



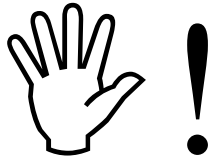
Installation Instructions for P/N 30-3020

Injection Monitor

Water/Methanol Injection Safety Device

WARNING:

Completely read this instruction manual before attempting to install or use this product! This installation is not for the electrically or mechanically challenged! Use this system with **EXTREME** caution! Misuse of this system can damage your engine!



If you are uncomfortable with anything about this, please refer the installation to an AEM trained tuning shop or call 800-423-0046 for technical assistance. You should also visit the AEM Performance Electronics Forum at <http://www.aemelectronics.com>.

NOTE: AEM holds no responsibility for any engine damage that results from the misuse of this product!

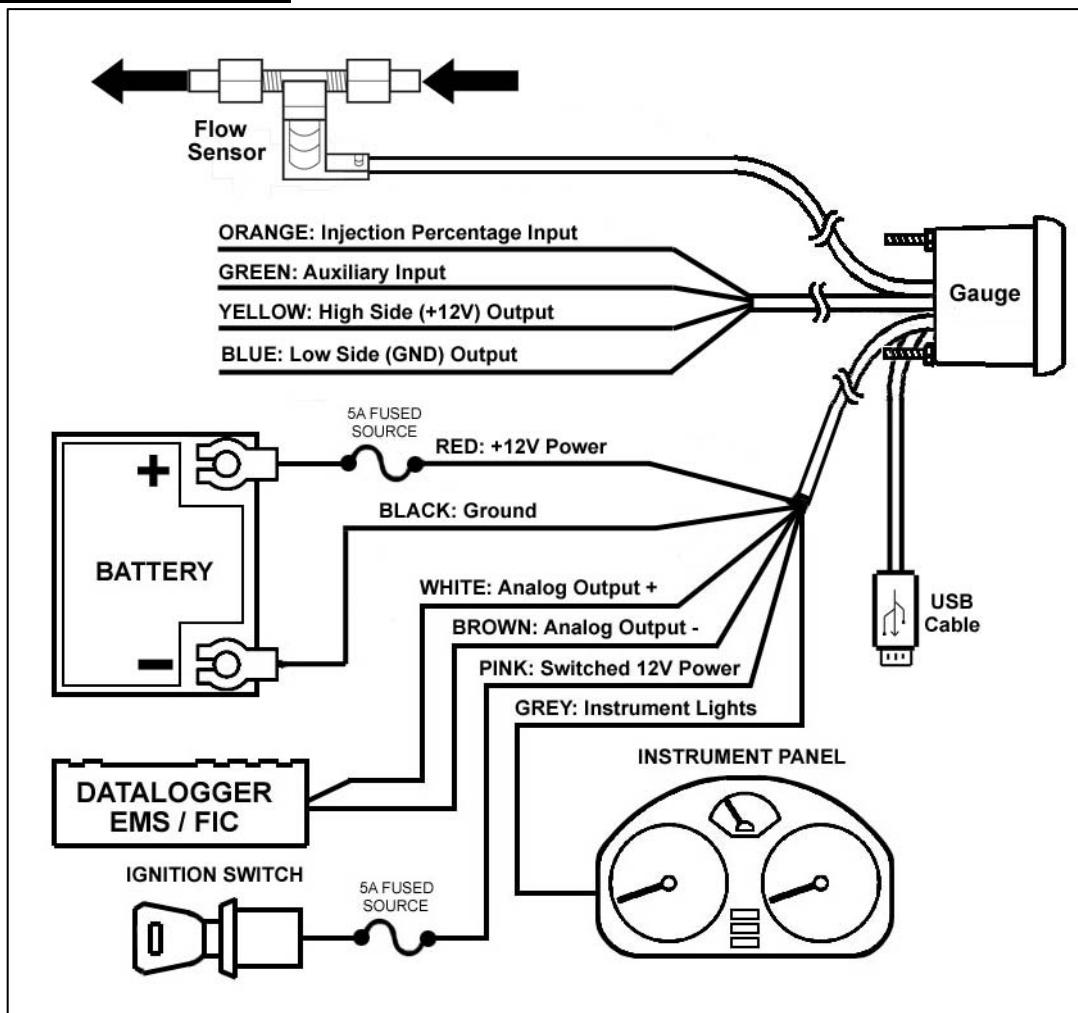
INJECTION MONITOR PARTS LIST

Qty	P/N	Description	Qty	P/N	Description
1	35-3020	Injection Monitor Gauge	1	35-8553W	Faceplate 1000 White
1	35-2126	Flow Sensor with Fittings	1	35-8529S	Silver Bezel
1	35-3411	8-Pin Power Harness	1	35-4302	Install Kit (6 Butt Connectors)
1	35-3418	4-Pin I/O Harness	1	35-8441	Rubber Band
1	35-3415	3-Pin Sensor Harness	1	10-3020	Inj Mon Instructions
1	35-3010	USB Cable	1		Faceplate Config Instructions
1	35-8552W	Faceplate 500 White	1		Needle Removal Tool
1	35-8552B	Faceplate 500 Black			

This product is legal in California for racing vehicles only and should never be used on public highways.

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 Instruction Part Number: 10-5141 Rev 01
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INSTALLATION DIAGRAM



OVERVIEW

Water/methanol injection is used to lower air charge temps and reduce detonation which allows for aggressive tuning to be utilized while using a low octane base fuel. When relying heavily on water/methanol injection a safety device is strongly recommended in order to prevent detonation and possible engine damage in the event of a leak or clog. Progressive injection systems have a dynamic flow output and monitoring both the injection flow rate and the injection percentage means a high level of engine protection can be achieved.

The AEM Injection Monitor is an advanced safety device that allows the end user to closely monitor the performance of their water/methanol injection system. The Injection Monitor collects flow versus injection percentage data points and plots them in a graph to create an injection flow curve using PC configuration software. "Injection percentage" is a calculated value that is indicative of injection pump or injection valve duty cycle and is based on a scale of 0-100 percent.

Once a baseline flow curve is established, the end user can then assign high and low flow threshold lines that can be contoured to closely follow the baseline flow curve. If injection data points occur outside of the high and low flow threshold lines, an alarm condition will be triggered. Injection data points that occur in the area between the high and low flow threshold lines are considered acceptable and an alarm condition will not be triggered.

Once an alarm condition is triggered, two outputs will activate along with a visual alarm alert. The Injection Monitor has one high side or +12 volt output and one low side or ground output. Both outputs can be configured to turn on or off when an alarm condition is triggered. These outputs can be used to turn off a boost controller, retard ignition timing, switch fuel and timing maps, activate a warning light or buzzer, or deactivate another external system (nitrous, etc.). The gauge backlighting and needle can also be set to flash to notify the vehicle operator of an alarm condition.

The Injection Monitor also has an auxiliary input that can be used to trigger an alarm condition. Users with the AEM Water/Methanol Injection System (PN 30-3000 & 30-3001) can use the “Boost Safe” ground output to trigger the auxiliary input if any of the internal fault conditions are detected by the AEM progressive controller.

NOTE: It is HIGHLY recommended that the Injection Monitor be used in conjunction with the AEM Water/Methanol Injection Filter (AEM part# 30-3003). Using a filter will maximize the performance and longevity of your flow sensor as well as your entire injection system.

