

# Model EIS-66R

## Remote Engine Information System

### Installation Manual

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Applicable to Software Versions 100 and above.

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Congratulations on your purchase of Grand Rapids Technologies' Engine Information System (EIS). We are pleased that you have chosen our product to meet your aircraft instrumentation needs. You will find this system will enhance your flying pleasure while increasing your level of safety.

## Read This First!

Advice Before Starting Your Installation: The basic steps to make your installation easier.

**Step 1.** Determine how you would like to arrange your EGT/CHT connections. The EGT/CHT inputs are numbered 1-6. You may simply connect EGT1 & CHT1 to cylinder number one (according to the engine manufacturer's cylinder numbering). This is common and works well. Other schemes can be used also. The main point is to make sure you know which cylinder corresponds to each of the readings on the instrument so that you will perform maintenance on the correct cylinder when it becomes necessary.

**Step 2.** Plan which functions you will wire to each of the 6 auxiliary inputs. Fuel pressure, fuel level, current (amperage), trim and flap positions, and any others that do not have a dedicated input to the instrument, must be connected through the auxiliary inputs. (The auxiliary inputs may be used for other functions also, but these are the most common uses. Keep in mind that unlike the EIS with a display, the remote EIS includes a manifold pressure sensor internally.)

**Step 3.** It does not matter which auxiliary input is used for the various auxiliary inputs. Settings in the EFIS will be used to define which function is performed by the various auxiliary inputs that you use.

**Step 4.** The Remote EIS include a dedicated warning light which will flash whenever the oil pressure is below 15 psi. Since the EIS starts up immediately when power is applied, this provides an immediate warning if oil pressure is not detected after engine start. Once the EFIS boots up, all other alarms will become active via the EFIS warning function.

...now on to the installation!

## An Overview of Installation & Setup

Installation of the EIS includes the physical mounting of the instrument, making the electrical connections from the pre-wired cables to the various sensors, and finally setting entries in the instrument to customize your instrument for your installation. The first two steps are quite obvious. The entries made to the instrument for your installation tells the instrument such things as how many pulses per revolution of your engine, units (Fahrenheit or Celsius), etc.

After following these steps, operation of the instrument will be verified by applying power to it. Finally, you will set your engine limits with EFIS settings.

## Using the Engine Information System

### The Basics of the Engine Information System Operation

- **Power to EIS when starting the engine.** The EIS should be powered whenever the master switch is on. Before starting the engine, a flashing warning light should be observed, indicating that low oil pressure is being sensed correctly. The instrument may be left on, and the engine started, at which time the warning light should go off, indicating oil pressure is within limits. While the oil pressure sensor is very reliable, this procedure is recommended because it requires little more than turning the instrument on before starting your engine.
- **The Alarms – The most important part!** Be sure you set all engine alarms in the EFIS. The EFIS alarm function will alert you to out-of-limit conditions by flashing its warning light (to get your attention), generating an audio alert, and displaying a warning message on the EFIS screen(s). The warning light will go out when everything is within limits. An alarm that goes away, and then returns, is treated as a new warning, and will again generate the response described here. Multiple alarms are presented according to priority, one at a time.
- **Determining Alarm Status** – After acknowledging one or more alarms, the warning light will stay continuously on indicating as long as one or more functions are out-of-limits. To review the current out-of-limit conditions, select the ENG page, and note the items displayed in red. The “Status” page may also be reviewed to see a list of alarm conditions.
- **Set Unused Limits to Zero.** By setting a limit to zero, the alarm function for that limit will be turned off. It is a good idea to set limits for all unused functions to zero so that the instrument does not inadvertently generate nuisance warnings for signals you are not using.

## Before Each Flight

- Verify the remote EIS warning light is flashing when power is on, and the engine is not running.
- If the instrument includes the fuel flow option, review or update the fuel quantity setting as necessary.

**Suggestion!** Include in your checklist a step to verify a low oil pressure warning is generated before starting the engine. This is a simple way of verifying the oil pressure sensor is correctly measuring zero oil pressure. This is recommended because it is a very easy test to verify the most critical engine monitoring function.

NOTE: It is possible for the instrument or its sensors to suffer various kinds of failures that cannot be detected by the self-test. It is good practice to review the various display pages periodically as necessary to verify that the instrument and its sensors are operating normally.

## Status and Settings

A considerable number of settings will be made to configure the Remote EIS for your airplane, define engine limits, and configure the graphical engine pages. These settings are stored in the EFIS and will be shared with other GRT EFIS screens connected via the inter-display link. The “EFIS Setting Backup, accessed from the Set Menu, Display Unit Maintenance menu, will save these settings to a USB memory stick so they can be easily restored in the event of a failure. ***We recommend backing up your settings whenever they are changed.***

## Configuring the EFIS Serial Port

The EFIS serial port is configured as follows:

Serial Port Input: EIS/Engine Monitor

Serial Port Output: EIS/Engine Monitor

Serial Port Rate 9600

## Status – Verifying EIS Model and Options

The Remote EIS status is displayed via the “Remote EIS Status” menu. This menu is accessed via the “Set Menu”, “Display Unit Maintenance”, and scrolling down to the “Remote EIS Status” menu. The following status is displayed:

The following data is displayed when serial data is valid.

**EIS Serial Input: OK/Not Connected** - “OK” will be displayed when the remote EIS is receiving valid data from the EFIS. “Not Connected” will be displayed otherwise.

**EIS Mode: Remote/Non-Remote** – This indicates if the EIS that is connected is a remote EIS, or an EIS with a display. If the EIS has a display, refer to the EIS User Manual, as this manual does not apply.

### **Air Data/Manifold Pressure Options**

Displays the manifold pressure type that is installed in the unit. A 52 In Hg unit MAP sensor is required for turbocharged engines.

### **Unit Temperature**

This temperature is used to for the EGT/CHT temperature calculation. It will typically be 10-20 degrees higher than ambient temperature.

### **Software Version**

The software version.

### **Hardware Version**

This shows the if this is a piston or turbine/turboprop remote EIS. For piston engine versions, the maximum number of cylinders that can be monitored for EGT/CHT is shown, and the type of fuel flow input. Flow Sensor FF indicates that the fuel flow function requires a flow sensor, such as the Electronics International red cube, or a Floscan 201B. Pulse Width FF indicates that fuel flow is read from an engine computer or electronic fuel injector that outputs fuel flow using the pulse duty cycle.

### **Sensor Configuration**

Type of fluid temperature, oil pressure sensor, etc.

### **Load Software**

A menu to allow updating of the EIS software.

## Settings- Configuration

Some settings configure the remote EIS for your installation. These are not limits, but settings that allow the tachometer, fuel flow, auxiliary inputs, and other things, to work correctly. See the “Configuring the EIS for your Airplane” section below to make these settings.

## Settings – Engine Limits

All engine limits must be set using the “Engine Limits” menu, accessed from the “Set Menu” list of menus. Minimum and maximum limits are included for most functions, even when some of the limits may have no everyday practical use. This allows additional flexibility to assist with engine troubleshooting, especially to help alert you to intermittent problems that would otherwise be hard to detect.

All limits must be set in the same units used for display of engine data. If you change the units (from Fahrenheit to Celsius for example), the limits will not change, making all temperature limits incorrect unless reset to Celsius.

**NOTE:** Limits that are not used should be set to zero. This disables the limit to prevent nuisance false warnings. Some limits may not have a practical use for routine flying but have been included to provide additional flexibility in diagnosing engine problems. Normally these limits are set to zero.

## Engine Limits-Table of Limits.

Setting	Use	Recommended Setting
Max Time	Alerts pilot when flight time exceeds this limit. Useful as a warning to check fuel. Limit is entered in minutes, so 2 hours is entered as 120, etc.	30-45 minutes less than airplane's endurance.
Fuel	Fuel quantity calculated by the fuel flow function. After adding fuel to the airplane, set this to match the quantity in the airplane.	Set to match amount of fuel in the airplane. Not applicable if the fuel flow option is not installed.
Interval	Provides a warning that repeats at the interval entered in minutes. Useful as a reminder to perform periodic tasks such as switching fuel tanks. Acknowledging this alarm cancels the warning completely, therefore the warning light will not remain on after acknowledging this alarm.	As required. Typically 30-60 minutes is used for changing fuel tank selection.
Min EFIS Voltage – Bus x	Indicates the voltage sensed on this input to the EFIS. A limit should be set to warn if this input is not receiving power.	See “Min EIS Voltage” below.
Max EFIS Voltage – Bus x	Warns of over-charging. Do not set this alarm for the bus that is monitored by the EIS max volts alarm so that multiple alarms will not be generated by an over-voltage event.	Start with 15.6 volts. Lower as much as possible without getting false alarms. Typical limit should be 14.6



