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NOTE TO THE INSTALLER

The µMONITOR 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, electrical characteristics and, most important, installation procedures for the µMONITOR engine monitor. Programming details that complement the installation are contained in the µMONITOR Programming manual.

Description

The µMONITOR is a microprocessor controlled engine monitor for all aircraft engines. The Greek symbol µ (mu) is used to represent the word micro in electronics. µMONITOR is pronounced micro-monitor.

The µMONITOR, 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. For full details, refer to the µMONITOR operation manual in this same booklet.

The µMONITOR 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. Before installing an optional backup battery, you should note that the current drain of the unit is low, about 150ma (.15 amps). Since the µMONITOR will sound an alarm if the alternator fails, allowing you to immediately take steps to conserve the battery, with such low current drain you would probably not even consider shutting the unit off even without the backup battery.

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 µAMP @12/24VDC

Audio output:	200mw into 600 ohm load @max volume
Operating temperature:	-15 to 50°C (-45 to 65°C 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 liquid crystal display is designed for maximum contrast when the pilot's eyes are above an imaginary line drawn perpendicular into the display of the unit and if at all possible, within 30° of either side of the perpendicular. Ideal is 5° to 15° above the perpendicular.

_ 2. Avoid mounting the µMONITOR 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 µMONITOR is installed in the tray. It controls the amount of clearance between the edge connector of the µMONITOR 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.

_ 3. 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 µMONITOR and the mounting tray sides. The beveled sides of the mounting screw and the corresponding beveled sides of the screw mounting hole will easily allow the thin mounting tray material to form a countersink.

_ 4. 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 AWG 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** AWG wire if a commercial crimp tool is used (see Figure 5). Avoid soldering the crimp terminals as the heat may destroy their spring temper, resulting in 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 µMONITOR. The shields should initially only be grounded at the end near the µMONITOR.

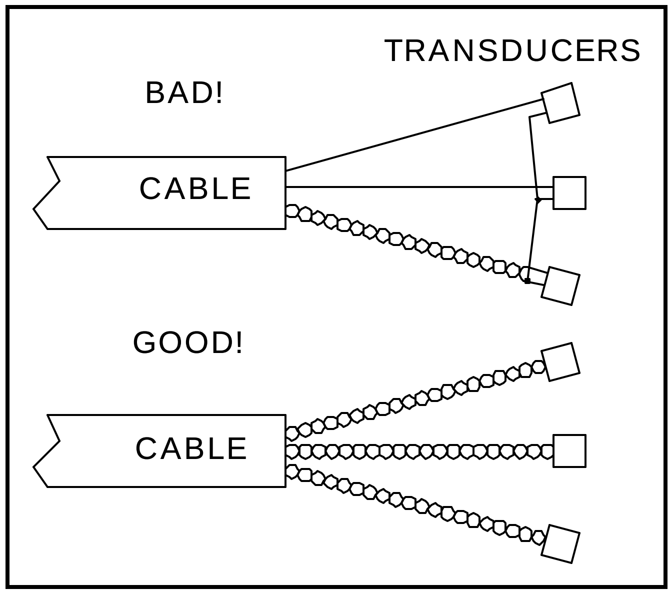


Figure 1 How to construct an unwanted loop antenna.

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 µMONITOR to the sensors. The ultimate method of making all the wiring connections is by using a RM-1B Wiring Harness Expander made by Vx Aviation at www3.telus.net/aviation/vx.

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 ammeter assembly measures the current flow in a wire that is passed through the center hole of the sensor assembly. Using a shielded wire to carry current through the sensor will not affect the operation of the sensor, as shielding will not stop a magnetic field.

Install the three supplied box-type crimp terminals on the wires you are using, and install into the connector housing using Figure 2 for polarity. If you are using a twisted-pair, shielded cable, connect the shield to minus and the other two wires for plus and output. Note the wire colors used in your notes before installing the supplied heat-shrink tubing over the connector and wires.

The index/lock pin will only take so many bends before the pin will fail, so leave the pin straight until you have finished testing for proper operation.

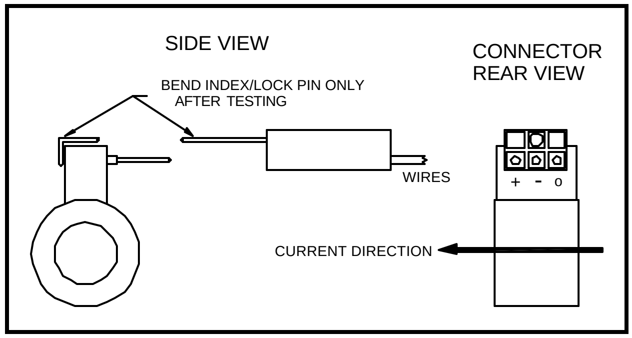


Figure 2 Ammeter sensor and connector.

For orientation, the arrow in the figure 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 µMONITOR is reading negative during engine operation, turn the sensor around on the wire. Two small tie wraps around the current carrying wire on both sides of the sensor will keep the sensor from traveling down the wire. 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 µMONITOR EGT and CHT measuring circuits have been designed to work with both types of thermocouples, but not a mixture of the two. If you will be using all grounded thermocouples, one of the resistors in the µMONITOR 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 µMONITOR, 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 µMONITOR 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 µMONITOR 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 µMONITOR. 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 µMONITOR 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 µMONITOR. 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.

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 25°C, 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

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.

4. Do not use Teflon tape. Though fuel-tight, Teflon tape can also allow copious amounts of air to be drawn in under partial vacuum. These air leaks are not large enough to affect engine performance but will cause high, and/or erratic fuel flow readings.

5. Do use pipe thread sealants such as Jomar Teflon/Seal or Locktite PST. They are a combination sealant and lubricant. They not only lubricate during assembly allowing for a tight fit, but also seal any leakage paths.

6. 37° HC, & AN flare fittings, and 45° SAE flare fittings have a tendency to leak at their mating surfaces. Just like threaded fittings, they can be tight enough to hold fuel in but still allow air to be drawn into the system under partial vacuum. The fluid power industry routinely uses copper conical sealing washers, "Connie Seals" to prevent high-pressure leaks on flared fittings. They work equally well

on low-pressure fuel systems and can be purchased from any hydraulic supply house as AP 50 fitting seals.

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 µMONITOR 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

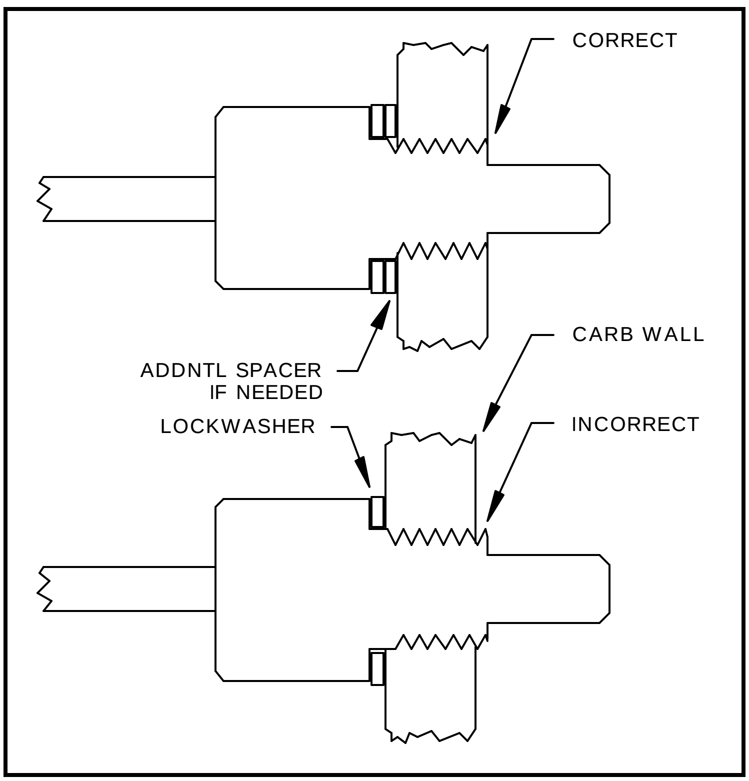


Figure 3 Temperature sensor in wall of carburetor, showing lock washer or lock washer/spacer controlling depth of sensor tip.

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 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 3. 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, Low Range - 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.

