CHANGE 1 TO TECHNICAL MANUAL FOR ELECTRICAL FREQUENCY SYNTHESIZERS O-1115/URC AND O-1494/URC, NAVSHIPS 0969-256-6010.

This permanent change is in effect immediately.

This permanent change revises the technical manual to include coverage for Electrical Frequency Synthesizer O-1494/URC delivered under Contract N00024-67-C-1551. The primary difference between the Electrical Frequency Synthesizers O-1115/URC and O-1494/URC is that the O-1115/URC operates from 115V AC, 400 cps and the O-1494/URC operates from 115V AC, 60 cps.

1. Remove superseded pages and insert revised pages as indicated below:

PAGE	REMOVE	INSERT	PAGE	REMOVE	INSERT
Cover	Orig	New	4-3/4-4	Orig/Orig	Chg 1/Orig
T.P./ii	Orig/Orig	Chg 1/Chg 1	4-47/4-48	Orig	Chg 1
v/vi	Orig/Orig	Chg 1/Orig	5-1/5-2	Orig/Orig	Chg 1/Orig
ix/1-0	Orig/Orig	Chg 1/Orig	5-53/5-54	Orig/Orig	Orig/Chg 1
1-1/1-2	Orig/Orig	Chg 1/Chg 1	5-54A		Chg 1
1-5/1-6	Orig/Orig	Chg 1/Orig	5-81/5-82	Orig/Orig	Orig/Chg 1
2-1/2-2	Orig/Orig	Chg 1/Chg 1	5-101/5-102	Orig	Chg 1
2-3/2-4	Orig	Chg 1	6-0		Chg 1
2-5/3-0	Orig/Orig	Orig/Chg 1	6-1/6-2	Orig/Orig	Chg 1/Orig
4-1/4-2	Orig/Orig	Chg 1/Orig			

2. If necessary, make the following pen-and-ink corrections:

PAGE NO.	CHG IN EFFECT	PARA AND LINE OR FIG./ TABLE AND LOCATION	ACTION
1-6	Orig	Table 1-3	Transfer all information that may have been written in on this table to the new page 1-6 supplied with Chg 1 to the manual.

3. Destroy superseded pages, but not until the complete manual has been checked against the "List of Effective Pages."

4. Insert this Instruction Sheet just behind the front cover.

NAVSHIPS 0969-256-6010

TECHNICAL MANUAL

for

ELECTRICAL FREQUENCY SYNTHESIZER O-1115/URC O-1494/URC

DEPARTMENT OF THE NAVY

NAVAL ELECTRONIC SYSTEMS COMMAND

Publication: 28 June 1968
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LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title Page	Change 1	4-2	Original
ii	Change 1	4-3	Change 1
iii to iv	Original	4-4 to 4-46	Original
v	Change 1	4-47	Change 1
vi to viii	Original	4-48	Original
ix	Change 1	5-1	Change 1
1-0	Original	5-2 to 5-53	Original
1-1 to 1-2	Change 1	5-54 to 5-54A	Change 1
1-3 to 1-4	Original	5-55 to 5-81	Original
1-5	Change 1	5-82	Change 1
1-6	Original	5-83 to 5-100	Original
2-1 to 2-3	Change 1	5-101	Change 1
2-4 to 2-5	Original	5-102	Original
3-0	Change 1	6-0 to 6-1	Change 1
3-1 to 3-9	Original	6-2 to 6-60	Original
4-0	Original	i-0 to i-8	Original
4-1	Change 1		

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TABLE OF CONTENTS (continued)

LIST OF ILLUSTRATIONS

LIST OF TABLES

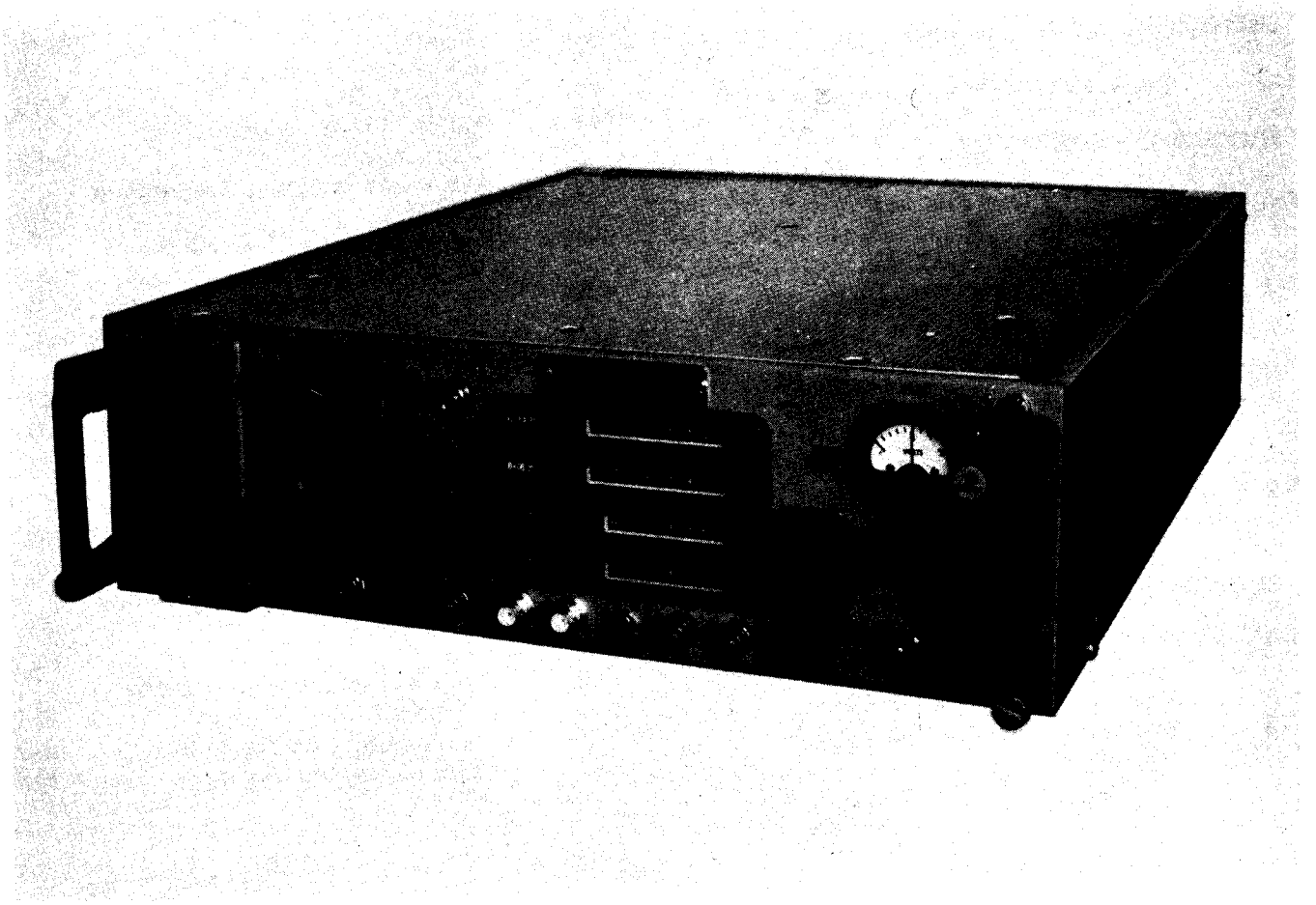


Figure 1-1. Synthesizer, Electrical Frequency 0-1115/URC

SECTION 1

GENERAL INFORMATION

1-1. SCOPE

This Technical Manual is in effect upon receipt. When superseded by a later edition, this publication should be destroyed. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications. This manual covers Synthesizer, Electrical Frequency O-1115/URC with either A, B, C, or D prefix on serial numbers. In addition, coverage is also included for Synthesizer, Electrical Frequency O-1494/URC with an A prefix on serial numbers. All Synthesizers, Electrical Frequency O-1115/URC (serial numbers A, B, C, or D) are electrical identical, mechanical similar, and directly interchangeable. Since the Synthesizer, Electrical Frequency O-1494/URC requires 115V AC, 60 cps input power (the Synthesizer, Electrical Frequency O-1115/URC requires 115V AC, 400 cps), it is not electrically identical or directly interchangeable with the Synthesizer, Electrical Frequency O-1115/URC. The primary power input connections of the A, B, C, or D versions (serial number) of Synthesizer, Electrical Frequency O-1115/URC are different. With the exception of the primary power requirements for the Synthesizer, Electrical Frequency O-1494/URC, the primary power input connections are similar to the A version of the Synthesizer, Electrical Frequency O-1115/URC.

1-2. GENERAL DESCRIPTION

a. Synthesizer, Electrical Frequency O-1115/URC or O-1494/URC (to be commonly referred to as "synthesizer") is a precision frequency generator that provides more than 690,000 output frequencies with a stability of 1 part in 10^8 per day, in the range of 2 to 34 mc covered in four bands: 2.00 to 4.25 mc, 4 to 8.50 mc, 8 to 17 mc, and 16 to 34 mc. An illuminated front panel readout indicates the output frequency. Auxiliary outputs of 1 mc and 100 kc are also provided. The synthesizer consists of a main variable frequency oscillator (vfo) which is disciplined by three secondary variable frequency oscillators. All four oscillators are phase locked to a stable (1 part in 10^8 per day) crystal-controlled 1-mc reference oscillator, and therefore the stability of the synthesizer output frequency equals that of the reference oscillator. Three straight line tuning controls are connected through a gear box to the tunable components and to four readout counters (one for each band). Detent mechanisms with warning lights assure accurate positioning of the controls. The warning lights also indicate when the associated secondary vfo is out of lock.

b. An external 1-mc standard frequency may be injected to monitor the internal reference oscillator, to substitute for a defective internal reference oscillator or to replace the internal reference if an output stability greater than 1 part in 10^8 per day is required. Two front-panel jacks allow the 2-34-mc output frequencies to be checked against a frequency counter using the 100-kc auxiliary output of the synthesizer as the time base. A vacuum-tube voltmeter and an audio amplifier built into the set are used to check overall performance and individual circuit performance of the synthesizer. A complete set of major test points is also readily available. The synthesizer and its case may be bench mounted with a shock and vibration mount or rack mounted using auxiliary brackets. In either installation, the chassis may be slid out of its case and tilted for servicing. A built-in tool and spare-parts kit is included for easy maintenance.

1-3. REFERENCE DATA.

a. FREQUENCY RANGE. - 2 to 34 mc.

b. TUNING BANDS. - Four.

Band 1: 2.0 to 4.25 mc in 12.5-cycle steps
Band 2: 4.0 to 8.50 mc in 25-cycle steps
Band 3: 8.0 to 17 mc in 50-cycle steps
Band 4: 16.0 to 34.0 mc in 100-cycle steps

c. AUXILIARY OUTPUT FREQUENCIES. - 1 mc and 100 kc.

d. OUTPUT LEVELS. - Adjustable within 1.0 to 2.5 vrms at 2 to 34 mc; 1 vrms at 1 mc and 100 kc.

e. OUTPUT IMPEDANCES. - 50 ohms at 2 to 34 mc and 1 mc; 500 ohms at 100 kc.

f. EXTERNAL AUXILIARY REFERENCE SOURCE.

(1) FREQUENCY. - 1 mc or 100 kc.

(2) SIGNAL LEVEL. - 1 volt.

g. READABILITY ERROR. - Zero.

h. RESETTABILITY ERROR. - Zero.

i. MOUNTING. - Bench or relay rack.

j. CRYSTAL.

(1) DESIGNATION. - MIL-C-3098B type CR28/U; 93279 type MLS-33.

(2) TYPE OF CUT. - AT

(3) CRYSTAL FREQUENCY. - 999.967 kc ± 2 cps.

(4) OSCILLATION FREQUENCY. - 1 mc.

(5) TEMPERATURE COEFFICIENT. - 0.25 parts/million/°C max.

(6) OPERATING TEMPERATURE. - 75°C (167°F).

k. FREQUENCY STABILITY. - 1 part in 10^8 per day.

l. OPERATING AMBIENT TEMPERATURE. - 0°C to +50°C (32°F to 122°F).

m. INPUT POWER REQUIREMENTS. -

(1) SYNTHESIZER, ELECTRICAL FREQUENCY O-1115/URC. 105 – 125 vac, 400 cps, 1.7 amperes at 115 vac.

(2) SYNTHESIZER, ELECTRICAL FREQUENCY O-1494/URC. 105 – 125 vac, 60 cps, 1.7 amperes at 115 vac.

1-4. EQUIPMENT SUPPLIED.

Equipment supplied with the synthesizer is listed in table 1-1. The list includes the unit, its case and technical manuals.

1-5. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED.

Equipment and publications required but not supplied with the synthesizer are listed in table 1-2. The list includes accessories, test equipment, technical manuals and special tools.

TABLE 1-1. EQUIPMENT SUPPLIED

QTY PER EQUIP	NOMENCLATURE		OVER-ALL DIMENSIONS (IN.)			VOLUME	WEIGHT
	NAME	DESCRIPTION	HEIGHT	WIDTH	DEPTH	(CU FT)	(LB)
1	Synthesizer, Electrical Frequency	O-1115/URC or O-1494/URC	5-1/4	19	21-1/2	1.23	90
2	Technical Manual for Synthesizer, Electrical Frequency O-1115/URC and O-1494/URC	NAVSHIPS 0969-256-6010 (Change 1 reqd) for coverage of O-1494/URC)	11	8-1/2	1	–	–
1	Adapter	CP1	1	2-1/2	1-1/4	–	–
4	Relay Rack Mounting Brackets (with Attaching Hardware)	(2) MP29 (2) MP30	–	–	–	–	5
1	Cable, Power	W1	6	Foot	Length	–	–

1-6. FACTORY OR FIELD CHANGES.

