MAINTENANCE MANUAL

SERVICE SECTION FOR EDACS FMD™ MOBILE RADIO COMBINATIONS

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NOTICE

DESCRIPTION

This Service Section contains the information necessary for aligning and troubleshooting the EDACS FMD mobile radio. In addition, information is provided for removing and replacing chip components, disassembly procedures, and module replacement procedures.

INITIAL ADJUSTMENT & CONFIGURATION

Refer to the Installation Manual for details on installing the EDACS FMD radio. The following adjustments should be made by a qualified technician when the radio is put into service. Make sure the radio jumpers are configured properly.

PROGRAMMING

Before the FMD radio is placed into service, it must be programmed using the PC programmer (refer to programming manual TQ3340). The programmer allows you to set the radio for operation in your radio system.

NOTE

The yellow ignition sense lead on the power cable must be connected to A+ (13.8 V nominal) for the radio to be programmed (R662 must have A+ applied). Be sure power is applied to this lead when programming the radio in the vehicle if ignition switch bypass is selected.

Test receive and transmit frequencies are programmed into the radio when it is delivered. Some tests described in this section require the use of these test frequencies. Save the test personality using the PC programmer if you need to reprogram these frequencies.

JUMPER CONFIGURATION

Before installing the radio or making any electrical connections, it is necessary to configure jumpers on the internal circuit card assemblies in order to support the selected options. Refer to Table 1 for information. Only the installed options should be enabled.

TABLE 1 - OPTION CONFIGURATION

OPTION	PANEL CONTROL BOARD JUMPERS						SYSTEM CONTROL BOARD JUMPERS		
	A	C	N/D	F	X	Y	W1	J604	J603
SHIPPED CONFIGURATION	I	I	I	I	R	I	I	1 & 2	
EXTERNAL SPEAKER									
REMOTE INTERNAL SPEAKER		R							
EMERGENCY SWITCH									
BYPASS IGNITION SWITCH								2 & 3	
CONTROL PANEL CLOCK SHIFT				R					
SYSTEM CONTROL CLOCK FREQUENCY SHIFT							R		
NPSPAC									2 & 3
HANDSET					I	R			

NOTE

I = Jumper Installed R = Jumper Removed
Some jumpers must be removed by cutting the printed wire and installed by restoring the run.

Clock Frequency Shift

The clock frequency of the microprocessor on the System Control board and Panel Control board may be shifted by removing a jumper. If the clock frequency of either microprocessor causes interference with other components of the communication system, removing the indicated jumpers may correct the problem.

TRANSMITTER ADJUSTMENT

The transmitter has been adjusted at the factory and should require no adjustment. However, the antenna length should be adjusted for optimum VSWR, and the frequency and modulation measured and recorded for future reference. For the complete transmitter adjustment, refer to the alignment procedure.

RECEIVER ADJUSTMENTS

Refer to the receiver alignment procedure.

RE-INSTALLATION

The EDACS FMD mobile radio is designed to operate in 12-volt, negative ground vehicles only. If the mobile radio is moved to a different vehicle, always check the battery polarity of the new vehicle electrical system.

MAINTENANCE

PREVENTIVE MAINTENANCE

To insure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. Preventive maintenance should include items described in the following paragraphs.

Connections

Ground connections to the voltage source should be periodically checked for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation. When ground connections are not made directly to the battery, the connection from the battery to vehicle chassis must be checked for low resistance. A high resistance may cause excessive voltage drops and alternator noise problems.

Electrical System

Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe and economical operating limits. Over voltage is indicated when the battery looses water rapidly. Usage of one or two ounces of water per cell per week is acceptable for batteries in continuous operation. A weak battery will often cause excessive noise or faulty operation.

Mechanical Inspection

Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws and parts to make sure that nothing is working loose.

Antenna

The antenna, base and all contacts should be kept clean and free from dirt or corrosion. If the antenna or its base should become coated or poorly grounded, loss of radiation and a weak signal will result.

Alignment

The transmitter and receiver meter reading should be checked periodically, and the alignment "touched up" when necessary. Refer to applicable alignment procedure and troubleshooting for typical voltage readings.

Frequency Check

Check transmitter frequency and deviation. Normally, these checks are made when the unit is first put into operation, after the first six months, and once a year thereafter.

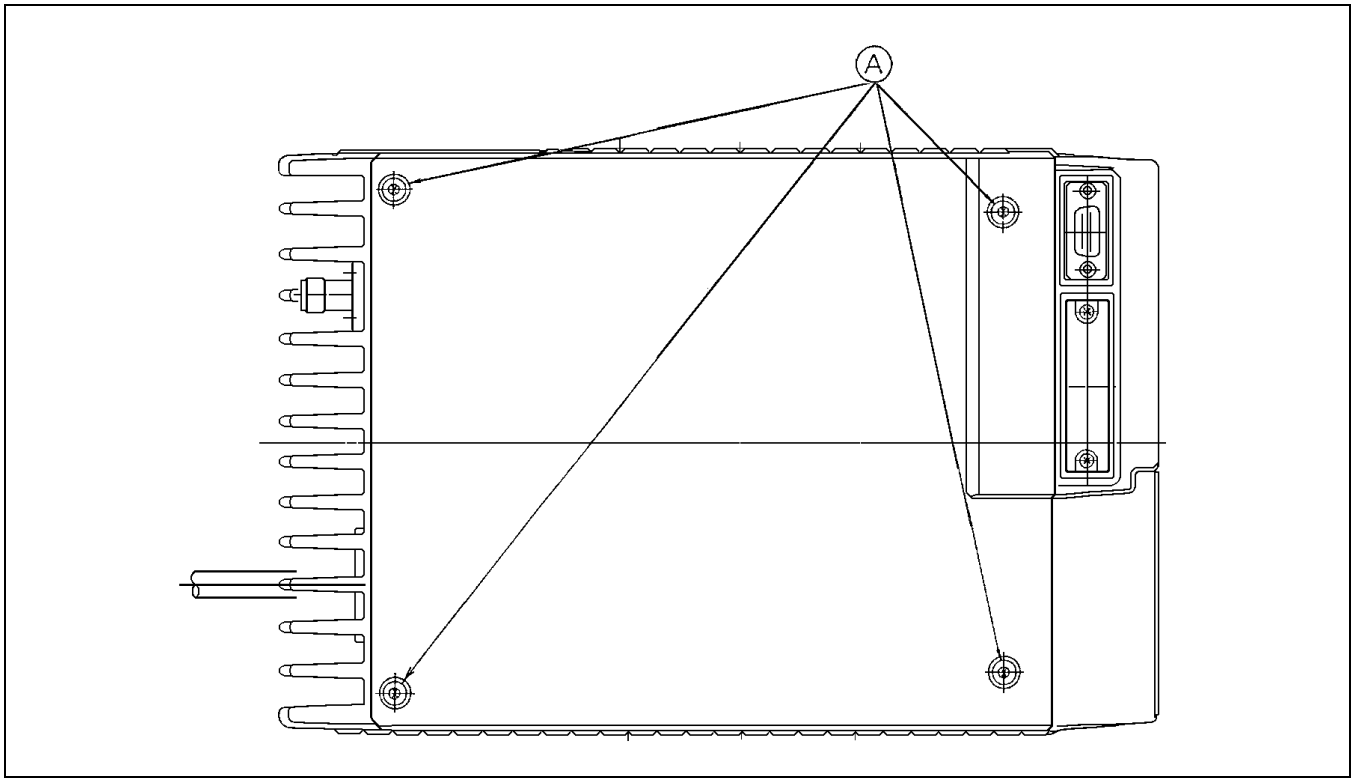

Figure 1 - Removing The Covers

DISASSEMBLY

To gain access to the transmitter, receiver, system control, and the synthesizer for servicing, loosen the four screws [A] in the bottom cover (Figure 1), then remove each cover.

IMPORTANT NOTE

When reassembling an FMD after service, special care must be taken to maintain the waterproof qualities of the radio. The correct torque and tightening sequence must be used on the chassis screws. If the improper torque or tightening sequence is used, the waterproof capability of the radio will be lost. Refer to the Reassembly Diagram for this procedure.

DRIVER REPLACEMENT

To Remove Driver HC2 on the Transmitter board:

1. Remove the two screws securing the driver module (HC) to the printed wire board.
2. Unsolder the five leads bridging HC to the printed board while lifting each lead as they ar unsoldered.

NOTE

These leads are soft and can be bent easily.

3. Gently lift up on the module taking care not to damage the spacer under the module.

NOTE

The module may stick to the printed board.

To Replace Driver HC2:

1. Position the module properly, aligning the screw holes and leads with the printed board. Trim the new HC leads (if required) to the lead length of the removed HC (see Figure 2).
2. Replace the two screws securing the driver to the printed board, using a moderate torque of 0.5 ±0.1 Newton-meters (5 inch-pounds).

3. Solder the five leads of driver HC2 to the printed board and ground strap.

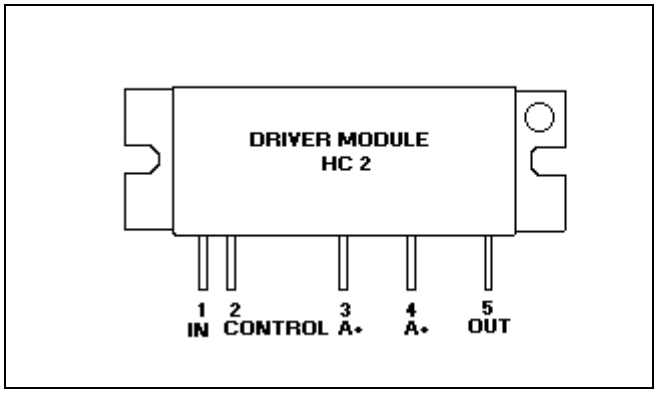

Figure 2 - Driver Lead Identification

PA TRANSISTOR REPLACEMENT

WARNING

The PA transistor contains Berllium Oxide, a TOXIC substance. If the Ceramic or other encapsulation is opened, crushed, broken or abraded, the escaping dust may be hazardous if inhaled. Use care when replacing the module.