INSTALLATION

1. Disconnect the negative battery cable.
2. Temporarily install gauge without bracket into desired mounting location. Gauge mounts into a 2 1/16” (52MM) hole. The supplied rubber band can be used as a spacer around the gauge if it fits loosely in mounting hole.
3. Splice into injection line and install flow sensor as close as practically possible to final injection point. Flow sensor can be installed before or after check valves or flow control solenoids. A filter is highly recommended and should be installed ahead of the sensor. Ensure arrow on flow sensor points in the direction of flow. Avoid exposing flow sensor to high heat sources (exhaust, turbo, etc.). Route flow sensor cable to gauge mounting location.
4. Install USB cable so the PC end of the cable is easily accessible and route the gauge end of cable to the gauge mounting location. USB cable is meant to be permanently installed to gauge and left in vehicle. Stow PC end of cable in location such as glove box or center console, etc.
5. Install the 4 & 8 pin harnesses and connect wires as described below:

8 Pin Power Harness		
Color	Label	Description
Red	PWR	Constant power; connect to a fused constant +12V power source
Black	GND	Ground; connect to good chassis ground or directly to battery negative (-) terminal
Pink	IGN PWR	Ignition power; connect to a fused key on +12V power source
Grey	LIGHT	Gauge backlighting; connect to instrument lighting dimmer wire
White	ANALOG +	*OPTIONAL* 0-5V analog output for flow; connect white wire to + analog input and brown wire to - analog input of data logger or EMS; see note below
Brown	ANALOG -	

4 Pin Input & Output Harness		
Color	Label	Description
Yellow	HI SIDE	+12V output; connect to an external auxiliary device (1.5A max current)
Blue	LOW SIDE	Ground output; connect to an external auxiliary device (1.5A max current)
Green	AUX	*OPTIONAL* Auxiliary alarm input; if using AEM Water/Methanol Injection System, connect to the green wire of progressive controller (Boost Safe output); other injection systems may connect to optional ground switch (fluid level, etc.) input
Orange	INJ PER	Injection percentage input; if using AEM Water/Methanol Injection System, tap orange wire of progressive controller; all others tap wire that connects from progressive controller to pump

6. NOTE: The analog output is a differential output so the brown wire should be connected to an analog ground input for best results. If the EMS, logger or similar device does not have an analog ground input, the brown wire should be connected to a sensor ground. If no sensor ground is available, the brown wire should be connected to a power ground. The brown wire **must** be connected in order to obtain correct flow readings from the analog output.
7. Connect all cables and wiring harnesses to gauge. Fully install gauge into hole using mounting bracket and nuts.

PC SOFTWARE

Download and install the Injection Monitor configuration software from the AEM Performance Electronics forum at <http://forum.aempower.com/forum/>. Open the configuration software and connect the USB cable to the PC. If permanent power is present the Injection Monitor will turn on with ignition key-on power. Alternatively, the Injection Monitor can be bench-programmed outside of the vehicle without powering it by connecting just the USB cable, however, the backlighting, needle and warning lights will not activate.

Injection Monitor Configuration Tab

This is the section where the flow monitoring and alarm output functionality of the Injection Monitor is configured.



Flow vs. Injection Graph

Description

Displays flow vs. injection percentage data points. Flow points will be populated live whenever the PC is connected to the Injection Monitor and injection is occurring. The current injection percentage and flow rate values are shown live on the right side of the graph. This is also where the high and low flow limit lines are established.

Graph

Button	Description
Auto Scale	Scales the graph down to best resolution; the graph automatically scales up in the event flow data is collected beyond the highest shown flow value
Auto Set Limits	Automatically sets the upper and lower flow limit lines based on an average of the collected flow data points
Reset Limits	Resets the upper flow limit line to max and the lower flow limit line to zero
Clear Graph	Clears all the displayed flow data points from the graph; does not clear stored flow data from logger

Logger

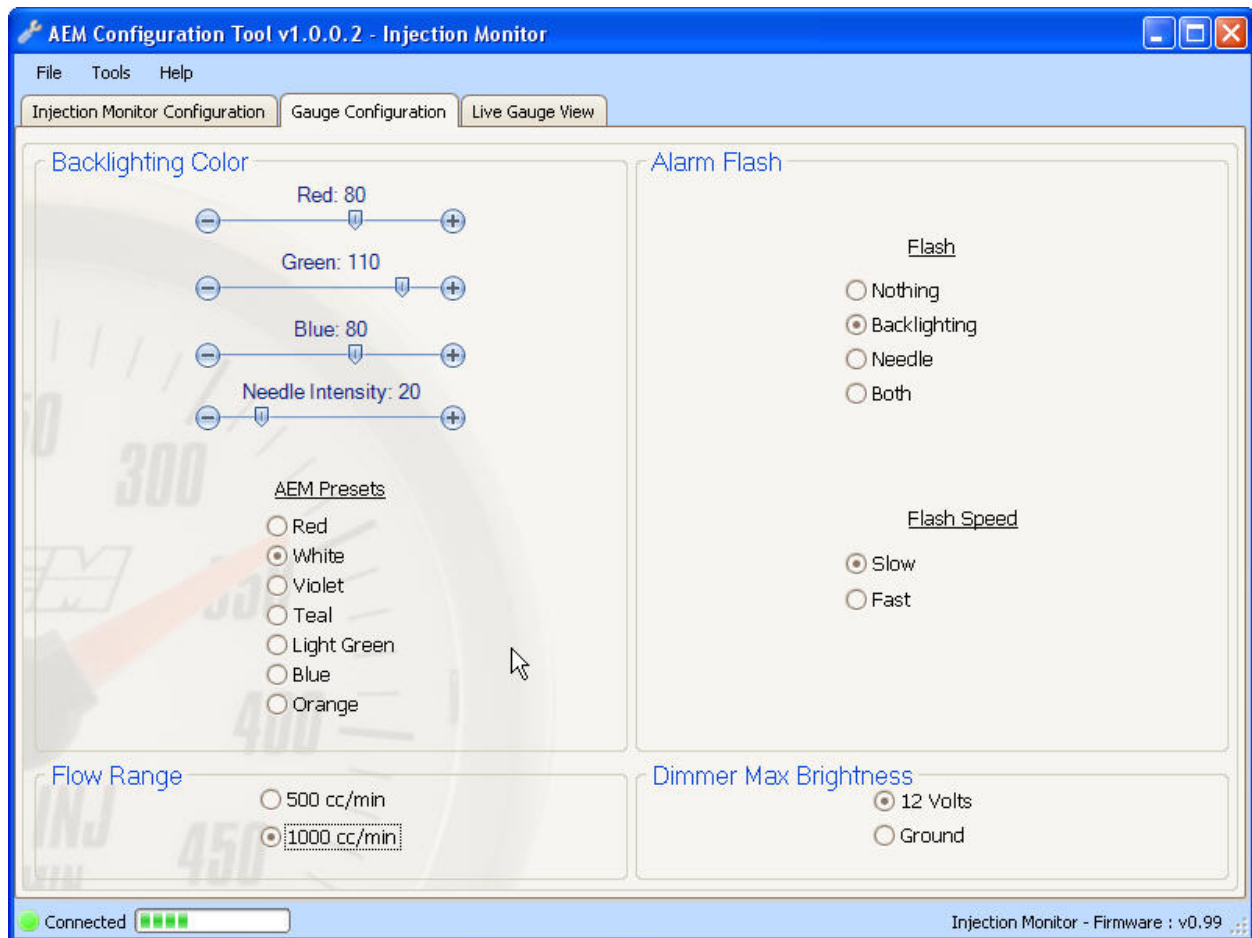
Button	Description
Download Log	Downloads all the collected flow data that is stored in the logger; will prompt to save log to disk; log files saved as .stf for direct viewing in AEMLog program
Clear Log	Clears all stored flow data from the logger