Factory modifications have been made to the synthesizer in the form of factory-selected values for certain components. Table 1-3 lists the basic component reference designation, the selected component reference designation such as C128-3, and the associated value of the component. Refer to this table when trouble shooting or replacing any parts. No factory or field changes have been made to the synthesizer.

1-7. EQUIPMENT SIMILARITIES

The synthesizers covered in this technical manual are similar to Synthesizer, Electrical Frequency O-1131/GRC except that the latter has an auxiliary 1.75 mc output, has its output frequency readout shifted by 1.75 mc and does not contain auxiliary items such as a phase monitor, an audio amplifier, a tool kit, and a 1-mc output.

1-8. PREPARATION FOR RESHIPMENT.

Make sure that the tubes, assemblies, and fuses are installed in the synthesizer and are properly seated in their sockets. Wrap the technical manuals in a separate package and label this package "TECHNICAL MANUALS INSIDE". If the original shipping case is not available, refer to table 1-1 for the necessary dimensions. If the unit is to be packaged for overseas shipment, include an outer barrier; if it is to be stored or shipped domestically, the outer barrier is not required. Make sure to prepare a separate package of relay-rack mounting parts and ship these with the synthesizer. Always include a packing slip in each box, listing all the items packed in the box.

TABLE 1-3. FACTORY MODIFICATIONS FOR EQUIPMENT SERIAL NO. _____

REF DESIGNATION		SELECTED VALUE (PICOFARADS)	REF DESIGNATION		SELECTED VALUE (OHMS)
BASIC	SUFFIX		BASIC	SUFFIX	
C105	-		R112	-	
C126	-		R1004	-	
C128	-		R1243	-	
C140	-		R1244	-	
C200	-		R1245	-	
C906	-		R1246	-	
C1540	-		R1247	-	
C1761	-		R1248	-	
C1837	-		R1819	-	
C1940	-		R1820	-	
			R1919	-	
			R1920	-	
			R1936	-	

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING.

a. UNPACKING. - Synthesizer, Electrical Frequency O-1115/URC or O-1494/URC (to be commonly referred to as "synthesizer") is shipped in a single container. The individual items are listed in table 1-1. Unpack the synthesizer as follows:

(1) Set up wooden crate or corrugated carton as designated by markings on the outside.

(2) Remove fasteners from bottom of crate or top of carton.

(3) Lift crate or open carton and remove technical manuals.

(4) If necessary, cut two straps which secure synthesizer in place, using sheet metal shears.

(5) Slit waterproof barrier and open corrugated wrapping.

(6) Carefully lift out synthesizer and place it on a work bench.

(7) Open small box containing rack mounting parts, check contents against table 1-1, and store container with parts in suitable place.

b. HANDLING. - When handling, assure that the synthesizer is secured in its case with the front-panel thumbscrews tightened.

2-2. POWER REQUIREMENTS.

a. SYNTHESIZER, ELECTRICAL FREQUENCY O-1115/URC. - This synthesizer requires 105-125 vac, 400 cps, single phase primary voltage with 1.7 amperes drain at 115 vac. (See figure 5-70.)

b. SYNTHESIZER, ELECTRICAL FREQUENCY O-1494/URC. - This synthesizer requires 105-125 vac, 60 cps, single phase primary voltage with 1.7 amperes drain at 115 vac. (See figure 5-70.)

2-3. SITE SELECTION.

The synthesizer should be located to permit connections to the equipment(s) being supplied the output frequencies during normal operation. The location should provide adequate clearance for removal of the synthesizer from its case, tilting it on the tilt-slide assembly for servicing, and access to the connectors at the rear of the case. The area must be dust free and large enough for efficient operation of the blower and air filter, and for adequate heat dissipation. Figure 2-1 illustrates the dimensional requirements for installation.

2-4. INSTALLATION REQUIREMENTS.

a. PREPARATION FOR INSTALLATION. - The synthesizer is primarily designed for rack mounting; however, it may also be bench installed with an auxiliary shock and vibration mount. Prior to installation, separate the synthesizer from the case as follows:

(1) Place synthesizer on work bench and solidly secure case.

(2) Loosen thumbscrew on each handle and carefully slide synthesizer out of case until it locks in position.

(3) Pull tilt latch on each side of front panel and swing synthesizer chassis to vertical position for access to rear panel. (See figure 2-2.)

(4) Disconnect all power and r-f connectors from rear panel jacks and tag them for identification.

(5) Remove cable clamp from rear panel.

(6) Tilt synthesizer chassis so front panel faces upward.

CAUTION

Two men should be employed when performing next step.

(7) Loosen pivot screw on slide at each side of synthesizer chassis and carefully lift unit, separating it from tilt-slide assembly. Set it aside on a work bench.

b. RELAY-RACK INSTALLATION. - Prior to rack installation, separate the synthesizer from the case as described in paragraph 2-4a. Install the case in the rack as follows:

(1) Install two front brackets (MP30), furnished with synthesizer (refer to table 1-1) to case and secure with four no. 10-32 x 3/8-inch flat-head screws included with each bracket. Make sure to insert screws from inside of case.

(2) Install two rear brackets (MP29), furnished with synthesizer, to rear of rack using four no. 10-32 x 3/8-inch binding-head screws included with each bracket.

(3) Support case in position, and using four no. 10-32 x 3/8-inch binding-head screws, secure each front bracket to rack.

(4) Insert twoNo. 10-32 x 3/8-inch flat-head screws, supplied, from inside of case into rear bracket, and screw in lightly. Mechanical connections to rear brackets are horizontally adjustable to correctly position case in rack. Tighten all mounting screws after case has been properly positioned.

(5) To replace synthesizer in its case reverse order of removal.

(6) Check operation of synthesizer in tilt-slide assembly by placing it in each of its applicable positions. Check for abnormal interference or operation of cable retractor, making sure that cables are not pinched at any time. Check that synthesizer locks in extended position of tilt-slide assembly.

c. BENCH INSTALLATION. - Prior to bench installation, separate synthesizer from case as described in paragraph 2-4a. Bench-mount case as follows:

(1) Locate position of synthesizer case on bench, making sure to provide adequate clearance for movement of mounting at least 1 inch in each direction, and for tilting synthesizer in tilt-slide assembly.

(2) Drill required number of holes to secure mounting to bench and bolt mounting to bench.

(3) Install case on mounting and secure in place.

(4) To replace synthesizer in its case, reverse order of removal.

(5) Check operation of synthesizer in tilt-slide assembly by placing it on each of its applicable positions. Check for abnormal interference or operation of cable retractor, making sure that cables are not pinched at any time. Check that synthesizer locks in extended position of tilt-slide assembly.

2-5. CABLE ASSEMBLIES.

Table 2-1 is a list of cables required for installation of the synthesizer. The table includes information such as the number of active and spare conductors, load handling capability, color code, and associated connectors or adapters. No maximum length is applicable.

2-6. INSPECTION AND ADJUSTMENT.

After the installation is completed, check the synthesizer as follows:

a. Check OVEN indicator lamp to make sure that it is "on" or that it cycles "on" and "off" at a regular rate.

b. Turn on POWER switch; blower should begin operating, OVEN indicator lamp should remain "on" or cycle, and detent lamps should blink for approximately one minute and then extinguish.

c. Set synthesizer to low, middle and high frequencies on each band, following operating procedures.

d. Check readings of VTVM for all vtvm switch positions, as listed in table 3-2.

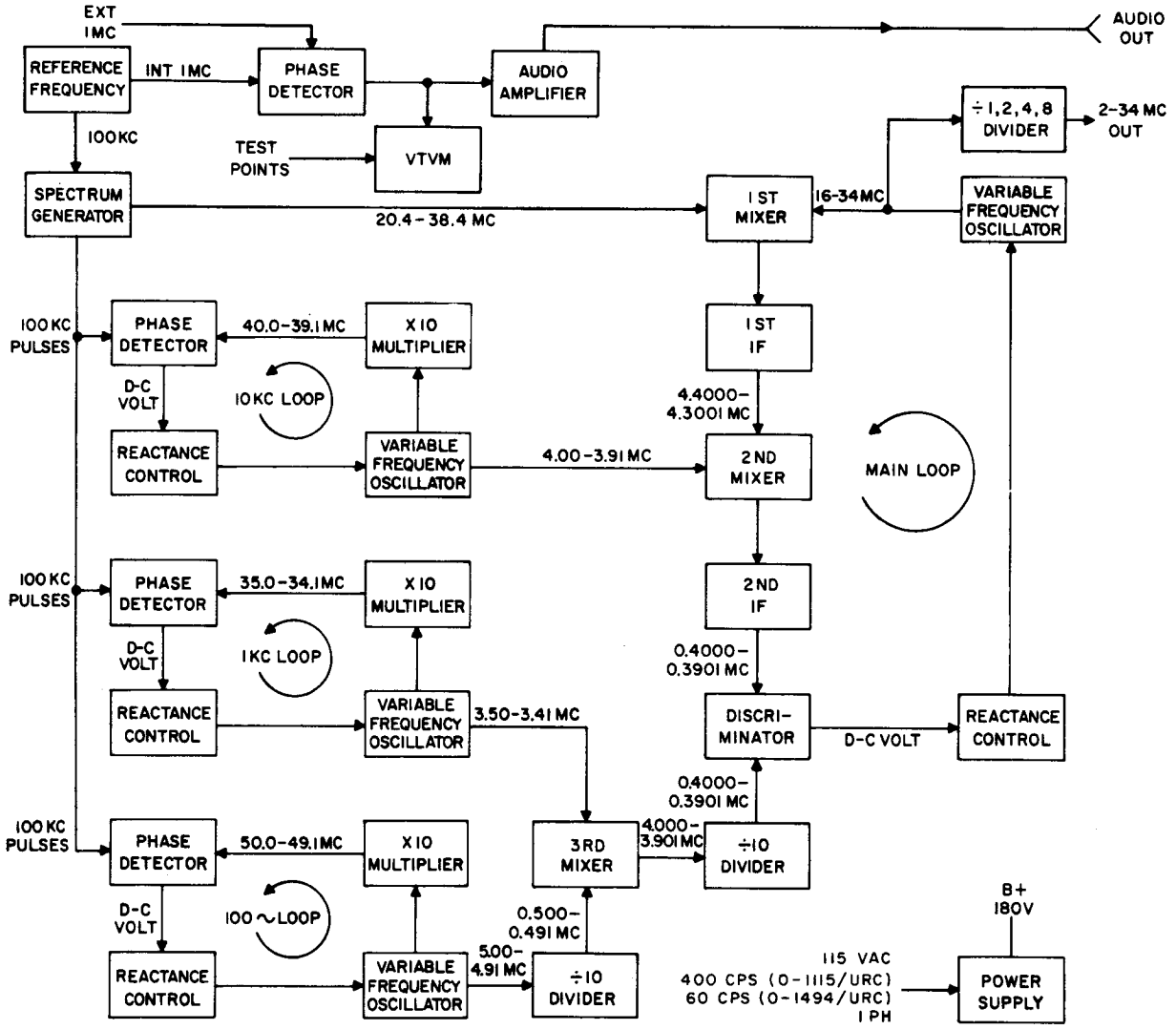


Figure 4-1. Synthesizer, Electrical Frequency 0-1115/URC, Overall Functional Block Diagram

mixer, and produces a d-c voltage in proportion to the frequency and phase difference between these two inputs. The d-c voltage is applied to the main-loop reactance, which changes the operating frequency of the main loop vfo to minimize the error voltage.

g. Table 4-1 depicts the output frequencies of the various circuits with the synthesizer when the MAIN TUNE, TUNE (1KC) and TUNE (100 ~) controls are in positions zero (16.000-000 mc) through nine (16.099900 mc). The output frequency of the first and second mixers is the difference of the input frequencies and the output of the third mixer is the sum of the input frequencies. For example when the three tuning controls are in position five, the 20.4 mc spectrum generator output is combined in the first mixer with the 16.055500 mc main loop vfo signal to produce a first i-f frequency of 4.3445 mc. The 3.95-mc output of the 10-kc loop is combined in the second mixer with the 4.3445 first i-f frequency to produce a second i-f frequency of 0.3945 mc. The 4.95-mc output of the 100 cycle loop is divided to 0.495 mc and combined in the third mixer with the 3.45-mc output of the 1-kc loop to produce a 3.945-mc output. The 3.945-mc output of the third mixer is divided to 0.3945-mc and then compared in the discriminator with the 0.3945-mc second i-f signal.

4-3 REFERENCE STANDARD, FUNCTIONAL SECTION DESCRIPTION.

a. OVERALL FUNCTIONAL SECTION DESCRIPTION. - The reference standard functional section (see figure 4-2)consists of the following circuits: high stability 1-mc oscillator and oven control circuit, regenerative divider, 1 mc buffer amplifier, 100 kc buffer amplifier and spectrum generator driver. The reference standard provides the auxiliary 1 mc and 100 kc sine wave frequencies and the 100 kc driving signal which are derived directly from the high stability 1 mc reference oscillator. The 100 kc driving signal is fed to a spectrum generator and used as a stable reference for the main loop, 10-kc loop, 1-kc loop, and 100-cycle loop. To control the synthesizer with an external reference source having a greater stability than that of the internal oscillator, or if the internal 1-mc oscillator should become faulty, the INT-EXT switch (S100) is placed in the EXT position and the external reference source fed into the EXT 1 MC REF IN jack. The internal high stability 1-mc oscillator generates the basic 1-mc reference frequency and a crystal oven maintains the oscillator crystal at the correct operating temperature to reduce frequency drift due to ambient temperature changes. The 1 mc sine wave signal is then fed to a regenerative divider and converted to a 100-kc frequency with a stability equal to that of the 1-mc reference. The 1-mc signal is also fed through a 1 mc buffer amplifier for use as an auxiliary output. The 100-kc output of the regenerative divider is fed to the spectrum generator driver which raises the input to the high output necessary to drive the spectrum generator. The regenerative divider output is also fed through the 100 kc buffer amplifier for use as an auxiliary 100-kc output.

b. OVERALL FUNCTIONAL SECTION TEST DATA. - Information which will aid in determining the overall performance of the reference standard is listed below. Refer to figure 4-36 for the circuit location of test points and figures 3-2, 5-31, 5-35 and 5-36 for the physical location of test points.

