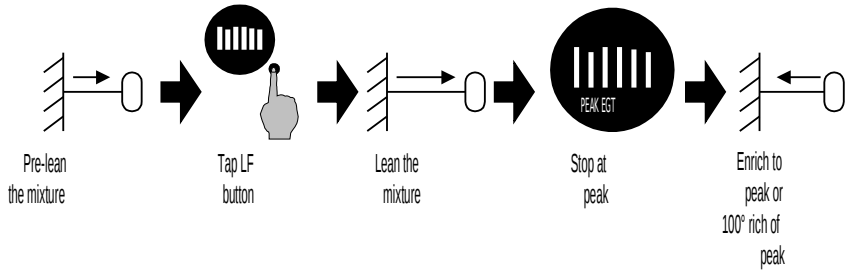
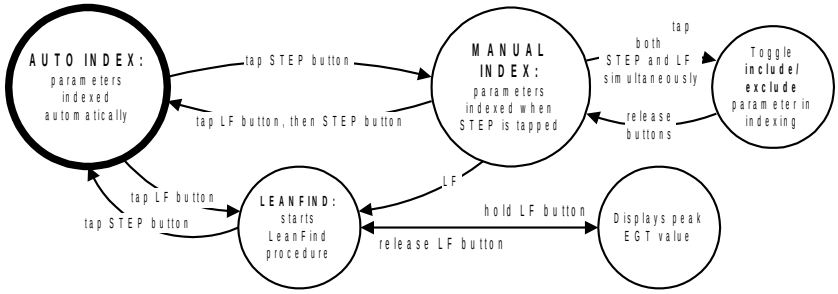
EDM-760 Quick Reference Guide

How to use LeanFind™ (page 13)



How to Change Modes (page 7)

EDM-760 enters Automatic indexing mode two minutes after power up



How to …

Note Tank size can be entered by holding in the step button upon start-up.

Specifications

FAA Approved
Indicator TSO & STC
Fuel Flow Option STC

Display Size:
3 1/8 in panel mount
3.5 in. sq., 7.5 in. deep

Common Mode Range:
± 4v, rejection > 80db

Analog Thermocouples
Response curve: All Linearized.
Resolution: 1.0 ^{o}F
Accuracy: ± 1.0 ^{o}F
Calibration: type K (J CHT avail.)

Operating Temperature Range:
-40 to 195 ^{o}F

Temperature Range:
EGT bar graph: variable
EGT, TIT digital: -40 to 2500 ^{o}F
CHT, OAT, IAT: -40 to 800 ^{o}F

Analog input channels:
12 Exhaust Gas Temperature (EGT)
12 Cylinder Head Temperature (CHT)
2 Turbine Inlet Temperature (TIT)
2 additional channels
(either OIL, CRB or second TIT)
1 Outside Air Temperature (OAT)
1 System Bus Voltage (BAT)

Resolution and Display Range (Fuel Flow Option)

display	*maximum display value*	*resolution*
K factor range:	5,000 to 99,990	10
Fuel flow:	Accuracy (8 to 60 GPH)	1 %
	140.0 GPH at K factor 85,000	0.1 GPH
	410.0 GPH at K factor 29,000	0.1 GPH
	820 PPH at K factor 85,000	1 PPH
	2400 PPH at K factor 29,000	1 PPH
	560 LPH at K factor 85,000	1 LPH
	1640 LPH at K factor 29,000	1 LPH
	372 KPH at K factor 85,000	1 KPH
	1088 KPH at K factor 29,000	1 KPH
Fuel Remaining:	999.9 Gal	0.1 Gal
	999 Lbs., L, or Kg	1 Lb., L, or Kg
Fuel Used:	999.9 Gal.	0.1 Gal
	9999 Lbs., L, or Kg	1 Lb., L, or Kg
Time to Empty:	50 hours	1 minute

Long Term Memory

Data capacity: up to 17 hours sampled every 6 seconds
Recording rate: programmable, every 2 seconds to 500 seconds

Pilot's Guide

EDM-760 TWIN

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Table of Contents

Section 1 - Introduction

Product Features

EDM-760 Standard Instrument:

- Hands-free, automatic scanning
- Bar graph
- LeanFind™ mode
- Battery voltage
- Normalize view
- DIF low to high EGT spread
- Shows largest EGT variance
- Oil temperature option
- EGTs to 1°F resolution
- Shock cooling monitoring
- Outside air temperature (OAT) option
- User selectable index rate
- Alarm “red line” limits
- Fast response probes
- Real-time serial data port

Fuel Flow Option:

- Solid-state pulse generating rotor fuel flow transducer
- Fuel quantity measured in gallons, kilograms, liters, or pounds
- Low fuel quantity alarm
- Low fuel time alarm
- GPS interface
- Instantaneous fuel flow rate,
- Total amount of fuel consumed,
- Total fuel remaining, and
- Time to empty at the current fuel flow rate.

Long Term Memory:

- Records and stores data every 2 to 500 seconds
- Non-volatile memory
- Post-flight data retrieval
- Data retrieval software
- 17 hours data capacity at 6 second sample rate

Engine Data Management

The EDM-760 Engine Data Management system is the most advanced and accurate piston engine monitoring instrument on the market. Using the latest microprocessor technology, the EDM-760 will monitor up to twenty-four critical measurements in your engines, three times a second, with a linearized thermocouple accuracy of better than 0.1 percent or 2°F.

As your built-in flight engineer, the EDM-760 is constantly “red line” checking: all critical measurements are automatically checked several times a second, regardless of the current display status. Leaning is accomplished quickly and automatically using the LeanFind™ procedure.

With the EDM-760 it is now possible to have substantially more diagnostic information available to you in a timely and usable manner.

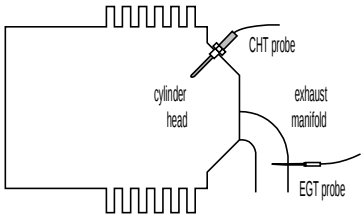
The included data memory permits you to record all measurements for later down loading to your laptop or Palm handheld.

Benefits of Proper Mixture Control

- Improved engine efficiency
- Greater fuel economy
- Smoother engine operation
- Longer spark plug life
- Reduced maintenance costs
- Reduced operating costs
- Proper engine temperatures
- Reduced engine vibration

JPI Probes

Temperature information processed by the EDM-760 is captured by **fast response**, grounded ***JPI*** temperature probes, that accurately measure the small temperature changes—as small as 1°F—that occur during mixture adjustment.

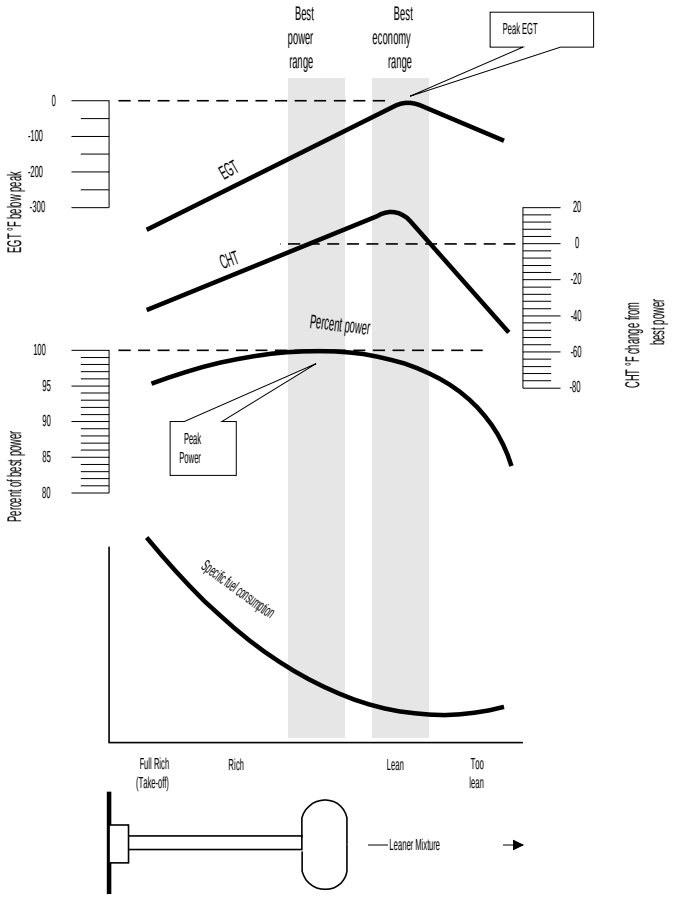


Temperature and Mixture

In a piston engine only a small portion of the energy from combustion produces movement of the piston during the power stroke. The majority of energy passes into the exhaust pipe as hot gasses. By monitoring the temperature of these exhaust gasses you will have an indication of the quality of the combustion process. Low compression, non-uniform fuel distribution, faulty ignition, and clogged injectors diminish the efficiency of the combustion process that generates power.

From the cockpit you can adjust the fuel/air ratio by a process called *leaning*. Retarding the mixture control changes the fuel/air ratio and hence the resulting Exhaust Gas Temperature (EGT).

The following figure depicts the mixture and temperature relationship.



As the mixture is leaned, *EGT* rises to a peak temperature, and then drops as the mixture is further leaned. Peak *power* occurs at a mixture using more fuel than at peak EGT. Best *economy* occurs at peak EGT. Accurate leaning yields optimal engine temperatures. By being able to precisely adjust the mixture, your engines can produce either the highest fuel economy or maximum power, whichever you choose.

A single EGT gauge merely gives you an average of each cylinder's temperature: some cylinders can be too rich, while others too lean. Variations produced by differences in fuel distribution, ignition, and compression will cause each cylinder to follow its own mixture and temperature relationship such that one cylinder will reach peak before another.

