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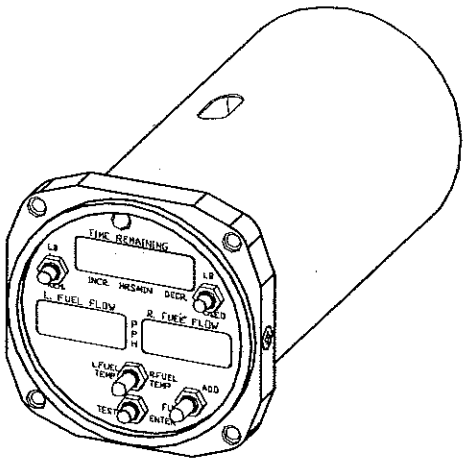
Digiflo™

Digital Fuel Management System With Temperature Compensation



Operation and Installation Manual

For P/N: 911218

Shadin Co., Inc.

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Shadin
COMPANY INCORPORATED
6831 Oxford Street
St. Louis Park, MN 55426
U.S.A.
Sales: (800)-328-0584
Technical Support: (800)-388-2849

Digiflo™

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

1. SYSTEM DESCRIPTION

DIGIFLO part number 911218 is a Digital Fuel Management System with Temperature Compensation designed to improve fuel monitoring and management. It utilizes a microprocessor to display fuel flow, fuel remaining, fuel temperature, fuel used, time remaining, and totals the fuel used within an accuracy of ± 2%.

The system tracks fuel usage in pounds and can be installed on virtually any turbine engine.

This system features solid-state microprocessor based electronic components designed to process pulses generated by the fuel flow transducer. The 911218 model also includes a temperature compensation feature that adjusts fuel flow for greater accuracy based on fuel temperature input.

Fuel flow is continuously displayed in the lower windows. Time remaining, fuel used, temperature, and fuel remaining are continuously computed and either displayed or stored for later display in the upper window.

During power shut down, the amount of fuel remaining is stored in a non-volatile memory that requires no power to retain the data.

Time remaining calculations are based on fuel remaining and actual fuel flow, which means reducing the power or leaning the mixture will result in an increase in the time remaining. If the calculated time remaining at any particular power setting drops below a selected endurance time, the "Time Remaining" digits in the display window will start flashing.

1.1 FUEL FLOW TRANSDUCER:

The fuel flow transducer mounted in the fuel line measures the flow of fuel and generates electrical impulses directly proportional to the fuel flow. The transducers are fail-safe designed; rotor locking will not interrupt fuel flow.

1.2 INDICATOR:

All system electronics, function controls, and digital displays are contained in a single instrument that mounts in a standard 3 1/8" hole and requires no periodic maintenance, adjustment, or calibration once properly installed.

2. INITIAL PROGRAMMING

Initial programming is intended to enter the total usable fuel figure into the memory as defined in the flight manual. Extra attention must be paid to aircraft with reduced fuel load devices. This "full" value can then be recalled whenever you fill the fuel tanks up to the maximum usable fuel.

2.1. INITIAL PROGRAMMING PROCEDURE:

1. Power the unit by switching on the aircraft master switch.

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

3. Press the fuel "REM" and fuel "USED" buttons simultaneously. The system will then count down for 15 seconds, displaying the 15-second count in the lower left window.

4. The code message "FUL" will be displayed in the lower left window and the current full fuel value in the same unit of display (lbs.) will be shown in the upper window. Release the fuel "REM" and fuel "USED" buttons while continuing to hold "ADD/FULL" toggle switch.

5. Press the fuel "REM" button to increment the full fuel number or the fuel "USED" button to decrement it. The longer the button is pressed, the faster it is 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" will disappear and the computer will return to the operate mode. Release the "ADD/FULL" 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 newly entered maximum usable fuel value during its self-test routine. See section 3.5 for more information on test functions.