Fuel Pressure Sensor, High Range - Marked with 0-10 bar on the hex. Follow the installation directions as for the low range sensor. When using this sensor for fuel pressure, the computer calculation constants must be changed as per the **Formula Menu** section of the programming manual.

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

Outside Air Temperature Sensor - Figure 4 shows the AD590 temperature transducer. When handling the transducer, be sure to observe reasonable static protection precautions.

Prepare one end of a proper length of twisted pair, shielded cable as follows:

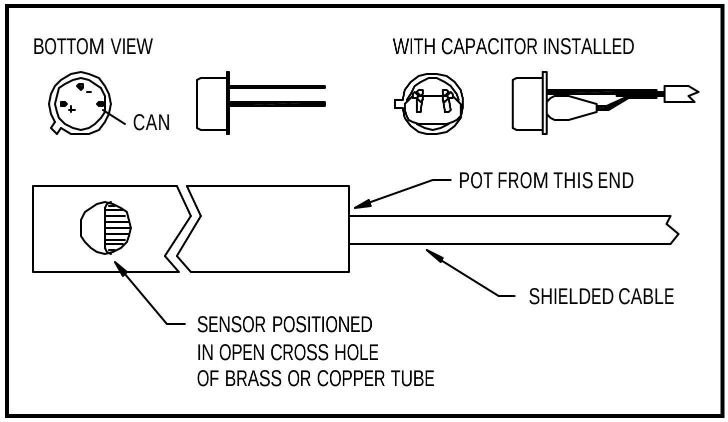


Figure 4 Outside air temperature sensor details. Bottom of figure is one possible OAT probe.

__ 1. Remove the outer insulation for 1 inch (don’t cut shield wires!). If the shield on the cable is a braided one, use a needle or sharp tool to unbraid the shield wires, gather about a third of the shield wires and twist them into a wire and fold it out of the way and gather the remaining shield wires and cut them completely off. If the shield on the cable is a foil type, just bend the bare drain wire (touches the foil shield) out of the way.

__ 2. Strip 3/16 inch from each of the twisted pair wires. Heat your solder iron, apply a small blob of solder to the tip and “tin” each of the bare leads. This keeps the stranded wire together and makes it easier to solder the lead to the sensor later.

__ 3. Cut two 1/2 inch pieces of the small shrink tubing and slide one over each insulated wire. You may want to wrap a temporary piece of electrical tape around the assembly to hold the shrink tubing so that they won’t keep falling off during assembly and soldering.

__ 4. Cut a 1-1/2 length of the large shrink tubing and slip over the entire cable for later use.

__ 5. Locate the temperature sensor (marked AD590) and the .01µFD ceramic capacitor (marked 103) from the black anti-static box. Use the figure to identify the lead marked “CAN” and bend it about 45° out of the way. Trim the capacitor leads to about 3/8 inch long. Position and hold the capacitor as shown in the figure and then trim the “+” and “–” leads off so the ends of the sensor leads match the ends of the capacitor leads.

__ 6. Hold the capacitor and sensor in one hand so that the end of a capacitor lead and the end of a sensor lead are touching. Melt a small blob of solder on the tip of your solder iron to and temporarily solder tack the two leads together. Now that the assembly is better held together, position and solder the other capacitor and sensor lead together.

__ 7. Lightly clamp the previously prepared cable in a vise so the black and white wires are in a position to solder the sensor assembly to them.

__ 8. Overlap the “+” lead of the joined capacitor and sensor with the lighter colored wire and with your free hand apply the solder iron with a little solder on the tip to the junction. Make sure you have a good joint. Repeat with the “–”lead and the darker wire.

__ 9. Slip the two small shrink tubes down over the two completed joints and shrink into place.

__ 10. Overlap the twisted shield wire with the “CAN” lead from the sensor and trim the shield wire so the overlap will be about 1/4 inch. Solder the shield and “CAN” lead.

__ 11. Slide the large shrink tube up until it touches the back of the AD590. Shrink into place. This completes the attachment of the AD590 sensor to the wire cable.

__ 12. You may wish to test the sensor before potting and installing by cutting the cable to length and temporarily attaching the wires to the edge connector housing. Mark the lighter colored wire with a "+" to later identify the positive lead. Reverse connection of the sensor will not damage the sensor.

Since the variety of possible installation locations is so large, a specific design can not be given, but the following points are universal:

- If the metal case of the transducer itself is not exposed to the outside air, the thermal connection between the transducer and the probe material that is exposed to the air should be metal to metal with little if any insulating adhesives etc. between them.

- The mass of the probe material should be small as possible. The intent of this and the previous instruction is to minimize the time for the transducer to respond to a change in temperature.

- Use minimum solder heat when connecting the leads to the wiring harness. Cover the finished joints with shrink tubing and mark both ends of the wires with the proper polarity.

- Minimize the strain placed on the leads entering the transducer. If the transducer can be inserted into a probe far enough, pot the wires with RTV cement or similar compounds.

- Direct moisture contact between the two leads (on bare wires) will affect the accuracy of the temperature readout.

- It is OK to clip off the little polarity tab with diagonal cutters if necessary.

Oil Temperature Sensor - The AD590 temperature sensor used for oil temperature is the same as that used for outside air temperature above.

__ 1. Repeat the Outside Air Temperature Sensor instructions through step 12.

The completed sensor/cable assembly must be potted into a proper fitting for the engine used. A "plug" of the proper thread for your engine is modified to hold the sensor. If the engine already has a different type of sensor installed, or the blank plug is not installed, you may get a blank from the engine manufacturer. It has also been reported that a common automobile oil drain plug works well. The engine manufacturer's blank is brass and the automobile type is steel. You may also use a 1/4 or 3/8 inch pipe thread plug if that will work with your engine. George Orndorf at (940) 648-0841 can provide a brass, one-piece (5/8-18 thread) housing that reaches the oil stream for $12.00 plus shipping (fits all Lycomings and Continentals).

__ 2. Determine the proper plug for your engine oil temperature connection. Drill a 15/64 (.234) diameter hole from the outside face of the plug toward the tip. Leave approximately .100 of material between the bottom of the hole and the bottom of the plug. If you have the capability of going in with an end mill to leave a flat bottom, that would be better.

__ 3. Clean the pipe plug and insert the probe assembly into the hole. Fixture the cable to hold the transducer firmly against the bottom of the brass plug and fill the cavity with RTV sealant. The transducer should not lift off the bottom. The intent is to provide maximum thermal contact between the transducer and the housing. If the plug has a flat bottom, a **light** coat of contact cement to both transducer and plug bottom will hold the transducer down while filling the cavity.

__ 4. Let the RTV set overnight.

Variations may be made on the above to suit your engine installation as long as the principle is the same.

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.

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.

Aircraft Power

An ideal circuit breaker size is 3 amps. If the installation also includes the RMI µENCODER, both units SHOULD NOT be on the same breaker, as the µENCODER does not have a power switch, and must be powered down when µMONITOR software upgrades are loaded through the serial port.

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 internal clock/calendar in the µMONITOR when the aircraft is shut down. Current drain is negligible (less than .001 amps) and the input to the µMONITOR 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 µMONITOR 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 µMONITOR is plugged in.

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 Figure 11). 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

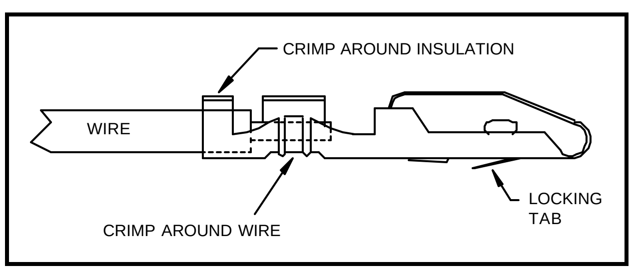


Figure 5 Crimp contact terminal detail.

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 5 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 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 µMONITOR 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 µFD capacitors directly to the "P" lead on each magneto. This capacitor is to allow the µMONITOR circuit to detect the ignition pulses while allowing normal magneto operation even in the event the lead to the µMONITOR is accidentally grounded. Connecting the two pulses together into one wire to the µMONITOR allows rpm to be read during a magneto check. The capacitors again allow normal magneto operation. The connections can also be made where the "P" leads connect at the magneto switch instead of directly to the magnetos.

