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UNCLASSIFIED

TECHNICAL MANUAL

for

CARRIER OPERATED ANTI-NOISE DEVICE

MODEL CDN-3



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N.Y.

OTTAWA, ONTARIO

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THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

W a r r a n t y

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,*fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes*furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

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At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York



INSTRUCTION BOOK CHANGE NOTICE

Date 11/12/66

Manual affected: Carrier Operated Anti-Noise Device, Model CDN-3 (issue date: 25 Oct. 1966) IN -4013A

Page 7-7/7-8. Figure 7-7.

1. Add C3 reference symbol to Q1 base circuit as indicated in figure A below.
2. In Q3 emitter circuit:
 - a. Change R15 to R17.
 - b. Add TP2 as indicated in figure B below.
3. In Q5 collector circuit, add 1800 (capacitance value) to C24.

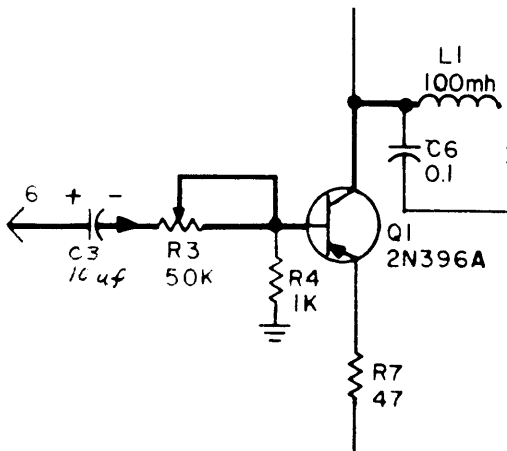


Figure A

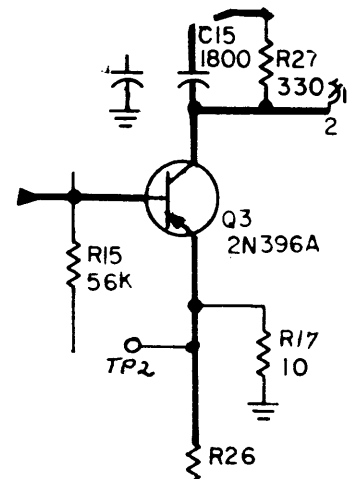


Figure B

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn.: Director of Eng. Services.

CHANGE NO. 2



INSTRUCTION BOOK CHANGE NOTICE

Date February 23, 1970

Manual affected: CDN-3 IN 4013A

Page 6-21

Change R-504 from 5,000 ohms to 10,000 ohms and change Part Number to RC20GF103J

Change R-505 from 50,000 ohms to 5,000 ohms and change Part Number to RV111U502A.

Change R-515 from "Same as R505" to Resistor, Fixed, Composition: 2,700 ohms, ±5%, 1/2 watt, Part Number RC20GF272J.

Page 7-7/7-8, Figure 7-6

Change frequency of Y1 from 354.480 to 354.840.

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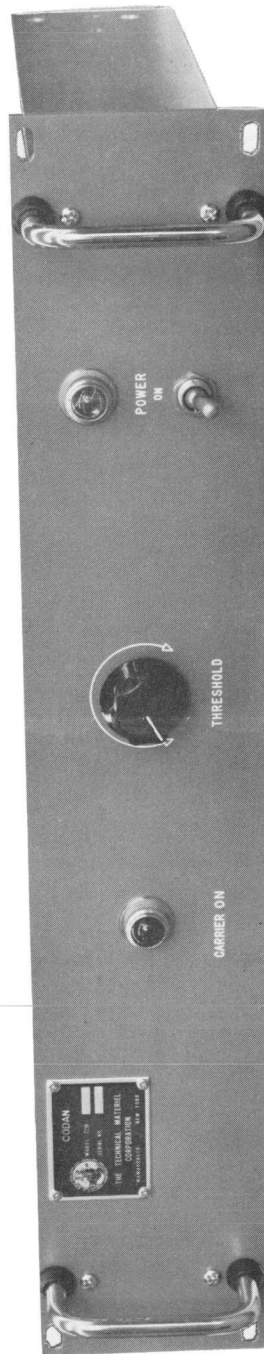
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Figure 1-1. Carrier Operated Anti-Noise Device, Model CDN-3

SECTION 1 GENERAL INFORMATION

1-1. GENERAL DESCRIPTION.

Carrier Operated Anti-Noise Device, Model CDN-3 is a compact, solid-state, receiver-controlled unit that will squelch or unsquelch the audio output of an associated receiver at a predetermined carrier-to-noise ratio. The CDN incorporates a built-in drift-cancelling loop that compensates for receiver instability, a front-panel THRESHOLD control that allows the operator to select the desired minimum carrier-to-noise ratio, and a carrier-controlled gating and muting circuit that automatically protects against false gating caused by noise bursts or interference. A selection of many inter-

mediate frequencies makes the CDN readily adaptable to most communication receivers that have either a high- or low-impedance i-f output facility.

Channel activity is indicated by a front-panel CARRIER ON lamp; associated alarm circuitry is designed so that an external indicating device may be readily connected.

1-2. TECHNICAL SPECIFICATIONS.

Technical specifications of the CDN are as follows:

I-F Inputs	455 kc (standard equipment), 100 kc, 200 kc, 250 kc, 500 kc, 1750 kc.
I-F Input Impedance	1. High impedance, 5,000 ohms, 100 millivolts to 1 volt. 2. Low impedance, 50 ohms, 1 millivolt to 1 volt.
Operating Bandwidth	2 kc at 3 dB points, 8 kc at 20 dB points.
Power Input	
A-C Operation	105, 115, 125/210, 230, 250 volts, 50/60 cps, approximately 10 watts.
Battery Operation	24 volts dc, approximately 8.5 watts. Positive and negative 12 volts or floating 24 volts.
Size	3-1/2 in. high x 19 in. wide x 16 in. deep (approximately).
Weight	Approximately 20 lbs.
Components and Construction	All equipment manufactured in accordance with JAN/MIL specifications wherever practicable.

SECTION 2 INSTALLATION

2-1. INITIAL INSPECTION.

The CDN is calibrated and tested at the factory prior to shipment. When it arrives at the operating site, inspect the packing case and contents for possible damage. Inspect all packing material for parts that may have been shipped as "loose items." With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and the furnishing of parts.

The equipment is shipped with all modules and other components installed. Check that all such components are properly positioned.

2-2. POWER REQUIREMENTS.

Normally the CDN is factory wired for 115 vac, 50/60 cps, single phase power and/or 24 vdc power.

For a-c operation on other than 115 vac, primary power transformer T1001 must be rewired as indicated in figure 2-1.

2-3. INSTALLATION.

a. **MECHANICAL.** - The CDN is designed for rack mounting; prime considerations when installing the CDN are: adequate ventilation; sufficient space to withdraw the unit for servicing. The CDN is equipped with a standard 19-inch front panel and is 3-1/2 inches high and 16 inches deep.

b. **ELECTRICAL.** - All external connections, with exception of a-c and d-c power, are made to jack and screw terminals located on the rear of CDN (see figure 2-2). Table 2-1 describes the connections to be made to jack and screw terminals.

TABLE 2-1. REAR-PANEL CONTROLS AND CONNECTIONS

ITEM NO. (Figure 2-2)	PANEL DESIGNATION	FUNCTION
1	AC POWER jack J1008	A-c power input connector receptacle.
2	CARR LVL jack J1011	Internal carrier level test jack.
3	POS 12V fuse F1002	Protects positive 12-volt supply.
4	ATTEN VAR control	In conjunction with the 40dB fixed attenuation network, adjusts the i-f to a nominal one millivolt at the RF MON jack.
5	40 DB switch	When set at IN, a fixed 40dB attenuation network is switched into the 50-ohm input circuit. This attenuation is normally used for input signals exceeding 100 mv. When set at OUT, 50-ohm input signals are applied directly to ATTN VAR control.
6	Barrier Strip TB1001 Terminals:	
	1	-12 volt dc output of internal power supply.
	2	+12 volt dc output of internal power supply.

TABLE 2-1. REAR-PANEL CONTROLS AND CONNECTIONS (CONT)

ITEM NO. (Figure 2-2)	PANEL DESIGNATION	FUNCTION
6 (Cont)	Barrier Strip TB1001 (Cont) Terminals:	
	3	Ground.
	4 and 7	Receiver audio terminating resistor.
	5 and 6	Terminals for receiver audio lines (audio input).
	8	Connection to external a-c alarm.
	9 and 12	Telephone line terminating resistor.
	10 and 11	Terminals for telephone line.
	13, 14, 15	Remote indicator: 15-normally closed contact 14-center post of relay 13-normally open contact
	16	Spare terminal.
7	BATT POWER jack	A 4-wire battery power jack. Terminal A is connected to the +12 volt line; terminal C is connected to the -12 volt line; terminal B is chassis ground.
8	5K OHM jack J1010	High impedance i-f input from receiver (BNC connector).
9	50 OHM jack	Low impedance i-f input from receiver (BNC connector).
10	NEG 12 V fuse F1003	Protects negative 12-volt supply.
11	AC fuse F1001	Protects a-c power supply during a-c operation.
12	RF MON jack J1012	Permits monitoring of I-F input signal.

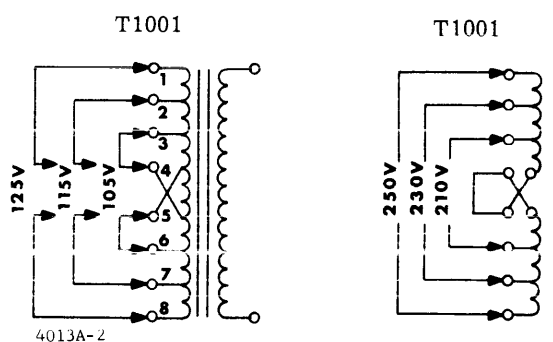


Figure 2-1. Power Transformer Wiring

2-4. INITIAL CHECKOUT PROCEDURE.

Although the CDN has been aligned and thoroughly checked against the manufacturer's specifications prior to shipment, it is necessary to insure correct installation and proper CDN operating condition by performing the following checkout procedure. Refer to section 3 for location and function of all operating controls and indicators.

NOTE

Unless otherwise indicated, item numbers (numbers in parenthesis) are callouts referenced to figure 2-2.

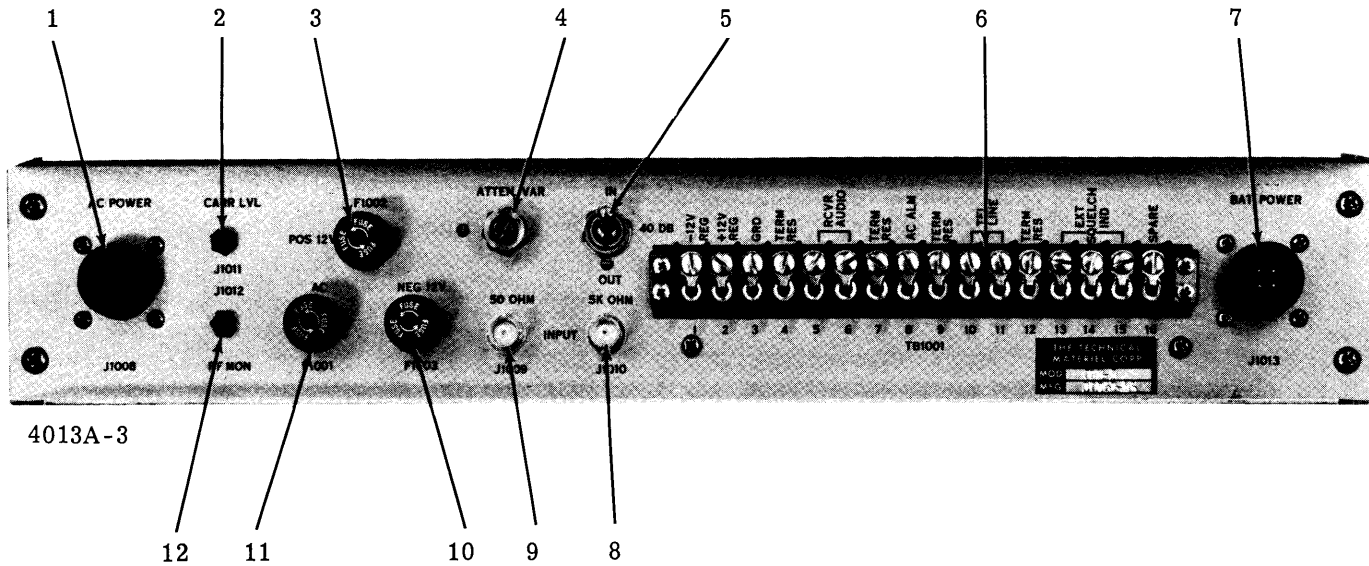


Figure 2-2. CDN, Rear View

a. Adjust VTVM controls as required for indication on 0 - 1 mv scale; connect VTVM to RF MON jack (12).

b. Connect signal generator to i-f INPUT jack J1010 (8). Tune signal generator to i-f frequency of associated receiver (refer to technical specifications given in section 1). Set THRESHOLD control (item 2, figure 3-1) at mid position. Increase signal generator level until CARRIER ON lamp (item 1, figure 3-1) lights; VTVM should indicate 1 mv.

c. Disconnect signal generator, and connect i-f output of associated receiver to i-f INPUT jack.

With receiver tuned to a strong signal and with agc functioning, adjust rear-panel attenuators (4 and 5) of CDN for a 1-mv indication on VTVM.

d. Remove all test equipment. Set POWER switch at off and disconnect d-c power cable attached to BATT POWER jack.

NOTE

When center-tapped d-c power is employed, circuits of the CDN will remain operative regardless of the POWER switch setting.

SECTION 3 OPERATOR'S SECTION

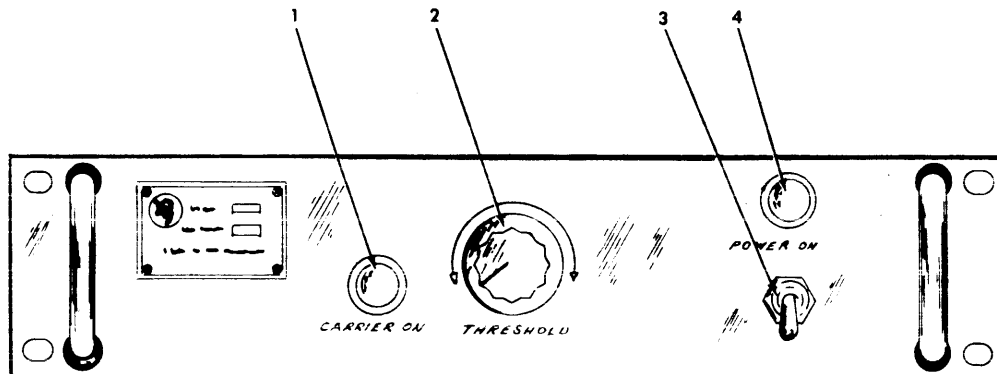
3-1. CONTROLS AND INDICATORS.

Before attempting to operate the CDN, the operator should familiarize himself with the operating

controls and indicators. Control and indicator functions are listed in table 3-1 and are illustrated in figure 3-1.

TABLE 3-1. CONTROLS AND INDICATORS

ITEM NO. (Figure 3-1)	PANEL DESIGNATION	FUNCTION
1	CARRIER ON lamp	Lights to indicate presence of carrier. Goes off to indicate absence of carrier or that noise level is of such magnitude that no intelligence can be received.
2	THRESHOLD control	Determines carrier-to-noise threshold of CDN.
3	POWER switch	Applies power to CDN from a-c line when set at ON.
4	POWER lamp	Lights when CDN is operated from a-c power.



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Figure 3-1. CDN, Front Panel Controls and Indicators

3-2. OPERATING PROCEDURE.

a. Before operating CDN with associated receiver, ensure that CDN is installed and checked-out according to information contained in section 2.

b. Apply power to CDN by attaching d-c power cable to BATT POWER jack and by setting front-panel POWER switch at ON.

NOTE

The CDN can be operated with both a-c and d-c power applied. During this operation, the a-c supply provides operating voltage for CDN circuits and charging current for

the d-c battery supply. Upon failure of a-c power, the battery supply will provide operating voltage for CDN with no interruption of service. During d-c operation, the POWER indicator lamp does not operate.

c. With associated receiver tuned to a signal that provides minimum carrier-to-noise ratio desired, set THRESHOLD control at position that activates CARRIER ON lamp of CDN. With THRESHOLD control set fully counterclockwise, CDN will trigger only when received signals have carrier-to-noise ratio in excess of 20 to 25 dB. With THRESHOLD control set fully clockwise, CDN is sensitive to all received signals regardless of carrier-to-noise ratio.

SECTION 4

PRINCIPLES OF OPERATION

4-1. FUNCTIONAL ANALYSIS.

Refer to figure 4-1. The i-f signal from an associated receiver is applied via a variable attenuator and broadband isolation amplifier to the first mixer stage of the In-Out module. The first mixer stage combines this i-f signal with the output of a crystal oscillator in the Buffer module to produce a 455 kc i-f output. This 455-kc output is applied via a double-tuned stage to both inputs of a drift-canceling loop in the Mixer Amplifier module.

