

DigiData™

Digital Fuel Management System &
Airdata Computer



Operating Manual



Note

Before using this information and the product it supports, be sure to read the section covering the product warranty.

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6831 Oxford Street
St. Louis Park, MN 55426
USA

Sales: (800)-328-0584
Technical Support: (800)-388-2849

While every precaution has been taken in the preparation of this manual, Shadin assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained herein.

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

WARNING

***DigiData* 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. It is imperative that an accurate figure of usable fuel on board be entered into the system to ensure accurate readings.**

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

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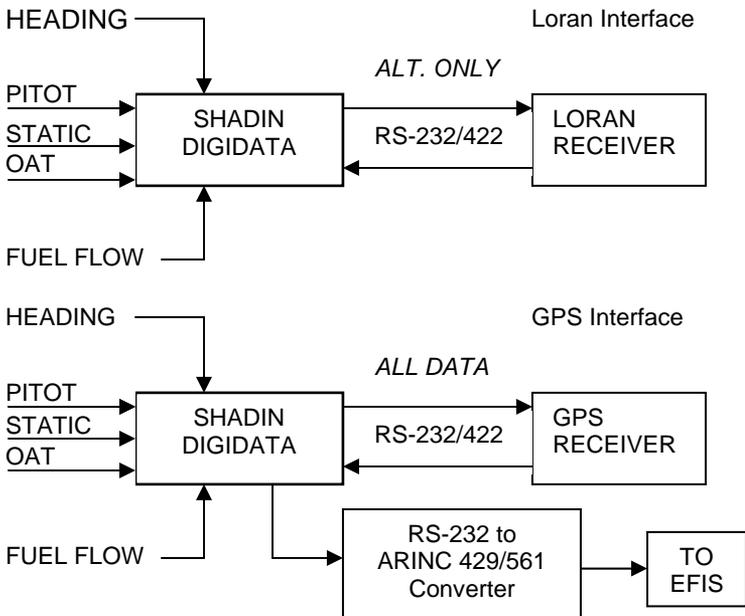
1.0 General Description

The DigiData 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). It is connected to the engines fuel flow transducers for fuel flow information and to a Loran-C or GPS receiver serial port for navigation data (ground speed, distance, and estimated time enroute). Additionally, the Loran-C or GPS receiver supplies information required for some of the DigiData's Airdata functions (i.e. winds aloft, drift, etc.).

The system is designed to measure the volume 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 or interface.

With an OAT probe, Pitot/Static connection, and heading input, the DigiData is capable of calculating heading, rate of turn, pressure altitude, density altitude, baro corrected altitude, outside air temperature, true (static) air temperature, vertical speed, indicated airspeed, true airspeed, mach and wind speed/direction.

DigiData System Schematics



2.0 DigiData Features and Components

The system consists of the fuel flow transducers, a navigational receiver (Loran-C or GPS), the panel mounted unit, heading input, OAT probe, and a Pitot/Static connection.

The Fuel Flow Transducer mounted in the fuel line measures the flow of fuel and generates electrical pulses directly proportional to the amount of fuel flow. The transducer is fail safe designed; rotor locking will not interrupt fuel flow to the engine.

The Loran-C or GPS receiver provides ground speed, distance, and estimated time enroute through the serial port.

The heading input, Pitot/Static connection and OAT probe allow the DigiData to perform its Airdata functions.

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

The system includes a non-volatile memory that retains fuel remaining information, display brightness settings, the currently selected Airdata page, and the latest barometric pressure setting. All of these parameters are retained when the power to the unit is shut down.

A dot matrix variable brightness display is used on the DigiData. The fuel flow is always displayed in the top window. All other functions are displayed in the bottom window.

