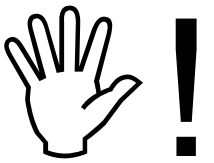
# *Installation Instructions for:*
# *EMS P/N 30-1611 and 30-1611U*
# *95-98 Nissan 240SX (OBD2)*
# *97-99 Sentra (Except 97 2.0L)*
# *97-98 200SX (Except 97 2.0L)*
# *96-99 Altima (Except 96 Non CA Models)*
# *99 Infiniti G20*

**WARNING:**



**This installation is not for the tuning novice nor the PC illiterate! Use this system with <u>EXTREME</u> caution! The AEM EMS System allows for total flexibility in engine tuning. Misuse of this product can destroy your engine! If you are not well versed in engine dynamics and the tuning of management systems or are not PC literate, please do not attempt the installation. Refer the installation to a AEM trained tuning shop or call 800-423-0046 for technical assistance. You should also visit the AEM EMS Tech Forum at http://www.aempower.com**

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

**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: 10-1611

The AEM Engine Management System (EMS) is the result of extensive development on a wide variety of vehicles. Each system is engineered for a particular application. The AEM EMS differs from all others in several ways. The EMS is a “stand-alone”, which completely replaces the factory ECU and features unique plug and play technology. There is no need to modify the factory wiring harness and in most cases the vehicle may be returned to stock in a matter of minutes. The AEMPro software is configured to work with the factory sensors and equipment, so there is no need for expensive or hard to find sensors, making replacements and repairs as simple as with any stock vehicle. For stock and slightly modified vehicles, the AEMPro software can be programmed with base parameters, providing a solid starting point for beginner tuning. For more heavily modified cars, the EMS has many spare inputs and outputs allowing the elimination of add-on rev-limiters, boost controllers, nitrous controllers, fuel computers, etc. It also includes a configurable onboard data logger capable of recording 512kb of information. Every EMS comes with all functions installed and activated, and there are no expensive options or upgrades to be performed.

Please visit the AEM EMS Forum at http://www.aempower.com to register the system before beginning. Make sure to enter the serial number found on the back of the EMS as doing this grants access to the calibration files. AEM always posts the most current software and base maps online. The forum also has many helpful hints/tips to make the EMS perform its best.

While the base map may be a good starting point and will save considerable time and money, it will not replace the need to tune the specific application. AEM base maps are tuned conservatively and are not intended to be driven aggressively. Ignoring this can and will damage your engine.

If the UEGO EMS was purchased, the stock O2 #1 sensor should be removed and replaced with the AEM sensor supplied with the EMS. The UEGO EMS furnishes the user with real time, accurate and repeatable air/fuel ratio values. The system consists of an internal air fuel ratio (AFR) controller, wiring harness, and a wide band oxygen sensor with a weld-in sensor bung.

The heart of the AEM wideband controller is the Bosch LSU4.2 Universal Exhaust Gas Oxygen (UEGO) sensor. This type of sensor is commonly referred to as “laboratory grade” and works on a different principle than the normal oxygen sensor found in most vehicles. Its unique design makes precision AFR measurements possible over the entire operating range. UEGO type sensors use a “current pump” within the sensor itself to determine the actual oxygen concentration within the sensing element or, lacking any oxygen, it determines the amount of oxygen required to regain stoichiometric operation. The output is in the form of a very small current, which varies depending on the air-fuel ratio. This is completely different from normal oxygen sensors (1, 2, and 4 wire types), which directly output a voltage.

Each AEM UEGO sensor is individually calibrated using a laser trimmed resistor integral found on the connector body. This process replaces the traditional “free air” calibration procedure when changing sensors and implements a sensor specific calibration for unparalleled accuracy.

