HKS

SUPER AFR
PART # 4606-RA001
### V. 110601

SUPER AFR OVERVIEW

The HKS Super AFR is the very first airflow meter correctional device in the industry with a built in CPU. The advantage of having a built in CPU is that instead of making corrections to the airflow meter voltage, the characteristics of each airflow meter is inputted in the CPU so it can calculate the accurate amount of air flowing in. Since the correction will be made to this specific intake volume, the correction ratio of fuel will be precise and proportionally correct. The Super AFR is compatible with most Import and Domestic 12V, 2~12cylinder vehicles that utilize a hot wire, Karmen Vortex, or pressure sensor. The internal CPU allows it to be versatile and be utilized on many of the newer type airflow meters. Also incorporated in the Super AFR is the ability of idle air/fuel ratio corrections as modification progress and require further specific tuning levels. The response function, similar to the one in the VPC, allows for adjustments to the fuel settings upon throttle inputs to improve driveability and performance. The EIDS function is automatically programmed with the data from the initial self-learning calibration and automatically activated to correct sudden imbalances is air/ratios from discharge valves upon deceleration.

NOTICE

This manual assumes that you have and know how to use the tools and equipment necessary to safely perform service operations on your vehicle. This manual assumes that you are familiar with typical automotive systems and basic service and repair procedures. Do not attempt to carry out the operations shown in this manual unless these assumptions are correct. **Always have access to a factory repair manual**. To avoid injury, follow the safety precautions contained in the factory repair manual.

BULLET CONNECTOR INSTALLATION

1. Remove a small section of insulation at the end of the wire to expose the wire strands.
2. Determine which connector (male/female) is needed.
3. Install the appropriate clear cover over the wire.
4. Crimp the center section of the connector onto the exposed wire strands.
5. Crimp the rear section of the connector onto the insulated portion of the wire.
6. Pull on the wire and the connector to confirm a good connection.
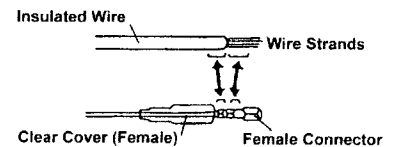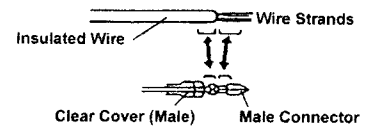
SPLICE CONNECTOR INSTALLATION

1. Place the wire to be spliced into side A (the side without the stopper) and the wire from the AFR to side A (the side with the stopper). Make sure the wire touches the stopper.
2. Fold side B over side A using pliers, making sure the snap is secured.
3. Fold side C over and make sure it snaps completely closed.

NOTE: Do not strip wire ends. Gently pull on the wire to insure a proper splice.

1. Disconnect the negative terminal from the battery.
2. Locate the factory ECU using the factory shop manual and the SUPER AFR wiring chart portion of this manual. If the vehicle is equipped with an HKS FCD, install the SUPER AFR between the FCD and the factory ECU.
3. Use the supplied Vehicle Specific Wiring Diagram and a factory repair manual as a reference to confirm the locations of:
   - B- 12 volt ignition
   - U- 12 volt battery
   - E- ECU Ground (Ground wire should be connected to ECU ground as shown in HKS wiring diagram to ensure best results)
   - P- Pressure sensor, air flow signal
     (Note: some applications have multiple "P" signals-Use P(AFR) for AFR and P(FCD) for FCD)
   - I- RPM signal
   - S- Speed Sensor
   - T- Throttle Position Sensor
   - #- Injector Signal

4. Connect the Super AFR with the supplied connectors to the appropriate wires as shown in the diagram.
   - Connect the red wire to (B) the 12-volt ignition power source.
   - Connect the black wire to (E) the ECU ground source.
   - Cut Pressure sensor / Air flow signal wire (P);
     -Connect the yellow Super AFR wire to the portion of wire (P) going to the factory ECU (AFS Output).
     -Connect the white Super AFR wire to the portion of wire (P) going away from the ECU (AFS Input).
   - Connect the brown wire to (I) the RPM signal. [Must be a used with a 5V digital signal – For applications with an analog signal, an HKS RPM Signal Level Converter (p/n 4299-RA004) must be used.]
   - Connect the orange wire to (T) the throttle position signal. (Not applicable with switching-type throttle position sensors.)
5. Re-examine all wire connections for proper installation.
6. Securely mount the Super AFR using double sided tape.
7. Reconnect the negative terminal to the battery.

