

**ARNAV Systems, Inc.
EMM-35
Supplementary
Installation Guide
Document 570-1080
February 27, 2001**

Prepared By: Delyle Danner
Project Engineer **Date:** 02-27-2001

Approved By: Gary Haupt
Quality Assurance Manager **Date:** 02-27-2001

Approved By: Lynn Johnson
Director of Engineering **Date:** 02-27-2001

Proprietary Notice

The information contained in this document is proprietary to ARNAV Systems, Inc.,
and shall not be reproduced or disclosed in whole or in part
to persons not authorized by ARNAV.

Table Of Contents

1.0 Introduction	3
2.0 Specifications	3
2.1 Physical	3
2.2 Electrical	4
2.3 Environmental.....	4
2.4 Input / Output	4
3.0 Equipment list	5
3.1 Single Engine.....	5
3.2 Twin Engine	5
3.3 Optional Items.....	6
4.0 System description	6
4.1 EMM35.....	6
4.2 Thermocouple Inputs.....	7
4.3 Analog Inputs.....	8
4.4 Counter Inputs.....	8
4.5 Switch Inputs (Ground Sense).....	8
4.6 Enunciator Drive	8
4.7 RS232 Communication.....	9
5.0 Installation details	11
5.1 EMM35.....	11
5.2 Fuel Flow.....	17
5.3 Tachometer.....	19
5.4 Manifold Pressure / Vacuum Pressure.....	21
5.5 Outside Air Temperature.....	23
5.6 EGT/CHT Temperature Probes.....	25
6.0 Installation Testing.....	29
6.1 MFD - EMM35 Communication Verification.....	29
6.2 Sensor Input Verification.....	30

1.0 Introduction

ARNAV's Engine Monitor Module, or EMM35, is the real world data gathering portion of the MFD 5200 EICAS system. It's features and typical uses are:

- 21 channels of analog input - Vacuum, Manifold Pressure, OAT, Engine Temperatures.
- 4 counters - RPM, Fuel flow.
- 8 ground sensing inputs - Gear position indicator, Cowl Flaps, Cabin Door.
- bus voltage and cold junction temperature.
- 8 output enunciator controlled by internal Stored range settings - independent of MFD display.
- 8 output enunciator controlled by programmable engine conditions.
- 2 EMM35's may be daisy-chained together for up to 70 channels of data monitoring and logging.
- Thermocouple preamp model (453-5030) for direct connect of up to 12 type J or K thermocouples.
- Model 453-5020 (without thermocouple preamp), for more channels that do not need signal conditioning.

When the EMM35 is used in conjunction with an MFD 5200 and an ARNAV navigation system, the pilot has the benefit of full visual navigation as well as full EICAS. The combination of the EMM35 and the MFD 5200 will provide many automatic monitoring and alert features that can help extend engine life, and give the pilot more valuable information.

The EMM35 system should be installed in accordance with the instructions and limitations provided by ARNAV Systems, Inc.

Read these instructions thoroughly before installing the EMM35 System.

Perform the installation of the EMM35, its component parts and any other work performed on the airframe during installation in accordance with FAA regulations AC 43.13-1B-2B and all other applicable regulations and manufacturer recommendations.

2.0 Specifications

2.1 Physical

- Height: 1.8" (45.72mm)
- Width: 6.35" (including connectors) (161.29mm)
- Depth: 7.0" (177.8mm)
- Weight: 1.5 LB

2.2 Electrical

- Input Voltage: 10-35 VDC
- Input Power: 2.5 watts
- Circuit Breaker 3 Amp

2.3 Environmental

- Operating Temperature: -45°C to +70°C
- Storage Temperature: -55°C to +80°C
- Operating Altitude: 55,000 feet above sea level

2.4 Input / Output

- 6 Channels of Thermocouple input with Gain of 100 (Use for EGT and TIT) - 0 to 50mv (model 453-5030).
- 6 Channels of Thermocouple input with Gain of 400 (Use for CHT) - 0 to 12.5mv (model 453-5030).
- 9 Channels of Analog input - 0 to 5 Volts DC 10 Bit A/D resolution.
- 1 Channel fixed for measuring Bus Voltage up to 35 Volts DC - .1volt resolution.
- 1 Channel fixed for measuring Cold Junction temperature for thermocouples.
- 2 Channels of un-filtered counter input (Counters 1, and 2) - 8.1 Hz to 3 kHz. - Minimum amplitude 0 to 4.5 volt square wave. Maximum amplitude 0 to 8 volt square wave.
- 2 Channels of filtered counter input (Counters 3 and 4) - 8.1 Hz to 300 Hz. Minimum amplitude 0 to 5 volt square wave. Maximum amplitude 0 to 150 volt peak pulse.
- 1 RS232C serial communication port - 9600 baud, No Parity, 8 Data bits, 1 Stop.
- 16 Enunciator outputs - Current Sink from < 40 Volts at < 100ma.
- 8 Switch inputs - Ground Sense (Connect to Ground with switch to activate).

3.0 Equipment list

The standard equipment supplied with the EMM35 system will vary with the aircraft. The lists below show the equipment shipped for single engine aircraft and for twin engine aircraft. Most installations will require some optional transducers or installation items. The optional items are listed below.

3.1 Single Engine

Item	Qty.	Part Number
EMM35	1	453-5030
DB25 Male Connector	1	150-1124
Crimp Contact, Male 20-26 AWG	25	151-6627
DB25 Connector Shroud	4	151-6234
DB25 Female Connector	3	150-3153
Crimp Contact, Female 20-26 AWG	75	151-6671
DB9 Female Connector (Vacuum, MP)	1	150-1902
DB9 Connector Shroud	1	151-6246
EMM35 Installation Manual (This manual)	1	570-1068
Transducer , 201b Fuel Flow	1	116-0201
Transducer, Manifold / Vacuum Pressure	1	116-0140-00
Thermocouple, EGT	1	116-5450
Thermocouple, CHT	1	116-5453
Thermocouple Extension Wire (Teflon)	12ft.	604-2000

3.2 Twin Engine

Item	Qty.	Part Number
EMM35 (With Thermocouple amplifier)	2	453-5030
DB25 Male Connector	2	150-1124
Crimp Contact, Male 20-26 AWG	50	151-6627
DB25 Connector Shroud	8	151-6234
DB25 Female Connector	6	150-3153
Crimp Contact, Female 20-26 AWG	150	151-6671
DB9 Female Connector (Vacuum, MP)	2	150-1902
DB9 Connector Shroud	2	151-6246
EMM35 Installation Manual (This manual)	1	570-1068B
Transducer , 201b Fuel Flow	2	116-0201
Transducer, Manifold / Vacuum Pressure	1	116-0140-00
Thermocouple, EGT	2	116-5450
Thermocouple, CHT	2	116-5453
Thermocouple Extension Wire (Teflon)	24ft.	604-2000

3.3 Optional Items

<u>Item</u>	<u>Qty.</u>	<u>Part Number</u>
Thermocouple, EGT	1 / cyl	116-5450
Thermocouple, CHT (Spark Plug Probe)	1 / cyl	116-5453
Transducer , OAT	1	116-0122
Thermocouple Extension Wire (Teflon)	6 ft. / cyl	604-2000

Note: The CHT spark plug probe is a spark plug gasket CHT probe.

4.0 System description

This section will familiarize the installer with the overall engine monitoring system. Reviewing this section will help show the purpose and relationship of the various components described below. This section will contain general descriptions and information necessary to properly install the system.

4.1 EMM35

The EMM35 (453-5030) is the heart of the engine monitoring system. The EMM35 contains a powerful computer that monitors up to 35 engine related parameters. The EMM35 will convert the various types of sensor data into digital format, do appropriate filtering and data conversion, and then send the data to the MFD 5200 for display and monitoring. Figure 4-1 below is a view of the EMM35 box.

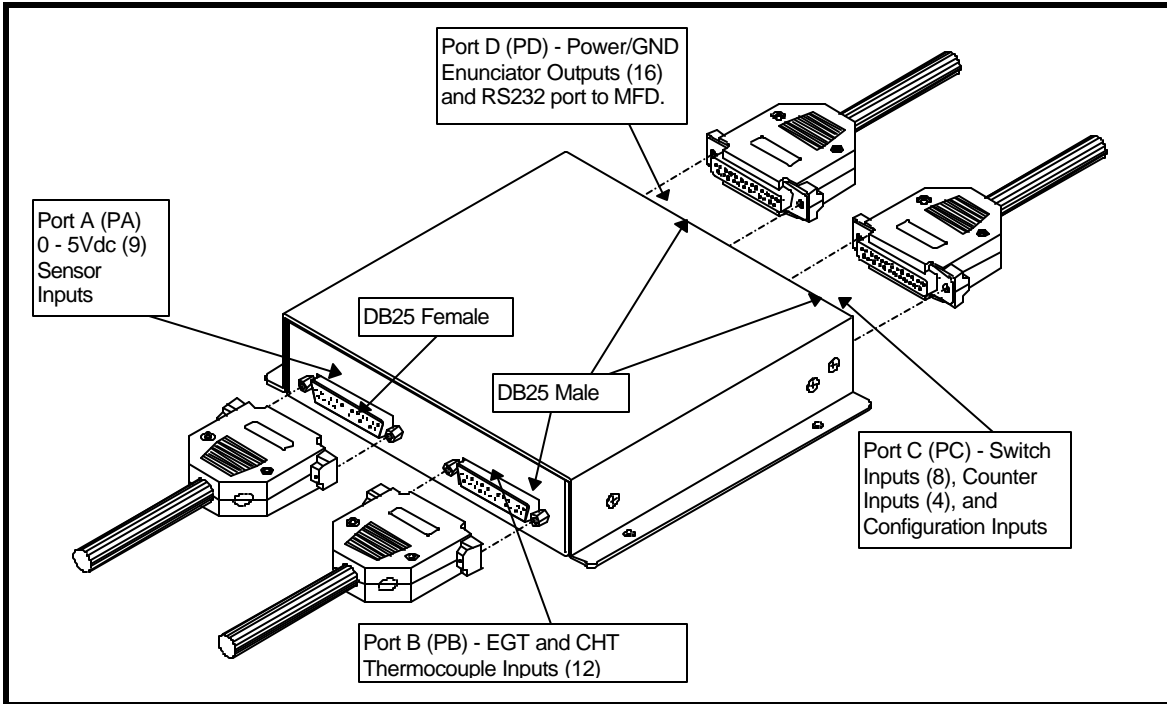


Figure 4-1 EMM35

The 4 DB25 connectors marked PA, PB, PC, and PD are used for the inputs and outputs of the EMM35. Port A is the signal and common inputs for the 9 channels of analog input. Port B (PB) is used for connection to the EGT and CHT thermocouples. Port C has the 4 frequency inputs, the 8 switch inputs, and configuration jumper inputs. Port D is for aircraft power input, serial communication, and enunciator outputs. In the installation details below these connectors will be referred to with a pin number (i.e. - PA-3 is Port A pin 3).

4.2 Thermocouple Inputs

Thermocouples are probes made of two different types of metal wire that are bonded together at the point of the probe. The junction of the two wires will create a small change in voltage when the temperature of the junction changes. The voltage levels are in the 1 to 50 millivolt range and must be amplified before they can be useful. As mentioned above, Port B is for thermocouple inputs. Channels 1 through 6 are for EGT or TIT type probes, and 7 through 12 are for CHT type probes. Both probes are "Type K" thermocouples, and provide the same change of voltage per degree of temperature. The EGT probes can range to much higher temperatures than the CHT so the EGT input channels are set to amplify the voltage by 100 times. The CHT operates in a range that requires an amplification of 400 times.

The factory supplied probes have leads only 2 feet long, so we provide thermocouple extension wire to go from the end of the leads to the EMM35. The thermocouple wire is Teflon insulated wire made of the same metal that the thermocouples are made from. The installation kit provides only enough extension wire for 6 foot extension of each probe. IF the EMM35 can not be mounted close enough to require no more than the total 8 feet of leads you will need to get longer lengths of extension wire.

More detail and descriptions of the probes are contained in the installation details below.

4.3 Analog Inputs

The 9 channels of analog input measure voltages in the range of 0 to 5.000 volts. The measurement resolution is better than 5 millivolts. The 9 analog channels are on connector port A.

Each analog channel has a signal input and a common. When connecting to an analog input from a remote Transducer you should always use shielded pair wire with one wire connected to the signal source and the other connected to the Transducer common. The shields should all be terminated to aircraft ground at the EMM35 end only.

In the MFD 5200 each analog channel must be configured for the sensor that is attached. The configuration consists of entering range values, alarm high and low limits, and the transducer calibration factors. The calibration factors are listed on each Transducer that has unique values and should be recorded as part of the installation preparation. The factors are listed as 'A', 'B', and 'C' values. Almost all transducers are set to standard values at the factory, but if changes are required the process is fully explained in Appendix A.