(1) TEST DATA.

(a) R-f output (J2). - 1 mc @ 1.5 vrms minimum into 50 ohms.

(b) R-f output (J3). - 100 kc @ 0.7 vrms minimum into 500 ohms.

(c) R-f output (V102, pin 5). - 100 kc @ 250 vac p-p minimum.

(d) B+. - +180 vdc .

(e) Crystal oven voltage (pins 5 and 7 of oven). - 6.3 vac ±10%.

(2) TESTS. - Perform the following tests to determine if the reference standard functional section is faulty. The test equipment required to perform the tests is a frequency meter, a vtvm, and an oscilloscope (refer to Section 1 for type designations). The tests are performed with the INT-EXT selector switch (S100) in the INT position.

WARNING

Observe safety precautions when trouble shooting; high voltages exist.

(a) Measure r-f output signal at INT 1 MC REF OUT jack J2.

(b) Measure r-f output signal at 100 KC OUT jack J3.

(c) Measure r-f output signal at plate of spectrum generator driver V102, pin 5.

(d) Measure B+ voltage applied to functional section.

(e) Check stability of internal 1 mc reference oscillator as described in paragraph 3-6b (1).

5-35. FRONT I-F SUBASSEMBLY REMOVAL AND REPLACEMENT

The front i-f subassembly may be lifted out of the synthesizer (and be kept energized) for servicing and access to various components. However, not all r-f input and output connections are maintained and if these are required, jumper cables must be used. To lift out the subassembly proceed as follows:

a. Loosen thumbscrews on each handle and slide synthesizer out of case until it locks in position.

b. Remove top and bottom covers by releasing captive fasteners and lifting off covers.

c. Remove top right channel (angle bracket) by taking out the ten securing screws.

d. Unsolder five color coded coaxial cables connected to front i-f subassembly. Four cables(color coded orange, yellow, blue, and white) are accessible from bottom of synthesizer and connect to switch assemblies A1501, A1700,

