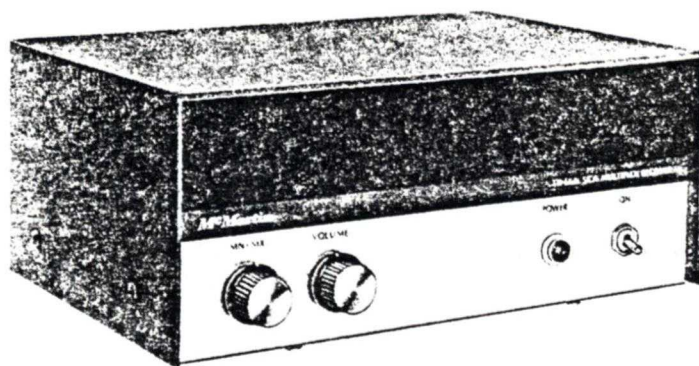


TR-66A



SCA TRANSISTORIZED MULTIPLEX RECEIVER

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RECEIVER HEREIN COMPLIES
WITH PART 15 OF F.C.C.
RULES & REGULATIONS

McMartin industries, inc.
omaha, nebraska

UNPACKING

Remove the receiver from the carton and examine it for signs of external physical damage. Remove the top cover by loosening the four screws at the sides. Examine transistors, crystal and etc., to see that they are properly seated in their sockets. If any damage is noticed, immediately notify the shipping agency and advise McMartin Industries, Inc. of such action.

Contents of Carton:

- 1 McMartin Multiplex Receiver
- 1 Instruction Manual
- 1 Cover Nut (for MN-MX Switch)

WARRANTY

McMARTIN Broadcast and Audio Products are warranted to be free from defects in workmanship - - FOREVER.

At our discretion, we will exchange or repair any defective unit or components, at any time, without charge. Material and components are guaranteed for a period of ninety days from the date of original purchase. Return authorization should be obtained and transportation charges must be prepaid on equipment returned for warranty service.

This warranty does not extend to any of our products which have been subjected to misuse, neglect, accidents, incorrect wiring not our own, improper installation, or to units that have been used in violation of the instructions furnished by us; nor to units that have been altered outside our factory.

SPECIFICATIONS

Main Channel

Range	88-108 mHz, crystal controlled
Sensitivity	1 microvolt for 30 db of quieting, complete limiting at 3 microvolts
Selectivity	Fixed 250 kHz at 3 db points, 553 kHz at 50 db points
Capture Ratio	Better than 1.25 db
RF Input Antenna	50-72 ohms (solderless coax connector)
Distortion	Less than 0.5% at 100% modulation (400 Hz)

Subchannel

Range	41, 42, 65 or 67 kHz at + 6 kHz deviation - other frequencies special order. (Must specify frequency when ordering.)
Sensitivity	(20% Inj.) 5 microvolt/45 db quieting (10% Inj.) 5 microvolt/30 db quieting
Selectivity	\pm 7.5 kHz at 3 db points
De-emphasis	150 microsecond standard, 75 microsecond on special request
Cross Talk	Main to SCA -55 db SCA to SCA -55 db Stereo to SCA -55 db
Frequency response	30-8,000 Hz \pm 2 db at 150 microsecond de-emphasis
Distortion	Less than 1.0% \pm 6 kHz Dev., 400 Hz.
Hum and noise	Greater than 60 db below full output

General

Outputs	Main and sub-channel switched 1.0V at 600 ohms unbalanced (phono jack). Optional: Balanced 25 and 70.7 volt (terminal board) with LT-10A or LT-20 plug-in amp.
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SPECIFICATIONS
(continued)

Front Panel Controls	Main/sub-selector switch, volume control, power ON-OFF
Rear Chassis	AC convenience outlet (unswitched) Antenna connector Antenna B+ switch Fuse holder Mike preamp input (4 pin Jones plug)
Under Chassis	Adjustable automatic main channel muting
Power Supply	105-120V AC 50/60 Hz fused at 0.5 amp; normally 5 watts, with LT-10A - 15 watts, with LT-20 - 22 watts.
Dimensions and finish	11" wide x 4 1/2" high x 8 3/4" overall depth, gray cover and brushed chassis
Shipping weight	7 lbs.
Pilot Light Lamp	Neon assembly

SPECIAL FEATURES

- * The elimination of tunable IF transformers. The IF transformers have been replaced by a single 10.7 MHz solid state filter. The bandwidth remains constant at all signal levels and is phase linear over 220 kHz.
- * All transistors operate at less than 50% of their rated dissipation for increased long life through cool operation.
- * The sub-carrier uses a phase linear bandpass filter with steep sided skirts for rejection of stereo and second sub-carrier.
- * Noise rejection is excellent due to the elimination of time constants in the limiters.
- * A pulse counting detector is used eliminating drift and the necessity for tuning. Near perfect linearity is also obtained.
- * Convenient test points for easy alignment of the RF section.
- * Integrated circuitry is used in both the main channel and sub-channel limiter amplifiers.
- * RF shielding meets FCC requirements.
- * Unit is supplied with an RF solderless connector, both male and female for 72 ohm coax.
- * There is a front panel switch for MN (main) and MX (sub-channel). This switch simplifies servicing and enables a customer to switch to the main channel for special announcements, such as historical events or local distress notices. A cover nut is supplied with all units and can replace the knob if it is desired that the customer be prevented from using the switch.
- * Two plug-in amplifiers are available: LT-10A, 5-watt amplifier; LT-20, 12-watt amplifier. A socket is provided for these plug-in amplifiers and all wiring is incorporated in the receiver. The 25 and 70.7 volt outputs are available on a terminal strip on the rear of the chassis.
- * A plug-in mike preamp is also available for connecting a mike to either the tuner or tuner-amplifier combination. This preamp employs solid state switching to mute music when a push-to-talk mike is used.