NOTE: The white wired jumper plug (Not shown in diagram below) is used to complete the "P" circuit when bypassing the Super AFR.
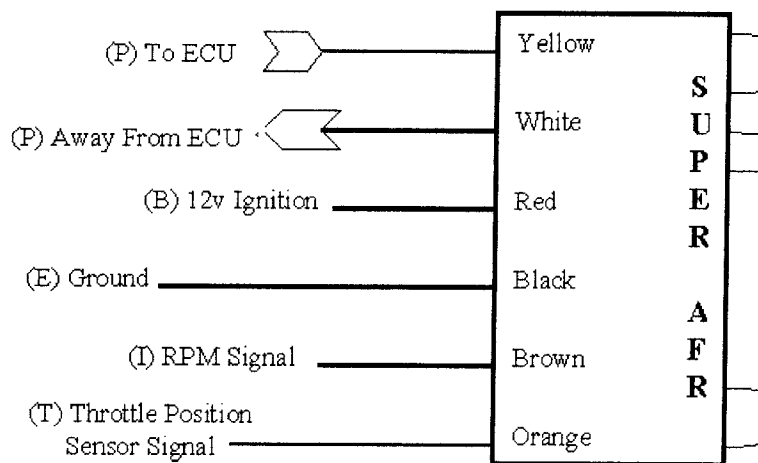
1. **Air Meter Type Selection**

    The DIP switches allow for the selection between Hot Wire, Karmen Vortex, and Pressure sensor calibrations for the Super AFR. The airflow meter type settings are made with the combinations of DIP switches 1 and 2 as listed below.

	SW1	SW2
Hot Wire (0-5V)	OFF	OFF
Hot Wire (5-0V)	ON	OFF
Karmen Vortex	OFF	ON
Pressure Sensor	ON	ON

Rear View

Airflow meter distinction DIP switch   Current / Voltage switch
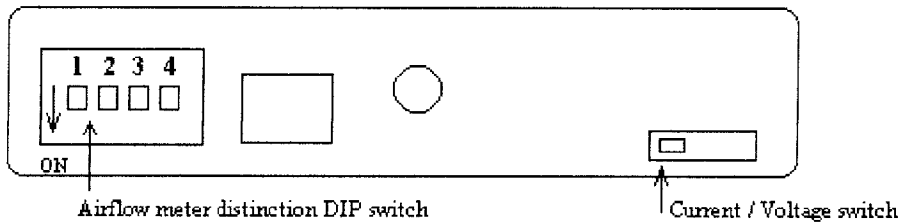
2. **Voltage Switch Setting**

    This switch is specifically used to select between the normal Hot Wire voltage range and the specific 1999+ Mazda Miata (NB8C) voltage range. When using the Super AFR on a Mazda Miata, the voltage switch should be in the left position as pictured below. For all other applications, the voltage switch should be in the right position.
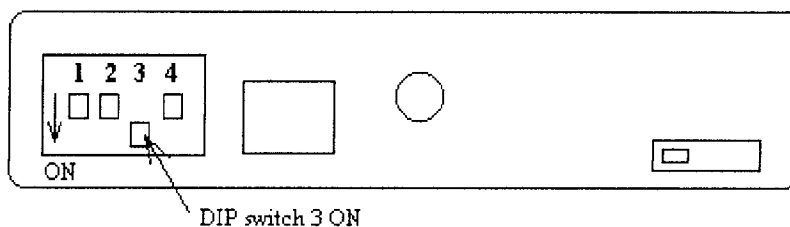
Rear View
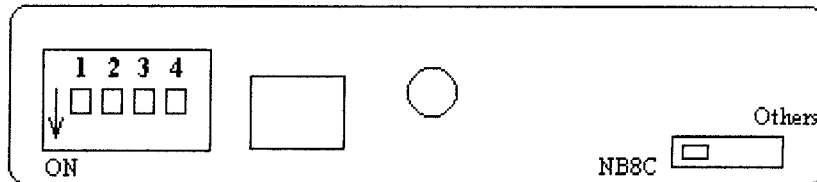
3. **EIDS Correction Function Switch Setting**

    The Super AFR's EIDS function can be set active or inactive via DIP switch 3. The EIDS function is not applicable on speed-density applications and should be switched to the "Off" position. To have the EIDS function active, switch the Super AFR DIP switch 3 to the ON position as pictured below.
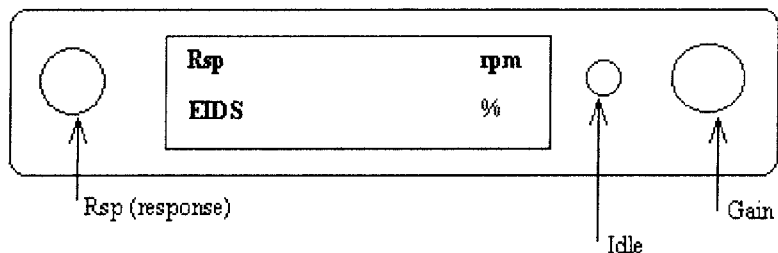
Rear View

DIP switch 3 ON

4. Cylinder Number Selection

Turn the key to the ignition (12 V) position. The numeral "2" should be flashing at this point, indicating that the Super AFR is set at "2" cylinders. Select the number of cylinders by turning the Response Knob on the front of the Super AFR.

