

## Data Sheet



# FORCE FEEDBACK DIGITAL ACCELEROMETER

**MODEL EADA-350F**

## INTRODUCTION

Encardio-rite model EADA-350F is a digital, force feedback, triaxial accelerometer with digitizer and data acquisition system integrated in a single unit, designed for specific applications in seismology, hazard mitigation and civil & earthquake engineering to study the response of mega structures like dams, barrages, underground caverns & tunnels etc., in case of any seismic activity. It's extremely large dynamic range exceeding 145 dB makes it ideal equipment for the applications in the open field and to study the ambient ground accelerations. The unit is manufactured by Encardio-rite in India under license from Gaiacode, UK

## DESCRIPTION

Model EADA-350F triaxial accelerometer is based on a truly rectilinear suspension system. The internal 8 channel 24 bit high resolution digitizer utilizes the wide dynamic range of the feedback sensor. The three axis strong motion accelerometer is housed in an 'O' ring sealed Hard Anodized water proof Aluminium case. The system is self-contained, except for the power source.

Three separate concurrent digital data outputs ports are provided, which are Ethernet, USB and serial RS-232 outputs. External GPS module time synchronizes the digital accelerometer.



As a backup NTP time synchronization is available. An isolated dc-dc converter ensures galvanic isolation of the system and operates from 9 to 36 Volts.

The analogue feedback accelerometer has an extremely large dynamic range and 8 channel 24 bit acquisition system is incorporated to exploit the full dynamic range of the sensor as high gain and low gain digital outputs.

The low and high gain outputs are set digitally using the Programmable Gain Amplifiers (PGA) of the 8 channel Acquisition system. Nominally the high gain outputs are set to have a 12 times larger output than the low gain outputs.

The sensor's Analogue differential outputs are interfaced to the differential inputs of the digitizer. The digital part of the circuit is optically isolated from the front end ADC converter circuitry.

Figure 1 shows the sensor connector turret. The connector turret allows easy connection to the sensor. All the connectors are water proof with O ring seals to a depth of 2 meters of water. The display provides state of health information of the feedback sensor and the digitizer.

Full-scale low and high gain sensitivity is digitally user-adjustable from  $\pm 4.0$  g to  $\pm 0.33$  g on individual channels of the digitizer. The standard frequency pass band is flat to acceleration from DC to 350 Hz.

Detailed sensor calibration information is provided with every sensor, including sensor dc calibration levels, frequency response of the instrument and the transfer function in poles/zeros notation. The digitizer calibration values are also provided and the calibration values are stored within the digitizer.

It is extremely simple to install the digital sensor, Single point slotted base bolt point ensures that the sensor is fixed firmly to the installation point. Three levelling feet with the bubble level indicator on top are provided to level the sensor and lock the installation bolt.

The North/South ordination point is machined on the sensor base and the sensor component fixing screws are fixed with dowel pins to achieve highest possible orientation accuracy. The errors in pointer to the sensor orientation is less than  $\pm 0.1$  degrees.

After installation the sensor output offsets are nulled

electronically, without exposing the insides of the accelerometer.

The digital sensor noise performance is better than  $0.15 \mu\text{m/s}^2/\sqrt{\text{Hz}}$ .

The digital accelerometer is provided with different connector options. Either with Encardio-rite D type water proof connectors or Mil-spec connectors as shown in the following Figure 3 and 4.



Figure 1 Feedback accelerometer with our unique D Type waterproof connectors

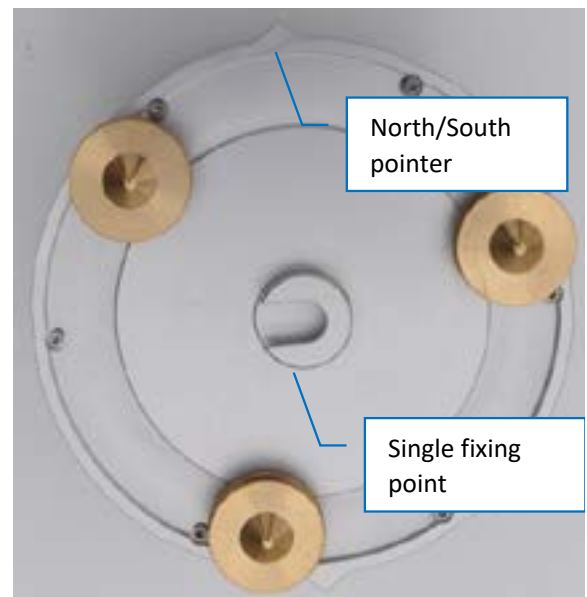


Figure 2 Accelerometer base with fixing point and Orientation indicators machined to the base of the sensor



