

## BROADBAND SEISMOMETER WITH DIGITAL OUTPUT

### MODEL ESDA-120S



### INTRODUCTION

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Encardio-rite model ESDA-120S digital feedback broad band seismometer is based on a truly rectilinear suspension system. Internal 8 channel 24 bit high resolution digitizer utilizes the wide dynamic range of the feedback sensor.

Three axis broad band sensor 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, these being 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 wide input range dc-dc converter ensures galvanic isolation of the system and operates from 9 to 36 Volts. The power input is reverse polarity protected including the protection provided by the dc-dc converter.



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 digital outputs are set to have a 12 times larger output than the low gain outputs. Sensor Analogue outputs are all differential interfaced to the differential inputs of the digitizer. The digital part of the circuit is optically isolated from the front end ADC converter circuitry.

### Description

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. The sensor housing including the connectors are water proof to a depth of 3 meters of water.

The standard frequency pass band is flat to velocity from (120 Seconds period) 0.00833 Hz to 150 Hz.

Detailed sensor calibration information is provided with every sensor, including sensor feedback coil constant, frequency response of the instrument and the transfer function in poles/zeros notation.

The digitizer calibration values for the sensor and digitizer are stored with in the digitizer.

It is extremely simple to install the digital sensor. Three levelling feet ensure that the sensor to be levelled. The North/South ordination pointes are machined on the sensor base to align the sensor accurately. The errors in pointer to the sensor orientation is less than 0.1 degrees.

After installation the sensor output offsets are nulled with motorized zeroing mechanism.

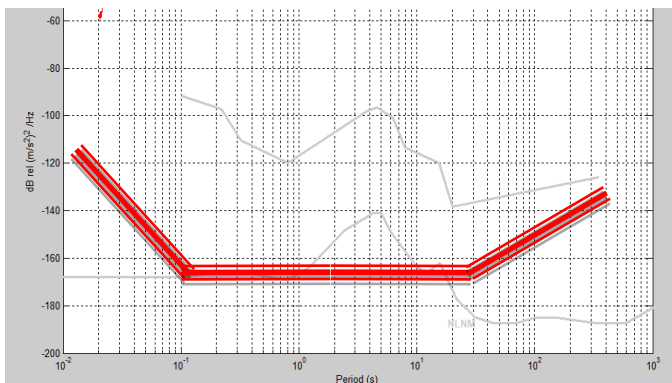


Figure 1 Strong motion Accelerometer



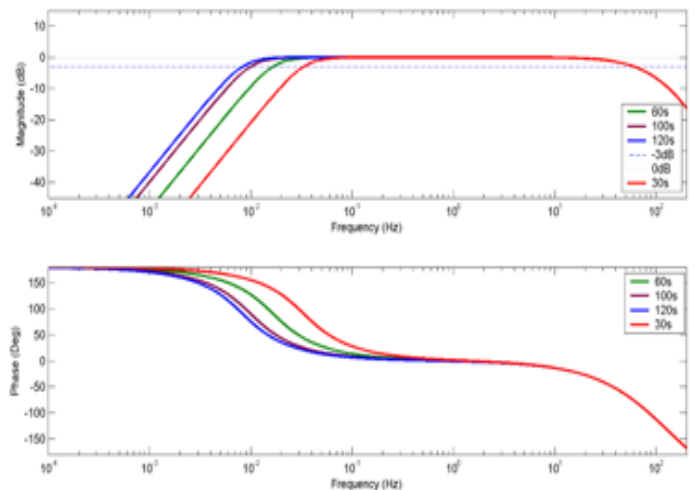
Figure 2 Accelerometer base with fixing point and Orientation indicators machined to the base of the sensor

Acceleration Ground referenced Power Spectral noise estimate in 1 Hz bandwidth in units of  $(m^2/s^4)/Hz$



Triple red line is estimate of sensor power spectral noise density over the entire seismic spectrum.

The frequency response options for the broad band sensor





## SPECIFICATIONS

|                          |  |
|--------------------------|--|
|                          | Flat velocity (120 sec) 0.008333 Hz to 150 Hz            |
| Standard response        | 2*1200 V/m/s   |
| Other optional responses | 0.01666 (60 sec) to 150 Hz<br>0.03333 (30 sec) to 200 Hz |

## Controls

|                  |   |
|------------------|---|
| Calibration      | The calibration signal can be connected to each axis. Calibration enable line provided. Cal enable lines (active low) <1 mAmp |
| Mass centering   | Microprocessor controlled. Automatic centering with remote control  |
| Mass lock/unlock | Not required  |

## Physical

|                           |                                       |
|---------------------------|---------------------------------------|
| Lowest spurious resonance | 320 Hz vertical,<br>375 Hz Horizontal |
| Mass re-centering range   | ±4.0° from horizontal                 |
| Operating temp. range     | - 20 to + 75°C                        |
| Base plate and top cap    | Hard Anodized Aluminium               |
| Pressure jacket material  | Hard Anodized Aluminium               |
| Power/signal connector    | Air-tight Connectors                  |

## Power

|                                     |  |
|-------------------------------------|--|
| Standard power supply               | + 9 to 36 Vdc, with internal DC/DC converter |
| Current at standard (12 V) output   | + 75 mA                                      |
| Additional cal relay current        | < 25 mA                                      |
| Additional current when recent ring | + 35 mA (see Operator's Guide)               |

## Digitizer Performance

|                           |   |
|---------------------------|---|
| Standard Output Format    | 24 Bits   |
| Noise-free Resolution     | Sample rate 1K Hz -122.2 dB<br>Sample rate 100 Hz-134.3 dB<br>Sample rate 10 Hz -144 dB                         |
| Absolute Accuracy         | 0.1 %   |
| Differential inputs       | All inputs are adjusted o the digitizer output voltage and impedance  |
| Cross talk                | < -110 dB @ 40 s/s  |
| Total harmonic distortion | < -100 dB @ 40 sps  |
| Digital Signal Processor  | Multiple sample rates, with causal and a-causal filter selection and 4 concurrent sample rates for each channel |
| Maximum SAMPLE rate       | 1000 s/s  |
| Trigger Modes             | STA/LTA. Each Channel is programmable   |

## Timing options

|                      |   |
|----------------------|---|
| GPS Unit Time format | GPS, GNSS and NTP<br>NMEA, External GPS Receiver with RS232 Interface |
| Maximum Cable        | 10 meters   |

## Calibration controls – remotely calibrated

|                                    |   |
|------------------------------------|---|
| Step function response             | Digitally generated signal. , from 24 bit DAC       |
| Calibration inputs from 24 Bit DAC | Sine, step and pseudo-random inputs may be inserted |

## Physical

|                        |   |
|------------------------|---|
| Power/signal connector | Gold plated water proof D Type connector. |
|------------------------|---|