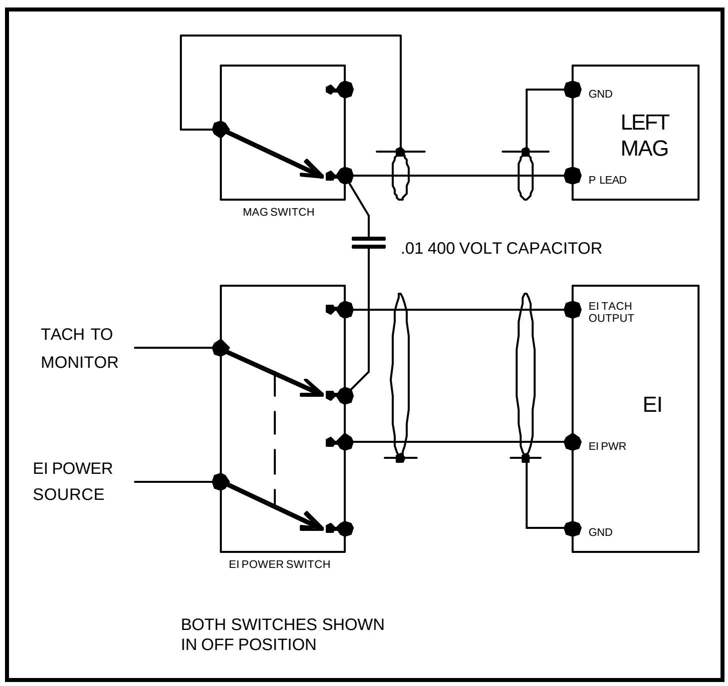


Figure 6 Using two toggle switches to control the tachometer signals from one electronic ignition and one magneto

_ 1. Crimp 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 Figure 13.

Although the µMONITOR input for RPM is designed for magneto connection, it can also connect to all aftermarket electronic ignition systems that have a digital tachometer output signal/pulse.

For two EI systems, follow the same “Y” connection as for magnetos, but WITHOUT the capacitors. Check with the EI manufacturer to see if connection of both EIs tach outputs to each other will cause damage to the tach output circuits. You may have to install isolating diodes if this is the case.

For installations using one electronic ignition system and one magneto, there are two options. The first is to connect the EI tach output signal directly to the µMONITOR, and make no connection to the magneto. The only drawback to this method is losing the RPM on the µMONITOR when you switch to the magneto during engine run-up. The second option is to use toggle switches to control the EI and magneto instead of the standard magneto key-switch. If using a single-pole double-throw switch to control the EI on/off, then change to a double-pole, double-throw switch. One pole is still for the EI on/off. The other pole switches the tachometer input signal for the µMONITOR. The common terminal of the tachometer pole of the EI switch goes to the µMONITOR magneto input. The switch able terminal that matches the ON position of the EI should be connected to the EI tachometer output. The switch able terminal that matches the OFF position of the EI connects to the "P" lead of the magneto THROUGH a .001 400 volt capacitor (two supplied with µMONITOR). If the EI is off, the magneto pulse goes to the µMONITOR and if the EI is on, the magneto signal is disconnected and the EI tachometer signal is connected to the µMONITOR. Be sure to use non-shorting (break before make) switches.

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 below.

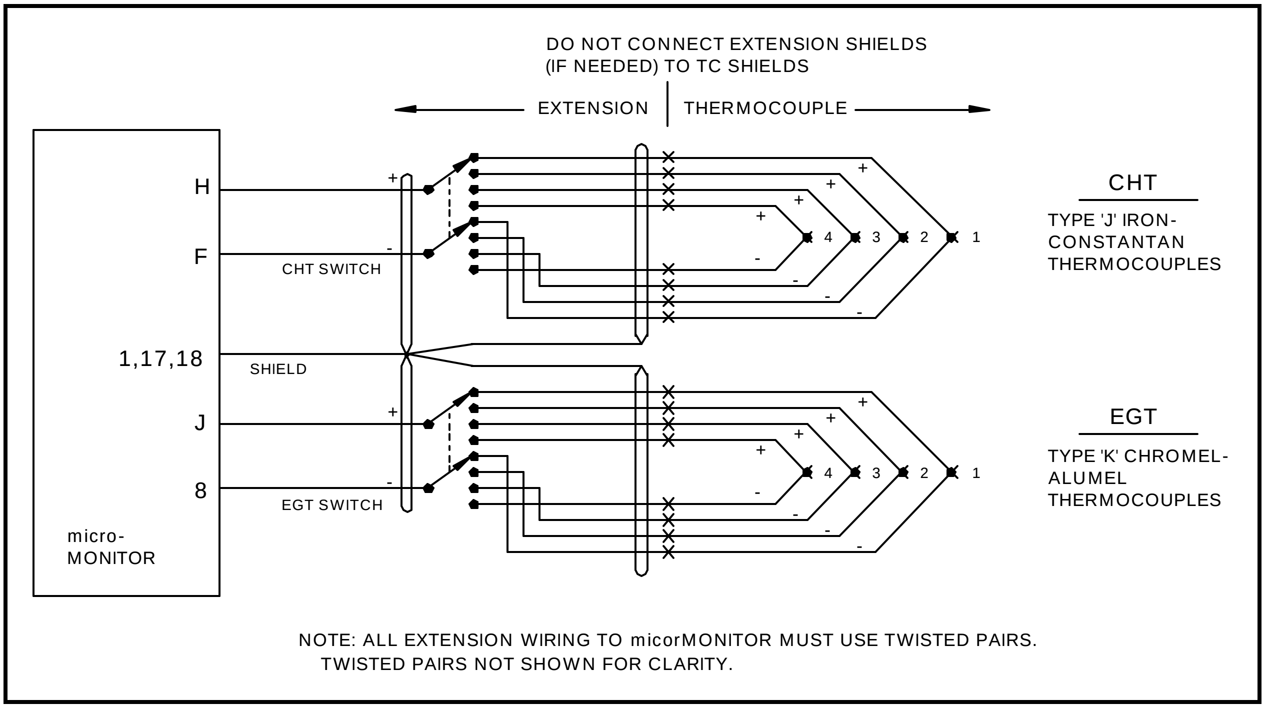


Figure 7 Multiple EGT/CHT wiring. Shielded cables of twisted pair wires are used to reduce RFI/EMI.

A double pole switch is needed to multiplex each individual function and the number of switch 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 be 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 µMONITOR 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 7 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.

RS232 Data Port Jack

The µMONITOR has a multiple use serial port (RS232) for communication with other instruments or peripherals. The input of the serial port can only be connected to a RMI µENCODER to receive air data information such as altitudes, airspeeds and compass headings, among others. The µMONITOR then adds fuel information to the airdata and this combined information is then passed on through the output of the serial port to a GPS or other instrument.

The data port jack is in parallel with the µMONITOR's serial port to provide outside access to a laptop or PC to allow the engine log memory to be downloaded (using a supplied PC/laptop-to-jack adapter cable), or to allow software upgrades to be uploaded to the µMONITOR. See the programming manual for detailed information.

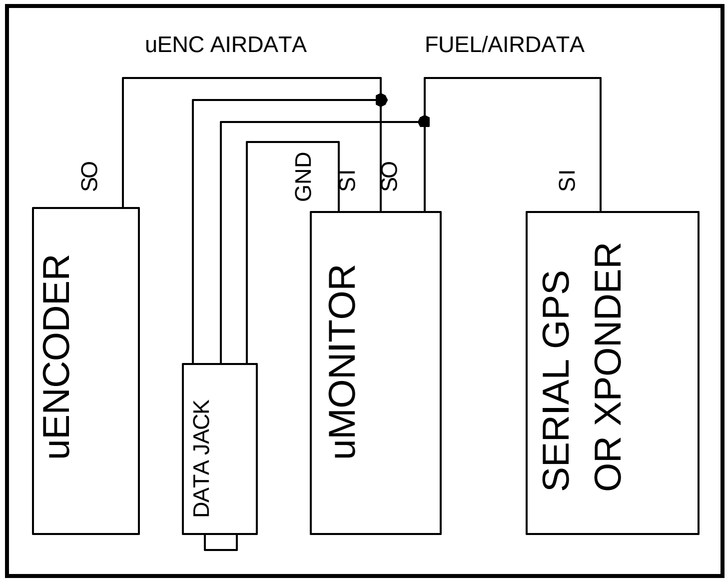


Figure 8 Data port connections in relation to other serial port equipment.