1. Remove the two retaining screws securing PA transistor TR1 to chassis assembly.

2. Remove capacitors and unsolder. Use a desoldering tool as necessary while lifting the transistor leads with a small screwdriver or pick. Discard old capacitors.

3. Unsolder the emitter, base and collector leads of the transistor, and remove it from the printed board.

4. Remove all excess solder from the board, and clean the holes to allow the new transistor to be positioned properly and the capacitors to fit into proper locations. Refer to Figure 3.

5. Apply silicon grease to back of the replacement transistor and place the transistor into the mounting slot.

6. Replace the transistor mounting screws using a moderate torque of 0.5 Newton-meter (4.5 inch-pounds).

7. Tack solder the four base leads to the printed board, using minimum solder. Then solder the emitter and collector leads.

8. Install the capacitors into their proper mounting areas, flush to the board.

9. Solder the capacitor bodies to the printed board by first soldering the outside edge. Then, holding the iron to the outside edge, touch the solder to the inside edge of the capacitor. Be careful not to create solder bridges at the front and back edges of the capacitors.

10. Remove any flux left on board.

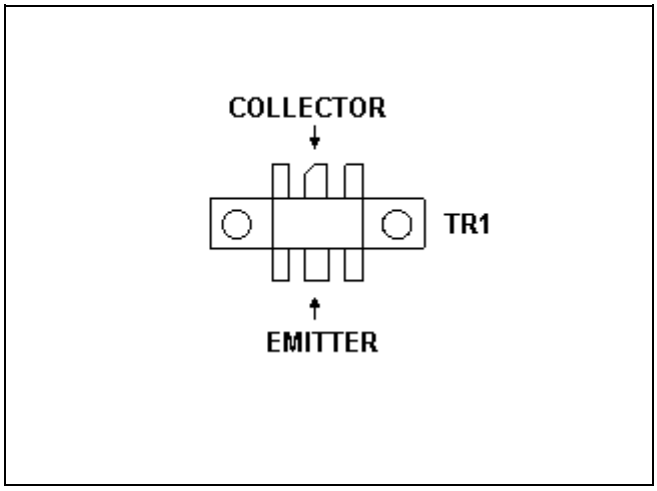

Figure 3 - PA Transistor Lead Identification

CHIP COMPONENT REPLACEMENT

Replacement of chip capacitors should always be done at a temperature controlled soldering iron, using a controlled temperature of 700°F (371°C). However, do not touch the black metal film of the resistors or the ceramic body of capacitors wit the soldering iron.

NOTE

The metallized end terminations of the parts may be touched with the soldering iron without causing damage.

To Remove Chip Components

1. Using two soldering irons, heat each end of the chip at the same time until solder flows, and then remove and discard the chip.

2. Remove excess solder with a vacuum solder extractor.

3. Carefully remove the epoxy adhesive and excess flux to prevent damage to the printed board.

To Replace Chip Components

1. Using as little solder as possible, tin one end of the component and one of the pads on the printed wiring board.

2. Place the tinned end of the component on the tinned pad on the board and simultaneously touch the component and the pad with a well tinned soldering iron while pressing the component down on the board.

3. Place the tinned soldering iron on the other end of the component and the pad simultaneously. Apply solder to the top of the end of the component until the solder starts to flow. Use as little solder as possible while getting a good joint.

CAUTION

The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, discharge yourself by touching the case of a bench test instrument that has a three-prong plug connected to an outlet with a known good earth ground. When soldering or desoldering a CMOS device, the soldering iron should also have a three-prong power plug connected to n outlet with a know good earth ground. A battery-operated soldering iron may be used in place of the regular soldering iron.

4. After the component has cooled, remove all flux from the component and printed wiring board area with alcohol.

DISASSEMBLY PROCEDURE

To Remove System Control Board
(refer to Figures 1 and 4)

1. Remove the four screws [A] securing the top and bottom covers.

2. Disconnect the interconnecting cables.

3. Remove the four screws [B] securing the System Control board to the frame.

4. Remove the screw [C] securing regulator IC608, and carefully lift up and remove the board.

To Remove Frequency Synthesizer Board
(refer to Figures 1 and 4)

1. Remove the four screws [A} securing the top and bottom cover.

2. Disconnect interconnecting cables.

3. Remove the eight screws [D] securing the synthesizer shield and remove shield.

4. Remove the screw [E] securing the board.

5. Remove the screw [F] securing regulator IC209, and carefully lift up and remove the board.

To Remove Receiver Board:

1. Remove the four screws [A] securing the top and bottom cover.

2. Disconnect the interconnecting cables connected to other boards, and then remove the seven screws [G] securing the Receiver board.

3. Remove the screw [H] securing regulator IC501, and carefully lift up and remove the board.

To Remove Transmitter Board (refer to Figures 1 and 5)

1. Remove the screws [A] securing the top and bottom cover.

2. Disconnect the interconnecting cables and remove three screws [I] securing the Antenna shield, then remove the shields.

3. Remove the one screw [J] connecting the power supply cable to the transmitter board.

4. Remove the two screws [K] securing power module. Then, remove the screws [L] securing power transistors TR1.

5. Remove the two screws [M] securing transistors TR3 and TR4.

6. Remove the five screws [N] securing the Transmitter board, and carefully lift up and remove the board.

To Remove Panel Control Board
(refer to Figures 1 and 6)

