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NOTE TO THE INSTALLER

The FMONITOR manuals are open to revision based on your needs. If you have suggestions for improvement or clarification, please write or call.

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Introduction

This manual contains information relative to the physical, mechanical, and electrical characteristics and installation procedures for the FMONITOR engine monitor. Assembly and calibration details which relate to the installation are found in the FMONITOR ASSEMBLY MANUAL and the FMONITOR OPERATIONS MANUAL.

Description

The FMONITOR is a microprocessor controlled engine monitor for 4 and 6 cylinder aircraft engines. The Greek symbol F (mu) is used to represent the word micro in electronics. FMONITOR is pronounced micro-monitor.

The FMONITOR, in one compact instrument, continuously monitors and displays all of the usual engine functions. In addition to displaying the engine functions in a digital readout, all critical engine functions have user selected alarm points. If any of the critical functions are out of limits, that particular function will blink on the display and an audio alarm will sound. There are additional features which blend with the engine functions such as a multi-function clock and user customized alarm inputs. The list of functions provided are listed below:

function	range	alarm
OIL PRESSURE	0 to 99 psi	LOW
FUEL PRESSURE	0 to 31 psi ***note4**	LOW
MANIFOLD PRESSURE	10.0 to 51.0 inhg	HI
OIL TEMPERATURE	-9 to +199 EC	HI
CYLINDER TEMPERATURE	0 to 500 EC	HI
EXHAUST GAS TEMPERATURE	0 to 999 EC	NONE
CARBURETOR TEMPERATURE	-19 to +100 EC	LO
OUTSIDE AIR TEMPERATURE	-50 to +199 EC ***note2**	NONE
AMMETER	-9 to +75 amp	LO
VOLTMETER	0 to 39.9 V ***note1**	NONE
TACHOMETER	0 to 4500 RPM 4 cyl ***note3** 0 to 3000 RPM 6 cyl	HI
FUEL FLOW	.6 to 60 GPH	NONE
FUEL QUANTITY REMAINING	0 to 99.9 gal	LO
GMT	0 to 2359.9	NONE
LMT	0 to 2359.9	NONE
TIMER	0 to 59.9 min	AT '0'
FLIGHT TIME	0 to 25.5 hr	NONE
TACH TIME	0 to 6553.5 hr	NONE
ENDURANCE	0 to 99.9 hr ***note1**	NONE
USER FUNCTION #1		SWITCH CLOSE
USER FUNCTION #2		SWITCH CLOSE
USER FUNCTION #3		SWITCH CLOSE

***note1:** Voltage and endurance are only displayed when the **[SIL/VOLT]** button is pressed and held in. The voltage then appears in the **Utility** position of the display and the endurance appears in the clock position of the display.

***note2:** Outside air temperature is displayed when the **[SIL/VOLT]** button is pressed and held in. If carburetor temperature is not installed, the outside air temperature can be displayed continuously by setting the OAT flag on (see PROGRAMMING EXTRA FEATURES in the operations manual). When displayed, the outside air temperature appears in the **Utility** position of the display.

***note3:** Tachometer will operate to 7500 RPM. The limits shown are the maximum that resolution of every 10 RPMs will always display. Over these limits, RPM resolution will become larger. For example: 5110 - 5120 - 5130 - 5150 or 7100 - 7120 - 7150.

***note4:** Optional 0 to 99 psi for high pressure fuel systems.

The FMONITOR has a float charging circuit and connections for an external gel-cell battery that will operate the instrument for 8 to 10 hours in the event of electrical failure. The unit will operate on 12 or 24 volt electrical systems.

In addition to the 90db+ alarm, the unit provides a 600 ohm audio output for audio input to a mixer or direct to the headphones.

Technical Characteristics

specification	characteristic
Electrical:	a. All solid state using CMOS integrated circuits b. Electronically controlled by an 8 bit microprocessor c. Large digit liquid crystal display
Panel height:	3.25 inches
Panel width:	6.31 inches
Overall dimensions: (including mounting tray and connectors)	
Depth from back of faceplate:	4.6 inches (add apx 1 inch for wiring)
Width:	6.31 inches face 6.25 inches mounting tray
Height:	3.25 inches
Weight:	1.5 pounds less senders & wiring
Power requirements:	12-31VDC @ 1.8 amp max startup, 150ma typ.
Clock power requirements:	8-31VDC @ 140/280 FAMP @12/24VDC
Audio output:	200mw into 600 ohm load @max volume
Operating temperature:	-15 to 50EC (-45 to 65EC storage)
Operating altitude:	0-30,000 feet

Installation

Please read all installation instructions and examine the installation figures before beginning your aircraft installation.

Mounting Tray & Audio Transducer

__ 1. Plan a location on the aircraft panel that is clearly visible and within easy reach of the pilot. The pilots eyes should be above an imaginary line drawn perpendicular into the display of the unit and if at all possible, within 30E of either side of the perpendicular. Ideal is 5E to 15E above the perpendicular.

__ 2. Avoid mounting the FMONITOR close to heater vents or other high heat sources.

The top front of the mounting tray has a lip edge that sticks out more than the other three edges. This lip is intended to be **flush** to the back of the faceplate when the FMONITOR is installed in the tray. It controls the amount of clearance between the edge connector of the FMONITOR and the bottom of the wiring connector installed in the tray.

If your mounting tray is to be installed so that the back of the faceplate will not make contact with the top lip of the tray, shim the black wiring connector in the tray forward an amount at least as thick as the distance from the lip to the front of your instrument panel. The tray lip is designed to provide .050 clearance between the edge connector and the bottom of the wiring connector in the tray when the lip is in contact with the back of the faceplate so you may use washers or spacers on the connector screws as shims up to .025 thicker than your distance from the lip to the front of your instrument panel. You may have to install longer #4-40 screws than those provided... they should stick out at least 1/8" to 1/4" behind the back of the mounting tray after the spacers are installed.

__ 4. Install the mounting tray in the aircraft. The mounting screws you provide install from the inside of the tray and must be flat-head screws or others with a low head profile because of the small clearance between the FMONITOR and the mounting tray sides.

__ 5. Install the audio transducer in the cockpit. If the audio transducer can not be installed in the instrument panel, direct the sound openings in the transducer as much as possible into the cockpit.

General Wiring

Due to the variety of possible installations and engine locations, a wire harness is not provided. All wire connections to the sensors should be done using standard connectors and/or methods. Due to the very low currents to all sensors, 20 to 26 gage wire may be used although wire sizes smaller than 22 gage is physically harder to work with. The more flexible teflon (plenum cable) wire instead of the regular aircraft wire will make the installation and maintenance easier. The Molex crimp terminals provided are suitable for **18 to 24** gage wire if a commercial crimp tool is used (see **Figure 3**). Avoid soldering the crimp terminals as the heat may destroy their spring temper, resulting is a possible poor connection between the crimp terminal and the unit's gold edge connector when installed.