3.0 Fuel Management Functions

- 3.1 *Cruise Efficiency:*** The efficiency is displayed in nautical miles per gallon, nautical miles per ten pounds, nautical miles per 5 liters, or nautical miles per 5 kilograms depending upon which display units have been pre-configured. This is an indication of how efficient the cruise is and the optimum cruise speed can be determined by selecting the power setting that yields the highest nautical miles per fuel unit.
- 3.2 *Fuel to Destination:*** The system calculates (under 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 enroute to the destination. (Note: Some Loran-C or GPS receivers transmit intermediate waypoint data. If an intermediate waypoint is selected for navigation purposes the displayed fuel to destination represents the fuel needed to reach the intermediate waypoint. This is also true for Fuel Reserve calculations.)
- 3.3 *Fuel Reserve:*** The system calculates the amount of fuel that 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.
- 3.4 *Endurance:*** The system calculates the time left to fly in hours and minutes based on the fuel remaining and the present fuel flow.
- 3.5 *Fuel Remaining:*** The system keeps track of the fuel remaining on board. Fuel Remaining is calculated by subtracting the fuel used from the initial starting fuel.
- 3.6 *Fuel Used:*** The system keeps track of the fuel used since the last fuel entry or reset.
- 3.7 *Fuel Flow:*** The system provides a digital readout of the fuel flow per hour to a tenth of a gallon up to 99.9 gallons/hour and to the nearest gallon above 100 gallons/hour. For other fuel units (lbs. for example), the readout is to the nearest lb. up to 999 lbs./hour and to the nearest 10 lbs. above 999 lbs./hour.

4.0 Airdata Functions

- 4.1 *Airdata Pages:*** Several Airdata functions have been incorporated into the DigiData. These functions include Pressure Altitude, Density Altitude, Baro Corrected Altitude, Instantaneous Vertical Speed, Indicated Airspeed, True Airspeed, Mach, Outside Air Temperature, True Air Temperature, Heading, Rate of Turn, Wind Component and Wind Direction/Speed. All of these functions can be accessed when the rotary switch is in the AIRDATA position provided that all of the pages are enabled (see section 9.4). The ADD/FULL switch is used to page through the functions.
- 4.2 *Navigational Receiver Pages:*** In addition to Airdata functions, the AIRDATA position allows access to navigational data as it is received from a Loran-C or GPS receiver. These include Ground Speed, Distance to Destination (or waypoint), Track (Magnetic or True depending on the GPS) and Magnetic Variation. These pages are included for your convenience, as well as providing a way to view the data that is used in many of the DigiData's calculations.

5.0 Description of Airdata Functions

- 5.1 Pressure Altitude (PA):** The pressure altitude measures altitude in feet referenced to mean sea level (MSL). The reading is affected by atmospheric pressure (see barometric corrected altitude). The pressure altitude can be used by your GPS Receiver for automatic altitude aiding. This provides uninterrupted 24-hour 3D positioning with only three satellites in range.
- 5.2 Density Altitude (DA):** The density altitude readout is necessary to calculate the aircraft's take off and landing performance. This is useful since aircraft performance is dependent on density altitude, not pressure altitude.
- 5.3 Barometric Corrected Altitude (BA):** Barometric pressure changes caused by changes in the weather can lead to errors in the altitude readings. The current barometric pressure at sea level in inches of mercury can be entered into the DigiData. Subsequent readings will display barometric corrected altitude based on your entry.
- 5.4 Instantaneous Vertical Speed (IVS):** This is a real time display of vertical speed expressed in 10-foot increments.
- 5.5 Indicated Airspeed (IAS):** Indicated airspeed measures the aircraft's speed through the air in knots. Indicated airspeed displays readings directly from the pitot air pressure.
- 5.6 True Airspeed (TAS):** True airspeed is indicated airspeed corrected for density altitude.
- 5.7 Air Temperature (OAT/TAT):** The outside air temperature (OAT, also known as total air temperature) is the reading from the aircraft's outside air temperature probe. The DigiData provides static air temperature (TAT, or true air temperature) at speeds above 20 knots. Due to the friction between the air and the outside temperature probe, the temperature rise must be subtracted from the OAT. This correction yields the TAT, sometimes called static air temperature (SAT).
- 5.8 Heading (HDG):** This displays the current magnetic heading expressed in degrees.

