

# Instruction Manual



## P/N 30-2500 AQ-1 DATA LOGGER



### **STOP! - READ THIS BEFORE INSTALL OR USE!**

**WARNING:**

THIS INSTALLATION MAY REQUIRE WELDING OR INTEGRATION INTO A VEHICLE'S ELECTRICAL SYSTEM. DAMAGE TO SENSITIVE ELECTRONICS, FIRE, OR EXPLOSION MAY OCCUR IF PROPER PRECAUTION IS NOT TAKEN. IF THERE IS ANY DOUBT, **DO NOT** ATTEMPT THE INSTALLATION AND CONSULT A PROFESSIONAL.

**NOTE:** IT IS THE RESPONSIBILITY OF THE ENGINE TUNER TO ULTIMATELY CONFIRM THE CALIBRATION USE FOR ANY PARTICULAR ENGINE IS SAFE FOR ITS INTENDED USE. AEM HOLDS NO RESPONSIBILITY FOR ANY ENGINE DAMAGE THAT RESULTS FROM THE MISUSE OF THIS PRODUCT.

The AEM AQ-1 Data Logger is the ideal entry level data logger for virtually all forms of racing and Motorsports because it installs easily, can read live parameters from ancillary sensors, AEMnet enabled devices, GPS and more, and put them into a single log make your data easy to view. Whether you race a late model EFI-equipped OR carbureted vehicle, the AQ-1 is the ideal solution for your data acquisition needs.

### Features

- Four (4) 0-5VDC Analog Inputs with software selectable 2.2k pull-up resistor
- Four (4) 0-16.5VDC Analog / Frequency Inputs
- Three (3) Digital (Switch to Ground, 16V Max) Inputs
- Serial (RS-232) Input (AEM EMS / NMEA0183 GPS Only)
- AEMnet (CAN) Input (AEMnet Devices Only)
- 3-axis Internal Accelerometer +/- 4g
- 1000Hz Maximum Logging Rate
- EnviroSeal Boot / Sealed Connector
- 2 GB SD Card (Supports up to 32GB)
- AQ-1 Data Acquisition System Configuration Software (USB)
- AEMdata Analysis Software

PN	Description
35-2500	DATA LOGGER MODULE
35-5603	DATALOGGER ENVIROSEAL
35-3008	USB A-B CABLE
1-2059	NUT, 6-32 NYLOCK STAINLESS (4)
1-2047	SCREW,PAN HD 6-32x1-1/4 SS (4)
10-2500	INST, AQ-1

### **Optional**

PN	Description
30-2906-96	HARNESS, AQ1

## Installation

### Mounting

The AQ-1 is provided with a sealed main connector and EnviroSeal boot to cover the integrated USB port and SD card slot. Nevertheless, care should be taken to locate the logger in a relatively clean, dry environment as it is not completely water-proof. The provided hardware and mounting template (included in this manual) may be used to mount the unit; alternatively, hook and loop fastener (not provided) may be used. It is acceptable to pierce the EnviroSeal boot to accommodate mounting hardware.

For the internal accelerometer to work properly, the AQ-1 must be mounted such that its largest surface (top or bottom) is either coincident with, or at a right angle to one of the primary axes of the vehicle. Please reference the accelerometer calibration section of this manual and/or the configuration software for more detail and images of acceptable orientations.

### Electrical Wiring Installation

A wiring harness is not included with the 30-2500 kit, however the purchase and use of the AEM 30-2906-96 AQ-1 Data Logger Harness is *highly* recommended. This harness has been designed to ensure easy installation, signal integrity, and proper logger operation.

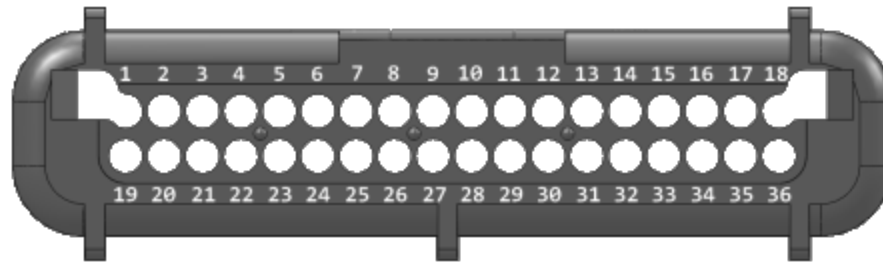
Only skilled, experienced installers should attempt to source and design their own harness. The connector part numbers (AEM does not supply these parts separately outside the 30-2906-96 or 30-2907-96) are provided below for this purpose.

Manufacturer	Part Number	Description
Delphi	12110487	36 Way Black Micro-Pack 100W Sealed Female Connector, Max Current 7.5 amps
Delphi	12110490	LOCK STRAIN RLF MIC/P 100W RH GRA
Delphi	12110488	LOCK RETAINER CONN 36 CLR
Delphi	12110489	Green Multiple Cable Seal
Delphi	12084913	Micro-Pack 100W Series Female Unsealed Gold Plating Terminal Assembly, Cable Range 0.35 - 0.50 mm <sup>2</sup>
Delphi	12084912	Micro-Pack 100W Series Female Unsealed Gold Plating Terminal Assembly, Cable Range 0.80 - 0.80 mm <sup>2</sup>

### Important Wiring Tips

- Permanent 12V (Pin 6) *must* be connected to a constant 12V battery source that is not disconnected via a cut-off switch or similar.
- Switched/Ignition 12V (Pin1) must be connected to a switched ignition source that energizes when the vehicle is in use and is off when the vehicle is not in use.
- Frequency inputs (Pins 12-15) must only be connected to clean DC square wave signals. Connections to ignition coils or magnetic/VR sensors *will* damage the logger.
- CAN wiring (Pins 27-28, 33-34) must utilize twisted pairs with greater than one twist per inch.
- USB wiring (Pins 31-32, 35-36) is only required if users wish to mount a USB port remotely; the integrated USB port functions exactly the same. USB wiring requires special care; please contact the USB consortium (usb.org) for proper wiring conventions.
- Proper crimping, shielding, and harness routing practices should always be implemented.

## Pinout



Pin	Description	Notes
1	Switched/Ignition 12V	"Battery Voltage" log channel source
2	Digital Input 1 (16V Max)	Must be a switched ground signal
3	Digital Input 2 (16V Max)	Must be a switched ground signal
4	Digital Input 3 (16V Max)	Must be a switched ground signal
5	Power Ground	
6	Permanent 12V	This must be connected to a permanent 12V source (~200mA)
7	Sensor Ground	
8	Analog Input 1 (5V Max)	Software selectable 2.2k pull-up
9	Analog Input 2 (5V Max)	Software selectable 2.2k pull-up
10	Analog Input 3 (5V Max)	Software selectable 2.2k pull-up
11	Analog Input 4 (5V Max)	Software selectable 2.2k pull-up
12	Analog / Frequency Input 5 (16V Max)	Frequency signals must be "clean" DC square wave only
13	Analog / Frequency Input 6 (16V Max)	Frequency signals must be "clean" DC square wave only
14	Analog / Frequency Input 7 (16V Max)	Frequency signals must be "clean" DC square wave only
15	Analog / Frequency Input 8 (16V Max)	Frequency signals must be "clean" DC square wave only
16	RS-232 Serial Tx	AEM EMS Series 1/2 or NMEA0183 GPS Only
17	RS-232 Serial Rx	AEM EMS Series 1/2 or NMEA0183 GPS Only
18	RS-232 Serial Ground	AEM EMS Series 1/2 or NMEA0183 GPS Only
19	Sensor Ground	
20	5V Sensor Reference	100mA maximum
21 - 26	Reserved	
27	AEMnet+ (CANH)	AEMnet devices only
28	AEMnet- (CANL)	AEMnet devices only
29	Reserved	
30	Sensor Ground	
31	USB D-	Redundant with integrated USB port
32	USB D+	Redundant with integrated USB port
33	OBD-II (CANH)	30-2501 Only
34	OBD-II (CANL)	30-2501 Only
35	USB Ground	Redundant with integrated USB port
36	USB 5V	Redundant with integrated USB port

## Wiring: Analog Input 1 - 4

This class of inputs is suitable for logging the output from a variety of sensors which have a continuously variable (analog) output between 0 and 5 Volts. A software selectable 2.2kOhm pull-up resistor is available.

### *Typical Automotive 0-5V Analog Sensors*

- Throttle Position Sensor (TPS)
- Accelerator Pedal Position Sensor (APP)
- Manifold Absolute Pressure Sensor (MAP)
- Shock Travel Sensor
- Gear Position Sensor (GPS)
- AEM UEGO/AFR, Pressure, Temperature Gauges with 0 - 5V Outputs
- Mass Airflow Sensor (MAF) \*Analog type only!\*
- Engine Coolant Temperature (ECT)
- Engine Oil Temperature (EOT)
- Air Inlet Temperature (AIT)
- ...and many more!

The majority of these sensors are either "two wire" or "three wire" type sensors. Typically, these sensors will have a 1) signal ground wire, 2) signal wire, and sometimes 3) power (5V) wire. Wiring the sensor into the analog input of the AQ-1 logger is a matter of connecting one of the logger's analog inputs to the "signal" wire of the sensor. Please refer to the documentation that came with your sensor, gauge, or the factory service manual for your vehicle to locate and identify the appropriate signal wire.

