ENGINE MONITOR
MODEL 995
MANUAL

FLIGHT SYSTEMS®

207 Hempt Road Mechanicsburg, PA 17050 USA
Phone: 717-590-7330 Fax: 717-590-7327
www.flightsystems.com

REV 8/08 - *Printed in USA*

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

1.0 PRODUCT DESCRIPTION

The Model 995 GEN SET MONITOR is designed to provide a complete engine protection system that is both cost effective and easy to install. The Model 995 consists of a main electronic unit, a remote annunciator panel, and a basic engine sensor group. The unit may be applied to main propulsion or gen set engines and is easily adaptable to diesel, gasoline or LP gas fuels.

Parameters monitored consist of RPM, auxiliary, oil pressure, coolant pressure, and coolant temperature. To enhance reliability, the pressure, temperature and flow sensors are failsafe. An open circuit in any of these sensors or their wiring will result in an alarm. For added protection, and to minimize false alarms, oil and coolant pressure is monitored in two RPM ranges (idle and power).

The compact-sized Bridge Remote Annunciator Panel places engine status information conveniently in front of the operator. A green POWER indicator tells when the system is powered. An amber ENABLED indicator tells when the system is actively monitoring engine parameters and in which RPM range (idle-blinking or power-solid). Five red fault indicators warn of overspeed, aux fault (if used), low oil pressure, low coolant pressure, or high coolant temperature. Time delays prevent a fault indication due to momentary out-of-limit conditions. Up to two remote panels may be connected by simply extending each circuit to the corresponding terminal on the second panel.

If any fault persists of 15 seconds, a red fault indicator comes on. If the fault condition clears itself, the indicator goes off. If the fault remains for more than 30 seconds, an audible alarm on the remote panel is activated. The audible alarm remains until silenced by the operator, but will silence automatically if the fault condition clears itself. If an alarm is silenced by the operator, the fault indicator that caused it will remain on and, in addition, an alarm reminder indicator on the alarm silence button will light. If the fault clears itself after the silence button has been pressed, both the fault and the alarm reminder indicators will go off automatically. An overspeed alarm cannot be silenced by the operator.

Thus the operator receives a timely warning of a possible developing engine problem without undue distractions. Once warned, the operator may choose to silence the alarm, but the fault that caused the alarm is still displayed along with a “reminder” that he/she has pressed the silence button. If the alarm silence button is pressed when there is no fault present, it performs an indicator test. There can be no mistake about the status of the system at any time.

For auxiliary or unattached engine operation, a shutdown feature is included as standard. Its use is optional by simply connecting a shutdown device. The shutdown device may only be needed during unattended operation and at the other times can be overridden if desired, with a simple user-installed toggle switch. After automatic shutdown, the engine can be re-started with or without faults present by simply pressing the alarm silence button.

The alarm and enable outputs allow the 995 to “talk to” other systems that may be on board. For example, the alarm output could be used as an input to a master alarm system or to activate an indicator or an audible alarm device at a location other than the operator’s console. The enable output could be used to enable another monitoring function only when the engine is running, such as gear oil pressure or temperature.

2.0 THEORY OF OPERATION

The probability of an engine failure can be drastically reduced and TBO extend with the use of an effective engine protection system. The simplest systems consist of a single oil pressure switch, a thermostatic switch and warning device, but offer only very limited protection. Some are not failsafe or suited for unattended operation. Some give you an alarm after it's too late! As an example, over temperature; in most cases, when an engine overheats, damage has already started. A multi-parameter, dual-range, early warning failsafe system is needed.

The Model 995 engine monitor keeps a close watch over your expensive engines. It checks the oil pressure in two RPM ranges, 350-1400 (700-2800) and 1400-3000 (2800-6000). These ranges are referred to as "idle" and "power", respectively. In the idle range, oil pressure requirements are modest and pressures are lower. To avoid false alarms, a low pressure (8-12 PSI) sensor is used. In the power range, bearing loads and piston cooling requirements are higher. For safe operation, oil pressures must be higher and a 22-28 PSI sensor is used. Since both of these sensors open on falling pressure, an open circuit in the wiring will cause an alarm, making the system failsafe.

Coolant pressure is likewise checked in both the idle and power range (if optional idle range coolant pressure sensor is installed). In the idle range, coolant pressures can be very low on some makes and models of engines. To avoid false alarms, it is sometimes necessary to use a very low pressure sensor, typically 2-4 PSI. In the power range, the cooling requirements of the engine are greatly increased and a 5-8 PSI sensor is used. Some types of fresh water cooling system defects such as a broken belt, failed pump, low coolant level or massive coolant loss can be detected much earlier from pressure information than from temperature information. Any failure or condition, even aerated coolant or pockets of vapor (cavitations), that causes the pump to lose efficiency will result in a pressure drop at the pump outlet and will be detected almost immediately, long before there is any significant rise in temperature. Therefore, in order to realize the maximum "early warning" benefits from coolant pressure monitoring, it is imperative that the pressure pickoff point be located as close as possible to the circulating pump outlet.

Overspeed protection saves your engine from damage when a sudden loss of load occurs. The Model 995 sensing system reacts within milliseconds- and is much faster and more accurate than many factory installed governors- many of which are worn, have unknown settings or have no way to test for operation. There are 2 ranges- one for Diesel engines- where the overspeed trip point is adjustable between 500 RPM and 3000 RPM and one for Gas/LPG engines with an adjustable trip point from 1000 RPM to 6000 RPM.

MARINE: If yours is a marine application, all marine engines ultimately depend on sea water(a.k.a Raw Water) through a heat exchanger instead of air through a radiator to get rid of the heat of combustion. The result is much more effective cooling… as long as water is moving through the heat exchanger. The most common fault of marine applications is loss of sea water flow due to failed pump, dirt blocking the heat exchanger or an obstruction - something as common as a fish or plastic bag jamming the through hull intake. It is recommended you purchase a Flight Systems Model 612 Sea Water Flow Monitor, which is specifically designed for this application.

For increased protection, the temperature of the fresh water (circulating) cooling system is monitored as well as the pressure. A temperature sensor located in the hottest part of the system (cylinder head outlet, etc.) is activated whenever the engine is running, i.e. above 350 RPM. This detects fresh water cooling system problems that do not necessarily result in an immediate loss of pressure and also serves as a backup for the seawater flow sensing system. The sensor consists of a special semiconductor resistor (not thermistor) sealed in a solid brass housing for reliability and fast response. The semiconductor resistor has a positive temperature coefficient, i.e. it increased its resistance with increasing temperature. It is therefore inherently failsafe since any open circuit in the sensor or its wiring will be interpreted by the unit as high temperature and will result in an alarm.

3.0 INSTALLATION INSTRUCTIONS

INSTALLATION PLANNING

Locate a bulkhead near the engine to mount the Electronic Module where the side-mounted LED Indicators can be readily seen and the wires exiting the removable Main and Remote plugs can be routed and secured properly. DO NOT MOUNT THE ELECTRONIC MODULE ON THE ENGINE. Place the Module on a sheet of paper to trace out a mounting template and locate the best places to mount, allowing for plug removal, etc. Wires will be routed to the engine-mounted Sensors and Remote Annuciator. Plan the best route for these connections. The Remote Annunciator comes with a drill template to assist in deciding the proper placement within the bridge controls. Use illustrations below as a general reference.

