FLOCAT

Flow meters, applications assistance and technical support

C-SF45-A Series
Instruction Manual

P.N. C-SF99-B001

FLOCAT

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DESCRIPTION:

C-SF45-A series turbine flow sensors measures the flow of hydrocarbon fuels such as gasoline, kerosene, #2 diesel fuel, and other light transmitting, non-corrosive liquids of similar viscosity. Typical fuel flow applications include aircraft fuel monitoring systems; gasoline, diesel, and gas turbine engine test stands; and industrial furnaces.

The transducers give repeatable signals on gasoline across a 100 to 1 flow range down to 0.3 GPH. The higher viscosity of diesel fuel reduces signal repeatability at flow rates below 2 GPH. Pressure drops are very low compared to other turbine flow sensors. The sensor's bearing system is rated for continuous operation at the upper end of the flow range.

The sensor produces a current pulse signal from an opto-electronic pickup with a preamplifier.

PRINCIPAL OF OPERATION

Liquid enters the flow chamber tangentially, follows a helical flow path, and exits vertically, thereby venting any entrained vapor bubbles. The rotational velocity of the liquid is directly proportional to flow rate. A neutrally buoyant rotor spins with the liquid between V-jewel bearings. Rotor movement is sensed when notches in the rotor interrupt an infrared light beam between an LED and phototransistor.

The vapor venting design requires that the transducer be positioned with the wires pointing up. Turbulence caused by valves or sharp elbows mounted close to the transducer inlet can affect the sensor's K-Factor and should be minimized.

PERFORMANCE SPECIFICATIONS

Model Number	C-SF45-A001	C-SF45-A002	C-SF45-A003
Flow Range,			
Gasoline	0.3 - 30 GPH	0.6 - 60 GPH	2.0 - 80 GPH
#2 Diesel	2.0 - 30 GPH	3.0 - 60 GPH	8.0 - 80 GPH
Approximate K Factor (Pulses/Gallon @ 16 GPH)			
Gasoline	32,000	28,000 - 31,000	24,000
#2 Diesel	33,000	28,000	25,000
Pressure Drop			
Gasoline	0.6 psi @ 15 GPH	1.2 psi @ 30 GPH	1.4 psi @ 40 GPH
	2.4 psi @ 30 GPH	4.8 psi @ 60 GPH	5.8 psi @ 80 GPH
#2 Diesel	0.8 psi @ 15 GPH	1.5 psi @ 30 GPH	1.8 psi @ 40 GPH
	3.0 psi @ 30 GPH	6.0 psi @ 60 GPH	7.2 psi @ 80 GPH
Repeatability	±¼% @ 16 GPH	±¼% @ 16 GPH	±¼% @ 16 GPH
Working Pressure	200 psi	200 psi	200 psi
Temperature Range	-65° / 100°C	-65° / 100°C	-65° / 100°C
Bearing Life Expectancy	10,000 hr. min.	10,000 hr. min.	10,000 hr. min.

C-SF45-A SERIES FLOW SENSOR INSTALLATION

Sensors must be placed in a horizontal section of fuel line at a low point in the fuel system. Fuel should travel, “Up-hill” when exiting the sensor. Its outlet should be at least 1 or 2 inches lower than the fuel pump inlet, or priming bulb. Placing the sensor at least 12” upstream of the fuel pump improves system accuracy.

To prevent the sensor from clogging, it is recommended that the sensor(s) be installed downstream of a coarse fuel filter or water separator. For applications not equipped with an off engine filter we suggest installing a model ILA-02 Flow Ezy filter w/238 micron screen directly to the inlet of the flow sensor.

Caution: Never Plumb Flow Sensor(s) Downstream of an Engine Mounted Fuel Filter.

The sensors ports are marked with IN and OUT. They must be installed with the proper orientation and with the wires up.

Minimize the number of 90º elbows and pipe fittings. Excessive use may create a high vacuum, fuel restricting pressure drop across the fuel system. Whenever possible, use a large radius hose bend instead of elbows. Refer to the engine owner’s manual for maximum fuel pump vacuum. A vacuum gauge can be used to confirm that the system is within limits.