Shielding

A single short ground wire can be connected from terminal 1, 17 or 18 to all of the shields behind the FMONITOR. The shields should initially only be grounded at the end near the FMONITOR.
Since there are many wires that need to be connected to ground (1,17 & 18) it is a good idea to attach a terminal block to the rear of the mounting tray with one of the screw terminals connected to one of the ground pins. A 'jumper' strip then connects all of one side of the terminal screws together. Radio shack has a #274-670 eight position terminal strip and a #274-650 eight position 'jumper' strip. Use ring or spade terminals on the wires before connecting to the terminal strip. An additional terminal strip may be use for all of the signal grounds connected to pin 14. See appendix B for a neat but slightly more labor intensive method of organizing the wiring from the FMONITOR to the sensors.

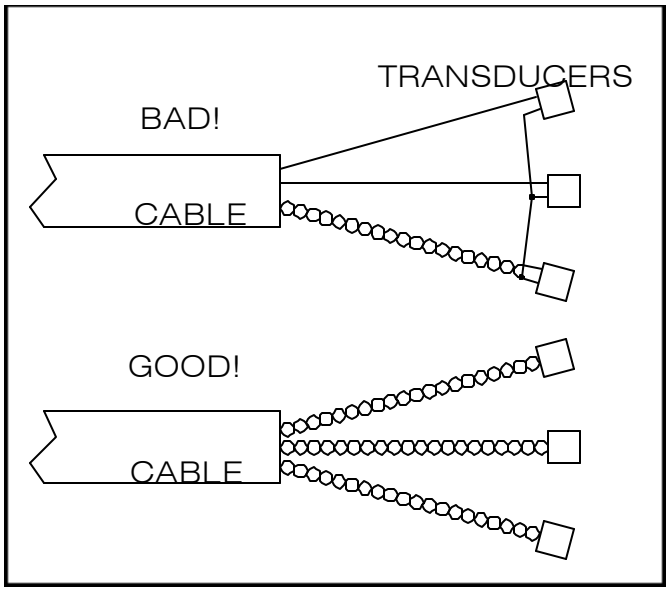


Figure 1 How to construct an unwanted loop antenna.

Avoid constructing loop antennas when wiring the sensors as shown in the bad example of **Figure 1**. The use of twisted pair wires wherever possible will cancel out radio frequency interference and shielding will reduce electromagnetic interference. Run twisted pair wires to each sensor if possible and shields as close as possible to the sensor to cover as much wire as possible.

Sensor Installation

Ammeter - The ammeter sensor is intended to be placed on the main current carrying wire out of the alternator to measure the total amp output of the alternator. Alternate placement may be used, keeping in mind that the unit will only indicate a minimum of -9 amps. Locate the ammeter sensor at least 6 inches away from the alternator or other strong magnetic fields since it operates by detecting a magnetic field generated by the current through the wire that is passing through the hole of the sensor. The '+', '-', and 'O' wires can be determined from the markings on the sensor (refer also to appendix A of the assembly manual regarding construction of the sensor).

The ammeter assembly measures the current flow in a wire that is passed through the center hole of the sensor assembly.

For orientation, the arrow on the ammeter assembly PC board shows the direction that current should flow in the wire that passes through the sensor. If the sensor is installed on the main wire coming out of the alternator, then this arrow will point away from the alternator. If the installation proves to be incorrect and the FMONITOR is reading negative during engine operation, turn the sensor around on the wire. Tie wrap or tape around the current carrying wire and sensor leads about six inches away from the sensor to hold the sensor in place. The current carrying wire must pass through the sensor hole only once... it is OK if it goes through at an angle.

Manifold Pressure - Connect the GM MAP sensor to the intake manifold using fuel compatible **3** inch internal diameter tubing of sufficient thickness so that the small vacuum does not collapse the tubing. At the MAP sensor end, secure the tubing with a hose clamp. A thread to tubing barb adapter at the intake manifold end should also be secured with a tubing clamp. Most standard aircraft engines have a threaded port for the MAP sensor near an intake valve on a rear cylinder.

The male connector pins provided with the GM MAP sensor may be attached to the connecting wires and plugged directly into the female sockets on the sensor. After all testing is done and the MAP installation is operating correctly, you may then pot the connector cavity on the sensor with RTV (silicon seal). If the sensor ever needs replaced, the wires can be pulled out of the RTV. Currently, we have been unable to find an exact matching connector.

EGT & CHT - Standard aircraft wire (twisted pair) may be used from the ends of the thermocouple wires to the measuring unit without seriously affecting the accuracy. Since each connection of dissimilar materials creates another thermocouple, be sure to keep connector materials the same for both leads of a thermocouple so errors cancel out. In other words, don't make a connection with a brass terminal on one lead and a plated brass terminal on the other lead.

> **IMPORTANT NOTE**: Most thermocouples have the measuring junction in the sensor welded to the metal sheath, protecting the junction. These are called grounded thermocouples. Some thermocouples have the measuring junction isolated from the sheath and are called ungrounded thermocouples. The FMONITOR EGT and CHT measuring circuits have been designed to work with both types of thermocouples. If you will be using a grounded thermocouple, one of the resistors in the FMONITOR

should be taken out of the circuit to reduce noise effects and increase accuracy. (EGT and CHT from RMI are the grounded type... as most are).

The resistor does not have to be unsoldered. Remove the top cover of the FMONITOR, locate the proper resistor, and cut the lead apart at the top of the bend of the lead above the resistor. Bend the lead and resistor slightly apart so that the lead is parted. Using this method, if you ever have to switch to ungrounded thermocouples, you can push the leads together and re-solder.

You can confirm if your thermocouples are the grounded or ungrounded type by measuring the resistance from the metal sheath of the sensor to either of the thermocouple leads. Use the results of the measurement in the following charts:

	Measure	Thermocouple Type	ACTION
CHT	open (infinite ohms)	ungrounded	do nothing
	short (1 ohm or less)	grounded	cut R17
EGT	open (infinite ohms)	ungrounded	do nothing
	short (1 ohm or less)	grounded	cut R20

Our TC (thermocouple) sensors have long enough leads to reach the monitor or multiplex switch without adding any additional leads. When installing multiple TCs, soldering TC wires to the switch is difficult as the TC lead materials just don't take solder well. The extra heat may also cause the switch contacts to lose their "spring". We recommend ending all the TC leads about six or eight inches short of the multiplex switch. It is OK to shorten the leads. That is why we supply the shrink tubing and label separately so they can be applied over the probable "sticky" ends of the shield that needs trimming back when shortening the leads. We also supply two pair of male/female quick-connects with each TC. Crimp these onto the TC leads, using a male for all the positive leads and a female for all the negative leads. Then use 8" pieces of standard twisted pair wire (shielding not necessary here) soldered to the switch lugs per the instructions that come with the switch. Bundle all the CHT leads together (marked such as C4, for CHT # 4 cylinder), cut to length so the bundle ends about 6" from the switch, and install corresponding male/female crimp terminals that will properly match the TCs crimp terminals. It is easier to solder the standard wires to the switch and form a harness before installing the switch. If a TC ever needs replacing, you can just unplug it. Be sure to label all switch wires and ends of TC leads so number one cylinder TC gets connected to the number one wire harness on the switch.

