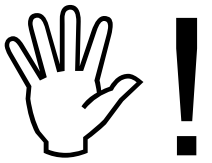
Installation Instructions for: EMS P/N 30-1900U & 30-1901U

UNIVERSAL EMS

WARNING:

This installation is not for the tuning novice nor the PC illiterate! Use this system with <u>EXTREME</u> caution! The Universal AEM EMS System allows for total flexibility in engine tuning. Misuse of this product WILL destroy your engine!



Installation of the Universal EMS is only allowed by AEM authorized Universal EMS tuner shops. AEM will not support individual user installations. All support regarding your specific installation will be performed by the shop where you choose to purchase the EMS.

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: 10-1900
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Read and understand these instructions BEFORE attempting to install this product.

The AEM Engine Management System (EMS) is the result of extensive development on a wide variety of vehicles. The AEMPro software can be configured to work with most OEM sensors so there is no need for expensive or hard to find sensors. Every EMS comes with all functions activated, there are no expensive options, advanced features or upgrades to be performed.

The AEM Universal EMS is not sold directly to end users. It is only sold and supported through an authorized installer/tuner network. The process of installing & tuning an advanced stand alone engine management system is beyond the scope of most people and no amount of technical support can offset a lack of experience. Therefore, it is assumed that the person installing this system already possesses a good knowledge of the AEM EMS unit and general engine tuning principles. The instructions will focus on the installation of the unit and the base map generation, not on basic EMS programming or engine tuning methodology.

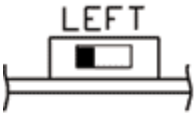
Please visit the AEM EMS Forum at http://www.aempower.com. AEM always posts the most current software and base maps online. The forum also has many helpful hints/tips to make the EMS perform its best.

AEM Universal startup calibrations are be made available in as many possible combinations as practical, simplifying the initial setup. While the startup 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. The supplied startup maps are automatically installed in the AEM/AEMPro/Startup Calibrations directory.

INITIAL EMS CONFIGURATION

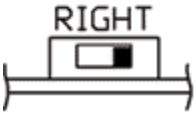
All of the AEM Universal EMS's come with two internal UEGO sensor controllers. All you have to do to gain this functionality is to add the proper UEGO sensors and wire them in, no expensive external controller is needed. The sensors are available from AEM. The UEGO sensors furnish the user with real time, accurate and repeatable air/fuel ratio values.

Both Hall Effect and Magnetic (VR) speed sensors are supported. The type of Crank, Cam and Vehicle speed sensors are configured via switches located behind the rear ECU endplate.



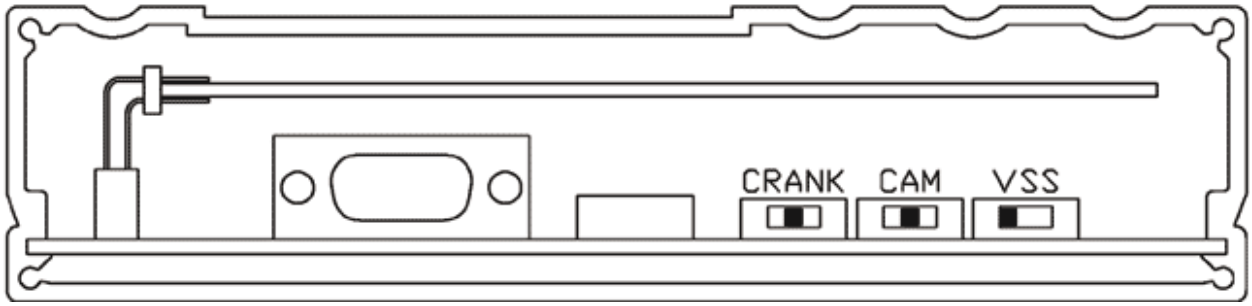
HIGH SENSITIVITY MAG: Setting the switch to the left position applies a weak pull down resistor to the speed input and also offsets the voltage to just below the trigger point.

MAG: Setting the switch to the middle position applies a weak pull down resistor to the speed input.



HALL: Setting the switch to the right-most position applies a 5 volt pull up resistor to the speed input.

In the example below, the CRANK and CAM are set to MAG (VR) sensor type and the VSS is set to High Sensitivity Mag type.



The EMS can directly drive both low impedance (peak & hold style) injectors as well as high impedance injectors. No resistor box is required for low impedance injectors nor is any configuration required by the user.

The 30-1900U EMS supports only direct drive coils or CDI units. Coils that have an internal igniter will not function properly! Direct drive coils do not have any logic circuitry built into the coil, they are also referred to as "dumb" coils. They typically have only 2 wire terminals. Make sure your coils are compatible before you start the engine. Failure to do this WILL damage your engine and your failure to use the correct coils is not a warranty problem!

Only firmware versions 1.11b and later are suitable for use in the 30-1900 Universal EMS. The included install disk contains the configuration files designed specifically for the Universal EMS.

The software contained on the enclosed disk will create an AEMPro installation that is customized for use with the Universal EMS. It includes new parameters only available on the 30-1900/1901 EMS's as well as customized menus. All the current base maps as well as the manuals & wiring diagrams will be installed as well.

SENSORS

AEM carries many different high quality sensors. These are available from your AEM Dealer.

Pressure Sensors:

AEM offers high accuracy stainless steel pressure sensors. All pressure sensors feature an 1/8" NPT fitting and include a -4 AN adapter. Also included is a 12" mating connector/flying lead assembly. The 5 bar and lower sensors include a hose barb fitting as well.

30-2130-30 "MAP Sensor Kit, 2 BAR"
Typically used to measure intake, air box and crankcase pressures.

30-2130-50 "MAP Sensor Kit, 3.5 BAR"
Typically used to measure intake & exhaust back pressures.

30-2130-75 "MAP Sensor Kit, 5 BAR"
Typically used to measure intake & exhaust back pressures.

30-2130-100 "Fluid Pressure Sensor Kit, 100 PSI"
Typically used to measure fuel & oil pressures.

30-2130-150 "Fluid Pressure Sensor Kit, 150 PSI"
Typically used measure to fuel & oil pressures.

30-2130-500 "Fluid Pressure Sensor Kit, 500 PSI"
Typically used to measure transmission line pressure.

30-2130-1000 "Fluid Pressure Sensor Kit, 1,000 PSI"
Typically used to measure brake line or CO2 pressure.

30-2130-2000 "Fluid Pressure Sensor Kit, 2,000 PSI"
Typically used to measure brake line, Nitrous or CO2 pressure.

Temperature Sensors:

30-2010 "Air Temp Sensor Kit 3/8" NPT"
This is a GM style brass sensor. Each kit includes a 3/8" NPT aluminum bung and a 12" mating connector/flying lead assembly.

30-2011 "Coolant Temp Sensor Kit 3/8" NPT"
This is a GM style brass sensor. Each kit includes a 3/8" NPT aluminum bung and a 12" mating connector/flying lead assembly.

Air Fuel Ratio Sensors & parts:

30-2001 "Replacement Bosch UEGO Sensor"
This is a replacement sensor only.

30-2002 “UEGO Sensor with Install Kit, Bosch”
This kit includes a Bosch UEGO sensor, mating connector, contacts, wire-seals and a weld in bung.

35-2613 “Connector Kit, Bosch UEGO”
Includes the mating connector, contacts and wire-seals for the 30-2001 Bosch UEGO. The sensor is not included.

Injectors & Connectors:

30-2020 “Injector Connector Kit, Bosch Style, 4pcs”
Includes 4 Bosch/Rochester style injector connectors and terminals.

Relays & Wiring:

30-2060 “Micro Relay with Installation kit”
Includes a Bosch micro-relay, mating connector & all required terminals.