3. PREFLIGHT PROCEDURES

Prior to flight, one or more of the following steps are required to ensure accurate fuel measurement. Sections 3.1, 3.2, 3.3, and 3.4 apply to procedures for updating and inputting fuel data. 3.1 concerns no fuel being added, 3.2 concerns entering data for the maximum usable fuel amount, 3.3 describes the procedure for updating the correct fuel amount after partial fuel has been added, and 3.4 describes the procedure for correcting errors occurring in the data entry for usable fuel amounts. Section 3.5 describes the procedure to check the system for software and hardware malfunctions.

WARNING

DIGIFLO is a fuel flow measuring system and NOT a quantity-sensing device. Therefore, it cannot determine the amount of usable fuel in the fuel tanks. Thus, it is imperative that an accurate figure of the usable fuel on board be entered into the system to ensure accurate readings.

3.1 NO FUEL ADDED:

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

3.2 MAXIMUM USABLE FUEL (FULL TANK):

If you have filled the fuel tanks, perform the following procedure to get the Digiflo to set the fuel remaining to the full fuel amount.

1. Move the "ADD/FULL" toggle switch to the "FULL" position and hold. The maximum usable fuel figure will be displayed in the upper window.

2. Press the "TEST/ENTER" button.

3. Return the toggle switch to the center position.

4. To verify, push the fuel "REM" button. The total usable fuel will be displayed in the upper window.

3.3 PARTIAL FUEL ADDED:

If you have added some fuel, but not completely filled the tanks, follow this procedure to add the same amount of fuel to the Digiflo.

1. Move the "ADD/FULL" toggle switch to the "ADD" position and hold.

2. Press the fuel "REM" button to increment the added fuel figure. When the added fuel figure amount is reached, release the fuel "REM" button. If the correct figure has been exceeded, press the fuel "USED" button to decrement the added fuel figure.

3. Press the "TEST/ENTER" button when the correct figure is reached.

4. Return the "ADD/FULL" toggle switch to the center position. The computer will add the fuel added to the fuel remaining and use the total as the current fuel remaining.

5. To verify, press the fuel "REM" button; current usable fuel remaining will be displayed in the upper window.

3.4 CORRECTING FUEL REMAINING FIGURE ENTRY ERRORS:

In the event that an error has been made by exceeding the correct amount in entering the amount of total usable fuel, press and hold the fuel "USED" button and simultaneously press the "TEST/ENTER" button. Fuel used will be reset and the fuel remaining will appear and pause on display for 4 seconds. The figure will decrement. When the correct figure is reached (the longer you press, the faster it decrements), release both fuel "USED" and "TEST/ENTER" buttons. To avoid repeating the 4 second pause while decrementing, do not release the fuel "USED" button, but use the "TEST/ENTER" button to control the decrementing.

3.5 TEST FUNCTION:

The Test Function enables the pilot to check the software and hardware against malfunction.

Press the "TEST/ENTER" button and hold until "8's" begin to appear across the display windows and then release. If the test is not successful, the word "bAd" will be displayed and the unit must be considered unserviceable until corrective action is taken. If the computer checks out, the word "Good" will appear in the top window. This will be followed by:

1. The K-factor setting for the left flow transducer in the left flow window, the K-factor setting for the right flow transducer in the right flow window, and units of display, lbs., in the upper window.

2. Maximum usable fuel setting in the upper window and "FUL" in the left window.

3. Temperature displayed in the left and right fuel flow windows.

4. Software basic # 60.04.78 and revision level in lower windows.

NOTE: Using the test function while engines are running will cause the computer to lose 13 seconds of fuel count.

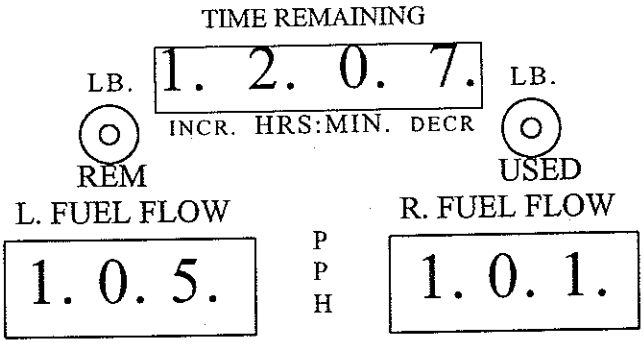
4. IN-FLIGHT OPERATIONS

4.1 INSTRUMENT OPERATION:

The fuel flow is continuously displayed in the lower windows. The upper window displays the time remaining in hours and minutes. Fuel remaining is displayed by pressing the fuel "REM" button and fuel used can be displayed by pressing the fuel "USED" button. The time remaining will return once the "REM" or "USED" button is released.

