NAVSHIPS 94376(A) *(Non-Registered)*

TECHNICAL MANUAL

for

TERMINAL TELEGRAPH AN/UGC-1A

TRAK ELECTRONICS COMPANY, INC.
WILTON, CONNECTICUT

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

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To: All Activities concerned with the Installation, Operation, and Maintenance of the Subject Equipment

Subj: Technical Manual for Terminal Telegraph AN/UGC-1A, NAVSHIPS 94376(A)

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SECTION 1

GENERAL INFORMATION

1-1. GENERAL DESCRIPTION.

This manual provides installation, operation, theory and maintenance information for Terminal Telegraph AN/UGC-1A. The major units of the equipment are: the Transmitter Group OA-3445/UGC-1A; the Receiver Group OA-3444/UGC-1A; and the Oscillator-Power Supply O-872/UGC-1A.

a. Terminal, Telegraph AN/UGC-1A is a completely transistorized unit providing terminal facilities for a multiplex system. The equipment may be installed either in a ship or at a shore-based station. A pictorial representation of a typical shipboard installation is shown in Figure 1-1. The external equipment is not supplied, but is Government Furnished Equipment.

b. The primary purpose of a multiplex system such as the Terminal, Telegraph AN/UGC-1A is to increase the message handling capacity of telegraph channels and the transmission equipment associated with them. This end is accomplished by the transmission of several messages over a common channel. The transmitting equipment of a time sharing multiplex system accepts start-stop signals from a number of circuits, converts them to multiplex signals (in effect, compressing them in time) and transmits them over a common channel. The receiving equipment at a distant station accepts the multiplex signals, converts them to start-stop signals (in effect,expands them in time) and distributes them in the proper order to a corresponding number of circuits.

c. The Multiplex Set is housed in three cabinets, one each for the Transmitter and Receiver Groups and the Oscillator-Power Supply. Each cabinet may be rack or floor mounted, or they may be stacked one on top of the other in any desired order. A floor mounting is provided.

d. Basic mounting facilities for the components of each major unit of the Transmitter and Receiver Groups are provided by an aluminum frame and a front panel. A maximum of six printed circuit cards is inserted into connectors in each drawer. The other components of the unit, such as switches, fuses, variable resistors, capacitors, relays, etc., are located on a bracket beneath the printed circuit cards. All output circuits of a drawer lead to an AN-type connector at the rear of the drawer. The twelve units, referred to as drawers, slide into vertical slots in their respective cabinets. The AN-type connectors are linked to connectors on the rear plate of the cabinet by flexible cables which permit the drawers to be withdrawn for servicing while the set is in operation. All components are visible and readily accessible when the drawers are withdrawn.

e. The Oscillator-Power Supply is housed in a separate cabinet and can be withdrawn for servicing.

f. External connections to the cabinets are made by AN-type connectors located on the rear plates. An input-output connector, 3P3, (without cable) on the Transmitter Group provides for the input start-stop signals and the output multiplex signals. A similar connector, 2P3, on the Receiver Group provides for the input multiplex signals and the output start-stop signals. If desired, the above connections can be made to terminal strips located under small covers on the rear plate. Connectors 3P1 and 2P1 (drip-proof) on the Transmitter and Receiver Groups provide for interconnection with auxiliary equipment (not furnished). The Transmitter and Receiver Groups are linked to the power supply by interconnecting cables and connectors. A connector (1P14), cable, and plug connect the Oscillator-Power Supply with the primary ac power. A coaxial cable connector 1P13 (drip-proof) is used when an external frequency standard is employed in place of the crystal oscillator.

1-2. EQUIPMENT DESCRIPTION.

a. The Terminal, Telegraph AN/UGC-1A is made up of the following major units as shown in Figure 1-2.

(1) Transmitter Group OA-3445/UGC-1A.

(a) Cabinet, Electrical Equipment CY-3255/UGC-1A.

(b) Telegraph Code Converter CV-1217/UGC-1A.

(c) Multiplexer-Demultiplexer TD-515/UGC-1A.

(d) Control Amplifier AM-3107/UGC-1A.

(e) Code Converter Indicator ID-965/UGC-1A.

(2) Receiver Group OA-3444/UGC-1A.

(a) Electrical Equipment Cabinet CY-3254/UGC-1A.

(b) Electrical Synchronizer SN-313/UGC-1A.

(c) Multiplexer-Demultiplexer TD-515/UGC-1A.

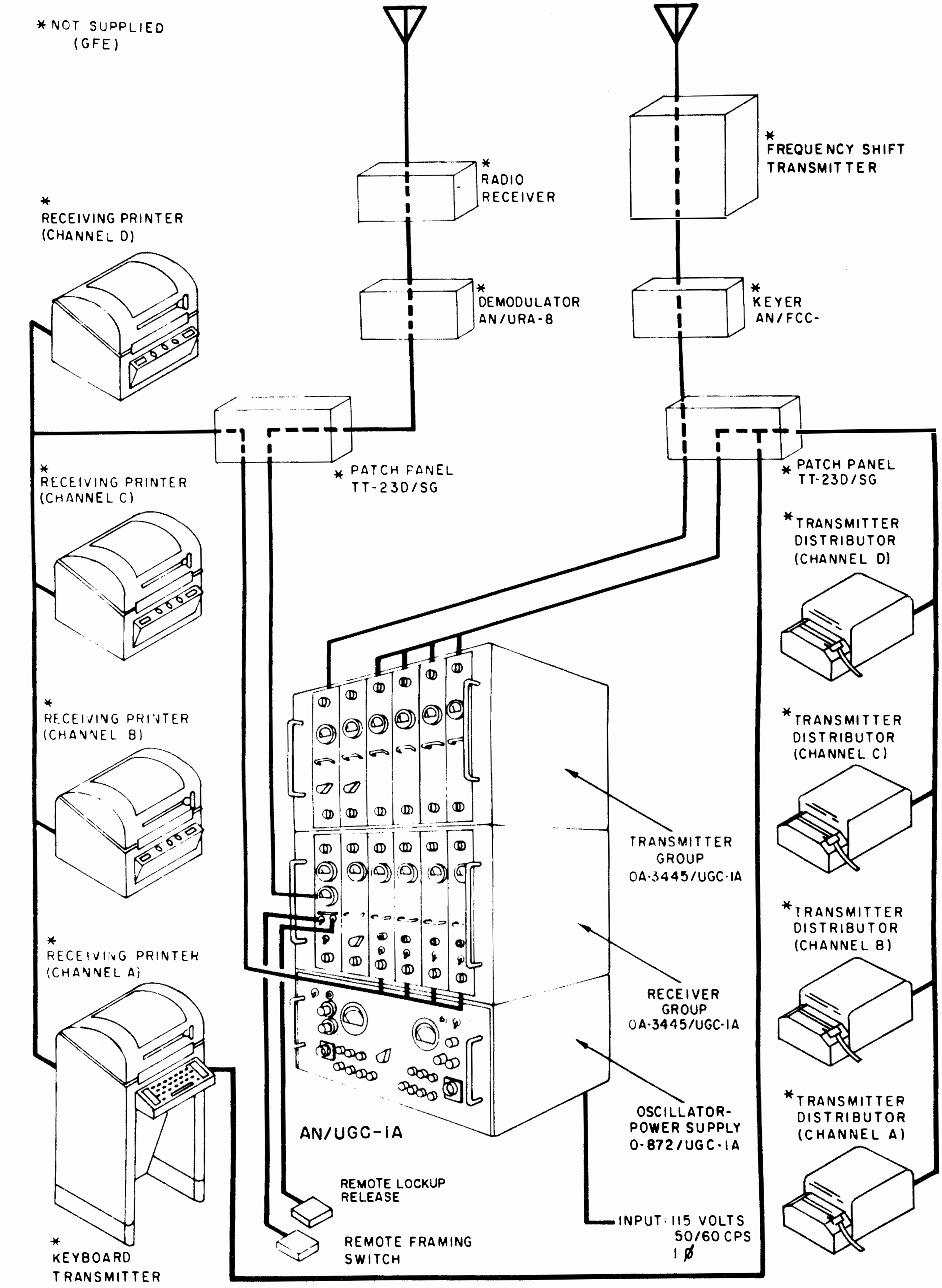


Figure 1-1. Typical Terminal Telegraph Send-Receive Station

(d) Telegraph Code Converter CV-1218/UGC-1A.

(3) Oscillator-Power Supply O-872/UGC-1A.

(4) Electrical Equipment Cabinet CY-3253/UGC-1A.

b. Transistors and other solid-state devices are employed in the design of the Multiplex Set to achieve minimum size, weight and power consumption. A primary ac power source of 115 volts ± 10%, single phase, 50/60 cycles per second ± 5% is required. The Multiplex Set will operate with start-stop equipment running at speeds of 60, 75, and 100 words per minute. Framing may be accomplished either semi-automatically or manually, and the Multiplex Set may be operated on a local loop to effect circuit line up. Various meters and a portable neon indicator are provided for test and adjustment purposes. Test jacks on the various printed circuit cards provide for monitoring the circuit waveforms by an oscilloscope (not furnished). The equipment is drip-proof and will operate in an ambient temperature range of 0 to 50 degrees centigrade (32 to 122 degrees F). The multiplex signals of this Multiplex Set are completely compatible with those of the AN/FGC-5 Electronic Multiplex Set at 60 and 75 wpm.

1-3. FUNCTIONAL DESCRIPTION.

a. GENERAL. - The Transmitter Group accepts neutral start-stop signals from two, three, or four separate circuits and assembles them in sequential order for multiplex transmission over a single circuit. The Receiver Group accepts multiplex signals from a distant source, converts them to start-stop form and distributes them to two, three, or four separate circuits. The Oscillator-Power Supply provides the necessary voltages and a frequency standard for the Transmitter and Receiver Groups.

b. TRANSMITTER GROUP OA-3445/UGC-1A. - The Transmitter Group consists of four Converters, Telegraph Code CV-1217/UGC-1A, one Demultiplexer-Multiplexer TD-515/UGC-1A, and one Amplifier, Control AM-3107/UGC-1A. The Indicator, Code Coverter ID-965/UGC-1A , is stored in the Control Amplifier drawer.

(1) CONVERTER, TELEGRAPH CODE CV-1217 /UGC-1A. - The Transmitter Code Converter accepts conventional start-stop signals from an external equipment and converts them to multiwire signals. The outputs of the Transmitter Code Converters are six-wire parallel signals applied to the Mux-Demux. The Transmitter Group may employ two, three, or four Transmitter Code Converters depending on the number of start-stop channels in use. One Transmitter Code Converter is required for each channel.

(2) DEMULTIPLEXER-MULTIPLEXER TD-515 /UGC-1A.- The Mux-Demux plays a dual role of a multiplexing device in the Transmitter Group, and a demultiplexing device in the Receiver Group. In the Transmitter Group, the Mux-Demux accepts the multiwire signals from the operating Transmitter Code Converters and combines them into multiplex signals which are applied to the control amplifier.

(3) AMPLIFIER,CONTROL AM-3017/UGC-1A.- The Control Amplifier accepts multiplex signals from the Mux-Demux unit and amplifies them to the voltage or current levels suitable for use by local or remote signal circuits. The control amplifier has provisions for generating a steady mark, a steady space, or ac reversals for test and alignment purposes. The unit also furnishes signals to auxiliary equipment at the proper voltage levels.

(4) INDICATOR, CODE CONVERTER ID-965/ UGC-1A. - The Code Converter Indicator is a test instrument which is normally stored in the Control Amplifier drawer. The neon indicator provides a visual indication of the operation of the Transmitter and Receiver Code Converters. Seven neon lamps are located on the front of this unit. Six of these lamps, each of which is driven by one level of the multiwire signals at the code converter, indicate the condition of the storage circuits. The seventh lamp is an ac power indicator. The neon indicator is connected to the code converter under test by a flexible cable and a plug arrangement.

c. RECEIVER GROUP OA-3444/UGC-1A.- The Receiver Group consists of one Synchronizer, Electrical SW-313/UGC-1A, one Demultiplexer-Multiplexer TD-515/UGC-1A and four Converters, Telegraph Code CV-1217/UGC-1A.

(1) SYNCHRONIZER , ELECTRICAL SN-313/ UGC-1A. -The Synch Unit accepts multiplex signals from a local or remote signal line, amplifies them and furnishes both inverted and normal versions to the Mux-Demux. In addition, the Synch Unit maintains the correct phase relationship between the incoming multiplex signals and the local frequency standard by adding or subtracting from drive pulses derived from the Oscillator-Power Supply. The Synch Unit also provides special signals used by auxiliary equipment.

(2) DEMULTIPLEXER-MULTIPLEXER TD-515/UGC-1A. The Mux-Demux accepts synchronous multiplex signals from the Synch Unit and furnishes multiwire signals to the Receiver Code Converters.

(3) CONVERTER, TELEGRAPH CODE CV-12 18/UGC-1A. -The Transmitter Code Converter accepts multiwire signals from the Mux-Demux and converts them to start-stop signals suitable for operation of corresponding receiving equipment. The Receiver Group may employ two, three or four Receiver Code Converters depending on the number of start-stop channels in use. One code

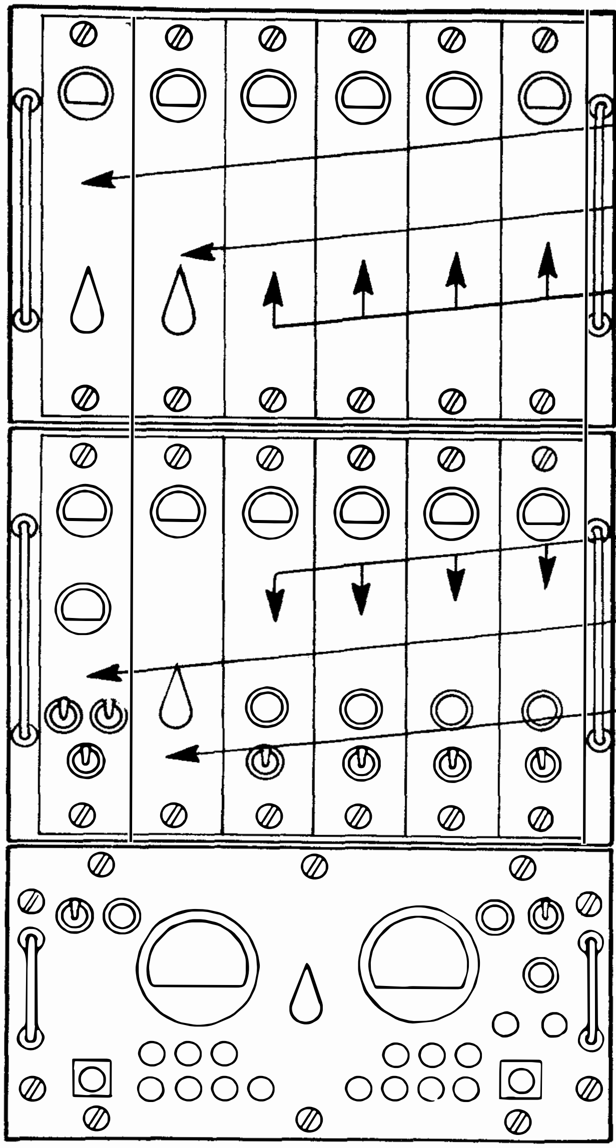


Figure 1-2. Terminal, Telegraph AN/UGC-1A.

converter is required for each channel. In addition, this unit contains alarm circuits which detect out-of-frame conditions at the Receiver Code Converters. An out-of-frame condition results whenever the Receiver Code Converter is displaced in time one or more signal elements from its transmitting counterpart. When this condition is detected, an audio and visual alarm occurs and the output lines of the Receiver Code Converters are locked-up in a marking condition.

d. OSCILLATOR-POWER SUPPLY 0-872/UGC-1A. - The power supply provides dc and ac voltages and accurately-timed frequency drive pulses for the Transmitter and Receiver Groups. The binary drive pulses are provided by a crystal oscillator. This oscillator is packaged in a hermetically sealed oven. Two crystal oscillators are contained in the power supply, one for 60 and 75 word-per-minute operation and one for 100 word-per-minute operation.

1-4. QUICK REFERENCE DATA.

Power input requirement

115V ±10%, 1 phase, 50/60 ±5% cps power factor 0.9, current 1.5A, power dissipation 160 watts.

Ambient temperature range

Operation, $0^{o}C$ to $50^{o}C$ ($32^{o}F$ to $122^{o}F$), storage $-40^{o}C$ to $+65^{o}C$ ($-40^{o}F$ to $+149^{o}F$)

Input to Transmitter Group

Neutral start-stop signals of 0.020 or 0.060 ampere dc; external battery required.

Output of Transmitter Group

Multiplex signals, current keyed neutral dc signals of 0.020 or 0.060 ampere for remote transmission line; external battery of 130v (not exceeding 150v) required.

Input to Receiver Group

Multiplex signals, current keyed neutral dc signals of 0.020 or 0.060 ampere; external battery required.

Output of Receiver Group

Neutral start-stop signals of 0.020 or 0.060 ampere dc; less than 2% distortion of signals for all specified conditions of temperature and voltage; external battery required.

Auxiliary output signals of Transmitter Group

a. Positive-going pulses, amplitude 37v 10,000 ohm impedance, minimum duration 150 μs, repetition rates: 60 wpm-450 pps; 75 wpm-562.5 pps; 100 wpm-773, 69 pps.

b. Signal corresponding to normal multiplex signal but inverted: amplitudes of 0v for mark and +50v for space developed across 220,000 ohms.

c. Negative pulses with 24v amplitude across 1 megohm; time duration of each pulse greater than 7 μs, repitition rate equal to baud of multiplex signal; pluses occur within 30 μs, of start of each code element specified in b. above.

d. Positive pulse with 37v amplitude developed across 10,000 ohms; time duration of pulse greater than 150 μs; pulse occurs within 30 μs after start of first code element in channel B appearing in inverted multiplex output signal.

Auxiliary output signals of Receiver Group

a. Positive-going pulses: Same as specified in a. of Auxiliary output signals of Transmitter Group.

b. Signal corresponding to normal multiplex signal but inverted: Same as specified in b. of Auxiliary output signals of the Transmitter Group.

c. Positive pulse with amplitude between +32.5 and +42v developed across impedance not greater than 10,000 ohms; time duration of pulse 150 μs or greater; rise time one millisecond or less; pulse occurs within first half of sixth code element of channel A as an inverted multiplex signal and occurs only when the sixth code element of the signal being received by channel A is marking.

d. Negative-going pulses with amplitudes not less than 15v developed across not greater than 10,000 ohms impedance; time duration of pulses less than 5% of width of multiplex code element; pulses occur coincidently with nominal center of code elements of inverted multiplex output signal specified in b. above.

Auxiliary input signals of Transmitter Group

Inverted multiplex signal from auxiliary equipment; signal amplitude of 0 (±2) volts for mark and +55 (+20, -10 volts) for space; input impedance is 50,000 ohms.

Auxiliary input signals of Receiver Group

Inverted multiplex signal from auxiliary equipment; signal amplitude of 0 (± 2) volts for mark and +9 (+20, -10 volts) for space; signal is delayed 1/2 of a code element from signal specified in b. of Auxiliary output signals of Transmitter Group.

Overall dimensions (Transmitter Receiver Groups and Oscillator Power Supply Groups without base or shock mount)

33-1/4 in. (h) x 17 in. (w.) x 25 in. (d.)

Total weight
280 lbs.

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING.

a. The Terminal Telegraph AN/UGC-1A is packed in a large wooden box, which also contains maintenance spare parts, the instruction manual, the mounting hardware and the accessories requireed for installation. It is important to inspect the location where the equipment is to be installed to make certain that ample room is provided at the rear of the cabinet after the set is installed. Figure 2-1 provides dimension information for this purpose.

b. The equipment is packaged with a moisture-vapor-proof barrier. Individual items in the maintenance spare parts box are also so packaged. If the unit is removed from the shipping box do not break the moisture-proof barrier until final installation is begun.

c. Remove the nails that secure the front panel and the top of the wooden box. This exposes the unit in its protective covering. Remove the corrugated detail at the top and lift the unit from the skid and lower detail. Remove the protective covering when the unit is to be installed. If the unit is to be rack mounted remove the brackets (107, 377, 101, 397), the rear brackets and the bag of mounting hardware from the shipping box.

2-2. SITE SELECTION.

a. The equipment may be installed in either a fixed or mobile station. The arrangement of the equipment is dependent upon the space available and the amount of traffic to be handled. Where space permits, it is recommended that the Multiplex Set be mounted at table-top height above the floor. The base (201, 892) is not required for this type of mounting. Where large amounts of traffic are to be handled within a limited floor area, two complete Multiplex Sets can be bolted together one above the other. This method of mounting results in a "package" approximately 6 feet high but narrower (17 inches) than conventional relay racks. If possible, a Transmitter Group, a Receiver Group and a common Oscillator-Power Supply Group should be installed together. This arrangement facilitates the overall testing of the equipment during routine maintenance checks.

b. The Multiplex Set should be installed in a shelter which is kept at temperature consistent with human habitation.

c. Where rear accessibility is limited to less than 18 inches, the Oscillator-Power Supply Group should be installed as the lower unit in the cabinet assembly--see figure 2-1. This procedure permits final bolting of the assembled cabinets to the mounting base from the front.

CAUTION

The distance between the rear panels of the cabinet and a vertical wall surface should not be less than 5 1/2 inches. If this minimum distance is not maintained, the AN-type connectors on the rear panels cannot be removed. A shock mounting bracket (201, 891) is provided with the equipment to protect the AN-type connectors and provide minimum cabinet to wall distance.

2-3. POWER REQUIREMENTS AND DISTRIBUTION

During operation at normal room temperatures, the Multiplex Set requires 160 watts of power from a 115 volt ac source. The unit has a power factor of 0.5. Refer to the power distribution information in figure 2-2. Note that the set will function on 50 to 60 cycle current; however, the associated motor driven readers and printers will require a frequency tolerance of $\pm$ 0.5 cycle unless governed motors are used.

2-4. INSTALLATION LAYOUT.

a. The Multiplex Set will operate for long periods of time with a minimum amount of attention. The automatic misframe detection circuits provide visual and audible alarms to prevent misrouting of traffic.

b. A typical shipboard installation in which the TT-23/SG patch panels are used is shown in figure 1-1.

c. If possible, a send-receive teletypewriter should be located near the Multiplex Set for monitoring and order wire purposes. The order wire can be a separate circuit or one of the multiplex channels.

d. All incoming and outgoing signal leads should be shielded pairs. The shields must be grounded to the equipment at the ground terminations provided on the terminal blocks or in the AN-type connectors.

e. The cabinets, which are bonded by a ground strap, must be connected to station ground.

f. Mount base to floor or to table. Drill the

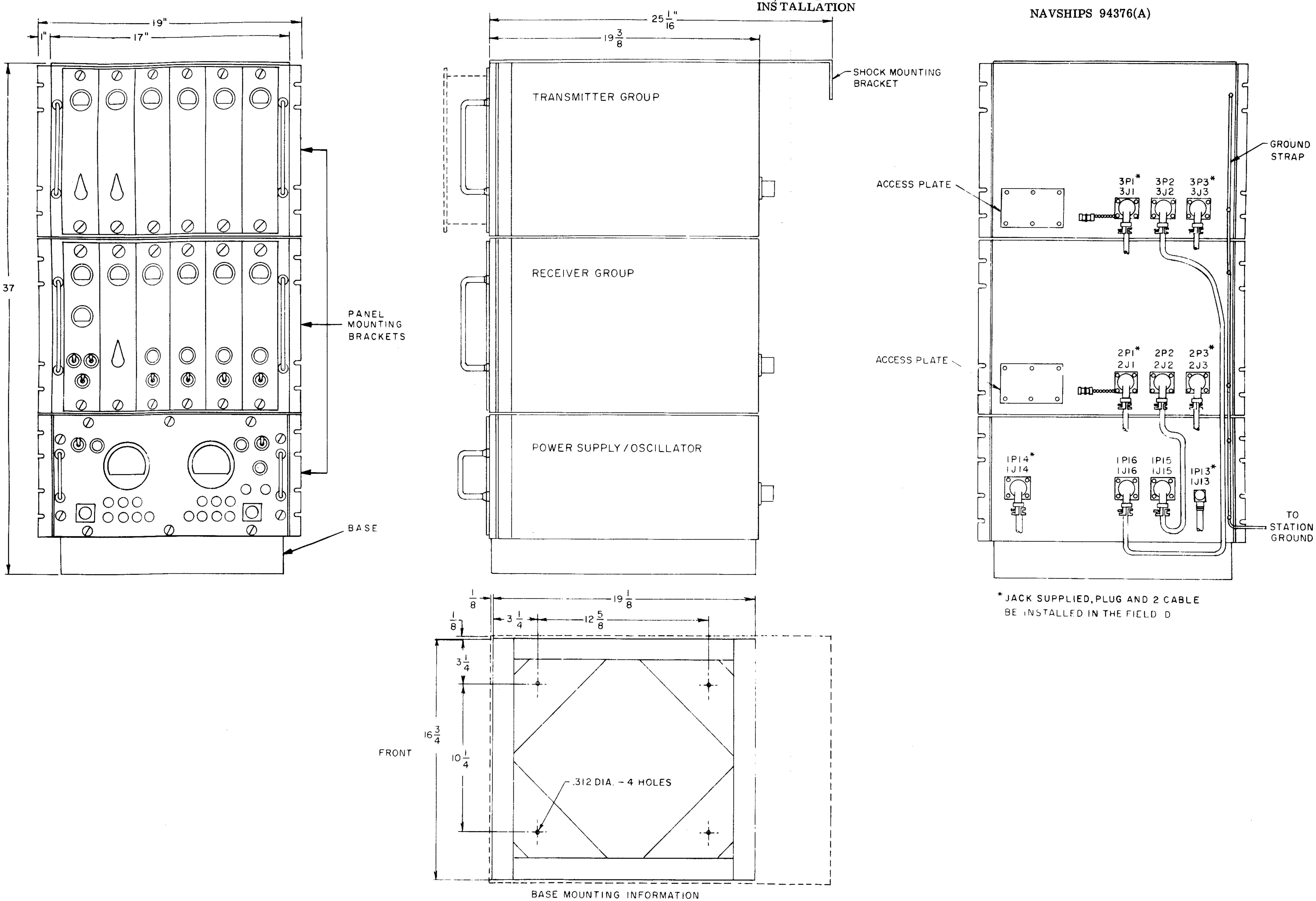


Figure 2-1. AN/UGC-1A, Assembly Drawing

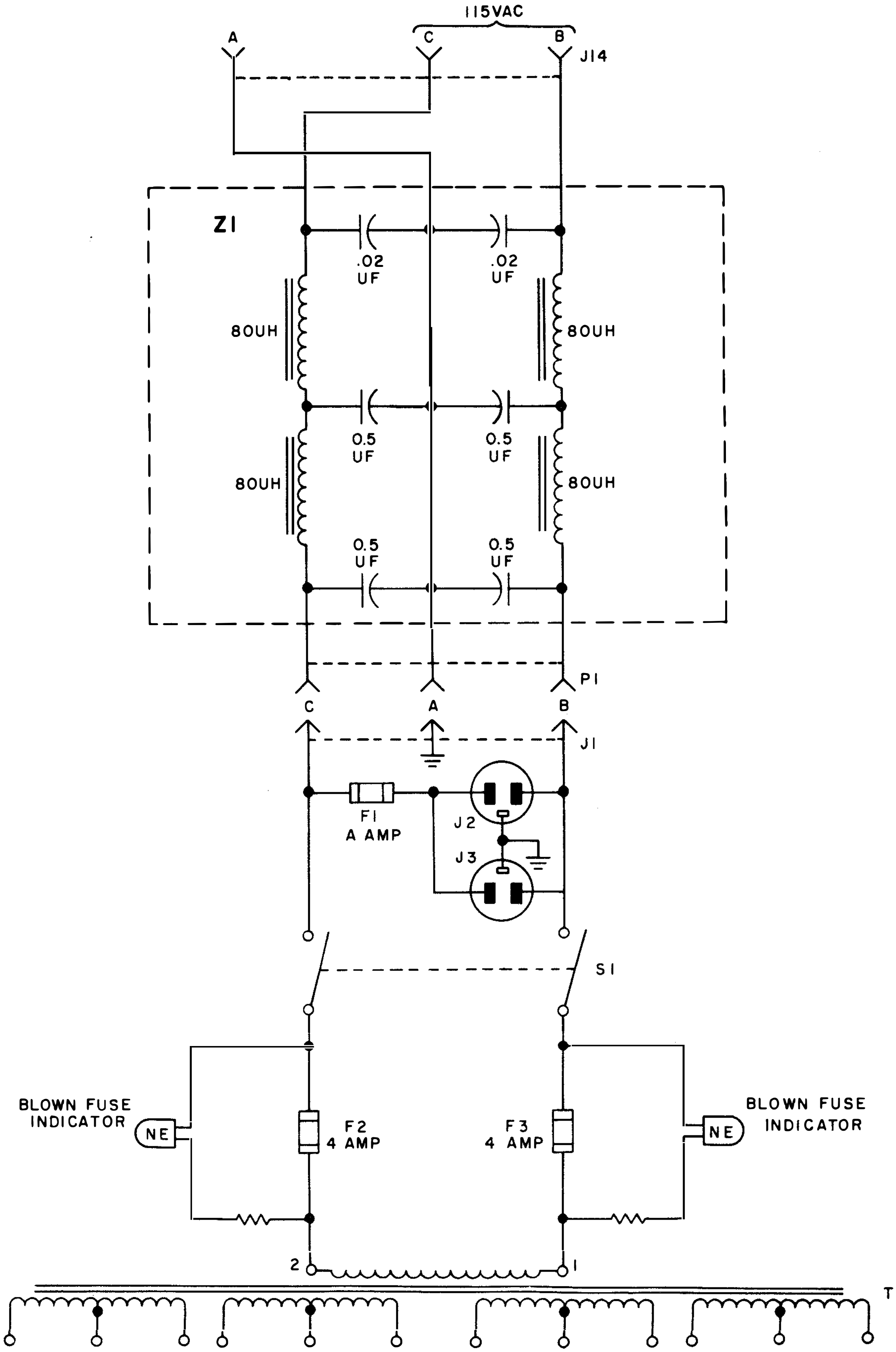


Figure 2-2. Primary Power Distribution

mounting holes in accordance with the dimensions shown on figure 2-1.

g. Fasten lower cabinet to the base using the 1/4 x 20-1/2 inch screws with the moisture sealing gasket. See figure 2-3.

h. Connect the power cables from the Oscillator Power Supply to the Transmitter and Receiver Groups as shown in figure 2-4. Connect the patch panel (TT-23/SG) in accordance with figure 2-4.

i. Connect an ac power cable (three wires) to the plug (1P14) that is furnished. Connect the input and output circuits (shielded pairs) to the Transmitter and Receiver Groups. The latter connection is made to terminal boards 2TB2, 2TB3, 3TB2, and 3TB3 when the access plates (101, 453) are removed. On installation where it is necessary to maintain a drip proof seal, the signal connections should be made to the AN-type connectors. See figures 2-4 or 2-1.

j. If auxiliary equipment is to be used in conjunction with the Multiplex Set, remove the dummy plugs from 2J1 and 3J1. Use plugs 2P1 and 3P1 for this purpose, and connect cables to plugs as shown in figure 2-4.

k. Make sure that power switch S1 on the Oscillator-Power Supply is in its OFF position. Connect the power cable plug 1P14 to 1J14. The equipment is now ready for operation.

2-5. ASSEMBLY OF MULTIPLEX SET IN A RELAY RACK (Navy Type CY597 A/G).

a. Attach the cabinet ear brackets (101, 377, and 101, 397) to the Transmitter Group Cabinet, Receiving Group Cabinet, and Oscillator Power Supply Cabinet.

b. Install the right and left brackets on the right and left vertical angles of the CY597 A/G cabinet. The angles are positioned approximately 15 inches to the rear of the front surface of the cabinet. The brackets should be mounted using the pretapped holes in the angles so that the rear of each cabinet rests on the brackets.

c. Fasten the cabinets in the rack using the mounting screws for the front ear brackets.

d. Connect the power, signal, and auxiliary circuits as described previously.

2-6. INSTALLATION REQUIREMENTS.

a. INSTALLATION POINTERS.

(1) Ground all shielded leads to the cabinet ground.

(2) Exercise care when the signal input and output leads are connected to their terminals so that the polarities shown in figure 2-4 are maintained.

b. OUTLINE DRAWINGS. - Refer to figures 2-2 and 2-1 to obtain the dimensional requirements for installation. Note that the Oscillator-Power Supply Group may be placed on the lower level when space limitations at the rear of the cabinet hinders a direct approach to the mounting screws.

c. LOCAL TEST. - If the Transmitter and Receiving Groups are installed at different locations it is recommended that the Oscillator-Power Supply circuits be used to connect them. The local multiplex signal is brought out to terminal No. 5 of 2TB3 and 3TB3, as well as pin L of 2J3 and 3J3. The groups are wired at the factory so that the local connection for the usual send-receive combination is made through the oscillator power supply by means of 2J2 and 3J2--pin L. If the Transmitter and Receiving Groups are separated, it is necessary to remove the brass strap between the upper and lower screw of No. 5 terminal on 2TB3 and 3TB3. Refer to figure 2-4.

d. INTERCONNECTION DIAGRAMS. - If the Transmitter and the Receiver Groups are to be installed at different locations it is required that the local multiplex circuits be used to connect them. The LOCAL multiplex signal is brought out to the Terminal Boards (2TB2 and 2TB3) on the rear of the Receiver Group and to the Terminal Boards (3TB2 and 3TB3) on the Transmitter Group. The Groups are factory wired so that the local multiplex circuits be used to connect them. The LOCAL multiplex signal is brought out to the Terminal Boards (2TB2 and 2TB3) on the rear of the Receiver Group and to the Terminal Boards (3TB2 and 3TB3) on the Transmitter Group. The Groups are factory wired so that the local connection for the usual send-receive combination is made through the Oscillator-Power Supply by means of the appropriate Connector (Refer to figure 2-4.) Note that in case the Groups are separated, it will be necessary to remove the jumper between terminals 7 of Terminal Board 2TB2 and Terminal Board 2TB3.

2-7. INSPECTION AND ADJUSTMENT.

a. The crystal oscillator for the desired speed of operation should be located in socket 1J8. The alternate oscillator should be in the reserve socket 1J7.

b. ENERGIZING THE EQUIPMENT.

(1) With the power switch OFF, pull the Oscillator-Power Supply out of its cabinet so that the control mounting bracket is accessible.

(2) Turn the power switch ON.

(3) With power applied, the dc voltmeter should be observed as the voltmeter selector switch (on the front panel) is rotated. The dc voltages furnished by

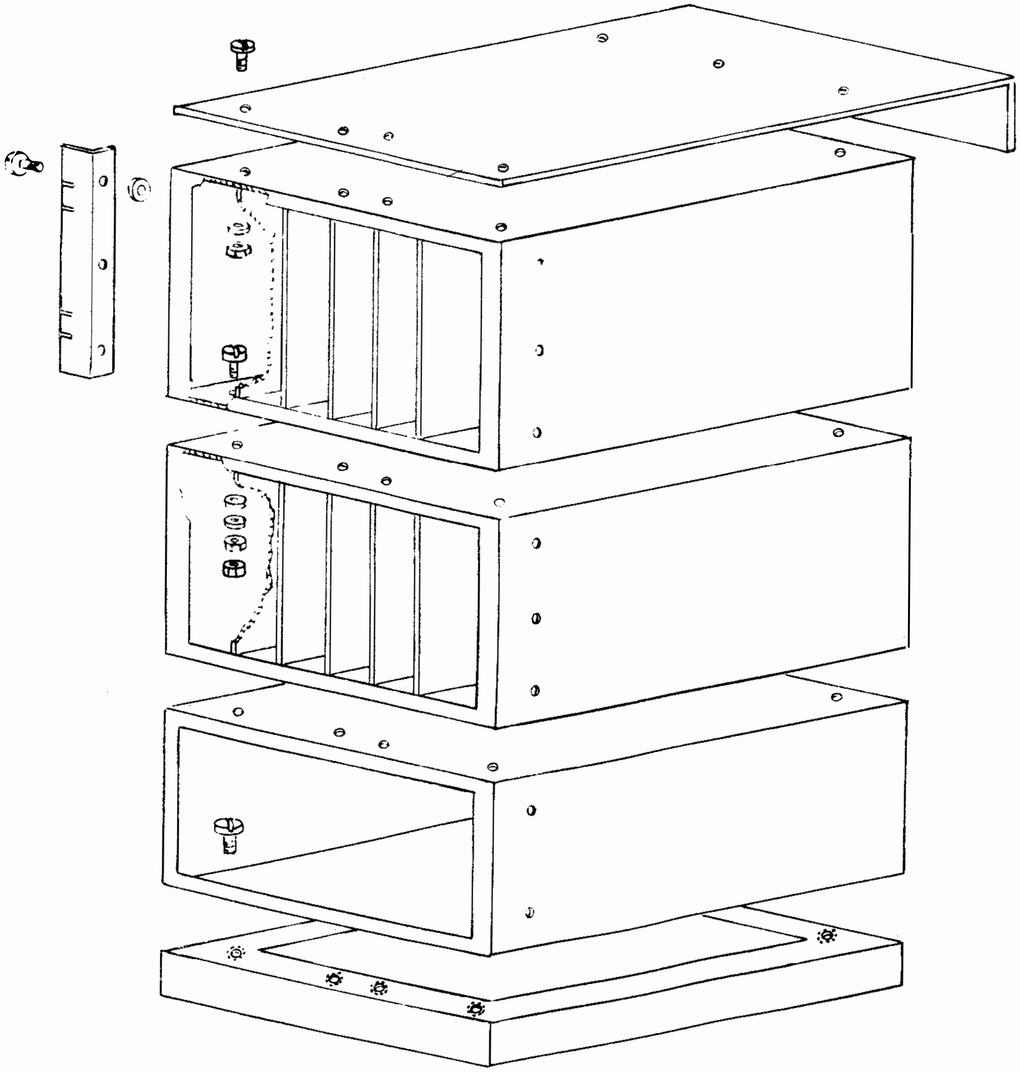


Figure 2-3. Cabinet Assembly

the Oscillator-Power Supply should fall within 5% of their nominal values. The rheostats on the control mounting bracket are factory-set and locked in position. They should not require adjustment this time.

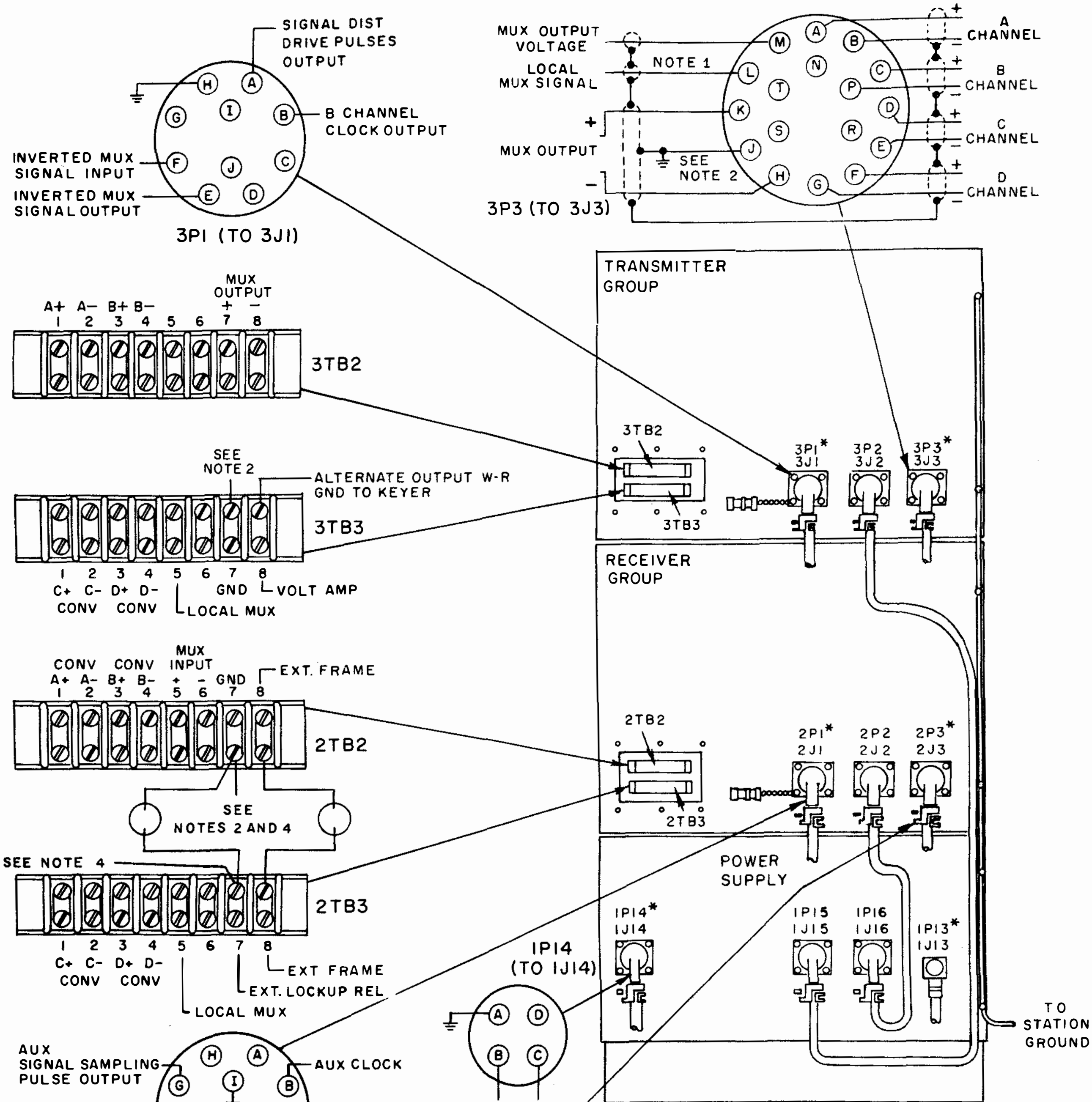
(4) The dc line currents are supplied by the external 130 volt supplies. Observe each code converter line current meter to see that it provides an indication. Set the local-remote switches in the Control-Amplifier and the Synch-Unit to LOCAL. Set the Control Amplifier switch on the output-meters on the Transmitter and Receiver Code Converters and the MUX LINE CURRENT meters on the Synch Unit and Control Amplifier drawers. If any of the signal lines were reversed during installation, the meters will be pegged to the left of zero and steps will have to be taken to correct the signal polarity.

(5) Note that the DISTRIBUTOR CYCLE meter on both Mux-Demux functions units for all settings of the CHANNELS switch on the front panel.

(6) Set both CHANNELS switches to the same number of channels. The equipment is now ready for operation with actual signals.

NOTE

When power switch is turned ON, allow approximately ten minutes for the oscillator to reach its operating temperature before the set is placed in service.



*JACK SUPPLIED, PLUG AND CABLE TO BE INSTALLED IN THE FIELD

NOTES:

(1) LOCAL MUX SIGNAL OUTPUT NEEDED ONLY WHEN TRANSMITTER AND RE - CEIVER GROUPS ARE SEPARATED AND BRASS LINKS ON TERM 5 OF 2TB3 AND 3TB3 ARE REMOVED.

(2) USE SHIELDED PAIRS FOR ALL CABLE RUNS TO TT-230/SG JUNCTION BOXES GROUND SHIELDS AT GROUND TERMINAL 7 ON 3TB3 AND 2TB2 OR PIN J OF 3P3 AND 2P3.

(3) EXTERNAL FRAMING SWITCH SHOULD BE LOCATED NEAR RECEIVING PRINTER AND LINE CURRENT METER MONITOR- ING "A" CHANNEL.

(4) REMOVE JUMPER BETWEEN 2TB3-7 AND 2TB2-7 IF EXTERNAL LOCKUP RELEASE CIRCUIT IS IN OPERATION

Figure 2-4. Installation Drawing

SECTION 3

OPERATOR'S SECTION

3-1. FUNCTIONAL OPERATION.

a. The Terminal, Telegraph AN/UGC-1A provides facilities at a given station for combining two, three, or four two-way start-stop circuits into common long-distance telegraph circuits through the use of time sharing principles. At the distant end of the telegraph loop circuit, a duplicate equipment performs the complementary multiplexing functions. The start-stop circuits of both terminals are made according to conventional practices, and may include any apparatus which utilizes the standard 7.42 unit start-stop code at the speed chosen for the system operation.

b. The function of the Transmitter Group OA-3445/UGC-1A is to accept start-stop signals, detect and store the intelligence contained in the code to a sequential pattern, channel by channel, thereby forming the multiplex signal. The signal is then amplified and dispatched to the transmitting facilities of the telegraph circuit.

c. The function of the Receiver Group OA-3444/USG-1A is to accept the multiplex signal as delivered by the receiving facilities of the telegraph circuit. The receiver group in turn detects and stores the intelligence contained in the code combinations, and distributes such information in start-stop form to the proper destination.

d. The equipment transmits and receives a special type of telegraph signal (multiplex) which is intelligible only to a similar set (AN/UGC-1) or to an AN/FGC-5 telegraph terminal set with which it is compatible. It should be noted that the latter unit operates only at speeds of 60 or 75 wpm.

3-2. PREPARATION FOR USE.

Since this equipment is a permanent installation no preparation for use is required by the operator other than setting up a monitor in certain installations. For this discussion, a typical installation consisting of the Transmitter Group, Receiver Group, and Oscillator-Power Supply is considered. However, other applications may group two Transmitter Groups in a relay rack powered by a common Oscillator-Power Supply and two Receiver Groups with a power supply located some distance from the transmitters. It may be necessary to provide some additional equipment to monitor the receivers.

3-3. OPERATING PROCEDURES.

a. DESCRIPTION OF CONTROLS. - The more frequently used controls of the Multiplex Set are located on the front panels of the various major units in the Transmitter and Receiver Groups and the Oscillator-Power Supply. These controls are marked (EXT) in Table 3-1 NORMAL OPERATING CONTROLS. Those located within the various drawers are marked (INT) in Table 3-1.

b. SEQUENCE OF OPERATIONS (see figures 3-1 and 3-2).

(1) Place the POWER switch, located on the Oscillator-Power Supply to the ON position. The green POWER indicator lamp should glow, the red MISFRAME lamps on the Receiver Code Converters should glow, the LINE CURRENT meters on the Receiver Code Converters should read 20/60 milliamperes, and the audible alarms in the Receiver Code Converters should be sounded. The two misframe indications will occur in the absence of traffic as well as for misframed traffic. The audible alarm may be interrupted by placing the audible ALARM switch in the BYPASSED position. The red bypass lamp will glow when the alarm circuit is disabled. However, when the equipment is operating on the line, the alarm switch should be placed in the AUDIBLE ALARM position which will allow the audio alarm to be activated when any traffic misframing occurs. It may be noted that the MISFRAME lamps will remain on until such time as an inframe traffic condition is obtained.

(2) Rotate the D.C. VOLTS switch located on the Oscillator-Power Supply through the seven indicated positions. Observe the VOLTS D.C. meter for the voltage readings corresponding to the switch positions. The absence of a voltmeter reading at any switch position may indicate a blown fuse. Replace the fuse with an appropriate spare. Should any voltage deviate more than 5% from normal, report the condition to a technician.

(3) Observe the illumination of the amber XTAL OVEN lamp. It should remain on for a period of 15 minutes or less following the first application of power, then cycle on and off at regular intervals. If lamp does not light, check the 12.6 VAC fuse. If lamp still does not light, report the condition to a technician. Continuous burning of the lamp should be reported to a technician.

(4) Observe the operation of the two Mux-Demux DISTRIBUTOR CYCLE meters. The meters on the Transmitter and Receiver Code Converters should be pulsing regularly.

c. PREPARING FOR OPERATION. - The following operations are to be performed when initially starting, and when preparing the equipment for application to telegraph circuits.

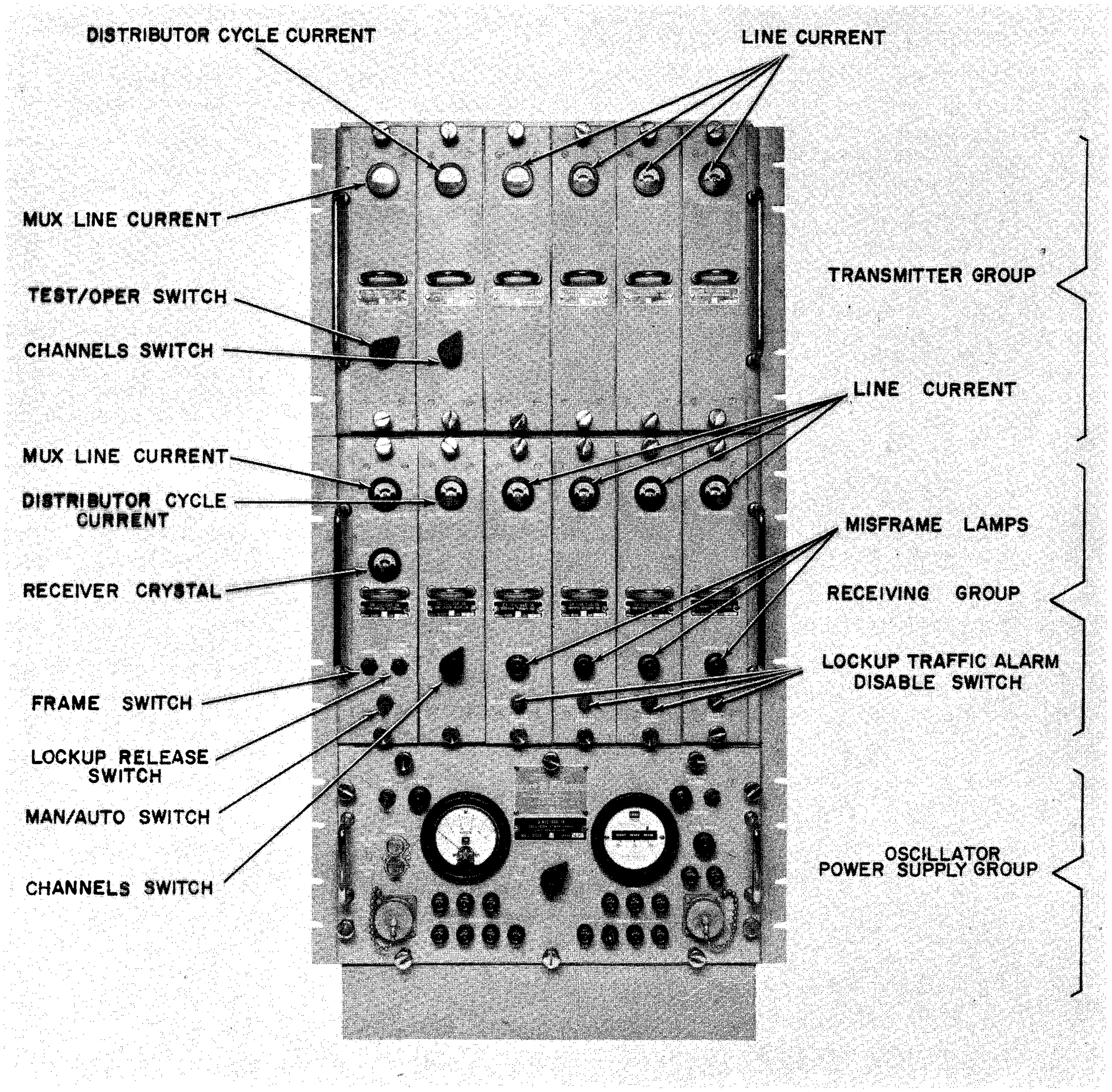


Figure 3-1. Multiplex Set, Controls and Indicators

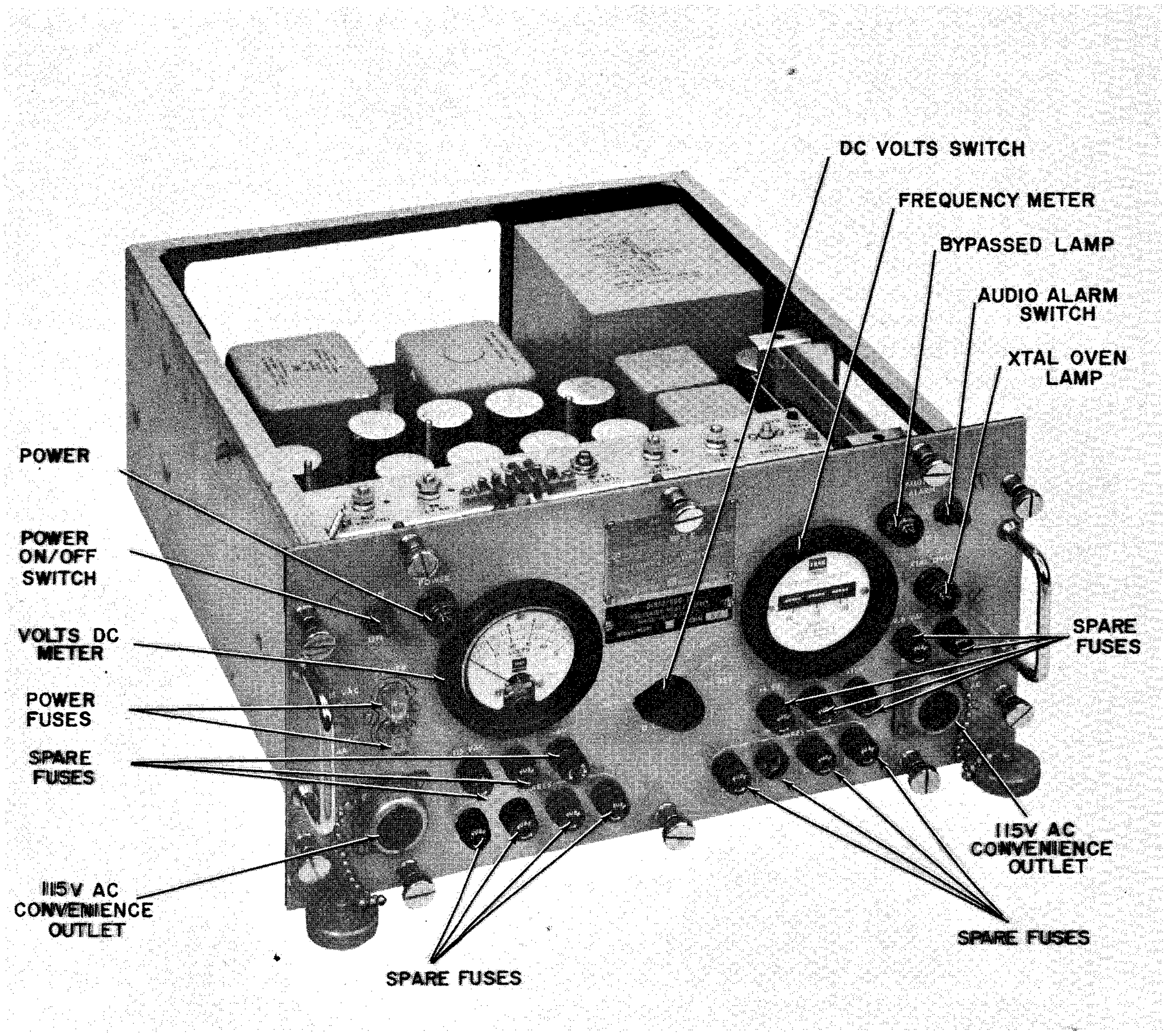


Figure 3-2. Multiplex Set, Controls and Indicators

TABLE 3-1. NORMAL OPERATING CONTROLS

UNIT	CONTROL	FUNCTION	REMARKS
Oscillator Power Supply	POWER Sw (EXT.)	Switches primary ac power input on or off.	
	ALARM Sw (EXT.)	Enables or disables audio mis-frame alarm.	
Transmitter Code Converter	DC-VOLTS Sw (EXT.)	Selects voltage input to voltage monitor meter.	
	WPM Sw (INT.)	Selects word-per-minute operating speed.	All four Transmitter Code Converters must have same switch setting.
Control Amplifier	TEST/OPER Sw (EXT.)	Provides 3 special multiplex outputs (for circuit test purposes) in addition to the regular multiplex signal.	
	LOCAL-REMOTE Sw (INT.)	Routes the multiplex signals to the remote or local circuits.	Receiver Mux-Demux
Mux-Demux	CHANNELS Sw (EXT.)	Determine the number (2, 3, 4) of multiplex channels which are in use.	
	WPM Sw (INT.)	Same as Transmitter Code Converter WPM switch.	Must be in agreement with the group code converter settings.
	NORMAL-INVERTED Sw (INT.)	Reverses polarity of multiplex signal applied to the matrix inputs at the receiver terminal.	Switch is bypassed in the Transmitter Group.
	NORMAL-AUX Sw (INT.)	Applies signal sampling pulses to sync amplifier and aux equipment.	When equipment is used in conjunction with aux equipment, switch is in AUX. Otherwise in NORMAL. When Multiplex Set is not used with external equipment, plugs 3P1 and 2P1 located on rear of cabinet must be in place.
	MAN AUTO Sw (EXT.)	Determines whether pulses are fed automatically to the framing circuit or individually.	
	FRAME Sw (EXT.)	Passes framing pulses for achieving a proper phase relationship between transmitting and receiving terminals.	
Synch Unit	LOCK-UP RELEASE	Releases locked output loops	

TABLE 3-1 (CONT'D)

UNIT	CONTROL	FUNCTION	REMARKS
Synch Unit (cont'd)	Sw (EXT.)	during the reframing process. When an inframe condition is established, this switch must be depressed to deenergize the lockup circuit.	
	LOCAL REMOTE Sw (INT.)	Determines which input circuit (local or remote) will be applied to the receiving terminal.	
Receiver Code Converter	LOCKUP-TRAFFIC ALARM DISABLE Sw (EXT.)	Provides a manual lockup of the channel (LOCKUP), provides normal operation (TRAFFIC) and deactivates the alarm circuit (ALARM DISABLE).	In the ALARM DISABLE position, the output loop is also locked in Marking configuration.
	WPM Sw (INT.)	Same as Transmitter Code Converter WPM switch.	Must be in agreement with the demultiplexer in the Receiver Mux-Demux Also all four Receiver Code Converters must have the same switch setting.

TABLE 3-2. POSITIONS OF OPERATING CONTROLS WHEN AN/UGC-1 IS OPERATED WITH THE TSEC/KW-22 AUXILIARY EQUIP.

UNIT	CONTROL	POSITION FOR OPERATION	REMARKS
Transmitter Code Converter	2P1	Remove shorting plug - insert 2P1 in 2J1.	Connect 2P1 cable (not supplied) to TRANS portion of /KW-22.
Receiver Group	3P1	Remove shorting plug - insert 3P1 in 3J1.	Connect 3P1 cable (not supplied) to REC portion of /KW-22.
Mux-Demux	AUX-NORMAL (INT.)	AUX	All other controls set as shown in Table 3-1.

(1) Place the CHANNELS selector switch on each Mux-Demux drawer to the number of channels to be used (2, 3, or 4). The DISTRIBUTOR CYCLE meter should continue to pulse at a constant rate.

(2) Place the LOCAL-REMOTE switch in the Control Amplifier(figure 3-1 to the REMOTE position.

(3) Place the LOCAL-REMOTE switch in the Synch Unit (figure 3-1) to the REMOTE position.

(4) Place the TEST/OPER switch located on the Control Amplifier unit to the M (constant mark) position and observe the mux line current meter. The meter should read 60 to 65 ma (unless operated on 20 ma.) Place the switch to the S (constant space) position. The meter should read zero. Place the switch to the AC (alternating mark and space) position. The meter should read 1/2 mark value. Should the meter be pinned to the left on any channel, the input line current is improperly polarized and must be reversed. This condition, as well as high or low current readings on any channel, should be reported to a technician.

(5) Place the TEST/OPER switch to the MUX position. The equipment may now be operated in conjunction with a distant terminal.

d. MULTIPLEX TELEGRAPH CIRCUIT OPERATION.

(1) For initial lineup purposes, it is desirable that voice or telegraph contact be made between distant terminals on separate facilities from those being used by the Multiplex Set, however, this is not absolutely necessary.

(2) If voice or telegraph contact can be made, the transmitting terminal should be requested to send a constant mark signal. The multiplex line current meter located on the Synch Unit should read 60 to 65 ma, as in paragraph c. (4). Although a constant mark is being received, the output start-stop devices will be inactive since the equipment is still in an out-of-frame condition.

(3) The transmitting facility should be requested to transmit a multiplex signal with an idle pattem for channel A. The multiplex line current meter should now pulse irregularly.

(4) Observe the RECEIVER CRYSTAL meter on the Synch Unit (figure 3-1). Initially , the meter should deflect full scale to FAST or SLOW, followed by a series of needle kicks. When the kicks cease, the equipment should be synchronized. Additional kicks should be observed on either the FAST or SLOW side of the meter, but at a much reduced rate. Each kick indicates the addition or subtraction of a pulse to the crystal oscillator drive at the receiver terminals.

(5) Check the position of the various controls as shown in Table 3-1.

(6) If a multiplex signal is being generated at the transmitting terminals, traffic on channel B, and channel A is idle, the MAN/AUTO switch should be placed to the AUTO position. The FRAME switch should then be depressed until the equipment is in proper frame. By observing the misframe lamps, it is possible to ascertain an "in-frame" condition. These lamps will go out when the FRAME switch is depressed, but will relight if the equipment is still out-of-frame. When these lamps remain off, the alarm switch on the power supply should be placed to the AUDIBLE ALARM position. The associated bypass lamp should go out. If difficulty is experienced in framing the receiving group, place the signal polarity switch located in the Mux-Demux (see figure 3-1) to the Mux-Demux INVERTED position. If the equipment can now be framed, signals to the receiver are inverted.

(7) It is not always practical to establish parallel voice or telegraph facilities, in which case the receiving terminal must be framed when traffic may be present on channel A. If this is the case, throw the MAN/AUTO switch to the MAN position. Depress the FRAME switch as many times as required to obtain the "in-frame" condition mentioned above.

(8) When the "in-frame" condition is obtained, depress the LOCKUP RELEASE switch. The LINE CURRENT meters on the Receiver Code Converters which have traffic should pulse and legible copy should appear on the appropriate start-stop equipments.

TABLE 3-3. TERMINAL TELEGRAPH AN/UGC-1A NORMAL INDICATIONS

TRANSMITTER GROUP	Normal Current
MUX LINE CURRENT	20.0 to 60.0 ma (operator's choice)
DISTRIBUTOR CYCLE	25.0 ma
LINE CURRENT	20.0 to 60.0 ma
SWITCH POSITIONS	
TEST/OPER.	MUX
CHANNEL	2-3- or 4
RECEIVER GROUP	
MUX LINE CURRENT	20.0 to 60.0 (Operator's choice)
RECEIVER CYSTAL	0.0 ma (In phase condition)
DISTRIBUTOR CYCLE	25.0 ma
LINE CURRENT	20.0 ma to 60.0 ma

TABLE 3-3 (CONT'D)

SWITCH POSITIONS	
FRAME	Normally Open (Momentary Hold)
LOCK UP	Normally Closed (Momentary Hold)
MAN/AUTO	AUTO
CHANNEL	2-3- or 4
CONVERTER LOCK UP	TRAFFIC (Four Drawers Identical)
INDICATOR LAMPS LIGHTED ONLY IN MISFRAME CONDITION	
OSCILLATOR-POWER SUPPLY	
POWER-ON	
VOLTMETER SELECTOR SWITCH	Operator selects
XTAL OVEN-INDICATOR LAMP	ON intermittantly
BYPASS ALARM	Operator selects

e. TUNING ADJUSTMENTS.

(1) WORDS PER MINUTE. -The equipment is set up initially to operate with associated 60 word-per-minute terminal equipment. A change in operation speed involves a gear change of all readers and printers associated with the Multiplex Set. Speeds of operation should be set or changed using the following procedure:

(a) Select the proper crystal oscillator unit located in the Oscillator Power Supply (1A1Z1 for 60-75 wpm, 1A1Z2 for 100 wpm) and insert in the Oscillator Power Supply. Place the oscillator unit not in use in the reserve socket.

(b) Set the WPM switch (S1) located in both Mux-Demux drawers to the proper speed.

(c) Set the WPM switch (S1) located in the four Transmitter Code Converters to the proper speed.

(d) Set the WPM switch (S1) located in the four Receiver Code Converters to the proper speed.

(e) Adjust the start-stop oscillator frequency in the Transmitter and Receiver Code Converters as outlined in Section 5. This adjustment is made by a technician.

(2) LINE CURRENTS. -The start-stop input, multiplex output, multiplex input, and start-stop output line currents must be adjusted prior to achieving operation. A rheostat is supplied in the set for fine adjustment of line current at each of the input and output circuits. Coarse adjustment may be made by subtracting or adding resistances externally. Each of the circuits is adjusted as indicated below:

(a) INPUT START-STOP CIRCUIT. - The line current requirements are dependent upon the associated external equipment. Connect the appropriate terminals on 3TB2 of the Transmitter Code Converters and electrical Synch Unit for either 20 or 60 milliampere requirements as described in Section 5. Then while receiving a steady mark, adjust the line current on each of the four input lines by means of the LINE CURRENT potentiometer (R1) located in the Transmitter Code Converters. (figure 3-1) Should the line current meters read in the reverse direction, the battery is improperly polarized and must be reversed.

(b) OUTPUT MULTIPLEX CIRCUIT. -While receiving a steady mark, adjust the multiplex output line current by means of the LINE CURRENT potentiometer located in the Control Amplifier. (figure 3-1).

(c) INPUT MULTIPLEX CIRCUIT. -While receiving a steady mark, adjust the multiplex line current by means of the LINE CURRENT potentiometer (R2) located in the electrical Synch Unit.

(d) OUTPUT START-STOP CIRCUIT. -While receiving a steady mark, adjust the line current in each of the four output lines by means of the LINE CURRENT potentiometer (R4) located in the Receiver Code Converters.

TABLE 3-4. MULTIPLEX OPERATING SPEEDS

Words/Min	Operations Per Minute	Dot Cycles Per Sec. 4 Chan.	3 Chan.	2 Chan.	Pulse Duration (Millisec.) 4 Chan.	3 Chan.	2 Chan.
60	375	75	56.25	37.5	6.66	8.9	13.33
75	468	93.75	70.31	46.88	5.34	7.11	10.68
100	611.413	122.26	91.70	61.13	4.09	5.45	8.18

3-4. SUMMARY OF OPERATING PROCEDURES.

a. A complete Summary of Operating Procedures is presented in Table 3-5, enabling the operator to start check and adjust the equipment and to shutdown the equipment.

TABLE 3-5. SUMMARY OF OPERATING PROCEDURES

Step	Procedure	Remarks
1.	Power Switch ON (Power Supply Drawer)	Located in power supply.
2.	Rotate DC VOLTS switch to all positions (Power Supply Drawer.)	Observe all voltages present.
3.	Observe XTAL OVEN Indicator Lamp on (Power Supply Drawer.)	Must cycle after 15 minutes warmup.
4.	Observe operation of Mux-Demux meters	Must pulse regularly.
5.	Place CHANNEL Selector switch on each Oscillator-Power Supply Drawer to number of channels to be used (2-3-4)	Cycle meter pulses.
6.	Place LOCAL-REMOTE switch in Control Amplifier to REMOTE.	
7.	Place LOCAL-REMOTE switch of Synch Unit to REMOTE.	Read 60-65 ma on front panel meter.
8.	a. Place TEST-OPERATE Switch on Control Amplifier to M (Mark).	Read 30-32 ma on front panel meter.
	b. Place Switch to S (Space.)	Read 0 current on front panel meter.
	c. Place TEST/OPERATE SWITCH to MUX.	Equipment is now ready to operate.
9.	Power Switch OFF.	Equipment is shutdown.

3-5. EMERGENCY OPERATION.

The Terminal, Telegraph AN/UGC-1A is not designed for emergency operation.

3-6. OPERATOR'S MAINTENANCE.

a. OPERATING CHECKS AND ADJUSTMENTS.

Prior to and during operation, observe the Multiplex Set for visual signs of malfunction in either the Multiplex Set or the Receiver Group. Consult Table 3-3 for NORMAL INDICATIONS. Periodically, for circuit lineup or maintenance purposes, apply the signals from the local Transmitter Group or the Local Receiver Group. This mode of operation is to be originated by a serviceman or an experienced operator.

b. In this mode of operation, the text messages transmitted by the local Transmitter Group will be recorded by the telegraph equipment of the local Receiver Group.

c. The local message center using the channels of the multiplex system should be notified whenever a local test is conducted. In this manner, traffic from the local message center will not be lost. The following procedure should be used to place the equipment in local test.

(1) Place the LOCAL REMOTE switch S2 in the Control Amplifier to the LOCAL position. Place the LOCAL REMOTE switch S3 in the Synch Unit to the LOCAL position.

(2) Check the position of the various controls as shown in Table 3-1.

(3) If a multiplex signal is being generated at the transmitting terminals , traffic on channel B, and channel A is idle, the MAN/AUTO switch should be placed to the AUTO position. The FRAME switch should then be depressed until the equipment is in proper frame. By observing the mis-frame lamps, it is possible to ascertain an "in-frame" condition. These lamps will extinguish when the FRAME switch is depressed, but will illuminate if the equipment is still out-of-frame. When these lamps remain off, the alarm switch on the Oscillator Power Supply should be placed to the AUDIBLE ALARM position. The associated bypass lamp should go out. If difficulty is experienced in framing the Receiving Group, place the signal polarity switch located in the Mux-Demux (figure 3-1) to the INVERTED position. If the equipment can now be framed, signals to the receiver are inverted.

(4) It is not always practical to establish parallel voice or telegraph facilities, in which case the receiving terminal must be framed when traffic may be present on channel A. If this is the case, throw the MAN/AUTO switch to the MAN position. Depress the FRAME switch as many times as required to obtain the "in-frame" condition mentioned in paragraph above.

d. PREVENTIVE MAINTENANCE.-The Multiplex Set maintenance is accomplished by the equipment technician as described in Section 5 of this manual. Emergency maintenance by the Operator is limited to the replacement of fuses as described in the following paragraph .

e. EMERGENCY MAINTENANCE.-Emergency maintenance by operating personnel is limited to the replacement of defective fuses. These fuses are located on the front panel of the Oscillator-Power Supply and in each of the companion drawers. REPLACE DEFECTIVE FUSES WITH THE EXACT TYPE AND SIZE. Fuse failure will be indicated by:

(1) No LINE CURRENT in active channel;

(2) No VOLTS DC in one or more meter positions (Selector Switch, Oscillator Power Supply Drawer);

(3) In case of any visual or aural alarm, operating circuit may indicate defective fuse.

SECTION 4

TROUBLESHOOTING

4-1. LOGICAL TROUBLE SHOOTING.

a. SYMPTOM RECOGNITION. -This is the first step in the trouble shooting procedure and is based on a complete knowledge and understanding of equipment operating characteristics. All equipment troubles are not the direct result of component failure. Therefore, a trouble in an equipment is not always easy to recognize since all conditions of less than peak performance are not always apparent. This type of equipment trouble is usually discovered while accomplishing preventive maintenance procedures, such as the POMSEE checks. It is important that the "not so apparent" troubles, as well as the apparent troubles, be recognized.

b. SYMPTOM ELABORATION. -After an equipment trouble has been "recognized," all available aids designed into the equipment should be used to further elaborate on the original trouble symptom. Use of front panel controls and other built-in indicating or testing aids should provide better identification of the original trouble symptom. Also, checking or otherwise manipulating the operating controls may eliminate the trouble.

c. LISTING PROBABLE FAULTY FUNCTION. - The next step in logical trouble shooting is to formulate a number of "logical choices" as to the cause and likely location (functional section) of the trouble. The "logical choices" are mental decisions which are based on knowledge of the equipment operation, a full identification of the trouble symptom, and information contained in this manual. The over-all functional description and its associated block diagram should be referred to when selecting possible faulty functional sections.

d. LOCALIZING THE FAULTY FUNCTION. - For the greatest efficiency in localizing trouble, the functional sections which have been selected by the "logical choice" method should be tested in the order that will require the least time. This requires a mental selection to determine which section to test first. The selection should be based on the validity of the "logical choice" and the difficulties in making the necessary tests. If the tests do not prove that functional section to be at fault, the next selection should be tested, and so on until the faulty functional section is located. As aids in this process the manual contains a functional description and a servicing block diagram for each functional section. Waveforms (or other pertinent indications) are included at significant check points on servicing block diagrams to aid in isolating the faulty section. Also, test data (such as information on control settings, critical adjustments, and required test equipment) is supplied to augment the functional description and servicing block diagram for each functional section.

e. LOCALIZING TROUBLE TO THE CIRCUIT. - After the faulty functional section has been isolated, it is necessary to make additional "logical choices" as to which group of circuits or circuit (within the functional section) is at fault. Servicing block diagrams for each functional section and individual functional circuit groups (when required) provide the signal flow and test location information needed to bracket and then isolate the faulty circuit. Functional descriptions; simplified schematics, and pertinent test data for individual circuits or groups of circuits comprising the functional section are all placed together in one area of the manual. Insofar as practicable, this information is contained on facing pages. Information which is too lengthy in nature to be included in this arrangement is readily referenced from the test data portion of the trouble shooting information.

f. FAILURE ANALYSIS. -After the trouble (faulty part, misalignment, etc.) has been located (but prior to performing corrective action), the procedures followed up to this point should be reviewed to determine exactly why the fault affected the equipment in the manner it did. This review is necessary to make certain that the fault discovered is actually the cause of the malfunction, and not just the result of the malfunction.

4-2. OVER-ALL FUNCTIONAL DESCRIPTION, AN/UGC-1A.

a. This section explains the operation of the Telegraph Terminal AN/UGC-1A. The set provides terminal facilities for a multiplex system which will simultaneously transmit two, three or four separate teletypewriter messages over a common channel.

b. Multiplexing can be accomplished in several different ways. Frequency-division multiplexing, for example, employs a number of tone channels slightly displaced in frequency. Each tone channel carries the signals from a separate teletypewriter circuit and modulates a common frequency carrier. Time division multiplexing, on the other hand, divides the time duration of a standard start-stop signal into a number of equal intervals and allots each interval to a separate teletypewriter circuit. Thus, the start-stop signals are, in effect, compressed in time for transmission. The set covered in this manual is designed to operate in a time-division system.

4-3. OVER-ALL OPERATION.

(See figure 4-28, page 4-70.)

a. Figure 4-28 is a simplified block diagram of a typical time-division multiplex system employing a multiplex set. Ac and dc voltages for the major units are provided by the Oscillator-Power Supply 0-872/UGC-1A which is not shown in figure 4-28.

b. At the transmitting station, four start-stop transmitters (not furnished with the set) simultaneously send four messages in the form of start-stop signals to respective transmitting Converter, Telegraph Code CV-1217/UGC-1A in the Transmitter Group 0A-3445/UGC-1A. The Transmitter Code Converters translate these signals, which are in sequential form, into six-wire parallel form. The start and stop elements of the signals are discarded and a sixth element is added. The Demultiplexer-Multiplexer TD-515/UGC-1A sweeps over the outputs of the Transmitter Code Converters, channel by channel, and picks up, in turn, a complete signal (character) from each converter at the multiplex frequency rate. This rate is controlled by a crystal-oscillator circuit.

Pulses generated by this circuit and various dividing circuits step the Mux-Demux at the proper rate. By varying the pulse-division ration, the equipment may be switched to operate with two-three or four start-stop circuits (referred to as channels A, B, C, and D), or to accommodate start-stop speeds of 60, 75, or 100 words per minute. The Mux-Demux combines the multiwire signals received from the Transmitter Code Converters into multiplex signals and sends them to the Control Amplifier. The latter amplifies the signals and furnishes them to transmitting equipment which is not furnished with the set. The outputs of the Control Amplifiers may be either keyed voltage or 60 milliampere dc multiplex signals. The transmitting equipment applies the multiplex signals to the radio channel which carries them to a distant station. As indicated in figure 4-28, the multiplex signals contain certain inversions which are explained later in this section.

c. At the receiving station, the multiplex signals are accepted by receiving equipment (not furnished) and sent to the Synchronizer, Electrical SN-313/UGC-1A. The Sync Unit amplifies the signals and sends inverted and normal versions to the Demultiplexer-Multiplexer TD-515/UGC-1A. The latter performs functions complementary to the multiplexing in the transmitting group. It separates the multiplex signals into six-wire parallel signals, and as it sweeps over the input wiring of the receiving Converter, Telegraph Code CV-1218/UGC-1A it applies, channel by channel, the proper Receiver Code Converters. The converters examine these signals and, provided true character transmission has been recognized, begin the process of regenerating the start-stop signals. The sixth pulse of the parallel signals, which is used only to recognize the presence of bona fide blank transmission, is dropped. The start and stop elements are added, and start-stop signals are sent at the proper speed to the four printers (not furnished) respectively. The printers simultaneously record the four messages which were originated at the transmitting station.

d. The frequency standard of the Receiver Group performs a function identical to that in the Transmitting Group. However, to maintain synchronism in the system, the local standard's drive must be modified by a circuit in the Synch Unit which operates on a digital basis. By noting the time location of the space-to-mark transitions of the incoming multiplex signals, the circuit establishes the exact phase relationship between these signals and the multiplex drive. The Synch Unit then adds or subtracts drive pulses in individual steps until a proper phase-time relationship is achieved. Since the original frequency remains fixed, a single crystal oscillator may be used to drive both the transmitting and receiving groups at a given location.

e. In addition to the fact that synchronism must be maintained, the Receiver Group must initially be placed in the proper channel register with relation to the Transmitter Group (referred to as "framing"). That is, the proper signal must be routed to the proper channels by the Mus-Demux. The operation of a framing button causes a train of framing pulses to be generated. These pulses advance the Mux-Demux selection by integral signal pulses. When the proper channels come into register, the framing pulses are automatically stopped.

f. The Receiver Code Converters contain circuits which detect misframe conditions. A misframe condition exists when signals are not routed to the proper channels. Upon misframe detection, an audio and visual misframe alarm occurs and all four output lines are locked up in a marking configuration.

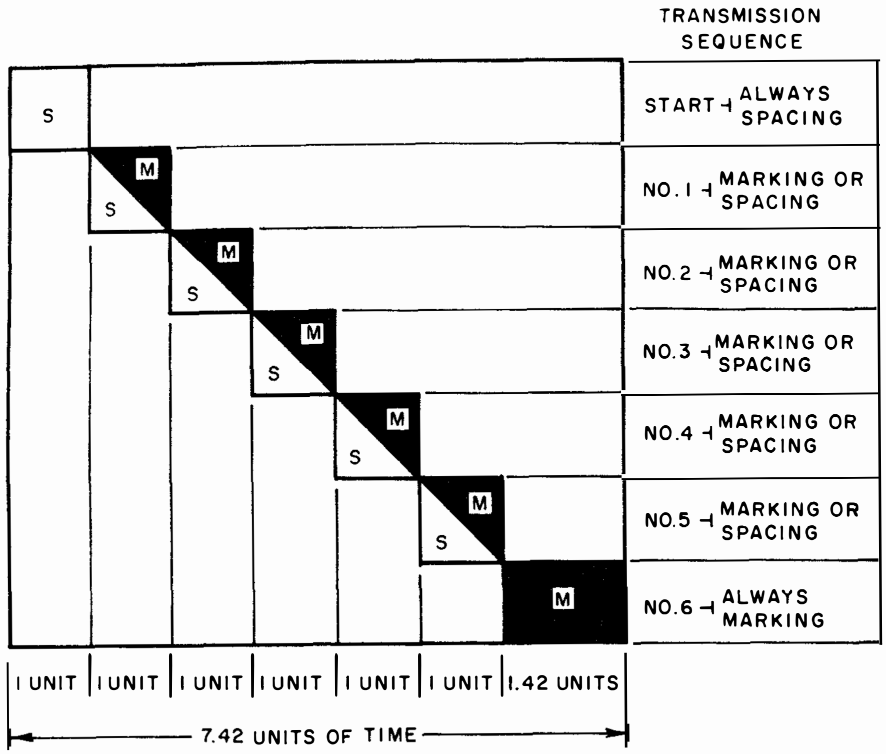
4-4. SIGNALING.

a. START-STOP SIGNALS.

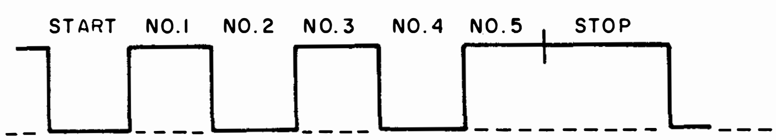
(1) Standard teletypewriter equipment transmits messages in the form of a five-unit, start-stop signaling code in which each character or function is represented by a sequential combination of current and no-current time intervals. Intervals during which current flows in the signal circuit are referred to as marking elements, and during which no current flows as spacing elements. Every combination includes five elements that carry the intelligence, each of which may be either marking or spacing, as illustrated in figure 4-1. The intelligence elements are preceded by a start element (always spacing) and are followed by a stop element (always marking) which is 1.42 times as long as each of the other elements. Thus, each combination consists of 7.42 units of time (referred to as 7.42 unit transmission pattern). The start and stop elements ensure synchronism between the transmitting and receiving equipment by bringing the receiving equipment to a complete stop at the end of each combination. The letter "Y", plotted in figure 4-1, is usually used for testing and illustration purposes because it has alternate intelligence elements.

(2) The total number of permutations of a

A. SIGNALING CODE



B. GRAPHIC REPRESENTATION OF LETTER "Y"



FIGURES	-	?	:	$	3	!	&	#	8	'	(	)	.	,	9	0	1	4	🔔	5	7	;	2	/	6	"	§	<	≡	■	↓	↑
LETTERS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	BLANK	CR	LF	SPACE	LTR	FIG
FEED HOLES 1	O	O		O	O	O				O	O						O		O		O		O	O	O	O					O	O
2	O		O				O		O	O	O	O				O	O	O			O	O	O						O		O	O
(feed)	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
3			O			O		O	O		O		O	O		O	O		O		O	O		O	O					O	O	
4		O	O	O		O	O			O	O		O	O	O			O				O		O				O			O	O
5		O					O	O				O	O		O	O	O			O		O	O	O	O	O					O	O

C. CODE HOLE COMBINATIONS OF TYPICAL CHARACTER ARRANGEMENT

Figure 4-1. Start-Stop Signaling Code

five-unit code is two to the fifth power, or 32. In order to transmit more than 32 characters and functions, a letters-figures shift operation is designed into printing equipment. Thus each permutation, excluding those used to shift and unshift the apparatus, may represent two characters or functions.

(3) Only the intelligence elements of the code appear in perforated tape. The start and stop elements are added by the transmitting equipment. The marking pulses are represented by holes and the spacing pulses by the absence of holes. The various code combinations of a typical character arrangement as they appear in chadless tape form is shown in figure 4-1.

b. MULTIPLEX SIGNALS.

(1) Consideration of the concept of time-division multiplexing will reveal several important consequences:

(a) The original start-stop signal must be compressed (figure 4-2).

(b) The outputs of the channels (referred to as A, B, C, and D) must be transmitted in the proper sequence (in this case ABCDABCDAB--).

(c) Both transmitting and receiving equipment must be running in synchronism within very close limits.

(2) In conventional teletypewriter systems, the essential synchronization between the transmitting and receiving equipments is accomplished on a character-by-character basis with the start pulse synchronizing the start of all receiving equipments and the stop pulse providing an idle time interval so that all units can start together on the next start pulse. On the other hand, the time-division multiplex system covered here is a fully synchronous system. The receiving terminal is maintained in step with the transmitting terminal in both frequency and phase. Frequency is maintained by a very accurate standard which is derived from a temperature-controlled crystal oscillator. Phase relationships are maintained by special circuitry in the receiving equipment. There is no need to transmit a start pulse or a stop pulse as part of the multiplex signal. Consequently, only the five intelligence elements of the start-stop signal are used, and a sixth pulse, whose function will be described later, is added.

(3) In order to provide for speed and phase differences in start-stop systems, the receiving unit always runs slightly faster than the transmitting unit. This speed difference is not cumulative because the stop pulse and the next start pulse permit synchronizing on every character. On the other hand, although the multiplex transmitting equipment operates faster than the start-stop input equipment, there is a constantly sliding, or varying, phase relationship between the start-stop and the multiplex signal with the multiplex signal continuously gaining on the start-stop signal. When the multiplex signal has moved so far ahead that the next start-stop signal cannot be transmitted, the system transmits an idle signal for that channel. The following multiplex signal will then carry the start-stop signal which could not be transmitted previously.

(4) The multiplex equipment must be capable of distinguishing between an all-spacing combination in the start-stop code (blank) and a multiplex idle signal. The start-stop blank is a true character which must be transmitted, while the multiplex idle signal signifies the absence of a start-stop signal. The multiplex equipment utilizes a sixth pulse to make this distinction. The sixth pulse is transmitted along with each character. When a bona fide blank is to be transmitted, the sixth pulse is the only pulse sent in that particular channel. During idle periods, or the speed difference delay period, no sixth pulse is sent, consequently the receiving multiplex recognizes the idle condition and an idle signal (continuous marking for the period of the signal) is sent to the receiving teletypewriter.

(5) Since timing is a basic concept in understanding multiplex transmission, it is worthwhile to consider some actual examples of the periods involved. At 60 wpm, a start-stop character is nominally 163 milliseconds long. A multiplex signal is slightly shorter (thus faster), nominally 160 milliseconds. Thus a time difference of three milliseconds exists for every start-stop character coming in. After 53 characters the accumulated time difference is 159 milliseconds and the next multiplex signal to be transmitted will be the time differential blank. Thus, one time differential blank will be transmitted for every 53 (approximately) start-stop characters transmitted. Minute speed variations may affect this figure slightly.

(6) Since four characters (one from each of the four channels) are transmitted in sequence as a multiplex signal in 160 milliseconds, each character must be "compressed" to a 40 millisecond signal. This 40 Millisecond signal must include the five intelligence pulses plus the sixth pulse (figure 4-2). Consequently, each mark or space in the multiplex signal is one-sixth of 40 milliseconds or 6.66 milliseconds long.

(7) As mentioned above, the receiving equipment must remain in synchronism with the transmitting equipment within rather close limits. For example, at the time the number 1 pulse on Channel A is transmitted, the receiving equipment must be ready for Channel A, number 1 pulse, and not one of the other 23 pulses. The initial synchronizing, explained elsewhere in the text, is called "framing." Crystal control of timing gives a "coarse" control to maintain proper synchronism.

(8) The alarm circuits utilize the characteristics of the multiplex signal for detecting misframe conditions. The sixth pulse of every channel is

marking when receiving traffic. If a misframe condition exists, the multiplex signal is displaced in time from the receiving terminal. For example, if the multiplex signal is displaced one interval to the right, the A6 pulse would appear in the B1 position, the A5 pulse would appear in the A6 position, the D6 pulse would appear in the A1 position, etc. The probability that the A5 pulse, which is in the A6 position, is spacing, is one half.

(9) The alarm circuits in any channel will sense a misframe condition if any of the five intelligence pulses are marking and the sixth pulse is spacing. Therefore, in the example in paragraph 8 above, since A1 is marking (the displaced D6 pulse), whenever the A5 pulse (in the A6 position) is spacing, the misframe will be detected. Character D would satisfy the above condition since the corresponding Baudot code is 1--4-.

(10) Fine control is achieved by the continuous examination of the timing of space-to-mark transitions so that any timing differences between transmitting equipment and receiving equipment are continuously corrected and do not become cumulative. However, it is possible that all four start-stop circuits could be idle for varying periods of time. The absence of space-mark transitions could cause loss of synchronism when traffic resumes and result in garble and lost messages. This possibility is eliminated by certain signal inversions that are built into the multiplex signal. The transmitting equipment inverts the second, third and fourth pulse of Channel A and all pulses of Channels C and D (figure 4-2). Without these inversions, an idle condition in the start-stop equipment would be transmitted as all-spacing groups. The inversions result in the following pattern:

A	B	C	D
123456	123456	123456	123456
SMMMSS	SSSSSS	MMMMMM	MMMMMM

These inversions appear in all multiplex transmission; corresponding reinversions in the receiving equipment result in the reproduction of the original intelligence. (See figure 4-29 which follows a number of typical signals through the system.)

4-5. TRANSMITTER CODE CONVERTER FUNCTIONAL DESCRIPTION (See figure 4-30).

a. The Transmitter Code Converter accepts start-stop signals from a signal line and converts them to multiwire signals. The multiwire signals are sent on a parallel six-wire basis to the Mux-Demux. The general circuits of the unit are the input circuit, range control, start-stop oscillator, start-stop distributor, selection gates, first-level storage, transfer gates, second-level storage, and transfer circuits.

b. Start-stop signals from the associated transmitting equipment are applied at the input circuit. Two outputs are obtained from this circuit: normal and inverted. The output signal is applied in normal form to the start control gate and range control, and in inverted form to the signal selection gates.

c. The range control circuit consists of a univibrator. The natural period of the univibrator is adjustable by means of the RANGE ADJ and is usually set to time out during a period equal to half of a signal element. The stop-start (mark to space) transition in the normal signal causes the univibrator to operate, and the output is applied to the control gate. The change in voltage that occurs upon relaxation of the range control gate unclamps the start-stop oscillator. The normal output of the input circuit is connected to the control gate to insure that the start-stop oscillator is unclamped only by start elements which continue, at least, until the range circuit relaxes. Thus, false starts due to hits of short duration on the input circuit are eliminated.

d. When the start-stop oscillator is unclamped, it begins oscillating at a frequency whose period is equivalent to that of the telegraph input signal (22 milliseconds at 368 wpm). The oscillator output, after being shaped by the squaring amplifier, is used to generate drive pulses for firing the elements of the start-stop distributor. The start-stop distributor consists of a ring of fourteen transistors, two

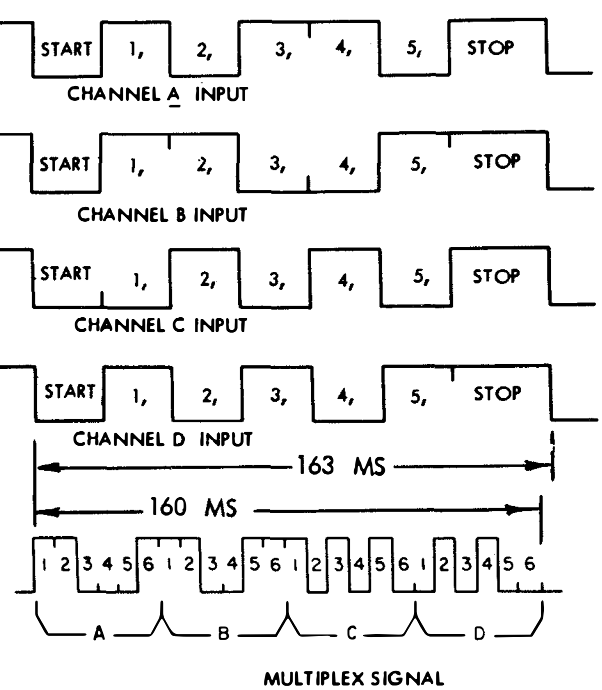


Figure 4-2. Multiplex Signal

each for the start element, five code elements and the stop element of the start-stop signal. The transistors conduct in sequence to perform a distributing cycle, the firing of each element being controlled by the timed drive pulses. Thus, the start element of the distributor fires in response to the first drive pulse and the first element fires in response to the second drive pulse. Each transistor conducts in turn until the seventh drive pulse fires the stop element of the start-stop distributor. An output from the stop element of the start-stop distributor is applied to the control gate. When the stop element fires, this voltage passes through the control gate and clamps the start-stop oscillator. As a result, no additional drive pulses are generated and the start-stop distributor comes to rest, with the stop element conducting. The start-stop oscillator will remain clamped and the stop element of the start-stop distributor will remain conducting until the next start pulse arrives at the input circuit. The output of each code element of the start-stop distributor is applied to a corresponding storage selection gate. Outputs from the start and stop elements are applied to the transfer and transfer prime circuits.

e. The inverted signal is applied to the five storage selection gates. Each gate also has a signal applied to it from the corresponding code element of the start-stop distributor. Timing is such that the leading edges of the distributor's code elements occur at a time determined by the delay introduced by the range control. This delay, as was mentioned, is normally the nominal center of the incoming start-stop signal. This leading edge is employed to sample the incoming signal. Thus, for each marking impulse in the start-stop input signal, an output pulse is directed from the distributor through a storage selection gate to the corresponding first level storage element.

f. The first level storage consists of five flip-flop circuits, one for each of the five code elements of the start-stop signal. When an output pulse from a selection gate is received by a storage element, the storage element is triggered into an on condition. Thus, as each start-stop distributor code element fires, an impulse is passed to a corresponding storage selection gate which will turn on the corresponding first level storage element if the storage selection gate has been primed by the presence of a marking impulse. Each marking selection is thus stored in the first level storage and is used to condition the storage transfer gates.

g. The first level storage release circuit is operated whenever the start element of the start-stop distributor fires. This applies a pulse to all first level storage elements simultaneously and causes those elements which were in an on condition, as a result of the previous character, to be turned off and made ready for the reception of the next character.

h. The storage transfer gates consist of five diode AND gates, one for each code pulse in the start-stop signal. Each gate will have a marking signal applied to it if the corresponding first level storage element has been triggered on. In addition, the output of the transfer circuit is applied simultaneously to the five transfer gates. Thus a particular transfer gate will produce an output whenever there is a coincidence between its corresponding first level storage being on and the transfer being on. Outputs from these gates are applied directly to the first five second level storage elements.

i. The second level storage consists of six flip-flop circuits, one for each of the five code elements of the start-stop signal and one for blank indication. When an output pulse from a transfer gate is received by a storage element, the storage element is triggered into an on condition. Thus, by means of the transfer gates, the first five elements of the second level storage are made to turn on in the same pattern that was set up in first level storage. The sixth second level storage element is controlled directly by the output of the transfer circuit, and is turned on whenever the transfer fires. Both normal and inverted outputs from each element of the second level storage are applied simultaneously to the Mux-Demux.

j. Before the second level storage elements can respond to a new code pattern being impressed upon them by the first level storage, they must be relieved of the previous character. The second-level storage-release circuit is operated by a clock pulse which is received from the Mux-Demux and inverted by the clock inverter. The clock pulse arrives at a regular rate just after a stored code pattern has been utilized in the Mux-Demux. The storage release circuit applies a pulse to all the second-level storage elements simultaneously and causes those elements which were in an on condition to be turned off.

k. The transfer circuit is capable of operation as either a flip-flop or a univibrator. During operation as a univibrator the transfer has a fixed relaxation period of approximately 0.5 milliseconds. The output of the transfer circuit is applied to the transfer gates and thereby controls the firing of the second level storage. The firing of the transfer circuit is controlled by the transfer firing gate which will produce an output pulse whenever there is coincidence between the output of the clock delay and the output of the transfer prime circuit. The clock delay circuit consists of a univibrator. The natural period of the univibrator is fixed to normally time out after a period of approximately 3.0 milliseconds. The clock delay is operated by the clock pulse which is received from the Mux-Demux. The purpose of the clock delay is to permit a short time to elapse between the release of the second-level storage elements and their subsequent reoperation. The transfer prime circuit consists of a flip-flop. The transfer prime is turned on by the firing of the start element of the start-stop distributor and is turned off when the transfer releases. The purpose of the transfer prime is to prevent the transfer from firing more than once per incoming character. The transfer normally is turned off by the firing of the stop element of the start-stop distributor. However, if the transfer should fire while the stop element of the start-stop distributor is conduting, the transfer will operate as a univibrator and turn itself off after producing an output pulse of approximately 0.5 milliseconds.

l. Because the Multiplex Set is operating continuously and the start-stop signals are being received either randomly or automatically from a distributor operating at a slightly slower speed, the transfer circuits include a variable synchronizing feature that coordinates the two. The Multiplex Set operates faster by approximately two per cent (375 opm vs. 368 opm, 469 opm vs. 460 opm, or 611.413 opm vs. 600 opm) so that, for about every 13 start-stop characters handled on a continuous basis, the Multiplex Set advances one complete character. The transfer circuit, accordingly, pauses at this time and permits a completely idle signal to be inserted. the second-level storage elements fire individually or collectively depending upon the instantaneous phase relationships between the clock pulse and the start-stop distributor. When the clock-delay transition occurs during the stop element interval of the start-stop distributor cycle, the second-level storage elements fire collectively. As each succeeding clock pulse arrives earlier and earlier in the start-stop distributor cycle, the number of second-level storage elements firing collectively will decrease and the number of storage elements firing individually will increase. This will continue until the clock pulse begins arriving during the start element interval of the start-stop distributor. At this time the second-level storage elements will fire individually as the elements are selected by the start-stop distributor. The first clock delay transition that occurs during the stop-element interval will find that the transfer prime has not yet been turned off. As a result, the transfer does not fire, and an idle blank is inserted in the multiplex signal. The next clock pulse which arrives will find the transfer prime off. It will operate the transfer and cause the second-level storage elements to fire simultaneously.

m. The clock delay circuit, in addition to permitting a short time to elapse between the release and refiring of the second-level storage elements, also provides safe operating margins when the firing of the transfer occurs late in the stop element interval of the start-stop distributor. This condition exists for several characters following the insertion of the blank. The relaxation period of the clock delay univibrator is gradually increased from approximately 3.0 milliseconds to 6.0 milliseconds just prior to the insertion of the blank. Then, immediately following the insertion of the blank, the relaxation period of the clock delay is instantly restored to its normal 3.0 milliseconds delay. The short transfer pulse is advanced by approximately 3.0 milliseconds and prevents the possible loss of a character in the first-level storage. Otherwise, the character could be lost if a start-stop signal arrived earlier than usual and caused a premature release of the first-level storage.

4-6. TRANSMITTER CODE CONVERTER, TEST DATA.

a. Table 4-1 is a list of the steps to be performed to localize transmitter failures to the Transmitter Code Converter. If a specific transmitter difficulty does not appear in this table, refer to the trouble shooting information given in the test data sections for the Transmitter Mux-Demux or Control Amplifier.

Note

The trouble shooting chart of Table 4-1 will localize a failure to a specific board in a specific Transmitting Code Converter. When the functional section has been located, immediate repair is affected by the replacement of that printed circuit board which contains the faulty section.

TABLE 4-1. TRANSMITTER CODE CONVERTER, TROUBLESHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1		Distant terminal asks for a signal check.	Good copy is received at the distant terminal.	If the distant terminal reports some channels faulty, proceed to step 2.
2		Check meter 3A1M1 on the Control Amplifier.	The meter should be vibrating for an idle or active output.	If the meter indicates normally and the distant terminal still reports faulty channels, proceed to step 3.
3		Check meter 3A2M1 on the Mux-Demux drawer.	The meter should be vibrating.	If the meter indicates normally, the trouble is in the associated equipment or in the distant terminal. If the meter reading is incorrect, check the drawers of the Transmitter Group according to steps 4 or 6.
4		Distant terminal reports garbling on one channel only. Equipment garbles locally.	All channels should receive good copy.	Check the monitor printer. If the printer is printing legible copy, the fault is in the external transmitter distributor or the Transmitter Code Converter. To check the Transmitter Code Converter, proceed to step 5.
5		Switch any two drawers: 2A3, 2A4, 2A5, or 2A6 as required.	Faulty channel should show in a different location.	If the faulty channel switches position, the difficulty is in the Transmitter Code Converter drawer associated with the new faulty channel. Proceed to step 7. If the faulty channel does not switch position, the difficulty is in the transmitter distributor to that channel.
6		Distant terminal reports garbling on all channels. The Equipment garbles locally.	Good copy received at the distant terminal.	If all channels are garbled, the difficulty is not in Transmitter Code Converter, but in one of the other drawers of the Transmitter Group, or in the associated external equipment. For information regarding trouble shooting information of the other transmitting Group drawers, refer to tables 4-6 and 4-8.
7		Apply a start-stop signal to the channel.	Meter, M1, should show a pulsing indication.	If an indication is present, proceed to step 8.
8	J8	Connect the Neon Indicator to test jack J8 on the inside of the Transmitting Code Converter. Supply the Transmitter Code Converter with an all "mark" start-stop signal from the external sending equipment.	All lamps of the Neon Indicator should flash on and off at a periodic rate, while displaying a beat pattern of approximately one flash every eight seconds. The number six lamp will appear to be illuminated continuously, except for a brief interval at the eight second period.	If all lamps are extinguished, a loss of input signal is indicated. Proceed to step 9. If any one lamp fails to illuminate, or if any one lamp fails to extinguish, proceed to step 12.

TABLE 4-1. (CONT'D)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
9	1	Connect the vertical input of an oscilloscope to test point J1 on printed circuit board A1.	The waveform should be as indicated on figure 4-3, 4-30 or 5-66.	If the waveform is abnormal, proceed to step 10.
10	A	Connect the vertical input of an oscilloscope to terminal 6 of A10.	The waveform should be as indicated on figure 4-3 or 5-66.	If the waveform is normal proceed to step 11. If the waveform is abnormal check the following components: Input Transformer T1, (A10). Jumper of TB2. Fuse F1.
11	B	Connect the vertical input of the oscilloscope to the junction of R4 and R5 on printed circuit board A1.	The waveform should be as indicated on figure 4-3, 4-30, or 5-66.	If the waveform is normal, then transistor Q3, or associated circuitry is faulty. If the waveform is abnormal the failure is in the input flip-flop circuit. In either case, refer to paragraph 4-7a for the circuit description.
12	5	Connect the vertical input of an oscilloscope to test point J1 on printed circuit board A3.	The waveform should be as indicated on figure 4-9, 4-30 or 5-66.	If the waveform is normal, the start-stop oscillator, start control gate, squaring amplifier, distributor drive amplifier and start-stop dsitributor are functioning normally, proceed to step 21. If the waveform is abnormal, proceed to step 13.
13	5	With the oscilloscope connected as in step 12, connect a jumper from R8 to R18 on printed circuit board A2. (The ends of the resistors closest to the transistors.)	The waveform should be the same as in step 12, except, the waveform will be free running.	If the waveform is free running, leave the jumper in place and proceed to step 18. If the waveform is abnormal leave the jumper in place and proceed to step 14.
14	4	Connect the vertical input of the oscilloscope to test point J4 on printed circuit board A2.	The waveform should be as indicated on figure 4-7, 4-30 or 5-66, except it will be free running.	If the waveform is free running, the start-stop oscillator and squaring amplifier are functioning properly, have the jumper in place and proceed to step 16. If the waveform is abnormal, leave the jumper in place and proceed to step 15.
15	3	Connect the vertical input of the oscilloscope to test point J3 on printed circuit board A2.	The waveform should be as indicated on figure 4-6, 4-30 or 5-66, except it will be free running and without a clamp interval.	If the waveform is normal, the failure is in the squaring amplifier circuit. Refer to paragraph 4-7e for circuit description. If the waveform is abnormal, the start-stop oscillator has failed. Refer to paragraph 4-7d for circuit description. Remove the jumper when the trouble has been remedied.

TABLE 4-1. (CONT'D)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
16	(E)	Connect the vertical input of the oscilloscope to the junction of R23 and R24 on printed circuit board A3.	The waveform should be as indicated on figure 4-8, 4-30 or 5-66. (These are narrow pulses. It may be necessary to increase oscilloscope intensity to see them.)	If the waveform is normal, the driver amilifier is functioning properly. The failure is in the start-stop distributor. Proceed to step 17. If the waveform is abnormal, the driver amplifier has failed. Refer to paragraph 4-7f for circuit description.
17	(F)	With a voltmeter set on the 15v range, measure the voltage on the collector of each element of the start-stop distributor. Measurements can be made at the junction of the 820 ohm resistors and 0.01 uf capacitors for each element.	A cutoff transistor should measure -6 volts. A conducting transistor should measure +1 volts. Since ring is cycling, the voltmeter reading should flicker at the character rate.	A failure is evident in any element of the ring whose collector is at constant voltage. Refer to paragraph 4-7g for circuit description. Once the malfunctioning component has been replaced, remove the jumper.
18	2	Connect the vertical input of the oscilloscope to test point J2 on printed circuit board A2.	The waveform should be as indicated on figure 4-5, 4-30 or 5-66, except that a free running positive pulse of 1 volt amplitude and 1/2 bit duration should run through the waveform.	If the waveform is normal, except for the absence of the free running pulse, the failure is in the range control univibrator. Proceed to step 19. If the -6 volt portion of the waveform is absent, the failure is in the start control gate. Refer to paragraph 4-7c for circuit description. After the malfunctioning component has been replaced, remove the jumper. If the waveform is normal, the failure is in the start-stop oscillator control amplifier or the start-stop oscillator clamp. Proceed to step 20.
19	(C)	Connect the vertical input of the oscilloscope to the junction of R14 and CR6 on printed circuit board A1.	The waveform should be as indicated on figure 4-4, 4-30 or 5-66.	If the waveform is abnormal, the failure is in the range control univibrator. Refer to paragraph 4-7b for circuit description.
20	(D)	Connect the vertical input of the oscilloscope to the junction of R11 and R12 on printed circuit board A2.	The waveform should be as indicated on figures 4-5, 4-30 or 5-66.	If the waveform is normal, the failure is in the start-stop oscillator clamp. Refer to paragraph 4-7c for the circuit description. If the waveform is abnormal, the failure is in the start-stop oscillator control amplifier. Refer to paragraph 4-7c for the circuit description. Once the malfunctioning component has been replaced, remove the jumper.

TABLE 4-1. (CONT'D)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
21	G	Connect the vertical input of the oscilloscope to the junction of R25 and the collector of Q6 or printed circuit board A4.	The waveform should be as indicated on figure 4-10, 4-30 or 5-66	If the waveform is normal, proceed to step 22.
22	G	As step 21, but to the following junctions: R21 - coll, Q5 R17 - coll, Q4 R13 - coll, Q3 R9 - coll, Q2	As step 21.	If all waveforms are normal for each element, proceed to step 24. If the waveform is abnormal for any or all elements, proceed to step 23.
23	8	Connect the vertical input of the oscilloscope to test point J2 on printed circuit board A4.	The waveform should be as indicated on figure 4-10, 4-30 or 5-66	If the waveform is normal, the failure is in that element of the storage selection gates indicated in steps 21 and 22. Refer to paragraph 4-7h for the circuit description. If the waveform is abnormal, the failure is in the inverter circuit of Q16 (A3). Refer to paragraph 4-7h for the circuit description.
24	J	Connect the vertical input of the oscilloscope in turn, to the output side of CR2, CR5, CR8, CR11, CR14, of printed circuit board A4.	The waveform should be as shown in figure 4-12, 4-30 or 5-66	If the waveform is normal, proceed to step 26. If the waveform is abnormal, proceed to step 25.
25	8 8	Connect the vertical input of the oscilloscope to the emitters of the transfer flip-flops on printed circuit board A5, in turn, as follows: Junction of R40 and R38 Junction of R31 and R29 Junction of R22 and R20 Junction of R13 and R11 Junction of R4 and R2.	The waveform should be as shown in figure 4-11, 4-30 or 5-66.	If all the waveforms are normal the failure is in the first level release amplifier on printed circuit board A2. Refer to paragraph 4-7i, for the circuit description. If any single waveform is abnormal, the failure is in that element of the storage. Refer to paragraph 4-7i for the circuit description.
26	10	Connect the vertical input of the oscilloscope to test point J2 on printed circuit board A1.	The waveform should be as shown on figure 4-16, 4-30 or 5-66.	If the waveform is normal, proceed to step 32. If the waveform is abnormal, proceed to step 27.
27	H	Connect the vertical input of the oscilloscope to the junction of R4 and the collector of Q1 on printed circuit board A4.	The waveform should be as shown on figure 4-15, 4-30 or 5-66.	If the waveform is normal, the failure is in the transfer circuit. Refer to paragraph 4-7n for the circuit description. If the waveform is abnormal, proceed to step 28.

TABLE 4-1. (CONT'D)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
28		Connect the vertical input of the oscilloscope to the junction of R25 and R24 on printed circuit board A1.	The waveform should be as shown on figures 4-14, 4-30, or 5-66.	If the waveform is normal, proceed to step 29. If the waveform is abnormal, proceed to step 30.
29	8	Connect the vertical input of the oscilloscope to test point J2 on printed circuit board A4.	The waveform should be as shown in figure 4-15, 4-30 or 5-66.	If the waveform is normal, the failure is in the transfer firing gate. Refer to paragraph 4-7m for the circuit description. If the waveform is abnormal, the failure is in the transfer prime circuit. Refer to paragraph 4-7i for the circuit description.
30	7	Connect the vertical input of the oscilloscope to test point J1 on printed circuit board A2.	The waveform should be as indicated on figure 4-11, 4-30 or 5-66.	If the waveform is normal, the failure is in the clock delay univibrator. Refer to paragraph 4-7l for the circuit description. If the waveform is abnormal, proceed to step 31.
31		Connect the vertical input of the oscilloscope to the input side of C2 on printed circuit board A2.	The waveform should be as shown on figure 4-11, 4-30 or 5-66.	If the waveform is normal, the failure is in the clock inverter. Refer to paragraph 4-7o for circuit description. If the waveform is abnormal, check the output of the Oscillator-Power Supply.
32		Connect the vertical input of the oscilloscope in turn to each of the following junctions on printed circuit board A6. R45 - C10 R36 - C8 R27 - C6 R18 - C4 R9 - C2 R54 - C12	The waveform should be as shown on figure 4-13, 4-30, or 5-66.	If all the waveforms are normal, the failure is in the element of the second level storage corresponding to the faulty output. Refer to paragraph 4-7k for the circuit description. If any waveform is abnormal, the failure is in the storage transfer gate corresponding to the faulty element. Refer to paragraph 4-7j for the circuit description.

TABLE 4-2. REQUIRED TEST EQUIPMENT

EQUIPMENT	RECOMMENDED TYPE	EQUIVALENT
Multimeter, Volt-Ohm-Milliameter. 20,000 ohms per volt dc 1,000 ohms per volt ac 0 - 5,000 volts, 0 - 10A, dc 0 - 1,000 volts, ac 0 - 10 megohms	AN/PSM-4C	TS-352( )/U
Transistor Test Set	TS-1100/U	
Oscilloscope dc - 15 mc	AN/USM-105A	AN/USM-24 B, C HP 150A, w 152B HP 160B, w 162A Tek 535, w C-A Tek 531 Tek 514

b. Table 4-2 is a list of the test equipment required to perform the localization of faulty components through the use of Table 4-1.

c. Table 4-3 is a list of the controls and indicators of the Transmitter Code Converter. Column one indicates the name of the control or indicator and column two lists the position of the component on the drawer. Column three lists the normal position of the control or the normal indication of the indicator.

d. Table 4-4 is a list of the adjustments and alignment procedures which affect the operation of the Transmitter Code Converter. The actual procedures are given in Section 5, in the paragraphs noted in column 3.

e. The logic block diagram for the Transmitter Code Converter is shown on figure 4-30. The interconnecting wiring diagram and the schematic diagram for this drawer are shown on figures 5-65 and 5-66. Figures 5-32 and 5-33 show the position of all adjustment controls and indicators. Test jacks for the individual circuits are shown on figures 5-34 through 5-38.

TABLE 4-3. TRANSMITTER CODE CONVERTER, CONTROLS AND INDICATORS

CONTROL	LOCATION	NORMAL POSITION	REMARKS
WPM switch S1	Front Panel	1, 2, 3, or 4 as required.	The setting of this control must agree with the setting of the WPM switches on the Transmitter Mux-Demux drawer.
Line Current Meter, M1	Front Panel	20 to 25 ma, or 60 to 65 ma.	The line current meter reading depends upon the preset current level. The adjustment of R1, the LINE RHEOstat will affect the indication of this meter. If zero line current is indicated, with a known signal into the transmitter, check fuse F1, as explained in paragraph 3-6e.

TABLE 4-4. TRANSMITTER CODE CONVERTER, ADJUSTMENT AND ALIGNMENT PROCEDURES

ADJUSTMENT	CIRCUIT	REFER TO
LINE RHEO	Input circuit	Paragraph 5-4. b, (1)
RANGE CONTROL	Range Control Univibrator	Paragraph 5-4. b, (2)
CLAMP ADJUST	Start-Stop Oscillator	Paragraph 5-4. b, (3)
FEEDBACK ADJUST	Start-Stop Oscillator	Paragraph 5-4. b, (4)
FREQUENCY ADJUST	Start-Stop Oscillator	Paragraph 5-4. b, (5)

f. Occasionally it becomes desirable, for circuit lineup or maintenance purposes, to connect the local Transmitter Group to the local Receiver Group. This mode of operation is usually originated by a serviceman or experienced operator.

(1) The local Transmitter Group is connected directly to the local Receiver Group. Text messages transmitted by the local start-stop transmitters will be recorded by the local telegraph receiving equipments.

(2) The local message center using the channels should be notified whenever a local test is being made. Bona fide traffic must not be lost by initiating a test when the circuits are in use. The following procedure should be followed:

(a) Turn the LOCAL REMOTE switch of the Control Amplifier to LOCAL. Likewise, turn the LOCAL REMOTE switch located at the Sync Unit to LOCAL. Turn the operating mode switch to M (mark) and observe multiplex line current. The line current should be approximately 53 milliamperes which is more than adequate for local test purposes.

(3) Providing a multiplex signal is being generated at the transmitting terminal, and channel A is idle, AUTO MANUAL switch should be moved to its AUTO position. The framing switch should then be depressed until the equipment is in proper frame. By observing the channel A line current meter it is possible to ascertain an "in-frame" condition. So long as an incorrect frame condition exists, the line current meter indicator will pulse. When the equipment is properly framed, the indicator will come to rest. If difficulty is experienced in framing the Receiver Group, operate the signal polarity switch to the INVERTED position. If one is now able to frame the unit it indicates that inverted signals are being received. If difficulty in framing the unit is still experienced, check the position of the various controls.

(4) Tests may now be run. Signals may be monitored at both the transmitting and receiving converters on each channel. Troubles within the equipment may therefore be isolated from those elsewhere in the system.

g. The following caution must be observed when performing trouble shooting procedures:

CAUTION

Deenergize the equipment prior to removing or installing drawers. After the reinstallation of drawers, the equipment is to warm up for fifteen minutes to ensure oscillator stability.

4-7. TRANSMITTING CODE CONVERTER, CIRCUIT DESCRIPTIONS.

a. INPUT CIRCUIT. (See figure 4-3.)

(1) CIRCUIT DESCRIPTION.

(a) Transistors Q1 and Q2 on printed circuit board A1 comprise the input flip-flop circuit. This flip-flop receives its set and reset inputs through transformer T1 and line filter A12.

