Fuel Flow/Pressure
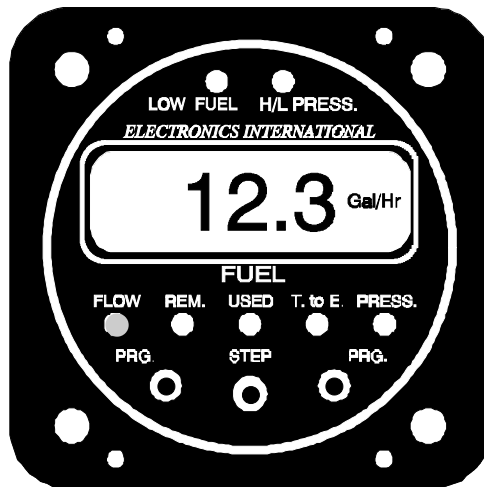## *(FP-5 and FP-5L)*
Operating Instructions

OI 0505931

> **You must read this manual before installing or operating the instrument. This manual contains warranty and other information that may affect your decision to install this product and/or the safety of your aircraft.**

Electronics International Inc. ®

63296 Powell Butte Hwy • Bend, OR 97701 • (541) 318-6060 • Buy-EI.com

FP-5 and FP-5L
<u>Important Notice</u>

********** Must Read **********

   <u>If you think it is not important to read this manual, you're wrong!</u> This manual contains important information that may affect the safety of your aircraft.

   <u>Read the Warranty / Agreement</u>. There is information in the Warranty / Agreement that may alter your decision to install this product. <u>If you do not accept the terms of the Warranty / Agreement, do not install this product</u>. This product may be returned for a refund. Contact Electronics International inc. for details.

   <u>The fuel remaining displayed by the FP-5 is not a measurement of the fuel in the tanks.</u> It is an amount calculated from the starting fuel level you programmed into the FP-5, minus the fuel used while the engine was running. When properly calibrated, the FP-5 can accurately measure the fuel used. **It is imperative the pilot verify the calibration of the FP-5 over many tanks of fuel before using the "REM" and/or "USED" Modes as an indication of the fuel in the tanks or fuel used. Even after verifying the calibration of the FP-5 it should never be used as the primary indicator of fuel quantity in the tanks. It is important the pilot visually check/ measure the fuel quantity for each tank before takeoff and crosscheck these readings against the Fuel Level Gauges and the FP-5.** The FP-5 reminds you to do this by blinking the "REM" LED and displaying the current fuel remaining in the tanks each time the aircraft power is turned on. **Also, it is important the pilot use preflight and flight planning techniques, in accordance with the FAR's, which will help insure the proper amount of fuel for the intended flight is on board the aircraft before takeoff.**

   While in flight the FP-5 readings should only be used to crosscheck the fuel level gauges, calculations of the fuel onboard from flow rates specified in the specification for your aircraft and calculations of the fuel onboard from flow rates that you measured from previous flights. The use of the FP-5 does not eliminate or reduce the necessity for the pilot to use good flight planning, preflight and in-flight techniques for managing fuel. If you are not familiar with these techniques, contact the FAA to acquire proper training.

   It is possible for any instrument to fail thereby displaying inaccurate high, low or jumpy readings. Therefore, you must be able to recognize an instrument failure and you must be proficient in operating your aircraft safely in spite of an instrument failure. If you do not have this knowledge, contact the FAA or a local flight instructor for training.

   The pilot <u>must</u> understand the operation of this product before flying the aircraft. Do not allow anyone to operate the aircraft that does not know the operation of this product. <u>A copy of this manual must be kept in the aircraft at all times.</u>

Contents

Warranty / Agreement

Electronics International 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. <u>Fuel Flow and Pressure Transducers are NOT covered under this warranty</u>. They are covered by the original equipment manufacture. Electronics International Inc. will repair or replace any item covered under the terms of this Warranty provided the item is returned to the factory prepaid.

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

2. This warranty does not extend to any machine, vehicle, boat, aircraft or any other device to which the Electronics International Inc. product may be connected, attached, interconnected or used in conjunction with in any way.

3. The obligation assumed by Electronics International Inc. under this warranty is limited to repair, replacement or refund of the product, at the sole discretion of Electronics International Inc.

4. Electronics International Inc. is not liable for expenses incurred by the customer or installer due to factory updates, modifications, improvements, upgrades, changes, or any other alterations to the product that may affect the form, fit, function or operation of the product.

5. Personal injury or property damage do to misinterpretation or lack of understanding this product is solely the pilots responsibility. The pilot <u>must </u>understand the operation of this product before flying the aircraft. Do not allow anyone to operate the aircraft that does not know the operation of this product. Keep the Operating Manual in the aircraft at all times.

6. E. I. Inc. is not responsible for shipping charges or damages incurred under this Warranty.

7. No representative is authorized to assume any other liability for Electronics International Inc. in connection with the sale of Electronics International Inc. products.