Section 2 - Displays and Controls

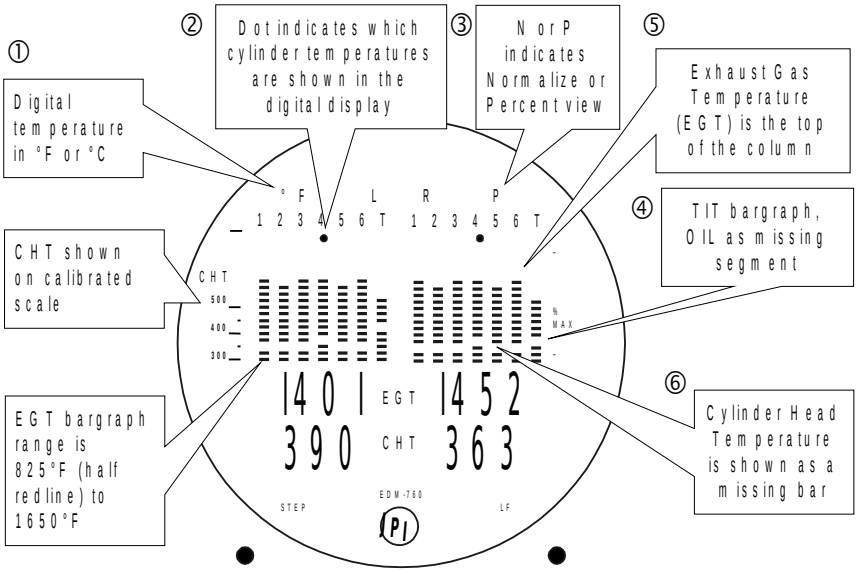
The EDM-760 monitors engine temperatures and voltages, assists in adjusting the fuel/air mixture, and helps diagnose engine malfunctions. There are three components of the user interface:

- Analog display including cylinder number and index dot
- Digital display for numeric readouts and messages
- Two front panel operating buttons.

Displays

Analog Display

The upper half of the face of the EDM-760 is the analog display.



The following is a description of the analog display, from top to bottom. Numbers in circles refer to features in the above diagram.

①Temperature Units (°F or °C)

- °F temperatures in the digital display are in Fahrenheit degrees.
- °C temperatures in the digital display are in Celsius degrees.

To change the display of OAT see “Pilot Programming” on page 37. To change the display of engine temperatures see “Changing the Alarm Limits” on page 44.

②④Cylinder Numbers and Dot Index

A row of numbers 1 through 6 and the letter T are the column labels for the analog display. The 1 through 6 are the cylinder numbers. If the TIT option is installed, the T denotes the last column is displaying Turbine Input Temperature (TIT). If the T is absent and the Oil temperature option is installed, the last column displays Oil temperature. If both TIT and Oil temperature options are installed, the last column displays TIT and the missing segment displays OIL. A round dot under the numbers 1 through 6 indicates that particular column is shown numerically in the EGT and CHT digital display.

③Normalize and Percentage View Indicators

- Percentage view: when there is a P at the top of the display, the columns indicate percent of EGT red line. Each column is composed of a stack of segments. A maximum height column depicts 100 percent of red line and a one segment-high column depicts 50 percent of red line. For example, if the red line is 1650°F, a maximum height column represents 1650°F and a one segment-high column represents half that value, or 825°F. The *Percentage view* permits comparison of EGTs *across all* cylinders. Hotter cylinders display higher columns than cooler cylinders.

- Normalize view: when there is an N at the top of the display, the EGT columns are displayed normalized. When you change to the Normalize view, all column peaks are set to the same half-height level for trend analysis. Any changes are shown as an increase or decrease in column height. A one-segment change in column height represents a 10°F change. The Normalize view permits rapid visualization of EGT *trends*, rather than a percentage of red line. You may use normalize in level cruise.

To toggle between Percentage and the Normalize views, hold the LF button for three seconds. The analog display becomes half height and the display changes to the Normalize view. Selecting the Normalize view does not affect the digital display nor alter the measurement sequence. The

CHT display—described later—is not affected by the Normalize or Percentage view.

You may select the Normalize view in either the Manual or Automatic indexing mode. Normalize view is most helpful for engine trend monitoring of each cylinder's operation. For example using the Normalize view during engine run-up, a fouled spark plug will appear as a higher column.

A common mistake is to be in the Normalize view and then change your power setting, causing all columns to go off scale, high or low. Set to the Percentage view before adding or reducing power. Always set Percentage View when beginning your descent.

⑤⑥Bar Graph EGT and CHT

Each column in the bar graph is composed of a stack of segments. The total height of each column represents the EGT and the missing segment in the column represents the CHT trend.

- In the Percentage view, the EGT and TIT (or Oil temperature) columns' resolutions depend on the programmed red line limits.
- CHT is displayed by a missing segment or a single isolated lighted segment, in 25°F increments.

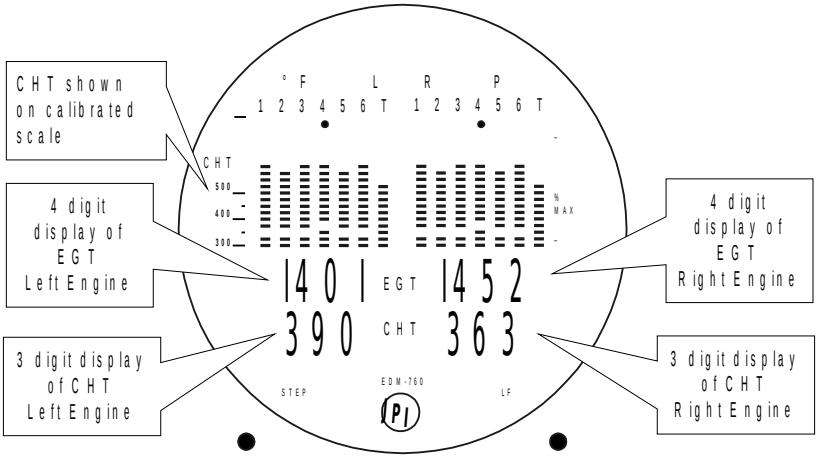
The CHT display is the not affected by mode or view.

Digital Display

Beneath the bar graph is the 9-segment alphanumeric display.

EGT and CHT

When the dot index is beneath a cylinder number, 1 through 6, the digital display shows the EGTs on the top (four digits for each engine) and the CHTs on the bottom (three digits for each engine). Other measurements are displayed in the digital display as described in the subsection "Measurement Indexing—without Fuel Flow Option" on page 10.



Display Dimming

The entire display panel features automatic dimming. Allow ten seconds for the display to adjust to ambient lighting conditions.

Modes

There are three standard operating modes of the EDM-760: *Automatic indexing*, *Manual indexing*, and *LeanFind*. **These modes will be described in more detail beginning on page 11.** Most of the time you will operate the EDM-760 in the Automatic indexing mode. When you first turn on the power the EDM-760 starts in the Manual indexing mode, but will enter the Automatic indexing mode after two minutes. The three modes affect primarily the digital display.

Automatic Indexing Mode

Just tap the LF button, then tap the STEP button. No user intervention is required to use this mode. Each cylinder and each measurement value is automatically sequenced and shown in the digital display for a few seconds.

Manual Indexing Mode

Just tap the STEP button. Automatic Indexing stops. Each indexed measurement is frozen in the digital display until you manually index to the next measurement by tapping the STEP button.

LeanFind Mode

Simply pre-lean, tap the LF button and begin leaning. The EDM-760 will assist you in finding the first cylinder to peak.

Buttons

Buttons, Front Panel

Two operating buttons control all functions of the EDM-760.

The term ***tap*** will be used to denote pressing a button momentarily. The term ***hold*** will be used to denote pressing and holding a button for five seconds or longer.

STEP Button

Located on the lower left side near the instrument face.

- In the Automatic indexing mode, *tapping* the STEP button will stop indexing and change to the Manual indexing mode. Then each *tap* of the STEP button will display the next measurement in the sequence.
- In the LeanFind mode *tapping* the STEP button will terminate the LeanFind mode and change to the Automatic indexing mode.

Secondary functions of the STEP button include:

- In the Manual indexing mode *holding* the STEP button will display the previous measurements in the sequence (rapidly backwards).
- In the programming procedures, described on page 37, *tapping* the STEP button will advance to the next item in the list.
- When an alarm is displayed ("Alarms" are described on page 43), tapping the STEP button will temporarily delete that measurement from the sequence for the next ten minutes.
- When an alarm is displayed, holding the STEP button until the word OFF appears will delete that measurement from the sequence for the remainder of the flight.

LF Button

Located on the lower right side near the instrument face.

- In Automatic or Manual indexing modes, *tapping* the LF button will change to the LeanFind mode.
- In Automatic or Manual indexing modes *holding* the LF button for three seconds will toggle between Percentage and Normalize views.

- In the LF mode *holding* the LF button after peak EGT is found will display peak EGT.
- In the LF mode *tapping* the LF button twice will mark a data record in memory.

Secondary functions of the LF button include:

- In the pilot programming procedure, *holding* or *tapping* the LF button is used to increment or decrement parameter values and toggle between yes and no answers to questions.

STEP and LF Buttons

- Holding both the STEP and LF buttons simultaneously for five seconds changes to the pilot programming procedure.
- Holding both the STEP and LF buttons simultaneously for five seconds after tapping LF but before beginning to lean will toggle between Rich of Peak and Lean of Peak
- Tapping both the STEP and LF buttons simultaneously in Manual indexing mode toggles to include or exclude the displayed measurement from the Automatic indexing mode. It has no affect on the displayed measurements in the Manual indexing mode.

Measurement Indexing—without Fuel Flow Option

The EDM-760 steps through the engine measurements in a specific sequence. Listed below is the indexing sequence, measurement description and example of the digital display.

Measurement	*Example*	*Comments*
Voltage, System Bus **Outside Air** Temperature	I4.2 8I BAT OAT	Battery voltage and OAT °F or °C
Difference between hottest and coolest EGT	80 EGT 52 DIF DIF	Dot indicates most widely deviating cylinder
EGT, CHT	I340 I430 376 385	EGT, left, CHT, right. Dot indicates cylinder
TIT, Turbine Inlet Temperature	I370 I450 TIT TIT	
Oil Temperature	I 7 7 I80 OIL OIL	Only one of these three options may be installed in the aircraft
TIT #2 Second Turbine Inlet Temperature	I450 I460 T I2 T I2	
Carburetor Temperature	20 25 CRB CRB	

Shock Cooling	-30 -40 CLD CLD	Dot indicates fastest cooling cylinder

The display will pause at each measurement for four seconds in the Automatic indexing mode. (The four second indexing rate can be changed. See “Pilot Programming” on page 37.) In the Manual indexing mode, tap the STEP button to advance to next measurement. Only the measurements for the options that are installed will be displayed; uninstalled measurements will not appear.