One of the 455 kc i-f inputs to the drift-canceling loop in the Mixer Amplifier module is applied to the second mixer where it is beat with a 355-kc crystal-controlled frequency thereby producing a 100-kc signal. The other 455-kc input signal of the drift-canceling loop is applied to the third mixer where it is combined with the 100-kc signal from the second mixer. The output of the third mixer, a 355-kc i-f signal with the same stability as the 355-kc crystal oscillator, is applied via a double-tuned stage to both the Carrier and Noise-Channel modules.

The 355-kc i-f signal applied to the carrier channel, is fed through a narrow carrierpass filter that excludes everything but the carrier component; this 355-kc carrier component is then routed to a carrier-amplifier stage in the Comparator module.

The other 355-kc i-f output signal from the Mixer Amplifier module is applied simultaneously to: (1) an a-f controlled gate circuit in the noise-channel module; (2) an audio detector stage in the Carrier-Channel module. The output of the audio-detector stage is applied to the a-f controlled gate (via amplifier stages, a lowpass filter, and a-f rectifier) and controls the flow of the 355-kc i-f signal from the Mixer Amplifier module to the carrier reject filter and noise-amplifier stages; the output of the noise amplifier is applied to a noise-detector stage in the Comparator module. The flow of the 355-kc i-f signal through the a-f controlled gate circuit is inversely proportional to the modulation level of the i-f signal.

At the comparator board, the noise and carrier signals are rectified producing a negative and positive d-c voltage respectively. These d-c voltages are applied to a combining network and are extended via the THRESHOLD control and Schmitt trigger stage to the relay control circuit. The Schmitt trigger circuit activates the control relay circuit when the carrier-to-noise ratio reaches the desired level as set by the THRESHOLD control.

4-2. IN-OUT MODULE, CIRCUIT ANALYSIS.

Refer to figure 7-1 and 7-2. The In-Out module, in conjunction with rear-panel attenuation controls, provides proper attenuation and frequency conversion to adapt the CDN for operation with most communication receivers. Incoming i-f input signals from an associated receiver are extended through an attenuation network (resistors R704, R706, and R707) and/or potentiometer R1003 to the base circuit of isolation amplifier Q701. The amplified output of Q701 is capacitively coupled to the base circuit of mixer Q702. The amplified i-f input signal applied to the base of Q702 is beat with an injection frequency (i-f input \pm 455-kc) that is generated by oscillator Q606 in the Buffer module and is applied to the emitter of Q702. If the CDN is used with a receiver having an i-f output of 455 kc, oscillator Q606 in the Buffer module is disabled and Q702 functions as an ordinary 455-kc amplifier. The output of Q702, a 455-kc signal (plus receiver i-f instabilities, if any) selected by the double-tuned stage (comprising L701, T701, C710, C711, and C712) in the collector circuit, is applied simultaneously to amplifiers Q601 and Q603 of the Buffer Module.

The bandwidth of isolation amplifier Q701 is adequate for processing signals from receivers having an i-f output between 100 kc and 1750 kc; Q701 also prevents undesired CDN internal signals from leaking back into the receiver i-f circuits. Switch S1003 (40 DB) permits the 40 dB attenuation network consisting of resistors R704 and R706 to be switched into or out of the 50-ohm input circuit.

4-3. BUFFER MODULE, CIRCUIT ANALYSIS.

Refer to figures 7-1 and 7-3. The Buffer module comprises two independent 455-kc amplifiers and an oscillator amplifier stage.

a. 455-KC AMPLIFIER STAGES. - The high-level 455-kc input signal from the In-Out module is applied to the base of transistor Q601 which is configured with Q602 as a Darlington amplifier (a two-stage emitter follower). The amplified low-impedance 455-kc output at the emitter of Q602 is extended to the emitter of third mixer Q505 in the Mixer Amplifier module.

The low-level 455-kc input signal from the In-Out module is applied to the base of isolation amplifier Q603. The output at the collector of Q603 is capacitively coupled to the base of second mixer Q504 in the Mixer Amplifier module. Isolation amplifier Q603 and its associated circuitry prevents 355-kc energy

present in second mixer Q504 of the Mixer Amplifier module from leaking back through the 455-kc amplifier stages (Q603, Q601, and Q602).

b. **OSCILLATOR-AMPLIFIER STAGE.** - The oscillator-amplifier stage provides an injection frequency to the first mixer stage when the CDN is operated with a receiver having an i-f output other than 455 kc (refer to paragraph 4-2). The output of crystal-controlled oscillator Q606 is applied to the base of Q605 which is configured with Q604 as a two-stage emitter follower (Darlington amplifier). The amplified output at the emitter of Q604 is then applied to the emitter of mixer Q702 of the In-Out module.

The emitter follower configuration provides high-power gain and minimum loading of the oscillator circuitry while providing low output impedance for driving the first mixer stage. Oscillator output level may be controlled by varying the setting of potentiometer R614. Adjustment of variable capacitor C605 compensates for a small amount of error in crystal frequency.

4-4. MIXER AMPLIFIER MODULE, CIRCUIT ANALYSIS.

Refer to figures 7-1 and 7-4. The Mixer Amplifier module contains the major circuits of the CDN drift-canceling loop (figure 4-2).

A 455-kc signal from isolation amplifier Q603 in the Buffer module is capacitively coupled to the base circuit of mixer Q504. This 455-kc signal (containing receiver i-f instabilities, if any) is beat with a 355-kc injection frequency that is generated by oscillator Q501, amplified by Q502 and Q503 (a two-stage emitter follower) and applied to the emitter of Q504. The 100-kc difference frequency at the collector of Q504 is applied via a double-tuned stage (comprising L502, T501, C512, C513, and C514, and having a -3dB bandwidth of slightly less than 2 kc) to the base of mixer Q505.

A second injection frequency (455-kc from Q602 in the Buffer module) that also contains the receiver i-f instabilities (if any) is capacitively coupled to the emitter of Q505. The 355-kc difference frequency output at the collector of Q505 is applied via a double-tuned stage (comprising L502, T501, C517, C518, and C519) to the Carrier- and Noise-Channel modules (paragraphs 4-5 and 4-6).

The 355-kc output of the drift-canceling loop has: (1) the amplitude characteristics of the associated receiver i-f signal; (2) the frequency stability of the 355-kc crystal oscillator. This stability is necessary due to the use of very narrow crystal filters in the Carrier- and Noise-Channel modules.

4-5. CARRIER CHANNEL MODULE, CIRCUIT ANALYSIS.

Refer to figures 7-1 and 7-5. The Carrier-Channel module contains an audio-detector stage, and a carrierpass filter and the associated circuitry.

a. **CARRIERPASS FILTER.** - The high-level 355-kc output from Q505 in the Mixer Amplifier module is applied to the base of filter driver Q301, an emitter follower. The amplified, low-impedance output of Q301 is coupled by means of a carrierpass filter (comprising C312, C313, Y301 and T301) to the base of carrier amplifier Q208 in the Comparator module.

The use of a crystal filter provides a narrow bandwidth of approximately 35 cps in the carrier channel which is sufficient to exclude all but carrier energy.

b. **AUDIO DETECTOR.** - A portion of the low-level 355-kc output of Q505 in the Mixer Amplifier module is applied to the base of detector driver Q302. The amplified output at the collector of Q302 is transformer coupled to envelope detector CR301. The detected output is then routed to audio amplifier, Q401 of the Noise Channel card and is also used as an input level monitor at the CARRIER LEVEL jack located on the rear panel.

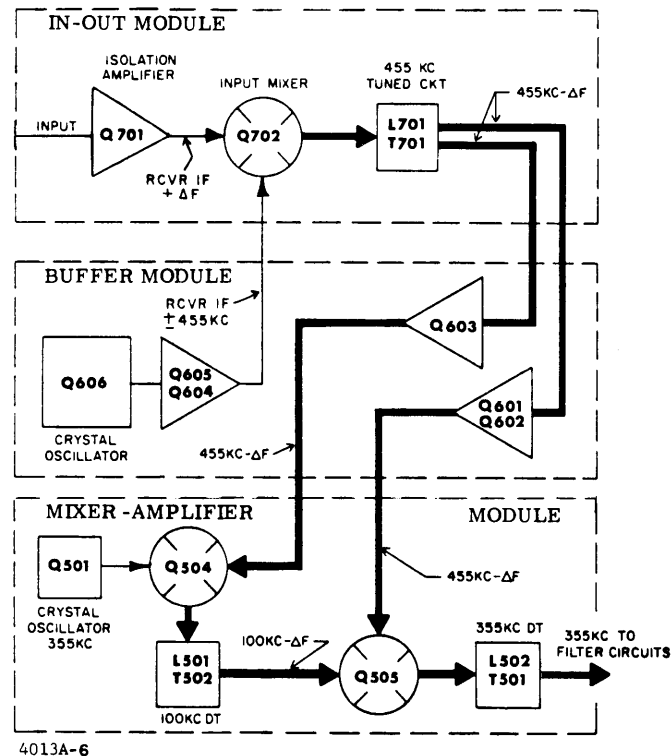
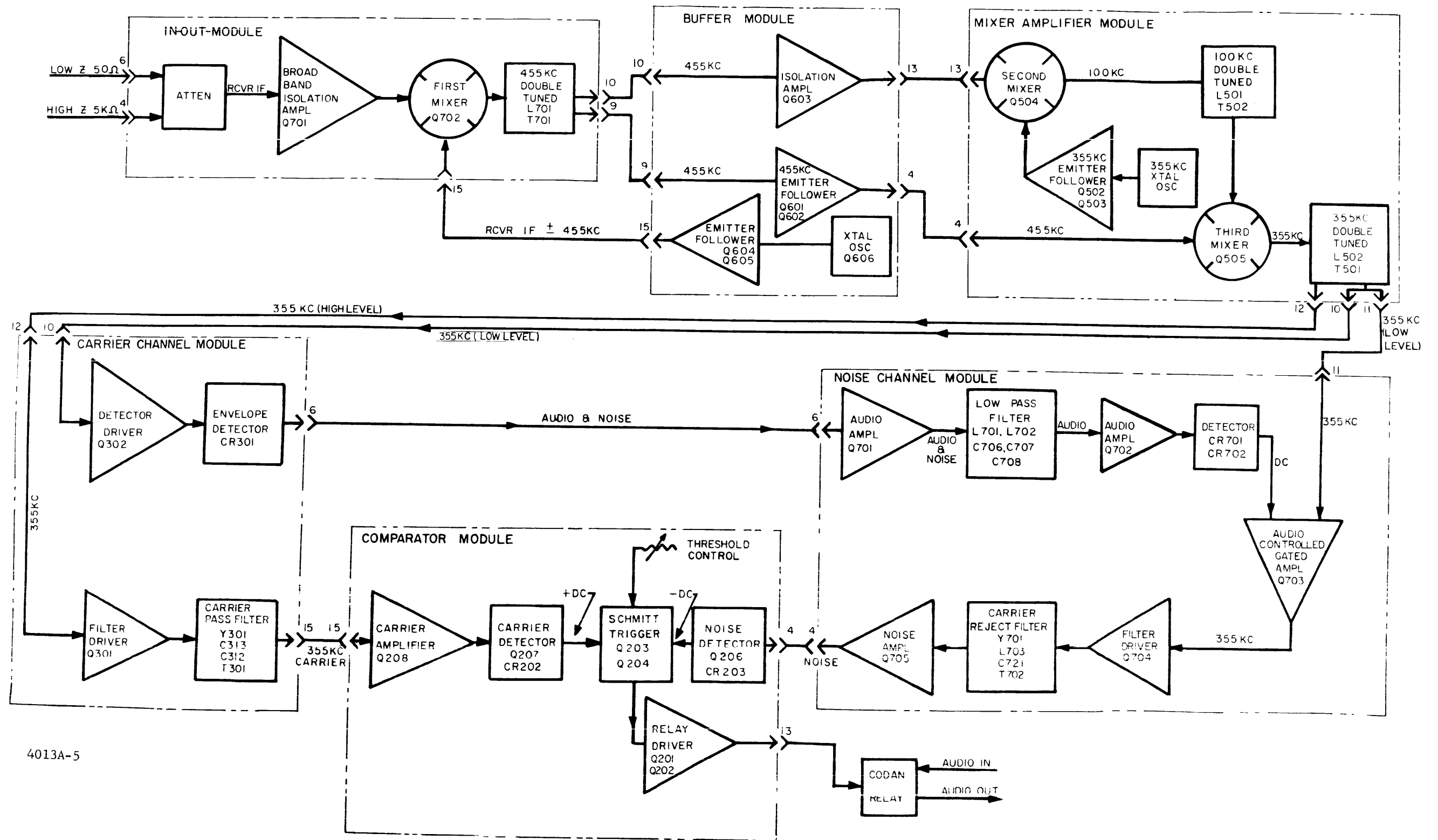


Figure 4-2. Drift Cancelling Loop, Block Diagram

4-6. NOISE-CHANNEL MODULE, CIRCUIT ANALYSIS.

Refer to figures 4-3, 7-1 and 7-6. The Noise Channel module contains an audio filter network, an a-f controlled gating circuit, and a carrier-reject filter circuit.

a. **AUDIO FILTER NETWORK.** - Audio signals from Q701 in the Carrier Channel are applied via LEVEL ADJ. control R403 to the base of amplifier



4013A-5

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Figure 4-1. Block Diagram, CDN

Q401. The amplified output at the collector of Q401 is supplied via a low-pass filter (comprising L401, L402, C406, C407, C408, and C409) to the base of amplifier Q402. The amplified output of Q402 is capacitively coupled to the audio rectifier circuit comprising diodes CR401 and CR402. The d-c voltage produced by CR401 and CR402 is applied directly to the base of a-f controlled gate Q403.

The low-pass filter network (L401, L402, C406, C407, C408 and C409) has a cutoff frequency of 1 kc; the filter therefore discriminates between voice modulation and random noise energy.

b. A-F CONTROLLED GATING CIRCUIT. - A-f controlled gate Q403 is a tuned common base amplifier with its emitter driven by a portion of the low-level 355-kc signal from mixer Q505 in the Mixer Amplifier module. Resistors R414 and R415 bias Q403 for full gain only in the absence of a d-c control signal from rectifiers CR401 and CR402. When audio energy is present, the positive d-c voltage developed at CR402 is applied to the base of Q403, the cut-off bias of Q403 is increased, and the 355-kc output at the collector of Q403 is reduced accordingly.

The function of the audio controlled gating circuit is to disable the noise channel during moments of heavy modulation from strong received signals. If this precaution were not taken, the sideband energy associated with the heavy voice modulation would be passed on to the carrier reject filter and would be measured as noise energy, thereby yielding an erroneous measure of signal quality.

c. CARRIER REJECT FILTER. - The output at the collector of Q403 is transformer coupled to the base of emitter follower Q404 (filter driver). The amplified output at the emitter of Q404 is extended through a carrier reject filter network (comprising Y401, C421, L403, and T402) to the base of noise amplifier Q405. The amplified output at the collector of Q405 is then transformer coupled to the noise detector stage of the Comparator module.

The filter network (Y401, C421, L403, and T402) attenuates 355-kc energy from 25 to 30dB while offering little attenuation to sideband energy associated with the 355-kc carrier.

4-7. COMPARATOR MODULE, CIRCUIT ANALYSIS.

Refer to figures 7-1 and 7-7. The Comparator module compares relative amounts of signal and noise contained in the receiver i-f spectrum. Carrier energy (355-kc) from the carrierpass filter of the Carrier Channel module is applied to the base of Q208, amplified by Q208 and Q207, and coupled via transformer T202 to diode detector CR202. Noise energy from amplifier Q405 in the Noise Channel module is applied to a similar circuit comprising Q206, T201 and CR203. The outputs of both diode detectors (CR202 and CR203) are applied via a resistive network (consisting of R219, R223, and R224) to the base of Q204 which is configured with Q203 as a Schmitt trigger. The detector polarities are such that carrier energy yields a positive voltage while noise energy yields a negative voltage at a common junction point (TP4) of the resistive network. In the absence of any input signal or noise, the quiescent voltage at TP4 is determined by the position of the front panel THRESHOLD control. With input signals present, the voltage at TP4 will deviate from this quiescent value according to signal quality. A signal of sufficiently high quality (as determined by the THRESHOLD control) will cause an increase in the voltage at TP4 thus activating the Schmitt trigger. (Noisy signals will tend to keep the input of the Schmitt trigger below its triggering threshold.) Once turned on, the Schmitt trigger will turn off only when signal quality is drastically reduced or when the transmission ends.

The output of the Schmitt trigger is applied to the base of Q202 which is configured with Q201 as a relay-driver circuit. When the Schmitt trigger is in the "on" state, the relay driver conducts, current flows from the collector of Q201 to the emitter, and relay K1002 is energized. With relay K1002 energized, the audio output of the associated receiver is switched from a terminating resistor to the audio transmission line (i. e., the receiver is unscquelched).

A regulator circuit consisting of Q205, R209, R210 and R211 maintain a constant, negative, common-emitter bias level for the Schmitt trigger circuit. Diode CR201 is a transient suppression device.

