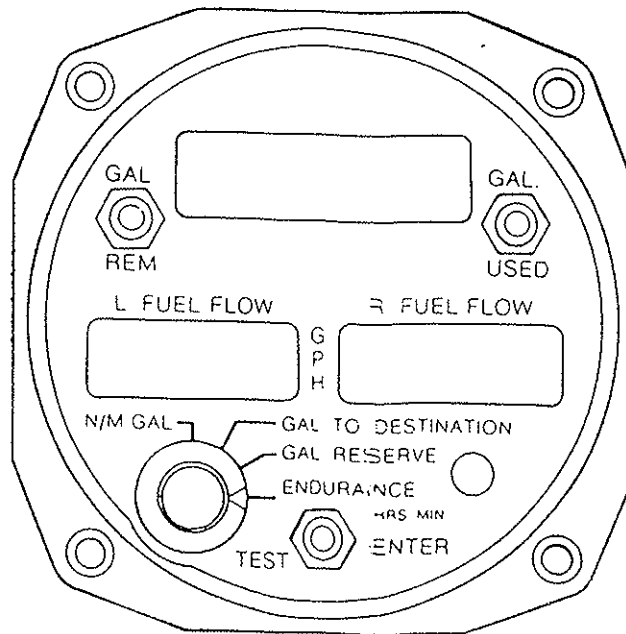


DIGIFLO-L<sup>TM</sup>

DIGITAL FUEL MANAGEMENT SYSTEM  
FOR OPERATION WITH THE LORAN-C RECEIVERS



O P E R A T I N G     M A N U A L

FOR P/N'S: 91053X

SHADIN Co., Inc.

## TABLE OF CONTENTS

Section		Page
1.	System Description	3
2.	Preflight Procedures	5
3.	Inflight Operations	7
4.	Specifications	9
5.	Warranty Information	10

SHADIN Co., Inc.

6950 Wayzata Boulevard, Minneapolis, MN 55426, USA  
Phone: (612) 544-6422 Telex: 290852 (SHADIN SLPK)

TM  
DIGIFLO-L

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

## 1. GENERAL DESCRIPTION

DIGIFLO-L is a Digital Fuel Management System designed to provide complete Fuel Management information under real flight conditions without any manual entry of data (except for the initial fuel on board information). It is connected to the engine Fuel Flow Transducer for Fuel Flow information and to the Loran-C receiver serial port for navigation data (ground speed, distance and estimated time enroute).

The system is available with either gallons or pounds readouts, and it can be installed virtually on any reciprocating or turbine engine by selecting the proper size Fuel Flow Transducer.

### 1.1 The SYSTEM PROVIDES:

1.1.1 Specific Range: in NM/Gal. or NM/10 Lb. of Fuel Burned. This is an indication of how efficient is the cruise and the optimum cruise speed could be obtained by selecting the power setting which yields the highest NM/Gal.  $\text{Specific Range} = (\text{G/S Kt.}) / \text{Fuel Flow}$

1.1.2 Fuel to Destination: It calculates (under the real wind conditions) the Fuel necessary to reach the destination as selected on the Loran receiver by multiplying the Fuel Flow by the ETE to the destination. (If an intermediate way point is selected for navigation purposes the displayed "Fuel to Destination" represents the fuel needed to reach the intermediate waypoint.

1.1.3 Fuel reserve: The system calculates the amount of Fuel which will be available on board when the aircraft reaches its destination as indicated on the Loran-C receiver way point. This feature provides the pilot with the necessary information to evaluate the reserve fuel situation based on accurate information early enough to take the necessary action.  $\text{Reserve Fuel} = \text{Fuel on Board} - \text{Fuel to Destination}$  (See above note for intermediate waypoints).

1.1.4 Endurance: The system calculates the time left to fly in hours and minutes based on the fuel on board and fuel consumption.  $\text{Endurance} = (\text{Fuel available in gallons}) / (\text{Fuel Flow in GPH})$ .

- 1.1.5 Fuel Remaining: The system keeps track of the fuel remaining on board. Fuel Remaining = Initial starting fuel minus used fuel.
- 1.1.6 Fuel used: The system keeps track of the fuel used since the last fuel entry.
- 1.1.7 Not Enough Fuel: The system will flash the top window display digits (when the rotary switch is in the Fuel to Destination 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 the destination.
- 1.1.8 Fuel reserve will be Used: The system will flash the display digits (when the rotary switch is in either Fuel to Destination or Reserve Fuel 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 Fuel Reserve to reach destination.
- 1.1.9 Fuel Flow: The system provides a digital readout of the Fuel Flow per hour for each engine to a tenth of a gallon up to 100 gallons and to the nearest gallon above 100 gallons. For LB/HR versions the readout is to the nearest LB up to 999 LB/HR and to the nearest 10 LB above 999 lb/hr.

