1. **Tech Support for the EIS**

In the past we have provided technical support for any issue related, or not, to an airplane equipped with an EIS. A large percentage of our calls and e-mail are not directly related to an EIS. For example, "Why is my voltmeter reading low and my battery not being charged?".

The majority of our remaining calls are also directly answered by the user manual, such as, "How do I set a CHT limit?".

To give priority to customers who have questions that are not answered by our user manuals or troubleshooting guide, we ask that you first review this troubleshooting guide and user manual data available on our website.

2. **Before Troubleshooting, Read This!**

All the tests here assume you are using the display on the EIS to read the values. It is preferable to use the EIS screen when troubleshooting. If you are troubleshooting EIS problems by looking at the EFIS screen, be sure the EFIS has been properly configured, especially the auxiliary input setup on the "Graphical Engine Monitor" set page.

The table of contents to find your problem. Searching on a keyword with CNTRL-F can also work, but we recommend first reading the table of contents.

Table of Contents

3. **New to the EIS? Setup Basics**

The EIS has a great deal of flexibility, and many settings to allow this flexibility, but very little is actually required to make the EIS ready for use. See the next two sections for how to review and change settings in the EIS.

To make and EIS ready for flight:

1. Set the TachP/R setting on the “configuration set” pages (see next section) so that the tachometer reads correctly. Verify the tachometer is accurate before flight. See the user manual for ways to do this.
2. Configure whatever you have wired to the auxiliary inputs. Note that the auxiliary inputs are commonly used for manifold pressure, fuel pressure, fuel levels, and ampmeter, but can also be used for trim position, extra voltmeters, oxygen pressure, hydraulic pressure, etc. Each auxiliary input requires that its scale factor (SF), offset (Off) and forward/reverse (+/-) be set, as well as decimal/integer (D/I). These are all set on the “configuration set” pages.
3. Set engine limits. Don't get carried away and set too many lower limits, as these can generate nuisance warnings. Use lower limits when appropriate, or when troubleshooting an engine problem. All engine limits are set on the “Set Limits” pages.

Users who have bought an airplane equipped with the EIS should review engine limits. They should ask the builder how he has configured the auxiliary inputs. If this is not available, reviewing the setup in the EIS, especially the auxiliary labels that set into the instrument on the configuration set pages, can give a good idea of how the auxiliary inputs were used. GRT tech support at will not know how each builder has configured the EIS, so be sure to determine this before you call.

4. **Accessing the Set Limits Pages**

Press the **CENTER** and **LEFT** button at the same time. The first set page will be show immediately. Release the buttons. Use the right button to find the setting you want to change. Use the left button to increase the value of the setting, and center to decrease.

5. **Accessing the Configuration Set Pages**

Press and hold the **CENTER** and **RIGHT** buttons until the first configuration set page is displayed. This will take about 5-10 seconds. Release the buttons. Use the right button to find the setting you want to change. Use the left button to increase the value of the setting, and center to decrease.

6. **Auxiliary Input – Checking or Setting Configuration**

The EIS contains two general types of inputs, dedicated, and auxiliary. The dedicated inputs are shown on the wiring diagram and will have an input dedicated to that function. The auxiliary inputs are configurable so they can be used for a wide-variety of functions. The most common uses of the auxiliary inputs are:

- Manifold pressure
- Fuel pressure
- Fuel level(s)
- Ampmeter

- Trim position sensing
- Coolant pressure
- Extra voltmeter inputs
- Hydraulic pressure

To make and auxiliary input function correctly requires the instrument be programmed with certain data. This data is:

- Auxiliary scale factor (identified on the EIS as 1SF, 2SF, etc for the aux inputs)
- Auxiliary offset (identified on the EIS as 1OFF, 2OFF, etc.)
- Forward/Reverse sensing (the +/- setting on the EIS)
- Decimal/Integer (D/I setting. This does not apply to Model 2000 EIS Instruments)

The required setting are described on separate sheets for each auxiliary input function, and are available on the website. These sheets also show the wiring that is required.

The "Configuration Set" pages are used to set and review these settings. These pages are accessed by pressing and holding the right and center buttons until the screen shows "UP DOWN NEXT" on the bottom row. The right button can then be used to advance through the various configuration settings. The changing the setting is accomplished with the left or center button (to increase (UP) or decrease (DOWN)) the value of the item being set. The user manual includes more details.

The on-screen labels for the auxiliary inputs can changed. This is described in the user manual.

7. **Instrument does not turn on when power is applied.**

Background

The instrument will turn on whenever 10V or more is applied to it and none of its power outputs are shorted to ground.

To verify the instrument is not turning on when power is applied, verify that all of these are true:

1. The screen stays completely clear (nothing appears on the screen…numbers, letters or black boxes).
2. The warning light does not flash on and off when power is applied.
3. The back-light for the screen does not come on. (This is impossible to see in sunlight. Check for this in a darkened hangar.)

If any of these are not true, see the section, "Instrument turns on for a short time and then turns off", or "Instrument turns on, but the display is blank".

Cause

1. No power to the EIS.
2. The 4.8V output is shorted to ground.
3. The 12V fuel flow power output is shorted to ground

4. The ground connection to the instrument is open.
5. The instrument is damaged.

Troubleshooting

1. Using a voltmeter, place one lead of the voltmeter on ground, and the other other the case or metal edge of the faceplate of the instrument. Turn on power. If the voltmeter shows more than 0.5V, the ground connection to the EIS is open or bad.
2. Disconnect connector A (this is the cable that does not have all of the EGT and CHT twisted pairs). Turn on power to the EIS. Verify 12V (or 24V, for a 28V airplane) is measured between the ground and power input pins on the D-sub connector for the aircraft wiring.
3. Turn off aircraft power. Measure the resistance between the 4.8V output pin and ground, and verify this resistance is greater than 100 ohms. Alternatively, the 4.8V output from the instrument can be disconnected, and power can be applied to the EIS to see if it turns on with this wire disconnected.
4. Turn off aircraft power. Measure the resistance between the 12V fuel flow power output pin and ground, and verify this resistance is greater than 100 ohms. Alternatively, this output from the instrument can be disconnected, and power can be applied to the EIS to see if it turns on with this wire disconnected.
5. If the internal ground trace in the instrument is damaged (this can happen if 12V power touches the case of the EIS when it is plugged into the airplane wiring), a separate ground connection can be run to the case of the EIS. This will sometime restore operation. The EIS may then be used until there is a convenient time to return it for repair.
6. If none of these steps resolve the problem, the instrument will need to be returned for repair. Often we receive instruments that are not faulty, so it can be a good idea to make a test cable that just supplies power and ground to the EIS, and see if the instrument will work when powered by this cable using a 12V power supply. If the instrument operates with this test cable, re-check the above steps.

8. **Instrument turns on for a short time and then turns off.**

Cause

1. The airplanes battery is not charged.
2. The 4.8V output is delivering too much current.
3. The 12V fuel flow power output is delivering too much current.
4. Too much voltage is being applied to the instrument.
5. The instrument has had too much voltage applied to it in the past, and the internal over-voltage circuit is damaged.

Troubleshooting

1. Verify the airplanes battery is not discharged.
2. Verify the 4.8V output is not connected directly to a VDO fuel pressure sensor. An inline resistor is required. See the “Fuel Pressure via Auxiliary Input” diagram.
3. If the instrument is powered by 28V, and it was not originally designed for this voltage, it may shut off a minute or an hour or more after it is turned on, depending on the ambient temperature.
4. If none of these steps resolve the problem, the instrument will need to be returned for repair. Often we receive instruments that are not faulty, so it can be a good idea to make a test cable that just supplies power and ground to the EIS, and see if the instrument will work when powered by this cable using a 12V power supply. If the instrument operates with this test cable, re-check the above steps.