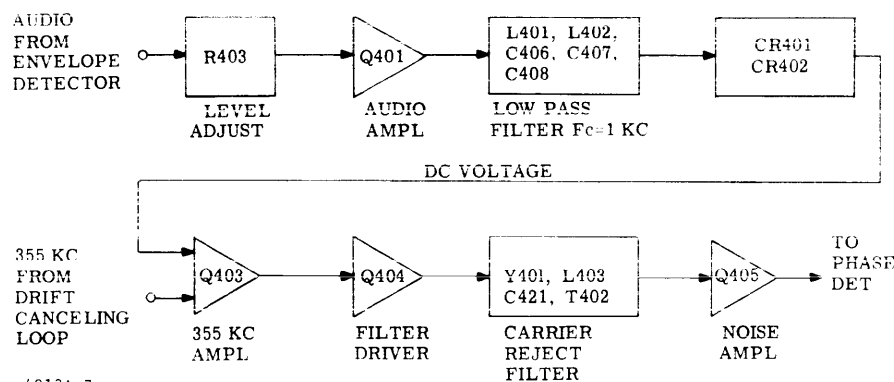


Figure 4-3. Noise Channel, Block Diagram

4-8. POWER SUPPLY, CIRCUIT ANALYSIS.

Refer to figures 4-4, 7-1, and 7-8. The power supply provides fully-regulated outputs at +12 and -12 volts and has a capacity of 0.5A.

NOTE

Components of the power supply are located in both the power-supply p/c board and also on the main chassis. Components located on the Power Supply Card are indicated by the 100 series, e.g., R102. Chassis mounted components are indicated by the 1000 series, e.g., R1002.

The 28 vac from power transformer T1001 is rectified by a full-wave bridge rectifier consisting of diodes CR101 through CR104. The negative output of the bridge is applied to the collector of Q1001 whereas the positive output of the bridge is applied via diode CR105 to the cathodes of Zener diodes CR1001 and CR1002. Resistor R101 forward biases Q1001 to a voltage level determined by 24-volt Zener diode

CR1002 thus producing a regulated -12 vdc at the emitter of Q1001. Zener diode CR1001 establishes a common ground for both positive and negative 12-volt outputs. The 24 vdc output at the bridge rectifiers is filtered by C1001, and the positive and negative 12 vdc outputs are filtered individually by C105, R103, C104, and C106.

Relay K1001 is an a-c failure device that is energized through resistor R102. When relay K1001 is de-energized (a-c power failure) a ground is applied to pin 8 of TB1001 activating an externally connected alarm device. Pilot lamp DS1001 indicates when the unit is in a-c operation.

When a battery is connected to the BATT POWER jack on the rear-panel, it will receive a trickle charge through resistor R1002. In the event of a-c power failure, diode CR1003 bypasses resistor R1002 thus allowing negative battery voltage to be applied to the collector of Q1001. Positive 12 vdc is connected to the cathode junction of Zener diodes CR1001 and CR1002. Diode CR1005 prevents relay K1001 from energizing during battery operation. AC fuse F1001 protects the power supply in a-c operation.

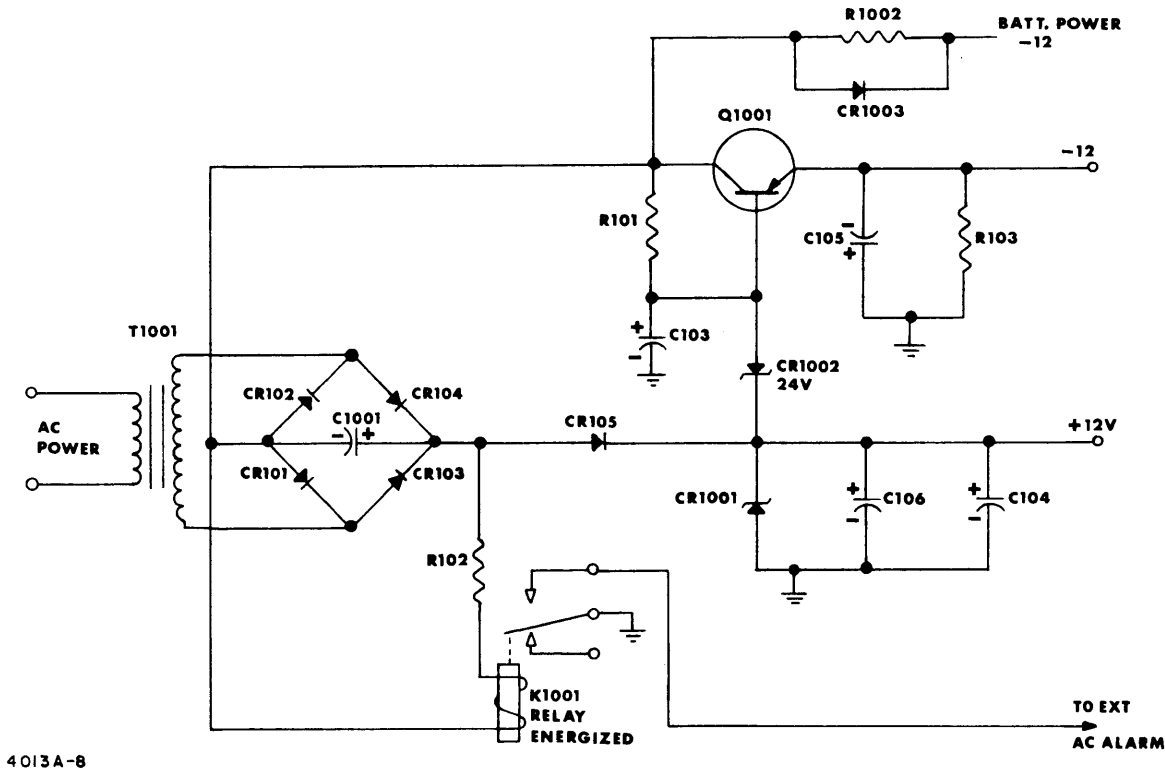


Figure 4-4. Power Supply, Simplified Schematic Diagram

SECTION 5 MAINTENANCE

5-1. PREVENTIVE MAINTENANCE.

The CDN has been designed to provide long-term, trouble-free operation under continuous duty conditions. However, in order to prevent failure of the equipment due to corrosion, dust, or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to.

At periodic intervals, the equipment should be removed from its mounting for cleaning and inspection. All accessible covers should be removed and the wiring and all components inspected for dirt, corrosion, charring, discoloring or grease. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease from other parts with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichlorethylene or methyl chloroform may be used, providing the necessary precautions are observed.

NOTE

When using toxic solvents, make certain that adequate ventilation exists. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with skin. Flammable solvents shall not be used on

energized equipment or near any equipment from which a spark may be received. Smoking, "hot work", etc. is prohibited in the immediate area.

CAUTION

When using trichlorethylene, avoid contact with painted surfaces due to its paint removing effects.

5-2. TROUBLESHOOTING

a. GENERAL. - Since the CDN is a modular constructed unit, troubleshooting consists of localizing the malfunction to a specific module. Table 5-2 (troubleshooting chart) should be used as a guide in locating and correcting trouble that might occur in the CDN. Once the malfunction has been localized to a particular module, refer to the detailed circuit analysis given in section 4 and the schematic diagrams contained in section 7.

b. TEST EQUIPMENT. - Table 5-1 lists the test equipment required to troubleshoot and align the CDN.

TABLE 5-1. TEST EQUIPMENT REQUIRED FOR TEST AND ALIGNMENT

QTY	ITEM	MANUFACTURER, MODEL OR TYPE
1	Oscilloscope with low capacity probe (10 pf or less)	Tektronix, Model 541 A with type "L" head or equivalent
1	Signal Generator	Hewlett Packard, Model 606 or equivalent
1	AC VTVM	Ballantine, Model 314A or equivalent
1	Frequency Counter	Hewlett Packard Model 5244L or equivalent
1	VTVM	Hewlett Packard, Model 410B or equivalent
1	100 dB Step Attenuator	

TABLE 5-2. TROUBLESHOOTING CHART

STEP	OPERATION	NORMAL INDICATION (NOMINAL)	PROBABLE CAUSE OR ABNORMAL INDICATION
<p>NOTE</p> <p>All voltage measurements in this table are nominal.</p>			
1.	Remove all modules except the power supply.		
2.	Set POWER switch S1001 at ON.	Pilot light DS1001 should light. +12 volts dc $\pm 20\%$ should be present at pin 1 of J1002 thru J1007. -12 volts dc $\pm 20\%$ should be present at pin 2 of J1002 thru J1007.	Open filament. Blown fuse F1001, F1002, or F1003
3.	Set Power switch S1001 at OFF; insert Comparator Module into its socket. Set POWER switch S1001 at ON.	See step 2.	Short circuit in module.
4.	Repeat step 3 for all other modules.	See step 2.	Short circuit in associated Module.
5.	<p><u>In Out Module</u></p> <p>Set signal generator output to 1 mv, with 50% modulation at exactly the i-f frequency as indicated on frequency counter. Connect signal generator to input jacks J1009. Set ATTEN VAR control at maximum CW position. Connect frequency counter to vertical output of scope.</p> <p>a. Connect scope to TP701.</p> <p>b. Connect scope to TP702</p> <p>c. Connect scope to TP704</p> <p>d. Connect scope to TP705</p>	<p style="text-align: center;">NOTE</p> <p>Although all reference symbols of the IN OUT module are in the "700" number series, the p/c board is marked in the "1-100" series</p> <p>a. Scope should indicate +.1 vdc.</p> <p>b. Scope should indicate 400 mv peak to peak; counter should indicate applicable Y601 crystal frequency for the i-f being used (refer to table 5-3).</p> <p>c. Scope should indicate .64 to .76 volts peak to peak, counter should indicate 455 kc.</p> <p>d. Scope should indicate .50 to .68 volts peak to peak.</p>	<p>a. Defective wiring to pin 13 of J1007. No d-c voltage from power supply.</p> <p>b. No oscillator injection frequency. Defective Q604, Q605, and Q606 stages or R614 of the Buffer module</p> <p>c. Defective Q701 Q702 or T701 stages.</p> <p>d. See step c above.</p>

TABLE 5-2. TROUBLESHOOTING CHART (CONT)

STEP	OPERATION	NORMAL INDICATION (NOMINAL)	PROBABLE CAUSE OR ABNORMAL INDICATION
5. (cont)	c. Connect scope to TP706	e. Scope should indicate .02 volts peak to peak	e. See step c above.
6.	<p><u>Buffer Module</u></p> <p>a. Connect scope to TP601</p> <p>b. Connect scope to TP602</p> <p>c. Connect scope to TP603</p> <p>d. Connect scope to TP604</p> <p>e. Connect scope to TP605.</p>	<p>NOTE</p> <p>Although all reference symbols of the Buffer module are in the "600" number series, the P/C board is marked in the "1-100" series</p> <p>a. Scope should indicate .50 to .68 volts peak to peak.</p> <p>b. Scope should indicate .02 volts peak to peak.</p> <p>c. Scope should indicate .44 volts peak to peak.</p> <p>d. Scope should indicate 400 mv peak to peak.</p> <p>e. Scope should indicate .44 volts peak to peak.</p>	<p>a. See step 5c above.</p> <p>b. See step 5c above.</p> <p>c. Defective Q603 stage.</p> <p>d. See step 5b above.</p> <p>e. Defective Q601 or Q602 stage.</p>
7.	<p><u>Mixer Amplifier Module</u></p> <p>a. Connect scope TP505</p> <p>b. Connect scope to TP508</p> <p>c. Connect scope to TP502</p> <p>d. Connect scope to TP506</p> <p>e. Connect scope to TP504</p>	<p>NOTE</p> <p>Although all reference symbols of the Mixer Amplifier module are in the "500" number series, the P/C board is marked in the "1-100" series</p> <p>a. Scope should indicate .44 volts peak to peak.</p> <p>b. Scope should indicate .44 volts peak to peak.</p> <p>c. Scope should indicate 3.2 volts peak to peak, counter should indicate 355 kc.</p> <p>d. Scope should indicate 3 volts peak to peak; counter should indicate 100 kc.</p> <p>e. Scope should indicate 3 volts peak to peak.</p>	<p>a. See step 6c above.</p> <p>b. See step 6c above.</p> <p>c. Defective Q501, Q502, Q503 or Y501 stage.</p> <p>d. Defective Q504 or L501 stage.</p> <p>e. Defective C513 or T502 stage.</p>

TABLE 5-2. TROUBLESHOOTING CHART (CONT)

STEP	OPERATION	NORMAL INDICATION (NOMINAL)	PROBABLE CAUSE OF ABNORMAL INDICATION
7. (cont)	f. Connect scope to TP503 g. Connect scope to TP507 h. Connect scope to TP501	f. Scope should indicate 1.14 volts peak to peak. g. Scope should indicate 3 volts peak to peak; counter should indicate 355 kc. h. Scope should indicate 1 volt peak to peak.	f. Defective C513 or T502 stage. g. Defective Q505 or L502 stage. h. Defective T501 stage.
8.	<u>Noise Channel Module</u> a. Connect scope to TP402 b. Connect scope to TP404 c. Connect scope to TP401	<p style="text-align: center;">NOTE</p> Although all reference symbols of the Noise Channel module are in the "400" number series, the P/C board is marked in the "1-100" series a. Scope should indicate .25 volts peak to peak. b. Scope should indicate .42 volts peak to peak. c. Scope should indicate .12 volts peak to peak.	a. Defective T501 stage of Mixer Amplifier Module b. Defective CR301 or Q302 of Carrier Channel Module Q401, L401, L402, Q402, CR-401, CR-402 Q403 or Q404 stage. c. Defective Y401, L403, C421, T402 or Q405 stage.
9.	<u>Carrier Channel Module</u> a. Connect scope to TP302 b. Connect scope to TP303	<p style="text-align: center;">NOTE</p> Although all reference symbols of the Carrier Channel Module are in the "300" number series, the P/C board is marked in the "1-100" series a. Scope should indicate 400 millivolts peak to peak. b. Scope should indicate +2.5 vdc.	a. Defective Q301 Y301, C313, or T301 stage. b. Defective CR301 or Q302 stage.

TABLE 5-2. TROUBLESHOOTING CHART (CONT)

STEP	OPERATION	NORMAL INDICATION (NOMINAL)	PROBABLE CAUSE OF ABNORMAL INDICATION
10.	<p><u>Comparator Module</u></p> <p>a. Connect scope to TP203</p> <p>b. Connect scope to TP202</p> <p>c. Connect scope to TP206</p> <p>d. Connect VTVM to TP204 alternately short TP202 and TP203 to TP205</p> <p>e. Connect VTVM to TP201 and alternately short TP202 and TP203 to TP205</p>	<p>NOTE</p> <p>Although all reference symbols of the Comparator module are in the "200" number series, the P/C board is marked in the "1-100" series</p> <p>a. Scope should indicate .12 volts peak to peak.</p> <p>b. Scope should indicate .12 volts peak to peak.</p> <p>c. Scope should indicate 20 to 40 volts peak to peak.</p> <p>d. VTVM should indicate -11V and -3V respectively.</p> <p>e. VTVM should indicate -12 and +11.5.</p>	<p>a. See step 8c.</p> <p>b. See step 9a.</p> <p>c. Defective Q208 or Q207 stages.</p> <p>d. Defective CR203 or Q206 stages or d-c combining network</p> <p>e. Defective Q205, Q203, Q204, Q202, or Q201 stages.</p>

5-3. REPAIR OF PRINTED CIRCUITS.

a. GENERAL. - Although the troubleshooting procedure for printed circuits is similar to those for conventional circuits, the repair of printed circuits requires considerably more skill and patience. The printed circuits are small and compact; therefore, personnel should become familiar with the special servicing techniques required.

The defective part should be pinpointed by a study of the symptoms and by careful and patient analysis of the circuit before attempting to trace trouble on a printed circuit board. Ascertain whether the conducting strips are coated with a protective lacquer, epoxy resin, or similar substance. If so, carefully scrape it away.

Breaks in the conducting strip (foil) can cause permanent or intermittent trouble. In many instances, these breaks will be so small that they cannot be detected by the naked eye. These almost invisible cracks (breaks) can be located only with the aid of a powerful hand- or stand-held magnifying glass.

b. MULTIMETER CHECKOUT. - The most common cause of an intermittent condition is poorly soldered connections. Other causes are: broken

boards, broken conducting strips, fused conducting strips, arc-over, loose terminals, etc.

To check out and locate trouble in the conducting strips of a printed-circuit board, set up a multimeter (one which does not use a current in excess of 1 ma) for making point-to-point resistance tests, using needle-point probes. Insert one point into the conducting strip, close to the end of the terminal, and place the other probe on the terminal or opposite end of the conducting strip. The multimeter should indicate continuity. If the multimeter indicates an open circuit, drag the probe along the strip (or if the conducting strip is coated, puncture the coating at intervals) until the multimeter indicates continuity. Mark this area, then use a magnifying glass to locate the fault in the conductor.

CAUTION

Before using an ohmmeter for testing a circuit containing transistors or other voltage-sensitive semiconductors, check the current it passes under test on all ranges. DO NOT use a range that exceeds 1 ma.

c. HOW TO REPAIR THE BREAK. - If the break in the conducting strip is small, lightly scrape away any coating covering the area of the conducting strip to be repaired. Clean the area with a firm-bristle brush and approved solvent. Then repair the cracked or broken area of the conducting strip by flowing solder over the break. Considerable care must be exercised to keep the solder from flowing onto an adjacent strip.

