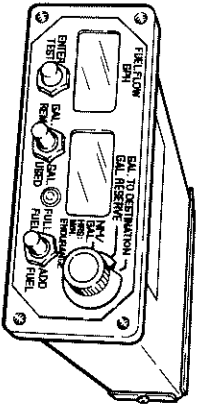


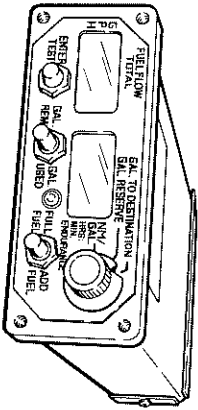
Miniflo-L™

DIGITAL FUEL MANAGEMENT SYSTEM

with interface to LORAN-C and GPS receivers
with RS-232 or RS-422 output format



SINGLE ENGINE



TWIN ENGINES

OPERATING MANUAL

Single and Twin Engine Indicators

For P/Ns: 91204X

Shadin Co., Inc.

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NOTE: Though references are made in this manual to fuel measured in gallons, the information applies equally to measurements in pounds, kilos or liters.

MiniFlo-L™

Although not required by the FAA, it is recommended that this manual be attached to the FAA-approved flight manual, or be kept on-board for reference.

1. GENERAL DESCRIPTION

MINIFLO-L™ is a digital fuel flow management system designed to provide complete fuel management information under real flight conditions without any manual entry of data (after entry of the initial fuel on board information). It is connected to the engine fuel flow transducer for fuel flow information and to the Lorán-C or GPS receiver serial port for navigation data (ground speed, distance and estimated time en route). MiniFlo-L™ is also capable of transmitting the fuel information to the Bendix KLN-88, KLN-90, Trimble TNL 2000A/3000, and all ARNAV navigation receivers for additional calculations and display of fuel management data.

The system is set up to measure the flow of fuel in either gallons, liters, pounds or kilos, and it can be installed on virtually any reciprocating or turbine engine by selecting the proper size fuel flow transducer.

1.1 MiniFlo-L™ PROVIDES:

1.1.1 **SPECIFIC RANGE:** in nautical miles per gallon of fuel burned. This is an indication of how efficient the cruise is and the optimum cruise speed can be determined by selecting the power setting which yields the highest nautical miles per gallon. Specific Range = (G/S Kt.) Fuel Flow per hour.



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1.1.2 FUEL TO DESTINATION: Miniflo-L™ calculates (under the real wind conditions) the fuel necessary to reach the destination as selected on the Loran-C or GPS receiver by multiplying the fuel flow by the estimated time en route to the destination. (If an intermediate waypoint is selected for navigation purposes, the displayed fuel to destination represents the fuel needed to reach the intermediate waypoint.)

1.1.3 FUEL RESERVE: Miniflo-L™ calculates the amount of fuel which will be available on board when the aircraft reaches the destination or waypoint indicated on the Loran-C or GPS receiver. This feature provides the pilot with accurate information so that the reserve fuel situation can be evaluated and action can be taken if necessary. (If an intermediate waypoint is selected for navigation purposes, the displayed fuel reserve represents fuel reserve at the intermediate waypoint.) Fuel Reserve = Fuel Remaining - Fuel to Reach Destination.

1.1.4 ENDURANCE: Miniflo-L™ calculates the time left to fly in hours/minutes based on fuel remaining and present fuel flow.

1.1.5 FUEL REMAINING: Miniflo-L™ keeps track of the fuel remaining on board. Fuel Remaining is equal to Initial Starting Fuel minus Fuel Used.

1.1.6 FUEL USED: Miniflo-L™ keeps track of the fuel used since the last fuel entry or reset.

1.1.7 NOT ENOUGH FUEL: The information in the display window will flash (when the rotary switch is in the FUEL TO DEST. position) if the calculated fuel needed to reach the destination is more than the fuel remaining on board and will show a negative sign followed by the amount of fuel short to reach destination.