8. <u>If you do not agree to and accept the terms of this warranty, you may return the product for a refund.</u>

This Warranty is made only to the original user. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OR OBLIGATIONS: EXPRESS OR IMPLIED. MANUFACTURER EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. PURCHASER AGREES THAT IN NO EVENT SHALL MANUFACTURER BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS OR LOSS OF USE OR OTHER ECONOMIC LOSS. EXCEPT AS EXPRESSLY PROVIDED HEREIN, MANUFACTURER DISCLAIMS ALL OTHER LIABILITY TO PURCHASER OR ANY OTHER PERSON IN CONNECTION WITH THE USE OR PERFORMANCE OF MANUFACTURER'S PRODUCTS, INCLUDING SPECIFICALLY LIABILITY IN TORT.
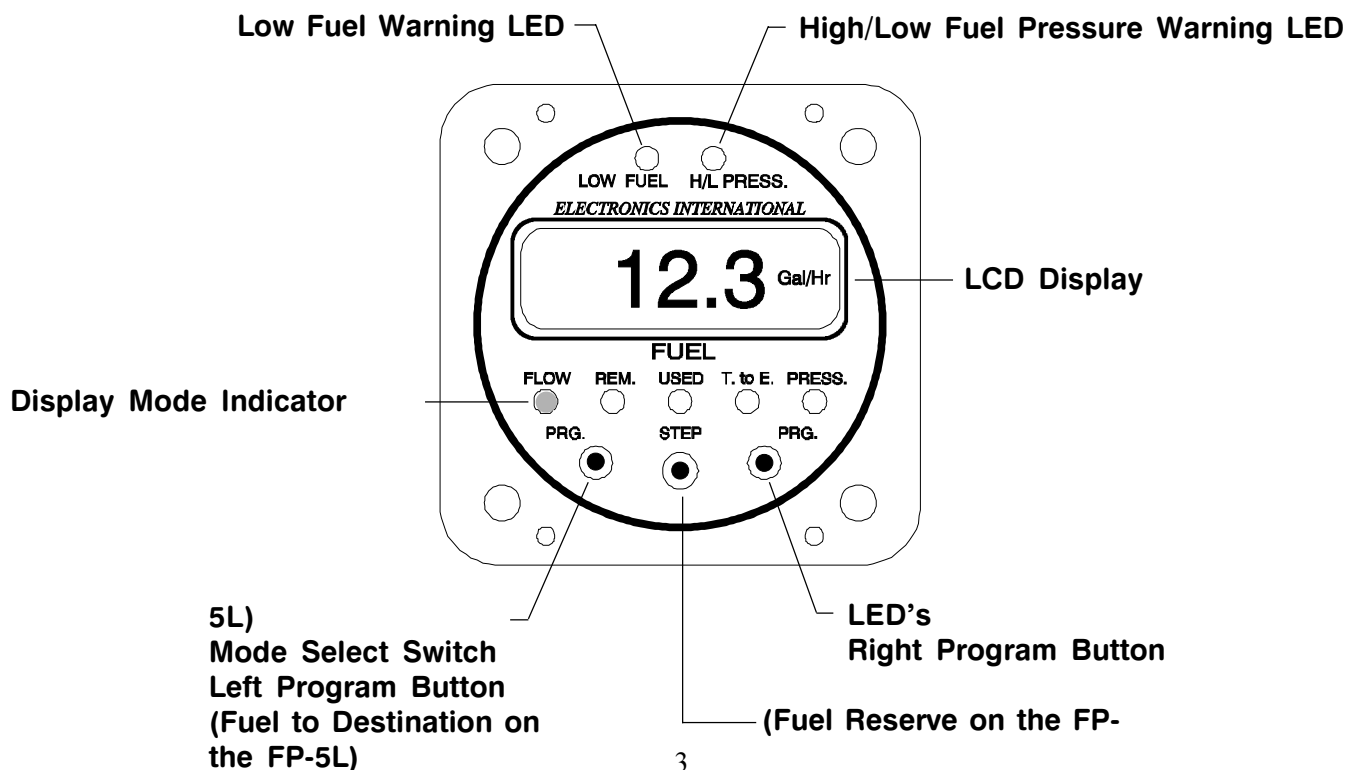
FP-5 and FP-5L
Operating Instructions

System Description:

The FP-5 and FP-5L are models of fuel flow computer and pressure instruments packaged in a 2.5" by 2.5" by 3.65" depth case. Each connects to a fuel flow transducer and a fuel pressure transducer which are mounted in the engine cowling area. The fuel pressure transducer is optional and is required only if fuel pressure is to be monitored.

The fuel flow transducer is mounted in the fuel line going to the carburetor (or flow divider on an injected engine). If the rotor in the flow transducer becomes blocked, it will not reduce the flow of fuel to the engine. The FP-5 instrument connects to the transducers via a wire harness. The instrument and transducers employ connectors so they may be removed safely and quickly from the aircraft.

The FP-5 and FP-5L have five display modes: Fuel Flow, Fuel Remaining, Fuel Used, Time to Empty, and Fuel Pressure. The FP-5L has all the feature of the FP-5 with two additional display modes: Fuel to Destination and Fuel Reserve. In addition to these five display modes both units have the following pilot programmable modes: Full Fuel Level, K Factor, Filter, Display Update Time, Loran/GPS Interface (FP-5L only), Display in Gallons, British (Imperial) Gallons, Pounds or Liters, Fuel Remaining, two Low Fuel Alarms, Time to Empty Alarm, High Fuel Pressure Alarm, and a Low Fuel Pressure Alarm. Although the FP-5 and FP-5L are simple to operate, the 11 pilot programmable modes make them very effective and sophisticated fuel management systems.

Note: After the FP-5 or FP-5L has been installed in an aircraft it should be programmed initially as described in the "Initial Programming" section of the Installation Manual.

Low Fuel Warning LED

High/Low Fuel Pressure Warning LED

LCD Display

Display Mode Indicator

5L)
Mode Select Switch
Left Program Button
(Fuel to Destination on
the FP-5L)

LED's
Right Program Button

(Fuel Reserve on the FP-

Display Modes and Operating Features:

1. Digital LCD Display and LED Display Mode Indicators:

If the digital LCD display backlight has been permanently powered up (as recommended), the display will be easier to see during low ambient light conditions and at night. In direct sunlight the digital LCD display is easy to see.