The Left and Right Fuel Temperatures can be displayed in the upper window by pressing the fuel temperature toggle switch toward the side you intend to indicate.

When the Digiflo is displaying a value too large to fit in the available number of digits on the display, the value will be shifted such that the tens digit occupies the right most position, and all digits will have the decimal points lighter.



Example:

- The upper window display would be a value of 12,070 Lbs.
- The left fuel flow window would be a value of 1,050.
- The right fuel flow window would be a value of 1,010.

4.2 WARNINGS:

4.2.1 ENDURANCE LEVEL WARNING:

The time remaining display digits will flash whenever the actual endurance is less than the pre-programmed LOW ENDURANCE WARNING level. Dash lines in the time remaining window indicate that there are over ten (10) hours of flight time remaining.

4.2.2 LOW FUEL LEVEL WARNING:

If fuel drops below the pre-programmed level, the left fuel flow indicator will display "LoF" and the right fuel flow indicator will display "UEL." In the event that fuel is added and again drops below the desired level, the identical warning message will appear again. Example of window display:

L. FUEL FLOW	R. FUEL FLOW
L o F	U E L

4.3 EMERGENCY PROCEDURE:

In case of an electrical power failure in flight, the instrument will cease to function. Once power is restored, the left window will resume accurate fuel flow reading. However, the Time Remaining, Fuel Used, and Fuel Remaining figures 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 figure.

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: **EO1**

This refers to Error 1, or *Group 1*. The flow meter will not continue to function after this point, and will continue flashing **EO1**, alerting the flow meter must be serviced.

ERROR 2:

The Flow Meter will still be accurate and operate under NON-LORAN pages if the checksum of *Group 2* is bad. In this case, under any Loran page, the Loran information will be replaced by: **EO2**.

This display refers to Error 2, or *Group 2*. This is to alert the pilot that the Flow Meter does have valid Loran and Output selections, and therefore can not rely on Loran and Output Information.

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
Flow Meters Versions 61+

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

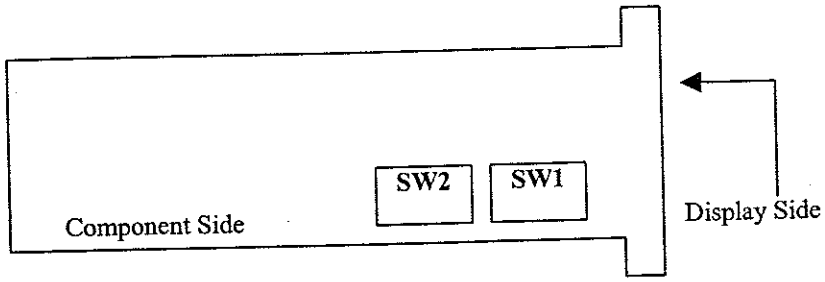
Previously, all switches depended upon the switches mounted on the processor board. Currently, the Digiflo processor board 310550 and software version 60.04.78 has a feature that is referred to as *Manual Entry Mode*. In this mode, the Flow Meter settings are stored as two groups: *Group 1* and *Group 2*.

Group 1: 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.

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.

The locations of the switches for the Digiflo 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.

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

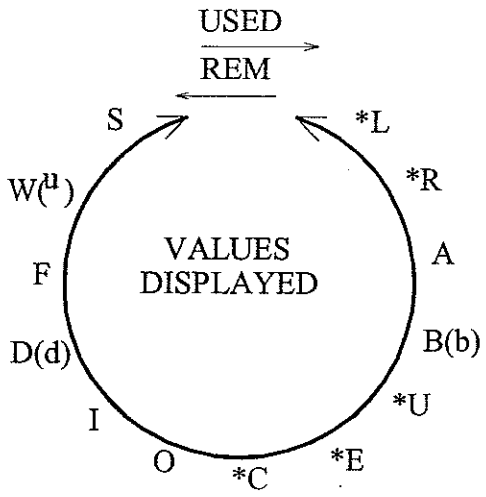
There are two ways to access the Manual Entry Page.

