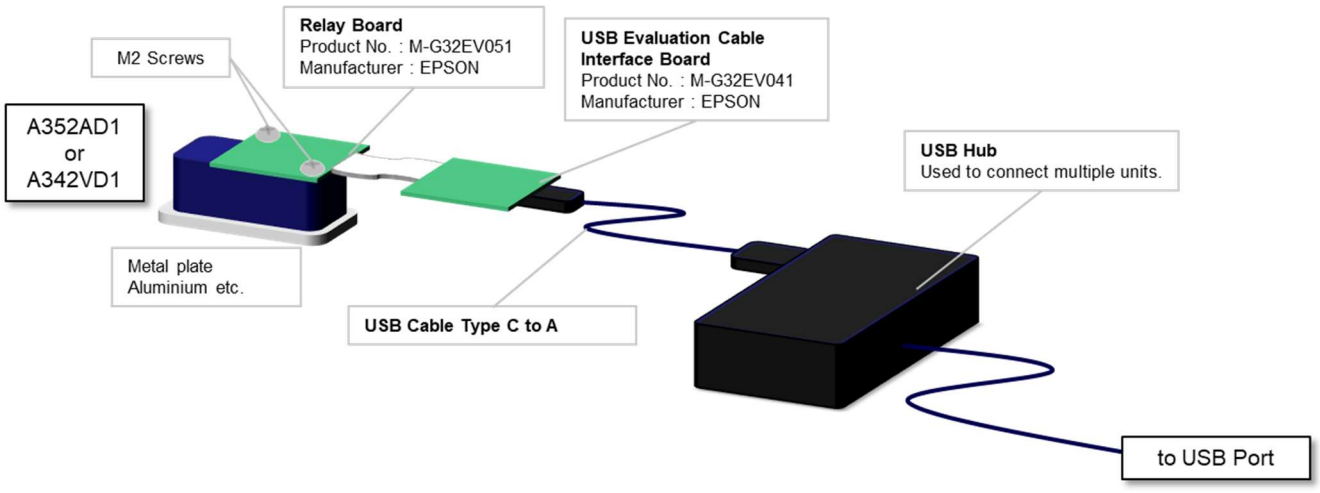

Figure 2.2 Evaluation System Configuration Example (Case 2)

Table 2.3 Noise Countermeasure Examples

Messures	Effects
Use a Relay Board*1	Reduction of the effect of cable vibration
Attach a metal base plate with M2 screws	Electrical noise reduction
Run a PC on battery power	Power supply noise reduction

*1 Figure 2.2 shows the configuration example of using a relay board with A342 or A352.

Table 2.4 shows a list of tested accessories. Accessories marked "Required" in the table are required to be used. Accessories listed as "Optional" are to be prepared when necessary. Please contact us for EPSON accessories or prepare other manufacturer's accessories by customers. A harness and a metal base plate shall be designed and fabricated by customers.

Table 2.4 Tested Accessories for Case 2

Accessories Tested (product number / manufacturer)	Use Cases / Remarks
Relay Board for EPSON Accelerometer / IMU Product No.: M-G32EV051 Manufacturer: EPSON	**Required** ・ For connecting the sensor output pins with a pin header on the relay board. ・ Recommended when measuring minute vibrations.
USB Evaluation Cable Interface Board for EPSON IMU / Accelerometer Product No.: M-G32EV041 Manufacturer: EPSON	**Required** ・ For converting the sensor I/F (UART) to USB. ・ A dedicated driver may be required to connect to a PC. Install the driver according to the M-G32EV041 manual.
USB Cable Type C to A (USB 2.0)	**Required** ・ A standard USB cable can be used. ・ The maximum cable length for USB 2.0 standard is 5 m. ・ Communication quality may be degraded when using a repeater cable for extension. Check the communication quality before use. ・ If more than 5 m cable length is required, the configuration using the A552AR1 or A542VR1 (Section 2.3) is recommended.
USB Hub (USB 2.0)	**Optional** ・ Prepare a USB hub when connecting multiple sensors. ・ A general USB Hub can be used. ・ There is a limit to the amount of current supply from a USB port on a PC. To prevent malfunction due to insufficient current supply, using a USB hub powered by a dedicated AC adapter is recommended.
Metal Base Plate	**Optional** ・ Co-tightening the sensor with M-G32EV051 or M-G32EV041 stabilizes the frame GND level and reduces the influence of electrical noises. ・ Use conductive material for fabrication. ・ Use M2 screws supplied with M-G32EV051 or M-G32EV041.