(b) The input signal to the Transmitter Code Converter is applied through pins h and j of connector J9. With a steady mark signal at the input, meter M1 indicates approximately 20 or 60 milliamperes, depending upon the terminal connections of terminal board TB2. These connections are dependent upon the requirements of the external equipment used with the Multiplex Set. The LINE RHEOstat, R1, limits the current for the proper operating level.

(c) When the Multiplex Set is energized, plus and minus six volts are applied to the differentiating network of C1, R4 and R5 on board A11. The junction of R4 and R5 is instantaneously positive, causing the reset side of the input flip-flop to become positive through conduction of CR4 on board A1 and CR4 on board A11.

(d) T1 is a specially wound transformer with a nearly square hysteresis curve. The input signal is developed across the primary windings connected to terminals 2 and 3 of A10 when used with 60 ma external equipment. (Terminals 1 and 3 of A10 are used with 20 ma external equipment.) The primary windings connected to terminals 4 and 5 apply a bias current to place the transformer coil near the saturation level. An input mark signal introduces current flow in the input primary windings driving the transformer core into saturation. When the core is saturated, the impedance of the secondary windings drops to a negligible level. At this time, current flows from the -12 volt supply through R3, R2, CR1, and the secondary winding of T1 to ground. The base of Q1 goes positive, setting the input flip-flop. The other secondary winding of T1 (terminals 7 and 8 of A11) also provides a low impedance path to ground at saturation of the core of T1, but diode CR4 presents a high impedance to any current flow.

(e) An input space (or start pulse) stops current flow in the primary of T1. The core of T1 is unsaturated generating a pulse in the secondary windings. The negative signal at terminal 8 of A10 is conducted by CR5 to the base of transistor Q2 on A1 to reset the input flip-flop. Diode CR1 offers a high impedance path to any current flow in the circuits of the set side of the input flip-flop.

(f) Q3 is an inverter circuit. The input to Q3 is taken from the collector of Q2 (the 0 output of the flip-flop). When a mark signal is the input, the output of the flip-flop (set) is -6 volts. Q3 is cut off and the voltage to the start control gate is a 0 voltage level. When a space period is the input, the output of the flip-flop (reset) is 0 volts. Q3 conducts and the voltage to the start control gate is -6 volts.

(2) TEST DATA.

(a) The input circuit is shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The intraconnection information and the complete schematic diagram is shown on figures 5-65 and 5-66, respectively.

(b) The only adjustment which will affect the input circuit is the adjustment of the LINE RHEOstat. The procedure for performing this adjustment is given in paragraph 5-4. b, (1).

(c) The components of the input circuit are located on printed circuit boards 3A3A1, 3A4A1, 3A5A1, and 3A6A1 of the respective Transmitter Code Converter drawers.

(d) The only test equipment required for trouble shooting or repair of the input circuit is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The test point for the input circuit is indicated on Figure 5-34.

b. RANGE CONTROL. (See figure 4-4.)

(1) CIRCUIT DESCRIPTION.

(a) Transistors Q4, Q5 and Q6 on printed circuit board A1 comprise a univibrator circuit. Q4 is normally conducting and Q5 is cut off. Q6 is a buffer amplifier in the feedback circuit between Q4 and Q5. The univibrator receives its input signal through C12 and R21 which are connected to the base of Q5 and the junction of CR9, CR10, and R22.

(b) CR9, CR10 and R22 form an AND gate. The inputs to this gate are the input signal and the stop element of the start-stop distributor. With a steady mark signal at the input to the Transmitter Code Converter and with the stop element of the start-stop distributor fired, both inputs to the gate are at 0 volts. The output of the gate is also 0 volts. Receipt of a space signal at the input circuit applies -6 volts to CR9, disabling the AND gate and driving the voltage across R22 to -6 volts. This negative transition goes through C12 and R21 to the base of Q5 to fire it.

(c) The collector of Q5 rises from -6 to 0 volts. Emitter follower Q6 conducts this negative voltage through the RANGE CONTROL potentiometer R2, and C2 to the base of Q4, turning it off. The univibrator remains in this state for a period of time determined by the charging rate of C2 and the RANGE CONTROL potentiometer. The normal setting of R2 is such that the univibrator will remain in its set condition for a period of time equal to one half the start pulse.

(d) Firing of the range control univibrator enables a gate which allows the input pulse to initiate the start-stop cycle. The first pulse of this cycle turns off the stop element which has enabled the AND gate of CR9 and CR10. When this gate is disabled, mark-space transitions following the initial start-stop transition will not cycle the range control univibrator.

(e) The output of the range control univibrator is applied to the start control gate, as a 0 voltage level.

(2) TEST DATA.

(a) The range circuit is shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The intraconnection information and the complete schematic diagram is shown on figure 5-65 and 5-66, respectively.

(b) The only adjustment which will affect the operation of the range univibrator is the RANGE CONTROL adjustment. The procedure for performing this adjustment is given in paragraph 5-4, b, (2).

(c) The components of the range control circuit are located on printed circuit boards 3A3A1, 3A4A1, 3A5A1, and 3A6A1 of the respective Transmitter Code Converter drawers. Capacitor C2 and resistor R2 are located on terminal board 1, and the bottom board of the drawer.

(d) The only test equipment required for trouble shooting or repair of the range control circuit is the test equipment listed in table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no major test points for the range control circuit.

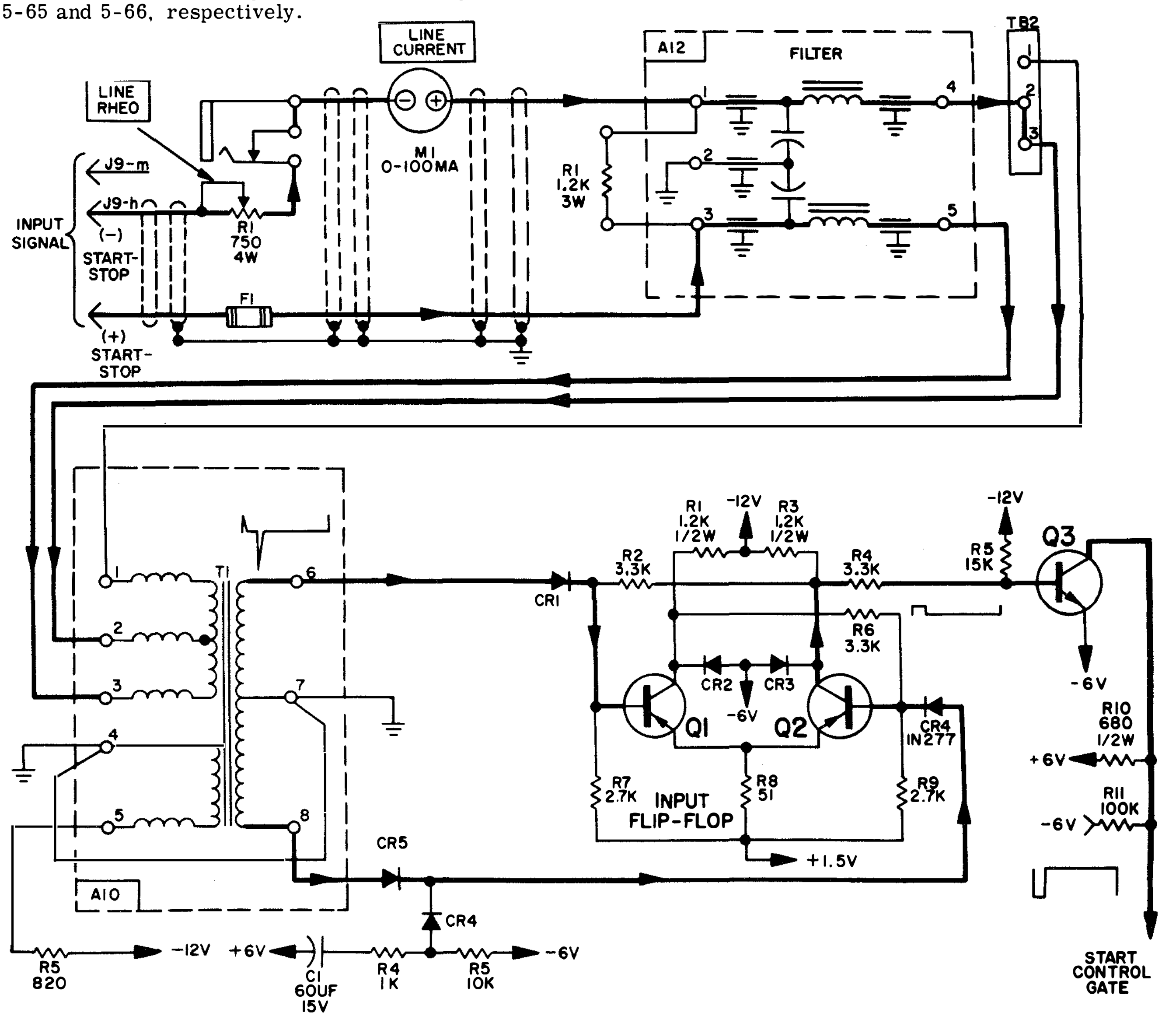


Figure 4-3. Simplified Schematic, Input Circuit

c. START CONTROL GATE. (See figure 4-5.)

(1) CIRCUIT DESCRIPTION.

(a) CR7, CR8, and R15 on printed circuit board A1 comprise a negative AND gate AG-1 on logic diagram 4-30. The inputs to this gate are the outputs from the input flip-flop and from the range control univibrator. With a steady mark signal to the input flip-flop, these voltages are 0 at CR8 and -6 at CR7. The output of the AND gate is a 0 voltage which is applied to CR2 on printed circuit board A2.

(b) CR2, CR3, and R8 on printed circuit board A2 comprise an OR gate OG-1 on logic diagram 4-30. As mentioned previously, one input to this gate is the output of gate AG-1. The second input, to CR3, is the output of the stop element of the start-stop distributor. If the stop element is conducting, the voltage to CR3 is 0. The output of the OR gate is 0, allowing current flow through R9 and R10. The junction of R9 and R10 is connected to the base of Q3. Q3 is saturated to control the clamping of the start-stop oscillator.

(c) Receipt of a start pulse at the input flip-flop fires the range control univibrator to instantaneously apply a 0 voltage to CR7. CR8 is at -6 volts from the input flip-flop. The output of the AND gate is still 0 volts. When the range control univibrator times out, the voltage applied to CR7 drops to -6 volts, driving the output of OR gate to -6 volts. This voltage is applied to CR2 on printed circuit board A2 to enable the OR gate. The output of the gate drops to -6 volts, driving Q3 into cut off and unclamping the start-stop oscillator. The operation of the start-stop oscillator steps the start-stop distributor to turn off the stop element of the distributor. When this element is cut off, OR voltage to CR3 drops to -6 volts, inhibiting the OR gate until the stop element of the distributor is again fired.

(d) When Q3 is saturated, the start-stop oscillator is clamped and when Q3 is cut off, the oscillator is unclamped. With Q3 saturated, -6 volts appears at the collector. This voltage is applied through R12 to the base of Q7, the start-stop oscillator clamp. Bias current flows and Q7 becomes saturated, resulting in 0 voltage at the collector. This voltage is applied through the CLAMP ADJUST potentiometer R3, located on the side panel, to the junction CR4 and CR5.

(2) TEST DATA.

(a) The start control gate and control amplifier are shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The logic symbols are OG-1 and IV-2. The intraconnection information and the complete schematic diagram are shown on figure 5-65 and 5-66, respectively.

(b) There are no adjustments which affect the start control gate.

(c) The components of the start control gate are located on printed circuit boards 3A3A1, 3A4A1, 3A5A1, and 3A6A1 of the respective Transmitter Code Converter drawers. The components of the control amplifier and OR gate OG1 are located on printed circuit boards 3A3A2, 3A4A2, 3A5A2, and 3A6A2.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no test points for these circuits.

d. START-STOP OSCILLATOR. (See figure 4-6.)

(1) CIRCUIT DESCRIPTION.

(a) The start-stop oscillator, Q4, is a sine wave oscillator which is turned on or off by Q7, the start-stop oscillator clamp. Q4 is connected as a Hartley oscillator with the output taken from its emitter. The WPM switch S1 permits changing the capacity of the tuned circuit to match different wpm operations. For example, at 60 wpm a single pulse (mark or space) is 22 milliseconds long. FREQUENCY ADJUST L1, C1A and C1B, connected in parallel, constitute a tuned circuit which is adjusted to produce a sine wave with a frequency of 45.45 cycles per second, resulting in a cycle duration of 22 milliseconds.

(b) With Q7 conducting, current flows through CLAMP ADJ R3, CR4, and R18 to the -6 volt supply. CR5 clamps the base of Q4 to the voltage at the junction of the CLAMP ADJUST potentiometer and CR4, preventing any variations in the base voltage of Q4. This action holds a constant charge on the externally located C1 and prevents oscillation.

(c) The CLAMP ADJUST potentiometer, R3, permits the adjustment of the base voltage of Q4 to any value between 0 and -4 volts. This determines the current through FREQUENCY ADJUST L1. During the idle condition, the emitter of Q4 is at -6 volts so that no current is flowing in the feedback circuit consisting of the -6 volt supply, the lower section of FREQUENCY ADJUST L1, FEEDBACK ADJUST R4, R14, RT-1, the collector of Q4, and the -12 volt supply.

(d) As soon as Q7 is cut off, its collector goes to -12 volts, back biasing CR5 and unclamping the base of Q4. As current through L1 starts to decrease, the voltage across it decreases, C1A or C1B discharges and the base of Q4 goes more negative. This biases Q4 and increases conduction, driving the emitter more negative. Current begins to flow through the feedback circuit, and through the circuit in parallel with the lower section of L1, from the -6 volt supply, through C1, through section 4-3 of L1 and through the remainder of the feedback

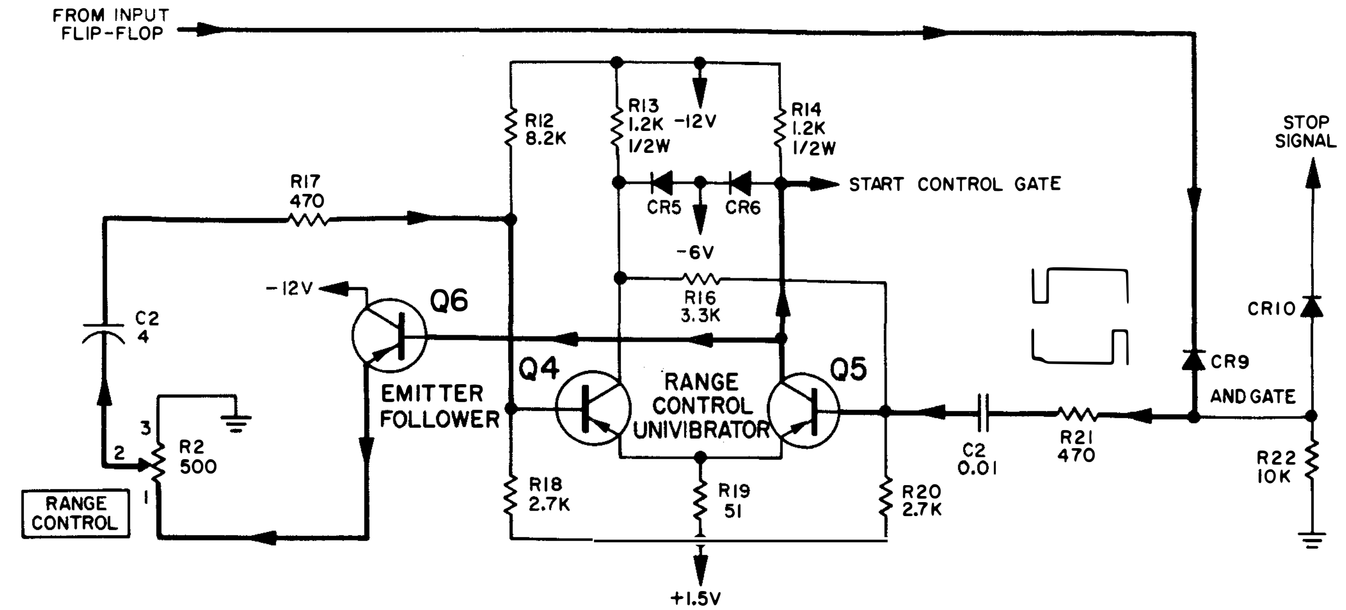


Figure 4-4. Simplified Schematic, Range Control Circuit

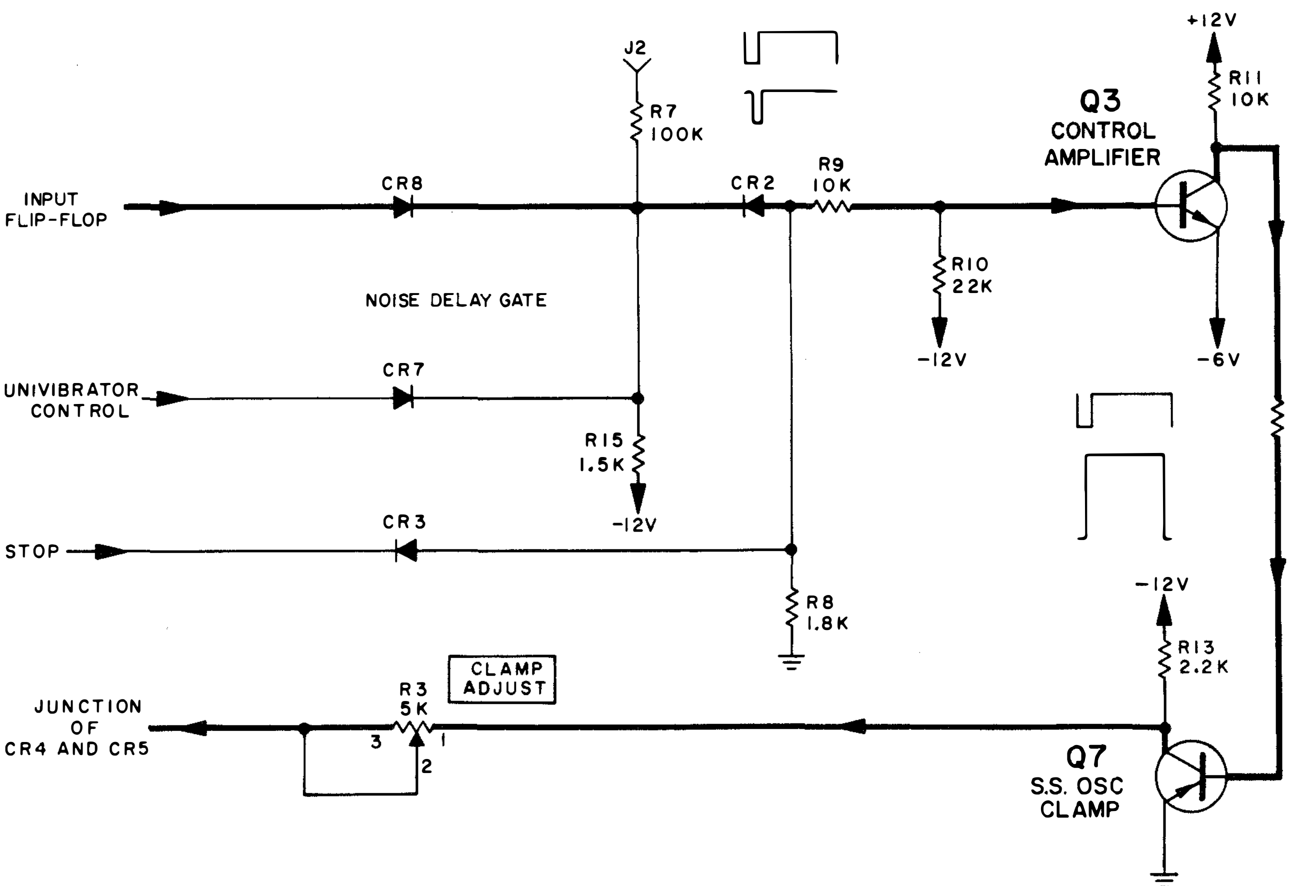


Figure 4-5. Simplified Schematic, Start-Stop Gate, Control Amplifier and Clamp

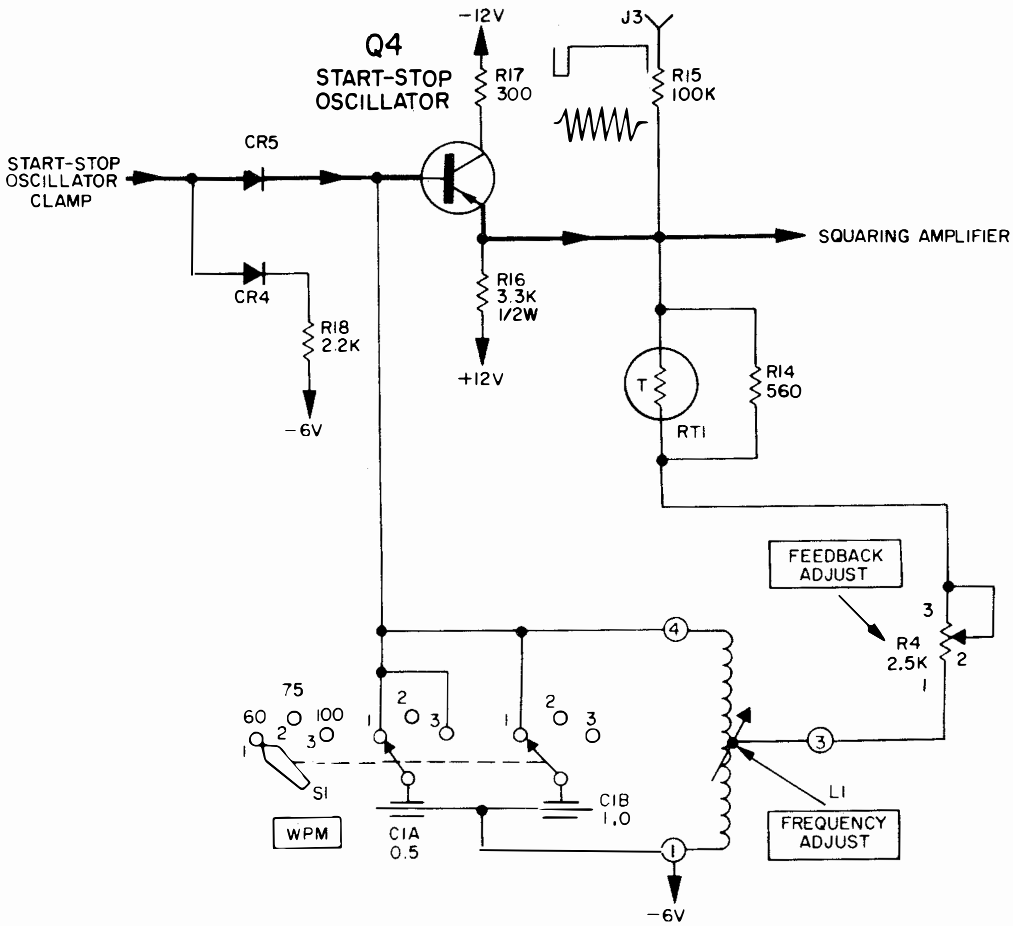


Figure 4-6. Simplified Schematic, Start Stop Oscillator

circuit. This action continues until C1 is completely discharged and becomes charged in the opposite direction to the same voltage as exists across the lower section of L1. At this point, the current in L1 is zero, and the emitter voltage of Q4 is about -10 volts (according to the setting of the FEEDBACK ADJUST control, R4).

(e) C1A and C1B now begin to discharge, and the base of Q4 goes less negative, decreasing conduction in Q4. The emitter voltage increases resulting in a current through the feedback circuit charging C1 on the opposite polarity. As a result of this continuous action, a sine-wave oscillation occurs with the frequency determined by the capacitance and inductance in the circuit. When Q7 turns on again, the base voltage of Q4 is clamped and oscillation ceases.

(2) TEST DATA.

(a) The start-stop oscillator is shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The intraconnection information and the complete schematic diagram are shown on figure 5-65 and 5-66, respectively.

(b) The adjustments which affect the start-stop oscillator circuit are the adjustment of the FEEDBACK ADJUST, the FREQUENCY ADJUST, and the CLAMP ADJUST. The procedure for performing these adjustments is given in paragraph 5-4. b, (3), 5-4. b, (4), and 5-4. b, (5).

(c) The components of the start-stop oscillator are located on printed circuit boards 3A3A2, 3A4A2, 3A5A2, and 3A6A2.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The test points for the start-stop oscillator circuit are indicated on figures 5-32 and 5-35.

e. SQUARING AMPLIFIER. (See figure 4-7.)

(1) CIRCUIT DESCRIPTION.

(a) Transistors Q5 and Q6 on printed circuit board A2 comprise a squaring amplifier. With the

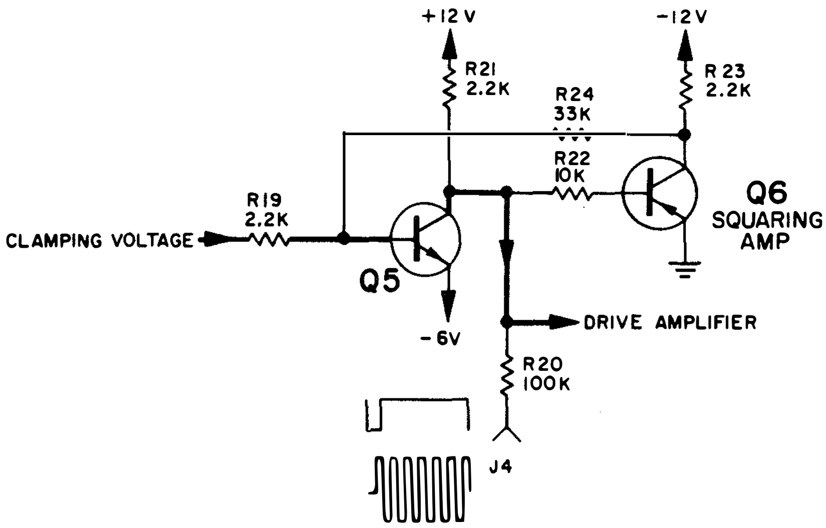


Figure 4-7. Simplified Schematic, Squaring Amplifier

start-stop oscillator clamped, -5 volts appears at its emitter. This potential is sufficient to drive Q5 into saturation, the emitter having been returned to -6 volts. With Q5 saturated, -6 volts appears at the collector and, when applied to the base of Q6, saturates that transistor.

(b) The first half-cycle generated by the start-stop oscillator is always negative-going and drives Q5 into cut off. Then, one half cycle later, the oscillator swings positive, Q5 conducts into saturation and draws Q6 into saturation. A feedback current through R24 aids in squaring the waveform at the collector of Q5. The output of Q5 is applied to the distributor drive circuit.

(2) TEST DATA.

(a) The squaring amplifier is shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for the squaring amplifier circuit.

(c) The components of the squaring amplifier are located on printed circuit boards 3A3A2, 3A4A2, 3A5A2, and 3A6A2.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards the precautions given in paragraph 5-6 are to be observed.

(e) The test point for this circuit is indicated on figure 5-35.

e. DISTRIBUTOR DRIVE CIRCUIT. (See figure 4-8.)

(1) CIRCUIT DESCRIPTION.

(a) The output of the squaring amplifier on printed circuit board A2 is applied to the drive amplifier on printed circuit board A3 via C9. Capacitor C9 and R25 differentiate the square wave signals from the squaring amplifier. The positive-going transitions from the squaring amplifier are differentiated into narrow pulses with a sharp peak. Transistor Q15 is connected as a common emitter amplifier which is normally conducting. The collector load, R23, is connected to R24 which in turn couples the output of Q15 to the common emitters of the transistors of the start-stop distributor.

(b) Each positive pulse from the differentiating circuit drives normally conducting Q15 to cut off for the duration of the pulse. The output from the collector of Q15 is a drive pulse for each positive input. The drive pulses (approximately 10 microseconds long) swing from +6 volts to -6 volts.

(2) TEST DATA.

(a) The distributor drive circuit is shown in logic form on the Transmistter Code Converter logic diagram, figure 4-30. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for this circuit.

(c) The components of this circuit are located on printed circuit boards 3A3A3, 3A4A3, 3A5A3, and 3A6A3.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no test points for this circuit.

f. START-STOP DISTRIBUTOR. (See figure 4-9.)

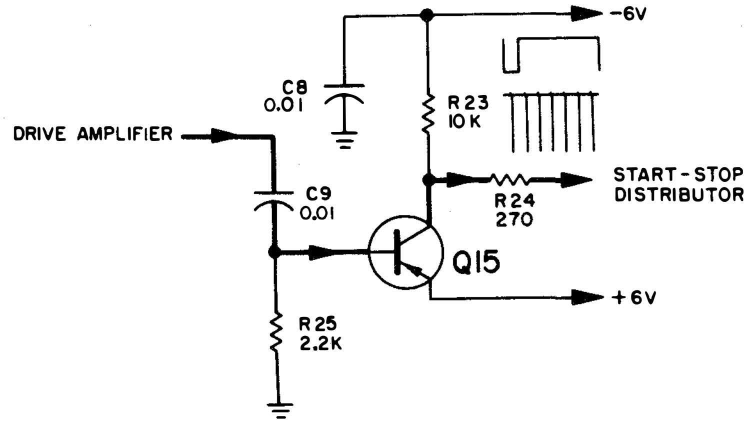


Figure 4-8. Simplified Schematic, Distributor Drive Circuit

(1) CIRCUIT DESCRIPTION.

(a) The basic elements in the start-stop distributor are a PNP and NPN transistor connected in a "truncated N" circuit. The start-stop distributor consists of seven elements, one each for the start element, the five code elements, and the stop element of the start-stop signal.

(b) The "truncated N" circuit uses the two stable states of the element to form the basic sequential switching functions on and off. The on state is defined as the interval of heavy conduction in which the element is passing approximately 16.5 milliamperes of current. The off state is the interval in which the element is passing approximately 6 milliamperes of current.

(c) The emitters of the PNP transistors are connected to a common emitter load resistor, R24. The drive amplifier Q15 is normally biased into saturation so the emitter-to-collector potential is practically zero. When Q15 is conducting, the common emitter resistor R24 is returned to +6 volts at the collector of Q15.

(d) As the collector potential is applied, the distributor will turn on. The NPN transistor having the lowest collector-to-base resistance (highest current gain) will cause the associated PNP transistor to turn on, since this particular base reaches the conducting bias first. The start element in the ring is purposely arranged to have a lower collector-to-base resistance, by use of a lower value of collector resistance (3300 ohms in place of 3900 ohms). The current through the PNP transistor divides between its collector load and the NPN transistor. Initially, the PNP transistor is an open circuit until the emitter potential reaches the potential on its base (approximately 2.6 volts). In the off state, approximately 6 milliamperes flows. When the critical current of 7.3 milliamperes is reached the clamp diode is unable to hold the base of the NPN transistor at -6 volts. It conducts and changes the potential on the base of the PNP transistor. Thus, the PNP transistor is driven into saturation. This results in a current flow of approximately 16.5 milliamperes to establish the on state of the element. The PNP transistor collector-to-ground potential in the on state is approximately zero volts. In its off state, a value of -6 volts is maintained by clamp diodes CR1 through CR7.

(e) The dynamic action of the ring occurs as follows. Negative-going drive pulses of approximately 7 microseconds in duration and 12 volts in amplitude are applied to the common emitters of the ring through R24. Each of these drive pulses will turn off the conducting ring element. The collector potential of the conducting element swings sharply negative and generates a charging current through its associated capacitor (C1 through C6) connected to the base of the following transistor. This charging current generates a negative voltage which primes the next stage. At the end of the 7 microsecond switching period, the primed transistor will turn on. Each stage of the distributor will be fired in turn. Each stage will prime the next when the negative 12 volt pulse is applied. The primed stage fires when the 12 volt pulse ends.

(f) The output of each element is obtained at the junction of the PNP collector and the NPN base. The output of the start element is applied to the first-level release amplifier Q2 on printed circuit board A2. Outputs from elements 1 through 5 are applied to the storage selection gates on printed circuit board A4. The stop element is applied to the start-stop control gate (AG2) and AND gate OG1 on printed circuit board A2 and A1, respectively.

(2) TEST DATA.

(a) The start-stop distributor is shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments which affect the start-stop distributor.

(c) The components of this circuit are located on printed circuit boards 3A3A3, 3A4A3, 3A5A3, and 3A6A3.

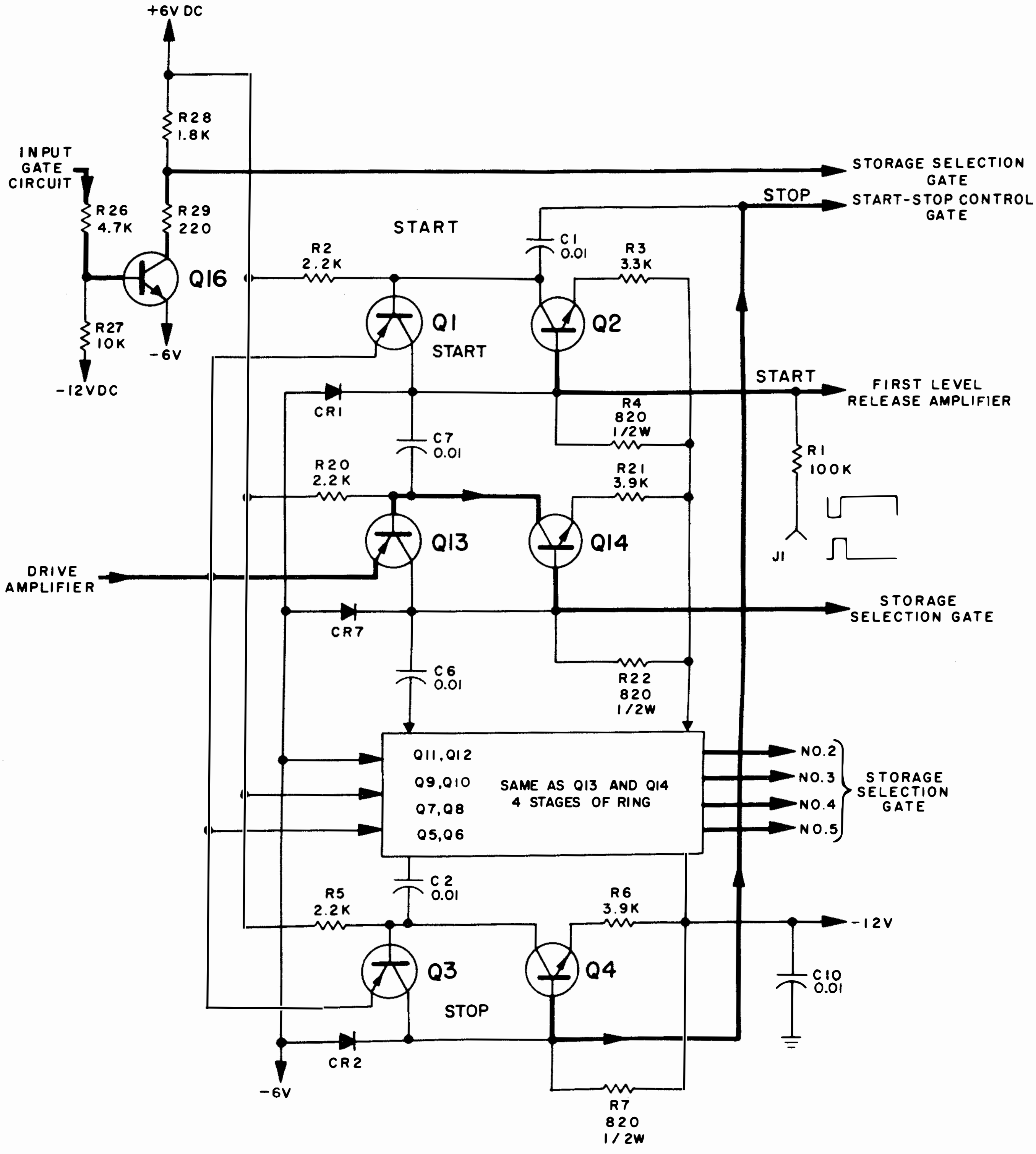


Figure 4-9. Simplified Schematic, Start-Stop Distributor

g. STORAGE SELECTION GATES. (See figure 4-10.)

(1) CIRCUIT DESCRIPTION.

(a) The storage selection gates on printed circuit board A4 consist of five identical transistor AND gates, one for each code pulse in the start-stop signal. The output of the corresponding code element of the start-stop distributor is applied to the emitter of Q2 through Q6 via the 0.01 uf capacitor. The input signal is applied to the base circuits via pin f of the board connector and the associated 470 ohm resistors.

(b) Initially, the emitter potential of Q2 through Q6 is held at -6 volts by the potential applied via pin c of the board connector and the corresponding 22K resistor. The common base lead of the transistors is connected to the collector of Q16 on printed circuit board A3. The base of Q16 is connected via R26 to the collector of Q3 on printed circuit board A1.

(c) The input flip-flop furnishes inverted start-stop signals to the base of Q3. Transistor Q3 inverts this signal and applies in-phase start-stop signals to the base of Q16 on printed circuit board A3 via R26. The application of a mark (0v) to R26 drives Q16 to conduction, resulting in -6 volts at the collector. This voltage is divided by voltage divider R28 and R29 on printed circuit board A3, and by the voltage divider consisting of a 470 ohm and 4.7K resistor in the base circuit of each gate. The bases of Q2 through Q6 are driven negative (-3.5 volts) by this voltage, and the corresponding AND gate is enabled. The application of a space (-6 volts) to R26 results in cutting off Q3 on printed circuit board A3. In this condition, +6 volts appears at the base of Q2 through Q6.

(d) Since the emitters of Q2 through Q6 on printed circuit board A4 are connected to -6 volts, these transistors are normally non-conducting, and -12 volts appears at the collector. As each element of the start-stop distributor fires, a positive-going transition is applied to the corresponding emitter connection of Q2 through Q6. These pulses are +6 volts in amplitude. If the voltage at the common base lead is -3.5 volts signifying a mark, the transistor which received the fired element from the start-stop distributor will saturate, driving its collector to 0. If the potential at the common base lead is at +6 volts signifying a space, the emitter of the transistor which received the fired elements from the start-stop distributor remains more negative than the base, and the transistor will not conduct.

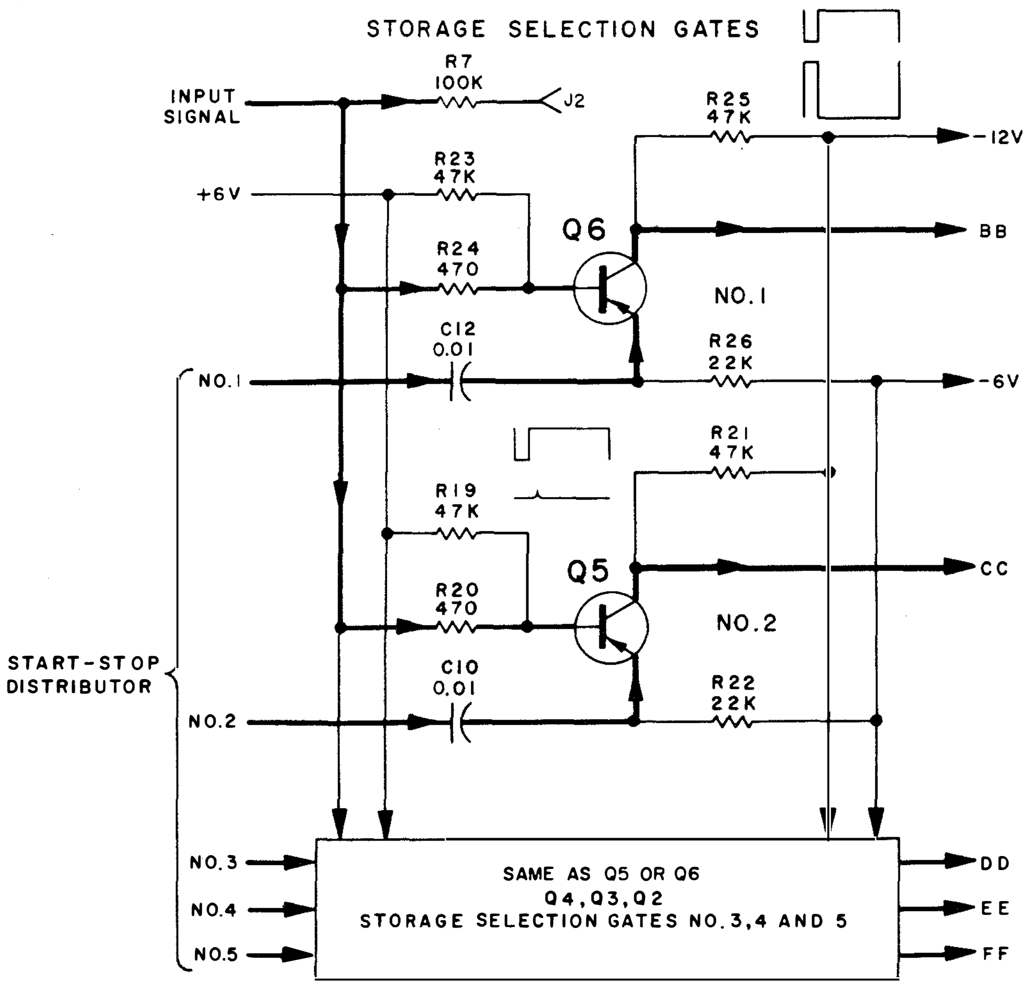


Figure 4-10. Simplified Schematic, Storage Selection Gates

As each element of the start-stop distributor conducts, a pulse is generated at the corresponding collector of Q2 through Q6 whenever a mark is present on the common base lead. The output of each gate is applied to a corresponding first-level flip-flop on printed circuit board A5.

(2) TEST DATA.

(a) The storage selection gates are shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The logic symbols are AG3 to AG7. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for this circuit.

(c) The components of this circuit are located on printed circuit boards 3A3A4, 3A4A4, 3A5A4, and 3A6A4.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no test points for these circuits.

h. TRANSFER FLIP-FLOPS AND RELEASE AMPLIFIER. (See figure 4-11.)

(1) CIRCUIT DESCRIPTION.

(a) The transfer flip-flops located on printed circuit board A5, consist of five identical flip-flops, one for each code pulse in the start-stop signal. These five flip-flops receive their input from the transistor AND gates and are reset by the first level release amplifier. In the reset state, transistors Q1, Q3, Q5, Q7, and Q9 are conducting. The flip-flops are set whenever the corresponding transistor AND gate develops a positive-going pulse. When triggered, the output signal of the flip-flop swings from -6 volts to 0 voltage.

(b) The first-level release amplifier is an emitter follower having as an input the start pulse from the start-stop distributor. The output of Q2 on printed circuit board A2 is applied via the diode network on printed circuit board A11 to the transfer flip-flops as the reset pulse. The output from the first-level release amplifier swings from -6 volts to 0 voltage upon receipt of a start pulse. The positive transition of this pulse is differentiated by the input capacitors to drive transistors Q2, Q4, Q6, Q8, and Q10 into cut off. Thus, the flip-flops are reset to the normal condition. The first-level release amplifier also supplies a pulse to set the transfer prime flip-flop, Q11 and Q12, on printed circuit board A5.

(c) When the start element of the start-stop distributor is fired, the first-level release amplifier sets the transfer prime flip-flop. The output of the transfer prime flip-flop enables the transfer firing gate. As the transfer circuit is reset by the application of the stop pulse from the start-stop distributor, the resulting positive transition from the collector of Q9 on printed circuit board A1 is applied to the transfer prime flip-flop as a reset pulse.

(2) TEST DATA.

(a) The transfer flip-flops are shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The logic symbols are FF3 - FF8. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for these circuits.

(c) The components of these circuits are located on printed circuit boards 3A3A5, 3A4A5, 3A5A5, and 3A6A5.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no test points for these circuits.

i. STORAGE TRANSFER GATES. (See figure 4-12.)

(1) CIRCUIT DESCRIPTION.

(a) The storage-transfer gates consist of five identical AND gates located on printed circuit board A4. One gate is provided for each code element in the start-stop signal. The output of the transfer amplifier Q12 on printed circuit board A1 and the output of the corresponding storage element of the first-level storage are applied as inputs to each gate.

(b) When both inputs to a gate are 0 voltage, the output of the gate will be 0 voltage. However, if either input is -6 volts, the output of the gate will be -6 volts. The output of each gate is applied to the corresponding second-level storage flip-flop.

(2) TEST DATA.

(a) The storage transfer gates are shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The logic symbols are AG8 to AG12. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for this circuit.

(c) The components of the storage transfer gates are located on printed circuit boards 3A3A4, 3A4A4, 3A5A4, and 3A6A4.

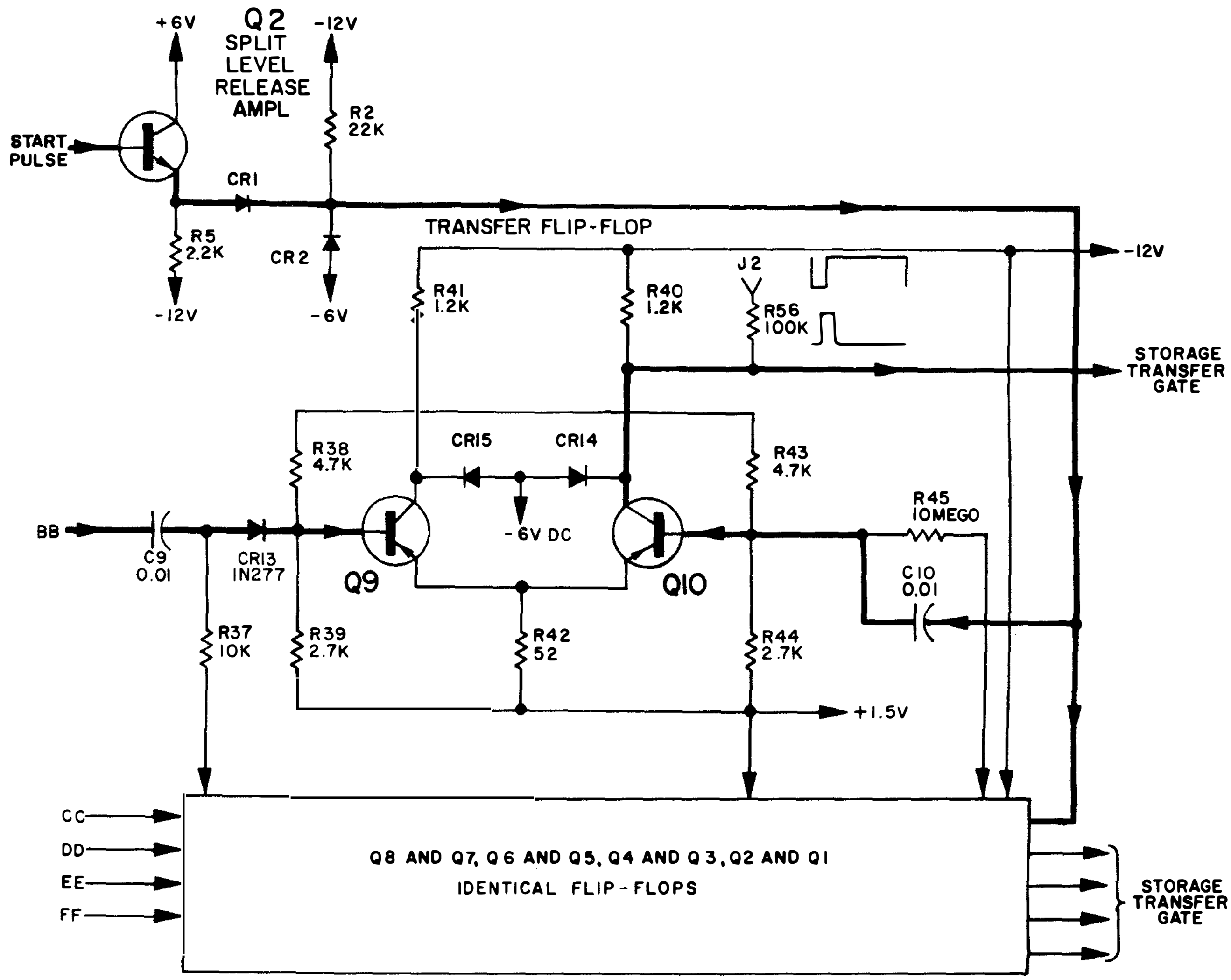


Figure 4-11. Simplified Schematic, First Level Storage

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no test points for these circuits.

j. SECOND LEVEL STORAGE. (See figure 4-13.)

(1) CIRCUIT DESCRIPTION.

(a) The second-level storage consists of six identical flip-flops, one for each code pulse and one for the blank indication. These flip-flops are located on printed circuit board A6. The five code element flip-flops are formed by transistors Q1 through Q10. In the reset state, transistors Q2, Q4, Q6, Q8, and Q10 are conducting. The application of a positive pulse from the storage gates sets the second-level storage flip-flop. The positive transition of the gate pulse is differentiated by the input capacitor resulting in a positive pulse which turns off the conducting flip-flop. The trailing edge of the gate pulse has a sloping edge due to the long discharge time constant. This sloping edge does not reset the transistor. The outputs of the flip-flops are applied to the Mux-Demux via J9 and to the neon indicator connector J8.

(b) The no. 6 flip-flop in the second-level storage consists of transistors Q11 and Q12. This flip-flop is reset at the time the five code element flip-flops reset. When the transfer amplifier Q12 on printed circuit board A1 develops a positive pulse, the no. 6 flip-flop becomes set. The pulse from the transfer amplifier is applied via CR3 on printed circuit board A11. The outputs of this flip-flop are applied to the Mux-Demux via J9 and to the neon indicator connector J8.

(2) TEST DATA.

(a) The second level storage flip-flops are shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The logic symbols are FF9 through FF14. The intraconnection information and the complete schematic diagram

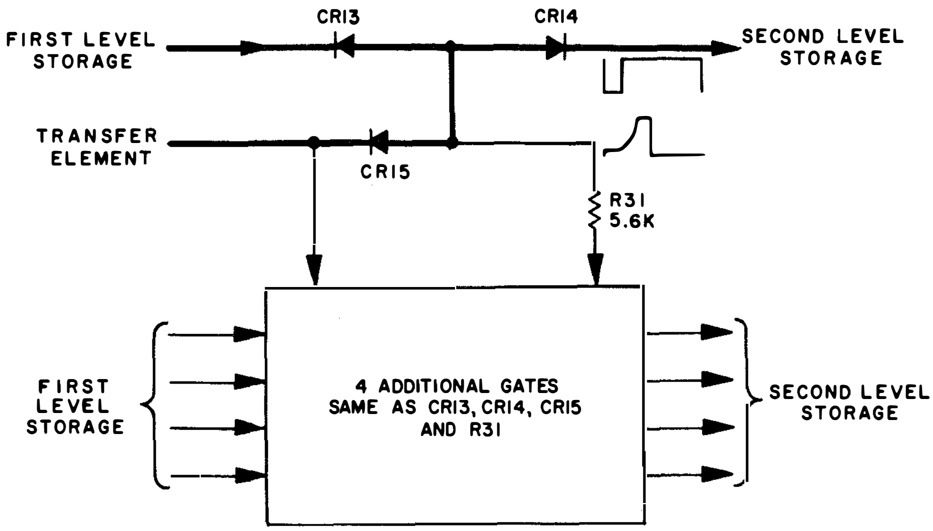


Figure 4-12. Simplified Schematic, Storage Transfer Gates

are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for these circuits.

(c) The components of the storage flip-flops are located on printed circuit boards 3A3A6, 3A4A6, 3A5A6, and 3A6A6.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no test points for these circuits.

k. CLOCK DELAY. (See figure 4-14.)

(1) CIRCUIT DESCRIPTION.

(a) The clock-delay circuit is a univibrator consisting of transistors Q7 and Q8 on printed circuit board A1. The clock-delay circuit is driven from the signal supplied by the clock inverter. In the univibrator circuit, Q7 is normally conducting. Upon application of the clock-inverter pulse, Q7 turns off and Q8 conducts. After a timed interval, determined by the fixed time constant of C3, R27, R23, R28, and the voltage applied to R28, the circuit switches back to its stable condition, with Q7 conducting.

(b) The inverted output of the transfer prime flip-flop is applied to R28 on printed circuit board A1 and controls the time delay produced by the clock delay univibrator. When the voltage applied to R28 from the collector of Q11 is -6 volts, the univibrator will time out an interval of approximately 3 milliseconds. When the voltage applied to R28 is 0 voltage, the univibrator will time out an interval of approximately 6 milliseconds. The output from the collector of Q7 swings from 0 voltage to -6 volts and is applied to the emitter of transfer firing gate through C2 on printed circuit board A4.

(2) TEST DATA.

(a) The clock delay univibrator is shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The logic symbol is OS-2. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for this circuit.

(c) The components of the circuit are located on printed circuit boards 3A3A1, 3A4A1, 3A5A1, and 3A6A1.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no test points for this circuit.

l. TRANSFER FIRING GATE. (See figure 4-15.)

(1) CIRCUIT DESCRIPTION.

(a) The transfer firing gate operates in a manner similar to the storage selection gates described in paragraph 4-7i. Transistor Q1 on printed circuit board A4 receives inputs from the transfer flip-flops and the clock-delay univibrator. The transfer firing gate transistor Q1 is normally biased into cut off by the -6 volt potential applied to the emitter by R54. The base circuit is connected via R3 to the collector of the transfer prime flip-flop. When 0 voltage is applied from the transfer flip-flop, signifying that the transfer prime circuit has not been fired, no output can be generated by a differentiated positive-going pulse applied at the emitter by the clock-delay

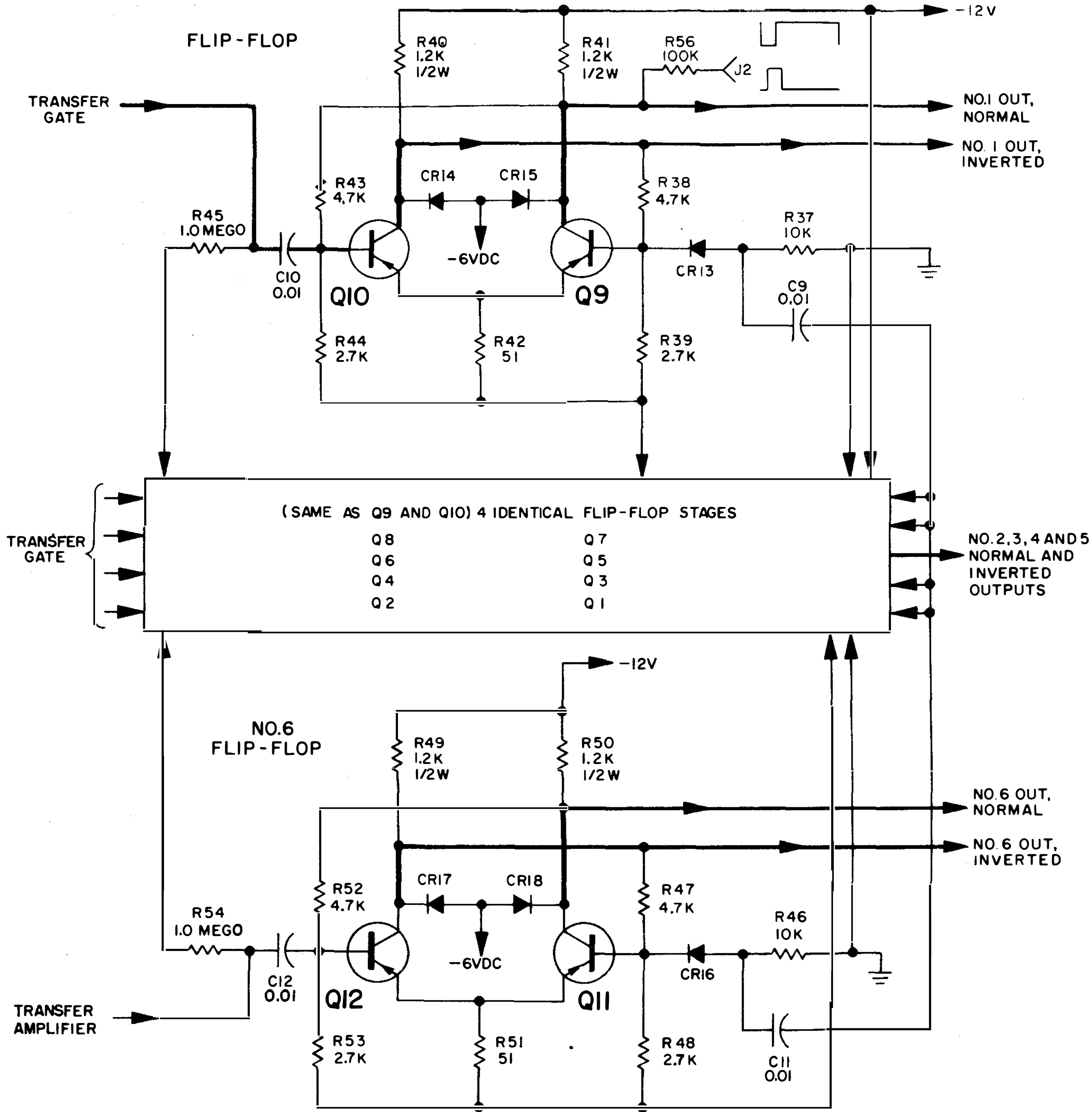


Figure 4-13. Simplified Schematic, Second Level Storage

univibrator, since the emitter is 6 volts negative, as compared to the base.

(b) When the base of Q1 is at -6 volts, signifying that the transfer prime circuit has been fired, a positive-going pulse applied at the emitter will cause Q1 to conduct. The positive-going pulse generated at the collector of Q1 is applied to the transfer circuit.

(2) TEST DATA.

(a) The transfer firing gate is shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The logic symbol is AG-3. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for this circuit.

(c) The components of the gate are located on printed circuit boards 3A3A4, 3A4A4, 3A5A4, and 3A6A4.

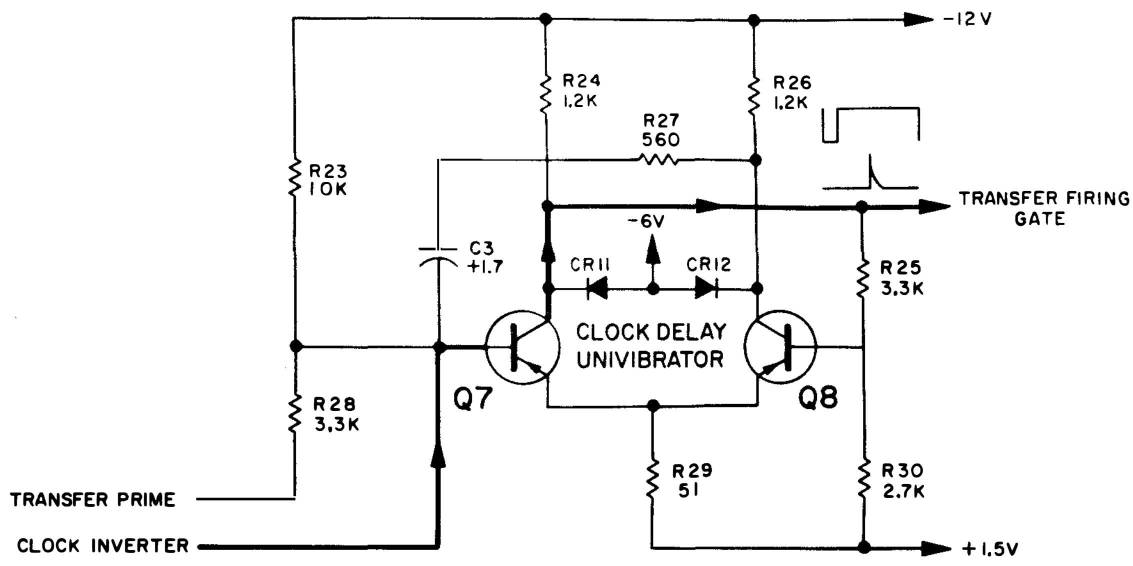


Figure 4-14. Simplified Schematic, Clock Delay

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The test point for the gate circuit is indicated on figure 5-37.

m. TRANSFER GATES. (See figure 4-16.)

(1) CIRCUIT DESCRIPTION.

(a) The transfer circuit on printed circuit board A1 consists of transistors Q9 through Q12 which are capable of operating as either a flip-flop or a univibrator. Transistor Q9 is normally conducting and Q10 is normally cut off. The output of the transfer firing gate, and the output of the stop element of the start-stop distributor are applied as inputs to the transfer circuits. When the stop element is conducting (0 voltage applied to R42 on printed circuit board A1), Q11 is biased into cut off by the voltage developed at the junction of R41 and R42. In this condition, cross coupling from the collector of Q9 to the base of Q10 is accomplished via C5 and R35 and the circuit functions as a univibrator.

(b) If the stop element is not conducting (-6 volts applied to R42 on printed circuit board A1), Q11 is saturated. In this condition, an additional cross-coupling circuit is available from the collector of Q9 through R32 and Q11 to the base of Q10. The circuit is stable in each of its two states and will

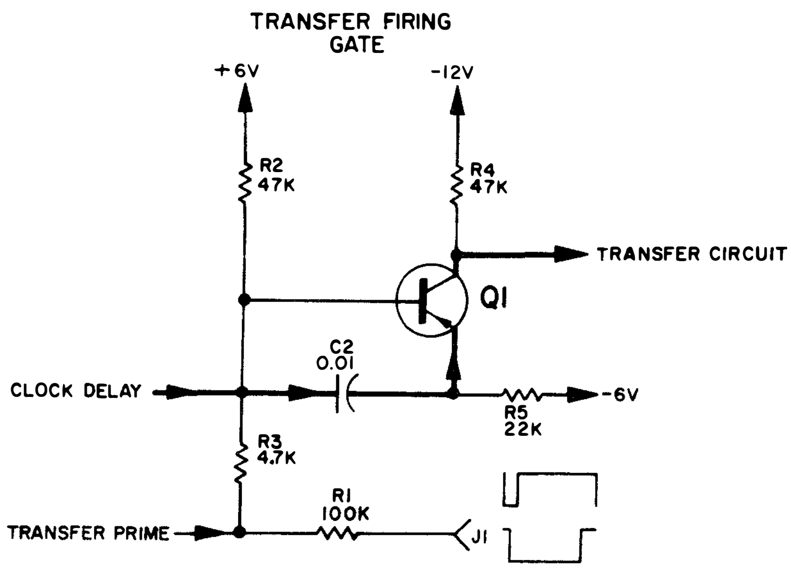


Figure 4-15. Simplified Schematic, Transfer Firing Gate

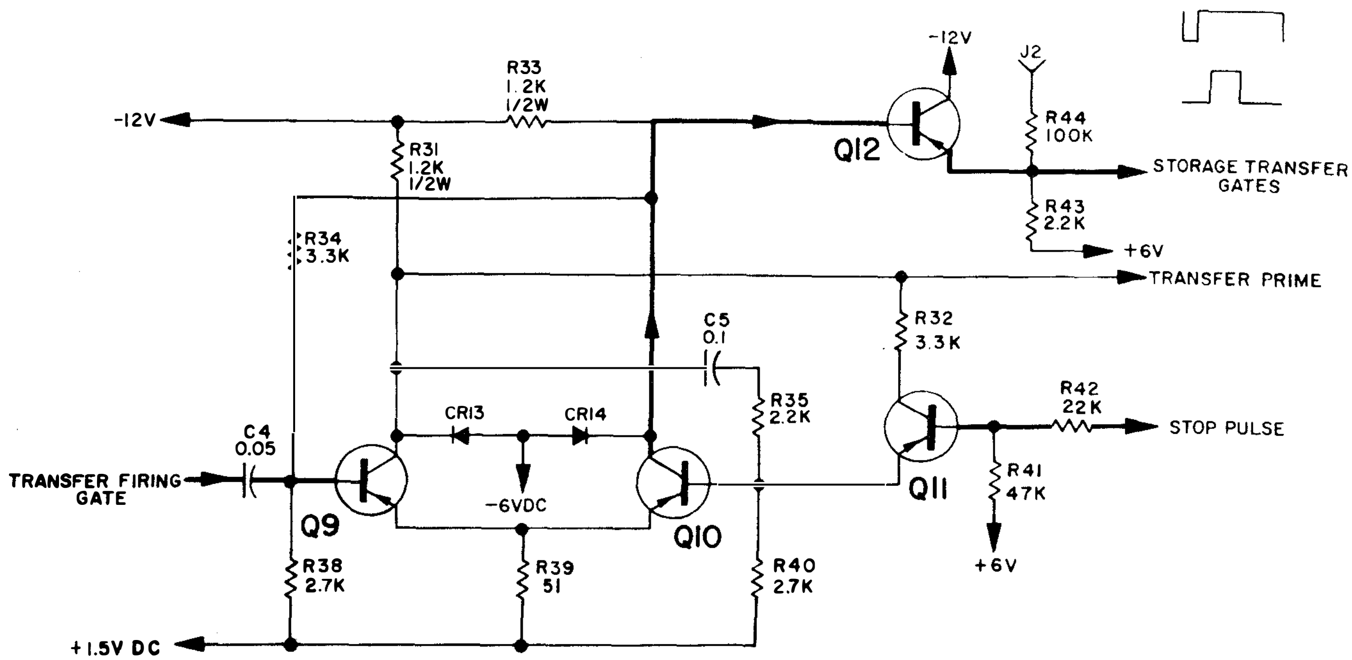


Figure 4-16. Simplified Schematic, Transfer Circuit

function as a flip-flop. When a positive pulse is applied to the base of Q10, the transistor will reset after a timed interval if a stop pulse is applied to R42, or will remain in the set condition until the stop element of the start-stop distributor is fired, at which time the circuit will be reset.

(c) The output of the transfer circuit is applied via the emitter follower Q12 to the storage transfer gates. The set condition of the transfer circuit inhibits the transfer gates and the reset state of the transfer circuit enables these gates.

(2) TEST DATA.

(a) The transfer circuit is shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The logic symbol is FF2 and an amplifier. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for these circuits.

(c) The components of these circuits are located on printed circuit boards 3A3A1, 3A4A1, 3A5A1, and 3A6A1.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The test point for this circuit is indicated on figure 5-34.

n. CLOCK INVERTER. (See figure 4-17.)

(1) CIRCUIT DESCRIPTION.

(a) The second level storage is reset by a signal supplied from the clock inverter, Q1 on printed circuit board A1. Q1 is normally biased into cut off by a +2 volt potential on the base, developed by the divider consisting of R3 and R4. The clock input, from the Mux-Demux, is applied through C2 to the base of Q1.

(b) The input is differentiated by C2 to develop a negative going transition at the base of Q1. Q1 is driven into saturation, developing a positive spike at the collector. This positive spike is applied to all flip-flops in the second level storage to reset them.

(2) TEST DATA.

(a) The clock inverter is shown in logic form on the Transmitter Code Converter logic diagram, figure 4-30. The logic symbol is IV-4. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-66, respectively.

(b) There are no adjustments for this circuit.

(c) The components of this circuit are located on printed circuit boards 3A3A2, 3A4A2, 3A5A2, and 3A6A2.

(d) The only test equipment required for trouble shooting or repair of this circuit is the test

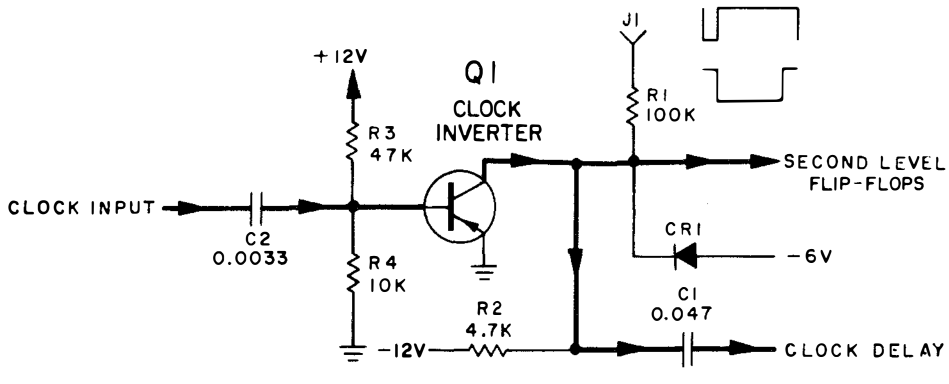


Figure 4-17. Simplified Schematic, Clock Inverter

equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The test point for this circuit is indicated on figure 5-35.

4-8. DEMULTIPLEXER-MULTIPLEXER, FUNCTIONAL DESCRIPTION. (See figure 4-32.)

a. The Transmitter Mux-Demux receives multiwire signals from the Transmitter Code Converters and combines them into multiplex signals for the Control Amplifier. The Receiver Mux-Demux receives multiplex signals from the Synch Unit and supplies multiwire signals to the Receiver Code Converters. Since the operation of the Mux-Demux is similar for both the Receiver and Transmitter Groups, only the transmitter uses will be discussed. For those areas where the receiver use is different from the transmitter use, the differences are explained.

b. The general circuits of the demultiplexer-multiplexer are divider no. 2, divider no. 3, divider no. 4, signal distributor (divider no. 6), divider no. 7, signal matrix and the signal sampling pulse gate.

c. The dividers and distributors are transistor ring circuits that function in a manner similar to the start-stop distributor of the Transmitter Code Converter. A drive circuit similar to the start-stop distributor drive is associated with each ring.

d. Dividers 2, 3, and 4 are used almost exclusively for frequency division. The output frequencies of these rings are shown in Table 4-5. The signal and channel distributors are used to distribute the incoming or outgoing multiplex signal. Divider no. 7 is used as a frequency divider to provide an output for use with associated auxiliary equipment. Certain elements of rings 2 and 3 and the channel distributor are connected, through switches, to change the number of elements in the ring and thus provide the correct output frequency for a given speed and channel position.

TABLE 4-5. DEMULTIPLEXER-MULTIPLEXER FREQUENCY DIVISION CHART.

Stage	Input (cps)	Ratio	Output (cps)	Speed (WPM)	Channels
Divider 2 (Ratio determined by WPM switch)	From Divider 1				
	15,750	5/1	3150	60	
	15,750	4/1	3937.5	75	
	15,407.5	3/1	5135.833	100	
Divider 7	From Divider 2				
	3150	7/1	450	60	
	3937.5	7/1	562.5	75	
	5135.833	7/1	733.690	100	
Divider 3 (Ratio determined by WPM switch	From Divider 2				
	3150	3/1	1050	60	4
	3150	4/1	787.5	60	3
	3150	6/1	525	60	2
	3937.5	3/1	1312.5	75	4
	3937.5	4/1	984.375	75	3
	3937.5	6/1	656.25	75	2
	5135.833	3/1	1711.944	100	4
	5135.833	4/1	1283.958	100	3

TABLE 4-5. (CONT'D)

Stage	Input (cps)	Ratio	Output (cps)	Speed (WPM)	Channels
	5135.833	6/1	855.972	100	2
Divider 4	From Divider 3				
	1050	7/1	150	60	4
	7875	7/1	112.5	60	3
	525	7/1	75	60	2
	1312.5	7/1	187.5	75	4
	984.375	7/1	140.625	75	3
	656.25	7/1	93.75	75	2
	1711.944	7/1	244.563	100	4
	1283.958	7/1	183.423	100	3
	855.972	7/1	122.282	100	2

Mux Signaling Rate

60 WPM	375 Operations per Minute
75 WPM	468.75 Operations per Minute
100 WPM	611.19/46 Operations per Minute

e. Input drive pulses are coupled to the distributor drive circuit associated with divider no. 2. These input pulses are originated at the crystal-oscillator subpanel located in the Oscillator-Power Supply. Ring dividers 2, 3, and 4 reduce the pulse frequency to a rate required by the signal distributor. The signal distributor, in turn, drives the channel distributor. Outputs from the signal and channel distributors are applied to the signal matrix.

f. The signal matrix consists of 24 similar groups of 4 diodes and a load resistor, each connected in an AND-OR gate configuration. This configuration is known as a star matrix. (Matrix on figure 4-32.)

g. As a multiplexer (transmitting function) the matrix is operated as follows. Each star is operated as an AND gate which is primed from three sources: the signal received from the converters, the signal distributor, and the channel distributor. All three must be present (0 voltage) simultaneously to produce an output signal. The fourth diode in each group is connected in common with all corresponding diodes so that a 24-element OR gate results, which will accept a signal from any one of the 24 diode groups.

h. Signals from respective channel code converters in the form of dc voltages (0 to -6 volts) are introduced into the matrix through diodes labeled A1, A2, ---A6; B1, B2, ---B6, and so on. These signals are read by the appropriate signal and channel distributors which sample each converter second-level storage flip-flop (24 in all for 4 channel operation) and generate the multiplex signal. The multiplex signal is applied to the Control Amplifier.

i. The multiplex signal generated in the matrix must be assembled with certain pulses inverted (mark for space) in order to provide transitions during an idle signal period. These transitions are necessary for synchronizing purposes. Elements 2, 3, and 4 of channel A plus all of channels C and D are inverted for this purpose. Since each converter supplies both a normal and inverted output, the proper output is connected to the proper matrix diode. Thus, inverted outputs are connected to A2, A3, A4, and all outputs of C and D.

j. As a demultiplexer (receiving function) the matrix functions in the following manner. Multiplexer signals are received from the Synch Unit. These signals are connected through the signal polarity switch and applied to the matrix on two wires. One wire carries the normal signal, and the other wire carries the inverted signal. Each wire is connected to the appropriate diode to compensate for the inversions in the transmitted multiplex signal. Signals which have been inverted at the transmitter will appear on the inverted signal lead. Signals which were not inverted appear on the normal signal lead. The signal and channel distributors at the demultiplexer perform functions complementary to those of the multiplexer. The distributors, by sampling each of the 24 stars in turn, separate the information contained in the multiplex signal and route it to the proper code converter through diodes A1, A2, ---A6; B1, B2, etc.

k. The sampling pulse gate is used at the receiver terminal only. Element no. 4 of divider no. 4 (a seven element divider) is gated with element 2 of divider no. 3 to create a narrow pulse of the order of 1 millisecond. This pulse occurs at the nominal center of each incoming multiplex signal element, and is used by the Synch Unit as a sampling pulse to sample the incoming signal.

l. When the multiplex is used with auxiliary equipment, the no. 6 output from divider no. 4 is employed for signal sampling. This output is available at connector J9.

m. An output from the A6 matrix star is also provided at the receive terminal for use with auxiliary equipment.

n. To detect phase relationships between the incoming signal and the local drive, additional phase lead and phase lag outputs are required. Two OR gates, OG-2, which gates elements 1,2,3, and 4 of divider 4 to produce the phase lag output, and OG-3, which gates elements 5, 6, and 7 of divider 4 to produce a phase lead output, are employed to generate phase shift correction pulses. Phase shift correction pulses are sent to the phase lag output and the phase lead output amplifiers, in Synch Unit, respectively, where these pulses gate two AND gates to correct for phase shifts. The phase shifts are corrected by the appropriate triggering of the advance univibrator or the retard univibrator, resulting from the enabling of the AND gate, causing a pulse of altered phase (correct occurence in time) to be inserted in the correct bit time of the message.

o. A milliammeter (DISTRIBUTOR CYCLE meter M1), receiving a rectified output (through diode A3CR12) from common-emitter amplifier A3Q2, is provided to monitor the channel distributor operation on a "go, no-go" basis. When the channel distributor is operating properly, meter M1 fluctuates at a speed determined by the number of channels in operation. When four channels are operating, meter M1 fluctuates at a fast rate compared to the interval during which only two channels are in operation. During three channel operation, meter M1 fluctuates at a speed faster than two channel operation, but slower than four channel operation.

4-9. TRANSMITTER, RECEIVER MUX-DEMUX, TEST DATA

a. Table 4-6 is a list of the steps to be performed to localize transmitter failures to the Transmitter Mux-Demux, or some receiver failures to the Receiver Mux-Demux. If a specific difficulty does not appear in this table, refer to the trouble shooting information given in the test data sections for the Transmitter Code Converter or Control Amplifier (for transmitter difficulties), or in the Synch Unit or Receiver Code Converter (for receiver difficulties).

NOTE

The trouble shooting chart of Table 4-6 will localize the failures to a specific printed circuit board in the Mux-Demux. When the functional section has been located, immediate repair is effected by the replacement of that printed circuit board which contains the faulty section.

TABLE 4-6 MUX-DEMUX, TROUBLE SHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1		The distant terminal reports garbling on all channels, or the local receiving terminal reports garbling on all channels.	All channels should receive clean copy.	The multiplex receiving distributor rate is not compatible with the transmitter. If the received signal is garbled, proceed to step 2. If the distant terminal receiver signal is garbled, proceed to step 5.
2		Check the switch position of the Receiver Mux-Demux.	Channels switch must agree with the number of channels used.	If the switch position does agree, proceed to step 3.
3		Operate the equipment in the LOCAL mode of operation.	Printers should print good copy.	If the local printer prints good copy, the failure is in the distant terminal transmitter. If the local printer does not print good copy, the failure is in either the Receiver Mux-Demux or the Synch Unit. Proceed to step 4.
4		Observe the mux line current and receiver crystal meters on the Synch Unit drawer.	The line current meters should vibrate at the channel rate. The Receiver crystal meter should kick at intervals indicating addition of correcting pulses.	If meter indications are not normal the Synch Unit is at fault. Refer to the trouble shooting chart, Table 4-12 for the Synch Unit. If the meter indications are correct, the failure is in the Mux-Demux drawer. Proceed to step 7.

TABLE 4-6. (CONT'D)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
5		Operate the equipment in the LOCAL mode of operation.	Printers should print good copy.	If the local printers print good copy, the failure is in the distant terminal receiver. If the local printer does not print good copy, the failure is either in the Transmitter Mux-Demux or the Control Amplifier. Proceed to step 6.
6		Interchange the Transmitter Mux-Demux with the Receiver Mux-Demux. Operate the equipment in the REMOTE mode of operation.		If the distant terminal reports garbled copy, the failure is the Receiver Mux-Demux. Proceed to step 7.
7	2	Connect the vertical input of the oscilloscope to test point J1 on printed circuit board A4. Place the CHANNELS switch in the 4 position.	The waveform should be as shown on figures 2-37 or 5-67.	If the waveform is normal, proceed to step 8. If the waveform is abnormal, the failure is in either the circuits of of Q1 and Q2 and printed circuit board A3, or the matrix. If the matrix has failed, proceed to step 13.
8	B	Connect the vertical input of the oscilloscope to the junction of R24 and CR11 on printed circuit board A4.	The waveform should be as shown in figures 4-32 or 5-67.	If the waveform is normal, the failure is in divider No. 6, on printed circuit board A4. Refer to paragraph 4-10e, for the circuit description.
9	C	Connect the vertical input of the oscilloscope to the junction of R42 and C16 on printed circuit board A2.	The waveform should be as shown on figures 4-32 or 5-67.	If the waveform is normal, the failure is in divider No. 5 on printed circuit board A2. Refer to paragraph 4-10 d. for the circuit description. If the waveform is abnormal, proceed to step 10.
10	3	Connect the vertical input of the oscilloscope to test point J1, on printed circuit board A2.	The waveform should be as shown on figures 4-32 or 5-67.	If the waveform is normal, the failure is in divider No. 4 on printed circuit board A2. Refer to paragraph 4-10 c. for the circuit description. If the waveform is abnormal, proceed to step 11.
11	1	Connect the vertical input of the oscilloscope to test point J1, on printed circuit board A1.	The waveform should be as shown on figures 4-32. or 5-67.	If the waveform is normal, the failure is in divider No. 3 on printed circuit board A2. Refer to paragraph 4-10 b. for the circuit description. If the waveform is abnormal, proceed to step 12.
12	A	Connect the vertical input of the oscilloscope to the junction of R2 and C1 on printed circuit board A1.	The waveform should be as shown on figures 4-32 or 5-67.	If the waveform is normal, the failure is in divider No. 2 on printed circuit board A7. Refer to paragraph 4-10 a. for the circuit description.

TABLE 4-6. (CONT'D)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
				If the waveform is abnormal check the power supply.
13	7	Correct the vertical input of the oscilloscope to test point J4 of printed circuit board A5.	The waveform should be as shown on figures 4-32 or 5-67.	If the waveform is normal, the failure is in the Transmitter Code Converter associated with that channel.

b. The only test equipment required for the performance of trouble shooting procedures is the test equipment listed in Table 4-2.

c. Table 4-7 is a list of the controls and indicators of the Transmitter and Receiver Mux-Demux drawers. Column one indicates the control or indicator and column two lists the position of the component on the drawer. Column three lists the normal position of the control or the normal indication of the indicator.

d. There are no adjustment or alignment procedures for either the Transmitter or Receiver Mux-Demux.

e. The logic block diagram for the Mux-Demux drawer is shown on figure 4-32. The interconnecting wiring diagram and the schematic diagram for this drawer are shown on figure 5-65 and 5-67. Test jacks for the individual circuits are shown on figures 5-59 through 5-63.

TABLE 4-7. MUX-DEMUX UNIT, CONTROLS AND INDICATORS

Control	Location	Normal Position	Remarks
CHANNELS switch	Front Panel	2, 3, or 4 as required	The position of the switch must agree with the number of channels of information that are used.
DISTRIBUTOR CYCLE meter	Front Panel	20 to 25 ma or 60 to 65 ma	The meter should agree with the preset current level.
WPM switch	Interior of Drawer	60, 75, or 100 as required	The position of the switch must agree with the wpm rate of the transmission.
AUX-NORMAL switch S2	Interior of Drawer	AUX, NORM as required	The position of the switch is NORMAL unless auxiliary equipment is used with the Multiplex Set.
NORMAL-INVERTED	Interior of Drawer	NORMAL	The switch is placed in the INVERTED position when that mode of signal output is desired

f. The Multiplex Unit is placed in the LOCAL TEST mode of operation by following the procedure given in paragraph 4-6, f.

g. The following caution must be observed when performing trouble shooting procedures:

CAUTION

Deenergize the equipment prior to removing or installing drawers. After installing the drawers, allow a fifteen minute warm-up period, to insure stable oscillator operation.

4-10. DEMULTIPLEXER-MULTIPLEXER, CIRCUIT DESCRIPTIONS.

a. DIVIDER NUMBER TWO (A1Q2 - A1Q11) AND DIVIDER AMPLIFIER (A1Q1). (See figure 4-18)

(1) CIRCUIT DESCRIPTION.

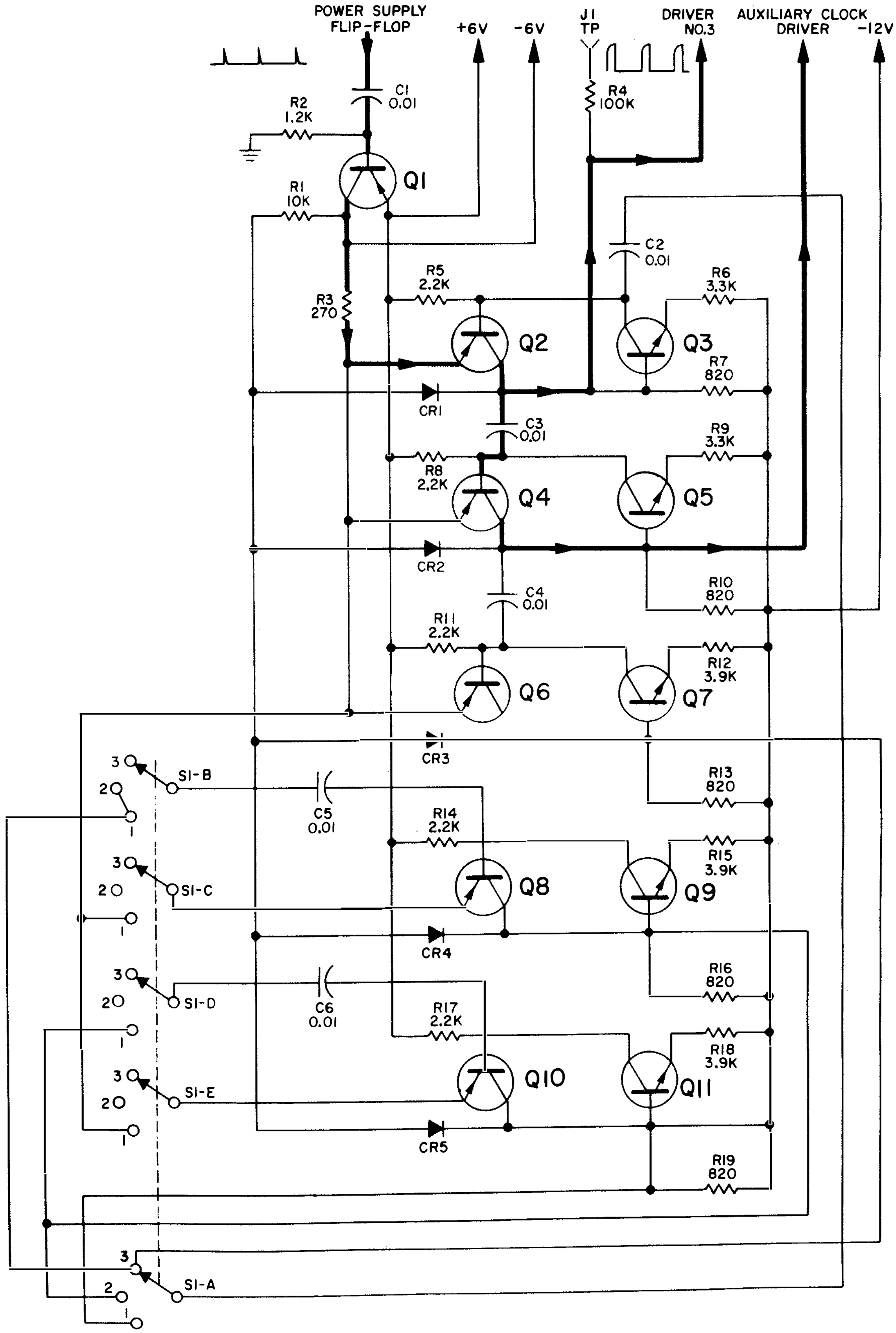


Figure 4-18. Simplified Schematic, Divider No. Two

(a) Transistors Q14 through Q27, on printed circuit board A1, comprise a frequency divider circuit. Q1 supplies the drive input to the divider. The Drive input is derived from the oscillator in the Oscillator-Power Supply drawer.

(b) A positive-going, square-wave pulse, from the timing flip-flop in the Oscillator-Power Supply, is applied to the input of the divider amplifier once every 254 microseconds. These 254-microsecond-duration square-wave pulses are differentiated by a high-pass RC network, consisting of input-coupling capacitor A1C1 and base-bias resistor A1R2, into 10-microsecond-duration spikes. Each spike is applied to transistor A1Q1's base causing the normally-conducting transistor to be driven out of the conduction. The positive-going spike causes a negative-transition at transistor A1Q1's collector, which appears across collector load resistor A1R1, and lasts for the duration of the spike (10 microseconds). The negative-going amplified spike is then coupled through series resistor A1R3 to the emitter leads of divider transistors A1Q2 through A1Q11. In divider number two (as in the other divider circuits) one stage is always conducting. The rest of the stages are turned off so the negative-going amplified spike has no effect on these stages. The conducting stage, (Q2 and Q3) which has a reduced positive bias at its emitter (with respect to the collector level), is turned off by the negative-going amplified spike. As the stage is driven to cut-off the collector level of the PNP transistor element of the stage climbs towards the negative supply bias level. The transistion of the PNP transistor's collector is coupled through a divider interstage capacitor to the base of the following stage's PNP transistor, cutting it off. The divider stage following the newly cut-off stage is the only stage supplied an enabling pulse during the disabling pulse interval. The stage is the only stage properly biased and is the only stage that can conduct. The negative-going transition, also a 10 microsecond spike due to the time constant of the inter-stage coupling capacitor and associated resistances, causes the next stage to conduct. After the newly cut-off stage is cut-off and the negative-going spike resulting from the differentiation has disappeared, the NPN element of the now conducting stage is driven into saturation (and held there) by the positive transition of the now-conducting PNP transistor's collector. The NPN transistor's collector then makes a negative transition which holds the PNP transistor element's base in the conducting region. After the formerly-conducting stage is stable (spike disappears) the NPN transistor element holds the PNP transistor element in the conducting region (via base bias), preceeded by the PNP transistor (first element to conduct) element causing the NPN transistor element to conduct. When the next amplified 10-microsecond spike is generated at amplifier A1Q1's output, the conducting stage is cut-off and the following stage is triggered on, repeating the cycle.

(c) Every five, amplified, 10-microsecond spikes generated at amplifier A1Q1's output cause divider number two to complete a counting cycle. A counting cycle is five consecutive sequential stage transitions to effectively divide the pulse-per-second (pps) rate that appears at amplifier A1Q1's input at a rate of 3937.5 pps, by a factor of five. The output of the last stage of divider number two is 787 pps. Depending on the word speed to be used (60 wpm, 75 wpm, or 100 wpm) the feedback to the first stage of divider number two is taken from the third, fourth, or fifth stage. This results in the divider output from the second divider stage being divided by a factor of three, four, or five, respectively. When the Multiplex Set is used at 100 wpm speed, a clock oscillator (located in the Oscillator-Power Supply) with a frequency of 15,407.5 cps is used in place of the normal 15,750.0 cps clock oscillator plug-in module. Switching to 100 wpm speed is performed by removing the 15,750.0 cps clock oscillator module from the active socket and replacing it with the 15,407.5 cps clock oscillator module. The 15,740.0 cps clock oscillator module is then placed in the storage (inactive) socket and is used when the Multiplex Set is again operated at 60 or 75 wpm speed. The word-per-minute (WPM) switches in the Mux-Demux and Transmitter and Receiver Code Converters must be set to the 100 wpm positions.

(d) The output of each stage of divider number two is a seven volt dc square-wave pulse varying between -6 to +1 volt levels. The output of divider stage A1Q2/A1Q3 (collector lead of transistor A1Q3) is applied to divider (number three) amplifier A2Q1 through input-coupling capacitor A2C1. An output at the collector of divider element A1Q4 is sent to the auxiliary clock-450 cps driver amplifier A1Q26.

(2) TEST DATA

(a) The divider number three circuit is shown in logic form on the Mux-Demux Logic Diagram, figure 4-32. The logic symbols are CD-1 and Driver #2. The intraconnection information and the complete schematic diagram are shown on figure 5-65 and 5-67, respectively.

(b) There are no adjustment or alignment procedures for this circuit.

(c) The components of this circuit are located on printed circuit boards 2A2A1 and 3A2A1, respectively, of the Receiver or Transmitter Mux-Demux drawers.

(d) The only test equipment required for trouble shooting of this circuit is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The test point for this circuit is shown on figure 5-59.

b. DIVIDER NUMBER THREE (A2Q2 - A2Q13) AND DIVIDER AMPLIFIER (A2Q1).

(1) CIRCUIT DESCRIPTION

(a) Transistors Q2 through Q13, on printed circuit board A3, comprise divider number three. Q1 is the driver amplifier for the ring.

(b) The output of divider number two is coupled to divider amplifier A2Q1 through input-coupling capacitor A2C1. The square-wave output of divider number two is differentiated by input-coupling capacitor A2Q1 and base-bias resistor A2R2, producing 10-microsecond spikes of alternate negative and positive polarity. Divider amplifier A2Q1 is normally conducting (during no-spike interval) and transistor A2Q1's collector terminal is at a low negative level (A2Q1 is PNP transistor). The negative spikes applied to the base of transistor A2Q1 have no effect on the amplifier, since the PNP transistor is negatively-biased to saturation. The positive spikes applied to the base of transistor A2Q1 cause it to be driven below cut-off. The collector of A2Q1 rises to a level approaching the negative bias source voltage and causes an inverted 10-microsecond spike to appear across collector load resistor A2R1. This amplified spike is coupled through resistor A2R3 to the triggering input of divider number three which is directly connected to transistors A2Q2 through A2Q13 at their emitter leads. The ring circuits in divider number three operate in the same manner as the ring circuits in divider number two. The output (7v, varying -6 to +1 volt) of divider number three is taken from the collector of A2Q2 and coupled through capacitor A2C17 to divider amplifier A2Q28 for divider number four. A second output of divider number three is taken from the collector of A2Q4 and coupled as an input gate to one of the multiplex sampling gate circuits.

(c) CHANNELS switch S3 is part of divider number three and determines the number of divider stages used for two, three, and four channel operation. Position one of CHANNELS switch S3 sets up two-channel operation, using six divider stages (A2 Q2/A2Q3 - A2Q12/ A2Q13); position two of CHANNELS switch S3 sets up three-channel operation, using four divider stages (A2Q2/ A2Q3 - A2Q8 / A2Q9); position three of CHANNELS switch S3 sets up four-channel operation, using three divider stages (A2Q2/ A2Q3 - A2Q6 / A2Q7). The pulse-per-second rate at the output of divider number three, with respect to the pulse-per-second rate at the input, equals the reciprocal of the number of divider stages used (three stages of number three divider = two divider pps rate).

(2) TEST DATA

(a) The divider number three circuit is shown in logic form on the Mux-Demux Logic Diagram, figure 4-32. The logic symbols are CD-2 and divider #3. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-67, respectively.

(b) There are no adjustment or alignment procedures for this circuit.

(c) The components of this circuit are located on printed circuit boards 2A2A2 and 3A2A2, respectively of the Receiver or Transmitter Mux-Demux.

(d) The only test equipment required for trouble shooting of this circuit is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no major test points for this circuit.

c. DIVIDER NUMBER FOUR (A2Q14 - A2Q27) AND DIVIDER AMPLIFIER (A2Q28).

(1) CIRCUIT DESCRIPTION

(a) Transistors Q14 through Q27, on printed circuit board A2, comprise divider number four. The input driver for this ring is transistor Q28. The schematic for this circuit is identical to the schematic on figure 4-18.

(b) The operation of divider amplifier A2Q28 is identical to that of divider amplifier A2Q1 discussed in paragraph 4-10b (1) (b). The output of A2Q28 is coupled through resistor A2R46 to the triggering input of divider number three. Divider number four operates in the same manner as divider number three, discussed previously, except that divider number three has one less ring circuit stage (divider number four has seven ring circuit stages). The main output of divider number four is taken from divider stage A2Q14/ A2Q15 (collector of transistor A2Q14) and is sent through divider amplifier A4Q23 to divider number five. The divider amplifier circuit is composed of OR gate A3CR4 and A3CR5 (with associated components A3R1, A3R2, A4C12, and A4C13), and divider amplifier A4Q23. The secondary outputs are taken from divider number four stages A4Q11/ A4Q12, A4Q13/ A4Q14, A4Q15/ A4Q 16, and A4Q17/ A4Q18, and ORed by diodes A3CR6 - A3CR9 (with associated resistor A3R3) and then generated as a phase lag output to terminal J9-J. Another secondary output is taken from divider number four stages A2Q18/ A2Q19, A2Q16/ A2Q17, and A2Q14/ A2Q15, and ORed by diodes A3CR1 - A3CR3 (with associated resistor A3R4) and then generated as a phase lead output to terminal J9-K.

(2) TEST DATA

(a) The divider number four circuit is shown in logic form on the Mux-Demux Logic Diagram, figure 4-32. The logic symbols are CD-4 and divider #4. The intraconnection information and the complete schematic diagram are shown on figures

5-65 and 5-67, respectively.

(b) There are no adjustment or alignment procedures for this circuit.

(c) The components of this circuit are located on printed circuit boards 2A2A2 and 3A2A2, respectively, of the Receiver or Transmitter Mux-Demux.

(d) The only test equipment required for trouble shooting of this circuit is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no major test points for this circuit.

d. DIVIDER NUMBER FIVE (A4Q11 - A4Q22) AND DIVIDER AMPLIFIER (A4Q23). (See figure 4-19)

(1) CIRCUIT DESCRIPTION.

(a) Transistors Q11 through Q22, on printed circuit board A4, comprise divider number five. The drive amplifier for this divider is shown in figure 4-29.

(b) The operation of divider number five is identical to that of divider number three, discussed previously. Divider amplifier A4Q23 is different to a marked degree from the other divider amplifiers in both function and implementation. Divider amplifier A3Q23 is comprised of a differentiating, buffer-type OR circuit (consisting of diodes A3CR4/ A3CR5, capacitors- A3C12/ A3C13, and resistors A3R1, A3R2, and A3R44), and an inverting switching circuit (consisting of PNP transistor A3Q23 in a common-emitter amplifier configuration).

(c) A square-wave signal appearing at input 1 of the differentiating OR gate is coupled through diode A3CR4 and appears across diode load resistor A3R1. A differentiating network, consisting of coupling capacitor A3C12 and OR gate load resistor A3R44, permits the leading and trailing edges of the square-wave signal to pass. The differentiation results in the appearance of alternating positive-going and negative-going 10-microsecond spikes, of approximately six volts peak, across the OR gate load resistor A3R44 (which also establishes base bias for transistor A3Q23). The six-volt spikes are prevented from being generated in the reverse direction,through input 2, by the high back impedance of diode A3CR5 which is in series with the input. Any square-wave signal appearing at this input is coupled through diode A3CR5 with negligable attenuation, regardless of the signal applied to input 1. The square wave at input 2 will be altered in the same way as the signal at input 1, resulting in alternate positive-going and negative-going 10-microsecond spikes. The differentiated square-wave from input 2 appears across OR gate load resistor A3R44, along with the differentiated square-wave signal from input 1. The differentiated square-wave output from input 2 is prevented from being generated in the reverse direction, through input 1, by the high back impedance of diode A3CR4. Thus, the OR gate passes a square-wave signal at either input while isolating each input from the other. The output of the OR gate, appearing across resistor A4R44, is a composite waveform of one or two differentiated square-wave signals.

(d) The negative-going 10-microsecond spikes appearing across resistor A4R44 have no effect on the inverting switching circuit, since transistor A 4Q23 is a PNP unit operating "full-on" it cannot be driven to greater conduction. The positive-going 10-microsecond spikes appearing across A4R44 cause A4Q23's base to be driven below cut-off, cutting off A4Q23. The collector voltage of A4Q23 then rises toward the negative bias source level (-6v dc) and remains there for the duration of the spike. When the spike at A4Q23's base disappears, the bias level established by A4R44 is restored and A4Q23 resumes its normally on condition. Therefore, every positive-going 10-microsecond spike appearing across A4R44 will cause a negative-going, amplified spike of slightly longer duration (12 μs) at the collector of A4Q23. This amplifier output, appearing across collector load resistor A4R40, is coupled to the trigger input of divider number five through series coupling resistor A4R41.

(e) Normally, the primary output of the divider number four is coupled through input 2 of divider amplifier A4Q23, causing a negative-going 12-volt spike to appear at the collector of transistor A4Q23. A sporadic 180° phase reversal in the multiplex signal will cause one or more pulses (occupying 1 bit each) of the square-wave signal to be applied to input 2 of divider amplifier A4Q23, to be displaced one bit time. The displaced square-wave pulse can be corrected by inserting a pulse in the multiplex signal through use of the framing circuits. The framing circuits are located in the Synch Unit and Mux-Demux. The framing circuits can be operated either manually or automatically through the FRAME and MAN-AUTO switches located on the Synch Unit (front panel). The square-wave pulse to be inserted in the multiplex signal, either manually (depressing FRAME switch) or automatically (feeding marker pulses from idling channel A in telegraph code converter), is fed to input 1 of divider amplifier A4Q23. The OR gate in divider amplifier A4Q23 produces alternate-polarity six-volt (peak) spikes of approximately 10-microseconds duration. The positive-going (only) 10-microsecond spikes are applied to the inverting switch amplifier input, causing the collector of transistor A4Q23 to climb towards the negative bias voltage level. Since transistor A4Q23 is normally saturated, the negative-going spike inputs have no effect on inverting switch amplifier A4Q23. This results in a twelve-volt (peak), negative-going spike of approximately 12-microseconds duration being generated at the inverting switch amplifier's

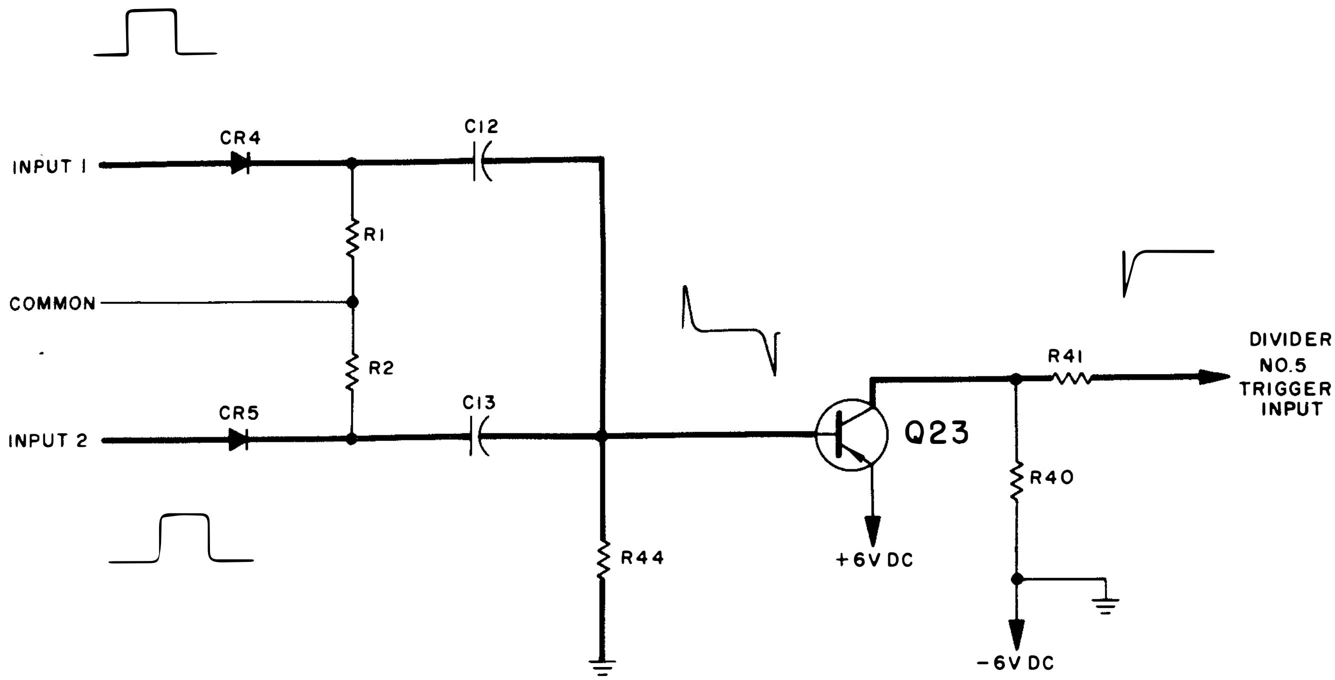


Figure 4-19. Simplified Schematic, Divider Amplifier

output (collector of transistor A4Q23). The pulses from input 1 are combined with the pulses from input 2, and both inputs (now differentiated) appear at the output of OR gate A3CR4/ A3CR5 across base bias resistor A4R44. Each input is therefore superimposed upon the other across resistor A4R44, and the composite wave-form is applied to inverting switch amplifier A4Q23. If the square-wave signal at input 2 occurs at the same time as the square-wave signal of the framing circuit output, no pulse is added to the multiplex signal until the FRAMING switch is again depressed (MANual operation), or another marker pulse occurs on channel A (AUTOmatic operation). The usual case is that the square-wave signals applied to inputs 1 and 2 of OR gate A3CR4/ A3CR5 occur at different times. The signal at input 2 occurs constantly whereas the signal at input 1 occurs sporadically. The pulses added through divider amplifier A4Q23 to the regular divider number four output will shift the serial occurance of bit pulses until the multiplex signal is in synchronization with the remote transmitting source on a bit-by-bit basis. This automatically brings the frame intervals in synchronization. The output divider number four is still fed through input 2 of divider amplifier A4Q23 to divider number five, but no pulses are added through input 1 of divider amplifier A4Q23. In AUTOmatic correcting operation, the pulses being added to divider amplifier A4Q23's input 1 terminate automatically upon achieving synchronization. In MANual correcting operation, a pulse is added every time the operator depresses the FRAMING switch. The operator must continue to depress this switch until the MISFRAME panel lamps are extinguished, indicating that synchronization has been achieved. In either manual or automatic mode of correction, the LOCK-UP RELEASE switch must be depressed before normal operation is resumed after a correction operation.

(f) Divider number five advances one stage at a time for every negative-going spike appearing at the output of divider amplifier A4Q23, including any spikes generated remotely by the framing circuits for synchronization correction. The main output from divider number five is taken from stage A4Q11/ A4Q12 (collector of transistor A4Q11), and is fed to divider number six amplifier A4Q1's input, and to diodes A5CR4 (Normal A1 gate), A5CR8 (Normal B1 gate), A6CR4 (Inverted C1 gate), and A6CR8 (Inverted D1 gate) in the diode coding matrix. Five other outputs are generated by divider number five, these being: collectors of divider stage transistors A4Q13, A4Q15, A4Q17, A4Q19, and A4Q21. The output of transistor A4Q13 is coupled to diodes A5CR44 (Normal A6 gate), A5CR48 (Normal B6 gate), A6CR44 (Inverted C6 gate), and A6CR8 (Inverted D6 gate). The output of transistor A4Q15 is coupled to diodes A5CR36 (Normal A5 gate), A5CR 40 (Normal B5 gate), A6CR36 (Inverted C5 gate), and A6CR40 (Inverted D5 gate). The output of transistor A4Q17 is coupled to diodes A5CR28 (Inverted A4 gate), A5CR32 (Normal B4 gate), A6CR28 (Inverted C4 gate), and A6CR32 (Inverted D4 gate). The output of transistor A4Q19 is coupled to diodes A5CR20 (Inverted A3 gate), A5CR24 (Normal B3 gate), A6CR20 (Inverted C3 gate), and A6CR24 (Inverted D3 gate). The last divider number five output is at transistor A4Q21, which is coupled to diodes A6CR12 (Inverted C2 gate), A6CR16 (Inverted D2 gate), A5CR12 (Inverted A2 gate), and A5CR16 (Normal B2 gate). Divider number five divides the pulse-per-second input frequency, occurring at the output of divider amplifier A4Q23, by a factor of six during all operation, regardless of word speed or the number of active channels.

(2) TEST DATA

(a) The divider number five circuit is shown in logic form on the Mux-Demux Logic Diagram, figure 4-32. The logic symbols are CD-6 and divider #5. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-67, respectively.

(b) There are no adjustment or alignment procedures for this circuit.

(c) The components of this circuit are located on printed circuit boards 2A2A4 and 3A2A4,respectively, of the Receiver or Transmitter Mux-Demux.

(d) The only test equipment required for trouble shooting of this circuit is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no major test points for this circuit.

e. DIVIDER NUMBER SIX (A4Q2-A4Q9) AND DIVIDER AMPLIFIER (A4Q1).

(1) CIRCUIT DESCRIPTION

(a) Transistors Q2 through Q9, on printed circuit board A4, comprise the divider number six circuit. Transistor Q4 is the drive amplifier for this ring.

(b) Divider number six and divider amplifier A4Q1 operates in a manner identical to divider number two and its amplifier (A1Q1). The only difference exists in the capacity of divider number two compared to divider number six, since divider number six has one less stage than divider number two (five stages). Divider number six determines the clock intervals for all four channels (A, B, C, and D) during all operations, regardless of word speed or channels being employed (2, 3, or 4). Divider number six also generates the channel gates for the diode coding matrix. The pulse-per-second rate of the divider number five output (divider stage A4Q11/A4Q12) is coupled to the divider number six input through divider amplifier A4Q1, and is divided by a factor of four. The pulse width at the output of divider number five (at 60 wpm; 4-channel operation) is 160 milliseconds (6.25 pps per pulse, which is 3 milliseconds short of standard teletype frame interval at sixty wpm (single channel). The pulse width at the output of divider number six is 40 milliseconds at a rate of 6.25 pps, with each of the four divider number six outputs consecutively displaced within the 160 microsecond interval. These pulses are generated as the A, B, C, and D clock pulses (in that order) to the diode coding matrix and to the required synchronization inputs in other drawer units.

(2) TEST DATA

(a) The divider number six circuit is shown in logic form on the Mux-Demux Logic Diagram figure 4-32. The logic symbols are CD-7 and divider #6. The intraconnection information and the complete schematic diagram are shown on figure 5-65 and 5-67, respectively.

(b) There are no adjustment or alignment procedures for this circuit.

(c) The components of this circuit are located on printed circuit boards 2A2A4 and 3A2A4, respectively, of the Receiver or Transmitter Mux-Demux.

(d) The only test equipment required for trouble shooting of this circuit is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The test points for this circuit are shown on figures 5-62.

f. DIODE CODING MATRIX (A5CR1 - A5CR48, A6CR1 - A6CR48).

(1) GENERAL. - The diode coding matrix circuit is composed of four sections fed by the A, B, C, and D converters. Each section contains six AND gates with each gate composed of four diodes and a resistor.

(2) MULTIPLEXER OPERATION.

(a) A clock pulse (divider no. 6), and signal-distributor pulse (divider no. 5), and signal-information pulse is applied to each gate. The clock pulse determines which of the four sections is to be used. The signal-distributor pulse determines which of the six gates in a section is to be used, and the signal-information pulse will appear as either a marking or spacing impulse. These three pulse sources are wired to three of the four diodes that make up each gate. The fourth diode is used for the output signal of the gate, which appears across the resistor.

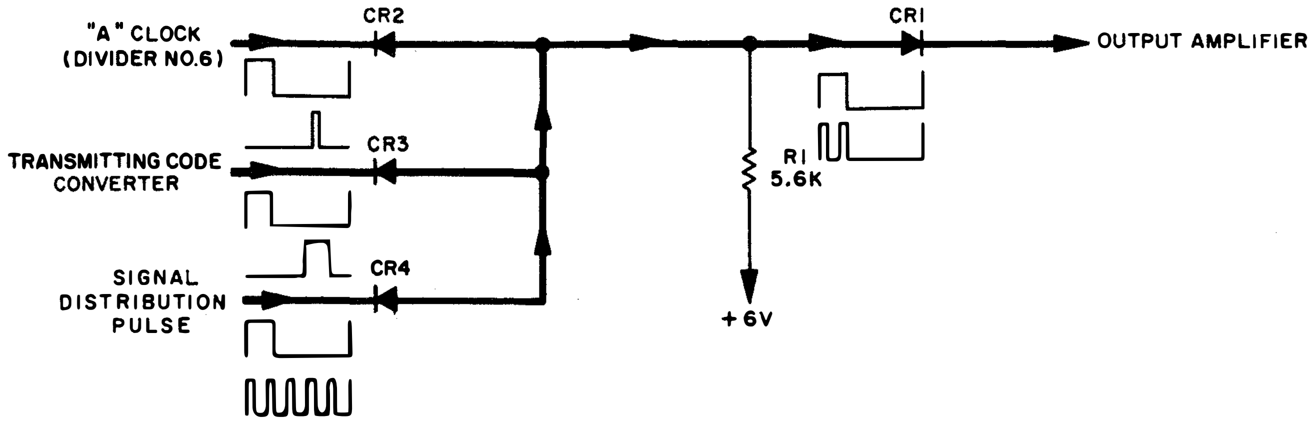


Figure 4-20. Simplified Schematic, Diode Coding, Multiplexer

(b) Since the operation of each gate is identical only the operation of the no. 1 gate for the A section is described. The gate is composed of diodes A5CR1 through A5CR4 and resistor A5R1. The A clock pulse is generated by means of stage A5Q2/ A4Q3 (divider no. 6) and is applied to the diode A5CR2. When stage A4Q2/ A4Q3 is off, -6 volts is applied to the diode which conducts and produces -6 volts across A5R1. When stage A4Q2/ A4Q3 is on, +1 volt is applied to the diode, which now cannot conduct and does not produce a voltage across A5R1.

(c) The signal-distributor pulse is generated by means of stage A4Q11/ A4Q12 (divider no. 5)and is applied to diode A5CR4. When stage A4Q11/ A4 Q12 is off, -6 volts is applied to the diode which conducts and produces -6 volts across A5R1. When stage A4Q11/ A4Q12 is on, +1 volt is applied to the diode which cannot conduct and does not produce a voltage across A5R1.

(d) The signal-information pulse is generated in the Transmitter Code Converter and is applied to diode A5CR3. The pulse varies in potential from -6 to +1 volt. When the potential is -6 volts (space) the diode conducts and produces -6 volts across A5R1. When the voltage is +1 volt (mark) the diode cannot conduct and does not produce a voltage across A5R1.

(e) When -6 volts exists across A5R1, diode A5CR1 cannot conduct. This potential can be caused by any of diodes CR2, CR3, or CR4 conducting. With zero voltage across A5R1, due to the above diodes not conducting, A5CR1 conducts and produces -1 volt across A5R1. The input to the output amplifier is either -1 or -6 volts.

(f) The function of this gate can be summarized as follows: With any transistor in the channel or signal distributors on the corresponding diodes cannot conduct. This leaves a specific gate open to respond to the signal information pulse. A space produces -6 volts at the junction, a mark produces -1 volt at the junction. The timing is such that, when clock pulse "A" of the channel distributor is on, elements 1 through 6 of the distributor go on in sequence, thus opening each gate in channel A. The same action occurs for channel B, C, and D.

(g) The output signal of A5CR1 is converted with other diode gate outputs (5 and 6 or channel A) to the positive signal output terminal (normal signal).

(3) DEMULTIPLEXER OPERATION.

(a) Demultiplexer operation is the reverse of multiplexer operation. Timing of channel and signal distributors is identical to that for multiplexer operation as described above. However, the diodes and leads that carried the signal output for multiplexer operation now become the signal inputs for demultiplexer operation. The diodes connected to A1, A2, ---, B1, B2, etc. now carry the output of the demultiplexer and deliver the signals to the Receiver Code Converter. Signal input pulses from the Synch Unit (0 voltage for mark, -6 volts for space), are applied to diode A5CR1.

(b) With 0 voltage across A5R1, due to A6CR2, A5CR3, and A5CR4 not conducting, A5CR1 conducts to the input flip-flop of the Receiving Code Converter and produces -1 volt across A5R1.

(4) TEST DATA

(a) The diode coding matrix circuits are shown on the Mux-Demux Logic Diagram, figure 4-32.

(b) There are no adjustments or alignment procedures for this circuit.

(c) The components of this circuit are located on printed circuit boards 2A2A5, 2A2A6, 3A2A5, and 3A2A6, respectively, of the Receiver or Transistor Mux-Demux.

(d) The only test equipment required for trouble shooting of this circuit is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The test points for this circuit are shown in figures 5-62 and 5-63.