9. **Instrument turns on, but the display is blank**

Causes

1. The power supplied to the EIS is less than 9V
2. The temperature is very low (less than 0 deg F)

Troubleshooting

Verify the power supplied to the EIS is at least 10V, especially in very cold conditions. The display on the EIS will operate to 0 deg F, but below this temperature it may not provide a display. Setting the backlight to maximum brightness can improve cold-weather start-up by helping the instrument self-heat.

10. **Instrument occasionally locks up or has erratic operation**

Background

Cause

Intermittent power being supplied to very early models of the EIS Model 3 (produced prior to 1999).

Troubleshooting

Power-interruptions can be detected by noting if the flight timer is resetting in flight, causing it so show a much less than actual time that the engine has been running. The warning light will also flash each time the instrument is re-started. Frequent, short, power-interruptions can cause early model 3 EIS (this instrument can be identified by its two 9-pin connectors) to lock up. To find the problem, shake the wiring to the EIS to located the loose connection.

11. **Flight Timer Resetting or Flight Timer not working correctly.**

Cause

Power interruptions will restart the flight timer.

Troubleshooting

Turn on the EIS and acknowledge all alarms so the warning light is on steady. Shake or move the wiring to the EIS to locate the loose connection. Watch for the warning light to flash. When the when the power is interrupted, the EIS will always flash the warning light once when it restarts, and then continue to flash it if there are any alarms (such as low oil pressure) that are present.

12. **Hourmeter Counting Backwards**

Some models of the EIS will show negative hours and count backwards (actually up from a large negative number), after the hourmeter reaches 3276.7 hours.

Cause

Software limitation in some Model 2000 EIS instruments.

Troubleshooting

Note the hours in the airplane and engine logbook, and reset the hourmeter to zero from the configuration set pages. This process can take many minutes to complete. Be sure to exit the set pages after resetting the hourmeter to store the new setting.

13. **Oil Temperature, Coolant Temperature Troubleshooting**

Background

The EIS uses thermistor-type fluid temperature sensors for oil and water (coolant) temperatures. These sensors vary in resistance corresponding to changes in temperature. There are two types of sensors that might be used with the EIS. The type of sensor must match the type of instrument.

To determine the type of sensor the instrument requires:

The software version (SW Ver) of the EIS contains an "S", "V" or "J" in the 3rd position that indicates the type of sensor it can use. For example, 44S84F would by an "S" type, where a 44V89F would be a "V" type.

To determine the sensor type:

The "S" type fluid temperature sensors will always have two wires coming from the body of the sensor, and will measure between 5000 and 15,000 ohms at room temperature.

The "V" or "J" type fluid temperature sensors are made by VDO. They have a round terminal on the top that a quick-disconnect slides over, and the case is used for ground. This sensor must be the VDO 300F/150C type (it is stamped onto one of the flats on the side of the sensor). This sensor has a resistance of between 800-1300 ohms at room temperature.

The EIS measures the resistance of the sensor via a 5-Volt excitation signal. This excitation is combined with the same pin that is used to sense the temperature.

14. **Oil Temperature / Coolant Temperature always displays 59 F (14 C).**

Cause: This is the minimum value the EIS will display for fluid temperature inputs. It will read this whenever there is

1. An open circuit in the fluid temperature sensing circuit (the wire from the EIS to the sensor), or
2. If an "S" type sensor is used with a "V" type instrument.
3. The sensor is failed.
4. If the ambient temperature is below 65 degrees F

Troubleshooting

1. Checking for an open in the fluid temperature sensing circuit.

Troubleshooting without a voltmeter: Turn on the EIS.   Locate the connection connection between the EIS and the temperature probe. Short this connection to ground. (It is not necessary to disconnect the fluid temperature probe for this test, but it is ok to do so if you wish.) The EIS should read a very high value (above 300 F). If the reading does not change, the connection to the EIS is open, or this is not the correct into input to the EIS (wrong wire). An open may be at the d-sub connector, or the wire to the EIS may be broken.

If the EIS does show above 300F in this test, then the ground to the sensor may be open.

Troubleshooting using a voltmeter: To determine if the connection to the EIS is good, turn on the EIS, and with the fluid temperature probe connected, measure voltage on the wire that goes to the EIS. This voltage should be less than 4.85V, and greater than 1.0V, depending on the temperature of the sensor. If this voltage is zero, the connection to the EIS is open. If the voltage is above 4.85V, the ground to the sensor is open.

2. Checking the sensor and instrument type. (See the background section for the oil temperature / coolant temperature section above.)

3. Checking for a bad oil / coolant temperature sensor. An ohmmeter can be used to test the sensor. At room temperature an "S" type sensor will read 5k-15k (5,000 – 15,000) ohms. A VDO type will read 800-1300 ohms.

15. **Oil Temperature / Coolant Temperature always reads above 300 F (150 C).**

Cause: The input to the EIS is shorted to ground.

Troubleshooting: Disconnect the wire from the sensor. If the problem goes away, it indicates a bad (shorted) sensor. If the problem persists, it indicates that the input (wire) connection to the EIS is shorted to ground.

16. **Oil Temperature / Coolant Temperature are inaccurate.**

Cause:

1. The instrument is configured for the wrong temperature units (Fahrenheit vs. Celsius).
2. The wrong type sensor is being used with the EIS.
3. The sensor is bad.

Troubleshooting:

1. Checking the EIS temperature units configuration. (See the user manual.) The most likely cause of this problem is simply that the instrument is operating in Celsius instead of Fahrenheit, or vice versa.
2. The incorrect sensor is being used. (See the background section for the oil temperature / coolant temperature section above.)
3. It is very unlikely that the instrument or the sensor has become inaccurate. The accuracy of the sensor can be checked by placing it it boiling water. A ground wire must be connected to its body while performing this test. It should register 212 F (100C) within a few degrees at sea level.

17. **Oil Pressure**

Background

The EIS uses VDO brand sensors for oil pressure. These sensors vary in resistance corresponding to changes in pressure. There are two types of sensors that might be used with the EIS. The type of sensor must match the type of instrument.

To determine the type of sensor the instrument requires:

The software version (SW Ver) of the EIS contains an "S", "V" or "J" in the 3rd position that indicates the type of sensor it can use. For example, 44S84F would by an "S" type, where a 44V89F would be a "V" type.

If it is difficult to see this label, a 100 ohm resistor test can be used to determine the type of EIS. To perform this test, remove the oil pressure connection from the airplane's oil pressure sensor, and connect it to a 100 ohm resistor. Ground the other lead of the 100 ohm resistor. A type V or S instrument will read about 75 psi (+/- 10) and a type J will read about 37 psi (+/- 5).

To determine the oil pressure sensor required:

The oil pressure sensor is labeled on the flat of the nut used to tighten the sensor when it is installed.

The “S” and “V” type instruments require the VDO 0-10 bar (150 psi) pressure sensor.

The “J” type instruments require the VDO 0-5 bar (80 psi) pressure sensor.

The EIS measures oil pressure via a variable resistance oil pressure sending unit. The sending unit varies its resistance between its terminal and its case (which is a connection to ground). Its provides 10 ohm resistance at zero oil pressure, and about 1.2 ohms per psi (or about 100 ohms at 75 psi) for the 150 psi sending unit. The 80 psi (5 bar) sending unit is about 2.4 ohms per psi (or about 100 ohms at 38 psi).

Early Model 3 EIS for 4-stroke engines (“Advanced EIS models”), which can be identified by their two 9-pin connectors) include an OilZero setting. This can be used to account for an offset in the oil pressure sending unit. This setting should normally be 0. Set it to 0 before proceeding further.

