Ballantine

MODEL

6126M

OSCILLOSCOPE

CALIBRATOR

INSTRUCTION MANUAL

MODEL
6126M
OSCILLOSCOPE
CALIBRATOR

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90102585A

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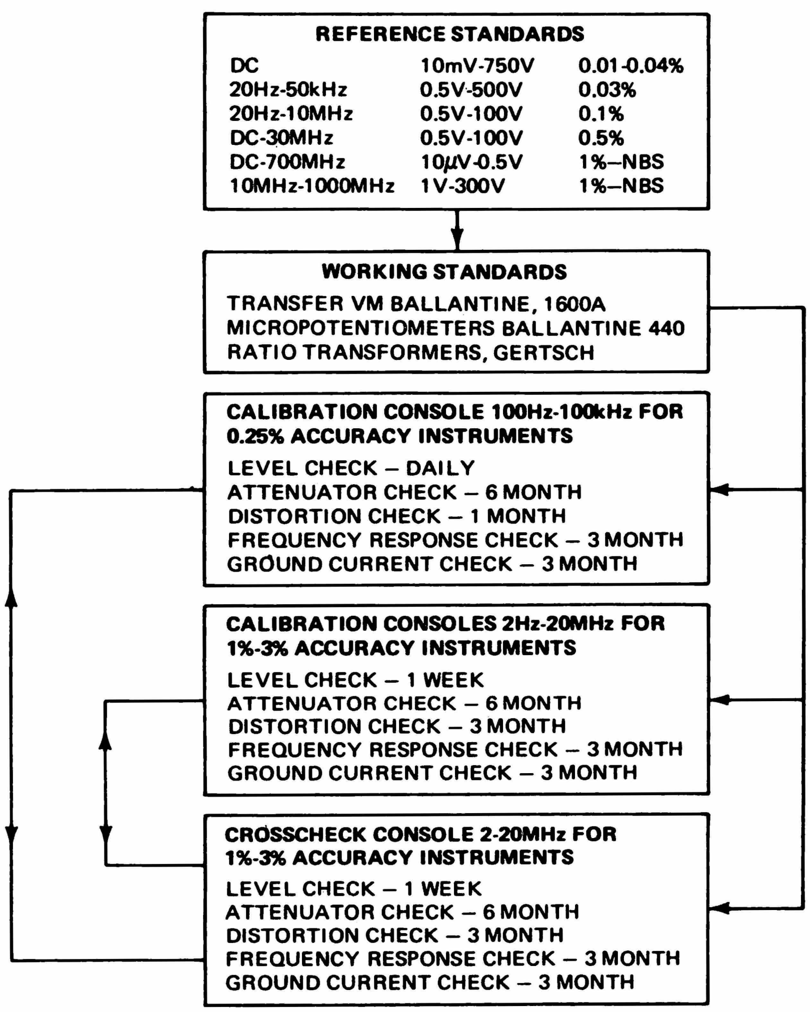
WARRANTY

This Ballantine Laboratories, Inc. product is warranted against defects in materials and workmanship for a period of one year from the date of shipment, except for batteries, electron tubes, vacuum thermocouples, and certain other components, if any, listed in this manual. Ballantine Laboratories, Inc. will, at its option, repair or replace products which prove to be defective during the warranty period provided they are returned to Ballantine Laboratories, Inc. prepaid, and provided the proper preventive maintenance and calibration procedures as listed in this manual have been followed. Repairs necessitated by misuse of the product are not covered by this warranty. NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. BALLANTINE LABORATORIES, INC. IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

CERTIFICATION

Ballantine Laboratories, Inc. certifies that this equipment meets all applicable Ballantine specifications at time of shipment from the factory as determined by thorough testing and inspection. Ballantine further certifies that its measurements are traceable to the United States National Bureau of Standards. All instruments used in calibrating Ballantine products are standardized by systematic reference to NBS-traceable standards as described in the validation procedures shown below.



Ballantine's Quality Assurance program satisfied the requirements of MIL-I-45208

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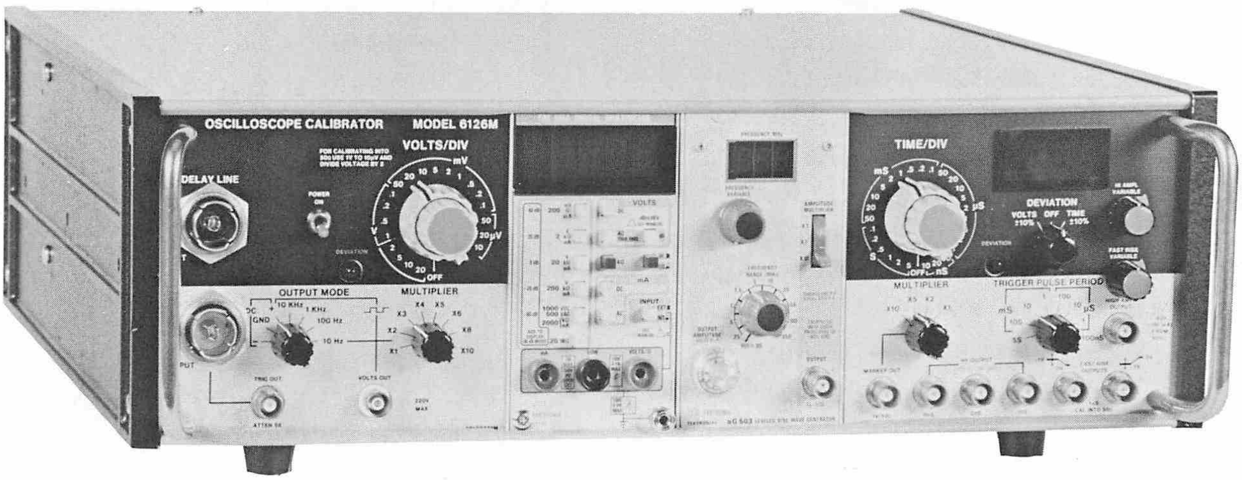


Figure 1-1. Model 6126M Oscilloscope Calibrator

SECTION 1
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. The Ballantine 6126M is a compact Test Set intended for calibration and maintenance of oscilloscopes and related instruments. The 6126M incorporates the following functions:

Amplitude Calibrator;
$\pm$dc and square wave to 200 Volts peak

Time Mark Generator;
1 ns to 50 seconds

Fast Rise Pulse Generator;
1 ns rise time positive and negative going pulses

High Amplitude Pulse Generator;
60 Volts unterminated

Delay Line and Trigger take off;
75 ns, 50 Ω

Constant Amplitude Sinewave Generator;
250 KHz to 250 MHz

4½ Digit Multimeter;
DC Volts, DC Amps, Ohms, AC Volts, AC Amps, dB, Temp

Tunnel Diode Fast Pulse Accessory;
125 ps rise time

1-3. The 6126M consists of the Ballantine 6125B repackaged in a deeper case, a Tektronix Model NO DM501A digital multimeter and a Tektronix Model SG503 sine-wave generator. The 6126M Options include rackmount capability in a 19 inch EIA rack. The 6126M includes all the electronics of the 6125B with the addition of:

High Amplitude Pulse Generator

Fast Rise Pulse Generator

50 Ohm Output Amplitude Calibrator

Delay Line and Trigger Take Off

Constant Amplitude Signal Generator

4½ Digit Multimeter

1-4. INSTRUMENT AND MANUAL IDENTIFICATION

1-5. The 6126M is supplied with a 6126M manual, a Tektronix SG503 and Tektronix DM501A manual. These manuals fully define operation, theory, maintenance and calibration. Schematics and parts lists are included in each manual.

1-6. The Tektronix SG503 and DM501A are part of the 6126M system. Their serial numbers are located on the top rail of each plug-in.

1-7. The Ballantine 6126M system has a serial number nameplate on the rear panel. The first three digits of the serial number identify the configuration. Any change of the units affecting configuration will result in a change in the configuration code listed on the serial number and the front page of this manual. Addendum sheets supplied with the manual will identify the changes.

1-8. SPECIFICATIONS

1-9. Technical specifications for each function are compliant with MIS-28714.

1-10. AMPLITUDE CALIBRATOR SPECIFICATIONS.

High Impedance Output (into 1 Megohm)

Range: 200 volts to 2 volts in 1, 2, 5 sequence.

Low Impedance Output (into 50 ohms)

Range: 10 volts to 10 microvolts

Output Waveform

$\pm$DC
Square wave of 10 Hz, 100 Hz, 1 kHz and 10 kHz

Accuracy

0.25% of reading + 1 uV

Variable Amplitude - Deviation

Deviation range of $\pm$10% with a resolution of 0.1% read out on a digital meter.

1-11. HIGH AMPLITUDE PULSE GENERATOR SPECIFICATIONS.

Amplitude

Continuously variable from 6 to 60 V when unterminated and from 0.5 to 5 volts when terminated in 50 ohms.

Period

100 ns to 5 sec in 8 steps selected by the TRIGGER PULSE PERIOD switch.

Output Resistance

60 ohms $\pm$5%

Wave shape

Square wave with 50% duty cycle. Leading edge aberrations less than 2% or 50 mV peak-to-peak into 50 Ohms.

Rise Time

Pulse will rise from a negative potential to ground. 100 nanoseconds; unterminated. 10 nanoseconds; into 50 ohms.

1-12. FAST RISE PULSE GENERATOR SPECIFICATIONS.

Two outputs one negative, one positive; specifications apply equally to both outputs.

Amplitude

100 mV to 1 Volt into 50 ohms continuously variable.

Rise Time

1 nanosecond or less into 50 ohms.

Wave Shape

Outputs are simultaneously positive and negative going from negative and positive rest potentials. Outputs are square waves with 50% duty cycle. Leading edge aberrations are less than 2% or 50 mV peak-to-peak during the first 10 nanoseconds and flatness is within ±5% after the first 10 nanoseconds.

Period

Output square waves have 100 ns to 5 second periods in 8 steps selected by the TRIGGER PULSE PERIOD control.

Trigger

The two output squarewaves are locked to the internal crystal oscillator and the MARKER OUT signal provides a positive trigger of 1 volt into 50 ohms locked to the square wave and the internal crystal oscillator.

1-13. TIME MARK GENERATOR SPECIFICATIONS.

Output Markers

1 nanosecond to 50 seconds in 1, 2, 5 sequence.

Marker Amplitude

10 nanosecond to 50 seconds; 1 volt into 50 ohms.

5 and 2 nanoseconds; 750 mV into 50 ohms.

1 nanosecond; 250 millivolts into 50 ohms.

Trigger Output

Selected from 100 nanoseconds to 5 seconds in 8 steps. Amplitude is 1 volt into 50 ohms as provided by the Fast Rise pulse generator outputs.

Variable Marker (Deviation)

A deviation control provides continously variable period deviation to ±10% for markers and triggers. A digital deviation meter provides resolution of 0.1%. There is no deviation control for the 5 ns, 2 ns and 1 ns markers.

Internal Time Base

An internal temperature compensated 10 MHz crystal oscillator provides long term stability to better than 1 part in 10^{-5} per month after 72 hours and temperature stability of better than 1 part in 10^{-5} from + 4°C to + 40°C after a 30 minute warmup.

1-14. DELAY LINE SPECIFICATIONS.

Time Delay

Passive delay of 75 ± 1 nanoseconds.

Impedance

50 ohms ±2%.

Connectors

GR874 series.

Attenuation

Factor of 2 ±2% into 50 ohms.

Rise Time

195 picoseconds.

Maximum Input Voltage

50 volts peak; not to exceed 5 volts rms.

TRIGGER Output

Rise Time: At least 600 ps.

Output Amplitude: Factor of 5 attenuation ±10% over input signal to delay line.

Output Impedance: 50 ohms.

1-15. MULTIMETER SPECIFICATIONS.

Reference

Tektronix DM501A plug-in.

DC Voltage

Ranges: ± 200 mV, 2, 20, 200 and 1000 volts full scale.

Resolution: 10 microvolts.

Accuracy (18°C to 28°C):

200 mV Range	±(0.05% + 3 LSD)
2V to 1000V Ranges	±(0.05% + 2 LSD)

Accuracy (0°C to 18°C and 28°C to 50°C):

200 mV Range	±(0.1% + 5 LSD)
2V to 1000V Ranges	±(0.1% + 5 LSD)

CMR: ≥ 100 dB at dc
≥ 80 dB at 60 Hz with 1K imbalance

NMR: ≥ 60 dB at 60 Hz ±0.2 Hz

Input Resistance: 10 Megohms

Response Time: < 1 second

Maximum Input Voltage: 1000 V peak

True RMS AC Voltage

NOTE

Input Signal must be between 5% and 100% of full scale.

Ranges: 200 mV, 2, 20, 200 and 500 volts

Resolution: 10 microvolts

Accuracy (18°C to 28°C):

20 Hz to 40 Hz	±(1% + 10 LSD)
40 Hz to 10 kHz	±(0.6% + 10 LSD)
10 kHz to 20 kHz	±(1% + 10 LSD)

Accuracy (0°C to 18°C and 28°C to 50°C):

20 Hz to 40 Hz	±(1.3% + 15 LSD)
40 Hz to 10 kHz	±(0.8% + 15 LSD)
10 kHz to 20 kHz	±(1.3% + 15 LSD)

Input Impedance: 10 Megohms shunted by 160 pF.

Maximum Input Voltage: 500 V ac rms, 600 V dc, not to exceed 1000 V peak.

dB (True RMS)

Zero dB reference: 1 mW in 600 (0.775 V)(dBm). Internal jumper change for zero dB reference of 1.0000 V (dBV).

Accuracy (18°C to 28°C)*:

+20 dB to -15 dB	±0.5 dB
-15 dB to -20 dB	
20 Hz to 2 kHz	±0.5 dB
2 kHz to 10 kHz	±1.5 dB
10 kHz to 20 kHz	±2.5 dB

*Accuracy (0°C to 18°C and 28°C to 50°C):

Add 0.6 dB to accuracy specifications.

Maximum Resolution: 0.1 dB

Response Time: < 2 seconds

Input Impedance: 10 Megohms shunted by 160 pF

Maximum Input Voltage: 500 V rms, not to exceed 1000 V peak. Equivalent to +54 dBV or +56.2 dBm.

Crest Factor: 4 at full scale

Resistance

Ranges: 200 Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ and 20 MΩ.

Resolution: 10 mΩ

Accuracy (18°C to 28°C):

200 Ω Range (LO Ω) ±(0.15% + 3 LSD)
2 kΩ to 2000 kΩ Ranges (HI Ω) ±(0.15% + 2 LSD)
2 kΩ to 200 kΩ Ranges (LO Ω) ±(0.15% + 3 LSD)
2000 kΩ Range (LO Ω) ±(0.3% + 3 LSD)
20 MΩ Range (HI Ω) ±(0.5% + 2 LSD)

Accuracy (0°C to 18°C and 28°C to 50°C):

200 Ω Range (LO Ω) ±(0.3% + 5 LSD)
2 kΩ to 2000 kΩ Ranges (HI Ω) ±(0.3% + 5 LSD)
2 kΩ to 200 kΩ Ranges (LO Ω) ±(0.3% + 5 LSD)
2000 kΩ Range (LO Ω) ±(1.2% + 5 LSD)
20 MΩ Range (HI Ω) ±(1.2% + 5 LSD)

Response Time:

200 Ω to 2000 kΩ Ranges	< 2 sec
20 MΩ Range	< 10 sec

Maximum Input Volts: 250 V peak

Maximum Open - Circuit Voltage: < 6 V

DC Current

Ranges: 200 uA, 2, 20, 200 and 2000 milliamps.

Resolution: 10 nanoamps

Accuracy (18°C to 28°C):

±(0.2% + 3 LSD)

Accuracy (0°C to 18°C and 28°C to 50°C):

±(0.3% + 5 LSD)

Response Time: < 1 sec

Input Resistance:

200 uA Range	1.0 kΩ
2 mA Range	100 Ω
20 mA Range	10.2 Ω
200 mA Range	1.2 Ω
2000 mA Range	0.4 Ω

True RMS AC Current

Ranges: 200 uA, 2, 20, 200 and 2000 milliamps

Resolution: 10 nanoamps

Accuracy (18°C to 28°C):
(20 Hz to 10 kHz)*

±(0.6% + 10 LSD)

Accuracy (0°C to 18°C and 28°C to 50°C):

±(0.7% +15 LSD)

* Usable to 20kHz

Response Time: < 2 sec

Input Impedance:

200 uA Range	1.0 kΩ
2 mA Range	100 Ω
20 mA Range	10.2 Ω
200 mA Range	1.2 Ω
2000 mA Range	0.4 Ω

Maximum Open - Circuit Voltage
(mA to LOW):

250 V peak, fused with 2 A fast blow.

Temperature

Range: -62°C to +240°C

Resolution: 0.1°C

Accuracy (18°C to 28°C ambient temperature)*

P6601 and DM501A calibrated as a pair:

-62°C to +150°C	±2°C
+150°C to +240°C	+0°C to -6°C

P6601 and instruments not calibrated as a pair:

-62°C to +150°C	±4°C
+150°C to +240°C	+2°C to -8°C

*Accuracy (0°C to 18°C and 28°C to 50°C ambient temperatures):

Add 1.5°C to accuracy limit in each direction.

General

4½ digit LED display

Automatic polarity indication

Automatic decimal point indication

OFF ground operation to ±1000 Volts peak.

1-16. CONSTANT AMPLITUDE SINE WAVE GENERATOR SPECIFICATIONS.

Reference

Tektronix SG503 plug-in.

Frequency Range

250 kHz to 250 MHz continuously variable; plus fixed 50 kHz reference.

Readout

Three digit LED display automatically ranged with frequency.

Accuracy

±0.7% of the lease significant digit.

Output Impedance

50 ohms

Output Amplitude

Continuously variable from 5 millivolts to 5.5 volts peak-to-peak into 50 ohms.

Amplitude Accuracy

50 kHz reference
±3% on X1 range
±4% on X0.1 range
±5% on X0.01 range

Frequency Response

50 kHz reference
±1.5% of %0 kHz reference from 250 kHz to 100 MHz
±3% of 50 kHz reference from 100 MHz to 250 MHz

Harmonic Content

Second Harmonic greater than -35 dB below fundamental

All other Harmonics at least -40 dB below fundamental

1-17. GENERAL SPECIFICATIONS, 6126M

AC Mains Voltage

105 to 130 volts, 50 to 60 Hz and 400 Hz single phase sinusoidal with one lead at ground potential.

Power

Approximately 100 watts

Weight

53 lbs.

Height

5.25 inches

Width

Bench Mount	-	17 inches
Rack Mount	-	18.5 inches

Depth

Overall	-	20 inches
Behind Panel	-	18 inches

Environmental

Altitude: Storage: to 40,000 feet

Operating: to 10,000 feet

Humidity: Operating: 0 to 90% RH

Temperature: Storage: -55°C to +60°C

Operating: +4°C to +40°C

Shock: 3 shocks, vertical and lateral

15G for 11 milliseconds

Tilt Drop: 4" drops for each side, 4 drops total to wooden surface.

Vibration: 3 planes, once 5 Hz to 55 Hz to 5 Hz cycle in 5 minutes. 0.010 inches +.002/-0. Peak-to-peak.

1-18. ACCESSORIES

1 each: Ballantine Model 10800C High Voltage Probe; to 40 kV

1 each: Tunnel Diode Test Fixture, Ballantine 61252A

2 each: 2 ns delay cables; 50 Ω ; GR874 connectors P/N.88100741

1 each: Card Extender, Ballantine P/N 89101231

1 each: Card Extender, Ballantine P/N 89110981

1 each: AC Power Cable, Ballantine P/N 31100000

SECTION 2

PREPARATION FOR USE AND SHIPMENT

2-1. GENERAL

2-2. This section contains information and instructions necessary for the installation and reshipment of the 6126M Oscilloscope Calibrator. Details are provided for initial inspection, performance checks, power connections, grounding safety requirements, installation information, and repacking instructions for storage or shipment.

2-3. UNPACKING AND INITIAL INSPECTION

2-4. Unpacking and initial inspection of the calibrator require only the normal precautions and procedures applicable to the handling of sensitive electronic equipment. The contents of all shipping containers should be checked for included accessories and certified against the packing slip to ascertain that the shipment is complete.

2-5. PERFORMANCE CHECKS

2-6. This instrument was carefully inspected for mechanical and electrical performance before shipment from the factory. It should be free of physical defects and in acceptable operating condition upon receipt. Check the instrument for possible damage incurred while in transit. Complete the performance checks beginning with paragraph 5-3. If there is any indication of damage or improper operation, refer to the warranty included in this manual and notify the manufacturer or the manufacturer's field representative.

2-7. POWER REQUIREMENTS

2-8. The generator may be operated from an ac voltage source rated at 100, 120, 220, or 240 volts rms at 50 to 400 Hz. The orientation of the printed circuit board in the ac power connector on the rear of the instrument matches the instrument to the ac voltage source. See Figure 2-1.

2-9. The instrument should be operated from a power source with its neutral at or near ground (earth) potential. The instrument is not intended for operation from two phases of a multiphase ac system or across the legs of a single-phase, three-wire ac power system. Crest factor (ratio of peak voltage to rms) should be typically within the range of 1.3 to 1.6 at $\pm$10% of the nominal line voltage. Use a true rms responding voltmeter, such as the Ballantine Model 3620A, to measure the power line voltage.

2-10. GROUNDING REQUIREMENTS

2-11. To insure the safety of operating personnel, the U.S. Occupational Safety and Health Act (OSHA) and good engineering practice require that the instrument panel and enclosure be "earth" grounded. All Ballantine instruments are provided with a three-connector power cable assembly which, when plugged into an appropriate power receptacle, grounds the instrument. The offset pin on the male end of the power cable is the ground wire connection to the connector on the rear panel of the instrument.

<u>CAUTION</u>

Failure to orient the printed circuit board properly will damage the instrument and void the warranty.

2-12. To preserve the safety protection feature, when operating the instrument from a two-contact power outlet, use a three-prong to two-prong adapter and connect the green lead or terminal on the adapter to "earth" ground.

NOTE

In addition to the two methods of grounding stated, the instrument also incorporates a case ground lug on the rear panel.

2-13. INSTALLATION AND MOUNTING

2-14. General. The calibrator is fully solid state and dissipates minimal heat. No special cooling is required; however, the instrument should not be operated where the ambient temperature exceeds 40°C (104°F) or when condensation due to high humidity appears anywhere on the instrument.

2-15. Bench Mounting. The calibrator is shipped with plastic bumper-feet and metal tilt-stand in place, ready for use as a bench instrument. Outline dimensions are shown in Figure 2-2.

2-16. Rack Mounting. The calibrator may be rack-mounted in a standard 19-inch EIA rack. Ballantine P/N 89107531, is required to provide rack-mount side brackets. Before installing the instrument in the rack, remove the plastic bumper-feet and tilt-stand. Do not discard these items, but store them for future use.

2-17. Portable Use. The instrument as supplied includes side carry-handles.

2-18. SHORT TERM STORAGE

2-19. If the instrument is to be stored for a short period of time (less than three months), place cardboard over the panel and cover the instrument with a suitable protective covering, such as a plastic bag or strong, draft paper.

Place power cable and other accessories with the instrument. Store the covered instrument in a clean, dry area that is not subject to extreme temperature variations or conditions which may cause moisture to condense on the instrument.

2-20. LONG TERM STORAGE OR REPACKAGING FOR SHIPMENT

2-21. If the instrument is to be stored for a period longer than three months, or if it is to be repackaged for shipment, as a general guide, repackage the instrument as described in the following procedure and shown in Figure 2-3. Use either the original packing material, if available, or material similar to that specified. Proceed as follows:

a. Place the instrument accessories, if any, in a plastic bag and seal the bag.

b. For long distance shipping only, use U.S. Government packaging method IIC and tape a two-unit bag of dissicant (MIL-D-3464) on the rear cover.

c. Place a piece of sturdy cardboard over the front panel for protection. Enclose the instrument in a plastic bag and seal the bag.

d. Wrap the bagged instrument and accessories in a 1-inch thick, flexible, cellular plastic-film, cushioning material (PPP-B-795) and place in a barrier bag (MIL- B-131). Extract the air from the bag and heat seal.

e. Place the wrapped instrument and accessories into a fiberboard box (PPP-B-636) of suitable size. Fill spaces with rubberized hair or cellular plastic cushioning material. Close the box in accordance with container specifications. Seal with sturdy, water-resistant tape or with metal straps.

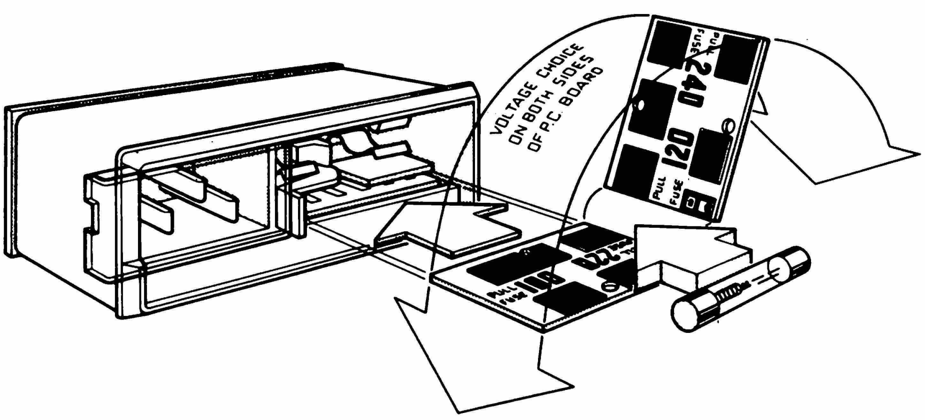
f. Mark container "FRAGILE," " HANDLE WITH CARE" or similar precautionary notice. Affix shipping labels as required or mark in accordance with MIL-STD-129.

NOTE

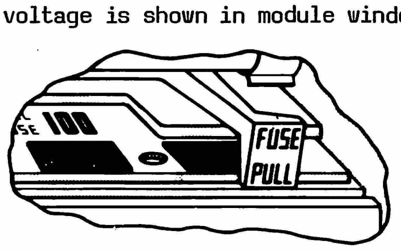
If the instrument is to be returned to Ballantine Laboratories, Inc. for calibration or repair, attach a tag to the instrument identifying the owner; also, note the problem, symptoms, and service or repair desired. List the model and serial number of the instrument. Ship the instrument prepaid to Ballantine Laboratories, Inc., 90 Fanny Road, Boonton, New Jersey 07005, U.S.A. In any correspondence, identify the instrument by model number, serial number, work authorization order, and date and method of shipment.

2-22. SAFETY

Figure 2-4 delineates the safety aspects of this instrument.



Operating voltage is shown in module window.



SELECTION OF OPERATING VOLTAGE

1. Open cover door and rotate fuse-pull to left.
2. Select operating voltage by orienting PC board to position desired voltage on top-left side. Push board firmly into module slot.
3. Rotate fuse-pull back into normal position and re-insert fuse in holders, using caution to select correct fuse value.