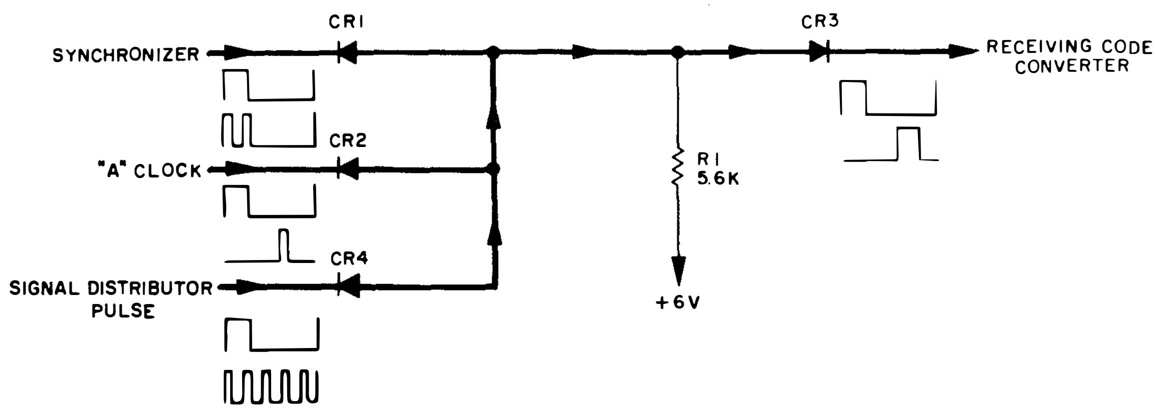


Figure 4-21. Simplified Schematic, Diode Coding, Demultiplexer

4-11. CONTROL AMPLIFIER, FUNCTIONAL DESCRIPTION.

a. GENERAL

(1) The Control Amplifier accepts the multiplexed outputs from the Transmitter Mux-Demux and amplifies, inverts, and regenerates them as a voltage keyed or current keyed multiplexed teletype (telegraph) signal at the Transmitter Group output. The Control Amplifier also provides auxiliary circuits to receive the divider number five outputs from the Transmitter Mux-Demux, amplify them, and apply them to six separate neon indicators for the visual indication of bit time occurrence and sequence.

(2) The Control Amplifier also receives the following outputs from the Transmitter Mux-Demux: the output of divider number seven, the multiplex channel B clock from divider number six, and the diode coding matrix output from the NORMAL-INVERTED switch.

(3) The input from divider number seven is amplified and fed to the Transmitter Group output for use by auxiliary equipment. The B clock pulses from divider number six are amplified and also fed as an output from the Transmitter Group for use by auxiliary equipment. The number four divider, which supplies the pulse source for the multiplexed signal circuits in the Control Amplifier, also provides a drive signal for an amplifier and inverter to generate the signal distributor drive clock for auxiliary equipment.

(4) The inverted multiplex signal from the diode coding matrix of the Transmitter Mux-Demux is reinverted and fed through the SIGNAL SELECT switch, to another inverter and amplifier. The output of this stage is then applied to the voltage keyed and current keyed teletype line transmitting circuits through separate states of inversion. As a result of this last stage of inversion, the multiplex signal is normal and can be employed to gate the respective keyer oscillator.

(5) The uninverted multiplex signal from the diode coding matrix is also applied as input to the Control Amplifier. The signal is amplified, inverted, and regenerated as a high-level, inverted multiplex signal for the use of auxiliary equipment. The Transmitter Group outputs provided by the Control Amplifier serve to make the Multiplex Set completely compatable with the auxiliary equipment with which it will be operated. The availability of both current keyed and voltage keyed multiplexed teletype outputs enhances the utility and flexibility of the set, since it can operate with either current mode or voltage mode systems.

b. FUNCTIONAL DESCRIPTION. (See figure 4-33)

(1) CURRENT KEYED AND VOLTAGE KEYED OUTPUTS.

(a) The main outputs of the Control Amplifier are the current keyed output signal and the voltage keyed output signal. In normal Transmitter Group operation, the SIGNAL SELECT switch on the Control Amplifier is in the MUX position. The inverted multiplex signal from the NORMAL-INVERTED switch of the Transmitter Mux-Demux is applied to an inverter stage (IV-1 on figure 4-33), where it is amplified and inverted. The output of this inverter stage is coupled to the MUX terminal of the SIGNAL SELECT switch. This signal is then fed to another inverter stage (IV-3), reinverted and amplified, and coupled to two inverter stages (IV-4 and IV-5). The multiplex signal at the output of inverter stage IV-3, is of the same phase as the input signal to inverter IV-1. As a result, the multiplex signals at the outputs of inverters IV-4 and IV-5 are a normal multiplex signal with substantial gain.

(b) The output of inverter stage IV-4 is fed to a resistive network (A1R43 and R1) to allow for the adjustment of the output signal. The slightly attenuated output from this network is coupled to a LC filter circuit to remove local and remote interference which might otherwise affect transmission. The filtered multiplex signal is then generated as an output of the Transmitter Group.

(c) The output of inverter stage IV-5 is coupled to the gate input of the keyer oscillator (KO-1) causing oscillation for the duration of the input pulse. The oscillations are coupled through the oscillators output transformer to a center-tapped, full-wave rectifier. This rectified output is filtered by an RC filter circuit. The filter circuit forms the two output pulses of the rectifier output into a single pulse for every sine wave appearing across the secondary of the keyer oscillator transformer. The output of the filter circuit is then applied to the input of the keyer line switch (KLS-1) to drop the collector-to-emitter resistance. The transistor's collector-to-emitter resistance is in series with the teletype line bias voltage. As the resistance drops the current increases in the teletype loop.

(d) As soon as the pulse from the RC filter is removed; the collector-to-emitter resistance increases sharply, dropping the teletype loop current to a quiescent level (space). Gating of the keyer oscillator creates a mark condition, and the lack of gating creates a space condition, in the teletype loop.

(2) BIT TIME PULSE AMPLIFIER CIRCUITS.

(a) Six voltage amplifiers make up the bit time amplifier circuits. Each amplifier receives an input signal from divider number five in the Transmitter Mux-Demux, in the sequence indicated by the stage numbers. The amplifiers amplify the input voltage to the level required to fire the neon lamps connected in parallel with the collector load. Since the bit times are sequential, the sequential order of firing enables the operator to have a visual indication that the pulses do occur, and occur in the proper order.

(b) Because of the high firing voltage required by the neon indicators, the bit time pulse amplifiers have their own d-c power supply. This half-wave power supply, with RC filter, consists of transformer A9T1 and silicon diode A9A1CR1.

(3) HIGH-LEVEL MULTIPLEX SIGNAL CIRCUIT.

(a) The normal Transmitter Mux-Demux matrix output line from the NORMAL-INVERTED switch is applied to the input of a current driver (CD-2 on figure 4-33). The signal current component is amplified and applied to an inverter stage (IV-6) without any phase inversion. Inverter IV-6 inverts and amplifies the normal signal, resulting in the signal becoming identical to the inverted matrix output, with respect to phase.

(b) The inverter output is coupled to the input of the common base amplifier, CA-1. The amplifier raises the zero reference level of the now inverted multiplex signal to +50 volts, and provides a moderately high impedance output. This output is then generated to the auxiliary equipment as required.

(4) AUXILIARY CLOCK PULSE GENERATING CIRCUIT.

(a) The output from divider number seven of the Transmitter Mux-Demux is fed to the input of a current driver (CD-3). The output is slightly attenuated and applied to the first of two, cascaded inverter stages (IV-7 and IV-8).

(b) Since the inverters are cascaded, the signal realizes high gain with no inversion. The output of the second inverter stage (IV-8) is coupled through the d-c isolating capacitor C1 to the output to the auxiliary equipment.

(5) B CHANNEL CLOCK PULSE GENERATING CIRCUIT. -The output from divider number six of the Transmitter Mux-Demux is fed to the input of a current driver (CD-4). The output is slightly attenuated and applied to the first of two inverter stages (IV-9 and IV-10). Since the inverter stages are cascaded, the signal realizes high gain with no inversion. The output of the second inverter stage (IV-10) is coupled through the d-c isolating capacitor (C2) to the auxiliary equipment output.

(6) SIGNAL DISTRIBUTOR DRIVE CIRCUIT. The output from divider number four of the Transmitter Mux-Demux is coupled to the input of a current driver (CD-1). The signal's current component is amplified and coupled to an inverter stage (IV-2). The inverted output signal from IV-2 is fed to the Transmitter Group output for utilization by auxiliary equipment.

4-12. CONTROL AMPLIFIER, TEST DATA

a. Table 4-8 is a list of the steps to be performed to localize transmitter failures to the Control Amplifier. If a specific transmitter difficulty does not appear in Table 4-8 refer to the trouble shooting information given in the test data sections of the Transmitter Code Converter or Transmitter Mux-Demux. Table 4-9 lists some of the test points for auxiliary outputs supplied by the Control Amplifier.

NOTE

The trouble shooting chart of Table 4-8 and 4-9 will localize the failure to a specific board in the Control Amplifier. When the functional section has been located, immediate repair is effected by the replacement of that printed circuit board which contains the faulty section.

TABLE 4-8. CONTROL AMPLIFIER, TROUBLESHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1		Distant terminal reports loss of all multiplex signal.	Distant terminal should receive good copy.	Switch to the LOCAL mode of operation. Proceed to step 2.
2		Check the local monitor printer, with an all mark input to the multiplex.	The local printer should print good copy.	If the indicator is normal, the failure is in the remote terminal. If the indicator is abnormal, proceed to step 3.
3		Check the line current meter on the Transmitter Mux-Demux.	This meter should vibrate at the channel rate.	If the indication is abnormal, proceed to step 4. If the indication is abnormal, check the Transmitter Code Converters as specified in Table 4-1, or the Transmitter Mux-Demux as specified in Table 4-6.
4		Connect the vertical input of an oscilloscope to pin 4 of subassembly 3A1A7.	The waveform should be as shown on figure 4-33 or 5-68.	If the waveform is normal, check fuse 3A1F1 or meter 3A1M1. If the waveform is abnormal, proceed to step 5.
5		Set the TEST/OPERATE switch to the AC position.	The line circuit meter, M1, should read 30 ma.	If the indication is normal, the failure is in the circuits of Q4 on printed circuit board A1. If the indication is abnormal, proceed to step 6.
6	(A)	Connect the vertical input of the oscilloscope to the junction of C8 and R4 on printed circuit board A1.	The waveform should be as shown on figure 4-33 or 5-68.	If the waveform is normal, proceed to step 10. If the waveform is abnormal, proceed to step 7.
7	(1)	Connect the vertical input of the oscilloscope to test point J2 on printed circuit board A1.	The waveform should be as shown on figure 4-33 or 5-68.	If the waveform is normal, the failure is in the circuits of Q5, Q6, Q7, or Q8 on printed circuit board A1. If the waveform is abnormal, proceed to step 8.
8	(B)	Connect an oscilloscope to the junction of R2 and the collector of Q4 on printed circuit board A1.	The waveform should be as shown in figure 4-33 or 5-68.	If the waveform is normal, the high level mux signal is available as an auxiliary output. Proceed to step 10. If the waveform is abnormal, proceed to step 9.

TABLE 4-8 (CONT'D)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
9	2	Connect an oscilloscope to test point J1 on printed circuit board A1.	The waveform should be as shown on figure 4-33 or 5-68.	If the waveform is normal the failure is in transistors Q1, Q2, or Q3 on printed circuit board A1.
10	C	Connect the vertical input of the oscilloscope to pin 1 of subassembly A12.	The waveform should be as shown on figure 4-33 or 5-68.	If the waveform is abnormal, proceed to step 11. If the waveform is abnormal, check the circuits of Q15 and Q16 on printed circuit board A1.
11	D	Connect the vertical input of the oscilloscope to pin 5 of subassembly A7.	The waveform should be as shown on figure 4-33 or 5-68.	If the waveform is normal, the failure is in subassembly A7. Refer to paragraph 4-12 for the circuit description. If the waveform is abnormal, the failure is in subassembly A12. Replace the subassembly.

TABLE 4-9. CONTROL AMPLIFIER, AUXILIARY CIRCUITS, TROUBLESHOOTING.

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1	3	Connect an oscilloscope to the junction of R35 and the collector of Q13 on printed circuit board A1.	Auxiliary B channel clock output.	If the waveform is abnormal, check transistors Q12, Q13 and Q14 and associated circuits.
2	4	Connect an oscilloscope to the junction of R28 and the collector of Q10 on printed circuit board A1.	Auxiliary clock output.	If the waveform is abnormal, check transistors Q9, Q11 and Q10 and associated circuits.
3	DS1-DS7	Observe the indication of lamps DS1 through DS7.	Output lights should flash at a constant rate.	If the waveform is abnormal, and the Transmitter Code Converter is operating properly, check the associated amplifier for the light which has failed.

b. The only test equipment required for the localization of failures through the use of Tables 4-8 and 4-9 and is the test equipment listed in Table 4-2.

c. Table 4-10 is a list of the controls and indicators of the Control Amplifier. Column one indicates the name of the control or indicator and column two lists the position of the component on the drawer. Column three lists the normal position of the control or the normal indication of the indicator.

d. Table 4-11 is a list of the adjustment and alignment procedures which affect the operation of the Control Amplifier. The actual procedures are given in Section 5, in paragraphs noted in column three.

TABLE 4-10. CONTROL AMPLIFIER, CONTROLS AND INDICATORS

Control	Location	Normal Position	Remarks
TEST/OPER switch	Front Panel	MUX	Positions of the switch are M, S, AC, and MUX. The first three positions of the switch are used for test purposes to supply a steady mark (M), a steady space (S) and an a-c signal (AC).
REMOTE-LOCAL switch	Interior of Drawer	REMOTE	The LOCAL position is used only for internal testing of the Multiplex Set.
MUX LINE CURRENT meter	Front panel	Constant Deflection	The meter will deflect to a degree dependent upon the number of channels in use.

TABLE 4-11. CONTROL AMPLIFIER, ADJUSTMENT AND ALIGNMENT PROCEDURES

Adjustment	Circuit	Refer to.
LINE RHEO	Input Circuit	Paragraph 5-4, c, (1).
VOLTAGE AMPLIFIER	Current keyed output	Paragraph 5-4, c, (2).
ADJUST		

e. The logic block diagram for the Control Amplifier is shown on figure 4-33. The interconnecting wiring diagram and the schematic diagram for this drawer are shown on figures 5-65 and 5-68. Figures 5-39 and 5-40 show the position of all adjustment controls and indicators. Test jacks for the individual circuits are shown on figure 5-41.

f. The Multiplex Set is placed in the LOCAL TEST mode of operation by following the procedures given in paragraph 4-6, f.

g. The following caution must be observed when performing trouble shooting procedures:

CAUTION

Deenergize the equipment prior to removing or installing drawers. After installing the drawer, allow a fifteen minute warm-up period to insure oscillator stability.

4-13. CONTROL AMPLIFIER, CIRCUIT DESCRIPTIONS.

(a) GENERAL. -The circuits of the Control Amplifier are comprised of seven functional elements: current driver, inverter, flip-flop, common-base amplifier, keyer oscillator, bit time pulse amplifier, and the keyer line switch. The current driver, inverter, and flip-flop circuits are identical to the circuits discussed in the previous sections. The common-base amplifier, the bit time pulse amplifier, the keyer oscillator, and the keyer line switch will be discussed in detail in this paragraph.

b. COMMON-BASE AMPLIFIER

(1) CIRCUIT DESCRIPTION (See figure 4-22)

(a) Transistor Q3, on printed circuit board A1, is the common - base amplifier. The base of Q3 is returned to ground. The input signal is applied across the emitter bias resistor and the output appears across the collector load.

(b) The input to the common-base amplifier is the normal Transmitter Mux-Demux matrix line output. The signal is amplified in current by the current driver Q1 and inverted by inverter stage Q2. Therefore, the input signal is identical to the inverted matrix output.

(c) Q3 is an NPN transistor. A negative input pulse developed across the emitter bias resistor causes Q3 to be forward biased. Prior to conduction, the collector is at +50 volts. With a negative input pulse, Q3 is driven into saturation, causing

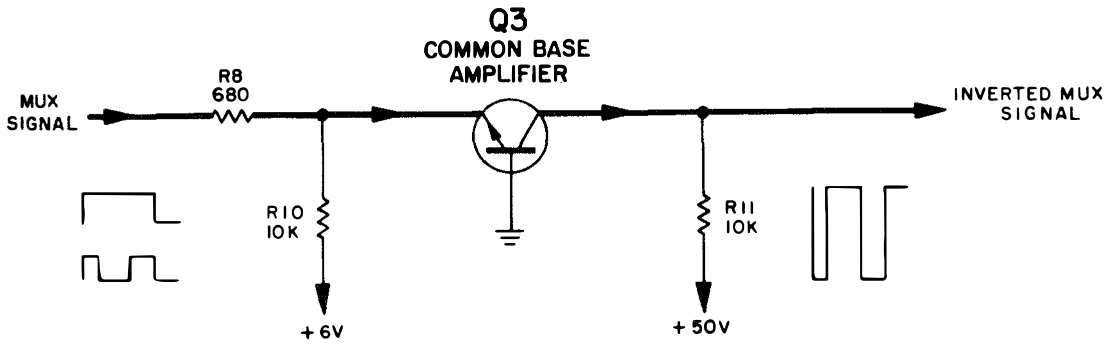


Figure 4-22. Simplified Schematic, Common Base Amplifier CA-1

the collector to be driven to a negative voltage for the duration of the input pulse.

(d) The common-base amplifier output is a negative-going square wave of 50 volts peak amplitude.

(2) TEST DATA

(a) The common-base amplifier is shown in logic form on the Control Amplifier logic diagram, figure 4-33. The logic symbol is CA-1. The intraconnection information and the complete schematic diagram is shown on figure 5-65 and 5-68, respectively.

(b) There are no adjustment for this circuit.

(c) The components of this circuit are located on printed circuit board 3A1A1 of the Control Amplifier drawer.

(d) The only test equipment required for trouble shooting or repair of this circuit is the test equipment listed in table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no major test points for this circuit.

c. BIT TIME PULSE AMPLIFIERS.
(See figure 4-23)

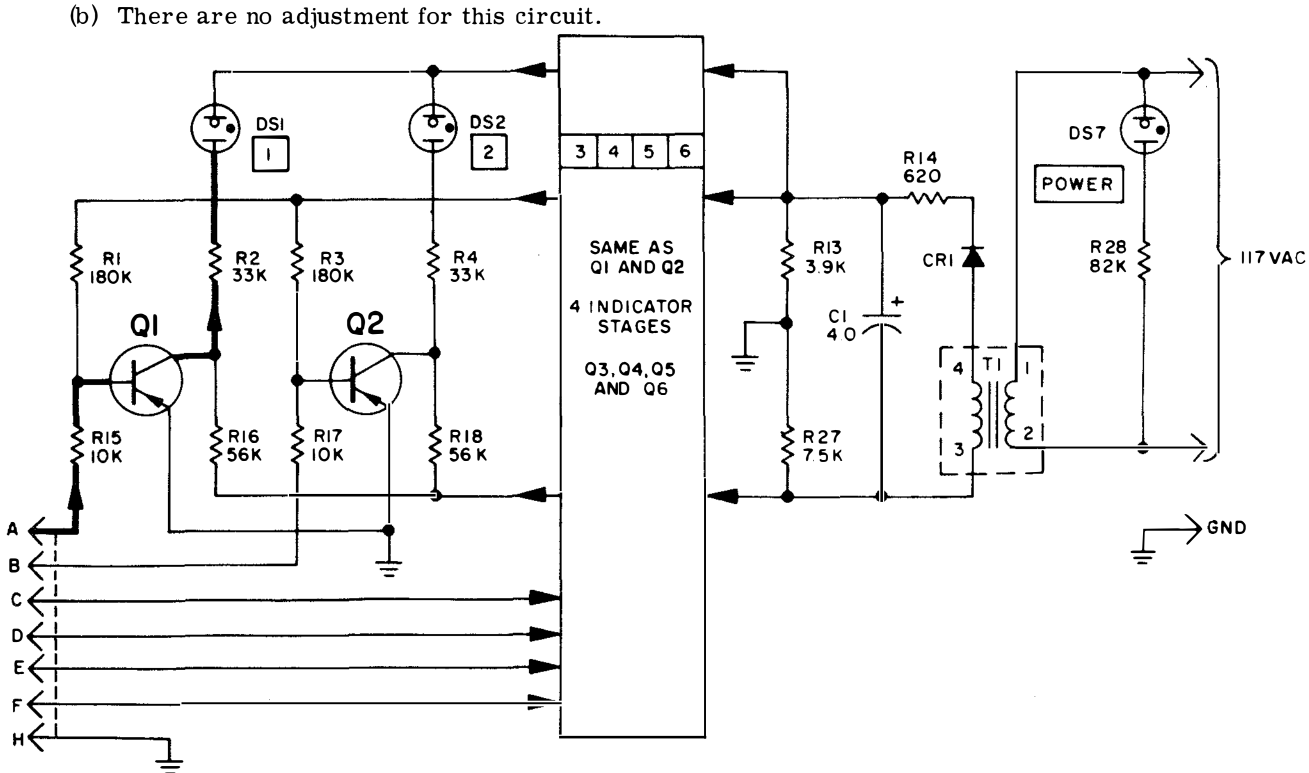


Figure 4-23. Simplified Schematic, Bit Time Pulse Amplifier

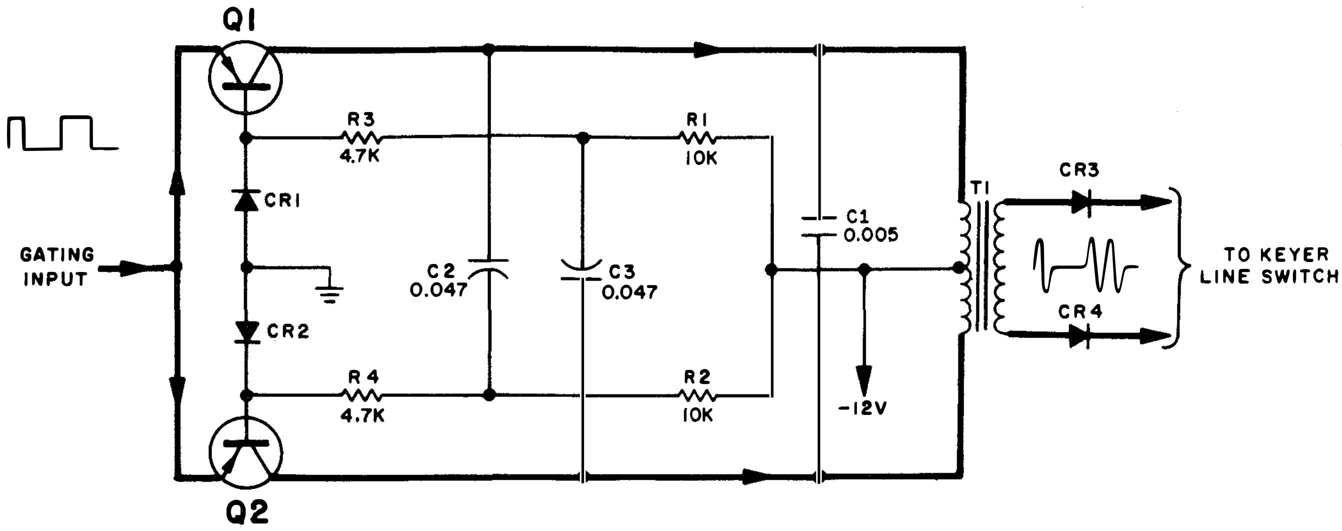


Figure 4-24. Simplified Schematic, Keyed Oscillator, KO-1

(1) CIRCUIT DESCRIPTION.

(a) Transistors Q1 through Q6 on printed circuit board A9 comprise the bit time pulse amplifiers. All six stages are identical: they differ only in their respective inputs. Each stage is a voltage amplifier in a common emitter circuit.

(b) The PNP transistor is normally saturated with the collector at ground potential. The input to the amplifier is a bit time pulse from divider number five of the Transmitter Mux-Demux. This input is fed through an isolation resistor (R15) to the base of Q1. The bit time pulse is a positive-going six-volt square wave which drives Q1 to cut-off.

(c) When cut-off, Q1 stops conducting and the collector voltage is driven negative. The neon lamp indicators are connected through a series resistor (R2) to the positive d-c voltage source. When Q1 is saturated, the voltage drop across the neon indicator is too low to cause conduction. When Q1 is cut-off, the negative level increases the voltage d drop across the neon indicator and the lamp illuminates. The lamp will remain illuminated until the bit time pulse disappears at the input of Q1.

(d) The d-c bias voltage source is a center-grounded supply. Each pulse amplifier has its emitter to ground so that the high voltage required to fire the neon indicator does not appear across the transistor.

(2) TEST DATA

(a) The bit pulse amplifiers are shown in logic form on figure 4-33. The logic symbols are PA-1 through PA-6. The intraconnection information and the complete schematic diagram is shown on figure 5-65 and 5-68, respectively.

(b) There are no adjustments for this circuit.

(c) The components of this circuit are located on printed circuit board A9 of the Control Amplifier drawer.

(d) The only test equipment required for trouble shooting or repair of this circuit is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no major test points for this circuit.

d. KEYER OSCILLATOR

(1) CIRCUIT DESCRIPTION (See figure 4-24)

(a) Transistors Q1 and Q2 on printed circuit board A7 comprise, with their associated circuits, the keyer oscillator. The input to this stage is the normal multiplex signal.

(b) The keyer oscillator (KO-1) is a gated, push-pull oscillator consisting of two PNP transistors with the respective collector terminals connected to opposite sides of the primary of a center-tapped output transformer. Feedback is provided by capacitors C2 and C3, connected between the collector of one transistor and the base of the other. Since the push-pull oscillator (Q1-Q2) is a common type, no further discussion is given here. The gating arrangment for the keyer oscillator (KO-1) and its effect on the circuit's output require discussion.

(c) Whenever a bit-time (Multiplex) pulse, indicating a mark, appears at the output of the inverter stage (Q1 on printed circuit board A12) a positive-going square-wave pulse is applied to the gating input of the push-pull oscillator. Since the emitter terminals of these transistors are unbiased in normal operation, oscillations do not take place unless a positive gate is applied. If the output of the inverter is a space, a ground potential signal is

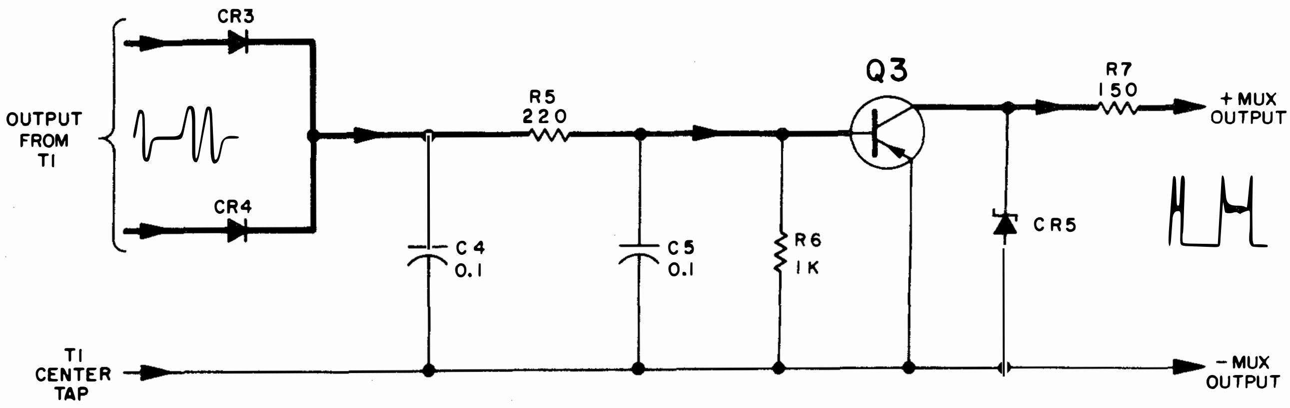


Figure 4-25. Simplified Schematic, Keyer Line Switch, KLS-1

applied to the emitters of the push-pull oscillator transistors to cut-off oscillations. The positive gate, resulting from a mark occupying the particular multiplex bit-time, causes a positive pulse at the output of the inverter. The positive pulse causes the push-pull oscillator to oscillate.

(d) The push-pull oscillator makes one complete sine-wave cycle for each gate, representing one mark bit-time. The sinusoidal output of the push-pull oscillator is coupled through an output transformer to a center-tapped full-wave rectifier (diodes A7CR3/ A7CR4). Each sine-wave cycle is converted into two serial positive-going pulses. A smoothing filter removes the valley between the two pulses, resulting in a single pulse resembling a decayed-square-wave. The output pulse, representing a mark bit, is applied to the keyer line switch (KLS-1).

(2) TEST DATA

(a) The keyer oscillator is shown in logic form on the Control Amplifier logic diagram, figure 4-33. The logic symbol is KO-1. The intraconnection information and the complete schematic diagram is shown on figures 5-65 and 5-68 respectively.

(b) There are no adjustments for this circuit.

(c) The components of this circuit are located on printed circuit board 3A1A7 of the Control Amplifier drawer.

(d) The only test equipment required for trouble shooting or repair of this circuit is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no major test points for this circuit.

e. KEYER LINE SWITCH (See figure 4-25)

(1) CIRCUIT DESCRIPTION.

(a) Transistor Q3 on printed circuit board A7 comprises the keyer line switch. The input to this circuit is the output of the keyer oscillator.

(b) The keyer line switch (KLS-1) is a power switch driven to conduction by a positive-going pulse (mark bit condition) from the center-tapped full-wave rectifier smoothing filter. The output terminals of the keyer line switch are connected in series with the teletype loop line, to determine current flow at any given time (no current or 20/60 milliamps).

(c) NPN transistor Q3 is connected in a common-emitter configuration, with the base-to-emitter bias determined by the filter circuit output (smoothing filter stage A7R5/ A7C4/ A7C5). Whenever a mark bit-time occurs, a positive-going pulse appears at the filter circuit output. This causes the NPN transistor to conduct, resulting in the collector-to-emitter resistance of the transistor dropping to a lower value. The current in the teletype loop line, biased by an external 120 volt dc battery, increases from less than five milliamps to more than 20 or 60 milliamps (depending on the loop current level).

(d) A 20 or 60 milliamp current flow in the teletype loop line indicates a mark bit-time condition. A quiescent or negligible current condition indicates a space bit-time condition. When a space bit-time (no filter circuit output) occurs, the keyer line switch transistor remains cut-off. The cut-off condition presents a high series impedance in the teletype loop line, causing the loop line current to approach zero.

(2) TEST DATA

(a) The keyer line switch is shown in logic form on figure 4-33. The logic symbol is KLS-1. The intraconnection information and the complete schematic diagram is shown in figures 5-65 and 5-68, respectively.

(b) There are no adjustment for this circuit.

(c) The components of this circuit are located on printed circuit board A7 of the Control Amplifier drawer.

(d) The only test equipment required for trouble shooting or repair is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) There are no major test points for this circuit.

4-14. SYNCH UNIT.

a. GENERAL.

(1) The Synch Unit, receives multiplexed teletype signals of a neutral mode at either 20 or 60 ma. These signals may be generated locally or remotely depending on the position of the Synch Unit LOCAL-REMOTE switch. After processing the multiplexed teletype signals, the Synch Unit furnishes them to the Receiver Mux-Demux. The Synch Unit also maintains a correct phase relationship between the clock frequency of the signal transmitting source and the local clock frequency in the Receiver Group.

(2) The Synch Unit maintains an optimum phase relationship by inserting or removing pulses from the processed multiplex teletype signal in an asynchronous manner. An optimum phase relationship is sensed when the mid bit sampling pulse interrogates the processed multiplex teletype signal and finds a coincidental mark pulse with a confirming mark pulse occupying the sixth bit-time (frame coding bit) in the same frame. The Synch Unit then corrects for any sensed phase shift in effect, matching the local clock frequency to that of the incoming multiplexed teletype signal. The phase correction circuits are necessary because the Receiving Group is always operating at a slightly faster (approximately 3 milliseconds) clock rate than the Transmitting Group.

(3) The phase position will also be affected by variations in the propagation delay of the radio path and extraneous pulses produced by atmospheric or man-made noise. Since the advance or delay in phase due to the latter two items will tend to cancel or average zero over a long period of time, the Synch Unit disregards these effects and acts only to insert the difference frequency between the frequency standards.

(4) On figure 4-34 the logic functions can be divided into three main groups: (a) the input circuit, (b) the phase sensing circuits, and (c) the phase correcting circuits.

b. DETAILED FUNCTIONAL DESCRIPTION. (See figure 4-34)

(1) INPUT SIGNAL CIRCUIT. - The Synch Unit accepts multiplexed teletype signals from local (same station's Transmitter Group) and remote points (normal operation). The Synch Unit filters the multiplex teletype signal to remove radio-frequency interference and decouples the signal from the teletype loop. The decoupled signal is then amplified, squared up, and generated to the signal limiting amplifiers in an inverted form in normal operation. If the multiplex teletype signal is scrambled, a descrambling unit can be inserted in the line between the inverting amplifier and the signal limiting amplifier input. The signal limiting amplifier output is then coupled to two parallel circuits. One parallel circuit contains a signal sampling gate and the normal (multiplex) signal driver which leaves the signal limiting amplifier output uninverted and sends it to position A of the NORMAL-INVERTED switch of the Receiver Mux-Demux. The other parallel circuit contains the multiplex signal inverting amplifier followed by another signal sampling gate, and the inverted multiplex signal driver to invert the signal-limiting-amplifier output. The signal is sent to position B of the NORMAL-INVERTED switch. Both the normal signal driver and the inverted signal driver generate complementary signals on balanced, floating lines so that the NORMAL-INVERTED switch can be used to change the signal lines that are fed to the Receiver Mix-Demix diode coding matrix. The balanced floating signal lines are required since signals are applied to many single diode inputs connected in parallel with outputs at floating ground potential.

(2) PHASE SENSING. - Any phase shift in the incoming multiplex teletype signal is detected in the Synch Unit by comparing the processed Multiplex teletype signal at the phase lead and phase lag gates (AG-1 and AG-2). The multiplex signal from the input flip-flop (FF1) is sampled every A clock interval (first compressed frame interval), and the resultant A time sample signals are coupled to the phase signal-sampling amplifier. The output of this amplifier is coupled as an input of both the phase-lead AND gate and the phase-lag AND gate. Phase-lead clock signals and phase-lag clock signals are generated from separate OR gates at the output of divider number four in the Receiver Mix-Demix. The phase-lead clock signals are single d c levels occurring during the first 3.8 milliseconds of every first compressed bit interval (approximately 6.65 milliseconds long). The phase-lag clock signals are single d c levels occurring during the last 2.85 milliseconds of every first compressed-bit interval. If the A time sample signal (a differentiated spike from the square-wave leading edge of each mark bit) occurs during the first 3.8 millisecond interval, the phase sensing circuits recognize a phase lead condition which can be corrected by speeding-up (advancing) divider number two cycle (in the Receiver Mux-Demux). If the A time sample signal occurs during the last 2.85 millisecond interval, the phase sensing circuits recognize a phase lag condition which can be corrected by slowing-down (retarding) divider no. 2.

(3) PHASE CORRECTING.

(a) Assuming that the phase of the incoming signal is leading the local standard, there will be coincidence of the signal transition pulse with the phase lead gate. Each time that a signal transition occurs during channel A clock pulse, an output will be produced by the advance AND gate. A normalizing univibrator times out a fixed millisecond pulse to charge a large capacitor in a positive direction, via a constant current transistor circuit. A similar circuit is provided for lagging phase inputs.

(b) Since the energy in one pulse is a very small percentage of the total energy needed to raise the potential of this capacitor from 0 to +6 volts, the voltage of the capacitor will increase only a very small increment for each input pulse. If the phase leading condition persists for a sufficiently long time (approximately 20 seconds), the capacitor potential will become more positive than +6 volts. An isolating amplifier couples this potential to a level sensing circuit. The output of the level sensing circuit is raised to the proper level by a phase inverter.

(c) A positive output voltage from the phase inverter turns off one side of the advance flip-flop circuit. A discharge circuit connected to the flip-flop immediately begins to discharge the capacitor. After a short period the initial positive d c potential applied to the flip-flop is removed. The flip-flop remains in its primed condition until the next channel A clock pulse is received. It then triggers back to its initial condition and at the same time triggers the ADD univibrator for a timed period of 40 microseconds. The output of this univibrator is applied to an AND gate (24), to gate in an additional drive pulse through the amplifier to the train of drive pulses obtained from the (1) side of binary no. 2 of the oscillator-power supply.

(d) The added pulse is derived from the (0) side of binary no. 2, thus, it falls between adjacent pulses in the train. The addition of this drive pulse advances the phase of the local standard by the period of one drive pulse, and makes it more nearly in phase with the assumed leading input signal. Continuous pulses are added to the drive-pulse train until the phase sensing circuits detect coincidence of the signal-transition pulse with the phase-lag gate. At this time, the retard portion of the corrector begins to operate and nullifies the positive increase of charge on the capacitor produced by the advance side.

(e) The action of the retard portion of the corrector is identical to that of the advance side with few exceptions. The capacitor is discharged in a negative direction, and a level of -6 volts is recognized. At this point the level-sensing circuit develops a positive voltage to drive a flip-flop as above. Operation of the subtract univibrator interrupts, for a period of 70 microseconds, the train of pulses from (1) side of binary no. 2 in AND gate and thus retards the phase of the local standard by one drive pulse.

(f) The phase sensing circuits of the Synch Unit can detect only phase shifts of less than frame displacement. Phase shifts of more than a full frame interval cannot be recognized by the Synch Unit. Frame-displacement alarm circuits must be employed to prevent frame-interval phase shifts from interfering with the operation of the Multiplex Set. The frame alarm and framing circuits are discussed in paragraph 4-16, b.

(4) FREQUENCY METER CIRCUIT. - RECEIVER CRYSTAL FAST-SLOW meter M2 is a high-impedance, zero-center voltmeter which measures the charge voltage level and polarity of the phase-correction response-time circuit (an RC network). Voltmeter M2 is connected across capacitor C2, and indicates that the capacitor is charging (voltage drop across C2 rises) or discharging (voltage drop across C2 declines). Capacitor C2 is part of the RC network that determines when the phase correction circuits will be activated. The monitoring of the voltage level and polarity of capacitor C2 enables the Multiplex Set operator to determine whether the local frequency source (for clock reference signals) is fast or slow compared to the remote signal source (another telegraph terminal set).

4-15. SYNCH UNIT, TEST DATA

a. Table 4-12 is a list of the steps to be performed to localize receiver failures to the Synch Unit. If a specific receiver failure does not appear in this table, refer to the trouble shooting information given in the test data sections for the Receiver Code Converter or Receiver Mux-Demux.

NOTE

The trouble shooting chart of table 4-12 will localize the failure to a specific printed circuit board in the Synch Unit. When the functional section has been located, immediate repair is effected by the replacement of that printed circuit board which contains the faulty section.

b. The only test equipment required for the localization of failures through the use of table 4-12 is the test equipment listed in table 4-2.

c. Table 4-13 is a list of the controls and indicators of the Synch Unit. Column one indicates the name of the control or indicator and column two lists the position of the component on the drawer. Column three lists the normal position of the control or the normal indication of the indicator.

TABLE 4-12. SYNCH UNIT, TROUBLESHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1		Output of all channels garbled	Good copy should be received on all channels	Switch to LOCAL operation. If the copy is good, the distant terminal is at fault. If the output is still garbled, proceed to Step 2.
2		Check the receiver crystal meter, M2, on the Synch Unit	Meter should show phase kicks in deflection	If the indication is normal, check the Receiver Mux-Demux according to the steps outlined in Table 4-6. If the indication is not normal, proceed to Step 3.
3	2	Connect the vertical input of the oscillo-scope to test point J1 on printed circuit board A4	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, proceed to Step 6.
4	3	Connect the vertical input of the oscillo-scope to test point J1 on printed circuit board A3	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, the failure is in the A channel clock pulse circuit of the Receiver Mux-Demux. Refer to Table 4-6. If the waveform is abnormal, proceed to Step 5.
5	A	Connect the vertical input of the oscillo-scope to terminal 6 of transformer T1	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, the failure is in the input flip-flop transistors on printed circuit board A3. Check transistors Q7 - Q8, and associated circuits. If the waveform is abnormal, the failure is in resistor R2, transformer T1, Meter M1, or fuse F1.
6	C	Connect the vertical input of the oscillo-scope to the junction of R25 and CR11 on printed circuit board A2. Place the Receiver Mux-De-Mux switch in the AC position	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, proceed to Step 7. If the waveform is abnormal, proceed to Step 8.
7	D	Connect the vertical input of the oscillo-scope to the junction of R38 and CR18 on printed circuit board A7	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, proceed to Step 9. If the waveform is abnormal, proceed to Step 8.
8	B	Connect the vertical input of the oscillo-scope to the junction of CR16 and CR17 on printed circuit board A2	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, the failure is in the circuits of Q7 or Q10 on printed circuit board A2. If the waveform is abnormal, the failure is in the circuit of Q1 on printed circuit board A4.

TABLE 4-12 (CONT'D)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
9		With the Receiver Mux-Demux in the AC position, check the indication of the FAST/SLOW RECEIVER CRYSTAL meter	The meter should continuously deflect in the FAST direction return to zero, and then deflect in the SLOW direction	If the meter reads near zero, or is not increasing to the FAST direction, proceed to Step 10. If the meter reads near zero, or is not moving in the SLOW direction, proceed to Step 11. If the meter reads off scale in the FAST direction, proceed to Step 12. If the meter reads off scale in the SLOW direction, proceed to Step 14. If the indicator is normal, proceed to Step 16.
10	(E)	Connect the vertical input of the oscilloscope to the junction of R16 and C5 of printed circuit board A4	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, the failure is in amplifier Q5 on printed circuit board A4. Refer to paragraph 4-15.b. for the circuit description. If the waveform is abnormal, the failure is in transistor Q8 and Q9 of the retard univibrator on printed circuit board A2.
11	(F)	Connect the vertical input of the oscilloscope to the junction of C4 and C3 of printed circuit board A4	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, the failure is in amplifier Q2 or associated circuits on printed circuit board A4. Refer to paragraph 4-15.b. for the circuit description. If the waveform is abnormal, the failure is in transistor Q11 and Q12 of the advance univibrator on printed circuit board A2.
12	4	Connect the vertical input of the oscilloscope to test point J2 on printed circuit board A4	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, proceed to Step 13. If the waveform is abnormal, the failure is in transistor Q3 or Q4 and associated circuits on printed circuit board A4. Refer to paragraph 4-15.b. for the circuit description.
13	(G)	Connect the vertical input of the oscilloscope to the junction of R9 and R11 on printed circuit board A3	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, the failure is in transistor Q6 or associated circuits on printed circuit board A4. Refer to paragraph 4-15.b. for the circuit description. If the waveform is abnormal, the failure is in the retard flip-flop, transistor Q4 or Q3 on printed circuit board A3.
14	5	Connect the vertical input of the oscilloscope to test point 3 on printed circuit board A4	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, proceed to Step 15. If the waveform is abnormal, the failure is in transistor Q8, Q9, Q10, or their associated circuits. Refer to paragraph 4-15.b. for the circuit description.
15	(H)	Connect the vertical input of the oscilloscope to the junction of R17 and R19 on	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, the failure is in transistor Q7 or associated circuits on printed circuit board A4. Refer to paragraph 4-15.b. for the circuit description.

TABLE 4-12 (CONT'D)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
15 (Cont'd)		printed circuit board A3		If the waveform is abnormal, the failure is in the advance flip-flop, transistor Q5 or Q6 on printed circuit board A3.
16	6	Connect the vertical input of the oscilloscope to test point J2 on printed circuit board A2	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, the failure may be the input from the Oscillator-Power Supply. Proceed to Step 17. If the waveform is abnormal, the failure is in the subtract gate univibrator. Refer to paragraph 4-15.b. for the circuit description.
17	7	Connect the vertical input of the oscilloscope to test point J1 of printed circuit board A2	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is normal, the failure may be the input signal from the Oscillator-Power Supply. If this input is correct, proceed to Step 18. If the waveform is abnormal, the failure is in the add gate univibrator. Refer to paragraph 4-15.b. for the circuit description.
18	6	Connect the vertical input of the oscilloscope to the junction of R23 and the collector of Q6 on printed circuit board A2	The waveform should be as shown on figure 4-34 or 5-68	If the waveform is abnormal, the failure is transistor Q5 or Q6 or their associated circuits. Refer to paragraph 4-15.b. for the circuit description.

TABLE 4-13. SYNCH UNIT, CONTROLS AND INDICATORS

CONTROL	LOCATION	NORMAL POSITION	REMARKS
FRAME switch	Front Panel	Off	The switch is spring loaded to automatically return to the OFF position.
LOCK-UP RELEASE switch	Front Panel	Off	The switch is spring loaded to automatically return to the OFF position.
MAN-AUTO	Front Panel	AUTO	In the MANUAL position, single step framing can be performed by the operator.
MUX LINE CURRENT meter	Front Panel	Constant deflection	The meter will deflect to a degree dependent upon the number of channels in use.
RECEIVER CRYSTAL meter	Front Panel	Zero, with kicks	The meter will deflect, dependent upon input and corrections made in the Synch Unit.

TABLE 4-14. SYNCH UNIT, ADJUSTMENT AND ALIGNMENT PROCEDURES

ADJUSTMENT	CIRCUIT	REFER TO
LINE RHEO	Input	Paragraph 5-4, d
ADVANCE GEN	Current generators	Paragraph 5-4, d, (1)
RETARD GEN	Current generators	Paragraph 5-4, d, (1)
ADD UNIVIBRATOR	Add gate univibrator	Paragraph 5-4, d, (2)
SUBTRACT UNIVIBRATOR	Subtract gate univibrator	Paragraph 5-4, d, (3)

d. Table 4-14 is a list of the adjustment and alignment procedures which affect the operation of the Synch Unit. The actual procedures are given in Section 5, in the paragraphs noted in column 3.

e. The logic diagram for the Synch Unit is shown on figure 4-34. The interconnecting wiring diagram and the schematic diagram for this drawer are shown on figures 5-65 and 5-69. Figures 5-42 and 5-43 show the positions of all adjustment controls and indicators. Test jacks for the individual circuits are shown on figures 5-44 through 5-47.

f. The Multiplex Set is placed in the LOCAL TEST mode of operation by following the procedures given in paragraph 4-6, f.

g. The following caution must be observed when performing trouble shooting procedures:

CAUTION

Deenergize the equipment prior to removing or installing drawers. After installing the drawers, allow a fifteen minute warm-up period to insure oscillator stability.

4-16. SYNCH UNIT, CIRCUIT DESCRIPTIONS

a. GENERAL.

(1) The circuits of the Synch Unit compose three functional areas: input, phase sensing, and phase correction. The input circuit, comprised of the input flip-flop and transformer T1, is identical in operation to the input circuits previously discussed. Refer to paragraph 4-7, a, b, for a discussion of a similar circuit.

(2) The Synch Unit also contains circuits which are part of the framing system. These circuits will not be discussed here, but will be discussed in detail in the description of the Receiver Code Converters. Refer to paragraph

b. PHASE SENSING CIRCUITS (See figure 4-26 and figure 5-68)

(1) CIRCUIT DESCRIPTION.

(a) Seven pulses of equal time duration are furnished by divider number four in the Receiver Mux-Demux to the inputs of the phase lead and lag gates (AG-1 and AG-2 on figure 4-34). The number one through four pulses are applied to the phase lag amplifier (AMPL-2), while five through seven are applied to the phase lead amplifier (AMPL-3). The emitter output signals of the two amplifiers vary between 0 and -6 volts, at a 180 degree phase difference.

(b) The two AND gates are identical. Gate AG-1 is enabled for the first 3.8 milliseconds of a mark signal, while gate AG-2 is enabled for the last 2.85 milliseconds of a mark signal. Optimum phasing occurs when the sampled input spike is sufficiently displaced in time to provide a signal from the output of both AND gates.

(c) The output of the phase lead and lag AND gates is coupled to the retard and advance univibrators (OS-1 and OS-2 on figure 4-34). If optimum phasing conditions occur both univibrators are triggered, producing a four millisecond square wave from the reset side. If the sampled pulse is leading or lagging, only the appropriate univibrator is triggered. The output of the univibrators is coupled to the constant-current generators (AMPL-4 and AMPL-5).

(d) Transistor Q2, the retard constant-current generator, functions as a switch with a current limiting resistor in the emitter circuit. Transistor Q5 is off when no signal is applied to its base. The positive pulse from the retard univibrator is coupled through capacitor C4 and resistor R6 to drive the base from -12 to -8 volts for the duration of the pulse. When Q2 conducts the emitter is also at -8 volts. Capacitor C2 discharges from the output side, through Q2, R8, and variable resistor R6, to the -12 volt supply. Current limiting resistors R8 and external resistor R6 limit the discharge current of C2 to a safe value.

(e) The C2 discharge current flow produces a negative voltage at the junction of R11 and C2. If no other signal is applied to the integrating capacitor, the charge of the capacitor decreases with each pulse of energy furnished by Q2. Since C2 is discharged by a constant current source, the capacitor voltage decreases linearly with each applied current pulse. The voltage at the junction of R11 and C2 is indicated on M2, the RECEIVER CRYSTAL FAST/SLOW meter.

(f) A similar action occurs when the advance constant-current generator is triggered. In this case, the voltage at the junction of R11 and C2 increases because of the positive current flow through Q5 and associated circuits. At optimum phase conditions both Q2 and Q5 are triggered. The triggering causes a positive buildup (charge) of C2 from Q5, and a negative buildup (discharge) from Q2. The net effect of this dual conduction of opposing voltages is the maintaining of the junction of C2 and Rll at a zero voltage level.

(g) The voltage at the junction of C2 and R11 is coupled to the bases of transistors Q3 and Q8, the voltage sensing amplifiers. If the voltage at this point drops to below -6 volts, because of a constant phase lag, transistor Q8 conducts. If the voltage increases to above +6 volts, due to a constant phase lead, transistor Q3 conducts. While the voltage is in the range of -6 to +6, neither transistor conducts, allowing a self-correction time for the lead and lag gates.

(h) If the advance circuit is turned on, the slowdown flip-flop (FF-3 on figure 4-34) is set. If the retard circuit is turned on, the speedup flip-flop is set. The outputs of the flip-flops is coupled to two circuits: the discharge circuits discussed below, and the phase correction circuits discussed in paragraph 4-15. c.

(i) The speedup and slowdown flip-flops are reset by the A channel clock pulses. When set, as discussed above, the output of the reset side (0) of the speedup flip-flop is coupled to the base of Q6, the retard discharge amplifier. When Q6 conducts the collector goes to zero potential, providing a charge path for C2. The junction voltage of C2 and R11 returns to a zero potential while the flip-flop is set (until the next A channel clock pulse). The speedup flip-flop provides a signal from its set side (1) to the advance discharge amplifier, Q7. When Q7 conducts, its collector goes to 0, and C2 is discharged.

(2) TEST DATA.

(a) The phase sensing circuits are shown in logic form on figure 4-34, the Synch Unit logic diagram. The logic symbols are OS-1, OS-2, and AMPL-4 through AMPL-10. The intraconnection information and the complete schematic diagram are shown on figures 5-65 and 5-69 respectively

(b) The adjustments which affect the phase sensing circuits are the adjustments of the ADVANCE GEN and DISCHARGE GEN potentiometers. The procedure for performing these adjustments is given in paragraphs 5-4, d. , (1).

(c) The components of these circuits are located on printed circuit board 2A1A2 and 2A1A4 of the Synch Unit drawer.

(d) The only test equipment required for trouble shooting or repair of the phase sensing circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The major test points for this circuit are illustrated on figures 5-45 and 5-47.

c. PHASE CORRECTION CIRCUITS (See figure 4-27 and figure 5-68)

(1) CIRCUIT DESCRIPTION.

(a) The phase correction circuit consists of the add and subtract univibrators and the add and subtract gates (OS-3, OS-4, AG-5 and AG-6 on figure 4-34, the Synch Unit logic diagram).

(b) The input to the subtract gate univibrator is taken from the set side (1) of the slowdown flip-flop. The input to the add gate univibrator is taken from the set side of the speedup flip-flop. The output of the phase correction circuit is coupled to divider number two of the Receiver Mux-Demux.

(c) With neither the slowdown or speedup flip-flops set, (due to a phase lead or lag) Q1 and Q3 or the subtract gate univibrators are conducting. The junction of CR6 and C4 of the subtract gate is at 0 volts and the junction of CR5 and C3 of the add gate is at a -6 volts. The input to C4 of the subtract gate is the set side of the second divider binary in the Oscillator-Power Supply. The input to C3 of the add gate is the reset side of the same divider. The add and subtract gates are positive AND gates (AG-5 and AG-6). Gate AG-5 is enabled and AG-6 is inhibited. Under these conditions, the clock pulse will drive the output amplifier to provide normal clock pulses for every positive pulse from the set side of the binary divider of the Oscillator-Power Supply. Every positive pulse from the reset side is stopped by inhibited AND gate AG-6.

(d) When the slowdown flip-flop is set, the subtract gate univibrator is triggered by the output pulse. The output of the univibrator goes from 0 to -6 volts for a period of time depending upon C5 (70 microseconds). This negative pulse inhibits AG-5 for that period. Therefore, the next clock pulse is not passed by the inhibited AND gate and one pulse is subtracted from the train of pulses sent to the Receiver Mux-Demux.

(e) When the speedup flip-flop is set, the add gate univibrator is triggered by the output pulse. The output of the univibrator goes from -6 to 0 volts for 40 microseconds to enable AG-6 for that period. The positive going transition from the reset side of the binary clock in the Oscillator-Power Supply is passed through the enabled AND gate to add a pulse to the string of pulses sent to the Receiver Mux-Demux. This positive going transition is normally blocked by the inhibited AND gate.

(2) TEST DATA

(a) The phase correction circuits are shown in logic form on figure 4-34, the Synch Unit logic diagram. The logic symbols are OS-3, OS-4, AG-5, AG-6, and AMPL-11 and 12. The intraconnection information and the complete schematic diagram are shown on figure 5-65 and 5-69, respectively.

(b) The adjustments which affect the phase correction circuits are the adjustments of the TRACT UNIVIBRATOR and the ADD UNIVIBRATOR potentiometers. The procedures for performing these adjustments is given in paragraphs 5-4, d, (2) and 5-4, d, (3).

(c) The components of these circuits are located on printed circuit board 2A1A2 of the Synch Unit drawer.

(d) The only test equipment required for trouble shooting or repair of these circuits is the test equipment listed in Table 4-2. When repairing printed circuit boards, the precautions given in paragraph 5-6 are to be observed.

(e) The major test points for these circuits are illustrated on figure 4-45.

4-17. RECEIVER CODE CONVERTER

a. GENERAL (See figures 4-35 and 4-36.)-The Receiver Code Converter accepts multiwire signals from the Receiver Mux-Demux and converts them to output signals suitable for the operation of external start-stop equipment. The Receiver Code Converter is comprised of two functional sections: the multiplex conversion circuits discussed in paragraph 4-16 b, and the misframe detection and lockup circuits discussed in paragraph 4-16c.

b. CIRCUIT DESCRIPTION, MULTIPLEX CONVERSION CIRCUITS (See figure 4-35 and 4-36)

(1) The multiplex conversion circuits are: storage circuits, traffic recognizer circuits, start-stop control circuits, start-stop distributor circuits, signal gates, and output circuits.

(2) The storage circuits are comprised of five identical flip-flops (FF-1 through FF-6, on figure 4-35) corresponding to the first five elements of the multiplex signal. For each marking element detected by the Receiver Mux-Demux matrix, the corresponding storage flip-flop is set by an input pulse. When a complete sequence of five pulses, representing a single character, has been received, the status of the five flip-flops represent that character. The reset output (0) of each of the flip-flops is coupled to the corresponding signal gates. Both the set and reset outputs (1 and 0) of the storage flip-flops are coupled to special detection circuits. (See paragraph 4-16 c).

(3) The traffic recognizer and start-stop circuits consist of a flip-flop (FF-6) with control gates (AG-6 and OG-1) for determining the operation of the start-stop oscillator. The primary purpose of these circuits is to insure that the start-stop distributor only counts when a legitimate character or idle signal is received. When any element of the storage flip-flops is set by a mark signal, a positive going pulse is coupled to OR gate OG-3. The output of this gate is a positive going pulse to set the traffic recognizer flip-flop. The second input to the set side of the traffic recognizer flip-flop is the traffic trigger, a signal derived from the number six element flip-flop. This element is of main concern during idle conditions when all other storage flip-flops have not been set, but a legitimate traffic condition is realized.

(4) The first pulse to set the traffic recognizer generates an output to the start-stop control gates. The reset output (0) of the traffic recognizer is a positive going pulse to enable AND gate AG-6. The next clock pulse, from current driver OD-1, is passed by AND gate AG-6 to one input of the negative OR gate OG-1. The other input to this gate is from the stop element of the start-stop distributor. Gate OG-1 is normally inhibited until the stop element of the distributor is fired, indicating a complete cycle of oscillation. At this time, the gate is enabled and theanded clock and traffic recognizer signal are passed to inverter IV-1 to clamp the start-stop oscillator.

(5) The start-stop oscillator and control circuits, the squaring and drive amplifier circuits, and the start-stop distributor circuits are identical in operation with the corresponding circuits in the Transmitter Code Converter. When the start-stop oscillator is unclamped, it oscillates at a frequency whose period is equal in width to the code element of the start-stop signal (22 milliseconds at 368 opm). The oscillator output is shaped into square waves by the squaring amplifier, and coupled to the distributor drive amplifier. The output of the distributor drive is a series of positive pulses to trigger the elements of the start-stop distributor.

(6) An output from the stop element of the start-stop distributor is applied to the start-control gate OG-1. When the stop element is fired, the gate is enabled, clamping the start-stop oscillator. As a result, no additional drive pulses are generated, so that the distributor comes to rest until the next input cycle. The output of each element of the distributor is applied to one of the inputs of the signal gates.

(7) The signal gates consist of five AND gates (AG-1 through AG-5), one for each code pulse of the start-stop signal. Each gate has two inputs: one from the corresponding storage flip-flop, and one

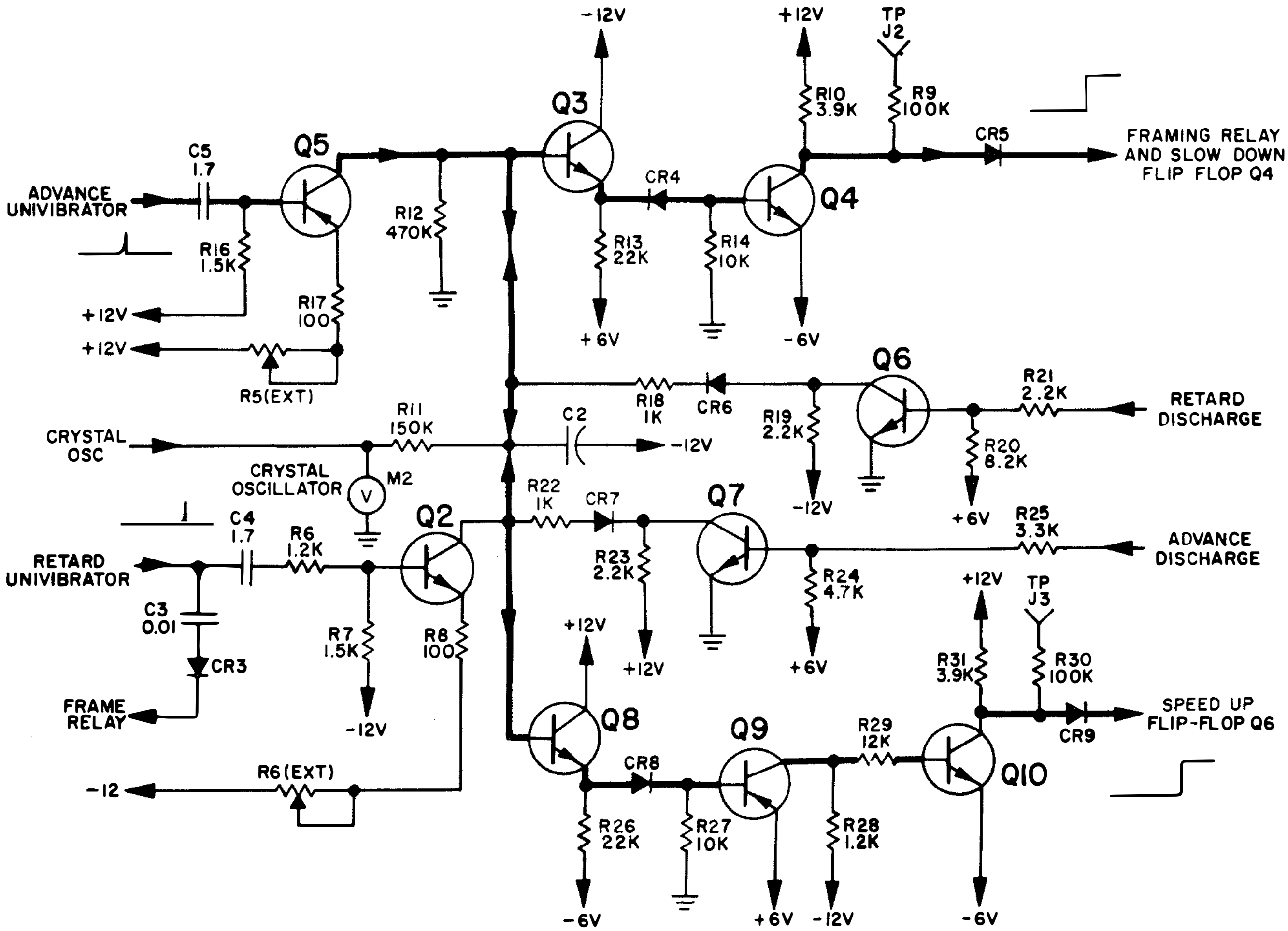


Figure 4-26. Simplified Schematic, Retard and Advance Circuits

from the corresponding distributor element. As each distributor element fires, the signal gates are consecutively enabled. Each AND gate provides a marking output when a mark is stored in the storage flip-flop. As the start-stop distributor goes through one complete cycle, the character represented by the enabled and inhibited gates is ORed in OG-2 and coupled to the output circuits.

(8) Before the storage elements can assume the characteristice of the new input character, they must be reset by the appropriate elements of the start-stop distributor. Flip-flop one is reset by distributor element two-flip-flop two is reset by distributor element three, etc.

(9) In the A channel Receiver Code Converter only, an output of the start element of the start-stop distributor is supplied to the Synch Unit for framing purposes.

(10) The outputs of the signal gates are coupled to an OR gate (Og-2). A sixth input to this gate is the four channel lockup signal from the LOCKUP RELEASE switch on the Synch Unit. The functions of this input is to inhibit the Receiver Code Converter outputs so there can be no crosstalk between channels.

(11) The printer loop keyer circuits are identical in operation with the keyer circuits discussed in the Control Amplifier Section. The output signal is a five code character with a current (20 or 60 ma) flow for a mark signal, and a lcak of current flow for a space. The timing characteristics of the Receiver Code Converter are shown on figure 4-36.

c. CIRCUIT DESCRIPTION, MISFRAME DETECTION AND LOCKUP
(See figure 4-37)

(1) IN FRAME CONDITION, LOGIC

(a) In frame condition of the Receiver Code Converters is determined by the condition of the logic circuits comprised of the number six element flip-flop (FF-2) the traffic recognizer, and negative OR gate OG-1. The two inputs to the negative OR gate are from the set output (1) of the traffic flip-flop and the reset output (0) of the number six element flip-flop. In the in frame condition, both of these flip-flops are set and reset during the exact same time duration. The input to OG-1 is always a -6 volt and a 0 volt level. The output from this gate (0 volts) is inverted by inverter IV-1, and coupled as an input ot OR gate OG-4.

(b) This inverted signal level is ORed with the identical inverter outputs of all the Receiver Code Converters by OG-4. If the Multiplex signals in frame, the output of this gate is a -6 volt level to inverter IV-5. The signal is inverted to a 0 volt level, so that the integrator is not charged. The misframe circuits are inhibited by this lack of charging current.

(2) MISFRAME LOGIC

(a) If the Receiver Code Converters are out-of-frame, one of the number six element flip-flops of at least one of the Receiver Code Converters will not be set. In this case, the input to OG-1 will be a -6 volt level from the set side (1) of the set traffic flip-flop and a -6 volt level from the reset side (0) of the reset (not set) number six element flip-flop. The output of the OR gate will also be at a -6 volt level.

(b) The voltage level from the OR gate is inverted by IV-1 and coupled as a 0 voltage level to the input of OG-4. The output of this gate is the highest potential of the inputs, or a 0 voltage level. This level is inverted by inverter IV-5, placing a negative voltage on the diode in series with the integrating capacitor and ground.

(c) The diode is forward biased and conducts to discharge the integrating capacitor. This discharge current flows until the traffic flip-flop is reset by the start-stop distributor, inhibiting OG-1. If the out-of-frame condition continues the foregoing action is repeated, with the voltage across the integrating capacitor becoming more negative since no discharge path is available for the integrating capacitor.

(d) The differential amplifier and level senser are not triggered until the voltage across the integrating capacitor reaches a certain negative value. This value is determined by the setting of the ALARM THRESHOLD adjustment in the Receiver Code Converter. When the voltage is sufficiently negative, the level sneser and inverter stage (IV-7) is turned on to place a -6 volt potential on the input to inverter IV-6.

(e) The 0 voltage level from the output of inverter IV-6 provides a current path to energize relay K1, the misframe alarm relay. Contacts on K1 provide a current path to energize K2, the lockup relay. The energizing of the misframe alarm relay illuminates the misframe indicator and sounds the alarm buzzer. The ALARM BYPASS switch, in the BYPASS position, removes the power inputs from the alarms and illuminates the ALARM BYPASSED indicator, if a misframe condition occurs.

(f) Energizing of the lockup alarm K2 places a 0 voltage level on the output OR gate of the Receiver Code Converter to prevent the transmission of any intelligence.

(g) The lockup output and the misframe alarm output are also coupled to the OG-3 and OG-4 gates of every Receiver Code Converter. A misframe and the consequent lockup of any channel, will cause a misframing and lockup of all channels.

(h) The LOCKUP-ALARM DISABLE switch has two functions. In the ALARM DISABLE position, the output of OG-1 is clamped at a 0 voltage level to effectively inhibit the remainder of the alarm circuits. In the LOCKUP position, OR gate OG-3 is inhibited to cause all channels to be locked up and subsequently indicate a misframe condition.

(3) MISFRAME CORRECTION - FRAMING

(a) The framing of a misframed system can be accomplished in either of two modes of operation, manual or automatic. The choice is dependent upon the operator and traffic conditions. The mode of framing is selected by positioning the AUTO-MANUAL FRAMING switch in the desired position.

(b) When the AUTO-MANUAL FRAMING switch is in the MANUAL position, a single input is added by the framing flip-flop (FF-1, located on the Receiver Mux-Demux) every time that the FRAME switch is depressed. Depressing of the spring loaded switch sets the framing flip-flop through the contacts of relay K1. The output pulse from this flip-flop (reset side) is added to the clock pulses of the Synch Unit to bring the system into frame.

(c) When the AUTO-MANUAL FRAMING switch is in the AUTO position, inputs are added to the clock pulses automatically as long as the FRAME switch is depressed. If Channel A is idling the automatic mode of operation causes the start element of the A channel start-stop distributor to coincide with the start signal of the incoming pulses. Contacts on relay K2 cause the last pulse added to be again subtracted to prevent overdriving due to time lag. Without this circuit the automatic framing would subtract one pulse too many from the input train, throwing the system out-of-frame.

(d) In either position of the switch, depressing of the FRAME switch energizes relays K1 and K2. Contacts on K2 place a ground potential on the input of the differential amplifier. The integrating capacitor discharges through this path, in preparation for new misframe detection.

(e) If traffic is being received at the A channel Receiver Code Converter. The automatic position of the AUTO-MANUAL FRAMING switch will only serve to provide a continuous series of pulses to be added. In this case, there is no automatic framing.

(4) SPECIAL SIGNAL DETECTION CIRCUITS

(a) The set and reset outputs (1 and 0) from the storage flip-flops are coupled to special AND gates (AG-1 and AG-2) for the detection for special characters. AG-1 is designed for the detection of the Z character, and AG-2 for the detection of the C character. The purpose of these circuits is to cause a misframe alarm should a series of C's or Z's, or combination of the two be received at the storage flip-flops.

(b) AND gates AG-1 and AG-2 are enabled by the reset output (0) of the set number six element flip-flop. If the storage flip-flops have the characteristics of C or Z, the appropriate AND gate applies to 0 voltage level to OR gate OG-1. The output of this gate is amplified in current by CD-2 and sets the first stage of a three stage alarm counter (FF-3, FF-4, and FF-5).

(c) The output of the current driver is also inverted by IV-4, to enable negative AND gates AG-3 and AG-4. If eight successive C's or Z's or a combination of the two are received as inputs, to the AND, C and Z gates, the output of AG-5 goes to a -6 volt level to drive inverter IV-3. The output of IV-3 enables the misframe circuits.

4-18. RECEIVER CODE CONVERTER, TEST DATA

a. Tables 4-15 and 4-16 list the steps to be performed to localize Receiver Group failures to the Receiver Code Converters. If a specific receiver difficulty does not appear in this table, refer to the trouble shooting information given in the test data sections for the Synch Unit and Receiver Mux-Demux.

NOTE

The trouble shooting chart of Tables 4-15 and 4-16 will localize the failure to a specific board in a specific Receiver Code Converter. When the functional section has been located, immediate repair is effected by the replacement of that printed circuit board which contains the faulty section.

TABLE 4-15. TROUBLESHOOTING, RECEIVER CODE CONVERTER

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1		Local printers are receiving garbled copy.	Printers should receive good copy.	The distant terminal may be defective. If verification indicates the distant terminal is functioning properly, proceed to step 2 or step 4.
2		Observe the indication of meters M1 and	The RECEIVER CRYSTAL meter	If the indications are normal, the failure is in the Receiver Code Con-

TABLE 4-15 (Cont'd)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
2 (Cont'd)		M2 on the Synch Unit.	M2 should kick at intervals, and the MUX line current meter should vibrate.	verters or the Receiving Mux-Demux , proceed to step 3. If the indications are abnormal, refer to the trouble shooting charts for the Synch Unit. Table 4-12.
3		Observe the indications of meter M1 on the Receiver Mux-Demux.	The meter should pulse at the channel rate.	If the indications are normal, the failure is in the Receiver Code Converter, proceed to step 5. If the indication is not normal, refer to the trouble shooting charts for the Receiver Mux-Demux, Table 4-6.
4		Only one channel is receiving garbled copy.	All channels should receive good copy.	The failure is in the Receiver Code Converter, proceed to step 5.
5	J8	Connect the neon signal indicator to test point J8. Supply an all works input to the Receiver Code Converter.	All neon lamps should illuminate and extinguish at the character rate.	If the indicator is normal, proceed to step 15. If any single lamp fails to be illuminated, proceed to step 17. If any single lamp fails to extinguish, or is erratic in operation, proceed to step 16. If all the lamps fail to extinguish, proceed to step 6.
6	4	Connect the B vertical input of an oscilloscope to test point J4 on printed circuit board A2. Connect the A vertical input and the external trigger input to the output of the start control gate.	The waveform should be as shown on figures 4-35 and 5-21.	If the waveform is normal, the SS oscillator and squaring amplifier are functioning, proceed to step 9. If the waveform is abnormal, proceed to step 7.
7	4	With the oscilloscope connected as in step 6, connect a jumper from the junction of R19 and CR6 to the end of R5 nearest the left side of printed circuit board A2.	The waveform should be as step 6, but free running.	If the waveform is normal, the oscillator clamp and control amplifier has failed. Make repairs as indicated. Remove the jumper. If the waveform is abnormal, proceed to step 8, leaving the jumper in place.
8	0	Connect the vertical input of the oscilloscope to test point J3 on printed circuit	The waveform should be as shown on figures 4-35 and 5-71.	If the waveform is normal, the malfunction is in the squaring amplifier. Make repairs as indicated and remove the jumper.

TABLE 4-15 (Cont'd)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
8 (Cont'd)		board A2.		If the waveform is abnormal, the malfunction is in the start-stop oscillator, make repairs as indicated and remove the jumper.
9	B	Connect the vertical input of the oscilloscope to junction of the collector of Q15 and R23 on printed circuit board A1.	The waveform should be as shown on figures 4-35 and 5-71.	If the waveform is normal, proceed to step 10. If the waveform is abnormal, the distributor drive amplifier has malfunctioned. Make repairs as indicated.
10	5	Connect the vertical input of the oscilloscope to test point J1 on printed circuit board A1.	The waveform should be as shown on figures 4-35 and 5-71.	If the waveform is normal, proceed to step 12. If the waveform is abnormal, proceed to step 11.
11	C	Connect a voltmeter to the collector of each ring element.	The ring should be cycling, so that the meter deflects at the character rate.	If any element voltage reading does not flicker, the failure is in the start-stop distributor. Make repairs as indicated.
12	1	Connect the vertical input of the oscilloscope to test point J1 on printed circuit board A2.	The waveform should be as shown on figures 4-35 or 5-71.	If the waveform is normal, proceed to step 13. If the waveform is abnormal, the malfunctions is in the traffic flip-flop clock current driver or start control gage. Proceed to step 13.
13	A	Connect the vertical input of the oscilloscope to the junction of the collector of Q1 and R1 on printed circuit board A2.	The waveform should be as shown on figures 4-35 or 5-71.	If the waveform is normal, the failure is in the start control gates. Proceed to step 14. If the waveform is abnormal, the failure is in the clock current driver. Make repairs as indicated.
14	2	Connect the vertical input of the oscilloscope to test point J2 on printed circuit board A2.	The waveform should be as shown on figures 4-35 or 5-71.	If the waveform is not normal, the malfunction is in the diodes which make up the signal gates. Make repairs as indicated.
15	F	Check the indication of the line current meter.	Meter should read approximately 50 ma or a 60 ma circuit.	If the indication is abnormal, the malfunction is in the output current drives, inverters, or keyer line switch. Make repairs as indicated.
16	D	Connect the vertical input of the oscilloscope to base, in turn, of Q1, Q3, Q5, Q7, and Q9 on printed circuit board A3.	The waveform should be as shown on figures 4-35 or 5-71.	If the indication is normal, proceed to step 7. If the indication is abnormal, check the operation of the start-stop distributor as indicated in step 11.

TABLE 4-15 (cont'd)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
16 (Cont'd)				Make repairs as indicated.
17	(E)	Connect the vertical input of the oscillo-scope to the bases, in turn, of Q2, Q4, Q6, Q8 and Q10 of printed circuit board A3.	The waveform should be as shown on figures 4-35 or 5-71.	If the indication is normal, the malfunction is in the corresponding flip-flop which is remaining in the set as reset condition. Make repairs as indicated.

TABLE 4-16. TROUBLE SHOOTING, ALARM CIRCUITS

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1		Equipment does not indicate misframe, although garbled information is being received.	Equipment should misframe and lock up.	If the input is a constant C, Z or combination of the two, proceed to step 6. If the input is other, proceed to step 2.
2	8	Connect the vertical input of the oscillo-scope to test point J1 on printed circuit board A5. Misframe the system with all Receiver Code Con-verter switches in the TRAFFIC position.	The system should alarm. The wave-form should be as shown on figures 4-37 or 5-71.	If the waveform is normal, pro-ceed to step 3. If the waveform is abnormal, the malfunction is in the number six element flip-flop or the start control gages. Make repairs as indicated.
3	9	Connect the vertical input of the oscillo-scope to test point J2 on printed circuit board A5.	The waveform should be as shown on figures 4-37 or 5-71.	If the waveform is normal, proceed to step 4. If the waveform is abnormal, the malfunction is in the mis-frame alarm OR gate, or invert-er amplifier. Make repairs as indicated.
4	10	Connect the vertical input of the oscillo-scope to test point J3 on printed circuit board A5.	The waveform should be as shown on figures 4-35 or 5-71.	If the waveform is normal, pro-ceed to step 5. If the waveform is abnormal, the malfunction is in the inverter amplifier, or integration circuit. Make repairs as indicated.
5	11	Connect the voltmeter to test point J4 on printed circuit board A5.	The meter should indicate zero.	If the reading is correct, relay K1 is malfunctioned. Replace. If the meter reading pulses to -6 volts, check diode CR7 and replace. If the reading is not normal, the malfunction is in the differen-tial amplifier, level senser, or

TABLE 4-16 (Cont'd)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
5 (Cont'd)				alarm signal inverter. Make repairs as indicated.
6	6	Connect the vertical input of the oscilloscope to test point J1 on printed circuit board A6. Frame the system, feed the series CZ, CZ, CZ etc to the input.	The waveform should indicate a step function.	If the waveform is normal, proceed to step 7. If the waveform is abnormal, the malfunction is in the "C" AND gate. Make repairs as indicated.
7	7	Same as step 6, but connect the vertical input of the oscilloscope to test point J2 on printed circuit board A6.	The waveform should indicate a step function.	If the waveform is normal, proceed to step 9. If the waveform is abnormal, the malfunction is in the Z AND gate. Make repairs as indicated.
8		As step 6, but connect the vertical input of the oscilloscope to the junction of collector Q6 and R28 on printed circuit board A6.	The waveform should indicate a step function.	If the waveform is normal, proceed to step 9. If the waveform is abnormal, the malfunction is in the CZ OR gate, current driver, or binary counter. Make repairs as indicated.
9		As step 6, but connect the vertical input of the oscilloscope to the junction of collector Q6 and R38 on printed circuit board A6.	The waveform should indicate a step function.	If the waveform is abnormal, the malfunction is in the binary AND gate, or inverter. Make repairs as indicated.

b. The only test equipment required for the use of Tables 4-15 and 4-16 is the test equipment listed in Table 4-2.

c. Table 4-17 is a list of the controls and indicators of the Receiver Code Converters. Column two list the position of the component on the drawer. Column three lists the normal indication of the indicator.

TABLE 4-17. RECEIVER CODE CONVERTER, CONTROLS AND INDICATORS

CONTROL	LOCATION	NORMAL POSITION	REMARKS
Line Current Meter, M1	Front Panel	20-25 ma. or 60-65 ma.	The line current meter reading depends upon the present current level. The adjustment of the LINE rheostat will affect the indication of the meter. If zero line current is indicated in a known good Receiver Code Converter, check fuse F1 as explained in paragraph 3-6 e.

TABLE 4-17 (Cont'd)

CONTROL	LOCATION	NORMAL POSITION	REMARKS
WPM switch S1	Internal	60, 75, or 100 as required.	The setting of this control must agree with the wpm mode of the Multiplex signal.
LOCKUP ALARM DISABLE switch	Front panel	TRAFFIC	The LOCKUP and ALARM disable positions of the switch are used for special procedures only. Refer to section three.

d. Table 4-18 is a list of the adjustment and alignment procedures which affect the operation of the Receiver Code Converter. The actual procedures are given in Section 5, in the paragraphs noted in column three of the table.

TABLE 4-18. RECEIVER CODE CONVERTER, ADJUSTMENT AND ALIGNMENT PROCEDURES.

ADJUSTMENT	CIRCUIT	REFER TO
LINE RHEO	Output keyer	Paragraph 5-4 e (1)
CLAMP CONTROL	Start-stop oscillator	Paragraph 5-4 e (2)
FEEDBACK CONTROL	Start-stop oscillator	Paragraph 5-4 e (3)
FREQUENCY	Start-stop oscillator	Paragraph 5-4 e (4)
ALARM THRESHOLD	Framing circuits	Paragraph 5-4 e (5)

e. The logic block diagrams for the Receiver Code Converter are shown on figures 4-35 and 4-37. The interconnecting wiring information and the schematic diagram for this drawer are shown on figures 5-65 and 5-70. Figures 5-50 and 5-51 show the position of all adjustment controls and indicators. Test jacks for the individual circuits are shown on figures 5-52 through 5-56.

f. The Multiplex Set is placed in the LOCAL TEST mode of operation by following the procedures given in paragraph 4-6, f.

g. The following caution must be observed when performing trouble shooting procedures:

CAUTION

Deenergize the equipment prior to removing or installing drawers. After installing the drawers allow a fifteen-minute warmup period to ensure oscillator stability.

4-19. OSCILLATOR-POWER SUPPLY (See figure 5-72).

a. GENERAL. - The Oscillator-Power Supply contains three separate functional circuits. The primary purpose of the power supply is to provide regulated d-c bias voltages for the circuitry in the Receiver Group and Transmitter Group as well as the power supply itself. The secondary purpose of the power supply is to provide clock pulses for synchronizing the Transmitter Group and Receiver Group with external telegraph terminal sets. For the purpose of facilitating periodic checks and trouble shooting of the Multiplex Unit, a frequency measuring circuit is provided. This frequency monitoring circuit is connected to front-panel meter M2 FREQUENCY METER, and is read-out directly in words-per-minute (wpm). The schematic for all circuits in the power supply is shown in figure 5-72. A detailed functional description of the circuits in the power supply follows.

b. DETAILED FUNCTIONAL DESCRIPTION

(1) REGULATED D-C BIAS SOURCES. - As shown in figure 5-72, seven regulated d-c bias voltages and two unregulated a-c control voltages are generated by the power supply to external loads in the Transmitter and Receiver Groups. In addition, the power supply circuits also provide a-c filament power to the hermetically sealed plug-in module containing the clock oscillator.

(a) +12v D-C REGULATED BIAS CIRCUIT. - A-c power (nominally 115v a-c at 60 cps) is applied through self-indicating fuses on both sides of the line to electrostatically shielded power transformer T1. Transformer T1 has four center-tapped windings, three of which are connected to series interference suppressors (inductive types) on the high and low sides of the windings. Since all d-c bias and a-c control voltages are derived from the a-c power source, the detailed functional description of the remaining bias and control voltages will not discuss the a-c power input. The a-c voltage from the first transformer T1 winding is rectified by center-tapped full wave rectifier CR3/CR4, and the 120 cps ripple is filtered by a T-type RC filter network. The d-c voltage is then regulated by a zener shunt regulator (CR7/R18). The regulated +12 volts is then generated as an output and fed through position three of the D.C. VOLTS switch S2 (wafer A) to VOLTS, D.C. meter M1 for visual monitoring.

(b) +50v D-C REGULATED BIAS CIRCUIT. - The third winding of transformer T1 is coupled to center-tapped full-wave rectifier A1CR1/A1CR2, rectified, and filtered by an "inverted-L" RC ripple filter. The filtered d-c is then regulated by a zener shunt regulator (CR8/R19). The regulated +50 volts is then generated as an output, and fed to the D.C. VOLTS switch S2 and the +37 volts circuit discussed below. The +50 volts is fed through position one of switch S2 (wafer A) to VOLTS, D.C. meter M1 for visual monitoring.

(c) +37v D-C REGULATED BIAS CIRCUIT. - The output of the zener shunt regulator (CR8/R19) used to regulate the +50 volt bias is fed to voltage divider network A1R9/R12/A1R10. Potentiometer R12 is set to select +37 volts for bias. The +37 volt bias is then fed to terminal two of the D. C. VOLTS switch S2 (wafer A) and to the power supply output.

(d) -12v D-C REGULATED BIAS CIRCUIT. - The first winding of transformer T1 is coupled to center-tapped full-wave rectifier CR1/CR2, which is in parallel with center-tapped full-wave rectifier CR3/CR4. The rectified output of CR1/CR2 is filtered of its 120 cps ripple by a choke-input LC filter, and coupled to the inputs of the d-c reference source (A2Q3-A2Q8) and the transistor series regulator Q1-Q3. The d-c reference source is a group of error-sensing amplifiers, to generate the error-signal voltages to all transistor series regulators with the voltage being regulated in the transistor series d-c regulators. The d-c reference source generates a -12 volts reference to transistor series regulator Q1-Q3. The transistor series regulator compares the -12 volt reference with the input received from the choke-input LC ripple filter. The transistor series regulator then maintains an output voltage equal to the -12 volt reference. The regulated -12 d-c output is then generated to the output of the power supply, the transistor series regulator Q5, input, and the fifth position of the D. C. VOLTS switch S2 (wafer B) for visual monitoring a VOLTS D.C. meter M1.

(e) -6v D-C REGULATED BIAS CIRCUIT. - The output of transistor series regulator Q1-Q3 is coupled to the input of transistor series regulator Q5. The input is a regulated -12 volts d-c, which is regulated a second time to provide a constant -6 volt d-c source. The regulated -6 volt bias appears at the transistor series regulator Q5 output. The -6 volt bias is then generated as a power supply output, and is also coupled to the sixth position of the D-C VOLTS switch S2 (wafer C) for visual monitoring by VOLTS, D-C meter M1.

(f) +1.5v D-C REGULATED AND FILTERED BIAS CIRCUIT. - The source of the +1.5 volt bias is transistor series regulator Q1-Q3. The voltage is developed across a resistor network, through which the current is maintained constant. Therefore, a +1.5 volt d-c regulated bias is obtained. The regulated bias is then sent to the power supply output and the fifth position of D-C VOLTS switch S2 (wafer B) for visual monitoring on VOLTS, D-C meter M1.

(g) +6v D-C REGULATED BIAS CIRCUIT. - The second transformer T1 secondary winding is coupled to center-tapped full-wave rectifier CR5/-CR6. The rectified output of CR5/CR6 has the 120 cpx component filtered out by an inverted-L RC ripple filter. The filtered d-c is coupled to the input of transistor series regulator Q4. This transistor series regulator compares the ripple filter output with the +6 volt reference received from the d-c reference source (A2Q3 - A2Q8), and generates a +6 volt regulated output. This output is sent to the power-supply output terminals and the fourth position of the D-C VOLTS switch S2 (wafer B) for visual monitoring on VOLTS, D-C meter M1.

(h) A-C BIAS CIRCUITS. - The first and fourth windings (secondary) of transformer T1 provide a-c voltages for control and heating functions. The first transformer winding is tapped-off following the series interference suppressors (high and low side leads) to provide 24 volt a-c (48 volt a-c center-tapped) for alarm buzzer power. The 24 volt a-c line to the alarm buzzers can be deactivated by placing the BYPASSED switch S3 on the power supply front panel in BYPASSED position. When this is done, only the ALARM panel lamps will light. This condition is indicated when the BYPASSED panel lamps will light. This condition is indicated when the BYPASSED panel lamp illuminates, indicating that the buzzer alarm is bypassed. The fourth (secondary) winding of transformer T1 is used to provide 12.6 volt a-c for the clock-oscillator-module (oven) heater. The voltage illuminates the POWER panel lamp to indicate that a-c power is present. The CRYSTAL OVEN panel lamp is in series with the 12.6 volt a-c line to the clock-oscillator-module heater, and is illuminated whenever the power supply is operating, as long as the clock oscillator module has not be removed.

c. CLOCK PULSING GENERATING CIRCUITS. - The clock pulse generating circuits, are comprised of four functional elements. These functional elements are: clock oscillator in (hermetically - sealed crystal-oven module), switching amplifier A3Q5, bistable multivibrator A3Q1/A3Q2, and bistable multivibrator A3Q3/A3Q4, the last three aforementioned functional elements are referred to as amplifier Q5, flip-flop 1, and flip-flop 2, respectively. The clock oscillator generates an appropriate sinusoidal output for the word-per-minute rate set at the Terminal, Telegraph Set. The frequency of the cl9ck oscillator can be varied externally by the FREQ ADJ capacitor, C12, mounted behind the front panel of the Oscillator Power Supply. The output of the clock oscillator is coupled to amplifier Q5's input. The negative going peaks of the clock oscillator output cause amplifier Q5 to saturate causing a decayed square wave to appear at amplifier Q5's output. This output is coupled to the symmetrically-triggered complementary flip-flop 1 to advance a state ("count 1"). The output of flip-flop 1 is square wave, the leading edges of which cause flip-flop 2 to advance a state every other "count" of flip-flop 1. The two identical flip-flops serve as a counter, with a capacity of four counts until the output of flip-flop 2 is reset at the same time flip-flop 1 is reset (original condition). In effect, the two flip-flops divide the frequency of the clock oscillator by four. The output of flip-flop 2 is coupled to the output terminals of the power supply, and is generated to the Transmitter and Receiver Groups as required.

d. FREQUENCY MONITOR CIRCUIT. - The frequency monitor circuit consists of a high-impedance emitter-follower amplifier A2Q1, and FREQUENCY METER M1. To monitor the word speed frequency, FREQ METER jack A2J5 is connected to start-stop oscillator 2A1A2Q4's test jack 2A1A2J3 (in the Synch Unit) after the start-stop oscillator control circuitry is disabled (permitting the start-stop oscillator to run freely). The sinusoidal output of the start-stop oscillator in Synch Unit) is then impedance-matched through amplifier Q1 to meter M1. Amplifier Q1 prevents meter M1 from loading the output of start-stop oscillator 2A1A2Q4. The frequency of the start-stop oscillator can then be read directly from meter M1 in words-per-minute. The frequency monitor circuits are used mainly for self checks of the terminal test set, and such troubleshooting as required. Other circuits in the Multiplex Set which employ the same frequency as the start-stop oscillator may be checked.

e. A-C POWER HANDLING CIRCUITRY. - The a-c power handling circuitry is straight-forward. The only difference from a standard a-c power supply is the series-inductance-type interference filters connected in the high and low sides of power transformer T1's secondary windings, with the exception of the fourth secondary winding that supplies the a-c control and crystal-oven heater power (24 volt a-c, 12.6 volt a-c, center-tapped feed respectively). Fused (five amp) dual convenience outlets are provided, both coupled in parallel with power transformer T1's primary winding, for attaching ancillary equipment as required. The 115 volt a-c input across power transformer T1's primary is fused on both sides of the line, and has self-indicating fuse posts which are illuminated when the fuse blows.

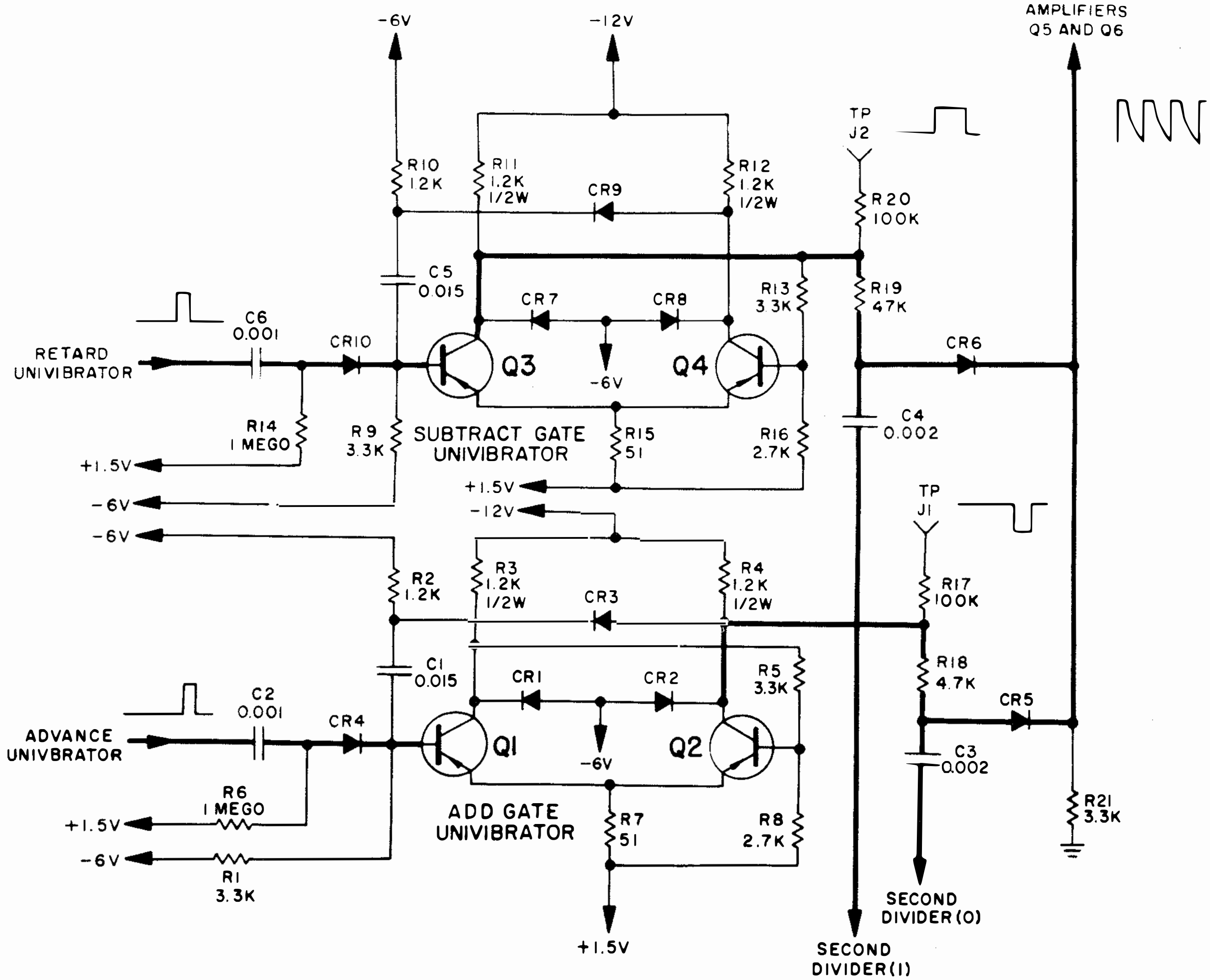


Figure 4-27. Simplified Schematic, Add and Subtract Circuits

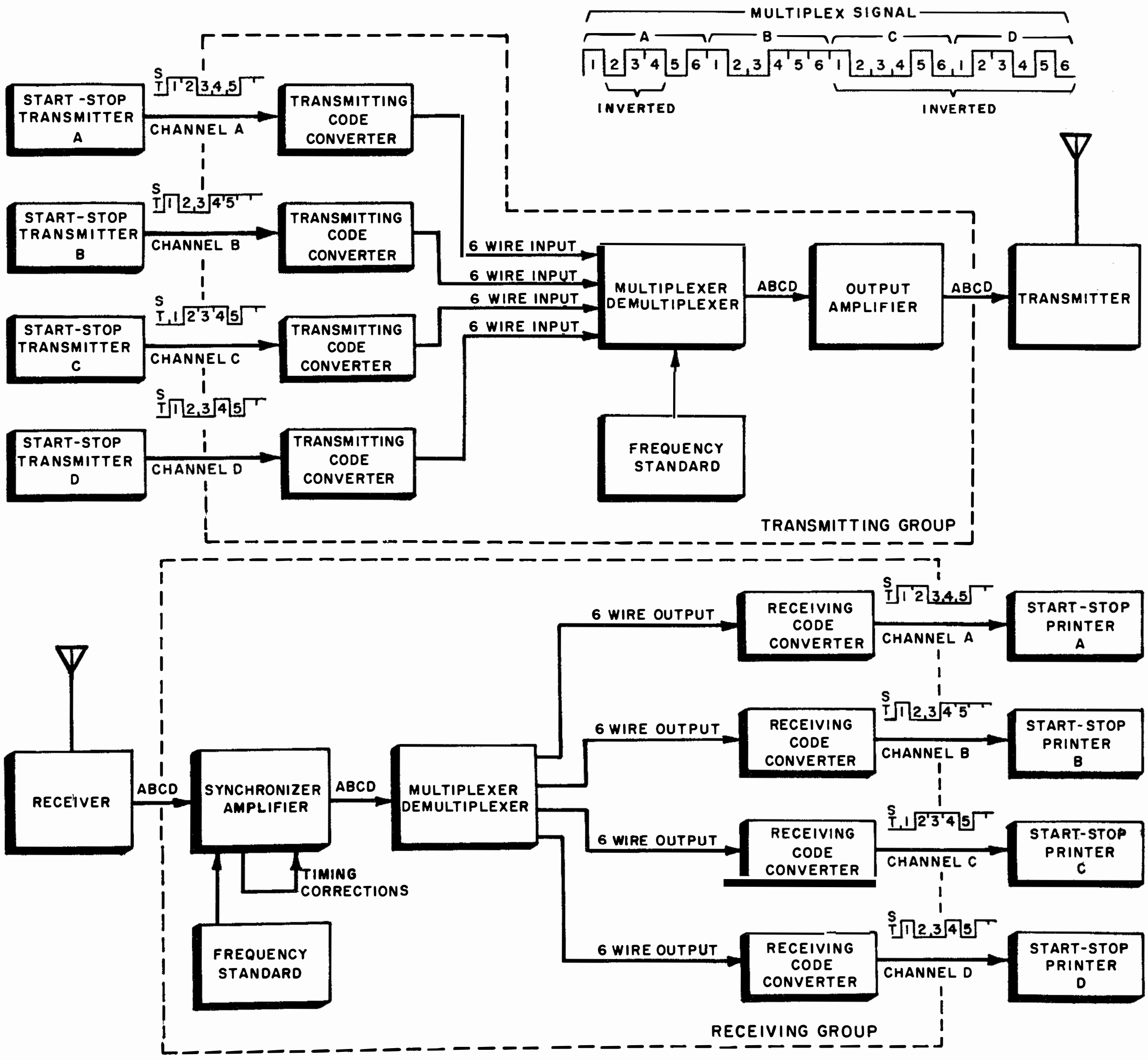


Figure 4-28. Multiplex Set, Block Diagram

START-STOP SIGNALS INTO TRANSMITTING CODE CONVERTERS (S 1 2 3 4 5 Sp)	OUTPUTS FROM TRANSMITTING CODE CONVERTERS A (1 2 3 4 5 6)	B (1 2 3 4 5 6)	C (1 2 3 4 5 6)	D (1 2 3 4 5 6)
M M M M M M M* (IDLE, 4 CHAN)	S S S S S S	S S S S S S	S S S S S S	S S S S S S
S S S S S S M (BLANK, 4 CHAN)	S S S S S M	S S S S S M	S S S S S M	S S S S S M
S M M M M M M (LETTERS, 4 CHAN)	M M M M M M	M M M M M M	M M M M M M	M M M M M M
S M S M S M M (Y, 4 CHAN)	M S M S M M	M S M S M M	M S M S M M	M S M S M M

* Absence of start pulses (spacing) block input of succeeding marking pulses, and the receiving code converters deliver all spacing pulses.

WIRING BETWEEN CODE CONVERTER AND MUXER: Inverts 2, 3 and 4 pulses on channel A and all pulses on channels C and D.

6-WIRE PARALLEL SIGNALS INTO MATRIX OF MULTIPLEXER A (1 2 3 4 5 6)	B (1 2 3 4 5 6)	C (1 2 3 4 5 6)	D (1 2 3 4 5 6)
S M M M S S	S S S S S S	M M M M M M	M M M M M M
S M M M S M	S S S S S M	M M M M M S	M M M M M S
M S S S M M	M M M M M M	S S S S S S	S S S S S S
M M S M M M	M S M S M M	S M S M S S	S M S M S S

WIRING BETWEEN MUXER AND OUTPUT AMPLIFIER: The matrix of the multiplexer produces signals on two lines: pulses 1, 5 and 6 of channel A and all pulses of channel B come out on a "normal" line; pulses 2, 3 and 4 of channel A and all pulses of channels C and D come out on an "inverted line."

SEQUENTIAL SIGNALS INTO OUTPUT AMPLIFIER	A (1 2 3 4 5 6)	B (1 2 3 4 5 6)	C (1 2 3 4 5 6)	D (1 2 3 4 5 6)
NOR.	S S S	S S S S S S		
INV.	M M M		M M M M M M	M M M M M M
NOR.	S S M	S S S S S M		
INV.	M M M		M M M M M S	M M M M M S
NOR.	M M M	M M M M M M		
INV.	S S S		S S S S S S	S S S S S S
NOR.	M M M	M S M S M M		
INV.	M S M		S M S M S S	S M S M S S

OUTPUT AMPLIFIER: Nor. & inv. signals are combined by output amplifier into a multiplex signal which is transmitted on the common teletypewriter channel.

	MULTIPLEX SIGNAL INTO SYNCHRONIZER - AMPLIFIER A (1 2 3 4 5 6)	B (1 2 3 4 5 6)	C (1 2 3 4 5 6)	D (1 2 3 4 5 6)
	S M M M S S	S S S S S S	M M M M M M	M M M M M M
	S M M M S M	S S S S S M	M M M M M S	M M M M M S
	M S S S M M	M M M M M M	S S S S S S	S S S S S S
	M M S M M M	M S M S M M	S M S M S S	S M S M S S
TEST SIGNALS: STEADY MARK	M M M M M M	M M M M M M	M M M M M M	M M M M M M
TEST SIGNALS: STEADY SPACE	S S S S S S	S S S S S S	S S S S S S	S S S S S S
TEST SIGNALS: REVERSALS	M S M S M S ↕	M S M S M S ↕	M S M S M S ↕	M S M S M S ↕
TEST SIGNALS: REVERSALS	S M S M S M	S M S M S M	S M S M S M	S M S M S M

(Above two signals can be changed from one to the other by operating framing switch.)

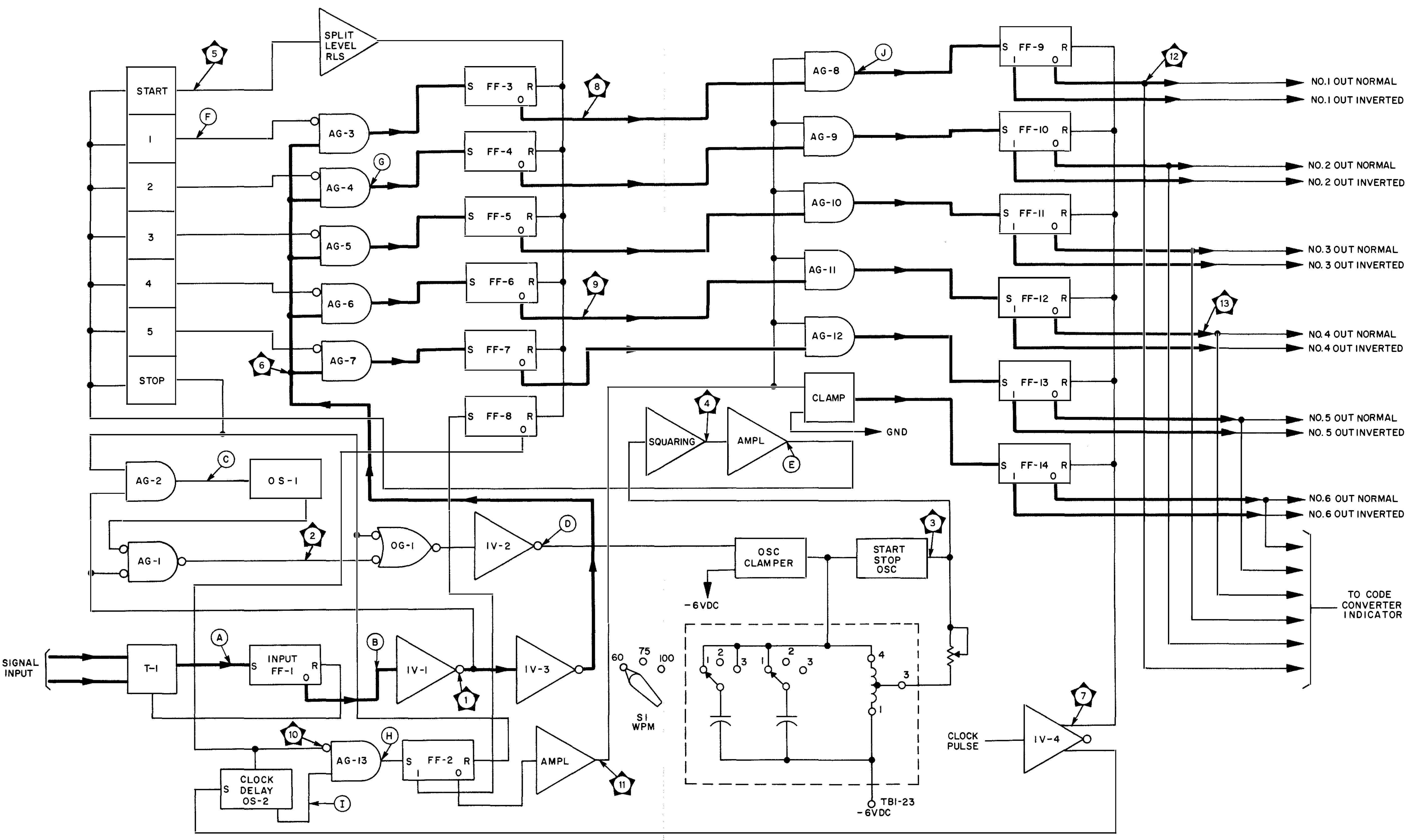
Figure 4-29. Multiplex Signaling (Sheet 1 of 2)

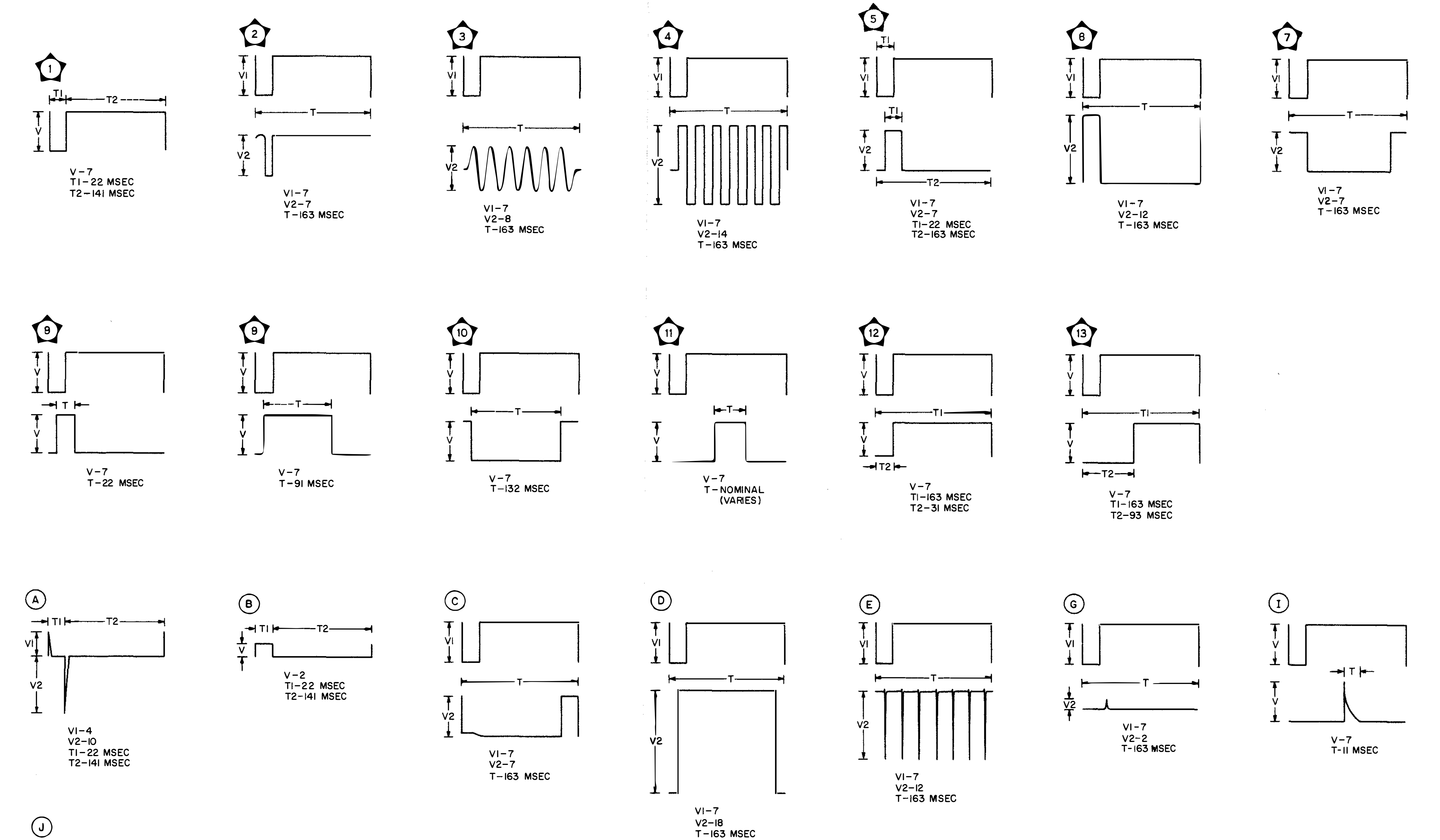
SYNCHRONIZER AMPLIFIER		MULTIPLEX SIGNAL INTO DEMULTIPLEXER A 1 2 3 4 5 6	B 1 2 3 4 5 6	C 1 2 3 4 5 6	D 1 2 3 4 5 6	WIRING INTO DEMULTIPLEXER MATRIX
Using the normal multiplex signal, the synchronizer creates an additional inverted signal. Both are then sent to demultiplexer.	NOR.	S M M M S S	S S S S S S	M M M M M M	M M M M M M	The inputs to the demultiplexer matrix is on two wires: pulses 1, 5 and 6 of channel A and all pulses of channel B come in on the normal line; pulses 2, 3 and 4 of channel A and all pulses on channels C and D come in on the inverted line.
	INV.	M S S S M M	M M M M M M	S S S S S S	S S S S S S	
	NOR.	S M M M S M	S S S S S M	M M M M M S	M M M M M S	
	INV.	M S S S M S	M M M M M S	S S S S S M	S S S S S M	
	NOR.	M S S S M M	M M M M M M	S S S S S S	S S S S S S	
	INV.	S M M M S S	S S S S S S	M M M M M M	M M M M M M	
	NOR.	M M S M M M	M S M S M M	S M S M S S	S M S M S S	
	INV.	S S M S S S	S M S M S S	M S M S M M	M S M S M M	
	NOR.	M M M M M M	M M M M M M	M M M M M M	M M M M M M	
	INV.	S S S S S S	S S S S S S	S S S S S S	S S S S S S	
	NOR.	S S S S S S	S S S S S S	S S S S S S	S S S S S S	
	INV.	M M M M M M	M M M M M M	M M M M M M	M M M M M M	
	NOR.	M S M S M S	M S M S M S	M S M S M S	M S M S M S	
	INV.	S M S M S M	S M S M S M	S M S M S M	S M S M S M	
	NOR.	S M S M S M	S M S M S M	S M S M S M	S M S M S M	
	INV.	M S M S M S	M S M S M S	M S M S M S	M S M S M S	

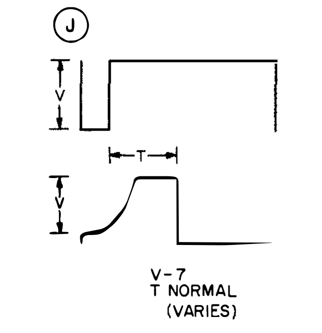
	SEQUENTIAL SIGNALS INTO MATRIX OF DEMULTIPLEXER A 1 2 3 4 5 6	B 1 2 3 4 5 6	C 1 2 3 4 5 6	D 1 2 3 4 5 6
NOR.	S S S	S S S S S S		
INV.	S S S		S S S S S S	S S S S S S
NOR.	S S M	S S S S S M		
INV.	S S S		S S S S S M	S S S S S M
NOR.	M M M	M M M M M M		
INV.	M M M		M M M M M M	M M M M M M
NOR.	M M M	M S M S M M		
INV.	S M S		M S M S M M	M S M S M M
NOR.	M M M	M M M M M M		
INV.	S S S		S S S S S S	S S S S S S
NOR.	S S S	S S S S S S		
INV.	M M M		M M M M M M	M M M M M M
NOR.	M M S	M S M S M S		
INV.	M S M		S M S M S M	S M S M S M
NOR.	S S M	S M S M S M		
INV.	S M S		M S M S M S	M S M S M S

6-WIRE PARALLEL SIGNALS INTO RECEIVING CODE CONVERTERS A 1 2 3 4 5 6	B 1 2 3 4 5 6	C 1 2 3 4 5 6	D 1 2 3 4 5 6	RELAYS OF RECEIVING CODE CONVERTERS	START-STOP SIGNALS FROM CODE CONVERTERS A S 1 2 3 4 5 Sp	B S 1 2 3 4 5 Sp	C S 1 2 3 4 5 Sp	D S 1 2 3 4 5 Sp	PAGE PRINTER RESPONSE A B C D
S S S S S S	S S S S S S	S S S S S S	S S S S S S	Output line relays of receiving code converters are spring biased to spacing condition, but traffic recognizer produces a steady mark when no traffic is being transmitted.	M M M M M M M	M M M M M M M	M M M M M M M	M M M M M M M	IDLE (4 CHANNELS)
S S S S S M	S S S S S M	S S S S S M	S S S S S M		S S S S S S M	S S S S S S M	S S S S S S M	S S S S S S M	BLANK (4 CHANNELS)
M M M M M M	M M M M M M	M M M M M M	M M M M M M		S M M M M M M	S M M M M M M	S M M M M M M	S M M M M M M	LETTERS (4 CHANNELS)
M S M S M M	M S M S M M	M S M S M M	M S M S M M		S M S M S M M	S M S M S M M	S M S M S M M	S M S M S M M	Y (4 CHANNELS)
M S S S M M	M M M M M M	S S S S S S	S S S S S S		S M S S S M M	S M M M M M M	M M M M M M M	M M M M M M M	Z LTRS IDLE IDLE
S M M M S S	S S S S S S	M M M M M M	M M M M M M		S S M M M S M	M M M M M M M	M M M M M M M	M M M M M M M	C IDLE IDLE IDLE
M M S M M S	M S M S M S	S M S M S M	S M S M S M		S M M S M M M	S M S M S M M	S S M S M S M	S S M S M S M	FIGS Y R R
S S M S S M	S M S M S M	M S M S M S	M S M S M S		S S S M S S M	S S M S M S M	S M S M S M M	S M S M S M M	SPCE R Y Y

Figure 4-29. Multiplex Signaling (Sheet 2 of 2)







NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE. OSCILLOSCOPE CONTROL SETTINGS:
   - PRESENTATION: CHOPPED
   - A CHANNEL: V-1 VOLT/CM
     H-20 MSEC/CM
   - B CHANNEL: V-1 VOLT/CM
     H-20 MSEC/CM
   - SYNCH: EXTERNAL, SAME AS A INPUT, TEST POINT A1S1.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   - T, T1, T2 - DURATION OF PORTION OF THE WAVEFORM INDICATED.
   - V, V1, V2 - PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS:
   - PRESENTATION: B CHANNEL
   - B CHANNEL: V-1 VOLT/CM
     H-20 MSEC/CM
   - SYNCH: INTERNAL, (+)
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT.

