MAF Fusion

Installation and operating instructions

MAF Fusion **mass airflow sensor signal interface module & auxiliary injector controller**

Part #: MF-001

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Parts list

Quantity	Description
1	MAF Fusion module
1	MAF Fusion harness, 6 ft leads w 8 ft bulk-head USB cable
1	USB bulk-head cap (*on USB bulk-head cable*)
1	USB cable, USB-A to Mini-B 2.0 Cable, Black, 6ft
1	USB flash drive (with product software)
2	Stainless machine screw, 8/32 x 5/8”
2	Stainless nylon-insert lock nut, 8/32”
22	Heat shrink tube, cut

Optional items

Part #	Description
104847-USCAR3L	Fuel injector wiring harness w loom, 3 cylinders, USCAR connector
104847-USCAR4L	Fuel injector wiring harness w loom, 4 cylinders, USCAR connector
104847-Minitimer3L	Fuel injector wiring harness w loom, 3 cylinders, Minitimer connector
104847-Minitimer4L	Fuel injector wiring harness w loom, 4 cylinders, Minitimer connector
104847-Multec2-3L	Fuel injector wiring harness w loom, 3 cylinders, Multec 2 connector
104847-Multec2-4L	Fuel injector wiring harness w loom, 4 cylinders, Multec 2 connector
TBD	MAF Fusion harness connector kit

Recommended tools

Part #	Description
	Wire crimping tool
	Wire stripping tool
	Vehicle calibration software (EFILive, HP Tuners, SCT, etc.)
	Windows 7, 8 or 10 PC

MAF Fusion Features:

- Inputs
    - Two frequency type MAF sensor inputs (0 to 20,000 Hz input range)
    - RPM input (with software selectable pull-up circuit), 0-12,000 RPM input range
    - MAP/boost sensor input (user configurable for most 0-5 volt linear output MAP and pressure sensors)
    - Data log activation
    - Built in USB cable with remote bulk-head connector (for live view of data, reprogramming MAF Fusion & reading data logs)
- Outputs
    - Frequency type MAF signal output (0-20,000 Hz)
    - Voltage type MAF signal output (0.1-4.9 volts)
    - Bank 1 injector control (up to 4 high impedance injectors)
    - Bank 2 injector control (up to 4 high impedance injectors)
    - Auxiliary injector driver signal (Push/Pull +12V, low current)
    - LED indicators for power, status of MAF sensor inputs & error condition notification built into enclosure
- MAF sensor signal related features:
    - Accepts one or two frequency type MAF sensors
    - Outputs for frequency and voltage type MAF sensors
    - When using two MAF sensors, MAF input signals can be averaged, combined or subtracted from each other
    - Allows the user to adjust or scale the MAF sensor output across the entire output range or anywhere in between (up to 250 individual adjustment points)
    - Fast and slow response filtering of each MAF input at each frequency step (up to 250 points)
    - MAF sensor curves can be different for all inputs and outputs
    - MAF frequency input and output range from 0 to 20,0000 Hz
    - Up to 250 calibration data points for each MAF curve (in and out)
- Auxiliary injector control features:
    - Directly control up to 8 high impedance injectors (up two banks of four)
    - Additional driver output signal for use with external injector driver modules
    - Auxiliary injector control by MAP or airflow vs RPM
        - Up to 21 x 21 table size with user defined axis break points for RPM and load
    - Auxiliary injector control can be used on its own or in conjunction with the MAF sensor functions
- Additional features:
    - Precision, high speed microcontroller operation
    - Data logging of all inputs and outputs
        - 10, 20, 50 or 100 samples/second (Hz) user selectable sample rate
    - Live data view mode for monitoring of inputs and outputs
    - On-board barometric pressure sensor
    - On-board module temperature sensor
    - Includes universal style 6’ wiring harness
    - Automotive temperature grade components
    - Fully epoxy potted construction for increased durability
    - Compact design with black hard coat anodized aluminum enclosure
    - Free Windows PC software for module programming, viewing live data & reading logged data
    - One year limited warranty

Applications:

- Scaling, calibrating and/or filtering of mass airflow sensor signals
    - Scale the entire curve or individual frequencies or frequency ranges
- Converting from voltage output based mass airflow (MAF) sensors to frequency type MAF sensors
    - Allow vehicles that require voltage type MAF sensors to use the more common frequency type MAF sensors
- Custom air intake systems with two MAF sensors on vehicles where the engine management system is only able to recognize one MAF sensor. Reasons for the need for twin MAF sensors may include:
    - Reduced inlet restriction
    - Better inlet duct work packaging
    - Better sensor location (especially in twin turbocharged applications)
    - Better low airflow MAF sensor resolution
- Auxiliary fuel control, especially in high power applications where the original engine controller is not able to recognize the actual airflow values and/or is not able to be calibrated for the needed fuel injector flow rate due to software limitations.
    - Examples:
        - 1994-2008 model year Corvette and other GM applications with 512 grams/second maximum ECM/ PCM recognized/measured airflow limit
        - 2004-2008 model year Corvette and other GM applications with a 8 grams/second maximum ECM recognized injector flow rate limit

- Auxiliary port fuel injection (PFI) control in direct injection (DI) engine applications where available injectors and/or fuel pumps may not be able to supply the required fuel flow.
- Airflow or boost based water or alcohol injection control
- Airflow or boost based intercooler radiator water spray/evaporative cooling system control
- Flow bench testing of MAF sensors including comparison testing of MAF sensors
    - Provides sensor power, live data view, data logging and signal output capability (as a voltage and a frequency)
    - Use to compare or calibrate one MAF sensor using a second known output signal MAF sensor
- Engine or chassis dynamometer applications where you want airflow to the ECM also to be recorded by the dynamometer data acquisition system
    - Airflow to the ECM as a pass thru frequency and then airflow to the data acquisition system as a voltage

Software Installation:

The MAF Fusion software requires Windows 7 or newer. MAF Fusion works with 32 bit and 64 bit systems. It is not compatible with Windows XP or older Windows software operating systems.

We recommend installing the software as a PC administrator. You must have proper usage rights to install new software on the PC.

If you already have the software installed and are updating to a newer version you will need to uninstall the existing software first (see the next section for uninstall instructions).

Insert the supplied USB drive into the PC or download the installation software from the Internet. If you downloaded the software, unzip the files and save them to a local drive or a USB flash drive.

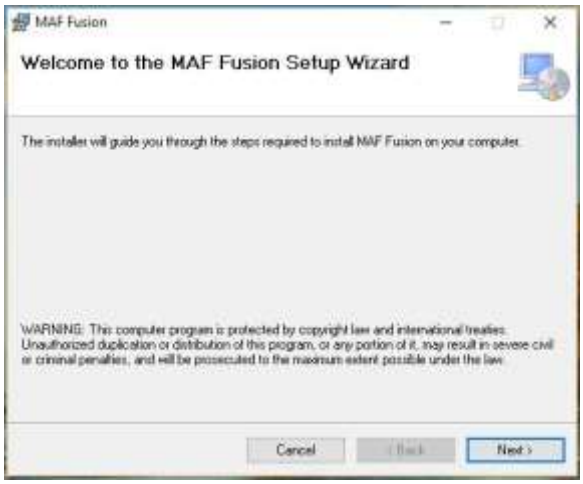
The install software may be run directly from the supplied USB drive (no need to make a local copy)

Double click on “MAF Fusion III Setup” (version 2_0_0 shown).

NOTE—you may get an “Error reading from file…” error during the install process if you try to install the software from some network and cloud drives. If this occurs, make a local copy of the installation software and run from the local drive.

Welcome to the MAF Fusion Setup Wizard dialog box will appear.

Click Next.

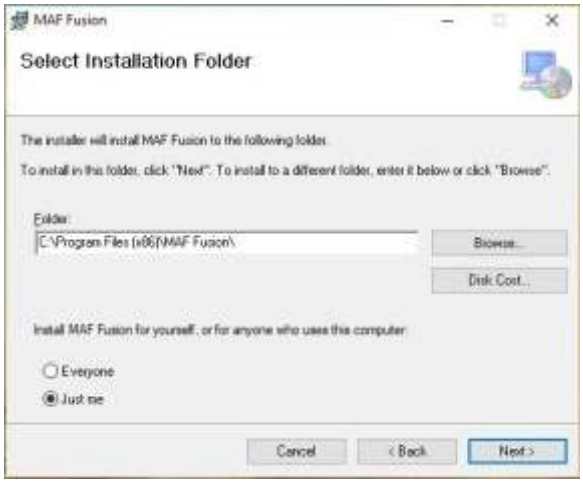


Select Installation Folder dialog box will appear.

We recommend leaving it saved in the default Windows location.

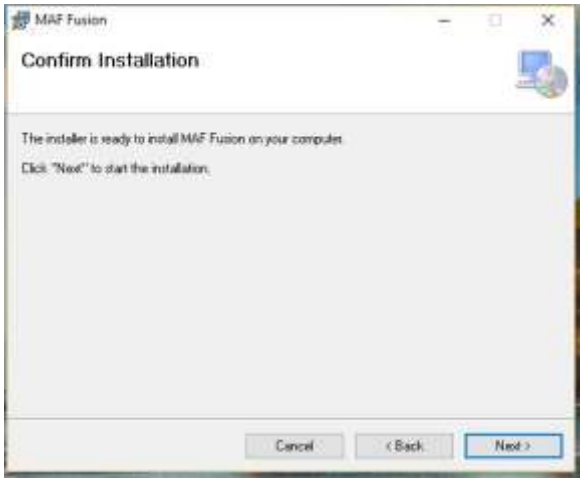
Select if the software should be installed for just this user login or all PC user logins (Everyone or Just me).

Click Next.

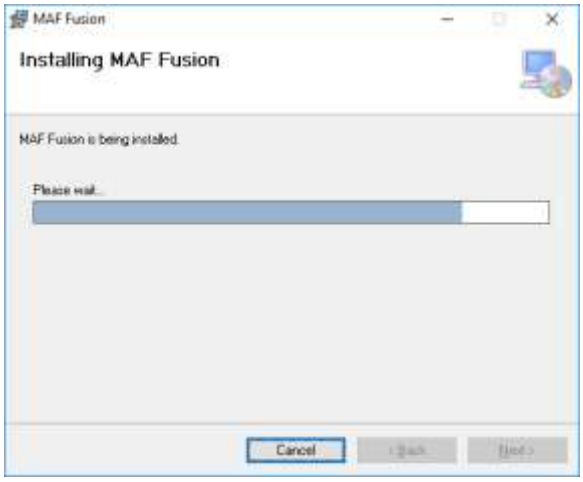


Confirm Installation window appears.

Click Next



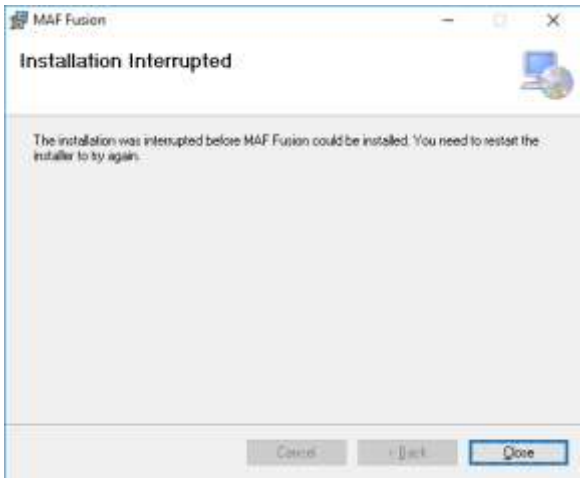
Installing MAF Fusion window will open.



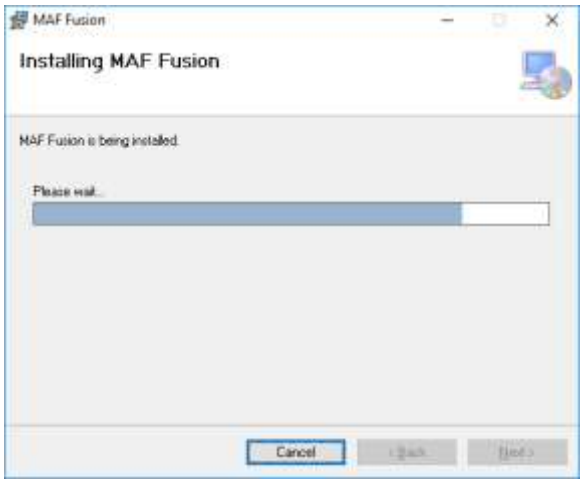
Depending on the operating system and security settings, you will likely get a window asking “Do you want to allow this app from an unknown publisher to make changes to your device”.

Click “YES”

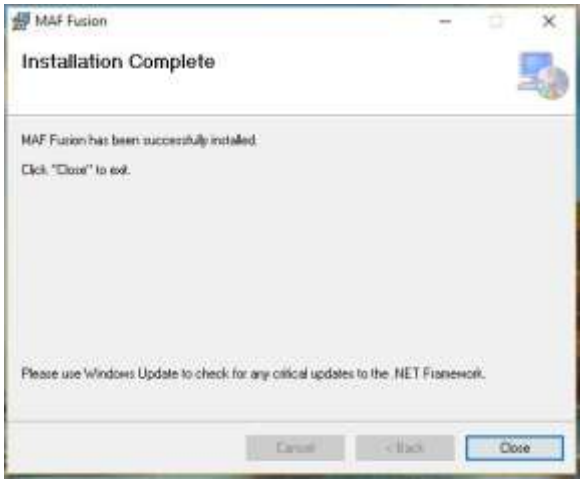
If you wait too long to click yes, you will get an “Installation Interrupted” window. Just press close and start the process over if this happens.



The software will then return to the installing MAF Fusion window. Depending on the speed of your PC and the drive it is being installed on, you may only briefly see this window.



The software will then indicate that the MAF Fusion software installation is complete.

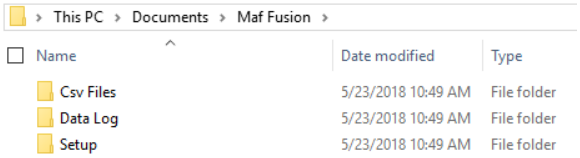


MAF Fusion will create a Start menu group called “MAF Fusion” with links to the MAF Fusion software and the uninstall utility.