If a strip is burned out or fused, cut and remove the damaged strip. Connect a length of insulated wire across the breach or from solder-point to solder-point.

After the repairs are completed, clean the repaired area with a stiff brush and solvent. Allow the board to dry thoroughly, and then coat the repaired area with an epoxy resin or similar compound. This coating not only will protect the repaired area, but will help to strengthen it.

CAUTION

After repairs, always scrutinize the board for solder droppings that may cause possible shorts.

Frequently, a low-resistance leakage path will be created by moisture and/or dirt that has carbonized onto the phenolic board. This leakage can be detected by measuring the suspected circuit with a multimeter. To overcome this condition, thoroughly clean the carbonized area with solvent and stiff brush. If this does not remove it, use a scraping tool (spade end of a solder-aid tool or its equivalent) to remove the carbon, or drill a hole through the leakage path to break the continuity of the leakage. When the drilling method is used, be careful not to drill into a part mounted on the other side of the board.

5-4. ALIGNMENT.

a. GENERAL. - The alignment procedures given in this paragraph are continuous and must be performed in the order given. A Riser Card is supplied so that the plug-in printed circuit cards may be aligned as an integral part of the CDN. Refer to figures 5-1 and 5-2 for locations of cards and components.

CAUTION

When performing any of the procedures given in the following paragraphs, do not remove or insert the riser card with the power on.

b. TEST EQUIPMENT REQUIRED. - Table 5-1 lists the test equipment required to align the CDN.

c. IN-OUT MODULE, ALIGNMENT. - Proceed as follows:

(1) Tune signal generator for 455 kc output at 1 mv. Using frequency counter, check output of signal generator.

(2) Connect signal generator to INPUT jack J1009, and turn ATTEN VAR control located on rear-panel fully clockwise. Also, set 40 DB control at OUT.

(3) For receivers with i-f output other than 455 kc, disable conversion oscillator located in Buffer Module by pulling crystal Y601 out of socket.

(4) Connect scope probe to test point TP704.

(5) Short test point TP-705 to ground with short jumper from TP705 to TP-703.

(6) Tune L1 for peak indication on scope.

(7) Disconnect shorting jumper from TP705; tune T701 as required to obtain minimum indication on scope.

d. BUFFER MODULE, ALIGNMENT. - Upon completion of alignment procedure given in paragraph 5-4 c, proceed as follows:

(1) If the i-f output of the associated receiver is other than 455 kc, replace crystal Y601, and proceed to step (2). If the i-f output of the receiver is 455 kc, omit steps (2) and (3), and proceed to step (4).

(2) Remove signal generator from INPUT jack J1009. Connect frequency counter to vertical output of oscilloscope; connect scope probe to test point TP604, and adjust C605 as required to obtain proper frequency (see table 5-3).

TABLE 5-3. FREQUENCY CONVERSION CHART

RECEIVER I-F FREQUENCY (KCS)	Y601 CRYSTAL FREQUENCY (KCS)
100	555
200	655
250	705
455	none required
500	955
1,750	1,295

(3) Adjust R614 as required to obtain 400 mv peak-to-peak indication at TP604.

(4) Remove 355 kc crystal (Y501) from Mixer Amplifier Module.

(5) Tune signal generator to i-f output of associated receiver; reconnect signal generator to INPUT jack J1009.

(6) Connect scope probe to TP603, and tune L601 for maximum indication on scope.

(7) Reinsert crystal Y501 in Mixer Amplifier module.

e. MIXER AMPLIFIER MODULE, ALIGNMENT. - Upon completion of paragraphs 5-4 c and 5-4 d, proceed as follows:

(1) Connect scope probe to test point TP502.

(2) Connect frequency counter to vertical output of scope. Adjust R505 as required to obtain clean waveform on scope. Tune C503 as required to obtain 355-kc indication on counter.

(3) Tune 100-kc double tuned stage Q504 as follows:

(a) Connect scope probe to TP506; short TP504 and TP509 with jumper. Frequency counter should indicate 100-kc.

(b) Adjust L501 as required for maximum output as indicated on scope.

(c) Remove jumper from TP504; adjust T502 as required for minimum indication on scope.

(4) Tune 355-kc double-tuned stage Q505 as follows:

(a) Ensure that signal generator connected to INPUT jack J1009 is tuned to i-f output of associated receiver; output level of signal generator should be 1 mv.

(b) Connect scope probe to TP503 (frequency counter should be connected to output of scope, see step 2 above). Indication on frequency counter should be 100-kc.

(c) Connect scope probe to TP507. Connect TP501 and TP509 with jumper. Adjust L502 for maximum indication on scope; indication on frequency counter should be 355-kc.

(d) Remove jumper from TP501, and adjust T501 as required for minimum indication on scope.

(e) Disconnect signal generator from INPUT jack J1009.

(5) Set controls of oscilloscope as required for high-sensitivity d-c range; connect scope probe to TP204.

(6) Connect short jumper from TP202 to TP205, and tune T201 for maximum-negative-voltage

indication on scope. Remove jumper from TP202 and TP205.

(7) Connect short jumper from TP203 to TP205, and tune T202 for maximum positive voltage indication on scope. Remove jumper for TP203 and TP205.

(8) Connect scope probe to TP206; indication on scope should be 45-volts peak to peak.

(9) Connect scope probe to TP203. Vary percent modulation of signal generator output; signal at TP203 should disappear with about 50% modulation. If proper indication is not obtained, adjust R403 of Noise Channel module as required until proper indication is obtained.

f. CARRIER CHANNEL MODULE, ALIGNMENT. - Upon completion of paragraphs 5-4 c, 5-4 d, and 5-4 e, proceed as follows:

(1) Connect signal generator to TP501 of Mixer Amplifier Module. Connect AC VTVM (set for 1-volt scale measurements) to TP302 of Carrier Channel module.

(2) Tune signal generator to 355 kc \pm 10-cps as indicated on frequency counter (connected to TP507 of Mixer Amplifier in paragraph 5-4 e). Adjust output level of signal generator as required to obtain 640 mv indication on AC VTVM.

(3) Tune signal generator as required to obtain peak indication (center frequency response) on AC VTVM. Adjust signal generator level as required to obtain +4dB indication on AC VTVM; center frequency response at this point should be 355-kc \pm 10-cps.

(4) Check -3dB bandwidth of 355-kc carrier pass filter as outlined below. Bandwidth should be 35-cps \pm 10 cps.

(a) Tune signal generator to low side of 355-kc to point that provides -3dB indication on VTVM; note indication on frequency counter.

(b) Tune signal generator to high side of 355-kc to point that provides -3dB indication on VTVM; note indication on frequency counter.

(5) Using procedure outlined in step (4) above, check -20dB bandwidth. Adjust C313 as required to obtain bandwidth symmetry (within 5-cps) between the 355-kc carrier and the -20dB points.

(6) If required, adjust transformer T301 to meet tolerances specified in steps (4) & (5) above.

NOTE

T301 has only a slight effect and will normally require no adjustment.

(7) Repeat steps (3) through (6) until no further improvement is noted.

(8) Sweep signal-generator frequency $\pm 5\text{KC}$ about center frequency and observe typical bandpass characteristics on AC VTVM.

(9) Connect signal generator to INPUT jack J1009. Tune signal generator to i-f output of associated receiver; adjust signal generator for 1 mv output level.

NOTE

When adjusting C513 in step (10), accuracy is very important.

(10) Connect AC VTVM to TP302 and adjust C513 of Mixer Amplifier Module for maximum indication on VTVM.

(11) Connect scope and counter to TP302; counter should indicate $355.000\text{ kc} \pm 10\text{ cps}$.

(12) Connect scope probe to TP303. Set scope to monitor d-c voltage on 0.05 V/CM scale. Adjust T302 for maximum positive d-c voltage.

g. NOISE CHANNEL MODULE, ALIGNMENT. - Upon completion of paragraph 5-4 c, 5-4 d, 5-4 e and 5-4 f, proceed as follows:

(1) Connect oscilloscope to TP404 and tune T401 for maximum indication.

(2) Connect oscilloscope to TP401 and make following adjustments:

(a) Adjust T403 for maximum indication.

(b) Adjust T402 for maximum indication.

(c) Adjust L403 and C420 for minimum indication.

(d) Repeat (b) and (c) above until no further improvement is noted.

(3) Tune C503 of Mixer Amplifier module as required for minimum indication on scope.

(4) Using frequency counter connected to output of scope, check frequency at TP401; indication on frequency counter should be $355\text{ kc} \pm 10\text{cps}$.

h. COMPARATOR MODULE, ALIGNMENT. - Upon completion of paragraphs 5-4c through 5-4g, proceed as follows:

(1) Parallel connect signal generator, AC VTVM, and i-f output of associated receiver to INPUT jack J1009 of CDN via a step attenuator.

(2) Tune receiver for noise input (i. e., no station).

(3) With 0dB attenuation in step attenuator, adjust noise-level output of receiver for 100 mv RMS indication on AC VTVM. Then reduce noise source by setting step attenuator to approximately 100dB attenuation.

(4) Tune signal generator to i-f output of receiver, and adjust signal generator for 1.0 volt RMS output level as indicated on AC VTVM. Modulate this signal 40% with 400 cps.

(5) Adjust oscilloscope controls as required for high-sensitivity d-c range indication; connect scope probe to TP204.

(6) Connect short jumper from TP202 to TP205; tune T201 for maximum negative-voltage indication on scope. Remove jumper from TP202 and TP205.

(7) Connect short jumper from TP203 to TP205; tune T202 for maximum positive-voltage indication on scope. Remove jumper from TP203 and TP205.

(8) Connect scope probe to TP206 and check for 45 volts peak to peak, as indicated on scope.

(9) Connect scope probe to TP203. Vary percent modulation of signal generator; signal at TP203 should disappear with approximately 50% modulation. If proper indication is not obtained, adjust R403 on Noise Channel module until proper indication is obtained.

i. THRESHOLD CONTROL, ALIGNMENT. - Upon completion of paragraphs 5-4c through 5-4h, proceed as follows:

(1) Disconnect signal generator from INPUT jack J1009.

(2) Rotate THRESHOLD control fully clockwise.

(3) At Comparator module: (a) rotate R227 fully clockwise; (b) rotate R215 to point where CARRIER ON lamp goes off.

(4) Set THRESHOLD control at mid-point. Tune signal generator to i-f output of associated receiver; adjust signal generator for 1 mv output level. Reconnect signal generator to INPUT jack J1009; CARRIER ON lamp should light.

(5) Rotate R227 counterclockwise until CARRIER ON lamp just goes off; then rotate R227 clockwise until CARRIER ON lamp lights. If CARRIER ON lamp will not go off when R227 is varied over its entire range: (a) rotate R227 fully counterclockwise; (b) adjust R215 as required until CARRIER ON lamp just goes off; then Return R215 to point where CARRIER ON lamp lights.

(6) Decrease output level of signal generator to "0". CARRIER ON lamp of CDN should go off.

Slowly increase output level of signal generator. CARRIER ON lamp should light when signal generator output level is approximately 1 mv.

(7) With signal generator output level at 1 mv, rotate THRESHOLD control fully counterclockwise from mid-position; CARRIER ON lamp should go off. Return THRESHOLD control to mid-position; CARRIER ON lamp should light.

(8) Rotate THRESHOLD control as far as possible in counterclockwise direction without causing CARRIER ON lamp to go off.

(9) Remove 100 dB of attenuation in series with noise source (inserted in paragraph 5-4h); CARRIER ON lamp should go off.

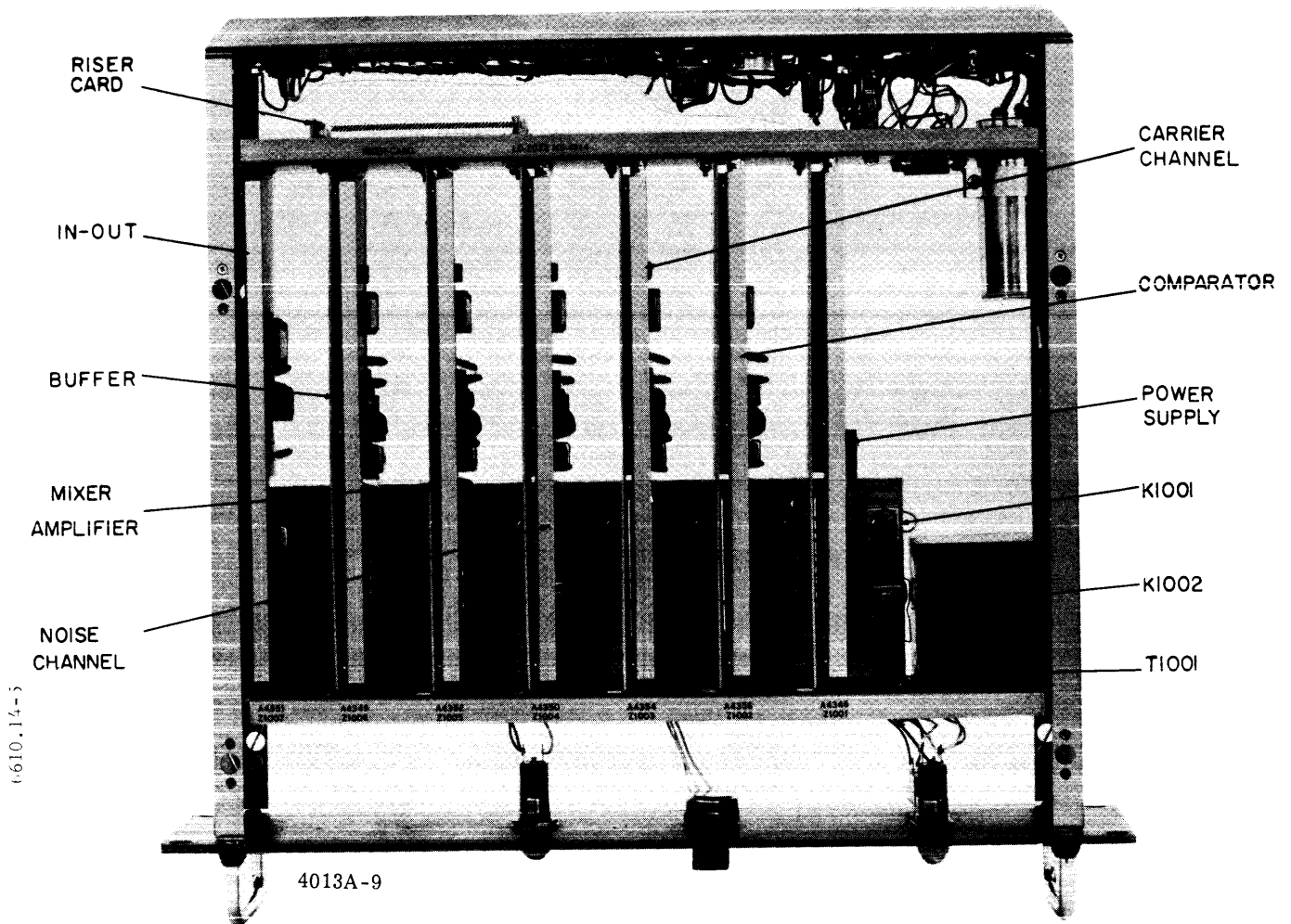
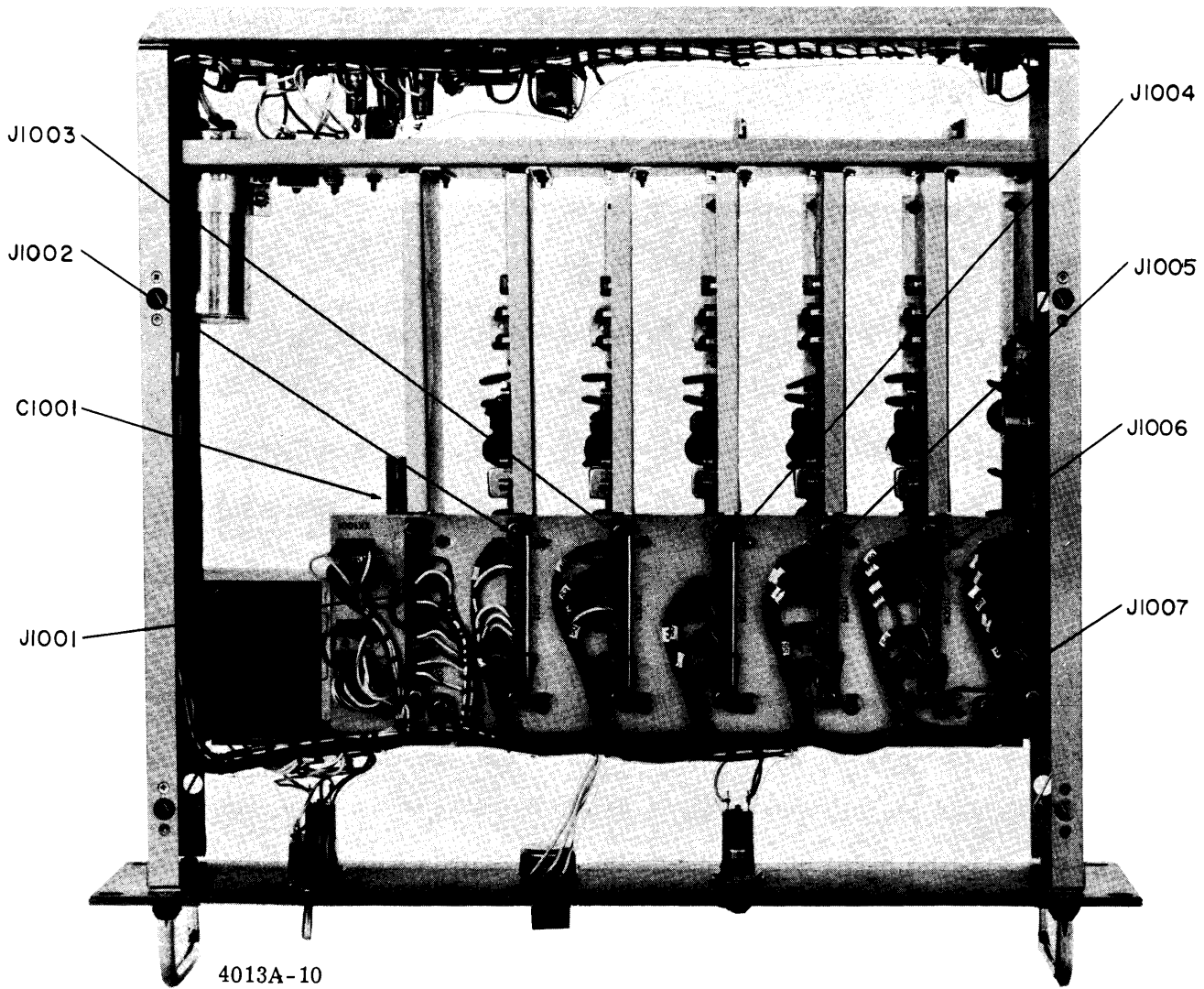


Figure 5-1. CDN, Top View



4013A-10

Figure 5-2. CDN, Bottom View

6610.14-6

SECTION 6

PARTS LIST

6-1. INTRODUCTION.