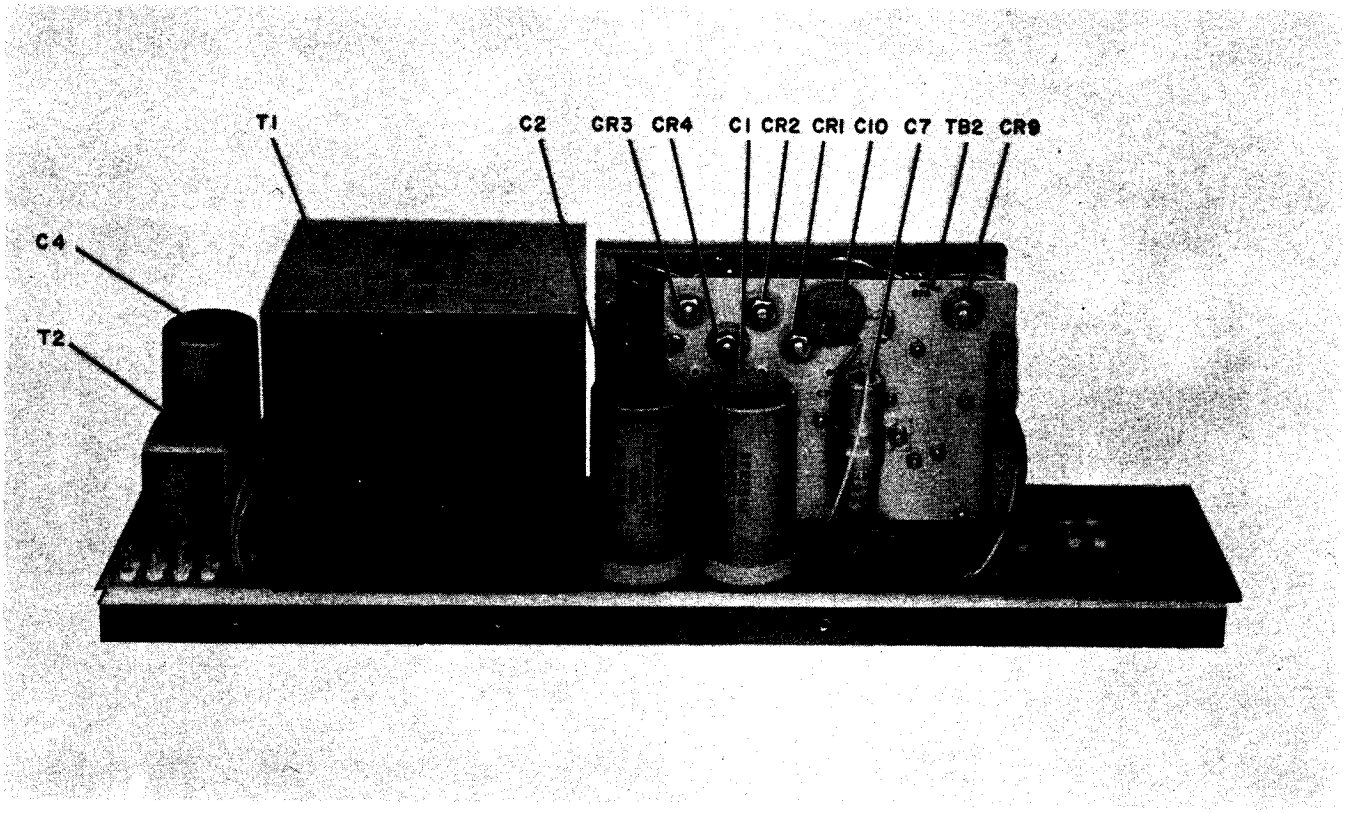


Figure 5-67. Power Supply, Rear View, Component and Test Point Locations

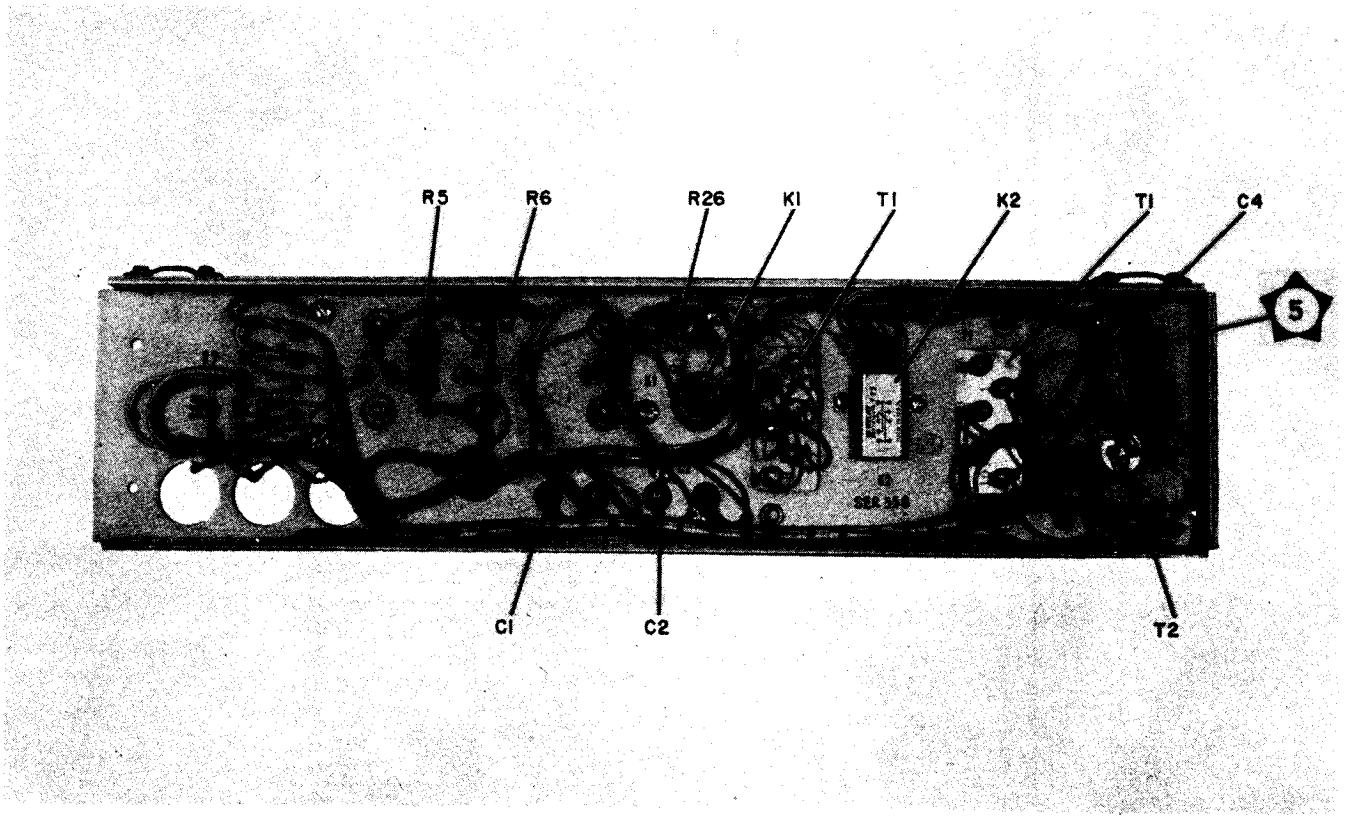


Figure 5-68. Power Supply, Bottom View, Component and Test Point Locations

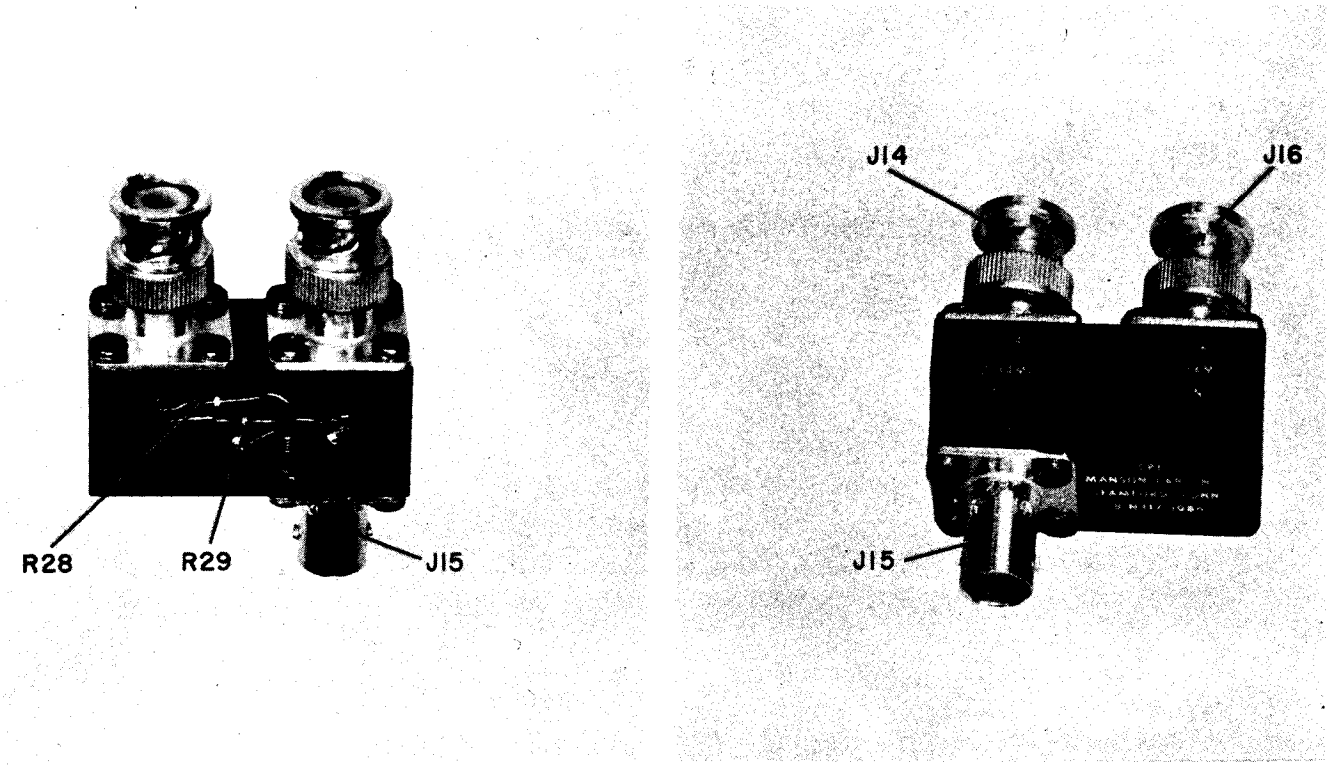


Figure 5-69. Adapter CP1, Component Location

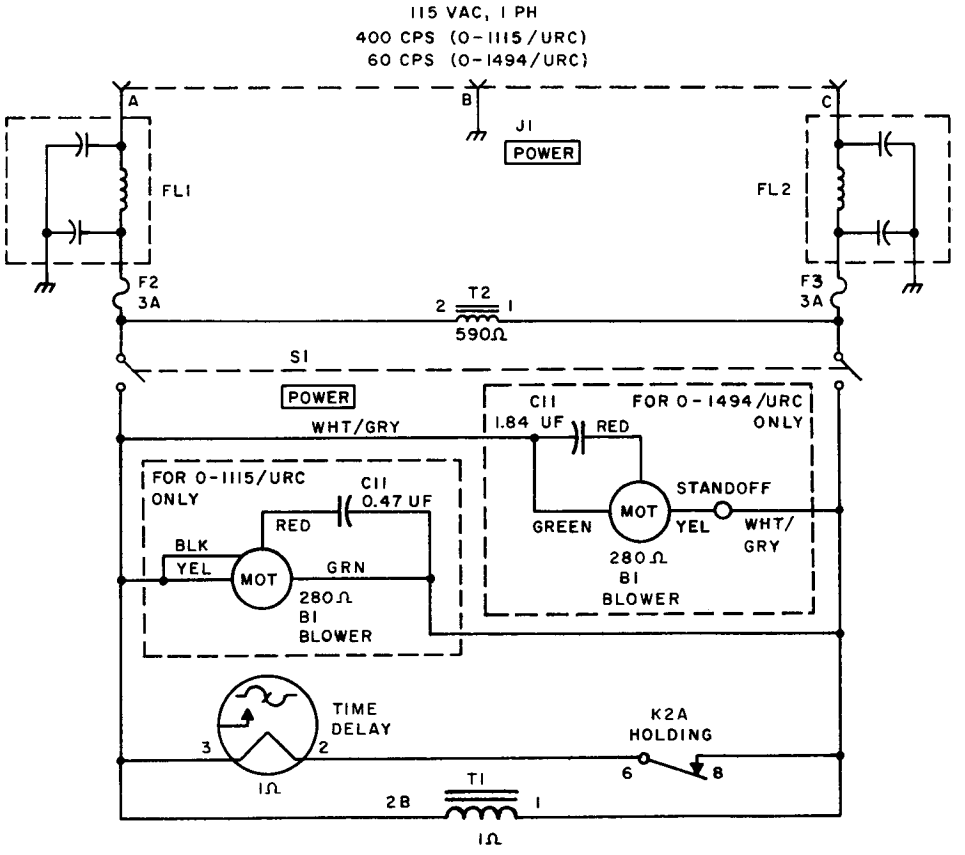


Figure 5-70. Primary Power Distribution, Schematic Diagram

SECTION 6

PARTS LIST

6-1. MAINTENANCE PARTS LIST.

NOTE

The parts list section has been revised with the addition of supplementary parts list table 6-0. This table lists the parts contained in the Synthesizer, Electrical Frequency O-1494/URC that are different from the equivalent part in the Synthesizer, Electrical Frequency O-1115/URC. For any given item of the Synthesizer, Electrical Frequency O-1494/URC, always refer to table 6-0 first. If no information is shown for a given item, then refer to the basic table (table 6-1) for the required information. For any given item of the Synthesizer, Electrical Frequency O-1115/URC, disregard table 6-0 and refer directly to table 6-1.

Table 6-1 lists all parts of maintenance significance for the synthesizer. The parts are listed in numerical sequence. Maintenance parts are listed alphabetically — numerically by class of part. Table 6-1 provides the following information: (1) the complete reference designation of each assembly, subassembly, or part, (2) reference to explanatory notes in paragraph 6-4, (3) noun name and brief description, and (4) identification of the illustration which pictorially locates the part. Assembly boards and modules are listed first as individual items in the maintenance parts list. In addition, at the completion of a parts listing for each unit, the individual circuit board, assembly board, module, etc., is then broken down by components into separate parts listings. When there is a redundancy of such electronic assemblies in subsequent units, reference is made to the parts breakdown previously listed.

NOTE

A brief description is given for all key parts (parts differing from any parts previously listed in this table) and sub-key parts (parts identical to a key part but appearing for the first time for a unit). The names and descriptions are omitted for other parts, but reference is made to the key or sub-key part for the data. Unless otherwise indicated, all drawing numbers apply to equipment manufacturer and all type numbers apply to part manufacturer.

6-2. LIST OF MANUFACTURERS.

Table 6-2 lists the manufacturers of parts used in the equipment. The table includes the manufacturers code used in tables 6-0 and 6-1 to identify the manufacturers.

6-3. STOCK NUMBER IDENTIFICATION.

Allowance Part List (APL) issued by the Electronics Supply Office (ESO) include Federal Stock Numbers and Source Maintenance and Recoverability Codes. Therefore, reference should be made to the APL prepared for the equipment for stock numbering information.

6-4. NOTES.

The following notes provide information as referenced in table 6-1.

1. Not replaceable in this application. Listed for reference only.

2. Factory-selected value. Refer to table 1-3 for complete reference designation and value. Replace defective part with identical component.

3. Replacement part must include kit.

4. Part of adapter CP1. Replacement not recommended.

5. Used only on synthesizers with A and D prefixes on serial numbers.

6. Used only on synthesizers with B and C prefixes on serial numbers.

TABLE 6-0. SUPPLEMENTARY MAINTENANCE PARTS LIST

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
A1		SYNTHESIZER SUBASSEMBLY, GEAR SPEED DECREASER: 26916 type 150-012793	5-31
A5		FAN, CENTRIFUGAL: elect mot dr; 3300 rpm; 115 vac; 1 ph; 60 cps; w/1.84 uf starting cap.; 26916 type 150-017509-001	5-31
B1		MOTOR, ALTERNATING CURRENT: 1 ph, 115 vac; 60 cps; 26916 type 020-000997	5-51
C11		CAPACITOR: blower motor type; 1.84 uf; ±10%; 200 vdc; 26916 type 046-002329	5-53

TABLE 6-1. MAINTENANCE PARTS LIST

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
A1		SYNTHESIZER SUBASSEMBLY, GEAR SPEED DECREASER: 26916 type 150-017478	5-31
A2		SYNTHESIZER SUBASSEMBLY, POWER SUPPLY: electronic, full-wave rect; d-c output voltage, adj ±5v, at 250 ma; 6.4vac at 9A; input voltage 115 vac, 400cps; 26916 type 150-017439	5-31
A3		SYNTHESIZER SUBASSEMBLY, LIGHT INDICATOR: 26916 type 150-017614	5-51
A4		Deleted	
A5		FAN, CENTRIFUGAL: elect mot dr; 3300 rpm; 115vac; 1 ph; 400 cps; w/4.7 uf starting cap.; 26916 type 150-017509-002	5-31
A6		Not used	
A7		Not used	
A100		Not used	
A101		OVEN, CRYSTAL: for single CR28/U xtal unit; oper temp 75 deg. C; 6.3vac, 60/400 cps, 1 ph; 26916 type 150-017005	5-31
A102		SYNTHESIZER SUBASSEMBLY, REFERENCE SIGNAL GENERATOR: w/int freq std; 6.3 vac, 400 cps, 1 ph; 180 vdc max; for cont oper; oper freqs: 100 kc, 1 mc; 26916 type 150-017401	5-31
A103		SYNTHESIZER SUBASSEMBLY, PLATE TANK 26916 type 150-016588	5-34
A500		Deleted	
A501		SYNTHESIZER SUBASSEMBLY, ELECTRON TUBE MOUNTING: 26916 type 150-017361	5-37
A600		Not used	
A700		SYNTHESIZER SUBASSEMBLY, ELECTRON TUBE MOUNTING: 26916 type 150-017360	5-38
A800		SYNTHESIZER SUBASSEMBLY, VFO AND SPECTRUM GENERATOR: 26916 type 150-017358	5-31
A801		Deleted	
A802		SYNTHESIZER SUBASSEMBLY, ELECTRON TUBE MOUNTING: 26916 type 150-016639	5-38
A803		SYNTHESIZER SUBASSEMBLY, ELECTRON TUBE MOUNTING: 26916 type 150-016638	5-38

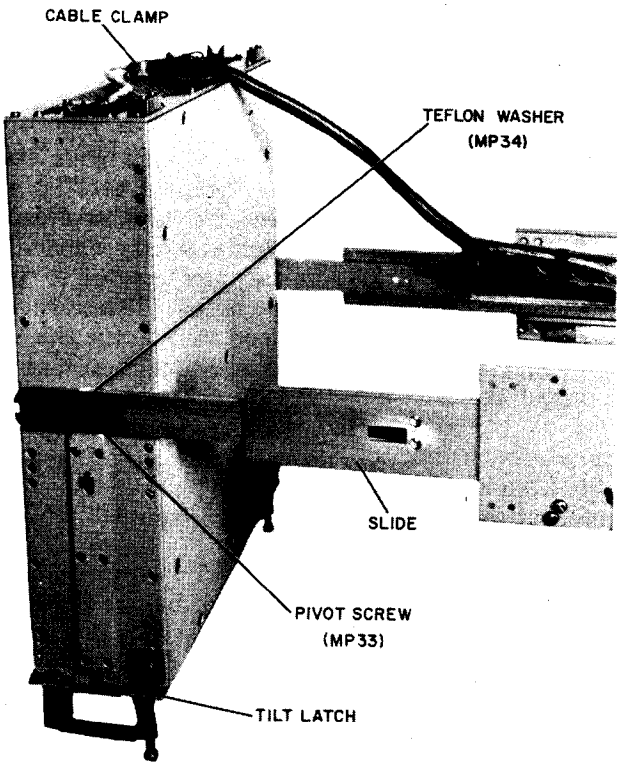


Figure 2-2. Synthesizer Tilted

TABLE 2-1 CABLE ASSEMBLIES

SYMBOL	CONDUCTORS NUMBER & ACTIVE	TYPE	LOAD CURRENT (AMPERES)	COLOR CODE	CONNECTORS
W1**	3	TCOP-3	3	White Black Red	(1) MIL-C-5015 type AN-3106A-10SL-3S (1) MIL-C- 3767/4 type UP121M
*	2	RG-58/U	N/A	N/A	Type BNC
*	2	RG-58/U	N/A	N/A	Type BNC
*	2	RG-58/U	N/A	N/A	Type BNC

* These cables are not supplied.

** Connectors shown are for synthesizers with A prefix on serial numbers. Synthesizers with B or C prefix on serial number have following connectors: (1) 652-R-3-GNG (1) MIL-C-3767/4 type UP121M.

SECTION 3

OPERATION

3-1. FUNCTIONAL OPERATION.

a. Synthesizer, Electrical Frequency O-1115/URC or O-1494/URC (to be commonly referred to as "synthesizer") provides more than 690,000 highly stabilized output signals in the frequency range of 2 to 34 mc. In addition, 1 mc and 100 kc auxiliary reference signals are available from separate output jacks.

b. The synthesizer has an internal 1 mc crystal oscillator which controls the stability of all output frequencies. A temperature-regulated oven maintains the oscillator crystal at its optimum operating temperature.

c. The stable output frequencies are obtained from four free-running, variable-frequency, oscillators (main vfo, 10-kc vfo, 1-kc vfo, and 100 cycle vfo) in a double-superheterodyne type circuit. Each oscillator is disciplined by the 1 mc standard frequency through phase-detector-fed reactance controls. The desired output frequency is selected through operation of the BAND switch to one of the four bands and rotation of the tuning controls until the frequency is noted on the appropriate counter.

d. If higher stability than that provided by the internal oscillator (1 part in 10^8 per day) is desired, any external frequency standard of superior stability whose output is 1 mc or 100 kc at 1 volt can be used to discipline the synthesizer frequencies. The external 1-mc source can also be used to monitor the internal oscillator frequency to make certain that the output signals are accurate and stable. The external frequency source can also be used if the internal oscillator fails.

3-2. PREPARATION FOR USE.

There are no special procedures to be performed before operation of the synthesizer can be started.

3-3. OPERATING PROCEDURES.

a. DESCRIPTION OF CONTROLS. (See figure 3-1.) - Table 3-1 identifies and describes the function of each control needed to operate the synthesizer. All operating controls are located on the front panel of the synthesizer.

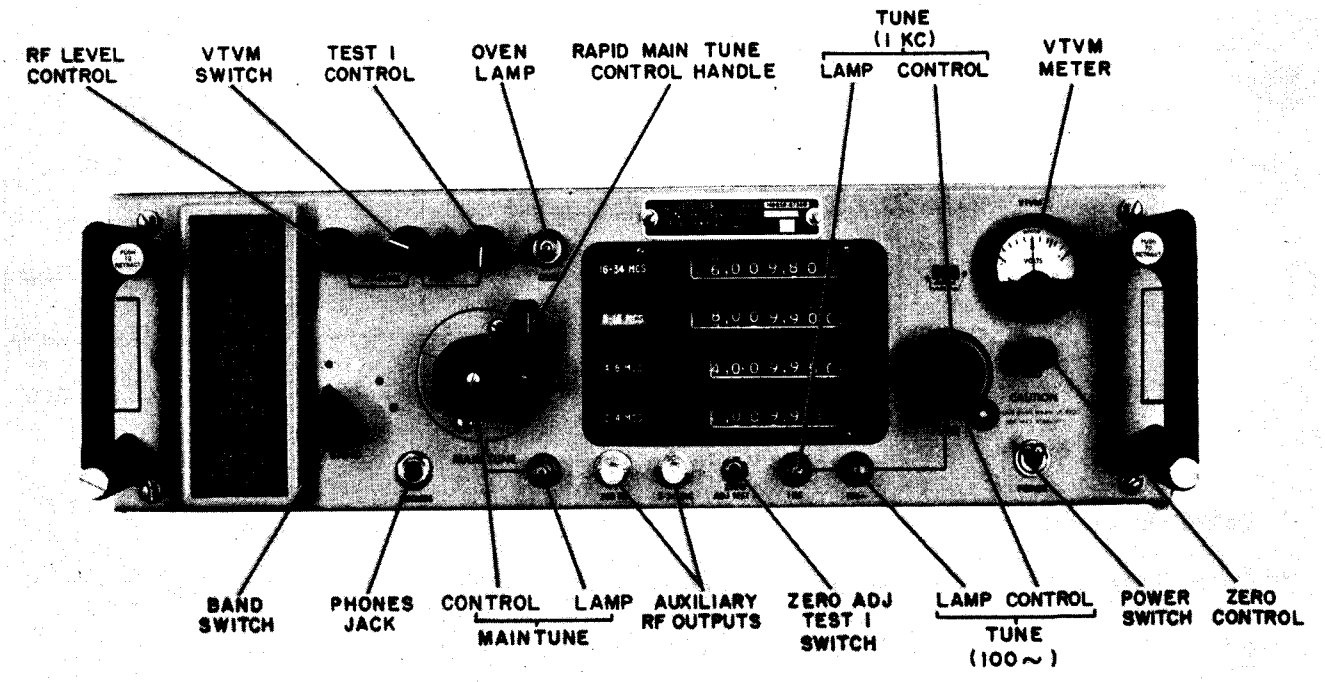


Figure 3-1. Front Panel Controls

ing the functional section are all placed together in one area of the manual.

