NAVSHIPS 0967-034-9010
(Formerly 94028)

Non-Registered

TECHNICAL MANUAL

for

COMPARATOR-CONVERTER GROUP AN/URA-17

HOFFMAN ELECTRONICS CORPORATION
MILITARY PRODUCTS DIVISION
LOS ANGELES 7, CALIFORNIA

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

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7 APRIL 1961

DEPARTMENT OF THE NAVY
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From: Chief, Bureau of Ships
To: All Activities concerned with the Installation, Operation, and Maintenance of the Subject Equipment

Subj: Technical Manual for Comparator-Converter Group AN/URA-17, NAVSHIPS 94028

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2. When superseded by a later edition, this publication shall be destroyed.

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R. K. JAMES
Chief of Bureau

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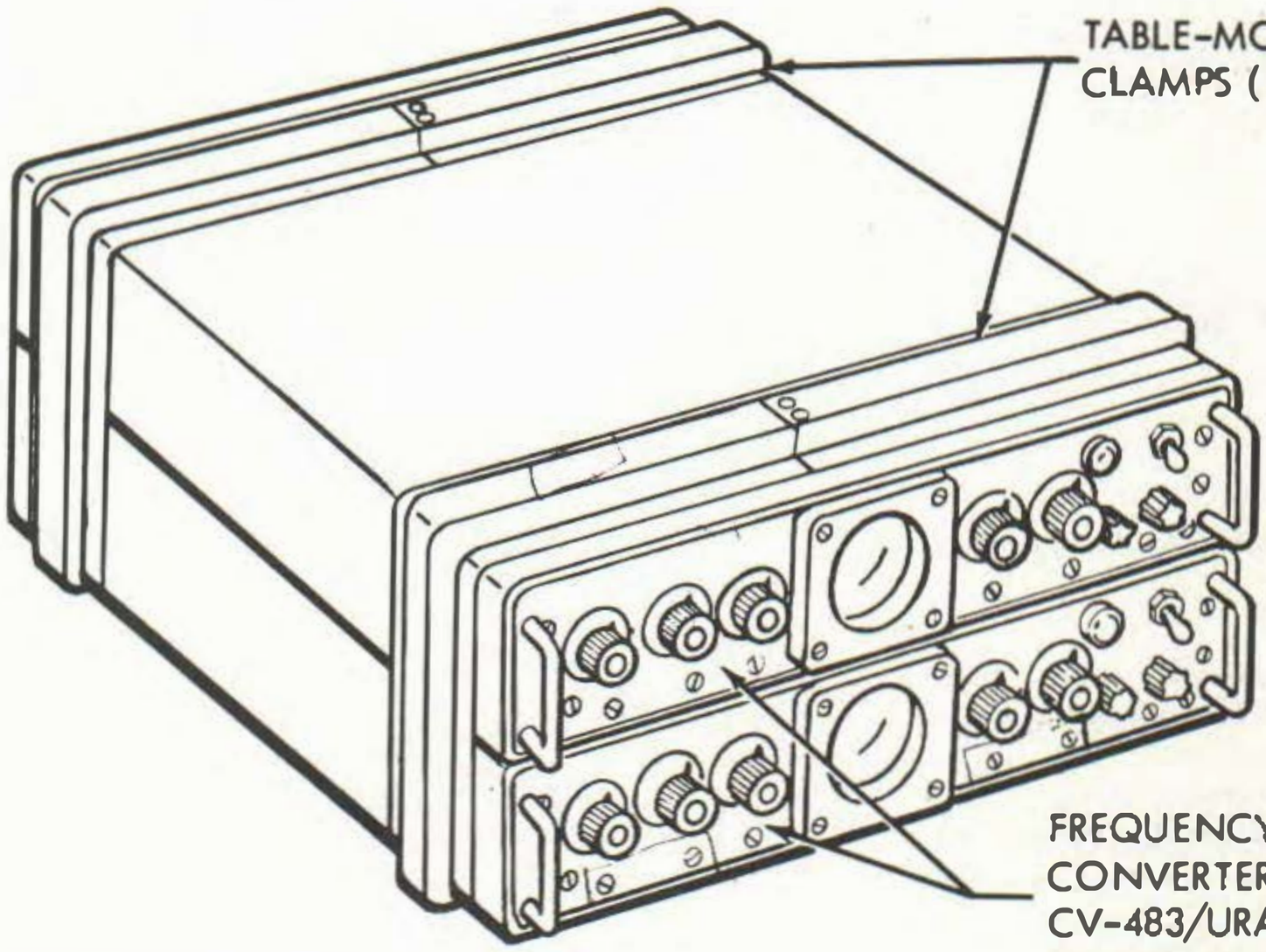

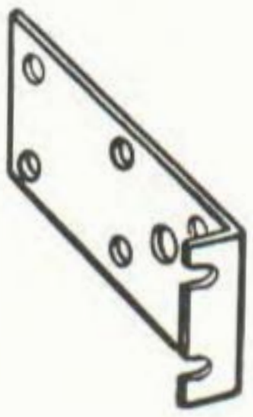

RACK-MOUNTING
BRACKETS (4)

UG-88D/U
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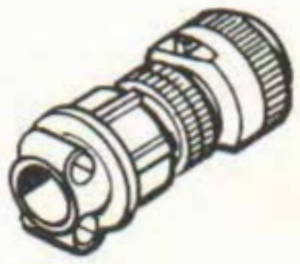


MS3106A14S-7P
CONNECTORS (2)
MS3106A14S-7S
CONNECTORS (2)
MS3106A14S-9S
CONNECTORS (2)

Figure 1-1. Comparator-Converter Group AN/URA-17,
Equipment Supplied

SECTION 1
GENERAL INFORMATION

1-1. EQUIPMENT ILLUSTRATION.

Figure 1-1 illustrates Comparator-Converter Group AN/URA-17, Federal Stock No. F5820-474-3975, the equipment supplied under Contract NObsr 81579.

1-2. FUNCTIONAL DESCRIPTION.

Comparator-Converter Group AN/URA-17, hereinafter referred to as the AN/URA-17, provides a link in the receiving end of a frequency-shift communication system. In this system, teletype mark-space characters are transmitted as rapid shifts above and below the center frequency of an rf carrier. These frequency-shift-keyed (fsk) signals are translated by a standard communications receiver into frequency variations about a center frequency of 1000 or 2550 cycles per second (cps). The AN/URA-17 changes these frequency-shifted audio signals into dc mark-space pulses for operation of a loop keying circuit of an automatic recording device. This method of communication provides the noise reduction advantages of frequency modulation for coded teletype messages at speeds to 400 words per minute.

The AN/URA-17 consists of two Frequency Shift Converters CV-483/URA-17, hereinafter referred to as converters. Either converter may be operated in a single-receiver fsk receiving system or used together in combination with two receivers and a single teletype printer to provide a "diversity" receiving system. The diversity system makes use of the principles of space-diversity or frequency-diversity reception to eliminate severe signal fading over long transmission distances.

In space-diversity operation, two receivers are tuned to the same rf carrier frequency but their receiving antennas are spaced several wavelengths apart. The advantage of this method of reception is that maximum fading of a given carrier frequency usually does not coincide in time at points so separated. The audio output of each receiver is applied to a separate converter.

In frequency-diversity operation, two receivers are tuned to different rf carrier frequencies, both containing the same mark-space modulation. The audio output of each receiver is applied to a separate converter. The advantage of this method of reception is that maximum fading of two different carrier frequencies seldom occurs at the same time in a given location. Two transmitting stations as well as two frequency channels are required. This method may be used when space limitations at the receiving site do not allow sufficient antenna separation for effective space-diversity operation.

During diversity operation, a comparator circuit in each converter continuously compares the two received signals, selecting the stronger signal for operation of the teletype printer. The teletype printer may be connected to either of the converters. When operating in a single-receiver system, the comparator circuits are inoperative.

1-3. DESCRIPTION OF THE MAJOR UNIT.

Each converter is installed in a navy gray aluminum cabinet. A handle is provided on each side of the front panel and at each end of the back panel. The cabinet is equipped with ball-bearing drawer slides which lock in the fully withdrawn position (figure 1-2). When fully withdrawn, all chassis terminals and connections are visible and easily accessible.

All external cables are attached to the converter by means of connectors which match receptacles on a removable panel at the rear of the cabinet. This panel is sloped 30 degrees to allow easy access to the cable receptacles. The cable receptacles at the rear of the cabinet are connected to the chassis by a single cable and connector. This cable is equipped with a retractor which keeps the cable in place.

A tuning indicator (two-inch cathode-ray tube) is located in the center of the front panel of each converter to allow a quick visual check of receiver tuning. The tuning indicator uses a 60 cps sweep voltage. An external indicator may be connected to a receptacle on the rear panel, for use when the operator cannot see the converter tuning indicator while tuning the receiver.

The converters each operate from a power source of 105, 115, or 125 volts, 50 to 400 cps,

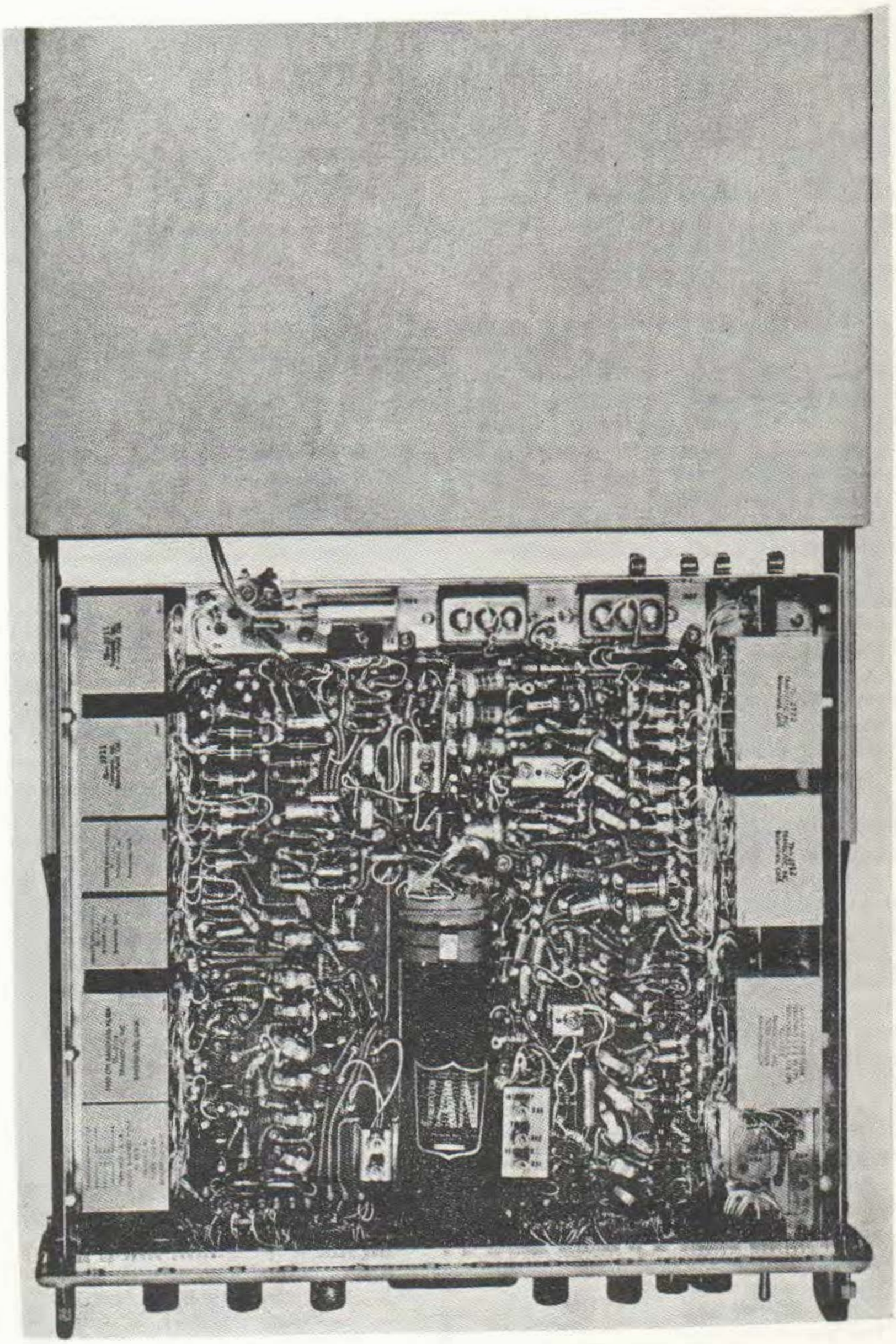


Figure 1-2. Frequency Shift Converter CV-483/URA-17,
Top View, Chassis Fully Withdrawn

single phase ac. Except for the tuning indicator cathode-ray tube, only semiconductors are used.

Brackets and mounting bolts are supplied (figure 1-1) for installation of the converters in standard 19-inch racks. Feet for table-mounting a single converter and clamps for table-mounting two converters (one above the other) are also included.

1-4. FACTORY OR FIELD CHANGES.

No factory or field changes have been made at this date.

1-5. QUICK REFERENCE DATA.

a. AF INPUT SIGNAL. - Operates from 600 ohm line, with input signals of 60 microwatts to 60 milliwatts power.

b. OPERATING FREQUENCIES. - Narrow shift, 1000 cps mean frequency; width of shift, 10 to 200 cps. Wide shift, 2550 cps mean frequency; width of shift, 200 to 1000 cps.

c. MAXIMUM KEYING SPEEDS. - 100 words per minute, single channel; 400 words per minute, when used in four-channel, time-division multiplex with each channel operating at 100 words per minute.

d. OUTPUT. - Keys 60 ma current in teletype printer dc loop circuit.

e. POWER SOURCE REQUIREMENTS. - Frequency Shift Converter CV-483/URA-17, 35 watts each, with source of 105 to 125 volts, 50 to 400 cps, single phase ac.

1-6. EQUIPMENT LISTS.

a. EQUIPMENT SUPPLIED. - Table 1-1 lists equipment supplied.

b. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED. - Table 1-2 lists equipment and publications required but not supplied.

c. TEST EQUIPMENT REQUIRED BUT NOT SUPPLIED. - Table 1-3 lists test equipment required but not supplied.

d. SHIPPING DATA. - Table 1-4 provides information covering the complete equipment as packed for shipment.

e. EQUIPMENT SIMILARITIES. - Comparator-Converter Group AN/URA-17 performs functions similar to those of Comparator-Converter Group AN/URA-8. The AN/URA-17 uses semiconductors rather than vacuum tubes. The AN/URA-17 is not electrically or mechanically interchangeable with the AN/URA-8.

f. TRANSISTOR AND DIODE COMPLEMENT. Tables 1-5 and 1-6 list the transistor and diode complement.

TABLE 1-1. COMPARATOR-CONVERTER GROUP AN/URA-17, EQUIPMENT SUPPLIED

QUANT. PER EQUIP.	NOMENCLATURE		*OVERALL DIMENSIONS			*VOLUME	*WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
2	Frequency Shift Converter	CV-483/URA-17	3-15/32	16-11/16	18-7/8	0.63	26
2	Clamps for table-mounting AN/URA-17		8	17-11/16	3-3/4	0.08	1.5
8	Feet for table-mounting Frequency Shift Converter CV-483/URA-17		1/4	2-3/8	2-3/8	0.005	0.12
4	Bracket for rack-mounting Frequency Shift Converter CV-483/URA-17		3-15/32	1-5/32	8	0.007	0.75
6	Cable connector	UG-88D/U					
2	Cable connector	MS3106A14S-7S					
2	Cable connector	MS3106A14S-7P					
2	Cable connector	MS3106A14S-9S					
2	Technical manual	NAVSHIPS 94028					

* Unless otherwise stated, dimensions are in inches, volume in cubic feet, weight in pounds.

TABLE 1-2. COMPARATOR-CONVERTER GROUP AN/URA-17, EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED

QUANT. PER EQUIP.	NOMENCLATURE		REQUIRED USE	REQUIRED CHARACTERISTICS
	NAME	DESIGNATION		
2	Standard navy radio receiver	RBA, RBB, RBC, SRR-11, SRR-12, SRR-13, or equivalent.	To receive frequency-shifted rf signals and deliver frequency-shifted af signals to input of Comparator-Converter Group AN/URA-17.	Frequency-shifted af output of 600 ohms impedance, and up to 60 milliwatts power.
-	Technical manual for each receiver used.	--	For operating instructions.	---
4	Mounting bolts	--	For table-mounting the AN/URA-17.	1/4-28 thread x mounting surface thickness + 3/8 inch long.
-	Interconnecting cables	MCOS-2	Connect source power to POWER connector (J3).	---
		TTHFWA-1-1/2	Connect teletype printer to TTY OUTPUT connector (J6).	
		TTHFWA-1-1/2	Connect audio input to AUDIO INPUT connector (J2).	
		RG-58A/U	Connect remote indicator (if used) to REMOTE TUNING IND connector (J7).	
		RG-58A/U	Connect DIV. A connector (J4) of each converter to the DIV. B connector (J5) of the other converter.	
1	Teletype printer, or other automatic recorder	--	To record messages represented by the keyed output of the AN/URA-17.	Keying loop current of 60 ma, dc.

TABLE 1-3. COMPARATOR-CONVERTER GROUP AN/URA-17, TEST EQUIPMENT REQUIRED BUT NOT SUPPLIED

QUANT. PER EQUIP.	NOMENCLATURE		REQUIRED USE	REQUIRED CHARACTERISTICS
	NAME	DESIGNATION		
1	Oscilloscope	DuMont 304-A	Trouble-shooting the AN/URA-17.	Display 800 to 3600 cps audio frequency signals at amplitude of 0.1 to 50.0 volts.
2	Vtvm, ac	ME-30/U	Trouble-shooting and alignment of converters; checking filters and discriminators.	Measure audio frequency voltages, 0.1 to 20 volts at 800 to 3600 cps, ±5%.
1	Audio oscillator	TS-382A/U	Alignment of converters; checking filters and discriminators.	Audio frequency output: 800 to 3600 cps at amplitudes 0 to 10 volts.
1	Frequency meter	AN/TSM-3	Checking filters and discriminators.	Measurement of audio frequencies, ±1%.
2	Multimeter	AN/PSM-4	Trouble-shooting, measurement of power supply outputs, alignment, checking filters and discriminators.	DC voltages 0 to 560 volts ±3%, ac voltages 0 to 125 volts ±5%, at 50 to 400 cps.
1	Test set, transistor	TS-1100/U	Test transistors and diodes.	Test semiconductors (in circuit or out).

TABLE 1-4. COMPARATOR-CONVERTER GROUP AN/URA-17, SHIPPING DATA

BOX NO.	NOMENCLATURE		*OVERALL DIMENSIONS			*VOLUME	*WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Comparator-Converter Group	AN/URA-17	16-3/4	26-3/4	24-3/4	6.42	125

* Unless otherwise stated, dimensions are in inches, volume in cubic feet, and weight in pounds; equipment crated and ready for shipment.

TABLE 1-5. FREQUENCY SHIFT CONVERTER CV-483/URA-17,* TRANSISTOR COMPLEMENT

SYMBOL	NUMBER OF TRANSISTORS OF TYPES INDICATED								
	2N328A	2N333	2N336	2N497	2N424	2N526	2N657	2N1412	TOTAL
Q1						1			1
Q2						1			1
Q3						1			1
Q4								1	1
Q5								1	1
Q6		1							1
Q7		1							1
Q8		1							1
Q9		1							1
Q10							1		1
Q11			1						1
Q12				1					1
Q13		1							1
Q14	1								1
Q15	1								1
Q16		1							1
Q17							1		1
Q18							1		1
Q19		1							1
Q20					1				1
Q21		1							1
Q22		1							1
Q23					1				1
Q24				1					1
Total Number of Each Type	2	9	1	2	2	3	3	2	24

* The AN/URA-17 complement is twice the above.

TABLE 1-6. FREQUENCY SHIFT CONVERTER CV-483/URA-17,* DIODE COMPLEMENT

SYMBOL	NUMBER OF DIODES OF TYPES INDICATED						
	1N457	1N538	1N1731	1N3025B	1N3029B	1N3042B	TOTAL
CR1		1					1
CR2		1					1
CR3		1					1
CR4		1					1
CR5		1					1
CR6		1					1
CR7				1			1
CR8				1			1
CR9		1					1
CR10		1					1
CR11	1						1
CR12	1						1
CR13	1						1
CR14	1						1
CR15	1						1
CR16	1						1
CR17	1						1
CR18		1					1
CR19	1						1
CR20		1					1
CR21						1	1
CR22						1	1
CR23		1					1
CR24		1					1
CR25		1					1
CR26		1					1
CR27					1		1
CR28		1					1
CR29		1					1
CR30		1					1
CR31		1					1
CR32			1				1
CR33			1				1
CR34					1		1
Total Number of Each Type	8	18	2	2	2	2	34

* The AN/URA-17 complement is twice the above.

SECTION 2
INSTALLATION

2-1. UNPACKING AND HANDLING.

Comparator-Converter Group AN/URA-17 (hereinafter referred to as the AN/URA-17) and accessories are packed in one wooden shipping box. The equipment is packaged in a corrugated fiberboard carton inside a moisture-vaporproof wrapper with a desiccant included. Do not unpack until ready for use.

Place shipping box in right-side-up position, break the steel straps, and remove the top cover. Open the outer fiberboard carton and the barrier bag. Open the inner carton and remove the equipment.

CAUTION

Do not cut the inner carton open unless the cutting blade has a guard which will prevent cutting deeper than the thickness of the fiberboard.

Remove the accessories from the packing cells and check the equipment for shipping damage, and against the list of equipment supplied, table 1-1.

2-2. POWER REQUIREMENTS AND DISTRIBUTION.

The AN/URA-17 consists of two Frequency Shift Converters CV-483/URA-17. Each Frequency Shift Converter CV-483/URA-17 (hereinafter referred to as the converter) requires 35 watts of input power and is internally wired for operation on 115 volts, 50 to 400 cps, single phase ac. If 105 or 125 volt line voltage is to be used, the connections to power transformers T3 and T4 (figure 5-1) will require changing (refer to paragraph 2-4c(4)). Figure 5-9 shows the primary power distribution for the converter.

2-3. INSTALLATION LAYOUT.

Install the AN/URA-17 so the tuning indicators may be observed while tuning the associated receivers. If this is not feasible, any oscilloscope with a dc vertical amplifier may be used as a remote tuning indicator, located near the receivers. It is desirable to install the two converters together if used for diversity operation. Converters used for single-receiver operation should be located near their respective receivers. The installation layout should also allow sufficient space in front of the converters to permit withdrawal of the chassis for servicing (refer to paragraph 2-4a).

2-4. INSTALLATION REQUIREMENTS.

a. OUTLINE DRAWINGS. - Figure 2-1 shows all mounting dimensions and clearances required for table-mounting the AN/URA-17. Figure 2-2 shows all mounting dimensions and clearances required for table-mounting the CV-483/URA-17. Figure 2-3 shows all mounting dimensions and clearances required for rack-mounting the CV-483/URA-17.

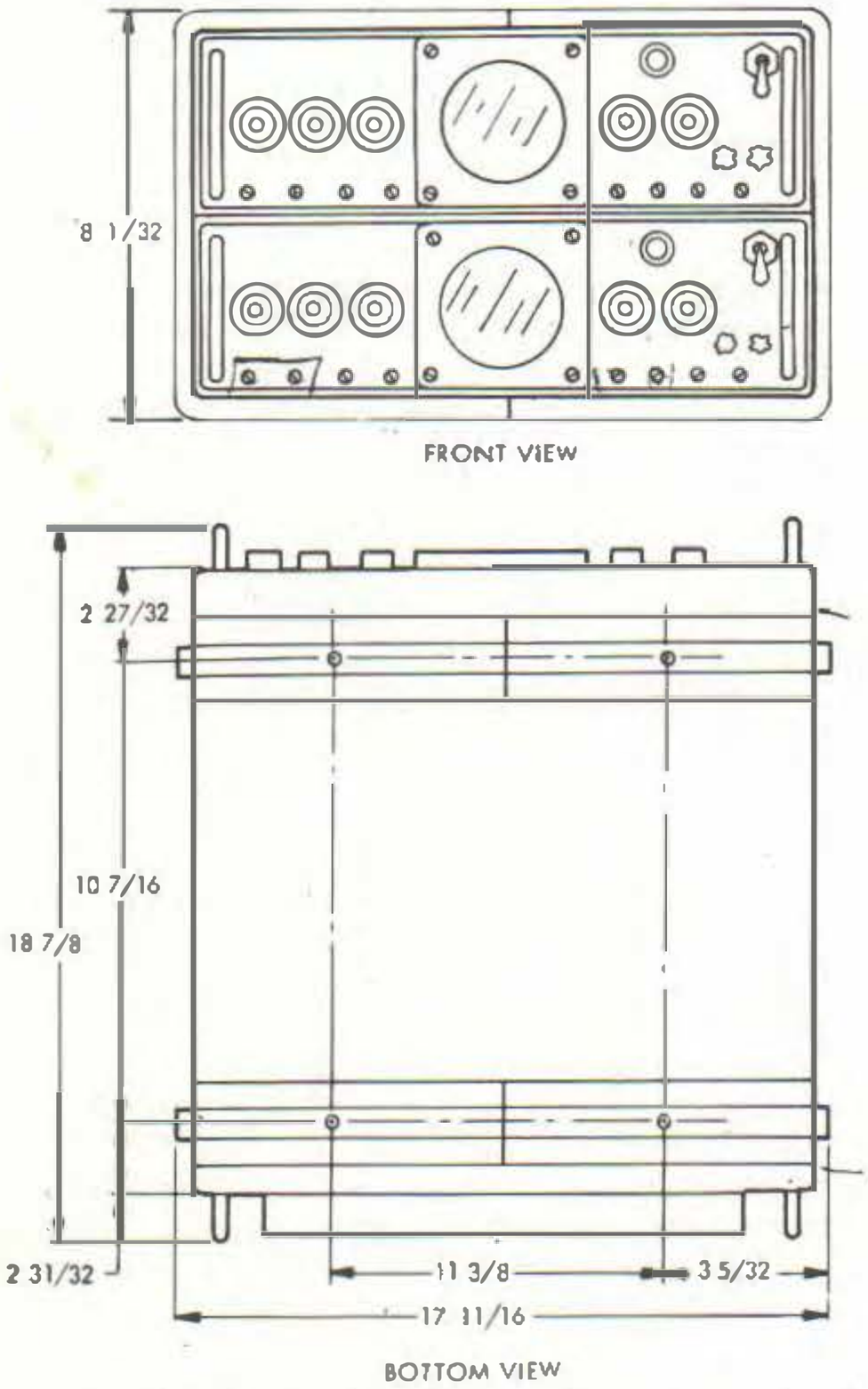
b. EQUIPMENT MOUNTING. - The AN/URA-17 may be table-mounted, or the clamps removed and the individual converters separately table or rack-mounted. Refer to applicable mounting procedure in the following paragraphs.

(1) TABLE-MOUNTING THE AN/URA-17. - Table-mounting of the AN/URA-17 is performed as follows:

Step 1. Layout and drill four 9/32 inch holes (figure 2-1) through mounting surface.
Step 2. Place AN/URA-17 in position on mounting surface.
Step 3. Insert four bolts (1/4-28 thread x mounting surface thickness + 3/8 inch long) up through mounting surface into captive nuts in AN/URA-17. Tighten securely.

(2) TABLE-MOUNTING THE CV-483/URA-17. - Table-mounting of the CV-483/URA-17 is performed as follows:

Step 1. Layout and drill four 9/32 inch holes (figure 2-2) through mounting surface.
Step 2. Install mounting feet on bottom of cabinet, using 8-32 binder-head screws and washers provided.
Step 3. Remove chassis from cabinet (Section 6, paragraph 6-3c(1)).



NOTE: ALL DIMENSIONS ARE IN INCHES

Figure 2-1. Comparator-Converter Group AN/URA-17, Table-Mounting Installation Drawing

Step 4. Insert four socket-head cap screws (1/4-20 thread) through holes in bottom of cabinet (of sufficient length to pass through mounting surface and allow use of flat washer and lockwasher under each nut).
Step 5. Install flat washer, lockwasher, and nut on each bolt and tighten securely.
Step 6. Replace chassis in cabinet.

(3) RACK-MOUNTING THE AN/URA-17. - Rack-mounting of the AN/URA-17 is performed as follows:

Step 1. Remove clamps holding converters together, and lift off upper converter.
Step 2. Remove 10-32 binder-head screws (six on side of each cabinet, figure 2-3).
Step 3. Fasten rack-mounting brackets on each cabinet, using screws just removed (figure 2-3). Tighten screws securely.
Step 4. Remove chassis from each cabinet (Section 6, paragraph 6-3c(1)).
Step 5. Install cabinets in rack. Bolt securely.
Step 6. Replace chassis in cabinets.

(4) RACK-MOUNTING THE CV-483/URA-17. - Rack-mounting of the CV-483/URA-17 is performed as follows:

Step 1. Remove 10-32 binder-head screws (six on each side of cabinet, figure 2-3).
Step 2. Fasten rack-mounting brackets on cabinet, using screws just removed (figure 2-3). Tighten screws securely.
Step 3. Remove chassis from cabinet (Section 6, paragraph 6-3c(1)).
Step 4. Install cabinet in rack. Bolt securely.
Step 5. Replace chassis in cabinet.

c. INTERCONNECTION. - All interconnecting cables attach to receptacles on the rear of the con-

verter cabinets. These cables must be fabricated during installation, in lengths determined by equipment layout. Instructions for attaching the supplied connectors to the required cables are given in paragraph 2-4d.

NOTE

Interconnecting cable types may vary between installations. Refer to applicable ship or station plans to determine the correct cabling for the specific installation.

(1) INTERCONNECTING CABLES FOR SINGLE-RECEIVER OPERATION. - Table 2-1 lists the required cable and connector information for single-receiver operation of one converter. Figure 2-4 illustrates the interconnection to associated equipment.

(2) INTERCONNECTING CABLES FOR DIVERSITY OPERATION. - Table 2-2 lists the required cable and connector information for diversity operation of the AN/URA-17. Figure 2-5 illustrates the interconnection to associated equipment.

(3) AUDIO INPUT LINES. - The AN/URA-17 requires 600 ohm, 60 milliwatt outputs from the associated receivers. If the receiver outputs are balanced, STANDOFF E1 in each converter should be grounded. To accomplish this, loosen the four captive screws at corners of receptacle panel, remove panel from the rear of each converter cabinet (figure 2-6), and solder a lead from STANDOFF E1 to a nearby ground terminal. If the receiver outputs are unbalanced (one side grounded), leave STANDOFF E1 ungrounded.

(4) POWER TRANSFORMER CONNECTIONS. - The AN/URA-17 is shipped from the factory with power transformers T3 and T4 in each converter connected for a nominal line voltage of 115 volts. If nominal line voltage is 105 volts, the leads con-

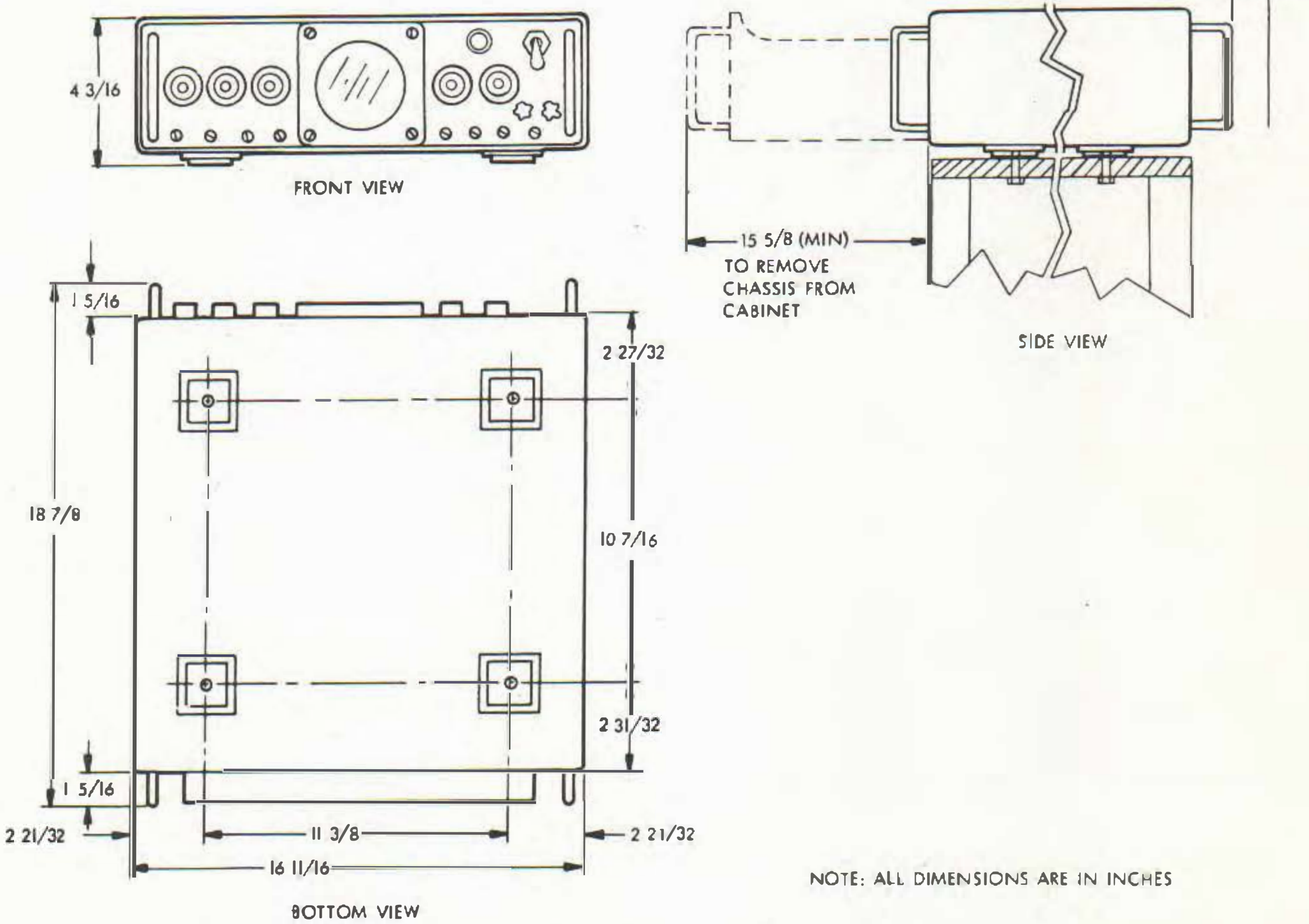


Figure 2-2. Frequency Shift Converter CV-483/URA-17, Table-Mounting Installation Drawing

nected to terminal 3 of T3 and T4 (see Section 5, figure 5-1) must be moved to terminal 2 of the respective transformer. If nominal line voltage is 125 volts, the leads connected to terminal 3 of T3 and T4 must be moved to terminal 4 of the respective transformer.

d. CABLE ASSEMBLY. - Attach the connectors to interconnecting cables as follows:

(1) ATTACHING UG-88D/U CONNECTORS TO RG-58A/U COAXIAL CABLE. - Attach the UG-88D/U connectors (supplied) to RG-58A/U coaxial cable as described in figure 2-7.

(2) ATTACHING MS CONNECTOR TO MCOS-2 CABLE. - Attach each MS connector (supplied) to MCOS-2 cable as described below (see figure 2-8).

Step 1. Cut cable end even.
Step 2. Slide cable clamp (1), rubber washer (2), soldering ring (3), and extension (4) over end of cable, in order given.
Step 3. Remove vinyl jacket from 11/16 inch of cable.
Step 4. Unbraid and pigtail braid.
Step 5. Remove insulation from 3/16 inch of leads.
Step 6. Tin bare lead ends.
Step 7. Slide a 1/2 inch length of vinyl tubing over end of each lead.
Step 8. Solder each lead to plug pin, according to table 2-1 or 2-2, as applicable.
Step 9. Slide vinyl tubing on each lead so it covers soldered connection. Wrap a layer of adhesive plastic tape around leads.
Step 10. Slide extension (4) over pigtail and screw it on shell (5).

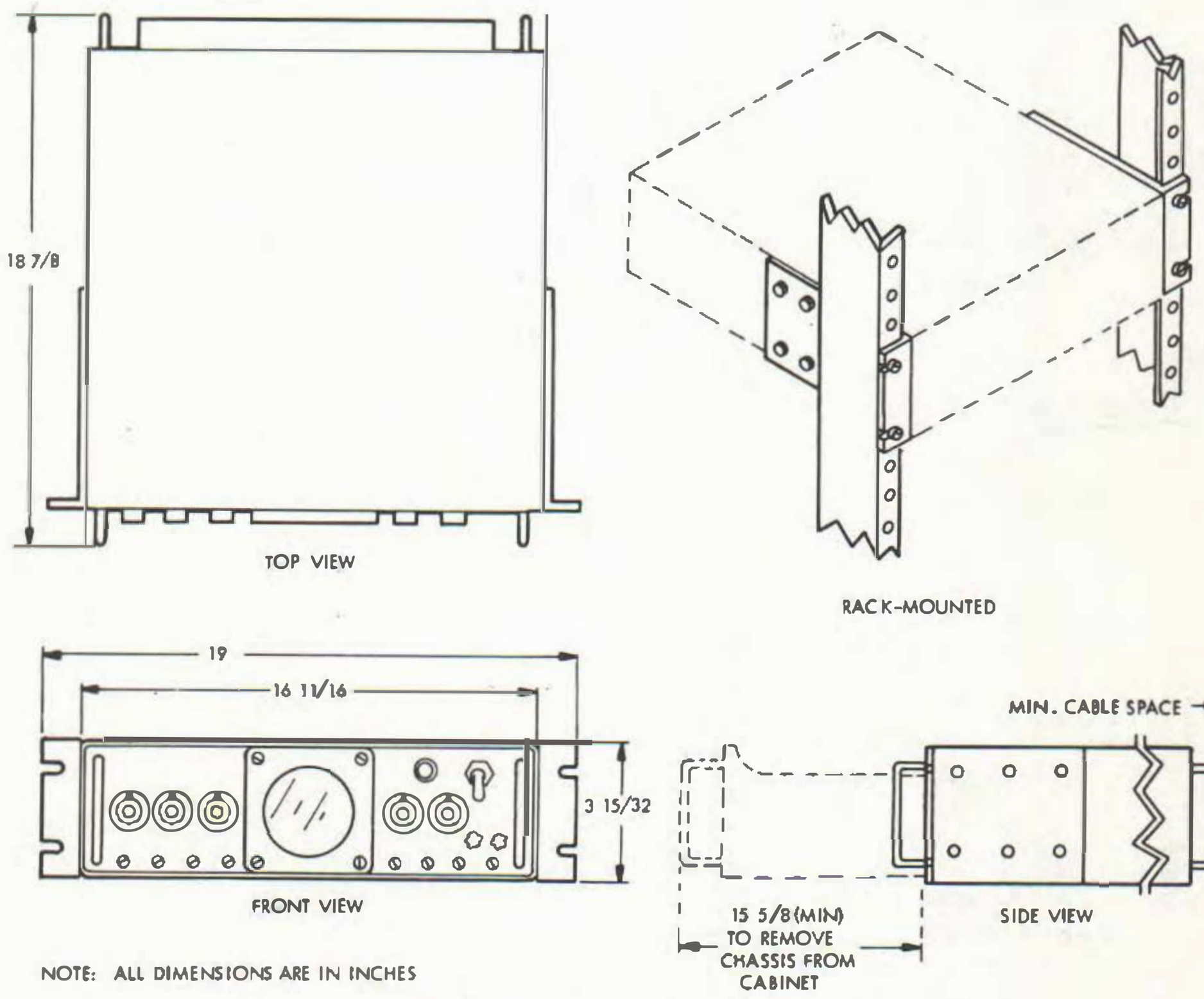


Figure 2-3. Frequency Shift Converter CV-483/URA-17, Rack-Mounting Installation Drawing

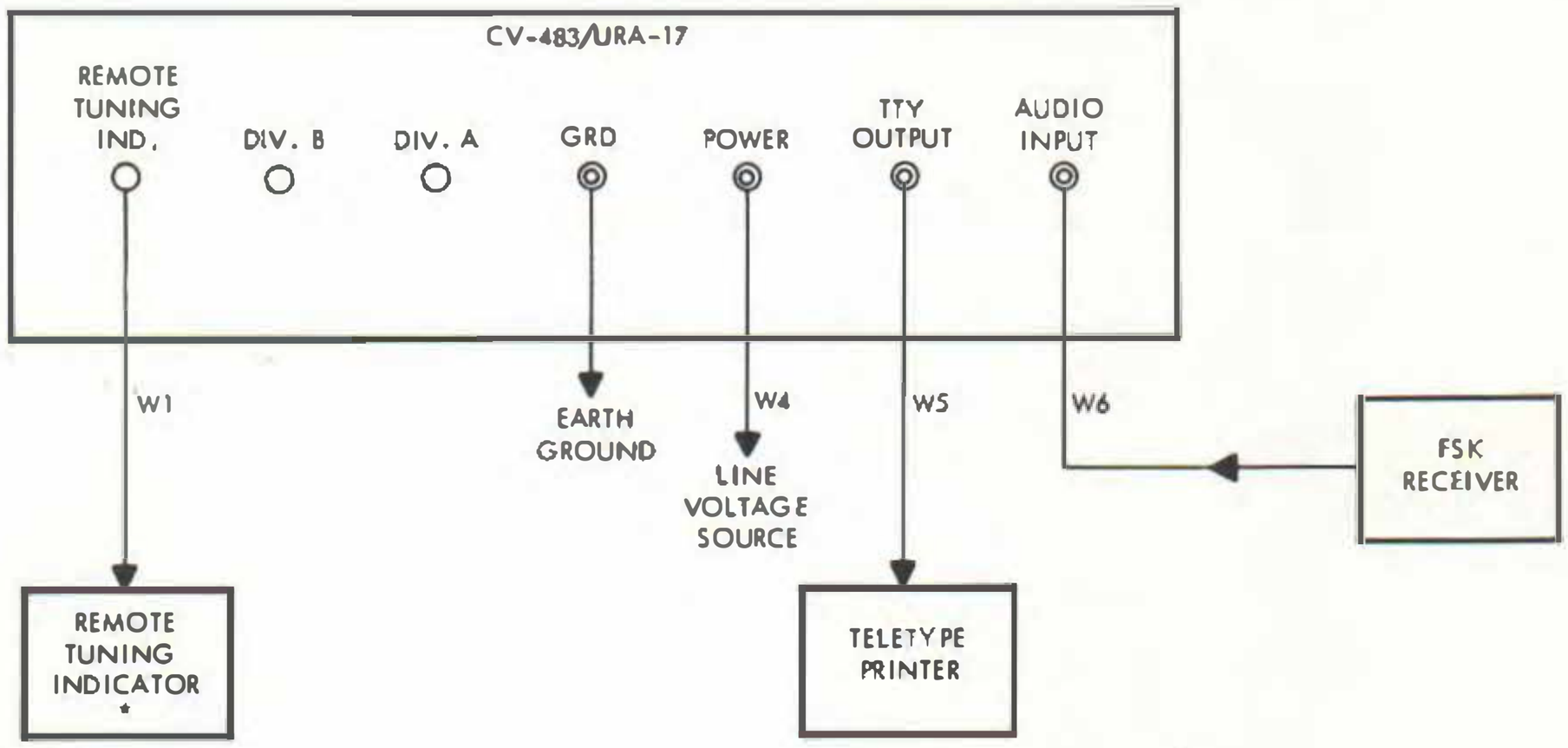


Figure 2-4. Frequency Shift Converter CV-483/URA-17, Interconnecting Data for Single-Receiver Operation

TABLE 2-1. CABLING REQUIRED FOR SINGLE-RECEIVER OPERATION*

CABLE TYPE	PLUG		CONNECTIONS		TERMINATIONS	
	SYMBOL	DESIGNATION	LEAD COLOR	PIN NO.	FROM	TO
TTHFWA-1-1/2 (W6)	P202	MS3106A14S-7P	BLACK WHITE RED	A B SPARE	AUDIO INPUT connector J2	FSK receiver
MCOS-2 (W4)	P203	MS3106A14S-7S	BLACK WHITE	A B (GRD)	POWER INPUT connector J3	Line voltage source
TTHFWA-1-1/2 (W5)	P206	MS3106A14S-9S	BLACK WHITE RED	B (GRD) A (HOT) SPARE	TTY OUTPUT connector J6	Teletype printer keying loop
RG-58A/U (W1)**	P207	UG-88D/U	---	---	REMOTE TUNING IND. connector J7	Remote tuning indicator
Copper braid	---	---	---	---	GRD terminal	Good earth ground

* Use in conjunction with figure 2-4.
** Required only when remote tuning indicator is used.

