CE-15
SPECTRUM MONITOR

INSTRUCTION MANUAL

CUSHMAN
ELECTRONICS, INC.
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JANUARY 1977

CUSHMAN CE-15 SPECTRUM MONITOR MANUAL SCAN

This manual has been scanned from a well used 1977 Cushman original and a previous user has added diagnostic notes and signal level information to some of the schematic pages.

No attempt has been made to remove these handwritten notes as they may be useful to other users but they were written in pencil so could be faint in places.

No guarantee is implied as to the accuracy of this added information, I have no reason to doubt it but no way of verifying it either, so please use your own judgement if making use of it.

A partial photocopy of the High Voltage Supply schematic, pages 5-77/5-78, with voltage levels added, was inserted into the original manual and this has been included here as page 5-78a.

Pages 5-3/5-4, listed as being the Front Panel Interconnection diagram, are not included as they were missing from the original manual.

This manual has been reproduced in three versions which should be identifiable from the file name.

"Cushman CE15 Full Size" has been reproduced to exactly match the original, including full size 24 inch foldouts.

"**Cushman CE15 Split Pages"** has been reproduced with the diagrams split, where appropriate, into an 8 1/2 inch page for the PCB layout and a 15 1/2 inch page for the schematic, just because I found it more convenient to read the schematics this way.

"Cushman CE15 Single Pages" has all pages split into 8 1/2 inch sections for anyone who might want to print it on a single page printer.

Discrete page numbering has been added to the second two versions, just in case anyone drops a pile of unbound prints and needs to get them back in order:-)

GM8PZR
July 2013

CUSHMAN INSTRUMENT WARRANTY

All instruments manufactured by Cushman Electronics, Inc. are warranteed against defects in material and workmanship for a period of one year from the date of original shipment. Cushman will repair or replace instruments, which prove to be defective, in accordance with the following policy. This policy does not apply to repair service, parts sales, nor does it apply to instruments, or parts of the instrument, which in the opinion of Cushman, have been altered or misused.

All Countries

- During the first three months after the date of original shipment, no charge for parts, replacement PC boards, labor, or freight for instruments serviced at an authorized Cushman Service Center. Free freight applies only within the customer's country. Method of transportation shall be designated by an authorized Cushman representative or Service Center.

- During the fourth through the twelfth month after the date of original shipment, no charge for parts, replacement PC boards, and labor for instruments serviced at an authorized Cushman Service Center. All transportation charges for instruments, parts, or replacement PC boards shall be paid by the customer during this period.

- Replacement PC boards during the first year are warranteed only when the defective boards have been identified by an authorized Cushman Service Center and the defective PC board is returned in accordance with Cushman's exchange board policy.

U.S.A. and Canada

In the U.S.A. and Canada an additional two year limited warranty is offered extending from the 13th until the 36th month from the date of original shipment. This warranty is effective beginning with instruments purchased on or after October 1, 1975. During this period, the following limited warranty policy applies:

- No charge for parts* used by an authorized Cushman Service Center to repair an instrument.

- Cushman will replace at no charge, PC boards which are found to be defective by an authorized Cushman Service Center. Defective boards must be returned to Cushman in accordance with Cushman's PC board exchange policy.

- A free annual calibration will be performed at any authorized Cushman Service Center during this extended two year warranty period.

- All transportation charges for instruments, parts, and replacement PC boards shall be paid by the customer during this period.

* Cathode ray tubes and batteries excluded.

Cushman

NEW

CE-15
Spectrum Monitor
1.5GHz Extended Frequency
Option M-2

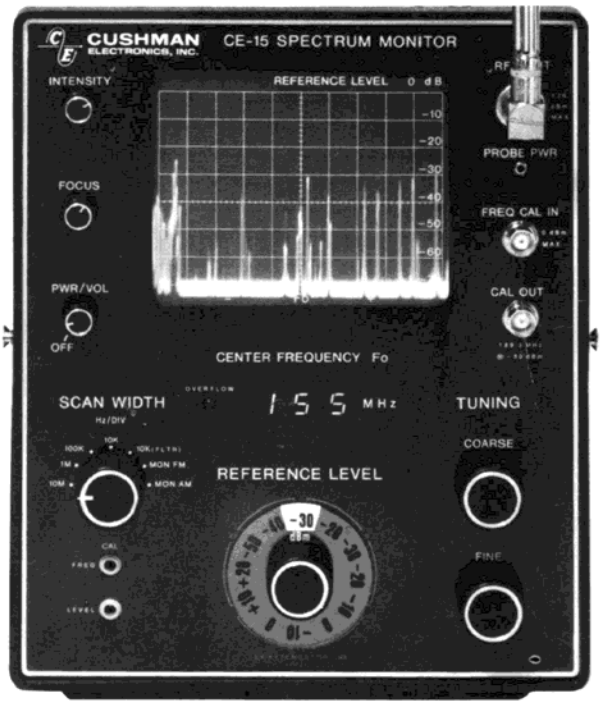
Cushman is pleased to announce that the CE-15 frequency range can now be extended from 1GHz to 1.5Ghz. This special feature is available as **Purchase Option M-2.**

The CE-15 is a special purpose spectrum analyzer designed especially for monitoring and servicing mobile radio systems. Typical applications include troubleshooting transmitters, receivers, and tracking and identifying sources of interference.

Service technicians can verify proper radio performance, tune out spurs and harmonics, and see stray signals that are causing interference. Isolating defecting circuits is quick and easy using a high impedance signal tracing probe.

The CE-15 can improve the efficiency of your shop by reducing the time it takes to troubleshoot and service mobile radio systems.

Contact your Cushman Sales Representative for more information.



Features

- ☐ 1 to 1500 MHz frequency range
- ☐ FM and AM reciever with built-in speaker
- ☐ Level accuracy ±3 dB
- ☐ Simplified controls for easier operation
- ☐ −115 dBm (0.4 μV) sensitivity
- ☐ 70-dB display range, 7 x 10 cm CRT
- ☐ Four scan widths, 10 kHz/div to 10 MHz/div
- ☐ RF input fuse protected
- ☐ External marker input
- ☐ Provision for high impedance probe for RF and IF signal tracing
- ☐ 12-Vdc operation

Specifications

Frequency

Range: 1 to 1500 MHz (usable to 100kHz)
Readout
Digital: Three red LED's, 1MHz resolution
Overflow: Indicates frequency ≥ 1000MHz

Amplitude

Sensitivity–10kHz/div (fltr) mode
Freq > 1000MHz: < −100dBm in 10kHz/div scan
Level Accuracy
Freq ≥ 1000MHz: +4dB for levels
≥ −85dBm in 10kHZ/div scan
≥ −75dBm in 100kHz/div scan
≥ −65dBm in 1 and 10MHz/div scan

All other specifications are listed in the current CE–15 Sales Brochure

Cushman Electronics, Inc.
2450 North First Street
San Jose, CA 95131
(408) 263-8100
TWX: 910-338-0556

(Special Insert to CE–15 Sales Brochure)

The many applications of the CE-15 Spectrum Monitor could fill a book

And they have. There are so many different ways the mobile radio service shop can use the CE-15 Spectrum Monitor™, we decided to write them all down. The result is an applications book that will help expand the test capability of your operation and at the same time increase efficiency.

For a free copy of this new book, arrange for a demonstration of the CE-15. Contact Cushman for the name of your nearest sales representative.

Cushman Electronics, Inc., 2450 North First Street, San Jose, CA 95131, (408) 263-8100;
Cushman Electronics, c/o ~~Thomas Mercer Ltd. Eywood Road, St. Albans, Herts, England (0727) 55313~~

Cushman

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UNPACKING AND INSPECTION

When unpacking the Model CE-15 Spectrum Monitor, inspect the packing box and the instrument for possible damage. The instrument was carefully inspected before shipment and should be ready to operate properly when received. Confirm satisfactory performance by following the procedures given in the Operating section of the Instruction Manual. If the equipment is damaged or fails to operate properly, file a claim with the transportation agency, or if insured separately, with the insurance company.

SECTION 1
GENERAL

INTRODUCTION

1.01 The Cushman CE-15 Spectrum Monitor is particularly designed for use in the Radio Maintenance field. It provides the user with the capability of visually monitoring a selected portion of the radio frequency spectrum for the purpose of determining spurious emissions, intermodulation interference, unwanted oscillator radiation, and harmonic levels. This instrument can monitor and audibly identify AM and FM carriers, which is particularly useful in the case of interference. It may be used to check intermodulation distortion between RF signals, do IF and RF signal tracing and may be used as a field strength receiver when using a calibrated antenna.

DESCRIPTION

1.02 The Spectrum Monitor is essentially a triple conversion superheterodyne receiver with a video display as well as an audio output demodulated from either AM or FM signals. The frequency range is from 1 to 1000 MHz. It has four scan widths, 10 kHz, 100 kHz, 1 MHz and 10 MHz per division. It also has a selectable 2 kHz bandwidth filter on the 10 kHz scan width range to reduce noise when viewing low level signals.

1.03 An LED frequency display with Coarse and Fine tuning controls provides for accuracy in setting the center frequency of the display and a graticule calibrated in 10 dB per step divisions makes it possible to view a 70 dB amplitude signal. Its high sensitivity, -115 dBm (0.4μV), permits viewing extremely low level signals.

1.04 Front panel access to an internal level and frequency reference makes it possible to maintain a level accuracy of measurement of better than ± 3 dB. It is possible to introduce an external calibrated signal from an accurate source such as a CE-6A Communications Monitor for use as a frequency calibrating marker simultaneously with the signal being monitored.

1.05 Sweep rate and IF filter controls have been eliminated. These are set to their optimum value for each range selected. A first IF of 2100 MHz eliminates problems from image frequencies, since they will be 4.2 GHz away from the frequency of interest.

1.06 The input circuits are protected by a fuse mounted in the RF input connector to guard the circuits from accidental overloads. This method of mounting makes it possible to change the fuse without getting into the instrument.

1.07 A high impedance probe may be directly connected to the input connector. A probe power supply jack is located adjacent to the RF input to provide for the use of active probes.

1.08 A 12V DC Inverter is available as a factory modification, M1, to permit operation of the CE-15 from a 12V DC supply.

ACCESSORIES AND OPTIONS

1.09 The following accessories are furnished with each Spectrum Monitor:

Whip Antenna

One spare RF input fuse

dBm/Volts conversion scale

Operating and Maintenance Manual

Other accessories available:

C/E P/N	Description
Option M-1	12 Volt Inverter
2180-0165	CRT Viewing Hood
7021-0002	Probe. 500 ohm in parallel with 1 pF, to 1 GHz. 20 dB insertion loss (Tektronix 010-6056-03).
7021-0003	Probe. 5K ohm in parallel with 1 pF, to 1 GHz. 40 dB insertion loss (Tektronix 010-6057-03).
7021-0001	10 spare RF input fuses 1/8A 125V
7001-0403	Printed circuit board extender
7005-0060	Front panel cover
5287-0045	Fiberglass shipping trunk
5287-0044	Soft protective zipper cover
2346-0005	Spare antenna
1262-0001	50Ω BNC Plug Terminations

1.10 The specifications for the CE-15 Spectrum Monitor are given in Table 1-1.

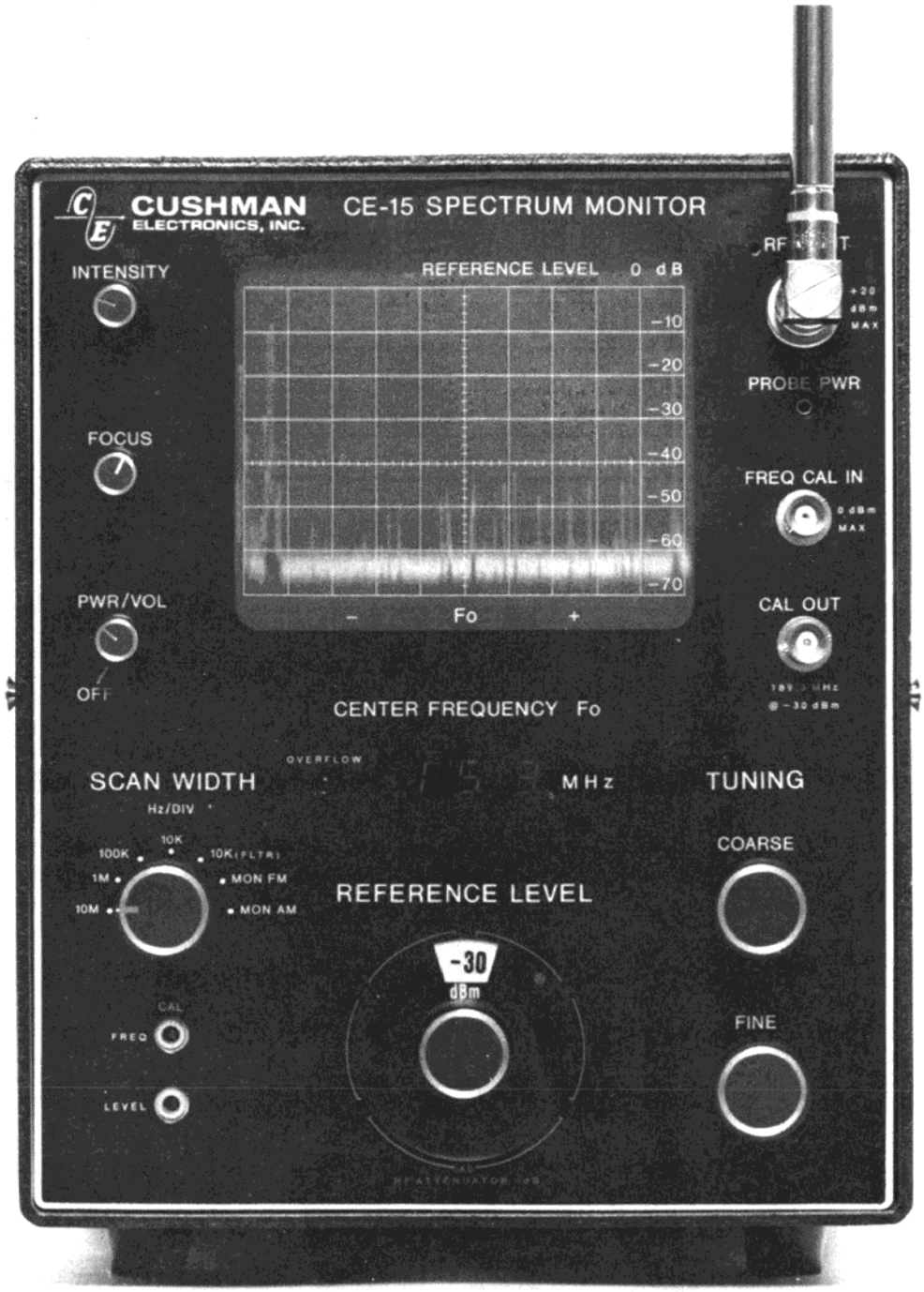


Figure 1-1. CE-15 Spectrum Monitor

Table 1-1. CE-15 Spectrum Monitor Specifications

ITEM	CHARACTERISTIC
FREQUENCY	
Range	1-1000 MHz (usable to 100 kHz)
Accuracy, F_O 5-1000 MHz	±5 MHz
Drift, after 2 hours warm-up	50 kHz/5 min, typical
LEVEL	
Range ≥5 MHz	-115 to +20 dBm
<5 MHz	-95 to +20 dBm
Accuracy, 1-1000 MHz, S/N ≥15 dB, after internal calibration at -10 dBm REF LEVEL in SCAN WIDTH mode selected	±3 dB
DYNAMIC RANGE	
Total	135 dB
Level range for specified Level Accuracy	F_O ≥5 MHz / F_O <5 MHz
10 kHz/cm Filter	-100 to +20 dBm / -80 to +20 dBm
10 kHz/cm	-100 to +20 dBm / -70 to +20 dBm
100 kHz/cm	-90 to +20 dBm / -70 to +20 dBm
1 MHz/cm	-80 to +20 dBm / -60 to +20 dBm
10 MHz/cm	-80 to +20 dBm / -80 to +20 dBm
Spurious response, (no input signal) 1-1000 MHz	≤-100 dBm
IF rejection (0-1000 MHz)	>70 dB
Image rejection (0-1000 MHz)	>70 dB
VIDEO DISPLAY	
Log Display Range	≥70 dB
Resolution, two signals having ≤50 dB difference in amplitude	
Scan Width	
10 kHz/cm FLTR	10 kHz separation
10 kHz/cm	10 kHz separation
100 kHz/cm	60 kHz separation
1 MHz/cm	0.8 MHz separation
10 MHz/cm	1 MHz separation
Noise sidebands, 50 kHz away in 10 kHz/cm FLTR mode	>70 dB down
Sweep Rate	
Scan Width	
10 kHz/cm FLTR	1 Hz ± 15%
10 kHz/cm	10 Hz ± 15%
100 kHz/cm	20 Hz ± 15%
1 MHz/cm	20 Hz ± 15%
10 MHz/cm	20 Hz ± 15%
Horizontal Linearity	± 5%
Graticule	7 x 10 cm, 10 dB/cm, 2 dB minor divisions

Table 1-1. CE-15 Spectrum Monitor Specifications (cont'd)

ITEM	CHARACTERISTIC
INPUT	
RF INPUT (fuse protected) FREQ CAL IN	
Impedance	50Ω nominal
Maximum input level	+20 dBm
Maximum input DC	±50 volts
L.O. leakage (1.9 GHz)	-40 dBm nominal
Connector	BNC
OUTPUTS	
CAL OUT	
Impedance	50Ω nominal
Level	-30 dBm nominal
Frequency	189.3 MHz ± 0.1%
Connector	BNC
DEMOD OUT (rear panel)	
Impedance	600Ω nominal
Level, 50% AM or 6 kHz P-P FM (1 kHz Mod. rate)	0.1V P-P nominal
3 dB bandwidth, FM	90 Hz - 5.4 kHz nominal
3 dB bandwidth, AM	20 Hz - 4.5 kHz nominal
Connector	BNC
Speaker	
Power, 50% AM or 6 kHz P-P FM	0.1 watt max
Squelch	-50 dB video display level nominal
PROBE POWER	+10V DC, 0.1A maximum
POWER REQUIREMENTS	
Standard	115/230V AC, ±10%, 50-400 Hz, 30VA
Inverter, optional	11.5 - 15V DC at 3A
MECHANICAL	
Height	9.5 inches (24.1 cm)
Width	8.6 inches (21.8 cm)
Length	18.4 inches (46.7 cm)
Weight	30 lbs. (13.6 kg)
Temperature	
Operating	0 to 55°C
Storage	-40° to +75°C

SECTION 2
OPERATION

CONTROLS AND INDICATORS

2.01 The location of the front panel controls can be seen in Figure 1-1. In Table 2-1 the function and a brief description of the controls is given. Figure 2-1 is a sketch showing the rear panel controls and connectors.

OPERATION

Initial Set-Up and Calibration

2.02 Connect line cord to an AC source. When first put into service make certain that line voltage switch on rear panel is set to show the line voltage of the AC source and that correct fuse is in the holder. For 12V DC operation disconnect the line cord from the instrument and slide the metal door over the AC connector to expose the banana jacks. Connect battery to the two jacks observing polarity, positive to the red jack. Set the line switch to 12V position.

2.03 Set the INTENSITY control maximum CCW and turn PWR/VOL control CW just out of the detent position. Set SCAN WIDTH to 1 MHz, REFERENCE LEVEL to -30 dBm, COARSE and FINE tuning for a CENTER FREQUENCY of 189 MHz. Connect a BNC connector cable from CAL OUT to RF INPUT.

2.04 Turn the INTENSITY control CW for a trace of suitable brilliance.

CAUTION

Prolonged display of a stationary signal or trace of high intensity may damage the phosphor of the CRT screen. Therefore the trace brilliance should not be set higher than is necessary for comfortable viewing.

2.05 Center the CAL signal on the F_0 line with the COARSE and FINE TUNING controls. Using a small screwdriver adjust the CAL FREQ adjust control for a CENTER FREQUENCY F_0 display of 189 MHz. (Make certain display is the 189 MHz Cal signal and not a harmonic, negative frequency or the First L.O. See Operation Note 1 and 2.) Set the REFERENCE LEVEL control to -10 dBm. Set the SCAN WIDTH control for the Scan Width to be used in making the next level measurement. Adjust the screwdriver-set CAL LEVEL control until the peak of the Reference signal is at the -20 dB line of the graticule. Disconnect the BNC cable from the RF INPUT and the CAL OUT connectors. The instrument is now ready for use.

Spectrum Measurements

2.06 Connect the signal to be observed to the RF INPUT connector, observing the maximum level restrictions. Tune the COARSE and FINE controls to the frequency of the desired signal and center it on the CRT display. Set the REFERENCE LEVEL for a display peaked within the graticule area and better than 15 db above the residual noise.

2.07 Set the SCAN WIDTH to a band that will include the other signals of interest, harmonics, spurious, interference. Read relative levels on the CRT graticule. Use the REFERENCE LEVEL control to attenuate high levels or to bring up low level signals. The absolute level is the algebraic sum of the dial and the graticule readings. The frequencies of the various signals seen, relative to the F_0 frequency can be determined by applying the Hz/Div setting of the SCAN WIDTH switch. Refer to Operation Note 3 for use of the red dot and red lines around the REFERENCE LEVEL control.

Higher Resolution

2.08 If it is desired to obtain better resolution between signals that are close together, the SCAN WIDTH switch should be set to 10 kHz (FLTR). This adds a 100 Hz video filter which increases the usable sensitivity as well as increasing the resolution.

Audio Monitoring

2.09 If it is desired to listen to the modulation on a signal for identification purposes, tune the signal to the F_0 line on the CRT graticule, step SCAN WIDTH switch down to 10 kHz and set signal to the Reference Level on the graticule. When stepping down on the SCAN WIDTH switch, readjust the signal to the F_0 line $\pm$ 1/2 of one small division at each step, to prevent signal from being lost. For FM step the SCAN WIDTH switch down to MON FM or for AM step down to MON AM. Signal modulation will now be heard on the built-in speaker. The squelch turn on level is at the -50 dB graticule line.

Marker Usage

2.10 When it is desired to identify some point on a waveform display, connect the output of an accurately calibrated signal generator, such as the CE-6A to the FREQ CAL IN connector, observing the maximum level limitations. Adjust the signal generator level to provide a suitable marker and adjust frequency until the marker is at the point of interest. The frequency may now be read from the signal generator setting. A counter can be used to check the generator frequency if greater accuracy is desired.

Table 2-1. Controls, Indicators and Connectors

ITEM	DESCRIPTION	FUNCTION
INTENSITY	Potentiometer	Adjusts CRT grid bias to control trace brilliance.
FOCUS	Potentiometer	Adjusts CRT electrode potentials to control trace line thickness.
PWR/VOL	Switch/Potentiometer	Controls AC to power supply. Adjusts speaker amplifier gain.
SCAN WIDTH	Switch	Selects sweep rate and bandpass filters for optimum display.
CAL FREQ	Trimpot	Sets Fo CAL OUT reference frequency.
LEVEL	Trimpot	Sets level to CAL OUT reference level.
REFERENCE LEVEL	Switch	Controls Input Attenuator. Level relative to 0 dB Reference line on CRT graticule.
CENTER FREQUENCY F_O	LED Display	Indicates frequency in MHz to which RF circuits are tuned, refers to F_O line on CRT graticule.
CRT Graticule	Plastic	Vertically 10 dB per division, horizontally according to setting of SCAN WIDTH switch.
TUNING, COARSE - FINE	Potentiometer	Coarse adjustment of first LO. Fine adjustment of first LO.
RF INPUT	BNC Connector	Input to RF attenuator. Contains RF fuse (F1001)
PROBE PWR	Pin jack	+10V DC at 0.1A for active probe.
FREQ CAL IN	BNC Connector	Input to Input attenuator through a 20 dB pad.
CAL OUT	BNC Connector	Frequency and Level reference for instrument calibration.
REAR PANEL		
DEMOD OUT	BNC Connector	FM/AM Demodulated output
2A	Fuse	Internal 10V DC supply
3A/12V DC	Fuse	External 12V DC supply
1/2A 115V AC 1/4A 230V AC	Fuse	External AC supply
	AC Connector	115/230V AC external supply
12V DC	Banana jacks	12V DC external supply

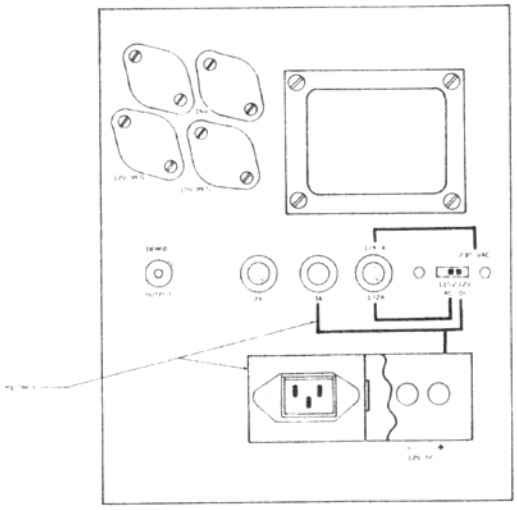


Figure 2-1. CE-15 Rear Panel

SERVICE OR REPAIR

2.11 In the event that factory service or repair is required, contact the Cushman Electronics Customer Service Department for further service information or to make arrangements for shipment to the factory or to a Service Center. The factory address is:

Cushman Electronics, Inc.
Customer Service Department
830 Stewart Drive
Sunnyvale, California 94086
Telephone: (408) 739-6760

2.12 Cushman Electronics repair service is also available at the following service centers:

Anderson Associates
204 Bedford Euless Road West/Suite H
Hurst, Texas 76053
Telephone: (817) 268-2327

B.C.S. Associates, Inc.
940 North Fern Creek Avenue
Orlando, Florida 32803
Telephone: (305) 896-4881

B.C.S Associates, Inc.
1310 Beaman Place
Greensboro, North Carolina 27408
Telephone: (919) 273-1918

Ossman Instruments Service Corp.
6666 Old Collamer Road
East Syracuse, New York 13057
Telephone: (315) 437-7245

Reshal Associates, Inc.
219 West University Drive
Arlington Heights, Illinois 60004
Telephone: (312) 398-7660

Tele-Radio
301 Supertest Road
Downsview P.O.
Toronto, Ontario, Canada M3J2M4
Telephone: (416) 661-3221

PREPARATION FOR SHIPMENT

2.13 It is recommended that the shipping box and foam packaging be kept in case it becomes necessary to ship the instrument to the service point or factory for service or repair. (Contact Cushman Electronics Customer Service Department before returning an instrument).

2.14 The following is a general guide for repackaging the instrument for shipment.

NOTE

If the instrument is to be shipped, attach a tag to the instrument identifying the owner and indicate the service or repair to be accomplished. Include the model number and full serial number of the instrument. In any correspondence, always identify the instrument by model number and serial number.

2.15 If the original container is to be used, proceed as follows:

a. Place the instrument in the original container. (If the original container is not available, one can be purchased from Cushman Electronics).

b. Make sure that the container is well sealed with strong tape.

2.16 If the original container is not used, proceed as follows:

a. Wrap the instrument in plastic or heavy paper before placing in an inner container.

b. Place the instrument and inner container in a heavy carton or wooden box and seal with strong tape or metal bands.

c. Mark the shipping container: "DELICATE ELECTRONIC INSTRUMENT", "FRAGILE".

OPERATION NOTES

1. For improved accuracy in setting the CAL FREQUENCY to the F_0 line, rotate the COARSE control fully CCW, then fully CW, then fully CCW, then to the CAL signal display. This removes slight hysteresis from the YIG oscillator.

2. If there is any doubt as to the location of the 189 MHz signal on the display, disconnect the CAL signal from the RF input. Rotate the CENTER FREQUENCY F_0 control toward zero frequency, until the L.O. signal appears. Set the SCAN WIDTH to 10 MHz and then set the L.O. signal exactly one division (10 MHz) to the left of the F_0 line on the graticule. Adjust the CAL FREQ control until the CENTER FREQUENCY F_0 display reads 010 MHz. Reconnect the CAL signal to the RF INPUT and rotate CENTER FREQUENCY F_0 control toward 189 MHz. The first signal that appears will be the 189 MHz CAL signal.

3. The red dot on the dial, with the red marked RF ATTENUATION dB ranges, indicates the amount of input RF Attenuation switched in. The -30 and -20 dBm REFERENCE LEVEL positions may be set for either 0 or 20 dB RF Attenuation and the -10 and 0 dBm positions for either 20 or 40 dB. If spurious signals due to high level overload are seen, they may be reduced or eliminated by switching to the same level with the increased RF Attenuation. To verify that spurious signals are generated externally, note that they remain at the same relative level when switching between two RF Attenuator positions, most desirably between -30, -30; -20, -20; etc. If there is a marked change, they are being generated in the Mixer due to interfering signal overload. (Increased IF gain is automatically switched in to compensate for the increased RF Attenuation).

SECTION 3
THEORY OF OPERATION

INTRODUCTION

3.01 The Theory of Operation is divided into three sub-sections. The first sub-section is a description of the Circuit Reference Series which is used for circuit and component identification. The following sub-section describes the overall functioning of the instrument from a block diagram viewpoint. The final sub-section is a description of the operation of the individual circuit boards.

CIRCUIT REFERENCE SERIES

General Description

3.02 The Circuit Reference Series is a series of numbers assigned to the circuits of the instrument to make it possible to relate the actual circuit board or assembly to the schematic diagrams, the parts lists and the text of the manual with a minimum of effort.

3.03 The series of numbers assigned to the CE-15 are as follows:

Front Panel 1000-1300

RF Casting 2000-2700

Main Chassis 3000-3800

Rear Panel 4000

The Front Panel itself is 1000 and 1100 is an assembly attached to the front panel containing circuits 1200 and 1300. The RF Casting is 2000 with the circuits 2100-2400 mounted inside the casting. Circuits 2500-2700 are mounted outside the casting but closely associated with it. The Main Chassis is 3000 and the circuits 3100-3700 are plugged into it. 3800 is the CRT assembly. 4000 is the Rear Panel.

Component Numbering

3.04 In each circuit the components are individually numbered with a separate series for each type of component. The complete identification for a component consists of the type designation letter, the circuit reference series number for that circuit and the component number. For example, the first resistor in the Log Converter will be R3301, the fourth capacitor C3304, etc.

3.05 When the individual circuits are described in the Circuit Description the component references will be abbreviated for convenience. Thus R1 will refer to a resistor on the board under consideration only. If reference is made to a component outside that board or when more than one circuit is being described the full reference designation will be used.

Cross Reference

3.06 In order to identify each board a cross reference list is given at the beginning of section 5 listing the basic board number, which is etched on each board, and the title, assembly number, circuit reference number and the figure and page number of the schematic diagram. The basic board number is in the 1780-xxxx series. However, in some cases the board is so small that sufficient room was not available to etch the full number. In these cases only the last four digits are etched with the 1780 to be understood. The 1780-xxxx number appears also in the parts lists along with the assembly number and the circuit reference number.

FUNCTIONAL DESCRIPTION

3.07 The CE-15 functions as a triple conversion superheterodyne receiver. Levels throughout the instrument are carefully controlled so that an accurately calibrated oscilloscope display is obtained as the output. Refer to Figure 3-1.

3.08 The first Local Oscillator (L.O.) is a YIG oscillator. The 2.1-3.1 GHz frequency is adjusted by the front panel COARSE and FINE controls. The 2100 MHz first IF is mixed with the 1900 MHz VCO second LO in the second converter to provide a second IF of 200 MHz. A feedback loop from the third IF output controls the 1900 MHz VCO to provide frequency stability in the Monitor mode. The third LO is a 189.3 MHz crystal controlled oscillator. This produces the 10.7 MHz third IF. An output from this oscillator is also brought to the front panel for use as the calibrating signal for the instrument.

3.09 The 10.7 MHz output from the third IF goes to the Log Converter and to the FM Demodulator. The FM Demodulator output is used to complete the AFC feedback loop to the 1900 MHz VCO second LO. It also is amplified and appears as the audio output through the built-in speaker. The Log Converter changes the linear amplitude signals to a logarithmic output which is detected, and then appears as the vertical display on the CRT screen. This detected output is also applied to the audio amplifier and appears as the detected AM audio signal on the speaker.

3.10 The horizontal display comes from a ramp generator. The ramp generator output also controls the YIG oscillator to sweep the frequency at the ramp generator rate to provide the swept display of the frequency spectrum being observed.

CIRCUIT DESCRIPTION

RF Attenuator. 2100

3.11 Input to the CE-15 is through the RF Attenuator which is adjustable for three attenuation levels, 0 dB, 20 dB and 40 dB. See Figure 5-5. The 20 dB attenuator is made up of C2, C5, R3, R5-R8, and the 40 dB attenuator is C7, C10, R9, R11-R14. Switching diodes, CR1-CR8, which are controlled by the RF ATTENUATOR wafer on the REFERENCE LEVEL switch, either switch in the proper attenuator or bypass the signal around the attenuators according to the setting of the switch. The diode switches are turned on by applying a positive voltage to the selected diode pair. Isolating RF chokes, L1, L3, L5, provide the ground return for the switching current. L2, L4 isolate input-output diodes.

3.12 Signal input from the RF INPUT connector comes in through terminal 5 and C1 to the attenuator. The signal from the FREQ CAL IN connector comes to terminal 6 and is connected to the input RF Attenuator through 20dB attenuator R1, R2. Output from the RF Attenuator passes to the First Converter through a 1 GHz low pass filter.

First Converter. 2200

3.13 The 0.5-1000 MHz signal from the RF Attenuator enters through terminal 1 and goes to the VHF diode mixer, Z1. Refer to Figure 5-6. The 2100-3100 MHz L.O. comes in through terminal 2, through a high pass filter made up of C2 and the printed circuit inductor, to the mixer through matching transformer, T1. The 2100 MHz output from the mixer passes through a high pass filter, C4, C5 and the printed circuit inductor to the first IF amplifier, Q1, Q2. Printed circuit components provide RF chokes and coupling inductors. Output from the first IF amplifier passes out through terminal 4 to a cavity type 2100 MHz band pass filter, 2600 board, before going to the second converter.

YIG Driver. 3100

3.14 The first L.O. is a YIG (Yittrium, Iron Garnet) oscillator. The YIG resonant frequency is determined by the strength of the magnetic field in which it operates. This makes it possible to smoothly control the oscillator frequency by varying the strength of the magnetic field. The YIG Driver, Figure 5-11, performs this function for the YIG oscillator, which is contained in the 2500 assembly.

3.15 The control inputs to the YIG Driver circuit are from the COARSE and FINE front panel frequency controls, a ramp generator input for sweeping the frequency and control from the SCAN WIDTH switch to adjust the sweep width. Outputs are current to the main coil and the Tickler (FM) coil of the YIG oscillator and a voltage, adjusted by the FREQ CAL control, to the Digital Panel Meter display circuit to indicate the frequency to which the instrument is tuned.

3.16 The COARSE and FINE controls apply a DC voltage to the non-inverting input of U1 through board pin 6. Current amplifier Q1, Q3 drives the Main Coil of the YIG to adjust the L.O. frequency. Coil current through R25 produces a voltage at the current junction (R24-R25) and is applied to the inverting input of U2 to drive the A/D Converter and Frequency display through the level adjusting buffer Q4. Q2 is a switch which shunts C10 across the Main Coil in all but the 10 MHz/cm mode to prevent any ripple appearing on the Main Coil.

3.17 Input from the Ramp Generator comes in through board pin 13 to the inverting input of U3 and to Q8. Q8 is switched off except in the 10 MHz/cm mode. The output of U3 controls the current amplifier, Q12, Q13 which drives the Tickler (FM) coil of the YIG. Gain of U3 is controlled by a switchable feedback loop. In the 10 kHz/cm mode Q10 switches in R17 as the feedback resistor. For 100 kHz/cm R19 is switched in by Q11, and for 1 MHz/cm all but R48 are switched out. The switches are activated by a ground closure at the SCAN WIDTH switch.

3.18 In the 10 MHz/cm mode Q9 is turned on to short out all feedback resistors reducing the gain of U3 to zero, setting the current through the Tickler coil at a constant level. At the same time Q5 and Q8 are also turned on, which then turn on Q6, Q7. Q5 also turns off Q2, taking C10 out of the circuit. The ramp is now applied to the summing junction R24-R25 through Q8, Q6, to sweep the Main Coil for the 10 MHz/cm mode. The output of Q6 is also applied to U2 inverting input to sweep the Frequency display.

3.19 In the MON AM mode Q9 is turned on to short the feedback loop around U3 to turn off the sweep so that AM audio may be heard on the speaker. The front panel FREQ CAL control adjusts a voltage at the non-inverting input of U2 while the internal calibration adjustment is made with R3 to calibrate the Frequency display. The overall display is centered with R41 and the 10 MHz/cm sweep by R37. Calibration of the narrow band sweep widths is with R43 and the wide band with R14.

Second Converter. 2300

3.20 Output from the First Converter passes through a 2100 MHz band pass filter through terminal 2 on the Second Converter to the Mixer, CR1, CR2. See Figure 5-7. The 1900 MHz Second L.O. comes in through terminal 1, through high pass filter C1, C2 and the printed circuit inductive elements, then through T1 to the mixer. 200 MHz output is amplified by Q1 and then passes through the 200 MHz band pass filter L4-L6, C9, C11-C15 to the output terminal 3.

1900 MHz Oscillator. 2700

3.21 This oscillator is made up of common base connected Q1 and printed circuit reactive elements. See Figure 5-9. CR1, CR2 are part of a voltage divider that sets the bias on the base of Q1. This bias is varied, however by the AFC voltage which comes in from board 3500 through C3, R4, R7. Oscillator output from terminal 3 goes through a variable pickup loop.

Third Converter. 2400

3.22 200 MHz input to the Third Converter comes in through terminal 2 to T4 of the Third Mixer which is made up of T1-T4, CR1-CR4. See Figure 5-8. Input from the 189.3 MHz Third L.O. comes to T1 and the 10.7 MHz output goes out through terminal 3.

3.23 The 189.3 MHz oscillator, Q1, Y1, is mounted on the same board as the Third Mixer. C5 provides fine adjustment of the oscillator frequency. Output is through a 3dB pad, R4-R7. R6 is made variable to tap off an output to be used as the front panel CAL OUT source.

IF Switchable Gain and Bandwidth. 3200

3.24 10.7 MHz input through board pin 3 goes to the switchable 20dB amplifier, Q1, through buffer Q3 to switchable 10dB amplifier, Q4 and through buffer, Q5 to the switchable bandpass filters, through buffer Q9 to the 30dB amplifier, Q7, Q8 and out through board pin 18. Refer to Figure 5-12.

3.25 The switches Q2 and Q6 are controlled by the front panel RF ATTENUATOR switch to switch the amplifiers to either 20dB, 10dB or 0dB gain. The bandpass filters are selected by the SCAN WIDTH switch. The 10 kHz bandpass filter is controlled through diodes CR1, CR2, the 100 kHz BPF by CR3, CR4 and the 2 kHz BPF by CR5, CR6. Equal levels through the BP Filters are adjusted by R21 in the 10 kHz filter and R26 in the 100 kHz filter. Level through the 2 kHz filter is the reference for this adjustment.

Log Converter. 3300

3.26 The 10.7 MHz IF signal comes in through board pin 21 to the ±6dB variable gain amplifier, Q11, Q12. See Figure 5-13. Q10 controls this gain according to the setting of the front panel CAL LEVEL control. Q12 is a common base amplifier. Filtering is provided by the 10.7 MHz parallel resonant circuit, L10, C43.

3.27 The 15dB IF Amplifier/Limiter Q13-Q17 raises the level to a 0dB reference which is required at U1-9, and limits the output to 5 volts P-P to prevent overloading U1. A 15dB attenuator, R55, R56, at the input to the 15dB Amplifier/Limiter provides the -30dB input required at U1-7 and the 30dB attenuator, R23, R24 adjusts the level to -60dB at U1-4. From the 0dB output of the 15dB Amplifier/Limiter, two 15dB amplifiers in series, Q1-Q7 raise the level to the +30dB required at U1-12. The gain of these amplifiers is adjusted by R1. The break points on the logarithmic curve of the Log Converter U1 are adjusted by R27, R28, R29.

3.28 Voltage output from the Log Converter is amplified in the Voltage/Current Detector Driver, Q8, Q9, which drives the detector CR2, CR3. The recovered modulation is amplified by U2 and passes to the vertical deflection amplifier through board pin 13. R69 calibrates the gain and R66 sets the no-signal zero reference trace on the CRT display. The output of U2 is also taken through R70 to board pin 14 and from there to the Audio/+10 volt supply board.

Audio/+10V Supply. 3500

3.29 AC input from the rear panel mounted power transformer comes in through board pins 21, 22, to the bridge rectifier Z1. See Figure 5-15. One output from the rectifier passes through a current source Q1, Q2, Q4, to supply the Logic board. The +10 volt supply is regulated by Q3, Q5, Q6, Q7, U1. Q7 is the series voltage regulator driver for the series pass transistor mounted on the rear panel. Q3, Q5 form a starter circuit to turn on Q7 when power is first applied. U1, Q6 form the error amplifier and CR8 is the voltage reference. The +10V regulated current goes out through board pin 11 to the main +10V distribution terminal. A connection from this terminal comes back through board pin 12 as the regulator sense voltage. Regulator output voltage is adjusted by R14.

3.30 A 10.7 MHz output from the IF Switchable Gain and Bandwidth board comes in through board pin 2 to the FM Demodulator U2, Y1. Demodulated FM from U2-6 is applied to audio buffer amplifier, Q9, through switch, CR9, which is on in the FM mode. Audio output goes to the rear panel connector through board pin 14 and to the VOL control through board pin 16. The attenuated audio comes back in through board pin 15 to the speaker amplifier U4, Q14, Q15. In the AM mode the demodulated AM comes in through board pin 13, through switch CR10, which is turned on in the AM mode, to the audio buffer amplifier Q9.

3.31 An Automatic Frequency Control voltage from U2-7 passes through buffer, Q10, and switch, Q11, to the AFC amplifier, U3, and out through board pin 9 to control the 1900 MHz VCO on the 2700 board. When there is sufficient signal present to cause a squelch voltage to appear at U2-13, to turn on squelch threshold switch Q8, and at the same time the SCAN WIDTH switch is in either MON FM or AM, AND gate CR13, CR14 will be open, turning off Q12 and turning on Q11 to pass the AFC to the 1900 MHz VCO. When SCAN WIDTH is not in MON FM or AM the AND gate conducts, turning on Q12 and turning off Q11 to turn off the AFC and set it to a constant +5V. At the same

time Q12 also turns on Q13 which turns off the audio buffer, Q9, to quiet the speaker output.

