Midland

70-066 & 70-076

Service

Manual

Low Band

Midland 70-066 & 70-076 Service Manual

Part 1

MIDLAND® SYN-TECH™

VHF (MID BAND)

SERVICE MANUAL

70-066

70-076

MIDLAND MR

The Midland Models 70-066A, 70-066B 70-076A and 70-076B are solid state VHF High Band Land Mobile transceivers designed to operate in the 66-80 MHz (70-066A, 70-076A) and 75-88 MHz (70-066B, 70-076B) ranges. Providing up to 80 channel capability and field programmable frequencies and options, these SYNTECH models are designed to provide flexible communications for a variety of applications.

The Service Manual is laid out to facilitate maintenance and service of the units. As necessary, manual supplements will be published and distributed in the following forms:

Manual Addition (MA)	provides additional information useful in unit alignment and service or upgrade for increased capability. Printed on blue paper.
Change Notice (CN)	details circuitry changes made during production by model and serial number. Printed on yellow paper.
Manual Correction (MC)	corrects manual errors not related to production changes. Printed on green paper.
Technical Bulletin (TB)	provides solutions for field problems and tips for performance improvement. Printed on pink paper.

Careful use of the manual information will insure properly aligned, installed and maintained units. Comments or suggestions concerning areas of manual improvement are welcome.

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GENERAL SPECIFICATIONS

Nominal operating voltage:	13.6V DC (negative ground) (12.2-16V DC range)
Temperature range:	-30 deg. C to +60 deg. C
Antenna impedance:	50 ohms, unbalanced
Microphone:	Dynamic element, with amplifier
Speaker - internal:(70-066A/066B)	8 ohms
external:	3.2 ohms
Frequency control:	Frequency synthesized with EPROM programming
Frequencies of operation:	66-80 MHz (70-066A/076A) 75-88 MHz (70-066B/076B)
Receiver & transmitter performance bandwidth without adjustment:	2.0 MHz Rx/Tx (Standard) 3.0 MHz Rx/8 MHz Tx (Optional)
Frequency tolerance & stability:	±5 PPM Tx and Rx (Standard) ±2.5 or 2.0 PPM Tx & Tx (Optional)
Duty cycle:	Intermittent EIA RS 152-C (1 minute Tx, 4 minutes Rx)
High humidity:	95% at 50 C per EIA RS-152-C, sec. 13
Vibration stability:	EIA RS-152-C, sec. 14
Shock stability:	EIA RS-152-C, sec. 15
Channel capability:	Up to 80 channel transmit/receive
Current drain - Standby:	0.35 A DC
Receive:	1.00 A DC
Transmit:	8.00 A DC
Dimensions (HWD):	
Main chassis: (70-066/076)	65 x 185 x 280mm (2.5" x 7.25" x 1
Control head: (70-076)	50 x 88 x 80mm (2" x 3.5" x 3 3/16
Speaker: (70-076)	100 x 100 x 77mm (4" x 4" x 3")
Weight:	
Main chassis: (70-066/076)	3.0 kg (6.6 lb.)
Control head: (70-076)	0.8 kg (1.8 lb.)
Speaker: (70-076)	0.71 kg (1.581b.)

RECEIVER PERFORMANCE SPECIFICATIONS

Refer to EIA RS-204-D and DOC RSS-119 Issue 3 for Method of Measurement and Standard of Performance.

Sensitivity:	12dB SINAD	0.25uV @ 50 ohm
Squelch sensitivity:	Threshold	0.2uV max or 6dB SINAD
	Tight	1.0uV min, 2.0uV max
Squelch blocking:	10dB	
Receiver attack (squelch release) time:	100ms max	
Receiver squelch closing time:	200ms max	
Acceptable RF displacement:	±3.5KHz min at 20/25/30 KHz ±2.25KHz min at 12.5 KHz	
Adjacent channel two signal selectivity and desensitization:	90dB @ ±30KHz	
Spurious response attenuation:	90dB	
Intermodulation spurious response attenuation: (measured at useable sensitivity)	80dB	
Audio power output:	1W @ 5% THD @ 8 ohms (Internal) 5W @ 5% THD @ 3.2 ohms (External)	
Audio frequency response:	Per EIA and DOC Specifications	
Hum and noise:	Unsquelched 40dB Squelched 50dB	
Conducted spurious RF power:	200uV across 50 ohms (800pW) from DC to 1000MHz	
Intermediate Frequencies:	21.4MHz (1st) and 455KHz (2nd)	

SCAN SPECIFICATIONS

Scan speed:	3-20 channels/second
Channel capacity:	64 (PRI) 64 (SCAN)
Scan detection:	Carrier, tone or vacancy
Scan resume delay:	0.3, 2.5, 5 seconds or infinite

TRANSMITTER PERFORMANCE SPECIFICATIONS

Refer to EIA RS-152-C and DOC RSS-119 Issue 3 for Method of Measurement and Standard of Performance.

Carrier power output:	40W maximum adjustable 20 - 40W 1-10W optional
Modulation system:	PM
Audio frequency response:	Per EIA and DOC RSS-119 Specifications
Audio frequency harmonic distortion:	3% @ 1000Hz for ±3.0KHz deviation
System deviation:	±KHz, max
Modulation limiting:	Instantaneous peak clipping with low pass audio filter
Hum and noise:	50dB
Occupied bandwidth:	Less than 25uW adjacent channel power, ±30KHz (-60dB from carrier power)
Transmitter carrier attack time:	100ms max for 50% rated power
Conducted spurious emissions:	Less than 25uW, 1MHz to 1000MHz
Microphone input level and impedance:	-8dbm ±3dB/600 ohms
Output protection:	Shall withstand for 5 minutes all VSWR around Smith Chart of 20:1 without failure or damage.
Output stability:	Shall not exceed spurious emission requirements when operated into a mis-match load with 5:1 VSWR at any point on the Smith Chart.