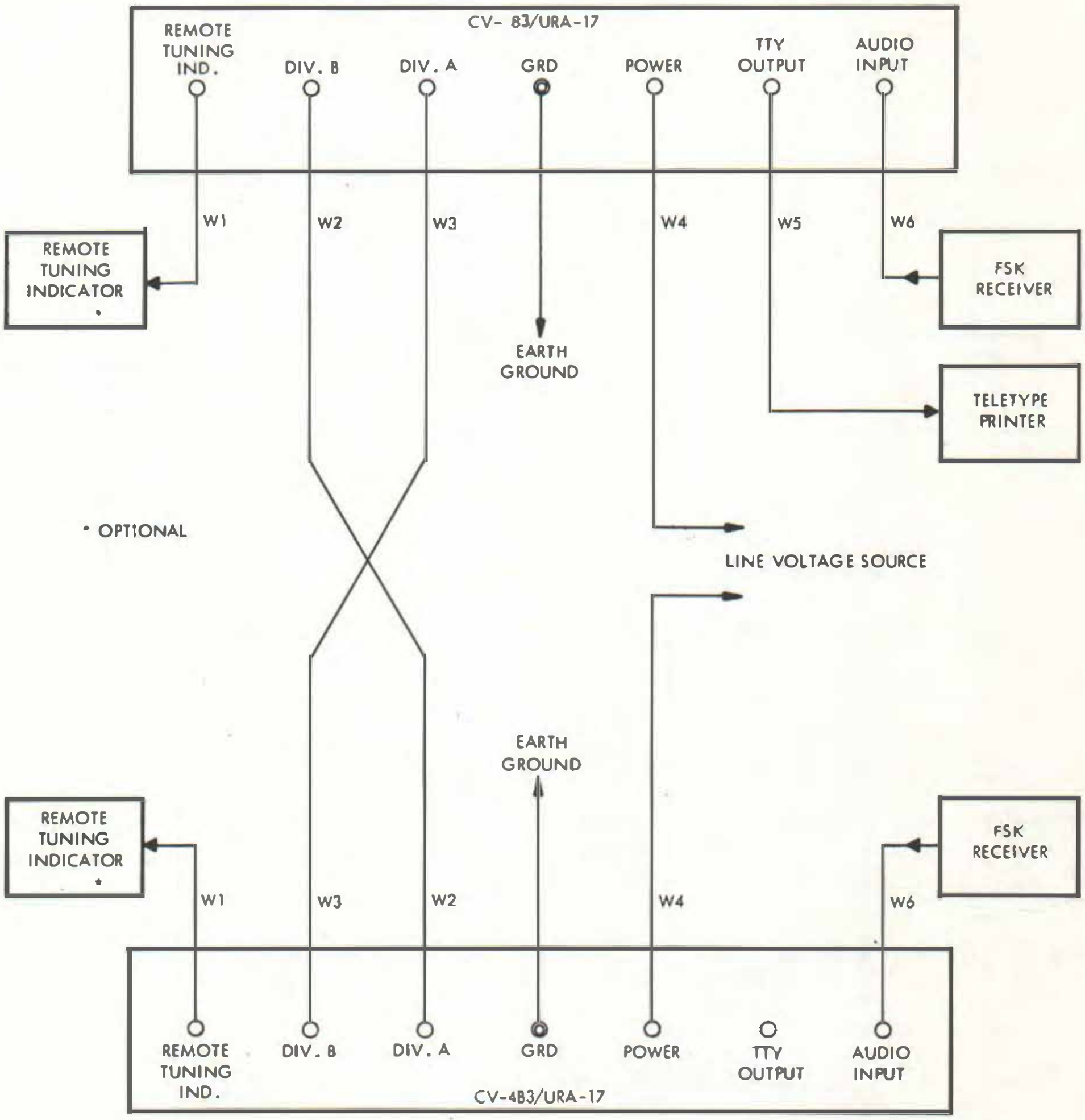


Figure 2-5. Comparator-Converter Group AN/URA-17, Interconnecting Data for Diversity Operation

Step 11. Solder pigtail to soldering ring (3).
Step 12. Screw cable clamp (1) on extension and tighten cable clamp screws.

(3) ATTACHING MS CONNECTORS TO TTHFWA-1-1/2 CABLE. - Attach each MS connector (supplied) to TTHFWA-1-1/2 cable as described below (see figure 2-9):

Step 1. Cut cable end even.
Step 2. Wrap layer of adhesive plastic tape around armor (exposing 11/16 inch end of cable).
Step 3. Slide cable clamp (1), rubber washer (2), soldering ring (3), and extension (4) over end of cable in order given.
Step 4. Remove armor, vinyl jacket, and wrappings from 11/16 inch of cable.
Step 5. Remove insulation from 3/16 inch of leads to be used. Do not remove insulation from "spare" lead.

TABLE 2-2. CABLING OF EACH CONVERTER FOR DIVERSITY OPERATION*

CABLE TYPE	PLUG		CONNECTIONS		TERMINATIONS	
	SYMBOL	DESIGNATION	LEAD COLOR	PIN NO.	FROM	TO
TTHFWA-1-1/2 (W6)	P202	MS3106A14S-7P	BLACK WHITE RED	A B SPARE	AUDIO INPUT connector J2	FSK receiver
MCOS-2 (W4)	P203	MS3106A14S-7S	BLACK WHITE	A B (GRD)	POWER input connector J3	Line voltage source
TTHFWA-1-1/2 (W5)**	P206	MS3106A14S-9S	BLACK WHITE RED	B (GRD) A (HOT) SPARE	TTY OUTPUT connector J6	Teletype printer keying loop
RG-58A/U (W3)**	P204	UG-88D/U	---	---	DIV. A connector J4	DIV. B, on other converter
RG-58A/U (W2)**	P205	UG-88D/U	---	---	DIV. B connector J5	DIV. A, on other converter
RG-58A/U (W1)***	P207	UG-88D/U	---	---	REMOTE TUNING IND. J7 connector	Remote tuning indicator
Copper braid	---	---	---	---	GRD terminal	Good earth ground

* Use in conjunction with figure 2-5.
** These cables required only for one converter.
*** Required only when remote tuning indicator is used.

Step 6. Tin bare lead ends.

Step 7. Slide a 1/2 inch length of vinyl tubing over end of each lead to be used. Slide a 11/16 inch length of vinyl tubing over end of spare lead.

Step 8. Solder each lead to plug pin, according to table 2-1 or 2-2, as applicable.

Step 9. Slide vinyl tubing on each lead so it covers soldered connection. Wrap a layer of adhesive plastic tape around leads.

Step 10. Slide extension (4) over pigtail and screw it on shell (5).

Step 11. Screw cable clamp (1) on extension and tighten cable clamp screws.

2-5. INSPECTION AND ADJUSTMENTS.

a. MECHANICAL AND ELECTRICAL CHECKS. - Before releasing the AN/URA-17 to operating personnel, perform the following mechanical and electrical checks:

(1) MECHANICAL CHECKS. - Check each control for smoothness of operation. Check chassis drawer slides and lubricate lightly with lubriplate, if required.

TABLE 2-3. FREQUENCY SHIFT CONVERTER CV-483/URA-17, CRT ADJUSTMENT CONTROLS

CONTROL	FUNCTION
FOCUS	Used to sharpen the lines in the cathode-ray tube display.
INTENSITY	Used to adjust the intensity of the cathode-ray tube display.
VERT CTR	Used to center the cathode-ray tube display (with no signal input).

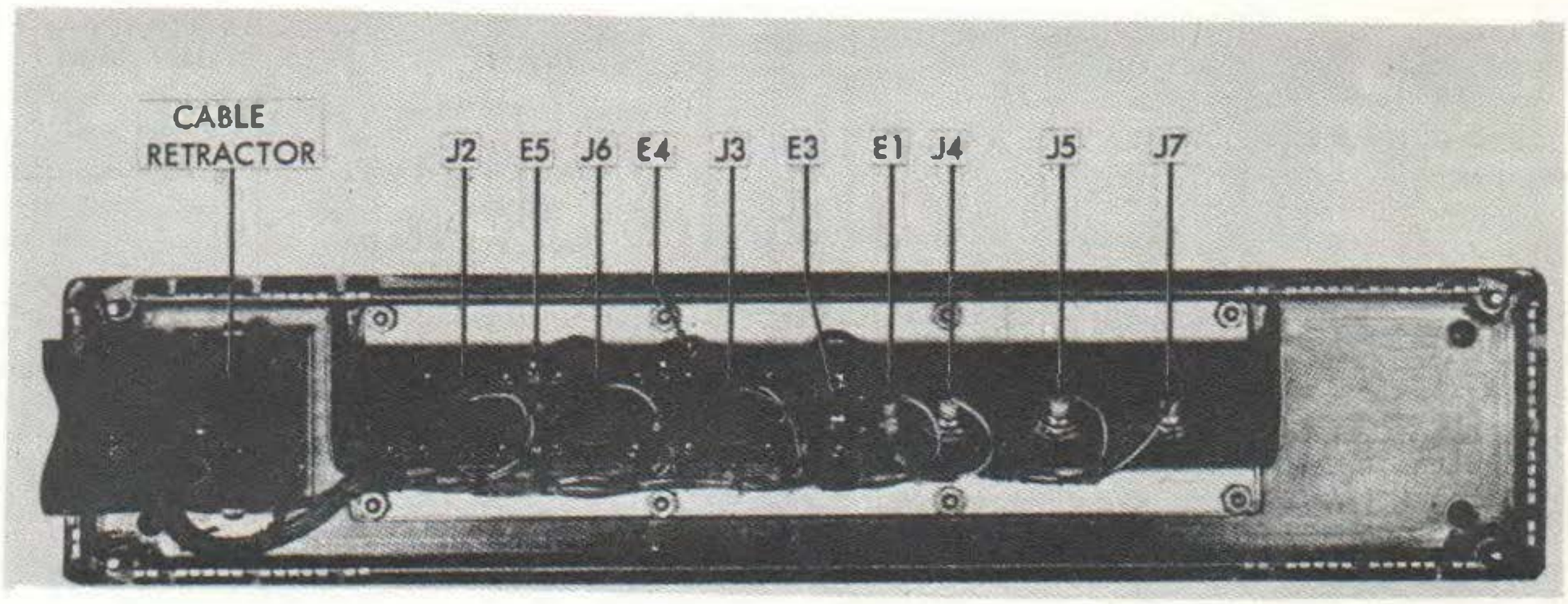


Figure 2-6. Frequency Shift Converter CV-483/URA-17, Cable Receptacle Panel, Interior View

(2) ELECTRICAL CHECKS.

(a) CRT ADJUSTMENT CONTROLS. (Table 2-3.) - Turn POWER switch of one converter to On and set the FUNCTION switch to TUNE. With no signal input to converter, horizontal trace on tuning indicator should coincide with center line of crt bezel and be bright and sharp. If not, proceed as follows:

Step 1. Loosen captive screw at each corner of front panel.
Step 2. Pull chassis forward until controls (figure 2-10) are accessible.
Step 3. Operate interlock switch (figure 2-10) by pressing in on button at left side of switch.
Step 4. Adjust FOCUS, INTENSITY, and VERT CTR controls as required, push chassis back into cabinet, and tighten captive screws.
Step 5. Repeat for second converter.

(b) PRE-OPERATIONAL CHECK. - Interconnect the converter and teletype printer as illustrated in figure 2-11. Turn teletype printer dc loop current supply on. Check teletype printer dc loop voltage and polarity. It should be approximately 12 volts, positive with respect to chassis, at terminal A of TTY OUTPUT receptacle (J6) on rear of converter to which teletype printer is connected. Adjust teletype printer dc loop current for 60 milliampere indication on TTY panel ammeter by means of applicable rheostat.

(c) OPERATIONAL CHECK. - Upon completion of pre-operational checks, check equipment for proper operation as described in Section 3, paragraph 3-2g(1) for single-receiver operation or in Section 3, paragraph 3-2g(2) for diversity operation. Check with both narrow-shift and wide-shift input signals, if practicable. If operation is not correct, recheck all steps of installation. If difficulty cannot be found and corrected, notify communications officer at station or ship.

NOTE

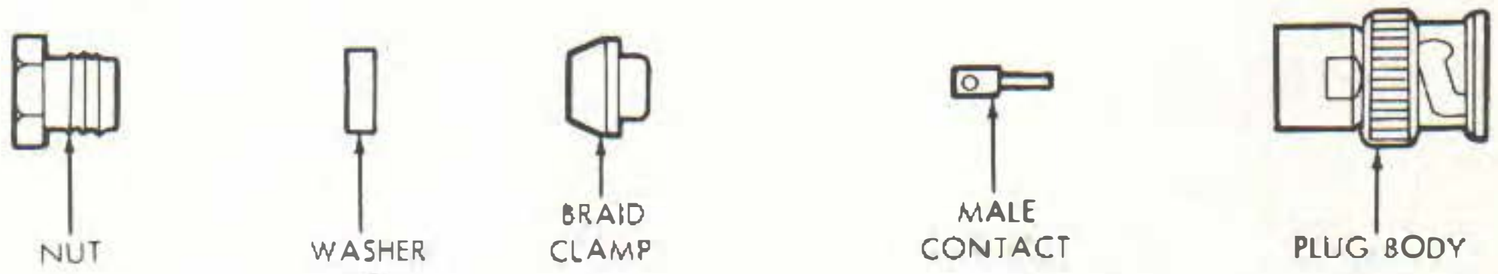
Unmodified R390-A radio receivers have insufficient audio output to operate this equipment efficiently. The required modification is Field Change 2-8-390A/URR (Electronics Information Bulletin 542, dated 22 August 1960). After modification, set Line Meter switch to +10 position and adjust Line Gain control for +10 indication on Line Level meter.

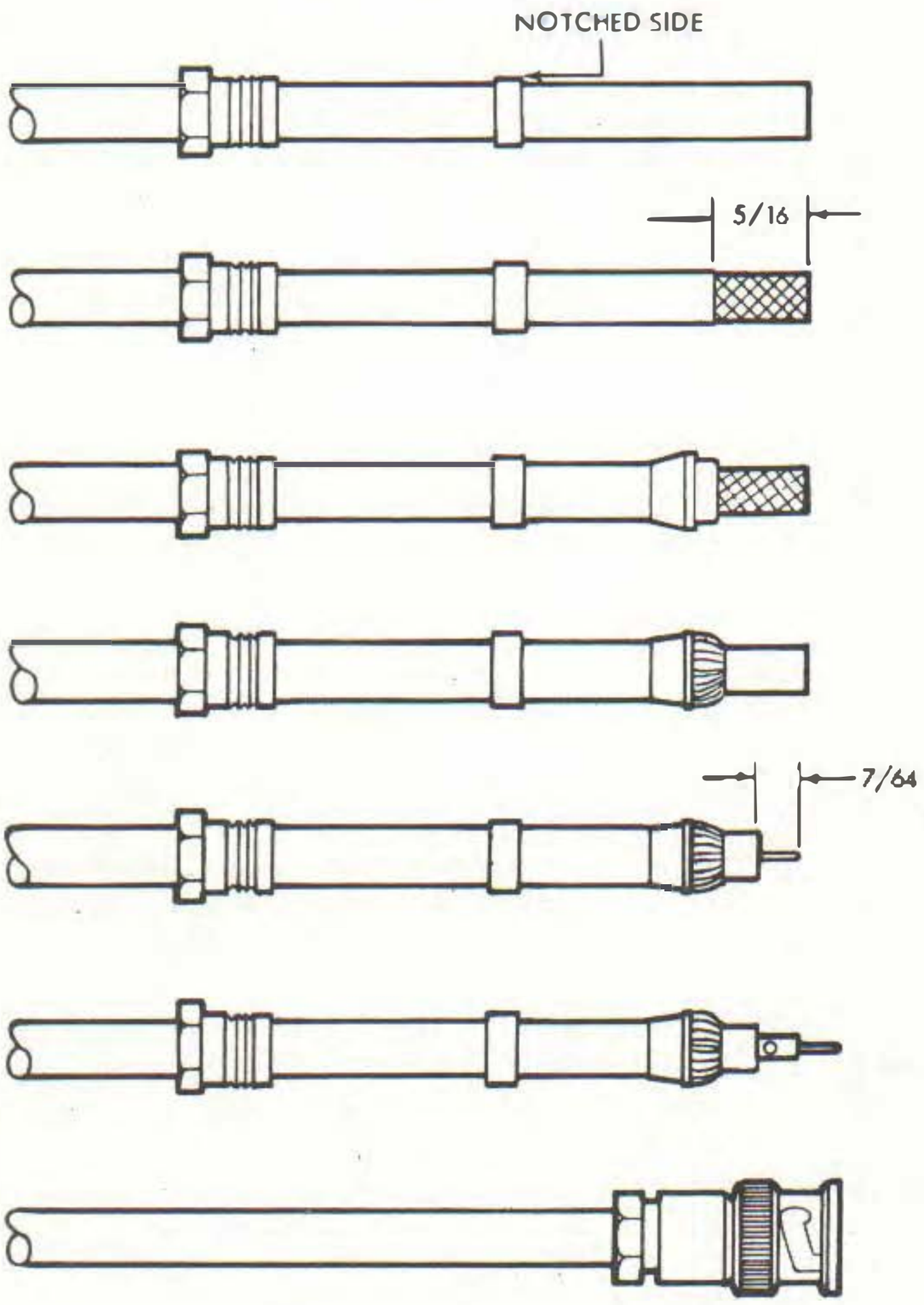
2-6. PREPARATION FOR RESHIPMENT.

a. INTERCONNECTING CABLES. - Disconnect all cables from the receptacles on rear of converters. Remove all connectors from cable ends at converter, for use at next installation.

b. DISMOUNTING EQUIPMENT. - If table-mounted, remove the converter chassis from cabinet (as described in Section 6, paragraph 6-3c (1)), and take out bolts holding cabinet to mounting surface. If rack-mounted, remove converter from rack and take off mounting brackets. Replace bolts removed from converter cabinet.

c. PACKING. - Before packing for shipment, check all items against table 1-1. Instruct packaging and packing facility as to type of equipment and whether the preparation shall be for domestic shipment-immediate use, domestic shipment and storage, or for overseas shipment; and to mark the box containing the technical manuals, "TECHNICAL MANUALS INSIDE."





1. CUT END OF CABLE EVEN. SLIDE NUT AND WASHER (NOTCHED SIDE OUT) ON CABLE.

2. REMOVE 5/16 INCH OF VINYL JACKET. DO NOT NICK BRAID.

3. SLIDE BRAID CLAMP OVER BRAID. INSIDE SHOULDER OF CLAMP MUST SEAT AGAINST END OF CABLE JACKET.

4. COMB OUT BRAID, BEND BACK OVER CLAMP, AND TRIM TO LENGTH.

5. REMOVE 7/64 INCH OF DIELECTRIC. DO NOT NICK CONDUCTOR. TIN CONDUCTOR LIGHTLY.

6. SOLDER MALE CONTACT TO CONDUCTOR. OUTSIDE SURFACE MUST BE FREE OF SOLDER.

7. PUSH INTO PLUG BODY AS FAR AS IT WILL GO. SCREW NUT INTO PLUG BODY WITH WRENCH UNTIL MODERATELY TIGHT.

NOTE: ALL DIMENSIONS ARE IN INCHES

Figure 2-7. Attaching UG-88D/U Plug to RG-58A/U Coaxial Cable

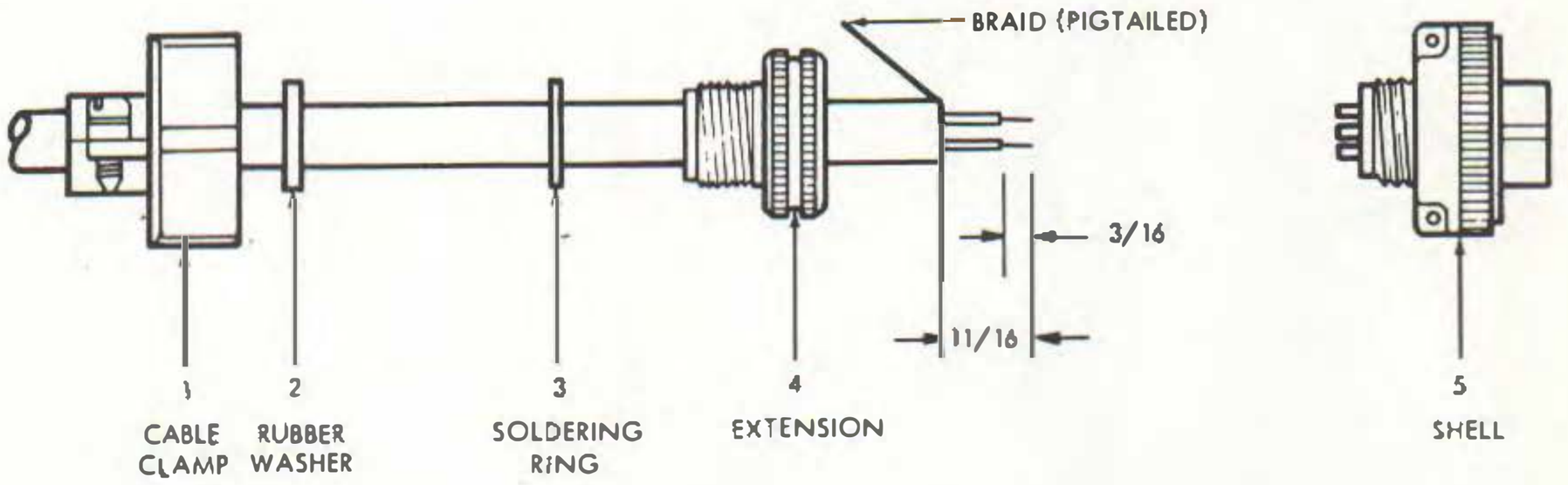
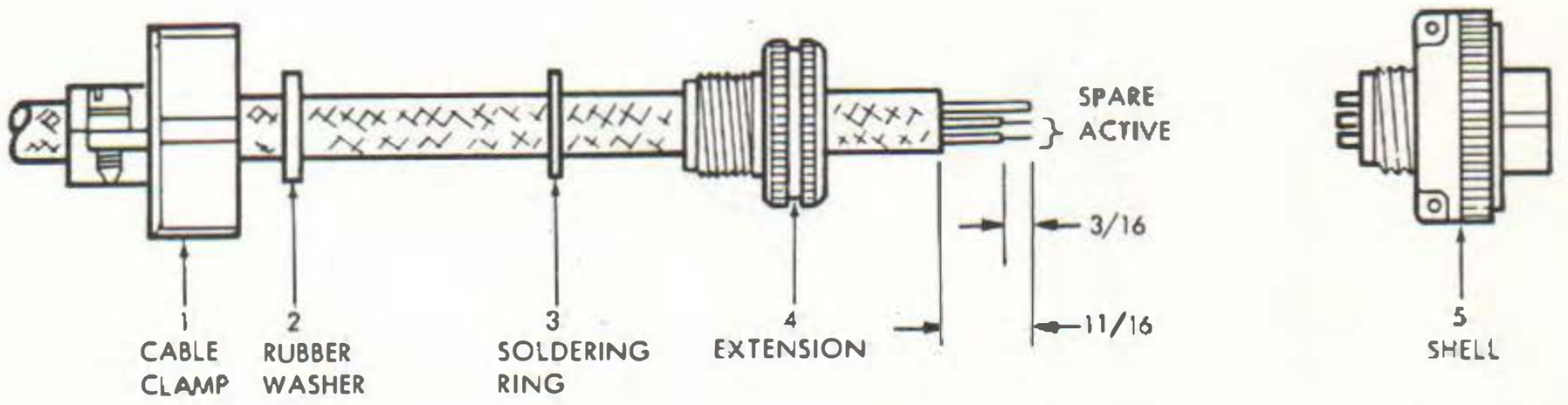


Figure 2-8. Attaching MS Plug to MCOS-2 Cable



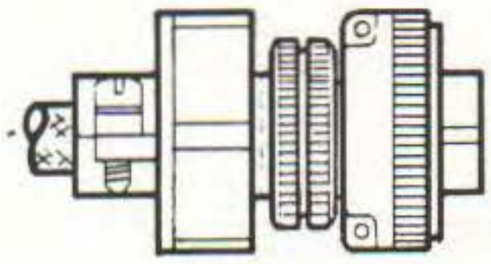


Figure 2-9. Attaching MS Plug to TTHFWA-1-1/2 Cable

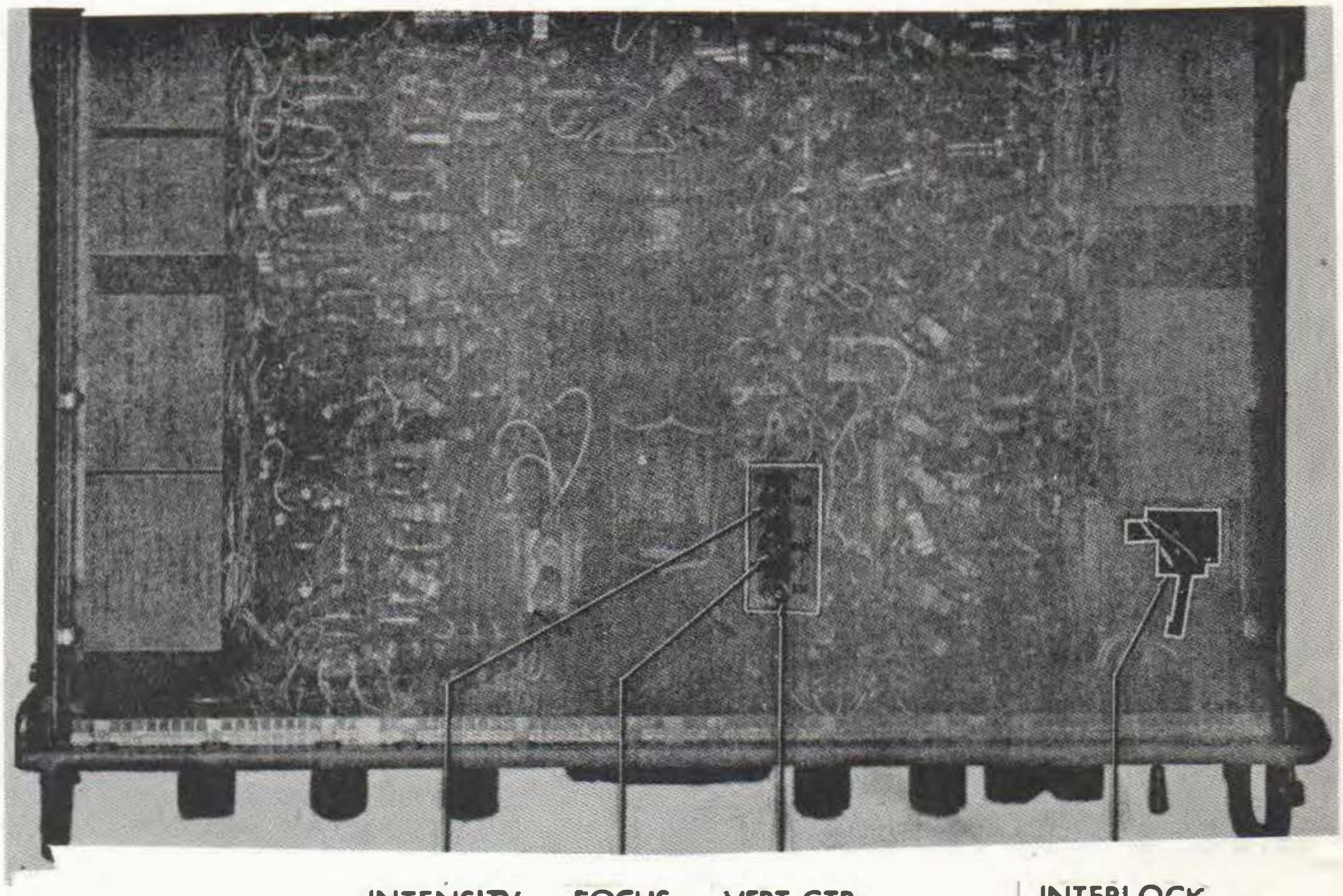


Figure 2-10. Location of Cathode-Ray Tube Controls

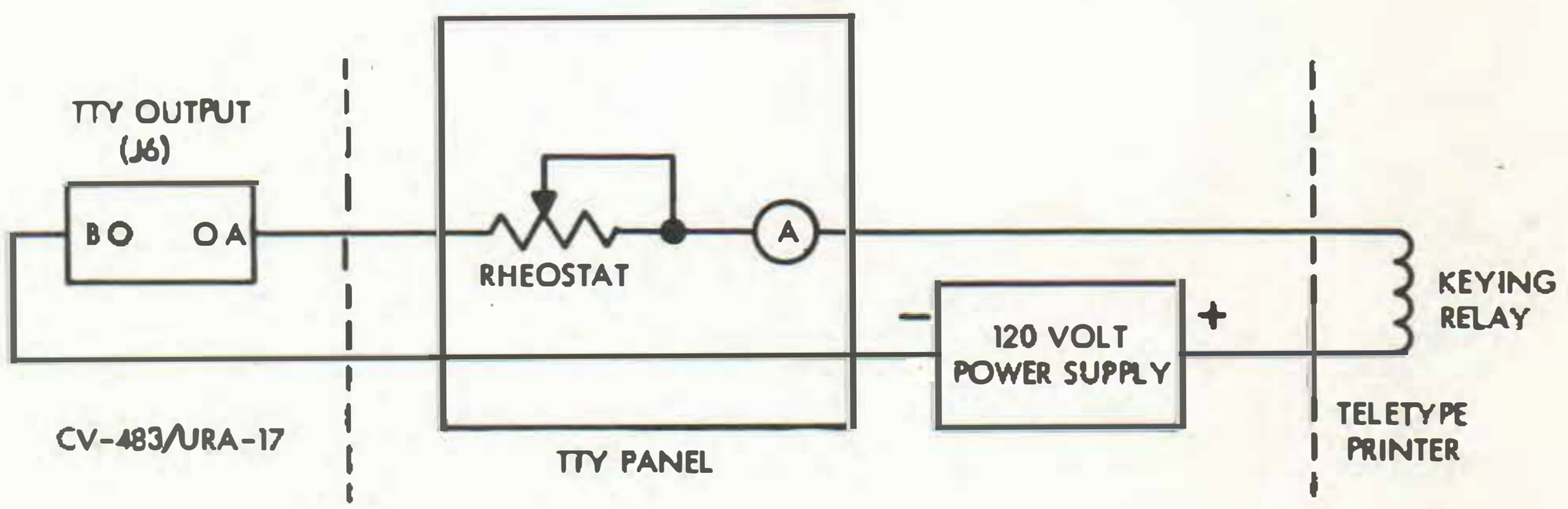


Figure 2-11. Teletype Printer DC Keying Relay Circuit, Simplified Schematic Diagram

SECTION 3

OPERATOR'S SECTION

3-1. FUNCTIONAL OPERATION.

a. GENERAL. - Comparator-Converter Group AN/URA-17, hereinafter referred to as the AN/URA-17, is used to convert the frequency-shift-keyed (fsk) audio output of standard radio receivers into dc pulses for the operation of teletype printers. The AN/URA-17 may be used in one or two single-channel receiving systems or in a single "diversity" system.

b. FREQUENCY-SHIFT METHOD OF COMMUNICATION. - In the frequency-shift method of communication, code messages are transmitted as shifts in the rf carrier frequency. These frequency shifts represent the mark and space portions of code characters for operation of a teletype printer. Radio receivers are used to change these rf carrier frequency shifts into audio tones containing the same frequency shift information. Coded messages transmitted at speeds to 400 words per minute may be received and recorded in this system.

The AN/URA-17 consists of two Frequency Shift Converters CV-483/URA-17. The CV-483/URA-17, hereinafter referred to as the converter, changes audio frequency tones into dc pulses for operation of a teletype printer.

c. DIVERSITY OPERATION. - The AN/URA-17 may be used with two radio receivers operating in a diversity system. There are two methods of diversity operation, space-diversity and frequency-diversity. Diversity operation provides an improvement over single-receiver operation by reducing the effects of signal fading.

In space-diversity operation, two receivers are tuned to the same frequency but their antennas are spaced several wavelengths apart. An rf carrier usually does not fade simultaneously at spots that are several wavelengths apart.

In frequency-diversity operation, two receivers are tuned to different rf carrier frequencies, each carrying the same frequency-shift information. Carriers of different frequencies do not generally fade simultaneously at a given spot.

The audio output from the receivers is applied to the converters. The converters change the frequency-shifted audio signals into dc pulses representing the mark-space information. These dc pulses are applied to a comparator circuit in each converter. The comparator circuits continuously select the better of the two signals for control of the teletype printer. A teletype printer may be connected to the output of either converter.

d. SINGLE-RECEIVER OPERATION. - When conditions do not require diversity operation (strong signals with no evidence of fading), either converter may be used separately with a receiver for reception of fsk signals. In this mode of operation, the two converters may be used simultaneously in two independent single-receiver systems. A teletype printer is connected to the output of each converter.

3-2. OPERATING PROCEDURES.

a. GENERAL. - Since the AN/URA-17 is part of a system for the reception of coded teletype messages, the operator must be familiar with the complete system before attempting any of the following procedure.

b. DESCRIPTION OF CONTROLS. - All controls normally used during operation are located on the front panels of the two identical converters (figure 3-1). Table 3-1 lists all operator's controls by name and function. Other controls are to be adjusted only by a technician.

c. SEQUENCE OF OPERATION.

(1) BEFORE USE. - Ascertain if equipment is connected for diversity or single-receiver operation. Allow the associated receivers and teletype printer(s) to warm up (see applicable technical manuals). Turn the converter POWER switches to the On (up) position and allow a five minute warmup period.

(2) DURING USE. - Adjust converters and associated equipment as directed in paragraph 3-2g(1) for single-receiver operation or paragraph 3-2g(2) for diversity operation.

(3) SECURE. - To secure the AN/URA-17, turn POWER switch on each converter to Off (down) position.

TABLE 3-1. FREQUENCY SHIFT CONVERTER CV-483/URA-17, OPERATING CONTROLS

CONTROL	POSITION	FUNCTION
LEVEL	Variable, 0 to 10	Adjusts the signal level to the discriminator.
SHIFT	NARROW	Selects the narrow input filter and discriminator (10 to 200 cps shift width).
	WIDE	Selects the wide input filter and discriminator (200 to 1000 cps shift width).
FUNCTION	SINGLE	Used for single-receiver operation.
	TUNE	Used when tuning the receiver (removes the input signal from teletype printer).
	DIVERSITY	Used for diversity operation.
POLARITY	NORMAL	Used when keying pulses are of normal polarity.
	REVERSE	Used when keying pulses are of reversed polarity.
SPEED	FAST	Used for high speed keying signals.
	SLOW	Used for low speed keying signals.
POWER	On - Off	Turns line voltage on and off.

d. INDICATOR PRESENTATIONS. - Figure 3-2 illustrates the tuning indicator displays obtained when the associated receiver is properly tuned (A) and when the associated receiver needs retuning (B or C).

e. TUNING ADJUSTMENTS.

(1) SINGLE-RECEIVER OPERATION. - The need for retuning the associated receiver to compensate for frequency drift can be determined by observing the converter tuning indicator pattern

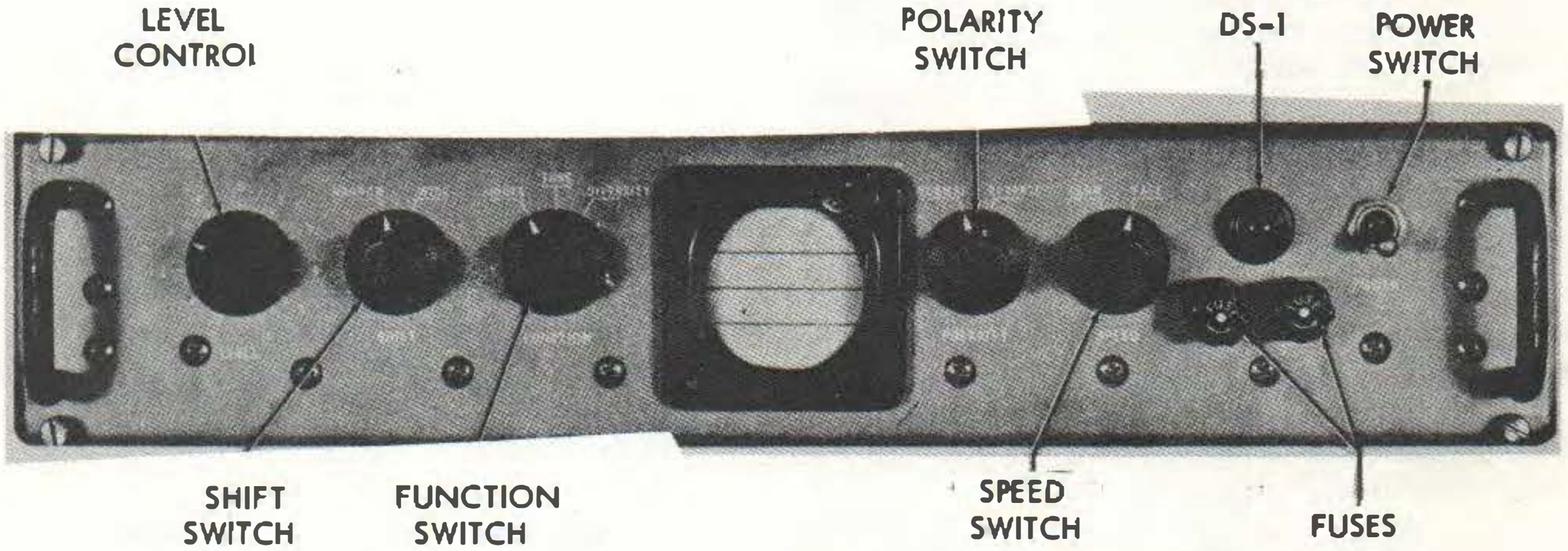


Figure 3-1. Frequency Shift Converter CV-483/URA-17, Front Panel Controls

(figure 3-2). If the pattern departs from that in(A) of figure 3-2, retune the receiver.

(2) DIVERSITY OPERATION. - Retuning the associated receivers to compensate for frequency drift is the same as for single-receiver operation. However, to prevent interruption of communication while one of the receivers is being tuned, set the FUNCTION switch of the associated converter to TUNE. During retuning, the other receiver-converter combination will operate the teletype printer. After the receiver has been tuned, set the converter FUNCTION switch to DIVERSITY.

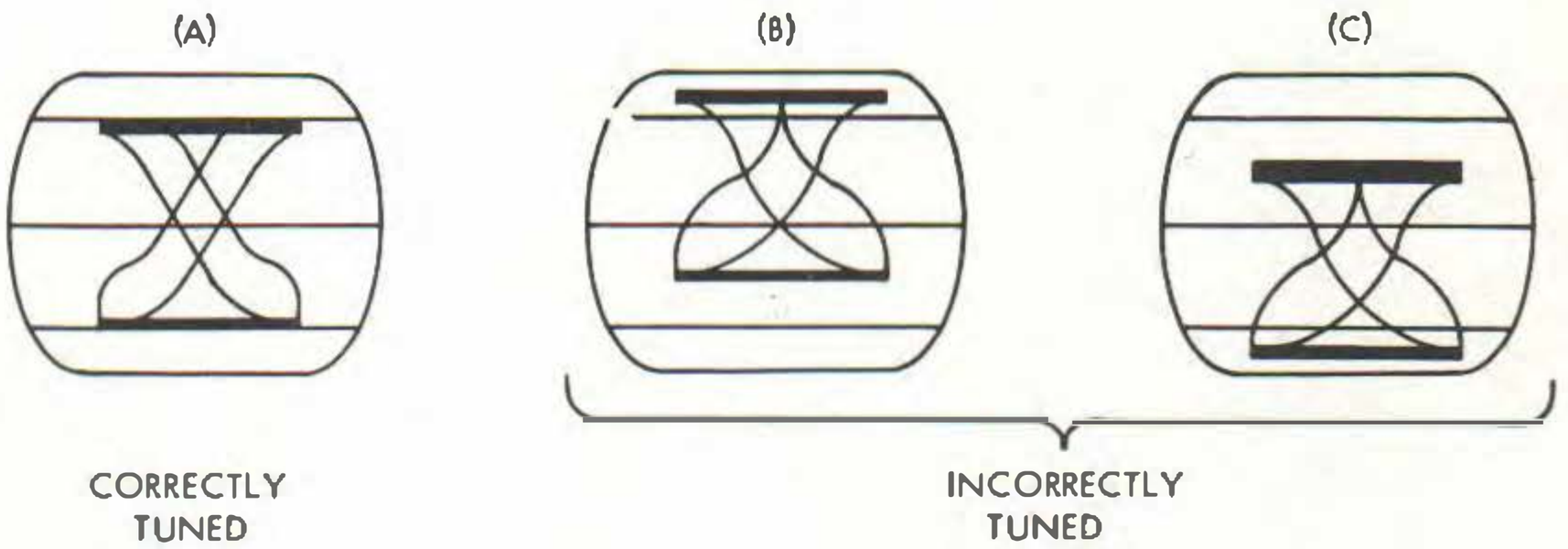


Figure 3-2. Tuning Indicator Patterns

f. ILLUSTRATIONS.

(1) CONTROLS. - The controls used by the operator are illustrated in figure 3-1 and listed in table 3-1.

(2) INDICATOR PRESENTATION. - Refer to figure 3-2 for tuning indicator presentations during receiver tuning.

g. MODES OF OPERATION. - The operator has a choice of two modes of operation: 1) single-receiver operation or 2) diversity operation.

(1) SINGLE-RECEIVER OPERATION. - Either converter may be adjusted for single-receiver operation, as follows:

Step 1. Turn POWER switch to ON.
Step 2. Set FUNCTION switch to TUNE.
Step 3. Set POLARITY switch to NORMAL.
Step 4. Set LEVEL control to 3.
Step 5. Set SHIFT switch to WIDE if wide-shift signals (200 to 1000 cps) are being received or to NARROW if narrow-shift signals (10 to 200 cps) are being received.
Step 6. Adjust associated receiver bfo to 1 kc for narrow-shift signals or to 2.5 kc for wide-shift signals. If receiver has agc switch, turn on.
Step 7. Tune receiver to desired rf signal. Set receiver bandwidth to approximately 800 cps for narrow-shift signals or to approximately 3 kc for wide-shift signals. Tune receiver until strongest beat-note is heard in headphones plugged in receiver headphone jack. Adjust receiver tuning for symmetrical, vertically centered pattern on tuning indicator (as in (A) figure 3-2). There are sometimes two receiver tuning positions that give a proper tuning indication; always select the stronger. Adjust audio output of receiver to 60 milliwatts.
Step 8. Set converter SPEED switch to SLOW if single-channel teletype signals are being received or to FAST if four-channel, time-division multiplex is being received.
Step 9. Adjust LEVEL control until pattern fills space between upper and lower horizontal lines on crt bezel.
Step 10. Set FUNCTION switch to SINGLE.
Step 11. Teletype printer should be printing properly. If not, set POLARITY switch to REVERSE.

(2) DIVERSITY OPERATION. - Each converter of the AN/URA-17 is adjusted for diversity operation as follows:

Step 1. Turn POWER switch to On.
Step 2. Set FUNCTION switch to TUNE.
Step 3. Set LEVEL control to approximately 3.
Step 4. Set POLARITY switch to NORMAL.
Step 5. Set SHIFT switch to WIDE if wide-shift

signals (200 to 1000 cps) are being received or to NARROW if narrow-shift signals (10 to 200 cps) are being received.

Step 6. Adjust associated receiver bfo to 1 kc for narrow-shift signals or to 2.5 kc for wide-shift signals. If receiver has agc switch, turn on.

