KINEMETRICS, Inc.

EpiSensor2

Shallow Borehole

Strong Motion Accelerometer
User Manual

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No User-Serviced Parts

The Shallow Borehole EpiSensor2 is a self-contained seismic accelerometer packaged in a slimline borehole package. There is no reason to open the sensor package, or to modify the electronics or sensor elements contained within it. There are no internal manual adjustments to make, nor are there any user-serviced parts within the sensor. Opening and/or modifying the sensor is unnecessary, and doing so will void the instrument's warranty.

Electrical Safety Notice

As with all electrical instruments, potentially lethal potentials can be present on all metal surfaces, including conductors within any cables. Proper grounding of these elements is important to minimize these risks. The user of this product is responsible for its installation and operation in a safe manner, and in accordance with all local requirements for electrical safety.

Introduction and Product Description

The Shallow Borehole EpiSensor2 is an advanced force-balance, triaxial accelerometer that builds upon the outstanding record of its predecessor, the EpiSensor (the world's first seismological-grade strong motion accelerometer). It is packaged for small diameter borehole applications, to depths of about 100 meters. The high dynamic range of the EpiSensor2 allows both weak and strong motion recording from a single sensor.

The EpiSensor2 provides a broad set of electronically-controlled operational modes, including range-switching (allowing 4g, 2g, 1g, 0.5g, and 0.25g peak, full-scale ranges), Offset removal (AUTOZERO mode), and calibration. These modes can be controlled remotely, either via the digitizer (using selected enable lines) or via an RS-422 command line interface.

An important feature of the EpiSensor2 is its very low quiescent power consumption: under 350 mW. The sensor consumes 60% to 70% lower power than competing strong motion accelerometers. This makes it ideal for remote, battery-powered applications.

The Shallow Borehole EpiSensor2 module, including its potted cable, is shown in Figure 1.

Figure 1 Shallow Borehole EpiSensor2 module.

Electrical Connections

The Shallow Borehole EpiSensor2 contains an integral potted cable, design for high reliability and long lifetime, at depth. The cable is “pigtailed”, providing bare wire connections at its outer end. Figure 2 shows a close up of the pigtailed end. This reflects the existence of three (3) “bundles” of wires: Signal Bundle (SB), Control Bundle (CB), and Power Bundle (PB). Each bundle is wrapped with insulating tubing at the pigtailed and, and each comes with a dedicated drain wire that has black insulation on it.. The connection details of the cable are shown in Table 1.

Pigtaile End Connection	Signal	Notes
Wire 1/Pair 1 (SB): White	X_ACC_PLUS	
Wire 2/Pair 1 (SB): Black	ACC_MINUS	
Wire 1/Pair 2 (SB): White	Y_ACC_PLUS	
Wire 2/Pair 2 (SB): Brown	Y_ACC_MINUS	
Wire 1/Pair 3 (SB): White	Z_ACC_PLUS	
Wire 2/Pair 3 (SB): Red	Z_ACC_MINUS	
Wire 1/Pair 4 (SB): White	ANALOG_GND	
Wire 2/Pair 4 (SB): Orange	ENABLE_GND_FIELD	
Wire 1/Pair 5 (CB): White	Z_RANGE_VOLTAGE	
Wire 2/Pair 5 (CB): Yellow	Y_RANGE_VOLTAGE	

Wire 1/Pair 6 (CB): White	X_RANGE_VOLTAGE	
Wire 2/Pair 6 (CB): Green	MSP430_RESET_FIELD	
Wire 1/Pair 7 (CB): White	CAL_ENABLE_FIELD	
Wire 2/Pair 7 (CB): Blue	AUTOZERO_ENABLE_FIELD	
Wire 1/Pair 8 (CB): White	CAL_PLUS	
Wire 2/Pair 8 (CB) :Violet	CAL_MINUS	
Wire 1/Pair 9 (CB): White	RANGE_ENABLE_FIELD	
Wire 2/Pair 9 (CB): Gray	MSP430_RS422_GND_FIELD	
Wire 1/Pair 10 (CB): Black	MSP430_RS422_TX+_FIELD	
Wire 2/Pair 10 (CB): Brown	MSP430_RS422_TX-_FIELD	
Wire 1/Pair 11 (CB): Black	MSP430_RS422_RX+_FIELD	
Wire 2/Pair 11 (CB): Red	MSP430_RS422_RX-_FIELD	
Wire 1/Pair 12 (PB): Black	INPUT_POWER_PLUS_FIELD	

Wire 2/Pair 12 (PB): Orange	INPUT_POWER_RETURN_FIELD	
Signal Bundle (SB) Drain Wire (Black Insulation)	SIGNAL_BUNDLE_SHIELD	
Control Bundle (CB) Drain Wire (Black Insulation)	CONTROL_BUNDLE_SHIELD	
Power Bundle (PB) Drain Wire (Black Insulation)	CASE_GND	

Table 1 Connections to sensor through pigtail cable. The "FIELD" suffix reflects those lines that are outside the system's galvanic isolation barrier.