1.1.8 FUEL RESERVE WILL BE USED: The information in the display window will flash (when the rotary switch is in either the FUEL TO DEST. or the F. AT DEST. position) if the endurance is less than the time to reach the destination plus 45 minutes. This warning is intended to alert the pilot that the prevailing condition will require the use of some of the 45 minutes of reserve fuel to reach the destination.

1.1.9 FUEL FLOW: Miniflo-L™ provides a digital readout of the fuel flow per hour to a tenth of a gallon up to 100 gallons and to the nearest gallon above 100 gallons. For the pounds version, the readout is to the nearest pound up to 999 lbs./hour and to the nearest 10 lbs. above 999 lbs./hour.

1.2 SYSTEM COMPONENTS:

The system consists of three (3) basic units: the fuel flow transducer, the navigation receiver (Loran-C or GPS) and the panel mounted unit.

1.2.1 FUEL FLOW TRANSDUCER: The fuel flow transducer mounted in the fuel line measures the flow of fuel and generates electrical pulses directly proportional to the fuel flow. The transducer is fail-safe designed; rotor blockage will not interrupt fuel flow to the engine.

1.2.2 LORAN-C OR GPS RECEIVER: The Loran-C or GPS receiver provides ground speed, distance, and estimated time en route through the serial port.

1.2.3 PANEL MOUNTED UNIT: All system electronics, function controls and digital displays are contained in a single instrument that mounts in a standard 3 1/4" wide and 1 1/4" high opening. This unit requires no periodic maintenance, adjustment or calibration once it is properly installed.

The Display: The fuel flow is always displayed on the left side of the display window. All other functions, with the priority for the rotary switch functions, are displayed on the right side of the display window.

System Memory: The Miniflo-L™ includes a non-volatile memory that retains fuel remaining and fuel used information when the power to the unit is shut down.

1.3 TEST FUNCTION:

Diagnostic software is built into the system. To activate it, press the ENTER/TEST button. All of the digits will be sequentially on in a rotating pattern for ten seconds. If the test is successful, the word "GOOD" will appear in the display window for three seconds. (If the test is not successful, the word "bAd" and an error message identifying the error will be displayed. In such case, the unit will cease to function and must be considered unserviceable until corrective action is taken.) This is followed by:

1. The K-factor setting (PPG) and units of measure the system is set to (gal., liters, lbs., kilos).
2. Maximum usable fuel setting.
3. Software basic # and revision level.
4. The distance to way point or destination as shown on the Loran-C or GPS receiver to check the data interface integrity. If the system is not capable of reading the navigation receiver data, the word "LbAd" will appear in the display window.

NOTE: Using the test function while the engine is running will cause the computer to lose 17 seconds of fuel count.

2. PREFLIGHT PROCEDURES

MINIFLO-L is a fuel flow measuring system and NOT a quantity sensing device. A visual inspection and positive determination of the usable fuel in the fuel tanks is a necessity. Therefore, it is imperative that the determined available usable fuel be manually entered into the system.

2.1 INITIAL PROGRAMMING:

The function of initial programming is to enter the total usable fuel into the memory. It can then be recalled whenever you fill the fuel tanks up to the maximum usable fuel.

PROCEDURE:

1. Power the unit up.
2. Move the ADD/FULL toggle switch to the FULL position and hold for the entire procedure.
3. Simultaneously press the ENTER/TEST button and move the USED/REM. toggle switch to the REM. position. Hold both. The system will count down for 15 seconds, displaying the count on the left in the display window.
4. The message "FUL" and the current full fuel value will appear in the display window. Release the ENTER/TEST button and the USED/REM. toggle switch. Keep holding the ADD/FULL toggle switch in the FULL position.

INITIAL PROGRAMMING PROCEDURE, cont'd

5. Move the USED/REM. toggle switch to the REM. position to increment the full fuel number or to the USED position to decrement the number. (The longer you hold the switch in position, the faster the number will be updated.)
6. After reaching the correct total usable fuel figure, press the ENTER/TEST button and the computer will store that number as full fuel. The word "FUL" disappears and the computer returns to the operating mode. Release the ADD/FULL toggle switch.
7. To verify that the data is stored properly, press the ENTER/TEST button. The computer will run a diagnostic check and then display "GOOD". If the test is successful, it displays the maximum usable fuel value.