Install the data port jack in the instrument panel as close as possible to the µMONITOR.

Data port jack assembly. Refer to wiring schematic.

1. Trim 3/8" of white outer jacket insulation from supplied cable.
2. Use sharp tool to unbraid shield.
3. Twist about ¼ of the shield wires into a ground wire and trim off the remaining.
4. Cut newly formed shield wire to 1/4 inch overall length.
5. Strip about 1/8 inch off the black and white wires.
6. Solder white wire to #1 terminal on jack.
7. Solder black wire to #2 terminal on jack.
8. Solder shield wire to large, remaining terminal on jack.
9. Slip heat shrink tubing supplied over assembly. Shrink tubing should cover about half of the metal part of the jack. Shrink the tubing.

RS232 Adapter Cable Construction

The RS232 adapter cable enables connection from the RS232 data port jack and a laptop or PC serial port to allow log memory data downloads and upload of new µMONITOR software.

The wiring schematic is shown in Figure 9. Using RMI supplied serial cable and phone plug, details are as follows:

____ 1. Use a box-cutter or Xacto knife to remove ½" of insulation from the end of the cable. Carefully score around the cable and keep bending the wire to break open the outer jacket. You may have to lightly press the sharp tool in thicker spots. The idea is to get to the inner wires without harming the inner wire insulation or the wires themselves.

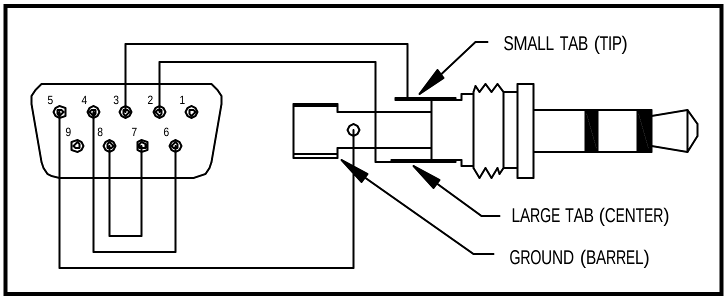


Figure 9 Adapter cable wiring schematic. Shorting 4 &6 and 7 & 8 are done at the end of the cable since the plug is molded.

IMPORTANT! Although we purchase the cables from the same vendor, we have found that the colors of the inner wires can be different. Mark the box below that matches the colors of your cable:

- ❑ My cable has a violet wire, but no white wire.
- ❑ My cable has a white wire, but no violet wire.

Before performing the following steps, mark either the top or bottom box in the following pairs of boxes, to match which box is marked above. When you get to the boxed steps, follow the one that is marked and ignore the unmarked box.

____ 2. Gather up all of the bare drain wires and cut off as short as possible as these are not used.

____ 3. ❑ Cut off the black and the grey wires as short as possible.
❑ Cut off the black and the white wires as short as possible.

____ 4. Gather the orange and green wires next to each other and cut them both back ¼".
❑ Repeat with the blue and violet wires.
❑ Repeat with the blue and grey wires.

____ 5. Use the box cutter to bevel the end of the cable insulation to make it easier to later install the phone plug spring without catching the square edges of the cable insulation.

____ 6. Disassemble the phone plug into three parts, noting the orientation of how the parts are joined. Discard the clear plastic insulator if found.

Refer to Figure 10 for the following steps. Some of the following is easier if a friend helps.

____ 7. IMPORTANT! Slide the knurled plug body over the cable, NON-THREADED end first.

____ 8. Install the spring on the cable, slender end first, until the cable insulation is even or slightly protrudes from the flared end. It helps to use a little liquid lubrication (no oil) and to screw the spring and cable (while pushing) in the same direction as putting a screw and nut together.

If you do not have the proper stripping tools to strip all the wires, use the solder iron tip to burn a line around the wires and then strip off the remainder of the insulation with your thumbnail and finger. These wires are small, and if you are not careful with normal stripping, you can break so many strands that you would have to start all over.

____ 9. Strip all the wires about 1/8". If you use to solder iron to strip with, make sure that ALL the insulation is removed or it may hamper getting a good solder joint.

____ 10. Lay the orange/green pair next to each other so the bare wires are parallel and touching. Solder the wires. The soldered pair of bare wires should not be overloaded with solder or you will be unable to slip the shrink tubing over the joint.

____ 11. Use the two supplied male RS232 pins plugged into the connector, and your ohmmeter to make sure that pins 4 & 6 show that they are shorted together.

____ 12. ❑ Repeat the solder process with the blue/violet pair and test that pins 7 & 8 are shorted.
❑ Repeat the solder process with the blue/grey pair and test that pins 7 & 8 are shorted.

____ 13. Cut two 3/8" lengths of shrink tubing supplied, slip over each pair and heat to shrink. The completed shrink tubing should not have any wire protruding from the end.

When soldering wires to the three phone plug terminals, the end of the wires should come from the inside to the outside so the solder connection is easier to get to, and the wire bodies are inside the ground tab.

____ 14. Solder the yellow wire to the ground tab of the phone plug.

____ 15. Solder the red wire to the smaller side tab of the phone plug.

____ 16. Solder the brown wire to the larger side tab of the phone plug.

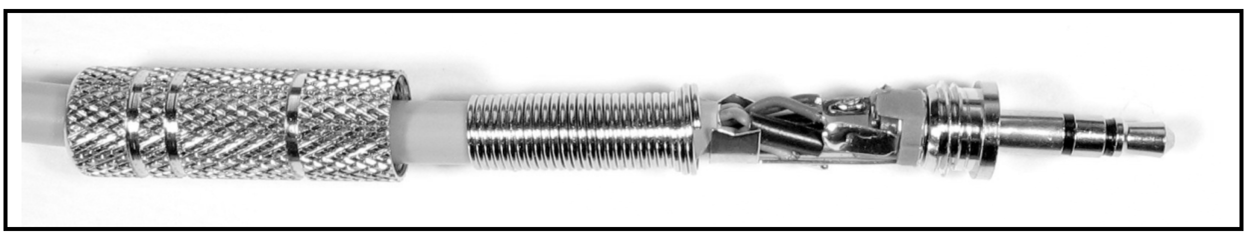


Figure 10 RS232 adapter cable plug before adding the electrical tape.

Make sure all the wires and shrink tubes are inside the side tangs of the ground lug as shown in Figure 10. DO NOT squeeze the ground lug tangs around the wires. The spring will supply all the strain relief needed.

____ 17. Use the male RS232 pins and your ohmmeter to check that pin 3 goes to the tip, pin 2 goes to the center ring, and pin 5 goes to the barrel.

____ 18. Cut a ¾” square of electrical tape and wrap around the wires and solder joints between the back of the threads and the spring. Start the wrap at the ground lug, and make sure the tape will insulate any part of the two side tabs from touching the knurled body of the plug when it is screwed back on.

____ 19. Slide the knurled body over the spring and screw onto the front part of the plug.

Harness Connections Table

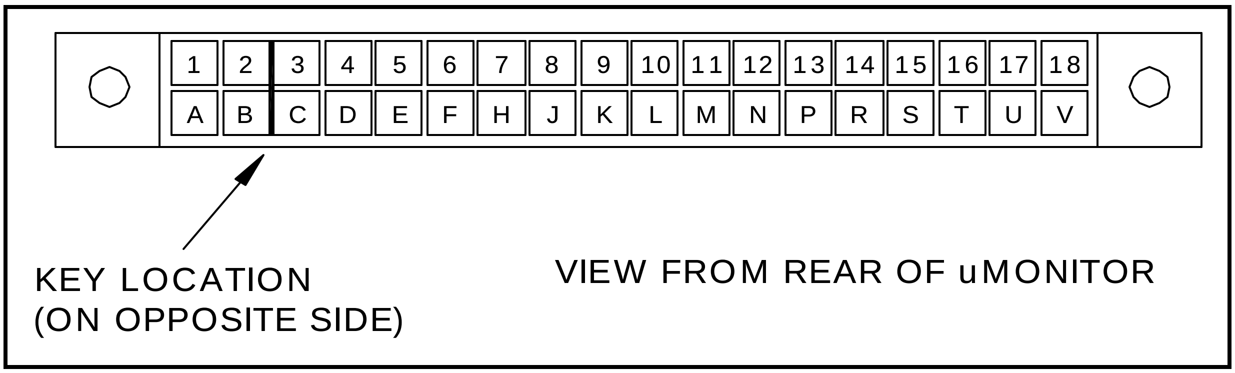


Figure 11 Connector numbering as viewed from the back of the uMonitor.