Generally, we recommend connecting the Signal Bundle (SB) and Control Bundle (CB) shields, to an Analog Ground signal, at the digitizer end. For users of Quanterra Q330 or Kinemetrics' Rock series digitizers, these would connect to digitizer pins C and F, respectively.

The digital enable lines are fully-isolated from other lines in the system. They operate over an approximate 2V to 10V input range. The RS-422 interface is fully isolated as well.

The power inputs (pins b and c) require voltage range of 9-36V at the sensor input. This galvanically-isolated input has reverse-polarity protection, as well as overcurrent protection.

The ANALOG_GND ground line is the common mode voltage reference for the differential signal lines. It also serves as the reference ground for the range voltage signals.

The calibration (CAL) input is differential, with a +/-12V range. The common mode reference for these signals is ANALOG ground.

DO NOT USE THE ELECTRICAL CABLE FOR LIFTING!!! As discussed below, there is a bolt pattern on the sensor top cap designed for lifting/deployment hardware.

Please contact Kinemetrics to discuss specific cable requirements.

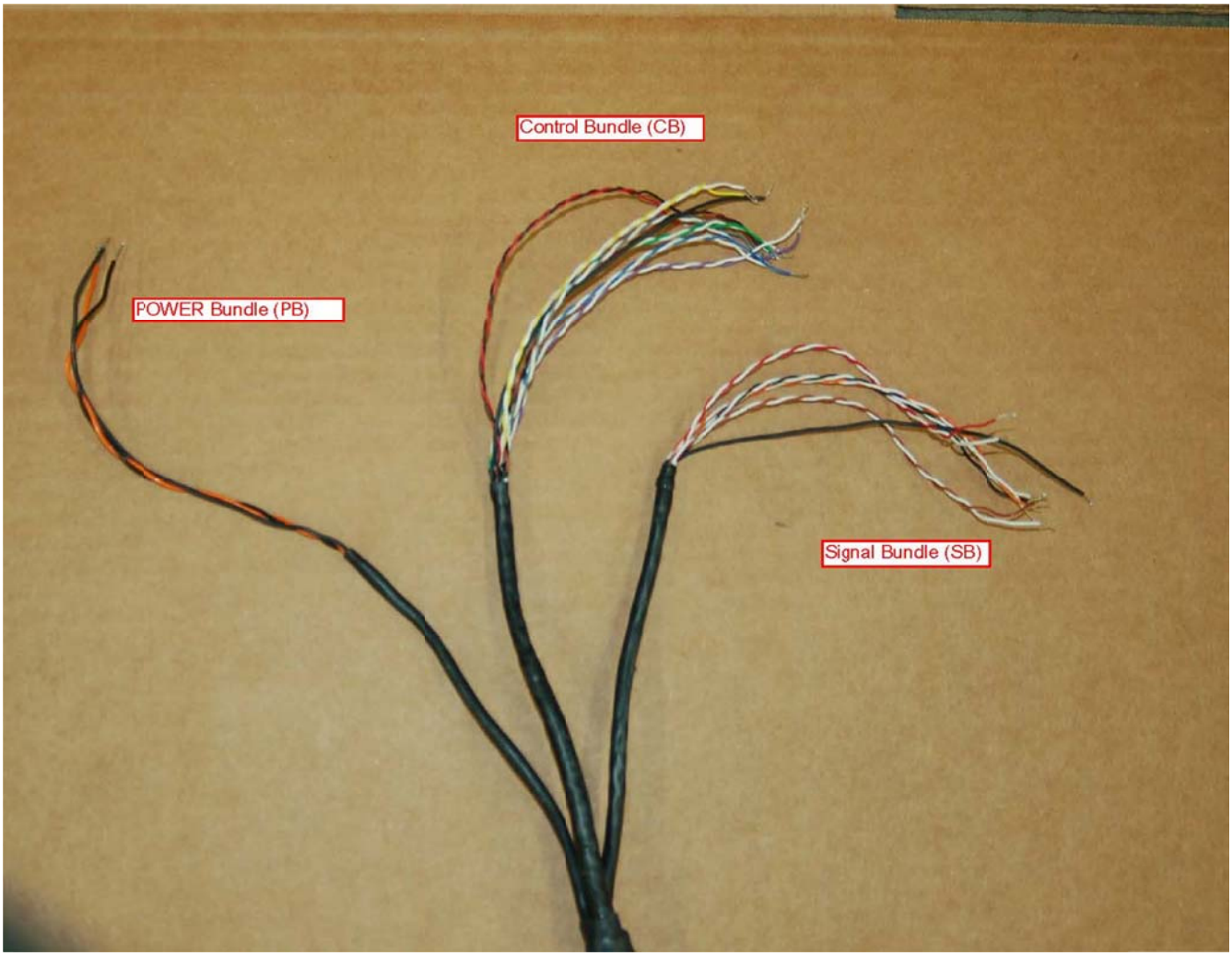

Figure 2 Details of pigtail end of cable.

Operational Control of the Shallow Borehole EpiSensor2

The sensor can be controlled in two ways: digitizer enable lines (remote) and RS-422 (local and/or remote). Using either of these, the operator can control the full-scale range, and AUTOZERO state, of the sensor. Using either control mode, the user can exercise a complete calibration (CAL) capability. Using a dedicated digital line connected to the digitizer, the operator can issue a RESET to the sensor that is similar to a Power-ON-RESET. Finally, the user can employ the RS-422 interface to communicate with the sensor to receive a variety of sensor-specific information (serial numbers, scalar response values, etc.). The RS-422 command line menu is discussed further below.