During night operation the green LED Display Mode Indicators may be too bright. If so, turn the panel light rheostat up and the LED's will dim. The two red Warning LED's will always be displayed at full intensity.

2. Low Fuel Warning LED:

There are two pilot programmable Low Fuel Reminder Limits that will blink the red Low Fuel Warning LED when violated. One may be set for a low fuel level and the other may be set for a time to empty value (see the "Pilot Programmable Modes" section of this manual). When either of these two limits are violated the red Low Fuel Warning LED will start to blink. Pushing any button or switch will stop the blinking and turn off the warning LED. Also, a bar in the upper or lower left corner of the display will be shown when displaying "REM" or "T. to E." depending on which limit is violated.

There is one pilot programmable Low Fuel Warning Limit that will blink the red Low Fuel Warning LED when the limit is violated. This limit is set for a low fuel remaining level (see the "Pilot Programmable Modes" section of this manual). When this limit is violated the red Low Fuel Warning LED will start to blink. Pushing any button or switch will cause the LED to stop blinking and go solid red. Also, a bar in the lower left corner of the display will be shown when displaying "REM." **This limit is an emergency warning** and should be set to the lowest acceptable fuel level.

3. H/L Pressure Warning LED:

There are pilot programmable High and Low Fuel Pressure Warning Limits that will blink the red H/L PRESS Warning LED when violated. Pushing any button or switch will cause the LED to stop blinking and go solid red. If the High Limit is violated, a bar in the upper left corner of the display will be shown when displaying "PRESS." If the Low Limit is violated, a bar in the lower left corner of the display will be shown when displaying "PRESS."

4. Power-Up:

When the aircraft master switch is turned on, the FP-5 will perform a self-diagnostics test and flash the red warning LED's. This allows you to check the Warning LED's for proper operation.

After power-up, the FP-5 will blink the Fuel Remaining (REM) LED, and display the fuel remaining in the tank(s). The "REM" LED will continue to blink until any button or switch is pushed. The blinking "REM" LED is intended as a reminder to update the FP-5 if you've added fuel to the aircraft since the last flight (see "REM" Display Mode).

5. "FLOW" Display Mode:

By pushing the mode select switch to the right or left, you can select the various display modes. In the "FLOW" Mode, the FP-5 will display fuel flow as follows:

A. When set to display in Gallons the display will read in .1 Gal/Hr increments up to 199.9 Gal/Hr.

B. When set to display in Imperial Gallons the display will read in .1 Gal/Hr increments up to 162.0 Gal/Hr.

C. When set to display in Pounds the display will read in 1 Lb/Hr increments up to 1199 Lbs/Hr.

D. When set to display in Liters the display will read in 1 Ltr/Hr increments up to 749 Ltrs/Hr.

Special algorithms in the micro-processor are used to insure a quick response and a stable display. Also, there are two programmable filter settings that will affect the stability and response of the fuel flow readings (see the "Pilot Programming Modes" section of this manual).

The accuracy of the displayed fuel flow can be affected by the value of the K Factor and Display Update Time programmed into the FP-5 (see the "Pilot Programmable Modes" section of this manual).

6. "REM" (Remaining) Display Mode:

In the "REM" (Fuel Remaining) Display Mode, the FP-5 will display the fuel in the aircraft tanks as follows:

A. When set to display in Gallons the display will read in .1 Gal increments up to 99.9 Gals. and 1 Gal increments from 100 to 999 Gals.

B. When set to display in Imperial Gallons the display will read in .1 Gal increments up to 99.9 Gals. and 1 Gal increments from 100 to 811 Gals.

C. When set to display in Pounds the display will read in 1 Lb increments up to 1999 Lbs.

D. When set to display in Liters the display will read in 1 Ltr increments up to 1999 Ltrs.

The fuel remaining displayed by the FP-5 is not a measurement of the fuel in the tanks. It is an amount calculated from the starting fuel level you programmed into the FP-5, minus the fuel used while the engine was running. When properly calibrated, the FP-5 can accurately measure the fuel used. **It is imperative the pilot verify the calibration of the FP-5 over many tanks of fuel before using the "REM" and/or "USED" Modes as an indication of the fuel in the tanks or fuel used. Even after verifying the calibration of the FP-5 it should never be used as the primary indicator of fuel quantity in the tanks. It is important the pilot visually check/ measure the fuel quantity for each tank before takeoff and crosscheck these readings against the fuel level gauges and the FP-5.** The FP-5 reminds you to do this by blinking the "REM" LED and displaying the current fuel remaining in the tanks each time the aircraft power is turned on. **Also, it is important the pilot use preflight and flight planning techniques, in accordance with the FAR's, which will help insure the proper amount of fuel is on board the aircraft before takeoff.**

While in flight the FP-5 readings should only be used to crosscheck the fuel level gauges, calculations of the

fuel onboard from flow rates specified in the specification for your aircraft and calculations of the fuel onboard from flow rates that you measured from previous flights. The use of the FP-5 does not eliminate or reduce the necessity for the pilot to use good flight planning, preflight and in-flight techniques for managing fuel. If you are not familiar with these techniques, contact the FAA to acquire proper training.

If you have added fuel to the aircraft but have not filled the tanks, set the FP-5 REM value for the fuel remaining shown on the FP-5, plus the fuel added to the tanks as shown on the fuel pump. If you have filled the tanks, set the FP-5 REM value for the full fuel level (total useable fuel) in the tanks as specified by the airframe manufacturer in your flight manual. **It is important you verify the fuel levels in the tanks before takeoff.**

To change the Fuel Remaining shown on the FP-5, perform the following steps:

A. Select the "REM" display mode (this mode is displayed during power-up).

B. Momentarily push both programming buttons at the same time (you are entering the "Add" programming mode). The display will show "Add" at this point.