2.3. (Case 3): A542 or A552 connection to USB port (RS422 to USB connection)

Case 3 explains how to connect the A542 or A552 to a USB port. Case 3 assumes that the sensor output is acquired for evaluation with Epson Logger Software or the like. Figure 2.3 shows an evaluation system configuration example, and Figures 2.4 and 2.5 show cable connection configuration examples. The performance will not change regardless of whether Example 1 or 2 is selected, thus the calbe connection configuration can be chosen according to the availability of the accessories.

DB9 to RJ45 Modular Adapter requires lead wire connections. Pin assignments for lead wire connections are shown in Table 2.5. Also check the modular adapter datasheet, as specifications are subject to change.

The power supply to the sensor in this configuration is DC 12 V from an AC adapter. Note that the sensors do not operate properly without a DC 12 V supply in this configuration.

A variety of electrical noises may affect the vibration measurement. If abnormal signal components are detected, or when measuring minute vibrations, etc., consider the countermeasures shown in Table 2.6.

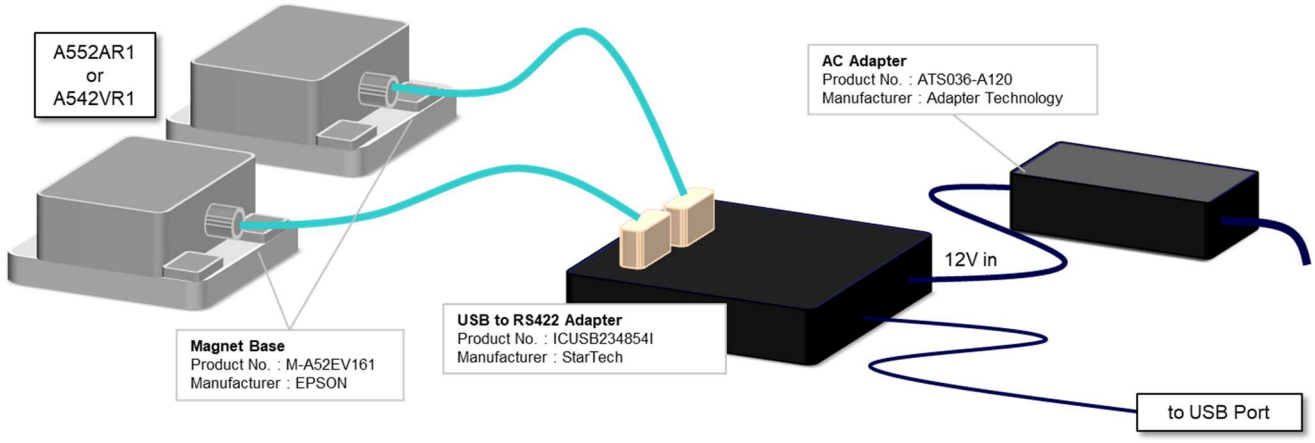

Figure 2.3 Evaluation System Configuration Example (Case 3)