The parts list presented in this section is a cross-reference list of parts identified by a reference designation and TMC part number. In most cases, parts appearing on schematic diagrams are assigned reference designations in accordance with MIL-STD-16. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part numbers stamped on them.

To expedite delivery when ordering any part, specify the following:

- a. Generic name.
- b. Reference designation.
- c. TMC part number.
- d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

The Technical Materiel Corporation
Attention: Sales Department
700 Fenimore Road
Mamaroneck, New York

<u>Assembly or Sub-assembly</u>	<u>Page</u>
Main Chassis, Codan Model CDN-3	6-2
Power Supply, A4346	6-6
Comparator Module, A4356	6-7
Carrier Channel Module, A4354	6-11
Noise Channel Module, A4350	6-14
Mixer-Amplifier Module, A4352	6-19
Buffer Module, A4349	6-23
Input-Output Module, A4351	6-26

PARTS LIST
for
CODAN, MODEL CDN-3

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1001	CAPACITOR, FIXED, ELECTROLYTIC: polarized; 2,600 uf, 50 WVDC; insulated clear plastic case.	CE112-6
CR1001	SEMICONDUCTOR DEVICE, DIODE: 12 volts nominal at 25°C; power dissipation 10 watts at 50°C; current rating 210 ma; max. impedance 3 ohms; hermetically sealed case.	IN2976B
CR1002	SEMICONDUCTOR DEVICE, DIODE: silicon; 24 volts nominal; +5%; power dissipation 10 watts at 25°C; current rating 105 ma; max. impedance 5 ohms; max. operating temperature 150°C; stud mounted; hermetically sealed metal case.	IN2986B
CR1003	SEMICONDUCTOR DEVICE, DIODE: silicon; 600 volts nominal; max. forward voltage drop 1.0 V; max. continuous DC current 0.50 amp at 100°C; peak surge current 75 amps; max. reverse current 1,000 ua; max. operating temperature 150°C; hermetically sealed.	IN2484
DS1001	LAMP, NEON: 105/125 volts, 1/7 watt; miniature bayonet base T-3-1/4 bulb.	BI100-51H
DS1002	NOT USED	
DS1003	LAMP, INCANDESCENT: 28 volts, 0/04 amp; bayonet base T-3-1/4 bulb.	BI101-1819
F1001	FUSE, CARTRIDGE: 1/2 amp; 1-1/4" long x 1/4" dia.; quick acting. (For 115 V operation)	FU100-.500
F1001	FUSE, CARTRIDGE: 1/4 amp; 1-1/4" long x 1/4" dia.; quick acting. (For 230 V operation)	FU100-.250
F1002	Same as F1001. (For 115 V operation)	
F1003	Same as F1001. (For 115 V operation)	

PARTS LIST (CONT)

CODAN, MODEL CDN-3

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
J1001	CONNECTOR, RECEPTACLE, ELECTRICAL: 30 female contacts; double sided printed circuit board type; float bushing.	JJ319A15DFE
J1002 thru J1007	Same as J1001.	
J1008	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 number 16 male contacts, straight type.	MS3102A-14S1P
J1009	CONNECTOR, RECEPTACLE, ELECTRICAL: RF; 1 round female contact, straight type; 52 ohms; series BNC to BNC.	UG625*/U
J1010	Same as J1009.	
J1011	JACK, TIP: 1 female contact, phosphor bronze, silver plated; current rating 10 amps, 5,000 VDC; red nylon body with brass, nickel plated jacket.	JJ114-2
J1012	Same as J1011.	
J1013	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 number 16 male contacts, straight type.	MS3102A-14S2P
K1001	RELAY, ARMATURE: DPDT: 700 ohms, $\pm 10\%$ DC resistance; operating voltage 24 VDC; current rating 35 ma, 700 mw at 25°C; 8 contacts rated for 5 amps at 29 VDC; clear high impact styrene dust cover case.	RL156-1
K1002	RELAY, ARMATURE: 4PDT; 700 ohms, $\pm 10\%$ DC resistance; operating voltage 24 VDC; current rating 35 ma, 700 mw at 25°C; 14 contacts rated for 5 amps at 29 VDC; clear high impact styrene dust cover case.	RL156-8

PARTS LIST (CONT)

CODAN, MODEL CDN-3

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Q1001	TRANSISTOR: germanium, PNP; collector to base and emitter to base voltage 45 VDC at 300 ma 30 VDC at 500 ma; emitter base voltage 25 volts; collector current 3 amps; power dissipation 62.5 watts at 25°C; junction temperature range -65°C to +100°C; hermetically sealed.	2N2143
R1001	RESISTOR, VARIABLE, COMPOSITION: 5,000 ohms, <u>+20%</u> ; 2 watts; linear taper.	RV4NAYSD-502B
R1002	RESISTOR, FIXED, WIREWOUND: 100 ohms, current rating 223 ma; 5 watts.	RW107-18
R1003	RESISTOR, VARIABLE, COMPOSITION: 50 ohms, <u>+20%</u> ; 2 watts; linear taper.	RV4LAYSA-500B
R1004	RESISTOR, FIXED, COMPOSITION: 220,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF224J
R1005	NOT USED	
R1006	RESISTOR, FIXED, COMPOSITION: 560 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF561J
R1007	Same as R1006.	
S1001	SWITCH, TOGGLE: DPST; 28° angle of throw; bat type handle.	ST22K
S1002	NOT USED	
S1003	SWITCH, TOGGLE: SPDT; 28° angle of throw; bat type handle.	ST12D
T1001	TRANSFORMER, POWER ISOLATION, STEP-DOWN: primary input 105, 115, 125 or 210, 230, 250 V; 50/60 cps, single phase; secondard 28 V, 500 ma; 2-13/16" long x 2-11/16" wide x 2-3/8" high; hermetically sealed steel case.	TF269
TB1001	TERMINAL BOARD, BARRIER: 16 terminals; 6-32 thd x 1/4" long binder head machine screws; black phenolic body.	TM100-16

PARTS LIST (CONT)

CODAN, MODEL CDN-3

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
XDS1001	LIGHT, INDICATOR: with clear unfrosted lens; for miniature bayonet base T-3-1/4 bulb.	TS106-2
XDS1002	NOT USED	
XDS1003	LIGHT, INDICATOR: with green frosted lens; for miniature bayonet base T-3-1/4 bulb.	TS106-3
XF1001	FUSEHOLDER: extractor post type; accommodates cartridge fuse 1-1/4" long x 1/4" dia.; moveable end terminals.	FH100-1
XF1002	Same as XF1001.	
XF1003	Same as XF1001.	
XQ1001	SOCKET, TRANSISTOR: 7 pin contact accommodation; 0.040 or 0.050 dia.; polarized; 1 terminal lug grounding strap; o/a dim. 1-27/64" x 1" max.	TS166-1
Z1001	POWER SUPPLY MODULE (SEE SEPARATE PARTS LIST FOR BREAKDOWN)	A4346
Z1002	COMPARATOR MODULE (SEE SEPARATE PARTS LIST FOR BREAKDOWN)	A4356
Z1003	CARRIER CHANNEL MODULE (SEE SEPARATE PARTS LIST FOR BREAKDOWN)	A4354
Z1004	NOISE CHANNEL MODULE (SEE SEPARATE PARTS LIST FOR BREAKDOWN)	A4350
Z1005	MIXER-AMPLIFIER MODULE (SEE SEPARATE PARTS LIST FOR BREAKDOWN)	A4352
Z1006	BUFFER MODULE (SEE SEPARATE PARTS LIST FOR BREAKDOWN)	A4349
Z1007	INPUT-OUTPUT MODULE (SEE SEPARATE PARTS LIST FOR BREAKDOWN)	A4351
Z1008	RISER CARD MODULE: 1/16" P.C. bd. Consists of one female connector.	A4378

PARTS LIST
for
POWER SUPPLY MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C101	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 5,000 uuf, GMV; 500 WVDC.	CC100-15
C102 thru C104	Same as C101.	
C105	CAPACITOR, FIXED, ELECTROLYTIC: 500 uf; 15 WVDC; polarized; hermetically sealed alumi- num case with clear vinyl plastic sleeve.	CE116-6VN
C106	Same as C105.	
CR101	SEMICONDUCTOR DEVICE, DIODE: peak inverse voltage 200 V; average forward DC current 0.75 amps at 25°C; max. reverse current 10 ua; max. forward voltage drop 1.2 V; max. temperature 100°C; hermetically sealed.	1N2069
CR102 thru CR105	Same as CR101.	
R101	RESISTOR, FIXED, COMPOSITION: 220 ohms, +5%; 2 watts.	RC42GF221J
R102	RESISTOR, FIXED, COMPOSITION: 470 ohms, +5%; 2 watts.	RC42GF471J
R103	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, +5%; 2 watts.	RC42GF102J

PARTS LIST
for
COMPARATOR MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C201	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200,000 uuf, +80% -20%; 25 WVDC.	CC100-33
C202	Same as C201.	
C203	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 100 WVDC.	CC100-28
C204	CAPACITOR, FIXED, ELECTROLYTIC: 2 uf, -10% +150% at 120 cps at 25°C; 50 WVDC; polar- ized; insulated tubular case.	CE105-2-50
C205	Same as C203.	
C206	CAPACITOR, FIXED, MICA DIELECTRIC: 2,200 uuf, +5%; 300 WVDC; straight wire leads.	CM111F222- J3S
C207 thru C210	Same as C203.	
C211	Same as C206.	
C212 thru C215	Same as C203.	
CR201	SEMICONDUCTOR DEVICE, DIODE: germanium; max. peak inverse voltage 60 V; continuous average forward current 50 ma; max. peak forward cur- rent 150 ma; max. surge current 500 ma; max. inverse current 500 ua at 10 V; hermetically sealed.	1N34A
CR202	Same as CR201.	
CR203	Same as CR201.	
Q201	TRANSISTOR: NPN, silicon mesa; collector to base voltage 60 V; collector to emitter voltage 40 V; emitter to base voltage 5 V; collector current 175 ma; power dissipation 2 watts at 25°C; junction temperature 175°C; hermetically sealed metal case.	2N697

PARTS LIST (CONT)
COMPARATOR MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Q202	TRANSISTOR: NPN, diffused silicon; collector to base 25 V; collector to emitter 20 V; emitter to base 3 V; collector current 200 ma; power dissipation 1 watt at 25°C; junction temperature range -65°C to +175°C; metal case.	2N706
Q203 thru Q205	Same as Q202.	
Q206	TRANSISTOR: PNP germanium, alloy-junction; collector to base voltage 30 volts; collector to emitter and emitter to base voltage 20 volts; collector current 200 ma; power dissipation 200 mw; storage temperature range -65°C to +100°C; hermetically sealed metal case.	2N296A
Q207	Same as Q206.	
Q208	Same as Q206.	
R201	RESISTOR, FIXED, COMPOSITION: 47 ohms, +5%; 1/2 watt.	RC20GF470J
R202	Same as R201.	
R203	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, +5%; 1/2 watt.	RC20GF104J
R204	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, +5%; 1/2 watt.	RC20GF682J
R205	RESISTOR, FIXED, COMPOSITION: 18,000 ohms, +5%; 1/2 watt.	RC20GF183J
R206	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, +5%; 1/2 watt.	RC20GF472J
R207	Same as R206.	
R208	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, +5%; 1/2 watt.	RC20GF272J

PARTS LIST (CONT)
COMPARATOR MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R209	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, +5%; 1/2 watt.	RC20GF103J
R210	Same as R209.	
R211	RESISTOR, FIXED, COMPOSITION: 5,600 ohms, +5%; 1/2 watt.	RC20GF562J
R212	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, +5%; 1/2 watt.	RC20GF102J
R213	RESISTOR, FIXED, COMPOSITION: 180 ohms, +5%; 1/2 watt.	RC20GF181J
R214	Same as R206.	
R215	RESISTOR, VARIABLE, COMPOSITION: 250,000 ohms, +10%; nom. power rating 0.25 watt at 70°C; linear taper.	RV111U254A
R216	RESISTOR, FIXED, COMPOSITION: 8,200 ohms, +5%; 1/2 watt.	RC20GF822J
R217	RESISTOR, FIXED, COMPOSITION: 3,300 ohms, +5%; 1/2 watt.	RC20GF332J
R218	Same as R212.	
R219	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, +5%; 1/2 watt.	RC20GF473J
R220	NOT USED	
R221	RESISTOR, FIXED, COMPOSITION: 12 ohms, +5%; 1/2 watt.	RC20GF120J
R222	Same as R206.	
R223	Same as R219.	
R224	Same as R203.	

PARTS LIST (CONT)
COMPARATOR MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R225	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, +5%; 1/2 watt.	RC20GF223J
R226	NOT USED	
R227	RESISTOR, VARIABLE, COMPOSITION: 5,000 ohms, +10%; nom. power rating 0.25 watt at 70°C; linear taper.	RV111U502A
R228	Same as R217.	
R229	Same as R212.	
R230	Same as R209.	
R231	Same as R206.	
R232	RESISTOR, FIXED, COMPOSITION: 470 ohms, +5%; 1/2 watt.	RC20GF471J
T201	TRANSFORMER, RADIO FREQUENCY: adjustable; operating frequency 355 KHZ; inductance rated at 790 KHZ; primary inductance 12 uh, +20%; 4 solder lug type terminals; copper can, tin plated case.	TT278
T202	Same as T201.	
TP201	TERMINAL, STUD	TE127-2
TP202 thru TP206	Same as TP201.	

PARTS LIST
for
CARRIER CHANNEL MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C301	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200,000 uuf, +80% -20%; 25 WVDC.	CC100-33
C302	Same as C301.	
C303	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 100 WVDC.	CC100-26
C304	Same as C303.	
C305	Same as C303.	
C306	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf, GMV; 500 WVDC.	CC100-16
C307 thru C310	Same as C303.	
C311	CAPACITOR, FIXED, MICA DIELECTRIC: 180 uuf, +2%; 500 WVDC; straight wire leads.	CM111F181- G5S
C312	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf, +1%; 500 WVDC; straight wire leads.	CM111F101- F5S
C313	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC; miniature disc type; 2-8 uuf; 200 WVDC; operating temperature range -55°C to +125°C; silver plated terminals; steatite ceramic base.	CV112-4
C314	CAPACITOR, FIXED, MICA DIELECTRIC: 1,800 uuf, +5%; 500 WVDC; straight wire leads.	CM112F182- J5S
CR301	SEMICONDUCTOR DEVICE, DIODE: germanium; max. peak inverse voltage 60 V; continuous aver- age forward current 50 ma; max. peak forward current 150 ma; max. surge current 500 ma; max. inverse current 500 ua at 50 volts or 30 ua at 10 volts.	1N34A

PARTS LIST (CONT)
CARRIER CHANNEL MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Q301	TRANSISTOR: PNP germanium, alloy-junction; collector to base voltage 30 volts; collector to emitter and emitter to base voltage 20 volts; collector current 200 ma; power dissipation 200 mw; storage temperature range -65°C to +100°C; hermetically sealed metal case.	2N396A
Q302	Same as Q301.	
R301	RESISTOR, FIXED, COMPOSITION: 47 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF470J
R302	Same as R301.	
R303	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF102J
R304	Same as R303.	
R305	RESISTOR, FIXED, COMPOSITION: 470 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF471J
R306	RESISTOR, FIXED, COMPOSITION: 1,500 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF152J
R307	Same as R301.	
R308	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF103J
R309	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF223J
R310	RESISTOR, FIXED, COMPOSITION: 2,200 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF222J
R311	Same as R308.	
R312	Same as R308.	