18. **Oil Pressure displays 99 psi at all times**

This indicates the electrical connection between the instrument and the sensor is open circuit. This is most likely caused when the wrong wire in connected to the oil pressure sending unit (so that the actual oil pressure input is unconnected). To verify you have a good electrical connection to the instruments oil pressure input, remove this wire from the oil pressure sending unit and touch it to the case of the engine (which should be ground). The oil pressure reading should read 0 psi. If it does, the instrument and the wiring to it is good, and the sensor, or its connection to ground is bad. (Note: It is possible for teflon tape applied to the threads of the oil pressure sending unit to electrically insulate it from ground. Do not use teflon tape to seal the oil pressure sending unit.

If the reading does not go to zero when the oil pressure wire is shorted to ground, use a continuity tester or ohm meter to verify a good electrical connection from the connector that plugs into the instrument to the end of the wire where it attaches to the oil pressure sending unit. It is very rare for the instrument to have a failure such that it does not read oil pressure correctly.

19. **Oil Pressure displays 0 psi at all times**

Verify the connection between the instrument and the sending unit is not shorted to ground by disconnecting the wire to the oil pressure sending unit. If this causes the oil pressure reading to read 99 psi, there is no short in this wire. If it remains at 0, this wire is shorted to ground.

If there is no short in the wire, either the oil pressure is actually 0, or the oil pressure sending unit is failed.

20. **Oil Pressure Fluctuations Intermittently**

This either an intermittent electrical connection (intermittent short if the pressure drops, or intermittent open if the pressure increases), or the engine's oil pressure is actually fluctuating. Variations in the ground voltage between the EIS and the oil pressure sensor can also cause this problem. This is rare in aluminum airplanes, but can sometimes be seen in composite airplanes when the EIS shares the same ground path to the battery with other devices that can draw large currents.

21. **Oil Pressure is Inaccurate**

Cause:

1. The wrong oil pressure sensor is being used with a particular model of the EIS.
2. The ground connection to the pressure sensor is not good.
3. The engine actually has this pressure.

Troubleshooting

1. See the "Background" section of the Oil Pressure section to verify the sensor type matches with the EIS instrument type.
2. With the EIS turned on, measure the voltage between the case of the oil pressure sensor, and the case of the EIS (the metal edge of the faceplate can be used). This voltage should be less than 0.1 volts. The stainless steel overbraid of a hose is usually not a good source of ground for the sensor. The sensor should be mounted to a manifold that is grounded.
3. Occasionally we hear from a customer that they think the EIS oil pressure is inaccurate when they are reading very low oil pressure, and it turns out that this is not true. Don't assume this is an instrumenation problem. Verify the pressure with another oil pressure gauge. This can also be done by replacing the oil pressure sensor with a new VDO 150 psi sensor, and measuring the resistance of this sensor with a known good ohm meter. The pressure can be calculated by as follows: Pressure = (ohms – 10)/1.2

22. **Fuel Flow - Troubleshooting**

Background

The flow sensor provides an open/ground output that the instrument detects via a 5V pull-up through a resistor. The output from the flow sensor is a square wave that varies in frequency according to the flow rate.

The fuel flow connections are electrically protected inputs. The instrument is very unlikely to experience a failure in this circuit. The most likely cause of any problem associated with the fuel flow function is the wiring to the flow sensor, an incorrect FloCal entry, or a blocked flow sensor paddlewheel. Flow sensor failure is possible, and although more likely than a failure internal to the instrument, is not very likely.

When testing the flow sensor is is often possible to see a non-zero fuel flow rate (FLOW) on the EIS for a short time when the backup (boost) pump is turned on. This can be a useful way to verify a complaint of zero fuel flow has been fixed.

Note that the totalizer function (identified as "FUEL" on the EIS) will count down to zero and stop. It must be manually set to match the amount of fuel in the airplane when the airplane is fueled.

23. **Fuel Flow - Reads 0.0 at all times.**

Causes:

1. The Flocal setting is zero or very low.
2. An electrical connection to the flow sensor is open or incorrect.
3. The flow sensor had debris in it.
4. The flow sensor is failed.

Troubleshooting

1. Verify the FloCal entry on the combination set pages is not set to a value of zero, or near zero. It should be approximately 170 when using the FloScan fuel flow sending unit, and about 83 with the EI red cube. This setting is accessed by holding the center and right buttons until the configuration set pages appear, and then paging down with the right button. To accurately adjust this value, follow the instructions for calibrating the fuel flow in the user manual.
2. Visually inspect the electrical connections to the flow sensor. Verify that the cable that plugs into the the rear of the EIS is fully mated. Also verify the electrical connections from this cable to the flow sensor are secure, and that the wire colors are matched.
3. A voltmeter can be used to verify the electrical connections. 9-12 volts should be present between the black and red wires in the cable connecting to the flow sensor. Make this measurement at the flow sensor. (No voltage at the flow sensor indicates a broken wire.)
4. Disconnect the wire that connects to the white wire of the flow sensor. Measure the voltage on wire that was connected to the white wire of the flow sensor. This wire should be connected to the EIS and show 5V when the EIS is turned on. If a voltmeter is not handy, a test signal can be created to determine if the EIS is operating normally and the fuel flow signal wire to the EIS is good. This is accomplished by disconnecting the white wire from the flow sensor. This wire is then repeatedly and rapidly touched to a source of electrical ground. This should cause the EIS to show a fuel flow of something greater than 0.0. If this test fails, check the electrical continuity of this wire connection to the EIS. If this test again fails, this suggests a failure in the EIS. If it passes, it suggests a possible malfunctioning flow sensor.
5. Re-connect the white wire to the flow sensor. Remove the fuel line connections to the flow sensor. Inspect for debris that could cause the paddle wheel inside the flow sensor to be stuck. Back flush the flow sensor. If no blockage is found, and all other tests passed, the flow sensor is faulty.

24. **Fuel Flow - Reads too low.**

Causes:

1. FloCal is set too low.
2. Flow sensor is partially blocked.

Troubleshooting

1. Verify the FloCal entry on the combination set pages is not set to a value of zero, or near zero. It should be approximately 170 when using the FloScan fuel flow sending unit, and about 83 with the EI red cube. This setting is accessed by holding the center and right buttons until the configuration set pages appear, and then paging down with the right button.
2. To check for a partially blocked fuel flow sensor, the sensor should be back-flushed with fuel.

25. **Fuel Flow - Reading is erratic.**

Fuel flow is not always constant with carburetor-equipped engines due to the nature carburetor. Some variation can be expected, typically less that +/- 0.5 gal/hour.

Cause

1. Turbulence in the fuel line upstream of the flow sensor.

Troubleshooting

1. Verify that no turbulence producing items are closer than 5” to the input side of the flow sensor. Turbulence producing items are things such as elbows, fuel pumps, fuel selectors, etc.

26. **Fuel Flow - Reads too high.**

Causes:

1. FloCal is set too high.
2. Flow sensor is partially blocked.

Troubleshooting:

1. Verify the FloCal entry on the combination set pages is set correctly. It should be approximately 170 when using the FloScan fuel flow sending unit, and about 83 with the EI red cube. This setting is accessed by holding the center and right buttons until the configuration set pages appear, and then paging down with the right button. To accurately adjust this value, follow the instructions for calibrating the fuel flow in the user manual.
2. To check for a partially blocked fuel flow sensor, the sensor should be back-flushed with fuel.

27. **Fuel Flow - Changes when an auxiliary pump is turned on or off.**

Cause:

The action of the pusling-type fuel pump.

Troubleshooting:

This is normal and typically results in the indicated fuel flow increasing by 1-2 gallons/hour. The use of a pulsation dampener may reduce this effect.

The damper can be constructed by installing a tee in the fuel line, running 1-2 feet of fuel line off the tee, and capping the end to trap air in this line. The tee can be positioned anywhere in the fuel system after the fuel pump.