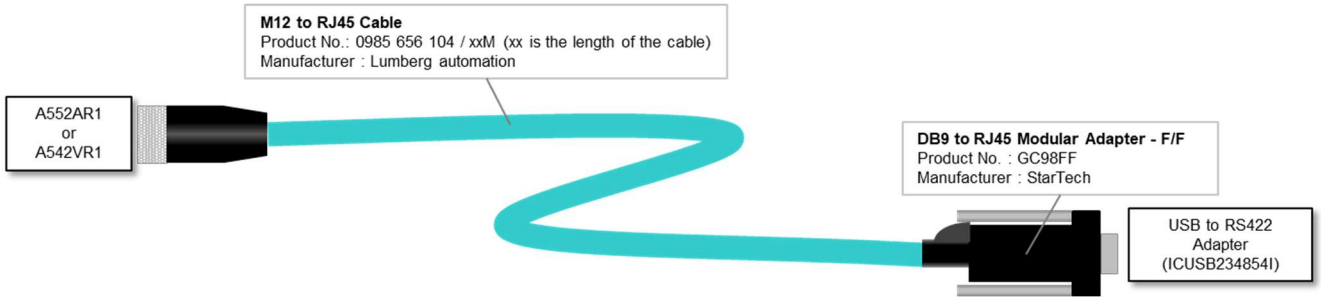

Figure 2.4 Cable Connection Configuration Example 1

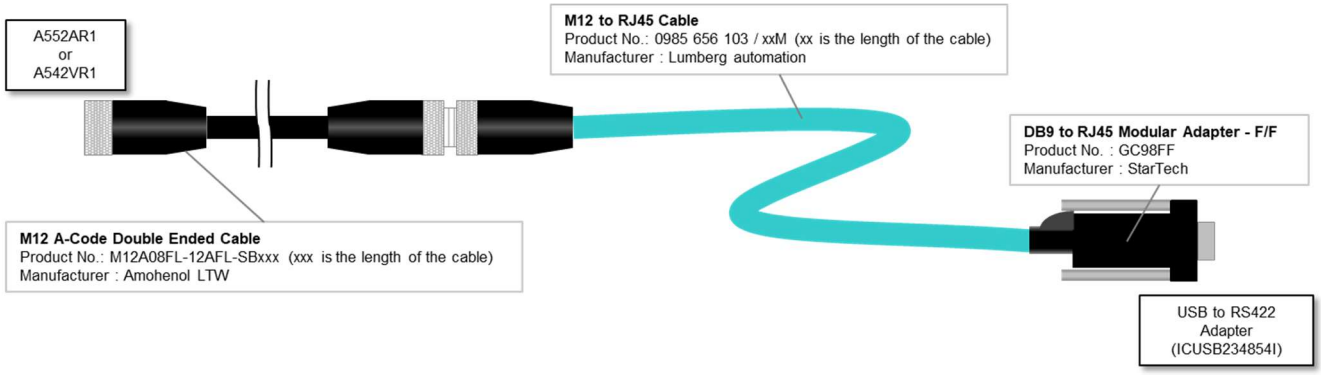

Figure 2.5 Cable Connection Configuration Example 2

Table 2.5 Pin Assignments for Lead Wire Connections

M12 Connector			DB9 to RJ45 Modular Adapter		
Pin No.	Description		RJ45	Lead wire	D-Sub 9
1	NC		5	Green	6
2	VIN		7	Brown	9
3	GND		8	White	5
4	TD-		2	Orange	4
5	RD+		3	Black	2
6	TD+		1	Blue	3
7	NC		4	Red	8
8	RD-		6	Yellow	1

Table 2.6 Noise Countermeasure Example

Messure	Effect
Use a battery or a linear power supply for DC 12 V supply.	Power supply noise reduction

Table 2.7 shows a list of tested accessories for the evaluation system, and Tables 2.8 and 2.9 show accessories for the connecting cables. Accessories marked "Required" in the tables are required to be used. Accessories listed as "Optional" are to be prepared when necessary. Please contact us for EPSON accessories or prepare other manufacturer's accessories by customers. A harness and a metal base plate shall be designed and fabricated by customers.

Table 2.7 Tested Accessories for Case 3 Evaluation System

Accessories Tested (product number / manufacturer)	Use Cases / Remarks
USB to RS422 adapter Product No.: ICUSB234854I Manufacturer: StarTech	**Required** ・ For converting sensor I/F (RS422) to USB. ・ Up to 4 sensors can be connected with this product. ・ A dedicated driver may be required to connect to a PC. Install the driver according to the product manual. ・ Settings on communication mode, power supply, and termination are required. Configure these settings according to the product manual before connecting sensors.
AC adapter Product No.: ATS036-A120 Manufacturer: Adapter Technology	**Required** ・ For supplying DC 12 V 3 A to sensors. ・ Input: Voltage 100-240 VAC, 50-60 Hz, Current 1 A max.
Magnet Base Product No.: M-A52EV161 Manufacturer: EPSON	**Optional** ・ The sensor can be mounted with this magnet base if the target cabinet is made of a magnetic material such as iron.