Since TC operation is dependent on measuring very small voltages, they are the most prone to interference from noise sources, possible causing the readings to jump around rather than being steady. Since the TC leads are already shielded with the outer stainless steel braid, and grounded at the engine, the shield does not need to be connected to anything where it ends at the monitor or switch. A shield is pretty good at stopping noise from getting into the interior wires when the source of the noise is airborne radio frequency, but is totally vulnerable to noise being injected by magnetic coupling. This is when shielded cable runs alongside (basically touching) other cables carrying noisy magnetic fields from P leads, alternator, strobe, magnetos etc. Thermocouple leads are definitely leads that you would prefer to have pass through the firewall in their own opening, not combined with high current cables.

EGT Thermocouple - All standard aircraft EGT thermocouples are type 'K' (which means cromel-alumel wires) and will function properly with the FMONITOR. RMI's EGT sensors follow industry standard wire marking colors for type 'K' which is yellow for positive and red for negative. There are exceptions to the standard colors so if it is certain that the thermocouple is type 'K', hook the sensor up, heat it up, and observe

the reading on the monitor display. If the reading is zero the sensor is connected backwards. If the reading is room temperature and increases when warmed, it is connected properly. If you have a sensitive voltmeter (digital) you can heat the thermocouple and measure the voltage. Swap the voltmeter leads if the reading is negative. When the reading is positive, the black (negative) lead of the voltmeter is the one connected to the negative thermocouple lead.

The ideal distance down the exhaust tubes to install the EGT thermocouples is 2-4 inches. Keep all the distances the same if installing multiple EGTs.

CHT Thermocouple - All standard aircraft CHT thermocouples are type 'J' (which means iron-constantan) and will function properly with the FMONITOR. RMI's CHT sensors follow industry standard wire marking colors for type 'J' which is white for positive and red for negative. As with EGT thermocouples, the colors may vary with different suppliers. Testing for polarity for proper connection of type 'J' thermocouples with other than standard colors is the same as for EGT thermocouples. CHT is displayed in ten degree increments, so a match may be needed to warm the sensor enough to change the reading.

NOTE: If you have a thermocouple that you are not sure of the type, connect a sensitive (digital) voltmeter to the thermocouple. With the tip of the thermocouple in boiling water and the room temperature about 25EC, measure the voltage using the lowest scale on the voltmeter. Use the following table to determine the type of thermocouple:

4.0mv = J 3.1mv = K 4.8mv = E

Special Function Alarms - In addition to switch activation of the special function alarms, a low logic TTL (or CMOS with 5v max high) signal referenced to either signal ground or aircraft ground may also be used.

Fuel Flow Sensor - The FloScan 201B sensor should be mounted with the connection wires pointing up (keeps air from getting trapped) and avoiding (as much as possible) valves or sharp elbows next to the sensor inlet. The following is from the application notes provided with the 200 series fuel flow sensors:

1. A screen or filter should be installed upstream of the flow sensor to screen out debris which could affect rotor movement or settle in V-bearings. As turbulence upstream of the sensor affects its performance there should be a reasonable length of straight line between the sensor inlet and the first valve, elbow, or other turbulence producing device.

2. Install flow sensor with wire leads pointed UP to vent bubbles and insure that rotor is totally immersed in liquid. For maximum accuracy at low flow rates the sensor should be mounted on a horizontal surface.

3. Use only 1/4 NPT fittings. Do not exceed two full turns past hand tight, or 15 ft. Lbs torque (180 inch lbs.) WHICHEVER HAPPENS FIRST. FloScan will not warranty cracked castings caused by incorrect fittings or assembling them beyond specified depth.

The output of the sensor should go only to the engine. Bypasses around the sensor with check valves can affect the accuracy if the check valve is allowing fuel to leak through in either direction. The FloScan specs indicate that the pressure drop across the sensor is .6 psi at 15 GPH even with the turbine rotor blocked and not turning.

There is a paragraph on the FloScan spec sheet that the 201 series are for fuel injected engines only and to order a different model for carbureted engines where the flow to the engine is erratic. We use the 201 series anyway (so does everyone else) because the non 201 series have never been STC'd. When calculating the fuel flow the FMONITOR averages the fuel pulses over six seconds to compensate for the bursts of fuel to the carburetor.

Carburetor Temp Sensor

Marvel Schebler and Bendix furnishes some carburetors provided with a threaded brass plug in a 1/4x28 tapped hole instead of filling this drill-access hole with a lead plug. The following steps install the sensor in these carburetors.

__ 1. Unscrew threaded plug.

__ 2. Apply thread lubricant to the threads of the sensor, install the toothed lock washer over the threads and screw the sensor into hole. Tighten.

If your carburetor does not have a factory drilled, tapped and spot-faced hole you will need to perform the following steps using precautions to make sure that the sensor does not interfere with the normal operation of the carburetor during all ground and flight operations.

Adjacent to the butterfly valve in all Marvel-Schebler Ma2, MA3, MA4, Ma4-5 and Bendix NA-S3B and NA-S3A1 series carburetors is a lead plug that fills the access hole through which the idler jets were drilled on the far side of the carburetor barrel. This lead plug fills a stepped hole in the aluminum casting. The wall of the carburetor is approximately 1/4" thick at the boss where this lead plug is inserted. The following instructions describe a procedure in which this plug is removed, the hole enlarged and threaded so that the carburetor temperature sensor can be mounted at a point adjacent to the butterfly valve where it will accurately measure the temperature of the fuel-air mixture.

__ 1. Remove carburetor from engine.

In the following drilling, counter boring and tapping steps it helps to put an appropriately sized amount of putty inside the carburetor over the inner end of the lead plug to keep metal chips out of the carburetor. If the tool does not go through the putty the problem of removing chips is simplified.

__ 2. Support the carburetor firmly under a drill press, and drill out the lead plug with a 7/32" tap drill. Drill slowly or limit the drill travel so the drill does not break through and plunge into the valve.