PARTS LIST (CONT)

CARRIER CHANNEL MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T301	TRANSFORMER, RADIO FREQUENCY: adjustable; operating frequency 355 KHZ; inductance rated at 250 KHZ; primary inductance 2.74 uh, +8 uh; secondary- not rated; bottom retainer, cadmium plated brass, top retainer nickel silver H/H.	TT277
T302	TRANSFORMER, RADIO FREQUENCY: adjustable; operating frequency 355 KHZ; inductance rated at 790 KHZ; primary inductance 12 uh, +20 uh; secondary- not rated; 4 solder lug type terminals; copper can, tin plated case.	TT278
TP301	TERMINAL, STUD	TE127-2
TP302	Same as TP301.	
TP303	Same as TP301.	
XY301	SOCKET, CRYSTAL: clip type; 2 cadmium plated contacts; 3/64" x 5/32" tail slots.	TS167-1
Y301	CRYSTAL, QUARTZ: operating frequency 354.975 Kc.	CR109-87

PARTS LIST

for

NOISE CHANNEL MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C401	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200,000 uuf, +80% -20%; 25 WVDC.	CC100-33
C402	Same as C401.	
C403	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf, -10% +150% at 120 cps at 25°C; 25 WVDC; polarized; insulated tubular case.	CE105-10-25
C404	CAPACITOR, FIXED, ELECTROLYTIC: 2 uf, -10% +150% at 120 cps at 25°C; 25 WVDC; polarized; insulated tubular case.	CE105-2-25
C405	Same as C403.	
C406	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 100 WVDC.	CC100-28
C407	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 470,000 uuf, +20%; radial lead type terminals.	CC112R474M
C408	Same as C406.	
C409 thru C412	Same as C403.	
C413	CAPACITOR, FIXED, ELECTROLYTIC: 1 uf, -10% +150% at 120 cps at 25°C; 15 WVDC; polarized; insulated tubular case.	CE105-1-15
C414	Same as C406.	
C415	CAPACITOR, FIXED, MICA DIELECTRIC: 1,800 uuf, +5%; 500 WVDC; straight wire leads.	CM112F182-J5S
C416	NOT USED	
C417 thru C419	Same as C406.	

PARTS LIST (CONT)

NOISE CHANNEL MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C420	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 2.5- 11 uuf; 200 WVDC; miniature disc type.	CV112-3
C421	CAPACITOR, FIXED, MICA DIELECTRIC: 68 uuf, $\pm 1\%$; 500 WVDC; straight wire leads.	CM111E680-F5S
C422	NOT USED	
C423	Same as C406.	
C424	Same as C415.	
C425	Same as C406.	
CR401	SEMICONDUCTOR DEVICE, DIODE: germanium; max. peak inverse voltage 60 V; continuous average forward current 50 ma; max. peak forward current 150 ma; max. surge current 500 ma; max. inverse current 500 ua at 50 volts or 30 ua at 10 volts.	1N34A
CR402	Same as CR401.	
L401	COIL, RADIO FREQUENCY: fixed; 100,000 uh, $\pm 20\%$; current rating 20 ma; operating temperature range -55°C to $+125^{\circ}\text{C}$; molded case.	CL275-104
L402	Same as L401.	
L403	COIL, RADIO FREQUENCY: adjustable.	AC213
Q401	TRANSISTOR: PNP germanium, alloy-junction; collector to base voltage 30 V; collector to emitter and emitter to base voltage 20 V; collector current 200 ma; power dissipation 200 mw; storage temperature range -65°C to $+100^{\circ}\text{C}$; hermetically sealed metal case.	2N396A
Q402 thru Q405	Same as Q401.	

PARTS LIST (CONT)

NOISE CHANNEL MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R401	RESISTOR, FIXED, COMPOSITION: 47 ohms, +5%; 1/2 watt.	RC20GF470J
R402	Same as R401.	
R403	RESISTOR, VARIABLE, COMPOSITION: 50,000 ohms, +10%; nom. power rating 0.25 watt at 70°C; linear taper.	RV111U503A
R404	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, +5%; 1/2 watt.	RC20GF102J
R405	Same as R404.	
R406	RESISTOR, FIXED, COMPOSITION: 560 ohms, +5%; 1/2 watt.	RC20GF561J
R407	Same as R401.	
R408	RESISTOR, FIXED, COMPOSITION: 3,300 ohms, +5%; 1/2 watt.	RC20GF332J
R409	Same as R404.	
R410	Same as R404.	
R411	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, +5%; 1/2 watt.	RC20GF272J
R412	Same as R401.	
R413	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, +5%; 1/2 watt.	RC20GF682J
R414	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, +5%; 1/2 watt.	RC20GF104J
R415	RESISTOR, FIXED, COMPOSITION: 56,000 ohms, +5%; 1/2 watt.	RC20GF563J
R416	Same as R404.	

PARTS LIST (CONT)
NOISE CHANNEL MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R417	RESISTOR, FIXED, COMPOSITION: 10 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF100J
R418	Same as R404.	
R419	RESISTOR, FIXED, COMPOSITION: 270 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF271J
R420	Same as R404.	
R421	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF223J
R422	RESISTOR, FIXED, COMPOSITION: 18,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF183J
R423	Same as R404.	
R424	RESISTOR, FIXED, COMPOSITION: 100 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF101J
R425	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF103J
R426	Same as R401.	
R427	RESISTOR, FIXED, COMPOSITION: 330 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF331J
T401	TRANSFORMER, RADIO FREQUENCY: adjustable; operating frequency 355 KHZ; inductance rated at 790 KHZ; primary inductance 115 uh; secondary- not rated; 4 solder lug type terminals; copper can, tin plated case.	TT279
T402	TRANSFORMER, RADIO FREQUENCY: adjustable; operating frequency 355 KHZ; inductance rated at 250 KHZ; primary inductance 2.74 uh; secondary- not rated; bottom retainer, cadmium plated brass, top retainer, nickel silver H/H.	TT277
T403	Same as T401.	

PARTS LIST (CONT)
NOISE CHANNEL MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
TP401	TERMINAL, STUD	TE127-2
TP402 thru TP404	Same as TP401.	
XY401	SOCKET, CRYSTAL: clip type; 2 cadmium plated contacts; 3/64" x 5/32" tail slots.	TS167-1
Y401	CRYSTAL, QUARTZ: operating frequency 354.840 Kc.	CR109-86

PARTS LIST

for

MIXER AMPLIFIER MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C501	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200,000 uuf, +80% -20%; 25 WVDC.	CC100-33
C502	Same as C501.	
C503	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: miniature disc type; 5.5-18 uuf; 200 WVDC; operating temperature range -55°C to +125°C; silver plated terminals; steatite ceramic base.	CV112-1
C504	CAPACITOR, FIXED, MICA DIELECTRIC: 390 uuf, +1%; 500 WVDC; straight wire leads.	CM111F391-F5S
C505	CAPACITOR, FIXED, MICA DIELECTRIC: 820 uuf, +5%; 500 WVDC; straight wire leads.	CM111F821-J5S
C506	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 100 WVDC.	CC100-28
C507 thru C511	Same as C506.	
C512	CAPACITOR, FIXED, MICA DIELECTRIC: 5,600 uuf, +5%; 500 WVDC; straight wire leads.	CM112F562-J5S
C513	CAPACITOR, FIXED, MICA DIELECTRIC: 82 uuf, +1%; 500 WVDC; straight wire leads.	CM111E820-F5S
C514	Same as C512.	
C515	Same as C506.	
C516	Same as C506.	
C517	CAPACITOR, FIXED, MICA DIELECTRIC: 2,700 uuf, +1%; 500 WVDC; straight wire leads.	CM112F272-F5S
C518	CAPACITOR, FIXED, MICA DIELECTRIC: 33 uuf, +2%; 500 WVDC; straight wire leads.	CM111E330-G5S
C519	Same as C517.	

PARTS LIST (CONT)

MIXER AMPLIFIER MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C520	Same as C506.	
C521	Same as C506.	
L501	COIL, RADIO FREQUENCY: adjustable; operating frequency 100 KHZ; inductance rated at 790 KHZ; primary inductance 450 uh, +10uh; 4 solder lug type terminals; copper can, tin plated case.	AC214
L502	COIL, RADIO FREQUENCY: adjustable; operating frequency 355 KHZ; inductance rated at 2.5 MHZ; primary inductance 73 uh; 4 solder lug type terminals; copper can, tin plated case.	AC215
Q501	TRANSISTOR: JEDEC type 2N706 transistor with a controlled hfe limit.	TX114/2N706
Q502	TRANSISTOR: NPN diffused silicon; collector to base voltage 25 V; collector to emitter voltage 20 V; emitter to base voltage 3 V; collector current 200 ma; power dissipation 1 watt at 25°C; junction temperature range -65°C to +175°C; metal case.	2N706
Q503	Same as Q502.	
Q504	TRANSISTOR: PNP germanium, alloy junction; collector to base voltage 30 V; collector to emitter and emitter to base voltage 20 V; collector current 200 ma; power dissipation 200 mw; storage temperature range -65°C to +100°C; hermetically sealed metal case.	2N396A
Q505	Same as Q504.	
R501	RESISTOR, FIXED, COMPOSITION: 47 ohms, +5%; 1/2 watt.	RC20GF470J
R502	Same as R501.	
R503	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, +5%; 1/2 watt.	RC20GF473J

PARTS LIST (CONT)

MIXER AMPLIFIER MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R504	RESISTOR, FIXED, COMPOSITION: 5,600 ohms, +5%; 1/2 watt.	RC20GF562J
R505	RESISTOR, VARIABLE, COMPOSITION: 50,000 ohms, +10%; linear taper.	RV111U503A
R506	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, +5%; 1/2 watt.	RC20GF103J
R507	RESISTOR, FIXED, COMPOSITION: 470 ohms, +5%; 1/2 watt.	RC20GF471J
R508	RESISTOR, FIXED, COMPOSITION: 560 ohms, +5%; 1/2 watt.	RC20GF561J
R509	Same as R508.	
R510	RESISTOR, FIXED, COMPOSITION: 330 ohms, +5%; 1/2 watt.	RC20GF331J
R511	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, +5%; 1/2 watt.	RC20GF102J
R512	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, +5%; 1/2 watt.	RC20GF472J
R513	RESISTOR, FIXED, COMPOSITION: 100 ohms, +5%; 1/2 watt.	RC20GF101J
R514	RESISTOR, FIXED, COMPOSITION: 8,200 ohms, +5%; 1/2 watt.	RC20GF822J
R515	Same as R505.	
R516	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, +5%; 1/2 watt.	RC20GF682J
R517	Same as R501.	
R518	Same as R506.	

PARTS LIST (CONT)

MIXER AMPLIFIER MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T501	TRANSFORMER, RADIO FREQUENCY: adjustable; operating frequency 355 KHZ; inductance rated at 2.5 MHZ; primary inductance 73 uh, +5 uh; 4 solder lug type terminals; copper can, tin plated case.	TT281
T502	TRANSFORMER, RADIO FREQUENCY: adjustable; operating frequency 100 KHZ; inductance rated for 790 KHZ; inductance rated for 790 KHZ; primary inductance 450 uh, +15 uh; 4 solder lug type terminals; copper can, tin plated case.	TT282
TP501	TERMINAL, STUD	TE127-2
TP502 thru TP509	Same as TP501.	
XY501	SOCKET, CRYSTAL: clip type; 2 cadmium plated contacts; 3/64" x 5/32" tail slots.	TS167-1
Y501	CRYSTAL, QUARTZ: operating frequency 355 Kc.	CR109-88

PARTS LIST
for
BUFFER MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C601	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200,000 uuf, +80% -20%; 25WVDC.	CC100-33
C602	Same as C601.	
C603	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 100 WVDC.	CC100-28
C604	CAPACITOR, FIXED, MICA DIELECTRIC: 390 uuf, +1%; 500 WVDC; straight wire leads.	CM111F391-F5S
C605	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: miniature disc type; 5.5-18 uuf; 200 WVDC; operating temperature range -55°C to +125°C; silver plated terminals; steatite ceramic base.	CV112-1
C606	CAPACITOR, FIXED, MICA DIELECTRIC: 820 uuf, +5%; 500 WVDC; straight wire leads.	CM111F821-J5S
C607 thru C612	Same as C603.	
C613	CAPACITOR, FIXED, MICA DIELECTRIC: 3,900 uuf, +1%; 300 WVDC; straight wire leads.	CM112F392-F3S
C614	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf, +1%; 500 WVDC; straight wire leads.	CM111F101-F5S
C615	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf, GMV; 500 WVDC.	CC100-16
L601	COIL, RADIO FREQUENCY: adjustable; operating frequency 455 KHZ; inductance rated at 2.5 MHZ; primary inductance 31 uh, +10 uh; 4 solder lug type terminals; copper can, tin plated case.	AC216
Q601	TRANSISTOR: NPN diffused silicon; collector to base voltage 25 V; collector to emitter voltage 20 V; COLLECTOR TO EMITTER VOLTAGE 20 V; emitter to base voltage 3 V; collector current 200 ma; power dissipation 1 watt at 25°C; junction	2N706

PARTS LIST (CONT)

BUFFER MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Q601 (cont)	temperature range -65°C to $+175^{\circ}\text{C}$; metal case.	
Q602	Same as Q601.	
Q603	TRANSISTOR: PNP germanium, alloy junction; collector to base voltage 30 V; collector to emitter and emitter to base voltage 20 V; collector current 200 ma; power dissipation 200 mw; storage temperature range -65°C to $+100^{\circ}\text{C}$; hermetically sealed metal case.	2N396A
Q604 thru Q606	Same as Q601.	
R601	RESISTOR, FIXED, COMPOSITION: 470 ohms, $\pm 5\%$; 1/2 watt.	RC20GF471J
R602	RESISTOR, FIXED, COMPOSITION: 560 ohms, $\pm 5\%$; 1/2 watt.	RC20GF561J
R603	RESISTOR, FIXED, COMPOSITION: 150 ohms, $\pm 5\%$; 1/2 watt.	RC20GF151J
R604	RESISTOR, FIXED, COMPOSITION: 47 ohms, $\pm 5\%$; 1/2 watt.	RC20GF470J
R605	Same as R604.	
R606	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, $\pm 5\%$; 1/2 watt.	RC20GF272J
R607	RESISTOR, FIXED, COMPOSITION: 10 ohms, $\pm 5\%$; 1/2 watt.	RC20GF100J
R608	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF103J
R609	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF102J

PARTS LIST (CONT)

BUFFER MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R610	Same as R601.	
R611	Same as R602.	
R612	Same as R602.	
R613	Same as R609.	
R614	RESISTOR, VARIABLE, COMPOSITION: 50,000 ohms, +10%; nom. power rating 0.25 watt at 70°C; linear taper.	RV111U503A
R615	Same as R606.	
R616	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, +5%; 1/2 watt.	RC20GF473J
TP601	TERMINAL, STUD	TE127-2
TP602 thru TP606	Same as TP601.	
XY601	SOCKET, CRYSTAL: clip type; 2 cadmium plated contacts; 3/64" x 5/32" tail slots.	TS167-1
*Y601	CRYSTAL, QUARTZ	CR109-X

*Frequency of Crystal Y601 is dependent upon customer request.