Figure 4-30. Transmitter Code Converter, Logic Diagram

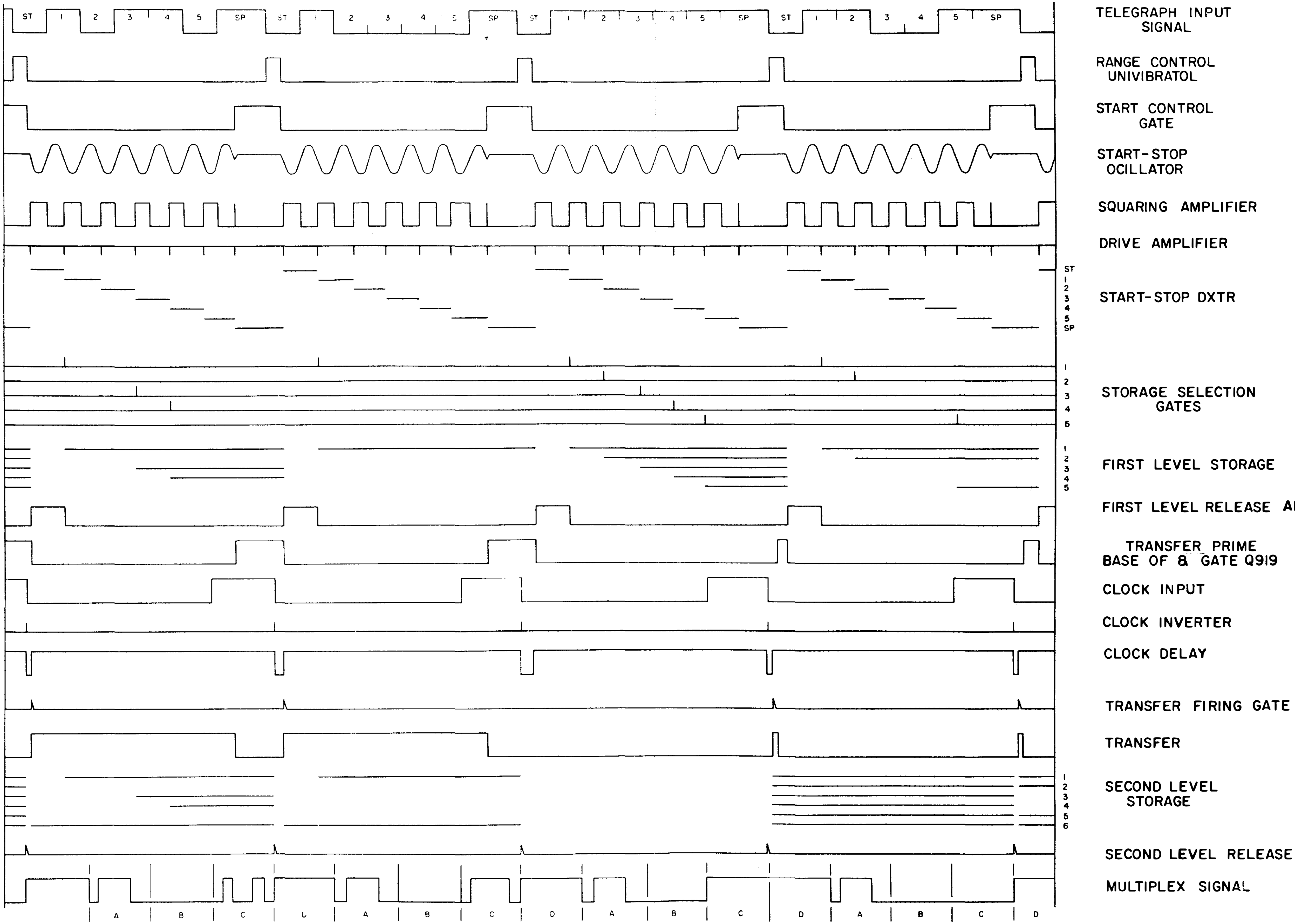
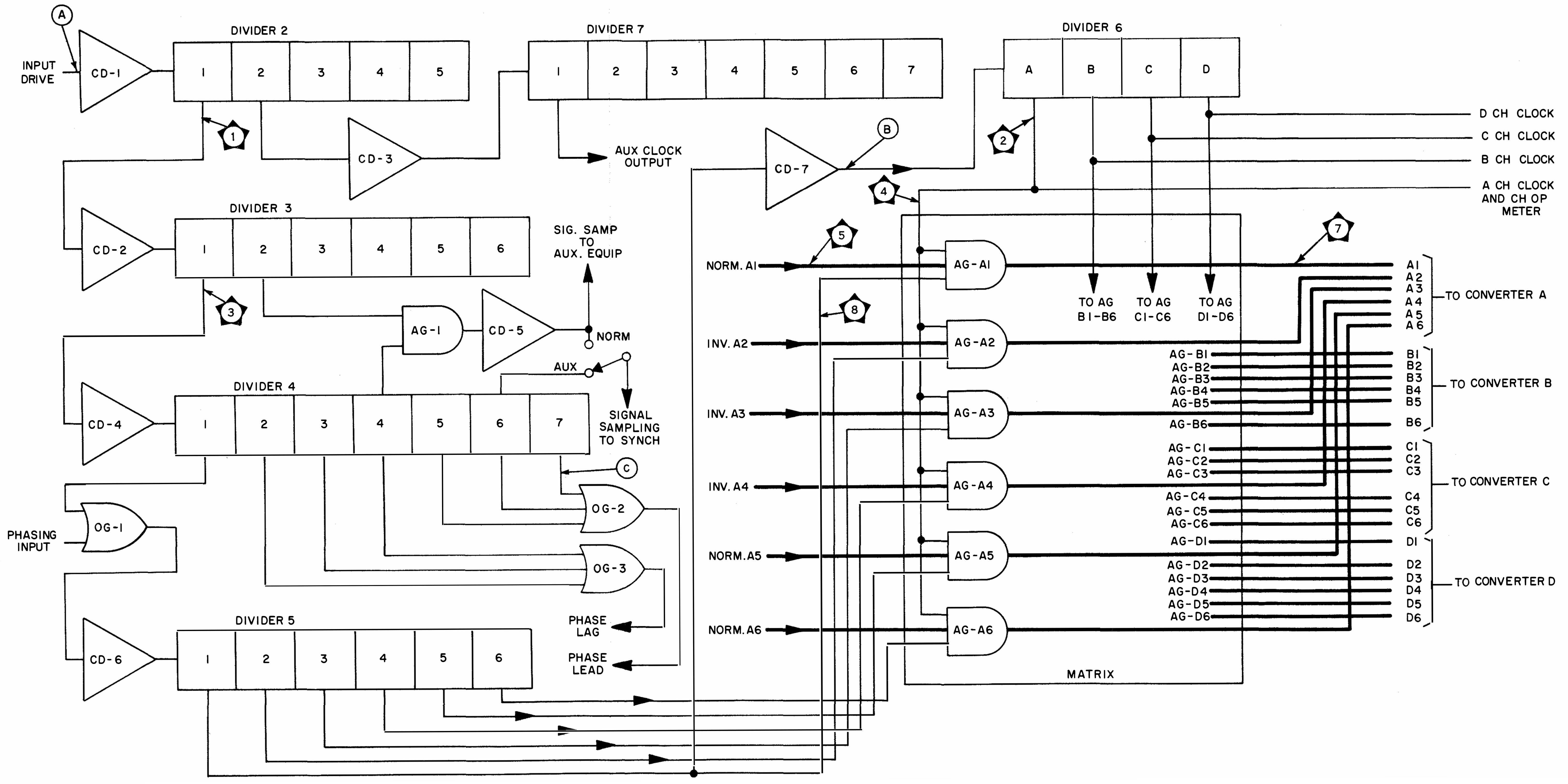
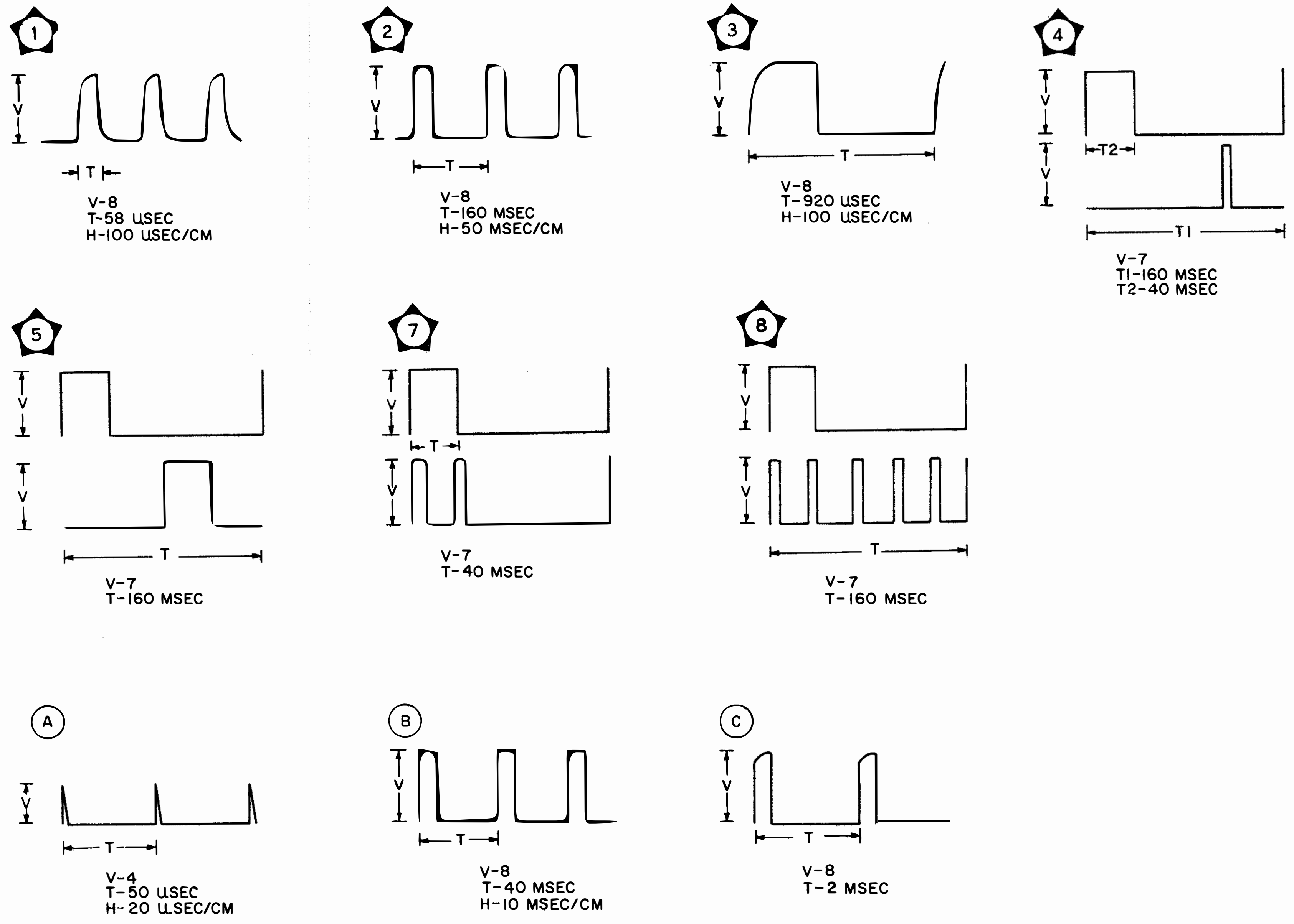


Figure 4-31. Transmitter Code Converter, Timing Chart

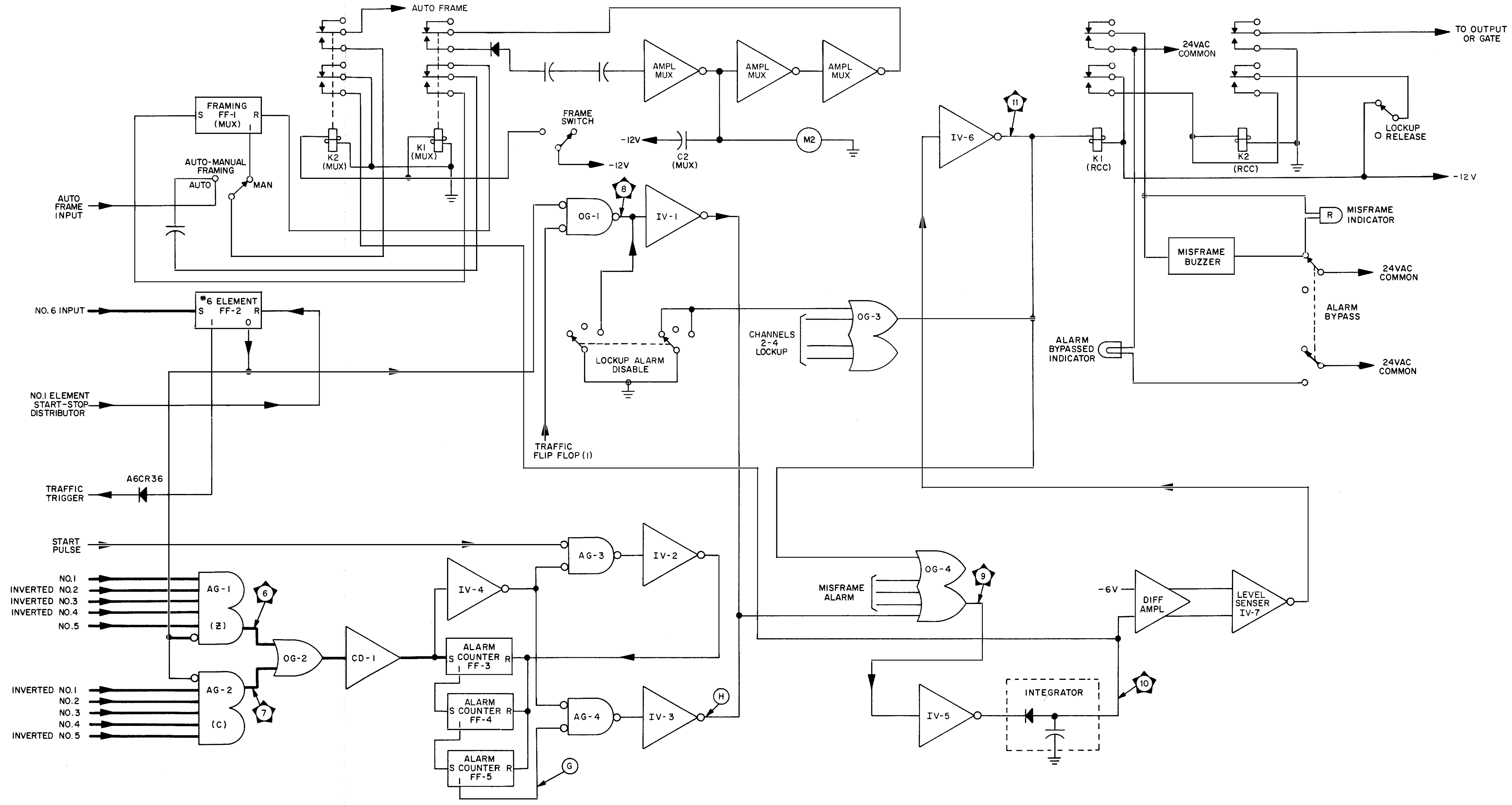


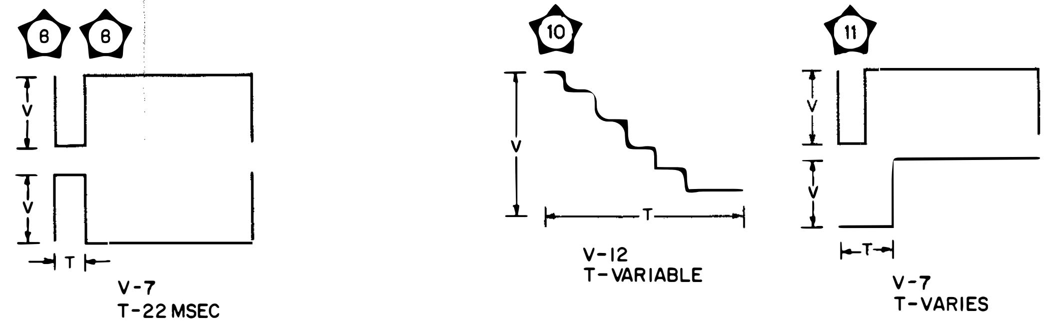


NOTES

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE OSCILLOSCOPE CONTROL SETTING:
   PRESENTATION: CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM (UNLESS OTHERWISE NOTED)
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM (UNLESS OTHERWISE NOTED)
   SYNCH: EXTERNAL, SAME AS A INPUT, TEST POINT A4J1.
3. EXPLANATION OF SYMBOLYS PLACED AT WAVEFORMS
   T,T1,T2-DURATION OF THE PORTION OF THE WAVEFOM INDICATED.
   V, -PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTING:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1VOLT/CM
   H-20 MSEC/CM (UNLESS OTHERWISE NOTED)
   SYNCH: INTERNAL (+)
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT.

Figure 4-32. Multiplexer Demultiplexer, Logic Diagram

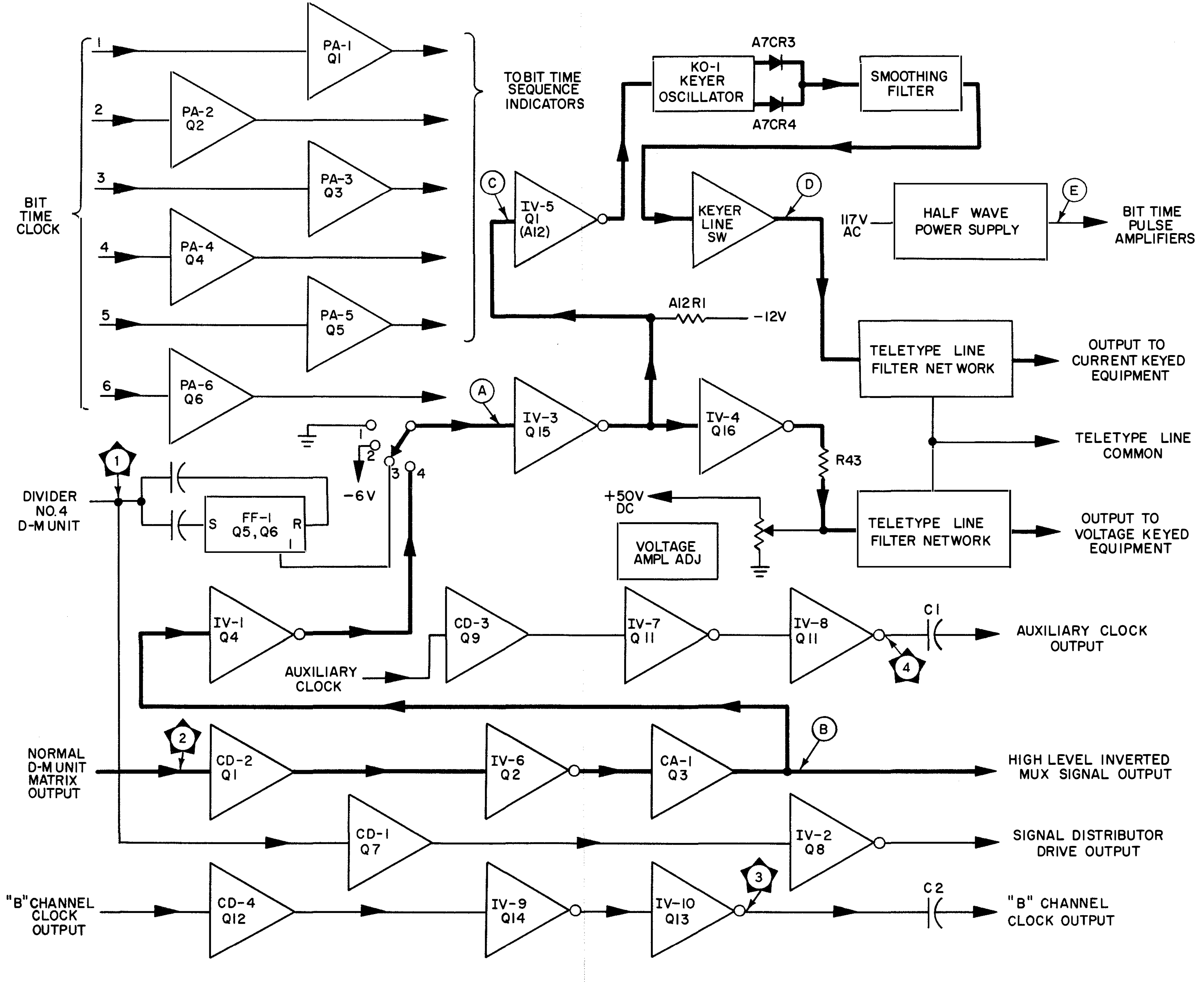


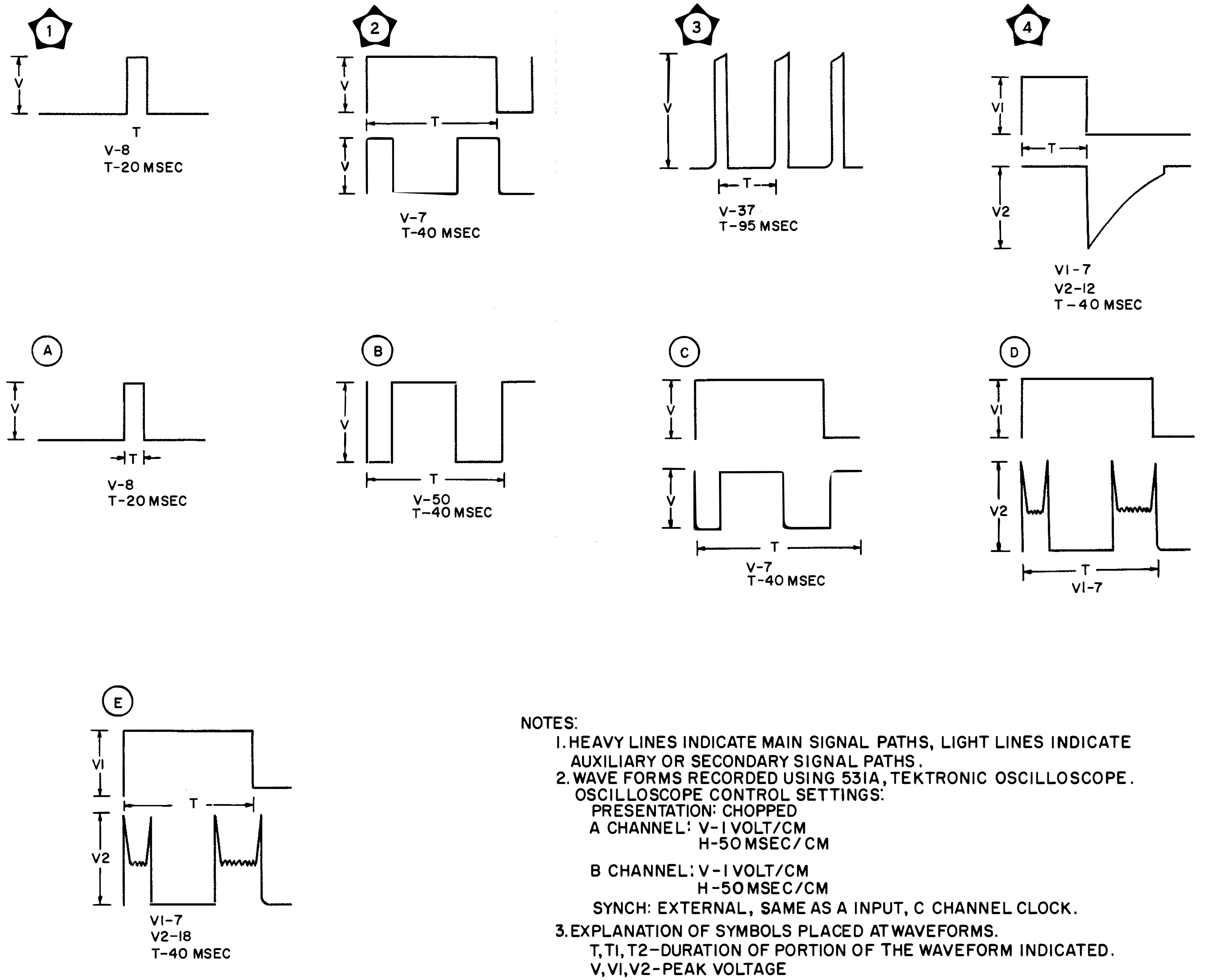


NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONICS OSCILLOSCOPE. OSCILLOSCOPE CONTROL SETTINGS
   PRESENTATION CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-50 MSEC/CM
   B CHANNEL: V-1 VOLT/CM
   H-50 MSEC/CM
   SYNCH EXTERNAL, SAME AS A INPUT, C CHANNEL CLOCK
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T, T1, T2 - DURATION OF PORTION OF THE WAVEFORM INDICATED
   V, V1, V2 PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS.
   PRESENTATION B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-50 MSEC/CM
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT.

Figure 4-33. Control Amplifier, Logic Diagram

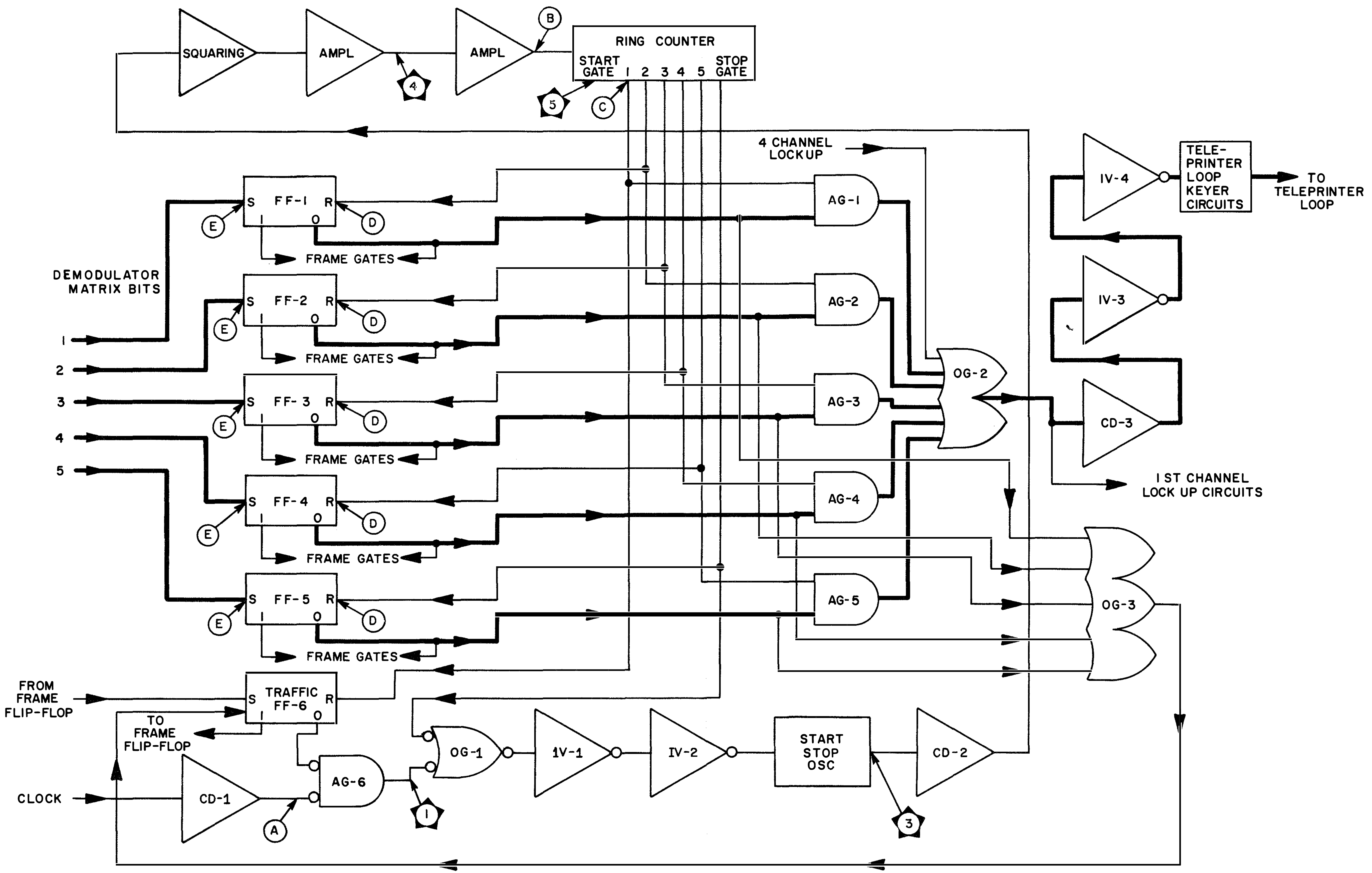


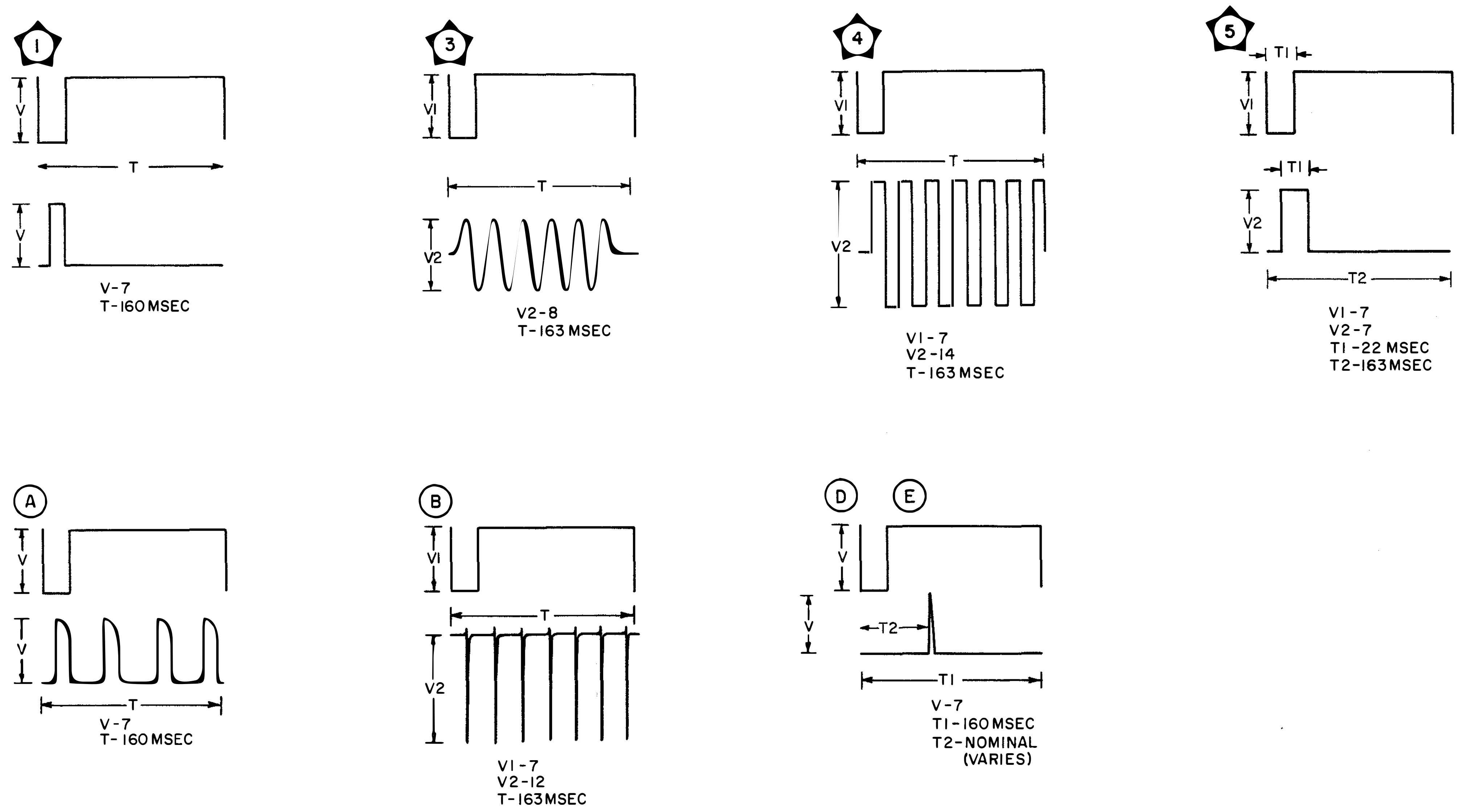


NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVE FORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE. OSCILLOSCOPE CONTROL SETTINGS:
   PRESENTATION: CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-50 MSEC/CM
   B CHANNEL: V-1 VOLT/CM
   H-50 MSEC/CM
   SYNCH: EXTERNAL, SAME AS A INPUT, C CHANNEL CLOCK.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T, T1, T2-DURATION OF PORTION OF THE WAVEFORM INDICATED.
   V, V1, V2-PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-50 MSEC / CM
5. MULTIPLEX UNIT IN LOCAL OPERTION, WITH ALL MARKS INPUT.

Figure 4-34. Electrical Synchronizer, Logic Diagram





NOTES

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE. OSCILLOSCOPE CONTROL SETTINGS:
   PRESENTATION: CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM
   SYNCH: EXTERNAL, SAME AS A INPUT, TEST POINT A1S1.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS,
   T, T1, T2 - DURATION OF PORTION OF THE WAVEFORM INDICATED.
   V, V1, V2 - PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM
   SYNCH: INTERNAL, (+)
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT.

Figure 4-35. Receiver Code Converter, Logic Diagram

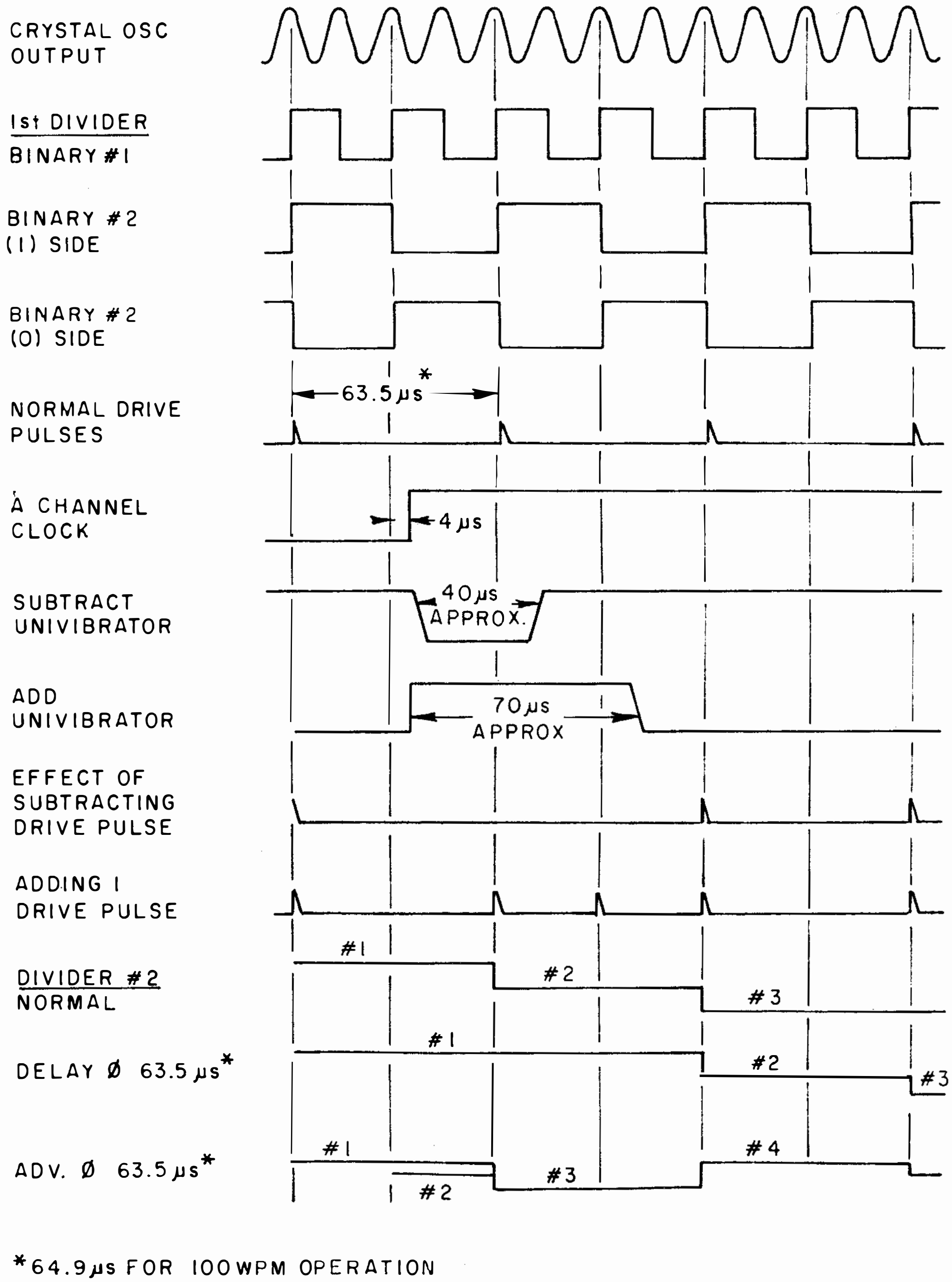
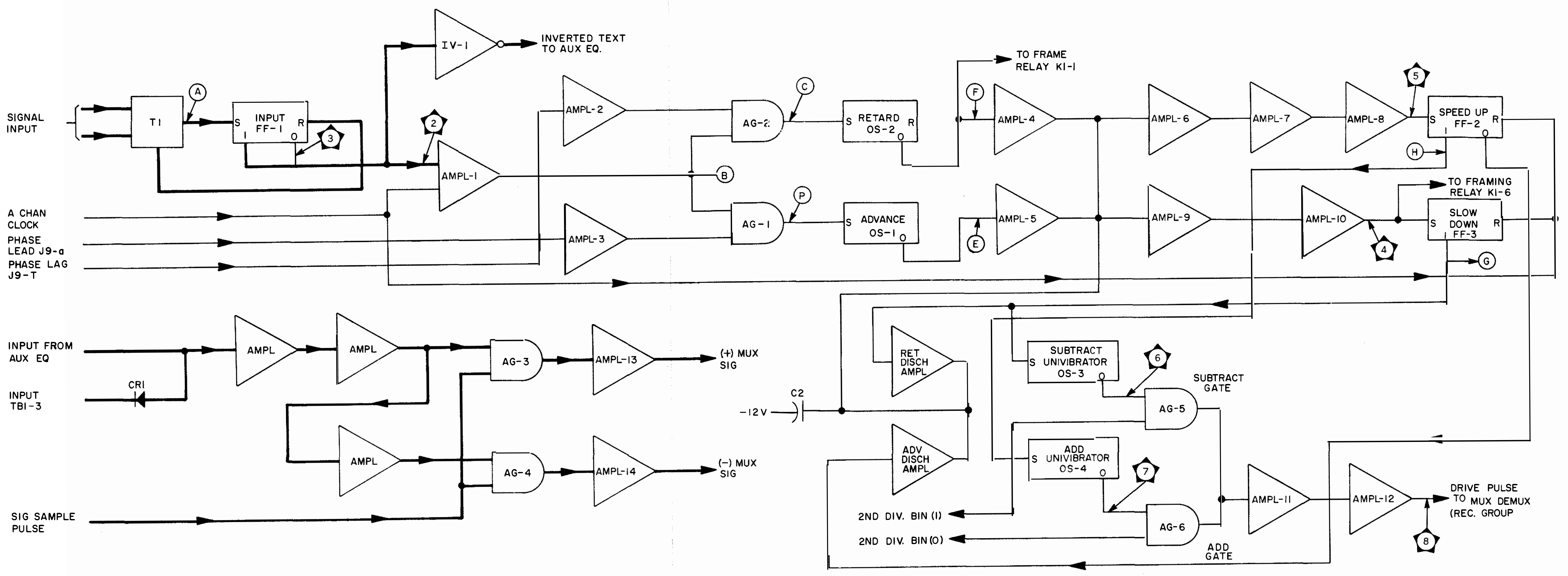
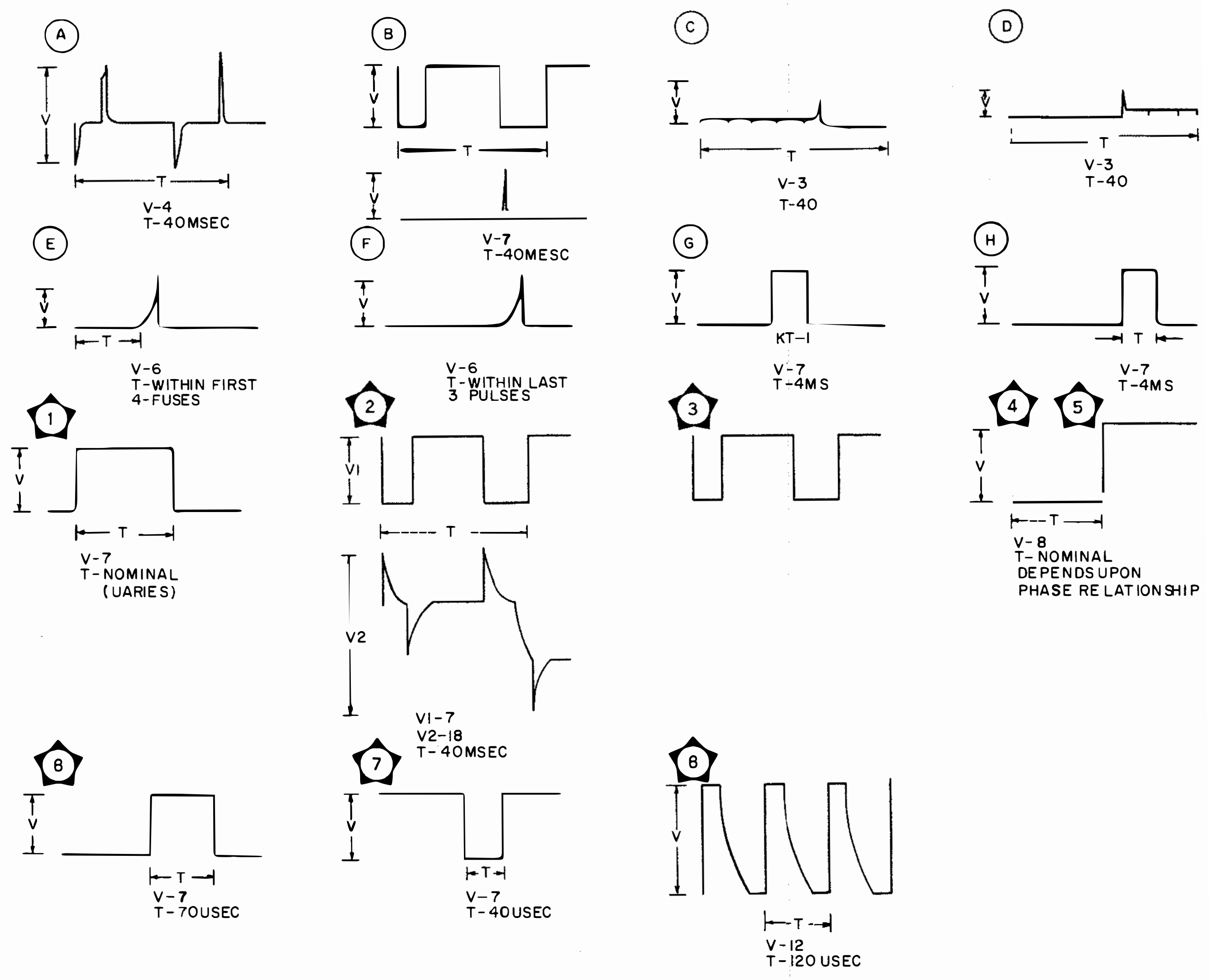


Figure 4-36. Receiver Code Converter, Timing Chart





NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVE FORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE. OSCILLOSCOPE CONTROL SETTINGS:
   PRESENTATION: CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-20MSEC/CM
   B CHANNEL: V-1 VOLT/CM
   H-20MSEC/CM
   SYNCH: EXTERNAL, SAME AS A INPUT, TEST POINT A CLOCK.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T,T1,T2- DURATION OF PORTION OF THE WAVEFORM INDICATED.
   V,V1,V2-PEAK VOLTAGE
4. SINGLE TRACE WAVE FORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM
   SYNCH: INTERNAL, (+)
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT.

Figure 4-37. Misframing Circuits, Logic Diagram

SECTION 5

MAINTENANCE

5-1. FAILURE, AND PERFORMANCE AND OPERATIONAL REPORTS.

The Bureau of Ships no longer requires the submission of failure reports for all equipments. Failure Reports and Performance and Operational reports are to be accomplished for designated equipments (refer to Electronics Installation and Maintenance Book, NAVSHIPS 900,000) only to the extent required by existing directives. All failures shall be reported for those equipments requiring the use of Failure Reports.

5-2. EQUIPMENT IDENTIFICATION.

The Multiplex Set consists of three main sections. The following description of the Multiplex Set is based upon viewing it from the front and numbering the drawers from left to right.

a. SECTION ONE. - The lower, full width drawer which contains the Oscillator-Power Supply, is section one.

b. SECTION TWO. - The Receiver Group, which consists of the six drawers located above the Oscillator-Power Supply, is section two. Five of the drawers contain six removable printed circuit boards. One drawer contains four printed circuit boards. With a drawer open and viewing from front to rear, two rows of jacks are visible. The left row contains the odd-numbered jacks in numerical sequence from front to back; the right row contains the even-numbered jacks in numerical sequence from front to back.

c. PRINTED CIRCUIT BOARD IDENTIFICATION. Each printed circuit board is marked with an identifying code number at the top edge of the component side of the board. The following example illustrates the method of properly matching the correct board and jack.

Example: Board number 2A6A4

1. The first number, 2, designates section two.

2. The second number, 6, designates drawer six.

3. The third number, 4, indicates that the board is connected to jack J4.

Drawer one, which contains four printed circuit boards is similarly coded.

d. SECTION THREE. - The transmitter group, which consists of the six drawers located above the Receiver Group, is section three. The drawers, jacks, and boards are numbered in the same manner as those of section two except for the first digit on the printed circuit board numbering code. Five of the drawers contain six removable printed circuit boards. One drawer contains one printed circuit board. The following example illustrates the numbering system of the section three printed circuit boards.

Example: 3A5A1

1. The first number, 3, designates section three.

2. The second number, 5, designates drawer five.

3. The third number, 1, indicates that the board is connected to jack J1.

5-3. PREVENTIVE MAINTENANCE.

Preventive maintenance is the systematic performance of actions which tend to reduce or eliminate failure and prolong the useful life of the equipment. In equipment like the Terminal Telegraph AN/UGC-1A, maintenance needs are minimized by the use of long-life transistors and germanium diodes. Transistorized equipment provides an ideal environment for long service life from all circuit components because no heaters are required and operating potentials are low (6 to 12 volts dc). Therefore, the frequent maintenance and marginal checking routines used in the electron-tube equipment are not required when transistors are used in circuits designed with adequate margins. Current meters on each module of the equipment and the frequency meter and voltmeter on the Oscillator-Power Supply provide a continuous visual indication of equipment functions. In addition to normal observation of meter indications, 10,000 hour maintenance interval is suggested. Transistors should not be removed for testing at this time. However, the following items should be checked and corrective action taken as required.

a. VISUAL INSPECTION. - Remove any dust accumulation, replace any discolored components and the related faulty component responsible for the discoloration, and check lead and cable dressing, paying attention to scuffed or frayed leads.

b. MARGINS. - Check operating margins by varying the input line voltage $\pm$ 10 per cent. This is accomplished by utilizing a variac to raise the ac input voltage above and below its nominal setting. In this manner, the maximum and minimum voltage limits at which traffic can still be handled when the units are in proper adjustment may be established. Any marked deviation from this voltage range would indicate reduced performance. The marginal method of checking has been instituted to detect imminent failures and to provide reasonable assurance that the equipment will operate properly for long periods of time.

c. ANALYSIS. - If normal operation of the unit is impaired or interrupted by a defective part, the source of trouble may then be isolated within a particular section of the circuit. In many cases, verification of the area of failure can be expedited by the interchangeability of the modules. Quickly replaceable component boards, from the furnished spares, minimize out of service time for any module of the complete system.

d. REFERENCE STANDARDS. - Table 5-1 is a list of the adjustments required to maintain the Multiplex Set in optimum operating condition. The capital letter in column one is referenced to the test equipment chart, table 5-2, which indicates the test equipment required to perform the action required in column two. Columns three, four, and five list the appropriate paragraph number, the suggested adjustment interval, and the adjustment procedure pertaining to the required action.

TABLE 5-1 REFERENCE STANDARDS PROCEDURES

1 Equipment Section	2 Action Required	3 Text Section	4 Refer to Period	5 Step
Oscillator-Power Supply A	Adjust voltage outputs Adjust frequency	5-4a(1) 5-4a(2)	Monthly Monthly	1 through 5 1 and 2
Transmitter Code Converters (4) B	Adjust line current Adjust range control Adjust clamp control Adjust feedback control Adjust frequency	5-4b(1) 5-4b(2) 5-4b(3) 5-4b(4) 5-4b(5)	Annual Annual Annual Annual Annual	1 and 2 1 through 5 1 and 2 1 through 5
Control Amplifier C	Adjust voltage amplifier	5-4c(2)	Monthly	1 and 2
Synch Unit D	Adjust line current Adjust constant current generator Adjust add gate univibrator Adjust subtract gate univibrator	5-4d 5-4d(1) 5-4d(2) 5-4d(3)	Annual Annual Annual Annual	1 1 through 7 1 through 4 1 through 4
Receiver Code Converters (4) E	Adjust line current Adjust clamp control Adjust feedback Adjust frequency Adjust alarm threshold	5-4e(1) 5-4e(2) 5-4e(3) 5-4e(4) 5-4e(5)	Annual Annual Annual Annual Monthly	 1 through 4 1 through 5 1 through 8
Demultiplexer-Multiplexer (2) F	Check switch functions	5-4f(1) 5-4f(2) 5-4f(3)	Monthly Monthly Monthly	1 through 6 1 and 2 1 through 3
Oscillator-Power Supply Voltmeter G	Check calibration with a primary standard voltmeter (DC)		Semi-annually	

TABLE 5-2. TEST EQUIPMENT (OR EQUIVALENT) TO BE USED

Test Equipment	Type	Maintenance Standards A	B	C	D	E	F	G
Dual Trace Oscilloscope	AN/USM-105A	X	X	X	X	X	X	
Frequency Meter	Hewlett-Packard 524D w/Hewlett-Packard 525A	X						
Primary Frequency Standard	AN/URQ-9	X						
Voltmeter, Primary Standard (DC)	John Fluke Co. 801-H-G							X

NOTE

The procedures listed in table 5-1 consist of the minimum number of reference standards which will indicate the performance of the system. The procedures are listed in the suggested sequence of performance; however, except for the Oscillator-Power Supply, deviation from the listed order will not affect the unity or reference standards.

e. CONTROL SETTINGS. -All operating controls are set as required for normal operation. Changes need only to be made as defined in the various steps of the adjustment procedures.

f. TEST EQUIPMENT AND SPECIAL TOOLS. -Table 5-2 lists the test equipment required to accomplish the adjustment procedures. A screwdriver, an open-end wrench, and several test leads, for patching and making test equipment connections, are all that is required to accomplish the adjustments.

5-4. TUNING AND ADJUSTMENTS.

The following checks and adjustment procedures will insure optimum performance of the Multiplex Set.

a. OSCILLATOR-POWER SUPPLY.

(1) OSCILLATOR-POWER SUPPLY VOLTAGE ADJUSTMENTS. -During normal operation power line fluctuations will be somewhat predictable. Adjustments should be made when the line voltage is known to be at its mean value. Once made, it is not necessary to refine the adjustment unless it is noted that output voltages deviate more than two per cent from their nominal values during a major portion of the operating time. The Multiplex Set will operate satisfactorily with line voltage variations of ±10 per cent. If it is decided that adjustments must be made, refer to figure 5-1 and proceed with the following steps:

Step 1. Set the voltmeter selector switch S1 to +37V. A tolerance of ± 2 volts is allowable. If the value is not within the allowable limits loosen the locknut on variable resistor R12. Adjust R12 until the proper indication is obtained. Retighten the locknut, noting that the meter indication does not change.

Step 2. Set S1 to +6V. The allowable tolerance is +0. 2 volts. If the value is not within the allowable limits loosen the locknut on variable resistor R10. Adjust R10 until the proper indication is obtained. Retighten the locknut, noting that meter indication does not change.

Step 3. Set S1 to +1. 5V. The allowable tolerance is +0. 1 volts. If the value is not within the allowable limits loosen the locknut on variable resistor R4. Adjust R4 until the proper indication is obtained. Retighten the locknut, noting that the meter indication does not change.

Step 4. Set S1 to -6V. The allowable tolerance is ±0. 2 volts. If the value is not within the allowable limits loosen the locknut of variable resistor R8. Adjust R8 until proper indication is obtained. Retighten the locknut, noting that the meter indication does not change.

Step 5. Set S1 to -12V. The allowable tolerance is ±0. 2 volts. If the value is not within the allowable limits loosen the locknut on variable resistor R6. Adjust R6 until the proper indication is obtained. Retighten the locknut, noting that the meter indication does not change.

(2) OSCILLATOR FREQUENCY CHECK. -The frequency output of each of the two oscillators must be measured individually. The oscillator to be checked is installed in jack J8. Following the completion of the check on one oscillator, install the other oscillator in jack J8 and allow at least ten minutes for warmup. The amber XTAL OVEN lamp should illuminate and then flash on and off at regular intervals. Terminals 4 and 5 of TB1 must be connected unless an external oscillator is used in place of 1A1Z1 or 1A1Z2. If an external oscillator is used, connect terminals 3 and 4 of TB1. Refer to figure 5-2 for adjustment points.

CAUTION

Do not disturb the oscillator frequency adjustments unless 1A1Z1 or 1A1Z2 are interchanged, or an oscillator is known to have deviated from its assigned frequency.

NOTE

For mutual compatability of all stations in a system one transmitting group should be designated as the master group. The frequency of the master group should be calibrated by means of a primary standard. If a primary standard is not available a secondary standard can be used provided it is calibrated (just prior to adjustment) against a signal transmitted from radio station WWV. After the oscillator of the master group is calibrated, the frequency of the distant terminal oscillator should be adjusted while receiving a multiplex signal. Observe the movement of the needle on the phase meter, M2, of Synch Unit. If the needle moves to the slow side, the receiving oscillator is oscillating at a frequency which is lower than the transmitting terminal and C12 should be adjusted slightly to increase the oscillating frequency. If the indication is toward the fast side, the opposite condition exists and the crystal oscillator frequency should be decreased by adjusting C12 in the opposite direction. As the frequency of the distant crystal oscillator comes closer to the transmitting frequency; the interval, in which the relationship between the distant and master stations can be determined, increases.

The following steps will be used to adjust oscillator frequency:

Step 1. Oscillator 1A1Z1 should have a nominal frequency of 63,000 kilocycles. The frequency measurement is made from terminal 4 of TB1. To adjust the frequency, loosen the locknut on capacitor C12 and carefully position C12 until the desired frequency is obtained. Retighten the locknut, noting that frequency output does not change.

Step 2. Oscillator 1A1Z2 should have a nominal frequency of 61.63043 kilocycles. The frequency adjustment is the same as that used for 1A1Z1.

b. TRANSMITTER CODE CONVERTER ADJUSTMENTS.

(1) LINE CURRENT. -Refer to figure 5-3 and use the following procedures to perform the line current adjustments.

Step 1. Connect the jumper of TB2 to terminals 2 and 3, for 60 ma operation. Connect the jumper to terminals 1 and 2 of TB2, for 20 ma operation. The terminal closest to the cable harness is TB2-1.

Step 2. Adjust the LINE CURRENT potentiometer R1 for proper current value on M1.

(2) RANGE CONTROL. -Refer to figure 5-4 and use the following procedures to perform the range control adjustment.

Step 1. Apply a start-stop "letters" signal to the transmitter code converter. (Elements 1 through 5 steadily "marking").

Step 2. Synchronize the oscilloscope externally, from test point J1 on board 1 "(-)".

Step 3. Connect the oscilloscope input 'A' to the external sync terminal. Adjust the sweep time of the oscilloscope so that the negative start pulse extends over some convenient interval, such as ten divisions.

Step 4. Connect oscilloscope input 'B' to test point J1 on board 3.

Step 5. Adjust the RANGE CONTROL potentiometer R2 until the leading edge of the distributor element occurs exactly in the center of the start pulse (five units if the duration set in step 3 was ten units).

(3) CLAMP CONTROL. -Refer to figure 5-5 and use the following procedures to perform the clamp control adjustments.

Step 1. Trigger the oscilloscope as discussed in Step 2, above.

Step 2. Connect the oscilloscope input to test point J3 on board 2. Adjust the oscilloscope sweep time until five cycles of a sine wave are observed.

Step 3. Adjust the CLAMP ADJ potentiometer R3 until the first negative cycle of the waveform has the same amplitude as the other negative cycles.

(4) FEEDBACK CONTROL. -While observing the waveform obtained in the Step (3)above, adjust the FEEDBACK ADJ potentiometer R4 until the waveform has a minimum amount of distortion.

(5) FREQUENCY. -Refer to figure 5-6 and use the following steps to perform the frequency adjustment.

Step 1. Connect a clip lead from the junction of R8 and R9 on board 2 to any convenient -6V terminal. (TB-16 and TB1-23 are -6V terminals.)

Step 2. Connect test point J4, on board 2, to the FREQ METER jack J6 within the Oscillator-Power Supply, with the test lead loacted in the Control Amplifier (tip at each end).

Step 3. Position the WPM switch S1 to the desired wpm speed.

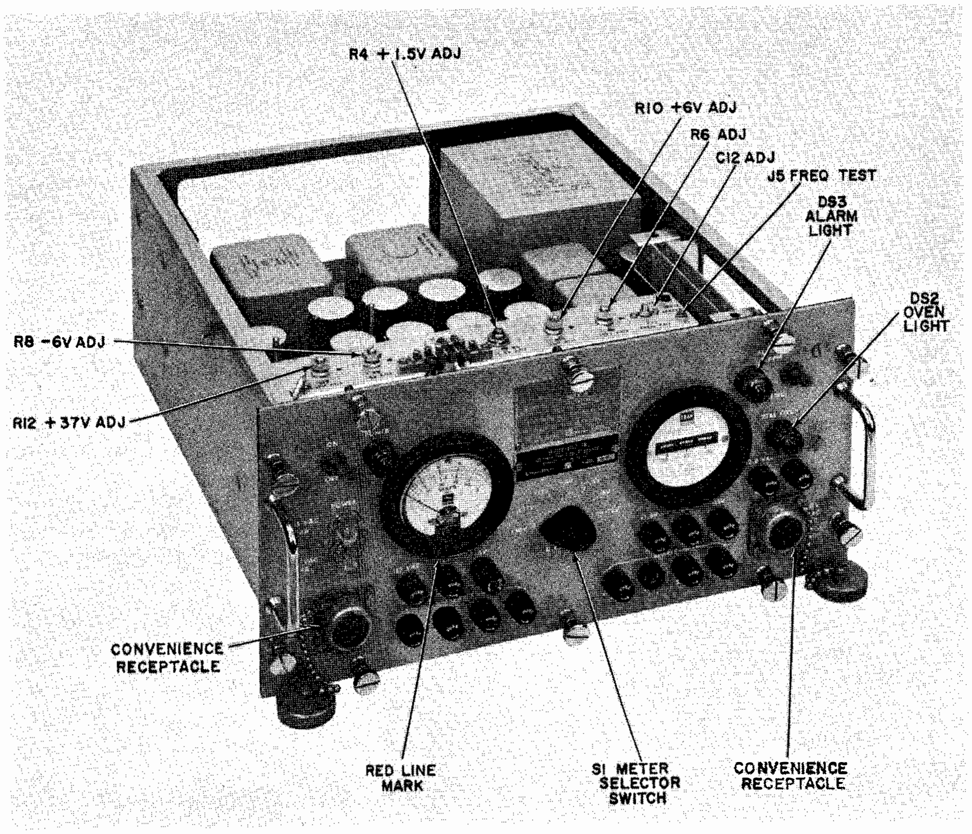


Figure 5-1. Oscillator-Power Supply, Adjustment Locations

Step 4. Adjust the FREQ ADJ control L1 until the desired wpm reed vibrates on the WPM FREQUENCY METER located on the Oscillator-Power Supply front panel.

Step 5. The frequency may also be adjusted by using an oscilloscope. Synchronize the scope externally from TB1-25 and connect the oscilloscope input to the external synch terminal. Adjust L1 until the stop element is the correct duration. (31 ms at 60 wpm; 24.8 ms at 75 wpm; 18.6 ms at 100 wpm.) (Clip lead connection called in step 1 of (5) above must be removed and start-stop "letters" applied to the Transmitter Code Converter input.)

c. CONTROL AMPLIFIER ELECTRICAL ADJUSTMENTS.

(1) LINE CURRENT. -Perform adjustment as indicated in paragraph b (1) steps 1 and 2.

(2) VOLTAGE AMPLIFIER. -Refer to figure 5-7 and use the following procedures to perform the adjustment.

Step 1. With a start-stop signal applied to the Transmitter Code Converters, connect oscilloscope to the junction of R43 and R45 on printed circuit board A1.

Step 2. Adjust VOLTAGE AMP ADJ potentiometer R1 until the transitions swing from 0 v to +35 v.

d. SYNCH UNIT ADJUSTMENTS. -Perform adjustment as indicated in paragraph b (1) steps 1 and 2. In the Synch Unit the LINE CURRENT potentiometer is R2.

(1) CONSTANT CURRENT GENERATORS. -Use the following steps to perform the adjustment.

Step 1. Place the LOCAL-REMOTE switches in the Control Amplifier and the Synch Unit to the LOCAL position, and TEST/OPER switch on Control Amplifier to AC position.

Step 2. Connect a clip lead between R3 and R4 on board 3 in the Receiver MUX-DEMUX drawer, and connect another clip lead between R38 on board 2 (resistor end closest to the red dot marking) in the Synch Unit and a -6v terminal such as TB1-6.

Step 3. Place the CHANNELS switch on both MUX-DEMUX units to channel 4 position.

Step 4. Momentarily ground the end of R12 on card 4 in the Synch Unit. Note the duration of time required for the RECEIVER CRYSTAL meter on the front panel to swing from zero current to first small "kick," as the meter approaches +50 microamperes. Adjust the ADVANCE GEN potentiometer R5 until the value listed below is obtained for the swing from 0 to +50 microamperes.

WPM	ZERO (MID SCALE) READING ON RECEIVER CRYSTAL TO FIRST "KICK"
60	10 seconds ±1 second
75	8 seconds ±1 second
100	7 seconds ±1 second

Note

Under actual field conditions it may be found that other delay periods provide a better match for the multipath delays normally encountered. Exercise care when longer delays are used, so that corrective action is not lost on a two channel 60 wpm idle signal.

Step 5. Disconnect clip leads mentioned in steps 3 and 4 above. The needle of the meter will swing to the opposite side and then approach zero. Adjust the RETARD GEN potentiometer R6 for a zero reading.

(2) ADD GATE UNIVIBRATOR. -Refer to figure 5-8.

Step 1. Perform steps 1 through 5 listed in paragraph (2) above, for the constant current generator adjustment.

Step 2. Connect the oscilloscope input to test point J1 on board 2 of the Synch Unit.

Step 3. Set the oscilloscope for + internal trigger and set the sweep time for 10 milleseconds per centimeter.

Step 4. The duration of the positive pulse on the oscilloscope should be approximately 70 microseconds. Adjust the ADD UNIVIBRATOR potentiometer R4 to obtain this value.

(3) SUBTRACT GATE UNIVIBRATOR. -Refer to figure 5-8.

Step 1. Perform steps 1, 2, and 3 listed in paragraph (1) above, for the constant current generator adjustment.

Step 2. Connect a clip lead between R25 on board 2 (lower end of resistor R25) and a -6v terminal such as TB1-6.

Step 3. Set the oscilloscope as mentioned in step 3 of (2) above.

Step 4. Connect the oscilloscope to test point J2 on board 2.

Step 5. Adjust the SUBTRACT UNIVIBRATOR potentiometer until the duration of the positive pulse on the oscilloscope is 40 microseconds.

e. RECEIVER CODE CONVERTER ADJUSTMENTS.

(1) LINE CURRENT. -Adjust LINE CURRENT potentiometer R4 for the desired current value with the system in idle condition. (Continuous current into Transmitter Code Converter input).

(2) CLAMP CONTROL. -Make oscilloscope connections identical to those used in figure 5-4 for Transmitter Code Converters.

Step 1. Apply a multiplex signal to the Receiver Group.

Step 2. Synchronize the oscilloscope sweep externally from test point J1 on printed circuit board A2.

Step 3. Connect the oscilloscope input to test point J3 on printed circuit board A2. Adjust the oscilloscope sweep time until five cycles of a sine wave are observed.

Step 4. Adjust CLAMP ADJ potentiometer R2 until the first negative cycle of the waveform has the same amplitude as the other negative cycles.

(3) FEEDBACK CONTROL. -While observing the waveform obtained in section (2) above, adjust FEEDBACK ADJ potentiometer R3 until the waveform has a minimum amount of distortion.

(4) FREQUENCY. -Connect oscilloscope as shown in figure 5-5 except test points shall be as outlined in steps 1 through 5 below.

Step 1. Connect a clip lead from the junction of R4 and R5 on board 2 to any convenient -6v terminal (TB1-6 and TB1-23 are -6v terminals).

Step 2. Connect test point J4 on printed circuit board A2, with test lead located in the Control Amplifier (phone tip at each end), to the FREQ METER jack J6 within the Oscillator-Power Supply.

Step 3. Position the WPM switch S1 to the desired wpm speed.

(text continues on page 5-12)

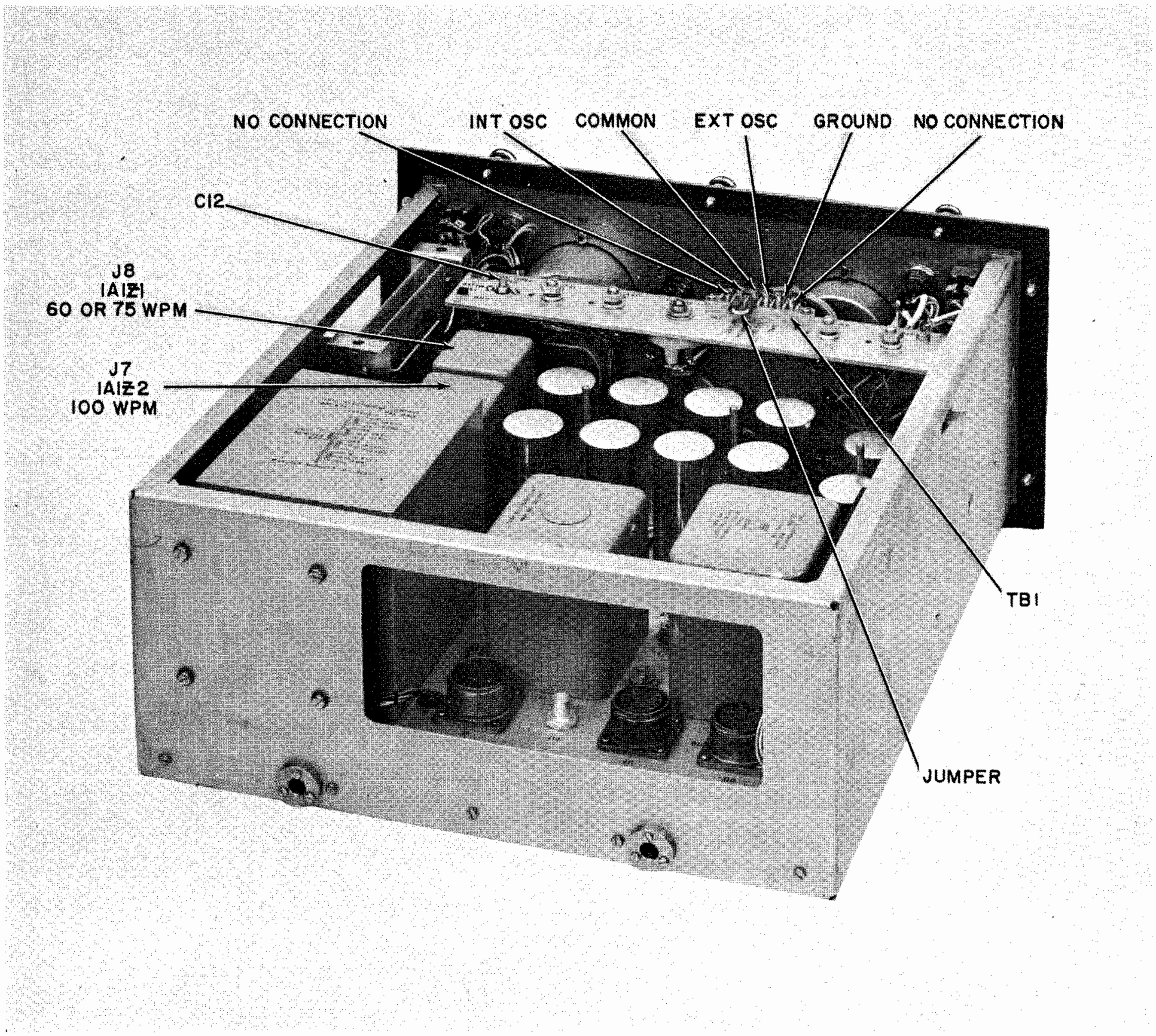


Figure 5-2. Oscillator-Power Supply, Oscillator Adjustment

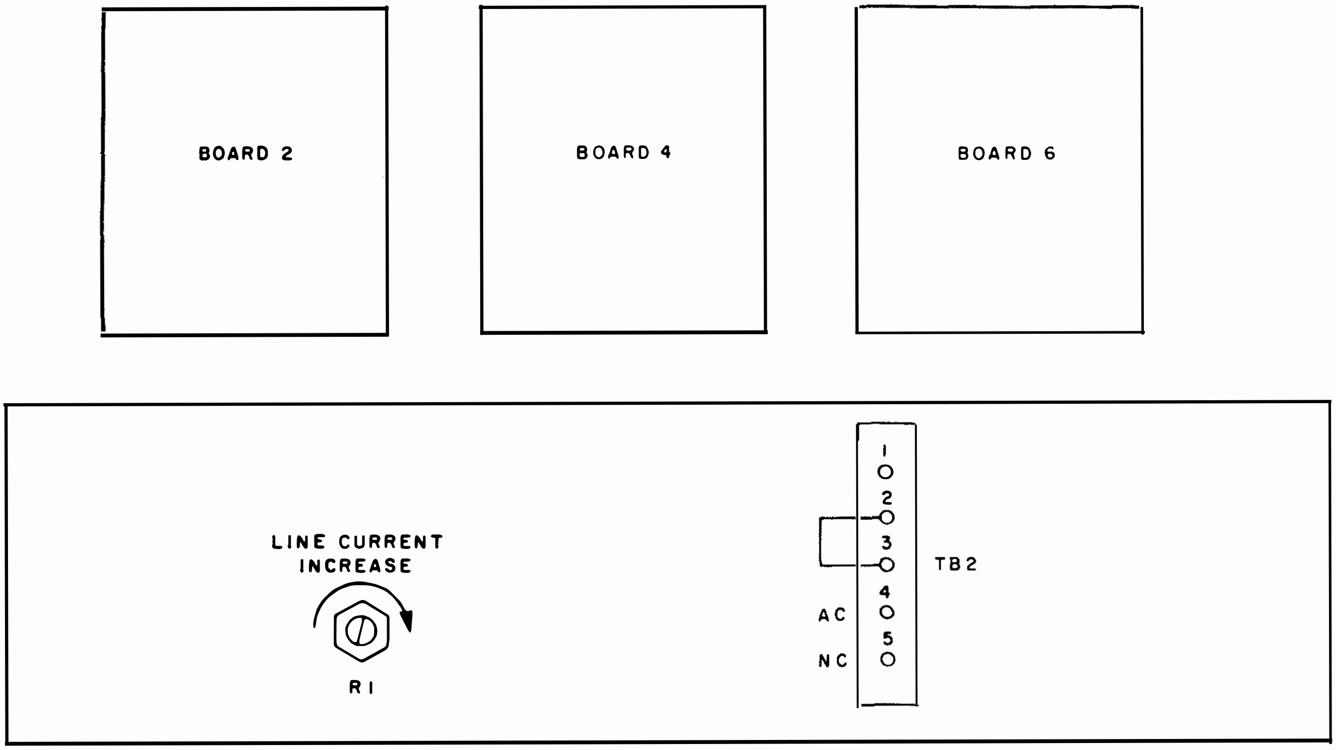


Figure 5-3. Transmitter Code Converter, Line Current Adjustment

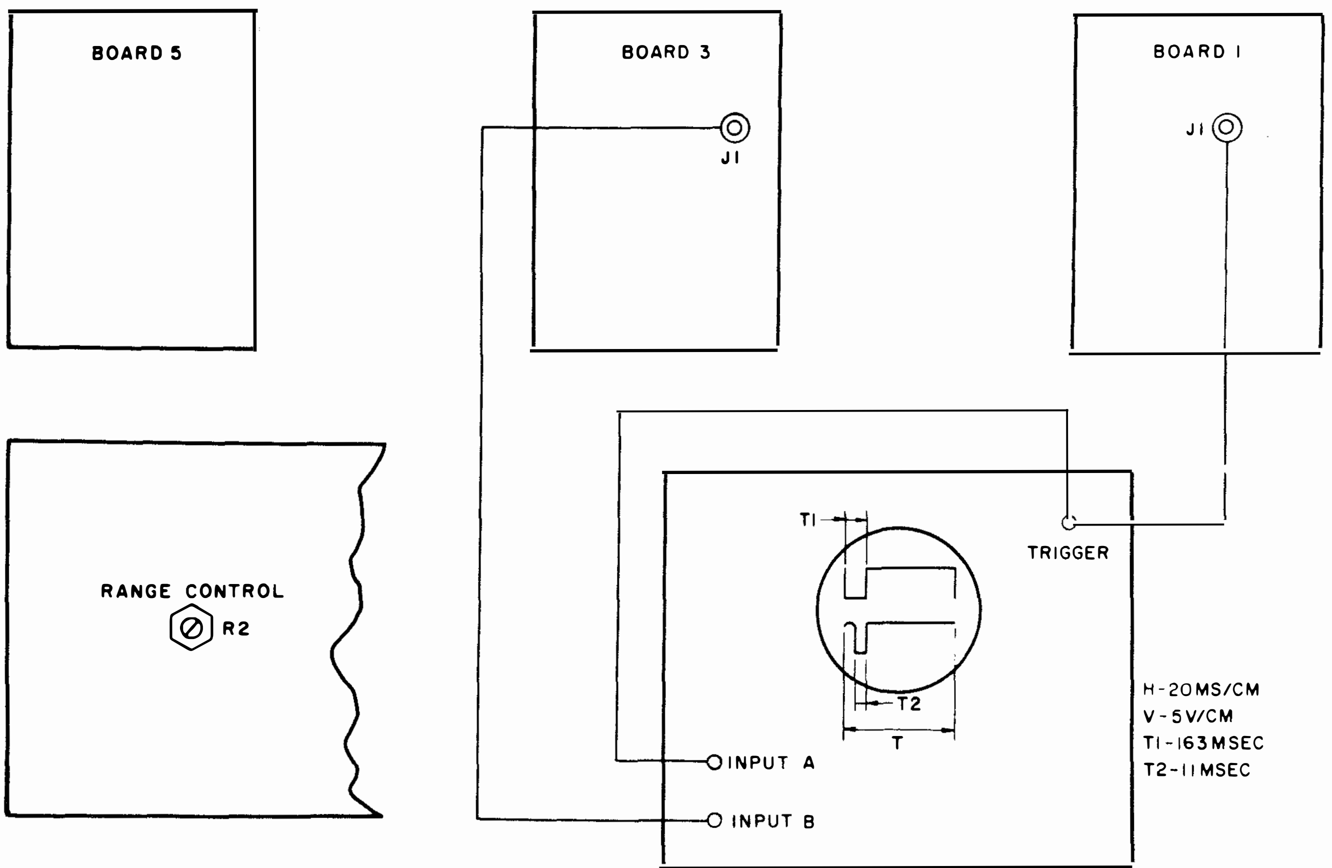


Figure 5-4. Transmitter Code Converter, Range Control Adjustment

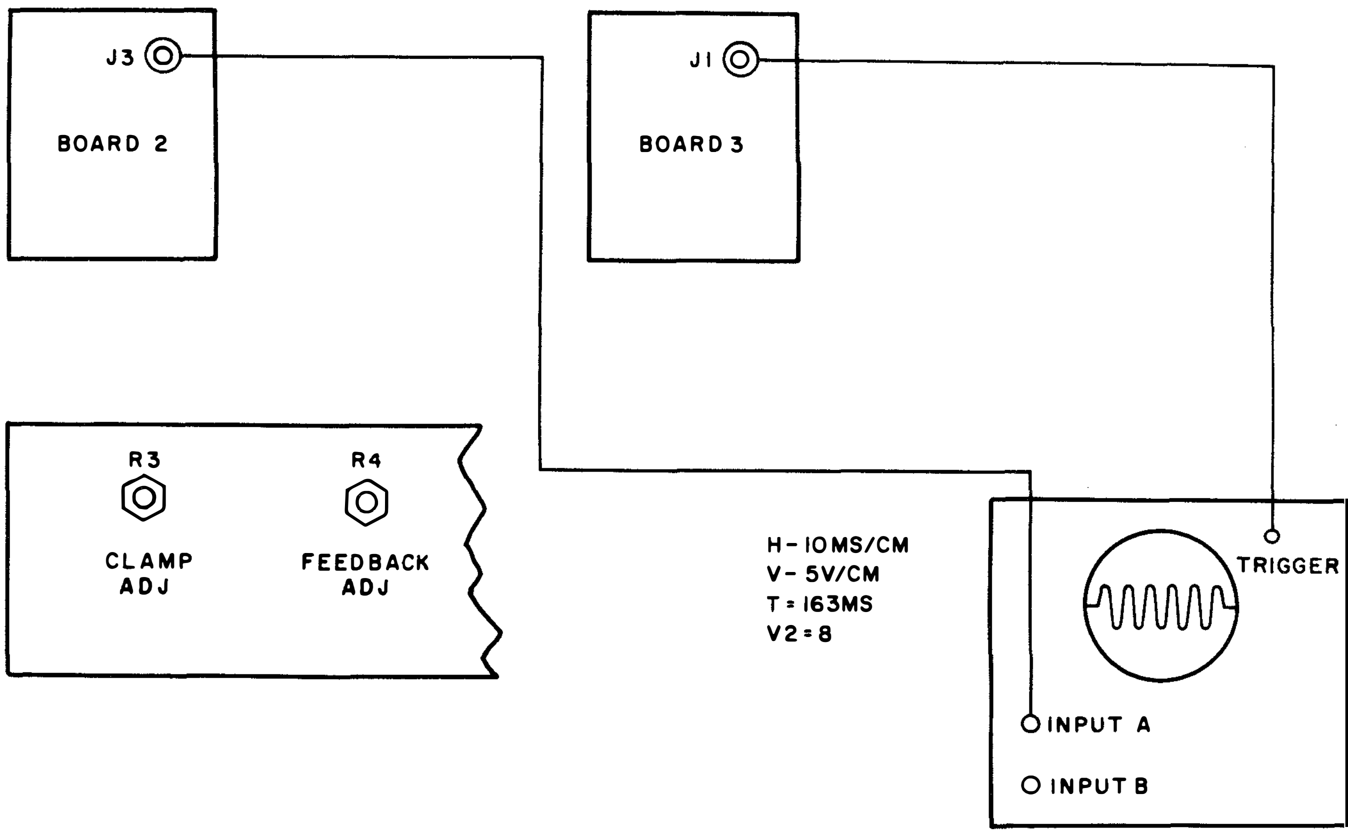


Figure 5-5. Transmitter Code Converter, Clamp Control Adjustment

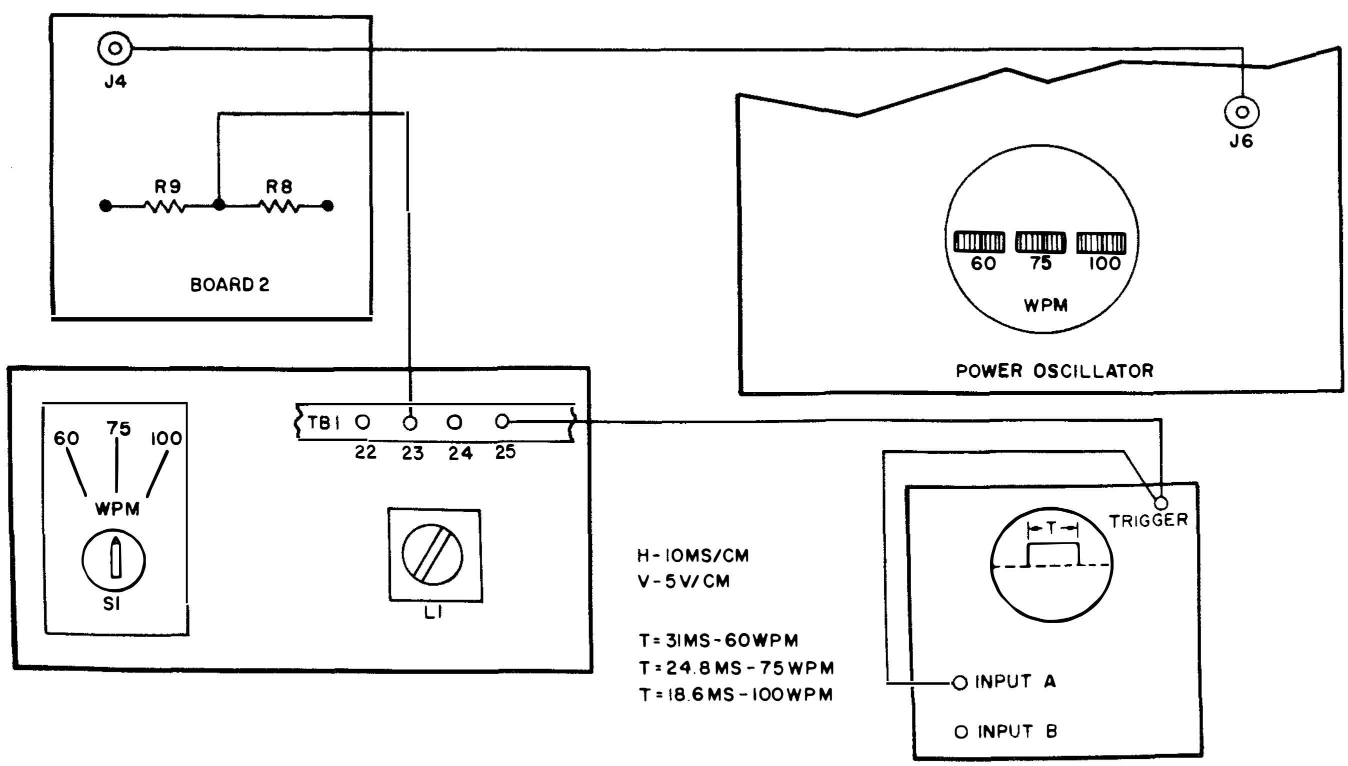


Figure 5-6. Transmitter Code Converter, Frequency Control Adjustment

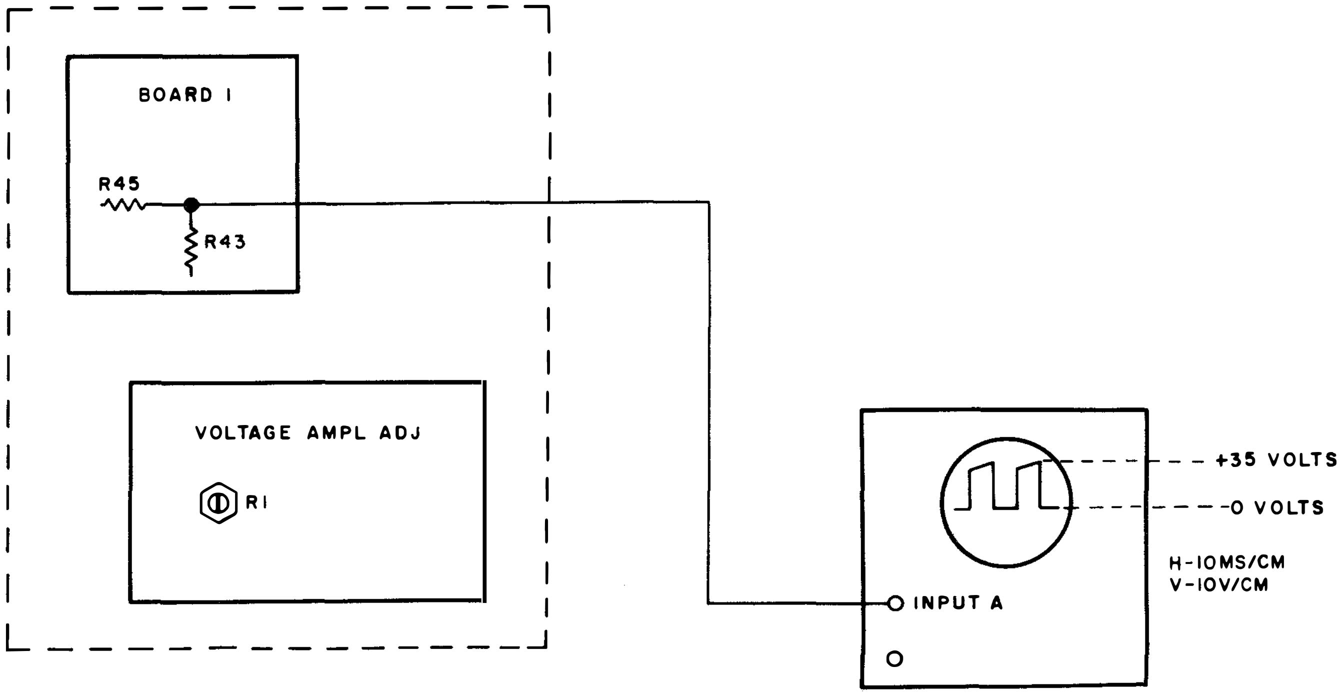


Figure 5-7. Control Amplifier, Voltage Adjustment

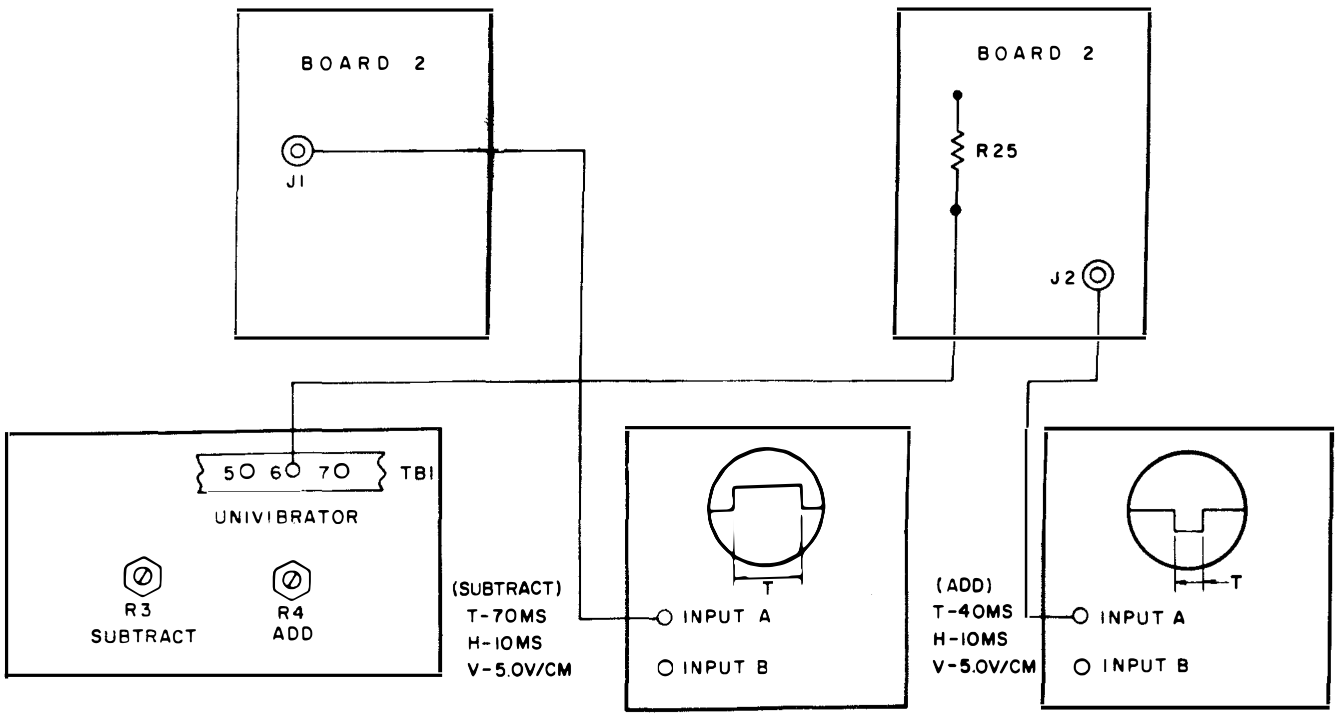


Figure 5-8. Synch Unit, Univibrator Adjustment

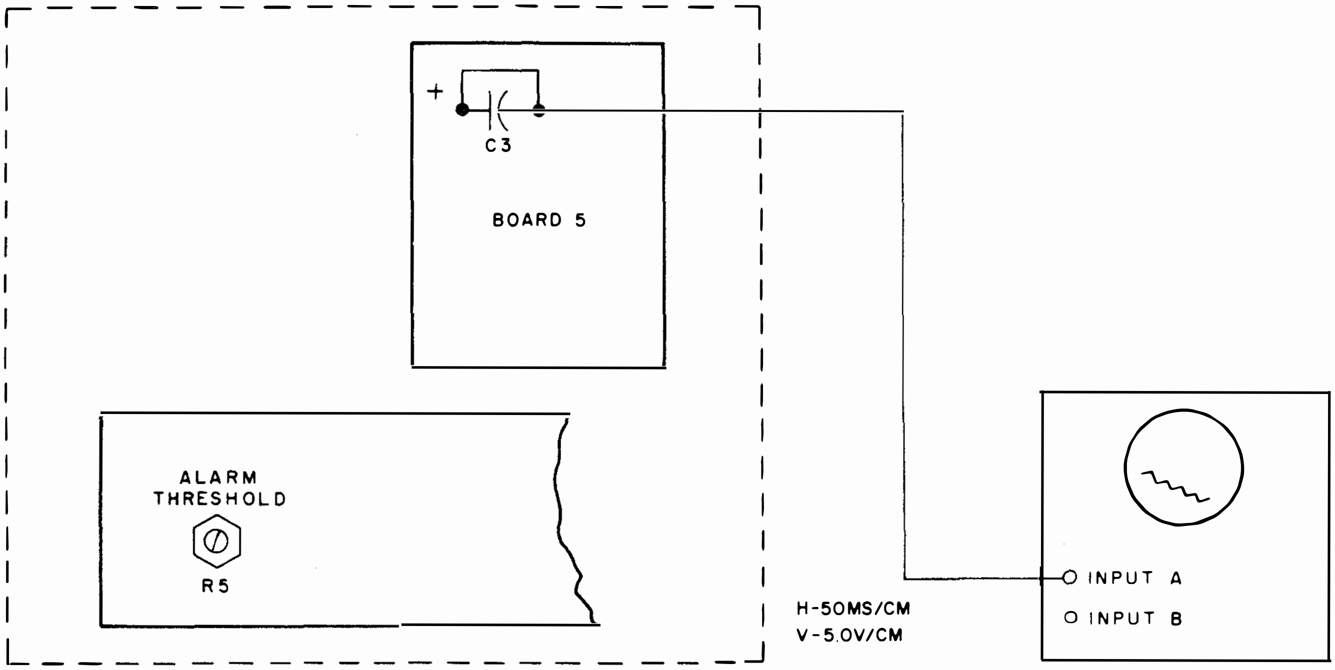
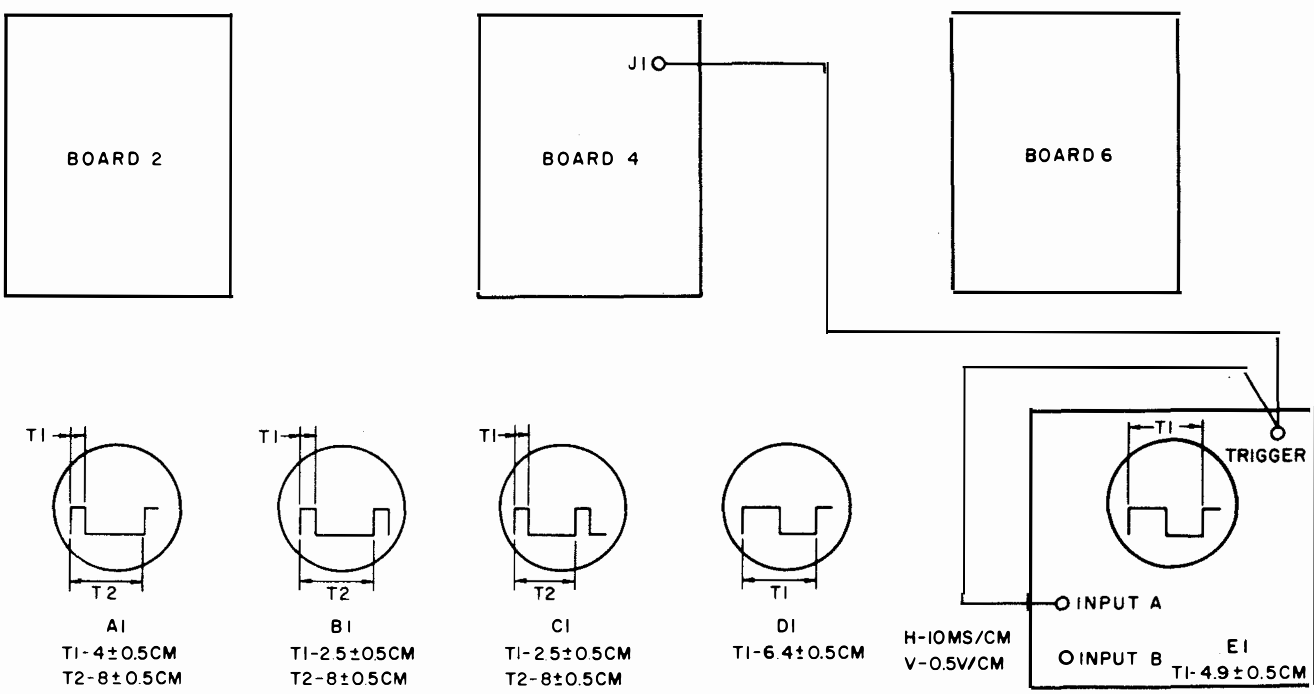
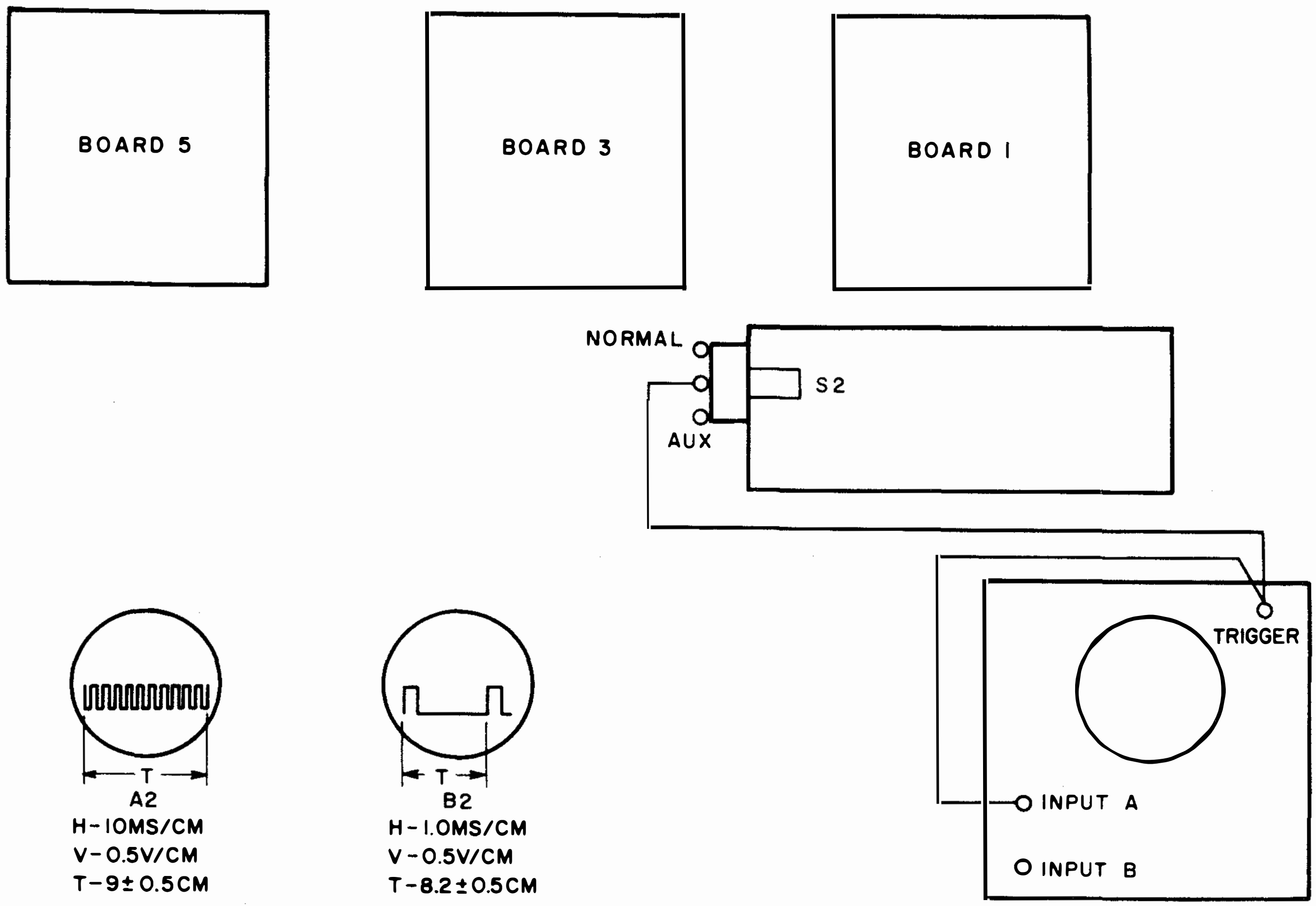


Figure 5-9. Receiver Code Converter, Alarm Threshold Adjustment



Figures 5-10 thru 5-14. Mux-Demux Waveforms A1, B1, C1, D1, and E1



Figures 5-15 & 5-16. Mux-Demux, Waveforms A2 & B2

Step 4. Adjust FREQ ADJ control L1 until the desired wpm reed vibrates on the WPM FREQUENCY METER located on the Oscillator-Power Supply front panel.

Step 5. The frequency may be also adjusted by using an oscilloscope. Connect the oscilloscope to the junction of R7 and CR2 on board 1 and adjust L1 until the stop element is the correct duration: 28 ms at 60 WPM; 22.4 ms at 75 WPM; 16.8 ms at 100 WPM. Remove the clip lead after completion of the adjustment.

(5) ALARM THRESHOLD. - Refer to figure 5-9 and use the following steps to perform the alarm threshold adjustment.

Step 1. Apply a constant character to the Receiver Code Converter under test.

Step 2. Depress the FRAME switch on the Synch Unit until an out-of-frame condition is obtained. The MISFRAME lamp on the Receiver Code Converter illuminates when an out-of-frame condition is present.

Step 3. Place a jumper across C3 on board 5.

Step 4. Set the oscilloscope for 1 second sweep time and place the synch control to internal.

Step 5. Connect the oscilloscope input to the + side of C3 on board 5.

Step 6. As the oscilloscope trace begins its excursion from left to right remove the jumper across C3.

Step 7. The oscilloscope trace will fall in discrete steps to the alarm sensing voltage level.

Step 8. To obtain the alarm condition adjust the ALARM THRESHOLD potentiometer R5 until the number of steps on the oscilloscope trace is equal to the desired number of misframe characters.

f. DEMULTIPLEXER-MULTIPLEXER SWITCH FUNCTIONS. -The Mux-Demux drawer being tested must be in shelf two of section two (next to Synch Unit).

(1) CHANNEL AND WPM SWITCH CHECK. -Connect the oscilloscope as shown in figures 5-10 through 5-16.

Step 1. Set the CHANNEL switch on the front panel to "2".

Step 2. Set the WPM switch to 60. Compare the scope pattern with figure 5-10.

Step 3. Set the CHANNEL switch to 3. Compare scope pattern with figure 5-11.

Step 4. Set the CHANNEL switch to 4. Compare the scope pattern to figure 5-12.

Step 5. Set the CHANNEL switch to 2.

Step 6. Set the WPM switch to 75. Compare the scope pattern to figure 5-13.

Step 7. Set the WPM switch to 100. Compare the scope pattern to figure 5-14.

(2) NORMAL-AUX SWITCH S2 CHECK. -Move the oscilloscope input lead from J1 to the common terminal of the NORMAL-AUX switch S2.

Step 1. Set the NORMAL-AUX switch S2 to NORMAL. Compare the scope pattern to figure 5-15.

Step 2. Set NORMAL-AUX switch S2 to AUX. Compare the scope pattern to figure 5-16.

(3) NORMAL-INVERTED SWITCH S4 CHECK. -Remove the two neon light cable and plug assemblies from the Control Amplifier drawer (drawer one of section three) and connect the female plug to jack J8 of drawer four of section two. Connect the male power plug to a 115 vac source.

Step 1. Set the switch on the front panel of the Control Amplifier (drawer one of section three) to M.

Step 2. Set the NORMAL-INVERTED switch S4 to NORMAL. Note that neon indicator lamps one through six are on.

Step 3. Set the NORMAL-INVERTED switch S4 to INVERTED. Note that neon indicator lamps one through six are off.

(4) TEST COMPLETION. -If the test results are satisfactory remove all test connections and restore the system to normal.

5-5. CORRECTIVE ACTION.

Failure to obtain the required indications or oscilloscope test patterns in any of the six preceding tests requires a systematic check of the printed circuit boards, the Oscillator-Power Supply, and the interconnecting cables. Oscilloscope checks at the various test points indicated on the equipment electrical schematic diagrams and reference to the trouble shooting section will facilitate rapid and efficient repairs.

5-6. REPAIR.

a. PRINTED CIRCUIT BOARDS.

Repair of a defective printed circuit board consists of replacement of a defective transistor, diode, resistor, or capacitor. Refer to figure 5-17 for the correct procedures in replacing a defective component.

(1) TOOL REQUIREMENTS.

(a) Diagonal cutters

(b) Long nose pliers

(c) 23.5 watt pencil soldering iron

(2) PROCEDURE.

Step 1. Cut leads of defective component and remove component. Cut leads close to component not close to board.

Step 2. Bend the leads at right angles to board after removal of a component.

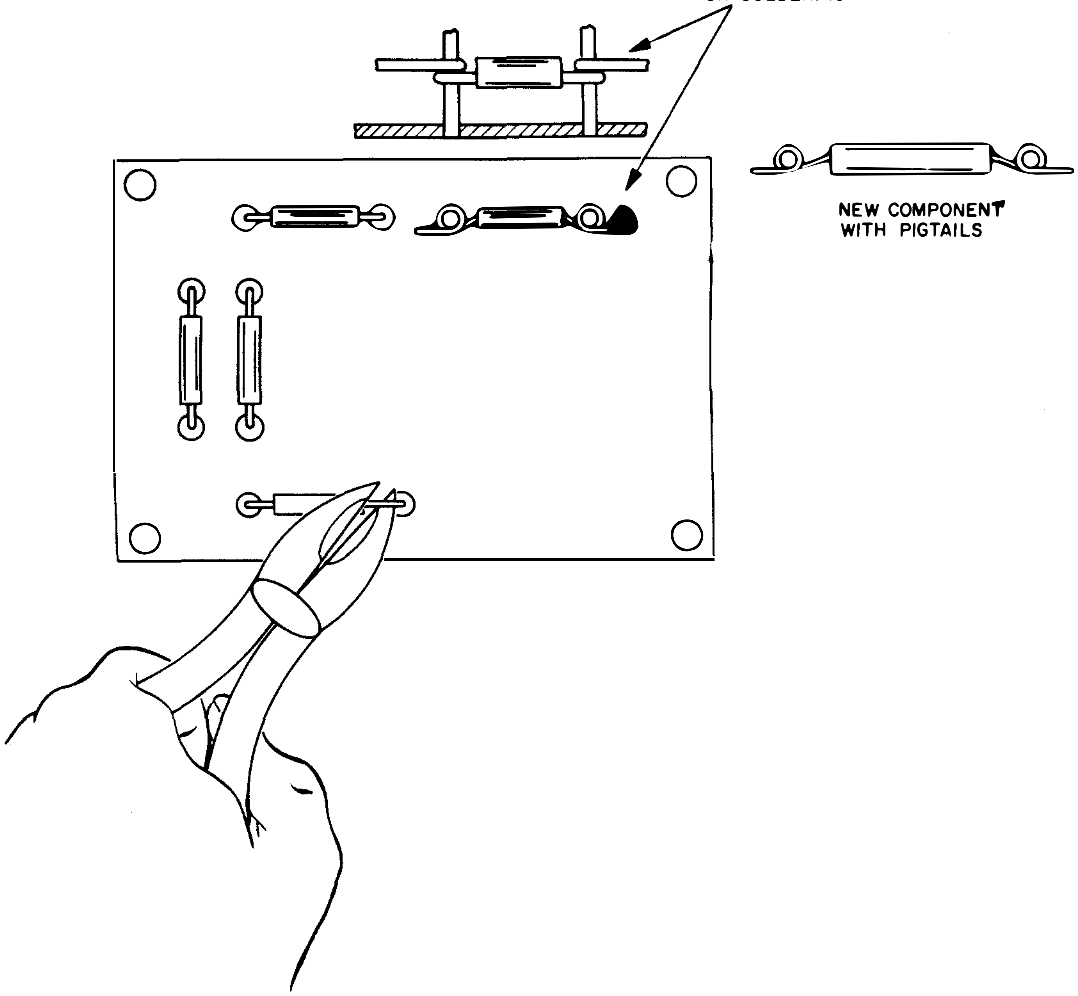


Figure 5-17. Component Replacement

Step 3. When working close to an adjacent transistor, provide an appropriate heat sink to prevent heat damage.

Step 4. Using long nose pliers, put a pigtail in each lead of replacement component.

Step 5. Put a component on a board by slipping the pigtails over the vertical leads.

Step 6. Solder component leads.

Step 7. Trim excess leads.

Step 8. Remove any heat sinks.

CAUTION

Do not use excessive heat or hold the soldering iron in contact with the etched circuit board for an extended length of time. When possible, use the long nose pliers as a heat sink between the connection to be soldered and the printed circuit board. A small soldering iron such as the pencil type 23.5 watts is a necessity. The tip of the iron should be cleaned and tinned at regular intervals to insure a good connection. Avoid making cold solder joints.

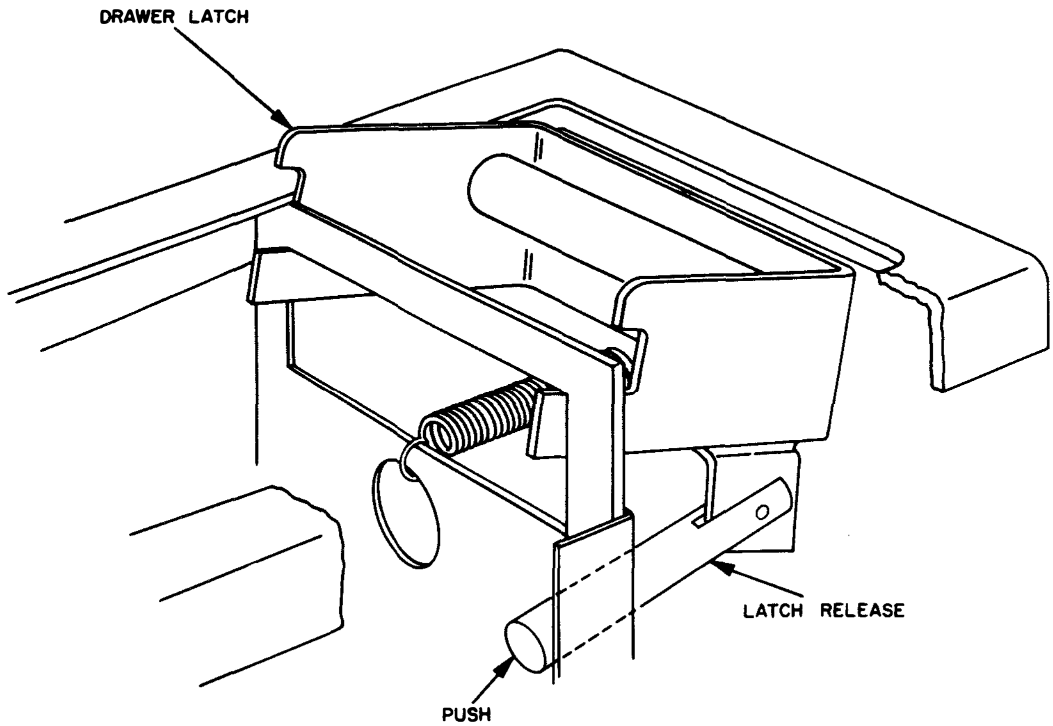


Figure 5-18. Drawer Latch Mechanism

b. METER REPLACEMENT. -The Oscillator-Power Supply voltmeter and frequency meter are hermetically sealed units and must be replaced if they are determined defective by measurement against a primary standard.

c. OTHER REPAIRS. -The remaining components in the Multiplex Set are standard electronic items and require no special replacement instructions.

d. REMOVAL and REASSEMBLY of SUBASSEMBLIES. -The cabinets, drawers, and connecting cables are arranged to permit rapid access to the internal controls and circuit boards of each drawer. When the upper and lower thumbscrews are released, a drawer may be pulled forward approximately 4 inches exposing the controls at the front of each drawer. When it is desired to inspect a complete circuit board the drawer may be pulled farther toward the front until the latch engages its stop. Note the moisture seals (gaskets) located between each drawer front panel and the cabinet. The same arrangement is used to seal the rear panels of each cabinet.

CAUTION

Use care in removing the drawers and panels to avoid damage to the gaskets.

(1) REMOVING DRAWERS FROM CABINETS.

(a) Loosen the upper and lower thumbscrews that secure the drawer to the cabinet. Rotate the thumbscrews counter-clockwise until they are disengaged.

(b) Using the thumbscrews as handles, pull the drawer forward until it engages its latch.

(c) Press the metal rod located at the rear of the drawer just under the top, (see figure 5-18) to release the latch and pull the drawer out as far as the cable will permit.

(d) Tilt the front of the drawer downward to permit access to the rear of the drawer. Turn the two blue thumbscrews at the rear of the drawer while simultaneously disengaging the rear connector assembly from the drawer.

(2) INSTALLING DRAWER.

(a) Align the rear connector assembly with the rear end of the drawer. Align the pins at either side of the mating connectors and tighten the thumbscrews simultaneously to assure a flat contact between the connectors.

(b) Align the drawer and slide it into its slot.

(c) Align the thumbscrews at the front of the drawer and tighten them by turning in a clockwise direction until they are secure.

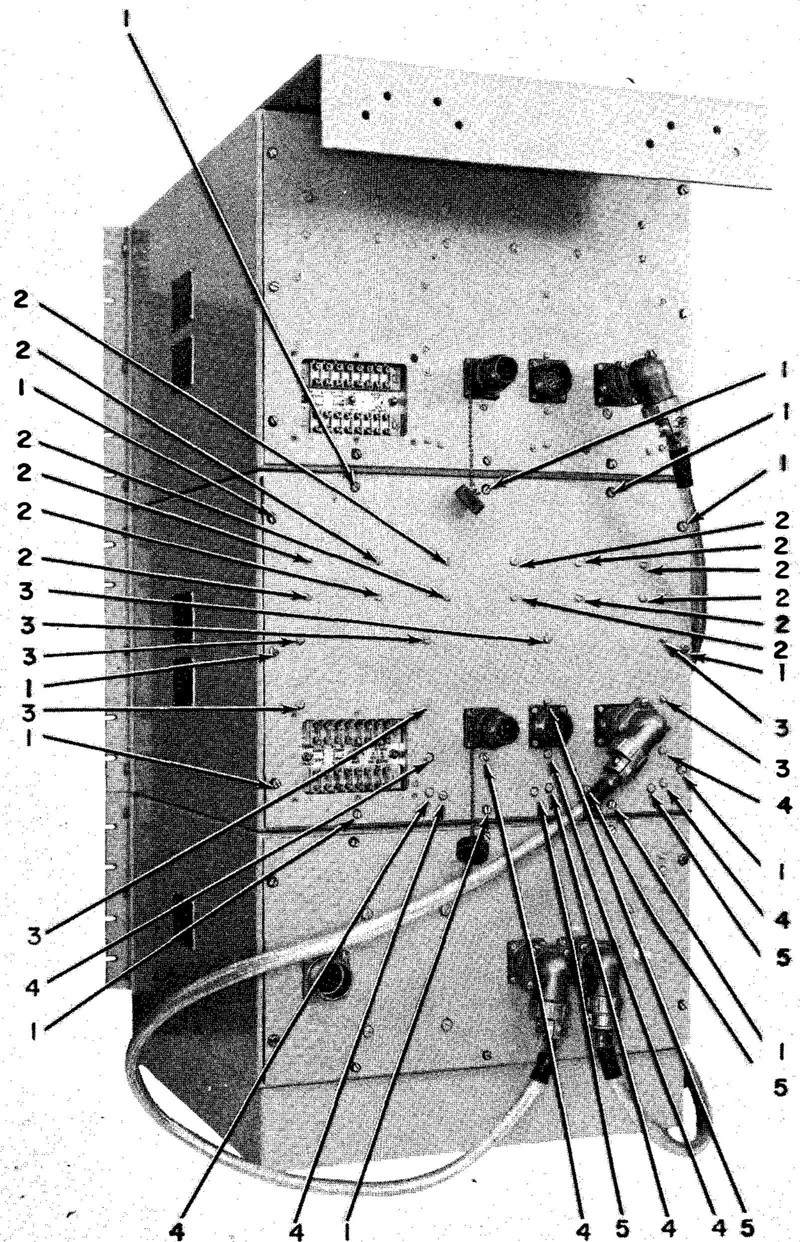


Figure 5-19. Transmitter and Receiver Groups, Rear Cover

(3) REMOVING PLUG-IN CIRCUIT CARD FROM DRAWER.