Full-Scale Ranges

The Shallow Borehole EpiSensor2 supports five digitally-selectable ranges (with nominal scale factors):

Range 5: +/-4g (5 V/g)
Range 4:+/-2g (10 V/g)
Range 3: +/-1g (20 V/g)
Range 2: +/-0.5g (40 V/g)
Range 1: +/-0.25g (80 V/g)
The scale factors for these ranges are factory-trimmed to an accuracy of +/- 0.25%.

Digitizer Enable Lines (Q330 used for this description)

1. The sensor monitors the Q330's Generic Enable line 3 (“AUX 2”).
2. A pulse-length encoding scheme is used to select the range
   - Asserting the line for between 4.5 and 5.5 seconds places the sensor range at +/-4g
   - Asserting the line for between 3.5 and 4.5 seconds places the sensor range at +/-2g
   - Asserting the line for between 2.5 and 3.5 seconds places the sensor range at +/-1g
   - Asserting the line for between 1.5 and 2.5 seconds places the sensor range at +/-0.5g
   - Asserting the line for between 0.5 and 1.5 seconds places the sensor range at +/-0.25g

RS-422 Command Line Interface

1. At the MAIN prompt, enter “enable12345” to allow access to command menus
2. Type “OPERATE” to select OPERATE page
3. At the OPERATE prompt, type command to select range:
   1. “4g” for +/-4g
   2. “2g” for +/-2g
   3. “1g” for +/-1g
   4. “0.5g” for +/-0.5g
   5. “0.25g” for +/-0.25g

Range Signaling

The EpiSensor2 feeds a range-dependent signal into the the low resolution mass position channels of the Q330 or Rock digitizers:

5V (~50 counts) for +/-4g range
4V (~40 counts) for +/-2g range
3V (~30 counts) for +/-1g range
2V (~20 counts) for +/-0.5g range
1V (~10 counts) for +/-0.25g range

In addition, the Episensor2 outputs a coded range signal to each of the channels' SIGNAL line:

5 pulses for +/-4g range
4 pulses for +/-2g range
3 pulses for +/-1g range
2 pulses for +/-0.5g range

1 pulse for +/-0.25g range

This signal is output at power-ON, following a RESET event, and following any range-setting activity. Typical pulses, for 4g range, are shown in Figure 3.