		Volts.
Max Fuel Flow	Generates a warning when the fuel flow (rate of fuel burn) exceeds this limit. Useful for detecting badly leaking fuel lines, loose connections to fuel injectors, etc. Very useful safety feature for all engines, but especially fuel injected engines. Be sure to use it!	Set about 10-20% above max fuel flow rate at full takeoff power. Applicable only if the fuel flow option is installed.
Min Oil Pressure	Although the Remote EIS includes a dedicated oil pressure alarm, we recommend the use of this alarm also, as it will generate an audio alert if oil pressure fall below this limit.	As recommended by the engine manufacturer, or 20 psi.
Max Oil Pressure	Useful as a reminder to reduce RPM when warming a cold engine, especially in winter conditions, to avoid excessive oil pressure.	98 or less. Max oil pressure displayed by the instrument is 99 psi.
Min Cruise Oil Pressure	Generates a warning when the oil pressure is below this limit. This limit is active only when the engine RPM is above the min Lim-RPM setting. This allows setting a low oil pressure limit that apply only at higher engine RPM.	As recommended by engine manufacturer, if available. If not provided, set based on experience.
Max OilT	Maximum Oil Temperature	As recommended by engine manufacturer.
Min OilT	Minimum Oil Temperature – Intended for troubleshooting engine problems. Also useful as an “engine not warmed up yet” reminder.	Set limit based on experience.
Max RPM, Max RPM2, Max RPM3	Warns when engine exceeds maximum RPM	Set according to engine manufacturer’s recommendation.
Min RPM, Min RPM2, Min RPM3	Warns when engine RPM falls below this entry. Useful for troubleshooting engine problems. May also be used as a warning that the engine RPM is dropping too low on the landing rollout which could result in engine stall.	Set limit based on experience.
Min N1, Min N2, Min N3	Minimum and Maximum RPMs for turbine/turboprop engine speeds, in percent.	Set according to engine manufacturer recommendation.
Max N1, Max N2, Max N3		
Min Fuel	Minimum Fuel Totalizer Quantity – Generates a warning when the fuel flow function’s totalizer quantity drops below this limit.	Set to at least enough useable fuel to provide 30-60 minutes of fuel at cruise power. Applicable only if the fuel flow option is installed.
Min Aux (1-6) Max Aux (1-6)	Minimum & Maximum for Aux input. After the auxiliary input has been assigned to a function, the name of the limit will show the auxiliary number, and the assignment, such as:  Min Aux 1 (Fuel Pressure)	Set limit as needed depending on the use of the auxiliary input. Some uses of the auxiliary inputs do not require limits (such as manifold pressure) and some do, such as fuel pressure.
Max Coolant Temperature	Applicable to water cooled engines.	Set limit as recommended by engine manufacturer

Min Coolant Temperature	Intended for troubleshooting engine problems. Also useful as an “engine not warmed up yet” reminder, although we do not recommend extensive use of alarms of this type, as they end up being nuisance alarms.	Set limit based on experience.
Max EIS Volt	Maximum Voltage Limit – Allows for detection of failed regulator. Loss of correct voltage regulation resulting in over-charging (and subsequent high voltage) will greatly shorten the life of the battery, and could be dangerous. (To avoid duplicate alarms, do not set this alarm for the EFIS bus that corresponds to this bus.)	Start with 15.6 volts. Lower as much as possible without getting false alarms. Typical limit should be 14.6 Volts.
Min EIS Volt	Minimum Voltage Limit – Allows for detection of loss of charging. This limit is only tested when the engine RPM is greater than the EGT-RPM setting. This prevents false alarms on final approach (low RPM) with landing lights on.	12.8 volts will generate immediate alerting of loss of charging, although this will cause low voltage alarm whenever instrument is on while engine is not running, and when the battery is discharged. Set to 12.4 volts or less to avoid alarm when engine not running, but still gives alarm shortly after battery discharging has begun.
Max Carb	Carb temp warning is generated when the carb temp falls between the Max Carb and Min Carb Limit.	40-60 °F
Min Carb	See Max Carb	0-20 °F
Max EGT	Maximum EGT – Not all engines have published limits, nor do all engines require a maximum EGT limit. Exceeding this limit may indicate a cylinder has a fouled plug, or one ignition system is turned off. This alarm can be useful for troubleshooting engine problems also.	Set limit according to engine manufacturer recommendation, or based on experience. Typically 1500 F is a good starting point.
Min EGT	Minimum EGT – This alarm is active only when the engine RPM is above the entry for EGT-RPM. This alarm is useful to detecting the loss of a cylinder, or for troubleshooting engine problems.	800-1200 °F, depending on sensitivity desired. If false alarms are consistently generated, reduce the limit to less than 800 °F, or set to 0.
Lim-RPM	Defines the RPM at which the following RPM dependent limits become active. These are: Min EGT, Min Volt, Min Cruise Oil Pressure	Set limit to an RPM slightly less than the RPM used for the MAG check. This allows the Min Volt test to become active during the MAG test to automatically test for charging.
Max EgtSpan	Maximum difference between the highest and lowest EGT. This limit can be used to help detect changes in normal engine operation. It is also useful when leaning using the digital leaning pages, as it is possible to not notice a EGT that is abnormally low when using these pages to lean the engine. (Its more obvious on the bar graph pages.)	Set this limit based on experience. It may take some trial and error to arrive at a good limit. After establishing a limit that rarely generates alarms, activation of this alarm may indicate developing engine problem.
Max EGT Increase	Maximum Increase in EGT when the “Normal” (normalize) function is active. This alarm will often generate a false alarm	Set limit based on experience. A small value will allow sensitive

	when the load on the engine significantly reduced during descent. To avoid this false alarm, turn off the “Normal” mode.	detection of EGT increases, which is useful for detection of intermittent problems. Normal operation may require a larger setting to prevent false alarms due to normal EGT fluctuation caused by turbulence or other small power/load fluctuations.
Max EGT-Dec	Maximum Decrease in EGT from the Lean Point. See also Max EGT-Inc description.	Set limit based on experience. You may find that this limit is significantly different from the Max EGT-Inc. See also Max EGT-Inc description.
Max CHT Cooling Rate	Maximum Cooling Rate for CHT – The alarm is provided in degrees/minute and corresponds to the maximum rate of decrease in CHT. No limit applies to the maximum rate of increase. All cylinders are checked for this limit.	Set limit based on engine manufacturer’s recommendation. If no limit is provided, establish a limit based on experience. A recommended starting point is 100 °F/minute, or 50 °C/minute.
Max CHT	Maximum Cylinder Head Temperature. Often engines will normally operate significantly lower than the engine manufacturer’s limit. Consider setting this limit lower than the maximum to get early warning of abnormal CHTs.	Set according to engine manufacturer’s recommendation.
Min CHT	Minimum Cylinder Head Temperature. Intended for engine troubleshooting problems. Also useful as an “engine not warmed up yet” reminder.	Set limit based on experience or to zero if not used.
Min/Max Manifold Pressure – (from internal sensor)	Upper and lower limits for the pressure sensed by the internal manifold pressure sensor	No limits are recommended unless troubleshooting a problem.

## Other Engine Settings – Engine Performance and Fuel Data Scale

Refer to the EFIS manual for making engine performance (percent power) and fuel level scaling settings.

## INSTALLATION

### Mounting the Instrument – Position and other considerations

The first step in mounting the instrument is selection of a suitable location in the aircraft. The location must be selected such that it is not exposed to water, fuel, or engine heat and should not have cabin heat or vent air blowing on it. The instrument does not generate electrical noise that will interfere with radios, nor is it affected by transmissions from radios or engine ignition systems. It is not likely to affect a magnetic compass.

The instrument should be secured using the mounting holes in the baseplate. Figure 4 provides the physical dimensions of the instrument and a full-size mounting template. If the mounting template is used, its dimensions should be verified, as paper may expand and contract with humidity.

**NOTE:** No special consideration must be given regarding protection from vibration.

## Sensor Installation and Wiring

Figure 5a & 5b illustrates all electrical connections made to the EIS. The “Detailed Wiring Description” below provides additional information about wiring the instrument into your aircraft. Review this material to familiarize yourself before proceeding further.

Using this figure, start the wiring process by carefully planning and **DRAWING A WIRING DIAGRAM** for your aircraft. The wiring diagram is essential in planning a successful installation. Install the wiring, routing all wires required by the EIS to its planned location. A high-quality 22-gauge stranded wire, 7 or 19 strands, is recommended for all connections other than those made to the CHT and EGT probes. Solid conductor wiring is not acceptable. Thermocouple extension wire must be used for the CHT and EGT probes to prevent the introduction of errors into these measurements.

The general instructions provided here will apply to most engines, but specific installation recommendations are provided for UL Engine in the section, "UL Engine Installation Notes" below.

**CAUTION:** Use a separate ground wires for the ignition kill switches and the remainder of the electrical system if possible. These separate ground wires should attach to different places on the case of the engine so that both sets of grounds could not disconnect from the engine while remaining connected to each other. This provides additional protection for the instrument (although its internal protection is usually more than adequate), but more importantly, protects other electronic equipment in your airplane from potential damage. See the sheet at the back of the manual for more information.

All electrical connections are made to the EIS via two 25-pin sub-D type connectors. Pre-wired, color-coded cables are supplied with the instrument.