**Read and understand these instructions <u>BEFORE</u> attempting to install this product.**

1) **Removing the Stock Engine Control Unit**
   a) Access the stock Engine Control Unit (ECU). The 240SX ECU is found behind the passenger-side kick panel. All other Nissan engine control units are found on the floor in front of the center console.
   b) Carefully disconnect the wiring harness from the ECU. Avoid excessive stress or pulling on the wires, as this may damage the wiring harness. Some factory ECUs use a bolt to retain the factory connectors, and it must be removed before the harness can be disconnected. There may be more than one connector, and they must all be removed without damage to work properly with the AEM ECU. Do not cut any of the wires in the factory wiring harness to remove them.
   c) Remove the fasteners securing the ECU to the car body, and set them aside. Do not destroy or discard the factory ECU, as it can be reinstalled easily for street use and troubleshooting.
2) **Installing and Routing the UEGO Sensor (UEGO EMS Only)**
   a) Remove the forward most O2 sensor and replace it with the supplied UEGO sensor.
   b) Connect the sensor and route the wire through the firewall to the EMS being careful in staying away from heat and the suspension.
3) **Installing the AEM Engine Management System.**
   a) Plug the factory wiring harness into the AEM EMS and position it so the wires are not pulled tight or stressed in any manner. Secure the EMS with the provided Velcro fasteners.
   b) Plug the comms cable into the EMS and into the PC (not supplied).
   c) Install the supplied AEM CD and open the AEMPro software.
   d) Turn the ignition "on" but do not attempt to start the engine.
   e) Go to: "*ECU* | *Send New Calibration"*. Upload the base calibration file (.cal) that most closely matches the vehicle's configuration to be tuned. Full details of the test vehicle used to generate each map can be found in the *"Notes"* section in the *"Setup"* window of the AEMPro software. The base maps can be found in the Nissan folder located in: *"My Computer* | *Local Disk (C:)* | *Program Files* | *AEM* | *AEMPro* | *Startup Calibrations"*
   f) Set the throttle range: Select the "*Configure"* drop down menu, then "*ECU Setup* | *Set Throttle Range"* and then follow the instructions given on the screen.
   g) Verify the ignition timing: Select the "*Configure"* drop down menu, then "*ECU Setup* | *Set Ignition"*. Use a timing light and compare the physical engine timing to the parameter "*Ignition Timing"* displayed. Use the "*Advance/Retard"* buttons to make the timing number match.
   h) Calibrate the lambda sensor channel (UEGO Only): With the ignition "on" and the sensor unplugged, change the *"O2 #1 Gain" (Setup* | *Sensors* | *Oxygen Sensor* | *Oxygen Sensor #1* | *Options - O2 Sensor #1)* until the *"O2 #1 Volts"* parameter displays 3.94 Volts (+/- 0.02 Volts). This should yield an "*O2 #1 Gain"* near 1.28. If using the non-UEGO EMS, keep the "*O2 #1 Gain"* at 1.0.
4) **Ready to begin tuning the vehicle.**
   a) Note: This calibration needs to be properly tuned and is not recommended for street use. **<u>NEVER TUNE THE VEHICLE WHILE DRIVING.</u>**

# Application Notes for EMS P/N 30-1611 and 30-1611U

| | |
|---|---|
| Make: | Nissan |
| Models: | 240SX/Sentra/200SX/Altima/G20 |
| Years Covered: | 1996-1999 |
| Displacement: | 1.6-2.4L |
| Engine Configuration: | Inline 4 |
| Firing Order: | 1-3-4-2 |
| N/A, S/C or T/C: | N/A |
| Load Sensor Type: | MAF or MAP |
| MAP Min: | 0.5 Volts |
| MAP Max: | 4.5 Volts |
| MAF Min: | 0.47 Volts |
| MAF Max: | 4.98 Volts |
| # Coils: | 1 |
| Ignition driver type: | 0-5V High Switch Low |
| How to hook up CDI: | Wire in after Igniter |
| # Injectors: | 4 (Inj 1-4) |
| Factory Injectors: | 185cc-250cc |
| Factory Inj Resistors: | --- |
| Injection Mode: | Sequential |
| Knock Sensors: | 1 |
| Lambda Sensors: | 1 |
| Idle Motor Type: | Pulse Width |
| Main Relay Control: | No (hardware controlled) |
| Crank Pickup Type: | Optical |
| Crank Teeth/Cycle: | 360 |
| Cam Pickup Type: | Optical |
| * Cam Teeth/Cycle: | * 3 Short + 1 Long |
| Trans Offered: | Manual/Automatic |
| Trans Supported: | Manual |
| Drive Options: | FWD & RWD |
| Supplied Connector: | N/A |
| | |
| | |
| | |

