



**USER'S MANUAL  
FOR THE  
ENGINE INFORMATION SYSTEM**

---

**Grand Rapids Technologies Incorporated  
889 76th St SW #2  
Byron Center, MI 49315  
(616) 583-8000 Fax (616) 583-8001**

<b>1. USING THIS MANUAL .....</b>	<b>5</b>
<b>2. USING THE ENGINE INFORMATION SYSTEM .....</b>	<b>5</b>
2.1 THE BASICS OF THE ENGINE INFORMATION SYSTEM OPERATION .....	5
<b>3. BEFORE EACH FLIGHT .....</b>	<b>5</b>
<b>4. SET PAGES – SETTING ENGINE LIMITS AND OTHER USER ENTRIES.....</b>	<b>6</b>
<b>5. CONFIGURATION SET PAGES – SETTINGS UNIQUE TO YOUR ENGINE AND INSTALLATION .....</b>	<b>7</b>
5.1 OPTIONS – USER SELECTABLE FEATURES .....	7
5.2 EMP SETTING FOR CORRECT TACHOMETER READINGS .....	8
5.2.1 <i>Setting the EMP (Standard EIS Models Only)</i> .....	8
5.2.2 <i>Setting the EMP – (Advanced EIS Only)</i> .....	8
5.3 AUXILIARY INPUT FUNCTION SCALE FACTOR AND OFFSET .....	9
<b>6. INSTALLATION.....</b>	<b>10</b>
6.1 MOUNTING THE INSTRUMENT .....	10
6.2 WIRING .....	10
6.3 DETAILED WIRING DESCRIPTION .....	11
6.4 USE OF THERMOCOUPLE EXTENSION WIRE.....	13
6.5 VERIFY THE WIRING – A QUICK CHECK .....	13
<b>7. CHECK-OUT.....</b>	<b>13</b>
7.1 INITIAL APPLICATION OF POWER TO THE INSTRUMENT .....	13
7.2 TACHOMETER INITIAL TEST .....	14
<b>8. CHECK ENTRIES MESSAGE.....</b>	<b>14</b>
<b>9. DESCRIPTION OF EIS FUNCTIONS.....</b>	<b>14</b>
<b>10. WARRANTY .....</b>	<b>16</b>

Figure 1 - Description of Pages

Figure 2. Operation

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

Installation instructions begin on page 10. Before turning to this page, we recommend that you read the following description for the use of your system so that you are familiar with its operation.

## 1. Using this Manual

Some of the text within this manual refers to specific models of the Engine Information System, and it is identified as such by a heading according to the following table. If you are unsure which model of the EIS you have, refer to the label on the rear cover of the instrument.

Pre-fix used in this manual	Refers to these models as identified on the rear cover
Std-	All models identified as STD-
Adv-	All models identified as ADV-
Adv-A	All models identified as ADV-A, or ADV-A(vdo)
Adv-W	All models identified as ADV-W or ADV-W/912, 914

## 2. Using the Engine Information System

Refer to figure 1 for a description of the various display pages, and to figure 2 for an illustration of the use of the EIS from panel keys to control the operation of the instrument.

### 2.1 The Basics of the Engine Information System Operation

- **Turn off power to EIS when starting the engine.** It is good practice to turn off the power to the EIS, as well as to all other avionics connected to your aircraft's electrical system, before engaging the engine starter. Large currents demanded by the engine starter can produce undesirable voltage fluctuations and surges. Depending on the nature of your electrical system, it is possible that the instrument may not continue to operate normally if it is on while the engine starter is engaged. NOTE: Turning off power to the EIS and then turning it on again will restore normal operation if this should occur, and this will not damage the instrument in any way.
- **The Display button and your favorite page.** Pressing the “Display” key will immediately change screens to the page you have selected as your favorite display page. This provides a quick and simple means of returning your instrument to your favorite page, after you have been reviewing other display pages. To make your selection of which page is to be displayed by the “Display” key, see the “Set Pages” section.
- **The Alarms – The most important part!** The instrument's alarm function will alert you to out-of-limit conditions by flashing the warning light (to get your attention), and simultaneously changing pages to a labeled screen and flashing the reading above its label to identify it. If the problem can not be immediately solved, the alarm should be acknowledged by pressing the “Next/Ack” button on the EIS. Acknowledging an alarm returns the instrument to the page it was previously on, and allows it to alert you to the next problem. After acknowledging an alarm, warning light will remain on while any problem exists.
- **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.

## 3. Before Each Flight

No special action is required by the pilot before each flight, as the instrument will perform a self-test and (assuming the test passes) will select your favorite display page if no alarms are pending. If your instrument includes the internal Altimeter/VSI option, the altimeter should be set before each flight. (Include this step in your checklist.)

NOTE: It is possible for the instrument or its sensors to suffer various kinds of failures that can not 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.

#### **Expert Advice! Pre-flight tests for Pressure Senders**

We recommend that you include in your engine start checklist a step where the EIS is turned on prior to engine start. With the engine off, you should observe a warning for low oil pressure (and fuel and/or coolant pressure, if one is connected via the auxiliary inputs). This is a great way to verify these sensors are operating properly, especially in the case of the very critical oil pressure sensor.

#### **4. SET PAGES – Setting Engine Limits and other User Entries**

The “Set” pages are used to enter engine limits and other selections into the EIS. These pages are accessed by simultaneously pressing the two keys marked “SET LIMITS”, as illustrated in figure 2. The use of the engine limits, and the other features controlled on these pages, are described below. All entries on these pages are retained when the instrument is turned off.

Since all limits can be entered easily by the pilot at any time, it is practical to set engine limits lower than those indicated by the engine manufacturer, but slightly higher than encountered in normal operation. In this way, a change in normal engine operation may be detected earlier.

**NOTE:** Limits that are not used should be set to zero. This disables the limit to prevent nuisance false warnings.

**CAUTION:** While the “Set” pages are selected, the automatic warning feature of the instrument is disabled. This is necessary to allow the pilot the ability to change an engine limit in the presence of an engine parameter that is intermittently outside of its limit. The auxiliary annunciator light is illuminated while the “Set Limits” pages are selected to remind you that the warning feature has been disabled---and as a convenient means of testing this light.

Entries that are made on the “Set” pages are as follows:

- **Altitude** – (Std- w/ Altimeter only) Set the altitude to match your field elevation before each flight.
- **Time** – This limit is used to generate a warning when the flight timer has exceeded the entry made on this page. The time limit is entered in minutes (i.e., a time limit of 1 hour 30 minutes would be entered as 90).
- **Contrast** – The contrast of the LCD display is set on this page. Four levels of contrast may be selected, 0-3, with the lower settings best for higher ambient temperatures, and the higher settings best for normal and cooler temperatures. Make your selection to achieve the most desirable appearance of the display. It may be necessary to change it in response to large ambient temperature changes.
- **MinALT** - (Std without Altimeter Only) - Set the minimum altitude at which the external altimeter sensor will operate.
- **RPM** – The engine's RPM limit is entered on this page. A warning will be generated when the engine's RPM, as sensed by the instrument, exceeds this limit.
- **CHT** – The engine's cylinder head temperature limit is entered on this page. A warning will be generated when a cylinder head temperature exceeds this limit.
- **EGT** – The engine's exhaust gas temperature limit is entered on this page. A warning will be generated when an exhaust gas temperature, as sensed by the instrument, exceeds this limit.
- **TEMP** – (Std- Only) The engine's coolant temperature limit is entered on this page. A warning will be generated when the temperature, as sensed by the instrument, exceeds this limit.
- **TEMP** – (Adv- Only) The engine's oil temperature limit is entered on this page. A warning will be generated when the temperature exceeds this limit.
- **PRESS** – (Adv Only) The engine's oil pressure limit is entered on this page. A warning will be generated when the oil pressure falls below this limit.

- **COOL** – (Adv-W Only) The engine's coolant temperature limit is entered on this page. A warning will be generated when the temperature exceeds this limit.
- **OAT** – (Adv-A Only) A lower limit on can be entered for the outside air temperature. This can be useful for alerting you to conditions that could cause airframe icing conditions.
- **VOLT** – A lower limit for the voltmeter input is entered on this page. A warning will be generated when this voltage is lower than this limit. For 12V electrical systems, a limit of 12.7 V will generate a warning shortly after a charging system failure. A slightly lower limit can be used so that a warning is not generated with a fully charged battery with the engine off.
- **AuxHi or Aux1Hi or Aux2Hi** -- The upper limit for the auxiliary input(s) is set on this page. A warning will be generated when the auxiliary input exceeds this limit.
- **AuxLo or Aux1Lo or Aux2Lo** -- The lower limit for the auxiliary input(s) is set on this page. A warning will be generated when the auxiliary input falls below this limit.
- **Display** – This page is used to define which display page is your favorite. Enter the page number corresponding to the page you have selected. (Figure 1 illustrates the page numbers for the various pages.) Your “selected” page will be displayed when the “Display” key is pressed. Your selected page will also be displayed when the instrument turns on, and after the last “SET” page.