1. Start by making the power and tachometer connections as illustrated in figure 7. Note that 10.5-20 Volts DC, 0.20 Amperes is required to power the instrument. The instrument includes an internal thermally activated fuse that protects the instrument. A fuse should be used in the aircraft wiring so that a short in the wiring external to the instrument does not cause an electrical fire. Typically a fuse up to 5 amps may be used for this purpose, depending on the wire gauge and lengths. This fuse may be shared with other devices if desired.
2. For proper operation of the instrument, the ground (black wire) from the instrument must be connected to the negative battery terminal or ground bus. A connection to the engine case must be made to either the negative battery terminal or

ground bus. On engines with electric starters, this cable will already be in place and an additional cable is not required. The EIS ground (black wire) should NOT be directly connected to the engine. This is to prevent damage to the EIS in the event that the engine ground cable becomes loose. Ideally, the ground wire for the instrument should not be shared with other electrical devices. If other devices share the ground wire used by the instrument, use a digital voltmeter to verify the voltage difference between the case of the EIS, and the negative terminal of the battery is less than 20 mV with all electrical devices which share this ground wire turned on.

3. Do not use the same ground lead for the instrument, and the ignition kill switch(es). Be sure these separate ground leads do not connect to the engine in such a way that they could become disconnected from the engine, but remain connected together.
4. The remainder of the signals are now connected. Accuracy of these sensors is not affected by the length of the leads. Refer to figure 5a & 5b for an illustration of these connections.

### Serial Communication Port

An RS-232 serial port is used for all communication from and to the remote EIS.

The serial output can be wired to multiple display screens. This allows each display screen to receive engine data without be dependent on any other screen.

Wiring from a serial output of the EFIS to the remote EIS serial input is optional. It allows the EFIS to update the software in the EIS but is not required for normal operation. The EIS serial input should be connected to only one display screen.

### Tachometer

See figure 4 at the end of this document.

### Outside Air Temperature Sensor

The sensor for this unit is mounted using the plastic clip, or a plastic nut, depending on the type of sensor being used. To assure maximum accuracy, do not install the sensor such that it is in the path of engine exhaust gases or cooling air outputs. Also avoid attaching it to aircraft structure that is warmed by the sun. The ideal location is under the wing, or under the fuselage for pusher-engine installations. It is very easy for the probe to get warmed by the engine if it is installed behind the engine, usually resulting in readings that are 5-10° F too high. Generally, mounting the OAT sensor 2 feet from the centerline of the airplane will be sufficient to avoid elevated readings from engine exhaust and cooling. (For example, in an RV-6/7, mounting the sensor under a screw in the wing to fuselage fairing will provide accurate readings.)

Avoid routing the wires to this sensor near radios, ignition systems, or other electronic devices as much as practical. Ground the sensor near then instrument. To help prevent electrical noise from affecting the sensor, twist the entire length of leads from the instrument to the OAT probe.

## Water Coolant/Oil Temperature Sensor

Start by installing the sensor in the engine according to the recommendations of the engine manufacturer. After installation, route the wires through engine compartment, making certain the wire is supported so that it will not be chaffed. A connector or terminal strip may be used between the aircraft wiring and the sensor to enhance maintainability if desired. Single-wire type sensors, (those which have a one electrical connection to them) require that their cases be connected to ground. For these sensors pipe thread compound should be used to seal the sensor. Teflon tape should be avoided because it may electrically insulate the case of the sensor from ground. If practical, connect the ground wire to the same point where the instrument is grounded to minimize differences in ground voltages.

## Voltmeter

The voltmeter senses its voltage through the power input to the instrument, and thus does not require a separate connection.

## Oil Pressure

The preferred installation for the VDO pressure sender is to mount it remotely, with a flexible hose connection to the sensor. This isolates the pressure sensor from engine vibration and elevated temperatures, which extends its life, and is typically required due to space constraints on the engine. The sender uses a male 1/8-27 NPT pipe thread fitting.

The electrical connections are made through the case of the sender (ground) and the electrical terminal opposite the pipe thread fitting. Since the ground connection is made through the case, be sure to mount the sensor in such a manner to allow the case to be electrically tied to ground. The ground provided by a stainless steel over braid on the oil pressure line is not adequate and will typically cause the oil pressure reading to be slightly higher than actual.

## Magnetic Tachometer Sensor

See instructions with this sensor for installation recommendations.

## External Alarm Output

This output is used to control the external LED warning light included. The output is an OPEN/GROUND type output. This means that when this output is off (the alarm is not active), this line is equivalent to an OPEN circuit. When this output is on, this output is switched to GROUND. Thus, the external warning light (or annunciator) is connected to this output and +12 Volts. The maximum current this output can control is 0.11 Amperes, or 110 mA. Exceeding 110 mA will normally cause this output to go to the open state, although it is possible to damage this output if the condition is not corrected.

## Auxiliary Inputs

Your instrument includes 6 auxiliary inputs. Wire these inputs to your sensors for the auxiliary inputs according to the sheets included with the auxiliary input sensors.

If you are using the auxiliary input for your own custom application, this input must be in the range of 0-5 Volts DC and must not exceed 5.5 Volts. The scaling of this auxiliary input set using the scale factor, offset, forward/reverse, and decimal/integer settings described below. If this input is not used (not assigned to a function), its limits are ignored.

**CAUTION:** This input must not exceed 5.5 Volts. Although no damage will occur the accuracy of the instrument will be adversely affected while an aux input exceeds 6.0 Volts.

## Cylinder Head Temperature Probe Installation

Ring-terminal type CHT probes are installed by removing the spark plug, placing the sensor under it, and re-installing the plug into the engine. Orient the sensor so that as much clearance as possible is provided between its leads and the engine structure.

Bayonet type CHT probes (for Lycoming and Continental engines) are retained by a bayonet adapter. This adapter is screwed into the engine, in a threaded hole near the bottom spark plug. This hole can be identified by its solid bottom. ***Do not use the primer hole to mount this adapter! If you are in doubt, consult an expert!*** The CHT probe is adjusted by turning the locking collar on the spring so that its tip is pressed against the bottom of the CHT probe well when it is locked onto the adapter.

NOTE: To prevent false readings for inputs that are not used, it is recommended that unused CHT inputs be shorted together. Unused EGT inputs may also be shorted together or may be hooked up in parallel with another EGT input so that the EGT Span calculation remains meaningful.

## Exhaust Gas Temperature Probe Installation

Start by drilling an 1/8-inch diameter holes at the appropriate position in the exhaust manifold as indicated by the engine manufacturer. If the manufacturer provides no guidance on the location of the EGT probes, we recommend the following:

1. Position the probe 2-8 inches from the cylinder.
2. Although not critical, it is preferable to position all probes the same distance from the cylinder.
3. If possible, position the probes so that they are mounted on a straight (not curving) portion of the exhaust manifold. The hose clamps fit slightly better on straight portions of the manifold.
4. Position the hole around the manifold so that the probe does not interfere with the cowl, and takes into consideration practical needs related to maintenance (does not interfere with the access to the oil filter, etc.), inspections, or probe mounting.

Insert the probe into the exhaust manifold and secure it by tightening the clamp firmly. Do not over-tighten.

**CAUTION:** Secure installation of the exhaust gas temperature sensor is critical to safe operation of your engine. Failure of this sensor to remain installed in the exhaust manifold could result in an exhaust leak of hot exhaust gases containing carbon monoxide. This poses a potential fire and/or cabin air-contamination threat. Inspection of the installation by a licensed A&P mechanic is recommended.

It may be necessary to safety wire the EGT probe such that it is impossible for the probe to come in contact with rotating engine parts or the propeller should its attachment fail. This is especially of concern with pusher-type engine installations.

It is necessary for this probe to be grounded. In most cases no special provisions are required to achieve this, since the exhaust manifold is normally connected to ground via the engine, and the EGT probe clamp typically makes a good electrical connection to the exhaust manifold. An ungrounded probe may cause erratic EGT readings.

### EGT & CHT Extension Wire

All models of the EIS correct the EGT and CHT inputs (the thermocouple inputs) for the ambient temperature. This is called “cold-junction compensation”. To perform this compensation accurately requires use of thermocouple extension wire.

Unlike other types of wire, thermocouple extension wire is polarized. Each conductor is made of a different alloy and is identified by the color of the insulation. It is necessary to use matching extension wire for thermocouple probes, and to observe this polarity, for accurate readings. For example, the EIS requires type J thermocouple for sensing cylinder head temperature. To extend the leads of the cylinder head temperature probe, type J extension wire is required.

Extension wire type is identified by the color of the insulation on the two wires.

Type	Color of Insulation on the Wires	Use
J	Red and White	Cylinder Head Temperature
K	Red and Yellow	Exhaust Gas Temperature

Leave slack in the wire between the engine and airframe to account for engine motion. To avoid confusion, it is recommended to label each wire to identify which cylinder it is to be used for.

Crimp the mating connectors onto the extension wire. Plug the color-coded leads onto the matching color extension wires. Secure the probe leads with suitable wire clamps to prevent them from chaffing against the engine or airframe. Heat shrink tubing can be used to protect the leads from abrasion and insulate the electrical connections to the probe.

**NOTE:** The length of wire on the EGT & CHT probes, or the extension wire may be shortened as desired for your installation.



## Carburetor Temperature Probe

The carburetor temperature probe is mounted in the carburetor such that it senses the air temperature in the venturi. See the sheet that accompanies this probe for further details about its mounting.

## Fuel Flow Sensor

The fuel flow sensor is installed in the fuel line and must conform to these instructions and pass the tests specified in FAA Advisor Circular AC 23-16 before flying the airplane.