__ 3. Use a 1/2" counter bore with a 7/32" pilot to lightly create a flat surface at the outside of the hole. The function of the flat, which should be square with the hole, is to provide a locking surface for the

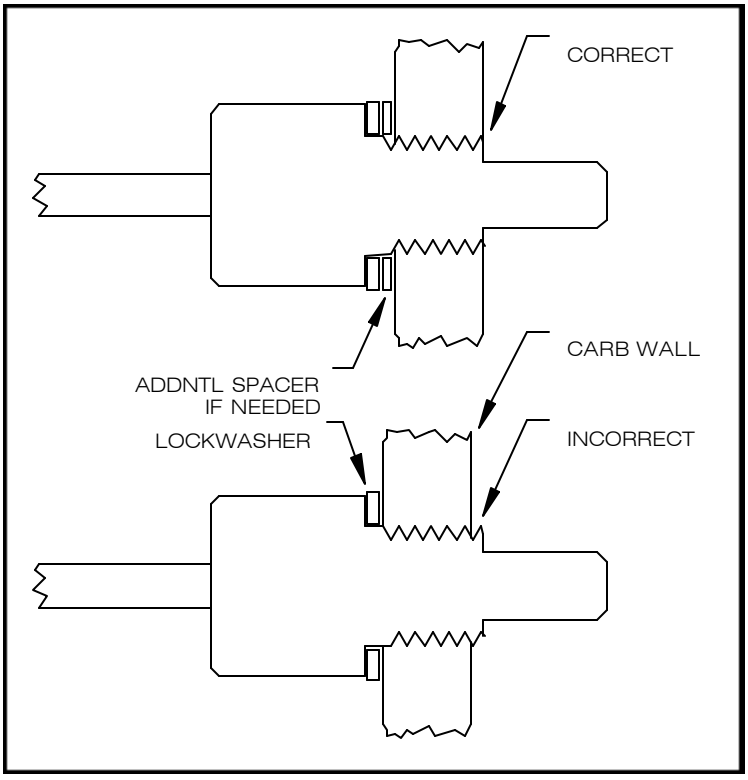


Figure 2 Temperature sensor in wall of carburetor, showing lock washer or lock washer/spacer controlling depth of sensor tip.

toothed lock-washer between the carburetor and the sensor.

__ 4. Lubricate a 1/4x28 tap and tap out the hole.

__ 5. Carefully remove all chips and metal shavings from the inside of the carburetor.

__ 6. Apply thread lubricant to threaded portion of the carburetor temperature sensor.

__ 7. Screw the sensor with lock-washer into the hole and note whether a portion of the threaded length protrudes into the inner barrel of the carburetor as shown in **Figure 2**. Note the approximate error if any.

__ 8. If so, remove the sensor, and select a combination of washers which will make the small diameter end of the probe start flush with the wall of the inner barrel of the carburetor. There must always be one lock-washer next to the hex of the sensor. There must never be two washers next to each other or two lock-washers next to each other. Allowable combinations are:

sensor/lock-washer
sensor/lock-washer/washer
sensor/lock-washer/washer/lock-washer

If the sensor does not reach all the way into the carburetor barrel, using just a single lock-washer, the counter bore can be used again to reduce the thickness of the casting slightly at the outside of the hole.

Fuel Pressure Sensor - Marked with 0-2 bar on the hex. If at all possible install the sensor with the inlet pointing down... the inlet hole of the sensor is very small and mounting the sensor with the inlet pointing up may allow contamination to settle in and block the hole. It is best to isolate the sensor from engine vibration by using a standard aircraft hose from the engine to the sensor. The hose can be tie-wrapped to a support structure so the sensor is supported by only the hose and isolated from vibration.

Oil Pressure Sensor - Marked with 0-10 bar on the hex. Install like the fuel pressure sensor.

Audio - The audio output is capacitive coupled and referenced to aircraft ground. The output is designed to directly power the headset and there is an internal volume control. You may try to connect to AUX inputs on some radios or intercoms, but may find that the extra amplification of some equipment will bring out low-level noise.

Clock Power - This connection should go directly to the positive of the aircraft battery without benefit of a switch (anywhere on the hot side of the master switch). This power connection will maintain the GMT and LMT internal clock in the FMONITOR when the aircraft is shut down. Current drain is negligible (less than .001 amps) and the input to the FMONITOR is current limited to 1 milliamp so a fuse is not required, but it may be prudent to place one near the source. Removal of the aircraft battery will necessitate resetting the clock.

Internal Backlighting Power - The FMONITOR does not have provision for external dimming of the backlighting.

Molex Connector Assembly

Use a crimping tool (Molex #6115 or #1921, Radio Shack #276-1595 or other universal open barrel crimp tool), and follow it's instructions for installation of the crimp terminals to the wires for connection to the connector. The crimp terminals are for a range of wire sizes from 18 to 24 gage. Avoid soldering the terminals to the wires, as the heat will cause loss of spring temper, resulting in a weak connection between the terminal and the gold edge connector when the monitor is plugged in..

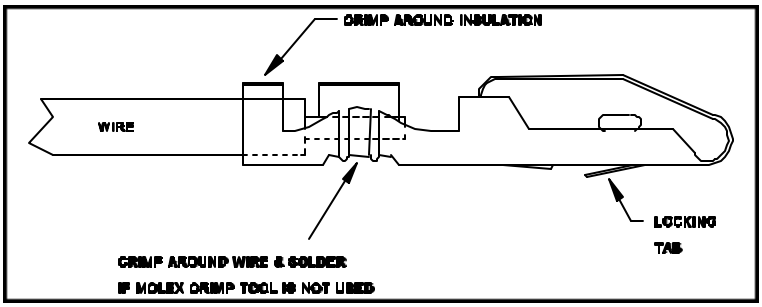


Figure 3 Crimp contact terminal detail.

Strip length for each wire is 5/32 inch

__ 1. After the contact terminals have been installed on the wiring harness, the contact terminals can be inserted into the proper location in the connector housing (see Figures). The terminal cannot be inserted upside down. Be sure to push the terminal all the way in until a click can be felt or heard. Gently pull on the wire to assure that the terminal is locked in. If a terminal needs to be removed from the connector housing and a Molex extractor tool is not available, insert a thin narrow blade (a flattened wire or paper clip) into the housing (from the opposite side of the wire) between the crimp terminal and the housing to release the locking tab while gently pulling on the wire. See **Figure 3** to locate the locking tab on the crimp terminal. When making the removal tool, be sure that the height of the tool is slightly taller than the opening, and has a square nose.

__ 2. Connect aircraft power through a 3 to 5 amp circuit breaker.

__ 3. Connect edge connector numbers 17 and/or 18 to aircraft ground. The two are connected internally so either or both may be used.

__ 4. Install the connector housing from the inside of the mounting tray with two #4-40 x 7/16 pan-head screws. Make **CERTAIN** that the polarizing key in the connector is next to the narrow space between the connector and the wall of the mounting tray.

__ 5. Install the unit in the mounting tray. Turn the retaining screw clockwise until the top of the unit meets the top of the mounting tray. Do not over tighten.