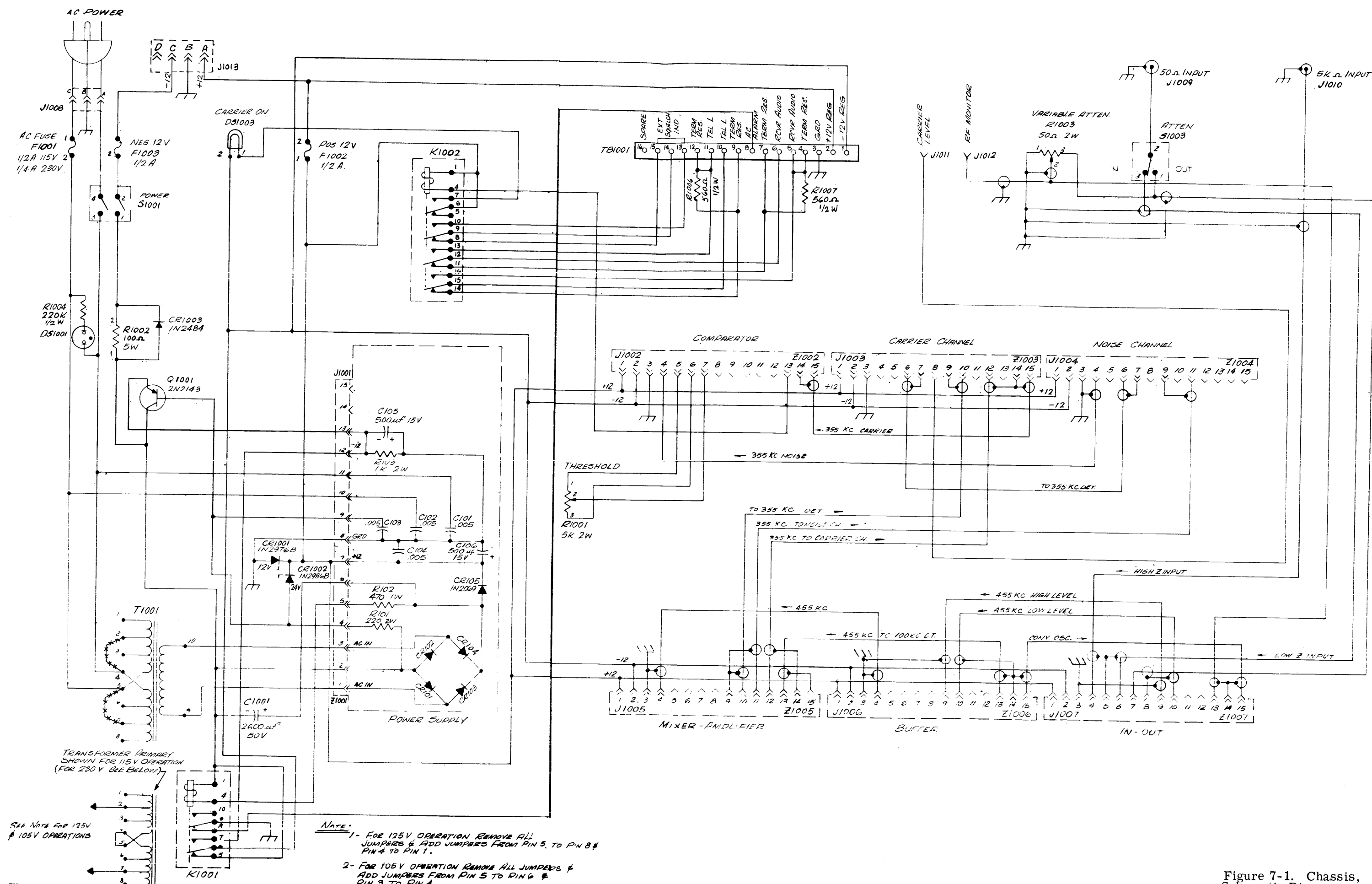
PARTS LIST
for
INPUT-OUTPUT MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C701	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200,000 uuf, +80% -20%; 25 WVDC.	CC100-33
C702	Same as C701.	
C703	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, +60% -40%; 150 WVDC.	CC100-35
C704	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 100 WVDC.	CC100-28
C705 thru C709	Same as C704.	
C710	CAPACITOR, FIXED, MICA DIELECTRIC: 3,300 uuf, +5%; 500 WVDC; straight wire leads.	CM112F332- J5S
C711	CAPACITOR, FIXED, MICA DIELECTRIC: 56 uuf, +5%; 500 WVDC; straight wire leads.	CM111E560- J5S
C712	Same as C710.	
L701	COIL, RADIO FREQUENCY: adjustable; operat- ing frequency 455 KHZ; inductance rated at 2.5 MHZ; primary inductance 38 uh, +5 uh; 4 solder lug type terminals; copper can, tin plated case.	AC217
Q701	TRANSISTOR: germanium; emitter to base voltage 0.5 V; collector to base voltage 40 V; power diss- ipation 120 mw; junction temperature 100°C; herm- etically sealed metal case.	2N1225
Q702	Same as Q701.	
R701	RESISTOR, FIXED, COMPOSITION: 47 ohms, +5%; 1/2 watt.	RC20GF470J
R702	Same as R701.	
R703	RESISTOR, FIXED, COMPOSITION: 270 ohms, +5%; 1/2 watt.	RC20GF271J

PARTS LIST (CONT)
INPUT-OUTPUT MODULE

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R704	Same as R701.	
R705	Same as R701.	
R706	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, +5%; 1/2 watt.	RC20GF472J
R707 thru R709	Same as R706.	
R710	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, +5%; 1/2 watt.	RC20GF272J
R711	Same as R710.	
R712	RESISTOR, FIXED, COMPOSITION: 8,200 ohms, +5%; 1/2 watt.	RC20GF822J
R713	Same as R712.	
R714	RESISTOR, FIXED, COMPOSITION: 1,800 ohms, +5%; 1/2 watt.	RC20GF182J
R715	RESISTOR, FIXED, COMPOSITION: 15,000 ohms, +5%; 1/2 watt.	RC20GF153J
R716	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, +5%; 1/2 watt.	RC20GF103J
T701	TRANSFORMER, RADIO FREQUENCY: adjust- able; operating frequency 455 KHZ; inductance rated at 2.5 MHZ; primary inductance 38 uh, +5 uh; 4 solder lug type terminals; copper can, tin plated case.	TT280
TP701	TERMINAL, STUD	TE127-2
TP702 thru TP706	Same as TP701.	

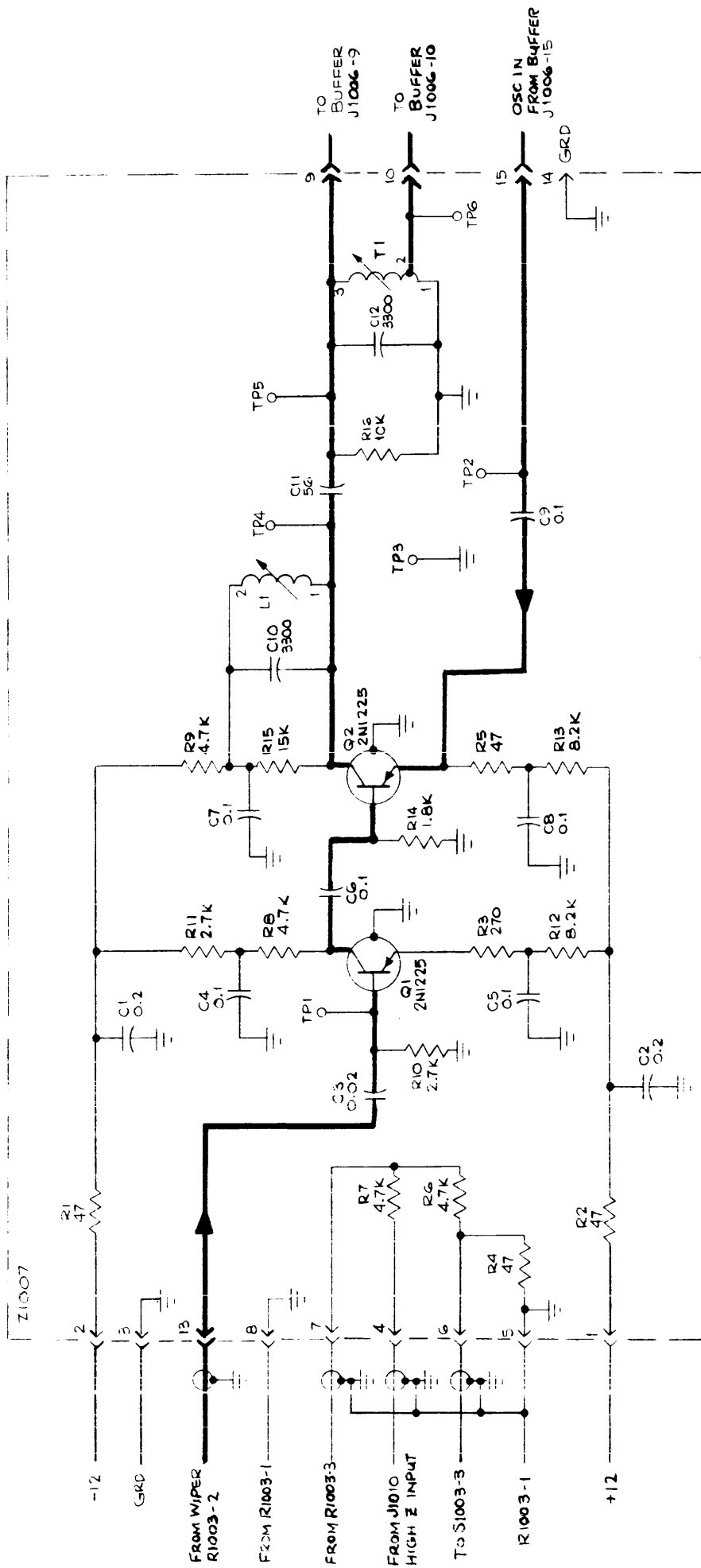
SECTION 7
SCHEMATIC DIAGRAMS



SEE NOTE FOR 125V & 105V OPERATIONS

NOTE:
 1- FOR 125V OPERATION REMOVE ALL JUMPERS & ADD JUMPERS FROM PIN 5 TO PIN 8 & PIN 4 TO PIN 1.
 2- FOR 105V OPERATION REMOVE ALL JUMPERS & ADD JUMPERS FROM PIN 5 TO PIN 6 & PIN 3 TO PIN 4.

Figure 7-1. Chassis, Schematic Diagram 7-1/7-2



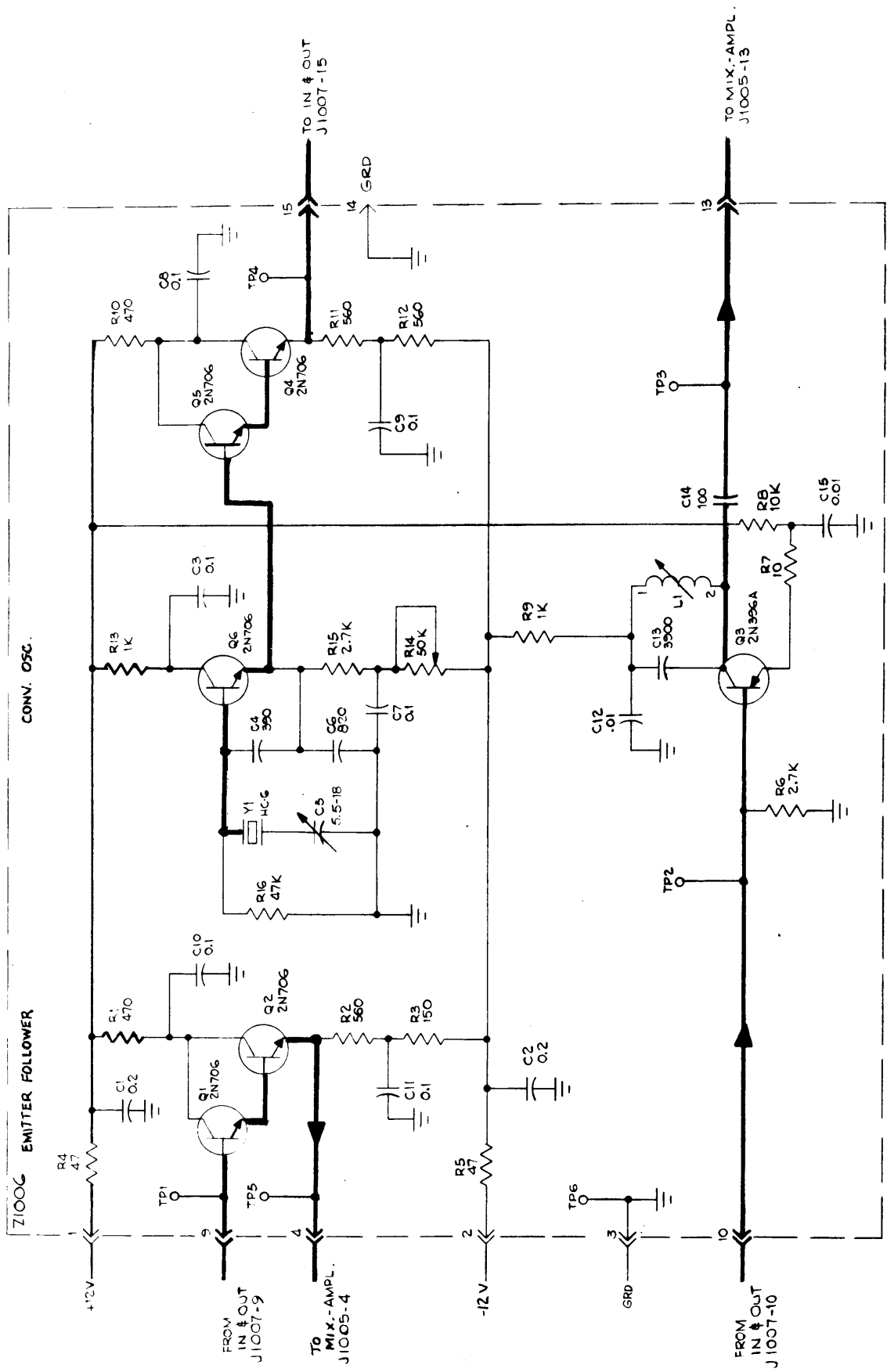
CK-1075 Ø

NOTE:

UNLESS OTHERWISE SPECIFIED-

1. All Whole Number Capacitor Values Are in pf.
2. All Decimal Number Capacitor Values Are in uf.
3. All Resistor Values Are in Ohms, 1/2 W
4. Circuit Symbols - "700" Series

Figure 7-2. In and Out, Schematic Diagram.

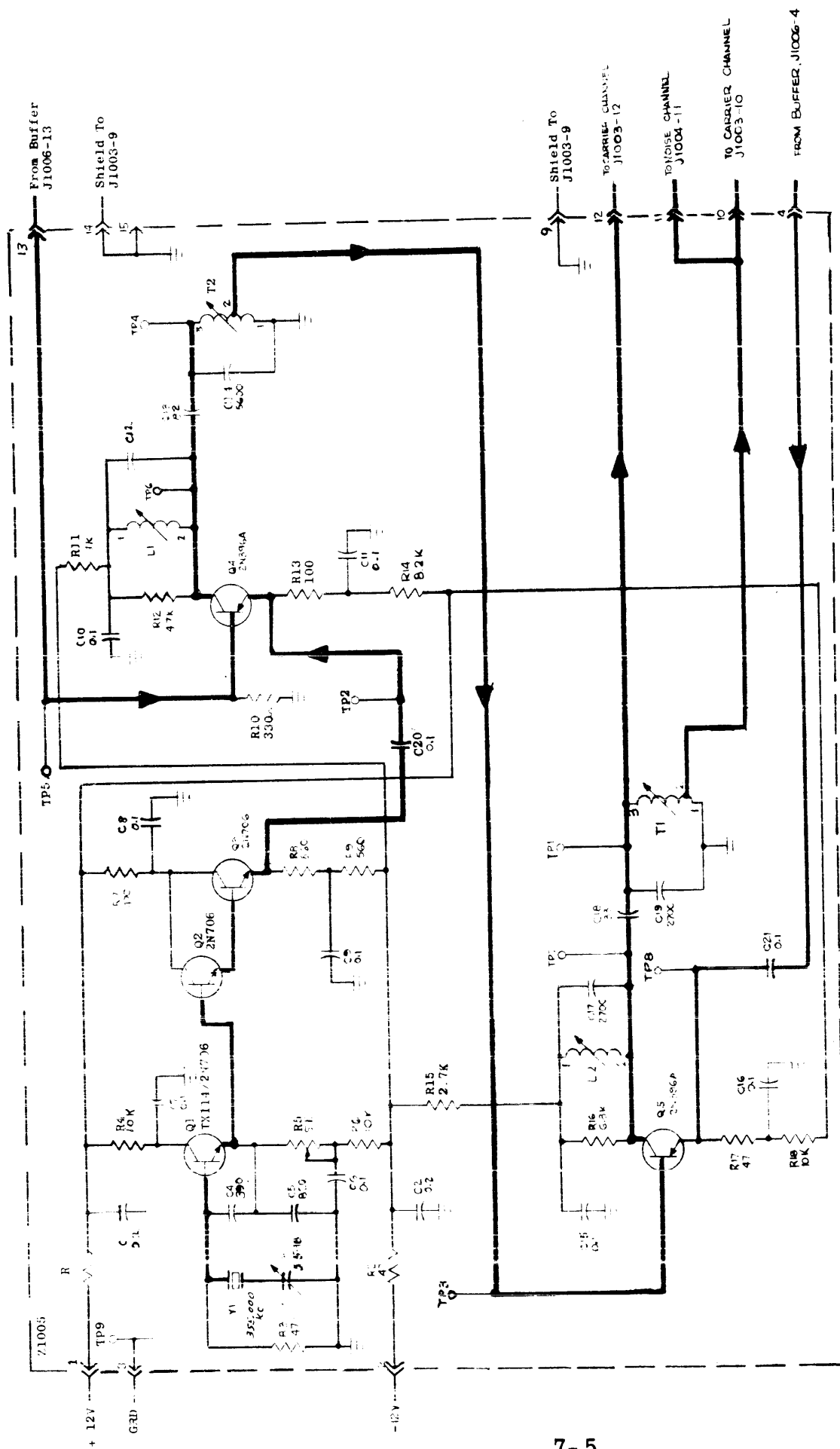


NOTE: UNLESS OTHERWISE SPECIFIED-

1. All Whole Number Capacitor Values Are in pf.
2. All Decimal Number Capacitor Values Are in uf.
3. All Resistor Values Are in Ohms, 1/2 W
4. Circuit Symbols - "600" Series