### **Software Selectable 2.2kOhm Pull-Up Resistor**

Analog inputs 1-4 are the only AQ-1 inputs that are equipped with a pull-up resistor. Pull-up resistors are required when using two wire sensors (RTD, thermistor, temperature sensors, e.g. ECT, EOT, AIT) that **ARE NOT** already wired to a second data system or ECU.

#### *Yes, you need a pull-up resistor when*

You want a log a pre-existing AIT sensor that's already wired to your engine management system or ECU.

#### *No, you don't need a pull-up resistor when*

You want to log an AIT sensor that you purchased from a third party, like AEM, and installed in your intake and is not connected to any other ECU, EMS, logger.

## Wiring: Analog / Frequency Input 4 - 8

This class of inputs is suitable for logging the output from a variety of sensors which have a continuously variable (analog) output or, optionally a DC frequency, between 0 and up to 16 Volts. These inputs do *not* have any pull-ups available.

### *Typical Automotive 0-5V Analog Sensors*

- Throttle Position Sensor (TPS)
- Accelerator Pedal Position Sensor (APP)
- Manifold Absolute Pressure Sensor (MAP)
- Shock Travel Sensor
- Gear Position Sensor (GPS)
- AEM UEGO/AFR, Pressure, Temperature Gauges with 0 - 5V Outputs
- Mass Airflow Sensor (MAF) \*Analog type only!\*
- Engine Coolant Temperature (ECT)
- Engine Oil Temperature (EOT)
- Air Inlet Temperature (AIT)
- ...and many more!

The majority of these sensors are either "two wire" or "three wire" type sensors. Typically, these sensors will have a 1) signal ground wire, 2) signal wire, and sometimes 3) power (5V) wire. Wiring the sensor into the analog input of the AQ-1 logger is a matter of connecting one of the logger's analog inputs to the "signal" wire of the sensor. Please refer to the documentation that came with your sensor, gauge, or the factory service manual for your vehicle to locate and identify the appropriate signal wire.

### **No Pull-Up Resistor Available**

Analog inputs 4-8 do not have any pull-up resistor available. Two wire sensors may only be connected to this input if they are connected to another data system or ECU within which there is a pull-up resistor.

### *Typical Automotive Frequency Type Sensors*

- Engine Speed / Tachometer (RPM)
- Vehicle Speed Sensor (VSS)
- Mass Airflow Sensor (MAF) Frequency type
- Flow Sensor
- Flex Fuel Sensor
- Hall Effect Sensor

- Injector Duty Cycle
- Boost Control Solenoid
- ...and many more!

**THIS INPUT ONLY ACCEPTS CLEAN DC SQUARE WAVE SIGNALS. DAMAGE TO THE LOGGER IS LIKELY TO OCCUR WHEN DIRECTLY CONNECTED TO COILS OR MAGNETIC SENSORS.**

*Engine Speed / Tachometer (RPM) / Vehicle Speed Sensor (VSS) / Hall Effect Sensor*

The use of a tach adapter such as the MSD "Tach Signal GMR Pickup" Part Number #8918 is usually required when attempting to log engine rpm from high-voltage noisy sources.

*Injector Duty Cycle / Boost Control Solenoid*

Solenoids are typically two wire devices where 1) one wire is connected to battery voltage and the 2) second wire is connected to a low-side output of an ECU or controller -- wire 2) should be connected to this input for the purposes of logging.

## Wiring: Digital Input 1 - 3

This class of inputs is suitable for logging the output from "switched to ground" digital signals with a maximum voltage of 16V.

*Typical Automotive Digital Signals*

- Clutch Switch
- Brake Switch
- Cooling Fan Switch
- Nitrous Solenoid
- Transmission Shift Solenoid (non-pulsed)
- Driver operated start/stop switch
- ...and many more!

Solenoids are typically two wire devices where 1) one wire is connected to battery voltage and the 2) second wire is connected to a low-side output of an ECU or controller or ground -- wire 2) should be connected to this input for the purposes of logging.

A start/stop switch typically has two terminals where 1) is to be connected to the logger and 2) is connected to ground.

*Important Note:* These inputs are not intended for use with solenoids or signal sources that are pulsed with a (high) frequency for the purposes of control or feedback.

## Wiring: Serial/GPS

This input is only compatible with the AEM EMS Series 1/2 serial telemetry output or a serial (RS-232) NMEA0183 GPS receiver.

*AEM EMS Series 1 / 2 Serial Telemetry*

The 30-2906-96 or 30-2907-96 AQ-1 Harness comes with the appropriately wired DB9 connector that can simply be plugged into the Series 1 or 2 EMS.

The following connections should be made if constructing your own harness.

Series 1 or 2 EMS / GPS	AQ-1 Logger
Serial Tx - DB9 Pin3	Serial Rx - Pin 17
Serial Rx - DB9 Pin 2	Serial Tx - Pin 16
Gnd - DB9 Pin 5	Gnd - Pin 18

*GPS Receiver - NMEA0183 RS-232 Serial*

The following Garmin GPS receivers have been validated for use with the AQ-1

- Garmin GPS 18x PC – 1 Hz model with DB9 connector and 12 volt power adapter - The 30-2906-96 AQ-1 Harness comes with the appropriately wired DB9 connector that can simply be plugged into the Garmin GPS 18x PC.
- Garmin GPS18x 5Hz- 5 Hz OEM model - This unit will require wiring; please refer to Garmin documentation and the following pinout.

**AQ-1 DATA LOGGER**

GPS	AQ-1 Logger
5V	5V (100mA max) - Pin 20
Serial Tx	Serial Rx - Pin 17
Serial Rx	Serial Tx - Pin 16
Gnd	Gnd - Pin 18

**Wiring: AEMnet**

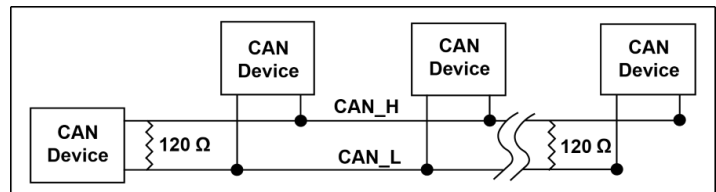
The AQ-1 AEMnet is designed only to work with approved AEMnet devices; please reference the "Compatible AEM Products" section located within this manual. The 30-2906-96/30-2907-96 AQ-1 Harness comes with an appropriately wired Deutsch DTM 4-pin AEMnet connector allowing easy connection to most AEMnet devices. The following AEMnet pinout is provided for users constructing their own harness.

Pin	Name
1	AEMnet+ (CANH)
2	AEMnet- (CANL)
3	Switched +12V
4	Ground

*Termination, Wiring, and Resistors*

Refer to the following guidelines when wiring AEMnet (CAN) devices.

- Twisted wire is required with >1 twist per inch.
- AEMnet buses must be properly terminated. Termination resistors are 120 Ohms each, two total, located at the physical ends of the bus wires.
- The AQ-1 logger is equipped with a non-configurable 120 Ohm resistor.



The following Deutsch DTM 4-pin termination plugs are available from your AEM dealer.