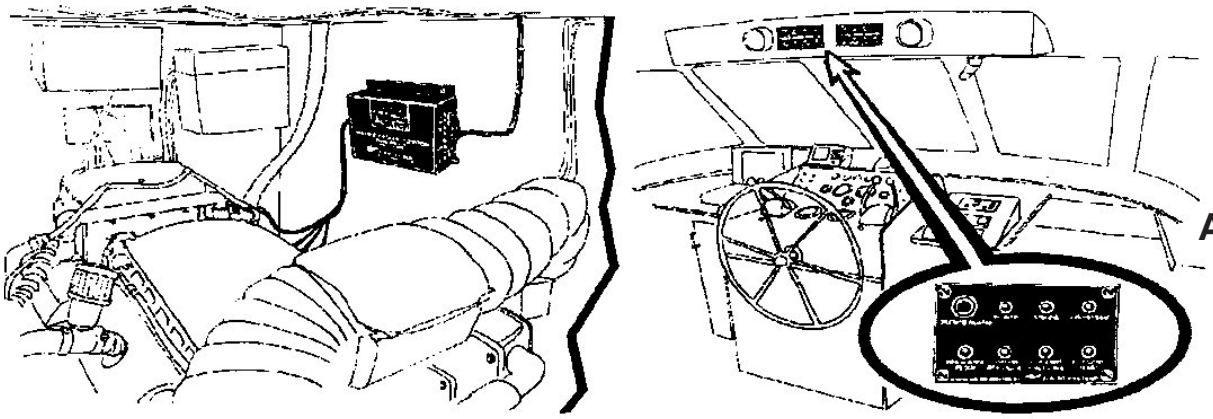


Figure 3-0
Module/ Annunciator Typical Location

INSTALLING SENSORS

Install the oil pressure sensor supplied (57-9954-28) on the engine main oil gallery or at a piston cooling nozzle tap (if so equipped; consult your engine manual if unsure) farthest away from the oil pump. This sensor opens on falling pressure at 22-28 PSI and is activated at 1400 RPM and above. For idle range oil pressure monitoring, install the 8 PSI sensor at the same point using a tee fitting. This sensor opens on falling pressure and is activated at 350 RPM & above. Both sensors have a 1/8”-27 NPT male pipe thread. Use Teflon compound on pipe threads.

Install the coolant pressure sensor supplied (57-9954-22) on the engine AS CLOSE AS POSSIBLE to the engine circulating pump outlet (This is the fresh water pump, not the raw or seawater pump). DO NOT install at any other point in the cooling system as this will result in false pressure information. This sensor opens on falling pressure at 5-8 PSI and is activated at 1400 RPM and above. Idle range coolant pressure protection is available on installation of an optional idle range pressure sensor. Before installing this option, make sure there is at least 2 PSI coolant pressure at the selected pick-off point with the engine hot and loaded low idle; otherwise, false trips will occur. This sensor opens on falling pressure and is activated at 350 RPM and above. Both sensors have a 1/8”-27 NPT male pipe thread. Use Teflon compound on pipe threads. Note: Higher-pressure sensors are available for all ranges - see Accessory List on page 21.

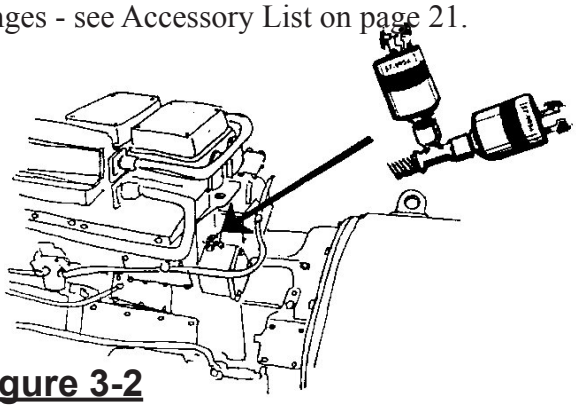


Figure 3-2
Oil Pressure Sensor(s) - Typical Location

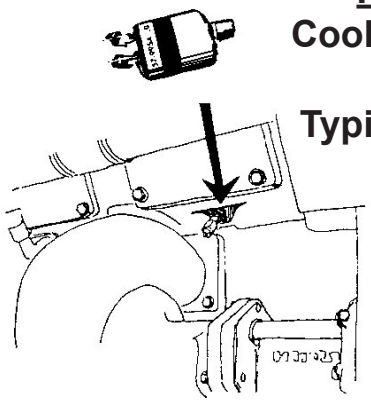


Figure 3-3
Coolant Pressure Sensor - Typical Location

Install the coolant temperature sensor supplied (57-5500-68) on the engine at a point where the hottest coolant is present. This will usually be at the block or cylinder head outlet or the thermostat housing. If the thermostat housing is chosen, make sure that the tap point is on the hot or engine side of the thermostat. The coolant temperature sensor contains a semiconductor resistor that increases its resistance with rising temperature, and has a 3/8" NPT male pipe thread. A ½" NPT and a metric M18 version are also available (see accessory list). Use Teflon compound on pipe threads.

The use of a reducing bushing, although it will fit, is not recommended because it prevents the coolant from fully contacting the sensor, slowing response time. This results in a partial loss of protection in those situations where the engine overheats rapidly.

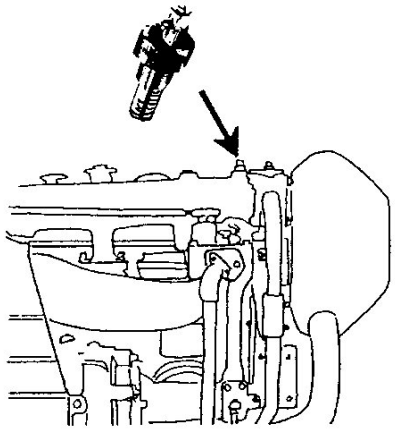


Figure 3-4
Coolant Temperature Sensor Typical Location

RPM SIGNAL SOURCE SELECTION

Engine RPM information is required by the unit for proper functioning. To allow for the maximum flexibility in application, the RPM signal may be obtained in one of five ways: 1) magnetic pickup on the flywheel, 2) tachometer generator on the engine tach drive, 3) alternator "R" terminal*, 4) ignition coil primary, and 5) solid state ignition tach output. The following discussion should help you determine which method of RPM pickup is best suited to your particular situation.

The magnetic pickup on the flywheel is preferred on all types of engines for reliability under all operating conditions. Many diesels already have a 5/8"-18 tapped hole in the bell housing for this purpose. Smaller (or older) diesel and gas engines may not have a pre-tapped hole and it is often difficult to add with the engine in place because of inaccessibility.

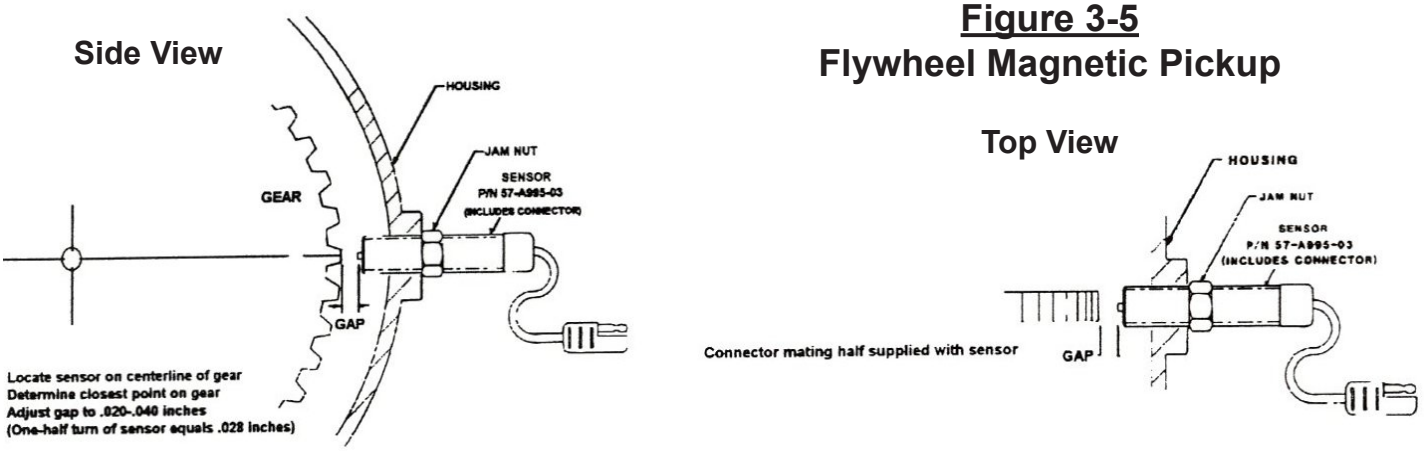


Figure 3-5
Flywheel Magnetic Pickup

An existing tach generator can be used by connecting the unit RPM wires in parallel with the existing tachometer, provided that there is a strong enough signal for both. If none exists, a tach generator such as the "mini gen" (see accessory list) can be added easily if the engine has a 7/8"-18 SAE tach drive outlet. On diesels, this is usually located on the injector pump or blower housing. The "mini gen" is available in a feed-thru version in the event that a mechanical tach drive cable was connected to the engine. (See Fig. 3-6 on following page)