C. Push either one of the "Prg" Buttons. The display will show the current fuel remaining. The blinking
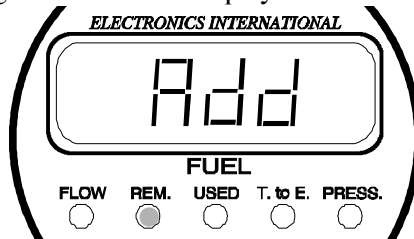
left digit indicates that you may program this digit first.
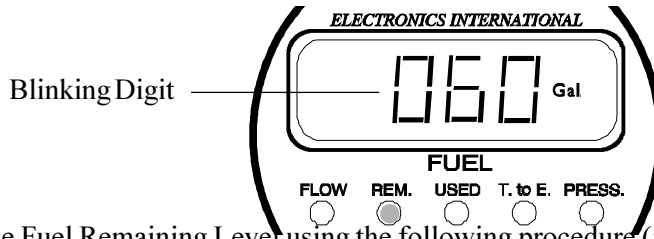
Blinking Digit

D. Set the Fuel Remaining Level using the following procedure (if you have topped off the tank, see step "c" below):

a) Select a Digit - The Right and Left "Prg" Buttons move the blinking digit to the right or to the left.

b) Advance a Digits Count - Moving the Mode Select Switch to the right will increase the blinking digits count by one. After the blinking digit reaches 9 it will reset to 0.

c) Change Functions - Each time the Mode Select Switch is pushed to the left, the display will switch between the Full Fuel Level (set during Power-up Programming) and the current reading.

d) To Exit - To exit the Add Programming Mode, momentarily push both "Prg" Buttons at the same time. The programmed values will be stored in memory and no internal batteries or external power are required to store this information for life.

Fuel remaining is one of the most important calculations the FP-5 can provide. The differences between the

flow transducers, elbows, fittings, pipe sizes, hoses and routing methods used during installation for any fuel flow gauge can cause the flow transducer to output different electrical pulses per gallon (called K Factor) than what it did when it was tested on the bench. To insure accuracy, which is essential, the FP-5 provides a Pilot Programmable K Factor to correct for these differences.

Initially, the FP-5 K factor is set to a value which is marked on a tag shipped with the flow transducer. After the first few fill-ups, the K Factor may be adjusted to correct for any inaccuracies. See the "Pilot Programmable Modes" section in this manual for further details.

If the programmable Low Fuel Reminder Limit has been violated, a bar in the upper left corner of the display will be shown when this mode is selected. If the programmable Low Fuel Warning Limit has been violated, a bar in the lower left corner of the display will be shown when this mode is selected.

7. "USED" Display Mode:

In the "USED" Display Mode, the FP-5 will display the fuel used from the time the aircraft electrical power was turned on. If the electrical power is turned off, the Fuel USED will reset to "000". Fuel USED will be displayed as follows:

A. When set to display in Gallons the display will read in .1 Gal increments up to 99.9 Gals. and 1 Gal increments up to 999 Gals.

B. When set to display in Imperial Gallons the display will read in .1 Gal increments up to 99.9 Gals. and 1 Gal increments up to 811 Gals.

C. When set to display in Pounds the display will read in 1 Lb increments up to 1999 Lbs.

D. When set to display in Liters the display will read in 1 Ltr increments up to 1999 Ltrs.

The K Factor programmed into the FP-5 will affect the Fuel USED. See the "Pilot Programmable Modes" section in this manual for further details.

8. "T. to E." (Time to Empty) Display Mode:

Time to Empty is calculated by dividing Fuel Remaining by Fuel Flow. The value is displayed in hours and minutes up to 19 hours and 59 minutes.

If the programmable Low T. to E. Limit has been violated, a bar in the upper left corner of the display will be shown when this display mode is selected.

9. "PRESS" (Pressure) Display Mode:

In the "PRESS" mode, the FP-5 will display fuel pressure in .2 PSI increments from 1 to 99.9 PSI. Readings below 1 PSI will be displayed as "000".

If the programmable High Pressure Limit is violated, a bar will appear in the upper left corner of the LCD

display in the "PRESS" mode, and the H/L Press Warning LED will blink. If the programmable Low Pressure Limit is violated, a bar will appear in the lower left corner of the LCD display in the "PRESS" mode, and the H/L PRESS Warning LED will blink. If the High and Low Pressure Limits are programmed to "00.0", the FP-5 will display "OFF" when the "PRESS" mode is selected.

10. "F. to D. (Fuel to Destination) Display Mode (FP-5L only):

When the left button is pushed the FP-5L will read the serial data from your Loran/GPS unit and compute the Fuel to Destination (or next way point) for the current conditions: Fuel Flow, Fuel Remaining, Ground Speed and Distance to Destination. This process will take from **one to three seconds** depending on the update time of the Loran/GPS unit. If the fuel required to reach the way point is more than the fuel remaining as shown on the FP-5L, the Low Fuel Warning LED will come on.

If serial data is not present on the proper pin of the FP-5L, the display will read "OFF". This may be the case if the Loran/GPS unit is not receiving a signal. If serial data is present, the display will read " on." If the serial data does not match RS232 protocol, a bar high in the left display will appear along with " on". Once speed and distance data has been received, the Fuel to Destination (or next way point) will be computed instantly and displayed on the FP-5L.