GENERAL DESCRIPTION

The TR-66A multiplex receiver is designed for continuous duty reception of commercial FM/SCA multiplex programming.

The TR-66A is built on a modular construction basis utilizing five glass epoxy printed circuit boards.. These consist of an RF amplifier, IF amplifier and demodulator, subchannel demodulator, dual gate squelch and audio amplifier, and power supply.

The RF amplifier board uses two silicon field effect transistors (FET's) in a cascode configuration for excellent AGC with minimum cross-modulation. The local oscillator is crystal controlled. A silicon bipolar transistor is used for a mixer which is suitable for driving the low impedance solid state 10.7 mHz filter. A 10.7 mHz IF trap is used in the mixer input to improve the conversion gain.

The main channel IF board consists of two high gain, wide band integrated circuits (IC's), an AGC and squelch circuit, pulse counting demodulator and an audio amplifier.

The subchannel demodulator uses 1 integrated circuit (IC) for an amplifier and limiter, a pulse counting detector, a squelch voltage amplifier and a one stage audio amplifier.

The dual gate squelch board and audio amplifier consists of a main and subchannel gate which requires both main and subchannel squelch voltage for operation. Positive squelch will occur in case of main channel failure. The audio amplifier has an unbalanced low impedance output.

Two plug-in audio modules are available to transform the TR-66A into a tuner-amplifier combination. A mike preamp is also available for the TR-66A.

The power supply board has a regulated 13V output for operating the receiver and the optional plug-in mike preamp, and an unregulated 36V output to operate either of the two optional plug-in power amplifiers.

Straight line design with test points make the TR-66A a very easy unit to align. There are no tuned circuits past the RF section. With no LC tuned circuits in the IF, the problem of drift need not be considered.

The main channel is crystal controlled to receive an FM frequency between 88 and 108 mHz. An extremely well regulated power supply, utilizing electronic control, assures circuit stability. The subcarrier is fixed at ± 6 kHz deviation and may be ordered on 41, 42, 65 or 67 kHz. Other subcarrier frequencies are available upon special request. The frequency must be specified when ordering.

INSTALLATION PROCEDURE

Inspection

Upon receipt of your TR-66A remove it from the packing material and inspect carefully for any damage caused in transit due to rough handling or vibration. If damage is found, notify the shipping agency and advise McMartin Industries, Inc. of such action.

Receiver Location

Sufficient space should be allowed for proper circulation of air to aid in the cooling of the unit. Keyhole slots are provided in all bottom plates to facilitate mounting the receiver on a wall. This is important in order to increase air circulation and also to prevent use of the receiver as a "shelf" for paper, books, etc. It will also eliminate the possibility of your customer moving the receiver and shorting or breaking connecting wires. The receiver should be located as near to the entrance of the antenna coaxial cable as possible.

Antenna

A properly selected and installed antenna is one of the most important factors for satisfactory multiplex reception. Good directional characteristics are very important in the reduction of "multipath" (cross talk) reception and only proper antenna installation can eliminate this. This condition is most common in large metropolitan areas and mountainous country. High gain antennas normally have the best directional pattern and although signal strength may be high at a given location, it may still be necessary to use this type to eliminate multipath. The antenna should be oriented for a combination of best signal and lowest multipath.

For all installations we recommend the use of either a McMartin outside (A-72-SF) 3 or 5 element, 72 ohm, cut-to-frequency directional antenna or indoor (A-72PA) transistor, fixed-frequency antenna. For proper location and orientation of the antenna, we recommend using the McMartin TX-200 Field Strength Meter.

Antenna Connection

An RF coaxial receptacle is provided on the rear of the chassis for the recommended outside antenna. A solderless connector plug is furnished with the receiver for connection to the cable. The coaxial lead-in eliminates receiving ignition and other man-made noises by the antenna line.

The recommended input impedance is 72 ohms, however, a 50 ohm impedance may be used with little mismatch. Additional antenna connector plugs may be obtained from McMartin Industries by ordering part #173009.

FIELD ADJUSTMENTS

A considerable amount of time has been spent aligning your receiver to your exact center frequency. Normally, the only field alignment that should be necessary is to peak the antenna coil to match the receiver to your antenna.

The following procedure can be used if a frequency change is required or for touch up alignment under field conditions. It should be noted that it is very easy to peak the RF section to an adjacent station so extreme care should be taken in the RF alignment.

Local Oscillator and RF Alignment.

1. Remove only the receiver top cover.

CAUTION: Do not remove the bottom plate in high RF signal areas.