The use of a pulsation dampener tends to help, but ultimately does not usually completely cure the above problems. In our experience we see about 1-2 gallons per hour caused by the action of the electric fuel pump with carburetored engines. The net effect is that this causes the totalizer to be slightly lower than actual, but by a small enough amount that we don't feel it is worth the effort to include a pulsation dampener in most installations. (For example, leaving the fuel pump on for 15 minutes will result in a fuel totalizer that shows 0.25-0.5 gallons less than actual.)

28. **Fuel Flow (PWM Type Fuel Flow) – Reading is always the same, regardless of actual flow.**

An EIS with “PWM fuel flow” will have a “P” in the software version on the label on the back of the EIS.

Cause:

1. The EIS is connected to a EI red cube or a flowscan fuel flow sensor. This sensor is not compatible with the PWM fuel flow option. The EIS must as the normal “F” type fuel flow option. The “F” will be in the SW version on the rear cover.
2. An EIS with connected to the wrong type of fuel consumption signal on a UL Power Engine. This engine's ECU provides two types of fuel consumption outputs. An EIS set up for PWM type fuel flow must connect to the “Injector Pulse Fuel Consumption” output.

Troubleshooting

1. Inspect the installation to see if the type of instrument is compatible with the signal being provided to it. An instrument with an “F” in the SW version must use a flow sensor or a signal that represents pulses/gallon or pulses/liter. An instrument with a “P” in the SW version must use a fuel injector type PWM signal.

29. **Tachometer**

Overview: The tachometer measures the engine RPM by determining the frequency of the tachometer signal from the engine. This information is combined with the pilot’s entry of TachP/R (EMP on very old instruments), which is set according to the number of tachometer pulses per revolution of the engine, to allow the EIS to calculate engine RPM.

In general, 4-stroke engines like Lycoming, Continental, Rotax 912, Subaru, etc, will provide a dedicated tach signal, or a something almost as good (like the p-lead from a mag). Tachometer sensing from 2-stroke engines and HKS generally require that the lighting coil be used both as a tach source, and to charge the aircraft battery via a regulator/rectifier. Some 2-stroke engines will have other signals that could be used as a tachometer source.

Lighting Coil Equipped Engines (2-stroke engines, HKS, Jabiru etc.)

The switching characteristics of the regulator/rectifier is highly dependent on its type, the design of the lighting coil, the battery and its state of charge, the electrical load on the engine, and the engine RPM. Regulator/rectifiers generally operate by shorting the power input to them (the lighting coil leads) to control charging and thus regulate. Since the lighting coil is also used as the tach source, there are situations where the tachometer signal can be affected.

Generally, if the tachometer reading is not erratic, and the TachP/R (or EMP) setting is correct, the tach will be accurate.

30. **Tachometer is erratic (4-stroke engines, engines with magnetos or electronic ignition.)**

Problem : Tachometer is inaccurate, reading a fixed percentage too high or low at all RPMs, although it is steady.

Almost certainly you have the TachP/R (in very old instruments, the EMP) set incorrectly. When sensing engine RPM via the mag P-lead, it is common for a mag to generate ½ as many pulses you expected. (A mag for a 4-cylinder engine, would be expected to produce 2 pulses per revolution, but it might produce only 1.) See the user manual for the correct setting.

31. **Tachometer is erratic (2-stroke engines, Jabiru, engines with charging or lighting coils.)**

This is most commonly caused by the switching characteristics of the regulator/rectifier. The lighting coil can not be used for tachometer connections with Key West regulator/rectifiers. For Tympanium single and three-phase regulator/rectifiers, this problem can be cured by moving the tachometer connection to the other regulator/rectifier lighting coil input, or in some cases, reversing of the lighting coil leads to the regulator/rectifier. This can also be cause by an EMP setting above 9 for an Advanced EIS. EMP settings above 9 are invalid for the Advanced model EIS.

Rotax Two-Stroke Engines : The gray tach lead will often give erratic tachometer readings around mid-range power, when the lighting coil is connected to a battery via a regulator/rectifier. Installing a 10k Ohm resistor inline between the gray tach lead and the tach input to the EIS will cure this problem. (This resistor is included in the parts pack, and is available at no charge from Grand Rapids Technologies. - Not required for model 2000/4000/6000 instruments as it is internal to the instrument.) The gray tach lead will not give a good tach reading when one of the two mags is turned off, as the signal on this wire comes from one of the mags, but other than this drawback it works no matter what is happening to the lighting coil.

Rotax 912/914 : On about 1 engine in 10, the tach reading from the dedicated tach output will be erratic. This is cured by reversing the two tach output wires from the engine, or installed a 10k Ohm resistor (1/4 W or larger) inline in the tachometer lead.

Lighting Coil Equipped Engines in airplanes without batteries.

When using the Tympanium 3-phase, or Key West regulator/rectifier, the lighting coil leads can not be used for sensing the engine RPM. On Rotax engines, the gray tach lead must be used. On some Rotax engines, erratic tach readings will be experienced at high rpm. In these cases a 10k Ohm resistor (included in the parts pack) is required. It is OK to use this resistor even if your tach readings are not erratic.

For Hirth engines, the spare, small lighting coil must be used for sensing engine RPM. Ground one side of this coil, and connect the other directly to the tach input of the EIS. The EMP must be set to 60.

32. **Tachometer reads 0 at all times.**

This is caused by no tachometer signal from the engine, or by an open circuit to the tachometer signal from the engine, or an EMP that is set to 0 on a Standard (2-stroke) EIS model instrument. Check you wiring to be sure you have a good connection to the EIS tachometer input.

When using the lighting coil as a tachometer source, a failed regulator/rectifiger can short out the lighting coil and causes a loss of the tachometer signal. A simple way to see if this is the case is to run the engine and observe the battery voltage using the EIS Volt display. If the voltage is 12.8V or less, the battery is not charging. Fix the charging problem and the tachometer problem will also be fixed. The charging problem can be caused by a bad regulator/rectifier, or wiring problem between it, the engine's lighting coil, or the battery.

A simple test is to disconnect the tach wire from the engine. Using **the tach lead to goes to the instrument**, tap this on and off onto a source of 12V power. This should cause the EIS to show some tach reading other than zero. If it does, the EIS is most likely working correctly. (This test will not work if any tach resistors are installed in the tach lead that are greater than 27k ohm.) If you are unable to get a non-zero tach reading while performing this test, perform a continuity test (using a test light or ohmmeter) to verify the wiring from the EIS connector to the end of the tach lead is good.

Rotax 914 (does not apply to Rotax 912) The tachometer output passes through the turbo control box. The tach output from this box is polarized (although Rotax fails to note this) so that it will only work when connected in one of the two possible ways. If you do not get a tachometer reading on a Rotax 914, reverse the tachometer connections.

For Rotax 2-cycle engines, a zero RPM reading can be experienced when using the gray tach lead during the Mag check. The gray tach lead is a tap off the coil used to power one of the mags. When this mag is shut down, the tach signal is reduced, and may be unreadable by the instrument. In some cases performing the mag check at 3500 RPM or higher may allow a tach reading to be made.

Note: For instruments which include an "EMP" setting (these are model 3, 2-stroke or Standard instruments), an EMP setting of zero will cause a tach to read zero at all times. Set the EMP according to the maual (typically 20 for Rotax CDI, 60 for all else.)

33. **Serial Data Output - EIS Data Logging software does not receive data**

Serial data communication problems can require some trial and error to correct, as there are many possible problems that can give the same symptoms. The serial port in the EIS is used by the factory during the instruments manufacture, assuring that it is functional when it leaves our factory. With some versions of the EIS it is possible for the port could be damaged if 12V power is connected to this output, but this is uncommon.

Problem: Unable to receive data from the EIS on the EIS data logger software running on a PC. (No data shows up on the computer screen when running the data collection program.)