| | |
|---|---|
| Spare Injector Drivers: | Inj #5, Pin 29 |
| Spare Injector Drivers: | Inj #6, Pin 30 |
| Spare Injector Drivers: | Inj #7, Pin 31 |
| Spare Injector Drivers: | Inj #8, Pin 32 |
| Spare Injector Drivers: | Inj #9, Pin 116 |
| Spare Injector Drivers: | Inj #10, Pin 117 |
| Spare Coil Drivers: | Coil #2, Pin 58 |
| Spare Coil Drivers: | Coil #3, Pin 64 |
| Spare Coil Drivers: | Coil #4, Pin 36 |
| Spare Coil Drivers: | Coil #5, Pin 69 |
| Boost Solenoid: | PW #2, Pin 34 |
| EGT #1 Location: | Pin 62 |
| EGT #2 Location: | Pin 65 |
| EGT #3 Location: | Pin 2 |
| EGT #4 Location: | Pin 67 |
| Spare 0-5V Channels: | PR Press, Pin 9 |
| Spare 0-5V Channels: | Gear, Pin 24 |
| Spare 0-5V Channels: | Spare Temp, Pin 7 |
| Spare 0-5V Channels: | Knock #2, Pin 68 |
| Spare 0-5V Channels: | --- |
| Spare Low Side Driver: | Low Side #1, Pin 115 |
| Spare Low Side Driver: | Low Side #2, Pin 37 & 57 |
| Spare Low Side Driver: | Low Side #4, Pin 108 |
| Spare Low Side Driver: | Low Side #8, Pin 114 |
| Spare Low Side Driver: | Low Side #9, Pin 110 |
| Spare Low Side Driver: | Low Side #12, Pin 105 |
| Check Engine Light: | Low Side #10, Pin 18 |
| Spare High Side Driver: | High Side #1, Pin 11 |
| Spare Switch Input: | Switch #1, Pin 35 |
| Spare Switch Input: | Switch #2, Pin 25 |
| Spare Switch Input: | Switch #3, Pin 60 |
| Spare Switch Input: | Switch #4, Pin 22 |
| Spare Switch Input: | Switch #5, Pin 27 |
| A/C Switch Input: | Switch #6, Pin 21 |

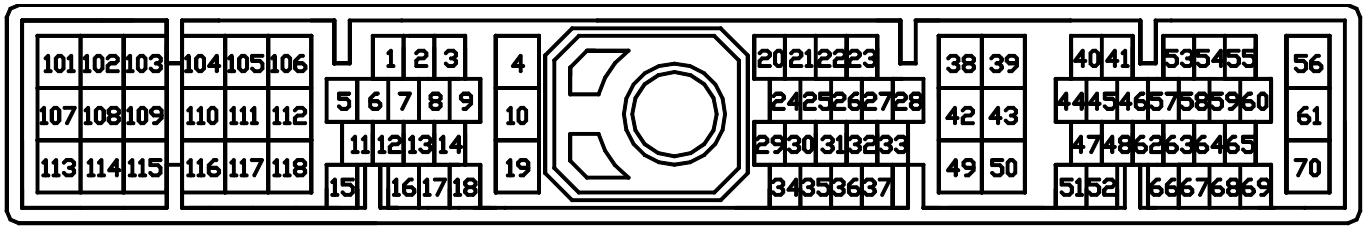
* Nissan manufactures many different optical-type cam and crank sensors. These discs have different teeth patterns that, for the most part, are physically interchangeable with one another and can easily be installed upside down. If the vehicle has the stock cam/crank arrangement, the appropriate base map will work and there are no adjustments needed. However, if the engine has been tampered with at some point and is not starting with the AEM EMS, check the parameter “Stat Sync’d”. If this parameter turns ON while cranking the engine, the cam/crank disc is correct and the starting problem lies elsewhere. If “Stat Sync’d” stay OFF while cranking, log the parameter “S Tooth”. Find a unique number here to synchronize from. In other words, there should be at least one value displayed in the “S Tooth” parameter that only happens once per engine cycle (1 camshaft revolution). This value should be entered in the option “MX Sync Test”. Note: Some Nissan cam/crank sensors will have multiple unique values to sync from. If a change was necessary, be sure to confirm the ignition timing using the “Ignition Sync” option.