### Location of the flow Sensor

A fuel filter or gas collator must be installed upstream of the flow sensor to assure no debris can enter the flow sensor.

**Caution:** Failure to include a gas collator or fuel filter upstream of the flow sensor can result in the blockage of the flow sensor, and engine stoppage.

To achieve the steadiest readings, the flow sensor should be mounted with at least 5 inches (12 cm) of straight or gently curving fuel line on the input side of the flow sensor. Sharp elbows, valves, or other turbulence producing devices must not be mounted closer than 5 inches (12 cm) of the sensor. Most gas collators do not produce turbulence that will influence the flow sensor, so it is acceptable to mount the flow sensor close its output.

The fuel line exiting the flow sensor should be at or above the height of the flow sensor for at least 2 inches (5 cm).

### Detailed Flow Sensor Installation

Refer to the manufacturer's installation instructions for the latest instructions regarding proper installation. For the red cube (Electronics International FT-60), the instructions can be found here at the time of this writing:

<https://buy-ei.com/downloads>

### Effect of Electric Fuel Pumps and Pulsation Dampeners

In some installations it will be noted that turning on the electric fuel pump can result in a reported fuel flow increasing. The typical increase is a gallon or two per hour. This increase is not real but can be caused by the pulsation action of the pump. In

the past we have suggested the use of a pulsation dampener for some installations to reduce this effect. Since it is unclear how effective this is, and since this effect has only a small influence the totalizer (a fraction of a gallon, depending on how long the electric pump is operated), and tends to error in a safe direction (showing less fuel than actual), we leave it to the installer to decide if this is worthwhile.

If desired, a pulsation dampener can be fashioned by installing a tee in the fuel line between the electric fuel pump, and the flow sensor, and connecting a 1 or 2-foot piece of tubing to this tee, capped and oriented vertically up, so air will be trapped in it. Be sure to use secure the fuel lines so that they are supported and will not break to due vibration.

## **Wiring**

Refer to the wiring diagram at the end of this manual. No fuse is required in the 12V fuel flow power supplied to the flow sensor from the instrument.

## **Testing the Installation**

Refer to FAA Advisory Circular AC 23-16 specifies minimum fuel pressure/flow limits. These limits must be observed to assure that the flow sensor installation does not unsafely reduce the fuel pressure supplied to the engine.

A quick verification of the electrical connections to the flow sensor can be made by observing the fuel flow reading and turning on the electric fuel pump (if equipped). The fuel flow will typically register a non-zero value when the fuel pump is first turned on.

## **Calibration**

The fuel flow and totalizer accuracy are adjusted using the "Fuel Flow Calibration (FloCal) setting accessed from the "Set Menu", "Graphical Engine Monitor" menu. A starting value of 83.0 should be used. To fine tune this value, the airplane is flown, and the actual amount of fuel consumed is compared with the amount reported by the fuel flow totalizer function. This can be done with a single re-fueling of the airplane if the airplane can be re-filled to the same level at which it started, which requires consideration of how level the airplane is when it is initially fueled, and re-filled, and how accurately you can judge the level to which the tank is filled. If the amount consumed and the amount reported by the totalizer function is logged over many flights, the sensitivity to the accuracy of the final re-fueling is reduced by using the sum total of all fuel consumed and the sum total of the totalizer's reported fuel consumption.

To adjust the FloCal entry, compute the new value as follows:

$$\text{New\_FlowCal\_Value} = \text{Current\_FlowCal} * \text{Actual\_Fuel\_Consumed} / \text{Totalizer\_Fuel Consumption}$$

## Manifold Pressure

The remote EIS includes an internal manifold pressure sensor. The sensor can measure up to 52 In Hg.

The manifold pressure measurement is typically made via one of the primer ports on the intake manifold. While this means one cylinder does not get primed for starting, this does not affect the starting of the engine. A fitting and a copper line (the same type used for the primer) runs from the engine, through a bulkhead fitting on the firewall. On the cockpit side of the firewall, the tubing can transition to silicone rubber tuber to connect to the MAP nipple on accessed via the hole on the side of the remote EIS instrument.

No adjustments settings are required.

## UL Power Installation Notes

Specific recommendations for all UL Power engines are described here. All other connections not described in this section follow the normal methods described elsewhere in this manual.

**Oil Temperature** – The oil temperature sensors that are used with the ECU cannot be shared with the EIS. A separate oil temperature sensor is used with the EIS. Our part number FT-1827-02 should be used and requires an adapter available from UL Power (part number E041510). A port for this sensor is provided on the engine, as indicated in the engines user manual.

**Fuel Flow** – The engine ECU provides a “fuel consumption” output signal that provides a pulse output with a duty-cycle (percent of on time vs off time) that varies with fuel flow. This output is compatible with the fuel flow input of the EIS when the EIS is equipped with the “PWM (Pulse Width)” fuel flow option. No flow sensor is required.

**Tachometer** – The engine ECU provides a tachometer output that is compatible with the EIS tachometer input. The EIS should be configured as 2 pulses per revolution on the EFIS, and tachometer sensitivity to “HI”, by grounding the tach sensitivity input.

## Verify the Wiring – A Quick Check

Take a moment now to review all wiring connections you have made to the EIS. Double check the following wiring:

- power
- ground
- tachometer connections
- Verify that the same ground wire is not used as both a ground to the engine for the EIS, and as a ground for the ignition kill switches. Verify that these separate ground leads do not connect to the engine in such a way that they could be

become disconnected from the engine but remain connected together. Do not use the same connection to the engine for these ground leads.

Finally, install the connector backshell using the supplied hardware. Secure the wiring, using cable clamps to the aircraft structure so that no strain is transmitted to the connector. Plug the connectors into the EIS and secure them to the instrument with the screws included with the backshell.

## Configuring the EIS for your airplane.

Configuring the EIS for your airplane simply involves setting various entries in the EFIS. These settings describe the details about your engine (such as how many pulses per revolution for the tachometer, units, etc.), how the auxiliary inputs are used, the desired units, etc. The best way to set these items is to work your way through the list describing these settings below.

All remote EIS configuration settings are made on the “Graphical Engine Display” set menu, which is accessed from the main “Set Menu”.

### Fuel Flow Calibration (FloCal)

This entry allows for fine tuning the accuracy of the fuel flow function. The typical setting for entry is 83 for the Electronics International "red cube" type flow sensor (180 for the Floscan 201B). To adjust the FloCal entry to maximize the accuracy of the fuel flow function, keep track of the amount of fuel burned by noting the amount of fuel added to the airplane over a period of time (at least 100 gallons), and the amount of fuel used according the fuel flow function. If the amount of fuel used according the fuel flow function is 1% low, increase the FloCal entry by 1%. Similarly, decrease the FloCal entry by the percentage the fuel flow function is over-reporting fuel used.

### Setting up your Auxiliary Inputs – Labels and Scaling

Any auxiliary input may be used for any auxiliary function. A one-page diagram describes the wiring and setup for each of the various sensors, with the most common ones included at the end of the document. Other auxiliary input uses are available on our website. After wiring up the auxiliary input, the scale factor, offset, forward/reverse, and decimal/integer settings are made on the “Graphical Engine Display” set menu. These settings are approximately midway down this menu.

### Setting the Label for the Auxiliary Input

The “Aux Function” setting allows you to select a label for each of the auxiliary inputs. A large variety of pre-defined labels are provided. In addition, a user-defined label can also be selected by setting the “Aux Function” to “Aux”. This will cause the “Aux Name” setting to appear below the “Aux Function”. Use the “Aux Name” function to define your label by selecting the “Aux Name” and clicking the knob to display the label editing screen.

## Dual TIT Option and Aux5/Aux6

Instruments that have the dual TIT option will use Auxiliary 5 and 6 for TIT1 and TIT2 respectively. The dual TIT option allows two type K thermocouples probes to provide turbine inlet temperature measurements. These probes are wired to connector A, as shown on figure 5A.

Use the label selection to label these inputs appropriately. Entries for the scale factor, offset, forward/reverse are not required, and will be ignored when the auxiliary function is set to TIT1 or TIT2, as no scaling entries are required.

## Auxiliary Scale Factors, Offsets, and Forward/Reverse Sensing

These entries are used to calibrate each auxiliary input so that the value displayed has meaningful units and is accurate. Documentation for GRT Avionics sensors describe the settings for the auxiliary scale factor (sometimes abbreviated AuxSF), auxiliary offset (sometimes abbreviated AuxOff), Forward/Reverse (+/-), and decimal/integer (D/I). These settings are made on the “Graphical Engine Display” menu.

## Other (Custom) Uses of the Auxiliary Inputs

Auxiliary inputs can be used to display any sensor input that provides a voltage in the 0-5 volt range, that changes by about half volt or more (depending on the resolution required). This allows for custom uses of these inputs to support a user’s specific need. This section describes how the scale factor, offset, forward/reverse, and decimal/integer settings are used to accomplish this.

### Auxiliary Forward/Reverse Sensing Selection (+/-)

This selection tells the instrument whether each auxiliary input will be sensed forward (increasing voltage = increasing value) or reverse (increasing voltage = decreasing value). The sheet included with the auxiliary input sensor will tell you if forward or reverse is required. For custom uses, see the description of the effect of this entry in the “Transfer Function” section below.