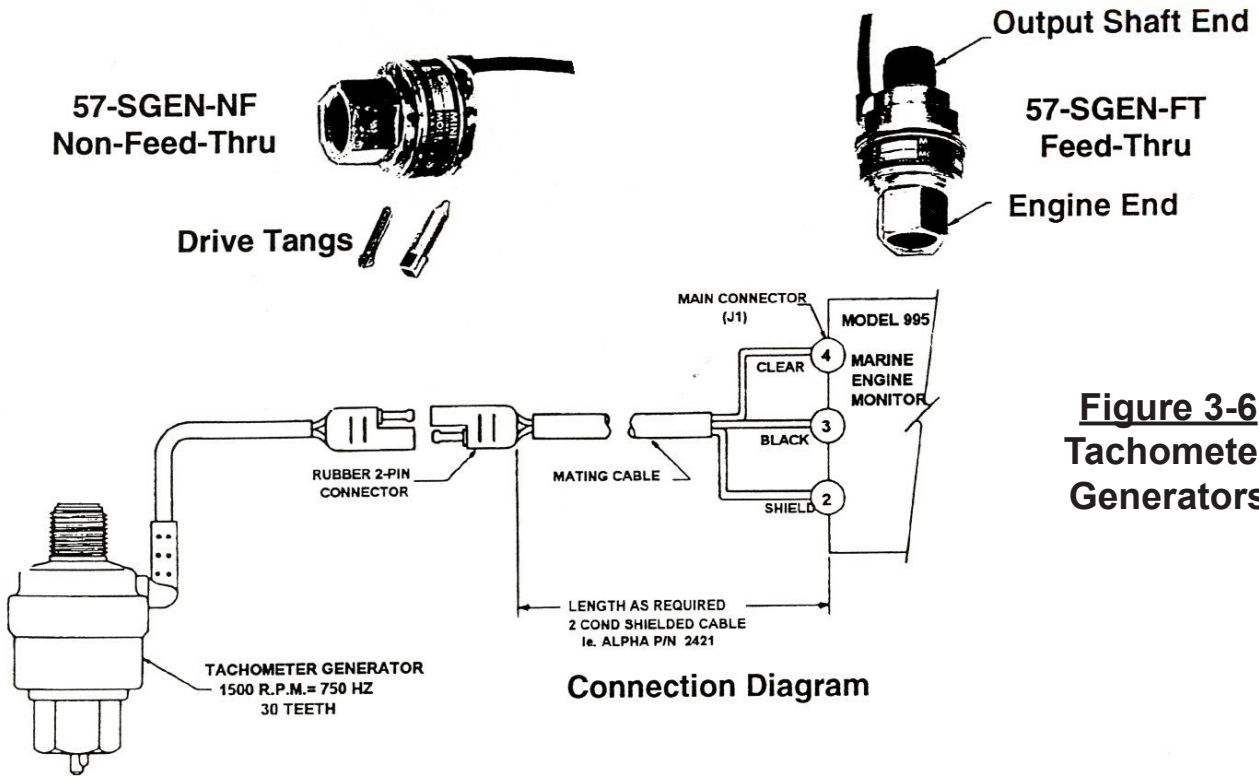


Figure 3-6
Tachometer Generators

The RPM signal can usually be obtained from the alternator "R" terminal. The "R" terminal produces a pulsating voltage that is very similar to the signal from a tach generator. The "R" terminal is located on the rear of the housing near the main DC output terminal but is smaller in size. On certain Delco alternators, it is a smooth pin covered by a rubber boot. This type requires a special connector (see accessory list). If the alternator is not factory equipped with an "R" terminal, it may be added by a qualified alternator rebuild shop, however, this requires removal from the engine.

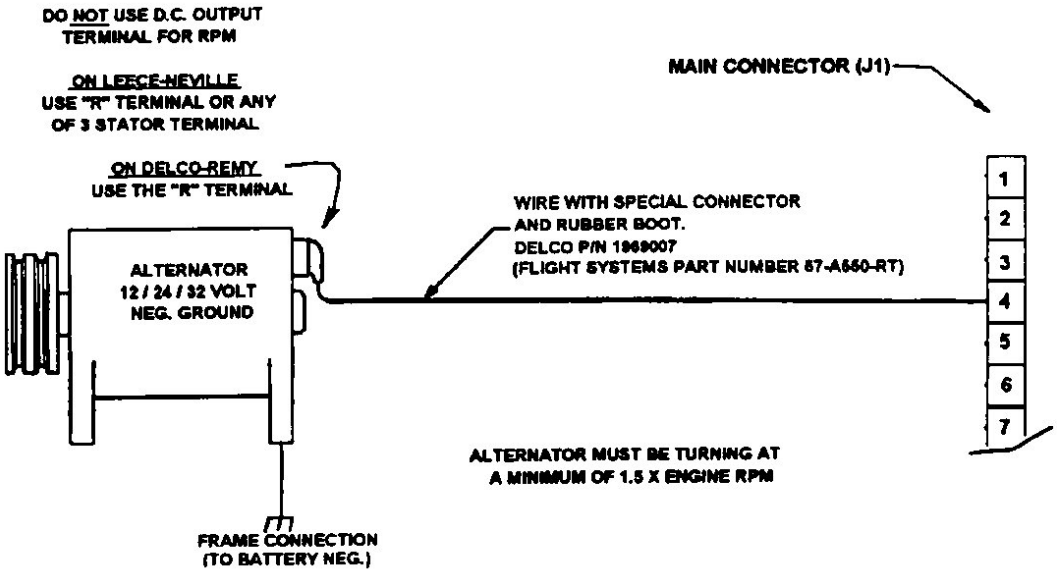


Figure 3-7
Wiring Diagram for Alternator RPM Pickup (Standard)

Smaller diesels used on gen sets may not have a magnetic pickup, a tach drive take-off or an alternator equipped with an "R" terminal. In these applications, a small step-down transformer (115 to 12VAC) is used to derive an RPM signal from the 115 VAC alternator output. The transformer output should be connected to pins J1-2 & J1-4.

On gas engines where all the above methods may be impractical, the ignition coil primary may be used. Connection is made to the negative coil terminal (where the wire going to the ignition points in the distributor is connected). This connection is the same for solid state or "breakerless" ignition systems.

Some late model gas engines with electronic ignition have a special output terminal on the ignition module for connecting a tachometer. This terminal may be used to supply the unit with RPM information. If this source is used, it should be connected to J1-5.

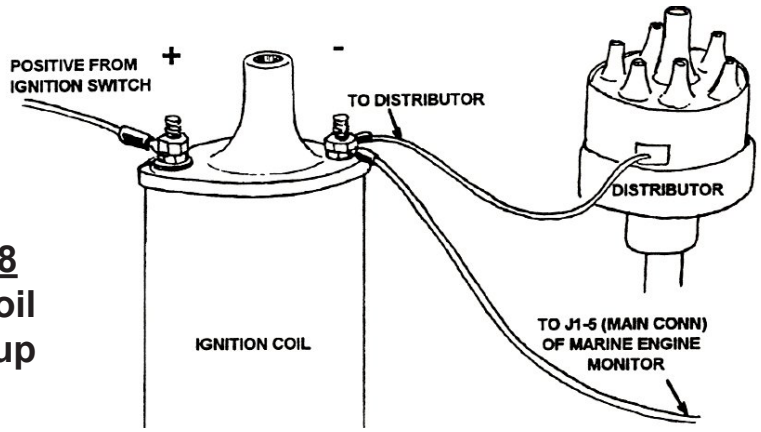
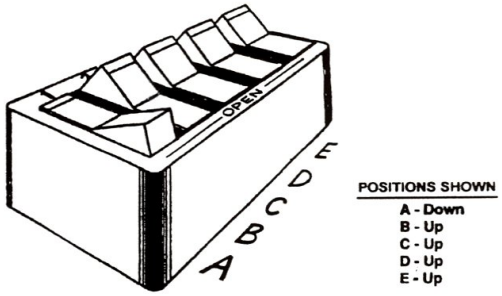


Figure 3-8
Ignition Coil RPM Pickup

RPM SIGNAL PROGRAMMING

After the RPM signal source has been chosen, the programming switches inside of the unit must be set accordingly. To do this, remove the four screws on the end with the 14 pin connector and slide the circuit boards out together. Carefully move the top circuit board in order to gain access to the programming DIP switches located on the lower circuit board. NOTE: If you are using the alternator "R" terminal and the 0-3000 RPM range, there is no need to open the unit.