Section 3 - Operating Procedures

Diagnostic Testing on Startup and During Flight

When your EDM-760 is first turned on, all digits light up for a few seconds, permitting you to check for non-functional segments. Then each column is self-tested in sequence while the EDM-760 tests internal components, calibration and integrity of the probes. If a problem is found, it will be displayed as OPEN PRB or CAL ERR, followed by the name of the probe or channel. During flight, probes are constantly checked for inconsistent or intermittent signals. A faulty channel or probe encountered during start-up or during flight will be deleted from the sequence, producing a missing column or blank digital data.

Modes

The EDM-760 has three different operating modes: *Automatic indexing*, *Manual indexing* and *LeanFind*. When you first turn on the power the EDM-760 starts in the Manual indexing mode, but will enter the Automatic indexing mode after a few minutes. The Automatic indexing mode provides you with engine monitoring information for the majority of flight conditions. To adjust the mixture, use the LeanFind mode. And to display specific measurements, use the Manual indexing mode. In both the Automatic and Manual indexing modes the analog display shows a bar graph of EGT and CHT for each cylinder and the TIT, if installed (or Oil temperature, if it is installed and TIT is not installed).

Automatic Indexing Mode

Just tap the LF button, then tap the STEP button. No user intervention is required to use this mode. In the Automatic indexing mode the EDM-760 displays the measurement sequence at a user-selected indexing rate (see “Personalizing” on page 37).

Individual measurements can be excluded from the *Automatic indexing mode*: tap STEP to enter the Manual indexing mode. Tap STEP to index to the measurement you want to exclude. Then tap both the STEP and LF buttons simultaneously. Excluded measurements display a decimal point before the measurement name.

For example:

Included I84 OIL ↓ Excluded I84 .OIL

Tapping the STEP and LF buttons simultaneously will toggle back and forth between *include* and *exclude*.

- You can program whether every time you turn on the EDM-760, it will remember which measurements were excluded or defaults to none excluded. See on page 45.
- *All* installed measurements are always displayed in the Manual indexing mode. Exclusion only applies to the Automatic indexing mode.
- All measurements are checked for alarm conditions every second *regardless of their included or excluded status*.

Manual Indexing Mode

Just tap the STEP button. Use the Manual indexing mode when you want to monitor one specific measurement such as shock cooling during descent, or a particular cylinder temperature during climbs. To change to the Manual indexing mode, tap the STEP button once. Subsequent taps will index the digital display through the measurement sequence (see “Measurement Indexing—without Fuel Flow Option” on page 10). To exit the Manual indexing mode and return to the Automatic indexing mode, either tap the LF button and then tap the STEP button (see “How

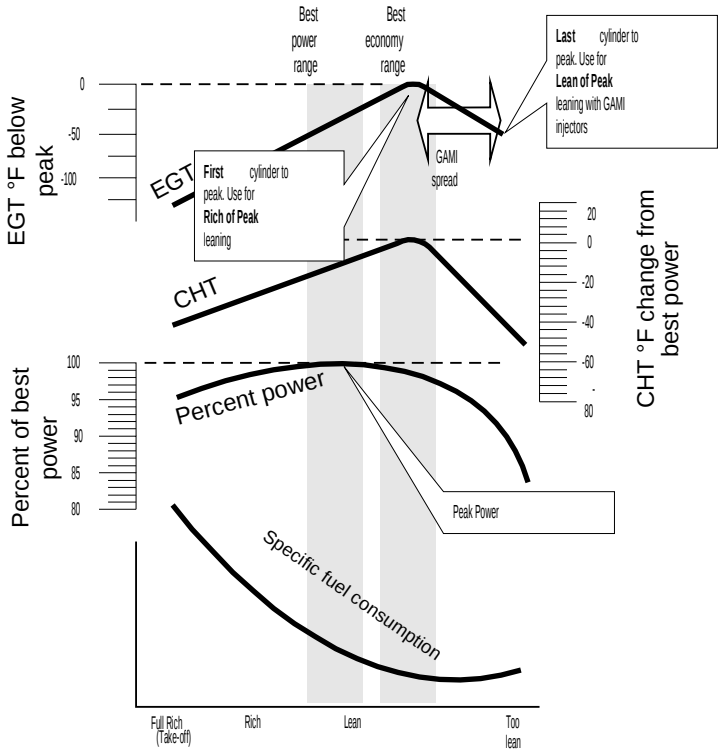
to Change Views" in the front of this manual). You may disable the Automatic indexing mode. See "Personalizing" on page 37.

LeanFind Mode—Leaning Rich of Peak

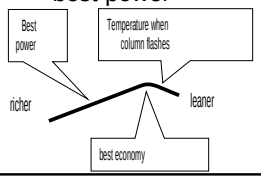
- **JPI's EDM-760 provides two methods of leaning:** lean **rich of peak** (LEAN R) or **lean of peak** (LEAN L)**.** The standard method is to lean about 20° rich of peak. With the advent of GAMI injectors it is now possible to set the mixture lean of peak—saving fuel and running the engine cooler. Teledyne Continental recommends lean of peak for the Malibu. This manual primarily describes the rich of peak method, and provides the procedure for the lean of peak method. The factory default method is set to rich of peak, but you can change this to lean of peak. See Changing the Alarm Limits Procedure on page 45.

Simply pre-lean, tap the LF button and begin leaning. Upon reaching cruise configuration, you will use the LeanFind mode to identify the first cylinder to reach peak EGT.

A more detailed explanation of the LeanFind procedure follows this step-by-step procedure.


Best power range
Best economy range
Last cylinder to peak. Use for Lean of Peak leaning with GAMI injectors
GAMI spread
First cylinder to peak. Use for Rich of Peak leaning
EGT °F below peak
0
-50
-100
EGT
CHT
20
0
-20
-40
-60
80
CHT °F change from best power
Percent of best power
100
95
90
85
80
Percent power
Peak Power
Specific fuel consumption
Full Rich (Take-off)
Rich
Lean
Too lean

LeanFind Procedure—Step-by-Step

	Procedure	Example	Comments
1	Establish cruise at approx. 65 to 75% power.		
2	Pre-lean the mixture to 50°F on the rich side of the estimated peak EGT on any cylinder: _____°	I490 370	*For your *first flight* with the EDM-760, use the method shown below.
3	Wait one minute		Let engine stabilize.
4	Tap the LF button	I490 LF	Start the LeanFind mode.
5	Slowly lean the mixture—approx. 4°/second—while observing the display. When there is a 15°F rise in EGT, LeanFind mode becomes active.	I520 LF (Fuel Flow Option shows flow)	Flashing cylinder number indicates hottest cylinder and that LeanFind mode is active.
6	Stop leaning when a column begins flashing. You will see PEAK EGT for two seconds, followed by:	I550 SET or with Fuel Flow I550 I 2.4	Flashing cylinder number & column indicates leanest cylinder. (SET means that the peaked cylinder is "set" into the display.) Due to thermal inertia this will usually be about 10°F lean of peak.
7	If you hold LF, peak EGT will be displayed while the LF button is held down.	I560 PEAK	Captured peak EGT value is displayed.
8	Slowly enrich the mixture. the temperature will increase, returning to peak. Stop enriching at the desired EGT. Best economy Best power	I560 SET I560 SET I460 SET	• Peak EGT for best economy • 100° cooler than peak for best power 

*Here is how to determine the pre-lean value: while in cruise at under 65 percent power, choose any cylinder and lean that cylinder to peak EGT in the Manual indexing mode or to engine roughness, whichever occurs first. Note the peak, subtract 50° and write the resulting number in the space provided in step 2.

LeanFind Procedure—General Explanation

Lycoming and Continental engines have established specific restrictions on leaning that must be followed, such as percentage of power, climb leaning, and TIT limits. Lycoming recommends operation at peak EGT for power settings of 75% or lower, while Continental recommends operation at peak EGT for power settings of 65% or lower. This guide is not meant to supersede any specific recommendations of the engine manufacturer or airframe manufacturer**.**

It is your responsibility to know your aircraft's limitations.

Pre-lean the mixture to about 50° below peak. After pre-leaning, wait for one minute for the temperatures to stabilize. Next, begin the leaning process by tapping the LF button.

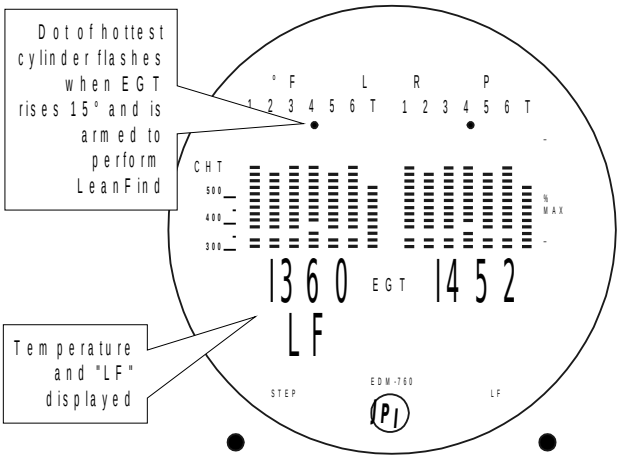
The LeanFind procedure will begin on the first engine you lean — the one that first indicates a 15° EGT temperature rise. The examples below assume the left engine is leaned first. Begin leaning the mixture. When a 15° rise occurs, the LeanFind mode becomes activated, shown when the cylinder number above the column of the hottest cylinder begins flashing. LeanFind is not active if a cylinder number is not blinking.

> With the Fuel Flow Option, instead of seeing the word LF in the display, you will see numerical fuel flow rate during the leaning process on the right side of the digital display. This allows you to observe the EGT rise and at the same time watch the fuel flow rate decrease.

To show the progress of the leaning process, the EDM-760 selects the hottest cylinder for reference in the digital display. In the example below, the 1360 is the current temperature of the hottest cylinder. If the fuel flow option in installed, instead of LF you will see the fuel flow rate, for example 12.4.

When LF is activated:

To show the progress of the leaning process, the EDM-760 selects the hottest cylinder for reference in the digital display.



