

Digiflo™

Digital Fuel Management System



OPERATING MANUAL Single and Twin Engine Indicators

For P/N: 91052XP

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.

Digiflo™

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

Digiflo 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).

Digiflo is set up to measure the flow of fuel in either gallons, liters, or pounds, 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

Digiflo 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 3 1/8" dia x 6.5" Deep 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 lower windows. All other functions are displayed on the upper 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 TEST/ENTER button and hold until “8’s” begin to appear across the display windows and then release. If the test is successful, the word “Good” will appear on the upper 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. In the twin engine models the left lower window displays the K-factor for the left engine, and the right lower window displays the K-factor for the right engine. The next screen displays the right engine K-factor again. This number must match the pulse count stamped on the fuel flow transducer otherwise all the readout will be inaccurate. The units (Gal, LB5.8, LB6.7, etc) display in the upper window.
2. “FUL” appears in the lower left window and the maximum usable fuel in the upper 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

Digiflo 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 Digiflo.

PROCEDURE:

1. Power the unit up.
2. Move the FULL/ADD toggle switch to the FULL position and hold for the entire procedure.
3. Press and hold both the REM and USED buttons, simultaneously. The system will then countdown for 15 seconds, displaying the count on the left display window.
4. The word “FUL” appears in the lower display window, and the current full fuel value appears in the upper display. Release the REM and USED buttons. Keep holding the FULL/ADD toggle switch in the FULL position.
5. Use the REM button to increment the full fuel number or the USED button to decrement the full fuel number. (The longer you hold the button, the faster the number will be updated.)

6. After reaching the correct total usable fuel figure, press the TEST/ENTER 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 TEST/ENTER 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

Diagnostic software is built into the system. To activate it, press the TEST/ENTER button and hold until "8's" begin to appear across the displays windows and then release. If the test is successful, the word "Good" will appear on the upper 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. In the twin engine models the left lower window displays the K-factor for the left engine, and the right lower window displays the K-factor for the right engine. The next screen displays the right engine K-factor again. This number must match the pulse count stamped on the fuel flow transducer otherwise all the readout will be inaccurate. The units (Gal, LB5.8, LB6.7, etc) display in the upper window.
2. "FUL" appears in the lower left window and the maximum usable fuel in the upper window.

3. Software version.

Press the USED button, and the system will display the fuel used since last fuel entry or fuel used since last reset.

Press the REM button, and 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

- Press the REM button and hold.
- Press the TEST/ENTER button to increment the fuel remaining until the total usable fuel is reached. (The longer you press, the faster the incrementing.)
- Release the REM button and the TEST/ENTER 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 TEST/ENTER button.
- Release the FULL/ADD toggle switch so it returns to the center position.
- To verify, press the REM button. The total usable fuel will be displayed on the upper window.

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:

- Press the REM button and hold.
- Press and hold TEST/ENTER button to increment fuel remaining until figure to be entered is reached; then release button.
- Release the REM button. 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 the FULL/ADD toggle switch to the ADD position and hold.
- Press the REM button to increment the fuel added figure until the amount of fuel added is reached.
- Press the TEST/ENTER 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, press the REM button. The current usable fuel remaining will be displayed on the upper window.

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, press and hold the USED button, and simultaneously press and hold TEST/ENTER 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 USED and the TEST/ENTER buttons. To avoid repeating the four-second pause before decrementing, hold the USED button, and use the TEST/ENTER 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

Fuel Flow is displayed continuously on the lower display windows.

3.1.2 FUEL USED

Fuel used is displayed by pressing the USED button. The information is shown on the upper display window as long as the button is held in the USED position. The display represents the fuel used since last reset.

3.1.3 FUEL REMAINING

Fuel remaining is displayed by pressing the REM button. The information is shown on the upper display window as long as the button is held in the REM position. 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 upper display window except when viewing fuel remaining or fuel used information.