The 5-switch group is designated "A" thru "E" from bottom to top. Refer to the detail drawing and the programming chart. If the alternator "R" terminal is used as the RPM signal source, set switch "A" to its "DOWN" or "ON" position (factory setting). For all other RPM signal sources, switch "A" should be in its "UP' or "OFF" position. IF the RPM range is to be 0-3000 RPM, set switch "B" to its "DOWN' or "ON" position (factory setting). If the RPM range is to be 0-6000 RPM, set switch "B" to its "UP" or "OFF" position. NOTE: IF the switches are improperly set for the type of RPM pickup being used, RPM calibration will be difficult or impossible. DO NOT change the factory settings of switches C, D or E. These control the operation of the auxiliary. If these switches have been inadvertently altered, set them as follows: C-"UP", D and E "DOWN".



***NOTE**: Figure 3-9 is for illustration only - Refer to text above for actual settings.*

Figure 3-9
Programming Switch Detail

Referring to the RPM CALIBRATION CHART (Figures 3-11 and 3-12, found on the next two pages), you can see that for each type of RPM signal source there are approximate settings given for the RPM "COARSE" and "FINE" dials. Locate the settings that represent your situation as closely as possible and dial them in. Final adjustment will be done after the engine is running. Carefully slide the boards together back into the housing and replace the cover and screws.

MOUNTING

Select a location that minimizes excessive heat and/or vibration. Do not mount directly on the engine or near hot exhaust systems or turbochargers. The unit can be hard or soft mounted in any position by means of its pre-drilled flanges. Position the unit so that its LED indicators are easily seen and both connectors are accessible.

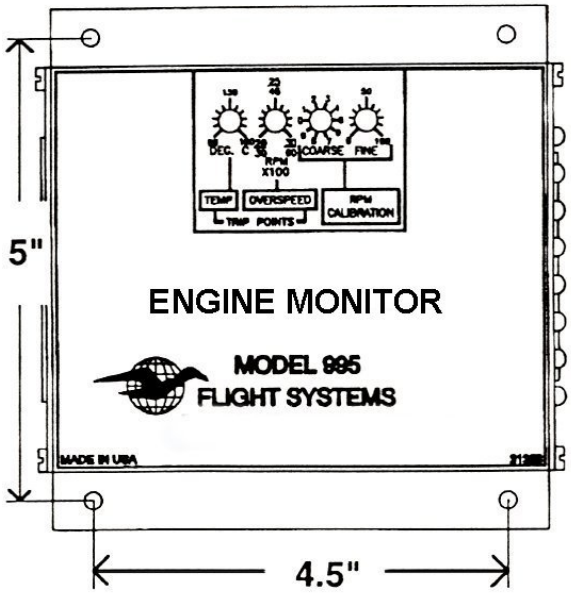
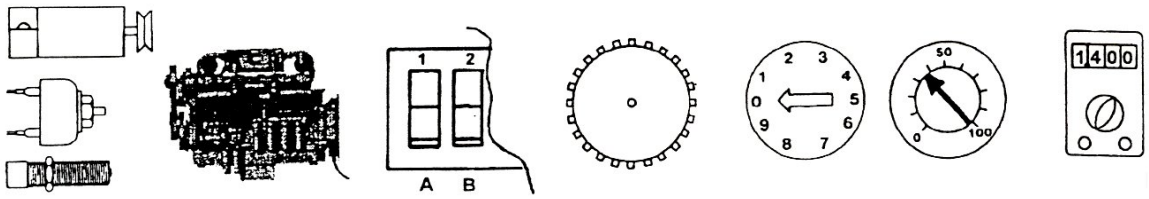


Figure 3-10
Module Mounting Detail

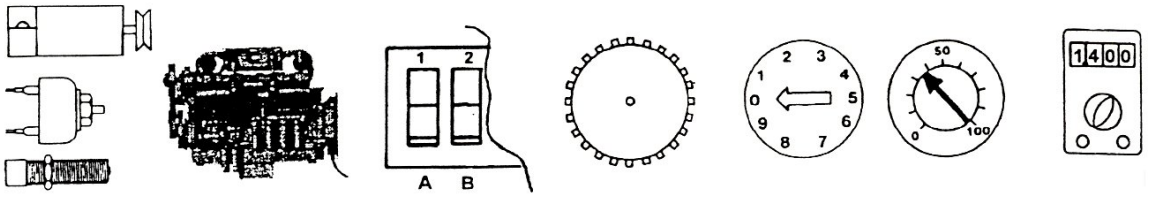
Figure 3-11
RPM Signal Source Selection and Calibration Chart 0-3000 RPM



TYPE OF PICKUP	LOCATION ON ENGINE		PROGRAMMING SWITCHES		EQUIV. NO. OF TEETH (E.T.)	RPM CALIBRATION APPROX DIAL SETTINGS		J2-11 VOLTS DC
			S2A	S2B		COARSE	FINE	
VARIABLE RELUCTANCE MAGNETIC	FLYWHEEL RING GEAR		UP	DOWN	168	0	31	6.0VDC AT 3000RPM 3.6VDC AT 1800RPM 2.8VDC AT 1400RPM
					142		40	
					118		51	
					103		61	
MINI-GEN OR TACH-GEN	CAM 2CYCLE				30	1	67	
	CAM 4CYCLE				15	3	30	
OTHER TACHOMETER GENERATORS	CRANKSHAFT OR CAMSHAFT*				10	4	34	
					8	5	38	
					6	7	34	
					4	8	34	
ALTERNATOR "R" TERMINAL	ALTERNATOR E.T.=POLES X RATIO TO CRANKSHAFT		DOWN		20-28	2	27-15	
					18		32	
					12-15	3	42-30	
IGNITION COIL	DIST COIL TERM.	4 CYL.	UP		2	9	78	
		6 CYL.			3		47	
		8 CYL.			4	7	59	

* ON 4 CYCLE CRANKSHAFT, 2 CYCLE CRANK/CAM E.T.=PULSES/REV OF TACH GENERATOR
ON 4 CYCLE CAMSHAFT E.T.= 1/2 PULSES/REV OF TACH GENERATOR

Figure 3-12
RPM Signal Source Selection and Calibration Chart 0-6000 RPM



TYPE OF PICKUP	LOCATION ON ENGINE		PROGRAMMING SWITCHES		EQUIV. NO. OF TEETH (E.T.)	RPM CALIBRATION APPROX DIAL SETTINGS		J2-11 VOLTS DC
			S2A	S2B		COARSE	FINE	
VARIABLE RELUCTANCE MAGNETIC	FLYWHEEL RING GEAR		UP	DOWN	168	0	7	6.0VDC AT 6000RPM 3.0VDC AT 3000RPM 1.4VDC AT 1400RPM
					142		12	
					118		18	
					103		22	
MINI-GEN OR TACH-GEN	CAM 2CYCLE				30	1	25	
	CAM 4CYCLE				15		67	
OTHER TACHOMETER GENERATORS	CRANKSHAFT OR CAMSHAFT*				10	2	27	
					8	3	28	
					6	4	25	
					4	5	38	
ALTERNATOR "R" TERMINAL	ALTERNATOR E.T.=POLES X RATIO TO CRANKSHAFT		DOWN		20-28	1	46-28	
					18		53	
					12-15	2	20-12	
IGNITION COIL	DIST COIL TERM.	4 CYL.	UP		2	9	31	
		6 CYL.			3	6	39	
		8 CYL.			4	5	38	

* ON 4 CYCLE CRANKSHAFT, 2 CYCLE CRANK/CAM E.T.=PULSES/REV OF TACH GENERATOR
ON 4 CYCLE CAMSHAFT E.T.= 1/2 PULSES/REV OF TACH GENERATOR

PRIMARY POWER SOURCE

Primary power at 12, 24 or 32 VDC is supplied to the unit on the main 14-pin connector J1-1. If possible, select a circuit that is free of electrical noise and is energized when the ignition or master switch is on. Use a separate 1 amp fuse. Connect pin J1-2 to common negative. Engine or frame grounding of the common negative is optional.