11. "F. Reserve (Fuel Reserve) Display Mode (FP-5L only):

When the right button is pushed the FP-5L will read the serial data from your Loran/GPS unit and compute the Fuel Reserve for the current conditions: Fuel Flow, Fuel Remaining, Ground Speed and Distance to Destination. The Fuel Reserve is the fuel you will have in your tank once you reach the destination (or next way point) programmed on the Loran/GPS unit (Fuel Reserve = Fuel Remaining - Fuel to Destination). If the fuel required to reach the way point is more than the fuel remaining as shown on the FP-5L, the Low Fuel Warning LED will come on and the Fuel Reserve will be displayed as a negative number (i.e., " -3" would mean you are 3 gallons short of reaching your destination).

When the Fuel Reserve button is pushed it will take from **one to two seconds**, depending on the update time of the Loran/GPS unit, to read and compute the serial data. If serial data is not present on the proper pin of the FP-5L, the display will read "OFF". If serial data is present the display will read " on." If the serial data does not match RS232 protocol, a bar high in the left display will appear along with " on". Once speed and distance data have been received, Fuel Reserve will be computed instantly and displayed on the FP-5L.

Pilot Programmable Modes:

The FP-5 has 11 Pilot Programmable Modes. These programmable modes are what make the FP-5 versatile, accurate and so effective at managing fuel. For power-up and each of the display modes there are one to three programmable modes that may be set from the front panel of the FP-5. Most of these programmable modes need to be set only once to match your engine and desired warning levels. The matrix outlines the Pilot Programmable Modes for power-up and the different display modes. The method used to program the FP-5 is the same method used to program the Ultimate Analyzer (US-8).

Although programming may be new to some of you, programming the FP-5 is simple. After a few tries, you should have the hang of it. No matter which buttons you push or parameter you set you cannot hurt the FP-5 and any parameter can be reset.

Note: The FP-5 will not account for any fuel used while in the any of the programming modes.

1. Power-up Programming Mode (Setting Full Fuel Level, K Factor, Filter and Loran/GPS Interface):

		Display Modes				
	Power-up	**FLOW**	**REM**	**USED**	**T. to E.**	**PRESS**
Programming	Full Fuel Level	Display in Gal, br Gal, Lbs. or Ltr.	Add Fuel	Low Fuel Reminder Alarm	Time to Empty Alarm	High Pressure Alarm
Modes	K Factor			Low Fuel Warning Alarm		Low Pressure Alarm
	Filter					
	Display Update Time					
	Loran/GPS Interface (FP-5L only)					

In the Power-up Programming Mode the following functions may be set:

Full Fuel Level - The Full Fuel Level should be set for the total useable fuel for your aircraft as specified by the airframe manufacturer in the Flight Manual or it may be set for a level to which you most often fill your tanks. This value is used as a default level when programming the Fuel Remaining Level of the FP-5.

K Factor - The K Factor represents the number of electrical pulses per gallon the FP-5 expects to see from the flow transducer. **Changing the K Factor changes the accuracy of the FP-5.** Initially, the K Factor should be set to a value which is marked on the tag attached to the flow transducer.

    Example: Value marked on tag: 16-8604.
    16 = 16 gallon per hour bench test flow rate.
    8604 = 86,040 pulses per gallon measured on the bench.
    Set the K Factor on the FP-5 for the first three digits on the tag (860).

The differences between the elbows, fittings, pipe sizes, hoses and routing methods used during installation and the fuel pressure for your aircraft can, for any fuel flow gauge, cause the flow transducer to output a different number of electrical pulses per gallon (K Factor) than when it was tested on the bench. To correct for any errors in the K Factor, keep track of the Actual Fuel Used (fuel required to bring the tanks back to full) and compare this with the FP-5 Fuel Used (Full Tank Level minus Fuel Remaining as displayed on the FP-5). If your error is less than 3 gallons for a single tank, you should average the error over 3 tanks of fuel. Use the following formula to correct the K Factor:

Note: When refueling an aircraft fuel tank, it is not easy to fill the tanks to the same exact level each time.

$$\text{New K Factor} = \frac{(\text{FP-5 Fuel Used}) \times (\text{Current K Factor})}{\text{Actual Fuel Used}}$$

Some variables are: 1. How level the wings are during refueling. 2. The effects of any crossover tubes. 3. The ability of the line attendant to fill the tank to the same mark. The shape of the tank and the dihedral of the wing can aggravate the situation.

Note: K Factor settings below 580 will cause the display resolution to increase above .1 Gal/Hr. when used with a Display Update Time setting of "UP2." K Factors below 180 will cause the display resolution to increase above .1 Gal/Hr. when used with a Display Update Time setting of "UP1." The FT-90 Flow Transducer has a K Factor around 198.

Filter - There are two filters used by the FP-5 to remove fluctuation or jump in the fuel flow readings. Selecting either filter will not affect the accuracy of the FP-5. Use filter "F 1" for most fuel-injected engines. This filter has the fastest response time (eight times faster than other flow gauges). Use filter "F 2" for most carbureted engines. This filter has a slightly slower response time than F1 (still faster than other flow gauges) but will take out any fluctuation or jump you may have seen using the F1 filter.

Display Update Time - The Display Update Time may be set to "UP2" or "UP1". A "UP2" setting causes the display to update two times per second and a .1 Gal/Hr. resolution can be maintained for K Factors from 580 to 999. A "UP1" setting causes the display to update once per second and a .1 Gal/Hr. resolution can be maintained for K Factors from 180 to 999. When using the FT-60 Flow Transducer use the "UP2" setting. When using the FT-90 Flow Transducer use the "UP1" setting if .1 Gal/Hr. resolution is required, otherwise a "UP2" setting would be preferred.