### Auxiliary Decimal/Integer Selection

This selection allows you to choose whether the display includes a decimal point before the last digit (the D selection), or not (the I selection). These settings are referred to as D (decimal) or I (integer) on the installation sheets.

The decimal selection is useful for displaying such values as Manifold Pressure (inches and tenths of inches of mercury), or possibly fuel level (gallons and tenths of gallons). Integer values are typically used for most auxiliary input functions, including fuel pressure, coolant pressure, ammeter etc. Set this as is appropriate for your custom auxiliary input use.

## Transfer function

The transfer function mathematically defines the relationship between the auxiliary input voltage, and the numeric data displayed on the instrument. This function is of no use to most users but is provided here for those interested in creating custom applications for the auxiliary inputs.

When the forward/reverse setting is “Forward”:

$$\text{AuxDisplay} = (\text{AuxVoltage} * \text{AuxScaleFactor} / 2.5) + \text{AuxOffset}^*$$

When the forward/reverse setting is “Reverse”:

$$\text{AuxDisplay} = ((5.00 - \text{AuxVoltage}) * \text{AuxScaleFactor} / 2.5) + \text{AuxOffset}^*$$

\*Refer to the next section for how this value is entered.

## Setting the Auxiliary Offset

Auxiliary installation sheets show the offset using the legacy EIS offset entry method. This method uses odd numbers to represent negative values (a setting of 1 represents -1, 3 represents -2, 5 represents -3, etc.), and even numbers for positive values (a setting of 2 represents positive 1, 4 represents 2, etc.) The EFIS shows both the legacy EIS offset entry, and the value it represents in parenthesis.

## Tach Pulses per Revolution (Calibration) Setting

This setting defines the number of pulses per revolution of the engine is generated by the tachometer signal. **This setting must be set correctly for the RPM display to be accurate.** A setting is provided for each tachometer input (1 & 2) to allow differing types of tachometer sources, such as a magneto and an electronic ignition.

The table below describes the common settings.

**CAUTION:** If there is any doubt about the accuracy of the tachometer reading, verify the reading using another tachometer. Attempting to take-off with less than full power can be very dangerous. In general, if the EIS tachometer reading is not erratic, and this setting is correct, the tachometer will be accurate to 5 RPM.

## Typical Tachometer Calibration Settings Table

Pulses per Revolution Setting	Typical Use
1	4-cylinder 4-strokes with magneto, Rotax 912 Tach Output
1.5	6 -cylinder 4-strokes with magneto
2	4-Cylinder 4-stroke with Electronic Ignition, Rotax 2-cylcle non-cdi
3	6-cylinder 4-stroke with electronic ignition
4	8-cylinder 4 stroke with single ignition coil
5	Jabiru 4-cylinder (s/n 22A2662 and older)
6	Jabiru 4-cylinder (s/n 22A2663 and newer)
6	Jabiru 6-Cylinder
6	Rotax 2-cycle CDI (Lighting Coil or Tach Output)
6	HKS Lighting Coil
1.25	5-cylinder 4-stroke with magneto
1.75	7-cylinder 4-stroke with magneto
2.25	9-cylinder 4-stroke inc. M14 Radial with magneto

## More about Tach Connections to Magneto P-leads, Ignition Coils or Tach Outputs

These types of tachometer connections typically generate one pulse for every, or every other, spark plug fired per revolution of the engine. Thus 4-cylinder engine will have 1 or 2 pulses per revolution, while a 6-cylinder, 4-stroke engine will have 1.5 or 3. If you choose the wrong setting the tachometer reading will be off by half or double the actual RPM. A 27 k Ohm resistor must be connected between the instrument and the mag P-lead as shown in figure 7 to protect the mag from being turned off by a failure in the instrument.

A magneto or ignition test is commonly performed before each flight for airplanes that include dual ignition systems. This test requires turning off each ignition system and verifying that the engine will function on the remaining ignition system. Two tachometer inputs are provided to allow sensing the engine RPM from either of two ignition systems so that the RPM indication is not lost during the magneto test. The EIS will use tachometer input 1 when a tachometer signal is sensed. If tachometer input #1 is not providing any RPM indication, the EIS will use tachometer input #2.

An external switch may also be used to manually select which ignition system provides the tachometer source. Since magneto problems can often be detected early on by erratic tachometer readings, an external switch allows the pilot to choose which magneto is to be monitored, allowing him to choose a different mag on each flight, and thus providing some monitoring of the health of each magneto. A switch can be wired to choose which tachometer output is provide to the EIS tachometer input #1

(as shown on the tachometer wiring diagram), or alternatively, an on/off switch can be wired in line with tachometer input #1. This switch can be opened to force the EIS to use tachometer input #2.

### More about Tach Connections to Lighting Coils (Jabiru, Rotax, and others)

When the tachometer connection is made to the lighting coil, typically 1/2 as many pulses will be generated, as there are poles in the lighting coil. (For 3-phase electrical systems, 1/3 as many pulses as there are poles in the lighting coil.) For CDI-equipped Rotax Engines, 12 magnets are used, generating 6 pulses per revolution of the engine. For non-CDI type Rotax engines, 2 pulses per revolution is generated. Jabiru 4-cylinder engines generate 5 pulses/revolution, and Jabiru 6-cylinder engines generate 4 pulses/revolution.

## Tachometer Input Sensitivity

Each tachometer input includes a sensitivity adjustment, identified as Tach 1 Sensitivity and Tach 2 Sensitivity. The "Low" sensitivity setting is best for most tachometer connections as it provides the greatest amount of filtering and tolerance of noise on the tachometer signal from the engine. The "High" sensitivity setting is best for connections to electronic ignition systems that provide a 0-5V pulse output. Since less filtering is provided when the high sensitivity setting is used, it should not be used unless required.

The tachometer sensitivity setting is stored within the remote EIS, and defaults to "Low" for both tachometer inputs for the piston engine version, and "High" for the turbine engine version. This setting can only be changed by configuring a serial port output on the EFIS to "Remote EIS" with a rate of 9600 and wiring this (at least temporarily) to the remote EIS serial input.

The tachometer input can tolerate signals of 200V or greater, regardless of this setting.

## Fuel Flow Max Fuel – (Fuel Capacity Entry for Fuel Flow Function)

This setting is made on the "Graphical Engine Display" set menu and is used by the fuel flow function to provide a simple means of resetting the fuel quantity to the airplane's usable fuel capacity. It defines the pre-set value you can choose from when updating the fuel flow totalizer.

## Hours (Setting Hourmeter)

The hourmeter cannot be altered. The hourmeter data is stored in the remote EIS. The hour meter (and flight timer) will advance only when the RPM is not zero.

## RPM Range Limit

This function is available in software version 5.0 and above, only.



The TachHi, and TachLo settings are also used to specify an RPM range for which an alarm will be generated. When used in this manner, these entries will not function as a checklist reminder.

**To use the TachHi and TachLo entries as an RPM range alarm, the TachHi setting must be a lower value than the TachLo setting.** When the EIS detects that you have set them in this way, these entries define the RPM range within which it will generate an RPM alarm. For example, if you wish an alarm when the RPM falls between 2000 and 2250 RPM, set TachHi to 2000, and TachLo to 2250.

## Check-Out

### Initial Application of Power to the Instrument

Apply power to this instrument, and the GRT EFIS display unit it is wired to. Select the Remote EIS status from the “Set Menu”, “Display Unit Maintenance” menu. Verify valid serial communication, and the instrument type and options are as expected.

At this point, you may wish to completely configure the instrument for your installation. Refer the section “Configuring the EIS for your Installation”.

### Tachometer Initial Test

Turn on the EIS. The tachometer will display 0 when the engine is not operating. Refer to the “Configuration Set Pages” section and set the TachP/R according to the type of engine you have. Turn off the EIS. Start the engine; turn on the EIS and verify that the tachometer reading is active and appears reasonable.

### Testing Tachometer Inputs

Two inputs are provided for the tachometer sensing. The EIS will use tachometer input 1 when a tachometer signal is sensed. If tachometer input #1 is not providing any RPM indication, the EIS will use the tachometer input #2. Each input must be tested to make sure it is functioning. This test is accomplished by turning off tachometer input #1 (such as by turning off the magneto) and observing if tachometer input #2 provides an accurate and stable tachometer reading. Repeat this by turning off the tachometer input #2 and verifying the tachometer input #1 is accurate and stable.

### Testing Tachometer Accuracy

A simple test to help verify the RPM readings are accurate can be made by running the engine at night and looking through the propeller at a florescent or mercury vapor light. The pulsation of the light will make the propeller to appear to stop at various RPMs. Verify the propeller appears stopped at the RPMs shown in the following table. Note that this applies to lights

powered by 60 Hz electrical power, such as that used in the United States and Canada. Also remember that this is the propeller RPM, and the engine RPM will be higher by the reduction ratio if the engine includes a propeller speed reduction unit.

2-Blade Propeller	3-Blade Propeller
600	240
720	300
1200	480
1440	600
1800	1200
3600	2400

**CAUTION:** If there is ANY DOUBT that the tachometer is working correctly, use another tachometer that is known good to verify the EIS is giving the correct tachometer reading. Attempting a take-off with an inaccurate tachometer could result in less than full power being available, and this could be very dangerous.