Figure 2-1. Voltage Selection and Fused Receptacle Printed Circuit Board Location and Orientation

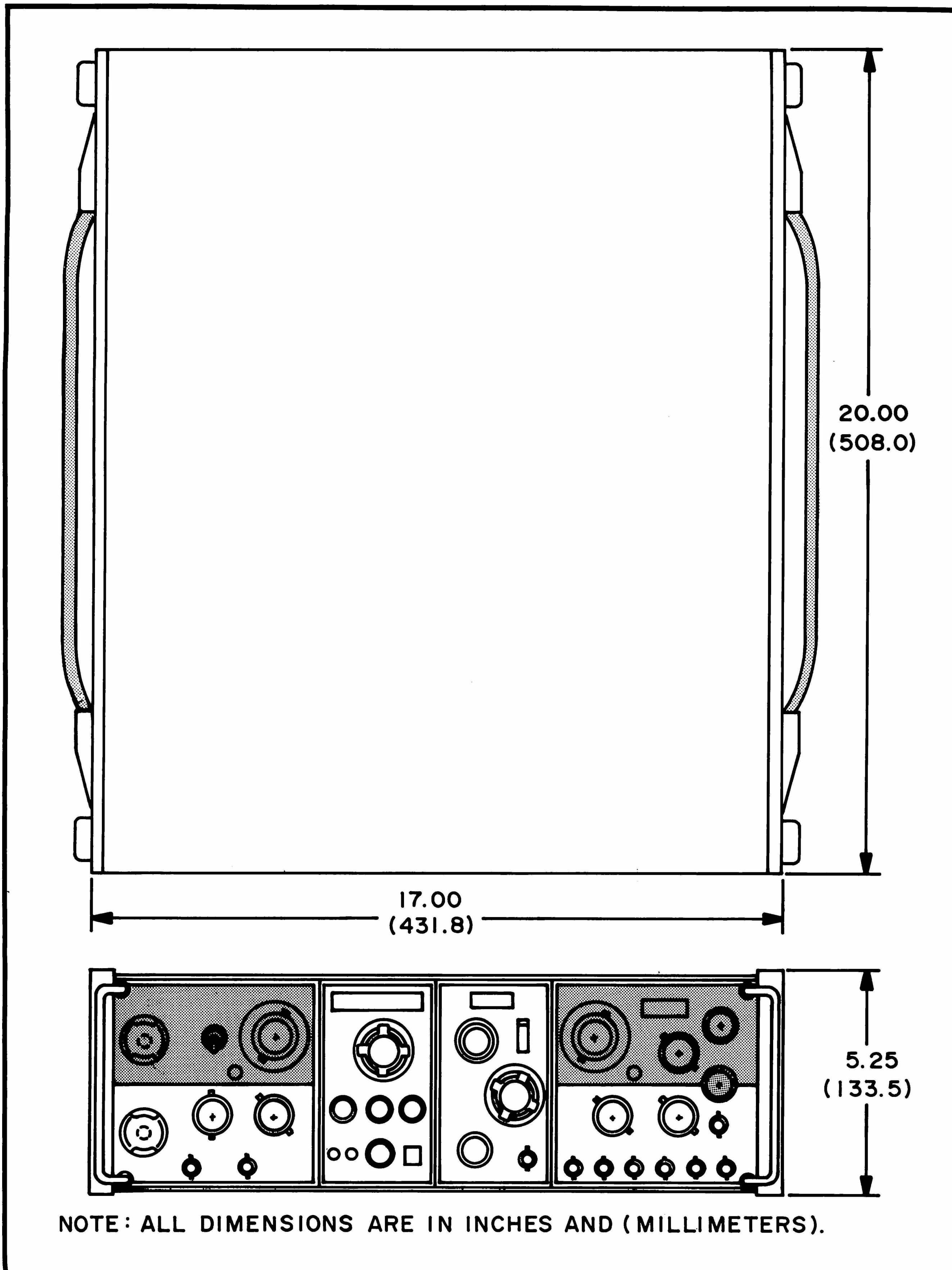


Figure 2-2. Model 6126M Outline Drawing

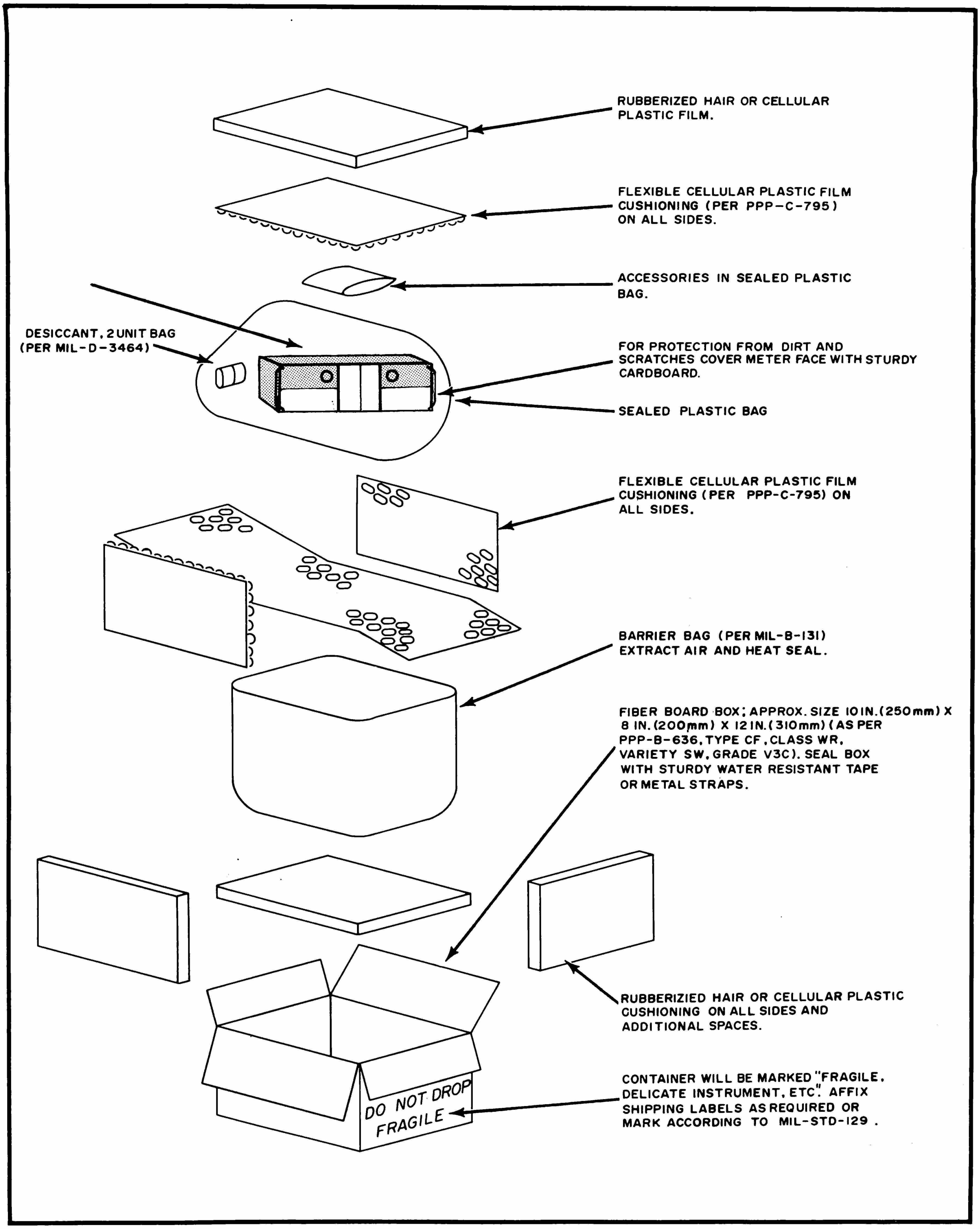


Figure 2-3. Model 6126M Packing Diagram

SAFETY CONSIDERATIONS

GENERAL

This is a Safety Class I instrument. This instrument has been designed considering IEC Publication 348 and ANSCI C39.5, "Safety Requirements for Electronic Measuring Apparatus".

This manual contains information, cautions, and warnings which must be followed by the service person to ensure safe operation and to retain the instrument in safe condition.

WARNINGS

SAFETY

If this instrument is to be energized via an autotransformer for voltage reduction, make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding).

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.

Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

GROUNDING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal is likely to make this instrument dangerous. Intentional interruption is prohibited.

HIGH VOLTAGE

Warning — These servicing instructions are for use by qualified personnel only. To avoid dangerous electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

CAUTIONS

LINE VOLTAGE SELECTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the instrument is set to the voltage of the power source. Verify that the power transformer primary is matched to the available line voltage. Verify that the correct fuse is installed.

GROUNDING

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that all devices connected to this instrument are connected to the protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.)

⚠ ATTENTION ⚠

This symbol: ⚠, which appears on the instrument means: Read the instruction manual before operating the instrument. If the instrument is operated without reading the instructions, it may not operate correctly.

Figure 2-4. Safety Considerations

SECTION 3

OPERATION

3-1. INTRODUCTION

3-2. This section contains instructions and information required for the operation of the 6126M. Included are identification of controls, connectors and indicators. Refer to Figures 3-1, 3-2, and 3-3 as well as Tables 3-1 and 3-2.

NOTE

This section only covers the main frame 6126M. Refer to the applicable plug-in manuals for the Tektronix SG503 Constant Amplitude Sine Wave Generator and Tektronix DM501A Multimeter for full operating instructions regarding these instruments.

3-3. POWER REQUIREMENTS

3-4. See Paragraphs 2-7 through 2-9. For grounding and safety earth connections, see Paragraphs 2-10 through 2-12. Always check rear panel voltage selector card in the power receptacle.

CAUTION

Failure to apply the correct ac mains power voltage will cause serious damage to the instrument and will void the Warranty.

CAUTION

Always turn POWER to OFF when inserting or removing either of the two Tektronix plug-ins. Failure to do so may damage the plug-ins and void the Warranty.

3-5. OPERATING INSTRUCTIONS

3-6. Turn calibrator on by setting the power toggle switch to POWER ON.

3-7. OUTPUT CONNECTIONS

3-8. Eight BNC output connectors are provided.

a. TRIG OUT - Trigger pickoff signal output from Delay Line INPUT.

b. VOLTS OUT - Provides accurate dc voltage with positive or negative polarity. Zero check and four positive going square wave outputs of 10 Hz, 100 Hz, 1 kHz, Are also provided. The square wave outputs may be used to check true rms ac voltmeters, to compensate attenuators, calibrate the amplitude of oscilloscopes, check the response of input coupling filters and check solid state dc amplifier thermal drift compensation. Amplitude deviation capability of $\pm 10\%$ is provided.

c. MARKER OUT - Provides outputs from 10 ns to 50 seconds in 1, 2, 5 steps. The associated MULTIPLIER provides time multiplication of these markers by X1, X2, X5, and X10 to simplify time calibration of oscilloscopes and digital counters. Time deviation capability of $\pm 10\%$ is provided.

d. 5 ns HF OUTPUT - Provides 200 MHz sine wave output from a 50 ohm source impedance.

e. 2 ns HF OUTPUT - Provides 500 MHz sine wave output from a 50 ohm source impedance.

f. 1 ns HF OUTPUT - Provides 1 GHz sine wave output from a 50 ohm source.

g. FAST RISE ╲ OUTPUT - Provides a negative going signal falling from a positive voltage to ground. The amplitude of this signal is continuously variable from +100 mV to +1 V. The rise time is equal to or less than 1 ns. Frequency is determined by the TRIGGER PULSE PERIOD control.

h. FAST RISE ╱ OUTPUT - Provides a positive going signal rising from a negative voltage to ground. The amplitude of this signal is continuously variable from -100 mV to -1 V. The rise time is equal to or less than 1 ns. Frequency is determined by the TRIGGER PULSE PERIOD control.

i. HIGH AMPLITUDE OUTPUT - Provides a square wave signal, continuously variable from -6V to -60V unterminated or -0.5V to -5V when terminated into 50 Ω. The frequency of the square wave signal is selected by the TRIGGER PULSE PERIOD control.

NOTE

An internal MARKER-TRIGGER INTERLOCK switch may be set to LOCKOUT to provide gated time coincidence between markers and triggers whenever the trigger period is longer than the marker period. In the LOCKOUT mode, the HIGH AMPLITUDE OUTPUT signal will be automatically shut off when the trigger period is equal to or shorter than the marker period.

3-9. VOLTAGE CALIBRATION

3-10. DC VOLTAGE OUTPUT

3-11. The VOLTS OUT BNC provides an accurate dc voltage of either positive or negative polarity or zero output as selected by the OUTPUT MODE switch. This dc output voltage may be used to calibrate analog and digital dc voltmeters and other dc level sensitive circuits. A typical test condition is illustrated in the following paragraph.

3-12. CHECKING OR CALIBRATING A DC VOLTMETER

a. Check the voltmeter to be tested to be sure it is functioning properly and that its specified accuracy is commensurate with the ±0.25% of setting accuracy of the 6126M. The input resistance of the voltmeter under test should be 1 megohm or higher to avoid loading the 6126M when using positions above 1V on the VOLTS/DIV Switch.

b. Set the voltmeter controls as follows:

Range: Highest Voltage Range
Mode: DC Voltage
Polarity: Positive (or automatic)

c. Set the 6126M controls as follows:

VOLTS/DIV	10uV
OUTPUT MODE	DC+
MULTIPLIER	X10
DEVIATION	OFF

d. Connect the input of the voltmeter under test to the VOLTS OUT BNC of the 6126M. Connect the + or HI input connector of the voltmeter to the center pin of the VOLTS OUT BNC and the voltmeter common (LO or -) terminal to the BNC shell. Use short twisted leads or a shielded cable to interconnect the voltmeter to the 6126M.

e. Rotate the VOLTS/DIV switch counter-clockwise until the voltmeter under test reads approximately full scale. Note that the VOLTS/-DIV setting is one tenth the full range setting of the voltmeter since the MULTILPLIER switch is set to increase the VOLTS/DIV potential by X10.

f. Set the DEVIATION switch to VOLTS ±10% and observe that the volts DEVIATION lamp is illuminated.

g. Rotate the VOLTS/DIV DEVIATION control (concentric with the VOLTS/DIV switch) until the voltmeter under test reads exactly full scale indication. Note the reading of the digital DEVIATION meter on the 6126M; it represents the correction factor of the voltmeter under test.

h. Check the accuracy specification of the voltmeter under test. Accept the calibration if the 6126M deviation meter reading is less than the allowable error. If the deviation percentage is greater than the voltmeter's specified calibration error, the voltmeter is out of calibration and should be recalibrated.

i. When recalibrating the voltmeter under test, set the 6126M DEVIATION switch to OFF. Set the proper output voltage of the 6126M with the VOLTS/DIV switch and the volts MULTIPLIER. Adjust the voltmeter's calibration control for an exact voltmeter indication of the output voltage of the 6126M.

j. Decading Check. To check voltmeter decading, simply change the VOLTS/DIV MULTIPLIER switch from X10 to any of the other seven cardinal points. Check the accuracy of the voltmeter under test at any of these points and determine calibration error as a percent of reading by using the 6126M VOLTS DEVIATION control. Proceed at each point as detailed in Paragraphs f, g, and h.

3-13. SQUARE WAVE VOLTAGE OUTPUT

3-14. The VOLTS OUT BNC provides an accurate zero based positive going square wave for amplitude, gain, and attenuator compensation in oscilloscopes, digital counters,amplifiers, and instrumentation systems. The OUTPUT MODE switch permits selection of four square wave frequencies - 10 Hz, 100 Hz, 1 kHz and 10 kHz.

3-15. CHECKING OR CALIBRATING OSCILLOSCOPE VERTICLE AMPLITUDE AND ATTENUATOR COMPENSATION

a. The crystal controlled square wave has a fast risetime and flat top that provides a suitable signal for the compensation of the input attenuators.

b. Set the oscilloscope controls as follows:

Volts/Div:	Lowest voltage range. Variable control to calibrated position.
Volts Coupling:	DC
Triggering:	Internal source AC Coupling + Slope
Time Base:	200 us/div.

c. Set the 6126M controls as follows:

VOLTS/DIV:	Same as volts/div set on oscilloscope under test.
OUTPUT MODE:	1 kHz
MULTIPLIER:	5
DEVIATION:	OFF

d. Connect the VOLTS OUT BNC of the 6126M to the oscilloscope vertical input connector.

e. Observe that the oscilloscope under test displays the square wave signal at approximately 5 divisions peak-to-peak. See Figure 3-4.

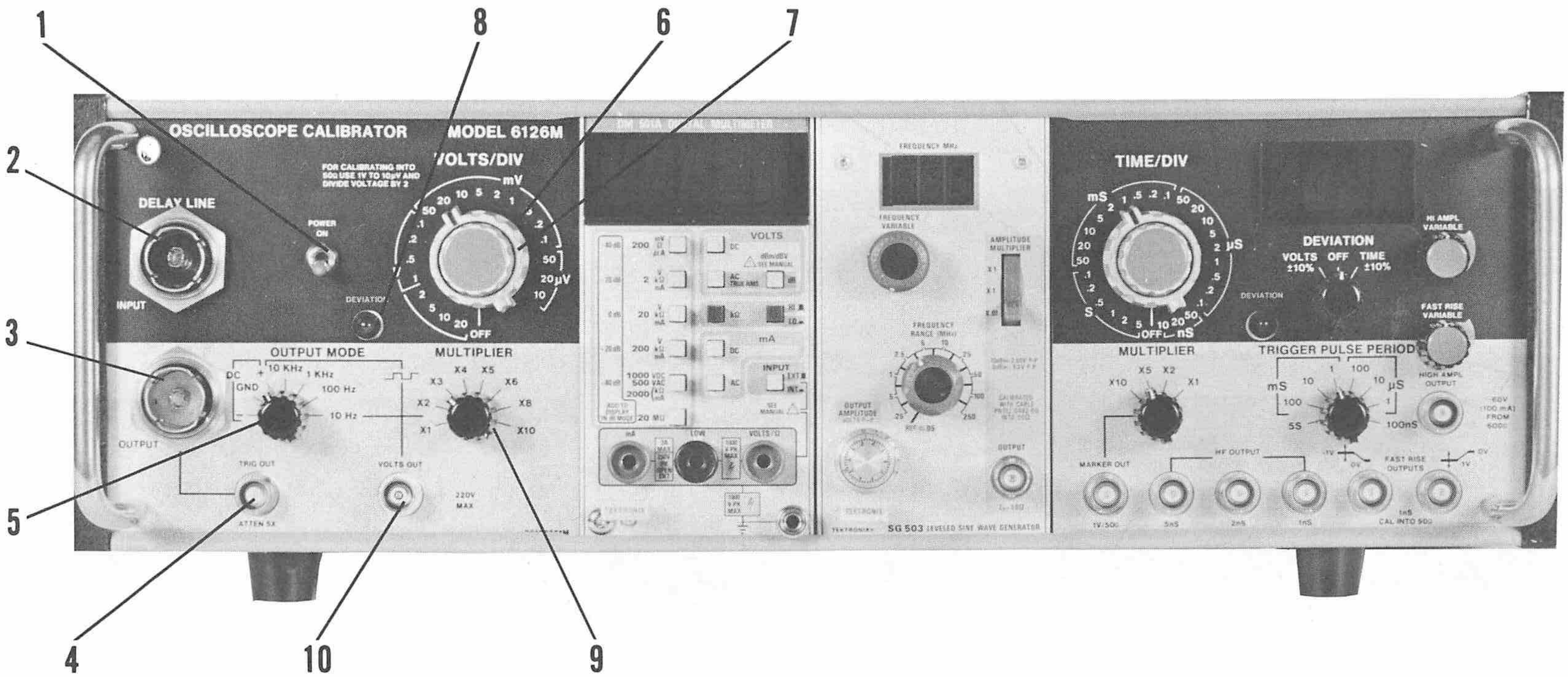


Figure 3-1. Volts - Controls, Indicators, and Connectors

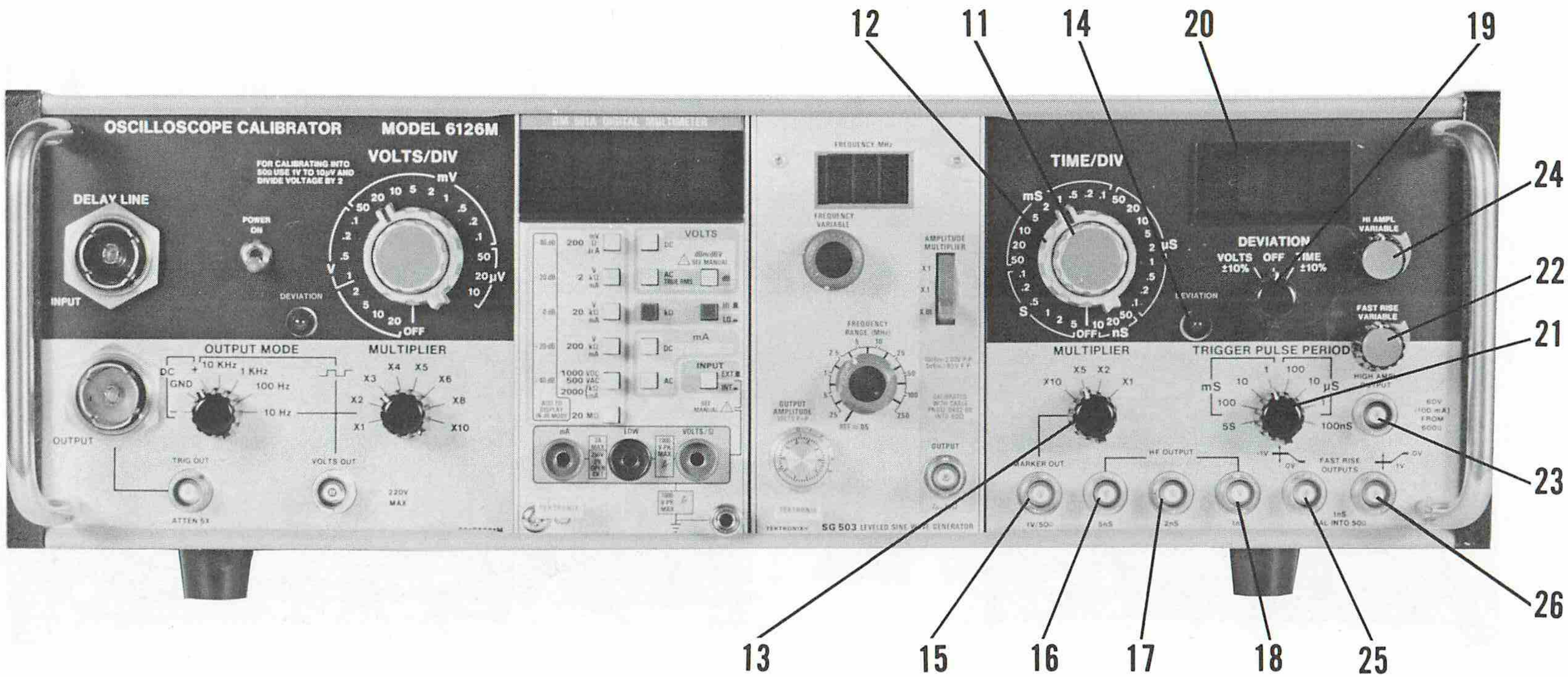


Figure 3-2. Time - Controls, Indicators, and Connectors

TABLE 3-1. FRONT PANEL CONTROLS, INDICATORS AND CONNECTORS

Index No. (Fig. 3-1, 3-2)	Control, Indicator, Connector	Function
1	POWER ON switch	Toggle switch that applies ac power to instrument.
2	INPUT connector	Delay line input connector.
3	OUTPUT connector	Delay line output connector. Signal delayed 75 ns from input signal.
4	TRIG OUT connector	Provides trigger signal picked off from delay line. Input signal is attenuated 5X at TRIG OUT connector when applied to 50 ohm load.
5	OUTPUT MODE switch	Selects ±DC signal, GND, or square wave of 10 Hz, 100 Hz, 1 kHz or 10 kHz.
6	VOLTS/DIV switch	Selects calibrated voltage output from 10uV to 20V.
7	DEVIATION Adj. (Volts)	Provides continuous adjustment of Volts deviation.
8	DEVIATION (Volts) lamp	Illuminates when VOLTS DEVIATION has been selected.
9	MULTIPLIER (Volts)	Multiplies value selected by VOLTS/ DIV switch by X1 to X10.
10	VOLTS OUT connector	VOLTS/DIV signal output connector.
11	DEVIATION Adj. (Time)	Provides continuous adjustment of Time deviation.
12	TIME/DIV switch	Selects calibrated time markers from 10 ns to 5 sec.
13	MULTIPLIER (Time)	Multiplies value selected by TIME/ DIV switch by X1 to X10.
14	DEVIATION (Time) lamp	Illuminates when TIME DEVIATION has been selected.

TABLE 3-1. FRONT PANEL CONTROLS, INDICATORS AND CONNECTORS (Con't)

Index No. (Fig. 3-1, 3-2)	Control, Indicator, Connector	Function
15	MARKER OUT connector	Provides marker output from 10 ns to 50 seconds.
16	H. F. OUTPUT, 5 ns	Provides 5ns (200 MHz) markers.
17	H. F. OUTPUT, 2 ns	Provides 2ns (500 MHz) markers.
18	H. F. OUTPUT, 1 ns	Provides 1ns (1 GHz) markers.
19	DEVIATION switch	Selects VOLTS or TIME deviation or no deviation, (OFF).
20	DEVIATION meter	Digital meter that indicates deviation from calibrated time and voltage by > ±10.00%.
21	TRIGGER PULSE PERIOD switch	Selects period of trigger output pulses from 100 ns to 5 seconds.
22	FAST RISE VARIABLE control	Adjusts amplitude of both FAST RISE trigger outputs; from -100 mV to -1 V p-p and -100 mV to +1 V p-p.
23	HIGH AMPL OUTPUT connector	Provides High Amplitude square wave trigger output.
24	HIGH AMPL VARIABLE control	Adjusts voltage level of HIGH AMPL output from -6 to -60 V (unterminated) or -0.5 to -5 V (terminated into 50 Ω).
25	FAST RISE OUTPUT	Provides a negative going signal falling from a positive voltage to ground; ≤ 1 ns rise time.
26	FAST RISE OUTPUT	Provides a positive going signal rising from a negative voltage to ground; ≤ 1 ns rise time.

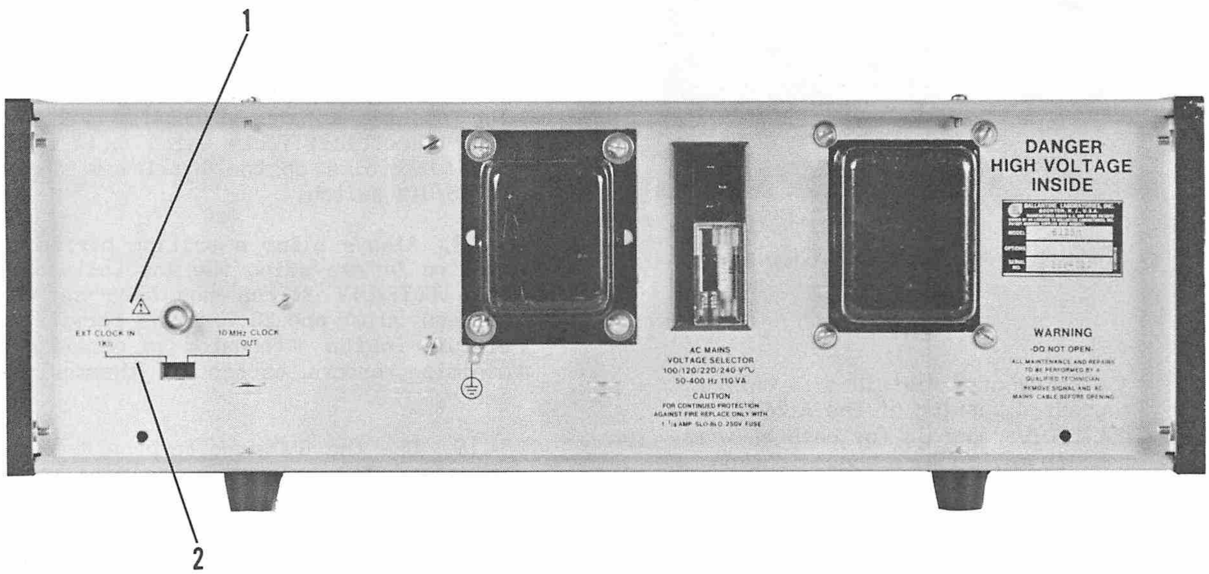


Figure 3-3. Rear Panel Controls and Connectors

TABLE3-2. REAR PANEL CONTROLS AND CONNECTORS

Index No. (Fig. 3-3)	Control, Connector	Function
1	EXT CLOCK IN 1 kΩ/10 MHz CLOCK OUT switch.	Slide switch that selects either external clock in or 10 MHz clock out.
2	EXT CLOCK IN 1 kΩ/10 MHz CLOCK OUT connector	BNC connector for applying external clock signal or providing 10 MHz clock output signal, depending on the position of the slide switch.

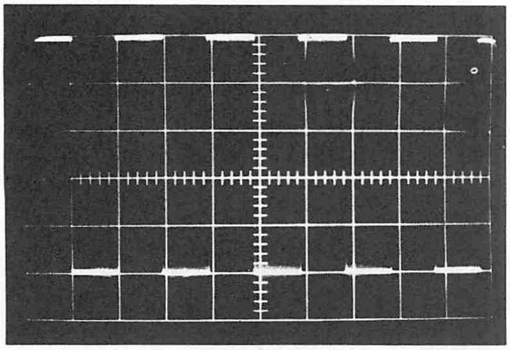


Figure 3-4. Volts Out Display

NOTE

A display of 5 divisions is only a suggested setting of the 6126M VOLTS/DIV controls for ease of readinG. It may be more convenient on an oscilloscope having an 8 cm high display, to select the X6 or X8 MULTIPLIER position on the 6126M and provide a signal that is closer to the full scale vertical deflection.

f. Set the DEVIATION switch to VOLTS ±10% and observe that the volts DEVIATION lamp is illuminated.

g. Rotate the VOLTS/DIV DEVIATION control (concentric with the VOLTS/DIV switch) until the oscilloscope indicates a square wave signal of exactly 5 divisions peak-to-peak. Note the reading of the digital DEVIATION meter on the 6126M; it represents the calibration error of the oscilloscope under test.

h. Check the accuracy specification of the oscilloscope under test. If the reading of the % DEVIATION digital meter is less than the specified calibration error allowable (typically ±3%) proceed to the next higher oscilloscope VOLTS/DIV range and the corresponding VOLTS/DIV setting of the 6126M.

i. If the reading of the % DEVIATION digital meter exceeds the allowable calibration error of the oscilloscope, note the reading and recalibrate the oscilloscope.

NOTE

When recalibrating the oscilloscope under test, set the DEVIATION switch to OFF. Adjust the oscilloscope calibration control for an exact indication of the output voltage of the 6126M.

j. Test each Volts/Div range on the oscilloscope, as indicated in the preceeding steps, until all ranges are calibrated on each vertical channel.

3-16. DC OFFSET ERRORS

3-17. At VOLTS/DIV switch settings above 50 mV, the output attenuator resistors must dissipate sufficient power to produce heat in the wire-wound resistors. This heat differential is especially noticeable on the DC+ and DC- modes where the attenuator dissipates twice the power of the square-wave output mode and when using the X5, X6, X8, X10 setting of the MULTIPLIER. The heating in the attenuator will result in thermoelectric effects which cause offsets of a few microvolts on the low level ranges of the VOLTS/DIV switch.

3-18. Always allow a waiting period of 3 to 5 minutes before using the low voltage output if the VOLTS/DIV switch has been set to ranges between 50 mV and 20 V. This permits the temperature in the attenuator to equalize so as to minimize errors caused by thermoelectric effects.

3-19. Use the GND mode to provide zero voltage reference for voltmeters or oscilloscopes. Do not use the switch on the oscilloscope itself or otherwise short the input terminals of the voltmeter under test. Using the GND mode eliminates most of the remaining thermal effects in the attenuator of the 6126M. The voltmeter reading with GND input represents The thermal voltage of the 6126M, the connecting leads and the voltmeter. The GND reading is the minimum voltage of the entire measurement system and it must be measured and arithmetically added to the reading of the voltmeter for all calibrations below +10 mV.

NOTE

If the 6126M VOLTS OUT cable is terminated in 50 ohms, use an output amplitude setting of the VOLTS/-DIV switch in the 1 volt to 10 microvolt range; the output amplitude will be one-half the reading of the VOLTS/DIV switch. The MULTIPLIER setting will still provide the necessary graticule divisions of amplitude and extend the output to 10 volts peak-to- peak which will translate into 5 volts peak-to-peak across the external 50 ohm load.

3-20. GROUND CURRENT ERRORS

3-21. Always ground the power cord ground pins on the calibrator and the instrument under test to earth ground. This is especially important to avoid noise interference on low VOLTS/DIV ranges. The VOLTS OUT circuitry is offset from ground by internal resistor R which is used to avoid circulating ground loop currents between the VOLTS OUT connector shell and the instrument under test. When using VOLTS/DIV ranges below 0.1 volt and the calibration is suspect or displays power frequency distortion, carefully check the instrument for input power circuit leakage problems.

3-22. If the instruments are found safe, it is recommended that one or the other instrument be temporarily isolated from the power mains earth ground and that a well shielded and safe isolation transformer be used in its power input. This will remove or reduce circulating ground currents so that errors from this source may be minimized for low output voltage level applications.

WARNING

Disconnecting earth grounds may provide a personnel safety hazard in some instruments. Use extreme caution to avoid shock hazard and restore normal earth ground once low voltage calibrations are completed.

3-23. WARMUP ERRORS

3-24. The unit is fully operative within one minute of POWER turn ON. The amplitude calibration drift during the first 20 minutes of operation in a constant temperature laboratory environment is less than ±0.2 percent in normal or subsequent operation.

3-25. TIME CALIBRATION

3-26. TIME MARK GENERATOR

3-27. The MARKER OUT BNC is an accurate time signal in the shape of a pulse train. The positive going pulses occupy 5 percent of the marker period for intervals longer than 0.1 us and approximate a square wave at 10 nanoseconds. The TIME/DIV MULTIPLIER permits decading checks as well as oscilloscope magnifier check and picket fence simulation in radar range calibration. Digital counters and signal sources may also be checked. The markers are rich in harmonics. They may be used to check spectrum analyzers. An external time base input provision permits use of a 10 MHz frequency standard for traceable calibration. The EXT clock input may be used to provide arbitrary TIME/DIV marker output selection below 0.1 us (10 MHz) as may be required for video markers, ultrasonic delay calibration and engineering unit readouts. A typical test procedure for oscilloscopes is outlined in the following paragraphs.