Magneto Hookup

The FMONITOR determines the engine RPM by measuring the time between ignition pulses. The connection is made at the 'P' lead on the magnetos. Be certain to connect the .01 FFD capacitors directly to the 'P' lead on each magneto. This capacitor is to allow the FMONITOR circuit to detect the ignition pulses while allowing normal magneto operation even in the event the lead to the FMONITOR is accidentally grounded. Connecting the two pulses together into one wire to the FMONITOR allows rpm to be read during a magneto check. The capacitors again allow normal magneto operation. The connections can also be made at the magneto switch instead of directly to the magnetos.

__ 1. Crimp and solder a proper size ring terminal to one end of each capacitor. Plan ahead to install shrink tubing over the capacitor and leads and connectors to each end of the capacitors.

__ 2. Attach the capacitors to the 'P' leads (or matching connections at the magneto switch) and connect as shown in the Figures.

The FMONITOR input for RPM is designed for magneto connection. A circuit change as outlined in the assembly manual adapts the unit for a Hall effect magnetic pickup of a crankshaft (or equivalent) mounted magnet. If you are going to use an electronic ignition please check with us after determining the type and voltage of the pulse that can be picked off the electronic ignition. The circuitry is versatile enough that together we can probably work out your RPM connection to other than the standard devices.

The software measuring the RPM is expecting 2 pulses per revolution for a 4 cylinder engine. If a Hall effect device is used or an electronic ignition is used that produces only one pulse per revolution, you must program the FMONITOR accordingly or the RPM will read half the proper amount (see Programming Special Functions in the operations manual).

Multiple Cylinders for EGT & CHT

To add multiple cylinder readout for EGT and/or CHT requires the installation of an external switch. Refer to the multiple EGT/CHT schematic **Figure 4**.

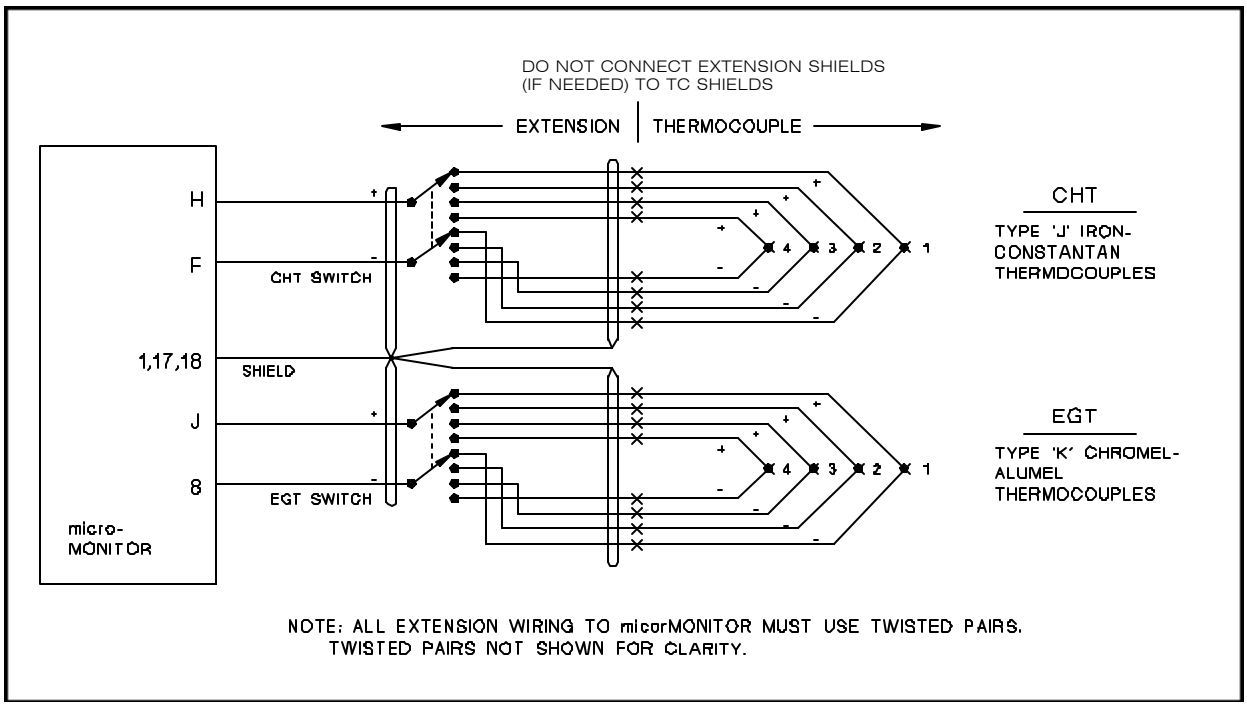


Figure 4 Multiple EGT/CHT wiring. Shielded cables of twisted pair wires are used to reduce RFI/EMI**.**

A double pole switch is needed to multiplex each individual function and the number of positions determine how many cylinders can be switched. If only EGT or CHT is to be multiplexed, a double pole switch with the number of cylinders positions is needed. If both EGT and CHT are to multiplexed with one switch, two double pole switches with the number of cylinders positions is needed.

Suitable Switches for Multi EGT/CHT - CENTRALAB PSA-211 or C&K A206-15-N/or/S-Z-B/or/Q with stop ring. Both are double pole 2 to 6 position adjustable 4/6 cylinder for both CHT and EGT switching.

A thermocouple generates a voltage that is dependent on temperature. The voltage generated is a result of two dissimilar metals being joined. The voltage depends on the types of metals used and the temperature of the junction. The voltage is very repeatable for each type of thermocouple.

Because of the way thermocouples work, the absolute accuracy of the FMONITOR is not only dependent on the accuracy of the internal amplifier but to a larger part on the wiring between the thermocouple measuring junction and the instrument. Each joining of wires to wires or wires to terminals creates another thermocouple voltage that adds to or subtracts from the measuring junction voltage, which can create an error. When using thermocouples for measurement of temperatures with the µMonitor, standard aircraft hookup wire can be used between the 'x' points in **Figure 4** and the instrument without serious loss of accuracy. Just remember to keep everything identical on both leads. In other words, don't use a copper wire on one of the leads and a plated wire on the other (can't happen when using recommended twisted pair wire). The same goes for any connectors used also. The connections on either side should be kept at the same temperature.