PN	Description
35-3440-F	AEMNET TERMINATION PLUG, FEMALE
35-3440-M	AEMNET TERMINATION PLUG, MALE

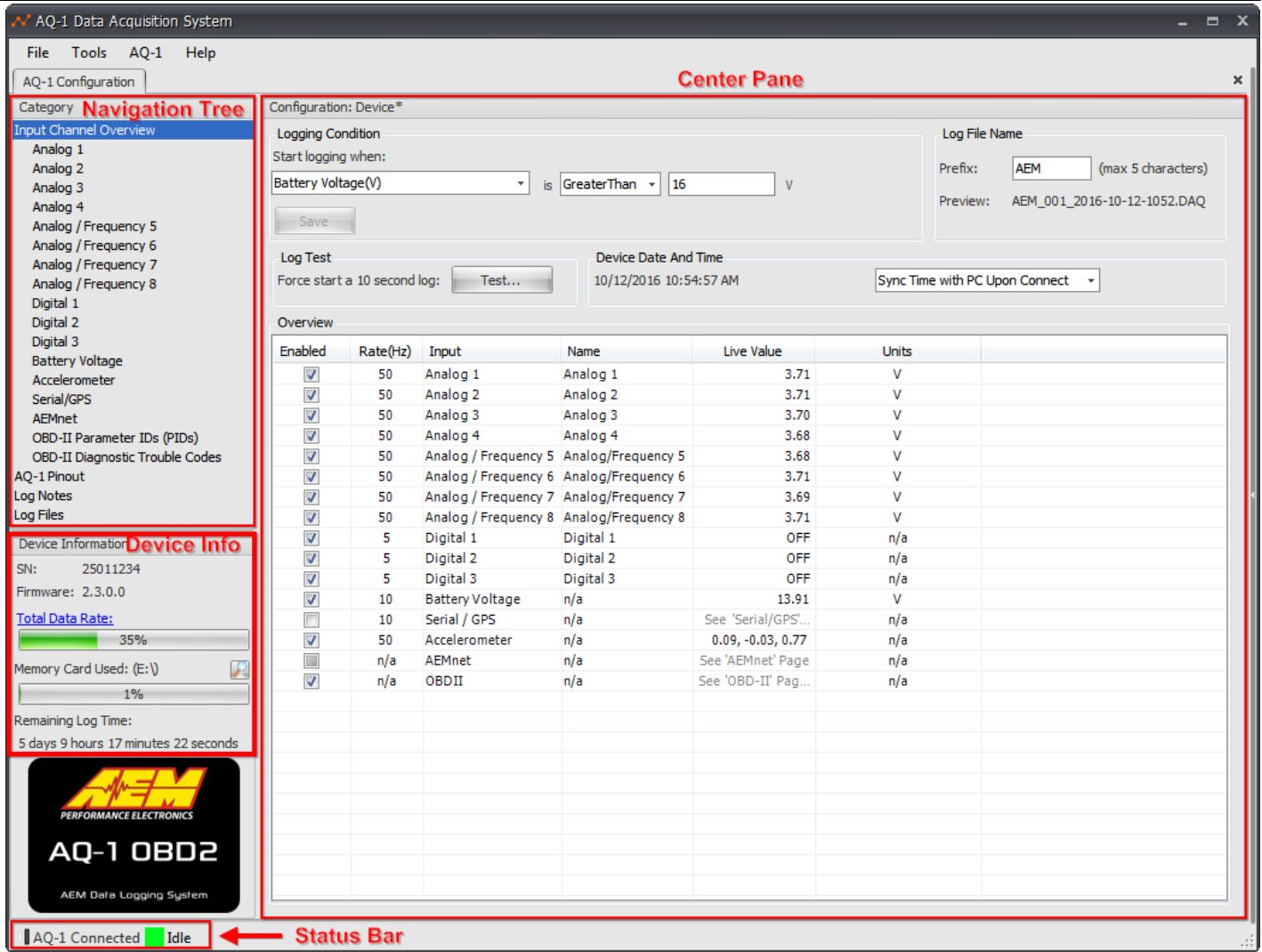
**Configuration Software Overview**

The AEM AQ-1 Data Logger is configured using PC software available for download at [www.aemelectronics.com](http://www.aemelectronics.com). Once downloaded and installed, connect the provided USB cable to the PC and the AQ-1.

The USB cable may be plugged either directly into AQ-1 itself or, if using the AEM 30-290x-96 harness, may be plugged in to the harness' USB connector -- they are electrically equivalent. Note: if this is the first time the AQ-1 is being used, please wait for Windows to recognize the device which, on some PCs may take up to sixty seconds; no additional drivers are necessary and a system restart is not typically required.

**NOTE:** The device can be powered by USB (alone) for certain configuration or viewing tasks. Certain functions or live readings will not be available, however, unless the AQ-1 is powered by a 12V system through its main connector.

The annotated image below shows the main user interfaces of the software.



**Navigation Tree**

The Navigation Tree allows the user to switch between the available configuration pages. Each configuration page provides the available options for each of the logger's inputs or other feature. Click on the desired input/feature to navigate to its configuration page.

**Center Pane**

All configurable options or live readings from the device will be displayed in this area. Some information or options are only available when connected through USB to an AQ-1 that is powered by a 12V system through the main connector.

**Device Information**

When connected to an AQ-1 via USB, this area will display information about the device itself and its SD card if installed.

**Status Bar**

Displays the current connection and logging status.

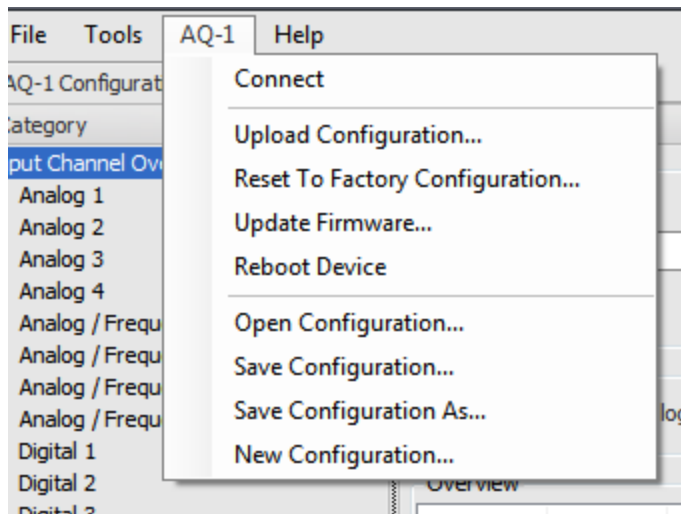
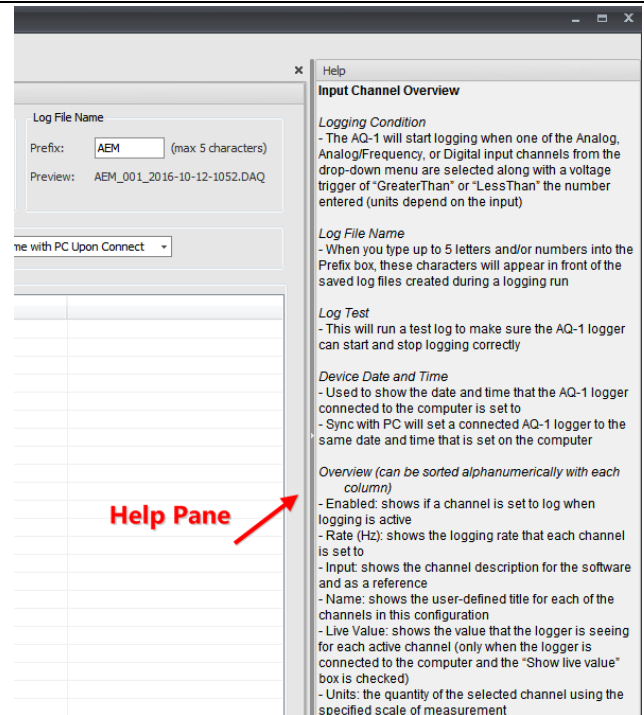
## AQ-1 DATA LOGGER

### Help Pane

In addition to this manual, detailed information about the currently viewed page is available in the Help Pane located on the right side of the screen. The Help Pane may be collapsed when not needed using the slide control.

### Important Notes to Remember When using Software

- Logger can be configured when powered by USB only but Permanent 12V at main connector is required for all live readings and functions to work properly
- Monitor the Status Bar to determine when the logger is actively logging; many functions will be disabled while logging is active to conserve resources



### AQ-1 Pull-down Menu

**Connect** - Connects (or reconnects) to logger.

**Upload Configuration** - Sends logger configuration from PC to the logger.

**Reset To Factory Configuration** - Resets connected logger's configuration to factory default settings.

**Update Firmware** - Do not perform unless instructed by AEM Technical Support.

**Reboot Device** - Performs a reboot of the currently connected logger. Not typically necessary.

**Open Configuration** - Open configuration from PC and edit offline.

**Save Configuration** - Save currently opened configuration to PC with same filename.

**Save Configuration As** - Save currently opened configuration to PC with different filename.

**New Configuration** - Create a new configuration offline and begin editing.

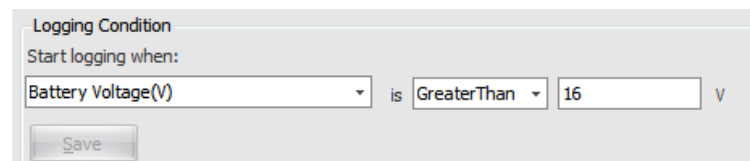
## Configuration: Input Channel Overview / Logging Conditions

This page provides some important interfaces for configuring the operation of your logger. The following things should be considered when selecting and configuring logging conditions:

- Logging conditions should be selected such that there is a clear transition to and from logging mode. For example 'Engine RPM > 350' would provide a clear transition from engine running (logging on) and engine off (logging off.) Selecting something like 'Engine RPM > 2000' will cause the logger to try and start and stop logging every time the engine transitions through 2000 RPM which could happen many times within a short duration of time.
- Logging will start/stop one to two seconds after the logging conditions have been satisfied. This is required to properly open/close the SD card log file.

### Logging Condition

- Determines when logging starts and stops
- Select channel, conditional, and threshold
- Channel must be enabled to be used as a logging condition



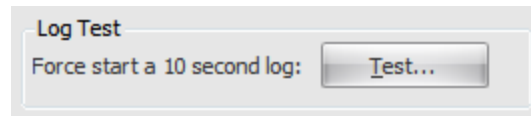


## AQ-1 DATA LOGGER

- All Analog, Digital, Frequency channels may be used as logging conditions
- Only Engine RPM and Vehicle Speed are available from GPS, AEMnet, or OBD-II

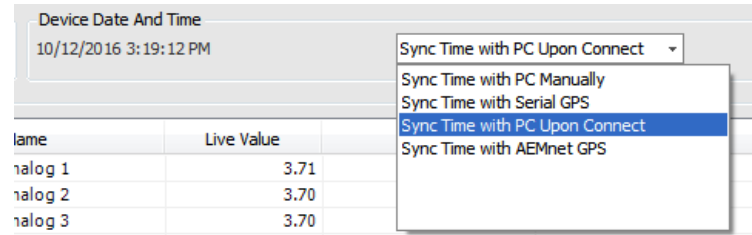
### Log Test

- Temporarily forces the logger to begin logging and terminate after 10 seconds
- Useful for testing logger configuration



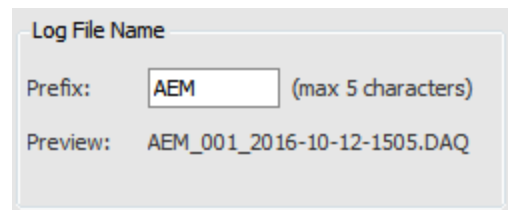
### Device Date And Time

- Log files will be time stamped using this date/time
- AQ-1 date/time setting will reset if permanent 12V power is removed
- Select method by which AQ-1 date/time should be synced