1.2 SYSTEM COMPONENTS: The system consists of 3 basic units.

1.2.1 FUEL FLOW TRANSDUCER:

The fuel flow transducer(s) mounted in the fuel line(s) measure the flow of fuel and generates electrical pulses directly proportional to the amount of fuel flow. The transducers are fail-safe designed; rotor blockage will not interrupt fuel flow to the engine.

1.2.2 LORAN-C RECEIVER:

The Loran-C receiver provides ground speed, distance and estimated time enroute 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 3-1/8" hole and requires no periodic maintenance, adjustment or calibration once properly installed.

THE DISPLAY: The Fuel Flow is always displayed at the lower windows. The top window displays all other functions with the priority for the rotary switch functions.

SYSTEM MEMORY: The system includes a non-volatile memory for retaining the basic settings, the Fuel remaining and Fuel Used during the power shut down which require no electrical power for retaining the information.

### 1.3 TEST FUNCTION:

A diagnostic software is built into the system and is initiated by pressing the "TEST" button; the program checks the hardware and the display. If the test is successful a "Good" is displayed on the top window, if not a "bAd" is displayed. The system is considered unserviceable until a 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 for each engine in the respective flow window (pulse count/gallon). This number must match the pulse count stamped on the Flow Transducer otherwise all the readout will be inaccurate.
3. The display units (Gal., LB 5.8, LB 6.7 etc.) as part of checking the internal settings.
4. The Loran-C distance as shown on the Loran-C receiver to check the Data Interface Integrity. If the system is not capable of reading the Loran-C data the word "LbAd" will be displayed on the top window.

The use of the test functions while the engines are running, the system to lose 18 seconds of the fuel count.

## 2. PREFLIGHT PROCEDURES

DIGIFLO-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 must. Therefore, it is imperative that the determined available usable fuel be manually entered into the system.

## 2.1 PREFLIGHT CHECK

Initiate the diagnostic software built into the system by pressing the "TEST" button; the program checks the hardware and the display. If the test is successful a "Good" is displayed on the top window, if not a "bAd" is displayed. The system is considered unserviceable until a 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 for each engine in the respective flow window (pulse count/gallon).
  3. The display units (Gal., LB 5.8, LB 6.7 etc.) as part of checking the internal settings.
  4. The Loran-C distance as shown on the Loran-C receiver to check the Data Interface Integrity. If the system is not capable of reading the Loran-C data the word "LbAd" will be displayed on the top window.
- . Press "Gallons Used" button; upper window will display gallon used since last reset.
  - . Press "Gallons Remaining" button; upper window will display gallons of fuel remaining onboard. Pilot should confirm this figure with actual fuel onboard.

## 2.2 NO FUEL ADDED

As data is already stored, no action is needed.

## 2.3 FUEL TANKS FULL

- \* Press the "Gal. REM." button 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 "Gal. Rem." and "Enter/Test" button and the total usable fuel onboard is entered into memory.

## 2.4 PARTIAL FUEL ADDED

Add the amount of fuel remaining to the amount of fuel from the refueling meter. Enter the number as follows:

- \* Press "Gal. Rem." button and HOLD.
- \* Press "Enter/Test" button to increment the fuel remaining until the figure to be entered is reached; then release the "ENTER" button
- \* Release "Gal. Rem." button. The total usable fuel onboard is entered into memory.

## 2.5 CORRECTING INPUT ERROR

In case an error has been made by exceeding the correct amount in entering the number for total usable fuel, press and hold down "Gal. Used" button and simultaneously press and hold "Enter/Test" button. Gallons used will be reset and the fuel remaining will appear on display for 4 seconds. The figure will decrement until the correct figure is reached (the longer you press, the faster the decrementing), then release both the "Gal. Used" and "ENTER" buttons.

To avoid repeating the 4 seconds pause before decrementing, do not release the "Gal. Used" button but use the "Enter" button to control the decrementing.

## 3. INFLIGHT OPERATIONS:

### 3.1 INSTRUMENT OPERATION:

3.1.1 THE FUEL FLOW will be displayed continuously on the lower windows

3.1.2 ENDURANCE could be selected by rotating the knob clockwise to the last position, the endurance is displayed in hours and minutes

3.1.3 FUEL USED is displayed by pressing the top right button; information shown on the top window (as long as the button is pressed) and shows the fuel used since last reset

3.1.4 FUEL REMAINING is displayed by pressing the top left button; information shown on the top window (as long as the button is pressed). The display represent the fuel remaining on board at the time of reading.

3.1.5 NAUTICAL MILES per GALLON is selected by rotating the knob counter-clockwise to the last position; information shown on the top window.