1 OPTIONAL ACFT GND
2 ALARM -
3 FUEL FLOW
4 HEADSET AUDIO
5 USER ALM #2
6 NOT CONNECTED
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 SI (RS232 IN)
M SO (RS232 OUT)
N NOT CONNECTED
P OIL PRESSURE
R NOT CONNECTED
S CARB TEMP
T 5.12V (MAP+)
U EXT BATTERY
V ACFT POWER

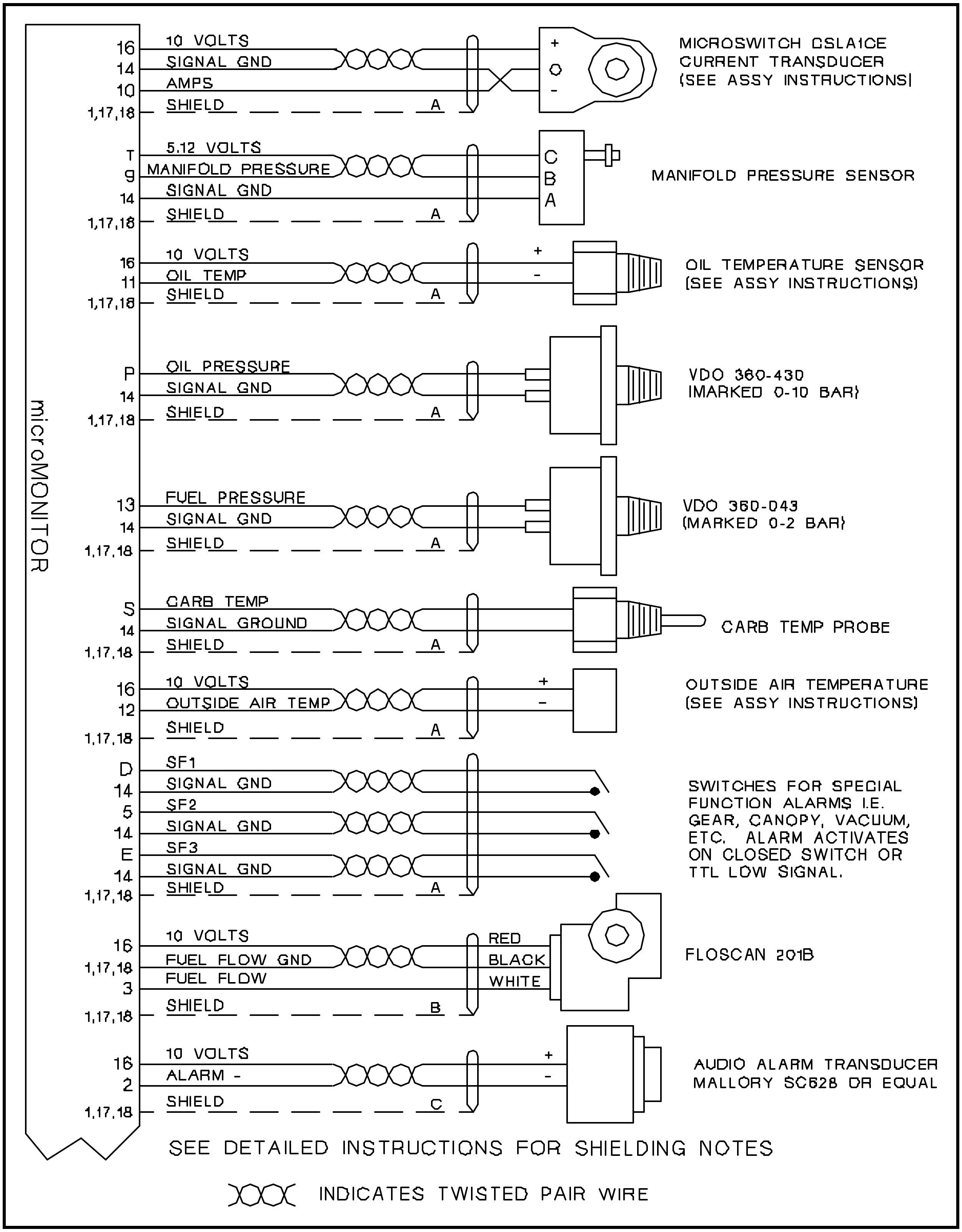


Figure 12 Partial wiring schematic #1.

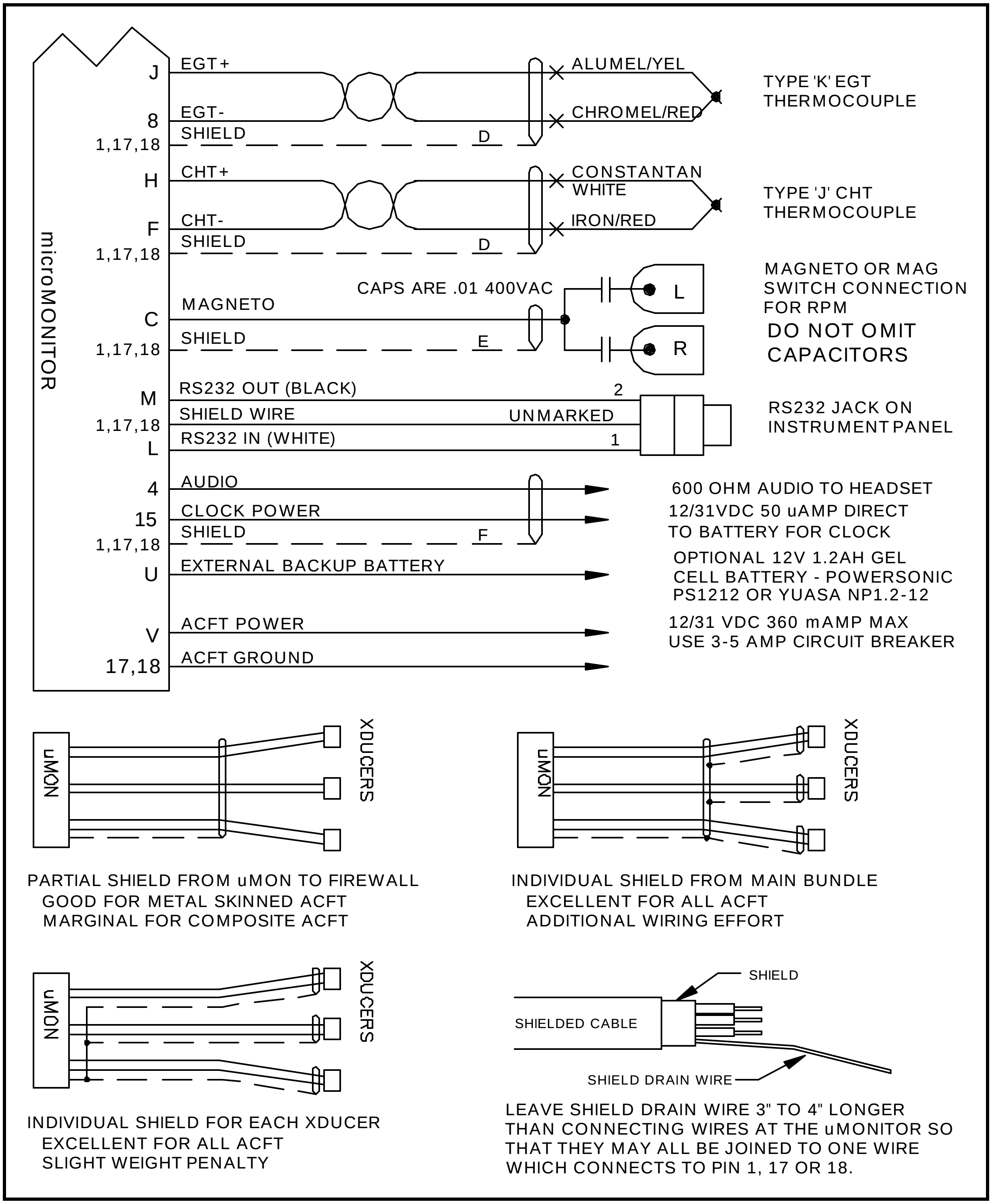


Figure 13 Partial wiring schematic #2. Note maximum use of shielded cables and twisted pair wires in the cables. Connecting like wires such as signal ground at a remote location and running a single return to the µMONITOR is not recommended.