WIRING

AEM offers 3 different options for wiring your universal EMS.

30-2900-72 “Harness, EMS Universal 72 inch kit”
This is the preferred wiring kit. It includes a 6’ long un-terminated harness that features high temp wire, the fuse/relay block, most splices, all wires are individually colored & ink stamped with their function. This is suitable when building an entire harness from scratch.

30-2901-24 “Harness, EMS Flying Lead Kit”
This is a fully populated mating connector with 24” long wires individually colored and ink stamped with their function. This is suitable for re-terminating an existing vehicle harness or making an adapter harness.

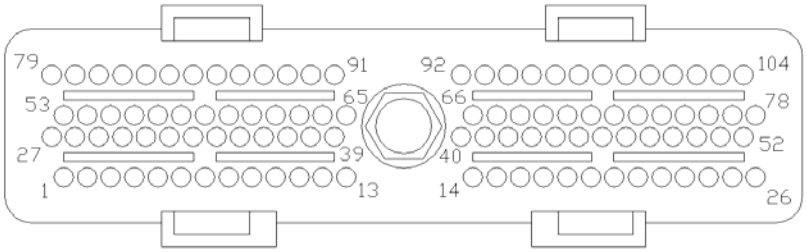
30-2902 “Connector Kit”
This is a mating connector & 104 contacts. This is suitable for use when re-terminating an existing harness or for use by professional harness builders. Proper wire, crimp tools & techniques must be used when terminating this connector.

AEM Universal EMS 30-1900U / 30-1901U Connector Pinouts

Pin	Name	I/O	30-1900U Notes
1	Switched +12v	Input	
2	Injector #1 Switched Ground	Output	Hook to the first injector in the firing order
3	Injector #2 Switched Ground	Output	Hook to the second injector in the firing order
4	Injector #3 Switched Ground	Output	Hook to the third injector in the firing order
5	Injector #4 Switched Ground	Output	Hook to the fourth injector in the firing order
6	Injector #5 Switched Ground	Output	Hook to the fifth injector in the firing order
7	Injector #6 Switched Ground	Output	Hook to the sixth injector in the firing order
8	Injector #7 Switched Ground	Output	Hook to the seventh injector in the firing order
9	Injector #8 Switched Ground	Output	Hook to the eighth injector in the firing order
10	Injector #9a Switched Ground	Output	Hook to the ninth injector in the firing order
11	Injector #10a Switched Ground	Output	Hook to the tenth injector in the firing order
12	Injector #9b Switched Ground	Output	Hook to the ninth injector in the firing order
13	Injector #10b Switched Ground	Output	Hook to the tenth injector in the firing order
14	---	---	Not Populated
15	---	---	Not Populated
16	---	---	Not Populated
17	Switch #1	Input	Open = "OFF", Ground = "ON"
18	Idle Pair 5/6 Switched Ground	Output	
19	Idle Pair 5/6 Switched +12v	Output	
20	Idle Pair 7/8 Switched Ground	Output	
21	Idle Pair 7/8 Switched +12v	Output	
22	High Side #1, Switched +12v	Output	
23	High Side #2, Switched +12v	Output	
24	High Side #3, Switched +12v	Output	
25	High Side #4, Switched +12v	Output	
26	Battery NEG	Input	
27	Switched +12v Input	Input	
28	Coil 1 Output, Direct Drive	Output	Hook to the first coil in the firing order
29	Coil 2 Output, Direct Drive	Output	Hook to the second coil in the firing order
30	Coil 3 Output, Direct Drive	Output	Hook to the third coil in the firing order
31	Coil 4 Output, Direct Drive	Output	Hook to the fourth coil in the firing order
32	Coil 5 Output, Direct Drive	Output	Hook to the fifth coil in the firing order
33	---	---	Not Populated
34	---	---	Not Populated
35	---	---	Not Populated
36	Switch #3	Input	Open = "OFF", Ground = "ON"
37	Switch #4	Input	Open = "OFF", Ground = "ON"
38	Switch #5	Input	Open = "OFF", Ground = "ON"
39	Switch #6	Input	Open = "OFF", Ground = "ON"
40	LS #1, General Purpose	Output	Switched Ground, 1.5a Max
41	LS #2, General Purpose	Output	Switched Ground, 1.5a Max
42	LS #3, General Purpose	Output	Switched Ground, 1.5a Max
43	LS #4, General Purpose	Output	Switched Ground, 1.5a Max
44	LS #5, General Purpose	Output	Switched Ground, 1.5a Max
45	LS #6, General Purpose	Output	Switched Ground, 1.5a Max
46	LS #7, Tach	Output	Switched Ground, 1.5a Max
47	LS #8, Fan #1	Output	Switched Ground, 1.5a Max
48	LS #9, Fan #2	Output	Switched Ground, 1.5a Max

49	LS #10, Shift Light	Output	Switched Ground, 1.5a Max
50	LS #11, Fuel Pump #1	Output	Switched Ground, 1.5a Max
51	LS #12, Fuel Pump #2	Output	Switched Ground, 1.5a Max
52	Battery NEG	Input	
53	Switched +12v	Input	
54	Permanent 12V	Input	Direct to Battery, not switched
55	Throttle Position Sensor	Input	0-5Volt, 100K Pull up to 5.0v
56	Manifold Pressure Sensor	Input	0-5Volt, 100K Pull up to 5.0v
57	Mass Air Flow Sensor	Input	0-5Volt, 100K Pull up to 5.0v
58	Knock Sensor #1	Input	
59	Knock Sensor #2	Input	
60	Inlet Air Temp Sensor	Input	Thermister, 2.2K Pull up to 5.0v
61	Coolant Temp Sensor	Input	Thermister, 2.2K Pull up to 5.0v
62	Sensor Ground	Output	
63	Sensor Ground	Output	
64	Sensor Ground	Output	
65	+5.0 volts, Vcc	Output	
66	+5.0 volts, Vcc	Output	
67	+5.0 volts, Vcc	Output	
68	PC Comms Receive	Input	RS232, DSUB-9 Pin 2, Shield to pin 70
69	PC Comms Transmit	Output	RS232, DSUB-9 Pin 3, Shield to pin 70
70	PC Comms Ground	Output	RS232, DSUB-9 Pin 5
71	Speedometer	Output	5 Volt Pulse, Varying Period
72	Vehicle Speed Sensor Ground	Output	Shield to pin 78, Twist with pin 73
73	Vehicle Speed Sensor	Input	Shield to pin 78, Twist with pin 72
74	Cam Sensor Ground	Output	Shield to pin 78, Twist with pin 75
75	Cam Sensor	Input	Shield to pin 78, Twist with pin 74
76	Crank Sensor Ground	Output	Shield to pin 78, Twist with pin 77
77	Crank Sensor	Input	Shield to pin 78, Twist with pin 76
78	Cam, Crank, VSS Shield Ground	Output	
79	Switched +12v	Input	
80	Idle Solenoid (PW1)	Output	Switched Ground for IAC
81	---	---	
82	Boost Solenoid (PW2)	Output	Switched Ground for Boost Sol
83	---	---	Not Populated
84	---	---	Not Populated
85	Spare 0-5V Sensor #1	Input	0-5Volt, 100K Pull up to 5.0v
86	Spare 0-5V Sensor #2	Input	0-5Volt, 100K Pull up to 5.0v
87	Spare 0-5V Sensor #3	Input	0-5Volt, 100K Pull up to 5.0v
88	Spare 0-5V Sensor #4	Input	0-5Volt, 100K Pull up to 5.0v
89	Spare 0-5V Sensor #5	Input	0-5Volt, 100K Pull up to 5.0v
90	Spare 0-5V Sensor #6	Input	0-5Volt, 100K Pull up to 5.0v
91	Spare 0-5V Sensor #7	Input	0-5Volt, 100K Pull up to 5.0v
92	AFR Sensor IP #1	Input	
93	AFR Sensor VM #1	Input	
94	AFR Sensor UN #1	Input	
95	AFR Sensor IA #1	Input	
96	AFR Sensor VH+ #1	Input	
97	AFR Sensor VH- #1	Input	
98	AFR Sensor IP #2	Input	