## 5. CONFIGURATION SET PAGES – Settings Unique to your Engine and Installation

The “Configuration Set” pages are used to enter information unique to your particular installation. **To access these pages, press the center and right keys simultaneously for 3 seconds.** These separate pages are used to safeguard this data from unintentional changes that could occur if this data had been entered in the previously described “Set” pages. Entries that are made on the “Configuration Set” pages are as follows:

### 5.1 Options – User Selectable Features

All options are controlled by the settings on this page. The particular combination desired is selected with the “UP” and “DOWN” keys. These options are indicated by the symbols as shown in the following table. Which options you have will vary depending on the exact model and features included with your instrument.

Symbol	Description	
W (or N) / S (Adv Models) N/A (Std without Altimeter)	W (or N) = Warning Light Output N = Normal (no external altimeter)	S = Serial Channel Output A = External Altimeter Sensor Connected
+ / -	+ = Normal Aux Sensing	- = Reverse Aux Sensing
F/C	F = Fahrenheit Temperatures	C = Celsius Temperatures
E/e	E = EGT displayed in 10's	e = EGT displayed in 1's
C/c	C = CHT displayed in 10's	c =CHT displayed in 1's

- The “W (or N) /S” selection determines whether the warning light output is used to control a warning light, the “W” selection – or is used as a serial channel output, the “S” selection. (Adv Models Only). For Std models without altimeter, the N/A selection is provided. The "A" selection is used only when an external altimeter sensor is connected to the instrument.
- The “Reverse Aux Sensing” causes the AUX display to start at its maximum when input is 0 volts, and then to decrease to its minimum as this voltage reaches 5 volts. This feature proves very useful for correcting a “backwards” reading fuel display, for instance.
- The “F/C” selection allows you to chose whether all temperature information is displayed in degrees Fahrenheit, or degrees Celsius. **CAUTION: The limits entered for all temperature data are not changed by this option. Be sure to enter temperature limits in same units as you have chosen for display.**
- The “E/e” and “C/c” options allow you to select the EGT and CHT displays in 10-degree or 1-degree increments. (The larger letter corresponds to the larger increment.)

## 5.2 EMP Setting for Correct Tachometer Readings

The EIS is able to sense engine RPM correctly from practically any engine, requiring only the setting of the EMP (Engine Measurement Parameter) to tell the instrument how many pulses per revolution the engine provides to the instrument.

### 5.2.1 Setting the EMP (Standard EIS Models Only)

When sensing RPM using a connection to the lighting coil, set EMP to 20 for CDI equipped Rotax Engines. Set it to 60 for non-CDI Rotax or any Hirth, Zenoah, Cyuana, or most other engines. These settings are typical of other makes of engines also. In general, the EMP can be set according to the number of magnets on the flywheel of the engine. For flywheels with 12 magnets, enter an EMP of 20; for 8 magnets, enter 30; for 6 magnets, enter 40; and for 4 magnets, enter 60. (Refer to your engine manual to determine the number of magnets on your flywheel, or try an EMP of 20 or 60, as 12 or 4 magnets on the flywheel are most common.)

When using the magnetic tach sensor, or other means, the correct EMP setting may be determined by dividing 120 by the number of pulses provided to the instrument per revolution of the engine.

**NOTE:** Power to the EIS must be turned off and then back on before the new entry will be used. The EIS comes from the factory programmed for CDI-equipped Rotax engines, and thus EMP will be 20. No change is required if your engine is CDI-equipped.

### 5.2.2 Setting the EMP – (Advanced EIS Only)

The EIS employs a sophisticated method of measuring engine RPM to provide 10 RPM resolution independent of the number of pulses per revolution of the engine. To provide this flexibility, the EMP value is set to a code corresponding to the number of pulses the instrument detects per revolution of the engine. To set the EMP correctly for your engine, first determine how many pulses per engine revolution will be generated, according to the following paragraphs, and set the EMP as indicated by the EMP Table.

**Tach Connections to Mag P-leads, Ignition Coils or Tach Outputs** – These types of tachometer connections typically generate one pulse for every spark plug fired per revolution of the engine. Thus, a 4-stroke, 4-cylinder engine will have 2 pulses per revolution, while a 6-cylinder, 4-stroke engine will have 3. With some mags, every other pulse is opposite polarity, causing only half the number of pulses to be sensed, resulting in a tachometer reading  $\frac{1}{2}$  of the actual RPM. The EMP can be adjusted to account for this condition according to the table below.

**Tach Connections to Lighting Coils** – When the tachometer connection is made to the lighting coil, typically  $\frac{1}{2}$  as many pulses will be generated as there are magnets on the flywheel. For CDI-equipped Rotax Engines, 12 magnets are used, generating 6 pulses per revolution of the engine, and requiring an EMP value of 6. For non-CDI type Rotax engines, an EMP value of 2 is required.

**Rotax 912 Engine** – The tachometer output from this engine provides 1 pulse per revolution.

EMP Setting	Pulses
0	$\frac{1}{2}$ *
1	1
2	2
3	3
4	4
5	5
6	6
7	8
8	12**
9	1.5



\* ½ represents 1 pulse every other revolution. \*\* SW Version 5.9 for dual aux, Adv Models only. All others are 10.

### 5.3 Auxiliary Input Function Scale Factor and Offset

The “Aux SF” and “Aux Off” entries on the “Set Limit” pages are provided to allow the user a means of adjusting the digital Aux display value for a given voltage on the Auxiliary input so that it provides meaningful information. For example, in the case of this input being used to display fuel level, the “Aux SF” (Scale Factor) and “Aux Off” (Offset) can be set such that 0-10 will be displayed even when the input signal is 0.5 Volts when empty, and 4.5 Volts when full. (The auxiliary input signal must fall within the range of 0-5 Volts, however, and fall as close as practical so as not to exceed the limits of adjustment available through the Aux Scale Factor and Offset.)

**CAUTION: This input must not exceed 5.5 Volts. Although no damage will occur, the accuracy of other functions in the instrument will be severely reduced while this input exceeds 6.0 Volts.**

#### Setting the Aux Scale Factor and Offset

For most uses of the auxiliary input, a separate sheet is provided that indicates the setting for the auxiliary scale factor and offset. The setting indicated on those sheets should be used. In the event that you are using this input for a custom application, the relationship between the displayed auxiliary output and the scale factor, offset, and input voltage is given here.

**NOTE:** The Aux Display is capable of displaying a range of 0-512 or 0-51.2 (dependent on whether or not there is a decimal point in the auxiliary display). The auxiliary input voltage should be in the range of 0-5V.

#### Definition of the Aux Scale Factor and Offset

The Aux Scale Factor (Aux SF) can be thought of as a multiplying factor or gain, and the Offset (Aux Off) can be thought of as an additive factor, or bias. More precisely, the displayed value will be as follows:

$$\text{Aux Output} = \frac{(\text{Aux Input Voltage}) \times (\text{Aux Scale Factor})}{2.5} + \text{Aux Offset}$$

For auxiliary displays which include a decimal point, the Aux Output value will be effectively one-tenth the value indicated in the equation above.

The Aux Offset may be positive or negative. Since only positive numbers can be entered on the display, the following scheme is used to enter positive and negative numbers:

- To enter a positive number, enter double the desired value. (The entered number will always be even for a positive Aux Offset.)
- To enter a negative number, enter double the desired value minus 1. (The entered number will always be odd for a negative Aux Offset.)

For example, if you want to enter an offset of +12, set Aux Offset to 24. If you want to enter an offset of -5, enter 2 x 5 - 1 = 9. Nothing to it!

**OilZero (Adv- Only)** – This entry provides an adjustment to correct for small differences in installations that could result in a non-zero oil pressure display when the engine is not running. To use this adjustment, start by setting it to zero, and noting the oil pressure displayed on the EIS.

- If the oil pressure is not zero, progressively set OilZero to larger odd numbers (1,3,5,7,9,...) until the oil pressure display first goes to zero. The correct OilZero value is the first setting which results in a zero oil pressure display.

- If the EIS displays an oil pressure of 0 when the OilZero is set to 0, progressively set OilZero to larger even numbers (2,4,6,8,...) until the oil pressure display first reads a non-zero value. Then subtract 2 from OilZero, making the adjustment complete.

**NumEGTs** (Adv- Only with Single Aux Input) – This setting is used to specify how many of the EGT/CHT inputs are used for EGT inputs. value of 0 through 4 may be entered. This function is only available in versions which do not include the dual auxiliary inputs, and does not include fuel flow.

EGT inputs are assigned starting with EGT/CHT1. Thus, if NumEGTs is set to 3, EGT/CHT1, 2, and 3 will be EGT inputs, and EGT/CHT 4 will be a CHT input. NumEGTs must be set to correspond to the EGT and CHT inputs wired to the EIS so that these signals are processed correctly, and the correct limits are applied.

**AltCal** - This entry is used with the external altimeter sensor to calibrate the altimeter function. Enter the number on the sensor here to properly calibrate the altimeter.

**Hours** – This function allows you to set the hour meter so that it matches the actual time on your engine. The hour meter may be set to any value between 0 and 6553.5 hours. The hour meter will advance only when the tachometer reads above 250 RPM. It will reset to zero after 6553.5 hours.

## 6. INSTALLATION

### 6.1 Mounting the Instrument

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 or fuel, and preferably away from other devices that generate heat. 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 Super Size version (this is the version that is 6 inches wide) has such excellent readability that little or no consideration must be given to where the instrument is mounted with respect to the pilots eyes. The original size (4 ½” wide) should be mounted within roughly a 30 degree viewing angle. Both instrument use anti-glare windows that minimize reflections. Of course the instruments should be positioned to allow easy access to its front panel buttons.