Table 2.8 Accessories for Case 3 Connecting Cables (Example 1)

Accessories Tested (product number / manufacturer)	Use Cases / Remarks
M12 to RJ45 Cable Product No.: 0985 656 104 / xxM (xx: cable length) Manufacturer : Lumberg automation	**Required** ・ Cable to be connected to the sensor. ・ Refer to the manufacturer's website for the cable length.
DB9 to RJ45 Modular Adapter - F/F Product No.: GC98FF Manufacturer: StarTech	**Required** ・ For converting a D-Sub 9 (DB9) male connector into an RJ45 female connector. ・ Refer to Table 2.5 for pin assignments for lead wire connections.

Table 2.9 Accessories for Case 3 Connecting Cables (Example 2)

Accessories Tested (product number / manufacturer)	Use Cases / Remarks
M12 A-Code Double Ended Cable Product No.: M12A08FL-12AFL-SBxxx (xxx: cable length) Manufacturer : Amohenol LTW	**Required** ・ For converting M12 male to M12 female. ・ Refer to the manufacturer's website for the cable length.
M12 to RJ45 Cable Product No.: 0985 656 103 / xxM (xx: cable length) Manufacturer : Lumberg automation	**Required** ・ For connecting the sensor via RS422. ・ The above conversion cable is required as the M12 connector is male. ・ Refer to the manufacturer's website for the cable length.
DB9 to RJ45 Modular Adapter - F/F Product No.: GC98FF Manufacturer: StarTech	**Required** ・ For converting a D-Sub 9 (DB9) male connector into an RJ45 female connector. ・ Refer to Table 2.5 for pin assignments for lead wire connections.

3. Connection Board Design Considerations

This chapter explains design considerations when incorporating the A342/A352 into customer's system.

3.1. Recommended Sockets

Samtec headers are used in the A342/A352 interface connection. The corresponding socket is mounted on the customer's board and connected to the sensor header.

The sockets conforming to A342/A352 headers are listed in Table 3.1. Use of Samtec 1 or 2 sockets are recommended.

Samtec 1 and 2 have the same dimensions, but the thickness of the gold plating on the terminal pins differs. Samptec 1 is a standard thickness model and is commonly expected to be used. Samtec 2 is a thick-plated model and should be used for applications requiring high connection reliability.

Table 3.1 Socket List Conforming to A342/A352 headers

	Manufacturer	Parts Number	RoHS Compliant
1	Samtec	CLM-110-02-L-D	Yes
2	Samtec	CLM-110-02-H-D	Yes
3	Harwin	M40-3101045R	Yes

3.2. Recommended Power Supply

A linear power supply or linear regulator is recommended for A342/A352 power supply.

The A342/A352 are quartz oscillator-based acceleration sensors. Acceleration is detected as the resonant frequency of the quartz oscillator shifts. Periodic voltage fluctuations caused by a switching power supply or a switching regulator superimposed on the supply voltage of the quartz oscillator may cause frequency miscounting. This may cause the appearance of pseudo signal components that depend on the power supply frequency or as an increase in the noise floor, which degrades the measurement accuracy. The use of the switching power supply or the switching regulator is not recommended for such reason.

4. Sensor Installation Considerations

This chapter explains sensor installation considerations when preparing measurements.

4.1. Mounting Sensors

Contact resonance may arise when the sensor is mounted on the target cabinet, depending on the mounting method and conditions. If the contact resonance appears within or near the measurement frequency range, the sensor gain changes and accurate measurement may not be performed. To suppress these phenomena and to achieve the intended sensor performance, the sensor must be mounted on the target cabinet. This chapter describes the recommended mounting methods.