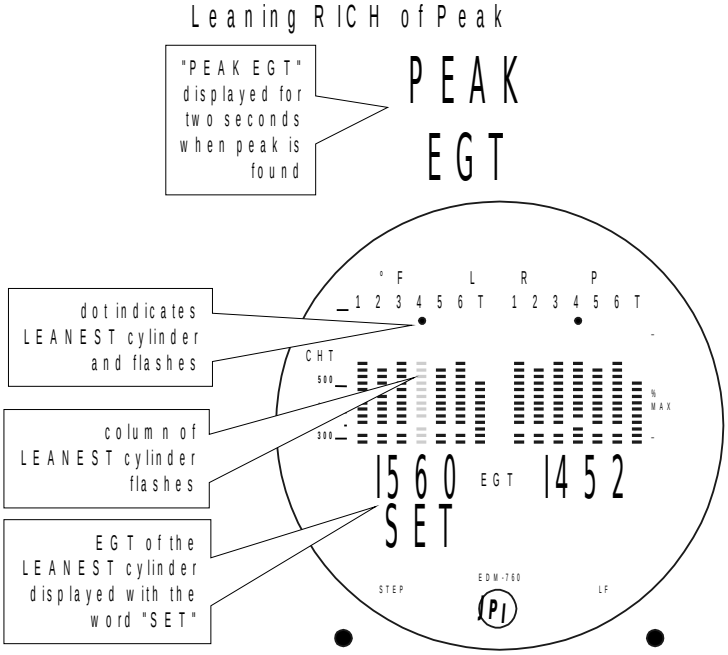
Continue leaning slowly *without pausing*. With a vernier mixture control, turn the knob about a quarter turn every five seconds. With a non-vernier or quadrant mixture control, lean slowly and smoothly about 1/16 inch every five seconds. Eventually, one cylinder will reach peak before any of the other cylinders. The EDM-760 will determine this automatically. *Notice that this cylinder does not necessarily have the hottest EGT.*

The EDM-760 will indicate success in finding a peak by displaying the words PEAK EGT for two seconds, followed by flashing the column of—and displaying the value of—the EGT of the cylinder that peaked first. The word SET will also be displayed. (With the Fuel Flow Option the current fuel flow rate will be displayed on the right side of the digital display instead of the word SET.) The flashing cylinder will be locked — or set—into the digital display during the remainder of the LeanFind procedure to allow you to set the final mixture. The peak EGT value is remembered by the EDM-760 and will be displayed as long as you hold the LF button.

You may now enrichen the mixture to operate at peak or continue enriching to 100° rich of peak, or a value of your choice, consistent with

the procedures defined in your aircraft engine manual. If you tap the LF button, the digital display will toggle between displaying the peak EGT or the number of degrees below peak.

If you lean too much, the EGT will drop and the engine will be operating lean of peak.

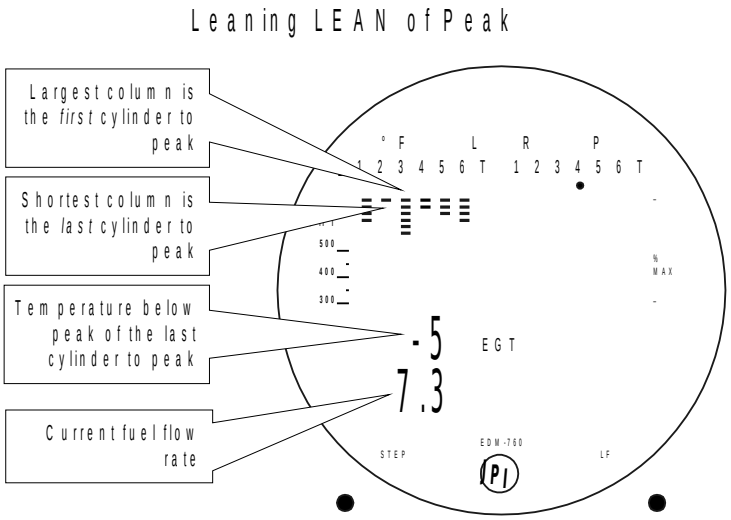


Lean of Peak Leaning with GAMI injectors

To use the “lean of peak” method, tap LF and then immediately hold both STEP and LF until you see LEAN L. Once you begin leaning (flashing dot) you cannot change leaning methods. You may toggle back to LEAN R by holding both buttons again.

In the “lean of peak” method the columns will **invert** with the first to peak progressing down from the top of the display. The inverted column scale is **5° per segment** below peak. As you continue to lean past peak the dot of the each successive cylinder will flash as it peaks. The peaks will be shown as an **inverted bar graph;** when the last cylinder peaks its column will flash. The analog display is an inverted bar graph showing where each cylinder peaked. When the LF button is held the display will show the delta fuel flow between

the first and last to peak (GAMI Spread), as well as the richest peak EGT.



Fine Tuning the Mixture

Fuel flow is the critical issue in the leaning process. Uniform fuel distribution to all cylinders results in the best economy and smooth operation. Estimate the uniform fuel distribution by the heights of the EGT columns on the analog display. Uniform fuel balance among all cylinders occurs when the heights of the columns, displayed in Percentage view, are uniform. Minor adjustments in throttle position, RPM, and mixture settings can dramatically improve uniformity of the fuel distribution. In fuel injected engines, interchanging injector nozzles between high and low EGT cylinders will improve fuel distribution in many cases.

If you tap STEP, scanning will resume. Or instead, if you tap LF you will return to the inverted bar graph, which can be used for fine tuning. To begin the LeanFind procedure anew, tap LF a second time.

Turbocharged Engines

The leaning process for turbocharged engines is by reference to the first cylinder or TIT to reach peak. However, the TIT *factory red line* may

limit the leaning process. TIT red line is generally 1650°F, and up to 1750°F in some installations. If during leaning the TIT exceeds red line by less than 100°, the LeanFind procedure will continue to operate and the TIT redline alarm will be suppressed for one minute, allowing you to complete the leaning process. Otherwise the digital display will show, for example, I650 TIT and TIT will flash. You will notice that in some cases the TIT reads 100°F hotter than the hottest EGT. This is caused by unburned fuel in the exhaust igniting at the turbine inlet.

The reduced size of the ***JPI*** Hastaloy-X-tip probes produces faster response and more accurate than the massive factory installed probe. Therefore ***JPI*** probes may read as much as 100°F higher than the factory installed probe. However, note that the engines were certified with the factory installed probe and gauge, and this gauge reading is the limiting factor when adjusting your engines.

Never exceed red line on the factory installed instruments.

Operation for each Phase of Flight

 **Engine Run-Up** (you can add this to your run-up checklist.)

Suggested setup:

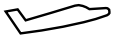
- Set engine to runup RPM
- *Normalize* view
- *Manual mode*

Verify:

- uniform rise of about 50°F in all EGTs in single magneto operation.
- uniform rise of EGTs with application of the mixture control.

Be alert for:

- unusually low voltage (less than nominal battery voltage)
- cold OIL and normal oil pressure
- abnormally high CHT
- large drop in EGT on one cylinder in single magneto operation—may be fouled spark plug.



Take-Off, Climb, and Full Throttle Operations

Suggested setup:

- Percentage view
- Automatic mode

Verify:

- EGTs and CHTs consistent with past climbs. EGTs should be in the 1100 to 1300°F range (100° to 300°F cooler than cruise) due to fuel cooling.

Be alert for:

- high EGT in one cylinder, 300°F above the others may indicate plugged injector or leaking manifold gasket on a carbureted engine.
- If all EGT columns go off scale to the top of the column, be sure you are not in Normalize view, as indicated by the symbol NRM to the left of the horsepower display.

At high density altitude an overly rich mixture can significantly reduce engine power.

Cruise

After the engine is warmed up, use LeanFind to lean the mixture.

Suggested setup:

- Normalize view
- Automatic mode

Be alert for:

- uneven EGTs (injected engines). Make fine adjustments to throttle, then RPM, then mixture to level the display columns.
- abnormal patterns of EGTs and CHT. (see “Engine Diagnosis Chart” on page 24).

Descent

Suggested setup:

- Percentage view
- Manual mode

Be alert for:

- CLD: shock cooling alarm is set to -60°F. Average cool rates of -40°F/minute to –60°F/minute are normal, depending on the engine size.

Common Misapplications

Some of the more common misapplications made by first-time EDM-760 users are presented here in an attempt to help you avoid similar problems.

Problem	*Cause*	*Correction*
finds a premature "false" peak.	Failure to pre-lean before performing LeanFind.	Follow the pre-lean procedure on page 13.
	Pausing during leaning.	Lean continuously, do not pause.
	Retarding mixture too slowly.	Lean more quickly.
Peak not found	Leaning too quickly.	Lean at the speed of approx. 10°F per sec.
Off-scale EGT bars, too high or low	EDM-760 is in the Normalize view and later observe off-scale EGT bar readings.	Set to Percentage view
First cylinder to peak is not the hottest	This is normal. The first to cylinder peak is unrelated to the hottest.	
EGTs rise during single magneto check	This is normal, due to incomplete combustion persisting longer.	
EGTs not uniform during low power operation	This is normal. Fuel and air distribution is not optimal at low power settings.	

Section 4 - Diagnosing Engine Problems

Normal Engine Limits

The follow chart lists typical *normal* measurement values that you will observe for most general aircraft engines.

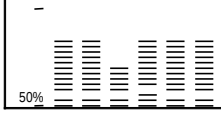
Measurement	*Normal range*	*Comments*
EGTs in Cruise	1350°F 1550°F	• under 200 HP • high performance • EGT should drop 200°F when full throttle is applied
EGT span (DIF)	70 to 90°F 120 to 150°F	• fuel injected • carbureted
TIT	1600°F average	• 100° higher than EGT
CHTs	350°F(OAT 60°F) 410°F	• normally aspirated • Turbocharged
CHT span	50 to 70°F	
OIL	200°F	• oil cooler thermostat opens at 180°F
Shock cooling*	-40°/minute -55°/minute -200°/minute	• tightly cowled • Bonanza • helicopter

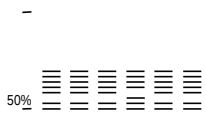
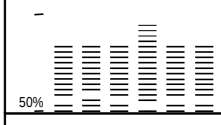
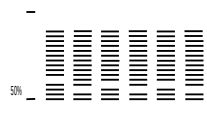
* Maintain a cooling rate of less than -60°/minute. You will find that the cylinder with the greatest shock cooling will shift from front cylinders (during climb out) to the rear cylinders (during descent).