* Cylinder settings can be made from between 2 ~ 12 cylinders. *

Front View

* **NOTE**: If the wrong number of cylinders is inputted, the rpm signal will not match the actual reading *

5. Self-Learning Calibration

The Self-Learning mode will automatically calibrate the Super AFR to the vehicle's Airflow Signal and Throttle Position Signal voltage. To activate the Self-Learning mode, make sure all accessories are turned off (A/C, lights, stereo, etc.) and then start the engine. The display will now show the engine rpm. At this point, set the *Idle* to "0" and turn the *Response* knob to "0". Let the engine warm up to normal operating temperature (Level where water temp is stable). While the motor is at full operating temperature, switch DIP switch 4 to the ON position as pictured below. Self-Learning mode is now complete.

Rear View
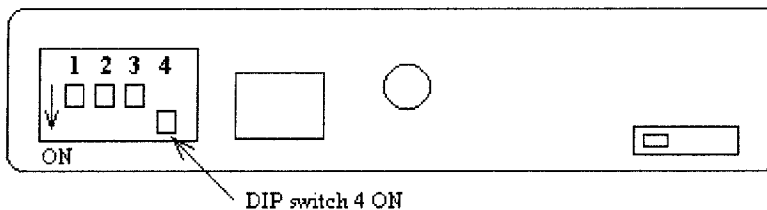
* **NOTE**: If the engine shuts off at anytime during the learning mode, you must start over from step #1 *

HKS RECOMMENDS TUNING FOR THIS DEVICE TO BE DONE ON A CHASSIS DYNAMOMTER ALONG WITH THE USE OF AN ACCURATE AIR/FUEL RATIO MEASURING DEVICE.

TUNING ATTRIBUTES AND RANGES

- **Airflow Meter / Pressure Sensor Correction Function**
  - **Idle Mixture**
    Idle mixture can be adjusted in the range between 650 to 1500 rpm.
    Adjustments are independent of the eleven Gain mixture settings
    Settings can be adjusted between −50% ~ +50% in 1% increments.
  - **Gain-Fuel Curve**
    Airflow output corrections can be adjusted in the range between 650~8000rpm.
    Eleven adjustable settings between 650~800rpm that can be arbitrarily adjusted in 50rpm increments.
    Settings can be adjusted between −50% ~ +50% in 1% increments.

- **Response function**
  The engine's initial throttle response can be adjusted to improve driveability and over all performance.
  6 adjustable RPM point settings between 650~5000 rpm that can be arbitrarily adjusted in 50rpm increments.
  RPM point setting values can be made between the range of 1m/sec.~100m/sec. in increments of 1m/sec.

- **EIDS function**
  The EIDS correction function, an electronic idle stabilizer, is automatically enabled after performing the Self-Learning calibration. The EIDS will automatically compensate for sudden imbalances in air/fuel ratios at idle and at deceleration.

MONITOR MODE

In **Monitor Mode**, the Super AFR will display the current engine rpm and fuel % change values. The rpm function displays the current rpm in 1/10 of the actual rpm. The fuel % value function will display the current % gain change according to the current engine speed. Press the *Gain* knob to toggle between the rpm display screen and the % gain display screen. The *EIDS* indicator will light up during its automatic operation when the airflow signal surpasses the set range of inputs when the throttle is released. The response indicator, *Rsp*, operates in the same manner in regards to the response function.

IDLE FUEL % SETTING

While in **Monitor Mode**, depress the *Idle* button so that it pops up. Rotate the knob to adjust the idle fuel mixture % between the range of −50% to +50% in 1% increments over the factory setting- Clockwise to richen and Counter-Clockwise to lean out. As you adjust the knob, the numeric setting and the % indicator will blink. After you have selected the numeric % value, the number and % indicator will stop flashing and will revert back to monitor mode to indicate that the setting has been saved into the memory and the idle setup is now complete.
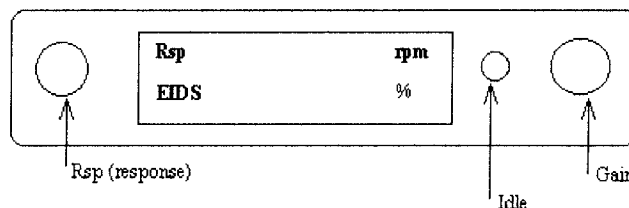
GAIN ADJUSTMENT MODE