Harness Connections Table

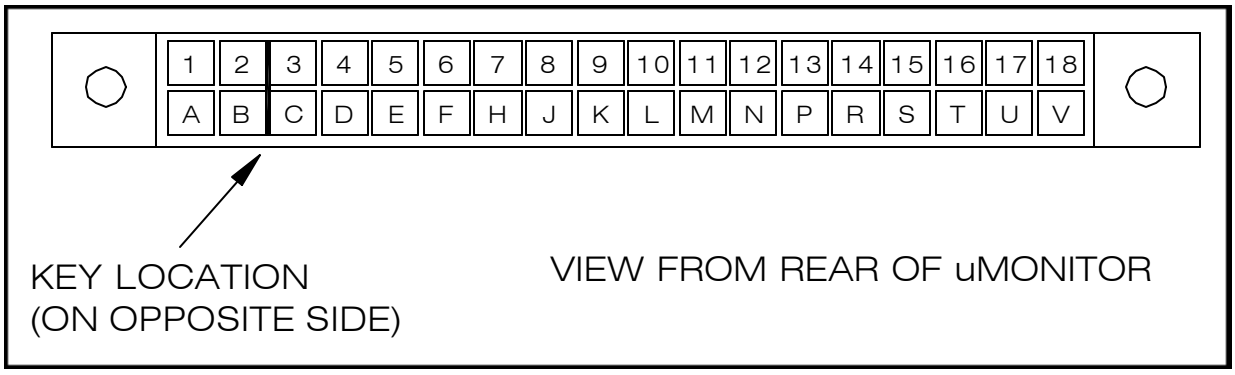


Figure 5 Connector numbering as viewed from the back of the uMonitor.

1 OPTIONAL ACFT GND
2 ALARM -
3 FUEL FLOW
4 HEADSET AUDIO
5 USER ALM #2
6 COMM (UNUSED)
7 NOT CONNECTED
8 EGT -
9 MANIFOLD INHG
10 AMMETER
11 OIL TEMP
12 OUTSIDE TEMP
13 FUEL PRESSURE
14 SIGNAL GND
15 CLOCK POWER
16 +10V (ALM, AMP+
OIL TEMP,
OAT, FUEL+)
17,18 ACFT GND

A BACKLIGHT +
B NOT USED
C MAGNETO
D USER ALM #1
E USER ALM #3
F CHT -
H CHT +
J EGT +
K NOT CONNECTED
L NOT CONNECTED
M NOT CONNECTED
N NOT CONNECTED
P OIL PRESSURE
R NOT CONNECTED
S CARB TEMP
T 5.12V (MAP+)
U EXT BATTERY
V ACFT POWER

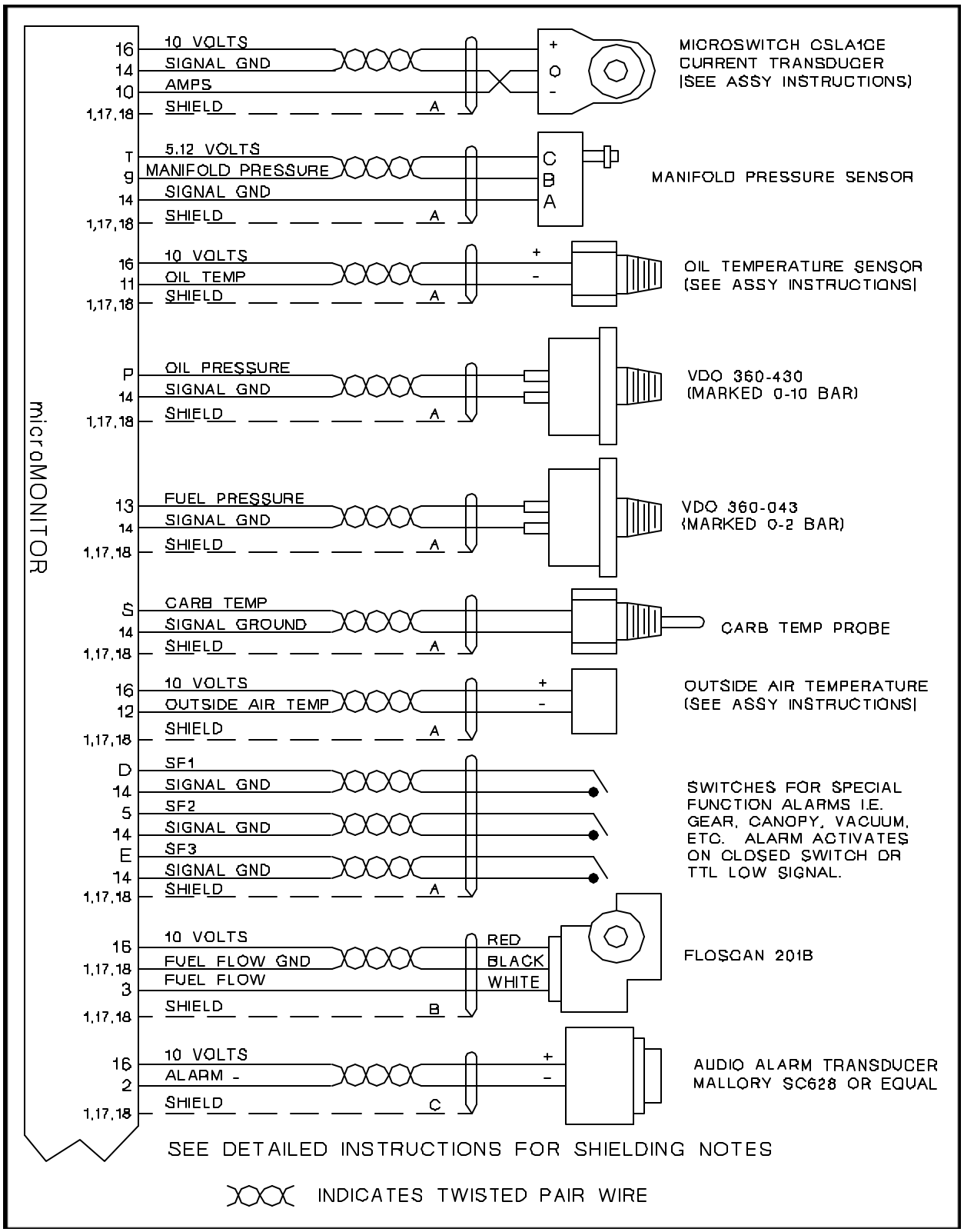


Figure 6 Partial wiring schematic #1.