99	AFR Sensor VM #2	Input	
100	AFR Sensor UN #2	Input	
101	AFR Sensor IA #2	Input	
102	AFR Sensor VH+ #2	Input	
103	AFR Sensor VH- #2	Input	
104	Battery NEG	Input	



30-1900 CONTACT NUMBERING
AS VIEWED FROM THE WIRE ENTRY SIDE

STARTUP CALIBRATION

The startup calibrations supplied by AEM should be used as templates in designing your own base map. Startup calibrations are available based on different combinations of the following:

- Cam/Crank trigger pattern
- Engine load determination (Speed-Density, MAF or Speed-Throttle)
- Number of engine cylinders
- Ignition configuration (coil on plug, wasted-spark, distributor)

The assumptions used for generating the specific startup calibrations are as follows:

- Hook the coils and injectors up according to the engines firing order. Coil #1 output should go to the first coil in the firing order, Coil #2 output should go to the second coil in the firing order. etc…
- The fuel map is zero.
- The ignition map is flat at 10 BTDC.
- The COOLANT sensor is assumed to be a GM Style (AEM 30-2011).
- The IAT sensor is assumed to be a GM Style (AEM 30-2010).
- The MAP sensor is assumed to be an AEM 3.5 bar (AEM 30-2130-50).
- The O2 sensor type is the AEM UEGO (30-2002).
- The closed loop AFR feedback is configured but flagged off. You still have to put in a target A/F in the O2 FB Target map.
- The idle control is fully configured for a PW style motor (Ford/Honda, etc…).
- The cylinder firing is configured for even-fire engines, odd-fire must change the individual injector & coil phasing or damage WILL occur.
- Knock control options are configured but the knock noise table is zeroed out, knock control is flagged off.
- Rev limiters are set to 12,000 rpm.
- Injector offset (battery response) is set to RC Engineering 550cc, 3 ohm.
- The CAM, CRANK and VSS sensors are triggering on the falling edge.
- Cooling Fan #1 (LS8) set to turn on at 80 deg C (176 deg F).
- Cooling Fan #2 (LS9) set to turn on at 94 deg C (201 deg F).
- Tach output (LS7) set to 1 pulse per cylinder except 8 cylinder where it is 1 pulse for every 2 cylinders.
- Speed-Throttle base maps have empirical fuel corrections for the Barometric Pressure and Inlet Air Temp.
- Speed-Density base maps have an empirical fuel correction for Inlet Air Temp and no Barometric pressure correction.
- 0-5v MAF sensor base maps have no Barometric or Inlet Air Temp density corrections.

INSTALLATION CONFIRMATION

It is assumed that you followed the included wiring diagrams using the best possible practice.

With the ECU disconnected, verify that there is no continuity between the power and ground wires. This will minimize any possible shorting due to incorrect wiring.

Disconnect the Coils and Injectors. Power up the ECU and connect to it with AEMPro. If you have trouble connecting to the ECU, confirm that there are no external devices installed on your computer which may conflict with the proper com port operation (i.e. palm pilot dock, infrared port, etc…). One by one, confirm proper operation of the sensors. You can view them under the appropriate Parameters menu in AEMPro.

Crank the engine and check for engine RPM. If there is RPM, check to see that the parameter Stat Sync'd is on. If it is not on or there is no RPM, watch for sync errors or timing errors. If there is a steady count of errors, the cam or crank pickup is configured improperly. Recheck all settings and connections. If there is engine rpm displayed and there are no timing or sync errors (other than when starting and stopping cranking) then the pickups are configured correctly. If there are timing or sync errors, there will be no spark or injection. You must fix this problem before proceeding.

Attach the coil(s) and a timing light. Under cranking, confirm the proper location of the spark. It should be the same as the parameter Ign Timing (base maps are set to 10 degrees). If not, adjust it to match. Then move the timing light to another cylinder and confirm the proper spark location for all cylinders.

Disconnect the fuel pump and hook up the injectors. Crank the engine and verify injector pulsing under cranking. If injection is present, hook up the fuel pump.

Now you can attempt to start the engine. You may have to adjust the Crank Injector Time Table (Engine Start => Crank Injector Time) to get the proper A/F ratio while cranking. Once the engine is running and the speed is above the Crank Exit threshold, the ECU uses fuel and ignition values from the main Fuel Map and Ignition Map.

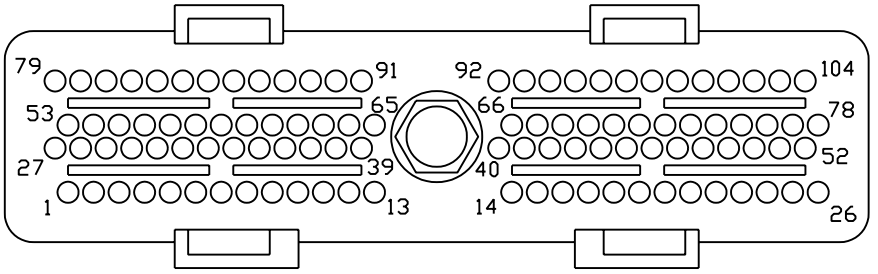
If the engine is getting fuel and spark but does not start, confirm that the ignition is not 360 out of phase (coil on plug cars only).

THIS WIRING DIAGRAM SHOWS THE PROPER CONNECTIONS FOR ALL THE FEATURES OF THE 30-1900U UNIVERSAL EMS. NOT EVERYTHING SHOWN MAY BE REQUIRED FOR YOUR INSTALLATION.

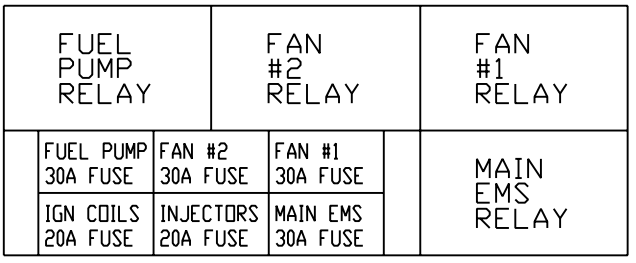
IF YOU ARE NOT USING AN AEM SUPPLIED HARNESS KIT, MAKE SURE TO USE HIGH QUALITY WIRE AND TO PROPERLY CRIMP ALL THE TERMINALS. ALSO, YOU MUST USE RELAYS AND FUSES AS DEPICTED IN THIS DRAWING.

AEM STRONGLY RECOMMENDS THE USE OF THE 30-2900-XX WIRING HARNESS KIT FOR ALL INSTALLATIONS. IT FEATURES HIGH QUALITY AUTOMOTIVE WIRE, AN INTEGRAL FUSE & RELAY BLOCK AND EVERY WIRE IS INDIVIDUALLY COLORED & LABELED. ADDITIONALLY, THE BEST PRACTICES ARE FOLLOWED REGARDING SPLICES & CRIMPS. IT WILL RESULT IN THE HIGHEST QUALITY & LEAST EXPENSIVE ROUTE TO A SUCCESSFUL INSTALLATION.

THIS DIAGRAM SHOWS THE WIRE COLORS AND INDIVIDUAL WIRE MARKING FOR EACH WIRE USED IN THE 30-2900-XX WIRE HARNESS KIT.