- 5.9** **Rate of Turn (ROT):** This feature is intended for checking the turn portion of the turn and bank indicator. The calibration of a turn indicator is based on the fact that when the needle is under the tent, the plane is doing a 3-degree per second turn. This can be confirmed by monitoring the DigiData's rate of turn display.
- 5.10** **Winds Aloft/Wind Component (W/WCOMP):** The winds aloft display gives a continuous reading of prevailing wind direction (in degrees) and speed (in knots). This display is continuous as long as the aircraft is not in a turn, and is not accelerating or decelerating. The head or tailwind component is derived as a difference between ground speed in relation to airspeed.
- 5.11** **Magnetic Variation (MVAR):** Magnetic variation from GPS.
- 5.12** **Nautical Miles Per Gallon ($\frac{N}{M/G_L}$):** Nautical Miles per Gallon is an indication of cruise efficiency when display units have been pre-configured to gallons.
- 5.13** **Barometric Pressure (Hg or mB):** Barometric pressure set to local conditions.
- 5.14** **Ground Speed (GSP):** Ground Speed from GPS.
- 5.15** **Track (TRK):** Magnetic track indication from GPS.
- 5.16** **Distance to Destination (DIS):** Distance to destination (or waypoint) from GPS.
- 5.17** **Mach Airspeed (MACH):** Airspeed in MACH units derived from True Airspeed.

6.0 Configuration

In most cases your DigiData will be pre-configured according to the parameters specified when it was purchased. A special harness is required to allow access to the configuration mode. The configuration settings should only be changed under the direction from a Shadin technical support staff member, or from the location where you purchased your DigiData. The configuration mode allows access to the following options:

Left K-Factor and Offset

Right K-Factor and Offset

Display Units (Gallons, Liters, Lbs. 5.8 or 6.3 or 6.5 or 6.7, Kilograms)

Engine Type (Single or Twin)

Filter Type (Normal or Carb.)

Loran Input Type (i.e. Trimble, Arnav, Garmin, Foster, Northstar, Bendix, etc.)

Loran Output Format (i.e. Format X, Format Z, Generic, Surveyor, Bendix C, Bendix D, etc.)

Serial Port Baud Rate (9600, 1200, 2400, 4800)

Pressure Altitude Correction (aircraft model will determine the Static Source Error Correction to use – SSEC)

Low Endurance Warning Time (10-45 min. in 5 min. increments)

Low Fuel Warning Level (0-500 Gal.)

Barometric Pressure Units (In. Hg or Millibars)

Out Probe Type (Shadin = 0, Ros 1, Ros 2)

Fuel Flow Delay (0-45 sec. in 5-sec increments)

NCD STAT (NCD or OK)

OAT A=X; B=Y; C=Z where X, Y, and Z are Shadin OAT correction codes.

To enter the configuration mode:

1. Connect the special configuration harness to the DigiData.
2. Press and hold the TEST/ENTER button until the DigiData enters the test mode. At the end of the normal test mode displays, the unit will display "System Setup" and enter the configuration mode.
3. The ADD/FULL switch is used to page through the options. Use the USED and REM buttons to scroll through the selections (or to increase/decrease the value in the case of the K-Factors and Offsets and Low Fuel Warning).
4. Once all of the desired selections have been made, press and hold the TEST/ENTER button until the message "Saving Changes" appears. The DigiData will reset, and the new selections will now be in effect.

7.0 Test Function

Diagnostic software is built into the system. To activate it, press the TEST/ENTER button and hold until all of the display digits are filled with this pattern: $\ddot{y} \ddot{y} \ddot{y} \ddot{y} \ddot{y} \ddot{y} \ddot{y} \ddot{y}$. Examining this pattern will allow you to detect any malfunctioning pixels of the dot matrix display.

If the self-test is successful, the word "GOOD" will appear in the lower display window.

If the test is not successful, the word "BAD" and an error message identifying the error will be displayed. In such a case, the unit should be sent in for repair.

The test is followed by a series of displays that list the current configuration of the DigiData. These displays include:

Software Version

The K-Factor settings (PPG)

The units of measure (gal., liters, lbs., kilos)

Engine Type (single, twin)

Loran Input Type

Loran Output Type

Baud Rate

Filter Type (normal, carburetor)

Endurance Warn Time (45 min., 40, 35, 30, 25, 20, 15, or 10)

Low Fuel Level Warning (in current units)

Barometric Pressure Units

OAT Probe Type

Fuel Flow Delay

NCD STAT

OAT A=X; B=Y; C=Z where X, Y, and Z are Shadin OAT probe correction codes.

Note: Using the test function while the engine is running will cause the DigiData to lose about 40 seconds of fuel count.

WARNING

***DigiData* 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. It is imperative that an accurate figure of usable fuel on board be entered into the system to ensure accurate readings.**

8.0 Initial Programming

The DigiData 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.

Initial programming is intended 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.