CTCSS SPECIFICATIONS

(Optional, not supplied with unit)

Code Frequencies:	All EIA Standard from 67Hz to 241.8Hz
Modulation limits:	500 - 1000Hz
Decode sensitivity:	Less that 6dB SINAD
Receiver response time:	200ms max
Encoder response time:	50ms max
Transmitter tone distortion:	5% max
Transmitter intermodulation distortion:	10%

E/PROM MODULE LOCATION AND REMOVAL

The operating frequencies and optional functions for the Midland 70-066/076 tranceivers are programmed in a semiconductor memory E/PROM module. To remove the module for programming, first remove the transceiver top cover, then locate the small printed circuit board near the front of the unit marked "Z-273". The module is mounted on two connectors and can be separated from the main printed circuit board by simply pulling straight up.

PROGRAMMING PREPARATION

NOTE: The 70-066/076 contains the HD44840A27 microcomputer (IC901). The 70-1000 programmer used to program E/PROM modules for the 70-066/076 must be upgraded to the "E0" or later configuration.

The 70-1000 E/PROM Programmer Operator's Manual contains detailed information concerning E/PROM module programming. Be careful to observe the following precautions.

DO NOT APPLY OR REMOVE PROGRAMMED AC POWER WHILE THE E/PROM MODULE IS PLUGGED INTO THE PROGRAMMER.

IT IS NOT NECESSARY OR RECOMMENDED TO PLUG THE E/PROM MODULE INTO THE PROGRAMMER EXCEPT TO PERFORM BLANK CHECK, WRITE, VERIFY OR COPY OPERATIONS.

Apply power to the 70-1000 programmer and confirm the correct display is present.

HEADING INPUT

Input the optional heading data as described in the 70-1000 manual.

BAND SELECTION

A band selection code must be entered to program the frequency range, IF and reference frequencies and local oscillator injection. The standard configuration 70-066/076 will accept only Band 80 which is entered as BAND CODE 2. Band 80 corresponds to a 66-88 MHz frequency range, 21.4 MHz RX IF, 20.48 MHz TX IF, 5 KHz reference frequency and low side local oscillator injection.

The 70-066/076 can be converted to accept bands 8A, 8B, 8C, 8D or 8E as follows:

NOTE: 8D and 8E are only available with the $\phi.\phi$ and later version software.

SCAN PROGRAMMING

Up to 64 channels can be programmed in each of 2 scan groups. Refer to the 70-1000 Operator's Manual for programming details.

FUNCTION CODE PROGRAMMING

Eight transceiver functions are programmable by function code inputs as detailed in the 70-1000 Operator's Manual.

The Busy Channel Lockout Function, if programmed, prevents inadvertent transmission on an occupied frequency and can be programmed to audibly warn the operator that transmission is not occurring. The BCLO function can be jumper selected to operate on carrier or CTCSS tone. The standard radio is configured for carrier BCLO by JP107. If Tone BCLO is desired, remove JP107 and install a jumper in the JP108 position. DO NOT operate the radio with both JP107 and JP108 installed. Time Out Timer programming is selectable from 30 to 210 seconds as detailed in the 70-1000 manual.

Note that for all radios programmed for either noise squelch scan or CTCSS scan, the automatic default condition should be used for function codes 3 and 4 (intervals A and B). These same default conditions should also be used if no scan channels are programmed.

PROGRAMMING THE E/PROM MODULE

Carefully check the programming data entered in the buffer RAM for correctness by repeatedly pressing ENTER or by printing out the buffer RAM contents on the 70-1300A printer.

Prepare the E/PROM module for programming by a thorough erasure in the 70-1100 E/PROM Eraser. Plug the E/PROM module in the programmer adapter, noting the following precaution.

> MAKE SURE THE E/PROM MODULE CONNECTORS MATE PROPERLY WITH THE ADAPTER PINS AND ARE NOT OFFSET IN EITHER DIRECTION.

Remove the module at the completion of the Blank Check, Write and Verify operations. Reinstall the E/PROM module in the transceiver, again checking for proper mating of the connectors.

PROM PROGRAMMING

1. Band 8A BAND CODE 1A differs from Band 150 only in using high side receiver local oscillator injection instead of low side. High side injection may be used to reduce or eliminate interference from intermodulation products. Band 15A should be programmed only if the appropriate High Side Injection Kit 70-2171 (70-066B/076B) or 70-2172 (70-066B/076B) has been installed in the transceiver. If this kit has been installed, Band 150 cannot be used.

2. Band 8B; BAND CODE 1B, utilizes a 19.2 MHz TX IF, 12.5 KHz reference frequency and low side local oscillator injection. This band selection allows the programming of "splinter" frequencies. Only those frequencies which are evenly divisible by 12.5 KHz may be programmed in Band 15B. If full-specification receiver performance is required on adjacent 12.5 KHz spaced channels the 12.5 KHz 1st/2nd IF filter Kit 70-2135 should also be added to the transceiver.

3. Band 8C BAND CODE 1C, allows the programming of "splinter" frequencies with high side local oscillator injection instead of low side. To utilize this band, both the 70-2134 12.5 KKHz Channel Spacing Kit and the appropriate 70-2173/2174 High Side Injection Kit must be installed in the transceiver. Other band selection codes may not be used after this conversion.

4. Band 8D, band code 1D, utilizes a 20.48 MHz TX IF, 2.5 KHz reference frequency and low side local oscillator injection. This band selection allows the programming of standard 15 KHz spaced channels and 12.5 KHz "splinter" frequencies. To utilize this band the 70-2138 2.5 KHz Channel Spacing Kit must be installed.

5. Band 8E, BAND CODE 1E, allows the programming of standard 15 KHz spaced channels and 12.5 KHz "splinter" frequencies with high side local oscillator injection instead of low side. High side injection may be used to reduce or eliminate interference from intermodulation products. The appropriate high side injection kit with the 70-2138 kit must be used.

CHANNEL PROGRAMMING

When the band selection has been made channel frequencies and auxiliary codes can be entered as outlined in the 70-1000 operators manual.