Step 7. Tune associated receiver to desired rf signal. Set receiver bandwidth to approximately 800 cps if narrow-shift signals are being received or to approximately 3 kc if wide-shift signals are being received. Tune receiver until strongest beat-note is heard in headphones plugged in receiver headphone jack. Adjust receiver tuning for a symmetrical, vertically centered pattern on tuning indicator (as in (A) figure 3-2). There are sometimes two receiver tuning positions that give a proper tuning indication; always select the stronger. Adjust audio output of receiver to 60 milliwatts.

Step 8. Set converter SPEED switch to SLOW if single-channel teletype signals are being received or to FAST if four-channel, time-division multiplex is being received.

Step 9. Adjust LEVEL control until pattern fills space between upper and lower horizontal lines on crt bezel.

Step 10. Set FUNCTION switch to DIVERSITY.

Step 11. The teletype printer should be printing properly. If not, set POLARITY switch to REVERSE.

Step 12. Set FUNCTION switch to TUNE.

Step 13. Repeat steps 1 through 11 for the second converter.

Step 14. Set FUNCTION switch of first converter to DIVERSITY.

3-3. SUMMARY OF OPERATING PROCEDURES.

a. SINGLE-RECEIVER OPERATION.

(1) Turn receiver and teletype printer power switches to On.

(2) Set converter controls as follows:

(a) POWER switch to On.

(b) FUNCTION switch to TUNE.

(c) POLARITY switch to NORMAL.

(d) LEVEL control to 3.

(e) SHIFT switch to WIDE (for wide-shift signals) or to NARROW (for narrow-shift signals).

(3) Set receiver controls as follows:

(a) Set receiver bfo to 1 kc for narrow-shift signals or to 2.5 kc for wide-shift signals.

(b) Tune receiver to desired rf signal.

(c) Set receiver bandwidth to approximately 3 kc for wide-shift signals or to approximately 800 cps for narrow-shift signals.

(d) Tune receiver for strongest beat-note.

(e) Tune receiver for symmetrical, vertically centered pattern on converter tuning indicator. (If two receiver tuning positions occur, use stronger.)

(f) Adjust receiver audio output to 60 milliwatts.

(4) Set converter SPEED switch to SLOW for single-channel teletype signals or to FAST for four-channel, time-division multiplex.

(5) Adjust converter LEVEL control until pattern fills space between upper and lower horizontal lines on crt.

(6) Set converter FUNCTION switch to SINGLE.

NOTE

If teletype printer is printing garbled copy, set converter POLARITY switch to REVERSE.

b. TO SECURE.

(1) Turn converter POWER switch to Off.

c. DIVERSITY OPERATION.

(1) Turn receiver and teletype printer power switches to On.

(2) Set controls on one converter as follows:

(a) POWER switch to On.

(b) FUNCTION switch to TUNE.

(c) POLARITY switch to NORMAL.

(d) LEVEL control to 3.

(e) SHIFT switch to WIDE for wide-shift signals or to NARROW for narrow-shift signals.

(3) Adjust associated receiver controls as follows:

(a) Set receiver bfo to 1 kc for narrow-shift signals or to 2.5 kc for wide-shift signals. If receiver has age switch, turn on.

(b) Tune receiver to desired rf signal.

(c) Set receiver bandwidth to approximately 3 kc for wide-shift signals or to approximately 800 cps for narrow-shift signals.

(d) Tune receiver for strongest beat-note.

(e) Tune receiver for symmetrical, vertically centered pattern on converter tuning indicator. (If two receiver tuning positions occur, use stronger.)

(f) Adjust receiver audio output to 60 milliwatts.

(4) Set converter SPEED switch to SLOW for single-channel teletype signals or to FAST for four-channel, time-division multiplex.

(5) Adjust converter LEVEL control until pattern fills space between upper and lower horizontal lines on crt.

(6) Set converter FUNCTION switch to DIVERSITY.

NOTE

If teletype printer is printing garbled copy, set converter POLARITY switch to REVERSE.

(7) Set FUNCTION switch to TUNE.

(8) Repeat steps 2 through 6 for second converter.

(9) If teletype printer is printing garbled copy, set converter POLARITY switch to REVERSE.

(10) Set FUNCTION switch of first converter to DIVERSITY.

d. TO SECURE.

(1) Turn POWER switches of both converters to Off.

3-4. OPERATOR'S MAINTENANCE.

a. GENERAL. - Maintenance responsibility of the operator is limited to monitoring equipment controls and the tuning indicator during operation,

TABLE 3-2. OPERATOR'S CHECK CHART

CONTROL	SETTING	NORMAL INDICATION
Receiver power switch	On	Indicator light glows.
Receiver frequency control	To desired rf signal	Audio in headphones or loudspeaker; pattern on converter tuning indicator similar to A in figure 3-2.
Converter POWER switch	On	Indicator light glows.
Converter LEVEL control	---	Tuning indicator pattern fills space between horizontal lines on crt (see A in figure 3-2).
Teletype printer power switch	On	Teletype printer printing readable copy.

plus indicator lamp and fuse replacement. If troubles develop in the system that cannot be remedied by the specific instructions in the following paragraphs, qualified maintenance personnel must be notified.

b. ROUTINE CHECK CHART. - Table 3-2 outlines checks that should be made in the course of normal operation. If indications are other than normal, the operator should refer to the operator's troubleshooting chart, table 3-3. Troubles listed in table 3-3 should be considered and checked in the order given.

c. DAILY CHECK FOR CORRECT DIVERSITY OPERATION. - When the AN/URA-17 is used for diversity operation, a daily check should be made by the operator to assure optimum results.

The signals from both converters are compared in the converter to which the teletype printer is connected. Failure of one section of the comparator will eliminate the selection function and the advantage of diversity operation. To check for faulty section in the comparator, proceed as follows:

Step 1. Check each converter for single-receiver operation per paragraph 3-2g(1).

TABLE 3-3. COMPARATOR-CONVERTER GROUP AN/URA-17, OPERATOR'S TROUBLE-SHOOTING CHART

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTION
Indicator light off with POWER switch On.	Defective indicator lamp bulb.	Replace bulb. Refer to paragraph 3-4d.
	Fuse blown.	Replace fuse. Refer to CAUTION and fuse replacement, paragraph 3-4e.
	Interlock switch open.	Tighten the four captive screws on front panel.
	AC power not on, or defective power input cable or connector.	Turn ac power on; report power failure. Check power input cable and connectors.
Still does not light.	---	Notify technician.
No tuning indicator display.	Blown fuse.	Replace fuse. Refer to CAUTION and fuse replacement, paragraph 3-4e.
Tuning indicator display not centered vertically.	Receiver mistuned.	Retune receiver. Refer to paragraph 3-2e.
Tuning indicator display centered and of proper amplitude, but teletype printer is locked up.	Converter FUNCTION switch in TUNE position.	Set FUNCTION switch to SINGLE or DIVERSITY position, as applicable.
Tuning indicator display correct, but teletype printer runs open.	Teletype printer power supply defective.	Notify technician.
	Teletype printer defective.	Notify technician.

Step 2. Connect receiver (tuned for fsk reception) to AUDIO INPUT receptacle on one converter (see figure 3-3).

Step 3. Connect teletype printer to TTY OUTPUT receptacle on other converter.

Step 4. Set FUNCTION switches on both converters to DIVERSITY.

Step 5. Energize equipment.

Step 6. If teletype printer prints readable copy, switch receiver and teletype printer connections to converters as shown by broken lines in figure 3-3. If teletype printer does not print, notify technician.

NOTE

If teletype printer prints readable copy during one of the preceding tests, the equipment may be operated with teletype printer so connected until technician can make necessary repairs.

d. INDICATOR LAMP REPLACEMENT. - To replace indicator lamp, unscrew lens assembly from the front panel. Release lamp by pressing in and turning counterclockwise. Insert new lamp and lock it in place by pressing in and turning clockwise. Reinstall the lens assembly.

e. FUSE REPLACEMENT. - Fuses F1 and F2 are mounted on the front panel (see figure 3-1). Both fuses are 1/2 ampere. To remove, press in on the cap, turn counterclockwise, and pull out the cap with the fuse attached. Remove and discard blown fuse. Insert a new fuse in the cap, insert cap in the holder, press in, and turn clockwise to lock. Replenish spare fuses from general stock.

CAUTION

Never replace a fuse with one of higher rating unless continued operation of the equipment is more important than possible damage to the equipment. If a fuse blows immediately after replacement, do not replace it a second time until the cause has been corrected.

f. EMERGENCY MAINTENANCE. - No maintenance other than that described in this section is to be performed by the operator.

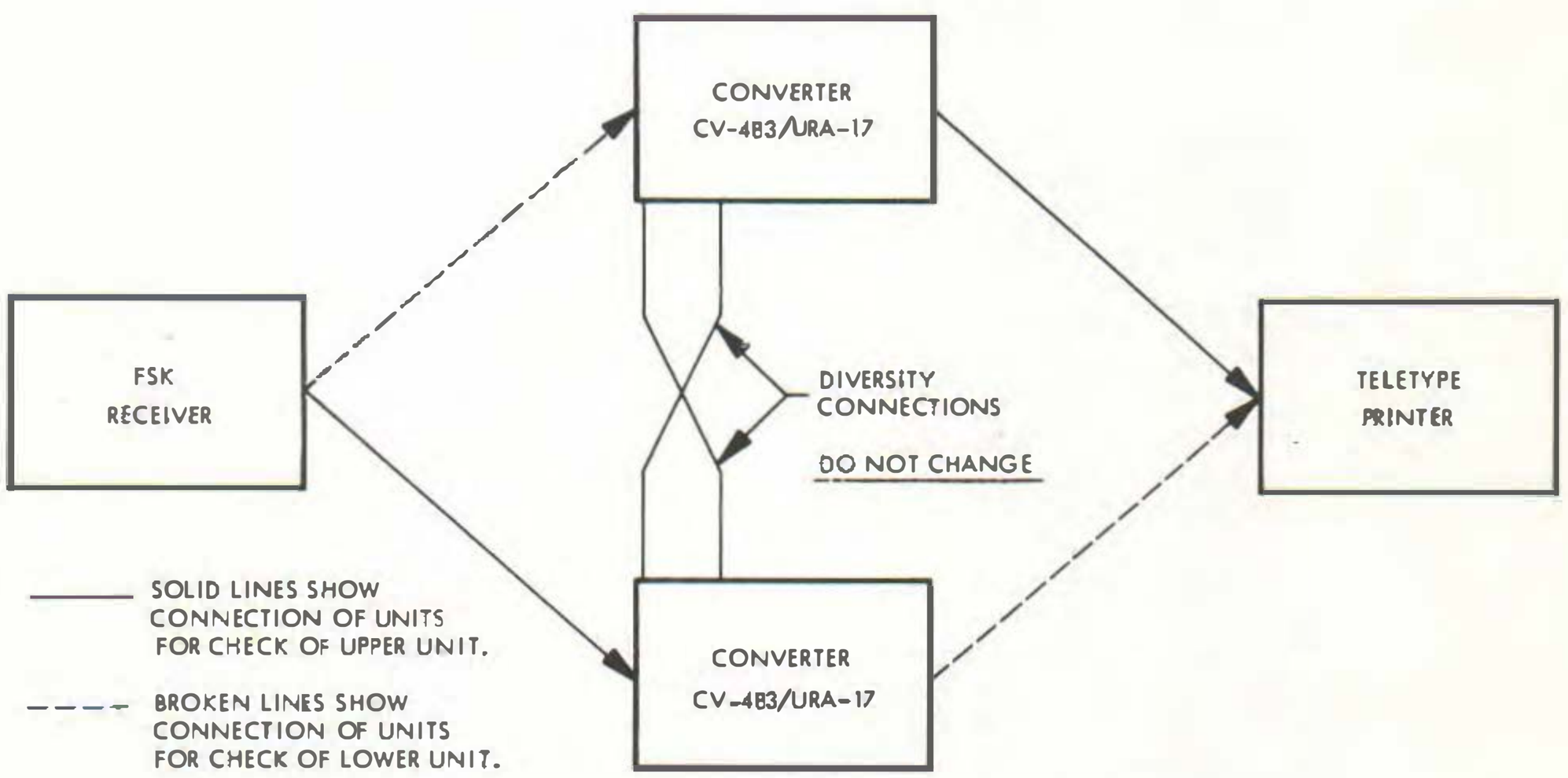


Figure 3-3. Connections between Receiver, Teletype Printer, and Converter Group for Daily Check of Diversity Operation

SECTION 4

PRINCIPLES OF OPERATION

4-1. OVERALL FUNCTIONAL DESCRIPTION.

a. GENERAL. - The overall function of Comparator-Converter Group AN/URA-17 is to provide a link in the receiving end of a frequency-shift communication system. The frequency-shift method of communication is a system of automatic code transmission, and reception, by means of a frequency modulated rf carrier. In this system, the mark and space portions of the code characters are represented by shifts above and below the rf carrier frequency.

The frequency-shift separation employed between mark and space signals may be as little as 10 cycles per second or as much as 1000 cycles per second. This scope of frequency-shifts is divided into two ranges called "narrow shift" and "wide shift." Narrow shift covers the range of 10 to 200 cycles per second, and wide shift covers the range of 200 to 1000 cycles per second.

The system of reception to be considered here involves the use of a radio receiver for changing the rf carrier into an audio tone by means of a beat-frequency oscillator. The carrier-shift then becomes an audio frequency-shift of the same number of cycles per second.

b. DIVERSITY OPERATION. - Comparator-Converter Group AN/URA-17 consists of two Frequency Shift Converters CV-483/URA-17, designed for use with two standard radio receivers operating in a diversity system. In space-diversity operation, the two receivers are tuned to the same frequency but the receiving antennas are spaced more than one wavelength apart. In frequency-diversity operation, the two receivers are tuned to separate frequency-shift carriers (of different frequencies) which are simultaneously carrying the same mark-space characters. The advantage of space-diversity operation for reception of distant signals results from the fact that a single rf carrier does not generally fade simultaneously at spots more than one wavelength apart. The advantage of frequency-diversity operation results from the fact that fading of carriers of different frequencies does not generally occur at the same time.

The output of each receiver is connected to one Frequency Shift Converter CV-483/URA-17 (hereinafter referred to as the converter) which converts the frequency-shift characters into dc pulses. These dc pulses are applied to a comparator circuit in each of the converters. The comparators select the better of the two input signals for operation of the teletype printer. The teletype printer may be connected to the output of either converter.

c. SINGLE-RECEIVER OPERATION. - Where conditions do not require diversity operation, each converter may be used separately with a single receiver for reception of frequency-shift signals. In this case, the two converter units may be used in two independent communication circuits.

d. SIMPLIFIED BLOCK DIAGRAM. - The simplified block diagram, figure 4-1, indicates the basic functions of converting the rf frequency-shift signal into a signal for controlling the dc loop of a teletype printer. The frequency shifts of the audio-frequency output of the radio receiver are converted into dc pulses by the action of an audio-frequency discriminator. The dc pulses are fed into a loop keyer which opens and closes the dc loop of the associated teletype printer in accordance with the mark and apace characters received.

The frequency versus mark-space relationship shown in figure 4-1 is the most typical. The higher frequency represents the mark signal and the lower frequency represents the space signal. However, the opposite is also used, or the tuning and heterodyning of the signal in the receiver may reverse the relationship. When such reversed characters are applied to the teletype printer, garbled copy results. A reversing switch (not shown) is provided on each converter to reverse the relationship when required.

e. FUNCTIONAL BLOCK DIAGRAM. - Figure 4-2 is a block diagram representing the principal functions of the circuits of the complete equipment. Two receivers and a teletype printer are also shown, connected for diversity operation. The two converters are identical and one is shown as a single block for simplicity. The receivers may be operating in apace diversity or frequency diversity on any radio frequency within their ranges.

The converter circuits represented by the blocks are discussed separately in the following paragraphs. Reference should be made to the

overall schematic, figure 6-5. For the functions of the individual component parts of figure 6-5, refer to the parts list, table 7-1, Section 7.

4-2. FUNCTIONAL SECTIONS.

a. GENERAL. - Each converter is a single unit, with the filters and transformers mounted around the sides of printed circuit boards. In the following paragraphs, the converter is covered as three functional sections: 1) signal processing circuits, 2) keyer circuits, and 3) power supplies (see figure 4-2). Waveforms at significant test points are illustrated in table 5-5. Refer to the overall schematic, figure 6-5, during the detailed theory which follows.

b. SIGNAL PROCESSING CIRCUITS. - The input signal from the receiver is applied to the AUDIO INPUT connector J2 (figure 6-5). A center-tap is provided at STANDOFF E1 for the accommodation of balanced inputs. The input transformer matches the 8000 ohm impedance of the bandpass filter to the 600 ohm line from the receiver. The input transformer is encased with the bandpass filter in Z1.

(1) BANDPASS FILTERS. - The bandpass filters attenuate high frequency noise pulses while passing both extremes of the shifted audio signal to the limiter. Selection of the correct filter for the shift-width of the input signal is made by section A of the SHIFT switch, S1. The narrow filter, Z1, is used when the center frequency of the input signal is 1000 cycles per second (cps) with shifts of 5 to 100 cps each side of center. The wide filter, FL1, is used when the center frequency of the input signal is 2550 cps with shifts of 100 to 500 cps each side of center. The characteristics of the bandpass filters are given in table 6-2.

(2) LIMITER. - The limiter holds the output level at the detector to within 2 db with input signals of from 60 microwatts to 60 milliwatts. The limiter consists of two 1N538 silicon diodes, CR1 and CR2, connected in parallel with opposite polarities grounded. These diodes have a very high forward resistance to signals below approximately 0.6 volt in amplitude. Their resistance is very low to signals of greater amplitude. By maintaining the signal level at approximately 0.6 volt, strong noise pulses are removed from the input signal and the signal to the discriminator is held at a constant level with fading input signals. The limiter output is amplified by Q1, a common-emitter amplifier that uses the LEVEL control, R4, as a collector load. The LEVEL control is used for adjustment of the signal level to the discriminators. The signal level during reception of a narrow-shift signal must be higher than when receiving a wide-shift signal. The amplified signal is applied to the discriminator through section B of SHIFT switch S1.

(3) DISCRIMINATORS. - The discriminators are frequency-selective networks that determine the frequency versus amplitude slope of the mark and space signals. Each discriminator consists of two resonant networks with overlapping frequency response patterns (see figure 4-3).

The narrow-shift discriminator, FL2, is used for signals with shift-widths of from 10 to 200 cps. The output from terminal 1 of the narrow-shift discriminator increases with frequency to a maximum at about 1200 cps. At terminal 4 the output increases as frequency decreases to a maximum at about 800 cps. The cross-over point at which

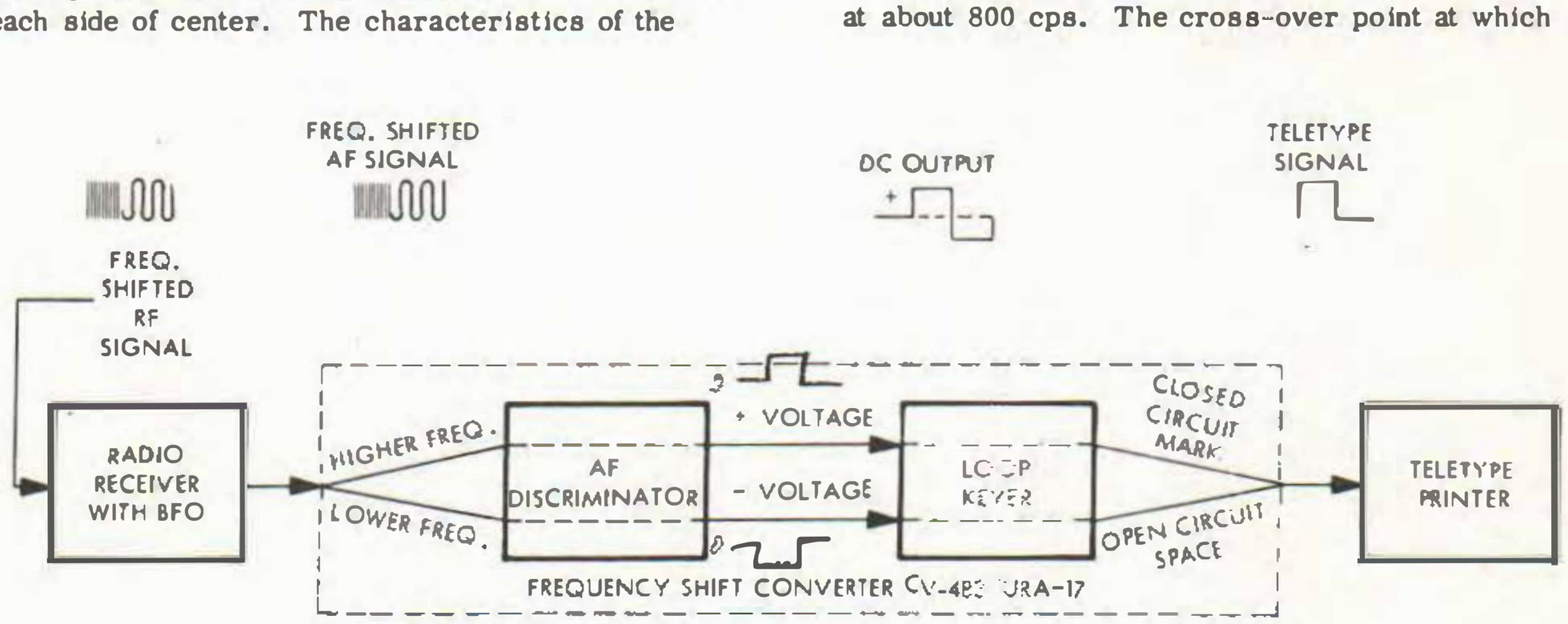


Figure 4-1. Frequency-Shift Receiving System, Simplified Block Diagram

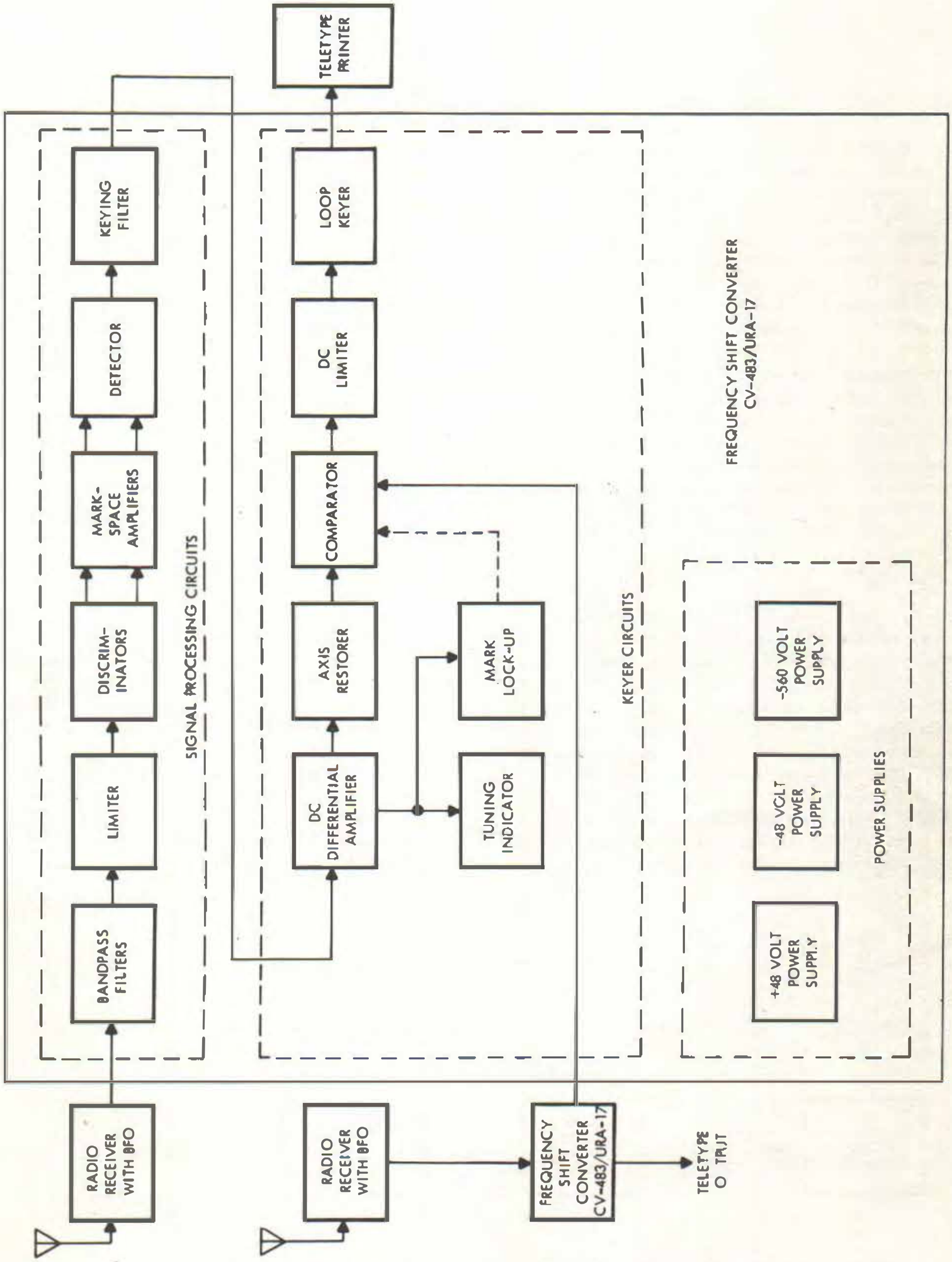
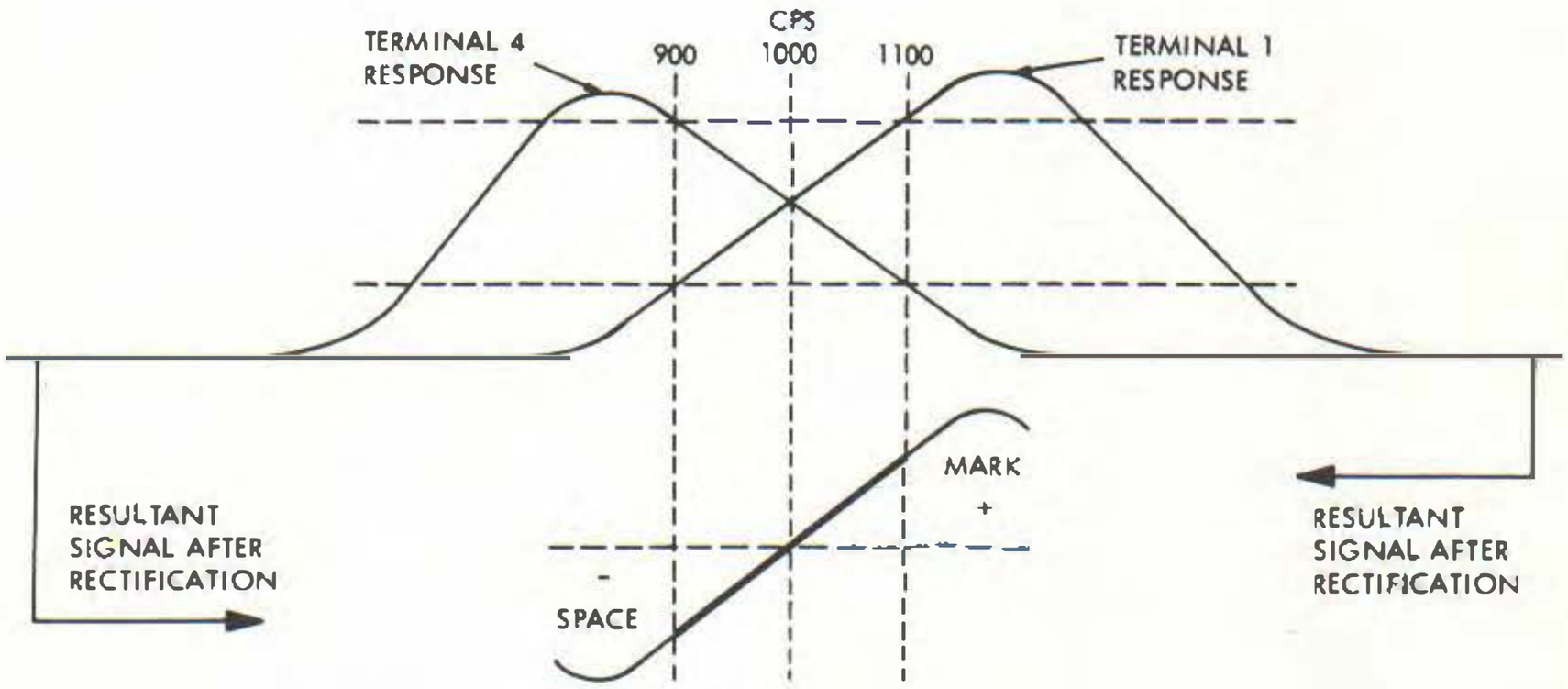
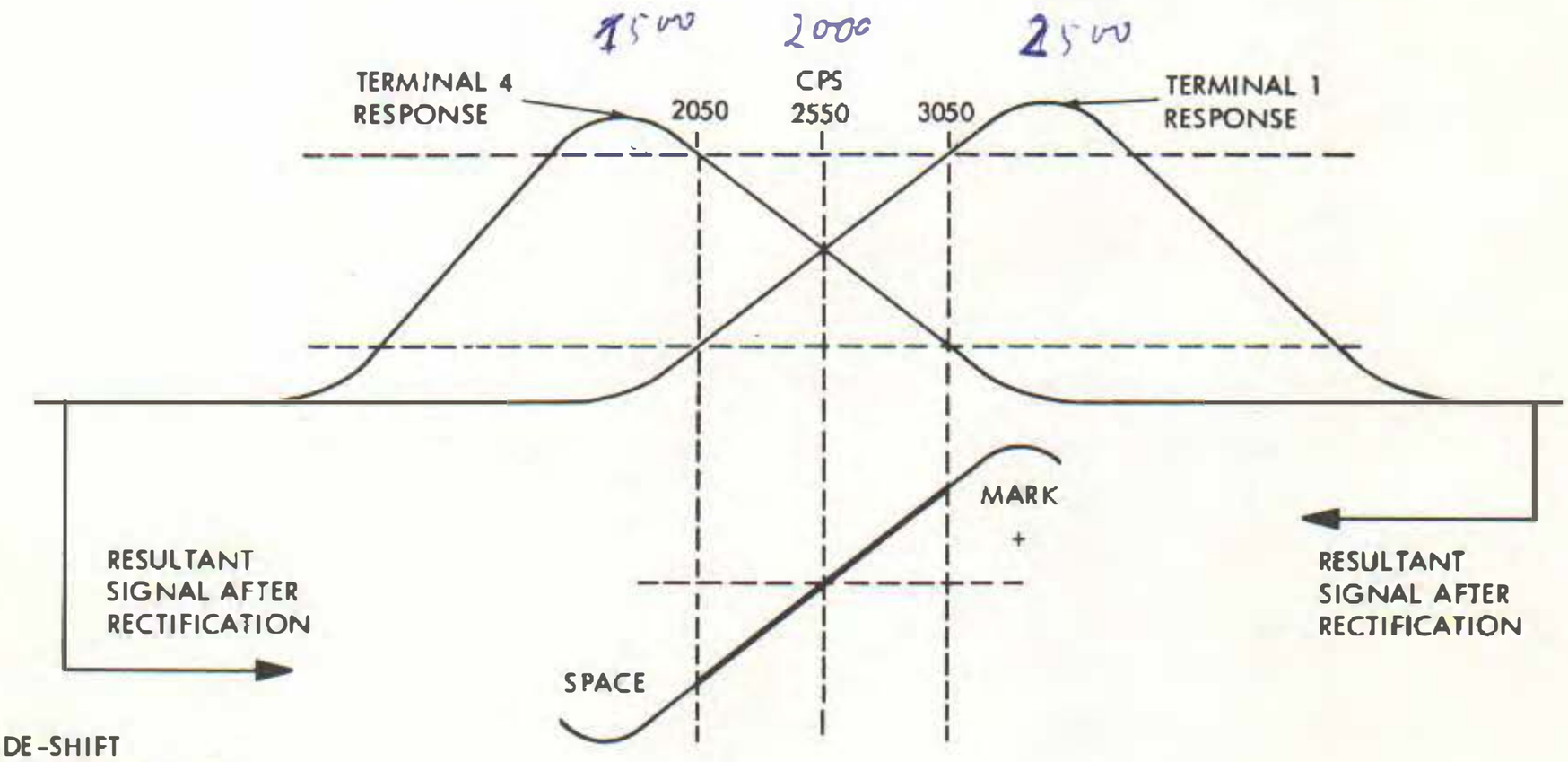


Figure 4-2. Comparator-Converter Group AN/URA-17, Functional Block Diagram



NARROW-SHIFT
DISCRIMINATOR, FL2



WIDE-SHIFT
DISCRIMINATOR, FL3

Figure 4-3. Discriminator Response Curves

the voltages from terminals 1 and 4 are equal is 1000 cps ±15 cps.

The wide-shift discriminator, FL3, is used for input signals with shift-widths between 200 and 1000 cps. The wide-shift discriminator contains two resonant networks with a cross-over frequency of 2550 cps ±40 cps. The output from terminal 1 increases with frequency to about 3400 cps. The output from terminal 4 increases as frequency decreases to a maximum at approximately 1700 cps.

The output from terminal 1 of the discriminator is applied to the first mark amplifier, and the output from terminal 4 is applied to the first space amplifier. The characteristics of the discriminators are given in figure 6-1.

(4) MARK-SPACE AMPLIFIERS. - The first mark amplifier, Q2, is common-emitter connected. Fixed base biasing is provided by R11 and R12. The MARK GAIN control, R96, provides adjustment of the signal gain by controlling degeneration in the emitter circuit. The mark signal is coupled from the collector of Q2 to the base of Q4, the second

mark amplifier, by C8. The space amplifiers, Q3 and Q5, are identical to the mark amplifiers. The SPACE GAIN control is R17. The MARK GAIN and SPACE GAIN controls allow equalizing the mark and space amplifier outputs at the cross-over frequencies. The mark amplifier output signal is applied to the primary of discriminator transformer T1. The space amplifier output is applied to the primary of discriminator transformer T2.

(5) DETECTOR. - The detector rectifies and combines the outputs of the discriminator transformers into a pulsating dc which contains the mark-space intelligence. The mark signal at the secondary of T1 is full-wave rectified by CR3 and CR4, and the space signal at the secondary of T2 is full-wave rectified by CR5 and CR6. The rectified mark and space signals are next combined across R25 and R26 (see figure 4-4). The dc signal from the detector is applied to the POLARITY switch, S2.

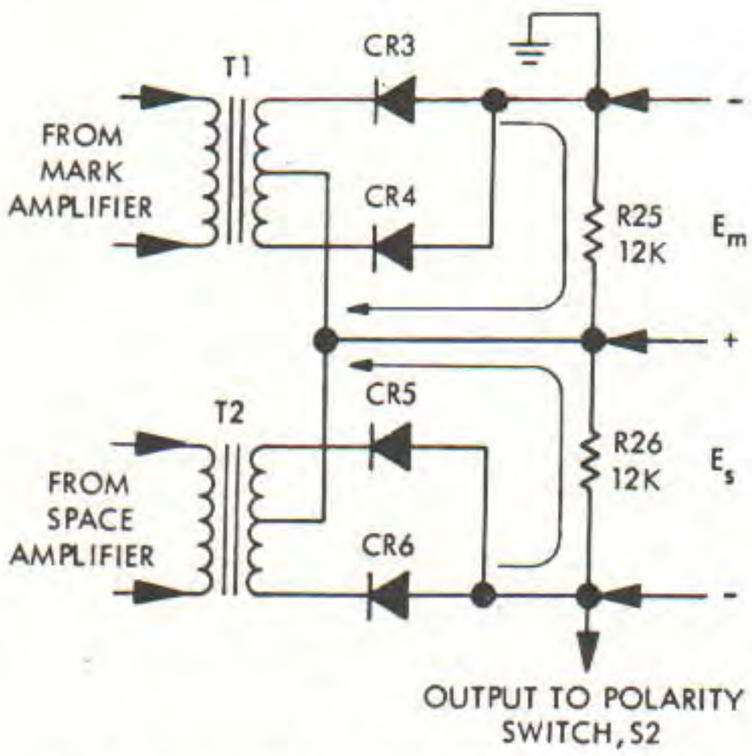


Figure 4-4. Discriminator Detector, Simplified Diagram

In conventional frequency-shift keying transmissions, the high frequency portion of the shifted signal corresponds to teletype mark pulses and the low frequency corresponds to space pulses. Because of unusual conditions, the mark-space relationship may be reversed. When such reversed characters are applied to a teletype printer, garbled copy results. The POLARITY switch, S2, is provided for inverting the mark-space relationship when required.

(6) KEYING FILTER. - The low-pass keying filter, FL4, removes noise pulses and the carrier from the signal at the output of the detector. The keying filter consists of two sections, with selection being made by the position of the SPEED switch, S3. When the switch is in the SLOW position, the keying filter section passes keying signals up to 100 words per minute, and attenuates all frequencies above 45 cps. The other section of the keying filter, selected by the FAST position of the SPEED switch, passes keying signals up to 400 words per minute (four-channel, time-division multiplex, up to 100 words per minute per channel), and attenuates all frequencies above 180 cps. Keying filter characteristics are included in table 6-2.

c. KEYER CIRCUITS. - The pulsating dc signals from the detector are converted by the keyer circuits into off-on pulses for operation of the teletype printer relay.

(1) DC DIFFERENTIAL AMPLIFIER. - The dc differential amplifier provides amplification of the mark-space signals before they are applied to the dc limiter. Transistors Q6 and Q9 comprise an emitter-coupled amplifier. The input to the base terminal of Q6 is the output signal from the keying filter; the input to the base terminal of Q9 is supplied by Q10, via the feedback resistor, R41, from the output of the dc differential amplifier. These two signals are amplified by another emitter-coupled amplifier consisting of Q7 and Q8. The two signals (input and feedback) are mixed in Q8 and then applied to the base terminal of the output transistor, Q10. Zener diodes CR7 and CR8 establish -32 volts at the emitter of Q10.

The feedback from the output to the base of Q9 stabilizes the gain of the dc differential amplifier over wide temperature variations. The VERTICAL CTR control, R31, is adjusted for vertical centering of the tuning indicator display and establishes zero balance of the amplifier. The LIN (linearity) control, R39, (part of the voltage divider for the base terminal of Q10), is provided to adjust the bias of Q10 for the most linear signal capability.

The input signal to the base of Q6 is approximately ±1.7 volts for the mark and space signals. The dc differential amplifier raises this level to approximately ±20 volts. This level is suitable for operating the mark lock-up, the tuning indicator, the axis restorer, and subsequent keying circuitry.

(2) AXIS RESTORER. - The axis restorer maintains the signal axis at ground potential and restores signal symmetry when the transmitter or receiver frequency drifts during operation. The positive mark signal from the dc differential amplifier charges C17 and C18 through CR9 which clamps the signal to ground. The negative space signal

charges C19 and C20 through CR10 which clamps the signal to ground. The signals are combined again through R45 and R46. By clamping both the mark and space signals separately and then recombining them, the signal axis is automatically placed at ground potential. The signal is coupled to the comparator through the FUNCTION switch, S4.

(3) COMPARATOR. - The main function of the comparator is to compare the strength of signals from the two receivers during diversity operation, and allow only the stronger signal to be applied to the dc limiter. The comparator consists of CR14, CR15, CR16, CR17, R54, and R55. In diversity operation, two converters are used with two receivers for the operation of a single teletype printer. The signals are compared at the comparator in each of the converters (see figure 4-5), with the stronger signal being applied to the dc limiter. The FUNCTION switch, S4, on both converters must be placed at DIVERSITY. The teletype printer may be connected to either converter.

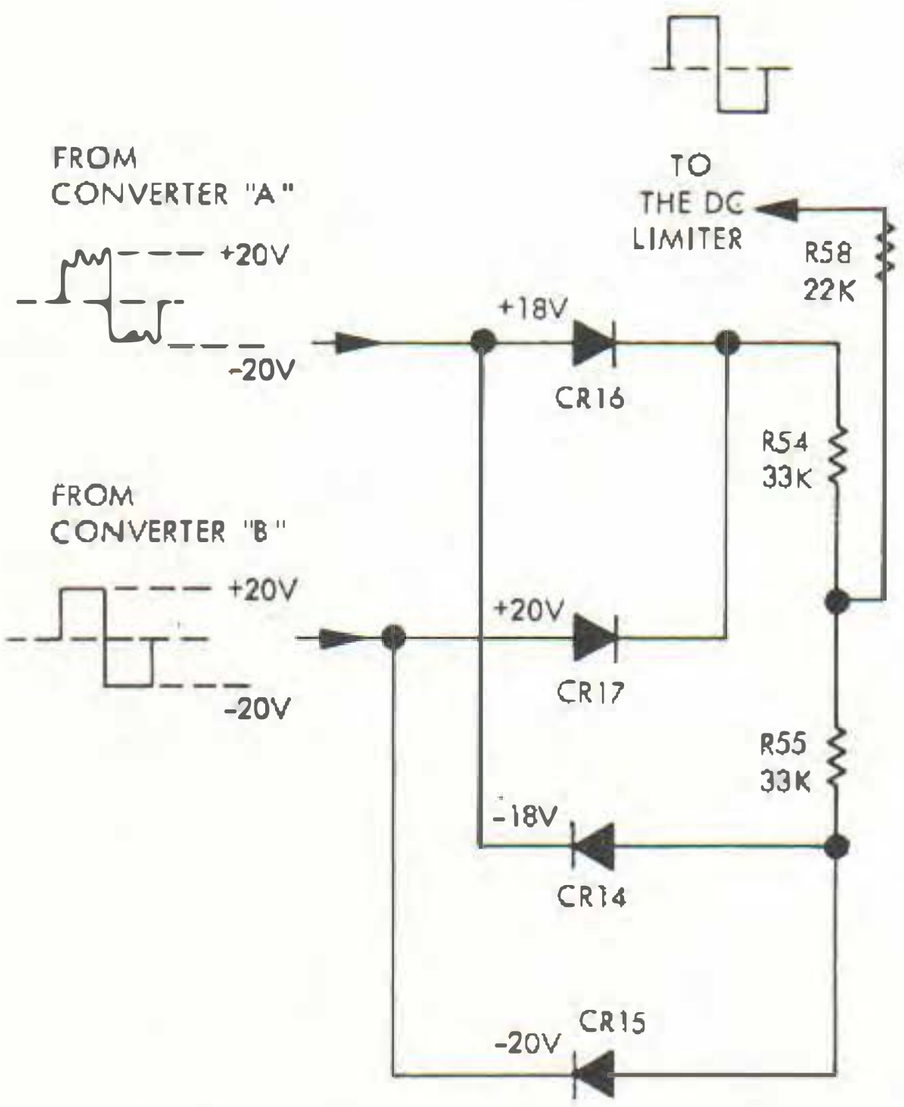


Figure 4-5. Comparator Circuit, Simplified Schematic Diagram

In figure 4-5, the peak amplitudes of both input signals are equal but the signal from converter A contains noise. The signal from converter B has a constant peak value of ±20 volts and will develop a greater voltage across R54 and R55. This places a reverse bias of two volts on CR14 and CR16, preventing converter A from actuating the dc limiter. The FUNCTION switch, S4, has two other positions, SINGLE and TUNE. In the SINGLE position, the positive mark pulses cause CR16 to conduct and negative space pulses cause CR14 to conduct. In the TUNE position, the signal input to the dc limiter is removed while the receiver is being tuned. A small, positive voltage is applied to the dc limiter input by R56 and R57 to lock up the teletype printer during the interruption in the input signal. Without this positive voltage, the teletype printer would run open.

(4) DC LIMITER. - The dc limiter, Q13, Q14, Q15, Q16, and associated circuit, is a class B push-pull circuit which supplies approximately 20 db of post-detection limiting and aids in proper operation during reception of signals containing strong noise pulses. The signal from the comparator is applied simultaneously to the base terminals of Q13 (an npn transistor), and Q15 (a pnp transistor). A positive mark signal causes Q13 to conduct but cuts off Q15. The collector of Q13 is direct-coupled to the base of Q14. The signal is phase-shifted 180 degrees by Q13, causing Q14, a pnp transistor, to conduct and deliver a strong positive signal at its output. A negative space signal causes Q15 to conduct but cuts off Q13. The collector of Q15 is direct-coupled to the base of Q16 (an npn transistor), and because of the 180 degree signal voltage phase-shift, Q16 conducts and delivers a strong negative signal at its output. The dc limiter controls the switching action of the loop keyer.