Figure 3 Feedback accelerometer with Mil spec connectors



Figure 4 Feedback accelerometer with Encardio-rite D Type waterproof connectors

## SPECIFICATIONS

Sensor Module	
Standard frequency response	Flat acceleration response dc to 350 Hz
Damping	0.7 critical
Clip level	> FS
Analogue sensor sensitivity	
Differential	$\pm 4 \text{ g} \cdot 2 \cdot 0.5 \text{ V/m/s}^2$ for 20 Vdc
Configurable	$\pm 2 \text{ g}, \pm 1 \text{ g}, \pm 0.5 \text{ g}$
Sensor control lines	
Centre the sensor mass positions	Serial (RS 232) and Logic line control.
Offset adjustment	On demand
Calibration On/Off	Serial (RS 232) and Logic control line
Calibration signal	Can be applied to each axis. The calibration signal can be any form of signal
Feedback calibration Constant	Provided in the calibration document for each sensor axis
Cross axis rejection	0.001 g/g, 3-axis orthogonal rectilinear suspension system
Linearity	0.01%. 90 % of full-scale
Lowest spurious resonance	550 Hz for vertical and horizontal modules

Digitizer recorder module	
Operational performance	Independent 8--24 bit Delta Sigma Digitizer with simultaneous sampling
Dynamic range	Sample rate: 1 KHz: -122.2 dB, at:100 Hz:-136.3 dB, at: 10 Hz - 138.4 dB (full scale P-P to RMS shorted input noise)
Gain accuracy	$\pm < 0.5\%$ , Each channel calibrated
Configurable preamplifier (PGA)	Gain settings *1, *2, *4, *8 *12. Each channel independently controlled
Sample rates	1, 2, 5, 10, 20, 40, 50, 100, 125, 200, 250, 500, 1000 (user selectable). Four separate same rates are available concurrently
Wave forms	Square, Sine, Step, Pulse with duty cycle and frequency control and Pseudo random signals. Generated with an internal synthesizer
Digital filters	User selectable, high pass and band pass digital filters
Data storage format	MiniSEED and PCF (proprietary data Format)
Internal storage memory	32 GB SD card. Data downloadable via USB or Ethernet
External storage	2 X 32 GB hot swappable media
Triggers	Threshold trigger with high-pass filter (user selectable). STA/LTA: Band passed ratio-metric trigger. 244 sec. pre and post event recording in SEED protocol.
LED indicators	TCP/IP activity
Colour display	Displays operational parameters, State of health information
Available interfaces	10/100 Base-Ethernet, USB, Serial RS232
IP addressing	Static, dynamic (DHCP)
Protocols	UDP/IP unicast/multicast



<b>Recording/acquisition software options</b>	SeisGram2K: Swarm: Earthworm: jAmaSeis
<b>GPS Unit</b>	External GPS receiver with RS232 interface
<b>Time source</b>	GPS, GNSS, NTP or internal source. (NTP software selectable)
<b>Time format</b>	NMEA
<b>Timing accuracy</b>	±<50 Nanoseconds
<b>Maximum cable</b>	15 m (for GPS) standard; extendable up to 150 m using specified cable only
<b>Step function response</b>	Digitally generated signal, from 24 bit DAC
<b>Output voltage</b>	±20 V (40 V PP)
<b>Operating temperature range</b>	-20 to +75°C
<b>Humidity</b>	0 to 100%
<b>Current at 12 Vdc</b>	197 milli amp with polarity protection. With TCP/IP communication and GPS included
<b>Power supply</b>	+9 to +36 VDC, Galvanically isolated supply input with reverse voltage protection
<b>Power consumption</b>	Less than 2.1 Watts
<b>Pressure jacket material</b>	Hard anodized aluminium
<b>Power/signal connector</b>	Unique water proof D Type connector. Mil-spec connectors on the connector turret
<b>Protection</b>	IP-68
<b>North South pointer</b>	Machined to the base. North-black; South-white.
<b>Case dimensions &amp; weight</b>	Dia: 165 mm Height/Weight: 155 mm/2.75 kg with Mil-spec connector; 145 mm/2.45 kg with D type connector
Calibration controls - can be remotely calibrated Sensor casing is isolated for the signal ground and sensor input power. All outputs are protected against transients	

Made by Encardio-rite in India under license from Gaiacode, UK

\*All specifications are subject to change without prior notice

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