2. Connect a volt ohmmeter (20k ohm/volt VOM), or preferably a VTVM to test point "A" (TP-A) and ground. (-3.0 VDC scale).
3. Turn the oscillator slug counterclockwise (out) as far as it will go.
4. Insert the proper crystal into the crystal socket.

$$\text{Crystal frequency} = \frac{\text{Operate Frequency} - 10.7 \text{ MHz}}{2}$$

5. Slowly turn the oscillator slug clockwise (in) until the negative voltage rises abruptly, indicating oscillation. Continue clockwise until the voltage drops 1/10 to 2/10 of a volt below the peak to insure positive starting. This voltage should be at least one volt dc with a 20 k ohm/volt VOM.
6. With the meter on TP-A, tune the doubler coil for a sharp dip. Minimum meter reading with a rapid voltage rise when the core is turned right or left indicates proper tuning.
7. Connect an antenna to the TR-66A.
8. Connect a VTVM to TP-C or TP-B (-3.0 VDC scale) (see note).
9. Tune the mixer coil for maximum negative voltage reading. If two peaks are noted, tune to the peak producing the highest voltage.
10. With a VTVM connected to TP-C or TP-B, tune the RF coil for maximum negative voltage.

FIELD ADJUSTMENTS
(Continued)

11. With a VTVM connected to TP-C or TP-B, tune the doubler coil for maximum negative voltage.
12. With the VTVM connected to TP-C or TP-B, tune the antenna coil for maximum negative voltage.
13. Repeat steps 8, 9, 10, 11, and 12, until no further improvement can be made.

NOTE: Since there are no tuned circuits in the rest of the TR-66A you may listen for quality on both the main channel and the SCA multiplex channel.

Test point "C" should be used in areas where there is more than 50 microvolts of signal available. In strong signal areas the signal must be attenuated during alignment to minimize the AGC action of the front end, especially in a metropolitan area with a strong adjacent or alternate channel.

If the TR-66A is installed in a fringe area, and no voltage is present at test point "C", test point "B" should be used for alignment. (In very weak signal areas the voltage may be positive and the receiver should be tuned for minimum positive or a negative going voltage).

For steps 5, 6, 8, 9, 10, 11, and 12, it is PREFERABLE to USE a VTVM.

This completes the oscillator and RF alignment.

* On units with screw driver adjusted oscillator slug - steps 3 and 5 should be as follows:

3. Turn the oscillator slug clockwise (in) as far as it will go.
5. Slowly turn the oscillator slug counterclockwise (out) until the negative voltage rises abruptly, indicating oscillation. Continue counterclockwise until the voltage drops 1/10 to 2/10 of a volt below the peak. This voltage should be at least -1.5 volts DC with a 20 K VOM.

De-Emphasis

The TR-66A subchannel has a standard de-emphasis of 150 microseconds. To change this de-emphasis to 75 microseconds, change capacitor C-12 on the subchannel demodulator board from .001 mfd to .00075 mfd.

Speaker and Output Connections

1. The 25 and 70.7 volt speaker terminations are available on the rear of the chassis through the use of either of the plug-in amplifiers (LT-10A, 5 watts; LT-20, 12 watts).

To change the plug-in amplifier to 8 ohm output, make the following circuit changes on the octal socket on the TR-66A chassis:

- a. Remove the wire from Pin No. 6 and connect to Pin No. 2.
 - b. Place a jumper from Pin No. 3 to Pin No. 4.
 - c. Eight ohms is now present across the 70.7V terminals.
2. 600 ohms (unbalanced output) at 1.0 volt is available through the phono jack on the rear of the chassis.
 - a. In order to obtain the best noise figure possible, it is recommended that when using the TR-66A with an external amplifier, the volume control on the TR-66A be set at maximum and all adjustment of volume be made with the amplifier.

Main Channel Automatic Muting

1. The bottom plate must be removed for adjusting the main channel mute.
2. The tuner is shipped from the factory with the mute adjusted for approximately 5 microvolts.
3. The main channel mute control is located on the mute and audio printed circuit board under the chassis (blue control).
4. The main channel mute should be adjusted with the main channel off the air, or the antenna disconnected from the receiver.
5. Adjust the mute control toward the rear of the chassis until the noise disappears, then 1/8 of a turn farther to insure proper muting.

B+ Switch (Rear Chassis)

There is a B+ switch above the antenna terminal to provide power (+12VDC) to the antenna terminal.

This power is used when connecting a McMartin indoor transistorized antenna (A-72-PA) to the TR-66A. The internal connections are all made. Simply remove the lock plate from the B+ switch and turn the switch on. Reverse the lock plate and install it back on the tuner.

FIELD ADJUSTMENTS
(continued)

CAUTION: THE RECEIVER MUST NOT BE CONNECTED TO AN OUTSIDE ANTENNA IF THE ANTENNA B+ SWITCH IS IN THE "ON" POSITION, AS THIS WILL SHORT CIRCUIT B+ DAMAGING THE POWER SUPPLY AND WILL MAKE THE RECEIVER COMPLETELY INOPERATIVE. THE SWITCH MUST ALSO BE IN THE "OFF" POSITION WHEN CONNECTING THE TR-66A TO A SIGNAL GENERATOR OR ANY TEST EQUIPMENT.