Note that Auxiliary Code "0" (tone disable) is automatically programmed for each transmit and receive channel if no other code is entered. Auxiliary data may be programmed in E/PROM even if the CTCSS option is not installed in the transceiver.

If the transceiver installation causes all power to be removed from the unit by the ignitioin switch, it should be noted that the powerup channel will always be the lowest channel number programmed. As long as power is supplied to the radio power/auxiliary connector, the channel in use at

PLL/Synthesizer Function

The frequency synthesizer consists of two phase-locked loops. One loop (Main PLL) is controlled directly by the microcomputer and generates the receive local oscillator frequency. This loop also generates a frequency used in the second loop (Transmit PLL) for transmitter operation.

Reference Oscillator and Main PLL

A stable frequency for the entire radio is generated by a crystal oscillator composed of X101, Q701 and related components. This oscillator operates at 5.12 MHz and stability is maintained by use of a posistor crystal heater. This 5.12 MHz signal is divided by 1024 in IC 701 to give the 5KHz reference frequency for the Main PLL loop, consisting of IC 701 phase comparator and programmable divider, Q704-706 loop low pass filter, VCO D702/Q707 and pre-scaler IC 703. The VCO frequency is equal to the channel frequency +21.4 MHz in receive and channel frequency +20.48 MHz in transmit. The VCO frequency is divided by 32/33 by pre-scaler IC 703 and further divided in IC 701, this division ratio being controlled by the output of the EPROM which is latched in the 8 bit shift register IC 902 under control of the microcomputer IC901. Besides being a programmable divider, IC 701 also is a phase comparator which generates an error signal for VCO control if programmable divider output is out of phase with the 5 KHz reference frequency.

Modulator and Transmit PLL

The 5.12 MHz oscillator output is also fed to IC 702 where it is divided by 4 to give 1.28 MHz. This signal goes directly to the transmit phase shift modulator D101/102. Audio from the microphone is shaped and limited by IC 101 (instantaneous deviation control) filtered and buffered and fed to the phase shift modulator. The modulator output becomes the reference frequency for the Transmit PLL loop, consisting of IC 103 phase comparator, D104/Q108 VCO, D108 Mixer and IC 106 fixed divider. The VCO output is at the transmit channel frequency and is mixed at D108 with the ftx +20.48 MHz signal from the Mail PLL loop to yield 20.48 MHz. This frequency is divided by 16 at IC 106 to give 1.28 MHz and compared with the 1.28 MHz reference signal from the modulator. Thus the VCO output is forced to track the modulated reference signal, reproducing this modulation at the transmit frequency. IC 102 detects any large difference between the two phase comparator inputs and generates an out-of-lock signal which biases Q111 on and prevents any transmitter signal from reaching the power amplifier stages. Q111 is also biased on during receive by a signal from the microcomputer IC 901.

Transmit Power Amplifier and APC (Automatic Power Controller)

The transmit PLL output is amplified by Q110 and fed to the PA section, where it is amplified to rated output. A sample of the RF output is detected by D504 and coupled to the differential amplifier Q505/Q506. The output of Q505 controls the conduction of Q504 which in turn controls the gain of the pre-driver Q501. Thus any changes in output power are automatically corrected by this control loop. Output power is set at alignment by RV502. Transmitter harmonics are eliminated by output low pass filtering composed of L516-L519 and C531-C535. The PIN diode switch D501 is biased to a low resistance state during transmit and a high impedance condition during receive.

Receiver RF/IF/Detector

The receiver front end consists of filtering by C201-C206 and L201-L203 and RF amplification by Q201. After further filtering the RF signal is mixed at the FET mixer Q202 with the local oscillator signal generated by the Main PLL loop to give the 21.4 MHz IF. The IF signal is filtered by the crystal filter FL 251, amplified by Q251 and fed to the internal mixer of IC 251. The 2nd local oscillator frequency of 20.945 MHz is generated by X251 and the IC251 internal oscillator and injected into the internal mixer, producing the 2nd IF of 455 KHz. The 2nd IF signal is filtered by FL252 and FL253, amplified and limited by the amplifier-limiter stage of IC251, and injected into the quadrature detector circuit consisting of L252 and the internal balanced mixer of IC 251. The output of the balanced mixer is the detected audio signal.

Squelch and Audio Amplifier

The noise signal from the detector is amplified by Q252, detected by D253 and controlled in level by the squelch control RV301. This detected noise signal is coupled to the DC switching amplifier of IC 251. Under conditions of no RF signal, the detected noise signal increases and turns on the DC switching amplifier, which in turn biases off the transceiver audio squelch gate (Q259). The detected audio signal is buffered by Q250 and passed through the squelch gate and volume control RV302 to the audio power amplifier IC252 and then to the speaker.

Microcomputer Channel Data Transfer

At unit power up a pulse is generated by Q405, resetting the microcomputer to an autotest mode. A check is made to insure the EPROM module is installed. If valid data is present at the EPROM, 3 bits of address data corresponding to the selected receive channel frequency are strobed from the microcomputer IC 901 to the latch IC 952. The remaining three address bits are then strobed and latched in IC 952. The EPROM data corresponding to the selected receive channel frequency is then strobed to the 8 bit shift register IC 902 which transfers this data to the programmable divider IC 701 under microcomputer control. IC 701 divides its input signal by the correct ratio to yield the desired local oscillator frequency. IC 701 outputs an out-ot-lock signal which mutes the receiver until phase lock is achieved. The microcomputer strobes data corresponding to the selected channel to the latched LED display drivers IC 301 and IC 302 which in turn drive the channel LEDS. Brightness of the LED display is automatically adjusted to ambient light conditions by photosensor CDS 301 and transistors Q301 and Q302.

anual Channel Selection

ctivation of the Up-Down channel selector switch is sensed by the microomputer, the receive audio is muted and incrementing or decrementing of he channel display is begun. Upon release of the channel selector switch, PROM data corresponding to the new channel is strobed to the programmble divider. If the synthesizer lock signal is not detected after a hannel change, receiver and transmitter are inhibited and the channel ndicator displays the error code 95. When the PTT is depressed, the icrocomputer switches the voltage regulator IC 401 to the transmit conition, outputting 8VDC to the transmitter and disabling the receive 8VDC tput. The microcomputer then outputs EPROM address data

70-2135 12.5 KHz 1st/2nd IF Filter Kit Installation Instructions

70-340/440/066/076

NOTE: The 70-2134 12.5 KHz Channel Spacing Kit must be installed in the transceiver if programming for 12.5KHz channel spacing operation is desired. Refer to the transceiver Service Manual for 70-2134 installation and programming instructions.

