

The Definitive SAFC/AFR Install by OpusX v0.9

Disclaimer: I am in no way responsible for any damage caused from using this document. If you have any questions/suggestions/corrections on this document, please send me an e-mail at: opus_x2@yahoo.com

Note:

Before attempting this install, make sure that the negative terminal is removed from the battery. While wiretaps ease the install process, it is always better to solder all connections so that the wires do not become loose from vibrations.

Introduction

It has been known for the past two years that when you install the S-AFC or the AFR, you would need either the Satchmo Fix or the Kaeyo Fix. It was determined that the S-AFC/AFR looks for a standard TTL signal where it triggers a single revolution when a signal is sent to the device that is greater than 2.8 volts and then drops the signal when it goes below 0.8 volts.

The Satchmo's Fix taps the RPM signal on Pin 11. This is the signal that the ECU sends to the ignition coil on when to fire the spark. The reason why the fix is needed for the Pin 11 tap is because the signal is only 2.2 volts and it's not enough to trigger the S-AFC/AFR. What the Satchmo's fix does is takes that 2.2 volt incoming signal and amplifies it to a 4.2 volt signal and sends it to the S-AFC/AFR to trigger the rpm signal.

Kaeyo's Fix taps the RPM signal via pin 47 which is also the same signal on the white wire from the distributor. This is the actual pulse from the ignition coil that sends the spark which is around 500 volts. The problem with this particular wire is that it is very noisy and the S-AFC was getting confused from all the noise. With a potentiometer installed, the signal from the coil could be "dampened" so that the noise was below the 0.8 volt trigger on the S-AFC and the 500 volt signal could be brought down to around 25 volts. The only catch with this fix is that if the area you live in have largely varying weather (i.e. cold at night, hot during the day), the sweet spot you had originally found for a solid rpm signal may not work and you would have to turn the knob to find the sweet spot again. I had mixed results with this fix where my car would get a spike in the Karmen reading and would sometimes cause the car to stall at idle. I fault this to the potentiometer that I had purchased as other people have not reported this problem.

After researching the Service Manual, I discovered that the Crank Position Sensor sends a 5 volt pulse for each crank revolution to the ECU. I tapped the S-AFC's RPM signal wire to this wire on the ECU (Pin 43 on a 5spd) and was rewarded with a nice solid RPM Signal. I was lucky enough to have some volunteers that offered their cars and their S-AFC/AFR to try this on. To this date, I've tried this on 5 different V6 3G's and none of them had any problems using the Crank Position Sensor as the source for the RPM signal.

Ok, enough of the technical babble and let's move on to the actual install.

Installation

The ECU for the 3G/Stratus is located on the passenger side foot well below the glove box mounted against the firewall.

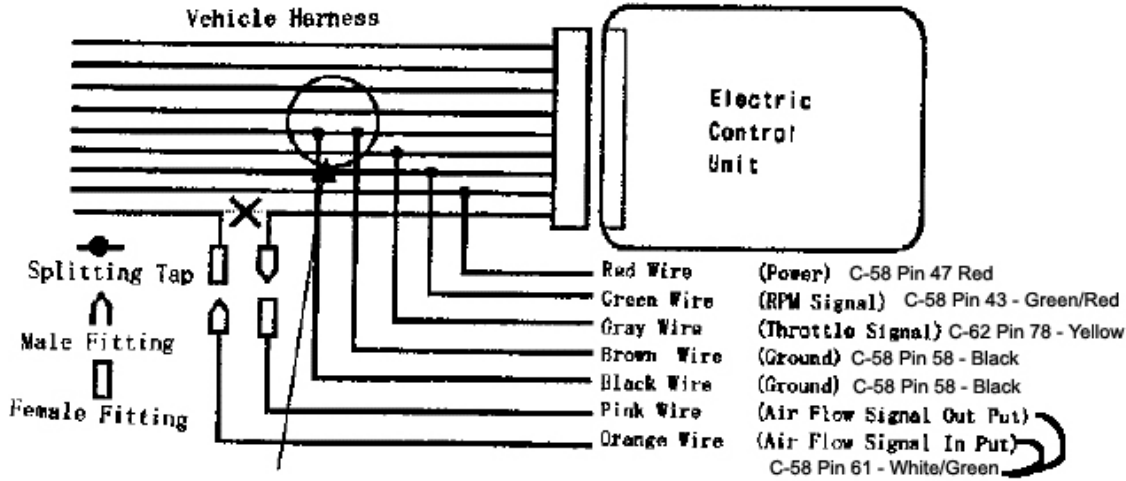


You will need to remove the air horn to gain access to the wires. To remove the air horn, push in at the middle of the plastic fastener.