4.4 Counter Inputs

There are 4 counter inputs to the EMM35. The EMM35 measures the average pulse width of the input signal to determine the frequency of the signal. The range of measurement depends on the input channel. Counters 1 and 2 are not filtered and will measure frequency in the range of 8 Hz to over 3000 Hz. Counters 3 and 4 are filtered and attenuated for measuring higher voltage signals with noise (i.e. Magneto P lead).

The standard method of connecting a counter input is with shielded pair cable. At port C where the counter inputs are, there are common pins for connecting the signal common. As with the analog inputs the shield should be connected to aircraft ground at the EMM35 end only.

In the standard installation the counter inputs are used for fuel flow and tachometer inputs.

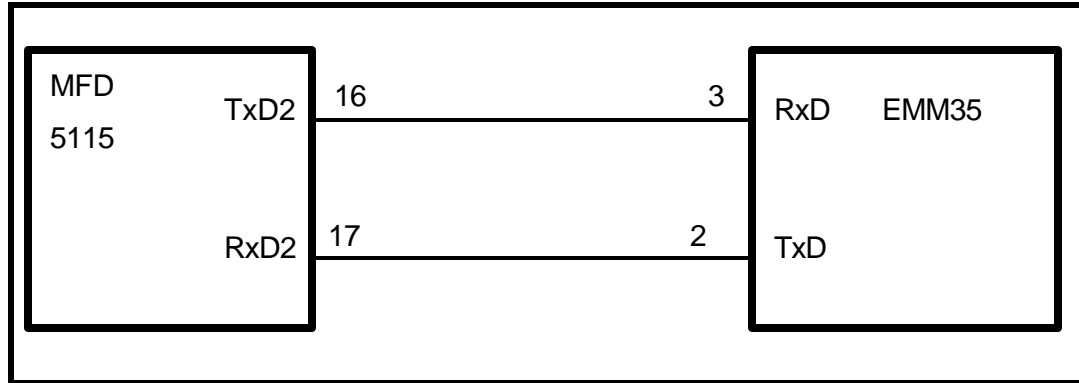
4.5 Switch Inputs (Ground Sense)

There are 8 switch inputs that are used to sense events. The way they work is to detect when an input is connected to ground. Typical inputs might be gear up, gear down, doors closed, liftoff, etc. Since all inputs can be assigned to any definable display on the MFD 5200 you can monitor anything that can be detected by a switch closing or opening.

The standard method of wiring switch inputs is to use Teflon insulated single wire. The gauge of wire should be 24 to 20 AWG

4.6 Enunciator Drive

The EMM35 has 16 annunciation drive outputs on Port D. Each output is an open collector current sink device that is capable of sinking up to 100ma from a voltage source of up to 40 volts. Typically the voltage is aircraft power (i.e. 14 or 28 volts).



Enunciators 1 through 8 are driven automatically by the EMM35, while enunciators 9 through 16 are driven by command from the MFD 5200. The automatic enunciators are associated with analog input channels 1 through 8 on Port A of the EMM35. Enunciators 1 through 8 will light if the analog input voltage is below a programmable low limit or above a high limit. The purpose of the enunciators being driven independent of the MFD is to provide backup indication of out of tolerance engine parameters even if the video display of the MFD 5200 is not working. The limits for the automatic enunciators are programmed into the EMM35 from the diagnostics program in the MFD 5200.

Enunciators 9 through 16 are controlled by the MFD 5200 program. Specific events can instruct an annunciation to be on or off. Enunciators 9 and 10 are currently reserved for camera triggering and altitude alert. More information on camera trigger and altitude alert are found in the MFD 5200 operations manual. Enunciators 11 through 16 are currently undefined, and are not used in a standard installation.

4.7 RS232 Communication

The EMM35 communicates with the MFD 5200 with RS232 serial communication. In a single engine installation one EMM35 will connect with the MFD 5115 by connecting the transmit line of the EMM35 to the receive line number 2 of the MFD 5115, and by connecting the transmit line number 2 of the MFD 5115 to the receive line of the EMM35 (see Fig. 4-2 below).

Figure 4-2

In a twin engine installation you will have two EMM35s and they communicate with the MFD 5200 by chaining together. In the case of two EMM35's they are identified by a node number. Node one should be for right engine monitoring and node two should be for left engine monitoring. The transmit line number 2 of the MFD 5115 will connect to the receive line of EMM35 node 2, transmit of EMM35 node two will connect to receive of EMM35 node one, and transmit of EMM35 node one will connect to receive number 2 of the MFD 5115 (see Fig. 4-3 below).

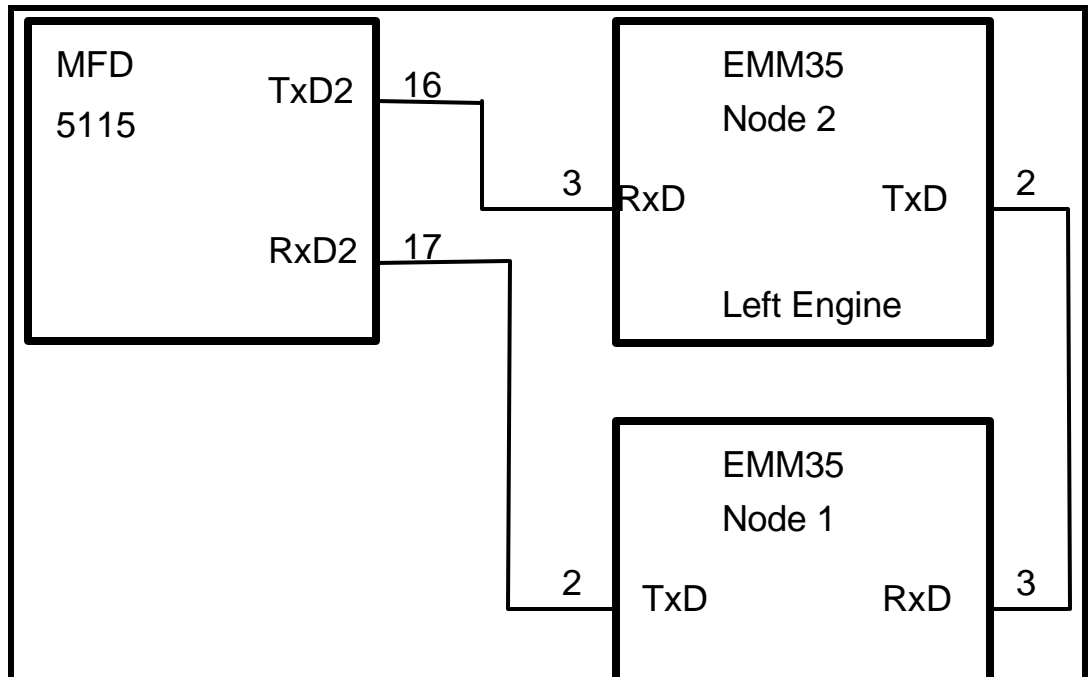


Figure 4-3

The Node numbers of an EMM35 are set by a configuration jumper on Port C. The details of configuration will be explained in the installation details below.

5.0 Installation details

In this section you will find the detailed information for installation of the EMM35 and each transducer. Each item will be described in its own detailed section, but there will also be references to drawings that will give the overall installation detail.

5.1 EMM35

Before installing the EMM35 review figure 41 above for the general layout of the system. Drawing 591-3472 in Appendix A is an installation template that can be used to locate and drill the four (4) mounting holes for the EMM35. If practical the EMM35 should be located close enough to the engine so the 6 foot thermocouple extensions will reach from the EMM35 to the engine. The EMM35 should be mounted in an avionics compartment or on the cabin side of the firewall. In twin engine installations, you may have to run longer thermocouple extension wires to a good mounting location. The EMM35 can be mounted with four (4) screws to any flat surface, where there is access to the DB25 connector ports.

Below is a general description of the cables and connectors. Review this section before beginning transducer installation to get an idea of where the cables will be going and what is connected to them.

Port D - EMM35 Power, Serial Communication, Enunciators.

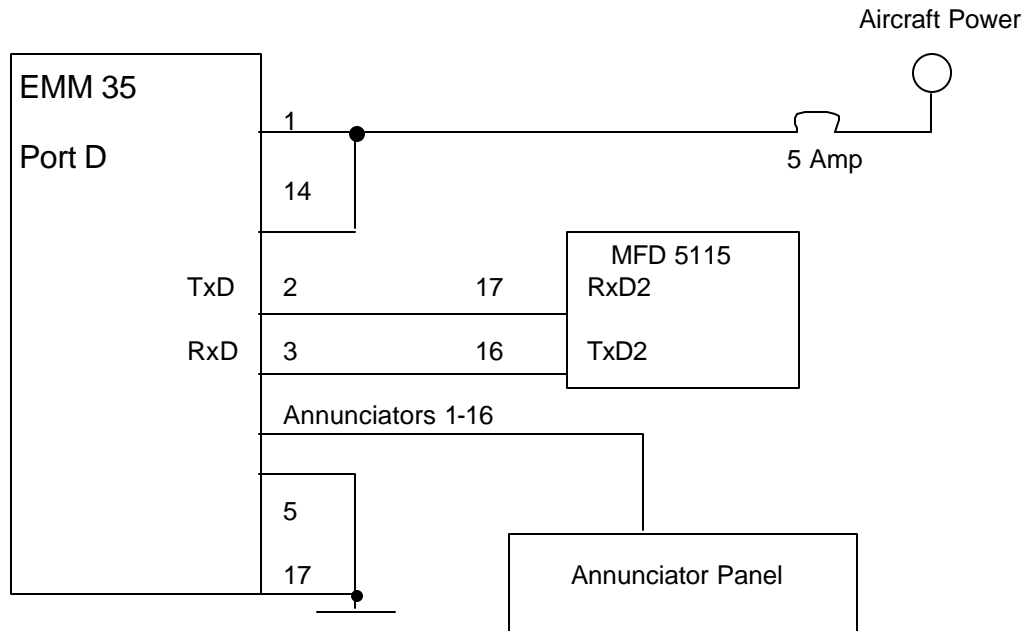


Figure 5-1

Note in Figure 5-1 above that Port D is where the EMM35 gets its power. Power can be routed from the breaker panel where a 5 Amp breaker should be used for the EMM35. The

other connections on Port D are the enunciator drives and the RS232 communication lines. The enunciator drives are an optional part of the installation, but should be routed to the back of the instrument panel if they are used. The RS232 communication lines will route to where the MFD 5115 is mounted (The 5115 is the remote portion of the MFD 5200 system, and can be mounted in the instrument panel or in a remote location.).

In a twin engine installation the communications from the Node 2 EMM35 will chain through the Node 1 EMM35 before going to the MFD 5115. The best way to do the communication chain in a twin install would be to put a terminal block at the MFD 5115 as shown in Fig 5-2 below.

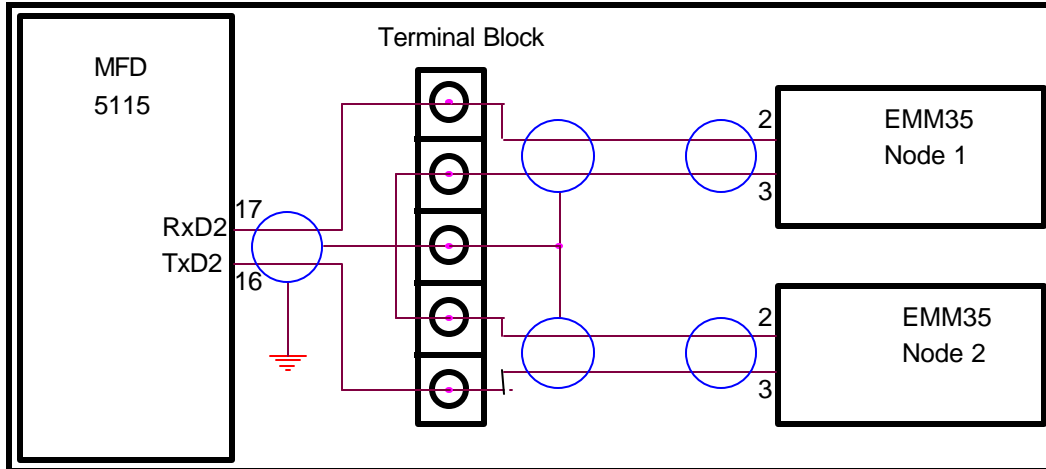


Figure 5-2

The communication lines should use shielded pair Teflon wire (24 to 22 gauge) with one wire used for transmit data, one used for receive data, and the shield terminated to aircraft ground at the MFD end of the cable.

The enunciator drive lines can be single conductor Teflon wire (24 to 22 gauge).

The power should use 18 to 20 gauge Teflon wire. In non-metal aircraft both the power and return wired should be routed from the area of the circuit breakers.