3.1.6 FUEL TO DESTINATION is selected by positioning the knob to the second position clockwise; information shown on the top window and it represents the fuel needed to the active waypoint selected on the LORAN-C receiver provided that the aircraft ground speed and fuel flow remain constant and moving in a straight line. (Readings obtained during climb and decent are invalid).

3.1.7 FUEL RESERVE is selected by positioning the knob to the third position clockwise; information shown on top window and it represents the fuel that is going to be available when the aircraft reaches its destination as indicated on the selected waypoint provided that the aircraft ground speed fuel flow and direction remain constant and at the same altitude. Readings obtained during climb and decent are invalid.

### 3.2 WARNINGS:

3.2.1 FUEL NOT ENOUGH: When the knob is on the Fuel to Destination position, the top window display flashes if the fuel on board is not enough to reach the destination as selected on the active waypoint. The display shows the amount of fuel short to reach the destination preceded by a negative sign.

A search for a more suitable destination could be done by selecting different destinations and monitoring the "Fuel to Destination" until a reachable destination could be found.

3.2.2 RESERVE FUEL WILL BE USED: When the knob is on the reserve fuel position, the top window display flashes if the aircraft will arrive to the destination with less than 45 minutes fuel, calculated at the same present cruise power setting.

3.2.3 NOT ENOUGH ENDURANCE: When the knob is on the endurance position, the top window display flashes if the time remaining to fly at the present power setting is less than 30 minutes.



=====  
INSTALLATION PROCEDURE  
=====

GENERAL

A complete thorough familiarization and understanding of the system is necessary before commencing the installation. All work must conform to A. C 43.13-1A ch. 11, Sec. 2, 3, 7 requirements.

This procedure is limited and is to be used when P/N 91053X indicator is to be installed and interfaced to one of the compatible Loran-C navigation receiver.

PROCEDURE

1. Install the system as outlined under installation procedure including the wiring and circuit breaker.
2. Install the Loran-C receiver using the original manufacturer installation drawings, procedure, applicable STC's and advisory circular AC 20-121.
3. For the IIMORROW Loran-C receiver:  
The wire labeled "Loran Signal" must be connected to pin 6 of the Loran Receiver rear connector on model 611, 612, 614P and the Serial Port BNC connector on model 614.
4. For the ARNAV Loran-C receiver:
  - A. R-40:  
The wire labeled "Loran Signal" must be connected to pin 3 (TXD) RS-232C. Pin 16 (RTS) and pin 17 (CTS) must be jumpered.
  - B. R-60  
The wire labeled "Loran Signal" must be connected to J2 pin B. Jumper pin A (DTR) to pin G (CTS).
  - C. R-21/DMS  
The wire labeled "Loran Signal" must be connected to pin 3 (TXD). Jumper pin 17 (CTS) to pin 1 (power input)

=====

INITIALIZATION:

Refer to the Operator's Manual (for the individual receiver) to set and initialize the RS-232C output to the following settings (all performed from the receiver front panel):

- a: STD complete navigation information.
  - b: U field (update) to 1 (every one second).
  - c: C field (character) to 120 (1200 baud).
  - d: PW field (page width) to 1 (unformatted data) with carriage return and line feed.
- All the parameters are stored in the receiver memory.

5. For the ANI model 7000:  
Refer to ANI installation manual for model 7000  
Connect the wire labeled "Loran Sig" to 2J6 pin A.  
Set the baud rate switch (on interface board) S3 to OFF and S4 to ON to obtain 1200 baud.
6. For the TEXAS INSTRUMENT model 9100:  
Connect the wire labeled "Loran Sig" to P18 pin 8. Pin 25 (CTS) to be jumpered to pin 7 (RTS).
7. Turn the D.C. power on to power the Fuel Management Indicator and the Avionics Master to power the Loran-C Receiver.
8. To check that the fuel management indicator is able to read the Loran data press the Test button, the system will run the diagnostic program and will display the word GOOD (if the test is successful and the word BAD if not) followed by the k-factor setting, units of measure (Gal., Lb.) the distance as read from the Loran-C. If unable to read the distance the word "LbAd" will be displayed.
9. Make necessary entry into the Airframe Log.

1

#### 4. SPECIFICATIONS

Digital Fuel Flow Meter Part Number 91053X

##### SPECIFICATIONS:

Maximum usable fuel:	900 gallons
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 Kt.
Functions	Fuel Flow (30 minutes endurance warning. Fuel Used Fuel Remaining (Fuel not enough to reach destination. Endurance NM/Gal. Fuel to Destination Fuel Reserve (Fuel reserve will be used.

##### ELECTRICAL RATING:

Input voltage:	14-28 volt D.C.
Input current:	500 ma @ 14V. or 28V. Avg.

##### ELECTRICAL INTERFACE:

RS-232-C

##### MECHANICAL RATING:

Vibration:	5g
Weight:	Panel Unit: 1.3 lb.