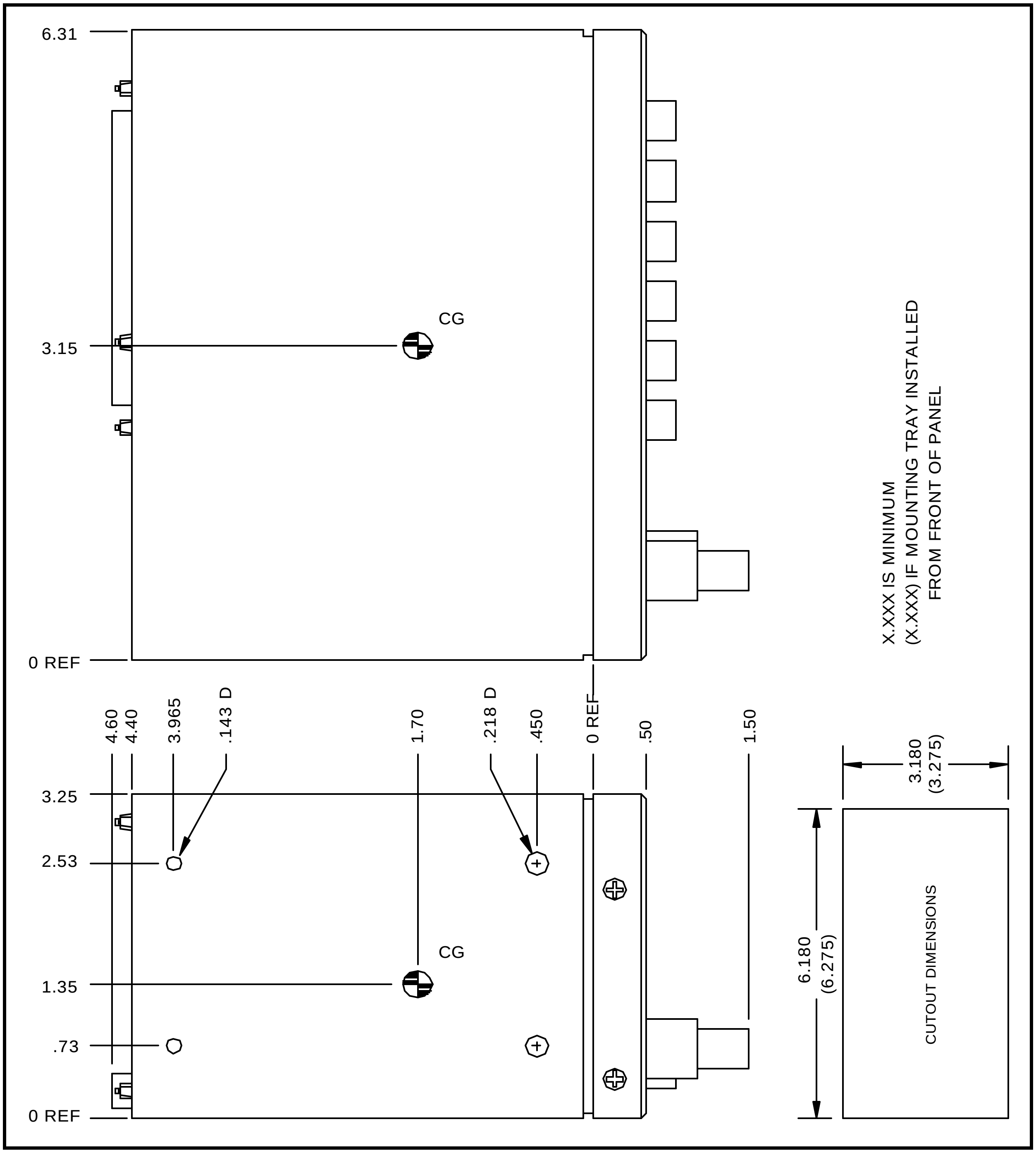


Figure 14 Mounting/cutout dimensions.

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

Alternate EGT sensor for Rotax 914
  Threaded type for 914 exhaust pipes
    #712-4D6K
      Westberg Mfg., Inc (see above)

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 µMONITOR to warn of low water pressure, low vacuum etc.
    World Magnetics - 616-946-3800 for catalog (handled by Digikey below)

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.

Crimper:
  Goodmart @ 877-402-6100 to request catalog or place orders (www.goodmart.com)
    Good quality crimp tool - #30-506, IDEAL, frame only for interchangeable dies,, $43
      Red, blue, yellow crimp dies, 22-10 AWG - #30-579, $26
      Uninsulated open-barrel crimp dies, 39-18 AWG, #30-599, $26 (RMI stuff)

RG58,59 coax crimp dies, #30-598, $26

Many more die sets for frame… see website.

Appendix B – Wiring Harness Expander

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 µMONITOR. 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.

A customer designed a PC board expander that attaches to the back of the µMONITOR, changing the edge connector into a couple of D-Sub type connectors that gives each wire its own terminal. The customer makes and sells the expander to others through Vx Aviation.

The 15 pin connector is for power, audio, clock power and other connections that usually originate from inside the cockpit while the 50 pin connector is for sensors that are firewall-forward.

Additional over-voltage protection is also built-in to the assembly.

The RMI edge connector is replaced with a solder pin connector that joins the expander PC board assembly.

The assembly is anchored by drilling two holes through the back of the RMI mounting tray.

For complete details:
www3.telus.net/aviation/vx

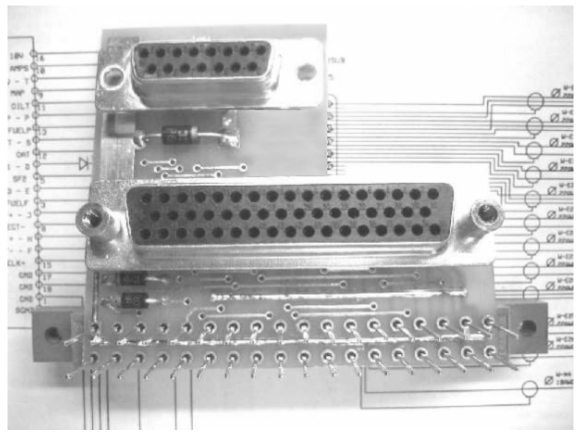
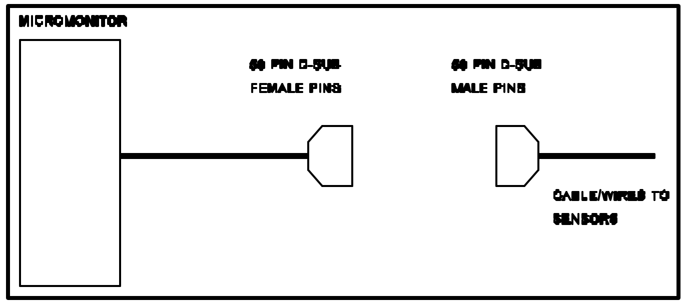


Figure 15 Vx Avitation's wiring harness expander.

Appendix C – Home-made Wire Harness

One of our customers came up with an idea of using a 50 pin D-SUB connector to make the transition between the µMONITOR 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	µMONITOR 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

Appendix D – Troubleshooting Guide

WHAT DO I CHECK BEFORE FIRST STARTING THE ENGINE?

A common-sense check of the monitor's readings before engine start will go a long way in preventing after-start "why doesn't that look right?" problems. If everything is in the ballpark before engine start, it most likely will be OK. The calibration routine outlined in the programming manual will not correct for sensors that have been incorrectly wired or aren't connected. With no calibration, all the readings should be in the ballpark. These readings should be:

MAP - usually an inch or two less than 29.9 InHg, DEPENDING on your altitude. A quick check is to crank your altimeter so it reads 000 feet and read the barometric window. That, rounded to the nearest tenth, is what your MAP should read. If the MAP reads 3.1 InHg, there is something misconnected, and no amount of calibration will fix it.