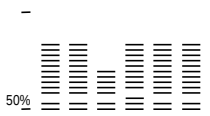
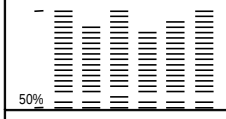
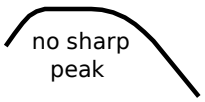
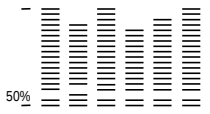
If one CHT is reading 20° to 50° above or below the others, this may be due to that cylinder having a spark plug gasket probe instead of a bayonet probe. This is necessary because the aircraft's factory original CHT probe is occupying the socket in the cylinder head rather than the EDM-760. This is normal. If the discrepancy is greater, be sure the spark plug gasket probe is mounted on the *top* spark plug. An adapter probe is available to occupy the same socket as the factory original probe. Contact your dealer.

Engine Diagnosis Chart

The following chart will help you diagnose engine problems in your aircraft. (Views are Percentage views). Notice that there is always one CHT that is shown hotter than the others.

Display	*Symptom*	*Probable Cause*	*Recommended Action*
	75° to 100° rise for one cylinder during flight	Spark plug not firing due to fouling, faulty plug, lead or distributor.	Enrich mixture to return EGT to normal. Have plugs checked.
	Increase or decrease after ignition system maintenance	Improper timing: high EGT → retarded ignition; low EGT → advanced ignition.	Check EGT for each mag to determine any uneven timing.
	Loss of EGT for one cylinder. Engine rough	Stuck valve. Other cylinders are okay.	Have valve train checked.
	Loss of EGT for one cylinder; no digital EGT	Failed probe or failed wire harness.	Swap probes to determine if probe or wire harness is bad.
	Decrease in EGT for one cylinder	Intake valve not opening fully; faulty valve lifter.	Have valve lifter or rocker arm checked.

Display	*Symptom*	*Probable Cause*	*Recommended Action*
	EGT and CHT not uniform	Dirty fuel injectors or fouled plugs.	Check injectors and plugs. Non-uniformity is normal for carbureted engines
	Decrease in EGT for all cylinders	Decrease in airflow into the induction system. Carb or induction ice. Engine units set to Celsius	Check for change in manifold pressure. Set alarm limits to Celsius degrees
	Slow rise in EGT. Low CHT	Burned exhaust valve. CHT is low due to low power output.	Have compression checked.
	High CHT on cylinders on one side of engine	Obstruction under cowling.	Check for improper installed baffling, cowl flap misalignment or bird nests.
	EGT on one cylinder jumps up and down 100°	Spark plug fouling at higher temperatures.	Check spark plug.

Display	*Symptom*	*Probable Cause*	*Recommended Action*
	Decrease in EGT for one cylinder at low RPM	Low compression.	Check compression.
	Sudden off scale rise for any or all cylinders	Pre-ignition, or Normalize view, or failed probe	Full rich and reduce power. Change to Percentage view. Check probe
	Loss of peak EGT	Poor ignition or vapor in fuel injection system.	Have magneto tested.
	Decrease in peak or flat EGT response to leaning process	Detonation. Usually the result of 80 Octane fuel in 100 Octane engine.	Enrich mixture, reduce power and relean mixture. Repeat to find power setting where normal peak is obtained or run rich.
	Below 10,000 ft. full throttle causes EGTs to rise	Weak or defective mechanical fuel pump.	Apply booster pump. If EGTs drop, replace fuel pump.
	CHT more than 500°, EGT normal. Adjacent EGT may be low	Leaking exhaust gasket blowing on CHT probe.	Look for white powder around cylinder to determine leak area.

Alarms

The EDM-760 has programmable alarms. When a measurement falls outside of its normal limit(s), the digital display will flash with the value and abbreviation of the alarming item. If the condition triggering the alarm returns to within normal limit(s), the display will stop flashing the alarm.

If your installation includes a separate panel mounted alarm warning enunciator light or audible warning, it too will be activated.

There is no alarm for the individual EGTs because the temperature values can assume different ranges depending on the flight configuration (run up, climb, cruise). There *is* an alarm on the DIF measurement, the difference between the hottest and coolest EGTs. DIF—or span—is the important measurement for monitoring the EGTs. See “Factory Set Default Limits” on page 43 for a list of the alarms and their factory default settings.

When an alarm is displayed, *tapping* the STEP button will temporarily disable the alarm indication for the next ten minutes.

When an alarm is displayed, *holding* the STEP button until the word OFF appears will disable that alarm indication for the remainder of the flight. See Alarm Limits” on page 43.

Alarm Priority

If multiple alarms occur simultaneously, the higher priority alarm will temporarily “hide” the lower priority alarm(s). When an alarm occurs, note the cause of the alarm and tap the STEP button to clear the alarm indication so that you will be notified of any other alarm that might have occurred. The alarm priorities are as follows:

Highest priority	TIT	TIT over temperature
	CHT	CHT over temperature
	OIL	OIL temperature
	CLD	CHT cooling rate
	DIF	EGT span
	BAT	Battery voltage
	LO FUEL	Fuel remaining low
Lowest priority	LO TIME	Fuel endurance low

Pre-Ignition and Detonation

Combustion that is too rapid leads to detonation and possibly pre-ignition. *Detonation* is abnormally rapid combustion where the fuel-air mixture explodes instead of burning uniformly. It causes the EGT to decrease and the CHT to increase, and can appear during the leaning process. It occurs under high compression from fuel with too low an octane rating, or from avgas contaminated by jet fuel. Fuel additives, such as lead, boost the octane rating and slow down the combustion process, producing an even pressure to the piston.

Pre-ignition is caused by hot spots in the cylinder. Ignition occurs prior to the spark plug firing. The EDM-760 depicts pre-ignition as a sudden red line of the EGT on the analog display. This may occur in one or more cylinders. The affected cylinder column(s) will flash while the digital display will show an EGT higher than 2000°F. **At this temperature pre-ignition will destroy your engines in less than a minute unless you take immediate corrective action.**

Data Logging

On monthly intervals, you may choose to jot down peak EGT, measurement sequence values, and cruise engine settings on a *data logging worksheet* in the back of this book. Look for trends as well as absolute values. DIF is a good indicator of the overall health of the engines. Typical values are less than 80°F for a factory new fuel injected engine, and less than 150°F for a carbureted engine. If you discover a DIF spread greater than this, identify the effected cylinder and initiate preventive maintenance.

Trend data for EGT and CHT is also of value. Any departure from a cylinder's baseline requires investigation. Refer to the "Engine Diagnosis Chart" on page 24. Data logging as a means of identifying trends is of considerable value in preventative engine maintenance.

Fuel Flow Option Operation

Select Switch

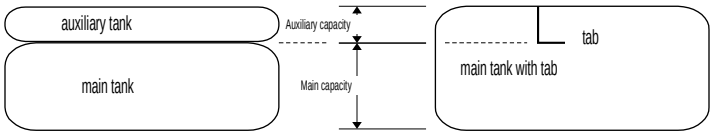
The select switch is a three-position toggle switch mounted on your instrument panel near the display of the EDM-760. Any alarm warning will appear regardless of the select switch setting.

- In the **EGT** (**T***emperature)* position only the installed temperature (and battery voltage) measurements are displayed in the digital display in either the Automatic or Manual indexing modes or during the pilot programming procedure.
- In the **FF** (**F***uel Flow)* position only fuel flow measurements are displayed in the digital display in either the Automatic or Manual indexing modes or during the pilot programming procedure.

- In the **ALL** (**A***ll*) position, the EDM-760 both installed temperature and fuel flow measurements are displayed in the digital display in either the Automatic or Manual indexing modes or during the *pilot* procedure.

Start Up Fuel

After initial self-test, you will be asked to inform the EDM-760 of start up fuel. The EDM-760 will display FUEL for one second, and then flash FILL? N until any button is pressed. If your aircraft has tank fill tabs and no auxiliary tanks, you can use the auxiliary tank feature to select either filling to the tank tabs or topping the tank. See "Main Tank Capacity" and "Auxiliary Tanks" beginning on page 47 to program the EDM-760 for this feature. The EDM-760 does not differentiate fuel flow between the main and auxiliary tanks; it considers only *total* fuel in the aircraft. **During flight you may also inform the EDM-760 of startup fuel using the pilot program mode, page 37, if you forgot to do so at start up.**



Refer to the column in the chart below corresponding to your fuel tank configuration. Tap the LF button to select one of the four following fueling choices on the left column of the chart.

LF to choose ⇓	*Main tanks only, no tabs*	*Main tanks with tabs*	*Main & Auxiliary tanks*
FILL? N	Did not add any fuel since last shutdown.		
FILL 75 GAL	Topped the main tanks.	Filled only to the tabs.	Topped the main tanks. If some additional fuel is added to the auxiliary tanks, you will input this next when .0 GAL is displayed
FILL I20 GAL	(not available)	Topped the main tanks.	Topped both the main and auxiliary tanks.
FILL + GAL	Did not top, but added additional fuel to the aircraft, or removed fuel from the aircraft.		

Then tap the STEP button to complete the entry and advance to the Manual indexing mode.

Adding Fuel and Auxiliary Tanks

If you either

a) added less than full fuel to only the main tanks, or
b) topped the main tanks but have some fuel remaining in the auxiliary tanks,

then select FILL + and the next display will ask you how much you added: .0 GAL (or selected units). Hold the LF button to count up, tap the LF button to count down. The count up will stop at full tanks, since you cannot add more fuel than would top the tanks.

If you added fuel to only the main tanks, then input how much you added.

If you topped the main tanks, but have some fuel remaining in the auxiliary tanks, input how much is now in the auxiliary tanks.

You can "add" a negative amount of fuel if you remove fuel from the aircraft or wish to correct the total quantity of fuel on board.