Adjustments to the fuel curve on the 11 RPM points between 650rpm ~ 8000rpm (arbitrarily adjustable in increments of 50rpm) can be selected for fuel % adjustments from −50% ~ +50% in increments of 1%.
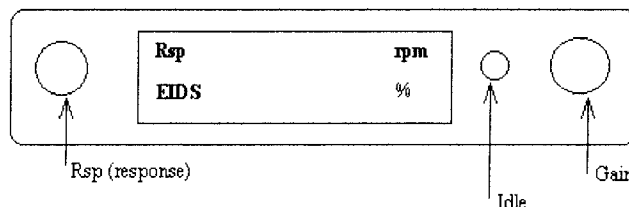
- **To Adjust/Change RPM Points**

(1) While in **Monitor Mode** (displays the current rpm or % gain) press the *Gain* knob to have the rpm displayed, if not already so.
(2) Hold down the *Gain* knob (more than 1sec) to switch to the Gain Adjustment Mode.
(3) At this point, you will be in **RPM confirmation Mode**. You will be able to display the current 11 RPM settings by rotating the *Gain* knob. This will allow you to easily verify the rpm settings of each of the 11 points.
(4) Select the rpm point you want to change and then double click (each click should be less than 0.5sec) the *Gain* knob to enter the **RPM Setting mode**. Rotate the *Gain* knob to change the rpm setting- Clockwise to raise the RPM point and counter-clockwise to lower the RPM point.
(5) Press the *Gain* knob to have the new setting saved to memory. When the setting is saved the unit will be back will return to the **Rpm Confirmation Mode** (Step 3). At this point you can change additional RPM settings by repeating steps 3 through 5. (NOTE-Each setting's RPM level can only be adjusted down to/up to 50 RPM of the previous/next respective setting of the 11 settable points.)
(6) Hold down the *Gain* knob, and the Super AFR will return to back to the Monitor Mode and will display the current rpm.

- **To Adjust/Change Fuel % Value**

(1) While in **Monitor Mode** (displays the current rpm or % gain) press the *Gain* knob to have the RPM displayed, if not already so.
(2) Hold down the *Gain* knob (more than 1sec) to switch to the **Gain Adjustment Mode**.
(3) At this point, you will be in **RPM confirmation Mode**. You will be able to display the current 11 RPM point settings by rotating the *Gain* knob. This will allow you to easily verify the rpm settings of each of the 11 points.
(4) Select the rpm point where you want to change the % value and then single click the *Gain* knob to display the Gain value for that rpm point. You now are able to verify the % value of the current rpm setting.
(5) To change the % value, double click (each click should be less than 0.5sec) the *Gain* knob to enter the Gain setting mode. Rotate the *Gain* knob to change the % value in 1% increments- Clockwise to raise the % of fuel up to a maximum of +50% and counter-clockwise to lower the % of fuel down to minimum of –50%.
(6) Press the *Gain* knob to have the new setting saved to memory. When the setting is saved the unit will return back to the **Rpm Confirmation Mode** (Step 3). At this point you can change additional % value settings by repeating steps 3 through 6. (NOTE-Each setting's % value level can be adjusted down to –50% and up to the +50%, BUT tuning is still limited to the vehicle's engine, fuel capabilities and the sensor metering range.)
(7) Hold down the *Gain* knob and the Super AFR will return back to **Monitor Mode** and it will display the current engine rpm.

RESPONSE SETTING

You can adjust the ratio of the response setting that has previously been inputted in the **Response Adjustment Mode** and in the initial setup. Use this operation to adjust the increased acceleration interval by depressing the *Rsp* knob and rotate to adjust all of the increased acceleration interval points.
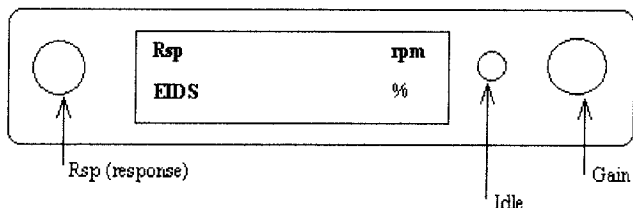

In cases where the Default Response Settings are set as followed, the *Rsp* knob allows for fine tuning the fuel curve adjustments...