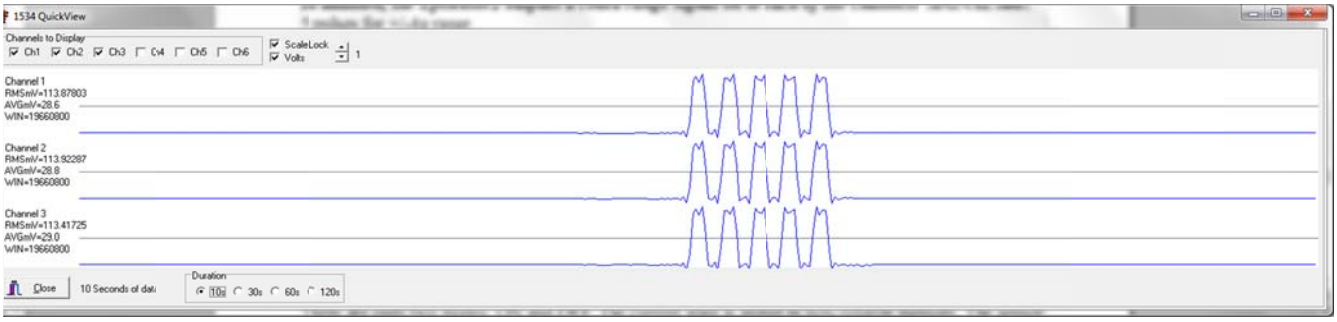

Figure 3 Pulse-train range signal for +/-4 g range.

AUTOZERO

The Shallow Borehole EpiSensor2 has an autozero capability that will remove DC-offsets from the signal, up to an acceleration-equivalent limit of +/-100 mg. Autozero operates simultaneously on all three channels. There are only two modes: ON and OFF. The current state is stored in non-volatile memory. The sensor will enter the appropriate state after a POR event.

There are two ways to control the Autozero state:

Q330 Enable Lines (Q330 used for this description)

1. The sensor monitors Q330 Generic Enable line 1.
2. A pulse-length encoding scheme is used to set the AUTOZERO state:
   - Asserting the line for between 1 and 3 seconds (2 seconds nominal) turns AUTOZERO ON
   - Asserting the line for between 4 and 6 seconds (5 seconds nominal) turns AUTOZERO OFF

RS-422 Command Line Interface

1. At the MAIN prompt, enter “enable12345” to allow access to command menus
2. Type “OPERATE” to select OPERATE page
3. At the OPERATE prompt, type command to select range:
   - “AUTOZEROON” turns ON Autozero
   - “AUTOZEROOFF” turns OFF Autozero

CAL (Calibration)

The Shallow Borehole EpiSensor2 allows the injection of external calibration signals into the sensors. All three axes are excited simultaneously.

There are two ways to control the CAL state.

Q330 Enable Lines (Q330 used for this description)

1. The sensor monitors Q330 CAL_ENABLE line
2. Asserting the line enables CAL. Signals presented at the CAL+/- input pins of the connector will be injected into the calibration circuit of the sensor
3. De-asserting the line disables CAL
4. The sensor operates seamlessly with the standard "Start/Stop Sensor Calibration" commands in the Q330 control software (Willard).

RS-422 Command Line Interface

1. At the MAIN prompt, enter "enable12345" to allow access to command menus
2. Type "OPERATE" to select OPERATE page
3. At the OPERATE prompt, type command to select range:
   - "CALON" enables CAL
   - "CALOFF" disables CAL

RESET

Asserting the Q330 Generic Enable 2 ("AUX 1") line rests the sensor. It effect is equivalent to a Power-ON-RESET (POR) event, without interrupting the power.

Setup and Initial Operation

The Shallow Borehole EpiSensor2 should be deployed within a well-formed hole that completely surrounds and covers the sensor. The sensitive horizontal directions (X and Y) are defined via a marking (so-called "N") on the top cap of the sensor. The line next to "N" is aligned with Y. On the higher ranges (i.e., 4g, 2g, and 1g), the sensor can operate at nearly any tilt angle. However, the lowest noise performance is achieved by leveling the sensor carefully (with the package body being aligned to the local vertical).

Upon power-ON, or a RESET event, the sensor will output an analog signal on its range indicator lines. These will be recorded by the digitizer. The user can verify the current range setting by monitoring these values, or by analyzing the pulse-train sequence, shown in Figure 3. It is recommended to monitor the sensor output via the RS-422 interface, to verify proper startup. The sensor will output a set of status values, as indicated below, at startup.

At this point, the sensor is operational.

