Miniflo™

Digital Fuel Management System

OPERATING MANUAL

Single and Twin Engine Indicators

For P/N: 91202X-D

Shadin

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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™

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

1. GENERAL DESCRIPTION

Miniflo is a Digital Fuel 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).

Miniflo 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 THE SYSTEM PROVIDES

1.1.1 ENDURANCE

Miniflo calculates the time left to fly in hours and minutes based on the fuel remaining and the present fuel flow.

1.1.2 FUEL FLOW

The system provides a digital readout of the fuel 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.

1.1.3 FUEL USED

The system keeps track of the fuel used since the last fuel entry or reset.

1.1.4 FUEL REMAINING

The system keeps track of the fuel remaining on board. Fuel Remaining is equal to Initial Starting Fuel minus Fuel Used.

1.2 SYSTEM COMPONENTS

The system consists of two (2) basic units: the fuel flow transducer, 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, and stopped rotor will not interrupt fuel flow to the engine.

1.2.2 PANEL MOUNTED UNIT

All system electronics, function controls, and digital displays are contained in a single instrument that mounts in a standard 3¼" wide and 1¼" 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.

System Memory: The system 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.

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

1. The K-factor for the flow transducer in the left window, and the display units (i.e. gal, P5.8, P6.7) in the right window. Note: In the twin-engine models the K-factor for the right engine appears in the right window of the next display screen.

2. “FUL” appears in the left window and the maximum usable fuel in the right window.

3. Software version.

Note: Using the test function while engines are running will cause the computer to lose 17 seconds of fuel count.

2. PREFLIGHT PROCEDURES

Miniflo 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 the fuel tanks are filled up to the maximum usable fuel. The "FUL" fuel setting determines the maximum amount of fuel that can be entered by any method into the Miniflo.

PROCEDURE:

1. Power the unit up.

2. Move the FULL/ADD toggle switch to the FULL position and hold for the entire procedure.

3. Simultaneously press the ENTER/TEST button and move the REM/USED toggle switch to the REM position. The system will then count down for 15 seconds, displaying the count on the left in the display window.

4. The word "FUL" and the current full fuel value will appear in the display window. Release the ENTER/TEST button and REM/USED toggle switch. Keep holding the FULL/ADD toggle switch in the FULL position.

5. Move the REM/USED 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 will return to the operating mode. Release the FULL/ADD 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 will display the maximum usable fuel.

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

2.2 PREFLIGHT CHECK

Initiate the diagnostic software built into the system 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. The K-factor for the flow transducer in the left window, and the display units (i.e. gal, P5.8, P6.7) in the right window. Note: In the twin-engine models the K-factor for the right engine appears in the right window of the next display screen.

2. “FUL” appears in the left window and the maximum usable fuel in the right window.

3. Software version.

Note: Using the test function while engines are running will cause the computer to lose 17 seconds of fuel count.

Move the REM/USED 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 REM/USED 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

This automatically stores information concerning previous fuel levels, even in the case of a power down. If no fuel is added, no action is needed in updating fuel data.

2.4 FUEL TANKS FULL

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

Ramping Method

- Move the REM/USED toggle switch to the REM position and hold.
- 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.)
- Release the REM/USED toggle switch and the ENTER/TEST button to enter the total usable fuel on board into memory.
- If the required figure is exceeded, follow the procedure in this manual, section 2.6 Correcting Fuel on Board Entry Error.

FULL/ADD Toggle Switch Method

- Move the FULL/ADD toggle switch to the FULL position and hold.
- Press the ENTER/TEST button.
- Release the FULL/ADD toggle switch so it returns to the center position.
- To verify, move the REM/USED 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:

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

FULL/ADD Toggle Switch Method

- Move FULL/ADD toggle switch to ADD position and hold.
- Move REM/USED toggle switch to REM position to increment fuel added figure until amount of fuel added is reached.
- Press the ENTER/TEST button.
- Release the FULL/ADD toggle switch so it returns to the center position. The computer will add the added fuel remaining and use the total as the current fuel remaining.
- To verify, move the REM/USED 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 total usable fuel, move the REM/USED toggle switch to the USED position and simultaneously press and hold ENTER/TEST button. 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 it decrements). When the correct figure is reached, release both the REM/USED toggle switch and the ENTER/TEST button. To avoid repeating the four-

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

Note: Adding or subtracting fuel by any method resets the fuel used value to zero.