Port D - Pinout List

Pin Number	Pin Description
1	Aircraft Power (V+) 10 - 35 Vdc
2	RS232 Transmit Data (TXD)
3	RS232 Receive Data (RXD)
4	NC
5	Power Return (Ground)
6	Enunciator 15
7	Enunciator 13
8	Enunciator 11
9	Enunciator 9
10	Enunciator 7

11	Enunciator 5
12	Enunciator 3
13	Enunciator 1
14	Aircraft Power (V+) 10 - 35 Vdc
15	NC
16	NC
17	Power Return (Ground)
18	Enunciator 16
19	Enunciator 14
20	Enunciator 12
21	Enunciator 10
22	Enunciator 8
23	Enunciator 6
24	Enunciator 4
25	Enunciator 2

Port C - Counter Inputs, Switch Inputs, Configuration Inputs.

Port C is where the counter inputs (tachometer and fuel flow), switch inputs (gear, doors, etc.), and the configuration jumpers connect. Figure 5-3 below shows the general routing of signals. Configuration jumpers are either left open or connected to ground pins that are also on connector C. Counter inputs come from sensors in the engine area. Switch inputs can come from anywhere you are trying to sense a switch closing to ground. Switch inputs are definable and can be anything that can be detected with a switch closure (see setup and calibration section below).

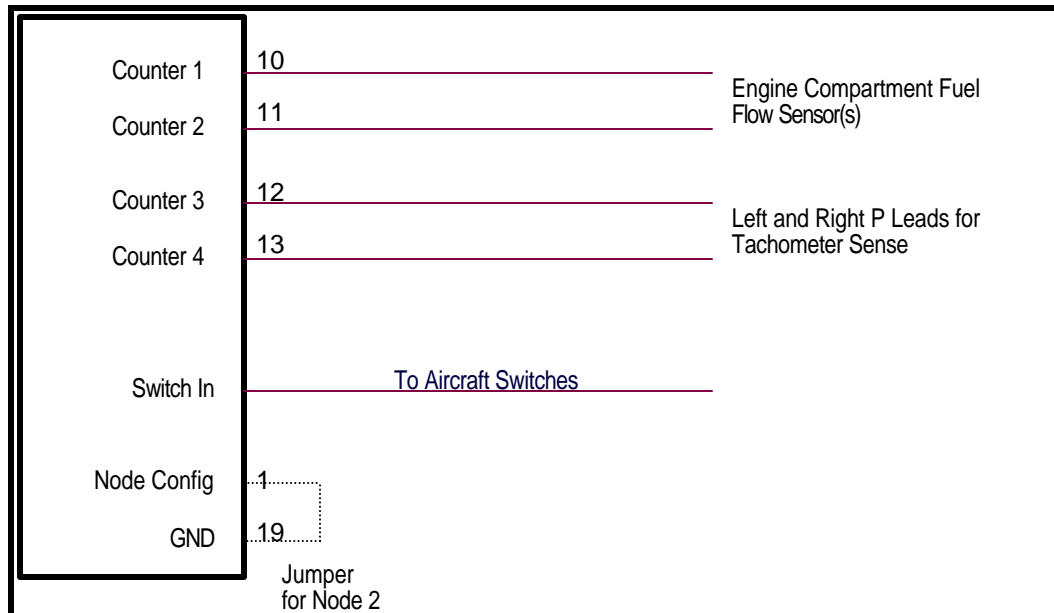


Figure 5-3

Port C - Pinout List

Pin Number	Pin Description	Pin Function / Channel Number
1	Configuration - 1	Node 1 = Open Node 2 = GND
2	Configuration - 3	Not Used
3	Switch In - 1	Switch 1
4	Switch In - 3	Switch 3
5	Switch In - 4	Switch 4
6	Switch In - 5	Switch 5
7	Switch In - 6	Switch 6
8	Switch In - 7	Switch 7
9	Switch In - 8	Switch 8
10	Counter In - 1	Node 1 Counter 1 Fuel Flow Node 2 Counter 1
11	Counter In - 2	Node 1 Counter 2 Fuel Return Node 2 Counter 2
12	Counter In - 3	Node 1 Counter 3 Tach P-lead Node 2 Counter 3
13	Counter In - 4	Node 1 Counter 4 Tach P-lead Node 2 Counter 4
14	Configuration - 2	Not Used
15	Configuration - 4	Not Used
16	Switch In - 2	Switch 2
17	5 Volts DC	Fuel Sensors Power
18	5 Volts DC	Fuel Sensors Power
19	Ground	GND for Configuration 1 (Node 2)
20	Ground	GND Tie Point
21	Ground	GND Tie Point
22	Ground	Signal common - Counter 1 (Fuel)
23	Ground	Signal common - Counter 2 (Fuel)
24	Ground	GND Tie Point
25	Ground	GND Tie Point

The configuration jumper should be set as required for single or twin engine nodes.

Switch inputs should be wired with single conductor Teflon wire (24 to 22 gauge). Since the wires can go to many parts of the aircraft you should consider proper lengths of wire after the location of the EMM35 has been determined.

Counter inputs used for fuel flow should use shielded three conductor Teflon cable (24 to 22 gauge). The reason for three conductors is that fuel flow transducers require 5 volt power to operate. One conductor is for 5volts DC and can be obtained on Port C pins 17 and 18. One conductor is for signal common, and the last conductor is for the counter signal. The shield for the counter inputs should be terminated to aircraft ground at the EMM35 end of the cable only.

The normal method of getting tach information is to tie counter 3 or 4 to the “P” lead of the magneto (you can also tie one counter to each magneto for redundant RPM). If you use the “P” lead you will route the cable from counter 3 or 4 to the engine compartment to tie to the magneto. When using the magneto lead a single wire connected to the counter input is all that is needed.

Port A - Analog Inputs

Port A is where the Analog inputs (manifold pressure, vacuum, etc.) connect. The analog inputs are all routed to the EMM35 from the engine section where connections are made to each individual transducer. Powered transducers use aircraft power on one wire, ground on one wire and signal on one wire. The powered transducers are Manifold pressure, Vacuum, and Outside Air Temperature (OAT). To wire a powered transducer use shielded 3 conductor cable with the shield grounded at the EMM35 end.

Port A - Pinout List

Pin Number	Pin Description	Pin Function / Channel Number
1	Spare	Node 1 Channel 1 Node 2 Channel 36
2	Manifold Pressure Signal	Node 1 Channel 2 Node 2 Channel 37
3	Vacuum Signal	Node 1 Channel 3 Node 2 Channel 38
4	Spare	Node 1 Channel 4 Node 2 Channel 39
5	Spare	Node 1 Channel 5 Node 2 Channel 40
6	Spare	Node 1 Channel 6 Node 2 Channel 41
7	Spare	Node 1 Channel 7 Node 2 Channel 42
8	Spare	Node 1 Channel 8 Node 2 Channel 43
9	Outside Air Temp Signal	Node 1 Channel 9 Node 2 Channel 44
10	NC	Not Used
11	NC	Not Used
12	NC	Not Used
13	5 Volts DC	5volts for sensors that require 5 volts
14	Ground	Spare Common
15	Ground	Manifold Pressure Common
16	Ground	Vacuum Common
17	Ground	Spare Common
18	Ground	Spare Common
19	Ground	Spare Common
20	Ground	Spare Common
21	Ground	Spare Common

22	Ground	OAT Common
23	Ground	Spare Common
24	Ground	Spare Common
25	Ground	Spare Common

Port B - Thermocouple Inputs

Port B is where the Thermocouple inputs (EGT, CHT) connect.

Port B - Pinout List

Pin Number	Pin Description	Pin Function / Channel Number
1	EGT 1 +	Node 1 - EGT 1 + Channel 11 Node 2 - EGT 1 + Channel 46
2	EGT 2 +	Node 1 - EGT 2 + Channel 12 Node 2 - EGT 2 + Channel 47
3	EGT 3 +	Node 1 - EGT 3 + Channel 13 Node 2 - EGT 3 + Channel 48
4	EGT 4 +	Node 1 - EGT 4 + Channel 14 Node 2 - EGT 4 + Channel 49
5	EGT 5 +	Node 1 - EGT 5 + Channel 15 Node 2 - EGT 5 + Channel 50
6	EGT 6 +	Node 1 - EGT 6 + Channel 16 Node 2 - EGT 6 + Channel 51
7	CHT 1 +	Node 1 - CHT 1 + Channel 17 Node 2 - CHT 1 + Channel 52
8	CHT 2 +	Node 1 - CHT 2 + Channel 18 Node 2 - CHT 2 + Channel 53
9	CHT 3 +	Node 1 - CHT 3 + Channel 19 Node 2 - CHT 3 + Channel 54
10	CHT 4 +	Node 1 - CHT 4 + Channel 20 Node 2 - CHT 4 + Channel 55
11	CHT 5 +	Node 1 - CHT 5 + Channel 21 Node 2 - CHT 5 + Channel 56
12	CHT 6 +	Node 1 - CHT 6 + Channel 22 Node 2 - CHT 6 + Channel 57
13	Spare	Not used
14	EGT 1 -	Node 1 - EGT 1 - Channel 11 Node 2 - EGT 1 - Channel 46
15	EGT 2 -	Node 1 - EGT 2 - Channel 12 Node 2 - EGT 2 - Channel 47
16	EGT 3 -	Node 1 - EGT 3 - Channel 13 Node 2 - EGT 3 - Channel 48
17	EGT 4 -	Node 1 - EGT 4 - Channel 14 Node 2 - EGT 4 - Channel 49
18	EGT 5 -	Node 1 - EGT 5 - Channel 15

		Node 2 - EGT 5 - Channel 50
19	EGT 6 -	Node 1 - EGT 6 - Channel 16 Node 2 - EGT 6 - Channel 51
20	CHT 1 -	Node 1 - CHT 1 - Channel 17 Node 2 - CHT 1 - Channel 52
21	CHT 2 -	Node 1 - CHT 2 - Channel 18 Node 2 - CHT 2 - Channel 53
22	CHT 3 -	Node 1 - CHT 3 - Channel 19 Node 2 - CHT 3 - Channel 54
23	CHT 4 -	Node 1 - CHT 4 - Channel 20 Node 2 - CHT 4 - Channel 55
24	CHT 5 -	Node 1 - CHT 5 - Channel 21 Node 2 - CHT 5 - Channel 56
25	CHT 6 -	Node 1 - CHT 6 - Channel 22 Node 2 - CHT 6 - Channel 57

5.2 Fuel Flow

Installation of fuel flow will vary based on factors such as single or twin engine and if the aircraft has a fuel return flow. In a twin engine airplane you will attach the fuel flow sensors for an engine to the EMM35 dedicated to that engine. On each EMM35 you will need only one fuel flow sensor unless the airplane uses a fuel return line. The connections to the counter inputs of the EMM35 are on port C. The fuel flow is **EMM35 Counter 1** and fuel return is **EMM35 Counter 2**.

The normal flow sensor is a Flowscan model 201B (ARNAV part number 116-0201). See figure 5-4 below.

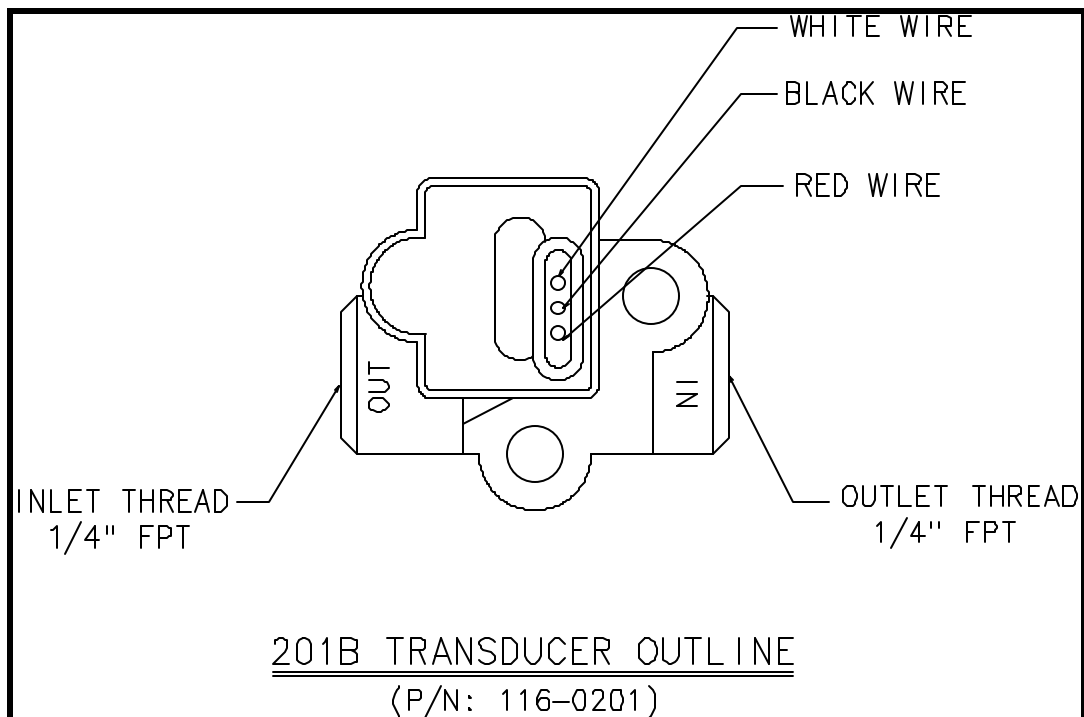


Figure 5-4

Fuel transducers are individually calibrated to generate a known number of pulses for a given fuel flow. The calibration factor is a number called a "K" factor. The K factor number is written on a tag that is attached to the transducer. You will need the K factor number later when you set up the transducer parameters on the MFD 5200. Do not confuse the serial number, which is stamped into the flow transducer, with the K factor.