Operational Details

Choice of Digitizer

The instantaneous dynamic range of the sensor is greater than that of any modern seismic digitizer, particularly when operating on the 4g and 2g ranges. 26-bit digitizers (such as the Q330HR) are preferred for utilizing the greatest part of this range. More conventional 24-bit digitizers also work well, however, the self-noise of a properly installed sensor is well below that of the input noise of the digitizer. Some digitizers provide integrated preamplifiers. While these are useful for investigation of the exact levels of sensor self-noise, their use will greatly reduce the full-scale range of the sensor. This effectively defeats the purpose of a "strong

motion accelerometer"! **Typically, the best system performance will be achieved by use of a Q330HR (26-bit) digitizer, with its preamplifiers OFF.**

Full-Scale Range Selection

Sensor dynamic range is typically highest on the highest full-scale range settings (+/-4g and +/-2g), where the 1 Hz dynamic range is in excess of 160 dB. However, sensor self-noise typically drops with range setting (although noise on 0.5g and 0.25g ranges are practically identical). *The choice of (peak) full-scale range should ensure that there is near-zero chance of clipping due to maximum local accelerations. Users should select ranges above the maximum expected signal.*

AUTOZERO Mode

The AUTOZERO system records and corrects the sensor offsets *in situ*. This correction cancels fixed mechanical offsets in the sensor element, as well as tilt-related offsets due to sensor mounting. It injects a separate feedback current that is automatically generated to cancel the observed offset. AUTOZERO is either OFF (standard mode), or ON. Any time that the sensor is RESET, or it experiences a Power-ON-RESET, or the AUTOZERO is explicitly set via the various control interfaces, the sensor re-calculates and corrects its offsets. When continuously powered, the sensor retains the same offset removal current setting.

AUTOZERO requires higher quiescent power consumption (about 120 mW extra), and it increases self-noise levels. Unless the user has special requirements (e.g., using a very low dynamic range digitizer requiring the use of input preamplifiers), *we recommend leaving the AUTOZERO in its OFF state. Any modern digitizer, as well as many data analysis algorithms, are not affected by DC-offsets in the signals, or in the digital data.*

Calibration (CAL)

Calibration is seamlessly supported through the digitizer connection. This includes a digital control line for connecting the (differential) calibration input signals to the sensor elements, and use of the voltage sources provided by the digitizer. For the Shallow Borehole EpiSensor2 (with DC-320+Hz bandwidth), random noise is an excellent calibration stimulus source.

Retention of Settings

The current full-scale range and AUTOZERO status (ON or OFF) is stored in EEPROM within the sensor. These settings are updated whenever the status is changed by the user (or the digitizer). Upon a system Power-ON-RESET, or simple RESET, the sensor is restored to the the stored operating configuration. The calibration status, however, is volatile. Following any RESET event, the calibration mode must be re-entered using either the digitizer enable line, or an RS-422 command.

Sensor Response Values

Each sensor element is trimmed during manufacture, to provide a standard scalar response (Volts/g) on each of the five (operating ranges). In addition, each sensor axis is trimmed to ensure that its response bandwidth falls within a set range (-3 dB amplitude point at or above 320 Hz).

The scalar responsivity (G) is stored on the "RESPONSE" page that is described below. A command query on this page ("status" command) will return the scalar response values for each element, at the current full-scale range setting.

The Episensor2 frequency response can be described well by a simple set of conjugate pole pairs:

P1 = -700+/-1250j (radians/second)
P2 = -1340+/-3350j (radians/second)

The full response is defined as:

$$V(s) = \frac{G\,|P1|^2\,|P2|^2}{(s-P1)(s-P1^*)(s-P2)(s-P2^*)}$$

where G is the scalar responsivity (Volts/Standard g). (A standard g is defined as 9.81 m/sec^2).

Input Power Requirements

The Shallow Borehole EpiSensor2 operates from a wide (9-36V) input supply range. The quiescent power consumption (input power in the absence of significant seismic signals, with the RS-422 interface disconnected) is under 350 mW. Typically, the current draw is 25 to 28 mA @ 12V.

A persistent RS-422 connection increases power consumption by 10 to 20 mW.

Dynamic signals increase *instantaneous* power consumption. A typical rule of thumb is that for every 1g increase in input signal, per axis, power consumption increases by about 150 mW. At the absolute highest drive levels: 4g simultaneously on each of the three axes (unheard of from natural seismic sources), this excess power consumption would amount to about 1.8W. Naturally, dynamic signals impose lower mean energy demands. Also, exact temporal correlation between signals on the three axes is very unlikely. The absolute maximum dynamic input power is almost certainly lower than 1.8W. As such, the maximum input power requirements, quiescent plus dynamic, is expected to be under 2W. As such, a low impedance, 2W power supply is sufficient for the EpiSensor2.