4.1.1. A342/A352

The A342 and A352 employ the design fixed at the three locations (g) shown in Figure 4.1. With the relay board placed on top of the A342/A352, use M2 screws to co-tighten them to the customer's cabinet. This suppresses the effects of contact resonance and stabilizes the frame GND potential, thereby reducing noise influences.

This product is calibrated based on the three horizontal reference surfaces (A1, A2, A3), and the rotational reference points (B1, B2). Alignment errors can be reduced by positioning the sensor in the customer’s cabinet based on these references.

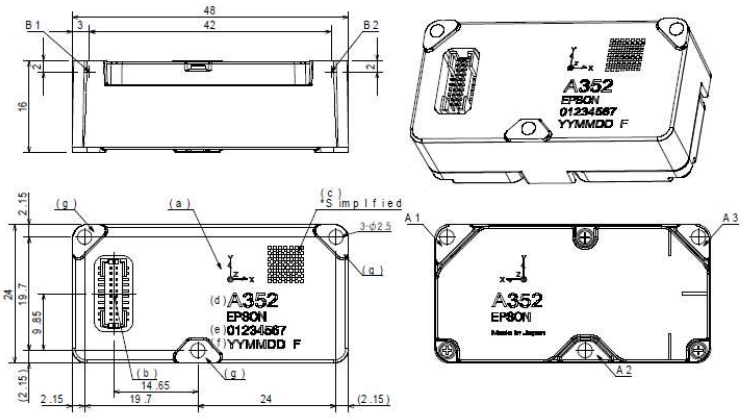

Figure 4.1 A352 Outline Dimensions [mm] (same as A342 except for markings)

4.1.2. A542/A552

The A542 and A552 employ the design to be placed with three mounting feet (Figure 4.2) to the target cabinet with screws.

The magnet base can also be used as an option if the target cabinet is made of a magnetic material. Consider this option when screw mounting is not feasible. Refer to Table 2.7 for the product information of the magnet base.

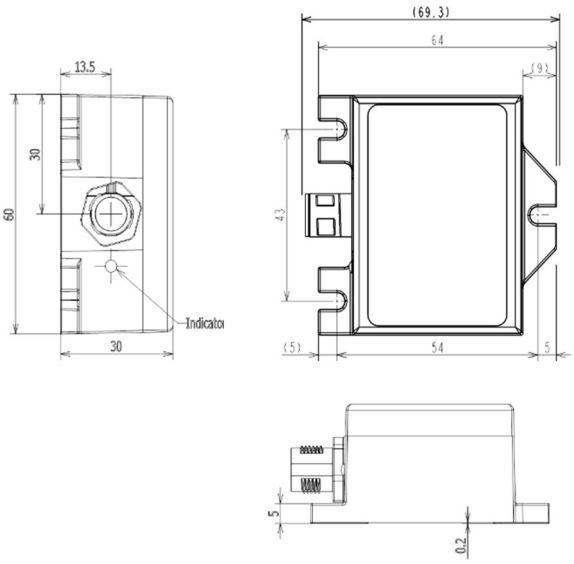

Figure 4.2 A542/A552 Outline Dimensions [mm]

Figure 4.3 shows the installation configuration of A542/A552 with the magnet base. Refer to the Magnet Base Instruction Manual for detals.