Ramp Generator/Deflection Amplifier. 3600

3.32 This board contains the power supply for the Astigmatism adjustment, the Vertical Amplifier, the Ramp Generator and the horizontal amplifier. Refer to Figure 5-16. A.C. from the power transformer through board pins 20, 21 is connected to the rectifier, Z1. Rectifier output is regulated by Q4, Q5 to approximately 250V across the astigmatism voltage divider, R20-R22.

3.33 Output from the Log Detector Amplifier on the Log Converter board is brought in through board pin 12 to cascode amplifier Q14, Q15, Q17, Q18. Q16 is a current source for the amplifier. R55 adjusts vertical centering and R49 adjusts vertical gain. Output to the CRT vertical deflection plates is through board pins 13 and 15. Q10, Q12 switch in C14 as a smoothing filter when the SCAN WIDTH switch is in the 10K (FLTR) position.

3.34 In the Ramp Generator Q1 is a switch which turns on to charge timing capacitor, C3, during retrace. Q2, Q3 are switches operated by the SCAN WIDTH control on the front panel to select the proper timing discharge resistor R6 or R9 to determine the ramp rate. U1 is the integrator and U2, U3 are comparators which control the Ramp. U2 stops the ramp at approximately +7 volts and starts the retrace by turning on Q1 to charge C3. U3 stops the retrace at approximately +3V by switching U2, to turn off Q1, allowing the ramp to start again.

3.35 Ramp output from U1-6 goes through push-pull amplifier Q9, Q13 to the horizontal deflection plates through board pins 6, 8. R45 adjusts horizontal centering and R31 adjusts horizontal gain. Q7 is a common base amplifier which buffers the retrace blanking pulse to the High Voltage Supply circuit. Ramp output through board pin 4 goes to the YIG Driver to generate the sweep of the First Local Oscillator.

High Voltage Supply. 3700

3.36 A.C. at 960 VRMS (1353 P-P) is brought in through terminals 4, 5 to the voltage doubler circuit CR1, CR2, C1, C2 to provide an output of approximately -2500V DC. See Figure 5-17. Q2-Q5 is a voltage controlled variable resistor, controlled by U1, an optical isolator amplifier. Output at about -2000V is applied to the voltage divider, R10-R13, R17-R21, R27. The positive end of the divider is tied to the +10V regulated voltage.

3.37 U2 is the high voltage regulator error amplifier. It is referenced to the voltage at the wiper of R14, which is the high voltage set adjustment. The regulated point is the junction of R21, R27, which is about +4V DC. Diodes CR4-CR6 prevent the U2 output from falling below +3V DC.

3.38 The CRT cathode potential is taken from the junction of R12, R17. It is approximately -1875V and is connected to the CRT through terminal 2. The wiper arm of the Intensity control, R11, is connected to the CRT through terminal 3, and the Focus control, R13, wiper arm is connected to the CRT through terminal 1. The retrace blanking pulse from the Ramp Generator comes in through board pin 1 to the optical isolator amplifier, U3, which controls switch, Q6. During retrace Q6 is turned on to bring the CRT intensity level down to a voltage below the CRT cut off point which turns off the CRT beam. Q1 is effectively a variable resistance in the rotation coil around the CRT, controlled by R2 to adjust the inclination of the horizontal trace.

A/D Converter. 1300

3.39 This circuit board contains both the A/D converter and a logic power supply regulator. Refer to Figure 5-3. Current from a current source on the Audio/+10V supply board, 3500, comes in through board pin 4 to an isolation stage, Q1, Q2. The function of this stage is to isolate the rest of the instrument from the logic noise generated in board circuits 1200 and 1300. The regulator consists of the error amplifier, U3, and shunt regulator, Q3. The reference voltage for the error amplifier is the regulated +10 volts brought in through board pin 5. See Figure 5-3. The output is +5V regulated to the logic boards 1200 and 1300.

3.40 A variable voltage proportional to the YIG oscillator frequency is brought in from the YIG Driver board, 3100, through board pin 3. This voltage is applied to the A/D system U1, U2. The output of U2 is a BCD form of the three decimal numbers to be displayed on the 1200 board display readout. Output passes through terminals 7, 8, 9, 10. These BCD numbers are multiplexed by the U2 outputs through terminals 3, 4, 6, to the anode drivers of the display units to turn on each unit in the proper sequence. Another output from U2 through terminal 2 goes to the OVERFLOW light driver to indicate that the frequency has been set out of range.

Display. 1200

3.41 The BCD output from the A/D converter through terminals 7, 8, 9, 10, is applied to the BCD to 7 segment decoder, U1, to generate the seven segment display in LED1-LED3. The anode drivers Q2-Q4 multiplex the display according to the sequence generated in U1302 and brought in through terminals 3, 5, 6. The OVERFLOW light driver, Q1, is controlled by an output from U1302 through terminal 2.

12V DC Inverter. 3400

3.42 The 12V DC Inverter is a modification, M1, which is available on factory order. The function of the inverter is to provide an A. C. source to operate the instrument transformer to provide the required 6.3V, 250V, 960V AC outputs. It also provides regulation for the AC output. Refer to Figure 5-14.

3.43 The instrument +10V supply is obtained from the 12V DC input which is regulated through the series regulator Q4001. See the M1 Rear Panel Interconnection Diagram, Figure 5-19. The 10V DC for the Inverter is reduced from the 12V input by zener regulator CR3402. The AC is generated by RC oscillator U2 which operates at about 400 Hz. The signal is squared up by U1-1,5, to operate the flip-flop divider U1-11, 8, 9 to produce a 200 Hz (approximately) output to the switch drivers Q3401, Q3402.

3.44 The Relay K4001 automatically connects the switching transistors Q4003, Q4004 to the Inverter winding of the transformer, T4001-9, 11 and to series regulator Q4002 whenever 12V DC is connected to the DC input terminals.

3.45 Positive 12V is regulated to +10V through Q4002, passes through polarity reversal preventing diode, CR4002, to the center tap of transformer, T4001-10. Current through the transformer is switched alternately through each winding by Q4003, Q4004. The reference voltage for Q4003 is provided by R3401, CR3401. CR4001 is also a polarity reversal preventing diode causing fuse F4002 to blow in case polarity is reversed.

SECTION 4
MAINTENANCE

GENERAL

4.01 This section of the manual contains the information necessary to check the performance of the Model CE-15. It also contains the procedures for adjustment and calibration recommended for field maintenance.

4.02 The Performance Checks are to be used to verify proper operation and may be used for incoming inspection. Adjustment and calibration procedures should be carried out only if out-of-tolerance operation is observed.

4.03 If the Adjustment procedures fail to correct the difficulty, and the cause of the trouble is not readily apparent or repairs cannot conveniently be made, it is recommended that the instrument be returned to the factory or sent to a service center for repair. Always contact Cushman Electronics Customer Service Department before returning equipment or shipping to a service center. See paragraph 2.11.

4.04 The Model CE-15 should be turned on and warmed up for two hours before beginning the Performance Check or the Calibration and Adjustment procedures.

PERFORMANCE CHECK

Test Equipment Required

4.05 Any equivalent instrument may be used:

Signal Generator	HP8640B
Power Meter	HP435A/8481A
Precision Step Attenuator	HP355C/D
Oscilloscope	HP180/1801/1820

4.06 Set up the controls and make front panel connections as follows:

PWR/VOL	On (just out of detent)
SCAN WIDTH	1 MHz/DIV
REFERENCE LEVEL	0 dBm
RF ATTENUATOR	20dB (red dot)
CENTER FREQUENCY	189 MHz

4.07 Connect CAL OUT to RF INPUT with a short BNC connector coaxial cable. Adjust INTENSITY for desired display brightness. Adjust FOCUS for a sharp trace.

4.08 Adjust CAL FREQ until the displayed trace is centered on the F_O line of the graticule. Adjust CAL LEVEL until the top of the trace just reaches to -30dB line on the graticule. Disconnect the CAL OUT/RF INPUT cable.

Level Accuracy

4.09 Set the Signal Generator to an accurate +20 dBm reference level at 189 MHz, with the Power Meter as follows:

a. Set the Precision Attenuator to 30dB attenuation and connect to the Signal Generator output. Set Signal Generator to 189 MHz.

b. Set the Power Meter to -10 dBm and connect to the output of the Attenuator. Connecting cables should be as short as possible.

c. Set the Signal Generator output for +20 dBm and adjust for a Power Meter reading of exactly -10 dBm. Disconnect the power meter from the Attenuator and connect the Attenuator output to the CE-15 RF INPUT. Tune CE-15 for the signal at F_O.

d. Check the level accuracy of the REFERENCE LEVEL control in 10dB steps using the Precision Attenuator to set the signal input levels. Level error should not exceed ± 2 dB.

e. Check each graticule division for level accuracy using Precision Attenuator to set levels. Error should not exceed ± 3 dB.

Frequency Response

4.10 With the Signal Generator and Precision Attenuator connected as in the previous steps, check the frequency response as follows:

a. Set the Precision Attenuator for 50dB attenuation. Set the CE-15 REFERENCE LEVEL to -30 dBm and RF ATTENUATION to 0dB. Check that trace is at the 0dB REFERENCE LEVEL graticule division.

b. Set the Signal Generator and the CE-15 to 1 MHz, 400 MHz and 1000 MHz. Tune the CE-15 for a response at F_O for each frequency.

c. Check the level and frequency accuracy at each frequency. Level should not vary more than ± 3 dB. Frequency should be within ± 5 MHz at 400 MHz and 1000 MHz.

Scan Width Functions

4.11 With the Signal Generator and Precision Attenuator connected as in previous steps check the Scan Width functions as follows:

a. Set the CE-15 to -30 dBm and RF Attenuator to 0dB. Set Precision Attenuator to put top of trace on the 0dB Reference Level graticule line. Tune trace to F_0 line with COARSE and FINE controls.

b. Set SCAN WIDTH control to each Scan Width mode from 10M to 10K (FLTR). Recenter trace to F_0 line at each step. Jump in horizontal position of trace between SCAN WIDTH positions should not exceed ± 2 divisions. The level displayed should not change more than 3dB P-P through all positions.

FM Demodulation

4.12 With the Signal Generator and Precision Attenuator set up as in previous steps check FM Demodulation as follows:

a. Set the CE-15 to +20 dBm and RF Attenuator to 40dB.

b. Set the output of the Precision Attenuator to -10 dBm (30dB attenuation). Trace should now be on -30dB graticule line. Set SCAN WIDTH control to 10K and center trace on F_0 line.

c. Set the Signal Generator modulation to Internal FM, 1 kHz rate and 3 kHz peak deviation.

d. Set SCAN WIDTH control to MON FM. Adjust VOL control for audible 1 kHz tone on internal speaker. Connect oscilloscope to DEMOD OUTPUT (Rear Panel) and check for sine wave output .15V ± .05V P-P at 1 kHz.

AM Demodulation

4.13 With setup the same as in the previous step check AM Demodulation as follows:

a. Set Signal Generator for Internal 50% AM at 1 kHz rate.

b. Set SCAN WIDTH control to MON AM. Check for audible 1 kHz tone on internal speaker. Check that DEMOD OUTPUT on oscilloscope is a 0.11V ± .02V P-P, 1 kHz sine wave.

ADJUSTMENTS

General

4.14 The Model CE-15 should be turned on and warmed up for two hours before beginning the Adjustment procedures. The following procedures should be carried out only if out-of-tolerance operation is observed while making the performance checks given above.

4.15 The AC power source should be checked for a voltage of 115V AC. If necessary use a voltage variable transformer (Variac or Powerstat) to supply 115V AC to the CE-15 during calibration procedures. After making calibration adjustments they should remain stable over a range of 105.5V to 126.5V AC.

NOTE

Circuit boards are not normally interchangeable between instruments without full recalibration.

Equipment Required

4.16 Any equivalent instruments may be used.

DVM	Dana 4300
High Voltage Probe	Dana 82
DC Power Supply	Power Designs 6050
Oscilloscope	HP180/1801/1820
Frequency Counter	Dana 8020B
Signal Generator	HP8640B
Test Oscillator	HP652A

NOTE

A less accurate Signal Generator, set to frequency with a Frequency Counter, may be substituted for the HP8640B.

Power Supply Adjustment

4.17 Make adjustments as follows: (Refer to Figure 4-1 for circuit board and assembly locations).

a. Connect the DVM between WT3001 (gnd) and WT3002 (+10V) turret terminals. Adjust R3514 for a reading of +10.000 volts.

b. Connect DVM across R3501 (board pin 4 and Q3501 emitter). Adjust R3505 for a reading of 1.53V DC.

c. Connect the High Voltage Probe to the DVM and touch probe to terminal 3702 (blue) on the High Voltage supply board. Adjust R3714 for a reading of -1875V DC.

Ramp Generator/Deflection Amplifier Adjustment

4.18 Make setup and adjustment as follows:

a. Use insulated clip leads to short board pins 3606 to 3608 and pin 3613 to 3615. NOTE: Pins are at 250V DC potential.

b. Set FOCUS for approximately a one

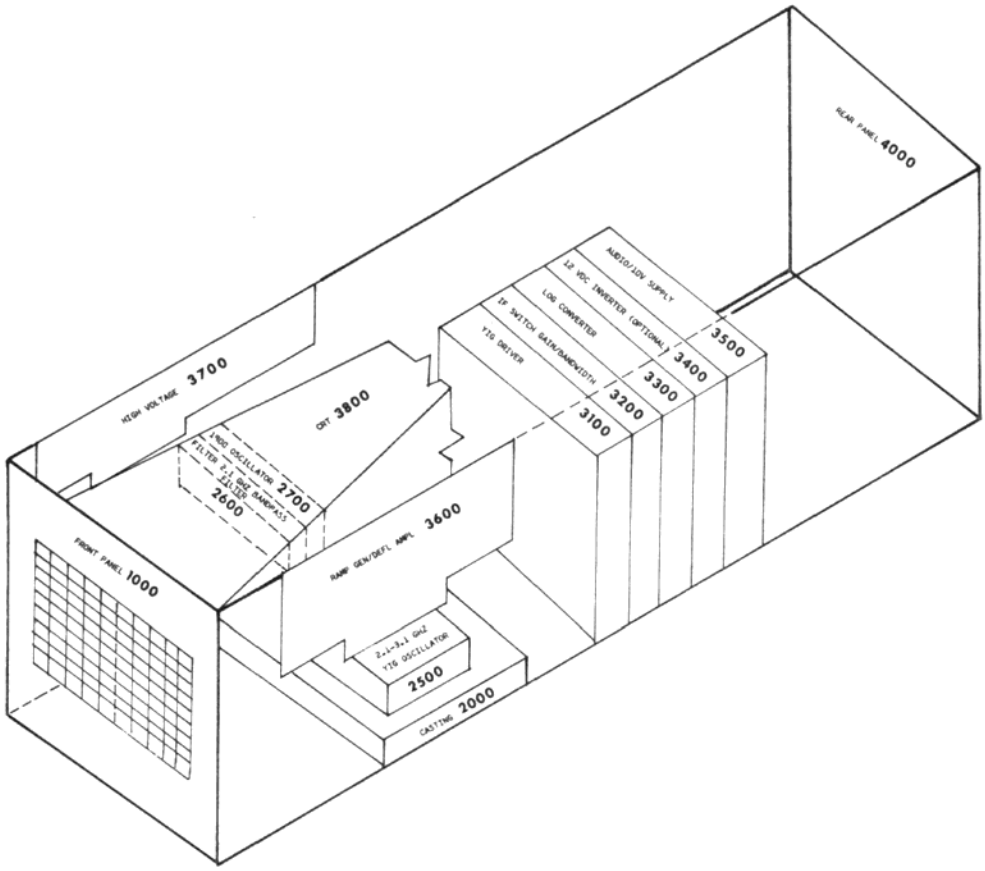


Figure 4-1. Circuit Board and Assembly Locations

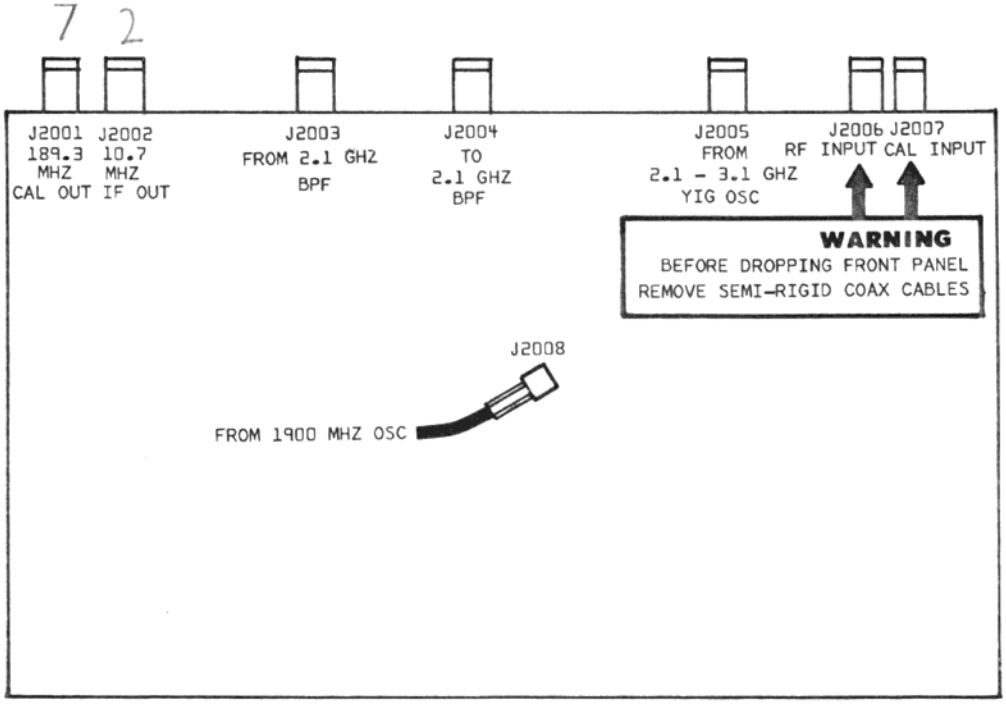


Figure 4-2. RF Casting Cable Connection Locations

division diameter spot. Turn INTENSITY up to full intensity.

c. Adjust R3621 (ASTIG) for a circular spot.

d. Reduce INTENSITY, refocus spot to normal size and remove clip leads.

e. Remove Log Converter board, 3300, from the instrument. Set the Power Supply to +4.500V DC with the DVM. Connect negative to ground (chassis) and positive to pin 3612.

f. Adjust R3655 to place horizontal trace on the -40dB line. View from directly in front of line to prevent parallax. Adjust R3702 (ROTATION) until trace is parallel with the horizontal graticule line.

g. With DVM connected to power supply set it to +3.000V, +4.000V, +5.000V, +6.000V and check that trace falls on the -70, -50, -30, -10dB lines respectively. Adjust R3649 (VERT GAIN) and R3655 (VERT CNTR) and check repeatedly until all traces fall within ± .05 division of each graticule line. (Small marks are 0.2 division graduations).

h. Set power supply to 3.500V, 4.500V, 5.500V, 6.500V and check that trace is within ± .05 division of -60, -40, -20, -0dB graticule lines. If necessary readjust R3649 and R3655 slightly. Repeat g. and h. until specifications are met at each graticule line.

i. Adjust R3645 (HORIZ CNTR) and R3631 for a trace 10 divisions long, centered horizontally in the graticule.

j. Connect the oscilloscope probe to pin 3604. Verify a sawtooth wave period of 50 ms ± 6.5 ms in 10 MHz/DIV, 1 MHz/DIV, 100 kHz/DIV mode and 100 ms ± 15 ms in the 10 kHz/DIV mode and 1 sec ± .15 sec in 10 kHz/DIV FLTR mode. Disconnect power supply and replace Log Converter board, 3300.

Frequency Scan Adjustment

4.19 Adjustment for 1 MHz/DIV

a. Set the Signal Generator to 1.0 MHz unmodulated at 0 dBm output level and connect to the CE-15 RF INPUT connector. Set the CE-15 SCAN WIDTH to 1 MHz/DIV and set REFERENCE LEVEL to -40 dBm.

b. Adjust the CE-15 COARSE TUNE and the Signal Generator to place one harmonic on each of the vertical graticule lines. (If harmonic on first line of graticule does not line up disregard and line up the other ten.) (Line to far left is first line and last line to the right is the eleventh line.)

c. Adjust R3631 (HORIZ GAIN) and R3645 (HORIZ CNTR) so that the harmonic on line #3 is shifted to line #1 (far left) and harmonic on line #10 (next to last on right) is shifted 0.7 DIV to the right.

d. Adjust R3143 (TICK GAIN) and the COARSE TUNE for one harmonic per vertical line ± 0.5 DIV.

4.20 Adjustment for other Scan Rates

a. Set Signal Generator to 10 MHz and set CE-15 SCAN WIDTH to 10 MHz/DIV. Adjust COARSE TUNE for eleven harmonics showing on the CRT screen, and set R3137 (100 MHz OFFSET) to mid-range.

b. Adjust R3114 (100 MHz SWEEP) and COARSE TUNING so that the eleven harmonics are as close to the eleven graticule lines as possible. Each harmonic peak should be within ± 0.5 DIV of its respective graticule line.

c. Set the Signal Generator to 100 kHz, set SCAN WIDTH to 100 kHz/DIV. Set COARSE TUNING for 11 harmonics on the CRT. Each harmonic peak should be within ± 0.5 DIV of its respective vertical graticule line.

d. Disconnect the Signal Generator and connect the Test Oscillator to the CE-15 RF INPUT connector. Set the Test Oscillator to 10 kHz at +20 dBm. (Use counter to set the Test Oscillator frequency). Set the CE-15 to 10 kHz/DIV.

e. Adjust the COARSE TUNING and R3155 (10 kHz Sweep) so that the eleven harmonics are as close to the eleven graticule lines as possible. Each harmonic peak should be within ± 0.5 DIV of its respective graticule line.

4.21 Centering Scan Width Modes

a. Disconnect Test Oscillator and connect CAL OUT to RF INPUT. Set SCAN WIDTH to 10 kHz/DIV and tune CAL signal to F_0 graticule line with COARSE and FINE TUNING controls.

b. Switch SCAN WIDTH to 1 MHz/DIV. Adjust R3141 (DSP CNTR) to center the L.O. signal on the F_0 graticule line.

c. Switch SCAN WIDTH to 10 MHz/DIV and adjust R3137 (100 MHz OFFSET) to center the L.O. on the F_0 graticule line.

4.22 Adjust DPM Voltage Output

a. Set Signal Generator to 100 MHz at +10 dBm and connect to CE-15 RF INPUT. Set CE-15 REFERENCE LEVEL

to -40 dBm and SCAN WIDTH to 10 MHz/DIV.

b. Clear YIG by adjusting COARSE TUNING control fully CCW, then fully CW, then fully CCW, then tune to the 10th harmonic of 100 MHz and set to F_O line. (Reduce input until only 100 MHz line seen, then increase input and count up ten harmonics).

c. Carefully zero the DVM and connect between 3100 board pin 10 and ground, on 3100 board. Adjust front panel CAL FREQ adjustment for a reading of +1.000V DC on DVM.

d. Adjust COARSE TUNING fully CCW, then set 100 MHz signal to F_O graticule line. Adjust R3103 (DVM GAIN) for a reading of +0.100V DC on the DVM.

e. Reset 10th harmonic of 100 MHz to the F_O line and readjust CAL FREQ control for a DVM reading of 1.000V DC.

f. Repeat d. and e. until there is no more than ±.001V DC difference in the two readings.

g. Turn COARSE TUNING control fully CCW and verify a DVM reading of 5mV ± 5mV.

h. Adjust COARSE TUNING for a frequency display from 999 to (1)000 plus OVERLOAD. If the display jumps 3 or more digits adjust R3505 slightly clockwise until reading is stable.

Digital Panel Meter Adjustment

4.23 Turn COARSE TUNING control fully CCW, then fully CW, then fully CCW.

a. Adjust R1303 (ZERO ADJ) for a reading of 005 MHz on the CENTER FREQUENCY display.

b. Set the SCAN WIDTH switch to 1 MHz/DIV. With the COARSE TUNING set the 100 MHz signal to the F_O graticule line. Adjust FREQ CAL for a CENTER FREQUENCY reading of 100 MHz.

c. Set the 10th harmonic (1000 MHz) to the F_O line (see para. 4.22b). Adjust R1301 (FULL SCALE CAL) for a CENTER FREQUENCY reading of (1)000 with the OVERFLOW light on.

d. Repeat b. and c. until no further adjustment is required.

e. With the COARSE TUNING control, set each harmonic in order (100, 200, 300, ..., 1000 MHz) to the F_O graticule line. CENTER FREQUENCY should be the same as the harmonic ± 5 MHz. To obtain the best linearity over the full range R1301 may be adjusted to set the 1000 MHz reading at some number between 997 and (1)003 MHz. Repeat check and adjustment until best linearity is obtained.

f. Check COARSE TUNING over the full range, using the 100 MHz harmonics. Range should be from less than -100 MHz to greater than 1100 MHz. (The CENTER FREQUENCY display will only read a minimum of 005 MHz but the -100 MHz signal can be seen on the CRT display as the first harmonic below the L.O. signal).

g. Set one of the harmonic signals to the F_O graticule line. Adjust the FINE TUNING control from the fully CCW to fully CW position and note how far the signal display on the CRT moves. Range should be 1.5 MHz ± .5 MHz.

h. Note reading of CENTER FREQUENCY. Adjust FREQ CAL control from maximum to minimum. There should be a range greater than 30 MHz on each side of the calibrated setting of the control.

4.24 After completing the Adjustment procedures the Performance Check procedures, paragraphs 4.05-4.13 should be carried out.

Table 4-1. Troubleshooting Chart

Indication	Possible Cause	Check
1. Does not operate when switched on	1. Main fuse open 2. AC cord loose 3. No AC at source 4. Line switch wrong position	1. Replace 1/2A fuse (F4001) 2. AC cord - both ends 3. AC source 4. Line switch rear panel
2. Does not work when 12V applied	1. Inverter board not plugged in. 2. 3A fuse open	1. Check 3400 M1 board 2. Replace 3A fuse (F4003)
3. CRT spot but no deflection	1. +10V supply fuse open 2. Component in +10V supply	1. Replace 2A fuse (F4002) 2. 3500 board
4. Frequency read-out ok but no CRT trace	No high voltage or filament current to CRT	CRT socket, 3700 board
5. CRT trace dim, not sharp	1. Low output from high voltage 2. Defective CRT	1. 3700 board 2. V3801
6. Trace not horizontal	Rotation control out of adjustment. Defective transistor	R3702, Q3701
7. Coarse and fine do not tune	Fuse to YIG oscillator open	Replace F3001
8. Large signal variations with frequency	Components in microwave casting	Check output level from microwave casting
9. No 189.3 MHz cal signal	Bad connection at microwave casting	Check microwave casting connections
10. Spurious responses	Component failure in microwave casting	Check microwave casting
11. Decreased sensitivity	1. RF fuse bad 2. Bad connections to microwave casting 3. Low 1st or 2nd L.O. levels 4. Possible component failure in microwave casting 5. 2nd L.O. not on frequency 6. 2.1 GHz filter not operating properly	1. Check RF fuse (F1001) 2. Check connections on microwave casting 3. Check for L.O. levels 4. Check microwave casting 5. Check 2nd L.O. frequency 6. Check 2.1 GHz filter insertion loss
12. Unable to calibrate with 189.3 MHz internal osc.	1. Microwave casting output not set properly 2. Front panel pot not operating properly 3. Microwave casting not tuned up properly	1. Check the 189.3 MHz output from casting 2. Check the level set control 3. Check casting output levels

SECTION 5
PARTS LISTS AND SCHEMATIC DIAGRAMS

Parts Lists and Schematic Diagrams

5.01 The following parts lists and schematic diagrams have been arranged in order according to the Circuit Reference Series numbers. Refer to paragraphs 3.02-3.06. Each schematic diagram and parts list is identified with this number. The circuit boards in the instrument are marked with an identifying Assembly Number. The PC board number is etched on the board. See Cross Reference Table 5-1 below.

3.02 Parts list pages are grouped with the schematic diagrams to which they refer. Component identification drawings showing the location of the individual components on the circuit board are placed on the inner sheet of the schematic diagram to which they apply.

Table 5-1. Circuit Reference Series Printed Circuit Board Cross Reference

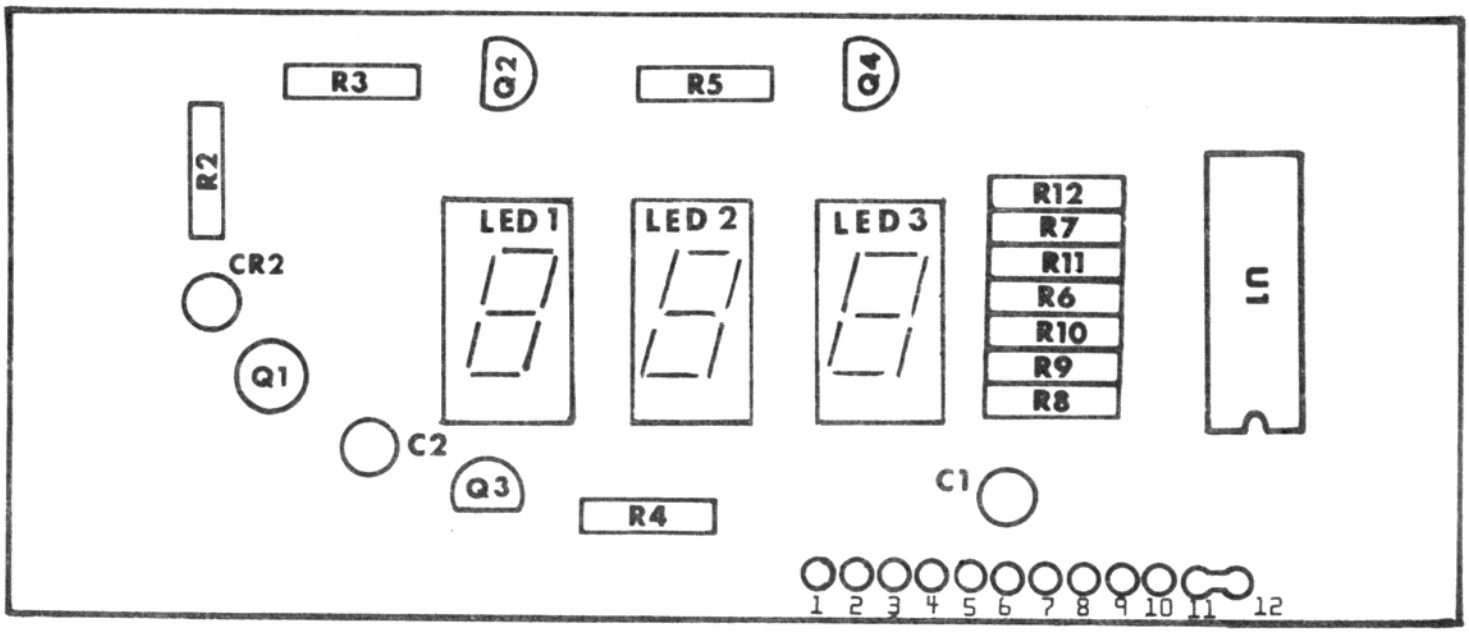
PCB No.	Title	Assy No.	Ckt Ref No.	Fig No.	Page No.
1780-0651	PCB Extender	7001-0403	---	---	
1780-0652	YIG Driver	7001-0369	3100	5-11	5-45
1780-0653	3rd Converter	7001-0363	2400	5-8	5-31
1780-0654	2nd Converter	7001-0362	2300	5-7	5-27
1780-0655	1st Converter	7001-0361	2200	5-6	5-23
1780-0657	RF Attenuator	7001-0364	2100	5-5	5-19
1780-0658	Ramp Gen/Defl. Ampl	7001-0367	3600	5-16	5-73
1780-0659	High Voltage Supply	7001-0366	3700	5-17	5-77
1780-0660	Display	7001-0359	1200	5-2	5-7
1780-0661	A/D Converter	7001-0360	1300	5-3	5-11
1780-0662	IF Switchable Gain and BW	7001-0370	3200	5-12	5-51
1780-0663	Audio/+10V Supply	7001-0372	3500	5-15	5-67
1780-0664	Log Converter	7001-0371	3300	5-13	5-57
1780-0665	1900 MHz Oscillator	7001-0365	2700	5-9	5-35
1780-0667	12V DC Inverter	7001-0384	3400M1	5-14	5-61
	Front Panel Interconnection	---------	1000	5-1	5-3
	High Frequency Sect. Intcon.	---------	2000	5-4	5-15
	Main Chassis Interconnection	---------	3000	5-10	5-39
	Rear Panel Interconnection	---------	4000	5-18	5-81
	Rear Panel Interconnection	---------	4000M1	5-19	5-85
[redacted]-12/70 8021	CRO TUBE				

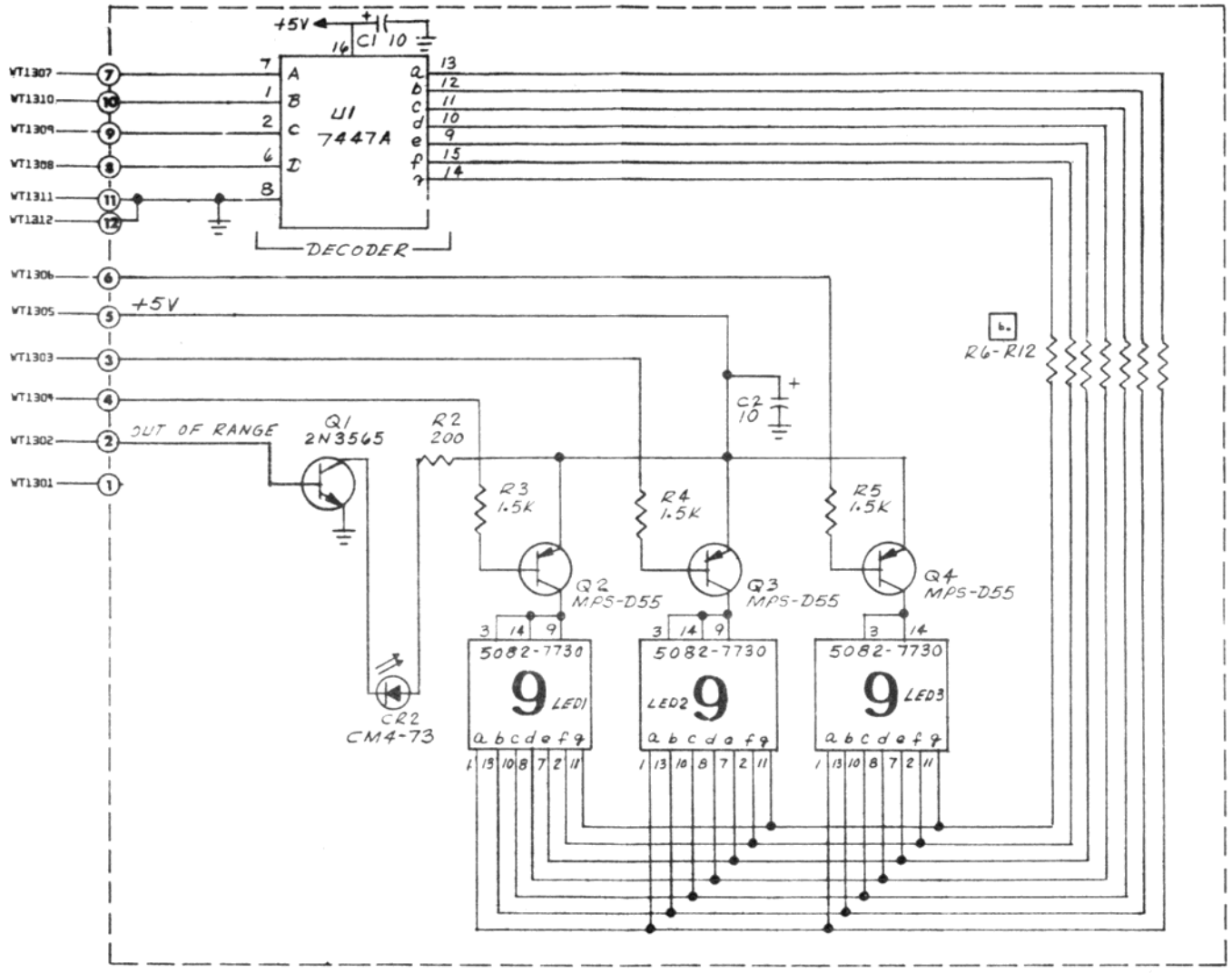
FRONT PANEL, 1000

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
1000	Pnl Assy, Front	7003-0107		
	CONNECTORS			
F1	RF FUSE 1/8A	7021-0001		
J1	Conn, BNC Jk, SMC Jk Blkhd Mt	2536-0083	Cablewave	CD701938-002B
J2	P/O Cable Assy	7033-0029	Cushman	
J3	Conn, BNC Jack Rect. Panel Mt.	2536-0010	Kings	KC79-35
J4	JK, 2 Cndctr Sgl Clckt Submntr Phn	2586-0026	Switchcraft	TR-2A
	DIODES			
CR1	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR2	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR3	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR4	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR5	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR6	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR7	Diode, G633	1282-0005	ITT	G633
CR8	Diode, G633	1282-0005	ITT	G633
	RESISTORS			
R1	Pot, 200 Ohm, 10%, 3/4W Cermet	1215-0033	Spectrol	43P201T000
R2	Pot, 10K, 10%, 3/4W Cermet Trmr	1215-0034	Spectrol	43P103T000
R3	Pot, 10K, 5%, 2W, 10 Turn	1203-0067	Spectrol	534
R4	Pot, 10K, 5%, 2W, 10 Turn	1203-0067	Spectrol	534
R5	MF, 13K, 1%, 1/8W	1075-0128	Dale	MFF 1/8
R6	MF, 17.8K, 1%, 1/10W	1074-1021	Dale	MFF 1/8
R7	Comp, 51M, 5%, 1/4W	1066-5165	Allen-Bradley	CB5165
	SWITCHES			
S1	SW, Rotary 2 Pole 7 Position	1851-0102	Cushman	
S2	Not Used			
S3	SW, Rotary 6 Pole 12 Position	1851-0103	Cushman	

DISPLAY, 1200

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
1200	Display	7001-0359	Cushman	
	PC Board	1780-0660	Cushman	
	CAPACITORS			
C1	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C2	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
	DIODES			
CR1	Not Used			
CR2	Diode, Light emitting	1281-0073	Chgo Min Lamp	CM4-73
	INDICATORS			
LED1	Alpha-Numeric Seg, Readout	1281-0081	HP	HP7730
LED2	Alpha-Numeric Seg, Readout	1281-0081	HP	HP7730
LED3	Alpha-Numeric Seg, Readout	1281-0081	HP	HP7730
	INTEGRATED CIRCUIT			
U1	IC, BCD to 7-segment Decoder	2025-0035	TI	SN7447N
	RESISTORS			
R1	Not Used			
R2	Comp, 200Ω, 5%, 1/4W	1066-2015	Allen-Bradley	CB2015
R3	Comp, 1.5K, 5%, 1/4W	1066-1525	Allen-Bradley	CB1525
R4	Comp, 1.5K, 5%, 1/4W	1066-1525	Allen-Bradley	CB1525
R5	Comp, 1.5K, 5%, 1/4W	1066-1525	Allen-Bradley	CB1525
R6	Comp, 62Ω, 5%, 1/4W	1066-6205	Allen-Bradley	CB6205
R7	Comp, 62Ω, 5%, 1/4W	1066-6205	Allen-Bradley	CB6205
R8	Comp, 62Ω, 5%, 1/4W	1066-6205	Allen-Bradley	CB6205
R9	Comp, 62Ω, 5%, 1/4W	1066-6205	Allen-Bradley	CB6205
R10	Comp, 62Ω, 5%, 1/4W	1066-6205	Allen-Bradley	CB6205
R11	Comp, 62Ω, 5%, 1/4W	1066-6205	Allen-Bradley	CB6205
R12	Comp, 62Ω, 5%, 1/4W	1066-6205	Allen-Bradley	CB6205
	TRANSISTORS			
Q1	XSTR, 2N3565	1272-0017	Fairchild	2N3565
Q2	XSTR, MPS-D55, PNP, Si	1272-0092	Motorola	MPS-D55
Q3	XSTR, MPS-D55, PNP, Si	1272-0092	Motorola	MPS-D55
Q4	XSTR, MPS-D55, PNP, Si	1272-0092	Motorola	MPS-D55


R3
Q2
R5
Q4
R2
LED 1
LED 2
LED 3
R12
R7
R11
R6
R10
R9
R8
U1
CR2
Q1
C2
Q3
R4
C1
1 2 3 4 5 6 7 8 9 10 11 12



NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

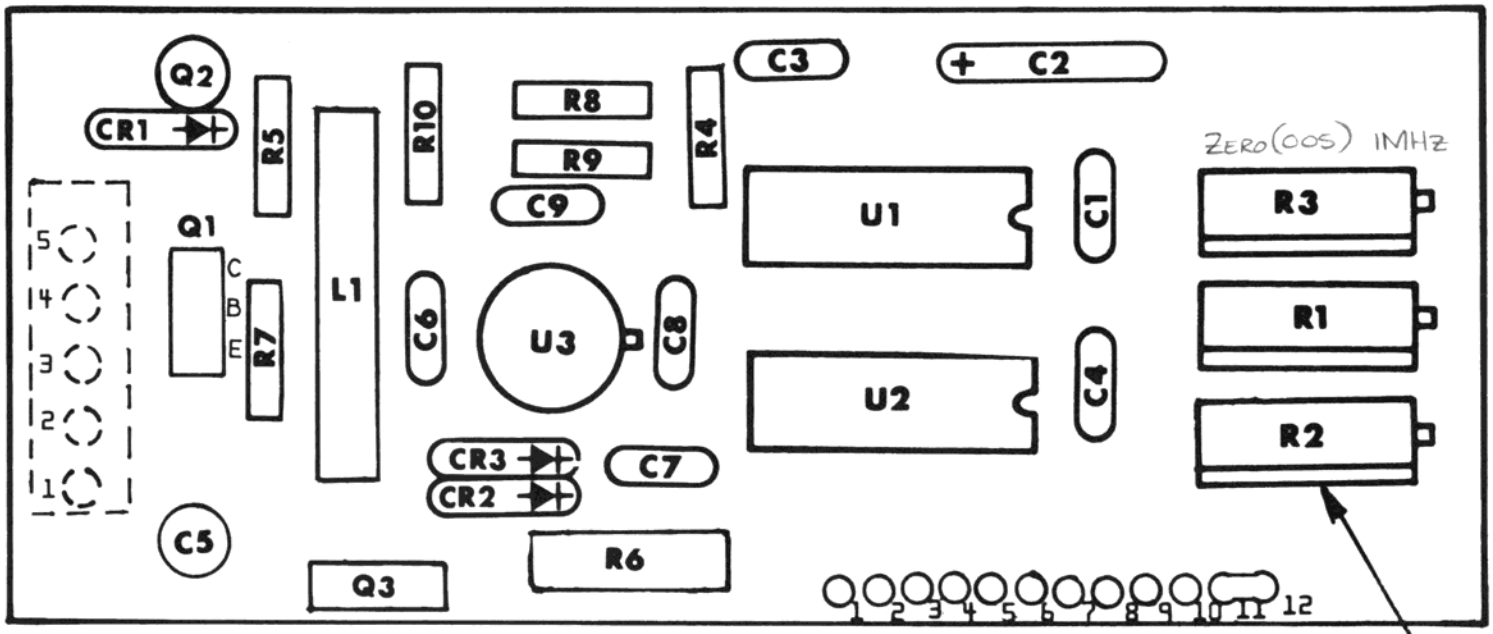
[b.] ALL RESISTORS FROM R6 THRU R12 ARE 62 OHMS.