Alarm Configuration	
Option	Description
Aux Input Status	Shows the status of the auxiliary alarm input; on or off
Alarm Delay	Period of time that measured flow can be outside the upper and low flow limit lines before an alarm condition is triggered; 100-1000 milliseconds
Alarm Reset	Period of time flow must be within the acceptable range before the alarm will reset; 1-10 seconds
12V Output	Select to turn the 12V output on when an alarm is triggered or to turn the 12V output off when an alarm is triggered; 1.5 amps max
GND Output	Select to turn the ground output on when an alarm is triggered or to turn the ground output off when an alarm is triggered; 1.5 amps max

Alarm Status	
Parameter	Description
Status Indicator	Color indicates status; green is system ready, red is alarm triggered
Source	Indicates the source of the alarm condition; possible alarm conditions are high flow, low flow, auxiliary input, and alarm test
Alarm Flow	Flow rate when alarm was triggered; cc/min
Alarm INJ	Injection percentage when alarm was triggered
Option	Description
Alarm Test	Simulates an alarm to test output configuration; test duration set by Alarm Delay value

Gauge Configuration Tab

This is the section where the gauge backlighting is configured.



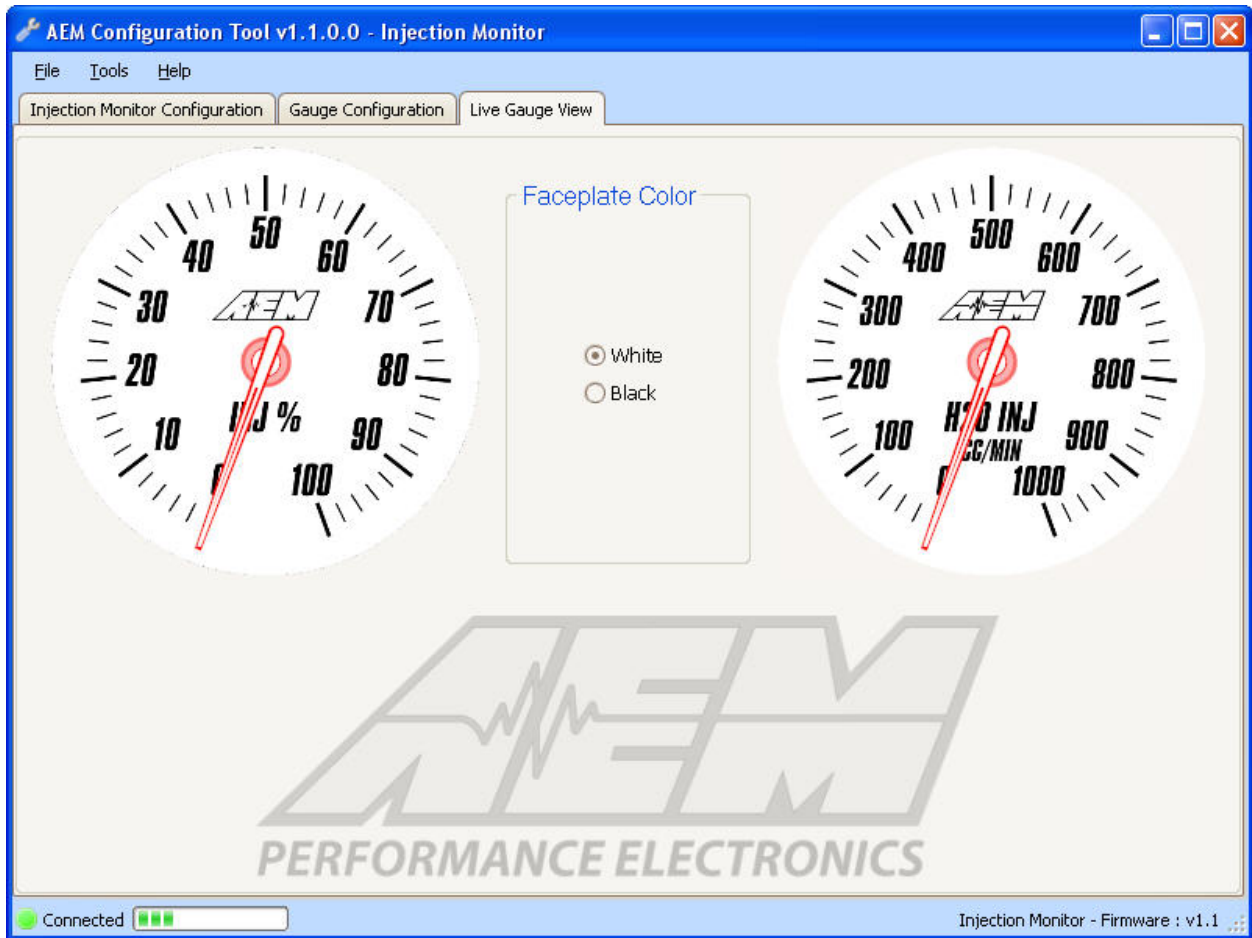
Backlighting Color	
Option	Description
Color Scale	Adjustable RGB color levels; use to match gauge backlighting to OEM gauge backlighting color
Needle Intensity	Adjustable intensity level; use to select desired needle brightness
AEM Presets	Preset backlighting colors to match existing AEM analog gauges; seven color options are red, white, violet, teal, green, blue and orange

Alarm Flash	
Option	Description
Flash	Select visual output to occur when alarm is triggered; can flash gauge backlight only, flash needle only, flash both backlight and needle alternately, or do nothing
Flash Speed	Select speed of flashing while alarm is triggered; flash slow or fast

Flow Range & Dimmer Max Brightness	
Option	Description
Flow Range	Select 500 or 1000 cc/min; gauge face plate must match flow range selection - see additional instructions for face plate removal information
Dimmer Max Brightness	Select whether +12V or ground indicates maximum backlighting brightness