| | |
|---|---|
| **PnP** | The Plug & Play system comes with this configured for proper operation of this device. It is still available for reassignment by the end user. |
| **Available** | The function is not currently allocated and is available for use |
| **Dedicated** | The location is fixed and can not be changed |

| Pin | 1995-1998 Nissan 240SX (OBD2)<br>1997-1999 Nissan Sentra (Except 1997 2.0L)<br>1997-1998 Nissan 200SX (Except 1997 2.0L)<br>1996-1999 Nissan Altima (Except 1996 Non California Models)<br>1999 Infiniti G20 | P/N 30-1611(U) | I/O | Availability |
|---|---|---|---|---|
| **1** | Ignition Signal | Coil #1 | Output | PnP for Coil 1 |
| **2** | Ignition Check | EGT #3 | Input | Avail, RTD Temp |
| **3** | Tachometer | Tachometer (LS7) | Output | PnP for Tachometer |
| **4** | ECCS Self-Shutoff Relay | Main Relay | Output | Dedicated |
| **5** | EVAP Purge Control Valve | Idle #4 | Output | Avail, Ground / +12V, 1.5 A Max |
| **6** | EVAP Purge Control Valve (Except Altima) | Idle #3 | Output | Avail, Ground / +12V, 1.5 A Max |
| **7** | 5th Position Switch (240SX Only) | Spare Temp | Input | Avail, 0-5 Volt Input |
| **8** | Fuel Pump Relay | Low Side Driver #11 | Output | PnP for Fuel Pump |
| **9** | A/C Pres Sw (240SX & Altima Only) | PR Press | Input | Avail, 0-5 Volt Input |
| **10** | ECCS Ground | Power Ground | Input | Dedicated |
| **11** | --- | High Side Driver #1 | Output | Avail, +12V, 1.5A Max |
| **12** | A/C Hand Power Switch (95-96 240SX Only) | --- | --- | Not Used |
| **13** | Cooling Fan High Relay (240SX & Altima Only) | Low Side Driver #5 | Output | PnP for Cooling Fan |
| **14** | Cooling Fan Low Relay | Low Side Driver #3 | Output | PnP for Cooling Fan |
| **15** | Air Conditioner Relay | Low Side Driver #6 | Output | PnP for A/C Compressor |
| **16** | EVAP Purge Control Valve (Except Altima) | Idle #2 | Output | Avail, Ground / +12V, 1.5 A Max |
| **17** | EVAP Purge Control Valve (Except Altima) | Idle #1 | Output | Avail, Ground / +12V, 1.5 A Max |
| **18** | Malfunction Indicator Light | Low Side Driver #10 | Output | Avail, Switched Gnd, 1.5A Max |
| **19** | ECCS Ground | Power Ground | Input | Dedicated |
| **20** | Start Signal | Cranking | Input | Dedicated |
| **21** | Air Conditioner Switch | Switch #6 | Input | PnP for A/C Switch |
| **22** | Neutral Position Switch | Switch #4 | Input | Avail, Switched Input |
| **23** | Throttle Position Sensor | TPS | Input | Dedicated |
| **24** | Blower Fan Switch (97-99 1.6L Only) | Gear | Input | Avail, 0-5 Volt Input |
| **25** | Power Steering Oil Pressure Switch | Switch #2 | Input | Avail, Switched Input |
| **26** | Vehicle Speed Sensor | Vehicle Speed | Input | Dedicated |
| **27** | Throttle Closed Switch | Switch #5 | Input | Avail, Switched Input |
| **28** | Intake Air Temperature Sensor | AIT | Input | Dedicated |
| **29** | --- | Injector #5 | Output | Avail, Switched Gnd, 1.5A Max |
| **30** | --- | Injector #6 | Output | Avail, Switched Gnd, 1.5A Max |
| **31** | --- | Injector #7 | Output | Avail, Switched Gnd, 1.5A Max |
| **32** | --- | Injector #8 | Output | Avail, Switched Gnd, 1.5A Max |
| **33** | Throttle Position Sensor Signal (A/T) | Idle #6 | Output | Avail, Ground / +12V, 1.5 A Max |
| **34** | --- | PW #2 | Output | Avail, Pulse Width Out |
| **35** | --- | Switch #1 | Input | Avail, Switched Input |
| **36** | --- | Coil #4 | Output | Avail, Switched Gnd, 1.5A Max |
| **37** | Air Conditioner FICD (Except 95-96 240SX) | Low Side Driver #2 | Output | Avail, Switched Gnd, 1.5A Max |
| **38** | Ignition Switch | Ignition Switch | Input | Avail, 0-5 Volt Input |
| **39** | ECCS Ground | Power Ground | Input | Dedicated |
| **40** | Camshaft Position Reference Signal | Cam | Input | Dedicated |
| **41** | Camshaft Position Signal | Crank | Input | Dedicated |
| **42** | IACV-AAC Close Valve (97-99 1.6L) | --- | --- | Not Used |