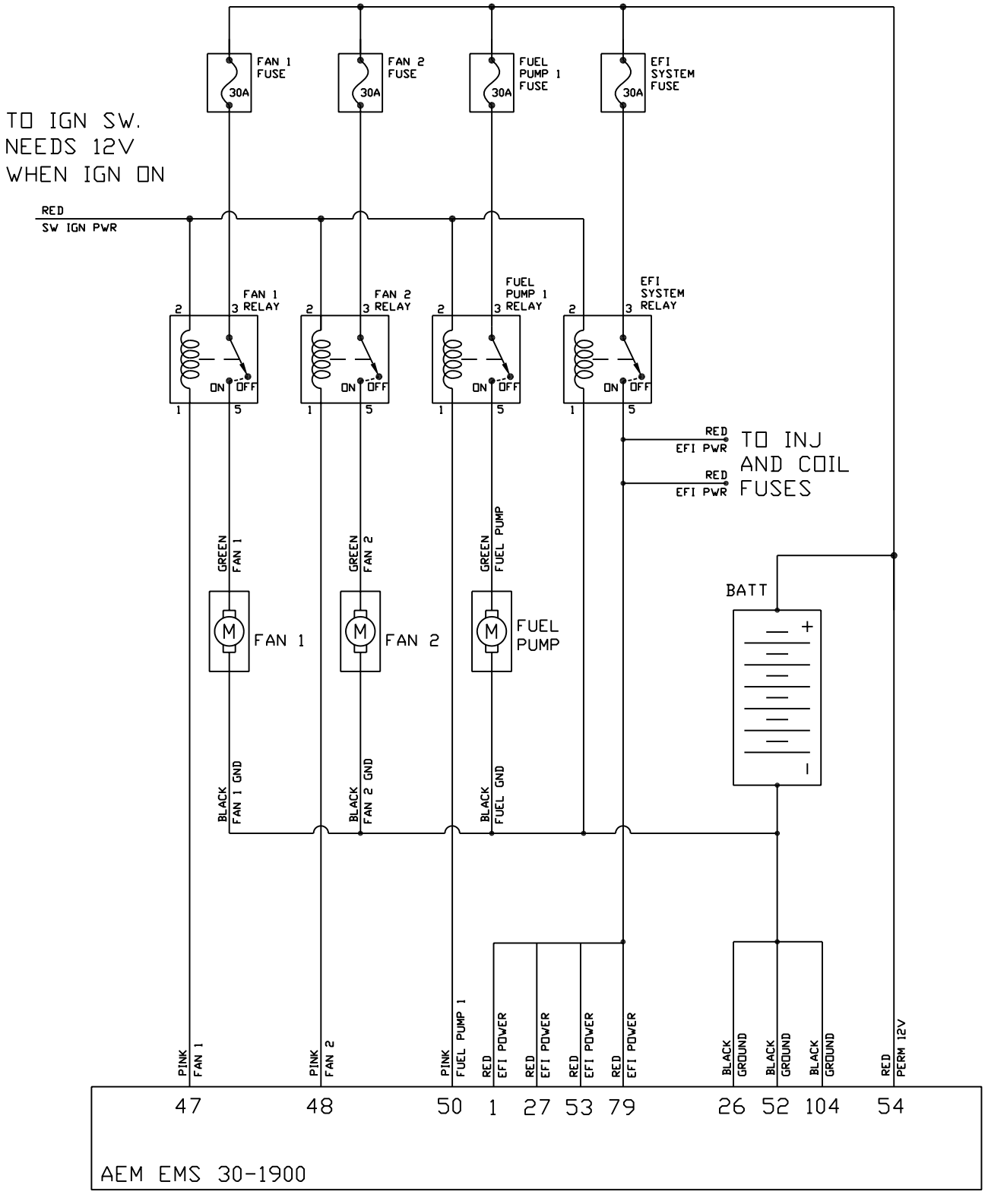


30-1900 CONTACT NUMBERING
AS VIEWED FROM THE WIRE SIDE



ELECTRICAL CENTER COMPONENT LOCATIONS
ON THE 30-2900-XX UNIVERSAL EMS WIRING HARNESS

POWER SUPPLY, RELAYS, FUSES, FANS & FUEL PUMP

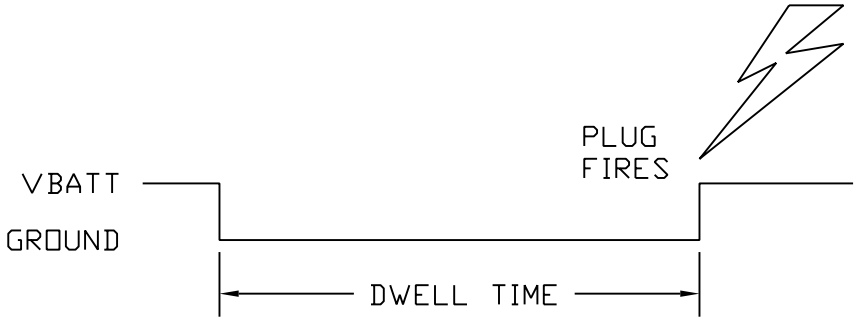


IGNITION COILS

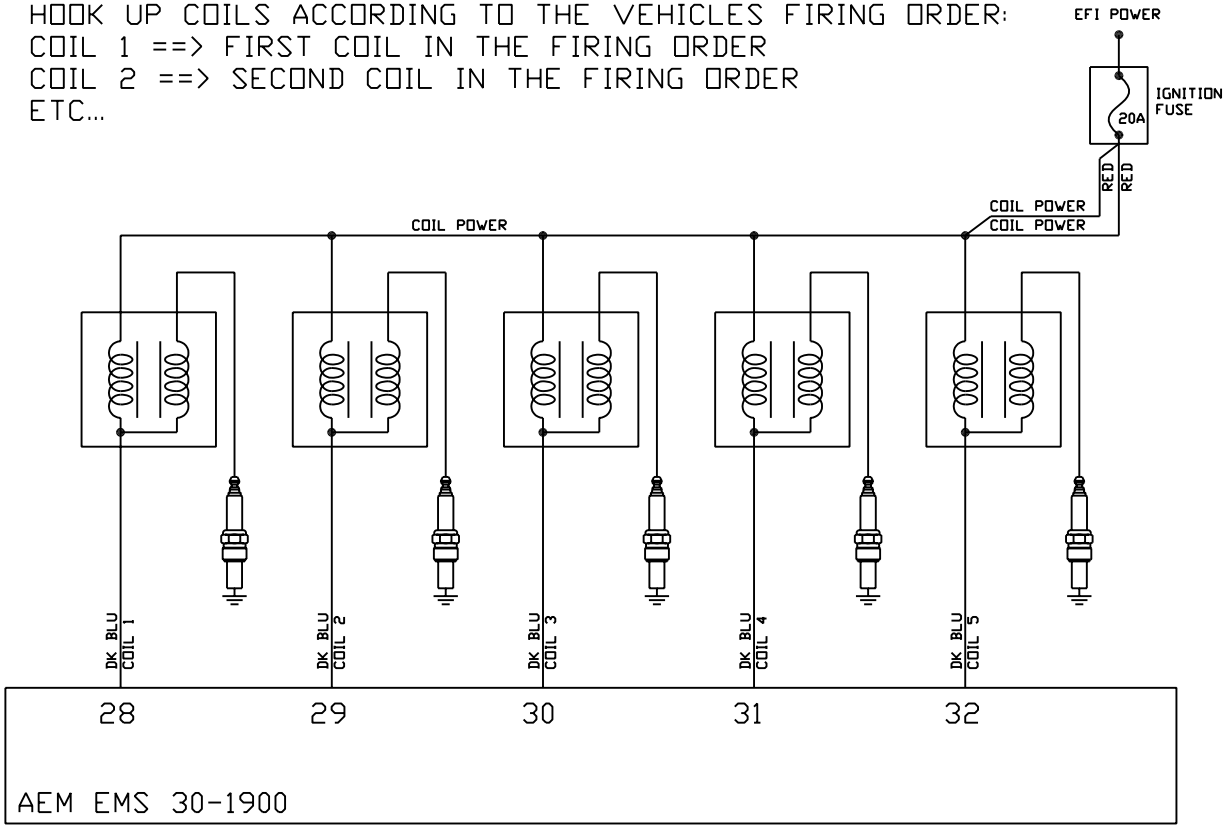
THE 30-1900 UNIVERSAL EMS IS CAPABLE OF DRIVING UP TO 5 INDUCTIVE COILS DIRECTLY (IT DOES NOT REQUIRE AN EXTERNAL IGNITOR). UP TO A 10 CYLINDER ENGINE CAN BE CONTROLLED BY USING DOUBLE ENDED COILS (WASTED SPARK).