### Log File Name

- Log files will be named using the configurable prefix, file count, and date/time



### Input Overview

- Provides an overview of which channels are enabled for logging and other settings
- Enabled flag, logging rate, and name can be set for most channels
- Live channel reading can be viewed for most channels. Note: Permanent 12V must be present on main connector for proper operation

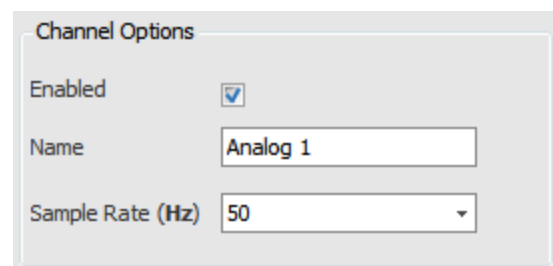
Enabled	Rate(Hz)	Input	Name	Live Value	Units
<input checked="" type="checkbox"/>	50	Analog 1	Analog 1	3.71	V
<input checked="" type="checkbox"/>	50	Analog 2	Analog 2	3.70	V
<input checked="" type="checkbox"/>	50	Analog 3	Analog 3	3.70	V
<input checked="" type="checkbox"/>	50	Analog 4	Analog 4	3.68	V
<input checked="" type="checkbox"/>	50	Analog / Frequency 5	Analog/Frequency 5	3.68	V
<input checked="" type="checkbox"/>	50	Analog / Frequency 6	Analog/Frequency 6	3.70	V
<input checked="" type="checkbox"/>	50	Analog / Frequency 7	Analog/Frequency 7	3.69	V
<input checked="" type="checkbox"/>	50	Analog / Frequency 8	Analog/Frequency 8	3.71	V
<input checked="" type="checkbox"/>	5	Digital 1	Digital 1	OFF	n/a
<input checked="" type="checkbox"/>	5	Digital 2	Digital 2	OFF	n/a
<input checked="" type="checkbox"/>	5	Digital 3	Digital 3	OFF	n/a
<input checked="" type="checkbox"/>	10	Battery Voltage	n/a	13.89	V
<input type="checkbox"/>	10	Serial / GPS	n/a	See 'Serial/GPS'...	n/a
<input checked="" type="checkbox"/>	50	Accelerometer	n/a	0.13, -0.05, 0.78	n/a
<input type="checkbox"/>	n/a	AEMnet	n/a	See 'AEMnet' Page	n/a
<input checked="" type="checkbox"/>	n/a	OBDII	n/a	See 'OBD-II' Pag...	n/a

## Configuration: Analog Inputs 1 - 4

The first four analog inputs are designed to accept and sample a 0-5V signal at up to 1000Hz. This signal may be scaled to engineering units and recorded in the data log for post-analysis. A software configurable pull-up resistor is provided for two-wire RTD sensors or similar.

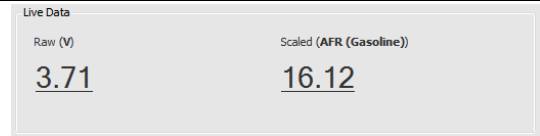
### Channel Options

- Enabled checkbox determines if channel is logged or not
- Set the name that will appear in the data log
- Set the sampling rate of this input



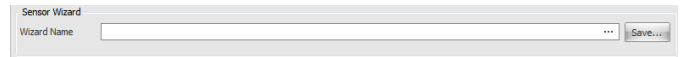
**Live Data**

- Displays the raw voltage measured at the input pin
- Displays the scaled value as will be recorded in the log
- AQ-1 requires 12V power at main connector for proper readings



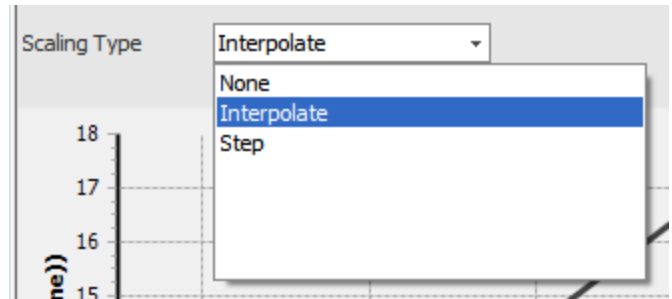
**Sensor Wizard**

- Load known sensor calibrations from Wizard database
- Save custom sensor calibrations to Wizard database



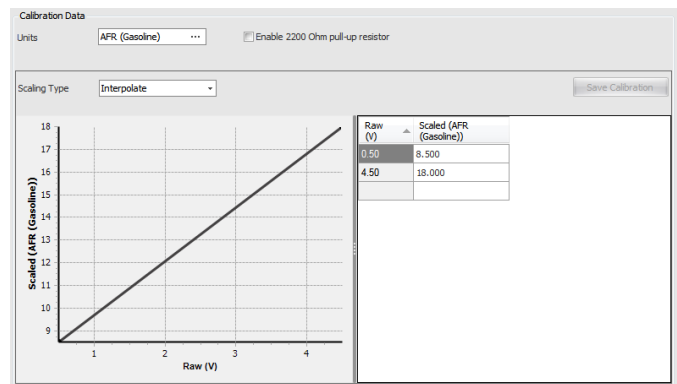
**Scaling Type**

- Scaling type is typically set to *Interpolate*. *Step* can be used for gear position sensors as an example



**Calibration Data**

- View/create sensor calibrations
- View/set the units of the scaled value to be recorded in the data log
- View/set the calibration points/curve
- The 2200 Ohm pull-up resistor is typically enabled for two-wire RTD type sensors, unless that sensor is already connected to another logger/ECU device



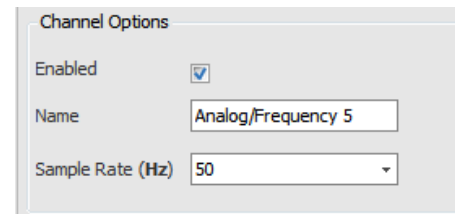
**Configuration: Analog / Frequency Inputs 5 - 8**

The second four analog/frequency inputs are designed to accept and sample a 0-5V signal or a 0-16V signal at up to 1000Hz. In addition, frequency and duty cycle type signals may be logged. This signal may be scaled to engineering units and recorded in the data log for post-analysis. There is no software configurable pull-up resistor available on this input type.

Please reference *Configuration: Analog Inputs 1-4*

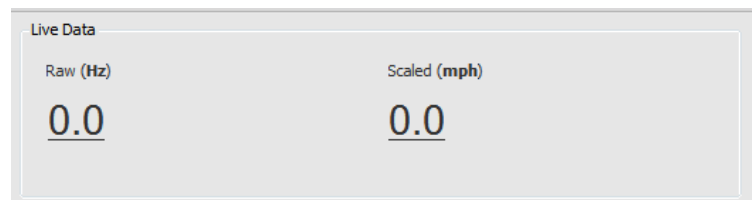
**Channel Options**

- Enabled checkbox determines if channel is logged or not
- Set the name that will appear in the data log
- Set the sampling rate of this input
- Frequency mode sampling is



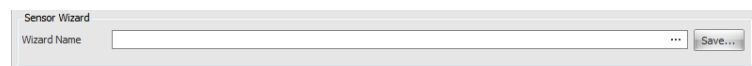
**Live Data**

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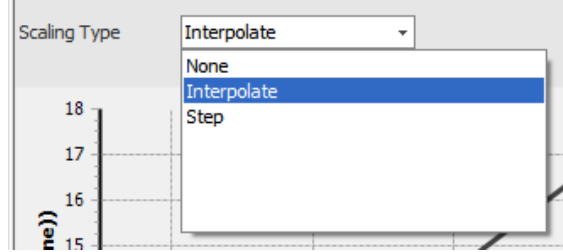
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- Save custom sensor calibrations to Wizard database



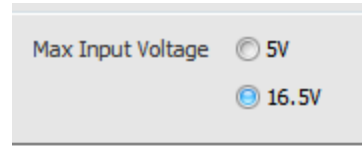
**Scaling Type**

- Scaling type is typically set to *Interpolate*. *Step* can be used for gear position sensors as an example



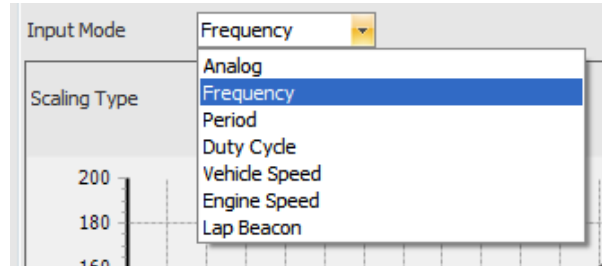
**Max Input Voltage**

- This setting should be configured to be higher than the maximum voltage expected from the sensor/ actuator being logged