WIRING

After the unit has been permanently mounted, the various sensors installed on the engine and the RPM signal and power sources determined, the wiring can be planned, run and tied. Refer to the wiring diagram for details. Connect the power feed on J1-1 LAST to prevent possible shorting to other circuits during hookup. IMPORTANT: If the optional idle range coolant pressure sensor is not used, J1-9 must be connected to common negative J1-2.

The connectors supplied with the unit are easy to wire and will accept #22 to #14 AWG wire sizes. Use stranded 105 deg. C PVC wire (grade AWM 1015 or 1230 CSA TEW preferred) at least #18 AWG gauge for primary power, pressure and flow sensors and engine accessory devised except the temperature sensor and the RPM pickup. For these use #18 twisted, shielded and jacketed cable (such as Alpha 2421C or Belden 3460). Notice that the temperature probe return is connected to J1-3 NOT J1-2. When using shielded wire, connect the shield wire to common negative (J1-2) at the unit end. Do not connect anything to the sensor end of the shield. All wiring should conform to accepted marine practice and USCG regulations.

NOTE: It is not necessary to use shielded wire for the RPM pickup if the source is the alternator or the ignition system, however, its use may still be advisable to prevent possible interference to other electronics aboard.

A wire stripper, common terminal crimping tool and a small screwdriver are required. Use #8 ring terminals for connections to all screw type terminals and crimp splices where a rubber connector is supplied, such as the temperature sensor. Be careful that wiring is routed away from hot objects or sharp edges. Once in place, wiring should be secured with wire ties.

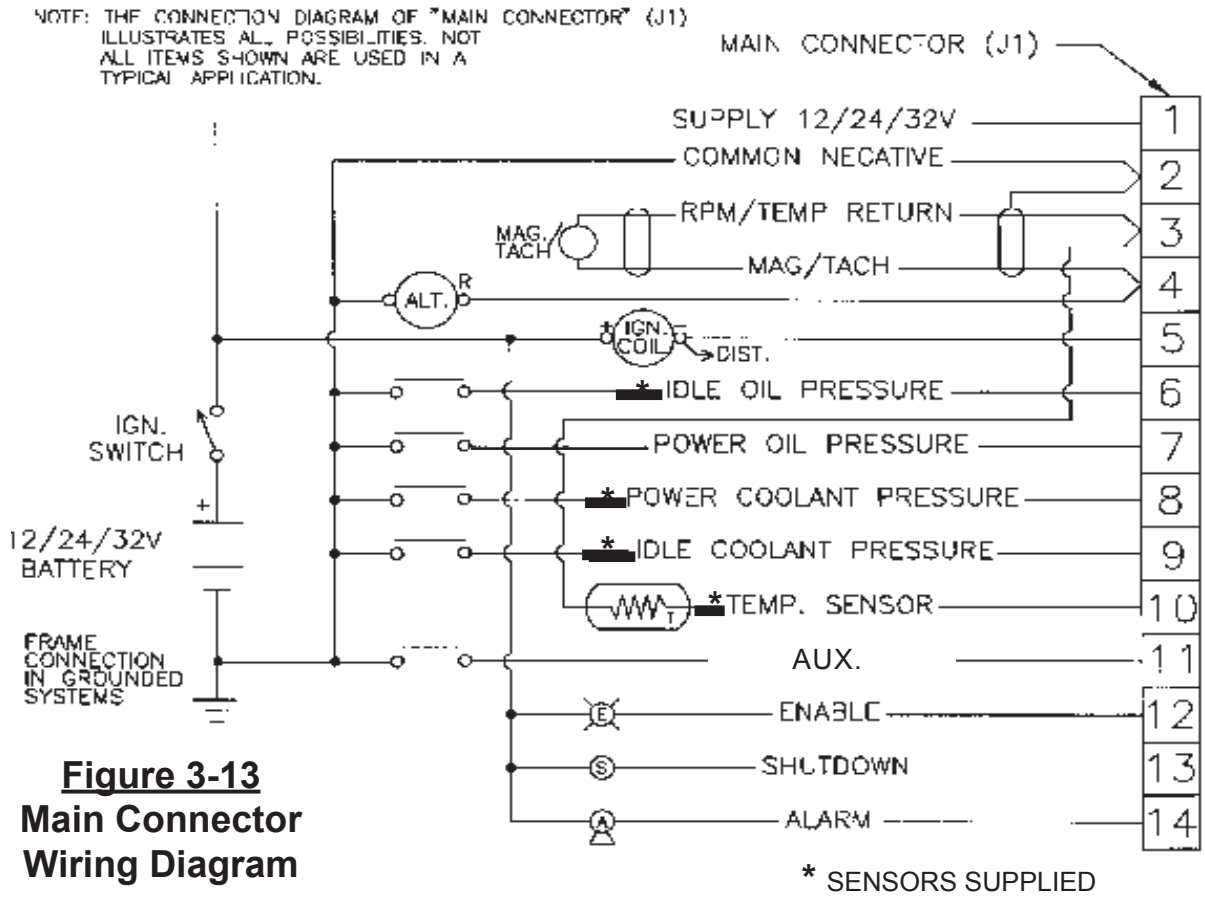


Figure 3-13
Main Connector Wiring Diagram

REMOTE ANNUNCIATOR PANEL

Select a suitable location on the operator's console for the Remote Annunciator Panel (Bridge Remote). Refer to the drawing showing the panel cutout and mounting details. The 12-pin connector should be pre-wired and mated with the panel before final mounting in the console. Each of the 11 circuits on Expansion Connector J2 is to be wired to like numbered pins on the Remote Annunciator Panel connector (analog RPM, pin 11, is not used). Refer to the Remote Annunciator Wiring Diagram.

For the sake of convenience and neatness, the remote Annunciator Panel wiring can be run with multi-colored jacketed cable such as Belden #8457 (#22 AWG) or 9457 (#20 AWG). Individual wires can also be used.