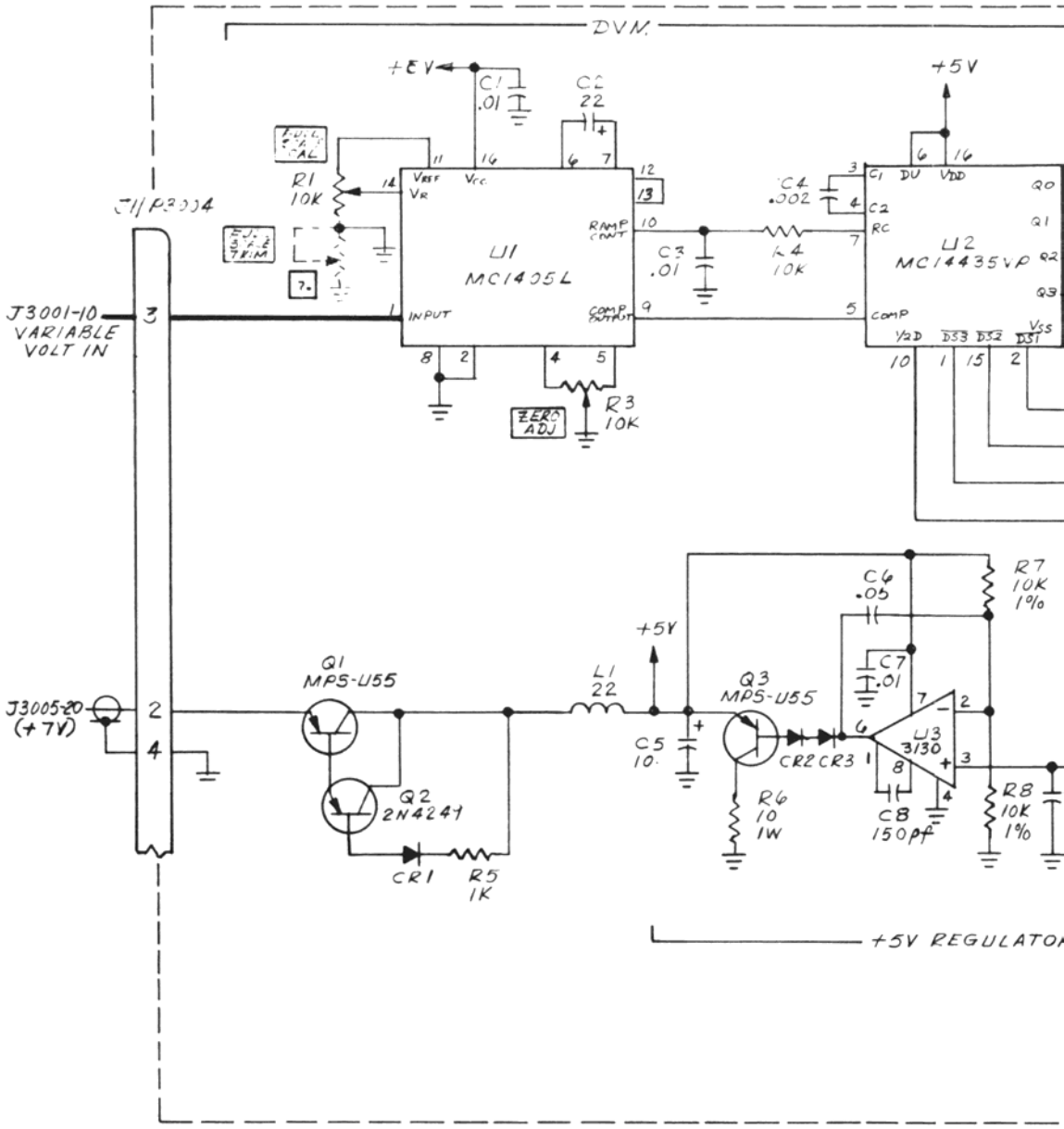
R1 AND CR1 NOT USED

Figure 5-2. Display, 1200

A/D CONVERTER, 1300

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
1300	PCB Assy A /D Converter	7001-0360	Cushman	
	PC Board	1780-0661	Cushman	
	CAPACITORS			
C1	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C2	Tant, 22μF, 10%, 15V	1011-0003	Sprague	150D226X9015B2
C3	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C4	Cer, .002μF, 20%, 500V	1005-0003	Erie	831-596-Z5U-202M
C5	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C6	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C7	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C8	Mica, 150PF, 5%, 500V	1002-0021	Elmenco	DM15-F-151J
C9	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
	DIODES			
CR1	Diode, IN3064	1281-0013	Teledyne	IN3064
CR2	Diode, IN3064	1281-0013	Teledyne	IN3064
CR3	Diode, IN3064	1281-0013	Teledyne	IN3064
	INDUCTOR			
L1	RF CH, 22μH, 10%	1585-0070	Delevan	2890-28
	INTEGRATED CIRCUITS			
U1	IC, MC1405L, A/D Converter	2025-0162	Motorola	MC1405L
U2	IC, MC14435VP 3 1/2 Digit A/D Logic	2025-0163	Motorola	MC14435VP
U3	IC CA3130T Op Ampl	2025-0161	RCA	CA3130T
	RESISTORS			
R1	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R2	Pot, 100Ω, (Fact. Inst. Sm. Insts)			
R3	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R4	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R5	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R6	Comp, 10 Ohm, 5%, 1W	1068-1005	Allen-Bradley	GB1005
R7	MF, 10K, 1%, 1/8W	1075-0009	Dale	MFF 1/8
R8	MF, 10K, 1%, 1/8W	1075-0009	Dale	MFF 1/8
R9	MF, 255K, 1%, 1/8W	1075-0017	Dale	MFF 1/8
R10	MF, 768K, 1%, 100 PPM	1075-0146	Dale	MFF 1/8
	TRANSISTORS			
Q1	Trans, MPS-U55	1272-0074	Motorola	MPS-U55
Q2	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q3	Trans, MPS-U55	1272-0074	Motorola	MPS-U55


Q2
CR1
R5
R10
R8
R9
R4
C3
+ C2
ZERO(005) 1MHz
C9
U1
C1
R3
Q1
C
B
E
L1
C6
U3
C8
R7
U2
C4
R1
R2
CR3
CR2
C7
C5
R6
Q3
5
4
3
2
1
1 2 3 4 5 6 7 8 9 10 11 12
1.
1. INSTALLED IN CERTAIN UNITS DURING FINAL TEST.



NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. ALL DIODES ARE 1N3064 UNLESS OTHERWISE NOTED.

[7.] INSTALLED IN SOME UNITS.

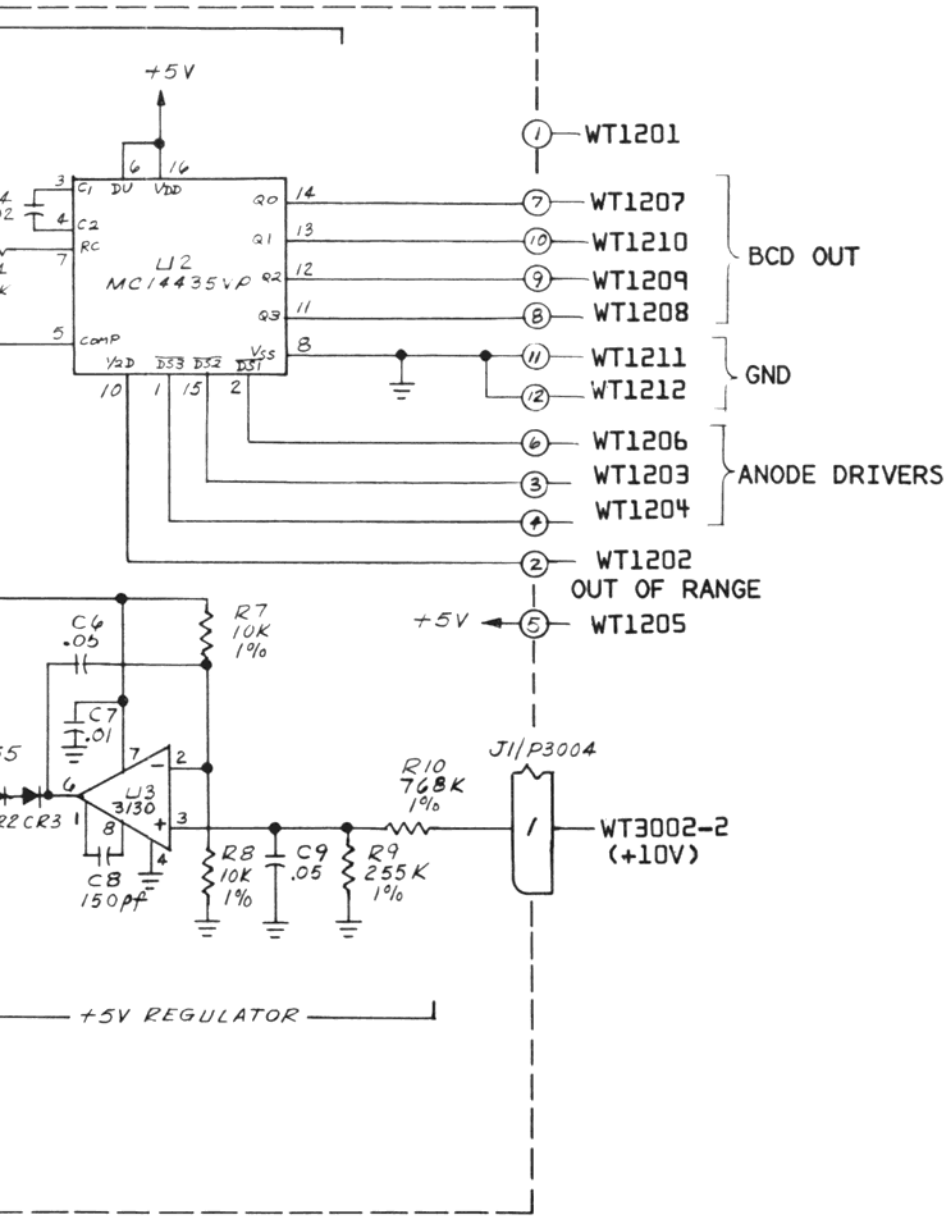
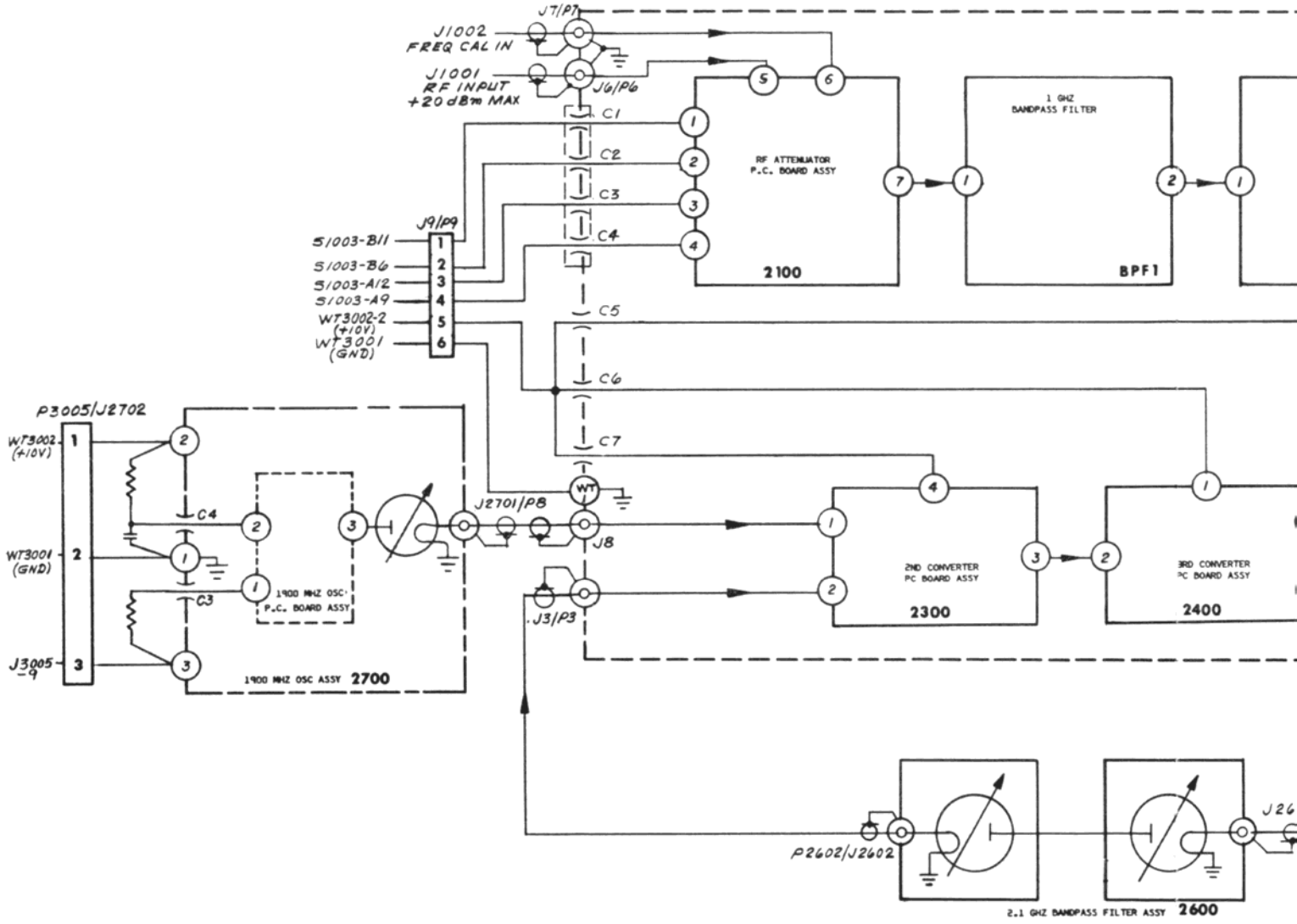


Figure 5-3. A/D Converter, 1300

MICROWAVE CASTING, 2.1 GHz BAND PASS FILTER, 2000, 2600

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2000	Casting Assy, Microwave	7046-0034	Cushman	
	CAPACITORS			
C1	Cap, 1000PF, 500V Cer Feed Thru	1005-0107	Erie	321-101-X5U0-102M
C2	Cap, 1000PF, 500V Cer Feed Thru	1005-0107	Erie	321-101-X5U0-102M
C3	Cap, 1000PF, 500V Cer Feed Thru	1005-0107	Erie	321-101-X5U0-102M
C4	Cap, 1000PF, 500V Cer Feed Thru	1005-0101	Erie	2404-000-X5U0-102P
C5	Cap, 1000PF, 500V Cer Feed Thru	1005-0101	Erie	2404-000-X5U0-102P
C6	Cap, 1000PF, 500V Cer Feed Thru	1005-0101	Erie	2404-000-X5U0-102P
C7	Cap, 1000PF, 500V Cer Feed Thru	1005-0101	Erie	2404-000-X5U0-102P
	CONNECTORS			
J1	Conn, SMB 50 Ohm Str Ft Bhd Mt	2536-0084	Cablewave	700166NP
J2	Conn, SMB 50 Ohm Str Jk Ft Bhd Mt	2536-0084	Cablewave	700166NP
J3	Conn, SMB 50 Ohm Str Jk Ft Bhd Mt	2536-0084	Cablewave	700166NP
J4	Conn, SMB 50 Ohm Str Jk Ft Bhd Mt	2536-0084	Cablewave	700166NP
J5	Conn, SMB 50 Ohm Str Jk Ft Bhd Mt	2536-0084	Cablewave	700166NP
J6	Conn, SMB 50 Ohm Str Jk Ft Bhd Mt	2536-0084	Cablewave	700166NP
J7	Conn, SMB 50 Ohm Str Jk Ft Bhd Mt	2536-0084	Cablewave	700166NP
J8	P/O Cable Assembly	7032-3729	Cushman	
BPF1	Low Pass Filter	1780-0656	Cushman	
2600	2.1 GHz Band Pass Filter	7041-0015	Cushman	


J7/P7
J1002
FREQ CAL IN
J1001
RF INPUT
+20 dBm MAX
J6/P6
C1
C2
C3
C4
C5
C6
C7
J9/P9
5/1003-B11
5/1003-B6
5/1003-A12
5/1003-A9
WT3002-2
(+10V)
WT3001
(GND)
RF ATTENUATOR
P.C. BOARD ASSY
2100
1 GHZ
BANDPASS FILTER
BPF1
P3005/J2702
WT3002
(+10V)
WT3001
(GND)
J3005
-9
1900 MHZ OSC
P.C. BOARD ASSY
1900 MHZ OSC ASSY 2700
J2701/P8
WT
J8
J3/P3
2ND CONVERTER
PC BOARD ASSY
2300
3RD CONVERTER
PC BOARD ASSY
2400
P2602/J2602
2.1 GHZ BANDPASS FILTER ASSY 2600

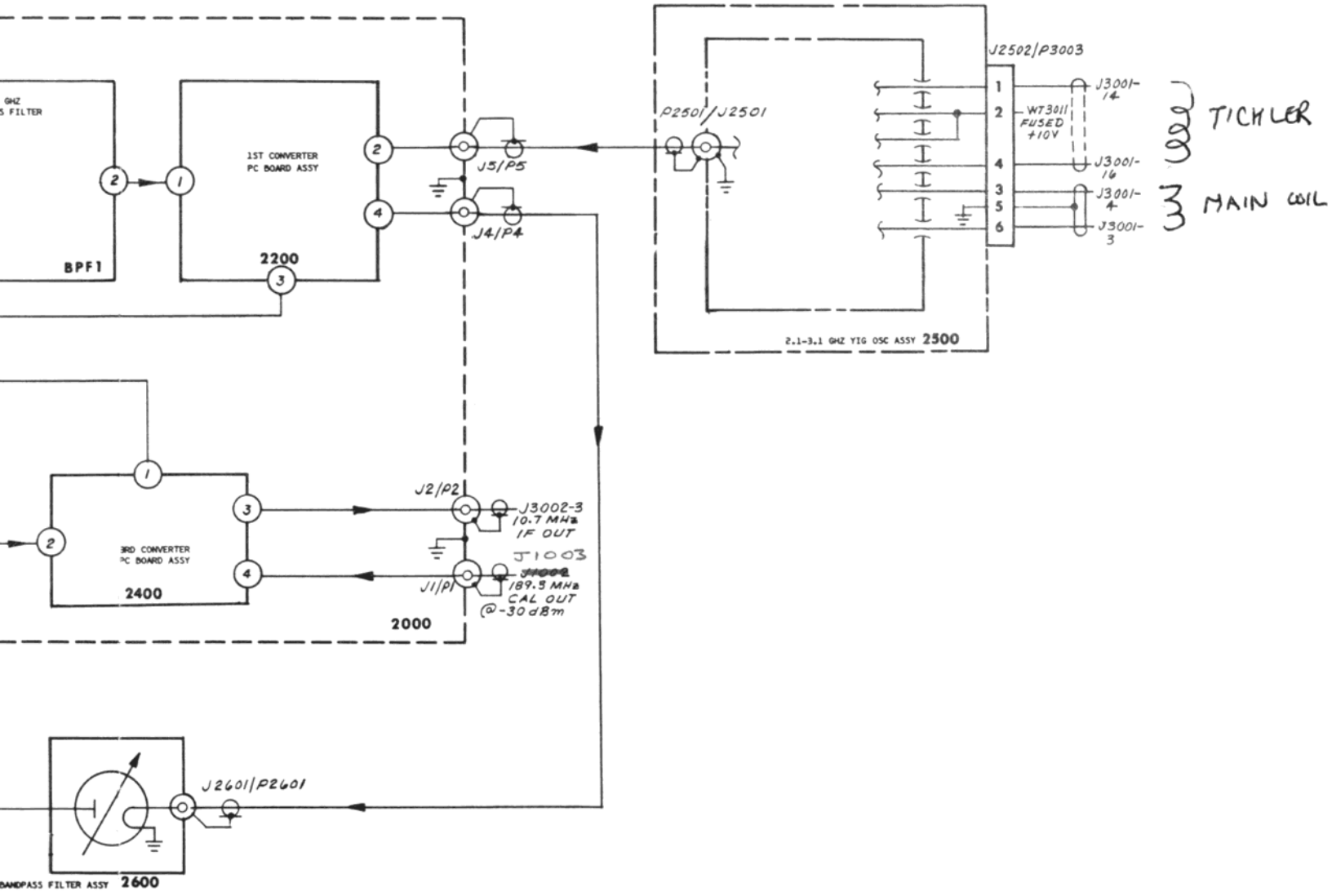
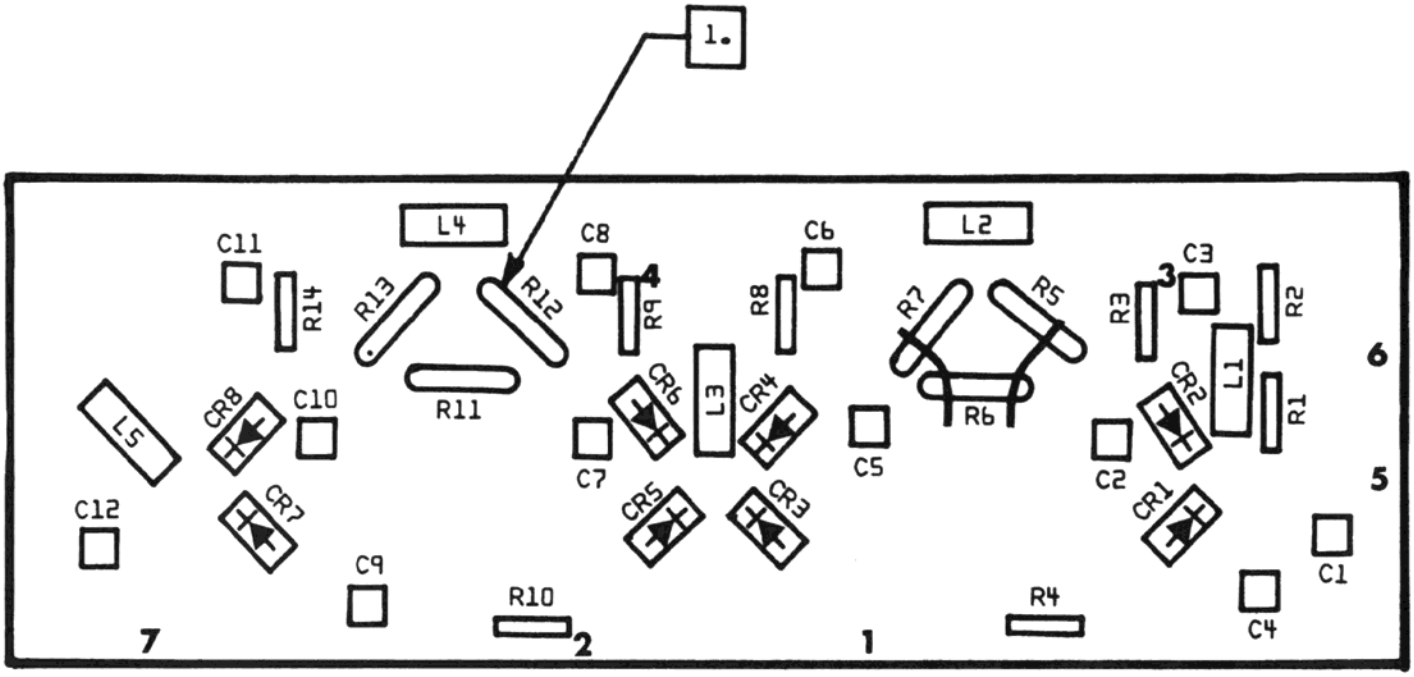


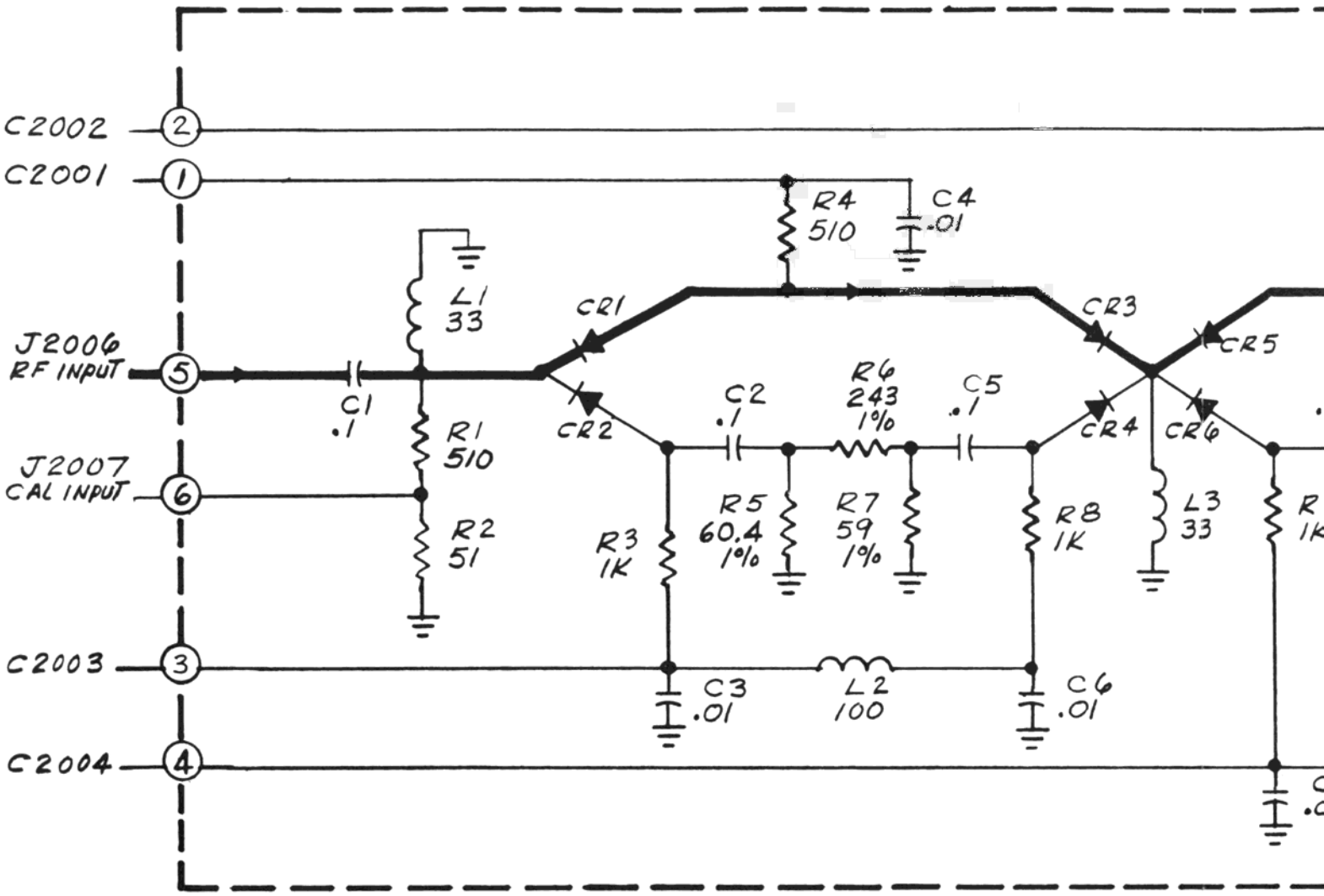
Figure 5-4. High Frequency Section Interconnection Diagram, 2000

RF ATTENUATOR, 2100

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2100	PCB Assy, RF Attenuator	7001-0364	Cushman	
	PC Board	1780-0657	Cushman	
	CAPACITORS			
C1	Cer, .1μF, 20%, 50V	1005-0097	Erie	8121-050-651-104M
C2	Cer, .1μF, 20%, 50V	1005-0097	Erie	8121-050-651-104M
C3	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C4	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C5	Cer, .1μF, 20%, 50V	1005-0097	Erie	8121-050-651-104M
C6	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C7	Cer, .1μF, 20%, 50V	1005-0097	Erie	8121-050-651-104M
C8	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C9	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C10	Cer, .1μF, 20%, 50V	1005-0097	Erie	8121-050-651-104M
C11	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C12	Cer, .1μF, 20%, 50V	1005-0097	Erie	8121-050-651-104M
	DIODES			
CR1	Dio, BA379, Si Pin	1281-0101	Siemens	BA379
CR2	Dio, BA379, Si Pin	1281-0101	Siemens	BA379
CR3	Dio, BA379, Si Pin	1281-0101	Siemens	BA379
CR4	Dio, BA379, Si Pin	1281-0101	Siemens	BA379
CR5	Dio, BA379, Si Pin	1281-0101	Siemens	BA379
CR6	Dio, BA379, Si Pin	1281-0101	Siemens	BA379
CR7	Dio, BA379, Si Pin	1281-0101	Siemens	BA379
CR8	Dio, BA379, Si Pin	1281-0101	Siemens	BA379
	INDUCTORS			
L1	RF CH, 33μH, 10%	1585-0071	Delevan	1025-56
L2	RF Choke, 100μH, 10%	1585-0054	Delevan	1025-68
L3	RF CH, 33μH, 10%	1585-0071	Delevan	1025-56
L4	RF Choke, 100μH, 10%	1585-0054	Delevan	1025-68
L5	RF CH, 33μH, 10%	1585-0071	Delevan	1025-56
	RESISTORS			
R1	Comp, 510 Ohm, 5%, 1/8W	1065-5115	Allen-Bradley	BB5115
R2	Comp, 51 Ohm, 5%, 1/8W	1065-5105	Allen-Bradley	BB5105
R3	Comp, 1K, 5%, 1/8W	1065-1025	Allen-Bradley	BB1025
R4	Comp, 510 Ohm, 5%, 1/8W	1065-5115	Allen-Bradley	BB5115
R5	MF, 60.4 Ohm, 1%, 100 PPM	1074-0115	Dale	MFF 1/10
R6	MF, 243 Ohm, 1%, 100 PPM	1074-0114	Dale	MFF 1/10
R7	MF, 59 Ohm, 1%, 100 PPM	1074-0116	Dale	MFF 1/10
R8	Comp, 1K, 5%, 1/8W	1065-1025	Allen-Bradley	BB1025
R9	Comp, 1K, 5%, 1/8W	1065-1025	Allen-Bradley	BB1025
R10	Comp, 510 Ohm, 5%, 1/8W	1065-5115	Allen-Bradley	BB5115
R11	MF, 243 Ohm, 1%, 100 PPM	1074-0114	Dale	MFF 1/10
R12	MF, 59 Ohm, 1%, 100 PPM	1074-0116	Dale	MFF 1/10
R13	MF, 59 Ohm, 1%, 100 PPM	1074-0116	Dale	MFF 1/10
R14	Comp, 1K, 5%, 1/8W	1065-1025	Allen-Bradley	BB1025



1. FACTORY SELECT VALUE.

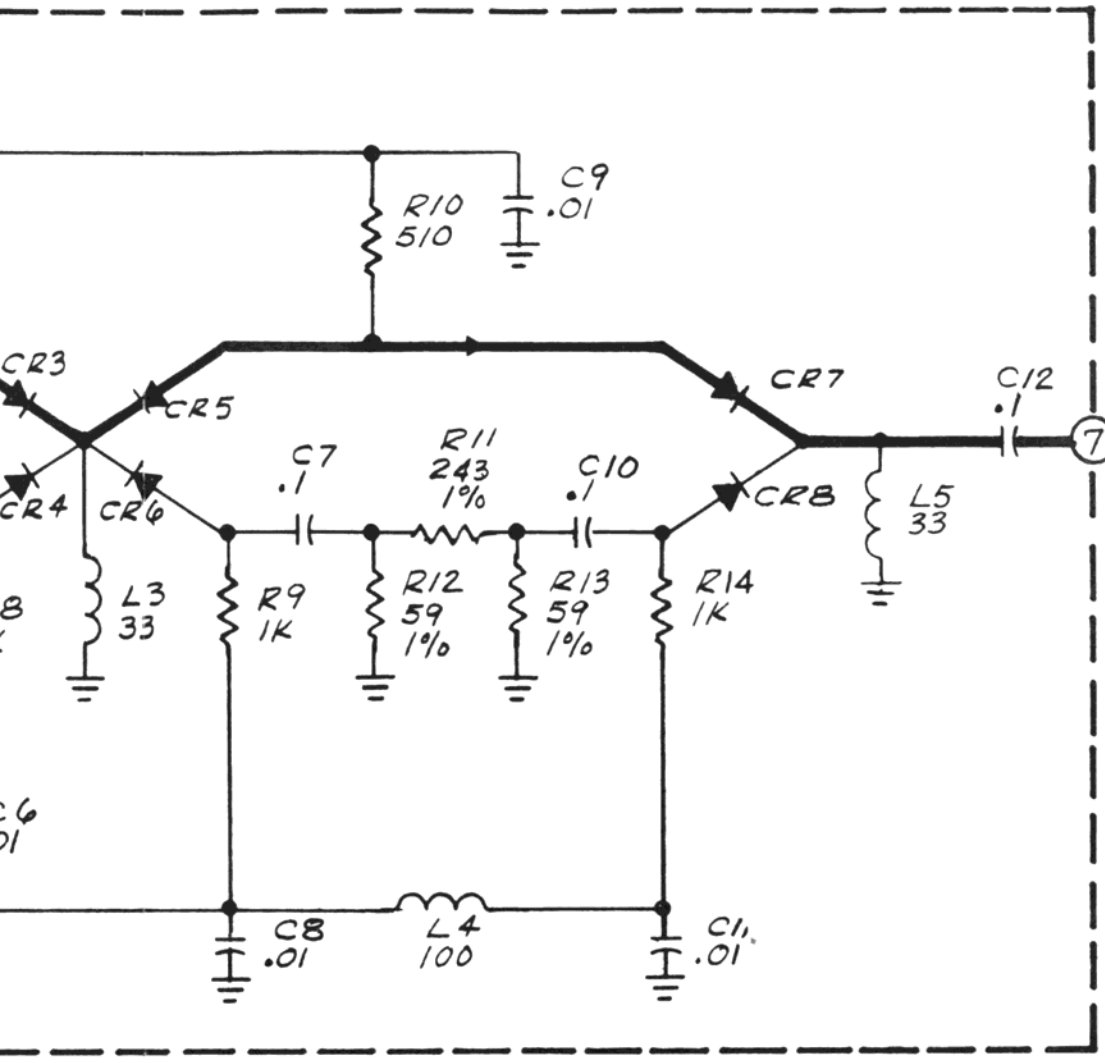


NOTE:

1. RESISTORS - 1/8W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. ALL DIODES ARE BA 379 UNLESS OTHERWISE NOTED.

ATTEN CODE

dB ATTEN.	1	2	3	4
0	ON	ON	-	-
20	-	ON	ON	-
40	-	-	ON	ON



CODE

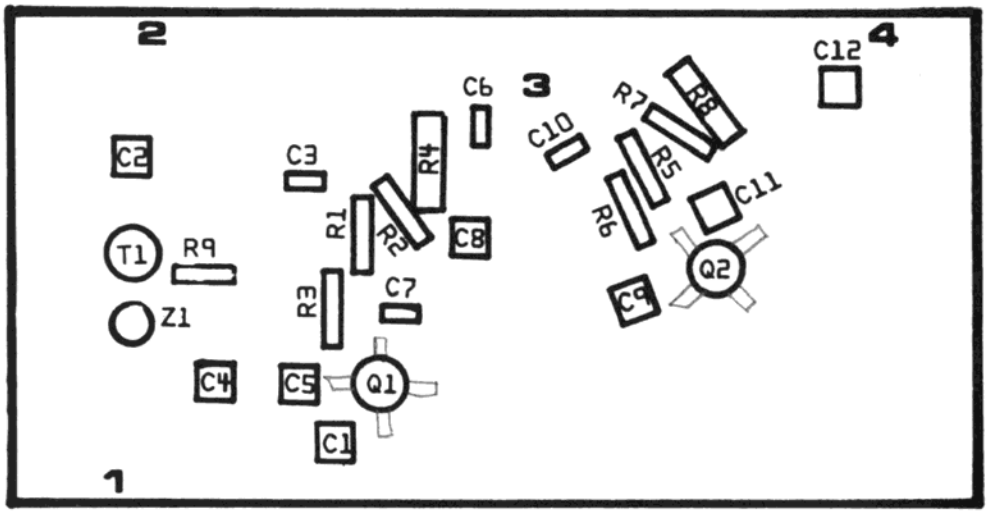
	3	4
	–	–
	ON	–
	ON	ON

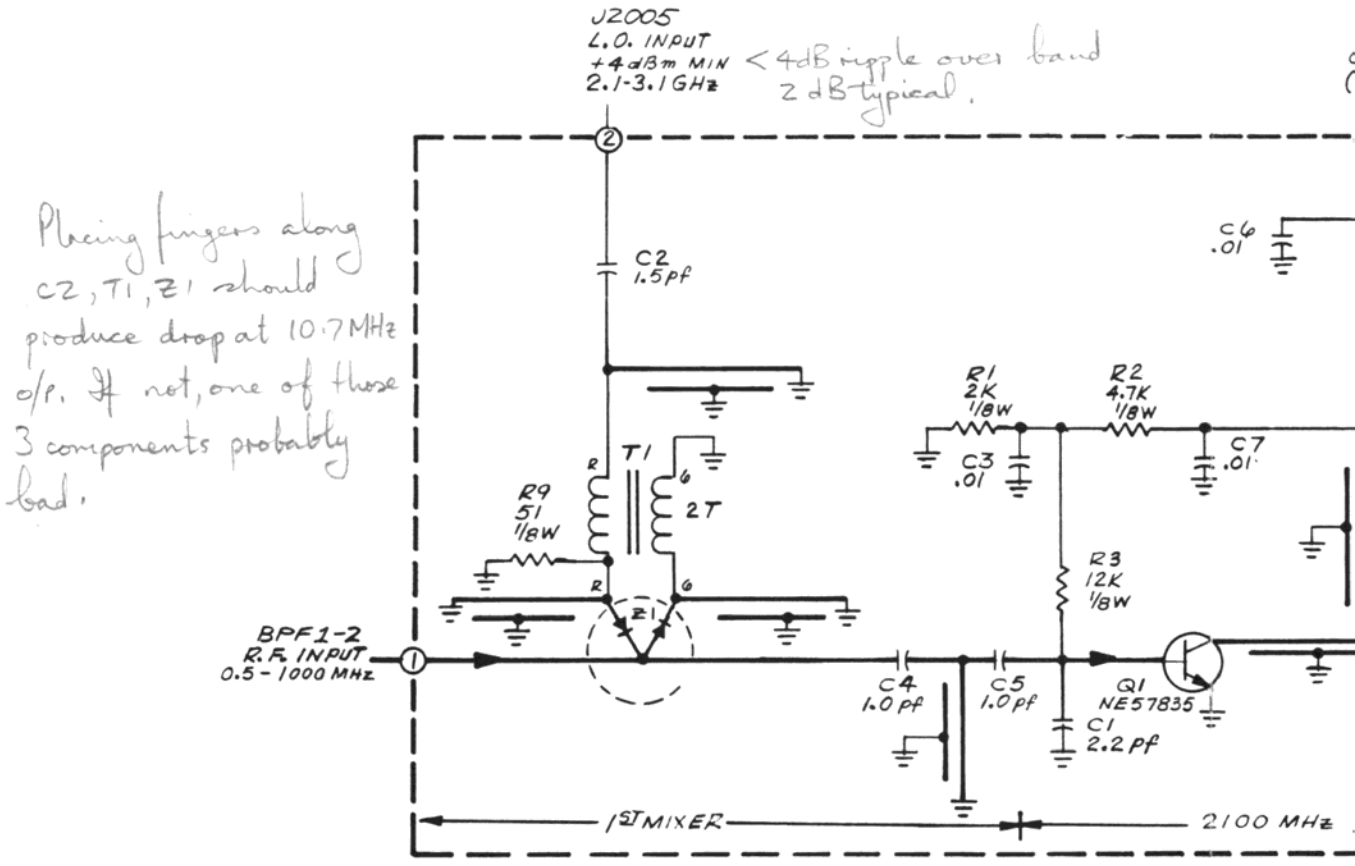
Figure 5-5. RF Attenuator, 2100

FIRST CONVERTER, 2200

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2200	PCB Assy, 1st Converter	7001-0361	Cushman	
	PC Board	1780-0655	Cushman	
	CAPACITORS			
C1	Chip, 2.2PF, .25PF%, 50V	1012-0003	Varadyne	3BN050S2R2C
C2	Chip, 1.5PF, .25PF%, 50V	1012-0002	Varadyne	3BN050S1R5C
C3	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C4	Chip, 1.0PF, +1/2PF-1/2PF, 50V	1012-0019	Varadyne	2BN050S1R0D
C5	Chip, 1.0PF, +1/2PF-1/2PF, 50V	1012-0019	Varadyne	2BN050S1R0D
C6	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C7	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C8	Chip, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K
C9	Chip, 1.5PF, .25PF%, 50V	1012-0002	Varadyne	3BN050S1R5C
C10	Cer, .01μF, 20%, 50V	1005-0102	Erie	8121-050-651-103M
C11	Chip, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K
C12	Chip, 1.5PF, .25PF%, 50V	1012-0002	Varadyne	3BN050S1R5C
	DIODES			
Z1	DIO, DMD, 6460 Schottky Barrier Dual	1281-0095	Cushman	
	RESISTORS			
R1	Comp, 2K, 5%, 1/8W	1065-2025	Allen-Bradley	BB2025
R2	Comp, 4.7K, 5%, 1/8W	1065-4725	Allen-Bradley	
R3	Comp, 12K, 5%, 1/8W	1065-1235	Allen-Bradley	BB1235
R4	Comp, 270 Ohm, 5%, 1/4W	1066-2715	Allen-Bradley	CB2715
R5	Comp, 2K, 5%, 1/8W	1065-2025	Allen-Bradley	BB5125
R6	Comp, 5.1K, 5%, 1/8W	1065-5125	Allen-Bradley	BB5125
R7	Comp, 4.7K, 5%, 1/8W	1065-4725	Allen-Bradley	BB4725
R8	Comp, 130 Ohm, 5%, 1/4W	1066-1315	Allen-Bradley	CB1315
R9	Comp, 50 Ohm, 5%, 1/8W	1065-5105	Allen-Bradley	BB5105
	TRANSFORMER			
T1	XFMR, Toroidal Bifilar	1579-0042	Cushman	
	TRANSISTORS			
Q1	XSTR, NE57835 PNP Si	1272-0086	Cal East Lab	NE57835
Q2	XSTR, NE57835 PNP Si	1272-0086	Cal East Lab	NE57835