3-28. CHECKING OSCILLOSCOPE TIME BASE CALIBRATION

a. Connect the MARKER OUT BNC connector of the 6126M to the vertical amplifier of the oscilloscope to be tested. Use a 50 ohm coaxial cable terminated in 50 ohms at the input BNC of tHe oscilloscope. The Ballantine Model 12249D four foot BNC cable and the Model 12630A 50 ohm Feed Thru Termination is recommended.

b. Set the 6126M controls as follows:

TIME/DIV	Same as the oscilloscope TIME/DIV range to be checked.
MULTIPLIER	X1
DEVIATION	OFF

c. Set the oscilloscope vertical attenuator to 0.2 VOLT/DIV and adjust the scope trigger circuits for proper internal triggering when the oscilloscope TIME/DIV switch and the 6126M TIME/DIV switch are set to the same range.

d. Use the oscilloscope position controls and properly center the display on the CRT. Figure 3-5 shows a typical presentation. Note that ten time intervals are defined on an approximately 5 division high display.

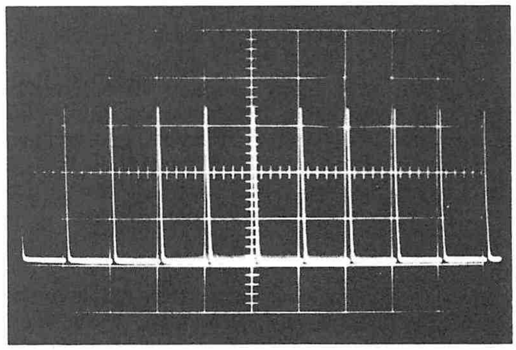


Figure 3-5. Marker Out Display

e. Position the first rise to the left most graticule line. Observe that one calibration marker falls on each graticule line. The error of marker alignment on the eleventh (right most) graticule line represents the observed calibration error.

f. Set the DEVIATION switch to TIME ±10% and note that the TIME/DIV deviation indicator lamp is illuminated. Rotate the TIME/DIV deviation control until the right hand marker pulse aligns with the right hand graticule line and a marker falls on each graticule line of the scale.

g. Read the % DEVIATION digital meter on the 6126M and note the measured error for the oscilloscope time base range under test. If this is within the oscilloscope calibration error allowance (usually ±3%) proceed; if not, note the error and recalibrate the oscilloscope.

h. Observe the alignment of the leading edge of the marker on the second thru the tenth graticule lines. This is an indication of time base linearity.

i. Continue to check calibration accuracy of all the time base ranges of the oscilloscope under test. TIME/DIV settings slower than 1 ms may be easier to check when the TIME/DIV MULTIPLIER is set to X5 and even X10 for the slowest sweeps.

NOTE

Use triggered sweep synchronization for all TIME/DIV settings slower than 1 ms. Do not use AUTO triggering, since erratic synchronization for slow pulse rates will result in misalignment of the first marker pulse with the first CRT graticule line.

3-29. PULSE GENERATOR MODES

3-30. General instructions for both the High Amplitude and Fast Rise Pulse Generator Modes are as follows:

a. The TRIGGER PULSE PERIOD switch on the 6126M controls the period of both the High Amplitude and Fast Rise Generators from 100 ns to 5 sec in 8 crystal controlled steps. These signals are all derived from the 10 MHz master clock.

b. Use only high quality 50 ohm cables, connectors, attenuators and terminations. Be sure cables are not damaged and that connectors are clean with plating in good condition to assure optimum conductivity. All cables should be as short as possible and all connectors properly tightened.

c. Inductive and capacitive loads should be reduced to a minimum. Remember that frequency components in excess of 1 GHz are present in the harmonics of the fast rise pulse. Avoid degradation caused by both long cables and those of small diameter. Use cables that are shorter than 30 inches and never use 50 ohm cables having a diameter smaller than that of RG-58/U. Those with foamed polyethylene or teflon dielectrics are preferred.

d. 50 ohm precision loads are required to obtain minimum pulse aberrations and best rise times. Terminating loads must be capable of handling the power available at the High Amplitude and the Fast Rise Output connectors. A load wattage derating of two or three to one is recommended.

e. When testing equipment which also puts a dc voltage across the load driven by the 6126M, an error in the amount of this dc offset will be obtained. To avoid this dc offset error, couple the 6126M voltage outputs through a dc blocking capacitor. (Of course this must not be done in the DC Output Mode.) Take care to preserve the integrity of the 50 ohm transmission system. Select a coupling capacitor that, when combined with the total resistance it drives, produces a large enough time constant to preserve the pulse flatness inherent in the 6126M square wave outputs.

3-31. HIGH AMPLITUDE OUTPUT

a. Connect an output cable to the 6126M HIGH AMPL OUTPUT BNC to use the High Amplitude Pulse Generator. Use the TRIGGER PULSE PERIOD switch to select square waves from 100 ns to 5 sec.

b. Adjust the output amplitude with the HI AMPL VARIABLE control.

c. The High Amplitude Pulse may be used to adjust the input attenuators of oscilloscopes similar to the Amplitude Calibration generator. The High Amplitude output rise time rises toward ground and starts from a negative voltage which is set by the VARIABLE amplitude control. The peak-to-peak value of the High Amplitude square wave is determined by the load resistance as indicated in Table 3-3. Fast rise time and minimum pulse aberrations are only obtained when using 50 ohm termination.

TABLE 3-3. HIGH AMPLITUDE OUTPUT vs. LOADING

HIGH AMPL OUTPUT	VARIABLE control	
Termination	Maximum	Minimum
50 Ω load 600 Ω load 1M Ω load	0.3 V p-p 2.0 V p-p 4.0 V p-p	5 V p-p 32 V p-p 60 V p-p

3-32. FAST RISE OUTPUTS

a. The FAST RISE PULSES are available as a negative going signal falling to ground and a positive going signal rising to ground. Both outputs are similar and are controlled together by the FAST RISE VARIABLE control. Both outputs are fast rise for use in 50 ohm systems and have a peak-to- peak amplitude variation from 100 millivolts to 1 volt. The precision pulse rise time and aberrations are only specified to 1 volt.

b. For selection of the square wave frequency, use the TRIGGER PULSE PERIOD switch and select 100 ns to 5 sec square waves.

3-33. The FAST RISE OUTPUT is used for checking ratio mode in digital counters and trigger circuits in oscilloscopes. The FAST RISE signal has a very fast rise time (< 1 ns) and is therefore rich in harmonics for checking frequency calibration of spectrum analyzers and other frequency domain devices. The fast rise time is intended for checking the vertical amplifier alignment of oscilloscopes as detailed in paragraph 3-37.

3-34. EXTERNAL TRIGGERING OF OSCILLOSCOPES

a. See the scope for external triggered operation. Connect the 6126M FAST RISE signal to the scope's external trig input and use a 50 ohm termination at the scope.

b. In general, the trigger period should be slower than the marker period displayed on the scope. This avoids the appearance of an unmarked base line on the scope. Keeping trigger rate high will give the brightest display on the scope.

c. Varying the trigger period while checking calibration of any one scope time base range will check scope time base calibration, jitter factor and general trigger stability when signals of varying repetition rates are displayed on the oscilloscope during its normal use.

3-35. The internal MARKER-TRIGGER INTERLOCK switch in board assembly A16 is used in conjunction with external trigger operation for oscilloscopes, radar sets and other applications involving exact time coincidence between the FAST RISE OUTPUTS and MARKER OUT signals.

a. In the NORMAL setting of the internal MARKER-TRIGGER INTERLOCK switch, the digital dividers in the trigger and marker circuits are independent ripple counters with no compensation for the few nanoseconds of accumulated delay which may be different in each divider chain. The NORMAL setting provides FAST RISE OUTPUTS for all settings of the TRIGGER PULSE PERIOD and TIME/DIV (and MULTIPLIER) settings.

b. Use of the NORMAL mode in externally triggered scope calibration may require reset of horizontal trace positioning when checking fast time base speeds (faster than 1 us/DIV). The phasing changes of the FAST RISE OUTPUTS with respect to the MARKER OUT signals will require this trace alignment. As an extra convenience and to speed up calibration, the LOCKOUT mode is provided.

c. In the LOCKOUT mode a gating circuit provides exact time coincidence between the rise of the FAST RISE and MARKER OUT signals. This time coincidence is advantageous when calibrating complex timing circuits such as radars and facilitates externally triggered sweep time calibration of oscilloscopes.

d. As a convenience, the scope being calibrated with the 6126M may be externally triggered at a fixed rate (i.e. 1 ms). This avoids the need to adjust scope triggering when the faster sweep speed ranges are being calibrated or checked. This is of special advantage on scopes with poor trigger performance.

3-36. RISE TIME MEASUREMENT

3-37. The FAST RISE OUTPUTS of the 6126M provide a clean, fast rise which is intended for use as a test signal for checking the bandwidth and high frequency alignment of wideband amplifiers such as the vertical amplifiers of oscilloscopes. See figure 3-6.

3-38. AMPLITUDE FOR RISE TIME MEASUREMENTS

a. It is usual to measure the rise time of an oscilloscope amplifier with the scope input attenuator set for maximum sensitivity (i.e. straight through with no attenuation).

b. The FAST RISE VARIABLE control on the 6126M provides a continuously variable FAST RISE amplitude over the range of 100 mV to 1 V when terminated in 50 ohms. This amplitude adjustment permits exact alignment of the rise time on the scope graticule for 4 or 5 divisions and avoids using the scope variable gain control for exact trace alignment. The scope variable gain control often deteriorates the effective amplifier response and the 6126M provides control without loss of fidelity.

c. For scopes and amplifiers having greater sensitivity (i.e. to 1 mV or 5 mV/DIV), an additional coaxial wideband attenuator (such as the GR874 Series) should be included in the 50 ohm transmission line from the FAST RISE OUTPUT connector to the input of the amplifier. Always use a feed-thru 50 ohm termination such as the Ballantine 12630A directly at the input connector of the amplifier.

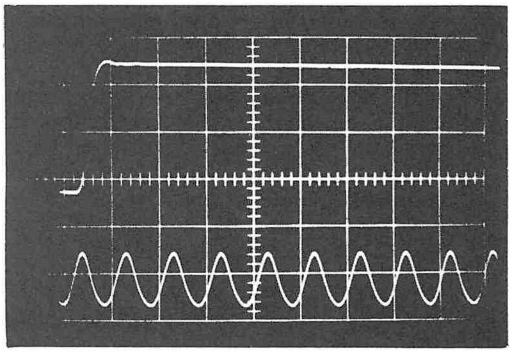


Figure 3-6. Rise Time Display

3-39. CABLE MATCHING FOR RISE TIME MEASUREMENTS

a. The impedance of the connecting cable and coaxial components should be 50 ohms ±2%. Cable length should be kept as short as possible since long cables (longer than 1 meter) will degrade the rise time of the FAST RISE square wave.

b. The 50 ohm cable should be terminated in 50 ohms. This also presents a low source impedance for driving the input impedance of the amplifier. It may be desirable to use a 2X (or greater) divider for the 50 ohm termination so that the loading of the amplifier is minimized by the lower driving impedance. Many high frequency oscilloscopes are designed to be calibrated and checked from a 25 ohm source.

c. In practice the deteriorating effect of scope amplifier input loading on the properly terminated FAST RISE OUTPUT signal is of importance only for scopes having greater than 50 MHz bandwidth (< 7 nanosecond rise time).

3-40. RISE TIME MEASUREMENT ACCURACY

a. Before measuring the rise time of a scope amplifier, the time calibration of the scope time base should be checked at the speed and in the graticule area to be used for displaying the rise time signal.

NOTE

Always calibrate the time base of the oscilloscope in the region where rise time checks are made (usually on the fastest sweep range). The operator must correct for beginning trace nonlinearity and magnifier errors which often account for 8 to 10% timing error. Rise times should be measured some 50 or more nanoseconds from the beginning of the visible scope trace and near screen center for best results.

b. The 1 nanosecond rise of the FAST RISE square wave is adequate to check scopes having bandwidths to 250 MHz. The 1 nanosecond rise will increase the rise time displayed on the scope by only 1% for 50 MHz scopes having 7 nanosecond rise time. For slower scopes the true rise time is given by:

$$\text{True Rise Time} = \sqrt{(\text{Displayed rise time})^2 - (\text{Source Rise Time})^2}$$

3-41. FAST RISE MEASUREMENT PROCEDURES

a. Connect either of the FAST RISE OUTPUTS to the amplifier input by a short 50 ohm cable, any required coaxial attenuators and a 50 ohm termination at the input of the amplifier.

b. Select the desired TRIGGER PULSE PERIOD. Use a faster trigger rate to optimize display brightness.

c. Adjust the scope trigger circuit and TIME/DIV control to display the fast rise on the CRT. Position the pulse past the first 50 nanoseconds of sweep and horizontally position it at the center of the graticule. Be sure the sweep has been accurately calibrated at this point and that the slope of the rise time extends over more than half a major graticule division.

d. Use the 6126M FAST RISE VARIABLE control to align the top and bottom of the rise to 0% and 100% reference line or use 5 graticule divisons. Measure the time between the 10% and 90% amplifier high frequency alignment.

3-42. HF OUTPUTS

3-43. High frequency sine wave markers are avialable at 1 ns, 2 ns, and 5 ns. The 6126M provides independent 200 MHz, 500 MHz and 1 GHz sine wave outputs derived from the master clock as the MARKER OUT and FAST RISE OUTPUT signals. Should an external clock input be used, it must be exactly 10 MHz or the multipliers used to obtain the 5 ns and 2 ns signals will not activate.

3-44. The 1 ns frequency doubler is built into the 6126M rather than being supplied as an optional accessory. Since the 1 ns (1 GHz) output is derived from the 2 ns (500 MHz) only one or the other may be used at any one time.

NOTE

There is no deviation capability with the three High Frequency Outputs since they are derived through narrow band multipliers from the 10 us (100 MHz) VCO which must be locked to the 10 MHz internal crystal oscillator. Always set the DEVIATION control to OFF when the signal from the High Frequency Output is required.

3-45. Always use the High Frequency Outputs in a matched 50 ohm transmission system. Use low VSWR connectors and termination. High quality, low loss cables no greater than 12 inches in length should be used with the 1 ns and 2 ns outputs to assure specified signal amplitude.

3-46. To connect the HF OUTPUTS to an oscilloscope, digital counter, spectrum analyzer or sweep generator marker input, use a short 50 ohm cable terminated in BNC connectors. If the instrument under test has a 50 ohm input impedance, no further termination is required. If the input impedance is high (such as a 1 megohm oscilloscope or counter) use a 50 ohm feed-thru termination at the input connector of the instrument under test. The Ballantine Model 12630A feed-thru termination is recommended. It is important to present a true 50 ohm terminated system to the HF ouputs. VSWR higher than 1.1 on large capacitive loads may detune the multipliers and result in loss of output amplitude and increased distortion. If a high VSWR load is unavoidable, buffer it with a coaxial attenuator of 6 db or 10 db attenuation to minimize termination difficulties.

SECTION 4

THEORY OF OPERATION

4-1. INTRODUCTION

4-2. The 6126M Oscilloscope Calibrator is comprised of an independent amplitude generator and an independent time generator. Only the ac mains power transformers and the deviation meter are common. Both generators are electrically controlled for function and range so that the front panel controls do not carry measurement signals. The theory of operation for the Calibrator is separated into main functions as follows:

a) Volts Generator

High Impedance Output
50 ohm output

b) Time Mark Generator

High Amplitude Pulse Generator
Fast Rise Pulse Generator

c) Constant Amplitude Sine Wave Generator -Tektronix SG503 Manual

d) Multimeter -Tektronix DM501A Manual

4-3. The following discussion of the theory of operation will treat the TIME and VOLTS generators separately. A simplified Block Diagram for the 6126M main frame is shown in Figure 4-1.

4-4. VOLTS GENERATOR

4-5. GENERAL DESCRIPTION

4-6. The basic VOLTS generator circuit consists of a resistance programmable regulated precision d.c. power supply, a high voltage low impedance transistor switch circuit used to generate square waves from the d.c. power supply output, a precision resistor multirange attenuator, and a 50 ohm power output stage which functions from 10 V to 10 uV. The combination of resistance programming of the power supply and range selection of the attenuator provides calibrated voltage from 200 V down to 10 uV in 1, 2, 5 steps. The VOLTS/DIV switching logic is first applied to A1 U1 where it is modified to accommodate the 50 Ω output. This "new" logic then controls A5 U1, A6 U1, and A100 U1; providing a high impedance output for the 20 V to 2 V positions of the VOLTS/DIV switch and a 50 Ω output impedance for the 1 V and lower positions. The VOLTS MULTIPLIER extends the high impedance range to 200 V and the 50 Ω range to 10 V. When the VOLT OUT is terminated in a 50 load and any of the low impedance positions of the VOLTS/DIV switch are used, then the actual voltage output is the VOLTS/DIV switch position divided by two. The output voltage may be positive or negative d.c., or positive square waves of 10, 100, 1000, or 10,000 Hz as determined by the MODE selection circuits. A deviation circuit permits calibrated, metered deviation of the output voltage for direct read out of percentage from the nominal settings.

4-7. PROGRAMMABLE DC SUPPLY

4-8. The programmable DC power supply utilizes circuitry located on PC boards A2, A3, and A4. It provides the precise initial dc voltage from which both dc and square wave output signals are derived. The full wave rectifier bridge CR1, CR2, CR3, CR4 in power supply assembly A2 provides a nominal 260 volts, unregulated across C2. A voltage doubler CR5, CR6 provides an additional 240 volts across C3. A 17 volt transformer secondary winding on T2 drives CR1 and CR2 of assembly A3 to provide 12 volts, plus and minus, from the reference "HI" voltage supply line.

4-9. A floating dc regulator, programmable from the front panel MULTIPLIER switch and DEVIATION controls, provides the precise initial dc voltage between the "HI" and "LO" supply lines. The zener voltage reference diode CR5 in A3 provides a comparison standard that controls the initial voltage. A constant current for Q5, Q6, Q7, and Q8 of A2 is provided by zener A3 CR5. The ratio of the controlled voltage to the reference diode voltage is determined by precision resistors A3 R10, A3 R11, A3 R12, and precision resistors A4 R1 through A4 R8 in the multiplier selector assembly A4.

4-10. Adjustable potentiometer A3 R9 provides a precise calibration of the initial dc voltage when the DEVIATION switch is OFF or in its TIME position. When the DEVIATION switch is turned to the VOLTS position, a variable voltage from the DEVIATION control provides for a variation of plus and minus 10 percent. This difference voltage is monitored by the deviation readout meter.

4-11. The voltage regulator operates with a high degree of negative feedback. Any decremental voltage difference between output line "HI" and the base of transistor A3 Q1-B causes a current change from the collector of A3 Q1-A, operating through Q4, Q3 and Q2 to make the correction.

4-12. The MULTIPLIER switch provides control signals, J, K, L, which select, by means of relays K1 through K7 in A4R, the precision resistors used for voltage comparison. The control is basically a resistance programmable precision output voltage.

4-13. In the DC mode, A3 Q3 remains saturated, and A3 Q4 and A3 Q5 remain open, so that the dc output voltage amplitude is exactly that set by the programmable power supply. In AC modes, the above transistors are switched between open and saturation so that the ac output amplitude has the identical peak amplitude as in the ±DC output mode.

4-14. SQUARE WAVE CHOPPER SWITCH

4-15. The controlled voltage between line 26 from A2-7 and the "LO" dc supply line is directed into a chopper switch comprised of A3 Q3, A3 Q4 and A3 Q5. When square waves are called for by the OUTPUT MODE switch, chopper control signal at TP1 alternates between high and low logic. When it is at low level, A3 Q4 and A3 Q5 are open. A3 Q3 saturates, passing voltage from the controlled dc voltage line 26 to line "HI" which directs it to the mode selector assembly A7. When TP1 is high, A3 Q4 and A3 Q5 conduct, cutting off A3 Q3. The voltage level between "HI" and "LO" reduces to an exact zero level obtained by the adjustment of A3 R2, the square wave zero level adjust.

4-16. The timing of the TP1 signal is derived from a programmed divider A7 U1 which divides the frequency of its input signal on pin 3 by a power of 10 determined by input control lines X, Y, and Z. The input signal at A7 U1-3 is a crystal-controlled 1 MHz signal received from the TIME generator A18 pin R. The output from A7 Q3 provides the floating output chopping wave TP1 to the chopper switch in A3.

4-17. OUTPUT MODE SELECTION

4-18. The calibrated DC or calibrated chopped signal from the chopper stage in A3 is received on lines "HI" and "LO" at the OUTPUT MODE selector Assembly A7. The signal then passes through relays A7 K2, A7 K3, and A7 K4 and connect to the calibrated attenuator R22, R23. Relays A7 K2 and A7 K3, acting together, function as a reversing switch to provide negative dc at the output terminal when energized. Relay A7 K4 connects the input end of the precision attenuator directly to the output return terminal to provide zero output volts when the OUTPUT MODE selects GND.

4-19. OUTPUT MODE control is provided by the front panel output mode switch S1. This is connected through shorting board A1. The mode selection is accomplished through control lines X, Y, and Z. These lines control the square wave frequency at A7 U1, and operating through logic elements A7 U5 and A7 U6, control transistors A7 Q5, Q6 and Q7. They control relays A7 K2, A7 K3 and A7 K4 to provide positive, negative or zero dc output voltages. The seven output modes, the control line and logic states are summarized in Table 4-1.

4-20. PRECISION ATTENUATOR

4-21. The precision attenuator comprises two stages. The first stage in assembly A7 comprises precision resistors A7 R22 and A7 R23 which provide an attenuation of 1000 to 1 when relay A6 K6 is energized. Relays A6 K1 through A6 K5 are located on the 1 mV to 20 V divider assembly A6 and control the four steps from 20 volts to 1 volt. The remaining steps, 1 V to 10 V, are controlled by a combination of the relays on A5, A6, and A100 assemblies.

4-22. Selection of the degree of attenuation originates at the VOLTS/DIV switch on the front panel which defines the logic states of control lines A, B, C, D, and E. Table 4-2 summarizes the switch positions, the logic line states, and the decoder and operating relay states for A5 and A6 assemblies.

4-23. 50 OHM OUTPUT

4-24. Assembly A100 provides a 50 ohm source impedance with 100 mA current capability. Relays A100 K1 and A100 K2 always act together to provide either high source impedance for the 20 V to 2 VOLT/DIV ranges or 50 ohm source impedance for the 1 volt to 10 microvolt ranges. The MULTIPLIER remains operative so that 200 volts and 10 volts are respectively provided. The logic table for the VOLTS/DIV range selection is given in Table 4-3.

4-25. The 50 ohm source circuit consists of high gain stability voltage follower A100 U1. Transistors A100 Q1 and A100 Q2 are complimentary power amplifiers which are within the feedback loop and provide 100 mA output current capability. A100 R4 provides gain adjust on the 10 volt range by slightly altering the gain to provide unity gain from input to output on the 10 volt range. A100 R1 nulls out offsets and sets ZERO at the VOLTS OUT connector when GND mode is selected at .2 V (unterminated).

4-26. The output impedance at the emitters of A100 Q1 and A100 Q2 is very low since these transistors are in the feedback loop of the amplifier. A100 R9 provides 50 ohm source resistance when relay A100 K3 is closed. The maximum output voltage is plus or minus 5.5 volts so that the maximum voltage at the emitters of A100 Q1 and A100 Q2 is plus or minus 12.1 volts. The exact voltage is set by A100 R4, the 10 V CAL adjust.

4-27. A100 R10 through A100 R15 comprise a constant impedance, precision 50 ohm attenuator. When A100 K4 is closed, an attenuation of 100 (40 db) is provided. When relay A100 K5 is closed, the entire attenuation of 1000 (60 db) is used. All of the low level output ranges use attenuation of 1000 to minimize the effects of noise and thermal drifts in amplifier A100 U1.

4-28. VOLTS DEVIATION CIRCUITRY

4-29. The VOLTS PERCENT DEVIATION feature of the 6126M provides a controllable measured percent variation, plus or minus (high or low), available in all of the output voltage modes and amplitudes when the front panel DEVIATION switch is in the VOLTS position.

4-30. Voltage deviation takes place when current, either positive or negative, is injected at the collector of transistor Q1-B in the programmable dc supply circuitry described in paragraph 4-7. The control current is a function of the output voltage of op amp A7 U3 and is proportional to the VOLTS DEVIATION control, R1. The output of A7 U3 is coupled through opto-isolator A7 U4 which in turn controls the current of A7 Q4. It is this current, applied through the resistor string on assembly A18, that is directed to A3 Q1-B.

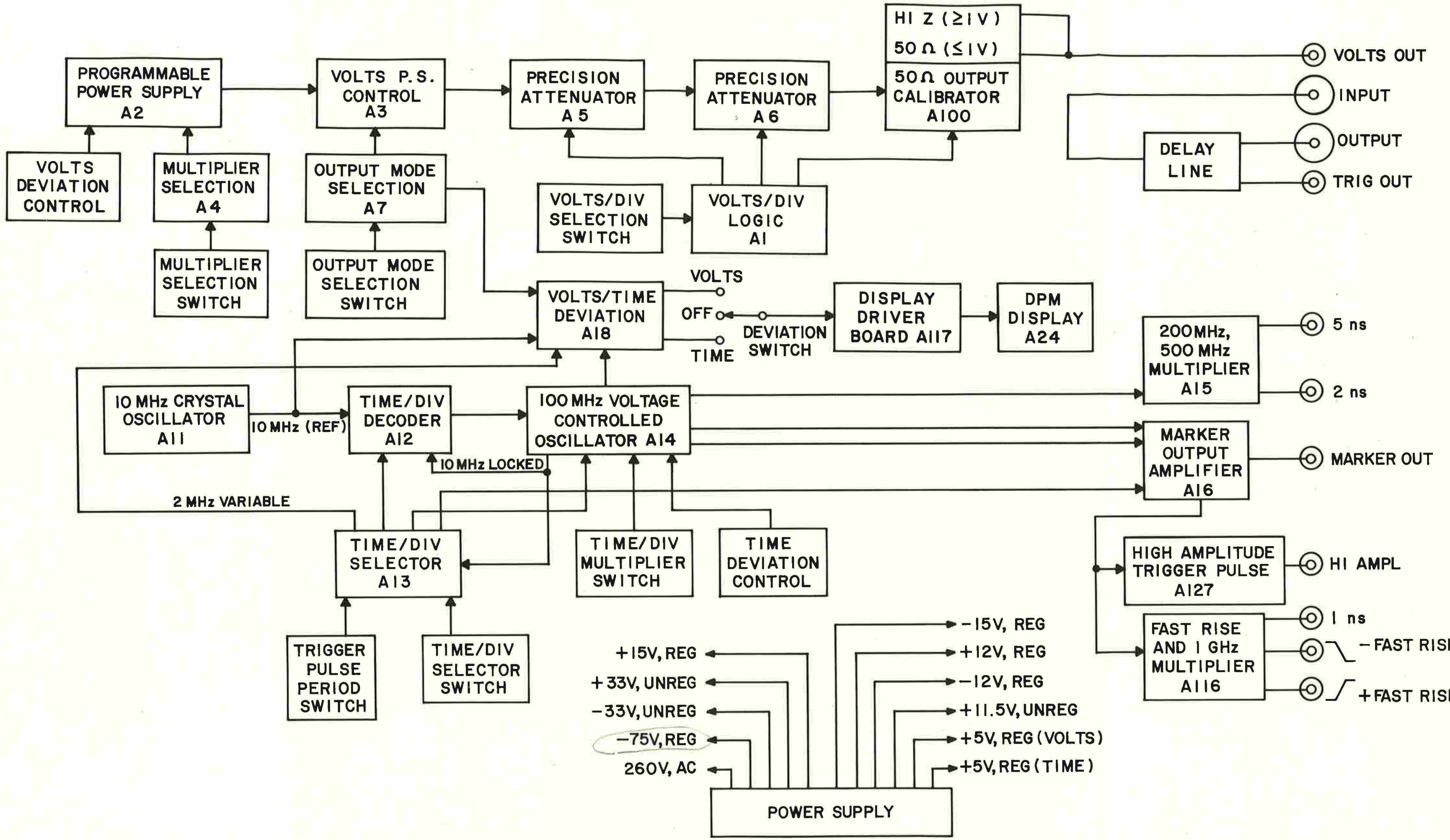
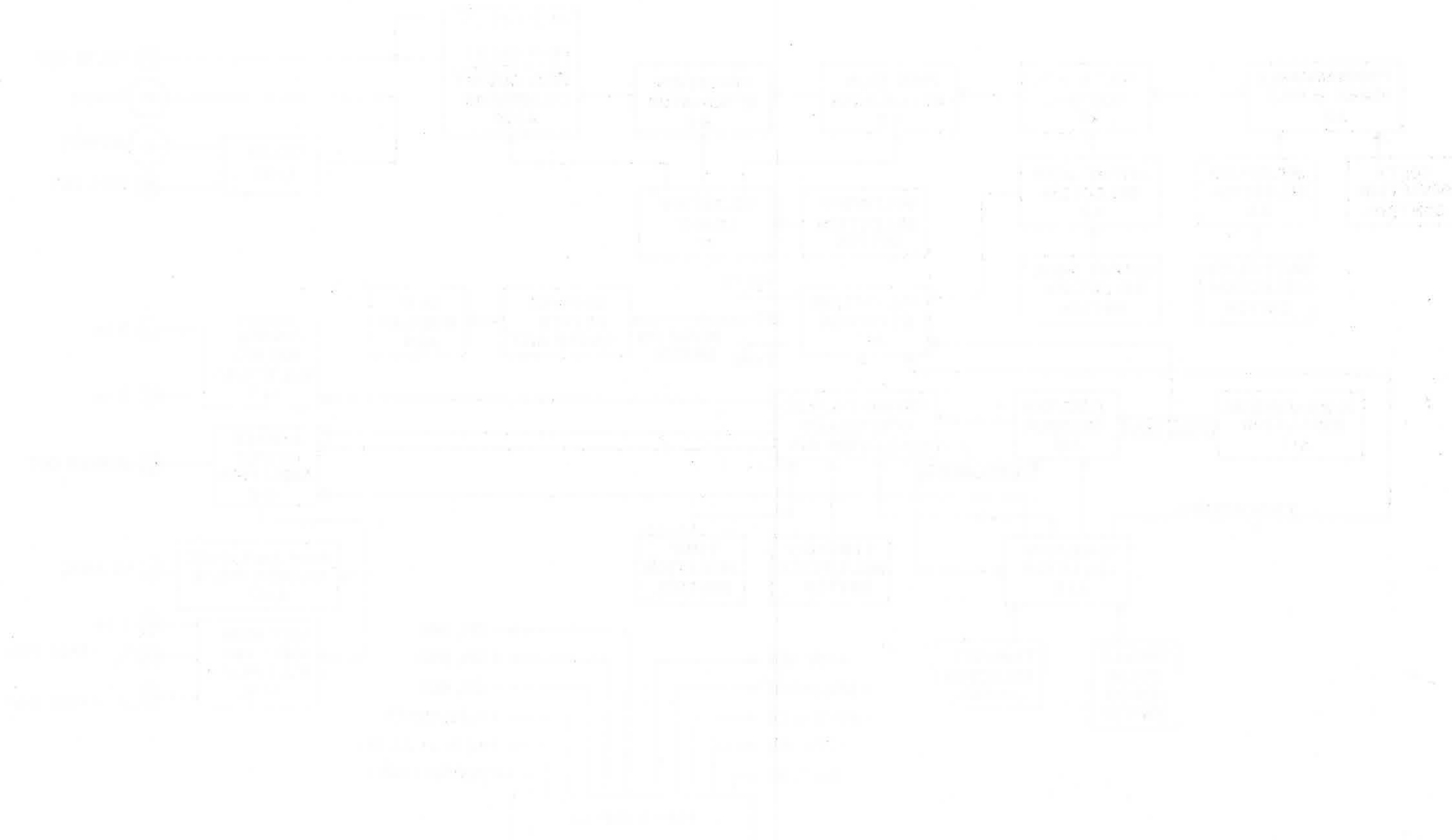


Figure 4-1. 6126M Block Diagram



4-31. The VOLTS DEVIATION measurement voltage is taken through the relay contacts of A18 K2 and A18 K3 which close when the DEVIATION switch is in its VOLTS position. Current then flows from the source of the deviation control voltage through a series circuit comprised of A18 R1, A18 R2, A117 R14 and A18 R16. The voltage across A117 R14 is monitored by A117 U3, a 3-1/2 digit A/D converter. The BCD output of U3 is then directed to U5, a BCD-to-7 segment decoder. The amount of deviation in percent is then displayed on the 3-1/2 digit DPM.