1. Remove the 2 screws securing the radio bottom cover and remove the cover.

2. Disconnect J352, J353 and J354. Remove the 5 screws securing the receiver board, slide the board slightly to the rear, then lift up to allow access to the bottom side of the PCB.

3. With a solder removal tool clear the mounting leads of FL252 and FL253. Remove the two filters and install the units provided with the kit.

4. Remove the solder securing the shield located beneath FL251 and remove the shield, noting its orientation. Remove the solder from the two mounting tabs and 4 leads of FL251. Remove FL251 and install the Kit-provided replacement, orienting it so that the lettering faces the front of the radio. Replace the shield in the correct orientation.

5. Re-install the receiver board in the radio, reconnect J352, J353 and J354 and install the unit bottom cover. It is recommended that a label be attached inside the unit cover to indicate kits installed.

6. Coils L208 and L251 should be re-aligned for maximum sensitivity. Refer to the applicable service manual receiver alignment procedure.

70-2135 KIT COMPONENTS

DESCRIPTION	QUANTITY	PART NUMBER
21.4MHz Crystal Filter	1	70-179026
455KHz Ceramic Filter	2	70-179025

to selected transmit channel, which results in the programmable divider IC 701 being reprogrammed for the correct transmit frequency.

Scan Operation

When Scan Operation is activated by selection of either of the front panel pushbuttons, the transmit and receive addresses of the displayed channel are stored in microcomputer memory as the priority channel. The address data corresponding to the first scan channel is then strobed to the latch IC 952, resulting in the generation of the correct local oscillator frequency as described above. The microcomputer then checks for the presence of a high signal level on its Pin 4 input indicating the squelch gate is open (active channel). If this signal is present, scanning stops until the squelch gate stays closed for 5 seconds, at which time address data for the next scan channel is sent to IC 952. If the active channel address is identical to the priority channel address stored in memory, a two-beep signal is generated to alert the operator of the priority channel signal. When a PTT switch closure is sensed by the microcomputer Pin 30, the priority channel transmit address is immediately latched in IC 952 and an audio beep signal is generated. When a second PTT switch closure is sensed by the microcomputer the transmitter is activated.

Busy Channel Lockout and Time Out Timer

The Busy Channel Lockout function can be jumper selected by JP107 to provide lockout on either carrier or CTCSS tone. The busy channel signal, tone or carrier, is input to the microcomputer pin 28 (transmit inhibit). If the Busy Channel Lockout function is programmed in E/PROM transmit is inhibited while the busy channel signal is present. An audio alert signal (if programmed) is generated when the transmitter is keyed to indicate the channel busy condition. The time out timer function is completely internal to the microcomputer. If the continuous transmit time exceeds the time limit programmed in E/PROM, the transmitter is disabled and an audio beep signal is sounded to alert the operator.

Power Supply

The 13.6 VDC input is filtered by L256 and related components and switc ed by K201 (70-076) or the unit on-off switch (70-066). This filtered 13.6 VDC is supplied directly to the transmit PA driver and final stage and also to pin 2 of IC401, the main voltage regulator. IC401 outputs a constant 8VDC from Pin 1 as well as 8VDC during receive from pin 8 and 8VDC during transmit from pin 6. The receive/transmit switching signal is output from IC901 pin 13 through Q402 and Q403 to IC401 Pin 5 Regulator IC402 (TX board) provides +5VDC for the reference oscillator, synthesizer integrated circuits and the E/PROM module. Regulator IC303 70-066 control panel and 70-076 control head) supplies +8VDC for micro phone bias and LED displays. The microcomputer IC901 is supplied +5VDC from zener diode D402, which is powered by an unswitched 13.6 VDC sourc This allows the microcomputer to retain memory of the last selected cha nel as long as power is connected to the radio. Other microcomputer functions are disabled at unit turn off, since power is removed from pin 19, the standby control pin.

CTCSS Operation (Optional Accessory)