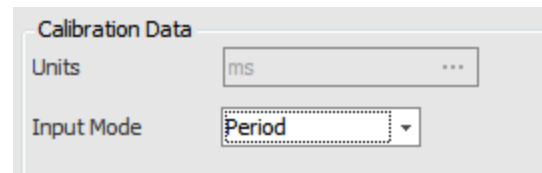
**Input Mode - Frequency**

- Can be scaled further using the calibration table or left as raw Hertz



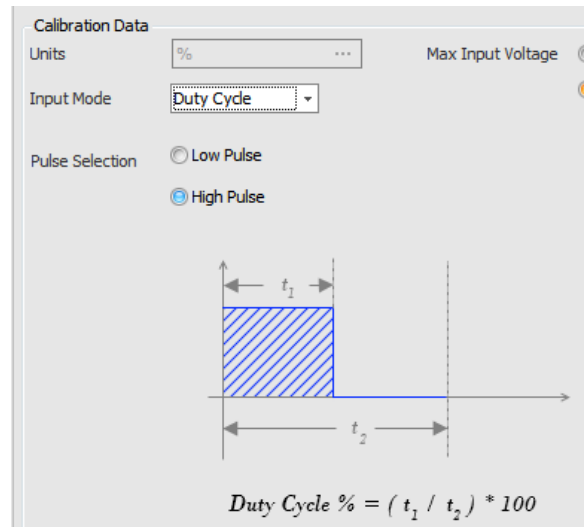
**Input Mode - Period**

- Logs the period of the sampled signal in milliseconds, no other scaling options are provided



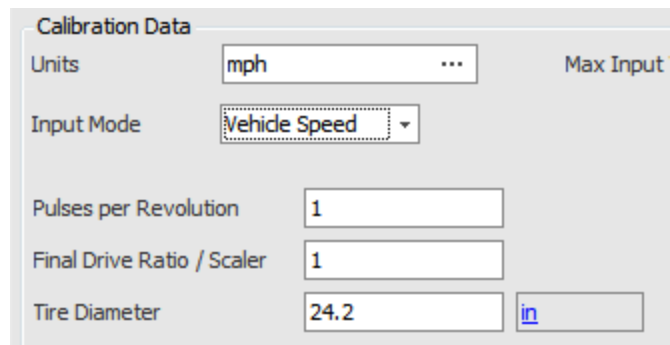
**Input Mode - Duty Cycle**

- Records the duty cycle (in percentage) of the incoming signal such as may be typical on a fuel injector
- The AQ-1 accommodates a typical 12V port injection fuel injector is without additional input circuitry/ conditioning
- Duty cycle percentage may be based off the high or low pulse of the signal



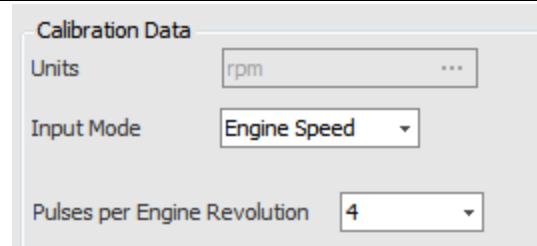
**Input Mode - Vehicle Speed**

- Intended for use with hall-effect style vehicle speed sensors such as are typically installed in a transmission
- SIGNAL MUST BE A CLEAN DC SQUARE WAVE OR DAMAGE TO THE LOGGER MAY OCCUR!!
- Set scaling options based on vehicle configuration



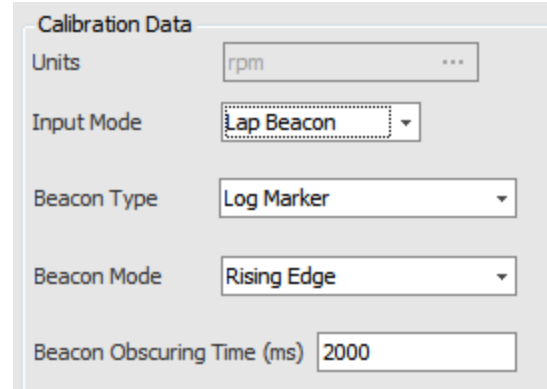
**Input Mode - Engine Speed**

- Intended to log a "tachometer style" output
- SIGNAL MUST BE A CLEAN DC SQUARE WAVE OR DAMAGE TO THE LOGGER MAY OCCUR!!
- The use of a tach adapter such as the MSD "Tach Signal GMR Pickup" Part Number #8918 is usually required when attempting to log engine rpm from high-voltage noisy sources



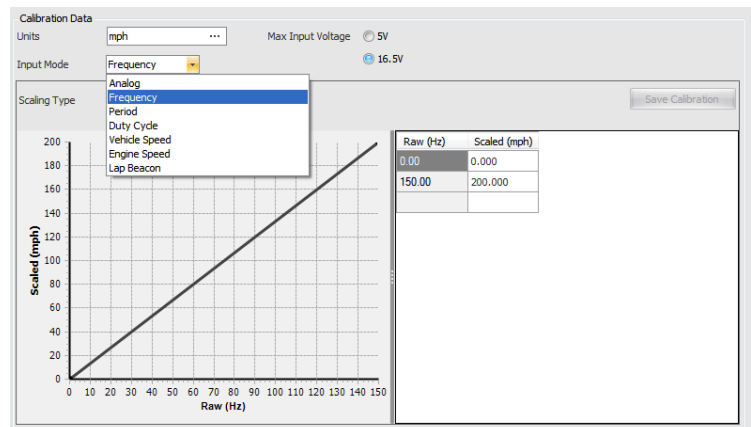
**Input Mode - Lap Beacon**

- Intended for use with a lap beacon receiver or similar
- Inserts a generic, start/finish, or split marker into the log file. See the AEMdata manual for further information.
- Configure whether marker is inserted on rising or falling edge of lap beacon receiver output
- After a lap beacon is detected on the input, lap beacons will be ignored for the amount of time configured by Beacon Obscuring Time



**Calibration Data**

- View/create sensor calibrations
- Scaling type is typically set to *Interpolate*. *Step* can be used for gear position sensors as an example
- View/set the units of the scaled value to be recorded in the data log
- View/set the calibration points/curve
- The 2200 Ohm pull-up resistor is typically enabled for two-wire RTD type sensors, unless that sensor is already connected to another logger/ECU device

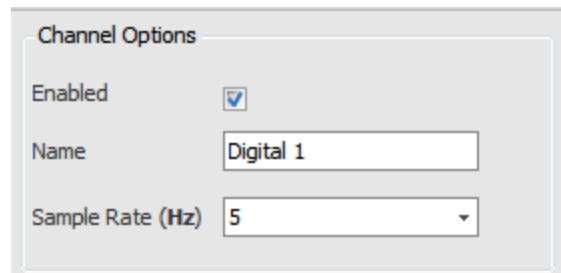


**Configuration: Digital Inputs 1 - 3**

Three digital inputs are available which are 12V tolerant and are considered 'ON' when a ground signal is applied to the input pin.

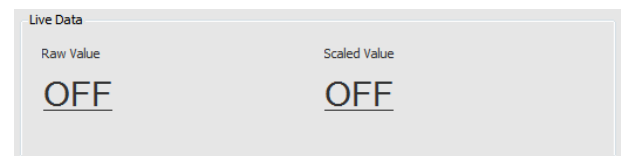
**Channel Options**

- Enabled checkbox determines if channel is logged or not
- Set the name that will appear in the data log
- Set the sampling rate of this input



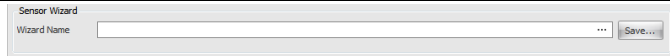
**Live Data**

- Displays the raw level measured at the input pin
- Displays the scaled value as will be recorded in the log
- AQ-1 requires 12V power at main connector for proper readings



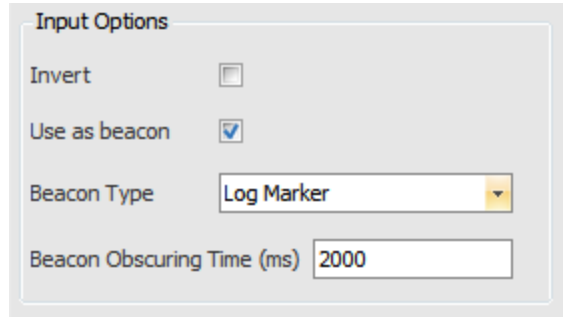
**Sensor Wizard**

- Load known sensor calibrations from Wizard database
- Save custom sensor calibrations to Wizard database



**Input Options**

- Choosing Invert will make an "OFF" at the pin to an "ON" in the data log and vice versa
- Digital inputs may be used as beacon inputs but with lower timing accuracy than Frequency Inputs which makes them more suitable for Log Markes than for lap timing

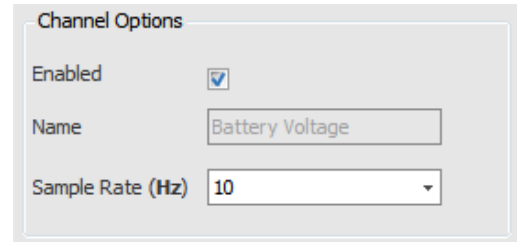


**Configuration: Battery Voltage**

This channel records the voltage that is applied Pin 1 - Switched 12V.

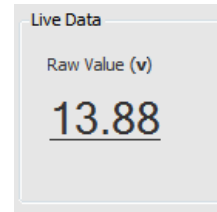
**Channel Options**

- Enabled checkbox determines if channel is logged or not
- The channel name is fixed at 'Battery Voltage'
- Set the sampling rate of this input



**Live Data**

- Displays the voltage level measured at the input pin

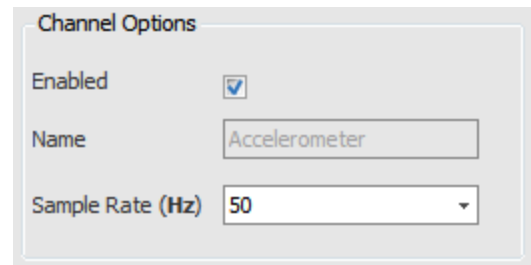


**Configuration: Accelerometer**

The internal 3-axis accelerometer (+/- 4g) requires a simple calibration procedure prior to use.