4-32. TIME CALIBRATOR

4-33. GENERAL DESCRIPTION

4-34. The Time Calibrator derives its basic reference from a 10 MHz crystal controlled oscillator. All other frequencies are derived from this reference by multiplication divison or phase locked loop techniques. The reference frequency is first used to phase lock a 100 MHz voltage controlled oscillator. The 100 MHz oscillator is multiplied by 2 and 5 to provide 5 ns and 2 ns output markers and is also divided in a 1, 2, 5, 10 sequence to provide markers with periods from 10 ns to 50 sec. A 1 ns output marker is obtained by multiplying the 500 MHz signal by 2. This is done on assembly A116. A square wave trigger source with periods ranging from 100 ns to 5 sec is also provided. The FAST RISE OUTPUT rise time is 1 ns or less; permitting rise time checks of wideband amplifiers. A deviation measuring circuit provides direct reading time deviation measurements on all ranges except the 1, 2, and 5 ns outputs.

4-35. 100 MHz OSCILLATOR

4-36. The 100 MHz oscillator A14 U1, is a voltage controlled oscillator phase locked to the 10 MHz reference crystal oscillator except when the deviation mode is selected. The 100 MHz oscillator is a Motorola MECEL IC Type 1658.

4-37. Frequency control is accomplished through the use of voltage-variable current sources which control the slew rate of a single external capacitor. In the calibrated mode, the output of the VCO is applied to decade counter, A14 U2 (MC 10138) and the resultant 10 MHz output is phase compared to the 10 MHz crystal reference in A12 U2, a Motorola MC 4044 Phase Frequency Detector. The output of the phase detector is then applied to the voltage control input of the MC 1658 to complete the phase locked loop and ensure that the 100 MHz oscillator frequency is as accurate and stable as the 10 MHz crystal reference, except for some second order short term jitter. In the deviation mode the voltage control input of the oscillator is switched to a variable voltage source which is controlled by a front panel potentiometer.

4-38. COUNTER CHAIN AND MULTIPLEXING

4-39. The 100 MHz oscillator frequency is counted down in 1, 2, 5, 10 steps by a number of bi-quinary counters and binary flip-flops. From 10 ns periods to 50 ns periods, MECL devices are used; while from .1 us to 5 sec., low power Schottky TTL is used. For a given range, digital multiplexers then route the particular timing signal required to the output circuits for processing and shaping. One additional bi-quinary and binary counter and digital multiplexer provides 1, 2, 5, and 10 times multiplication of the time period selected by the range switching.

4-40. MARK/SPACE RATIO ENCODER AND OUTPUT DRIVER

4-41. The marker outputs have a mark/space ratio of 5% on all ranges except the 10 and 20 ns ranges which have a 50% ratio and the 50 ns range which has a 20% mark/space ratio. The 5% mark/space ratio is produced by NORing .05T, .1T, .2T, .5T and T signals. Since all the signals are low for only 1/20 of the time period, the mark is 1/20 of T or 5%. This signal, which is at MECL levels, drives an output amplifier that provides the MARKER OUTPUT signals.

4-42. TIME GENERATOR CIRCUIT DESCRIPTION

4-43. The internal timing source is a crystal controlled 10 MHz master oscillator with a drift rate of less than 3 parts in 10^7 per day. It is utilized in the timing circuits when a rear panel CLOCK switch S4 is in its INTERNAL position. In this switch position, a buffered 10 MHz output signal is available at a rear panel BNC, J1. If an external frequency standard is to be used, switch S4 is changed to its EXTERNAL position, and an external 10 MHz signal source may be connected through J1.

4-44. When the front panel DEVIATION switch is OFF or in one of its VOLTS positions, all internal timing circuitry is locked to the internal or external primary source. When the DEVIATION switch is in the TIME position, the 1, 2, and 5 n sec signals are disabled and the TIME marker and trigger periods may be varied by plus or minus 10 percent.

4-45. When DEVIATION is set to OFF, the 10 MHz crystal controlled reference signal is introduced into phase comparator A12 U2. Here, a dc output signal at pin 8 is produced, which depends on the relative phase of the reference signal, and a controlled 10 MHz signal identified as "10 MHz LOCKED". The output of the phase comparator passes through an analog multiplexer A12 U1 to a voltage-controlled 100 MHz oscillator A14 U1. The output of the VCO is divided by ten in A14 U2 to provide the "10 MHz LOCKED" signal. This forms a phase-locked loop in which all derived frequencies from the 100 MHz VCO are phase-locked to the 10 MHz primary source.

4-46. In the TIME position of the DEVIATION switch, the 100 MHz oscillator receives its controlling dc voltage through the adjustable analog DEVIATION control potentiometer, R2.

4-47. The 100 MHz locked signal also operates frequency multiplier circuits in A15. A 2 ns signal is generated in oscillator A15 Q3. The 2 ns signal is multiplied by 2 on the A116 assembly,

TABLE 4-1. OUTPUT MODE SELECTION STATES.

OUTPUT MODE	CONTROL LINES			LOGIC ELEMENTS						RELAYS	
	X	Y	Z	U6-6	U5-4	U6-12	U5-13	U6-8	U5-10	K2, K3	K4
DC-	1	1	0	0	0	1	1	0	1	ON	OFF
GND	0	0	0	1	1	1	0	1	0	OFF	ON
DC+	1	1	1	0	0	0	1	1	1	OFF	OFF
10 kHz SQUARE	0	1	0	1	0	1	0	1	1	OFF	OFF
1 kHz SQUARE	0	1	1	1	0	0	0	1	1	OFF	OFF
100 Hz SQUARE	1	0	0	1	0	1	0	1	1	OFF	OFF
10 Hz SQUARE	1	0	1	1	0	1	0	1	1	OFF	OFF

TABLE 4-2. PRECISION ATTENUATOR CONTROL STATES.

V/DIV SWITCH S2	CONTROL LINES					ENERGIZED A6 TRANSISTORS	DECODER IC LOW OUTPUT PIN	ENERGIZED RELAYS
	A'	B'	C'	D'	E'			
20 V	1	1	1	0	1	03, Q1	A6U1-6	A6K7, A6K5
10	1	1	1	0	0	Q3, Q1	A6U1-7	A6K7, A6K4
5	1	1	0	1	0	Q3, Q1	A6U1-11	A6K7, A6K3
2	1	1	0	0	1	Q3, Q1	A6U1-10	A6K7, A6K2
1	1	1	0	0	0	Q3, Q1	A6U1-9	A6K7, A6K1
.5	1	0	1	1	0	Q3	A5U1-5	A6K7, A5K6
.2	1	0	1	0	1	Q3	A5U1-6	A6K7, A5K5
.1	1	0	1	0	0	Q3	A5U1-7	A6K7, A5K4
50 mV	1	0	0	1	0	Q3	A5U1-11	A6K7, A5K3
20	0	1	1	0	1	Q2, Q1	A6U1-6	A6K6, A6K5
10	1	1	0	0	0	Q3, Q1	A6U1-9	A6K7, A6K1
5	1	0	1	1	0	Q3	A5U1-5	A6K7, A5K6
2	1	0	1	0	1	Q3	A5U1-6	A6K7, A5K5
1	1	1	0	0	0	Q3, Q1	A6U1-9	A6K7, A6K1
.5	1	0	1	1	0	Q3	A5U1-5	A6K7, A5K6
.2	1	0	1	0	1	Q3	A5U1-6	A6K7, A5K5
.1	1	0	1	0	0	Q3	A5U1-7	A6k7, A5K4
50 uV	1	0	0	1	0	Q3	A5U1-11	A6K7, A5K3
20	0	1	1	0	1	Q2, Q1	A6U1-6	A6K6, A6K5
10	0	1	1	0	0	Q2, Q1	A6U1-7	A6K6, A6K4

providing a 1 ns signal. A 5 ns signal is generated in frequency doubler A15 Q20 and A15 Q21. When the DEVIATION switch is in the TIME position, the frequency multipliers are disabled by a high logic signal received in logic input line T, which cuts off transistors A15 Q1 and A15 Q2.

4-48. MARKER OUTPUT CIRCUITS

4-49. The "locked" 10 MHz signal (which may be variable frequency in the TIME DEVIATION mode) from A14 Q1 operates divide-by-five and divide-by-two counters in A13 to provide timing intervals which are multiples of 1, 2, and 5 ranging from 100 nanoseconds to 500 milliseconds. Multiplexers A13 U12 through A13 U15 select one of 21 time intervals under instructions from control lines $\overline{A}$, C, D, E, F, S1, S2, and S3.

4-50. The selected frequency is connected (line 24) to input pin 6 of multiplexer A14 U3. Here, control lines E' and F' select an output from input pin 3, 4, or 5 of A14 U3. The output signal at A14 U3-2, which may range between 10 nanoseconds and 500 milliseconds, provides a signal for counters A14 U4 and A14 U5 and multiplexer A14 U6. Control lines M' and N' from the multiplier switch increase the time interval by a factor of X1, X2, X5 or X10.

4-51. The timing signals from pins 2 and 15 of A14 U6 are square wave signals representing selectable time intervals between 10 nanoseconds and 5 seconds. These may be directed along either one of two paths. For most of the positions of the TIME/DIV switch. control line 2 to A14 U7 is low, enabling decade frequency divider A14 U7. NOR-gate A14 U8-2 utilizes the four output signals from A14 U7 to synthesize a marker pulse with a 5 percent duty factor at 10 times the time period of the input wave at A14 U7-7. From the output at A14 U8-2 this shaped marker pulse has a period ranging from 100 nanoseconds to 50 seconds. This drives a marker pulse output circuit A16 Q5, A16 Q6, and A16 Q7, which provides the front panel MARKER OUTPUT signal at J6.

4-52. In order to obtain marker pulses having the three shortest time intervals of the T/DIV switch, control signal 1 is made low, enabling A14 U8-3, and control signal 2 is high, disabling A14 U7 and A14 U8-2. The square wave from A14-U6-15 with a selectable period of 10, 20, or 50 nanoseconds drives the marker pulse output circuits in A16.

4-53. The logic states that control the A13 multiplexer are summarized in Table 4-4. The logic states that summarize the A14 U3 selection are shown in Table 4-5. The logic states that control multiplexer A14 U6 selection are summarized in Table 4-6.

4-54. TRIGGER PULSE PERIOD CIRCUITS

4-55. A 10 MHz locked signal from A14 Q1 operates a chain of decade frequency dividers A13 U5 through A13 U11 to provide timing pulses at intervals ranging between .1 microsecond and 1 second. These timing pulses are also used for the timing of the MARKER pulses.

4-56. A multiplexer A13 U16 selects a particular timing interval in accordance with control line J, K and L which carry instructions from the TRIGGER PULSE PERIOD switch S3 on the front panel. Table 4-7 summarizes the selection process and the control signal states.

4-57. The signal from A13 U16 is directed to A16 P1-D where it may be gated time coincident with the MARKER pulses in A16 U1 by MARKER TRIGGER INTERLOCK switch A16 S1. If synchronized, A16 U1 utilizes a marker drive clock pulse from A16 P1-1. From switch A16 S1, the trigger signal passes through a trigger pulse preamplifier comprising A16 Q2, and A16 Q3. The signal is then applied to both the FAST RISE and HIGH AMPLITUDE generators.

4-58. HIGH AMPLITUDE PULSE GENERATOR

4-59. The HIGH AMPLITUDE Pulse Generator provides a fast square wave which rises from a negative potential to ground. The pulse amplitude is variable over a ten to one range from a maximum of 60 volts into an open circuit, to 5 volts into 50 ohms. It has 100 mA current capability and a source impedance of 600 ohms. The period of the HIGH AMPLITUDE PULSE square wave is set by the TRIGGER PULSE PERIOD switch from 100 ns to 5 sec.

4-60. The input square wave from A16 P1-10 is applied through A127 P-2 through R100 to the base of A127 Q101. The output pulse is negative going from ground and is developed across 600 ohm resistor A127 R114 and the external load. A127 CR102 is a disconnect diode which operates at zero output volts. The rising edge of the square wave is the reference. It requires that A127 Q107 be switched off for the output to swing from negative to ground. VMOS power FET A127 Q106 acts as a high speed "anchored and switch" with its gate held at ten volts above the negative supply voltage. This ten volt level is established by Zener diode A127 CR104.

4-61. Transistor A127 Q105 acts as a 5 mA current source for disconnect diode A127 CR101. This circuit takes up the leakage current from A127 Q106 during transitions and provides a small reverse bias to output disconnect diode A127 CR2.

4-62. The output current swing is determined by the current through A127 R107 in the emitter of A127 Q108. The base of A127 Q108 is pulled positive by the collector current of A127 Q102. The voltage at A127 Q108 is set by variable level clipper A127 Q107. This variable level is set by its base potential which is derived from A127 U100 which acts as a voltage follower for the VARIABLE amplitude control A127 R112. This controls the negative potential from which the output pulse rises toward ground.

4-63. A127 Q104 acts as the switch which cuts off pulse current source transistor A127 Q108. This switch is driven by common base amplifier

A127 Q103 which, in turn, is driven by input emitter follower A127 Q101. This emitter follower also drives amplifier A127 Q102 which supplies the current to activate the variable level clipper when the input TTL square wave at the base of A127 Q101 is near ground potential. When the input square wave is positive, A127 Q102 is cut off and A127 Q103 conducts heavily, saturating switch A127 Q107 which in turn cuts off current source A127 Q108. This permits the output pulse to rise toward ground. Conversely, when the input square wave signal is near ground, switch A127 Q104 is open and the current supplying transistor A127 Q108 draws current to pull the pulse output down toward the negative voltage level set by the variable clipper and resistor A127 R107 in the emitter of A127 Q108.

4-64. FAST RISE PULSE GENERATOR

4-65. The Fast Rise Pulse Generator provides a negative going positive square wave and a positive going negative square wave output. The period of square wave is set by the TRIGGER PULSE PERIOD selection circuits on assembly A13. The square wave signal from A13 P1-D to A16 P1-15 centers the MARKER TRIGGER INTERLOCK slide switch, A16 S1. In the OFF position of A16 S1, the Trigger Pulse Period square wave is sent directly to the FAST RISE Pulse Generator input circuit through A116 R5 to the base of Q2. When the MARKER TRIGGER INTERLOCK switch A16 S1 is set to LOCKOUT, A16 U1 gates the trigger signal so that the MARKER and FAST RISE outputs are time coincident. This time coincidence is within a few nanoseconds as measured at the MARKER OUT and the + FAST RISE and - FAST RISE OUTPUT connectors. The FAST RISE pulse outputs are automatically disconnected in the interlock setting of A16 S1 when the TIME MARKERS are equal to or faster than the TRIGGER PULSE PERIOD.

4-66. The trigger signal from A16 P1-10 is connected to A116-16. The input square wave to A116 Q2 is emitter coupled to A116 Q3. The output square wave at the collectors of A116 Q2 and A116 Q3 is opposite in polarity and faster than the input. This faster square wave is then again amplified by A116 Q4 and A116 Q7 and leveled to ground reference at A116 R21 and A116 R22.

4-67. A116 Q8 and A116 Q9 comprise an emitter coupled amplifier which again inverts the rise time and drives the positive level, negative going - FAST RISE output. A116 Q10 and A116 Q11 are the drivers for the negative level, positive going + FAST RISE output.

4-68. The FAST RISE circuit provides two output square waves that occur simultaneously. A116 Q15 and A117 Q17 are fast non-saturated current mode switches. A116 CR2 and A116 CR3 are low leakage disconnect diodes which help establish good ground reference when A116 Q15 and A117 Q17 are cut off.

4-69. The output load seen by each current switch is 25 ohms. When the outputs are terminated in 50 ohms to produce 1 volt across 25 ohms, 40 mA is required. This current is supplied by transistors A116 Q14 in the - Fast Rise switch and A116 Q18 in the + Fast Rise switch. These current source transistors are controlled by A116 U2 and A116 U3 respectively which set the voltage across current metering resistors A116 R69 and A116 R43. The voltage input to the two constant current sources is set by the voltage applied to the non-inverting inputs to operational amplifiers A116 U2 and A116 U3. The current source voltages are simultaneously increased or decreased by current through A116 Q12. Its base potential controls the amplitude of both Fast Rise square waves. Diode A116 CR1 is used for temperature compensation.

4-70. Networks A116 R51, and A116 C19 and A116 R58, and A116 C20 are used to control the shape of the first ten nanoseconds after the fast rise toward ground. Diodes A116 CR2 and A116 CR3 are Schottky diodes with fast switching time and high back resistance. They assure optimum reverse termination of the pulse generator at zero-bias when the current switches are turned off.

4-71. TIME DEVIATION CIRCUITS

4-72. When the Deviation switch S1 is in the ±10% TIME position, the voltage controlled, 100 MHz oscillator A14 U1 is under the control of the front panel DEVIATION CONTROL potentiometer R2, so that any deviation of this oscillator from its nominal frequency causes all its derived timing functions to deviate from their nominal values by identical percentages. The percentage deviation that results from the control of A14 U1 is measured quantitatively by comparing it in assembly A18 to a fixed 1 MHz frequency derived from the crystal controlled 10 MHz reference source by decade counter A18 U1.

4-73. A variable 2 MHz signal derived from A14 U1, whose deviation from nominal is to be measured, is introduced into a set of D flip-flops (A18 U3, A18 U4 and A18 U5) which are NAND gated in A18 U2. Any frequency deviation from the fixed 1 MHz reference signal produces a dc voltage output which varies directly with the percentage deviation. Positive and negative dc output voltages are provided by the 90° phase shift of A18 U4B. When A18 U3A is providing a pulse, A18 U4B provides a steady dc output which is either high (positive) or low (negative) to define the direction of frequency deviation. The dc output voltage is filtered, controlled in amplitude and measured by the front panel DEVIATION meter.

TABLE 4-3. 6126M VOLTS/DIV RANGE SELECTION LOGIC

V/DIV SWITCH	A1 U1 OUTPUT CODE					A100 U2 INPUT CODE					A100 U2 OUTPUTS				A100 ENERGIZED RELAYS	A100 INPUT VOLTAGE	ATTEN. (÷)
	A'	B'	C'	D'	E'	A"	B"	C'	D'	E'	Q0	Q1	Q2	Q3			
20 V	1	1	1	0	1	1	1	1	0	1	1	1	1	1	NONE		
10	1	1	1	0	0	1	1	1	0	0	1	1	1	1	NONE		
5	1	1	0	1	0	1	1	0	1	0	1	1	1	1	NONE		
2	1	1	0	0	1	1	1	0	0	1	1	1	1	1	NONE		
1	1	1	0	0	0	0	1	0	0	0	0	0	1	1	K1, K2, K3	1 V	1
.5	1	0	1	1	0	0	1	1	1	0	0	0	1	1	K1, K2, K3	.5	1
.2	1	0	1	0	1	0	1	1	0	1	0	0	1	1	K1, K2, K3	.2	1
.1	1	0	1	0	0	0	1	1	0	0	0	0	1	1	K1, K2, K3	.1	1
50 mV	1	0	0	1	0	0	1	0	1	0	0	0	1	1	K1, K2, K3	50 mV	1
20	0	1	1	0	1	0	1	1	0	1	0	0	1	1	K1, K2, K3	20	1
10	1	1	0	0	0	1	0	0	0	0	0	1	0	1	K1, K2, K4	1 V	100
5	1	0	1	1	0	1	0	1	1	0	0	1	0	1	K1, K2, K4	.5	100
2	1	0	1	0	1	1	0	1	0	1	0	1	0	1	K1, K2, K4	.2	100
1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	K1, K2, K5	1	1000
.5	1	0	1	1	0	0	0	1	1	0	0	1	1	0	K1, K2, K5	.5	1000
.2	1	0	1	0	1	0	0	1	0	1	0	1	1	0	K1, K2, K5	.2	1000
.1	1	0	1	0	0	0	0	1	0	0	0	1	1	0	K1, K2, K5	.1	1000
50 uV	1	0	0	1	0	0	0	0	1	0	0	1	1	0	K1, K2, K5	50 mV	1000
20	0	1	1	0	1	0	0	1	0	1	0	1	1	0	K1, K2, K5	20	1000
10	0	1	1	0	0	0	0	1	0	0	0	1	1	0	K1, K2, K5	10	1000

TABLE 4-4. SELECTION BY MULTIPLEXERS A13 U12-U15

T/DIV SELECTOR SWITCH S1	CONTROL LOGIC STATES								INPUT		OUTPUT AT A12 P1-J	
	$\overline{A}$	C	D	E	F	S1	S2	S3	I.C.	PIN	TIME INTERVAL	FREQUENCY
5 s	1	0	1	1	0	1	1	0	U15	13	.5 sec	2 Hz
2	1	0	1	0	1	1	1	0		14	.2 sec	5
1	1	0	1	0	0	1	1	0		15	.1 sec	10
.5 s	1	0	0	1	0	1	1	0	U15	2	50 ms	20 Hz
.2	1	0	0	0	1	1	1	0		3	20	50
.1	1	0	0	0	0	1	1	0		4	10	100
50 ms	1	1	1	1	0	1	0	1	U14	13	5 ms	.2 kHz
20	1	1	1	0	1	1	0	1		14	2	.5
10	1	1	1	0	0	1	0	1		15	1	1
5 ms	1	1	0	1	0	1	0	1	U14	2	.5 ms	2 kHz
2	1	1	0	0	1	1	0	1		3	.2	5
1	1	1	0	0	0	1	0	1		4	.1	10
.5 ms	1	0	1	1	0	0	1	1	U13	13	50 us	20 kHz
.2	1	0	1	0	1	0	1	1		14	20	50
.1	1	0	1	0	0	0	1	1		15	10	100
50 us	1	0	0	1	0	0	1	1	U13	2	5 us	.2 MHz
20	1	0	0	0	1	0	1	1		3	2	.5
10	1	0	0	0	0	0	1	1		4	1	1
5 us	0	0	0	1	0	1	1	1	U12	2	.5 us	2 MHz
2	0	0	0	0	1	1	1	1		3	.2	5
1	0	0	0	0	0	1	1	1		4	.1	10
.5 us	0	1	0	1	0	1	1	1	U12	13	none	none
.2	0	1	0	0	1	1	1	1		14		
.1	0	1	0	0	0	1	1	1		15		
50 ns	0	1	1	1	0	1	1	1	U12	13	none	none
20	0	1	1	0	1	1	1	1		14		
10	0	1	1	0	0	1	1	1		15		

TABLE 4-5. T/DIV CONTROL OF LOWEST TIME INTERVAL BY MULTIPLEXER A14 U3

T/DIV SELECTOR SWITCH S1	CONTROL LOGIC STATES		U3 INPUT PIN	OUTPUT AT U3 PIN 2	
	E'	F'		TIME INTERVAL	FREQUENCY
.5 u sec	1	0	4	50 n sec	20 MHz
.2	0	1	5	20	50
.1	0	0	3	10	100
50 n sec	1	0	4	50 n sec	20 MHz
20	0	1	5	20	50
10	0	0	3	10	100
All Others	1	1	6	Controlled by Multiplexers in A13 (See Table 4-3)	

TABLE 4-6. MULTIPLIER SWITCH CONTROL OF A14 U6

MULTIPLIER SWITCH S2	CONTROL LOGIC STATES		U6 INPUT PIN	OUTPUT AT U6 PINS 2 and 15	
	M'	N'		TIME MULTIPLY	FREQUENCY DIVIDE
X 1	0	0	3	X 1	÷ 1
X 2	0	1	5	X 2	÷ 2
X 5	1	0	4	X 5	÷ 5
X 10	1	1	6	X 10	÷ 10

TABLE 4-7. TRIGGER PERIOD SELECTION, A13 U16

TRIGGER PERIOD SWITCH S3	CONTROL LOGIC STATES			U6 INPUT PIN	OUTPUT AT U16-5	
	J	K	L		TIME INTERVAL	FREQUENCY
100 ns	1	1	1	12	.1 us	10 MHz
1 us	0	0	0	4	1 us	1 MHz
10 us	0	0	1	3	10 us	100 kHz
100 us	0	1	0	2	.1 ms	10 kHz
1 ms	0	1	1	1	1 ms	1 kHz
10 ms	1	0	0	15	10 ms	100 Hz
100 ms	1	0	1	14	.1 sec	10 Hz
5 s	1	1	0	13	1 sec	1 Hz

WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

CAUTION

Semi-conductor devices using metal oxide junctions are liable to suffer destructive damage from electrostatic discharges. Such devices appear with several names, such as MOS, MCMOS, CMOS, MOSFET, IGET, detector diode, etc. Whenever these devices or assemblies including such devices are handled, the operator must be grounded, and only grounded soldering irons can be used safely. To facilitate identification of assemblies containing metal oxide devices, Ballantine pc boards containing such devices are marked with this symbol:

SECTION 5

MAINTENANCE

5-1. INTRODUCTION

5-2. This section contains information for maintaining the 6126M Oscilloscope System. Included are maintenance checks, calibration procedures and trouble-shooting information. The test equipment and special tools required to check, maintain and calibrate the 6126M are listed in Table 5-1.

5-3. PERFORMANCE CHECKS

5-4. GENERAL. The performance checks described in the following paragraphs are "in-cabinet" tests that compare the calibrator with the applicable specifications. These performance checks, paragraphs 5-5 through 5-15, should be performed and completed in the order listed before any attempt is made to calibrate the instrument. For optimum performance, after turn-on but before performing any checks, allow the instrument to warm up for at least 2 hours. Also, all performance checks and calibration should be performed at reference conditions of 22^{o} C (71.6^{o}F to 82.4^{o}F).

5-5. POWER LINE VOLTAGE SETTING. The primary winding of the transformer in the generator is connected to match the power line voltage being used by the orientation of the printed-circuit board in the rear panel mounted ac power receptacle. The instrument as supplied is set for operation from 120 volts ac. The performance checks which follow reference 120 volts as the nominal voltage setting for the 120 volt primary power line voltage. For the other power line voltages of 100, 220, and 240 volts ac, the following table lists the nominal midline voltages and the high-line and low-line voltages used for calibrating the instrument.

Line Voltage	Nominal Midline	Low Line	High Line
100 V	100 V	90 V	108 V
120 V	120 V	108 V	128 V
220 V	220 V	198 V	238 V
240 V	240 V	216 V	259 V

5-6. OSCILLATOR FREQUENCY ACCURACY

a. Interconnect the generator and the test equipment as shown in Figure 5-1.

b. Set the Calibrator TIME/DIV switch to .1S and the MULTIPLIER switch to X1.

c. Connect the MARKER OUT connector to the A input of the 5549A (Option 14) Frequency Counter. Use a 50-ohm feed-thru termination at the counter end of the connecting cable.

d. Set line voltage Variac to midline.

e. If available, use a 1 MHz atomic frequency standard or a WWV receiver to clock the 5549A and ensure absolute accuracy of the measurement.

f. Allow 20 minutes for warm-up; then measure the 0.1 us time (10 MHz frequency). Use the TRIG LEVEL control on the 5549A to obtain a stable count. To meet specification, the counter must read within the range of 9,999,919 to 10,000,081 Hz. If desired, allow the equipment to warm up 2 hours and repeat the frequency measurement. The counter should read within the range of 9,999,939 to 10,000,061 Hz.

g. With line voltage set to 103 volts by the Variac, the counter should read within the range of 9,999,899 to 10,000,101 Hz.

h. With line voltage set to 128 volts by the Variac, the counter should read within the range of 9,999,899 to 10,000,101 Hz.

i. Reset the line voltage to midline.

5-7. MARKER OUTPUT AMPLITUDE

a. Interconnect the Calibrator and the test equipment as shown in Figure 5-2.

b. Connect the MARKER OUT connector of the Ballantine 1032A Oscilloscope. Connect a 50-ohm feed-thru termination at the oscilloscope end of the connecting cable.

c. Set the TIME/DIV switch to .1 S and the MULTIPLIER switch to X1.

d. Set the 1032A Oscilloscope controls as follows:

CH1 VOLTS/DIV	.5 uV
CH1 Coupling	DC
CH1 Position	Centered
CH2 Position	OFF
TIME/CM	1 S
PULL x 10 MAG	Pulled Out (X10)
TRIG SELECT	CH1+
Trigger Coupling	AC

e. Use trigger LEVEL control and trace position controls to position a stable display on screen.

f. Observe a marker pulse on the oscilloscope at each vertical line of the CRT graticule. Continue to observe the same display but with somewhat narrower positive-going marker pulses at each TIME/DIV and oscilloscope sweep range through 0.5 second. Do not use X10 magnifier on the oscilloscope at time-base speeds slower than 0.5 us. Observe that the minimum marker pulse amplitude displayed on the oscilloscope is greater than 1 cm (0.5 volt) for each of the 27 TIME/DIV settings.