The flow transducer should be installed in the fuel line and mounted to a horizontal surface as described below.

- A screen or filter should be installed upstream of the flow transducer to screen out debris which could affect rotor movement or settle in V-bearings. As turbulence upstream of the transducer affects its performance, there should be a reasonable length of straight line between the transducer inlet and the first valve, elbow, or other turbulence producing device.
- Install flow transducer with wire leads pointed **UP** to vent bubbles and insure that the rotor is totally immersed in liquid. For maximum accuracy at low flow rates the transducer should be mounted on a horizontal surface.
- The power supply for the transducer will be 5 volts DC provided by the EMM35.

Figure 5-5 below shows the connection detail of a single transducer (no return flow).

Figure 5-5

Figure 5-6 below shows the connection detail of a system using return flow and requiring two flow sensors.

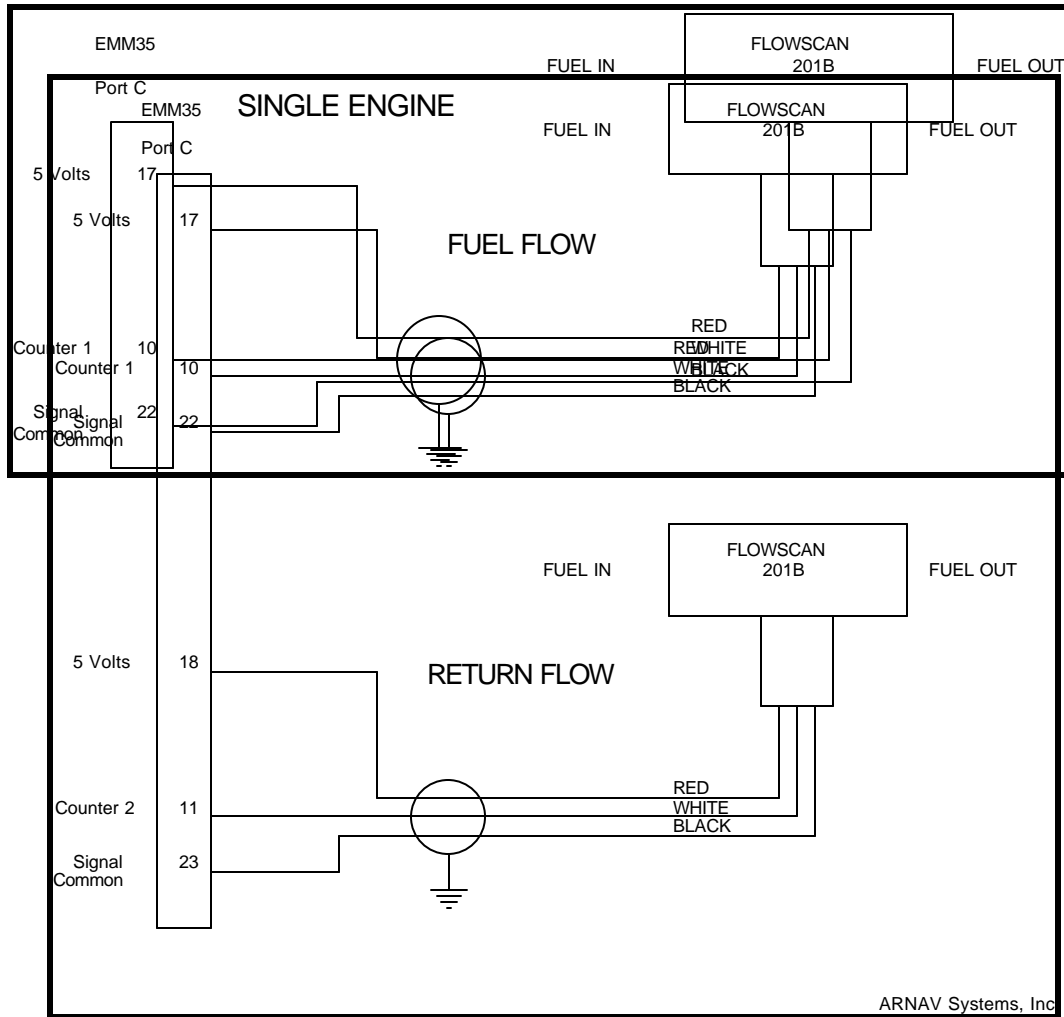


Figure 5-6

As shown above in both drawings the Flowscan 201B requires 5 volts on the red wire to operate. The cable for fuel sensor installation should be shielded three wire Teflon cable with the shield connected to aircraft ground at the EMM35 end of the cable.

The setup program, described in Appendix A, details how to configure the transducer K-factor into the EMM35 and what to set for Counters 1 and 2. There are different options for single and twin engines and for return flow or no return flow setups.

5.3 Tachometer

The standard method of tachometer measurement is to connect the magneto “P” lead directly into the EMM35 counter 3 or 4 input.

Magneto P-Lead

The “P” lead from the magneto provides electrical pulses that are directly related to engine RPM. The pulses are high voltage and must be used only on counters 3 or 4. Counters 3 and 4 have special signal conditioning circuitry that allows the magneto pulses to be counted for RPM measurement. The input to the EMM35 is also a very high impedance optical coupled input so that no failure will inadvertently ground out the magneto.

Figure 5-7 below shows the wiring detail for using the magneto for tach input to the EMM35.

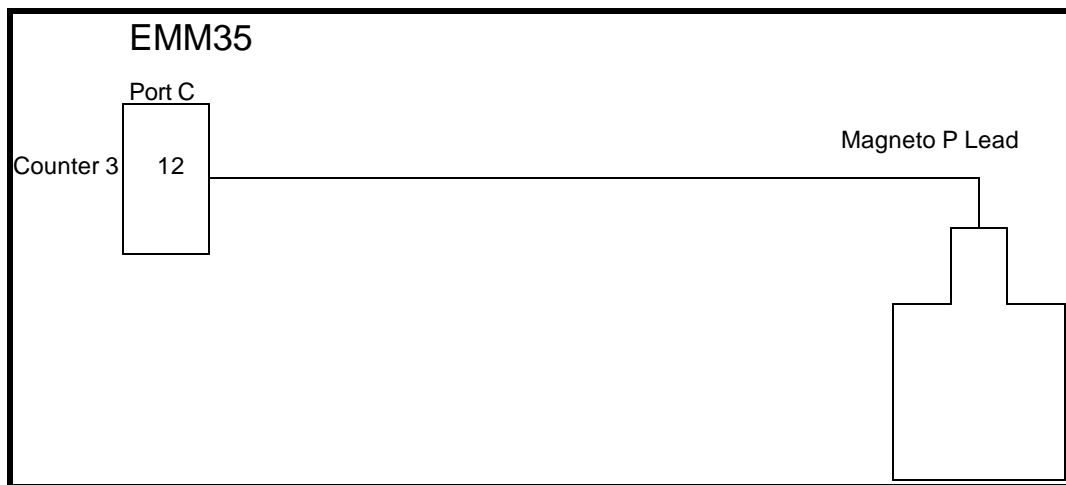


Figure 5-7

When connecting the “P” lead to the EMM35, as above use Teflon coated single wire of 24 to 26 gauge. There is no need to have a signal common or shield. **Verify connection to Pin 12 of Port C.** Any other connection of the “P” lead to the EMM35 may cause **damage to the system.**

5.4 Manifold Pressure / Vacuum Pressure

The manifold pressure is **EMM35 Channel 2**. The vacuum pressure is **EMM35 Channel 3**.

The manifold pressure and Vacuum are measured with a dual pressure sensor manufactured by ARNAV (Part Number 116-0140-00). The transducer is pictured below in Figure 5-8.

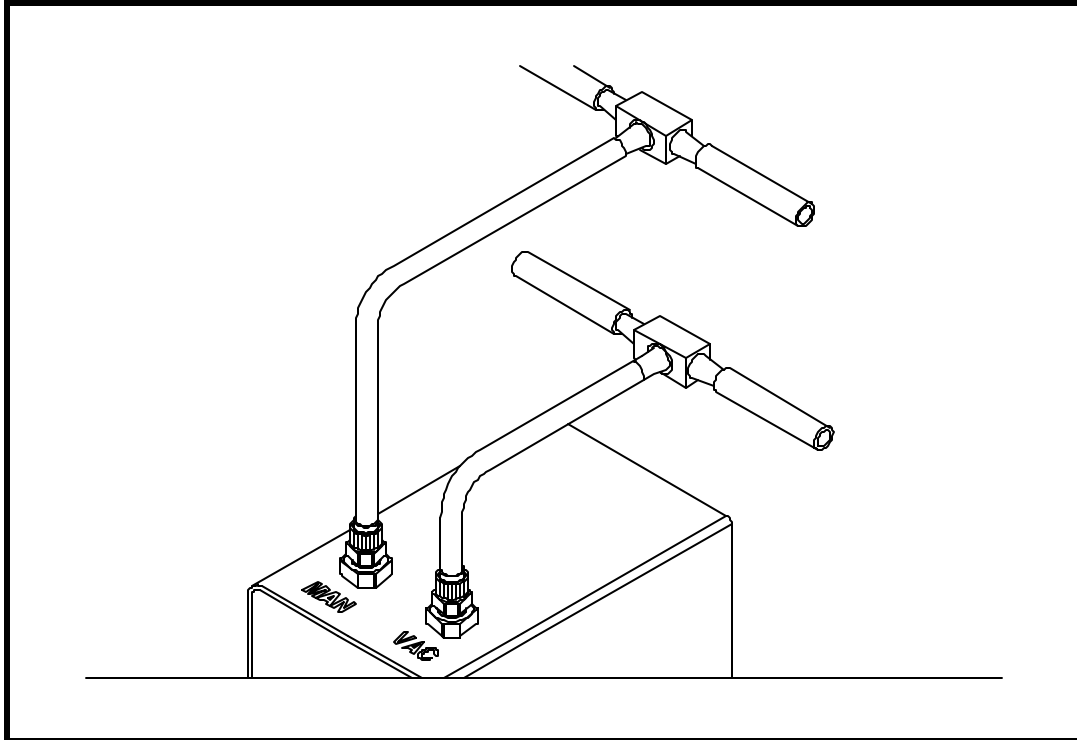


Figure 5-8

The manifold/vacuum pressure sensor has a DB9 Male connector which provides aircraft power, ground, and the output analog signals. The box also has two pressure ports for 1/4 inch O.D. air hose.

The sensor can be mounted to a flat surface anywhere inside the cabin. It should not be mounted in the engine compartment. A good place for mounting would be behind the instrument panel where the air hoses can be connected to the existing manifold pressure and vacuum with a "T" fitting as shown above in Figure 5-8.

Figure 5-9 below shows the detail of how the ¼" outside diameter air hose is mated to the threaded port on the manifold/vacuum sensor.

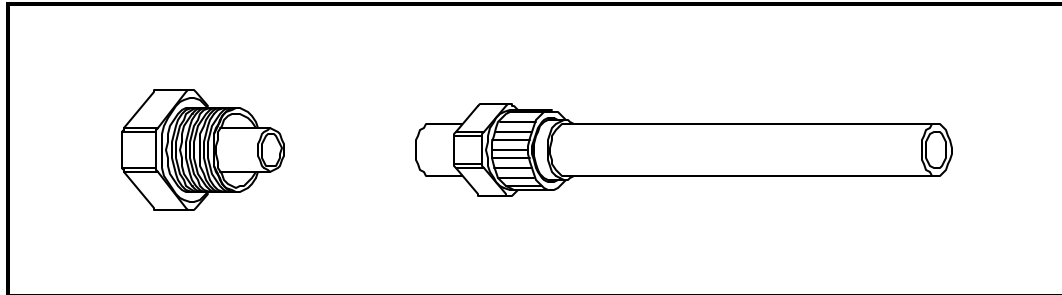


Figure 5-9

Manifold and vacuum pressure is the first sensor discussed that connects to the Analog Inputs of the EMM35. The analog inputs connect to Port A. The connection from Port A to the manifold/vacuum pressure transducer should use shielded pair Teflon cable. One wire is the analog signal, one wire is the signal common, and the shield connects to chassis ground at the EMM35 end of the cable. With manifold/vacuum pressure you must also provide aircraft power to the transducer 9 pin connector. If aircraft power is routed to the manifold/vacuum pressure sensor from a location other than the EMM35 the power can be routed with a single 18 to 20 gage Teflon wire.

Figure 5-10 below shows the cable interface for the manifold/vacuum pressure sensor.