Live Gauge View

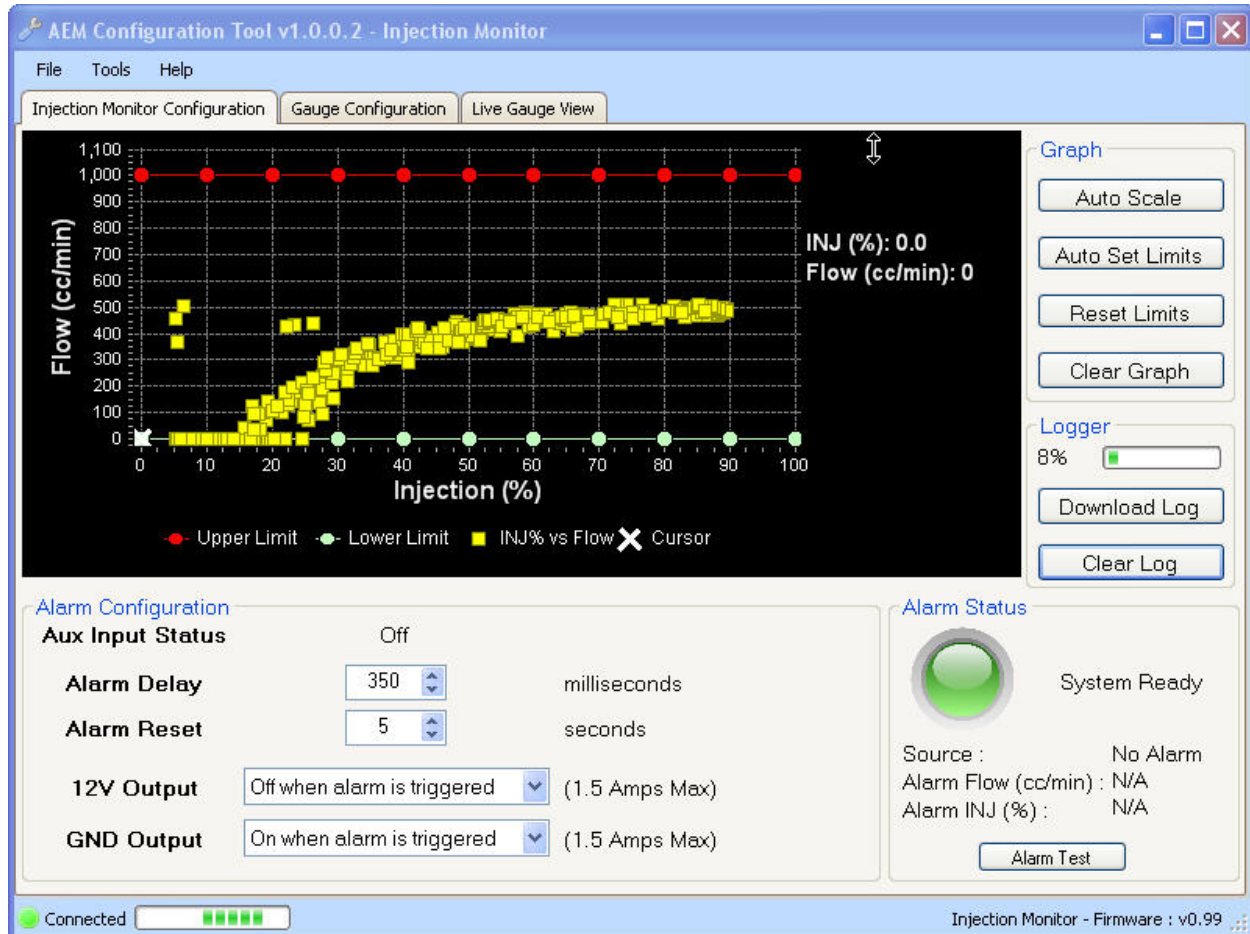
The Injection Monitor PC software has a live gauge display. Injection Percentage is shown on the left from 0-100% and flow, in cc/min, is shown on the right. The flow range shown in the live gauge will match the flow range selected in the Gauge Configuration tab. Faceplate color can be black or white.



INJECTION MONITOR CONFIGURATION

The following is a basic guideline strategy for configuring the Injection Monitor for the first time. The ideal time to configure the Injection Monitor is while the vehicle is being dyno tuned for water/methanol injection. **Ensure your injection system is fully functional with no leaks or clogs or other issues before starting to configure the Injection Monitor!**

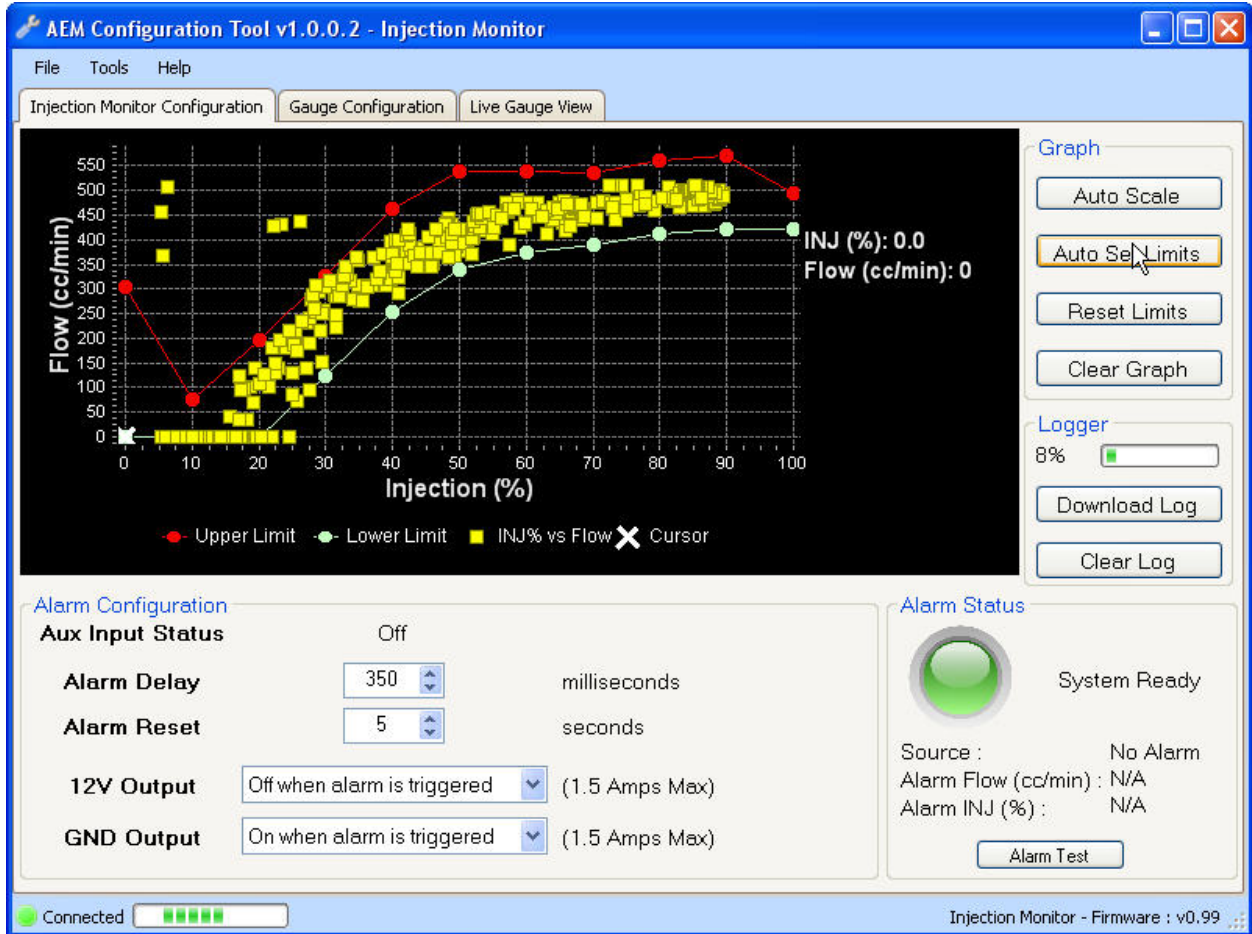
1. In the Injection Monitor Configuration tab, click on Clear Graph and Reset Limits to zero out all settings.
2. Complete a series of long sweeping high load 3rd and 4th gear pulls going from zero to full injection each time to populate the graph with flow data. Avoid making quick hard pulls as this may skew the flow data points. Repeat this procedure until a baseline flow curve is established. Alternatively, if using the AEM Water/Methanol Injection System, simply press and hold the test button on the progressive controller a number of times while the injection nozzle is removed from the intake and pointed into a container.