(a) Release the thumbscrews on the front of the drawer and pull the drawer forward until it engages its latch.

(b) Remove the card extracting tool located in the channel formed by the first pair of plug-in cards.

(c) Insert the prongs of the card extracting tool between the rear of the card and the drawer frame.

(d) Pull forward gently, while sliding the card out of its containing grooves.

(4) REPLACING PLUG-IN CIRCUIT CARD.

(a) Align the card with the grooves in the card container.

(b) Slide the card back along the grooves until mating is established between the rear connectors.

(c) Press the rear connectors firmly together to assure a good contact.

(d) Replace the drawer and tighten thumbscrews.

(5) REMOVING OSCILLATOR-POWER SUPPLY FROM CABINET.

(a) Loosen the 10 thumbscrews on the front panel and slide the drawer forward until the thumbscrews are disengaged.

(b) Slide the chassis drawer forward several inches. Reach into the cabinet at the upper left area and release the latch.

(c) Pull the drawer forward until most of the chassis is out of the cabinet. Be careful not to drop the unit.

(d) Disconnect the AN type connectors located at the rear of the chassis.

(e) Remove the unit from the cabinet.

(6) REPLACEMENT OF OSCILLATOR-POWER SUPPLY.

(a) Install the drawer so that one or two inches of the drawer extend into the cabinet.

(b) Connect the AN type connectors and slide the drawer inward.

(c) Line up the 10 thumbscrews. Start tightening the screws slowly and tighten them securely.

(7) REMOVING BACKS FROM CABINETS (TRANSMITTER AND RECEIVER GROUPS ONLY.)

(a) Remove the 12 screws which secure the back panel to the cabinet. (See figure 5-19).

(b) Remove the back panel from the cabinet. The panel will now be held only by the cables. If it is desired to remove the back panel completely, loosen the blue thumbscrews at the rear of each drawer until the connectors are separated.

(c) The method of replacement is the reverse of the above. However, it is important to align the engaging pins on the connectors and to tighten the thumbscrews evenly, to provide a flat contact between the cable connectors, to ensure circuit continuity.

e. ILLUSTRATIONS.-This section contains the photographs and drawings which identify all the components of each major assembly of the Multiplex Set. The applicable photographs or drawings are grouped in the same order as the adjustment procedures in the preceding paragraphs. The waveforms that are shown on the photographs and drawings illustrate the actual operation of the circuit. Since the calibration of the oscilloscope and the zero axis are given, the actual on-off potentials may be read directly from the waveforms. In general, voltages read in this manner are more reliable than voltages read by a meter because of the on-off nature of signals being observed. Since the sweep trigger is indicated for each waveform the timing relationships are also shown.

