FFM100 - Sensor Select Guide

The following process exists as an aid for selecting the appropriate size fluid flow sensor(s) for your motored application. We highly encourage consulting with the Engine's manufacturer for their recommendations before implementing any 3rd party solutions.

Maretron/Carling Technologies/Littelfuse will not be held responsible for any improper sensor selection or installation. Please consult with a local manufacturer and/or certified marine mechanic.

* If you are wanting to monitor a fluid other than a Fuel profile (Diesel, Gasoline/Petrol), please consult with our tech support team for guidance on the appropriate sensor line via email at Support@Maretron.com.

Terminology Reference Table

gph / GPH	Gallons per Hour
lph / LPH	Liters per Hour
HP	Horsepower
NPT	National Pipe Thread
Flow Rate	The quantity of fluid that is passing through a cross-section of a pipe in a specific period of time.
Burn Rate	Also known as Maximum Consumption, the quantity of fluid that is consumed for a period of time during a combustion process.

Sensor Table

Sensor Size	Flow Rate (gph)	Flow Rate (lph)	Port Inlet Size
M1AR	**0.53 – 26.4**	**2 – 100**	**¼" NPT**
M2AR	**6.60 – 132**	**25 – 500**	**¼" NPT**
M4AR	**47.6 – 396**	**180 – 1500**	**½" NPT**
M8AR	**127 – 1,110**	**480 – 4,200**	**¾" NPT**
M16AR	**158.5 – 1,585**	**600 – 6,000**	**1" NPT**

* Please take note of the inlet size of the sensor as an adapter may be required to interface into your fuel line setup. DO NOT choose a larger size sensor to mitigate fuel line adapters as this will hinder the accuracy of the readout or may not read at all. The flow sensors are rated according to the volume of fluid able to pass through the sensor and should not hinder the performance of the engine per principles of fluid dynamics.

For further technical reference about the Fuel Sensors behavior, please visit the FFM100 User Manual.

- https://www.maretron.com/products/ffm100-fuel-flow-monitor-2/#lqd-tab-7075

Step 1: Datasheet

Please locate the datasheet of your engine or generator. If you are unable to locate locally or online, please reach out to your local engine or generator manufacturer/dealer to obtain this information as it is crucial to identifying the appropriate sensors.

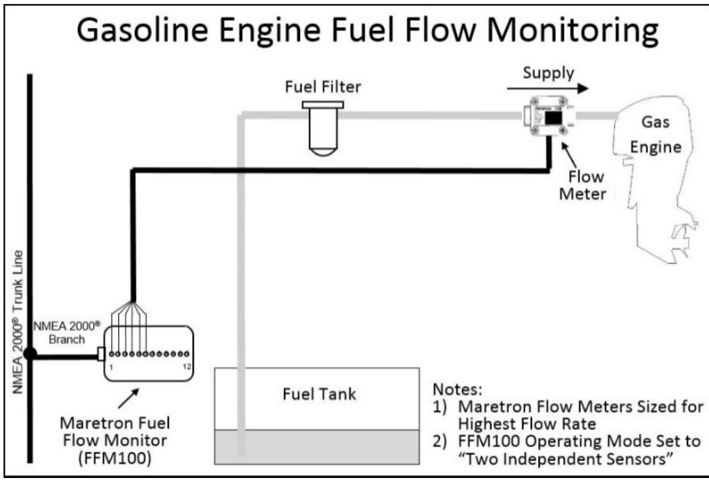
Step 2: Sensor Quantity

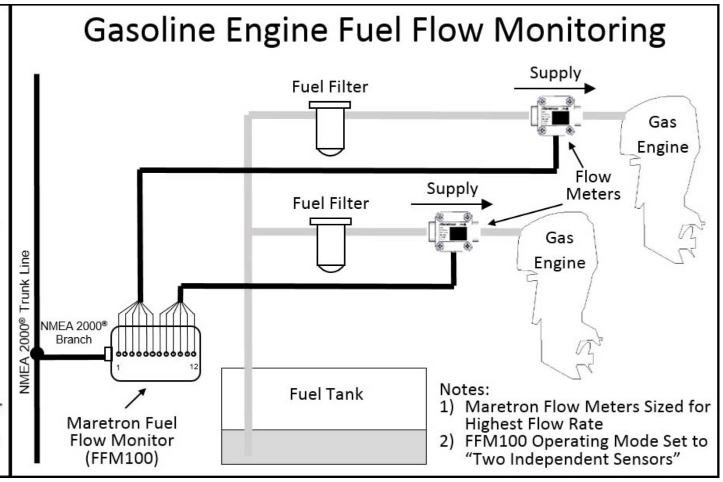
To determine the quantity of sensors per motor to apply, we must first review the engine setup.