Accumulate Total—Trip Total

You may either display total fuel *used* since the last time you informed the EDM-760 that the aircraft was refueled, or
for an extended trip with multiple fuel stops. This selection affects only the USD measurement. How to select whether to accumulate or reset is described in "Pilot Programming" beginning on page 37.

Resetting "USED"

Every time you inform the EDM-760 that the aircraft is refueled, the amount of fuel *used* is set to zero, unless the instrument is programmed to accumulate. The display of fuel *used* pertains only to the fuel used since the last time you informed the EDM-760 that the aircraft was refueled.

To reset to zero the amount of fuel *used* at any point in time, manually step to display USD and hold both buttons for five seconds until the display shows .0 USD.

Fuel Management

Without a means of measuring fuel flow, you must rely on the aircraft fuel gauges or total time of flight. Aircraft fuel gauges are notoriously

inaccurate (they are only required by the FAA to read accurately when displaying *empty)*. And measuring time of flight is only an approximation, and assumes a constant fuel flow rate for each phase of flight.

The EDM-760 Fuel Flow Option uses a small turbine transducer that measures the fuel flowing into each engine. Higher fuel flow causes the transducer turbine to rotate faster which generates a faster pulse rate. Because the transducer turbine generates thousands of pulses per gallon of fuel, it can measure with high resolution the amount of fuel that the engine has consumed. Prior to engine start you inform the EDM-760 Fuel Flow Option of the known quantity of fuel aboard, and it will keep track of all fuel consumed.

For fuel calculations to be accurate, it is imperative that you inform the EDM-760 of the correct amount of fuel aboard the aircraft. Do not rely on fuel flow instruments to determine fuel levels in tanks. Refer to original fuel flow instrumentation for primary information

Measurement Indexing—with Fuel Flow Option

The EDM-760 steps through the engine measurements in a specific sequence. Listed below is the indexing sequence, measurement description and example of the digital display. The display will pause at each measurement for a few seconds in the Automatic indexing mode. In the Manual indexing mode, tap the STEP button to advance to next measurement.

The first column indicates what position the select switch must be in to display that particular measurement. T is EGT, F is FF and A is ALL.

Measurement Start Up Indexing Sequence with Fuel Flow Option

Select Switch	*Measurement Description*	*Example*	*Comments*
T, A	**Voltage**, System Bus **Outside Air** Temperature	I4.2 8I BAT OAT	Battery voltage and OAT °F or °C
T, A	**Difference** between hottest and coolest EGT	80 EGT 52 DIF DIF	Dot indicates most widely deviating cylinder
F, A	**Fuel Flow Rate**	I3.5 I4.2 GPH GPH	Or KPH, LPH , PPH
F, A	**Fuel Used Each Engine**	28.0 27.I USD USD	Since last refueling or trip total, each engine
F, A	**Fuel Remaining Time to Empty**	45.2 0I.38 REM H.M	In gallons, liters or pounds or kilograms. **H**ours . **M**inutes Remaining at current fuel burn

F, A	**Total Fuel Used**	55 TOTL GAL USD	Since last refueling or trip total (won't reset)
F, A	**Fuel required to next GPS WPT or Destination. Fuel Remaining at WPT**	7.7 20.2 REQ RES	Present with GPS interface, valid signal and way point
F, A	**Nautical Miles per Gal**	6.5 357 MPG NM	Present with GPS interface and valid signal (or MPK, MPL, MPP)
T, A	**EGT, CHT**	I340 I430 376 385	EGT, left, CHT, right. Dot indicates cylinder
T, A	**TIT**, Turbine Inlet Temperature	I370 I450 TIT TIT	
T, A	**Oil** Temperature	I 7 7 I80 OIL OIL	Only one of these three options may be installed in the aircraft
T, A	**TIT #2** Second Turbine Inlet Temperature	I450 I460 T I2 T I2	
T, A	**Carburetor** Temperature	20 25 CRB CRB	
T, A	**Shock Cooling**	-30 -40 CLD CLD	Dot indicates fastest cooling cylinder

Long Term Memory

The EDM-760 Long Term Memory will record and store all displayed measurements once every six seconds (or at the programmed interval of between 2 and 500 seconds). At a later time, transfer them to a Palm™ handheld as an intermediate courier, or laptop PC.

When you retrieve recorded data to your palmtop or laptop PC you can choose to retrieve *all* the data in stored in the EDM-760, or only the *new* data recorded since your last retrieval. In either case, no data in the EDM-760 is erased. The data will be saved in the PC in a file in a compressed format.

The amount of total data that the EDM-760 can store will vary depending on how rapidly the measured temperatures change. The typical storage is 40 hours, but may vary depending on which options are installed. When the memory becomes full, the oldest data will be discarded to make room for the newest. In the LeanFind mode you may place a mark at the next data record by tapping the LF and STEP buttons simultaneously. You will see the word SNAP within the next six seconds, indicating a data record has been marked. Tap the STEP button to return to the Automatic indexing mode. Recording begins when EGTs are greater than 500°F or "snap" is requested.

All data are time-stamped. The EDM-760 Long Term Memory contains a real-time clock that may be reset to local time when you initially program your instrument. You may also program an *aircraft id* that will appear in the output data file. The aircraft id can be your aircraft registration number or your name. Initially the *aircraft id* is set to the EDM-760's serial number.

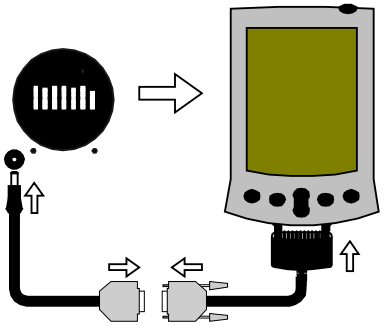
You may change the recording interval from 2 to 500 seconds, even in flight. When you change the interval in flight, the current flight file is closed and a new flight file is created with the new recording interval.

At power on, the EDM-760 will execute its self test and then display the date (e.g., 11.12.99), the time (13.26), the percentage of memory filled since the last save (FULL 24), and the Aircraft ID.

Transferring Data from the EDM-760 to a Palm Handheld

The examples shown here are specifically for the Palm™ handheld and a PC running Windows® 98. J. P. Instruments provides an optional cable to interface to the Palm cradle cable or travel cable.

J. P. Instruments has a downloadable data transfer application program for the Palm series called EzPalm™.



Downloading the EzPalm Program from the Internet

Go to our web page www.jpinstruments.com, go to the *downloads* page. Double click on EZPALM2.ZIP.

Transferring Data from the EDM-760 to the Palm Handheld

To transfer recorded data to your Palm Computer, proceed as follows:

1. Connect the Palm Computer cradle or travel cable option (available from Palm Computing) to the JPI Palm Download cable (gray). Insert the small round plug of the JPI cable into the data connector on your aircraft instrument panel, and the cradle or travel cable to the Palm Computer.
2. Simultaneously hold the STEP and LF buttons for five seconds. You will see the word PROGRAM for two seconds. Tap the STEP button until you see the question DUMP? N.
3. Tap the LF button once or twice to select either NEW or ALL.
   - NEW will transfer only data *newly* recorded since you last saved your data.
   - ALL will transfer *all* the data that is in the EDM memory.

   In either case, **no data will be erased** from the EDM.
4. On the Palm Computer, tap the EzPalm icon.

5. Tap the EzCapture™ button. The Palm Computer will wait a few seconds for you.

6. On the EDM-760, tap the STEP button to begin the transfer process. The EDM-760 display shows the percentage of memory remaining to be transferred. When this number reaches zero, the transfer is complete. If you want to terminate the transfer before it is complete, simultaneously hold the STEP and LF buttons for five seconds.
7. The Palm Computer will close the file named with today's date. Tap Exit to end EzPalm or tap Explorer to view the file list.

Transferring Recorded Data

To transfer recorded data to your palmtop or laptop PC, proceed as follows:

1. Connect the computer to the serial port using the serial cable. Insert the small round plug into the data connector on your aircraft instrument panel, and the other end into the computer serial port.
2. Start running the EzPlot program in the PC, referring to the instructions supplied with that program.
3. Simultaneously hold the STEP and LF buttons for five seconds. You will see the word PROGRAM for two seconds. Tap the STEP button until you see the question DUMP? NO.
4. Tap the LF button to select either NEW or ALL.
   - NEW will transfer only data *newly* recorded since you last saved your data.
   - ALL will transfer *all* the data that is in the EDM-760 memory.

   In either case, no data will be erased from the EDM-760.
5. Click Start on the EzPlot screen on the PC.
6. Tap the STEP button on the EDM to begin the transfer process. The display shows the percentage of memory remaining to be transferred. When this number reaches zero, the transfer is complete. If you want to terminate the transfer before it is

complete, simultaneously hold the STEP and LF buttons for five seconds.

Personalizing

Pilot Programming

You can program the automatic indexing rate (1-9 seconds or 0 = don't auto-index), the temperature display (°F or °C) and the EGT resolution (1 or 10°). To start the Pilot Programming Procedure, simultaneously hold the STEP and LF buttons for five seconds. You will see the word PROGRAM for two seconds and then the sequence shown in the chart below. Tap the STEP button to advance to the next item in the list. Tap the LF button to select alternate values of that item. The shaded areas in the chart below pertain only to the Fuel Flow Option.

Select switch	*Tap* STEP *to advance to the next item*	*Tap* LF *to sequence through these values*	*Comments*
T, F, A	PROGRAM		Stays on for two seconds.
T, F, A	FUEL ? N	N ⇄ Y	Y—Yes—to change fuel status (see page 29)
T, A	RATE 4	0 ⇄ 9	Indexing rate in the Automatic Indexing Mode. Selecting 0, disables the Automatic Indexing Mode.
T, A	OAT F	OAT F ⇄ OAT C	OAT readings in °F or °C. Special mode: To calibrate the OAT ±10°, hold both the STEP and LF buttons simultaneously for five seconds, which will proceed to the next step.