Once the horn is removed, unclip the two connections furthest away from the center console. If you have a manual transmission, one will have a Green connector and one will have an orange connection. If you have an auto/sporty, one will be Orange and the other will be Blue. It will also be necessary to undo the electric tape that's keeping all the wires bundled up to gain access to the wires that you'll need to tap.



Here is the wiring diagram for the Apex'i S-AFC for the Manual Transmission and its pin-out at the ECU.



CAUTION

● Be sure to connect the brown wire CLOSER to the ECU than the black wire. Failure to do so MAY HIGHLY result in improper product operation and engine damage.

(C-51) (MU803784) Blue								(C-58) (MU803782) Orange								(C-62) (MU803783) Green																							
1	2	3	4			5	6	7	8	41	42	43	44			45	46	47	71	72	73	74			75	76	77												
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	48	49	50	51	52	53	54	55	56	57	58	59	78	79	80	81	82	83	84	85	86	87	88	89	90
24	25	26	27	28	29	30	31	32	33	34	35	60	61	62	63	64	65	66	67	68	91	92	93	94	95	96	97	98	99	100									

Note: It may be a good idea to use the male and female butt connectors included in the SAFC Kit for the Air Flow Signal so that if there is ever a need to bypass the AFC, it would be easier to do. After crimping the butt connectors to the wires, drop a dab of solder to the crimp and wire to better secure the connection.

Once you have the wires soldered, plug the connectors back in to the ECU and reconnect the negative battery cable back to the negative terminal.

Turn the key to the on position (but **do not** start the car at this point) and make sure that the SAFC powers up correctly. If not, shut the car off immediately and double check your wiring work.

After the SAFC has powered up, go to the **etc** screen and change the sensor type to Karmen and change the Cylinder to 6 with a rising arrow for the throttle setting.

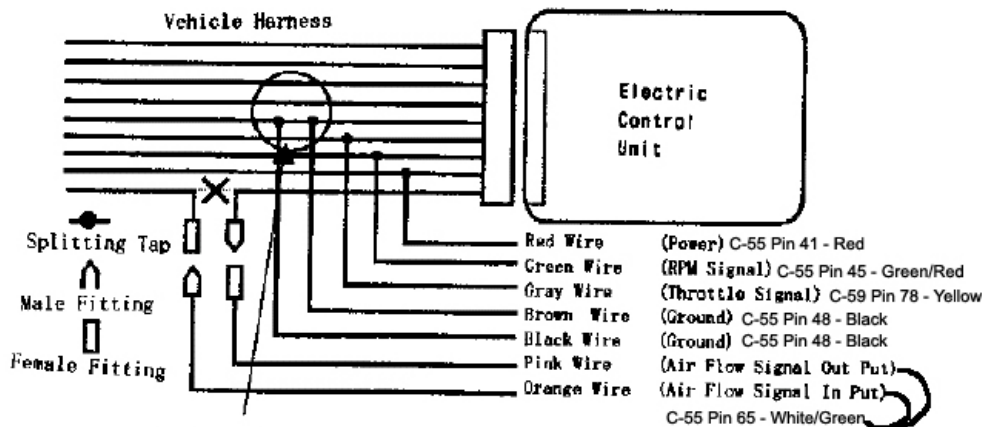
Go back to the Main Menu and go to **Settings** and make sure to zero out any corrections in both Hi and Lo throttle.

Once all the corrections has been cleared, start the car and check all the RPM readings to make sure it corresponds to what the Tachometer reads. Remember, if the car is cold, the idle will be high until the car fully warms up. The RPM reading for idle should be 750 ± 100.

After confirming everything is working, tidy up the wires and put everything back in place.

Note: The white, blue and yellow wires will not be used unless you plan to do the Blue Wire Mod. See Miscellaneous Notes below.

Here is the wiring diagram for the Apex'i S-AFC for the Auto/Sporty Transmission and its pin-out at the ECU.



CAUTION

● Be sure to connect the brown wire CLOSER to the ECU than the black wire
 Failure to do so MAY HIGHLY result in improper product operation and engine damage.