NOTE: Do not turn the power off to the computer for approximately one minute. This will insure that the unit has enough time to store the proper figures into the program.

2.2 PREFLIGHT CHECK:

Initiate the diagnostic software built in to the systems by pressing the ENTER/TEST button; the program checks the hardware and the display. If the test is successful the word "GOOD" will appear in the display window; if not, the word "bAd" appears. The system is considered unserviceable until corrective action is taken.

At the end of the test routine the system will display the following:

1. Software basic # and revision level
2. The K-factor setting (pulse count/gallon)
3. The display units (Gal., LB 5.8, LB 6.7, etc.) as part of checking the internal settings

Move the USED/REM. toggle switch to the USED position. The system will display the fuel used since last fuel entry or fuel used since last reset.

Move the USED/REM. toggle switch to the REM. position. The system will display the fuel remaining on board. The pilot should confirm this figure with the actual fuel on board.

2.3 NO FUEL ADDED:

As data is already stored, no action is needed.

2.4 FUEL TANKS FULL:

There are two methods to enter full fuel: the ramping method and the ADD/FULL toggle switch method.

Ramping Method

1. Move the USED/REM. toggle switch to the REM. position and hold.
2. Press the ENTER/TEST button to increment the fuel remaining until the total usable fuel is reached. (The longer you press, the faster the incrementing.)
3. Release the USED/REM. toggle switch and the ENTER/TEST button to enter the total usable fuel on board into memory.
4. If the required figure is exceeded, follow the procedure in this manual, section 2.6 Correcting Fuel on Board Entry Error.

ADD/FULL Toggle Switch Method

1. Move the ADD/FULL toggle switch to the FULL position and hold.
2. Press the ENTER/TEST button.
3. Release the ADD/FULL toggle switch so it returns to the center position.
4. To verify, move the USED/REM. toggle switch to the REM. position. Total usable fuel will be displayed.

2.5 PARTIAL FUEL ADDED:

There are two methods to enter partial fuel:

Ramping Method

Add the amount of fuel from the refueling meter to the amount of fuel remaining. Enter the total using the following steps:

1. Move the USED/REM. toggle switch to REM. position and hold.
2. Press and hold the ENTER/TEST button to increment fuel remaining until the figure to be entered is reached; then release the button.
3. Release the USED/REM. toggle switch. The displayed figure is entered into memory as fuel remaining on the board.
4. If the required figure is exceeded, follow the procedure in this manual, section 2.6 Correcting Fuel on Board Entry Error.

ADD/FULL Toggle Switch Method

1. Move the ADD/FULL toggle switch to the ADD position and hold.
2. Move the USED/REM. toggle switch to REM. position to increment the fuel added figure until amount of fuel added is reached.
3. Press the ENTER/TEST button.
4. Release the ADD/FULL toggle switch so it returns to the center position. The computer will add the added fuel to the fuel remaining and use the total as the current fuel remaining.
5. To verify, move the USED/REM. toggle switch to the REM. position. The current usable fuel remaining will be displayed.

2.6 CORRECTING FUEL ON BOARD ENTRY ERROR:

In case an error has been made by exceeding the correct amount in entering the number of total usable fuel, move the USED/REM. toggle switch to the USED position and simultaneously press and hold ENTER/TEST button. Fuel used will be reset and the fuel remaining figure will appear and pause in the display window for four (4) seconds. The figure will decrement (the longer you press, the faster the decrementing). When the correct figure is reached, release both the USED/REM. toggle switch and the ENTER/TEST button.

To avoid repeating the four-second pause before decrementing, hold the USED/REM. toggle switch in the USED position and use the ENTER/TEST button to control the decrementing.