The instrument should be secured using the mounting holes in the faceplate. 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. The mechanical design of the instrument is very rugged. This is of course not true of other instruments, especially mechanical airspeed indicators and altimeters.

### 6.2 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, unless your instrument is labeled “Ext CJ”.

**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 9-pin sub-D type connectors. Mating solder-type connectors are supplied with the instrument, and crimp-type are available on request. If needed, replacement connectors are available at Radio Shack. Pre-wired cables are also available from Grand Rapids Technologies that eliminate the need for making these connections.

### 6.3 Detailed Wiring Description

1. Start by making the power and tachometer connections as illustrated in figures 6 and 7. Note that 9-18 Volts DC, 0.25 Amperes is required to power the instrument. **DO NOT CONNECT THE POWER FOR THIS INSTRUMENT DIRECTLY TO THE LIGHTING COIL.**
2. Next, make the ground connections exactly as illustrated in figure 6. For proper operation of the instrument, the ground (black wire) from the instrument must be connected to the case of the engine. 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.
3. 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.

**Outside Air Temperature Sensor** – The sensor for this unit may be mounted in a variety of ways. 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. Avoid routing the wires to this sensor near radios, ignition systems, or other electronic devices as much as practical.

**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 chafed or exposed to high levels of heat. 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.

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

**(Adv-) Oil Pressure Sender** – The oil pressure sender should first be installed on the engine. This sender uses an 1/8-27 NPT pipe thread fitting, but may be adapted to any engine with the appropriate pipe fitting adapters. The sender may also be mounted remotely, using suitable hose connections. This is necessary with some engines, especially Lycoming.

The electrical connections are made through the case of the sender (ground) and the electrical terminal opposite the pipe thread fitting. Ground is normally provided by the engine when the sensor is mounted directly to it, but a separate ground wire may be necessary for remote installations.

**Magnetic Tachometer Sensor** – See instructions with this sensor for installation recommendations.

**External Alarm Output** – This output is used to control the external 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.

**(Std-) Auxiliary Input** – The Auxiliary input should be connected according to your needs. If you have purchased a sensor for this input from Grand Rapids Technologies, it will include a sheet that describes how it is wired to this input.

**(Adv-) Auxiliary Input(s)** – Your instrument included 2 auxiliary inputs (unless you have ordered the fuel flow option, in which case you will have 1). Auxiliary 1 is displayed on a labeled screen, and the first combination page. It includes a decimal point in the display for all models except the Adv-W/914. Auxiliary 2 is displayed on page 2 (just prior to the first combination page), and on the first combination page for Adv-A models. This input does not have a decimal point in the display. These Auxiliary inputs should be connected according to your needs. Since auxiliary 1 has a decimal point in the display, it is ideally suited for manifold pressure, fuel level, or anything else in which the decimal point is useful. Auxiliary 2 is ideal for fuel pressure, coolant pressure, or anything else that does not need a decimal point. If you have purchased a sensor for this input from Grand Rapids Technologies, it will include a sheet that describes how it is wired to this input.

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 display is set using the “Aux SF” and “Aux Off” as described in the “Configuration Set Pages” section. If this input is not used, the Aux limit should be set to zero on the “Set Limits” pages to prevent nuisance warnings.

**CAUTION:** This input must not exceed 5.5 Volts. Although no damage will occur the accuracy of the instrument will be severely reduced while this input exceeds 6.0 Volts.

Finally, all CHT and EGT probes are installed. The following section describes how these thermocouple-type probes are installed, and details the use of thermocouple extension wire to make the necessary electrical connections.

NOTE: To prevent false readings for inputs that are not used, it is recommended that unused CHT and EGT inputs be shorted together. This is accomplished by installing pin contacts on each end of a short piece of wire, and inserting this into the connector housing in place of the CHT or EGT connections for the unused channel.

### **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. 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.

### **Exhaust Gas Temperature Probe Installation**

Start by drilling 1/8-inch diameter holes at the appropriate position in the exhaust manifold as indicated by the engine manufacturer. Insert the probe into the exhaust manifold and secure it by tightening the clamp carefully.

**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.

## 6.4 Use of Thermocouple Extension Wire (Applies to all models except those labeled Ext CJ.)

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, all models of the EIS, except those marked with the “Ext CJ” designation, require thermocouple extension wire.

Unlike other types of wire, thermocouple extension wire is polarized. Each conductor is made of a different type of material, 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 inside the jacket or outer covering. The color of the jacket surrounding the two leads may vary, but the type of wire may be determined easily by the color of the insulation on the wire itself as follows:

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

Now select the proper type of thermocouple extension wire, solder it to the male d-sub connector according to figure 5b (pre-wired cables will have this connector already installed), and route it through the aircraft. Leave slack in the wire between the engine and airframe to account for engine motion. To avoid confusion, it is a good idea 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.

## 6.5 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 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.

## 7. Check-Out

### 7.1 Initial Application of Power to the Instrument

Apply power to the system. For aircraft not equipped with 12 V batteries, it will be necessary to start the engine. Do not operate your engine at any speed over idle until you have verified correct operation of the tachometer. This will minimize the chance of damage to your instrument if it has been wired incorrectly .

Verify that the LCD display becomes active. The instrument will be on display page 0. If this operation is not observed, immediately turn off power to the EIS (or stop the engine), and recheck all wiring---especially power, ground, and tachometer connections.

## 7.2 Tachometer Initial Test

Turn on the EIS. The tachometer will display 0 when the engine is not operating. Refer to the “Set Pages” section, and set the Engine Measurement Parameter (EMP) 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.

**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.

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.

## 8. Check Entries Message

The “Check Entries” message will be displayed immediately after power-up if the EIS determines that any user entry (including all limits, such as RPM, and all configuration data, such as EMP setting, Aux SF, etc.) may be lost or is incomplete. When this message is displayed, press the “Display” key (the key below the “Next” label on the screen). The EIS will force you to review all entries by taking you to the Set Limits and Configuration Set pages. Carefully review and correct any entries as necessary.

**Note:** This message will be generated if any user entry is changed, and the instrument is turned off before returning to the normal display pages. This message then serves a reminder that you were in the process of setting user entries when the instrument is last turned off.

If this message appears frequently, this is most likely due to the instrument getting poor quality electrical power. This is most common if the instrument is on while engaging an electric starter, or if it is turned on before the engine is started in airplanes without batteries.

## 9. Description of EIS Functions

The EIS is a precision instrument capable of measuring and displaying a variety of useful information. The following paragraphs detail each of the functions the system provides.

**Tachometer** – The tachometer display indicates engine speed in revolutions per minute. The tachometer can be configured to sense RPM accurately from almost any engine with the appropriate entry in the Engine Measurement Parameter (EMP). (See the “Configuration Set Pages” section.) The tachometer has a range of 0-9990 RPM.

**Cylinder Head Temperature (CHT)** – This display provides a measurement of the cylinder head temperature using a type J thermocouple temperature sensor. The CHT display is accurate for a range of ambient to 800 degrees F.

**Exhaust Gas Temperature (EGT)** -- This display provides a measurement of the exhaust gas temperature using a type K thermocouple sensor mounted in the exhaust manifold of the engine. This function has a range of ambient to 1650 degrees F.

**(Adv-) Coolant and/or Oil Temperatures** -- These temperatures are sensed via a sensor is installed in the water jacket or oil sump of the engine. The Advanced -A models allow for one fluid temperature measurement, and is labeled "TEMP" on the display. The Advanced EIS -W models allows for two fluid temperature inputs, and have labels of "TEMP" and "COOL". These fluid temperatures are accurate for a range of 80-300 degrees F. Readings below this range will be displayed as higher than actual.

**Coolant Temperature (Std- Only)** -- This temperature is sensed via a sensor installed in the water jacket the engine. It is labeled "TEMP" on the display. These fluid temperatures are accurate for a range of 80-300 degrees F. Readings below this range will be displayed as higher than actual.

**Voltmeter** -- This display indicates the voltage level being sensed at the power input of the EIS. It is used to monitor the voltage of the aircraft's electrical system.

**Auxiliary Input (Std- Only)** -- This is a general purpose display that may be adapted as desired by the user. It is ideally suited to display fuel level, fuel pressure or coolant pressure. A lower limit can be entered on the "Set" pages that will trigger a warning when the auxiliary input drops below this threshold. This gauge is scaled, or its sense reversed, according to the values you enter into the "Options", "Aux SF", and "Aux Off" entries on the "Configuration Set" pages. The input signal must be a DC voltage in the range of 0 to 5 Volts. For more information on the use of this function, refer to the "Installation" section.

**Auxiliary Input (Adv- Only)** -- This is a general purpose display that may be adapted as desired by the user. Two auxiliary inputs are provided (unless the fuel flow option is select, in which case one auxiliary input is provided) These inputs are typically used for manifold pressure, fuel pressure, fuel level, coolant pressure, or sometime rotor RPM (in the case of gyro planes). Grand Rapids Technologies has sensors with installation instructions for these applications. An upper and lower limit can be entered on the "Set" pages that will trigger a warning when the auxiliary input falls outside these thresholds. This gauge is scaled, or its sense reversed, according to the values you enter into the "Options", "Aux SF", and "Aux Off" entries on the "Configuration Set" pages. The input signal must be a DC voltage for a range of 0 to 5 Volts. For more information on the use of this function, refer to the "Installation" section.