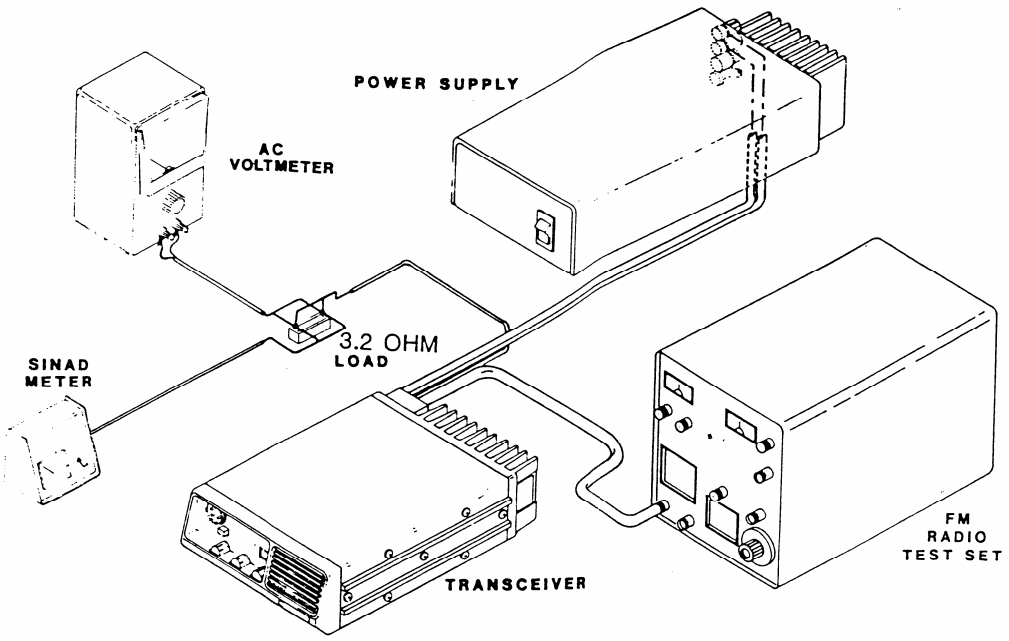
The CTCSS option provides, under microcomputer control, encode and decode of 35 standard EIA CTCSS tones. At each channel change and transmit/receive transition, data corresponding to the selected channel and mode is strobed on lines D0 - D4 and latched in IC1. IC1 outputs this data to IC3 for generation or detection of the correct CTCSS tone. This data is also input to IC2, which outputs a high logic level for encode/decode inhibit if all data lines are low (Aux Code "0"). Encode inhibit is accomplished by holding IC3 pin 17 at a high level through D2. Decode is inhibited by biasing Q1 on through D4. As long as the collector of Q1 is low, the base of Q261 (Receiver board) is also held low. The collector of Q261, which is also connected to the gate of the squelch FET, is then under control of the noise squelch signal from IC251 pin 13. If decode is not inhibited by Code "0" programming, control of the squelch FET is by IC251 pin 13 and Q261. Q261 is controlled by Q260, which is in turn switched by Q2 (CTCSS board). Q2 is normally biased on by IC1 pin 12 but is switched off when the correct tone is detected. The Monitor switch and microphone hangup box both control the status of Q1 and thus allow or inhibit squelch gate control by the CTCSS board in the same manner as Code "0" tone disable programming.

Crystal X1 generates a stable reference frequency for IC 3 tone generation and detection. IC 4 functions as an audio highpass filter to remove CTCSS tones from the speaker audio. Encode tone output is from IC3 pin 16 with tone modulation level adjustable by RV1.

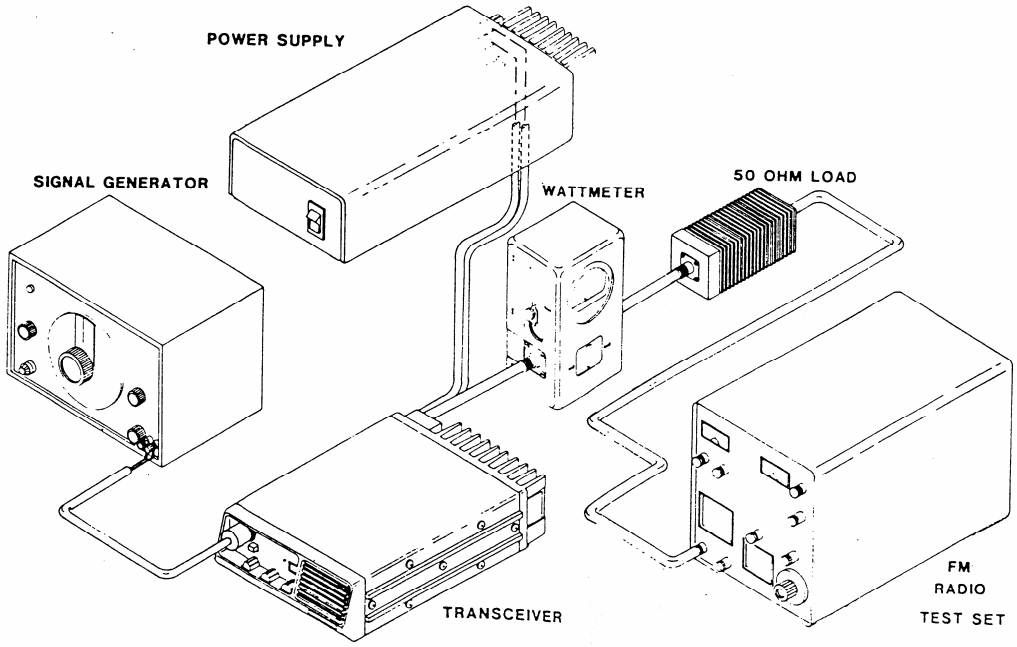
TEST INSTRUMENT	REQUIRED SPECIFICATIONS	INSTRUMENT TYPE
DC Power Supply	13.8 VDC 10 amps	Power/Mate BPA-20F
[illegible]tt Meter	66-88 MHz	Bird Model 43 with 50B element and 50 watt, 50 ohm load
[illegible]gital Multimeter	AC 100 mv - 10v DC 100 mv - 100v	B-K 2810
[illegible] Voltmeter	10mv - 10v	Heath SM-5238
Speaker Load	3.2 ohm speaker and resistive load (switchable)	Shop Fabricated
RF Signal Generator	66-88 MHz Range. Calibrated output 0.1 to 100 uV. Internal and external modulation capability with internal frequency of 1 KHz at 5 KHz deviation.	Cushman CE-31A
Deviation Meter	0 - 5 KHz Deviation Range ± Deviation Capability	Cushman CE-31A
Frequency Meter	Frequency Range 66-88 MHz Frequency tolerance of ± .00002%	Cushman CE-31A or Heath SM-4120
[illegible]gnal Generator	0-10 KHz Sine Wave 0-5V	Heath SG-5218
[illegible]R Test Set	- - - - - - - - - - - - - - - -	Midland 70-E10
Sinad Meter	- - - - - - - - - - - - - - - -	Helper Instruments Sinadder