Establishing baseline flow curve

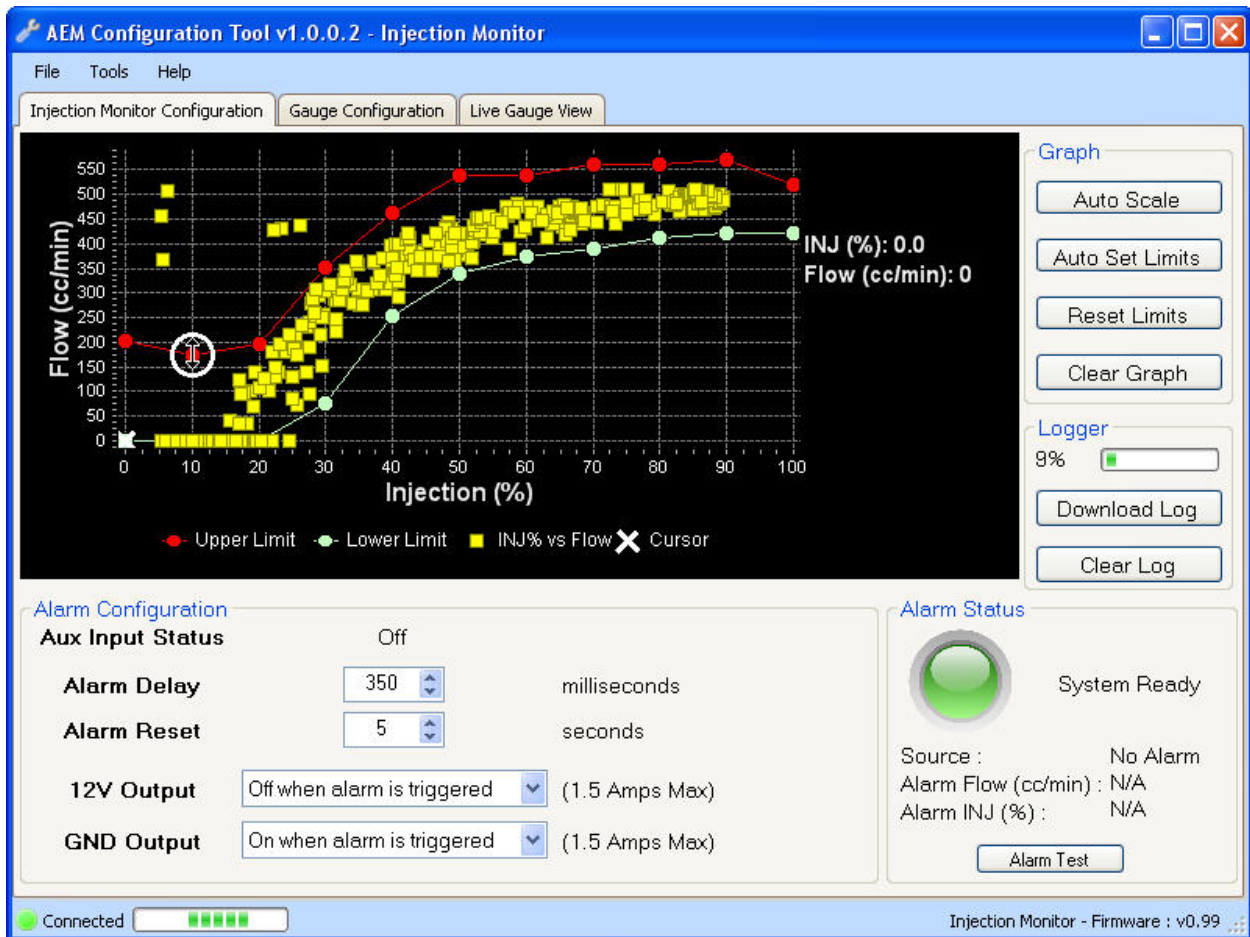
NOTE: You may notice that a few random flow data points are plotted well outside of the normal flow curve when the system goes from being commanded full on to full off very quickly. This occurs when the signal driving the pump is shut off and returns to 0% injection very quickly while there is still a slight amount of measureable flow. The electrical signal driving the pump can drop back to zero faster than the physical movement of the fluid flowing can be stopped. This is normal behavior which should not create a false trigger and can be ignored in virtually all cases.

3. With a baseline flow curve now established, click on Auto Set Limits and the software will produce its best suggested high and low flow limit lines based on the populated flow data shown on the graph.



High and low flow limit lines are automatically generated after pressing Auto Set Limits

- Review and adjust the high and low flow limit lines as needed to contour the lines around the baseline flow curve by clicking and dragging on a break point. Once a break point is selected you can also move left and right using the arrow keys and then move the break point up or down. Pressing the Tab key will toggle back and forth between the high and low limit lines.



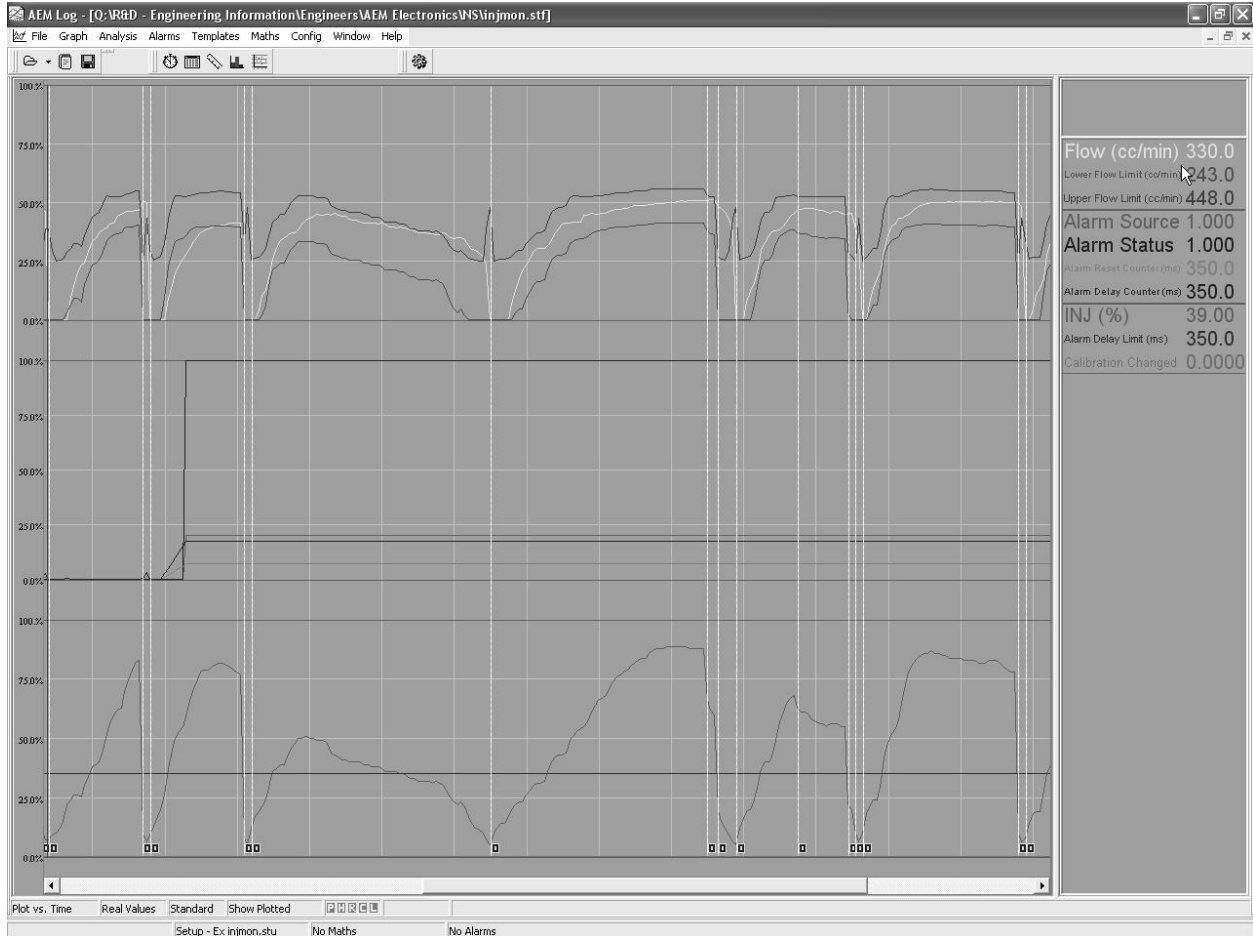
Contouring the high and low flow limit lines to better fit the baseline flow curve