**(Adv-) Oil Pressure** -- Oil pressure is sensed via a 150 psi oil pressure sender, and is displayed in PSI. A zero adjustment is provided to adjust the pressure display to read zero to compensate for small installation and sensor variations. (See the "Configuration Set" pages.) A lower limit is provided for this function.

**Unit Temperature** -- This display indicates the internal temperature of the EIS. This data is used by the instrument for "cold-junction compensation" of the EGT and CHT inputs. It will typically register about 35 degrees F above ambient temperature due to self heating of the instrument.

**Outside Air Temperature (OAT)** -- This display indicates the temperature of the air sensed by a remotely located temperature sensor. The sensor is typically accurate to +/- 2 degrees F and operates for the range of 15 to 180 degrees F or 0 to 75 degrees C.

**Engine Hour Meter** -- This display indicates the total accumulated engine time. The accumulated time will increase continuously only while the engine is above 250 RPM. Special nonvolatile memory will retain an accurate record of elapsed time without batteries or electrical power of any type. The hour meter can be set on the "Configuration Set" pages so that the displayed time matches the time on the engine.

**Flight Time** -- This display indicates the duration of the engine run. It is reset to zero automatically when the Engine Information System is turned on, and will count up when the engine is above 250 RPM. A time limit may be set for this function.

## 10. Warranty

Grand Rapids Technologies Incorporated warrants this instrument to be free of defects in material and workmanship for 1 year 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, 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.

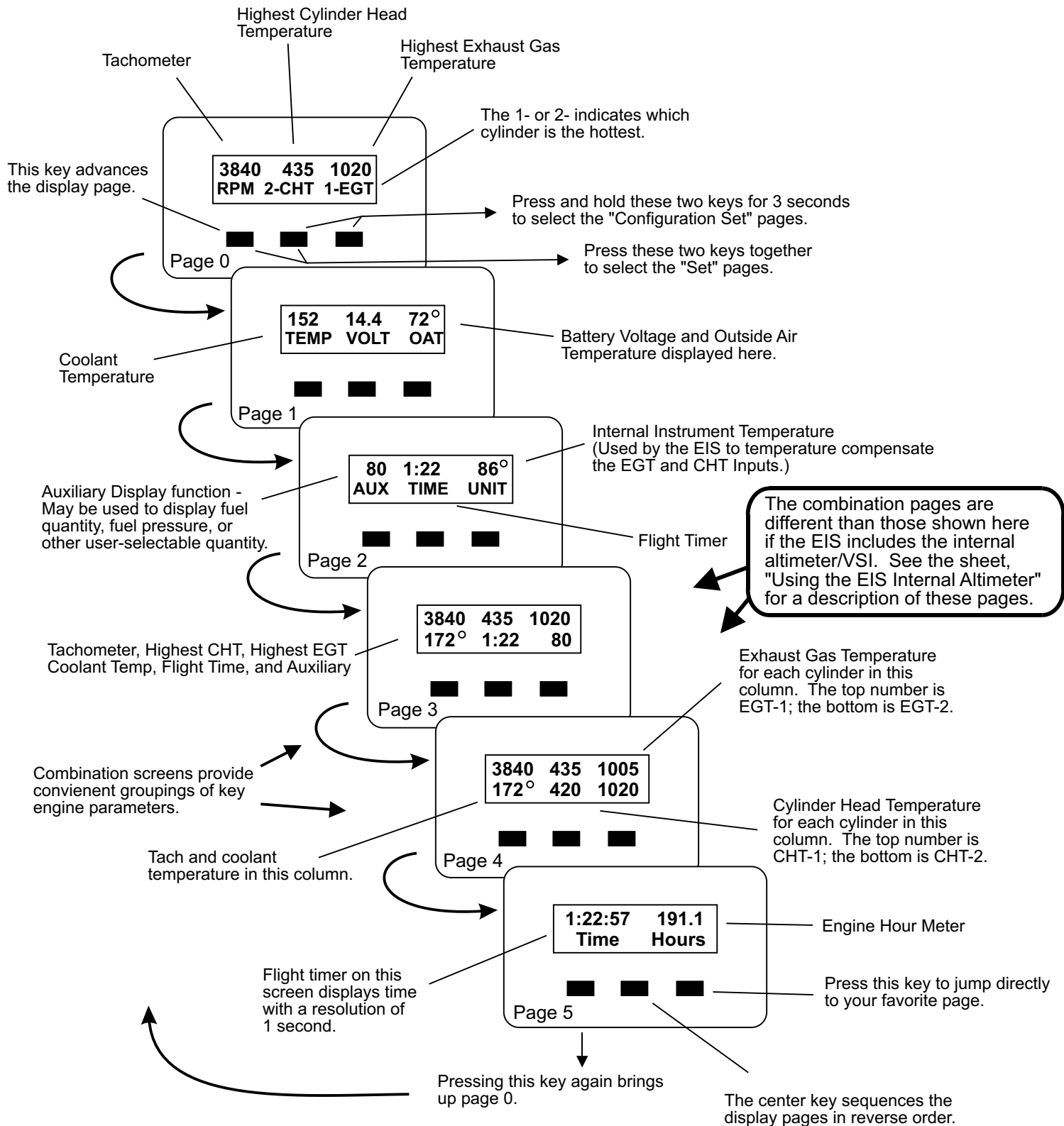
Service may be obtained by returning the instrument to this address:

Grand Rapids Technologies  
889 76th St SW #2  
Byron Center, MI 49315  
Attention: Service Dept.

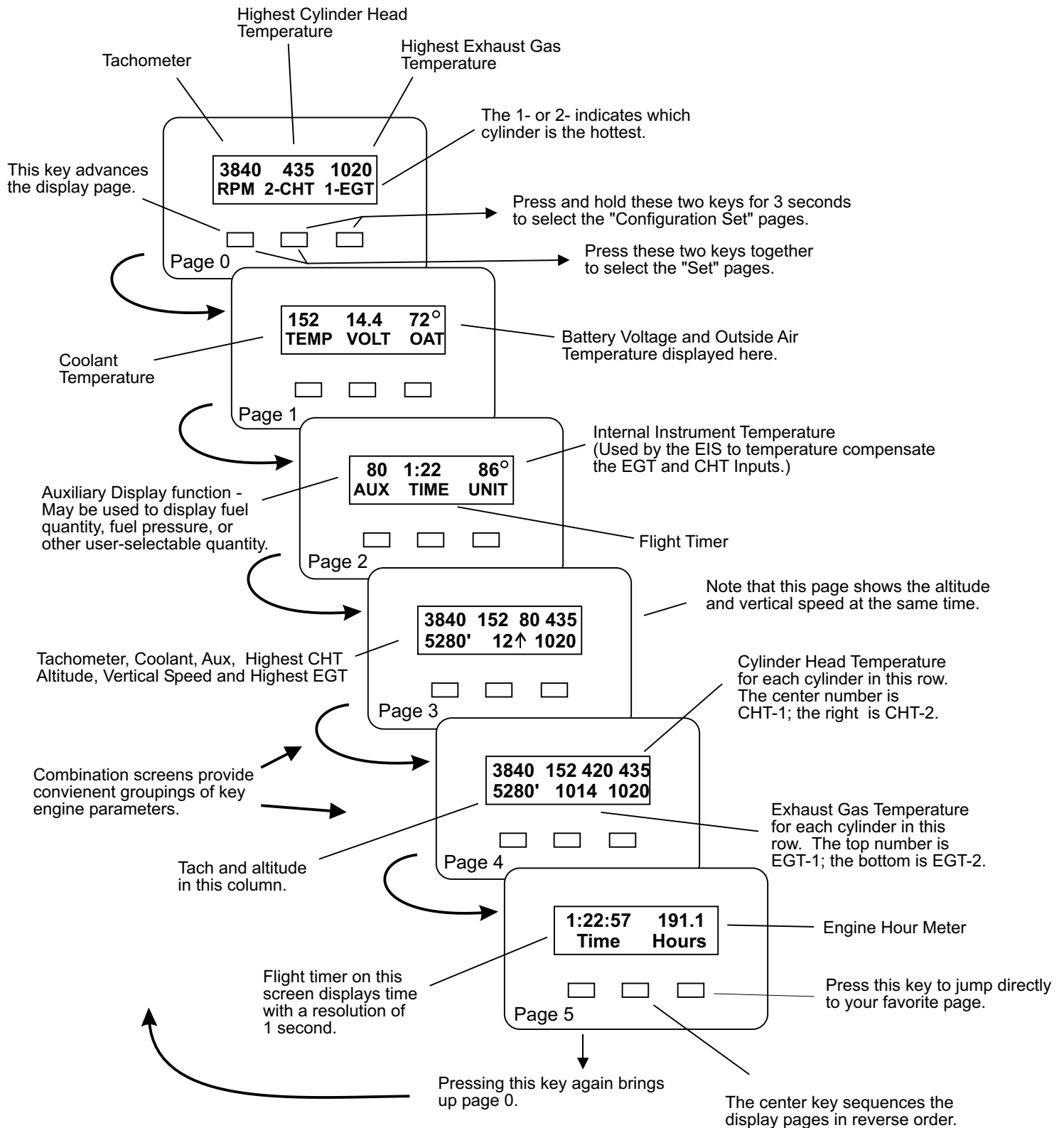
When returning the instrument for service, please specify the nature of the problem. Include a copy of your proof of purchase for warranty repairs.