TROUBLESHOOTING

The first step in troubleshooting is to check the B+ voltages to the RF board, 10.7 MHz IF board, sub-channel demodulator board, the dual gate squelch and audio amplifier board. The B+ voltage to these boards should be 13 volts \pm 1 volt. If not, check for a B+ short in the wiring or check the regulator board for proper voltage.

NOTE: The antenna B+ switch must be in the OFF position if it is used with an external antenna or generator, as this will short-circuit the B+ if this switch is in the ON position.

Failure of Main Channel Output

1. Check the audio output of the main channel board for an audio signal. If audio is not present at the main channel output of the main channel board, check the audio at the multiplex output. If no audio is present, check the following:
 - a. Connect an oscilloscope to the emitter of Q-4. If no signal is present, connect the scope to the base of Q-4. If the signal is present, Q-4 is defective.
 - b. If no signal is present at the base of Q-4, connect an oscilloscope to the collector of Q-3. If a signal is present at this point, check capacitor C-28 for an open or short-circuit condition.
 - c. If no signal is present at the collector of Q-3, connect an oscilloscope to the base of Q-3. If a signal is present at the base of Q-3, Q-3 is defective.

NOTE: If no audio is present at the base of Q-3, it is recommended that the unit be sent back for repair as the circuitry preceding this requires specialized test equipment for servicing.

Failure of Sub-Channel Audio

1. Check the voltage at the mute terminal on the sub-channel demodulator board. This voltage should be at least \pm .6 VDC. This positive voltage is necessary to unmute the audio section of the receiver.
 - a. If no voltage is present, check diode D-1 and D-2 on the sub-channel demodulator board.
 - b. A 67 kHz carrier signal must be present on the collector of Q-1.
 - c. If a 67 kHz carrier is not present at the collector of Q-1, check the input of the sub-channel board for a 67 kHz carrier.

TROUBLESHOOTING (continued)

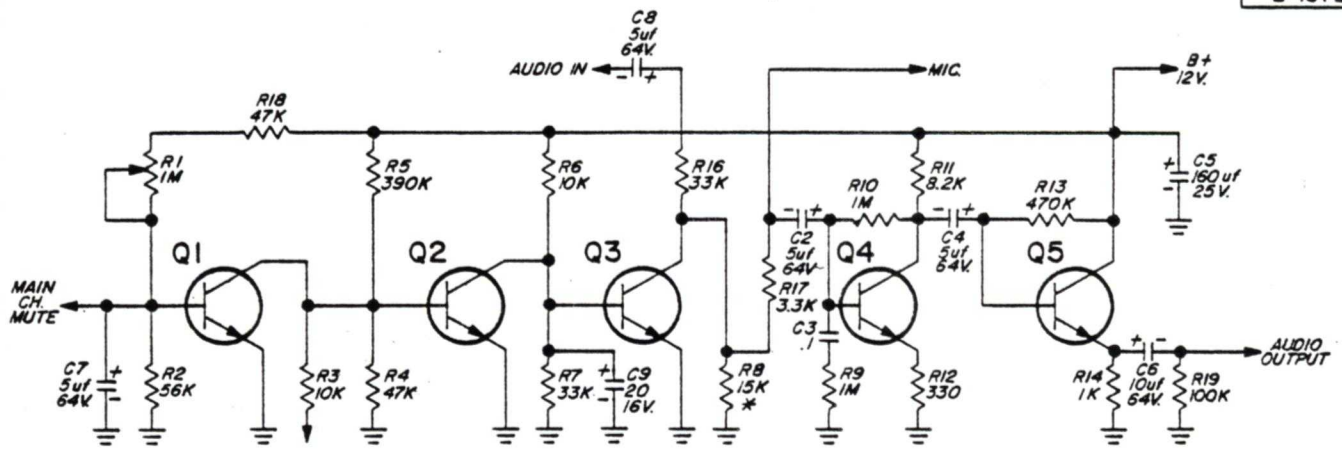
- d. If no 67 kHz carrier is present at this point, the problem is in the 67 kHz band pass filter or in the main channel board.
2. If it is determined that the mute voltage is correct and there is still no audio output, check the following:
 - a. Connect an oscilloscope to the audio output terminal of the sub-channel demodulator board and if audio is present at this terminal, the sub-channel demodulator board is working correctly and the trouble is following this demodulator board.
 - b. If no audio is present at the audio output terminal, then connect an oscilloscope to Pin No. 5 of IC (CA-3011). A square wave of approximately 4 volts peak-to-peak should appear at this point. If not, check the IC (CA-3011).
 - c. If a square wave is present at terminal No. 5 of IC, then connect the scope to the base terminal of Q-2. A sawtooth signal should be present at this point. If not, check C-11 and C-12 for a short-circuit.
 - d. If an audio signal is present at the base of Q-3, connect the oscilloscope to the collector of Q-3. This should be a high amplified audio signal with some residual RF. If not, check Q-3.
 - e. If an audio signal is present at the collector of Q-3 but does not appear at the audio output terminal, check capacitors C-14, C-15, C-16 for an open or short-circuit. Also check the 400 millihenry filter for continuity.
3. If it has been determined that the audio output is present at the audio output terminal of the sub-channel demodulator board, check to see if the audio is present at the audio input terminal of the audio amplifier board. If not, check continuity through the function switch to this terminal.