- Test the configuration using your anticipated normal operating conditions with varying injection progression rates to account for starting, stopping, accelerating, high boost, low boost, tip in, fast shifts, slow shifts, etc. If false triggers occur either adjust the high or low flow curve up or down at the injection percentage where the alarm occurred or adjust the Alarm Delay setting.

There are two general configuration strategies to follow when using the Injection Monitor. The high and low flow limit lines can be set very tightly to the baseline flow curve and a longer Alarm Delay can be used. Conversely, the high and low flow limit lines can be set further way from the baseline flow curve and a shorter Alarm Delay can be used. All injection systems are different and only through configuration testing will reveal which strategy is best for your application.

DATA LOGGER

The Injection Monitor has an internal logger that can store approximately 2.5 minutes of injection data. The logger maintains two levels of data logs. First, all flow data points are stored and downloadable for viewing on the Flow vs. Injection Graph in the Injection Monitor Configuration tab. Second, all injection events, inputs, outputs, and alarm triggers are logged in special log file format for viewing with the AEMLog software that comes as part of the Injection Monitor download package. Once the logger memory has filled up, the logger will begin to loop log and the oldest data will be discarded as new data is collected.



Logging will start when Injection Percentage is more than 5% and stop when Injection Percentage is less than 5%. Each individual injection event is indicated by a marker.

The following is a basic guideline on how to use the internal data logger.

1. Connect USB cable to PC. In the Injection Monitor Configuration tab under Logger, click Download Log. All logged flow data points will now be displayed in the Flow vs. Injection Graph.
2. To download the log to the PC click Yes when prompted to save data to disc and then save log in desired location.
3. Click Yes when prompted to open file in AEMLog.
4. The saved data log is now shown in a special log viewing template that is pre-loaded into AEMLog.

The data log will now open and be displayed in three separate plots as described on page 12.

Plot One	
Parameter	Description
Flow	Measured flow rate in cc/min
Lower Flow Limit	Lower flow limit value as related to Injection Percentage
Upper Flow Limit	Upper flow limit value as related to Injection Percentage

Plot Two	
Parameter	Description
Alarm Source	Indicates what triggered the alarm condition; 1-low flow condition, 2-high flow condition, 3-auxiliary input, 4-alarm test
Alarm Status	Indicates state of alarm; 1-alarm triggered, 0-alarm not triggered
Alarm Reset Counter	Counts up from zero to Alarm Reset value once flow has returned into the acceptable range
Alarm Delay Counter	Counts up from zero to Alarm Delay value when flow occurs outside the high or low flow limits; once full Alarm Delay value is reach the alarm will trigger; counter will reset back to zero if flow returns back into the acceptable range once count up has began

Plot Three	
Parameter	Description
INJ	Injection percentage value
Alarm Reset Limit	Alarm Reset value
Alarm Delay Limit	Alarm Delay value
Calibration Changed	Indicates that a configuration setting has changed

OUTPUT CONFIGURATION

The Injection Monitor has two outputs that are triggered when an alarm condition exists; one +12 volt (high side) output and one ground (low side) output. These outputs can be used in a multitude of ways to reduce boost, pull timing, or otherwise protect an engine in the event there is a problem with the water/methanol injection system. The following is an index of possible auxiliary devices that can be triggered by the alarm outputs:

<i>AEM EMS</i>	
Function	Description
Nitrous Fuel & Ignition Maps	Use the ground output to trigger the nitrous fuel and ignition maps; ignition timing can be reduced and fuel can be added
Boost Switch	Use the ground output to trigger the boost switch; a lower boost value can be targeted
Two-Step	Use the ground output to trigger the two-step; a lower engine rev limit can be selected

<i>MSD Ignition Products</i>	
Product	Description
DIS2 (62112)	Brown wire: apply +12V to trigger ignition interrupt Blue wire: apply +12V to trigger two step Pink wire: apply +12V to trigger timing retard
DIS4 (62152)	Brown wire: apply +12V to trigger ignition interrupt Blue wire: apply +12V to trigger two step Pink wire: apply +12V to trigger timing retard
6AL-2 (6421)	Blue wire: apply +12V to trigger two step
Programmable 6AL-2 (6530)	Dark blue wire: apply +12V to trigger launch rev limit, overrides all others Light blue wire: apply +12V to trigger burn out rev limit Pink wire: apply +12V to trigger timing retard
Digital 6 Plus (6520)	Blue wire: apply +12V to trigger two step Pink wire: apply +12V to trigger timing retard
Start/Retard Control (8982)	Violet wire: apply +12V to trigger timing retard
Timing Controller (8980)	Grey wire: remove ground input to trigger timing retard

NC/NO Relay

The following are examples of how a NC/NO relay (Bosch PN 0-332-019-203 or similar) can be configured for use with the Injection Monitor.

Signal Interrupt – The high side (12 volt) output from the Injection Monitor can be used to turn on a NC (normally closed) relay and interrupt the output signal from a boost controller to its boost control solenoid – see Figure 1. Conversely, the low side (ground) output can also be used to trigger the relay – see Figure 2.