3. INFLIGHT OPERATIONS

3.1 INSTRUMENT OPERATION

3.1.1 FUEL FLOW

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 side of the display window. To read each engine's fuel flow separately, move the FULL/ADD switch to FULL position, and the REM/USED switch to USED position, simultaneously. Left and right fuel flow will be displayed only as long as you hold the switches together and upon release the unit will return to combined fuel flow after 3 seconds.

3.1.2 FUEL USED

Fuel used is displayed by moving the REM/USED 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

Fuel remaining is displayed by moving the REM/USED 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

Endurance is displayed in hours and minutes on the right display window except when viewing fuel remaining or fuel used information.

3.2 WARNINGS

3.2.1 LOW ENDURANCE

The Miniflo can be configured to display a warning based on the time remaining to fly. When the actual endurance is less than the pre-programmed Endurance Warning Time, the data in the right half of the display flashes. Press the ENTER/TEST button to acknowledge the warning. (Note: Resetting the Miniflo or adding fuel resets this condition and the warning is enabled again).

3.2.2 LOW FUEL REMAINING

The system displays “Lo FUEL” when the fuel remaining reaches the pre-programmed Low Fuel Level configured in setup. Fuel flow information will not be displayed again until the pilot acknowledges this message by pressing the ENTER/TEST button. Fuel calculations are not interrupted by this message. (Note: Resetting the Miniflo or adding fuel resets this condition and the warning is enabled again).

4. EMERGENCY PROCEDURES

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

5. ERROR MESSAGES

ERROR 1:

Due to the necessity of *Group 1* settings, if the Flow Meter is set to Operate Mode and the checksum of *Group 1* is bad, the display will flash: **E1**.

This refers to Error 1, *Group 1*. The flow meter will not continue to function after this point, and will continue flashing **E1**, alerting that the flow meter must be serviced.

NOTE: Remember it is possible to set group settings without having to be in entry mode; therefore, this error can be fixed by going into *Manual Entry Mode.*

6. CONFIGURATION DATA ENTRY

Manual Entry Mode

Ordinarily, the fuel flow indicator has been set up by the factory to match the K-factor of the supplied transducers and other set-up information. However, there are built-in provisions to change the set-up. Please be sure to define and document initial set-up before attempting to make changes.

Overview

Previously, all settings depended upon the switches mounted on the processor board. Currently, the Miniflo processor board and software version 60.01.XX has a feature that is referred to as *Manual Entry Mode*. In this mode, the Flow Meter settings are stored as two groups: *Group 1* and *Group 2*.

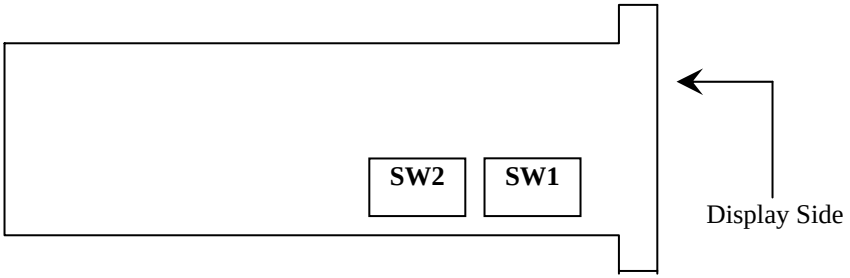
Group 1	Group 2
Left & Right K Factors	Output Type (King, AirData, Arnav)
Fuel Units	Loran Input (On, or Off)
Single or Twin Engine Type	Endurance Warning Time (45, 30, 20, 10, or 5 minutes)
Low Flow Cutoff (On or Off)*	Filter Type (Injector or Carburetor)
Left & Right Fuel Flow Offset Frequency*	Low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

*These functions are only applicable to DC systems.

Manual Entry Mode can be accessed in two ways: one providing access to both *Group 1* and *Group 2* values, and one providing 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.

Group 1: Generally, *Group 1* is set up by the distributor and contains information defined by the part number. However, although functions are defined here, do not change them without proper knowledge or they will affect performance of the indicator.

Group 2: Group 2 must be set up by programming the unit in *Manual Entry Mode*. Group 2 settings allow the user or installer to change Loran or GPS input and output parameters, endurance warning time, and fuel flow filtering types.
Locations of the switches for the Miniflo are as follows:



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

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

Operation Mode vs. Entry Mode

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

FF: Once the settings have been programmed, Switches 1 and 2 should be set to *FF*. This is the *Operation 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.