(C-52) (MU803784)

Blue

1	2	3	4		5	6	7	8
9	10	11	12	13	14	15	16	17
18	19	20	21	22	23			
24	25	26	27	28	29	30	31	32
33	34	35						

(C-55) (MU803781)

Blue

41	42	43		44	45	46
47	48	49	50	51	52	53
54	55	56	57			
58	59	60	61	62	63	64
65	66					

(C-59) (MU803782)

Orange

71	72	73	74		75	76	77
78	79	80	81	82	83	84	85
86	87	88	89				
90	91	92	93	94	95	96	97
98							

Note: It may be a good idea to use the male and female butt connectors included in the SAFC Kit for the Air Flow Signal so that if there is ever a need to bypass the AFC, it would be easier to do. After crimping the butt connectors to the wires, drop a dab of solder to the crimp and wire to better secure the connection.

Once you have the wires tapped/soldered, plug the connectors back in to the ECU and reconnect the negative battery cable back to the negative terminal.

Turn the key to the on position (but **do not** start the car at this point) and make sure that the SAFC powers up correctly. If not, shut the car off immediately and double check your wiring work.

After the SAFC has powered up, go to the **etc** screen and change the sensor type to Karmen.

Next, change the Cylinder to 6 with a rising arrow for the throttle setting.

Go back to the Main Menu and go to **Settings** and make sure to zero out any corrections in both Hi and Lo throttle.

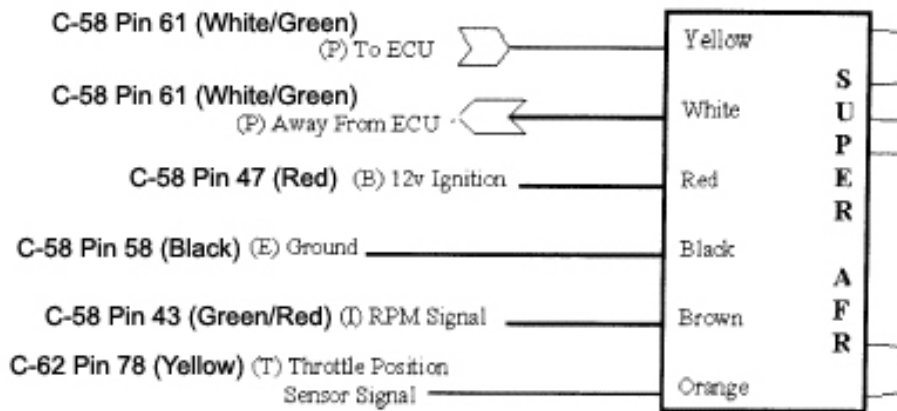
Once all the corrections has been cleared, start the car and check all the RPM readings to make sure it corresponds to what the Tachometer reads. Remember, if the car is cold, the idle will be high until the car fully warms up. The RPM reading for idle should be 750 ± 100 .

After confirming everything is working, tidy up the wires and put everything back in place.

Note: The white, blue and yellow wires will not be used unless you plan to do the Blue Wire Mod. See Miscellaneous Notes below.

Here is the wiring diagram for the HKS S-AFR for the Manual Transmission and the pin-out at the ECU.

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



(C-51) (MU803784)

Blue

1	2	3	4		5	6	7	8						
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31	32	33	34	35			

(C-58) (MU803782)

Orange

41	42	43	44		45	46	47				
48	49	50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68			

(C-62) (MU803783)

Green

71	72	73	74		75	76	77					
78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100			

Once you have the wires tapped/soldered, plug the connectors back in to the ECU and reconnect the negative battery cable back to the negative terminal.

Before turning the car on, go to the back of the unit and make sure that the dip switches are set with **SW1 Off** and **SW2 On**. **SW3** and **SW4** should be in the **Off** position and the voltage switch should not be touched (it should have come from the factory set to the Right hand position).

Turn the key to the ignition position (but **do not** start the car at this point) and make sure that the AFR powers up correctly. If not, shut the car off immediately and double check your wiring work.

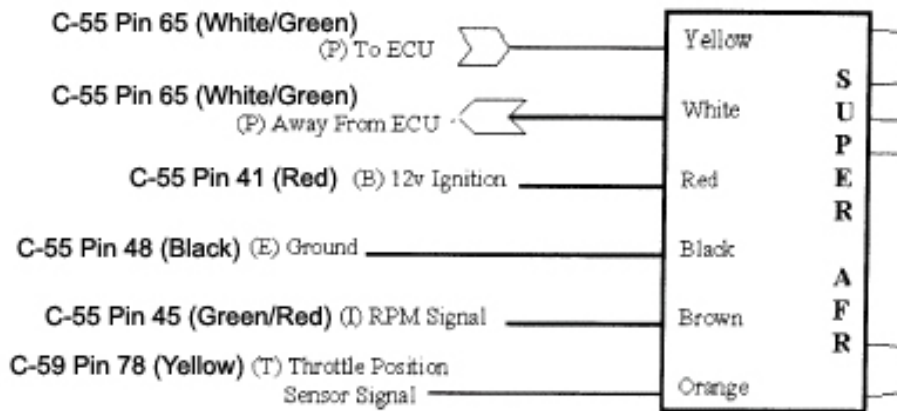
After the AFR has powered up, turn the **RSP** button until the display shows 6 for cylinders.