(5) LOOP KEYER. - The function of the loop keyer, Q17, Q18, and associated circuit, is operation of the teletype printer loop relay. The teletype printer loop keyer circuit consists of a 120 volt dc power supply, a relay winding, and a variable resistor used for adjusting the loop current to 60 ma (see figure 4-6). The 120 volt dc at J6 is applied across Q17, Q18, and R67 in series. When a positive (mark) signal is applied to the base of Q18, the forward base-emitter bias of Q18 is increased and Q18 conducts heavily. The heavy emitter-collector current in Q18 causes the emitter of Q17 to become more negative and Q17 conducts, closing the teletype printer keying relay. When a negative (space) signal is applied to the base of Q18, the forward base-emitter bias is reduced. This lowers the emitter-collector current of Q18 and the forward base-emitter bias of Q17, opening the teletype printer relay. The relay remains open until another positive (mark) signal is applied. Diode CR19 prevents a large emitter-base voltage (caused by an increase in the emitter-collector resistance of Q18) from damaging the emitter junction of Q17. Diode CR18 prevents the teletype power supply

(+120 volts) from feeding into the converter +48 volt supply. Diode CR20 prevents damage to the converter in the event the teletype power supply is reversed. Zener diodes CR21 and CR22 protect Q17 and Q18 from the inductive kickback voltage produced in the teletype printer relay.

(6) MARK LOCK-UP. - The mark lock-up provides a strong, artificial mark signal to the dc limiter during traffic interruptions. If a deep fade occurred or if the signal-to-noise ratio were very low, noise pulses could cancel the small positive bias on the dc limiter input, provided by R56 and R57, and allow garbled copy to be printed. A steady mark signal is transmitted between messages. This steady mark signal charges C17 in the axis restorer allowing no signal to be applied to the de limiter. The mark lock-up, Q11, Q12, and circuit, provides a bypass around the axis restorer (shown as dashed line in figure 4-2) during these signal interruptions.

During normal keying pulses, C19 charges through CR10 on the negative space pulses and slowly discharges through R48 and CR12, keeping Q11 cut off. While Q11 is cut off, Q12 conducts heavily (having a high base-emitter forward bias), reducing the voltage at the junction of R52 and R53 to near zero. When the keying pulses stop, the charge on C19 leaks off to the point where Q11 conducts, removing the forward bias from Q12 and causing it to cut off. When Q12 is cut off, +48 volts is supplied to the dc limiter from the junction of R52 and R53. When keying is resumed, the first mark-to-space transition charges C19 to a level which cuts off Q11 and turns on Q12, removing the artificial mark signal.

(7) TUNING INDICATOR. - Tuning indicator V1 is a 2BP1 cathode-ray tube. Horizontal deflection voltage (60 cps) is obtained from the high voltage transformer T4. Controls for HORIZontal CENTERING, FOCUS, INTensity, VERTical ADJustment, VERTical CTR, and LINearity (R77, R92, R93, R80, R31, and R39, respectively) are provided on the converter chassis as screwdriver adjustments. The vertical deflection voltage is supplied from the dc differential amplifier output. When the associated receiver is tuned properly, the crt pattern will be centered vertically. The LEVEL control adjustment is correct when the horizontal lines of the pattern coincide with those on the bezel.

d. POWER SUPPLIES. - Three de power supplies furnish all operating voltages and currents required by the converter. The ac line voltage is applied to POWER receptacle, J3, on the rear of the converter cabinet. Safety interlocks, S5A and S5B, and fuses, F1 and F2 (1/2 ampere each), are installed in the ac input lines. The indicator, DS-1, lights when power is applied to the converter by POWER switch S6. The two power transformers, T3 and T4, have tapped primaries to allow operation on line voltages of 105, 115, or 125 volts.

(1) +48 VOLT SUPPLY. - The +48 volt supply consists of a full-wave bridge rectifier and a series regulator circuit. The bridge rectifier consists of CR28, CR29, CR30, CR31, and associated circuit. The regulator consists of Q20, Q21, Q22, and circuit. An increase in output voltage increases the voltage at the arm of R89, increasing the base potential of Q22. Since the emitter voltage of Q22 is held constant by zener diode CR34, the forward base-emitter bias increases, increasing the collector current. The increased current through R87 reduces the collector voltage of Q22 and the forward base-emitter bias of Q21. The series regulator, Q20, is emitter-coupled to Q21 and the emitter-collector resistance of Q20 increases, reducing the output voltage to the correct value. If the output voltage decreases, the resistance of the series regulator decreases, increasing the output voltage to the correct value. The +48 ADJ control is provided to adjust the +48 volt supply output voltage.

(2) -48 VOLT SUPPLY. - The -48 volt supply consists of a full-wave bridge rectifier and a series regulator circuit. The bridge rectifier consists of CR23, CR24, CR25, CR26, and associated circuit. The regulator consists of Q19, Q23, Q24, and circuit. An increase in output voltage increases the potential on the arm of R72, increasing the base potential of Q19. Since the emitter voltage of Q19 is held constant by zener diode CR27, the forward base-emitter bias increases, increasing the collector current. The increased current through R70 reduces the collector voltage of Q19 and the forward base-emitter bias of Q24. The series regulator, Q23, is emitter-coupled to Q24 and the emitter-collector resistance of Q23 increases, reducing the output voltage to the correct value. If the output voltage decreases, the resistance of the series regulator decreases, increasing the output voltage to the correct value. The -48 ADJ control is provided to adjust the -48 volt supply output voltage.

(3) -560 VOLT SUPPLY. - The -560 volt supply uses two 1N1731 diodes, CR32 and CR33, series connected as a half-wave rectifier. A voltage divider consisting of R91, R92, R93, and R94 provide the high voltages required by the crt.

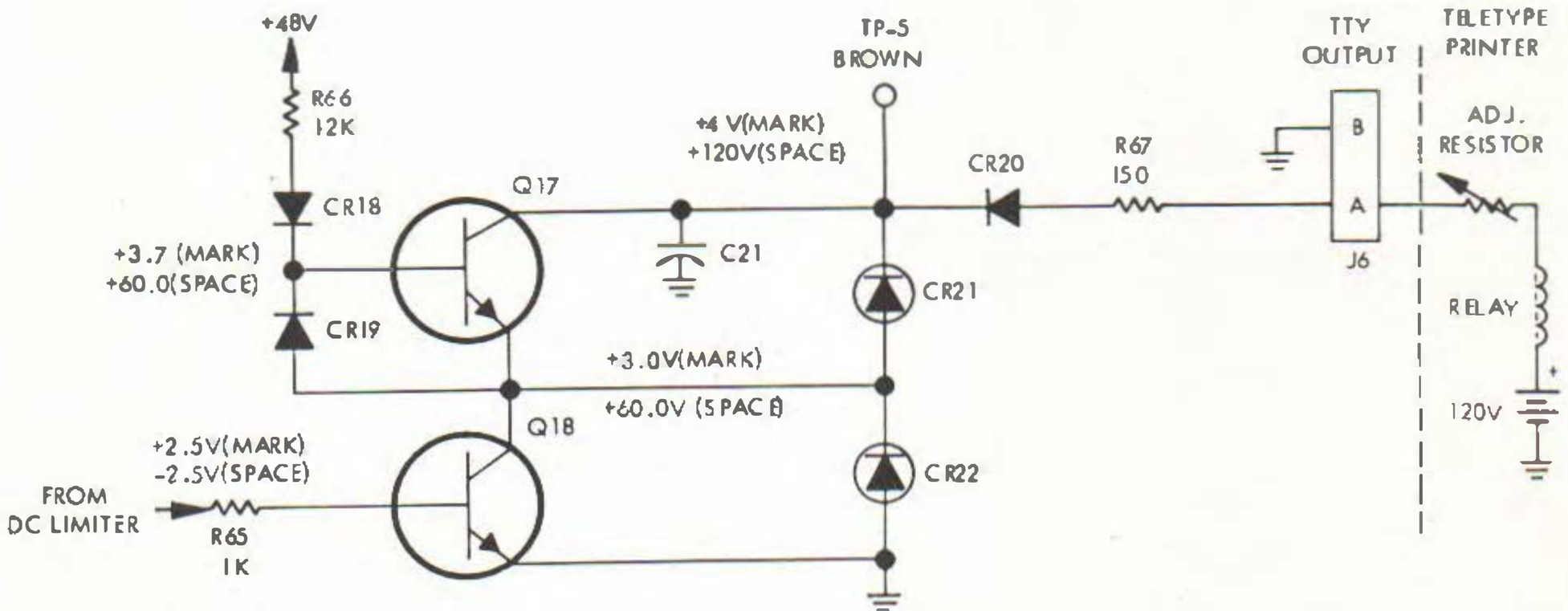


Figure 4-6. Loop Keyer and Teletype Printer Keying Circuits

SECTION 5
TROUBLE-SHOOTING

5-1. GENERAL.

Comparator-Converter Group AN/URA-17, hereinafter referred to as the AN/URA-17, is part of a system for the reception and recording of transmitted teletype messages.

The AN/URA-17 consists of two Frequency Shift Converters CV-483/URA-17, hereinafter referred to as the converters.

Maintenance personnel should be thoroughly familiar with the operation of the overall frequency-shift receiving system, and the function of each equipment used. The receivers and teletype printers used with the AN/URA-17 should be tested, adjusted, and maintained in accordance with their individual maintenance instructions.

Prior to trouble-shooting the AN/URA-17, the technician should become familiar with the equipment operation during normal conditions. By keeping records of discrepancies occurring during operation, it may be possible to prevent equipment breakdown by foreseeing failures. It is mandatory that maintenance personnel read Sections 1, 3, and 4 of this technical manual before performing any trouble-shooting procedures.

It is assumed that maintenance personnel are experienced in standard methods of testing and repairing naval electronic equipment; therefore, detailed descriptions of common tests are not given.

As an aid in trouble-shooting, the following system of test point symbols is used in tables and illustrations of this manual. The major test point symbol consists of the test point number enclosed within a star. The secondary test point symbol consists of the test point letter enclosed within a circle. Figure 5-2 shows locations of all test points used in this manual. In the text, major test points are shown as ★1, ★2, etc., and secondary test points are shown as ●A, ●B, etc.

5-2. TEST EQUIPMENT AND SPECIAL TOOLS.

a. TEST EQUIPMENT. - The following test equipment, or the equivalent (refer to table 1-3), will be required:

DuMont 304-A	oscilloscope
ME-30/U	ac vtvm
AN/PSM-4	multimeter
TS-1100/U	test set, transistor

b. SPECIAL TOOLS. - No special tools will be required.

5-3. OVERALL TROUBLE-SHOOTING.

a. PRELIMINARY CHECK. - A preliminary check of the equipment should be made before proceeding to the trouble-shooting charts. The first and most natural step in trouble-shooting is to analyze the symptoms of the equipment. Often the conclusions reached will aid the technician in selecting the test(s) that will most quickly locate the cause of trouble. The operator's maintenance tests in Section 3 will be of assistance in making this analysis. Normally, the malfunction can be traced to the receiver, the teletype printer, or one of the converters.

When possible, use sensory tests, such as visually checking parts (fuses, resistors, capacitors, etc.), and smelling or feeling for signs of overheating. Simple tests often will reveal the difficulty.

NOTE

If, during the preliminary check, a part is found that is responsible for the malfunction, determine what caused its failure before replacing it.

Malfunctions other than the result of faulty transmission, bad receiving conditions, or improper operating methods must first be localized to one of the system components. If the evidence is not definite, a simple expedient is to substitute equipment known to be in proper operating condition for the suspected equipment.

The receiver may be tested independently by monitoring the audio output with a headset or loudspeaker and tuning in various signals.

The teletype printer may be checked with signals from another source of known accuracy, such as another teletype circuit.

The best method of testing the converter is by recording its output with a teletype printer or other automatic recorder.

During the tests given in the following paragraphs, the converter is to be connected to a receiver adjusted to receive fsk signals and a teletype printer is to be connected to the output of the converter. The receiver and teletype printer are to be in satisfactory operating condition.

b. TEST EQUIPMENT AND SPECIAL TOOLS. - No test equipment or special tools are required.

c. CONTROL SETTINGS. - Set the converter controls as follows:

(1) LEVEL control to 0.

(2) SHIFT switch to NARROW.

(3) FUNCTION switch to TUNE.

(4) POLARITY switch to NORMAL.

(5) SPEED switch to SLOW.

(6) POWER switch to Off (down).

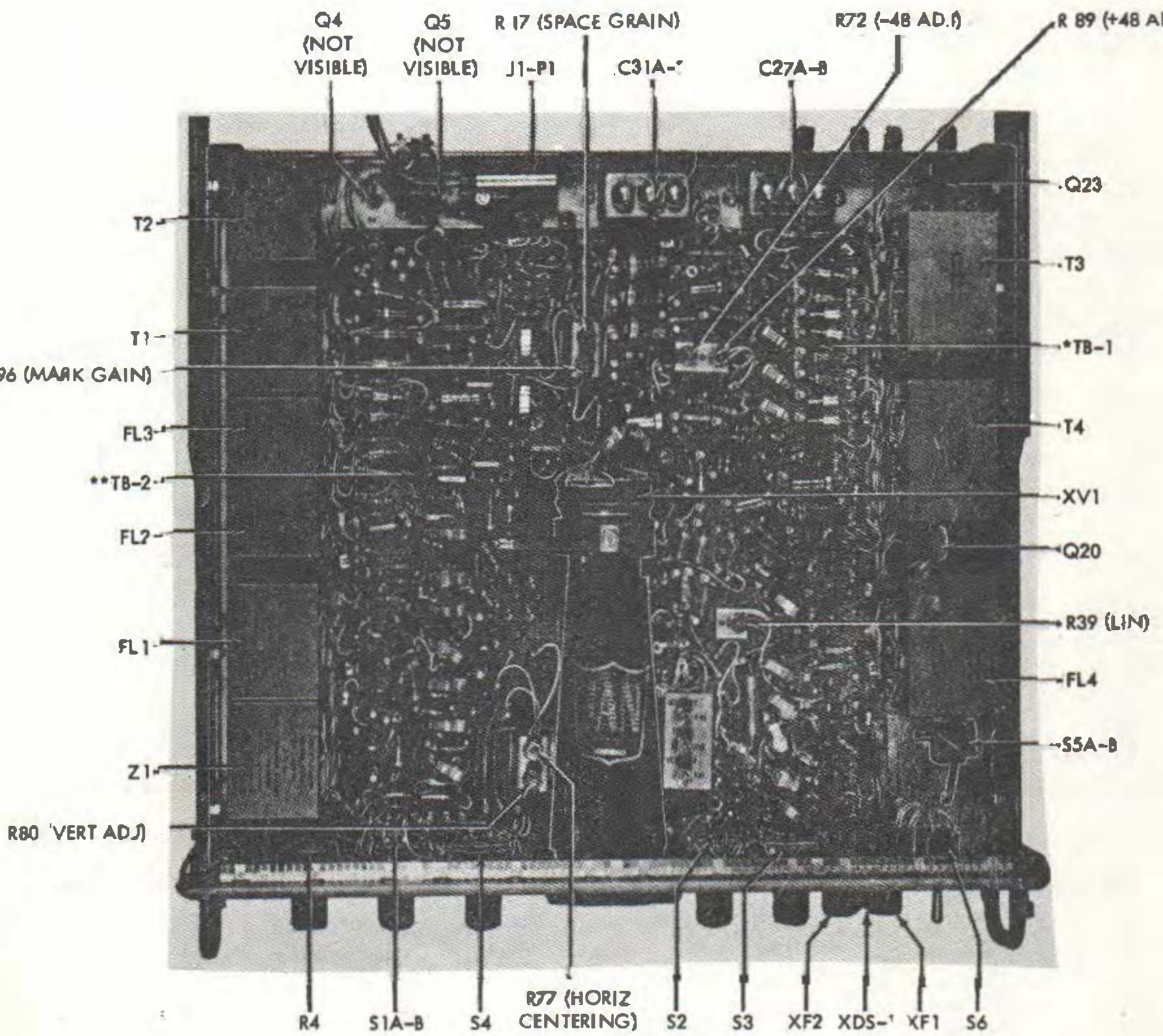
d. SYSTEM TROUBLE-SHOOTING CHART. - The system trouble-shooting chart, table 5-1, will aid the technician in isolating a malfunction to a functional section (paragraph 5-4). Table 5-1 is arranged so as to utilize the converter's front panel indicators as a means of determining which functional section is defective.

If the technician is thoroughly familiar with the equipment, he may start directly with functional section trouble-shooting. Refer to the overall schematic diagram, figure 6-5, during performance of the trouble-shooting procedures.

(1) MALFUNCTION DURING SINGLE-RECEIVER OPERATION. - If the equipment is rejected for malfunction during single-receiver operation, perform the procedures listed in table 5-1

TABLE 5-1. FREQUENCY SHIFT CONVERTER CV-483/URA-17, SYSTEM TROUBLE-SHOOTING CHART

STEP	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1	Turn converter POWER switch to On.	Indicator lamp glows.	If lamp glows, proceed to step 2; if not, proceed to table 5-4, step 1.
2	Connect fsk receiver audio output to AUDIO INPUT jack (J2) at rear of converter cabinet. Adjust receiver and converter controls for single-receiver operation (Section 3, paragraph 3-2g(1), steps 1 through 10).	Tuning indicator pattern as (A) in figure 3-2.	If pattern is ok, proceed to step 3; if not, proceed to table 5-2, step 1.
3	Connect teletype printer to TTY OUTPUT jack (J6) at rear of converter.	Teletype printer prints readable copy.	If teletype printer does not print readable copy, place POLARITY switch to REVERSE. If trouble still persists, proceed to table 5-3.



* FOR COMPONENTS MOUNTED ON TB-1, REFER TO FIGURE 6-4
** FOR COMPONENTS MOUNTED ON TB-2, REFER TO FIGURE 6-3.

Figure 5-1. Frequency Shift Converter CV-483/URA-17, Parts Location

(2) MALFUNCTION DURING DIVERSITY OPERATION. - If the equipment is rejected for malfunction during diversity operation, proceed as follows:

Step 1. Check each converter for single-receiver operation (Section 3, paragraph 3-2g(1)). If operation is satisfactory, continue with step 2 of this paragraph. If not, perform the procedures listed in table 5-1.

Step 2. Perform steps in Section 3, paragraph 3-4c. If, upon completion of the diversity check listed in paragraph 3-4c, the teletype printer does not print, check CR15 and CR17 (figure 6-3) in converter to which teletype printer is connected.

5-4. FUNCTIONAL SECTION TROUBLE-SHOOTING.

a. GENERAL. - Functional section trouble-shooting will aid the technician in isolating the malfunction to a defective part or parts. Tables 5-2, 5-3, and 5-4 are the functional section trouble-shooting charts for the three functional sections of this equipment: i.e., signal processing circuits; keyer circuits; and power supplies.

b. SIGNAL PROCESSING CIRCUITS TROUBLE-SHOOTING.

(1) PRELIMINARY CHECK. - The preliminary check for functional trouble-shooting of the

signal processing circuits is the same as the preliminary check for overall trouble-shooting (refer to paragraph 5-3a).

(2) TEST EQUIPMENT AND SPECIAL TOOLS.

(a) TEST EQUIPMENT. - The following test equipment will be required:

DuMont 304-A	oscilloscope
ME-30/U	ac vtvm
AN/PSM-4	multimeter
TS-1100/U	test set, transistor

(b) SPECIAL TOOLS. - No special tools will be required.

(3) CONTROL SETTINGS. - The control settings for the converter during functional trouble-shooting of the signal processing circuits are the same as the control settings for overall trouble-shooting (refer to paragraph 5-3c).

(4) ILLUSTRATIONS.

(a) TEST POINTS. - Figure 5-2 illustrates the physical locations of all test points to be used in functional section trouble-shooting.

(b) SCHEMATIC DIAGRAMS. - Figure 5-4 is the schematic diagram of the signal processing circuits.

(c) VOLTAGE AND RESISTANCE DIAGRAM. - Figure 5-3 lists dc voltages and resistance measured from the terminals of the transistors in the signal processing circuits to the converter chassis, with no signal applied.

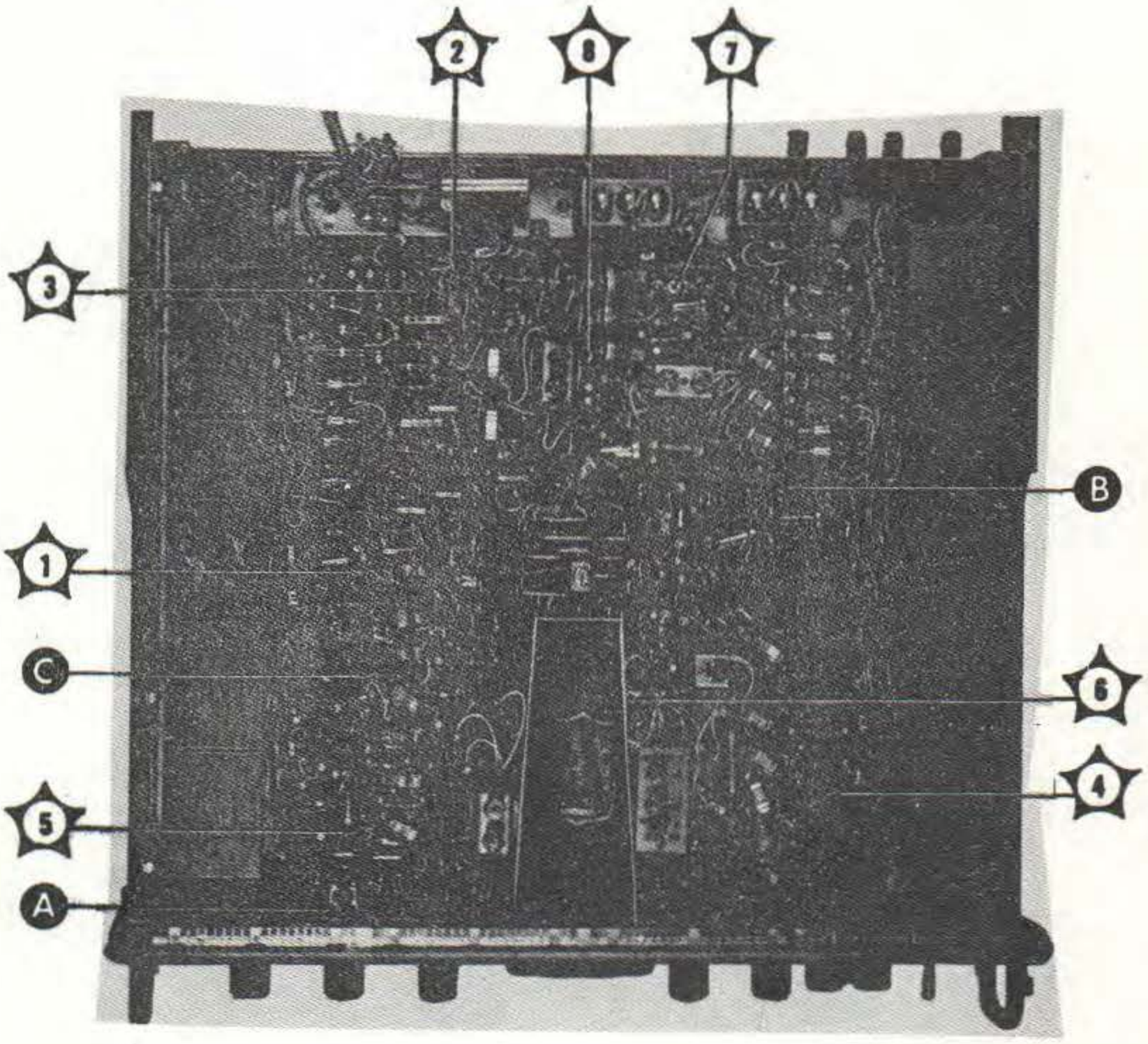


Figure 5-2. Frequency Shift Converter CV-483/URA-17, Location of Test Points

TABLE 5-2. FREQUENCY SHIFT CONVERTER CV-483/URA-17, SIGNAL PROCESSING CIRCUITS FUNCTIONAL SECTION TROUBLE-SHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1		Connect fsk receiver audio output to AUDIO INPUT jack (J2) at rear of converter. Adjust receiver and converter controls for single-receiver operation (Section 3, paragraph 3-2g(1), steps 1 through 10).	Tuning indicator pattern as (A) in figure 3-2.	(1) If pattern shifts unevenly above and below center line of crt bezel: recheck receiver tuning. If receiver tuning is ok, proceed to table 5-4, step 2; check Q2, Q3, Q4, and Q5 (figure 6-3); measure dc voltages on Q2, Q3, Q4, and Q5 terminals (figure 5-3); measure resistances of T1 and T2 windings (figures 5-1 and 6-2); check CR3, CR4, CR5, and CR6 (figure 6-3); measure resistances of R25 and R26 (figure 6-3); realign mark-space amplifiers (Section 6, paragraph 6-2h). (2) If pattern shifts up only: recheck receiver tuning. If receiver tuning is ok, proceed to table 5-4, step 2; check Q3 and Q5 (figure 6-3); measure dc voltages on Q3 and Q5 terminals (figure 5-3); measure resistances of T2 windings (figures 5-1 and 6-2); measure resistance of R26 (figure 6-3); check CR5 and CR6 (figure 6-3). (3) If pattern shifts down only: recheck receiver tuning. If receiver tuning is ok, proceed to table 5-4, step 2; check Q2 and Q4 (figure 6-3); measure dc voltages on terminals of Q2 and Q4 (figure 5-3); measure resistances of T1 windings (figures 5-1 and 6-2); measure resistance of R25 (figure 6-3); check CR3 and CR4 (figure 6-3). (4) If pattern's vertical amplitude is very small or zero: check LEVEL control setting. If LEVEL control setting is ok, proceed to table 5-4, step 2; check Q1 through Q10 (figures 6-3 and 6-4); measure dc voltages on terminals of Q1 through Q10 (figure 5-3). Realign dc amplifier (Section 6, paragraph 6-2i). If upon completion of dc amplifier alignment the trouble still persists, proceed to step 2.

TABLE 5-2. FREQUENCY SHIFT CONVERTER CV-483/URA-17, SIGNAL PROCESSING CIRCUITS FUNCTIONAL SECTION TROUBLE-SHOOTING CHART (Continued)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
2	① (Figures 5-2 and 5-4)	Set up oscilloscope to display low frequency signals. Connect oscilloscope ground terminal to converter chassis. Touch vertical input lead to TP-1.	Pattern as in step 2 of table 5-5.	If ok, proceed to step 3. If not, check Q1 (figure 6-3); measure dc voltages on terminals of Q1 (figure 5-3).
3	③ (Figures 5-2 and 5-4)	Touch oscilloscope vertical input lead to TP-2.	Pattern as in step 3 of table 5-5.	If ok, proceed to step 4. If not, check Q2 and Q4 (figure 6-3); measure dc voltages on terminals of Q2 and Q4 (figure 5-3).
4	③ (Figures 5-2 and 5-4)	Touch oscilloscope vertical input lead to TP-3.	Pattern as in step 4 of table 5-5.	If ok, proceed to step 5. If not, check Q3 and Q5 (figure 6-3); measure dc voltage on terminals of Q3 and Q5 (figure 5-3).
5	④ (Figures 5-2 and 5-4)	Touch oscilloscope vertical input lead to TP-4.	Pattern as in step 5 of table 5-5.	If not similar, check Q6, Q7, Q8, Q9, and Q10 (figure 6-4); measure dc voltages on terminals of Q6, Q7, Q8, Q9, and Q10 (figure 5-3).

(d) SIGNAL TRACING OSCILLOSCOPE PATTERNS. - Table 5-5 illustrates oscilloscope patterns to be used as guides during signal tracing.

(e) ALIGNMENT OF THE CONVERTER AFTER TROUBLE-SHOOTING. - After trouble-shooting the signal processing circuits, if repairs or component changes were made, refer to Section 6, paragraph 6-2, for alignment procedures. Table 6-1 lists adjustments required after specific transistors are replaced or values in the circuits of these transistors are changed.

c. KEYER CIRCUITS TROUBLE-SHOOTING.

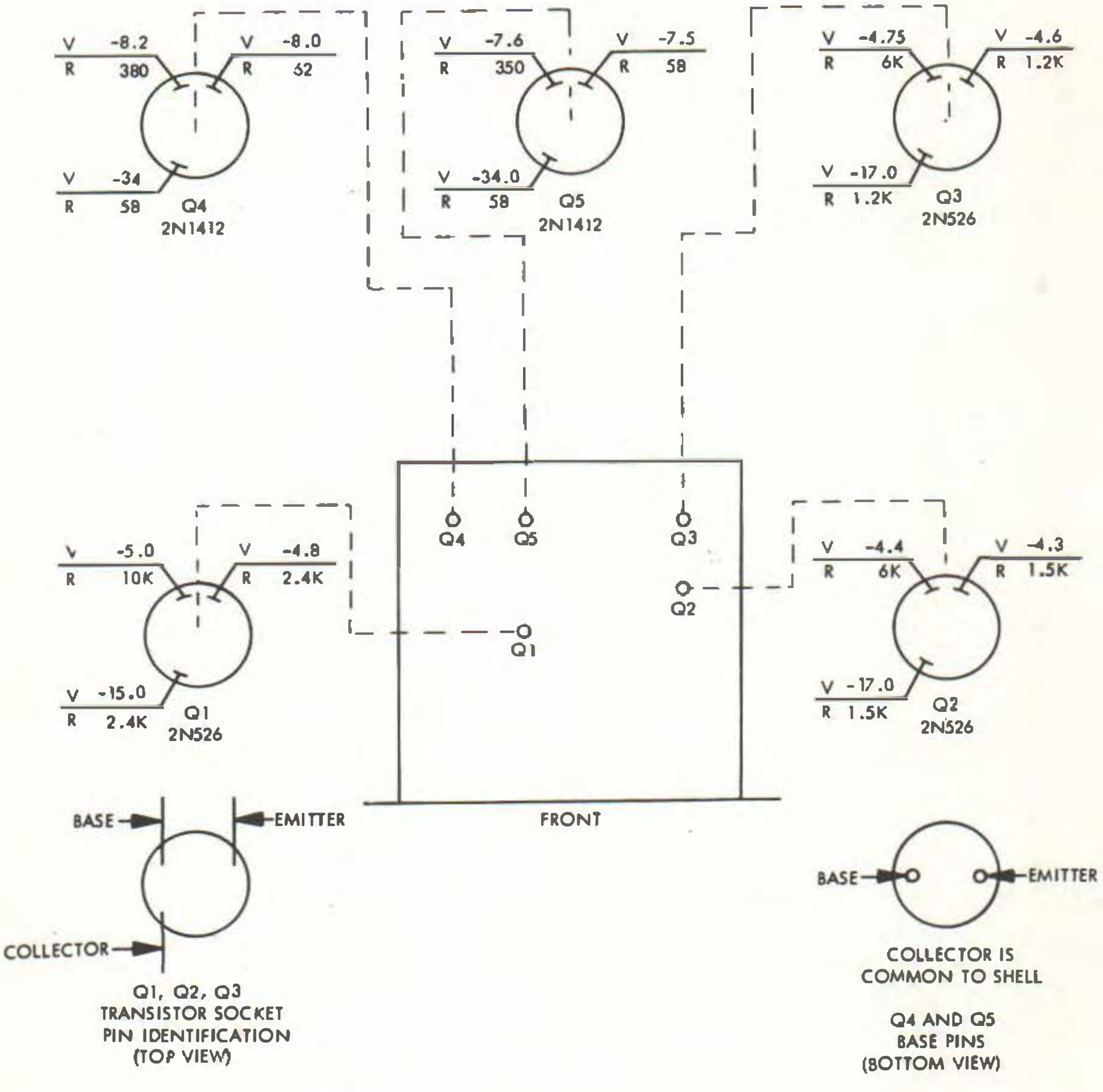
(1) PRELIMINARY CHECK. - The preliminary check for functional trouble-shooting the keyer circuits is the same as the preliminary check for overall trouble-shooting (refer to paragraph 5-3a).

(2) TEST EQUIPMENT AND SPECIAL TOOLS.

(a) TEST EQUIPMENT. - The following test equipment will be required:

DuMont 304-A	oscilloscope
ME-30/U	ac vtvm
AN/PSM-4	multimeter
TS-1100/U	test set, transistor

(b) SPECIAL TOOLS. - No special tools will be required.



NOTES:
V INDICATES DC VOLTAGE TO CHASSIS WITH VT VM (NO SIGNAL).
R INDICATES RESISTANCE (IN OHMS) TO CHASSIS WITH POWER SWITCH OFF.

Figure 5-3. Frequency Shift Converter CV-483/URA-17, Signal Processing Circuits, Voltage and Resistance Measurements

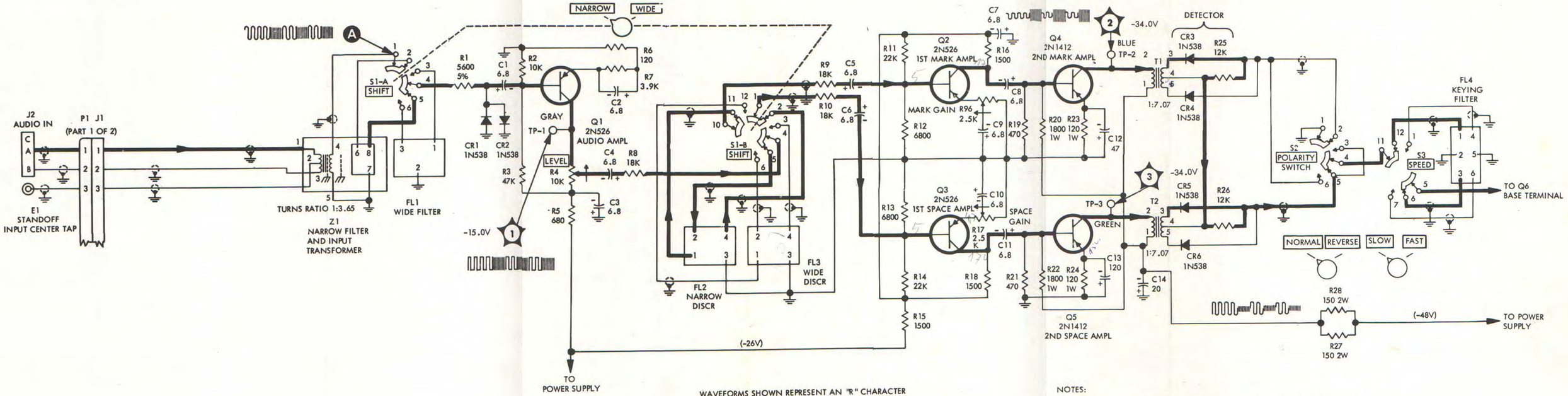
(3) CONTROL SETTINGS. - The control settings for the converter during functional trouble-shooting of the keyer circuits are the same as the control settings for overall trouble-shooting (refer to paragraph 5-3c.

(4) ILLUSTRATIONS.

(a) TEST POINTS. - Figure 5-2 illustrates the physical locations of all test points to be used in functional section trouble-shooting.

(b) SCHEMATIC DIAGRAMS. - Figure 5-6 is the schematic diagram of the keyer circuits.

(c) VOLTAGE AND RESISTANCE DIAGRAM. - Figure 5-5 lists voltages and resistances measured from the terminals of the transistors in the keyer circuits to the converter chassis, with no signal applied.



WAVEFORMS SHOWN REPRESENT AN "R" CHARACTER REPEATED CONTINUOUSLY AS RECEIVED FROM A TAPE FED TRANSMITTER AND DISPLAYED ON AN OSCILLOSCOPE WHOSE SWEEP IS OPERATING AT THE CHARACTER REPETITION RATE. WHEN SWEEP IS NOT IN SYNC WITH CHARACTER REPETITION RATE, OR WHEN MIXED CHARACTERS ARE RECEIVED, A DISTINCT WAVEFORM WILL NOT BE SHOWN BUT VARIOUS COMBINATIONS OF MOVING CHARACTERS WILL NORMALLY BE DISPLAYED.

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITORS ARE IN UF
   ALL RESISTORS ARE IN OHMS
   ALL RESISTORS 1/2 WATT 10%
   K = 1000 MEG = 1,000,000
2. UNLESS OTHERWISE INDICATED, ALL VOLTAGES TAKEN TO CHASSIS WITH 20,000 OHM/VOLT VOLTMETER, WITH NO INPUT SIGNAL
3. ALL VOLTAGES ARE DC
4. ALL ROTARY SWITCHES SHOWN IN FULLY CCW POSITIONS UNLESS OTHERWISE SPECIFIED
5. [ ] INDICATES FRONT PANEL CONTROL
6. ARROWS ON VARIABLE RESISTORS INDICATE CLOCKWISE ROTATION.
7. REFER TO FIGURE 6-2 FOR TRANSFORMER AND FILTER RESISTANCES.

Figure 5-4. Frequency Shift Converter CV-483/URA-17, Signal Processing Circuits, Functional Schematic Diagram

TABLE 5-3. FREQUENCY SHIFT CONVERTER CV-483/URA-17, KEYER CIRCUITS FUNCTIONAL SECTION TROUBLE-SHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1		Connect fsk receiver audio output to AUDIO INPUT jack (J2) at rear of converter. Connect teletype printer to TTY OUTPUT jack (J6) at rear of converter. Adjust receiver and converter controls for single-receiver operation (Section 3, paragraph 3-2g(1)).	Teletype printer prints readable copy.	If teletype printer is locked up: check Q11 through Q18 (figures 6-3 and 6-4); measure dc voltages on terminals of Q11 through Q18 (figure 5-5). If teletype printer runs open: check Q13 through Q18 (figure 6-3); measure dc voltages on terminals of Q13 through Q18 (figure 5-5). If trouble still persists, proceed to step 2.
2		Set up oscilloscope to display low frequency signals. Connect oscilloscope ground terminal to converter chassis.		If ok, measure resistance of R67 (figure 6-3); check CR20 (figure 6-3).
	⑤ (Figures 5-2 and 5-6)	Touch vertical input lead to TP-5.	Pattern as in step 6 of table 5-5.	If pattern is not ok: check Q13 through Q16 (figure 6-3): measure dc voltages on terminals of Q13 through Q16 (figure 5-5).

(d) SIGNAL TRACING OSCILLOSCOPE PATTERNS. - Table 5-5 illustrates oscilloscope patterns to be used as guides during signal tracing.

(e) ALIGNMENT OF THE CONVERTER AFTER TROUBLE-SHOOTING. - After trouble-shooting the keyer circuits, if repairs or component changes were made, refer to Section 6, paragraph 6-2, for alignment procedures. Table 6-1 lists adjustments required after specific transistors are replaced or values in the circuits of these transistors are changed.

d. POWER SUPPLIES TROUBLE-SHOOTING.

(1) PRELIMINARY CHECK. - The preliminary check for functional trouble-shooting the power supplies is the same as the preliminary check for overall trouble-shooting (refer to paragraph 5-3a).

(2) TEST EQUIPMENT AND SPECIAL TOOLS.

(a) TEST EQUIPMENT. - The following test equipment will be required:

AN/PSM-4 multimeter
ME-30/U ac vtvm
TS-1100/U test set, transistor

(b) SPECIAL TOOLS. - No special tools will be required.

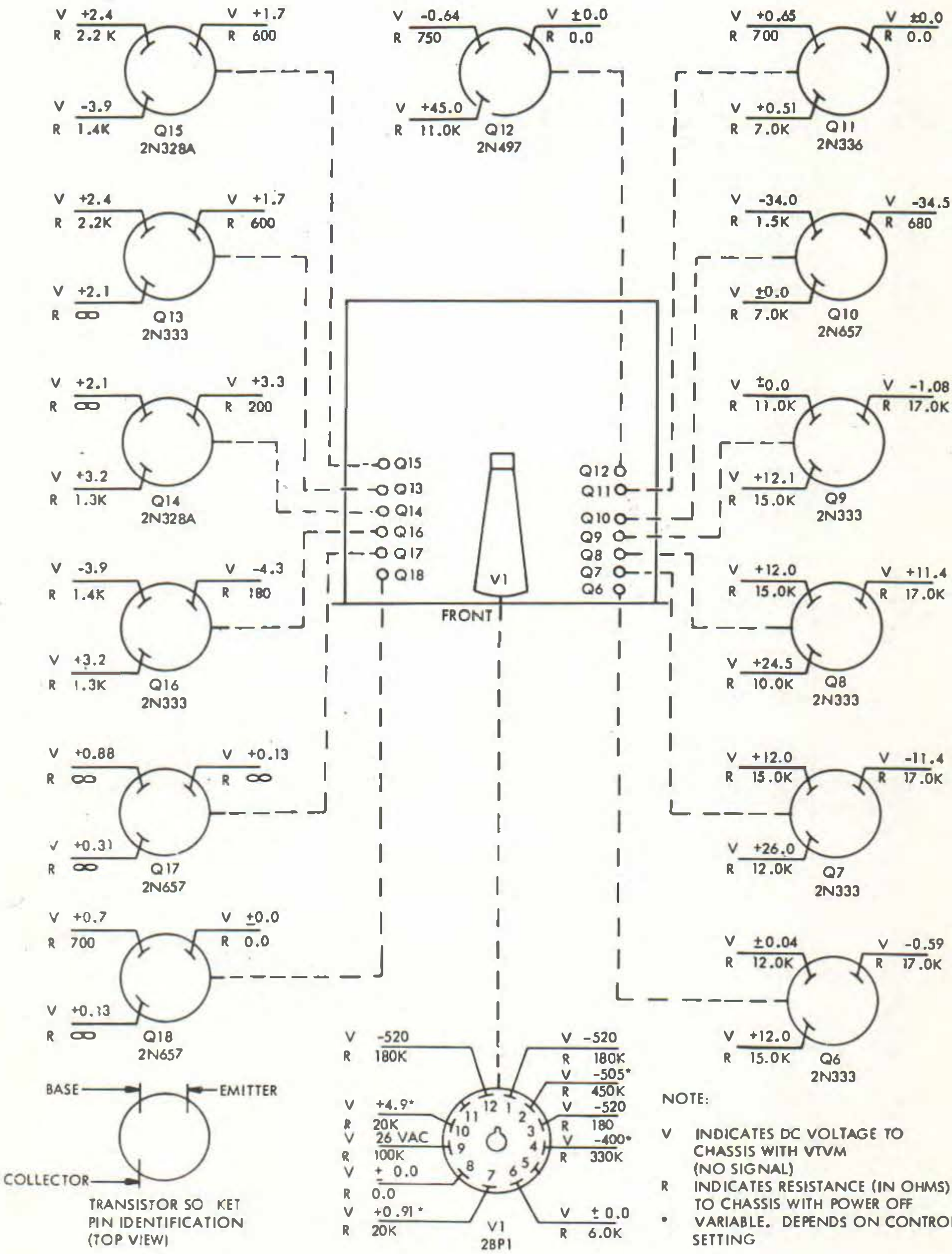
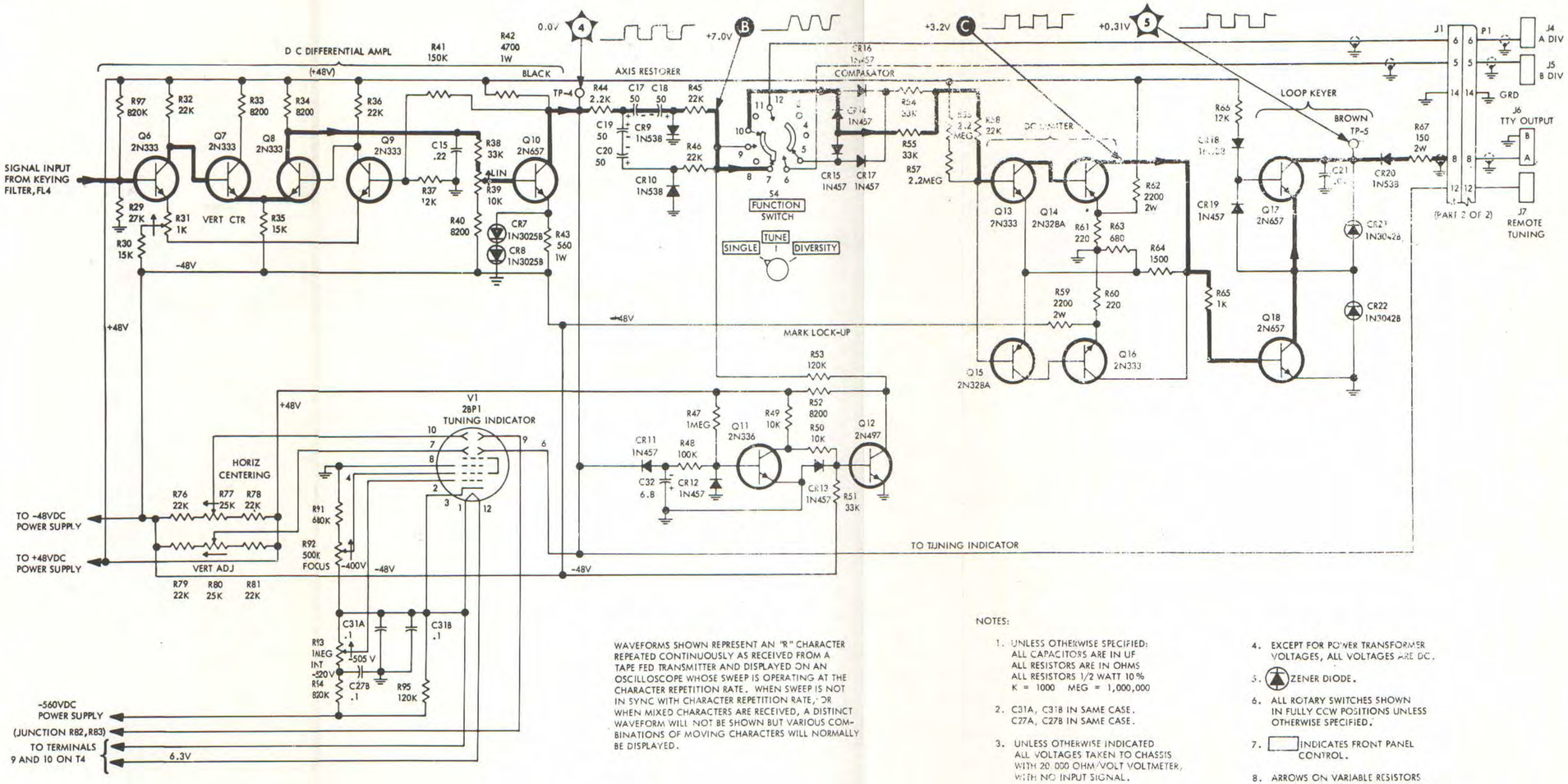


Figure 5-5. Frequency Shift Converter CV-483/URA-17, Keyer Circuits. Voltage and Resistance Measurements



WAVEFORMS SHOWN REPRESENT AN "R" CHARACTER REPEATED CONTINUOUSLY AS RECEIVED FROM A TAPE FED TRANSMITTER AND DISPLAYED ON AN OSCILLOSCOPE WHOSE SWEEP IS OPERATING AT THE CHARACTER REPETITION RATE. WHEN SWEEP IS NOT IN SYNC WITH CHARACTER REPETITION RATE, OR WHEN MIXED CHARACTERS ARE RECEIVED, A DISTINCT WAVEFORM WILL NOT BE SHOWN BUT VARIOUS COMBINATIONS OF MOVING CHARACTERS WILL NORMALLY BE DISPLAYED.