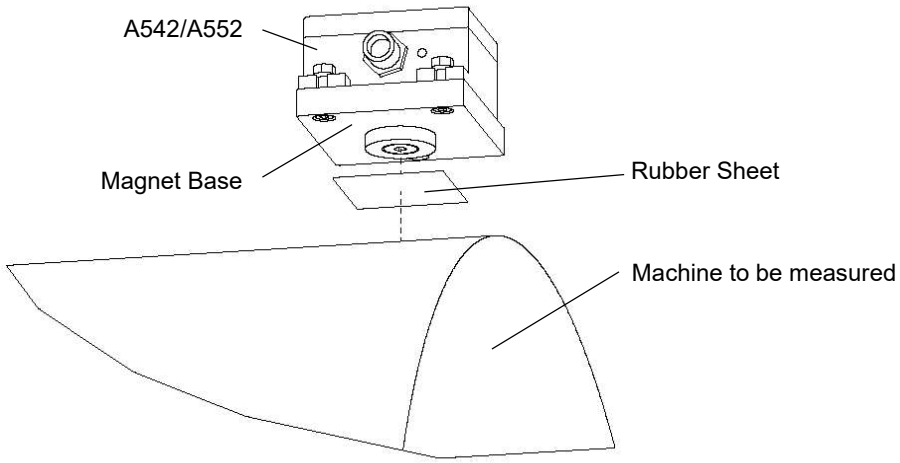

Figure 4.3 Installation on the Target Cabinet

4.2. Structural Resonance Prevention

The A342/A542 and A352/A552 may cause structural resonance due to their sensor structure. If strong vibration is applied at the structural resonance frequency of this product, the input signal may be improperly amplified, and proper measurement may not be performed or, in the worst case, damage to the sensor. This section describes countermeasures to prevent structural resonance.

4.2.1. A342/A542

The A342/A542 are implemented with a self test to determine the level of structural resonance, and a warning flag function for abnormal measurement due to the structural resonance.

Before starting measurement operation of the sensor, install the sensor at the measurement location and check if the structural resonance level is normal range by conducting a self test for the structural resonance level. If the diagnosis result is NG, change the measurement position or dampen the vibration components around the resonance frequency by damping, or other means.

In addition, monitoring the Structural Resonance Warning flag in FLAG (ND/EA) Register during sensor operation can determine if the measurement is being made properly. For details on these functions, please refer to the A342/A542 datasheet. The relevant descriptions are shown in Table 4.1.

Table 4.1 A342/A542 Structural Resonance Detection Functions

Usage Scenes	Functions	Data Sheet Descriptions
Preoperational Evaluation/Test	Self test function (structural resonance level test)	4.7 Self Test
In Operation	Flag function (structural resonance warning)	6.10 TEMP2 Register (Window 0) 6.4 FLAG (ND/EA) Register (Window 0)

4.2.2. A352/A552

In the case of the A352/A552, the output values can be used to determine whether there are any influences due to the structural resonance.

If the sensor outputs the upper and lower limits of the measurement range repeatedly or sharp spike-like waveforms are observed, measurement abnormality due to the structural resonance may be induced. Change the measurement position or dampen the vibration components around the resonance frequency by damping, or other means, if there are such indications.

5. Contact

AMERICA

EPSON AMERICA, INC.
214 Devcon Drive,
San Jose, CA 95112, USA
Phone: +1-800-228-3964 FAX: +1-408-922-0238

EUROPE

EPSON EUROPE ELECTRONICS GmbH
Riesstrasse 15, 80992 Munich,
GERMANY
Phone: +49-89-14005-0 FAX: +49-89-14005-110

ASIA

EPSON (CHINA) CO., LTD.
4F,Tower 1 of China Central Place,81 Jianguo Street, Chaoyang District, Beijing 100025 CHINA
Phone: +86-400-810-9972 X ext.2
Mail EPSON_MSM@ecc.epson.com.cm

EPSON SINGAPORE PTE. LTD.
438B Alexandra Road, Block B Alexandra TechnoPark, #04-01/04, Singapore 119968
Phone: +65-6586-5500 FAX: +65-6271-3182

EPSON TAIWAN TECHNOLOGY & TRADING LTD.
14F, No. 7, Song Ren Road,
Taipei 110, TAIWAN
Phone: +886-2-8786-6688 Fax: +886-2-8786-6660

EPSON KOREA Co., Ltd.
10F Posco Tower Yeoksam, Teheranro 134 Gangnam-gu,
Seoul, 06235 KOREA
Phone: +82-2-558-4270 Fax: +82-2-3420-6699

JAPAN

SEIKO EPSON CORPORATION.
DEVICE SALES & MARKETING DEPT.
29th Floor, JR Shinjuku Miraina Tower, 4-1-6 Shinjuku, Shinjuku-ku, Tokyo, 160-8801, Japan
Phone: +81-3-6682-4322 FAX: +81-3-6682-5016

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