TABLE 5-1. TEST EQUIPMENT

EQUIPMENT NO.	NOMENCLATURE	USE AND APPLICATION	MINIMUM SPECIFICATIONS
Ballantine Model 1032A	Oscilloscope	General Fault Finding	5 mV, dual trace, 8 x 10 cm graticule, Dc to 20 MHz; rise time < 17 ns. Signal delay. Sweep time < 50 ns/cm to > 1 s/cm.
Ballantine Model 3028B	Multimeter	Fault finding;power supply voltage and resistance checks.	Dc, 1 mV to 1 kV. Ac, 1 mV to 500 V, 10 Hz to 100 kHz rms responding. Ohms, 0.1 Ω to 20 MΩ , 0.2 V to 2 V measuring voltage. Ac amperes, 100 mA to 1A. Dc amperes, 100 mA to 1A. 3-1/2 digit display, battery and line operation.
Ballantine Model 3620A	Ac/Dc True RMS Digital Voltmeter	Line voltage measurement	4-1/2 digit display. 10 mV to 1 kV full scale. 1 uV resolution. Dc and ac to 1 MHz, dc coupled true rms response. Nominal accuracy 0.2%. Guarded and floating input.
Ballantine Model 5549A(with Option 14)	Digital Frequency Counter	Frequency calibration and check of frequency multipliers to 500 MHz (2 ns). Check of TIME DEVIATION range.	512-MHz nine-digit counter with high-stability clock (3 parts in 10^9 per day) and NBS frequency traceability. External clock input capability. Sensitivity better than 15 mV rms at 500 MHz. Period measurement.
Fluke Model 885AB	Differential Voltmeter	Dc Voltage Calibration	Dc; 1 volt to 300 volts with 10 uV resoulution. Accuracy 0.02%.
1 Meg Resistor	RN65D	Volts Out Termination	½ watt ±2%, film.
2.2 Meg Resistor	RN70D	Square Wave Level check.	½ watt ±2%, film.

TABLE 5-1. TEST EQUIPMENT (Cont)

EQUIPMENT NO.	NOMENCLATURE	USE AND APPLICATION	MINIMUM SPECIFICATIONS
Ballantine Model 12620A	Adapter	Test Equipment connections.	BNC female to General Radio GR-874 connector.
Ballantine Model 12625A	Adapter	Test Equipment connections.	BNC male to General Radio GR-874 connector.
Ballantine Model 12630A	Termination	Termination, 50 ohms, 2 watts.	BNC/BNC feed-thru, 50 ohms, 2 watts.
Ballantine Model 12249D.	Cable Assembly 8 in.	Test equipment connections.	RG-58C/U cable with male BNC terminations.
General Radio Type GR-874 (Ballantine Model 12626A)	Attenuator, 20 dB	Input attenuator for high-sensitivity sampling oscilloscope.	50-ohm, 20 dB attenuator, dc to 1 GHz, flatness 0.1%, dc to 100 MHz.
General Radio Type W5MT3A	Metered Variac	Line Voltage control; metered current and voltage.	(As required.)
Hewlett-Packard Model 651B or 652A	Test Oscillator	Test external clock input signal source.	10 Hz to 10 MHz (sinewave). 50-ohm output to 2 V rms. Distortion $< \pm 0.25\%$.
JFD Part No. 5284	Adjustment Tool	Adjustment of variable capacitors, resistors, and inductors.	Low-capacity alignment tool with 3/32 inch screwdriver blade and 5/64 hexagon drive.
Rhode & Schwarz Model XSAM or Model XSA/XKA*	Frequency Standard, Atomic or WWV Receiver	To calibrate clock frequency.	Rubidium frequency standard, 1 MHz, or WWV receiver/comparator, 1 MHz.
Tektronix Type 547 (with 1S1 plug-in)	Oscilloscope	Check fast rise time ($\lesssim$ 3 ns) of TRIGGER output square wave.	Frequency response to 1 GHz. Rise time < 0.35 ns. Internal and external triggering beyond 500 MHz. 50-ohm input. Sensitivity better than 50 mV/cm. Sweep time < 2 ns/cm to 0.1 us/cm.
UG-274A/U (Ballantine Model 12619A)	Adapter	Test equipment connections.	BNC tee adapter.

g. Set the MULTIPLIER control to X2 and the oscilloscope TIME/DIV switch at .5 SEC. Observe six pulses with each pulse coincident with alternate graticule lines, which checks the MULTIPLIER X2.

h. Set the MULTIPLIER control to X5. Observe three marker pulses on the screen, one at the left, one at the center, and one at the right graticule line, which checks the MULTIPLIER X5.

i. Set the MULTIPLIER control to X10. Observe two markers on the screen, one at the extreme left and one at the extreme right graticule line, which checks the 5 second marker and the MULTIPLIER X10.

j. With the MULTIPLIER control still set to X10, set the TIME/DIV switch to .2S and the oscilloscope TIME/CM control to .2 Sec. Observe that only two pulses appear on the screen, which checks the MULTIPLIER X10.

5-8. TRIGGER PULSE PERIOD

a. Refer back to the control settings of paragraph 5-10d and the test setup of Figure 5-2, except disconnect the cable from the MARKER OUTPUT connector and reconnect it to the HIGH AMPL OUTPUT connector. Also, set the TRIGGER PULSE PERIOD to 100 nS and the oscilloscope TIME/CM switch to 1 us. Activate the X10 MAG knob to X10 magnifier position for a sweep of 0.1 us/cm.

b. Observe a square wave display on the oscilloscope screen. Its amplitude must be greater than 1 cm and the period of each full square wave must occupy 1 cm.

c. Change the TRIGGER PULSE PERIOD to 1 uS and reset the oscilloscope. Pull X10 MAG knob to the X1 position (sweep of 1 us per cm). Observe a square waves as in the preceding step b.

d. In sequence, change the TRIGGER PULSE PERIOD and the oscilloscope TIME/CM settings to 10 uS, 100 uS (.1 mS), 1 mS, 10 mS, 100 mS (.1 SEC), and 1 s (1 SEC). Observe the same 1 cm square wave as in the the preceding step b on each of the paired settings.

5-9. HIGH AMPLITUDE OUTPUT RISE TIME

a. Interconnect the generator and the test equipment as shown in Figure 5-3.

b. Connect the HIGH AMPL OUTPUT BNC connector of the instrument to the sampling oscilloscope through a short (8-inch) 50-ohm cable. Use a BNC to GR adapter to connect the cable to the 20 dB attenuator. Set the oscilloscope to 100 mV vertical sensitivity, internal trigger, and 2 ns per cm sweep speed.

c. Set the TRIGGER PULSE PERIOD to 100 nS.

d. Obtain a stable display of a positive going edge of the square wave on the screen of the oscilloscope.

e. Observe that the leading edge of the waveform on display is at least 5 cm peak-to-peak. This amplitude verifies a High Ampl signal greater than 5 volts into 50 Ω.

f. Observe that the overshoot on the top of the leading edge is no greater than 2% of the 0% to 100% peak-to-peak value of the HIGH AMPL OUTPUT square wave.

g. Observe that the 10% to 90% rise time of the positive-going rise is no more than 10 ns (1 cm).

5-10. HIGH FREQUENCY OUTPUT

a. Continue with the test setup shown in Figure 5-3. Disconnect the cable from the HIGH AMPL OUTPUT connector and reconnect it to the H.F. OUTPUT 5 ns connector. Set the sampling oscilloscope time base to 5 ns per cm and the vertical sensitivity to 20 mV. Obtain a stable sine-wave display on the oscilloscope.

b. Observe a sine wave, greater than 3.75 cm peak-to-peak, which indicates that the H.F. OUTPUT signal is greater than 0.75 volt peak-to-peak into 50 ohms, since the oscilloscope sensitivity is 20 mV X10 or 200 mV per cm. Also note that the cycle-to-cycle amplitude does not vary by more than 5% peak-to-peak.

c. Observe a sine-wave for each graticule line to indicate that the H.F. OUTPUT frequency is 5 ns. Then, disconnect the short BNC cable from the BNC to GR adapter and connect it into the 50-ohm (C) input of the 5549 frequency counter. Set the counter to 1 second for a nine-digit display. Observe that the counter reads in the range of 200,001,601 to 199,998,399 Hz. Reconnect the BNC cable to the oscilloscope.

d. In sequence, select the H.F. OUTPUT 2 ns BNC and set the sampling oscilloscope time base to 2 ns. Repeat the observations of amplitude as in the preceding step b. Repeat the sine-wave period check of 1 cycle/cm as in the preceding step c. For each HIGH FREQUENCY selection also make the digital counter frequency check detailed in preceding step c. Use the following limits:

5 nS: 199,998,399 through 200,001,601 Hz.

2 nS: 499,995,999 through 500,004,001 Hz.

5-11. EXTERNAL CLOCK INPUT

a. Interconnect the generator and the test equipment as shown in Figure 5-4.

b. Set the TIME/DIV switch to 1 uS and the MULTIPLIER to X1. Set the rear panel INT-EXT clock switch to the EXT position. (These control positions check the shaper and digital-logic trigger circuitry for external clock input verification.)

c. Set the dual-trace oscilloscope control as follows:

CH1 VOLT/DIV	.5 V
CH1 Coupling	AC
CH1 Position	Centered
CH2 Position	OFF
TIME/CM	1 mS
TRIG SELECT	FREE RUN

NOTE

The oscilloscope should display a free-running, unsynchronized display of CH1 only.

d. Set the 5549A frequency counter to 1 second and a nine-digit display. Connect a 50-ohm feed-thru termination to the high-impedance (A) input.

e. Connect the MARKER OUT through the 50-ohm termination to the high-impedance, low-frequency input of the 5549A counter. Connect a BNC Tee-connector to the CH1 input of the 1032A Oscilloscope and connect the 50-ohm output of the 10 MHz oscillator and the EXT clock input (INT-EXT clock switch set to EXT) to the Tee-connector arms.

f. Adjust the oscillator amplitude to produce a 4 cm peak-to-peak vertical display on the oscilloscope. Set the frequency of the oscillator to 10 MHz maintaining the oscilloscope display of a constant 4 cm (2 volts) peak-to-peak amplitude. Note the counter which should display a frequency of 1 MHz. This checks the external clock input of the 6126M.

NOTE

Use only a 10 MHz EXT Input Frequency. All other frequencies will cause incorrect outputs from the 6126M.

5-12. TIME DEVIATION CHECK

a. Set the instrument to DEVIATION OFF. Set the TIME/DIV control to 10 us and the MULTIPLIER to X1.

b. Connect a frequency counter to the MARKER OUT BNC as shown in Figure 5-1. Observe a frequency of 100,000 Hz (± 50 Hz) displayed on the counter.

c. Set the DEVIATION switch to TIME ±10%. Observe that the time DEVIATION indicator is illuminated.

d. Rotate the TIME/DIV deviation control to each extreme and observe that the 6126M digital deviation meter displays a deviation range greater than +10% and greater than -10%.

e. Set the time deviation to +10%. Set the frequency counter to PERIOD AVERAGE and observe that the frequency counter reads 11.000 (±.003) us.

f. Set the time deviation to -10% and observe that the frequency counter reads 9.000 (±.003) us.

5-13. VOLT/DIV CHECK

a. Connect a high resolution battery operated dc differential voltmeter having 1 megohm input impedance, at balance, to the VOLTS OUT BNC connector. Be sure of the 1 megohm load resistance since the instrument is calibrated into this typical oscilloscope or voltmeter input resistance.

b. Set the 6126M controls as follows:

VOLTS/DIV	20
MULTIPLIER	X10
OUTPUT MODE	+DC
DEVIATION	OFF

c. Set the differential voltmeter dials to 200.00 volts and read the percent deviation on the voltmeter readout The error should be equal to or less than ±50 mV.

d. Repeat step c for each of the next 13 ranges through the 1 mV range. Checks for ranges of 0.1 V and below are optional. Check voltmeter error to the ±0.25% error budget of the 6126M.

NOTE

Always measure the dc offset voltage by using the GND Mode. Arithmetically add this thermal voltage to all readings under ±10 mV to obtain the exact output calibration voltage.

e. If errors exist for any reading, the instrument should be recalibrated as detailed in other paragraphs of this section.

f. Set the VOLTS/DC switch to 1 volt and the multiplier to X1, X2, X3, X4, X5, X6, and X8. Set the differential voltmeter to 1, 2, 3, 4, 5, 6, and 8 volts respectively and make the required calibration checks.

5-14. VOLTS DEVIATION CHECK

a. Leave the differential voltmeter connected as indicated above.

b. Set the VOLTS/DIV switch to 1 volt and the MULTIPILER to X10. Set the DEVIATION to volts ±10% and observe that the VOLTS DEVIATION lamp is illuminated.

c. Rotate the VOLTS/DIV DEVIATION control to both ends and observe that the digital deviation meter reads greater than ±10%.

d. Set the VOLTS/DIV DEVIATION control for a digital meter reading of +10.00%. Set the differential voltmeter dials to 11.000 volts. Note that the differential meter reads an error equal to or less than 330 mV.

e. Set the VOLTS/DIV DEVIATION control for a digital meter reading of -10.00%. Set the differential voltmeter dials to 9.000 volts. Note that the differential voltmeter reads an error equal to or less than 270 mV.

5-15. VOLTS OUTPUT MODE CHECK

a. Repeat steps 5-16b and 5-16c with the output mode set to -DC. Check proper output and disconnect the differential voltmeter.

b. Connect an oscilloscope to the VOLTS OUT BNC. Set the scope CH1 input to DC, 1 V/DIV and the time base to 50 us with Auto Triggering.

c. Set the 6126M VOLTS/DIV Switch to 1 V, the MULTIPLIER to X6 and the DEVIATION to OFF. Set the OUTPUT MODE to 10 kHz. Observe five cycles of a 6 division p-p square wave displayed across the graticule of the CRT.

d. Repeat step b with OUTPUT MODE set to 1 kHz, 100 Hz and 10 Hz with the oscilloscope time base set to 500 us, 5 ms, and 50 ms. Use normal internal triggering (not AUTO) on the 50 us and 500 us settings. Observe five cycles of a 6 division p-p square wave displayed across the graticule of the CRT.

5-16. LOCATION OF ADJUSTMENTS

5-17. The location of the internal adjustments and circuit boards is shown in Figure 5-5. Access to the adjustments and circuit boards is gained by removal of the top and bottom covers. Refer to paragraph 5-18.

5-18. COVER REMOVAL AND REPLACEMENT

5-19. The 6126M top and bottom covers are easily removed. First, turn the POWER switch to OFF and disconnect the power cord from the ac line to avoid shock hazard. Each cover is secured by two machine screws at the rear of the instrument. After removing both of these screws, lift the cover up slightly at the rear and slide it forward and off.

WARNING

A safety hazard exists when the 6126M top and bottom covers are removed. To avoid shock, exercise care when making checks and adjustments.

5-20. To replace the top or bottom cover, hook the curved cover lip on the flange of the 6126M front panel. Lay the cover to the rear and down. Align the two holes in the cover with the threaded holes at the rear of the chassis. Fasten the cover with the two machine screws.

5-21. REMOVAL AND REPLACEMENT OF TEKTRONIX PLUG-IN MODULES

5-22. Refer to the Tektronix Instruction Manuals. Removal and replacement information for the plug-in modules is provided in Section 1, Operating Instructions.

5-23. POWER SUPPLY CHECKS

5-24. To facilitate access to the test points referred to in the Power Supply Checks, it is recommended that the Service Extender Card be used. Remove the circuit board on which the voltage is to be measured, from the socket. (Note the direction of the board.) Install the card extender in its place and then insert the circuit board in the card extender socket. Make sure that the circuit board is oriented correctly. Refer to Figure 5-6 for location of the pin numbers on the card extender.

5-25. Connect the Model 6126M to the correct power source through a Variac or similar line voltage control unit. Use a true rms voltmeter, such as the Ballantine Model 3620A, to monitor the input voltage to the 6126M.

5-26. +5 VOLTS REGULATED, VOLTS (A4 P1)

a. Use a digital multimeter, such as the Ballantine Model 3028B, set to the 20 V dc range. Connect the common test lead to the 6126M circuit ground. Connect the V-Ω test lead to A4 P1-15.

b. The voltage should measure between +4.8 V and +5.2 V at nominal ac line. Vary the ac input voltage by ±10% and observe that the +5 V reading does not vary by more than ±1%.

5-27. ±5 VOLTS REGULATED, TIME (A11 P1)

a. Follow the same procedure as outlined in paragraph 5-26A. Except connect the V-Ω test lead to A11 P1-15.

b. The voltage should measure between +4.8 V and +5.2 V at nominal ac line. Vary the ac input voltage by ±10% and observe that the +5 V reading does not vary by more than ±1%.

5-28. +12 VOLTS REGULATED, -12 VOLTS REGULATED (A128 J21)

NOTE

The A100, A116, A126, and A128 circuit boards are mounted horizontally. Measurements on these boards are made by turning the 6126M on its side. The extender card is not required.

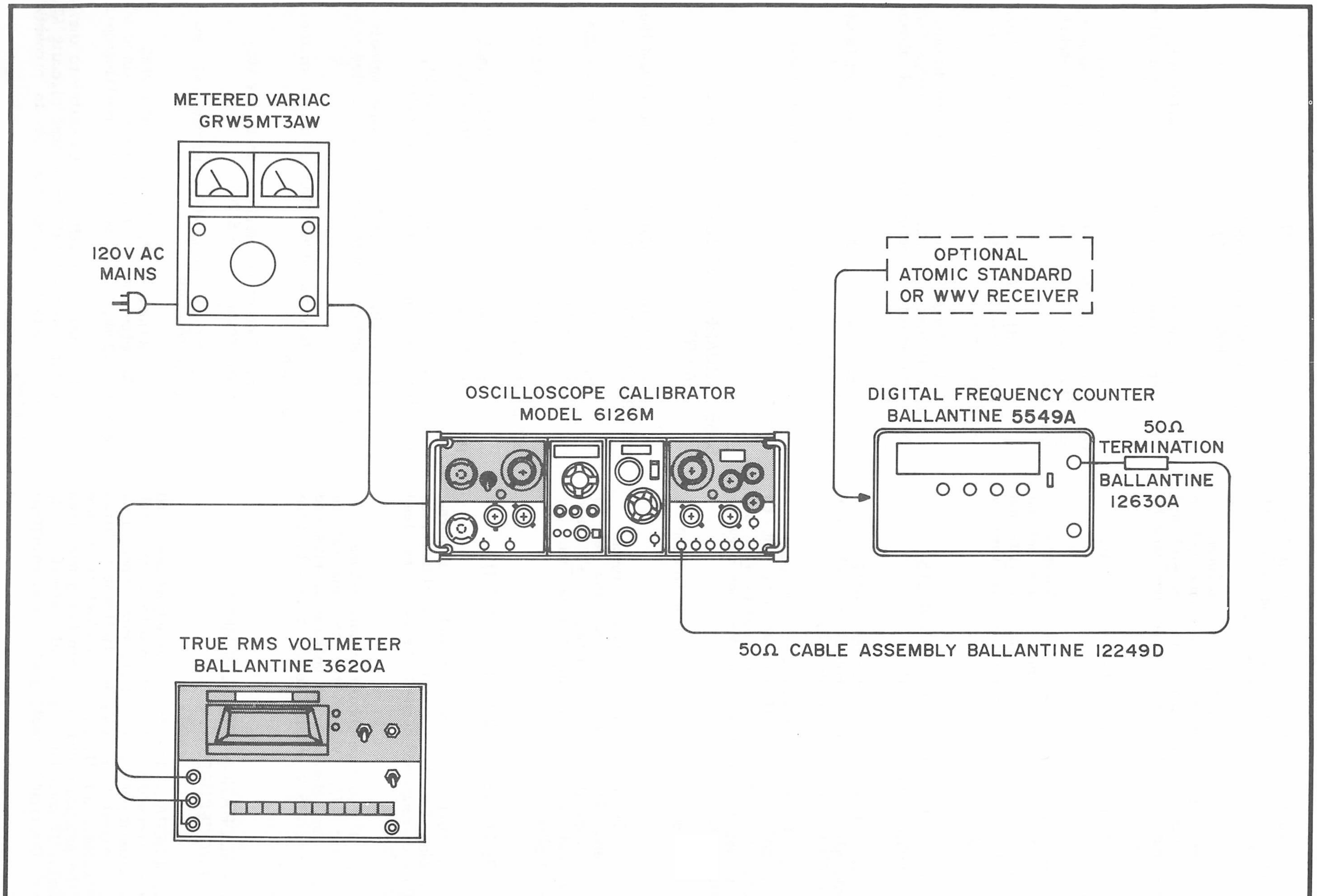


Figure 5-1. Clock Frequency Check, Bench Test Set-Up

a. Follow the same procedure as outlined in paragraph 5-26a except connect the V-Ω test lead to A128 J21-12. See Figure 5-7.

b. The voltage should measure between +11.5 V and +12.5 V with the ac line set to nominal. Vary the ac input voltage by ±10% and observe that the +12 V reading does not vary by more than ±1%.

c. Connect the V-Ω test lead to A128 J21-10.

d. The voltage should measure between -11.5 V and -12.5 V with the ac line set to nominal. Vary the ac input voltage by ±10% and observe that the -12 V reading does not vary by more than ±1%.

5-29. +15 VOLT REGULATED, -15 VOLTS REGULATED (A100 J1)

a. Follow the same procedure outlined in paragraph 5-26A. Except connect the V-Ω test lead to A100 J1-13. See Figure 5-8.

b. The voltage should measure between +14.4 V and +15.6 V with the ac line set to nominal. Vary the ac input voltage by ±10% and observe that the +15 V reading does not vary by more than +1%.

c. Connect the V-Ω test lead to A100 J1-15.

d. The voltage should measure between -14.4 V and -15.6 V with the ac line set to nominal. Vary the ac input voltage by ±10% and observe that the -15 V reading does not vary by more than ±1%.

5-30. -75 VOLTS REGULATED (A127 P1)

a. Follow the procedure outlined in paragraph 5-26a. Except set the digital multimeter to the 200 V dc range and connect the V-Ω test lead to A127 P1-13.

b. The voltage should measure between -72.5 V and -77.5 V with the ac line set to nominal. Vary the ac input voltage by ±10% and observe that -75 V reading does not vary by more than ±2%.

5-31. CALIBRATION AND ALIGNMENT PROCEDURES

5-32. GENERAL. The following adjustments and alignment procedures are performed to insure that the equipment meets its performance specifications. Failure to satisfy an adjustment requirement indicates a malfunction. Re-check to be sure that the procedure and setup are being performed correctly. If unsatisfactory results are obtained, refer to the trouble-shooting procedure, paragraph 5-50.

5-33. VOLTS CALIBRATION

5-34. 200 VOLT CALIBRATION ADJUST (A3 R9)

a. Connect the 6126M to the differential voltmeter as shown in Figure 5-9. Set the ac line voltage to midline.

b. Set the dials of the differential voltmeter to +200.00 volts and the null range to ±100 mV. Allow 5 minutes for temperature stabilization.

c. Adjust A3 R9, the 200 VOLT CALIBRATION Adj. potentiometer, until the differential voltmeter shows a null within ±25 mV.

d. Change OUTPUT MODE to -DC and differential voltmeter to -200.00 volts. Observe that the differential voltmeter indicates null within ±100 mV.

e. Check the VOLTS/DIV accuracy limits of Table 5-2a.

f. Trim A3 R9 for minimum error (Table 5-2a).

5-35. SQUARE WAVE ZERO LEVEL ADJ. (A3 R2)

a. Set the VOLTS/DIV switch to 20 and the MULTIPLIER (volts) to X1.

b. Set the OUTPUT MODE switch to any one of the ac positions.

c. Turn the 6126M POWER ON switch to the off position.

d. Remove the Volts Output Mode Select p.c. board assembly (A7) from its connector.

e. Remove integrated circuit, A7 U1, from its socket and carefully set it aside.

f. Re-install the A7 p.c. board assembly in its connector. Check that it is oriented correctly.

g. Turn the 6126M POWER ON switch to the ON position.

h. Connect an oscilloscope to the VOLTS OUT BNC connector on the 6126M.

i. Adjust the oscilloscope vertical sensitivity to 50 mV/DIV.

j. Adjust A3 R2, the SQUARE WAVE ZERO LEVEL ADJ potentiometer, for an offset reading of less than 20 mV, as indicated on the oscilloscope.

k. Turn the 6126M POWER ON switch to the OFF position an re-install integrated circcuit A7 U1 in its socket. Check that it is properly oriented.

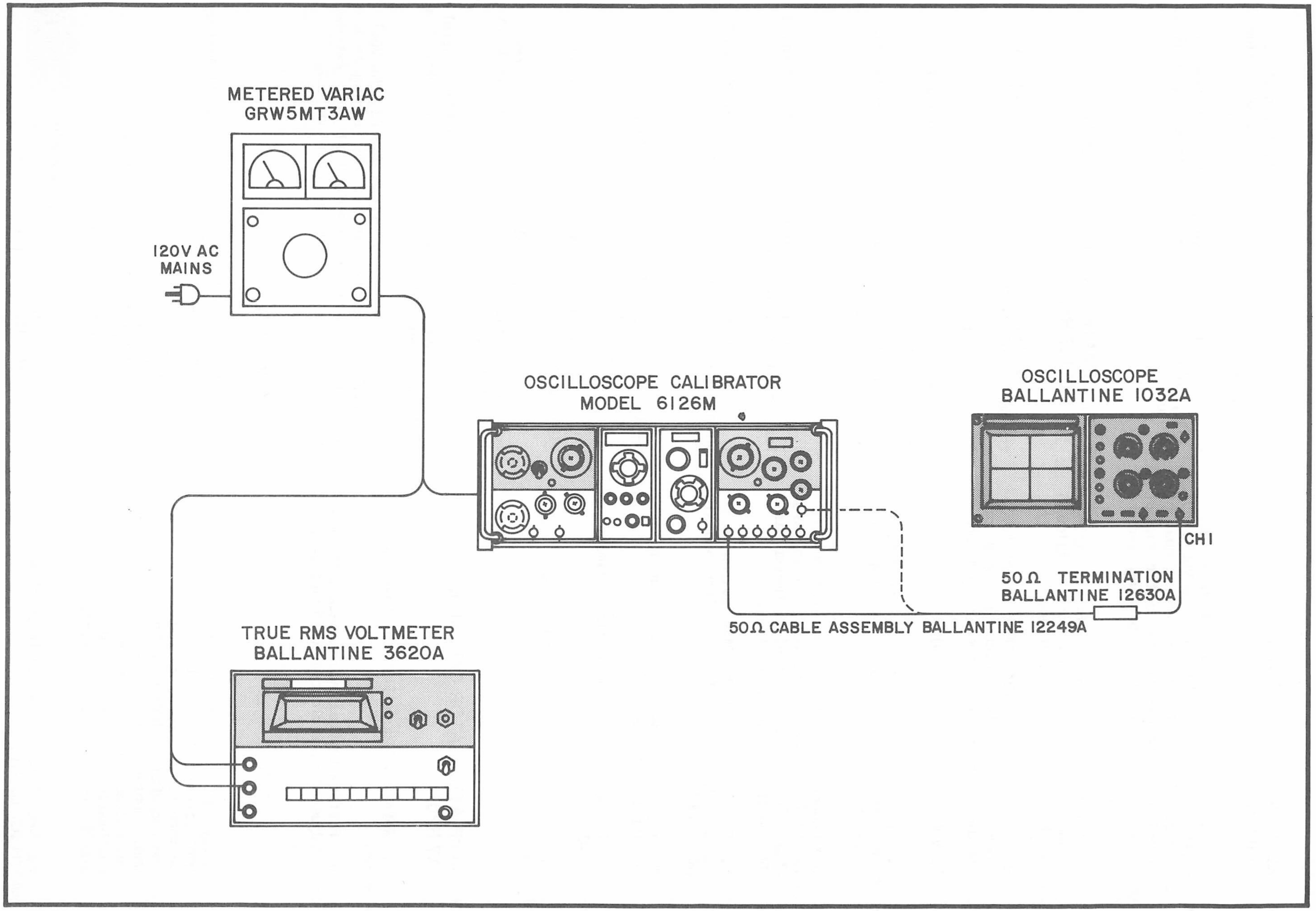


Figure 5-2. Trigger and Marker Amplitude Check, Bench Test Set-Up

5-36. ZERO VOLTS OFFSET ADJUST (A100 R1) must be in 20mV pos.

a. Connect a dc differential voltmeter, such as the Fluke Model 885AB, to the VOLTS OUT BNC connector. Connect the INPUT binding post of the differential voltmeter to the center pin of the BNC connector and the COMMON binding post to the shell of the connector.

b. Set the differential voltmeter dials to 0.000 and the NULL RANGE to 1 mV. Allow 5 minutes for temperature stabilization.

c. Set the 6126M OUTPUT MODE switch to the GND position and adjust A100 R1 for a zero reading on the differential voltmeter, ±100 uV.

5-37. 10 V CAL. ADJ. (A100 R4)

a. Check that the performance specification of the 200 volt calibration, paragraph 5-34, has been satisfied.

b. Connect the differential voltmeter to the VOLTS OUT BNC connector as outlined in paragraph 5-36a. Set the differential voltmeter dials to +10.000 and the NULL RANGE to 1 mV.

c. Set the 6126M OUTPUT MODE switch to +DC. Select 1 V on the VOLTS/DIV switch and X10 on the VOLTS MULTIPLIER.

d. Adjust A100 R4 for a zero reading on the differential voltmeter, ±100 uV.

e. Check the VOLTS/DIV accuracy limits of Table 5-2b.

f. Trim A100 R4 for minimum error (Table 5-2b).

5-38. 60 dB ATTENUATOR CAL. ADJ. (A7 R20)

a. Refer to Figure 5-10 for test equipment setup.

b. Perform the following check with test equipment adjusted as indicated in Figure 5-2.

NOTE

Always determine the measurement circuit offset voltage on each range step by switching the VOLTS OUTPUT MODE to GND. Subract this unwanted offset voltage from the range calibration being performed and the null limits indicated.

c. Set VOLTS/DIV switch to 20 mV and the MULTIPLIER to X10.

d. Set differential voltmeter dials to 0.20000 and the null range to ±100 uV. Allow 5 minutes for temperature stabilization.

e. Adjust A7 R20 , 60 dB ATTENUATOR CAL ADJ., until the differential voltmeter reads null, ±20 uV.

5-39. DEVIATION METER CALIBRATION (A117 R5)

a. Set the VOLTS/DIV switch to 20 V and the MULTIPLIER to X10.

b. Select the +DC OUTPUT MODE.

c. Set the DM 501A Digital Multimeter RANGE/FUNCTION switch to 200 V DC.

d. Patch the VOLTS OUT connector to the DM 501A LO/HI INPUT binding posts.

e. Select VOLTS ±10% DEVIATION.

f. Adjust the VOLTS/DIV DEVIATION control for a reading of 180.00 V dc.

g. Adjust A117 R5 for a display of -10.00 on the DEVIATION Digital Panel Meter.