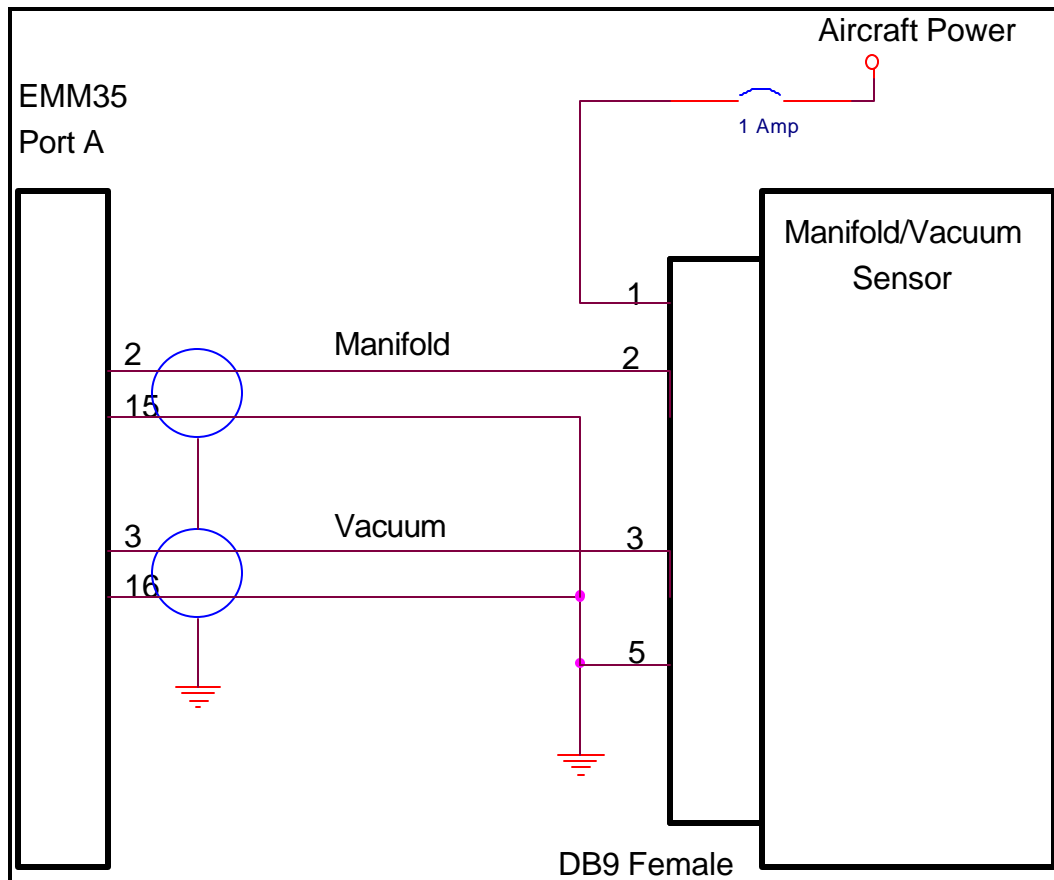


Figure 5-10

The manifold pressure sensor will measure from zero to over 60 inches of mercury. The setup program, described in Appendix A, has channel 2 (manifold pressure) already set for the ARNAV manifold sensor. Setup will allow different ranges to be set if the engine is turbocharged, but the normal settings will usually not be changed.

The vacuum sensor will measure from 0 to 15 PSI. The setup program, described in Appendix A, has channel 3 (vacuum) already set for the ARNAV vacuum sensor and does not need to be changed.

5.5 Outside Air Temperature

Outside Air Temperature is **EMM35 channel 9**. The Outside Air Temperature (OAT) is measured with an ARNAV solid state temperature transducer (Part Number 116-5030). The transducer is pictured below in figure 5-11.

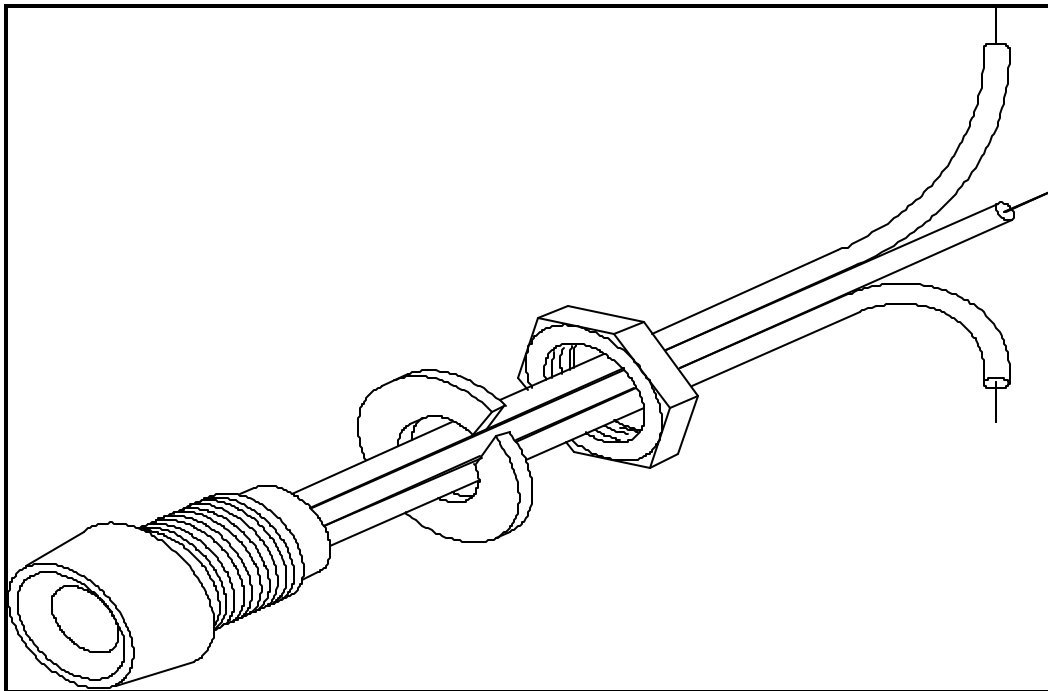


Figure 5-11

The OAT sensor has three wires which provide aircraft power, ground, and the output analog signal. The red wire is connected to aircraft power, the black wire to signal common, and the yellow wire is the analog signal. The sensor can be mounted in the inlet air channel or through an inspection plate somewhere in the air stream. It should not be mounted where the temperature of the air could be pre-heated by the engine before passing over the OAT probe.

The connection from Port A to the OAT transducer should use a shielded pair Teflon cable. One wire is the analog signal, one wire is the signal common, and the shield connects to chassis ground at the EMM35 end of the cable. With OAT you must also provide aircraft power to the transducer red wire. If this is routed from the area of the EMM35 you can use three wire shielded cable with the third wire used as aircraft power. If aircraft power is

routed to the OAT sensor from a location other than the EMM35 the power can be routed with a single 18 to 20 gauge Teflon wire.

Figure 5-12 below shows the cable interface for the OAT sensor.

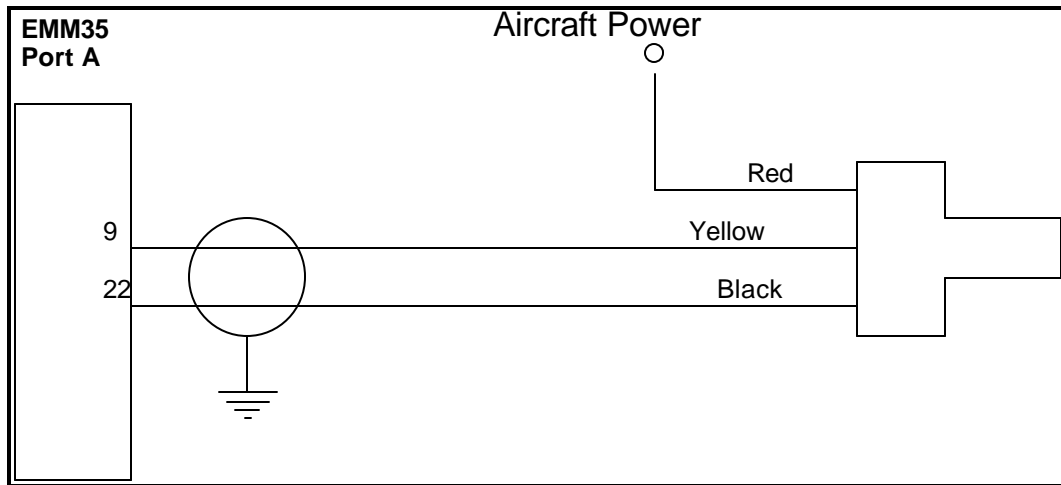


Figure 5-12

The OAT sensor will measure from -60°C to $+70^{\circ}\text{C}$. The setup program, described in Appendix A, has channel 9 (outside air temperature) set for LM135 type temperature sensor and does not need to be changed.

5.6 EGT/CHT Temperature Probes

The EGT's are **EMM35 Channels 11 through 16** and the CHT's are **EMM35 Channels 17 through 22**. All CHT and EGT thermocouple probes connect to the EMM35 through Port B. Each thermocouple probe has a positive wire and a negative wire. With thermocouples it is important to remember that the **negative lead is red** while the positive lead color will be yellow for a "K" type thermocouple and white for a "J" type thermocouple. The standard EGT thermocouples supplied by ARNAV (Part Number 116-5450) are "K" type (Red / Yellow).

Figure 5-13 below shows the installation detail for an EGT Probe.

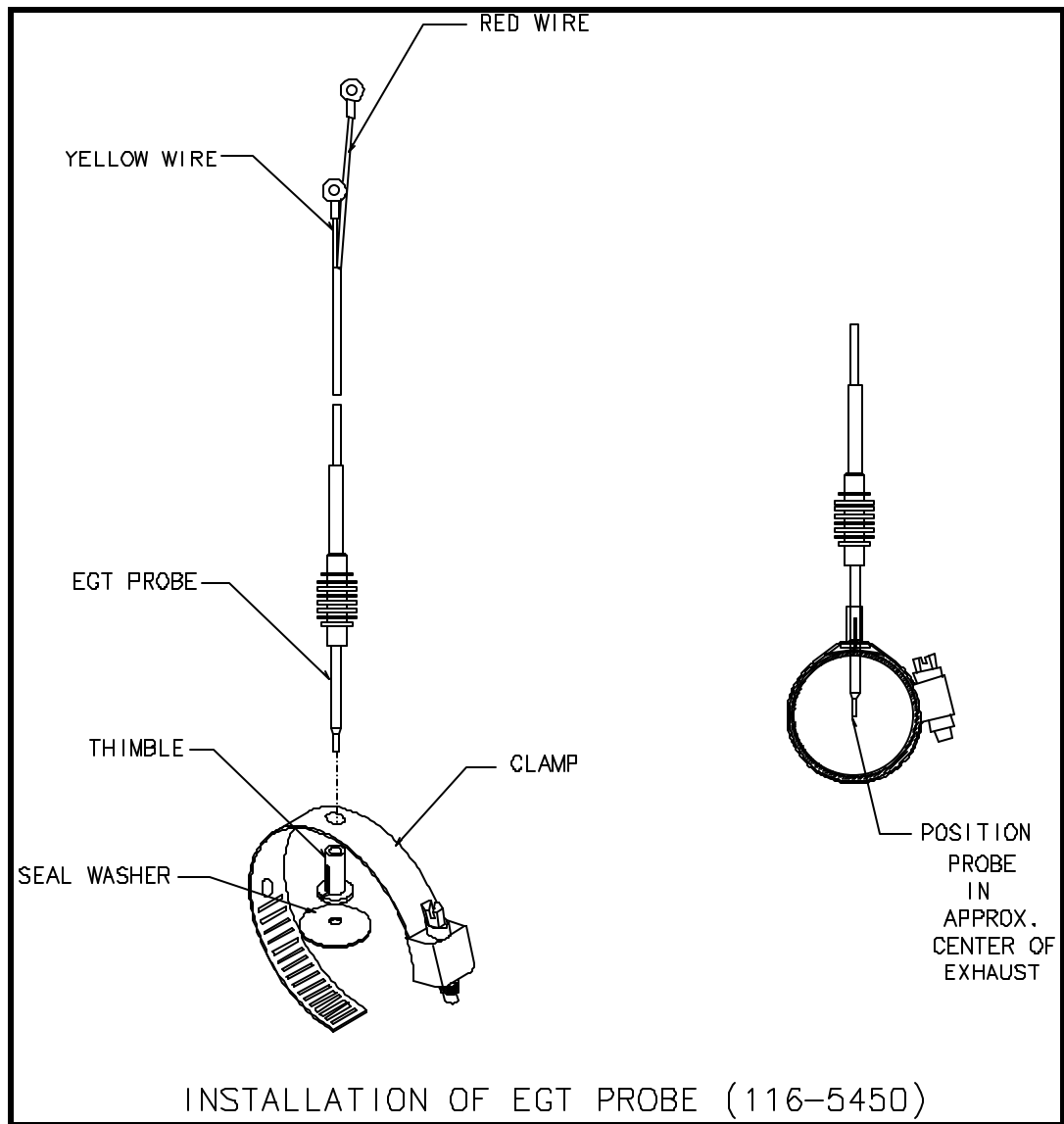


Figure 5-13

As shown in Figure 5-13, the probe is mounted in the exhaust through a hole and is held in place with a clamp around the exhaust. To install the probe you should determine the ideal location on each exhaust pipe for every cylinder you want to monitor. Sometimes it may be difficult to locate the probe the same on every cylinder, but you should try to mount the probes about 1 1/2 inches down from the exhaust ports. If you have a hard time a little difference will not matter too much. The placement of the probes will determine the spread of temperatures you might see from all cylinders.