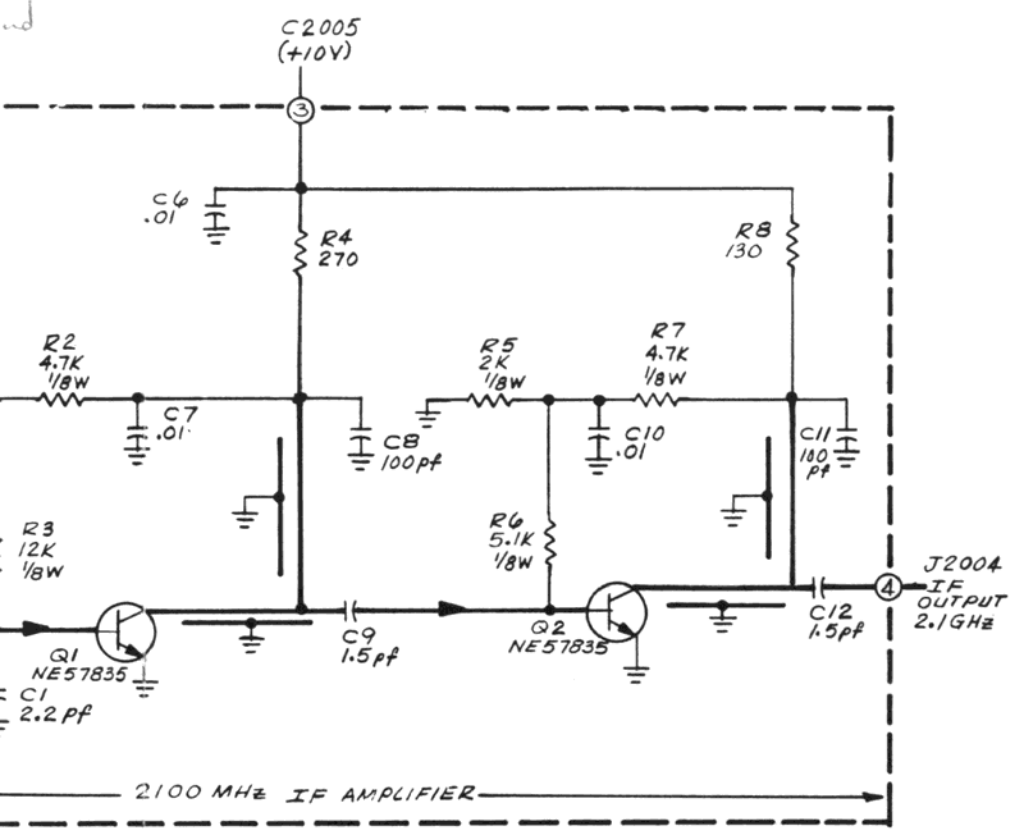

bottom
base
collector


2
3
4
1
C12
C6
C10
R7
R8
R5
C2
C3
R4
C11
R1
R2
R6
T1
R9
C8
Q2
C9
R3
C7
Z1
C4
C5
Q1
C1



NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

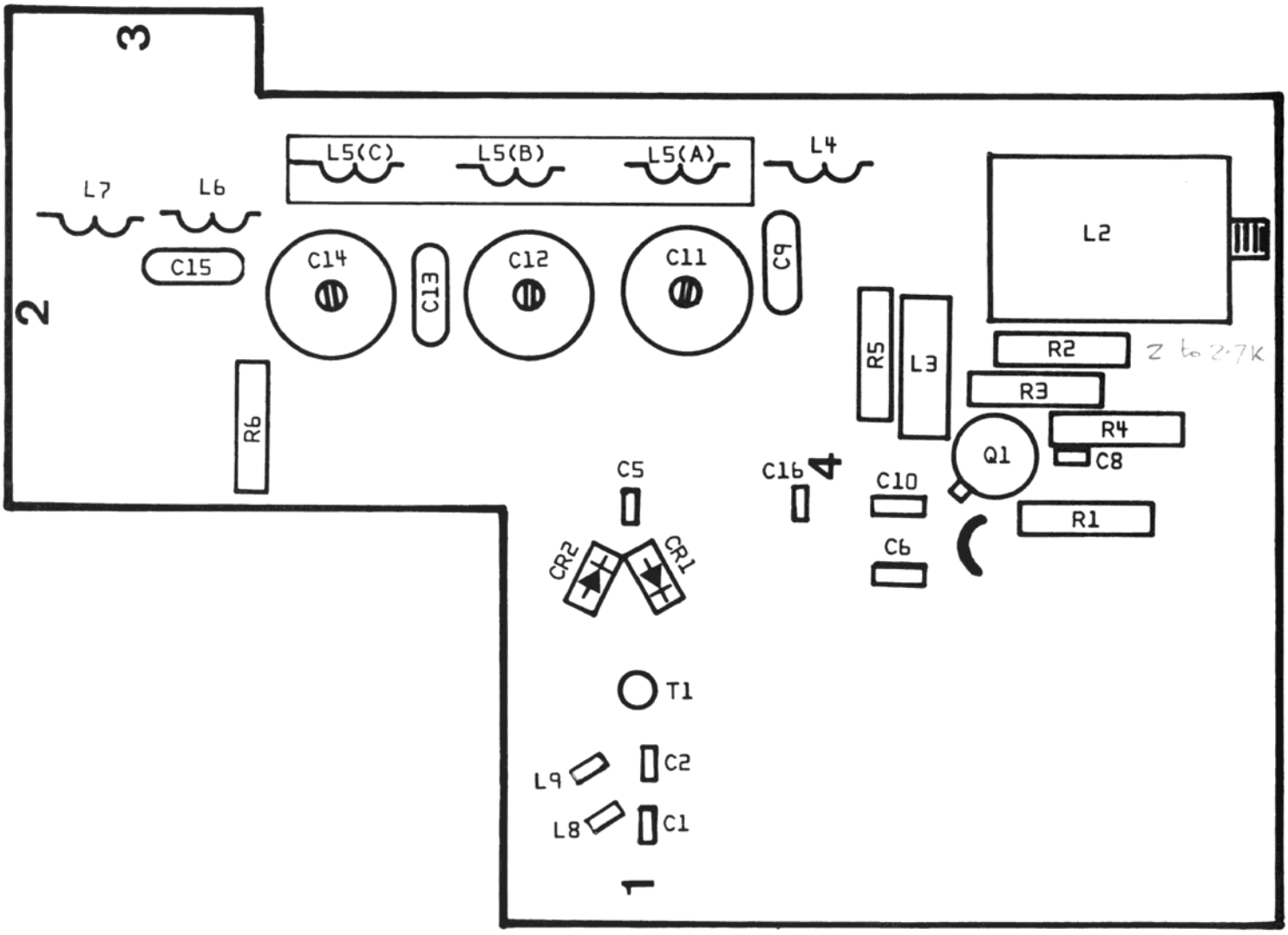


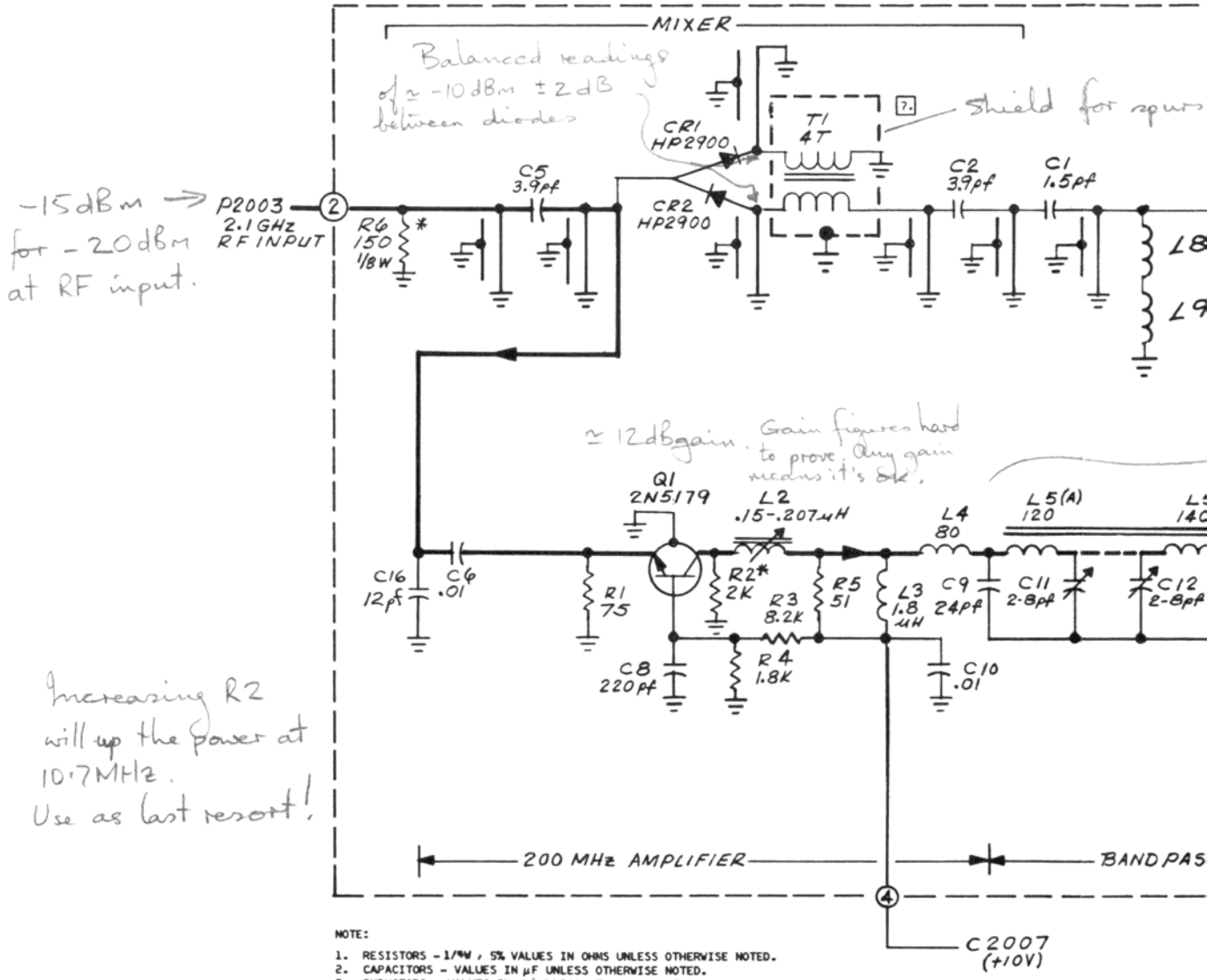
Measure at output of Cavity Filter
≃ -13dBm to -16dBm,
with -20dB at RF input.

Figure 5-6. First Converter, 2200

SECOND CONVERTER, 2300

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2300	PCB Assy, 2nd Converter	7001-0362	Cushman	
	PC Board	1780-0654	Cushman	
	CAPACITORS			
C1	Chip, 1.0PF, +1/2PF-1/2PF, 50V	1012-0019	Varadyne	2BN050S1R0D
C2	Chip, 1.0PF, +1/2PF-1/2PF, 50V	1012-0019	Varadyne	2BN050S1R0D
C3	Not Used			
C4	Not Used			
C5	Chip, 3.9PF, .5PF, 50V NPO	1012-0022	Varadyne	3BN050S3R9DS
C6	Cer, .01μF, 20%, 100V	1005-0100	Erie	8121-100-651-103M
C7	Not Used			
C8	Cer, 220PF, 10%, 100V	1005-0075	Erie	8101-A100-W5R0-221K
C9	Mica, 24PF, 5%, 500V	1002-0051	Elmenco	DM15-C-240J
C10	Cer, .01μF, 20%, 100V	1005-0100	Erie	8121-100-651-103M
C11	Trim, 2-8PF, 350V, Vert	1001-0004	Cushman	
C12	Trim, 2-8PF, 350V, Vert	1001-0004	Cushman	
C13	Mica, 24PF, 5%, 500V	1002-0051	Elmenco	DM15-C-240J
C14	Trim, 2 8PF, 350V, Vert	1001-0004	Cushman	
C15	Mica, 24PF, 5%, 500V	1002-0051	Elmenco	DM15-C-240J
C16	Chip, 12PF, 5%, 50V	1012-0005	Varadyne	3BN050S130J
	DIODES			
CR1	DIO, HPA2900	1283-0003	HP	5082-2900
CR2	DIO, HPA2900	1283-0003	HP	5082-2900
	INDUCTORS			
L1	Not Used			
L2	Coil, .150-2.07μH5, 1/2 Turn Var	1596-0220	Miller	A8A187MPC
L3	RF, CH, -1.8μH, 10%	1585-0072	Delevan	1537-18
L4	Coil, Air Core, 2 1/2T	1596-0233	Cushman	
L5	Coil Assy, 5/6/5 Turn	1596-0223	Cushman	
L6	Coil, Air Core, 22GA, 2 1/2T	1596-0233	Cushman	
L7	Coil, Air Core, .209 DIA, 22GA	1596-0232	Cushman	
L8	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L9	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
	RESISTORS			
R1	Comp, 75 Ohm, 5%, 1/4W	1066-7505	Allen-Bradley	CB7505
R2	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R3	Comp, 8.2K, 5%, 1/4W	1066-8225	Allen-Bradley	CB8225
R4	Comp, 1.8K, 5%, 1/4W	1066-1825	Allen-Bradley	CB1825
R5	Comp, 50 Ohm, 5%, 1/4W	1066-5105	Allen-Bradley	CB5105
R6	Comp, 150 Ohm, 5%, 1/8W	1065-1515	Allen-Bradley	BB1515
	TRANSISTORS			
Q1	Trans, 2N5179	1272-0060	Motorola	2N5179


3
2
L5(C)
L5(B)
L5(A)
L4
L7
L6
L2
C15
C14
C13
C12
C11
C9
R5
L3
R2
2 to 2·7K
R3
R4
Q1
C8
R6
C5
C16
4
C10
R1
C6
CR2
CR1
T1
L9
C2
L8
C1
1



NOTE:

1. RESISTORS - 1/4W , 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN NH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

6. 10 PF IN SOME UNITS.

7. RF SHIELD

8. FERRITE BEAD.

L1, C3, C4, C7 NOT USED

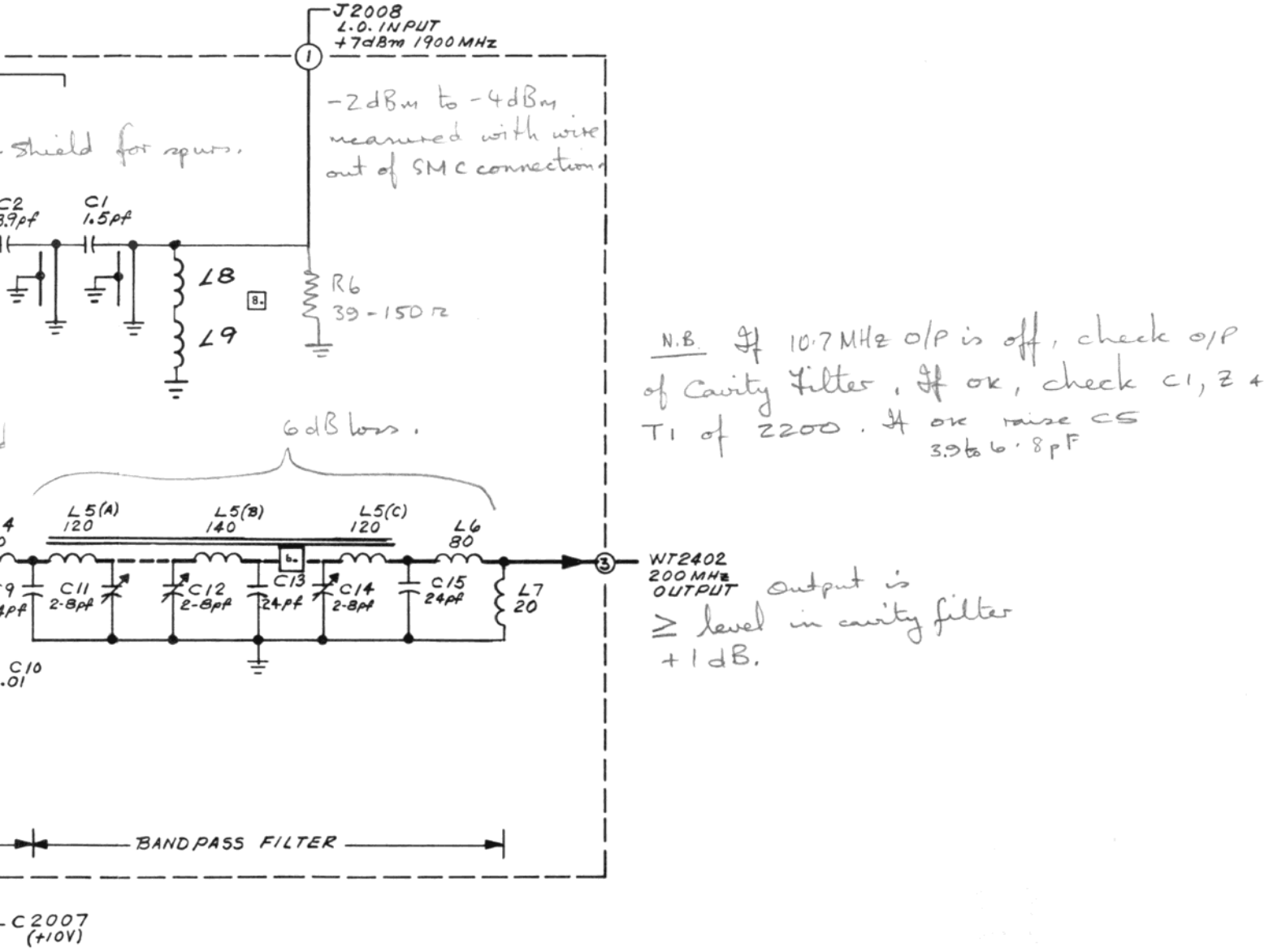
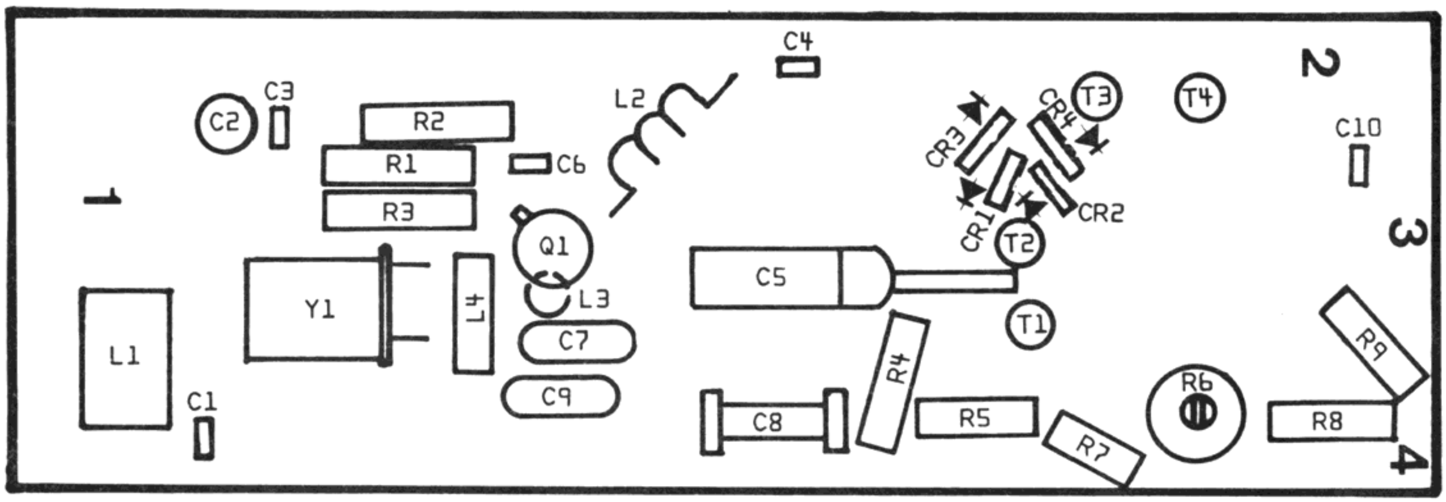
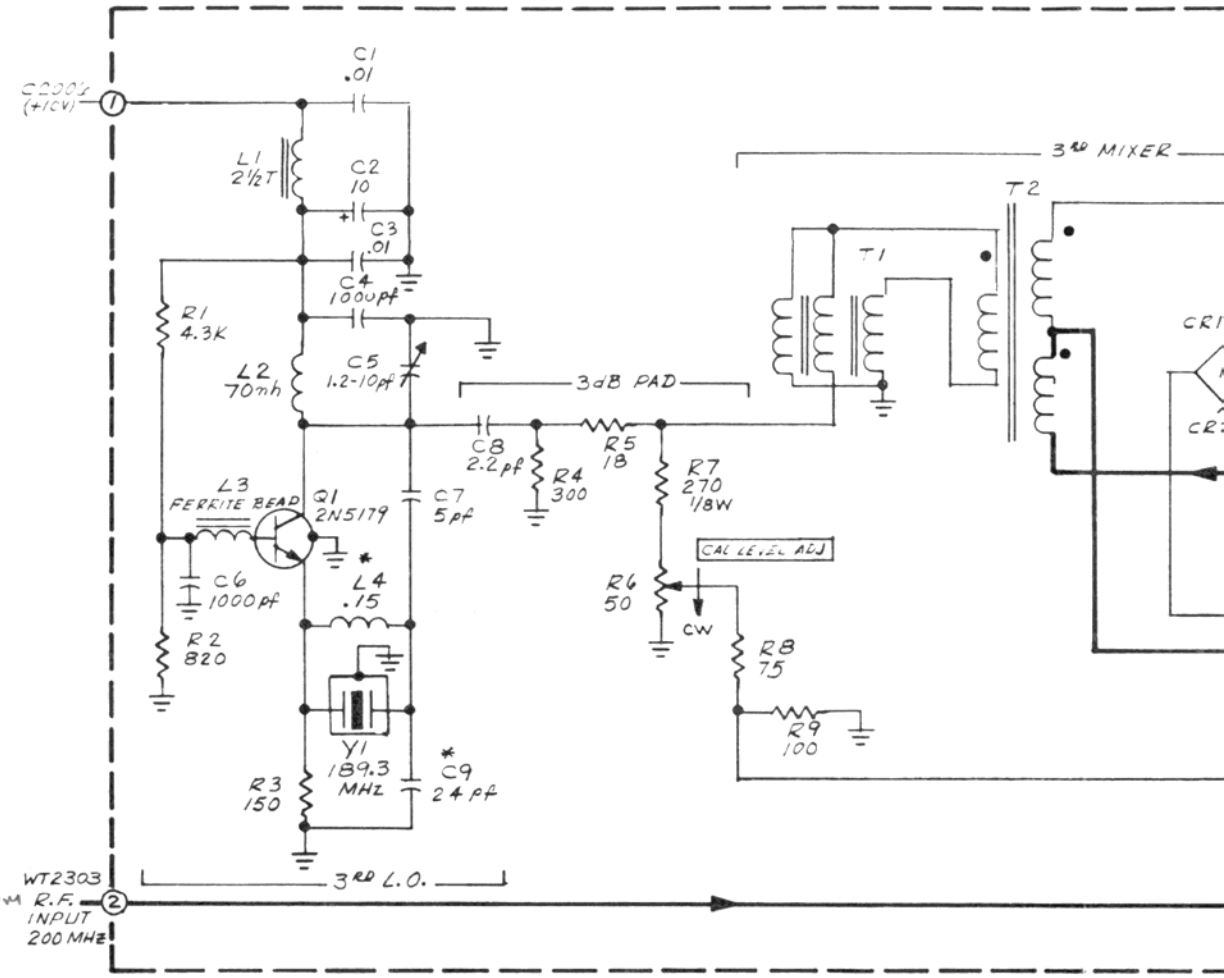


Figure 5-7. Second Converter, 2300

THIRD CONVERTER, 2400

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2400	PCB Assy, 3rd Converter	7001-0363	Cushman	
	PC Board	1780-0653	Cushman	
	CAPACITORS			
C1	Cer, .01μF, 20%, 100V	1005-0100	Erie	8121-100-651-103M
C2	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C3	Cer, .01μF, 20%, 100V	1005-0100	Erie	8121-100-651-103M
C4	Cer, 1000PF, 10%, 100V	1005-0081	Erie	8121-100-W5R-102K
C5	Trim, 1.2-10PF, -0+50%, 250V	1001-0013	R-Triko	122095
C6	Cer, 1000PF, 10%, 100V	1005-0081	Erie	8121-100-W5R-102K
C7	Mica, 5PF, .5PF%, 500V	1002-0028	Elmenco	DM15-C-050D
C8	Cer, 2.2PF, .25PF%, 500V	1005-0017	Erie	301-000-C0J0-229C
C9	Mica, 24PF, 5%, 500V	1002-0051	Elmenco	DM15-C-240J
C10	Cer, 10PF, 10%, 100V	1005-0074	Erie	8101-100-COG-100K
	CRYSTAL			
Y1	XTAL, 189.3 MHz	2035-0025	Cushman	
	DIODES			
CR1	Diode, HPA2800	1283-0001	HP	5082-2800
CR2	Diode, HPA2800	1283-0001	HP	5082-2800
CR3	Diode, HPA2800	1283-0001	HP	5082-2800
CR4	Diode, HPA2800	1283-0001	HP	5082-2800
	INDUCTORS			
L1	RF Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L2	Coil, Air Core, 2 1/2T	1596-0234	Cushman	
L3	RF Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L4	RF Choke, .15μH, 10%, RF	1585-0065	Delevan	1025-00
	RESISTORS			
R1	Comp, 4.3K, 5%, 1/4W	1066-4325	Allen-Bradley	CB4325
R2	Comp, 820 Ohm, 5%, 1/4W	1066-8215	Allen-Bradley	CB8215
R3	Comp, 150 Ohm, 5%, 1/4W	1066-1515	Allen-Bradley	CB1515
R4	Comp, 300 Ohm, 5%, 1/4W	1066-3015	Allen-Bradley	CB3015
R5	Comp, 18 Ohm, 5%, 1/4W	1066-1805	Allen-Bradley	CB1805
R6	Pot, 50 Ohm, 20%, 1/2W Cer Trim	1203-0081	Bourns	3339H-1 500
R7	Comp, 270 Ohm, 5%, 1/8W	1065-2715	Allen-Bradley	CB2715
R8	Comp, 75 Ohm, 5%, 1/4W	1066-7505	Allen-Bradley	CB7505
R9	Comp, 100 Ohm, 5%, 1/4W	1066-1015	Allen-Bradley	CB1015
	TRANSFORMERS			
T1	XFMR, Toroidal (Balun)	1579-0047	Cushman	
T2	XFMR, Toroidal (Balun)	1579-0046	Cushman	
T3	XFMR, Toroidal (Balun)	1579-0046	Cushman	
T4	XFMR, Toroidal (Balun)	1579-0047	Cushman	
	TRANSISTOR			
Q1	Trans, 2N5179	1272-0067	RCA	2N5179


1
2
3
4
L1
C1
C2
C3
R1
R2
R3
Y1
C6
Q1
L4
L3
C7
C9
L2
C4
C5
C8
R4
R5
R7
R6
R8
R9
CR1
CR2
CR3
CR4
T1
T2
T3
T4
C10



NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

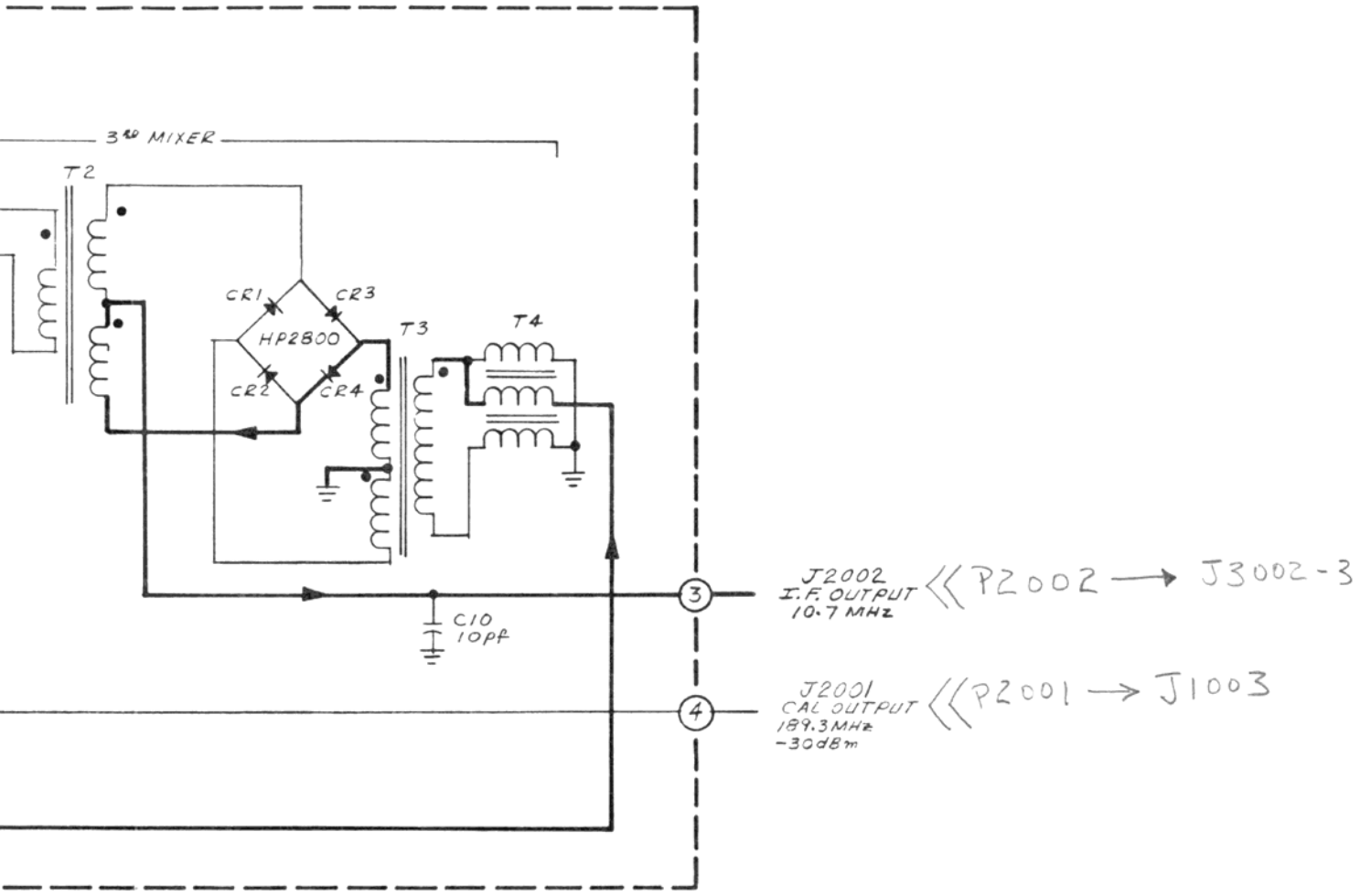
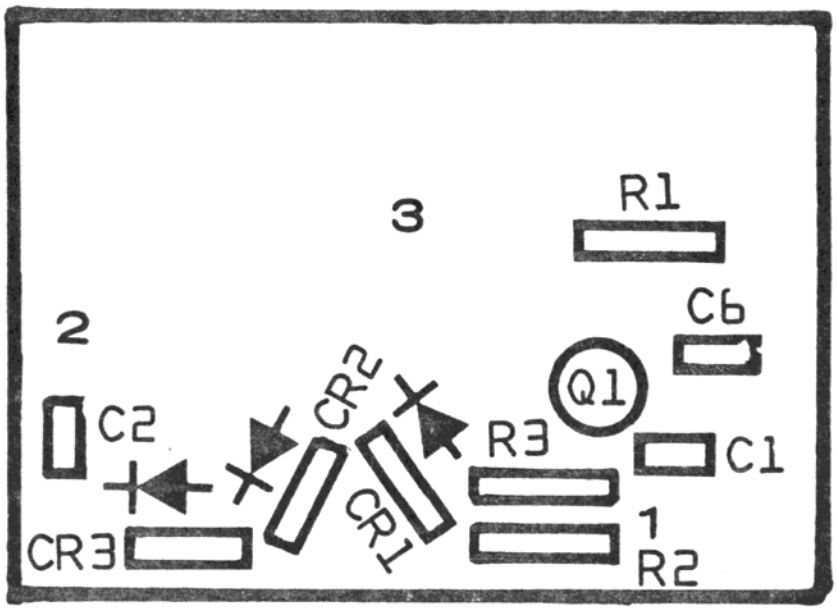


Figure 5-8. Third Converter, 2400

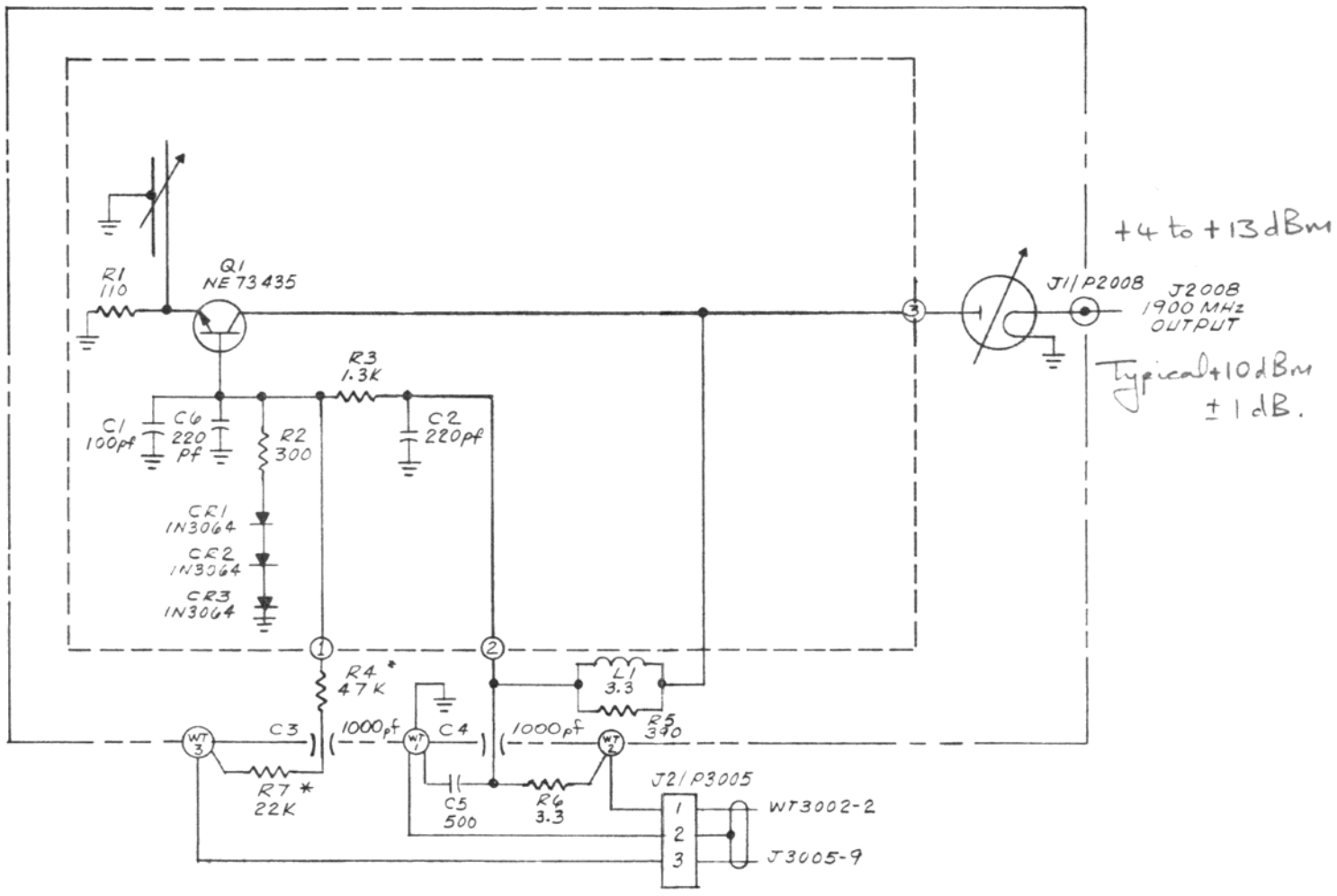
1900 MHz OSCILLATOR, 2700

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2700	PCB Assy, VCO 1900 MHz	7001-0365	Cushman	
	PC Board	1780-0665	Cushman	
	Container Assembly INCL. P.C.B ETC	7041-0018	Cushman	
	CAPACITORS			
C1	Chip, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C2	Cer, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C3	Feed Thru 1000PF	1005-0107	Erie	321-101-X5U0-102M
C4	Feed Thru 1000PF	1005-0107	Erie	321-101-X5U0-102M
C5	Elect, 500μF, ±20%, 15V	1013-0014	Mallory	TC1505B
C6	Cer, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
	CONNECTORS			
J1	Conn, SMB 50 Ohm, Str Jk Ft Bhd Mt	2536-0084	Cablewave	700166NP
J2	Conn, 3 Pin HSG Jk Mintr	2535-0035	Molex	1625-3-R-1
	Pins, .063 Female Crimp	4153-0006	Molex	1561TL
P3005	Conn, 3 Pin Hsg Pl Mintr	2535-0036	Molex	1625-3-P-1
	Pins, .063 Male Crimp	4153-0005	Molex	1560TL
	DIODES			
CR1	Dio, 1N3064, Si Signal	1281-0105	Teledyne	1N3064
CR2	Dio, 1N3064, Si Signal	1281-0105	Teledyne	1N3064
CR3	Dio, 1N3064, Si Signal	1281-0105	Teledyne	1N3064
	INDUCTORS			
L1	RF Choke, 3.3μH, 10%	1585-0080	Delevan	1025-32
L2	Coil, Output Loop	1596-0224	Cushman	
	RESISTORS			
R1	Comp, 110 Ohm, 5%, 1/8W Comp	1065-1115	Allen-Bradley	BB1115
R2	Comp, 390 Ohm, 5%, 1/8W CC	1065-3915	Allen-Bradley	BB3915
R3	Comp, 1.3K, 5%, 1/8W Comp	1065-1325	Allen-Bradley	BB1325
R4	Comp, 20K, ±5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R5	Comp, 390Ω, ±5%, 1/4W	1066-3915	Allen-Bradley	CB3915
R6	Comp, 3.3Ω, ±5%, 1/4W	1066-0006	Allen-Bradley	CB0006
R7	Comp, 22K, ±5%, 1/4W (FSV)	1066-2235	Allen-Bradley	CB2235
	TRANSISTOR			
Q1	XSTR, NE 73435 PNP Si	1272-0087	Nippon Elec	NE 73435



NOTE

1.
2.
3.
4.
5.