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 cases, "ENT" will be displayed in the left window.

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



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

Once the desired values are selected, press and hold the "TEST/ENTER" button until the display counts down from 5 to 1 and the display no longer reads "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 (F,F) and reboot (Power OFF/ON). Then confirm the settings. The Manual Entry Pages will be displayed as follows. Symbols in ( ) represent 7 segment characters actually displayed.

Display			Description
*L	xxxx	=	Left K-factor: Number of pulses per gallon (PPG) the Digiflo sees. Displayed in lower left window. Note: K-factor range for Right and Left is 500-120,000. The values displayed are divided by ten. A display of 50 would equal 500 and 12,000 would equal 120,000. Use this K-factor for single engine.
*R	xxxx	=	Right K Factor: As above, displayed in the lower right window. Use this K-factor for twin engine. In aircraft with front and rear engines, use left K-factor for front and Right K-factor for rear.
A	xxxx	=	Left Fuel Flow Offset used for DC linear Fuel Flow Systems only.
B(b)	xxxx	=	Right Fuel Flow Offset used for DC linear Fuel Flow Systems only.
*U	x	=	Fuel Units are defined by the part number. Do not adjust these as improper burn indication will occur.
*E	x	=	Engine Type: 0=Single 1=Twin
*C	x	=	Low Flow Cutoff: 0=Off 1=On Note: For Analog or DC systems. Once set to "On", the Digiflo will not display fuel flow until a rate of 50 pounds per hour is reached.
0	x	=	GPS/Output Type: Only used with Digiflo L which selects the serial data output type by GPS or Loran manufacturer. 0 = none 1 = Allied Signal, , KLN series. 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	=	GPS/Loran Input 0 = Off 1 = On
D(d)	x	=	Endurance Warning Time: as explained in section 4.2.1 0 = 45 minutes 1 = 5 minutes 2 = 10 minutes 3 = 20 minutes 4 = 30 minutes
F	x	=	Filter Type 0 = Injector, for engines not equipped with a carburetor.

			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 0. 1 = Ignore Loran Warnings. Used with Foster Loran only.
S	xxxx	=	Low Fuel Level: Displayed in same unites of measure as the flow rate.

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

7. SPECIFICATIONS

Fuel Flow Indicator with Temperature Compensation, Part Number: 911218

Certification:	TSO-C44a
Maximum Usable Fuel:	12,070 Lbs.
Maximum Altitude:	40,000 ft.
Operating Temperature:	-30°C to +50°C
Humidity:	up to 95% @ 32°C
Accuracy:	±2%
Fuel Flow Range:	Dependent on engine model.
Functions:	Fuel Flow (selectable endurance warning) Fuel Used Fuel Remaining Time Remaining Low Fuel Warning Full Fuel Add Fuel Left and Right Fuel Temperature
Electrical Rating:	
Input Voltage	14-28 VDC
Input Current:	110mA @ 14VDC to 28 VDC
Physical Dimensions:	
Face Size:	3.1 inches round
Length:	6.3 inches, including connector
Weight:	12 ounces, 336 grams

8. WARRANTY INFORMATION

6831 Oxford Street
St. Louis Park, MN 55426

Limited Warranty

Shadin Co., Inc. 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 Co., Inc. 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 Co., Inc. under this Warranty is limited to repair, replacement or refund of the product at the sole discretion of Shadin Co., Inc.

This Warranty shall not apply to any product that has been repaired or altered by any person other than Shadin Co., Inc. 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 Co., Inc. 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 Co., Inc. product may be installed, connected, attached, interconnected or used in conjunction with in any way.

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

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

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P/N OM1218 REV -