Loran/GPS Interface (FP-5L only) - The Loran/GPS Interface may be set to "L 1" or "L 2". A "L 1" setting is used to interface the FP-5L to any of the following units that have a moving map output: King, ARNAV, Garmin, Trimble, II Morrow or Foster. A "L 2" setting is used to interface the FP-5L to any Northstar unit with a moving map output.

To program the Full Fuel Level, K Factor, Filter Display Update Time and Loran/GPS Interface, perform the following steps:

A. Turn the aircraft electrical power off, push both "Prg" Buttons, and hold them in.

B. Turn the aircraft electrical power on, wait two seconds, then release the "Prg" Buttons. At this point, the far left digit should be blinking and there should be a "Gal" or "Lbs" annunciator in the right corner of the display. All the green display mode LED's should be off. If this is not the case, start over with step A. The Full Fuel Level is being displayed and you are now ready to program the Full Fuel Level, K Factor, Filter, Display Update Time and Loran/GPS Interface using the following procedure:

a) Select a Digit - The Right and Left "Prg" Buttons move the blinking digit to the right or to the

Blinking Digit ⎯⎯⎯⎯⎯⎯

ELECTRONICS INTERNATIONAL

□ 5 0 Gal

FUEL

FLOW   REM.   USED   T. to E.   PRESS.
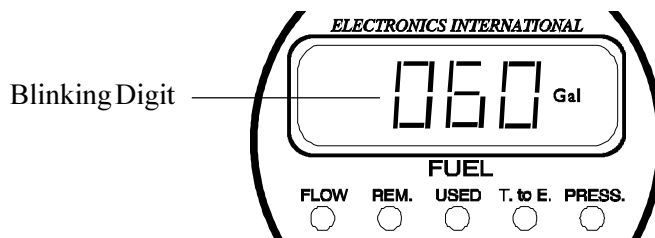
left.

b) Advance a Digits Count - Moving the Mode Select Switch to the right will increase the blinking digits count by one. After the blinking digit reaches 9 it will reset to 0.

c) Change Functions - Each time the Mode Select Switch is pushed to the left, the displayed function will change as follows:

Full Fuel Level (shown with a "Gal", "Lbs" or no indicator, for liters, at the right)
K Factor (shown with no indicators)
Filter (shown as "F 1" or "F 2")
Display Update Time (shown as "UP2" or "UP1")
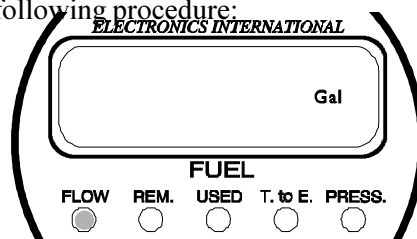Loran/GPS Interface on FP-5L only (shown as "L 1" or "L 2")

d) To Exit - To exit the Power-up Programming Mode, momentarily push both "Prg" Buttons at the same time. The programmed values will be stored in memory and no internal batteries or external power are required to store this information for life.

2. **"FLOW" Programming Mode (setting the display for "Gal", "br Gal", "Lbs" or "Ltr"):**

In the FLOW Programming Mode the FP-5 may be set to display Fuel Flow, Fuel Remaining and Fuel Used in Gallons, British (Imperial) Gallons, Pounds or Liters.

To program the display, perform the following steps:

A. Select the "FLOW" Display Mode.

B. Momentarily push both "Prg" Buttons. Either "Gal", "br Gal", "Lbs" or "Ltr" will be shown in the display. You are ready to program the FP-5 to display in Gallons, British (Imperial) Gallons, Pounds or Liters.

C. Set the Display using the following procedure:

a) Change the display to "Gal", "br Gal", "Lbs" or "Ltr" - Moving the Mode Select Switch to the right while pushing the left program button will alternate the display between "Gal", "br Gal", "Lbs" and "Ltr".

b) To Exit - To exit the Flow Programming Mode, momentarily push both "Prg" Buttons at the same time. The programmed values will be stored in memory and internal batteries or external power are not required to store this information for life.

3. **"REM" Programming Mode (Setting the Fuel Remaining Level):**

Each time you add fuel to the aircraft the Fuel Remaining (as shown on the FP-5 in the "REM" Display Mode) needs to be updated. This procedure was described previously in the "Display Modes and Operating Features" section of this manual.

4. "USED" Programming Mode (Setting the Low Fuel Reminder and Low Fuel Warning Alarms):

In the USED Programming Mode the following functions may be set:

Low Fuel Reminder Alarm - A low fuel alarm may be programmed to blink the Low Fuel Warning LED when the fuel remaining reaches your programmed set point. Pushing any button or switch will turn off the blinking LED. This limit is intended as a reminder. It may be set to remind you to switch tanks or when a specified amount of fuel remaining in the tanks has been reached. A good point to use in setting this alarm is at the 1/3 fuel remaining level. In the "REM" Display Mode a bar in the upper left corner of the display will be shown when the Low Fuel Reminder limit has been violated. Programming this alarm to "000" disables the alarm.

Low Fuel Warning Alarm - A low fuel warning may be programmed to blink the Low Fuel Warning LED when the fuel remaining reaches your programmed set point. Pushing any button or switch will stop the blinking but the Low Fuel Warning LED will stay on. **This limit is intended as an emergency warning**. It should be set to the lowest fuel level in the tanks you would ever want to reach. A good point to use in setting this alarm is thirty minutes' worth of fuel (at cruise) for a VFR pilot or forty-five minutes for an IFR pilot. In the "REM" Display Mode a bar in the lower left corner of the display will be shown when Low Fuel Warning limit has been violated. Programming this alarm to "000" disables the alarm.