For service questions or repair rates, call 616-583-8000.

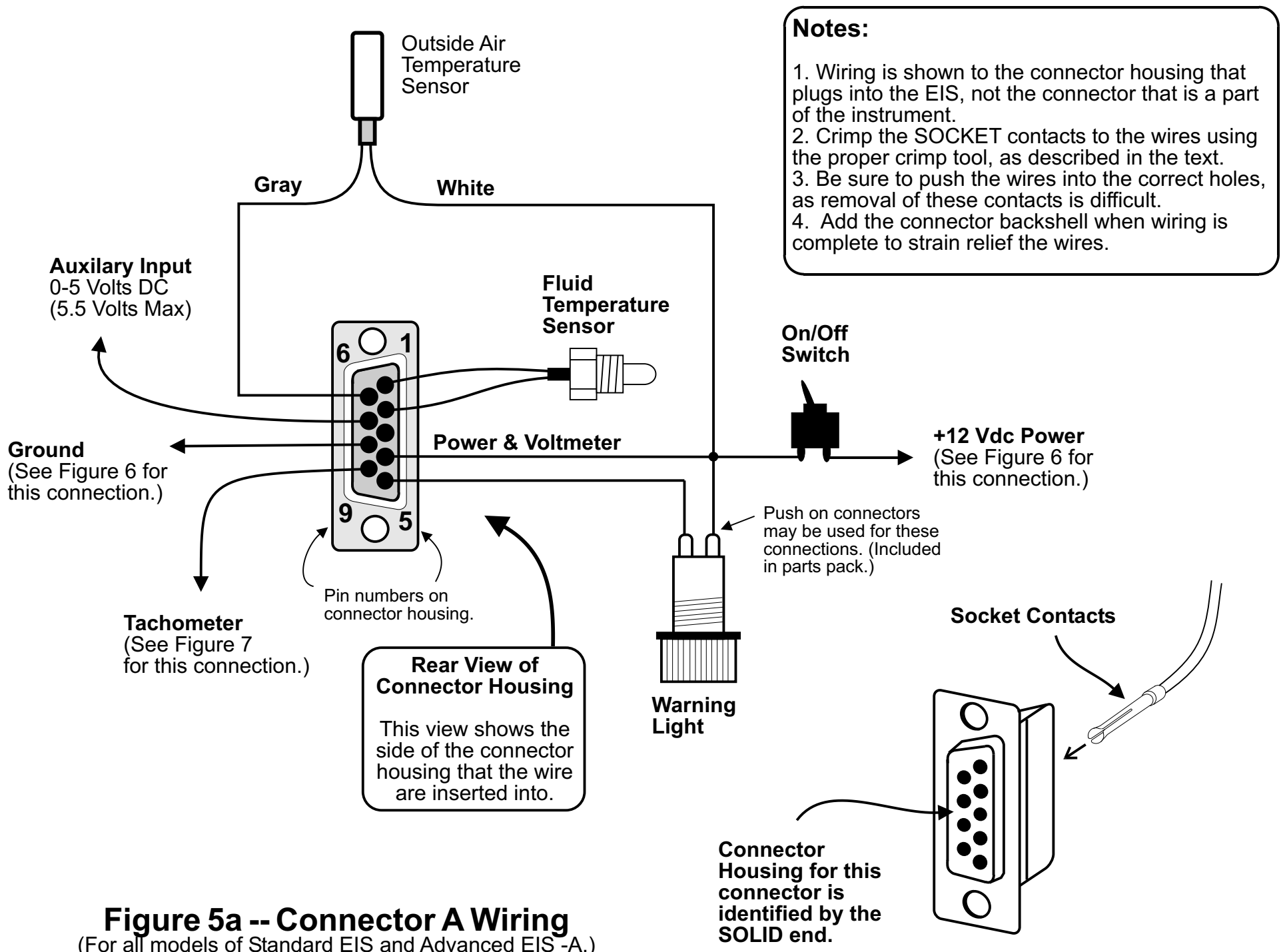




**Figure 1. Display Pages for the Standard EIS**



**Figure 1. Display Pages for the Standard EIS with Altimeter/VSI**

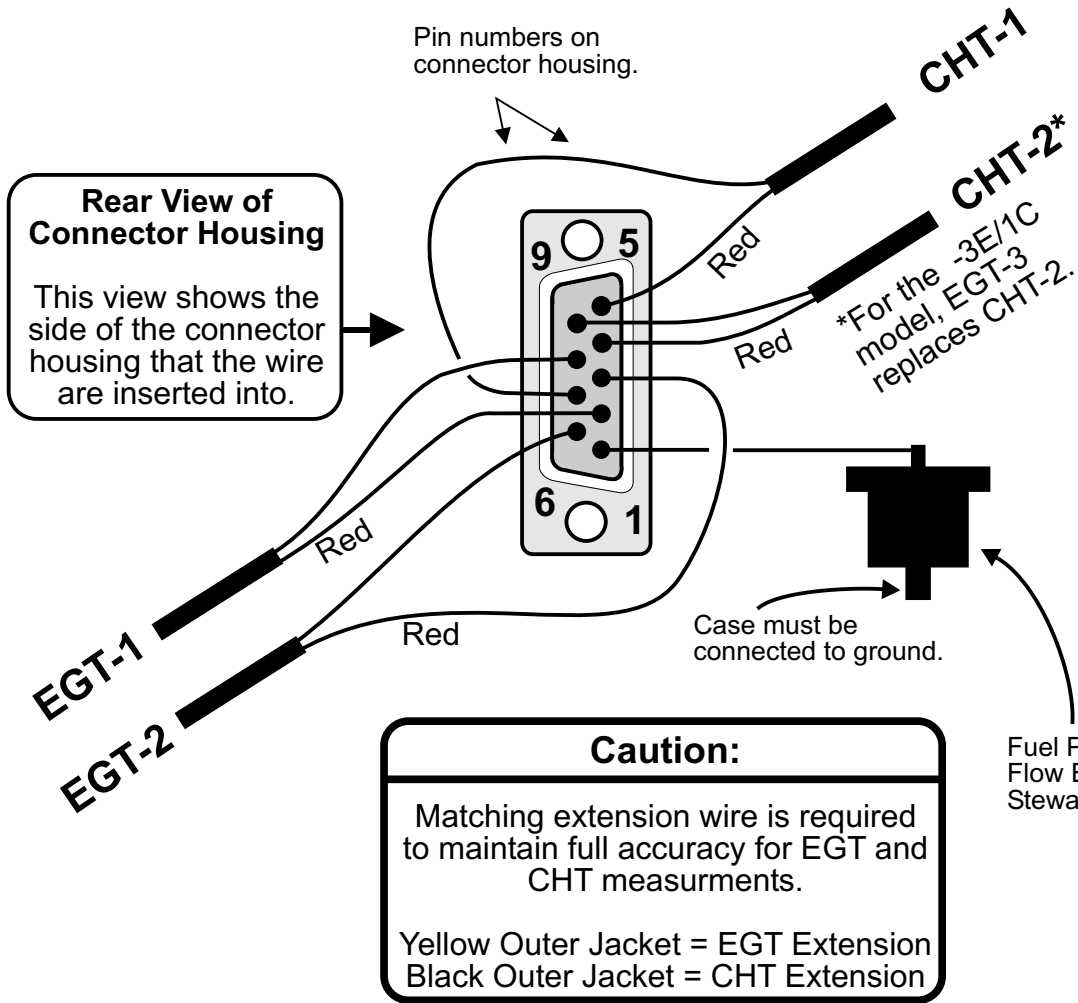


**Rear View of Connector Housing**

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

Push on connectors may be used for these connections. (Included in parts pack.)

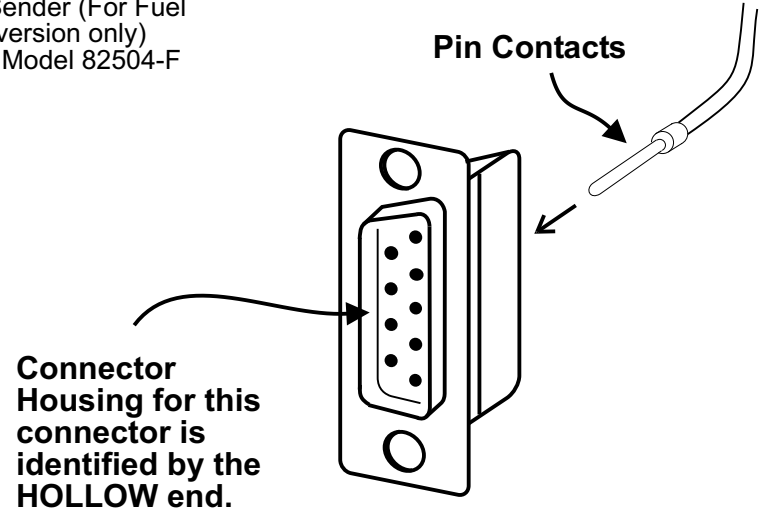
Connector Housing for this connector is identified by the SOLID end.