TRANSISTOR AND DIODE COMPLEMENT

SYMBOL	PART NO.	DESCRIPTION	FUNCTION
<u>RF TUNER BOARD</u> (PART NO. 012011)			
Q-1	201062	2N-5246	RF Amplifier)
Q-2	201062	2N-5246	RF Amplifier) Cascode
Q-3	201022	SE-4001	Local Oscillator
Q-4	201035	40243	Mixer
D-1	220005	IN-3604	Doubler
<u>10.7 mHz AMPLIFIER AND DEMODULATION BOARD</u> (PART NO. 012013)			
IC-1	230004	CA-2018A	Wide Band Amplifier
IC-2	230004	CA-3011	Wide Band Amplifier and Limiter
Q-1	201036	40245	IF Amplifier
Q-2	201050	SE-4010	Pulse Amplifier
Q-3	201049	SE-4002/SE-4001	Wide Band Audio Amplifier
Q-4	201049	SE-4002/SE-4001	Emitter Follower Output
D-1	220004	IN-51	AGC Voltage Doubling Diodes
D-2	220004	IN-51	AGC Voltage Doubling Diodes
D-3	220005	IN-3604	IF Limiter
D-4	220005	IN-3604	IF Limiter
D-5	220004	IN-51	Squelch Voltage Doubling Diodes
D-6	220004	IN-51	Squelch Voltage Doubling Diodes
D-7	220005	IN-3604	IF Limiter
D-8	220005	IN-3604	IF Limiter
D-9	220005	IN-3604	Demodulator Switch
<u>SUBCHANNEL DEMODULATOR BOARD</u> (PART NO. 012016)			
Q-1	201049	SE-4002	Isolation Amplifier
Q-2	201049	SE-4002	Demodulation Switch
Q-3	201049	SE-4002	Audio Amplifier
IC-1	230001	CA-3011	Wide Band Amplifier Limiter
D-1	220004	IN-51	Mute Voltage Doubling Rectifier
D-3	220004	IN-51	Demodulator Switch

TRANSISTOR AND DIODE COMPLEMENT
(continued)

SYMBOL	PART NO.	DESCRIPTION	FUNCTION
<u>DUAL GATE MUTE AND AUDIO AMPLIFIER</u>			
(PART NO. 012015)			
Q-1	201049	SE-4002	Main Channel Switch
Q-2	201049	SE-4002	Sub-Channel Switch
Q-3	201019	40232	Mute Switch
Q-4	201049	SE-4002 or SE-4001	Audio Amplifier
Q-5	201049	SE-4002 or SE-4001	Audio Amplifier
<u>POWER SUPPLY</u>			
(PART NO. 012014)			
Q-1	201046	40310	Regulator
D-1	210008	R8D8	Rectifier
D-2	210008	R8D8	Rectifier
D-3	210008	R8D8	Rectifier
D-4	210008	R8D8	Rectifier
D-5	220007	13V Zener	Reference Diode



TRANSISTORS
 Q1, Q2, Q4, Q5 - 2N3392 OR SE-4002
 Q3 - 40232
 * SELECTED IN PRODUCTION

M^c Martin Industries, Inc.
 OMAHA, NEBR.