DO NOT OVER TIGHTEN FITTINGS. Torque pipe thread fittings to a maximum of 15 ft-LB, (180 inch-Lb) or two full turns beyond hand tight, (Whichever comes first). FloCat recommends that a fuel proof pipe thread sealant be used when installing fittings into the flow sensors, (LockTite PST, Rector Seal, Leaklok, Permatex, Jomar, etc). NEVER USE TEFLON TAPE.

If swivel fittings are used, (JIC or SAE) their mating surfaces should be sealed with AP 50 Fitting Seals, or Copper Conical Sealing Washer, (Connie Seals)

MATERIAL SPECIFICATIONS:

Flow Sensor Body	Die-cast Aluminum, Cadmium Plated, Dichromate Finish
Rotor	Nylon 6/12
Rotor Pivot	Stainless Steel, Carpenter 420
Phototransistor	SD 1440
Light Emitting Diode	SE 1450
Connectors	22 Gauge Wire Leads (3)

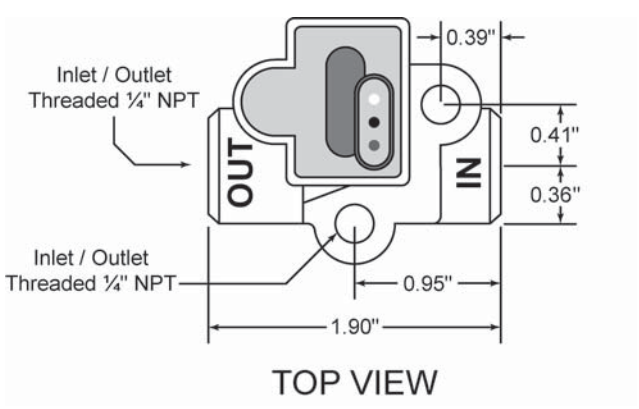
ELECTRICAL SPECIFICATIONS:

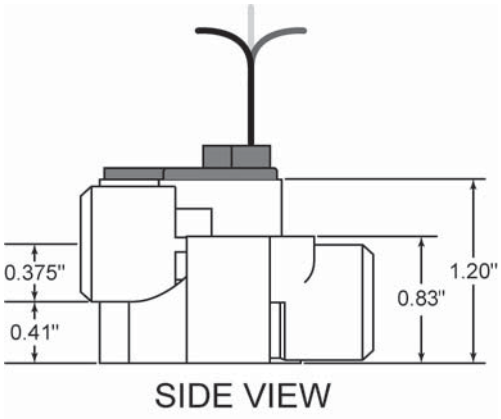
12 to 15 VDC between RED (+) wire and BLACK (-) wire. 30 to 50 mA at 12 VDC.

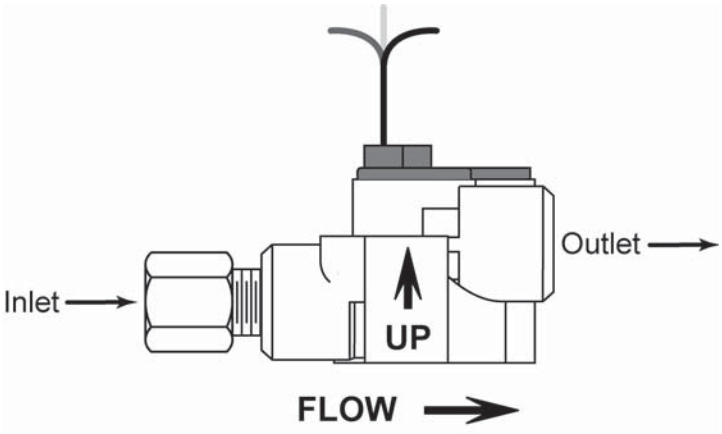
SIGNAL SPECIFICATIONS:

Open collector transistor output on WHITE wire. Sensor will pull-down to 1.0 volt with 10 - 15k ohm pull-up resistor installed.