Follow the instructions provided with the HKS S-AFR to zero out any corrections before starting the car.

Once all the corrections has been cleared, start the car and check all the RPM readings to make sure it corresponds to what the Tachometer reads. Remember, if the car is cold, the idle will be high until the car fully warms up. The RPM reading for idle should be 750 ± 100 . After confirming everything is working, tidy up the wires and put everything back in place.

Here is the wiring diagram for the HKS S-AFR for the Auto/Sporty Transmission and the pin-out at the ECU.

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



(C-52) (MU803784)

Blue

1	2	3	4		5	6	7	8
9	10	11	12	13	14	15	16	17
18	19	20	21	22	23			
24	25	26	27	28	29	30	31	32
33	34	35						

(C-55) (MU803781)

Blue

41	42	43			44	45	46
47	48	49	50	51	52	53	54
55	56	57					
58	59	60	61	62	63	64	65
66							

(C-59) (MU803782)

Orange

71	72	73	74			75	76	??
78	79	80	81	82	83	84	85	86
87	88	89						
90	91	92	93	94	95	96	97	98

Once you have the wires tapped/soldered, plug the connectors back in to the ECU and reconnect the negative battery cable back to the negative terminal.

Before turning the car on, go to the back of the unit and make sure that the dip switches are set with **SW1 Off** and **SW2 On**. **SW3** and **SW4** should be in the **Off** position and the voltage switch should not be touched (it should have come from the factory set to the Right hand position).

Turn the key to the ignition position (but **do not** start the car at this point) and make sure that the AFR powers up correctly. If not, shut the car off immediately and double check your wiring work.

After the AFR has powered up, turn the **RSP** button until the display shows 6 for cylinders.

Follow the instructions provided with the HKS S-AFR to zero out any corrections before starting the car.

Once all the corrections has been cleared, start the car and check all the RPM readings to make sure it corresponds to what the Tachometer reads. Remember, if the car is cold, the idle will be high until the car fully warms up. The RPM reading for idle should be 750 ± 100 .

Satchmo's Fix (fix provided by Pochemicro)

The best way to implement this fix is by using the above instructions for whatever device that you're installing **EXCEPT** the wire for the RPM signal. Tap the RPM signal to C-51 Pin 11 (Black/Blue wire) for Manual or C-52 Pin 11 (Black/Blue) for Sportronic.

You'll want to place the fix up on the harness by where it attaches to the other connector by the device. Here is a picture of what I'm talking about for the S-AFC:



There are 4 wires on the Satchmo fix provided by Pochemicro.

S-AFC

First, cut the green wire (RPM Signal) on the wiring harness, connect the Green wire from the fix to the section of wire coming from the ECU and then connect the white wire from the fix to the other section of the green wire going to the S-AFC.

Next, remove some of the sheathing (but do not cut) from the black wire (Ground) of the S-AFC wiring harness and connect the black wire from the fix to it. Do the same thing on the red wire (Power) from the S-AFC harness and connect the red wire from the fix to it. Secure all connections by whatever means you choose (solder and shrink tubing is always the preferred method).

HKS AFR

Cut the brown wire (RPM Signal) on the AFR wiring harness, connect the green wire from the fix to the section of the brown wiring coming from the ECU. Next, connect the white wire from the fix to the other section of the brown wire going to the AFR.

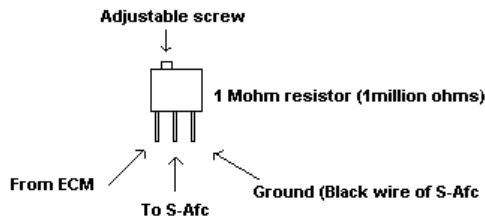
Remove some of the sheathing (but do not cut) from the black wire (Ground) of the AFR wiring harness and connect the black wire from the fix to it. Do the same on the red wire (Power) from the AFR harness. Secure all connections by whatever means you choose (solder and shrink tubing is always the preferred method).

Kaeyo's Potentiometer fix

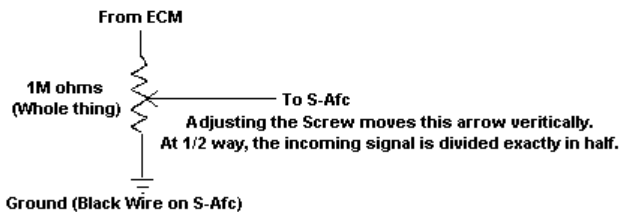
I pulled these instructions from Kaeyo's post on the boards.