5-40. VOLTS DEVIATION RANGE ADJ (A18 R2)

a. Set the DEVIATION switch to the VOLTS ±10% position.

b. Rotate VOLTS/DIV control to its maximum counter-clockwise position and note the DEVIATION reading.

c. Rotate the VOLTS/DIV deviation control to the maximum clockwise position and note the DEVIATION reading.

d. If necessary, adjust A18 R2, the VOLT DEV RANGE ADJ. control so that the reading on the DEVIATION meter indicates>10.00 at both extreme positions of the VOLT/DIV deviation control.

5-41. TIME CALIBRATION

5-42. Before calibrating or adjusting the 6126M, preset the controls as follows:

TIME/DIV	0.1 us
MULTIPLIER (Time)	X1
TRIGGER PULSE PERIOD	100 us
HI AMPL VARIABLE	Max. CW
FAST RISE VARIABLE	Max. CW
Marker Trigger Interlock (Located internally on A16 circuit board.)	Lockout

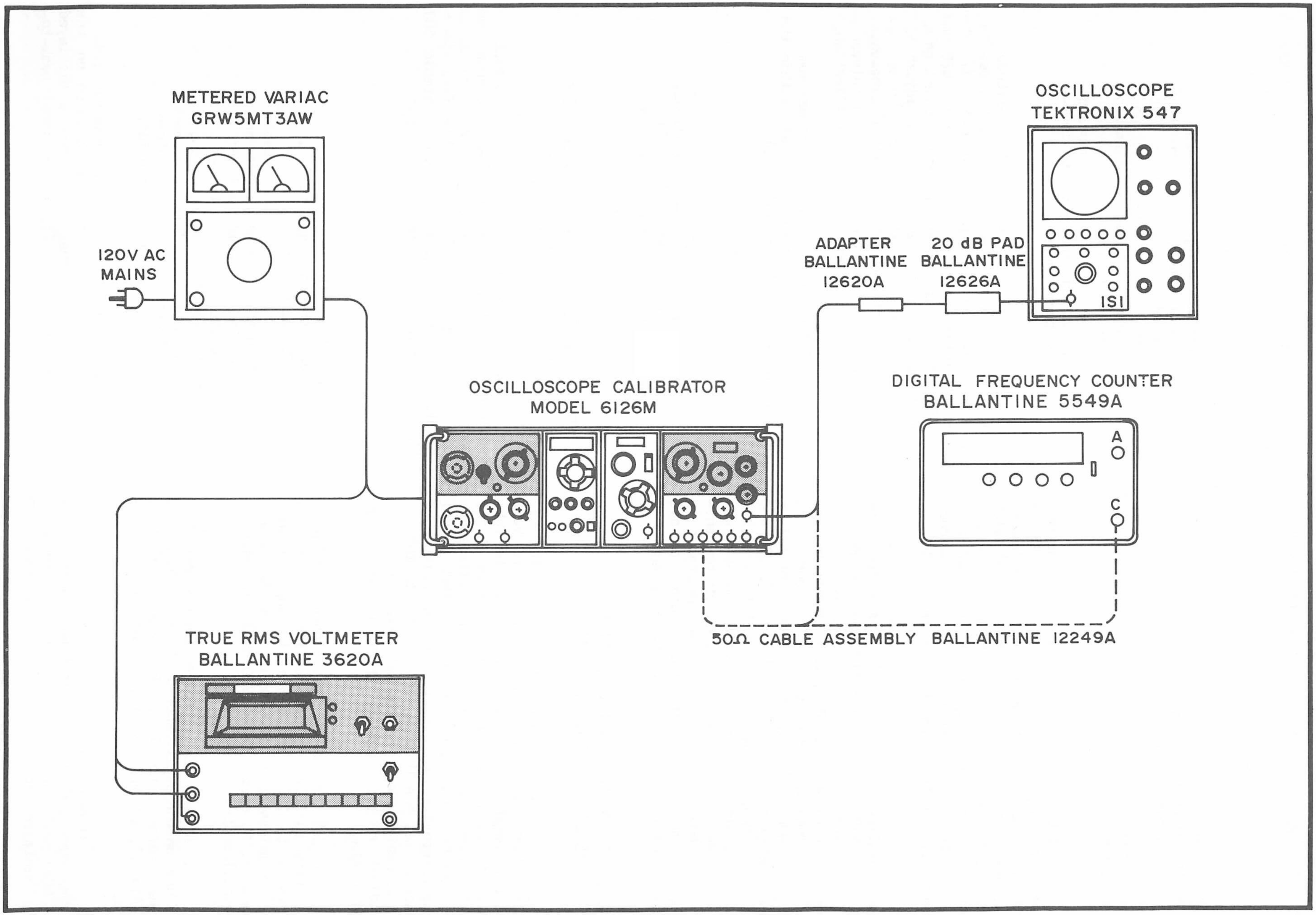


Figure 5-3. Trigger Rise Time and H. F. Out Check, Bench Test Set-Up

5-43. CLOCK FREQUENCY ADJUST (A11 C5)

NOTE

Before making any adjustment of the clock frequency or multiplier tuning, allow at least 2 hours warm-up at reference conditions. Make all adjustments in the sequence listed.

a. Interconnect the generator and the required test equipment as shown in Fig. 5-1. Use a frequency counter with a certified high-stability clock, such as the Ballantine Model 5549A with Option 14, connected to the MARKER OUT connector. Be sure that the clock frequency of the counter is fully stabilized and accurate. Use a frequency standard, if available, for the counter clock.

b. The frequency counter must read in the range of 10,000,081 to 9,999,919 Hz when measuring the 0.1 us MARKER OUT. If the frequency is near or over the limit, adjust A11 C5 until the counter reads in the range of 10,000,010 to 9,999,990 Hz. If A11 C5 does not have sufficient range or is near its minimum setting, select a value of A11 C6 (typical values for A11 C6 are 5, 12, 20, 27, and 36 pF) to bring the adjustment of A11 C5 within range, or replace the quartz crystal and oven assembly if the frequency adjustment cannot be centered on 10 MHz. If the clock of the generator is not set properly to 10 MHz, the accuracy on all generator outputs will be adversely affected.

5-44. 5 nS (200 MHz) ADJUSTMENT (A15 C4, A15 C6, A15 C21)

a. Interconnect the generator and the required test equipment as shown in Figure 5-9. Connect a sampling oscilloscope, such as the Tektronix 547 with 1S1 plug-in, to the 5 ns H. F. OUTPUT connector. Set the sampling oscilloscope time base to 5 ns/cm. Connect the HI AMPL OUTPUT to the external trigger input of the sampling oscilloscope. Set the TRIGGER PULSE PERIOD to 100 ns. Set the oscilloscope to external positive trigger and adjust the sweep triggering for a stable triggered display.

b. Set the sampling oscilloscope vertical sensitivity to 20 mV/cm. The oscilloscope is then calibrated to 200 mV/cm since the input signal from the generator is reduced by a 20 dB coaxial attenuator. Observe a 5 ns (200 MHz) sine wave on the oscilloscope.

c. Adjust A15 C21 for maximum sine-wave amplitude on the oscilloscope. If no tuning or too little tuning is noted, check A15 Q20, A15 Q21, and A15 Q2, as well as their associated components.

d. It may be necessary to readjust the 200 MHz tune and the 200 MHz trace in the 2 ns (500 MHz) multiplier. Cycle to cycle flatness is to be minimized to avoid amplitude modulation in the multiplier output. Therefore, touch up A15 C4 and A15 C6 for best MHz flatness.

NOTE

The preceding adjustments may interact. It is important to obtain cycle-to-cycle flatness so that intermodulation distortion will be minimized. This distortion adversely affects the multiplier; causing poor performance due to temperature changes.

e. Sine-wave cycle-to-cycle amplitude modulation should not exceed 5% at 25°C. Use the procedure described in paragraph 5-30. If the intermodulation is excessive, replace A15 Q20 and A15 Q21 with transistors whose beta (current gain) is matched within 25%, and carefully adjust A15 T21 no more than one-half turn for optimum amplitude flatness of the 5 ns H.F. OUTPUT sine-wave. The cycle-to-cycle amplitude modulation tolerance is for reference only and is not a specification.

f. Again touch up A15 C21 for maximum peak-to-peak amplitude which must fall within the range of 0.75 V p-p (3.75 divisions).

NOTE

If 0.75 V p-p amplitude is not obtainable, check A15 Q20 and A15 Q21 and associated components. Check A15 T21 and replace if damaged or misshaped.

5-45. 2 ns H.F. OUTPUT Adjust (A15 C7, A15 C9, A15 C11, A15 C14)

a. Interconnect the generator and test equipment as shown in Figure 5-9. Change the sampling oscilloscope time base to 2 ns per division and change the cable at the 6126M from the 5 ns H.F. OUTPUT connector. Observe a stable 500 MHz (2 ns) sine-wave on the oscilloscope.

NOTE

Do not use the PC card extender when making 2 ns H.F. OUTPUT adjustments. Do not extend the 50 ohm output cable within the instrument. Use an insulated alignment tool and allow the instrument to be fully warmed up before making adjustment. The 5 ns adjustment must be properly aligned before starting the 2 ns calibration.

b. Observe that the 2 ns frequency output provides one sine-wave per division on the scope graticule and that the sine-wave displayed is at least 0.75 VOLT (3.75 divisions) peak-to-peak.

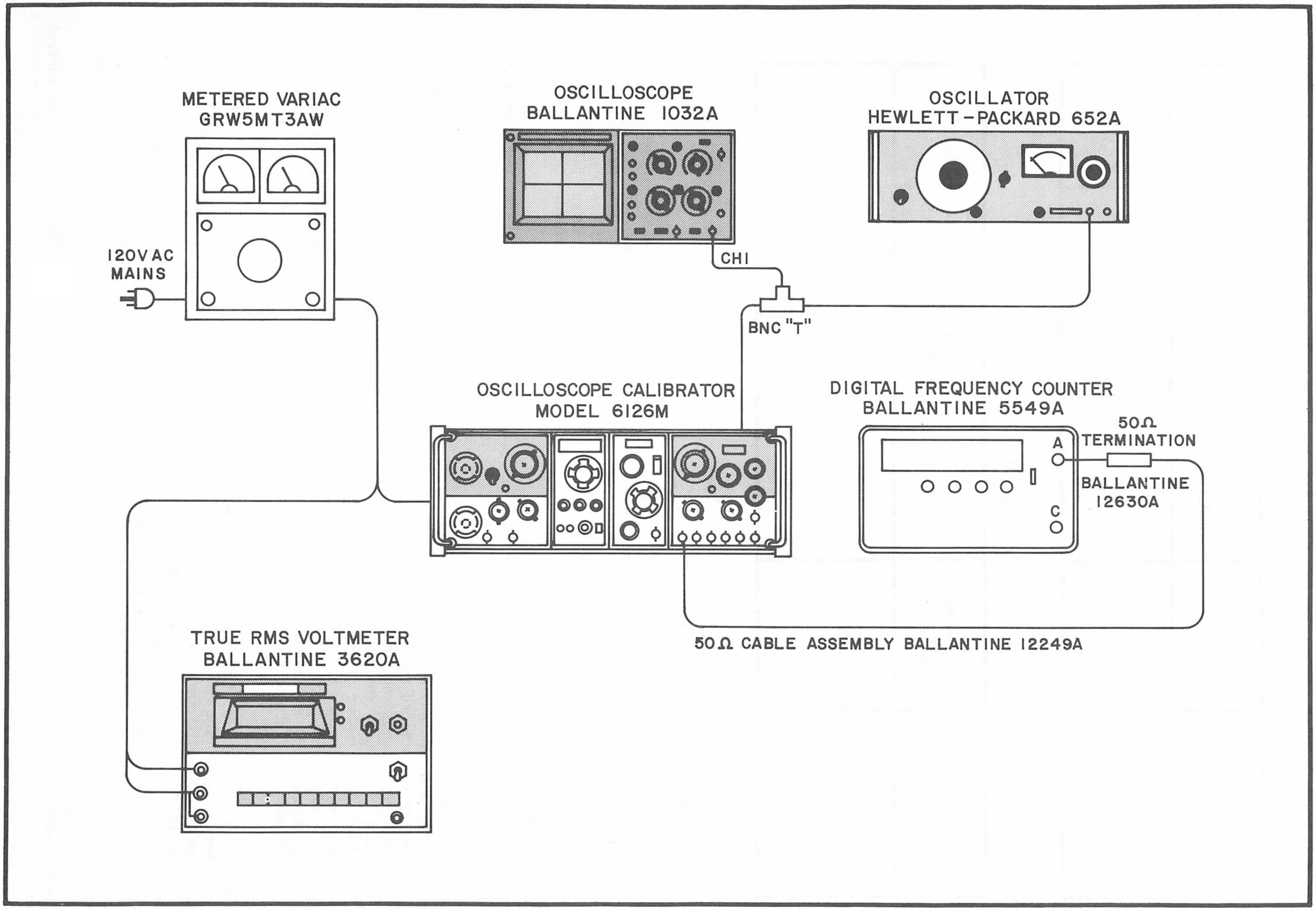


Figure 5-4. External Clock Input Check, Bench Test Set-Up

TABLE 5-2a. VOLTS/DIV ACCURACY LIMITS

OUTPUT MODE	6126M VOLT/DIV	MULTIPLIER	DIFFERENTIAL VOLTMETER DIALS	NULL LIMITS
+DC	20 V	X10	+200.00	±500 mV
+DC	10 V	X10	+100.00	±250 mV
+DC	5 V	X10	+ 50.000	±125 mV
+DC	2 V	X10	+ 20.000	±50 mV

TABLE 5-2b. VOLTS/DIV ACCURACY LIMITS

OUTPUT MODE	6126M VOLT/DIV	MULTIPLIER	DIFFERENTIAL VOLTMETER DIALS	NULL LIMITS
+DC	1 V	X10	+10.000	± 25 mV
+DC	0.5 V	X10	+ 5.0000	±12.5 mV
+DC	0.2 V	X10	+ 2.0000	± 5 mV
+DC	0.1 V	X10	+ 1.0000	± 2.5 mV
+DC	50 mV	X10	+ 0.5000	± 1.25 mV

c. Adjust A15 C9 and A15 C14 for maximum signal amplitude.

d. Adjust A15 C7 and A15 C11 for best flatness and amplitude.

NOTE

The adjustment of A15 C4 (100 MHz filter), A15 C6 (200 MHz trap), A15 C7 (300 MHz trap) and A15 C9 (500 MHz Filter A) interact. Repeat steps c and d as necessary for best tuning. Also, do not make any of the capacitor adjustments randomly or too far removed from the original settings. The controls interact and a number of combinations may produce a 500 MHz (2 ns) output; however, only one combination produces maximum amplitude and flatness.

e. If a 0.75 volt amplitude is not achievable, check A15 Q3, A15 CR1, and the associated components, including all transformers and inductors in the 500 MHz quintupler. Check that the printed circuit board and components are clean and free of flux or other contaminants which may lower the Q of tank circuits and the strip line filter so as to cause a reduction of the 2 ns output signal amplitude.

f. Touch up the output to limit the maximum peak-to-peak 500 MHz signal so that it falls within 0.5 V p-p to 0.6 V p-p; or the 10 MHz phase lock may not function properly.

NOTE

Because of the interaction between adjustments A15 C4, A15 C6, A15 C7 and A15 C9; the calibration of the 5 ns H. F. OUTPUT (paragraph 5-45) should be re-verified.

5-46. % TIME DEVIATION BALANCE ADJ. (A12 R2)

a. Allow instrument to be thoroughly warmed up with covers on to retain internal temperature.

b. Connect a frequency counter to the MARKER OUT BNC as shown in Figure 5-9.

c. Set the 6126M controls as follows:

TIME/DIV	100 us
MULTIPLIER	X1
DEVIATION	OFF

d. Observe a reading of 100.00 us.

e. Set DEVIATION to TIME ±10%. Note that the TIME DEVIATION indicator lamp is illuminated.

f. Rotate the TIME/DIV DEVIATION control to each end and observe that the frequency counter varies at least from 90.00 us to 110.00 us.

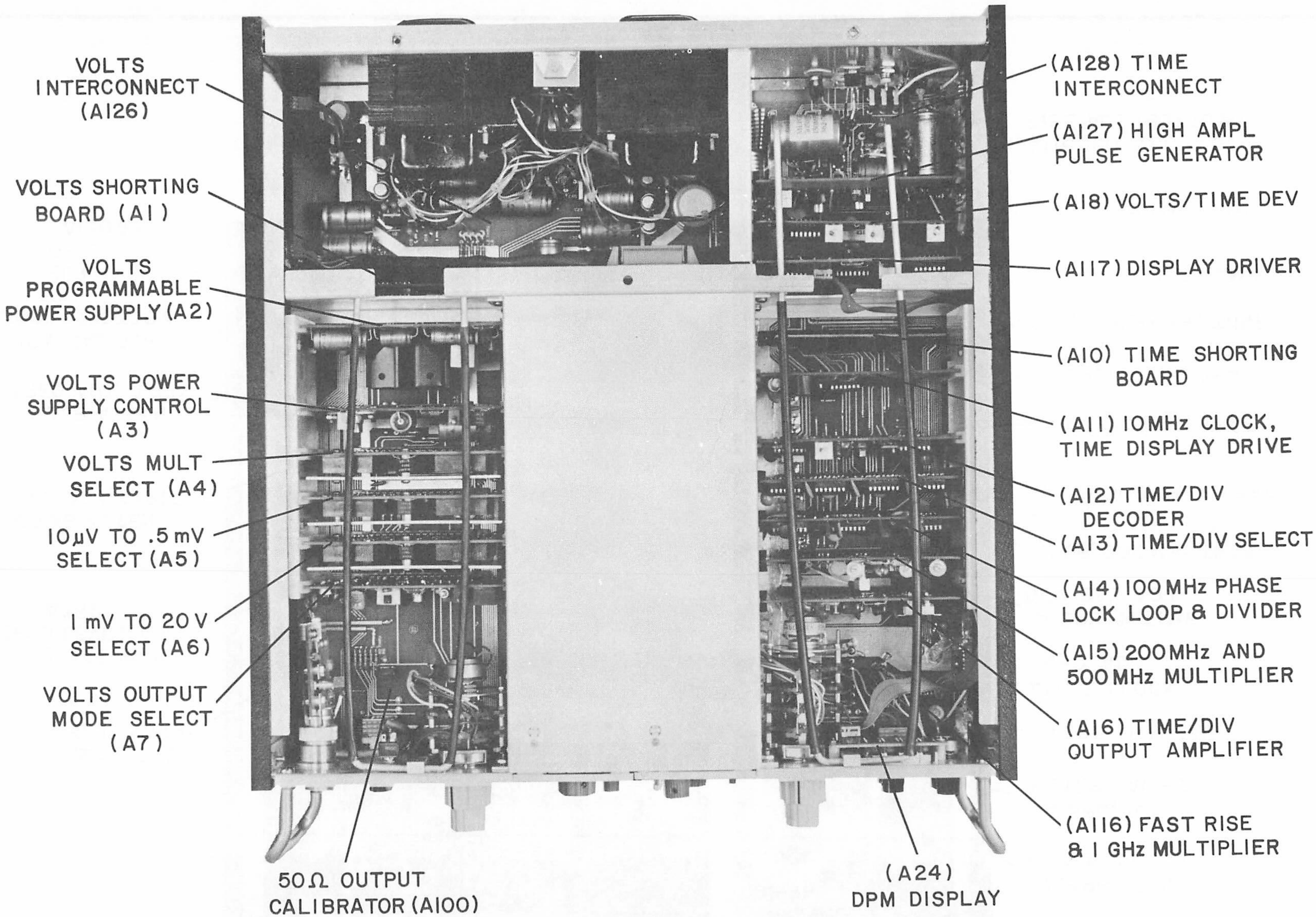


Figure 5-5a. 6126M Location of Boards

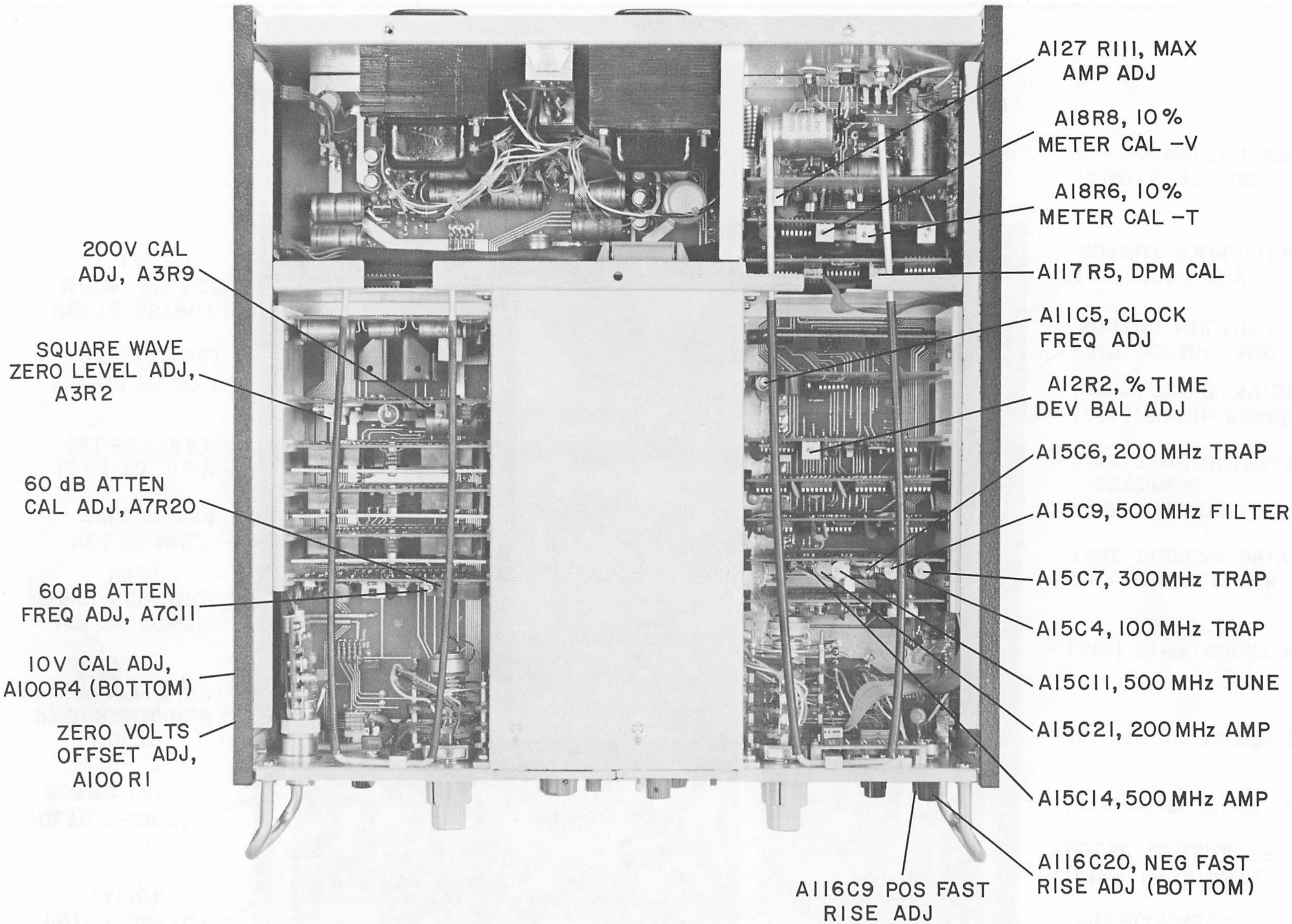


Figure 5-5b. 6126M Location of Adjustments

g. Adjust A12 R2 until the counter maximum and minimum frequency readings are approximately balanced for equal deviation from 100 us at each end of rotation of the TIME/DIV DEVATION control.

5-47. METER TIME CAL ADJ. (A18 R8, A18 R6)

a. Use the same test setup detailed in paragraph 5-46. Set the counter to PERIOD mode. Set the 6126M TRIGGER PULSE PERIOD switch to 100 us. Rotate the TIME/DIV control until the frequency counter reads 90 us. Adjust A18 R6, -TIME METER CAL adjust potentiometer, until the 6126M digital meter reads -10.00 (±5 digits).

b. Rotate the TIME/DIV control until the frequency counter reads 110 us. Adjust A18 R8 until the 6126M digital meter reads +10.00 (±5 digits).

c. A18 R6 and A18 R8 are somewhat interdependent. Therefore, repeat steps a and b until tracking is achieved.

5-48. MAX. AMPL. ADJUST (A127 R111)

a. Set the HI AMPL VARIABLE control fully clockwise.

b. Connect the HI AMPL OUTPUT BNC connector to the vertical input of an oscilloscope, such as the Ballantine Model 1032, through a 50 ohm termination.

c. Set the TRIGGER PULSE PERIOD switch to 1 ms.

d. Adjust A127 R111 for 5 volts minimum peak-to-peak as indicated on the oscilloscope.

e. Turn the HI AMPL VARIABLE control fully counterclockwise and observe that the peak-to-peak voltage indicated on the oscilloscope is less than 0.5 volts.

5-49. POSITIVE FAST RISE ADJUST (A116 C20)

a. Connect the positive FAST RISE OUTPUT through a short 50 Ω cable to a sampling oscilloscope, such as the Tektronix Model 547 (with the 1S1 plug-in). Set the sampling oscilloscope time base to 0.2 ns per cm.

b. Set the TRIGGER PULSE PERIOD switch to the 100 ns position.

c. Adjust A116 C19, using an insulated alignment tool, for minimum rise time on the falling edge as displayed on the sampling oscilloscope.

5-50. NEGATIVE FAST RISE ADJUST (A116 C20)

a. Connect the negative FAST RISE OUTPUT to the sampling oscilloscope as described in paragraph 5-49a. Set the sampling oscilloscope time base to 0.2 ns per cm.

b. Set the TRIGGER PULSE PERIOD switch to the 100 ns position.

c. Adjust A116 C20 using an insulated alignment tool, for minimum rise time on the leading edge as displayed on the sampling oscilloscope.

5-51. TROUBLESHOOTING

5-52. The troubleshooting procedures should be performed only when the instrument cannot be calibrated using the procedures of paragraph 5-31 through 5-50. Should the instrument be inoperative or completely out of specifications, proceed with the following faultfinding procedures:

a. Carefully examine the instrument and check for any visual evidence or trouble. Check for broken wires, burned resistors, loose components and shorted, open, or defective solder joints on the printed circuit board. Check for separation of printed circuit board lands and pads. Check for open, defective, or intermittent switches. Check that connectors are clean and mate properly. Check that the instrument circuit ground is connected to the chassis ground.

b. Understand and be familiar with the circuit theory of Section 4. Use the functional block diagram, Fig. 4-1. Also refer to the schematic diagrams in Section 6. Always check the power supply voltages and check for oscillations in the circuitry.

c. To locate faults see Table 5-3.

5-53. PRINTED WIRING BOARD REPAIR AND CLEANING

5-54. The calibrator uses an etched-copper printed circuit board. The main printed circuit board uses plated-through holes. To prevent damage to the circuit board and components, observe the following instructions when soldering:

a. Use a low-heat capacity soldering iron with a 700 F. tip, 1.5 mm (1/16 inch) to 2.5 mm (3/32 inch) wide, similar to Weller Model No. W-TCP, 60 watts.

b. Be sure that the solder iron tip is grounded to the power line "earth" ground to avoid possible overvoltage damage to semiconductor and tantalytic capacitors. Also, "earth" ground the case of the instrument.

c. When removing a component, clip a heat sink, such as long nose tweezers or alligator clips, to the component leads; as close as possible to the body of the component to ensure minimum heating of the component when soldering.

d. Place the soldering iron directly on the component lead on the conductor side of the printed circuit board. Use a desoldering tool such as the SOLDAPULLIT, manufactured by Edsyn Products, to remove all solder and free the component lead.

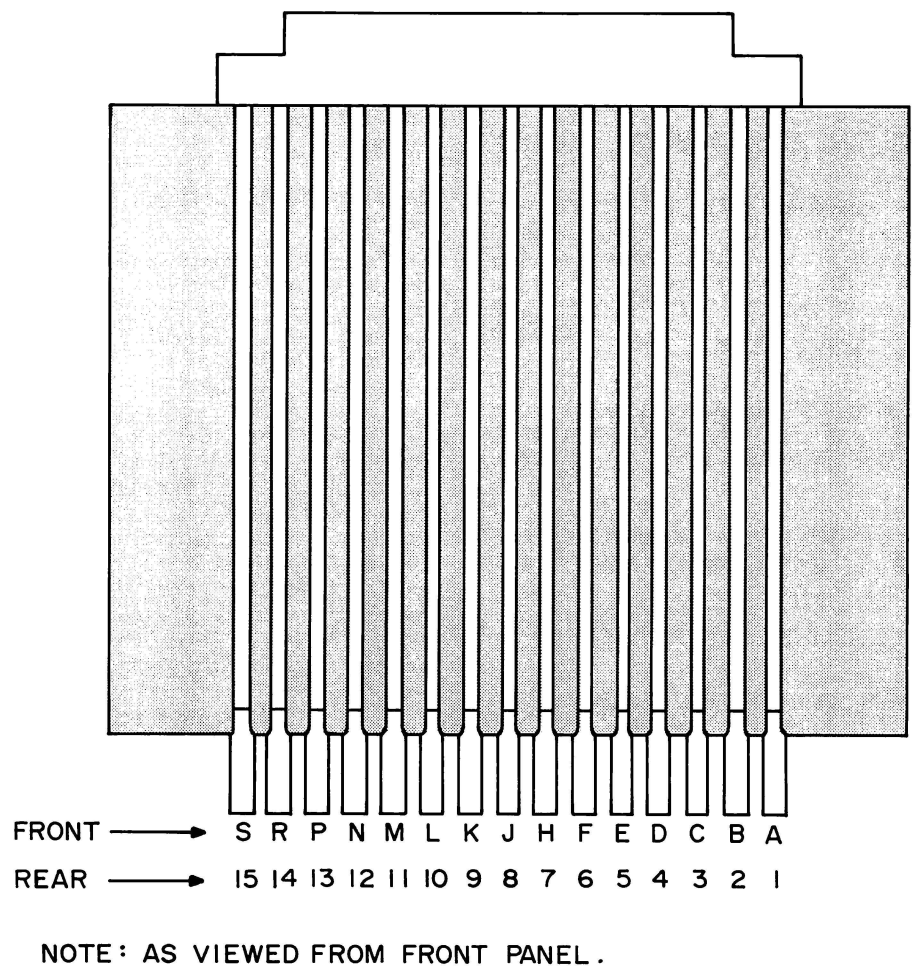


Figure 5-6. Service Extender Card

e. Straighten the component lead with long-nose pliers and remove the component from the board.

f. If a component is obviously faulty or damaged, clip the leads close to the body of the component and remove the leads remaining from the conductor side of the board.

g. Use a short soldering cycle since excessive or prolonged heat may destroy the laminate and lift the copper conductors from the circuit board; or cause immediate degrading or latent damage to the components.

h. Clean the component lead holes by heating the solder on the circuit board conductor pad, quickly removing the soldering iron, and inserting a pointed nonmetallic object, such as a toothpick, to clean the hole. Do not allow solder to cover the hole since new component leads may then push the pad away from the board.

i. To install a new component, straighten and shape the leads. Insert the component into the proper holes. Bend the leads on the conductor side of the circuit board so that they extend to the foil of the incoming conductor path. Cut the bent lead approximately 2.5 mm (3/32 inch) from the hole. Clip a heat sink to the component lead at the body of the component. Heat the lead and the pad with a soldering iron and form a meniscus over the hole to ensure a good electrical connection.

j. After removing or inserting a component, clean excess flux from the connection and surrounding area. Use TF Freon spray cleaner, such as Miller Stephenson Chemical Co., Type MS-180 (Ballantine P/N 80-10004- 01), low air pressure (5 to 20 PSIG), and a humidity seal spray, such as Humiseal, Columbia Technical Corp., Type 1B15 (Ballantine P/N 80-10005-0A), to seal the board and protect it against humidity. To avoid unwanted leakage, which may affect performance if the instrument is exposed to high humidity, do not touch the cleaned board or handle the components excessively.