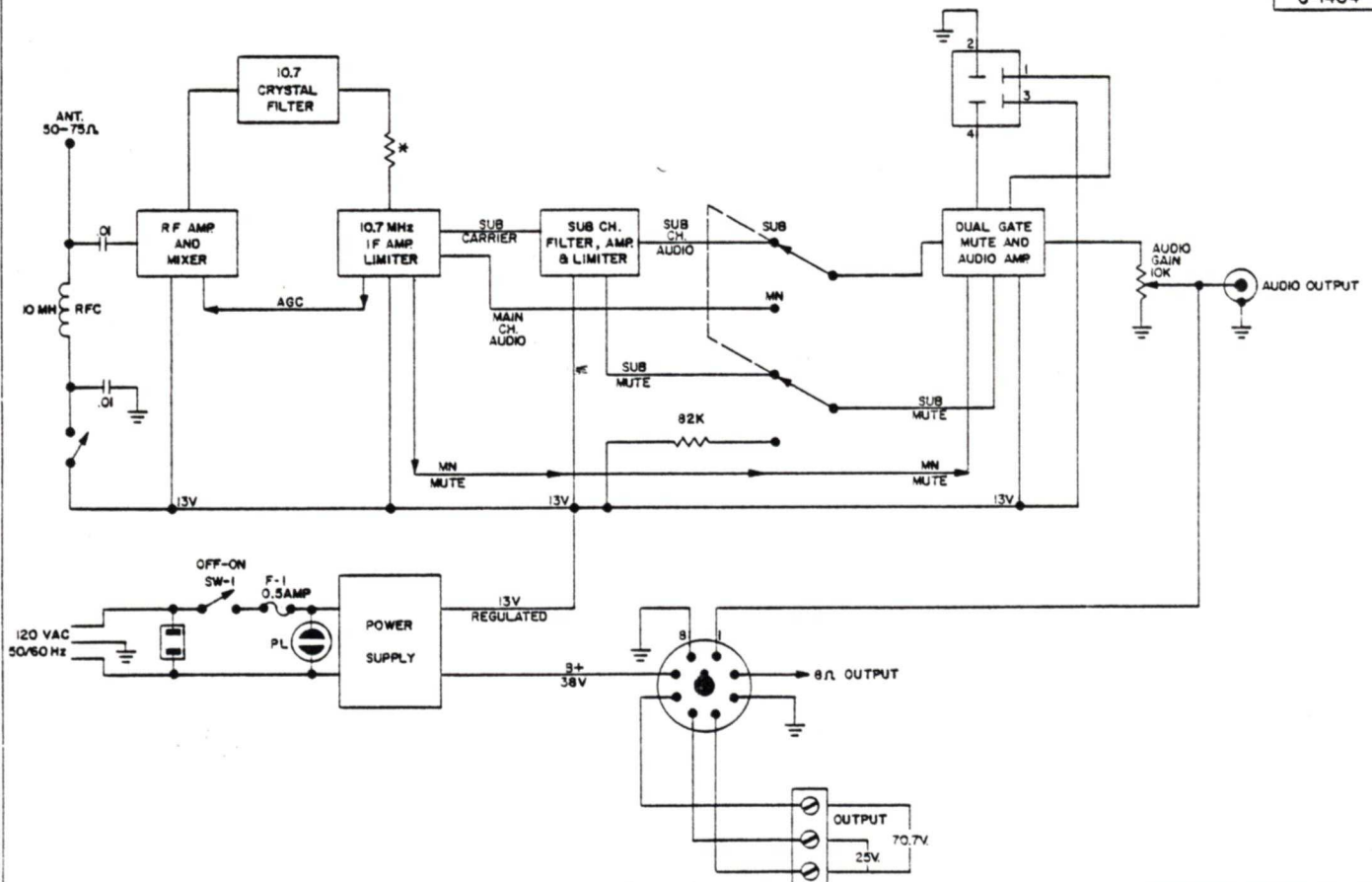
TITLE SCHEMATIC, DUAL GATE MUTE
 AND AUDIO AMPLIFIER
 TR-66A

OWN BY J. M. Hansen DATE 6-13-67

ENG HEDLUND SCALE NONE

APP'D BY DATE 8-1372

C-1404



M^c Martin Industries, Inc.
 OMAHA, NEBR.