To mount the probe drill a 1/8 inch hole in the exhaust stack. Place the probe in the hole with the clamp, thimble, and spacer as shown in Figure 5-13. Secure the clamp. It will be necessary to check the clamps after several hours of flight to make sure they have not become loose.

Note: Some airplanes have slip joints in the exhaust system (i.e. Cessna 210). If you have a slip joint make sure you do not mount the probe through a slip joint or you will destroy the probe.

Figure 5-14 below shows the detail for a Spark plug gasket CHT Probe (Part Number 116-5454).

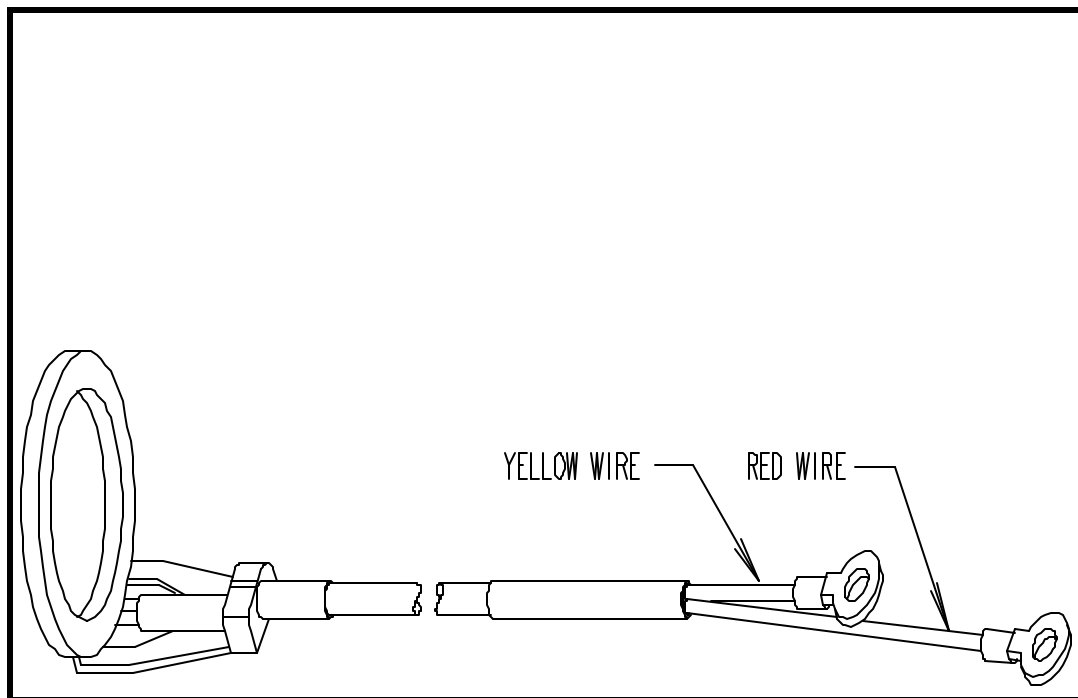


Figure 5-14

The spark plug gasket CHT probe is used by simply replacing the spark plug gasket on the selected cylinder with the gasket probe. The thermocouple junction is built into the gasket.

The EGT and CHT probes have short leads and require special thermocouple extension wire to complete the routing to the EMM35. ARNAV will supply 6 feet of type "K" thermocouple wire (Part Number 604-2000) with each EGT and CHT probe. The thermocouple extension

is connected to the probe leads with circular lugs, screws and locking nuts. Figure 5-15 shows the detail of extending the thermocouple leads with thermocouple extension wire.

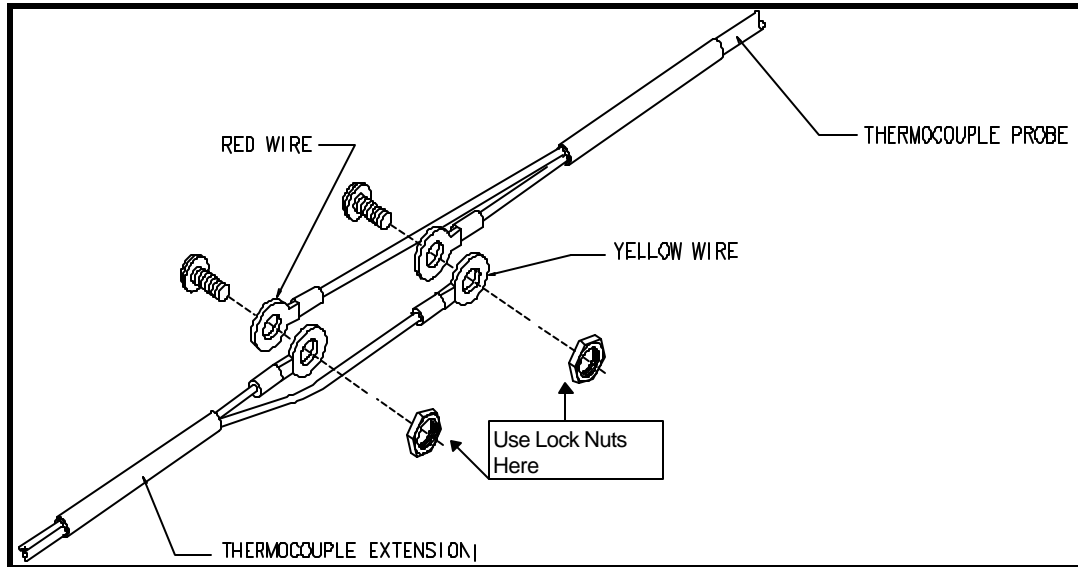


Figure 5-15

After the connection is made you should use Teflon insulation to cover the screw terminals. You can use Teflon wire ties to secure the insulation around the screws.

Since the thermocouples are tied to ground inside the probe at the wire junction, you will have a hard time using an ohm meter to identify which thermocouple wires attach to which probe. You should identify and label the extension leads before you bundle and tie all of the thermocouples together for routing to the EMM35.

Make sure you route the extension wires away from any moving parts or hot sections. The thermocouple wire is fairly stiff so do not make extreme bends.

Figure 5-16 shows the Port B wire diagram for connecting the EGT and CHT Thermocouple probes.

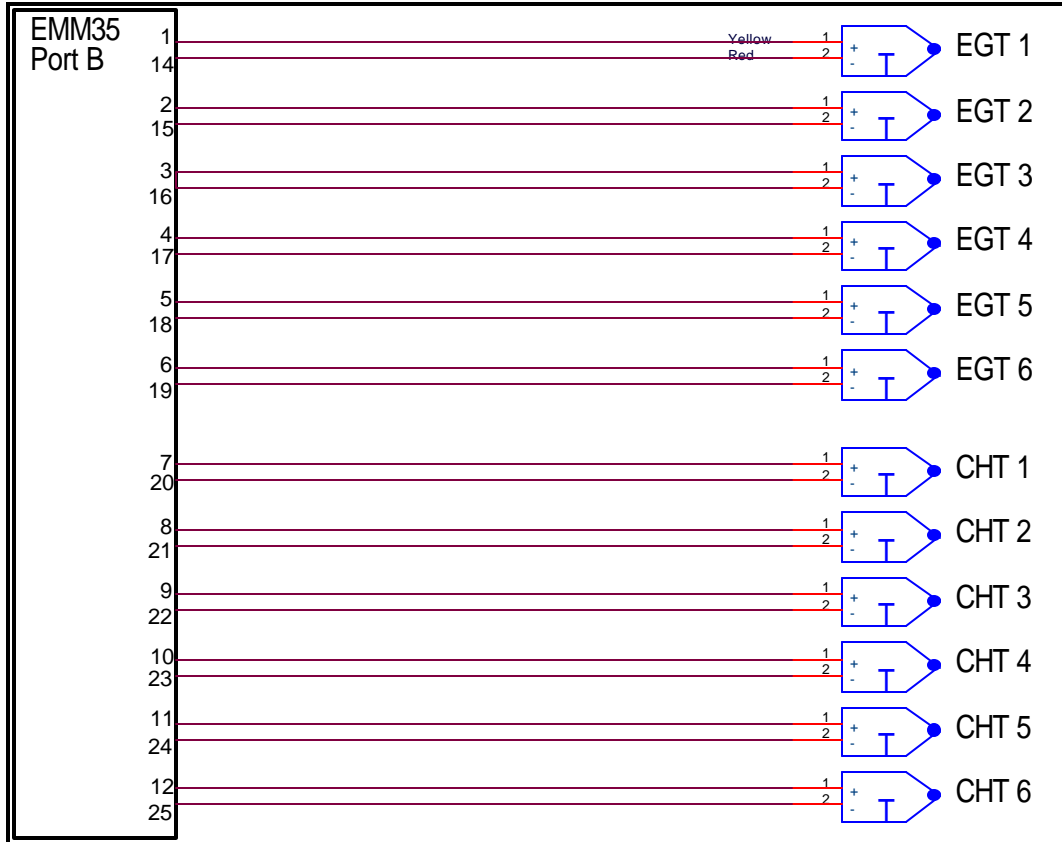


Figure 5-16

6.0 Installation Testing

Even though there are many components to the EMM35 EICAS system, it is easy to get on line and tested. The most frequent problems are wiring problems caused by not completing each phase of the installation before being distracted.

With the MFD /5200 connected you have the best diagnostic tool available for checking out an EMM35 installation. The logical progression of checking out the installation is listed below.

1. Connect only Port D (Power to the EMM35 and serial communication to the MFD 5115).
2. Apply power and verify that 5 volts is on Port C pins 17 and 18 of the EMM35 (If not check power to the DB25).
3. Verify EMM35 communication with the MFD as described below in section 6.1.
4. Connect Port A (Analog Inputs), re-power and verify serial communications is still OK.
5. Connect Port C (Counter inputs, Discrete inputs), re-power and verify serial communications is still OK.
6. Connect Port B (EGT and CHT inputs), re-power and verify serial communications is still OK.
7. Verify individual inputs as described in section 6.2 below.
8. Do gauge setup for ranges and limits as described in Appendix A.

6.1 MFD - EMM35 Communication Verification

To verify communication between the MFD and the EMM35 you must first enter the diagnostics mode of the MFD. Appendix A will describe step by step how to enter the diagnostics mode. Appendix A section 1.2.3.1 describes the exact steps to verify that you have serial communications between the MFD and the EMM35. If you do not get the raw data display you will need to verify the wiring of the RS232 data lines as described in section 5.1.

6.2 Sensor Input Verification

To verify the inputs from each transducer you will enter diagnostics mode as described in Appendix A. To get to the proper menu select choice 2 ("Engine Monitoring - Airdata"). In the engine monitoring - Airdata menu you will select choice 2 again ("MFD 5020/5030 (EMM35)"). The menu choice for sensor verification is "Display EMM35 Channels". Once you get to the channel display page you will see the screen below.

```

001300038240000000000024E22A1F01C91DF2041D71C71C416521521B3F01B32131E21F3255216
22B20F21702

Node: 0-02 48      Ch: 1  24E 2.88      Ch: 9  1C4 2.21      Ch: 17 1F3 2.44
ctr1 : 36.49      Ch: 2  22A 2.71      Ch: 10 165 1.74      Ch: 18 255 2.92
ctr2 : 0.00       Ch: 3  1F0 2.42      Ch: 11 215 2.61      Ch: 19 216 2.61
ctr3 : 0.00       Ch: 4  1C9 2.23      Ch: 12 21B 2.63      Ch: 20 22B 2.71
ctr4 : 0.00       Ch: 5  1DF 2.34      Ch: 13 3F0 4.93      Ch: 21 20F 2.58
voltage: 13.0     Ch: 6  204 2.52      Ch: 14 1B3 2.13      Ch: 22 217 2.61
lobyte: 00        Ch: 7  1D7 2.30      Ch: 15 213 2.60
00000000         Ch: 8  1C7 2.22      Ch: 16 1E2 2.36

rec len= 93

```

The top line is the raw data from the EMM35 and can be ignored for now.