EGT, CHT, OAT, Oil temp and carburetor temp - All should be IN THE NEIGHBORHOOD of ambient. They never do read identically because of different cooling rates of different parts of the aircraft. The OAT and oil temp are guaranteed to be within 5 degrees even without calibration.

AMPS - Should read zero before engine start (assuming it is located on the alternator output cable).

OIL & FUEL pressure - Should be within plus or minus 2 before calibration to zero. See other parts of this troubleshooting guide for details on how to troubleshoot an individual function.

HOW DO I TROBLE_SHOOT MY FUEL FLOW SENSOR?

To test the sensor, connect your voltmeter common lead (black) to engine ground somewhere near the fuel flow sensor. With the monitor turned on, measure the voltage at the three leads going to the sensor. Proper voltages are: RED = 10 volts, BLACK = 0 volts and WHITE = 5 volts. If the voltages are proper, and you can pass fuel through the sensor, the WHITE lead voltage should jump around, as each time a paddle goes by the internal photoreceptor, the WHITE voltage goes to zero. If the initial voltages are proper, but the WHITE voltage doesn't change with fuel flowing, the sensor may be plugged or defective.

Especially on new installations, it is not uncommon for debris from the fuel tank/system to block the paddle wheel from turning while still allowing adequate fuel to pass for the engine to function normally. The sensor should be removed and the system flushed and the sensor back flushed with fuel. DO NOT blow through the sensor with compressed air. The fragile turbine will be destroyed.

To confirm your connections, the black lead should show a short between it and engine ground (almost zero ohms). If the white lead is measuring about zero volts, then open the white lead at the junction near the sensor, and measure the volts from engine ground to the end of the wire that connects to the white wire (NOT the sensor white wire itself). If this now reads 5 volts, the sensor would be bad. If it still reads near zero volts, the input circuit(s) may have a short. In this case, check with RMI for directions.

Another cause for failure or intermittent operation after years of use is some lacquer buildup on the internal lens blocking the light from the photo-electrics. Remove the sensor, plug one end and fill with carburetor cleaner, let set 5-15 minutes and pour out. Don't use aerosol cans of carburetor cleaner or your air compressor, as the turbine could be damaged. If that doesn't do the job, it's time for a replacement.

After these tests/remedies the sensor still does not function, and your warranty is still good, we will exchange the sensor. Please exhaust the troubleshooting possibilities before requesting a new sensor under warranty, so we don't end up with a sensor that tests good here but cannot be resold.

WHY DOES THE ??? FUNCTION BLINK ALL THE TIME?

Any time any function on the monitor is out-of-limits (alarm setting) the display will blink. If you have the alarm setting on oil temperature set at 100 degrees and the oil temperature is running at (a safe) 110 degrees, the display will blink. Set the alarm setting (see operation manual) to the proper setting. Before engine start, many functions like oil and fuel pressure will always be below the alarm setting.

MY MONITOR HAS SOME DIGITS FADING ON THE DISPLAY AFTER USE.

Almost always, this is caused by excess flux remaining on the display drive PC board. Almost always, the symptom doesn't show up until months later as the flux becomes a better and better resistor to block the signals from reaching the display.

Everyone cleans the boards, but many end up just smearing the flux around on the board. Using lacquer thinner (fast dry type is best), and holding the board at a 45 degree angle, squirt, spray or pour the thinner across the board so that the thinner CARRIES off the flux. Use about a cup per board. It is more important to just let the thinner do the work than trying to scrub or brush. The thinner will dissolve the flux and, with enough quantity, carry it off. Immediately hit both sides of the board with compressed air (best) or a hair drier. If the board doesn't look squeaky clean, repeat.

There is nothing on the display board that the solvent will hurt. If you decide to also clean the other boards, be sure to keep the solvent away from the yellow and gray or white pushbuttons and from going into the back of the pushbutton switches where it removes the special lubricant. Also make sure to flush out the inside of the CPU/Main female, edge-board connector so the flux doesn't cause connection problems there.

Refer to the Faceplate Assembly section of the assembly manual before removing the display driver PC board if you need a reminder of where things go.

Our experience is that lacquer thinner is much better than the spray can flux removers that you can buy at places like Radio Shack. Cheaper too...

HOW DO I TEST MY AMMETER SENSOR/CIRCUIT?

Refer to the ammeter construction drawing in the installation part of this manual to determine the polarity of the wires entering the ammeter sensor connector housing. With the monitor turned on, measure the voltages at the three wires. Connect the common of your voltmeter at engine or battery ground, not the "-" point on the sensor. The "+" should read about 10 volts. The "-" should read zero volts. The "O" should be between 4.5 volts to 5.5 volts. If these are correct, only ammeter calibration using the instructions in the operations manual is needed.

If the "-" is not zero volts, then the lead is not properly connected at the monitor. If the "+" is not about 10 volts, then the 10 volts is not connected correctly at the monitor, or it is inadvertently being shorted to a ground/shield wire somewhere. In the latter case, oil temp and OAT would not be working either. If the "-" and "+" are OK, but the "O" is not, THEN open the "O" wire to the sensor and again measure the "O" voltage AT THE SENSOR. If it is now correct, then the wire is connected incorrectly and it is causing the reading in error. If the "+" and "-" are correct and the "O" reading AT THE SENSOR is not within the 4.5 to 5.5 volt range (WITH THE "O" LEAD STILL OPEN), the sensor is bad (rare!).

HOW DO I TEST MY OIL PRESSURE, FUEL PRESSURE and CARBURETOR TEMPERATURE?

All three of these circuits can be tested the same, as the sensors are all resistive. They are also not polarized, so cannot be connected backwards. NOTE that if the sensor IS NOT CONNECTED, it will read the maximum that the monitor will allow. This is 99 for oil and fuel pressure, and 200F for carburetor temperature.

A quick way to see if the sensor is OK, and wired properly, is to remove the monitor from the tray, and after determining the two terminals (using the connector table... remember it is mirrored when looking from the front) measure the resistance between those two terminals. The oil and fuel pressure should read ABOUT 10 ohms at zero pressure and the carburetor temp should read ABOUT 100 ohms at room temperature. If these readings measure OK but the monitor reading is still maximum for the function you are testing, the most likely problem is that the monitor, when plugged in, is not making contact with the terminals. This could be caused by 1) the crimp terminals were soldered on and not heat-sinked properly, causing the terminals to lose their "spring" (if all the terminals look in a row and have a gap less than the thickness of the PC board plugging into them, this is not the problem) or 2) the monitor is hitting the instrument panel before hitting the front of the mounting tray because the tray is back from the front edge of the instrument panel. If the latter is the case, measure the distance from the front of the instrument panel to the top lip of the mounting tray. Add .050 to that measurement and make two shims that thickness to put behind the black mounting tray connector (loosen the two screws) to move the connector forward.

If all this is good and you're not sure the monitor is working right, you can check the monitor for any of these circuits. Remove the monitor to the workbench. You will need a 12 volt battery. Rig up power to the monitor (even have a friend CAREFULLY hold the wires to the PROPER gold edge pads). With another short piece of wire, SHORT THE PROPER two gold pads together and the monitor should then read the MINIMUM for that function. This is -9 for oil and fuel pressure and -10 for carburetor temperature. IF SO, the monitor is OK.

HOW DO I TTROUBLE-SHOOT MY MANIFOLD PRESSURE?

The order of the connection terminals is A-B-C, with the C terminal closest to the sensor tubing barb, and the A terminal being the farthermost away.

Measure the voltage at each of the three terminal points on the sensor, with the monitor power on. Be sure to connect the voltmeter common (black lead) to engine ground somewhere. The C terminal should read about 5.1 volts. The A terminal should read zero volts (or a few millivolts). The B terminal voltage will depend if the sensor is an older 10-31 InHg sensor, or the newer 10-60 InHg sensor. The older sensor has a black body and a black shell down in the cavity where the terminals are. The newer sensor has a black body and an orange shell in the cavity. The older sensor will read about 4.8 volts and the newer sensor will read about 2.4 volts.

MY EGTs/CHTs READINGS JUMP AROUND WHEN THE ENGINE IS RUNNING.