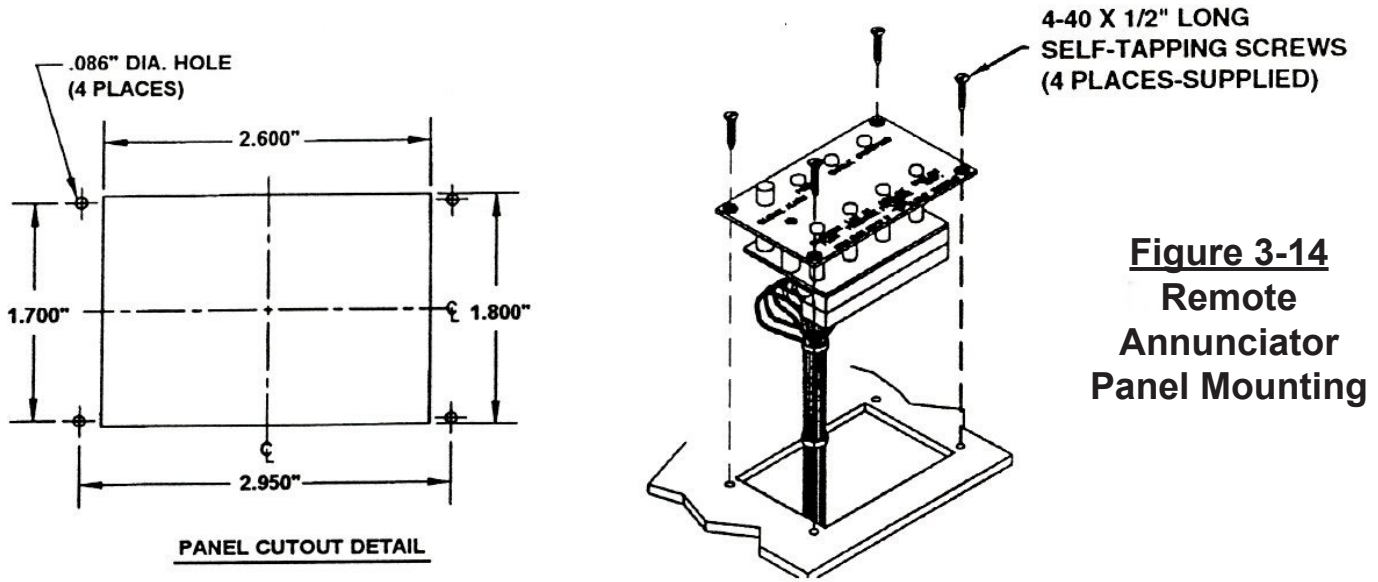


Figure 3-14
Remote Annunciator Panel Mounting

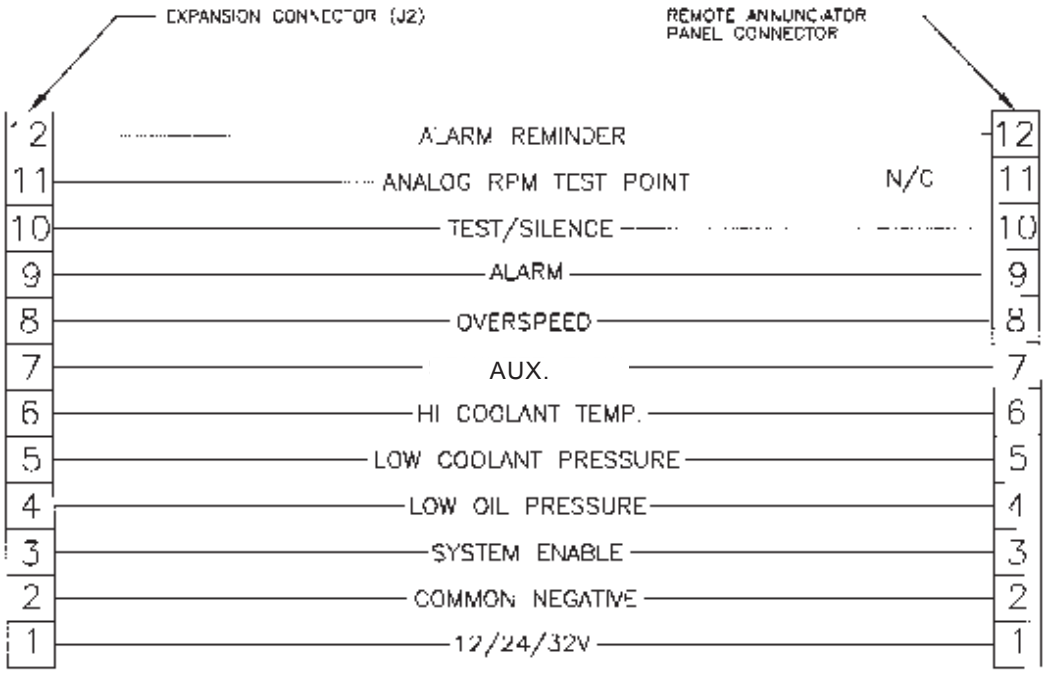


Figure 3-15
Expansion Connector Wiring Diagram

ENGINE SHUTDOWN OUTPUT (optional)

On auxiliary engine applications where operation may be unattended part of the time, it may be desirable to use the optional engine shutdown feature. The shutdown device (not supplied, see accessory list) may take several different forms but its job is always to stop the engine as quickly as possible in the event of trouble. For diesels, a fuel solenoid valve, air shutoff solenoid or a rack puller is used. For gasoline or LP gas engines, an ignition relay or fuel solenoid valve is used. In any case, the shutdown device must be ENERGIZED in order for the engine to run. This is failsafe since any interruption in current to the device will shut down the engine. If the current drawn by the shutdown device exceeds 1 Amp, a relay must be used. The shutdown device or relay coil is to be connected between the "cold" or switched side of the ignition or master switch and J1-13. If the shutdown device has polarity markings, its positive (+) terminal must be connected to the ignition or master switch. See wiring diagram. A shutdown override switch may be connected between J1-13 and common negative.

ALARM OUTPUT (optional)

Although the Remote Annunciator Panel has its own alarm device, an additional output is provided (J1-14) for the purpose of connecting an additional warning device or for interfacing with another system, possibly a computer. Alarm devices must have an appropriate voltage rating and not draw more than 0.25 amps. Observe polarity where applicable. The alarm device is to be connected between the "cold" side of the ignition or master switch and J1-14. See wiring diagram.

REMOTE ENABLE OUTPUT (optional)

The Remote Enable Output (J1-12) duplicates the action of the ENABLE indicator on the unit and the Remote Annunciator Panel. It may be used to "tell" another sensor or system when the engine is running, and switches to common negative when active. Current handling capacity is 0.25 amps.

4.0 COMMISSIONING AND ADJUSTMENT

When the installation has been completed, re-check all wiring before applying power to the system. Perform the following tests to verify proper operation. When reference is made in the following procedure to a fault indicator on the unit, it is understood that the action of this indicator will be duplicated by the indicators on any remote panels that are connected. The alarm function is represented by a flashing indicator on the unit and by an audible alarm on the remote panel(s). If the alarm is triggered during any of the tests, it may be silenced by pressing the ALARM SILENCE button on the remote panel or by momentarily connecting a jumper from pin J2-10 to pin J2-2 on the expansion connector. If any of the steps below cannot be satisfactorily completed, refer to the TROUBLESHOOTING section. NOTE: If using the 9943 Analyzer, refer to its instructions.

1) Disable the shutdown feature (if used) by temporarily connecting a wire from the shutdown device return, main connector J1-13, to common negative.

2) Turn on ignition or master switch. The green POWER indicator on the unit and remote panel(s) should come on.

3) Start engine and allow to warm up. At normal idle RPM (600-900), the yellow SYSTEM ENABLE indicator on the unit and the remote panel(s) should be flashing. If the indicator is not on at all, turn the RPM FINE dial clockwise. If it still does not flash, turn the RPM COARSE dial clockwise one click and repeat. If the indicator is on steady, turn the RPM FINE dial CCW until it begins to flash. If it still does not flash, turn the RPM COARSE dial CCW one click and repeat.

4) Hold the engine RPM steady at 1400. With the SYSTEM ENABLE indicator flashing, adjust RPM FINE dial CW until the indicator just comes on steady. If it is not possible to make the indicator flash at 1400 RPM by turning the FINE dial CCW, then it is necessary to turn the COARSE dial CCW by one click. The objective of this step is to make the SYSTEM ENABLE indicator transition from flashing to steady as the engine RPM passes thru 1400. Verify this now by moving the throttle and readjust only the FINE dial as necessary. See fig. 4-1 at right.

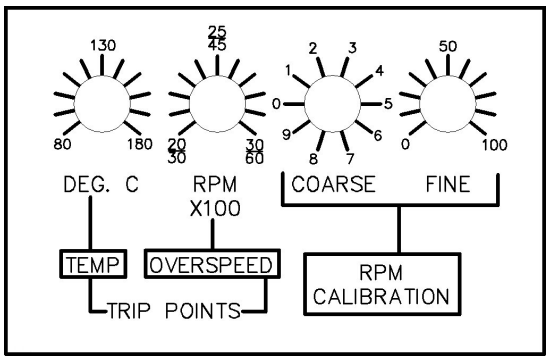
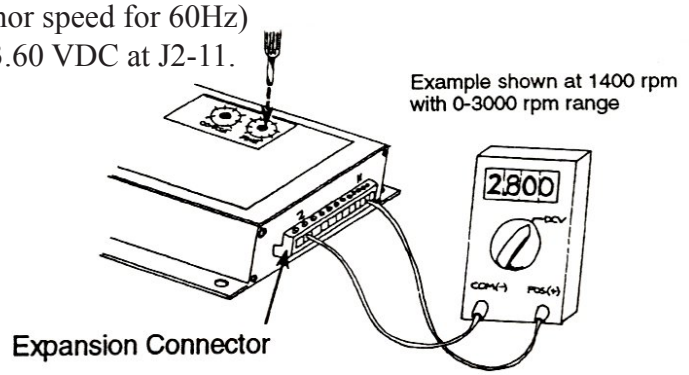


Figure 4-1 Adjustment Dials

THERE'S AN EASIER WAY ***(Alternate Step 4)***

Connect a digital multimeter positive lead to the expansion connector J2-11 and the negative lead to J2-2. With the engine RPM steady at 1400, adjust the COARSE and FINE dials for a reading of 2.80 VDC if 0-3000 RPM was selected (S2B Down) and 1.40 VDC if 0-6000 was selected (S2B Up). For generator sets, select 0-3000. With the engine RPM steady at 1800 (governor speed for 60Hz) adjust the COARSE and FINE dials for a reading of 3.60 VDC at J2-11.