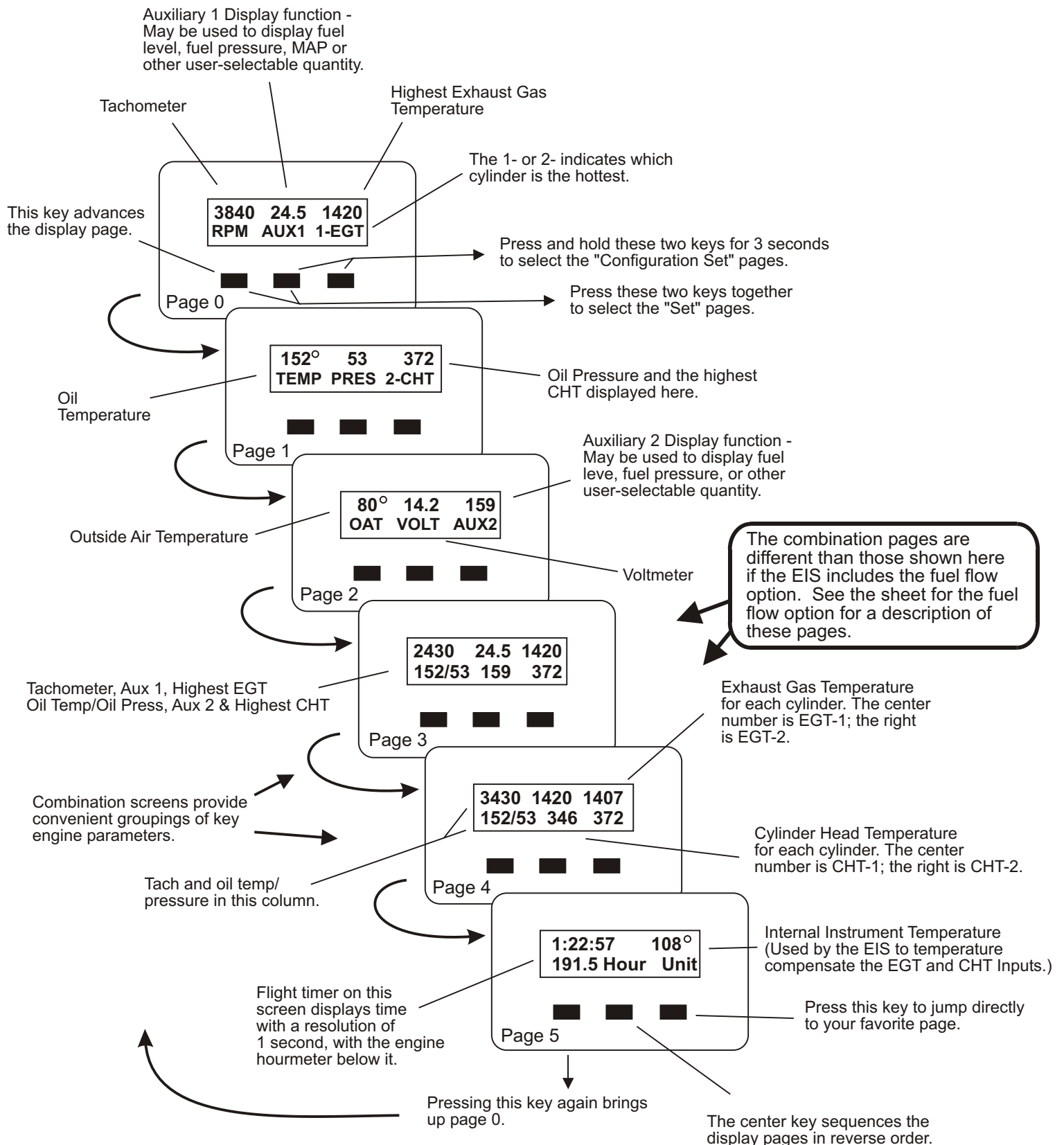
- Notes:**
1. Wiring is shown to the connector housing that plugs into the EIS, not the connector that is a part of the instrument.
  2. Remove 1 1/2 inches of the outer jacket of the thermocouple extension wire to provide enough clearance for the backshell to fit properly.
  3. Crimp the PIN contacts to the wires using the proper crimp tool, as described in the text.
  4. Be sure to push the wires into the correct holes, as removal of these contacts is difficult.
  5. Add the connector backshell when wiring is complete to strain relief the wires.

Crimp the #4 ring terminals onto the end of the thermocouple extension wire. Two crimps per terminal should be made using the proper crimping tool. Be sure a secure connection is made to avoid erratic readings.

Connect the extension wire to the probe leads using #4 x 1/4 screw, lockwasher and nut. Be sure to match wire colors for correct polarity. Use heat shrink tubing over these connections to insulate them.