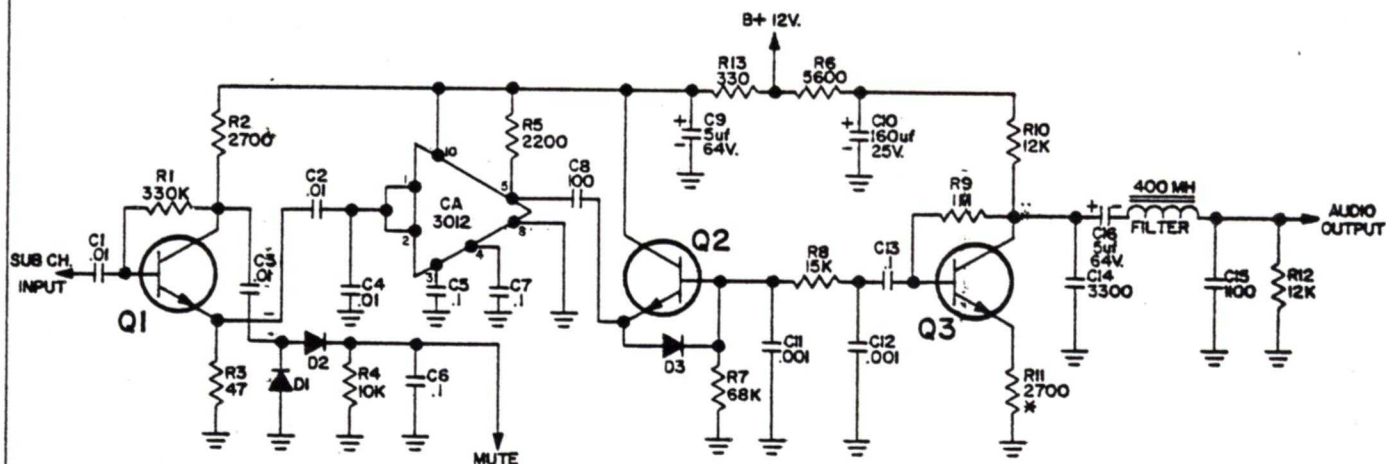
TITLE SCHEMATIC MAIN FRAME

TR-66A

OWN BY J. M. Hansen DATE 7-24-67

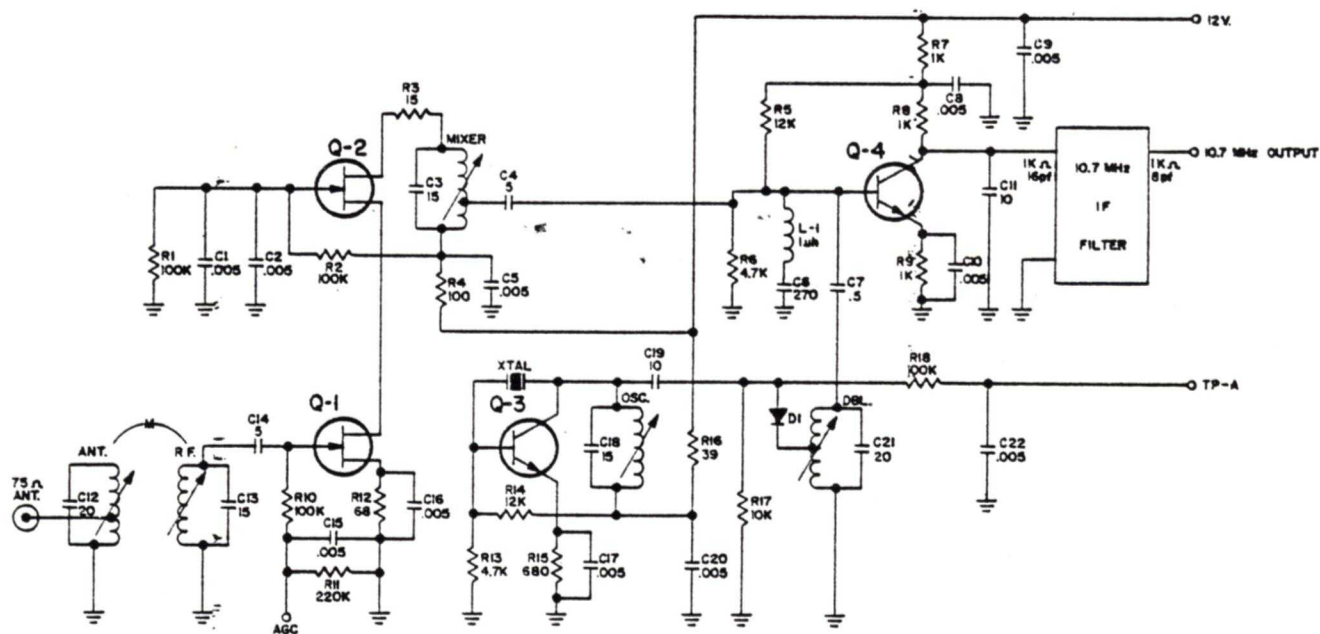
ENG HEDLUND SCALE NONE

APP'D BY DATE C-1404



D1, D2 & D3--1N51
Q1, Q2 & Q3--2N5246
* SELECTED IN PRODUCTION

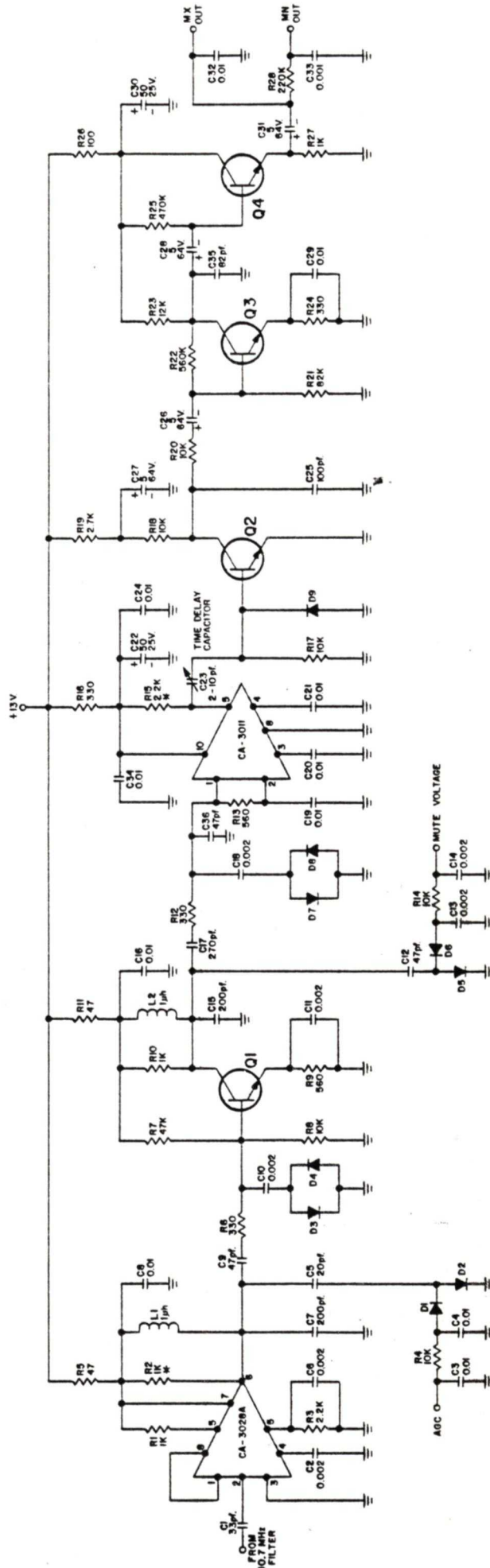
M ^o Martin Industries, Inc. OMAHA, NEBR.	
TITLE SCHEMATIC, SUB CH. DEMOD.	
TR-66A	
DES BY <i>W. Hansen</i>	DATE 6-14-67
CHK BY <i>W. Hansen</i>	SCALE NONE
APPRO BY	DRG B-1373



Q1 - 2N5246
Q2 - 2N5246
Q3 - 2N5246
Q4 - 40243
D1 - 1N3604

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. RESISTORS 1/2W ±10%
2. CAPACITORS IN MFD.