Figure 4-2
RPM Calibration
Using a Multimeter



5) Set the desired overspeed RPM on the OVERSPEED dial. Note that there are two scales depending on the RPM range selector of 0-3000 or 0-6000. If in doubt, set the dial in the center (2500/4500). If the application is a generator set running at 1800 RPM, the dial can be set at full CCW.

6) With the engine at idle, disconnect a wire from the idle oil pressure sensor or J1-6. Check that the red LOW OIL PRESSURE indicator comes on in 15 seconds. Reconnect the wire and the indicator goes off. If the wire is off for more than 30 seconds, the alarm will be triggered.

7) With the engine at idle, disconnect a wire from the idle coolant pressure sensor or J1-9 (if used). Check that the red LOW COOLANT PRESSURE indicator comes on in 15 seconds. Reconnect the wire and the indicator goes off. If the wire is off for more than 30 seconds, the alarm will be triggered.

8) Set the TEMP dial. With the engine at idle, disconnect the temperature sensor of J1-10. Check that the red COOLANT TEMPERATURE indicator comes on in 15 seconds. Re-connect the wire and the indicator goes off. If the wire is off for more than 30 seconds, the alarm will be triggered.

9) With the engine at 1500 RPM, disconnect a wire from the power oil pressure sensor or J1-7. Check that the red LOW OIL PRESSURE indicator comes on in 15 seconds. Reconnect the wire and the indicator goes off. If the wire is off for more than 30 seconds, the alarm will be triggered.

10) With the engine at 1500 RPM, disconnect a wire from the power coolant pressure sensor or J1-8. Check that the red COOLANT PRESSURE indicator comes on in 14 seconds. Reconnect the wire and the indicator goes off. If the wire is off for more than 30 seconds, the alarm will be triggered.

11) Remove the disabling jumper from the shutdown output (if used). With the engine at idle, disconnect the temperature sensor or the wire on J1-10 and allow the alarm to be triggered. Leave this wire off for now. Check that the red ALARM indicator on the unit is flashing and that the audible alarm on the remote panel(s) is sounding. If the shutdown feature is used, verify engine shutdown. Press the ALARM SILENCE button on the remote panel. The alarm should clear and it should now be possible to restart the engine (if applicable). The red ALARM REMINDER indicator on the ALARM SILENCE button should be illuminated along with the COOLANT TEMPERATURE indicator. Reconnect the temperature sensor or wire on J1-10. Both the COOLANT TEMPERATURE and ALARM REMINDER indicators should go off.

5.0 TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	SOLUTION
POWER LED DOES NOT LIGHT.	BLOWN FUSE. OPEN CIRCUIT J1-1,2. SUPPLY NOT POWERED WIRING ERROR. CONNECTOR OFF.	CHECK/REPLACE FUSE CHECK WIRING. CHECK SUPPLY CKT. CHECK WIRING. RE-SEAT CONNECTOR.
ENABLE LED DOES NOT LIGHT	WEAK OR NO RPM SIG. OPEN CKT. J1-3,4,5 WIRING ERROR. WRONG S2A,B POS. COARSE, FINE POS.	CHECK ACV @ J1-4,5. CHECK WIRING. CHECK WIRING. CHECK SN POSITONS. CHECK POSITONS.
ENABLE LED ON STEADY AT IDLE.	RPM COARSE AND/OR FINE DIALS TOO FAR CLOCKWISE. ELECTRICAL NOISE ON RPM CIRCUIT.	REPEAT INSTALL STEP 4. CHECK J1-11 VOLTS. CHECK SHIELDING AND SHIELD GROUND.
ENABLE LED ONLY FLASHES.	RPM COARSE AND/OR FINE TOO FAR CCW.	REPEAT INSTALL STEP 4. CHECK J2-11 VOLT.
OIL PRES FAULT LED COMES ON AT IDLE.	LOW OIL PRESSURE AT IDLE. OPEN CKT J1-6. PRESSURE SENSOR CLOGGED OR STUCK.	CHECK PRES AT IDLE TRY LOWER PRESSURE SENSOR. CHECK WIRING. CLEAN/REPLACE SENSOR.
OIL PRES FAULT LED COMES ON ONLY WHEN RPM IS ABOVE 1400.	LOW OIL PRESSURE. OPEN CIRCUIT J1-7. PRESSURE SENSOR CLOGGED OR STUCK.	CHECK PRES AT 1400. CHECK WIRING. CLEAN/REPLACE PRESSURE SENSOR
COOLANT PRES FAULT LED COMES ON AT IDLE.	COOLANT PRESSURE TOO LOW AT IDLE. OPEN CKT. J1-9. PRESSURE SENSOR CLOGGED OR STUCK.	CHECK PRES AT IDLE. TRY LOWER PRES SENSOR. CHECK TAP-OFF POINT. CHECK WIRING. CLEAN/REPLACE PRESSURE SENSOR.

COOLANT PRES FAULT LED COMES ON ONLY WHEN RPM IS ABOVE 1400.	LOW COOLANT PRESSURE AT 1400. OPEN CKT. J1-8 PRESSURE SENSOR CLOGGED OR STUCK.	CHECK PRESSURE. TRY LOWER PRESSURE SENSOR CHECK TAP-OFF POINT. CHECK WIRING. CLEAN/REPLACE PRESSURE SENSOR.
AUX FAULT LED COMES ON AT IDLE.	IMPROPER POSITIONS FOR S2C,D,E	VERIFY S2 C "UP" S2 D "DN" S2 E "DN"
AUX FAULT LED COMES ON ONLY WHEN RPM IS ABOVE 1400.	INSUFFICIENT FLOW. IMPROPER POSITION OF S2C. OPEN CKT. J1-11. FLOW SENSOR STUCK OR DEFECTIVE.	CJECL SYSTEM, PUMP CLEAN STRAINER. VERIFY S2-C "UP" CHECK WIRING. CLEAN/REPLACE FLOW SENSOR.
COOLANT TEMP FAULT LED COMES ON AT ANY RPM WHEN ENGINE IS NOT OVERHEATED.	TEMP DIAL SET TOO LOW. OPEN CKT J1-10. OPEN TEMP SENSOR.	CHECK TEMP DIAL SETTING. CHECK WIRING. VERIFY SENSOR OHMS IS 100-200. REPLACE IF NECESSARY.
SHUTDOWN DEVICE DOES NOT OPERATE PROPERLY.	WIRING ERROR. OPEN/SHORT J1-13. DEVICE WRONG VOLTS DAMAGE OUTPUT.	CHECK WIRING. CHECK WIRING. CHECK DEVICE RATING REPAIR UNIT.
EXTERNAL ALARM DEVICE DOES NOT OPERATE PROPERLY.	WIRING ERROR. OPEN/SHORT J1-14. DEVICE WRONG VOLTS DAMAGED OUTPUT.	CHECK WIRING. CHECK WIRING. CHECK DEVICE RATING REPAIR UNIT.
EXTERNAL ENABLE DEVICE DOES NOT OPERARE PROPERLY.	WIRING ERROR. OPEN/SHORT J1-12. DEVICE WRONG VOLTS DAMAGED OUTPUT	CHECK WIRING. CHECK WIRING. CHECK DEVICE RATING REPAIR UNIT
UNIT POWER LED ON BUT REMOTE POWER LED NOT ON.	POWER NOT REACHING REMOTE ON J2-1,2. WIRING ERROR. PLUGS NOT SEATED. DEFECTIVE REMOTE.	CHECK WIRING. CHECK WIRING. RE-SEAT PLUGS. REPAIR REMOTE.