T, A	OAT 0	OAT-I0 OAT I0	This step will be normally be skipped. See step above. Adjust the indicated temperature up or down by up to 10°. For example, OAT 3 adjust the OAT upward 3°.
T, A	EGT - I?N	EGT I? N EGT I?Y	Y—Yes—sets the digital display to one degree resolution; N—No—sets 10°. (10° is easier to see.)
F, A	29.00 = KF LFT	05.00 99.99	Used to set and fine tune the K factor. See text below.
F, A	KF= 29.00 RT	05.00 99.99	Used to set and fine tune the K factor. See text below.
F, A	ACCU M?N USD	ACCU M?N ACCU M?Y	N—No—Upon informing the EDM-760 that you refueled the aircraft, reset total fuel used to 0. Y—Yes—accumulate total fuel used rather than reset to 0.
F, A	GPS-C = 2 TO GPS	0 5	GPS Com Format.
T, F, A	DUMP? N MEM	N NEW ALL	Select to transfers ALL or only NEW data. (Next step is bypassed for a Long Term Memory DUMP.)
T, F, A	END Y	END Y END N	Y—Yes to exit; N—No to review list again.

Using a Factory Original TIT Probe

If your aircraft is using the factory original TIT probe and gauge, you will be required to calibrate the EDM-760 for that probe. The factory original

TIT probe must be a type K and the leads must be wired red-to-red and yellow-to-yellow. Both the EDM-760 and factory original gauge may be used concurrently. Due to the high input impedance of the EDM-760 instrument, it will not affect the accuracy of the factory installed probe or gauge.

In normal cruise flight, record the difference between the factory installed TIT gauge and the EDM-760 TIT reading.

TIT gauge _____ EDM _____.

If you haven't already done so, start the pilot programming procedure, by simultaneously holding the STEP and LF buttons for five seconds. You will see the word PROGRAM for two seconds.

Tap* STEP *to advance to the next item	***Tap the* LF *button to sequence through these values***	***Comments***
PROGRAM		Stays on for two seconds.
RATE 4	RATE 4	hold both STEP and LF buttons simultaneously for five seconds to begin the next sequence.
ORIG ?N TIT	ORIG T-N ⇕ ORIG T-Y	Y—Yes—selects factory original TIT probe and proceeds to the next step.
TIT +0 ADJ	TIT - 975 ⇕ TIT + 975	Tap the LF button to lower the correction; hold the LF button to raise the correction. For example, if the EDM-760 reads 100 less than the aircraft's TIT gauge, set the display to read TIT + I00.
		Tap STEP button to exit the procedure.

Fuel Flow Option Programming

Fuel Flow Parameters

Three additional parameters may be set by the pilot when the Fuel Flow Option is installed:

- K Factor—the fuel flow transducer calibration constant.

- Accumulate—default is OFF: reset the fuel *used* to 0 every time you inform the EDM-760 that the aircraft was refueled. With accumulate ON fuel *used* will not be reset to 0 when you inform the EDM-760 that the aircraft was refueled.
- GPS Communications fuel data format.

K Factor

The K factor is shown on the fuel flow transducer as a four digit number, which is the number of pulses generated per gallon of fuel flow. **Before installing the transducers, write down the K factors here (L)_____(R)_____.** To enter the number, move the decimal point three places to the left. For example if the K factor on the fuel flow transducer is 29,123, enter 29.12 in the K factor parameter.

The K factor can be changed in the pilot programming procedure. *When the K factor is changed during a trip, calculations of fuel used, fuel remaining and time to empty are not retroactively recalculated.*

Fine Tuning the K Factor

The K factor shown on the fuel flow transducer does not take into account your aircraft's particular installation. Fuel hose diameters and lengths, elbows, fittings and routing can cause the true K factor to be different from that shown on the fuel flow transducer.

You must use the following procedure to fine tune the K factor.

1. Make at least three flights of about two to three hours each. Note the actual fuel used (as determined by topping the tanks) and the EDM-760 calculation of the fuel consumed for each flight = USD L and USD R.

	Fuel USED shown by EDM-760		*Actual fuel used by topping tanks*	
Flight	*USD L*	*USD R*	*filled left*	*filled right*
1	❶		❷	
2				
3				

Total				

2. Total ❶ the EDM-760 fuel used and ❷ the actual fuel used for each tank.
3. Record the current K factor here ❸ left_____ right_____ and in the table below.
4. Calculate the New K Factor as follows:

New K Factor = (❶EDM-760 fuel used) x (❸Current K factor)
(❷actual fuel used)

New K Factor (L) = (❶(L)_____) x (❸(L)_____)
(❷(L))

New K Factor (R)= (❶(R)_____) x (❸(R)_____)
(❷ (R))

Every time you fine tune the K factors, record the measurements here:

Date	*❶EDM-760 fuel used*	*❷actual fuel used*	*❸Current K factor*		*New K factor = ❶x❸/❷*	
			Left	*Right*	*Left*	*Right*

Fuel Flow Option Programming Procedure

Setting the K factor

This procedure is different than for setting other parameters. Place the select switch in the FF position. If you haven't already done so, start the pilot programming procedure, simultaneously hold the STEP and LF buttons for five seconds. You will see the word PROGRAM for two seconds.

1. Tap STEP button to advance to the screen 29.00=KF

LFT

2. Hold both the STEP and LF buttons simultaneously for five seconds. First digit blinks: **2**9.00
3. Tap or Hold the LF button to change flashing digit: **I**9.00
4. Tap STEP button for next digit: I**9**.00
5. Tap or Hold the LF button to change flashing digit: I**8**.00
6. Tap STEP button for next digit: I8.**0**0
7. Repeat items 5 and 6 for the remaining two digits.
8. Hold STEP and LF buttons simultaneously for five seconds to store the left engine K-factor.
9. KF= 29.00 is now shown.
   RT
10. Repeat steps 2 through 8 to adjust the right engine K-factor.
11. Hold STEP and LF buttons simultaneously for five seconds to exit this procedure.

Accumulate Total—Trip Total

Select "no" if you wish to display total fuel used since the last time you informed the EDM-760 that the aircraft was refueled. Select "yes" to display total fuel used for an extended trip with multiple fuel stops. This selection affects only the USD measurement.

GPS-C Comm settings

The GPS-C setting selects the format of the *fuel data* output of the EDM-760. See "Setting GPS-C Fuel Flow Communications Format" on page 49.

Setting Long Term Memory Parameters

If you haven't already done so, start the pilot programming procedure, simultaneously hold the STEP and LF buttons for five seconds. You will see the word PROGRAM for two seconds. To change the date, time and user id for the Long Term Memory, tap the STEP button until the display shows DUMP? NO. Next, simultaneously hold the STEP and LF buttons for five seconds. Then set the date and time as show below:

Tap **STEP** *advances to next item*	*Tap the* **LF** *button to sequence*	*Comments*
TIME	2 ▯ 500	Record time interval, in seconds
MNTH	I ▯ I2	Month
DAY	I ▯ 3I	Day
YEAR	00 ▯ 99	Year (note: represents 1980 through 2079)
HOUR	OO ▯ 23	24 hour time. We suggest you set Zulu time
MIN	OO ▯ 59	This also zeros the seconds
N-----	**N** I23456	Displays current Aircraft ID. To *change* Aircraft ID, hold both STEP and LF buttons simultaneously until the first character flashes. Use LF to select the first character. STEP moves to the next character. To *Save* the Aircraft ID, Hold both STEP and LF for 5 sec.
END Y		Tap STEP button to exit the procedure.

Alarm Limits

Factory Set Default Limits

JPI conservatively sets the default alarm limits below Lycoming and Continental recommendations.

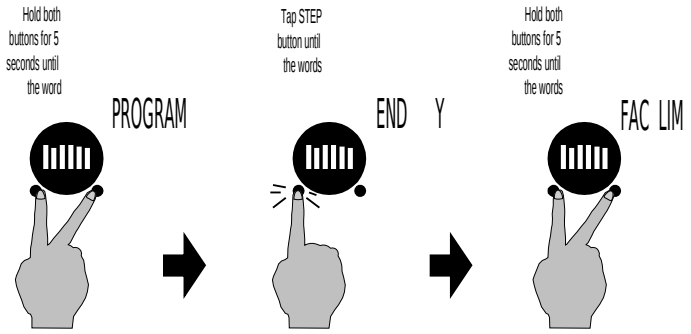
Measurement	*Default Low Limit*	*Default High Limit*	*Example*
CHT		450°F 230°C	465 **CHT**
OIL	90° F 32°C	230°F 110°C	280 **OIL**
TIT		1650°F 900°C	I720 **TIT**
CLD		-60°F/min. -33°C/min.	-65 **CLD**
DIF		500°F 280°C	525 **DIF**
BAT, 24 V	24V	32V	22 .4 **BAT**
BAT, 12 V	12V	16V	I7.6 **BAT**
LO FUEL	45 min		00.20 **H.M**

If you change the display to Celsius, be sure to change the alarm limits to Celsius degrees. This is not done for you automatically. When an alarm is displayed, *tapping* the STEP button will temporarily delete that measurement from the sequence for the next ten minutes. When an alarm is displayed, *holding* the STEP button until the word OFF appears will delete that measurement from the sequence for the remainder of the flight.

Changing the Alarm Limits

You may prefer to set your own alarm limits Follow the procedure outlined below to change any of the factory default settings.

To start the alarm limit procedure, after power up, wait until the EDM-760 completes its self test and is in the Automatic or Manual indexing mode. If in doubt, tap the STEP button a few times. Then follow the steps depicted here:



The display will then sequence as shown in the chart below. Tap the STEP button to advance to the next item in the list. Tap the LF button to select alternate values of that item. *Hold* the LF button to increase a numerical value; *tap* the LF button to decrease a numerical value. The shaded areas in the chart below pertain to the Fuel Flow Option only.