Default Response Settings		Response Settings Set at 50%	
Response Rpm (Rpm)	Response Settings (ms)	Response Rpm (Rpm)	Response Settings (ms)
650	10	650	10 % 0.5 = 5
1000	10	1000	10 % 0.5 = 5
2000	20	2000	20 % 0.5 = 10
3000	20	3000	20 % 0.5 = 10
4000	30	4000	30 % 0.5 = 15
5000	30	5000	30 % 0.5 = 15

RESPONSE ADJUSTMENT MODE
For each of the 6 rpm points set between 650rpm ~ 5000rpm (arbitrarily adjustable in 50 rpm increments), the increased acceleration interval can be adjusted from 1~100ms (1/1000sec~1/10sec).
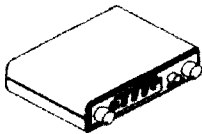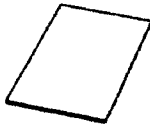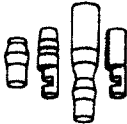

Rsp (response)   Idle   Gain
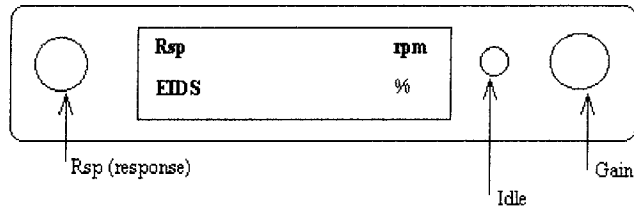
- **Response Rpm Settings**

(1) While in **Monitor Mode** (displays the current rpm or % gain) press the *Gain* knob to have the % value displayed, if not already so.
(2) Hold down the *Gain* knob to switch to the **Response Adjustment Mode**.
(3) At this point, you will be in **Response RPM Confirmation Mode**. You will be able to display the current 6 RPM Response point settings by rotating the *Rsp* knob. This will allow you to easily verify the rpm settings of each of the 6 points.
(4) Select the rpm point you want to change with the *Rsp* knob and then double click (each click should be less than 0.5sec) the *Gain* knob to enter the **Response RPM Setting Mode**. Rotate the *Rsp* knob to change the rpm setting- Clockwise to raise the RPM point and counter-clockwise to lower the RPM point.
(5) Press the *Gain* knob to have the new setting saved to memory. When the setting is saved the unit will be back will return to the **Response Rpm Confirmation Mode** (Step 3). At this point you can change additional Response RPM settings by repeating steps 3 through 5.
(NOTE-Each setting's RPM level can only be adjusted down to/up to 50 RPM of the previous/next respective setting of the 6 settable points)
(6) Hold down the *Gain* knob, and the Super AFR will return back to **Monitor Mode** and display the current % value.

- **Response *MS* Value Setting**

(1) While in **Monitor Mode** (displays the current rpm or % gain) press the *Gain* knob to have the % value displayed, if not already so.
(2) Hold down the *Gain* knob to switch to the **Response Adjustment Mode**.
(3) At this point, you will be in **Response RPM Confirmation Mode**. You will be able to display the current 6 RPM Response point settings by rotating the *Rsp* knob. This will allow you to easily verify the rpm settings of each of the 6 points that have been previously set.
(4) Select the rpm point where you want to change the response ms value and then single click the *Gain* knob to display the response ms value for that rpm point. You now are able to verify the response ms value of the current rpm setting.
(5) To change the Response ms value, double click (each click should be less than 0.5sec) the *Gain* knob to enter **the Response Setting Mode**. Rotate the *Rsp* knob to change the Response ms value in 1ms increments- Clockwise to raise the ms value up to a maximum of 100ms and counter-clockwise to lower the ms value down to minimum of 1ms.
(6) Press the *Gain* knob to have the new setting saved to memory. When the setting is saved the unit will return back to the **Response Rpm Confirmation Mode** (Step 3). At this point you can change additional Response ms value settings by repeating steps 3 through 6.
(NOTE-Each setting's Response ms value level can be adjusted down to 1ms and up to the 100ms, BUT tuning is still limited to the vehicle's engine and fuel capabilities.)
(7) Hold down the *Gain* knob, and the Super AFR will return back to **Monitor Mode** and display the current % value.

PARTS LIST

NO	QTY	ITEM	DESCRIPTION	NO	QTY	ITEM	DESCRIPTION
1	1	SUPER AFR HEADUNIT		5	1	DOUBLE-SIDED TAPE	
2	1	HARNESS		6	1	BULLET CONNECTOR SET	
3	4	SPLICE CONNECTOR		7	1	INSTRUCTIONS	
4	5	WIRE TIES		8	1	VEHILCLE SPECIFIC WIRING DIAGRAM	