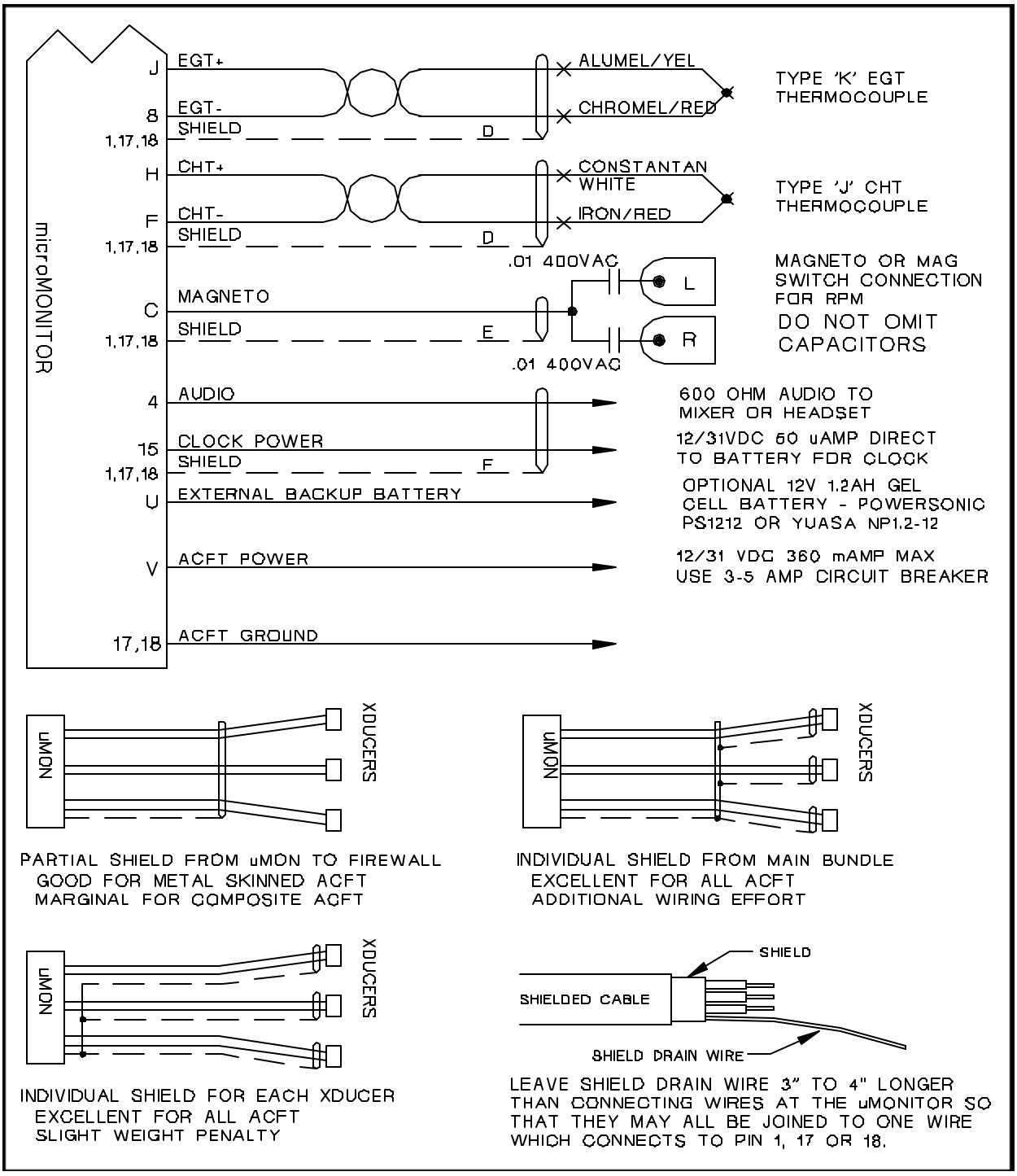


Figure 7 Partial wiring schematic #2. Note maximum use of shielded cables and twisted pair wires in the cables. Connecting like wires such as signal ground at a remote location and running a single return to the µMonitor is not recommended.

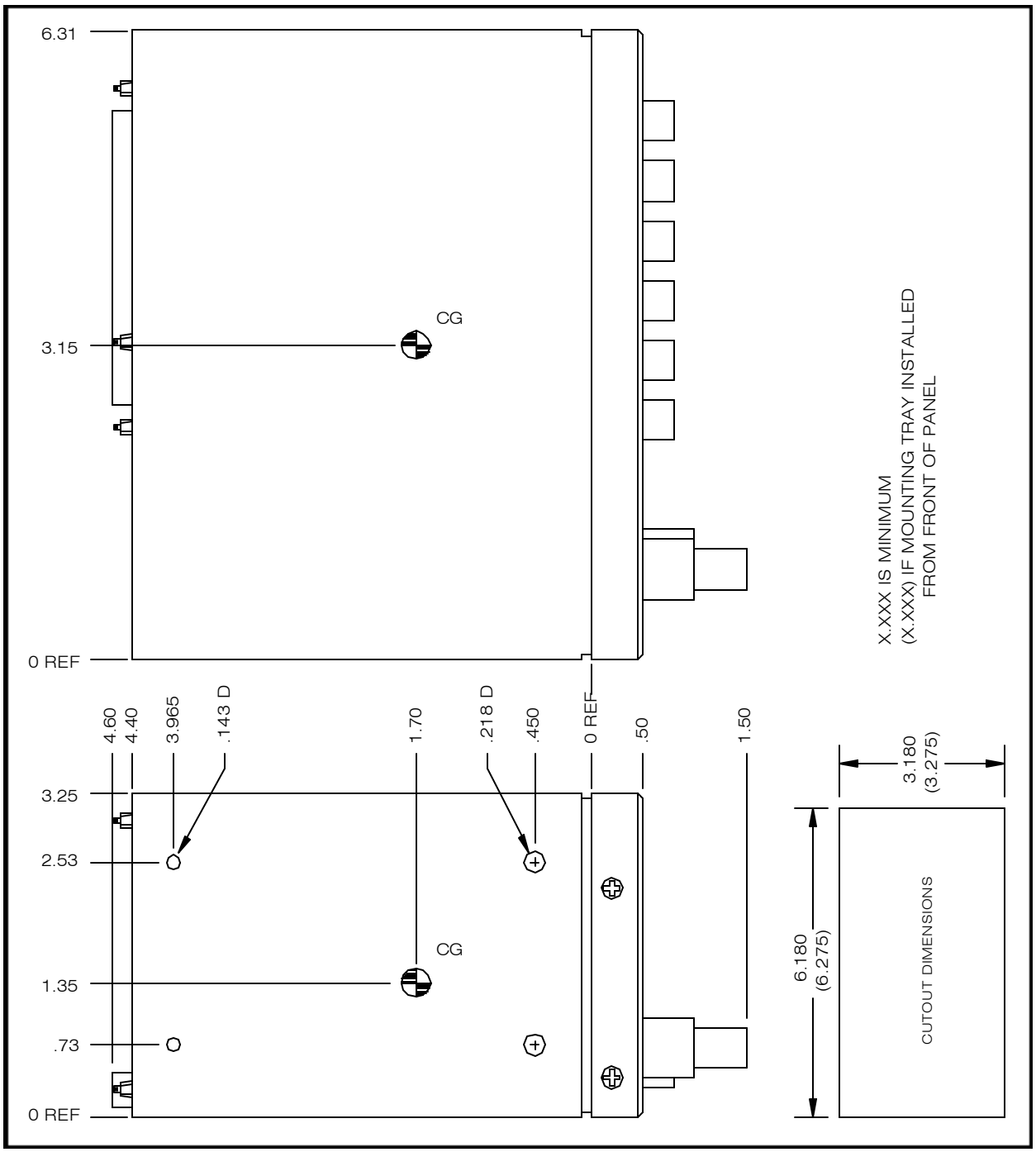


Figure 8 Mounting/cutout dimensions.