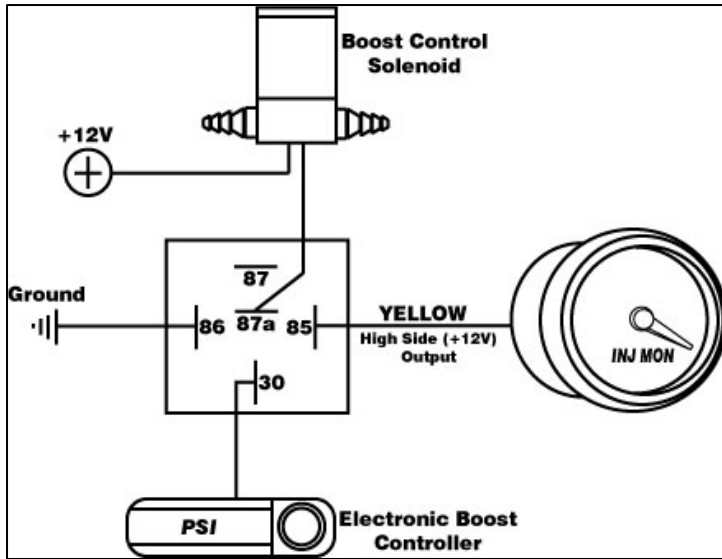


Figure 1

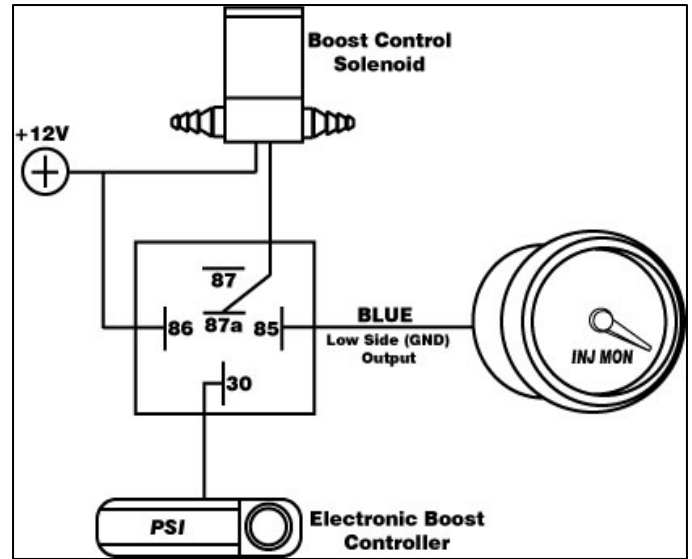


Figure 2

Auxiliary Device – The high side (12 volt) output from the Injection Monitor can be used to turn on a NO (normally open) relay and activate or deactivate an auxiliary device that can be used to reduce timing or boost or control some other function when the current requirement is greater than 1.5 amps – see Figure 3. Conversely, the low side (ground) output can also be used to trigger the relay – see Figure 4.

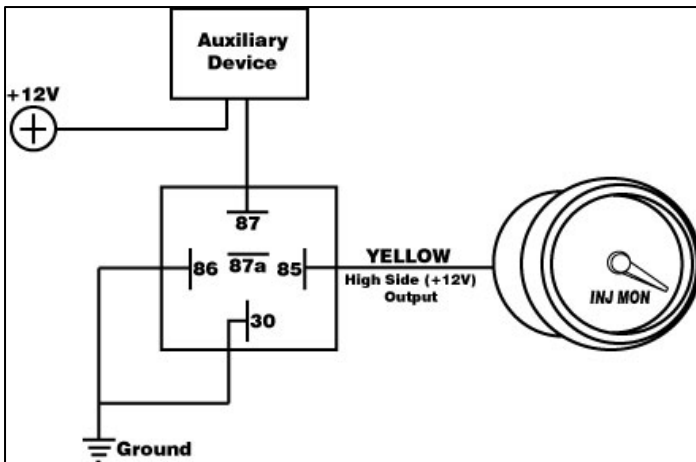


Figure 3

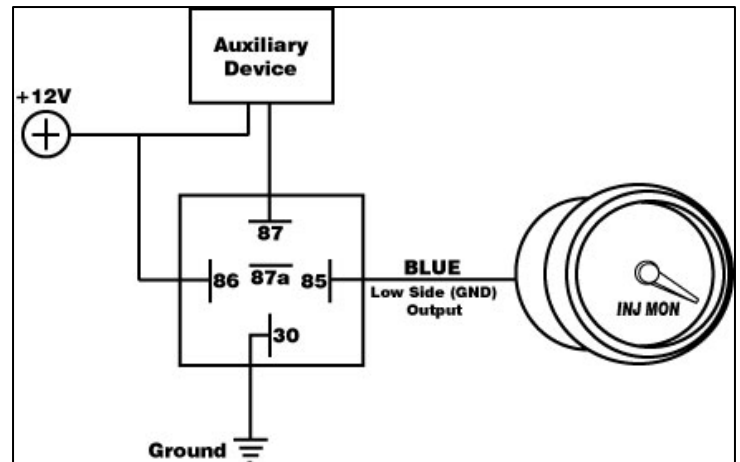


Figure 4

Warning Light

The Injection Monitor can also be used to directly activate a warning light (Autometer PN 3239 or similar). Connect the warning light black wire to ground and power the light with the high side output – see Figure 5. Alternatively, the low side output can also be used to turn the light on if the white wire is connected to +12V – see Figure 6.

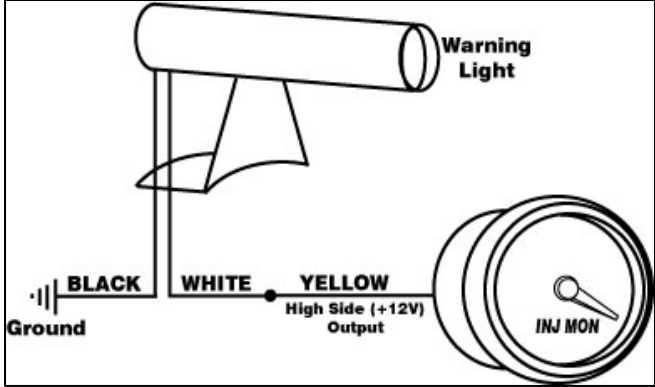


Figure 5

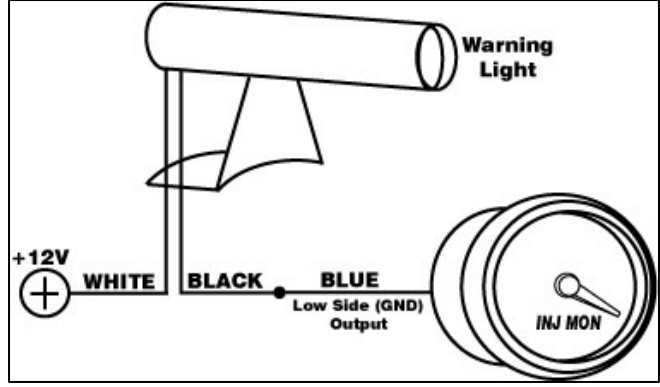


Figure 6

INJECTION MONITOR GAUGE

The Injection Monitor gauge comes with the black bezel installed however, a silver bezel is also included. To change the bezel, orient the gauge so you are looking at the faceplate. Rotate the bezel counter-clockwise to unscrew it from the gauge cup. The bezel, lens, and rubber spacer are all removable. Reassemble the gauge as shown below in Figure 7. Note: When reassembling the gauge, it may be necessary to apply a light amount of pressure on the lens and spacer to keep the faceplate from rotating when reinstalling the bezel. **Do not over tighten the bezel when reassembling the gauge.**