Changing the Alarm Limits Procedure

STEP *button sequences to next item* **LF** *button sequences through these values*	*Description*
FAC? N FAC? Y	Restore factory defaults?
REV X.XX	Firmware rev. number (momentary)
ENG F ENG C EGT CHT EGT CHT	Select F or C degrees for all engine temps. You must also change the alarm limits to °F or °C.
I6.0 H BAT OR 30.5 H BAT (I0.0 H BAT 35.0 H BAT)	Battery high voltage limit, set in 0.5 volt increments.
I2.0 L BAT OR 24.0 L BAT (8.5 L BAT 30.0 L BAT)	Battery low voltage limit, set in 0.5 volt increments.
500 DIF (30 DIF 990 DIF)	EGT difference limit, set in 10° increments.
450 H CHT (90 H CHT 500 H)	CHT high limit, set in 5° increments.
-60 CLD (-5 CLD -200 CLD)	Cooling limit, set in 5°/min. increments.
I650 TIT (650 TIT 2000 TIT)	Also sets the maximum scale of the EGT and TIT bar graph.
230 H OIL (40 H OIL 500 H OIL)	Oil temperature high limit, set in 5° increments.
90 L OIL (I0 L OIL 250 L OIL)	Oil temperature low limit set in 5° increments
TIT2 -N TIT2 -Y FOR OIL FOR OIL	If TIT2 probes are installed in place of oil probes
CARB -N CARB -Y FOR T I T FOR	If carburetor probes are installed in place of TIT probes

T I T	
FUEL FLOW IN GAL GAL□KGS□LTR□L BS□	Selects the units in **all** measurements where fuel quantity or fuel rate is displayed
MAIN=I00 TNK	Main tank capacity, in units selected. Can also be set by HOLDING in the STEP Button on start up will go directly to TANK SIZE.
AUX? N □ AUX? Y TNK TNK	Y—Yes—aircraft has auxiliary tanks
AUX=0 TNK	Auxiliary tank capacity

MIN = 45 LOW	Alarm limit in minutes for low time in tanks
REM = I 0 LOW	Alarm limit for low fuel quantity in tanks, in units selected
CARB? N CARB? Y	Y—Yes—carbureted engine
SAVE -N SAVE -Y DOT DOT	Whether excluded measurements are retained after power off. Y—Exclusions are saved. N—Exclusions are not saved
SAVE -N SAVE -Y LOP LOP	Whether Lean of Peak method is retained after power off. Y—Lean of Peak is default. N—Rich of Peak is default
M I N I 0 (0 3 I) BRT	Set low light display brightness from 0 to 31.
END Y END N	Y—Yes to exit; N—No to review list again

Fuel Flow Alarm Limits, Units, Fuel Capacity

Fuel Flow Units

Selects the units in *all* measurements where fuel quantity or fuel rate is displayed. If you change this parameter, it does *not* change the numerical value of the fuel tank capacity. You must do this manually. For example if you change from Gal. to Lbs., the tank capacity will be interpreted as 50 Lbs. rather than 50 gallons; the EDM-760 will not convert 50 Gal to equivalent pounds.

Main Tank Capacity

Enter the total capacity of the main tanks in the fuel flow units selected. If you have tank tabs (but no auxiliary tanks) and sometimes fill only to the tabs, set the main tank capacity to the capacity up to the tabs.

Auxiliary Tanks

If you do not have auxiliary tanks or tank tabs, answer “No.” If you answer “Yes,” you will be asked to input the capacity of the auxiliary

tanks in the fuel flow units selected. If you have tank tabs and sometimes fill only to the tabs, set the auxiliary tank capacity to the difference between full tank capacity and tab capacity. The EDM-760 does not differentiate fuel flow between the main and auxiliary tanks; it tracks only *total* fuel in the aircraft.

Low Time Alarm Limit

Select the value of the time remaining, in minutes, that triggers the alarm. Time remaining is calculated at the current fuel flow rate.

Low Fuel Alarm Limit

Select the value of the fuel remaining, in the selected fuel flow units, that triggers the alarm. Fuel remaining is calculated at the current fuel flow rate.

Carburetor?

Different response filters are used depending on whether your engines are carbureted or fuel injected. The filter for a carbureted engine has a slower response time to reduce sudden fluctuations in readings.

Fuel Flow Option—Formats, Diagnostics

Navigation Data Formats

Output of GPS; input to EDM-760. The EDM-760 automatically configures itself for one of three industry standard data formats:

Format	*Baud rate*	
NMEA-183 (Marine Navigation Data Format)	4,800	This is the format for most handheld GPS receivers. Loran must have sentences RMA & RMB. GPS must have sentences RMB & RMC.
Aviation Data Format	9,600	“Output sentence type 1” Req’d sentences: A, B, C, D, E, I and L first char id byte. Sentence terminator either <CR><LF> or <CR>.
Northstar (Northstar binary)	1,200	M1 setup select “NO EXTENDED”, “NAV ONLY”

Setting GPS-C Fuel Flow Communications Format

GPS-C	Input to GPS; output of EDM-760
0	No fuel data output
1	Garmin (Shadin Miniflow format)
2	Allied Signal (format B)
3	Arnav/EI fuel data
4	Allied Signal (format C) *
5	(not assigned)
6	UPS/Garmin fuel/air data

Diagnostic Messages, Fuel Flow

The following displays indicate a malfunction in the Fuel Flow Option transducer or associated electrical connections:

0.0 GPH	Zero's indicate Fuel flow is too low to register
--- GPH	Dashes indicate No fuel flow transducer signals
--- H.M	Dashes indicate No fuel flow transducer signals

GPS Interface Diagnostics

Measurements REQ, RES, & MPG are all missing from the scan.	No communications from GPS receiver to EDM-760. Possibly no connection or aircraft GPS is off.
NO - COM message and measurements REQ, RES, & MPG are missing.	Communications are received by EDM-760 and the Auto-Protocol setup is in process. Verify correct output format setup in GPS receiver; check GPS connections.
NO - SIG message and measurements REQ, RES, & MPG are missing.	GPS receiver has insufficient signal for valid data.
NO - WPT message and measurements REQ & RES, are missing.	No waypoints are programmed into the aircraft GPS receiver.
- - - REQ or - - - RES message	Your ground track is more than ±70° from your course to the next GPS waypoint.

Navigation Data Ports for GPS Comm

(These ports are completely independent of the EDM-760 serial data output port.)

Navigation Data (output of GPS; input to EDM-760)

Compatible with RS-232, TTL, RS-423, RS-422 SDA.

Serial data format 8 data, 1 start, no parity. Baud rates: 1,200, 4,800, or 9,600 depending on the GPS data output format. The EDM-760 automatically detects the GPS data output format and is independent of the GPS-C setting.

Fuel Data (input to GPS; output of EDM-760)

Serial data format 8 data, 1 start, no parity. Baud rate: 9,600.

Output format is determined by the GPS-C setting, but may be over-ridden by the GPS navigation format: If the EDM-760 senses Northstar or NMEA-183 navigation data input, there will be no fuel data output.

Section 5 - Option Connector Pin Assignments

P3(middle) 15-pin connector

Pin no.	*Pin no.*	*Probe or function*
yel 1	red 2	Left TIT
yel 3	red 4	Left OIL or TIT2
yel 5	red 6	OAT
yel 9	red 10	Right TIT
yel 11	red 12	Right OIL or TIT2
gray 7		Remote alarm
red 8		+ Power
wht 13		RS-232 data port
blk 15		Engine ground

Fuel Flow Option 15-pin connector

Pin no.	*Function*
1	RS-232 out
2	RS-232 in
wht 4	FF left signal
red 5	FF power
blk 6	FF return
7	Switch com
8	Switch EGT
9	Switch FF
11	Remote alarm
12	FF right signal

Interface connections to selected GPS models

EDM	P4 conn Pin 1	P4 conn Pin 2
Arnav 5000	Pin 4	Pin 5
Garmin 195	(nc)	Pin 4
Garmin 430 / 430	Pin 57	Pin 56
Northstar M3P	(nc)	Pin 6 (leave pin 11 open)
UPS GX50 / 60	Pin 4	Pin 5

Reference Reading

You may wish to know more about the effect of engine operations on EGT and CHT. The reading list below provides general overviews as well as original references on topics that may be of interest.

General Overview

These references are readily available to pilots and provide a readable source of general technical information.

- Teledyne Continental Motors, *Engine Operation for Pilots*, from the FAA Accident Prevention Program, FAA-P-8740-13.
- Editors of *Light Plane Maintenance* Magazine, *EGT Systems*, Belvoir Publications Inc., Greenwich, CT 06836. 1989.
- *Lycoming Flyer* Issue 53 dated January 93.

Technical Reviews and Original References

For those pilots who have engineering backgrounds, the references listed below present the original research on the combustion process and represent the source documents for those with technical interests.

- A. Hundere, "Autogas for Avgas," *AOPA Pilot*, October, 1969.
- A. Hundere and J. Bert, "Pre-ignition and Its Deleterious Effects in Aircraft Engines," *SAE Quarterly Transactions*, Vol. 2, No. 4, pages 547-562, October 1948.

Section 6 - Technical Support

JPI offers both e-mail and telephone technical support. Have your model and serial number ready when you call. Call ***JPI*** for a return authorization number before returning any equipment.

J.P.INSTRUMENTS
3185-B Airway Avenue
Costa Mesa, CA 92626
800 345-4574
jpinstruments.com

Limited Warranty

J.P. Instruments, Inc. (JPI), warrants all parts in your new EDM-760 to be free from defects in material and workmanship under normal use. Our obligation under this warranty is limited to repair or exchange of any defective part of this unit if the part is returned, shipping prepaid, within two years for electronics and one year for probes from the date of original purchase. Installation labor is the responsibility of the aircraft owner. Homebuilt aircraft warranty starts when the aircraft is certified for flight. Replacement parts carry a warranty for the balance of the warranty period.

Under this warranty, JPI is not responsible for any service charges, including removal, installation, nor any other consequential damages. JPI incurs no obligation under this warranty unless a Warranty Registration Certificate describing the warranted product has been completed and mailed to JPI with all information requested.

This warranty is void on any product which has been subject to misuse, accident, damage caused by negligence, damage in transit, handling or modification which, in the opinion of JPI, has altered or repaired the product in any way that effects the reliability or detracts from the performance of the product, or any product whereon the serial number has been altered, defaced, effaced or destroyed.

This warranty is in lieu of all other warranties expressed or implied and other obligations of liability on JPI's part, and it neither assumes nor authorizes any other person to assume for JPI any other liability in connection with the sale of JPI products.

To initiate this warranty, the aircraft owner must submit a completed Data Logging Worksheet to JPI. Upon receiving a completed worksheet, JPI will initiate the warranty from the date of original purchase. Any replacement parts carry a warranty that extends for the balance of the period of the original warranty. For homebuilt aircraft the warranty starts when the aircraft is certificated for flight and noted on the warranty card.

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