1. Remove the four screws [A] securing the top and bottom cover.

2. Remove the four screws [P] securing the front panel to the chassis.

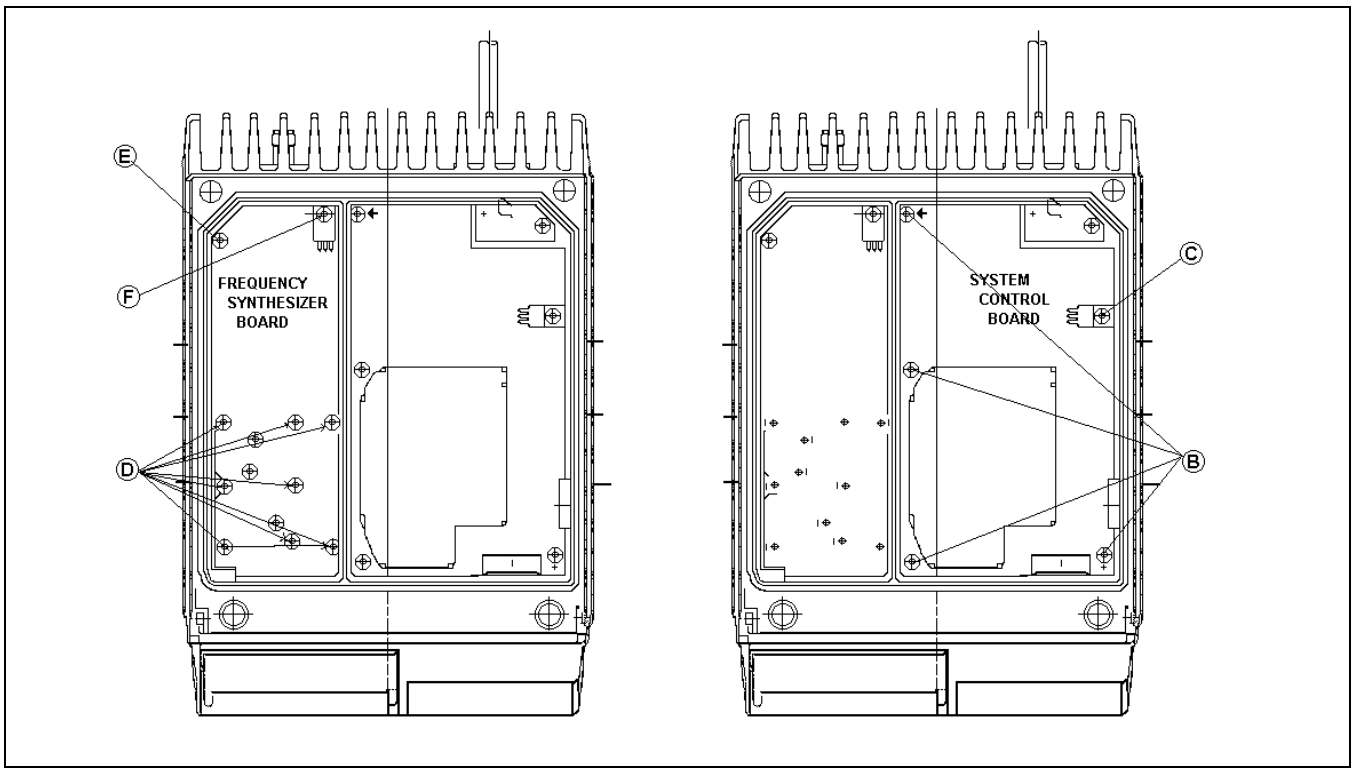

Figure 4 - Radio Top View

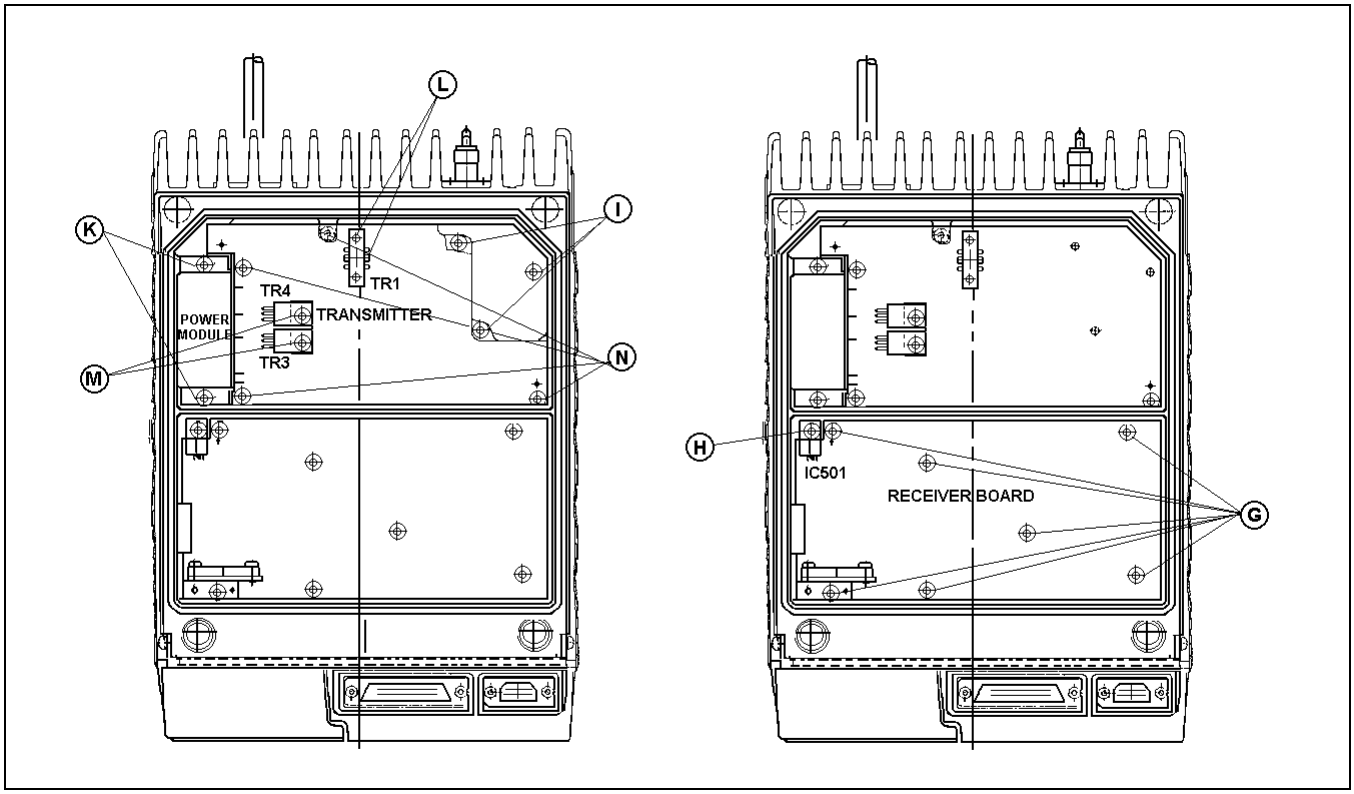

Figure 5 - Transmit and Receive Board Bottom View

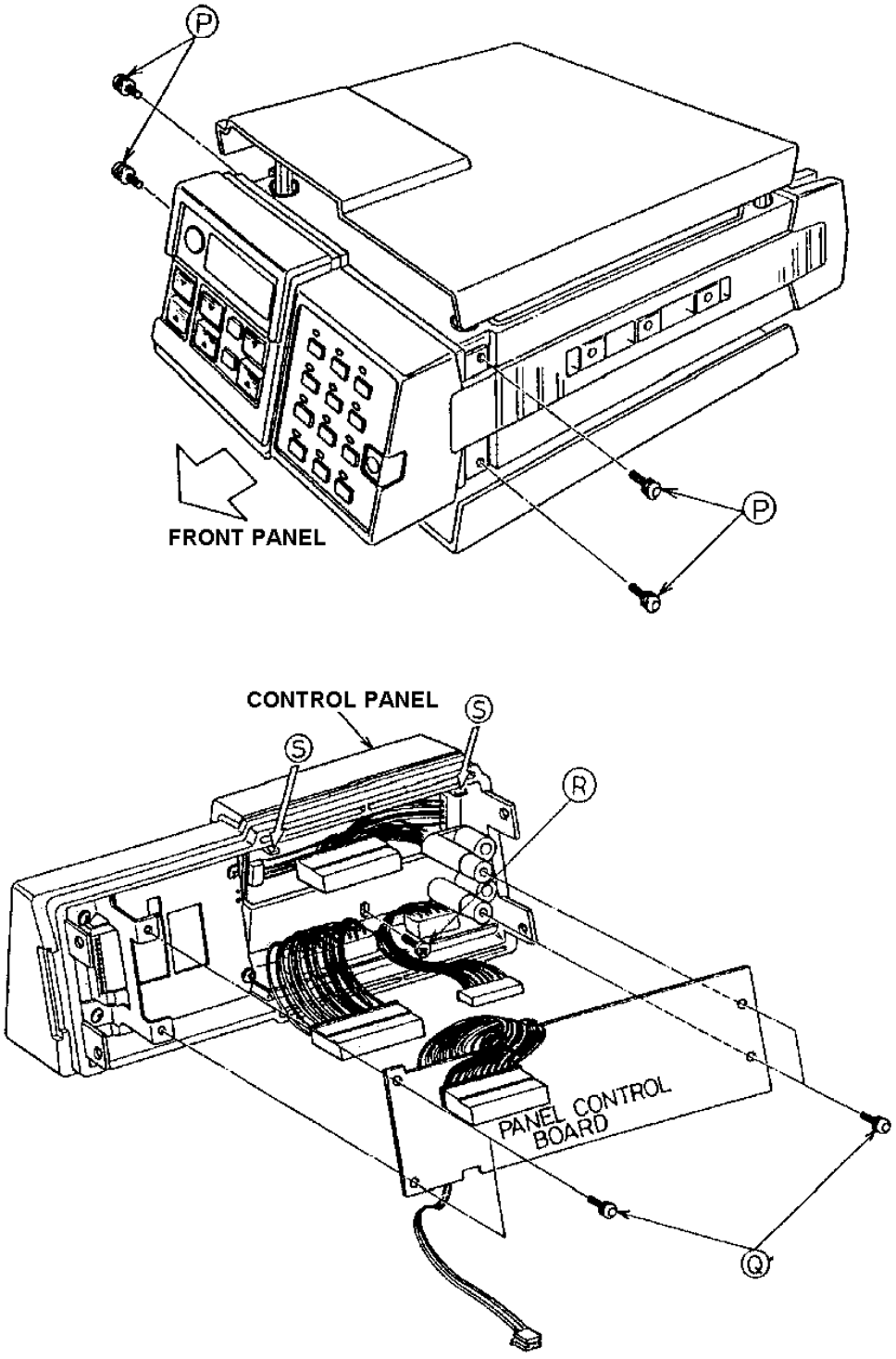

Figure 6 - Front Panel Disassembly

3. Disconnect the interconnecting cable.
4. Remove the front panel from the chassis
5. Remove the four screws [Q] securing the panel board.
6. Disconnect the interconnecting cables.

To Remove Display Unit (refer to Figures 1 and 6)

1. Remove the four screws [A] securing the top and bottom cover.
2. Remove the four screws [P] securing the front panel to the chassis.
3. Disconnect the interconnecting cable.
4. Remove the front panel from the chassis
5. Remove the four screws [Q] securing the panel board.
6. Disconnect the interconnecting cable.
7. Remove the screw located at [R].
8. While pushing the lock tabs at [S] remove the control panel toward the front.

RECEIVER TEST PROCEDURES

These test procedures are designed to help you to service a receiver that is not operating properly. The problems encountered could be low power, poor sensitivity, distortion, and low gain. By following the sequence of test steps, the defect can be quickly located.

Once the defective stage is located, refer to the Service Check listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the radio is properly programmed for testing, receiver is tuned and aligned to the proper operating frequency, and the transmitter is operating properly.

Test Equipment Required

1. Distortion analyzer
2. Signal generator
3. 6 dB attenuation pad
4. 16 Ohm, 6 watt resistor

Test Procedure

The receiver test procedure is listed in Table 2.

TABLE 2 - RECEIVER TEST PROCEDURE

TEST	PROCEDURE	SERVICE CHECK
AUDIO OUTPUT AND DISTORTION	a. Apply a 1000microvolt, on-frequency test signal modulated by 1000 Hz tone at 3.0 kHz deviation to antenna jack ZC1.	If distortion is more than 5% or is less than 4 watts, check the following:
	b. Disconnect speaker plug (if present and connect a 6 ohm, 6 watt resistor across the external speaker connections.	Battery and regulator voltage
	c. Adjust the volume control for rated power output of 4 watts (8 Vrms across 16 ohm load) using the distortion analyzer as a voltmeter.	Audio Gain
	d. Make distortion measurements according to the test equipment manufacturer's instructions. Readings should be less than 5%. If the receiver sensitivity is to be measured, leave all controls and equipment set up.	FM Detector Alignment (see alignment Procedure)
USABLE SENSITIVITY (12 dB SINAD)	a. Apply a 1000microvolt, on-frequency signal modulated by a 1000 Hz tone at 3.0 kHz deviation to J2.	If the sensitivity level is more than the rated 12 dB SINAD, check the alignment of the IF stage as directed in the alignment procedure.