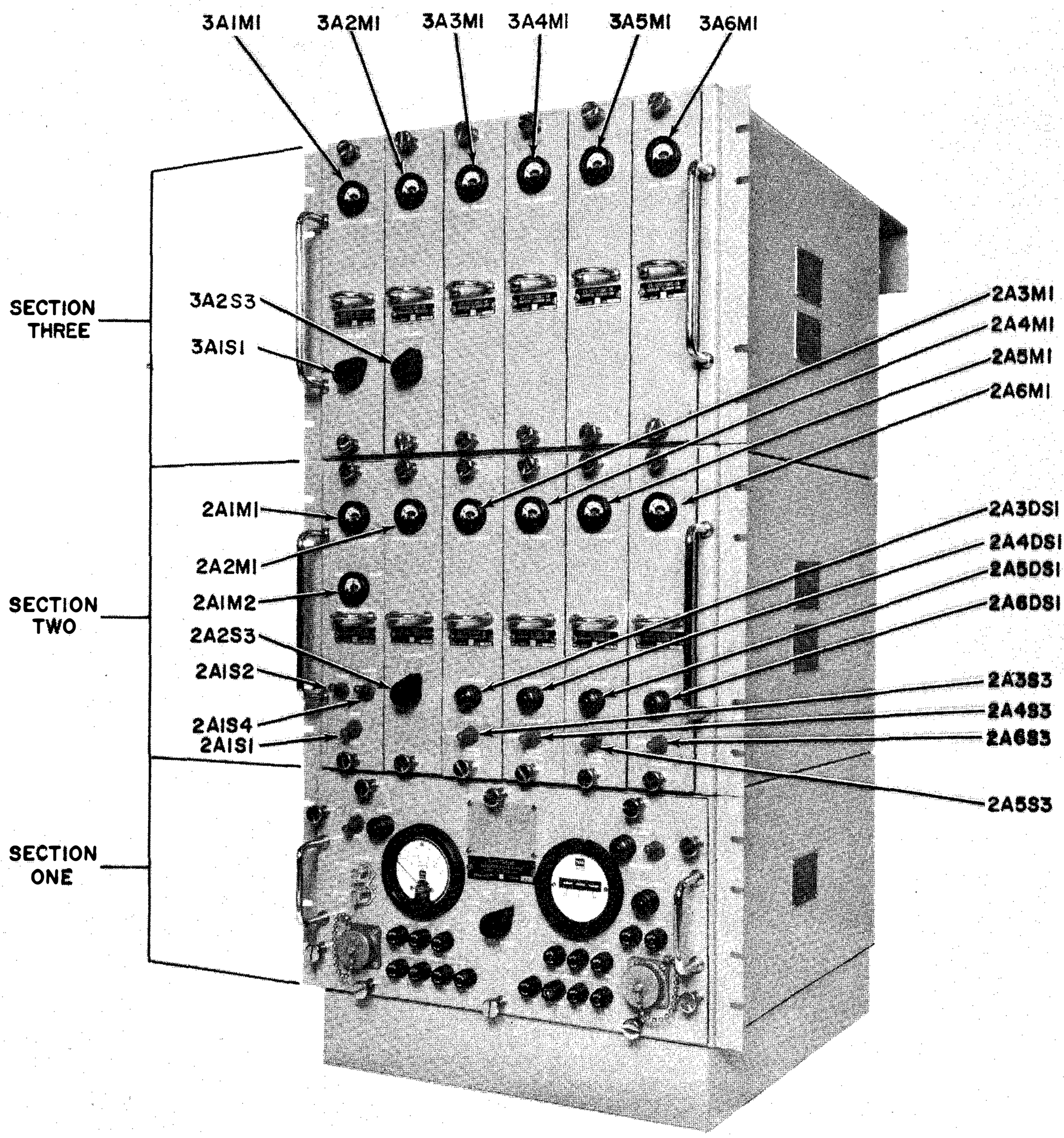


Figure 5-20. Multiplex Set, Front View

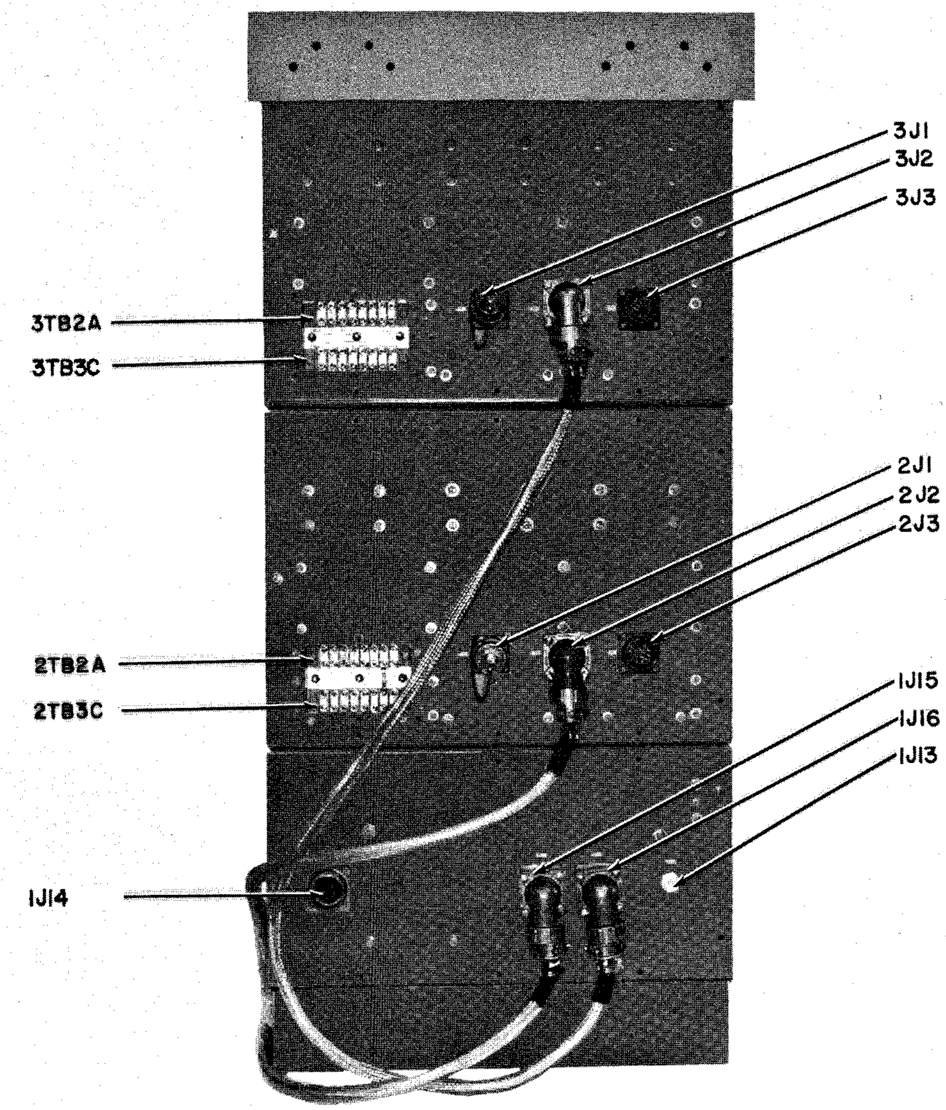


Figure 5-21. Multiplex Set, Rear View

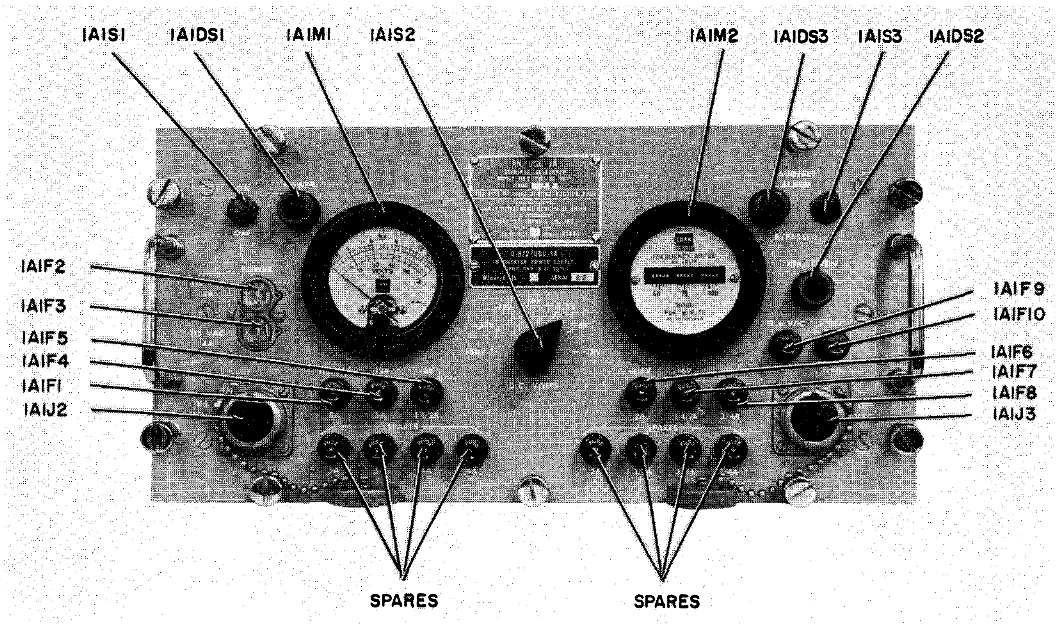


Figure 5-22. Oscillator-Power Supply, Front View

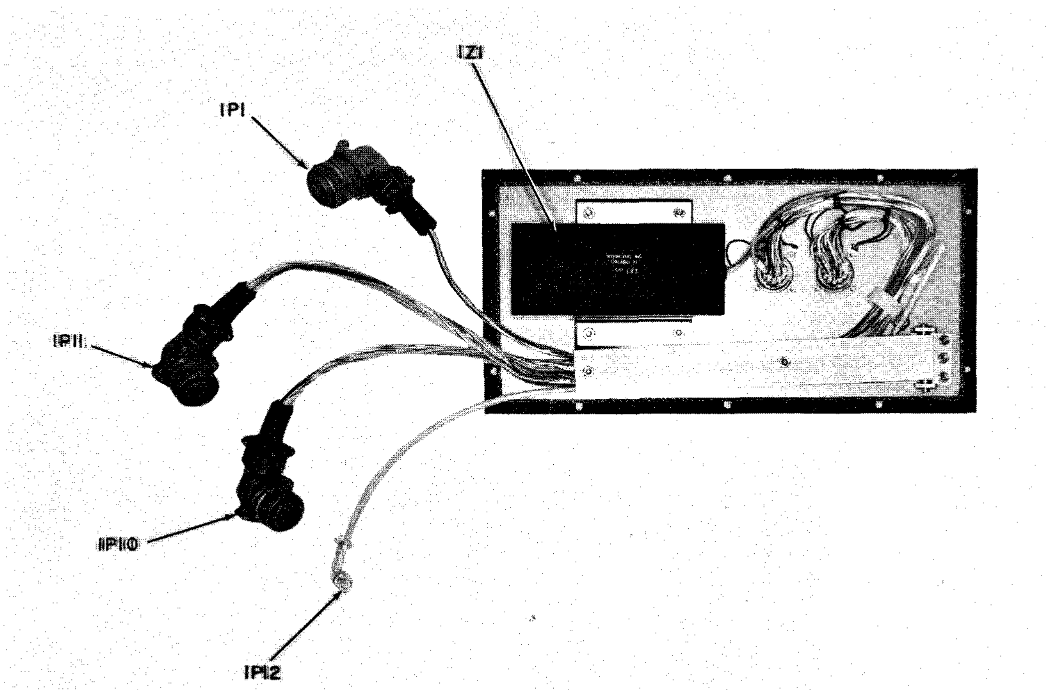


Figure 5-23. Oscillator-Power Supply, Interior, Rear Cover

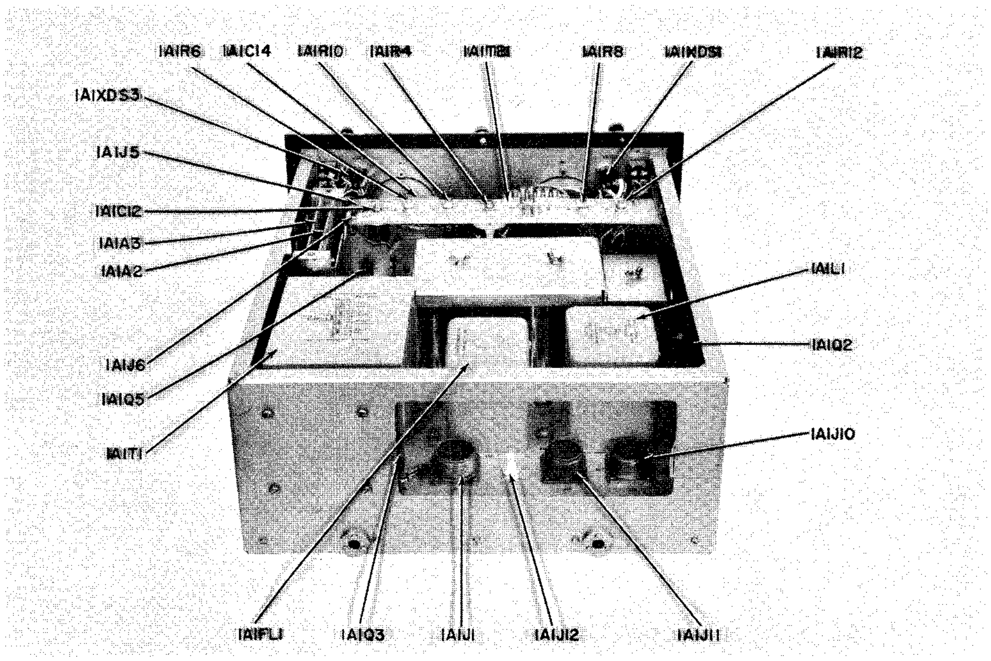


Figure 5-24. Oscillator-Power Supply, Top Rear View

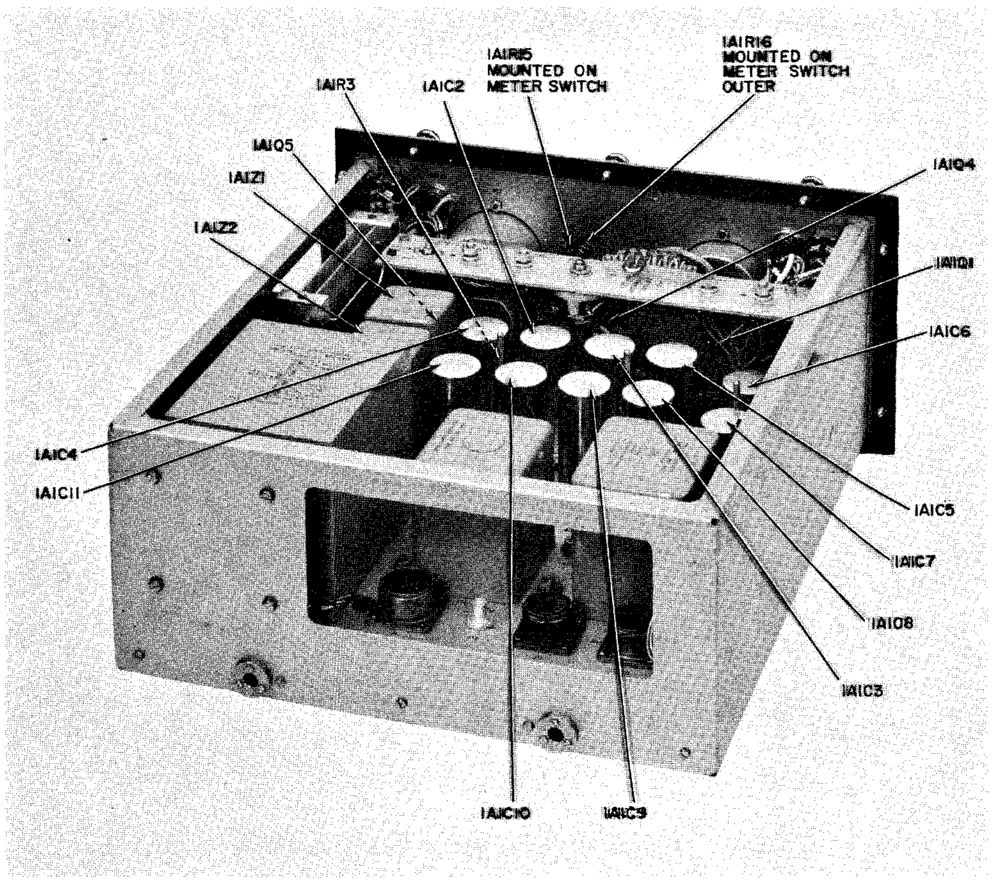


Figure 5-25. Oscillator-Power Supply, Top View

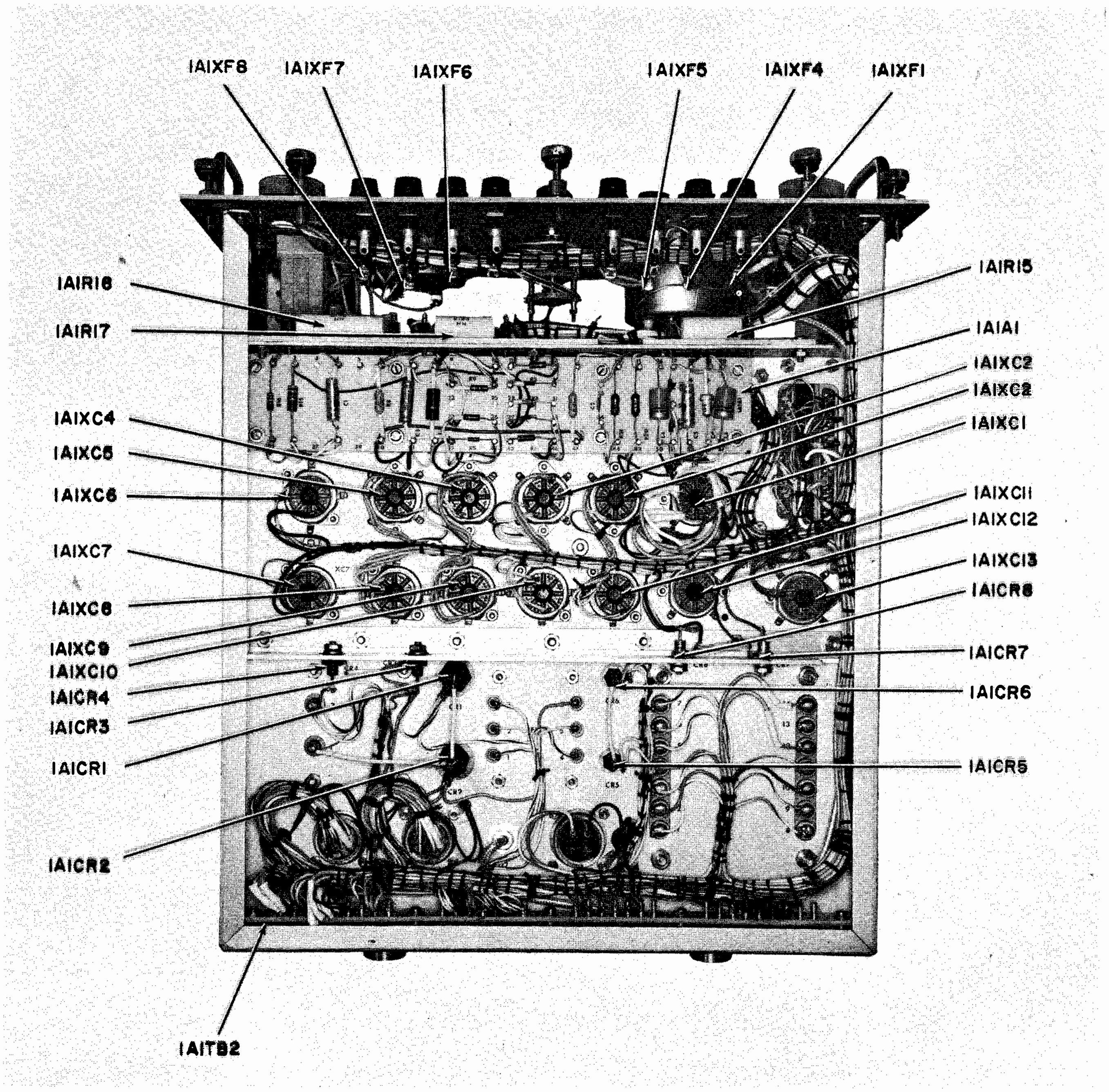


Figure 5-26. Oscillator-Power Supply, Bottom View

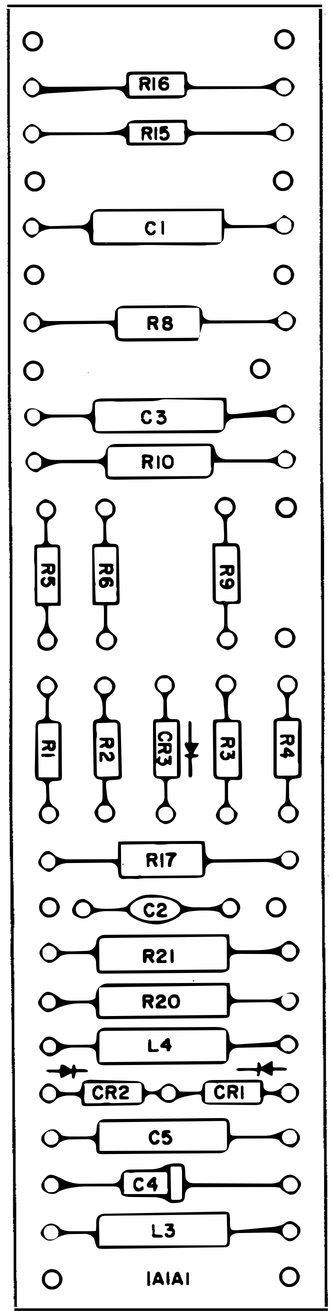


Figure 5-27. Oscillator-Power Supply, Printed Circuit Board 1A1A1

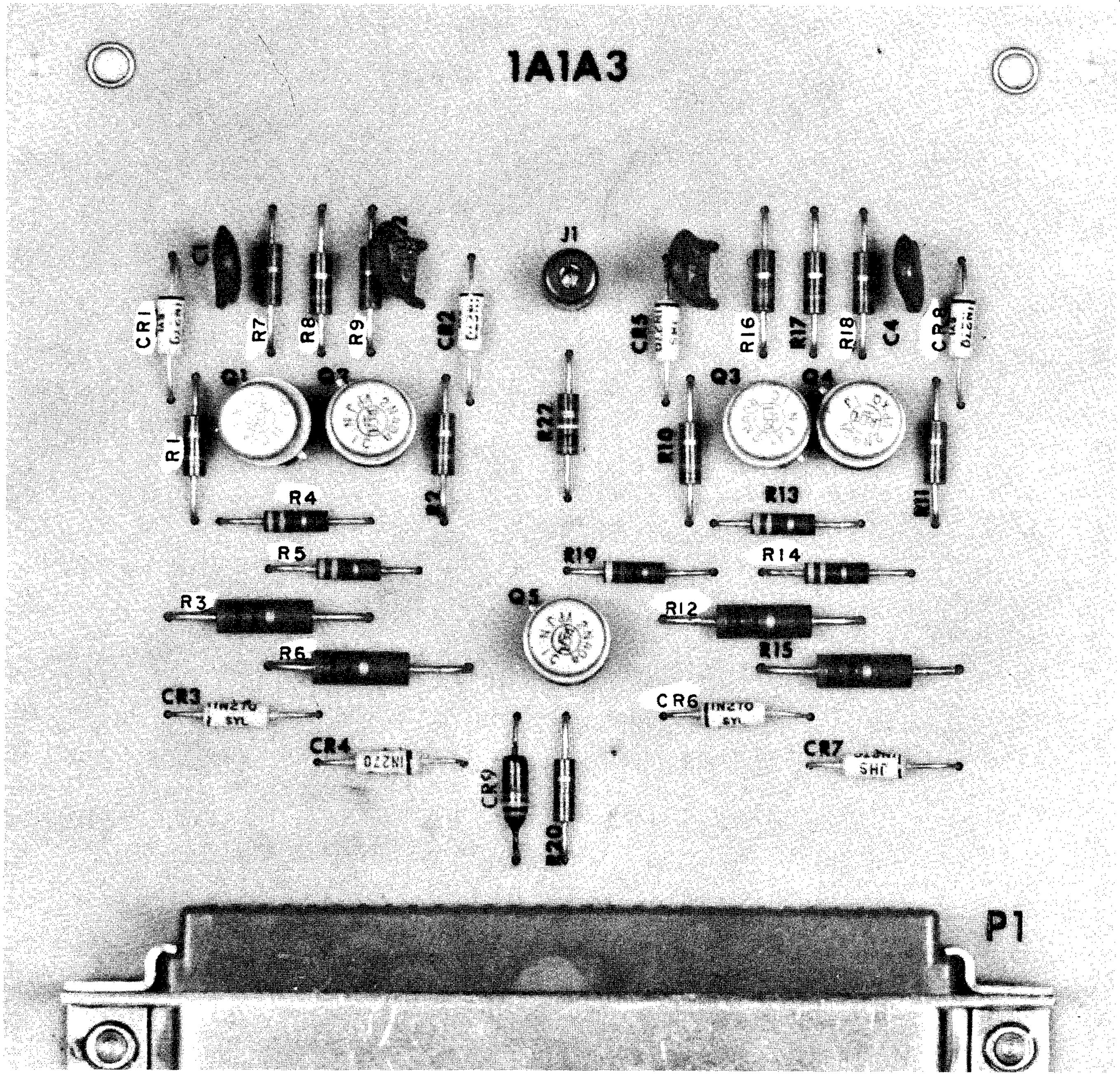


Figure 5-28. Oscillator–Power Supply, Printed Circuit Board 1A1A3

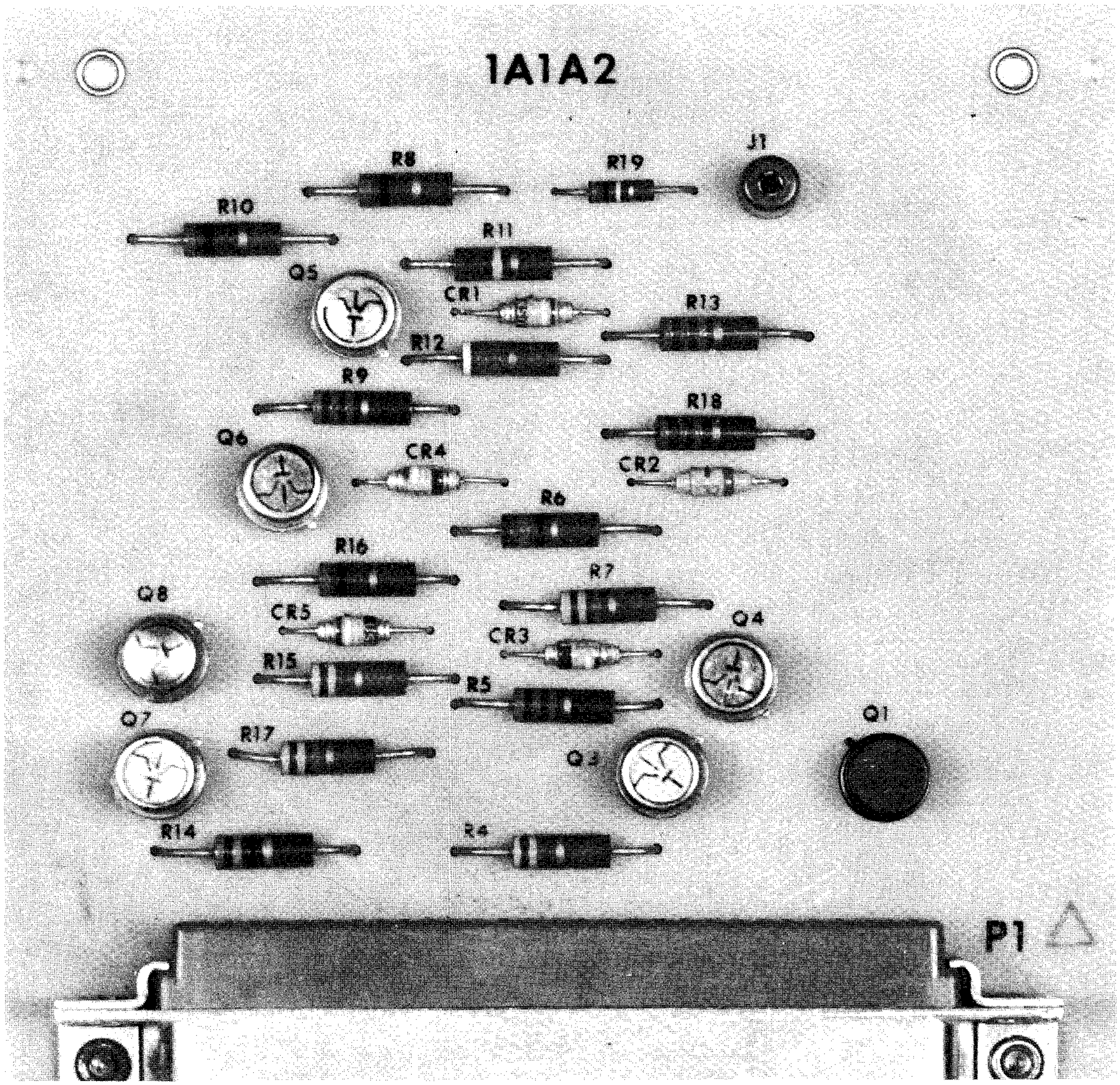


Figure 5-29. Oscillator-Power Supply, Printed Circuit Board 1A1A2

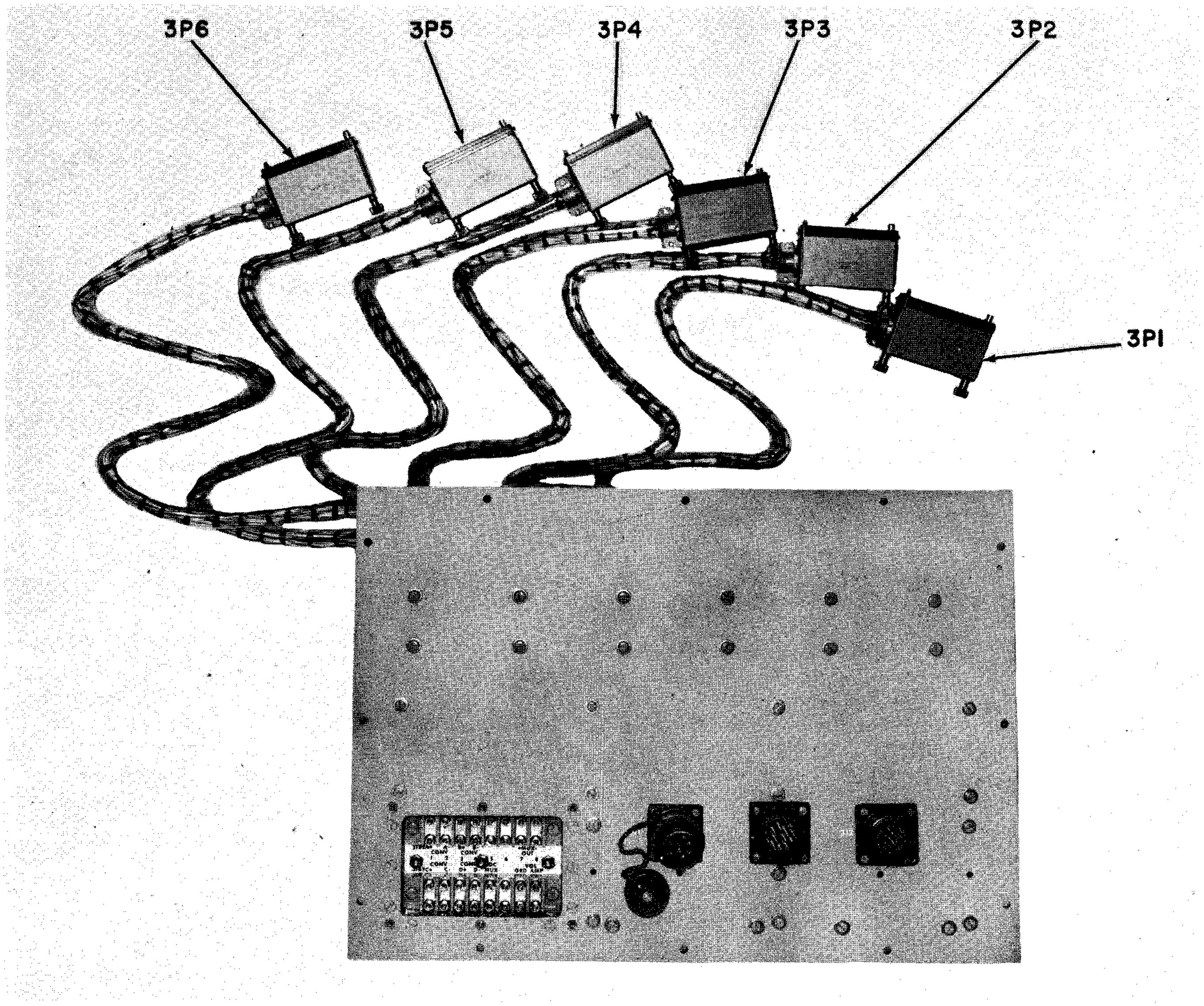


Figure 5-30. Transmitter Group, Rear Cover

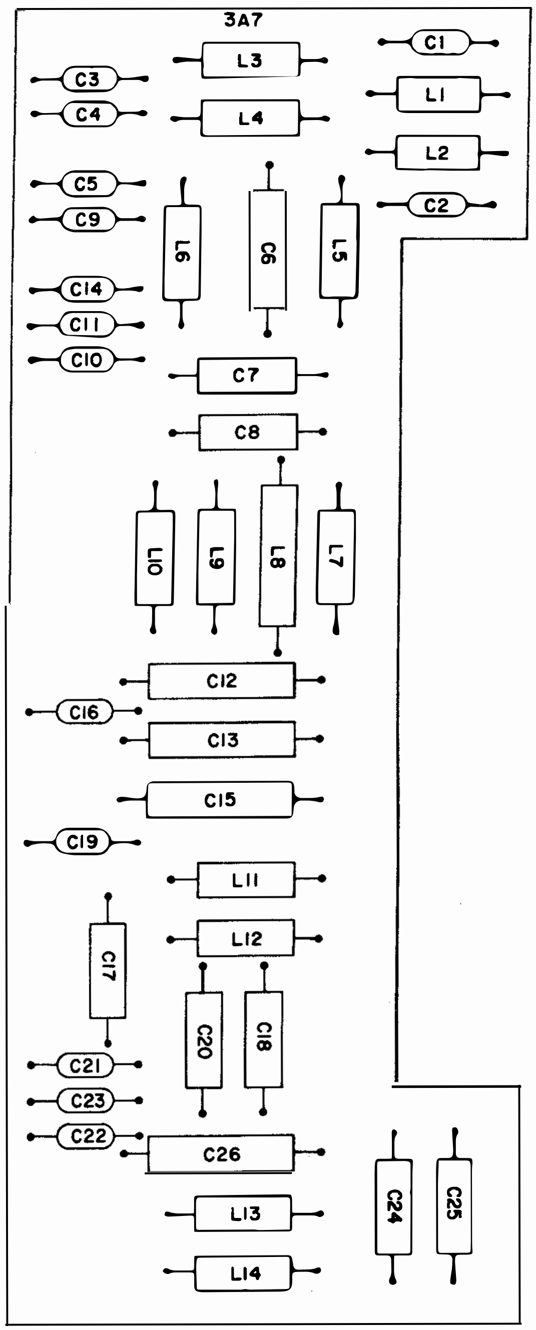


Figure 5-31. Transmitter Group, Rear Circuit Board 3A7

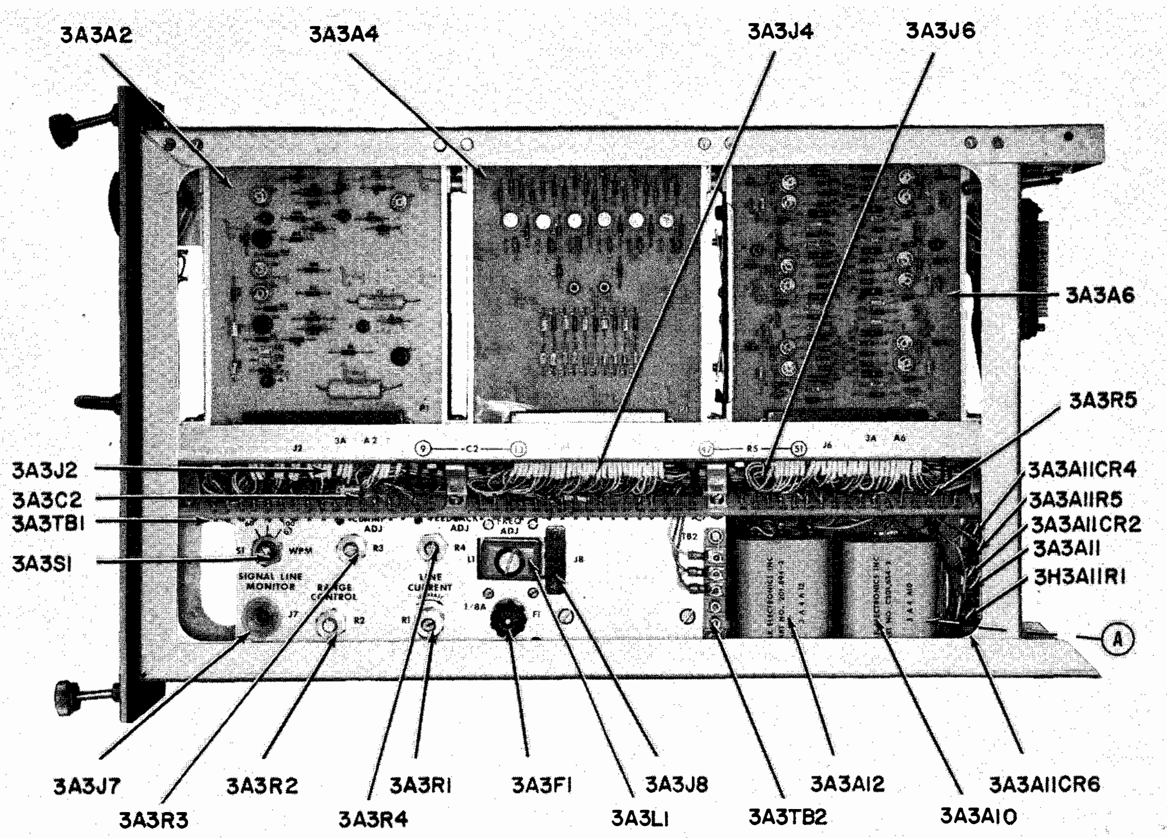


Figure 5-32. Transmitter Code Converter, Right Side

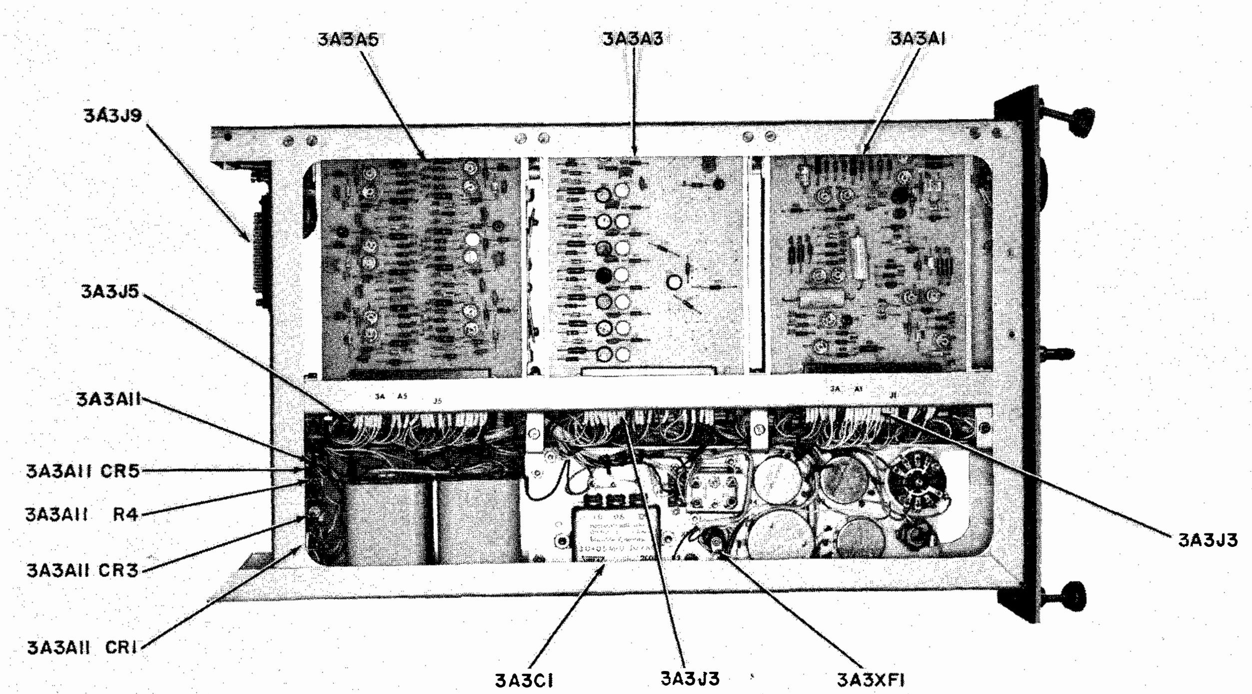


Figure 5-33. Transmitter Code Converter, Left Side

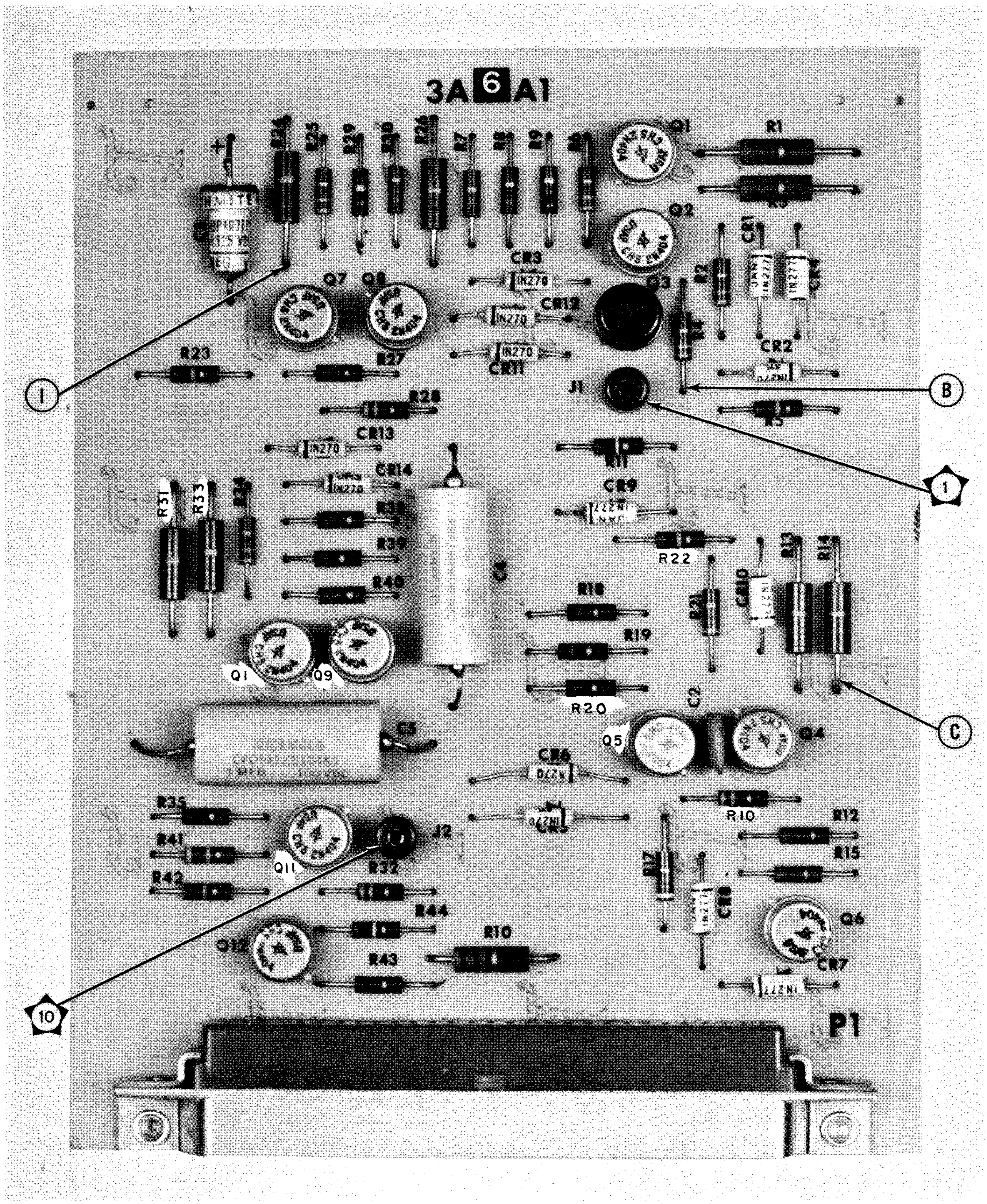


Figure 5-34. Transmitter Code Converter, Printed Circuit Board A1

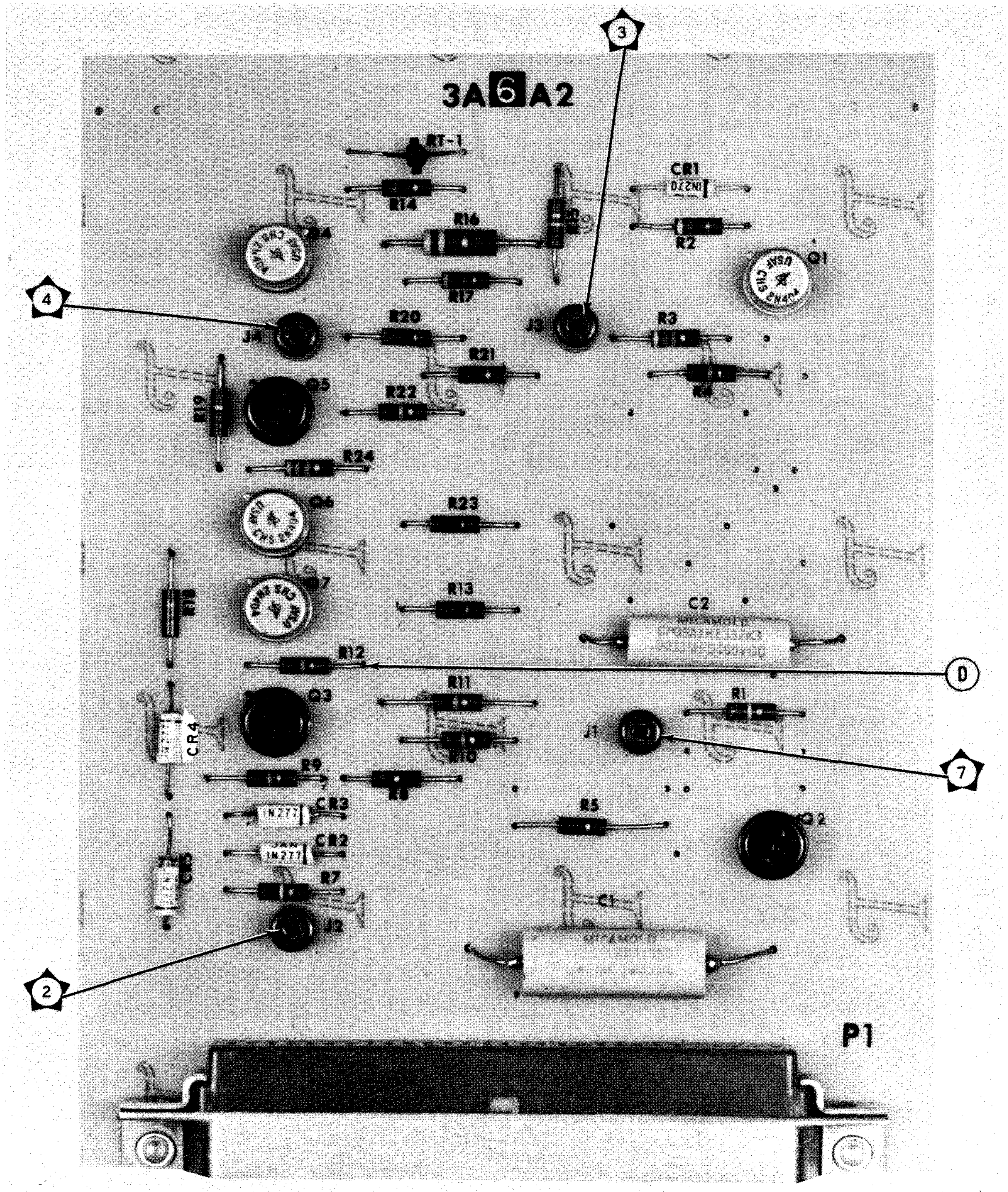


Figure 5-35. Transmitter Code Converter, Printed Circuit Board A2

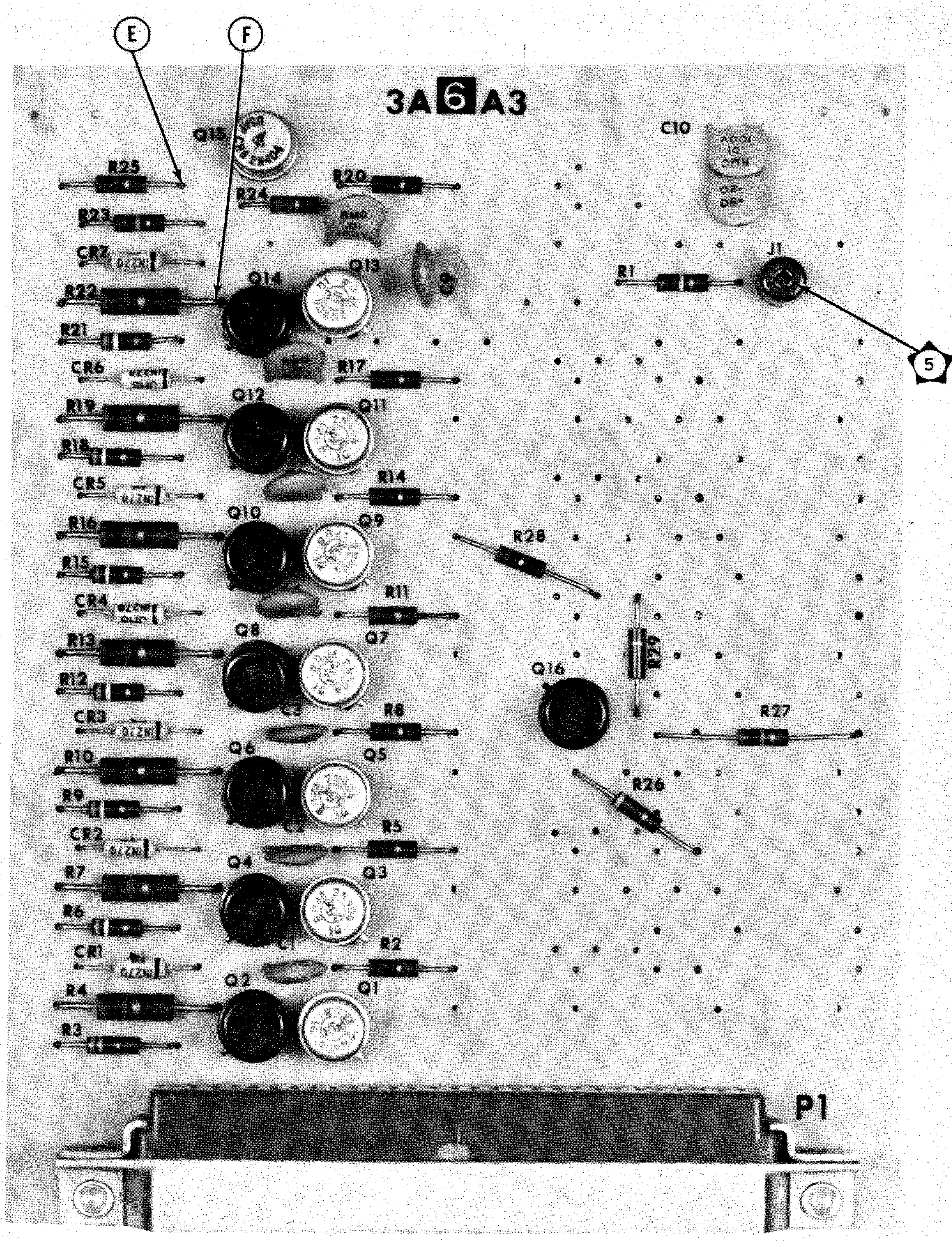


Figure 5-36. Transmitter Code Converter, Printed Circuit Board A3

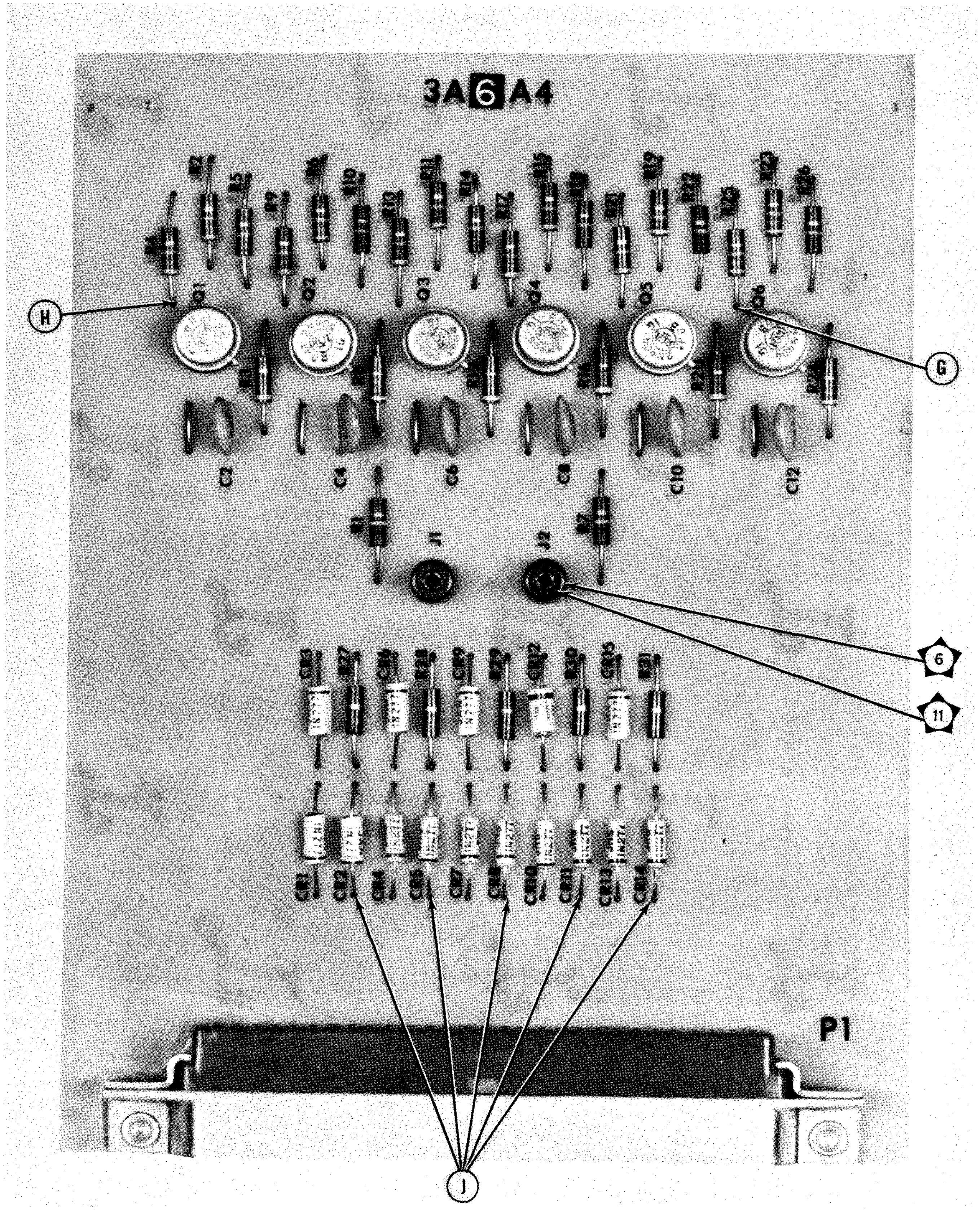


Figure 5-37. Transmitter Code Converter, Printed Circuit Board A4

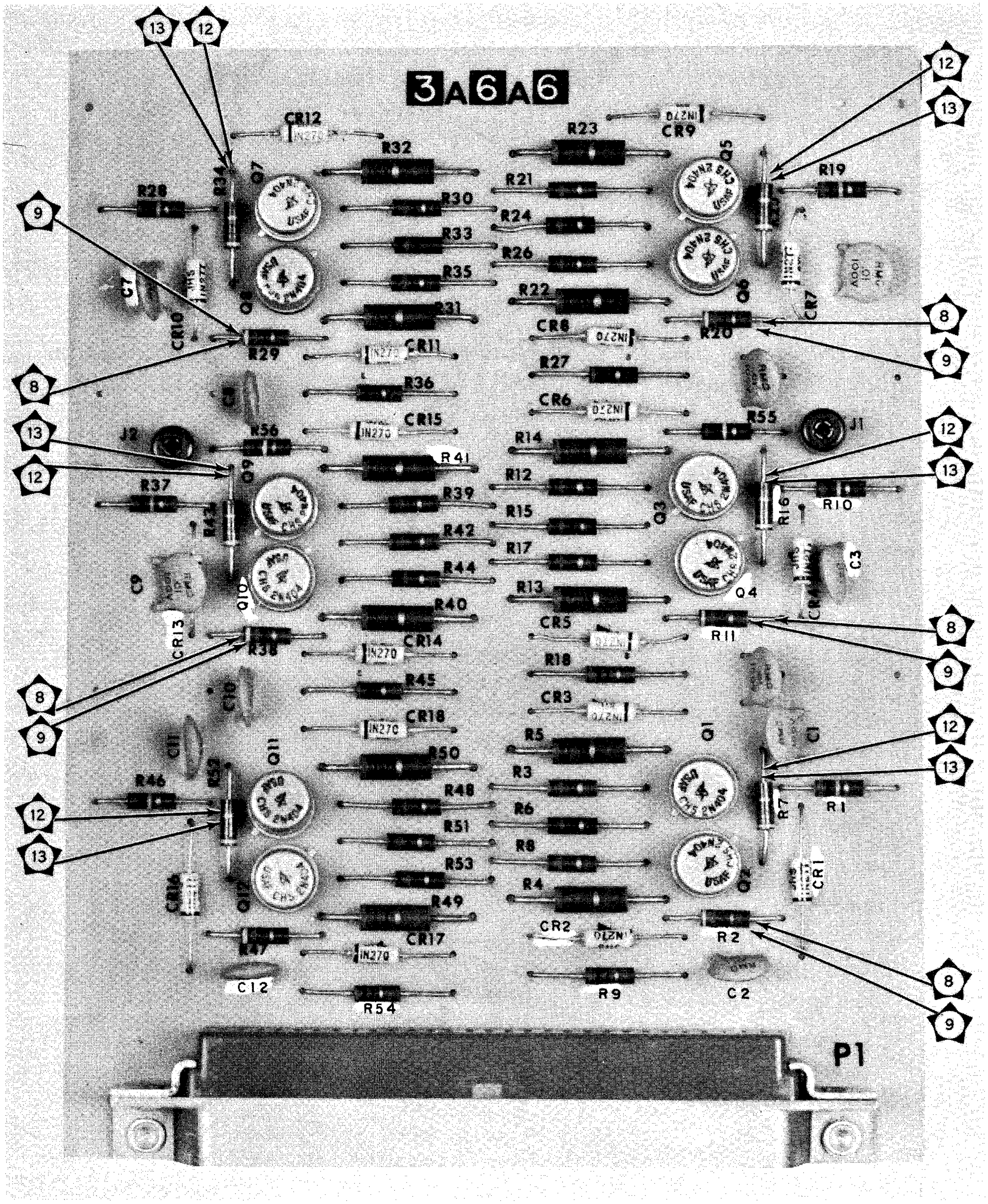


Figure 5-38. Transmitter Code Converter, Printed Circuit Board A5

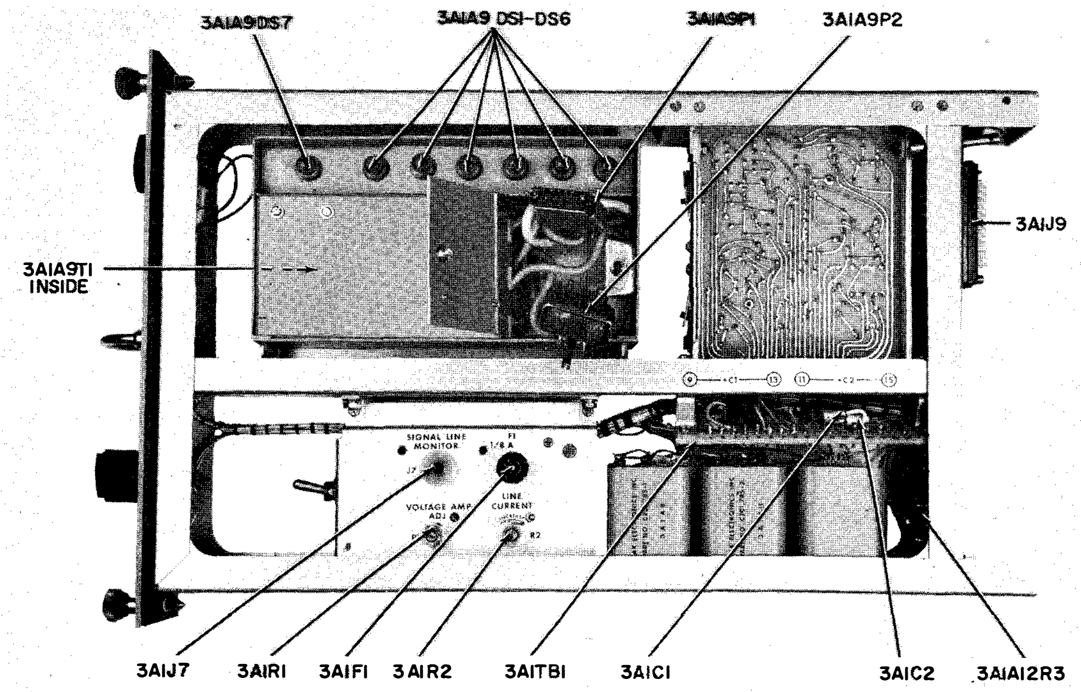


Figure 5-39. Control Amplifier, Right Side

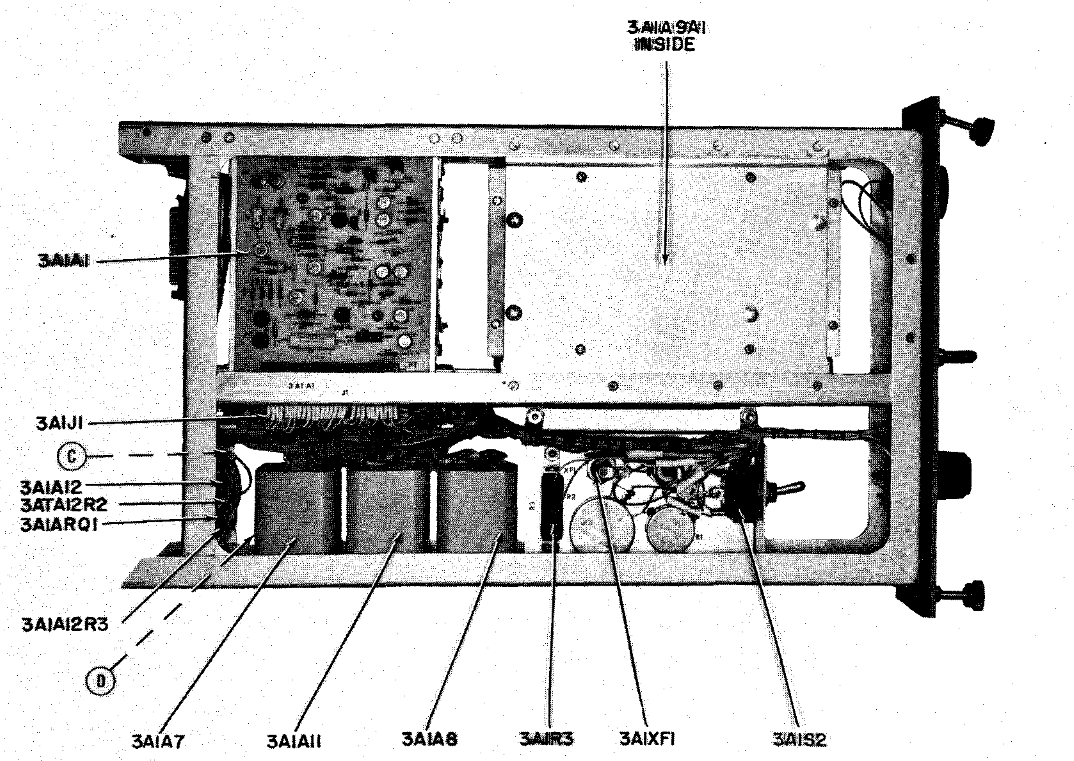


Figure 5-40. Control Amplifier, Left Side

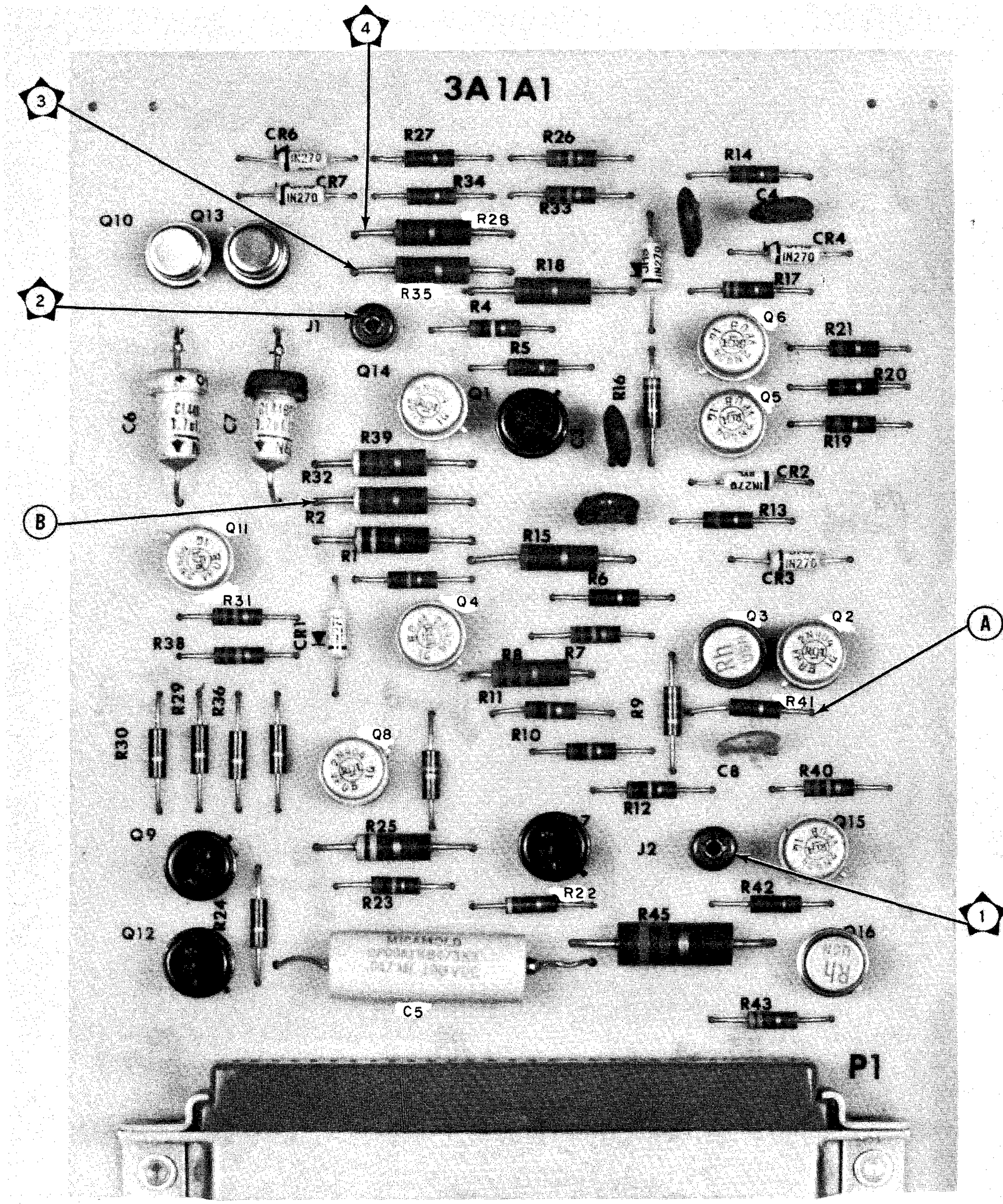


Figure 5-41. Control Amplifier, Printed Circuit Board A1

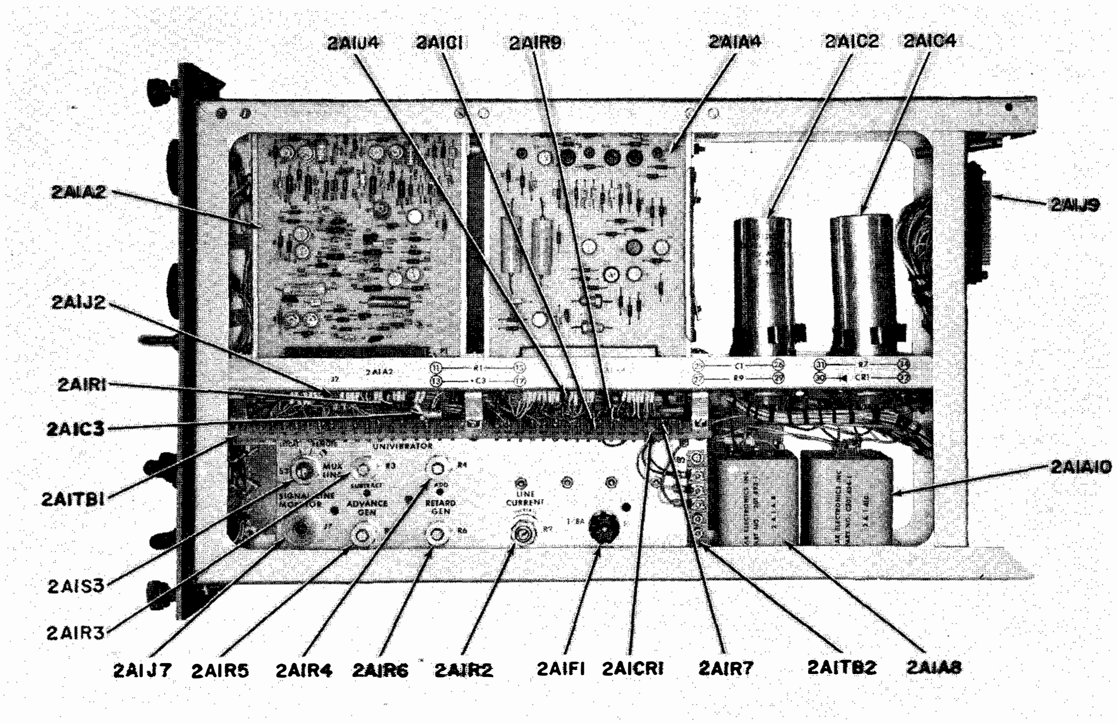


Figure 5-42. Synch Unit, Right Side

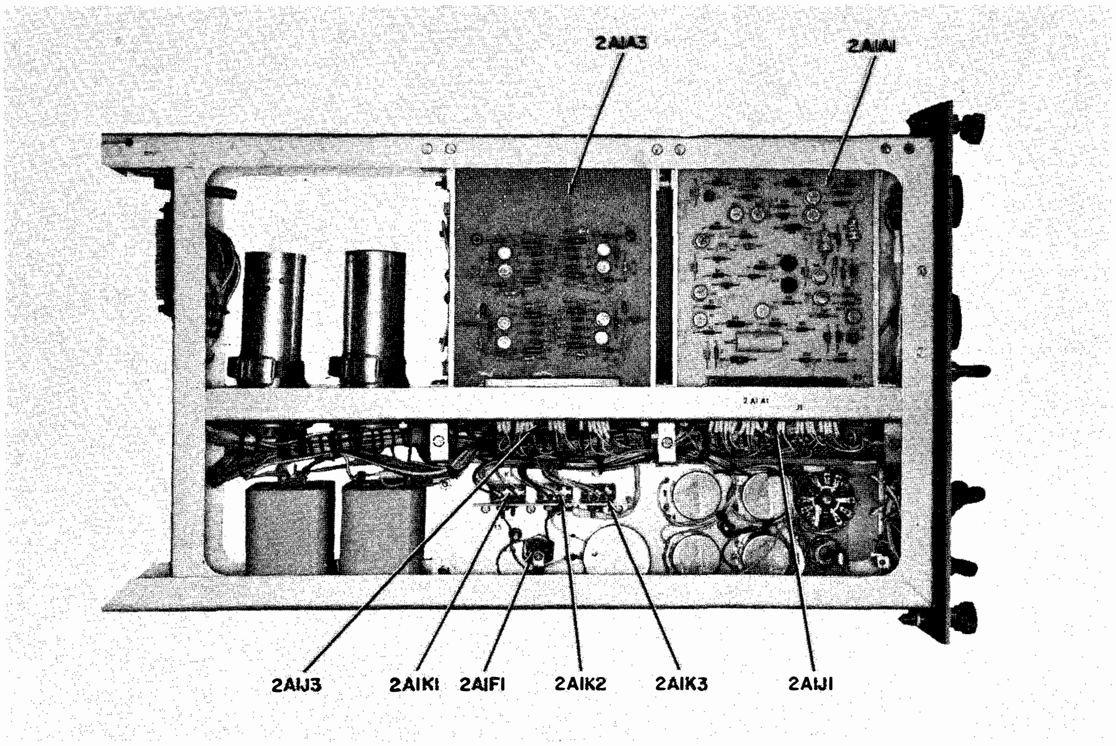


Figure 5-43. Synch Unit, Left Side

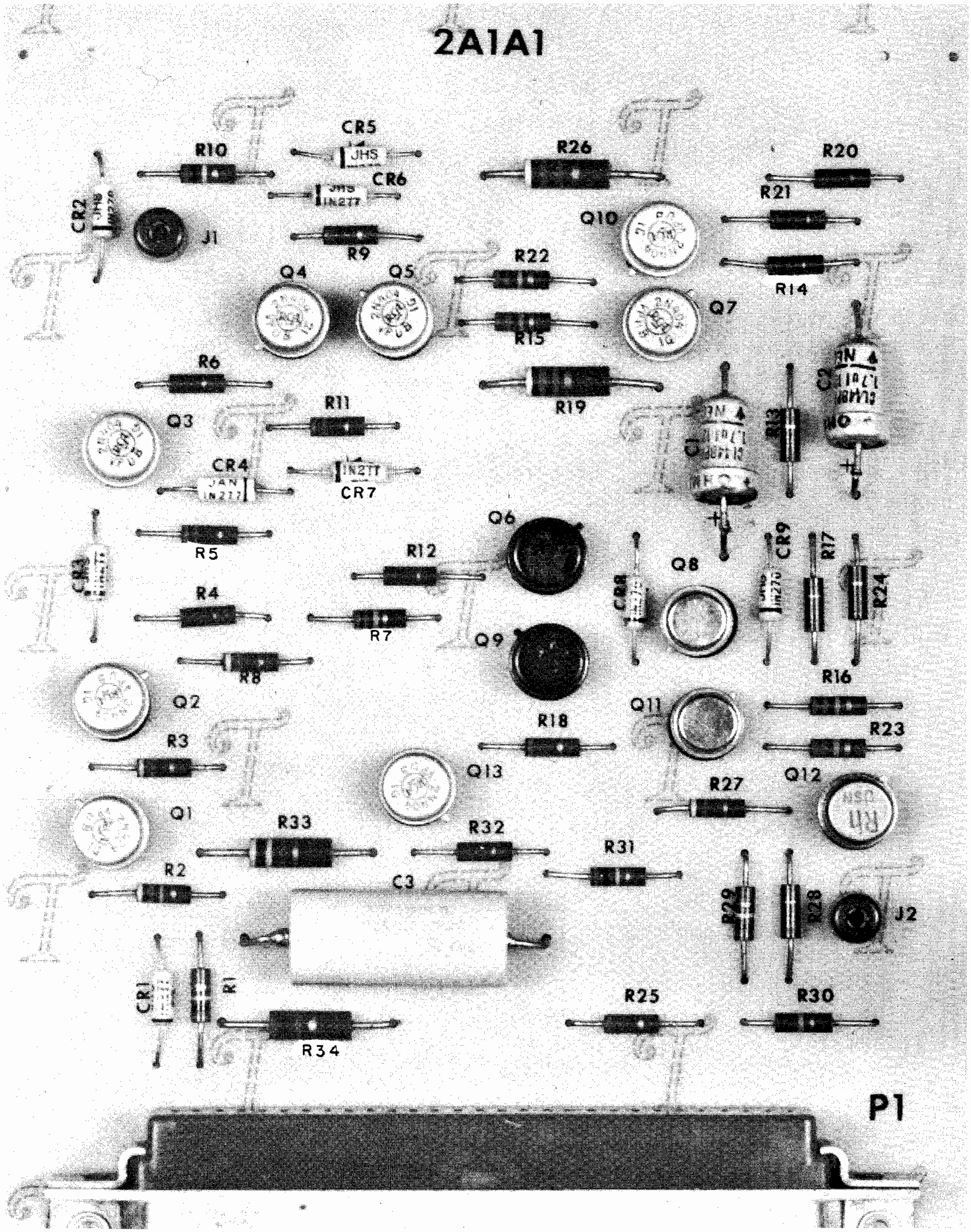


Figure 5-44. Synch Unit, Printed Circuit Board A1

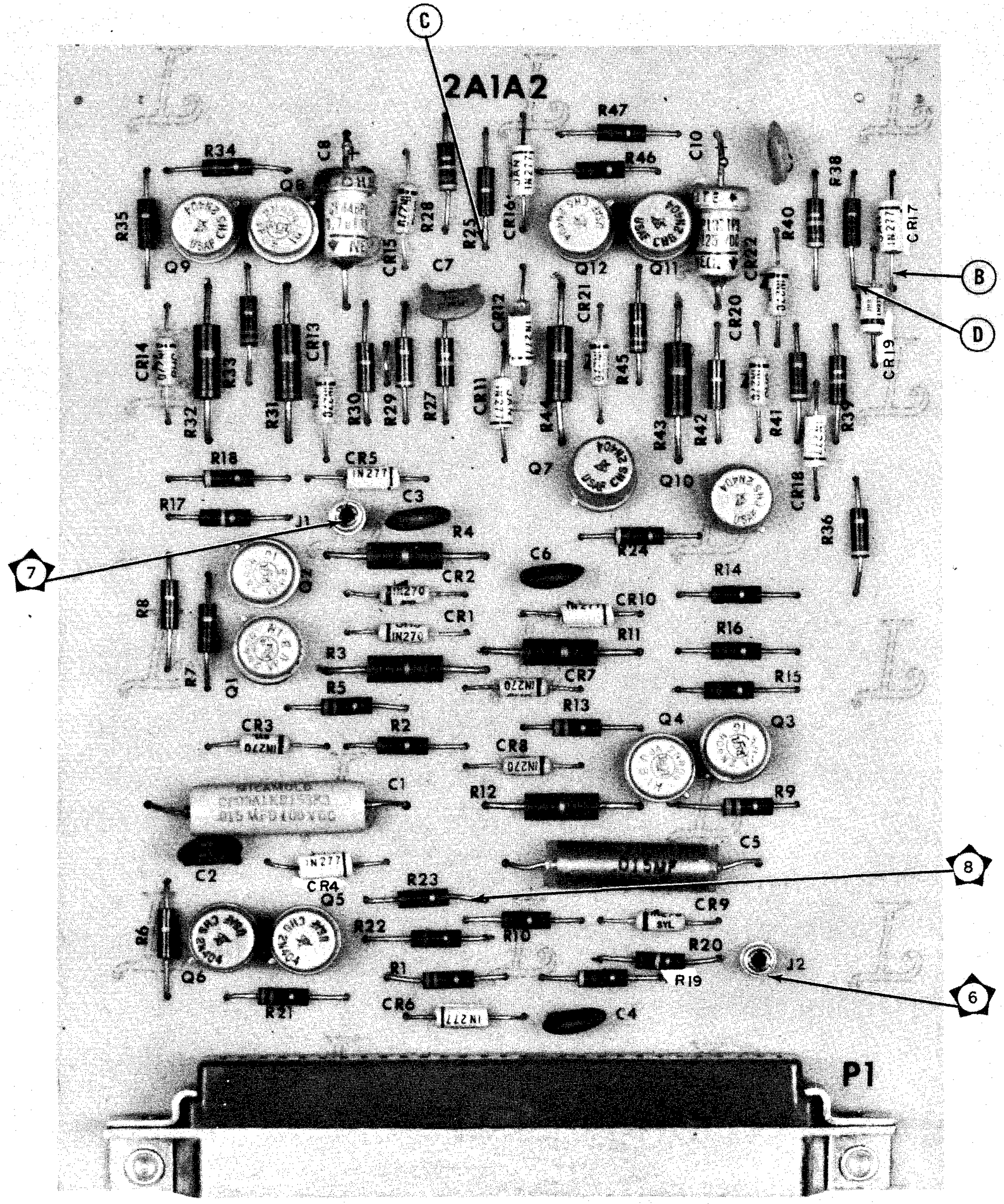


Figure 5-45. Synch Unit, Printed Circuit Board A2

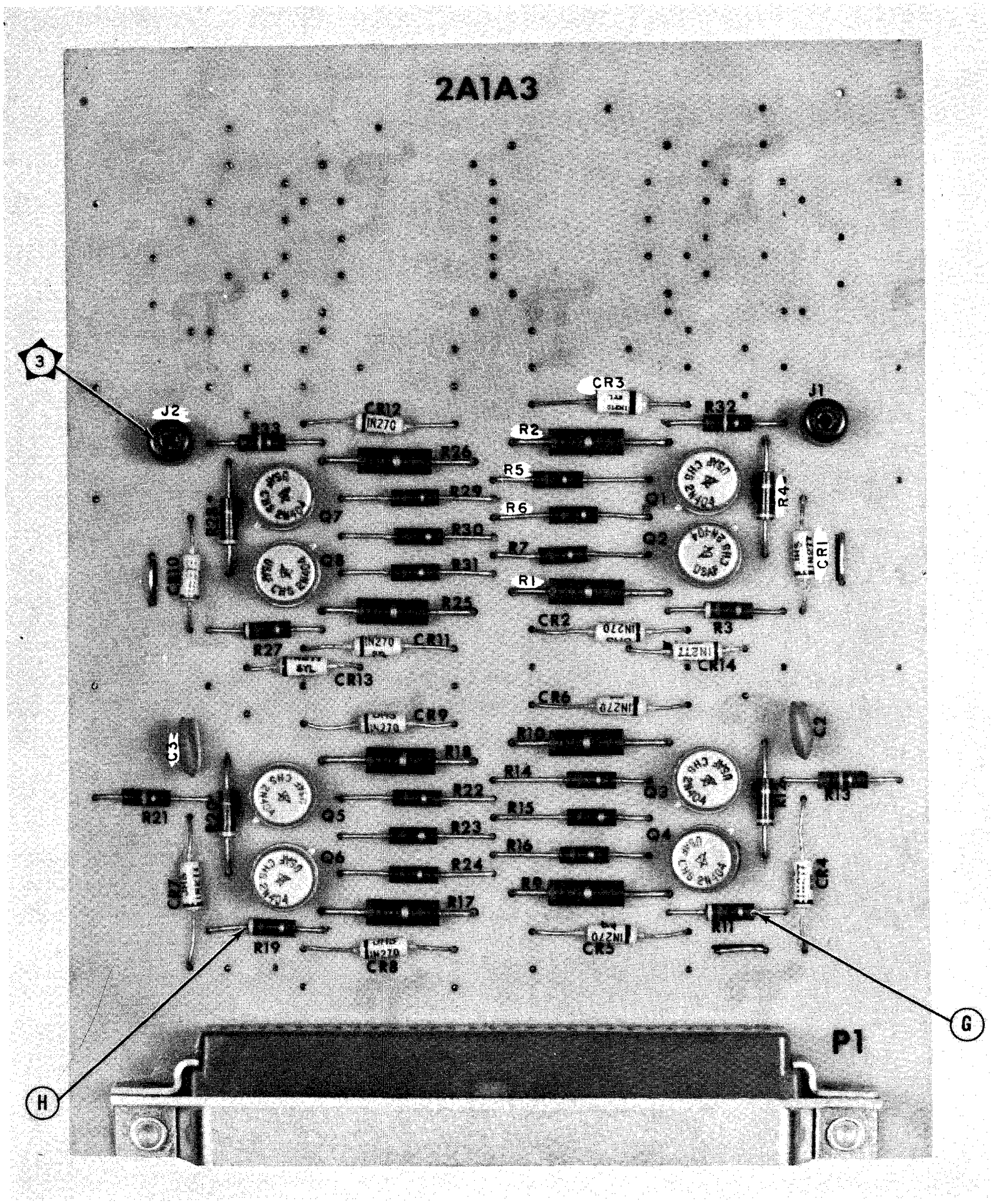


Figure 5-46. Synch Unit, Printed Circuit Board A3

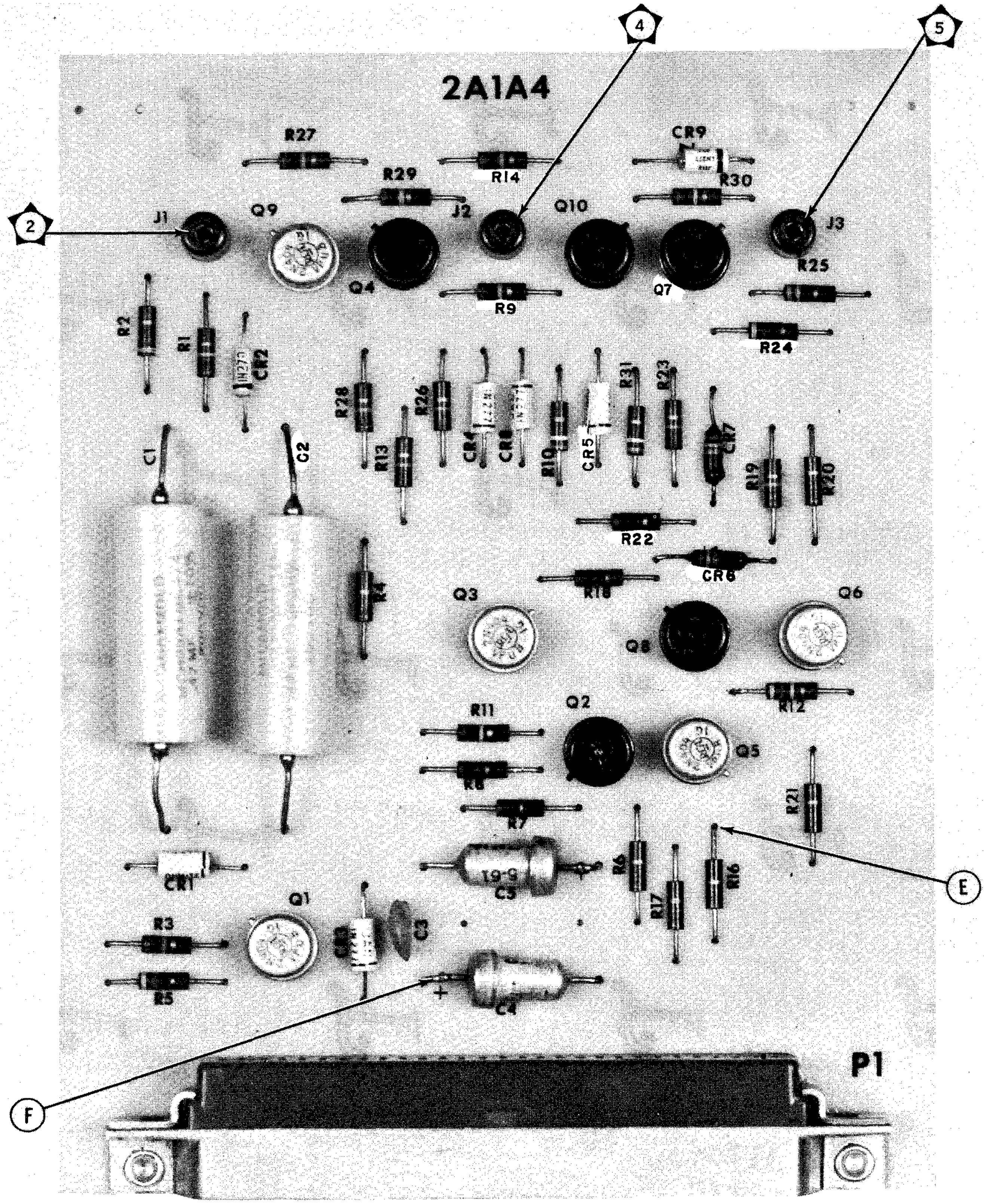


Figure 5-47. Synch Unit, Printed Circuit Board A4

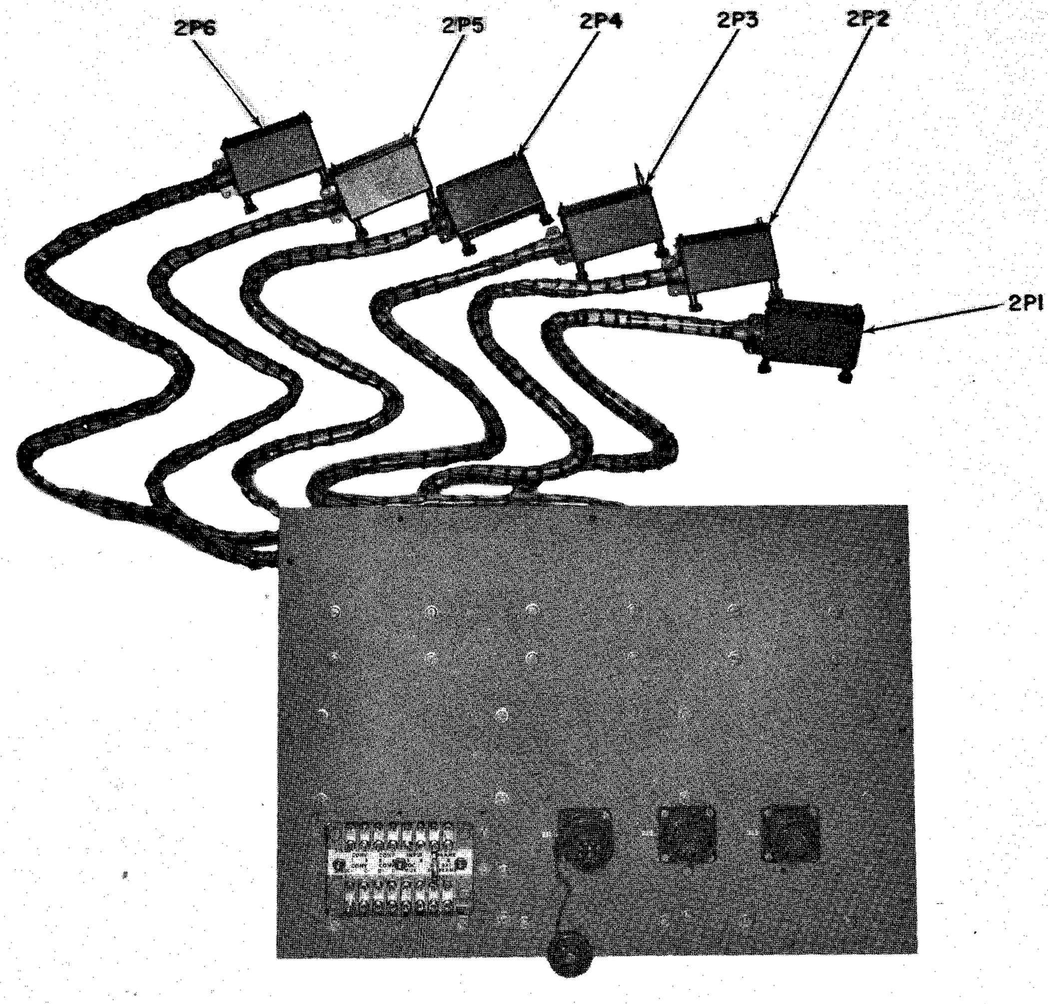


Figure 5-48. Receiver Group, Rear Cover

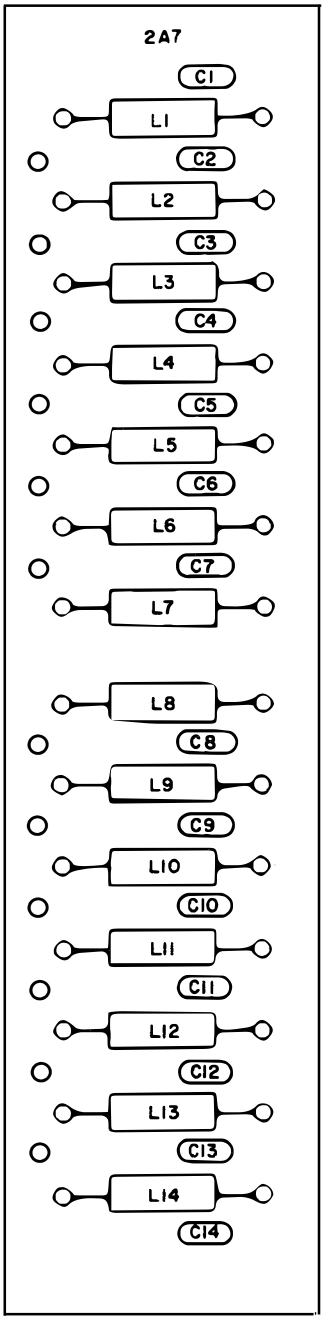


Figure 5-49. Receiver Group, Rear Circuit Board 2A7

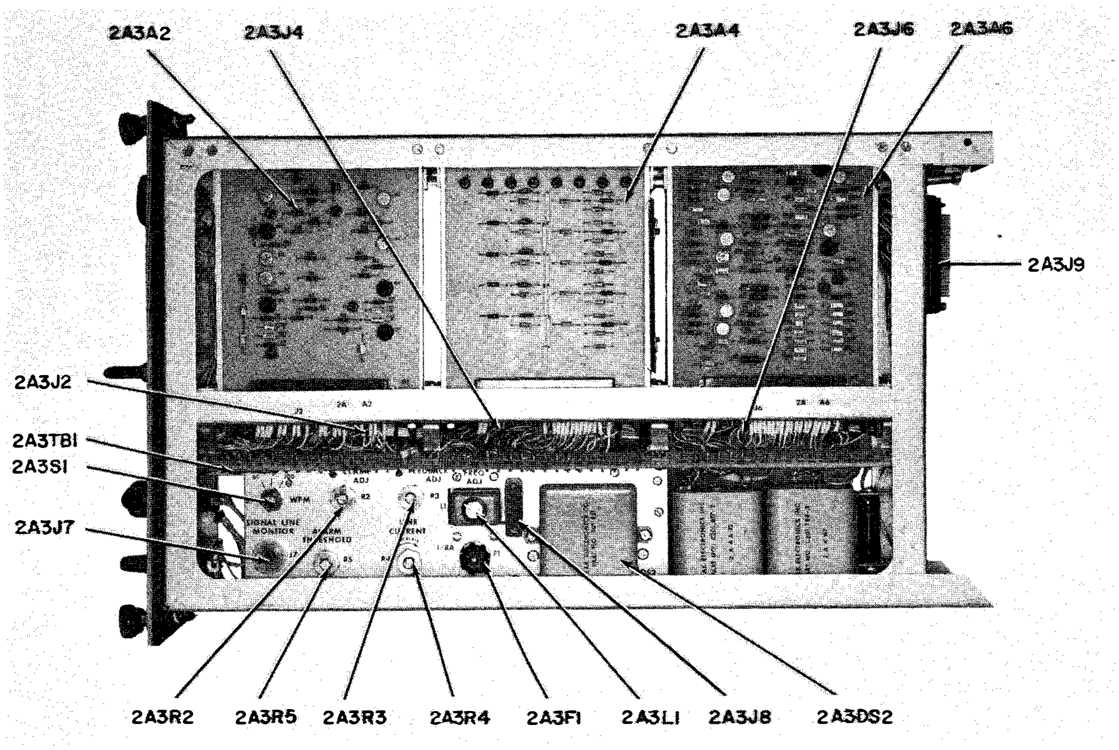


Figure 5-50. Receiver Code Converter, Right Side

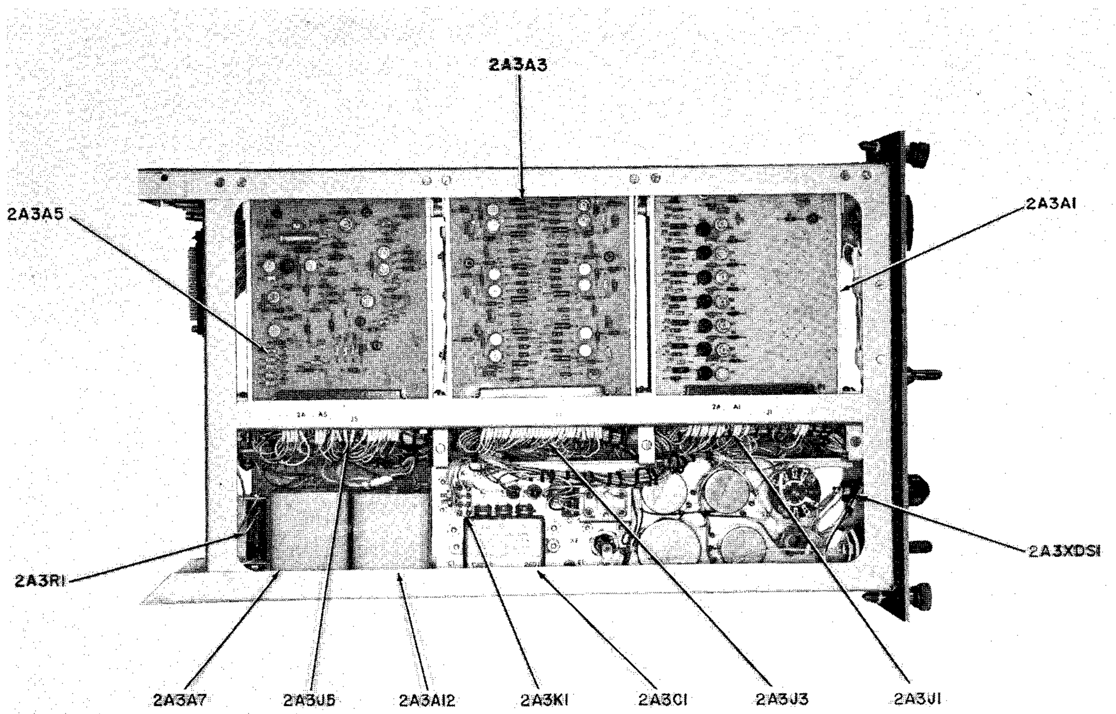


Figure 5-51. Receiver Code Converter, Left Side

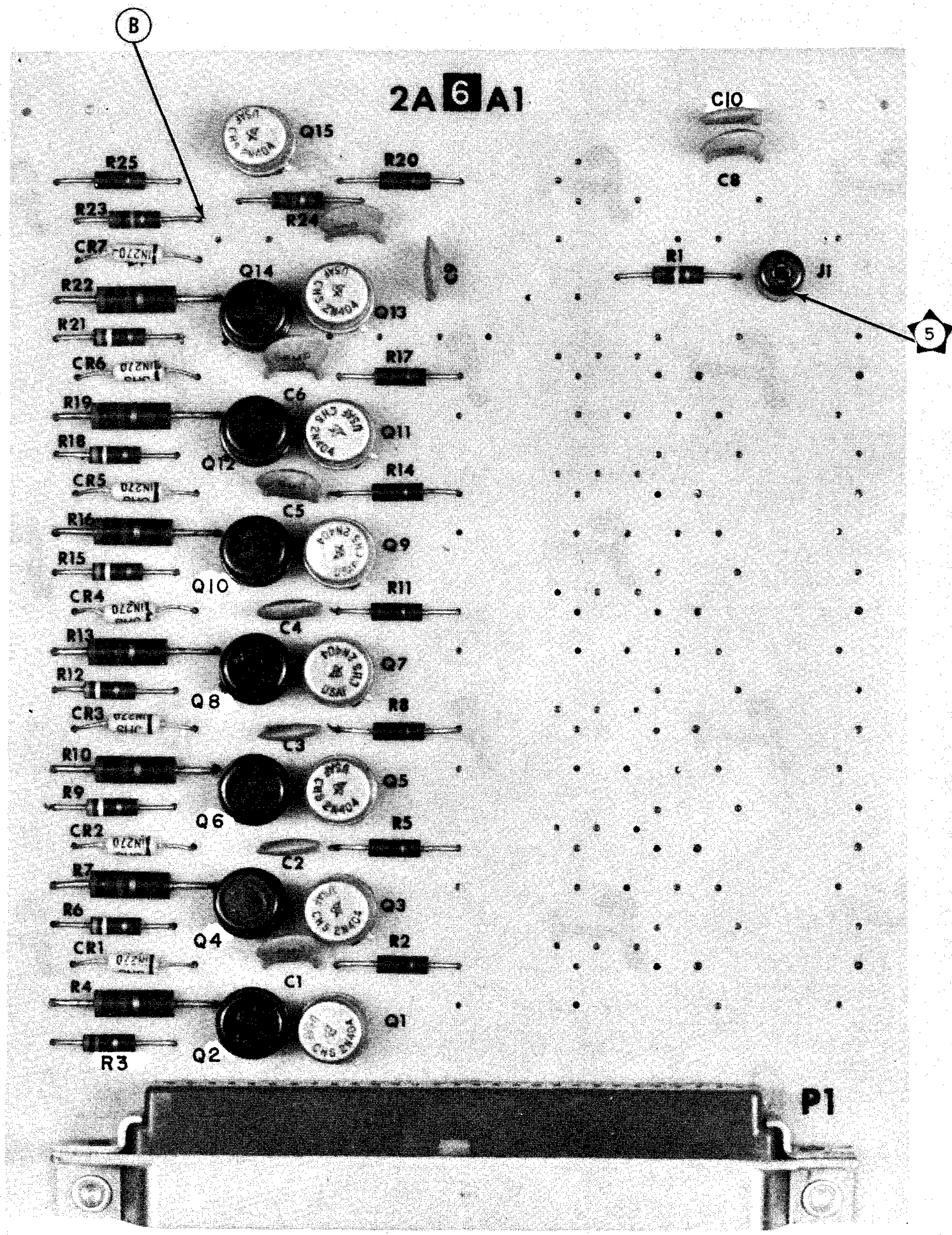


Figure 5-52. Receiver Code Converter, Printed Circuit Board A1

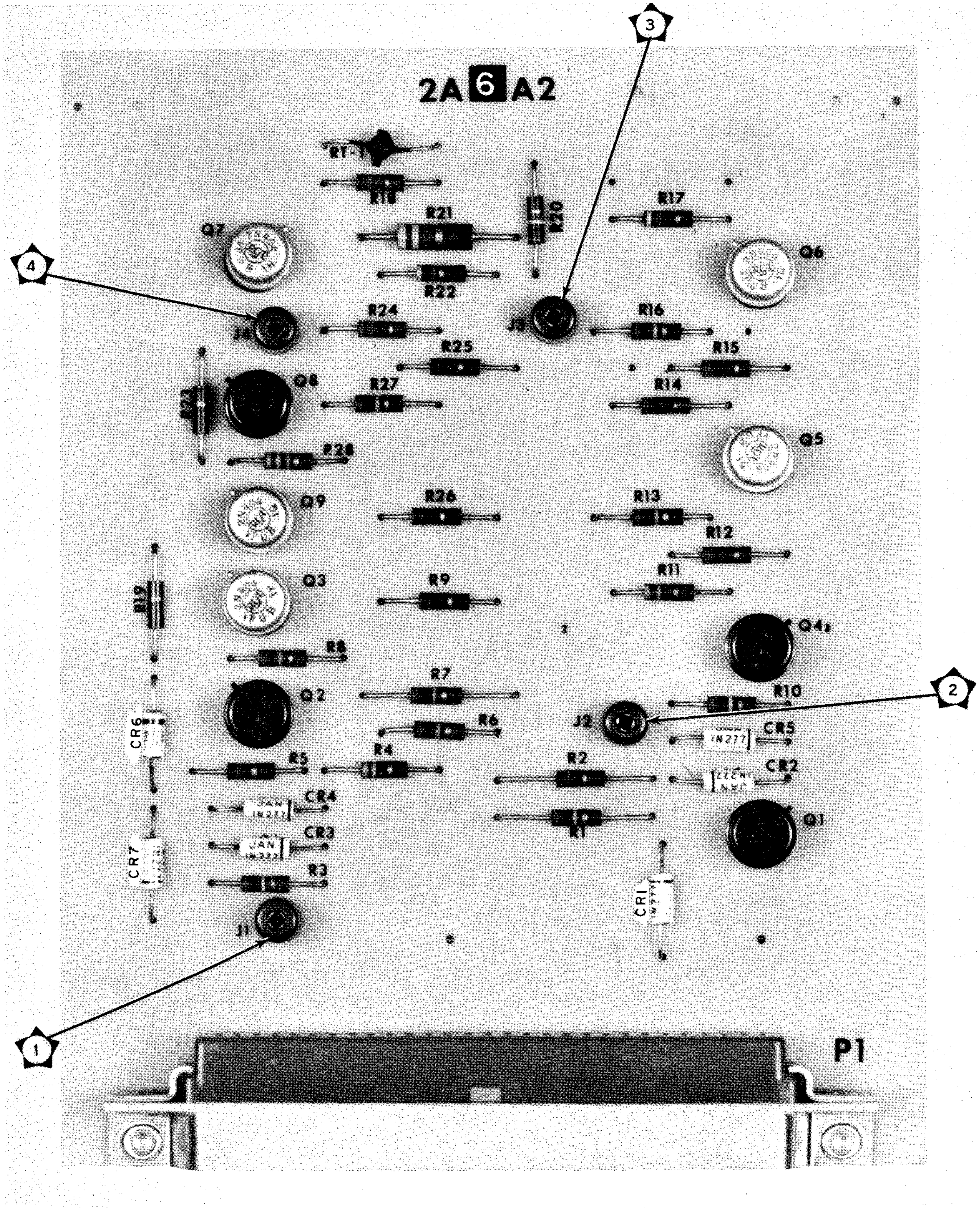


Figure 5-53. Receiver Code Converter, Printed Circuit Board A2

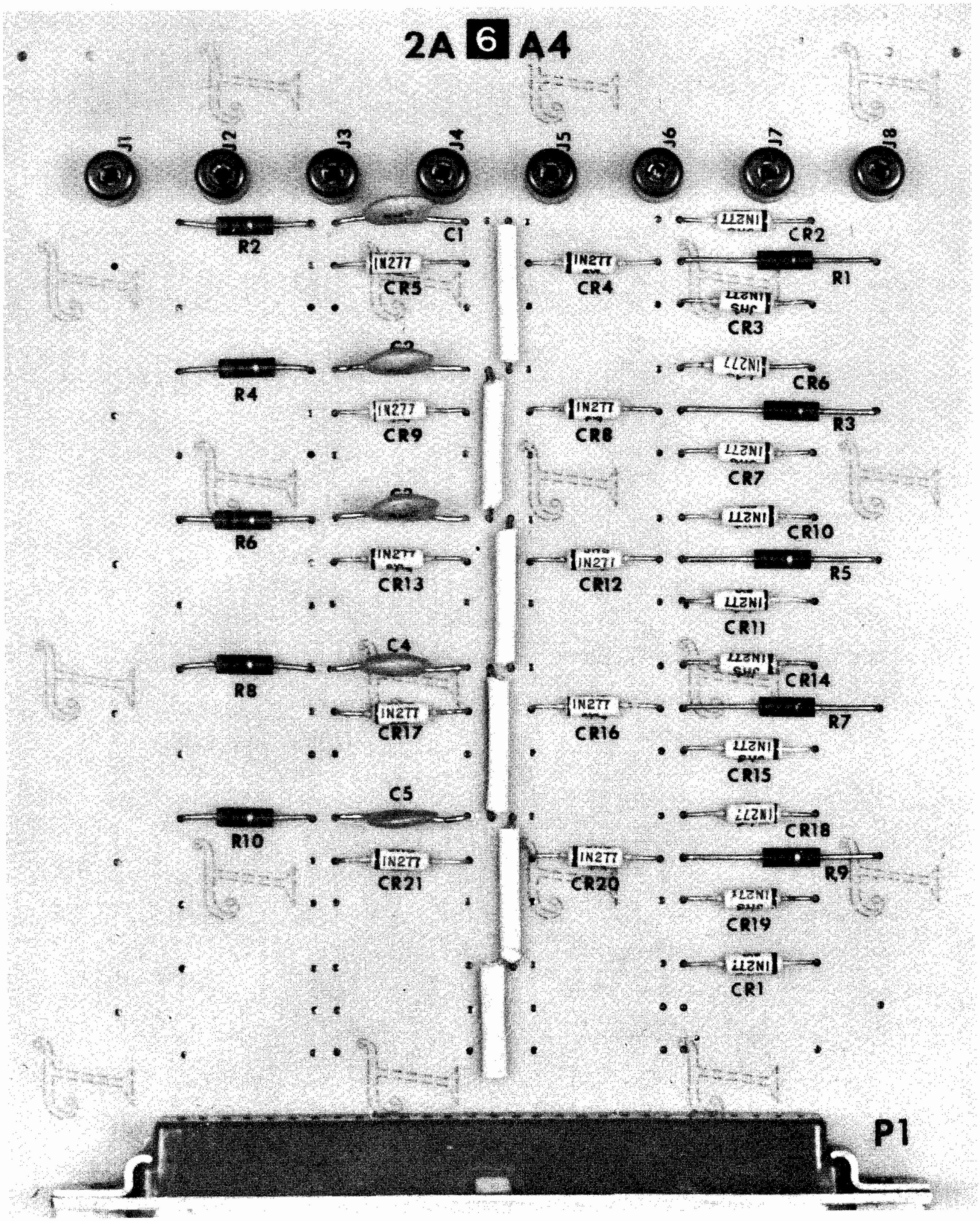


Figure 5-54. Receiver Code Converter, Printed Circuit Board A4

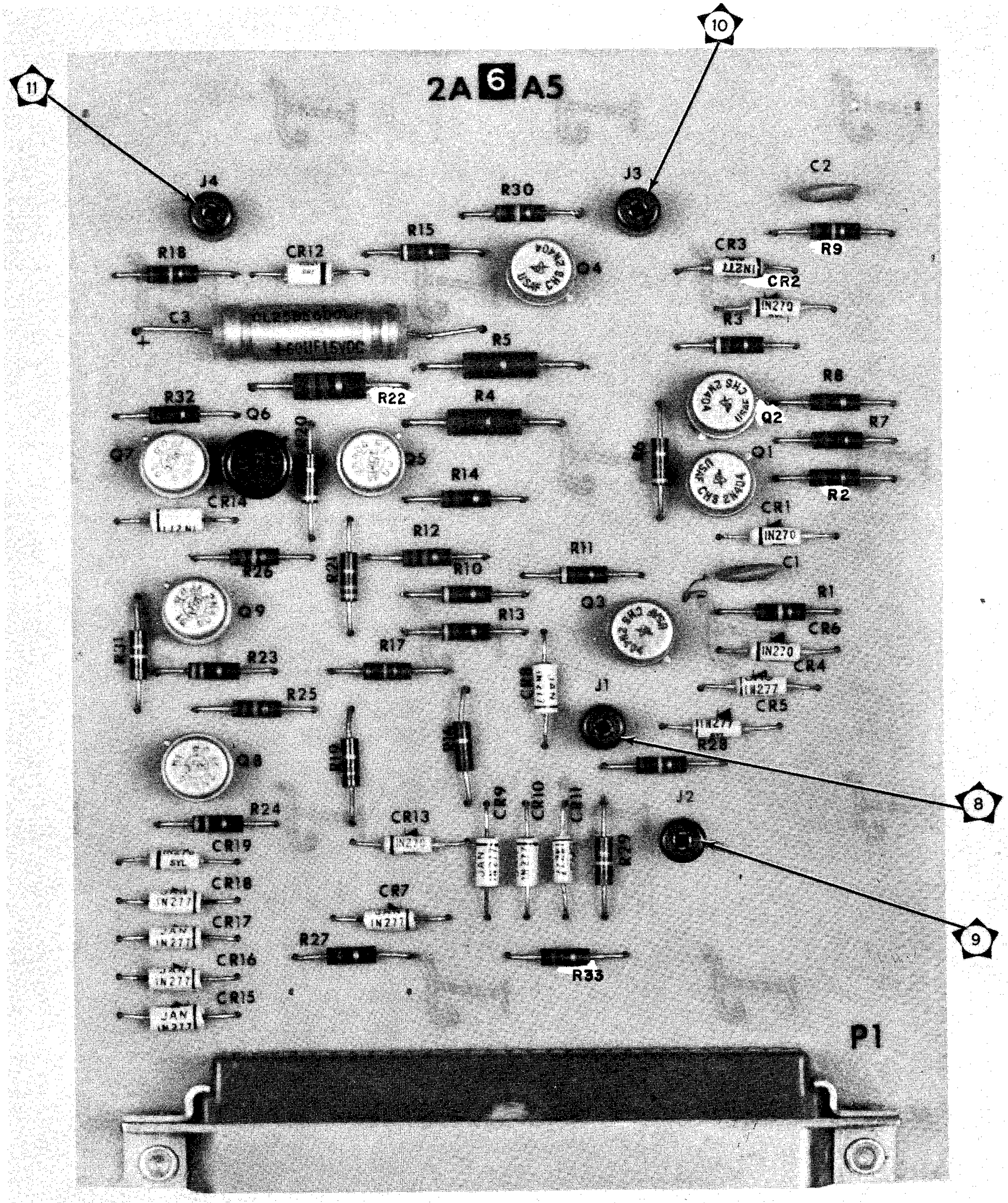


Figure 5-55. Receiver Code Converter, Printed Circuit Board A5

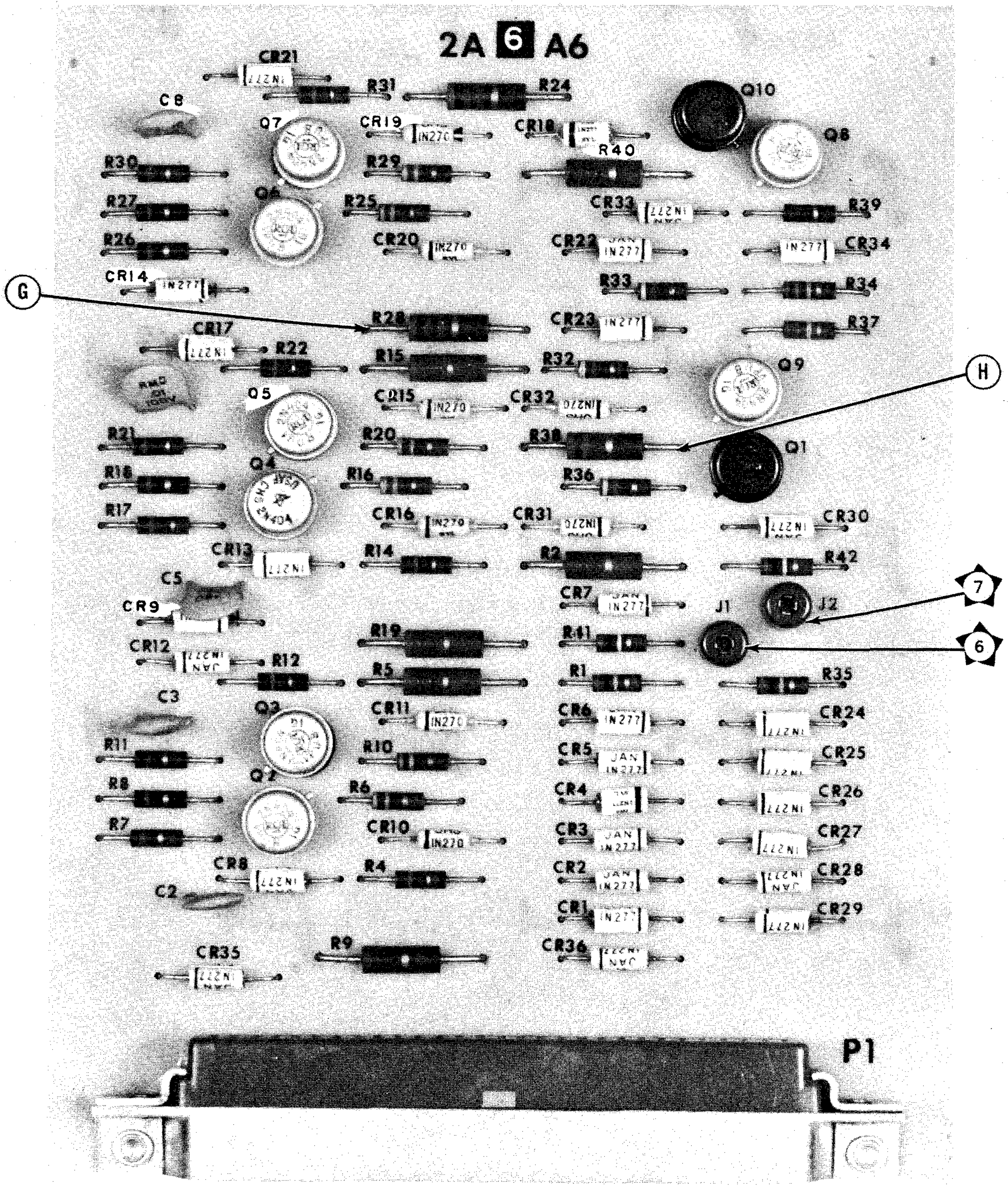


Figure 5-56. Receiver Code Converter, Printed Circuit Board A6

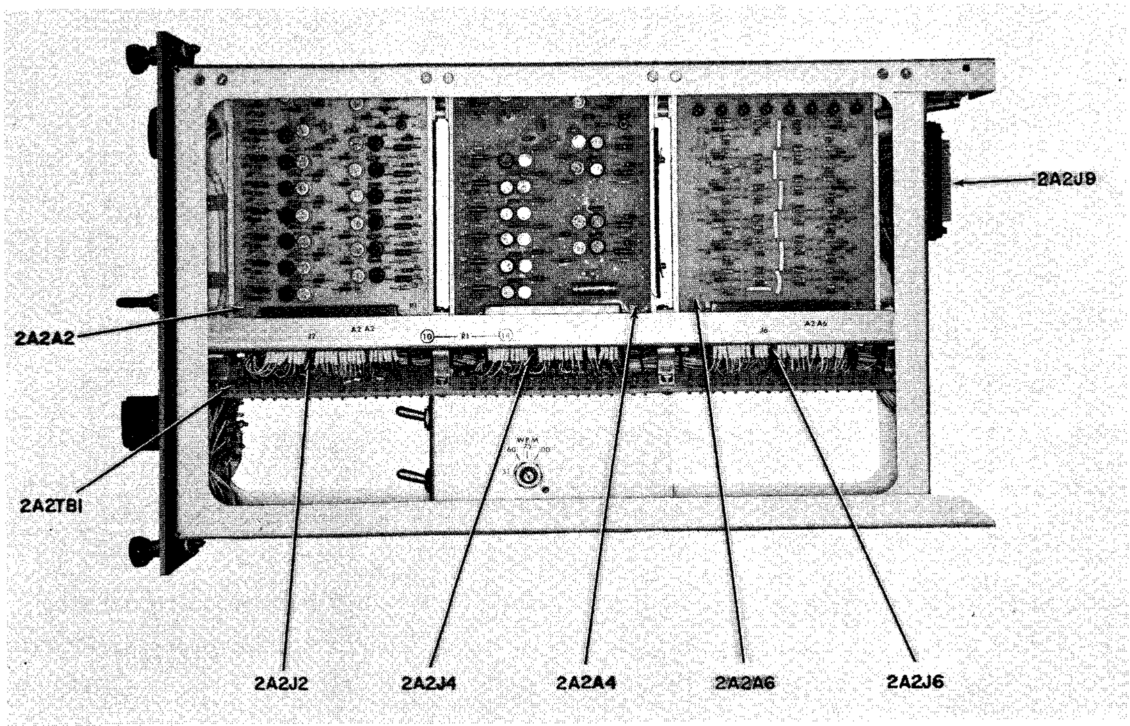


Figure 5-57. Mux-Demux, Right Side

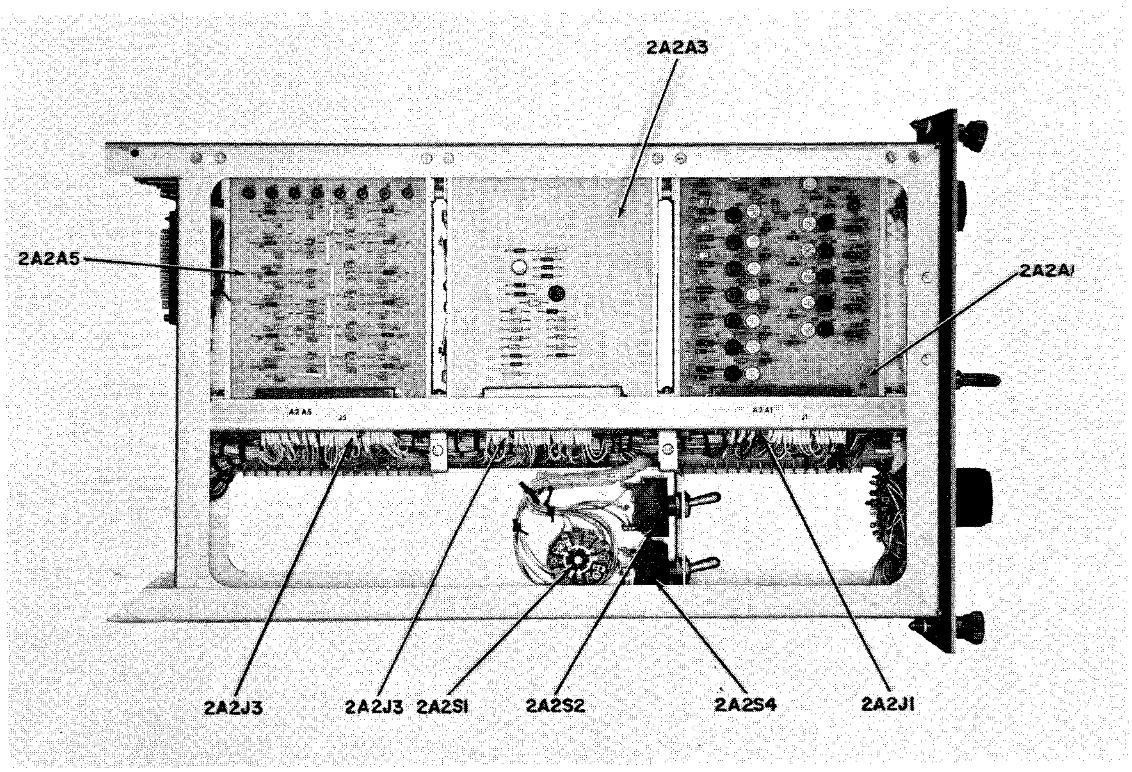


Figure 5-58. Mux-Demux, Left Side

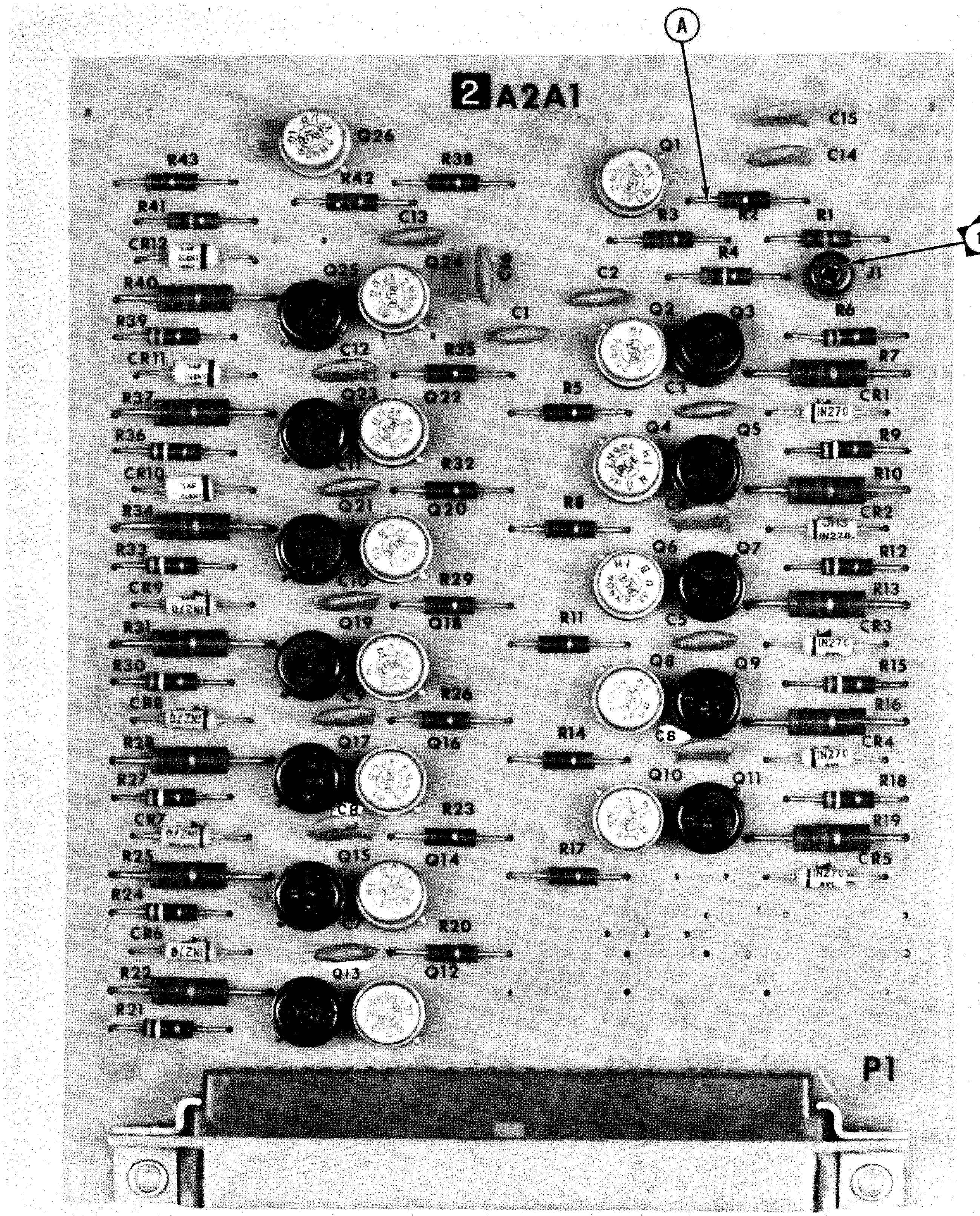


Figure 5-59. Mux-Demux, Printed Circuit Board A1

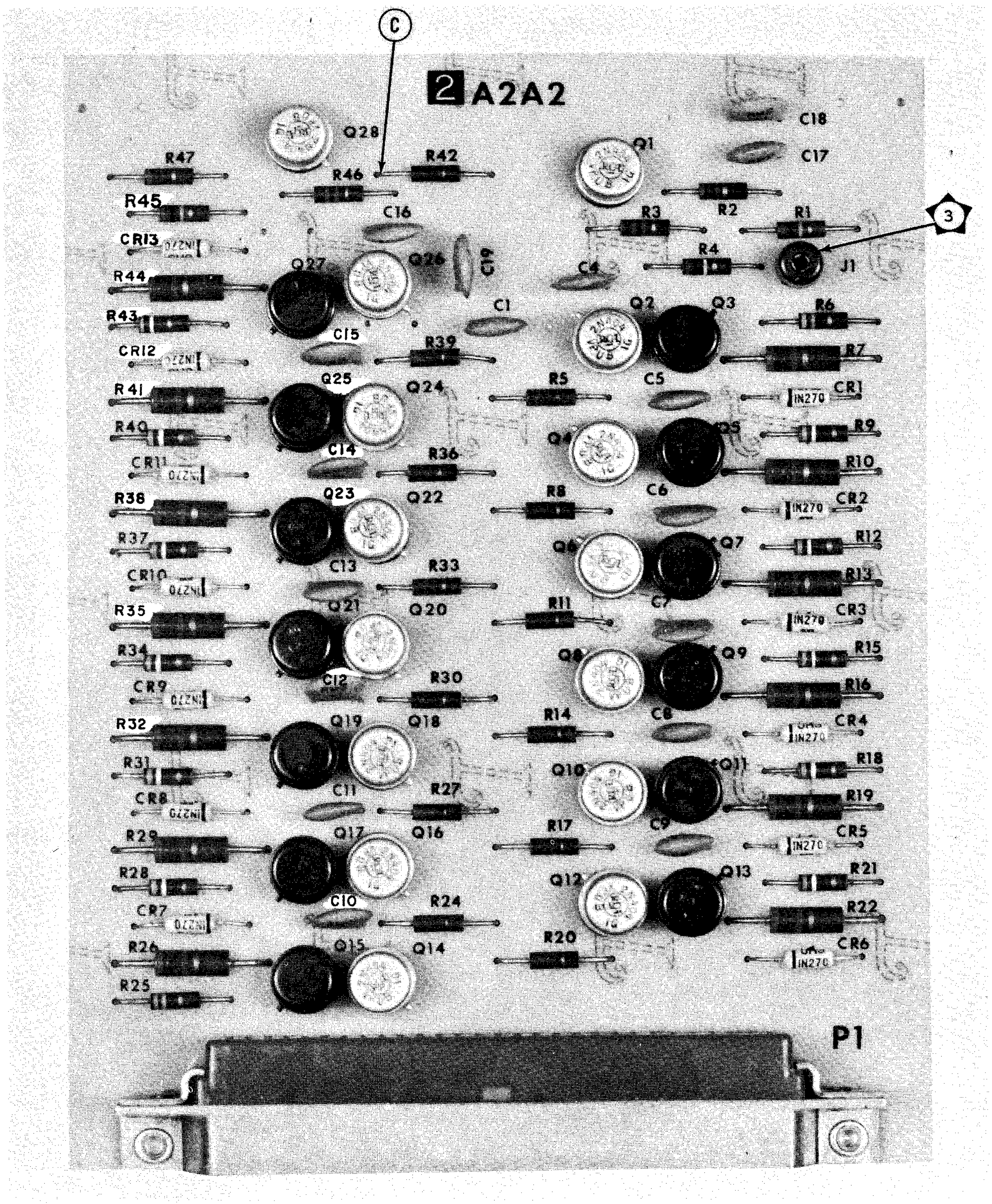


Figure 5-60. Mux-Demux, Printed Circuit Board A2

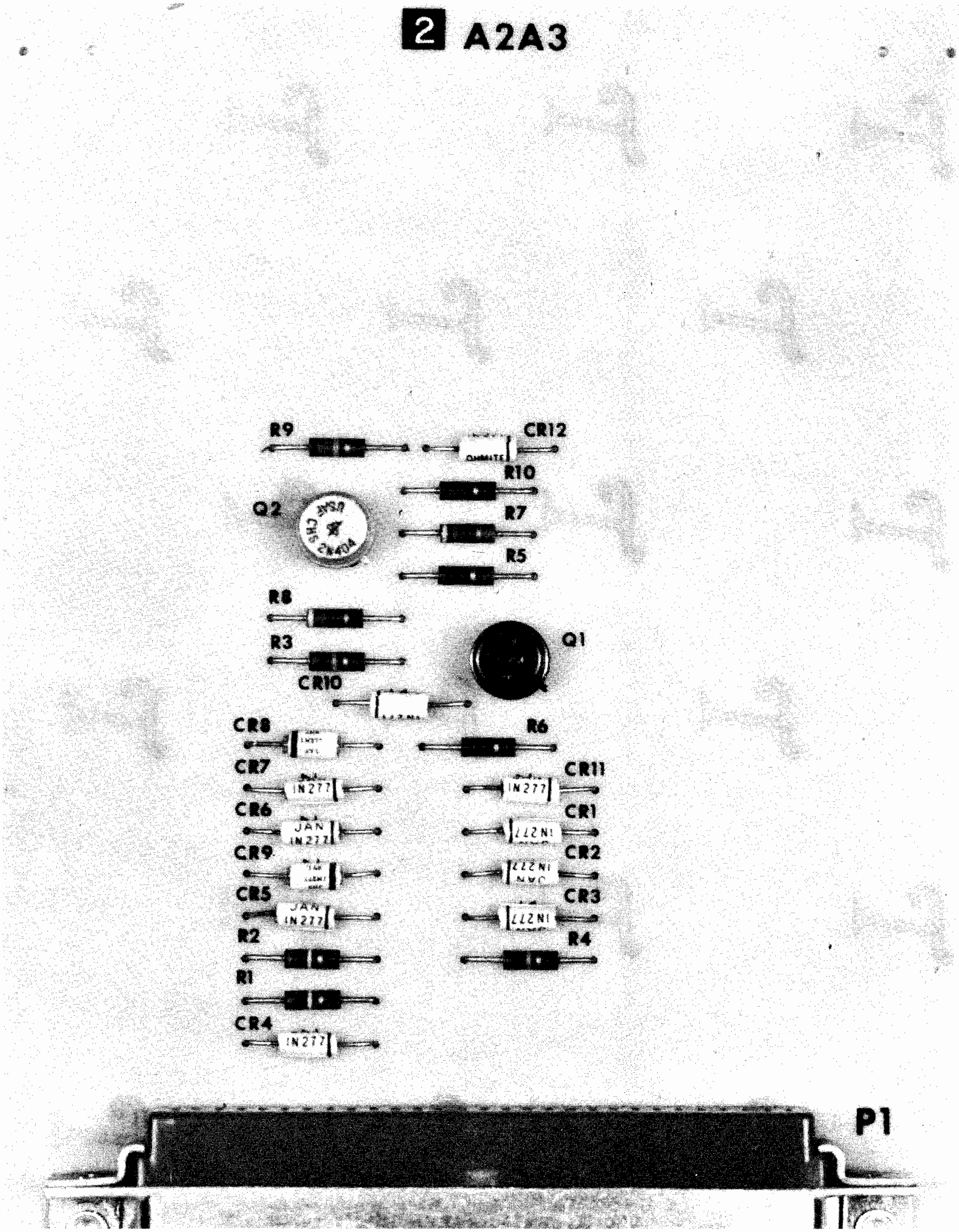


Figure 5-61. Mux-Demux, Printed Circuit Board A3

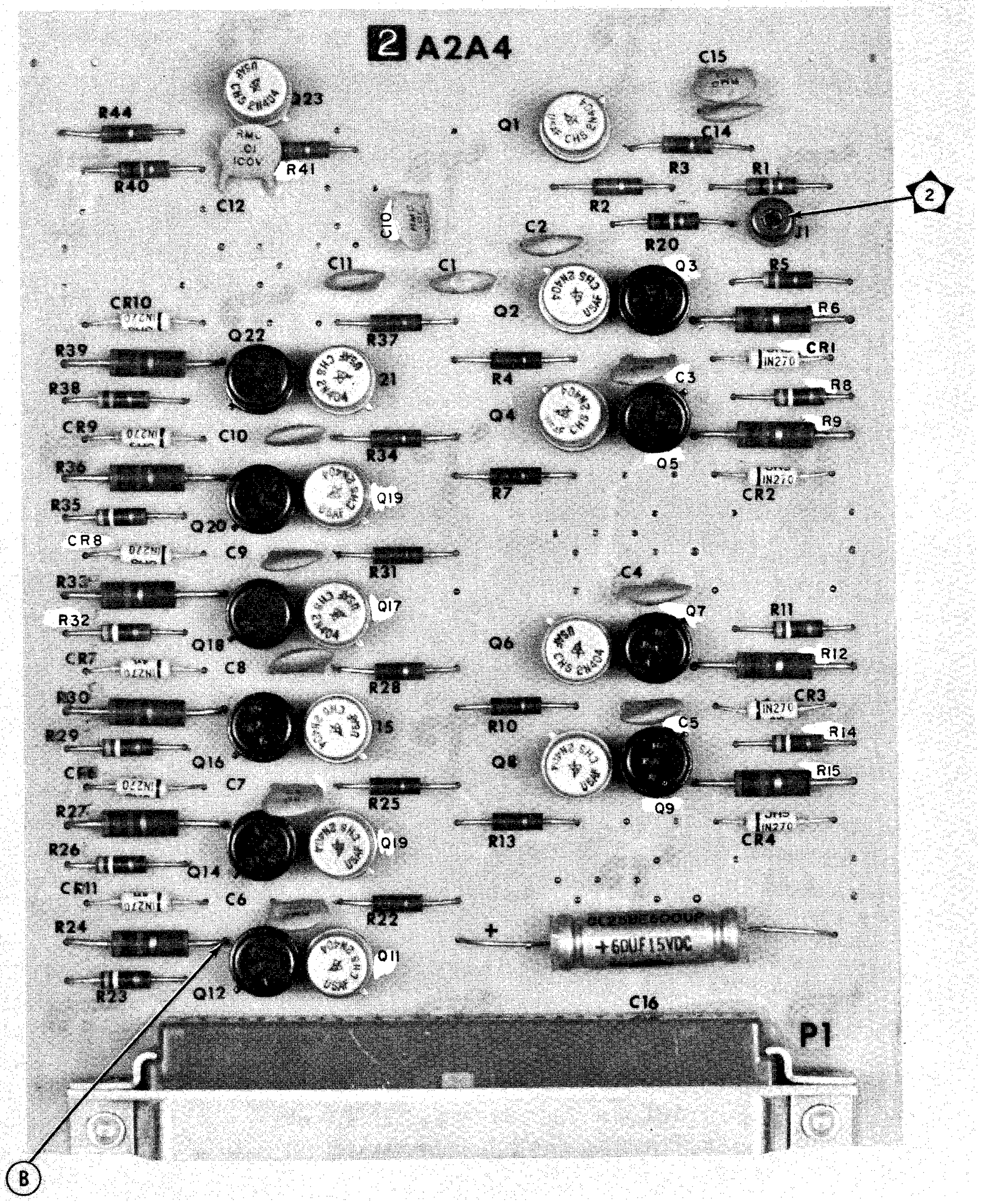


Figure 5-62. Mux-Demux, Printed Circuit Board A4

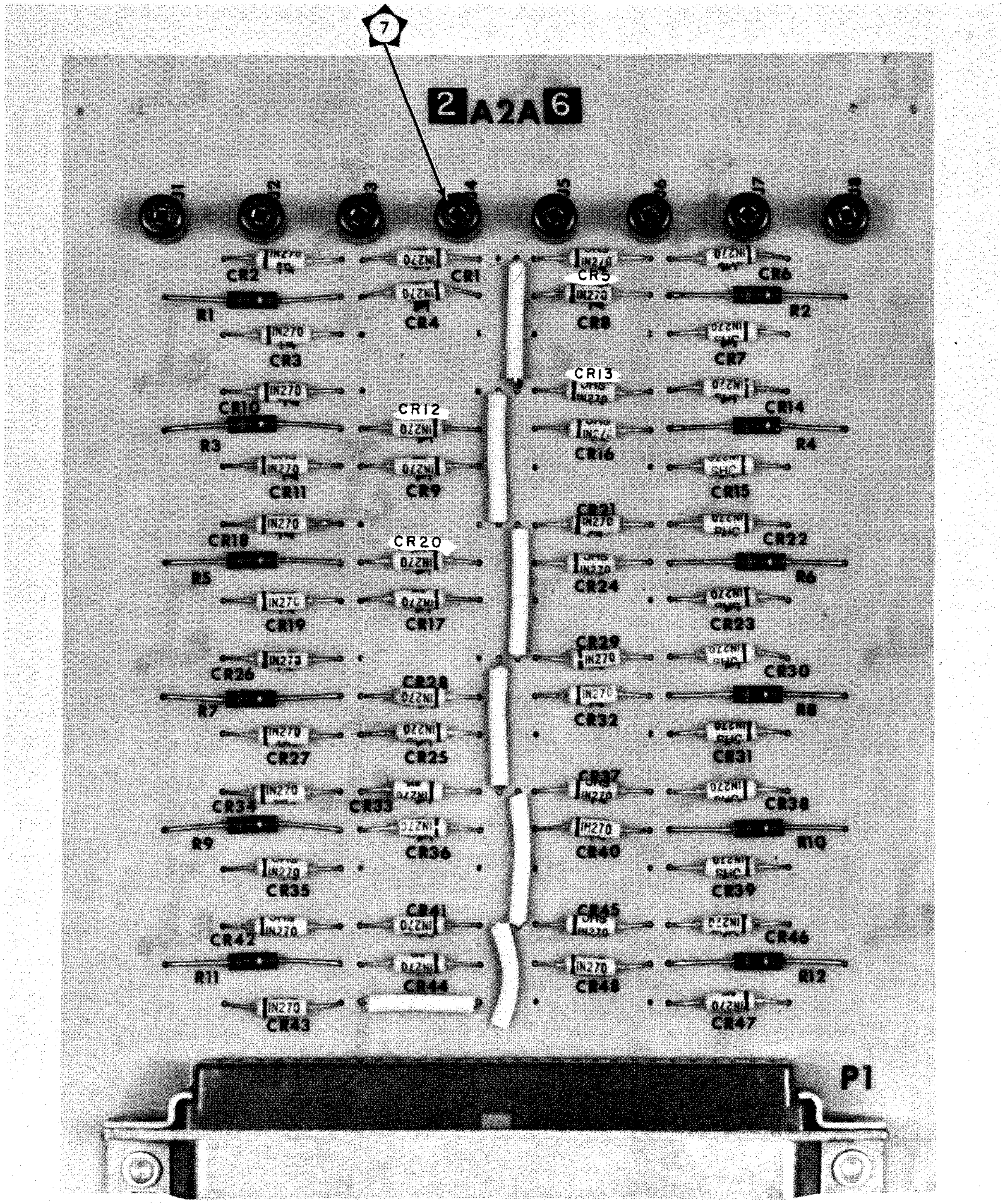


Figure 5-63. Mux-Demux, Printed Circuit Board A5

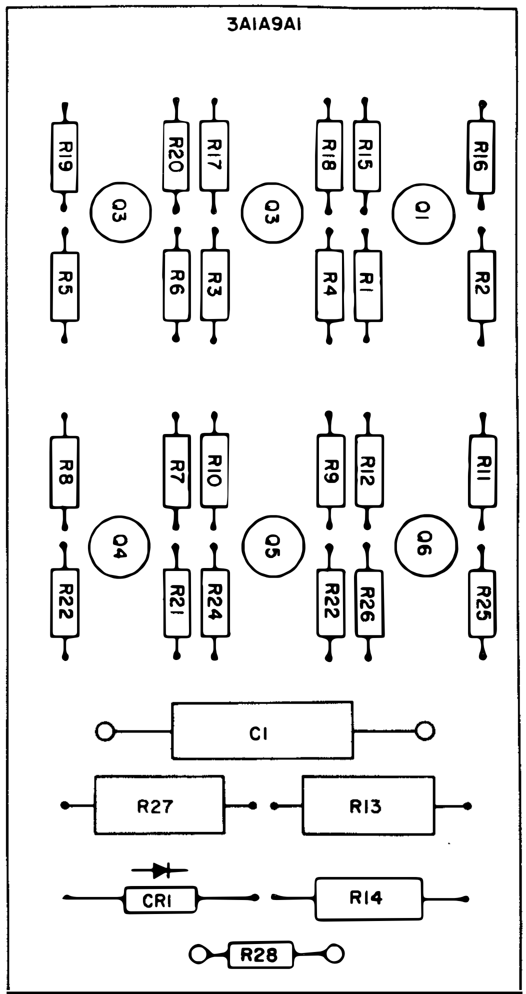


Figure 5-64. Code Converter Indicator, Printed Circuit Board 3A1A9A1

RUNNING LIST OF AN/UGC-1 UNIT #2 (Receiver)

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
1	2TB1-A1 FRONT	2TB-C1	Red	45	2TB1-F8 FRONT	2TB1-F9	Buss
2	2TB1-C1 FRONT	2TB1-C1	Red	46	2TB1-B8 FRONT	2TB1-A16	Wh/Brn/Yellow
3	2TB1-D1 FRONT	2TB1-E1	Red	47	2TB1-B9 FRONT	2TB1-A23	White
4	2TB1-E1 FRONT	2TB1-F1	Red	48	2TB1-B10 FRONT	2TB1-A40	Wh/Brn/Red
5	2TB1-A2 FRONT	2TB1-B1	Wh/Red	49	2TB1-B11 FRONT	2TB1-A34	Wh/Green
6	2TB1-B1 FRONT	2TB1-C2	Wh/Red	50	2TB1-B12 FRONT	2TB1-A15	Yellow
7	2TB1-C2 FRONT	2TB1-D2	Wh/Red	51	2TB1-A22 FRONT	2TB1-B13	Wh/Orange (A3)
8	2TB1-D2 FRONT	2TB1-E2	Wh/Red	52	2TB1-B13 FRONT	2TB1-C22	Wh/Orange (A3)
9	2TB1-E2 FRONT	2TB1-F2	Wh/Red	53	2TB1-B14 FRONT	2TB1-D22	Wh/Orange (A4)
10	2TB1-A3 FRONT	2TB1-A4	Buss	54	2TB1-B15 FRONT	2TB1-E22	Wh/Orange (A5)
11	2TB1-A4 FRONT	2TB1-C3	Wh/Red/Orange	55	2TB1-B16 FRONT	2TB1-F22	Wh/Orange (A6)
12	2TB1-C3 FRONT	2TB1-C4	Buss	56	2TB1-B17 FRONT	2TB1-C38	Wh/Black/Green
13	2TB1-C4 FRONT	2TB1-D3	Wh/Red/Orange	57	2TB1-B18 FRONT	2TB1-C40	Wh/Brown/Red
14	2TB1-D3 FRONT	2TB1-D4	Buss	58	2TB1-B19 FRONT	2TB1-C39	Wh/Black/Purple
15	2TB1-D4 FRONT	2TB1-E3	Wh/Red/Orange	59	2TB1-B20 REAR	2TB1-C20	Wh/Brown/Green
16	2TB1-E3 FRONT	2TB1-E4	Buss	60	2TB1-B21 REAR	2TB1-C21	Wh/Black/Orange
17	2TB1-E4 FRONT	2TB1-F3	Wh/Red/Orange	61	2TB1-B22 REAR	2TB1-C12	Wh/Black/Brown
18	2TB1-F3 FRONT	2TB1-F4	Buss	62	2TB1-B23 REAR	2TB1-D38	Wh/Black/Green
19	2TB1-A6 FRONT	2TB1-A5	Black	63	2TB1-B24 FRONT	2TB1-D40	Wh/Brown/Red
20	2TB1-A5 FRONT	2TB1-B2	Black	64	2TB1-B25 FRONT	2TB1-D39	Wh/Black/Purple
21	2TB1-B2 FRONT	2TB1-B3	Buss	65	2TB1-B26 REAR	2TB1-D20	Wh/Brown/Green
22	2TB1-B3 FRONT	2TB1-C6	Black	66	2TB1-B27 REAR	2TB1-D21	Wh/Black/Orange
23	2TB1-C6 FRONT	2TB1-C5	Black	67	2TB1-B28 REAR	2TB1-D12	Wh/Black/Brown
24	2TB1-C5 FRONT	2TB1-D6	Buss & Sleeve	68	2TB1-B29 REAR	2TB1-A14	Brown
25	2TB1-D6 FRONT	2TB1-D5	Black	69	2TB1-B30 REAR	2TB1-E38	Wh/Black/Green
26	2TB1-D5 FRONT	2TB1-E6	Buss & Sleeve	70	2TB1-B31 REAR	2TB1-E40	Wh/Brown/Red
27	2TB1-E6 FRONT	2TB1-E5	Black	71	2TB1-B32 REAR	2TB1-E39	Wh/Black/Purple
28	2TB1-E5 FRONT	2TB1-F6	Buss & Sleeve	72	2TB1-B33 REAR	2TB1-E20	Wh/Brown/Green
29	2TB1-F6 FRONT	2TB1-F5	Black	73	2TB1-B34 REAR	2TB1-E21	Wh/Black/Orange
30	2TB1-A7 FRONT	2TB1-B4	Wh/Purple	74	2TB1-B35 REAR	2TB1-E12	Wh/Black/Brown
31	2TB1-B4 FRONT	2TB1-C7	Wh/Purple	75	2TB1-B36 REAR	2TB1-F38	Wh/Black/Green
32	2TB1-C7 FRONT	2TB1-D7	Wh/Purple	76	2TB1-B37 REAR	2TB1-F40	Wh/Brown/Red
33	2TB1-D7 FRONT	2TB1-E7	Wh/Purple	77	2TB1-B38 REAR	2TB1-F39	Wh/Black/Purple
34	2TB1-E7 FRONT	2TB1-F7	Wh/Purple	78	2TB1-B39 REAR	2TB1-F20	Wh/Brown/Green
35	2TB1-A8 FRONT	2TB1-A9	Buss	79	2TB1-B40 REAR	2TB1-F21	Wh/Black/Orange
36	2TB1-A9 FRONT	2TB1-B6	Purple	80	2TB1-B41 REAR	2TB1-F12	Wh/Black/Brown
37	2TB1-B6 FRONT	2TB1-B5	Purple	81	2TB1-B42 FRONT	2TB1-A24	Wh/Black
38	2TB1-B5 FRONT	2TB1-C8	Purple	82	2TB1-B43 FRONT	2TB1-A26	Wh/Green/Blue
39	2TB1-C8 FRONT	2TB1-C9	Buss	83	2TB1-B44 FRONT	2TB1-A44	Wh/Red/Purple
40	2TB1-C9 FRONT	2TB1-D8	Purple	84	2TB1-B45 FRONT	2TB1-A13	Wh/Black/Blue
41	2TB1-D8 FRONT	2TB1-D9	Buss	85	2TB1-A19 FRONT	2TB1-C19	Wh/Brown/Blue
42	2TB1-D9 FRONT	2TB1-E8	Purple	86	2TB1-A35 FRONT	2TB1-C35	Wh/Blue
43	2TB1-E8 FRONT	2TB1-E9	Buss	87	2TB1-C35 FRONT	2TB1-D35	Wh/Blue
44	2TB1-E9 FRONT	2TB1-F8	Purple	88	2TB1-D35 FRONT	2TB1-E35	Wh/Blue

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #2 (Receiver

ITEM	FROM	TO	COLOR
87	2TB1-C35 FRONT	2TB1-D35	Wh/Blue
88	2TB1-D35 FRONT	2TB1-E35	Wh/Blue
89	2TB1-E35 FRONT	2TB1-F35	Wh/Blue
90	2TB1-A36 FRONT	2TB1-C36	Wh/Black/Red
91	2TB1-C36 FRONT	2TB1-D36	Wh/Black/Red
92	2TB1-D36 FRONT	2TB1-E36	Wh/Black/Red
93	2TB1-E36 FRONT	2TB1-F36	Wh/Black/Red
94	2TB1-A37 FRONT	2TB1-C37	Wh/Black/Yellow
95	2TB1-C37 FRONT	2TB1-D37	Wh/Black/Yellow
96	2TB1-D37 REAR	2TB1-E37	Wh/Black/Yellow
97	2TB1-E37 REAR	2TB1-F37	Wh/Black/Yellow
98	2TB1-C13 REAR	2TB1-D14	Brown
99	2TB1-D14 REAR	2TB1-E14	Brown
100	2TB1-E14 REAR	2TB1-F14	Brown
101	2TB1-C14 REAR	2TB1-D13	White/Black/Blue
102	2TB1-D13 REAR	2TB1-E15	Yellow
103	2TB1-E15 REAR	2TB1-F15	Yellow
104	2TB1-C15 REAR	2TB1-D15	Yellow
105	2TB1-D15 REAR	2TB1-E13	Wh/Black/Blue
106	2TB1-E13 REAR	2TB1-F16	Wh/Brown/Yellow
107	2TB1-C16 REAR	2TB1-D16	Wh/Brown/Yellow
108	2TB1-D16 REAR	2TB1-E16	Wh/Brown/Yellow
109	2TB1-E16 REAR	2TB1-F13	Wh/Black/Blue
110	2TB1-C23 REAR	2TB1-D24	Wh/Black
111	2TB1-D24 REAR	2TB1-E24	Wh/Black
112	2TB1-E24 REAR	2TB1-F24	Wh/Black
113	2TB1-C24 REAR	2TB1-D23	White
114	2TB1-D23 REAR	2TB1-E25	Orange
115	2TB1-E25 REAR	2TB1-F25	Orange
116	2TB1-C25 REAR	2TB1-D25	Orange
117	2TB1-E23 REAR	2TB1-E23	White
118	2TB1-E23 REAR	2TB1-F26	White/Green/Blue
119	2TB1-C26 REAR	2TB1-D26	White/Green/Blue
120	2TB1-D26 REAR	2TB1-E26	White/Green/Blue
121	2TB1-E26 REAR	2TB1-F23	White
122	2J2-F	2TB1-A1	Red
123	2J2-E FRONT	2TB1-A2	Wh/Red
124	2J2-D FRONT	2TB1-A3	Wh/Red/Orange
125	2J2-C FRONT	2TB1-A5	Black
126	2J2-B FRONT	2TB1-A7	Wh/Purple
127	2J2-A FRONT	2TB1-A8	Purple
128	2J2 -G FRONT	2TB1-A10	Wh/Red/Green
129	2J2-H FRONT	2TB1-A11	Wh/Red/Blue
130	2J2-R FRONT	2TB1-HJ9V	Purple Shielded
131	2J2-P FRONT	2TB1-AJ9X	White Shielded
132	2TB1-A28 FRONT	2J3-T	Wh/Yellow
133	2TB2-8 REAR	2TB1-F9	Purple
134	2TB3-8	2TB1-A28	Wh/Yellow
135	2J1-B FRONT	2TB1-A12	Wh/Black/Brown
136	2J1-G FRONT	2TB1-A25	Orange
137	2J1-J FRONT	2TB1-A27	Wh/Brown
138	2J1-E FRONT	2TB1-A17	Green
139	2J1-F FRONT	2TB1-A21	Wh/Black/Orange
140	2J3-N FRONT	2TB1-C9	Purple
141	Filter 3-1	2TB1-AJ9h	Shield Inner White
142	Filter 4-1	2TB1-AJ9j	Shield Inner Purple
143	Filter Gnd	2TB1-AJ9m	Shield of Double
144	Filter 3-2 FRONT	2TB2-6	Wh/Brown/Blue
145	Filter 3-2 FRONT	2J3-H	Wh/Brown/Blue
146	Filter 4-2	2TB2-5	Wh/Brown/Green
147	Filter 4-2	2J3-K	Wh/Brown/Green
148	Filter 5-1	CJ9h	Shield Inner White
149	Filter 6-1	CJ9j	Shield Inner Purple
150	Filter Gnd	CJ9m	Shield of Double
151	Filter 5-2	2TB2-2	Wh/Green/Blue
152	Filter 5-2	2J3-B	Wh/Green/Blue
153	Filter 6-2	2TB2-1	Wh/Black/Red
154	Filter 6-2	2J3-A	Wh/Black/Red
155	Filter 9-1	DJ9h	Shield Inner White
156	Filter 10-1	DJ9j	Shield Inner Purple
157	Filter Gnd	DJ9m	Shield of Double
158	Filter 9-2	2TB2-4	Wh/Black/Yellow
159	Filter 9-2	2J3-P	Wh/Black/Yellow
160	Filter 10-2	2TB2-3	Wh/Black/Green
161	Filter 10-2	2J3-C	Wh/Black/Green
162	Filter 11-1	EJ9h	Shield Inner White
163	Filter 12-1	EJ9j	Shield Inner Purple
164	Filter Gnd	EJ9m	Shield of Double
165	Filter 11-2	2TB3-2	Wh/Black/Purple

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #2 (Receiver)

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
166	Filter 11-2	2J3-E	Wh/Black/Purple	210	2TB1-A14	AJ9-R	Brown
167	Filter 12-2	2TB3-1	Wh/Brown/Yellow	211	2TB1-A15	AJ9-S	Yellow
168	Filter 12-2	2J3-D	Wh/Brown/Yellow	212	2TB1-A16	AJ9-T	Wh/Brown/Yellow
169	Filter 13-1	FS9h	Shield Inner White	213	2TB1-A17	AJ9-U	Green
170	Filter 14-1	FJ9j	Shield Inner Purple	214	2TB1-A19	AJ9-W	Wh/Brown/Blue
171	Filter Gnd	FJ9m	Shield of Double	215	2TB1-A21	AJ9-Y	Wh/Black/Orange
172	Filter 13-2	2 TB3-4	Wh/Brown/Red	216	2TB1-A22	AJ9-Z	Wh/Orange
173	Filter 13-2	2J3-G	Wh/Brown/Red	217	2TB1-A23	AJ9-a	White
174	Filter 14-2	2TB3-3	Wh/Yellow/Purple	218	2TB1-A24	AJ9-b	Wh/Black
175	Filter 14-2	2J3-F	Wh/Yellow/Purple	219	2TB1-A25	AJ9-c	Brown
176	Filter 1-1	AJ9n	Shield Inner Green	220	2TB1-A26	AJ9-d	Wh/Green/Blue
177	Filter Gnd	AJ9k	Shield of Inner	221	2TB1-A27	AJ9-e	Wh/Brown
178	Filter 1-2	2TB3-5	Wh/Orange/Green	222	2TB1-A28	AJ9-f	Wh/Yellow
179	Filter 1-2	2J3-L	Wh/Orange/Green	223	2TB1-A34	AJ9-p	Wh/Green
180	Filter 1-2	2J2-L	Wh/Orange/Green	224	2TB1-A35	AJ9-r	Wh/Blue
181	Filter Gnd-9	2TB1-D6	Black	225	2TB1-A36	AJ9-s	Wh/Black/Red
182	Filter Gnd-11	2J1-I	Black	226	2TB1-A37	AJ9-t	Wh/Black/Yellow
183	Filter Gnd-4	2J3-J	Black	227	2TB1-A38	AJ9-u	Wh/Black/Green
184	Filter Gnd-11	2TB2-7	Black	228	2TB1-A39	AJ9-v	Wh/Black/Purple
185	2J2-M FRONT	2TB1-C18	Wh/Blue	229	2TB1-A40	AJ9-w	Wh/Brown/Red
186	2J2-N FRONT	2TB1-E18	Wh/Black/Blue	230	2TB1-A41	AJ9-x	Wh/Brown/Orange
187	2J2-J FRONT	2TB1-C17	Blue	231	2TB1-A42	AJ9-y	Wh/Brown/Yellow
188	2J2-S FRONT	2TB1-C27	Green	232	2TB1-A43	AJ9-z	Wh/Red/Yellow
189	2J2-T FRONT	2TB1-E27	Wh/Black/Green	233	2TB1-A44	AJ9-AA	White
190	2TB1-C18 FRONT	2TB1-D18	Wh/Blue	234	2TB1-A46	AJ9-CC	Purple
191	2TB1-E18 FRONT	2TB1-F18	Wh/Black/Blue	235	2TB1-A45	AJ9-BB	Wh/Orange/Yellow
192	2TB1-C17 FRONT	2TB1-D17	Blue	236	2TB1-A47	AJ9-DD	Wh/Orange/Blue
193	2TB1-D17 FRONT	2TB-E17	Blue	237	2TB1-A48	AJ9-EE	Wh/Orange/Purple
194	2TB1-E17 FRONT	2TB1-F17	Blue	238	2TB1-A49	AJ9-FF	Blue
195	2TB1-C27 FRONT	2TB1-D27	Green	239	2TB1-A50	AJ9-HH	Wh/Blue
196	2TB1-E27 FRONT	2TB1-F27	Wh/Black/Green	240	2TB1-B1	BJ9-A	Wh/Red
197	2TB1-A1	AJ9-A	Red	241	2TB1-B2	BJ9-B	Black
198	2TB1-A2	AJ9-B	Wh/Red	242	2TB1-B3	BJ9-C	Black
199	2TB1-A3	AJ9-C	Wh/Red/Orange	243	2TB1-B4	BJ9-D	Wh/Purple
200	2TB1-A4	AJ9-D	Wh/Red/Orange	244	2TB1-B5	BJ9-E	Purple
201	2TB1-A5	AJ9-E	Black	245	2TB1-B6	BJ9-F	Purple
202	2TB1-A6	AJ9-F	Black	246	2TB1-B7	BJ9-H	Blue
203	2TB1-A7	AJ9-H	Wh/Purple	247	2TB1-B8	BJ9-J	Wh/Brown/Yellow
204	2TB1-A 8	AJ9-J	Purple	248	2TB1-B9	BJ9-K	Wh/Orange/Green
205	2TB1-A9	AJ9-K	Purple	249	2TB1-B10	BJ9-L	Wh/Red/Yellow
206	2TB1-A10	AJ9-L	Wh/Red/Green	250	2TB1-B11	BJ9-M	Green
207	2TB1-A11	AJ9-M	Wh/Red/Blue	251	2TB1-B12	BJ9-N	Yellow
208	2TB1-A12	AJ9-N	Wh/Black/Brown	252	2TB1-B13	BJ9-D	Wh/Orange
209	2TB1-A13	AJ9-P	Wh/Black/Blue				

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #2 (Receiver)

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
253	2TB1-B14	BJ9-R	Wh/Orange/Yellow	296	2TB1-C7	CJ9-H	Wh/Purple
254	2TB1-B15	BJ9-S	Wh/Orange/Blue	297	2TB1-C8	CJ9-J	Purple
255	2TB1-B16	BJ9-T	Wh/Orange/Purple	298	2TB1-C9	CJ9-K	Purple
256	2TB1-B17	BJ9-U	Wh/Red/Orange	299	2TB1-C10	CJ9-L	Wh/Red/Green
257	2TB1-B18	BJ9-V	Wh/Red/Blue	300	2TB1-C11	CJ9-M	Wh/Red/Blue
258	2TB1-B19	BJ9-W	Wh/Yellow/Purple	301	2TB1-C12	CJ9-N	Wh/Black/Brown
259	2TB1-B20	BJ9-X	Wh/Black/Green	302	2TB1-C13	CJ9-P	Wh/Black/ Blue
260	2TB1-B21	BJ9-Y	Wh/Blue	303	2TB1-C14	CJ9-R	Brown
261	2TB1-B22	BJ9-Z	Wh/Yellow	304	2TB1-C15	CJ9-S	Yellow
262	2TB1-B23	BJ9-a	Wh/Brown/Purple	305	2TB1-C16	CJ9-T	Wh/Brown/Yellow
263	2TB1-B24	BJ9-b	Orange	306	2TB1-C17	CJ9-U	Green
264	2TB1-B25	BJ9-c	Wh/Black/Brown	307	2TB1-C18	CJ9-V	Wh/Yellow/Purple
265	2TB1-B26	BJ9-d	Wh/Black/Red	308	2TB1-C19	CJ9-W	Wh/Brown/ Blue
266	2TB1-B27	BJ9-e	White	309	2TB1-C20	CJ9-X	Wh/Brown/Green
267	2TB1-B28	BJ9-f	Wh/Yellow/Blue	310	2TB1-C21	CJ9-Y	Wh/Black/Orange
268	2TB1-B29	BJ9-h	Brown	311	2TB1-C22	CJ9-Z	Wh/Orange
269	2TB1-B30	BJ9-j	Wh/Brown/Green	312	2TB1-C23	CJ9-a	White
270	2TB1-B31	BJ9-k	Wh/Brown/Blue	313	2TB1-C24	CJ9-b	Wh/Black
271	2TB1-B32	BJ9-m	Wh/Black/Purple	314	2TB1-C25	CJ9-c	Orange
272	2TB1-B33	BJ9-n	Wh/Green/Purple	315	2TB1-C26	CJ9-d	Wh/Green/Blue
273	2TB1-B34	BJ9-p	Wh/Brown/Orange	316	2TB1-C27	CJ9-e	Wh/Brown
274	2TB1-B35	BJ9-r	Wh/Black/Orange	317	2TB1-C28	CJ9-f	Wh/Yellow
275	2TB1-B36	BJ9-s	Wh/Brown/Red	318	2TB1-C31	CJ9-k	Black
276	2TB1-B37	BJ9-t	Wh/Brown	319	2TB1-C33	CJ9-n	Green
277	2TB1-B38	BJ9-u	Wh/Yellow/Green	320	2TB1-C34	CJ9-p	Wh/Green
278	2TB1-B39	BJ9-v	Wh/Green	321	2TB1-C35	CJ9-r	Wh/Blue
279	2TB1-B40	BJ9-w	Wh/Red/Green	322	2TB1-C36	CJ9-s	Wh/Black/Red
280	2TB1-B41	BJ9-x	Wh/Black/Yellow	323	2TB1-C37	CJ9-t	Wh/Black/Yellow
281	2TB1-B42	BJ9-y	Wh/Black	324	2TB1-C38	CJ9-u	Wh/Black/Green
282	2TB1-B43	BJ9-z	Wh/Green/Blue	325	2TB1-C39	CJ9-v	Wh/Black/Purple
283	2TB1-A44	BJ9-AA	White	326	2TB1-C40	CJ9-w	Wh/Brown/Red
284	2TB1-A46	BJ9-CC	Purple	327	2TB1-C41	CJ9-x	Wh/Brown/Orange
285	2TB1-B45	BJ9-BB	Wh/Black/Blue	328	2TB1-C42	CJ9-y	Wh/Brown/Yellow
286	2TB1-B47	BJ9-DD	Wh/Blue/Gray	329	2TB1-C43	CJ9-z	Wh/Red/Yellow
287	2TB1-B48	BJ9-EE	Wh/Orange/Gray	330	2TB1-C44	CJ9-AA	Wh/Red/Purple
288	2TB1-B49	BJ9-FF	Wh/Green/Gray	331	2TB1-C45	CJ9-BB	Wh/Orange/Yellow
289	2TB1-B50	BJ9-HH	Wh/Red/Gray	332	2TB1-C46	CJ9-CC	Wh/Orange/Green
290	2TB1-C1	CJ9-A	Red	333	2TB1-C47	CJ9-DD	Wh/Orange/Blue
291	2TB1-C2	CJ9-B	Wh/Red	334	2TB1-C48	CJ9-EE	Wh/Orange/Purple
292	2TB1-C3	CJ9-C	Wh/Red/Orange	335	2TB1-C49	CJ9-FF	Blue
293	2TB1-C4	CJ9-D	Wh/Red/Orange	336	2TB1-C50	CJ9-HH	Wh/Blue
294	2TB1-C5	CJ9-E	Black	337	2TB1-D1	DJ9-A	Red
295	2TB1-C6	CJ9-F	Black	338	2TB1-D2	DJ9-B	Wh/Red
				339	2TB1-D3	DJ9-C	Wh/Red/Orange

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #2 (Receiver)

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
340	2TB1-D4	DJ9-D	Wh/Red/Orange	384	2TB1-E1	EJ9-A	Red
341	2TB1-D5	DJ9-E	Black	385	2TB1-E2	EJ9-B	Wh/Red
342	2TB1-D6	DJ9-F	Black	386	2TB1-E3	EJ9-C	Wh/Red/Orange
343	2TB1-D7	DJ9-H	Wh/Purple	387	2TB1-E4	EJ9-D	Wh/Red/Orange
344	2TB1-D8	DJ9-J	Purple	388	2TB1-E5	EJ9-E	Black
345	2TB1-D9	DJ9-K	Purple	389	2TB1-E6	EJ9-F	Black
346	2TB1-D10	DJ9-L	Wh/Red/Green	390	2TB1-E7	EJ9-H	Wh/Purple
347	2TB1-D11	DJ9-M	Wh/Red/Blue	391	2TB1-E8	EJ9-J	Purple
348	2TB1-D12	DJ9-N	Wh/Black/Brown	392	2TB1-E9	EJ9-K	Purple
349	2TB1-D13	DJ9-P	Wh/Black/Blue	393	2TB1-E10	EJ9-L	Wh/Red/Green
350	2TB1-D14	DJ9-R	Brown	394	2TB1-E11	EJ9-M	Wh/Red/Blue
351	2TB1-D15	DJ9-S	Yellow	395	2TB1-E12	EJ9-N	Wh/Black/Brown
352	2TB1-D16	DJ9-T	Wh/Brown/Yellow	396	2TB1-E13	EJ9-P	Wh/Black/Blue
353	2TB1-D17	DJ9-U	Green	397	2TB1-E14	EJ9-R	Brown
354	2TB1-D18	DJ9-V	Wh/Yellow/Purple	398	2TB1-E15	EJ9-S	Yellow
355	2TB1-D19	DJ9-W	Wh/Brown/Blue	399	2TB1-E16	EJ9-T	Wh/Brown/Yellow
356	2TB1-D20	DJ9-X	Wh/Brown/Green	400	2TB1-E17	EJ9-U	Green
357	2TB1-D21	DJ9-Y	Wh/Black/Orange	401	2TB1-E18	EJ9-V	Wh/Yellow/Purple
358	2TB1-D22	DJ9-Z	Wh/Orange	402	2TB1-E19	EJ9-W	Wh/Brown/Blue
359	2TB1-D23	DJ9-a	White	403	2TB1-E20	EJ9-X	Wh/Brown/Green
360	2TB1-D24	DJ9-b	Wh/Black	404	2TB1-E21	EJ9-Y	Wh/Black/Orange
361	2TB1-D25	DJ9-c	Orange	405	2TB1-E22	EJ9-Z	Wh/Orange
362	2TB1-D26	DJ9-d	Wh/Green/Blue	406	2TB1-E23	EJ9-a	White
363	2TB1-D27	DJ9-e	Wh/Brown	407	2TB1-E24	EJ9-b	Wh/Black
364	2TB1-D28	DJ9-f	Wh/Yellow	408	2TB1-E25	EJ9-c	Orange
365	2TB1-D31	DJ9-k	Black	409	2TB1-E26	EJ9-d	Wh/ Green/ Blue
366	2TB1-D33	DJ9-n	Green	410	2TB1-E27	EJ9-e	Wh/Brown
367	2TB1-D34	DJ9-p	Wh/Green	411	2TB1-E28	EJ9-f	Wh/Yellow
368	2TB1-D35	DJ9-r	Wh/Blue	412	2TB1-E31	EJ9-k	Black
369	2TB1-D36	DJ9-s	Wh/Black/Red	413	2TB1-E33	EJ9-n	Green
370	2TB1-D37	DJ9-t	Wh/Black/Yellow	414	2TB1-E34	EJ9-p	Wh/Green
371	2TB1-D38	DJ9-u	Wh/Black/Green	415	2TB1-E35	EJ9-r	Wh/Blue
372	2TB1-D39	DJ9-v	Wh/Black/Purple	416	2TB1-E36	EJ9-s	Wh/Black/Red
373	2TB1-D40	DJ9-w	Wh/Brown/Red	417	2TB1-E37	EJ9-t	Wh/Black/Yellow
374	2TB1-D41	DJ9-x	Wh/Brown/Orange	418	2TB1-E38	EJ9-u	Wh/Black/Green
375	2TB1-D42	DJ9-y	Wh/Brown/Yellow	419	2TB1-E39	EJ9-v	Wh/Black/Purple
376	2TB1-D43	DJ9-z	Wh/Red/Yellow	420	2TB1-E40	EJ9-w	Wh/Brown/Red
377	2TB1-D44	DJ9-AA	Wh/Red/Purple	421	2TB1-E41	EJ9-x	Wh/Brown/Orange
378	2TB1-D45	DJ9-BB	Wh/Orange/Yellow	422	2TB1-E42	EJ9-y	Wh/Brown/Yellow
379	2TB1-D46	DJ9-CC	Wh/Orange/Green	423	2TB1-E43	EJ9-z	Wh/Red/Yellow
380	2TB1-D47	DJ9-DD	Wh/Orange/Blue				
381	2TB1-D48	DJ9-EE	Wh/Orange/Purple				
382	2TB1-D49	DJ9-FF	Blue				
383	2TB1-D50	DJ9-HH	Wh/Blue				

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #2 (Receiver)

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
424	2TB1-E44	EJ9-AA	Wh/Red/Purple	464	2TB1-F37	FJ9-t	Wh/Black/Yellow
425	2TB1-E45	EJ9-BB	Wh/Orange/Yellow	465	2TB1-F38	FJ9-u	Wh/Black/Green
426	2TB1-E46	EJ9-CC	Wh/Orange/Green	466	2TB1-F39	FJ9-v	Wh/Black/Purple
427	2TB1-E47	EJ9-DD	Wh/Orange/Blue	467	2TB1-F40	FJ9-w	Wh/Brown/Red
428	2TB1-E48	EJ9-EE	Wh/Orange/Purple	468	2TB1-F41	FJ9-x	Wh/Brown/Orange
429	2TB1-E49	EJ9-FF	Blue	469	2TB1-F42	FJ9-y	Wh/Brown/Yellow
430	2TB1-E50	EJ9-HH	Wh/Blue	470	2TB1-F43	FJ9-z	Wh/Red/Yellow
431	2TB1-F1	FJ9-A	Red	471	2TB1-F44	FJ9-AA	Wh/Red/Purple
432	2TB1-F2	FJ9-B	Wh/Red	472	2TB1-F45	FJ9-BB	Wh/Orange/Yellow
433	2TB1-F3	FJ9-C	Wh/Red/Orange	473	2TB1-F46	FJ9-CC	Wh/Orange/Green
434	2TB1-F4	FJ9-D	Wh/Red/Orange	474	2TB1-F47	FJ9-DD	Wh/Orange/Blue
435	2TB1-F5	FJ9-E	Black	475	2TB1-F48	FJ9-EE	Wh/Orange/Purple
436	2TB1-F6	FJ9-F	Black	476	2TB1-F49	FJ9-FF	Blue
437	2TB1-F7	FJ9-H	Wh/Purple	477	2TB1-F50	FJ9-HH	Wh/Blue
438	2TB1-F8	FJ9-J	Purple				
439	2TB1-F9	FJ9-K	Purple				
440	2TB1-F10	FJ9-L	Wh/Red/Green				
441	2TB1-F11	FJ9-M	Wh/Red/Blue				
442	2TB1-F12	FJ9-N	Wh/Black/Brown				
443	2TB1-F13	FJ9-P	Wh/Black/Blue				
444	2TB1-F14	FJ9-R	Blue				
445	2TB1-F15	FJ9-S	Yellow				
446	2TB1-F16	FJ9-T	Wh/Brown/Yellow				
447	2TB1-F17	FJ9-U	Green				
448	2TB1-F18	FJ9-V	Wh/Yellow/Purple				
449	2TB1-F19	FJ9-W	Wh/Brown/Blue				
450	2TB1-F20	FJ9-X	Wh/Brown/Green'				
451	2TB1-F21	FJ9-Y	Wh/Black/Orange				
452	2TB1-F22	FJ9-Z	Wh/Orange				
453	2TB1-F23	FJ9-a	White				
454	2TB1-F24	FJ9-b	Wh/Black				
455	2TB1-F25	FJ9-c	Orange				
456	2TB1-F26	FJ9-d	Wh/Green/Blue				
457	2TB1-F27	FJ9-e	Wh/Brown				
458	2TB1-F28	FJ9-f	Wh/Yellow				
459	2TB1-F31	FJ9-k	Black				
460	2TB1-F33	FJ9-n	Green				
461	2TB1-F34	FJ9-p	Wh/Green				
462	2TB1-F35	FJ9-r	Wh/Blue				
463	2TB1-F36	FJ9-s	Wh/Black/Red				

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #3 (Transmitter

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
1	3TB1-A1	3TB1-C1	Red	45	3TB1-F8	3TB1-F9	Buss
2	3TB1-C1	3TB1-D1	Red	46	3TB1-A26	3TB1-B43	Wh/Green/Blue
3	3TB1=D1	3TB1-E1	Red	47	3TB1-B42	3TB1-B43	Buss
4	3TB1-E1	3TB1-F1	Red	48	3TB1-A12	3TB1-B7	Wh/Black/Brown
5	3TB1-A2	3TB1-B1	Wh/Red	49	3TB1-A13	3TB1-B45	Wh/Black/Blue
6	3TB1-B1	3TB1-C2	Wh/Red	50	3TB1-A22	3TB1-B14	Wh/Orange
7	3TB1-C2	3TB1-D2	Wh/Red	51	3TB1-B14	3TB1-D22	Wh/Orange
8	3TB1-D2	3TB1-E2	Wh/Red	52	3TB1-B13	3TB1-C22	Wh/Orange
9	3TB1-E2	3TB1-F2	Wh/Red	53	3TB1-B15	3TB1-E22	Wh/Orange
10	3TB1-A3	3TB1-A4	Buss	54	3TB1-B16	3TB1-F22	Wh/Orange
11	3TB1-A4	3TB1-C3	Wh/Red/Orange	55	3TB1-B17	3TB1-C14	Brown
12	3TB1-C3	3TB1-C4	Buss	56	3TB1-B18	3TB1-C19	Buss
13	3TB1-C4	3TB1-D3	Wh/Red/Orange	57	3TB1-B19	3TB1-C18	Wh/Yellow/Purple
14	3TB1-D3	3TB1-D4	Buss	58	3TB1-B20	3TB1-C17	Green
15	3TB1-D4	3TB1-E3	Wh/Red/Orange	59	3TB1-B21	3TB1-C23	White
16	3TB1-E3	3TB1-E4	Buss	60	3TB1-B22	3TB1-C15	Yellow
17	3TB1-E4	3TB1-F3	Wh/Red/Orange	61	3TB1-B23	3TB1-D14	Brown
18	3TB1-F3	3TB1-F4	Buss	62	3TB1-B24	3TB1-D13	Wh/Brown/Blue
19	3TB1-A6	3TB1-A5	Black	63	3TB1-B25	3TB1-D12	Wh/Black/Brown
20	3TB1-A5	3TB1-B2	Black	64	3TB1-B26	3TB1-D24	Wh/Black
21	3TB1-B2	3TB1-B3	Buss	65	3TB1-B27	3TB1-D23	White
22	3TB1-B3	3TB1-C6	Black	66	3TB1-B28	3TB1-D15	Yellow
23	3TB1-C6	3TB1-C5	Black	67	3TB1-B30	3TB1-E20	Wh/Brown/Green
24	3TB1-C5	3TB1-D6	Buss	68	3TB1-B31	3TB1-E19	Wh/Brown/Blue
25	3TB1-D6	3TB1-D5	Black	69	3TB1-B32	3TB1-E18	Wh/Yellow/Purple
26	3TB1-D5	3TB1-E6	Buss	70	3TB1-B33	3TB1-E17	Green
27	3TB1-E6	3TB1-E5	Black	71	3TB1-B34	3TB1-E16	Wh/Brown/Yellow
28	3TB1-E5	3TB1-F6	Buss	72	3TB1-B35	3TB1-E21	Wh/Black/Orange
29	3TB1-F6	3TB1-F5	Black	73	3TB1-B36	3TB1-F20	Wh/Brown/Green
30	3TB1-A7	3TB1-B4	Wh/Purple	74	3TB1-B37	3TB1-F19	Wh/Brown/Blue
31	3TB1-B4	3TB1-C7	Wh/Purple	75	3TB1-B38	3TB1-F18	Wh/Yellow/Purple
32	3TB1-C7	3TB1-D7	Wh/Purple	76	3TB1-B39	3TB1-F17	Green
33	3TB1-D7	3TB1-E7	Wh/Purple	77	3TB1-B40	3TB1-F16	Wh/Brown/Yellow
34	3TB1-E7	3TB1-F7	Wh/Purple	78	3TB1-B41	3TB1-F21	Wh/Black/Orange
35	3TB1-A8	3TB1-A9	Jumper	79	3J2-F	3TB1-A1	Red
36	3TB1-A9	3TB1-B6	Purple	80	3J2-E	3TB1-A2	Wh/Red
37	3TB1-B6	3TB1-B5	Purple	81	3J2-D	3TB1-A3	Wh/Red/Orange
38	3TB1-B5	3TB1-C8	Purple	82	3J2-C	3TB1-A5	Black
39	3TB1-C8	3TB1-C9	Buss	83	3J2-B	3TB1-A7	Wh/Purple
40	3TB1-C9	3TB1-D8	Purple	84	3J2-A	3TB1-A8	Purple
41	3TB1-D8	3TB1-D9	Buss	85	3J2-G	3TB1-A10	Wh/Red/Green
42	3TB1-D9	3TB1-E8	Purple	86	3J2-H	3TB1-A11	Wh/Red/Blue
43	3TB1-E8	3TB1-E9	Buss	87	3J1-D	3TB1-A14	Brown
44	3TB1-E9	3TB1-F8	Purple	88	3J1-A	3TB1-A15	Yellow

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #3 (Transmitter

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
89	3J1-B	3TB1-A17	Green	133	Filter 13-1	FJ9-h	Shielded, Inner White
90	3J1-E	3TB1-A18	Wh/Yellow/Purple	134	Filter 14-1	FJ9-j	Shielded, Inner Purple
91	3J1-F	3TB1-A19	Wh/Brown/Blue	135	Filter Gnd-12	FJ9-m	Shield of Double
92	3J2-P	3TB1-B44	Wh/Red/Purple	136	Filter 13-2	3TB3-4	Wh/Brown/Red
93	Filter 1-1	AJ9n	Shielded Inner Green	137	Filter 13-2	3J3-G	Wh/Brown/Red
94	Filter Gnd-1	AJ9k	Shield of Single	138	Filter 14-2	3TB3-3	Wh/Yellow/Purple
95	Filter 1-2	3TB3-5	Wh/Orange/Green	139	Filter 14-2	3J3-F	Wh/Yellow/Purple
96	Filter 1-2	3J2-L	Wh/Orange Green	140	3TB1-A1	AJ9-A	Red
97	Filter 1-2	3J3-L	Wh/Orange/Green	141	3TB1-A2	AJ9-B	Wh/Red
98	3TB1-D6	Filter Gnd-9	Black	142	3TB1-A3	AJ9-C	Wh/Red/Orange
99	3J3-J	Filter Gnd-4	Black	143	3TB1-A4	AJ9-D	Wh/R ed/Orange
100	3J1-H	Filter Gnd-11	Black	144	3TB1-A5	AJ9-E	Black
101	3TB3-7	Filter Gnd-11	Black	145	3TB1-A6	AJ9-F	Black
102	Filter 3-1	AJ9h	Shielded, Inner White	146	3TB1-A7	AJ9-H	Wh/Purple
103	Filter 4-1	AJ9j	Shielded, Inner Purple	147	3TB1-A8	AJ9-J	Purple
104	Filter Gnd-3	AJ9m	Shield of Double	148	3TB1-A9	AJ9-K	Purple
105	Filter 3-2	3TB2-8	Wh/Brown/Blue	149	3TB1-A10	AJ9-L	Wh/Red/Green
106	Filter 3-2	3J3-H	Wh/Brown/Blue	150	3TB1-A11	AJ9-M	Wh/Red/Blue
107	Filter 4-2	3TB2-7	Wh/Brown/Green	151	3TB1-A12	AJ9-N	Wh/Black/Brown
108	Filter 4-2	3J3-K	Wh/Brown/Green	152	3TB1-A13	AJ9-P	Wh/Black/Blue
109	Filter 2-1	3TB1-A21	Wh/Black/Orange	153	3TB1-A14	AJ9-R	Brown
110	Filter 2-2	3TB3-8	Wh/Black/Orange	154	3TB1-A15	AJ9-S	Yellow
111	Filter 2-2	3J3-M	Wh/Black/Orange	155	3TB1-A16	AJ9-T	Wh/Brown/Yellow
112	Filter 5-1	CJ9h	Shielded, Inner White	156	3TB1-A17	AJ9-U	Green
113	Filter 6-1	CJ9j	Shielded, Inner Purple	157	3TB1-A18	AJ9-V	Wh/Yellow/Purple
114	Filter Gnd-5	CJ9m	Shield of Double	158	3TB1-A19	AJ9-W	Wh/Brown/Blue
115	Filter 5-2	3TB2-2	Wh/Green/Blue	159	3TB1-A20	AJ9-X	Wh/Brown/Green
116	Filter 5-2	3J3-B	Wh/Green/Blue	160	3TB1-A21	AJ9-Y	Wh/Black/Orange
117	Filter 6-2	3TB2-1	Wh/Black/Red	161	3TB1-A22	AJ9-Z	Wh/Orange
118	Filter 6-2	3J3-A	Wh/Black/Red	162	3TB1-A23	AJ9-a	White
119	Filter 9-1	DJ9-h	Shielded, Inner White	163	3TB1-A24	AJ9-b	Wh/Black
120	Filter 10-1	DJ9-j	Shielded, Inner Purple	164	3TB1-A25	AJ9-c	Orange
121	Filter Gnd-8	DJ9-m	Shield of Double	165	3TB1-A26	AJ9-d	Wh/Green/Blue
122	Filter 9-2	3TB2-4	Wh/Black/Yellow	166	3TB1-A27	AJ9-e	Wh/Brown
123	Filter 9-2	3J3-P	Wh/Black/Yellow	167	3TB1-A28	AJ9-f	Wh/Yellow
124	Filter 10-2	3TB2-3	Wh/Black/Green	168	3TB1-A31	AJ9-k	Black
125	Filter 10-2	3J3-C	Wh/Black/Green	169	3TB1-A33	AJ9-n	Green
126	Filter Gnd-10	EJ9-h	Shield of Double	170	3TB1-A34	AJ9-p	Wh/Green
127	Filter 11-1	EJ9-j	Shielded, Inner White	171	3TB1-A35	AJ9-r	Wh/Blue
128	Filter 12-1	EJ9-m	Shielded, Inner Purple	172	3TB1-A36	AJ9-s	Wh/Black/Red
129	Filter 11-2	3TB3-2	Wh/Black/Purple	173	3TB1-A37	AJ9-t	Wh/Black Yellow
130	Filter 11-2	3J3-E	Wh/Black/Purple	174	3TB1-A38	AJ9-u	Wh/Black/Green
131	Filter 12-2	3TB3-1	Wh/Brown/Yellow	175	3TB1-A39	AJ9-v	Wh/Black/Purple
132	Filter 12-2	3J3-D	Wh/Brown/Yellow	176	3TB1-A40	AJ9-w	Wh/ Brown/Red

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #3 (Transmitter

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
177	3TB1-A41	AJ9-x	Wh/Brown/Orange	221	3TB1-B35	BJ9-r	Wh/Black/Orange
178	3TB1-A43	AJ9-y	Wh/Brown/Yellow	222	3TB1-B36	BJ9-s	Wh/Brown/Red
179	3TB1-A43	AJ9-z	Wh/Red/Yellow	223	3TB1-B37	BJ9-t	Wh/Brown
180	3TB1-A44	AJ9-aa	Wh/Red/Purple	224	3TB1-B38	BJ9-w	Bh/Yellow/Green
181	3TB1-A45	AJ9-bb	Wh/Orange/Yellow	225	3TB1-B39	BJ9-v	Wh/Green
182	3TB1-A46	AJ9-cc	Wh/Orange/Green	226	3TB1-B40	BJ9-w	Wh/Red/Green
183	3TB1-A46	AJ9-dd	Wh/Orange/Blue	227	3TB1-B41	BJ9-x	Wh/Black/Yellow
184	3TB1-A48	AJ9-ee	Wh/Orange/Purple	228	3TB1-B42	BJ9-v	Wh/Black
185	3TB1-A49	AJ9-ff	Blue	229	3TB1-B43	BJ9-z	Wh/Green/Blue
186	3TB1-A50	AJ9-hh	Wh/Blue	230	3TB1-A44	BJ9-AA	White
187	3TB1-B1	BJ9-A	Wh/Red	231	3TB1-A46	BJ9-CC	Purple
188	3TB1-B2	BJ9-B	Black	232	3TB1-B45	BJ9-BB	Wh/Black/Blue
189	3TB1-B3	BJ9-C	Black	233	3TB1-B47	BJ9-DD	Wh/Blue/Gray
190	3TB1-B4	BJ9-D	Wh/Purple	234	3TB1-B48	BJ9-EE	Wh/Orange/Gray
191	3TB1-B5	BJ9-E	Purple	235	3TB1-B49	BJ9-FF	Wh/Green/Gray
192	3TB1-B6	BJ9-F	Purple	236	3TB1-B50	BJ9-HH	Wh/Red/Gray
193	3TB1-B7	BJ9-H	Blue	237	3TB1-C1	CJ9-A	Red
194	3TB1-B8	BJ9-J	Wh/Brown/Yellow	238	3TB1-C2	CJ9-B	Wh/Red
195	3TB1-B9	BJ9-K	Wh/Orange/Green	239	3TB1-C3	CJ9-C	Wh/Red/Orange
196	3TB1-B10	BJ9-L	Wh/Red/Yellow	240	3TB1-C4	CJ9-D	Wh/Red/Orange
197	3TB1-B11	BJ9-M	Green	241	3TB1-C5	CJ9-E	Black
198	3TB1-B12	BJ9-N	Yellow	242	3TB1-C6	CJ9-F	Black
199	3TB1-B13	BJ9-P	Wh/Orange	243	3TB1-C7	CJ9-H	Wh/Purple
200	3TB1-B14	BJ9-R	Wh/Orange/Yellow	244	3TB1-C8	CJ9-J	Purple
201	3TB1-B15	BJ9-S	Wh/Orange/Blue	245	3TB1-C9	CJ9-K	Purple
202	3TB1-B16	BJ9-T	Wh/Orange/Purple	246	3TB1-C10	CJ9-L	Wh/Red/Green
203	3TB1-B17	BJ9-U	Wh/Red/Orange	247	3TB1-C11	CJ9-M	Wh/Red/Blue
204	3TB1-B18	BJ9-V	Wh/Red/Blue	248	3TB1-C12	CJ9-N	Wh/Black/Brown
205	3TB1-B19	BJ9-W	Wh/Yellow/Purple	249	3TB1-C13	CJ9-P	Wh/Black/Blue
206	3TB1-B20	BJ9-X	Wh/Black/Green	250	3TB1-C14	CJ9-R	Brown
207	3TB1-B21	BJ9-Y	Wh/Blue	251	3TB1-C15	CJ9-S	Yellow
208	3TB1-B22	BJ9-Z	Wh/Yellow	252	3TB1-C16	CJ9-T	Wh/Brown/Yellow
209	3TB1-B23	BJ9-a	Wh/Brown/Purple	253	3TB1-C17	CJ9-V	Green
210	3TB1-B24	BJ9-b	Orange	254	3TB1-C18	CJ9-V	Wh/Yellow/Purple
211	3TB1-B25	BJ9-c	Wh/Black/Brown	255	3TB1-C19	CJ9-W	Wh/Brown/Blue
212	3TB1-B26	BJ9-d	Wh/Black/Red	256	3TB1-C20	CJ9-X	Wh/Brown/Green
213	3TB1-B27	BJ9-e	White	257	3TB1-C21	CJ9-Y	Wh/Black/Orange
214	3TB1-B28	BJ9-f	Wh/Yellow/Blue	258	3TB1-C22	CJ9-Z	Wh/Orange
215	3TB1-B29	BJ9-h	Brown	259	3TB1-C23	CJ9-a	White
216	3TB1-B30	BJ9-i	Wh/Brown/Green	260	3TB1-C24	CJ9-b	Wh/Black
217	3TB1-B31	BJ9-k	Wh/Brown/Blue	261	3TB1-C25	CJ9-c	Orange
218	3TB1-B32	BJ9-m	Wh/Black/Purple	262	3TB1-C26	CJ9-d	Wh/Green Blue
219	3TB1-B33	BJ9-n	Wh/Green/Purple	263	3TB1-C27	CJ9-e	Wh/Brown
220	3TB1-B34	BJ9-p	Wh/Brown/Orange	264	3TB1-C28	CJ9-f	Wh/Yellow

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #3 (Transmitter

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
265	3TB1-C31	CJ9-k	Black	307	3TB1-D24	DJ9-b	Wh/Black
266	3TB1-C33	CJ9-n	Green	308	3TB1-D25	DJ9-c	Orange
267	3TB1-C34	CJ9-p	Wh/Green	309	3TB1-D26	DJ9-d	Wh/Green/Blue
268	3TB1-C35	CJ9-r	Wh/Blue	310	3TB1-D27	DJ9-e	Wh/Brown
269	3TB1-C36	CJ9-s	Wh/Black/Red	311	3TB1-D28	DJ9-f	Wh/Yellow
270	3TB1-C37	CJ9-t	Wh/Black/Yellow	312	3TB1-D31	DJ9-k	Black
271	3TB1-C38	CJ9-u	Wh/Black/Green	313	3TB1-D33	DJ9-n	Green
272	3TB1-C39	CJ9-v	Wh/Black/Purple	314	3TB1-D34	DJ9-p	Wh/Green
273	3TB1-C40	CJ9-w	Wh/Brown/Red	315	3TB1-D35	DJ9-r	Wh/Blue
274	3TB1-C41	CJ9-x	Wh/Brown/Orange	316	3TB1-D36	DJ9-s	Wh/Black/Red
275	3TB1-C42	CJ9-y	Wh/Brown/Yellow	317	3TB1-D37	DJ9-t	Wh/Black/Yellow
276	3TB1-C43	CJ9-z	Wh/Red/Yellow	318	3TB1-D38	DJ9-u	Wh/Black/Green
277	3TB1-C44	CJ9-AA	Wh/Red/Purple	319	3TB1-D39	DJ9-v	Wh/Black/Purple
278	3TB1-C45	CJ9-BB	Wh/Orange/Yellow	320	3TB1-D40	DJ9-w	Wh/Brown/Red
279	3TB1-C46	CJ9-CC	Wh/Orange/Green	321	3TB1-D41	DJ9-x	Wh/Brown/Orange
280	3TB1-C47	CJ9-DD	Wh/Orange/Blue	322	3TB1-D42	DJ9-y	Wh/Brown/Yellow
281	3TB1-C48	CJ9-EE	Wh/Orange/Purple	323	3TB1-D43	DJ9-z	Wh/Red/Yellow
282	3TB1-C49	CJ9-FF	Blue	324	3TB1-D44	DJ9-AA	Wh/Red/Purple
283	3TB1-C50	CJ9-HH	Wh/Blue	325	3TB1-D45	DJ9-BB	Wh/Orange/Yellow
284	3TB1-D1	DJ9-A	Red	326	3TB1-D46	DJ9-CC	Wh/Orange/Green
285	3TB1-D2	DJ9-B	Wh/Red	327	3TB1-D47	DJ9-DD	Wh/Orange/Blue
286	3TB1-D3	DJ9-C	Wh/Red/Orange	328	3TB1-D48	DJ9-EE	Wh/Orange/Purple
287	3TB1-D4	DJ9-D	Wh/Red/Orange	329	3TB1-D49	DJ9-FF	Blue
288	3TB1-D5	DJ9-E	Black	330	3TB1-D50	DJ9-HH	Wh/Blue
289	3TB1-D6	DJ9-F	Black	331	3TB1-E1	EJ9-A	Red
290	3TB1-D7	DJ9-H	Wh/Purple	332	3TB1-E2	EJ9-B	Wh/Red
291	3TB1-D8	DJ9-J	Purple	333	3TB1-E3	EJ9-C	Wh/Red/Orange
292	3TB1-D9	DJ9-K	Purple	334	3TB1-E4	EJ9-D	Wh/Red/Orange
293	3TB1-D10	DJ9-L	Wh/Red/Green	335	3TB1-E5	EJ9-E	Black
294	3TB1-D11	DJ9-M	Wh/Red/Blue	336	3TB1-E6	EJ9-F	Black
295	3TB1-D12	DJ9-N	Wh/Black/Brown	337	3TB1-E7	EJ9-H	Wh/Purple
296	3TB1-D13	DJ9-P	Wh/Black/Blue	338	3TB1-E8	EJ9-J	Purple
297	3TB1-D14	DJ9-R	Brown	339	3TB1-E9	EJ9-K	Purple
298	3TB1-D15	DJ9-S	Yellow	340	3TB1-E10	EJ9-L	Wh/Red/Green
299	3TB1-D16	DJ9-T	Wh/Brown/Yellow	341	3TB1-E11	EJ9-M	Wh/Red/Blue
300	3TB1-D17	DJ9-U	Green	342	3TB1-E12	EJ9-N	Wh/Black/Brown
301	3TB1-D18	DJ9-V	Wh/Yellow/Purple	343	3TB1-E13	EJ9-P	Wh/Black/Blue
302	3TB1-D19	DJ9-W	Wh/Brown/Blue	344	3TB1-E14	EJ9-R	Brown
303	3TB1-D20	DJ9-X	Wh/Brown/Green	345	3TB1-E15	EJ9-S	Yellow
304	3TB1-D21	DJ9-Y	Wh/Black/Orange	346	3TB1-E16	EJ9-T	Wh/Brown/Yellow
305	3TB1-D22	DJ9-Z	Wh/Orange	347	3TB1-E17	EJ9-U	Green
306	3TB1-D23	DJ9-a	White	348	3TB1-E18	EJ9-V	Wh/Yellow/Purple

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT #3 (Transmitter

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
349	3TB1-E19	EJ9-W	Wh/Brown/Blue	393	3TB1-F16	FJ9-T	Wh/Brown/Yellow
350	3TB1-E20	EJ9-X	Wh/Brown/Green	394	3TB1-F17	FJ9-U	Green
351	3TB1-E21	EJ9-Y	Wh/Black/Orange	395	3TB1-F18	FJ9-V	Wh/Yellow/Purple
352	3TB1-E22	EJ9-Z	Wh/Orange	396	3TB1-F19	FJ9-W	Wh/Brown/Blue
353	3TB1-E23	EJ9-a	White	397	3TB1-F20	FJ9-X	Wh/Brown/Green
354	3TB1-E24	EJ9-b	Wh/Black	398	3TB1-F21	FJ9-Y	Wh/Black/Orange
355	3TB1-E25	EJ9-c	Orange	399	3TB1-F22	FJ9-Z	Wh/Orange
356	3TB1-E26	EJ9-d	Wh/Green/Blue	400	3TB1-F23	FJ9-a	White
357	3TB1-E27	EJ9-e	Wh/Brown	401	3TB1-F24	FJ9-b	Wh/Black
358	3TB1-E28	EJ9-f	Wh/Yellow	402	3TB1-F25	FJ9-c	Green
359	3TB1-E31	EJ9-k	Black	403	3TB1-F26	FJ9-d	Wh/Green/Blue
360	3TB1-E33	EJ9-n	Green	404	3TB1-F27	FJ9-e	Wh/Brown
361	3TB1-E34	EJ9-p	Wh/Green	405	3TB1-F28	FJ9-f	Wh/Yellow
362	3TB1-E35	EJ9-r	Wh/Blue	406	3TB1-F31	FJ9-k	Black
363	3TB1-E36	EJ9-s	Wh/Black/Red	407	3TB1-F33	FJ9-n	Green
364	3TB1-E37	EJ9-t	Wh/Black/Yellow	408	3TB1-F34	FJ9-p	Wh/Green
365	3TB1-E38	EJ9-u	Wh/Black/Green	409	3TB1-F35	FJ9-r	Wh/Blue
366	3TB1-E39	EJ9-v	Wh/Black/Purple	410	3TB1-F36	FJ9-s	Wh/Black/Red
367	3TB1-E40	EJ9-w	Wh/Brown/Red	411	3TB1-F37	FJ9-t	Wh/Black/Yellow
368	3TB1-E41	EJ9-x	Wh/Brown/Orange	412	3TB1-F38	FJ9-u	Wh/Black/Green
369	3TB1-E42	EJ9-y	Wh/Brown/Yellow	413	3TB1-F39	FJ9-v	Wh/Black/Purple
370	3TB1-E43	EJ9-z	Wh/Red/Yellow	414	3TB1-F40	FJ9-w	Wh/Brown/Red
371	3TB1-E44	EJ9-AA	Wh/Red/Purple	415	3TB1-F41	FJ9-x	Wh/Brown/Orange
372	3TB1-E45	EJ9-BB	Wh/Orange/Yellow	416	3TB1-F42	FJ9-y	Wh/Brown/Yellow
373	3TB1-E46	EJ9-CC	Wh/Orange/Green	417	3TB1-F43	FJ9-z	Wh/Red/Yellow
374	3TB1-E47	EJ9-DD	Wh/Orange/Blue	418	3TB1-F44	FJ9-AA	Wh/Red/Purple
375	3TB1-E48	EJ9-EE	Wh/Orange/Purple	419	3TB1-F45	FJ9-BB	Wh/Orange/Yellow
376	3TB1-E49	EJ9-FF	Blue	420	3TB1-F46	FJ9-CC	Wh/Orange/Green
377	3TB1-E50	EJ9-HH	Wh/Blue	421	3TB1-F47	FJ9-DD	Wh/Orange/Blue
378	3TB1-F1	FJ9-A	Red	422	3TB1-F48	FJ9-EE	Wh/Orange/Purple
379	3TB1-F2	FJ9-B	Wh/Red	423	3TB1-F49	FJ9-FF	Blue
380	3TB1-F3	FJ9-C	Wh/Red/Orange	424	3TB1-F50	FJ9-HH	Wh/Blue
381	3TB1-F4	FJ9-D	Wh/Red/Orange				
382	3TB1-F5	FJ9-E	Black				
383	3TB1-F6	FJ9-F	Black				
384	3TB1-F7	FJ9-H	Wh/Purple				
385	3TB1-F8	FJ9-J	Purple				
386	3TB1-F9	FJ9-K	Purple				
387	3TB1-F10	FJ9-L	Wh/Red/Green				
388	3TB1-F11	FJ9-M	Wh/Red/Blue				
389	3TB1-F12	FJ9-N	Wh/Black/Brown				
390	3TB1-F13	FJ9-P	Wh/Black/Blue				
391	3TB1-F14	FJ9-R	Brown				
392	3TB1-F15	FJ9-S	Yellow				

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT POWER SUPPLY

ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR	ITEM	FROM	TO	COLOR
	F4-2	Q2-COLL	GREEN		T1-4	XC4-5	BLUE		Q5-EMIT	1A1A1-27	W/PURPLE
	Q3-COLL	Q2-COLL	GREEN		XC4-5	XC2-5	BLUE		1A1A1-10	S2C-6	W/PURPLE
	S3-5	J10-M	W/BLUE		XC2-5	XC3-5	BLUE		1A1A1-10	J4-H	W/PURPLE
	S3-5	J11-M	W/BLUE		XC3-5	XC5-5	BLUE		R1-1	TB2-11	W/PURPLE
	J4-B	1A1A1-34	W/ORN/YEL		XC5-5	XC8-1	BLUE		TB2-11	J10-B	W/PURPLE
	1A1A1-36	Q1-EMIT	W/ORN/YEL		XC8-1	XC9-1	BLUE		TB2-11	J11-B	W/PURPLE
	Q1-EMIT	Q2-BASE	W/ORN/YEL		XC9-1	R3-1	BLUE		R1-1	J9-E	W/PURPLE
	Q2-BASE	Q3-BASE	W/ORN/YEL		R3-1	F6-1	BLUE		J8-3	DS2-2	SHIELD
	1A1A1-34	Q4-BASE	W/ORN/YEL		F6-1	DS3-1	BLUE		J8-1	DS2-1	SHIELD
	J4-c	1A1A1-4	W/GRN/PUR		DS3-1	TB2-9	BLUE		J8-3	DS1-2	SHIELD
	J4-K	1A1A1-53	W/YEL/GRN		TB2-9	J10-J	BLUE		J8-7	DS1-1	SHIELD
	1A1A1-30	R8-1	W/YEL/GRN		TB2-9	J11-J	BLUE		J8-7	T1-14	SHIELD
	Q1-BASE	1A1A1-53	W/YEL/GRN		DS3-2	S3-1	BLUE		J8-8	TB1-1	Coax
	J4-A	1A1A1-52	W/RED/BLK		T1-7	XC11-5	W/RED		J9-R	TB1-2	Coax
	J4-V	R8-2	W/ORN/PUR		XC11-5	XC10-5	W/RED		F9-1	TB2-5	SHIELD
	1A1A1-32	R6-3	W/ORN/PUR		XC10-5	F7-1	W/RED		F9-2	J8-3	SHIELD
	J4-a	Q5-BASE	W/ORN/BLUE		F7-2	1A1A1-23	W/RED		TB2-5	T1-12	SHIELD
	R18-2	F8-1	RED		1A1A1-23	1A1A1-7	W/RED		TB1-3	J12	SHIELD
	R18-2	CR7-CATH	RED		1A1A1-7	J4-L	W/RED		J10-L	J11-L	SHIELD
	F8-2	TB2-12	RED		F7-2	TB2-16	W/RED		J9-X	TB2-1	SHIELD
	F8-2	S28-3	RED		TB2-16	J10-E	W/RED		TB2-1	J10-P	SHIELD
	TB2-12	J10-F	RED		TB2-16	J11-E	W/RED		TB2-1	J11-P	SHIELD
	TB2-12	J11-F	RED		F7-2	S2B-4	W/RED		J9-g	TB2-6	SHIELD
	T1-5	1A1FL1-3	W/BRN/BLU		TB2-19	J10-A	PURPLE		TB2-6	J10-R	SHIELD
	J1-B	S1-1	GRAY		TB2-18	J11-A	PURPLE		TB2-6	J11-R	SHIELD
	J2-1	S1-1	GRAY		TB2-20	XC13-1	PURPLE				
	J2-1	J3-1	GRAY		XC13-1	1A1A1-46	PURPLE				
	F3-1	S1-3	GRAY		TB2-22	F5-1	PURPLE				
	F3-2	T1-2	GRAY		1A1A1-40	J4-M	PURPLE				
	J1-C	S1-2	W/GRAY		TB2-21	J8-6	PURPLE				
	J2-2	F1-2	W/GRAY		F5-1	S2C-7	PURPLE				
	J2-2	J3-2	W/GRAY		F5-2	Q5-COLL	PURPLE				
	F1-1	S1-2	W/GRAY		J8-6	J9-H	PURPLE				
	F2-1	S1-4	W/GRAY		1A1A1-47	1A1A1-40	PURPLE				
	F2-2	T1-1	W/GRAY		1A1A1-49	CR5-CATH	W/YELLOW				
	T1-8	1A1A1-14	W/BRN/ORN		CR5-CATH	1A1FL1-2	W/YELLOW				
	T1-9	1A1A1-20	W/BRN/RED		1A1A1-48	CR6-CATH	W/ORANGE				
	T1-6	1A1A1-15	W/BRN/YEL		CR6-CATH	1A1FL1-5	W/ORN				
	XC10-1	XC11-1	W/YEL/BLU		1A1A1-42	R12-1	W/GREEN				
	R17-2	XC10-1	W/YEL/BLU		R18-1	R14-2	YELLOW				
	R17-2	Q4-COLL.	W/YEL/BLU		R18-1	XC8-5	YELLOW				
	1A1A1-26	R10-3	W/BLK/ORN		XC8-5	XC9-5	YELLOW				
	T1-11	1A1A1-16	W/BLK/PUR		Q5-EMIT	R1-1	W/PURPLE				

Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT POWER SUPPLY(CONT'D)

ITEM	FROM	TO	COLOR
1	TB2-26	TB2-27, 28, 29, 30	BUSS
	TB2-18	TB2-19, 20, 21, 22	BUSS
	TB2-7	TB2-8	BUSS
	1A1A1-18	1A1A1-19	BUSS
	1A1A1-50	1A1A1-51	BUSS
	1A1A1-41	1A1A1-43	BUSS
	1A1A1-10	1A1A1-27	BUSS
	1A1A1-46	1A1A1-47	BUSS
	1A1A1-28	1A1A1-45	BUSS
	S2C-1	S2C-2, 3, 4, 5	BUSS
	S2C-2	S2B-6	BUSS
	S2B-6	S2B-7, 8	BUSS
	S2C-7	S2C-8	BUSS
	S2A-9	S2B-9	BUSS
	XC2-1	XC2-2	BUSS
	J2-	J3	BUSS
	J3-	GMd-2	BUSS
	CR2- ANODE	CR1- ANODE	BUSS
3	CR2- ANODE	L1-1	BUSS
	CR6- ANODE	CR5-ANODE	BUSS
1 1/4	CR3-CATH	CR4-CATH	BUSS
	R4-2	R4-3	BUSS
	CR-7 ANODE	CR8-ANODE	BUSS
1	T1-10	TB2-27	BLACK
2	R4-3	TB2-28	BLACK
3	TB2-28	CR7-ANODE	BLACK
4	CR8- ANODE	XC7-1	BLACK
5	XC7-1	XC6-1	BLACK
6	XC6-1	1A1A1-8	BLACK
7	1A1A1-12	TB2-29	BLACK
8	XC13-5	TB2-29	BLACK
9	1A1A1-43	Q4-E	BLACK
10	1A1A1-41	TB2-27	BLACK
11	1A1A1-18	TB2-30	BLACK

ITEM	FROM	TO	COLOR
12	J4-P	1A1A1-19	BLACK
13	GNd-2	J10-C	BLACK
14	GNd-2	J11-C	BLACK
15	R1-2	TB2-30	BLACK
16	R1-2	C-12	BLACK
17	C12-Rotor	S2C-5	BLACK
18	C12-Rotor	J6	BLACK
19	XC13-5	J8-4	BLACK
20	S2C-4	J9-N	BLACK
21	S2C-3	J9-V	BLACK
22	TB2-26	G2	BLACK
23	J1-A	G3	BLACK
24	1A1A1-2	1A1A1-29	BLACK
25	1A1A1-29	1A1A1-12	BLACK
	1A1A1-55	R19-1	W/ORN/GRN
	J4-b	L1-1	W/ORN/GRN
	1A1A1-31	R6-1	W/ORN/GRN
	J10-K	J11-K	W/RED/YEL
	T1-3	1A1AFL1-1	W/RED/YEL
	F6-2	S2B-5	W/RED/ORN
	F6-2	TB2-8	W/RED/ORN
	TB2-7	J10-D	W/RED/ORN
	TB2-7	J11-D	W/RED/ORN
	J4-h	M2-1	W/RED/BLU
	1A1A1-24	R19-2	W/RED/BLUE
	1A1A1-24	CR8-CATH	W/RED/BLUE
	R19-2	F10-1	W/RED/BLUE
	F10-2	TB2-15	W/RED/BLUE
	TB2-15	J10-H	W/RED/BLUE
	TB2-15	J11-H	W/RED/BLUE
	F10-2	S2A-1	W/RED/BLUE
	XC7-5	CR8-CATH	W/RED/BLUE
	S2A-1	M2-2	W/RED/BLUE
	1A1A1-17	1A1A1-54	W/RED/GRN
	XC6-5	R12-2	W/RED/GRN
	XC6-5	S2A-2	W/RED/GRN
	R12-2	TB2-14	W/RED/GRN
	TB2-14	J10-G	W/RED/GRN
	TB2-14	J11-G	W/RED/GRN
	J4-E	1A1A1-33	W/BLU/PUR
	1A1A1-21	R12-3	W/BLU/PUR
	1A1A1-33	R10-2	W/BLU/PUR

ITEM	FROM	TO	COLOR
	1A1A1-35	R6-2	W/RED/PUR
	J4-F	R6-2	W/RED/PUR
	1A1A1-44	R10-1	W/RED/PUR
	1A1A1-6	Q2-EMIT	ORANGE
	R14-1	CR3-CATH	ORANGE
	1A1A1-13	Q3-EMIT	W/BLK/YEL
	R17-1	CR6- ANODE	W/BLK/YEL
	1A1A1-11	R8-3	W/GRN/BLU
	J4-g	J5	W/GRN/BLU
	J8-2	C12- STATOR	WHITE
	TB1-1	TB1-2	WHITE
	S2B-9	M1 - +	WHITE
	S2C-12	M1 -	WHITE
	1A1A1-54	C14	W/YEL/PUR
	1A1A1-51	C14	W/BLK/GRN
	S3-6	J10-N	W/BLK/BLU
	S3-6	J11-N	W/BLK/BLU
	XC5-1	XC3-1	W/BLACK
	XC3-1	XC2-2	W/BLACK
	XC2-1	XC4-1	W/BLACK
	L1-2	F4-1	W/BLACK
	L1-2	1A1A1-38	W/BLACK
	1A1A1-38	XC2-1	W/BLACK
	R3-2	R4-1	W/BLACK
	1A1A4-3	CRI-CATH	W/BLK/GRN
	S3-4	CRI-CATH	W/BLK/GRN
	TB2-3	J10-T	W/BLK/GRN
	TB2-3	J11-T	W/BLK/GRN
	CR4-ANODE	S3-4	W/BLK/GRN
	S3-4	TB2-3	W/BLK/GRN
	1A1A4-4	Cr2-CATH	GREEN
	CR2-CATH	CR3- ANODE	GREEN
	TB2-13	J10-S	GREEN
	TB2-13	J11-S	GREEN
	1A1A1-1	Q3-COLL	GREEN
	S3-3	CR1- ANODE	GREEN
	TB2-13	S3-3	GREEN
	F4-2	Q1-COLL	GREEN

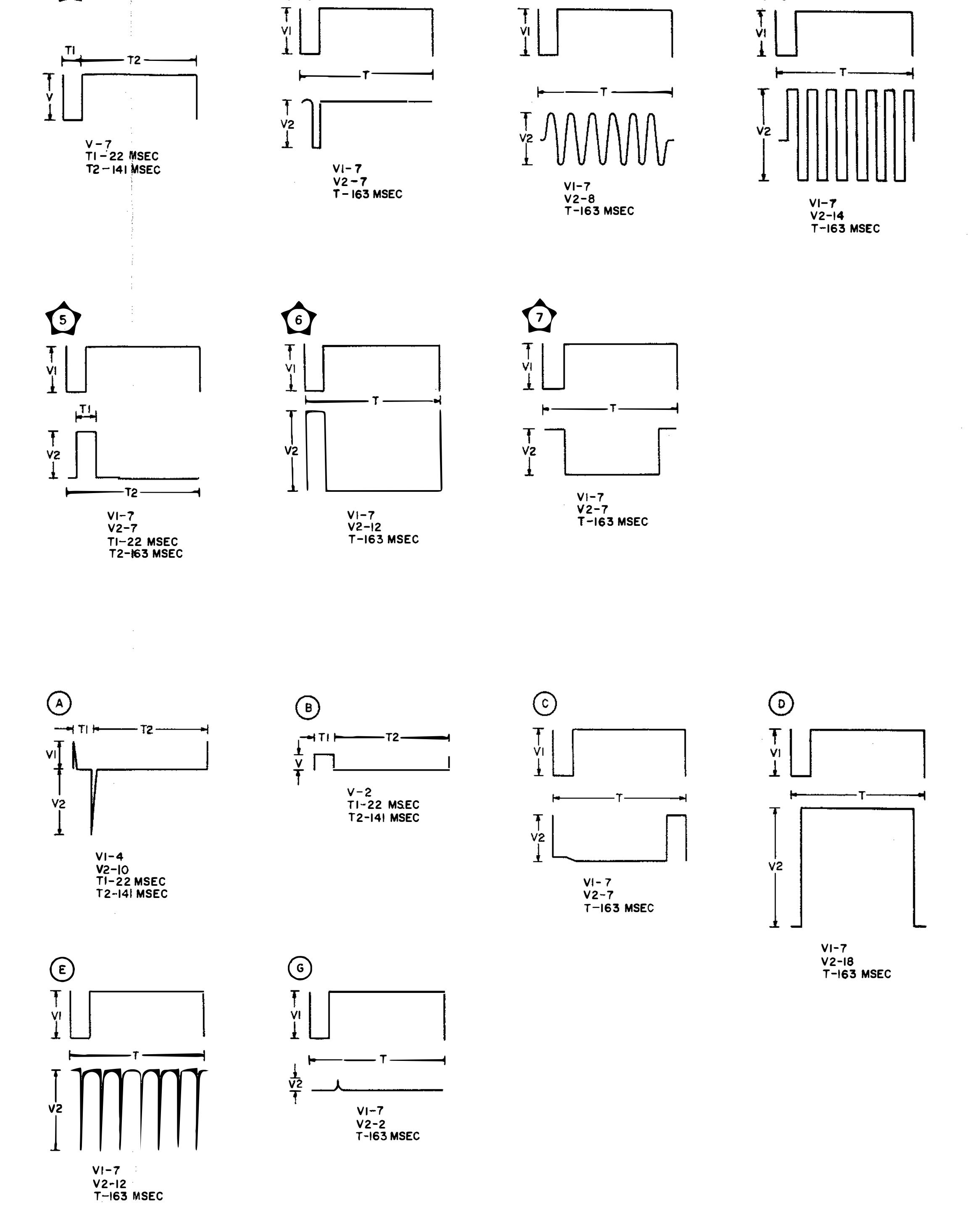
Figure 5-65. Intraconnecting Wiring Information

RUNNING LIST OF AN/UGC-1 UNIT INDICATOR

ITEM	FROM	TO	COLOR
	DS6-1	DS5-1	BUSSWIRE
	DS5-1	DS4-1	BUSSWIRE
	DS4-1	DS3-1	BUSSWIRE
	DS3-1	DS2-1	BUSSWIRE
	DS2-1	DS1-1	BUSSWIRE
	P-2	T1-1	RED
	P-2	T1-2	WHITE
	P-2	GNd	BLACK
	P-1-A	R-15	BROWN
	P-1-B	R-17	ORANGE
	P1-C	R-19	BLUE
	P1-D	R-21	GREEN
	P1-E	R-23	WHITE
	P1-F	R-25	RED
	P1-H	GNd	BLACK
	DS6-2	R-15	W/ORN/PUR
	DS5-2	R-10	W/YEL/PUR
	DS4-2	R-8	W/RED/PUR
	DS3-2	R-6	W/BLK/ORN
	DS2-2	R-4	W/ORN/GRN
	DS1-2	R-2	W/BLU/YEL
	DS1-1	C 1 +	W/RED/YEL
	T1-3	C 1 -	W/BRN/GRN
	T1-4	R27	W/PUR/GRN
	T1-GNd LUG	CR1	BLACK
	DS7-2	T1-1	RED
	T1-2	R-28	WHITE
	DS7-1	R-14	W/BLK/PUR

Figure 5-65. Intraconnecting Wiring Information

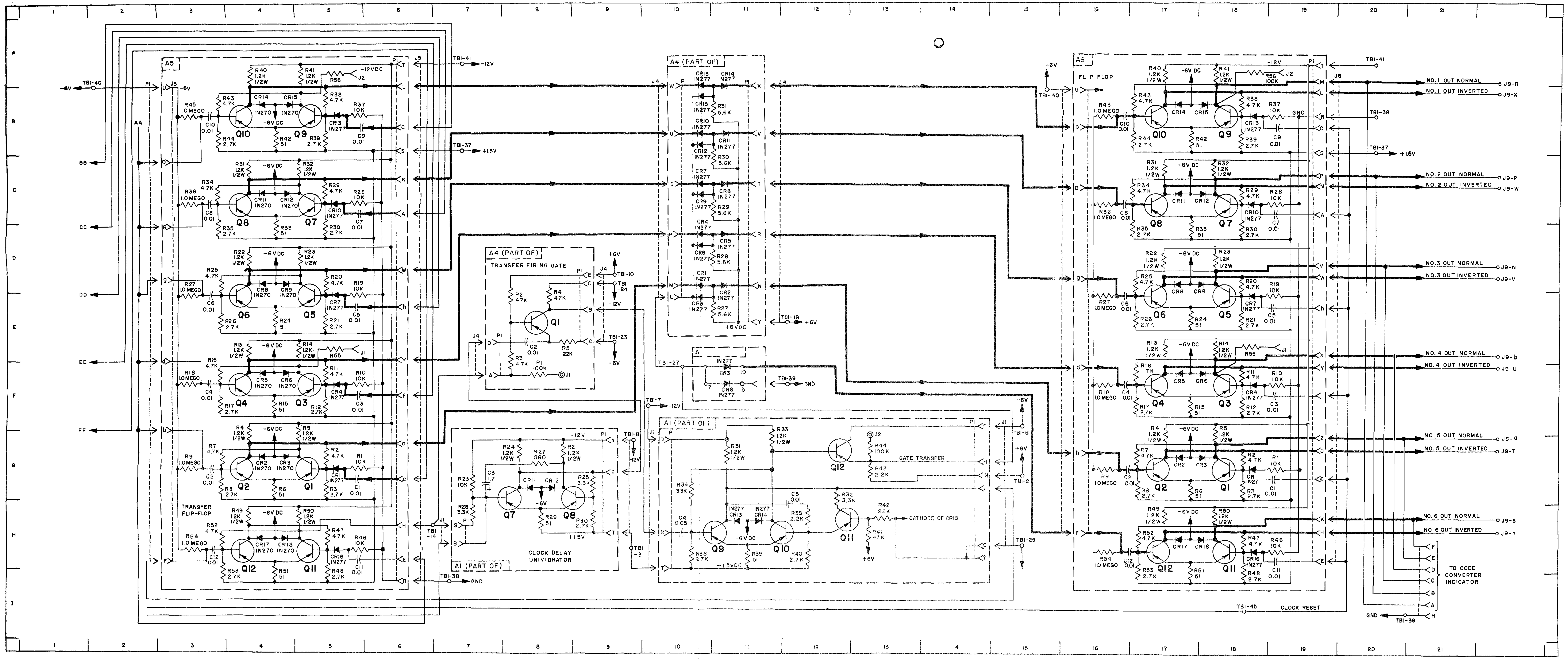
NOTE-UNLESS OTHERWISE SPECIFIED: ALL DIODES ARE IN270, UNLESS OTHERWISE SPECIFIED
ALL TRANSISTORS ARE 2N404 UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4W, VALUE IN OHMS
ALL CAPACITORS IN UF

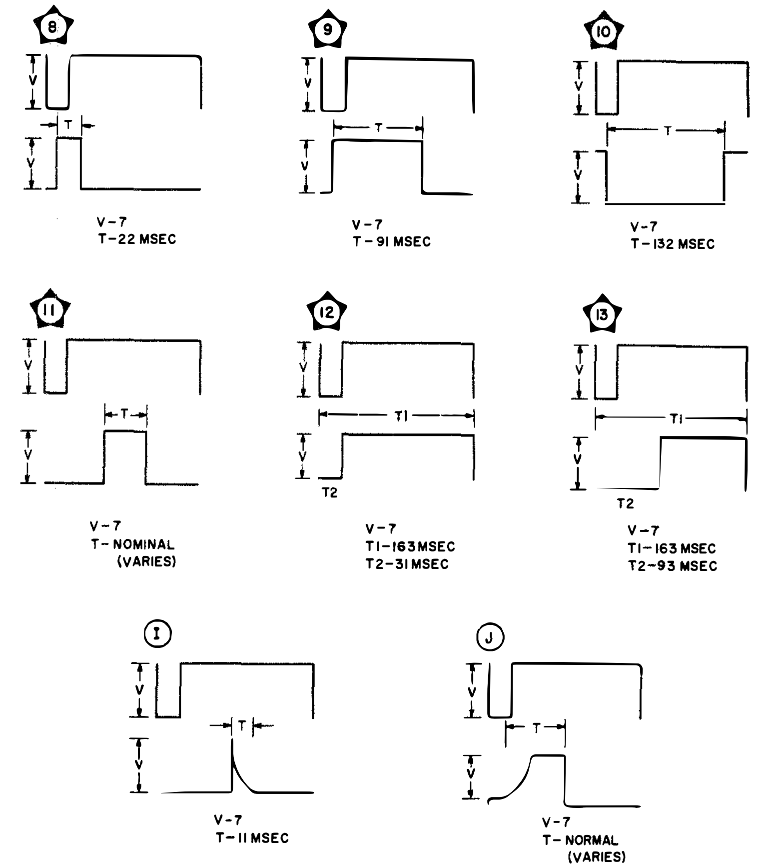


NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE. OSCILLOSCOPE CONTROL SETTINGS:
   PRESENTATION: CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM
   SYNCH: EXTERNAL, SAME AS A INPUT, TEST POINT A1S1.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T, T1, T2 - DURATION OF PORTION OF THE WAVEFORMS INDICATED.
   V, V1, V2 - PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM
   SYNCH: INTERNAL, (+)
5. MULTIPLEX SET IN REMOTE OPERATION, WITH ALL MARKS INPUT.