THE INDIVIDUAL COIL OUTPUTS OF THE EMS ARE PULLED TO GROUND FOR THE DURATION OF THE DWELL TIME WHICH CHARGES THE COIL. THE OUTPUT IS THEN RELEASED FROM GROUND, CAUSING THE COIL TO FIRE. THIS IS SOMETIMES REFERRED TO AS A RISING EDGE TRIGGER.

SINCE THE EMS ALREADY HAS AN INTEGRAL IGNITOR, IT DOES NOT NEED AN EXTERNAL IGNITOR NOR CAN IT DRIVE COILS THAT HAVE AN IGNITOR BUILT INTO THEM.



HOOK UP COILS ACCORDING TO THE VEHICLES FIRING ORDER:
COIL 1 ==> FIRST COIL IN THE FIRING ORDER
COIL 2 ==> SECOND COIL IN THE FIRING ORDER
ETC...

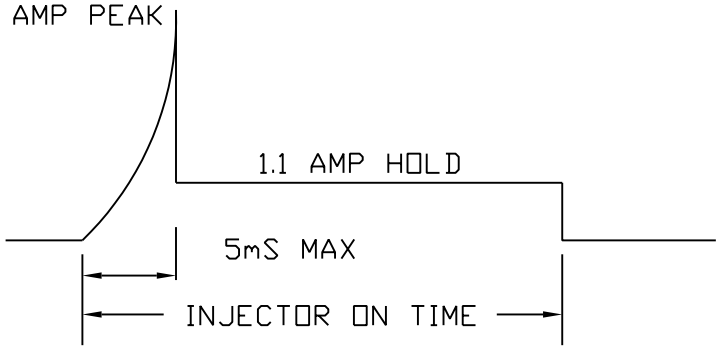


FUEL INJECTORS

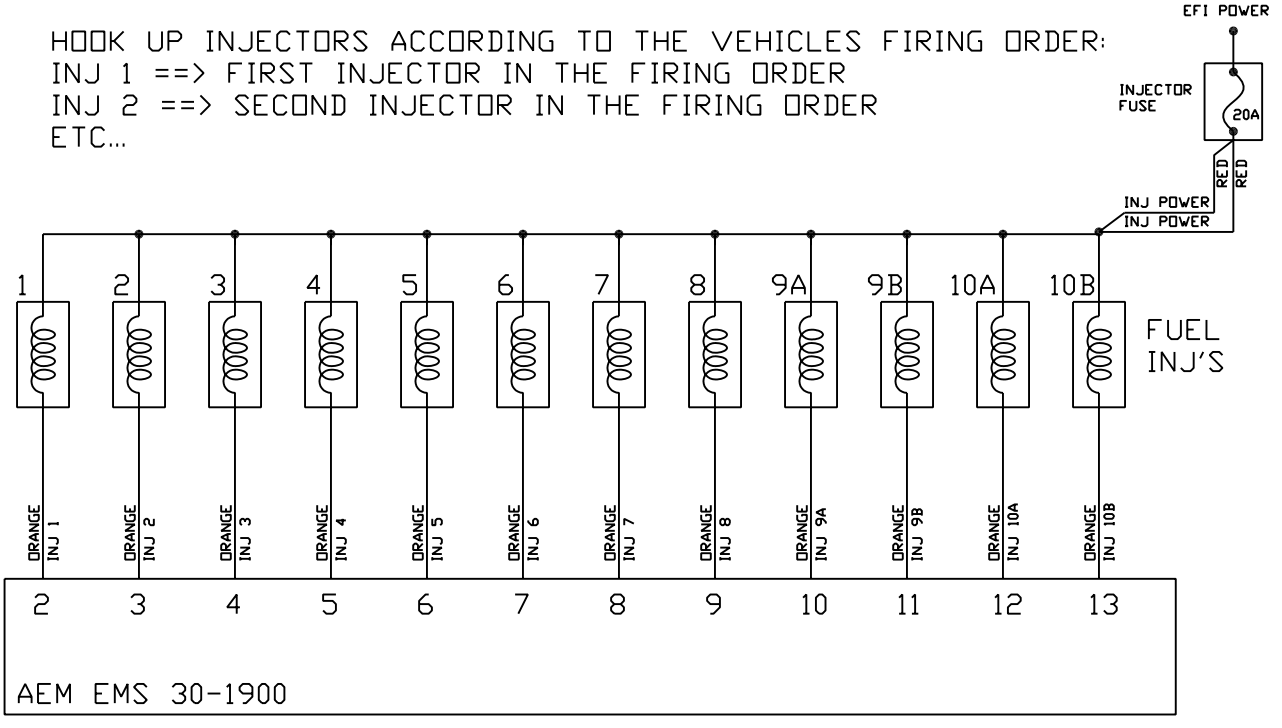
THE 30-1900 UNIVERSAL EMS IS CAPABLE OF DRIVING UP TO 10 FUEL INJECTORS SEQUENTIALLY. AN ADDITIONAL 2 CAN BE USED BUT ARE NOT INDEPENDANTLY CONTROLLED. INJ 9B IS DRIVEN FROM THE SAME SIGNAL AS INJ 9A. INJ 10B IS DRIVEN BY THE SAME SIGNAL AS INJ 10A.

THE INJECTOR DRIVE CIRCUITS OF THE 30-1900 EMS IS A PEAK AND HOLD TYPE DRIVER. WHEN THE INJECTOR DRIVER IS ACTIVATED THE INJECTOR CAN SOURCE UP TO 4.4 AMPS. ONCE THIS LEVEL IS ACHIEVED, THE CURRENT IS LIMITED TO 1.1 AMPS FOR THE DURATION OF THE INJECTOR ON TIME. IF 4.4 AMPS IS NOT REACHED WITHIN 5mS THEN THE CURRENT IS LIMITED TO 1.1 AMPS FOR THE DURATION OF THE ON TIME.