Troubleshooting:

1. Be sure the instrument is turned on, (it can be on any display page, but should not be on a "Set" page) the serial data cable is connected to the PC, and the PC is running the data collection software with the correct COM port being specified. If you experience serial data problems it is often necessary to re-boot the PC to restore the serial port for normal operation.

2. Use a voltmeter to verify data is present at the 9-pin d-sub connector that plugs into the PC. To do this, connect the black lead (-) of the voltmeter to the signal ground pin (pin 5) and the red lead (+) to the Rec Data pin (pin 2). A fluctuating voltage between 0 and 6V or so should be observed. Move the red lead (+) to the Data Set Ready Pin (pin 6). A voltage of 5-12V should be observed on this pin. This voltage should be steady. (Not all computers required the Data Set Ready Pin connection, although it is advisable to make this connection.)

3. Verify the serial port being opened is correct. The data collection software prompts for which serial port is to be used. You may find that the correct port will cause the error message "Device timeout in line ..." when the cable from the EIS is not plugged into the computer, although this may not always be the case. The serial port may also be tested by connecting it to other devices (such as an external modem) to verify it functions properly.

See also the Readme file for the serial data. This has a detailed troubleshooting procedure.

34. **Serial Data Output – No EIS data received by a GRT EFIS**

Cause:

1. Serial port on the EFIS has not been configured.
2. The serial data output from the EIS is not wired correctly.
3. The EIS is not turned on, or is is displaying the, “Check Entries” page.
4. The serial output from the EIS has failed.
5. The serial input to the EFIS has failed.

Troubleshooting:

1. Check the settings for the serial data input on the EFIS via the Set Menu, General Setup. The serial input must be configured for EIS data at 9600 baud.
2. Check the EIS to see if it turned on and is not the “Check Entries” page.
3. Check the serial input counter on the EFIS. If it is counting, and the EFIS is configured for an EIS at 9600 baud, something other than an EIS may be wired to the EFIS on that serial input.

4. Check the serial input counter on the EFIS. If it is not counting, no data is coming in. Disconnect the cable from the EFIS that has this serial data, and measure the AC voltage on the pin used for the EIS serial data input. The AC voltage should be above 1 volt with most meters and will probably fluctuate. A DC voltage measurement should should a fluctuating voltage. If the voltage is steady, or near zero, the connection to the EIS serial output may be open or the EIS serial data output may be failed (unlikely). (You can determine the pin used for the EIS serial data by noting the serial input used on the Set Menu, General Setup, and looking in the EFIS user manual to see which serial input uses this pin.)
5. If the voltage measurements in step 4 showed serial data was present, the EFIS serial input may be failed. This is unlikely. A display units serial port can be tested by connecting a serial port output to its input, and running the serial port loop-back test.

35. **EGT & CHT – Basic Troubleshooting – Checking probes and wiring.**

Checking the wiring to the probes:

Each EGT and CHT probe has two wires that must be connected to the EIS. A simple way to check for an open in either of the wires is to remove the d-sub connector from the instrument. Refer to the EIS manual to identify the EGT and CHT probe connections to this connector. Using a volt/ohm meter set to ohms, touch one meter lead to ground, and check each of the EGT/CHT pins to see if any of them are open circuit. Since the EGT and CHT probes are grounded type probes, each EGT and CHT leads should register very close to zero ohms to ground (any reading less than 20 ohms is good). (This test must be performed with the probe grounded by installing it in the engine.) Typically the open circuit will be found at the quick-disconnect on the probe itself, or where the probe plugs onto the extension wire. If an open circuit is found, it may be due to a bad probe.

Checking an EGT or CHT Probe:

EGT and CHT probes should measure less than 10 ohms resistance between their leads. Use an ohmmeter, and measure the resistance between the leads at the probe itself. This can be done with the probe plugged into the airplane's wiring. If the probe measures an open circuit, it is bad.

36. **EGT & CHT - Read too high or two low**

If this is an external cold-junction version (used primarily with powered-parachutes and 2-stroke engines), this can be caused by a bad reading on the OAT probe. If the OAT probe reads 20 degrees too high, so will the EGTs and CHTs. This does not apply to any EIS for 4-stroke engines.

37. **EGT & CHT - Reads about 1/2 of expected reading**

Cause:

1. The EIS is set up with units in Celsius when Fahrenheit is desired.
2. If only EGT reads low on one or more cylinders, it is possible the EGT probes is inserted too far into manifold and is touching the other side of the manifold.
3. One of the two wires to the probe is open circuit.
4. The probe is open circuit.

Troubleshooting:

1. Check the units selected for the EIS on the “Configuration Set Pages”.

2. Visually inspect the EGT probes to see if the probe is inserted too far into the exhaust pipe. With the hose clamp type EGT probes, the probe itself is normally 1 inch long. With the Rotax two-stroke engines, the probe can be inserted too far into the compression fitting when the user installs the probe.

38. **EGT & CHT - Reading is erratic.**

Cause:

1. Failed probe.
2. No ground connection to the engine.

Troubleshooting:

1. An open connection to one lead of the probe, or an open in the probe itself will often cause an erratic reading. Refer to "EGT & CHT – Basic Troubleshooting" to check for an open connection or a bad probe.
2. Verify the EIS and engine share a ground connection. If the airplane had two batteries, make their grounds are connected together. It is also possible that no ground wire is connected to the engine case, but is practically impossible if the engine includes an electric starter (unless the ground cable to the engine has broken). For engines that do not have an electric starter, the case of the engine must be tied to ground. Measuing the DC voltage between the case of the EIS and the engine should show less than 0.050 volts (50 mV), although up to 0.5V is acceptable when all electrical systems are tuned on in the airplane. With the airplane's electrical system off, the resitance between the case of the EIS and the engine should be less than 1 ohm.

39. **EGT & CHT - (or other readings) change when transmitting on a com radio.**

In rare cases the EIS can be affected by radio transmissions. This is caused by very high levels of the com radio's transmitter affecting the circuits in the EIS. Since the EIS is designed with a very high level of tolerance for this condition, this usually indicates a problem with the radio installation is present. In any case, the following should be considered.

- If the problem occurs inside of a metal hangar, re-test with the airplane outside of the hangar. The metal hangar walls can reflect large amounts of radio energy.
- Verify the coax to the radio is not shorted (it should be open circuit between the inner conductor and the shield.) A short might allow the radio to receive, but not transmit.
- Verify the antenna is good. This is most easily determined by testing the SWR. The SWR should be less than 2.0. A large SWR indicates reflections, and large amount of RF energy bouncing back from the antenna.

In most cases, the above should solve the problem. If the above items appear to be ok, and this can be verified also by the ability to transmit a normal distance, to some degree, then the following should be tried.

1. Verify the radio and the EIS do no share the ground wire for a long distance. Using the same heavy gauge ground wire for a couple feet is ok, but sharing a smaller wire (20 or 22 gauge) for many feet, could cause a problem.

2. Snap-on ferrite filters can be used to filter out RF energy. These snap over a wire, or group of wires, or even around a coax. These are easy to move around, and are very effective. Trial and error is needed to find the best location for them, but they tend to be very effective. Keep in mind that if you need them, there is probably something not quite right about your radio installation though, as they are normally not required.
3. If problems still persist, a dummy load can be used in place of the antenna. If the problem goes away with the dummy load, either the antenna is too close to the EIS, or you have problems with a bad SWR (reflections in the coax).
4. It might be possible that some older radios might emit enough interference that they could cause a problem if they are mounted next to the EIS. This is rare.

40. **EGT & CHT - Sharing EGT and/or CHT Probes with other gauges**

No probes which connect to the EIS can be also connected to an analog gauges. They will interact and cause inaccurate readings. It **may** (not always) be possible to share the same probe with another electronic instrument.

The tachometer signal and the voltmeter can be shared.