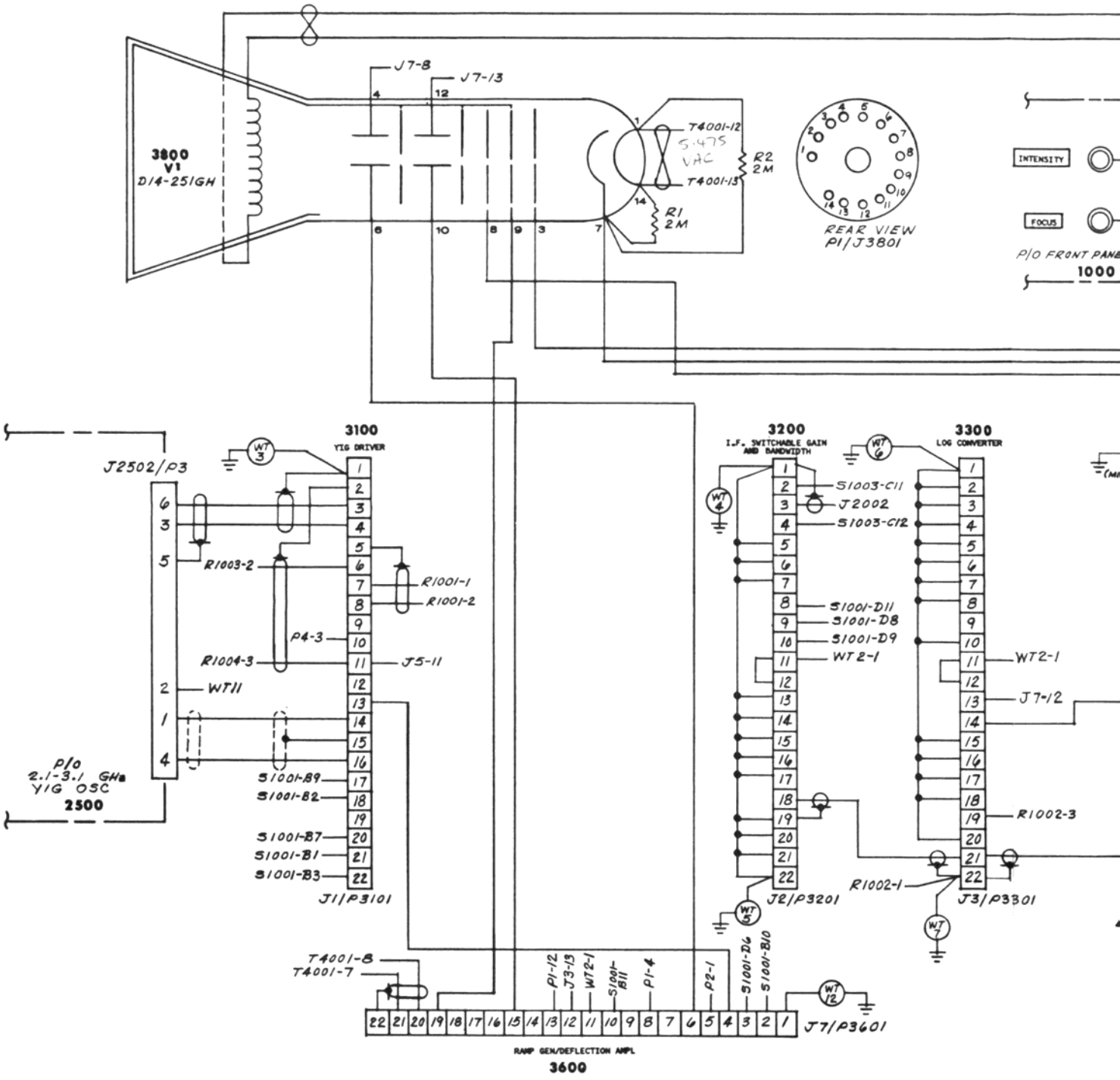
NOTE:

1. RESISTORS - 1/8 W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

Figure 5-9. 1900 MHz Oscillator, 2700

MAIN CHASSIS, 3000

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3000	Main Chassis	CE-15	Cushman	
	CONNECTORS			
J1	Conn, 22 Contact Sgl Row PCBd	2535-0018	Masterite	2MC22S/1-1
J2	Conn, 22 Contact Sgl Row PCBd	2535-0018	Masterite	2MC22S/1-1
J3	Conn, 22 Contact Sgl Row PCBd	2535-0018	Masterite	2MC22S/1-1
J4	P/O M1 12V Inverter Modification			
J5	Conn, 22 Contact Sgl Row PCBd	2535-0018	Masterite	2MC22S/1-1
J6	Not Used			
J7	Conn, 22 Contact Sgl Row PCBd	2535-0018	Masterite	2MC22S/1-1
P1	Comes with CRT (may order seprtly)	2605-0014	Amperex	55566
P2	Conn, 3 Pin, Lkg, Mintr Hsg Pl	2535-0045	Molex	09-50-3031
P3	Conn, 6 Pin Hsg, Recept Pl	2535-0053	Molex	P-3-06-2062
P4	Conn, 5 Pin, Lkg, Mintr, Hsg, Pl	2535-0072	Molex	09-50-3051
P5	Conn, 3 Pin, Hsg, Pl	2535-0036	Molex	1625-3-P-1
	FUSE			
F1	Fuse, 1/8 Amp at 125V	1955-0019	Littelfuse	275.125
	SPEAKER			
LS1	Speaker	1715-0006	Quam	25A07Z45
	RESISTORS			
R1	Comp, 2M ± 5%, 1/4W	1066-2055	Allen-Bradley	CB2055
R2	Comp, 2M ± 5%, 1/4W	1066-2055	Allen-Bradley	CB2055
R3/S1	Pot, 10K 20%, 1/2W Linear w/DPST	1203-0083	Logan	LM2954(FR-027-45-8D)
3800	Tube Assy, CRT	7041-0017	Cushman	
	CATHODE RAY TUBE			
V1	Tube, Rect CRT, 5.5IN Diag w/socket	1270-0021	Amperex	D14-251GH
	CONNECTOR			
P1	Conn, 2 Pin Locking Mintr Hsng Plug	2535-0085	Molex	09-50-3021


3800
V1
D14-251GH
J7-8
J7-13
T4001-12
5.475
VAC
T4001-13
R2
2M
R1
2M
REAR VIEW
P1/J3801
INTENSITY
FOCUS
P/O FRONT PANEL
1000
3100
YIG DRIVER
3200
I.F. SWITCHABLE GAIN AND BANDWIDTH
3300
LOG CONVERTER
J2502/P3
WT 3
WT 4
WT 5
WT 6
WT 7
WT 12
R1003-2
R1001-1
R1001-2
P4-3
R1004-3
J5-11
WT11
P/O
2.1-3.1 GHz
YIG OSC
2500
S1001-B9
S1001-B2
S1001-B7
S1001-B1
S1001-B3
J1/P3101
S1003-C11
J2002
S1003-C12
S1001-D11
S1001-D8
S1001-D9
WT2-1
J2/P3201
WT2-1
J7-12
R1002-3
R1002-1
J3/P3301
T4001-8
T4001-7
P1-12
J3-13
WT2-1
S1001-B11
P1-4
P2-1
S1001-D6
S1001-B10
J7/P3601
RAMP GEN/DEFLECTION AMPL
3600

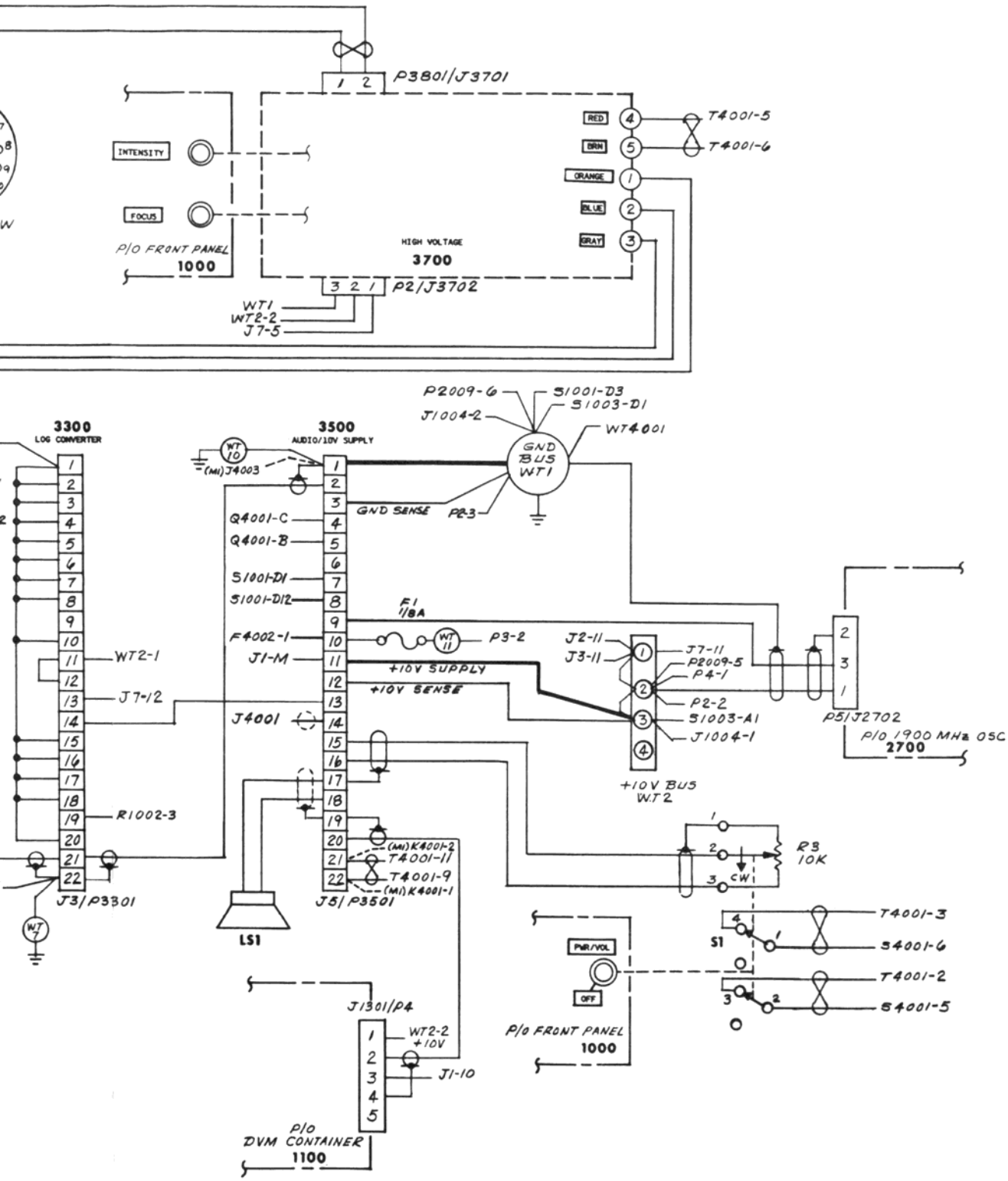


Figure 5-10. Main Chassis Interconnection Diagram, 3000

YIG DRIVER, YIG ASSEMBLY, 3100, 2500

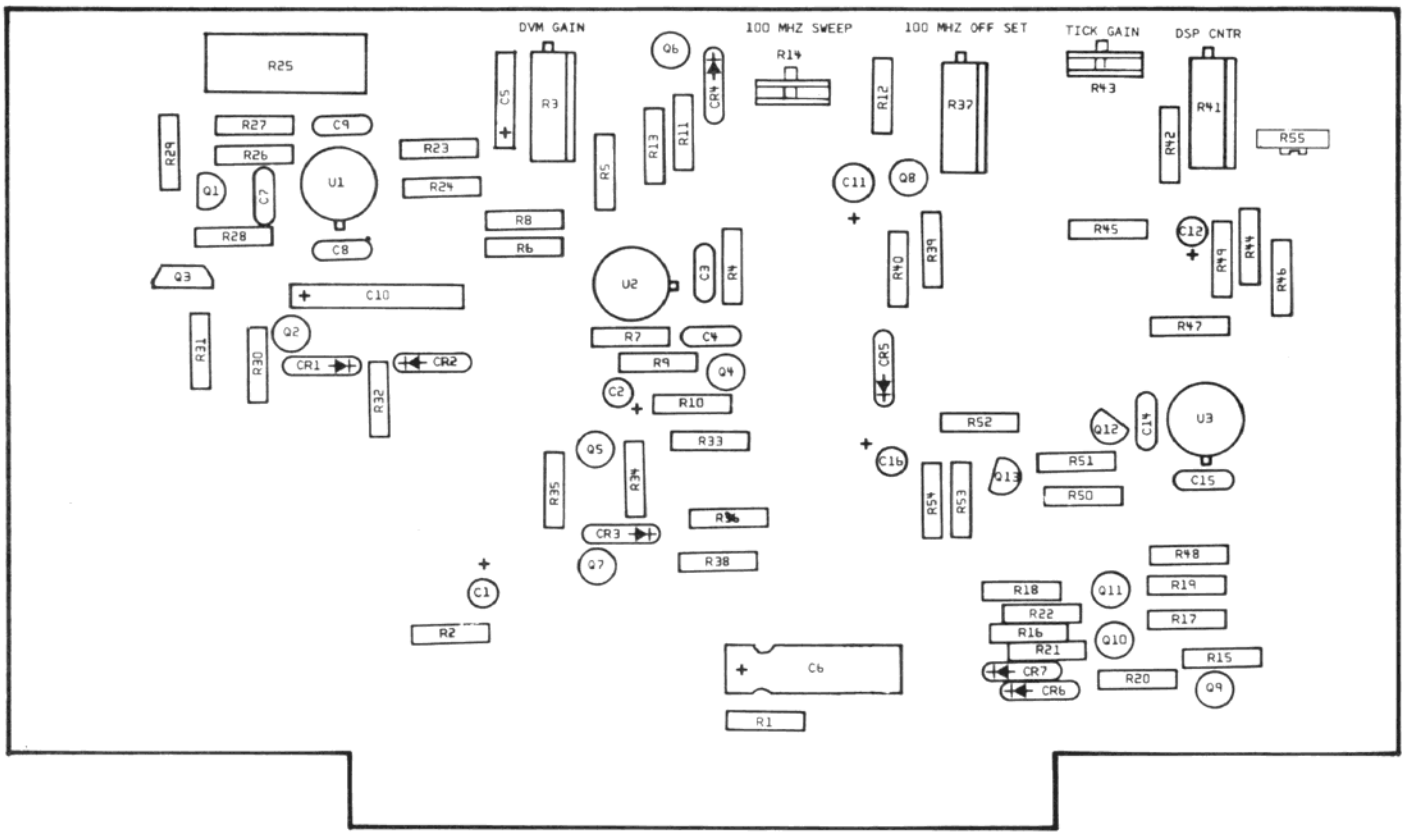
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3100	PCB Assy, Yig Driver	7001-0369	Cushman	
	PC Board	1780-0652	Cushman	
	CAPACITORS			
C1	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C2	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C3	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C4	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C5	~~Tant~~, 10μF, 20%, 15V MYLAR	~~1011-0019~~ 1008-0096	~~Hilton Ind~~ Reduces drift	~~SWT10-15-3B-M~~
C6	Elect, 100μF, 10%, 25V	1013-0003	Sprague	30D107G025DD5
C7	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C8	Mica, 30PF, 5%, 500V	1002-0043	Elmenco	DM15-E-300J
C9	Mica, 1000PF, 5%, 100V	1002-0015	Elmenco	DM15-F-102J
C10	Tant, 470μF, 20%, 6V	1011-0018	Hilton Ind	SWT470-6-5C-M
C11	Tant, 47μF, 20%, 20V	1011-0009	Dickson	D47GSC20M
C12	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C13	Not Used			
C14	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C15	Mica, 100PF, 5%, 500V	1002-0011	Elmenco	DM15-F-101J
C16	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
	DIODES			
CR1	Diode, IN3064	1281-0013	Teledyne	IN3064
CR2	Diode, IN3064	1281-0013	Teledyne	IN3064
CR3	Diode, IN3064	1281-0013	Teledyne	IN3064
CR4	Diode, IN3064	1281-0013	Teledyne	IN3064
CR5	Diode, IN3064	1281-0013	Teledyne	IN3064
CR6	Diode, IN3064	1281-0013	Teledyne	IN3064
CR7	Diode, IN3064	1281-0013	Teledyne	IN3064
	INTEGRATED CIRCUITS			
U1	IC, LM308H, 8 Pin Type Op Amp	2025-0057	National	LM308H
U2	IC, CA3130T, Op Amp	2025-0161	RCA	CA3130T
U3	IC, LM301A Op Amp	2025-0032	National	LM301A
	RESISTORS			
R1	MF, 8.25K, 1%, 1/8W	1075-0014	Dale	MFF 1/8
R2	MF, 1.43K, 1%, 1/8W	1075-0021	Dale	MFF 1/8
R3	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R4	MF, 130K, 1%, 25 PPM	1074-0110	Dale	MFF 1/10
R5	MF, 82.5K, 1%, 25 PPM	1075-0161	Dale	MFF 1/8
R6	MF, 10K, 1%, 1/10W	1074-1029	Dale	MFF 1/10
R7	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R8	MF, 30.1K, 1%, 25 PPM	1074-0107	Dale	MFF 1/10
R9	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R10	Comp, 30K, 5%, 1/4W	1066-3035	Allen-Bradley	CB3035
R11	MF, 402 Ohm, 1%, 100 PPM	1075-0151	Dale	MFF 1/8
R12	MF, 3.24K, 1%, 1/8W	1075-0092	Dale	MFF 1/8
R13	MF, 1K, 1%, 1/8W	1075-0037	Dale	MFF 1/8
R14	Pot, 5K, 20%, 1/4W	1215-0028	Mepco	2306-461-00-502
R15	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045

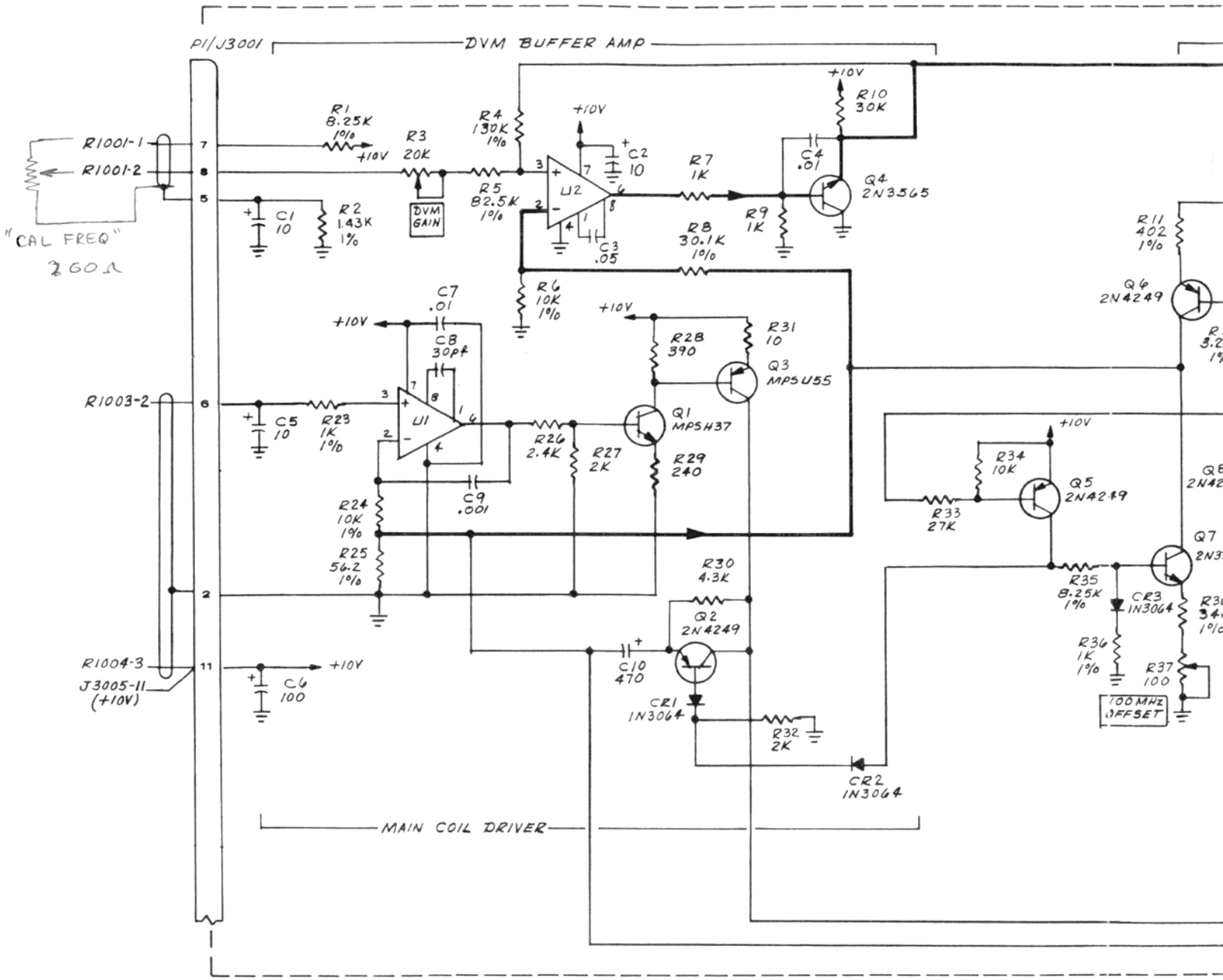
YIG DRIVER, YIG ASSEMBLY, 3100, 2500 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R16	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045
R17	MF, 909 Ohm, 1%, 1/10W	1074-1036	Dale	MFF 1/10
R18	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045
R19	MF, 11.0K, 1%, 100 PPM	1074-0106	Dale	MFF 1/10
R20	Comp, 1.2K, 5%, 1/4W	1066-1225	Allen-Bradley	CB1225
R21	Comp, 1.2K, 5%, 1/4W	1066-1225	Allen-Bradley	CB1225
R22	Comp, 6.2K, 5%, 1/4W	1066-6225	Allen-Bradley	CB6225
R23	MF, 1K, 1%, 1/8W	1075-0037	Dale	MFF 1/8
R24	MF, 10K, 1%, 1/10W	1074-1029	Dale	MFF 1/10
R25	WW, 56.2R, 1%, 1W 2 PPM	1157-0001	Jordan Elec	J-190
R26	Comp, 2.4K, 5%, 1/4W	1066-2425	Allen-Bradley	CB2425
R27	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R28	Comp, 390 Ohm, 5%, 1/4W	1066-3915	Allen-Bradley	CB3915
R29	Comp, 240 Ohm, 5%, 1/4W	1066-2415	Allen-Bradley	CB2415
R30	Comp, 4.3K, 5%, 1/4W	1066-4325	Allen-Bradley	CB4325
R31	Comp, 10 Ohm, 5%, 1/4W	1066-1005	Allen-Bradley	CB1005
R32	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R33	Comp, 27K, 5%, 1/4W	1066-2735	Allen-Bradley	CB2735
R34	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R35	MF, 8.25K, 1%, 1/8W	1075-0014	Dale	MFF 1/8
R36	MF, 1K, 1%, 1/8W	1075-0037	Dale	MFF 1/8
R37	Pot, 100 Ohm, 10%, 3/4W	1215-0010	Helitrim	89WR
R38	MF, 340 Ohm, 1%, 1/10W, 100 PPM	1074-1055	Dale	MFF 1/10
R39	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045
R40	Comp, 3.6K, 5%, 1/4W	1066-3625	Allen-Bradley	CB3625
R41	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R42	MF, 20K, 1%, 1/8W	1075-0096	Dale	MFF 1/8
R43	Pot, 25K, 20%, 1/4W	1215-0029	Mepco	2306-461-00-253 DANA 042234
R44	MF, 3.48K, 1%, 1/8W	1075-0093	Dale	MFF 1/8
R45	MF, 8.06K, 1%, 100 PPM	1074-0105	Dale	MFF 1/10
R46	MF, 75K, 1%, 1/8W	1075-0135	Dale	MFF 1/8
R47	MF, 100K, 1%, 100 PPM	1074-0109	Dale	MFF 1/10
R48	MF, 100K, 1%, 100 PPM	1074-0109	Dale	MFF 1/10
R49	MF, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R50	MF, 100 Ohm, 1%, 1/10W	1074-1033	Dale	MFF 1/10
R51	Comp, 51 Ohm, 5%, 1/4W	1066-5105	Allen-Bradley	CB5105
R52	MF, 75 Ohm, 1%, 1/8W	1075-0035	Dale	MFF 1/8
R53	MF, 1.05K, 1%, 1/8W	1075-0086	Dale	MFF 1/8
R54	MF, 931 Ohm, 1%, 100 PPM	1074-0103	Dale	MFF 1/10
R55	Pot, 100 Ohm, 20%, 1/4W	1215-0027	CTS	X201R101B
	TRANSISTORS			
Q1	Trans, MPS H37	1272-0073	Motorola	MPS-H37
Q2	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q3	Trans, MPS U55	1272-0074	Motorola	MPS-U55
Q4	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q5	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q6	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q7	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q8	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q9	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q10	Trans, 2N4249	1272-0024	Fairchild	2N4249

YIG DRIVER, YIG ASSEMBLY, 3100, 2500 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
Q11	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q12	Trans, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q13	Trans, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
2500	YIG Oscillator Assembly 2.1-3.1 GHz	7041-0016	Cushman	


DVM GAIN
100 MHZ SWEEP
100 MHZ OFF SET
TICK GAIN
DSP CNTR
R25
R27
C9
R26
R29
Q1
C7
U1
R28
C8
R23
R24
C5
R3
R5
R8
R6
Q6
R13
R11
CR4
R14
R12
R37
C11
Q8
R40
R39
R43
R41
R42
R55
R45
C12
R49
R44
R46
R47
Q3
C10
R31
Q2
R30
CR1
CR2
R32
U2
C3
R4
R7
C4
R9
Q4
C2
R10
R33
CR5
R52
Q12
C14
U3
C16
R51
Q13
C15
R50
R54
R53
Q5
R35
R34
CR3
Q7
R38
R36
R48
R18
Q11
R19
R22
R17
R16
Q10
R21
R15
CR7
R20
Q9
CR6
C1
R2
C6
R1

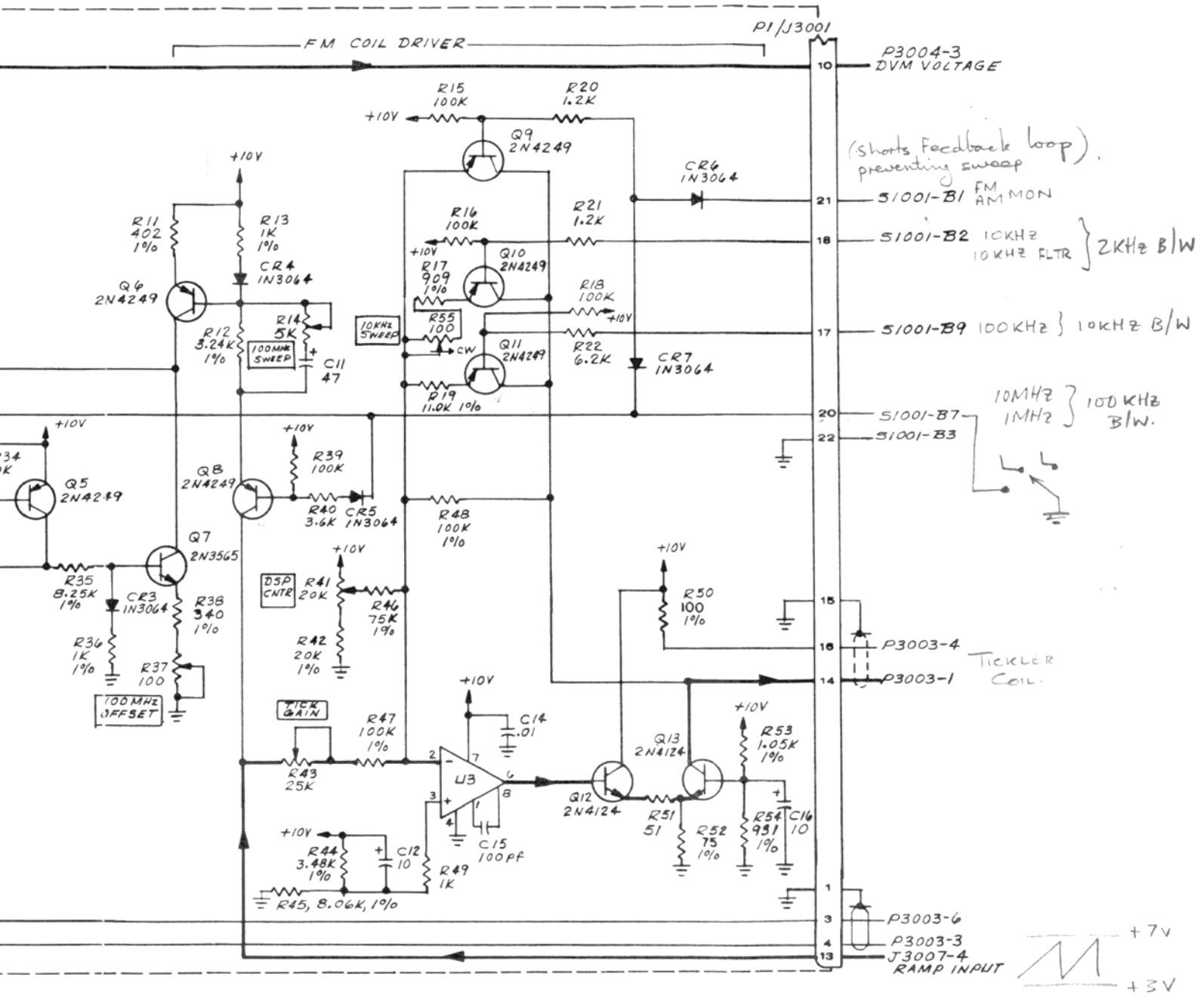


NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

U NO	TYPE	VCC	GND
1	LM308		
2	LM3130		
3	LM301A		

C13 NOT USED



C13 NOT USED

Figure 5-11. YIG Driver, 3100

IF SWITCHABLE GAIN & BANDWIDTH, 3200

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3200	PCB Assy, IF Switchable Gain & BW	7001-0370	Cushman	
	PC Board	1780-0662	Cushman	
	CAPACITORS			
C1	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C2	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C3	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C4	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C5	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C6	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C7	Mica, 10PF, 5%, 500V	1002-0016	Elmenco	DM15-C-100J
C8	Mica, 36PF, 5%, 500V	1002-0041	Elmenco	DM15-E-360J
C9	Mica, 47PF, 5%, 500V	1002-0012	Elmenco	DM15-E-470J
C10	Mica, 24PF, 5%, 500V	1002-0051	Elmenco	DM15-C-240J
C11	Mica, 47PF, 5%, 500V	1002-0012	Elmenco	DM15-E-470J
C12	Mica, 10PF, 5%, 500V	1002-0016	Elmenco	DM15-C-100J
C13	Mica, 39PF, 5%, 500V	1002-0018	Elmenco	DM15-E-390J
C14	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C15	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C16	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C17	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C18	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C19	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C20	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C21	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C22	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C23	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C24	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C25	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C26	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C27	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C28	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C29	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C30	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C31	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C32	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C33	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C34	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C35	Mica, 10PF, 5%, 500V	1002-0016	Elmenco	DM15-C-100J
C36	Mica, 180PF, 5%, 500V	1002-0005	Elmenco	DM15-F-181J
C37	Cer, 3.3PF, .25PF%, 500V Tub	1005-0011	Erie	301-000-C0J0-339C
C38	Mica, 180PF, 5%, 500V	1002-0005	Elmenco	DM15-F-181J
C39	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C40	Mica, 30PF, 5%, 500V	1002-0043	Elmenco	DM15-E-300J
C41	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C42	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C43	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C44	Mica, 75PF, 5%, 500V	1002-0025	Elmenco	DM15-E-750J
C45	Mica, 68PF, 5%, 500V	1002-0013	Elmenco	DM15-E-680J

IF SWITCHABLE GAIN & BANDWIDTH, 3200 (cont)

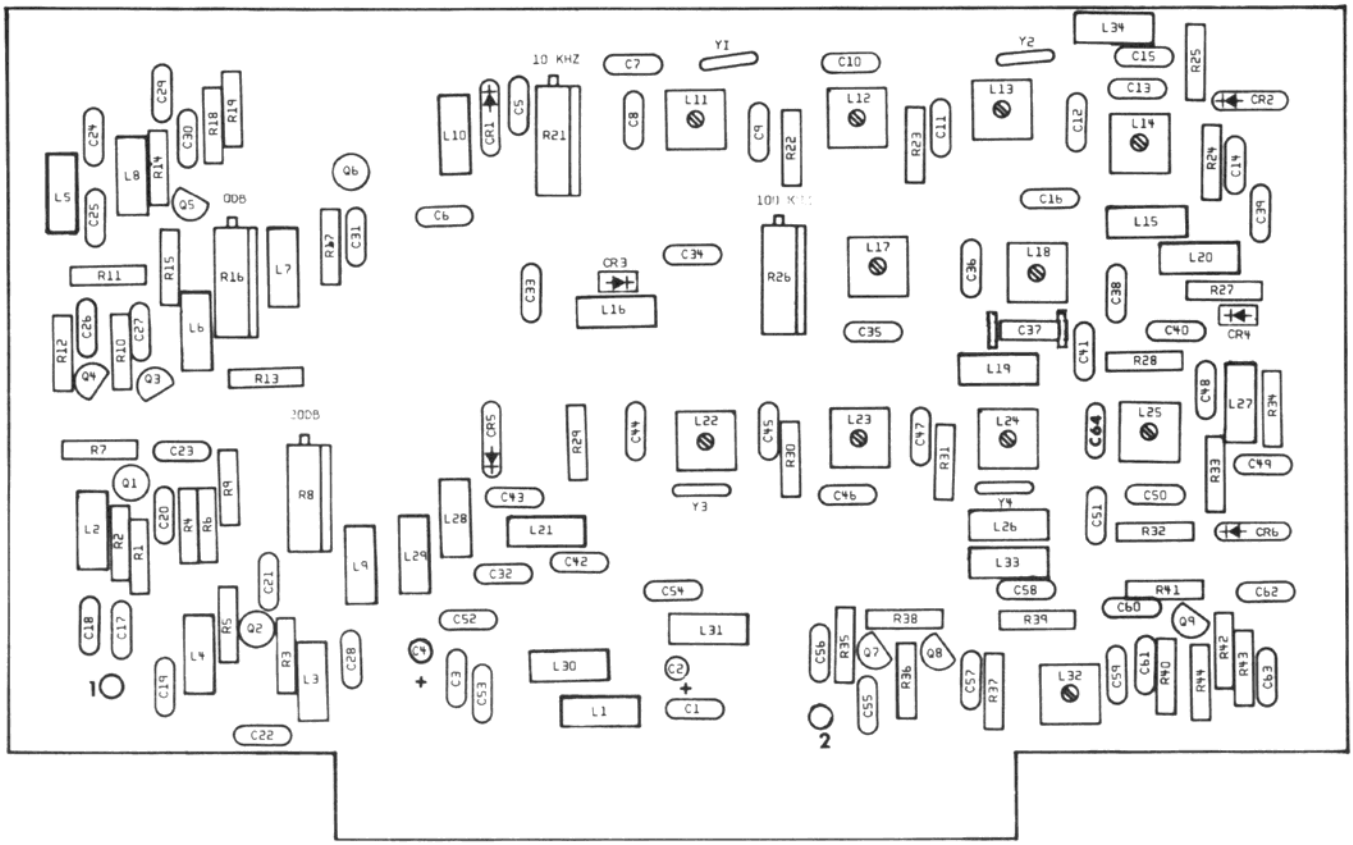
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
C46	Mica, 15PF, 5%, 500V	1002-0001	Elmenco	DM15-C-150J
C47	Mica, 91PF, 5%, 500V	1002-0027	Elmenco	DM15-F-910J
C48	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C49	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C50	Mica, 82PF, 5%, 500V	1002-0020	Elmenco	DM15-E-820J
C51	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C52	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C53	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C54	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C55	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C56	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C57	Mica, 30PF, 5%, 500V	1002-0043	Elmenco	DM15-E-300J
C58	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C59	Mica, 180PF, 5%, 500V	1002-0005	Elmenco	DM15-F-181J
C60	Mica, 5PF, .5PF%, 500V	1002-0028	Elmenco	DM15-C-050D
C61	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C62	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C63	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C64	Mica, 36PF, 5%, 500V	1002-0041	Elmenco	DM15-E-360J
	DIODES			
CR1	Diode, IN3064	1281-0013	Teledyne	IN3064
CR2	Diode, IN3064	1281-0013	Teledyne	IN3064
CR3	Dio, BA379 Si, Pin	1281-0101	Siemens	BA379
CR4	Dio, BA379 Si, Pin	1281-0101	Siemens	BA379
CR5	Diode, IN3064	1281-0013	Teledyne	IN3064
CR6	Diode, IN3064	1281-0013	Teledyne	IN3064
	FILTERS			
F1	Fltr, Xtal, 10.7 MHz (3dB BW 15kHz)	1040-0040	Cushman	
F2	Fltr, Xtal, 10.7 MHz (3dB BW 15kHz)	1040-0039	Cushman	
F3	Fltr, Xtal, 10.7 MHz (3dB BW 2kHz)	1040-0038	Cushman	
F4	Fltr, Xtal, 10.7 MHz (3dB BW 2kHz)	1040-0038	Cushman	
	INDUCTORS			
L1	Choke, 2 1/2 Turns, Wide Band	1586-0003	VK	20020/4B
L2	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L3	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L4	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L5	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L6	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L7	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L8	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L9	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L10	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L11	Coil, 3.9 MHz	1596-0104	Cushman	
L12	Coil, 3.9 MHz	1596-0104	Cushman	
L13	Coil, 3.9 MHz	1596-0104	Cushman	
L14	Coil, 3.9 MHz	1596-0104	Cushman	
L15	Choke, 100μH, 5%	1585-0017	Delevan	1537-76

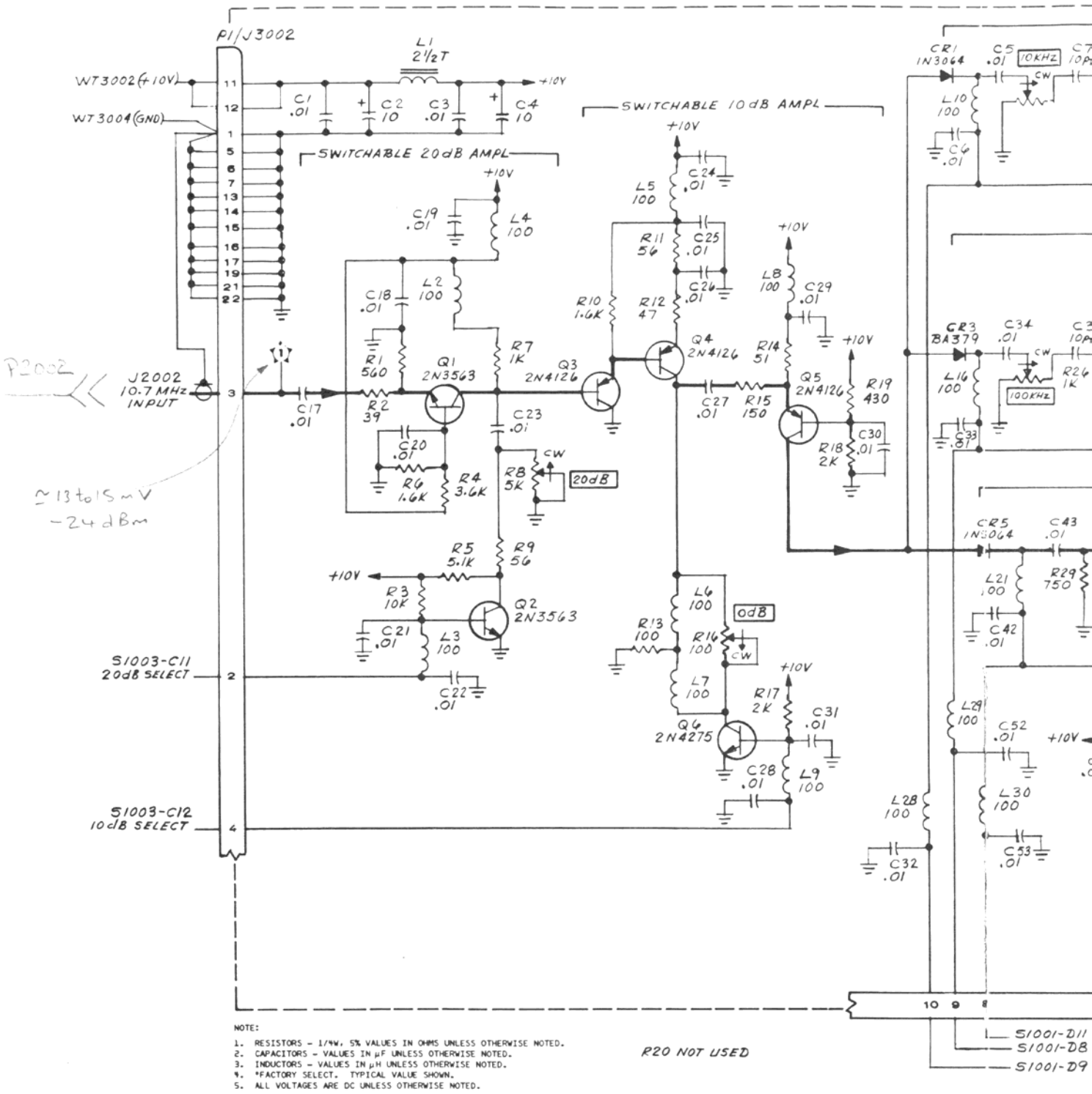
IF SWITCHABLE GAIN & BANDWIDTH, 3200 (cont)

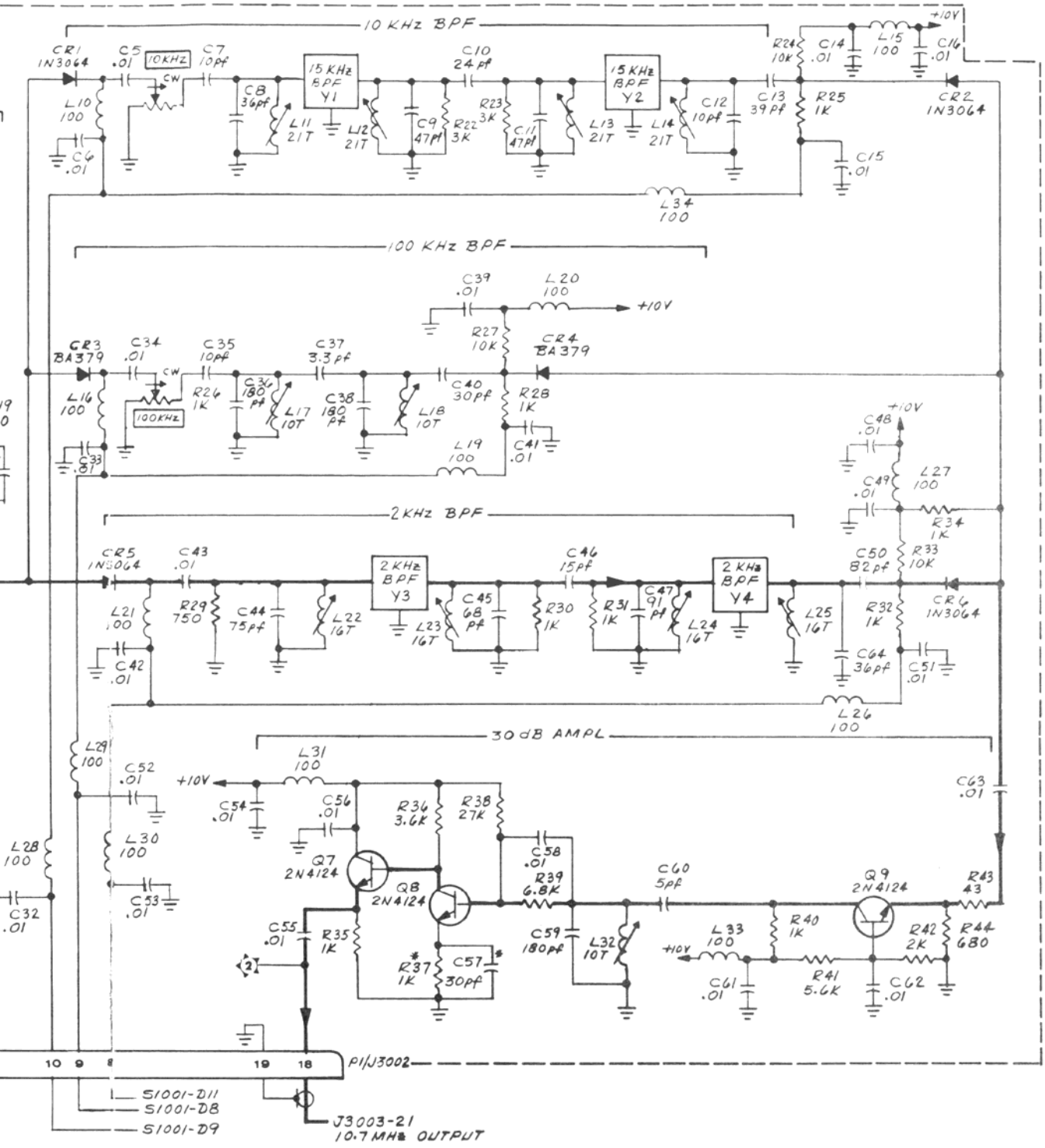
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
L16	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L17	Coil, Variable IF	7050-0131	Cushman	
L18	Coil, Variable IF	7050-0131	Cushman	
L19	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L20	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L21	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L22	Coil Assy, Variable	7050-0128	Cushman	
L23	Coil Assy, Variable	7050-0128	Cushman	
L24	Coil Assy, Variable	7050-0128	Cushman	
L25	Coil Assy, Variable	7050-0128	Cushman	
L26	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L27	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L28	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L29	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L30	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L31	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L32	Coil, Variable IF	7050-0131	Cushman	
L33	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L34	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
	RESISTORS			
R1	Comp, 560 Ohm, 5%, 1/4W	1066-5615	Allen-Bradley	CB5615
R2	Comp, 39 Ohm, 5%, 1/4W	1066-3905	Allen-Bradley	CB3905
R3	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R4	Comp, 3.6K, 5%, 1/4W	1066-3625	Allen-Bradley	CB3625
R5	Comp, 5.1K, 5%, 1/4W	1066-5125	Allen-Bradley	CB5125
R6	Comp, 1.6K, 5%, 1/4W	1066-1625	Allen-Bradley	CB1625
R7	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R8	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R9	Comp, 56 Ohm, 5%, 1/4W	1066-5605	Allen-Bradley	CB5605
R10	Comp, 1.6K, 5%, 1/4W	1066-1625	Allen-Bradley	CB1625
R11	Comp, 56 Ohm, 5%, 1/4W	1066-5605	Allen-Bradley	CB5605
R12	Comp, 47 Ohm, 5%, 1/4W	1066-4705	Allen-Bradley	CB4705
R13	Comp, 100 Ohm, 5%, 1/4W	1066-1015	Allen-Bradley	CB1015
R14	Comp, 51 Ohm, 5%, 1/4W	1066-5105	Allen-Bradley	CB5105
R15	Comp, 150 Ohm, 5%, 1/4W	1066-1515	Allen-Bradley	CB1515
R16	Pot, 100 Ohm, 10%, 3/4W	1215-0010	Helitrim	89WR
R17	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R18	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R19	Comp, 430 Ohm, 5%, 1/4W	1066-4315	Allen-Bradley	CB4315
R20	Not Used			
R21	Pot, 1K, 10%, 3/4W	1215-0013	Helitrim	89WR
R22	Comp, 3K, 5%, 1/4W	1066-3025	Allen-Bradley	CB3025
R23	Comp, 3K, 5%, 1/4W	1066-3025	Allen-Bradley	CB3025
R24	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R25	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R26	Pot, 1K, 10%, 3/4W	1215-0013	Helitrim	89WR
R27	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R28	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R29	Comp, 750 Ohm, 5%, 1/4W	1066-7515	Allen-Bradley	CB7515
R30	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025