Fold Out →

RECEIVER TEST SET-UP



TRANSMITTER TEST SET-UP



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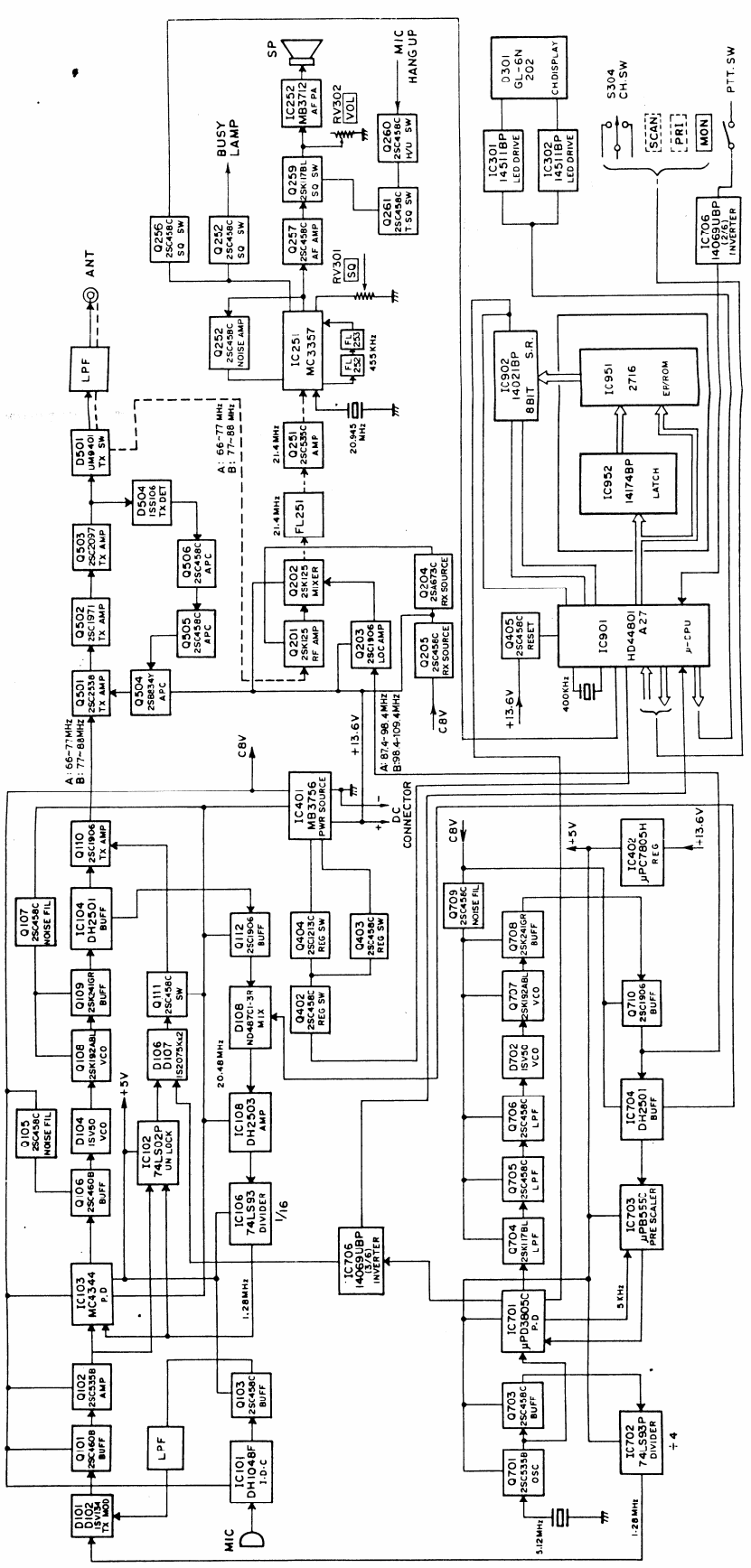
BLOCK DIAGRAM



Remove the 8 screws securing the top and bottom covers. Loosen the 4 screws securing the PA assembly and pivot the top of the PA assembly to the rear. Turn the volume control to a mid position and the squelch control fully counter clockwise. If the 70-E10 test set is used, the red 5 pin test socket should be connected to CM101 for transmitter alignment and the white 5 pin test socket to CM201 for receiver alignment. Both test sockets should be connected with the unused socket position toward the rear of the radio. Refer to the test pins switch position underlined in the steps below. Supply power to the radio and connect a wattmeter and dummy load with a reduced power output for a frequency counter and modulation meter.

IMPORTANT NOTE

A "95" error code display and triple beep can be expected at unit turn on if the channel frequencies programmed in the E/PROM are outside the 2.0 MHz band for which the Main VCO is currently aligned. To eliminate this error indication, adjust L702 (TX board) for approximately 4 volts at TP701. Cycle the unit power off and on. The normal alignment procedures can then be performed.

Error codes "90" and "94" indicate the E/PROM module to be missing, improperly inserted, or incorrectly programmed. Refer to the general troubleshooting chart if these error conditions occur.

VCO AND TRANSMITTER ALIGNMENT

1. Turn RV502 (PA) maximum counter clockwise.

Main VCO Alignment

2. The Main VCO should be adjusted with the radio operating on the channel and in the condition (transmit or receive) corresponding to the highest programmed frequency. If the highest frequency is a transmit frequency, select this channel, key the transmitter and adjust L702 to give 4.0 VDC at TP701. If the highest programmed frequency is a receive frequency, adjust L702 for 4.5 VDC at TP701 while in the receive mode.

Transmit VCO Alignment

3. Monitor TP101 (TX) with a DC voltmeter. Key the transmitter and adjust L107 for 4.5 VDC.

Transmit Driver Alignment

4. Monitor CM 101 pin 2 (position 9) with a selected channel frequency near the center of the programmed frequencies. Adjust CV102 for a dip between two peaks.

Power Amplifier Alignment

5. Adjust RV502 (PA) maximum clockwise and adjust CV501, CV502 & CV503 for maximum RF output power. Readjust RV502 for 40 watts RF output.

Modulation Adjustment

6. If the CTCSS option is installed, select any channel programmed for CTCSS encode. Key the transmitter and adjust RV1 (marked "MOD" on the CTCSS board) for the desired CTCSS modulation.