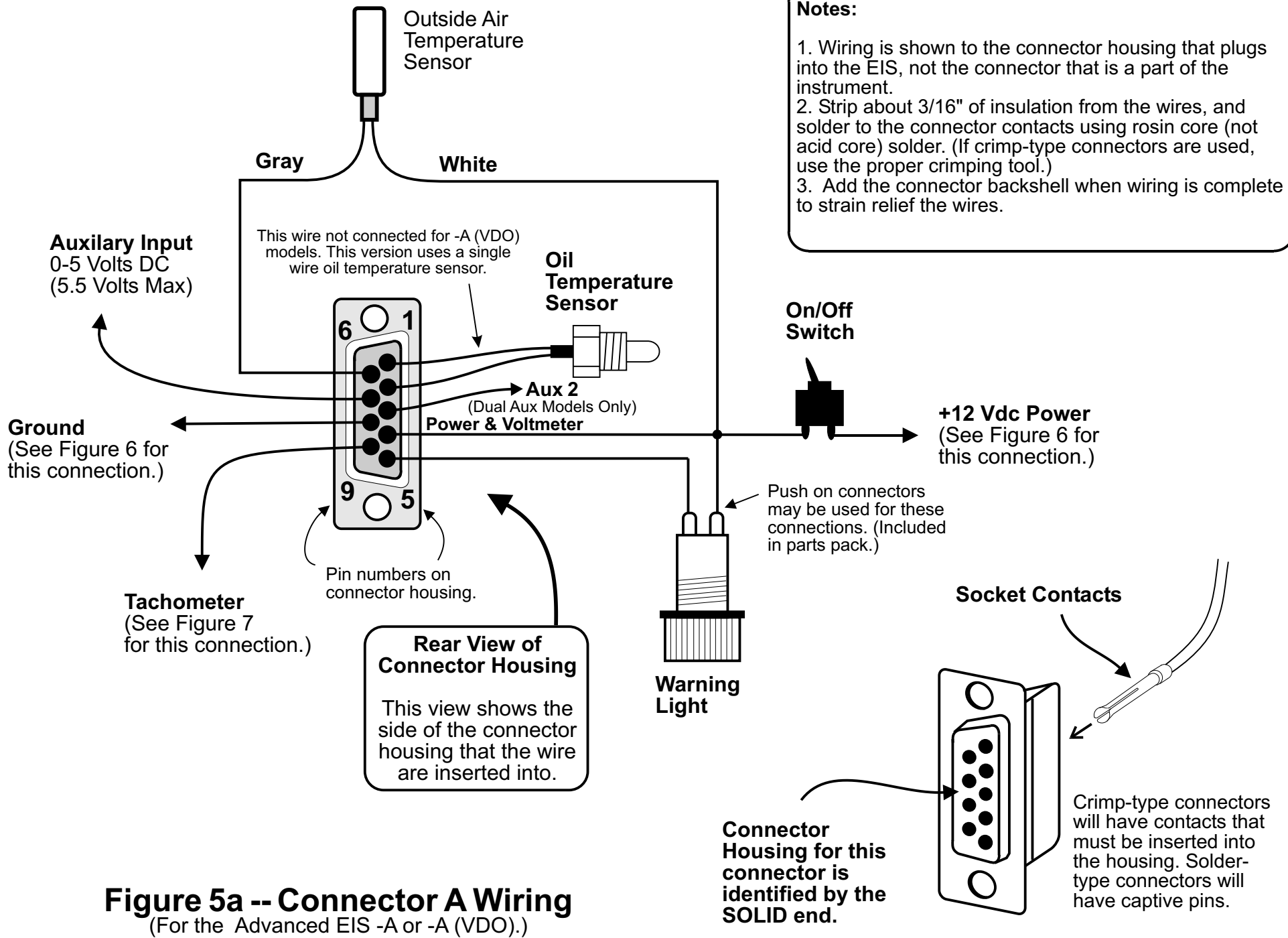


**Figure 5b -- Connector B Wiring**  
(For Standard EIS and Standard EIS -3E/1C Models)

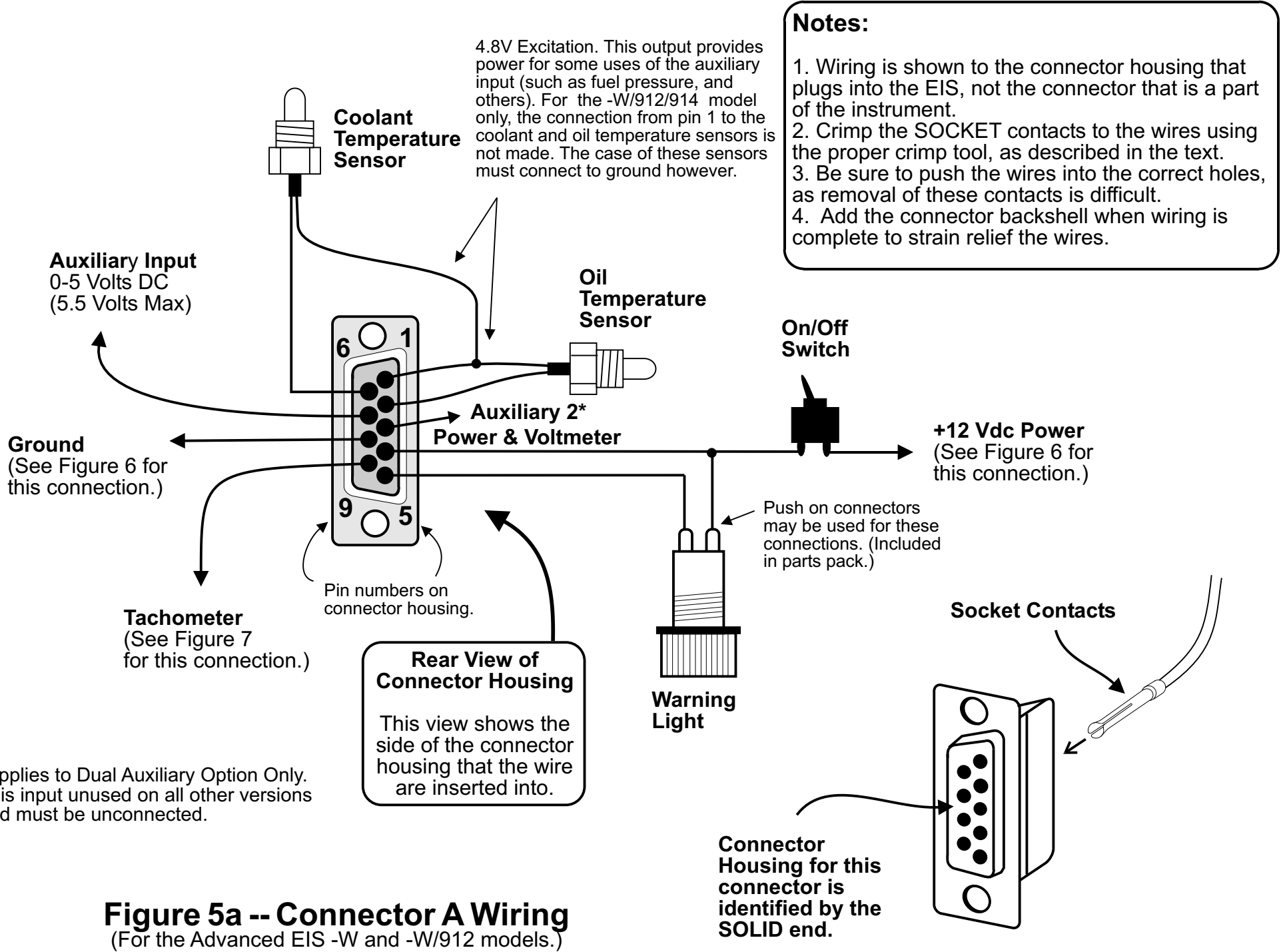


Note: For the Advanced -W/912 and Adv/W914 the OAT is replaced with the Coolant temperature on page 2, and Page 3 displays Coolant Temperature in place of Aux2. The /914 version does not include a decimal point in Aux 1.

**Figure 1. Display Pages for the Advanced EIS -A, -A(vdo), -J and -W**



**Figure 5a -- Connector A Wiring**  
 (For the Advanced EIS -A or -A (VDO).)



**Figure 5a -- Connector A Wiring**  
(For the Advanced EIS -W and -W/912 models.)

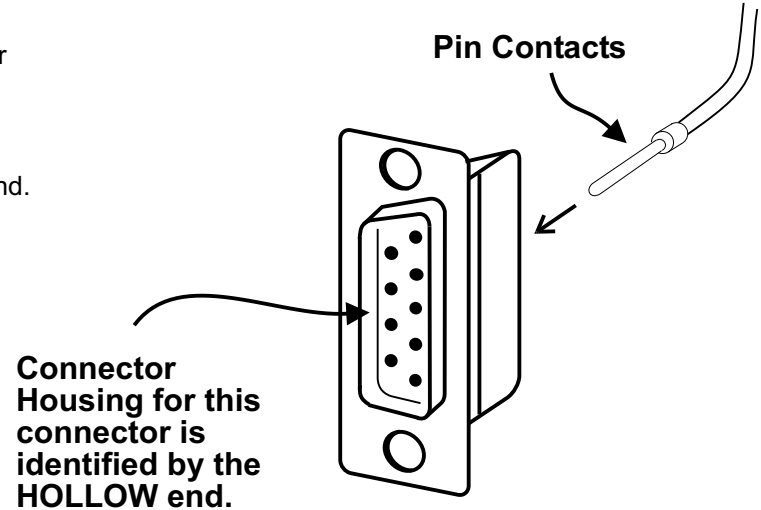
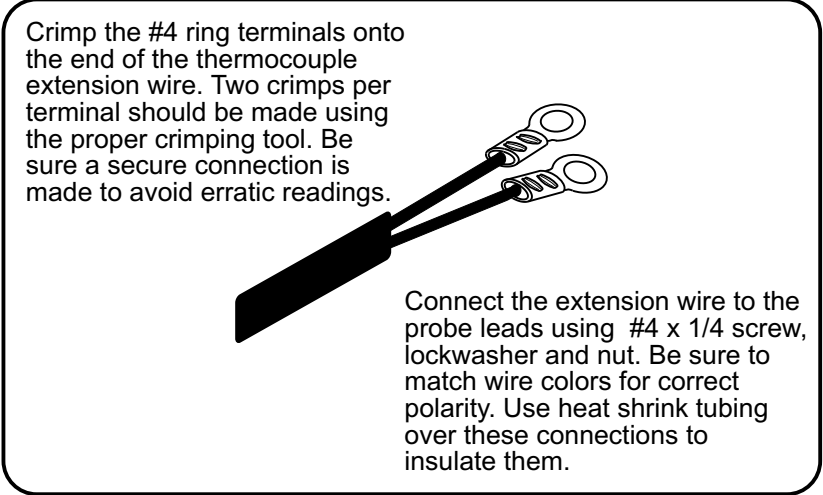
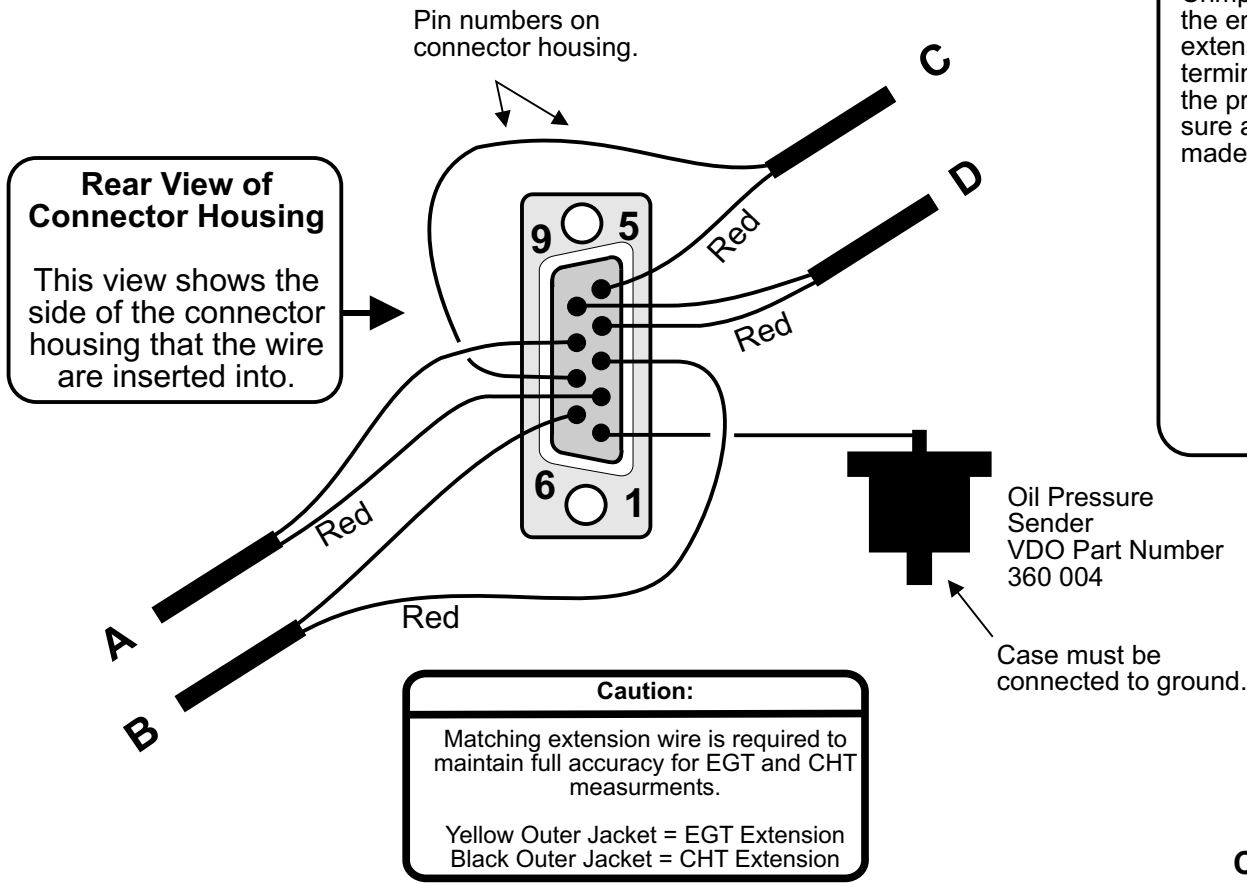
\*Applies to Dual Auxiliary Option Only. This input unused on all other versions and must be unconnected.