3.2 WARNINGS

3.2.1 LOW ENDURANCE

The Digiflo 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 TEST/ENTER button to acknowledge the warning. (Note: Resetting the Digiflo 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 TEST/ENTER button. Fuel calculations are not interrupted by this message. (Note: Resetting the Digiflo 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 Digiflo processor board and software version 60.10.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* 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)
Left & Right Fuel Flow Offset Frequency*	Low Fuel Level Warning (fuel level for warning to be issued)
	Ignore Loran Warning (Yes or No)

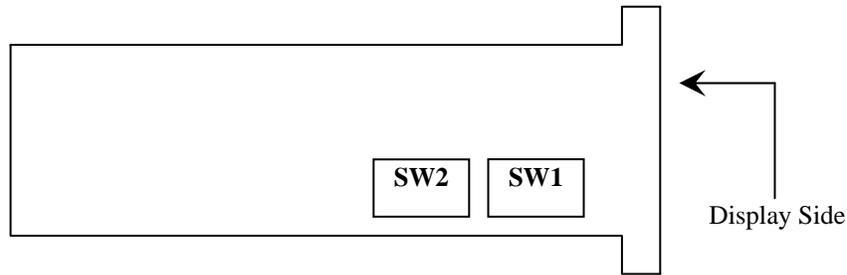
*These functions are only applicable to DC systems.

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 Digiflo 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

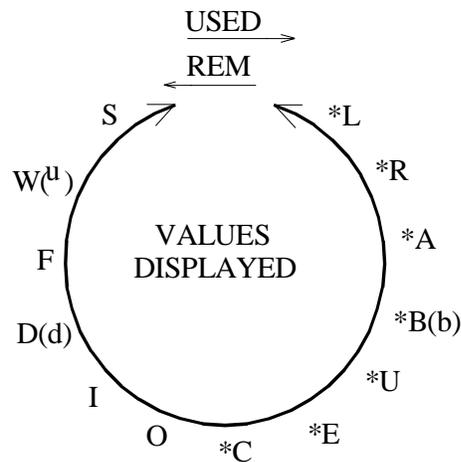
Manual Entry Mode

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 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 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 TEST/ENTER button while the upper window displays a countdown from 5 to 1. When the lower left window displays "SET," release the TEST/ENTER 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 60.10.72+

1. Remove the Digiflo from the instrument panel.
2. Remove the red label from the top of the Digiflo 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 lower left window and the most significant digit of the K-factor minus on the right side of the same window. The rest of the K-factor minus the least significant digit will appear in the upper window.

5. The K-factor values displayed can be adjusted with the FULL/ADD toggle switch. ADD increments the value, and FULL decrements the value.
6. Press the USED button to move to page “r” for the right engine in twin engine aircraft and repeat Step 5.
7. Press and hold the TEST/ENTER button (at the six o’clock position) for a five seconds countdown that will appear on the display. 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 TEST/ENTER 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 followed by a screen showing the K-factor for the right engine (if applicable). If the correct K-factor is displayed, the procedure was successful.

<u>Display</u>	<u>Description</u>
*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 Digiflo-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 ^(u) 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 xxxxx =	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

ELECTRICAL RATING

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

MECHANICAL RATING

Weight:	12 oz.
Dimensions:	3 1/8" DIA x 6.5" Deep
Mounting:	Instrument Panel

PIN ASSIGNMENTS:

PIN	Digiflo P/N 91052XP	Transducer 68050X	Transducer 6605xx
1	+28VDC (2A Circuit breaker)		
2	Airframe Ground		
3	FF Transducer Power (+12VDC to Transducer)	Red Wire	Pin A
4	NC		
5	TX RS-232		
6	TX RS-422 (+)		
7	NC		
8	TX RS-422 (-)		
9	NC		
10	Right/Rear Fuel Flow Signal Ground	Black Wire	Pin C
11	Left/Front Fuel Flow Signal Ground	Black Wire	Pin C
12	NC		
13	Right/Rear Fuel Flow Input (NC for single engine)	White Wire	Pin B
14	NC		
15	Left/Front Fuel Flow Input (Use for single engine)	White Wire	Pin B

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 (Digiflo)

Part Number: _____

Serial Number: _____

Left/Front/Single Transducer Part or Kit Number: _____

Left/Front/Single Transducer Serial Number: _____

Right/Rear Transducer Part or Kit Number: _____

Right/Rear 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^(t)	Ignore Loran Warnings	
S	Low Fuel Level	

NOTES:



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