## Validating all other EIS data

The following table describes the test method and expected readings. The most common problems are described here. The EIS troubleshooting guide provides extensive information for troubleshooting these problems.

Measurement	Expected Reading
Oil Pressure	Should read less than 5 psi with the engine off (will typically read 0) and should go up when the engine is started. If the EIS warning light is not flashing, the oil pressure connection is open. The EFIS will display 99 psi if the oil pressure connection is open.
Oil and Coolant Temperature	Should read approximately the ambient temperature. The lowest reading that these will display is 59 °F (15 °C). If the ambient temperature is below this temperature, then warm the sensor (by running the engine) and observe a reading goes up.
CHT	Should read approximately ambient temperature (+/- 10 °F) with a cold engine. When the engine is running, all CHT displays should be steady. If a reading is erratic, one connection is open. If it goes down as the engine warms, the sensor is wired backwards.
EGT	Should read approximately ambient temperature (+/- 10 °F) with a cold engine. When the engine is running, all EGT displays should be steady when observed on a bar graph. If a reading is erratic, one connection is open. If it goes down when the engine is running, the sensor is wired backwards.
Manifold Pressure	Should read the same as the altimeter setting, less 0.1 inches Hg per hundred feet above sea level. (For example, in Grand Rapids, elevation 700 feet, with an altimeter setting of 29.92, the manifold pressure reading should be $29.92 - 0.7 = 29.22$ . When the engine is started, the manifold pressure

	should be much less than 20 in Hg. (If it does not change, the manifold pressure hose connection is not connected to the engine's intake manifold.)
Voltmeter	Should read the battery voltage. If the reading is lower than it should be, the ground wire for the EIS is being shared with too many other devices, causing a voltage drop in the ground wire.
Amp Meter	If mounted on the alternator output, it should read zero with the engine off, and a positive value with the engine running. If on the battery lead it should show the current consumption of the airplane with the engine off, and the battery charge rate with the engine running and alternator on.
Fuel Pressure and Fuel Flow	Verify Fuel Pressure indicates very close to zero with the engine and fuel pump off. While observing the fuel flow reading, turn on the fuel pump. This will usually cause a momentary non-zero fuel flow reading, after which verify fuel pressure has increased. After turning off the fuel pump, it may take some time for the fuel pressure to bleed back down to zero.
Ground Voltage Drop Test	Observe the oil temperature reading when it is above 59 °F and turn off and on all electrical devices in the airplane. Verify the oil temperature does not change due to a device being turn on or off.

## Other Checks

**CAUTION:** Verify that no leaks are observed around the coolant temperature sensor (if so equipped), as well as the oil pressure and temperature sensors. Loss of engine oil or coolant will severely damage your engine and will result in sudden stoppage.

The remainder of the functions should now be checked out by observing the measurements displayed by the EIS. Any measurements that appear unreasonable should be checked to verify their accuracy.

Your EIS is now ready to use. Please refer to the “Before Each Flight” section.

## Detailed Description of Other Functions

### Unit Temperature

This function is displayed on the remote EIS status page (Set Menu, Display Unit Maintenance) and shows the internal temperature of the instrument. It is used by the instrument for cold-junction compensation of the EGTs and CHTs. Self-heating of the EIS will result in this temperature being 10-20 °F warmer than the ambient temperature.

The unit temperature can also be checked to see if the instrument is being exposed to excessive heat. Temperatures above 200 °F can activate the internal thermal fuse, shutting down the instrument.

## Coolant Temperature Function

This function is provided for those using water-cooled engines. It may also be useful for measuring other temperatures in the range of 80-300 degrees F, such as under cowl temperatures, especially for composite airplanes.

## Updating the EIS Software

Software can be updated in the EIS from the Remote EIS Status page on the “Display Unit Maintenance” menu (accessed from the main “Set Menu”).

## Troubleshooting Common Problems

Instrument does not turn on. Warning light is on steady.	Either the instrument is not receiving power, or the 12V or 4.8V output from the instrument is shorted to ground. A simple test is to make a cable with only power and ground wires, and power the instrument via this cable. (This test cable available at no charge.)
Instrument does not turn on. Warning light never comes on.	Open ground connection to instrument, or the voltage provided to the instrument is too low (less than 9V).
One EGT or CHT is erratic.	One of the two wires are unconnected between the instrument and the probe. Most commonly, a crimp connection on the quick disconnect on the probe, or the cable it plugs into, is loose. A visual inspection will usually be enough to find the problem. Another simple test is to use a continuity tester and verify each pin at the instrument end of the cable has good continuity to the engine case, since each probe is grounded to the engine. The pins numbers are listed on the wiring diagram in the back of this manual.
All EGT and CHT are erratic.	This is caused by an open ground connection to the case of the engine on engines which do not include an electric starter.
Oil Pressure Reads 99 with engine off.	Connection to oil pressure sensor is open circuit. A quick test is to touch the oil pressure lead to ground. This should cause the oil pressure to read 0. If it does, check connections and ground to oil pressure sensor (case must be grounded.) If this test does not cause a 0 reading, check the connection between this wire and the input to the instrument.
Oil or Coolant Temperature shows 59 °F all the time, even when the ambient temperature is above 59 °F.	The connection to the oil or coolant temperature probe is open, or not grounded. A quick test is to touch the coolant temperature sensor lead to ground. If the EIS show a high temperature, the connection to the instrument is good. If it does not change, check the wire between the instrument, and the oil or coolant temperature sensor, especially the crimp on the quick-disconnect that plugs onto the coolant temperature sensor.
Tach Reading is zero when one	This is normal if only one tach input is used, as the tach signal is generated by one of the

mag is turned off.	mags. If both tach inputs are used, this indicates that there is likely an open circuit between one of the tach inputs and one of the magnetos.
Tach is erratic.	Tachometer resistor is not installed, or its value is too low. See wiring diagram for tachometer connection.
Tach reading is steady, but too low or too high.	TachP/R is incorrectly set. See "Configuration Set Pages" section.
Voltmeter reads above 20 V and other readings incorrect.	More than 5 volts is being applied to an auxiliary input. This can be caused by an incorrectly calibrated capacitance fuel level probe, an open ground wire to a 12V powered sensor, or similar. Check the aux inputs to see if any are above 5 volts using a voltmeter.

## Warranty

Grand Rapids Technologies Incorporated warrants this instrument to be free of defects in material and workmanship for 2 years from the date the system is first used, or 5 years from date of purchase. This warranty includes parts and labor. Grand Rapids Technologies expressly reserves the right to repair or replace a defective unit with new or reconditioned parts or equipment, of the same or similar design. This warranty is void if damage to the instrument is caused by incorrect connection of the tachometer lead, reversal of connection of power and ground leads or is otherwise installed incorrectly. This warranty also does not cover the following:

- Damage during shipment
- Damage from accident, misuse, negligence, lightning, or water
- Damage caused by alteration or unauthorized repair

### Legal Rights/Limitations of Liability

Grand Rapids Technologies Incorporated is not liable for incidental or consequential damage, commercial loss, or any other loss or damage not specified in this warranty. Some states do not allow limitations on the length of implied warranties, or exclusion or limitation of incidental or consequential damages. The above limitations or exclusions may not apply to you. No individual or company may extend this warranty. This warranty is valid only for the original purchaser.

Service may be obtained by returning the instrument to this address:

Grand Rapids Technologies

3133 Madison Ave SE

Grand Rapids, MI 49548

Attention: Service Dept.

When returning the instrument for service, please specify the nature of the problem. Include a copy of your proof of purchase for warranty repairs.

For service questions or repair rates, call 616-245-7700.