Input	Number of EGTs Selected on Config Set Page				
	0	1	2	3	4
A	CHT1	EGT1	EGT1	EGT1	EGT1
B	CHT2	CHT1	EGT2	EGT2	EGT2
C	CHT3	CHT2	CHT1	EGT3	EGT3
D	CHT4	CHT3	CHT2	CHT1	EGT4

Use this table to determine which input (A,B,C & D) connects to which sensor (EGT1, EGT2, CHT1, etc.). For example, if NumEGTs is set to 2 (to select 2 EGT and 2 CHT inputs), input A is EGT1, B is EGT2, C is CHT1, D is CHT2. Be sure to use the correct type extension wire for each input type when wiring the connector.

**Notes:**

1. Wiring is shown to the connector housing that plugs into the EIS, not the connector that is a part of the instrument.
2. Remove 1 1/2 inches of the outer jacket of the thermocouple extension wire to provide enough clearance for the backshell to fit properly.
3. Crimp the PIN contacts to the wires using the proper crimp tool, as described in the text.
4. Be sure to push the wires into the correct holes, as removal of these contacts is difficult.
5. Add the connector backshell when wiring is complete to strain relief the wires.



**Figure 5b -- Connector B Wiring**  
(For all Advanced EIS Models.)

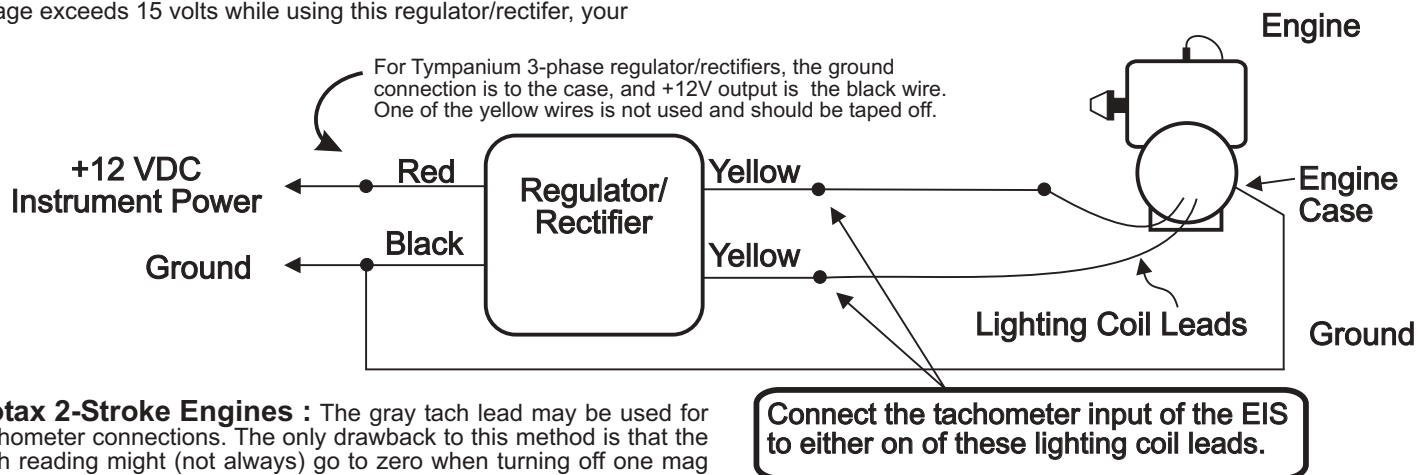


**Rotax (Tymanium) Regulator/Rectifiers** -- (Also applies to Jabiru, HKS, and most others not otherwise listed.) Only one of the two inputs to the regulator/rectifier will give a good tachometer reading. The incorrect lead will give a tachometer reading that decreases with engine rpm. The correct lead must be determined by trial and error.

The small Tymanium regulator rectifier (identified by its 2 yellow, 1 red and 1 black wires) often overcharges batteries. If your battery voltage exceeds 15 volts while using this regulator/rectifier, your

**Making the tachometer connection is dependant on the type of**

**Key West Regulator/Rectifier.** The gray tachometer lead must be used. The lighting coil wires may not be used as a tachometer source with this regulator/rectifier.



**Rotax 2-Stroke Engines :** The gray tach lead may be used for tachometer connections. The only drawback to this method is that the tach reading might (not always) go to zero when turning off one mag during the mag check, specially if the mag check is performed at low (less than 3000) RPM. . If a battery is used, tachometer connection may be made to the lighting coil as shown above to avoid loss of the tach reading during the mag check.

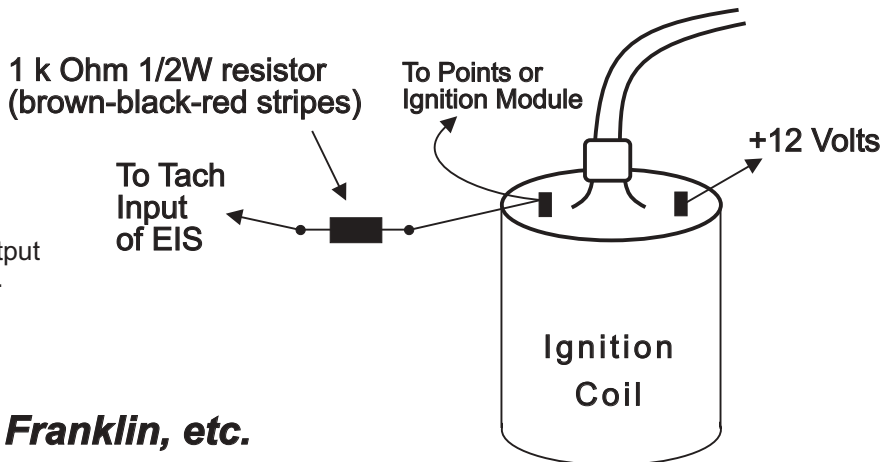
**Figure 7a. Tachometer Connections to Lighting Coil Equipped Engines (Rotax, Jabiru, Hirth, Zenoah, etc.)**

**Electronic Ignition**

Connect directly to the tach output from the ignition system. No resistor required.

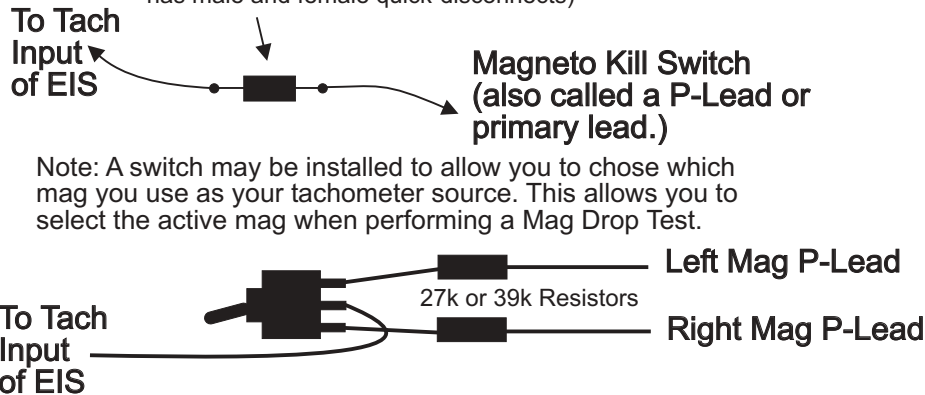
**Rotax 912/914**

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



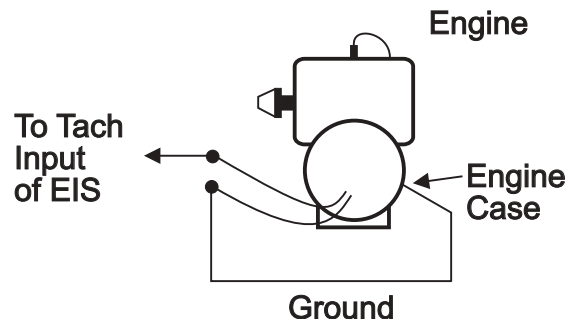
**Magneto Equipped Engines such as Lycoming/Continental, Franklin, etc.**

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)



Note: A switch may be installed to allow you to chose which mag you use as your tachometer source. This allows you to select the active mag when performing a Mag Drop Test.

**Point-Type Ignition**



**Spare Lighting Coil**

**Figure 7b. Other Tachometer Connections (Model 2000/4000/6000 EIS)**