TABLE 2 - RECEIVER TEST PROCEDURE (Continued)

TEST	PROCEDURE	SERVICE CHECK
	b. Place the range switch on the distortion analyzer in the 200 to 2000 Hz distortion range position (1000 Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.). c. Place the range switch in the set level position (filter out of the circuit) and adjust the input level control for a +2 dB reading. d. Set signal generator output to 0.3 V. Switch the range control from set level to the distortion range. Readjust the distortion analyzer set level as required until a 12 dB difference (+2 dB to -10 dB) is obtained between the set level and distortion range positions (filter out and filter in). e. The 12 dB difference (signal plus noise and distortion to noise plus distortion ratio) is the usable sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio input of at least 2 watts (5.66 Vrms across the 16 ohm receiver load using the meter). f. Leave all controls as they are and all equipment connected if the modulation acceptance bandwidth test is to be performed.	
MODULATION ACCEPTANCE (BANDWIDTH OR I-F BANDWIDTH)	a. Set the Signal generator output for twice the microvolt reding obtained in the 12 dB SINAD measurement. b. Set the range control on the distortion analyzer in the set level position (1000 Hz filter out of the circuit, and adjust the input level control for a +2 dB reading on the 30% range. c. While increasing the deviation of the signal generator, switch the range control from set level to distortion range until a 12 dB difference is obtained between the set level and distortion range readings (+2 dB to -10 dB). d. The deviation control reading for the 12 dB difference is the modulation acceptance bandwidth of the receiver. It should be more than ±5.6 kHz.	If the modulation acceptance bandwidth test does not indicate the proper width, refer to the receiver troubleshooting procedure.

ALIGNMENT AND TROUBLESHOOTING

Radio maintenance is facilitated by using the troubleshooting procedures and servicing techniques unique to this radio. The troubleshooting procedures are designed to lead you rapidly to the defective component or circuit.

Troubleshooting Procedures are provided for most major problems that might arise in the Transmitter, Receiver, and Synthesizer board.

MICROCOMPUTER DIAGNOSTICS

The microcomputer, in addition to all operational modes, contains software to perform diagnostics at powerup. Certain checks are made to verify proper operation of the radio system. The following error messages may appear if the programming/configuration is incorrect:

E1 - ROM test failure

E2 - RAM test failure

E8 - Voice Guard configuration error

E9 - Personality error

When the test mode is invoked a checksum is calculated on the program memory (IC-705). If an error occurs, E1 is flashed on the System display. Once the checksum test passes, a read/write test is performed to all RAM locations. If any location fails, an E2 is flashed on the System display. Once an error is displayed, the radio remains in the error-display state and no further operation is allowed.

Every time the power is applied in normal operation, the personality is checked for programming. If Voice Guard is enabled and forced private/auto select options are improperly enabled for the FS 1027 version, and E8 is flashed on the System display. If the personality is not programmed, an E9 is flashed on the System display. In either case, the radio remains in the error display state and no further operation is allowed.

A test mode is provided for adjusting and checking radio settings. The test mode is activated by powering down the radio and connecting the MOBILE TEST line (pin 12 of the MDT connector) to ground. When power is turned on again, the radio will enter the test mode.

In the test mode, the Group display shows the RF test channel and the System display shows the test number. The test channel is determined by the information in the personality PROM selected at programming.

NOTE

The transmit deviation is set to full deviation regardless of frequency (NPSPAC) or non-NPSPAC) while in the test mode.

There are nine tests which may be selected via the SYSTEM control. The tests available are as follows:

01 Mic Test -- used to set receive audio output level and microphone deviation.

02 Channel Guard Test -- used to set Channel Guard tone deviation.

03 Channel Guard plus Mic Test -- used to verify Channel Guard plus voice audio deviation.

04 Alert Tone Test -- used to test alert tone operation and verify receive Voice Guard audio operation.

05 Digital Data Test -- used to set digital data deviation and verify receive Voice Guard® audio operation.

06 Voice Guard Transmit Data Test -- transmits Voice Guard data (must be driven from an external source).

07 Voice Guard Transmit Audio Test -- transmits audio from the Voice Guard TX DATA HI line (must be driven from an external source).

08 Modem Data Loop-back Test -- checks modem receive and transmit paths.

09 Software Revision Test -- displays current software revision number in the Group display.

The GROUP control is used to select the test channel. Table 3 lists the test frequencies programmed when the radio is shipped from the factory.

The test routines are used during adjustment of the radio. When troubleshooting the radio, it is recommended that the transmitter and receiver alignment procedures be followed to locate the problem.

TABLE 3 - GROUP SETTINGS AND FREQUENCIES

GROUP SETTING	TRANSMIT FREQUENCY (MHz)	RECEIVE FREQUENCY (MHz)	CHANNEL GUARD	CCT
1	815.9625	860.9625	71.9	
2	824.9875	869.9875	023	
3	806.0125	851.0125		1 minute
4	860.9875	860.9625	71.9	
5	869.9875	869.9625		
6	815.9875	860.9875		
7	824.9625	869.9625		1 minute
8	806.0375	851.0325		
9	861.3250	860.9750		
10	869.9750	869.5000		
11	851.3500	851.3500		
12	823.0000	851.0000		1 minute

MODEM DATA LOOP-BACK TEST

This test verifies continuity from TX DATA (IC603-3) through IC605, IC604 and back to the modem as RX DATA (modem receive data).

Test Equipment

13.8 Vdc regulated power supply

Test Procedure

1. Place P601 in the TEST position (between pins 2 & 3).
2. Connect dc power to the mobile radio.
3. Set the system to 08 (modem data loop back test).
4. Momentarily key the transmitter. The BSY status flag will be displayed during the active part of the data test. When the test finishes, one of the following results will appear in the GROUP display.

   E0 Test completed without Failure.

   E1 First pass failed. Receive and transmit data not the same.

   E2 Second pass failed. Unable to disable receive data (check TR602).

5. Return jumper P601 to the NORMAL position.

SYNTHESIZER CHECK

Alignment and troubleshooting for the synthesizer circuitry is covered in this section. A synthesizer troubleshooting flowchart is provided in Figure 9.

Test Equipment

- 13.8 Volt dc power supply
- Two channel oscilloscope (storage model preferred)
- Communications service monitor
- RF signal generator

Test Procedure

1. Remove the top cover of the mobile, and remove P602.
2. Connect dc power to the radio.
3. Connect a 50-ohm dummy load to the antenna connector.
4. Connect ZC852-12 to ZC852-4 (A-) on the front panel to enable test mode.
5. Connect the scope's channel 1 probe to IC709 pin 2.
6. Connect the scope's channel 2 probe to the DEMOD OUT on the service monitor.
7. Tune the service monitor to receive on 815.9625 MHz and select wideband operation.
8. Calibrate the scope display as follows:

   a. Setup the RF generator to produce a 0 dBm signal on 815.9625 MHz with 1 kHz of deviation at 1 kHz rate.

   b. Remove the service monitor's antenna and connect the generator output in its place.

   c. Select AUTO triggering on the scope, and set channel 2 to dc coupling.

   d. Adjust the voltage gain on channel 2 so that the waveform amplitude is 2 centimeters peak-to-peak.

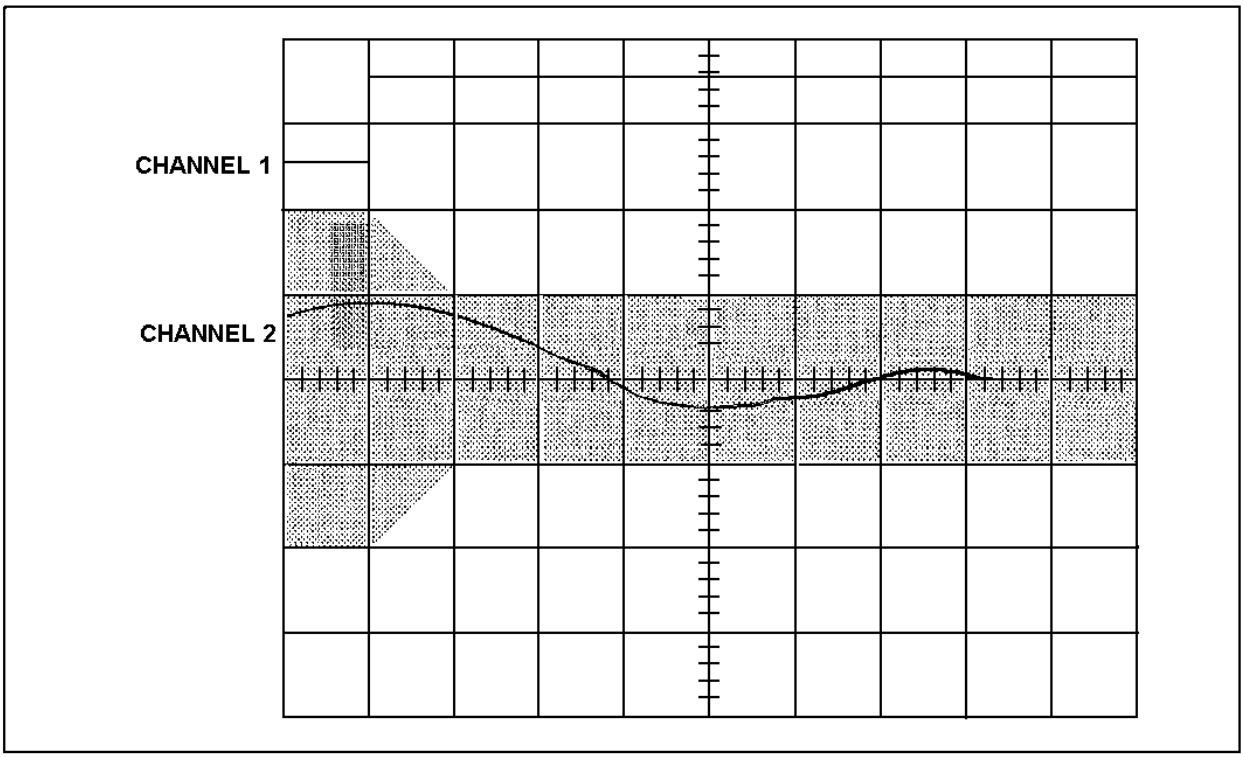

Figure 7 - Scope Display

e. Turn off the modulation at the RF generator, and adjust the VERTICAL POSITION on scope channel 2 so that the channel 2 trace lies along the center horizontal axis.

f. Turn off the RF generator and reconnect the service monitor's antenna.