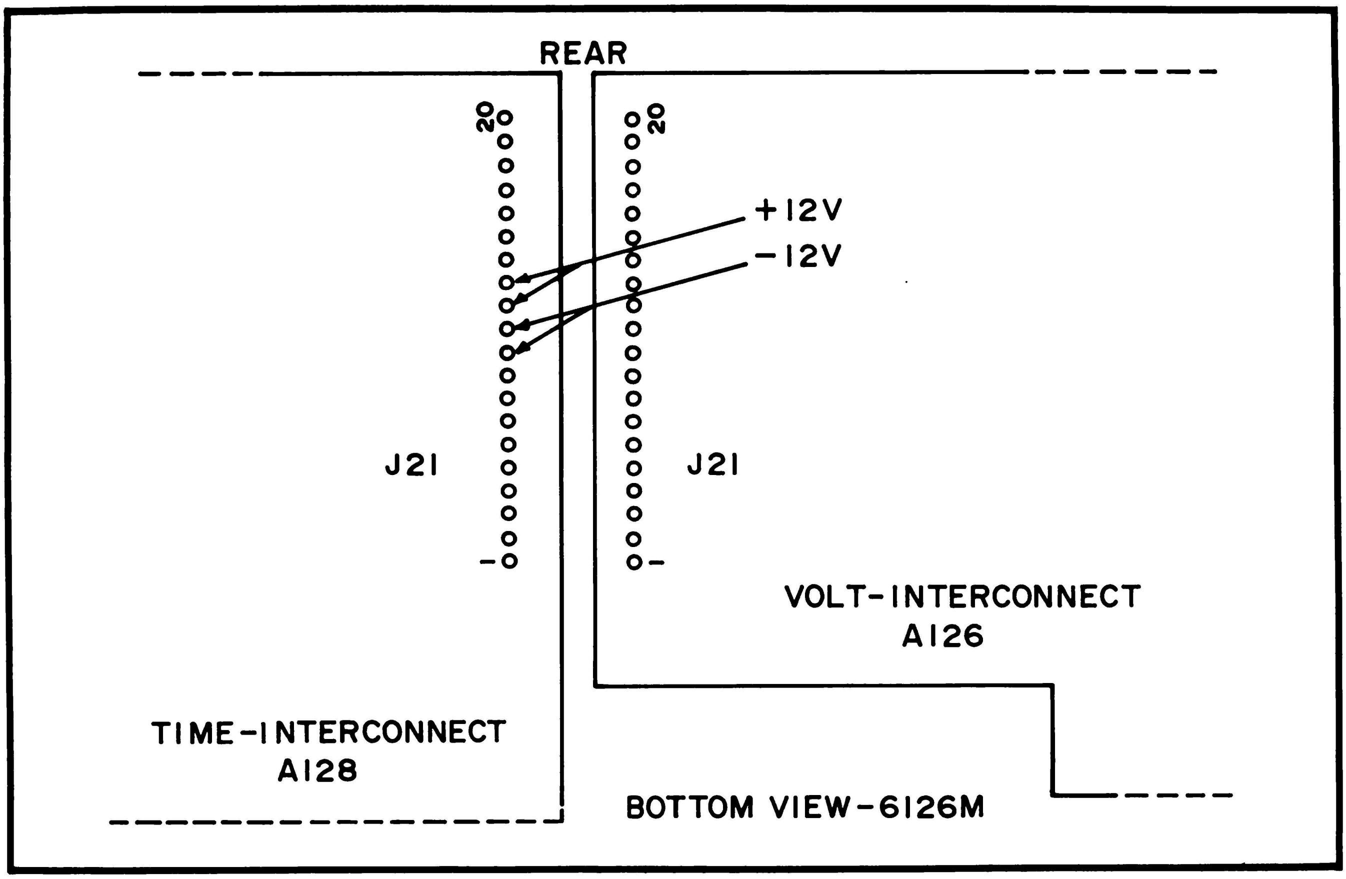


Figure 5-7. Time Base Connector

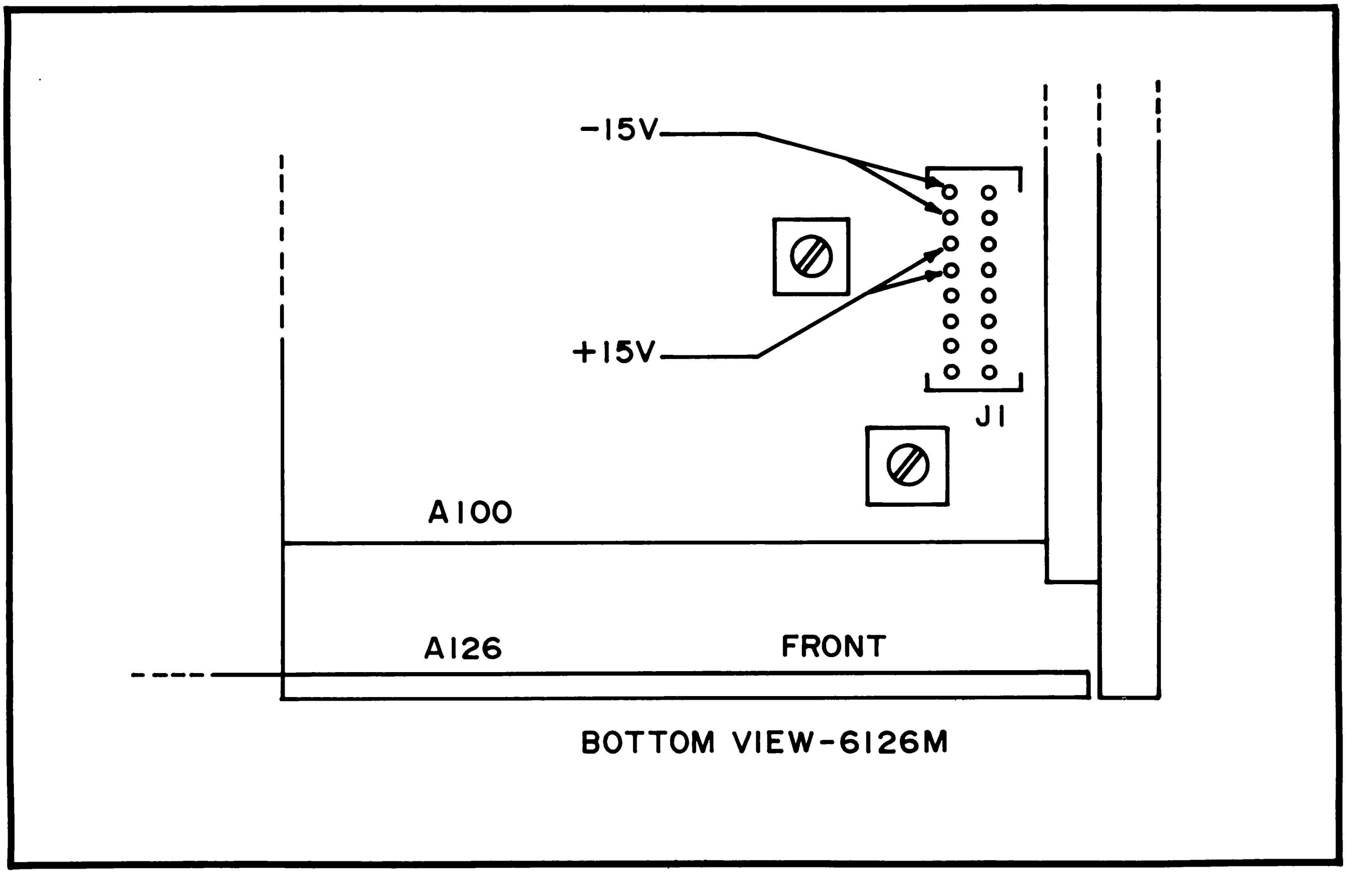


Figure 5-8. A100-J1 Connector

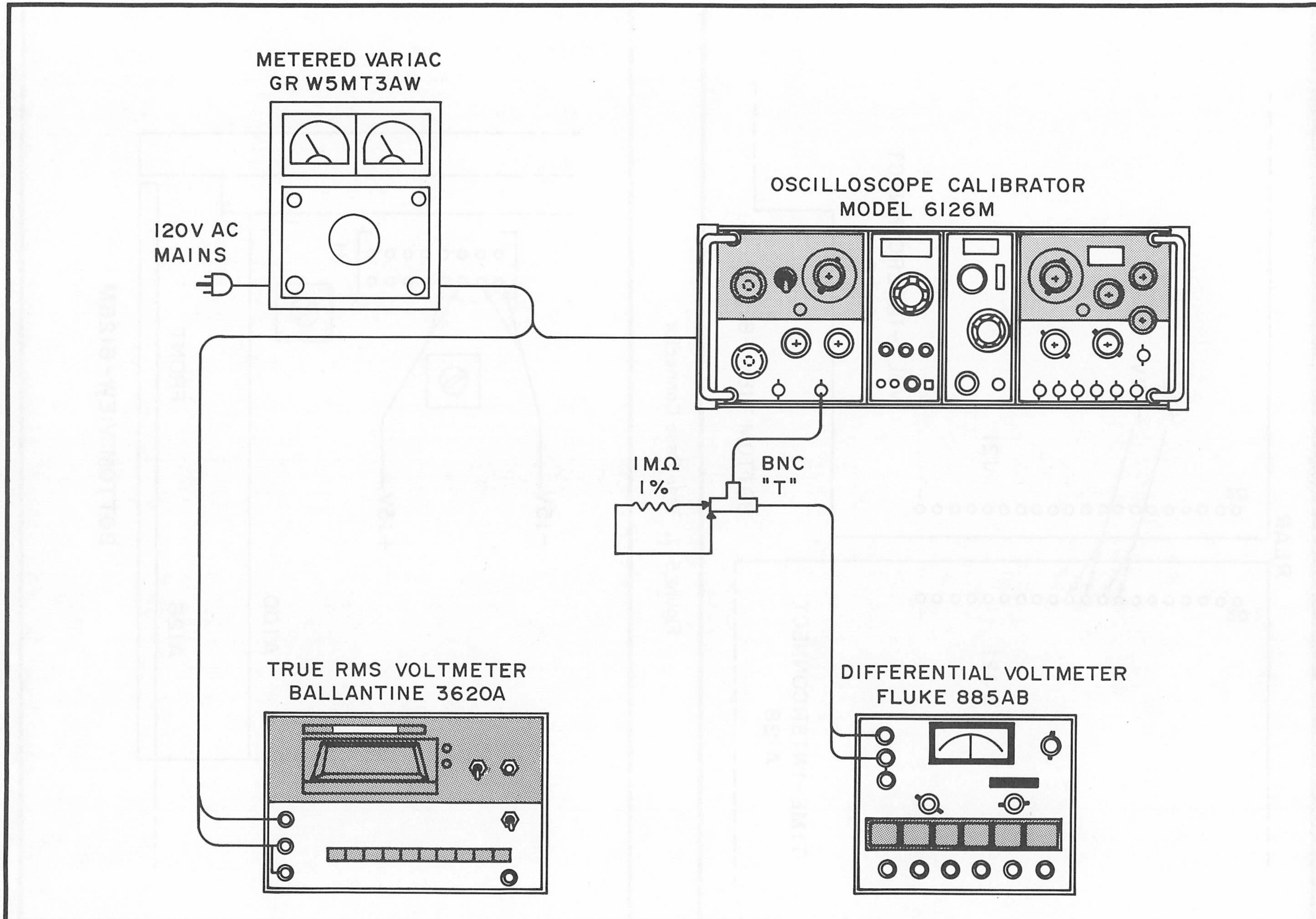


Figure 5-9. 200 Volt Calibration Adjust, Bench Test Set-Up

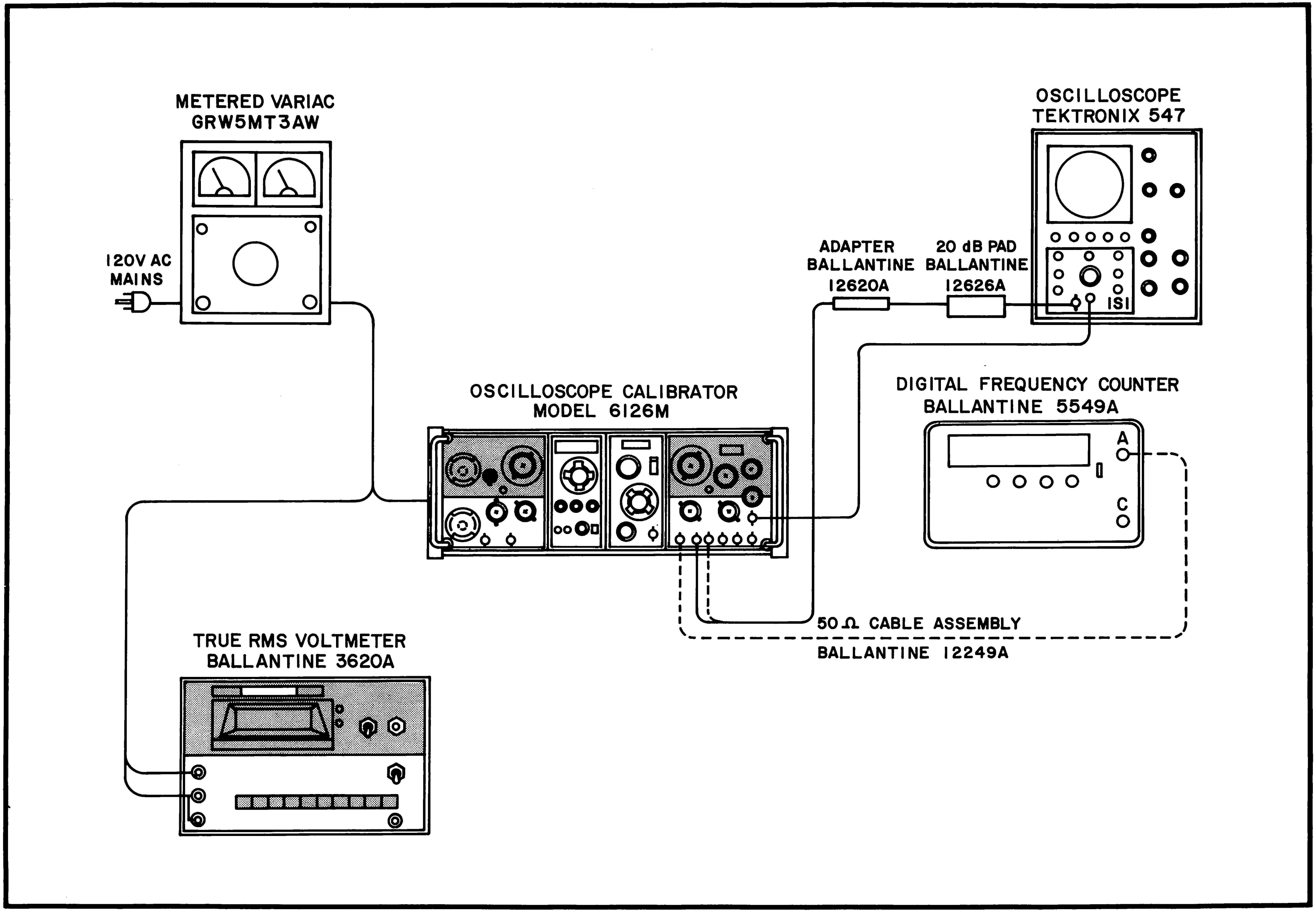


Figure 5-10. H. F. Out Adjust, Bench Test Set-Up

CAUTION

Be extremely careful when cleaning the multiplier coils and adjacent components. Never bend the coils. Distorted coils and transformers may drastically affect the functons, calibration and performance of the instrument.

CAUTION

Do not permit water or solvents to get into switches, connectors, or sockets. Avoid using corrosive cleaners which may damage metal or plastic parts.

5-55. KNOB REMOVAL

5-56. The instructions for removing the 6126M knobs; with the exception of the VOLTS/DIV and the TIME/DIV knobs, are described in the following procedure. For the removal of the VOLTS/DIV and TIME/DIV knobs refer to figure 5-11.

a. Remove the cap in the center of the knob with a small knife blade or scribe.

b. Using a medium blade screwdriver, turn the exposed screw in the center of the knob counterclockwise until the knob is free of the shaft.

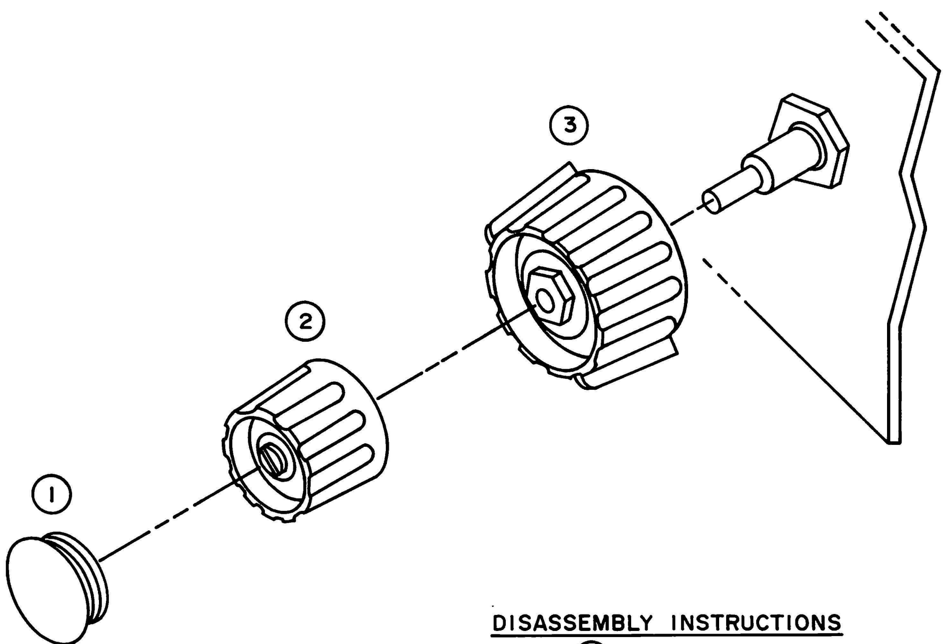
c. Remove the knob from the shaft.

5-57. To replace the knob on the shaft proceed as follows:

a. Install the knob on the shaft.

b. Tighten the screw in the center of the knob by turning it clockwise. Use a medium blade screwdriver and tighten until the knob firmly grips the shaft.

c. Press the decorative cap securely into the center of the knob.



DISASSEMBLY INSTRUCTIONS

STEP 1. PRY CAP (1) LOOSE FROM CENTER OF SMALL KNOB (2) WITH A SMALL KNIFE BLADE.

STEP 2. USING A MEDIUM BLADE SCREWDRIVER, TURN SCREW IN CENTER OF SMALL KNOB (2) COUNTERCLOCKWISE UNTIL KNOB IS FREE; THEN REMOVE FROM SMALL DIAMETER SHAFT.

STEP 3. USING A 3/8" NUT DRIVER, TURN NUT IN CENTER OF LARGE KNOB (3) COUNTERCLOCKWISE UNTIL KNOB IS FREE; THEN REMOVE FROM LARGE DIAMETER SHAFT.

Figure 5-11. Removal of VOLTS/DIV and TIME/DIV Knobs

TABLE 5-3. TROUBLESHOOTING HINTS

TROUBLE	REMEDY
DEVIATION display does not illuminate.	Check that POWER switch is ON and ac mains cable is connected. Check that rear panel mains voltage selector switch is properly set. Check fuse in ac mains receptacle. Check that all assembly boards are properly seated in the correct connectors. Check for presence of +5 V regulated on A117. Check power supply voltages per paragraph 5-23.
DEVIATION display does not return to 00.00 ±3 counts when DEVIATION switch is set to OFF.	Check that 2 ns and 5 ns outputs are within the maximum amplitude limits or temporarily remove A13. Check relays A18 K2 and K3. Replace A18 and recalibrate A12 R2 per paragraph 5-46 and A18 R6, R8 per paragraph 5-47.
Volts Calibration unstable with ac mains voltage change or ripple in mains frequency.	Check ac mains voltage and rear panel selector switch. Check calibration on +DC mode with DEVIATION OFF, VOLTS/DIV set to 20 V and MULTIPLIER X 10. Check voltages on A2. Replace A2. Check voltages on A3. Check main voltage reference A3 CR5 for 6.2 Volts ±5%. Replace A3. Temporarily remove A18 to check that relays are not malfunctioning so as to load the VOLTS generator.
VOLTS MULTIPLIER Malfunctions.	Replace A4. Check resistors A4 R1 through R8. Check that relays A4 K1 through K7 open in X 10 MULTIPLIER position. Check that only one relay closes for each step from X 1 to X 8.
Incorrect calibration of ±200 Volt output or no ±200 Volt output.	Check that A1 is installed. Check or replace A2 and A3. Recalibrate A3 R9 per paragraph 5-34. Check relays A6 K5, K6 and K7 for continuity from A6 P1-A to A6 P1-6. Check that +200 Volts appears at A6 K7 when MULTIPLIER is set to X 10. Check A7 K2 and K3 reversal relays for presence of 200 Volts input and malfunction. Check that GND relay A7 K4 is open and not malfunctioning. Replace A7. Check for continuity from VOLTS OUT BNC to A5 R7 through A6 P1-6.
±200 Volts and MULTIPLIER functioning but incorrect amplitude on 10 V to 50 mV VOLTS/DIV ranges.	Check A5 R1 through A5 R6 and associated relays A5 K1 through A5 K6. Check A6 R3 through A6 R6 and associated relays A6 K1 through K4. Check that all A5 and A6 relays are open except for the VOLTS/DIV range relay selected and A6 K7. Replace A5 and A6. Check A1 or replace.
±200 Volts and MULTIPLIER functioning through 50 mV but 20 mV through 10 uV VOLTS/DIV ranges show errors.	Check A6 K6 for contact and function. Check calibration of A7 R20 per paragraph 5-38. Replace A6 or A7. Check A1 or replace.
±200 Volts and MULTIPLIER functioning through 2 V but 1 V through 10 uV VOLTS/DIV inoperative.	Check or replace A100. Check A100 K1 and K2 for contact and function.

TABLE 5-3. TROUBLESHOOTING HINTS (Continued)

TROUBLE	REMEDY
1 V to 20 mV VOLTS/DIV inoperative.	Check or replace A100. Check A100 K3 for contact and function.
10 mV to 2 mV VOLTS/DIV inoperative.	Check or replace A100. Check A100 K4 for contact and function.
1 mV to 10 uV VOLTS/DIV inoperative	Check or replace A100. Check A100 K5 for contact and function.
Incorrect calibration of 1 V position and below on VOLTS/DIV ranges.	Recalibrate A100 R1 per paragraph 5-36. Recalibrate A100 R4 per paragraph 5-37. Check or replace A100.
DC polarity selection does not function.	Check polarity reversal relays A7 K2 and A7 K3. Check logic circuits on A7. Replace A7.
No square wave voltage output modes or incorrect frequency.	Check 1 MHz input to A7 U1. Check steering of A7 U1 from A1 and/or replace A1 and A7. Check ac switch components A7 U4, A7 Q4, A3 Q3, A3 Q4, and A3 Q5. Check for presence of square wave at A3 TP-1 and at A3 P1-7.
Poor square wave output wave shape 20 V to 50 mV VOLTS/DIV ranges.	Check A7 U1, A7 U4 and A7 Q4. Check faulty relays A18 K2 and K3. Temporarily pull out A18 to isolate its fault contribution. Replace A7. Check that the oscilloscope is properly compensated and presents 1 M Ω and less than 50 pF load for ranges higher than 1 V position on VOLTS/DIV switch.
Volts Deviation does not function.	Check that Deviation switch is set to volts $\pm$10%. Check at A7 P1-B that the voltage varies as the VOLTS DEVIATION control is rotated. Check that A7 U3, A7 U4 and A7 Q4 are functioning. Replace A7. Check operation of relays A18 K2 and K3 or replace A18. Check and calibrate DPM and its interconnections or replace A117 and A24. Check A2 and A3 and connection of deviation voltage from A7 R15 to A3 R1 and A2 R10. Replace A2 and A3.
No Time Marker Output -Deviation OFF.	Check that rear panel INT CLOCK OUT/EXT CLOCK input switch S4 is set to the INT CLOCK OUT position for internal clock operation. If using extenal clock input, check that it is 10 MHz and of sufficient amplitude. Check internal 10 MHz clock or replace A11. Check MARKER OUT amplifier on A16 or replace A16. Set TIME/DIV to 10 ns and MULTIPLIER X 1 and check output with 100 MHz scope. If still no output, replace A12 and A14 and check A13 selector logic.
Time Markers inaccurate or jittery.	Check frequency of 10 MHz clock, A11 C5 per paragraph 5-43. Replace A11 and A12.
Time Markers not functioning for 10 ns, 20 ns and 50 ns.	Check A14 U2 through A14 U8 or replace A14. Check MARKER OUT amplifier on A16. Check Decoders and Logic Select on A12 and A13.

TABLE 5-3. TROUBLESHOOTING HINTS (Continued)

TROUBLE	REMEDY
Time Markers not functioning for 100 ns to 5 second ranges.	Check decoders and logic select on A12 and A13. Check 14 U3 through U8. Replace A13 and A14. Replace A16.
No HIGH AMPL or FAST RISE outputs.	Check A16 Q2, Q3, and Q4. Check MARKER TRIGGER INTERLOCK switch, A16 S1. Replace A16.
HIGH AMPL Output inoperative on any TRIGGER PULSE PERIOD Range.	Check output amplifier located on A127. Check transistors and check that TTL level pulse is measured at input of amplifier. Repeat with MARKER TRIGGER INTERLOCK slide switch A16 S1, set to OFF. Check A13 U16 and its connections to the TRIGGER PULSE PERIOD selector switch.
No -FAST RISE output.	Check A116 U2, Q13, 14, 15. Replace A116.
NO + FAST RISE output.	Check A116 U3, Q16, 17, 18.
NO ± FAST RISE outputs.	Check or replace A116.
TRIGGER PERIOD range inoperative on 100 ns or any of the faster ranges.	If TIME/DIV switch and MULTIPLIER are set for a period equal to or slower than the TRIGGER PULSE PERIOD, the trigger will be inoperative when MARKER TRIGGER INTERLOCK switch A16 S1 is set to LOCKOUT. Check by setting A16 S1 to OFF and note that all functions are normal.
MULTIPLIER does not function.	Check A14 and replace if necessary.
Time Deviation inoperative.	Check that DEVIATION switch is set to time ±10%. Check that rotation of front panel TIME/DIV DEVIATION control will vary the voltage at A12 R2. Check that relay A12 K1 is functioning. Check calibration of A12 R2 per paragraph 5-40. Check DPM and replace A24 if necessary. Check function of time deviation % frequency shift circuit of A13. Check relays A18 K1, K2 and K3. Check 2 MHz input to A18 R15 from 0.5 us output of A13. Check 10 MHz input to A18 U1 pin 1. Check 1 MHz output from A18 U1 pin 12 and at A13 P1-R. Replace A18 if necessary.
5 ns output is inoperative.	Check that DEVIATION switch is set to OFF. Check connection from A15 P1-14 to 5 ns BNC on front panel. Check 100 MHz input to A15 P1-1 and base of A15 Q2. Check that switch A15 Q1 is not conducting and its base and emitter are near +5 volts. Check A15 Q20 and A15 Q21. Check calibration of A15 C21 per paragraph 5-44. Replace A15.
2 ns output is inoperative.	Check that DEVIATION switch is OFF and that 5 ns output is operative. Check that miniature coax from A15 J1 SMA connector to front panel 2 ns BNC is not open or shorted. Check A15 Q3 and A15 CR1.

TABLE 5-4. TROUBLESHOOTING HINTS, TEKTRONIX MODEL SG 503

TROUBLE	REMEDY
Display is inoperative.	Check A4 Display board. Check that +5.2V is present at display drivers. Check Display Flash Multivibrator circuitry. Check State Generator; U490, U432, U435.
A single display is inoperative.	Check or replace respective display. Check or replace respective display driver.
No decimal point for frequencies below 1.0 MHz.	Check or replace DS 500.
Auto Ranging is inoperative but reference clock signal present.	Check or replace U440 Check or replace U445 Check or replace U425 Check or replace U438 Check or replace U450
No reference clock signal.	Check or replace Y460 Check U460 and associated circuitry.
Not prescaling.	Check or replace U465 Check or replace U455 Check or replace U475 Check ÷8 signal prescaling; U390, U400 and associated circuitry. Check or replace Q420
Not counting.	Check or replace U425 Check counters; U430, U435, U436, and U437
Counter displays flashing zeros.	Check Leveling Circuitry. Check Display Flash Multivibrator; Q290, Q296 and associated circuitry.
Not oscillating on any range.	Check Q190 and associated circuitry. Check Q300 and associated circuitry. Check Q160 and associated circuitry. Check +4.5V supply. Check +5V supply. Check +22V supply.
Not oscillating on .05 to 100 MHz ranges inclusive.	Check Q130 and associated circuitry. Check functioning of FREQUENCY RANGE switch, S100.
Not oscillating on a particular range within the .05 to 50 MHz band.	Check the respective oscillator coil on A2 coil board. Check functioning of FREQUENCY RANGE switch, S100.
Not oscillating on 50 to 100 MHz range.	Check oscillator coil, L100 Check functioning of FREQUENCY RANGE switch, S100.
Not oscillating on 100 to 250 MHz range.	Check oscillator coil, L143. Check Q140 and associated circuitry. Check functioning of FREQUENCY RANGE switch, S100.
Excessive distortion at higher frequencies.	Check adjustment of R175; Page 3-6 in Tektronix instruction manual. Check Q180 and associated circuitry.