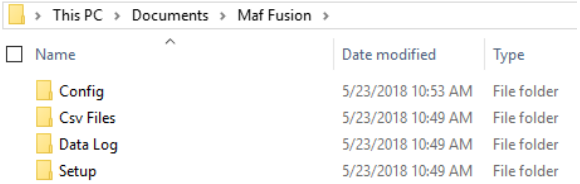
MAF Fusion will also create a desktop shortcut.

A folder in the user documents folder will have been created as well.

Initially the folder will have the following contents.



After the software is first opened a Config folder will also be created in the same MAF Fusion folder found in the local user documents directory.



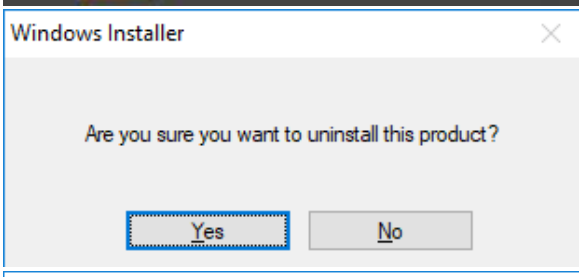
Uninstalling the MAF Fusion software:

NOTE: Un-installing the software from the uninstall menu will not erase any stored data logs or setup files but we always recommend backing up any data before un-installing the software if you have critical data stored in the local user folders.

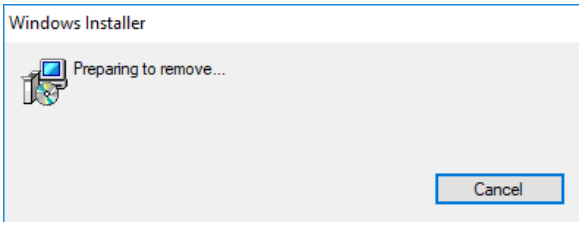
Go to the MAF Fusion Start folder or the Add/Remove programs section of the control panel.

Select Uninstall MAF Fusion.exe

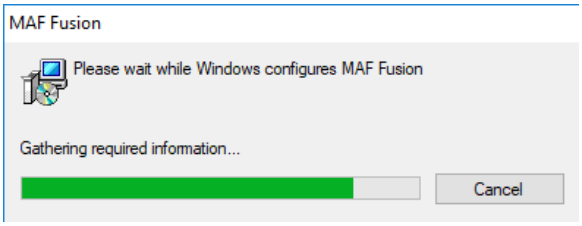
Windows installer dialog box will prompt you “Are sure you want to uninstall this product”. Click YES.



“Windows Installer”, “Preparing to remove…” dialog box will appear (depending on PC, anti virus software and other security settings this dialog box may take a little while).

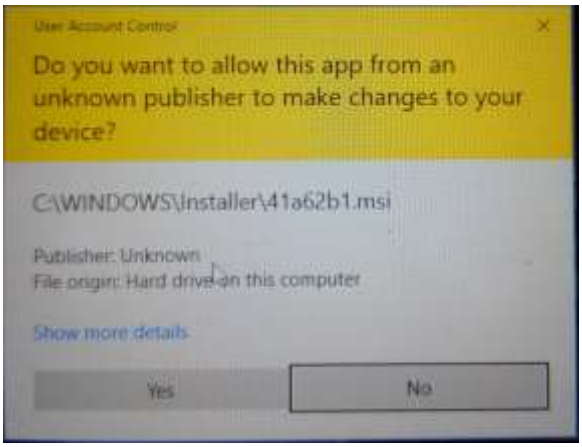


Please wait while Windows configures MAF Fusion window will appear.



Depending on operating system and security settings, a User account control window will likely appear. Click YES to allow the software to be uninstalled.

The software will then return to the “Please wait while Windows configures MAF Fusion” window. When the progress bar gets to the end and this window closes, uninstall is now complete.

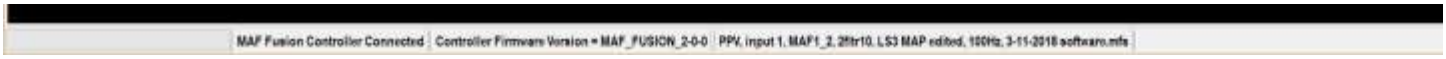


The desktop icon, Start menu items and the program files will have been removed.

The MAF Fusion folder in Documents will still exists with any user generated data and the MAF sensor base CSV files.

MAF Fusion software

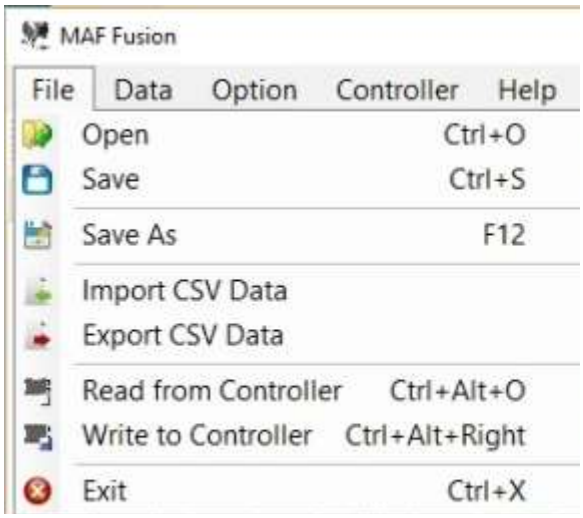
Bottom of software window (available in all software tabs)



In the bottom section of the MAF Fusion software window (in all tabs) you are able to see if a controller is connected, the firmware version of the controller (if one is connected) and the name of the user settings file (.mfs file) currently being viewed in the software.

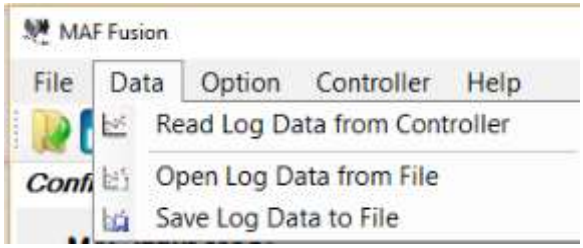
Main menu options

File



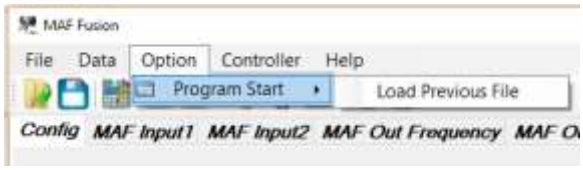
From the **File** menu option you are able to **Open** existing MAF Fusion user settings files (.mfs files), **Save** new user settings files, **Save As** user settings as a new file name, **Import CSV Data** for the MAF sensor calibration curves, **Export CSV Data** of the MAF sensor calibration curves, **Read** user settings files from the MAF Fusion controller, **Write** new user settings files to the MAF Fusion controller and **Exit** the program.

Data



From the **Data** menu option you can select to **Read** logged data from the controller, **Open** an existing data log file or **Save** the current log data to a file.

Option



From the **Option** menu you can configure if the software starts from a previously loaded file each time or if it starts from a blank new file each time. If you need to create a new user settings file from scratch, unselect the “Load Previous File” option and restart the software.

Controller

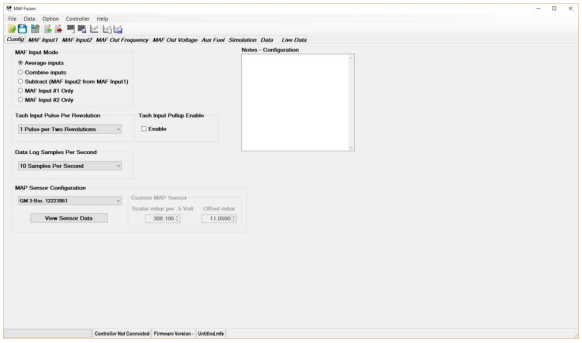
From the **Controller** menu you can select to update the firmware of the MAF Fusion controller. If major software updates occur that result in the software version main number (the first number in the revision number indicated by an “X”, X_0_0) not matching the first digit of the firmware revision number, then a firmware change is required.

Help

From the Help menu you can see the current software version number and access the user manual and wiring diagrams (*not yet added*).

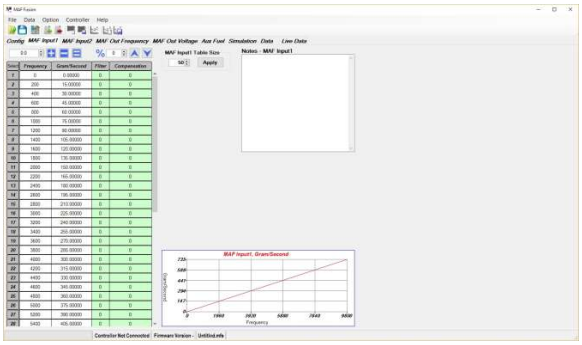
Main tabs in MAF Fusion software:

Config



The Config tab is used to setup the main MAF Fusion configuration settings for MAF configuration, RPM input, data log rate and MAP sensor calibration.

MAF Input1



MAF Input1 is used to define the calibration of the #1 input MAF sensor.

The MAF Fusion software uses this lookup table to determine the sensed airflow based on the frequency readings from input 1.

This tab is also used to adjust the signal filtering for MAF Input 1.

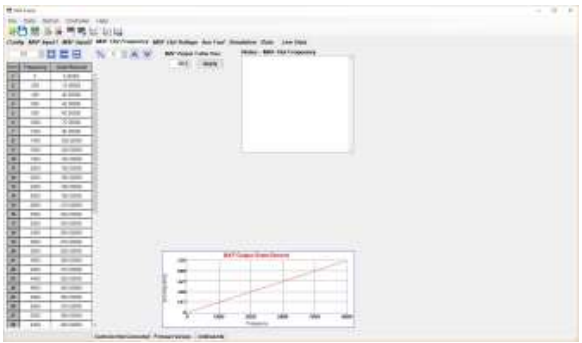
MAF Input 2

MAF Input2 is used to define the calibration of the #2 input MAF sensor.

The MAF Fusion software uses this lookup table to determine the sensed airflow based on the frequency readings from input 2.

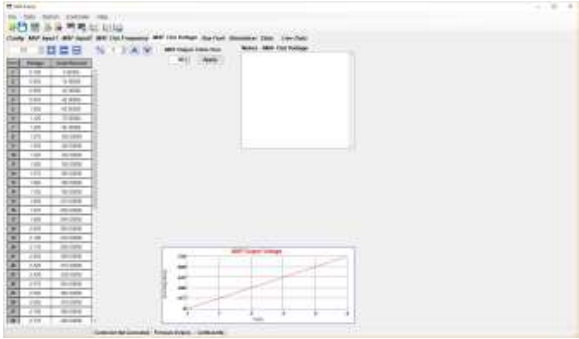
This tab is also used to adjust the signal filtering for MAF Input 2.

MAF Out Frequency



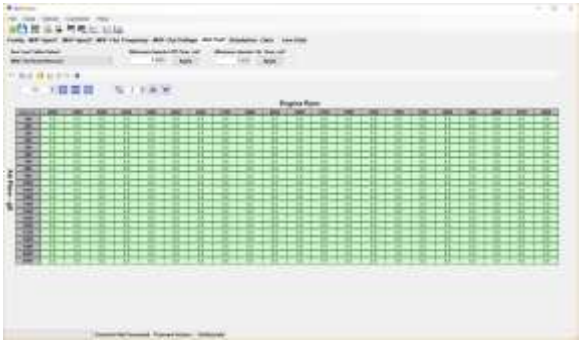
Based on the input mode selected and the airflow readings from MAF1 and MAF2, the MAF Fusion calculates the correct MAF output airflow value and then uses this lookup table determine the airflow to frequency correlation for the frequency type MAF sensor output signal.

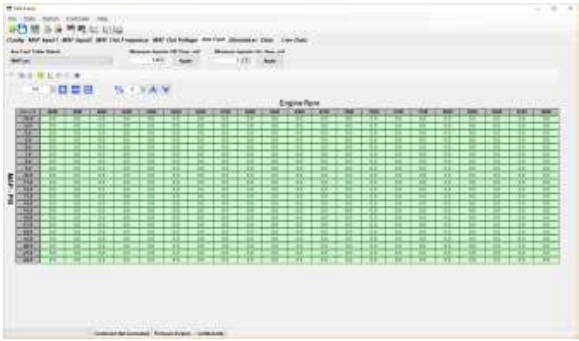
MAF Out Voltage



Based on the input mode selected and the airflow readings from MAF1 and MAF2, the MAF Fusion calculates the correct MAF output airflow value and then uses this lookup table determine the airflow to voltage correlation for the voltage type MAF sensor output signal.

Aux Fuel



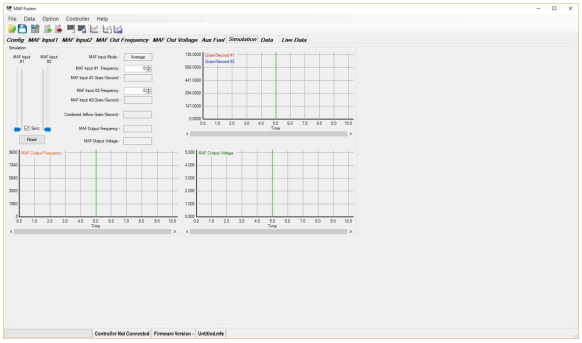


The auxiliary injection control table is used to control the auxiliary injector outputs. These outputs are:

- Aux Injector Output #1
- Aux Injector Output #2
- Aux Injector Out Low Level

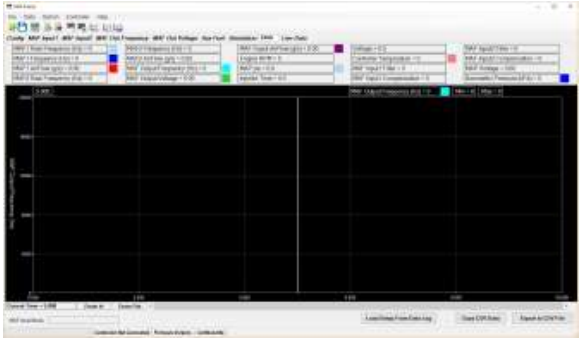
The table is RPM vs load where load can be selected as airflow (grams/second) or manifold air pressure (PSI). The values in the table are in milliseconds (ms).