The scope display is now calibrated to read deviation directly from the display along the vertical axis. Each centimeter represents 1 kHz of deviation.

9. Turn on the mobile, and set the GROUP control to 01 (815.9625 MHz RF test frequency).

10. Set the SYSTEM control to test 01.

11. Select 5 ms/cm on the scope's TIME switch. Select channel 1 as the trigger source, select positive edge triggering, and adjust the TRIGGER LEVEL control so that the scope triggers each time PTT is pressed.

12. Compare the waveform against Figure 7. The channel 2 trace should lie within the shaded region.

SYNTHESIZER ALIGNMENT

Alignment and troubleshooting for synthesizer circuitry on Synthesizer board CMG-168.

Test Equipment

- Audio Oscillator
- Deviation Monitor
- Oscilloscope
- Frequency Counter
- RF Wattmeter (50 ohms, 100 watt)
- VTVM
- Digital voltmeter
- Power Supply, 13.6 Vdc regulated

Measuring System

Connect the test equipment as shown in Figure 8.

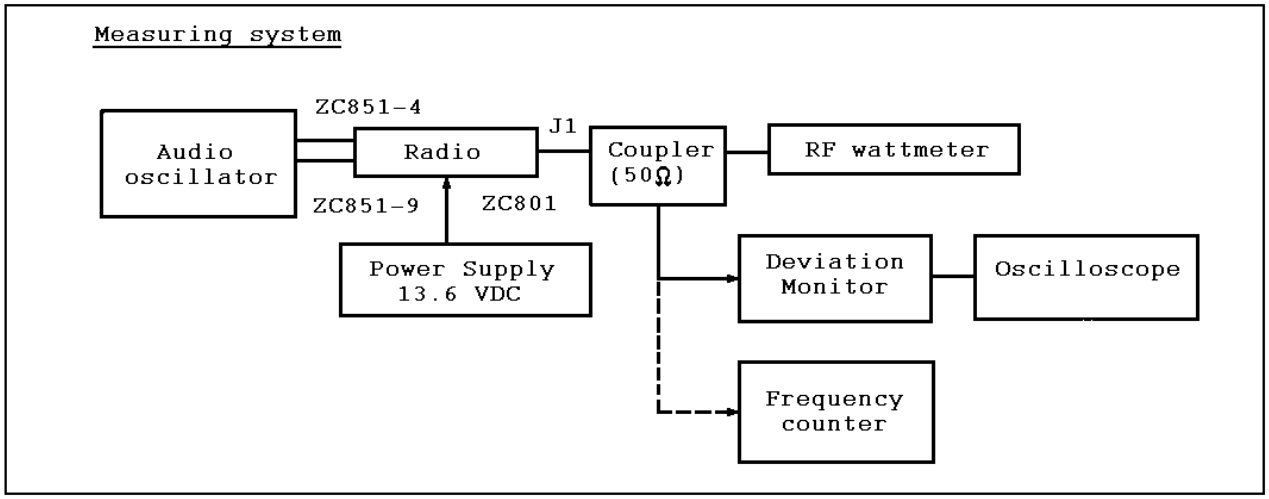

Figure 8 - Test Equipment

Receiver Frequency Adjustment

No receiver adjustment is required. When the TX frequency is adjusted, the RX injection frequency will follow.

Modulation Level Adjustment

The following procedure should be used to adjust the synthesizer transmit deviation.

1. Connect ZC852-12 to ZC852-4 (A-) on the front panel to enable test mode.
2. Connect dc power to the radio.
3. Set the radio group to 05 (869.9875 MHz TX test frequency).
4. Set the radio system to 01.
5. Rotate the Synthesizer board control RV201 fully counterclockwise.
6. Set the audio signal generator for a 1 kHz tone at 1 Vrms. Couple the output of the signal generator through a 100 µF capacitor (+ lead of capacitor) to MIC HI at ZC851-4.
7. Connect the deviation meter to antenna connector J1 through a 30 dB coupler terminated in a 50-ohm load.
8. Key the radio and set VCO MOD ADJUST control RV202 on the Synthesizer board for 3.75 kHz deviation.
9. Remove P602 on the System Control board and apply a 400 Hz sine wave to J602-1.
10. Key the radio and vary the amplitude of the audio signal until the deviation is 2 kHz. Unkey the radio and record the amplitude of the audio signal.
11. Change the audio signal generator frequency to 10 Hz and adjust the audio output to the same level obtained in the preceding step.
12. Key the radio and adjust the LOOP MOD ADJUST control RV201 for a deviation of 2 kHz.
13. Unkey the radio and disconnect the signal generator.
14. Place P602 in the 1-2 position.
15. Set the radio system to 02.
16. Key the radio and adjust the GCG DEVIATION ADJUST control RV6601 for a deviation of 0.75 kHz.
17. Unkey the radio and set the radio system to 03 (Channel Guard plus voice audio test).
18. Verify deviation does not exceed 4.5 kHz.
19. Unkey the radio and set the radio system to 05 (Digital Data Test).
20. Key the radio and adjust DATA DEVIATION ADJUST control RV602 for 3.0 kHz deviation.

AUDIO CHECK

Audio Sensitivity

1. Connect audio oscillator output to MIC HI, ZC851-4. Adjust output for 1 kHz at 1 Vrms.

2. Reduce generator output until deviation falls to 2.25 kHz. Voltage should be less than 120 millivolts.

TRANSMITTER

Alignment and troubleshooting for Transmitter board CAH-334L/H is covered in this section.

General Description Of Adjustment

This section of the manual covers the transmitter alignment. A list of required test equipment, sample test setups, and an alignment procedure is provided.

Test Equipment

- DC Power Supply, 0-20 V @ 20 A
- DC Power Supply, 0-10 V @ 1 A
- RF Power Meter (good for measurements over 80 watts).
- Directional Coupler
- Signal Generator
- Spectrum Analyzer
- Attenuator (30 dB above 80 W)
- Digital Voltmeter

Adjustment Circuit

Suggested connections for test equipment are shown in Figure 8.