The left of the screen shows the value of the four counter channels the aircraft voltage value and the value of the eight switch inputs (lobyte). In this example counter 1 shows 36.49 hertz. This means that there is a valid input on counter 1 and its' frequency is 36.49 hertz. The other counters show zero which means that there is not a valid input at the present time. To verify the fuel or tachometer sensor you must run the engine and note that there is a valid reading on the appropriate counter. If you have any switches set up on the eight switch input lines you can easily verify their operation by closing and opening the switch while watching the 8 numbers under the word "lobyte". The value of the 8 numbers will either be 0 or 1.

The other three columns of data are the analog and thermocouple channels. The channel number is identified, followed by a 3 digit hexadecimal number that you can ignore, and a voltage value between 0.00 and 5.00.

Without the engine running the thermocouple channels (11 - 22) will probably read close to 0.00. This is because the engine temperature is the same as the EMM35 if the engine has not been heated up. To check the thermocouple channels for operation you can either run the engine for a while or use a heat blower to heat individual probes. At this point all you have to do is verify that the voltage reading increases if the probes get hotter than the air around the EMM35.

You can verify each channel you have a sensor attached to by looking at the voltage for that channel and comparing the voltage with engine on or off. Each sensor will be different, but you will see the obvious changes of voltage for different conditions. If a voltage is stuck at zero or at 5 volts, and does not change, you probably have a problem in the wiring or a possible bad transducer. After verifying each channel that should have a sensor attached, you can move on the next step.

If you have a twin engine system with two EMM35's your screen will show two complete sets of channel data. The data at the top half of the screen will be for node 1 and the bottom data will be for node 2 (the screen will say node 0 and node 1). You simply follow the same procedures of verification, but you will check out transducers for both engines.

Appendix A - Transducer Setup

Diagnostics / EICAS Setup

Overview

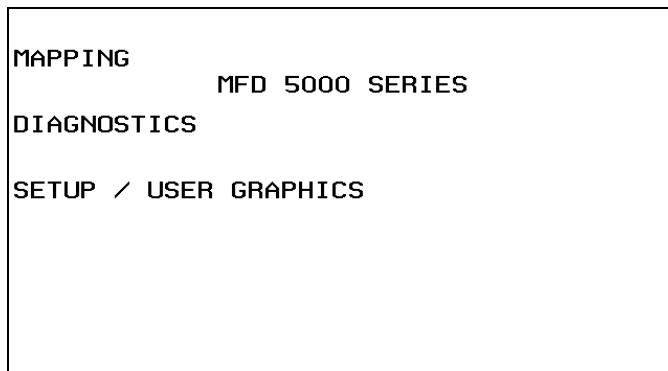
The MFD 5200 Diagnostics and Engine Indication Crew Alert System (EICAS) Setup facilities have several functions. During installation, the diagnostics portion allows testing of the communications between the navigation unit and the MFD RPU, testing of the communications between the MFD RPU and the EMM35, GeoLink, or other external sensors. Functions for factory testing of the MFD hardware and internal communications, and the resetting of NovRam to the factory defaults should only be carried out by the installer or under the direct supervision of ARNAV personnel.

The EICAS Setup facilities allows the user to set the high and low range and alarm range for various installed transducers, enter gauge description, and define gauge placement. There is also a function for sending the EMM35 these custom range settings for setting the external annunciator ranges.

Functions found within the Diagnostics area are primarily used during installation and should not need to be accessed once all communications have been established and the gauges are setup to your specifications.

Entering Diagnostics During Power-up:

During power-up, the MFD displays the system menu for five seconds.



Press the button corresponding with Diagnostics.

Entering Diagnostics / EICAS Setup From Mapping:

1. Display the Main Menu.
2. Press **FLIGHT PLAN**. The Flight Plan Menu is displayed.

LOAD FLP		NAV TO
	FLIGHT PLAN	
SAVE FLP		<input type="checkbox"/> OFF
CREATE FLP		BARO ADJ
DISPLAY FLP		EXIT
REVERSE FLP		END

1. Press **END**. The following toggle question box appears as shown below.

END PROGRAM:	
<input checked="" type="checkbox"/> END	CONTINUE
◀	▶
▶	▶
ACK	SEL

1. Use left or right arrows to highlight **EXIT**. Press **ACK** to acknowledge your selection.
2. Press the second button down on the left side of the display corresponding to the Diagnostics Menu selection.

DIAGNOSTICS MAIN MENU VERSION:V521B	
COMMUNICATIONS	EVENT TRIGGER
- LORAN/GPS	CONFIGURATION
COMMUNICATIONS	GEOLINK TEST
- AIRDATA/ENCODERS	
ENGINE MONITORING	
- TRANSDUCER SETUP	
EMM35 TEST/CONFIGURATION	
MFD 5000 EQUIPMENT	END

Engine Monitoring: Transducer Setup

Overview

This menu deals with the installation and calibration of the engine monitoring transducers. Through this menu the user may define the operating and alarm ranges for each transducer, change the descriptions, enter the round off factor, and choose how each gauge displays on the screen.

ARNAV's Engine Monitor Module, or EMM35, is the real world data gathering portion of the MFD RPU. It's features and typical uses are:

- 21 channels of analog input - Oil Pressure, Oil temp, Vacuum, Manifold Pressure, OAT, torque
- 4 counters - RPM, Fuel flow, Rotor RPM, fuel levels
- 8 ground sensing inputs - Gear position indicator, Cowl Flaps, Cabin Door
- bus voltage and cold junction temperature
- 8 output enunciator controlled by internal EEPROM ranges - independent of MFD 5200 display
- 8 output enunciator controlled by external device
- 2 EMM35's may be daisy-chained together for up to 70 channels of data monitoring and logging
- Thermocouple preamp (453-5030) for direct connect of up to 12 type J or K thermocouples

Procedure

1. Choose **ENGINE MONITORING - TRANSDUCER SETUP** from the Diagnostic Menu.

TRANSDUCER SETUP	
SETUP TRANSDUCERS	SETUP RIGHT FUEL FLOW
VIEW PARAMETERS	SETUP FUEL REMAINING
SETUP COUNTER CHANNELS	VIEW PAGE LAYOUT
SETUP SWITCH CHANNELS	
SETUP LEFT (OR SINGLE) FUEL FLOW	EXIT

2. Choose the desired function.

Setup Transducers

- **Overview**

This option allows you to configure EMM35 channels 1 through 23 (or 36 through 58 when two EMM35s are daisy-chained together). Each field is a required entry and must have appropriate data for correct operation. The information is stored in NovRam.

The first eight channels correspond to the 8 output enunciators controlled by the EMM35's internal EEPROM ranges. The EEPROM ranges should be set after all changes have been made to these first eight channels. Refer to the section on the EMM35 Configuration later in this chapter.

Channel 10 displays the cold junction. Channel 23 displays bus voltage. A channel may be turned off when not in use by entering a page type of zero (0).

- **Procedure**

1. From the TRANSDUCER SETUP menu choose **SETUP TRANSDUCERS**.
2. Enter the desired channel number by pressing **PREV** or **NEXT** to scroll through the options, then **SEL** to select and move the cursor. Press **ACK** to acknowledge the channel number and move to the next line. The current information about that channel appears.

CHANNEL 1-23:1		
	TRANSDUCER NAME :OILPR	
	TRANSDUCER TYPE :2	
BACK	HIGH RANGE :110	BACK
	LOW RANGE :5	
PREV	ALARM HIGH :80	PREV
	ALARM LOW :30	
	PAGE (0-8) :1	
NEXT	GAUGE TYPE (0-9) :1	NEXT
	X POSITION :252	
	Y POSITION :155	
ACK	PRIORITY (0-9) :1	SEL
	ROUNDING FACTOR :0	

- **Transducer Name**

Each transducer may be given a name of up to eight characters in length. This name will be displayed on the MFD 5200 Engine pages and Alarm status line.

- **Transducer Type**

Each transducer utilizes a specific equation which is used in the analog to digital data conversion. Standard transducers such as a K or J type thermocouples always use the same equation. Other transducers may have a known equation or the values used in the

calculation of the equation may be entered and the equation calculated. Enter the number of the transducer type installed.

```

TRANSDUCER TYPE SETUP
1=TYPE IN VALUES
2=TYPE IN EQUATION
3=K-TYPE THERMOCOUPLE
4=J-TYPE THERMOCOUPLE
5=LYCOMING OIL TEMP THERM
6=LM-135 SS TEMP TDx
7=K-THERM/NO COLD JUNCTION
8=J-THERM/NO COLD JUNCTION

```

All entered transducer equations are second order equations in the form $f(x)=ax^2+bx+c$. The screen will prompt for the equation after all the transducer information has been entered. Enter the value for each component separately. The C component is the same as an offset. It may be changed to make adjustments to the final transducer value.

```

BACK  SECOND ORDER EQUATION      BACK
PREV  F(X) = AX*X + BX + C       PREV
NEXT                                     NEXT
      AX*X : .000454
      BX  : -.0221
      C   : 3
ACK                                     SEL

```

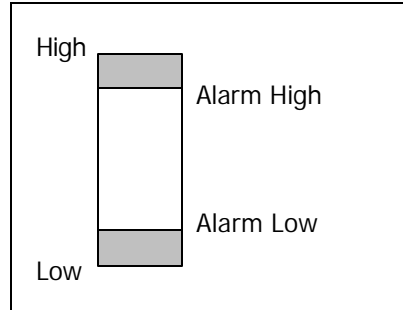
When a J or K thermocouple is entered, the screen also prompts for the gain. Choices for gain are 10, 40, 100, and 400. The offset may be either a positive or negative integer added to the final value. For example, the value calculated for a particular thermocouple taking into account the gain setting is 430. If the offset is -20, then the final value will be 410.

- **Ranges**
- **High/Low**

These are the highest and lowest indicated range of values for which the item is measured. The high value is the top of the "high" range and the low value is the bottom of the "low" range.

- **Alarm High/Low**

The alarm high and low values indicate what point the item measured is out of the normal/safe operation range. The alarm high value is the top of the normal operating range. The alarm low is the bottom of the normal operating range.



Whenever the alarm high or alarm low value is changed, the updated information must be sent to the EMM35. Refer to the section on "EMM35 Commands" below.

- **Page**

The MFD 5200 will accommodate up to three pages of Engine Monitoring. Each transducer may be displayed on any combination of pages. Gauge page 1 indicate that the transducer will only display on Engine page 1. Gauge page 5 will display on both page 1 and 3. Entering a page of zero (0) turns off this gauge and prevents it from being displayed on the Engine pages.

NOTE: If a transducer is displayed on more than one page, its location will remain the same on each page.

GAUGE	PG	PG1 DOES	PG2 NOT	PG3 SHOW
0		X		
1			X	
2				X
3				
4		X	X	
5		X		X
6			X	X
7	ALL	X	X	X

- **Gauge Type**

The type of gauge refers to the method of visual display on the MFD 5200 Engine Monitoring pages. The gauge may be text only in large or small print, a vertical sidebar, an extended vertical sidebar, or E-MACS style gauges. Each gauge requires a different amount of space. How each transducer is depicted will determine how much information may be displayed on each page.

GAUGE TYPE
0=BOXED TEXT (SMALL)
1=SLIDEBAR
2=TEXT LARGE NO BOX
3-6 RESERVED
7=EXTENDED SLIDEBAR
8 RESERVED
9=E-MACS

- **X and Y Position**

The X and Y position refers to the location on the screen the gauge information is displayed. Screen coordinates are measured in pixels. A standard monochrome screen measures 720 by 348 pixels and a standard color screen measure 640 by 350 pixels. The first number refers to the x-axis, the second to the y-axis. The coordinate (0,0) is the upper left corner.

For placement purposes, each gauge is considered to be rectangular. The X and Y position values given are for the upper left corner. Enter the x and y values for the upper left corner. The gauge position may be verified by viewing the page layout.

- **Priority**

Priority levels may be entered in the range of 0-9. Priority level 1 indicates the transducer is to be monitored for trending on the MFD 5200 . Other priority levels are reserved for future use. A maximum of 20 channels may be marked as priority 1.

- **Rounding Factor**

The rounding factor determines how the numeric information for each gauge is rounded for display. Specific gauges are typically displayed with a certain format. For example, fuel flow is displayed in tenths or one place past the decimal, such as 17.1 while RPM is typically rounded to the nearest 10's, such as 2250.

ROUNDING FACTOR: EXAMPLE	
0 = 1	XXX 8 = 5 XX5 X10
1 = RESERVED	9 = 2 XX0 XX2
2 = RESERVED	
3 = 1/100	XXX.XX
4 = 1/10	XXX.X
5 = 10	XX0
6 = 25	X00 X25 X50 X75
7 = 100	X00

View Parameters

- **Overview**

The View Parameters option lists each of the channels, counters, and switches to the screen. The high, low, and alarm values are listed as well as the equations used, page type, screen position, priority, and rounding. It is recommended that once all setting changes have been made that these values be written down for future reference.

- **Procedure**

1. Choose **VIEW PARAMETERS** from TRANSDUCER SETUP menu
2. The screen will pause after each page. Press any button to view the next page of information. The number of channels marked as priority 1 is display at the end of the list.