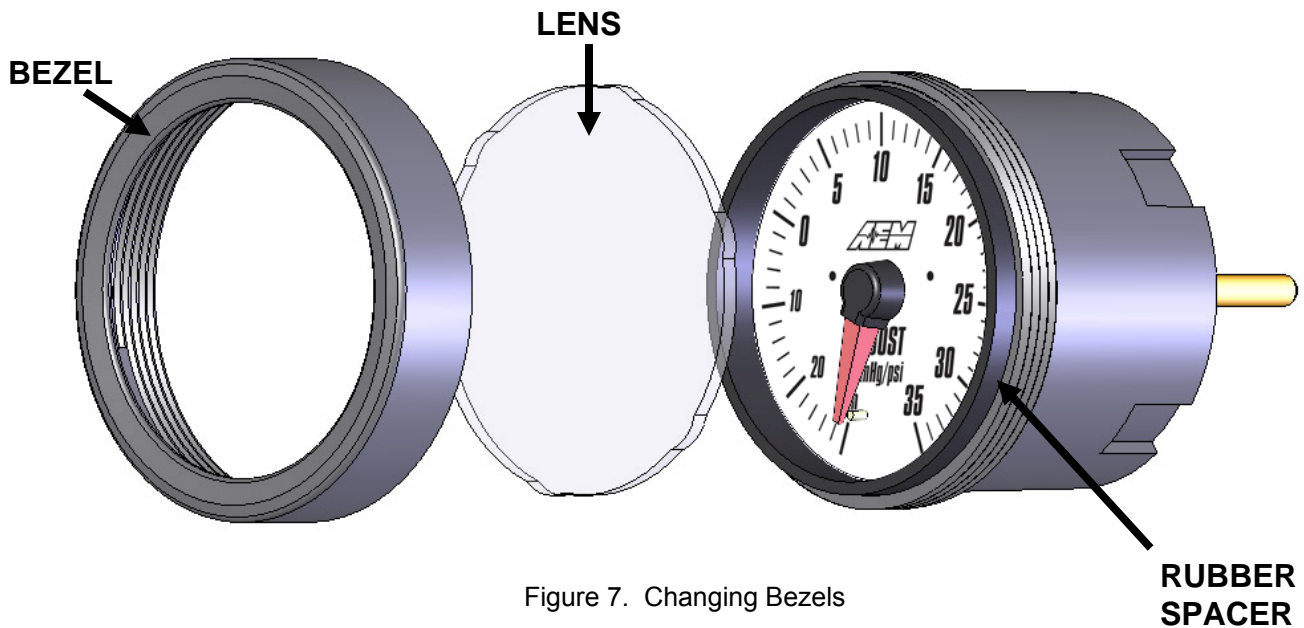


Figure 7. Changing Bezels

Status Lights

The Injection Monitor gauge has two status lights (see below) that indicate when an alarm has been triggered. The left status light will turn on if there is a low flow alarm. The right status light will turn on if there is a high flow alarm. Both status lights will turn on if the auxiliary input is triggered.



Illuminated Status Lights

Analog Output

The analog output from the Injection Monitor is a linear dc voltage signal that varies with flow. The signal is used for sending information to a data logger or an engine management system like the AEM EMS or F/IC. The output range is automatically scaled when either the 500 cc/min or 1000 cc/min flow range is selected in the Gauge Configuration tab. The transfer functions for the analog output of each flow range are listed below in cc/min and gal/hr.

500 cc/min Specifications:

Minimum Voltage/Flow: 0.5Vdc at 0 cc/min

Maximum Voltage/Flow: 4.5Vdc at 500 cc/min

Transfer Function cc/min: Flow (cc/min) = (125 * Voltage) – 62.5

Example: Output voltage of 2.5Vdc = 250 cc/min

$(125 * 2.5) - 62.5 = 250$ cc/min

Transfer Function gal/hr: Flow (gal/hr) = (1.98 * Voltage) – 0.99

Example: Output Voltage of 2.5Vdc = 3.96 gal/hr

$(1.98 * 2.5) - 0.99 = 3.96$ gal/hr

A list of output voltages and corresponding flow rates is shown on Page 17 - Table 1.

1000 cc/min Specifications:

Minimum Voltage/Flow: 0.5Vdc at 0 cc/min

Maximum Voltage/Flow: 4.5Vdc at 1000 cc/min

Transfer Function cc/min: Flow (cc/min) = (250 * (Voltage)) – 125

Example: Output voltage of 2.5Vdc = 500 cc/min

$(250 * 2.5) - 125 = 500$ cc/min

Transfer Function gal/hr: Flow (gal/hr) = (3.96 * (Voltage)) – 1.98

Example: Output Voltage of 2.5Vdc = 7.93 gal/hr

$(3.96 * 2.5) - 1.98 = 7.93$ gal/hr

A list of output voltages and corresponding flow rates is shown on Page 17 - Table 2.

Voltage	cc/min	gal/hr
0.50	0	0.00
0.75	31	0.50
1.00	63	0.99
1.25	94	1.49
1.50	125	1.98
1.75	156	2.48
2.00	188	2.97
2.25	219	3.47
2.50	250	3.96
2.75	281	4.46
3.00	313	4.95
3.25	344	5.45
3.50	375	5.94
3.75	406	6.44
4.00	438	6.93
4.25	469	7.43
4.50	500	7.93

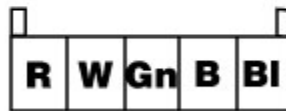
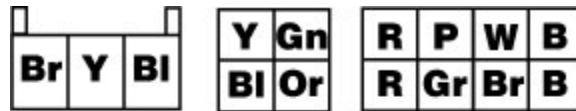
Table 1 – Analog Voltages
500 cc/min

Voltage	cc/min	gal/hr
0.50	0	0.00
0.75	63	0.99
1.00	125	1.98
1.25	188	2.97
1.50	250	3.96
1.75	313	4.95
2.00	375	5.94
2.25	438	6.93
2.50	500	7.93
2.75	563	8.92
3.00	625	9.91
3.25	688	10.90
3.50	750	11.89
3.75	813	12.88
4.00	875	13.87
4.25	938	14.86
4.50	1000	15.85

Table 2 – Analog Voltages
1000 cc/min

Connector Pinouts

The pinouts for the 3-pin sensor harness, 4 pin I/O harness, 8-pin power harness, and 5 pin USB harness are provided below.



Wire Entry View

Harness Pinouts

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.

An AEM Warranty Claim Form Must Accompany All Warranty Claims. Products returned to AEM with no Return Goods Authorization and or No Warranty Claim Form may be rejected and returned to sender.

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 Goods Authorization (RGA) number. Credit for defective products will be issued pending inspection. Product must be received by AEM within 30 days of the date RGA was issued.

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

AN AEM WARRANTY CLAIM FORM MUST ACCOMPANY ALL ELECTRONICS WARRANTY CLAIMS. AEM ELECTRONIC Products returned to AEM with no RGA and or No Warranty Claim Form may be rejected and returned to sender.

A copy of the AEM Warranty Claim Form can be e-mailed or faxed by contacting (310) 484-2322 and ask for Warranty/Claims Department.

Need additional help? Contact the AEM Performance Electronics tech department at 1-800-423-0046 or tech@aempower.com, or visit the AEM Performance Electronics forum at <http://forum.aempower.com/forum/>