To program the Low Fuel Reminder Alarm and the Low Fuel Warning Alarm, perform the following steps:

A. Select the "USED" Display Mode.

B. Momentarily push both "Prg" Buttons. A bar will appear in the upper left corner of the display and the left digit will be blinking. You are ready to program the Low Fuel Reminder level.

C. Set the Low Fuel Reminder and Low Fuel Warning levels using the following procedure:
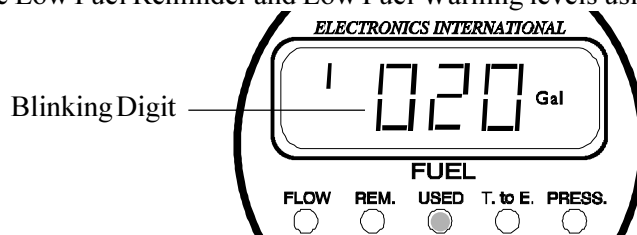
a) Select a Digit - The Right and Left "Prg" Buttons move the blinking digit to the right or to the left.

b) Advance a Digits Count - Moving the Mode Select Switch to the right will increase the blinking digits count by one. After the blinking digit reaches 9 it will reset to 0.

c) Change Functions - Each time the Mode Select Switch is pushed to the left, the display will

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switch between programming the "Low Fuel Reminder" alarm (shown with a bar in the upper left corner of the display) and the "Low Fuel Warning" alarm (shown with a bar in the lower left corner of the display).

d) To Exit - To exit the "USED" Programming Mode, momentarily push both "Prg" Buttons at the same time. The programmed values will be stored in memory and no internal batteries or external power are required to store this information for life.

5. *"T. to E." Programming Mode (Setting the Time to Empty Reminder Alarm):*

In the "T. to E." Programming Mode the Low Time to Empty Alarm may be programmed to blink the Low Fuel Warning LED when the Time to Empty calculated by the FP-5 reaches your programmed set point. Pushing any button or switch will turn off the blinking LED. This limit is intended as a reminder. It may be set to remind you to switch tanks or when a specified time to empty has been reached. In the "T. to E." Display Mode a bar in the upper left corner of the display will be shown when this limit has been violated. Programming this alarm to "0:00" disables the alarm.

To program the Time to Empty Alarm, perform the following steps:

A. Select the "T. to E." Display Mode.

B. Momentarily push both "Prg" Buttons. There will be a bar in the upper left corner of the display and the left digit will be blinking. You are ready to program the Time to Empty Reminder Level using the following procedure:

a) Select a Digit - The Right and Left "Prg" Buttons move the blinking digit to the right or to the
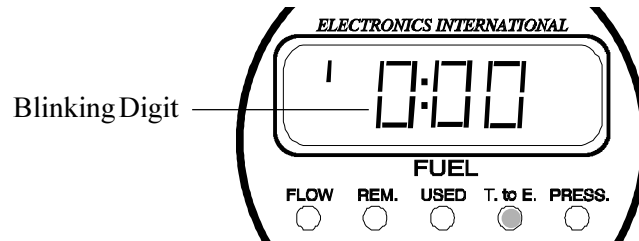
Blinking Digit

left.

b) Advance a Digits Count - Moving the Mode Select Switch to the right will increase the blinking digits count by one. After the blinking digit reaches 9 (or 5 for the "tens" minute digit) it will reset to 0.

c) To Exit - To exit the "T. to E." Programming Mode, momentarily push both "Prg" Buttons at the same time. The programmed values will be stored in memory and no internal batteries or external power is required to store this information for life.

6. *"PRESS" Programming Mode (Setting the High and Low Fuel Pressure Alarms):*

In the "PRESS" Programming Mode the following functions may be set:

High Fuel Pressure Alarm - A high pressure alarm may be programmed to blink the H/L Pressure Warning LED when the fuel pressure exceeds your programmed set point. Pushing any button or switch will stop the blinking but the H/L Pressure Warning LED will stay on. **This limit is intended as a warning.** It should be set to the highest acceptable pressure for your aircraft (see your Flight Manual). In the "PRESS" Display Mode a bar in the upper left corner of the display will be shown when this limit has been violated. Programming this alarm to "000" disables the alarm.

Low Fuel Pressure Alarm - A low pressure alarm may be programmed to blink the H/L Pressure Warning LED when the fuel pressure drops below your programmed set point. Pushing any button or switch will stop the blinking but the H/L Pressure Warning LED will stay on. **This limit is intended as a warning.** It should be set to the lowest acceptable pressure for your aircraft (see your Flight Manual). In the "PRESS" Display Mode a bar will be shown in the low left corner of the display when this limit has been violated. Programming this alarm to "000" disables the alarm.

If the Pressure Mode is not going to be used, program the High and Low Pressure Alarms to "00.0". This will cause the display to show "OFF" when the Pressure Display Mode is selected.

To program the High and Low Fuel Pressure Alarms, perform the following steps:

A. Select the "PRESS" Display Mode.

B. Momentarily push both "Prg" Buttons. The display will show a "PSI" annunciator in the right corner of the display and a bar will appear in the upper left corner of the display. Also, the left digit will be blinking. You are ready to program the High Fuel Pressure Alarm.