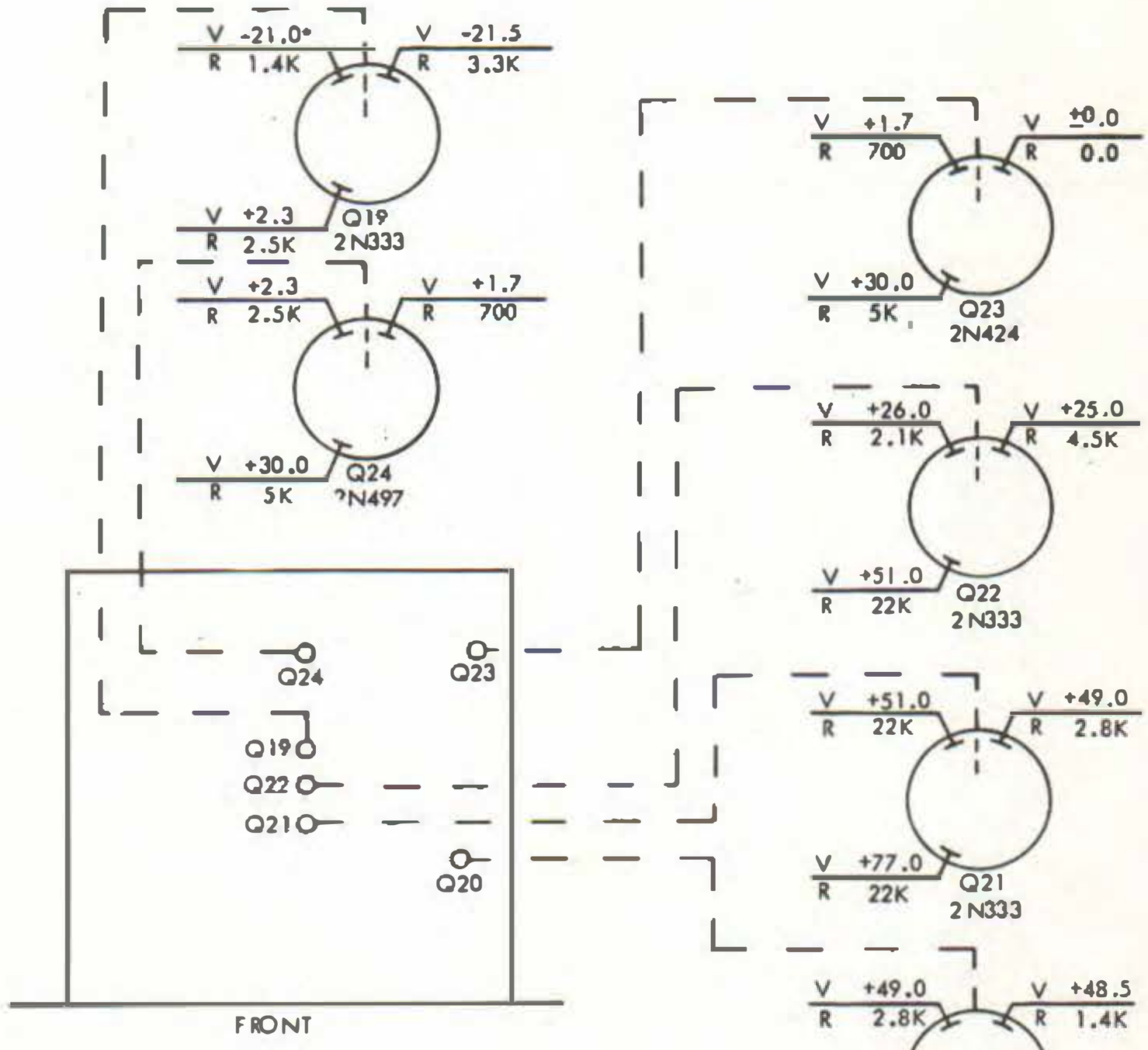
NOTES:

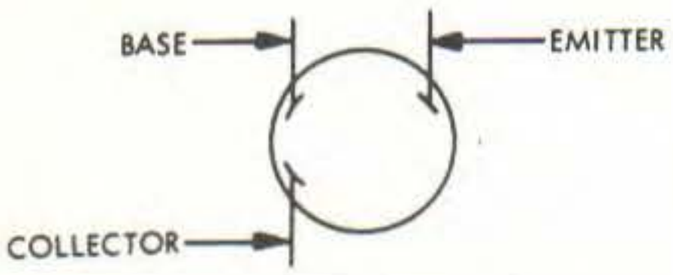
1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITORS ARE IN UF
   ALL RESISTORS ARE IN OHMS
   ALL RESISTORS 1/2 WATT 10%
   K = 1000 MEG = 1,000,000
2. C31A, C31B IN SAME CASE.
   C27A, C27B IN SAME CASE.
3. UNLESS OTHERWISE INDICATED ALL VOLTAGES TAKEN TO CHASSIS WITH 20,000 OHM/VOLT VOLTMETER, WITH NO INPUT SIGNAL.
4. EXCEPT FOR POWER TRANSFORMER VOLTAGES, ALL VOLTAGES ARE DC.
5. ZENER DIODE.
6. ALL ROTARY SWITCHES SHOWN IN FULLY CCW POSITIONS UNLESS OTHERWISE SPECIFIED.
7. ☐ INDICATES FRONT PANEL CONTROL.
8. ARROWS ON VARIABLE RESISTORS INDICATE CLOCKWISE ROTATION.

Figure 5-6. Frequency Shift Converter CV-483/URA-17, Keyer Circuits, Functional Schematic Diagram

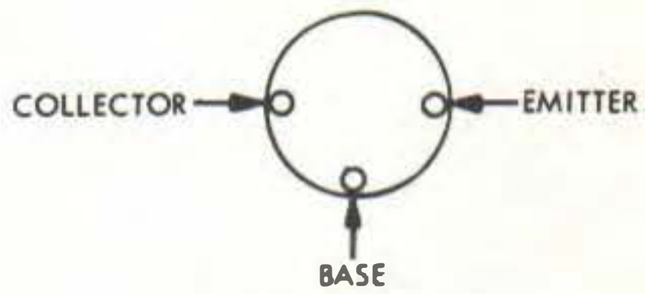
TABLE 5-4. FREQUENCY SHIFT CONVERTER CV-483/URA-17,
POWER SUPPLIES FUNCTIONAL SECTION
TROUBLE-SHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1		Turn converter POWER switch to On.	Indicator lamp glows.	If lamp glows, proceed to step 2. If lamp does not glow: (1) Check indicator lamp (paragraph 3-4d). (2) Check fuses F1 and F2 on front panel (refer to paragraph 3-4e). (3) Check that chassis is fully closed (table 3-3). If ok, loosen the captive screw at each corner of front panel, pull chassis forward to stops, and check interlock switches S5A and S5B (figure 2-10). (4) Check that chassis plug P1 (figure 6-3) and POWER plug (on rear of cabinet) are properly connected to mating receptacles. (5) Check line voltage source. (6) Check POWER switch (figure 3-1).
2	⑥ (Figures 5-2 and 5-8)	Turn converter POWER switch to Off. Adjust multimeter to measure -560 volts dc. Connect positive lead of multimeter to converter chassis. Connect negative lead of multimeter to TP-6. Turn converter POWER switch to On.	-560 volts ±10%	If ok, continue with step 2. If not, check CR32 and CR33 (figure 6-4); measure R84 (figure 6-4).
3	⑦ (Figures 5-2 and 5-8)	Adjust multimeter to measure -48 volts dc. Connect positive lead of multimeter to converter chassis. Connect negative lead of multimeter to TP-7.	-48 volts ±10%	If ok, continue with step 3. If not, adjust -48 ADJ control R72 (figure 5-1) as required; check Q19, Q23, and Q24 (figure 6-4); measure dc voltages at terminals of Q19, Q23, and Q24 (figures 5-7 and 6-4)
4	⑧ (Figures 5-2 and 5-8)	Adjust multimeter to measure +48 volts dc. Connect negative lead of multimeter to converter chassis. Connect positive lead of multimeter to TP-8.	+48 volts ±10%	If incorrect, adjust +48 ADJ control R89 (figure 5-1) as required; check Q20, Q21, and Q22 (figure 6-4); measure dc voltages at terminals of Q20, Q21, and Q22 (figures 5-7 and 6-4. If, upon completion of the trouble-shooting procedure given in this task, the tuning indicator pattern is not as (A) in figure 3-2, proceed to table 5-2 and applicable step.





Q19, Q21, Q22, Q24
TRANSISTOR SOCKET
PIN IDENTIFICATION
(TOP VIEW)



Q20 AND Q23
BASE PINS
(BOTTOM VIEW)

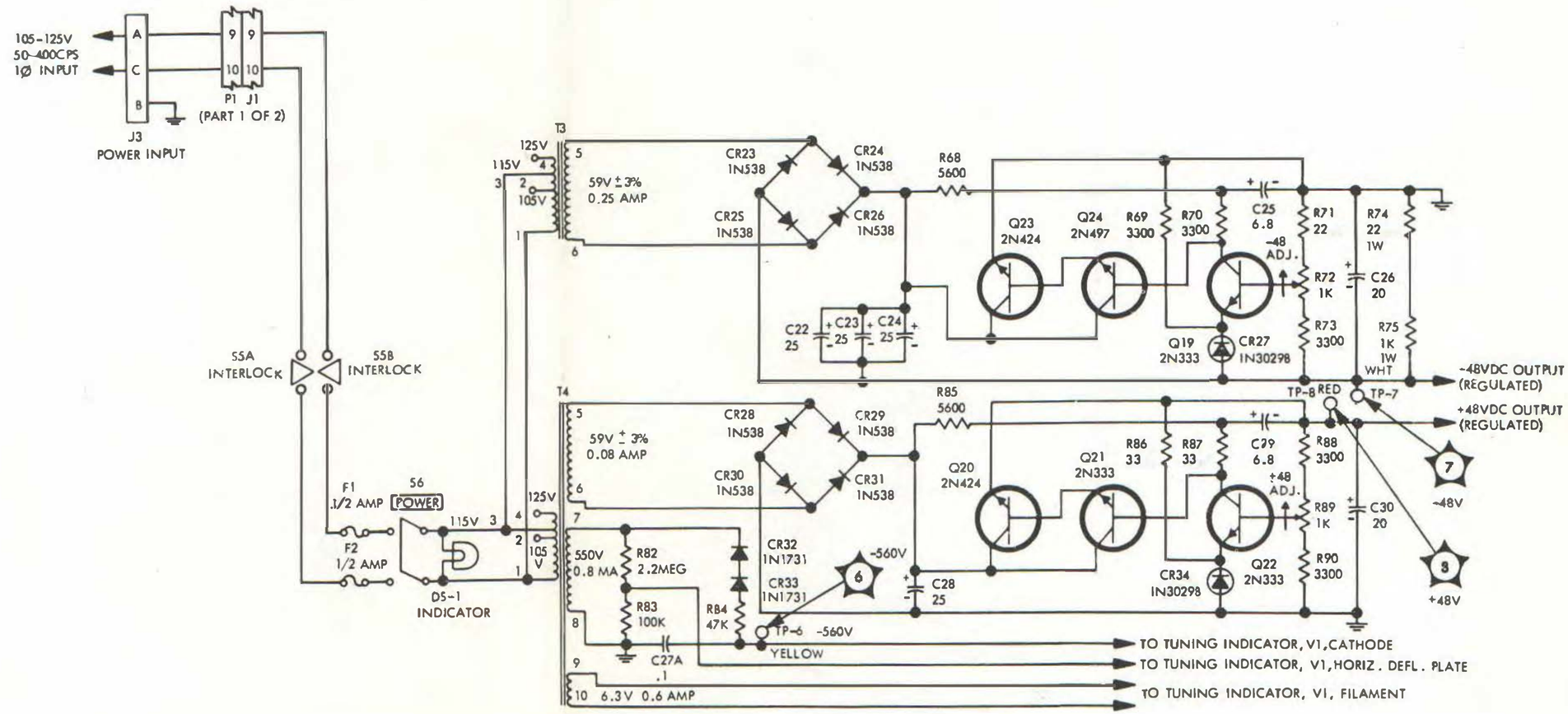
NOTES:

V INDICATES DC VOLTAGE TO CHASSIS WITH VTVM (NO SIGNAL).

R INDICATES RESISTANCE (IN OHMS) TO CHASSIS WITH POWER SWITCH OFF.

* VARIABLE. DEPENDS UPON CONTROL SETTING.

Figure 5-7. Frequency Shift Converter CV-483/URA-17, Power Supplies, Voltage and Resistance Measurements



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITORS ARE IN UF
   ALL RESISTORS ARE IN OHMS
   ALL RESISTORS 1/2 WATT 10 %
   K=1000 MEG= 1,000,000
2. UNLESS OTHERWISE INDICATED:
   ALL VOLTAGES TAKEN TO CHASSIS WITH 20,000 OHM/VOLT VOLTMETER, WITH NO INPUT SIGNAL.
3. EXCEPT FOR POWER TRANSFORMER VOLTAGES, ALL VOLTAGES ARE DC.
4. ZENER DIODE
5. INDICATES FRONT PANEL CONTROL.
6. ARROWS ON VARIABLE RESISTORS INDICATE CLOCKWISE ROTATION.

Figure 5-8. Frequency Shift Converter CV-483/URA-17, Power Supplies, Functional Schematic Diagram

(3) CONTROL SETTINGS. - The control settings for the converter during functional trouble-shooting of the power supplies are the same as the control settings for overall trouble-shooting (refer to paragraph 5-3c).

(4) ILLUSTRATIONS.

(a) TEST POINTS. - Figure 5-2 illustrates the physical locations of all test points to be used in functional section trouble-shooting.

(b) SCHEMATIC DIAGRAMS. - Figure 5-8 is the schematic diagram of the power supplies. Figure 5-9 is the primary power distribution diagram.

(c) VOLTAGE AND RESISTANCE DIAGRAM. - Figure 5-7 lists voltages and resistances measured from transistor terminals of the power supplies to the converter chassis with no signal applied.

(d) ADJUSTMENT OF POWER SUPPLIES. - After trouble-shooting the power supplies, if repairs or component changes were made, refer to Section 6, paragraph 6-2, for adjustment procedures.

5-5. TYPICAL TROUBLES.

Table 5-6 lists typical troubles that may occur during the service life of the AN/URA-17.

5-6. LOCATION OF PARTS.

Figures 6-3 and 6-4 illustrate the location of all circuit elements that may require replacement during the service life of the AN/URA-17.

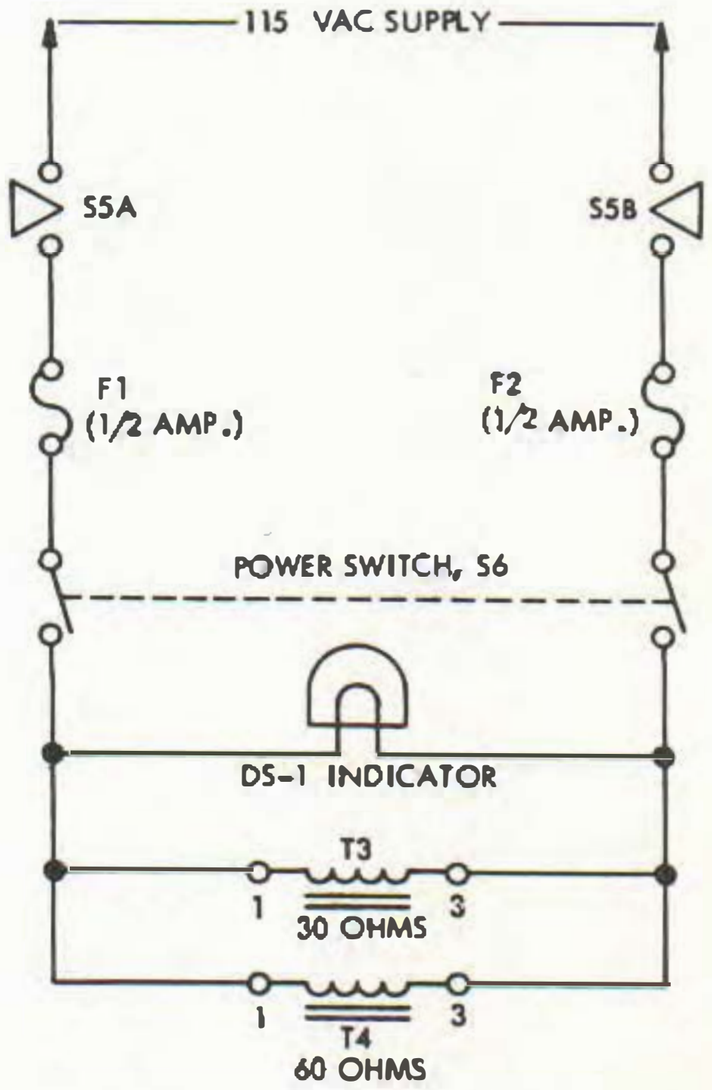
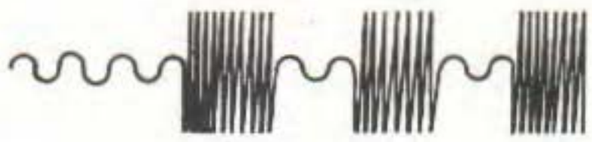
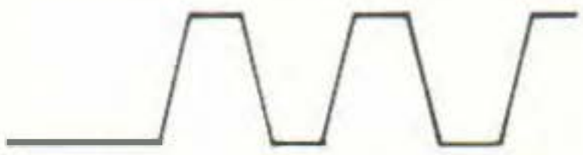


Figure 5-9. Frequency Shift Converter CV-483/URA-17, Primary Power Distribution Diagram

TABLE 5-5. SIGNAL TRACING OSCILLOSCOPE PATTERNS*

STEP	TEST POINT	WAVEFORM	NOTES
1	A (figure 5-2)		Terminal 1 of S1-A (figure 6-3)
2	1 (figure 5-2)		
3	2 (figure 5-2)		
4	3 (figure 5-2)		
5	4 (figure 5-2)		
6	5 (figure 5-2)		
7	B (figure 5-2)		Junction of R45 and R46 (figure 6-4)
8	C (figure 5-2)		Collector terminals of Q14 and Q16 (figure 6-3)

* Waveforms shown represent reception of an "R" character repeated continuously by a tape-fed transmitter and displayed on an oscilloscope whose sweep is operating at the character repetition rate. When receiving mixed characters or the sweep is not in sync with the character repetition rate, various moving characters will normally be displayed.

TABLE 5-6. FREQUENCY SHIFT CONVERTER CV-483/URA-17, TYPICAL TROUBLES

TROUBLE	NATURE OF TROUBLE	SYMPTOMS
Teletype printer runs open.	Fuses blown (F1 or F2, on front panel of converter). Ac power not on. Defective connection on power input cable. Defective POWER input receptacle (on rear of converter cabinet). Safety interlock switches open or defective (figure 2-10).	Indicator light out when POWER switch is On; no pattern on tuning indicator.
	Receiver detuned. Receiver output connection defective. Defective converter.	Indicator light is on but no pattern on tuning indicator.
	Teletype printer loop power supply defective. Loop keyer or dc limiter in converter defective.	Tuning indicator pattern normal, but teletype printer runs open.
Teletype printer locked up.	FUNCTION switch on converter left in TUNE position.	Tuning indicator pattern normal; teletype printer locked up.
Teletype printer prints garbled copy.	Receiver not properly tuned.	Tuning indicator pattern not centered vertically.
	POLARITY switch on converter in wrong position.	Tuning indicator pattern normal, teletype printer prints garbled copy.

SECTION 6
REPAIR

6-1. FAILURE REPORT.

FAILURE REPORT

"Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment identification plate), the type number and serial number of the major unit (from the major unit identification plate), and the type number and reference designation of the particular defective part (from the technical manual). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember--there are two sides to the failure report--

"YOUR SIDE"

"Every FAILURE REPORT is a boost for you:

1. It shows that you are doing your job.
2. It helps make your job easier.
3. It insures available replacements.
4. It gives you a chance to pass your knowledge to every man on the team.

"BUREAU SIDE"

"The Bureau of Ships uses the information to:

1. Evaluate present equipment.
2. Improve future equipment.
3. Order replacements for stock.
4. Prepare field changes.
5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest District Publications and Printing Office."

6-2. TUNING AND ADJUSTMENT.

a. GENERAL. - Reference to this section is usually made after completion of trouble-shooting procedures in Section 5. If the defective part has been found, but the method of replacement is not easily determined, refer to paragraph 6-3. Table 6-1 lists adjustments required after replacing specific transistors (or components in these transistor circuits). Tests of filter characteristics are given in paragraph 6-3d(5), and tests of discriminator characteristics are given in paragraph 6-3d(6).

The following procedures provide the required alignment for the converters. Each procedure is complete. If two or more procedures are to be performed, reading ahead can prevent duplicating steps.

WARNING

Dangerous voltages exist within the converter when connected to the line voltage source, even when the POWER switch is in the Off position.

b. STANDARDS. - Maintenance Standards Book NAVSHIPS 94028.42 contains a series of maintenance standard test procedures which provide indications representing optimum equipment performance, and a series of preventative maintenance procedures. Performance Standard Sheet NAVSHIPS 94028.32 lists minimum acceptable limits for overall performance of the equipment.

c. TEST EQUIPMENT AND SPECIAL TOOLS. - The following test equipment, or the equivalent (refer to table 1-3), will be required. Nc special tools will be required.

ME-30/U	vtvm (two required)
TS-382A/U	audio oscillator
AN/TSM-9	frequency meter
AN/PSM-4	multimeter

d. SPECIAL JIGS. - No special jigs, fixtures, etc., will be required.

e. CONTROL SETTINGS. - Set the converter POWER switch to the Off position. The other converter controls will be set during the respective adjustment or alignment procedures.

f. POWER SUPPLY ADJUSTMENTS.

(1) +48 VOLT SUPPLY.

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Connect negative lead from multimeter to chassis, and positive lead to red test point, TP- ★ 8 (figure 5-2).

Step 3. Adjust multimeter to appropriate dc voltage scale.

Step 4. Turn converter POWER switch to On and allow five minute warm-up period.

Step 5. Adjust +48 ADJ control, R89 (figure 5-1), for multimeter indication of +48 volts.

Step 6. Turn POWER switch to Off and disconnect multimeter leads from converter.

(2) -48 VOLT SUPPLY.

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Connect positive lead from multimeter to converter chassis, and negative lead to white test point, TP- ★ 7 (figure 5-2).

Step 3. Adjust multimeter to appropriate dc voltage scale.

Step 4. Turn converter POWER switch to On and allow five minute warm-up period.

Step 5. Adjust -48 ADJ control, R72 (figure 5-1), for multimeter indication of -48 volts.

Step 6. Turn POWER switch to Off and disconnect multimeter leads from converter.

g. CATHODE-RAY TUBE ADJUSTMENTS.

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Turn converter POWER switch to On position and allow five minute warm-up period.

Step 3. Adjust FOCUS control, R92, and INT (intensity) control, R93 (figure 2-10), for normal operation.

Step 4. Short black test point, TP- ★ 4 (figure 5-2), to converter chassis with a clip lead.

Step 5. Adjust VERT ADJ control, R80 (figure 5-1), to center trace on crt bezel.

Step 6. Adjust HORIZ CENTERING control, R77 (figure 5-1), to center trace on crt bezel.

Step 7. If trace on crt bezel is not horizontal, loosen the screw in clamp at crt base (figure 5-1), and rotate crt until trace is horizontal. Tighten screw in crt clamp.

Step 8. Turn POWER switch to Off and remove clip lead from TP- ★ 4.

h. MARK AND SPACE GAIN CONTROL ADJUSTMENTS.

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Connect vtvm's and audio oscillator to power source and turn power switches on. Allow at least five minute warm-up period.

Step 3. Adjust converter LEVEL control to 6, set SHIFT switch to WIDE and SPEED switch to SLOW. Turn POWER switch to On position and allow five minute warm-up period.

Step 4. Disconnect cable from AUDIO INPUT connector, J2, on rear of converter cabinet.

Step 5. Adjust audio oscillator frequency to 2550 cps.

Step 6. Set vtvm range switch to 10 volts and connect to audio oscillator output terminals.

Step 7. Connect audio oscillator output terminals to AUDIO INPUT connector, J2, on rear of converter cabinet or to terminals 1 and 3 of Z1 (figure 5-1). Adjust audio oscillator for output of 6.0 volts as measured on vtvm. Leave vtvm connected to audio oscillator terminals.

Step 8. Set range switch of second vtvm to 1 volt and connect between terminal 1 of FL3 (figure 5-1) and converter chassis. Record vtvm indication.

Step 9. Move vtvm lead from terminal 1 of FL3 to terminal 4 of FL3. Adjust vtvm range switch as required. Record vtvm indication.

Step 10. Adjust audio oscillator frequency and repeat steps 8 and 9 until voltages at terminals 1 and 4 of FL3 are equal. Maintain constant audio oscillator output voltage.

Step 11. Move vtvm lead from terminal 1 or 4 of FL3 to green test point, TP- ★ 3 (figure 5-2). Adjust SPACE GAIN control, R17 (figure 5-1), for 4.0 volt vtvm indication.

Step 12. Move vtvm lead from green test point, TP- ★ 3, to blue test point, TP- ★ 2 (figure 5-2), and adjust MARK GAIN control, R96 (figure 5-1), for 4.0 volt

vtvm indication.

Step 13. Repeat steps 11 and 12 until 4.0 volt indications are obtained at TP- ★ 2 and TP- ★ 3.

Step 14. Turn POWER switch to Off and disconnect audio oscillator and vtvm from converter. Reconnect cable removed from AUDIO INPUT connector, J2, on rear of converter cabinet.

i. DC DIFFERENTIAL AMPLIFIER ADJUSTMENTS.

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Connect vtvm and audio oscillator to power source and turn power switches on. Allow at least five minute warm-up period.

Step 3. Turn converter POWER switch to On and allow five minute warm-up period.

Step 4. Disconnect cable from AUDIO INPUT connector, J2, at rear of converter cabinet.

Step 5. Adjust converter LEVEL control to 0, and set POLARITY switch to NORMAL.

Step 6. Adjust multimeter to 40 volt dc scale.

Step 7. Connect negative lead from multimeter to converter chassis and positive lead to black test point, TP- ★ 4 (figure 5-2).

Step 8. Adjust VERT CTR control, R31 (figure 2-10), for a zero indication on multimeter. Change multimeter range switch as required to obtain exact setting for R31.

Step 9. Adjust audio oscillator for an output of 3200 cps.

Step 10. Set vtvm range switch to 10 volts and connect to audio oscillator output terminals.

Step 11. Connect audio oscillator output terminals to AUDIO INPUT connector, J2, on rear of converter cabinet or to terminals 1 and 3 of Z1 (figure 5-1). Adjust audio oscillator for 6.0 volt indication on vtvm. Leave vtvm connected to audio oscillator.

Step 12. Adjust multimeter to 40 volt dc scale.

Step 13. Adjust converter LEVEL control to 6.

Step 14. Adjust LIN (linearity) control, R39 (figure 5-1), for multimeter indication of +32 volts (at TP- ★ 4).

Step 15. Adjust audio oscillator output to zero, set converter LEVEL control to 0, and adjust VERT CTR control, R31 (figure 5-1), for zero multimeter indication. Adjust multimeter range switch as required. Return multimeter range switch to 40 volt dc scale.

Step 16. Set converter LEVEL control to 6 and adjust audio oscillator output to 6.0 volts as measured by vtvm.

Step 17. Adjust converter LIN (linearity) control, R39 (figure 5-1), for equal positive and negative voltages on multimeter as converter POLARITY switch is changed from NORMAL to REVERSE.

Step 18. Adjust audio oscillator output to zero, set converter LEVEL control to 0, and adjust VERT CTR control, R31 (figure 2-10), for zero multimeter indication.

Step 19. Turn POWER switch to Off and disconnect test equipment from converter. Reconnect cable removed from AUDIO INPUT connector, J2, on rear of converter cabinet.

6-3. REMOVAL, ADJUSTMENT, REPAIR, AND REASSEMBLY.

a. GENERAL. - All electrical components of the converter are installed on two printed circuit boards or the surrounding metal frame. See figures 5-1, 6-3, and 6-4 for locations of component parts.

CAUTION

Most of these components are small and a heat sink must be used when soldering or unsoldering them. Be sure all loose solder and bits of wire are removed before power is applied.

b. ILLUSTRATIONS.

(1) PHOTOGRAPHS. - Figure 5-1 illustrates the physical locations of all parts in the converter that may require replacement during the normal service life of the AN/URA-17. Figure 5-2 illustrates the physical location of all test points in the converter.

(2) WIRING DIAGRAMS. - Figures 6-3 and 6-4 are wiring diagrams of the converter.

c. REMOVAL AND REASSEMBLY. - Removal and reassembly instructions are given in the following paragraphs.

(1) CHASSIS REMOVAL. - To remove converter chassis from cabinet, proceed as follows:

Step 1. Loosen four captive screws on front panel, one at each corner.

Step 2. Pull converter chassis forward until drawer slides lock.

Step 3. Remove main cable plug, P1, from J1 at rear of chassis (figure 5-1), and remove cable from clamp near J1.

Step 4. Lift latch on bottom near front of each drawer slide, grasp both sides of converter chassis, and pull forward until chassis is free of cabinet drawer slides. To replace chassis, reverse this procedure.

(2) TRANSFORMER AND FILTER REPLACEMENT. - The transformers and filters are bolted to the metal frame around the printed circuit boards (figure 5-1). Remove the securing nuts and washers beneath the frame, tag and unsolder connecting wires, and lift transformer or filter straight upward. Replace by reversing this procedure.

(3) PRINTED CIRCUIT BOARD REPLACEMENT. - There are two printed circuit boards (figure 5-1) used in the converter. Remove either of them as follows:

Step 1. Tag for identification and unsolder leads to terminals on printed circuit board.

Step 2. Remove securing screws holding printed circuit board to metal frame and remove board. To replace printed circuit board, reverse this procedure.

(4) RECEPTACLE PANEL REMOVAL. - To remove receptacle panel at rear of converter (figure 2-6), loosen the captive screw at each corner of receptacle panel and pull panel from cabinet.

d. ADJUSTMENT AND REPAIR.

(1) TEST EQUIPMENT AND SPECIAL TOOLS. Refer to paragraph 6-2c.

(2) TRANSISTOR REPLACEMENT. - All transistors except power transistors Q4, Q5, Q20, and Q23 (figure 5-1) are mounted in sockets, with clamps holding them in place. The transistors are easily removed by pulling clamps away from the transistors.

The four power transistors are bolted to metal plates which serve as heat sinks. These metal plates are fastened to the chassis. Collector terminals of power transistors are common to their metal shells and must be insulated from the metal plates. Special anodized aluminum washers are provided for this purpose. When Q4, Q5, Q20, or Q23 is replaced, be sure the proper washer is installed and that mounting bolts are tightened. This is necessary to assure good heat conduction through the washer. See figures 5-3 and 5-7 for transistor base information. Refer to table 6-1 for adjustjustments required when specific transistors are replaced.

NOTE

Pins on replacement transistors (other than Q4, Q5, Q20, and Q23) must be cut to 13/64 ± 1/64 inch. Do not force transistors into sockets. Bending of pins may crack the seal. Never attempt to solder or otherwise apply heat to transistor pins.

(3) TUNING INDICATOR CATHODE-RAY TUBE REPLACEMENT. - Replace the tuning indicator crt as follows:

Step 1. Pull chassis forward on drawer slides.

Step 2. Remove socket from tube base.

Step 3. Loosen screws that hold hood and window assembly in front of tube face and remove the assembly.

Step 4. Loosen screw in clamp at tube base.

Step 5. Remove tube and shield. Install new tube in shield (tube socket key way up). Install tube and shield behind chassis opening. Replace tube socket, front hood, and window assembly. Push tube forward against hood assembly and tighten clamp.

Step 6. Perform cathode-ray tube adjustments in paragraph 6-2g.

(4) TRANSISTOR SOCKET REPLACEMENT. - Transistor sockets are attached to the printed circuit boards by screws. Remove the 3/32 inch lock nuts from below socket, unsolder socket terminals from printed circuit board, and lift off socket. To reinstall, position socket and check that socket terminals line up properly with printed circuit leads. Then replace the screws and lock nuts and solder socket terminals to printed circuit leads.

(5) ROTARY SWITCH REPAIRS.

(a) REPLACING DEFECTIVE SWITCH WAFER. - Replace defective switch wafer as follows:

Step 1. Remove nuts and washers from rear (chassis side) of switch.

Step 2. Slip defective wafer from switch shaft.

TABLE 6-1. ADJUSTMENTS AFTER TRANSISTOR REPLACEMENTS

TRANSISTOR REPLACED	ADJUSTMENTS TO BE MADE	ADJUSTMENT PARAGRAPH
Q2, Q3, Q4 or Q5	Mark and space gain adjustments	6-2h
Q6, Q7, Q8, Q9, or Q10	Dc amplifier adjustments	6-2i
Q19, Q23, or Q24	-48 volts adjustment	6-2f (2)
Q20, Q21, or Q22	+48 volts adjustment	6-2f (1)

NOTE

SHIFT switch (S1A-B) has two switch wafers. If front wafer is defective, remove rear wafer, spacers between wafers, and the defective wafer. Pay close attention to position of wafers on switch shaft.

Step 3. Place new wafer on switch shaft. Be sure wafer is correctly positioned.

Step 4. Replace removed hardware (nuts, lock washers, and spacers) if applicable).

Step 5. Unsolder wires (one at a time) from defective wafer and solder to replacement wafer. Be very careful that wires are correctly placed and mechanically secure before soldering.

(b) REPLACING DEFECTIVE SWITCH. - If defect is other than switch wafer, replace entire switch as follows:

Step 1. Loosen set-screw in front panel knob and remove knob.

Step 2. Remove securing nut and lock washer from switch shaft.

Step 3. Tag and identify wires on switch terminals.

Step 4. Unsolder wires from defective switch.

Step 5. Push switch back, through front panel hole.

Step 6. Solder wires to new switch, being sure wires are correctly placed and mechanically secure before soldering to new switch terminals.

Step 7. Place switch in position, add securing nut, lock washer, and knob.

(6) BANDPASS FILTER TESTS. - Table 6-2 lists characteristics of bandpass filters FL1 and Z1. Resistance information is given in figure 6-2. Perform the following procedures to check characteristics of bandpass filters. Replace any filter not passing applicable tests.

(a) WIDE-SHIFT FILTER FL1.

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Connect vtvm's, audio oscillator, and frequency meter to power source and turn power switches on. Allow at least 15 minutes warm-up for frequency meter.

Step 3. Set converter SHIFT switch to WIDE, and turn POWER switch to On position. Allow five minute warm-up period.

Step 4. Disconnect cable from AUDIO INPUT connector, J2, at rear of converter cabinet.

Step 5. Connect audio oscillator output terminals to AUDIO INPUT connector, J2, or to terminals 1 and 3 of Z1 (figure 5-1).

tep 6. Set audio oscillator to 2550 cps, measured with frequency meter.

Step 7. Set vtvm range switch to 10 volts and connect between gray test point TP-★ 1 (figure 5-2) and converter chassis.

Step 8. Adjust audio oscillator output to obtain vtvm indication of 5.0 volts.

Step 9. Set range switch of second vtvm to 10 volts and connect to audio oscillator output terminals.

Step 10. Decrease audio oscillator frequency until vtvm connected to TP-★ 1 indicates 2.5 volts, keeping audio oscillator output voltage constant. Record audio oscillator frequency. Increase frequency until vtvm connected to TP-★1 indicates 2.5 volts, keeping audio oscillator output voltage constant. Subtract lower frequency from higher frequency. Result must be 2100 cps ±150 cps.

Step 11. Increase audio oscillator frequency until vtvm connected to TP-★ 1 indicates

TABLE 6-2. FILTER CHARACTERISTICS

SYMBOL	NAME	INPUT TERMINATION (OHMS)	OUTPUT TERMINATION (OHMS)	REQUIRED FREQUENCY RESPONSE	ATTENUATION	INSERTION LOSS	TEST LEVEL
Z1 (figure 5-1)	Narrow-shift bandpass filter.	8000 ±5% at 1000 cps.	8000 ±5% at 1000 cps.	900 to 1100 cps.	6 db bandwidth: 500 ±50 cps. 40 db bandwidth: 1400 ±100 cps.	3 db max. at 1000 cps.	10v rms, (no dc)
FL1 (figure 5-1)	Wide-shift bandpass filter.	8000 ±5% at 2550 cps.	8000 ±5% at 2550 cps.	2050 to 3050 cps.	6 db bandwidth: 2100 ±150 cps. 40 db bandwidth: 3100 ±200 cps.	3 db max. at 2550 cps.	10vrms, (no dc)
FL4 (figure 5-1)	Lowpass keying filter. Section A: (terminals 1,2,3.)	20K ±20% at 5 cps.	20K ±20% at 5 cps.	0 to 45 cps.	2 db at 15 cps. 3.5 db at 45 cps. 18 db (min) at 140 cps. 50 db(min) at 560 cps. 65 db(min) from 1500 cps to 8000 cps.	- -	10vrms, (no dc
	Section B: (terminals 4,5,6.)	20K ±20% at 5 cps.	20K ±20% at 5 cps.	0 to 175 cps.	2 db at 15 cps. 3.5 db at 175 cps. 18 db(min) at 560 cps. 50 db(min) at 2240 cps. 65 db(min) from 4000 cps to 8000 cps.	- -	10v rms,

0.05 volts, keeping audio oscillator output voltage constant. Record audio oscillator frequency. Decrease frequency until vtvm connected to TP-★ 1 indicates 0.05 volt, keeping audio oscillator output voltage constant. Subtract lower frequency from higher frequency. Result must be 3100 cps ±200 cps.

Step 12. Turn POWER switch to Off and disconnect vtvm and audio oscillator from converter. Reconnect cable to AUDIO INPUT connector, J2, on rear of converter cabinet.

(b) NARROW-SHIFT FILTER (PART OF Z1).

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Connect vtvm's, audio oscillator, and frequency meter to power source and turn power switches on. Allow at least 15 minutes warm-up for frequency meter.

Step 3. Set converter SHIFT switch to NARROW, and turn POWER switch to On position. Allow five minute warm-up period.

Step 4. Remove cable attached to AUDIO INPUT connector, J2, at rear of converter cabinet.

Step 5. Connect audio oscillator output terminals to AUDIO INPUT connector, J2, or to terminals 1 and 3 of Z1 (figure 5-1).

Step 6. Set audio oscillator to 1000 cps, using frequency meter.

Step 7. Set vtvm range switch to 10 volts and connect between gray test point, TP-★ 1 (figure 5-2) and converter chassis.

Step 8. Adjust audio oscillator output to obtain vtvm indication of 5.0 volts.

Step 9. Set range switch of second vtvm to 10 volts and connect to audio oscillator output terminals. Record vtvm indication.

Step 10. Decrease audio oscillator frequency until vtvm connected to TP-★ 1 indicates 2.5 volts, keeping audio oscillator output voltage constant. Record audio oscillator frequency. Increase audio oscillator frequency until vtvm connected to TP-★ 1 indicates 2.5 volts, keeping audio oscillator output voltage constant. Subtract lower frequency from higher frequency. Result must be 500 cps ±50 cps.

Step 11. Increase audio oscillator frequency until vtvm connected to TP-★ 1 indicates 0.05 volt, keeping audio oscillator output voltage constant. Record audio oscillator frequency. Decrease audio oscillator frequency until vtvm connected to TP-★ 1 indicates 0.05 volt, keeping audio oscillator output voltage constant. Subtract lower frequency from higher frequency. Result must be 1400 cps ±100 cps.

Step 12. Turn POWER switch to Off and disconnect vtvm and audio oscillator from converter. Reconnect cable to AUDIO INPUT connector, J2, at rear of converter cabinet.

(7) DISCRIMINATOR TESTS. - Discriminator frequency response characteristics are given in the curves of figure 6-1. These are in terms of frequency versus output voltage. Resistance information is given in figure 6-2. Perform the following procedures to check the discriminator characteristics. Replace any discriminator not passing applicable tests.

(a) WIDE-SHIFT DISCRIMINATOR.

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Connect vtvm, audio oscillator, and frequency meter to power source and turn power switches on. Allow at least 15 minutes warm-up for frequency meter.

Step 3. Set converter SHIFT switch to WIDE, and SPEED switch to SLOW. Turn POWER switch to On position. Allow five minute warm-up period.

Step 4. Remove cable attached to AUDIO INPUT connector, J2, at rear of converter cabinet.

Step 5. Connect audio oscillator output terminals to AUDIO INPUT connector, J2, or to terminals 1 and 3 of Z1 (figure 5-1).

Step 6. Set audio oscillator to 3 kc, using frequency meter.