CK-1074 A

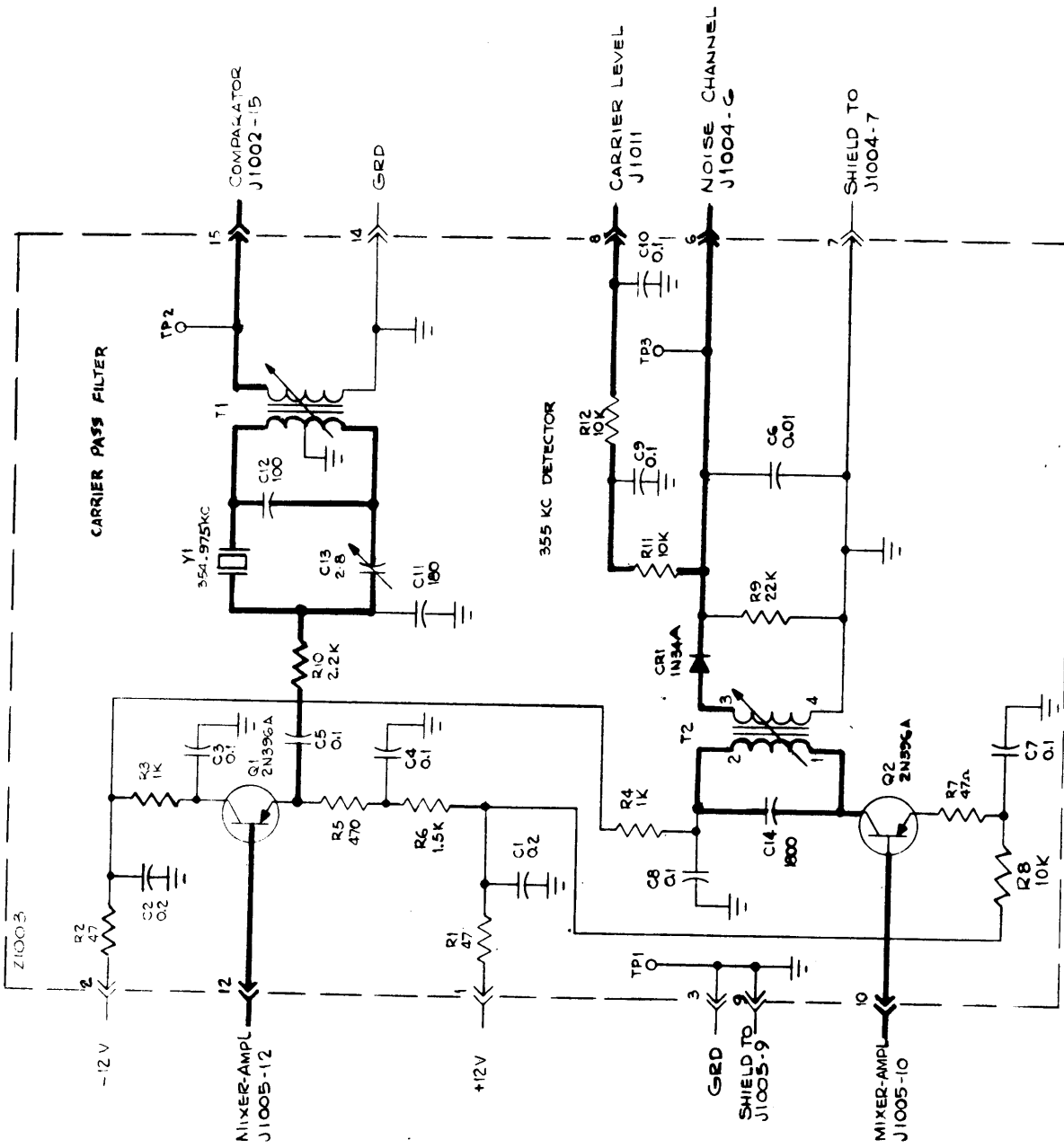
Figure 7-3. Buffer, Schematic Diagram.



NOTE: UNLESS OTHERWISE SPECIFIED --
 1. All Whole Number Capacitor Values Are in pf.
 2. All Decimal Number Capacitor Values Are in uf.
 3. All Resistor Values Are in Ohms, 1/2 W
 4. Circuit Symbols - "500" Series

(K-1073 B)

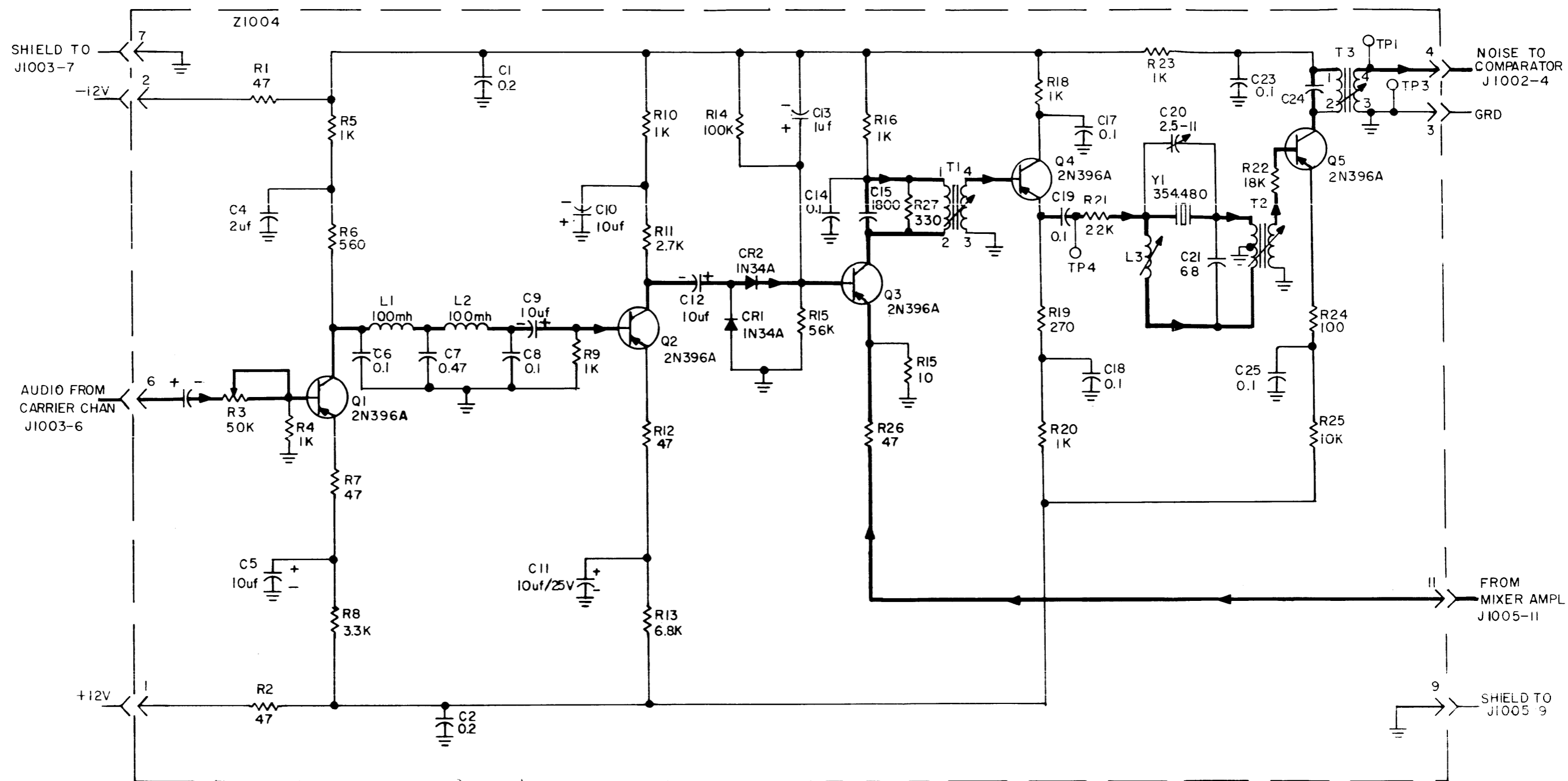
Figure 7-4. Mixer Amplifier, Schematic Diagram.



NOTE: UNLESS OTHERWISE SPECIFIED -
 1. All Whole Number Capacitor Values Are in pf.
 2. All Decimal Number Capacitor Values Are in uf.
 3. All Resistor Values Are in Ohms, 1/2 W.
 4. Circuit Symbols - "300" Series.

CK-1072 #

Figure 7-5. Carrier Channel, Schematic Diagram.



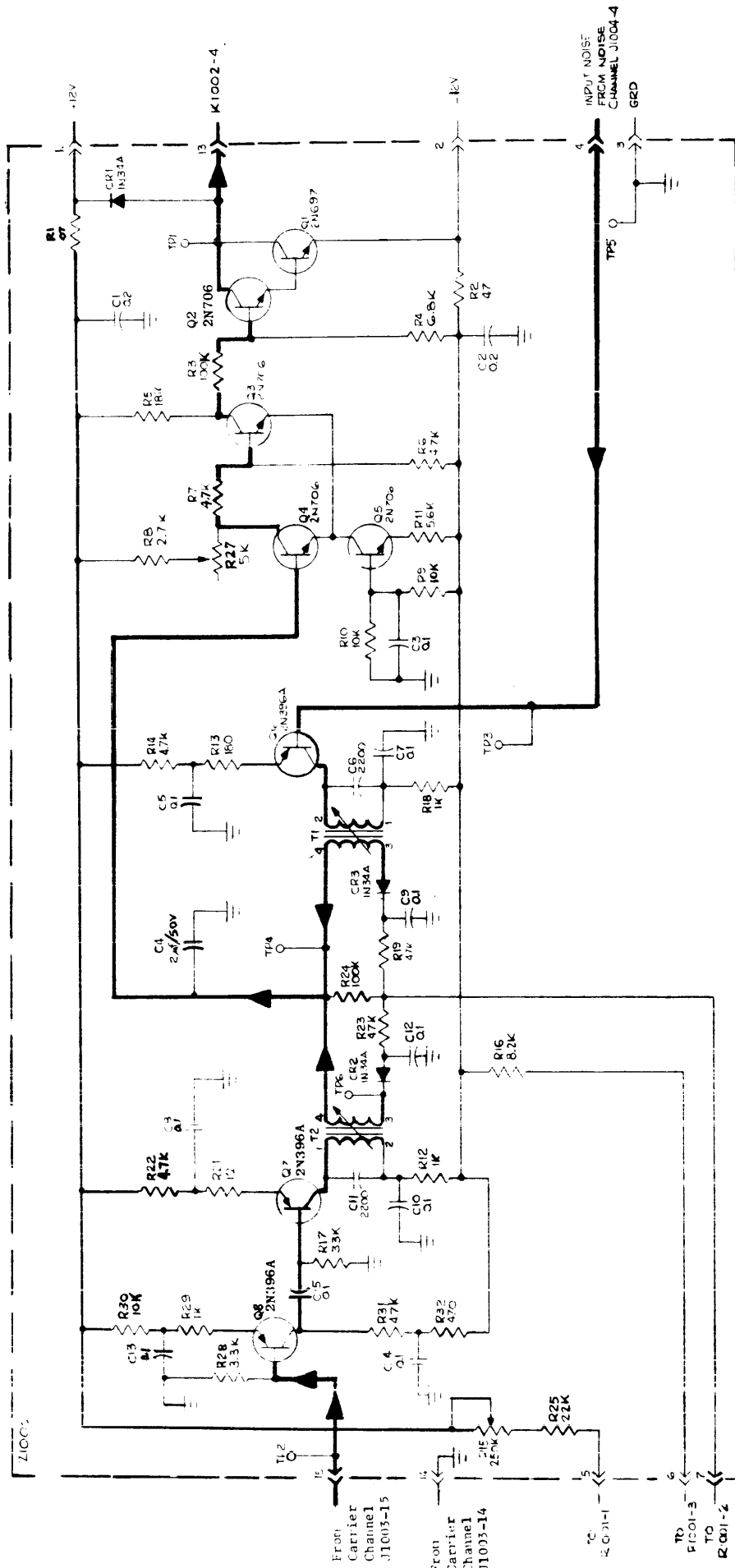
4013A-11 (CK-1071B)

NOTE:

- UNLESS OTHERWISE SPECIFIED
1. All Whole Number Capacitor Values Are in pf.
 2. All Decimal Number Capacitor Values Are in uf.
 3. All Resistor Values Are in Ohms, 1/2 W
 4. Circuit Symbols- "400" Series

010664013A

Figure 7-6. Noise Channel, Schematic Diagram



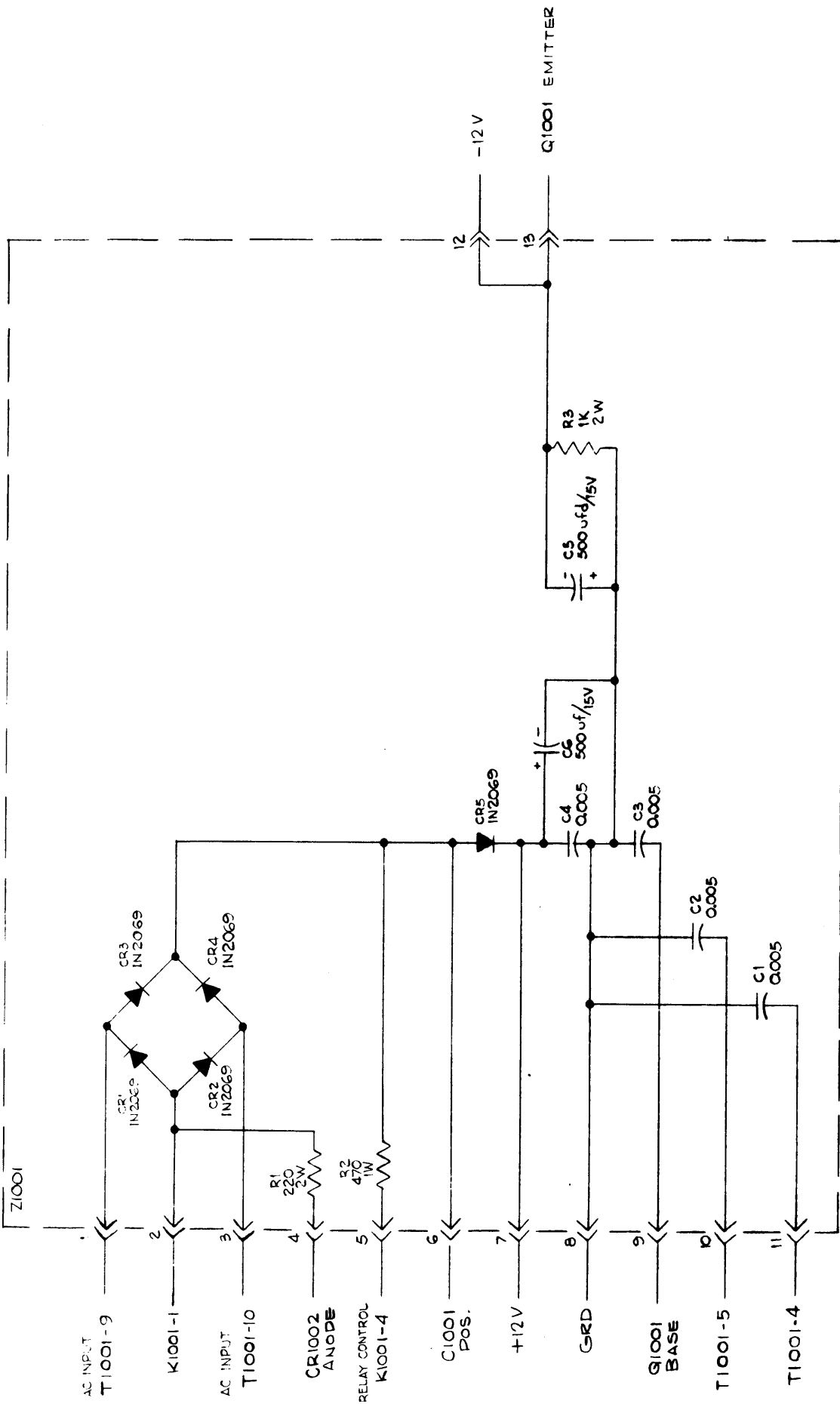
NOTE:

UNLESS OTHERWISE SPECIFIED-

1. All Whole Number Capacitor Values Are in pf.
2. All Decimal Number Capacitor Values Are in uf.
3. All Resistor Values Are in Ohms, 1/2 W
4. Circuit Symbols - "200" Series

CK-1076 A

Figure 7-7. Comparator, Schematic Diagram.



NOTE: UNLESS OTHERWISE SPECIFIED-

1. All Whole Number Capacitor Values Are in pf.
2. All Decimal Number Capacitor Values Are in uf.
3. All Resistor Values Are in Ohms, 1/2 W
4. Circuit Symbols - "100" Series

CK-1070 ⌀

Figure 7-8. Power Supply, Schematic Diagram.