7. Input audio modulation of 2500 Hz and adjust RV101 (TX) for 5 KHz deviation. Adjust L101 and L102 for maximum deviation and balance. Vary the modulating signal level to insure deviation does not exceed ±5 KHz.

Oscillator Frequency Adjustment

8. Monitor the frequency of the transmitted signal and adjust CV701 for the correct frequency.

   Note: RV102, L110-L112 and L707-L709 are factory set and should not require field adjustment.

9. Pivot the PA assembly to its original position and tighten the 4 retaining screws.

RECEIVER ALIGNMENT

L. O. Amplifier Alignment

1. Select a channel with a receive frequency near the center of the programmed frequencies. Monitor CM 202 Pin 1 (position 2) and adjust L209 and L210 for a maximum indication.

RF-IF Alignment

2. Connect an on-channel signal generator to the antenna connector. Adjust L201, L202, L204 and L205 for a maximum indication at CM202 Pin 2 (position 3).

3. Adjust L208 and L251 for minimum audio distortion.

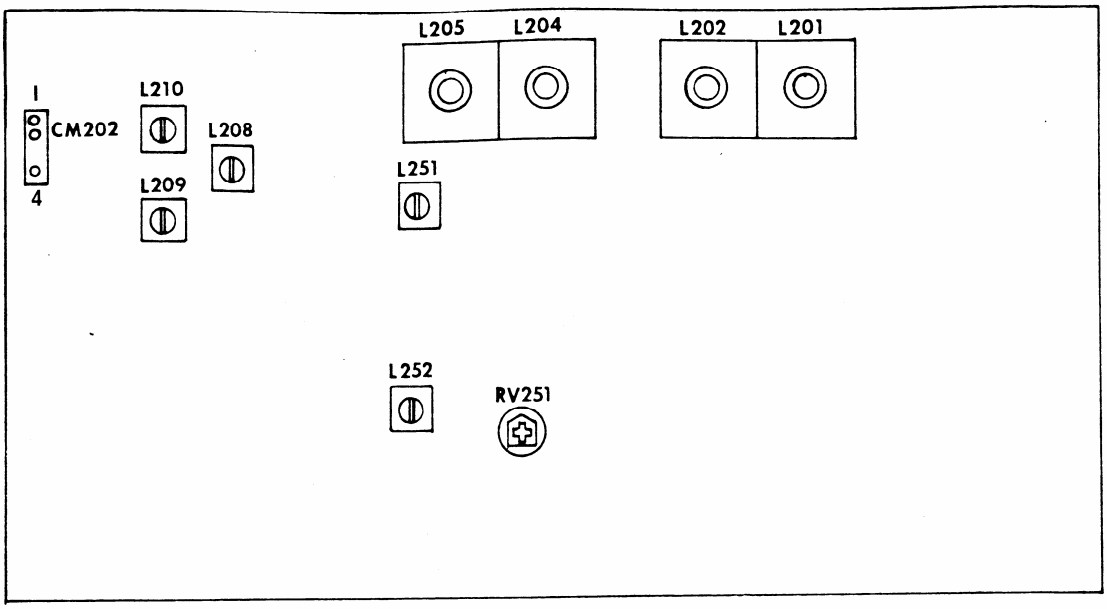
Quadrature Coil Alignment

4. Adjust L252 for maximum audio output.

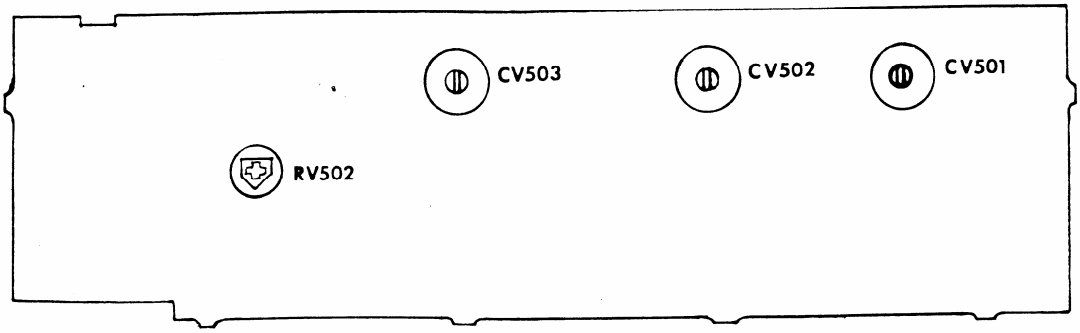
Tight Squelch Adjustment

5. Adjust RV251 for the desired tight squelch sensitivity.

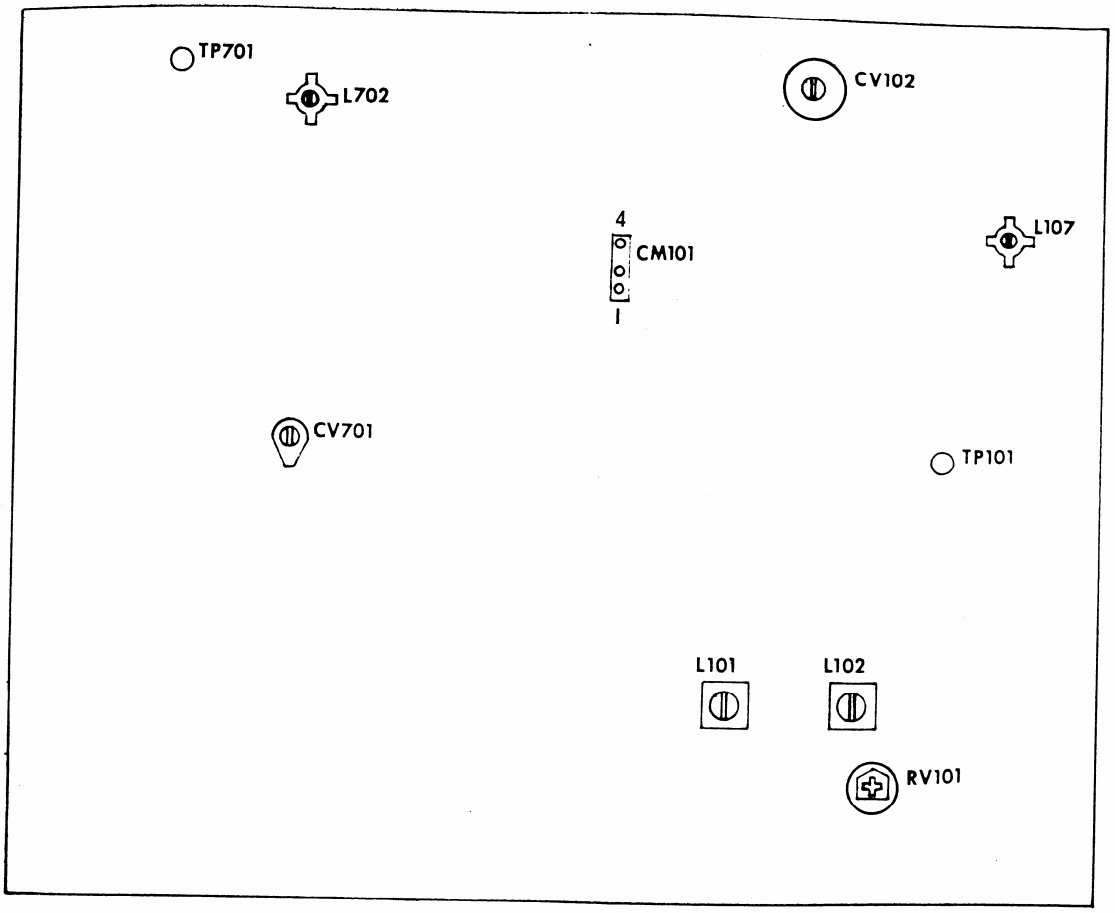
RECEIVER ALIGNMENT POINTS



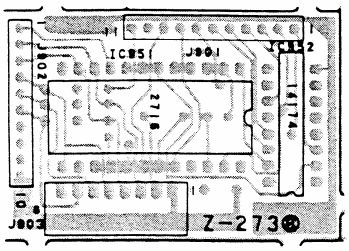
PA BOARD ALIGNMENT POINTS



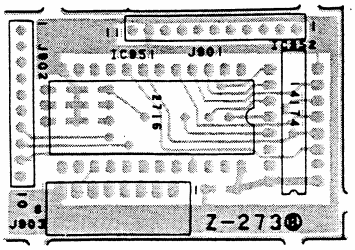
TRANSMITTER ALIGNMENT POINTS



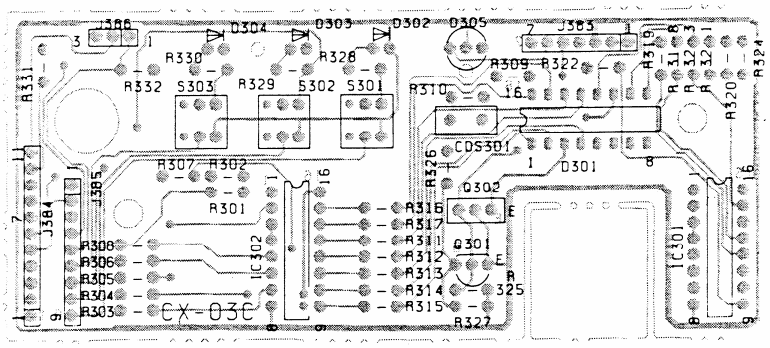
70-066/076
E/PROM MODULE PCB (TOP VIEW) (Z-273)



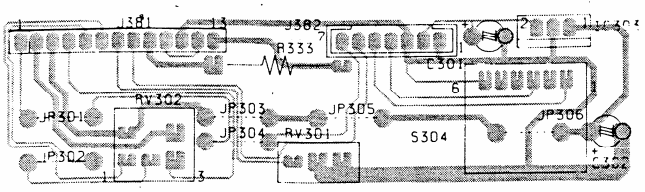
70-066/076
E/PROM MODULE PCB (BOTTOM VIEW) (Z-273)



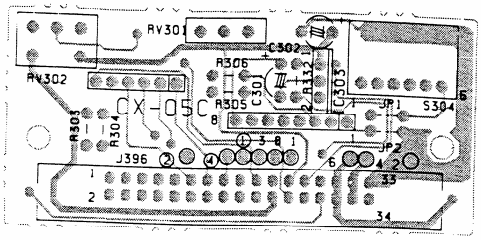
70-066 DISPLAY PCB (CX-03)



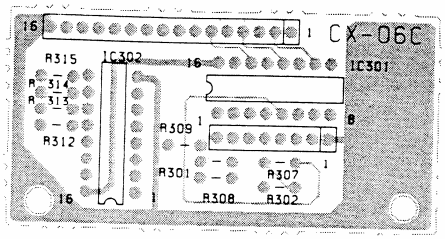
70-066 CONTROL PCB (CX-04)



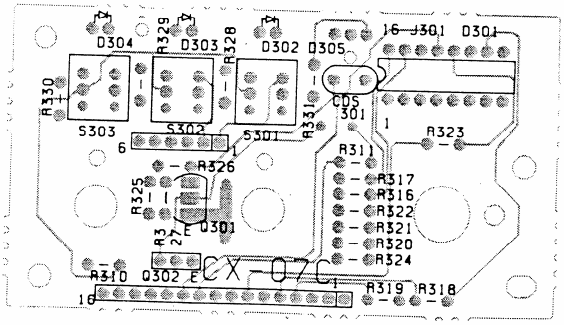
70-076 CONTROL INTERFACE PCB (CX-05)



70-076 DISPLAY DRIVER PCB (CX-06)



70-076 DISPLAY PCB (CX-07)



70-076 CONTROL CABLE INTERFACE PCB (CX-08)