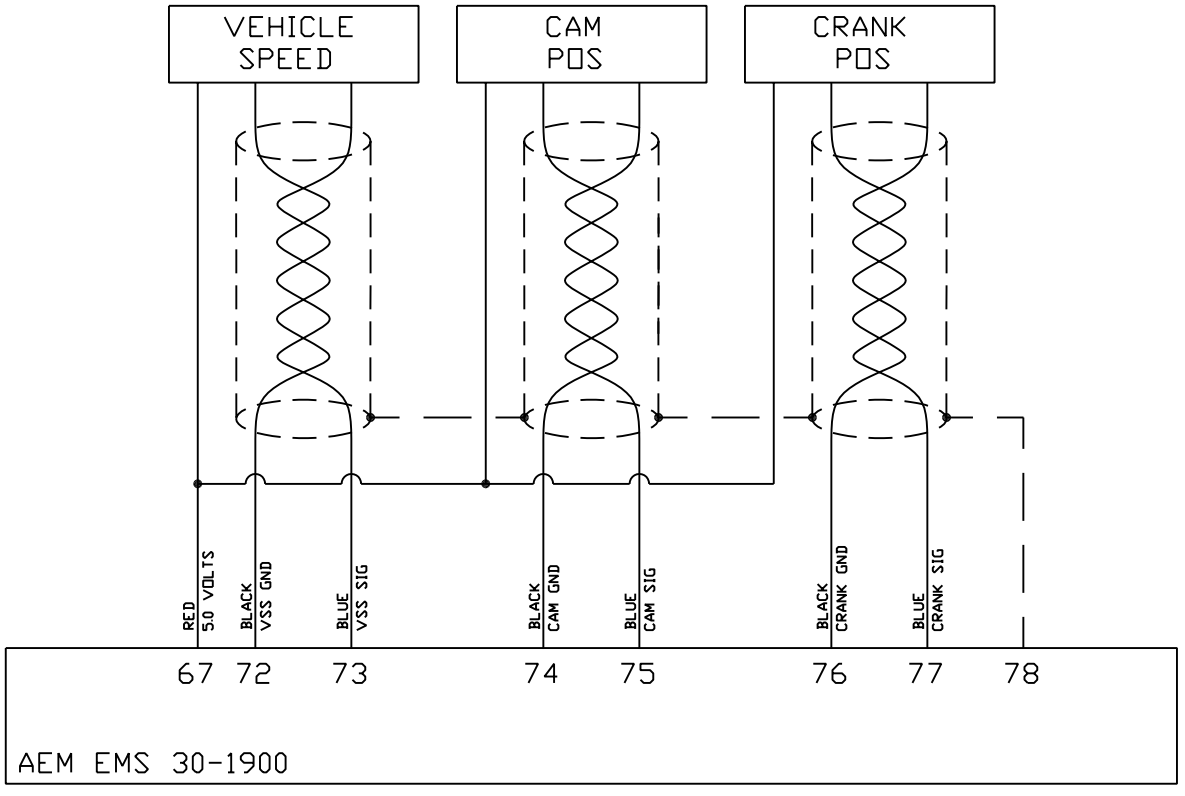
THE EMS CAN DIRECTLY DRIVE INJECTORS FROM 1-15 OHMS INTERNAL RESISTANCE.



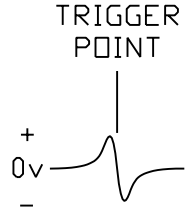
HOOK UP INJECTORS ACCORDING TO THE VEHICLES FIRING ORDER:
INJ 1 ==> FIRST INJECTOR IN THE FIRING ORDER
INJ 2 ==> SECOND INJECTOR IN THE FIRING ORDER
ETC...