If either or both thermocouple readings are erratic when the engine is running but are not during testing or when the engine is off, the cause is probably noise induced into the sensor wiring. It is easy for noise to be magnetically coupled to the TC leads if they run alongside something like P-leads, alternator leads, spark leads etc. This would account for OK operation without the engine running. Shielding on the cables won't stop magnetic coupling. Even 2 inches (5 cm) spacing will normally stop this. Another confirmation is if the temperatures stabilize and drop smoothly after the engine is stopped.

I HAVE A NUMBER OF MONITOR FUNCTIONS INTERMITTENT OR ALL OF THE READINGS JUMP AROUND.

Any time one or more functions are erratic, it is a good idea to check that the monitor is making GOOD contact with the crimp terminals at the back of the mounting tray. The back of our black faceplate is supposed to make contact with the top of the mounting tray. If the top lip of the mounting tray is behind the front of the instrument panel, you need to shim the connector at the back of the tray towards the instrument panel so the contacts make better. In fact, EVEN IF the faceplate is hitting the top lip of the tray, it doesn't hurt to add .050 inch shims behind the connector. Make sure to press in on the monitor when tightening the retaining screw.
Another possible cause of poor contact is loss of temper on the crimp terminals if the wires were soldered instead of crimped. You should be able to look at the two rows of terminals in the black housing at the back of the mounting tray and see that they are even and spaced ABOUT 1/32 inch apart. Remember, the PC board that goes into the socket is only 1/16 inch thick.

I'M PRETTY SURE MY MONITOR VOLTMETER FUNCTION IS READING LOW.

The µMONITOR reads the voltage coming into the instrument. If you have a dual bus system on your aircraft with a diode isolating the buses, AND the µMONITOR is powered off the bus being fed with the isolating diode, you will read .8 to 1.0 volts low. That is the normal voltage drop across a diode (the old "no free lunch" axiom). You can measure the bus voltage with a voltmeter and then calibrate the voltage as described in the programming manual.

MY RV'S FUEL PRESSURE DROPS ON CLIMBOUT, THEN COMES BACK UP.

This isn't a monitor fault... it is what is really happening. The pressure is actually low because the mechanical pump is having a hard time keeping up with the engine's demand. If you have installed the .024 orifice in the line leading to the fuel pressure sensor, this hinders the already low pressure reaching the sensor. Drilling the orifice out to at least .062 (1/16 inch) will help. It is also recommended that the boost pump be left on until leveling off. The previous info has been provided by George Orndorf.

MY FUEL FLOW INCREASES WHEN I TURN ON THE BOOST PUMP.

This happens with FACET type pulsing fuel pumps. The problem is an "elastic" fuel system downstream of the sensor, where the fuel flow is backward through the sensor during the "off" part of the boost pump cycle. So the sensor sends a pulse as a paddle wheel spoke passes the optic sensor, then that same spoke may trigger another pulse as the paddle wheel goes backwards.

There is no way to stop this error, with ours or others units, as we all rely on a "pulse" as being fuel used. I suspect that it can be reduced (but not eliminated) by reducing cavitations and vapor bubbles in the downstream portion (see the Ellison website) so there is less backwards flow.

In any event, the boost pump is normally only used during climb out, and the error is on the conservative side, showing more fuel used than actual.

Another solution is to use a non-pulse type fuel pump. One is a Holly "Black Pro-Series" high pressure pump with a regulated 14 psi output, part #510-12-815-1, about $140. It needs a bypass check-valve installed for when the pump is off. Source is JEGS (racing shop) at 800-345-4545. Direct web page is: http://www.jegs.com/cgi-bin/ncommerce3/ProductDisplay?prrfnbr=1497&prmenbr=361.

ALSO, be sure to check that you don't have the fuel flow sensor wiring included in the same wire bundle with the power leads to the fuel pump, as the power surges can be injected into the sensor wires, appearing as extra pulses.

HOW DO I TEST MY OAT & OIL TEMPERATURE?

Both functions use the same integrated circuit type sensor. When the sensor is not connected, connected backwards, or the wiring is "open", the display will read -40. (Connecting the sensor backward will not harm the sensor). If the two wires are shorted together (probably at the sensor assembly) the display will read the maximum 390F. There is no way to test the sensor with a multi-meter. With a voltmeter connected to engine ground, the voltages on the two leads should read 10 volts on one and ABOUT 3 volts on the other (actual volts depends on temperature). Constant erratic readings are most likely caused by an intermittent connection.

Readings that appear normal and then decay, MAY be caused by one of the µMONITOR's internal capacitors being connected backwards. They are tantalum type and are polarized. When connected backwards they slowly break down into a short circuit. For OAT the internal capacitors are C15 and C20. For oil temperature, the capacitors are C14 and C19.

A BAD MAGNETO CAN CAUSE µMONITOR SHUTDOWN? A CUSTOMER’S TALE.:

After level off the monitor sensor readings all scrambled and then went off. The labels all stayed on. When I shut it down and later tried it again, I had the same results so I shut it down for the remainder of the flight.

After checking all connections on the plug in the box to no avail, I did further testing. I started the engine and noticed noise in the head set with the radios off. With the radios on there was also noise. It seemed related to engine RPM. I turned off the alternator and the noise continued. By the way, the Monitor worked normal on battery without the engine running!

During a magneto check, going to left magneto stopped the noise. When I switched to the right magneto, the engine quit!! I changed the coil and capacitor in the magneto and then the engine checked out well with minimum RPM drop, the noise was gone and the monitor worked well.

On the bench the old coil on a Slick magneto had "0" continuity between the in wire and the distributor contact (all wires disconnected). The new magneto coil had a resistance between the same two points. I believe the capacitor was OK, but changed it on GP's advice.

RMI Note: While not tested, we have had enough feedback from customers with SIMILAR experiences to suggest that the µMONITOR can help detect failing magnetos. In those cases, the faulty magneto did not stop the engine, but would indicate that they were failing by causing erratic, noisy reading.

THE MONITOR TAKES 15 TO 30 SECONDS TO START & SOME FUNCTIONS ARE THEN WRONG.

The 10 volt output from pin 16 is shorted to ground or a shield. There is a solid-state fuse inside the unit that takes up to 30 seconds to "open" when the current through it is too high. Once open, the unit operates normally except for the functions that rely on the 10 volts for operation. All of these will read minimum. These "disabled" functions are fuel flow, oil temperature, OAT, amps and MAP (older units only).

MY RPM READINGS ARE ERRATIC.

This is usually caused by noise, either from the magneto itself or the 'P' lead is picking it up somewhere. Be sure to install a noise suppression capacitor on Bendix magnetos (Slicks have a capacitor built-in). Make sure that the leads don't run along or next to heavy current carrying wires. Shielding on the leads will not stop magnetic coupling between wires. Magnetos often get noisy as they are breaking down (close to needing a rebuild). If the RPM is steady on one magneto but erratic on the other, that indication will help in locating the problem.

MY MANIFOLD PRESSURE IS READING SO LOW I CAN'T CALIBRATE IT.

Most likely cause is the sensor is connected improperly. The order of the terminals is A B C, with the C terminal closest to the tubing barb. Unfortunately the sensor is marked on the opposite side from the terminals and aren't visible after mounting.

The voltages, with a voltmeter common (black) lead connected to ENGINE or BUSS ground should read 5.12 volts at C, zero volts at A and B will be either APPROXIMATELY 4.5 volts for an older sensor with an all black cavity around the terminals or APPROXIMATELY 2 volts for the current sensor with a red-orange liner around the terminals.

MY TACH TIME DOESN'T EQUAL MY CLOCK TIME.

Tach time on an engine is based on a "cruise RPM" setting, and is an indication of engine wear. Since an engine will experience more wear while in cruise, as compared to setting on the deck at idle speed, tachometer time uses a ratio to accumulate engine tachometer time. If the cruise RPM is programmed to 2400 in the monitor, at 2400 RPM, the tachometer time will equal "wristwatch" time. If you are setting on the deck idling at 1200 RPM, you would have to set there for two hours of wristwatch time to show one hour of tachometer time.

Note that while the monitor also has a redline alarm setting for an over speed warning, that is different from, and should not be the same value as your cruise RPM setting for tachometer time.

HOW DO I ADJUST THE AUDIO HEADSET VOLUME?

Locate trimpot R50, under the top cover and near the gold edge connectors. Turning the screw clockwise will increase the volume. This multi-turn control is a liner taper rather than audio taper, and there is only about two turns from maximum to minimum volume. Turning the control past the end points will not hurt the control as there is a built-in clutch.