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

4-2. OVERALL FUNCTIONAL DESCRIPTION.

a. Synthesizer, Electrical Frequency O-1115/URC or O-1494/URC (to be commonly referred to as "synthesizer") is a precision frequency generator that provides more than 690,000 discrete frequencies ranging from 2 to 34 mc. Auxiliary output frequencies of 1 mc and 100 kc are also provided. An internal high stability 1 mc reference frequency oscillator (1 part in 10^8 per day) is used to discipline (control) the synthesizer so that each output frequency has a stability equal to that of the reference frequency.

NOTE

A complete familiarity with the overall functional block diagram is necessary to understand operation of the synthesizer. The block diagram indicates relationships of the functional sections within the synthesizer. Study the block diagram in detail to fully understand the functional operation of the synthesizer before proceeding to the detailed circuit descriptions and trouble shooting.

b. The synthesizer (see figure 4-1) is very similar to a double conversion superheterodyne receiver circuit with the following analogy: The antenna signal of the receiver corresponds to the spectrum generator signal of the synthesizer. The first local oscillator of the receiver is similar to the main loop variable frequency oscillator (vfo) of the synthesizer. Both the receiver and synthesizer have first mixer and first i-f stages. The second local oscillator of the receiver is similar to the 10-kc loop vfo of the synthesizer. Both the receiver and synthesizer have second i-f stages. The f-m detector of the receiver is similar to the discriminator in the synthesizer; the output of the detector or discriminator is a varying d-c voltage which is used in the receiver for automatic frequency control (afc) and in a similar manner in the synthesizer to control the main-loop vfo.

c. The reference frequency standard consists of a 1-mc oscillator that is stable to 1 part in 10^8 per day, and is relatively free from any undesired variations. This 1-mc signal is divided to a 100 kc sine wave that is fed to the spectrum generator. The output of the spectrum generator consists of 100-kc pulses and a range of frequencies (spectrum) from 20.4 to 38.4 mc. The outputs of the spectrum generator serve to lock all frequencies in the synthesizer to the high stability crystal of the reference frequency standard.

d. The vfo in the 10-kc loop is locked to the reference frequency through a feed back network consisting of a multiplier, a phase detector, and a reactance control. The two inputs to the phase detector are the 100 kc reference pulses which contain all necessary harmonics of 100 kc, and the multiplied output of the vfo. These inputs are compared to produce a d-c voltage proportional to their difference in phase. The d-c voltage is then applied to the reactance control where it is converted to a proportional capacitance across the tank of the vfo, and consequently changes the vfo frequency. The reactance control provides afc action and holds the oscillator frequency constant despite any influences tending to change this frequency. The 1-kc and 100-cycle loops function in the same manner as the 10-kc loop.

e. The output of the main-loop vfo is mixed with the 20.4 to 38.4 mc output of the spectrum generator at the first mixer, to produce an output of 4.3001 to 4.4000 mc. (The frequency tuning controls of the spectrum generator and vfo are ganged, but the spectrum generator can produce frequencies only at 100-kc intervals, while the vfo can produce frequencies in 100-cycle steps; consequently, the mixer output frequency has a range of 99.9 kc.) The output of the first mixer is mixed with the 4.00 to 3.91 mc output of the 10-kc loop in the second mixer to produce an output of 0.4000 to 0.3901 mc.

f. The 5.00 to 4.91 mc output of the 100-cycle loop is divided by 10 and mixed with the 3.50 and 3.41 mc output of the 1-kc loop, in the third mixer. The resultant 4.000 to 3.901 mc output is again divided by 10 and applied to the discriminator of the main loop. The discriminator compares the combined outputs of the 1-kc and 100-cycle loops with the output of the second

TABLE 4-1. CIRCUIT FREQUENCY VS. TUNING CONTROL POSITIONS*

MAIN TUNE, TUNE (1KC), TUNE (100 ∿) CONTROL POSITIONS	CIRCUIT									
	Spectrum Generator (Mc)	Main Loop VFO (Mc)	1st Mixer (Mc)	10Kc Loop (Mc)	2nd Mixer (Mc)	100 Cps Loop (Mc)	500Kc Divider (Mc)	1Kc Loop (Mc)	3rd Mixer (Mc)	400Kc Divider (Mc)
0	20.4	16.000000	4.4000	4.00	0.4000	5.00	0.500	3.50	4.000	0.4000
1	20.4	16.011100	4.3889	3.99	0.3989	4.99	0.499	3.49	3.3989	0.3989
2	20.4	16.022200	4.3778	3.98	0.3978	4.98	0.498	3.48	3.978	0.3978
3	20.4	16.033300	4.3667	3.97	0.3967	4.97	0.497	3.47	3.967	0.3967
4	20.4	16.044400	4.3556	3.96	0.3956	4.96	0.496	3.46	3.956	0.3956
5	20.4	16.055500	4.3445	3.95	0.3945	4.95	0.495	3.45	3.945	0.3945
6	20.4	16.066600	4.3334	3.94	0.3934	4.94	0.494	3.44	3.934	0.3934
7	20.4	16.077700	4.3223	3.93	0.3923	4.93	0.493	3.43	3.923	0.3923
8	20.4	16.088800	4.3112	3.92	0.3912	4.92	0.492	3.42	3.912	0.3912
9	20.4	16.099900	4.3001	3.91	0.3901	4.91	0.491	3.41	3.901	0.3901

*At 0 position, output frequency is 16.000000 mc. Frequency increases with positions.

SECTION 5

MAINTENANCE

5-1. FAILURE, PERFORMANCE AND OPERATIONAL REPORTS.

NOTE

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

5-2. MAINTENANCE STANDARDS.

The tests and maintenance prescribed herein provide the technician with a systematic and efficient method for checking Synthesizer, Electrical Frequency O-1115/URC or O-1494/URC (to be commonly referred to as "synthesizer") and for performing routine preventive maintenance. When performed as directed, the preventive maintenance procedures will increase operating efficiency of the synthesizer and detect impending failures before they occur. The records that should be kept as a result of performing the preventive maintenance provide an equipment history of performance, which when properly analyzed will clearly indicate when or what preventive measures must be taken. Preventive maintenance contains daily and weekly steps which are both routine and technical. The time required is not a fixed standard but an established average. It is expected that the readings in each step will show nominal variances from time to time, but this does not necessarily mean that the equipment is operating improperly. However, if a particular step shows a reading which varies progressively in the same direction every time a check is made, it is an indication of improper operation and corrective measures must be taken.

a. TEST EQUIPMENT AND SPECIAL TOOLS. - The test equipment required to perform the preventive maintenance procedures consists of a frequency counter and a frequency standard (refer to Section 1 for type designation). There are no special tools required to perform the preventive maintenance procedures other than those supplied with the synthesizer.

b. SPECIAL PROCEDURES. - Prior to performing the preventive maintenance, set up the synthesizer for an output frequency of 16 mc as described in paragraph 3-3b and make sure that the synthesizer has been energized for at least one hour.

c. REFERENCE STANDARDS PROCEDURES. - Table 5-1 lists the reference standards procedures for Synthesizer, Electrical Frequency O-1115/URC or O-1494/URC.

NOTE

The procedures listed below consist of the minimum number of reference standards which will indicate, when completed, the relative performance of the synthesizer. Each group of tests represents a functional section of the synthesizer. The procedures are listed in the suggested sequence of performance; however, deviation from the listed order will in no way affect the unity or result of the reference standards, unless otherwise noted.

d. PERIODIC SCHEDULE CHARTS. - Tables 5-3, 5-5, and 5-7 contain test procedures in tabular form (procedure table)to be performed by the maintenance technician; these procedures are scheduled for regular periods (daily, weekly and monthly). Preceding each step or group of steps is a sample of a two-year check-off chart (see tables 5-2, 5-4 and 5-6)to be used in preparing periodic schedule charts.

TABLE 5-1. REFERENCE STANDARDS PROCEDURES

SECTION	ACTION REQUIRED	REFERENCE
REFERENCE STANDARD	Record frequency of internal 1-mc reference	M1
MAIN LOOP	Record VTVM reading	D7
10 KC LOOP	Record VTVM reading	D4
1 KC LOOP	Record VTVM reading	D5
100 CYCLE LOOP	Record VTVM reading	D6
OUTPUT DIVIDER	Record 2 to 34 mc r-f output level	D9

5-3. PREVENTIVE MAINTENANCE PROCEDURES.

The instructions for performing the preventive maintenance procedures are given in tables 5-2 through 5-7. The procedures are arranged numerically within each maintenance period. See figures 5-1 through 5-3 for location of the parts corresponding to the "step" numbers in the tables. Arrows leading from a given "step" number on the illustration graphically present certain basic information given in the associated step of the procedure table, as follows: The point where the test equipment is to be connected, the "indicator" from which the data is to be taken, and the applicable control used to obtain the reference standard data.

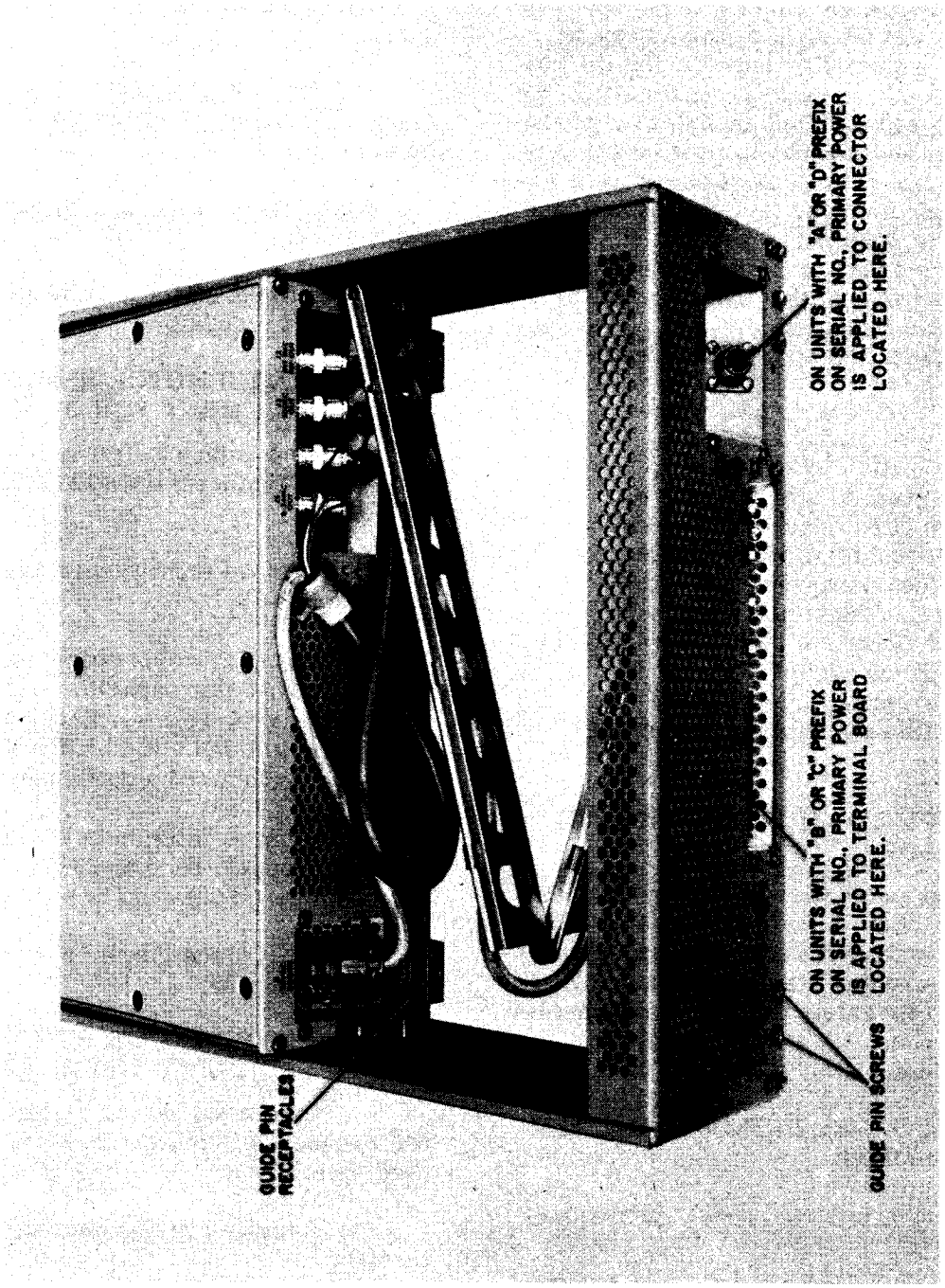


Figure 5-30. Adjustment of Guide Pins

synthesizer. There are two screw-type guide blocks.

e. Loosen two screws securing each nut-type guide block to front of case. There are two nut-type guide blocks that receive the two locking thumbscrews after matching screw-type guide blocks.

f. Slide synthesizer in and out of case until it operates normally and smoothly. Tighten guide blocks and check operation.

g. Tighten guide pins and guide pin receptacles.