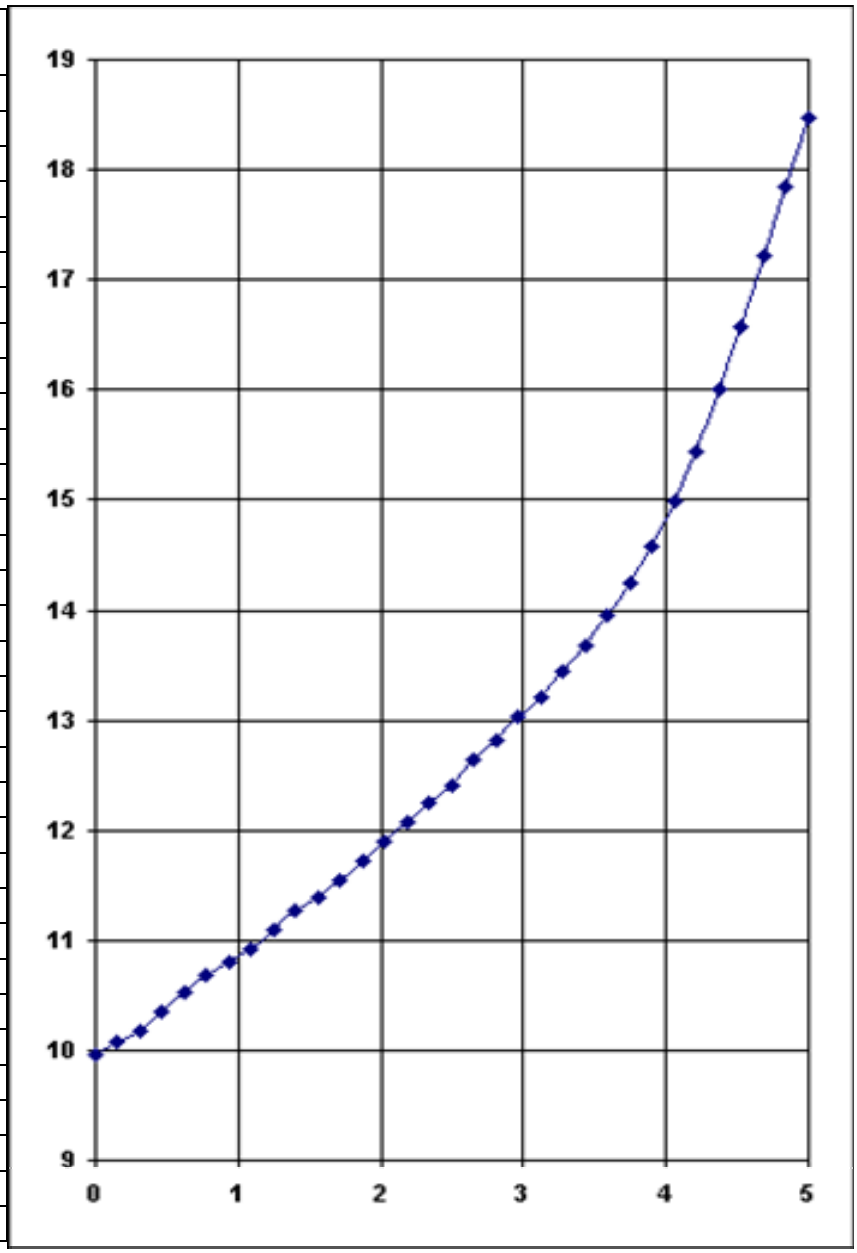
| | | | | |
|---|---|---|---|---|
| **43** | ECCS Ground | Power Ground | Input | Dedicated |
| **44** | Camshaft Position Reference Signal | Cam | Input | Dedicated |
| **45** | Cam Signal (97 Sentra & 200SX Only) | --- | --- | Not Used |
| **46** | Front Heated Oxygen Sensor | <Lambda #1> | <Input> | <O2 #1 Input \| N/A for 30-1611U> |
| **47** | Mass Air Flow Sensor | MAF | Input | PnP for MAF Sensor |
| **48** | Mass Air Flow Sensor Ground | Power Ground | Input | Dedicated |
| **49** | Sensor Power Supply | +5V Sensor | Output | Dedicated |
| **50** | Sensor Ground | Sensor Ground | Output | Dedicated |
| **51** | Engine Coolant Temperature Sensor | Coolant | Input | Dedicated |
| **52** | Rear Heated Oxygen Sensor | Lambda #2 | Input | Avail, O2 Sensor Input |
| **53** | Crankshaft Position OBD Sensor | --- | --- | Not Used |
| **54** | Knock Sensor | Knock #1 | Input | PnP for Knock Sensor |
| **55** | Rear Defogger Switch (Except 2.0L) | --- | --- | Not Used |
| **56** | Power Supply for ECM | +12V Switched | Input | Dedicated |
| **57** | Ambient Temp Switch (95-96 240SX Only) | Low Side Driver #2 | Output | Avail, Switched Gnd, 1.5A Max |
| **58** | Data Link Connector for GST | Coil #2 | Output | Avail, Switched Gnd, 1.5A Max |
| **59** | Blower Fan Switch (99 Altima Only) | --- | --- | Not Used |
| **60** | Headlamp Switch (Except 2.0L & 95-96 240SX) | Switch #3 | Input | Avail, Switched Input |
| **61** | Power Supply for ECM | +12V Switched | Input | Dedicated |
| **62** | EGR Temperature Sensor | EGT #1 | Input | Avail, RTD Temp |
| **63** | Tank Fuel Temperature Sensor | --- | --- | Not Used |
| **64** | Data Link Connector for CONSULT | Coil #3 | Output | Avail, Switched Gnd, 1.5A Max |
| **65** | Data Link Connector for CONSULT | EGT #2 | Input | Avail, RTD Temp |
| **66** | Absolute Pressure | MAP | Input | Avail, Speed Density |