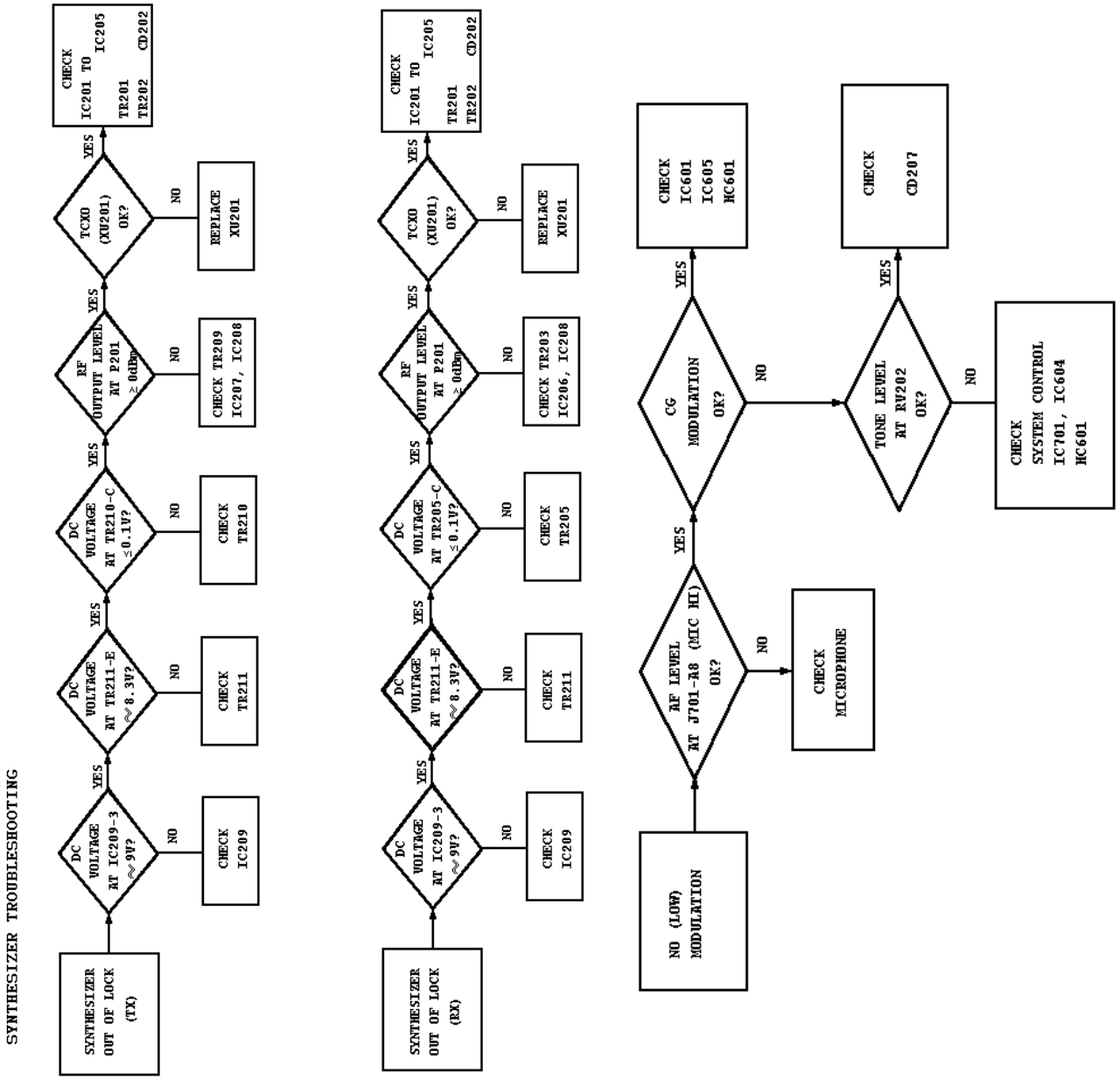

Figure 9 - Synthesizer Troubleshooting

TRANSMITTER ALIGNMENT PROCEDURE

The transmitter alignment procedure is given in Table 4.

TABLE 4 - TRANSMITTER ALIGNMENT

STEP	ADJUSTMENT POINT	MONITORING POINT	TEST EQUIPMENT	SPECIFICATION	PROCEDURE
1	RV1				a. Connect the test equipment as shown. b. Turn the volume on APC, RV1 fully counterclockwise.
2		TP3	DVM	13.6 Vdc	Turn on the power supply and confirm the voltage at TP3.
3	RV1		Signal Generator		a. Turn the signal generator on and set output to 850 MHz at +6 dBm.
	RV2	TP1	DVM	4-12 Vdc	b. Turn on the 10-volt power supply and confirm that the APC voltage at TP1 varies between 4 and 12 volts by turning the volume control on the APC.
	RV1			15 W (12WPA) 36 W (30WPA)	c. Trun the volume control RV2, APC counterclockwise until the output is 15 watts.
			Power Meter Ammeter	12 W (8A or less) 30 W (13A or less)	d. Set the output to the rated output at the test frequency.

NOTE

RGV2 is factory tuned and does not require further adjustment.

TX AND RX VCO ALIGNMENT

The alignment procedure for the TX and RX VCO is given in Table 5. Locations of the tuning controls are shown in Figure 10.

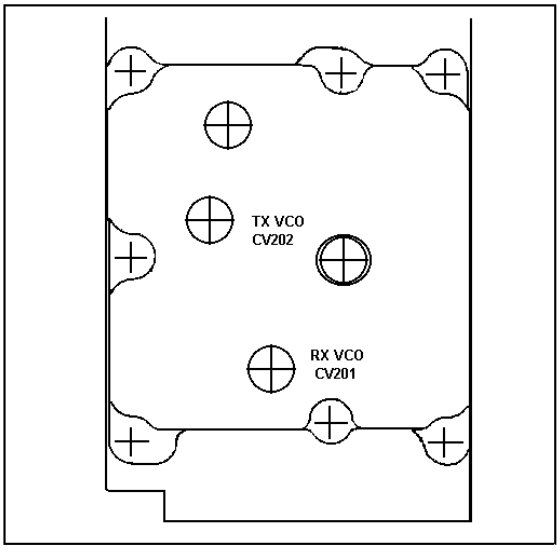

Figure 10 - Adjustment Controls

TABLE 5 - TX VCO AND RX VCO ALIGNMENT

STEP	METERING POINT	TUNING CONTROL	METER READING	PROCEDURE
1	TP201	CV202	7.0 VDC	a. Select group 02 (824.9875 MHz) b. Key the radio and adjust CV202 until the Lock-Detect indicator (CD606) goes out. c. Monitor TP201 with a DVM and adjust CV202 for a reading of 7.0 ±0.1 Vdc. d. Check that CD606 remains out, and unkey the radio.
2	TP201	CV201	7.0 VDC	a. Select group 02 (receive frequency 869.9875 MHz) b. Adjust CV201 until the Lock-Detect indicator (CD606) goes out. c. Monitor TP201 with a DVM and adjust CV201 for a reading of 7.0 ±0.1 Vdc. Check that CD606 remains out.
3	TP201		3.5-7.5 VDC	a. Select group 03, 07, 10 and 11 in turn, keying the radio on each group. b. On each group setting, the voltage at TP201 should be in the range of 3.5 to 7.5 Vdc.
4	TP201			Select group 02 and 11 and verify the voltage at TP201 is in the range of 3.5 to 7.5 Vdc.
5	P201			Monitor P201 and verify signal level of 0 to 6 dBm into 50 ohms.
6	P201 Control on TXCO (XU201)	FREQ TRIM		Press the PTT switch while mounting TX/RX injection frequency at P201. Adjust FREQ TRIM control on TCXO (XU201) for the assigned channel frequency ±0.2 ppm. **NOTE** This step assumes the frequency is measured when the transmitter is first keyed. If delayed, the rapidly rising ambient temperature must be taken into consideration. The oscillator frequency should be set at room temperature.

RECEIVER ALIGNMENT

Alignment and troubleshooting for Receiver board CMA-407 is covered in this section.

Test Equipment

1. RF Signal Generator (851-871 MHz)
2. DC Voltmeter
3. Frequency Counter (up to 900 MHz with 0.05 volt sensitivity)
4. Audio Level Meter and Distortion Analyzer
5. 16 ohm, 6 watt resistor

Preliminary Adjustment

1. Connect 13.8 Vdc to ZC801.
2. Select the conventional system using the SYSTEM buttons.
3. Press and hold the SCAN button while pushing the SYSTEM ▼ button until the BSY indicator is on continuously. Noise will be heard in the speaker if optional Channel Guard is not enabled.
4. Select desired channel.
5. Connect RF signal generator to antenna jack ZC1.
6. Continue with the alignment procedure in Table 6.

NOTE

Make sure that the transmitter is properly aligned before aligning the receiver.

TABLE 6 - ALIGNMENT PROCEDURE

STEP	METERING POINT	TUNING CONTROL	METER READING	PROCEDURE
1	TP502		8.0 ±0.2 Vdc	Connect the dc voltmeter to TP502.
2	TP509	L505	See Procedure	Connect rf signal probe from the frequency counter to TP505. Check for a reading of 82.655 MHz ±200 Hz.
3	TP504	L506	See Procedure	a. Set the signal generator on the receive frequency with ±3 kHz deviation and 1 kHz modulation. Set the rf signal level to 1000 microvolts. Connect the audio level meter to TP504 using a high-impedance probe. b. Adjust L506 for maximum audio output level.
4	MDT connector pins 23 & 24		See Procedure	a. Move P601 from J601-1 and -2 to J601-3 and -4 on the System control board. Terminate the MDT connector pins 23 and 24 with a 16 ohm, 6-watt resistor. Connect the Audio Level Meter and Distortion Analyzer input across the resistor. b. Adjust the volume control for 4 watts output (8.0 Vrms) using the Audio Level meter.
5	MDT	L501	See Procedure	Set the output level of the rf signal generator to obtain 12 dB SINAD at the audio output. Adjust coils L501 thru L503 to obtain maximum 12 dB SINAD sensitivity.

CONTROL PANEL TEST PROCEDURE

A test routine for checking the Panel Control board and the Display board has been incorporated in the EDACS FMD software. The test procedure given in Table 7 checks the LCD, backlighting, keys and switches.

TABLE 7 - CONTROL PANEL TEST PROCEDURE

STATE	STEP	OBSERVATION	CORRECTIVE ACTION
1	1. Ground pin 11 of MDT connector.		
	2. Apply power to ZC801 power cable.	All LCD displays and backlight are off.	
	3. Press the PWR switch.	All LCD displays and indicators will light.	a. Check PJ04 on System Control board and make sure A+ is properly connected. If PJ04 is set to 2-3, the radio powers up independent of PWR switch. b. Check IC901 and LCD901 on Display board. c. Check Panel Control board.
	4. Press the GROUP ▲ or ▼ switch.	Backlight level will change.	a. Check CD901 thru CD906, BL901, R901 and R902 on the Display board. b. Check TR922 thru TR925 and associated components on the Panel Control board.
2	5. Press the GROUP ▲ and SYSTEM ▲ switches at the same time.	LCD will go blank.	
	6. Press the SYSTEM ▲ switch.	LCD will indicate SYS UP.	Check R932 and CD931 on the Panel Control board.
	7. Press the SYSTEM ▼ switch	LCD will indicate SYS DWN.	Check R931 and CD930 on the Panel Control board.
	8. Press the GROUP ▲ switch.	LCD will indicate GRP UP.	Check R924 and CD924 on the Panel Control board.
	9. Press the GROUP ▼ switch.	LCD will indicate GRP DWN.	Check R923 and CD923 on the Panel Control board.
	10. Press the SCAN switch.	LCD will indicate SCAN.	Check R921 and CD921 on the Panel Control board.
	11. Press the SPC switch.	LCD will indicate SPC.	Check R922 and CD922 on the Panel Control board.
	12. Press the CLR switch.	LCD will indicate CLR.	Check R929 and CD928 on the Panel Control board.
	13. Press the SPKR or 2nd switch.	LCD will indicate SPKR or 2nd.	Check R930 and CD929 on the Panel Control Board.
	14. Press the EMER switch.	LCD will indicate EMER.	Check R928 and CD927 on the Panel Control board.