Figure 5-66. Transmitter Code Converter, Schematic Diagram, Page 1 of 2

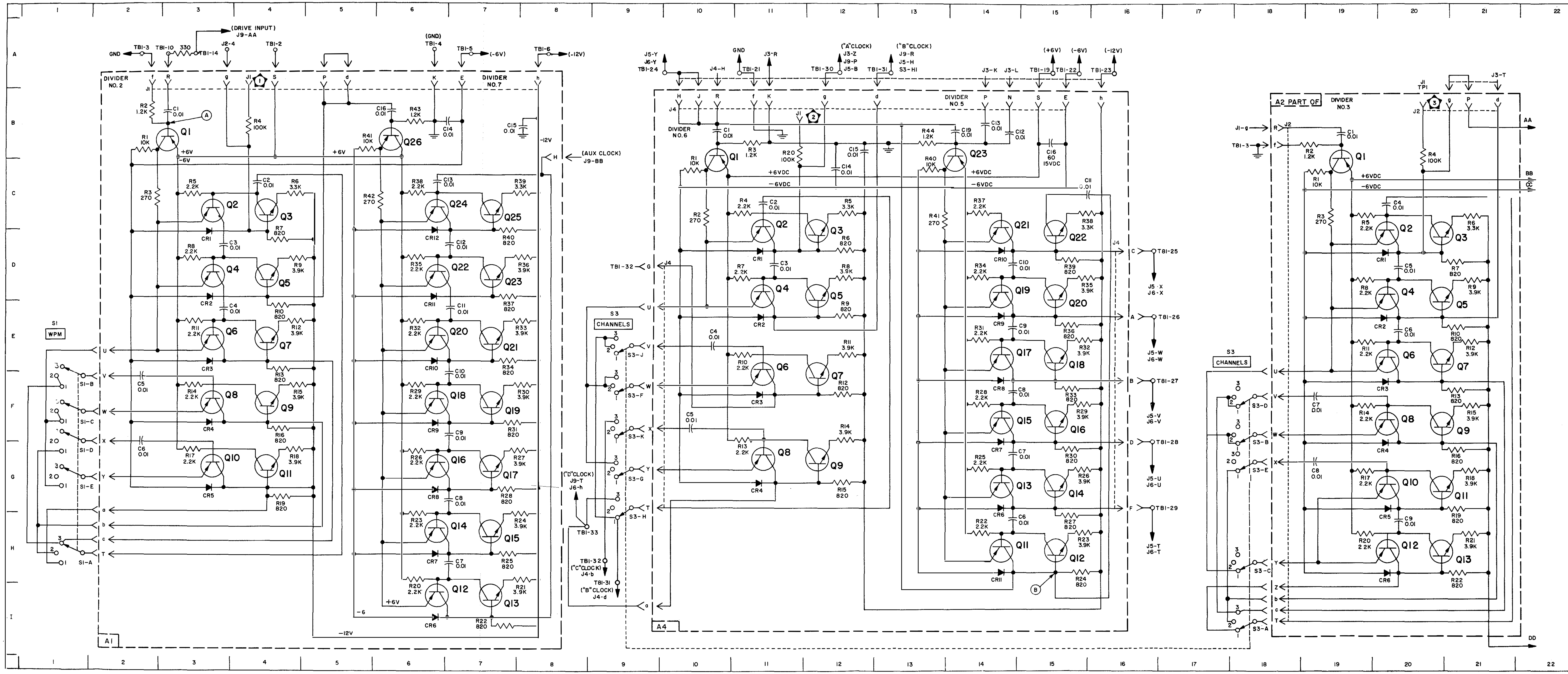




NOTES

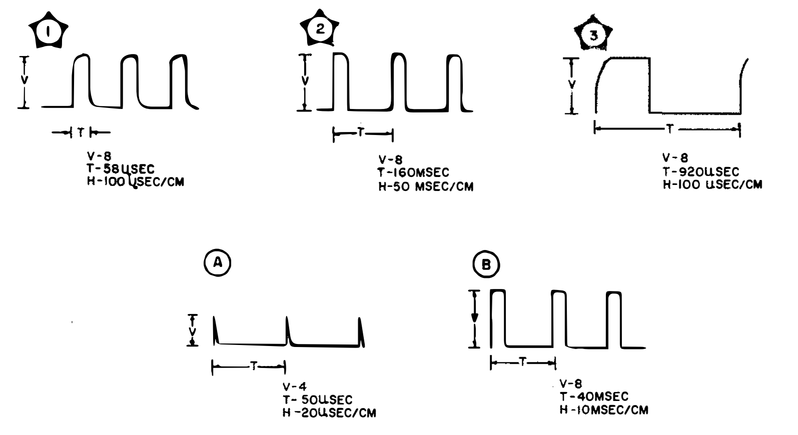
1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE OSCILLOSCOPE CONTROL SETTINGS–
   PRESENTATION: CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-20MSEC/CM
   B CHANNEL: V-1 VOLT/CM
   H-20MSEC/CM
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T,T1,T2 – DURATION OF PORTION OF THE WAVEFORM INDICATED.
   V,V1,V2–PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-20MSEC/CM
   SYNCH: INTERNAL, (+)
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT.

Figure 5-66. Transmitter Code Converter, Schematic Diagram, Page 2 of 2



J9 PIN	TO	FUNCTION
A	TB1-2	+ 6V
B	TB1-4	GND
C	TB1-3	GND
D	TB1-5	− 6V
E, F	TB1-6	− 12V
H	J2-J	AC GEN DRIVE
J	J3-J	PHASE LAG
K	J3-R	PHASE LEAD
L	J3-D	FRAMING INPUT
M	S2-2	AUX EQUIPMENT SIGNAL SAMPLING
N	S2-A	SIGNAL SAMPLING
P	TB1-30	"A" CLOCK
R	TB1-31	"B" CLOCK
S	TB1-32	"C" CLOCK
T	TB1-33	"D" CLOCK
U	J5-J	NORMAL A1
V	J5-H	INVERTED A2
W	J5-F	INVERTED A3
X	J5-E	INVERTED A4
Y	J5-D	NORMAL A5
Z	J5-C	NORMAL A6
a	J5-a	NORMAL B1
b	J5-b	NORMAL B2
c	J5-c	NORMAL B3
d	J5-d	NORMAL B4
e	J5-f	NORMAL B5
f	J5-g	NORMAL B6
h	J5-R	AUX EQUIPMENT A6
j	J6-J	INVERTED C1
k	J6-H	INVERTED C2
m	J6-F	INVERTED C3
n	J6-E	INVERTED C4
p	J6-D	INVERTED C5
r	J6-C	INVERTED C6
s	J6-a	INVERTED D1
t	J6-b	INVERTED D2
u	J6-c	INVERTED D3
v	J6-d	INVERTED D4
w	J6-f	INVERTED D5
x	J6-g	INVERTED D6
y	S4-A	SIGNAL OUT/IN NORMAL(+)
z	S4-B	SIGNAL OUT/IN INVERTED(-)
AA	TB1-14	DRIVE INPUT
J9-BB	J1-H	450 CPS (AUXILIARY CLOCK)

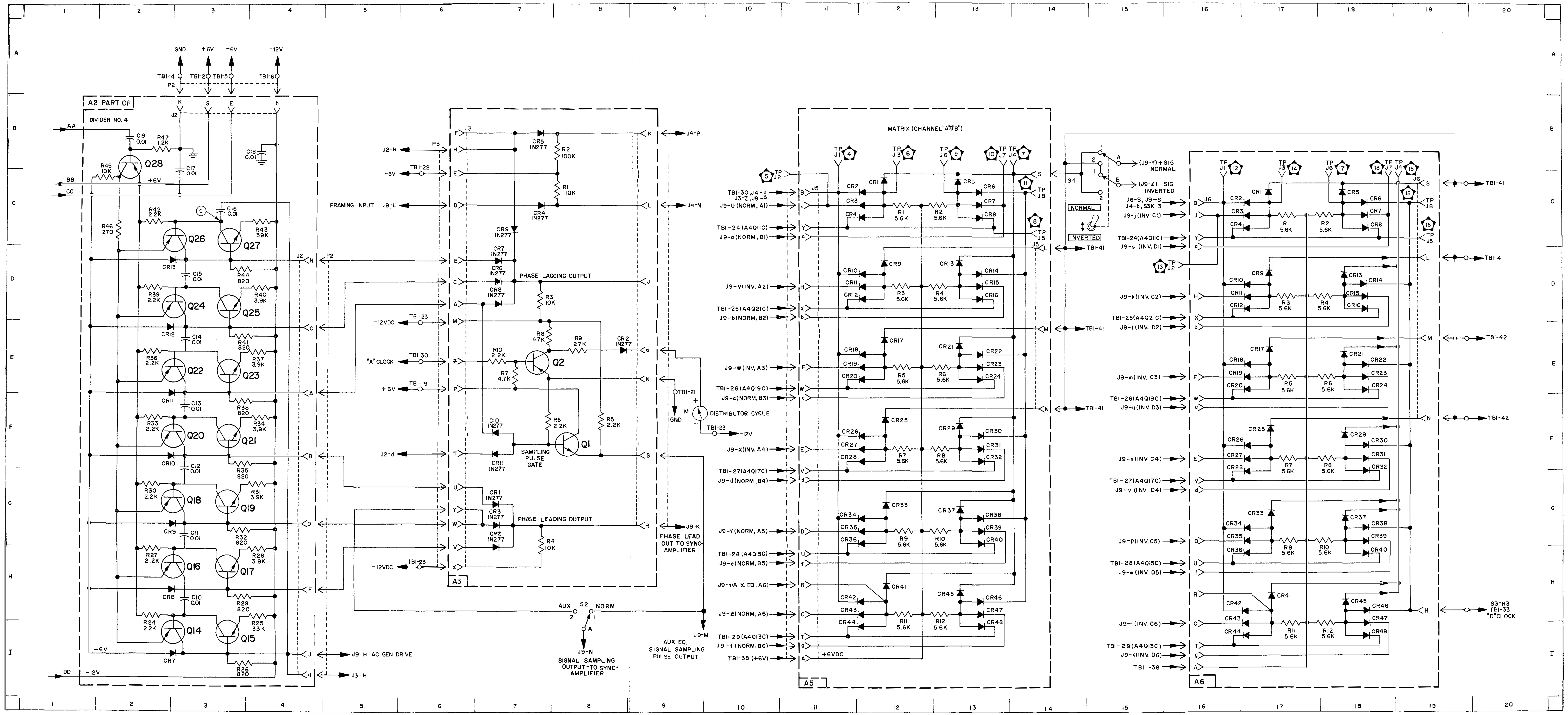
ALL PNP TRANSISTORS ARE TYPE 2N404
ALL NPN TRANSISTORS ARE TYPE 2N388
ALL RESISTORS ARE 1/4WATT UNLESS SPECIFIED
ALL DIODES ARE TYPE 1N270 UNLESS SPECIFIED
ALL CAPACITORS ARE IN UF UNLESS SPECIFIED

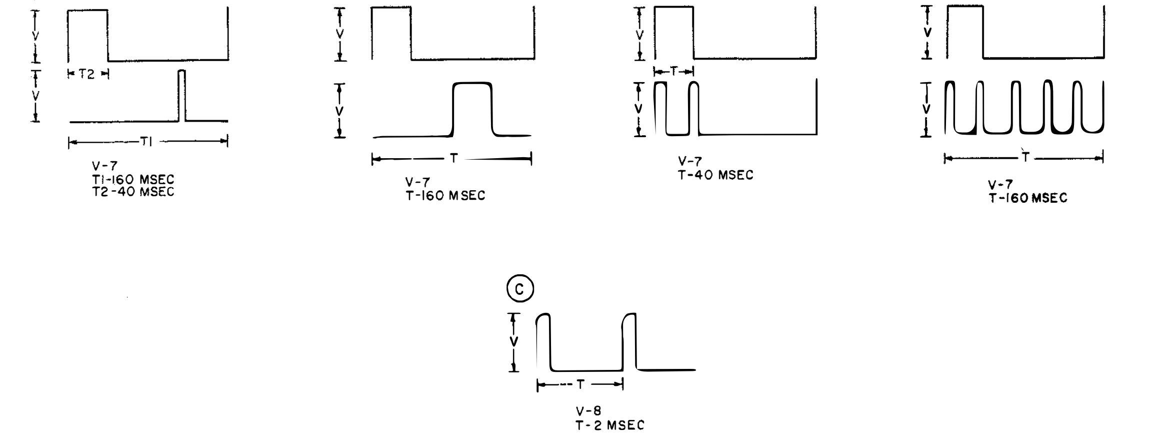


NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE.
   OSCILLOSCOPE CONTROL SETTING:
   PRESENTATION: CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-20MSEC/CM (UNLESS OTHERWISE NOTED)
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM (UNLESS OTHERWISE NOTED)
   SYNCH: EXTERNAL, SAME AS A INPUT, TEST POINT A4J1
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS
   T, T1, T2 - DURATION OF THE PORTION OF THE WAVEFORM INDICATED
   V - PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM (UNLESS OTHERWISE NOTED)
   SYNCH: INTERNAL (+)
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT

Figure 5-67. Mux-Demux, Schematic Diagram, Page 1 of 2





NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE OSCILLOSCOPE CONTROL SETTING:
   PRESENTATION: CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM (UNLESS OTHERWISE NOTED)
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM (UNLESS OTHERWISE NOTED)
   SYNCH: EXTERNAL, SAME AS A INPUT. TEST POINT A4J1
3. EXPLANATION OF SYMBOLYS PLACED AT WAVEFORMS
   T,T1,T2-DURATION OF THE PORTION OF THE WAVEFORM INDICATED
   V - PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTING:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM (UNLESS OTHERWISE NOTED)
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT
6. ALL RESISTORS 1/4 WATT UNLESS OTHERWISE SPECIFIED
7. ALL CAPACITORS ARE UF UNLESS OTHERWISE SPECIFIED
8. ALL PNP TRANSISTORS ARE TYPE 2N404
9. ALL NPN TRANSISTORS ARE TYPE 2N388
10. ALL DIODES ARE TYPE 1N270 UNLESS OTHERWISE SPECIFIED

Figure 5-67. Mux-Demux, Schematic Diagram, Page 2 of 2

NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDI
   AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVE FORMS RECORDED USING 531A TEKTRONIC OSCILLOSC
   OSCILLOSCOPE CONTROL SETTINGS:
   PRESENTATION CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-50 MSEC/CM
   B CHANNEL: V-1VOLT/CM
   H-50 MSEC/CM
   SYNCH: EXTERNAL, SAME AS A INPUT, C CHANNEL CLOCK.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.

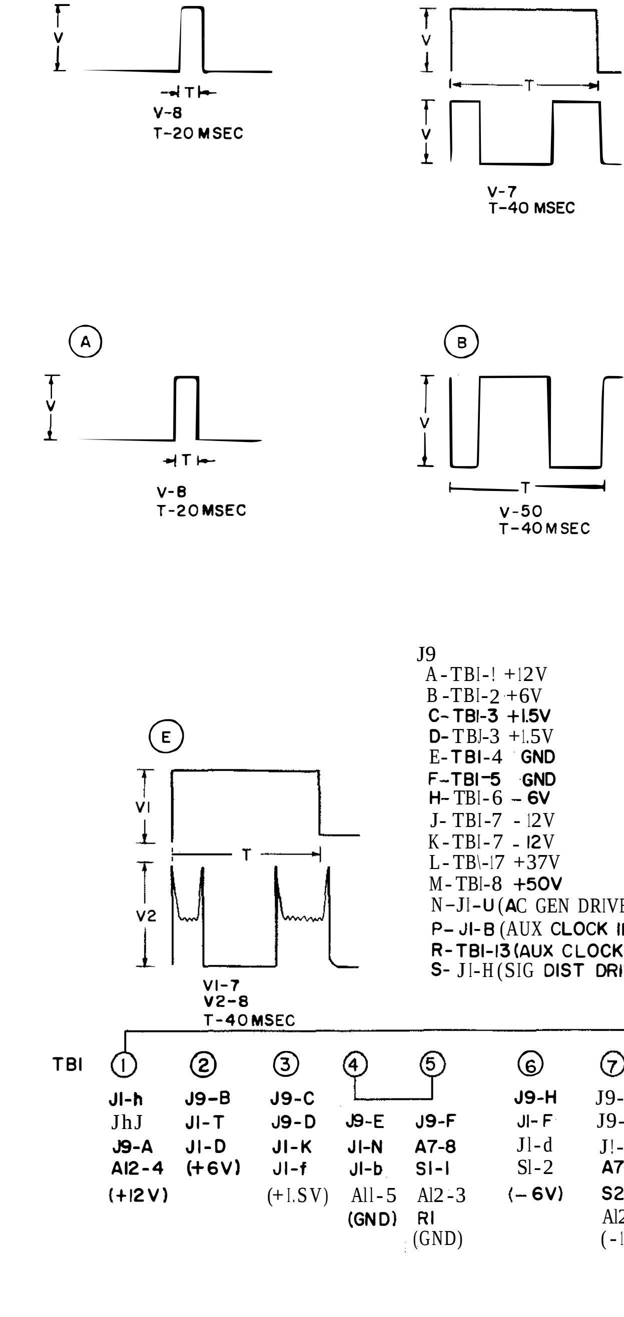
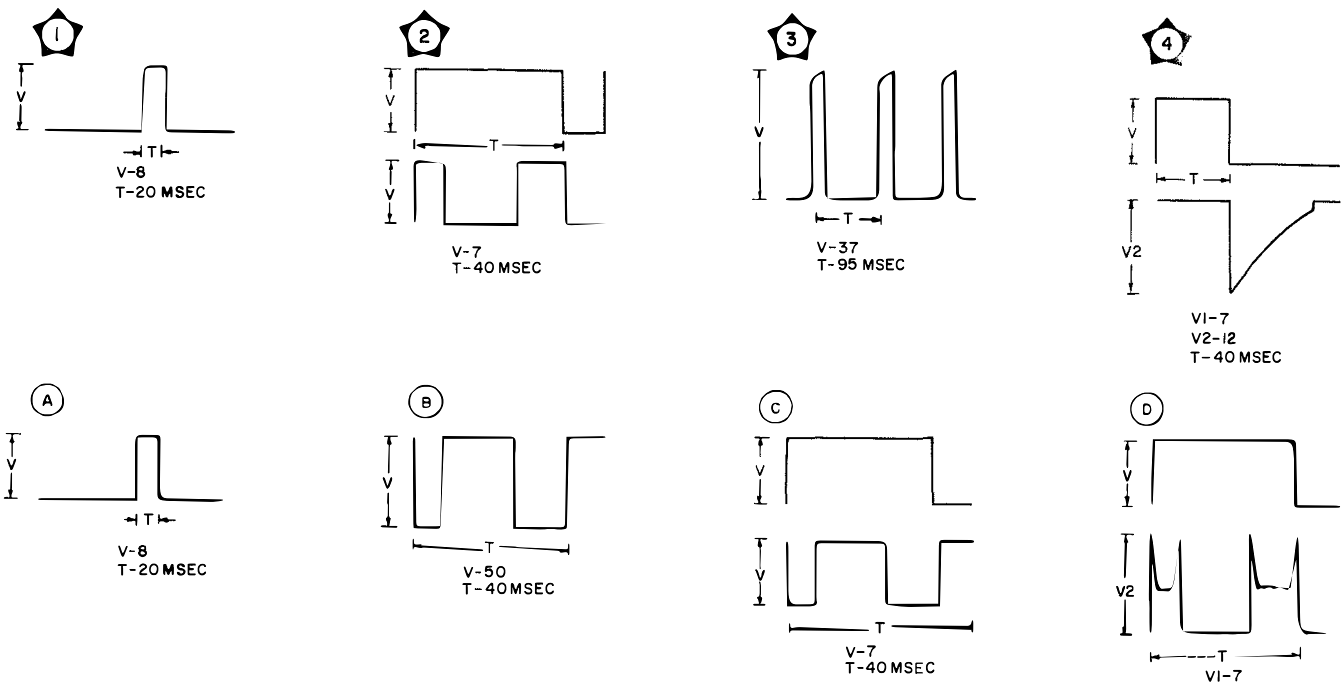
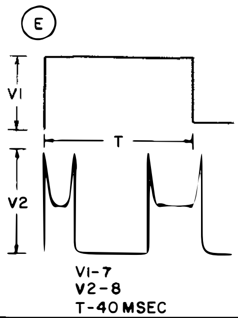


Figure 5-68. Co

NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVE FORMS RECORDED USING 531A TEKTRONIC OSCILLOSCOPE.
   OSCILLOSCOPE CONTROL SETTINGS:
   PRESENTATION CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-50 MSEC/CM
   B CHANNEL: V-1VOLT/CM
   H-50 MSEC/CM
   SYNCH: EXTERNAL, SAME AS A INPUT, C CHANNEL CLOCK.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T,T1, T2-DURATION OF PORTION OF THE WAVEFORM INDICATED.
   V,V1,V2-PEAK VOLTAGE
4. SINGLE TRACE WAVE FORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-50 MSEC/CM
5. MULTIPLEX UNIT IN LOCAL OPERTION WITH ALL MARKS INPUT.
6. ALL RESISTORS ARE OHMS UNLESS OTHERWISE SPECIFIED
7. ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED
8. ALL CAPACITORS ARE UF UNLESS OTHERWISE SPECIFIED



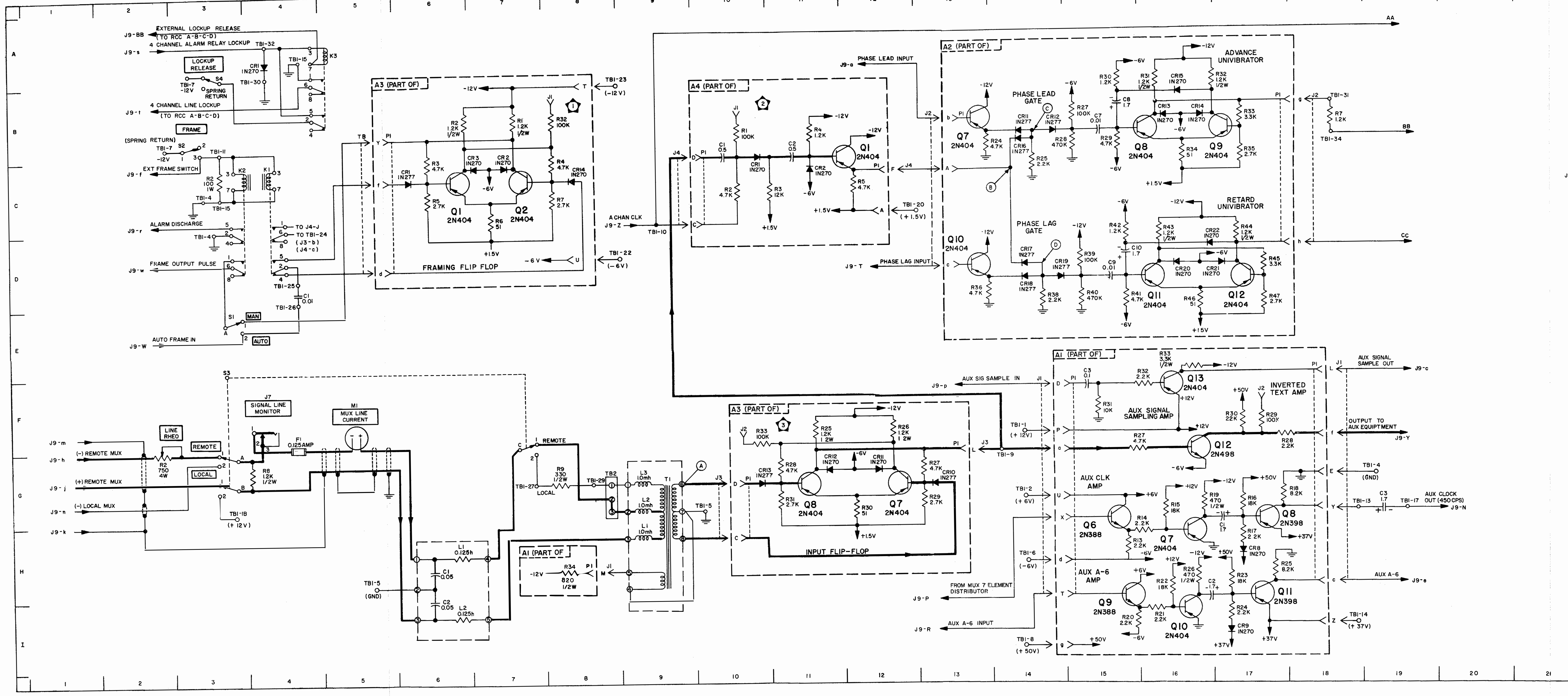


J9
A-TB1-1 +12V
B-TB1-2 +6V
C-TB1-3 +1.5V
D-TB1-3 +1.5V
E-TB1-4 GND
F-TB1-5 GND
H-TB1-6 -6V
J-TB1-7 -12V
K-TB1-7 -12V
L-TB1-17 +37V
M-TB1-8 +50V
N-J1-U (AC GEN DRIVE)
P-J1-B (AUX CLOCK IN)
R-TB1-13 (AUX CLOCK OUT)
S-J1-H (SIG DIST DRIVE OUT)
T-
U-TB1-15 ('B' CHAN CLOCK)
V-J1-Y (INVERTED MUX SIG OUT)
W-J1-M (INVERTED MUX SIG IN)
X-
Y-A11-1 (VOLTAGE AMP OUT)
Z-J1-E ('B' CHAN CLOCK AMP)
d-TB1-10 (MATRIX INPUT)
h-S2-B1 ((-) REMOTE MUX OUT)
j-R2 ((+) REMOTE MUX OUT)
k-
m-
n-S2-A2 (LOCAL MUX OUT)

TB1

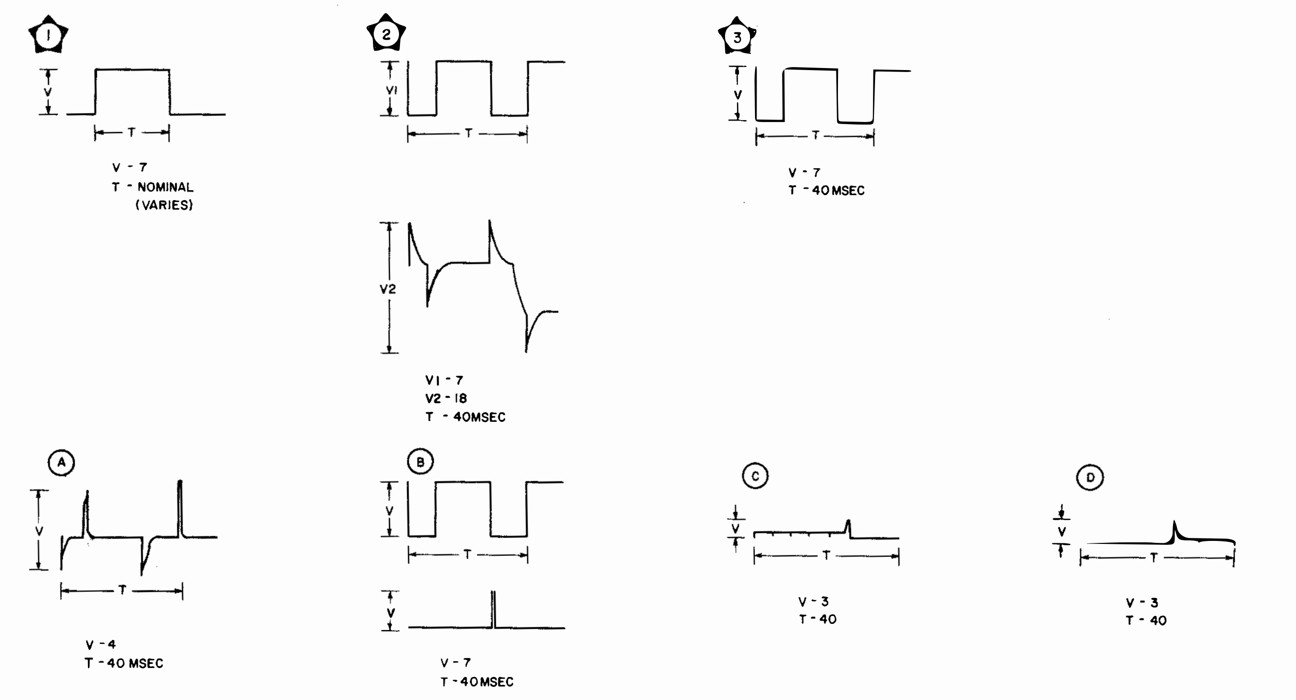
1	J1-h, J1-J, J9-A, A12-4, (+12V)
2	J9-B, J1-T, J1-D, (+6V)
3	J9-C, J9-D, J1-K, J1-f, (+1.5V)
4	J9-E, J1-N, J1-b, A11-5, (GND)
5	J9-F, A7-8, S1-1, A12-3, R1, (GND)
6	J9-H, J1-F, J1-d, S1-2, (-6V)
7	J9-J, J9-K, J1-P, A7-2, S2-B2, A12-5, (-12V)
8	J9-M, J1-R, R1
9	J1-C, C1(+)
10	J1-S, J9-d
11	J1-A, C2(+)
12	
13	J9-R, C1(-)
14	
15	J9-U, C2(-)
16	
17	J9-L, J1-g, (+37V)

Figure 5-68. Control Amplifier, Schematic Diagram



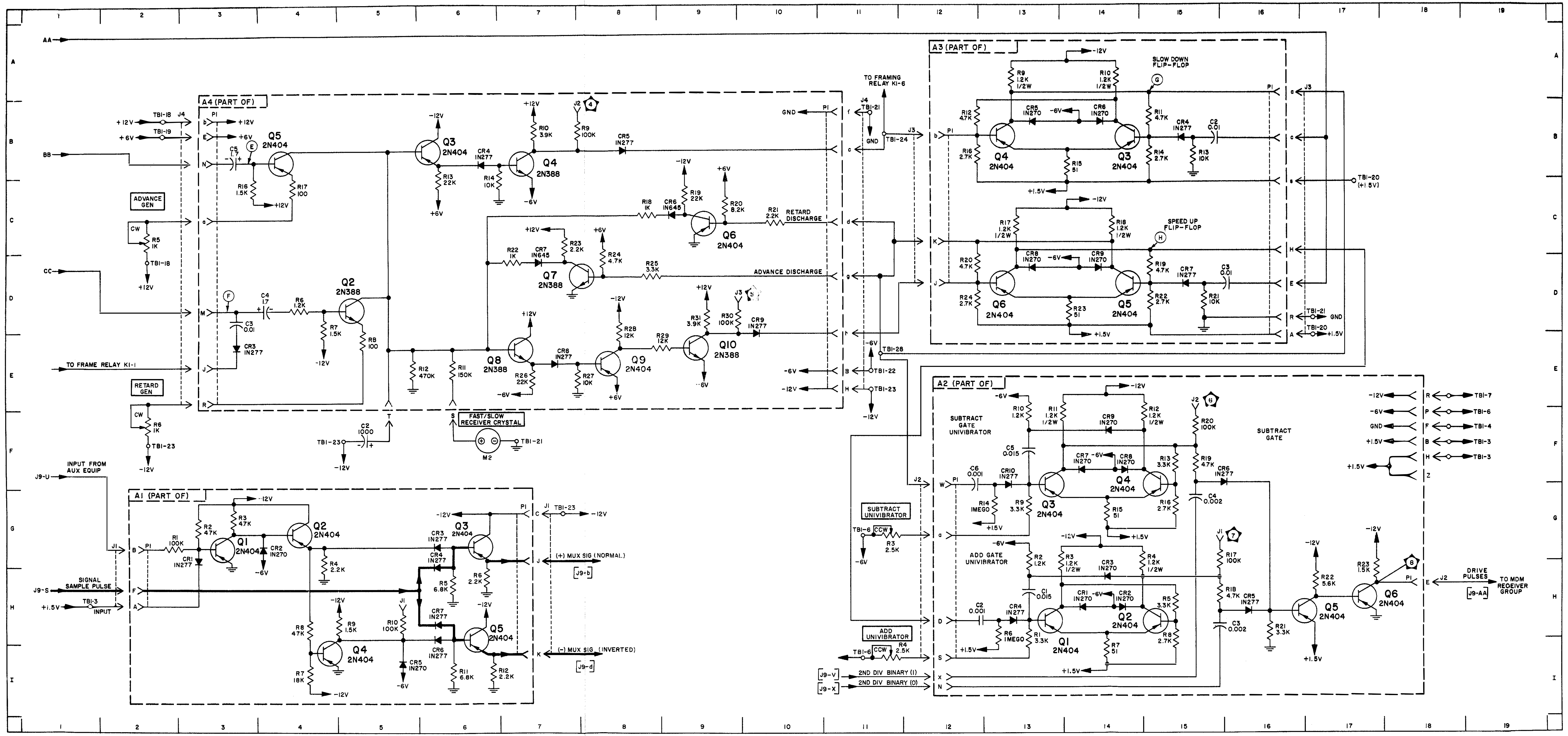
J9 PIN	TO	FUNCTION
A	TB1-1	+ 12V
B	TB1-2	+ 6V
C, D	TB1-3	+ 1.5V
E	TB1-4	GND
F	TB1-5	GND
H	TB1-6	-6V
J, K	TB1-7	- 12V
L	TB1-14	+ 37V
M	TB1-8	+ 50V
N	TB1-17	AUX CLOCK OUT (450 CPS)
P	J1-X	FROM MUX 7 ELEMENT DISTRIBUTOR
R	J1-T	AUX A6 INPUT
S	J1-F	SIGNAL SAMPLING PULSE INPUT
T	J2-c	PHASE LAG INPUT
U	J1-B	INPUT FROM AUX EQUIPMENT
V	J2-X	2 ND DIVIDER BINARY (1)
W	S1-2	AUTO FRAME IN
X	J2-N	2 ND DIVIDER BINARY (0)
Y	J1-f	OUTPUT TO AUX EQUIPMENT
Z	TB1-10	"A" CHANNEL CLOCK
a	J2-b	PHASE LEAD INPUT
b	J1-J	(+) MUX SIGNAL (NORMAL)
c	J1-L	AUX SIGNAL SAMPLING OUTPUT
d	J1-K	(—) MUX SIGNAL (INVERTED)
e	J1-c	AUX A6 OUTPUT
f	S2-3	EXTERNAL FRAME SWITCH
h	R-2	(—) REMOTE MUX
j	S3-B1	(1) REMOTE MUX
n	S3-A2	(—) LOCAL MUX (INVERTED)
p	J1-D	AUX SIGNAL SAMPLING OUTPUT
r	K2-5	ALARM DISCHARGE
s	K3-5	4 CHANNEL ALARM RELAY LOCKUP
t	K3-6	4 CHANNEL LINE LOCKUP
w	K2-6	FRAME OUTPUT PULSE
AA	J2-E	DRIVE PULSES TO MDM (RECEIVER GROUP)
BB	K3-7	EXTERNAL LOCKUP RELEASE

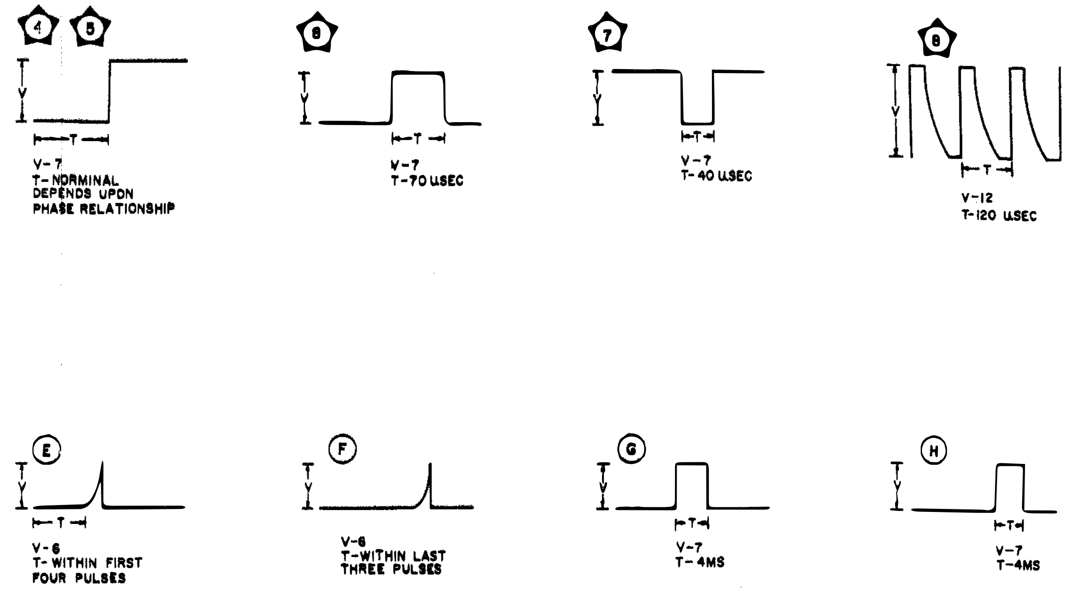
NOTES:
1. ALL RESISTORS SHALL BE 1/4 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS SHALL BE UF. UNLESS OTHERWISE SPECIFIED.



NOTES:
1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING S31A, TEKTRONIC OSCILLOSCOPE.
   OSCILLOSCOPE CONTROL SETTINGS:
   PRESENTATION: CHOPPED
   A CHANNEL: V-1 VOLT / CM
   H-20 MSEC / CM
   B CHANNEL: V-1 VOLT / CM
   H-20 MSEC / CM
   SYNCH: EXTERNAL, SAME AS A INPUT, TEST POINT A CLOCK.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T, T1, T2 - DURATION OF PORTION OF THE WAVEFORM INDICATED.
   V, V1, V2 - PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION: B CHANNEL
   B CHANNEL: V-1 VOLT / CM
   H-20MSEC/CM
   SYNCH: INTERNAL, (+)
5. MULTIPLEX UNIT IN REMOTE OPERATION, WITH ALL MARKS INPUT.

Figure 5-69. Synch Unit, Schematic Diagram, Page 1 of 2



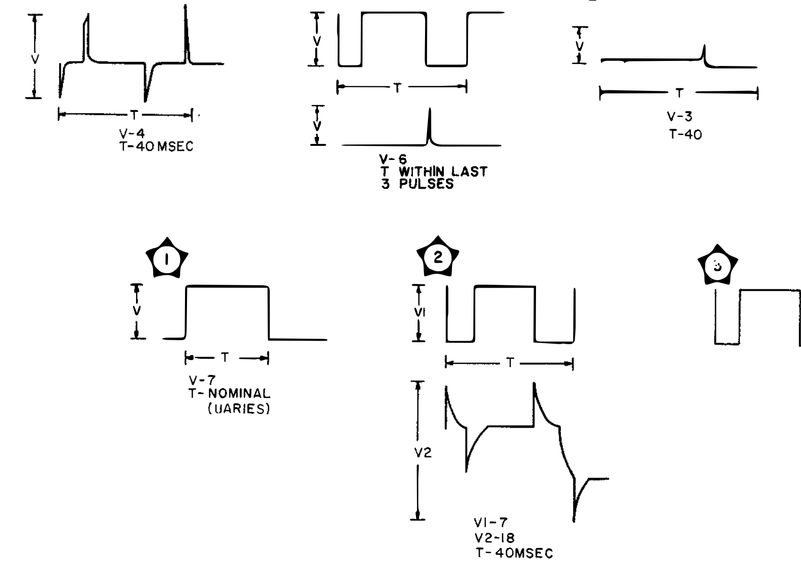


NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVE FORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE.
   OSCILLOSCOPE CONTROL SETTINGS:
   PRESENTATION CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-20MSEC/CM
   B CHANNEL: V-1 VOLT/CM
   H-20 MSEC/CM
   SYNCH: EXTERNAL, SAME AS A INPUT, TESTPOINT A CLOCK.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T,T1,T2-DURATION OF PORTION OF THE WAVEFORM INDICATED.
   V,V1,V2-PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION B CHANNEL
   B CHANNEL V-1 VOLT/CM
   H-20 MSEC/CM
   SYNCH INTERNAL, (+)
5. MULTIPLEX SET IN REMOTE OPERATION WITH ALL MARKS INPUT.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED.
ALL CAPACITORS ARE IN UF UNLESS OTHERWISE SPECIFIED.

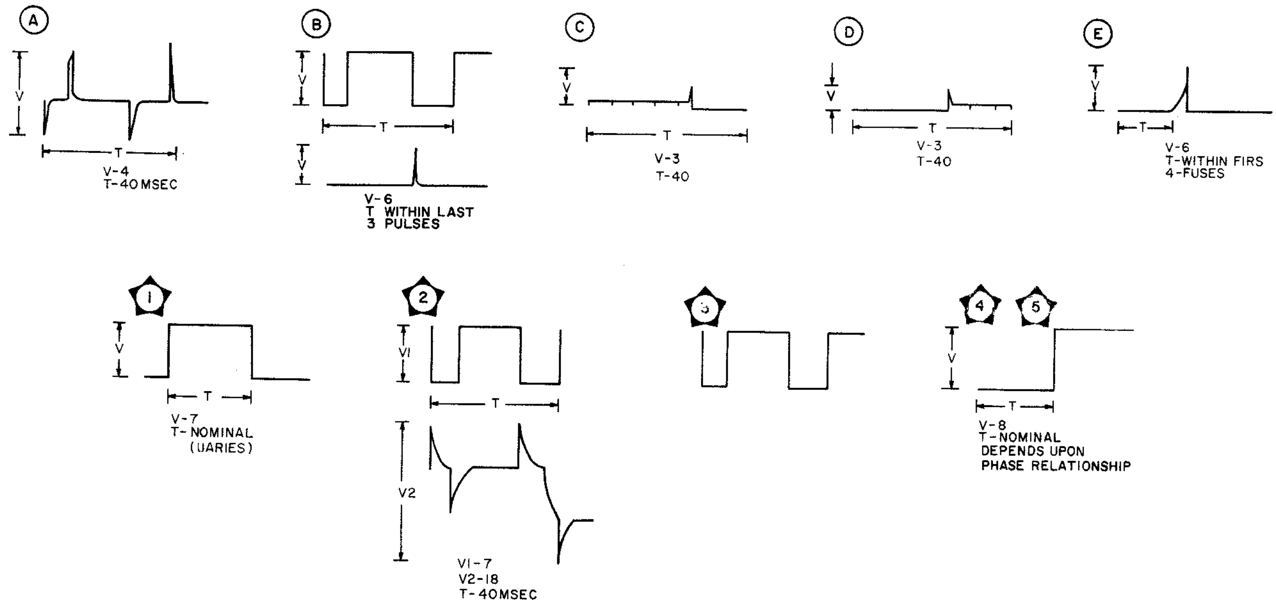
Figure 5-69. Synch Unit, Schematic Diagram. Page 2 of 2



NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGH
AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONIC
OSCILLOSCOPE CONTROL SETTINGS:
PRESENTATION CHOPPED
A CHANNEL V-1 VOLT/CM
H-20MSEC/CM
B CHANNEL V-1 VOLT/CM
H-20MSEC/CM
SYNCH: EXTERNAL, SAME AS A INPUT, TEST POI
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFOR
T,T1,T2-DURATION OF PORTION OF THE WAVEFOR
V, V1,V2-PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FO
PRESENTATION: B CHANNEL
B CHANNEL V-1 VOLT/CM
H-20 MSEC/CM
SYNCH: INTERNAL, (+)
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH AL

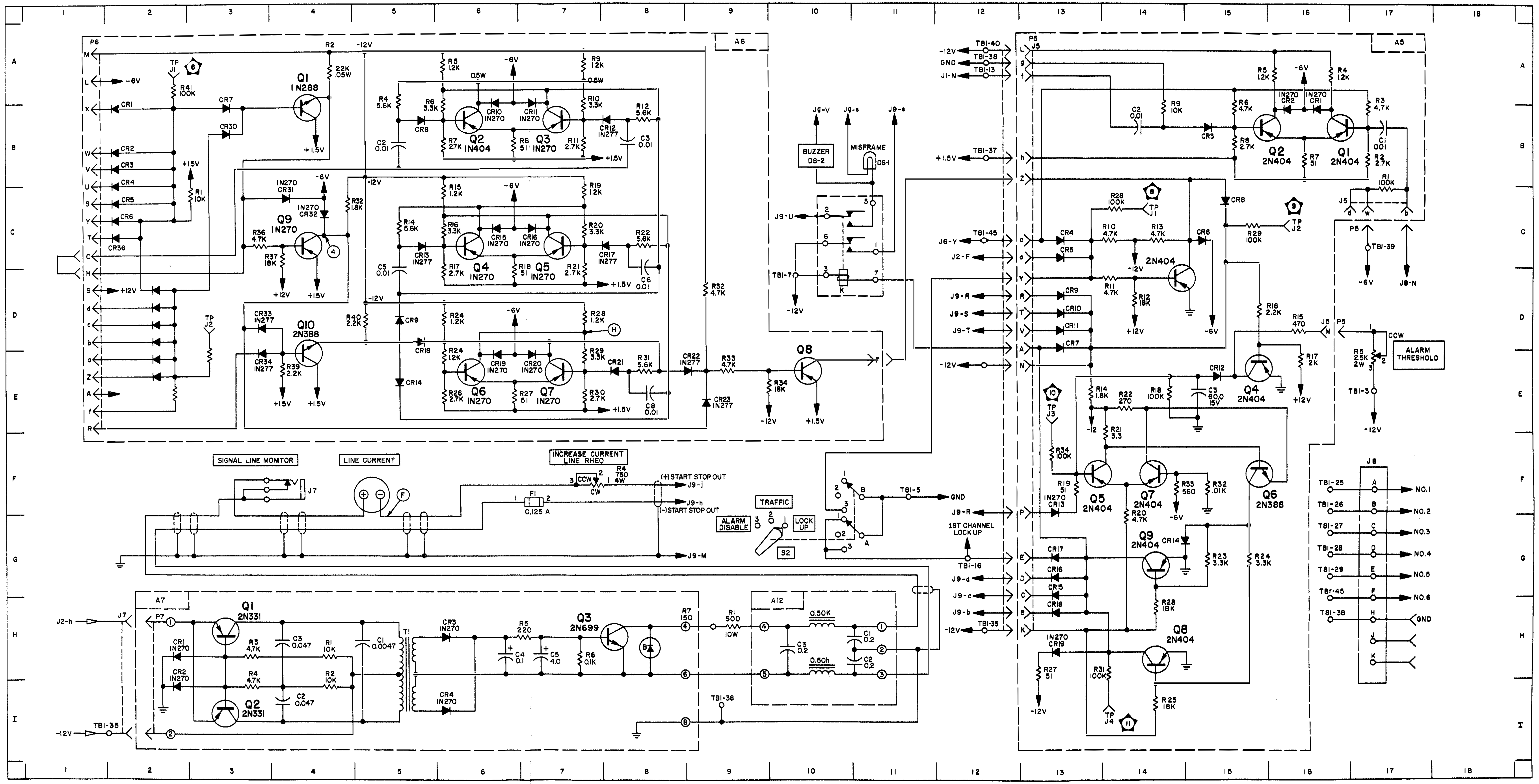
Figure 5-70. Receiver Code Converter, Schem

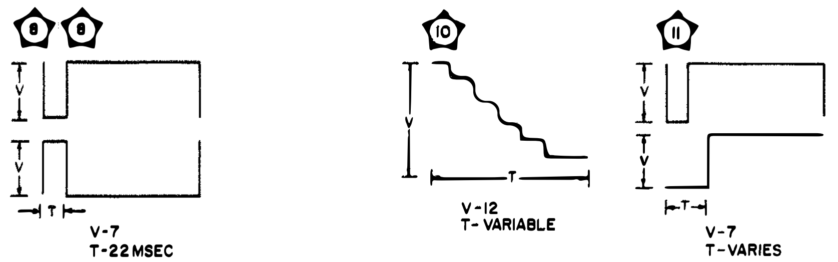


NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONIC OSCILLOSCOPE OSCILLOSCOPE CONTROL SETTINGS:
   PRESENTATION CHOPPED
   A CHANNEL V-1 VOLT/CM
   H-20 MSEC/CM
   B CHANNEL V-1 VOLT/CM
   H-20 MSEC/CM
   SYNCH: EXTERNAL, SAME AS A INPUT, TEST POINT A CLOCK.
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T,T1,T2-DURATION OF PORTION OF THE WAVEFORM INDICATED.
   V, V1,V2-PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS:
   PRESENTATION: B CHANNEL
   B CHANNEL V-1 VOLT/CM
   H-20 MSEC/CM
   SYNCH: INTERNAL, (+)
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT.

Figure 5-70. Receiver Code Converter, Schematic Diagram. Page 1 of 2.





NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. WAVEFORMS RECORDED USING 531A, TEKTRONICS OSCILLOSCOPE.
   OSCILLOSCOPE CONTROL SETTINGS
   PRESENTATION CHOPPED
   A CHANNEL: V-1 VOLT/CM
   H-50MSEC/CM
   B CHANNEL: V-1 VOLT/CM
   H-50MSEC/CM
   SYNCH EXTERNAL, SAME AS A INPUT, C CHANNEL CLOCK
3. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS.
   T, T1, T2 - DURATION OF PORTION OF THE WAVEFORM INDICATED
   V, V1, V2 PEAK VOLTAGE
4. SINGLE TRACE WAVEFORMS TAKEN WITH THE FOLLOWING SETTINGS.
   PRESENTATION B CHANNEL
   B CHANNEL: V-1 VOLT/CM
   H-50MSEC/CM
5. MULTIPLEX UNIT IN LOCAL OPERATION, WITH ALL MARKS INPUT.
6. ALL DIODES ARE TYPE 1N277 UNLESS OTHERWISE SPECIFIED.
7. ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED.
8. ALL CAPACITORS ARE IN UF UNLESS OTHERWISE SPECIFIED.

Figure 5-70. Receiver Code Converter, Schematic Diagram. Page 2 of 2

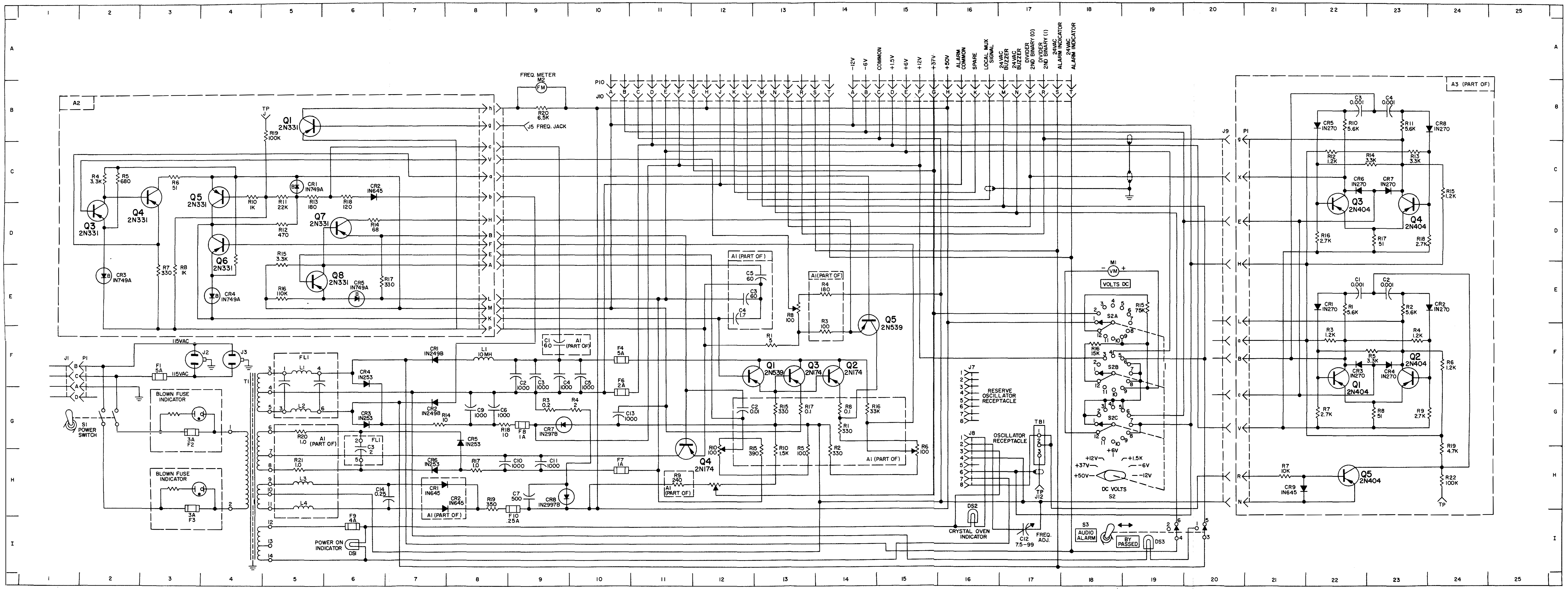


Figure 5-71. Oscillator-Power Supply, Schematic Diagram

SECTION 6

PARTS LIST

6-1. INTRODUCTION.

a. REFERENCE DESIGNATIONS. - The unit numbering method of assigning reference designations has been used to identify units, assemblies, subassemblies, and parts. This method has been expanded as much as necessary to adequately cover the various degrees of subdivision of the equipment. Examples of this unit numbering method and typical expansions of the same are illustrated by the following:

Example 1:

1 R 1

Unit No.	Class of Item	Item No. within class

Read as: First (1) resistor (R) of first unit (1).

Example 2:

4 A1 R1

Unit No.	Subassembly designation	Class and No. of item

Read as: First (1) resistor (R) of first (1) subassembly (A) of fourth (4) unit.

Example 3:

3 A1 A2 R1

Unit No.	Subassembly designation	Subassembly designation	Class and No. of item

Read as: First (1) resistor (R) of second (2) subassembly (A) of first (1) subassembly (A) of third (3) unit.

b. REF DESIG PREFIX. - Partial reference designations are used on the equipment and illustrations. The partial reference designations consist of the class letter(s) and the identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Prefixes are provided on illustrations following the notation "REF DESIG PREFIX."

6-2. LIST OF UNITS.

Table 6-1 is a listing of the units comprising the equipment. The units are listed by unit numbers in numerical order. Thus when the complete reference designation of a part is known, this table will furnish the identification of the unit in which the part is located, since the first number of a complete reference designation identifies the unit. Table 6-1 also provides the following information for each unit listed: (1) quantity per equipment, (2) official name, (3) designation, (4) colloquial name, and (5) location of the first page of its parts listing in table 6-2.

6-3. MAINTENANCE PARTS LIST.

Table 6-2 lists all units and their maintenance parts. The units are listed in numerical sequence. Maintenance parts for each unit are listed alphabetically-numerically by class of part following the unit designation. Thus the parts for each unit are grouped together. Table 6-2 provides the following information: (1) the complete reference designation of each unit, assembly, subassembly, or part, (2) reference to explanatory notes in paragraph 6-6, (3) noun name and brief description, and (4) identification of the illustration which pictorially locates the part.

Note

Classified parts are designated by the following classification symbols placed in the NOTES column (in addition to any numerically identified notes) of the Maintenance Parts List: "C" Confidential, "CMHA" Confidential Modified Handling, "S" Secret, "TS" Top Secret. A brief description is given for all key parts (parts identical to a key part but appearing for the first time for a a unit). The names and descriptions are omitted for other parts, but reference is made to the key or sub-key part for the data. Unless otherwise indicated, all drawing numbers apply to equipment manufacturer and all type numbers apply to part manufacturer.

6-4. LIST OF MANUFACTURERS.

Table 6-3 lists the manufacturers of parts used in the equipment. The table includes the manufacturer's code used in table 6-2 to identify the manufacturers.

6-5. STOCK NUMBER IDENTIFICATION.

Allowance Parts List (APL) issued by the Electronics Supply Office (ESO) include Federal Stock Numbers and Source Maintenance and Recoverability Codes. Therefore, reference should be made to the APL prepared for the equipment for stock numbering information.

TABLE 6-1. LIST OF UNITS

UNIT NO.	QTY	NAME OF UNIT	DESIGNATION	COLLOQUIAL NAME	PAGE
1	1	Oscillator-Power Supply	0-872/UGC-1A	Oscillator-Power Supply	
2	1	Receiver Group (Includes)	OA-3444/UGC-1A	Receiver Group	
2A1	1	Synchronizer, Electrical	SN-313/UGC-1A	Synch Unit	
2A2	1	Demultiplexer-Multiplexer*	TD-515/UGC-1A	Receiver Mux-Demux	
2A3 thru 2A6	4	Converter, Telegraph Code	CV-1218/UGC-1A	Receiver Code Converter	
3	1	Transmitter Group (Includes)	OV-3445/UGC-1A	Transmitter Group	
3A1	1	Amplifier, Control	AM-3107/UGC-1A	Control Amplifier	
3A2	1	Demultiplexer-Multiplexer*	TD-515/UGC-1A	Transmitter Mux-Demux	
3A3 thru 3A6	4	Converter, Telegraph Code	CV-1217/UGC-1A	Transmitter Code Converter	
		*Identical Assemblies			

TABLE 6-2. MAINTENANCE PARTS LIST

OSCILLATOR - POWER SUPPLY 0-872/UGC-1A

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
1		OSCILLATOR - POWER SUPPLY 0-872/UGC-1A (Unit 1): provides ac and dc voltages and timed frequency drive pulses to the Terminal Telegraph AN/UGC-1A. Cabinet is 19" W x 8 23/32" H x 19 3/8" D.	5-22
1A1		POWER SUPPLY SUBASSEMBLY: provides ac and dc voltages for the proper operation of Terminal, Telegraph. Primary power source is 115v, 50/60 cycles, single phase, dwg E400294. mfr 88769.	5-22
1A1A1		POWER SUPPLY SUBASSEMBLY: dwg B-101,430, mfr 88769	5-27
1A1A1C1		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type, polarized, 15vdcw, 60 uf, metal case, insulated, dim; D-9/32", L-7/8", MIL-MIL-R-3965B; type CL25BE600UP, cat B65B501, mfr 56289.	5-27
1A1A1C2		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100 vdcw, 10,000 pico, +80°C-20°C working temp. range ± 35%, insulated, dim: D-0.625" max; type TA. mfr 91418.	5-27
1A1A1C3		Same as 1A1A1C1.	5-27

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1A1C4		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type, polarized, sintered type, 125vdcw, 1.7 uf, -55°C to +85°C working temp range, metal uninsulated, dim; D-5/16", L-15/32", MIL-MIL-C-3965B; type CL44BP1R7TP, mfr 01002.	5-27
1A1A1C5		Same as 1A1A1C1.	5-27
1A1A1CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N645, mfr 94145.	5-27
1A1A1CR2		Same as 1A1A1CR1.	5-27
1A1A1CR3		SEMICONDUCTOR DEVICE, DIODE: type 1N749A, mfr 94145.	5-27
1A1A1L1		Not used.	
1A1A1L2		Not used.	
1A1A1L3		CHOKE, RADIO FREQUENCY: 510 ma current rating, designed for use at frequencies above 70 mc, MIL-C-15305/B; type MS16221, mfr 04061.	5-27
1A1A1L4		Same as 1A1A1L3.	5-27
1A1A1R1		RESISTOR, FIXED, COMPOSITION: 330 ohms ± 5%, 1/2w, MIL-R-11B; type RC20GF331J, part EB-3315, mfr 01121.	5-27
1A1A1R2		RESISTOR, FIXED, COMPOSITION: 330 ohms ± 5%, 1/4w, MIL-R-11B; type RC09GF331J, part CB-3315, mfr 01121.	5-27
1A1A1R3		RESISTOR, FIXED, COMPOSITION: 100 ohms ± 5%, 1/4w, MIL-R-11B; type RC09GF101J, part CB-1015, mfr 01121.	5-27
1A1A1R4		RESISTOR, FIXED, COMPOSITION: 180 ohms ± 5%, 1/2w, MIL-R-11B; type RC20GF181J, part EB-1815, mfr 01121.	5-27
1A1A1R5		Same as 1A1A1R3.	5-27
1A1A1R6		RESISTOR, FIXED, COMPOSITION: 390 ohms ± 5%, 1/2w, MIL-R-11B; type RC20GF391J, part EB-3915, mfr 01121.	5-27
1A1A1R7		Not used.	
1A1A1R8		RESISTOR, FIXED, WIREWOUND: inductive winding, 0.1 ohm ± 5% tolerance, 3w power dissipation, 350°C continuous operating temp, 25°C ambient temp, MIL-MIL-R-26C; type RW55V5R0, mfr 04061.	5-27
1A1A1R9		RESISTOR, FIXED, COMPOSITION: 240 ohms ± 5%, 1/2w, MIL-R-11B; type RC20GF241J, part EB-2415, mfr 01121.	5-27
1A1A1R10		RESISTOR, FIXED, COMPOSITION: 1.5K ± 5%, 2w, MIL-R-11B; type RC42GF152J, part EB-1525, mfr 01121.	5-27
1A1A1R11		Not used.	
1A1A1R12		Not used.	
1A1A1R13		Not used.	
1A1A1R14		Not used.	
1A1A1R15		RESISTOR, FIXED, COMPOSITION: 330 ohms ± 5%, 1w, MIL-R-11B; type RC32GF331J, part GB-3315, mfr 01121.	5-27
1A1A1R16		RESISTOR, FIXED, COMPOSITION: 33K ± 5%, 1/2w, MIL-R-11B; type RC20GF333J, part EB-3335, mfr 01121.	5-27
1A1A1R17		Same as 1A1A1R8.	5-27
1A1A1R18		Not used.	
1A1A1R19		Not used.	
1A1A1R20		RESISTOR, FIXED, WIREWOUND: inductive winding, 1 ohm ± 5% tolerance, 3w power description, 350°C max continuous operating temp, 25°C ambient temp, MIL-MIL-R-26C; type RW59V1R0, mfr 56289.	5-27
1A1A1R21		Same as 1A1A1R20.	5-27
1A1A2		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 777, mfr 88769.	5-29
1A1A2CR1		Same as 1A1A1CR3.	5-29
1A1A2CR2		Same as 1A1A1CR1.	5-29
1A1A2CR3		Same as 1A1A1CR3.	5-29
1A1A2CR4		Same as 1A1A1CR3.	5-29
1A1A2CR5		Same as 1A1A1CR3.	5-29

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1A2J1		JACK, TIP: Completely insulated, plastic, red, nonprecious metal, unplated; type 31-1; sleeve type 31-R, mfr 81073.	5-29
1A1A2P1		CONNECTOR, PLUG, ELECTRICAL: 29 contact, 1 connector mating end, part WM29-P-4, mfr 81312.	5-29
1A1A2Q1		TRANSISTOR: type 2N498, (EN2965-340).	5-29
1A1A2Q2		Not used.	
1A1A2Q3		TRANSISTOR: type 2N33, mfr 04713.	5-29
1A1A2Q4		Same as 1A1A2Q3.	5-29
1A1A2Q5		Same as 1A1A2Q3.	5-29
1A1A2Q6		Same as 1A1A2Q3.	5-29
1A1A2Q7		Same as 1A1A2Q3.	5-29
1A1A2Q8		Same as 1A1A2Q3.	5-29
1A1A2R1		Not used.	
1A1A2R2		Not used.	
1A1A2R3		Not used.	
1A1A2R4		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/2w, MIL-R-11B; type RC20GF332J, part EB-3335, mfr 01121.	5-29
1A1A2R5		RESISTOR, FIXED, COMPOSITION: 680 ohms ± 5%, 1/2w, MIL-R-11B; type RC20GF681J, part EB-6815, mfr 01121.	5-29
1A1A2R6		RESISTOR, FIXED, COMPOSITION: 51 ohms ± 5%, 1/2w, MIL-R-11B; type RC20GF510J, part EB-5105, mfr 01121.	5-29
1A1A2R7		Same as 1A1A1R1.	5-29
1A1A2R8		RESISTOR, FIXED, COMPOSITION: 1K ± 5%, 1/2w, MIL-R-11B; type RC20GF102J, part EB-1025, mfr 01121.	5-29
1A1A2R9		Same as 1A1A2R5.	5-29
1A1A2R10		Same as 1A1A2R8.	5-29
1A1A2R11		RESISTOR, FIXED, COMPOSITION: 22K ± 5%, 1/2w, MIL-R-11B; type RC20GF223J, part EB-2235, mfr 01121.	5-29
1A1A2R12		RESISTOR, FIXED, COMPOSITION: 470 ohms ± 5%, 1/2w, MIL-R-11B; type RC20GF471J, part EB-4715, mfr 01121.	5-29
1A1A2R13		Same as 1A1A1R4.	5-29
1A1A2R14		RESISTOR, FIXED, COMPOSITION: 68 ohms ± 5%, 1/2w, MIL-R-11B; type RC20GF680J, part EB-6805, mfr 01121.	5-29
1A1A2R15		Same as 1A1A2R4.	5-29
1A1A2R16		Same as 1A1A2R8.	5-29
1A1A2R17		Same as 1A1A1R1.	5-29
1A1A2R18		RESISTOR, FIXED, COMPOSITION: 120 ohms ± 5%, 1/2w, MIL-R-11B; type RC20GF121J, part EB-1215, mfr 01121.	5-29
1A1A2R19		RESISTOR, FIXED, COMPOSITION: 100 K ± 5%, 1/4w, MIL-R-11B; type RC07GF104J, part CB-1045, mfr 01121.	5-29
1A1A3		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 778, mfr 88769.	5-28
1A1A3C1		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 600vdcw, 1000 pico, +100% -20% tolerance, insulated body, dim; D-7/16", L-5/32", MIL-MIL-C-11015A; type CK61Y102, mfr 72982.	5-28
1A1A3C2		Same as 1A1A3C1.	5-28
1A1A3C3		Same as 1A1A3C1.	5-28
1A1A3C4		Same as 1A1A3C1.	5-28
1A1A3CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N270, mfr 94145.	5-28
1A1A3CR2		Same as 1A1A3CR1.	5-28
1A1A3CR3		Same as 1A1A3CR1.	5-28
1A1A3CR4		Same as 1A1A3CR1.	5-28
1A1A3CR5		Same as 1A1A3CR1.	5-28
1A1A3CR6		Same as 1A1A3CR1.	5-28
1A1A3CR7		Same as 1A1A3CR1.	5-28
1A1A3CR8		Same as 1A1A3CR1.	5-28
1A1A3CR9		Same as 1A1A3CR1.	5-28

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1A3J1		Same as 1A1A2J1.	5-28
1A1A3P1		Same as 1A1A2P1.	5-28
1A1A3Q1		Same as 1A1A2Q1.	5-28
1A1A3Q2		Same as 1A1A2Q1.	5-28
1A1A3Q3		Same as 1A1A2Q1.	5-28
1A1A3Q4		Same as 1A1A2Q1.	5-28
1A1A3Q5		Same as 1A1A2Q1.	5-28
1A1A3R1		RESISTOR, FIXED, COMPOSITION: 5.6K ± 5%, 1/4w, MIL-R-11B; type RC07GF562J, part CB-5625, mfr 01121.	5-28
1A1A3R2		Same as 1A1A3R1.	5-28
1A1A3R3		RESISTOR, FIXED, COMPOSITION: 1.2K ± 5%, 1/2w, MIL-R-11B; type RC20GF122J, part EB-1225, mfr 01121.	5-28
1A1A3R4		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/4w, MIL-R-11B; type RC07GF332J, part CB-3325, mfr 01121.	5-28
1A1A3R5		Same as 1A1A3R4.	5-28
1A1A3R6		Same as 1A1A3R3.	5-28
1A1A3R7		RESISTOR, FIXED, COMPOSITION: 2.7K ± 5%, 1/4w, MIL-R-11B; type RC07GF272J, Part CB-2725, mfr 01121.	5-28
1A1A3R8		RESISTOR, FIXED, COMPOSITION: 51 ohms ± 5%, 1/4w, MIL-R-11B; type RC07GF510J, part CB-5105, mfr 01121.	5-28
1A1A3R9		Same as 1A1A3R7.	5-28
1A1A3R10		Same as 1A1A3R1.	5-28
1A1A3R11		Same as 1A1A3R1.	5-28
1A1A3R12		Same as 1A1A3R3.	5-28
1A1A3R13		Same as 1A1A3R4.	5-28
1A1A3R14		Same as 1A1A3R4.	5-28
1A1A3R15		Same as 1A1A3R3.	5-28
1A1A3R16		Same as 1A1A3R7.	5-28
1A1A3R17		Same as 1A1A3R8.	5-28
1A1A3R18		Same as 1A1A3R7.	5-28
1A1A3R19		RESISTOR, FIXED, COMPOSITION: 4.7K ± 5%, 1/4w, MIL-R-11B; type RC07GF472J, part CB-4725, mfr 01121.	5-28
1A1A3R20		RESISTOR, FIXED, COMPOSITION: 1.0K ± 5%, 1/4w, MIL-R-11B; type RC07GF102J, part CB-1025, mfr 01121.	5-28
1A1A3R21		Not used.	
1A1A3R22		Same as 1A1A2R19.	5-28
1A1C1		Not used.	
1A1C2		CAPACITOR, FIXED, ELECTROLYTIC: 0.25vdcw, 1000 ufd, 40° to +85°C working temp range, metal case insulated, dim; D-1 3/8", H-3 1/2", MIL-MIL-C-62A; type CE51C102F, mfr 56289.	5-25
1A1C3		Same as 1A1C2.	5-28
1A1C4		Same as 1A1C2.	5-28
1A1C5		Same as 1A1C2.	5-28
1A1C6		CAPACITOR, FIXED, ELECTROLYTIC: 50vdcw, 500 ufd -40° to +85°C working temp range, metal case, insulated, dim; D-1 3/8", H-3", MIL-MIL-C-62A; type CE51C501G, mfr 56289.	5-28
1A1C7		Same as 1A1C6.	5-28
1A1C8		Same as 1A1C2.	5-28
1A1C9		Same as 1A1C2.	5-28
1A1C10		Same as 1A1C2.	5-28
1A1C11		Same as 1A1C2.	5-28
1A1C12		CAPACITOR, VARIABLE, AIR DIELECTRIC: 7.5 pf min, 99 pf max, straight line capacity turning characteristic, 500vacw, 27 plates, brass trimmer, MIL-MIL-C92; type CT12E099J, part ADC-100, mfr 89583.	5-24

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1C13		Same as 1A1C2.	
1A1C14		CAPACITOR, FIXED, PAPER DIELECTRIC: bathtub type, hermetically sealed, 600v, 0.25 ufd ± 10%, -55°C to +85°C working temp range, dim; D-1", W-1 13/16", MIL-C-25A; type CP53BIEF254M, mfr 56289.	5-24
1A1CR1		SEMICONDUCTOR DEVICE, DIODE: part 1N249B, mfr 03508.	5-26
1A1CR2		Same as 1A1CR1.	5-26
1A1CR3		SEMICONDUCTOR DEVICE, DIODE: part 1N253, mfr 03508.	5-26
1A1CR4		Same as 1A1CR3.	5-26
1A1CR5		Same as 1A1CR3.	5-26
1A1CR6		Same as 1A1CR3.	5-26
1A1CR7		SEMICONDUCTOR DEVICE, DIODE: part 1N2976B, mfr 01295.	5-26
1A1CR8		SEMICONDUCTOR DEVICE, DIODE: part 1N2997B, mfr 01295.	5-26
1A1DS1		LAMP, INCANDESCENT: 6v, 0.15 amps, MIL-MIL-STD-242B; type MS-15571-2, mfr 24455.	5-22
1A1DS2		Same as 1A1DS1.	5-22
1A1DS3		LAMP, INCANDESCENT: 28v, 0.04 amp, MIL-MIL-STD-242C; type MS15771-6, mfr 24455.	5-22
1A1F1		FUSE, CARTRIDGE: 5 amp, 250v max, time delay, 6 sec min at 300% load, MIL-MIL-F-15160 MS90079-22-1; type FO3G5R00B, mfr 71400.	5-22
1A1F2		FUSE, CARTRIDGE: 4 amp, 25v max, time delay, 6 sec min at 300% load, MIL-MIL-F-15160, MS90079; type FO3G4R00B, mfr 71400.	5-22
1A1F3		Same as 1A1F2.	5-22
1A1F4		Same as 1A1F1.	5-22
1A1F5		FUSE, CARTRIDGE: 1.5 amp, 250v max, normal instantaneous, MIL-MIL-F-15160, MS90079; type FO3G1R50A, mfr 71400.	5-22
1A1F6		FUSE, CARTRIDGE: 2 amp, 250v max, normal instantaneous, MIL-MIL-F-15160, MS90079; type FO3G2R00A, mfr 71400.	5-22
1A1F7		Same as 1A1F5.	5-22
1A1F8		FUSE, CARTRIDGE: 0.75 amp, 250v max, time delay, 6 sec min at 300% load, MIL-MIL-F-15160, MS90079-19-1; type FO3GR750B, mfr 71400.	5-22
1A1F9		Same as 1A1F2.	5-22
1A1F10		FUSE, CARTRIDGE: 0.25 amp, 250v max, time delay, 6 sec min at 300% load, MIL-MIL-F-15160, MS90079-16-1; type FO3GR125B, mfr 71400.	5-22
1A1FL1		FILTER ASSEMBLY: dwg C-201,945, mfr 88769.	5-24
1A1FL1C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 200vdcw, 2 uf ± 10%, metal case, insulated, plastic, hermetically sealed, dim; D-0.625", H-1 15/16", MIL-MIL-C-18312 (Navy); type CH05A1MC205M.	
1A1FL1C2		CAPACITOR, FIXED, PAPER DIELECTRIC: 150vdcw, 10 uf ± 20%, metalized paper case, hermetically sealed, dim; W-2", D-2", H-7/8"; type MD-1.5-10M, mfr 82376.	
1A1FL1L1		REACTOR: dwg B-101,623, mfr 88769.	
1A1FL1L2		Same as 1A1AFL1L1.	
1A1J1		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant plastic dielectric, MIL-MIL-STD-242B; type MS16108-2, mfr 02660.	5-24
1A1J2		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant plastic dielectric, part 7-8648, mfr 02660.	5-22
1A1J3		Same as 1A1J2.	5-22
1A1J4		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant plastic dielectric, part WM29-S, mfr 81312.	5-22
1A1J5		JACK, TIP: (Red); completely insulated, plastic, nonprecious metal, plated, MIL-MIL-STD-242B; type MS16108-2.	5-1

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1J6		JACK, TIP: (Black); completely insulated, plastic, nonprecious metal, plated, MIL-MIL-STD-242B; type MS16108-3.	5-1
1A1J7		SOCKET, ELECTRON TUBE: octal, standard mounting hole 0.093", JAN-S-28A-3; type TS101P02, part 336BC, mfr 71785.	
1A1J8		Same as 1A1J7.	
1A1J9		Same as 1A1J4.	
1A1J10		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant platic dielectric, MIL-MIL-C-5015C; type MS3102A-20-295, mfr 02660.	
1A1J11		Same as 1A1J10.	5-24
1A1J12		TIP, JACK: bulkhead type, series BNC, MIL; type VG-9091V, part 31-206, mfr 02660.	5-24
1A1L1		REACTOR: PEC4417, TF4RX04JB, 0.010h, dc res, 0.15 ohms max, wv, 425, 7.5 amps dc, dwg C-201,629, mfr 88769.	5-24
1A1M1		VOLTMETER: E-61, sealed, scale 0-75vdc high range, 0-15 vdc low range, dwg B-101,350, mfr 88769.	5-22
1A1M2		METER, FREQUENCY: sealed, Word Per Minute, 20v, scales; 60, 75, 100, dwg B-101,347, mfr 88769.	5-22
1A1Q1		TRANSISTOR: type 2N539, mfr 40931.	5-25
1A1Q2		TRANSISTOR: type 2N174, mfr 89869.	5-24
1A1Q3		Same as 1A1Q2.	5-24
1A1Q4		Same as 1A1Q2.	5-25
1A1Q5		Same as 1A1Q1.	5-25
1A1R1		RESISTOR, FIXED, WIREWOUND: inductive winding, 5 ohms total resistance, 5% tolerance, 18w power dissipation, 275°C max continuous operating temp, 25°C ambient temp, MIL-MIL-R-26C; type RW33G5RO, mfr 71450.	
1A1R2		Not used.	
1A1R3		RESISTOR, FIXED, WIREWOUND: inductive winding, 0.2 ohms total resistance, 10% tolerance, 18w power dissipation, 350°C max continuous operating temp, 25°C ambient temp, MIL-MIL-R-26C; type RW33VR20, mfr 71450.	5-25
1A1R4		RHEOSTAT: 2 ohms ± 10%, 25w norm power rating, MIL-MIL-R-22C; type RP101SA2ROKK, mfr 71450.	5-24
1A1R5		Not used.	
1A1R6		RESISTOR, VARIABLE, COMPOSITION: element, 100 ohms ± 10%, 2w, norm power rating, 1 section, std linear taper, single shaft; type RV4LAYSD101A, mfr 71450.	5-24
1A1R7		Not used.	
1A1R8		Same as 1A1R6.	5-1
1A1R9		Not used.	
1A1R10		Same as 1A1R6.	5-1
1A1R11		Not used.	
1A1R12		RESISTOR, VARIABLE, COMPOSITION: 1 section, 500 ohms ± 10%, 2w norm power rating, std A linear taper, single shaft, metal, slotted, dim; K-0.063", L-0.047", D-1/4", L-7/8", from mounting surface, normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-94B; type RV4LAYSD501A, mfr 71450.	5-24
1A1R13		Not used.	
1A1R14		RESISTOR, FIXED, WIREWOUND: inductive winding, 10 ohm ± 5% 10w power dissipation, 275°C max continuous oper temp, 25°C ambient temp, MIL-MIL-R-26C; type RW31G100, mfr 56289.	
1A1R15		RESISTOR, FIXED, COMPOSITION: 750 ohms ± 1%, 0.5w, MIL-R-10509C; type RN70B7502F, cat B10B134, mfr 75042.	5-26

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1R16		RESISTOR, FIXED, COMPOSITION: 15K ± 1%, 0.5w, MIL-MIL-R-10509C; type RN70B1502F, mfr 75042	
1A1R17		RESISTOR, FIXED, WIREWOUND: inductive winding, 1 ohm total resistance, ± 5% tolerance, 7w power dissipation, 350°C max continuous oper temp, 25°C ambient temp, MIL-MIL-R-26C; type RW33V1R0, mfr 71450.	5-26
1A1R18		RESISTOR, FIXED, WIREWOUND: inductive winding, 10 ohm ± 5% tolerance, 10w power dissipation, 275°C max continuous oper temp, 25°C ambient temp, MIL-MIL-R-26C; type RW56G100, mfr 71450.	5-26
1A1R19		RESISTOR, FIXED, WIREWOUND: inductive winding, 350 ohm ± 5% tolerance, 5w power dissipation, 275°C max continuous oper temp, 25°C ambient temp, MIL-MIL-R-26C; type RW55G351, mfr 71450.	
1A1S1		SWITCH, TOGGLE: dpdt, dim; W-3/4", L-1 5/16", H-2 7/32" overall, MIL-S-3950; type MS35059-4, mfr 04009.	5-22
1A1S2		SWITCH, ROTARY: 3 section, dwg C-201,844, modified 88769, mfr 76854.	5-22
1A1S3		Same as 1A1S1.	5-22
1A1T1		TRANSFORMER, POWER, VOLTAGE REGULATING: 103.5v to 126.5v range, 50 to 60 cycles, single phase, MIL-MIL-R27A, Grade 4, Class R, Life Expectancy X, dwg C-201,627, mfr 88769.	5-24
1A1TB1		TERMINAL BOARD: 6 terminal, MIL-T-16784; type 25TB6, mfr 75382.	5-24
1A1TB2		TERMINAL BOARD: 32 terminals, dwg B-101,417, mfr 88769.	5-26
1A1XC1		Not used.	
1A1XC2		SOCKET, CAPACITOR: molded, mica filled bakelite, MIL-12883-A; type TS101P02; type 8JMN-2, mfr 71785.	5-26
1A1XC3		Same as 1A1XC2.	
1A1XC4		Same as 1A1XC2.	5-26
1A1XC5		Same as 1A1XC2.	5-26
1A1XC6		Same as 1A1XC2.	5-26
1A1XC7		Same as 1A1XC2.	5-26
1A1XC8		Same as 1A1XC2.	5-26
1A1XC9		Same as 1A1XC2.	5-26
1A1XC10		Same as 1A1XC2.	5-26
1A1XC11		Same as 1A1XC2.	5-26
1A1XC12		Not used.	
1A1XC13		Same as 1A1XC2.	5-26
1A1XDS1		LAMPHOLDER: part 83SB410-XP3-112, mfr 72619.	
1A1XDS2		LAMPHOLDER: part 83SB410-XP3-113, mfr 72619.	
1A1XDS3		LAMPHOLDER: part 82410W-111, mfr 72619.	
1A1XF1		FUSEHOLDER: extractor post type, 250v max, 15 amp, MIL-MIL-STD-242B; type FD-1, mfr 71400.	5-26
1A1XF2/3		FUSEHOLDER: extractor post type, MIL-MIL-F-19207; type FHL10G, dwg 9000-56202-74228, mfr 71400.	5-26
1A1XF4		Same as 1A1XF1.	5-26
1A1XF5		Same as 1A1XF1.	5-26
1A1XF6		Same as 1A1XF1.	5-26
1A1XF7		Same as 1A1XF1.	5-26
1A1XF8		Same as 1A1XF1.	5-26
1A1XF9		Same as 1A1XF1.	
1A1XF10		Same as 1A1XF1.	
1A1Z1		OSCILLATOR, RADIO FREQUENCY: 63.000000KC, crystal frequency control, dwg B-101,407, modified 88769, mfr 83330.	5-25

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1Z2		OSCILLATOR, RADIO FREQUENCY: 61.63043KC, crystal frequency control, dwg B-101,407, modified 88769, mfr 83330.	5-25
1J13		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant plastic dielectric, MIL-MIL-STD-242C; type UG-909/U, part 31-206, mfr 02660.	5-21
1J14		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant plastic dielectric, MIL-MIL-C-5015C; type MS3102A-22-10P, mfr 02660.	5-21
1J15		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant plastic dielectric, MIL-MIL-C-5015C; type MS3102A-20-29S, mfr 02660.	5-21
1J16		Same as 1J15.	5-21
1P1		CONNECTOR, PLUG, ELECTRICAL: 4 contact, 1 connector mating end, MIL-MIL-C-5015C; type MS3108A-22-10S, mfr 02660.	5-23
1P10		CONNECTOR, PLUG, ELECTRICAL: 17 contact, 1 connector mating end, MIL-MIL-C-5015C; type MS3108-20-29P, mfr 02660.	5-23
1P11		Same as 1P10.	5-23
1P12		CONNECTOR, PLUG, ELECTRICAL: 1 contact, 1 connector mating end, MIL-MIL-C-5015C; type UG/913-U, mfr 02660.	5-23
1W2		CABLE ASSEMBLY: dwg B-101, 427, mfr 88769.	
1W3		CABLE ASSEMBLY: dwg B-101, 428, mfr 88769.	
1W4		Same as 1W3.	
1W5		CABLE ASSEMBLY: dwg B-101, 429, mfr 88769.	
1Z1		FILTER, RADIO, INTERFERENCE: 150vac, 7 amp, part 187, mfr 88721.	5-23
RECEIVER GROUP			
2		RECEIVER GROUP, CONSISTS OF SYNCHRONIZER ELECTRICAL SN-313/UGC-1A, DEMULTIPLEXER-MULTIPLEXER TD-515/UGC-1A, CONVERTER TELEGRAPH CODE CV-1218/UGC-1A (4 UNITS).	
2A1		ELECTRICAL SYNCHRONIZER: SN-313/UGC-1A, Drawer Assembly.	5-20
2A1A1		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,740, mfr 88769.	5-43
2A1A1C1		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type, polarized, sintered type, 125 vdcw, 1.7 uf, -55°C to 85°C working temp range, metal base, uninsulated, dim; dia 5/16", L-15/32", MIL-MIL-R-3965B; type CL44BP1R7TP, mfr 01002.	5-44
2A1A1C2		Same as 2A1A1C1.	5-44
2A1A1C3		CAPACITOR, FIXED, PAPER DIELECTRIC: 100vdc, 0.1 ufd ± 10%, metal case, insulated, hermetically sealed, dim; D-.375", H-15/16", MIL-MIL-C-25A; type CP09A1KB104K3, cat B64B, mfr 00656.	5-44
2A1A1CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N277, mfr 01295.	5-44
2A1A1CR2		SEMICONDUCTOR DEVICE, DIODE: type 1N270, mfr 01295	5-44
2A1A1CR3		Same as 2A1A1CR1.	5-44
2A1A1CR4		Same as 2A1A1CR1.	5-44
2A1A1CR5		Same as 2A1A1CR2.	5-44
2A1A1CR6		Same as 2A1A1CR1.	5-44
2A1A1CR7		Same as 2A1A1CR1.	5-44
2A1A1CR8		Same as 2A1A1CR2.	5-44
2A1A1CR9		Same as 2A1A1CR2.	5-44

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A1A1J1		JACK, TIP: completely insulated, plastic red, nonprecious metal unplated; type 31-1; sleeve type 31-R, mfr 81073.	5-44
2A1A1J2		Same as 2A1A1J1.	5-44
2A1A1P1		CONNECTOR, PLUG, ELECTRICAL: 29 contact, 1 connector mating end, part WM29-P-4, mfr 81312.	5-44
2A1A1Q1		TRANSISTOR: type 2N40A, mfr 49675.	5-44
2A1A1Q2		Same as 2A1A1Q1.	5-44
2A1A1Q3		Same as 2A1A1Q1.	5-44
2A1A1Q4		Same as 2A1A1Q1.	5-44
2A1A1Q5		Same as 2A1A1Q1.	5-44
2A1A1Q6		TRANSISTOR: type 2N388, mfr 07395.	5-44
2A1A1Q7		Same as 2A1A1Q1.	5-44
2A1A1Q8		TRANSISTOR: type 2N398.	5-44
2A1A1Q9		Same as 2A1A1Q6.	5-44
2A1A1Q10		Same as 2A1A1Q1.	5-44
2A1A1Q11		Same as 2A1A1Q8.	5-44
2A1A1Q12		TRANSISTOR: type 2N498, mfr 01295.	5-44
2A1A1Q13		Same as 2A1A1Q1.	5-44
2A1A1R1		RESISTOR, FIXED, COMPOSITION: 100K ± 5%, 1/4w, MIL-R-11B; type RC07GF104J, part CB-1025, mfr 01121.	5-44
2A1A1R2		RESISTOR, FIXED, COMPOSITION: 47K ± 5%, 1/4w, MIL-R-11B; type RC07GF473J, part CB-4705, mfr 01121.	5-44
2A1A1R3		RESISTOR, FIXED, COMPOSITION: 4.7K ± 5%, 1/4w, MIL-R-11B; type RC07GF472J, part CB-4725, mfr 01121.	5-44
2A1A1R4		RESISTOR, FIXED, COMPOSITION: 2.2K ± 5%, 1/4w, MIL-R-11B; type RC07GF222J, part CB-2225, mfr 01121.	5-44
2A1A1R5		RESISTOR, FIXED, COMPOSITION: 6.8K ± 5%, 1/4w, MIL-R-11B; type RC07GF682J, part CB-6825, mfr 01121.	5-44
2A1A1R6		Same as 2A1A1R4.	5-44
2A1A1R7		RESISTOR, FIXED, COMPOSITION: 18K ± 5%, 1/4w, MIL-R-11B; type RC07GF183J, part CB-1835, mfr 01121.	5-44
2A1A1R8		Same as 2A1A1R3.	5-44
2A1A1R9		RESISTOR, FIXED, COMPOSITION: 1.5K ± 5%, 1/4w, MIL-R-11B; type RC07GF152J, part CB-1525, mfr 01121.	5-44
2A1A1R10		Same as 2A1A1R1.	5-44
2A1A1R11		Same as 2A1A1R5.	5-44
2A1A1R12		Same as 2A1A1R4.	5-44
2A1A1R13		Same as 2A1A1R4.	5-44
2A1A1R14		Same as 2A1A1R4.	5-44
2A1A1R15		Same as 2A1A1R7.	5-44
2A1A1R16		Same as 2A1A1R7.	5-44
2A1A1R17		Same as 2A1A1R4.	5-44
2A1A1R18		RESISTOR, FIXED, COMPOSITION: 8.2K ± 5%, 1/4w, MIL-R 11B; type RC07GF822J, part CB-8225, mfr 01121.	5-44
2A1A1R19		RESISTOR, FIXED, COMPOSITION: 470 ohms ± 5%, 1/2 w, MIL-R-11B; type RC20GF471J, part EB-4715, mfr 01121.	5-44
2A1A1R20		Same as 2A1A1R4.	5-44
2A1A1R21		Same as 2A1A1R4.	5-44
2A1A1R22		Same as 2A1A1R7.	5-44
2A1A1R23		Same as 2A1A1R7.	5-44
2A1A1R24		Same as 2A1A1R4.	5-44
2A1A1R25		Same as 2A1A1R18.	5-44
2A1A1R26		Same as 2A1A1R19.	5-44
2A1A1R27		Same as 2A1A1R3.	5-44
2A1A1R28		Same as 2A1A1R4.	5-44
2A1A1R29		Same as 2A1A1R1.	5-44
2A1A1R30		RESISTOR, FIXED, COMPOSITION: 22K ± 5%, 1/4w, MIL-R-11B; type RC07GF223J, part CB-2235, mfr 01121.	5-44
2A1A1R31		RESISTOR, FIXED, COMPOSITION: 10K ± 5%, 1/4 w, MIL-R-11B; type RC07GF103J, part CB-1035, mfr 01121.	5-44

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A1A1R32		Same as 2A1A1R4.	5-44
2A1A1R33		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/2 w, MIL-R-11B; type RC20GF332J, part EB-3325, mfr 01121.	5-44
2A1A1R34		RESISTOR, FIXED, COMPOSITION: 820 ohms ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF821J, part EB-8215, mfr 01121.	5-44
2A1A2		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,741 mfr 88769.	5-45
2A1A2C		Same as 2A1A1C3.	5-45
2A1A2C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 100vdcw., .015 uf ± 10%, insulated, hermatically sealed, MIL-MIL-C25A; type CPO9A1KB153K, mfr 56289.	5-45
2A1A2C2		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500vdcw, .001 uf +100%, -20% tolerance, insulated body, dim; D-7/16", L-5/32", MIL-MIL-C-11015A; type CK61Y102Z, mfr 72982.	5-45
2A1A2C3		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 600vdcw, .002 uf +100%, -20% tolerance, uninsulated body, dim; D-7/16", L-5/32", MIL-MIL-C-11015A; type CK61Y102Z, mfr 72982.	5-45
2A1A2C4		Same as 2A1A2C3.	5-45
2A1A2C5		Same as 2A1A2C1.	5-45
2A1A2C6		Same as 2A1A2C2.	5-45
2A1A2C7		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100vdcw, .001 uf +80°C -20° working temp range ± 35%, insulated, dim; D-0.350", max; type TA, mfr 91418.	5-45
2A1A2C8		Same as 2A1A1C1	5-45
2A1A2C9		Same as 2A1A2C7.	5-45
2A1A2C10		Same as 2A1A1C1.	5-45
2A1A2CR1		Same as 2A1A1CR2.	5-45
2A1A2CR2		Same as 2A1A1CR2.	5-45
2A1A2CR3		Same as 2A1A1CR2.	5-45
2A1A2CR4		Same as 2A1A1CR1.	5-45
2A1A2CR5		Same as 2A1A1CR1.	5-45
2A1A2CR6		Same as 2A1A1CR1.	5-45
2A1A2CR7		Same as 2A1A1CR2.	5-45
2A1A2CR8		Same as 2A1A1CR2.	5-45
2A1A2CR9		Same as 2A1A1CR2.	5-45
2A1A2CR10		Same as 2A1A1CR1.	5-45
2A1A2CR11		Same as 2A1A1CR1.	5-45
2A1A2CR12		Same as 2A1A1CR1.	5-45
2A1A2CR13		Same as 2A1A1CR2.	5-45
2A1A2CR14		Same as 2A1A1CR2.	5-45
2A1A2CR15		Same as 2ApA1CR2.	5-45
2A1A2CR16		Same as 2A1A1CR1.	5-45
2A1A2CR17		Same as 2A1A1CR1.	5-45
2A1A2CR18		Same as 2A1A1CR1.	5-45
2A1A2CR19		Same as 2A1A1CR1.	5-45
2A1A2CR20		Same as 2A1A1CR2.	5-45
2A1A2CR21		Same as 2A1A1CR2.	5-45
2A1A2CR22		Same as 2A1A1CR2.	5-45
2A1A2J1		Same as 2A1A1J1.	5-45
2A1A2J2		Same as 2A1A1J1.	5-45
2A1A2P1		Same as 2A1A1P1.	5-45
2A1A2Q1		Same as 2A1A1Q1.	5-45
2A1A2Q2		Same as 2A1A1Q1.	5-45
2A1A2Q3		Same as 2A1A1Q1.	5-45
2A1A2Q4		Same as 2A1A1Q1.	5-45
2A1A2Q5		Same as 2A1A1Q1.	5-45

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A1A2Q6		Same as 2A1A1Q1.	5-45
2A1A2Q7		Same as 2A1A1Q1.	5-45
2A1A2Q8		Same as 2A1A1Q1.	5-45
2A1A2Q9		Same as 2A1A1Q1.	5-45
2A1A2Q10		Same as 2A1A1Q1.	5-45
2A1A2Q11		Same as 2A1A1Q1.	5-45
2A1A2Q12		Same as 2A1A1Q1.	5-45
2A1A2R1		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/4 w, MIL-R-11B; type RC07GF332J, part CB-3325, mfr 01121.	5-45
2A1A2R2		RESISTOR, FIXED, COMPOSITION: 1.2K ± 5%, 1/4 w, MIL-R-11B; type RC07GF122J, part CB-1225, mfr 01121.	5-45
2A1A2R3		RESISTOR, FIXED, COMPOSITION: 1.2K ± 5%, 1/2 w, MIL-R-11B; type RC20GF122J, part EB-1225, mfr 01121.	5-45
2A1A2R4		Same as 2A1A2R3.	5-45
2A1A2R5		Same as 2A1A2R1.	5-45
2A1A2R6		RESISTOR, FIXED, COMPOSITION: 1meg ± 5%, 1/4 w, MIL-R-11B; type RC07GF105J, part CB-1055, mfr 01121.	5-45
2A1A2R7		RESISTOR, FIXED, COMPOSITION: 51 ohms ± 5%, 1/4 w, MIL-R-11B; type RC07GF510J, part CB-5105, mfr 01121.	5-45
2A1A2R8		RESISTOR, FIXED, COMPOSITION: 2.7K ± 5%, 1/4 w, MIL-R-11B; type RC07GF272J, part CB-2725, mfr 01121.	5-45
2A1A2R9		Same as 2A1A2R1.	5-45
2A1A2R10		Same as 2A1A2R2.	5-45
2A1A2R11		Same as 2A1A2R3.	5-45
2A1A2R12		Same as 2A1A2R3.	5-45
2A1A2R13		Same as 2A1A2R1.	5-45
2A1A2R14		Same as 2A1A2R6.	5-45
2A1A2R15		Same as 2A1A2R7.	5-45
2A1A2R16		Same as 2A1A2R8.	5-45
2A1A2R17		RESISTOR, FIXED, COMPOSITION: 100K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF104J, part CB-1045, mfr 01121.	5-45
2A1A2R18		Same as 2A1A1R3.	5-45
2A1A2R19		Same as 2A1A1R3.	5-45
2A1A2R20		Same as 2A1A2R17.	5-45
2A1A2R21		Same as 2A1A2R1.	5-45
2A1A2R22		RESISTOR, FIXED, COMPOSITION: 5.6K ± 5%, 1/4 w, MIL-R-11B; type RC07GF562J, part CB-5625, mfr 01121.	5-45
2A1A2R23		Same as 2A1A1R9.	5-45
2A1A2R24		Same as 2A1A1R3.	5-45
2A1A2R25		Same as 2A1A1R4.	5-45
2A1A2R26		Not used.	
2A1A2R27		Same as 2A1A2R17.	5-45
2A1A2R28		RESISTOR, FIXED, COMPOSITION: 470K ± 5%, 1/4 w, MIL-R-11B; type RC07GF474J, part CB-4745, mfr 01121.	5-45
2A1A2R29		Same as 2A1A1R3.	5-45
2A1A2R30		Same as 2A1A2R2.	5-45
2A1A2R31		Same as 2A1A2R3.	5-45
2A1A2R32		Same as 2A1A2R3.	5-45
2A1A2R33		Same as 2A1A2R1.	5-45
2A1A2R34		Same as 2A1A2R7.	5-45
2A1A2R35		Same as 2A1A2R8.	5-45
2A1A2R36		Same as 2A1A1R3.	5-45
2A1A2R37		Not used.	
2A1A2R38		Same as 2A1A1R4.	5-45
2A1A2R39		Same as 2A1A2R17.	5-45
2A1A2R40		Same as 2A1A2R28.	5-45

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A1A2R41		Same as 2A1A1R3.	5-45
2A1A2R42		Same as 2A1A2R2.	5-45
2A1A2R43		Same as 2A1A2R3.	5-45
2A1A2R44		Same as 2A1A2R3.	5-45
2A1A2R45		Same as 2A1A2R1.	5-45
2A1A2R46		Same as 2A1A2R7.	5-45
2A1A2R47		Same as 2A1A2R8.	5-45
2A1A3		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,742, mfr 88769.	5-43
2A1A3C1		Not used.	
2A1A3C2		Same as 2A1A2C7.	5-46
2A1A3C3		Same as 2A1A2C7.	5-46
2A1A3CR1		Same as 2A1A1CR1.	5-46
2A1A3CR2		Same as 2A1A1CR2.	5-46
2A1A3CR3		Same as 2A1A1CR2.	5-46
2A1A3CR4		Same as 2A1A1CR1.	5-46
2A1A3CR5		Same as 2A1A1CR2.	5-46
2A1A3CR6		Same as 2A1A1CR2.	5-46
2A1A3CR7		Same as 2A1A1CR1.	5-46
2A1A3CR8		Same as 2A1A1CR2.	5-46
2A1A3CR9		Same as 2A1A1CR2.	5-46
2A1A3CR10		Same as 2A1A1CR1.	5-46
2A1A3CR11		Same as 2A1A1CR2.	5-46
2A1A3CR12		Same as 2A1A1CR2.	5-46
2A1A3CR13		Same as 2A1A1CR1.	5-46
2A1A3CR14		Same as 2A1A1CR1.	5-46
2A1A3J1		Same as 2A1A1J1.	5-46
2A1A3J2		Same as 2A1A1J1.	5-46
2A1A3P1		Same as 2A1A1P1.	5-46
2A1A3Q1		Same as 2A1A1Q1.	5-46
2A1A3R4		Same as 2A1A1R3.	5-46
2A1A3R5		Not used.	
2A1A3R6		Same as 2A1A2R7.	5-46
2A1A3R7		Same as 2A1A2R8.	5-46
2A1A3R8		Not used.	
2A1A3R9		Same as 2A1A2R3.	5-46
2A1A3R10		Same as 2A1A2R3.	5-46
2A1A3R11		Same as 2A1A1R3.	5-46
2A1A3R12		Same as 2A1A1R3.	5-46
2A1A3R13		Same as 2A1A1R31.	5-46
2A1A3R14		Same as 2A1A2R8.	5-46
2A1A3R15		Same as 2A1A2R7.	5-46
2A1A3R16		Same as 2A1A2R8.	5-46
2A1A3R17		Same as 2A1A2R3.	5-46
2A1A3R18		Same as 2A1A2R3.	5-46
2A1A3R19		Same as 2A1A1R3.	5-46
2A1A3R20		Same as 2A1A1R3.	5-46
2A1A3R21		Same as 2A1A1R31.	5-46
2A1A3R22		Same as 2A1A2R8.	5-46
2A1A3R23		Same as 2A1A2R7.	5-46
2A1A3R24		Same as 2A1A2R8.	5-46
2A1A3R25		Same as 2A1A2R3.	5-46
2A1A3R26		Same as 2A1A2R3.	5-46
2A1A3R27		Same as 2A1A1R3.	5-46
2A1A3R28		Same as 2A1A1R3.	5-46
2A1A3R29		Same as 2A1A2R8.	5-46

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A1A3R30		Same as 2A1A2R7.	5-46
2A1A3R31		Same as 2A1A2R8.	5-46
2A1A3R32		Same as 2A1A2R17.	5-46
2A1A3R33		Same as 2A1A2R17.	5-46
2A1A4		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 743, mfr 88769.	5-42
2A1A4C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 200vdcw, 0.47 uf ± 10%, metal case, insulated, plastic, hermetically sealed, dim; D-0.625", H-1 15/16", MIL-MIL-C-18312 (Navy); type MCH05A-1MC474K, mfr 56289.	5-47
2A1A4C2		Same as 2A1A4C1.	5-47
2A1A4C3		Same as 2A1A2C7.	5-47
2A1A4C4		Same as 2A1A2C8.	5-47
2A1A4C5		Same as 2A1A2C8.	5-47
2A1A4CR1		Same as 2A1A1CR1.	5-47
2A1A4CR2		Same as 2A1A1CR2.	5-47
2A1A4CR3		Same as 2A1A1CR1.	5-47
2A1A4CR4		Same as 2A1A1CR1.	5-47
2A1A4CR5		Same as 2A1A1CR1.	5-47
2A1A4CR6		SEMICONDUCTOR DEVICE, DIODE: type 1N645, mfr 81483	5-47
2A1A4CR7		Same as 2A1A4CR6.	5-47
2A1A4CR8		Same as 2A1A1CR1.	5-47
2A1A4CR9		Same as 2A1A1CR1.	5-47
2A1A4J1		Same as 2A1A1J1.	5-47
2A1A4J2		Same as 2A1A1J1.	5-47
2A1A4J3		Same as 2A1A1J1.	5-47
2A1A4P1		Same as 2A1A1P1.	5-47
2A1A4Q1		Same as 2A1A1Q1.	5-47
2A1A4Q2		Same as 2A1A1Q6.	5-47
2A1A4Q3		Same as 2A1A1Q1.	5-47
2A1A4Q4		Same as 2A1A1Q6.	5-47
2A1A4Q5		Same as 2A1A1Q1.	5-47
2A1A4Q6		Same as 2A1A1Q1.	5-47
2A1A4Q7		Same as 2A1A1Q6.	5-47
2A1A4Q8		Same as 2A1A1Q6.	5-47
2A1A4Q9		Same as 2A1A1Q6.	5-47
2A1A4Q10		Same as 2A1A1Q6.	5-47
2A1A4R1		Same as 2A1A2R17.	5-47
2A1A4R2		Same as 2A1A1R3.	5-47
2A1A4R3		RESITOR, FIXED, COMPOSITION: 12K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF123J, part CB-1235, mfr 01121.	5-47
2A1A4R4		Same as 2A1A2R2.	5-47
2A1A4R5		Same as 2A1A1R3.	5-47
2A1A4R6		Same as 2A1A2R2.	5-47
2A1A4R7		Same as 2A1A1R9.	5-47
2A1A4R8		RESISTOR, FIXED, COMPOSITION: 100 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF221J, part CB-1015, mfr 01121.	5-47
2A1A4R9		Same as 2A1A2R17.	5-47
2A1A4R10		RESISTOR, FIXED, COMPOSITION: 3.9K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF392J, part CB-3925, mfr 01121.	5-47
2A1A4R11		RESISTOR, FIXED, COMPOSITION: 150K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF151J, part CB-1515, mfr 01121.	5-47
2A1A4R12		RESISTOR, FIXED, COMPOSITION: 470K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF474J, part CB-4715, mfr 01121.	5-47
2A1A4R13		Same as 2A1A1R30.	5-47
2A1A4R14		Same as 2A1A4R8.	5-47

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A1A4R15		Not used.	
2A1A4R16		Same as 2A1A1R9.	5-47
2A1A4R17		Same as 2A1A4R8.	5-47
2A1A4R18		Same as 2A1A4R8.	5-47
2A1A4R19		Same as 2A1A1R30.	5-47
2A1A4R20		Same as 2A1A1R18.	5-47
2A1A4R21		Same as 2A1A1R4.	5-47
2A1A4R22		Same as 2A1A4R8.	5-47
2A1A4R23		Same as 2A1A1R30.	5-47
2A1A4R24		Same as 2A1A1R3.	5-47
2A1A4R25		Same as 2A1A2R1.	5-47
2A1A4R26		Same as 2A1A1R30.	5-47
2A1A4R27		Same as 2A1A4R8.	5-47
2A1A4R28		Same as 2A1A4R3.	5-47
2A1A4R29		Same as 2A1A4R3.	5-47
2A1A4R30		Same as 2A1A2R17.	5-47
2A1A4R31		Same as 2A1A4R10.	5-47
2A1A8		FILTER SUBASSEMBLY: dwg C201893, mfr 88769	5-43
2A1A8C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 400vdcw, 50,000 pf ± 20%, metal case, uninsulated, hermetically sealed, dim; D-0.312", H-13/16"; type 123ZN, mfr 00656.	5-43
2A1A8C2		Same as 2A1A8C1.	5-43
2A1A8L1		REACTOR: 1, 0.125 h inductance, 60 ma dc, 43 ohms dc resistance, part B-101,587, mfr 88769.	5-43
2A1A8L2		CHOKE, RADIO FREQUENCY: 185 ma current rating, designed for use with frequencies above 3 mc , MIL-MIL-C-15305; type MS16223-17, LT7K227, mfr 99800.	5-43
2A1A10		ASSY, FILTER/TRANSFORMER, INPT: part C-201,634, mfr 88769.	5-43
2A1A10L1		Same as 2A1A8L2.	5-43
2A1A10L2		Same as 2A1A8L2.	5-43
2A1A10L3		Same as 2A1A8L2.	5-43
2A1C1		Same as 2A1A2C7.	5-42
2A1C2		CAPACITOR, FIXED, ELECTROLYTIC: 25 vdcw, 1000 uf, -40^{o} to $+85^{o}$C working temp range, metal case, insulated, dim; dia 1 3/8", H-3 1/2", MIL-MIL-C-62A; type CE51C102F, mfr 56289.	5-42
2A1C3		Same as 2A1A1C1.	5-42
2A1C4		Same as 2A1C2.	5-43
2A1CR1		Same as 2A1A1CR2.	5-42
2A1F1		FUSE: 0.125 amp, 3AG, part F03GR100A, mfr 75915.	5-42
2A1J1		CONNECTOR, RECEPTACLE, ELECTRICAL: part WM29S, mfr 81312.	5-43
2A1J2		Same as 2A1J1.	5-42
2A1J3		Same as 2A1J1.	5-43
2A1J4		Same as 2A1J1.	5-42
2A1J5		Not used.	
2A1J6		Not used.	
2A1J7		JACK, TELEPHONE: spring leaf type, contact arrangement J4, MIL-MIL-J-641A; type JJ089, part C-12A, mfr 82389.	5-42
2A1J8		Not used.	
2A1J9		CONNECTOR, RECEPTACLE, ELECTRICAL: part GM50MTL, mfr 80586.	5-42
2A1K1		RELAY: part RP7640F, mfr 71482.	5-43
2A1K2		Same as 2A1K1.	5-43
2A1K3		Same as 2A1K1.	5-43

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A1M1		AMMETER: 0-100 ma; Series 100, mfr 16688.	5-20
2A1M2		METER: 50-0-50 ua, part 100, mfr 16688.	5-20
2A1R1		RESISTOR, FIXED, COMPOSITION: 100 ohms ± 5%, 1 w, MIL-R-11B; type RC32GF101J, part GB1015, mfr 01121.	5-42
2A1R2		RESISTOR, VARIABLE: 750 ohms ± 10%, 4 w, dim; 5/8" - slotted shaft, 1/2" long locking bushing, MIL-MIL-R-19A; type RA30LASB751A, cat B11B868, mfr 71450.	5-42
2A1R3		RESISTOR, VARIABLE: composition, 1 section 2.5K ± 10%, 2 w, norm power rating, std A taper, Ref dwg group 3, single shaft, metal, slotted, dim; K-0.063", L-0.047", dia 1/4", long 7/8" from mounting surface, normal torque equipped with shaft locking device, no switch, MIL-MIL-R-94B; type RV4LAYSD252A, mfr 97979.	5-42
2A1R4		Same as 2A1R3.	5-42
2A1R5		RESISTOR, VARIABLE: composition, 1 section, 1K ± 10%, 2 w, norm power rating, std A taper, Ref dwg group 3, single shaft, metal, slotted, dim; Ref dwg group 3 K- .063", L- .047", dia 1/4", long 7/8" from mounting surface, normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-94B; type RV4LAYSD102A, mfr 97979.	5-42
2A1R6		Same as 2A1R5.	5-42
2A1R7		Same as 2A1A2R3.	5-42
2A1R8		Same as 2A1A2R3.	5-42
2A1R9		RESISTOR, FIXED, COMPOSITION: 330 ohms ± 5%, 1/2 w, MIL-R-11B; type RC20GF331J, part EB-3315, mfr 01121.	5-42
2A1S1		SWITCH, TOGGLE: dpdt, dim; W-3/4", L-1 5/16", H-2 7/32", MIL-MIL-S-3950A; type MS35059-23, cat B46N253, mfr 04009.	5-20
2A1S2		SWITCH, TOGGLE: sp, MIL-MIL-S-3950A; type MS35058-30, cat B46N257, mfr 04009.	5-20
2A1S3		SWITCH, ROTARY: mux line, part C-201,697, modified 88769.	5-42
2A1S4		SWITCH, TOGGLE: sp, MIL-MIL-S-3950A; type MS35058-29, cat B46N256, mfr 04009.	5-20
2A1TB1		STRIP, TERMINAL: 34 terminals, part C-201697, mfr 88769	5-42
2A1TB2		TERMINAL BOARD: 5 terminals, MIL-T-16784 (Ships); type 25TB5, mfr 75382.	5-42
2A1XC2		SOCKET, CAPACITOR: molded, mica filled bakelite, MIL-12883-A; type TS101P02, mfr 71785.	5-42
2A1XC4		Same as 2A1XC2.	5-43
2A1XF1		FUSEHOLDER: part FHN20G	5-43
2A2		DEMULTIPLEXER-MULTIPLEXER: TD-515/UGC-1A Drawer Assembly.	5-20
2A2A1		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,752, mfr 88769.	5-57
2A2A1C1		Same as 2A1A2C7.	5-57
2A2A1C2		Same as 2A1A2C7.	5-57
2A2A1C3		Same as 2A1A2C7.	5-57
2A2A1C4		Same as 2A1A2C7.	5-57
2A2A1C5		Same as 2A1A2C7.	5-57
2A2A1C6		Same as 2A1A2C7.	5-57
2A2A1C7		Same as 2A1A2C7.	5-57
2A2A1C8		Same as 2A1A2C7.	5-57
2A2A1C9		Same as 2A1A2C7.	5-57
2A2A1C10		Same as 2A1A2C7.	5-57
2A2A1C11		Same as 2A1A2C7.	5-57
2A2A1C12		Same as 2A1A2C7.	5-57
2A2A1C13		Same as 2A1A2C7.	5-57

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A2A1C14		Same as 2A1A2C7.	5-57
2A2A1C15		Same as 2A1A2C7.	5-57
2A2A1C16		Same as 2A1A2C7.	5-57
2A2A1CR1		Same as 2A1A1CR2.	5-57
2A2A1CR2		Same as 2A1A1CR2.	5-57
2A2A1CR3		Same as 2A1A1CR2.	5-57
2A2A1CR4		Same as 2A1A1CR2.	5-57
2A2A1CR5		Same as 2A1A1CR2.	5-57
2A2A1CR6		Same as 2A1A1CR2.	5-57
2A2A1CR7		Same as 2A1A1CR2.	5-57
2A2A1CR8		Same as 2A1A1CR2.	5-57
2A2A1CR9		Same as 2A1A1CR2.	5-57
2A2A1CR10		Same as 2A1A1CR2.	5-57
2A2A1CR11		Same as 2A1A1CR2.	5-57
2A2A1CR12		Same as 2A1A1CR2.	5-57
2A2A1P1		Same as 2A1A1P1.	5-57
2A2A1Q1		Same as 2A1A1Q1.	5-57
2A2A1Q2		Same as 2A1A1Q1.	5-57
2A2A1Q3		Same as 2A1A1Q6.	5-57
2A2A1Q4		Same as 2A1A1Q1.	5-57
2A2A1Q5		Same as 2A1A1Q6.	5-57
2A2A1Q6		Same as 2A1A1Q1.	5-57
2A2A1Q7		Same as 2A1A1Q6.	5-57
2A2A1Q8		Same as 2A1A1Q1.	5-57
2A2A1Q9		Same as 2A1A1Q6.	5-57
2A2A1Q10		Same as 2A1A1Q1.	5-57
2A2A1Q11		Same as 2A1A1Q6.	5-57
2A2A1Q12		Same as 2A1A1Q1.	5-57
2A2A1Q13		Same as 2A1A1Q6.	5-57
2A2A1Q14		Same as 2A1A1Q1.	5-57
2A2A1Q15		Same as 2A1A1Q6.	5-57
2A2A1Q16		Same as 2A1A1Q1.	5-57
2A2A1Q17		Same as 2A2A1Q6.	5-57
2A2A1Q18		Same as 2A1A1Q1.	5-57
2A2A1Q19		Same as 2A1A1Q6.	5-57
2A2A1Q20		Same as 2A1A1Q1.	5-57
2A2A1Q21		Same as 2A1A1Q6.	5-57
2A2A1Q22		Same as 2A1A1Q1.	5-57
2A2A1Q23		Same ad 2A1A1Q6.	5-57
2A2A1Q24		Same as 2A1A1Q1.	5-57
2A2A1Q25		Same as 2A1A1Q6.	5-57
2A2A1Q26		Same as 2A1A1Q1.	5-57
2A2A1R1		Same as 2A1A1R31.	5-57
2A2A1R2		Same as 2A1A2R2.	5-57
2A2A1R3		RESISTOR, FIXED, COMPOSITION: 270 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF271J, part CB-2715, mfr 01121.	5-57
2A2A1R4		Same as 2A1A2R17.	5-57
2A2A1R5		Same as 2A1A1R4.	5-57
2A2A1R6		Same as 2A1A2R1.	5-57
2A2A1R7		RESISTOR, FIXED, COMPOSITION: 820 ohms ± 5%, 1/2 w, MIL-MIL-R-11B;type RC20GF821J, part FB-8215, mfr 01121.	5-57
2A2A1R8		Same as 2A1A1R4.	5-57
2A2A1R9		Same as 2A1A4R10.	5-57
2A2A1R10		Same as 2A2A1R7.	5-57
2A2A1R11		Same as 2A1A1R4.	5-57