Switch	Entry Mode	Operation Mode
1	F	F
2	E	F
3	0	0
4	0	0

Manual Entry Mode

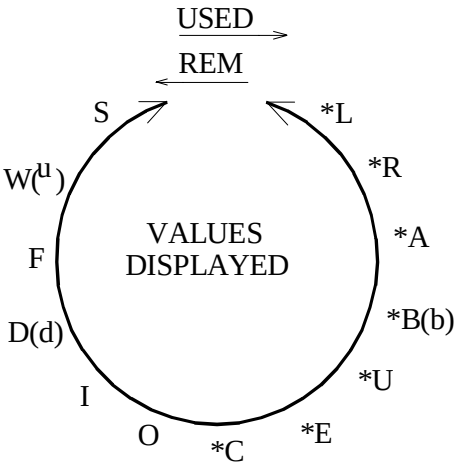
There are two ways to access the Manual Entry Page.

1. Set Switches 1 and 2 to Entry Mode and power up. This allows access to both groups.

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

In both instances, “ENT” will be displayed. When “ENT” appears release button.

The display can now be paged through using the fuel “USED” button to scroll forward or the fuel REM button to scroll back.



Note: See page 20 for description of parameters.

The values displayed can be adjusted with the FULL/ADD toggle switch. 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 the FULL/ADD toggle switch, press the fuel USED or fuel REM button.

Once the desired values are selected, press and hold the ENTER/TEST button while the upper window displays a count-down from 5 to 1. When the lower left window displays “SET,” release the ENTER/TEST button.

Note: It is recommended that you leave the unit powered up for at least one minute before turning the unit off. Reset switches 1 and 2 to Operate Mode (F,F) and reboot (Power ON). Then confirm the settings. The Manual Entry Pages will be displayed as follows. Symbols in ( ) represent 7 segment characters actually displayed.

Field K-factor adjust for Software Versions 60.01.72+

1. Remove the Miniflo from the instrument panel.

2. Remove the red label from the top of the Miniflo and save it to be put back in place after the adjustment is complete.

3. With a small, flat blade screwdriver change the hexadecimal switch (SW2) closest to the rear connector from position "F" to position "E".

4. Reconnect the unit to the aircraft harness and turn the aircraft master switch on. An "L" for the left engine will appear on the left side of the left window and the most significant digit of the K-factor on the right side of the same window. The rest of the K-factor minus the least significant digit will appear in the right window.

5. The K-factor values displayed can be adjusted with the FULL/ADD toggle switch located at the lower right corner. ADD increments the value, and FULL decrements the value.

6. Move the REM/USED switch at the lower center position to the USED position to move to page "r" for the right engine in twin engine aircraft and repeat Step 5.

7. Press and hold the ENTER/TEST button (located in the lower left corner) position for a five seconds countdown from 5 to 1. When the word "SET" appears, release the button and wait 30 seconds before turning the aircraft master switch off.

8. Change the SW2 (hexadecimal switch) closest to the rear connector back to the "F" position. Put the red label back on the can as it was before the K-factor adjustment.

9. Turn the aircraft master switch on again to test the system for changes made. When the fuel flow settles down to zero, press and hold the ENTER/TEST button until the “8’s” start to move across the screens then release the button. The first screen after “Good” and “Shadin” will display the K-factor for the left engine in the left screen while the right screen shows the units of measure (i.e. gallons, pounds, etc). The next set of screens will be blank on the left while the right displays the K-factor for the right engine (if applicable). If the correct K-factor is displayed, the procedure was successful.

Display			Description
*L	xxxxx	=	Left K-factor (where xxxxx is valid from 0 to 20,000. These are in 10s. A setting of 1234 would be a K-factor of 12,340)
*R	xxxxx	=	Right K-factor (as above).
*A	xxxxx	=	Left Fuel Flow Offset Frequency (Hz) for Analog Models Only
*B(b)	xxxxx	=	Right Fuel Flow Offset Frequency (Hz) for Analog Models Only
*U	x	=	Fuel Units are defined by the part number. Do not adjust these, as improper burn indication will occur. 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 1 = Twin
*C	x	=	Low Flow Cutoff: 0 = Off 1 = On NOTE: Will not display fuel flow until a rate of 50 pounds per hour is reached.
O	x	=	GPS/Output Type: Only used with Miniflo-L, which selects the serial data output type by GPS or Loran Manufacturer. 0 = none 1 = KLN series (Bendix/King) 2 = AirData, used to communicate with a Shadin Airdata computer 3 = Arnav, used to communicate with most Arnav Loran or GPS 4 = Trimble, used to communicate with most Trimble Loran or GPS 5 = Generic, used to communicate with most Garmin GPS
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, for engines equipped with a carburetor
W(")	x	=	Ignore Loran Warnings 0 = No (default) setting used with Shadin Flow Meter. With GPS, set to zero (0). 1 = Ignore Loran Warnings. Used with Foster Loran only.
S	xxxx	=	Low Fuel Level: Displayed in same units of measure as the flow rate.