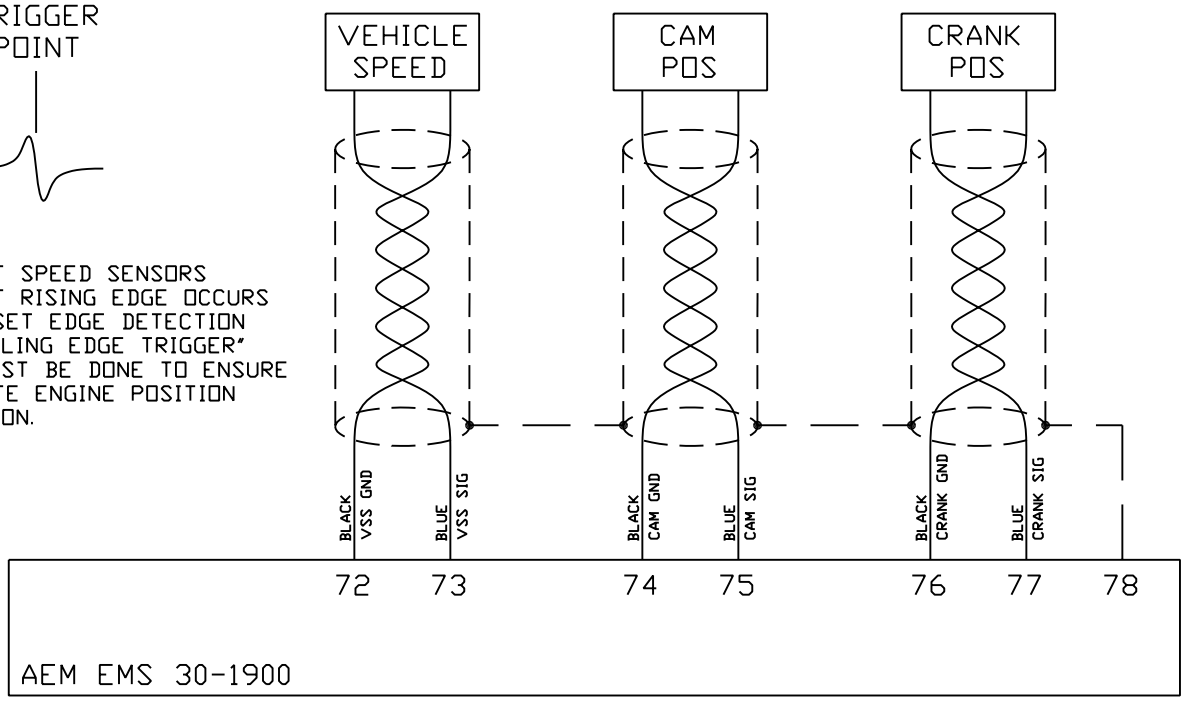
SPEED SENSOR INPUTS, HALL EFFECT TYPE. TWISTED, SHIELDED PAIRS



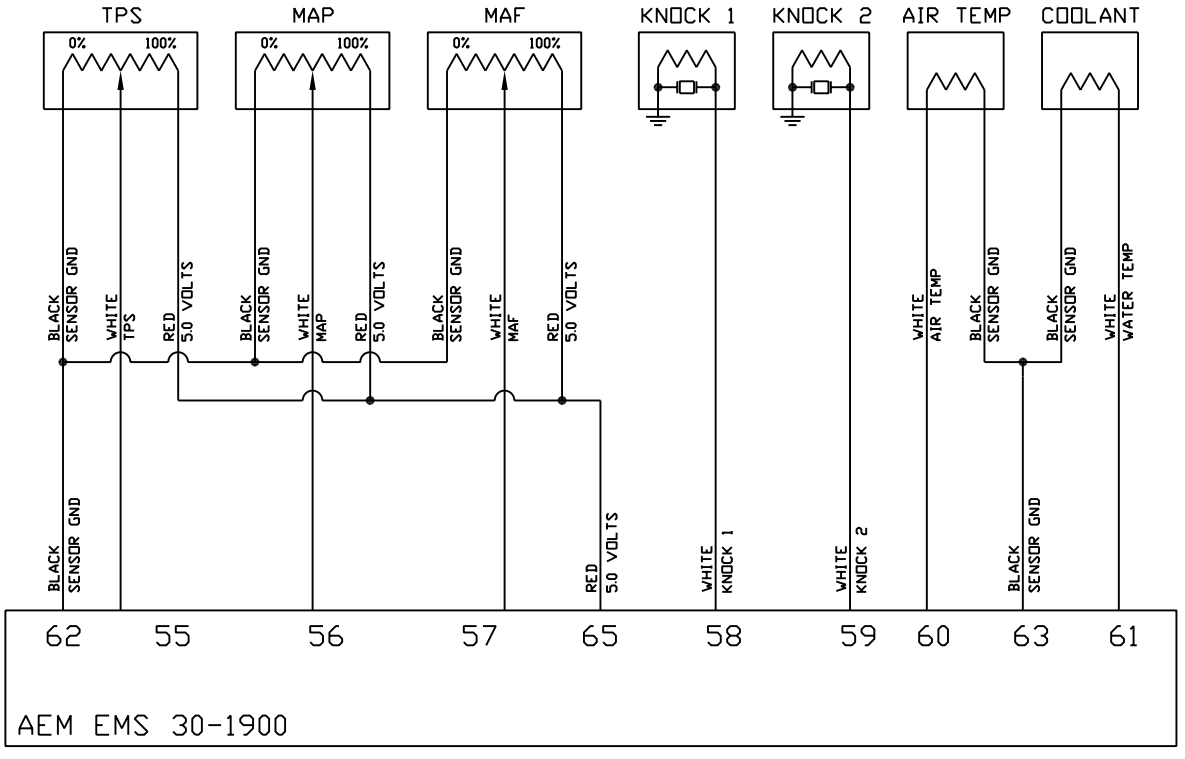
SPEED SENSOR INPUTS, MAGNETIC (VR) TYPE. TWISTED, SHIELDED PAIRS



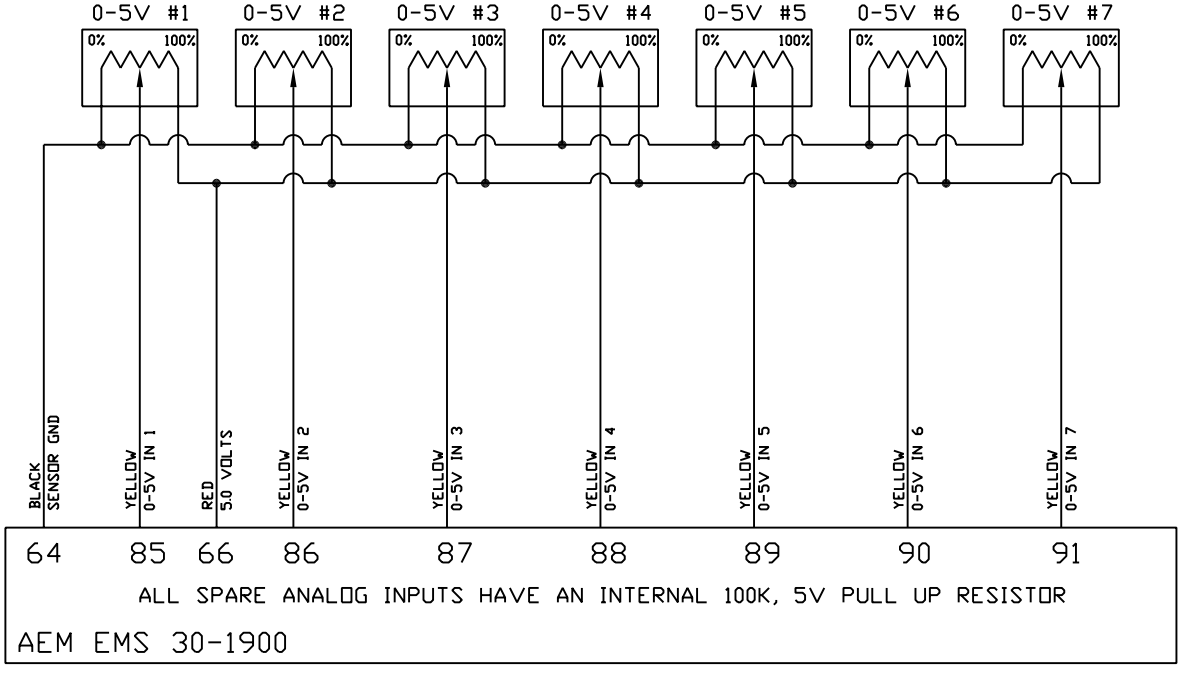
CONNECT SPEED SENSORS SO THAT RISING EDGE OCCURS FIRST. SET EDGE DETECTION TO "FALLING EDGE TRIGGER" THIS MUST BE DONE TO ENSURE ACCURATE ENGINE POSITION DETECTION.