41. **Airspeed does not read above about 50 mph (40 knots)**

Cause - Pitot and Static Port Connections are reversed.

42. **Vertical Speed Not Working (applies to Model 4000/6000/9000 only)**

Cause – The vertical speed displayed on a combination page (which is a user-programmable page) can be programmed incorrectly so that it does not provide a valid vertical speed. This occurs if the vertical speed value is being over-written by something else (such as the up/down arrow that is normally displayed next to this number). The vertical speed displayed on the labeled page will always be correct.

Troubleshooting – Refer to the user manual to learn how to program the combination screens, and using the configuration set pages, check the settings that are being used to show the vertical speed.

43. **Manifold Pressure always reads too low.**

MAP will display absolute air pressure. At sea level, it will match the altimeter setting. For every 100 feet above sea level, it will read 0.1" less than the altimeter setting.

Problem: Reads very low all the time. Does not change.
Cause: Scale factor is zero, or no connection between the auxiliary input on the EIS, and the output of the manifold pressure sensor.

Problem: Inaccurate and too low, but changes with changes in pressure.
Cause: Scale Factor and Offset not entered.

Problem: Reads correct when engine not running, but too high with engine running.
Cause: Leak in hose connection to the MAP sensor at the sensor.

44. **Manifold Pressure always reads too high.**

MAP will display absolute air pressure. At sea level, it will match the altimeter setting. For every 100 feet above sea level, it will read 0.1" less than the altimeter setting.

The ground for the sensor may be open circuit. To test, turn on the power to the instrument and MAP sensor. Using a voltmeter, touch the black lead to the ground for the airplane. Touch the red voltmeter lead to the metal part of the d-sub connector of the MAP sensor, with the connector plugged into the sensor. You should measure less than 0.020 volts (20 mV). If you measure something in the range of volts, the ground is missing.

The scale factor and/or offset may not be set correctly.

45. **Fuel Pressure (VDO Type) via Aux Input - Overview**

Overview

The VDO pressure sending unit converts a pressure into a variable resistance output. They can be identified by their one or two terminals on the side opposite the pressure connection. The sensor will be stamped with its pressure range and brand on the flats used to tighten the sensor, at the pressure port end. The sender is wired to the EIS in so that the 4.8V sensor excitation output provides a regulated voltage through a resistor to the sending unit. The variable resistance of the sending unit cause the voltage to vary across its terminals. With no pressure applied, the sensor will have about 10 ohms resistance. With increasing pressure, the resistance increases.

46. **Fuel Pressure (VDO Type) - Always reads zero .**

Cause:

1. The connection from the auxiliary input to the fuel pressure sensor is open.
2. The wrong resistor value (or the resistor was not installed) between the EIS 4.8V output and the fuel pressure sensor.
3. The scale factor for this auxiliary input is not correct.
4. No pressure is being applied to the sensor.
5. The sensor is failed.

Troubleshooting

1. Verify the auxiliary input's scale factor, offset, and forward/reverse sensing is configured correctly according to the diagram for the fuel pressure via auxiliary input. (See “How to configure an Auxiliary Input” section in the user manual, or in this troubleshooting guide.)
2. The sensor is wiring can be verified by temporarily configuring the auxiliary input as a sensitive voltmeter by setting the following items on the configuration set pages:

    - Set the forward/reverse sensing to forward (+ on the options page for the input the fuel pressure sender is connected to.)
    - Set the AUXSF to 250
    - Set the AUXOFF to 0

    The auxiliary display should now show 5-20 if the wiring is correct. (If the auxiliary is displayed with a decimal point, it should show 0.5 – 2.0).

If the auxiliary display shows 0, the connection to the auxiliary input is open, or the 4.8V excitation is open, or the resistor is the wrong value (too large).

If the auxiliary display is greater than 450 (45.0 if the auxiliary is displayed with a decimal point), the sensor ground is open, the 4.8V excitation was wired to the sensor without the resistor inline, or the sensor has failed.

If the auxiliary display is in the range of 20-450 (2.0 - 45.0 if the auxiliary is displayed with a decimal point), the resistor value may be incorrect. A simple way to measure this resistor can be to disconnect the 25-pin d-sub connector from the EIS, and measure the resistance to ground through the 4.8V output pin in the connector on the aircraft wiring. If only the fuel pressure sensor is being powered by the 4.8V output, the resistance measured will be about 10 ohm greater than the value of the resistor installed in the 4.8V output line. (If multiple devices use the 4.8V output, disconnect the ground to the other devices when making this measurement.)

Upon completion of this test, reset the auxiliary input and scale factor the to values specified on the fuel pressure diagram.

3. To check for a failed sensor, disconnect the wiring to the sensor. Measure the resistance (using a volt/ohmmeter) between the two terminals (or between the terminal case, if there is only one terminal). The VDO sensor should read in the range of 5-20 ohms.
4. If all these tests pass, either the sensor is failed, or no pressure is being applied to the sensor. It will be necessary to replace the sensor with another pressure gauge to see if pressure is present at the sensor's pressure port.

47. **Fuel Pressure (VDO Type) - Reading is too high.**

Cause:

1. The incorrect sensor is installed.
2. The ground to the sensor is open.

Troubleshooting

1. Verify the sensor is the correct sensor by They can be identified by their one or two terminals on the side opposite the pressure connection. The sensor will be stamped with its pressure range and brand on the flats used to tighten the sensor, at the pressure port end. A 30 psi sensor is also marked 0-2 Bar, 80 psi is also marked 0-5 bar, and 150psi also marked 0-10 Bar.
2. See sensor is wiring can be verified by temporarily configuring the auxiliary input as a sensitive voltmeter by setting the following items on the configuration set pages:
    - Set the forward/reverse sensing to forward (+ on the options page for the input the fuel pressure sender is connected to.)
    - Set the AUXSF to 250
    - Set the AUXOFF to 0

The auxiliary display should now show 5-20 if the wiring is correct. (If the auxiliary is displayed with a decimal point, it should show 0.5 – 2.0).

If the auxiliary display shows 0, the connection to the auxiliary input is open, or the 4.8V excitation is open, or the resistor is the wrong value (too large).

If the auxiliary display is greater than 450 (45.0 if the auxiliary is displayed with a decimal point), the sensor ground is open, the 4.8V excitation was wired to the sensor without the resistor inline, or the sensor has failed.

If the auxiliary display is in the range of 20-450 (2.0 - 45.0 if the auxiliary is displayed with a decimal point), the resistor value may be incorrect. A simple way to measure this resistor can be to disconnect the 25-pin d-sub connector from the EIS, and measure the resistance to ground through the 4.8V output pin in the connector on the aircraft wiring. If only the fuel pressure sensor is being powered by the 4.8V output, the resistance measured will be about 10 ohm greater than the value of the resistor installed in the 4.8V output line. (If multiple devices use the 4.8V output, disconnect the ground to the other devices when making this measurement.)

Upon completion of this test, reset the auxiliary input and scale factor the to values specified on the fuel pressure diagram.

48. **Fuel Pressure (VDO Type) - Reading is erratic.**

Cause :

1. The pressure sensor is old and needs to be replaced.
2. The pressure being sensed is fluctuating.

Troubleshooting:

1. The VDO type pressure sensor, when used to sense fuel pressure, has a lifespan of typically 200-500 hours. This is especially true with carburetor-equipped engines. When at the end of its life, it is typical for the sensor to be erratic with higher than actual readings being common.
2. If the sensor is less than 100 hours old, it is possible that the pressure is fluctuating, or the sensor is bad. The sensor can be replaced or another pressure gauge used to determine the cause.

49. **Coolant Pressure, or other pressures sensed via a VDO pressure sensor through an auxiliary input.**

Refer to the sections on fuel pressure (VDO Type).