## Figures

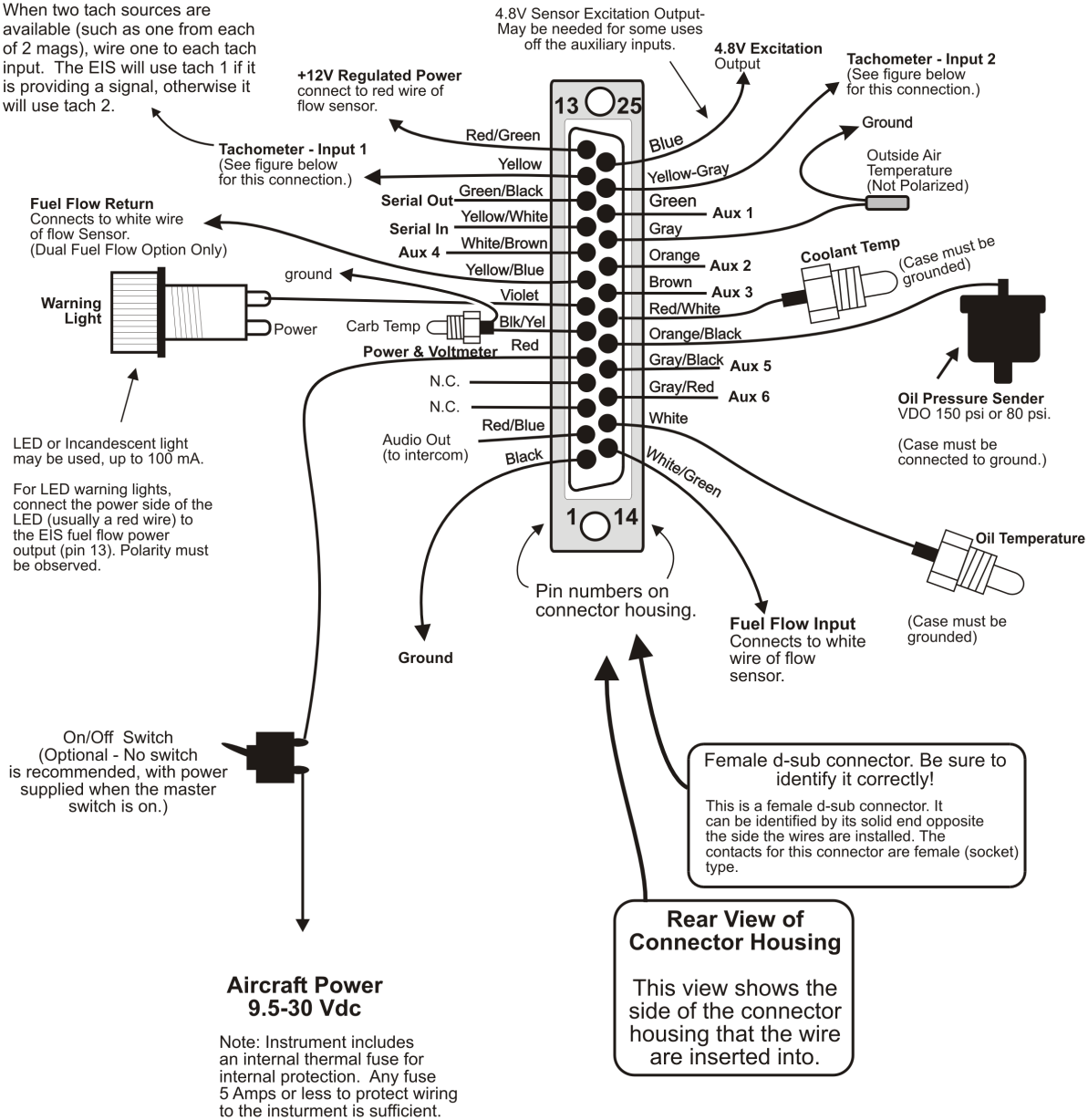
Figures for the EIS, and the most common uses of the auxiliary inputs, can be found in the following pages. See the website for more uses of the auxiliary inputs.



- ## Remote EIS Physical Dimensions (Actual Size)

## Remote Engine Information System Installation Manual

When two tach sources are available (such as one from each of 2 mags), wire one to each tach input. The EIS will use tach 1 if it is providing a signal, otherwise it will use tach 2.



### Notes:

N.C. indicates No Connection.  
Do not wire to these inputs. They are reserved for future growth.

Connector A.cdr

## Connector A Wiring - Remote EIS Model R66



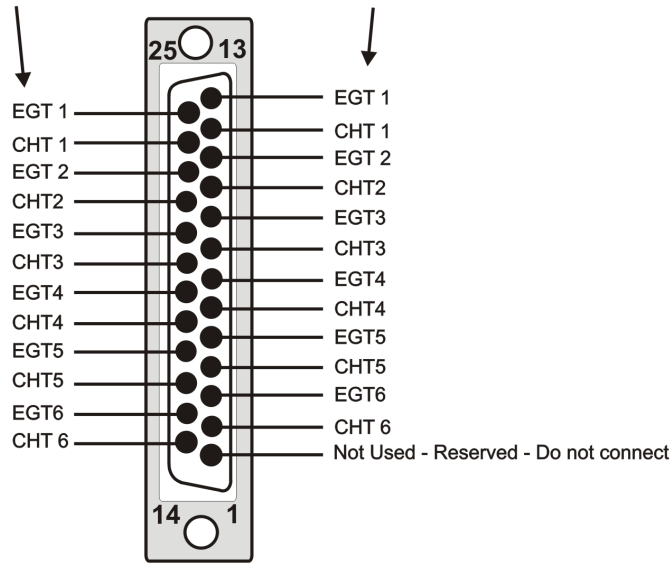
Yellow Wires for EGT Connections on this side.  
White wires for CHT connections on this side.

Red Wires on this side of connector

**Mark these wire pairs using this diagram before you install the cable!**

Our favorite method is to first cut the ends of the wire at different angles. (Keep notes so you don't forget what the cuts mean!) Other methods of labeling the wires, such as tags or ink, may come off when the wires are routed (pulled) through the firewall.

After the wires are routed through the firewall, water-proof tags may be used.



#### Rear View of Connector Housing

This view shows the side of the connector housing that the wire are inserted into.

Male d-sub connector. Be sure to identify it correctly!

This is a male d-sub connector. It can be identified by its hollow end opposite the side the wires are installed. The contacts for this connector are male pins.

#### Notes:

1. Type K thermocouple extension wire must be used for EGT connections, and type J thermocouple wire must be used for CHT connections.
2. For 4-cylinder engines, use EGT 1-4, and CHT 1-4.

Connector B.cdr

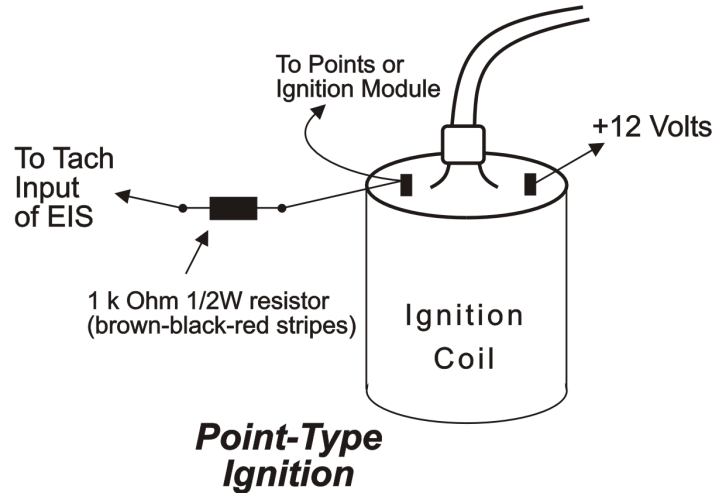
## Connector B Wiring

## Electronic Ignition

Connect directly to the tach output from the ignition system. No resistor required. Configure the tachometer sensitivity to "Hi"

## Rotax 912/914

Connect tach input to one of the two tachometer output wires. Connect the other tach output wire to ground.



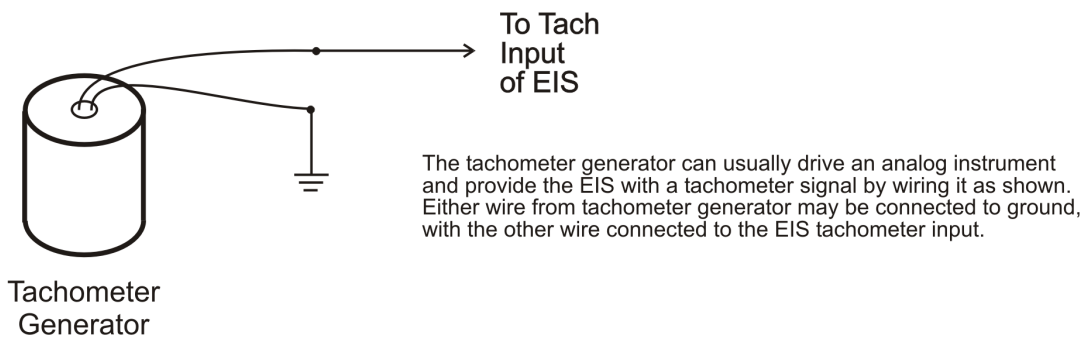
## Magneto Equipped Engines such as Lycoming/Continental, Franklin, etc.

39 k Ohm 1/2W resistor (orange-white-orange stripes) or 27 k Ohm 1/2W resistor (red-violet-orange stripes)  
(This resistor is Included in parts pack - it is covered with black heat shrink tubing and has male and female quick-disconnects). Use a resistor for each tachometer connection to the EIS.