STATUS LED(S) ON REMOTE DO NOT AGREE WITH LED(S) ON UNIT.	WIRING ERRORS ON J2 OR REMOTE PANEL. BAD CONNECTIONS. PLUGS NOT SEATED. DEFECTIVE REMOTE.	CHECK WIRING FOR CORRECTNESS. CHECK CONNECTIONS. RE-SEAT PLUGS. REPAIR REMOTE.
REMOTE ALARM NOT AUDIBLE.	FAULT CLEARS BEFORE 30 SEC ELAPSES. WIRING ERROR. OPEN CKT. ON J2-9. ALARM DEVICE MUFFLED. DEFECTIVE REMOTE.	FAULT MUST REMAIN FOR AT LEAST 30 SEC CHECK WIRING. CHECK WIRING. PROVIDE CLEARANCE FOR ALARM DEVICE. REPAIR REMOTE.
ALARM SILENCE INOPERATIVE.	WIRING ERROR. OPEN CKT. ON J2-12. DEFECTIVE REMOTE.	CHECK WIRING. CHECK WIRING. REPAIR REMOTE.
ALARM REMINDER LED DOES NOT LIGHT WHEN BUTTON IS PRESSED WITH A FAULT LED ON.	WIRING ERROR. OPEN CKT. ON J2-12. DEFECTIVE REMOTE.	CHECK WIRING. CHECK WIRING. REPAIR REMOTE.

6.0 VOLTAGE CHARTS

MAIN CONNECTOR J1

J1 PIN	FUNCTION	CONDITIONS OF MEASUREMENT	VOLTAGE REF TO 2
1	PRIMARY POWER	IGN/MASTER SW. ON FOR ALL TESTS.	BATTERY VOLTS
2	COMMON NEGATIVE	AT ALL TIMES.	0 VDC
3	RPM/TEMP. RETURN	AT ALL TIMES.	0 VDC
4	RPM, MAG/TACH/ALT	ENGINE RUNNING.	0.5-40 VAC*
5	RPM, IGNITION COIL	ENGINE RUNNING.	APPROX 1/3 BAT VOLTS*
6	IDLE OIL PRESSURE	ENGINE STOPPED. ENGINE RUNNING.	6 VDC** 0 VDC
7	POWER OIL PRESSURE	ENGINE STOPPED. RPM > 1400.	6 VDC 0 VDC
8	POWER COOLANT PRESSURE	ENGINE STOPPED. RPM > 1400.	6 VDC 0 VDC
9	IDLE COOLANT PRESSURE	ENGINE STOPPED. ENGINE RUNNING.	6 VDC** 0 VDC
10	COOLANT TEMPERATURE	TEMP. 25-100 DEG C	.4-.6 VDC+
11	AUX	ENGINE STOPPED. RPM > 1400.	6 VDC 0 VDC
12	REMOTE ENABLE	ENGINE STOPPED. 350< RPM< 1400.++	12 VDC MIN. PULSING .5 VDC MAX.
13	SHUTDOWN	NORMAL RUNNING.++ AUTO SHUTDOWN – ALARM NOT SILENCED.	.5 VDC MAX. 12 VDC MIN.
14	ALARM	NORMAL RUNNING. ALARM – NOT SILENCED	5 VDC MIN. PULSING

* If 5 is used, disregard 4 and visa versa.
** 0 VDC if input is not used.
+ Measure with respect to pin 3 instead of 2.
++ If a device is not connected, disregard voltage readings.

EXPANSION CONNECTOR J2

J2 PIN	FUNCTION	CONDITIONS OF MEASUREMENT*	VOLTAGE Ref. to 2
1	PRIMARY POWER	IGN./MASTER SW. ON FOR ALL TESTS.	BATTERY VDC.
2	COMMON NEGATIVE	AT ALL TIMES	0 VDC
3	ENABLE	ENGINE STOPPED. 350< RPM < 1400. RPM > 1400.	12 VDC. PULSING. 1 VDC MAX.
4	LOW OIL PRESSURE	NORMAL. OIL PRESSURE FAULT.	12 VDC. 1 VDC MAX.
5	LOW COOLANT PRESSURE	NORMAL. COOLANT PRESS FAULT.	12 VDC. 1 VDC MAX.
6	COOLANT TEMPERATURE	NORMAL. COOLANT TEMP FAULT.	12 VDC. 1 VDC MAX.
7	AUX	NORMAL. AUX FAULT.	12 VDC. 1 VDC MAX..
8	OVERSPEED	NORMAL. OVERSPEED FAULT.	12 VDC. 1 VDC MAX.
9	ALARM	NORMAL. ALARM-NOT SILENCED	12 VDC. PULSING.
10	TEST/ SILENCE	NORMAL. SILENCE BUTTON HELD.	9-12 VDC. 0 VDC
11	ANALOG RPM	ENGINE STOPPED. 1400 RPM (0-3000). 1400 RPM (0-6000).	0 VDC. 2.8 VDC. 1.4 VDC
12	ALARM REMINDER	NORMAL. SILENCE BUTTON PRESSED AFTER ALARM.	12 VDC. 1 VDC MAX.

7.0 ACCESSORY LIST

The Following Accessories are Available for the Model 995:

Magnetic Pickup RPM Sensor	57-A995-03
Tachometer Generator	57-4170-17
Mini-Gen (non-feed-thru)	57-SGEN-NF
Mini-Gen (feed-thru)	57-SGEN-FT
Delco Alternator Connector	57-A550-RT
Oil Pressure Sensor, 10 PSI	57-9954-24
Fuel Shut-off Solenoid 12 VDC, ¼" NPT	57-FS14-12
Fuel Shut-off Solenoid 24 VDC, ¼" NPT	57-FS14-24
Fuel Shut-off Solenoid 32 VDC, ¼" NPT	57-FS14-32
12-foot Pre-wired Harness	57-9955-11
Shutdown Relay, 12 VDC	57-9955-02
Shutdown Relay, 24 VDC	57-9955-03
Remote System Enabled Indicator (green)	57-9954-03
Remote Alarm Indicator (red)	57-9954-04
Audible Alarm, 12/24 VDC	57-9954-13
Audible Alarm, 32 VDC	57-9955-10
Remote Annunciator Panel (for 2nd station)	57-9955-01
Mating 14-pin connector (main) only	57-9954-05
Mating 12-pin connector (expansion) only	57-9955-04
In-Line Analyzer	Model 9943
Coolant Temperature Sensor, ½" NPT	57-5500-65
Coolant Temperature Sensor, M18	57-5500-69

Any of the items listed above can be ordered from Flight Systems Headquarters:
Toll-Free USA/Canada: 800-403-3728 International: 717-590-7330

8.0 WARRANTY INFORMATION

The MODEL 995 ENGINE MONITOR is carefully built to exacting standards and is warranted to be free from defects in materials and workmanship for a period of 24 months from the date of shipment, or the date it is first put in service, if the latter is documented by completing and returning the warranty registration card within 10 days of the in-service date.

FLIGHT SYSTEMS liability is limited to the repair or replacement of defective product within the effective warranty period, and does not cover any costs incurred due to installation or removal labor, downtime or loss-of-use, travel or consequential damage to any vessel or any equipment thereon, including engines or parts thereof as direct or indirect result of any malfunction or deficiency of the ENGINE MONITOR. You may have other specific warranty rights that vary from state to state within the U.S.

If, in the opinion of FLIGHT SYSTEMS (or its authorized agent) the malfunction of the ENGINE MONITOR was caused by abuse, misuse, or improper installation, the warranty shall not apply and established repair rates shall apply.

REPAIR SERVICE / PARTS/TECHNICAL SUPPORT

The Engine Monitor is fully rebuildable. Service, Parts and Technical Support can be obtained throughout the world from our PA Manufacturing Facility.

SALES AND SERVICE

Manufacturing, Engineering, Technical Support and Spare Parts

FLIGHT SYSTEMS, INC. -
207 Hempt Rd
Mechanicsburg, PA 17050

Ph: 800-403-3728 / 717-590-7330 Fax 717-590-7327

www.flightsystems.com