3. IN-FLIGHT OPERATIONS

3.1 INSTRUMENT OPERATIONS:

3.1.1 For Single Engine Aircraft, FUEL FLOW is displayed continuously on the left display window.

For Twin Engine Aircraft, TOTAL FUEL FLOW is displayed continuously on the left display window. To read each engine's fuel flow separately, move the ADD/FUEL switch to full and the REM/USED switch to used simultaneously (squeeze them).

3.1.2 FUEL USED is displayed by moving the USED/REM. toggle switch to the USED position; the information is shown on the right display window as long as the switch is held in the USED position and for three seconds after the switch is released. The display represents the fuel used since last reset.

3.1.3 FUEL REMAINING is displayed by moving the USED/REM. toggle switch to the REM. position; the information is shown on the right display window as long as the switch is held in the REM. position and for three seconds after the switch is released. The display represents the fuel remaining on board at the time of reading.

3.1.4 ENDURANCE is selected by rotating the rotary switch to the ENDURANCE position; endurance is displayed in hours and minutes on the right display window.

3.1.5 NAUTICAL MILES PER GALLON is selected by rotating the rotary switch to the NM GAL position; the information is shown on the right display window.

3.1.6 FUEL TO DESTINATION is selected by rotating the rotary switch to the FUEL TO DEST. position; the information is shown on the right display window and it represents the fuel needed to reach the active waypoint selected on the Loran-C or GPS receiver, provided the aircraft ground speed and fuel flow remain constant and move in a straight line. (Readings obtained during climb and descent are invalid.)

3.1.7 FUEL RESERVE is selected by rotating the rotary switch to the F. AT DEST. position; the information is shown on the right display window and represents the fuel that is going to be available when the aircraft reaches its destination as indicated on the selected waypoint, provided the aircraft ground speed, fuel flow, and direction remain constant and at the same altitude. (Readings obtained during climb and descent are invalid.)

3.2 WARNINGS:

3.2.1 NOT ENOUGH FUEL: When the rotary switch is in the FUEL TO DEST. position, the information in the display window flashes if the fuel on board is not enough to reach the destination as selected on the active waypoint. The display window shows the amount of fuel short to reach the destination preceded by a negative sign.

3.2.2 RESERVE FUEL WILL BE USED: When the rotary switch is in the F. AT DEST. position, the information in the display window flashes if the aircraft will arrive at the destination with less than 45 minutes of fuel, calculated at the present cruise power setting.

3.2.3 NOT ENOUGH ENDURANCE: When the rotary switch is in the ENDURANCE position, the information in the display window flashes if the time remaining to fly at the present power setting is less than 45 minutes.

4.0 EMERGENCY PROCEDURES:

In case of an electrical power failure in-flight, the instrument will cease to function. After restoring power the system will resume accurate fuel flow reading, but the time remaining, fuel used, fuel remaining, gallons reserve, gallons to destination and all the warnings will not be accurate unless the duration of the power failure is known and the fuel consumption during the electric power failure is calculated and subtracted from the fuel remaining.

5. SPECIFICATIONS

Mini0-1™

Maximum usable fuel: 1,800 gallons

6,822 liters

12,070 lbs @ 6.71 lb/gal.

10,440 lbs @ 5.81 lb/gal

5,484 Kg @ 0.805 Kg/lit

Maximum altitude: 40,000 ft.

Operating temperature: -30 to 50°C

Humidity: up to 95% @ 32°C

Accuracy: better than 2%

Ground Speed Range: 27 - 600 knots

Functions: Fuel Flow (45 minute endurance warning)

Fuel Used

Fuel Remaining

(fuel not enough to reach destination)

Endurance

NM/Gallon

Fuel to Destination

Fuel Reserve (fuel reserve will be used)

ELECTRICAL RATING:

Input voltage: 14-28 volt D.C.