NOTE: If fuel load limiting devices are used, the full fuel value should be changed accordingly whenever these devices are installed or removed.

8.1 Initial Programming Procedure:

1. Power up the unit.
2. Turn knob to ENDURANCE position.
3. Simultaneously press the TEST/ENTER button, the FULL button and the REM button.
4. The system will count up from 0 to 15 while displaying the count in the lower display.
5. After the count up to 15, the display will read "RELEASE SWITCHES." At this time, release all of the switches, you are now in Full Fuel Entry Mode.
6. The display will read "PROGRAM FUL" and the current full fuel value will appear in the lower display. Use the USED button to increase the value and the REM button to decrease the value. The longer you hold the switches, the faster the number will be updated.
7. After reaching the correct total usable fuel, press the TEST/ENTER button and the display will read "Saving Changes." The Full Fuel amount is now saved.

9.0 Preflight Check

9.1 TEST-ENTER Test

Initiate the diagnostic software built into the system by pressing the TEST/ENTER button. If the test does not pass, corrective action should be taken.

9.2 Fuel Remaining (REM.) and Fuel Used (USED)

Press the REM button. The system will display the fuel remaining on board. The pilot should confirm this figure with the actual fuel on board.

Press the FUEL USED button. The system will display the fuel that has been used since the last adjustment of the fuel remaining. See section 10 for fuel remaining adjustment methods.

9.3 Barometric Pressure Setting

The current barometric pressure can be programmed if barometric corrected altitude (BA) readings are desired. Move the rotary switch knob to the AIRDATA position. Use the ADD and FULL buttons to move through the Airdata pages until the barometric pressure is displayed (in inches mercury Hg or millibar mB). If programmed for Hg, the display will read:

Hg 29.92

29.92 is the default if no previous entries have been made. If a previous entry has been made, the stored value will be used. This value will also be retained after the DigiData has been powered down. To enter a new value, simultaneously press and hold the TEST/ENTER button and then the ADD button. The display will change to:

→ 29.92

Use the USED button to increment the value and the REM button to decrement the value. The values will be limited to a range of: 28.10 – 30.99. Once the desired value is reached, press the TEST/ENTER button. The barometric corrected altitude will now use the current setting for its calculations.

Note: If the TEST/ENTER button is not pressed within 10 seconds of changing the value, it will reset to its original setting (the value before entering the entry mode). This entry mode may be accessed during flight without any degradation to the fuel flow calculations.

9.4 Selection of Displayed AIRDATA Pages (Optional)

In software versions 93.10.72 and up, the DigiData provides a Selection Mode feature to enable or disable which AIRDATA pages are displayed during normal operation. Once a page is disabled it will remain disabled until enabled again.

To access the Select Mode:

- 9.4.1 Set the rotary switch in the AIRDATA position.
- 9.4.2 Simultaneously press and hold the FUEL REM and FUEL USED switches, the upper display window will show "SELECT" and the lower "AIRD 1". The digit will increment for fifteen (15) counts until an AIRDATA page is displayed. Release the switches.
- 9.4.3 Hold the TEST-ENTER switch for approximately one (1) second to enable or disable the currently displayed page. Pages shown with asterisk "****" are selectable and enabled, pages shown with "... " are enabled and not selectable, and pages shown with "are disabled and selectable.
- 9.4.4 To save the selected pages, simultaneously press and hold the FUEL REM and FUEL USED switches for approximately one (1) second. Normal operation mode is now enabled.

All AIRDATA pages are selectable EXCEPT:

| | |
|-------------------------|----------|
| True Airspeed | TAS |
| Outside Air Temperature | OAT |
| Wind Direction / Speed | W---/--- |

10.0 Filling the Tank

There are two methods to fill the tank; the full fuel method, or the add method.

10.1 Full Fuel Method

This should be used when the tanks are filled to the maximum usable fuel level (as programmed into the DigiData as Full Fuel in the “Initial Programming” section).

1. Turn the rotary switch knob to FUEL TO DESTINATION, FUEL RESERVE, or ENDURANCE position.
2. Press the FULL button and hold. Press the ENTER/TEST button.
3. The display will flash “FUL” and the full fuel value to confirm entry.
4. To verify, press the REM button. Total usable fuel will be displayed.

10.2 Add Method

This should be used to add partial fuel or to correct the current tank quantity.