| **67** | EVAP Pressure | EGT #4 | Input | Avail, RTD Temp |
| **68** | Data Link Connector for CONSULT | Knock #2 | Input | Avail, 0-5 Volt Input |
| **69** | MAP/BARO Switch | Coil #5 | Output | Avail, Switched Gnd, 1.5A Max |
| **70** | Back-Up Power Supply | Permanent +12V | Input | Dedicated |
| | | | | |
| **101** | IACV-AAC Open Valve | PW #1 | Output | PnP for Idle Air Control |
| **102** | Injector No. 1 | Injector #1 | Output | PnP for Injector 1 |
| **103** | EGRC-Solenoid Valve | Idle #5 | Output | Avail, Ground / +12V, 1.5 A Max |
| **104** | Injector No. 3 | Injector #3 | Output | PnP for Injector 3 |
| **105** | EVAP Canister Purge | Low Side Driver #12 | Output | Avail, Switched Gnd, 1.5A Max |
| **106** | ECCS Ground | Power Ground | Input | Dedicated |
| **107** | Injector No. 2 | Injector #2 | Output | PnP for Injector 2 |
| **108** | EVAP Vent / Rear O2 Heater (95-96 240SX Only) | Low Side Driver #4 | Output | Avail, Switched Gnd, 1.5A Max |
| **109** | Injector No. 4 | Injector #4 | Output | PnP for Injector 4 |
| **110** | Rear O2 Heater (Except 95-96 240SX) | Low Side Driver #9 | Output | Avail, Switched Gnd, 1.5A Max |
| **111** | Rear O2 Heater Ground (95-96 240SX Only) | Power Ground | Input | Dedicated |
| **112** | ECCS Ground | Power Ground | Input | Dedicated |
| **113** | Current Return | Permanent +12V | Input | Avail, Switched Gnd, 1.5A Max |
| **114** | REC Relay (240SX) / VTC Solenoid (1.6L) | Low Side Driver #8 | Output | Avail, Switched Gnd, 1.5A Max |
| **115** | Front Oxygen Sensor Heater | Low Side Driver #1 | Output | Avail, Switched Gnd, 1.5A Max |
| **116** | EVAP Vent (95-96 240SX Only) | Injector #9 | Output | Avail, Switched Gnd, 1.5A Max |
| **117** | Vacuum Cut Bypass Valve (240SX Only) | Injector #10 | Output | Avail, Switched Gnd, 1.5A Max |
| **118** | ECCS Ground | Power Ground | Input | Dedicated |