TABLE 7 - CONTROL PANEL TEST PROCEDURE
(Continued)

STATE	STEP	OBSERVATION	CORRECTIVE ACTION
2	15. Press the VOLUME ▲ switch.	LCD will indicate VOL UP.	Check R926 and CD926 on the Panel Control board.
	16. Press the VOLUME ▼ switch.	LCD will indicate VOL DWN.	Check R925 and CD925 on the Panel Control board.
	17. For the System mocel press the 1 key.	LCD will indicate 1 and the status LED above the key will light.	Check CD1001, R1001, TR1001, CD1004 and R1005 on the DTMF SW board and CD937, R938 and R939 on the Panel Control board.
	18. For the System model press the 2 key.	LCD will indicate 2 and the status LED above the key will light.	Check CD1002, R1001, TR1005, CD1008 and R1009 on the DTMF SW board and CD935, R936, CD938 and R939 on the Panel Control board.
	19. For the System model press the 3 key.	LCD will indicate 3 and the status LED above the key will light.	Check CD1003, R1001, TR1009, CD1012 and R1013 on the DTMF SW board and CD933, R934, CD938 and R939 on the Panel Control board.
	20. For the System model press the 4 key.	LCD will indicate 4 and the status LED above the key will light.	Check CD1001, R1002, TR1002, CD1005 and R1006 on the DTMF SW board and CD937, R938, CD936 and R937 on the Panel Control board.
	21. For the System model press the 5 key.	LCD will indicate 5 and the status LED above the key will light.	Check CD1002, R1002, TR1006, CD1009 and R1010 on the DTMF SW board and CD935, R934, CD936 and R937 on the Panel Control board.
	22. For the System model press the 6 key.	LCD will indicate 6 and the status LED above the key will light.	Check CD1003, R1002, TR1010, CD1013 and R1014 on the DTMF SW board and CD933, R934, CD936 and R937 on the Panel Control board.
	23. For the System model press the 7 key.	LCD will indicate 7 and the status LED above the key will light.	Check CD1001, R1003, TR1003, CD1006 and R1007 on the DTMF SW board and CD937, R938, CD934 and R935 on the Panel Control board.
	24. For the System model press the 8 key.	LCD will indicate8 and the status LED above the key will light.	Check CD1002, R1003, TR1007, CD1010 and R1011 on the DTMF SW board and CD935, R936, CD934 and R935 on the Panel Control board.
	25. For the System model press the 9 key.	LCD will indicate9 and the status LED above the key will light.	Check CD1003, R1003, TR1011, CD1014 and R1015 on the DTMF SW board and CD933, R934, Cd934 and R935 on the Panel Control board.
	26. For the System model press the * key.	LCD will indicate * and the status LED above the key will light.	Check CD1001, R1004, TR1004, CD1007 and R1008 on the DTMF SW board and CD937, R938, CD932 and R933 on the Panel Control board.

TABLE 7 - CONTROL PANEL TEST PROCEDURE
(Continued)

STATE	STEP	OBSERVATION	CORRECTIVE ACTION
2	27. For the System model press the 0 key.	LCD will indicate 0 and the status LED above the key will light.	Check CD1002, R1004, TR1008, CD1011 and R1012 on the DTMF SW board and CD935, R936, CD932 and R933 on the Panel Control board.
	28. For the System model press the # key.	LCD will indicate # and the status LED above the key will light.	Check CD1003, R1004, TR1012, CD1015 and R1016 on the DTMF SW board and CD933, R934, CD932 and R933 on the Panel Control board.
	29. Ground pin 6 (CGDIS) of mic connector (if the microphone is connected, the mic must be off-hook.	LCD will indicate 12.	Check R933, CD933 and C935 on the Panel Control board.
	30. Ground pin 16 (EMGFLSW) of the MDT connector.	LCD will indicate 13.	Check R968, CD936 and C937 on the Panel Control board.
3	31. Press the GROUP ▲ and System ▲ switches at the same time.	LCD will indicate RLY TEST.	
	32. Press the SPKR or 2nd switch.	An audible click will be heard from the speaker relay.	Check K921 and associated components on the Panel Control board.
4	33. For the System model press the GROUP ▲ and SYSTEM ▲ switches at the same time.	LCD will indicate DTMF.	
	34. For the System model press each of the DTMF SW keys. Press GROUP ▲, SYSTEM ▲, and VOLUME ▲ or ▼ switches.	DTMF tone will be output on the MIC HI line. DTMF level will increase one step for each press of VOLUME ▲ switch or decrease for each press of the VOLUME ▼ switch.	Check IC926, IC927 and associated components on the Panel Control board.

ERICSSON

Ericsson GE Mobile Communications Inc.
Mountain View Road• Lynchburg, Virginia 24502

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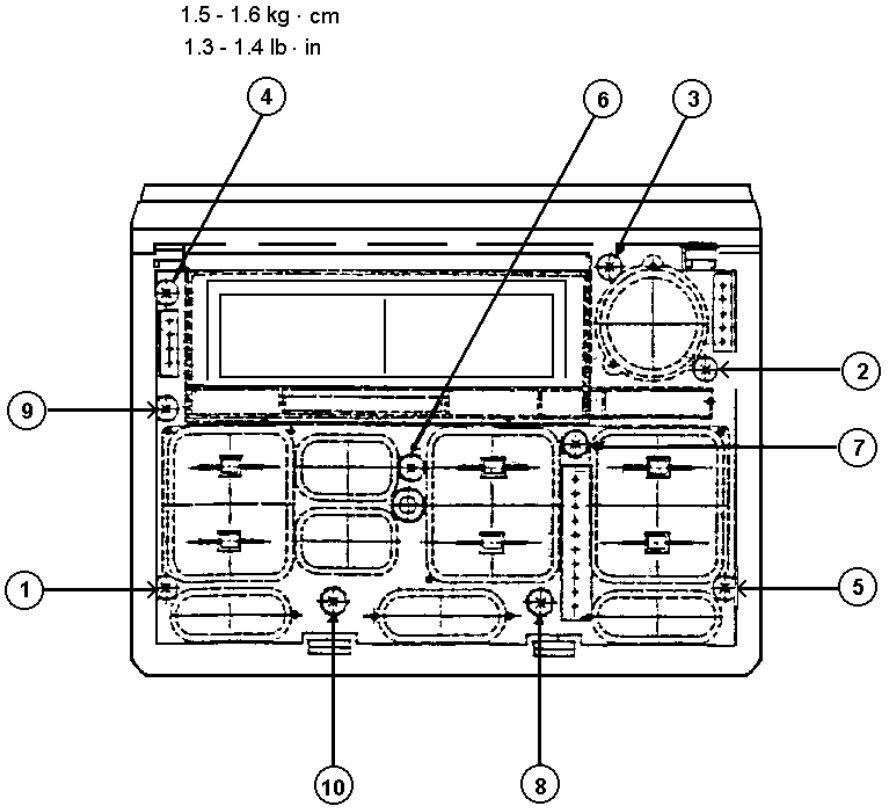
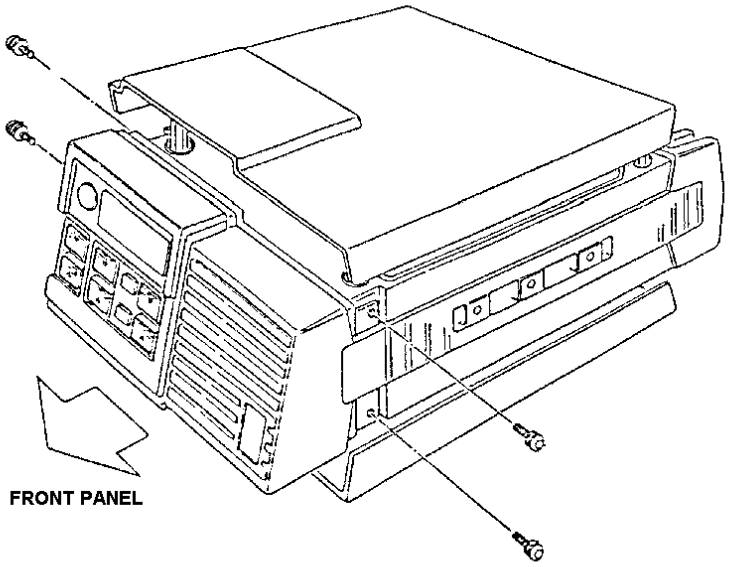
IMPORTANT NOTE