IF SWITCHABLE GAIN & BANDWIDTH, 3200 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R31	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R32	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R33	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R34	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R35	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R36	Comp, 3.6K, 5%, 1/4W	1066-3625	Allen-Bradley	CB3625
R37	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R38	Comp, 27K, 5%, 1/4W	1066-2735	Allen-Bradley	CB2735
R39	Comp, 6.8K, 5%, 1/4W	1066-6825	Allen-Bradley	CB6825
R40	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R41	Comp, 5.6K, 5%, 1/4W	1066-5625	Allen-Bradley	CB5625
R42	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R43	Comp, 43 Ohm, 5%, 1/4W	1066-4305	Allen-Bradley	CB4305
R44	Comp, 680 Ohm, 5%, 1/4W	1066-6815	Allen-Bradley	CB6815
	TRANSISTORS			
Q1	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q2	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q3	XSTR, 2N4026, PNP, Si	1272-0090	Fairchild	2N4126
Q4	XSTR, 2N4126, PNP, Si	1272-0090	Fairchild	2N4126
Q5	XSTR, 2N4126, PNP, Si	1272-0090	Fairchild	2N4126
Q6	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q7	XSTR, 2N4124, NPN, Si	1272-0091	Fairchild	2N4124
Q8	XSTR, 2N4124, NPN, Si	1272-0091	Fairchild	2N4124
Q9	XSTR, 2N4124, NPN, Si	1272-0091	Fairchild	2N4124


10 KHZ
Y1
Y2
Y3
Y4
CR1
CR2
CR3
CR4
CR5
CR6
C64
1
2


P1/J3002
L1 2½T
WT3002 (+10V)
WT3004 (GND)
C1 .01
C2 10
C3 .01
C4 10
+10V
SWITCHABLE 20dB AMPL
SWITCHABLE 10dB AMPL
C19 .01
L4 100
C18 .01
L2 100
R1 560
R2 39
R7 1K
Q1 2N3563
Q3 2N4126
C17 .01
C23 .01
C20 .01
R6 1.6K
R4 3.6K
R8 5K
CW
20dB
R5 5.1K
R9 56
R3 10K
Q2 2N3563
C21 .01
L3 100
C22 .01
P2002
J2002 10.7 MHz INPUT
≃13 to 15 mV -24 dBm
S1003-C11 20dB SELECT
S1003-C12 10dB SELECT
C24 .01
L5 100
R11 56
C25 .01
R10 1.6K
R12 47
C26 .01
Q4 2N4126
C27 .01
R15 150
L8 100
C29 .01
R14 51
Q5 2N4126
R19 430
R18 2K
C30 .01
L6 100
R13 100
R16 100
0dB
L7 100
R17 2K
Q6 2N4275
C28 .01
L9 100
C31 .01
CR1 1N3064
C5 .01
10KHZ
L10 100
C6 .01
CR3 BA379
C34 .01
L16 100
100KHZ
C33 .01
R24 1K
CR5 1N3064
C43 .01
L21 100
R29 750
C42 .01
L29 100
C52 .01
L28 100
L30 100
C53 .01
C32 .01
10 9 8
S1001-D11
S1001-D8
S1001-D9
NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN µF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN µH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
R20 NOT USED



R20 NOT USED

Figure 5-12. IF Switchable Gain and Bandwidth, 3200

LOG CONVERTER, 3300

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3300	PCB Assy, Log Converter	7001-0371	Cushman	
	PC Board	1780-0664	Cushman	
	CAPACITORS			
C1	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C2	Trim, 9-35PF, 200V Vert	1001-0006	Erie	538-002-94D
C3	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C4	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C5	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C6	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C7	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C8	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C9	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C10	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C11	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C12	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C13	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C14	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C15	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C16	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C17	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C18	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C19	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C20	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C21	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C22	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C23	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C24	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C25	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C26	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C27	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C28	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C29	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C30	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C31	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C32	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C33	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C34	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C35	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C36	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C37	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C38	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C39	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C40	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C41	Mica, 5PF, .5PF%, 500V	1002-0028	Elmenco	DM15-C-050D
C42	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C43	Mica, 180PF, 5%, 500V	1002-0005	Elmenco	DM15-F-181J
C44	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C45	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z

LOG CONVERTER, 3300 (cont)

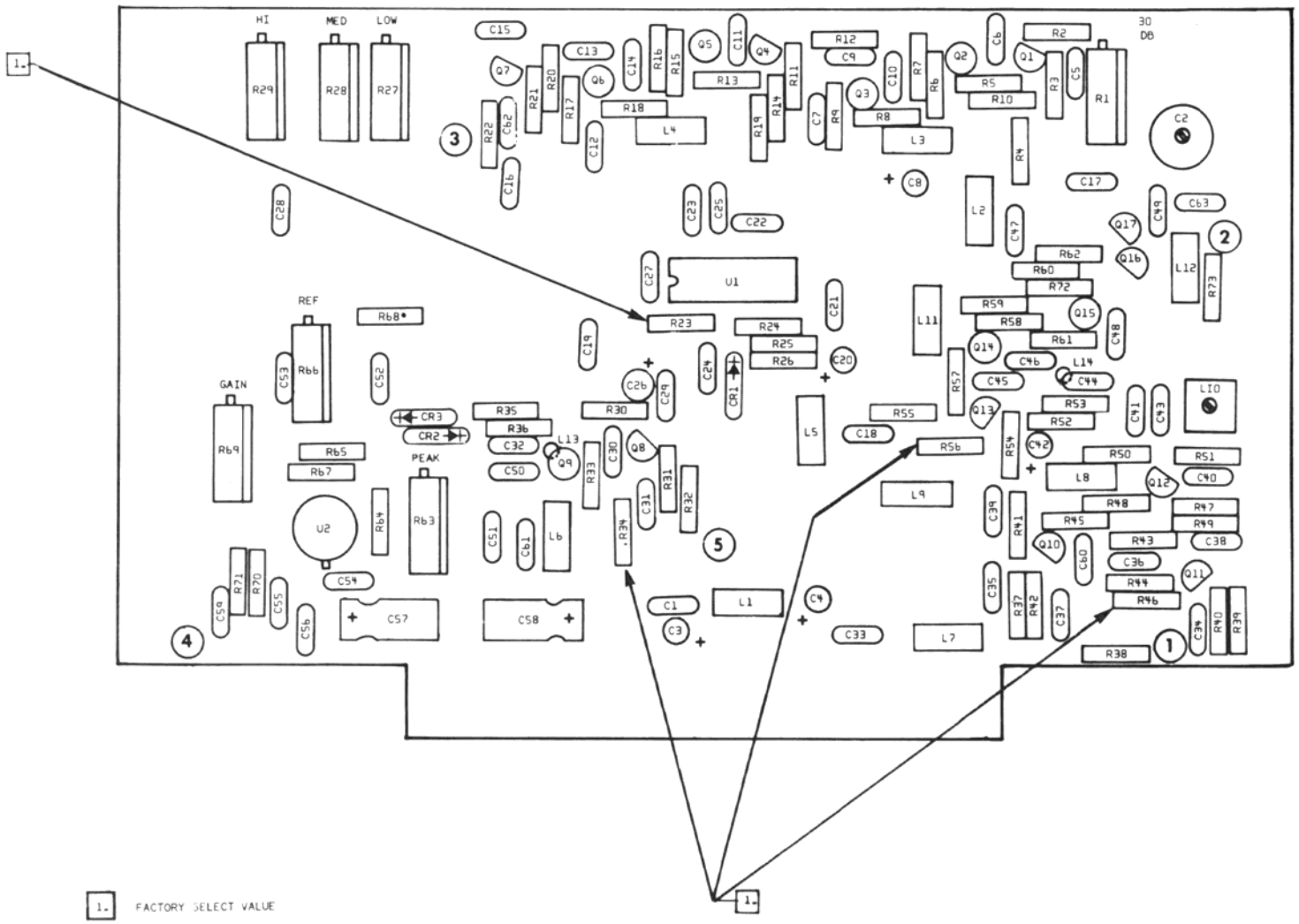
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
C46	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C47	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C48	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C49	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C50	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C51	Mica, 2000PF, 5%, 500V	1002-0077	Elmenco	DM19-E-202J
C52	Mica, 2000PF, 5%, 500V	1002-0077	Elmenco	DM19-E-202J
C53	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C54	Mica, 30PF, 5%, 500V	1002-0043	Elmenco	DM15-E-300J
C55	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C56	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C57	Elect, 1MF, 50V DC, 10%	1013-0004	Sprague	30D105G025BA5
C58	Elect, 1MF, 50V DC, 10%	1013-0004	Sprague	30D105G025BA5
C59	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C60	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C61	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
	DIODES			
CR1	Diode, IN4733	1281-0015	Motorola	IN4733
CR2	Diode, HPA2800	1283-0001	HP	5082-2800
CR3	Diode, HPA2800	1283-0001	HP	5082-2800
	INDUCTORS			
L1	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L2	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L3	Choke, 100μH, 5%	1585-0017	Delevan	1537-76 3100033
L4	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L5	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L6	Choke, 47μH, 5%	1585-0010	Delevan	1537-60
L7	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L8	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L9	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L10	Coil, Variable IF	7050-0131	Cushman	
L11	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L12	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L13	Choke, U-250 Ferrite Bead	1586-0004	Ferroxcube	56-590-65-4B
L14	Choke, U-250 Ferrite Bead	1586-0004	Ferroxcube	56-590-65-4B
	INTEGRATED CIRCUITS			
U1	IC, SN5650N, Logarithmic Amp	2025-0049	TI	SN56502N
U2	IC, LM301A, Op Amp	2025-0032	National	LM301A
	RESISTORS			
R1	Pot, 500 Ohm, 10%, 3/4W	1215-0011	Helitrim	89WR
R2	Comp, 11K, 5%, 1/4W	1066-1135	Allen-Bradley	CB1135
R3	Comp, 6.2K, 5%, 1/4W	1066-6225	Allen-Bradley	CB6225
R4	Comp, 1.5K, 5%, 1/4W	1066-1525	Allen-Bradley	CB1525
R5	Comp, 100 Ohm, 5%, 1/4W	1066-1015	Allen-Bradley	CB1015
R6	Comp, 15 Ohm, 5%, 1/4W	1066-1505	Allen-Bradley	CB1505
R7	Comp, 200 Ohm, 5%, 1/4W	1066-2015	Allen-Bradley	CB2015
R8	Comp, 15 Ohm, 5%, 1/4W	1066-1505	Allen-Bradley	CB1505
R9	Comp, 620 Ohm, 5%, 1/4W	1066-6215	Allen-Bradley	CB6215
R10	Comp, 100 Ohm, 5%, 1/4W	1066-1015	Allen-Bradley	CB1015

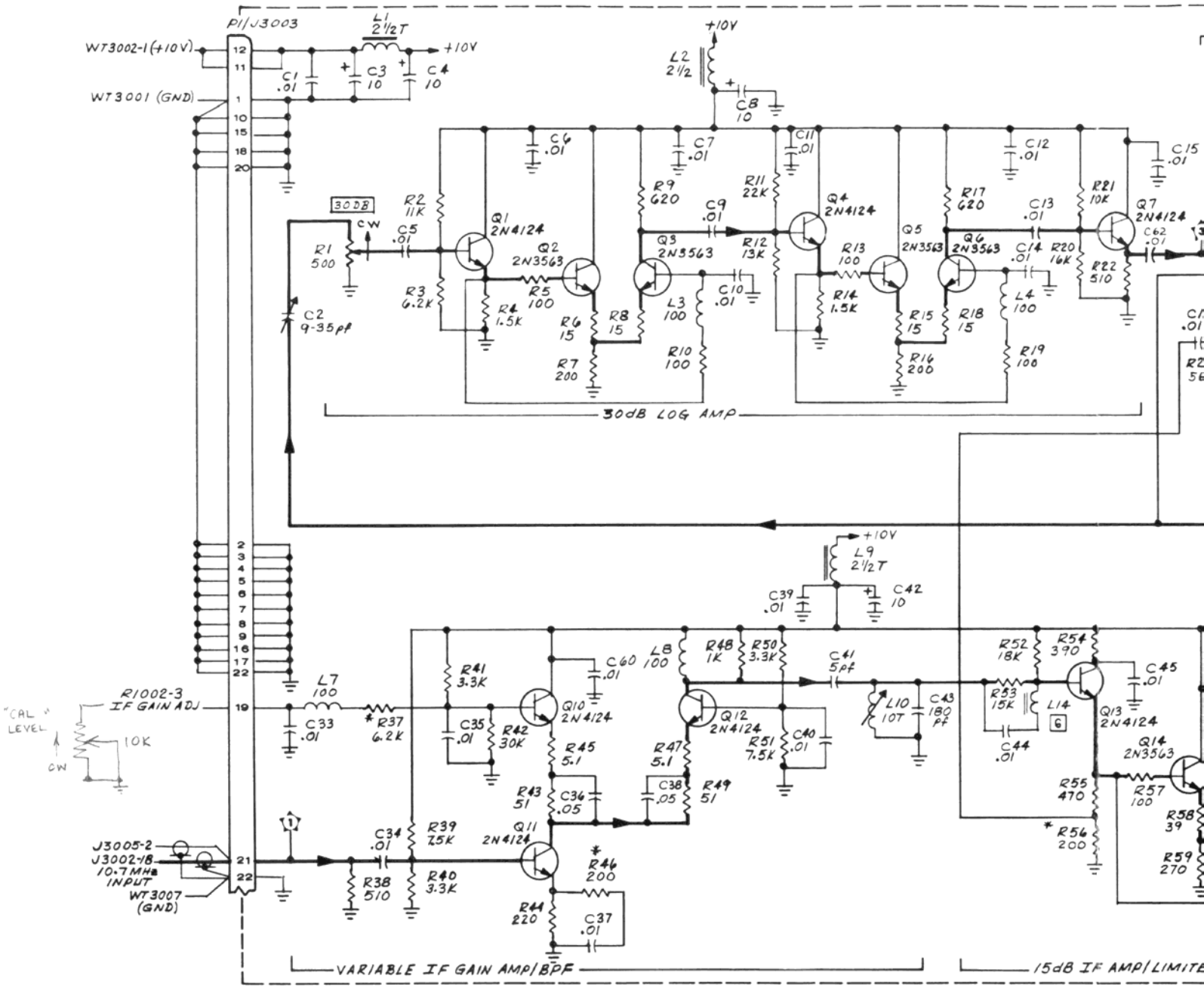
LOG CONVERTER, 3300 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R11	Comp, 22K, 5%, 1/4W	1066-2235	Allen-Bradley	CB2235
R12	Comp, 13K, 5%, 1/4W	1066-1335	Allen-Bradley	CB1335
R13	Comp, 100 Ohm, 5%, 1/4W	1066-1015	Allen-Bradley	CB1015
R14	Comp, 1.5K, 5%, 1/4W	1066-1525	Allen-Bradley	CB1525
R15	Comp, 15 Ohm, 5%, 1/4W	1066-1505	Allen-Bradley	CB1505
R16	Comp, 200 Ohm, 5%, 1/4W	1066-2015	Allen-Bradley	CB2015
R17	Comp, 620 Ohm, 5%, 1/4W	1066-6215	Allen-Bradley	CB6215
R18	Comp, 15 Ohm, 5%, 1/4W	1066-1505	Allen-Bradley	CB1505
R19	Comp, 100 Ohm, 5%, 1/4W	1066-1015	Allen-Bradley	CB1015
R20	Comp, 16K, 5%, 1/4W	1066-1635	Allen-Bradley	CB1635
R21	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R22	Comp, 510 Ohm, 5%, 1/4W	1066-5115	Allen-Bradley	CB5115
R23	Comp, 300 Ohm, 5%, 1/4W	1066-3015	Allen-Bradley	CB3015
R24	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R25	Comp, 240 Ohm, 5%, 1/4W	1066-2415	Allen-Bradley	CB2415
R26	Comp, 240 Ohm, 5%, 1/4W	1066-2415	Allen-Bradley	CB2415
R27	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R28	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R29	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R30	Comp, 5.1K, 5%, 1/4W	1066-5125	Allen-Bradley	CB5125
R31	Comp, 5.6K, 5%, 1/4W	1066-5625	Allen-Bradley	CB5625
R32	Comp, 750 Ohm, 5%, 1/4W	1066-7515	Allen-Bradley	CB7515
R33	MF, 301 Ohm, 1%, 1/8W	1075-0048	Dale	MFF 1/8
R34	Comp, 430 Ohm, 5%, 1/4W	1066-4315	Allen-Bradley	CB4315
R35	Comp, 1.5K, 5%, 1/4W	1066-1525	Allen-Bradley	CB1525
R36	Comp, 1.5K, 5%, 1/4W	1066-1525	Allen-Bradley	CB1525
R37	Comp, 6.2K, 5%, 1/4W	1066-6225	Allen-Bradley	CB6225
R38	Comp, 510 Ohm, 5%, 1/4W	1066-5115	Allen-Bradley	CB5115
R39	Comp, 7.5K, 5%, 1/4W	1066-7525	Allen-Bradley	CB7525
R40	Comp, 3.3K, 5%, 1/4W	1066-3325	Allen-Bradley	CB3325
R41	Comp, 3.3K, 5%, 1/4W	1066-3325	Allen-Bradley	CB3325
R42	Comp, 30K, 5%, 1/4W	1066-3035	Allen-Bradley	CB3035
R43	Comp, 51 Ohm, 5%, 1/4W	1066-5015	Allen-Bradley	CB5105
R44	Comp, 220 Ohm, 5%, 1/4W	1066-2215	Allen-Bradley	CB2215
R45	Comp, 5.1 Ohm, 5%, 1/4W	1066-0002	Allen-Bradley	CB0002
R46	Comp, 200 Ohm, 5%, 1/4W	1066-2015	Allen-Bradley	CB2015
R47	Comp, 5.1 Ohm, 5%, 1/4W	1066-0002	Allen-Bradley	CB0002
R48	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R49	Comp, 51 Ohm, 5%, 1/4W	1066-5105	Allen-Bradley	CB5105
R50	Comp, 3.3K, 5%, 1/4W	1066-3325	Allen-Bradley	CB3325
R51	Comp, 7.5K, 5%, 1/4W	1066-7525	Allen-Bradley	CB7525
R52	Comp, 18K, 5%, 1/4W	1066-1835	Allen-Bradley	CB1835
R53	Comp, 15K, 5%, 1/4W	1066-1535	Allen-Bradley	CB1535
R54	Comp, 390 Ohm, 5%, 1/4W	1066-3915	Allen-Bradley	CB3915
R55	Comp, 470 Ohm, 5%, 1/4W	1066-4715	Allen-Bradley	CB4715
R56	Comp, 110 Ohm, 5%, 1/4W	1066-1115	Allen-Bradley	CB1115
R57	Comp, 100 Ohm, 5%, 1/4W	1066-1015	Allen-Bradley	CB1015
R58	Comp, 39 Ohm, 5%, 1/4W	1066-3905	Allen-Bradley	CB3905
R59	Comp, 270 Ohm, 5%, 1/4W	1066-2715	Allen-Bradley	CB2715
R60	Comp, 560 Ohm, 5%, 1/4W	1066-5615	Allen-Bradley	CB5615

LOG CONVERTER, 3300 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R61	Comp, 39 Ohm, 5%, 1/4W	1066-3905	Allen-Bradley	CB3905
R62	Comp, 2.4K, 5%, 1/4W	1066-2425	Allen-Bradley	CB2425
R63	Pot, 500 Ohm, 10%, 3/4W	1215-0011	Helitrim	89WR
R64	MF, 1.21K, 1%, 1/8W	1075-0042	Dale	MFF 1/8
R65	Comp, 3K, 5%, 1/4W	1066-3025	Allen-Bradley	CB3025
R66	Pot, 1K, 10%, 3/4W	1215-0013	Helitrim	89WR
R67	MF, 15K, 1%, 1/8W	1075-0081	Dale	MFF 1/8
R68	Comp, 750 Ohm, 5%, 1/4W	1066-7515	Allen-Bradley	CB7515
R69	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R70	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R71	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R72	Comp, 100 Ohm, 5%, 1/4W	1066-1015	Allen-Bradley	CB1015
R73	Comp, 510 Ohm, 5%, 1/4W	1066-5115	Allen-Bradley	CB5115
	TRANSISTORS			
Q1	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q2	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q3	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q4	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q5	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q6	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q7	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q8	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q9	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q10	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q11	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q12	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q13	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q14	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q15	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q16	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124
Q17	XSTR, 2N4124, NPN Si	1272-0091	Fairchild	2N4124


HI
MED
LOW
30 DB
REF
GAIN
PEAK
U1
U2
L10
1. FACTORY SELECT VALUE



NOTE:

1. RESISTORS – 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

6. FERRITE BEAD

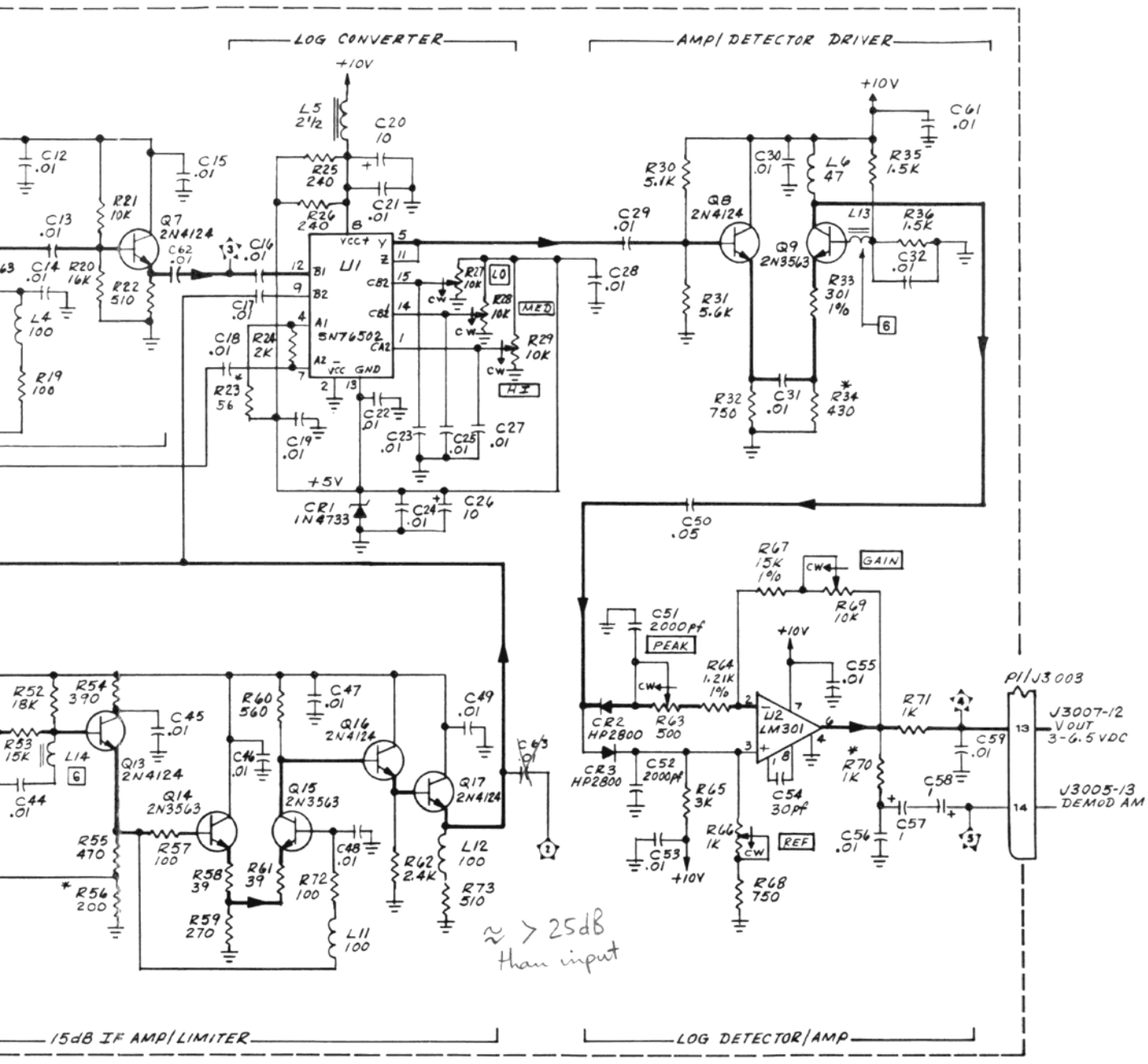
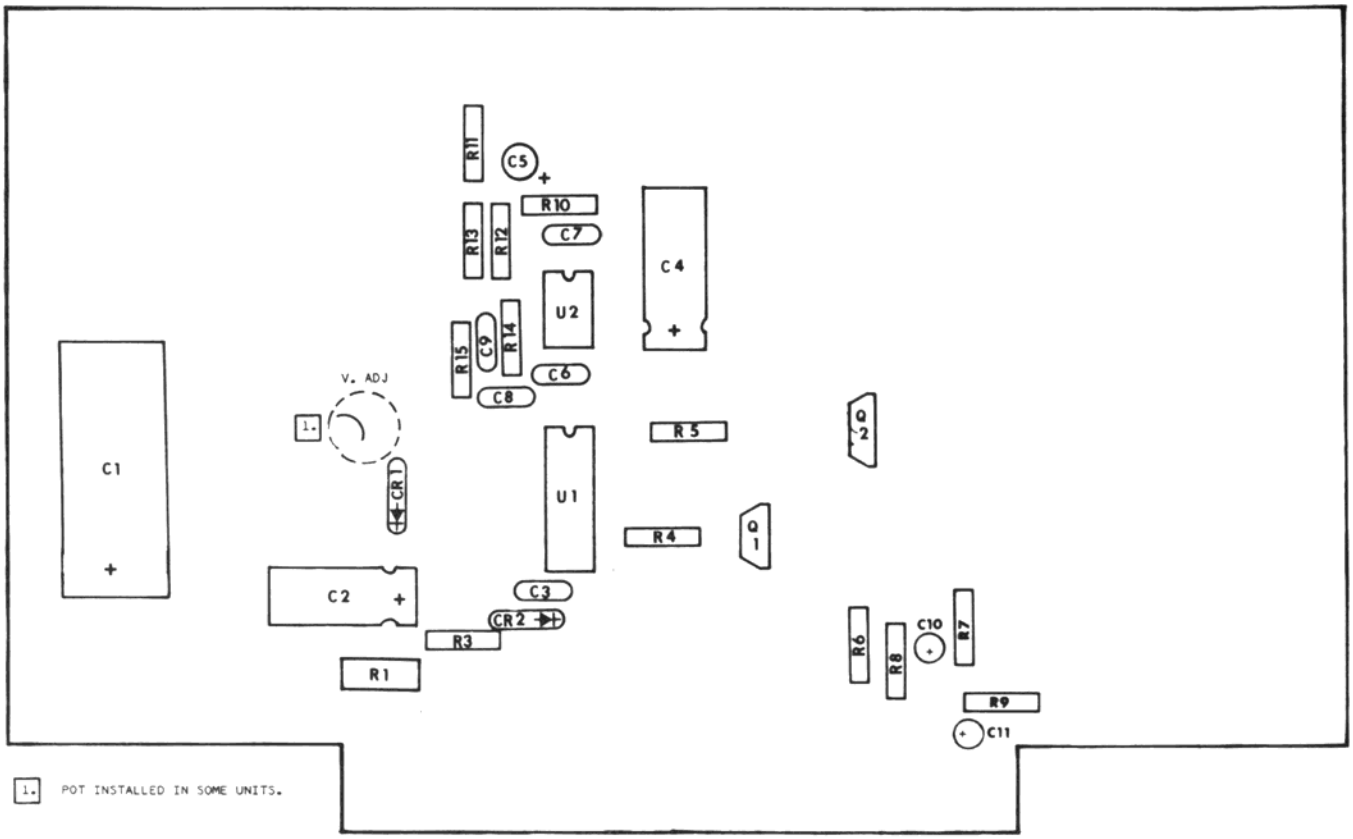
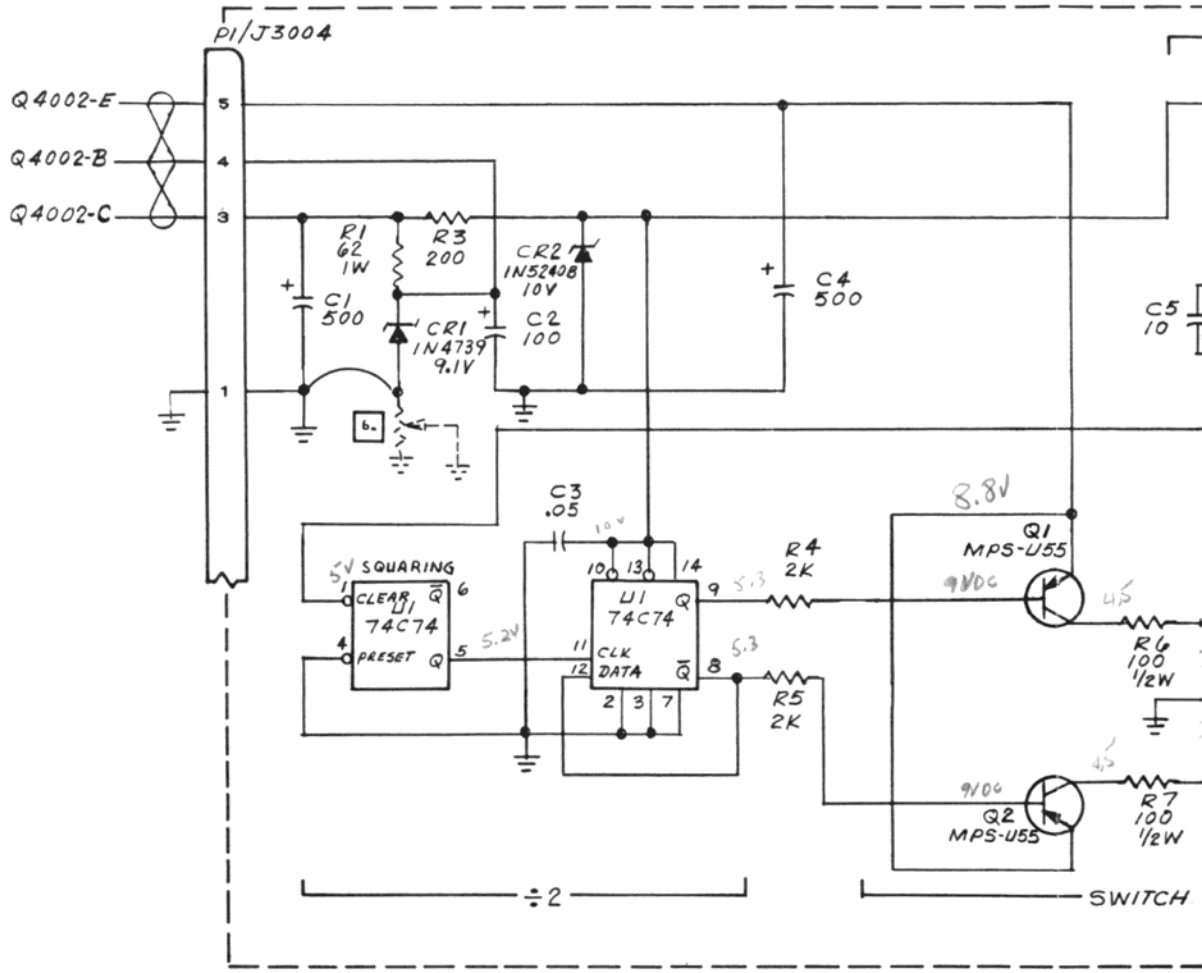


Figure 5-13. Log Converter, 3300

12V DC INVERTER, 3400

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3400	PCB Assy, 12V DC Inverter	7001-0384	Cushman	
	PC Board	1780-0667	Cushman	
	CAPACITORS			
C1	Elect, 500μF, +100-10%, 25V	1014-0002	Ill. Elna	25T500
C2	Elect, 100μF, ±10%, 25V	1013-0003	Sprague	30D107G025DD5
C3	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C4	Elect, 500μF, 15V	1013-0014	Ill. Elna	15T500
C5	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C6	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C7	Mica, 100pF, ±5%, 500V	1002-0011	Elmenco	DM15-F-101J
C8	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C9	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C10	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C11	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
	DIODES			
CR1	Diode, 1N4739A, Si, Zener, 9.1V	1281-0027	IRC	1N4739A
CR2	Diode, 1N5240B, Si, Zener, 10V, 5%	1281-0109	Motorola	1N5240B
	INTEGRATED CIRCUITS			
U1	IC, 74C74 Dual D F/F	2025-0169	National	MM74C74
U2	IC, LM308N, Op Ampl	2025-0070	National	LM308N
	RESISTORS			
R1	Comp, 62Ω, ±5%, 1W	1068-6205	Allen-Bradley	GB6205
R2	Not Used			
R3	Comp, 200Ω, ±5%, 1/4W	1066-2015	Allen-Bradley	CB2015
R4	Comp, 2K, ±5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R5	Comp, 2K, ±5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R6	Comp, 100Ω, ±5%, 1/2W	1067-1015	Allen-Bradley	EB1015
R7	Comp, 100Ω, ±5%, 1/2W	1067-1015	Allen-Bradley	EB1015
R8	Comp, 100Ω, ±5%, 1/2W	1066-1015	Allen-Bradley	EB1015
R9	Comp, 100Ω, ±5%, 1/2W	1066-1015	Allen-Bradley	EB1015
R10	Comp, 2.4K, ±5%, 1/4W	1066-2425	Allen-Bradley	CB2425
R11	Comp, 2.4K, ±5%, 1/4W	1066-2425	Allen-Bradley	CB2425
R12	Comp, 3K, ±5%, 1/4W	1066-3025	Allen-Bradley	CB3025
R13	Comp, 20K, ±5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R14	Comp, 20K, ±5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R15	Comp, 20K, ±5%, 1/4W	1066-2035	Allen-Bradley	CB2035
	TRANSISTORS			
Q1	XSTR, MPSU55, PNP, Si	1272-0074	Motorola	MPS-U55
Q2	XSTR, MPSU55, PNP, Si	1272-0074	Motorola	MPS-U55


R11
C5
R10
C7
R13
R12
C4
U2
R15
C9
R14
C6
C8
V. ADJ
1.
C1
CR1
U1
R5
Q2
R4
Q1
C2
C3
CR2
R3
R1
R6
R8
C10
R7
R9
C11
1. POT INSTALLED IN SOME UNITS.

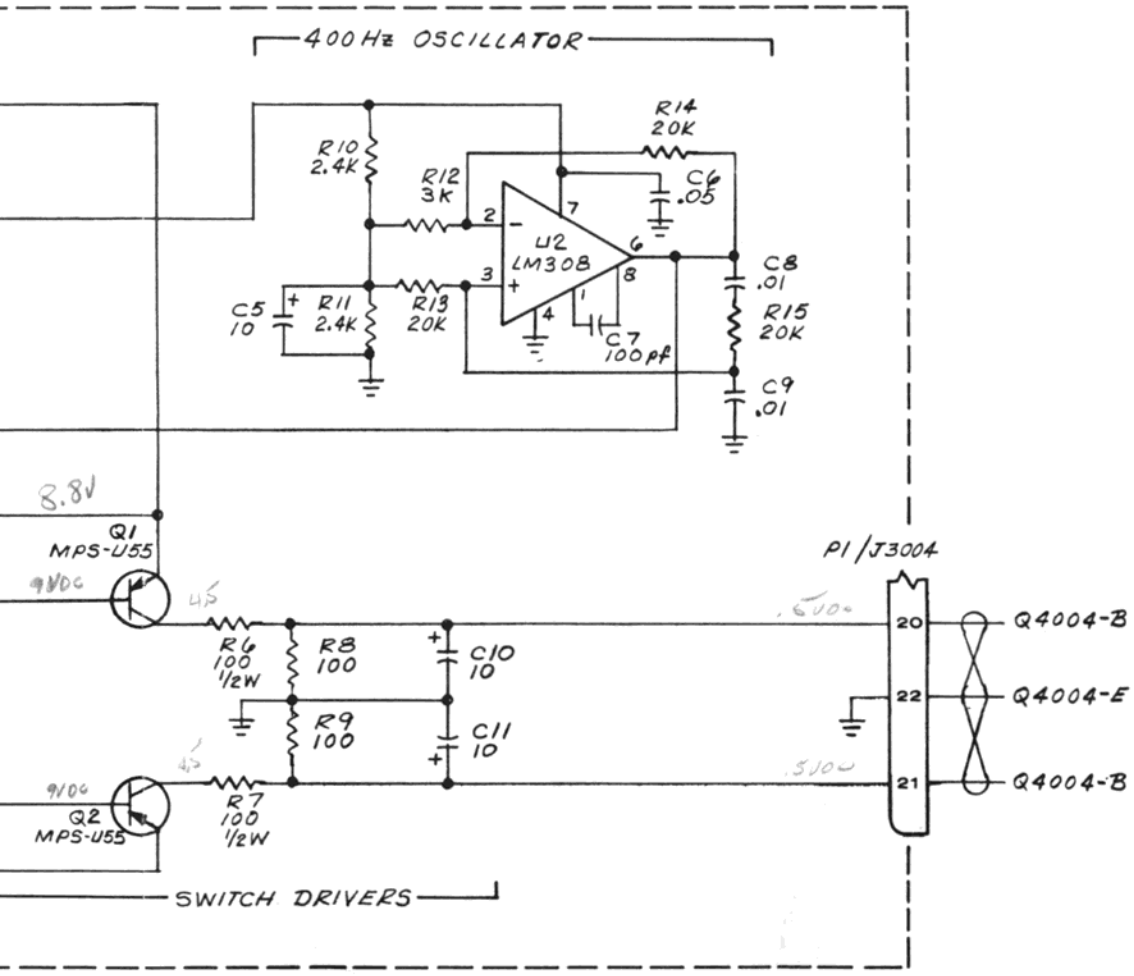


NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

[6.] INSTALLED IN SOME UNITS.

R2 NOT USED.



USED.