Input current: 230 mA @ 14 volts

240 mA @ 28 volts

ELECTRICAL INTERFACE:

RS-232-C, RS-422

MECHANICAL RATING:

Vibration: 5g

Weight: Panel unit: 8 ounces

COMPATIBLE RECEIVERS:

ARNAV-R-21, -25, -30, -40, -60 FMS 5000, FMS 7000

Bendix/King KLN-88, KLN-90

Garmin 1000

IIMorrow 612, 614, 618, NIMS 2001

Magellan Skynav 5000

Northstar M1A

ONI 7000

Trimble TNL 2000, -3000

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Limited Warranty

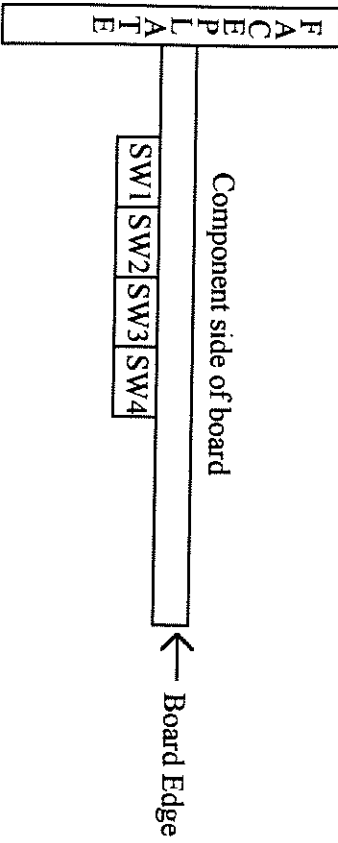
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FLOW METER PROCESSOR BOARD SWITCHES VERSION .61+

Hardware:	Software:
Processor Board 193802 Rev A	Flow Standard for Micro 60.08.59

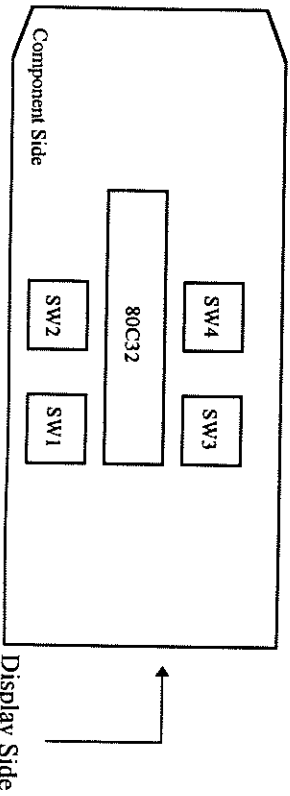
Location of the switches for the Micro Flow are as follows:



Each switch has 16 positions, 0-9,A,B,C,D,E,F.

Hardware:	Software:
Processor Board 190555 Rev B	Flow Standard for Mini 60.01.72
	Flow Standard for Digi 60.09.72
	Flow Standard for Micro 60.08.72

Location of the switches for the Mini/Digi Flow are as follows:



Each switch has 16 positions, 0-9,A,B,C,D,E,F.

Note: A hole has been cut into the can to allow access to switches normally covered by the red K factor sticker.

MANUAL ENTRY MODE FLOW METERS VERSIONS 61+

Overview

Previously, all settings depended upon the switches mounted on the processor board. Since software versions 60.XX.59, we have had a feature that is referred to as the *Manual Entry Mode*. In this mode, the Flow Meter settings are stored as two groups: *Group 1* and *Group 2* both shown in the table below.

Group 1	Group 2
Left & Right K Factors	Output Type (King, AirData, Arnav)
Fuel Units	Loran Input (On or Off)
Single or Twin Engine Type	Endurance Warning Time (45, 30, 20, 10, or 5 minutes)
Low Flow Cutoff (On or Off)*	Filter Type (Injector or Carburetor)
	Low Fuel Level Warning (fuel level for warning to be issued)
	Ignore Loran Warning (Yes or No)

* This function is only applicable to DC systems.

Group 1 may be set up in one of two ways. Either program the information into the non-volatile memory of the unit using *Manual Entry Mode* or use the switches to select the *Group 1* values.