Step 7. Set vtvm range switch to 10 volts and connect to audio oscillator output terminals. Adjust audio oscillator to obtain vtvm indication of 6.0 volts.

Step 8. Adjust multimeter to measure 15 volts dc. Connect positive lead of multimeter to black test point, TP-★ 4 (figure 5-2). Connect negative lead of multimeter to converter chassis.

Step 9. Adjust converter LEVEL control to obtain multimeter indication of 15 volts.

Step 10. Adjust audio oscillator to 1500 cps, using

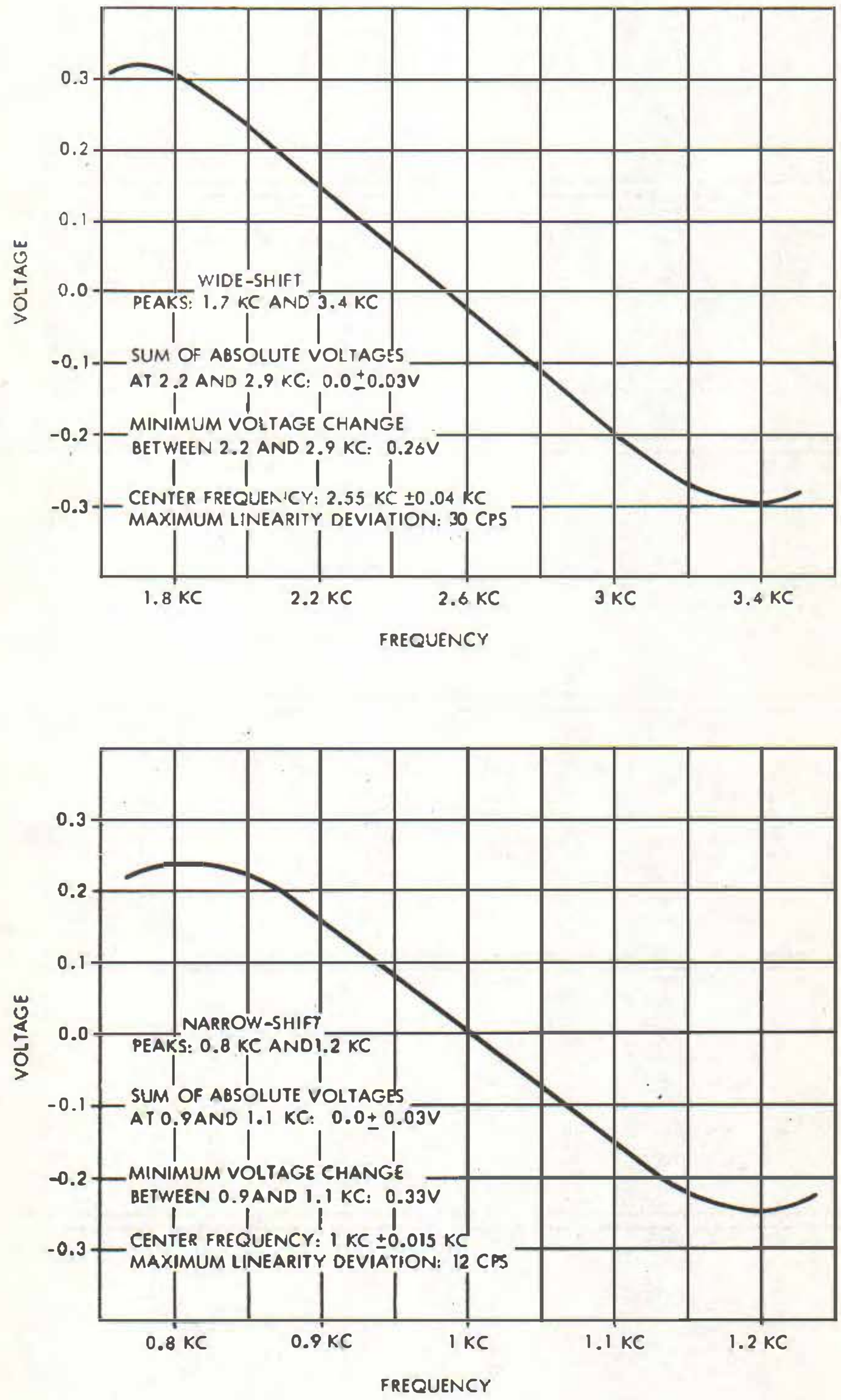
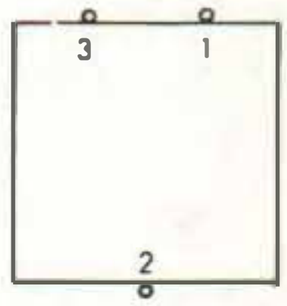
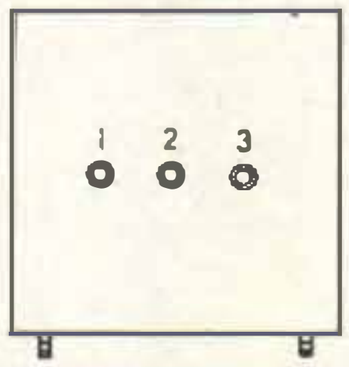
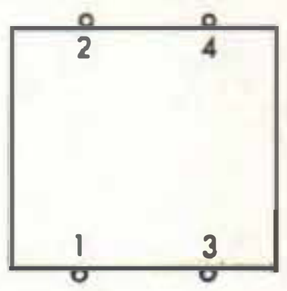
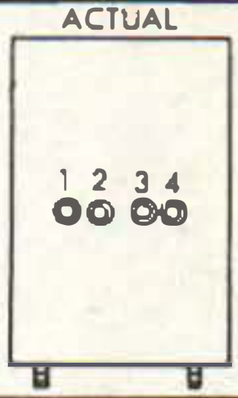
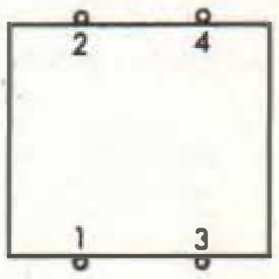
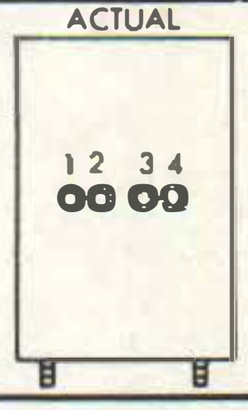
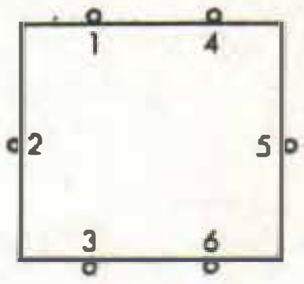
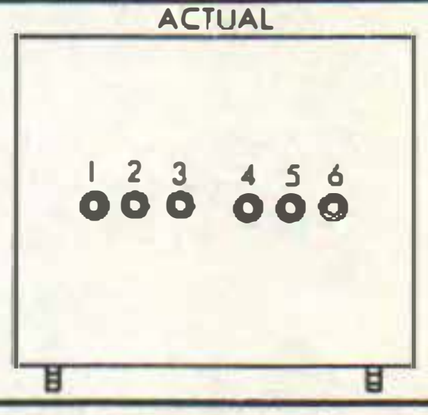


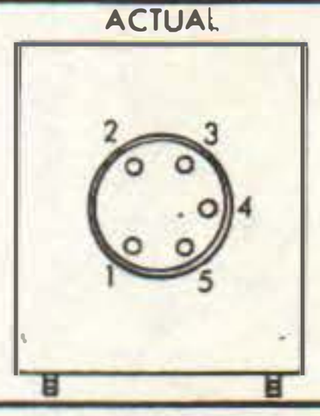
Figure 6-1. Discriminator Frequency Response Curves

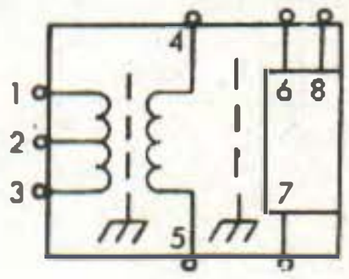
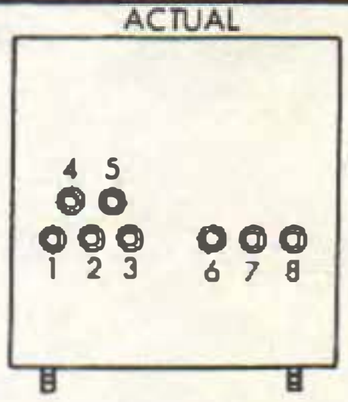
	TERMINALS	RESISTANCE	SCHEMATIC	ACTUAL
FL1	1 to 2 1 to 3 2 to 3	∞ ∞ ∞		

	TERMINALS	RESISTANCE	SCHEMATIC	ACTUAL
FL2	1 to 4 2 to 3 3 to 4	42 Ω 186 Ω 223 Ω		

	TERMINALS	RESISTANCE	SCHEMATIC	ACTUAL
FL3	1 to 3 2 to 3 3 to 4	42 Ω 160 Ω 103 Ω		

	TERMINALS	RESISTANCE	SCHEMATIC	ACTUAL
FL4	1 to 2 1 to 3 2 to 3 4 to 5 4 to 6 5 to 6	∞ 3060 Ω ∞ ∞ 3125 Ω ∞		

	TERMINALS	RESISTANCE	SCHEMATIC	ACTUAL
T1, T2	1 to 2 3 to 4 3 to 5 4 to 5	35 Ω 590 Ω 1260 Ω 670 Ω		

	TERMINALS	RESISTANCE	SCHEMATIC	ACTUAL
Z1	1 to 2 1 to 3 4 to 5 6 to 7 7 to 8	10.3 Ω 22.2 Ω 464 Ω 55 Ω 55 Ω		

ALL RESISTANCE MEASUREMENTS ±20%

Figure 6-2. Filter and Transformer Resistance Data

frequency meter, keeping output voltage at 6.0 volts. Reverse multimeter leads. Record multimeter indication.

Step 11. Increase audio oscillator frequency in 50 cps steps to 3700 cps. Record multimeter voltage indication at each frequency.

Step 12. Plot these points on a graph. Connect points with a smooth curve.

Step 13. Draw a straight line between 2200 and 2300 cps points. Frequency deviation from curve shall not be greater than 35 cps. Crossover point shall be between 2500 and 2600 cps. Peaks shall be 1700 ±100 cps and 3400 ±150 cps.

Step 14. Turn POWER switch to Off and disconnect vtvm, multimeter, and audio oscillator from converter. Reconnect cable to AUDIO INPUT connector, J2, at rear of converter cabinet.

(b) NARROW-SHIFT DISCRIMINATOR.

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Connect vtvm, audio oscillator, and frequency meter to power source and turn power switches on. Allow at least 15 minutes warm-up for frequency meter.

Step 3. Set converter SHIFT switch to NARROW and turn POWER switch to On position. Allow five minute warm-up period.

Step 4. Remove cable connected to AUDIO INPUT connector, J2, at rear of converter cabinet.

Step 5. Connect audio oscillator output terminals to AUDIO INPUT connector, J2, or to terminals 1 and 3 of Z1 (figure 5-1).

Step 6. Set audio oscillator to 1200 cps, using frequency meter.

Step 7. Set vtvm range switch to 10 volts and connect to audio oscillator output terminals. Adjust audio oscillator to obtain vtvm indication of 6.0 volts.

Step 8. Adjust multimeter to measure 15 volts dc. Connect positive lead of multimeter to black test point, TP-★4 (figure 5-2). Connect negative lead of multimeter to converter chassis.

Step 9. Adjust converter LEVEL control to obtain multimeter indication of 15 volts.

Step 10. Adjust audio oscillator to 500 cps, keeping output voltage at 6.0 volts. Reverse multimeter leads. Record multimeter indication.

Step 11. Increase audio oscillator frequency in 100 cps steps to 700 cps and in 20 cps steps from 700 cps to 1500 cps. Record multimeter voltage indication at each frequency.

Step 12. Plot these points on a graph. Connect points with a smooth curve.

Step 13. Draw a straight line between 900 and 1100 cps points. Frequency deviation from curve shall not be greater than 15 cps. Crossover point shall be between 980 and 1020 cps. Peaks shall be 800 ±30 cps and 1200 ±40 cps.

Step 14. Turn POWER switch to Off and disconnect vtvm, multimeter, and audio oscillator from converter. Reconnect cable to AUDIO INPUT connector, J2, at rear of converter cabinet.

(8) LOW-PASS KEYING FILTER TESTS. - Table 6-2 lists characteristics of low-pass keying filter. Resistance information is given in figure 6-2. Perform the following procedures to check characteristics of low-pass keying filter FL4. Replace filter if it fails these tests.

Step 1. Withdraw chassis to stops on drawer slides, and operate interlock switches (figure 2-10) by pressing in on button at left side of switch block.

Step 2. Connect vtvm's, audio oscillator, and frequency meter to power source and turn power switches on. Allow at least 15 minutes warm-up for frequency meter.

Step 3. Set converter SPEED switch to SLOW, and turn POWER switch to On position. Allow five minute warm-up period.

Step 4. Connect a 20k ±1% resistor to "hot" terminal of audio oscillator. Connect other end of resistor to terminal 1 of FL4 (figure 5-1). Connect ground terminal of audio oscillator to converter chassis.

Step 5. Adjust audio oscillator frequency to 15 cps, using frequency meter.

Step 6. Connect a 20k ±1% resistor across vtvm terminals.

Step 7. Set vtvm range switch to 10 volts. Connect vtvm between terminal 3 of FL4 and converter chassis using coaxial cable.

Step 8. Adjust audio oscillator for vtvm indication of 5.0 volts.

Step 9. Set range switch of second vtvm to 10 volts and connect to audio oscillator output terminals (on oscillator side of 20k resistor). Record vtvm indication.

Step 10. Increase audio oscillator frequency to 45 cps, keeping output voltage constant. Indication of vtvm connected to terminal 3 of FL4 must be 3.15 to 4.0 volts.

Step 11. Increase audio oscillator frequency to 140

cps, keeping output voltage constant. Indication of vtvm connected to terminal 3 of FL4 must not be greater than 0.63 volt.

Step 12. Increase audio oscillator frequency to 560 cps, keeping output voltage constant. Indication of vtvm connected to terminal 3 of FL4 must not be greater than 0.016 volt.

Step 13. Increase audio oscillator frequency to 8 kc, keeping output voltage constant. Indication of vtvm connected to terminal 3 of FL4 must not be greater than 0.0027 volt at any frequency from 1500 cps to8 kc.

Step 14. Set converter SPEED switch to FAST.

Step 15. Adjust audio oscillator frequency to 60 cps, using frequency meter.

Step 16. Move audio oscillator lead from terminal 1 of FL4 to terminal 4 of FL4.

Step 17. Move vtvm lead from terminal 3 of FL4 to terminal 6 of FL4.

Step 18. Adjust audio oscillator output for 5.0 volt indication on vtvm connected to terminal 6 of FL4.

Step 19. Record audio oscillator output voltage (on oscillator side of 20k resistor).

Step 20. Increase audio oscillator frequency to 175 cps, keeping output voltage constant. Indication of vtvm connected to terminal 6 of FL4 must be 3.15 to 4.0 volts.

Step 21. Increase audio oscillator frequency to 560 cps, keeping output voltage constant. Indication of vtvm connected to terminal 6 of FL4 must not be greater than 0.63 volt.

Step 22. Increase audio oscillator frequency to 2240 cps, keeping output voltage constant. Indication of vtvm connected to terminal 6 of FL4 must not be greater than 0.016 volt.

Step 23. Increase audio oscillator frequency to 8 kc, keeping output voltage constant. Indication of vtvm connected to terminal 6 of FL4 must not be greater than 0.0027 volt at any frequency from 4 kc to 8 kc.

Step 24. Turn POWER switch to Off and disconnect audio oscillator and vtvm from converter.

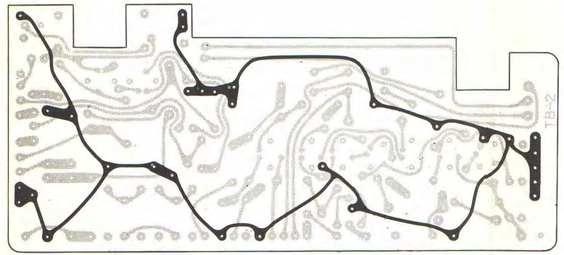
WIRE CHART

WIRE NO.	STA	FROM DESIGNATION	TERM.	STA	TO DESIGNATION	TERM.	COLOR
1	1	S4	1	34	TB2	27	WHT-RED
2	1	S4	10	16	TB2	44	WHT-YEL-RED
3	1	S4	12	17	J1	37	WHT-ORN-GRN(SHLD)
4		WIRE 3 SHLD	*	16	TB2	62	BLK
5	1	S4	5	16	TB2	39	WHT-ORN-VIO
5	1	S4	6	13	J1	5	WHT-BLK-BRN(SHLD)
		WIRE 4 SHLD	*	16	TB2	60	BLK
6	1	S4	7	1	S4	9	WHT
51	1	S1B	10	16	TB2	2	WHT-ORN-BRN(SHLD)
		WIRE 7 SHLD	*	16	TB2	54	BLK
8	1	S1B	11	7	FL2	4	WHT-BLK-VIO(SHLD)
		WIRE 8 SHLD	*	16	TB2	56	BLK
9	1	S1B	12	16	TB2	58	WHT-ORN-BRN(SHLD)
		WIRE 9 SHLD	*	16	TB2	57	BLK
10	2	S1B	1	16	TB2	3	ORN(SHLD)
		WIRE 10 SHLD	*	16	TB2	61	BLK
11	2	S1B	2	7	FL2	1	WHT-RED-GRN(SHLD)
		WIRE 11 SHLD	*	16	TB2	53	BLK
12	2	S1B	3	8	FL3	1	WHT-RED-BLU(SHLD)
		WIRE 12 SHLD	*	16	TB2	50	BLK
13	2	S1B	4	16	TB2	52	YEL
14	2	S1B	5	7	FL2	2	WHT-ORN-BLK(SHLD)
		WIRE 14 SHLD	*	16	TB2	51	BLK
15	2	S1B	6	8	FL3	2	WHT-BLK(SHLD)
		WIRE 15 SHLD	*	16	TB2	57	BLK
16	2	S1B	7	16	TB2	1	WHT-ORN-BLU(SHLD)
		WIRE 16 SHLD	*	16	TB2	54	BLK
17	3	S1A	2	5	J1	6	WHT-BRN-VIO
18	3	S1A	3	6	FL1	1	WHT-BLK-YEL
19	3	S1A	4	16	TB2	31	WHT-ORN-ORN
20	3	S1A	5	5	J1	8	WHT-VIO-GRN
21	3	S1A	6	6	FL1	3	WHT-BLK-GRN
22	3	K4	1	16	TB2	30	WHT-BLU
23	4	K4	2	16	TB2	33	WHT-GRN
24	4	K4	3	16	TB2	35	WHT-YEL
25	5	J1	1	13	J1	1	WHT-ORN-RED(SHLD)
		WIRE 25 SHLD	*	16	TB2	64	BLK
26	3	S1B	2	13	J2	1	WHT-BRN-GRN(SHLD)
		WIRE 26 SHLD	*	16	TB2	63	BLK
27	3	Z1	3	13	J1	3	BLK
28	3	Z1	3	13	J1	4	WHT-BRN-RED(SHLD)
		*					BLK
29	3	Z1	2	16	TB2	64	BLK
30	3	FL1	2	16	TB2	45	BLK
31	7	FL2	3	16	TB2	10	BLK
32	9	FL2	3	16	TB2	55	BLK
33	9	T1	1	16	TB2	11	WHT
34	9	T1	2	16	TB2	36	WHT-GRY-BLU
35	9	T1	3	16	TB2	43	WHT-ORN-GY
36	9	T1	5	16	TB2	38	WHT-VIO-VIO
37	9	T1	6	16	TB2	29	WHT-RED-RED
38	10	T2	2	16	TB2	8	BLU
39	10	T2	3	16	TB2	11	WHT
40	10	T2	5	16	TB2	30	WHT-GRN-BLU
41	10	T2	5	16	TB2	18	WHT-BLK-BLU
42	10	T2	6	16	TB2	19	WHT-BRN-GY
43	11	Q4	8	16	TB2	5	WHT-GRN-YEL

WIRE CHART (CONT)

WIRE NO.	STA	FROM DESIGNATION	TERM.	STA	TO DESIGNATION	TERM.	COLOR
44	11	Q4	C	16	TB2	6	WHT-GY-BLU
45	11	Q4	E	16	TB2	7	WHT-BRN-YEL
46	12	Q5	B	16	TB2	9	GRN
47	12	Q5	C	16	TB2	8	BLU
48	12	Q5	E	16	TB2	10	WHT-GY-YEL
49	13	J3	8	16	TB2	50	WHT-BLU-YEL(SHLD)
		WIRE 49 SHLD	*	16	TB2	51	BLK
50	13	J1	9	17	S5B	C	GY
51	13	J1	10	16	S5A	C	WHT-GY
52	13	J1	12	34	TB1	35	WHT-ORN-YEL
53	13	J1	14	16	TB2	13	BLU
54	14	#1F	1	16	TB2	1	WHT-YEL
55	14	#1F	2	16	TB2	14	WHT
56	14	#1F	3	16	TB2	1	BLK
57	14	#9G	1	16	TB1	22	YEL
58	14	#9G	2	16	TB1	23	WHT
59	14	#9G	3	16	TB1	24	BLK
60	15	#7F	1	16	TB1	46	WHT
61	15	#7F	2	16	TB1	48	YEL
62	15	#7F	3	16	TB1	47	WHT-YEL
63	15	#8D	1	16	TB1	59	WHT-ORN-VIO
64	15	#8D	2	16	TB1	60	YEL
65	15	#8D	3	16	TB1	61	WHT
66	16	TB2	37	34	TB1	58	VIO
67	16	TB2	37	34	TB1	59	YEL
68	16	TB2	37	34	TB1	42	RED
69	16	TB2	4	16	TB2	34	WHT-VIO
70	16	TB2	37	31	S5	2	WHT-ORN-BRN(SHLD)
		WIRE 70 SHLD	*	16	J1	12	BLK
71	16	TB2	21	31	S5	5	WHT-BRN-BLU(SHLD)
		WIRE 71 SHLD	*	16	J1	15	BLK
72	16	TB2	12	34	TB1	50	VIO
73	16	TB2	4	16	TB2	41	WHT-VIO
74	16	TB2	16	16	TB2	17	WHT
75	16	TB2	40	16	TB2	61	WHT
76	16	TB2	42	16	TB2	45	WHT
153	17	TB1	1	18	J5	1	WHT-ORN-RED(SHLD)
		WIRE 153 SHLD	*	18	J5	8	BLK
154	17	TB1	2	18	J5	8	WHT-BRN-RED(SHLD)
		WIRE 154 SHLD	*	18	J5	--	BLK
155	17	TB1	3	18	E1	--	WHT-BRN-GRN(SHLD)
		WIRE 155 SHLD	*	18	J3	--	BLK
156	17	TB1	5	18	J5	--	WHT-BLK-BRN(SHLD)
		WIRE 156 SHLD	*	18	E5	--	BLK
157	17	TB1	6	18	J4	--	WHT-ORN-GRN(SHLD)
		WIRE 157 SHLD	*	18	E5	--	BLK
158	17	TB1	8	18	J6	A	WHT-BLU-YEL(SHLD)
		WIRE 158 SHLD	*	18	J6	A	BLK
159	17	TB1	9	18	J3	B	WHT
160	17	TB1	10	18	J3	C	WHT-GY
161	17	TB1	12	18	J2	--	WHT-ORN-YEL
162	17	TB1	--	18	E5	--	BLK
163	18	J3	--	18	E5	--	BLK
164	18	J6	5	18	E5	--	BLK
165	18	E5	--	18	E4	--	BLK
166	18	E4	--	18	E5	--	BLK

NOTES:
* THIS END OF SHIELD NOT TERMINATED. (SHIELD ENDS IN CABLE, NEAR BREAKOUT.)

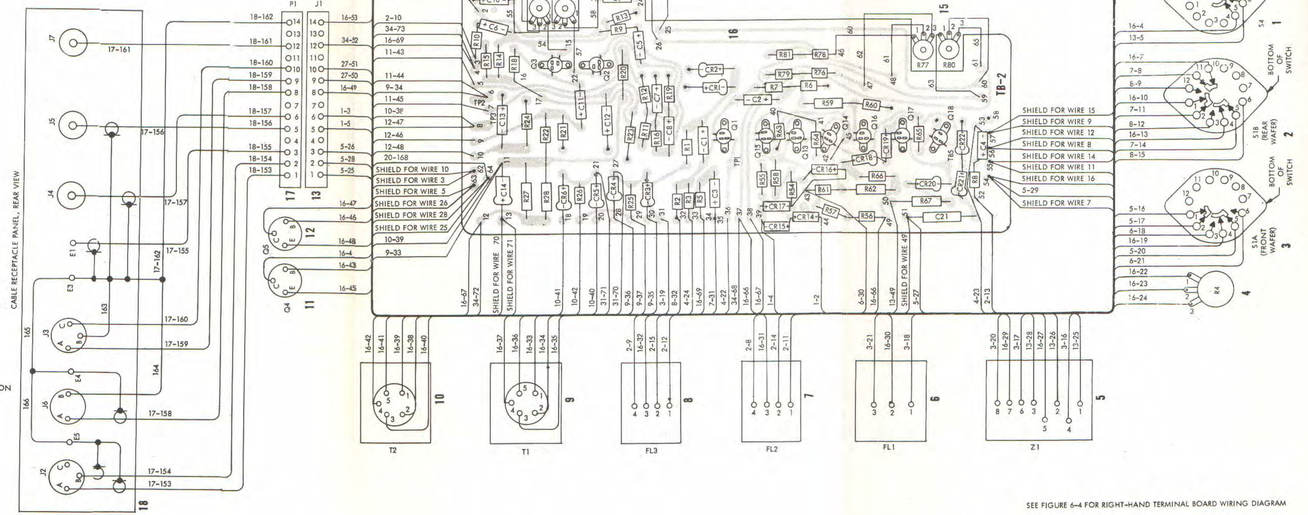


DARK LINES REPRESENT LEADS ON REAR OF TERMINAL BOARD.

LIGHT LINES REPRESENT LEADS ON FRONT OF TERMINAL BOARD.

NOTES:
1. DOTS ON TERMINALS INDICATE CONNECTION BETWEEN FRONT AND BACK LEADS
2. LARGE NUMBERS ARE STATION NUMBERS
3. CODING SYSTEM

2-6
- 2 = WIRE NUMBER
- 6 = STATION NUMBER (TO LOCATE OTHER END OF WIRE)



SEE FIGURE 6-4 FOR RIGHT-HAND TERMINAL BOARD WIRING DIAGRAM

Figure 6-3. Frequency Shift Converter CV-483/URA-17, Left-Hand Terminal Board, Wiring Diagram 6-11,6-12

SECTION 7
PARTS LIST

7-1. INTRODUCTION.

Reference designations have been assigned to identify all maintenance parts of Comparator-Converter Group AN/URA-17, hereinafter referred to as the AN/URA-17. They are used for marking the equipment (adjacent to the part they identify) and are included on drawings, diagrams, and the parts list. The letters of a reference designation indicate the kind of part (generic group), such as resistor, capacitor, transistor, etc. The number differentiates between parts of the same generic group. Sockets associated with a particular plug-in device, such as a transistor or fuse, are identified by a reference designation which includes the reference designation of the plug-in device. For example, the socket for fuse F1 is designated XF1.

Stock Number Identification Tables (SNIT) or Allowance Parts List (APS) issued by the Electronics Supply Office include Federal Stock Numbers and Source Maintenance and Recoverability Codes. Therefore, reference shall be made to the appropriate SNIT or APL for this information.

7-2. MAINTENANCE PARTS LIST.

Table 7-1 lists all maintenance parts used in the AN/URA-17. Column 1 lists the reference designations of the various parts in alphabetical and numerical order. Column 2 refers to explanatory notes, if any, that appear in paragraph 7-4. Column 3 gives the name and describes the various parts. Complete information is given for all key parts (parts differing from any part previously listed in this table). The name and description are omitted for other parts. However, reference is made to the key part for the data. Column 4 indicates how the part is used and gives its functional location in the equipment. The figure listed shows the physical location of the part.

7-3. LIST OF MANUFACTURERS.

Table 7-2 lists manufacturers of parts used in the AN/URA-17.

7-4. NOTES.

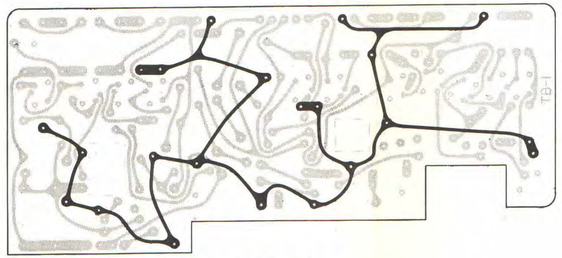
Not applicable.

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
1-199		CONVERTER, FREQUENCY SHIFT: CV-483/URA-17, Hoffman part/dwg No. 8020000098	Two such units constitute one AN/URA-17.
CR1		SEMICONDUCTOR DEVICE, DIODE: Germanium, Texas Instrument Corp., type 1N538	Limiter at input to Q1 (Figure 6-3)
CR2		Same as CR1	Limiter at input to Q1 (Figure 6-3)

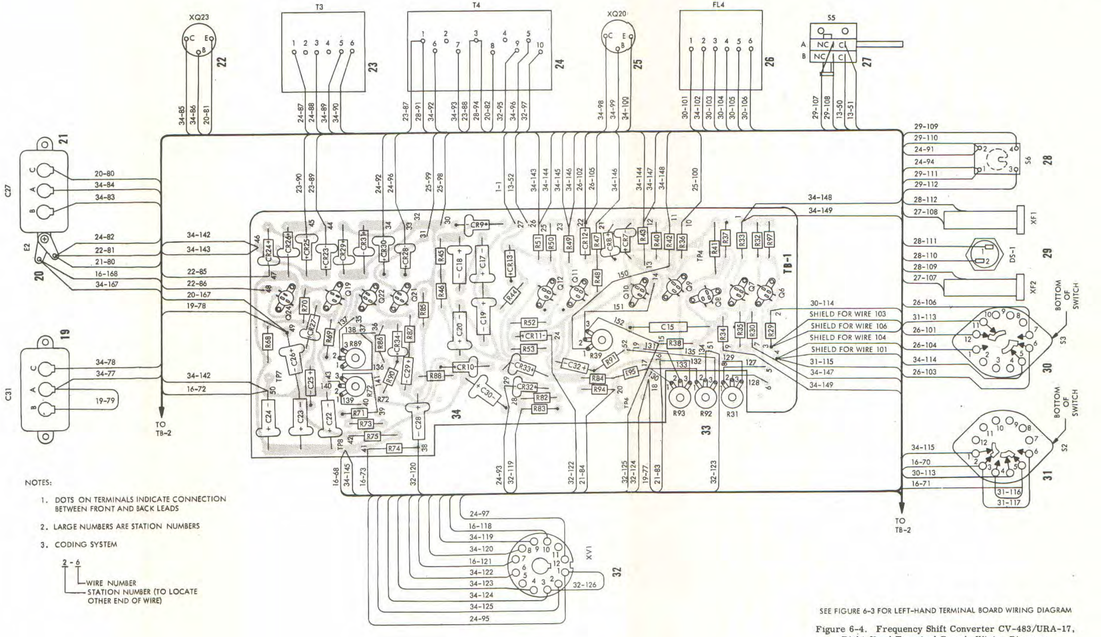
WIRE NO.	FROM STA	FROM DESIGNATION	FROM TERM.	TO STA	TO DESIGNATION	TO TERM.	COLOR
77	19	C31	A	34	TB1	18	WHT-ORN-VIO
78	19	C31	C	34	TB1	49	BLK
79	19	C31	A	19	C31	5	WHT
80	20	T2	--	31	C27	C	BLK
81	20	T2	--	22	Q23	E	WHT-BLK-YEL
82	20	T2	--	24	T4	6	WHT-BLK
83	21	C27	B	34	TB1	16	WHT-ORN-BLU
84	21	C27	A	34	TB1	30	WHT-ORN-RED
85	22	Q23	C	34	TB1	47	WHT-BLU-YEL
86	22	Q23	B	34	TB1	48	WHT-GRN-GY
87	23	T3	--	24	T4	1	WHT-GY-GY
88	23	T3	--	24	T4	3	WHT-RED-GY
89	23	T5	B	34	TB1	44	WHT-ORN-BLK
90	23	T5	A	34	TB1	45	WHT-BLK-VIO
91	24	T4	--	28	S4	2	WHT-GY-GY
92	24	T4	9	34	TB1	34	WHT-GRN-GRN
93	24	T4	7	34	TB1	29	WHT-BRN-GRN
94	24	T4	8	28	S4	1	WHT-RED-GY
95	24	T4	8	32	XV1		WHT-BRN
96	24	T4	9	34	TB1	33	WHT-VIO-YEL
97	24	T4	10	32	XV1	30	WHT
98	25	Q25	C	34	TB1	50	WHT-BLU-VIO
99	25	Q25	B	34	TB1	31	WHT-GRN
100	25	Q25	E	34	TB1	10	WHT-YEL-RED
101	26	FL4	1	30	S3	12	WHT-ORN-BLU(SHLD)
	WIRE 101 SHLD		4	34	TB1	4	BLK
102	26	FL4	2	34	TB1	32	BLK
103	26	FL4	3	30	S3	6	WHT-ORN-ORN(SHLD)
	WIRE 103 SHLD		4	30	S3	1	WHT-RED-GRN(SHLD)
104	26	FL4	4	34	TB1	4	BLK
	WIRE 104 SHLD		4	34	TB1	4	BLK
105	26	FL4	5	34	TB1	42	BLK
106	26	FL4	6	30	S3	7	WHT-BRN-GRN(SHLD)
	WIRE 106 SHLD		4	34	TB1		BLK
107	27	S5	NC	29	XF2	ENDS	WHT-ORN-BLU
108	27	S5	NC	29	XF1	ENDS	WHT-GY-BLU
109	28	S6	1	29	XF2	SIDE	WHT-BRN-GY
110	28	S6	2	29	XDS1	2	WHT-GY-GY
111	28	S6	3	29	XDS1	1	WHT-RED-GY
112	28	S6	3	29	XF1	SIDE	WHT-GRN-GY
113	30	S3	5	31	S2	4	WHT-RED-BLU
114	30	S3	8	34	TB1	7	WHT-RED-BLK
115	31	S2	1	31	S2	5	BLK
116	31	S2	3	31	S2	8	WHT
117	31	S2	7	31	S2	6	WHT
118	32	XV1	10	18	TB2	26	WHT-ORN-BRN
119	32	XV1	1	34	TB1	28	WHT-BRN-BLU
120	32	XV1	8	34	TB1	38	WHT-BLK
121	32	XV1	2	34	TB1	25	WHT-ORN
122	32	XV1	4	34	TB1	24	WHT-GRN-GRN
123	32	XV1	5	34	TB1	51	WHT-BLK-BRN
124	32	XV1	3	34	TB1	18	WHT-ORN-VIO
125	32	XV1	6	34	TB1	52	WHT-RED-GRN
126	32	XV1	7	32	XV1	3	WHT
127	33	R31	1	34	TB1	5	WHT-YEL
128	33	R31	2	34	TB1	6	WHT
129	33	R31	3	34	TB1	8	YEL
130	33	R92	1	34	TB1	17	BRN
131	33	R93	1	34	TB1	53	WHT-RED-GRN
132	33	R92	2	34	TB1	16	WHT
133	33	R93	2	34	TB1	17	BRN
134	33	R92	3	34	TB1	51	WHT-BLK-BRN
135	33	R93	3	34	TB1	39	WHT
136	34	R92	1	34	TB1	39	WHT
137	34	R89	1	34	TB1	35	GRN
138	34	R89	2	34	TB1	54	WHT-GRN
139	34	R89	3	34	TB1	40	WHT
140	34	S72	1	34	TB1	43	GRN
141	34	S72	2	34	TB1	39	WHT-GRN
142	34	S72	3	34	TB1	44	VIO
143	34	TB1	50	34	TB1	26	VIO
144	34	TB1	46	34	TB1	13	VIO
145	34	TB1	33	34	TB1	22	RED
146	34	TB1	45	34	TB1	21	RED
147	34	TB1	33	34	TB1	7	VIO
148	34	TB1	11	34	TB1	1	RED
149	34	TB1		34	TB1	9	RED
150	34	TB1	29	34	TB1	53	WHT
151	34	TB1	3	34	TB1	14	GRN
152	34	TB1	48	34	TB1	15	WHT-GRN
153	34	TB1	49	100	K5		BLK
154	34	TB1	49	18	TB2	64	BLK

NOTES:
* THIS END OF SHIELD NOT TERMINATED. (SHIELD ENDS IN CABLE, NEAR BREAKOUT.)



DARK LINES REPRESENT LEADS ON REAR OF TERMINAL BOARD.

LIGHT LINES REPRESENT LEADS ON FRONT OF TERMINAL BOARD.



NOTES:

1. DOTS ON TERMINALS INDICATE CONNECTION BETWEEN FRONT AND BACK LEADS
2. LARGE NUMBERS ARE STATION NUMBERS
3. CODING SYSTEM

2 - 6
- WIRE NUMBER
- STATION NUMBER (TO LOCATE OTHER END OF WIRE)

SEE FIGURE 6-3 FOR LEFT-HAND TERMINAL BOARD WIRING DIAGRAM

Figure 6-4. Frequency Shift Converter CV-483/URA-17, Right-Hand Terminal Board, Wiring Diagram