5-31. REPAIR

If access cannot be had to a part by removing the top and bottom covers of the synthesizer and the covers of the individual chassis, one or more subassemblies must be removed.

All subassemblies and parts which are not described in the following paragraphs can be removed and replaced by unsoldering the connecting wires and, if necessary, removing the attaching hardware. When unsoldering wires, be sure to tag and identify each wire and terminal so that the replacement part can be properly connected in place. Use the utmost care in removal and replacement operations as any change in wire dress or physical characteristics may affect the overall operation of the synthesizer. After repairing any part of the synthesizer, perform the applicable alignment procedures.

NOTE

Before starting any procedure, observe positions of all wires before unsoldering any connection. When necessary, refer to schematic diagrams for connections of electrical components and maintenance parts list (table 6-1) for references to appropriate identifying illustrations locating specific parts.

5-32. VACUUM TUBES WITH SOLDERED-IN LEADS

Remove a soldered-in tube by unsoldering each lead of the tube from the terminal board at the base of the tube and sliding the tube out of its holder. Replace the tube by first sliding it into its shield and then soldering its leads. Be certain that each lead goes to its proper terminal.

5-33. FRONT PANEL REMOVAL AND REPLACEMENT

To remove the front panel, proceed as follows:

a. Loosen thumbscrew on each handle and slide synthesizer out of case until it locks in position.

b. Remove top and bottom covers by releasing captive fasteners and lifting covers off chassis.

c. Loosen two screws at rear of each handle assembly.

d. Remove two screws in pushbutton linkage.

e. Remove BAND switch knob (with No. 4 Bristol wrench MP18) and remove TUNE (1 KC) and TUNE (100 ~) knobs (with No. 6 Bristol wrench MP20) from their respective shafts.

f. Lift up rapid MAIN TUNE control handle, pull off front panel, and let it hang loosely by attaching wires.

g. Replace front panel by reversing steps a through f.

5-34. BLOWER MOTOR REMOVAL AND REPLACEMENT

a. BLOWER MOTOR REMOVAL AND REPLACEMENT FOR O-1115/URC.

To remove blower motor for Electrical Frequency Synthesizer O-1115/URC, proceed as follows:

(1) Remove front panel as described in paragraph 5-33.

(2) Unsolder color coded wires connected to blower motor capacitor C11. There are four wires (red, yellow, black, and green). Make sure to label and identify each terminal as to proper colored wire connected to it.

(3) Remove three nuts which hold blower to shock mounted pads and remove entire blower assembly through top of synthesizer.

(4) To replace blower motor, reverse order of removal.

b. BLOWER MOTOR REMOVAL AND REPLACEMENT FOR O-1494/URC.

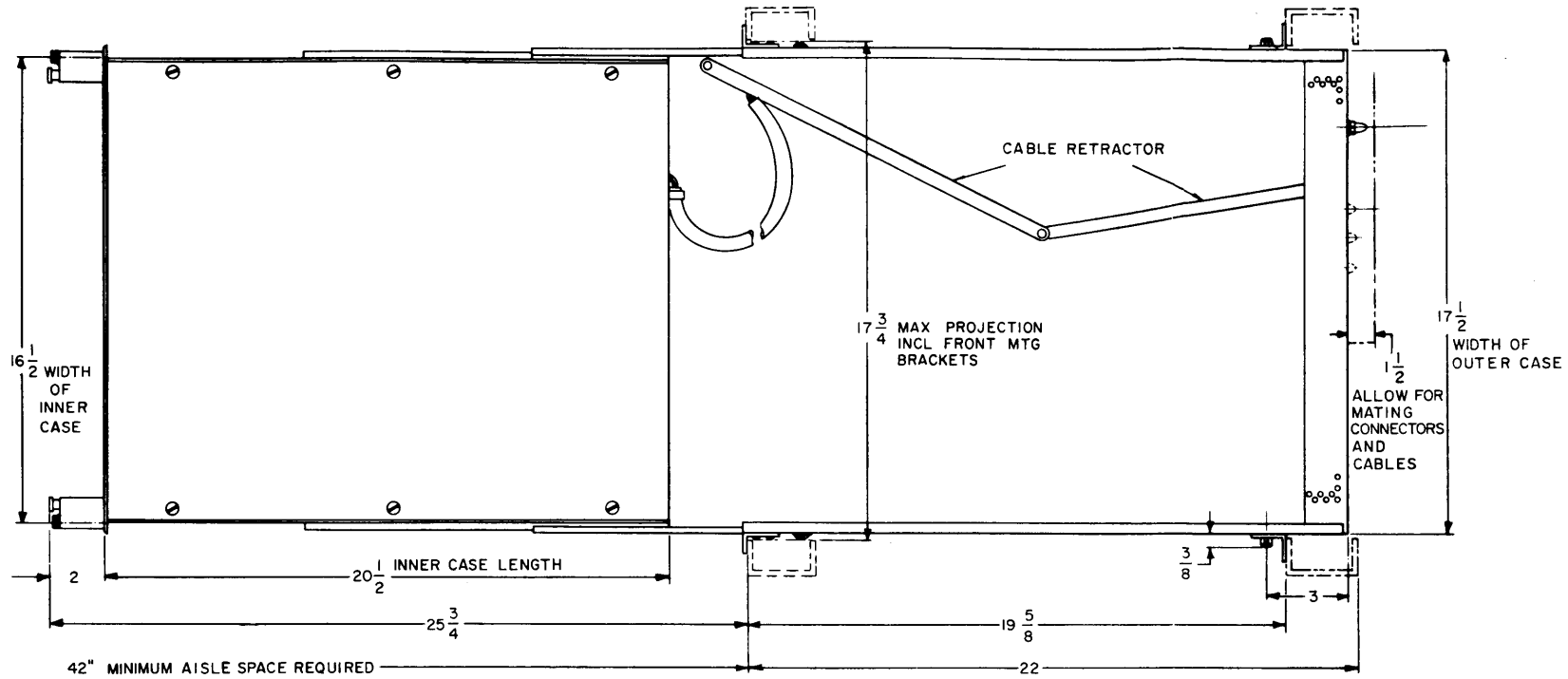
To remove blower motor from Electrical Frequency Synthesizer O-1494/URC, proceed as follows:

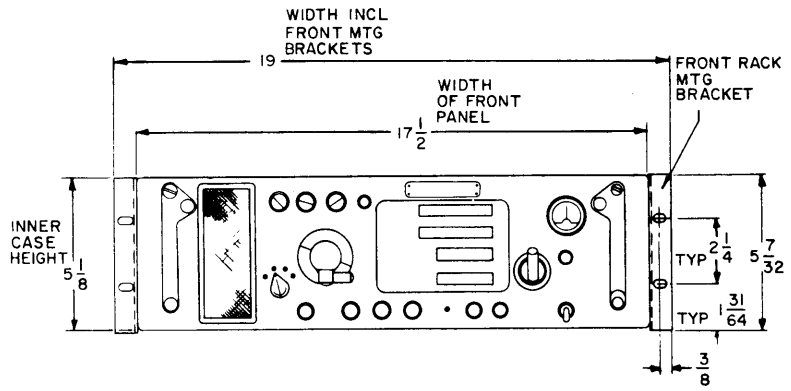
(1) Remove top and bottom cover of synthesizer.

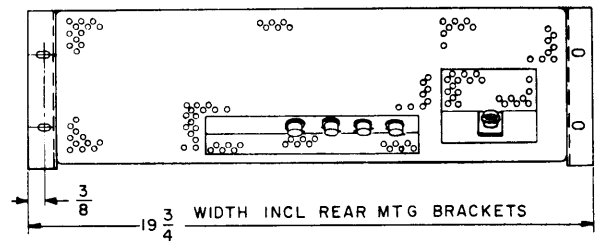
(2) Unsolder color coded wires connected to blower motor capacitor C11. There are three wires (red, green, and white/gray). Unsolder yellow wire from standoff located adjacent to capacitor C11 (yellow wire connects to blower motor). Make sure to label and identify each terminal as to proper colored wire connected to it.

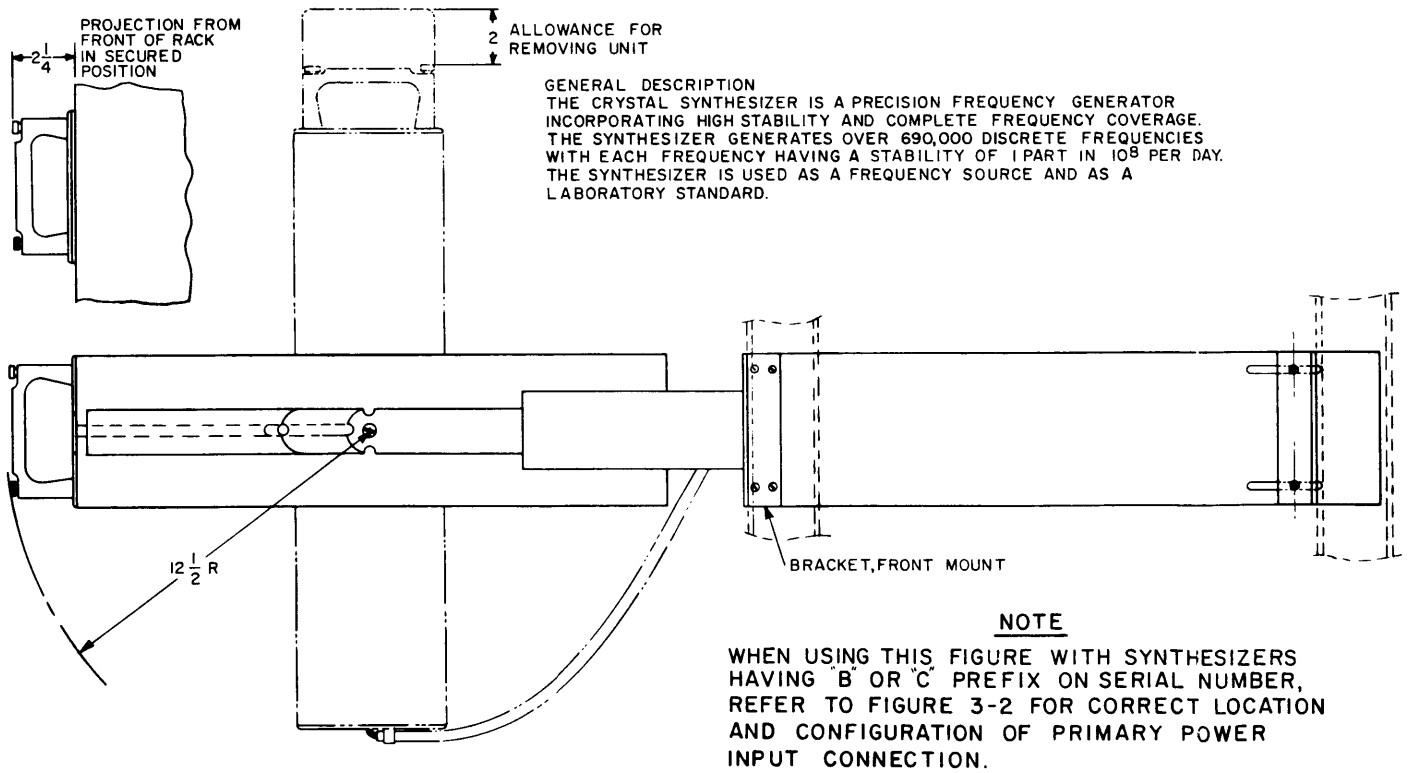
(3) Remove three nuts which hold blower to shock mounted pads and remove entire blower assembly through top of synthesizer.

(4) To replace blower motor, reverse order of removal.









GENERAL DESCRIPTION
THE CRYSTAL SYNTHESIZER IS A PRECISION FREQUENCY GENERATOR INCORPORATING HIGH STABILITY AND COMPLETE FREQUENCY COVERAGE. THE SYNTHESIZER GENERATES OVER 690,000 DISCRETE FREQUENCIES WITH EACH FREQUENCY HAVING A STABILITY OF 1 PART IN 10^8 PER DAY. THE SYNTHESIZER IS USED AS A FREQUENCY SOURCE AND AS A LABORATORY STANDARD.

NOTE

WHEN USING THIS FIGURE WITH SYNTHESIZERS HAVING "B" OR "C" PREFIX ON SERIAL NUMBER, REFER TO FIGURE 3-2 FOR CORRECT LOCATION AND CONFIGURATION OF PRIMARY POWER INPUT CONNECTION.