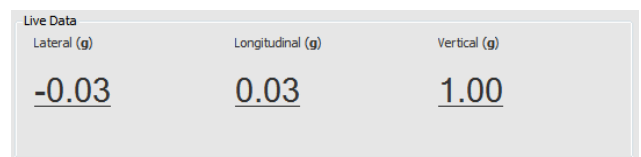
**Channel Options**

- Enabled checkbox determines if channel is logged or not
- The channel name(s) is fixed and will appear in the log as 'Accel Lateral', 'Accel Longitudinal', 'Accel Vertical'
- Set the sampling rate of this input



**Live Data**

- Perform calibration and ensure the AQ-1 is in the proper mounting position
- Displays the current acceleration measured by the logger including Earth's gravity (Vertical = 1g)



**Accelerometer Calibration**

- Click button and follow directions to calibrate and set mounting position
- This procedure must be performed to ensure proper accelerometer readings

Accelerometer Mounting Position

The following picture shows the AQ-1's mounting position in the vehicle.

Please ensure your AQ-1 is mounted properly within the vehicle, the vehicle is on level ground, and choose the picture that matches your AQ-1's actual position. The accelerometer will be calibrated based on the chosen position.

Choose and Calibrate...



**Configuration: Serial/GPS**

The serial input allows logging of an NMEA0183 Serial GPS or the serial telemetry output of an AEM Series I or Series II EMS.

**Channel Options**

- Enabled checkbox determines if channel is logged or not
- Set the sampling rate of this input
- Refer to your GPS or EMS user manual to determine the appropriate baud rate setting
- Select 'GPS' or 'AEM EMS' input mode

Channel Options

Enabled

Name

Sample Rate (Hz)

Baud Rate (bps)

Input Mode

Serial Connection Status **Receiving Data**

**Sensor Wizard**

- Load known sensor calibrations from Wizard database
- Save custom sensor calibrations to Wizard database

Sensor Wizard

Wizard Name

Save...

**Live Data (GPS)**

- GPS data will be displayed once a serial connection has been established and signal acquired
- The units for altitude and ground speed may be customized by clicking the unit hyperlinks

GPS Live Data

Latitude (deg)	Longitude (deg)	Ground Speed (mph)
<b>33.918716</b>	<b>-118.318413</b>	<b>0.00</b>
Altitude (ft)	Course (deg)	Fix Quality: Differential
<b>117.5</b>	<b>186.6</b>	Satellites In Use: 6 of 12
		Status: <b>Signal Acquired</b>

**Live Data (EMS)**

- EMS serial telemetry data will be displayed once a serial connection has been established
- Users may customize a scaler/offset to be applied to the values prior to being recorded in the data log which can be useful for ADCR channels
- The channel units may be customized by clicking the unit hyperlinks

AEM EMS Serial Telemetry				
Save Signals				
Name	Scaler	Offset	Live Data	Units
Engine Speed	1	0	0.00	<a href="#">rpm</a>
Engine Load	1	0	0.00	<a href="#">%</a>
Throttle	1	0	0.00	<a href="#">%</a>
Air Temp	1	0	0.00	<a href="#">°C</a>
Coolant Temp	1	0	0.00	<a href="#">°C</a>
ADCR11	1	0	0.00	<a href="#">V</a>
ADCR13	1	0	0.00	<a href="#">V</a>
ADCR14	1	0	0.00	<a href="#">V</a>
ADCR17	1	0	0.00	<a href="#">V</a>
ADCR18	1	0	0.00	<a href="#">V</a>
ADCR15	1	0	0.00	<a href="#">V</a>
ADCR16	1	0	0.00	<a href="#">V</a>
ADCR08	1	0	0.00	<a href="#">V</a>
O2 #1	1	0	0.50	<a href="#">Lambda</a>
O2 #2	1	0	0.50	<a href="#">Lambda</a>
Vehicle Speed	1	0	0.00	<a href="#">mph</a>
Gear Calculated	1	0	0.00	
Error #1	1	0	0.00	
Error #2	1	0	0.00	

**Configuration: AEMnet**

The AEMnet input provides "Plug and Play" functionality and allows logging for AEMnet devices.

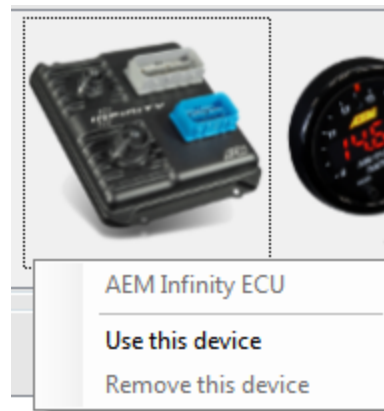
**AEMnet Devices / Auto Discover**

- Connect the AEMnet devices to the AQ-1 and ensure all devices are powered then click Auto Discover to configure the AQ-1 to log the connected devices



**Add/Remove Device**

- As an alternative to performing an Auto Discover, right-click the desired device icon and select 'Use this device' to configure it to be logged
- Devices may be removed by right-clicking its icon and selecting 'Remove this device'



**AEMnet Signals Live Data**

- Live data will be displayed for configured and connected devices
- AQ-1 requires 12V power at main connector for proper readings
- Users may customize a scaler/offset to be applied to the values prior to being recorded in the data log
- The channel units may be customized by clicking the unit hyperlinks

AEMnet Signals				
Save Signals				
Name	Scaler	Offset	Live Data	Units
<b>AEM X-Series AFR (ID 1)</b>				
Lambda	1	0	0.00	<a href="#">Lambda</a>
Oxygen	1	0	0.00	<a href="#">%</a>
Ready	1	0	0.00	

**Configuration: Log Notes**

Log notes are a way to record information about the conditions experienced while operating a vehicle and logging. This information will be stored in the data log and available for review in AEMdata by selecting the menu option View->Notes.

(426 characters left)

Save Notes

Notes

**Weather**

Wind:  [mph](#)

Temperature:  [°F](#)

Relative Humidity:  %

Barometer:

Correction:  %

Density Altitude:  [ft](#)

Track Surface Temperature:  [°F](#)

**Track**

Track:

Lap:  [mi](#)

Session:

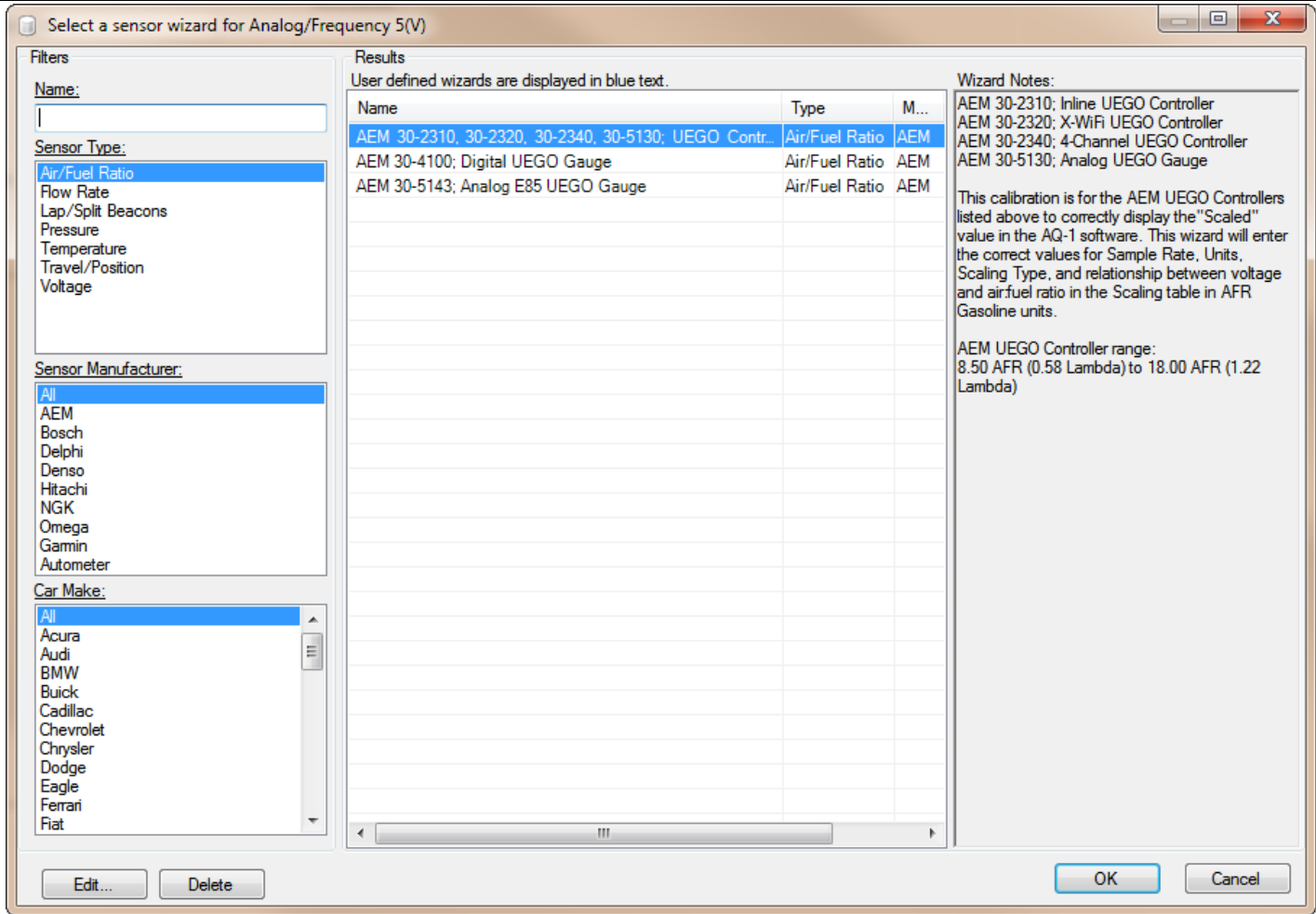
Outing:  [mi](#)

Driver Name:

**Configuration: Sensor Wizard**

The Sensor Wizard is available on the majority of the input configuration pages to assist in configuration. It is essentially a database of sensor calibrations that AEM has compiled and made available for selection. The filters may be utilized to drill down to find the sensor you would like to connect to a particular input; selecting the desired sensor (or device) and clicking OK will apply the appropriate configuration to that AQ-1 input, simplifying the configuration process.