Like most analog sensor products, the power input has a moderate level of input capacitance (a few tens of microfarads). Any competent power source should be able to provide the instantaneous inrush currents (a few amps over a few tens of microseconds) required to charge these capacitors. Battery power is ideal. Also, the Shallow Borehole EpiSensor2 has been fully tested using the integral sensor power supplies provided by the Quanterra Q330-series, and Kinemetrics Rock-series digitizers.

Although the sensor electronics employ multiple stages of power supply (noise) rejection, it is always best to use clean, well-regulated input power.

RS-422 Command Line Interface

The sensor provides an isolated, full-duplex RS-422 interface operating in a very standard mode: 9600 baud, 8 data bits, 1 start bit, No parity. The interface does not support hardware or software handshaking. This interface supports operation over distances of hundreds of meters. It is expected that the user is conversant with details of RS-422 operation (differential connections, external RX line termination, etc.). Please contact Kinemetrics if you have any questions.

Within a PC environment, we recommend using commercial USB-to-RS422 converters, such as those made by FTDI (e.g., USB-RS422-WE-1800-BT). One important point, in power-constrained applications, is that the standard RX termination used in most commercial products (120 ohms between RX+ and RX-) leads to higher quiescent power consumption. Replacing this resistor with a series R-C network (120 ohms +0.1 uF) will satisfy the specific termination requirements, while minimizing power consumption. R-C compensation is used on the RX lines within the sensor. Kinemetrcs can suggest some product options for implementing this on the "field" side of the interface.

A standard terminal emulator program (such as PuTTY) can be used to communicate with sensor. Note that the emulator should be set so that Control-H represents the backspace key. This will allow the sensor to respond properly to backspaces entered by users in the terminal.

After power-ON, the sensor will output sensor specific information and will leave the user at the Main page prompt. The commands are not case-sensitive. All keyboard commands are completed by hitting the "Enter" key. On any page, the "?" character will list the specific commands available on any page.

Main Page Commands

```
Epi2.0 Main Menu:MAIN> ?
Commands:
  OPERATE: Selects Sensor Control Menu
  RESPONSE: Selects RESPONSE Menu
  SAFE: Disables Sensor System Control
  ENABLE######: Enables Sensor System Control(###### is Password)
  STATUS: Print System Status Info
  ?: Help For Info on specific Command

Seconds=4179
Ticks=42
Epi2.0 Main Menu:MAIN>
```

The "status" command prompts the system to print out a set of system-related data:

```
Epi2.0 Main Menu:MAIN> status

Kinemetrics Borehole Episensor2.0 Serial Number 50015

Borehole Episensor2.0 Power Board Number: 40016
Borehole Episensor2.0 Main Board Number: 20015
```

Borehole Episensor2.0 Digital Board Number: 30015

Borehole Episensor2.0 MSP430 Code Revision 13.02.00

X Sensor Module Serial Number: Number 2071
Y Sensor Module Serial Number: Number 2234
Z Sensor Module Serial Number: Number 1130

Sensor FS Range is 4g
AUTOZERO is OFF
CAL is OFF

Seconds=283
Ticks=197
Epi2.0 Main Menu:MAIN>

Password Protection

The system must be enabled to allow access to other menus. ***The enable command is "enable12345".***

Operate Page Commands

Epi2.0 Operate Menu:OPERATE> ?
Commands:
4G: Sets Sensors to 4g FS Range
2G: Sets Sensors to 2g FS Range
1G: Sets Sensors to 1g FS Range
0.5G: Sets Sensors to 0.5g FS Range
0.25G: Sets Sensors to 0.25g FS Range
AUTOZEROON: Turns ON Autozero Mode
AUTOZEROOFF: Turns OFF Autozero Mode
CALON: Enables Sensor CAL
CALOFF: Disables Sensor CAL
STATUS: Prints Sensor Operating Mode Values
SAFE: Disables Sensor System Control
RETURN: Return to Previous Menu
?: Help for info on specific command

Seconds=328
Ticks=910
Epi2.0 Operate Menu:OPERATE>

The "status" command prompts the system to print out a set of system-related data:

Epi2.0 Operate Menu:OPERATE> status

Sensor FS Range is 4g
AUTOZERO is OFF
CAL is OFF

Seconds=4364
Ticks=36
Epi2.0 Operate Menu:OPERATE>

Response Page Commands

Epi2.0 Response Menu:RESPONSE> ?
Commands:
  SCALE: Shows Scale Factor for Each Range and Axis
  STATUS: Prints Current Sensor Response Values
  SAFE: Disables Sensor System Control
  RETURN: Return to Previous Menu
  ?: Help for info on specific command