1. Turn the rotary switch knob to FUEL TO DESTINATION, FUEL RESERVE, or ENDURANCE position.
2. Press and hold the ADD button.
3. Use the USED button to increment the value and the REM button to decrease the value. The DigiData will limit this value as follows: (Full Fuel Value – Fuel Remaining).
4. Once the desired figure has been reached, press the ADD button and hold. Then, press the TEST/ENTER button. The lower display will flash to confirm the entry has been stored.
5. To verify, press the REM button. The current usable fuel remaining will be displayed.

WARNING

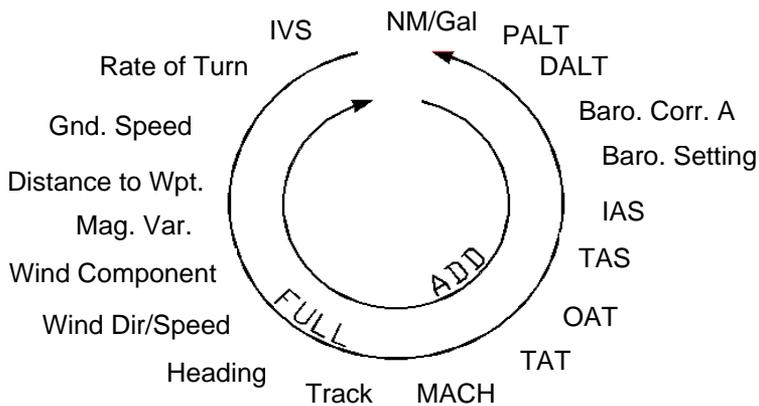
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11.0 In Flight Operations

- 11.1 Fuel Flow:** Fuel Flow is displayed continuously in the top window. If the DigiData is configured for a single engine aircraft, the right flow figure will be dashed “---.”
- 11.2 Display Brightness:** The display brightness can be changed at any time by pressing and holding the DIM/BRIGHT button while using the ADD button to brighten the display and the FULL button to dim the display. For convenience, this brightness setting is saved in non-volatile memory and will be used the next time the DigiData is powered up.
- 11.3 Fuel Used:** Fuel used is displayed by pressing the USED button. The information is shown in the lower window as long as the button is held, and for three seconds after the button is released. The display represents the fuel used since last reset or addition of fuel.
- 11.4 Fuel Remaining:** Fuel remaining is displayed by pressing the REM button. The information is shown in the lower window as long as the button is held, and for three seconds after the button is released. The display represents the fuel remaining on board at the time of reading.
- 11.5 Endurance:** Endurance is selected by rotating the rotary switch knob to the ENDURANCE position. Endurance is displayed in hours and minutes in the lower window.
- 11.6 Fuel to Destination:** Fuel to destination is selected by rotating the rotary switch knob to the FUEL TO DESTINATION position. The information is shown in the lower window and it represents the fuel needed to reach the active waypoint selected on the Loran-C or GPS receiver, provided that aircraft's ground speed and fuel flow remain constant and moving in a straight line. (Readings obtained during a climb or descent are invalid for both fuel to destination and fuel reserve.)
- 11.7 Fuel Reserve:** Fuel Reserve is selected by rotating the rotary switch knob to the FUEL RESERVE position. The information is shown in the lower window, and it represents the fuel that is going to be available when the aircraft reaches the active waypoint selected on the Loran-C or GPS receiver, provided that ground speed and fuel flow remain constant and the aircraft is moving in a straight line (Readings obtained during a climb or descent are invalid for both fuel to destination and fuel reserve).

11.8 Nautical Miles Per Gallon: Nautical miles per gallon is located in one of the Airdata pages. Select the AIRDATA position with the rotary switch knob. Use the ADD and FULL buttons to move through the Airdata pages until the “NM/GL” display appears.

11.9 Airdata Functions: moving the rotary knob to the AIRDATA position can access all selected AIRDATA functions (see section 9.4 for more information). Use the ADD and FULL switch to move through the Airdata pages until the desired function is displayed. Prior to editing, the pages are arranged as follows.