Simulation



The simulation tab is used to allow the user to calculate what the MAF Output values should be based on the MAF configuration and the MAF Input tables. The user can enter the frequency values in directly for MAF1 and MAF2 or can use the slider bars on the left to move across the range. The slider bars can be synchronized so that the frequency values are the same or unsynchronized so that MAF1 and MAF2 frequency values can be different.

Data



The data tab is used to view logged data in numeric and graph formats.

The data tab is also used to export the log data to a CSV file or to the clipboard.

From the Data tab you can also extract the setup file that was in the MAF Fusion when it was logging the data.

Live Data

The Live Data tab is used to view live real time data from the MAF Fusion controller. Available data includes:

- MAF1 raw frequency
- MAF1 filtered frequency
- MAF1 airflow
- MAF1 filter value
- MAF1 compensation value
- MAF2 raw frequency
- MAF2 filtered frequency
- MAF2 airflow
- MAF2 filter value
- MAF2 compensation value
- MAF Output Frequency
- MAF Output Voltage
- MAF Output airflow
- Engine RPM
- Battery voltage
- MAP sensor voltage
- MAP sensor PSI
- Barometric pressure
- MAF Fusion controller temperature
- Auxiliary injector pulse width

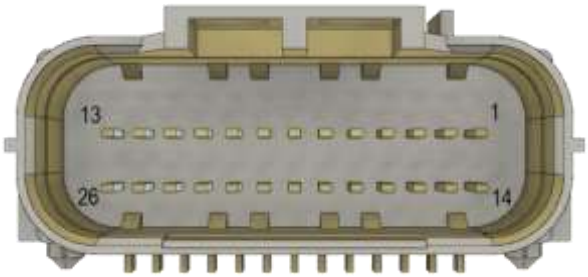
MAF Fusion software file types:

The MAF Fusion software has several different types of files it can save or open.

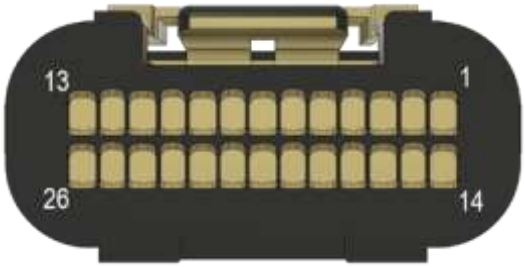
The primary file types and the corresponding windows extensions are:

Description	Windows file extension
User setup file	.mfs
Log data file	.mfd
MAF sensor calibration data file	.csv
Log data export file	.csv

MAF Fusion Connector End View



Harness Connector End View (as viewed from back of connector)



Pin	Group	Wire Color	Wire Size	Function
1	1	Green	18 AWG / 0.8 mm^2	Aux Injector Output #2, Ground
2	1	Tan	20 AWG / 0.5 mm^2	Aux Injector Out, Low Level, Push/Pull +12V
3	1	Blue	18 AWG / 0.8 mm^2	Aux Injector Output #1, Ground
4	2	Light blue	20 AWG / 0.5 mm^2	CAN High
5	2	Light green	20 AWG / 0.5 mm^2	CAN Low
6	USB	Black	24 AWG / 0.2 mm^2	USB Ground
7	USB	Red	24 AWG / 0.2 mm^2	USB Power, +5 volt
8	USB	White	28 AWG / 0.08 mm^2	USB Data, -
9	USB	Green	28 AWG / 0.08 mm^2	USB Data, +
10	Single	Gray	20 AWG / 0.5 mm^2	MAF Analog Voltage Signal Out to ECM
11	3	Blue w red	20 AWG / 0.5 mm^2	MAF Frequency Signal Out to ECM
12	3	Red w black	20 AWG / 0.5 mm^2	MAF Out +12V from ECM [MAF Fusion power]
13	3	Black	20 AWG / 0.5 mm^2	MAF Out Ground from ECM [MAF Fusion ground]
14	1	Black w blue	18 AWG / 0.8 mm^2	Aux Injector Ground
15	Single	Purple	20 AWG / 0.5 mm^2	Data Log Activation Input [+12V activation]
16	1	Black w white	18 AWG / 0.8 mm^2	Aux Injector Ground
17	Single	White	20 AWG / 0.5 mm^2	Tach Signal Input
18	4	Pink	20 AWG / 0.5 mm^2	MAP Sensor Signal Input
19	4	Red	20 AWG / 0.5 mm^2	MAP Sensor Power, +5V
20	4	Black w yellow	20 AWG / 0.5 mm^2	MAP Sensor Ground
21	5	Green w black	20 AWG / 0.5 mm^2	MAF #2 Signal Input
22	5	Orange w green	20 AWG / 0.5 mm^2	MAF #2 +12V
23	5	Brown w white	20 AWG / 0.5 mm^2	MAF #2 Ground
24	6	Yellow	20 AWG / 0.5 mm^2	MAF #1 Signal Input
25	6	Orange	20 AWG / 0.5 mm^2	MAF #1 +12V
26	6	Brown	20 AWG / 0.5 mm^2	MAF #1 Ground

Note:

- Group #1 is split into two sections in the above list because some wires are from the upper row of 13 pins in the connector and some wires are from the lower row of 13 pins in the connector.
- The following three wires are not part of any group (bundle):
  - MAF Analog out (10, gray)
  - Data Log Activation Input (15, purple)
  - Tach Signal Input (17, white)
- The above colors are for the second generation harness that added a color stripe to repeat colors for easier identification. If you have an early harness the primary color is the same as above.

MAF Fusion wiring:

Main power/ground

- The MAF Fusion gets primary power and ground from the ECM mass airflow sensor power and ground connections (MAF Out, group 3 wires). If you are not connected to the ECM MAF sensor input connector or want to power the MAF Fusion on a test bench then connect switched and fused +12V power to pin 12 (red wire) and ground to pin 13 (black wire).

MAF sensor signal to the ECU

- When being used to output a frequency type MAF signal the MAF Fusion should be connected directly to the ECU's MAF sensor power, ground and signal wires. These wires are in Group 3.

MAF Analog Voltage Signal

- The MAF Fusion can provide a 0-4.9 volt analog output voltage for a MAF signal. This can be connected to an ECM that is expecting an analog voltage type MAF signal or it can be connected to an external data acquisition system to monitor the airflow.
- The MAF analog voltage signal can be found on pin 10, gray wire.

MAF sensors into MAF Fusion (Group 5 & 6)

- When being used to output a MAF signal, the MAF Fusion must be connected to one or two frequency type MAF sensors. MAF sensor input 1 are the Group 6 wires and MAF sensor input 2 are the Group 5 wires.

Manifold Air Pressure (MAP) sensor, Group 4

- The MAF Fusion can be used with a dedicated stand-alone MAP sensor or, in many cases, it can connect to an existing MAP sensor already in use by the primary ECU.
- For dedicated stand-alone ratiometric MAP sensors that need a regulated 5 volt source, the MAF Fusion provides 5 volt regulated power for the MAP sensor on pin 19, sensor ground on pin 20 and pin 18 is the sensor signal. For dedicated stand-alone non-ratiometric sensors that are 12 volt powered, the sensor should get 12 volt power from a switched and fused 12 volt source and then the ground and signal wires should connect to the MAF Fusion.
- The MAF Fusion can also be used with an existing pressure sensor in many vehicles. If you are connecting to an existing in use sensor, only connect the MAP sensor signal wire from the vehicle to the MAP sensor signal wire on the MAF Fusion, Pin 18. Do not connect anything to the MAP sensor +5 volts or ground on the MAF Fusion. The MAF Fusion has been designed to have sufficient impedance to not impact the signal in most vehicle applications but it is always a good idea to double check that connecting to the vehicle MAP signal does not impact the measured MAP signal and voltage as seen by the OEM ECU. If this occurs the MAF Fusion may cause diagnostic codes or calibration issues and it is recommended that you use a dedicated MAP sensor instead.

RPM signal

- An RPM signal is required when you want to use the auxiliary injector output capability of the MAF Fusion. You may also want to connect to the RPM signal in order to be able to data log that data in combination with the other data channels.
- Connect wire/pin 17 (white wire) to a suitable RPM signal such as a tachometer signal wire.
    - If the MAF Fusion is the only device on the tachometer output wire you may need to enable the internal pull-up circuit in the MAF Fusion in the MAF Fusion software. Do NOT enable the internal pull-up if the circuit already has a pull-up in the system.

Aux injectors

- Output 1
    - Wire your injectors to Output 1 with the GROUND side of the injectors connected to pin #3 (blue wire) and the +12 volt side of your injector harness connected to ignition switched and fused +12 volt power.
    - No more than four (4) high impedance (10-14 ohm each) injectors should be connected to this output. Do not use low impedance injectors.
- Output 2
    - Wire your injectors to Output 2 with the GROUND side of the injectors connected to pin #1 (green wire) and the +12 volt side of your injector harness connected to ignition switched and fused +12 volt power.
    - No more than four (4) high impedance (10-14 ohm each) injectors should be connected to this output. Do not use low impedance injectors.
- Aux Injector Ground
    - When using the MAF Fusion to control auxiliary injectors make sure you also connect the two Aux Injector Ground wires (wire/pin 14 black wire and wire/pin 16 black wire) to a suitable chassis ground.

Low level output

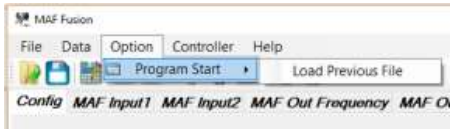
- This output is a low level, Push/Pull, +12V output. It is not designed to connect directly to injectors. It should connect to the control input on an external injector or solenoid controller.
- This output can also be used to PWM control a solid state relay in order to provide PWM control of a pump or other device (using the PWM Output Table option).

Data log enable

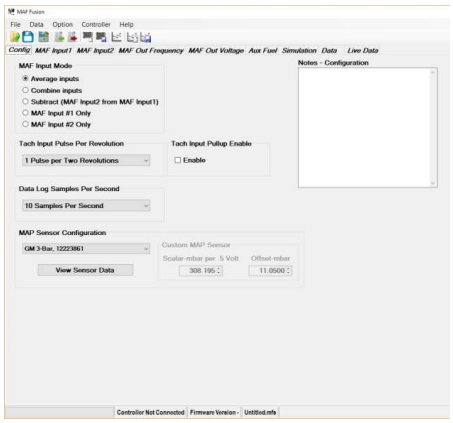
- Data logging is enabled via the violet “Data Log Activation Input” wire on pin 15 of the controller. Data logging begins when you apply +12 volts to this wire and ends when you remove +12 volts or when the data logging memory is full (which ever happens first).

Creating your first new MAF Fusion user setup file:

This section is intended to be a quick example of how to create a new user setup file. For more in-depth explanations please go to the menu and tab specific sections of the instructions.



To create a new MAF Fusion user setup file, make sure the software is set to not open a previous file in the Option>Program Start menu. Now close and open the software again. You now have a default starting file. “untitled.mfs” will show in the bottom right corner of the MAF Fusion software window.



In the “Config” tab you will first need to select how you want the MAF Fusion controller to interpret the MAF sensor signals (assuming you have a MAF sensor connected).

If you are only connecting to one MAF sensor, select the MAF input corresponding to how you have it wired to the MAF Fusion (Input 1 or 2).

If you have two MAF sensors in parallel (side by side), you typically want to combine the inputs from the two MAF sensors to generate a new combined flow output. Assuming this is the case, select Combine inputs.

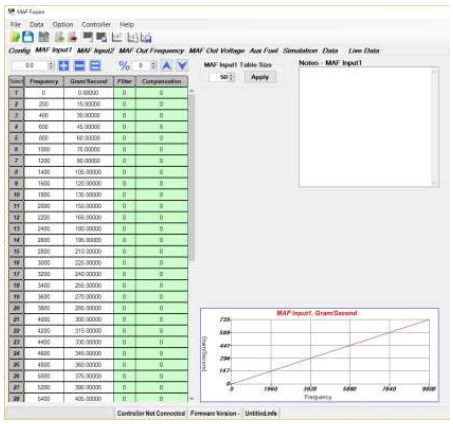
If you have two MAF sensors in series (in line with each other) then you typically want to average the inputs so select Average inputs.

If you are using the MAF Fusion for auxiliary injector control then you will need to connect an RPM signal to the MAF Fusion and you will need to calibrate the RPM signal via the “Tach Input Pulse Per Revolution” setting. You will also need to determine if you need to enable a pull-up circuit in the MAF Fusion. Make sure you do NOT have more than one pull-up circuit in the system. See the more detailed section on the Config tab and RPM input selection if you need more information.

If you plan to data log any data you will need to decide what sampling rate you want to use. The finer the sampling resolution the shorter the data log.

If you are using the auxiliary injection control function and will be using manifold air pressure (MAP) as your load axis then you will need to connect and calibrate a MAP sensor to the MAF Fusion. If you are using MAF as the load point you do not need a MAP sensor (but you must then be connected to a MAF sensor). Select the sensor type you are going to connect to (if applicable).

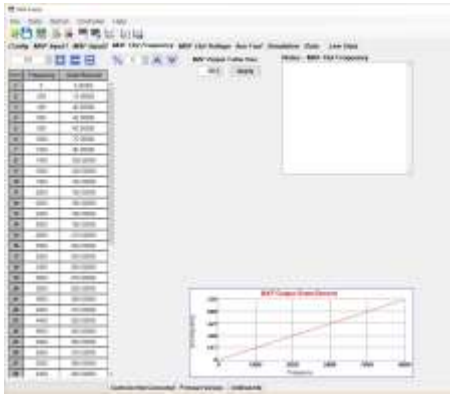
You may choose to type notes for this configuration in the notes area. A separate notes area exists for the Config, MAF Input 1, MAF Input 2, MAF Out Frequency and MAF Out Voltage tabs.