Seconds=4421
Ticks=222
Epi2.0 Response Menu:RESPONSE>

The “status” command prompts the system to print out a set of system-related data:

Epi2.0 Response Menu:RESPONSE> status

Sensor FS Range is 4g
X Sensor Module Scale Factor is 5001 mV per Standard g
Y Sensor Module Scale Factor is 4998 mV per Standard g
Z Sensor Module Scale Factor is 4999 mV per Standard g

AUTOZERO is OFF
CAL is OFF

Seconds=4447
Ticks=789
Epi2.0 Response Menu:RESPONSE>

Activity Timeout and Disable

Once enabled, the sensor will automatically be disabled after 3600 seconds of inactivity (no commands entered), or on a RESET or POWER-ON-RESET event. When disabled, the sensor is returned to the Main Page. The user would then need to re-enable the system to access other pages. System control is also disabled with a “safe” command entered on any page.

Seconds and Ticks

The sensor measures and reports elapsed time since its last RESET or Power-ON-RESET event. “Seconds” are the number of elapsed seconds. “Ticks” are a sub-second measure approximately equal to 1 msec.

Shipping and Handling

While it is called a “strong motion” accelerometer, the Shallow Borehole EpiSensor2 is still a precision instrument that should be handled with care. Avoid strong shocks during shipment and installation. It is recommended that customers utilize the original foam-filled packaging during any shipment and transport.

Deployment Hardware Interfaces

Figure 4 shows a bolt pattern on the sensor top cap that is designed to allow attachment of various deployment hardware. There are bolt holes (Qty. 6 of 8-32) and alignment pin holes (Qty. 2 of 0.126” diameter). At a minimum, the user should use the bolt holes for attachment of a lifting rope, when deployments are deeper than arm's length (where the sensor body van be held). DO NOT USE THE ELECTRICAL CABLE FOR LIFTING!!!

Please contact Kinemetrics to discuss deployment details and recommendations.

