

# 3 Axis Vibration Sensor

## M-A542VR10



Product number  
**M-A542VR10 : E91E614120**



- Capable of measuring velocity, velocity RMS, and velocity P-P (ISO10816 / ISO20816 compliant)
- Frequency response characteristics: 10 Hz to 1,000 Hz (-3dB)
- Insensitive to magnetic influences
- High dynamic range:  $\pm 100$  mm/s (110 dB)
- 3-axis digital output RS422
- Waterproof and dustproof IP67

### Recommended Application

- MHM (Machine Health Monitoring) • Condition Based Maintenance (CBM) • Motion analysis and control
- SHM (Structural Health Monitoring) • Vibration analysis, control and stabilization • Lissajous analysis

### Recommended Operating Condition

Parameter	Condition	Min	Typ	Max	Unit
V <sub>IN</sub> to GND		9	12	32	V
Input Voltage	RD+ / RD-		5		V
Operating Temperature Range		-30		70	°C

### Specifications

T<sub>A</sub> = -30°C to +85°C, VCC = 3.15V ~ 3.45V,  $\leq \pm 1G$ , unless otherwise noted.

Parameter	Test Conditions / Comments	Min	Typ	Max	Unit
<b>VELOCITY</b>					
Sensitivity					
Output Dynamic Range	f = 10 Hz ~ 1000Hz			$\pm 100$	mm/s
Scale Factor	2 <sup>-22</sup> m/s/LSB		2.38*10 <sup>-4</sup>		mm/s/LSB
Sensitivity Error	25 °C, $\leq 1 G$	-1550		1550	$\times 10^{-6}$ (ppm)
Nonlinearity	$\leq 1 G$ , Best fit straight line, RT	-0.15		0.15	% of FS
Cross Axis Sensitivity	No alignment correction		$\pm 0.9$ *3		%
Noise					
Noise Density	25 °C, Avg, f = 200 Hz ~ 1000Hz		1.4*10 <sup>-4</sup>		mm/s/√Hz, rms
Cantilever Resonance Frequency	25 °C, VCC 3.3 V		4,460		Hz
Frequency Property					
Frequency Range	-3 dB at 25 °C		10~1,000		Hz
<b>DISPLACEMENT</b>					
Sensitivity					
Dynamic Range	f = 1 Hz ~ 100 Hz			$\pm 200$	mm
Scale Factor	2 <sup>-22</sup> m/LSB		2.38*10 <sup>-4</sup>		mm/LSB
Nonlinearity	$\leq 1 G$ , Best fit straight line, RT	-0.15		0.15	% of FS
Cross Axis Sensitivity			$\pm 0.9$ *3		%
Noise					
Noise Density	25 °C, Avg, f = 20 Hz ~ 100 Hz		0.7*10 <sup>-5</sup>		mm/√Hz, rms
Frequency Property					
Frequency Range	-3 dB at 25 °C		1~100		Hz
<b>TEMPERATURE SENSOR</b>					
Output Range		-40		85	°C
16bit Scale Factor *1	Output = 2634(0x0A4A) at 25 °C		-0.0037918		°C/LSB
8bit Scale Factor *1	Output = 2634(0x0A4A) at 25 °C		-0.9707008		°C/LSB
<b>RELIABILITY</b>					
MTBF*2	JIS-C5003 TA = 25 °C	87,600			hour

\*1) This is a reference value used for the internal temperature correction, and is not guaranteed to accurately output the interior temperature.

\*2) The MTBF is an estimated value derived from the result of high temperature operation with a system requirement of TA = 25°C and a 60% reliability level.

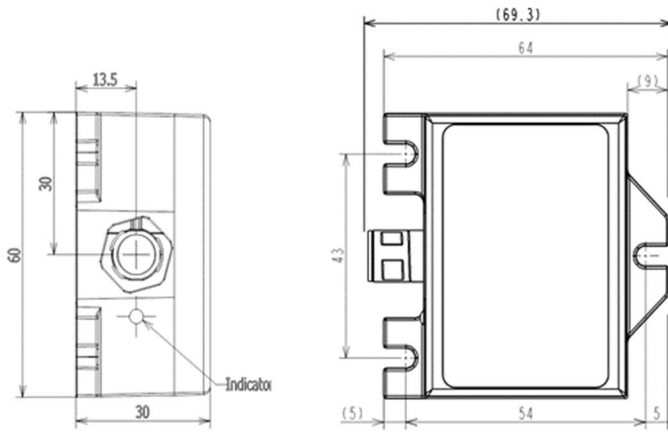
\*3) When the alignment is corrected by the host, the other axis sensitivity is Typ. 0.1 %.

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.

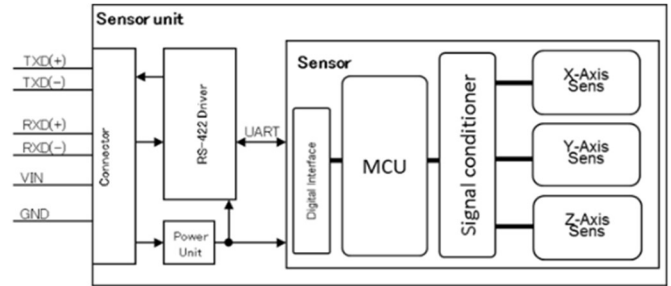
Note) The Max/Min value is the maximum/minimum value of the design or factory shipment examination, unless otherwise specified.