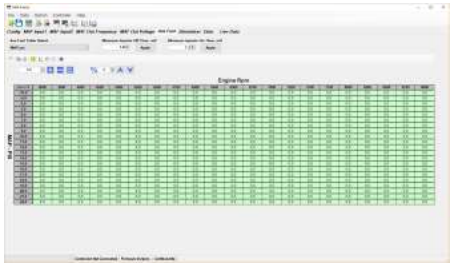
You must now enter the calibration data for the MAF sensor(s). This is done using the MAF Input1 and/or MAF Input2 tabs. You can enter the MAF data several ways—import from an existing CSV file (examples are provided by PSS), copy and paste from another program or manually enter the values. If you are manually entering the data or copying and pasting from another program you need to first set the MAF sensor calibration table size. To do so go to the

“MAF Input[1 or 2] Table Size” and enter the correct number of cells (rows) and then click “Apply”. If you are importing a MAF calibration using the File>Import CSV Data menu then you do not need to set table size—that will be set automatically when you import the data.

The frequency data and the airflow data must be in order from low to high. You can have up to 250 steps (rows) in the calibration and the step sizes (the frequency values) do not need to be in even step sizes. Frequency values can be from 0 to 20,000 Hz. Airflow values are in grams per second (gps) and can range from -5 gps to 2,000 gps in 0.00001 gps increments.



Now that you have the MAF Input table or tables configured, if you plan to output the MAF sensor signal to an ECM or other device you need to configure the MAF Out table(s). If you are sending the MAF data as a frequency signal, you need to populate the MAF Out Frequency table. If you are transmitting the airflow data as a voltage output then you need to populate the MAF Out Voltage table. So that the ECM reads the correct airflow, you normally want the values in the MAF Out table to match the values in the ECM MAF sensor calibration table. The step sizes do not need to be the same but the effective curve should be the same if you want the ECM to read the same airflow as the MAF Fusion module is calculating. You only need to calibrate the MAF Out table for the type of MAF output you will be connected to.



If you plan to use the auxiliary injector control feature you now need to populate the “Aux Fuel” tab values.

The first thing you need to decide is what your load axis will be. Load can either be a manifold air pressure (MAP) or mass air flow (MAF). To select your load axis, go to the upper left corner of the Aux Fuel tab and select the load axis you want from the pull down menu under “Aux Fuel Table Select” - the choices are “MAF Out grams/second” or “MAP psi”.

Once you have selected the load axis you will want to set the RPM and load breaks to the values. You may have up to 21 columns or rows. The step size between each row or column does not need to be the same but they must be in increasing order and you may not have duplicate row or column headings.

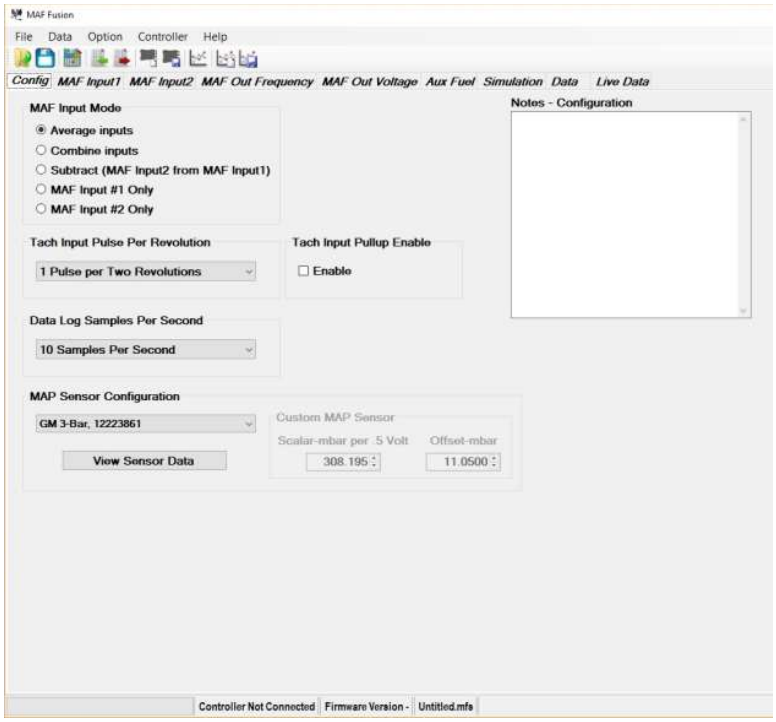
You then want to set the minimum injector off time (in milliseconds) and the minimum injector on time (also in milliseconds).

Now you are ready to populate the auxiliary injector control table with the desired injector pulse widths. Each injector output is pulsed once per engine revolution. The table will not let you enter values that exceed the maximum available pulse width (given the engine rpm and off time value). It will also not let you enter values that are less than the minimum on time.

Now go to the File pull down menu and select Save to save your file. You can also use the “CTRL-S” keyboard command or click on the save icon (looks like a floppy disk).

You have now completed creating your first user setup file.

Config tab:



The “Config” tab is used to set the main MAF Fusion configuration settings including:

- MAF Input Mode
- Tach Input Pulse Per Revolution
- Tach Input Pullup Enable
- Data Log Samples Per Second
- MAP Sensor Configuration

MAF Input Mode

MAF Input Mode is used to tell the MAF Fusion controller how to interpret the MAF sensor signals. The input mode options are:

- Average inputs
- Combine inputs
- Subtract (MAF Input2 from MAF Input1)
- MAF Input #1 Only
- MAF Input #2 Only

Average inputs

In the “Average inputs” mode the airflow values from MAF Input1 and MAF Input2 are averaged. The MAF Out Frequency and the MAF Out Voltage are then based on this average airflow value. This mode is normally used when two MAF sensors are installed in series (that is, one after the other) and you are using the MAF Fusion controller to average the data from the two sensors.

Combine inputs

In the “Combine inputs” mode the airflow values from MAF Input1 and MAF Input2 are combined (added together). The MAF Out Frequency and the MAF Out Voltage then based on this combined airflow value. The “Combine inputs” mode is usually used if you have two MAF sensors and they are installed in parallel (that is, side by side) such that part of the air entering the engine travels through one sensor and part of the air entering the engine travels through the other sensor.

Picture courtesy of Magnuson Products LLC

The “Combine inputs” mode allows you to have twin inlet air intakes with individual MAF sensors on vehicles with an engine control module (ECM) that is not able to recognize more than one MAF sensor.

Reasons for wanting to run two MAF sensors may include:

- Two MAF sensors to provide reduced inlet restriction in high horsepower applications.
- Easier packaging of MAF sensors in air inlet duct work where a smaller diameter MAF and the subsequently shorter straight section of ducting required before and after the MAF may make two smaller MAF sensors easier to package then one large sensor.
- Better airflow resolution and accuracy of two smaller MAF sensors compared to one large MAF sensor under low airflow conditions such as idle and light load cruising. As the MAF sensor housing gets larger, the sensor has to estimate the flow from a smaller and smaller percentage of the unmeasured airflow. In addition the larger sensor tube diameter (cross sectional area) is for a given amount of airflow, the lower the velocity of the airflow. At very low air velocities the sensors are especially sensitive to turbulence and sensor positioning.
- Packaging of the MAF sensors before the turbochargers on twin turbocharged engine applications in order to:
    - Keep the MAF sensor away from air that may be contaminated with oil from turbocharger seal leakage.
    - Install the MAF sensors in the low pressure side of the system instead of in the high pressure, high temperature post turbocharger side of the system (for durability and/or measurement reasons).

Subtract (MAF Input2 from MAF Input1)

In “Subtract” mode the airflow value from MAF Input2 is subtracted from the airflow value of MAF Input1 and then this airflow value is used to generate the output values for MAF Out Frequency and MAF Out Voltage.

This mode can be used to:

- Compare two MAF sensors on a flow bench.
- Subtract the airflow coming from a crankcase ventilation source (so effectively inert gas causing MAF Input1 to read higher than it should) using a small diameter MAF sensor in the PCV line.
- Subtract the airflow exiting the duct work via a blow off valve or boost bypass valve.

MAF Input #1 Only & **MAF Input #2 Only**

MAF Input #1 Only and MAF Input #2 Only modes are used if you only want to use one input sensor to the MAF Fusion to control the output signals.

In MAF Input #1 Only and MAF Input #2 Only modes only the data from the respective sensor 1 or 2 is used to calculate the total airflow and generate the MAF Out Frequency and the MAF Out Voltage.

One of these two modes is normally used when you have a single MAF sensor in the vehicle and are using the MAF Fusion to:

- Modify the sensor calibration curve to change sensor readings on systems where you can’t or do not want to recalibrate the sensor calibration data in the ECM. This may be to fix fuel trim issues

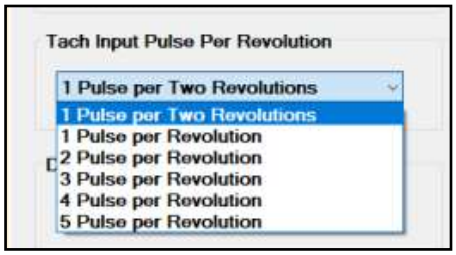
at idle or other load conditions and/or to change fueling at wide open throttle conditions with an existing MAF sensor or to adapt an all new sensor to the vehicle. Since the MAF Fusion software allows you to change the calibration data in up two 250 frequency and voltage steps, you are able to make changes in very small airflow areas or the entire table as desired.

- Install air intakes that have a different MAF sensor output curve without having to reprogram the ECM.
- Filter MAF readings in specific airflow/operating frequency ranges due to turbulence due to air intake design and/or MAF sensor placement, airflow reversion caused by MAF sensor placement/throttle body location/camshaft overlap or other causes of potentially erratic airflow values.
- To control auxiliary fuel injection in high horsepower applications where the OEM engine controller does not understand airflow past a certain value, understand injector flow rates past a certain injector flow rating and/or understand total fuel flow values above a certain value.

When in MAF Input1 or MAF Input2 mode you may still have two sensors connected. The system will still calculate the airflow from the second sensor and log that data but the other sensor's data will not be used for any of the MAF Out data and will not be used for the Aux Fuel table control.

Since the second sensor input is still being calculated, displayed and logged when in single sensor mode, you can also use this mode to generate the calibration curve for one sensor based on the calibration curve of a known sensor (the airflow and frequency of one sensor is known but the airflow to frequency output of the other sensor is not known). By data logging the two together you now have the airflow vs frequency of the second sensor assembly.

Tach Input Pulse Per Revolution



The “Tach Input Pulse Per Revolution” setting is used to calibrate the RPM signal input to the MAF Fusion. This input wire is normally connected to the tachometer output wire from the ECM but may also be connected to the coil negative terminal or coil trigger wire in some applications. The RPM signal is only currently used by the MAF Fusion for auxiliary injection control but, since it is also data logged by the MAF Fusion, it may be helpful to have this connected even in applications not using the auxiliary injection control function.

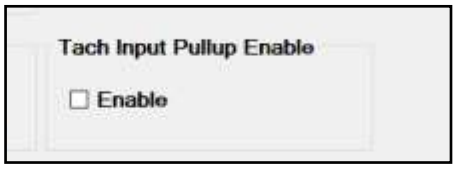
Available RPM pulse count configurations are as follows:

MAF Fusion menu choice	Pulse/ rev	Degrees/ pulse	Common application(s)
1 Pulse per Two Revolutions	0.5	720	One cylinder engines & individual coil ignitions such as '99+ V8 Mustang, Suzuki Hayabusa, Kawasaki ZX-14.
1 Pulse per Revolution	1	360	Two cylinder engines and wasted spark coil packs including Viper/SRT10 coil
2 Pulse per Revolution	2	180	Typical 4 cylinder engines & GM Gen III, IV & V V8 engine tachometer signal (LS1, LS2 etc.)
3 Pulse per Revolution	3	120	Typical 6 cylinder engines
4 Pulse per Revolution	4	90	Typical 8 cylinder engines
5 Pulse per Revolution	5	72	Typical 10 cylinder engines

The MAF Fusion software recognizes most common tachometer pulse frequencies. If your engine application is not accounted for, please contact Product & Service Solutions for technical assistance.

Some newer vehicle applications may not have a tachometer output wire as delivered from the factory and will require adding a tachometer signal output wire to the ECM and enabling the signal output in the ECM,

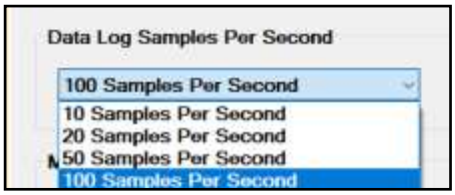
Tach Input Pullup Enable



The Tach Input Pullup Enable is used to enable a pullup circuit in the MAF Fusion controller.

If you are connecting to an existing tachometer wire already connected to something else in the vehicle then you do not normally need to enable this. If the ECM has a software or hardware enabled pullup turned on or if a pullup is wired into the system, do not also enable this pullup (only one pullup circuit should be in use).

Data Log Samples Per Second



The MAF Fusion controller has onboard memory to allow data logging of the MAF Fusion data. The MAF Fusion software allows you to adjust the logging rate. Available logging rates are 10, 20, 50 and 100 Hz (10, 20, 50 or 100 times per second). The higher the logging rate the shorter the amount of logging time available.

With the onboard memory and the data currently being recorded, the available recording time at each sample rate is as follows:

Sample rate	Log duration
Hz	Seconds
10	623.3
20	311.65
50	124.66
100	62.33

Data logging is enabled via the violet “Data Log Activation Input” wire on pin 15 of the controller. Data logging begins when you apply +12 volts to this wire and ends when you remove +12 volts or when the data logging memory is full (which ever happens first).

The power LED will blink when the Data Log Activation Input is receiving +12 volts to indicate logging is occurring (but it will continue to blink when the data log is full).

You must turn off the logging (remove +12 volts) before shutting off power to the MAF Fusion or the data log will not be saved properly.

NOTE—if you apply +12volts to the data log enable wire again without reading out the data log your existing data log will be erased and a new data log will be generated.

MAP Sensor Configuration

MAP Sensor Configuration is used to calibrate the sensor signal being used to measure manifold air pressure. This can be a factory type MAP sensor or other linear output 0-5 volt pressure sensors and transducers.