ANALOG SENSOR INPUTS

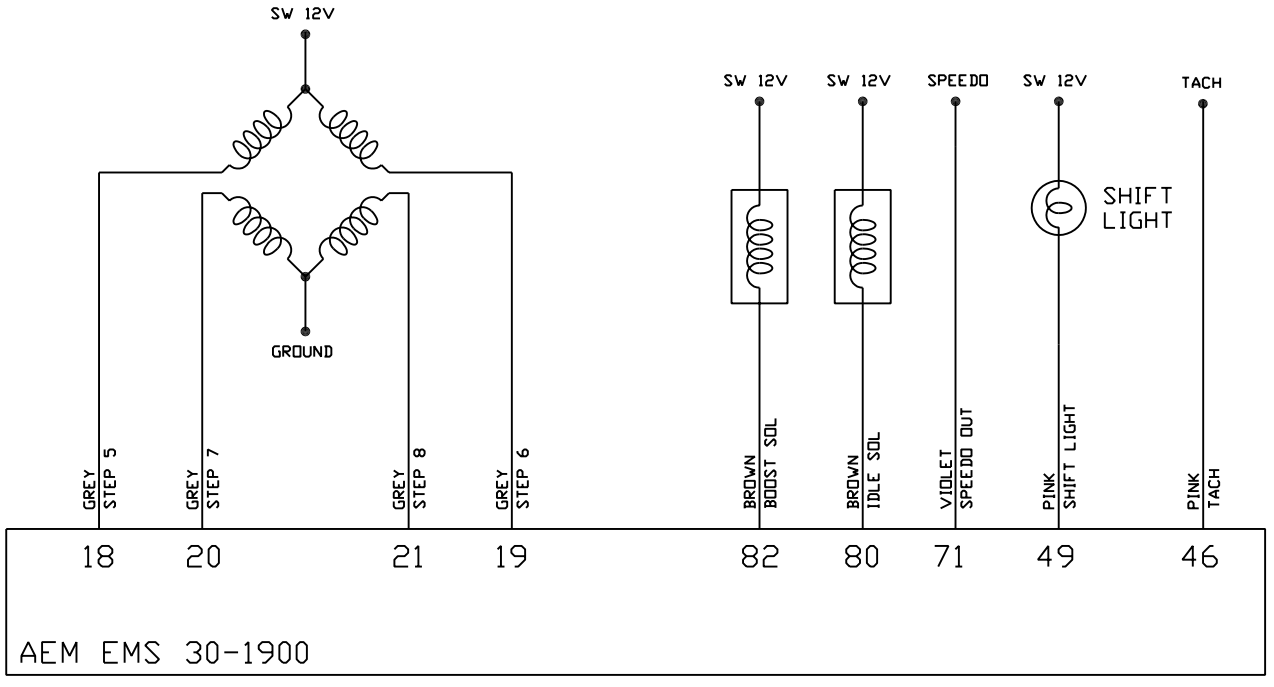


SPARE 0-5 VOLT ANALOG INPUTS

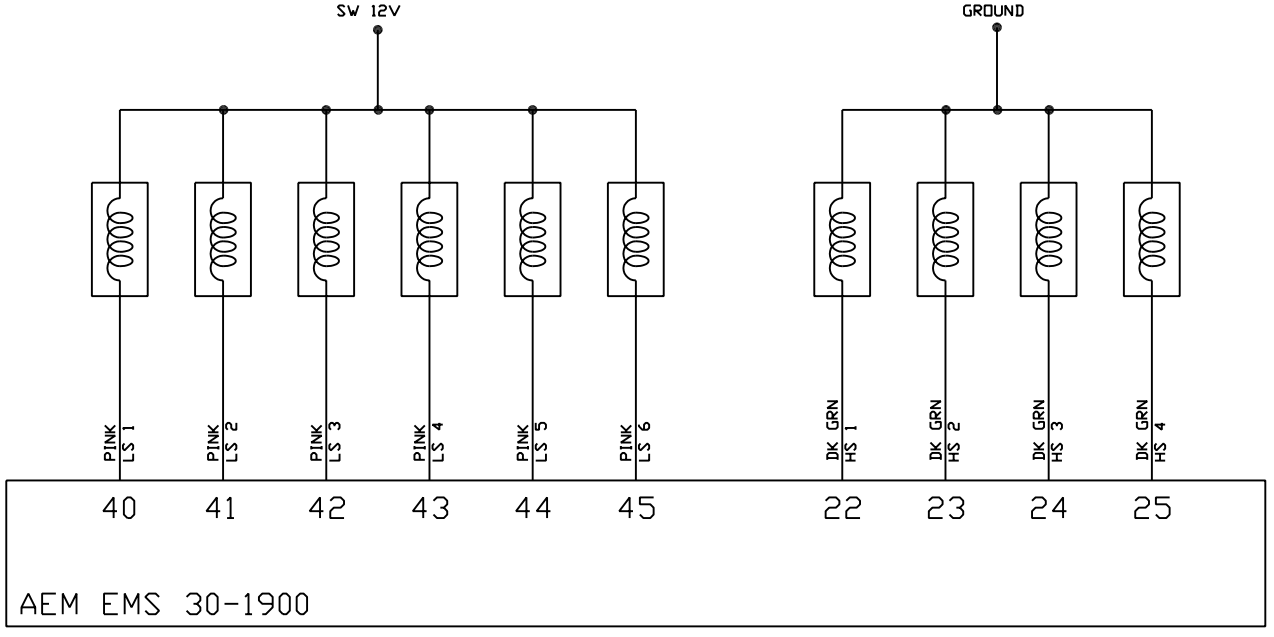


STEPPER MOTOR DRIVER

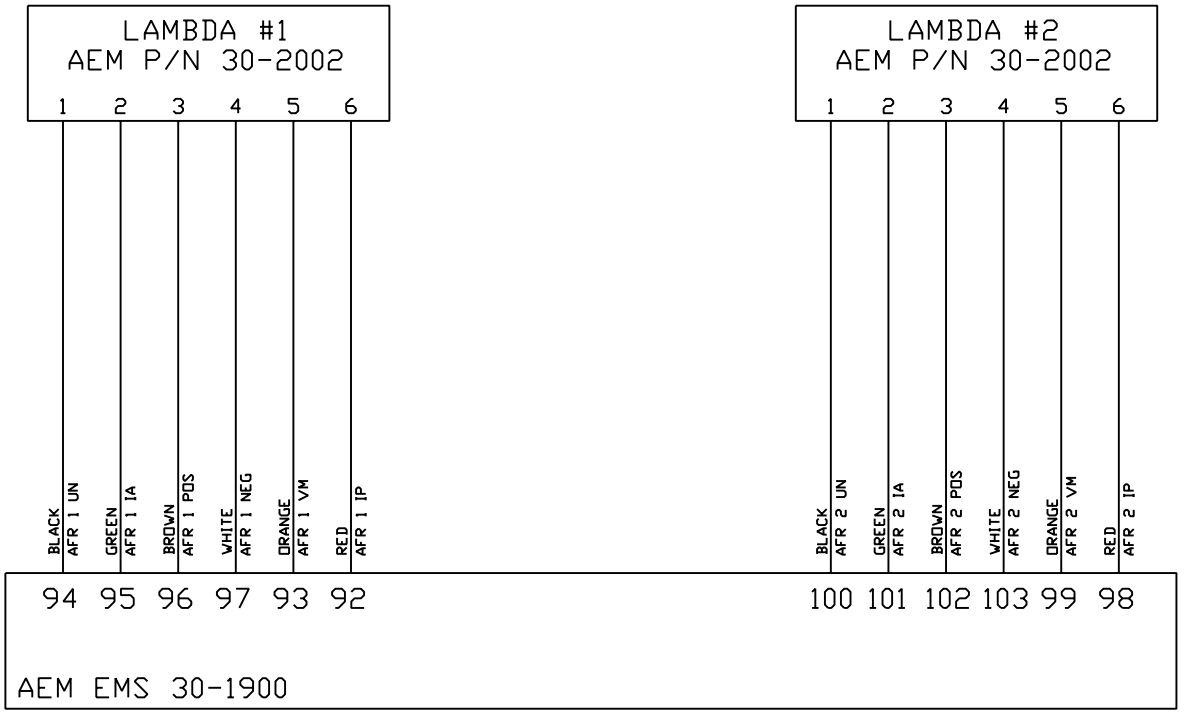
MISC OUTPUTS

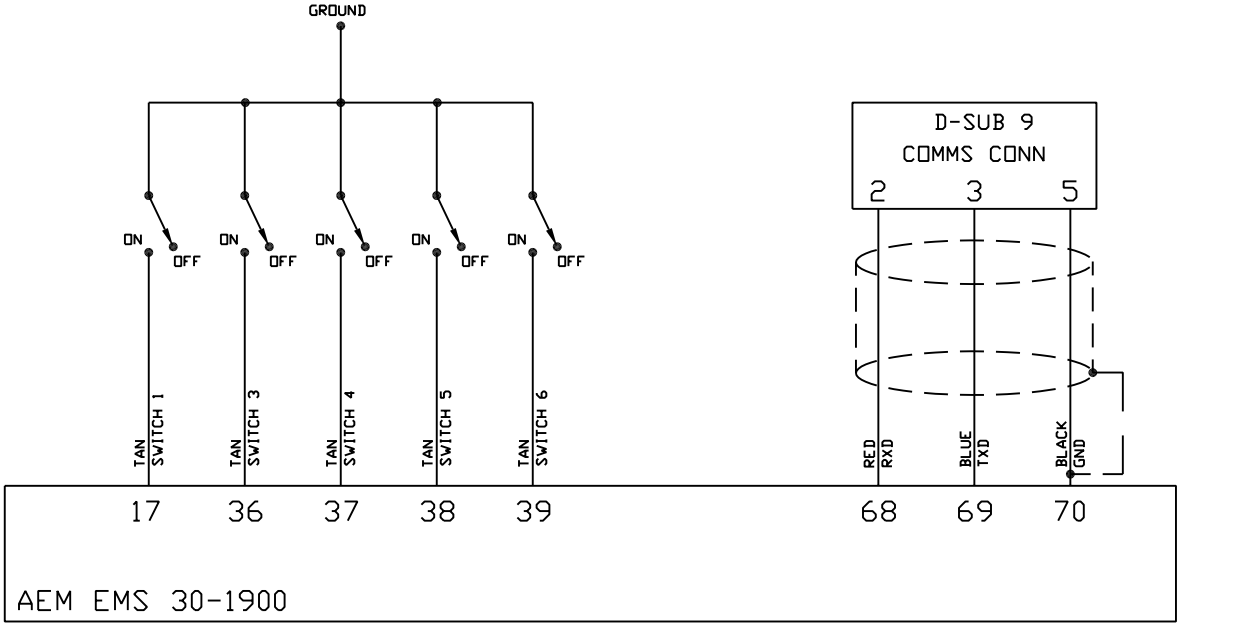


GENERAL PURPOSE OUTPUTS (RESISTANCE MUST BE GREATER THAN 10 OHMS)
WARNING LIGHTS, SOLENOIDS, RELAYS ETC... 1.5 AMP MAX



THE SUPPORTED AIR/FUEL RATIO SENSOR IS THE BOSCH LSU 4.2 UEGO



GENERAL PURPOSE SWITCH INPUTS
GROUND = ON

COMMS CONNECTOR
OPTIONAL FOR REMOTE ACCESS