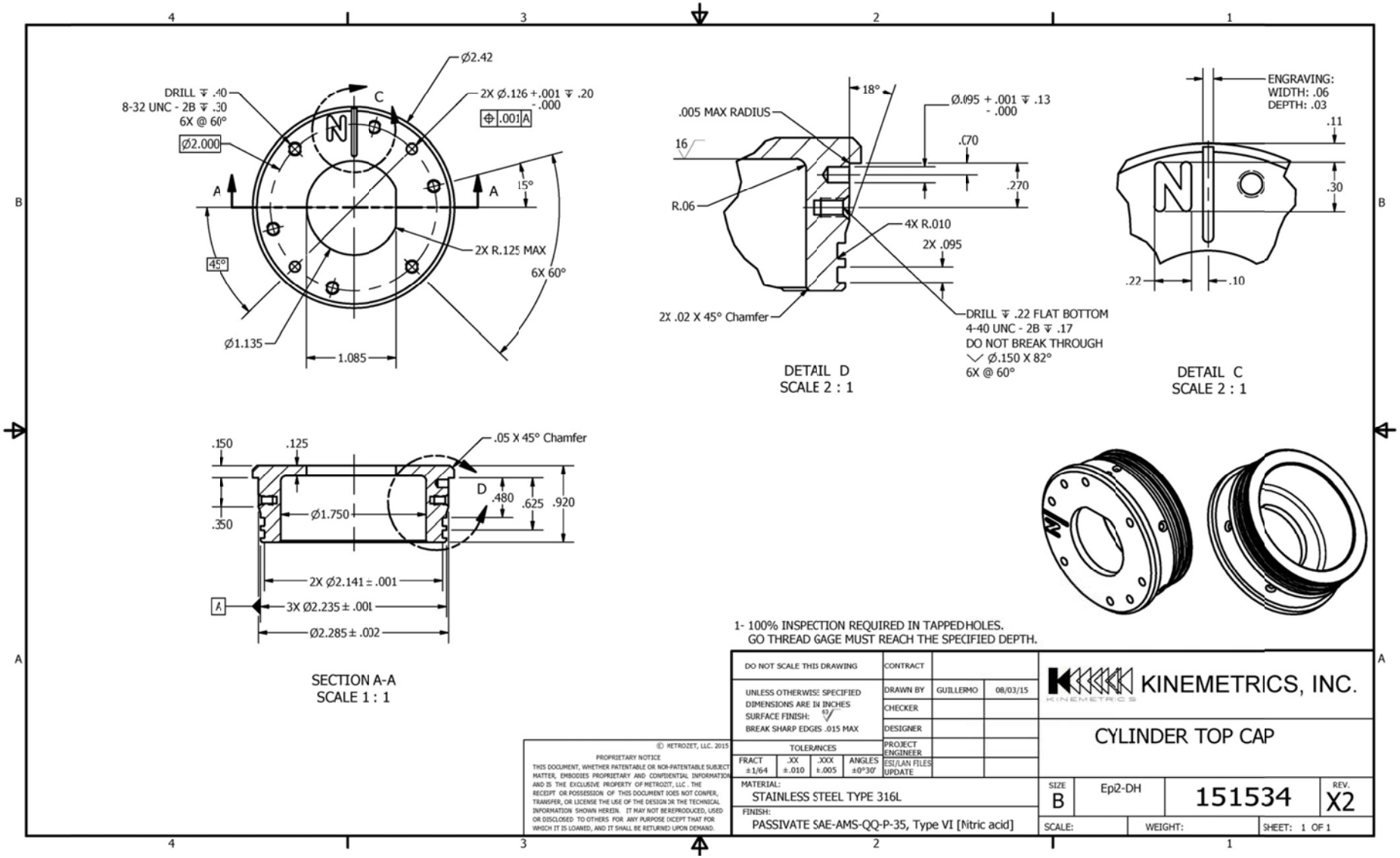

Figure 4 Top Cap details and mounting hole pattern.

Contact Kinemetrics

Please contact Kinemetrics with any questions or issues regarding this product.

1-626-795-2220 (Phone)

support@kmi.com

www.kinemetrics.com

Shallow Borehole EpiSensor2 Specifications

Architecture: Triaxial, force-balance accelerometer with capacitive displacement transducer; X/Y/Z (non-Galperin) configuration

Centering: Optional AUTOZERO mode to allow removal of static sensor offsets (zeroed to within ±0.005 g)

Full-scale Range: Electronically (and remotely) selectable range: ±4 *g*, ±2 *g*, ±1 *g*, ±0.5 *g*, and ±0.25 *g* (peak)

Bandwidth: DC to >320 Hz (-3 dB point)
Dynamic Range:
(Integrated RMS)
166 dB @ 1 Hz over 1 Hz bandwidth
155 dB, 3 to 30 Hz

Non-linearity: < 0.015% total non-linearity

Hysteresis: < 0.005% of full scale
Cross-axis Sensitivity: < 0.5% total
Offset Temperature Coefficient
Horizontal sensor: 60 μ*g*/°C, typical
Vertical sensor: 320 μ*g*/°C, typical

Power Supply Voltage: 9 to 36 V DC isolated input
Power Consumption: <350 mW typical quiescent

Power Protection: Reverse-voltage and over-/under-voltage protected
Over-current protection with self-resetting feature

Isolation: Input power, serial interface, and digital control lines galvanically isolated from sensor ground

Grounding: Case ground connected to dedicated cable line for automatic connection to digitizer grounding lug

Control Interfaces

Digital ENABLE Lines: Dedicated, isolated lines for control of full-scale range, CAL ENABLE and AUTOZERO ON/OFF

RS-422 Interface: Full-duplex isolated RS-422 with full command-line control of all sensor parameters and functions

Full-Scale Range Remote Signaling

Mass Position Interface: Range-dependent voltage output on traditional broadband sensor mass position lines
Signal Line Interface: Time/Amplitude-coded pulse train superimposed on differential signal lines: signaled upon full-scale range change, or upon power-ON reset

Electrical Interface

Acceleration Output: Up to 40 Vpp differential

Output Impedance: Under 2 x 100 Ohms

Calibration Input: Protected, differential input for exciting all three axes simultaneously; +/-15V Peak; acceleration-equivalent stimulus

Cable: Polyurethane-jacketed cable potted into sensor cap; outbound end is pigtailed; 40 meter typical length

Physical and Environmental

Housing: 316 Stainless Steel cylinder
Size: 2.38”OD x 17.8” L (6.03 cm OD x 45.2 cm L)

Weight: Approximately 9 Pounds

Operating Temperature: -40°C to 60°C

Storage Temperature: -65°C to 75°C

Humidity: 0 to 100%

RS-422 Remote Commands (password-protected access)

Full-scale range setting
Calibration ENABLE
AUTOZERO ON/OFF
System Response Values
System Information/Serial Numbers/Hardware and Firmware Revisions