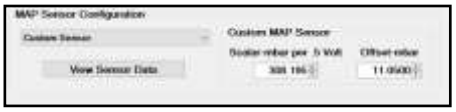
In many applications the input impedance on the MAF Fusion MAP sensor signal input is high enough that it can be safely connected to an existing MAP sensor signal wire as long as that sensor is a linear 0-5 volt type MAP sensor and you know the calibration curve for that sensor. We recommend checking the MAP sensor signal voltage as measured by the ECM to make sure the MAF Fusion does not impact the measured value. If the MAF Fusion is found to impact the MAP readings when it is connected to the existing MAP sensor then we recommend using a dedicated MAP sensor input to the MAF Fusion to prevent possible sensor signal errors.

If the existing factory MAP sensor does not read to the desired MAP value then it is also recommended that you use a dedicated sensor for this signal.

Several common sensor calibration curves are provided. These currently include:

Sensor	Part #
GM 3 bar	12223861
GM LSA/LS9	12592525
GM LS3/L99/LS7	55573248, 12591290

You can also enter your own custom sensor calibration values by selecting “Custom Sensor” from the bottom of the drop down menu.



If you don’t know the calibration values for your sensor we recommend contacting the sensor supplier or manufacturer. We also recommend checking online as many on-line resources exist for the sensor calibration values for common OEM pressure sensors (GM, Delphi, Bosch, etc.)

You can also use the Live Data view mode with an external pressure source and gauge to calibrate the sensor yourself.

NOTE—the sensor must be a linear output 0-5 volt type sensor.

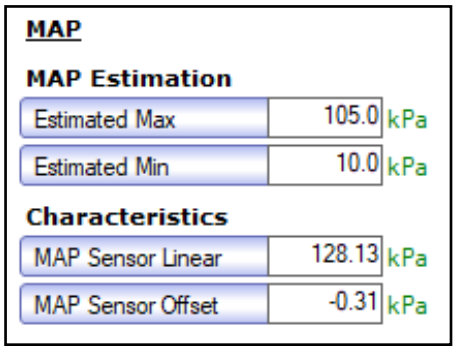
The MAF Fusion software uses the same scalar and offset type sensor calibration values used to characterize the pressure sensors in many tuning/calibration software programs. The “Scalar” value is in mbar per 0.5 volts and is effectively the slope of the sensor output curve.

The “Offset” value is in mbar and is the 0 volt axis pressure value (Y intercept). The MAF Fusion software accepts positive and negative Offset values.

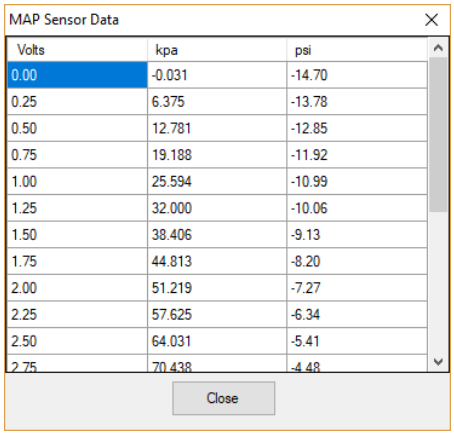
Example EFIlive MAP sensor calibration data:

Description	Value
{B2101} MAP Sensor Scaler	312.5000
{B2103} MAP Sensor Offset	-11.2500

Example HP Tuners MAP sensor calibration data:



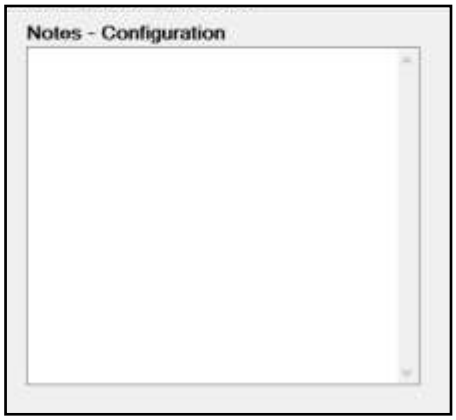
Once you have entered the sensor calibration values you can click the view sensor data button to see what the resulting pressure vs voltage data will be for your selected sensor calibration.



Volts	kpa	psi
0.00	-0.031	-14.70
0.25	6.375	-13.78
0.50	12.781	-12.85
0.75	19.188	-11.92
1.00	25.594	-10.99
1.25	32.000	-10.06
1.50	38.406	-9.13
1.75	44.813	-8.20
2.00	51.219	-7.27
2.25	57.625	-6.34
2.50	64.031	-5.41
2.75	70.438	-4.48

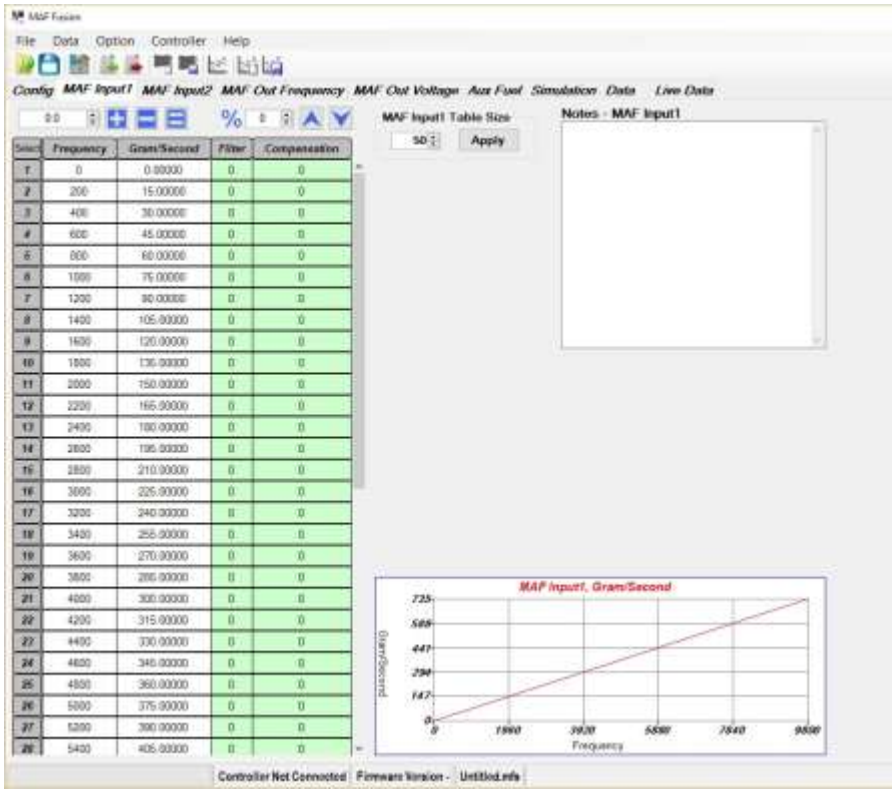
The manifold air pressure (MAP) reading is currently only used for auxiliary injection control but, since it is data logged, it may also be of interest to record this value in applications not using the auxiliary injection control capability of the MAF Fusion controller.

Notes—Configuration



You may choose to type notes for this user configuration file in the notes area. A separate notes area exists for the Config, MAF Input 1, MAF Input 2, MAF Out Frequency and MAF Out Voltage tabs.

MAF Input1 & MAF Input2 tabs:



The MAF Input1 and MAF Input2 tabs are used to calibrate the sensor output curves for the MAF sensors connected to Input1 and/or Input2. The input sensor calibration is frequency (Hz) vs airflow with airflow measured in grams/second.

- The first column in the table represents the row number (1 to up to 250).
- The second column is the sensor signal output frequency in Hz (pulses per second).
- The third column is the airflow in grams/second corresponding to that output frequency.
- The fourth column is the filter value at that frequency.
- The fifth column is the filter compensation value at that frequency.

The MAF frequency steps do not have to be even in step sizes but the frequency values can't repeat and they must be in the table in proper numerical order (low to high). If an error exists in the frequency values (repeated value or value not in correct numerical order) then the next cell after the error will be highlighted in red.

Select	Frequency	Gram/Second	Filter	Compensation
9	1650	11.12400	0	0
10	1700	12.95734	0	0
11	1950	15.09000	0	0
12	2100	17.55600	0	0
13	2100	20.37000	0	0
14	2500	23.55800	0	0

Airflow values are in grams per second (gps) and can range from -5 gps to 2,000 gps in 0.00001 gps increments.

You can obtain the MAF sensor frequency vs airflow data by several methods including:

- Use the PSS supplied sample MAF curves.
- Copy the MAF sensor frequency vs airflow data from an existing engine calibration file.
- Copy the MAF sensor frequency data from a manufacturer supplied flow sheet.
- Send a MAF sensor out to be flow tested and then import that data into MAF Fusion.
- Flow bench test the MAF sensor or air intake assembly yourself.

To bring this data into the MAF Fusion software you can:

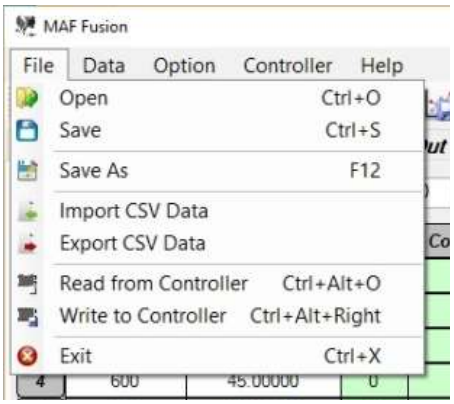
- Import an existing CSV file (supplied with the MAF Fusion software or by a third party)
- Copy and paste the data from other software (Excel, EFILive, HP Tuners)
- Manually enter the data.

Importing MAF data as CSV files:

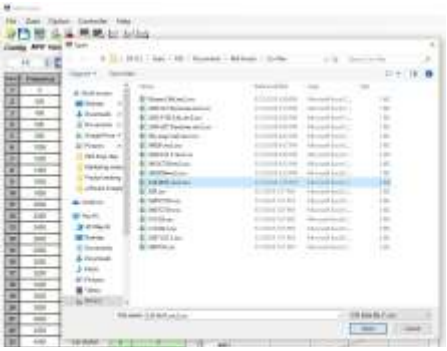
We have provided example MAF sensor calibration curves for many common OEM MAF sensors. If you are using one of these MAF sensor air intake assemblies, you can import the MAF sensor calibration into the MAF Fusion software using the supplied CSV files. If you are using a similar air intake you may also be able to use one of these curves as a starting point for your MAF calibration.

When importing an existing MAF sensor calibration curve as a CSV file you do not need to set the correct number of frequency steps. This gets done automatically when you import the file.

To import a CSV file, go to the “File” menu and select “Import CSV Data” or click on the spreadsheet icon with the green arrow pointing to the left.

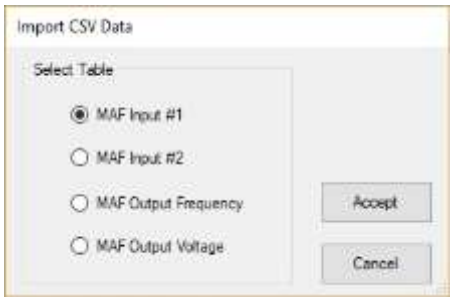


You will be prompted to select a CSV file. The software will default to the “Documents>MAF Fusion>CSV Files” directory where the sample provides files are located. You may browse to a different location if you have saved a MAF sensor CSV file elsewhere on your PC. Select a file that represents the MAF sensor data you want to import.



You will now be prompted to indicate which MAF Fusion table you want to populate with this data. The choices are:

- MAF Input #1
- MAF Input #2
- MAF Output Frequency
- MAF Output Voltage

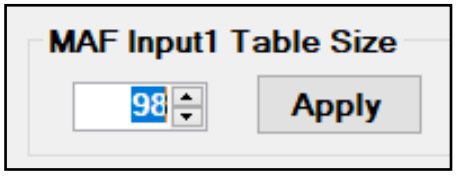


Select the MAF sensor location you want populated and press “Accept”. The number of rows, the frequency and the grams/second data for that sensor will be populated for that location. A graph of the sensor output curve will also be displayed at the bottom of the screen. Repeat the process for the second MAF sensor if you are using two MAF sensors.

Make sure you select the correct MAF sensor, including the correct sensor output configuration (frequency or voltage). Only frequency type sensor curves should be imported into MAF Input #1 and MAF Input #2.

Please note – changes to air duct shape, diameter and sensor placement along with changes to filter design and placement will impact the MAF sensor calibration curve.

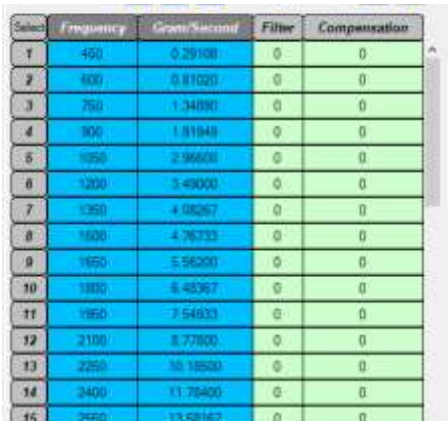
Manually entering MAF sensor data or copying it from other sources:



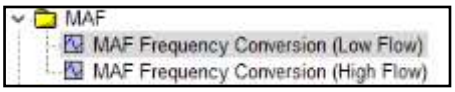
If you are manually entering the sensor calibration data or copying it from another program (for example, your calibration software), you must first set the number of break points (MAF Table Size) to the correct number of break points used. To do so, you can type the correct number into the table size location and click on the “Apply” button or you can use the small up and down arrows to increment the table size and then click on the “Apply” button.

To manually enter the data you will want to enter the frequency steps in the frequency column and the airflow values (in grams per second) into the gram/second column. This data could come from a manufacturer supplied flow sheet, calibration data or other sources. Make sure the frequency steps and the airflow steps increase order (low to high values). The frequency steps do not need to be even. If you find you need to increase the size of the table, you can increase the table size after you have started entering data. If you are using the MAF Input Table Size function at the top of the screen, the new rows will be added to the end (note they will be all zero values so they must get populated with valid data).

You can also insert a row anywhere in between other rows if you missed a table value. To insert a row, select where you want the row inserted, right click and then select “Insert Row”. From the right click menu you can also delete a row.