Setup Counter Channels

- **Overview**

Counter channels are used for such items as RPMs and Fuel Flow. They are setup in the same manner as transducer channels except they may use either a divisor factor or an equation to determine the displayed value. Refer to the Setup Transducer section, above, for information about the different fields.

Refer to the "EMM35 Installation Guide" for further information on the connections of channels and the various type of transducers.

- **Procedure**

1. Choose **SETUP COUNTER CHANNELS** from the TRANSDUCER SETUP menu.
2. Enter the desired counter number by pressing **PREV** or **NEXT** to scroll through the options, then press **ACK** to select the counter information. The current information about that counter is displayed. To move through this list, press **ACK** to move the cursor to the next line.

```

          COUNTER 1-4 :1
          COUNTER NAME :FLOW
          COUNTER TYPE :1
BACK      HIGH RANGE :26      BACK
          LOW RANGE  :3
PREV     ALARM HIGH :18      PREV
          ALARM LOW  :11
NEXT     GAUGE TYPE (0-8) :7
          TYPE (0-9) :2
          X POSITION  :172
          Y POSITION  :30
ACK      PRIORITY (0-9) :1
          ROUNDING FACTOR :4
          SEL

```

- **Counter Name**

Counter names are limited to four characters. Like transducer channels, this description is displayed on the Engine page of the MFD as well as on the Alarm status line.

- **Counter Type**

```

COUNTER TYPE SETUP
1=STANDARD CONSTANT RATE
EX: TACH / FUEL FLOW
2=VARIABLE RATE W/ EQUATION
EX: FUEL LEVEL

```

- **Constant Rate - Divisor Factor**

For flow transducers the divisor factor is determined by dividing the K-factor for that transducer by 3600. The K-factor is printed either on the transducer or on a tag tied to the transducer. Be careful not to confuse the serial number, which is also printed on the transducer, and the K-factor.

For RPM select the appropriate cylinder count or sensor type and enter the listed value.

```

DIVISOR FACTOR =
1. FLOW TRANSDUCERS:
   K-FACTOR / 3600
2. RPM:
   INLINE TACH SENSOR
   = .066667
   4 CYL. = .016666
   6 CYL. = .025
   8 CYL. = .033333

```

- **Variable Rate With Equation**

All entered counter equations are second order equations in the form $f(x)=ax^2+bx+c$. The screen will prompt for the equation after all the counter information has been entered. Enter the value for each component separately. The C component is the same as an offset. It may be changed to make adjustments to the final counter value.

Setup Switch Channels

- **Overview**

Switches are used to monitor items that exist in one of two states such as Gear UP or DOWN or Landing lights ON or OFF. Switches display as small text with the current state indicated such as GEAR UP.

Switches do not have high and low or alarm ranges. Refer to the Setup Transducer section above for information about the different fields.

- **Procedure**

1. Choose **SETUP SWITCH CHANNELS** from the TRANSDUCER SETUP menu.
2. Enter the desired switch number by pressing **PREV** or **NEXT** to scroll through your options, then pressing **ACK** to acknowledge your selection. The current information about that switch is displayed. Pressing **ACK** to move the cursor through the fields.

SWITCH 1-8 :1		
SWITCH NAME :LTIT		
SWITCH TYPE :7		
BACK		BACK
PREV		PREV
NEXT	PAGE (0-8) :1	NEXT
	GAUGE TYPE (0-9) :6	
	X POSITION :401	
	Y POSITION :323	
ACK	PRIORITY (0-9) :0	SEL

- **Switch Name**

The switch name is limited to four characters. Like transducer channels, this description is displayed on the Engine page of the MFD as well as on the Alarm status line.

- **Switch Type**

There are eight switch types to choose from. Each type describes a different state. For example, landing gear is either up or down. The cabin door is either open or closed. Choose the state that best represents the states in which the item exists.

SWITCH TYPE :			
TYPE 1 :	OPEN	/	CLOSED
TYPE 2 :	IN	/	OUT
TYPE 3 :	UP	/	DOWN
TYPE 4 :	ON	/	OFF
TYPE 5 :	LEFT	/	RIGHT
TYPE 6 :	HIGH	/	LOW
TYPE 7 :	YES	/	NO
TYPE 8 :	LOW	/	OK

- **Normal Switch Position**

Each switch has two states. The user must indicate in which state that item is normally found.

Switch normally ON : 1 1=yes 0=no
 the switch is normally ON
 the Strobe light is normally ON

Switch normally ON : 0 1=yes 0=no
 the switch is normally OFF
 landing lights are normally OFF

Setup Fuel Flow (Left and/or Right)

- **Overview**

When both a fuel flow transducer and a fuel flow return transducer are installed the actual fuel flow is a calculated value. The fuel flow transducer is installed on counter channel one. The fuel flow return transducer is installed on counter channel two. The EMM35 must be configured for the number of engines and whether or not flow return is installed. The K-factor for each of the fuel flow transducers must also be supplied to the EMM35. Refer to the section on "EMM35 Configuration" below.

If no fuel flow transducers are installed set the page type to zero (0) to turn off these gauges.

- **Procedure**

1. Choose **SETUP FUEL FLOW (LEFT/SINGLE OR RIGHT)** from the Transducer Setup menu.
2. Use standard data entry procedures to enter the desired settings. Refer to the Setup Transducer section above for information about the different fields.
3. Choose **SETUP COUNTER CHANNELS** and select counter 1 (the counter the fuel flow transducer is on). Set the page type to zero (0).
4. Choose **SETUP COUNTER CHANNELS** and select counter 2 (the counter the fuel flow return transducer is on). Set the page type to zero (0).

The values from the counter channels do not need to be displayed. Setting the page type to zero (0) turns off the display of the counters. The EMM35 still uses the information from these counter channels to calculate fuel flow. Only the fuel flow value from this gauge needs to be displayed.

Setup Fuel Remaining

- **Overview**

The fuel remaining is a calculated value based on the user supplied information of fuel onboard and the fuel flow detected by the fuel flow and fuel return transducers. The fuel remaining is setup like a transducer with high, low, and alarm values, priority level, and rounding factor.

The full fuel amount is entered in the Setup / User Graphics section. Current fuel levels are entered from the MFD mapping. Current fuel levels are only entered when fuel is added or if fuel is removed while the EMM35 is turned off. The user does not need to enter current fuel levels on every power-up.

- **Procedure**

1. Choose **SETUP FUEL REMAINING** from the TRANSDUCER SETUP menu.
2. Enter the desired settings by using standard data entry procedures. Refer to the Setup Transducer section above for information about the different fields

View Page Layout

- **Overview**

This option allows the user to view the layout of each of the three gauge pages. Use this function when relocating a gauge or changing a gauge type to verify that the new layout does not cause any overlapping. Only the gauge outlines are displayed. This function does not display current reading from the EMM35 and so may be used even when the EMM35 is disconnected or powered-off.

- **Procedure**

1. Choose **VIEW PAGE LAYOUT** from the TRANSDUCER SETUP menu
2. Choose gauge page 1, 2, or 3.
3. Press any button to return to the Transducer Setup menu.

EMM35: Test / Configuration

Overview

This section has several diagnostic tests and facilities to verify the communication between the MFD RPU and the EMM35.

Procedure

1. Choose **EMM35 - TEST / CONFIGURATION** from the DIAGNOSTICS menu

2. Select your the option.

```
EMM35 TEST/CONFIGURATION MENU
TEST EMM35                QUERY EMM35
                          SOFTWARE VERSION

CONFIGURE EMM35

DISPLAY EMM35 CHANNELS

VIEW RAWDATA FROM EMM35

VIEW GAUGE DATA                EXIT
```

Test EMM35

```
EMM35 TEST MENU
CHANGE COM PORT          SEND ANALOG OUT
- CURRENT PORT COM2:

CHANGE NODE NUMBER (1-2)
- CURRENT NODE  1

TEST EXTERNAL
ANNUNCIATORS 9-16

QUERY EMM35 RANGE DATA

GET ANNUNCIATOR STATUS    EXIT
```

- **Change Com Port**
- **Overview**

This option determines which communications port the diagnostic tests use for the EMM35 data. The default value is port 2 and should only be changed under directions from ARNAV personnel.

- **Change Node Number**

- **Overview**

A twin engine aircraft requires two EMM35 units. The units are then referred to as node 1 and node 2. When sending a query command, initializing the annunciator ranges, or setting the fuel parameters the desired EMM35 node must be chosen.

- **Procedure**

1. Choose **CHANGE NODE NUMBER** from the EMM35 Test menu. The selection toggles between node 1 and node 2.

- **Test External Enunciators 9-16**

- **Overview**

This option tests the 8 output enunciators (enunciators 9-16) by sending a series of commands testing all light combinations.

- **Query EMM35 Range Data**

- **Overview**

This diagnostic tool sends a query to the EMM35 requesting the current range settings for enunciators 1-8.

- **Get Annunciation Status**

- **Overview**

This diagnostic tool sends a request to the EMM35 asking for the current on or off status of enunciators 1-16.

- **Send Analog Out**

- **Overview**

Configure EMM35

- **Overview**

This section allows the user to send the EMM35 the high and low ranges to be used for the external enunciators, select and configure the fuel mode, and select how many times per second the EMM35 is to send information to the MFD RPU.

```
EMM35 CONFIGURATION MENU
ANNUNCIATOR RANGE
INITIALIZATION
SET FUEL MODE

SET EMM35 INTERVAL
(1 2 OR 4)

EXIT
```

- **Enunciator Range Initialization**

- **Overview**

This options takes alarm high and low ranges for transducer channels 1 through 8 and sends them to the EMM35 where they are stored in EEPROM. These ranges are then used to light the external enunciators independently of the MFD 5200 .

- **Procedure**

1. Choose **ENUNCIATOR RANGE INITIALIZATION** from the EMM35 Configuration menu

The ranges for channels 1-8 are transmitted to the EMM35. If two EMM35s are installed the appropriate ranges will be transmitted to each EMM35. When the transmission is complete the EMM35 Command Structure menu is displayed.

- **Set Fuel Mode**

- **Overview**

When using a fuel flow transducer and/or a fuel flow return, the K-factors for these transducers must be sent to the EMM35 so the fuel flow and fuel remaining calculation may be made. The EMM35 receives the information and stores it in EEPROM.

- **Procedure**

1. Choose **SET FUEL MODE** from the EMM35 Configuration menu.

```

EMM35 SET FUEL MODE
DISABLE FUEL RECORD   ENABLE TWIN ENGINE
                       / WITH FUEL RETURN

ENABLE SINGLE ENGINE
/ NO FUEL RETURN

ENABLE SINGLE ENGINE
/ WITH FUEL RETURN

ENABLE SPECIAL TWIN
WITH 1 NODE (OLD STYLE)

ENABLE TWIN ENGINE           EXIT
/ NO FUEL RETURN

```

2. Select the correct fuel configuration.
3. The screen will prompt for the K-factor and for the counter the transducer is connected to for the fuel flow and fuel return for each node as required by the selected option.

For example, the option Single Engine No Return will prompt for one KFactor and the associated counter channel. Twin Engine With Return will prompt for a total of four K-factors and associated counter channels.

```

          INIT FUEL FLOW NODE 1

          K-FACTOR
          00000-99999 : -
BACK      COUNTER 1-4 : -           BACK

PREV                                           PREV

NEXT                                           NEXT

ACK      REPOWER EMM35           SEL
          TO ACCEPT NEW VALUES

```

- **Set EMM35 Interval**
- **Overview**

This option selects how frequently the EMM35 transmits data to the MFD RPU. For a single engine the interval may be 1, 2, or 4 times per second. For twin installations the interval may be 1 or 2 times per second per node.

Display EMM35 Channels

- **Overview**

This option provides a diagnostic tool for verifying the data received by the MFD RPU from the EMM35. Each channel is listed followed by the raw data. For more information about this option refer to the "EMM35 Installation Guide".

View Raw Data From EMM35

- **Overview**

This option provides a diagnostic tool for verifying the communication link between the MFD RPU and the EMM35. The raw data from the EMM35 is displayed on the screen. For more information about this option refer to the "EMM35 Installation Guide".

View Gauge Data

- **Overview**

This option allows the user to view the layout of each of the three gauge pages with live EMM35 data. Use this function to verify that the high/low and alarm ranges are appropriate and that the entered equations are returning valid data. The EMM35 must be connected and powered before using this function.

- **Procedure**

1. Choose **VIEW GAUGE LAYOUT** from the EMM35 Test/Configuration menu.
2. Choose gauge page 1, 2, or 3.
3. Press any button to return to the EMM35 Test/Configuration menu.

Query EMM35 Software Version

- **Overview**

This option provides a diagnostic tool for verifying the communication link between the MFD RPU and the EMM35. The MFD RPU queries the EMM35 for the software version. After a successful query, the EMM35 Software Version is displayed on the screen.

ARNAV SYSTEMS, INC.

DESCRIPTION
MOUNTING TEMPLATE, ALT ENCODER
INTERFACE - MANIFOLD/VACUUM -
IAS SENSOR

DRAWING NUMBER:
ED-886