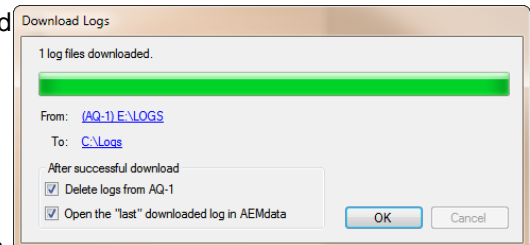


## Log Files / SD Cards

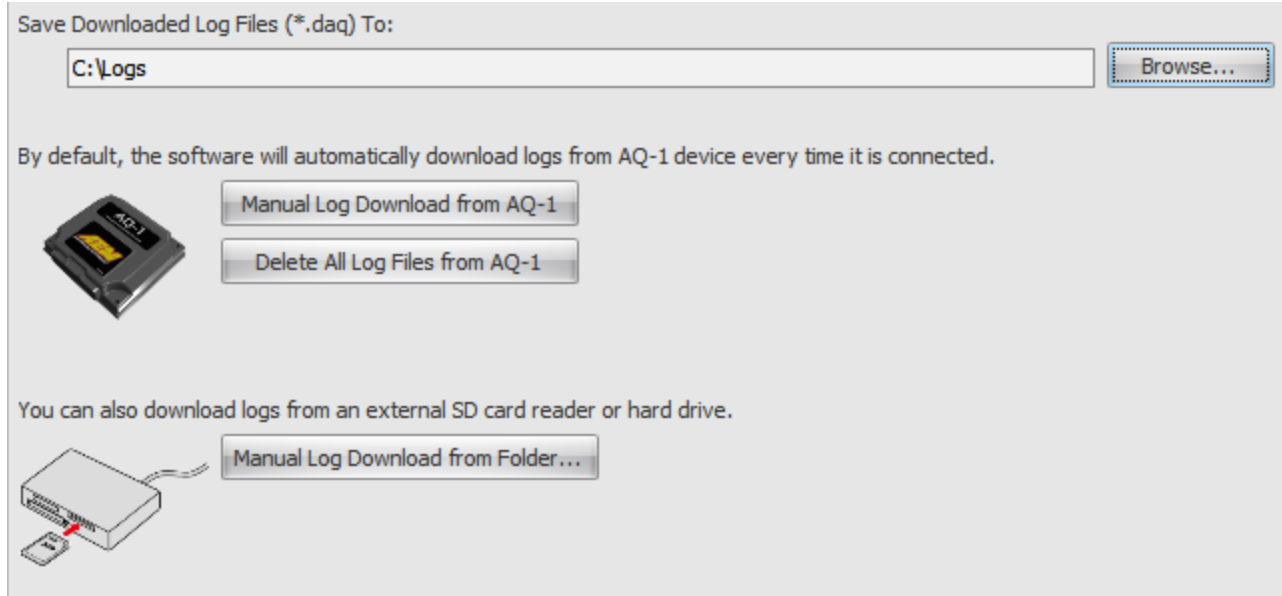
The AQ-1 Data Logger includes a removable Secure Digital (SD) Card 2GB card that is located on the back of the logger. To remove the SD card, push the card in until a soft click is heard. The card will release and can be pulled out. To insert the card, push the card in until a soft click is heard. The card will remain locked in place.



If any logs are present on the SD card, they will automatically be downloaded when the AQ-1 configuration software detects the logger through its USB connection. The following dialog will automatically open and download, convert, and copy the log file to the specified folder. The files then may be optionally opened in AEMdata for analysis. *Please note* that the files as recorded on the SD card are in a raw format (\*.AQ1) which **can not** be opened in AEMData. The files must be specifically downloaded using the AQ-1 software to convert them for use with AEMdata. AEMData log files are in \*.DAQ format.



The "Save To" or destination folder for downloaded log files (\*.DAQ) may be configured on the *Log File* page in the AQ-1 configuration software as seen below.



Occasionally, the SD card may require re-formatting. This can be accomplished by inserting the SD card into the AQ-1, connecting the AQ-1 to a PC via the USB cable, and using Windows Explorer to format the drive. FAT (or FAT16) is the recommended file system for the fastest performance; however, FAT32 is supported.

**Device Information**

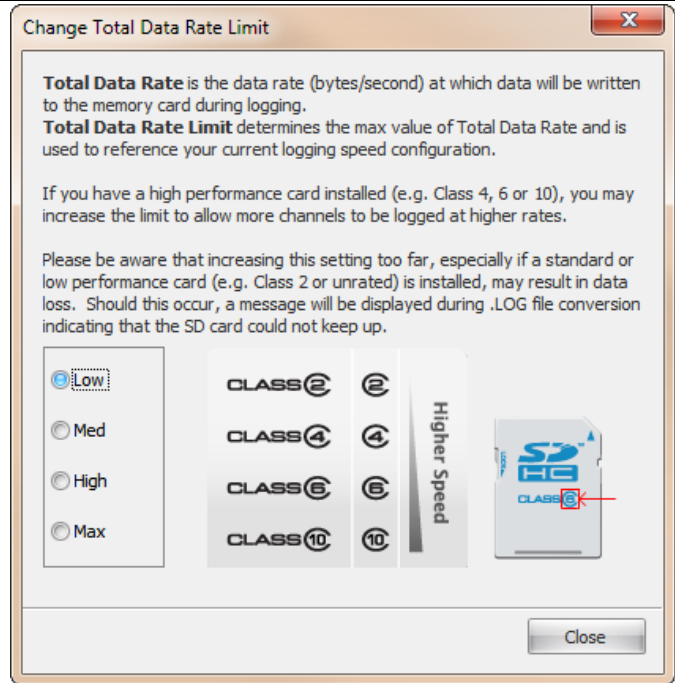
The device information pane displays information about the connected AQ-1, the currently configured data rate, and SD card status. Remaining Log Time describes how much time is well

Device Information	
SN:	25011234
Firmware:	2.3.0.0
<b>Total Data Rate:</b>	<div style="width: 49%; background-color: green; border: 1px solid gray;">49%</div>
<b>Memory Card Used: (E:)</b>	<div style="width: 1%; background-color: gray; border: 1px solid gray;">1%</div>
<b>Remaining Log Time:</b>	3 days 21 hours 24 minutes 51 seconds

**Total Data Rate**

Total Data Rate is calculated based on the number of channels enabled for logging, the type of channel, and the logging rate selected. The maximum possible data rate is a function of the SD card type being used and by the design of the logger itself. The AQ1 Data Logger comes with a 2GB Class 2 SD card that is suitable for most cases. Clicking the blue "Total Data Rate" hyperlink in the Device Information pane will open the following dialog. The purchase and use of third party high performance cards may allow higher total data rates as described below. A high data logging rate could cause a data loss if the data logging rate is set incorrectly. Secure Digital (SD) and Secure Digital High Capacity (SDHC) rated cards are compatible with the AQ-1. SDXC and beyond are not approved for use.

- SD/SDHC cards are rated as Class 2, Class 4, Class 6, or Class 10. The class can typically be identified by the Class number within a circle logo on the label of the card. Note: Class 2 cards commonly do not have the class number on the label. The AQ1 Data Logger comes with a 2GB Class 2 SD card that is suitable for most cases. Extremely high total logging rates may require use of a class 4, 6, or 10 SD/SDHC Card.
- Depending on the grade of the SD card, a high data logging rate could cause a data loss if the data logging rate is set incorrectly



**FAQ / Troubleshooting**

**I just tried to download some logs and it says there are files with errors.**

This is caused by either:

- a) Permanent 12V must be connected to Pin 6 and Switched 12V must be connected to Pin 1. Permanent 12V must remain constant to allow the logger to properly finish writing to the file after Switched 12V is removed.
- or, b) Logging conditions should be selected such that there is a clear transition to and from logging mode. For example 'Engine RPM > 350' would provide a clear transition from engine running (logging on) and engine off (logging off.) Selecting something like 'Engine RPM > 2000' will cause the logger to try and start and stop logging every time the engine transitions through 2000 RPM which could happen many times within a short duration of time.

**The live values for a specific input don't update or stopped updating.**

- a) 12V is required to be on on both Pin 6 and Pin 1 for live values to read properly. USB power alone is not sufficient.
- b) Live value readouts will slow down or stop altogether when logging is active. Confirm whether logging is active by referring to the status bar in the lower left hand corner of the screen.