If you are copying the entire MAF curve data from an ECM table, make sure the number of rows in your source data and in MAF Fusion match. Then copy the two columns of data (frequency and airflow) in your other software. Note different programs copy data to the clipboard in different ways. In some cases it may be necessary to copy the data from a spreadsheet program like Microsoft Excel. This may require copying the data from your calibration software and then pasting it into Microsoft Excel first. Then highlight the Frequency and Gram/Second columns in the MAF Fusion software and right click to paste the data (or use the “CTRL-V” keyboard command).



Be careful that some systems have multiple tables to provide the MAF calibration curve and the frequency points in each table may overlap (usually the end of one table and the beginning of the next). An example of this would be the 2005 Corvette (E40 ECM) and other similar vehicles. In this case the low flow portion of the table has one step size (150 Hz) and the high flow has a different step size (200 Hz) and the end of the low flow stops at 5800 Hz and the beginning of the high flow starts at 5800 Hz. You must remove this duplicate data frequency step when copying it into the MAF Fusion software. As seen in this example, also note that some systems may change the frequency step sizes so do not assume they are the same over the entire table.

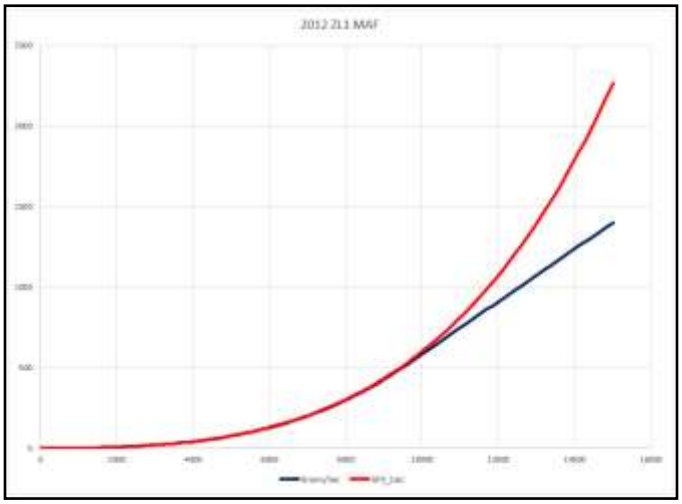
The MAF sensor calibration curves for the different tables in the MAF Fusion software do not need to be the same. They can have different frequency steps sizes and airflow values. If you have the exact same MAF sensor assembly connected to MAF Input 1 and MAF Input 2, you can copy and paste the calibration data from Input1 to Input2.

Input high and low table limit values:

If the measured MAF sensor input frequency exceeds the maximum value in the MAF Fusion table for that sensor then the airflow will be set to the maximum value in the table (the value at the highest indicated frequency). In order for the MAF Fusion to properly measure high airflow readings we recommend that the MAF Input curves be populated with valid data that significantly exceeds the engine's operating airflow range.

If the measured MAF sensor input frequency is below the minimum frequency specified in the table then the airflow reading will be set to the minimum airflow value listed in the table (the airflow value at the lowest frequency listed).

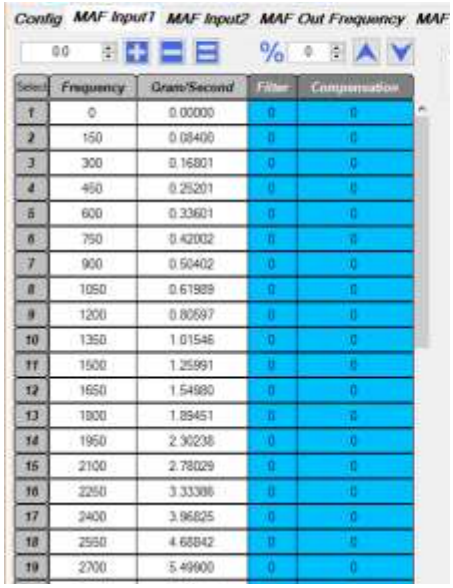
NOTE – A word of caution on using factory ECU MAF tables beyond the OEM flow range. Some vehicles will show data in the MAF table well beyond the factory airflow range but in some cases this data is not correct for the airflow sensor beyond a certain airflow. In some cases the data will become linear past a certain frequency point and the sensor's frequency vs airflow will no longer correctly describe the sensor output curve.



Examples of this include the production 2012-2013 ZL1 Camaro (example shown to the right) and many GM truck MAF curves. In the production ZL1 Camaro example shown to the right, the data in the calibration is plotted as the blue line whereas the output curve for the sensor extended to the full sensor output range is shown as the red line. As you can see, above roughly 500 gps and 9500 Hz, the factory data becomes linear but MAF sensor output is not linear so above 9500 Hz the factory calibration data is under-reporting the airflow. As the frequency increases the amount under-reported increases significantly. This results in airflow measurement errors and the ECU not commanding the correct amount of fuel to achieve the desired air fuel ratio.

If this is the case and you will be operating outside the accurate part of the MAF calibration curve you must perform a curve fit of the data to get the correct airflow or you need to send your air intake and MAF assembly out to be flow tested to obtain a MAF curve over the desired range.

MAF Input1 & Input2 Filter & Compensation settings



Select	Frequency	Gram/Second	Filter	Compensation
1	0	0.00000	0	0
2	150	0.08400	0	0
3	300	0.16801	0	0
4	450	0.25201	0	0
5	600	0.33601	0	0
6	750	0.42002	0	0
7	900	0.50402	0	0
8	1050	0.61989	0	0
9	1200	0.80597	0	0
10	1350	1.01546	0	0
11	1500	1.25991	0	0
12	1650	1.54980	0	0
13	1800	1.89451	0	0
14	1950	2.30238	0	0
15	2100	2.78029	0	0
16	2250	3.33386	0	0
17	2400	3.96825	0	0
18	2550	4.68842	0	0
19	2700	5.49900	0	0

The MAF Fusion allows you to filter the MAF input readings for each MAF sensor. The filter variables can be adjusted at every frequency step.

Two variables are used to adjust the filtering:

- **Filter**
- **Compensation**

Filter, as the name implies, is a filter value indicating how large a sample size is being averaged for the filtering. This value ranges from 0 to 10 with 0 being OFF (no filtering) and 10 being the maximum amount of averaging (highest filter value). A value of 2 means twice as many samples are being averaged as in filter setting 1, 3 indicates three times as many as setting one,… and 10 indicated ten times as many samples as setting 1.

Since this filter value is an indicator of the number of samples being averaged (NOT the amount of time), as the sensor output frequency goes up, the filtering is being applied over a shorter period of time for the same filter setting.

The second variable is **Compensation**. Compensation is a variable that indicates the level of change in airflow signal required to disable filtering. This is used to allow rapid changes in airflow to disable filtering.

The values for this variable can range from 0 to 9 with 0 being Compensation is OFF (no change in airflow will disable filtering). 9 results in the least filtering (the smallest change in airflow needed for filtering to be disabled).

0 = Filtering will not be disabled by any change in airflow

1 = 90 % change over 9 input signals disables filtering

2 = 80 % change over 8 input signals disables filtering

3 = 70 % change over 7 input signals disables filtering

4 = 60 % change over 6 input signals disables filtering

5 = 50 % change over 5 input signals disables filtering

6 = 40 % change over 4 input signals disables filtering

7 = 30 % change over 3 input signals disables filtering

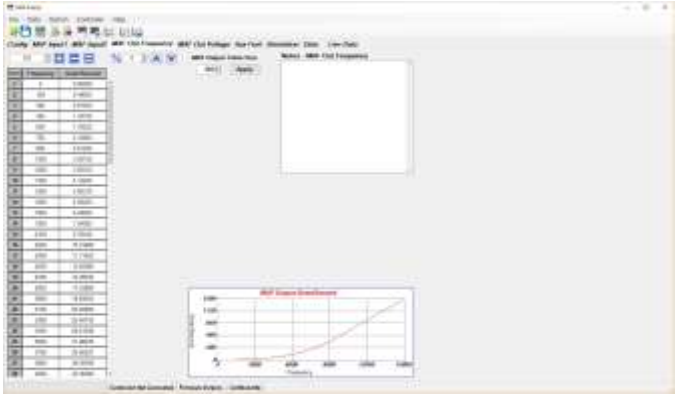
8 = 20 % change over 2 input signals disables filtering

9 = 10 % change over 1 input signals disables filtering

You can make global adjustments to these values by selecting the entire column and entering the value or change in value using the edit commands at the top of the screen. You can also select specific cells and manually enter the values in each cell.

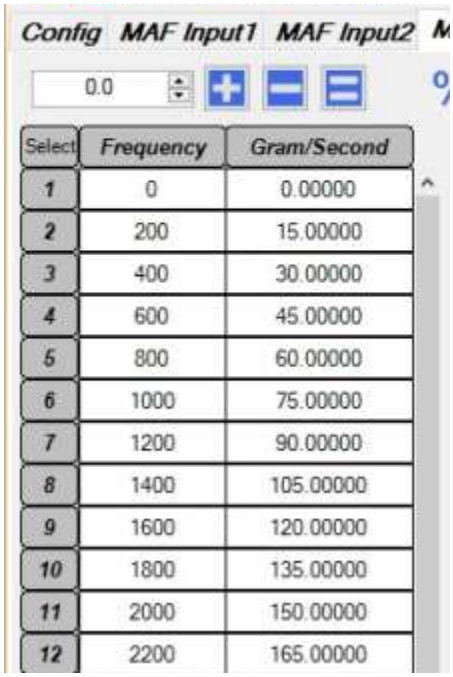
MAF Input#1 and MAF Input#2 can have different filtering values.

MAF Out Frequency tab:



The MAF Out Frequency table is a lookup table used to define the airflow to frequency output of the MAF Fusion. This is normally used to provide the mass airflow reading to applications that accept frequency type MAF sensors (most late model GM vehicles etc.).

The MAF Fusion software uses your assigned input mode from the “Config” tab and the airflow values from MAF Input#1 and/or MAF Input#2 to calculate the system airflow. This may be the combined output of Input #1 & #2, the average of #1 & #2, the airflow of just #1 or #2 or the airflow from #2 subtracted from #1. This output airflow is also after any filtering that may be enabled.

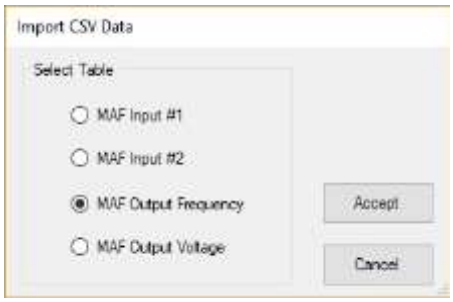


Select	Frequency	Gram/Second
1	0	0.00000
2	200	15.00000
3	400	30.00000
4	600	45.00000
5	800	60.00000
6	1000	75.00000
7	1200	90.00000
8	1400	105.00000
9	1600	120.00000
10	1800	135.00000
11	2000	150.00000
12	2200	165.00000

The MAF Fusion then uses the calculated system airflow to determine the output frequency using the look-up table in the MAF Out Frequency tab.

If you are not connecting anything to the frequency output wires on the MAF Fusion you do not need to populate the data in this tab in the software.

The MAF Out Frequency curve should normally be the same as the MAF calibration curve in your ECM. The step sizes do not need to be the same but the overall calibration curve should be the same if you want the ECM to read the same airflow as the MAF Fusion module.



Just like the MAF Input tabs, you can import the MAF curve function into the MAF Out Frequency table, you can copy and paste or you can manually enter the data.

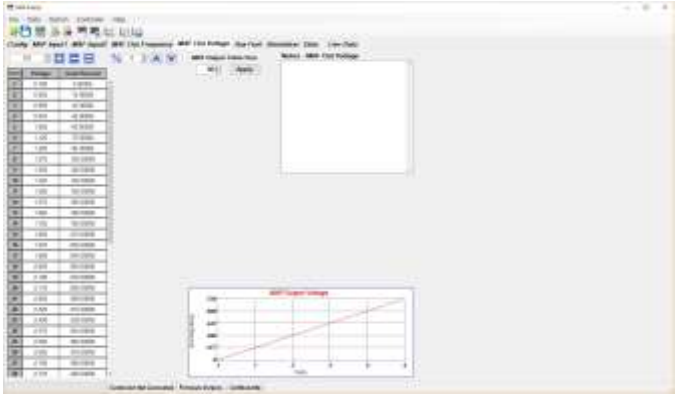
No filter variables exist for the MAF Out Frequency tab because the filtering is done to the input signals, not the output value.

When an airflow value is calculated by the MAF Fusion module that exceeds the maximum airflow value in the MAF Out Frequency table the MAF Fusion software will use the last frequency value in the table so the MAF Out frequency curve should be configured to exceed the maximum range of the ECU’s airflow table and the engine’s operating airflow range UNLESS you do not want to report anything higher than the last frequency value in the table to the ECU.

When airflow output is below the minimum frequency value in the table, then the minimum frequency value will be transmitted. If the airflow output is above the maximum frequency value in the table then the maximum frequency value in the table will be transmitted.

You may connect to both MAF outputs simultaneously (the frequency out and the voltage out). This allows you to send the airflow signal to two devices at once (ECM and data acquisition system, for example).

MAF Out Voltage tab:



The MAF Out Voltage signal range is 0.1 volts (minimum) to 4.9 volts (maximum).

The MAF Out Voltage table is a lookup table used to define the airflow to voltage output of the MAF Fusion. This is normally used to provide the mass airflow reading to applications that accept voltage type MAF sensors (many Ford applications, early GM EFI vehicles etc.) or to provide the airflow data to a data acquisition system or other device.

The airflow value used for the MAF Out Voltage is the same airflow value used for the MAF Out Frequency.

The MAF Fusion software uses your assigned input mode from the “Config” tab and the airflow values from MAF Input#1 and/or MAF Input#2 to calculate the system airflow. This may be the combined output of Input #1 & #2, the average of #1 & #2, the airflow of just #1 or #2 or the airflow from #2 subtracted from #1. This output airflow is also after any filtering that may be enabled.

The MAF Fusion then uses the calculated system airflow to determine the output voltage using the look-up table in the MAF Out Voltage tab.