NOTES:

1. **POWER REQUIREMENTS:**
   O-1115/URC, 115V±10%, 400CPS±5%
   SINGLE PHASE
   POWER CONSUMPTION 1.9AMP AT 115V
   0.8 POWER FACTOR
   O-1494/URC, 115V±10%, 60CPS±5%
   SINGLE PHASE
   POWER CONSUMPTION 1.9AMP AT 115V
   0.8 POWER FACTOR
2. HEAT DISSIPATION:
   STARTING CONDITION: 130 WATTS.
   STANDBY (OVEN ONLY) 2 WATTS.
   OPERATING CONDITION 210 WATTS.
3. VENTILATION CAPACITY - 11 CFM
   AIR INTAKE ON FRONT PANEL, EXHAUST THRU ENTIRE REAR PANEL.
4. APPROX WEIGHT OF UNIT 80 LBS.
5. CRATED UNIT - DIMENSIONS (INCHES)
   14.5 x 34.75 x 28.25
   CUBICAL CONTENTS 8.2 CU. FT.
   WEIGHT 142 LBS.
6. SERVICING ACCESS THRU TOP AND BOTTOM COVERS CABLE ENTRANCE AT REAR OF UNIT.
7. SPECIAL INSTRUCTIONS SEE MANUAL.
8. VACUUM TUBE SUMMARY:

5636 (1)	6AN5 (1)	6BE6 (1)	
5639 (1)	6AH6 (1)	12AT7 (1)	
5702 (19)	6021 (9)	6AU6 (3)	
5703 (5)	6832 (1)	7587 (2)	
5896 (1)			

9. GENERAL NOTES-
   ELECTRICAL REQUIREMENTS
   FREQUENCY STABILITY: 1 PART IN 10^8 PER DAY
   (MAY ALSO BE LOCKED TO EXTERNAL REFERENCE FOR HIGHER STABILITY).
   OUTPUT FREQUENCY RANGE:
   2-34 MC IN FOUR BANDS:
   2-4 MC IN STEPS OF 12.5 CYCLES
   4-8 MC IN STEPS OF 25.0 CYCLES
   8-16 MC IN STEPS OF 50.0 CYCLES
   16-34 MC IN STEPS OF 100.0 CYCLES
   AUXILIARY OUTPUTS OF 100 KC & 1 MC
   RESETTABILITY ERROR: ZERO
   READABILITY ERROR: ZERO
   SPURIOUS SIGNALS: DOWN A MINIMUM OF 100 DB EXCEPT FOR HARMONICS OF THE OUTPUT WHICH ARE DOWN A MINIMUM OF 40 DB.
   OPERATING AMBIENT TEMPERATURE RANGE
   0° C TO +50° C
   OUTPUT LEVELS: ADJUSTABLE 1.0V TO 2.5V AT 2-34 MC
   1.6V MIN AT 1 MC & 1.0 MIN AT 100 KC.
   OUTPUT IMPEDANCE:
   50 OHMS NOMINAL, UNBALANCED, AT 2-34 MC AND 1 MC: 500 OHMS AT 100 KC

Figure 2-1. Synthesizer, Electrical Frequency O-1115/URC, Outline Drawing

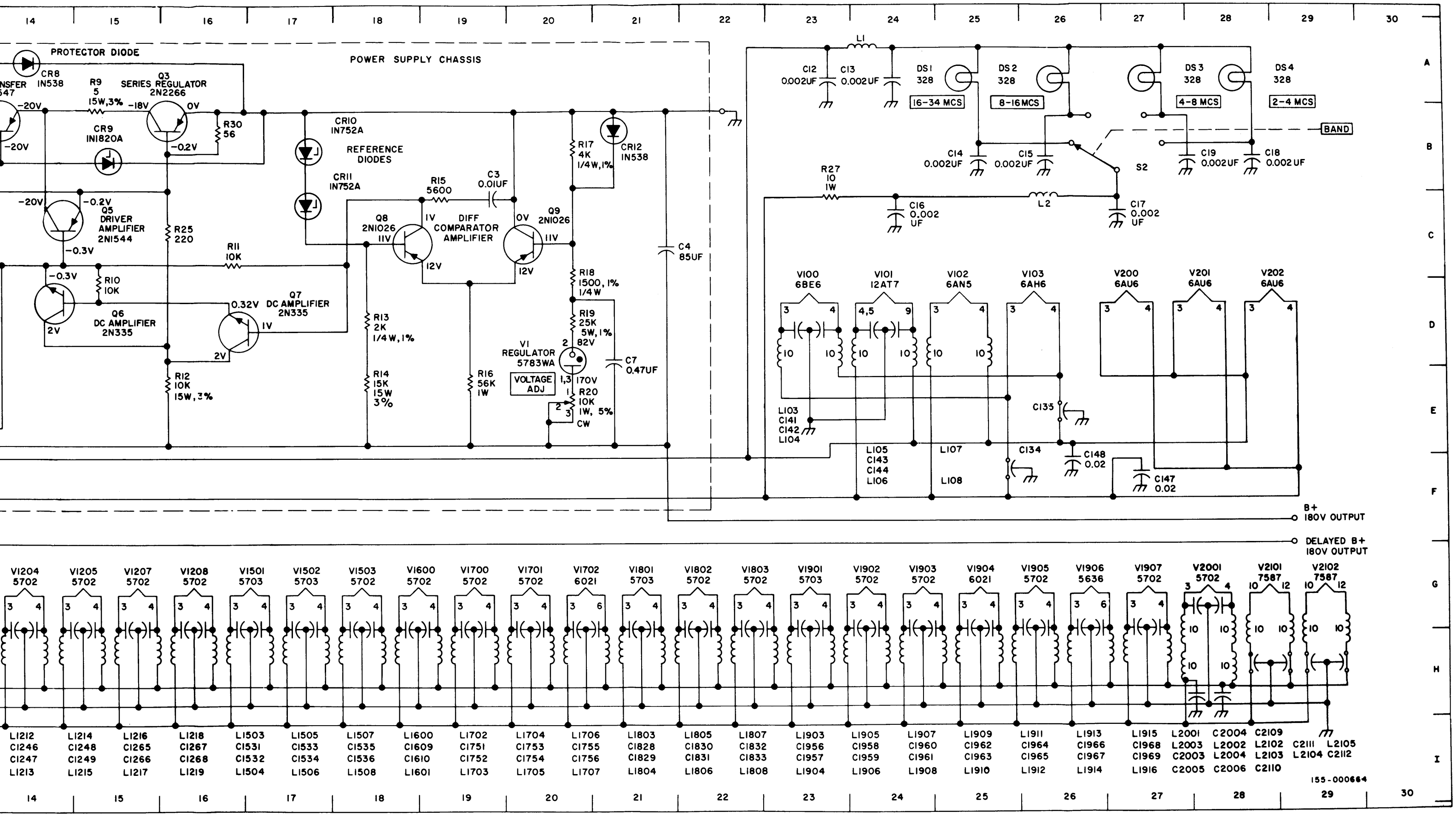


Figure 5-80. Power Supply, Schematic Diagram

F IG	LOC
0	23D
1	24D
2	25D
3	26D
0	27D
1	28D
2	28D
0	5G
0	6G
0	7G
1	7G
0	8G
00	8G
00	9G
01	10G
02	10G
03	10G
04	11G
05	11G
06	12G
01	13G
02	13G
04	14G
05	15G
07	15G
08	16G
01	17G
02	17G
03	18G
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01	20G
02	20G
01	21G
02	22G
03	22G
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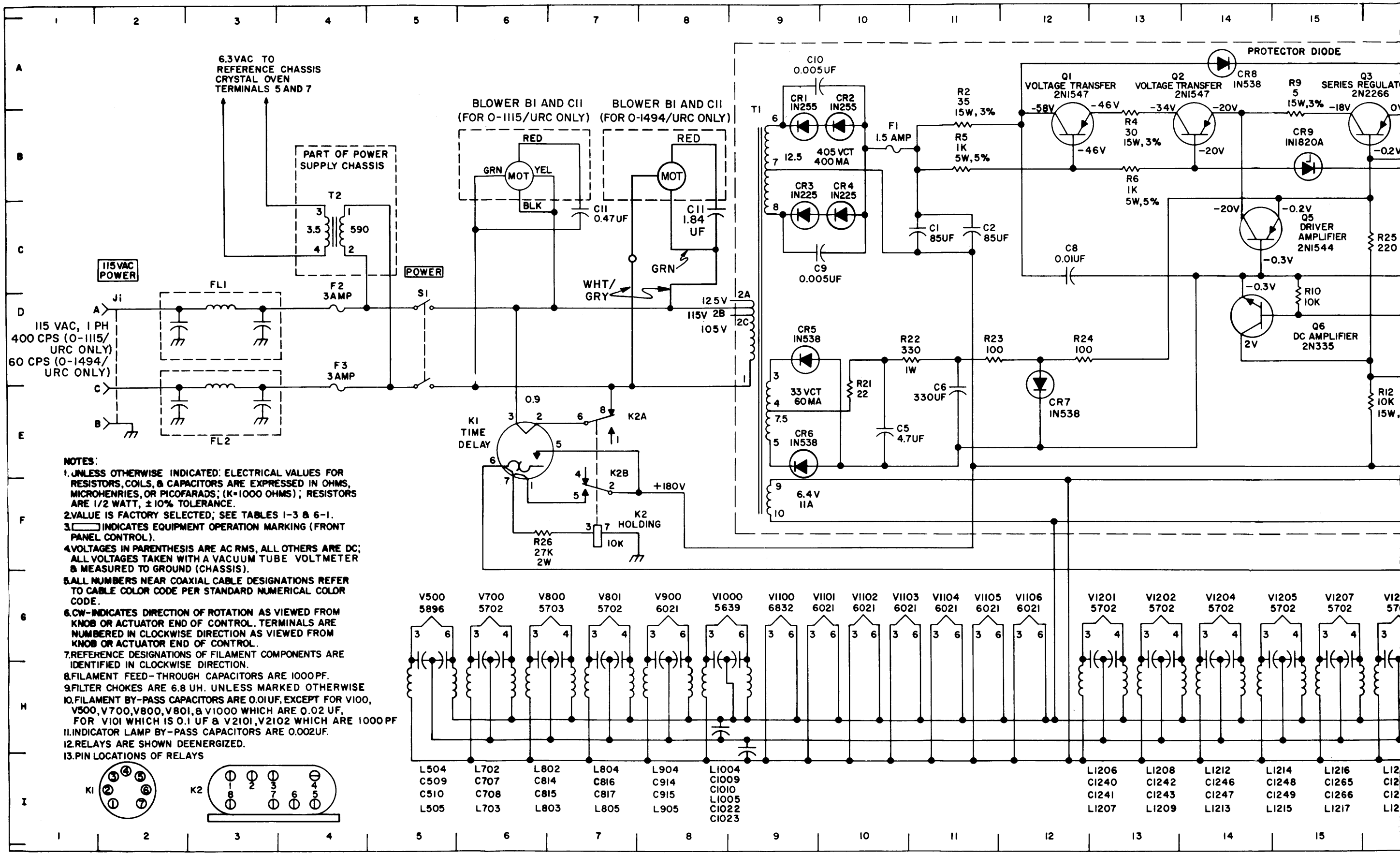
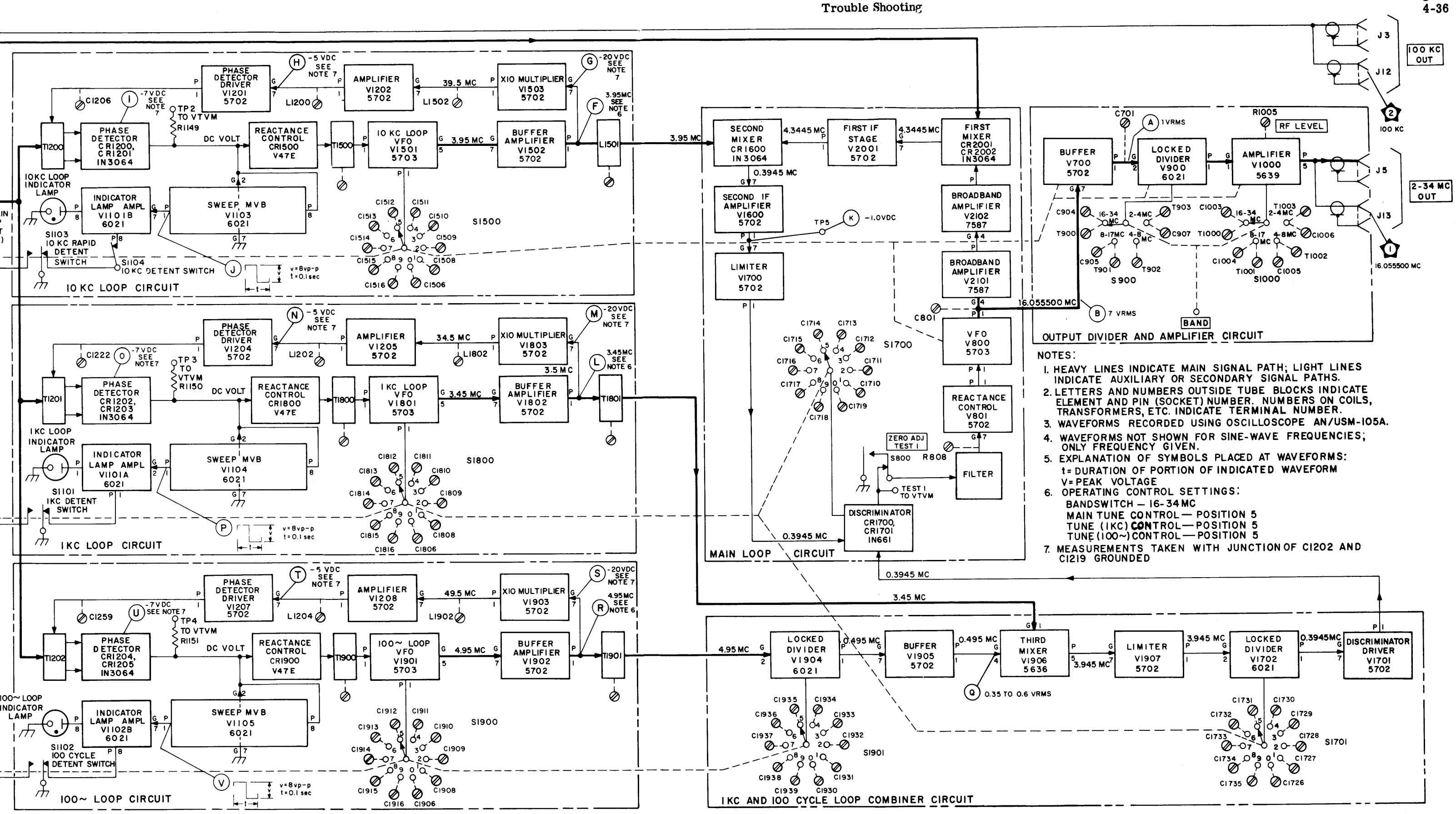
01	28G
01	28G
02	29G