Again, this fix is NOT Satchmo's version of the fix. I have used this fix for the past 1.5 years now, as have others without problems. It's your choice which fix you want to use. This one is just much easier to implement, and only requires 1 electrical component: a 1 Mega-Ohm Potentiometer. Go to any Radio Shack, and you should be able to buy one for a few dollars.

The diagram for the RPM fix. Your potentiometer may come in a different size. They come in a variety of sizes.



Inside a Potentiometer



Now, remember, the most important thing is that the pin that goes to the S-AFC is the MIDDLE pin. The two end pins have no particular order. Ground, or the incoming RPM signal can go on either end of the potentiometer.

Start twisting the knob of the potentiometer while your airflow wire is NOT connected to the S-AFC. Warning, do NOT run your car when the S-AFC does not have the RPM fix, with the airflow lines attached. Connected everything up for the S-AFC, EXCEPT for the airflow lines. Adjust the RPM first, then connect the airflow lines.

Depending on which end you connected to ground, as it didn't matter, start twisting the knob until you get a smooth RPM reading. The S-AFC might start off as being REALLY JUMPY, or give a value of 0 rpm. You need to find that "sweet spot".

Remember, most potentiometer can do 10+ full rotations, so be patient.

Drawback: If you live in a region where temperatures change dramatically, such as for me in Pennsylvania, you will most likely have to readjust this S-AFC knob twice a year. I found that I need to adjust it during the winter months, and once again in the summer months. Resistance is a function of temperature, and what you built was a voltage divider.

Miscellaneous Notes

If you have an SAFC or SAFC-2, you can also do the white/blue wire mod by tapping either the white or blue wire from the SAFC to your o2 sensor. If you have a California Emissions (i.e. Cali-spec) car, I imagine you can use both the white wire for the o2 sensor in the front bank and the blue wire for the rear bank. Make sure you tap the o2 sensor that goes before the cat (Sensor 1) to get an accurate reading.

Federal Emission Manual – C-62 Pin 71 (White)

Federal Emission Auto/Sporty – C-59 Pin 71 (White)

California Emission Manual – C-62 Pin 72 (Blue) Bank 1 Sensor 1
C-62 Pin 71 (White) Bank 2 Sensor 1

California Emission Auto/Sporty - C-59 Pin 72 (Blue) Bank 1 Sensor 1
C-59 Pin 71 (White) Bank 2 Sensor 1

* Bank 1 (Right) for the Cali cars is located between the engine and the firewall, Bank 2 (Left) is located towards the front of the car.

For SAFC-2 owners

The SAFC-2 also comes with a Knock sensor tap. To take advantage of this, tap the purple wire from the SAFC-2 to the following locations depending on the car:

Federal Emission Manual – C-62 Pin 91 (White)

Federal Emission Auto/Sporty – C-59 Pin 90 (White)

California Emission Manual – C-62 Pin 91 (White)

California Emission Auto/Sporty - C-59 Pin 90 (White)

To configure the knock features on the SAFC-2, make sure the car is fully warmed up (may be a good idea to drive it for about 15 minutes first). Keep the car in Park or Neutral while the car is running, go to the **Settings** menu and select **Knk Set**.

The top line will be the knock reading with the current RPM reading. To set Point 1, rev the engine to between 1300-1700 RPM and then push right on the control stick. You should now see the number set for Point 1. Do the same for Point 2 by keeping the RPM between 3300-3600.

I think this sets a baseline reading for the two RPM ranges and then compares them against the reading when you actually drive through those RPM points. Anything above those preset numbers will be registered as knocks. I think you would have to figure out at what knock point above the baseline when the ECU start to pull timing. The only way that you can check that is by having one person look at spark advance on a datalogger and the knock readings while another drives. If anyone has any information on how the Knock feature works, please let me know so I can include it in this document.

Credits

I want to thank [Road Race Engineering](#), Turbo3G, and Pochemicro for allowing me to use their images in this guide. I would also like to thank Kaeyo, Satchmo and Pochemicro for figuring out what the SAFC is looking for on the RPM tap.

Special thanks also needs to go to Bob1398, Eclipse9122, Channidai, and Pwrhouse3G for letting me try my RPM "non-fix" on their cars. It takes a lot of guts to say "sure, use my car and this \$300 device that I just bought to test something that hasn't been tested before."