* = Group 1 information ( ) = actual letter display. All others displayed as shown

7. SPECIFICATIONS

Certification:	TSO-C44a
Maximum usable fuel:	1,800 gallons 6,822 liters 9,999 lbs 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:	± 2%
Ground Speed Range:	27-600 knots
Functions:	Fuel Flow (selectable endurance warning) Fuel Used Fuel Remaining Full Fuel Add Fuel Endurance

ELECTRICAL RATING

Input Voltage:	14 – 28 VDC
Input Current:	200mA @ 14 VDC to 28 VDC

MECHANICAL RATING

Weight:	12 oz.
Dimensions:	3 ¼" x 1 ¼" x 7 ½"
Mounting:	Instrument Panel

PIN ASSIGNMENTS:

PIN	Miniflo P/N 91202X-D	TRANSDUCER 68050X	TRANSDUCER 6605XX
1	+14VDC or +28VDC (2A Circuit breaker)		
2	Airframe Ground		
3	Left/Single Fuel Flow Transducer Power (+12VDC to Transducer)	Red Wire (+12VDC input)	PIN A (+12VDC input)
4	Right Fuel Flow Transducer Power (+12VDC to Transducer)	Red Wire (+12VDC input)	PIN A (+12VDC input)
5	Ground to Left/Right Fuel Flow Transducer	Black Wire	PIN C
6	NC		
7	Left/Single Fuel Flow Transducer Signal	White Wire	PIN B
8	Right Fuel Flow Transducer Signal	White Wire	PIN B
9	NC		

8. WARRANTY INFORMATION

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Limited Warranty

Shadin warrants this instrument and system components to be free from defects in materials and workmanship for a period of one year from the user invoice date. Shadin will repair or replace any item under the terms of this Warranty, provided the item is returned to the factory prepaid.

This obligation assumed by Shadin under this Warranty is limited to repair, replacement or refund of the product at the sole discretion of Shadin.

This Warranty shall not apply to any product that has been repaired or altered by any person other than Shadin or that has been subjected to misuse, accident, incorrect wiring, negligence, improper or unprofessional assembly or improper installation by any person. ***This Warranty does not cover any reimbursement for any person's time for installation, removal, assembly or repair.*** Shadin retains the right to determine the reason or cause for warranty repair or replacement.

This Warranty does not extend to any aircraft, vehicle, boat, machine or any other device to which this Shadin product may be installed, connected, attached, interconnected or used in conjunction with in any way.

Shadin is not responsible for any shipping charges or damages incurred under this Warranty.

No representative is authorized to assume any other liability for Shadin in connection with the sale or resale of Shadin's products.

If you do not agree and accept the terms of this Warranty, you may return the product in new condition, with receipt, within thirty (30) days for a refund.

This Warranty is made only to the original user. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OR OBLIGATIONS: EXPRESSED OR IMPLIED. SHADIN EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. PURCHASER AGREES THAT IN NO EVENT SHALL SHADIN BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS OR LOSS OF USE OR OTHER ECONOMIC LOSS. EXCEPT AS EXPRESSLY PROVIDED HEREIN, SHADIN DISCLAIMS ALL OTHER LIABILITY TO PURCHASER OR ANY OTHER PERSON IN CONNECTION WITH THE USE OF PERFORMANCE OF SHADIN'S PRODUCTS, INCLUDING SPECIFICALLY LIABILITY IN TORT.**

Digital Fuel Management System Data (Miniflo)

Part Number: _____

Serial Number: _____

Left/Single Transducer Part or Kit Number: _____

Left/Single Transducer Serial Number: _____

Right Transducer Part or Kit Number: _____

Right Transducer Serial Number: _____

Installation Date: _____

Installed By: _____

Group 2 Configuration Selections

O	Serial Output Type	
I	Serial Input On/Off	
D(d)	Endurance Warning Time	
F	Filter Type	
W(u)	Ignore Loran Warnings	
S	Low Fuel Level	

NOTES:

P/N OP91202D

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