PART LOCATION INDEX

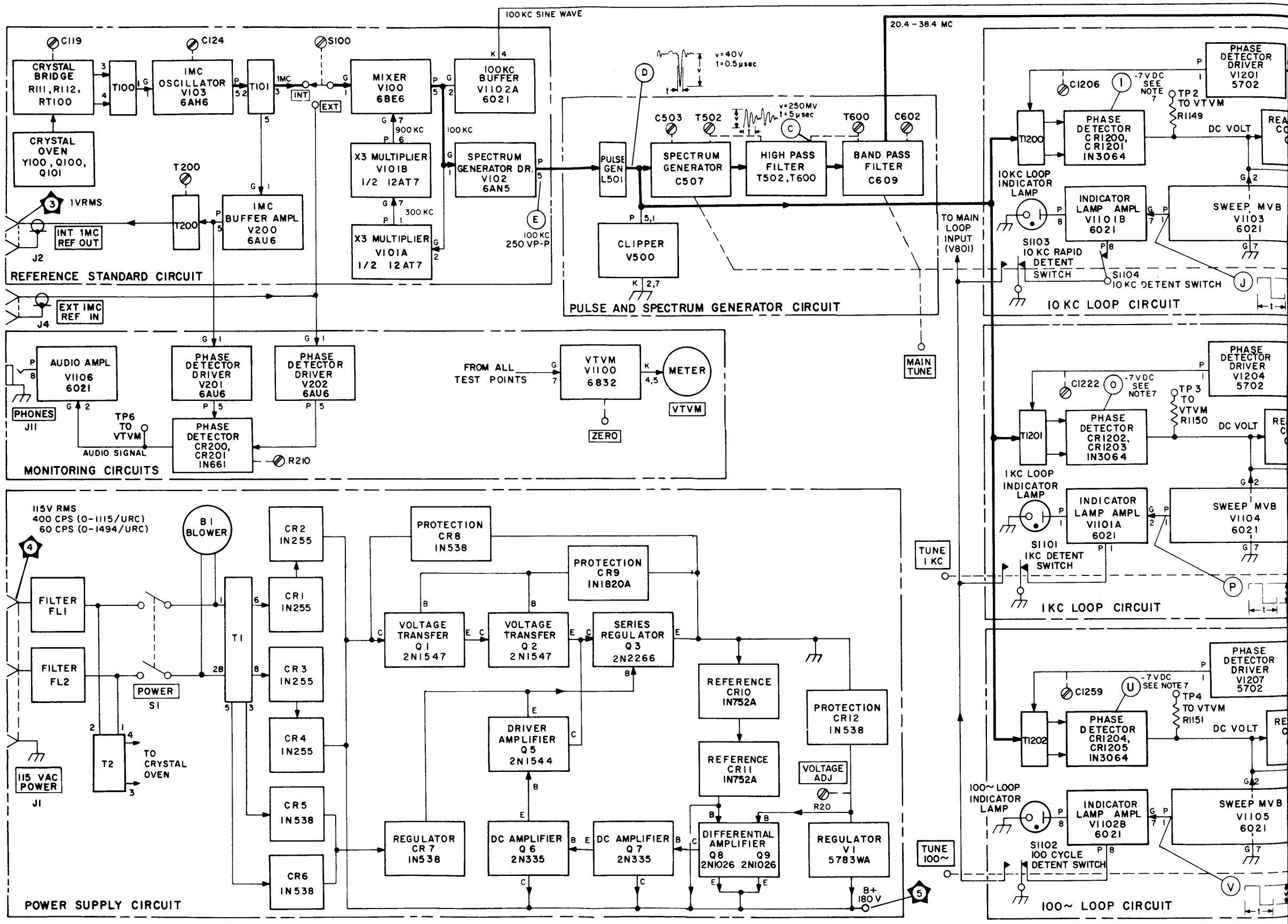
REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
B1	8B,6B	C1246	14I	C2109	28I	L1005	8I	L1916	27I	V100	23D
C1	11C	C1247	14I	C2110	28I	L1206	13I	L2001	27I	V101	24D
C2	11C	C1248	15I	C2111	29I	L1207	13I	L2002	28I	V102	25D
C3	19B	C1249	15I	C2112	29I	L1208	13I	L2003	27I	V103	26D
C4	21C	C1265	15I	CR1	9B	L1209	13I	L2004	28I	V200	27D
C5	10E	C1266	15I	CR2	10B	L1212	14I	L2005	29I	V201	28D
C6	11E	C1267	16I	CR3	9C	L1213	14I	L2102	28I	V202	28D
C7	21D	C1268	16I	CR4	10C	L1214	15I	L2103	28I	V500	5G
C8	12C	C1531	17I	CR5	9D	L1215	15I	L2104	29I	V700	6G
C9	9C	C1532	17I	CR6	9E	L1216	15I	Q1	12B	V800	7G
C10	9A	C1533	17I	CR7	12E	L1217	15I	Q2	14B	V801	7G
C11	8C,7C	C1534	17I	CR8	14A	L1218	16I	Q3	16B	V900	8G
C12	23A	C1535	18I	CR9	15B	L1219	16I	Q5	14C	V1000	8G
C13	24A	C1536	18I	CR10	18B	L1503	17I	Q6	14D	V1100	9G
C14	25B	C1609	18I	CR11	18B	L1504	17I	Q7	16D	V1101	10G
C15	26B	C1610	18I	CR12	21B	L1505	17I	Q8	18C	V1102	10G
C16	24C	C1751	19I	DS1	25A	L1506	17I	Q9	20C	V1103	10G
C17	27C	C1752	19I	DS2	25A	L1507	18I	R2	11A	V1104	11G
C18	28B	C1753	20I	DS3	28A	L1508	18I	R4	13B	V1105	11G
C19	28B	C1754	20I	DS4	29A	L1600	18I	R5	11B	V1106	12G
C134	26E	C1755	20I	F1	10B	L1601	18I	R6	13B	V1201	13G
C135	26E	C1756	20I	F2	4D	L1702	19I	R9	15A	V1202	13G
C141	23E	C1828	21I	F3	4D	L1703	19I	R10	15D	V1204	14G
C142	23E	C1829	21I	FL1	3D	L1704	20I	R11	16C	V1205	15G
C143	24F	C1830	22I	FL2	3E	L1705	20I	R12	16E	V1207	15G
C144	24F	C1831	22I	J1	2D	L1706	20I	R13	18D	V1208	16G
C147	27F	C1832	22I	K1	6E	L1707	20I	R14	18E	V1501	17G
C148	26F	C1833	22I	K2	7F	L1803	21I	R15	19B	V1502	17G
C509	5I	C1956	23I	L2	26C	L1804	21I	R16	19E	V1503	18G
C510	5I	C1957	23I	L103	23E	L1805	22I	R17	20B	V1600	18G
C707	6I	C1958	24I	L104	23E	L1806	22I	R18	20D	V1700	19G
C708	6I	C1959	24I	L105	24E	L1807	22I	R19	20D	V1701	20G
C814	7I	C1960	24I	L106	24F	L1808	22I	R20	20E	V1702	20G
C815	7I	C1961	24I	L107	25E	L1903	23I	R21	10E	V1801	21G
C816	7I	C1962	25I	L108	25F	L1904	23I	R22	11D	V1802	22G
C817	7I	C1963	25I	L504	5I	L1905	24I	R23	11D	V1803	22G
C914	8I	C1964	26I	L505	5I	L1906	24I	R24	12D	V1901	23G
C915	8I	C1965	26I	L702	6I	L1907	24I	R25	16C	V1902	24G
C1009	8I	C1966	26I	L703	6I	L1908	24I	R26	6F	V1903	24G
C1010	8I	C1967	26I	L802	7I	L1909	25I	R27	23B	V1904	25G
C1022	8I	C1968	27I	L803	7I	L1910	25I	R30	16B	V1905	26G
C1023	8I	C1969	27I	L804	7I	L1911	26I	S1	5D	V1906	26G
C1240	13I	C2003	27I	L805	7I	L1912	26I	S2	27B	V1907	27G
C1241	13I	C2004	28I	L904	8I	L1913	26I	T1	9B	V2001	28G
C1242	13I	C2005	27I	L905	8I	L1914	26I	T2	4C	V2101	28G
C1243	13I	C2006	28I	L1004	8I	L1915	27I	V1	20D	V2102	29G



NOTES:

1. HEAVY LINES INDICATE MAIN SIGNAL PATH; LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
2. LETTERS AND NUMBERS OUTSIDE TUBE BLOCKS INDICATE ELEMENT AND PIN (SOCKET) NUMBER. NUMBERS ON COILS, TRANSFORMERS, ETC. INDICATE TERMINAL NUMBER.
3. WAVEFORMS RECORDED USING OSCILLOSCOPE AN/USM-105A.
4. WAVEFORMS NOT SHOWN FOR SINE-WAVE FREQUENCIES; ONLY FREQUENCY GIVEN.
5. EXPLANATION OF SYMBOLS PLACED AT WAVEFORMS:
   t = DURATION OF PORTION OF INDICATED WAVEFORM
   V = PEAK VOLTAGE
6. OPERATING CONTROL SETTINGS:
   BANDSWITCH — 16-34 MC
   MAIN TUNE CONTROL — POSITION 5
   TUNE (1KC) CONTROL — POSITION 5
   TUNE (100~) CONTROL — POSITION 5
7. MEASUREMENTS TAKEN WITH JUNCTION OF C1202 AND C1219 GROUNDED

Figure 4-36. Synthesizer, Electrical Frequency 0-1115/URC, Servicing Block Diagram


100KC SINE WAVE
20.4 – 38.4 MC
C119
CRYSTAL BRIDGE R111, R112, RT100
CRYSTAL OVEN Y100, Q100, Q101
T100
C124
IMC OSCILLATOR V103 6AH6
T101
S100
INT
EXT
MIXER V100 6BE6
100KC BUFFER V1102A 6021
X3 MULTIPLIER V101B 1/2 12AT7
X3 MULTIPLIER V101A 1/2 12AT7
SPECTRUM GENERATOR DR. V102 6AN5
900 KC
300 KC
100 KC
T200
IMC BUFFER AMPL V200 6AU6
1VRMS
INT 1MC REF OUT
J2
EXT IMC REF IN
J4
100 KC 250 VP-P
REFERENCE STANDARD CIRCUIT
v=40V t=0.5μsec
v=250MV t=5μsec
C503
T502
T600
C602
PULSE GEN L501
SPECTRUM GENERATOR C507
HIGH PASS FILTER T502, T600
BAND PASS FILTER C609
CLIPPER V500
PULSE AND SPECTRUM GENERATOR CIRCUIT
TO MAIN LOOP INPUT (V801)
MAIN TUNE
PHASE DETECTOR DRIVER V1201 5702
C1206
-7VDC SEE NOTE 7
TP2 TO VTVM R1149
T1200
PHASE DETECTOR CR1200, CR1201 IN3064
DC VOLT
10KC LOOP INDICATOR LAMP
INDICATOR LAMP AMPL V1101B 6021
SWEEP MVB V1103 6021
S1103 10 KC RAPID DETENT SWITCH
S1104 10 KC DETENT SWITCH
10 KC LOOP CIRCUIT
AUDIO AMPL V1106 6021
PHONES J11
TP6 TO VTVM
AUDIO SIGNAL
PHASE DETECTOR DRIVER V201 6AU6
PHASE DETECTOR DRIVER V202 6AU6
PHASE DETECTOR CR200, CR201 IN661
R210
MONITORING CIRCUITS
FROM ALL TEST POINTS
VTVM V1100 6832
METER
VTVM
ZERO
PHASE DETECTOR DRIVER V1204 5702
C1222
TP3 TO VTVM R1150
T1201
PHASE DETECTOR CR1202, CR1203 IN3064
1KC LOOP INDICATOR LAMP
INDICATOR LAMP AMPL V1101A 6021
SWEEP MVB V1104 6021
S1101 1KC DETENT SWITCH
TUNE 1KC
1KC LOOP CIRCUIT
PHASE DETECTOR DRIVER V1207 5702
C1259
-7VDC SEE NOTE 7
TP4 TO VTVM R1151
T1202
PHASE DETECTOR CR1204, CR1205 IN3064
100~ LOOP INDICATOR LAMP
INDICATOR LAMP AMPL V1102B 6021
SWEEP MVB V1105 6021
S1102 100 CYCLE DETENT SWITCH
TUNE 100~
100~ LOOP CIRCUIT
115V RMS 400 CPS (0-1115/URC) 60 CPS (0-1494/URC)
B1 BLOWER
FILTER FL1
FILTER FL2
POWER S1
T1
T2
TO CRYSTAL OVEN
115 VAC POWER
J1
CR2 IN255
CR1 IN255
CR3 IN255
CR4 IN255
CR5 IN538
CR6 IN538
PROTECTION CR8 IN538
PROTECTION CR9 IN1820A
VOLTAGE TRANSFER Q1 2N1547
VOLTAGE TRANSFER Q2 2N1547
SERIES REGULATOR Q3 2N2266
DRIVER AMPLIFIER Q5 2N1544
REGULATOR CR7 IN538
DC AMPLIFIER Q6 2N335
DC AMPLIFIER Q7 2N335
REFERENCE CR10 IN752A
REFERENCE CR11 IN752A
DIFFERENTIAL AMPLIFIER Q8 Q9 2N1026 2N1026
PROTECTION CR12 IN538
VOLTAGE ADJ R20
REGULATOR V1 5783WA
B+ 180V
POWER SUPPLY CIRCUIT