M ^o Martin Industries, Inc. OMAHA, NEBR.	
TITLE SCHEMATIC, PC BOARD	
55-108 MC RF TUNER	
TR-66A	
DES BY <i>W. Hansen</i>	DATE 1-17-69
CHK BY <i>W. Hansen</i>	SCALE NONE
APPRO BY	DRG C-1589



NOTES: (UNLESS OTHERWISE SPECIFIED)

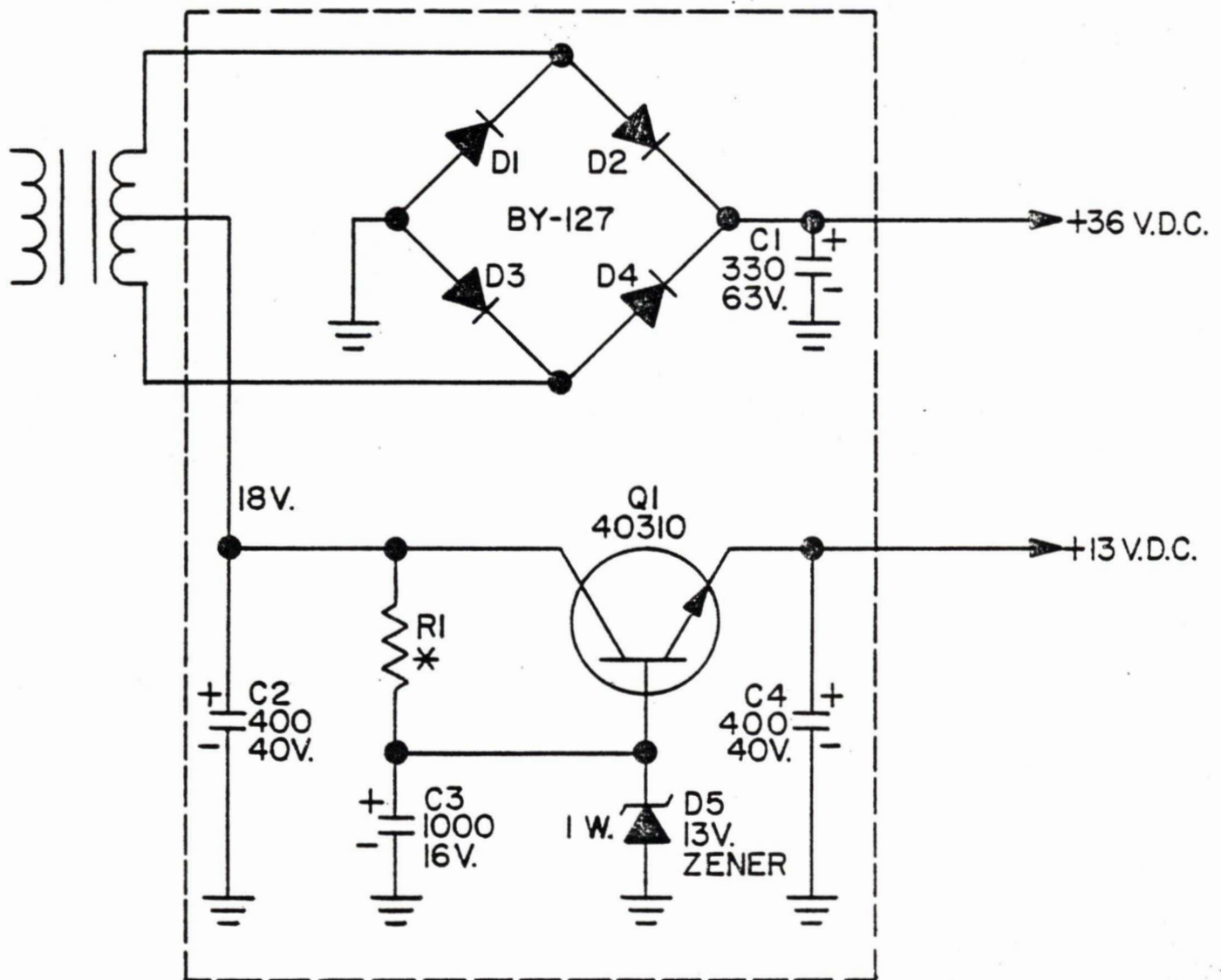
1. RESISTORS 1/2W 50%
2. CAPACITORS 50% TOLERANCE
3. DIODES POLARITY SHOWN
4. SOME VALUES MAY DIFFER WITH EACH UNIT. NEW SCHEMATICS WILL BE ISSUED WHEN MAJOR CHANGES OCCUR.
5. * SELECTED IN PRODUCTION.

TRANSISTORS

- Q1 40245
- Q2 40245
- Q3 40245
- Q4 40245

DIODES

- D1 IN51
- D2 IN51
- D3 IN51
- D4 IN51
- D5 IN51
- D6 IN51
- D7 IN51
- D8 IN51
- D9 IN51



* ADJUST TO DRAW 8 TO 10 Ma.

McMartin Industries, Inc.
OMAHA, NEBR.

TITLE SCHEMATIC, POWER SUPPLY

TR-66A

RECEIVER

DWN BY *J.M. Hansen*

DATE 7-27-67

ENG *L. Heavens*

SCALE NONE

APP'D BY

DWG

A-1584