50. **Fuel Level – General**

The EIS is typically used with either float-type resistive fuel level sensors, or Princeton capacitive fuel level probes. Some other capacitive probes are are also compatible with the EIS if their output is a voltage that exceeds 1V.

Documentation for how to install these probes is included at http://www.grtavionics.com/manualseis.html . The float-type resistive sensors can usually be identified by a single terminal electrical connection, while the Princeton capacative probes can be identified by their push-buttons and leds, with three wires exiting from the probe.

51. **Fuel Level (Resistive Type Probe) – Reading changes very little or not at all.**

Cause:

1. The pull-up resistor is the wrong value and is too large.
2. No ground to the probe.
3. Wiring is open circuit.
4. The auxiliary input is not configured correctly.

Troubleshooting:

1. Verify the auxiliary input scale factor is greater than 5. A scale factor of zero will cause the auxiliary input to not change as the auxiliary voltage changes. Small scale factors will result in a small change in readings in response to a change in the auxiliary voltage. Follow the sheet for float-type fuel level calibration if calibration is required.
2. Disconnect the d-sub cable from the EIS. Check the resistance between the 4.8V output and the auxiliary input. The resistance measured should be about 470 ohms (not 470k). If this is not found, the resistor is the wrong value or not installed.
3. Measure the resistance from the auxiliary input used for fuel level to ground. The reading should be less than 500 ohms. If the reading shows an open circuit, check the ground connection for the fuel level sensor, and the wiring to the fuel level sensor from the EIS.

52. **Fuel Level (Capacitive Type Probe) - Always reads zero.**

Cause:

1. The output of the fuel level probe is not connected to the EIS auxiliary input (or is connected to a different auxiliary input than expected).
2. The auxiliary input is not configured properly.
3. The capacitive fuel level probe is not receiving any power.
4. The capacitive fuel level probe is the wrong type.
5. The probe is not calibrated.
6. The probe is defective.
7. The fuel tank is empty.

Troubleshooting:

1. Check the configuration of the auxiliary input. See the section "Auxiliary Input – Checking or Setting Configuration" at the beginning of this document for this procedure. The auxiliary input should be configured with the scale factor (xSF) set to ½ the of the full tank reading in gallons or liters, offset (xOFF) set to zero, forward sensing (+/- set to +) and integer (I/D set to I). The scale factor must be set to a value greater than 10 for the troubleshooting. Temporarily set the scale factor to 10 or more during the troubleshooting procedure. Be sure to reset it to ½ of the full tank reading when troubleshooting is complete.
2. If the power to the fuel probe can be controlled separately from the EIS, try turning the power off, and then back on the probe while leaving the EIS on, and watching to see if this auxiliary input changes, (or if another auxiliary input changes, in case it was wired to a different input than expected). The probe will set its output to full for a few seconds after power up, and then empty, before showing the fuel level being sensed, and this will be observed as a changing value on the EIS auxiliary display. If the output of the probe is observed to change at power-up, the probe will need to be calibrated. See the website for instructions. If no change in the EIS auxiliary display is observed, continue to step 4.
3. If power to the probe can not be controlled separately from the EIS, turn off the EIS and probe, and then back on. Select the page on the EIS that shows the fuel level as quickly as possible to see if the aux input shows anything other than zero. If within 5 seconds after the power is turned on, a non-zero

reading is observed on the EIS auxiliary input, the probe is connected to the EIS. This indicates that the probe requires calibration or is failed. If no change in the EIS auxiliary display is observed, continue to step 4.

4. If no response is still detected in step 2 or 3, it is possible the probe is not receiving power, or is defective. Inspect the Princeton capacitive fuel level probe with power turned on. An LED on it should be illuminated or flashing if it is receiving power. If this is not the case, check the power to the probe. If the probe is receiving power, the probe is defective.
5. Verify the probe type is Princeton, or a type of capacitive fuel level probe that generates a 0-5V output. The EIS auxiliary input is not compatible with the "lumpy" cable Electronics International probe, or certain capacitive fuel level probes that don'. The output of the probe can be measured with a voltmeter to help confirm the probe is compatible. Set the voltmeter to DC Volts, and measure the output. A compatible probe will show at least 1V when the fuel tank is full. If the output of the probe is never greater than 1V, the probe is either the wrong type, or defective. If the output of the probe is greater than 1 volt, then the connection to the EIS auxiliary input is open.

53. **Fuel Level (Capacitive type probe) - Reading is Inaccurate.**

Cause:

1. The EIS auxiliary input is not configured correctly.
2. The fuel probe is not calibrated correctly.
3. The fuel contains alcohol.
4. The fuel contains water.
5. The probe output voltage is too low (wrong type of fuel level).
6. The ground voltage between the probe ground and the EIS ground is changing.

Troubleshooting:

1. Check the configuration of the auxiliary input. See the section "Auxiliary Input – Checking or Setting Configuration" at the beginning of this document for this procedure. The auxiliary input should be configured with the scale factor (xSF) set to ½ the of the full tank reading in gallons or liters, offset (xOFF) set to zero, forward sensing (+/- set to +) and integer (I/D set to I).
2. If the fuel level reading is not repeatable, it is possible that the fuel has alcohol in it. This will not be the case for aviation fuel, can can be the case for auto fuel. In some states the gas station is not required to disclose if the fuel being sold contains alcohol. Alcohol will make the fuel level read higher than actual.
3. Water can have varying effects on capacitive fuel level probes. Check the fuel tank for water by sumping the tank or visual inspection. Shake the airplane vigorously and repeat this check.
4. If the fuel level reading is repeatable, but inaccurate, the fuel probe may need to be calibrated. Follow the instructions for your type of fuel probe.
5. Verify the probe type is Princeton, or a type of capacitive fuel level probe that generates a 0-5V output. The EIS auxiliary input is not compatible with the "lumpy" cable Electronics International probe, or certain capacitive fuel level probes that don'. The output of the probe can be measured with a voltmeter to help confirm the probe is compatible. Set the voltmeter to DC Volts, and measure the output. A compatible probe will show at least 1V when the fuel tank is full. If the output of the probe is never greater than 1V, the probe is either the wrong type, or defective. If the output of the probe is greater than 1 volt, then the connection to the EIS auxiliary input is open.

6. It is possible that the varying currents in the aircraft electrical systems are causing the ground voltage to vary between the EIS ground, and the fuel probe ground. This is no usually a problem with aluminum airplanes, but can occur with composite airplanes. To check for this, try turning on and off different devices in the airplane, and see if doing so changes the fuel level reading. Devices that require high levels of power are more likely to cause the problem. Alternatively, a voltmeter can be used to measure the voltage between the ground for the EIS, and the ground for the fuel level probe. This voltage should be less than 0.05 volts (50 millivolts).

54. **Ampmeter Troubleshooting**

The amp sensor is powered by the 4.8V output from the EIS. The sensor will provide half of this voltage (about 2.4V) when no current is being sensed. For the 100 Amp sensor, the voltage will increase about 0.015V for each amp that is sensed, and for the 50 Amp sensor, 0.022V per amp. The amp sensor should be wired and the EIS configured according to the sheet, "Hall Effect Current Sensor".

55. **Testing the Ampmeter (current sensor)**

Amp sensor mounted on the battery cable - With the engine off, and no battery charger connected, verify the amp meter reading changes as various electrical loads are turned on or off.

Amp sensor mounted on the alternator cable - The ampmeter should read close to zero (+/- 2 amps) when the engine is off. When the engine is on, the ampmeter reading will show the current used to charge the battery, and to run the electrical system of the airplane.

56. **Ampmeter (current sensor) always reads zero, or close to zero.**

This reading is normal when the sensor is mounted in the cable going to the battery. When the battery is fully charged, and the alternator is functioning, the current charging the battery will be close to zero (usually less than 1 amp). If the alternator is not functioning, the current measured will be the opposite sign, and will show the power being consumed by the airplane's electrical system.