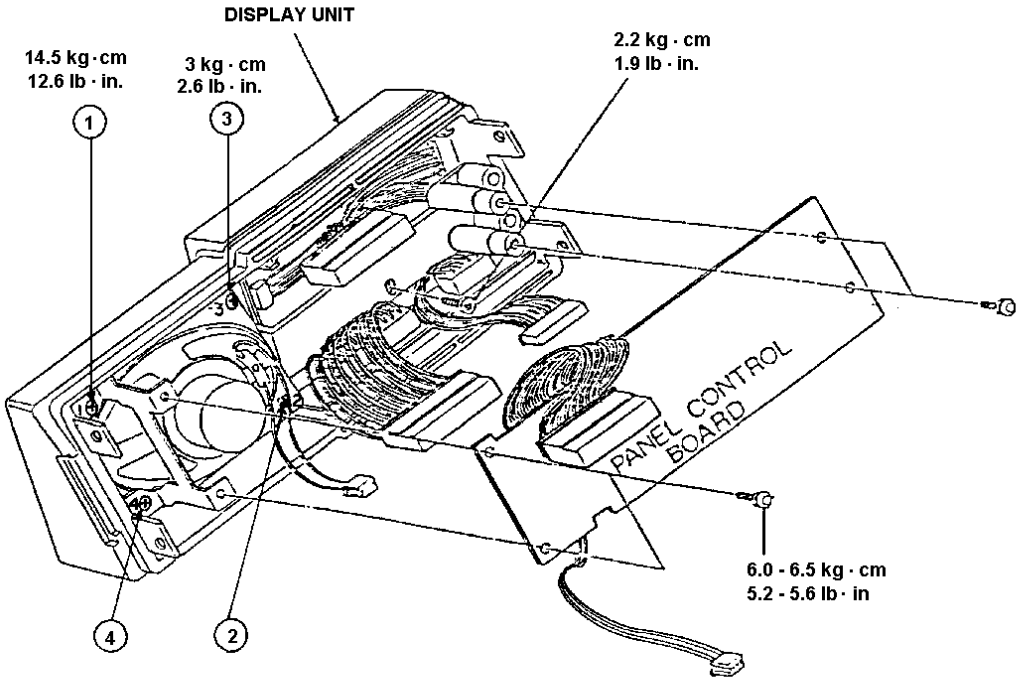
When reassembling an FMD after service, special care must be taken to maintain the waterproof qualities of the radio. The correct torque and tightening sequence must be used on the chassis screws. If the improper torque or tightening sequence is used, the waterproof capability of the radio will be lost.

Each screw in this diagram is numbered to indicate the correct tightening sequence beginning with the number 1. The corresponding torque specification for each screw is also shown.



TORQUE VALUES & SCREW DOWN SEQUENCE
EDACS FMD SCAN MODEL





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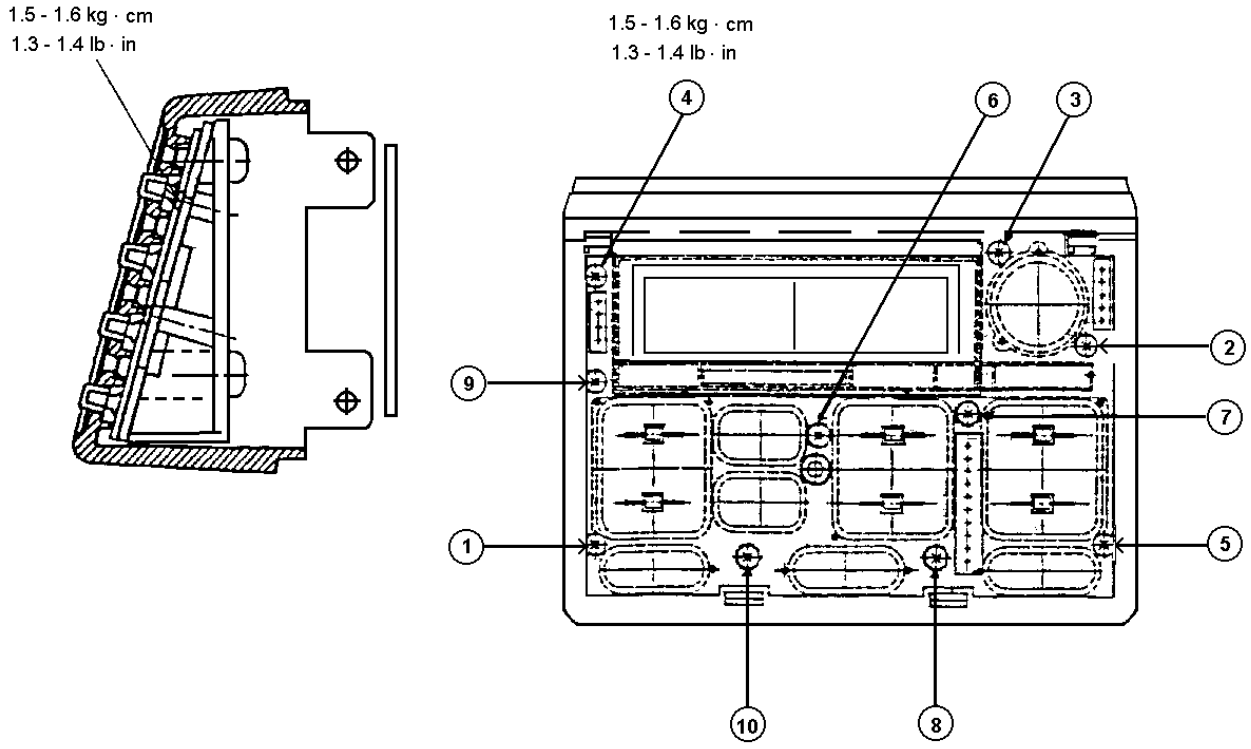
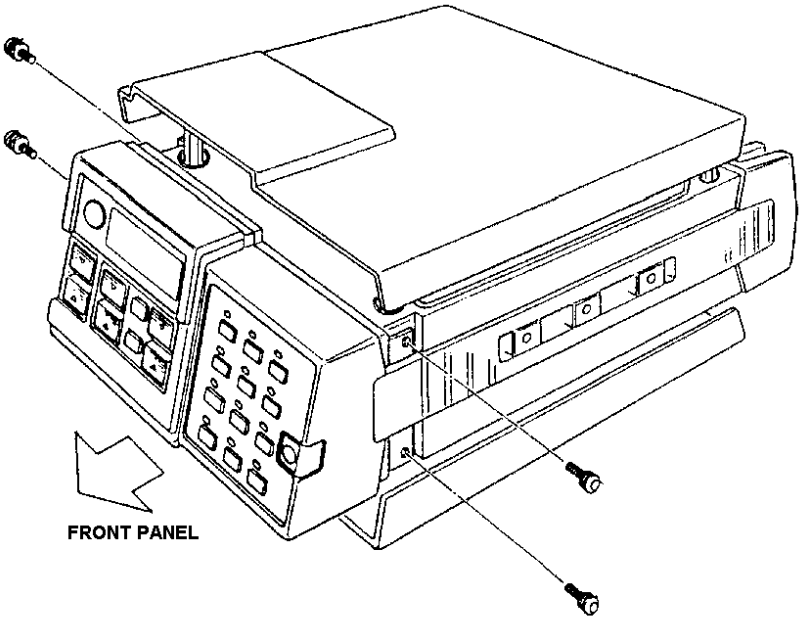
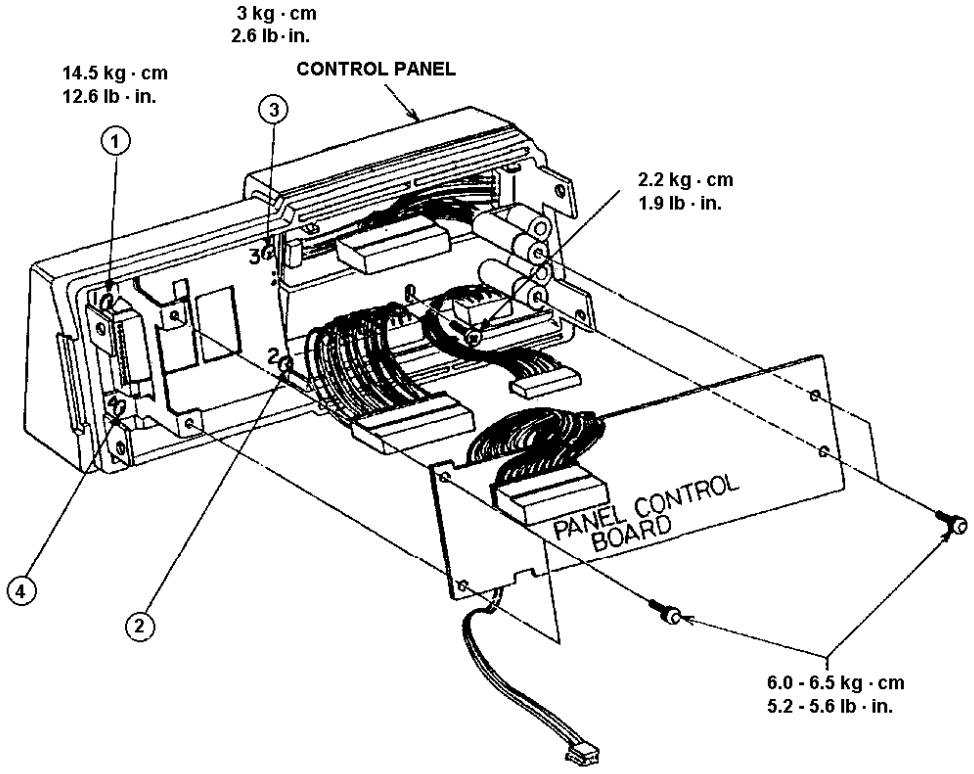


TORQUE VALUES & SCREW DOWN SEQUENCE
EDACS FMD SYSTEM MODEL





TORQUE VALUES & SCREW DOWN SEQUENCE
EDACS FMD SYSTEM MODEL

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