Figure 5-14. 12V DC Inverter, 3400

AUDIO/+10V SUPPLY, 3500

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3500	PCB Assy, Audio/+10V Supply	7001-0372	Cushman	
	PC Board	1780-0663	Cushman	
	CAPACITORS			
C1	Elect, 100μF, +75-10%, 12V	1013-0011	Sprague	30D107G012CC5
C2	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C3	Mica, 33PF, 5%, 500V	1002-0024	Elmenco	DM15-E-330J
C4	Elect, 1000μF, +150-10%, 25V	1014-0006	Corn Dubl	WHB10128
C5	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C6	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C7	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C8	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C9	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C10	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C11	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C12	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C13	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C14	Tant, 1μF, 20%, 50V	1011-0013	ITT	TAG F-20-1/50-20
C15	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C16	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C17	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C18	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C19	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C20	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C21	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C22	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C23	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C24	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C25	Cer, .002μF, 20%, 500V	1005-0003	Erie	831-596-Z5U-202M
C26	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C27	Mica, 24PF, 5%, 500V	1002-0051	Elmenco	DM15-C-240J
C28	Mica, 24PF, 5%, 500V	1002-0051	Elmenco	DM15-C-240J
C29	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C30	Trim, 9-35PF, 200V, Vert	1001-0006	Erie	538-002-94D
C31	Trim, 9-35PF, 200V, Vert	1001-0006	Erie	538-002-94D
C32	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C33	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C34	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C35	Tant, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C36	Tant, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C37	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C38	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C39	Mica, 30PF, 5%, 500V	1002-0043	Elmenco	DM15-E-300J
C40	Mica, 510PF, 5%, 500V	1002-0036	Elmenco	DM15-F-511J
C41	Tant, 47μF, 20%, 20V	1011-0009	Dickson	D47GSC20M
C42	Mica, 30PF, 5%, 500V	1002-0043	Elmenco	DM15-E-300J
C43	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C44	Mylar, .1μF, 10%, 100V	1008-0031	Sprague	225P10491
C45	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C46	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C47	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C48	Elect, 2200μF, Plus 150-20%, 25V	1014-0021	United Chem	25TAL2200
C49	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C50, 51	Cer, 1000PF, 10%, 100V	1005-0081	Erie	8121-100-W5R-102K

AUDIO/+10V SUPPLY, 3500 (cont)

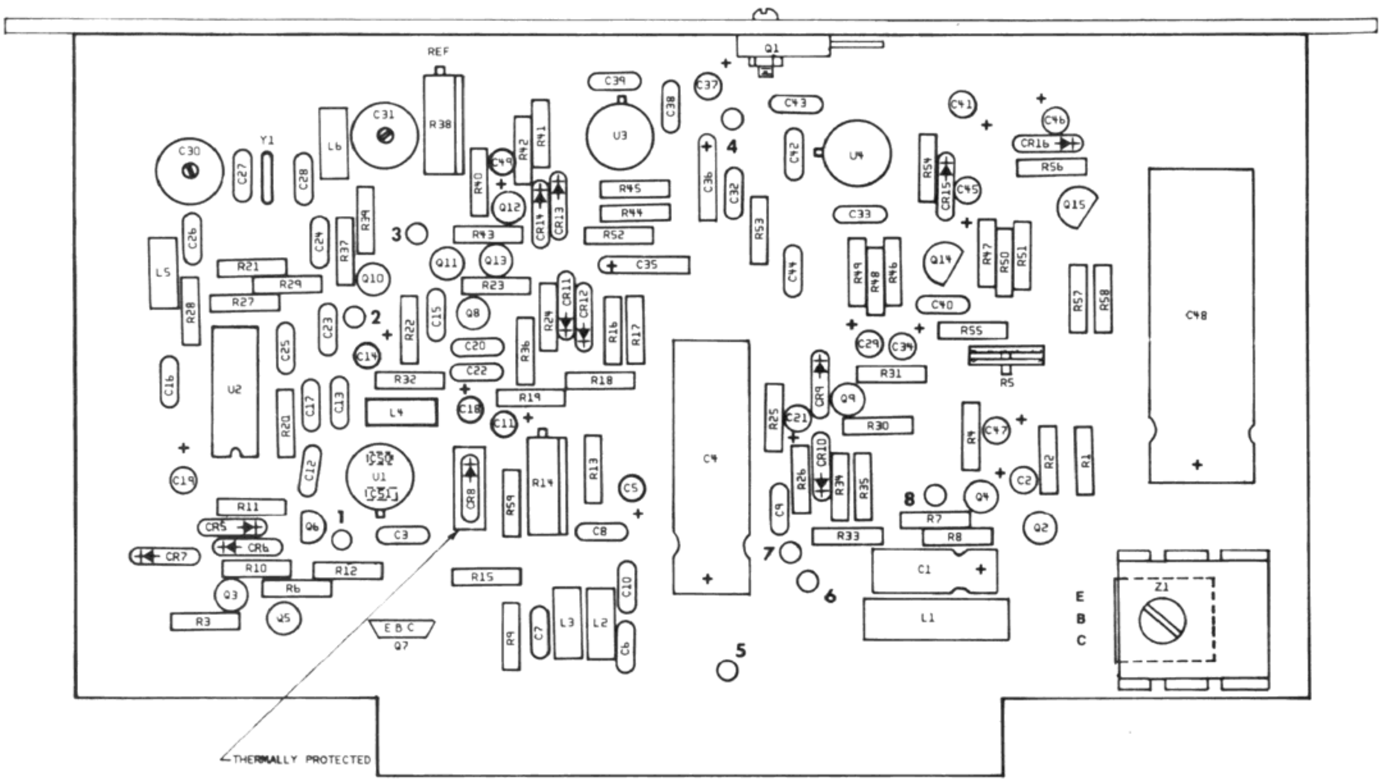
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	CRYSTAL			
Y1	XTAL, 10.700 MHz	2035-0027	Cushman	
	DIODES			
CR1	See Z1			
CR2	See Z1			
CR3	See Z1			
CR4	See Z1			
CR5	Diode, IN3064	1281-0013	Teledyne	IN3064
CR6	Diode, IN3064	1281-0013	Teledyne	IN3064
CR7	Diode, IN3064	1281-0013	Teledyne	IN3064
CR8	Dio, IN827, Si Zener, 6.2V Dif. Jct.	1281-0104	Motorola	IN827
CR9	Diode, IN3064	1281-0013	Teledyne	IN3064
CR10	Diode, IN3064	1281-0013	Teledyne	IN3064
CR11	Diode, IN3064	1281-0013	Teledyne	IN3064
CR12	Diode, IN3064	1281-0013	Teledyne	IN3064
CR13	Diode, IN3064	1281-0013	Teledyne	IN3064
CR14	Diode, IN3064	1281-0013	Teledyne	IN3064
CR15	Diode, IN3064	1281-0013	Teledyne	IN3064
CR16	Diode, IN3064	1281-0013	Teledyne	IN3064
Z1	Br. Rect.	1281-5003	Varo	VS-148
	INDUCTORS			
L1	Choke, 22μH, 10%	1585-0025	Delevan	2890-28
L2	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L3	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L4	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L5	Choke, 4.7μH, 10%	1585-0021	Delevan	1537-28
L6	Choke, 4.7μH, 10%	1585-0021	Delevan	1537-28
	INTEGRATED CIRCUITS			
U1	13, LM308H, 8 Pin Type Op Amp	2025-0057	National	LM308H
U2	IC, CA3089E, FM IF System	2025-0160	RCA	CA3089E
U3	IC, LM301A, Op Amp	2025-0032	National	LM301A
U4	IC, LM301A, Op Amp	2025-0032	National	LM301A
	RESISTORS			
R1	Comp, 5.1 Ohm, 5%, 1/2W	1067-0003	Allen-Bradley	EB0003
R2	Comp, 820 Ohm, 5%, 1/4W	1066-8215	Allen-Bradley	CB8215
R3	Comp, 1 Meg, 5%, 1/4W	1066-1055	Allen-Bradley	CB1055
R4	Comp, 820 Ohm, 5%, 1/4W	1066-8215	Allen-Bradley	CB8215
R5	Pot, 500 Ohm, 20%, 1/4W	1215-0026	CTS	X201R501B
R6	Comp, 30K, 5%, 1/4W	1066-3035	Allen-Bradley	CB3035
R7	Comp, 2.4K, 5%, 1/4W	1066-2425	Allen-Bradley	CB2425
R8	Comp, 2.4K, 5%, 1/4W	1066-2425	Allen-Bradley	CB2425
R9	Comp, 68 Ohm, 5%, 1/4W	1066-6805	Allen-Bradley	CB6805
R10	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R11	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R12	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R13	MF, 3.4K, 1%, 25 PPM FILM	1074-0112	Dale	MFF 1/10
R14	Pot, 1K, 10%, 3/4W	1215-0013	Helitrim	89WR
R15	MF, 5.62K, 1%, 25 PPM FILM	1074-0111	Dale	MFF 1/10

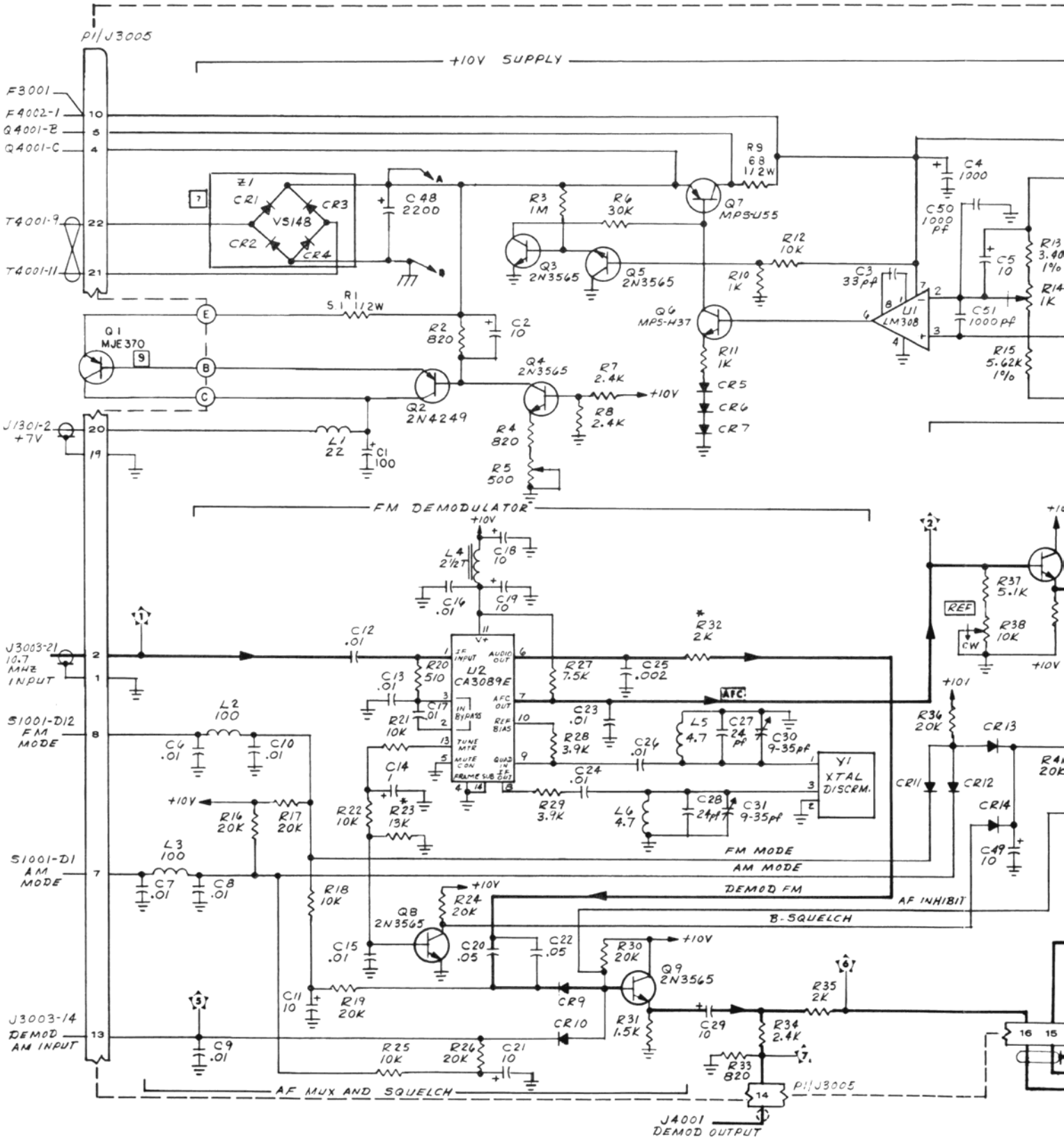
AUDIO/+10V SUPPLY, 3500 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R16	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R17	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R18	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R19	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R20	Comp, 510 Ohm, 5%, 1/4W	1066-5115	Allen-Bradley	CB5115
R21	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R22	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R23	Comp, 13K, 5%, 1/4W	1066-1335	Allen-Bradley	CB1335
R24	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R25	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R26	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R27	Comp, 7.5K, 5%, 1/4W	1066-7525	Allen-Bradley	CB7525
R28	Comp, 3.9K, 5%, 1/4W	1066-3925	Allen-Bradley	CB3925
R29	Comp, 3.9K, 5%, 1/4W	1066-3925	Allen-Bradley	CB3925
R30	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R31	Comp, 1.5K, 5%, 1/4W	1066-1525	Allen-Bradley	CB1525
R32	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R33	Comp, 820 Ohm, 5%, 1/4W	1066-8215	Allen-Bradley	CB8215
R34	Comp, 2.4K, 5%, 1/4W	1066-2425	Allen-Bradley	CB2425
R35	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R36	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R37	Comp, 5.1K, 5%, 1/4W	1066-5125	Allen-Bradley	CB5125
R38	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R39	Comp, 2K, 5%, 1/4W	1066-2025	Allen-Bradley	CB2025
R40	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R41	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R42	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R43	Comp, 5.1K, 5%, 1/4W	1066-5125	Allen-Bradley	CB5125
R44	MF, 10K, 1%, 1/10W	1074-1029	Dale	MFF 1/10
R45	MF, 10K, 1%, 1/10W	1074-1029	Dale	MFF 1/10
R46	Comp, 51K, 5%, 1/4W	1066-5135	Allen-Bradley	CB5135
R47	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R48	Comp, 5.1K, 5%, 1/4W	1066-5125	Allen-Bradley	CB5125
R49	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R50	Comp, 75 Ohm, 5%, 1/4W	1066-7505	Allen-Bradley	CB7505
R51	Comp, 75 Ohm, 5%, 1/4W	1066-7505	Allen-Bradley	CB7505
R52	Comp, 300K, 5%, 1/4W	1066-3045	Allen-Bradley	CB3045
R53	Comp, 30K, 5%, 1/4W	1066-3035	Allen-Bradley	CB3035
R54	Comp, 4.3K, 5%, 1/4W	1066-4325	Allen-Bradley	CB4325
R55	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045
R56	Comp, 4.3K, 5%, 1/4W	1066-4325	Allen-Bradley	CB4325
R57	Comp, 5.1 Ohm, 5%, 1/4W	1066-0002	Allen-Bradley	CB0002
R58	Comp, 5.1 Ohm, 5%, 1/4W	1066-0002	Allen-Bradley	CB0002
R59	MF, 511 Ohm, 1%, 1/10W	1074-1008	Dale	MFF 1/10
	TRANSISTORS			
Q1	Trans, MJE370	1272-0102	Motorola	MJE370
Q2	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q3	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q4	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q5	Trans, 2N3565	1272-0017	Fairchild	2N3565

AUDIO/+10V SUPPLY, 3500 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
Q6	Trans, MPS H37	1272-0073	Motorola	MPS-H37
Q7	Trans, MPS-U55	1272-0074	Motorola	MPS-U55
Q8	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q9	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q10	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q11	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q12	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q13	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q14	Trans, 2N3642	1272-0018	Fairchild	2N3642
Q15	Trans, 2N3644	1272-0040	Fairchild	2N3644


Q1
REF
R38
C39
C37
C43
C41
C46
CR16
R56
C31
L6
U3
C38
U4
C30
Y1
C27
C28
R42
R41
C49
R40
Q12
CR14
CR13
R45
R44
R52
C35
C36
C32
C42
R54
CR15
C45
Q15
C26
R39
R37
C24
3
R43
Q11
Q13
R53
C33
R49
R48
R46
Q14
R47
R50
R51
L5
R21
R29
R27
Q10
R23
C44
C40
R57
R58
C48
R28
2
C23
R22
C15
Q8
R24
CR11
CR12
R16
R17
R36
C20
C22
R18
R19
C29
C34
R55
R5
C16
U2
C25
C14
R32
C17
C13
L4
C18
C11
C4
R25
C21
CR9
Q9
R31
R30
R4
C47
R2
R1
R20
C19
C12
U1
CR8
R14
R13
R59
C5
R26
CR10
R34
R35
C2
R11
1
CR5
Q6
CR6
CR7
C3
C8
C9
8
R7
Q4
Q2
R33
R8
R10
R12
R15
7
6
C1
R6
Q3
Q5
R3
E B C
Q7
R9
C7
L3
L2
C10
C6
5
L1
Z1
E
B
C
THERMALLY PROTECTED


P1/J3005
+10V SUPPLY
F3001
F4002-1
Q4001-B
Q4001-C
T4001-9
T4001-11
Z1
CR1
CR2
CR3
CR4
V5148
C48 2200
R9 68 1/2W
Q7 MPS-U55
R3 1M
R6 30K
Q3 2N3565
Q5 2N3565
R12 10K
R10 1K
C3 33pf
C4 1000
C50 1000 pf
C5 10
C51 1000pf
U1 LM308
R13 3.40K 1%
R14 1K
R15 5.62K 1%
R1 5.1 1/2W
R2 820
C2 10
Q1 MJE370
Q6 MPS-H37
R11 1K
CR5
CR6
CR7
Q4 2N3565
R7 2.4K
R8 2.4K
+10V
Q2 2N4249
R4 820
R5 500
J1301-2 +7V
L1 22
C1 100
FM DEMODULATOR
L4 2½T
C18 10
C16 .01
C19 10
U2 CA3089E
IF INPUT
AUDIO OUT
AFC OUT
REF BIAS
IN BYPASS
TUNE MTR
MUTE CON
QUAD IN
FRAME SUB OUT
C12 .01
R32 2K
R37 5.1K
REF
R38 10K
CW
J3003-21 10.7 MHz INPUT
C13 .01
R20 510
C17 .01
R21 10K
R27 7.5K
C25 .002
AFC
C23 .01
R28 3.9K
C26 .01
L5 4.7
C27 24 pf
C30 9-35pf
Y1 XTAL DISCRM.
C24 .01
R29 3.9K
L6 4.7
C28 24pf
C31 9-35pf
C14 1
R22 10K
R23 13K
R36 20K
CR13
CR11
CR12
CR14
C49 10
S1001-D12 FM MODE
L2 100
C6 .01
C10 .01
R16 20K
R17 20K
S1001-D1 AM MODE
L3 100
C7 .01
C8 .01
R18 10K
FM MODE
AM MODE
DEMOD FM
AF INHIBIT
B-SQUELCH
R24 20K
Q8 2N3565
C15 .01
C20 .05
C22 .05
R30 20K
Q9 2N3565
C11 10
R19 20K
CR9
CR10
R31 1.5K
C29 10
R34 2.4K
R35 2K
J3003-14 DEMOD AM INPUT
C9 .01
R25 10K
R26 20K
C21 10
R33 820
AF MUX AND SQUELCH
P1/J3005
J4001 DEMOD OUTPUT

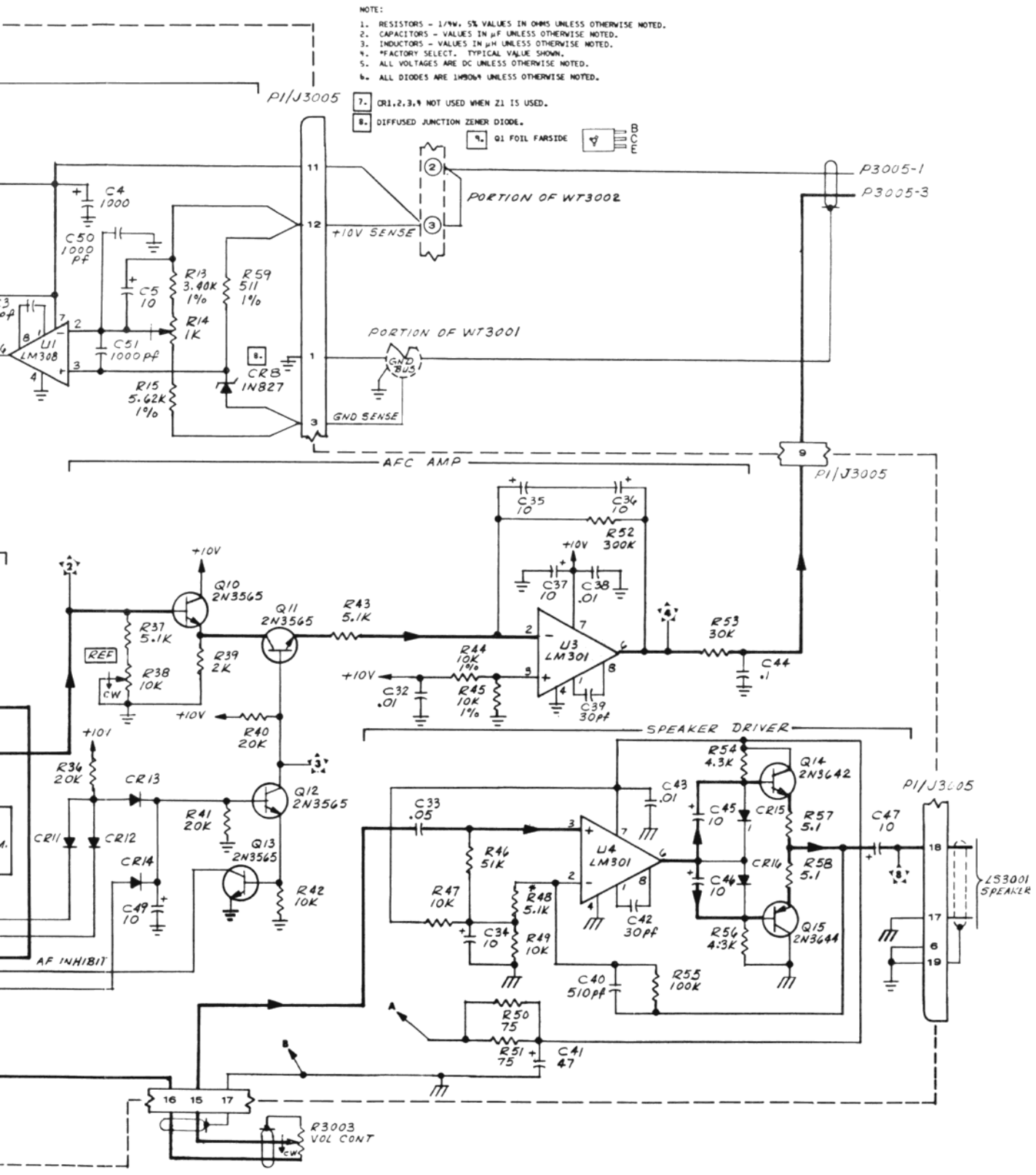


Figure 5-15. Audio/+10V Supply, 3500

RAMP GENERATOR/DEFLECTION AMPLIFIER, 3600

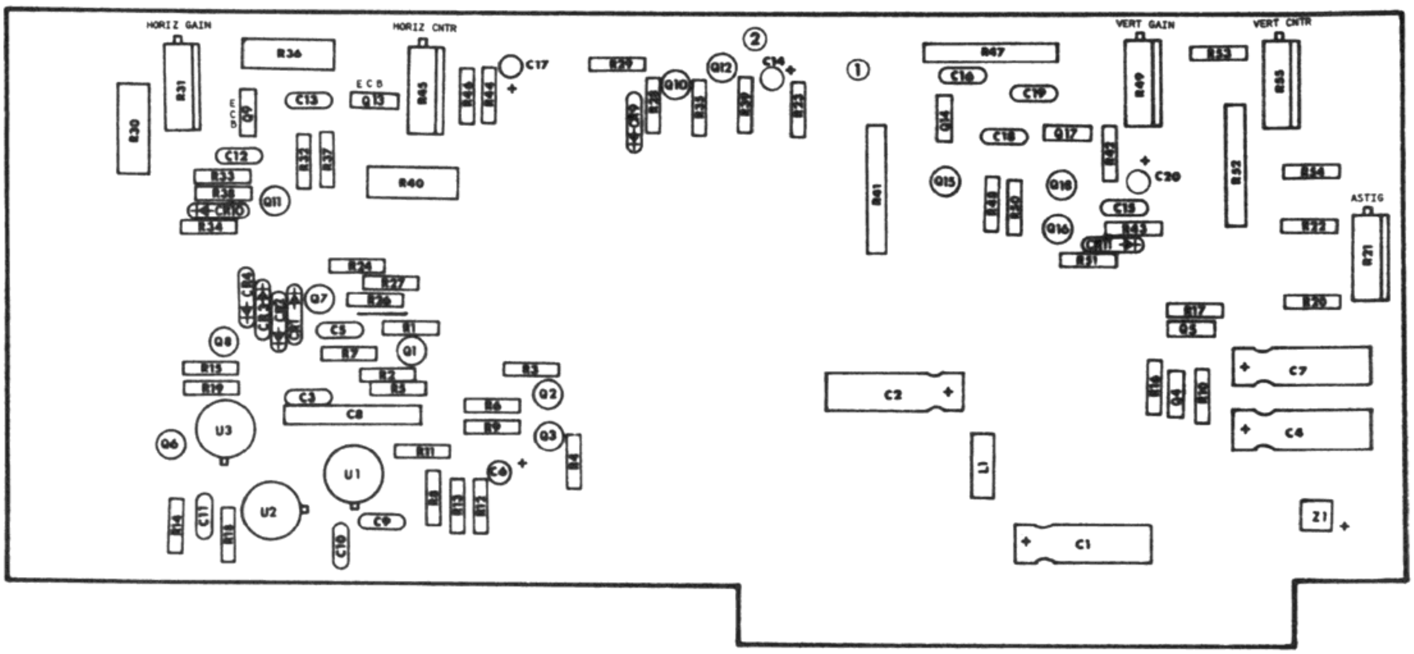
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3600	PCB Assy, Ramp Gen/Defl Ampl	7001-0367	Cushman	
	PC Board	1780-0658	Cushman	
	CAPACITORS			
C1	Elect, 100μF, +75-10%, 12V	1013-0011	Sprague	30D107G012CC5
C2	Elect, 100μF, +75-10%, 12V	1013-0011	Sprague	30D107G012CC5
C3	Cer, .02μF, +80-20%, 1K V	1005-0040	Erie	828-000-Z5U-203Z
C4	Elect, 1μF, +150-10%, 450V	1014-0011	STM	33C450DB10
C5	Mica, 10PF, 5%, 500V	1002-0016	Elmenco	DM15-C-100J
C6	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C7	Elect, 1μF, +150-10%, 450V	1014-0011	STM	33C450DB10
C8	Poly, .68μF, 10%, 100V	1008-0039	Electrocube	625B1B684K
C9	Mica, 33PF, 5%, 500V	1002-0024	Elmenco	DM15-E-330J
C10	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C11	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C12	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C13	Mica, 820PF, 5%, 300V	1002-0039	Elmenco	DM15-F-821J
C14	Tant, 1μF, 20%, 50V	1011-0013	ITT	TAG-F-20-1/50-20
C15	Cer, .05μF, +80-20%, 25V	1005-0014	Erie	5855-505-Y5U0-503Z
C16	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C17	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C18	Mica, 820PF, 5%, 300V	1002-0039	Elmenco	DM15-F-821J
C19	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C20	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
	DIODES			
CR1	Diode, IN3064	1281-0013	Teledyne	IN3064
CR2	Diode, IN3064	1281-0013	Teledyne	IN3064
CR3	Diode, IN3064	1281-0013	Teledyne	IN3064
CR4	Diode, IN3064	1281-0013	Teledyne	IN3064
CR5	See Z1			
CR6	See Z1			
CR7	See Z1			
CR8	See Z1			
CR9	Diode, HPA2800	1283-0001	HP	5082-2800
CR10	Diode, IN3064	1281-0013	Teledyne	IN3064
CR11	Diode, IN3064	1281-0013	Teledyne	IN3064
Z1	Dio, VM48 Br Rect	1281-0103	Varo	VM-48
	INDUCTOR			
L1	RF Choke, 330μH, 5%	1585-0045	Delevan	2500-04
	INTEGRATED CIRCUITS			
U1	IC, LM301A Op Amp	2025-0032	National	LM301A
U2	IC, LM301A Op Amp	2025-0032	National	LM301A
U3	IC, LM301A Op Amp	2025-0032	National	LM301A

RAMP GENERATOR/DEFLECTION AMPLIFIER, 3600 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	RESISTORS			
R1	Comp, 3.9K, 5%, 1/4W	1066-3925	Allen-Bradley	CB3925
R2	Comp, 6.8K, 5%, 1/4W	1066-6825	Allen-Bradley	CB6825
R3	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045
R4	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045
R5	Comp, 910 Ohm, 5%, 1/4W	1068-9115	Allen-Bradley	CB9115
R6	Comp, 75K, 5%, 1/4W	1066-7535	Allen-Bradley	CB7535
R7	Comp, 3.9K, 5%, 1/4W	1066-3925	Allen-Bradley	CB3925
R8	Comp, 1.8M, 5%, 1/4W	1066-1855	Allen-Bradley	CB1855
R9	Comp, 160K, 5%, 1/4W	1066-1645	Allen-Bradley	CB1645
R10	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045
R11	Comp, 910 Ohm, 5%, 1/4W	1066-9115	Allen-Bradley	CB9115
R12	MF, 24.3K, 1%, 1/8W	1075-0097	Dale	MFF 1/8
R13	MF, 24.3K, 1%, 1/8W	1075-0097	Dale	MFF 1/8
R14	MF, 6.19K, 1%, 1/8W	1075-0109	Dale	MFF 1/8
R15	MF, 14.3K, 1%, 100 PPM	1074-0113	Dale	MFF 1/10
R16	Comp, 510K, 5%, 1/4W	1066-5145	Allen-Bradley	CB5145
R17	Comp, 24K, 5%, 1/4W	1066-2435	Allen-Bradley	CB2435
R18	MF, 14.3K, 1%, 100 PPM	1074-0113	Dale	MFF 1/10
R19	MF, 6.19K, 1%, 1/8W	1075-0109	Dale	MFF 1/8
R20	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045
R21	Pot, 100K, 20%, 1/4W	1215-0030	Mepco	ET46X104W
R22	Comp, 100K, 5%, 1/4W	1066-1045	Allen-Bradley	CB1045
R23	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R24	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R25	Not Used			
R26	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R27	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R28	Comp, 5.1K, 5%, 1/4W	1066-5125	Allen-Bradley	CB5125
R29	Comp, 5.1K, 5%, 1/4W	1066-5125	Allen-Bradley	CB5125
R30	Comp, 51K, 5%, 1W	1068-5135	Allen-Bradley	CB5135
R31	Pot, 200K, 10%, 3/4W	1215-0032	Beckman	89WR
R32	Comp, 430 Ohm, 5%, 1/4W	1066-4315	Allen-Bradley	CB4315
R33	Comp, 3.9K, 5%, 1/4W	1066-3925	Allen-Bradley	CB3925
R34	Comp, 510 Ohm, 5%, 1/4W	1066-5115	Allen-Bradley	CB5115
R35	Comp, 5.1K, 5%, 1/4W	1066-5125	Allen-Bradley	CB5125
R36	Comp, 51K, 5%, 1W	1068-5135	Allen-Bradley	CB5135
R37	Comp, 430 Ohm, 5%, 1/4W	1066-4315	Allen-Bradley	CB4315
R38	Comp, 200 Ohm, 5%, 1/4W	1066-2015	Allen-Bradley	CB2015
R39	Comp, 10 Meg, 5%, 1/4W	1066-1065	Allen-Bradley	CB1065
R40	Comp, 51K, 5%, 1W	1068-5135	Allen-Bradley	CB5135
R41	MF, 49.9K, 1%, 1/2W, 150 PPM	1076-0019	Dale	MFF 1/2
R42	Comp, 3.9K, 5%, 1/4W	1066-3925	Allen-Bradley	CB3925
R43	Comp, 510 Ohm, 5%, 1/4W	1066-5115	Allen-Bradley	CB5115
R44	MF, 2K, 1%, 1/8W	1075-0103	Dale	MFF 1/8
R45	Pot, 1K, 10%, 3/4W	1215-0013	Helitrim	89WR
R46	MF, 2K, 1%, 1/8W	1075-0103	Dale	MFF 1/8
R47	MF, 30.1K, 1%, 1/2W, 150 PPM	1076-0018	Dale	MFF 1/2
R48	MF, 475 Ohm, PPM	1075-0023	Dale	MFF 1/8
R49	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R50	MF, 475 Ohm, PPM	1075-0023	Dale	MFF 1/8

RAMP GENERATOR/DEFLECTION AMPLIFIER, 3600 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R51	Comp, 200 Ohm, 5%, 1/4W	1066-2015	Allen-Bradley	CB2015
R52	MF, 49.9K, 1%, 1/2W, 150 PPM	1076-0019	Dale	MFF 1/2
R53	MF, 2K, 1%, 1/8W	1075-0103	Dale	MFF 1/8
R54	MF, 2K, 1%, 1/8W	1075-0103	Dale	MFF 1/8
R55	Pot, 1K, 10%, 3/4W	1215-0013	Helitrim	89WR
	TRANSISTORS			
Q1	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q2	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q3	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q4	Trans, MJE340	1272-0046	Motorola	MJE340
Q5	Trans, MJE340	1272-0046	Motorola	MJE340
Q6	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q7	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q8	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q9	Trans, MJE340	1272-0046	Motorola	MJE340
Q10	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q11	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q12	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q13	Trans, MJE340	1272-0046	Motorola	MJE340
Q14	Trans, MJE340	1272-0046	Motorola	MJE340
Q15	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q16	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q17	Trans, MJE340	1272-0046	Motorola	MJE340
Q18	Trans, 2N3565	1272-0017	Fairchild	2N3565


HORIZ GAIN
HORIZ CNTR
VERT GAIN
VERT CNTR
ASTIG
R36
R31
R30
R45
R46
R44
C17
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Q12
C14
R47
C16
C19
R49
R53
R55
Q13
C13
C12
R33
R38
R34
Q11
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R40
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R4
U2
C9
C10
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R14
R18
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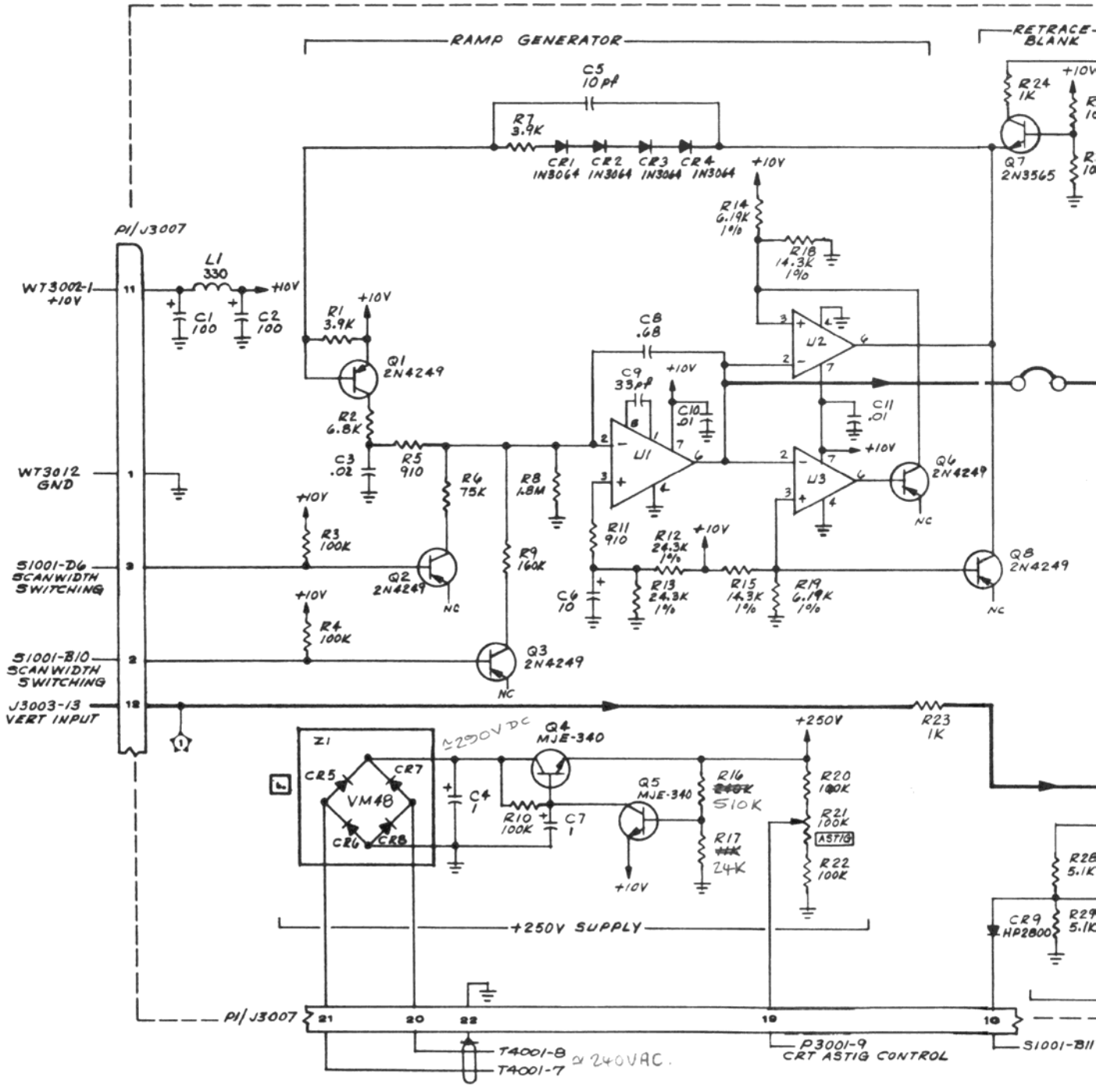
C7
C4
Z1



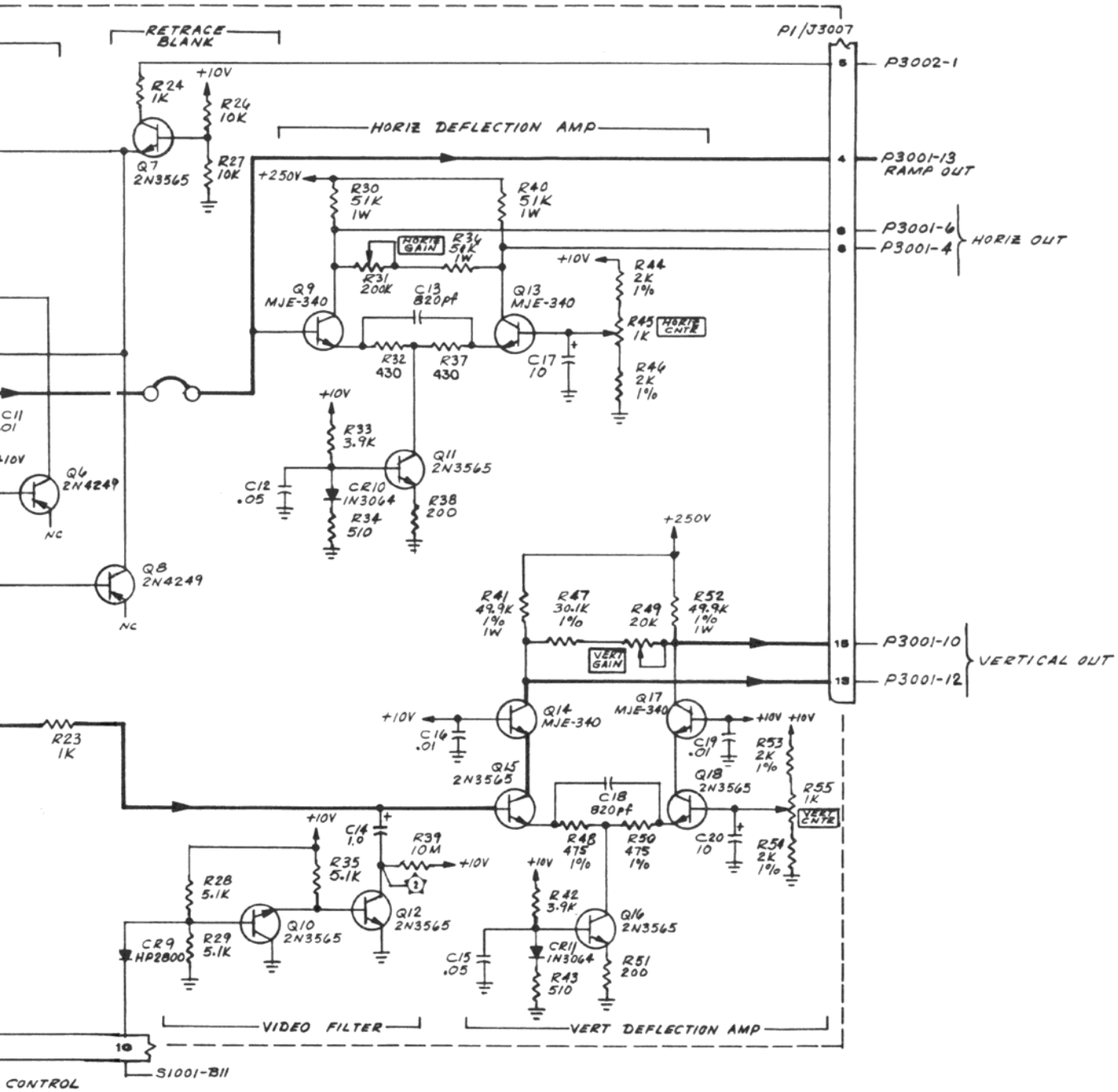
NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

[1] CR5, CR6, CR7, CR8 NOT USED WHEN Z1 IS USED.