# Wire View of AEM EMS



## Oxygen Sensor #1 Calibrations (UEGO EMS ONLY)

| O2 (V) | AFR (GAS) | LAMBDA |
|---|---|---|
| 0.000 | 9.950 | 0.679 |
| 0.156 | 10.070 | 0.687 |
| 0.312 | 10.180 | 0.695 |
| 0.468 | 10.350 | 0.706 |
| 0.624 | 10.520 | 0.718 |
| 0.780 | 10.690 | 0.730 |
| 0.936 | 10.810 | 0.738 |
| 1.092 | 10.920 | 0.745 |
| 1.248 | 11.090 | 0.757 |
| 1.404 | 11.270 | 0.769 |
| 1.560 | 11.380 | 0.777 |
| 1.716 | 11.550 | 0.788 |
| 1.872 | 11.720 | 0.800 |
| 2.028 | 11.900 | 0.812 |
| 2.184 | 12.070 | 0.824 |
| 2.340 | 12.240 | 0.835 |
| 2.496 | 12.410 | 0.847 |
| 2.652 | 12.640 | 0.863 |
| 2.808 | 12.810 | 0.874 |
| 2.964 | 13.040 | 0.890 |
| 3.120 | 13.210 | 0.902 |
| 3.276 | 13.440 | 0.917 |
| 3.432 | 13.670 | 0.933 |
| 3.588 | 13.950 | 0.952 |
| 3.744 | 14.240 | 0.972 |
| 3.900 | 14.580 | 0.995 |
| 4.056 | 14.980 | 1.023 |
| 4.212 | 15.440 | 1.054 |
| 4.368 | 16.010 | 1.093 |
| 4.524 | 16.580 | 1.132 |
| 4.680 | 17.210 | 1.175 |
| 4.836 | 17.840 | 1.218 |
| 4.992 | 18.470 | 1.261 |




### Calculating the Air Fuel Ratio of common fuels from the Lambda value

Gasoline AFR = Lambda * 14.65
Methanol AFR = Lambda * 6.47
Diesel AFR = Lambda * 14.5
Propane AFR = Lambda * 15.7
Ethanol AFR = Lambda * 9.00
CNG AFR = Lambda * 14.5

**UEGO Controller/Sensor Specifications (UEGO EMS Only)**

| | |
|---|---|
| Supply Voltage (nominal): | 9 to 18 Volts |
| Measuring range: | 0.68 to 1.26 Lambda |
| Type: | Bosch UEGO LSU4.2 |
| Accuracy: | +/- 1% |
| Temperature Limit: | 930C |
| Initial Warm-up Time: | Less than 20 seconds |
| Weight: | 80 grams |
| Heater Current: | 1.1A at 12.0V |
| Mounting: | M18 X 1.5 thread, Torque to 30 ft-lbs |
| Nominal Service Life: | 100,000 km for Unleaded Fuel |
| | 60,000 km for Leaded Fuel 0.15g Pb/l |
| | 30,000 km for Leaded Fuel 0.40g Pb/l |
| | 20,000 km for Leaded Fuel 0.60g Pb/l |

**Notes:**

*The sensor should not be subject to mechanical or thermal shock or it may be damaged.*
*The sensor is not designed for operation on leaded fuels, doing so will dramatically shorten sensor life.*
*Long term running in the rich region (Lambda < 0.95) will shorten sensor life.*
*High exhaust temperatures (over 850C) will shorten sensor life.*
*Engine oil consumption at a rate greater than 1 quart per 1,000 miles will shorten sensor life.*
*Do not run the engine with the UEGO sensor installed without power applied to the controller and the sensor plugged in.*

**Replacement Oxygen Sensor Components (UEGO EMS Only)**

30-2001 Replacement UEGO Sensor
35-4005 O2 Sensor Bung, mild steel, welding required
35-4001 O2 Sensor Plug, mild steel