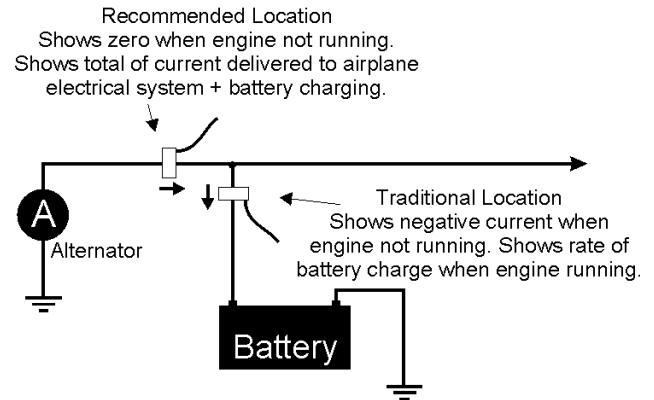
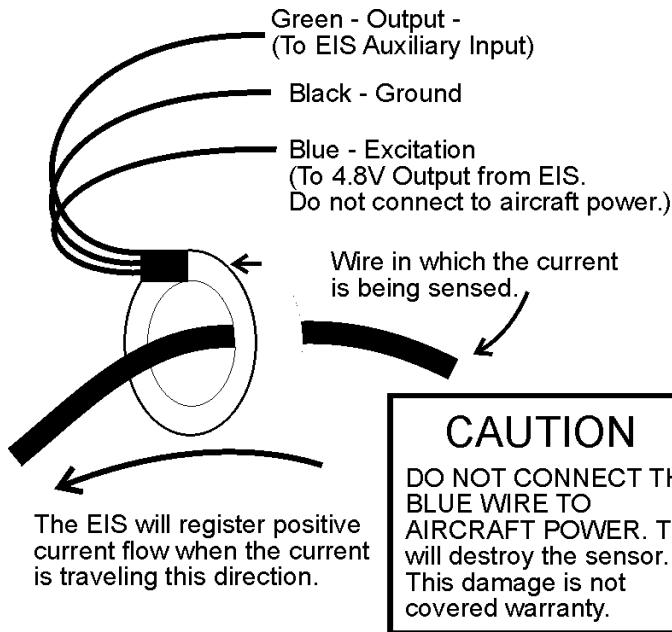


This resistor is required to prevent any failure in the EIS from affecting the operation of the magneto. It also works with circuits in the EIS to provide the necessary filtering for a steady tach reading.

## Typical Tachometer Connections for Piston Engines



## Typical Tachometer Connections



The recommended location shows the current output from the alternator. Since the battery typically recharges rapidly after startup, this location will show the current being consumed the airplane's electrical system. An abnormally high reading indicates the battery was significantly discharged, or something in the airplane is consuming an unusually high amount of electrical current.

The Hall Effect current sensor measures the current flow in the wire that passes through it, without any electrical connection to this wire. Two locations for mounting the sensor are commonly used.

**Sensing Battery Current:** Mounting the sensor such that the battery positive cable is passing through the sensor will show the amount of charge or discharge of the battery. A negative current indication indicates the battery is being discharged. A positive indication indicates the rate of charge. (The sensor may also be installed in the ground lead, with the arrow on the sensor pointing away from the battery.)

**Sensing Alternator Output:** Mounting the sensor such that the alternator output cable passes through the sensor will show the amount of current being supplied by the alternator. This will always result in a positive current flow, since current will normally not flow backward into the alternator.

The sensor may be mounted on the engine side of the firewall, or the cabin side.

For sensing current in the -100 to 100 Amp range, or -50 to +50 Amp range, an auxiliary input which does not include a decimal point in the display is the best choice, as the displayed value will have a resolution of 1 Amp.

For Sensing -100 to +100 Amps: (See note 1 below.)

Set the Forward/Reverse Sensing to FORWARD  
Set the Auxiliary Scale Factor to 164.  
Set the Auxiliary Offset to 313.

For Sensing -50 to +50 Amps: (See note 1 below.)

Set the Forward/Reverse Sensing to FORWARD  
Set the Auxiliary Scale Factor to 82.  
Set the Auxiliary Offset to 155.

Loop the wire which carries the current being sensed through the sensor so that it passes through it 2 times.

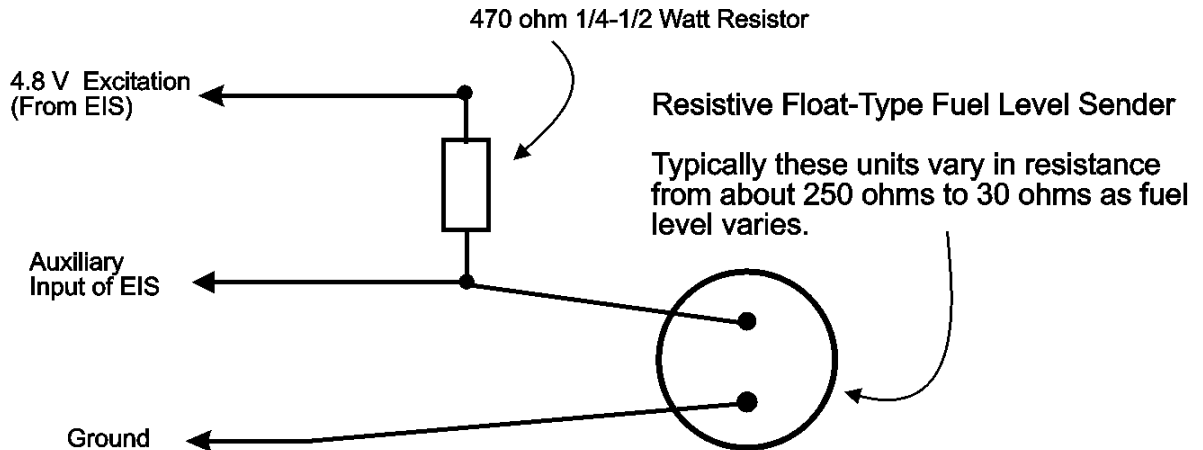
For Sensing -10.0 to +10.0 Amps:

Use the settings for -100 to +100 amps, but loop the wire which carries the current being sensed through the sensor 10 times. The display will indicate 1/10s of an Amp, making this arrangement best suited for an auxiliary input which includes a decimal point.

For Sensing +/- 25.0 or +/- 25 Amps . Use 4 turns of wire through the current sensor, and set the AuxSF to 410 and AuxOff to 783 to display current with 0.1 amp resolution (you will want a decimal point in the aux display for this). With these settings, the current display may be somewhat noisy (erratic) . If you prefer to show the current with a resolution of 1 amp , use and AuxSF of 41, and an offset of 77.

#### Notes

1. To display negative values an/or to enter auxiliary offset values greater than 256 into the EIS, a software version of 45 or greater is required. For software versions prior to 45, the -50 to +50 Amp range may be used, and only positive currents may be sensed. Alternatively, The aux offset may be set to 157 for the 100 Amp range, or 77 for the 50 Amp range. This will result in 0 current being displayed as 100, positive current as values greater than 100 (for example, 125 would correspond to +25 Amps), and negative values as values below 100 (for example, 75 would correspond to -25 Amps.)
2. The Auxiliary Offset may be adjusted if necessary to zero the reading by adjusting it up or down by 2 counts a time. (The aux offset value must remain an odd number, and only a small change should be required, if any.)



The following steps may be used to calibrate the aux display so that it displays fuel level in gallons, or any desired units.

Decide if you would like to display fuel with a resolution of 0.1 (decimal), or 1 (integer). For Model 2000 instruments, the auxiliary input is pre-set to 0.1 (decimal) or 1 (integer) resolution. Model 4000/6000/9000 can be user-configured using the I/D entry (integer/decimal) on the configuration set pages. Generally we recommend using a resolution of 1.

1. Start by setting AuxSF to 100, and AuxOff to 0, and the Aux Forward/Reverse to Forward (On the Configuration Set Pages). The Aux display should now read a value other than zero. If it still reads zero, check your wiring. It is suggested the following step be performed with the airplane in its flight attitude.

2. Write the Empty tank reading displayed on the EIS here \_\_\_\_\_.  
When draining fuel from the tank, the EIS auxiliary display may stop changing before the tank is empty. You may wish to note the amount of fuel remaining in the tank when the reading stops changing, as this fuel will not be sensed by the fuel level sensor, and in effect will be reserve fuel (that is, fuel remaining when the fuel level readin shows empty.)

3. Write the Full tank reading displayed on the EIS here \_\_\_\_\_.  
Note: As fuel is added to the tank, the EIS auxiliary display will change. Once the sending unit reaches its limit of travel, the reading will stop changing, even as more fuel is added. Note the amount of fuel in the tank when the reading stops changing, as this may be useful in step 6.

4. If the full tank reading is less than the empty tank reading, set the auxiliary Forward/Reverse selection to Reverse, and repeat steps 2 and 3.

5. Subtract the Empty Tank Reading from the Full Tank Reading. Enter the difference here. \_\_\_\_\_

6. Write down the reading you want to see when the tank is full. \_\_\_\_\_  
Note that in many tanks, the sending unit will reach its maximum travel before the tank is full of fuel. If this is the case with your tank, we recommend using this as your full tank reading. For example, if you note that the auxiliary display stops changing after 12 gallons of fuel is added to a 15 gallon tank, we suggest you use 12 gallons as your full tank reading. When more than 12 gallons of fuel is in the tank, the EIS will display 12, but this typically provides more accurate readings below 12 gallons, where accuracy is most desirable.

7. Divide line 6 by line 5 ( line 6/line 5) \_\_\_\_\_

8. Multiply line 7 times 100. Round this to the nearest whole number. This is the AuxSF you will enter \_\_\_\_\_

9. Multiply line 2 times line 7. If your auxiliary input being used to display fuel level includes a decimal point in the display, then multiply this result by 10. Write down the result, rounding it to the nearest whole number. \_\_\_\_\_

10. Multiply line 9 by 2. \_\_\_\_\_

11. Subtract 1 from line 10. This is the AuxOff \_\_\_\_\_ (This must be an odd number)

○ **CAUTION:** Be sure to connect the resistor as shown. Connecting power directly to the sensor will damage it.

## Use of Float-type Variable Resistive Fuel Level Sender with EIS Auxiliary Input