Gasoline/Petrol-based Engines

In most cases, offers a single fuel line to the engine with no return to the tank, this requires only **1** sensor.

There are instances, mostly newer model years higher HP, that offers a gas engine setup paired with a return fuel line, we will require **2** sensors for this setup to detect the differential.
* For engines with a return fuel line, we will treat this installation and setup as we do for Diesel engine setups within Step 4 below.

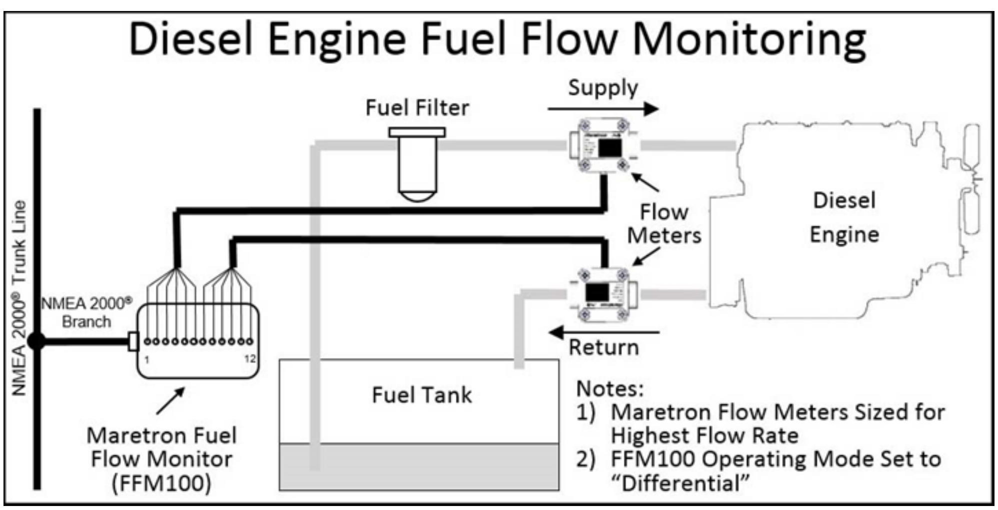




Diesel-based Engines

In most cases, there will be both supply and return fuel lines within the engine setup to be monitored, therefore we will require **2** sensors for this setup.

There are very few instances, diesel engines less than 100HP may only have a supply sensor, no return, we will only require 1 sensor for this setup.
* For engines without a return fuel line, we will treat this installation and setup as we do for Gasoline/Petrol engine setups within Steps 3 and 4 below.



Step 3: Sensor Selection

Once we have obtained our engine's datasheet and identified the quantity of sensors needed for your specific setup, we can now make our sensor selection.

Gasoline/Petrol-based Engines

For this type of setup where only a single sensor is being applied, review the engine's datasheet to reveal the value Max Consumption or Max Burn Rate. This value illustrates the maximum fluid flow that would be pushed through the fuel lines while at full throttle.

You will use this value Max Consumption/Burn Rate as the same value as our max **Flow Rate**. Using the Sensor Table above, locate the smallest size sensor that supports your value. Sensors do cross supported range values.

Diesel-based Engines

For this type of setup where we have both supply and return lines, review the engine's datasheet to reveal if the manufacturer has already provided these independent **Flow Rate** values. Unfortunately, most vendors haven't populated this on datasheets, but it is always the best place to start. If the manufacturer does not provide this value, please locate the value Max Consumption or Max Burn Rate.

Once this Max value is identified, we will need to multiply by **2.5-3**, marine industry average over the past 25-30 years, to approximate the maximum **Flow Rates** of the fuel lines. This estimates the maximum volume of fluid that is being pushed through the lines, whether or not it is used comes after this sensor.