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
CR3		Same as CR1	High frequency (mark) detector (Figure 6-3)
CR4		Same as CR1	High frequency (mark) detector (Figure 6-3)
CR5		Same as CR1	Low frequency (space) detector (Figure 6-3)
CR6		Same as CR1	Low frequency (space) detector (Figure 6-3)
CR7		SEMICONDUCTOR DEVICE, DIODE: Zener, Hoffman Semiconductor Div., type 1N3025B	Zener regulator, Q10 emitter (Figure 6-4)
CR8		Same as CR7	Zener regulator, Q10 emitter (Figure 6-4)
CR9		Same as CR1	Positive signal clamp at axis restorer (Figure 6-4)
CR10		Same as CR1	Negative signal clamp at axis restorer (Figure 6-4)
CR11		SEMICONDUCTOR DEVICE, DIODE: Silicon, Texas Instrument Corp., type 1N457	Key pulse rectifier, mark lock-up input (Figure 6-4)
CR12		Same as CR11	Bias discharge, Q11 base (Figure 6-4)
CR13		Same as CR11	Q12 base bias (Figure 6-4)
CR14		Same as CR11	P/O diversity comparator network work (Figure 6-3)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
CR15		Same as CR11	P/O diversity comparator network (Figure 6-3)
CR16		Same as CR11	P/O diversity comparator network (Figure 6-3)
CR17		Same as CR11	P/O diversity comparator network (Figure 6-3)
CR18		Same as CR1	Isolates +48 vdc and keyer +120 vdc (Figure 6-3)
CR19		Same as CR11	Protects Q17 emitter (Figure 6-3)
CR20		Same as CR1	Protects against reversal of +120 vdc keyer supply (Figure 6-3)
CR21		SEMICONDUCTOR DEVICE, DIODE: Zener, Hoffman Semiconductor Div., type 1N3042B	Protects against inductive kickback from keyer relay (Figure 6-3)
CR22		Same as CR21	Protects against inductive kick-back from keyer relay (Figure 6-3)
CR23		Same as CR1	-48 vdc supply rectifier (Figure 6-4)
CR24		Same as CR1	-48 vdc supply rectifier (Figure 6-4)
CR25		Same as CR1	-48 vdc supply rectifier (Figure 6-4)
CR26		Same as CR1	-48 vdc supply rectifier (Figure 6-4)
CR27		SEMICONDUCTOR DEVICE, DIODE: Zener; Hoffman Semiconductor Div., type 1N3029B	Bias stabilizer, Q19 emitter (Figure 6-4)
CR28		Same as CR1	+48 vdc supply rectifier (Figure 6-4)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
CR29		Same as CR1	+48 vdc supply rectifier (Figure 6-4)
CR30		Same as CR1	+48 vdc supply rectifier (Figure 6-4)
CR31		Same as CR1	+48 vdc supply rectifier (Figure 6-4)
CR32		SEMICONDUCTOR DEVICE, DIODE: Silicon, Pacific Semiconductor, Inc., type 1N1731	-560 vdc supply rectifier (Figure 6-4)
CR33		Same as CR32	-560 vdc supply rectifier (Figure 6-4)
CR34		Same as CR27	Bias stabilizer, Q22 emitter (Figure 6-4)
C1		CAPACITOR, FIXED, ELECTROLYTIC: Tantalytic, 6.8 uf, 35 vdc working, Sprague part No. 150D685X0035B2	Coupling, S1-A to Q1 base (Figure 6-3)
C2		Same as C1	Bypass, Q1 emitter (Figure 6-3)
C3		Same as C1	Decoupling, Q1 collector (Figure 6-3)
C4		Same as C1	Coupling, Q1 collector to S1-B (Figure 6-3)
C5		Same as C1	Coupling, S1-B to Q2 base (Figure 6-3)
C6		Same as C1	Coupling S1-B to Q3 base (Figure 6-3)
C7		Same as C1	Decoupling, Q2 collector (Figure 6-3)
C8		Same as C1	Coupling, Q2 collector to Q4 base (Figure 6-3)
C9		Same as C1	Bypass, Q2 emitter (Figure 6-3)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
C10		Same as C1	Bypass, Q3 emitter (Figure 6-3)
C11		Same as C1	Coupling, Q3 collector to Q5 base (Figure 6-3)
C12		CAPACITOR, FIXED, ELECTROLYTIC: 47 uf, 10 vdc working, Sprague solid tant. cap, ±10% insulating sleeve, part No. 150D476X9010R2	Bypass, Q4 emitter (Figure 6-3)
C13		CAPACITOR, FIXED, ELECTROLYTIC: 120 uf, 10 vdc working, Sprague solid tant. cap, ±10% insulating sleeve, part No. 150D127X9010R2	Bypass, Q5 emitter (Figure 6-3)
C14		CAPACITOR, FIXED, ELECTROLYTIC: 20 uf -15% +50%, 60 vdc working, MIL-C-3965-4 type CL45BK200TP1	Decoupling, Q5 collector (Figure 6-3)
C15		CAPACITOR, FIXED, PAPER DIELECTRIC: 0.22 uf ±10%, 100 vdc, MIL-C-25/1 type CP05A1KB224K1	Decoupling, Q8 collector (Figure 6-4)
C16		Not used	
C17		CAPACITOR, FIXED, ELECTROLYTIC: 50 uf -15% +50%, 60 vdc working, MIL-C-3965-4 type CL45BK500TP1	P/O axis restorer network (Figure 6-4)
C18		Same as C17	P/O axis restorer network (Figure 6-4)
C19		Same as C17	P/O axis restorer network (Figure 6-4)
C20		Same as C17	P/O axis restorer network (Figure 6-4)
C21		CAPACITOR, FIXED, PAPER DIELECTRIC: 0.047 uf, 200 vdc, MIL-C-25/1 type CP05A1KC473K1	Bypass, Q17 collector (Figure 6-3)
C22		CAPACITOR, FIXED, ELECTROLYTIC: 25 uf -15% +50%, 125 vdc, MIL-C-3965-4 type CL45BP250TP1	P/O -48 v power supply filter network (Figure 6-4)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
C23		Same as C22	P/O -48 v power supply filter network (Figure 6-4)
C24		Same as C22	P/O -48 v power supply filter network (Figure 6-4)
C25		Same as C1	P/O RC network for Q19 (Figure 6-4)
C26		Same as C14	P/O -48 v power supply filter network (Figure 6-4)
C27A-B		CAPACITOR, FIXED, PAPER DIELECTRIC: dual section; 0.1 uf ±20%, 1000 vdc working per section; MIL-C-25/4 type CP54B4EG104V1	P/O -560 v power supply filter network (Figure 5-1)
C28		Same as C22	P/O +48 v power supply filter network (Figure 6-4)
C29		Same as C1	P/O RC network for Q22 (Figure 6-4)
C30		Same as C14	P/O +48 v power supply filter network (Figure 6-4)
C31A-B		Same as C27A-B	P/O -560 v power supply filter network (Figure 5-1)
C32		Same as C1	P/O biasing RC network for Q11 (Figure 6-4)
DS1		LAMP, GLOW: 0.04 watt, T-3-1/4 bulb; MIL-L-15098B type NE-51	Power on-off indicator (Figure 5-1)
E1		TERMINAL STUD: silver plated brass term; 39/64 in. lg by 1/4 in. hex base; No. 6-32 threaded ceramic base; 2,500 RMS breakdown voltage at 60 cps; CTC part No. X2045-F6	Grounded input center tap (Figure 2-6)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
FL1		FILTER, BANDPASS: 2550 cps ±50 cps operating freq; 8000 ohms ±5% input/output impedance at 2550 cps; four terminals; 2-1/4 in. lg by 2-1/4 in. b by 1-3/4 in. w; Hoffman Spec Control dwg 8180000031; Transonic Inc., type TS-5214	Wideband filter, input to S1-A (Figure 5-1)
FL2		FILTER, BANDPASS: peaked at 800 cps ±40 cps and 1200 cps ±40 cps with crossover at 1000 cps ±15 cps, four terminals, 2-1/4 in. lg by 1-3/4 in. h by 1-1/2 in. w; Hoffman Spec Control dwg 8180000028; Transonic Inc., type TS-5215	Narrow-shift discriminator between Q1 and Q2 or Q3 (Figure 5-1)
FL3		FILTER, BANDPASS: peaked at 1700 cps ±100 cps and 3400 cps ±150 cps with crossover at 2550 cps ±40 cps; four terminals; 2-1/4 in. lg by 1-3/4 in. h by 1-1/2 in. w; Hoffman Spec Control dwg 8180000029; Transonic Inc., type TS-5216	Wide-shift discriminator between Q1 and Q2 or Q3 (Figure 5-1)
FL4		FILTER, BANDPASS, LOW PASS: section A: 45 cps cutoff frequency; 2 db or less insertion loss at 15 cps; 18 db at 140 cps; 50 db min at 560 cps; 65 db at 1500 cps to 8 kc; 20 k ±20% input and output impedance at 5 cps; Section B: 175 cps cutoff frequency, 2 db or less insertion loss at 15 cps; 18 db at 560 cps; 50 db at 2240 cps; 65 db at 4 kc to 8 kc; Hoffman Spec Control dwg 8180000030; Transonic Inc., type TS-5223	Keying filter at input to Q6 (Figure 5-1)
F1		FUSE, CARTRIDGE: silver plated, MS90079-18-1 type F03GR500B 5920-280-5038	AC line fuse (Figure 5-1)
F2		Same as F1 5920-280-3811	AC line fuse (Figure 5-1)
J1		CONNECTOR, RECEPTACLE, ELECTRICAL: 15 contacts, gold plated; low loss plastic dielectric; brass body, iridite finish; Cannon Electric Co. part No. DAM-15P	Distribution jack on CV-483/URA-17 chassis (Figure 5-1)
J2		CONNECTOR, RECEPTACLE, ELECTRICAL: three No. 16 female contacts, low loss plastic dielectric insulation; box type aluminum alloy body; cad plate and chromate finish; Cannon Electric Co. part No. MS3102A14S-7S	AUDIO INPUT connector on cable receptacle panel (Figure 2-4)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
J3		CONNECTOR, RECEPTACLE, ELECTRICAL: three No. 16 male contacts, low loss plastic dielectric insulation; box type aluminum alloy body; cad plate and chromate finish; Cannon Electric Co. part No. MS3102A14S-7P	POWER input connector on cable receptacle panel (Figure 2-4)
J4		CONNECTOR, RECEPTACLE, ELECTRICAL: MIL-C-3608 type UG-1094/U	DIV. A connector for comparator interconnection (Figure 2-4)
J5		Same as J4	DIV. B connector for comparator interconnection (Figure 2-4)
J6		CONNECTOR, RECEPTACLE, ELECTRICAL: two No. 16 male contacts, low loss plastic dielectric; box type aluminum alloy body; cad plate and chromate finish; Cannon Electric Co. part No. MS3102A14S-9P	TTY OUTPUT connector. Loop keyer output to TTY (Figure 2-4)
J7		Same as J4	REMOTE TUNING IND. connector to remote tuning indicator (Figure 2-4)
P1		CONNECTOR, PLUG, ELECTRICAL: 15 contacts, gold plated; low loss plastic dielectric; brass body, iridite finish; Cannon Electric Co. part No. DAM-15S	Connects J1 to external cable receptacle panel (Figure 5-1)
Q1		TRANSISTOR: germanium, PNP; Sylvania Electric Products Inc., type 2N526	Audio amplifier (Figure 6-3)
Q2		Same as Q1	1st mark amplifier (Figure 6-3)
Q3		Same as Q1	1st space amplifier (Figure 6-3)
Q4		TRANSISTOR: germanium, PNP; Delco Radio Div., type 2N1412	2nd mark amplifier (Figure 6-3)
Q5		Same as Q4	2nd space amplifier (Figure 6-3)
Q6		TRANSISTOR: silicon, NPN; MIL-T-19500/37A type 2N333	DC amplifier (Figure 6-4)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
Q7		Same as Q6	DC amplifier (Figure 6-4)
Q8		Same as Q6	DC amplifier (Figure 6-4)
Q9		Same as Q6	DC amplifier (Figure 6-4)
Q10		TRANSISTOR: silicon, NPN; Texas Instrument Corp., type 2N657	DC amplifier (Figure 6-4)
Q11		TRANSISTOR: germanium, NPN; General Electric, type 2N336	Mark lock-up control (Figure 6-4)
Q12		TRANSISTOR: silicon, NPN: Texas Instrument Corp., type 2N497	Mark lock-up switching (Figure 6-4)
Q13		Same as Q6	P/O dc limiter (Figure 6-3)
Q14		TRANSISTOR: germanium, PNP: Sylvania Electric Products Inc., type 2N328A	P/O dc limiter (Figure 6-3)
Q15		Same as Q14	P/O dc limiter (Figure 6-3)
Q16		Same as Q6	P/O dc limiter (Figure 6-3)
Q17		Same as Q10	P/O loop keyer (Figure 6-3)
Q18		Same as Q10	P/O loop keyer (Figure 6-3)
Q19		Same as Q6	P/O -48 vdc supply regulator (Figure 6-4)
Q20		TRANSISTOR: silicon, NPN; Texas Instrument Corp., type 2N424	P/O +48 vdc supply regulator (Figure 6-4)
Q21		Same as Q6	P/O +48 vdc supply regulator (Figure 6-4)
Q22		Same as Q6	P/O +48 vdc supply regulator (Figure 6-4)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
Q23		Same as Q20	P/O -48 vdc supply regulator (Figure 6-4)
Q24		Same as Q12	P/O -48 vdc supply regulator (Figure 6-4)
R1		RESISTOR, FIXED, COMPOSITION: 5600 ohms ±5%, 1/2 w; MIL-R-11, type RC20GF562J; part No. MS35043-105	Impedance matching (Figure 6-3)
R2		RESISTOR, FIXED, COMPOSITION: 10k ±10%, 1/2 w; MIL-R-11 type RC20GF103K; part No. MS35043-19	Base bias, Q1 (Figure 6-3)
R3		RESISTOR, FIXED, COMPOSITION: 47k ±10%, 1/2 w; MIL-R-11, type RC20GF473K; part No. MS35043-23	Base bias, Q1 (Figure 6-3)
R4		RESISTOR, VARIABLE, COMPOSITION: 10k, ±10%, 2 w; single section; MIL-R-94/5 type RV4NAYSD103C	LEVEL control, variable collector load, Q1 (Figure 6-3)
R5		RESISTOR, FIXED, COMPOSITION: 680 ohms ±10%, 1/2 w; MIL-R-11, type RC20GF681K; part No. MS35043-12	Decoupling -26 v (Figure 6-3)
R6		RESISTOR, FIXED, COMPOSITION: 120 ohms ±10%, 1/2 w; MIL-R-11, type RC20GF121K; part No. MS35043-198	Degeneration, Q1 emitter (Figure 6-3)
R7		RESISTOR, FIXED, COMPOSITION: 3.9k ±10%, 1/2 w; MIL-R-11, type RC20GF392K; part No. MS35043-207	Emitter bias, Q1 (Figure 6-3)
R8		RESISTOR, FIXED, COMPOSITION: 18k ±10%, 1/2 w; MIL-R-11, type RC20GF183K; part No. MS35043-211	Impedance matching (Figure 6-3)
R9		Same as R8	Impedance matching (Figure 6-3)
R10		Same as R8	Impedance matching (Figure 6-3)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
R11		RESISTOR, FIXED, COMPOSITION: 22k ±10%, 1/2 w; MIL-R-11, type RC20GF223K; part No. MS35043-21	Base bias, Q2 (Figure 6-3)
R12		RESISTOR, FIXED, COMPOSITION: 6.8k ±10%, 1/2 w; MIL-R-11, type RC20GF682K; part No. MS35034-18	Base bias, Q2 (Figure 6-3)
R13		Same as R12	Base bias, Q3 (Figure 6-3)
R14		Same as R11	Base bias, Q3 (Figure 6-3)
R15		RESISTOR, FIXED, COMPOSITION: 1.5k ±10%, 1/2 w; MIL-R-11 type RC20GF152K; part No. MS35043-14	Decoupling, -26 v line (Figure 6-3)
R16		Same as R15	Collector load, Q2 (Figure 6-3)
R17		RESISTOR, VARIABLE, COMPOSITION: 2500 ohms; MIL-R-94A type RV6LAYSA252A	SPACE GAIN control, Q3 emitter (Figure 5-1)
R18		Same as R15	Collector load, Q3 (Figure 6-3)
R19		RESISTOR, FIXED, COMPOSITION: 470 ohms ±10%, 1/2 w; MIL-R-11 type RC20GF471K; part No. MS35043-11	Base bias, Q4 (Figure 6-3)
R20		RESISTOR, FIXED, COMPOSITION: 1.8k ±10%, 1 w; MIL-R-11 type RC32GF182K; part No. MS35044-225	Degenerative feedback, Q4 (Figure 6-3)
R21		Same as R19	Base bias, Q5 (Figure 6-3)
R22		Same as R20	Degenerative feedback, Q5 (Figure 6-3)
R23		RESISTOR, FIXED, COMPOSITION: 120 ohms ±10%, 1 w; MIL-R-11 type RC32GF121K; part No. MS35044-218	Emitter bias, Q4 (Figure 6-3)
R24		Same as R23	Emitter bias, Q5 (Figure 6-3)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
R25		RESISTOR, FIXED, COMPOSITION: 12k ±10%, 1/2 w; MIL-R-11 type RC20GF123K; part No. MS35043-210	Mark signal summing resistor (Figure 6-3)
R26		Same as R25	Space signal summing resistor (Figure 6-3)
R27		RESISTOR, FIXED, COMPOSITION: 150 ohms ±10%, 2 w; MIL-R-11 type RC42GF151K; part No. MS35045-8	Voltage dropping resistor (Figure 6-3)
R28		Same as R27	Voltage dropping resistor (Figure 6-3)
R29		RESISTOR, FIXED, COMPOSITION: 27k ±10%, 1/2 w; MIL-R-11 type RC20GF273K; part No. MS35043-212	Base biasing, Q6 (Figure 6-4)
R30		RESISTOR, FIXED, COMPOSITION: 15k, ±10%, 1/2 w; MIL-R-11 type RC20GF153K; part No. MS35043-20	Emitter bias, Q6 and Q9 (Figure 6-4)
R31		RESISTOR, VARIABLE, COMPOSITION: 1k; MIL-R-11 type RV6LAYSA102A	VERT CTR control, variable emitter bias for Q6 and Q9 (Figure 5-1)
R32		Same as R11	Collector load, Q6 (Figure 6-4)
R33		RESISTOR, FIXED, COMPOSITION: 8.2k ±10%, 1/2 w; MIL-R-11 type RC20GF822K; part No. MS35043-209	Collector load, Q7 (Figure 6-4)
R34		Same as R33	Collector load, Q8 (Figure 6-4)
R35		Same as R30	Emitter bias, Q7 and Q8 (Figure 6-4)
R36		Same as R11	Collector load, Q9 (Figure 6-4)
R37		Same as R25	Base bias, Q9 (Figure 6-4)
R38		RESISTOR, FIXED, COMPOSITION: 33k ±10%, 1/2 w; MIL-R-11 type RC20GF333K; part No. MS35043-22	Base bias, Q10 (Figure 6-4)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
R39		RESISTOR, VARIABLE, COMPOSITION: 10k; MIL-R-94 type RV6LAYSA103A	LIN control,variable; base bias, Q10 (Figure 5-1)
R40		Same as R33	Base bias, Q10 (Figure 6-4)
R41		RESISTOR, FIXED, COMPOSITION: 150k ±10%, 1/2 w; MIL-R-11 type RC20GF154K; part No. MS35043-26	Degenerative feedback,Q10 to Q9 (Figure 6-4)
R42		RESISTOR, FIXED, COMPOSITION: 4.7k ±10%, 1w; MIL-R-11 type RC32GF472K; part No. MS35044-17	Collector load, Q10 (Figure 6-4)
R43		RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%, 1 w; MIL-R-11 type RC32GF561K; part No. MS35044-222	Emitter bias, Q10 (Figure 6-4)
R44		RESISTOR, FIXED, COMPOSITION: 2.2k ±10%, 1/2 w; MIL-R-11 type RC20GF222K; part No. MS35043-15	Isolates TP-4 from axis restorer (Figure 6-4)
R45		Same as R11	Axis restorer combining resistor (Figure 6-4)
R46		Same as R11	Axis restorer combining resistor (Figure 6-4)
R47		RESISTOR, FIXED, COMPOSITION: 1 meg ±10%, 1/2 w; MIL-R-11 type RC20GF105K; part No. MS35043-220	Voltage dropping resistor (Figure 6-4)
R48		RESISTOR, FIXED, COMPOSITION: 100k ±10%, 1/2 w; MIL-R-11 type RC20GF104K; part No. MS35043-25	P/O biasing RC network for Q11 (Figure 6-4)
R49		Same as R2	Collector load, Q11 (Figure 6-4)
R50		Same as R2	Coupling resistor, Q11 collector to Q12 base (Figure 6-4)
R51		Same as R38	Base bias, Q12 (Figure 6-4)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
R52		Same as R33	Collector load, Q12 (Figure 6-4)
R53		RESISTOR, FIXED COMPOSITION: 120k ±10%, 1/2 w; MIL-R-11 type RC20GF124K; part No. MS35043-216	Voltage dropping resistor (Figure 6-4)
R54		Same as R38	Comparison resistor (Figure 6-4)
R55		Same as R38	Comparison resistor (Figure 6-3)
R56		RESISTOR, FIXED, COMPOSITION: 2.2 meg ±10%, 1/2 w; MIL-R-11 type RC20GF225K; part No. MS35043-33	Base bias, Q13 and Q15 (Figure 6-3)
R57		Same as R56	Base bias Q13 and Q15 (Figure 6-3)
R58		Same as R11	Coupling, comparator to Q13 and Q15 base (Figure 6-3)
R59		RESISTOR, FIXED, COMPOSITION: 2.2k ±10%, 2 w; MIL-R-11 type RC42GF222K; part No. MS35045-15	Voltage dropping resistor (Figure 6-3)
R60		RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%, 1/2 w; MIL-R-11 type RC20GF221K; part No. MS35043-9	Emitter bias, Q16 (Figure 6-3)
R61		Same as R60	Emitter bias, Q14 (Figure 6-3)
R62		Same as R59	Emitter bias, Q14 (Figure 6-3)
R63		RESISTOR, FIXED, COMPOSITION: 680 ohms ±10%, 1/2 w; MIL-R-11 type RC20GF681K; part No. MS35043-12	Stabilizes dc limiter by feedback to Q13, Q15 emitters (Figure 6-3)
R64		Same as R15	Collector load, Q14 and Q16 (Figure 6-3)
R65		RESISTOR, FIXED, COMPOSITION: 1k ±10%, 1/2 w; MIL-R-11 type RC20GF102K; part No. MS35043-13	Base bias, Q18 (Figure 6-3)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
R66		Same as R25	Base bias, Q17 (Figure 6-3)
R67		Same as R27	Current limiting (Figure 6-3)
R68		RESISTOR, FIXED, COMPOSITION: 5.6k ±10%, 1/2 w; MIL-R-11 type RC20GF562K; part No. MS35043-208	P/O RC network for Q19 (Figure 6-4)
R69		RESISTOR, FIXED, COMPOSITION: 3.3k ±10%, 1/2 w; MIL-R-11 type RC20GF332K; part No. MS35043-16	Establishes current through CR27 (Figure 6-4)
R70		Same as R69	Collector load, Q19 (Figure 6-4)
R71		Same as R44	Base bias, Q19 (Figure 6-4)
R72		Same as R31	-48 ADJ, variable base bias for Q19 (Figure 6-4)
R73		Same as R69	Base bias, Q19 (Figure 6-4)
R74		RESISTOR, FIXED, COMPOSITION: 2.2k ±10%, 1 w; MIL-R-11 type RC32GF222K; part No. MS35044-15	P/O voltage divider, -48 vdc to -26 vdc (Figure 6-4)
R75		RESISTOR, FIXED, COMPOSITION: 1k ±10%, 1 w; MIL-R-11 type RC32GF102K; part No. MS35044-13	P/O voltage divider, -48 vdc to -26 vdc (Figure 6-4)
R76		Same as R11	P/O voltage divider for crt control (Figure 6-3)
R77		RESISTOR, VARIABLE, COMPOSITION: 25k; MIL-R-94/4 type RV6LAYSA253A	HORIZ CENTERING control for crt, P/O voltage divider (Figure 5-1)
R78		Same as R11	P/O voltage divider for crt control (Figure 6-3)
R79		Same as R11	P/O voltage divider for crt control (Figure 6-3)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
R80		Same as R77	VERT ADJ control for crt, P/O voltage divider (Figure 6-3)
R81		Same as R11	P/O voltage divider for crt control (Figure 6-3)
R82		Same as R56	Voltage divider, V1 sweep (Figure 6-4)
R83		Same as R48	Voltage divider, V1 sweep (Figure 6-4)
R84		Same as R3	Current limiting, -560 vdc supply (Figure 6-4)
R85		Same as R68	P/O RC network for Q22 (Figure 6-4)
R86		Same as R69	Establishes current through CR34 (Figure 6-4)
R87		Same as R69	Collector load, Q22 (Figure 6-4)
R88		Same as R69	Base bias, Q22 (Figure 6-4)
R89		Same as R31	+48 ADJ, variable control, base bias, Q22 (Figure 5-1)
R90		Same as R69	Base bias, Q22 (Figure 6-4)
R91		RESISTOR, FIXED, COMPOSITION: 680k ±10%, 1/2 w; MIL-R-11 type RC20GF684K; part No. MS35043-30	P/O voltage divider for crt controls (Figure 6-4)
R92		RESISTOR, VARIABLE, COMPOSITION: 500k; MIL-R-94/4 type RV6LAYSA504A	FOCUS, variable control for V1 (Figure 2-10)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
R93		RESISTOR, VARIABLE, COMPOSITION: 1 meg; MIL-R-94/4 type RV6LAYSA105A	INT, variable control for V1 (Figure 2-10)
R94		RESISTOR, FIXED, COMPOSITION: 820k ± 10%, 1/2 w; MIL-R-11 type RC20GF824K; part No. MS35043-221	P/O voltage divider for crt controls (Figure 6-4)
R95		Same as R53	Biasing resistor for V1 cathode (Figure 6-4)
R96		Same as R17	MARK GAIN, variable control, Q2 emitter (Figure 5-1)
R97		Same as R94	Base bias for Q6 (Figure 6-4)
S1A-B		SWITCH, ROTARY: First section, two position two shorting movable contacts, six fixed contacts; second section, two position three shorting movable contacts, nine fixed contacts; silver plated brass per QQ-B-613; non-sealed shaft per MIL-S-3786; solder type terminals on Mycalex sections; Hoffman Spec Control dwg 8180000033; Oak Mfg. part No. not assigned	SHIFT switch. S1-A selects bandpass filter. S1-B selects discriminator. (Figure 3-1)
S2		SWITCH, ROTARY: One-section, two-position; 30° positioning increments; two shorting moving contacts; six fixed contacts; silver plated brass per QQ-B-613; non-sealed shaft per MIL-S-3786; solder type terminals on Mycalex sections; Hoffman Spec Control dwg 8180000032; Oak Mfg. part No. not assigned	POLARITY switch. Changes polarity of signal to keying filter. (Figure 3-1)
S3		SWITCH, ROTARY: One-section, two-position; 30° positioning increments; two shorting moving contacts; six fixed contacts, silver plated brass per QQ-B-613; non-sealed shaft per MIL-S-3786; solder type terminals on Mycalex sections; Hoffman Spec Control dwg 8180000035; Oak Mfg. part No. not assigned	SPEED switch. Selects keying filter section. (Figure 3-1)
S4		SWITCH, ROTARY: One-section, three-position 30° positioning increments; two shorting moving contacts; ten fixed contacts, silver plated brass per QQ-B-613; non-sealed shaft per MIL-S-3786; solder type terminals on Mycalex sections; Hoffman Spec Control dwg 8180000034; Oak Mfg. part No. not assigned	FUNCTION switch. Selects input to comparator (Figure 3-1)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
S5A-B		SWITCH, SENSITIVE: Single pole, double throw; 5 amp rating at 125/250 vac; plastic body; 0.030 in. contact pre-travel; 0.034 in. contactovertravel; three solder type terminals; Hoffman dwg 2039900004; composed of two microswitches; Unimax part No. T-483	Cabinet interlock switches (Figure 2-10)
S6		SWITCH, TOGGLE: double pole, single throw; type MS25100-22 style ST22K	POWER switch (Figure 3-1)
TB1		TERMINAL BOARD: Epoxy glass lamin. 3/32" thick per MIL-C-18177, type GEE: Hoffman dwg No. 8100000344; Electro Board Corp., type No. TCB-620-1A	Provides support for component parts (Figure 5-1)
TB2		TERMINAL BOARD: Epoxy glass lamin. 3/32" thick per MIL-C-18177, type GEE: Hoffman dwg No. 8100000345; Electro Board Corp., type No. TCB-620-2A	Provides support for component parts (Figure 5-1)
T1		TRANSFORMER, DISCRIMINATOR: 600 cps to 3600 cps frequency range; shield between pri and sec grounded to case; 2-1/4 in. lg. 2-1/16 in. w, 1-3/4 in. h; Hoffman Spec Control dwg 8180000024; Transonic Inc., type TS-2711	Coupling from second mark amplifier (Figure 5-1)
T2		Same as T1	Coupling from second space amplifier (Figure 5-1)
T3		TRANSFORMER, POWER, STEP-DOWN: Terminals 1 and 2, 1 and 3, 1 and 4 for input voltages of 105 vac, 115 vac and 125 vac at 47.5 cps to 420 cps; 0.2 amp primary; 59 vrms ±3% secondary at 0.25 amp; 2-3/4 in. lg, 2-1/4 in. w, 1-3/4 in. h case; six solder stud terminals; four No. 6-32 by 9/32 in. mtg studs; internal shield between pri and sec grounded to case; Hoffman Spec Control dwg 8180000025; Transonic Inc., type TS-2772	Provides power for -48 vdc supply (Figure 5-1)
T4		TRANSFORMER, POWER, STEP-UP, STEP-DOWN: Input terminals 1 and 2, 1 and 3, 1 and 4 for 105 vac, 115 vac and 125 vac input voltages; 47.5 cps to 420 cps; output terminals 5 and 6 for 59 vrms ±3% and 85 ma; terminals 7 and 8 for 550 vac ±3% and 0.8 ma; terminals 8 and 9 for 6.3 vac ±3% and 0.6 amp; 2-3/4 in. lg, 2-1/4 in. w, 1-3/4 in. h case with four 6-32 by 9/32 in.	Supplies voltage for +48 vdc and -560 vdc supplies (Figure 5-1)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
T4 (Cont'd)		mtg studs; ten solder stud terminals; internal shield between pri and sec grounded to case; Hoffman Spec Control dwg 8180000026; Transonic Inc., type TS-2712	
V1		ELECTRON TUBE: Cathode ray; RCA type 2BP1	Tuning indicator visual display (Figure 5-1)
XDS1		LAMPHOLDER: MIL-S-12883 type LH64BR2	Holder for DS1 (Figure 5-1)
XF1		FUSEHOLDER: Extractor post type per MIL-F-19207	Holder for F1 (Figure 5-1)
XF2		Same as XF1	Holder for F2 (Figure 5-1)
XQ1		SOCKET, TRANSISTOR: Three contacts; Grayhill part No. 22-11	Socket for Q1 (Figure 6-3)
XQ2		Same as XQ1	Socket for Q2 (Figure 6-3)
XQ3		Same as XQ1	Socket for Q3 (Figure 6-3)
XQ4		Not used	
XQ5		Not used	
XQ6		Same as XQ1	Socket for Q6 (Figure 6-4)
XQ7		Same as XQ1	Socket for Q7 (Figure 6-4)
XQ8		Same as XQ1	Socket for Q8 (Figure 6-4)
XQ9		Same as XQ1	Socket for Q9 (Figure 6-4)
XQ10		Same as XQ1	Socket for Q10 (Figure 6-4)
XQ11		Same as XQ1	Socket for Q11 (Figure 6-4)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
XQ12		Same as XQ1	Socket for Q12 (Figure 6-4)
XQ13		Same as XQ1	Socket for Q13 (Figure 6-3)
XQ14		Same as XQ1	Socket for Q14 (Figure 6-3)
XQ15		Same as XQ1	Socket for Q15 (Figure 6-3)
XQ16		Same as XQ1	Socket for Q16 (Figure 6-3)
XQ17		Same as XQ1	Socket for Q17 (Figure 6-3)
XQ18		Same as XQ1	Socket for Q18 (Figure 6-3)
XQ19		Same as XQ1	Socket for Q19 (Figure 6-4)
XQ20		Not used	
XQ21		Same as XQ1	Socket for Q21 (Figure 6-4)
XQ22		Same as XQ1	Socket for Q22 (Figure 6-4)
XQ23		Not used	
XQ24		Same as XQ1	Socket for Q24 (Figure 6-4)
XV1		SOCKET, ELECTRON TUBE: 12 pin, per MIL-S-12883; Hoffman part No. 1949900091; Cinch Mfg. Co., type T-9470-12	Socket for V1 (Figure 5-1)

TABLE 7-1. COMPARATOR-CONVERTER GROUP AN/URA-17, MAINTENANCE PARTS LIST (Continued)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
Z1		FILTER-TRANSFORMER NETWORK: Filter and transformer circuits contained in single case, not interconnected; filter bandpass operating freq 1000 cps; 6 db bandwidth 500 cps, 40 db bandwidth 1400 cps; 8 k input and output impedance at 1000 cps; a-f input transformer pri impedance 600 ohms with secondary terminated in 8000 ohm load at 1000 cps; frequency response 600 cps to 3600; 2-1/4 in. lg by 2-1/4 in. w by 1-3/4 in. h; Hoffman Spec Control dwg 8180000027; Transonic Inc., type TS-5213	High frequency noise attenuation bandpass filter and impedance matching transformer (Figure 5-1)
P201		Not used	
P202		CONNECTOR, PLUG, ELECTRICAL: Three No. 16 male contacts; low loss plastic dielectric; straight shaped aluminum shell; Cannon Electric, type MS3106A14S-7P	External cable connector for AUDIO INPUT, J2 (Figure 2-4)
P203		CONNECTOR, PLUG, ELECTRICAL: Three No. 16 female contacts; low loss plastic dielectric; straight shaped aluminum shell; Cannon Electric, type MS3106A14S-7S	External cable connector for POWER INPUT, J3 (Figure 2-4)
P204		CONNECTOR, PLUG, ELECTRICAL: MIL-C-3608, type UG-88D/U	External cable connector for J4 (Figure 2-4)
P205		Same as P204	External cable connector for J5 (Figure 2-4)
P206		CONNECTOR, PLUG, ELECTRICAL: Two No. 16 female contacts; low loss plastic dielectric; straight shaped aluminum shell; Cannon Electric, type MS3106A14S-9S	External cable connector for TTY OUTPUT, J6 (Figure 2-4)
P207		Same as P204	External cable connector for REMOTE TUNING IND., J7 (Figure 2-4)

TABLE 7-2. COMPARATOR-CONVERTER GROUP AN/URA-17, LIST OF MANUFACTURERS

ABBREVIATION	NAME	ADDRESS
CTC	Cambridge Thermionic Corp.	Cambridge, Mass.
	Cannon Electric Co.	Los Angeles, Calif.
	Cinch Mfg. Co.	Chicago, Ill.
	Delco Radio (Div. General Motors Corp.)	Detroit, Mich.
	Electroboard Corp.	Costa Mesa, Calif.
	General Electric Co.	Schenectady, N. Y.
Grayhill	Grayhill Co.	Chicago, Ill.
	Hoffman Electronics Corp.	Los Angeles, Calif.
	Hoffman Semiconductor (Div. of Hoffman Electronics Corp.)	El Monte, Calif.
Littelfuse	Littelfuse, Inc.	Chicago, Ill.
Oak Mfg.	Oak Mfg. Co.	Chicago, Ill.
	Pacific Semiconductor, Inc.	Culver City, Calif.
RCA	Radio Corporation of America	New York, N. Y.
Sprague	Sprague Electric Co.	New York, N. Y.
	Sylvania Electric Products, Inc.	New York, N. Y.
	Texas Instrument Corp.	Dallas, Texas
	Transonic, Inc.	Bakersfield, Calif.
	Unimax Switch (Div. W. L. Maxson Corp.)	Wallingford, Conn.

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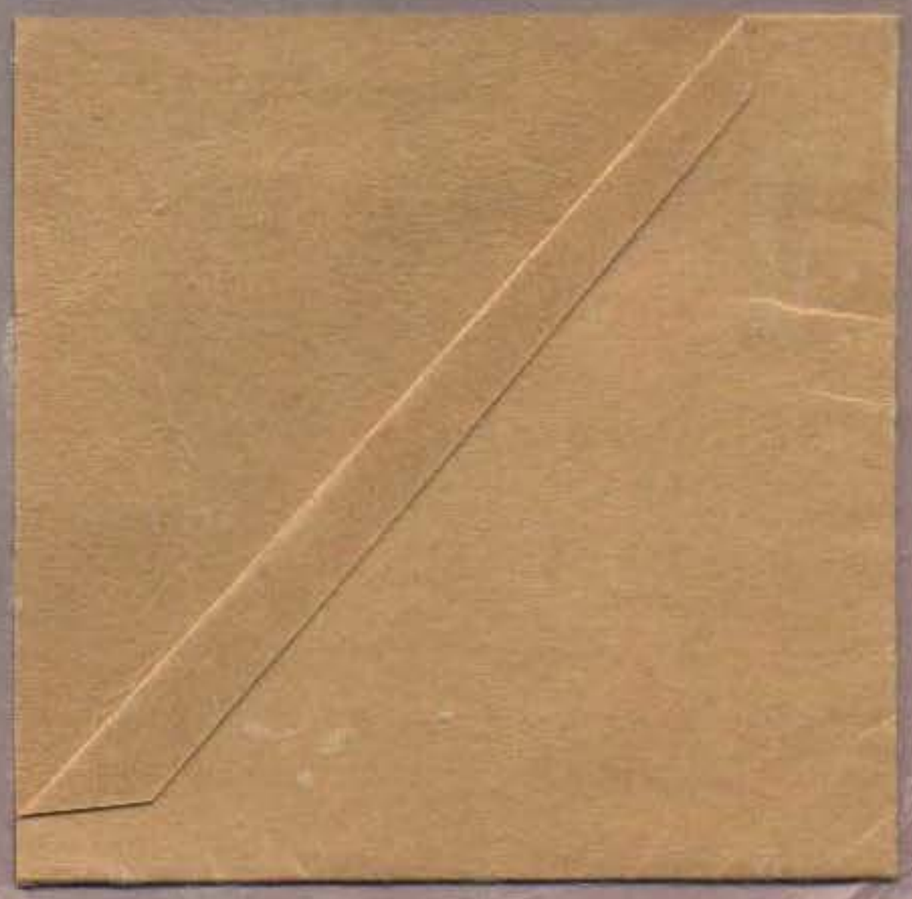
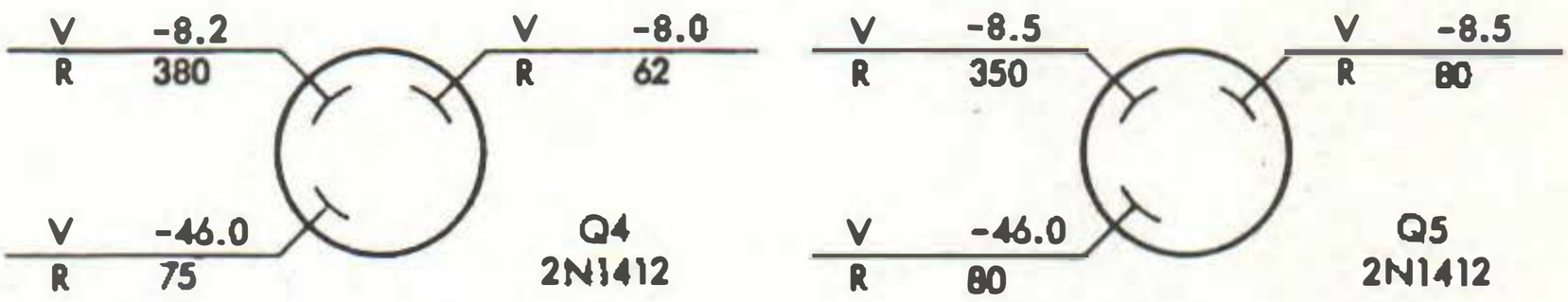


TEMPORARY CORRECTION T-1 TO TECHNICAL MANUAL FOR COMPARATOR-CONVERTER GROUP AN/URA-17, NAVSHIPS 94028

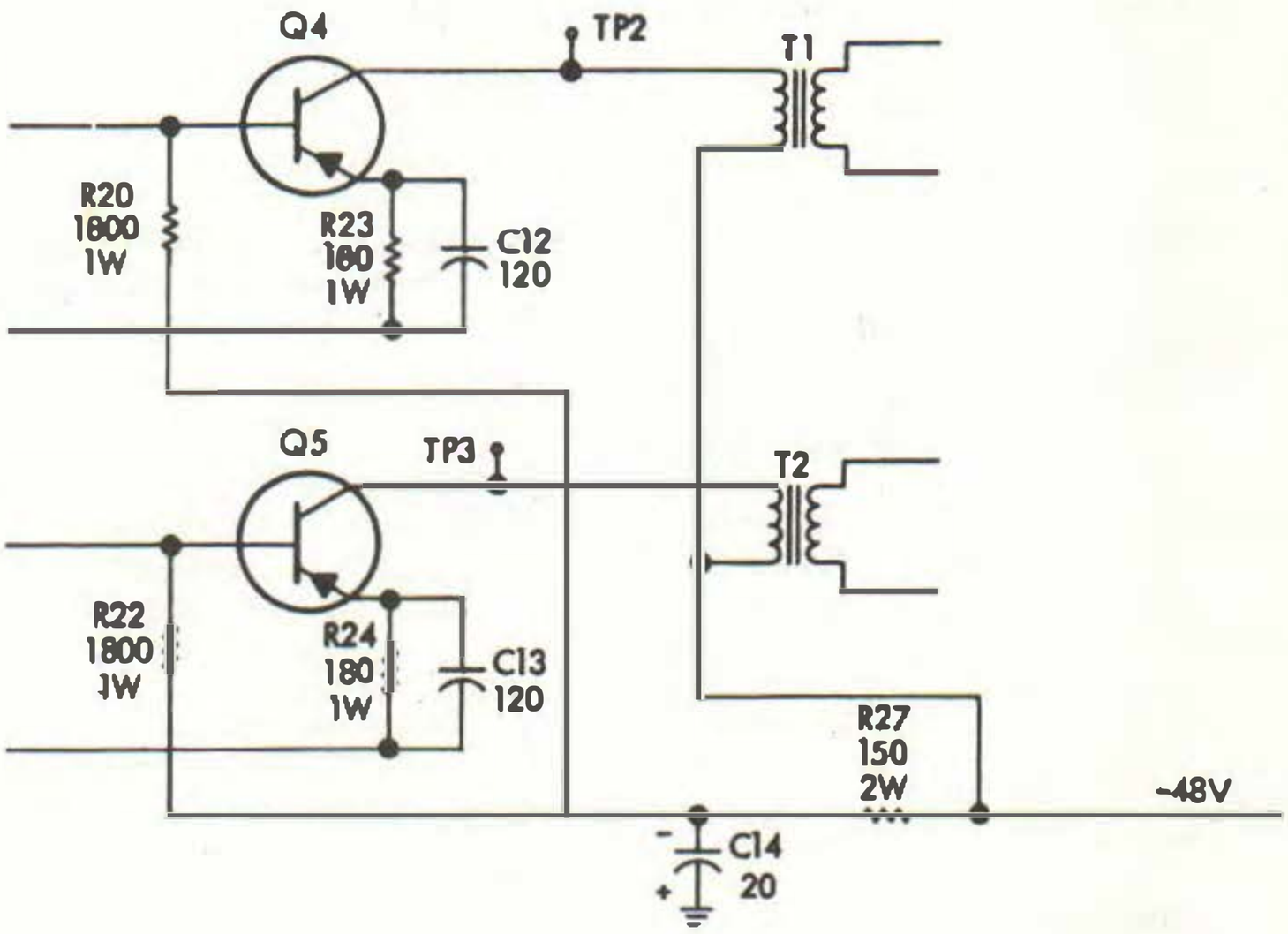
This temporary correction changes the manual to reflect the equipment changes made as the result of design changes.

Make the following pen and ink corrections. Insert this temporary correction in the technical manual immediately after the front cover.

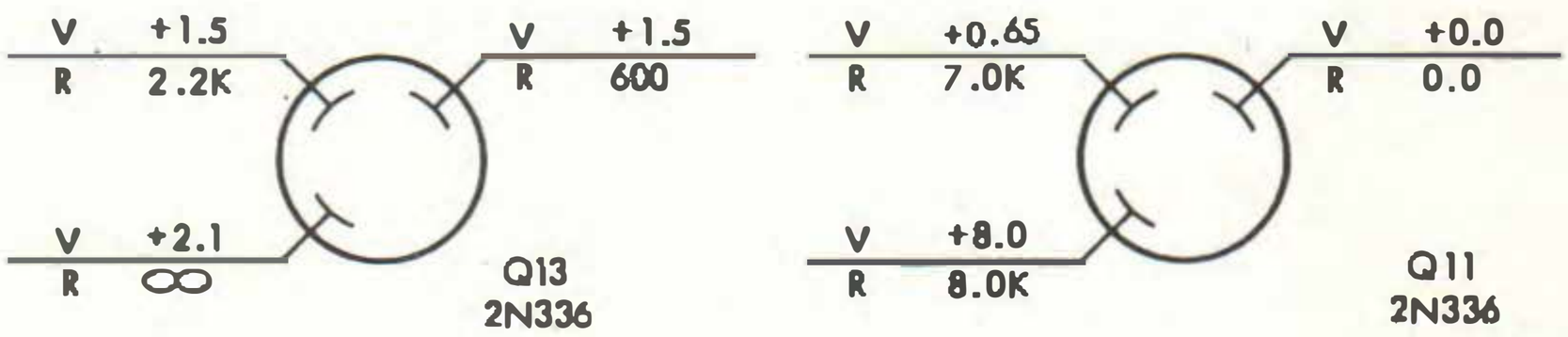
PAGE NO.	CHANGE IN EFFECT	PARA & LINE or FIG & LOCATION	ACTION
1-7	ORIG.	TABLE 1-5	Opposite Q13, delete the "1" in "2N333" column and add a "1" in the "2N336" column. Correct totals.
1-8	ORIG.	TABLE 1-6	Delete "CR33" and the "1" under "1N1731" on same line. Correct totals.
4-6	ORIG.	Second para under "4-2c(6) MARK LOCK-UP"	
		1st line:	Change "C19" to "C32"
		2nd line:	Change "CR10" to "CR11"
		8th line:	Change "C19" to "C32"
		13th line:	Change "C19" to "C32"
		Para 4-2d(3)	
		2nd line:	Change "two" to "one", Change "diodes" to "diode", Delete "and CR33".
		3rd line:	Delete "series connected".
5-6	ORIG.	Fig. 5-3, Top Left Corner.	Change voltages and resistances of Q4 and Q5 as shown below:



PAGE NO.	CHANGE IN EFFECT	PARA & LINE OR FIG & LOCATION	ACTION
5-7, 5-8	ORIG.	Fig. 5-4, right side.	Change values of R23 and R24 from "120" to "180" Change value of C12 from "47" to "120". Delete "R28" from schematic. (Do not short out its terminals.) Change wiring of "T1" and "T2" primary windings as shown below:



5-10	ORIG.	Fig. 5-5, Top.	Change Q13 from "2N333" to "2N336". Change voltages and resistances of Q11 and Q13 as shown below:



PAGE NO.	CHANGE IN EFFECT	PARA & LINE OR FIG & LOCATION	ACTION
5-11, 5-12	ORIG.	Fig. 5-6, Center.	Change value of R47 from "1 MEG" to "1.8 MEG". Change value of R48 from "100K" to "47K". Change value of R49 from "10K" to "15K". Change value of R51 from "33K" to "47K". Change Q13 from "2N333" to "2N336".
5-13	ORIG.	STEP 2, under "NEXT STEP", 2nd line.	Delete "and CR33".
5-15, 5-16	ORIG.	Fig. 5-8	Delete "CR33" completely. Add line across its terminals.
6-11, 6-12	ORIG.	Fig. 6-3, Lower left corner of TB-2.	Delete wires "10-39" and "9-33" from main cable and delete terminal "11" from TB-2. Number terminal at bottom of R28 as "11". Delete "R28". Connect now "10-39" and "9-33" wires from new terminal "11" to main cable.
6-13, 6-14	ORIG.	Fig. 6-4, Bottom, center.	Move "+" end lead of CR32 from present terminal to the terminal to which "+" end lead of CR33 is connected. Delete CR33 entirely. Move R82 to connect between terminals 28 and 29 on TB-1.
6-15, 6-16	ORIG.	Fig. 6-5.	See ACTION column for Figures 5-4, 5-6, and 5-8 and correct as indicated.
7-4	ORIG.	TABLE 7-1.	Delete CR33 entry entirely.
7-5	ORIG.	TABLE 7-1. NAME & DESCR. Column.	Change description of C12 to "Same as C13".
7-9	ORIG.	TABLE 7-1. NAME & DESCR. Column.	Change description of Q13 to "Same as Q11".
7-11	ORIG.	TABLE 7-1, NAME & DESCR. Column.	In description of R23, 1st line: Change "120" to "180". 2nd line: Change "RC32GF121K" to "RC32GF181K". 3rd line: Change "MS35044-218" to "MS35044-219".
7-12	ORIG.	TABLE 7-1,	Delete R28 entry entirely.

PAGE NO.	CHANGE IN EFFECT	PARA & LINE OR FIG & LOCATION	ACTION
7-13	ORIG.	TABLE 7-1. NAME & DESCR. Column.	In description of R47, 1st line: Change "1 MEG" to "1.8 MEG". 2nd line: Change "RC20GF105K" to "RC20GF185K". 3rd line: Change "MS35043-220" to "MS35043-223". Change description of R48 to "Same as R3". Change description of R49 to "Same as R30". Change description of R51 to "Same as R3".
7-16	ORIG.	TABLE 7-1. NAME & DESCR. Column.	Change description of R83 to "RESISTOR, FIXED, COMPOSITION: 100K ± 10%, 1/2 w, MIL-R-11, type RC20GF104K; part no. MS35043-25".

TEMPORARY CORRECTION T-2 to TECHNICAL MANUAL FOR COMPARATOR-CONVERTER AN/URA-17 NAVSHIPS 94028

This temporary correction revises the manual to reflect the equipment changes made by Field Change 2-AN/URA-17 and 3-AN/URA-17. The purposes of these field changes are to replace resistors R20 and R22 to improve reliability of capacitors C-12 and C-13, and replace resistor R71 to provide better centering of -48 volt DC power supply adjustment range. The field changes apply to AN/URA equipments, serials A1 through A155. All later AN/URA-17 equipments were corrected by identical production changes.