*For support, contact AEM Technical Support at 1-800-423-0046 or [gentech@aemelectronics.com](mailto:gentech@aemelectronics.com).*

**Compatible AEM Products**

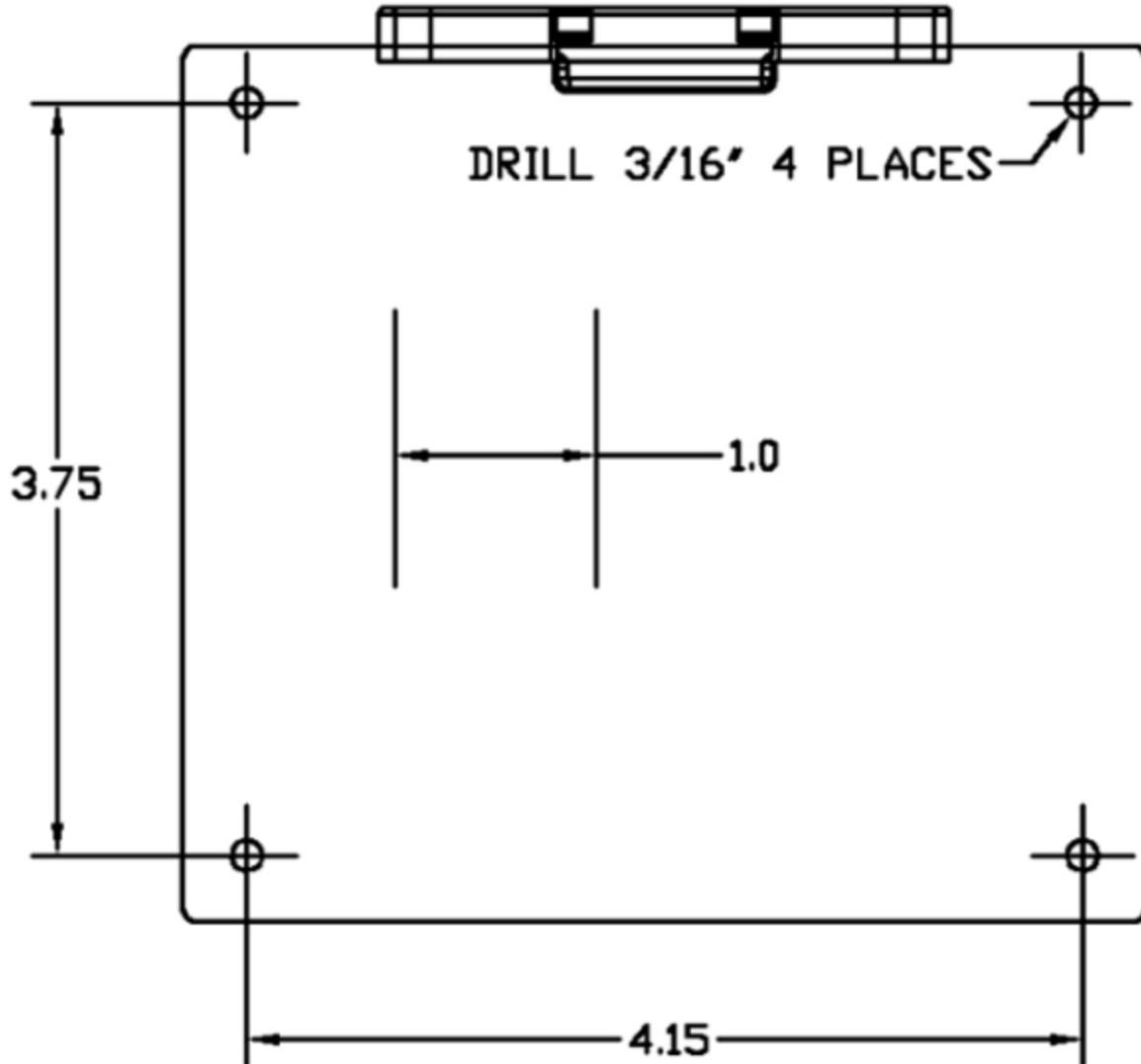
PN	Description	AQ-1 Input Type
30-2906-96	AQ-1 Data Logger Harness	n/a
35-3440-F	AEMNET TERMINATION PLUG, FEMALE	n/a
35-3440-M	AEMNET TERMINATION PLUG, MALE	n/a
30-201x	Temperature Sensors	Analog 1-4
30-2050	RTD EGT Sensor	Analog 1-4
30-213x-xxx	Pressure Sensors	Analog 1-8
30-220x	Flex Fuel Ethanol Content Sensors	Analog / Frequency 4-8

## AQ-1 DATA LOGGER

PN	Description	AQ-1 Input Type
30-51xx	Analog Display Gauges	Analog 1-8
30-41x0	Digital Wideband UEGO AFR Gauge	Analog 1-8
30-440x	"Classic" Digital Gauges	Analog 1-8
30-0300	X-Series Wideband UEGO AFR Gauge (LSU4.9)	Analog 1-8 / AEMnet
30-0301	X-Series Oil/Fuel Pressure Gauge 0 to 100psi / 0 to 7bar	Analog 1-8 / AEMnet
30-0302	X-Series Oil/Transmission/Water Temperature Gauge 100 to 300F / 40 to 150C	Analog 1-8 / AEMnet
30-0305	X-Series EGT Gauge 0 to 1800F / 0 to 1000C	Analog 1-8 / AEMnet
30-0306	X-Series Boost Gauge -30inHg to 35psi / -1 to 2.5bar	Analog 1-8 / AEMnet
30-0307	X-Series Oil Pressure Gauge 0 to 150psi / 0 to 10bar	Analog 1-8 / AEMnet
30-0308	X-Series Boost Gauge -30inHg to 60psi / -1 to 4bar	Analog 1-8 / AEMnet
30-0309	X-Series Boost/Fuel Pressure Gauge 0 to 15psi SAE Only	Analog 1-8 / AEMnet
30-0310	X-Series Inline Wideband UEGO AFR Controller (LSU4.9)	Analog 1-8 / AEMnet
30-0313	X-Series GPS Speedometer Gauge 0 to 160mph / 0 to 260kph	Analog 1-8 / AEMnet
30-2203	Vehicle Dynamics Module	Analog 1-8 / AEMnet
30-2340	4-Channel Wideband UEGO AFR Controller	Analog 1-8 / AEMnet
30-49xx	Wideband Failsafe / Wideband Flex Fuel Failsafe	Analog 1-8 / AEMnet
30-71xx	Infinity ECU (All firmwares)	AEMnet
30-xxxx	Series2 ECU / EMS-4	AEMnet

## Mounting Drill Template

A drill template is provided to aid in determining mounting hole locations when mounting the AQ1 Data Logger. Before drilling any holes, make sure the drill template is printed to the proper size. The two vertical lines on the drill template are spaced one inch apart when the drill template is printed to the proper size. Verify the two vertical lines are one inch apart on the printed drill template. Due to variances in printers, the print size may need to be adjusted if the two vertical lines are not one inch apart.



## 12 Month Limited Warranty

Advanced Engine Management Inc. warrants to the consumer that all AEM High Performance products will be free from defects in material and workmanship for a period of twelve (12) months from date of the original purchase. Products that fail within this 12-month warranty period will be repaired or replaced at AEM's option, when determined by AEM that the product failed due to defects in material or workmanship. This warranty is limited to the repair or replacement of the AEM part. In no event shall this warranty exceed the original purchase price of the AEM part nor shall AEM be responsible for special, incidental or consequential damages or cost incurred due to the failure of this product. Warranty claims to AEM must be transportation prepaid and accompanied with dated proof of purchase. This warranty applies only to the original purchaser of product and is non-transferable. All implied warranties shall be limited in duration to the said 12-month warranty period. Improper use or installation, accident, abuse, unauthorized repairs or alterations voids this warranty. AEM disclaims any liability for consequential damages due to breach of any written or implied warranty on all products manufactured by AEM. Warranty returns will only be accepted by AEM when accompanied by a valid Return Merchandise Authorization (RMA) number. Product must be received by AEM within 30 days of the date the RMA is issued.

UEGO oxygen sensors are considered wear items and are not covered under warranty.

Please note that before AEM can issue an RMA for any electronic product, it is first necessary for the installer or end user to contact the EMS tech line at 1-800-423-0046 to discuss the problem. Most issues can be resolved over the phone. Under no circumstances should a system be returned or a RMA requested before the above process transpires.

AEM will not be responsible for electronic products that are installed incorrectly, installed in a non-approved application, misused, or tampered with.

Any AEM electronics product can be returned for repair if it is out of the warranty period. There is a minimum charge of \$50.00 for inspection and diagnosis of AEM electronic parts. Parts used in the repair of AEM electronic components will be extra. AEM will provide an estimate of repairs and receive written or electronic authorization before repairs are made to the product.

## Specifications

<b>Dimensions</b>	width	4.55 / 122	in / mm
	length	4.8 / 116	in / mm
	height	1.44 / 37	in / mm
	mass	8 / 226	oz / g
<b>Supply Voltage</b>	min	7	VDC
	max	18	VDC
<b>Supply Current (13.8V)</b>	nominal	150.0	mA
<b>Operating Temperature</b>	min	-4 / -20	degF / degC
	max (16V Supply)	185 / 85	degF / degC