DIMENSIONS







TEST THE FLOW SENSORS.

At the readout, disconnect the RED (switched +12 VDC) wire from the switched source and temporarily connect it to an un-switched source so the instrument is powered even when the engine is OFF. All other wires are as per the wiring diagram.

FINDING SUCTION LEAKS IN FUEL SYSTEMS

By far, the most common complaint received is FLUCTUATING GPH READINGS or HIGH READINGS caused by a suction leak somewhere between the fuel tank and the inlet of the fuel pump. The symptom of a suction leak shows up on the GPH reading as a fluctuation. The more severe the leak, the greater the fluctuation will be. Typically, the fluctuation is around 2 - 4 GPH. This also affects the totalizer reading and usually shows a 15 - 30% higher reading than what you've put into the tank. Suction leaks occur with both gasoline and diesel engines and will not affect engine performance except in severe cases.

If you have fluctuating readings, but the totalizer reading is close to what you've put into the tank (+/- 6%), something is causing the fuel to flow through the system that way. The most likely causes are an anti-siphon valve set too stiff or a sticky or misadjusted float valve on the gasoline engine's carburetor. Repair or replace as needed.

Finding suction leaks can be a tedious and time-consuming chore, but properly approached, it can be repaired in a minimum amount of time. The two most common places for suction leaks to occur are at the primary fuel filter/water separator and/or from a loose valve stem packing gland nut.

First, remove the filter housing. Coat any o-rings or gaskets you find with a coating of light grease (not machine oil or diesel oil) and reassemble. Gently tighten all valve stem packing gland nuts. Do not over tighten, valve should turn freely. Tighten all hose clamps and compression fittings (do not over tighten). Run the engine for 5 - 10 minutes and observe readings. If you've found the problem, the fluctuations should reduce to less than ½ GPH of the reading.

If this does not cure the problem, the next step is to temporarily insert a clear piece of fuel resistant tubing. For gasoline engines, install it to the inlet of the fuel pump. For diesel engines, install it after the return flow sensor. Run the engine and watch the clear tubing for signs of a constant stream of small bubbles or an occasional larger bubble. Sometimes shining a light through the clear tube makes it easier to see.

Have someone observe the clear tube while you move any flexible hose(s) in the fuel system. If the amount of bubbles observed continually increase or decreases as you do this, you have found the area causing the leak. Repair or replace as needed. If it is a one time occurrence, you probably dislodged some air trapped in the fuel line.

If you haven't found it yet, the last step is to inspect each pipe joint in the system. You should be able to see joint compound all the way around the joint. If you do not, that joint is suspect and needs to be resealed. You should now see the clear tube running with solid fuel and free of any bubbles. You may need to run the engine for a few minutes to purge any air that was in the system. If you still see bubbles in the clear tubing, you missed the leak somewhere and need to check back over your work. Remove the clear tube and restore the fuel system to its normal condition.

FUEL FILTERS

A dirty fuel filter or one that is too fine (1-5 micron) may cause cavitation (drawing vapor out of the fuel). Replace the filter with a new one in the 10-20 micron range or larger, depending on engine manufacturers recommendations.

FLOW SENSOR ORIENTATION

The importance of proper orientation of the flow sensor can not be emphasized enough. All flow sensors come with the inlet and outlet distinctly marked (IN / OUT). This signifies fuel flow direction and is imperative for the sensor to work correctly in the system. There is an additional arrow on the body of the flow sensor. This will either be a label clearly marked or stamped onto

the body of the sensor itself. It is crucial that this single arrow points up. Please be careful to install the sensor in the proper orientation. Before installing the sensor(s), familiarize yourself how the sensor(s) is to be installed.

LOW RPM OPERATION

At idle, under no load conditions, it is not uncommon for the GPH reading to fluctuate by as much as .2 -.3 GPH. This fluctuation is caused by the engine governor fluctuating the fuel flow to maintain engine RPM.