When these changes are included in the manual, the manual shall cover the equipment as though Field Changes 2-AN/URA-17 and 3-AN/URA-17 had been accomplished on the equipment. This correction does not supersede any other corrections or changes.

Maintenance Support Activities shall make this correction in the technical manual immediately but shall keep the superseded data intact for support of equipments that have not been modified.

Holders of equipment accompanied by technical manuals shall not make this correction in the manual until accomplishment of the field change.

Make the following pen-and-ink corrections. Insert this temporary correction in the technical manual immediately after the front cover and preceding T-1.

1. Table 1-1. Comparator-Converter Group AN/URA-17, Equipment Supplied.
   Add, just above "2-Technical Manual - NAVSHIPS 94028": 6-CLAMP, CABLE -AN3057-6.
2. Figure 5-4. Frequency Shift Converter CV-483/URA-17, Signal Processing Circuits, Functional Schematic Diagram.
   Change values of R20 and R22 from 1800 to 2200.
3. Figure 5-8. Frequency Shift Converter CV-483/URA-17, Power Supplies, Functional Schematic Diagram.
   Change value of R71 from 2200 to 2700.
4. Paragraph 6-2h, "MARK AND SPACE GAIN CONTROL ADJUSTMENTS."

Step 3, line 2:	Change WIDE to NARROW
Step 5, line 1:	Change 2550 to 1000
Step 8, line 2:	Change FL3 to FL2
Step 9, lines 1 and 2:	Change FL3 to FL2
Step 10, line 3:	Change FL3 to FL2
Step 11, line 2:	Change FL3 to FL2

5. Paragraph 6-2i, "DC DIFFERENTIAL AMPLIFIER ADJUSTMENTS."

Step 9, line 2:	Change 3200 to 1200
Step 14, line 3:	Change +32 to +35
Step 15, lines 5, 6 and 7:	Delete last two sentences
Steps 16, 17, and 18:	Delete
Step 19:	Change to "Step 16"

6. Figure 6-5. Frequency Shift Converter CV-483/URA-17, Over-all Schematic Diagram.
   Change value of R71 from 2200 to 2700. Change values of R20 and R22 from 1800 to 2200.
7. Table 7-1. Comparator-Converter Group AN/URA-17, Maintenance Parts List.
   Add: "E2-CLAMP, CABLE: AN3057-6." Secure cables to connectors.
   Change "Name and Description" column entry for R20 to: RESISTOR, FIXED, COMPOSITION: 2.2k ±10%, 1 w; MIL-R-11 type RC32GF222K; part MS35044-15.
   Change "Name and Description" column entry for R71 to: RESISTOR, FIXED, COMPOSITION: 2.7k ±10%, 1/2 w; MIL-R-11 type RC20GF272K; part MS35043-206.
8. Record this action on RECORD OF CORRECTIONS MADE page.

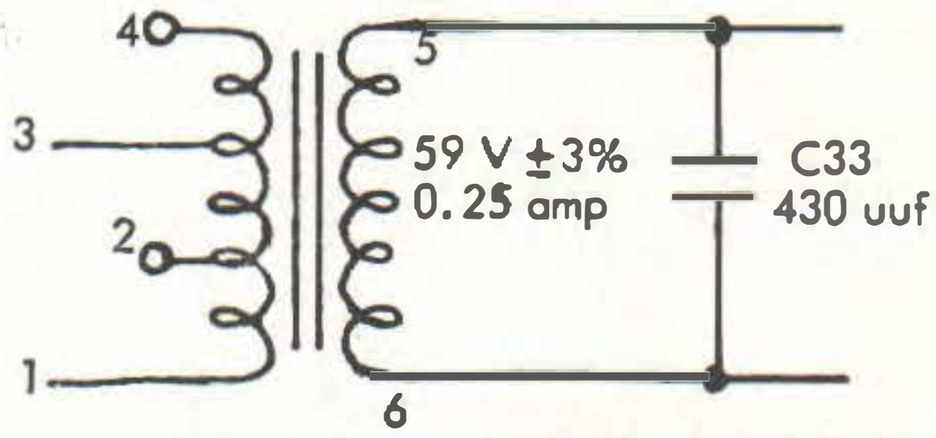
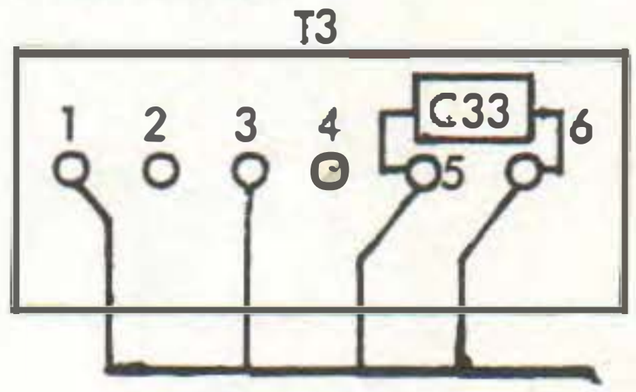
CORRECTION T-2

TEMPORARY CORRECTION T-3 to TECHNICAL MANUAL FOR COMPARATOR-CONVERTER AN/URA-17 NAVSHIPS 94028

This temporary correction revises the manual to reflect production changes mode to the equipment to reduce radio interference. This change applies to all equipments supplied under Contracts NObsr 87493 and NObsr 89307. This correction does not supersede any other corrections or changes.

Maintenance Support Activities shall make this correction in the technical manual immediately but shall keep the superseded data intact for support of equipments that do not include this production change.

Make the following pen-and-ink corrections. Insert this temporary correction in the technical manual immediately after the front cover and preceding T-2.

PAGE NO.	CHANGE IN EFFECT	PARA & LINE OR FIG & LOCATION	ACTION
5-15 5-16	ORIG.	Figure 5-8 Top right of center	Add C-33 across terminals 5 & 6 of T3 as follows: 
6-13 6-14	ORIG.	Figure 6-4 Top, Center	Add C-33 across terminals 5 & 6 of T3 as follows: 
6-15 6-16	ORIG.	Figure 6-5 Center, right hand side (Grid Coordinate B3)	See ACTION column for Figure 5-8 and correct as indicated.
		Figure 6-5, Table of Road Map Coordinates	After C32-11C, Add C33-38
7-6	ORIG.	Table 7-1	Enter the following information after C32.

C33		Capacitor, Fixed, Mica Dielectric 430 uuf - 5%, 500 vdc MIL-C-58 Type CM15E431KN3	Across T-3 Reduces radio interference (Figure 6-4)

18, May 1965

T-3 to NAVSHIPS 94028

TEMPORARY CORRECTION T-3 TO TECHNICAL MANUAL FOR COMPARATOR-CONVERTER GROUP AN/URA-17 NAVSHIPS 94028

This temporary correction revises the manual to reflect the equipment changes made by field change 4-AN/URA-17. The purpose of this field change is to replace wide bandpass filter FL1 and wide discriminator FL3 with filters having a new center frequency of 2000 cps. The field change applies to AN/URA-17.

When this change is included in the manual, the manual shall cover the equipment as though Field Change 4-AN/URA-17 had been accomplished on the equipment. This correction does not supersede any other corrections or changes.

Maintenance Support Activities shall make this correction in the technical manual immediately but shall keep the superseded data intact for support of equipments that have not been modified.

Holders of equipment accompanied by technical manuals shall not make this correction in the manual until accomplishment of the field change.

Make the following pen-and-ink corrections. Insert this temporary correction in the technical manual immediately after the front cover and preceding T-2.

1. Front cover, under AN/URA-17, add: "AN/URA-53".
2. Title sheet, under AN/URA-17, add: "AN/URA-53".

3. Paragraph 1-4b, add following sentence: "AN/URA-53: Wide shift, 2000 cps mean frequency; width of shift, 200 to 1000 cps."

4. Paragraph 3-2 g (1), step 6, add following sentence: "AN/URA-53: adjust receiver bfo to 2.0 KC for wide-shift signals".

5. Paragraph 3-2 g (2), step 6, add following sentence: "AN/URA-53: adjust receiver bfo to 2.0 KC for wide-shift signals".

6. Paragraph 3-3 a (3) (a), add following sentence: "AN/URA-53: set receiver bfo to 2.0 KC for wide-shift signals".

7. Paragraph 4-2 b (1), add following sentence: "AN/URA-53, the wide filter, FL1, is used when the center frequency of the input signal is 2000 cps with shifts of 100 to 500 cps each side of center.

8. Paragraph 4-2 b (3), add following new subparagraph:

"For AN/URA-53, the wide-shift discriminator, FL3, is used for input signals with shift widths of 200 and 1000 cps. The wide shift discriminator contains two resonant networds with a cross over frequency of 2000 cps ± 40 cps. The output from terminal 1 increases with frequency to about 2850 cps. The output from terminal 4 increases as frequency decreases to a maximum at approximately 1150 cps".

9. Figure 4-3, response curve for wide-shift discriminator, FL3, add following note:

"For AN/URA-53, the cross-over frequency is 2000 cps with a lower frequency of 1500 cps for space and an upper frequency

of 2500 cps for mark".

10. Paragraph 6-3d (6) (a), add following sentence: "For AN/URA-53, set audio oscillator to 2000 cps, measured with frequency meter".

11. Table 6-2 under INPUT TERMINATION and OUTPUT TERMINATION columns for FL1, add: "AN/URA-53: 8000 ± 5% at 2000 cps".

12. Table 6-2 under REQUIRED FREQUENCY column for FL1, add: "AN/URA-53: 1500 to 2500 cps".

13. Table 6-2 under INSERTION LOSS column for FL1, add: "AN/URA-53: 3 db maximum at 2000 cps".

14. Paragraph 6-3 d (7) (a), step 10, add following sentence: "AN/URA-53: Adjust audio oscillator to 950 cps, using frequency meter, keeping output voltage at 6.0 volts".

15. Paragraph 6-3 d (7) (a), step 11, add following sentences: "AN/URA-53: Increase audio oscillator frequency in 50 cps steps to 3150 cps. Record multimeter voltage indication at each frequency".

16. Paragraph 6-3 d (7) (a), step 13, add following sentences: "AN/URA-53: Draw a straight line between 1650 and 2350 cps points. Frequency deviation from curve shall not be greater than 35 cps. Cross-over point shall be between 1950 and 2050 cps. Peaks shall be 1150 ± 100 cps and 2850 ± 150 cps.

17. Figure 6-1 response curve for wide-shift discriminator, add following note:

"AN/URA-53: WIDE-SHIFT
Peaks: 1.15 KC and 2.85 KC
SUM OF ABSOLUTE VOLTAGES AT

1.65 and 2.35 KC: 0.0 ± 0.03 V

MINIMUM VOLTAGE CHANGE BETWEEN

1.65 and 2.35 KC: 0.26 V

CENTER FREQUENCY: 2.00 KC ± 0.04 KC

MAXIMUM LINEARITY DEVIATION: 30 cps".

18. Figure 6-1, response curve for wide-shift discriminator, add following scale:

AN/URA-53:

Under 1.8, add: "1.25".

Under 2.2, add: "1.65".

Under 2.6, add: "2.05".

Under 3.0, add: "2.45".

Under 3.4, add: "2.85".

19. Table 7-1, MAINTENANCE PARTS LIST, FL1, under NAME AND DESCRIPTION, add the following note:

"AN/URA-53: FILTER BANDPASS: 2000 cps ± 50 cps operating frequency;

8000 ohms ± 5% input/output impedance at 2000 cps;

four terminals;

2 ¼ in. (l) by 2 ¼ in. (h) by 1 3/4 in. (W)".

20. Table 7-1, MAINTENANCE PARTS LIST, FL3, under NAME AND DESCRIPTION, add the following note:

"AN/URA-53: FILTER BANDPASS: peaked at 1150 cps ± 100 cps and 2850 cps ± 150 cps with cross-over at 2000 cps ± 40 cps; four terminals; 2 ¼ in. (l) by 1 3/4 in. (h) by 1 ⅜ in. (W)".

24, June 1966

TEMPORARY CHANGE T-4 to
NAVSHIPS 0967-034-9012

TEMPORARY CHANGE T-4 TO TECHNICAL

MANUAL FOR COMPARATOR-CONVERTER

GROUP AN/URA-17 NAVSHIPS 0967-034-9010

(FORMERLY NAVSHIPS 94028)

This temporary change revises the manual to reflect equipment changes. The purpose of this change is to replace wide bandpass filter FL1 and wide discriminator FL3 with filters having a new center frequency of 2000 cps. The field change applies to AN/URA-17.

This correction does not supersede any other corrections or changes.

Make the following pen-and-ink corrections. Insert this temporary correction in the technical manual immediately after the front cover and preceding T-3.

1. Front cover, under AN URA-17, add: "AN/URA-17B".

2. Title sheet, under AN/URA-17, add: "AN/URA-17B".

3. Paragraph 1-4b, add following sentence: "AN/URA-17B: Wide shift, 2000 cps mean frequency; width of shift, 200 to 1000 cps."

4. Paragraph 3-2g (1), step 6, add following sentence: "AN/URA-17B: adjust receiver bfo to 2.0 KC for wide-shift signals".

5. Paragraph 3-2g (2), step 6, add following sentence: "AN/URA-17B: adjust receiver bfo to 2.0 KC for wide-shift signals".

6. Paragraph 3-3a (3) (a), add following sentence: "AN/URA-17B: set receiver bfo to 2.0 KC for wide-shift signals".

7. Paragraph 4-2b (1), add following sentence: "AN/URA-17B, the wide filter, FL1, is used when the center frequency of the input signal is 2000 cps with shifts of 100 to 500 cps each side of center.

8. Paragraph 4-2b (3), add following new subparagraph: "For AN/URA-17B, the wide-shift discriminator, FL3, is used for input signals with shift widths of 200 and 1000 cps. The wide shift discriminator contains two resonant networks with a cross over frequency of 2000 cps ± 40 cps. The output from terminal 1 increases with frequency to about 2850 cps. The output from terminal 4 increases as frequency decreases to a maximum at approximately 1150 cps".

9. Figure 4-3, response curve for wide-shift discriminator, FL3, add following note:

"For AN/URA-17B, the cross-over frequency is 2000 cps with a lower frequency of 1500 cps for space and an upper frequency of 2500 cps for mark".

10. Paragraph 6-3d (6) (a), add following sentence: "For AN/URA-17B, set audio oscillator to 2000 cps, measured with frequency meter".

11. Table 6-2 under INPUT TERMINATION and OUTPUT TERMINATION columns for FL1, add: "AN/URA-17B: 8000 ± 5% at 2000 cps".

12. Table 6-2 under REQUIRED FREQUENCY column for FL1, add: "AN/URA-17B: 1500 to 2500 cps".

13. Table 6-2 under INSERTION LOSS column for FL1, add: "AN/URA-17B: 3 db maximum at 2000 cps".

14. Paragraph 6-3d (7) (a), step 10, add following sentence: "AN/URA-17B: adjust audio oscillator to 950 cps, using frequency meter, keeping output voltage at 6.0 volts".

15. Paragraph 6-3d (7) (a), step 11, add following sentences: "AN/URA-17B: Increase audio oscillator frequency in 50 cps steps to 3150 cps. Record multimeter voltage indication at each frequency".

16. Paragraph 6-3d (7) (a), step 13, add following sentences: "AN/URA-17B: Draw a straight line between 1650 and 2350 cps points. Frequency deviation from curve shall not be greater than 35 cps. Cross-over point shall be between 1950 and 2050 cps. Peaks shall be 1150 ± 100 cps and 2850 ± 150 cps".

17. Figure 6-1 response curve for wide-shift discriminator, add following note:

"AN/URA-17B: WIDE-SHIFT

Peaks: 1.15 KC and 2.85 KC

SUM OF ABSOLUTE VOLTAGES AT

1.65 and 2.35 KC: 0.0 ± 0.03 V

MINIMUM VOLTAGE CHANGE BETWEEN

1.65 and 2.35 KC: 0.26 V

CENTER FREQUENCY: 2.00 KC ± 0.04 KC

MAXIMUM LINEARITY DEVIATION: 30 cps".

18. Figure 6-1, response curve for wide-shift discriminator, add following scale:

AN/URA-17B:

Under 1.8, add: "1.25".

Under 2.2, add: "1.65".

Under 2.6, add: "2.05".

Under 3.0, add: "2.45".

Under 3.4, add: "2.85".

19. Table 7-1, MAINTENANCE PARTS LIST, FL1, under NAME AND DESCRIPTION, add the following note:

"AN URA-17B: FILTER BANDPASS: 2000 cps ± 50 cps operating frequency: 8000 ohms ± 5% input/output impedance at 2000 cps; four terminals; 2 1/4 in. (l) by 2 1/4 in. (h) by 1 3/4 in. (W)".

20. Table 7-1, MAINTENANCE PARTS LIST, FL3, under NAME AND DESCRIPTION, add the following note:

"AN URA-17B: FILTER BANDPASS: peaked at 1150 cps ± 100 cps and 2850 cps ± 150 cps with cross-over at 2000 cps ± 40 cps; four terminals; 2 1/4 in. (l) by 1 3/4 in. (h) by 1 1/2 in (W)".

TEMPORARY CHANGE 5, NAVSHIPS 0967-034-9013, to TECHNICAL MANUAL FOR COMPARATOR-CONVERTER GROUP AN/URA-17A, NAVSHIPS 0967-034-9010, formerly NAVSHIPS 94028.

PREPARED BY Gulf Aerospace Corporation

Houston, Texas

This temporary change to the manual reflects the equipment changes in the Comparator-Converter Group AN/URA-17A as manufactured by Gulf Aerospace Corporation.

Make the following pen-and-ink corrections:

1. Throughout the manual, add "and AN/URA-17A" after every reference to Comparator-Converter Group AN/URA-17.

2. On page 1-1, paragraph 1-1, line 4, insert "and Contract NObsr 91222(FBM)" at the end of the line.

3. On page 7-22, Table 7-2, make the following additions:

Abbreviation	Name	Address
	Dialco Electric Corp.	Brooklyn, N. Y.
GAC	Gulf Aerospace Corp.	Houston, Texas
	Hughes Aircraft Corp.	Newport Beach, Calif.
	Motorola Inc.	Phoenix, Arizona
TRW	Thompson Ramo Wooldridge Inc.	Cleveland, Ohio
UTC	United Transformer Co.	New York, N. Y.

Insert pages 2 through 8 of this tempory change prior to page 7-1 of the technical manual.

Insert this temporary change in the technical manual immediately after the front cover.

SUPPLEMENTARY PARTS LIST

NOTE:

Table 7-1 has been corrected by means of the following supplementary table. For any given item, always refer first to the supplementary table, since it completely supersedes any corresponding listing in the basic table. If no information is shown for a given item, refer to the basic table for the required information.

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
CR7		SEMICONDUCTOR DEVICE, DIODE: Zener, Texas Instruments Inc., type 1N3025B	Zener regulator, Q10 emitter (Figure 6-4)
CR21		SEMICONDUCTOR DEVICE, DIODE: Zener, Texas Instruments Inc., type 1N3042B	Protects against inductive kickback from keyer relay (Figure 6-3)
CR27		SEMICONDUCTOR DEVICE, DIODE: Zener, Texas Instruments Inc., type 1N3029B	Bias stabilizer, Q19 emitter (Figure 6-4)
CR32		SEMICONDUCTOR DEVICE, DIODE: Silicon, TRW, Inc., type 1N1731	-560 vdc supply rectifier (Figure 6-4)
C1		CAPACITOR, FIXED, ELECTROLYTIC: Tantalytic, 6.8 uf, 35 vdc working, MIL type CS13BF685M	Coupling S1 to Q1 base (Figure 6-3)
C14		CAPACITOR, FIXED, ELECTROLYTIC: 20 uf -15% +50%, 60 vdc working, MIL type CL65BK200MP3	Decoupling, Q5 collector (Figure 6-3)
C15		CAPACITOR, FIXED, PAPER DIELECTRIC: 0.22 uf ± 10%, 100 vdc, MIL type CP05A1KB224K3	Decoupling, Q8 collector (Figure 6-4)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
C17		CAPACITOR, FIXED, ELECTROLYTIC: 50 uf -15% +50%, 60 vdc working, MIL type CL65BK500MP3	P/O axis restorer network (Figure 6-4)
C22		CAPACITOR, FIXED, ELECTROLYTIC: 25 uf -15% +50%, 125 vdc, MIL type CL65BP250MP3	P/O -48V power supply filter network (Figure 6-4)
C27		CAPACITOR, FIXED, PAPER DIELECTRIC: dual section; 0.1 uf +20%, 1000 vdc working per section; MIL-C-25/4 type CP54B4EG104V1	P/O -560 V power supply filter network (Figure 5-1)
C31		Same as C27	Same as C27
E1		TERMINAL STUD: silver plated brass term; 39/64 in. lg by 1/4 in. hex base; No. 6-32 threaded ceramic base; 2500 RMS breakdown voltage at 60 cps; CTC part No. 3650-2	Grounded input center tap (Figure 2-6)
FL1		FILTER, BANDPASS: 2550 cps +50 cps operating freq; 8000 ohms +5% input/output impedance at 2550 cps; four terminals; 2-1/4 in. lg by 2-1/4 in. h by 1-3/4 in. w; GAC dwg 000975; UTC, type BF442	Wideband filter, input to S1 (Figure 5-1)
FL2		FILTER, BANDPASS: peaked at 800 cps +40 cps and 1200 cps +40 cps with crossover at 1000 cps +15 cps, four terminals, 2-1/4 in. lg by 1-3/4 in. h by 1-1/2 in. w, GAC part No. 000972	Narrow-shift discriminator between Q1 and Q2 or Q3 (Figure 5-1)
FL3		FILTER, BANDPASS: Peaked at 1700 cps +100 cps and 3400 cps +150 cps with crossover at 2550 cps +40 cps; four terminals; 2-1/4 in. lg by 1-3/4 in. h by 1-1/2 in. w; GAC dwg 000973; UTC, type BF440	Wide-shift discriminator between Q1 and Q2 or Q3 (Figure 5-1)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
FL4		FILTER, BANDPASS, LOW PASS: Section A; 45 cps cuttoff frequency; 2 db or less insertion loss at 15 cps; 18 db at 140 cps; 50 db min at 560 cps; 65 db at 1500 cps to 8 kc; 20 k ±20% input and output impedance at 5 cps; Section B: 175 cps cuttoff frequency, 2 db or less insertion loss at 15 cps; 18 db at 560 cps; 50 db at 2240 cps; 65 db at 4 kc to 8 kc; GAC dwg 000974; UTC, type BF441	Keying filter at input to Q6 (Figure 5-1)
KT1		KIT, ACCESSORY: GAC part No. 000927	Repair parts kit
Q1		TRANSISTOR: germanium, PNP; Motorola Inc., type 2N526	Audio amplifier (Figure 6-3)
Q10		TRANSISTOR: silicon, NPN; General Electric, type 2N657	DC amplifier (Figure 6-4)
Q11		TRANSISTOR: germanium, NPN; Texas Instruments Inc., type 2N336	Mark lock-up control (Figure 6-4)
Q14		TRANSISTOR: germanium, PNP; Hughes Aircraft Co., type 2N328A	P/O dc limiter (Figure 6-3)
R23		RESISTOR, FIXED, COMPOSITION: 120 ohms ±10%, 1w; MIL-R-11 type RC32GF121K; part No. MS35044-219	Emitter bias, Q4 (Figure 6-3)
R47		RESISTOR, FIXED, COMPOSITION: 1 meg ±10%, 1/2 w; MIL-R-11 type RC20GF105K; part No. MS35043-223	Voltage dropping resistor (Figure 6-4)
R48		Same as R3	P/O biasing RC network for Q11 (Figure 6-4)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
R63		Same as R5	Stabilizes dc limiter by feedback to Q13, Q15 emitters (Figure 6-3)
S1		SWITCH, ROTARY: First section, two position two shorting movable contacts, six fixed contacts; second section, two position three shorting movable contacts, nine fixed contacts; silver plated brass per QQ-B-613; non-sealed shaft per MIL-S-3786; solder type terminals on Mycalex sections; GAC part No. 000977	SHIFT switch, selects bandpass filter and discriminator (Figure 3-1)
S2		SWITCH, ROTARY: One section, two position; 30° positioning increments; two shorting moving contacts; six fixed contacts; silver plated brass per QQ-B-613; non-sealed shaft per MIL-S-3786; solder type terminals on Mycalex sections; GAC part No. 000976	POLARITY switch. Changes polarity of signal to keying filter (Figure 3-1)
S3		SWITCH, ROTARY: One section, three position; 30° positioning increments; two shorting moving contacts; six fixed contacts; silver plated brass per QQ-B-613; non-sealed shaft per MIL-S-3786; solder type terminals on Mycalex sections; GAC part No. 000978	SPEED switch. Selects keying filter section (Figure 3-1)
S4		SWITCH, ROTARY: One section, three position; 30° positioning increments; two shorting moving contacts; ten fixed contacts; silver plated brass per QQ-B-613; non-sealed shaft per MIL-S-3786; solder type terminals on Mycalex sections; GAC part No. 000979	FUNCTION switch. Selects input to comparator (Figure 3-1)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
S4		SWITCH, ROTARY: One section, three position; 30° positioning increments; two shorting moving contacts; ten fixed contacts; silver plated brass per QQ-B-613; non-sealed shaft per MIL-S-3786; solder type terminals on Mycalex sections: GAC part No. 000979	FUNCTION switch. Selects input to comparator (Figure 3-1)
S5		SWITCH, SENSITIVE: Single pole, double throw; 5 amp rating at 125/250 vac; plastic body; 0.030 in. contact pre-travel; 0.034 in. contact overtravel; three solder type terminals; Unimax part No. T-483	Cabinet interlock (Figure 2-10)
TB1		TERMINAL BOARD: Epoxy glass lamin. 3/32 in. thick per MIL-C-18177, type GEE, GAC part No. 000958	Provides support for component parts (Figure 5-1)
TB2		TERMINAL BOARD: Epoxy glass lamin. 3/32 in. thick per MIL-C-18177, type GEE; GAC part No. 000962	Same as TB1
TP1		TEST JACK: Grayhill part No. 31B1002	Test point (Figure 5-2)
TP2		Same as TP1	Same as TP1
TP3		Same as TP1	Same as TP1
TP4		Same as TP1	Same as TP1
TP5		Same as TP1	Same as TP1
TP6		Same as TP1	Same as TP1
TP7		Same as TP1	Same as TP1
TP8		Same as TP1	Same as TP1

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
T1		TRANSFORMER, DISCRIMINATOR: 600 cps to 3600 cps frequency range; shield between pri and sec grounded to case; 2-1/4 in. lg by 2-1/16 in. w by 1-3/4 in. h; GAC dwg 000970; UTC, type PA5386	Coupling from second mark amplifier (Figure 5-1
T3		TRANSFORMER, POWER, STEP-DOWN: Terminals 1 and 2, 1 and 3, 1 and 4 for input voltages of 105 vac, 115 vac and 125 vac at 47.5 cps to 420 cps; 0.2 amp primary; 59 vrms +3% secondary at 0.25 amp; 2-3/4 in. lg by 2-1/4 in. w by 1-3/4 in. h case; six solder stud terminals; four No. 6-32 x 9/32 in. mtg studs; internal shield between pri and sec grounded to case; GAC dwg 000970; UTC, type PA 5387	Provides power for -48 vdc supply (Figure 5-1
T4		TRANSFORMER, POWER, STEP-UP, STEP-DOWN: Input terminals 1 and 2, 1 and 3, 1 and 4 for 105 vac, 115 vac and 125 vac input voltages; 47.5 cps to 420 cps; output terminals 5 and 6 for 59 vrms +3% and 85 ma; terminals 7 and 8 for 550 vac +3% and 0.8 ma; terminals 8 and 9 for 6.3 vac +3% and 0.6 amp; 2-3/4 in. lg by 2-1/4 in. w by 1-3/4 in h case with four 6-32 x 9/32 in. mtg studs; ten solder stud terminals; internal shield between pri and sec grounded to case; GAC dwg 000970; UTC	Supplies voltage for +48 vdc and -560 vdc supplies (Figure 5-1)
XDS1		LAMPHOLDER: Dialco; type MS90287-19	Holder for DS1 (Figure 5-1)
XF1		FUSEHOLDER: Littlefuse part No. 342025	Holder for F1 (Figure 5-1)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
XQ1		SOCKET, TRANSISTOR: Three contracts; Grayhill part No. 2244-2019	Socket for Q1 (Figure 6-3)
XV1		SOCKET, ELECTRON TUBE: 12 pin, per MIL-S-12883; Cinch Mfg. Co., type T-9470-12	Socket for V1 (Figure 5-1)
Z1		FILTER-TRANSFORMER NET - WORK: Filter and transformer circuits contained in a single case, not interconnected; filter bandpass operating freq 1000 cps; 6 db band-width 500 cps, 40 db bandwidth 1400 cps; 8 k input and output impedance at 1000 cps; a-f input transformer pri impedance 600 ohms with secondary terminated in 8000 ohm load at 1000 cps; frequency response 600 to 3600 cps; 2-1/4 in. lg by 2-1/4 in. w by 1-3/4 in. h; GAC dwg 000971; UTC, type BF438	High frequency noise attenuation bandpa ss filter and impedance matching transformer (Figure 5-1)
P206		CONNECTOR, PLUG, ELECTRI - CAL: Two No. 16 female contacts; low loss plastic dielectric; straight shaped aluminum shell; Cannon Electric, type MS3106B14S-9S	External cable connector for TTY OUTPUT, J6 (Figure 2-4)

TEMPORARY CHANGE T-6 to TECHNICAL MANUAL for Comparator-Converter Group AN/URA-17, NAVSHIPS 0967-034-9010 (Formerly NAVSHIPS 94028).

This Temporary Change contains information originally published as separate articles (Technical Manual Corrections) in the Electronics Information Bulletin, (EIB), numbers: 687.

The instructions, described herein, for making these changes shall be followed only if they have not been previously accomplished at the time the EIB, in which the information appeared, was received.

The purpose of this Temporary Change is to assure that publications drawn from stock, subsequent to publication of this information in the EIB, can be corrected.

Insert this Temporary Change in the technical manual immediately behind the front cover and preceding the title page or preceding the latest change or correction in effect.

Make pen-and-ink corrections or changes to the technical manual as follows:

This correction revises the manual to reflect the use of the latest preferred test equipment.

Refer to NAVSHIPS 94028, page 1-6, Table 1-3. With pen-and-ink, correct the NOMENCLATURE columns so that they agree with the following:

Oscilloscope	AN/USM-117
Electronic Multimeter	ME-6D/U
Signal Generator	AN/URM-127
Digital Readout Electronic Counter	AN/USM-207
Multimeter	AN/PSM-4B
Semiconductor Device Test Set	AN/USM-206

Page 5-5, paragraph 5-4c(2) (a). Correct the test equipment so that it agrees with the list above.

Page 5-9, paragraph 5-4d(2) (a). Correct the test equipment so that it agrees with the list above.

Page 6-0, paragraph 6-2c. Correct the test equipment so that it agrees with the list above.

TEMPORARY CORRECTION T-7

TO TECHNICAL MANUAL FOR COMPARATOR-CONVERTER GROUP

AN/URA-17, AN/URA-17A

NAVSHIPS 0967-034-9010 (formerly NAVSHIPS 94028)

The ordering number for this Temporary Correction is NAVSHIPS 0967-034-9015.

This temporary correction revises the manual to reflect the equipment change made by Field Change 6-AN/URA-17 and Field Change 2-AN/URA-17A. The purpose of this field change is to replace wide-shift bandpass filter, FL1, and wide-shift discriminator filter, FL3, with filters having a center frequency of 2000 Hz.

When this change is included in the manual, the manual shall cover the equipment as though Field Change 6-AN/URA-17 or Field Change 2-AN/URA-17A had been accomplished in the equipment. This correction supersedes T-3 to NAVSHIPS 0967-034-9010.

Maintenance support activities shall make this correction in the Technical Manual immediately, but shall keep the superseded data intact for support of equipment that has not been modified.

Holders of equipment accompanied by Technical Manuals shall not make this correction in the manual until accomplishment of the field change.

Make the following pen-and-ink corrections. Insert this temporary correction in the Technical Manual immediately after the front cover and preceding T-6.

1. Page 1-3, paragraph 1-5b., third line; correct 2550 to read 2000.

2. Page 3-3, paragraph 3-2g.(1)Step 6, second line; correct 2.5 to read 2.

3. Page 3-4, paragraph 3-2g(2), Step 6, second line; correct 2.5 to read 2. Paragraph 3-3a(3)(a),second line; correct 2.5 to read 2.

4. Page 4-1, Figure 4-3, Discriminator Response Curve (wide-shift Discriminator, FL3); correct 2050 to read 1500, 2550 to read 2000 and 3050 to read 2500. Paragraph 4-2b(1), eleventh line; correct 2550 to read 2000.

5. Page 4-3, paragraph 4-2b(3), second paragraph of the page, fifth line; correct 2550 to read 2000. Sixth line; correct 3400 to read 2850. Eighth line; correct 1700 to read 1150.

6. Page 6-4, paragraph 6-3d(6)(a), Step 6; correct 2550 to read 2000.

7. Page 6-5, Table 6-2 Filter characteristics: Column, "Input Termination"; correct 2550 to read 2000. Column "OUTPUT TERMINATION"; correct 2550 to read 2000. Column "REQUIRED FREQUENCY RESPONSE"; correct 2050 to read 1500 and 3050 to read 2500. Column "INSERTION LOSS"; correct 2550 to read 2000.

8. Page 6-6, paragraph 6-3d(7)(a), Step 10; correct 1500 to read 950.

9. Page 6-7, Figure 6-1, Discriminator Frequency Response Curves "WIDE SHIFT"; correct as indicated.

"PEAKS" -1.15 vice 1.7 and 2.85 vice 3.4 "SUM OF ABSOLUTE VOLTAGES"-1.65 vice 2.2 and 2.35 vice 2.9.

"MINIMUM VOLTAGE CHANGE" - 1.65 vice 2.2 and 2.35 vice 2.9.

"CENTER FREQUENCY" - 2.00 vice 2.55. Correct scale as indicated:

1.25 vice 1.8, 1.65 vice 2.2, 2.05 vice 2.6, 2.45 vice 3; 2.85 vice 3.4.

10. Page 6-9, paragraph 6-3d(7)(a), Step 11, second line; correct 3700 to read 3150. Step 13; correct 2200 to read 1650; correct 2900 to read 2350; correct 2500 to read 1950; correct 2600 to read 2050; correct 1700 to read 1150 and correct 3400 to read 2850.

11. Page 7-7, "MAINTENANCE PARTS LIST", REF DESIG FL1, under column, "NAME AND DESCRIPTION", correct 2550 where appearing to read 2000 and delete all after 1-3/4 in. W. REF DESIG FL3, under column "NAME AND DESCRIPTION"; correct 1700 to read 1150; correct 3400 to read 2850; correct 2500 to read 2000 and delete all after 1-1/2 in. W.

Record this action on the Record of Corrections Made page.

UNCLASSIFIED

T- 8 , NAVSHIPS 0967-034-9016 Date 1 AUGUST 1974

INTERIM CHANGE T- 8 TO NAVSHIPS 0967-034-9010 Technical Manual dated 7 April 1971 for Converter-Comparator AN/URA-17, AN/URA-17A, and AN/URA-17B.

☒ THIS CHANGE DOES NOT SUPERSEDE ANY OTHER CHANGE.
☐ THIS CHANGE SUPERSEDES _____.

This Interim Change revises the manual to reflect the equipment changes made by Field Change(s) 8-AN/URA-17, 4-AN/URA-17A, 2-AN/URA-17B, and 2-AN/URA-17C EFCB NAVSHIPS 0967-034-9130 dated 1 August 1974.

This Interim Change originally published in EIB 835 .

Maintenance Support Activities shall make this change immediately but shall keep the superseded data intact for support of equipments that have not been modified.

Holders of equipment shall not make this change in the manual until accomplishment of the field change referenced above.

Insert this Interim Change in the manual immediately after the front cover and preceding prior changes in effect.

Make pen-and-ink changes as follows:

1. Page 4-5, paragraph 4-2C(4):

(1) Line 13--change "deliver a strong positive" to read "deliver a positive 6 volt."

(2) Line 18--change "delivers a strong negative" to read "delivers a negative 6 volts."

(3) Last line--after word "keyer" add "for High Level systems or provides a ±6 volt polar signal for Low Level systems."

2. Refer to figure 1 of this article and make the following changes to page 5-11, 5-12 figure 5-6 and page 6-15, 6-16 figure 6-5:

(1) Delete "R60" and "220." Change the resistor symbol to show a zener diode with the anode (+) side connecting to the junction of R59 and Q16. Label this diode "CR35", "1N3828A."

(2) Delete the circuit symbol number "R61" and the value "220." Change the resistor symbol to show a zener diode with anode (+) side connecting to the junction of R63 and ground. Label this diode "CR36", "1N3828A."

(3) Add the symbol for a capacitor between the collector of Q16 and ground. Label this capitor "C33, 2.5."

(4) Add wire between collector of Q14 and J1-8.

(5) Delere the symbol, symbol number and value for resistors R65 and R67.

(6) At the top of page above Q13, waveform C, change "+3.2V" to read ±6.2V."

(7) On the bottom of the page following the word Diagram add "for Low Level Polar Output."

3. Page 6-15, 6-16, Table of coordinates:

(1) Under Reference Designation after C32 add "C33"; opposite C33 under coordinates add "13C."

(2) Under Reference Designation after CR34 add "CR35" and "CR36." Opposite CR35 and CR36 under coordinates add "12B."

4. Page 6-11, 6-12; figure 6-3:

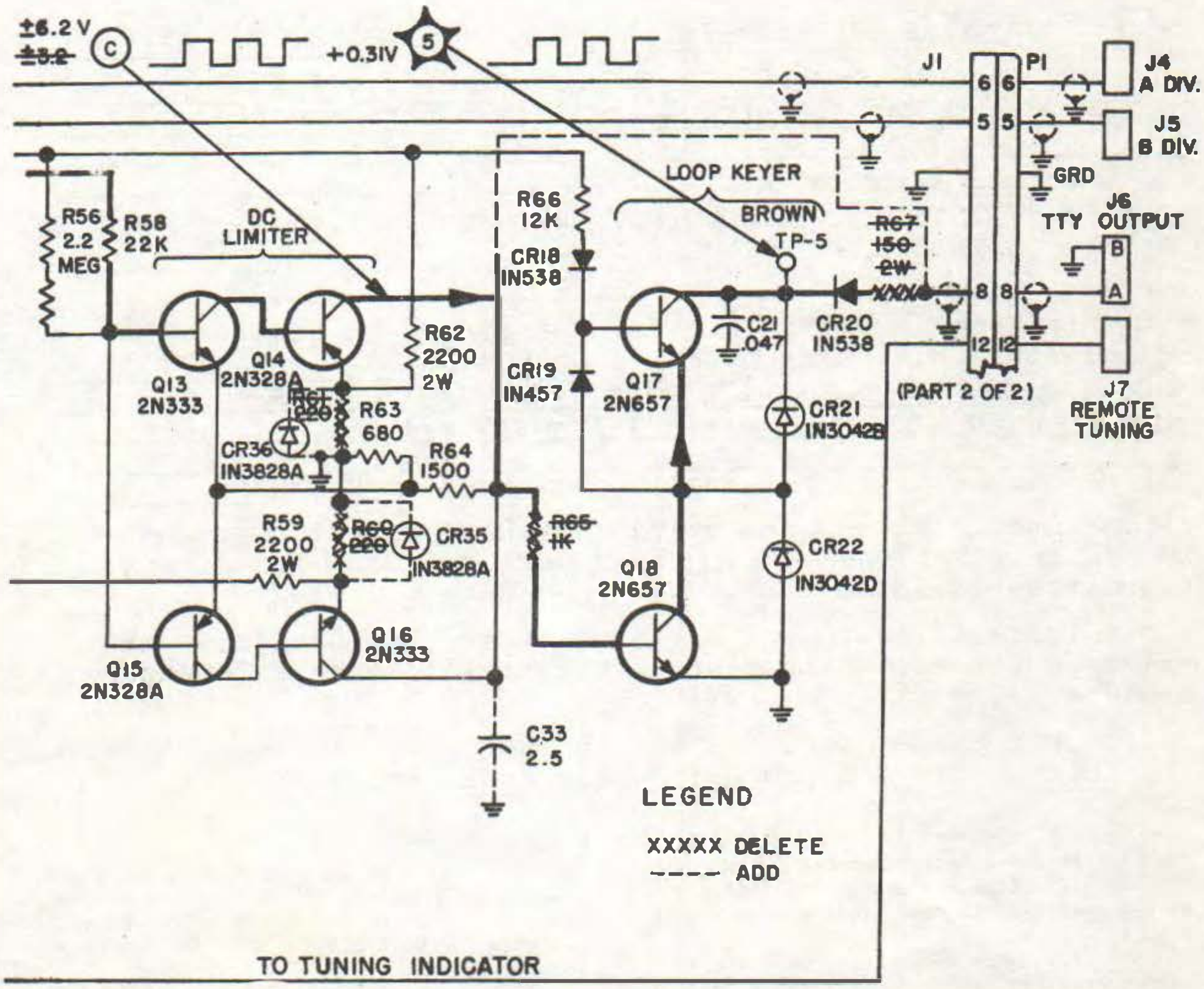
(1) Change R60 to show a diode with the (+) side connected to R59. Label this diode "CR35." Delete circuit symbol number "R60."

(2) Change R61 to show a diode with the (+) aide connected to terminal 43. Label this diode "CR36." Delete circuit symbol number "R61."

(3) Show a capacitor between the right terminal of R65 and the (+) side of CR22. Label this capacitor "C33."

(4) Show a wire connecting TB2 terminal 50 and the right terminal of R65.

(5) Delete resistors R65 and R67.



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITORS ARE IN UF
   ALL RESISTORS ARE IN OHMS
   ALL RESISTORS 1/2 WATT 10%
   K = 1000 MEG = 1,000,000

2. C31A, C31B IN SAME CASE.
   C27A, C27B IN SAME CASE.

3. UNLESS OTHERWISE INDICATED
   ALL VOLTAGES TAKEN TO CHASSIS
   WITH 20,000 OHM/VOLT VOLTMETER,
   WITH NO INPUT SIGNAL.

4. EXCEPT FOR POWER TRANSFORMER
   VOLTAGES, ALL VOLTAGES ARE DC.

5. ⊛ ZENER DIODE.

6. ALL ROTARY SWITCHES SHOWN IN
   FULLY CCW POSITIONS UNLESS
   OTHERWISE SPECIFIED.

7. ▭ INDICATES FRONT PANEL
   CONTROL.

8. ARROWS ON VARIABLE RESISTORS
   INDICATE CLOCKWISE ROTATION.

Figure 1. Frequency Shift Converter CV-483C/URA-17, Keyer Circuits, Functional Schematic Diagram for Low Level Polar Output

5. Page 7-4, Table 7-1:
(1) Under Reference Designation after CR34 add "CR35."
(2) Opposite CR35 under Name and Description add "Diode, zener, type 1N3828A." Under Locating Function add "DC Limiter Low Level Output."
(3) Under Reference Deaignation after CR35 add "CR36." Opposite CR36 under Name and Description add "Same as CR35." Under Locating Function add "DC Limiter Low Level Output."

6. Page 7-6, Table 7-1:
(1) Under Reference Deaignation after C32 add "C33."
(2) Opposite C33 under Name and Description add "Capacitor, 2.5 μf 50 volts Type CL27BJ2R5TN2." Under Locating Function add "Filter for Low Level Output."

7. Page 7-14, Table 7-1:
(1) Delete "R60" and "R61" and their asaociated Description and Locating Function.
(2) Delete "R65" and its Description and Locating Function.

8. Page 7-15, Table 7-1:
(1) Delete "R67" and its Description and Locating Function.

9. Page 1-8, Table 1-6:
(1) Add symbols "CR35" and "CR36."
(2) Add column for diode type "1N3828A."
(3) Opposite CR35 under 1N3828A add "1."
(4) Opposite CR36 under 1N3828A add "1."
(5) Opposite total number each type under 1N3828A add "2."
(6) Under total column change 34 to read "36."

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