Electronic Wiring Conventions

Noise can be a serious problem and can cause intermittent misfiring of the engine. Every precaution should be taken to prevent interference to the ECU's operation. Resistive plug leads are REQUIRED, and shielded cables from the crank and cam angle sensor inputs are highly recommended. All racing AEM PEMS wire harnesses come with properly shielded cables and are color coded for easy identification of circuits. They are also shrink wrapped for abrasion protection. The crank and cam angle sensor wire has a bare wire running down the length of it. It is **NOT** terminated at the sensor end of the cable because we ground it at the plug end of the harness. DO NOT GROUND THIS WIRE! This will cause a condition called ground looping and will remove any noise protection the cable has.

To eliminate or reduce the chance of EMI, wires that carry high current must run in twisted pairs. An example of this would be the power leads from a multiple spark ignition system. These ignition systems can carry up to 100 amps for a couple milliseconds at the time of discharge, which induces a strong magnetic field in close proximity of the wires.

The routing of the wire loom is critical to EFI system performance and safety. The following safety considerations should be made when installing the wire loom:

 Heat protection: the loom should be placed away from or insulated from sources of heat. The obvious item(s) that should be avoided are the exhaust manifolds, EGR delivery tubes, and turbochargers. If it is absolutely necessary to route a wire in close proximity to any of these items, then a suitable insulator must be used. • Noise suppression: do not route wires near the HT leads. For coil- on-plug ignition systems this is not as critical.

• Moving component protection: route wires away from moving components such as fans, the blower belt, or the throttle linkage. Also, make sure the wires are not under any strain when the engine is at full deflection on the motor mounts (we have seen map sensor wires disconnect while under full acceleration because the motor mounts were bad).

• Never have the wires in exposed bundles throughout the engine compartment. A professional harness has shrink tube over it to resist abrasion and chemical damage to the wire loom.

Grounding

The ECU must have an electrically secure ground connection, which means that the battery negative must be properly grounded to the chassis AND engine. The ground wire, weather it is from the battery or to the chassis and engine, must have perfect electrical conductivity. This means that there must not be any paint or rust under the wire terminal. Make sure that when you install the ground wire there is bare metal exposed where the wire contacts the vehicle component. To prevent rust build up, we recommend applying a protective layer of dielectric grease, such as Standard Ignition SL-4, to the bare metal surface. The ground wire must be **at least** the same gauge as the power lead to the ECU. We also recommend that the ground wire be as short as possible.

Power Requirements of the AEM PEMS

The AEM PEMS requires a minimum of 10V of electrical current to run. We recommend that the ECU be supplied with 13.8V nominal operating voltage. Ensure that the vehicle's charging system is in perfect operating condition prior to installing the AEM PEMS.

The AEM PEMS must have two sources of 12V power. One power source is continuous to the ECU; the other is switched 12V power. The AEM PEMS wire harness comes with a relay that is activated by the ignition switch to power up the ECU. The wire size for the lead to the relay is 14 gauge. In the event that the ECU must be removed from the vehicle, the memory for the microprocessor will NOT be lost. The reason for a continuous 12V supply of electricity to the ECU is to retain logged data until it is downloaded from the ECU. Should you choose to cut power off to the ECU completely, the same relay that is used to power up the ECU from the ignition switch can be used by connecting the ECU 12V continuous power lead to terminal 87 of the relay.

Use of Relays to Control Ancillary Devices

Relays are remote switching devices that are used to isolate a device from the ECU's circuitry to reduce noise and power constraints on the ECU. Typical devices that are powered by a relay are:

- Fuel Pump
- Variable Valve Control
- Oxygen Sensor Heater
- ECU power
- Nitrous Oxide solenoids

Noise can be caused by the electric motor in a fuel pump, which if connected directly to the ECU, may feed back into the circuit board ground plane. In the case of a fuel pump, the typical amperage required to run the pump is 10A or more depending on its size. The driver in the ECU that sends the command to run the fuel pump is only capable of supplying 1.5A, and clearly this type of load on the driver would cause it to burn out. There are drivers that can handle larger currents but cost, size, heat dissipation, and noise problems prevent their use.

- Typical relays in use today are capable of carrying 40A. A relay has an electromagnet inside it that is used as a switch. This electromagnet, or switch, is used to position a contact within the relay that is capable of carrying high current. There are typically four or five terminals on the base of a relay. These terminals can be wired in several ways to achieve different results. Refer to the appendix for common wiring schemes used with relays.

Wire Terminations and Solder Joints

A proper wiring job includes proper termination of the wire at the sensor. The wire terminal end must be moisture tight where it plugs into the sensor and it must have strong, electrically sound terminals. The preferred method of securing a wire to a terminal is to use a crimp terminal with NO solder. It is important to use the proper crimping tool for sound terminal construction.

Plastic terminal plugs must have moisture tight seals. Inspect each plug to make sure the seals are in place. Also, before the plug is installed on the sensor, apply a dab of di-electric grease in the terminal slots to further aid in corrosion resistance.

If a splice into a wire must be made and no solder-less terminals are available, then you must properly solder the splice.

It is extremely important to make sure that all wires are in their proper locations. Easy-to-read schematic for easy identification of wire assignments. If you are not sure of how a wire set is assigned for a given terminal, do NOT guess. Damage may occur to the ECU if any wires are crossed.