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A2A1R12		Same as 2A1A4R10.	5-57
2A2A1R13		Same as 2A2A1R7.	5-57
2A2A1R14		Same as 2A1A1R4.	5-57
2A2A1R15		Same as 2A1A4R10.	5-57
2A2A1R16		Same as 2A2A1R7	5-57
2A2A1R17		Same as 2A1A1R4.	5-57
2A2A1R18		Same as 2A1A4R10.	5-57
2A2A1R19		Same as 2A2A1R7.	5-57
2A2A1R20		Same as 2A1A1R4.	5-57
2A2A1R21		Same as 2A1A4R10.	5-57
2A2A1R22		Same as 2A2A1R7.	5-57
2A2A1R23		Same as 2A1A1R4.	5-57
2A2A1R24		Same as 2A1A4R10.	5-57
2A2A1R25		Same as 2A2A1R7.	5-57
2A2A1R26		Same as 2A1A1R4.	5-57
2A2A1R27		Same as 2A1A4R10.	5-57
2A2A1R28		Same as 2A2A1R7.	5-57
2A2A1R29		Same as 2A1A1R4.	5-57
2A2A1R30		Same as 2A1A4R10.	5-57
2A2A1R31		Same as 2A2A1R7.	5-57
2A2A1R32		Same as 2A1A1R4.	5-57
2A2A1R33		Same as 2A1A4R10.	5-57
2A2A1R34		Same as 2A2A1R7.	5-57
2A2A1R35		Same as 2A1A1R4.	5-57
2A2A1R36		Same as 2A1A4R10.	5-57
2A2A1R37		Same as 2A2A1R7.	5-57
2A2A1R38		Same as 2A1A1R4.	5-57
2A2A1R39		Same as 2A1A2R1.	5-57
2A2A1R40		Same as 2A2A1R7.	5-57
2A2A1R41		Same as 2A1A1R31.	5-57
2A2A1R42		Same as 2A2A1R3.	5-57
2A2A1R43		Same as 2A1A2R2.	5-57
2A2A2		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,753, mfr 88769	5-57
2A2A2C1		Same as 2A1A2C7.	5-60
2A2A2C2		Not used.	
2A2A2C3		Not used.	
2A2A2C4		Same as 2A1A2C7.	5-60
2A2A2C5		Same as 2A1A2C7.	5-60
2A2A2C6		Same as 2A1A2C7.	5-60
2A2A2C7		Same as 2A1A2C7.	5-60
2A2A2C8		Same as 2A1A2C7.	5-60
2A2A2C9		Same as 2A1A2C7.	5-60
2A2A2C10		Same as 2A1A2C7.	5-60
2A2A2C11		Same as 2A1A2C7.	5-60
2A2A2C12		Same as 2A1A2C7.	5-60
2A2A2C13		Same as 2A1A2C7.	5-60
2A2A2C14		Same as 2A1A2C7.	5-60
2A2A2C15		Same as 2A1A2C7.	5-60
2A2A2C16		Same as 2A1A2C7.	5-60
2A2A2C17		Same as 2A1A2C7.	5-60
2A2A2C18		Same as 2A1A2C7.	5-60
2A2A2C19		Same as 2A1A2C7.	5-60
2A2A2CR1		Same as 2A1A1CR2.	5-60
2A2A2CR2		Same as 2A1A1CR2.	5-60
2A2A2CR3		Same as 2A1A1CR2.	5-60

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A2A2CR4		Same as 2A1A1CR2.	5-60
2A2A2CR5		Same as 2A1A1CR2.	5-60
2A2A2CR6		Same as 2A1A1CR2.	5-60
2A2A2CR7		Same as 2A1A1CR2.	5-60
2A2A2CR8		Same as 2A1A1CR2.	5-60
2A2A2CR9		Same as 2A1A1CR2.	5-60
2A2A2CR10		Same as 2A1A1CR2.	5-60
2A2A2CR11		Same as 2A1A1CR2.	5-60
2A2A2CR12		Same as 2A1A1CR2.	5-60
2A2A2CR13		Same as 2A1A1CR2.	5-60
2A2A2J1		Same as 2A1A1J1.	5-60
2A2A2P1		Same as 2A1A1P1.	5-60
2A2A2Q1		Same as 2A1A1Q1.	5-60
2A2A2Q2		Same as 2A1A1Q1.	5-60
2A2A2Q3		Same as 2A1A1Q6.	5-60
2A2A2Q4		Same as 2A1A1Q1.	5-60
2A2A2Q5		Same as 2A1A1Q6.	5-60
2A2A2Q6		Same as 2A1A1Q1.	5-60
2A2A2Q7		Same as 2A1A1Q1.	5-60
2A2A2Q8		Same as 2A1A1Q1.	5-60
2A2A2Q9		Same as 2A1A1Q6.	5-60
2A2A2Q10		Same as 2A1A1Q1.	5-60
2A2A2Q11		Same as 2A1A1Q6.	5-60
2A2A2Q12		Same as 2A1A1Q1.	5-60
2A2A2Q13		Same as 2A1A1Q6.	5-60
2A2A2Q14		Same as 2A1A1Q1.	5-60
2A2A2Q15		Same as 2A1A1Q6.	5-60
2A2A2Q16		Same as 2A1A1Q1.	5-60
2A2A2Q17		Same as 2A1A1Q6.	5-60
2A2A2Q18		Same as 2A1A1Q1.	5-60
2A2A2Q19		Same as 2A1A1Q6.	5-60
2A2A2Q20		Same as 2A1A1Q1.	5-60
2A2A2Q21		Same as 2A1A1Q6.	5-60
2A2A2Q22		Same as 2A1A1Q1.	5-60
2A2A2Q23		Same as 2A1A1Q6.	5-60
2A2A2Q24		Same as 2A1A1Q1.	5-60
2A2A2Q25		Same as 2A1A1Q6.	5-60
2A2A2Q26		Same as 2A1A1Q1.	5-60
2A2A2Q27		Same as 2A1A1Q6.	5-60
2A2A2Q28		Same as 2A1A1Q1.	5-60
2A2A2R1		Same as 2A1A1R31.	5-60
2A2A2R2		Same as 2A1A2R2.	5-60
2A2A2R3		Same as 2A2A1R3.	5-60
2A2A2R4		Same as 2A1A2R17.	5-60
2A2A2R5		Same as 2A1A1R4.	5-60
2A2A2R6		Same as 2A1A2R1.	5-60
2A2A2R7		Same as 2A2A1R7.	5-60
2A2A2R8		Same as 2A1A1R4.	5-60
2A2A2R9		Same as 2A1A4R10.	5-60
2A2A2R10		Same as 2A2A1R7.	5-60
2A2A2R11		Same as 2A1A1R4.	5-60
2A2A2R12		Same as 2A1A4R10.	5-60
2A2A2R13		Same as 2A2A1R7.	5-60
2A2A2R14		Same as 2A1A1R4.	5-60
2A2A2R15		Same as 2A1A4R10.	5-60
2A2A2R16		Same as 2A2A1R7.	5-60

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A2A2R17		Same as 2A1A1R4.	5-60
2A2A2R18		Same as 2A1A4R10.	5-60
2A2A2R19		Same as 2A2A1R7.	5-60
2A2A2R20		Same as 2A1A1R4.	5-60
2A2A2R21		Same as 2A1A4R10.	5-60
2A2A2R22		Same as 2A2A1R7.	5-60
2A2A2R23		Not used.	
2A2A2R24		Same as 2A1A1R4.	5-60
2A2A2R25		Same as 2A1A2R1.	5-60
2A2A2R26		Same as 2A2A1R7.	5-60
2A2A2R27		Same as 2A1A1R4.	5-60
2A2A2R28		Same as 2A1A4R10.	5-60
2A2A2R29		Same as 2A2A1R7.	5-60
2A2A2R30		Same as 2A1A1R4.	5-60
2A2A2R31		Same as 2A1A4R10.	5-60
2A2A2R32		Same as 2A2A1R7.	5-60
2A2A2R33		Same as 2A1A1R4.	5-60
2A2A2R34		Same as 2A1A1R10.	5-60
2A2A2R35		Same as 2A2A1R7.	5-60
2A2A2R36		Same as 2A1A1R4.	5-60
2A2A2R37		Same as 2A1A4R10.	5-60
2A2A2R38		Same as 2A2A1R7.	5-60
2A2A2R39		Same as 2A1A1R4.	5-60
2A2A2R40		Same as 2A1A4R10.	5-60
2A2A2R41		Same as 2A2A1R7.	5-60
2A2A2R42		Same as 2A1A1R4.	5-60
2A2A2R43		Same as 2A1A4R10.	5-60
2A2A2R44		Same as 2A2A1R7.	5-60
2A2A2R45		Same as 2A1A1R31.	5-60
2A2A2R46		Same as 2A2A1R3.	5-60
2A2A2R47		Same as 2A1A2R2.	5-60
2A2A3		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 754 mfr 88769.	5-58
2A2A3CR1		Same as 2A1A1CR2.	5-61
2A2A3CR2		Same as 2A1A1CR2.	5-61
2A2A3CR3		Same as 2A1A1CR2.	5-61
2A2A3CR4		Same as 2A1A1CR2.	5-61
2A2A3CR5		Same as 2A1A1CR2.	5-61
2A2A3CR6		Same as 2A1A1CR2.	5-61
2A2A3CR7		Same as 2A1A1CR2.	5-61
2A2A3CR8		Same as 2A1A1CR2.	5-61
2A2A3CR9		Same as 2A1A1CR2.	5-61
2A2A3CR10		Same as 2A1A1CR2.	5-61
2A2A3CR11		Same as 2A1A1CR2.	5-61
2A2A3CR12		Same as 2A1A1CR2.	5-61
2A2A3P1		Same as 2A1A1P1.	5-61
2A2A3Q1		Same as 2A1A1Q6.	5-61
2A2A3Q2		Same as 2A1A1Q1.	5-61
2A2A3R1		Same as 2A1A2R17.	5-61
2A2A3R2		Same as 2A1A2R17.	5-61
2A2A3R3		Same as 2A1A1R31.	5-61
2A2A3R4		Same as 2A1A1R31.	5-61
2A2A3R5		Same as 2A1A1R4.	5-61
2A2A3R6		Same as 2A1A1R4.	5-61
2A2A3R7		Same as 2A1A1R3.	5-61

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A2A3R8		Same as 2A1A1R3.	5-61
2A2A3R9		RESISTOR, FIXED, COMPOSITION: 27K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF273J, part CB-2735, mfr 01121.	5-61
2A2A3R10		Same as 2A1A1R4.	5-61
2A2A4		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,755, mfr 88769.	5-57
2A2A4C1		Same as 2A1A2C7.	5-62
2A2A4C2		Same as 2A1A2C7.	5-62
2A2A4C3		Same as 2A1A2C7.	5-62
2A2A4C4		Same as 2A1A2C7.	5-62
2A2A4C5		Same as 2A1A2C7.	5-62
2A2A4C6		Same as 2A1A2C7.	5-62
2A2A4C7		Same as 2A1A2C7.	5-62
2A2A4C8		Same as 2A1A2C7.	5-62
2A2A4C9		Same as 2A1A2C7.	5-62
2A2A4C10		Same as 2A1A2C7.	5-62
2A2A4C11		Same as 2A1A2C7.	5-62
2A2A4C12		Same as 2A1A2C7.	5-62
2A2A4C13		Same as 2A1A2C7.	5-62
2A2A4C14		Same as 2A1A2C7.	5-62
2A2A4C15		Same as 2A1A2C7.	5-62
2A2A4C16		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type, polarized, foil type, 15vdcw 60 ref -55°C to +85°C working temp range, metal case, insulated, dim; MIL-MIL-R-3965B; type CL25BE600-UP, Cat B65B501, mfr 56289.	
2A2A4CR1		Same as 2A1A1CR2.	5-62
2A2A4CR2		Same as 2A1A1CR2.	5-62
2A2A4CR3		Same as 2A1A1CR2.	5-62
2A2A4CR4		Same as 2A1A1CR2.	5-62
2A2A4CR5		Not used.	
2A2A4CR6		Same as 2A1A1CR2.	5-62
2A2A4CR7		Same as 2A1A1CR2.	5-62
2A2A4CR8		Same as 2A1A1CR2.	5-62
2A2A4CR9		Same as 2A1A1CR2.	5-62
2A2A4CR10		Same as 2A1A1CR2.	5-62
2A2A4CR11		Same as 2A1A1CR2.	5-62
2A2A4J1		Same as 2A1A1J1.	5-62
2A2A4P1		Same as 2A1A1P1.	5-62
2A2A4Q1		Same as 2A1A1Q1.	5-62
2A2A4Q2		Same as 2A1A1Q1.	5-62
2A2A4Q3		Same as 2A1A1Q6.	5-62
2A2A4Q4		Same as 2A1A1Q1.	5-62
2A2A4Q5		Same as 2A1A1Q6.	5-62
2A2A4Q6		Same as 2A1A1Q1.	5-62
2A2A4Q7		Same as 2A1A1Q6.	5-62
2A2A4Q8		Same as 2A1A1Q1.	5-62
2A2A4Q9		Same as 2A1A1Q6.	5-62
2A2A4Q10		Not used.	
2A2A4Q11		Same as 2A1A1Q1.	5-62
2A2A4Q12		Same as 2A1A1Q6.	5-62
2A2A4Q13		Same as 2A1A1Q1.	5-62
2A2A4Q14		Same as 2A1A1Q6.	5-62
2A2A4Q15		Same as 2A1A1Q1.	5-62
2A2A4Q16		Same as 2A1A1Q6.	5-62
2A2A4Q17		Same as 2A1A1Q1.	5-62
2A2A4Q18		Same as 2A1A1Q6.	5-62

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A2A4Q19		Same as 2A1A1Q1.	5-62
2A2A4Q20		Same as 2A1A1Q6.	5-62
2A2A4Q21		Same as 2A1A1Q1.	5-62
2A2A4Q22		Same as 2A1A1Q6.	5-62
2A2A4Q23		Same as 2A1A1Q1.	5-62
2A2A4R1		Same as 2A1A1R31.	5-62
2A2A4R2		Same as 2A2A1R3.	5-62
2A2A4R3		Same as 2A1A2R2.	5-62
2A2A4R4		Same as 2A1A1R4.	5-62
2A2A4R5		Same as 2A1A2R1.	5-62
2A2A4R6		Same as 2A2A1R7.	5-62
2A2A4R7		Same as 2A1A1R4.	5-62
2A2A4R8		Same as 2A1A4R10.	5-62
2A2A4R9		Same as 2A2A1R7.	5-62
2A2A4R10		Same as 2A1A1R4.	5-62
2A2A4R11		Same as 2A1A4R10.	5-62
2A2A4R12		Same as 2A2A1R7.	5-62
2A2A4R13		Same as 2A1A1R4.	5-62
2A2A4R14		Same as 2A1A4R10.	5-62
2A2A4R15		Same as 2A2A1R7.	5-62
2A2A4R16		Not used.	
2A2A4R17		Not used.	
2A2A4R18		Not used.	
2A2A4R19		Not used.	
2A2A4R20		Same as 2A1A2R17.	5-62
2A2A4R21		Not used.	
2A2A4R22		Same as 2A1A1R4.	5-62
2A2A4R23		Same as 2A1A4R10.	5-62
2A2A4R24		Same as 2A2A1R7.	5-62
2A2A4R25		Same as 2A1A1R4.	5-62
2A2A4R26		Same as 2A1A4R10.	5-62
2A2A4R27		Same as 2 A2A1R7.	5-62
2A2A4R28		Same as 2A1A1R4.	5-62
2A2A4R29		Same as 2A1A4R10.	5-62
2A2A4R30		Same as 2A2A1R7.	5-62
2A2A4R31		Same as 2A1A1R4.	5-62
2A2A4R32		Same as 2A1A4R10.	5-62
2A2A4R33		Same as 2A2A1R7.	5-62
2A2A4R34		Same as 2A1A1R4.	5-62
2A2A4R35		Same as 2A1A4R10.	5-62
2A2A4R36		Same as 2A2A1R7.	5-62
2A2A4R37		Same as 2A1A1R4.	5-62
2A2A4R38		Same as 2A1A2R1.	5-62
2A2A4R39		Same as 2A2A1R7.	5-62
2A2A4R40		Same as 2A1A1R31.	5-62
2A2A4R41		Same as 2A2A1R3.	5-62
2A2A4R42		Not used.	
2A2A4R43		Not used.	
2A2A4R44		Same as 2A1A2R2.	5-62
2A2A5		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-801,756, mfr 88769.	5-58
2A2A5CR1		Same as 2A1A1CR2.	5-63
2A2A5CR2		Same as 2A1A1CR2.	5-63
2A2A5CR3		Same as 2A1A1CR2.	5-63
2A2A5CR4		Same as 2A1A1CR2.	5-63
2A2A5CR5		Same as 2A1A1CR2.	5-63

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A2A5CR6		Same as 2A1A1CR2.	5-63
2A2A5CR7		Same as 2A1A1CR2.	5-63
2A2A5CR8		Same as 2A1A1CR2.	5-63
2A2A5CR9		Same as 2A1A1CR2.	5-63
2A2A5CR10		Same as 2A1A1CR2.	5-63
2A2A5CR11		Same as 2A1A1CR2.	5-63
2A2A5CR12		Same as 2A1A1CR2.	5-63
2A2A5CR13		Same as 2A1A1CR2.	5-63
2A2A5CR14		Same as 2A1A1CR2.	5-63
2A2A5CR15		Same as 2A1A1CR2.	5-63
2A2A5CR16		Same as 2A1A1CR2.	5-63
2A2A5CR17		Same as 2A1A1CR2.	5-63
2A2A5CR18		Same as 2A1A1CR2.	5-63
2A2A5CR19		Same as 2A1A1CR2.	5-63
2A2A5CR20		Same as 2A1A1CR2.	5-63
2A2A5CR21		Same as 2A1A1CR2.	5-63
2A2A5CR22		Same as 2A1A1CR2.	5-63
2A2A5CR23		Same as 2A1A1CR2.	5-63
2A2A5CR24		Same as 2A1A1CR2.	5-63
2A2A5CR25		Same as 2A1A1CR2.	5-63
2A2A5CR26		Same as 2A1A1CR2.	5-63
2A2A5CR27		Same as 2A1A1CR2.	5-63
2A2A5CR28		Same as 2A1A1CR2.	5-63
2A2A5CR29		Same as 2A1A1CR2.	5-63
2A2A5CR30		Same as 2A1A1CR2.	5-63
2A2A5CR31		Same as 2A1A1CR2.	5-63
2A2A5CR32		Same as 2A1A1CR2.	5-63
2A2A5CR33		Same as 2A1A1CR2.	5-63
2A2A5CR34		Same as 2A1A1CR2.	5-63
2A2A5CR35		Same as 2A1A1CR2.	5-63
2A2A5CR36		Same as 2A1A1CR2.	5-63
2A2A5CR37		Same as 2A1A1CR2.	5-63
2A2A5CR38		Same as 2A1A1CR2.	5-63
2A2A5CR39		Same as 2A1A1CR2.	5-63
2A2A5CR40		Same as 2A1A1CR2.	5-63
2A2A5CR41		Same as 2A1A1CR2.	5-63
2A2A5CR42		Same as 2A1A1CR2.	5-63
2A2A5CR43		Same as 2A1A1CR2.	5-63
2A2A5CR44		Same as 2A1A1CR2.	5-63
2A2A5CR45		Same as 2A1A1CR2.	5-63
2A2A5CR46		Same as 2A1A1CR2.	5-63
2A2A5CR47		Same as 2A1A1CR2.	5-63
2A2A5CR48		Same as 2A1A1CR2.	5-63
2A2A5J1		Same as 2A1A1J1.	5-63
2A2A5J2		Same as 2A1A1J1.	5-63
2A2A5J3		Same as 2A1A1J1.	5-63
2A2A5J4		Same as 2A1A1J1.	5-63
2A2A5J5		Same as 2A1A1J1.	5-63
2A2A5J6		Same as 2A1A1J1.	5-63
2A2A5J7		Same as 2A1A1J1.	5-63
2A2A5J8		Same as 2A1A1J1.	5-63
2A2A5P1		Same as 2A1A1P1.	5-63
2A2A5R1		Same as 2A1A2R22.	5-63
2A2A5R2		Same as 2A1A2R22.	5-63
2A2A5R3		Same as 2A1A2R22.	5-63
2A2A5R4		Same as 2A1A2R22.	5-63

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A2A5R5		Same as 2A1A2R22.	5-63
2A2A5R6		Same as 2A1A2R22.	5-63
2A2A5R7		Same as 2A1A2R22.	5-63
2A2A5R8		Same as 2A1A2R22.	5-63
2A2A5R9		Same as 2A1A2R22.	5-63
2A2A5R10		Same as 2A1A2R22.	5-63
2A2A5R11		Same as 2A1A2R22.	5-63
2A2A5R12		Same as 2A1A2R22.	5-63
2A2A6		PRINTED CIRCUIT BOARD ASSEMBLY: Same as 2A2A5.	5-57
2A2J1		Same as 2A1J1.	5-58
2A2J2		Same as 2A1J1.	5-57
2A2J3		Same as 2A1J1.	5-58
2A2J4		Same as 2A1J1.	5-57
2A2J5		Same as 2A1J1.	5-58
2A2J6		Same as 2A1J1.	5-57
2A2J7		Not used.	
2A2J8		Not used.	
2A2J9		Same as 2A1J9.	5-58
2A2M1		AMMETER: 0-1 ma, dc, series 100, mfr 16688.	5-20
2A2R1		RESISTOR, FIXED, COMPOSITION: 330 ohms ± 5%, 1/4 w, MIL-R-11B; type RC07GF331J, part CB-3315, mfr 01121.	5-55
2A2S1		SWITCH, ROTARY: dwg C-201, 841, modified 88769, mfr 76854.	5-55
2A2S2		SWITCH, TOGGLE: dpdt, MIL-MIL-S-3950; type MS35059-4, cat B46N253, mfr 04009.	5-56
2A2S3		SWITCH, ROTARY: 2 section 10 pole, 3 position, dwg C-201, 843, modified 88769, mfr 76854	5-20
2A2S4		Same as 2A2S2.	5-56
2A2TB1		TERMINAL BOARD: dwg C-201, 696, mfr 88769.	5-55
2A3		CONVERTER, TELEGRAPH CODE CU-1218/UGC-1A, DRAWER ASSEMBLY.	5-20
2A3A1		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 762, mfr 88769.	5-52
2A3A1C1		CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 100vdcw, 10,000 pf, +80°C -20°C working temp range ± 35%, insulated, dim; D-0.625" max; type TA, mfr 91418.	5-52
2A3A1C2		Same as 2A3A1C1.	5-52
2A3A1C3		Same as 2A3A1C1.	5-52
2A3A1C4		Same as 2A3A1C1.	5-52
2A3A1C5		Same as 2A3A1C1.	5-52
2A3A1C6		Same as 2A3A1C1.	5-52
2A3A1C7		Same as 2A3A1C1.	5-52
2A3A1C8		Same as 2A3A1C1.	5-52
2A3A1C9		Same as 2A3A1C1.	5-52
2A3A1C10		Same as 2A3A1C1.	5-52
2A3A1CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N270, mfr 94145.	5-52
2A3A1CR2		Same as 2A3A1CR1.	5-52
2A3A1CR3		Same as 2A3A1CR1.	5-52
2A3A1CR4		Same as 2A3A1CR1.	5-52
2A3A1CR5		Same as 2A3A1CR1.	5-52
2A3A1CR6		Same as 2A3A1CR1.	5-52
2A3A1CR7		Same as 2A3A1CR1.	5-52
2A3A1J1		JACK, TIP: completely insulated, plastic, red, nonprecious metal, unplated; type 31-1; sleeve type 31R, mfr 81073.	5-52
2A3A1P1		CONNECTOR, PLUG, ELECTRICAL: 29 contact, 1 connector mating end, part WM-29-P-4, mfr 81312.	5-52

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3A1Q1		TRANSISTOR: type 2N404, mfr 49675.	5-52
2A3A1Q2		TRANSISTOR: type 2N388, mfr 07395.	5-52
2A3A1Q3		Same as 2A3A1Q1.	5-52
2A3A1Q4		Same as 2A3A1Q2.	5-52
2A3A1Q5		Same as 2A3A1Q1.	5-52
2A3A1Q6		Same as 2A3A1Q2.	5-52
2A3A1Q7		Same as 2A3A1Q1.	5-52
2A3A1Q8		Same as 2A3A1Q2.	5-52
2A3A1Q9		Same as 2A3A1Q1.	5-52
2A3A1Q10		Same as 2A3A1Q2.	5-52
2A3A1Q11		Same as 2A3A1Q1.	5-52
2A3A1Q12		Same as 2A3A1Q2.	5-52
2A3A1Q13		Same as 2A3A1Q1.	5-52
2A3A1Q14		Same as 2A3A1Q2.	5-52
2A3A1Q15		Same as 2A3A1Q1.	5-52
2A3A1R1		RESISTOR, FIXED, COMPOSITION: 100K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF104J, part CB-1045, mfr 01121.	5-52
2A3A1R2		RESISTOR, FIXED, COMPOSITION: 2.2K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF222F, part CB-2225, mfr 01121.	5-52
2A3A1R3		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF332J, part CB-3325, mfr 01121.	5-52
2A3A1R4		RESISTOR, FIXED, COMPOSITION: 820 ohms ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF821J, part CB-8215, mfr 01121.	5-52
2A3A1R5		Same as 2A2A1R2.	5-52
2A3A1R6		RESISTOR, FIXED, COMPOSITION: 3.9K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF392J, part CB-3925, mfr 01121.	5-52
2A3A1R7		Same as 2A3A1R4.	5-52
2A3A1R8		Same as 2A3A1R2.	5-52
2A3A1R9		Same as 2A3A1R6.	5-52
2A3A1R10		Same as 2A3A1R4.	5-52
2A3A1R11		Same as 2A3A1R2.	5-52
2A3A1R12		Same as 2A3A1R6.	5-52
2A3A1R13		Same as 2A3A1R4.	5-52
2A3A1R14		Same as 2A3A1R2.	5-52
2A3A1R15		Same as 2A3A1R6.	5-52
2A3A1R16		Same as 2A3A1R4.	5-52
2A3A1R17		Same as 2A3A1R2.	5-52
2A3A1R18		Same as 2A3A1R6.	5-52
2A3A1R19		Same as 2A3A1R4.	5-52
2A3A1R20		Same as 2A3A1R2.	5-52
2A3A1R21		Same as 2A3A1R6.	5-52
2A3A1R22		Same as 2A3A1R4.	5-52
2A3A1R23		RESISTOR, FIXED, COMPOSITION: 10K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF103J, part CB-1035, mfr 01121.	5-52
2A3A1R24		RESISTOR, FIXED, COMPOSITION: 270 ohms, ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF271J, part CB-2715, mfr 01121.	5-52
2A3A1R25		Same as 2A3A1R2.	5-52
2A3A2		PRINTED CIRCUIT BOARD ASSEMBLY: dwg; C-201, 763, mfr 88769.	5-50
2A3A2CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N277, mfr 94145.	5-53
2A3A2CR2		Same as 2A3A2CR1.	5-53
2A3A2CR3		Same as 2A3A2CR1.	5-53
2A3A2CR4		Same as 2A3A2CR1.	5-53
2A3A2CR5		Same as 2A3A2CR1.	5-53
2A3A2CR6		Same as 2A3A2CR1.	5-53
2A3A2CR7		Same as 2A3A2CR1.	5-53

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3A2J1		JACK, TIP: completely insulated, plastic, red, nonprecious metal, unplated; type 31-1; sleeve type 31-R, mfr 81073.	5-53
2A3A2J2		Same as 2A3A2J1.	5-53
2A3A2J3		Same as 2A3A2J1.	5-53
2A3A2J4		Same as 2A3A2J1.	5-53
2A3A2P1		CONNECTOR, PLUG, ELECTRICAL: 29 contacts, 1 connector mating end, part WM-29-P-4, mfr 81312.	5-53
2A3A2Q1		TRANSISTOR: type 2N388, mfr 07395.	5-53
2A3A2Q2		Same as 2A3A2Q1.	5-53
2A3A2Q3		TRANSISTOR: type 2N404, mfr 49675.	5-53
2A3A2Q4		Same as 2A3A2Q1.	5-53
2A3A2Q5		Same as 2A3A2Q3.	5-53
2A3A2Q6		Same as 2A3A2Q3.	5-53
2A3A2Q7		Same as 2A3A2Q3.	5-53
2A3A2Q8		Same as 2A3A2Q1.	5-53
2A3A2Q9		Same as 2A3A2Q3.	5-53
2A3A2R1		RESISTOR, FIXED, COMPOSITION: 10K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF103J, part CB-1035, mfr 01121.	5-53
2A3A2R2		RESISTOR, FIXED, COMPOSITION: 2.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF272J, part CB-2725, mfr 01121.	5-53
2A3A2R3		RESISTOR, FIXED, COMPOSITION: 100K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF104J, part CB-1045, mfr 01121.	5-53
2A3A2R4		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF332J, part CB-3325, mfr 01121.	5-53
2A3A2R5		Same as 2A3A2R2.	5-53
2A3A2R6		Same as 2A3A2R1.	5-53
2A3A2R7		Same as 2A3A2R1.	5-53
2A3A2R8		Same as 2A3A2R1.	5-53
2A3A2R9		RESISTOR, FIXED, COMPOSITION: 2.2K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF222J, part CB-2225, mfr 01121.	5-53
2A3A2R10		Same as 2A3A2R3.	5-53
2A3A2R11		Same as 2A3A2R4.	5-53
2A3A2R12		RESISTOR, FIXED, COMPOSITION: 1.5K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF152J, part CB-1525, mfr 01121.	5-53
2A3A2R13		Same as 2A3A2R1.	5-53
2A3A2R14		Same as 2A3A2R12.	5-53
2A3A2R15		Same as 2A3A2R12.	5-53
2A3A2R16		Same as 2A3A2R1.	5-53
2A3A2R17		RESISTOR, FIXED, COMPOSITION: 4.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF472J, part CN-4725, mfr 01121.	5-53
2A3A2R18		RESISTOR, FIXED, COMPOSITION: 560 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF561J, part CB-5615, mfr 01121.	5-53
2A3A2R19		Same as 2A3A2R9.	5-53
2A3A2R20		Same as 2A3A2R3.	5-53
2A3A2R21		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF332J, part EB-3325, mfr 01121.	5-53
2A3A2R22		RESISTOR, FIXED, COMPOSITION: 300 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF301J, part CB-3015, mfr 01121.	5-53
2A3A2R23		Same as 2A3A2R9.	5-53
2A3A2R24		Same as 2A3A2R3.	5-53
2A3A2R25		Same as 2A3A2R9.	5-53
2A3A2R26		Same as 2A3A2R9.	5-53
2A3A2R27		Same as 2A3A2R1.	5-53
2A3A2R28		RESISTOR, FIXED, COMPOSITION: 33K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF333J, part CB-3335, mfr 01121.	5-53

TABLE 6-2 (CONT'D)

REF. DESIG.	NAME	NAME AND DESCRIPTION	FIG. NO.
2A3A2RT1		RESISTOR, THERMAL: 1200 ohms ± 10%, dissipation constant, 7mw at 25°C, dim; D-1/4" max, L-1 1/4", part 31D7, mfr 83186.	5-53
2A3A3		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,764, mfr 88769.	5-51
2A3A3C1		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100vdcw, 10,000 pf +80°C -20°C working temp range, ± 35%, insulated, dim: D-0.625" max; type TA, mfr 91418.	5-38
2A3A3C2		Same as 2A3A3C1.	5-38
2A3A3C3		Same as 2A3A3C1.	5-38
2A3A3C4		Same as 2A3A3C1.	5-38
2A3A3C5		Same as 2A3A3C1.	5-38
2A3A3C6		Same as 2A3A3C1.	5-38
2A3A3C7		Same as 2A3A3C1.	5-38
2A3A3C8		Same as 2A3A3C1.	5-38
2A3A3C9		Same as 2A3A3C1.	5-38
2A3A3C10		Same as 2A3A3C1.	5-38
2A3A3C11		Same as 2A3A3C1.	5-38
2A3A3C12		Same as 2A3A3C1.	5-38
2A3A3CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N277, mfr 03877.	5-38
2A3A3CR2		SEMICONDUCTOR DEVICE, DIODE: type 1N270, mfr 95145.	5-38
2A3A3CR3		Same as 2A3A3CR2.	5-38
2A3A3CR4		Same as 2A3A3CR1.	5-38
2A3A3CR5		Same as 2A3A3CR2.	5-38
2A3A3CR6		Same as 2A3A3CR2.	5-38
2A3A3CR7		Same as 2A3A3CR1.	5-38
2A3A3CR8		Same as 2A3A3CR2.	5-38
2A3A3CR9		Same as 2A3A3CR2.	5-38
2A3A3CR10		Same as 2A3A3CR1.	5-38
2A3A3CR11		Same as 2A3A3CR2.	5-38
2A3A3CR12		Same as 2A3A3CR2.	5-38
2A3A3CR13		Same as 2A3A3CR1.	5-38
2A3A3CR14		Same as 2A3A3CR2.	5-38
2A3A3CR15		Same as 2A3A3CR2.	5-38
2A3A3CR16		Same as 2A3A3CR1.	5-38
2A3A3CR17		Same as 2A3A3CR2.	5-38
2A3A3CR18		Same as 2A3A3CR2.	5-38
2A3A3J1		JACK, TIP: completely insulated, plastic, red, nonprecious metal, unplated; type 31-1; sleeve type 31-R, mfr 81073.	5-38
2A3A3J2		Same as 2A3A3J1.	5-38
2A3A3P1		CONNECTOR, PLUG, ELECTRICAL: 29 contact 1 mating connector end, part WM-29-P-4, mfr 81312.	5-38
2A3A3Q1		TRANSISTOR: type 2N404, mfr 49675.	5-38
2A3A3Q2		Same as 2A3A3Q1.	5-38
2A3A3Q3		Same as 2A3A3Q1.	5-38
2A3A3Q4		Same as 2A3A3Q1.	5-38
2A3A3Q5		Same as 2A3A3Q1.	5-38
2A3A3Q6		Same as 2A3A3Q1.	5-38
2A3A3Q7		Same as 2A3A3Q1.	5-38
2A3A3Q8		Same as 2A3A3Q1.	5-38
2A3A3Q9		Same as 2A3A3Q1.	5-38
2A3A3Q10		Same as 2A3A3Q1.	5-38
2A3A3Q11		Same as 2A3A3Q1.	5-38
2A3A3Q12		Same as 2A3A3Q1.	5-38
2A3A3R1		RESISTOR, FIXED, COMPOSITION: 10K ±5%, 1/4 w, MIL-R-11B; type RC07GF103J, part CB-1035, mfr 01121.	5-38

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3A3R2		RESISTOR, FIXED, COMPOSITION: 4.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF472J, part CB-4725, mfr 01121.	5-38
2A3A3R3		RESISTOR, FIXED, COMPOSITION: 2.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF272J, part CB-2725, mfr 01121.	5-38
2A3A3R4		RESISTOR, FIXED, COMPOSITION: 1.2K ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF122J, part CB-1225, mfr 01121.	5-38
2A3A3R5		Same as 2A3A3R4.	5-38
2A3A3R6		RESISTOR, FIXED, COMPOSITION: 51 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF510J, part CB-5105, mfr 01121.	5-38
2A3A3R7		Same as 2A3A3R2.	5-38
2A3A3R8		Same as 2A3A3R3.	5-38
2A3A3R9		RESISTOR, FIXED, COMPOSITION: 1 meg ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF105J, part CB-1055, mfr 01121.	5-38
2A3A3R10		Same as 2A3A3R1.	5-38
2A3A3R11		Same as 2A3A3R2.	5-38
2A3A3R12		Same as 2A3A3R3.	5-38
2A3A3R13		Same as 2A3A3R4.	5-38
2A3A3R14		Same as 2A3A3R4.	5-38
2A3A3R15		Same as 2A3A3R6.	5-38
2A3A3R16		Same as 2A3A3R2.	5-38
2A3A3R17		Same as 2A3A3R3.	5-38
2A3A3R18		Same as 2A3A3R9.	5-38
2A3A3R19		Same as 2A3A3R1.	5-38
2A3A3R20		Same as 2A3A3R2.	5-38
2A3A3R21		Same as 2A3A3R3.	5-38
2A3A3R22		Same as 2A3A3R4.	5-38
2A3A3R23		Same as 2A3A3R4.	5-38
2A3A3R24		Same as 2A3A3R6.	5-38
2A3A3R25		Same as 2A3A3R2.	5-38
2A3A3R26		Same as 2A3A3R3.	5-38
2A3A3R27		Same as 2A3A3R9.	5-38
2A3A3R28		Same as 2A3A3R1.	5-38
2A3A3R29		Same as 2A3A3R2.	5-38
2A3A3R30		Same as 2A3A3R3.	5-38
2A3A3R31		Same as 2A3A3R4.	5-38
2A3A3R32		Same as 2A3A3R4.	5-38
2A3A3R33		Same as 2A3A3R6.	5-38
2A3A3R34		Same as 2A3A3R2.	5-38
2A3A3R35		Same as 2A3A3R3.	5-38
2A3A3R36		Same as 2A3A3R9.	5-38
2A3A3R37		Same as 2A3A3R1.	5-38
2A3A3R38		Same as 2A3A3R2.	5-38
2A3A3R39		Same as 2A3A3R3.	5-38
2A3A3R40		Same as 2A3A3R4.	5-38
2A3A3R41		Same as 2A3A3R4.	5-38
2A3A3R42		Same as 2A3A3R6.	5-38
2A3A3R43		Same as 2A3A3R2.	5-38
2A3A3R44		Same as 2A3A3R3.	5-38
2A3A3R45		Same as 2A3A3R9.	5-38
2A3A3R46		Same as 2A3A3R1.	5-38
2A3A3R47		Same as 2A3A3R2.	5-38
2A3A3R48		Same as 2A3A3R3.	5-38
2A3A3R49		Same as 2A3A3R4.	5-38
2A3A3R50		Same as 2A3A3R4.	5-38
2A3A3R51		Same as 2A3A3R6.	5-38
2A3A3R52		Same as 2A3A3R2.	5-38

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3A3R53		Same as 2A3A3R3.	5-38
2A3A3R54		Same as 2A3A3R9.	5-38
2A3A3R55		RESISTOR, FIXED, COMPOSITION: 100K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF104J, part CB-1045. mfr 01121.	5-38
2A3A3R56		Same as 2A3A3R55.	5-38
2A3A4		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 765, mfr 88769.	5-50
2A3A4C1		CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 100vdcw, 10,000 pf, +80°C -20°C working temp range ± 35%, insulated, dim: D-0.350" max; type TA, mfr 91418.	5-54
2A3A4C2		Same as 2A3A4C1.	5-54
2A3A4C3		Same as 2A3A4C1.	5-54
2A3A4C4		Same as 2A3A4C1.	5-54
2A3A4C5		Same as 2A3A4C1.	5-54
2A3A4CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N277, mfr 03877.	5-54
2A3A4CR2		Same as 2A3A4CR1.	5-54
2A3A4CR3		Same as 2A3A4CR1.	5-54
2A3A4CR4		Same as 2A3A4CR1.	5-54
2A3A4CR5		Same as 2A3A4CR1.	5-54
2A3A4CR6		Same as 2A3A4CR1.	5-54
2A3A4CR7		Same as 2A3A4CR1.	5-54
2A3A4CR8		Same as 2A3A4CR1.	5-54
2A3A4CR9		Same as 2A3A4CR1.	5-54
2A3A4CR10		Same as 2A3A4CR1.	5-54
2A3A4CR11		Same as 2A3A4CR1.	5-54
2A3A4CR12		Same as 2A3A4CR1.	5-54
2A3A4CR13		Same as 2A3A4CR1.	5-54
2A3A4CR14		Same as 2A3A4CR1.	5-54
2A3A4CR15		Same as 2A3A4CR1.	5-54
2A3A4CR16		Same as 2A3A4CR1.	5-54
2A3A4CR17		Same as 2A3A4CR1.	5-54
2A3A4CR18		Same as 2A3A4CR1.	5-54
2A3A4CR19		Same as 2A3A4CR1.	5-54
2A3A4CR20		Same as 2A3A4CR1.	5-54
2A3A4CR21		Same as 2A3A4CR1.	5-54
2A3A4J1		JACK, TIP: completely insulated, plastic, red, nonprecious metal, unplated; type 31-1; sleeve type 31-R, mfr 81073.	5-54
2A3A4J2		Same as 2A3A4J1.	5-54
2A3A4J3		Same as 2A3A4J1.	5-54
2A3A4J4		Same as 2A3A4J1.	5-54
2A3A4J5		Same as 2A3A4J1.	5-54
2A3A4J6		Same as 2A3A4J1.	5-54
2A3A4J7		Same as 2A3A4J1.	5-54
2A3A4J8		Same as 2A3A4J1.	5-54
2A3A4P1		CONNECTOR, PLUG, ELECTRICAL: 29 contacts, 1 mating connector end, part WM-29-P-4, mfr 81312.	5-54
2A3A4R1		RESISTOR, FIXED, COMPOSITION: 2.2K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF222J, part CB-2225, mfr 01121.	5-54
2A3A4R2		RESISTOR, FIXED, COMPOSITION: 1.0 meg ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF105J, part CB-1055, mfr 01121.	5-54
2A3A4R3		Same as 2A3A4R1.	5-54
2A3A4R4		Same as 2A3A4R2.	5-54
2A3A4R5		Same as 2A3A4R1.	5-54
2A3A4R6		Same as 2A3A4R2.	5-54
2A3A4R7		Same as 2A3A4R1.	5-54
2A3A4R8		Same as 2A3A4R2.	5-54

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3A4R9		Same as 2A3A4R1.	5-54
2A3A4R10		Same as 2A3A4R2.	5-54
2A3A5		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 66-1, mfr 88769.	5-51
2A3A5C1		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100vdcw, 10,000 pf, +80°C - 20°C working temp range, ± 35%, insulated, dim: D-0.625" max; type TA, mfr 91418.	5-55
2A3A5C2		Same as 2A3A5C1.	5-55
2A3A5C3		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type polarized, fail type, 15vdcw -55°C to +85°C working temp range, metal case, insulated, dim; D- , H- , MIL-MIL-R-3965B; type CL25BE600VP, cat B65B501, mfr 56289.	5-55
2A3A5CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N270, mfr 94145.	5-55
2A3A5CR2		Same as 2A3A5CR1.	5-55
2A3A5CR3		SEMICONDUCTOR DEVICE, DIODE: type 1N277, mfr 03877.	5-55
2A3A5CR4		Same as 2A3A5CR3.	5-55
2A3A5CR5		Same as 2A3A5CR3.	5-55
2A3A5CR6		Same as 2A3A5CR1.	5-55
2A3A5CR7		Same as 2A3A5CR3.	5-55
2A3A5CR8		Same as 2A3A5CR3.	5-55
2A3A5CR9		Same as 2A3A5CR3.	5-55
2A3A5CR10		Same as 2A3A5CR3.	5-55
2A3A5CR11		Same as 2A3A5CR3.	5-55
2A3A5CR12		Same as 2A3A5CR3.	5-55
2A3A5CR13		Same as 2A3A5CR1.	5-55
2A3A5CR14		Same as 2A3A5CR3.	5-55
2A3A5CR15		Same as 2A3A5CR3.	5-55
2A3A5CR16		Same as 2A3A5CR3.	5-55
2A3A5CR17		Same as 2A3A5CR3.	5-55
2A3A5CR18		Same as 2A3A5CR3.	5-55
2A3A5CR19		Same as 2A3A5CR1.	5-55
2A3A5J1		JACK, TIP: completely insulated, plastic, red, nonprecious metal, unplated; type 31-1; sleeve type 31-R, mfr 81073.	5-55
2A3A5J2		Same as 2A3A5J1.	5-55
2A3A5J3		Same as 2A3A5J1.	5-55
2A3A5J4		Same as 2A3A5J1.	5-55
2A3A5P1		CONNECTOR, PLUG, ELECTRICAL: 29 contacts, 1 mating connector end, part WM-29-P-4, mfr 81312.	5-55
2A3A5Q1		TRANSISTOR: type 2NA404, mfr 49675.	5-55
2A3A5Q2		Same as 2A3A5Q1.	5-55
2A3A5Q3		Same as 2A3A5Q1.	5-55
2A3A5Q4		Same as 2A3A5Q1.	5-55
2A3A5Q5		Same as 2A3A5Q1.	5-55
2A3A5Q6		Same as 2A3A5Q1.	5-55
2A3A5Q7		TRANSISTOR: type 2N388, mfr 07395.	5-55
2A3A5Q8		Same as 2A3A5Q1.	5-55
2A3A5Q9		Same as 2A3A5Q1.	5-55
2A3A5R1		RESISTOR, FIXED, COMPOSITION: 100K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF104J, part CB-1045, mfr 01121.	5-55
2A3A5R2		RESISTOR, FIXED, COMPOSITION: 2.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF272J, part CB-2725, mfr 01121.	5-55
2A3A5R3		RESISTOR, FIXED, COMPOSITION: 4.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF472J, part CB-4725, mfr 01121.	5-55
2A3A5R4		RESISTOR, FIXED, COMPOSITION: 1.2K ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF122J, part CB-1225, mfr 01121.	5-55
2A3A5R5		Same as 2A3A5R4.	5-55

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3A5R6		Same as 2A3A5R3.	5-55
2A3A5R7		RESISTOR, FIXED, COMPOSITION: 51 ohms ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF510J, part CB-5105, mfr 01121.	5-55
2A3A5R8		Same as 2A3A5R2.	5-55
2A3A5R9		RESISTOR, FIXED, COMPOSITION: 10K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF103J, part CB-1035, mfr 01121.	5-55
2A3A5R10		RESISTOR, FIXED, COMPOSITION: 4.7K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF472J, part CB-4725, mfr 01121.	5-55
2A3A5R11		Same as 2A3A5R10.	5-55
2A3A5R12		RESISTOR, FIXED, COMPOSITION: 18K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF183J, part CB-1835, mfr 01121.	5-55
2A3A5R13		Same as 2A3A5R10.	5-55
2A3A5R14		RESISTOR, FIXED, COMPOSITION: 1.8K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF182J, part CB-1825, mfr 01121.	5-55
2A3A5R15		RESISTOR, FIXED, COMPOSITION: 470 ohms ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF471J, part CB-4715, mfr 01121.	5-55
2A3A5R16		RESISTOR, FIXED, COMPOSITION: 2.2K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF222J, part CB-2225, mfr 01121.	5-55 5-55
2A3A5R17		RESISTOR, FIXED, COMPOSITION: 12K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF123J, part CB-1235, mfr 01112.	5-55
2A3A5R18		Same as 2A3A5R1.	5-55
2A3A5R19		Same as 2A3A5R7.	5-55
2A3A5R20		Same as 2A3A5R10.	5-55
2A3A5R21		Same as 2A3A5R3.	5-55
2A3A5R22		RESISTOR, FIXED, COMPOSITION: 270 ohms ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF271J, part CB-2715, mfr 01121.	5-55
2A3A5R23		Same as 2A3A5R3.	5-55
2A3A5R24		Same as 2A3A5R3.	5-55
2A3A5R25		Same as 2A3A5R12.	5-55
2A3A5R26		Same as 2A3A5R12.	5-55
2A3A5R27		Same as 2A3A5R7.	5-55
2A3A5R28		Same as 2A3A5R1.	5-55
2A3A5R29		Same as 2A3A5R1.	5-55
2A3A5R30		Same as 2A3A5R1.	5-55
2A3A5R31		Same as 2A3A5R1.	5-55
2A3A5R32		RESISTOR, FIXED, COMPOSITION: 1.0K ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF102J, part CB-1025, mfr 01121.	5-55
2A3A5R33		RESISTOR, FIXED, COMPOSITION: 560 ohms ± 5%, 1/4 w, MIL- MIL-R-11B; type RC07GF561J, part CB-5615, mfr 01121.	5-55
2A3A6		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 794, mfr 88769.	5-50
2A3A6C1		Not used.	
2A3A6C2		CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 100vdcw, 10,000 pf, +80°C -20°C working temp range, ± 35%, insulated, dim: D-0.625" max; type TA, mfr 91418.	5-56
2A3A6C3		Same as 2A3A6C2.	5-56
2A3A6C4		Not used.	
2A3A6C5		Same as 2A3A6C2.	5-56
2A3A6C6		Same as 2A3A6C2.	5-56
2A3A6C7		Not used.	
2A3A6C8		Same as 2A3A6C2.	5-56
2A3A6CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N277, mfr 03877.	5-56
2A3A6CR2		Same as 2A3A6CR1.	5-56
2A3A6CR3		Same as 2A3A6CR1.	5-56
2A3A6CR4		Same as 2A3A6CR1.	5-56
2A3A6CR5		Same as 2A3A6CR1.	5-56

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3A6CR6		Same as 2A3A6CR1.	5-56
2A3A6CR7		Same as 2A3A6CR1.	5-56
2A3A6CR8		Same as 2A3A6CR1.	5-56
2A3A6CR9		Not used.	
2A3A6CR10		SEMICONDUCTOR DEVICE, DIODE: type 1N270, mfr 03877.	5-56
2A3A6CR11		Same as 2A3A6CR10.	5-56
2A3A6CR12		Same as 2A3A6CR1.	5-56
2A3A6CR13		Same as 2A3A6CR1.	5-56
2A3A6CR14		Same as 2A3A6CR1.	5-56
2A3A6CR15		Same as 2A3A6CR10.	5-56
2A3A6CR16		Same as 2A3A6CR10.	5-56
2A3A6CR17		Same as 2A3A6CR1.	5-56
2A3A6CR18		Same as 2A3A6CR1.	5-56
2A3A6CR19		Same as 2A3A6CR10.	5-56
2A3A6CR20		Same as 2A3A6CR10.	5-56
2A3A6CR21		Same as 2A3A6CR1.	5-56
2A3A6CR22		Same as 2A3A6CR1.	5-56
2A3A6CR23		Same as 2A3A6CR1.	5-56
2A3A6CR24		Same as 2A3A6CR1.	5-56
2A3A6CR25		Same as 2A3A6CR1.	5-56
2A3A6CR26		Same as 2A3A6CR1.	5-56
2A3A6CR27		Same as 2A3A6CR1.	5-56
2A3A6CR28		Same as 2A3A6CR1.	5-56
2A3C6CR29		Same as 2A3A6CR1.	5-56
2A3A6CR30		Same as 2A3A6CR1.	5-56
2A3A6CR31		Same as 2A3A6CR10.	5-56
2A3A6CR32		Same as 2A3A6CR10.	5-56
2A3A6CR33		Same as 2A3A6CR1.	5-56
2A3A6CR34		Same as 2A3A6CR1.	5-56
2A3A6CR35		Not used.	
2A3A6CR36		Same as 2A3A6CR1.	5-56
2A3A6J1		JACK, TIP: completely insualted, plastic, red, nonprecious metal, unplated; type 31-1; sleeve type 31-R, mfr 81073.	5-56
2A3A6J2		Same as 2A3A6J1.	5-56
2A3A6P1		CONNECTOR, PLUG, ELECTRICAL: 29 contact, 1 mating connector end, part WM-29-P-4, mfr 81312.	5-56
2A3A6Q1		TRANSISTOR: type 2N388, mfr 07395.	5-56
2A3A6Q2		TRANSISTOR: type 2N404, mfr 49675.	5-56
2A3A6Q3		Same as 2A3A6Q2.	5-56
2A3A6Q4		Same as 2A3A6Q2.	5-56
2A3A6Q5		Same as 2A3A6Q2.	5-56
2A3A6Q6		Same as 2A3A6Q2.	5-56
2A3A6Q7		Same as 2A3A6Q2.	5-56
2A3A6Q8		Same as 2A3A6Q2.	5-56
2A3A6Q9		Same as 2A3A6Q2.	5-56
2A3A6Q10		Same as 2A3A6Q1.	5-56
2A3A6R1		RESISTOR, FIXED, COMPOSITION: 10 K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF103J, part CB-1035, mfr 01121.	5-56
2A3A6R2		RESISTOR, FIXED, COMPOSITION: 2.2K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF222J, part CB-2225, mfr 01121.	5-56
2A3A6R3		Not used.	
2A3A6R4		RESISTOR, FIXED, COMPOSITION: 5.6K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF562J, part CB-5625, mfr 01121.	5-56
2A3A6R5		RESISTOR, FIXED, COMPOSITION: 1.2K ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF122J, part EB-1225, mfr 01121.	5-56
2A3A6R6		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF332J, part CB-3325, mfr 01121.	5-56

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3A6R7		RESISTOR, FIXED, COMPOSITION: 2.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF272J, part CB-2725, mfr 01121.	5-56
2A3A6R8		RESISTOR, FIXED, COMPOSITION: 51 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF510J, part CB-5105, mfr 01121.	5-56
2A3A6R9		Same as 2A3A6R5.	5-56
2A3A6R10		Same as 2A3A6R6.	5-56
2A3A6R11		Same as 2A3A6R7.	5-56
2A3A6R12		Not used.	
2A3A6R13		Not used.	
2A3A6R14		Not used.	
2A3A6R15		Same as 2A3A6R5.	5-56
2A3A6R16		Same as 2A3A6R6.	5-56
2A3A6R17		Same as 2A3A6R7.	5-56
2A3A6R18		Same as 2A3A6R8.	5-56
2A3A6R19		Same as 2A3A6R5.	5-56
2A3A6R20		Same as 2A3A6R6.	5-56
2A3A6R21		Same as 2A3A6R7.	5-56
2A3A6R22		Not used.	
2A3A6R23		Not used.	
2A3A6R24		Same as 2A3A6R5.	5-56
2A3A6R25		Same as 2A3A6R6.	5-56
2A3A6R26		Same as 2A3A6R7.	5-56
2A3A6R27		Same as 2A3A6R8.	5-56
2A3A6R28		Same as 2A3A6R5.	5-56
2A3A6R29		Same as 2A3A6R6.	5-56
2A3A6R30		Same as 2A3A6R7.	5-56
2A3A6R31		Not used.	
2A3A6R32		RESISTOR, FIXED, COMPOSTION: 4.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF472J, part CB-4725, mfr 01121.	5-56
2A3A6R33		Same as 2A3A6R32.	5-56
2A3A6R34		RESISTOR, FIXED, COMPOSITION: 18K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF183J, part CB-1835, mfr 01121.	5-56
2A3A6R35		Same as 2A3A6R1.	5-56
2A3A6R36		Same as 2A3A6R32.	5-56
2A3A6R37		Same as 2A3A6R34.	5-56
2A3A6R38		RESISTOR, FIXED, COMPOSITION: 1.8K ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF182J, part CB-1825, mfr 01121.	5-56
2A3A6R39		RESISTOR, FIXED, COMPOSITION: 2.2K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF222J, part CB-2225, mfr 01121.	5-56
2A3A6R40		Same as 2A3A6R2.	5-56
2A3A6R41		RESISTOR, FIXED, COMPOSITION: 100K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF104J, part CB-1045, mfr 01121.	5-56
2A3A6R42		Same as 2A3A6R41.	5-56
2A3A7		OUTPUT CIRCUIT ASSEMBLY: dwg C-201, 784 mfr 88769.	5-50
2A3A7C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 200vdcw, .0047 uf ± 10% tolerance, 4230 to 5170 pf capacity range, metal insulated, plastic, hermetically sealed, dim; D-.298", L-13/16", MIL-MIL-C-25A; type CP09A1KC472K, mfr 01002.	5-50
2A3A7C2		CAPACITOR, FIXED, PAPER DIELECTRIC: 100vdcw., .047 uf ± 10%, 42,300 pf to 51700 pf capacity range, metal case, insulated, hermetically sealed, dim; D- .375", H-15/16", MIL-MIL-C-25A; type Cp09A1KB473K, cat B64B, mfr 00656.	
2A3A7C3		Same as 2A3A7C2.	5-50
2A3A7C4		CAPACITOR, FIXED, CERAMIC: 25vdcw, 0.1 uf, -20% to +80% tolerance, -50°C to +85°C working temp range, dim; D-1/8", L-1/2", W-1/2"; type 5C7A, mfr 56289.	5-50

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3A7C5		Same as 2A3A7C4.	5-50
2A3A7CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N270, mfr 03877.	5-50
2A3A7CR2		Same as 2A3A7CR1.	5-50
2A3A7CR3		Same as 2A3A7 CR1.	5-50
2A3A7CR4		Same as 2A3A7CR1.	5-50
2A3A7CR5		SEMICONDUCTOR DEVICE, DIODE: type 1N742, mfr 81483.	5-50
2A3A7Q1		TRANSISTOR: type JAN2N331.	5-50
2A3A7Q2		Same as 2A3A7Q1.	5-50
2A3A7Q3		TRANSISTOR: type JAN2N699.	5-50
2A3A7R1		RESISTOR, FIXED, COMPOSITION: 10K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF103J, part CB-1035, mfr 01121.	5-50
2A3A7R2		Same as 2A1A1R31.	5-50
2A3A7R3		RESISTOR, FIXED, COMPOSITION: 4.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF472J, part CB-4725, mfr 01121.	5-50
2A3A7R4		Same as 2A3A7R3.	5-50
2A3A7R5		RESISTOR, FIXED, COMPOSITION: 220 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF221J, part CB-2215, mfr 01121.	5-50
2A3A7R6		RESISTOR, FIXED, COMPOSITION: 1K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF102J, part CB-1025, mfr 01121.	5-50
2A3A7R7		RESISTOR, FIXED, COMPOSITION: 150 ohms ± 5%, 2 w, MIL-MIL-R-11B; type RC42GF151J, part CB1515, mfr 01121.	5-50
2A3A7T1		TRANSFORMER, AUDIO FREQUENCY: 12,000 ohms center tapped primary impedence rating, 10,000 ohms center tapped primary impedence rating, 2400 ohms split secondary impedence rating, MIL-MIL-T-27A, grade 4; type TF4RX13YY, DO-T38, mfr 80223.	5-50
2A3A12		FILTER ASSEMBLY: dwg C-201,817, mfr 88769.	5-50
2A3A12C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 200vdcw, 0.2 uf ± 20%, capacity range 160,000 uf to 240,000 uf, metal case, uninsulated, hermetically sealed, dim; D-.312", H-13/16", type 123ZN mfr 00656.	5-50
2A3A12C2		Same as 2A3A12C1.	5-50
2A3A12C3		Same as 2A3A12C1.	5-50
2A3A12L1		REACTOR: 1, 0.5 henry inductance, 60 ma, dc, 42 ohms dc resistance, dwg B-101,586, mfr 88769.	5-50
2A3A12L2		Same as 2A3A12L1.	5-50
2A3C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 10vacw, 1.0 uf and 0.5 uf ± 10% tolerance, 900,000 uf to 1,100,000 uf and 450,000 uf to 550,000 uf capacity range, metal case uninsulated, hermetically sealed, dim; D- 1 3/4", H-7/8", W-2", MIL-MIL-C-25A, part 2601BV, mfr 74861.	5-51
2A3DS1		LAMP, INCANDESCENT: 12-16v, 0.2 amp, T-3 1/4 bulb, MIL-MIL-L-3661; type MS15571-8, mfr 24455.	5-20
2A3DSZ		BUZZER: dwg B-101,421, mfr 88769.	5-50
2A3F1		FUSE: 0.125 amp, 250v max, dc, normal instantaneous, MIL-MIL-C-15160; type MS90078-4-1, FO2GR125A, mfr 71400.	5-50
2A3J1		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant plastic dielectric, part WM-29-S, mfr 81312.	5-51
2A3J2		Same as 2A3J1.	5-50
2A3J3		Same as 2A3J1.	5-51
2A3J4		Same as 2A3J1.	5-50
2A3J5		Same as 2A3J1.	5-51
2A3J6		Same as 2A3J1.	5-50
2A3J7		JACK, TELEPHONE: spring leaf type, contact arrangement J4, MIL-MIL-J-641A, part C-12A; type JJ-089, mfr 82389.	5-50
2A3J8		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant, plastic dielectric, MIL-MIL-P-14; type MS24007, part GM9FTG, mfr 80586.	5-50

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A3J9		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant, plastic dielectric, MIL-MIL-P-14, part GM50MTL, MS24025, mfr 80586.	5-51
2A3L1		REACTOR: 1, 1.1 to 11.0 henries inductance, 7 ma dc, 360 ohms dc resistance, tapped at 30% and 50% of total Turns, MIL-MIL-T-27A; type TF4RX20YY, part TVC-8, mfr 89665.	5-50
2A3K1		RELAY, ARMATURE: contact arrangement 2C, electrical ratings, dc, 26. 4vdcw max, 3 amps max nominal current rating, 28vdcw at max ratio current, 250 ma at max rated current, MIL-R-5757C exc 3.8.2, 2.1.2, 3.1.3, and 3.1.9, part RP-7640, mfr 7482.	5-51
2A3M1		AMMETER: part S100-10. 1060, mfr 16688.	5-20
2A3R1		RESISTOR, FIXED, WIREWOUND: inductive winding, 500 ohms ± 5% 10w, power consumption, 275°C max continuous operating temp, 25°C ambient temp, MIL-MIL-R-26C; type RW-31G501, mfr 56289.	5-51
2A3R2		RESISTOR, VARIABLE, COMPOSITION: 1 section 5K, 10%, 2w, nom-power rating, std A taper, single shaft, metal slotted, dim; dia 1/4", K-.063", L-.047", 7/8" long from mounting surface normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-94; type RV4LAYSDS03A, mfr 97979.	5-50
2A3R3		RESISTOR, VARIABLE, COMPOSITION: 1 section, 2.5K ± 10%, 2w, nom-power rating, std A taper, single shaft, metal slotted, dim; dia 1/4", K-.063",L.047", 7/8" long from mounting surface normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-94B; type RV4LAYSD252A, mfr 97979.	5-50
2A3R4		RESISTOR, VARIABLE WIREWOUND: 1 section, 750 ohms ± 10%, 4w, nom-power rating, std A taper, single shaft, metal slotted, dim; dia 1/4", K-.063", L-.047", 7/8" long from mounting surface, normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-19A; type RA30LASB751A, cat B11B872, mfr 71450.	5-50
2A3R5		Same as 2A3R3.	5-50
2A3S1		SWITCH, ROTARY: dwg C-201, 842, part modified 88769, mfr 76854.	5-50
2A3SZ		SWITCH, TOGGLE: dp, first position on, second position off, third position on, MIL-MIL-S-3950; type MS35059-21, cat B46N477, mfr 70453.	5-20
2A3TB1		STRIP, TERMINAL: dwg C-201, 696, mfr 88769.	5-50
2A3XDS1		LAMPHOLDER: 250v, MIL-MIL-L-3661, part 82410W-111, mfr 72619.	5-50
2A3XF1		FUSEHOLDER: extractor post type, 250v, 1.25 amp, MIL-MIL-F-19207; type MS90078, mfr 71400.	5-51
2A4		CONVERTER TELEGRAPH CODE, CU-1218/UGC-1A, DRAWER ASSEMBLY: Same as 2A3.	5-20
2A5		CONVERTER TELEGRAPH CODE, CU-1218/UGC-1A, DRAWER ASSEMBLY: Same as 2A3.	5-20
2A6		CONVERTER TELEGRAPH CODE, CU-1218/UGC-1A, DRAWER ASSEMBLY: Same as 2A3.	5-20
2A7		PRINTED CIRCUIT BOARD ASSEMBLY: dwg D-300, 871, mfr 88769.	5-49
2A7C1		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100vdcw, 0.01 uf, +80°C -20°C working temp range, ± 35%, insulated, dim; D-.350" max; type TA, mfr 91418.	5-49
2A7C2		Same as 2A7C1.	5-49
2A7C3		Same as 2A7C1.	5-49
2A7C4		Same as 2A7C1.	5-49

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
2A7C5		Same as 2A7C1.	5-49
2A7C6		Same as 2A7C1.	5-49
2A7C7		Same as 2A7C1.	5-59
2A7C8		Same as 2A7C1.	5-49
2A7C9		Same as 2A7C1.	5-49
2A7C10		Same as 2A7C1.	5-49
2A7C11		Same as 2A7C1.	5-49
2A7C12		Same as 2A7C1.	5-49
2A7C13		Same as 2A7C1.	5-49
2A7C14		Same as 2A7C1.	5-49
2A7L1		CHOKE, RADIO FREQUENCY: 105 ma current rating, designed for use with frequencies above 1 mc, MIL-MIL-C-15305; type MS16223-22, part 3500-42, mfr 99800.	5-49
2A7L2		CHOKE, RADIO FREQUENCY: 185 ma current rating, designed for use with frequencies above 3 mc, MIL-MIL-C-15305; type MS16223-17, part LT7K227, mfr 99800.	5-49
2A7L3		Same as 2A7L1.	5-49
2A7L4		Same as 2A7L1.	5-49
2A7L5		Same as 2A7L2.	5-49
2A7L6		Same as 2A7L1.	5-49
2A7L7		Same as 2A7L1.	5-49
2A7L8		Same as 2A7L2.	5-49
2A7L9		Same as 2A7L2.	5-49
2A7L10		Same as 2A7L2.	5-49
2A7L11		Same as 2A7L2.	5-49
2A7L12		Same as 2A7L2.	5-49
2A7L13		Same as 2A7L2.	5-49
2A7L14		Same as 2A7L2.	5-49
2J1		CONNECTOR, RECEPTACLE, ELECTRICAL: AN/MS3102A18-15, mfr 02660.	5-48
2J2		CONNECTOR, RECEPTACLE, ELECTRICAL: AN/MS3102A20-29P, mfr 02660.	5-48
2J3		CONNECTOR, RECEPTACLE, ELECTRICAL: AN/MS3106A20-29PZ, mfr 02660.	5-48
2P1		CONNECTOR, PLUG, ELECTRICAL: 50 contact, connector mating end, part 50 GMFTLKHS, mfr, 80586.	5-49
2P2		Same as 2P1.	5-49
2P3		Same as 2P1.	5-49
2P4		Same as 2P1.	5-49
2P5		Same as 2P1.	5-49
2P6		Same as 2P1.	5-49
2P7		CONNECTOR, RECEPTACLE, ELECTRICAL: AN/MS3106A18-1P, mfr 02660.	5-49
2TB1		BOARD, TERMINAL: dwg C-201,734, mfr 88769.	5-49
2TB2		BOARD, TERMINAL: per MIL-T-16784 (Ships), part 8TB8, mfr 75382.	5-48
2TB3		Same as 2TB2.	5-48
2W1		CABLE ASSEMBLY: dwg C-201, 735, mfr 88769.	5-49
2W2		CABLE ASSEMBLY: dwg C-201,735-2, mfr 88769.	5-49
2W3		CABLE ASSEMBLY: dwg C-201,735-3, mfr 88769.	5-49
2W4		Same as 2W3.	5-49
2W5		Same as 2W3.	5-49
2W6		Same as 2W3.	5-49

TABLE 6-2 (CONT'D)

TRANSMITTER GROUP

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3		TRANSMITTER GROUP, OA-3445/UGC-1A: CONSISTS OF CONTROL AMPLIFIER AM-3107/UGC-1A DEMULTIPLEXER-MULTIPLEXER TD515/UGC-1A, TELEGRAPH CODE CONVERTER CV-1217/UGC-1A (4 units).	5-20
3A1		AMPLIFIER CONTROL AM-3107/UGC-1A: DRAWER ASSEMBLY.	5-20
3A1A1		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 771, mfr 88769.	5-40
3A1A1C1		CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 600vdcw, .001 uf +100%, -20% tolerance, insulated body, dim; D-7/16", L-5/32", MIL-MIL-C-11015A; type CK61Y102Z, mfr 72982.	5-41
3A1A1C2		Same as 3A1A1C1.	5-41
3A1A1C3		Same as 3A1A1C1.	5-41
3A1A1C4		Same as 3A1A1C1.	5-41
3A1A1C5		CAPACITOR, FIXED, PAPER, DIELECTRIC: 100v, .047 uf ± 10%, metal case, insulated, hermetically sealed, dim; D-.375", H-15/16", MIL-MIL-C-25A; type CP09A1KB473K, mfr 01002.	5-41
3A1A1C6		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type, polarized, sintered type, 125vdcw, .047 uf, -50°C to +85°C working temp range, metal, uninsulated, dim; D-15/16", L-15/32", MIL-MIL-C-3965B; type CL44BP1R7TP, mfr 01002.	5-41
3A1A1C7		Same as 3A1A1C6.	5-41
3A1A1C8		CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 100v, .01 uf, +80°C -20°C working temp range, ± 35%, insulated, dim; D-.350", max; type TA, mfr 91418.	5-41
3A1A1CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N270, mfr 94145.	5-41
3A1A1CR2		Same as 3A1A1CR1.	5-41
3A1A1CR3		Same as 3A1A1CR1.	5-41
3A1A1CR4		Same as 3A1A1CR1.	5-41
3A1A1CR5		Same as 3A1A1CR1.	5-41
3A1A1CR6		Same as 3A1A1CR1.	5-41
3A1A1CR7		Same as 3A1A1CR1.	5-41
3A1A1J1		JACK, TIP: completely insulated, plastic, red, nonprecious metal, unplated; type 31-1; sleeve type 31-R, mfr 81073.	5-41
3A1A1J2		Same as 3A1A1J1.	5-41
3A1A1P1		CONNECTOR, PLUG, ELECTRICAL: 29 contact, 1 connector mating end, part WM-29-P-4, mfr 81312.	5-41
3A1A1Q1		TRANSISTOR: type 2N388, mfr 93332.	5-41
3A1A1Q2		TRANSISTOR: type 2N404, mfr 49675.	5-41
3A1A1Q3		TRANSISTOR: type 2N498, mfr 01295.	5-41
3A1A1Q4		Same as 3A1A1Q2.	5-41
3A1A1Q5		Same as 3A1A1Q2.	5-41
3A1A1Q6		Same as 3A1A1Q2.	5-41
3A1A1Q7		Same as 3A1A1Q1.	5-41
3A1A1Q8		Same as 3A1A1Q2.	5-41
3A1A1Q9		Same as 3A1A1Q1.	5-41
3A1A1Q10		TRANSMISTOR: type 2N398, mfr 49675.	5-41
3A1A1Q11		Same as 3A1A1Q2.	5-41
3A1A1Q12		Same as 3A1A1Q1.	5-41
3A1A1Q13		Same as 3A1A1Q10.	5-41
3A1A1Q14		Same as 3A1A1Q2.	5-41
3A1A1Q15		Same as 3A1A1Q2.	5-41
3A1A1Q16		Same as 3A1A1Q3.	5-41
3A1A1R1		RESISTOR, FIXED, COMPOSITION: 22K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF223J, part CB-2235, mfr 01121.	

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A1A1R2		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF332J, part EB-3325, mfr 01121.	5-41
3A1A1R3		RESISTOR, FIXED, COMPOSITION: 51K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF513J, part CB-5135, mfr 01121.	5-41
3A1A1R4		RESISTOR, FIXED, COMPOSITION: 100K ±5%, 1/4 w, MIL-MIL-R-11B; type RC07GF104J, part CB-1045, mfr 01121.	5-41
3A1A1R5		RESISTOR, FIXED, COMPOSITION: 1.5K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF152J, part CB-1525, mfr 01121.	5-41
3A1A1R6		RESISTOR, FIXED, COMPOSITION: 2.2K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF222J, part CB-2225, mfr 01121.	5-41
3A1A1R7		RESISTOR, FIXED, COMPOSITION: 18K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF183J, part CB-1835, mfr 01121.	5-41
3A1A1R8		RESISTOR, FIXED, COMPOSITION: 680 ohms ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF681J, part EB-6815, mfr 01121.	5-41
3A1A1R9		RESISTOR, FIXED, COMPOSITION: 680 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF681J, part CB-6815, mfr 01121.	5-41
3A1A1R10		RESISTOR, FIXED, COMPOSITION: 10K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF103J, part CB-1035, mfr 01121.	5-41
3A1A1R11		RESISTOR, FIXED, COMPOSITION: 10K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC20GF103J, part EB-1035, mfr 01121.	5-41
3A1A1R12		Same as 3A1A1R4.	5-41
3A1A1R13		RESISTOR, FIXED, COMPOSITION: 5.6K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF562J, part CB-5625, mfr 01121.	5-41
3A1A1R14		Same as 3A1A1R13.	5-41
3A1A1R15		RESISTOR, FIXED, COMPOSITION: 1.2K ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF122J, part EB-1225, mfr 01121.	5-41
3A1A1R16		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF332J, part CB-3325, mfr 01121.	
3A1A1R17		Same as 3A1A1R16.	5-41
3A1A1R18		Same as 3A1A1R15.	5-41
3A1A1R19		RESISTOR, FIXED, COMPOSITION: 2.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF272J, part CB-2725, mfr 01121.	5-41
3A1A1R20		RESISTOR, FIXED, COMPOSITION: 51 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF510J, part CB-5105, mfr 01121.	5-41
3A1A1R21		Same as 3A1A1R19.	5-41
3A1A1R22		RESISTOR, FIXED, COMPOSITION: 4.7K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF472J, part CB-4725, mfr 01121.	5-41
3A1A1R23		Same as 3A1A1R10.	5-41
3A1A1R24		Same as 3A1A1R6.	5-41
3A1A1R25		Same as 3A1A1R2.	5-41
3A1A1R26		Same as 3A1A1R7.	5-41
3A1A1R27		Same as 3A1A1R6.	5-41
3A1A1R28		RESISTOR, FIXED, COMPOSITION: 8.2K ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF822J, part EB-8225, mfr 01121.	5-41
3A1A1R29		Same as 3A1A1R6.	5-41
3A1A1R30		Same as 3A1A1R6.	5-41
3A1A1R31		Same as 3A1A1R7.	5-41
3A1A1R32		RESISTOR, FIXED, COMPOSITION: 470 ohms ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF471J, part EB-4715, mfr 01121.	5-41
3A1A1R33		Same as 3A1A1R7.	5-41
3A1A1R34		Same as 3A1A1R6.	5-41
3A1A1R35		Same as 3A1A1R28.	5-41
3A1A1R36		Same as 3A1A1R6.	5-41
3A1A1R37		Same as 3A1A1R6.	5-41
3A1A1R38		Same as 3A1A1R7.	5-41
3A1A1R39		Same as 3A1A1R32.	5-41

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A1A1R40		Same as 3A1A1R7.	5-41
3A1A1R41		Same as 3A1A1R6.	5-41
3A1A1R42		Same as 3A1A1R6.	5-41
3A1A1R43		RESISTOR, FIXED, COMPOSITION: 330 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF331J, part CB-3315, mfr 01121.	5-41
3A1A1R44		Not used.	
3A1A1R45		RESISTOR, FIXED, COMPOSITION: 5.6K ± 5%, 1 w, MIL-MIL-R-11B; type RC32GF562J, part GB-5625, mfr 01121.	5-41
3A1A8		FILTER SUBASSEMBLY: dwg C-201, 785, mfr 88769.	5-39
3A1A8C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 400 v, .05 uf ± 20%, capacity range 40,000 uf to 60,000 uf, metal case, uninsulated, hermetically sealed, dim; D-.312",H-13/16", type 123ZN, mfr 00656.	5-39
3A1A8C2		Same as 3A1A8C1	5-39
3A1A8C3		Same as 3A1A8C1.	5-39
3A1A8L1		REACTOR: 1, 0.125 henries inductance, 60 ma dc, 43 ohms dc resistance, dwg B-101, 587, mfr 88769.	5-39
3A1A8L2		Same as 3A1A8L1.	5-39
3A1A9		INDICATOR ASSEMBLY: dwg D-300, 888, mfr 88769.	5-39
3A1A9A1		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 772, mfr 88769.	
3A1A9A1C1		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type, polarized, fail type, 150vdcw, 4 uf, metal case, insulated, dim; D-3/8", L-2 1/8", MIL-MIL-R-3965B; type CL25BQ040UF, cat B65B531, mfr 56289.	5-64
3A1A9A1CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N645, mfr 94145.	5-64
3A1A9A1Q1		Same as 3A1A1Q10.	5-64
3A1A9A1Q2		Same as 3A1A1Q10.	5-64
3A1A9A1Q3		Same as 3A1A1Q10.	5-64
3A1A9A1Q4		Same as 3A1A1Q10.	5-64
3A1A9A1Q5		Same as 3A1A1Q10.	5-64
3A1A9A1Q6		Same as 3A1A1Q10.	5-64
3A1A9A1R1		RESISTOR, FIXED, COMPOSITION: 180K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF184J, part CB-1845, mfr 01121.	5-64
3A1A9A1R2		RESISTOR, FIXED, COMPOSITION: 33K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF333J, part CB-3335, mfr 01121.	5-64
3A1A9A1R3		Same as 3A1A9A1R1.	5-64
3A1A9A1R4		Same as 3A1A9A1R2.	5-64
3A1A9A1R5		Same as 3A1A9A1R1.	5-64
3A1A9A1R6		Same as 3A1A9A1R2.	5-64
3A1A9A1R7		Same as 3A1A9A1R1.	5-64
3A1A9A1R8		Same as 3A1A9A1R2.	5-64
3A1A9A1R9		Same as 3A1A9A1R1.	5-64
3A1A9A1R10		Same as 3A1A9A1R2.	5-64
3A1A9A1R11		Same as 3A1A9A1R1.	5-64
3A1A9A1R12		Same as 3A1A9A1R2.	5-64
3A1A9A1R13		RESISTOR, FIXED, COMPOSITION: 3.9 K ± 5%, 2 w, MIL-MIL-R-11B; type RC42GF392J, part HB-3925, mfr 01121.	5-64
3A1A9A1R14		RESISTOR, FIXED, COMPOSITION: 62 ohms ± 5%, 1 w, MIL-R-11B; type RC32GF621J, part GB-6215, mfr 01121.	5-64
3A1A9A1R15		Same as 3A1A1R10.	5-64
3A1A9A1R16		RESISTOR, FIXED, COMPOSITION: 56K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF563J, part CB-5635, mfr 01121.	5-64
3A1A9A1R17		Same as 3A1A1R10.	5-64
3A1A9A1R18		Same as 3A1A9A1R16.	5-64
3A1A9A1R19		Same as 3A1A9A1R10.	5-64

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG.
3A1A9A1R20		Same as 3A1A9A1R16.	5-64
3A1A9A1R21		Same as 3A1A9A1R15.	5-64
3A1A9A1R22		Same as 3A1A9A1R16.	5-64
3A1A9A1R23		Same as 3A1A1R10.	5-64
3A1A9A1R24		Same as 3A1A9A1R16.	5-64
3A1A9A1R25		Same as 3A1A1R10.	5-64
3A1A9A1R26		Same as 3A1A9A1R16.	5-64
3A1A9A1R27		RESISTOR, FIXED, COMPOSITION: 7.5K ± 5%, 2 w, MIL-MIL-R-11B; type RC42GF752J, part HB-7525, mfr 01121.	5-64
3A1A9A1R28		RESISTOR, FIXED, COMPOSITION: 82K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF823J, part CB-8235, mfr 01121.	5-64
3A1A9DS1		LAMP, GLOW: neon, 0.04 watt, T-2 bulb, part NE2D, mfr 24445.	5-39
3A1A9DS2		Same as 3A1A9DS1.	5-39
3A1A9DS3		Same as 3A1A9DS1.	5-39
3A1A9DS4		Same as 3A1A9DS1.	5-39
3A1A9DS5		Same as 3A1A9DS1.	5-39
3A1A9DS6		Same as 3A1A9DS1.	5-39
3A1A9DS7		Same as 3A1A9DS1.	5-39
3A1A9P1		CONNECTOR, PLUG, ELECTRICAL: 9 contact, 1 connector mating end, MIL-MIL-P-14; type MS24008, part GM9MG, mfr 80586.	5-39
3A1A9P2		CONNECTOR, PLUG, ELECTRICAL: 3 contact, 1 connector mating end, part UP-121M, mfr 00779.	5-39
3A1A9T1		TRANSFORMER, POWER ISOLATION: primary 115v, 50-60 cps, 1 single phase, secondary 115v, 15 ma dc, dwg C-201,633, mfr 88769.	5-40
3A1A9XDS1		INDICATOR LIGHT: 115vac-dc, T-2 neon bulb, MIL type MS-25 257-6, part 137-8536-937, mfr 72619.	5-39
3A1A9XDS2		Same as 3A1A9XDS1.	5-39
3A1A9XDS3		Same as 3A1A9XDS1.	5-39
3A1A9XDS4		Same as 3A1A9XDS1.	5-39
3A1A9XDS5		Same as 3A1A9XDS1.	5-39
3A1A9XDS6		Same as 3A1A9XDS1.	5-39
3A1A9XDS7		Same as 3A1A9XDS1.	5-39
3A1A11		Same as 3A1A8.	5-39
3A1A12		PRINTED CIRCUIT BOARD ASSEMBLY: dwg B-101,578, mfr 88769.	5-39
3A1A12Q1		Same as 3A1A1Q2.	5-39
3A1A12R1		Same as 3A1A1R5.	5-39
3A1A12R2		Same as 3A1A1R5.	5-39
3A1A12R3		Same as 3A1A1R10.	5-39
3A1A12R4		Same as 3A1A1R10.	5-39
3A1C1		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type polarized, sintered type, 125vdcw, 1.7 uf -55°C to +85°C working temp range, metal case, uninsulated, dim; D-15/16", L-15/32", MIL-MIL-C-3965B; type CL44BP1R7TP, mfr 01002.	5-39
3A1C2		Same as 3A1C1.	5-39
3A1F1		FUSE, CARTRIDGE: 0.125 amps, 250v, time delay, 6 sec min at 300% load, MIL-MIL-F-15160, MS90079, type FO3GR125B, mfr 71400.	5-39
3A1J1		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant plastic dielectric, part WM-29-S, mfr 81312.	5-40
3A1J2		Not used.	
3A1J3		Not used.	
3A1J4		Not used.	

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A1J5		Not used.	
3A1J6		Not used.	
3A1J7		JACK, TELEPHONE: spring leaf type, contact arrangement J4, MIL-MIL-J-641A; type JJ-089, mfr 82389.	
3A1J8		Not used.	
3A1J9		CONNECTOR, PLUG, ELECTRICAL: 50 contact, 1 connecting mating end, part GM-50-MTL, mfr 80586.	5-40
3A1M1		AMMETER: 0-100 ma dc, part 100, mfr 16688.	5-20
3A1R1		RESISTOR, VARIABLE, COMPOSITION: 1 section 2.5K ± 10%, 2w, nom-power rating, std A taper, single shaft, metal slotted, dim; K-.063", L-.047", dia-1/4", 7/8" long from mounting surface, normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-94B; type RV4LAYSD252A, mfr 97979.	5-39
3A1R2		RESISTOR, VARIABLE, WIREWOUND: 1 section 750 ohms ± 10%, 4 w, nom-power rating, std A taper, single shaft, metal slotted, dim; D-.063", L-.047", dia-1/4", 7/8" long from mounting surface, normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-19A; type RA30LASB751A, cat B11B872, mfr 71450.	5-40
3A1R3		RESISTOR, FIXED, WIREWOUND: inductive winding, 500 ohm ± %, 10 w, power consumption, 275°C max continuous oper temp, 25°C ambient temp, MIL-MIL-R-26C; type RW31G501, mfr 56289.	
3A1S1		SWITCH, ROTARY: dwg B-101,444, modified 88769, mfr 76854.	5-20
3A1S2		SWITCH, TOGGLE: dpdt, MIL-MIL-S-3950A; type MS35059-4, mfr 31356.	5-40
3A1TB1		TERMINAL BOARD: 17 terminals included, feed through solder stud type, dwg B-101,406, mfr 88769.	5-39
3AXF1		FUSEHOLDER: extractor post type, 0.125 amp, 250v, MIL-MIL-STD-242B (Ships); type FHN20G, mfr 71400.	5-39
3A2		DEMULTIPLEXER-MULTIPLEXER, TD 515/UGC-1A, DRAWER ASSEMBLY: Same as 2A1.	5-20
3A3		CONVERTER TELEGRAPH CODE, CV-1217/UGC-1A, DRAWER ASSEMBLY.	5-20
3A3A1		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,773, mfr 88769.	5-34
3A3A1C1		Not used.	
3A3A1C2		Same as 3A1A1C8.	5-34
3A3A1C3		Same as 3A1C1.	5-34
3A3A1C4		Same as 3A1A1C5.	5-34
3A3A1C5		CAPACITOR, FIXED, PAPER DIELECTRIC: 100vdcw, 0.1 uf ± 10%, 90,000 pf to 110,000 pf capacity range, metal case, insulated, hermetically sealed, dim; D-0.375", H-15/16, MIL-MIL-C-25A; type CP09A1KB104K, cat B64B099, mfr 56289.	5-34
3A3A1CR1		SEMICONDUCTOR DEVICE, DIODE: type 1N277, mfr 03877.	5-34
3A3A1CR2		Same as 3A1A1CR1.	5-34
3A3A1CR3		Same as 3A1A1CR1.	5-34
3A3A1CR4		Same as 3A3A1CR1.	5-34
3A3A1CR5		Same as 3A1A1CR1.	5-34
3A3A1CR6		Same as 3A1A1CR1.	5-34
3A3A1CR7		Same as 3A3A1CR1.	5-34
3A3A1CR8		Same as 3A3A1CR1.	5-34
3A3A1CR9		Same as 3A3A1CR1.	5-34
3A3A1CR10		Same as 3A3A1CR1.	5-34
3A3A1CR11		Same as 3A3A1CR1.	5-34
3A3A1CR12		Same as 3A1A1CR1.	5-34

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A3A1CR13		Same as 3A1A1CR1.	5-34
3A3A1CR14		Same as 3A1A1CR1.	5-34
3A3A1J1		Same as 3A1A1J1.	5-34
3A3A1J2		Same as 3A1A1J1.	5-34
3A3A1P1		Same as 3A1A1P1.	5-34
3A3A1Q1		Same as 3A1A1Q2.	5-34
3A3A1Q2		Same as 3A1A1Q2.	5-34
3A3A1Q3		Same as 3A1A1Q1.	5-34
3A3A1Q4		Same as 3A1A1Q2.	5-34
3A3A1Q5		Same as 3A1A1Q2.	5-34
3A3A1Q6		Same as 3A1A1Q2.	5-34
3A3A1Q7		Same as 3A1A1Q2.	5-34
3A3A1Q8		Same as 3A1A1Q2.	5-34
3A3A1Q9		Same as 3A1A1Q2.	5-34
3A3A1Q10		Same as 3A1A1Q2.	5-34
3A3A1Q11		Same as 3A1A1Q2.	5-34
3A3A1Q12		Same as 3A1A1Q2.	5-34
3A3A1R1		Same as 3A1A1R15.	5-34
3A3A1R2		Same as 3A1A1R16.	5-34
3A3A1R3		Same as 3A1A1R15.	5-34
3A3A1R4		Same as 3A1A1R16	5-34
3A3A1R5		RESISTOR, FIXED, COMPOSITION: 15K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF153J, part CB-1535, mfr 01121.	5-34
3A3A1R6		Same as 3A1A1R16.	5-34
3A3A1R7		Same as 3A1A1R19.	5-34
3A3A1R8		Same as 3A1A1R20.	5-34
3A3A1R9		Same as 3A1A1R19.	5-34
3A3A1R10		Same as 3A1A1R8.	5-34
3A3A1R11		Same as 3A1A1R4.	5-34
3A3A1R12		RESISTOR, FIXED, COMPOSITION: 8.2K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF822J, part CB-8225, mfr 01121.	5-34
3A3A1R13		Same as 3A1A1R15.	5-34
3A3A1R14		Same as 3A1A1R15.	5-34
3A3A1R15		Same as 3A1A1R5.	5-34
3A3A1R16		Same as 3A1A1R16.	5-34
3A3A1R17		RESISTOR, FIXED, COMPOSITION: 470 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF471J, part CB-4715, mfr 01121.	5-34
3A3A1R18		Same as 3A1A1R19.	5-34
3A3A1R19		Same as 3A1A1R20.	5-34
3A3A1R20		Same as 3A1A1R19.	5-34
3A3A1R21		Same as 3A3A1R17.	5-34
3A3A1R22		Same as 3A1A1R10.	5-34
3A3A1R23		Same as 3A1A1R10.	5-34
3A3A1R24		Same as 3A1A1R15.	5-34
3A3A1R25		Same as 3A1A1R16.	5-34
3A3A1R26		Same as 3A1A1R15.	5-34
3A3A1R27		RESISTOR, FIXED, COMPOSITION: 560 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF561J, part CB-5615, mfr 01121.	5-34
3A3A1R28		Same as 3A1A1R16.	5-34
3A3A1R29		Same as 3A1A1R20.	5-34
3A3A1R30		Same as 3A1A1R19.	5-34
3A3A1R31		Same as 3A1A1R15.	5-34
3A3A1R32		Same as 3A1A1R16.	5-34
3A3A1R33		Same as 3A1A1R15.	5-34
3A3A1R34		Same as 3A1A1R16.	5-34
3A3A1R35		Same as 3A1A1R6.	5-34

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A3A1R36		Not used.	
3A3A1R37		Not used.	
3A3A1R38		Same as 3A1A1R19.	5-34
3A3A1R39		Same as 3A1A1R20.	5-34
3A3A1R40		Same as 3A1A1R19.	5-34
3A3A1R41		RESISTOR, FIXED, COMPOSITION: 47K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF473J, part CB-4735, mfr 01121.	5-34
3A3A1R42		Same as 3A1A1R1.	5-34
3A3A1R43		Same as 3A1A1R6.	5-34
3A3A1R44		Same as 3A1A1R4.	5-34
3A3A2		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,774, mfr 88769.	5-32
3A3A2C1		Same as 3A1A1C5.	5-35
3A3A2C2		CAPACITOR, FIXED, PAPER DIELECTRIC: 400vdcw, 3300 pico 10%, 2700 pf to 3630 pf capacity range, metal case, insulated, plastic, hermetically sealed, dim; D-.298", L-13/16", MIL-MIL-C-25A; type CP09A1KE332K, cat B64B171, mfr 00656.	5-35
3A3A2CR1		Same as 3A1A1CR1.	5-35
3A3A2CR2		Same as 3A3A1CR1.	5-35
3A3A2CR3		Same as 3A3A1CR1.	5-35
3A3A2CR4		Same as 3A3A1CR1.	5-35
3A3A2CR5		Same as 3A3A1CR1.	5-35
3A3A2J1		Same as 3A1A1J1.	5-35
3A3A2J2		Same as 3A1A1J1.	5-35
3A3A2J3		Same as 3A1A1J1.	5-35
3A3A2J4		Same as 3A1A1J1.	5-35
3A3A2P1		Same as 3A1A1P1.	5-35
3A3A2Q1		Same as 3A1A1Q2.	5-35
3A3A2Q2		Same as 3A1A1Q1.	5-35
3A3A2Q3		Same as 3A1A1Q1.	5-35
3A3A2Q4		Same as 3A1A1Q2.	5-35
3A3A2Q5		Same as 3A1A1Q1.	5-35
3A3A2Q6		Same as 3A1A1Q2.	5-35
3A3A2Q7		Same as 3A1A1Q2.	5-35
3A3A2R1		Same as 3A1A1R4.	5-35
3A3A2R2		Same as 3A1A1R22.	5-35
3A3A2R3		Same as 3A3A1R41.	5-35
3A3A2R4		Same as 3A1A1R10.	5-35
3A3A2R5		Same as 3A1A1R6.	5-35
3A3A2R6		Not used.	
3A3A2R7		Same as 3A1A1R4.	5-35
3A3A2R8		RESISTOR, FIXED, COMPOSITION: 1.8K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF182J, part CB-1825, mfr 01121.	5-35
3A3A2R9		Same as 3A1A1R10.	5-35
3A3A2R10		RESISTOR, FIXED, COMPOSITION: 22K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF223J, part CB-2235, mfr 01121.	5-35
3A3A2R11		Same as 3A1A1R10.	5-35
3A3A2R12		Same as 3A1A1R10	
3A3A2R13		Same as 3A1A1R6.	5-35
3A3A2R14		RESISTOR, FIXED, COMPOSITION: 560 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF561J, part CB-5615, mfr 01121.	5-35
3A3A2R15		Same as 3A1A1R4.	5-35
3A3A2R16		RESISTOR, FIXED, COMPOSITION: 3.3K ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF332J, part EB-3325, mfr 01121.	5-35
3A3A2R17		RESISTOR, FIXED, COMPOSITION: 300 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF301J, part CB-3015, mfr 01121.	5-35

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A3A2R18		Same as 3A1A1R6.	5-35
3A3A2R19		Same as 3A1A1R6.	5-35
3A3A2R20		Same as 3A1A1R4.	5-35
3A3A2R21		Same as 3A1A1R6.	5-35
3A3A2R22		Same as 3A1A1R10.	5-35
3A3A2R23		Same as 3A1A1R6.	5-35
3A3A2R24		RESISTOR, FIXED, COMPOSITION: 33K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF333J, part CB-3335, mfr 01121.	5-35
3A3A2RT-1		RESISTOR, THERMAL: 1200 ohms ± 10%, at 25°C dissipation constant, 7 mw at 25°C time constant, 19 sec; type 31D7, mfr 83186.	5-35
3A3A3		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201, 775, mfr 88769.	5-33
3A3A3C1		Same as 3A1A1C8.	5-36
3A3A3C2		Same as 3A1A1C8.	5-36
3A3A3C3		Same as 3A1A1C8.	5-36
3A3A3C4		Same as 3A1A1C8.	5-36
3A3A3C5		Same as 3A1A1C8.	5-36
3A3A3C6		Same as 3A1A1C8.	5-36
3A3A3C7		Same as 3A1A1C8.	5-36
3A3A3C8		Same as 3A1A1C8.	5-36
3A3A3C9		Same as 3A1A1C8.	5-36
3A3A3C10		Same as 3A1A1C8.	5-36
3A3A3CR1		Same as 3A1A1CR1.	5-36
3A3A3CR2		Same as 3A1A1CR1.	5-36
3A3A3CR3		Same as 3A1A1CR1.	5-36
3A3A3CR4		Same as 3A1A1CR1.	5-36
3A3A3CR5		Same as 3A1A1CR1.	5-36
3A3A3CR6		Same as 3A1A1CR1.	5-36
3A3A3CR7		Same as 3A1A1CR1.	5-36
3A3A3J1		Same as 3A1A1J1.	5-36
3A3A3P1		Same as 3A1A1P1.	5-36
3A3A3Q1		Same as 3A1A1Q2.	5-36
3A3A3Q2		Same as 3A1A1Q1.	5-36
3A3A3Q3		Same as 3A1A1Q2.	5-36
3A3A3Q4		Same as 3A1A1Q1.	5-36
3A3A3Q5		Same as 3A1A1Q2.	5-36
3A3A3Q6		Same as 3A1A1Q1.	5-36
3A3A3Q7		Same as 3A1A1Q2.	5-36
3A3A3Q8		Same as 3A1A1Q1.	5-36
3A3A3Q9		Same as 3A1A1Q2.	5-36
3A3A3Q10		Same as 3A1A1Q1.	5-36
3A3A3Q11		Same as 3A1A1Q2.	5-36
3A3A3Q12		Same as 3A1A1Q1.	5-36
3A3A3Q13		Same as 3A1A1Q2.	5-36
3A3A3Q14		Same as 3A1A1Q1.	5-36
3A3A3Q15		Same as 3A1A1Q2.	5-36
3A3A3Q16		Same as 3A1A1Q1.	5-36
3A3A3R1		Same as 3A1A1R4.	5-36
3A3A3R2		Same as 3A1A1R6.	5-36
3A3A3R3		Same as 3A1A1R16.	5-36
3A3A3R4		RESISTOR, FIXED, COMPOSITION: 820 ohms ± 5%, 1/2 w, MIL-MIL-R-11B; type RC20GF821J, part EB-8215, mfr 01121.	5-36
3A3A3R5		Same as 3A1A1R6.	5-36
3A3A3R6		RESISTOR, FIXED, COMPOSITION: 3.9K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF392J, part CB-3925, mfr 01121.	5-36

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A3A3R7		Same as 3A3A3R4.	5-36
3A3A3R8		Same as 3A1A1R6.	5-36
3A3A3R9		Same as 3A3A3R6.	5-36
3A3A3R10		Same as 3A3A3R4.	5-36
3A3A3R11		Same as 3A1A1R6.	5-36
3A3A3R12		Same as 3A3A3R6.	5-36
3A3A3R13		Same as 3A3A3R4.	5-36
3A3A3R14		Same as 3A1A1R6.	5-36
3A3A3R15		Same as 3A3A3R6.	5-36
3A3A3R16		Same as 3A3A3R4.	5-36
3A3A3R17		Same as 3A1A1R6.	5-36
3A3A3R18		Same as 3A3A3R6.	5-36
3A3A3R19		Same as 3A3A3R4.	5-36
3A3A3R20		Same as 3A1A1R6.	5-36
3A3A3R21		Same as 3A3A3R6.	5-36
3A3A3R22		Same as 3A3A3R4.	5-36
3A3A3R23		Same as 3A1A1R10.	5-36
3A3A3R24		RESISTOR, FIXED, COMPOSITION: 270 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF271J, part CN-2715, mfr 01121.	5-36
3A3A3R25		Same as 3A1A1R6.	5-36
3A3A3R26		Same as 3A1A1R22.	5-36
3A3A3R27		Same as 3A1A1R10.	5-36
3A3A3R28		RESISTOR, FIXED, COMPOSITION: 1.8K ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF182J, part CB-1825, mfr 01121.	5-36
3A3A3R29		RESISTOR, FIXED, COMPOSITION: 220 ohms ± 5%, 1/4 w, MIL-MIL-R-11B; type RC07GF221J, part CB-2215, mfr 01121.	5-36
3A3A4		PRINTED CIRCUIT BOARD ASSEMBLY: dwg C-201,776, mfr 88769.	5-32
3A3A4C1		Not used.	
3A3A4C2		Same as 3A1A1C8.	5-37
3A3A4C3		Not used.	
3A3A4C4		Same as 3A1A1C8.	5-37
3A3A4C5		Not used.	
3A3A4C6		Same as 3A1A1C8.	5-37
3A3A4C7		Not used.	
3A3A4C8		Same as 3A1A1C8.	5-37
3A3A4C9		Not used.	
3A3A4C10		Same as 3A1A1C8.	5-37
3A3A4C11		Not used.	
3A3A4C12		Same as 3A1A1C8.	5-37
3A3A4CR1		Same as 3A3A1CR1.	5-37
3A3A4CR2		Same as 3A3A1CR1.	5-37
3A3A4CR3		Same as 3A3A1CR1.	5-37
3A3A4CR4		Same as 3A3A1CR1.	5-37
3A3A4CR5		Same as 3A3A1CR1.	5-37
3A3A4CR6		Same as 3A3A1CR1.	5-37
3A3A4CR7		Same as 3A3A1CR1.	5-37
3A3A4CR8		Same as 3A3A1CR1.	5-37
3A3A4CR9		Same as 3A3A1CR1.	5-37
3A3A4CR10		Same as 3A3A1CR1.	5-37
3A3A4CR11		Same as 3A3A1CR1.	5-37
3A3A4CR12		Same as 3A3A1CR1.	5-37
3A3A4CR13		Same as 3A3A1CR1.	5-37
3A3A4CR14		Same as 3A3A1CR1.	5-37
3A3A4CR15		Same as 3A3A1CR1.	5-37
3A3A4J1		Same as 3A1A1J1.	5-37

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A3A4J2		Same as 3A3A1J1.	5-37
3A3A4P1		Same as 3A1A1P1.	5-37
3A3A4Q1		Same as 3A1A1Q2.	5-37
3A3A4Q2		Same as 3A1A1Q2.	5-37
3A3A4Q3		Same as 3A1A1Q2.	5-37
3A3A4Q4		Same as 3A1A1Q2.	5-37
3A3A4Q5		Same as 3A1A1Q2.	5-37
3A3A4Q6		Same as 3A1A1Q2.	5-37
3A3A4R1		Same as 3A1A1R4.	5-37
3A3A4R2		Same as 3A3A1R41.	5-37
3A3A4R3		Same as 3A1A1R22.	5-37
3A3A4R4		Same as 3A3A1R41.	5-37
3A3A4R5		Same as 3A1A1R1.	5-37
3A3A4R6		Same as 3A3A1R41.	5-37
3A3A4R7		Same as 3A1A1R4.	5-37
3A3A4R8		Same as 3A3A1R17.	5-37
3A3A4R9		Same as 3A3A1R41.	5-37
3A3A4R10		Same as 3A1A1R1.	5-37
3A3A4R11		Same as 3A3A1R41.	5-37
3A3A4R12		Same as 3A3A1R17.	5-37
3A3A4R13		Same as 3A3A1R41.	5-37
3A3A4R14		Same as 3A1A1R1.	5-37
3A3A4R15		Same as 3A3A1R41.	5-37
3A3A4R16		Same as 3A3A1R17.	5-37
3A3A4R17		Same as 3A3A1R41.	5-37
3A3A4R18		Same as 3A1A1R1.	5-37
3A3A4R19		Same as 3A3A1R41.	5-37
3A3A4R20		Same as 3A3A1R17.	5-37
3A3A4R21		Same as 3A3A1R41.	5-37
3A3A4R22		Same as 3A1A1R1.	5-37
3A3A4R23		Same as 3A3A1R41.	5-37
3A3A4R24		Same as 3A3A1R17.	5-37
3A3A4R25		Same as 3A3A1R41.	5-37
3A3A4R26		Same as 3A1A1R1.	5-37
3A3A4R27		Same as 3A1A1R13.	5-37
3A3A4R28		Same as 3A1A1R13.	5-37
3A3A4R29		Same as 3A3A1R13.	5-37
3A3A4R30		Same as 3A1A1R13.	5-37
3A3A4R31		Same as 3A1A1R13.	5-37
3A3A5		PRINTED CIRCUIT BOARD ASSEMBLY: Same as 2A3A3.	5-33
3A3A6		PRINTED CIRCUIT BOARD ASSEMBLY: Same as 2A3A3.	5-32
2A3A10		CIRCUIT NETWORK: dwg C-201,634-3.	5-32
3A3A11		TERMINAL BOARD ASSEMBLY: dwg B-101,479, mfr 88769.	5-32
3A3A11C1		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type, 60 uf, fail type, metal case, insulated, dim; D-3/8", L-1 7/16" MIL-MIL-R-3965B; type CL25BE600VP, cat B65B501, mfr 56289.	5-32
3A3A11CR1		Same as 3A3A1CR1.	5-32
3A3A11CR2		Same as 3A3A1CR1.	5-32
3A3A11CR3		Same as 3A3A1CR1.	5-32
3A3A11CR4		Same as 3A3A1CR1.	5-32
3A3A11CR5		Same as 3A3A1CR1.	5-32
3A3A11CR6		Same as 3A3A1CR1.	5-32
3A3A11R1		RESISTOR, FIXED, WIREWOUND: inductive winding, 1200 ohms ± 5%, 3w power dissipation, 350°Cmax continuous oper temp, 250°C ambient temp, MIL-MIL-R-26C; type RW59V122, mfr 56289.	5-32

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A3A11R2		Same as 3A1A1R1.	5-32
3A3A11R3		Not used.	
3A3A11R4		RESISTOR, FIXED, COMPOSITION: 1K ± 5%, 1/4 w, MIL-R-11B; type RC07GF102J, part CB-1025, mfr 01121.	5-32
3A3A11R5		Same as 3A1A1R10.	5-32
3A3A12		FILTER SUBASSEMBLY: dwg C-201, 894, mfr 88769.	5-32
3A3A12C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 200 vdcw, 0.2 uf ± 20%, capacity range 160,000 uf to 240,000 uf, metal case, uninsulated, hermetically sealed, dim; D- .312", H-13/16", type 123ZN, mfr 00656.	5-32
3A3A12C2		Same as 3A3A12C1.	5-32
3A3A12L1		REACTOR: 1, 0.5 henries inductance, 60 ma dc, 42 ohms dc resistance, dwg B-101, 586, mfr 88769.	5-32
3A3A12L2		Same as 3A3A12L1.	
3A3C1		CAPACITOR, FIXED, PAPER DIELECTRIC: 10vacw, 1.0 uf and 0.5 uf, ± 10% tolerance, 900,000 uf to 1,100,000 uf and 450, 000 uf to 550,000 uf capacity range, metal case, uninsulated, hermetically sealed, dim; D-1 3/4", L-7/8", W-2", MIL-MIL-C-25A, part 2089BV, mfr 74861.	5-33
3A3C2		CAPACITOR, FIXED, ELECTROLYTIC: tantalum type, polarized, sintered type, 4.0 uf 60 vdc, -55°C to +85°C working temp range, metal uninsulated, dim; D-5/16", L-15/32", MIL-MIL-C-3965B; type CL44BK040TP, mfr 01002.	5-32
3A3F1		FUSE, CARTRIDGE: 0.125 amps, 250v, time delay, 6 sec min at 300% load, MIL-MIL-F-15160, MS90079; type FO3GR125B; mfr 71400.	5-32
3A3J1		Same as 3A1J1.	5-33
3A3J2		Same as 3A1J1.	5-32
3A3J3		Same as 3A1J1.	5-33
3A3J4		Same as 3A1J1.	5-32
3A3J5		Same as 3A1J1.	5-33
3A3J6		Same as 3A1J1.	5-32
3A3J7		JACK, TELEPHONE: spring leaf type, contact arrangement J4, MIL-MIL-J-641A; type JJ-089, part C-12-A, mfr 82389.	5-32
3A3J8		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant dielectric, MIL-MIL-P-14; type MS24007, part GM9FTG, mfr 80586.	5-32
3A3J9		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant, plastic dielectric, MIL-MIL-P-14; type MS2402S, part GM50MTL, mfr 80586.	5-32
3A3L1		REACTOR: 1, 1.1 to 11 henries inductance, 7 ma dc, 360 ohms dc resistance, tapped at 30% and 50% of Turns, MIL-MIL-T-27A; type TF4RX20YY, part TVC-8, mfr 89665.	5-32
3A3M1		AMMETER: 0-700 ma, dc, part S100-10. 1060, mfr 16688.	5-20
3A3R1		Same as 3A1R2.	5-32
3A3R2		RESISTOR, VARIABLE, COMPOSITION: 1 section, 500 ohms ± 10%, 2 w, nom-power rating, std A taper, single shaft, metal, slotted, dim: K-.063", L-.047", 1/4" dia, 5/8" long from mounting surface, normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-94B; type RV4LAYSA501A, mfr 04061.	5-32
3A3R3		RESISTOR, VARIABLE, COMPOSITION: 1 section, 5K ± 10%, 2 w nom-power rating, std A taper, single shaft metal,slotted, dim; K-.063", L-.047", 1/4" dia, 5/8" long from mounting surface, normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-94B; type RV4LAYSA502A, mfr 04061.	5-32

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A3R4		RESISTOR, VARIABLE, COMPOSITION: 1 section, 2.5K ± 10%, 2 w, nom-power rating, std A taper, single shaft, metal, slotted, dim; K-.063", L-.047", 1/4" dia, 5/8" long from mounting surface, normal torque, equipped with shaft locking device, no switch, MIL-MIL-R-94B; type RV4LAYSA252A, mfr 04061.	5-32
3A3R5		Same as 3A3A3R4.	5-32
3A3S1		SWITCH, ROTARY: dwg B-101,442, modified 88769, mfr 76854.	5-32
3A3TB1		TERMINAL BOARD: dwg C-201,696, mfr 88769.	5-32
3A3TB2		TERMINAL BOARD: 5 terminals included, screw type, MIL-MIL-T-16784; type 25TB5, mfr 75382.	5-32
3A3XF1		Same as 3A1XF1.	5-33
3A4		CONVERTER TELEGRAPH CODE, CV-1217/UGC-1A, DRAWER ASSEMBLY: Same as 3A3.	5-20
3A5		CONVERTER TELEGRAPH CODE, CV-1217/UGC-1A, DRAWER ASSEMBLY: Same as 3A3.	5-20
3A6		CONVERTER TELEGRAPH CODE, CV-1217/UGC-1A, DRAWER ASSEMBLY: Same as 3A3.	5-20
3A7		FILTER SUBASSEMBLY: dwg D-300,960, mfr 88769.	5-31
3A7C1		Same as 3A1A1C8.	5-31
3A7C2		Same as 3A1A1C8.	5-31
3A7C3		Same as 3A1A1C8.	5-31
3A7C4		Same as 3A1A1C8.	5-31
3A7C5		Same as 3A1A1C8.	5-31
3A7C6		Same as 3A1A1C8.	5-31
3A7C7		Same as 3A1A1C8.	5-31
3A7C8		Same as 3A1A1C8.	5-31
3A7C9		Same as 3A1A1C8.	5-31
3A7C10		Same as 3A1A1C8.	5-31
3A7C11		Same as 3A1A1C8.	5-31
3A7C12		Same as 3A1A1C8.	5-31
3A7C13		Same as 3A1A1C8.	5-31
3A7C14		Same as 3A1A1C8.	5-31
3A7C15		CAPACITOR, FIXED, PAPER DIELECTRIC: 200vdcw, 100,000 pf ± 10%, 90,000 pf to 110,000 pf capacity range, metal case, insulated, plastic, hermetically sealed, dim; D-.463", H-15/16", MIL-MIL-C-25A; type CP05A1EC104K, mfr 00656.	5-31
3A7L1		CHOKE, RADIO FREQUENCY: 105 ma current rating, designed for use with frequencies above 1.0 mc, MIL-MIL-C-15305; type MS16223-22, part 3500-42, mfr 99800.	5-31
3A7L2		CHOKE, RADIO FREQUENCY: 185 ma current rating, designed for use with frequencies above 3 mc, MIL-MIL-C-15305; type MS16223-17, part LT7K227, mfr 99800.	5-31
3A7L3		Same as 3A7L1.	5-31
3A7L4		Same as 3A7L1.	5-31
3A7L5		Same as 3A7L2.	5-31
3A7L6		Same as 3A7L2.	5-31
3A7L7		Same as 3A7L2.	5-31
3A7L8		Same as 3A7L1.	5-31
3A7L9		Same as 3A7L2.	5-31
3A7L10		Same as 3A7L2.	5-31
3A7L11		Same as 3A7L2.	5-31
3A7L12		Same as 3A7L2.	5-31
3A7L13		Same as 3A7L2.	5-31
3A7L14		Same as 3A7L2.	5-31

TABLE 6-2 (CONT'D)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
3J1		CONNECTOR, RECEPTACLE, ELECTRICAL: 10 contact, 1 connector mating end, MIL-MIL-C-5015C; type MS3102A-18-1P, mfr 02660.	5-40
3J2		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant, plastic, dielectric, MIL-MIL-C-5015C; type MS3102A-20-29P, mfr 02660.	5-19
3J3		CONNECTOR, RECEPTACLE, ELECTRICAL: arc-resistant, plastic, dielectric, MIL-MIL-C-5015C; type MS3102A-20-29PZ, mfr 02660.	5-19
3P1		CONNECTOR, PLUG, ELECTRICAL: 50 contact, 1 connector mating end, part GM50FTLKHS, mfr 80586.	5-19
3P2		Same as 3P1.	5-30
3P3		Same as 3P1.	5-30
3P4		Same as 3P1.	5-30
3P5		Same as 3P1.	5-30
3P6		Same as 3P1.	5-30
3P7		CONNECTOR, PLUG, ELECTRICAL: 10 contact, 1 connector mating end, MIL-MIL-5015C; type MS3106A-18-1S, mfr 02660.	
3TB1		TERMINAL BOARD: 300 terminals included, feedthru solder stud type, dwg C-201, 734, mfr 88769.	
3TB2		TERMINAL BOARD: 16 terminals included, screw type, MIL-MIL-T-16787 (Ships); type 8TB8, mfr 75382.	
3TB3		Same as 3TB2.	
3W1		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: dwg C-201, 735, mfr 88769.	
3W2		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: dwg C-201, 735-5, mfr 88769.	
3W3		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: dwg C-201, 735-6, mfr 88769.	
3W4		Same as 3W3.	
3W5		Same as 3W3.	
3W6		Same as 3W3.	

TABLE 6-3 LIST OF MANUFACTURERS

MFG CODE	NAME	ADDRESS
00656	Aerovox Corporation	New Bedford, Mass.
00779	Aircraft Marine Products, Ind.	Harrisburg, Pa.
01002	General Electric Co. Capacitor Department of Transformer and Allied Products Division of Apparatus Group	Hudson Falls, N. Y.
01121	Allen-Bradley	Milwaukee, Wisc.
01295	Texas Instruments, Inc.	Houston, Texas
02660	Amphenol Electronics Corp.	Chicago, Ill.
03508	General Electric Company Semi-Conductor Products Department of Electronic Components, Division of Electronic, Atomic, and Defense Systems Group	Syracuse, N. Y.
03877	Transitron Electronic Corp.	Wakefield, Mass.
04009	Arrow, Hart & Hegeman Electric Co.	Hartford, Conn.
04061	Allen-Bradley Company	Chicago, Ill.
07982	Borden Co.	New York, N. Y.
16688	Dejur-Amsco Corp.	Long Island City, N. Y.
24455	General Electric Co., Lamp Group	Nela Park, Cleveland, Ohio
31356	JBT Instruments Inc.	New Haven, Conn.
40931	Minneapolis-Honeywell Regulator Co.	Minneapolis, Minn.
49675	Radio Marine Corp. of America	New York, N. Y.
56289	Sprague Electric Co.	North Adams, Mass.
58769	Swift and Co.	Chicago, Ill.
71400	Bussman Fuse Division	St. Louis, Mo.
71450	Chicago Telephone Supply Corp.	Elkhart, Ind.
71482	C. P. Clare & Co.	Chicago, Ill.
71785	Cinch Manufacturing Corp.	Chicago, Ill.
72619	Dial Light Co. of America, Inc.	New York, N. Y.
72982	Erie Resistor Corp.	Erie, Pa.

TABLE 6-3 (Cont'd)

MFG CODE	NAME	ADDRESS
75042	International Resistance Co.	Philadelphia, Pa.
75382	Kukla Electric Mfg. Co. Inc.	Mount Vernon, N. Y.
75915	Littel Fuse, Inc.	Chicago, Ill.
76854	Oak Manufacturing Co.	Chicago, Ill.
80223	United Transformer Co.	New York, N. Y.
80583	Hammarlund Co. Inc.	New York, N. Y.
80586	Gorn Electric Co.	Stamford, Conn.
81073	Grayhill Co.	Chicago, Ill.
81312	Winchester Electronics Co.	Glenbrook, Conn.
82376	Astron Co.	East Newark, N. J.
82389	Switchcraft, Inc.	Chicago, Ill.
83330	Smith, Herman H. Inc.	Brooklyn, N. Y.
88721	Wyeth Co. Inc.	St. Joseph, Mo.
88769	CGS Laboratories, Inc.	Stamford, Conn.
89583	Bernstein, Geo. M. and Co.	Chicago, Ill.
89869	Delco Radio Division of General Motors Corp.	Detroit, Mich.
91418	Radio Material Corp.	Chicago, Ill.
94145	Raytheon Mfg. Co. Receiving Tube Division, Plant 2	Quincy, Mass.
97979	Reon Resistor Corp.	Yonkers, N. Y.
99800	Delavan Electronics Corp.	East Aurora, N. Y.