Config MAF Input1 MAF Input2

0.0

Select	Voltage	Gram/Second
1	0.100	0.04816
2	0.160	0.13000
3	0.240	0.31000
4	0.320	0.57000
5	0.400	0.91000
6	0.480	1.35000
7	0.560	1.88000
8	0.640	2.50000
9	0.720	3.22000
10	0.800	4.03000
11	0.880	4.94000
12	0.960	5.96000
13	1.040	7.15000

If you are not connecting anything to the voltage output wires on the MAF Fusion you do not need to populate the data in this tab in the software.

The MAF Out Volt curve should normally be the same as the MAF calibration curve in your ECM. The step sizes do not need to be the same but the overall calibration curve should be the same if you want the ECM to read the same airflow as the MAF Fusion module.

Just like the MAF Input tabs, you can import the MAF curve function into the MAF Out Frequency table, you can copy and paste or you can manually enter the data.

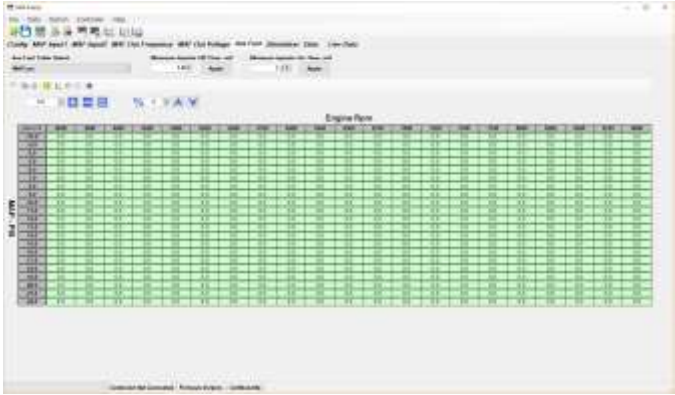
If you are importing existing data be sure to import voltage type MAF sensor values and not frequency type CSV files.

No filter variables exist for the MAF Out Voltage tab because the filtering is done to the input signals, not the output value.

When an airflow value is calculated by the MAF Fusion module that exceeds the maximum airflow value in the MAF Out Voltage table the MAF Fusion software will use the last voltage value in the table so the MAF Out Voltage curve should be configured to exceed the maximum range of the ECU’s airflow table and the engine’s operating airflow range UNLESS you do not want to report anything higher than the last voltage value in the table to the ECU.

When airflow output is below the minimum voltage value in the table, then the minimum voltage value will be transmitted. If the airflow output is above the maximum voltage value in the table then the maximum voltage value in the table will be transmitted.

Aux Fuel tab:



If you are not using the auxiliary injector control feature you do not need to populate this section.

The Aux Fuel tab is used to define the auxiliary injector operation. This data is used to control the output of:

- Aux Injector Output #1
- Aux Injector Output #2
- Aux Injector Out, Low Level +12V Push/Pull

All three outputs can be used simultaneously.

When active, all three injector outputs fire once per engine revolution (twice per cylinder event). All the injectors are fired simultaneously as a batch (batch fire, not sequentially).

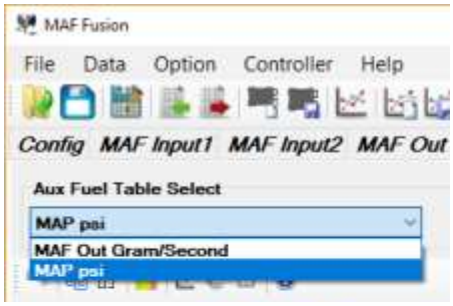
The values in the Aux Fuel table are in milliseconds (ms) of injector commanded on time.

Outputs #1 and #2 can directly control up to four high impedance (10-14 ohm each) injectors per channel for a total of 8 high impedance fuel injectors.

The Low Level output provides the same output function as Output #1 and #2 but it is a +12V low level Push/Pull control signal. This can be used to send a control signal to an external driver module in order to drive higher current injectors and solenoids. The Low Level output can not be used to drive injectors or other solenoids directly.

The auxiliary injectors are controlled by a load vs RPM table defined in the Aux Fuel tab. The load axis is user selectable as either manifold air pressure (MAP) in psi or mass air flow (MAF) in grams/ second. You must have the corresponding load sensor connected and calibrated for the Aux Injector control output to function properly.

To select your load axis, go to the upper left corner of the Aux Fuel tab and select the load axis you want from the pull down menu under “Aux Fuel Table Select” - the choices are:



- MAF Out Grams/Second
- MAP psi

When using the MAP for load, keep in mind that 0 psi is atmospheric pressure, -15 psi is total vacuum, 15 psi is one atmosphere of boost, 30 psi is two atmospheres of boost etc.

Both the RPM axis and the load axis may have up to 21 break points (column or row headings). The break points do not need to be evenly distributed. This allows you to increase the axis resolution in areas where it is needed (large changes in needed injector pulse width for small axis changes). The axis values must be in increasing order and you may not have duplicate axis values (row or column headings).

The allowed RPM axis values can range from 0 to 12,000 RPM.

The allowed MAP axis values can range from –15 psi to +150 psi

The allowed MAF axis values can range from 0 to 4000 grams/second.

It is usually recommended that the axis values correspond to the operating range of the engine.

Injector output when operating outside the table axis values:

- When the engine RPM or load are below the minimum values defined in the Aux Fuel table, the injector outputs will be off.
- When the engine RPM or load are above the maximum values defined in the Aux Fuel table, the injector outputs will be held at the last values in the corresponding table area.

Once you have configured your axis variables you now need to define the minimum injector off time (in milliseconds) and the minimum injector on time (also in milliseconds). The minimum injector on-time for most injectors is usually between 0.8 and 1.2 milliseconds. Below this minimum on-time most injectors are not repeatable for flow.

These two variables are adjusted using the dialog boxes above the Aux Fuel table. You can manually enter a value and click on the "APPLY" button or you can use the up or down arrows to change the value and then press the "APPLY" button.

You may be able to obtain recommended minimum injector on and off time values from your injector supplier or a manufacturer supplied data sheet.

Minimum Injector Off Time, ms:

The MAF Fusion software calculates the available injector pulse width time available at each RPM point and will not allow values higher than that value to be entered into the table. The higher the engine RPM, the shorter the time window available to fire the injector. The minimum injector off time further reduces the calculated available injection time by forcing the injector to be off for this amount of time prior to being fired again. The minimum injector off time can be adjusted from 0.1 to 2.0 ms.

Minimum Injector On Time, ms:

The minimum injector on time is the minimum amount of time the MAF Fusion will use for an injector on time in milliseconds of pulse width. Changing this value changes the minimum injector on pulse width value you can enter in the table. It also changes the value of any existing data if they are below the minimum. The minimum injector on time does not have any impact on the maximum injector pulse width time available.

Editing injector on time values:

Now you are ready to populate the table with the desired injector pulse widths. Each injector bank is pulsed once per engine revolution. The table will not let you enter values that exceed the maximum available pulse width (given the engine rpm and minimum off time value). It will also not let you enter values that are less than the minimum on time.

You can select the entire table by clicking in the upper left corner of the table. You can select a column or row by clicking on that axis value heading. If you want to select multiple rows or columns

you click on the first column or row heading you want to select and then drag the pointer to the left or right of that column or row to select additional columns or rows.

You can select an individual cell by click on just that specific cell. If you want to select a group of cells, select one cell in the corner of the area you want to select and then drag across the table with the pointer to select the range of cells you want to edit.

Once you have select the cell or cells you want to edit, you can enter values using the table editor tools found above the Aux Fuel table. You may either manually enter values in these editor tools or use the small black up and down arrows to increase or decrease the value already displayed.

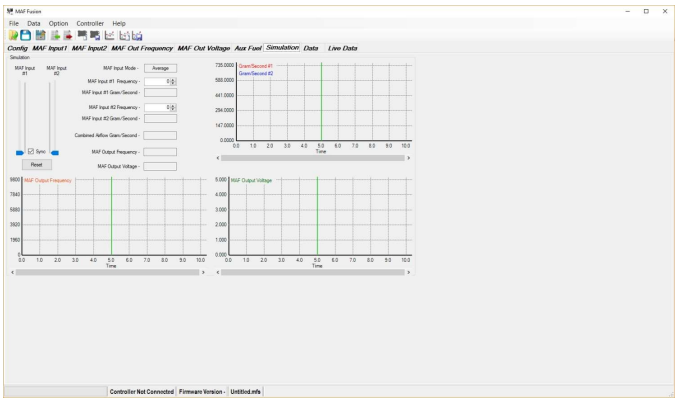
If you want to set all of the selected cells to a specific value, enter that value to the left of the “+ - =“ menu and then click on the equals sign. If you want to increase all of the values by that amount, click on the “+” sign. If you want to decrease all the values by that amount click on the “-” sign.

If you want to change the selected cells by a percentage, enter that percentage to the right of the “percentage” value and then click the large blue up or down arrows to increase or decrease the selected cells by the corresponding percentage.

If you select a single cell you can also manually enter the value in that cell via the keyboard.

You can also copy and paste the cell values between other programs including Microsoft Excel. You can copy and paste the entire table or just certain sections.

Simulation tab:

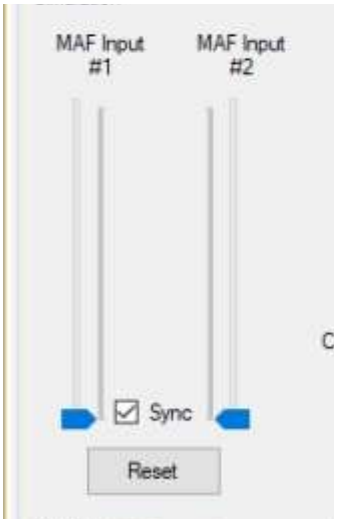


The simulation tab allows you to simulate what the output airflow (in grams/second) and the output frequency and voltage would be for your user configuration file.

The items in gray are not adjustable. The items in the boxes with the white background can be changed to change your simulation.

The MAF Input Mode comes from what you have selected in the Config tab. The airflow to frequency conversion for each of the MAF input sensors comes from the tables you have populated for MAF #1 and #2.

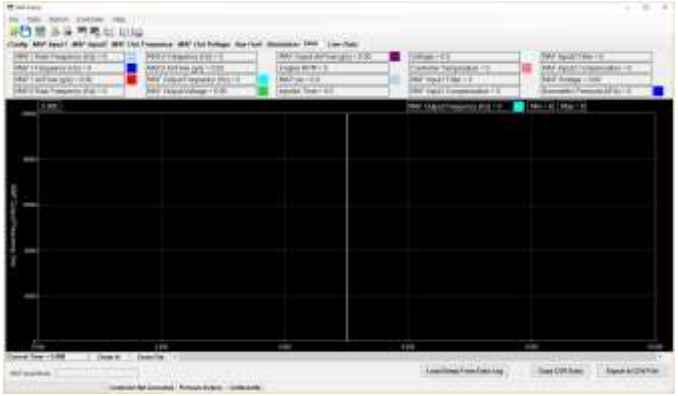
The output frequency and voltage our look-up values based on the data in the MAF Out tables.



You can synchronize the two MAF inputs using the “Sync” check box on the left side of the screen. In this mode the two sliders are linked and the frequency output of the two sensors are fixed at the same value. You can change the input values for the MAF sensors by either dragging the blue sliders for each sensor (or either one for both when synchronized) or you can manually enter the Input#1 and #2 frequency directly in the text boxes next to the variable name. You can also use the small black up and down arrows to increment the input frequency in one Hz increments.

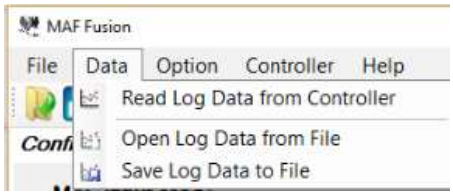
The simulation mode does not change any of the actual signal outputs—it is only a simulation of the data to show you what it should look like.

Data tab:

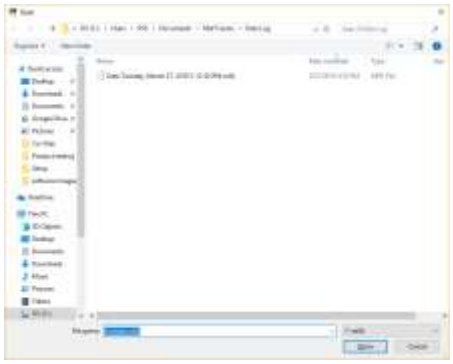


The data tab is used to view logged MAF Fusion data. It is also allows you to load the user configuration file (setup file) from the open data log, copy the data being viewed to the clipboard and export the data.

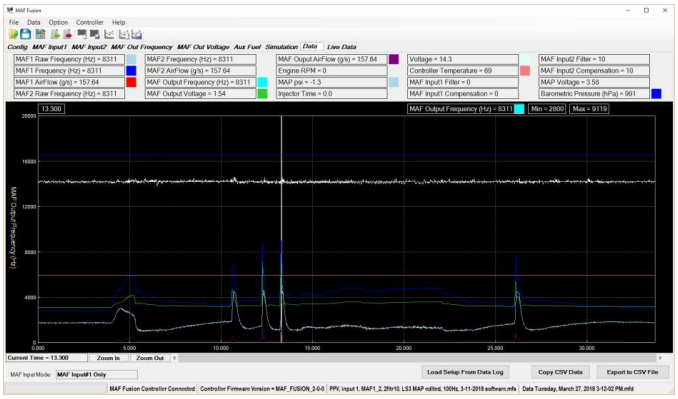
You can open an existing data log by selecting Open Log Data from File from the Data menu or by clicking on the corresponding icon in the icon menu (data graph with a file in front of it icon).



The MAF Fusion software will default to the “Documents>MAF Fusion>Data Log” folder for saved data logs. Select the file you want to view and click Open. If the log file you want to open is saved elsewhere, navigate to that directory to open the file. MAF Fusion data log files are saved as a “.mfd” Windows extension.



The selected file will open. The name of the open file will now be shown at the bottom of the screen.