Example: My engine's data sheet reveals my Maximum Consumption at Wide Open Throttle (WOT) is 25 gph.

25 gph x (2.5 – 3) = Maximum Flow Range of 62.5 – 75 gph Flow Rate
(same conversion when using lph)

This would position this setup to use a set of **M2AR** Sensors.

*You will need to apply the same size sensor for both the supply and return lines for accuracy.

Step 4: Installation and Setup

The following Knowledgebase articles outline the path for each setup process as described.

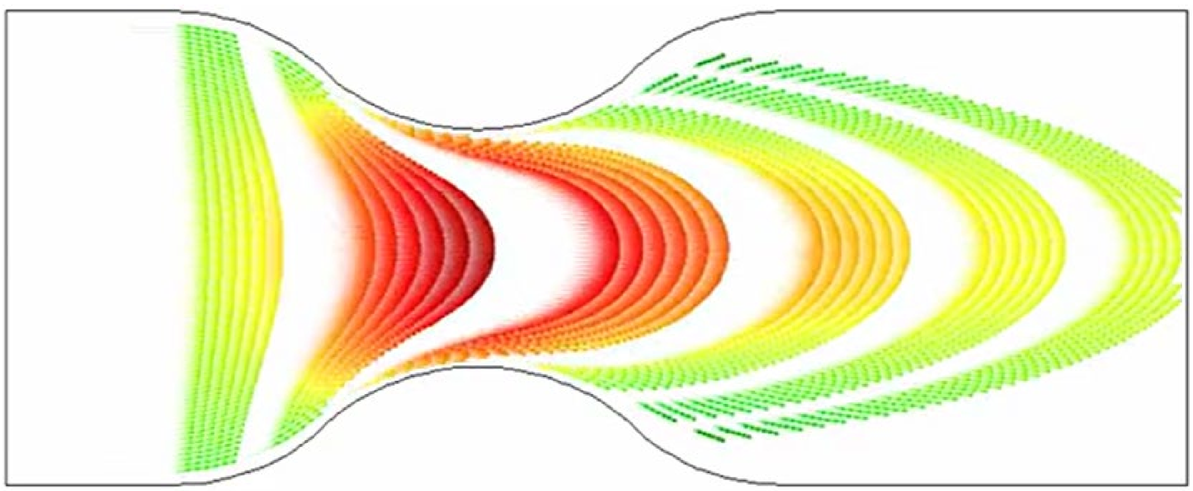
- Single Gasoline Engine and small Diesel Engine (No Return Fuel Line)
    - https://www.maretron.com/wp-content/phpkbv95/article.php?id=701
- Dual Gasoline Engine and small Diesel Engine (No Return Fuel Line)
    - https://www.maretron.com/wp-content/phpkbv95/article.php?id=700
- Single Diesel Engine and select Gasoline Engines (With Return Fuel Line)
    - https://www.maretron.com/wp-content/phpkbv95/article.php?id=603
- Dual Diesel Engine and select Gasoline Engines (With Return Fuel Line)
    - https://www.maretron.com/wp-content/phpkbv95/article.php?id=699

Remarks

We can understand and appreciate the concern with the sensor's ¼" fuel line port on both the M1AR and M2AR sensors. As part of fluid dynamics, the Venturi Effect arises from the conservation of momentum and conservation of mass and relates the pressure along an enclosed flow (in a pipe) to the flow rate through the pipe.

This might seem counterintuitive because the constricted region looks like it should be an obstacle (such as an inlet diameter reduction), so one would be tempted to think that the flow rate should decrease rather than increase. However, this would violate conservation of mass and conservation of momentum. Instead, to ensure the mass flow rate is conserved, meaning the continuity condition in the Navier-Stokes equation is satisfied, the flow rate must increase through this region.

This ensures that, once the constriction region is passed, the flow rate can be restored to its initial lower value and momentum is conserved throughout the flow region. Our applications rely on this principle to be able to predict a fluid's reaction when flowing through constricted piping.



If you have any questions, please contact our support team at (866) 550-9100 or Support@Maretron.com.