Note) The calibrated standard 1G gravitational acceleration value is 9.80665 m/s<sup>2</sup>

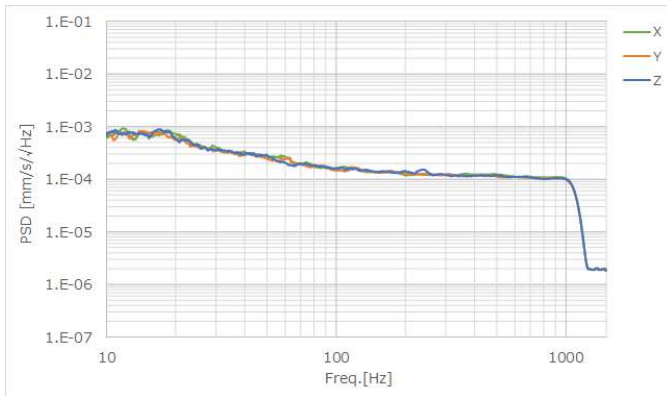
## Outline Dimensions



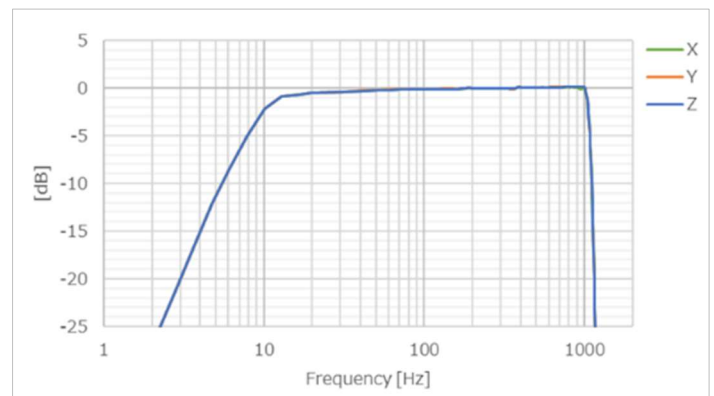
## Block Diagram



## Noise Density (Velocity Output)



## Frequency Response (Velocity Output)



The product characteristics shown above are just examples and are not guaranteed as specifications

## Notice of the Document

NOTICE : PLEASE READ CAREFULLY BELOW BEFORE THE USE OF THIS DOCUMENT ©Seiko Epson Corporation 2020

- The content of this document is subject to change without notice. Before purchasing or using Epson products, please contact with sales representative of Seiko Epson Corporation ("Epson") for the latest information and be always sure to check the latest information published on Epson's official web sites and resources.
- This document may not be copied, reproduced, or used for any other purposes, in whole or in part, without Epson's prior consent.
- Information provided in this document including, but not limited to application circuits, programs and usage, is for reference purpose only. Epson makes no guarantees against any infringements or damages to any third parties' intellectual property rights or any other rights resulting from the information. This document does not grant you any licenses, any intellectual property rights or any other rights with respect to Epson products owned by Epson or any third parties.
- Using Epson products, you shall be responsible for safe design in your products; that is, your hardware, software, and/or systems shall be designed enough to prevent any critical harm or damages to life, health or property, even if any malfunction or failure might be caused by Epson products. In designing your products with Epson products, please be sure to check and comply with the latest information regarding Epson products (including, but not limited to this document, specifications, data sheets, manuals, and Epson's web site). Using technical contents such as product data, graphic and chart, and technical information, including programs, algorithms and application circuit examples under this document, you shall evaluate your products thoroughly both in stand-alone basis and within your overall systems. You shall be solely responsible for deciding whether to adopt/use Epson products with your products.
- Epson has prepared this document carefully to be accurate and dependable, but Epson does not guarantee that the information is always accurate and complete. Epson assumes no responsibility for any damages you incurred due to any misinformation in this document.
- No dismantling, analysis, reverse engineering, modification, alteration, adaptation, reproduction, etc., of Epson products is allowed.
- Epson products have been designed, developed and manufactured to be used in general electronic applications and specifically designated applications ("Anticipated Purpose"). Epson products are NOT intended for any use beyond the Anticipated Purpose that requires particular quality or extremely high reliability in order to refrain from causing any malfunction or failure leading to critical harm to life and health, serious property damage, or severe impact on society, including, but not limited to listed below ("Specific Purpose"). Therefore, you are strongly advised to use Epson products only for the Anticipated Purpose. Should you desire to purchase and use Epson products for Specific Purpose, Epson makes no warranty and disclaims with respect to Epson products, whether express or implied, including without limitation any implied warranty of merchantability or fitness for any Specific Purpose. Please be sure to contact our sales representative in advance, if you desire Epson products for Specific Purpose:  
Space equipment (artificial satellites, rockets, etc.)/Transportation vehicles and their control equipment (automobiles, aircraft, trains, ships, etc.)/Medical equipment/Relay equipment to be placed on sea floor/ Power station control equipment/Disaster or crime prevention equipment/Traffic control equipment/Financial equipment  
Other applications requiring similar levels of reliability as the above
- Epson products listed in this document and our associated technologies shall not be used in any equipment or systems that laws and regulations in Japan or any other countries prohibits to manufacture, use or sell. Furthermore, Epson products and our associated technologies shall not be used for the purposes of military weapons development (e.g. mass destruction weapons), military use, or any other military applications. If exporting Epson products or our associated technologies, please be sure to comply with the Foreign Exchange and Foreign Trade Control Act in Japan, Export Administration Regulations in the U.S.A (EAR) and other export-related laws and regulations in Japan and any other countries and to follow their required procedures.
- Epson assumes no responsibility for any damages (whether direct or indirect) caused by or in relation with your non-compliance with the terms and conditions in this document or for any damages (whether direct or indirect) incurred by any third party that you give, transfer or assign Epson products.
- For more details or other concerns about this document, please contact our sales representative.
- Company names and product names listed in this document are trademarks or registered trademarks of their respective companies.

**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