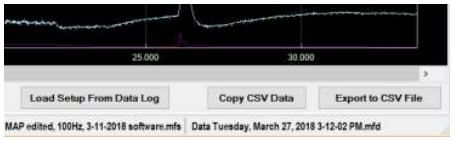
At the top of the window you will see a grid showing the numeric values for each variable at the current position of the cursor. Below the data grid will be graphs of all of the logged data.

You can click on the data in the upper area to remove or add it to the graph. When you select a variable to add it to the graph that variable will be the highlighted variable in the graph with the left axis now showing the units for that variable. Above the graph to the right will be the current, min and max values being displayed for that variable. The minimum and maximum values shown are for the entire log file, not just for the area currently being viewed. The current value being shown is for where the cursor is currently located.

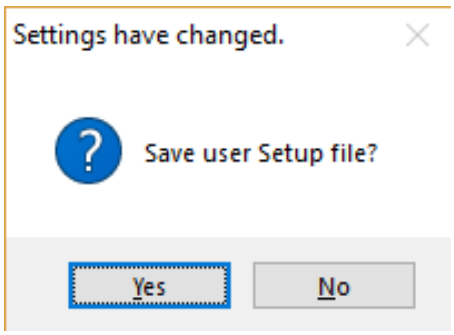
You can Zoom In our Out of the graph using the Zoom buttons at the bottom of the graph. The keyboard commands for zooming are “i” to zoom in and “o” to zoom out.

You can click on the graph to move the cursor on the graph or you can use the left and right arrows to scroll. For finer resolution when scrolling use the “CTRL”+ arrow keys and for the finest resolution use the “SHIFT” + arrow keys.

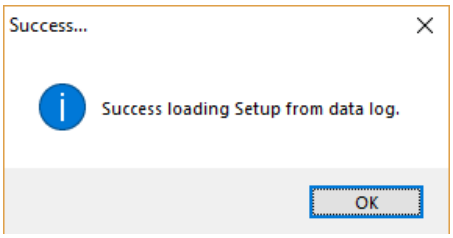
If you want to view the settings in the current data log, you can load the setup using the “Load Setup From Data Log” button at the bottom of the screen. Once you click that button the configuration settings will be populated based on what is stored in the data log.



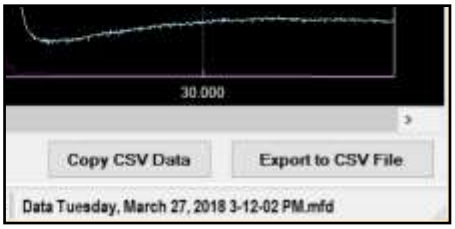
If you have made user configuration settings changes to the current file MAF Fusion will prompt you with “Settings have changed. Save user Setup file?” before it will let you import the data log configuration data. Select Yes if you want to save those changes before loading the setup file configuration values (you will then be prompted for a filename for your existing user setup). Select No if you don’t want to save the changes to the already open user setup.



You will then get a dialog box indicating the setup has been read from the data log.



With the a data log file open you can also export the data to a CSV file or copy it to the clipboard to paste it into some other program.



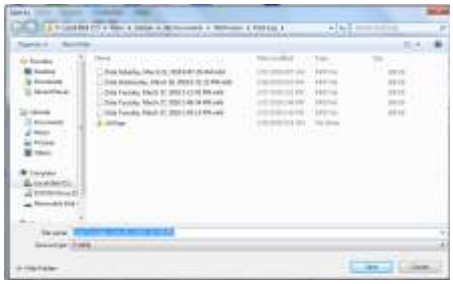
To copy to the clipboard, with a data log open click the “Copy CSV Data” button at the bottom right of the Data View window. The data will then be saved in the Windows clipboard. You can now go to another program, such as a text editor or spreadsheet program, and paste the data into that program.

To export to a CSV file, with a data log open, click the “Export to CSV File” button at the bottom right of the Data View window. A “Save As” Windows dialog box will appear. The default file name will be the data log name but with a .csv extension. The default directory for saving these files is the “Documents>MAF Fusion>CSV” Files directory.

Read a new data log from the MAF Fusion controller

If you are connected to the MAF Fusion and a saved data log exists in the controller, you can read the log file from the MAF Fusion by selecting the “Read Log Data from Controller” option or by clicking on the corresponding icon in the icon menu (data graph image with no other graphics in the icon).

You will then be prompted to save the file. The default file naming convention used by MAF Fusion for log files is the word “Data” and then the day, date and time.



Live Data tab:

The live data tab allows you to view live data from the MAF Fusion when you are connected via a USB cable.

For Live Data to function the MAF Fusion software must show the MAF Fusion controller to be connected (bottom left corner of the screen should indicate “MAF Fusion Controlled Connected”.

In Live Dave view the following data variables are shown:

- MAF Input #1
    - Raw Frequency (Hz)
    - Frequency (Hz) [this is filtered frequency]
    - Airflow (grams/second)
    - Filter [current value for MAF Input#1]
    - Compensation [current value for MAF Input #1]
- MAF Input #2
    - Raw Frequency (Hz)
    - Frequency (Hz) [this is filtered frequency]
    - Airflow (grams/second)
    - Filter [current value for MAF Input#2]
    - Compensation [current value for MAF Input #2]
- MAF Output
    - Output Frequency (Hz)
    - Output Voltage (vdc)
    - Output Air Flow (grams/second)
- Engine RPM
- Battery Voltage
- MAP Sensor Input
    - Volts
    - Pressure (psi)
- Barometric pressure (hPa)
- MAF Fusion temperature (degrees F)
- Injector on time (ms)

LED operation:

The MAF Fusion has three light emitting diodes (LED) on the module. The LEDs are red/green LEDs so they can be either red or green in color.

These LEDs are labeled as follows:

- Power
- Status 1
- Status 2

The Power LED has the following modes:

- Blinking red indicates the unit has power but no valid MAF signals are present
- Solid green indicates the unit has power and has the MAF signal(s) needed for the MAF Input Mode selected.
    - If Average, Combine or Subtract are selected two MAF signals must exist for it to be solid green.
    - If in MAF Input #1 Only mode then MAF Input #1 signal must exist
    - If in MAF Input #2 Only mode then MAF Input #2 signal must exist
- Blinking green indicates the data log is enabled and no error code exists
- Blinking green and red indicates the data log is enabled AND an error condition exists

The Status 1 and 2 LEDs are used to indicate the status of MAF Input1 and MAF Input2. The have the following modes:

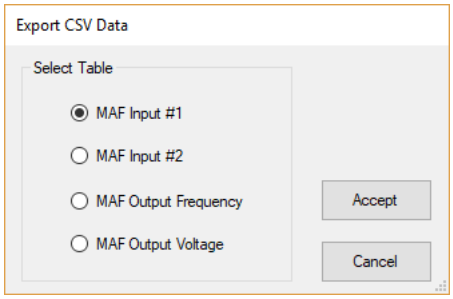
- Solid red indicates no valid signal.
- Solid green indicates a MAF signal is present

Creating new MAF sensor CSV files:

You can generate your own MAF sensor CSV files to be used with future configurations.

Two primary methods exist to do this.

The first method is to create the desired MAF curve in the MAF Fusion software (in the MAF input or output tabs). Then from within the MAF Fusion software you can select “Export CSV Data” from the File menu. You can also use the icon that looks like a spreadsheet with a red arrow point to the right to perform the same function.



Select which MAF sensor curve you want to export and then select Accept. A “Save As” dialog box will come up. The default file save location for the CSV file is the “Documents>MAF Fusion>CSV Files” folder. The default name is the user setup file name but with the .csv file extension. We recommend renaming the file to something that indicates the MAF sensor configuration.

The other way to generate a MAF sensor CSV file is to save the data from within a program like Excel. Be sure to look at other example files to make sure you have the correct formatting. The units (frequency and gram/second) should be the values at the top of column A and B. Then the frequency and airflow values should be in the rows below them. Enter the data into the spreadsheet and then perform a “SAVE AS” to save the file as a CSV (Comma delimited) file.

MAF sensor additional information and resources:

The mass airflow measurements in this software are all listed in grams per second (gps). If you have data in other units, here are the conversion factors for some of the other common airflow measurement units:

- Lbs/hr to grams/second1 lbs/hr
- To convert from lbs/hr to grams/second, multiply by 0.125997
- Grams/second to lbs/hr
- To convert from grams/second to lbs/hr, divide grams/second by 0.125997

Some MAF sensor calibration curves use the period instead of frequency for the primary axis. The period is just the inverse of the frequency. But you also have to convert the units of time. The frequency is in pulses per second (Hz). Some systems my have the period in microseconds (one millionth of a second).

- Frequency (in Hz) = (1 / period (in microseconds)) * 1,000,000
- For example:
    - 450 microsecond period
    - Frequency (Hz) = (1/450)*1,000,000
    - Frequency (Hz) = 2222

Some systems also have the axis values in ascending order (high frequency to low frequency). To avoid having to retype this data you can copy the data into Excel or some other spreadsheet and sort in descending order (smallest to largest) by the frequency axis. Make sure you select the frequency data and the airflow data so that both are sorted together.

Common tachometer ECU signal wire information										
Make	Model	Year(s)	ECM	Connector		Pin	Wire color	Circuit #	Pulse per rev setting	Enabled in stock ECU**
				#*	Color					
Chevrolet	Camaro	1996-1997	32U	C1	red	13	white	121	4	Yes
Chevrolet	Camaro	1998	Warren	C2	blue	35	white	121	2	Yes
Chevrolet	Camaro	1999-2002	Warren	C2	red	10	white	121	2	Yes
Chevrolet	Camaro	2010-2015	E38	C1	black	48	N/A	N/A	2	No
Chevrolet	ZL1 Camaro	2012-2015	E67	C1	blue	25				
Chevrolet	Camaro	2016-2019	E92	X2	black	39	white	121		Yes
Chevrolet	ZL1 Camaro	2017-2019	E92	X2	black	39				
Chevrolet	Corvette	1995-1996	32U	C1	red	13	white	121	4	Yes
Chevrolet	Corvette	1997-1998	Warren	C2	blue	35	white	121	2	Yes
Chevrolet	Corvette	1999-2003	Warren	C2	red	10	white	121	2	Yes
Chevrolet	Corvette	2004	Warren	C2	green	10	white	121	2	Yes
Chevrolet	Corvette	2005	E40	C1	blue	48	white	121	2	Yes
Chevrolet	Corvette	2006-2013	E38	C1	black	48	white	121	2	Yes
Chevrolet	Z06 Corvette	2006-2013	E38	C1	black	48	white	121	2	Yes
Chevrolet	ZR1 Corvette	2009-2013	E67	C1	blue	25	white	121	2	Yes
Chevrolet	Corvette	2014-2019	E92	X2	black	39	light green/ black	3633		Yes
Chevrolet	Z06 Corvette	2015-2019	E92	X2	black	39	light green/ black	3633		Yes
Chevrolet	ZR1 Corvette	2019	E99							
Chevrolet	SSR	2003-2004	Warren	C2	blue	10	white	121	2	Yes
Chevrolet	SSR	2005-2006	E40	C1	blue	48	white	121	2	Yes
Chevrolet	Trailblazer SS	2006	E40	C1	blue	48	white	121	2	Yes
Chevrolet	Trailblazer SS	2007-2009	E67	C1	blue	25	white	121	2	Yes
Cadillac	CTS-V	2004-2005	Warren	C2	green	10	white	121	2	Yes
Cadillac	CTS-V	2006-2007	E67	C1	blue	25	white	121	2	Yes
Cadillac	CTS-V	2009-2015	E67	C1	blue	25	N/A	N/A	2	No
Cadillac	CTS-V	2016-2019	E92	X2	black	39	white	121		Yes
GM	C/K truck***	2000-2006	Warren	C2	red or	10	white	121	2	Yes
GM	C/K truck***	2007-2013	E38	C1	black	48	N/A	N/A	2	No
GM	C/K truck***	2014-2019	E92							
GM	C/K truck***	2007-2019	E78							
Pontiac	Firebird	1996-1997	32U	C1	red	13	white	121	4	Yes
Pontiac	Firebird	1998	Warren	C2	blue	35	white	121	2	Yes
Pontiac	Firebird	1999-2002	Warren	C2	red	10	white	121	2	Yes
Pontiac	GTO	2004	Warren	C2	green	10	Brown	121	2	Yes
Pontiac	GTO	2005-2006	E40	C1	blue	48	Brown	121	2	Yes
Pontiac	G8	2008-2009	E38	C1	black	48			2	
Ford	Mustang GT	2011-2012		70 way (bottom)		10	N/A	N/A		Yes

*Connectors C1, C2 and C3 (or X1 and X2) are the term used in the service documents and may be labeled as J1, J2 and J3 on the ECM itself.

**If the tachometer output is not enabled in the stock ECU you will need to reprogram the ECU to enable the tachometer signal output.

***GM C/K trucks include: Avalanche, Suburban, Tahoe, Yukon, Silverado, Sierra, Escalade & H2

Limited Warranty

Product & Service Solutions LLC (PSS) warrants, to the original purchaser, the MF-001 MAF Fusion product to be free from defects in materials and workmanship under normal use for a period of twelve months from the original purchase date. If the product is found to be defective per above, it will be replaced or repaired if returned prepaid along with proof of the date of purchase. This shall constitute the sole remedy of the purchase and the sole liability of PSS. To the extent permitted by law, the foregoing is exclusive and in lieu of all other warranties or representations whether expressed or implied, including any implied warranty of merchantability or fitness. In no event shall LPE be liable for special or consequential damages. The warranty only covers the product itself and not the cost of removal and re-installation of the product.

Specific conditions that will VOID the product warranty: If the product has been opened, modified or repaired. If the product was not installed or used correctly. If the product has been tampered with by: negligence, misuse or accident. If the product is returned without explanation of the problem or Return Authorization.

Contact PSS at info@proservsolutions.com for a Return Authorization Number.

All warranty returns should be returned freight pre-paid and should include inside of the box:

- Proof of Purchase
- Letter that contains both the Return Authorization Number and a detailed explanation of the reason for the return.

The Return Authorization Number should also be clearly written on the outside of the box.

Send all returns to:

PSS MAF Warranty

6435 W Jefferson Blvd., Suite 208

Fort Wayne, IN 46804

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