Appendix A - Source list for optional sensors and parts

Alternate CHT Sensor

Washer type (under spark plug) - MFR is Westach (Westberg)

#712-4W, 14mm ring size
#712-5W, 18mm ring size
#712-8W, 12mm ring size
#712-9W, 10mm ring size

Westberg Mfg., Inc. - 707-938-2121
Wicks - 800-221-9425
Aircraft Spruce - 800-824-1930

Water Coolant Temperature Sensor - H_2O temperature into CHT position on display

3 inch long adjustable-depth thermocouple for insertion into water jacket through a 1/8 inch NPT or 1/4 inch NPT adapter (compression type fitting, install adapter, insert thermocouple to desired depth and tighten nut).

TJ36-ICSS-18G-3, about $40 - 36 is inches of lead provided, change if necessary
BRLK-18-18 adapter with 1/8 inch NPT, about $5
BRLK-18-14 adapter with 1/4 inch NPT, about $5

OR:

TC-J-NPT-G-72, about $40 - 1/4 NPT with 72 inch lead
OMEGA - 800-826-6342

Backup Battery

PowerSonic PS1212 12 volt 1.2 amp-hour gel-cel
Yuasa NP1.2-12 12 volt 1.2 amp-hour gel-cel
Local Motorcycle Shop
Mouser Electronics - 800-346-6873, part number 547-PS-1212, about $18

Pressure Switches for user alarms

A pressure switch can be used to activate any one of the three user alarms on the FMonitor to warn of low water pressure, low vacuum etc.

World Magnetics - 616-946-3800 for catalog

Sources of electronic parts, including other items (like wire marking) for the rest of your airplane:

Digikey @ 800-344-4539 to request catalog, www.digikey.com for catalog & ordering.
OK crimp terminal tool for all open-barrel terminals - #WM9900, $14
Mouser @ 800-346-6873 to request catalog, www.mouser.com for catalog & ordering.
Radio Shack or other local electronics store, for some items.

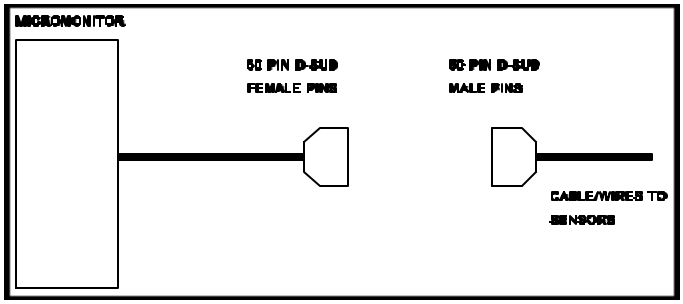
Best tool catalog:

Jensen @ 800-426-1194 to request catalog or place orders
Good quality crimp tool - #600-200, IDEAL, frame only, $39.95
Red, blue, yellow dies, 26-16 AWG - #600-214, $19.95
Uninsulated open-barrel dies, 22-12 AWG, #600-019, $19.95 (RMI stuff)
RG58,59 coax dies, #600-201, $19.95
Another, higher quality tool is Jensen 100 series crimp tool and dies - get catalog

Appendix B - Optional Wire Harness

If you check the installation manual schematics you will see that there are many sensors that use the same connector on the back of the FMONITOR. As an example, both oil pressure and fuel pressure (plus others) have a connection to signal ground but there is only one signal ground connection on the mounting tray connector. Trying to tie all these together at the connector can create a rats-nest of wires.

One of our customers came up with an idea of using a 50 pin D-SUB connector to make the transition between the monitor and the sensors as shown in the drawing at right.



A single cable, preferably, or multiple cables connect the monitor to the female D-sub connector, with one wire to each connector of the monitor. If only one cable is used, it should have an overall shield with the shield wire connected to one of the monitor grounds (pins 1, 17 or 18). Multiple signal wires such as +10 volts, signal ground etc. are then jumpered together in the female connector only.

The opposite male connector would then have connections for each 10 volt signal, signal ground etc. The wires exiting the male connector will more than likely be multiple cables with shields because not all of the sensors are located in the same place.

The table on the next page is only one way that the connections can be made. The table is laid out in the same orientation as a 50 pin D-sub, with the number at the left in each cell of the table representing the actual pin number of the D-sub connector. The number at the right of each cell in parentheses is the connection number/letter on the back of the monitor mounting tray. The 50 pin D-sub has three rows, with the two outside rows having 17 pins and the middle row having 16. Both the male and female D-subs must have the same layout as shown in the table. If you alter the table layout, then both male and female connectors must have the same changed layout. Note that the two connectors have a mirror image in their pin numbering, so be sure to use the actual numbers that are marked on each connector.

The suggested layout tries to keep the multiple signals together as much as possible to make it easier to jumper from one pin to another. A heavy border surrounds a group of pins that all apply to an individual sensor. As an example, pins 18, 34, 35, and 36 are for the three wires and shield for the manifold pressure sensor.

One possible connection layout

1	External Light Power	(A)	18	Shield	(17)	34	5.12 volts	(T)
2	Fuel Flow	(3)	19	Shield/FF Gnd	(17)	35	Manifold Pressure	(9)
3	10 volts	(16)	20	Shield	(17)	36	Signal Ground	(14)
4	10 volts	(16)	21	Shield	(17)	37	Oil Temperature	(11)
5	10 volts	(16)	22	Shield	(17)	38	Outside Air Temp.	(12)
6	10 volts	(16)	23	Shield	(17)	39	Alarm Sounder	(2)
7	10 volts	(16)	24	Shield	(17)	40	Ammeter	(10)
8	Tachometer/Magneto	(C)	25	Shield	(17)	41	Signal Ground	(14)
9	Oil Pressure	(P)	26	Shield	(17)	42	Signal Ground	(14)
10	Fuel Pressure	(13)	27	Shield	(17)	43	Signal Ground	(14)
11	Carb Temperature	(S)	28	Shield	(17)	44	Signal Ground	(14)
12	SF1	(D)	29	Shield	(17)	45	Signal Ground	(14)
13	SF2	(5)	30	Shield	(17)	46	Headset Audio	(4)
14	SF3	(E)	31	Shield	(17)	47	Clock Power	(15)
15	EGT +	(J)	32	Shield	(17)	48	EGT -	(8)
16	CHT +	(H)	33	Shield	(17)	49	CHT -	(F)
17	Acft. Ground	(18)				50	Acft. Power	(V)

Above parts from Digikey (www.digikey.com) – 1-800-344-4539

Qty.	Part	Desc	Comment
1	A2037	50 pin male housing	Sensor side
1	A2041	50 pin female housing	Monitor side
50	A1029	Solder cup socket for female	Minimum quantity
50	A1679	Crimp pin for male	Minimum quantity
2	A2075	Shields for housings	
1	A1010	Insertion/extraction tool	Optional