12.0 Warnings

- 12.1 *Not Enough Fuel:*** When the rotary switch knob is in the FUEL TO DESTINATION position, the information in the display window flashes if the fuel on board is not enough to reach the destination selected as the active waypoint. The display window shows the amount of fuel short to reach the destination preceded by a negative sign. A search for a more suitable destination (in the same direction) can be done by selecting different destinations on your GPS receiver. Monitor the Fuel To Destination figure until a reachable destination is found.
- 12.2 *Low Endurance:*** The DigiData can be configured to display a warning based on the time remaining to fly. For example, if the “Low Endurance Warning” is configured to 45 minutes, a warning will flash if the time remaining to fly at the present power setting is less than 45 minutes. The warning “Endur. Low” will flash on the lower window. This warning occurs regardless of the currently selected function on the rotary switch knob. Press the TEST/ENTER button to acknowledge the warning. Once the warning is acknowledged it will not be displayed in the future (Note: Resetting the DigiData or adding fuel resets this condition and the warning is enabled again).
- 12.3 *Low Fuel Remaining:*** The DigiData can be configured to display a warning based on the fuel remaining. For example, if the “Low Fuel Warning” is configured to 20 gallons, a warning will flash if the fuel remaining is less than 20 gallons. The warning “Fuel Rem Low” will flash on the lower window. This warning occurs regardless of the currently selected function on the rotary switch knob. Press the TEST/ENTER button to acknowledge the warning. Once the warning is acknowledged it will not be displayed in the future (Note: Resetting the DigiData or adding fuel resets this condition and the warning is enabled again).

13.0 System Failure Warnings

Return the unit for repair if any of the following warnings appear at power up:

- ROM BAD Service
- RAM BAD Service
- SerialEE Checksum
- SerialEE CommFail
- SerialEE LevelBad
- EE S BAD
- EE D BAD

14.0 Emergency

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

WARNING

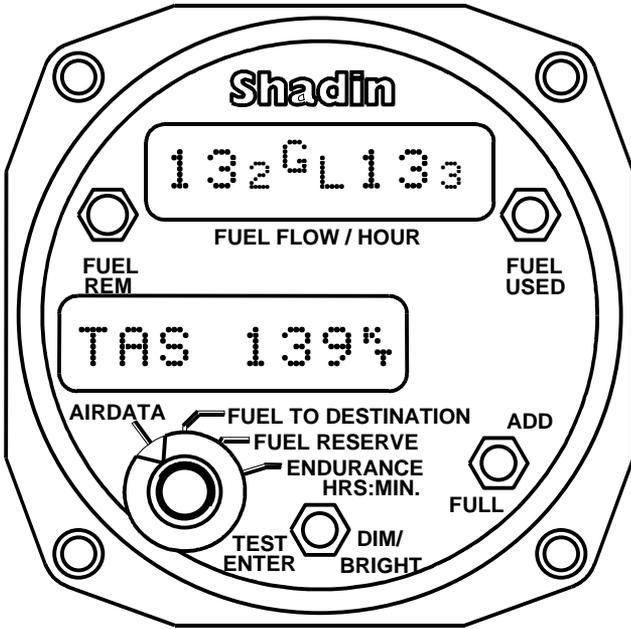
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15.0 DigiData Specifications

DigiData P/Ns: 912802-XX

| | |
|----------------------|--|
| Size: | 7.6" Deep x 3.3" Square (face) x 3.2" Diameter (can) |
| Power: | 14 VDC, 900 mA 28 VDC, 1300 mA |
| Weight: | (DigiData) 17 oz. (typical) (Transducer) 16 oz. |
| Flow Rate: | Up to 450 GPH |
| Maximum usable fuel: | 2980 gallons |
| Maximum altitude: | 50,000 ft. |
| Maximum airspeed: | 350 knots |
| Humidity: | up to 95% @ +32 degrees C |
| Accuracy: | Better than 2% |
| Serial Interface: | RS-232 or RS-422 |
| Environmental: | RTCA DO-160B |
| Software: | RTCA DO-178A, Level II |
| TSO Category: | C106, C44a |

16.0 Face Plate Diagram



Use this diagram as a reference while reading the manual.

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 to 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 OR PERFORMANCE OF SHADIN'S PRODUCTS, INCLUDING SPECIFICALLY LIABILITY IN TORT.



6831 Oxford Street
St. Louis Park, MN 55426

Sales: (800) 328-0584
Technical Support: (800) 388-2849
www.shadin.com

MANUAL NO: OM2802

REV G