If the amp sensor is mounted in the alternator output wire:

Cause:

1. The sensor is physically damaged. Visually inspect the sensor to see that the sensor is intact. The sensing element should be secure in the doughnut shaped body of the sensor.
2. The sensor is mounted on the wrong wire (is mounted on a wire that is not carrying current).
3. The auxiliary input has not been configured with the correct scale factor and offset.

57. **Ampmeter (current sensor) reads a very low value, such as -99 amps.**

,
Cause

1. The aux input to the amp sensor is unconnected, or the amp sensor is wired to a different auxiliary input.
2. The amp sensor is not connected to the 4.8V output from the EIS.
3. The auxiliary input has not been configured with the correct scale factor and offset.

58. **Ampmeter (current sensor) - Reads a very high value.**

Cause
1. It is possible a different aux input has more than 6V applied to it. When this happens it can affect other auxiliary inputs, and could be the cause of the auxiliary being used to sense amps reading too high.
2. The ground wire to the amp sensor is unconnected.
3. The sensor has failed.

Troubleshooting

1. Check to see if other EIS readings look incorrect. If so, one of the incorrectly reading auxiliary inputs probably has more than 6 volts present on its input. This can be caused by an auxiliary input that has a sensor that requires 12V power, such as manifold pressure, and the ground for this sensor is open.
2. If no other readings look incorrect, verify the auxiliary input is configured correctly according the the sheet that applies to the type of amp sensor you are using.
3. Check the ground connection to the sensor, and verify the connections to the sensor are secure.
4. It is unlikely for the sensor to fail in this manner, but as a last resort it can be disconnected. This should cause the reading to show a very low value, confirming it was connected to the auxiliary input. If this is observed, the amp sensor should be replaced.

59. **Ampmeter (current sensor) - Reads too high or too low.**

The EIS aux input is not configured correctly.

The ground voltage is changing between the EIS and the sensor. Ideally the ground for the AMP sensor should connect to the same location as the ground for the EIS. If this is not practical, the verify the ground voltage is good as follows:

1. Turn on the EIS.
2. Place on lead of a voltmeter on the case of the EIS, or on the bare metal edge of the faceplace.
3. Place the other lead of the voltmeter on the ground connection for the amp sensor.
4. The voltage should be less than 0.050 (50 mV)

60. **Outside Air Temperature (OAT) - Reads -50 degrees at all times.**

Background: One side of the OAT probe connects to ground, and the other to the OAT input of the EIS. If either of these connections is open, the EIS will show -50 F.

Cause: Open circuit.

1. The connection from the EIS to the OAT probe is open, or
2. The OAT connection to ground is open, or
3. The OAT probe is failed open.

Troubleshooting:

1. A simple way to check for a good OAT probe and the wiring is to disconnect the connector from the EIS, and measure the resistance from the OAT/Carb temperature probe, to ground. The reading should be less than 50k ohms, and is typically 10k ohms at 77 deg F. If open, check the probe and wiring. The probe should measure less than 50k ohms between its leads.

To see if the connection to the EIS is good:

Troubleshooting without a voltmeter: Turn on the EIS. Locate the connection connection between the EIS and the OAT probe. Short this connection to ground. (It is not necessary to disconnect the OAT probe for this test.) The EIS should read a very high value (above 120 F). If the reading does not change, the connection to the EIS is open. The open may be at the d-sub connector, or the wire to the EIS may be broken.

Troubleshooting using a voltmeter: To determine if the connection to the EIS is good, turn on the EIS, and with the OAT probe connected, measure the voltage at the point where the EIS OAT input connects to the OAT probe. If this voltage is very close to 5V (greater than 4.5V), the probe is bad or its connection to ground is open. If this voltage is zero, the connection to the EIS is open.

To see if the OAT/Carb Ground connection is good:

Using a voltmeter, connect on lead to a known good ground (such as the negative terminal of the battery), and the other lead to the point where the probe connects to ground. With the EIS turned on, the voltmeter should read very close to zero volts (less than 0.05 or 50 mV). If the voltmeter reads about 5V, the ground connection the probe is using is not a good ground.

To see if the OAT/Carb probe is good:

Disconnect one or both of its leads. Measure the resistance between the two leads using a volt-ohm meter set to OHMS. At room temperature the reading should be in the range of 5k-15k (5000 – 15,000) ohms. If the reading is a short (near zero ohms) or an open, the probe is bad.

61. **Outside Air Temperature (OAT) - reading is too high.**

If the OAT probe is accurate when the airplane is in the hangar before a flight, but reads high when in flight or outside the hangar, the OAT probe is being heated by the sun, or by the engine. The OAT will need to be re-located. In our experience with RV-6, 7, and 10's, the probe may be mounted under under in the wing-to-fuselage intersection sheet metal, and this is far enough off the center line of the airplane that the engine's heat does not affect the readings.

If the OAT reading is always too high, the OAT probe may not be a GRT OAT probe. A GRT probe will measure 10k ohms resistance at 77 deg F.

62. **Carburetor Temperature - Does not change when carburetor heat is applied.**

Cause:

1. The carburetor temperature probe is primarily measuring the temperature of the body of the carburetor. Carburetor heat will warm the body of the carburetor slowly, so it may take many seconds for a small change to be observed.
2. The carburetor temperature probe is not mounted in the carburetor.

Troubleshooting:

1. Allow sufficient time for the carburetor heat to warm the carburetor when testing.
2. Visually verify the sensor is mounted in the carburetor.

63. **Carburetor Temperature - Reads -50 degrees at all times.**

Refer to the troubleshooting for the OAT probe. The carburetor and OAT probes are electrically identical.

64. **Warning light never turns on.**

This can be verified by going to the set limits pages. While on a set limits page, the instrument will turn the warning light on steady. The warning light will also flash on for about ½ second or so when the instrument is turned on.

Possible causes

Wiring to the warning light is open circuit - Disconnect the d-sub connector which included the warning light output. Turn on the power, and measure the voltage on the pin in the cable for the warning light. 12V power should be present on this pin. If it is not, the wiring to the warning light is open circuit, or the bulb is bad.

Warning light is burned out. Test light by applying 12V power to one terminal, and ground to the other. The light should illuminate.

If the above tests are OK, the warning light may be drawing too much current. The instrument will not turn on the warning light if it draws more than about 120 mA. Replace the warning light.

65. **Warning light is always on.**

If the warning light flashes when the instrument is turned on, this indicates the warning light is being properly controlled by the instrument. In this case, the warning light will be on steady if an alarm is active, and has been acknowledged, or when on a set limits page. (Remember that the warning light will be on steady when on as set page.)

To identify the which alarm is causing the warning light to remain on, turn the instrument on, allow about 10 seconds for the instrument to initialize, ***and without pressing any buttons***, note the label on the display below the flashing number. Press the left button one time, and note if any other flashing numbers appear, and if so, note the label below the flashing number. Check the limits associated with these items. When reviewing the limits you have set, note that some limits are upper and some are lower, and the carb temp is actually a range between upper and lower. Also note that on older instruments (those with 9-pin d-sub connectors), some instrument only included one voltmeter limit…this being a lower limit.

Warning Light never flashes when the instrument is turned on - This indicates the instrument is not receiving power (in which case it will not be operating), or the warning light connection between the instrument and the warning light is shorted to ground, or the instrument has a faild warning light output. To test, turn off power, and disconnect the cable from the instrument that incudes the warning light connection. Re-apply power. If the warning light remains off with the instrument disconnected, but comes on steady when the instrument is connected, the instrument has a failed warning light output. (This is very rare, as the warning light output protects itself from damage due to most electrical faults.) If the warning light remains on when the cable is disconnected from the instrument, there is a short to ground of the warning light output wire in the aircraft wiring.