U NO	TYPE	VCC	GND
1,2,3	LM301A		

Q 4, 5



R25 NOT USED

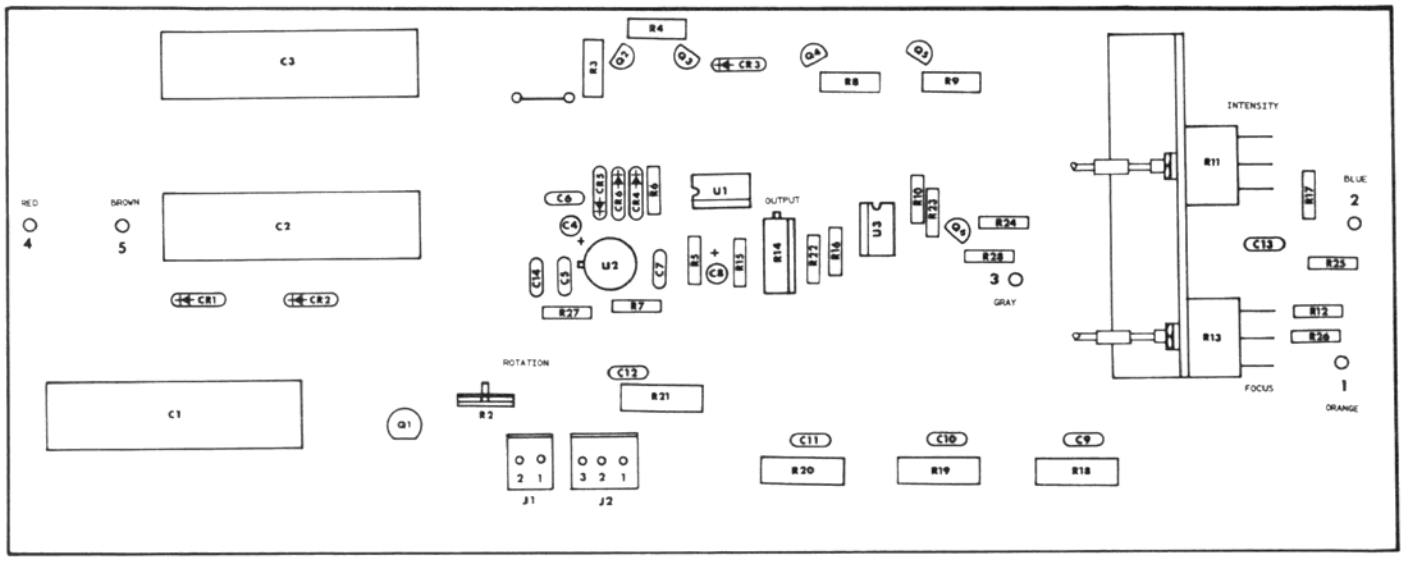
Figure 5-16. Ramp Generator/Deflection Amplifier, 3600

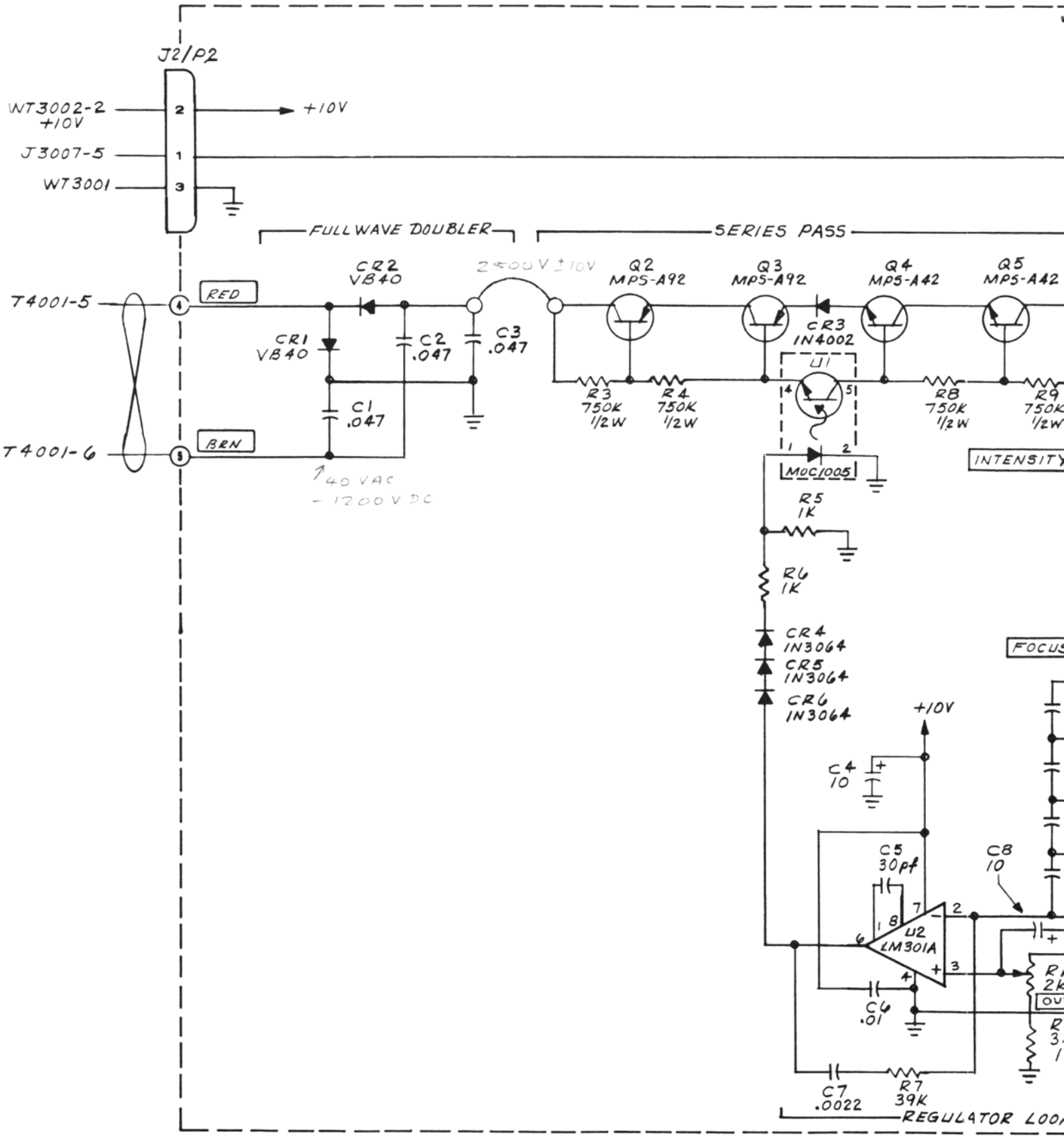
HIGH VOLTAGE, 3700

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3700	PCB Assy, High Voltage	7001-0366	Cushman	
	PC Board	1780-0659	Cushman	
	CAPACITORS			
C1	Mylar, .047μF, 10%, 4000V	1008-0083	F-Dyne	MPE-11H-.047-4000-10
C2	Mylar, .047μF, 10%, 4000V	1008-0083	F-Dyne	MPE-11H-.047-4000-10
C3	Mylar, .047μF, 10%, 4000V	1008-0083	F-Dyne	MPE-11H-.047-4000-10
C4	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C5	Mica, 30PF, 5%, 500V	1002-0043	Elmenco	DM15-E-300J
C6	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
C7	Cer, .002μF, 20%, 500V	1005-0003	Erie	831-596-Z5U-202M
C8	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C9	Mica, 100PF, 5%, 500V	1002-0011	Elmenco	DM15-F-101J
C10	Mica, 100PF, 5%, 500V	1002-0011	Elmenco	DM15-F-101J
C11	Mica, 100PF, 5%, 500V	1002-0011	Elmenco	DM15-F-101J
C12	Mica, 100PF, 5%, 500V	1002-0011	Elmenco	DM15-F-101J
C13	Cer, 680PF, 20%, 3K V	1005-0118	Sprague	30GA-T68
C14	Cer, .01μF, +80-20%, 25V	1005-0013	Erie	5835-512-Y5U-103Z
	DIODES			
CR1	Diode, VB-40	1281-0029	Varo	VB-40
CR2	Diode, VB-40	1281-0029	Varo	VB-40
CR3	Diode, IN4002	1281-0023	ITT	IN4002
CR4	Diode, IN3064	1281-0013	Teledyne	IN3064
CR5	Diode, IN3064	1281-0013	Teledyne	IN3064
CR6	Diode, IN3064	1281-0013	Teledyne	IN3064
	INTEGRATED CIRCUITS			
U1	IC, MOC1005, Op to-Isolator, 5000V	2025-0174	Motorola	MOC1005P
U2	IC, LM301A, Op Amp	2025-0032	National	LM301A
U3	IC, MOC1005, Op to-Isolator, 5000V	2025-0174	Motorola	MOC1005P
	RESISTORS			
R1	Not Used			
R2	Pot, 2.5K, 20%, 1/4W, CER TRMR	1215-0031	Mepco	FT46X252W
R3	Comp, 750K, 5%, 1/2W	1067-7545	Allen-Bradley	EB7545
R4	Comp, 750K, 5%, 1/2W	1067-7545	Allen-Bradley	EB7545
R5	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R6	Comp, 1K, 5%, 1/4W	1066-1025	Allen-Bradley	CB1025
R7	Comp, 39K, 5%, 1/4W	1066-3935	Allen-Bradley	CB3935
R8	Comp, 750K, 5%, 1/2W	1067-7545	Allen-Bradley	EB7545
R9	Comp, 750K, 5%, 1/2W	1067-7545	Allen-Bradley	EB7545
R10	Comp, 3.9K, 5%, 1/4W	1066-3925	Allen-Bradley	CB3925
R11	Pot, 100K, 20%, 1/2W	1203-0036	Allen-Bradley	WA4G032S104MA
R12	Comp, 300K, 5%, 1/4W	1066-3045	Allen-Bradley	CB3045
R13	Pot, 500K, 20%, 1/2W	1203-0038	Allen-Bradley	WA4G032S504MA
R14	Pot, 2K, 10%, 3/4W	1215-0015	Beckman	89 WR2K
R15	MF, 3.01K, 1%, 1/8W	1075-0127	Dale	MFF 1/8
R16	Comp, 5.1K, 5%, 1/4W	1066-5125	Allen-Bradley	CB5125
R17	Comp, 10K, 5%, 1/4W	1066-1035	Allen-Bradley	CB1035
R18	Comp, 750K, 5%, 1W	1068-7545	Allen-Bradley	GB7545
R19	Comp, 750K, 5%, 1W	1068-7545	Allen-Bradley	GB7545
R20	Comp, 750K, 5%, 1W	1068-7545	Allen-Bradley	GB7545

HIGH VOLTAGE, 3700 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R21	Comp, 750K, 5%, 1W	1068-7545	Allen-Bradley	GB7545
R22	NF, 4.99K, 1%, 1/8W	1075-0095	Dale	MFF 1/8
R23	Comp, 20K, 5%, 1/4W	1066-2035	Allen-Bradley	CB2035
R24	Comp, 1 Meg, 5%, 1/4W	1066-1055	Allen-Bradley	CB1055
R25	Comp, 56K, 5%, 1/4W	1066-5635	Allen-Bradley	CB5635
R26	Comp, 56K, 5%, 1/4W	1066-5635	Allen-Bradley	CB5635
R27	Comp, 13K, 5%, 1/4W	1066-1335	Allen-Bradley	CB1335
R28	Comp, 200K, 5%, 1/4W	1066-2045	Allen-Bradley	CB2045
	TRANSISTORS			
Q1	Trans, 2N3567	1272-0014	Fairchild	2N3567
Q2	XSTR, MPSA, 92 PNP, Si, Hi-Volt	1272-0088	Motorola	MPSA92
Q3	XSTR, MPSA, 92 PNP, Si, Hi-Volt	1272-0088	Motorola	MPSA92
Q4	XSTR, MPSA, 42 NPN, Si, Hi-Volt	1272-0089	Motorola	MPSA42
Q5	XSTR, MPSA, 42 NPN, Si, Hi-Volt	1272-0089	Motorola	MPSA42
Q6	XSTR, MPSA, 42 NPN, Si, Hi-Volt	1272-0089	Motorola	MPSA42
	CONNECTORS			
J5301	Conn, 2 Pin Locking Mintr JK	2535-0086	Molex	09-65-1021
J5302	Conn, 3 Pin Receptacle Mini	2535-0044	Molex	2391-3A


C3
R4
R3
Q2
Q3
CR3
Q4
R8
Q5
R9
INTENSITY
RED
4
BROWN
5
C2
C6
CR4
CR5
CR6
R6
U1
OUTPUT
C4
U2
C14
C5
C7
R5
C8
R15
R14
R17
U3
R10
R23
Q6
R24
R28
3
GRAY
BLUE
2
R11
C13
R25
CR1
CR2
R27
R7
R12
R26
R13
ROTATION
C12
R21
C1
Q1
R2
1
ORANGE
FOCUS
C11
C10
C9
R20
R19
R18
J1
J2



NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

R1 NOT USED

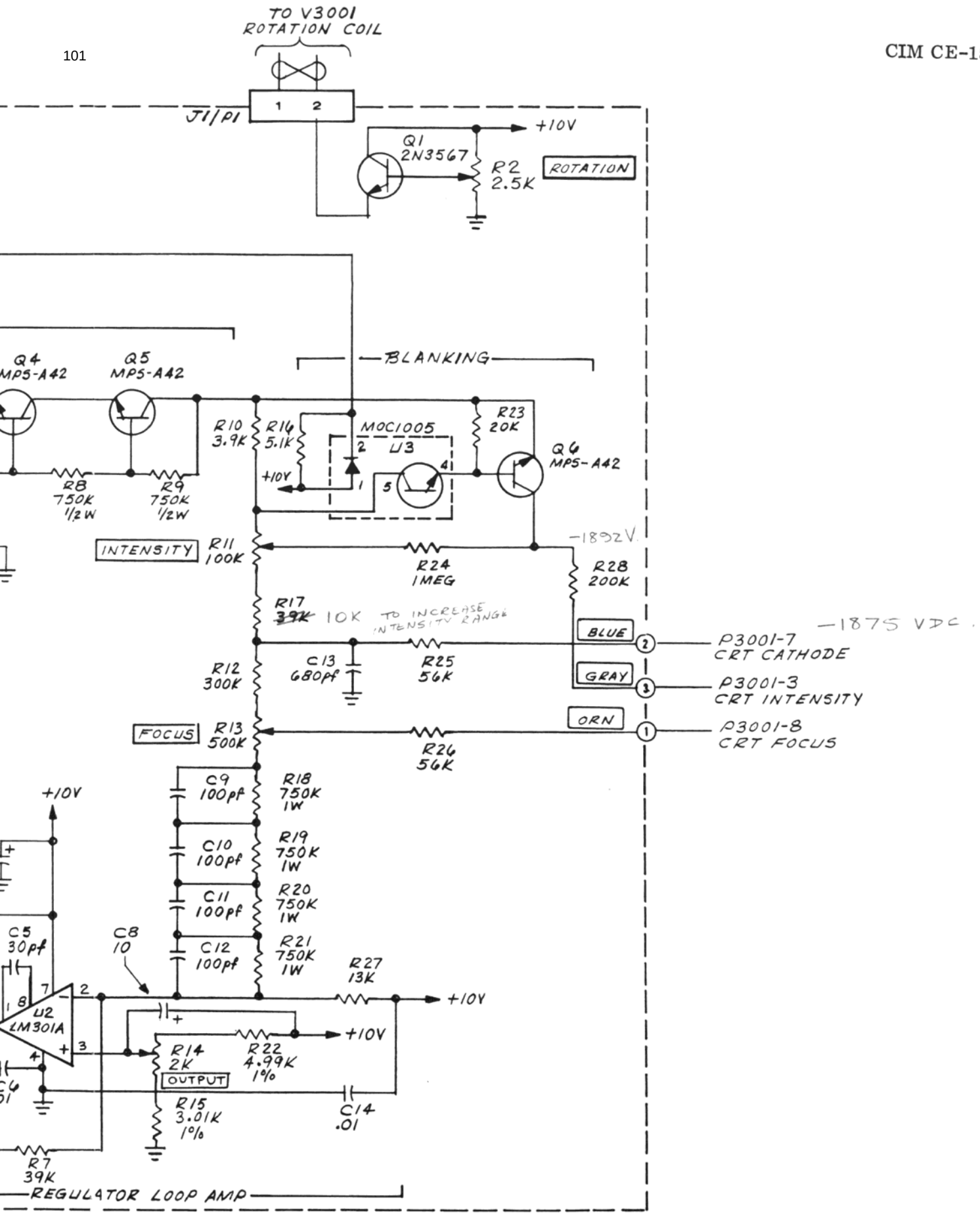
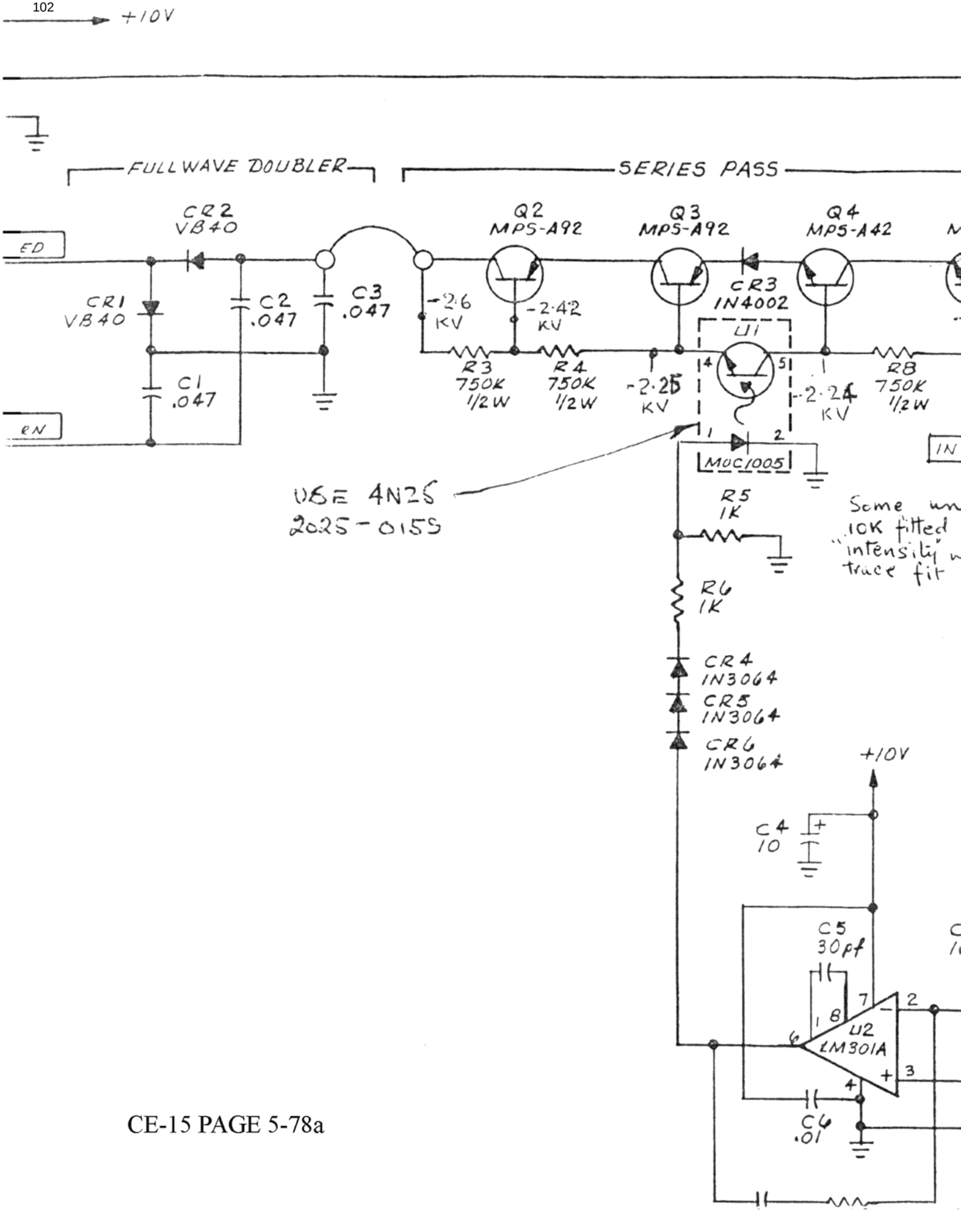
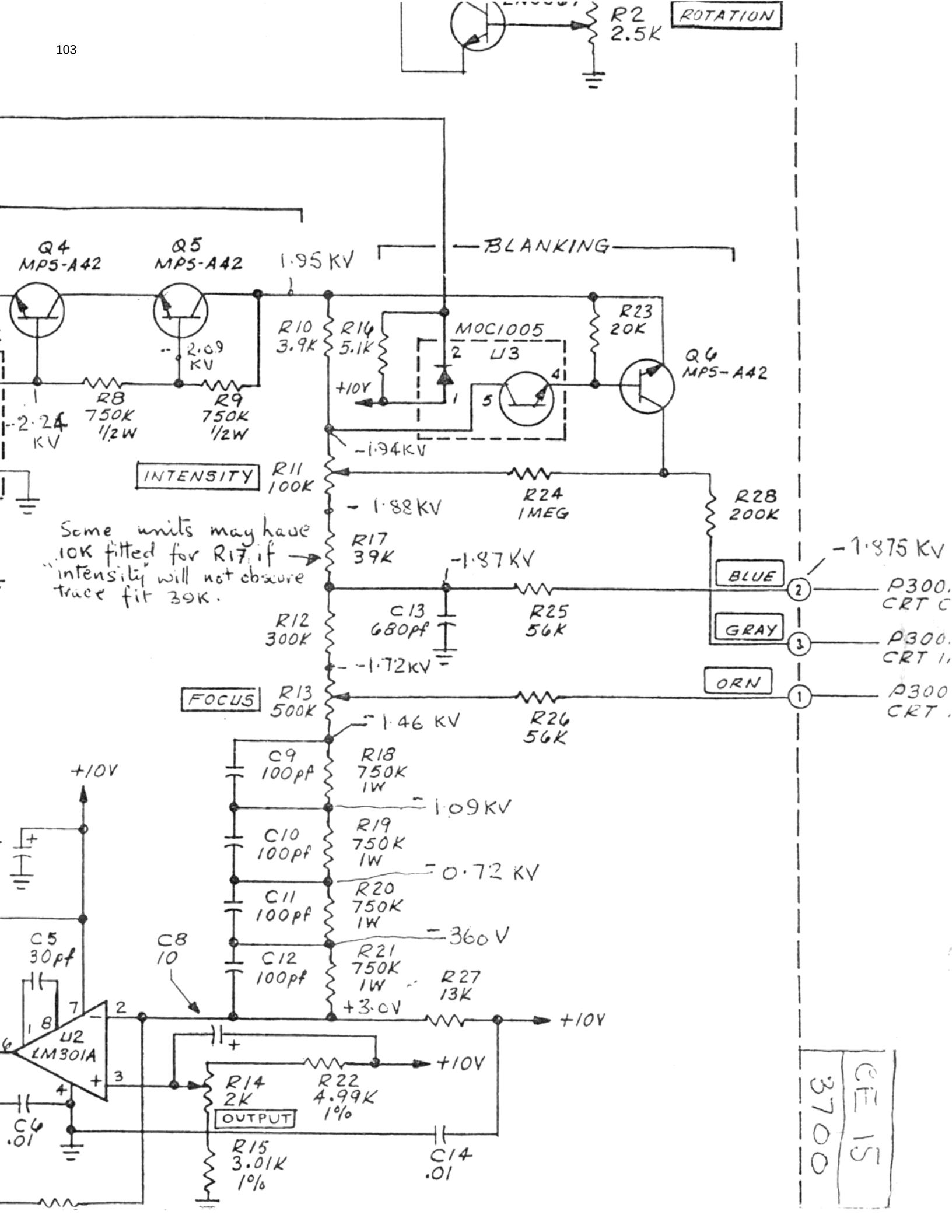


Figure 5-17. High Voltage Supply, 3700

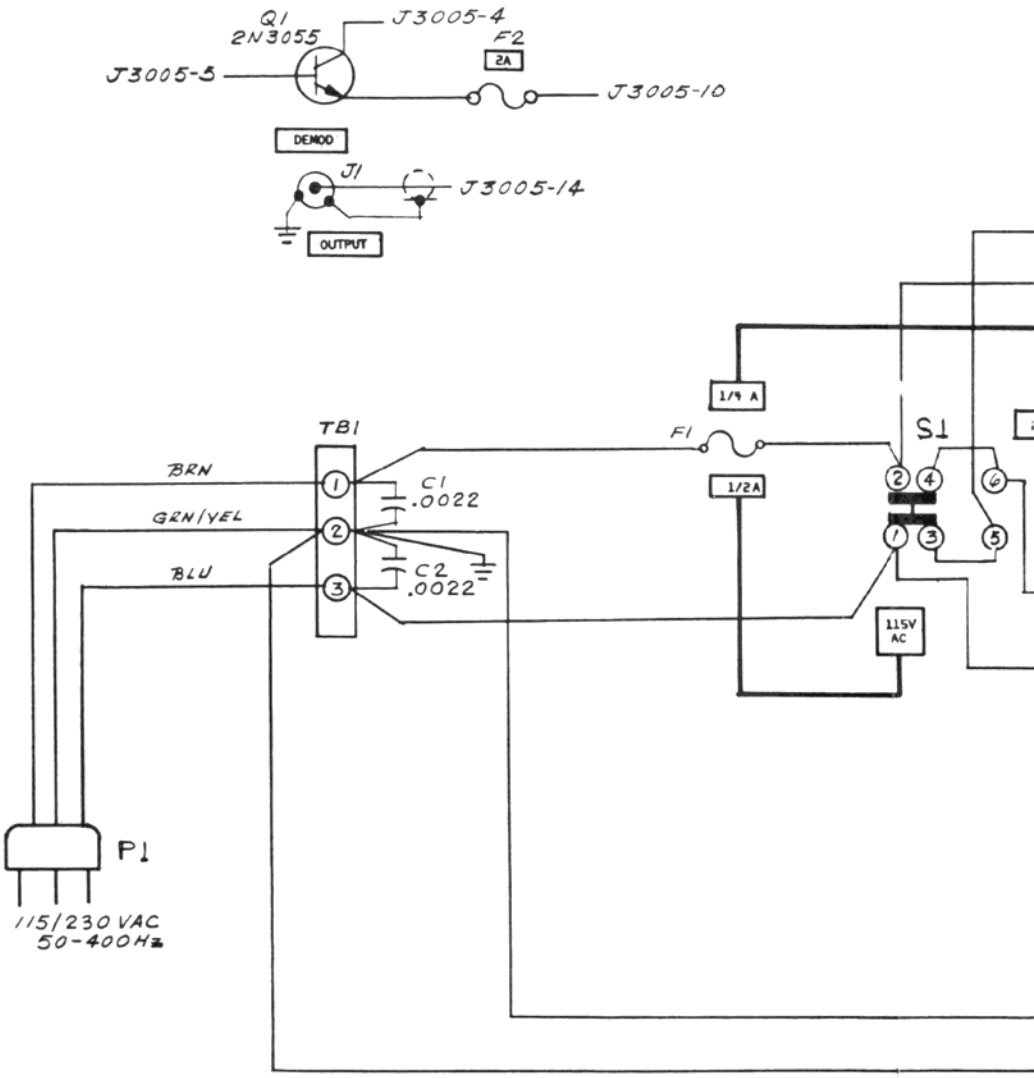


CE-15 PAGE 5-78a


R2
2.5K
ROTATION
Q4
MPS-A42
Q5
MPS-A42
1.95 KV
BLANKING
R10
3.9K
R16
5.1K
MOC1005
2
U3
4
5
1
R23
20K
Q6
MPS-A42
+10V
2.09
KV
2.24
KV
R8
750K
1/2W
R9
750K
1/2W
-1.94KV
INTENSITY
R11
100K
-1.88KV
R24
1MEG
R28
200K
Some units may have
10K fitted for R17, if
intensity will not obscure
trace fit 39K.
R17
39K
-1.87KV
-1.875 KV
BLUE
2
P300.
CRT C
C13
680pf
R25
56K
R12
300K
GRAY
3
P300.
CRT
-1.72KV
ORN
1
P300
CRT
FOCUS
R13
500K
-1.46 KV
R26
56K
C9
100pf
R18
750K
1W
+10V
-1.09KV
C10
100pf
R19
750K
1W
-0.72 KV
C11
100pf
R20
750K
1W
-360V
C5
30pf
C8
10
C12
100pf
R21
750K
1W
R27
13K
+3.0V
+10V
U2
LM301A
+10V
R14
2K
OUTPUT
R22
4.99K
1%
C6
.01
R15
3.01K
1%
C14
.01
CE 15
3700

REAR PANEL, 4000

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
4000	Pnl Assy, Rear	7003-0108	Cushman	
	CAPACITORS			
C1	Cer, 2200 PF, 20%, 3K	1005-0098	Sprague	30GA-D22
C2	Cer, 2200 PF, 20%, 3K	1005-0098	Sprague	30GA-D22
	CONNECTOR			
J1	Conn, BNC Jack Rect. Panel Mt.	2536-0010	Kings	KC79-35
	FUSES			
F1	Fuse, 1/2 Amp 3 AG Slo Blo	1955-0016	Littelfuse	313.500
F2	Fuse, 2 Amp Slo Blo	1955-0001	Littelfuse	313.002
	FUSE HOLDERS			
XF1	Holder, Fuse Blk Knrl Pnl Mt	1965-0015	Littelfuse	342-001AL
XF2	Holder, Fuse Blk Knrl Pnl Mt	1965-0015	Littelfuse	342-001AL
	SWITCH			
S1	SW, 2 Pole 3 Locking Pos Slide	1850-0025	Switchcraft	11D-1139
	TRANSFORMER			
T1	XFMR, Power	1575-0036	Cushman	
	TRANSISTOR			
Q1	Trans, 2N3055	1272-0041	RCA	2N3055


Q1
2N3055
J3005-4
F2
2A
J3005-5
J3005-10
DEMOD
J1
J3005-14
OUTPUT
1/4 A
TB1
F1
S1
BRN
C1
.0022
GRN/YEL
1/2A
C2
.0022
BLU
115V
AC
P1
115/230 VAC
50-400Hz

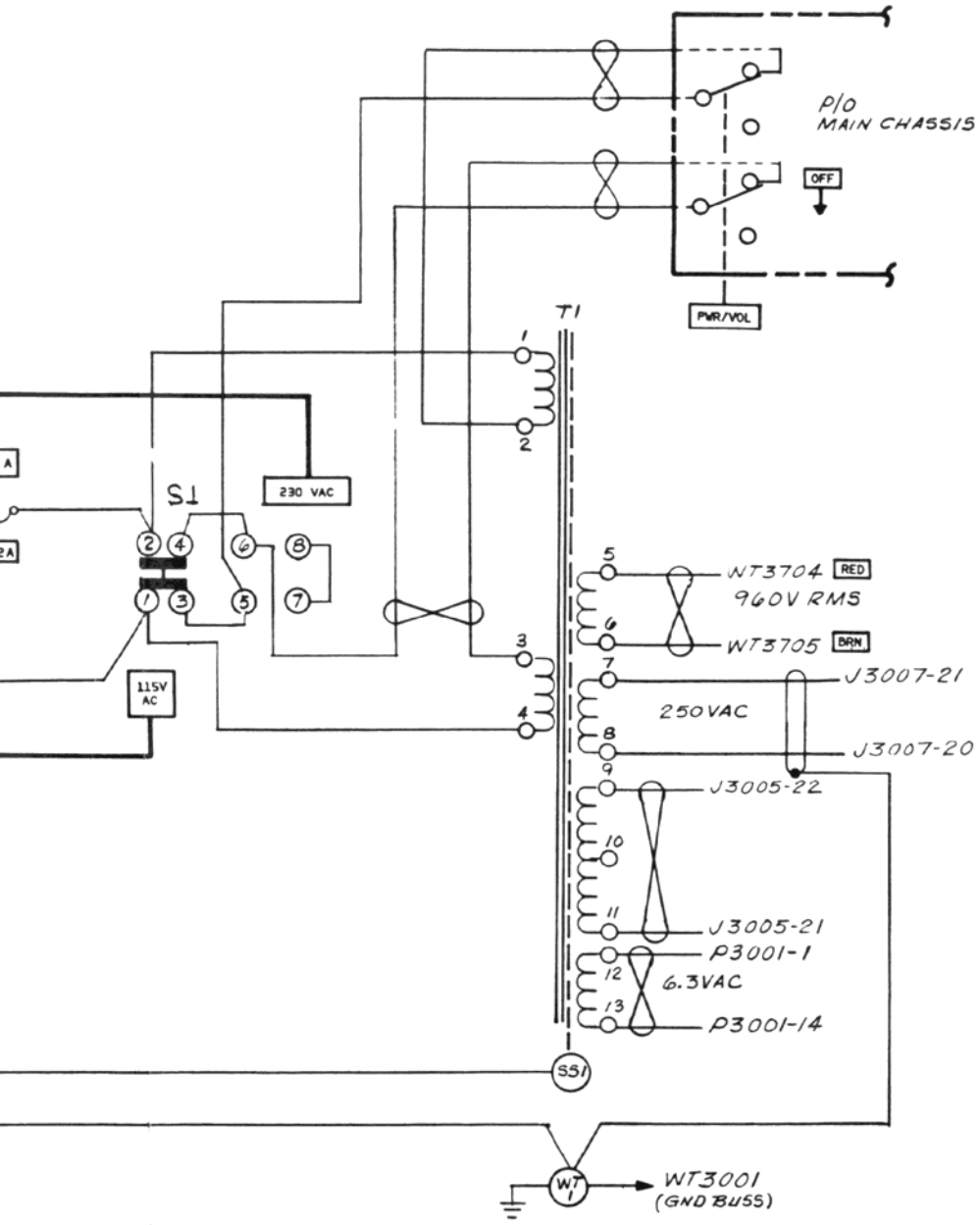
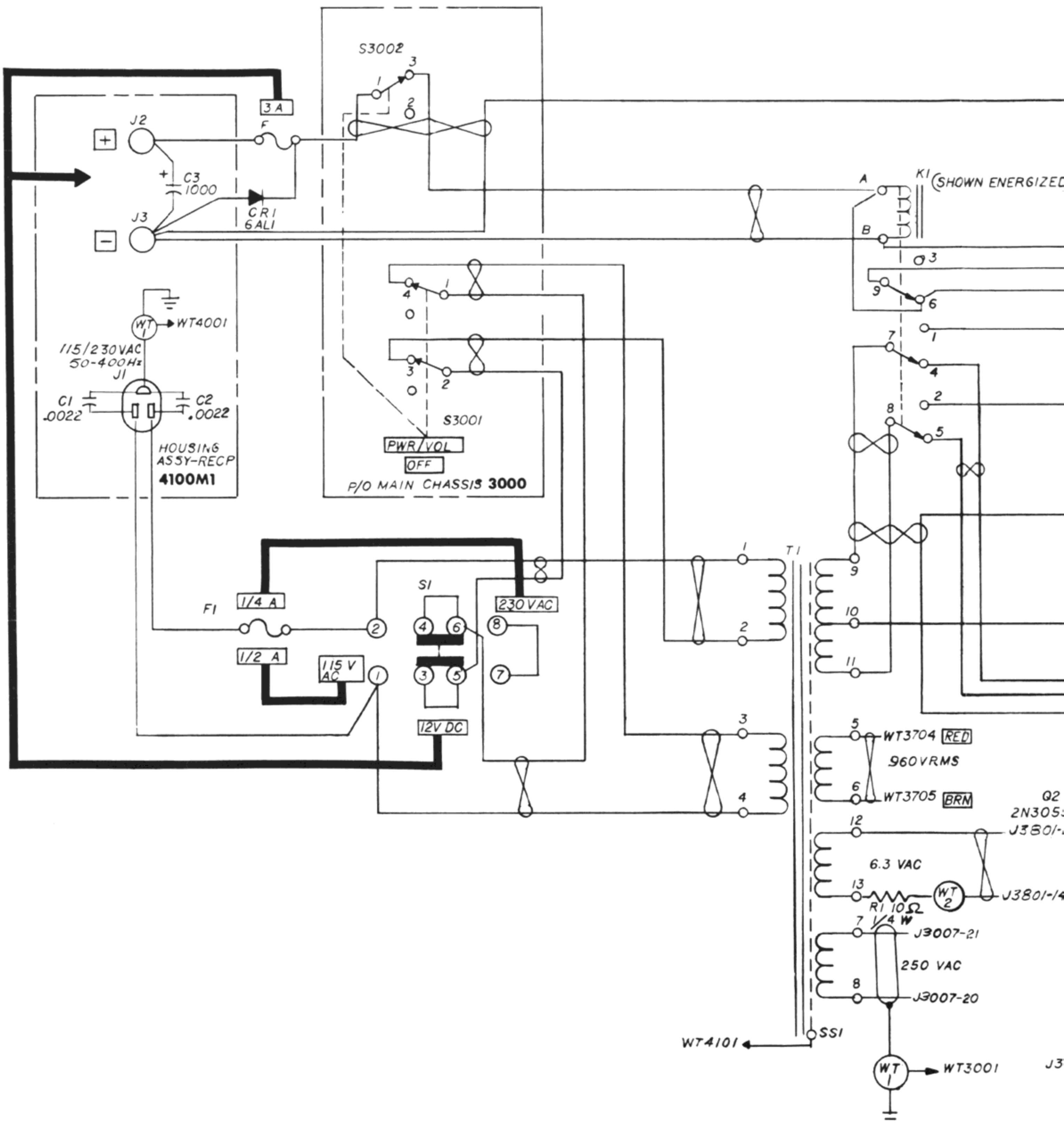


Figure 5-18. Rear Panel Interconnection Diagram, 4000

REAR PANEL 12V DC INVERTER, 4000M1

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
4000M1	Rear Panel 12V DC Inverter	7100-0078	Cushman	
4100M1	Receptacle Housing AC/DC Power	7046-0035	Cushman	
	CAPACITORS			
C1	Cer, .0022μF, ±20%, 3KV	1005-0098	Sprague	30GA-D22
C2	Cer, .0022μF, ±20%, 3KV	1005-0098	Sprague	30GA-D22
C3	Elect, 1000μF, +150-10%, 25V	1014-0006	Ill. Elna	25T1000
C4	Elect, 1000μF, +150-10%, 25V	1014-0006	Ill. Elna	25T1000
	CONNECTORS			
J1	Conn, 3 Pin AC Pwr, Recept, Pnl Mt	2535-0096	Switchcraft	EAC301
J2	Post, Binding, Red	2595-0003	Superior	DF21RC
J3	Post, Binding, Blk	2595-0002	Superior	DF21BC
	DIODES			
CR1	Diode, 6AL1 6 Amp, 100 PIV, Si	1281-0110	Sarkes-Tarz	6AL1
CR2	Diode, V334, 3A, 400V, Si	1281-0111	Varo	V334
	FUSES			
F1	Fuse, 1/2 Amp, 3AG Slo Blo	1955-0016	Littelfuse	315.500
F2	Fuse, 2 Amp, Slo Blo	1955-0001	Littelfuse	313.002
F3	Fuse, 3 Amp, 3AG, Slo Blo	1955-0012	Littelfuse	313.003
XF1	Holder, Fuse, Blk, Knrl, Pnl Mt	1965-0015	Littelfuse	342-001AL
XF2	Holder, Fuse, Blk, Knrl, Pnl Mt	1965-0015	Littelfuse	342-001AL
XF3	Holder, Fuse, Blk, Pnl Mt	1965-0015	Littelfuse	342-001AL
	RELAY			
K1	Rly, 3PDT, 12V Coil, 10 Amp Cont	1313-0019	Potter & Brum	KUP14A55-12V
	RESISTOR			
R1	Comp, 10Ω, 5%, 1/4W	1066-1005	Allen-Bradley	CB1005
	SWITCHES			
S1	SW, 2 Pole, 3 Locking Pos, Slide	1850-0025	Switchcraft	11D-1139
S2	SW, SPST, 10 Amp, 125/150V AC	1850-0026	Cherry Switch	E33-00A
	TRANSFORMER			
T1	Xfmr, Power	1575-0036	Cushman	
	TRANSISTORS			
Q1	XSTR, 2N3055	1272-0041	RCA	2N3055
Q2	XSTR, 2N3055	1272-0041	RCA	2N3055
Q3	XSTR, 2N3055	1272-0041	RCA	2N3055
Q4	XSTR, 2N3055	1272-0041	RCA	2N3055


S3002
3A
J2
F
C3
1000
CR1
6AL1
J3
K1 (SHOWN ENERGIZED
WT4001
115/230VAC
50-400Hz
J1
C1
.0022
C2
.0022
HOUSING
ASSY-RECP
4100M1
S3001
PWR/VOL
OFF
P/O MAIN CHASSIS 3000
S1
1/4 A
F1
1/2 A
115 V AC
230VAC
12V DC
T1
WT3704 RED
960VRMS
WT3705 BRN
Q2
2N305
J3801-
6.3 VAC
R1 10Ω 1/4 W
J3801-14
J3007-21
250 VAC
J3007-20
SS1
WT4101
WT3001

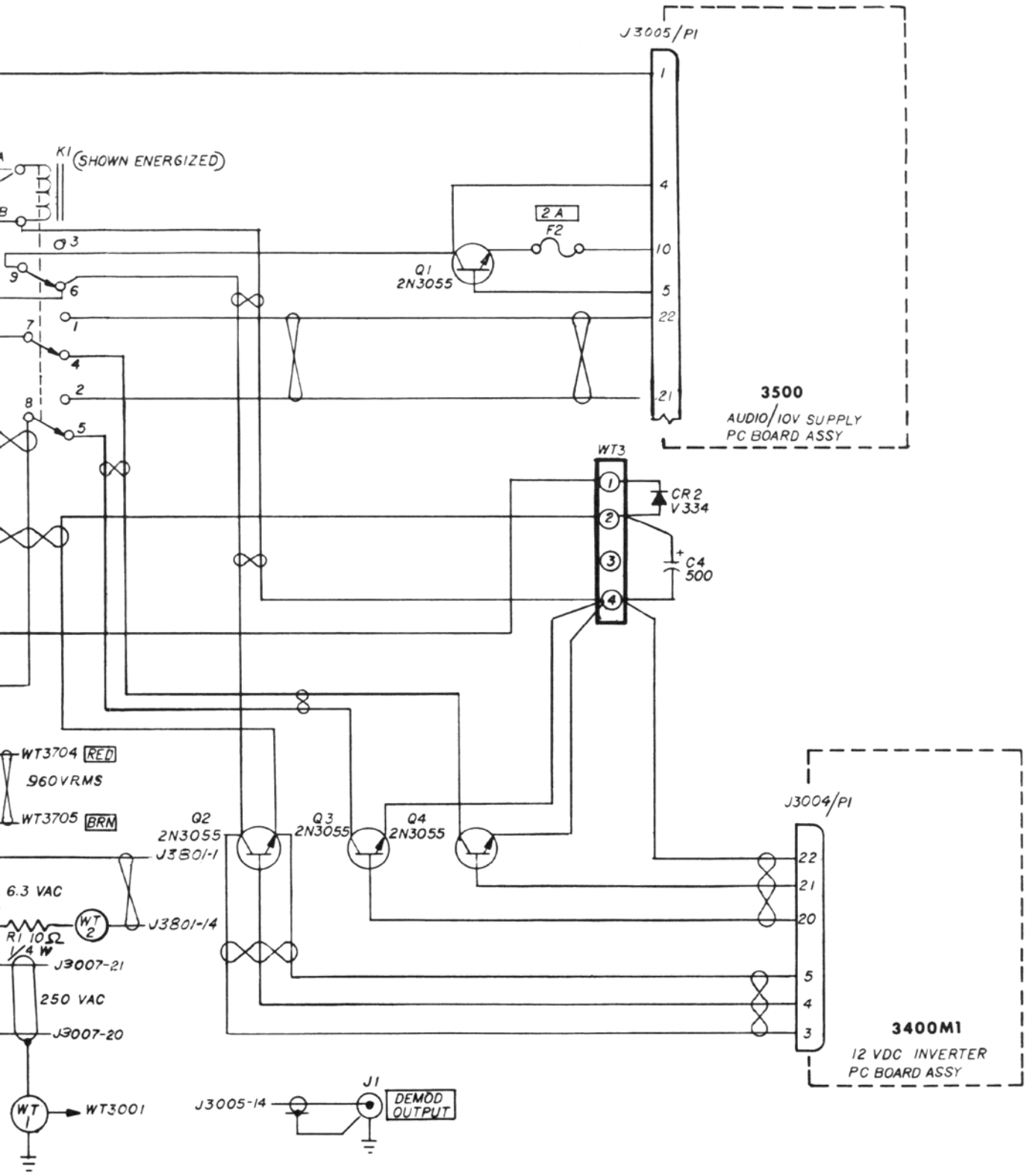


Figure 5-19. Rear Panel Interconnection Diagram, 4000 M1

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Please indicate where the error has been made. To improve future manuals your comments are requested.

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SIGNATURE _____

COMPANY _____

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