Group 2 can no longer be set using the switches. These items must be set up by programming the unit in *Manual Entry Mode*.

Manual Entry Mode can be accessed in two ways, one which provides access to both *Group 1* and *Group 2* values, and one which provides access to only *Group 2* values. The access to *Group 2* values can be obtained while the unit is installed in the aircraft. Access to *Group 1* however, requires removal of the unit to adjust switch settings.

Operate Mode vs. Calibrate Mode*

FE. If Switch 1 is set to F and Switch 2 is set to E, the unit is in the *Calibrate Mode*. This is the only mode which will allow the setting of *Group 1* values into the non-volatile memory of the unit. Once installed in the aircraft, this mode is no longer accessible. In this mode, both Groups can be set.

FF: Once the settings have been programmed, Switches 1 and 2 should be set to *FF*. This is the *Operate Mode*, which is required for normal operations. In this mode, settings previously recorded for Groups 1 and 2 will be utilized, and not the switches. Group 2 can still be accessed through the manual entry mode, but Group 1 is not accessible.

* If neither of the above settings are used, the unit will be in Operate Mode and Group 2 information will be obtained from non-volatile memory. Group 1 information will be obtained from the current switch settings.

Manual Entry Mode

There are two ways to get to the Manual Entry Page.

1. Set Switches 1 and 2 to Calibrate Mode, and power up. This allows access to both groups.
2. If the Switches are not set to Calibrate Mode, while running under normal conditions, press the TEST/ENTER button to start the test mode. When the version is displayed, press and hold the TEST/ENTER button for 15 seconds. This allows access to Group 2 only.

In both cases you will the following:

MIN/DIG1 = "ENT" in the left window.

or

MICRO = "ENTRY" in the left window.

The display can now be paged through with the USED and REM buttons. The values displayed can be adjusted with the ADD and FULL buttons. ADD increments the value, and FULL decrements the value. As you hold ADD or FULL the scrolling rate will increase, up to a maximum speed.

If you wish to jump directly into the fastest scrolling speed, while holding either ADD of FULL, press USED/REM.

Once the desired values are selected, press and hold the TEST/ENTER button for 5 seconds. When the settings have been recorded to the non-volatile memory, the display will read "SET". At this point you may release the TEST/ENTER button.

Note: It is recommended that you leave the unit powered up for at least one minute, then set Switches 1 and 2 to Operate Mode (FF) and reboot (Power OFF/ON). Then confirm the settings.

The Manual Entry Pages will be displayed as follows. Symbols in () represent 7 segment characters.

Display	Description
*L xxxxx =	Left K-factor (where xxxxx is valid from 0 to 20,000. These are in 10's. A setting of 1234 would be a K-Factor of 12,340)
*R(r) xxxxx =	Right K-factor (as above)
A xxxxx =	Left Fuel Flow Offset Frequency (Hz) for Analog Models
B(b) xxxxx =	Right Fuel Flow Offset Frequency (Hz) for Analog Models
*U x =	Units: 0 = Gallons 1 = Liters 2 = Lbs 5.8 3 = Lbs 6.7 4 = Kilograms 5 = Lbs 6.5 6 = Lbs 6.35
*E x =	Engine Type: 0 = Single Engine 1 = Twin Engine
*C x =	Low Flow Cutoff: 0 = Off 1 = On
O x =	Output Type: 0 = Off 1 = KLN-88 2 = AirData 3 = Arnav 4 = Trimble 5 = Generic
I x =	Loran Input: 0 = Off 1 = On
D(d) x =	Endurance Warning Time: 0 = 45 minutes 1 = 5 minutes 2 = 10 minutes 3 = 20 minutes 4 = 30 minutes
F x =	Filter Type: 0 = Injector 1 = Carburetor
W (u) x =	Ignore Loran Warnings 0 = No (default) 1 = Yes
S xxxxx =	Low Fuel Level Warning: displayed in current units

* = Group 1 information.