C. Set the High and Low Fuel Pressure Alarms using the following procedure:
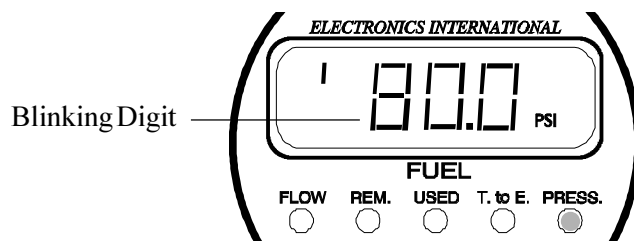
a) Select a Digit - The Right and Left "Prg" Buttons move the blinking digit to the right or to the left.

b) Advance a Digits Count - Moving the Mode Select Switch to the right will increase the blinking digits count by one. After the blinking digit reaches 9 it will reset to 0.

c) Change Functions - Each time the Mode Select Switch is pushed to the left, the display will switch between programming the High Fuel Pressure Alarm (shown with a bar in the upper left corner of the display) and the Low Fuel Pressure Alarm (shown with a bar in the lower left corner of the display).

d) To Exit - To exit the "PRESS" Programming Mode, momentarily push both "Prg" Buttons at the

same time. The programmed values will be stored in memory and no internal batteries or external power are required to store this information for life.

Specifications and Operating Features

Model:
      FP-5 and FP-5L (Fuel Flow/Pressure Instrument)

Case Dimensions:
      2.5" x 2.5" x 3.65" depth, 2 1/4" Bezel.

Weight:
Unit Only:	11 Oz.
Pressure Transducer:	6 Oz.
Flow Transducer:	3 Oz.

Environmental:
      Meets TSO C44a/C47

Power Requirements:
      7.5 to 35 Volts, 1/10 Amp.

Green Display Mode Indicator LED's:
      The intensity of these LED's is controlled by the dimming wire. 12 or 24 volts on this wire will dim the LED's for night operation.

Red Low Fuel Warning LED:
      This LED will blink any time the programmed Low Fuel Reminder, Low Fuel Warning or the Time to Empty Limit is violated. The Low Fuel Warning LED is always displayed at full intensity and will flash on power-up.

Red H/L Fuel Pressure Warning LED:
      This LED will blink any time the programmed High or Low Fuel Pressure limit is violated. The H/L Fuel Pressure Warning LED is always displayed at full intensity and will flash on power-up.

Digital Display:
      LCD (viewable in direct sunlight), with 12 and 24 volt backlight control wires for night operation. Displays "8888" on power up.

External Warning Control Line:
      Grounds when any Red Warning LED is on or blinking. Current should be limited to 2/10 amp.

Accuracy:
Flow:	2% or better in accordance with TSO C44a.
Pressure:	2% in accordance with TSO C47.

Resolution:
Fuel Flow:	.1 Gal. or 1 Lb. or 1 Ltr.
Fuel Remaining:	.1 Gal. up to 99.9 Gal or 1 Lb. or 1 Ltr.
Fuel Used:	.1 Gal. up to 99.9 Gal or 1 Lb. or 1 Ltr.
Time to Empty:	1 minute
Fuel Pressure:	.2 PSI.

Max Displayed Range (Unit Only):
     Fuel Flow: 199.9 Gals/Hr or 162.0 br Gal/Hr or 1199 Lbs/Hr or 749 Ltr/Hr.
     Fuel Remaining: 999 Gals. or 811 br Gal. or 1999 Lbs. or 1999 Ltr.
     Fuel Used: 999 Gals. or 811 br Gal. or 1999 Lbs. or 1999 Ltr.
     Time to Empty: 19 hours 59 minutes
     Fuel Pressure: 1.0 to 99.8 PSI (Readings below 1.0 PSI will be displayed as 00.0 PSI)

Pilot Programmable Modes:

		Display Modes				
	Power-up	FLOW	REM	USED	T. to E.	PRESS
Programming Modes	Full Fuel Level	Display in Gal, br Gal, Lbs. or Ltr.	Add Fuel	Low Fuel Reminder Alarm	Time to Empty Alarm	High Pressure Alarm
	K Factor			Low Fuel Warning Alarm		Low Pressure Alarm
	Filter					
	Display Update Time					
	Loran/GPS Interface (FP-5L only)					

RS-232/422 Input Ports (FP-5L Only):
     Single Line Receive Method: RS-232C, RS-423 or 5 Volt Serial.
     Dual Line Receive Method: RS-422 or RS-485.
     Protocol: 1 Start bit, 8 Data bits, 1 Stop bit.
     Baud Rate: 9600
     Recieve Format: Same as King, II Morrow, ARNAV and Trimble.

RS-232/422 Output Port (FP-5L Only):
     Transmit Method: RS-232C Single Line.
     Protocol: 1 Start bit, 8 Data bits, 1 Stop bit.
     Baud Rate: L 1 = 9600, L 2 = 1200
     Transmit Format: L 1 = King KLN-88, L 2 = Northstar

Fuel Flow Transducer, Standard (FT-60):
     Range: 0.6 to 60 GPH
     Linearity: 1% (8 to 60 GPH)
     K Factor: Approx. 85,000
     Pressure Drop: 1.2 PSI at 30 GPH
                  4.8 PSI at 60 GPH
     Working Press: 200 PSI
     Min. Burst Press: 2000 PSI
     Temp. Range: -65'C to 125'C
     Fuel Ports: 1/4" Female NPT

Fuel Flow Transducer, Special (FT-90):
     Range: 3 to 90 GPH
     K Factor: Approx. 19,500
     Pressure Drop: .31 PSI at 30 GPH
                  2.8 PSI at 90 GPH
     Working Press: 200 PSI
     Min. Burst Press: 2000 PSI
     Temp. Range: -65'C to 125'C
     Fuel Ports: 1/4" Female NPT

Fuel Pressure Transducer (PT-100GA):
     Range: 0 to 100 PSI
     Over Press: 300 PSI without damage.
     Min. Burst Press: 500 PSI
     Temp. Range: -40'C to 125'C
     Material: 303 Stainless Steel
     Press. Port: 1/4" Male NPT