TABLE 5-4. TROUBLESHOOTING HINTS, TEKTRONIX MODEL SG 503 (Cont)

TROUBLE	REMEDY
Oscillator amplitude is not leveled.	Check peak-to-peak detector, U225. Check error amplifier, U280, and associated circuitry.
Oscillator amplitude is not multiplying correctly.	Check functioning of AMPLITUDE MULTIPLIER switch, S240. Check attenuators, U250 and U245.
No -22V regulated.	Check -33.5V unregulated supply. Check series-pass transistor. Check components in -22V filter circuitry.
-22V not regulating.	Check U695 and associated circuitry. Check Q685 and Q690
-22V regulated is out of limit.	Refer to -22V Calibration procedure; Page 3-4 in Tektronix instruction manual.
No +5V regulated.	Check -22V regulated supply. Check +11.5V supply. Check series-pass transistor. Check fuse, F620.
-5V not regulating.	Check U610 and associated circuitry. Check or replace Q600 Check or replace Q610 Check or replace Q620 Check or replace VR610

SECTION 6

PARTS LIST & CIRCUIT DIAGRAMS

The replacement parts listed are available from the vendors listed or from Ballantine Laboratories. Your local Ballantine Field Engineering Representative may also carry a stock of parts and can assist you. If pricing quotations are required for parts and/or repairs, your local representative will give the most rapid service or you may contact the Ballantine Factory directly.

When ordering replacement parts always give the following information:

a) Instrument Model number

b) Serial number

c) Ballantine Part number

d) Schematic Symbol number

e) Identification and description of part

Ballantine will do its best to improve the instrument and make changes in style of components and replacement parts. Replacement parts may differ in appearance from those found in your instrument but are always equal or superior in performance. Where necessary minor mechanical modifications may be required in the replacement of the components.

Parts are generally available locally for most replacements. The parts list calls out the recommended vendors where applicable.

Alternate components may be substituted but the use of parts specified in this parts list is recommended. A part similar to the part initially installed at the factory may be used, i.e., a 5% composition resistor may be replaced with a similar part or a 5% film resistor or the preferred 1% metal film resistor. Use of the preferred component will always simplify calibration and speed repairs.

Selected components are identified in this manual and may be replaced with a similar valued part unless re-selection is required due to replacement or change of a related part. The schematics and calibration procedures identify selected components and replacement procedures.

The Manufacturer Code is taken from Federal Supply Code Cataloging Handbooks H4-1, H4-2, and H4-3. Ballantine Code is 50423.

The following parts coding are used:

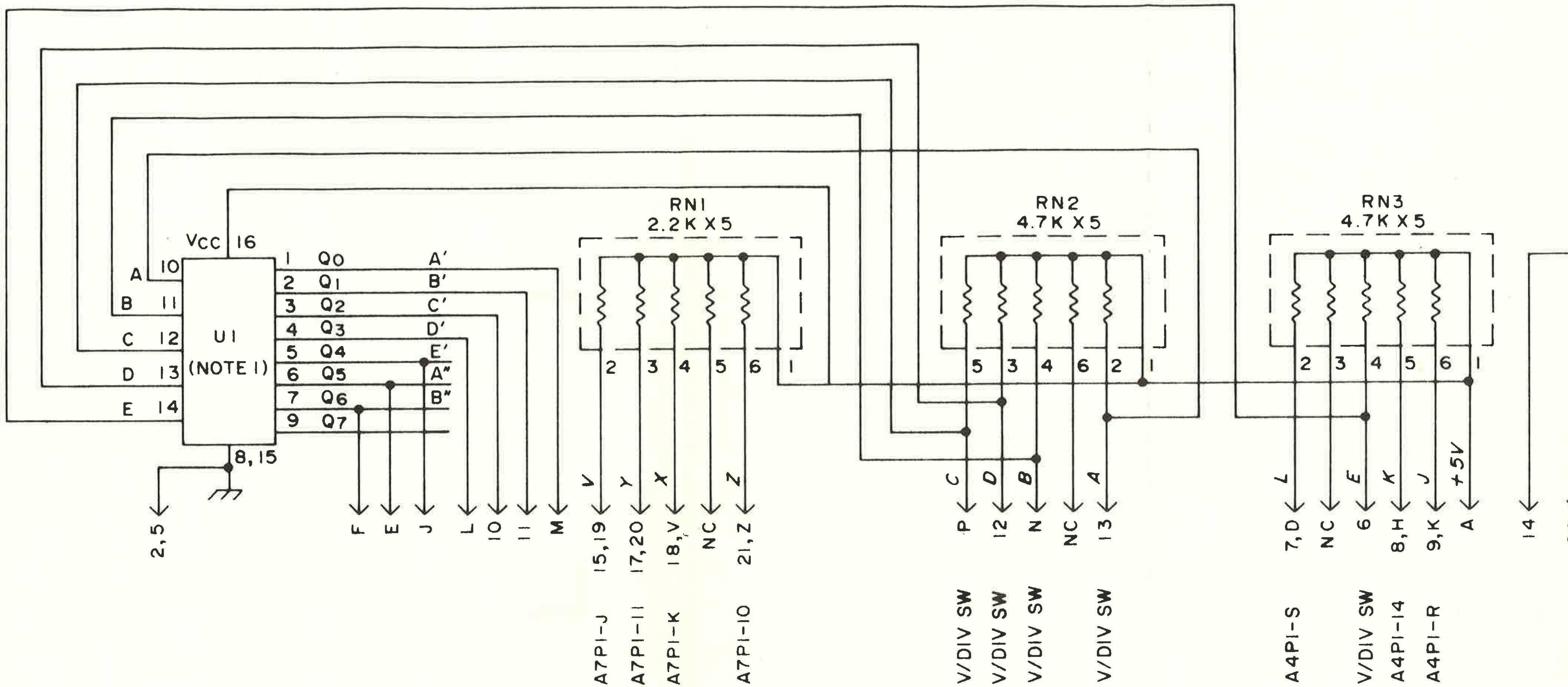
CVC	Capacitor, Variable, Ceramic
CCT	Capacitor, Ceramic, Tubular
CFP	Capacitor, Fixed, Plastic
CCD	Capacitor, Ceramic, Disc
CYF	Capacitor, Mylar, Foil
CMD	Capacitor, Mica, Dipped
CMM	Capacitor, Mica, Molded
CEA	Capacitor, Electrolytic, Aluminum
CET	Capacitor, Electrolytic, Tantalum
DGP	Diode, General Purpose
DZG	Diode, Zener, General Purpose
DRP	Diode, Bridge, Power
FLT	Filter
ICP	Integrated Circuit
TRQ	Transistor
RFF	Resistor, Fixed, Film
RFC	Resistor, Fixed, Composition
RVC	Resistor, Variable, Composition
RFW	Resistor, Fixed, Wirewound
SWC	Switch
LMP	Lamp
TRX	Transformer

Resistors may generally be replaced by Corning Electronics (CCW) type N-55, N-60 and C-32. Allen Bradley carbon composition resistors type EB may also be used but should generally be avoided (except for emergency replacements) in favor of the preferred part listed in this parts list.

Table 6-1 lists the replaceable assemblies used in the 6126M. The parts lists and circuit diagrams of these assemblies are also included in this section.

TABLE 6-1. REPLACEABLE ASSEMBLIES

ASSEMBLY	BALLANTINE P/N	DESCRIPTION
A1	89109611A	Shorting Board - Volts
A2	89104991A	Programmable P.S. - Volts
A3	89105001A	P.S. Control - Volts
A4	89105011A	MULTIPLIER Select - Volts
A5	89105021A	10 uV to .5 mV Select - Volts
A6	89105031A	1 mV to 20 V Select - Volts
A7	89105241A	Output Mode Select - Volts
A10	89105091A	Shorting Board - Time
A11	89105251A	Display Drive and 10 MHz Osc. - Time
A12	89105121A	Time/Div Decoder - Time
A13	89109771A	Time/Div Select - Time
A14	89105141A	100 MHz Phase Lockloop - Time
A15	89105151A	200 MHz and 500 MHz Multiplier - Time
A16	89109631A	Marker Output Amplifier - Time
A18	89105261A	DEVIATION Board - Time
A24	89109641A	DPM Display
A100	89109651A	50 Ω Output Calibrator - Volts
A116	89109661A	Fast Rise Output - Time
A117	89109671A	Display Driver
A126	89109681A	Interconnect - Volts
A127	89109691A	High Amplitude Pulse Generator - Time
A128	89109701A	Interconnect - Time



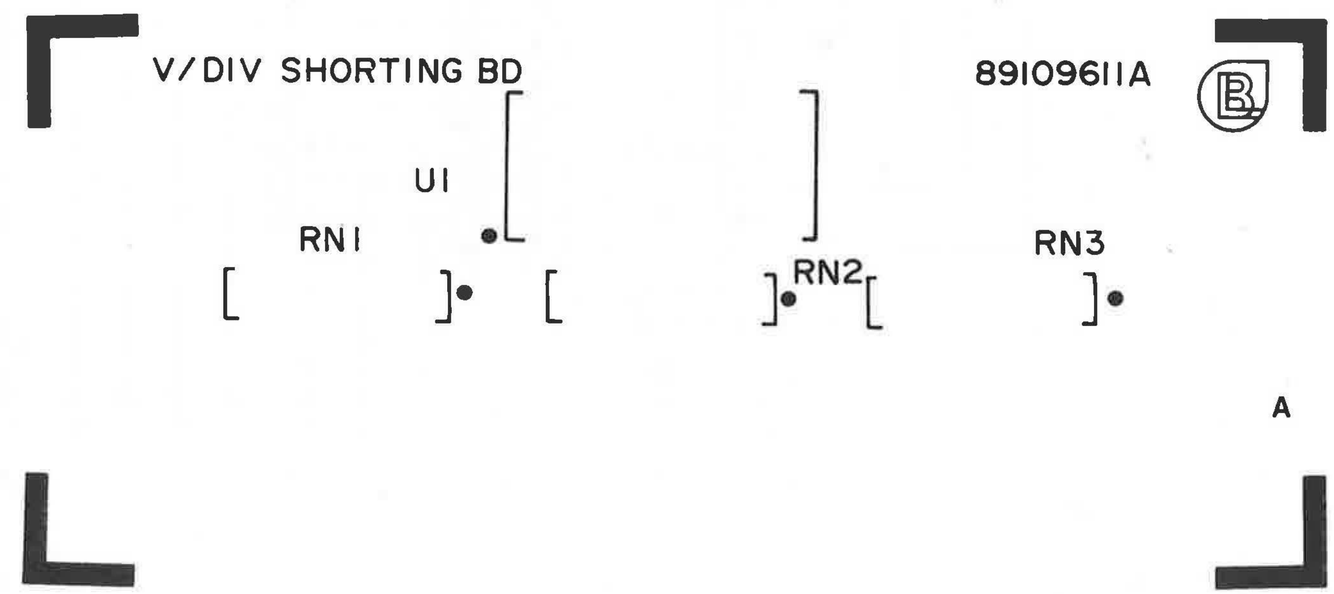
NOTES:

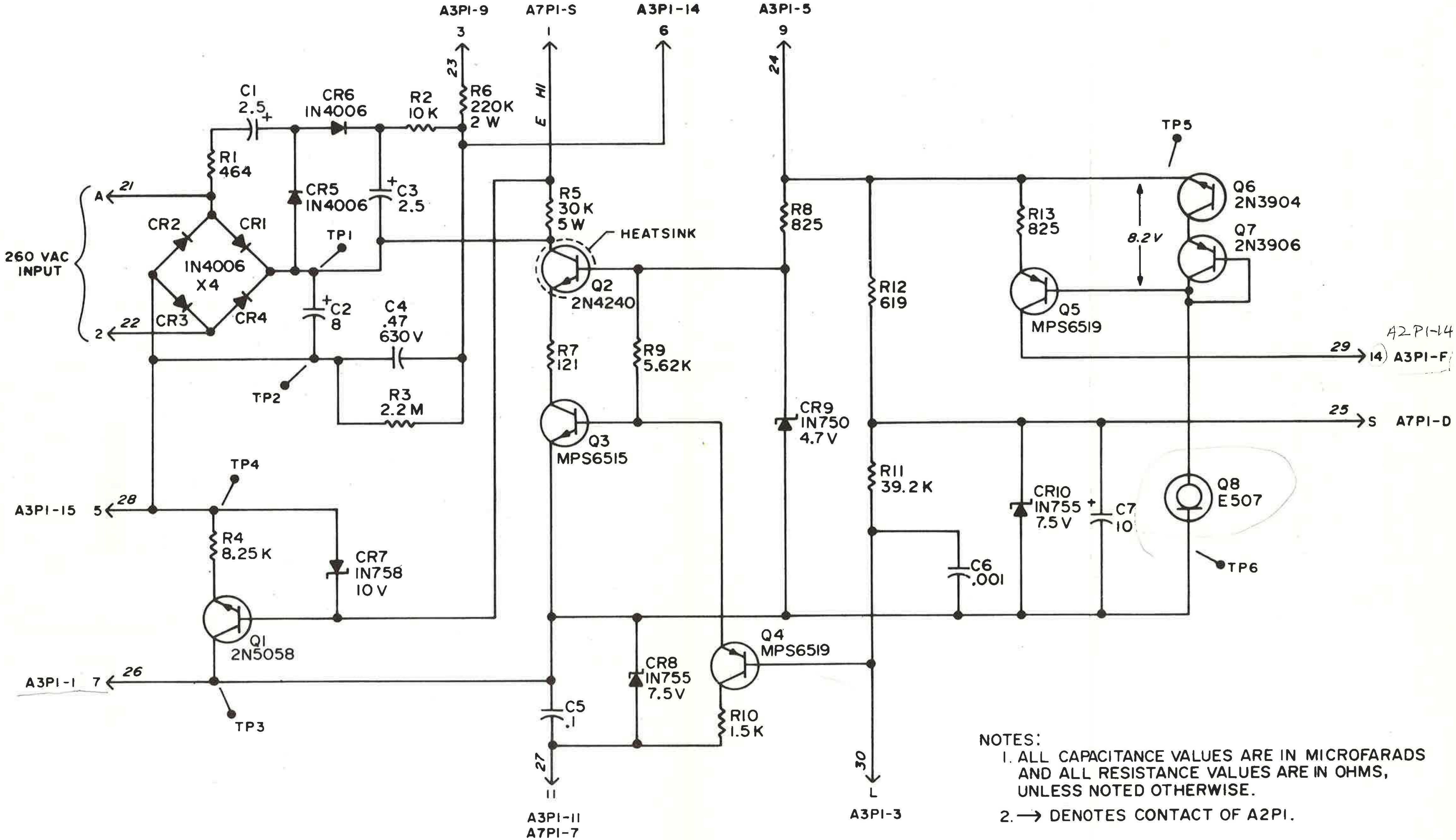
1. U1 BIPOLAR PROM BLI P/N 24-10299-1A.
2. —> DENOTES CONTACT OF A1P1.

Figure 6-1. A1 6126M V/Div Shorting Board

PARTS LIST, A1 VOLTS SHORTING BOARD

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
RN..1	13-10056-0A	RNF 2.2 K 6 PIN SIP 5 RES	80053	BECKMAN #783-1-R-2.2K
RN..2	13-10047-0A	RNF 4.7 K 6 PIN SIP 5 RES.	80053	BECKMAN 783-1-R4.7K
RN..3	13-10047-0A	RNF 4.7 K 6 PIN SIP 5 RES.	80053	BECKMAN 783-1-R4.7K
U...1	24-10299-1A	ICP 6126M PROM 61M2' PROG.	50423	





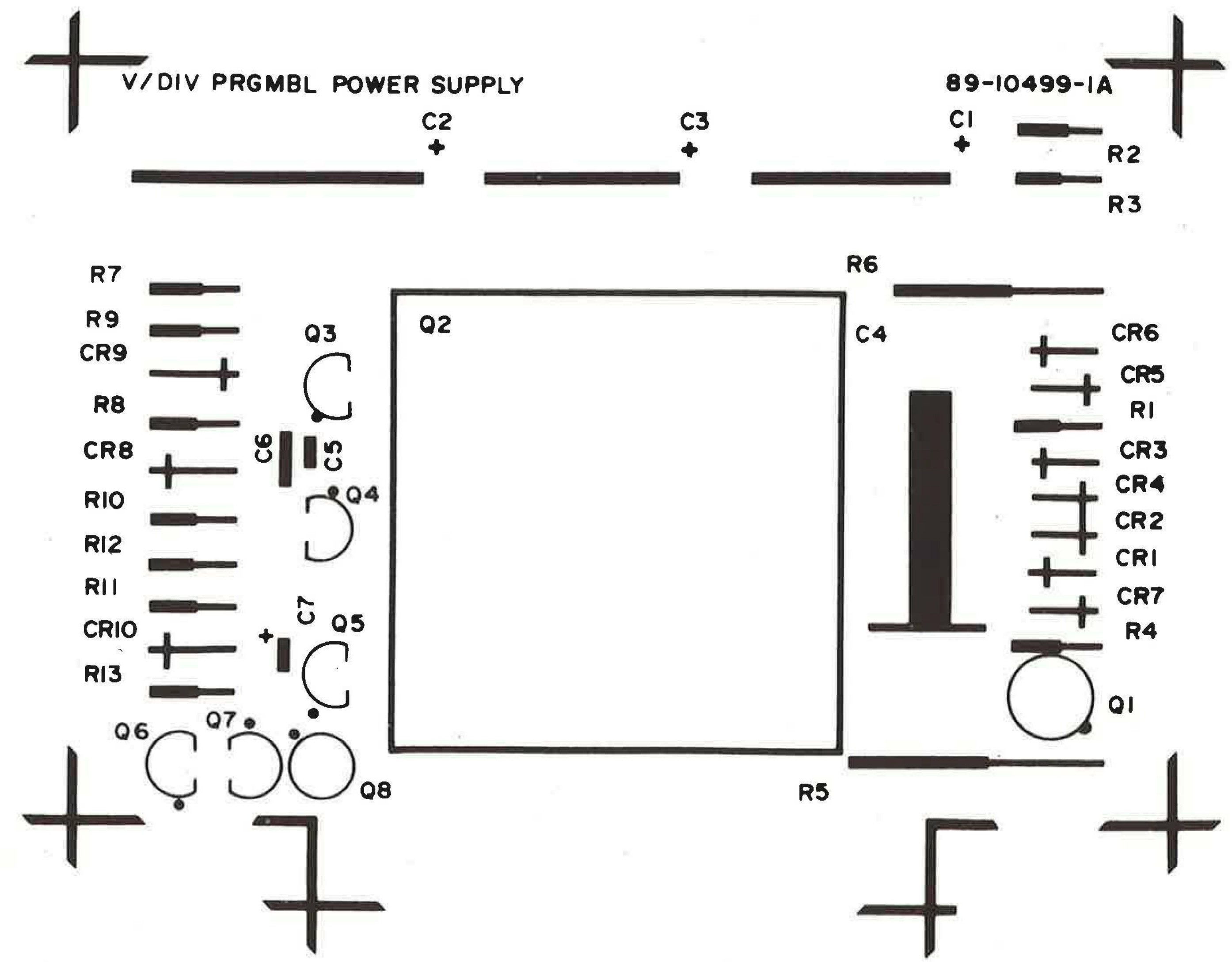
NOTES:

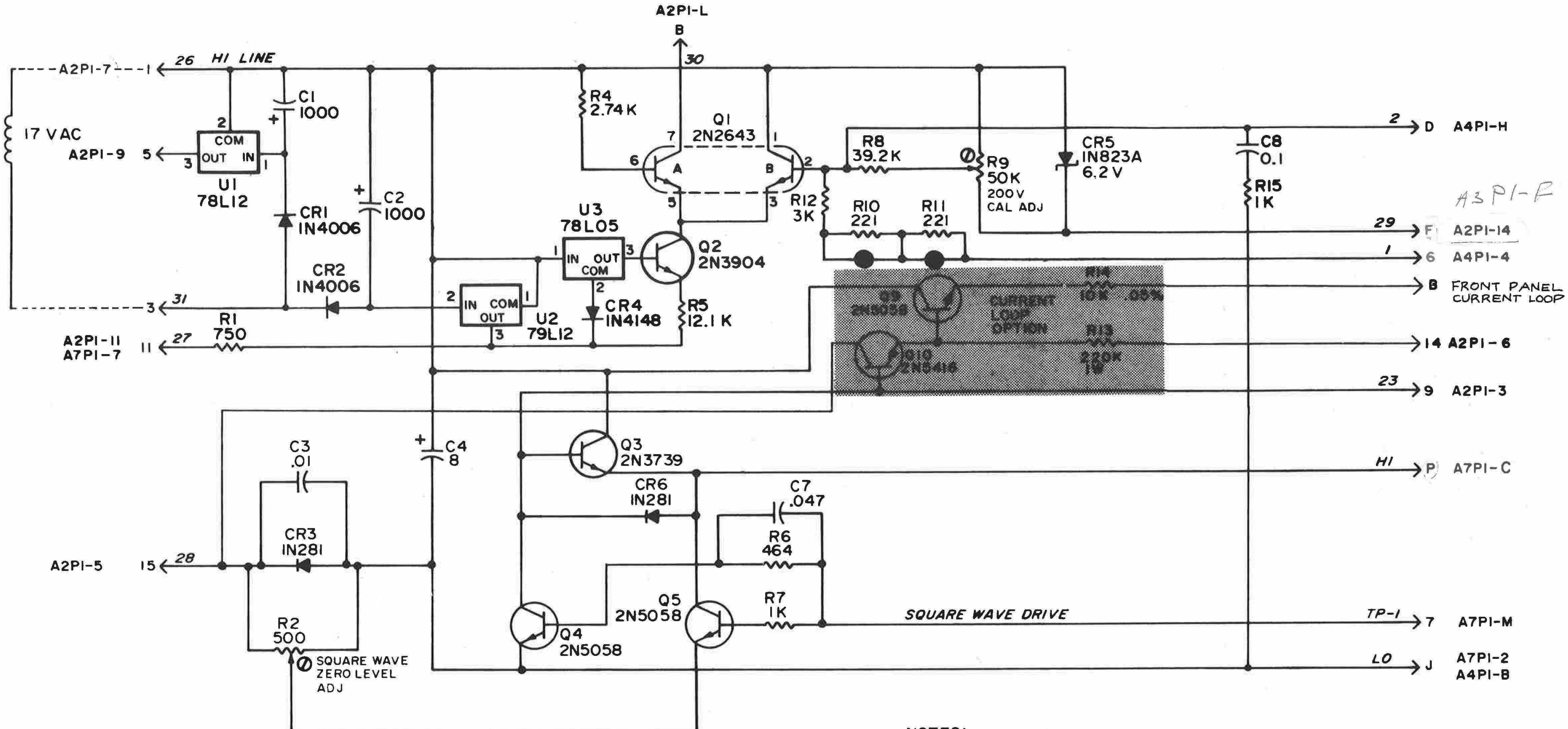
1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS NOTED OTHERWISE.
2. ⟶ DENOTES CONTACT OF A2PI.

Figure 6-2. A2 6126M Programmable Volts Power Supply

PARTS LIST, A2 PROGRAMMABLE POWER SUPPLY - VOLTS

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10421-0A	CER 2.5UF 350.0 V-10+50%	80031	MEPCO C436AR/P2.5
C...2	07-10420-0A	CEA 8.0PF 350.0 V-10+50%	80031	MEPCO C436AR/P8
C...3	07-10421-0A	CER 2.5UF 350.0 V-10+50%	80031	MEPCO C436AR/P2.5
C...4	07-10423-0A	CBM 470.0NF 630.0 VK	80031	MEPCO C280MCG/A470K
C...5	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C...6	07-10170-0A	CCD 1.0NF 1.0KV 10%	71590	CENTRALAB DD102
C...7	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
CR..1	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..2	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..3	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..4	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..5	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..6	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..7	05-10035-0A	DZG 1N 758A 10 20M .4	4713	MOT SI
CR..8	05-10007-0A	DZG 1N 755A 7.5 20M .4	4713	MOT SI
CR..9	05-10010-0A	DZG 1N 750A 4.7 20M .4	4713	MOT SI
CR.10	05-10007-0A	DZG 1N 755A 7.5 20M .4	4713	MOT SI
Q...1	10-10016-0A	TRQ 2N5058 NPN 1 300	7263	FCH 5 10
Q...2	10-10123-0A	TRQ 2N4240 HI VOLTAGE NPN	3607	RCA 2N4240
Q...3	10-10005-0A	TRQ MPS6515 NPN 1 25 PTO-92	4713	MOT .350 390M 150
Q...4	10-10009-0A	TRQ MPS6519 PNP 1 25 PTO-92	4713	MOT 1 340M 250
Q...5	10-10009-0A	TRQ MPS6519 PNP 1 25 PTO-92	4713	MOT 1 340M 250
Q...6	10-10043-0A	TRQ 2N3904 NPN 1 40 PTO-92	4713	MOT 1 300M 40
Q...7	10-09473-0A	TRQ 2N3906 PNP 1 40 PTO-92	4713	MOT 1 200M 60
Q...8	10-10099-0A	TRQ E507	17856	SILICONIX
R...1	12-12264-0A	RFF 464.0 250 MW F+-1%	16299	CGW RN55D 4640 F
R...2	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	16299	CGW RN55D 1002 F
R...3	12-09823-0A	RFC 2.2 M 250.0MW J+- 5%	1121	A-B TYP CB
R...4	12-12388-0A	RFF 8.25K 250.0MW F+- 1%	16299	CGW RN55D 8251 F
R...5	12-12734-0A	RFW 30.0 K 5.0 W F 20PPM	75042	IRC AS-5
R...6	12-13112-0A	RFC 220.0 K 2.0 W J	1121	A-B 220K HB TYPE 5%
R...7	12-12208-0A	RFF 121.0 250.0MW F+- 1%	16299	CGW RN55D 1210 F
R...8	12-12288-0A	RFF 825.0 250 MW F+-1%	16299	CGW RN55D 8250 F
R...9	12-12372-0A	RFF 5.62K 250.0MW F+- 1%	16299	CGW RN55D 5621 F
R..10	12-12317-0A	RFF 1.50K 250 MW F+-1%	16299	CGW RN55D 1501 F
R..11	12-12457-0A	RFF 39.2 K 250.0MW F+- 1%	16299	CGW RN55D 3922 F
R..12	12-12276-0A	RFF 619.0 250 MW F+-1%	61299	CGW RN55D 6190 F
R..13	12-12288-0A	RFF 825.0 250 MW F+-1%	16299	CGW RN55D 8250 F





CURRENT LOOP OPTION
Q9 2N5058
Q10 2N5416
R13 220K 1W
R14 10K 0,05%

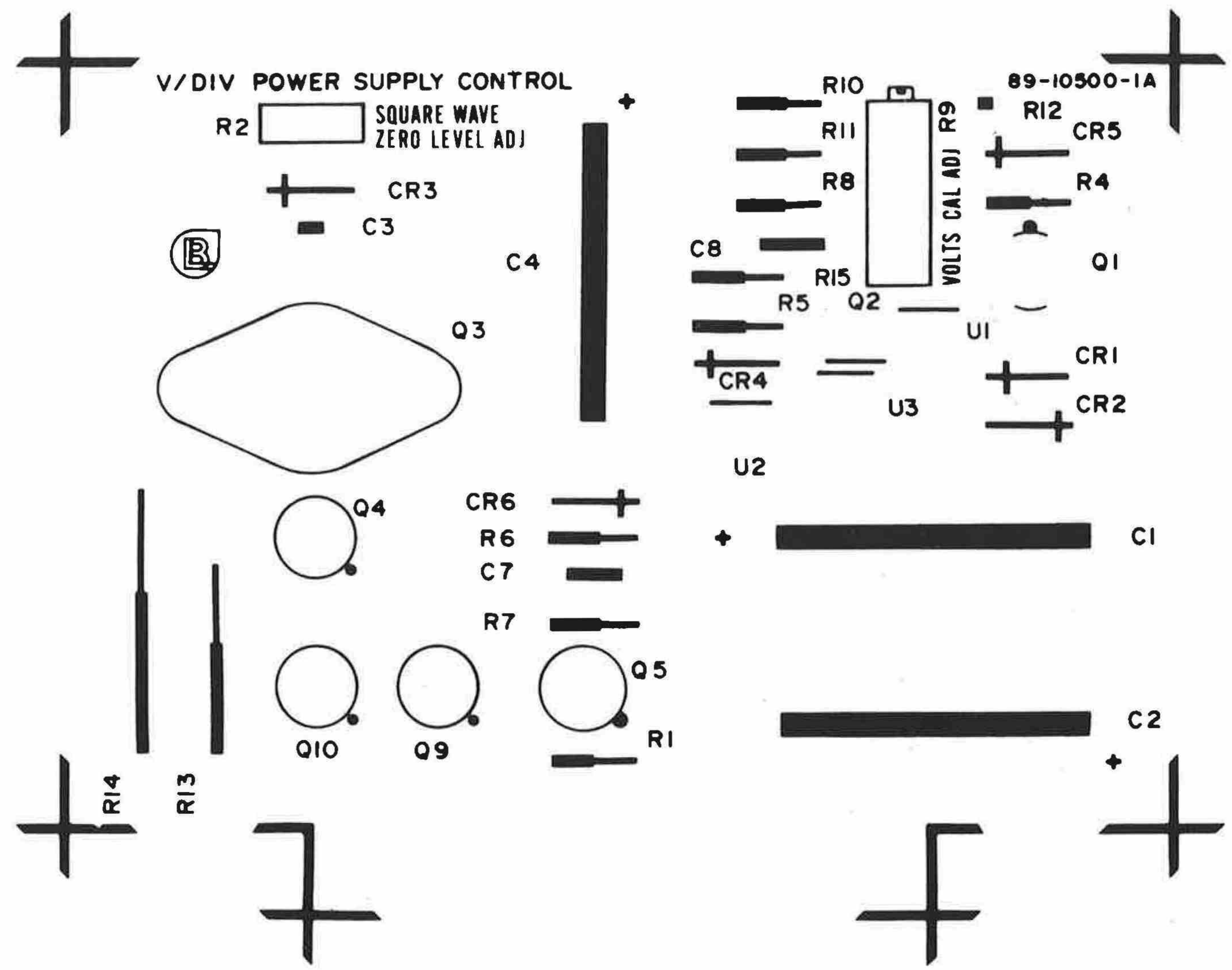
NOTES:

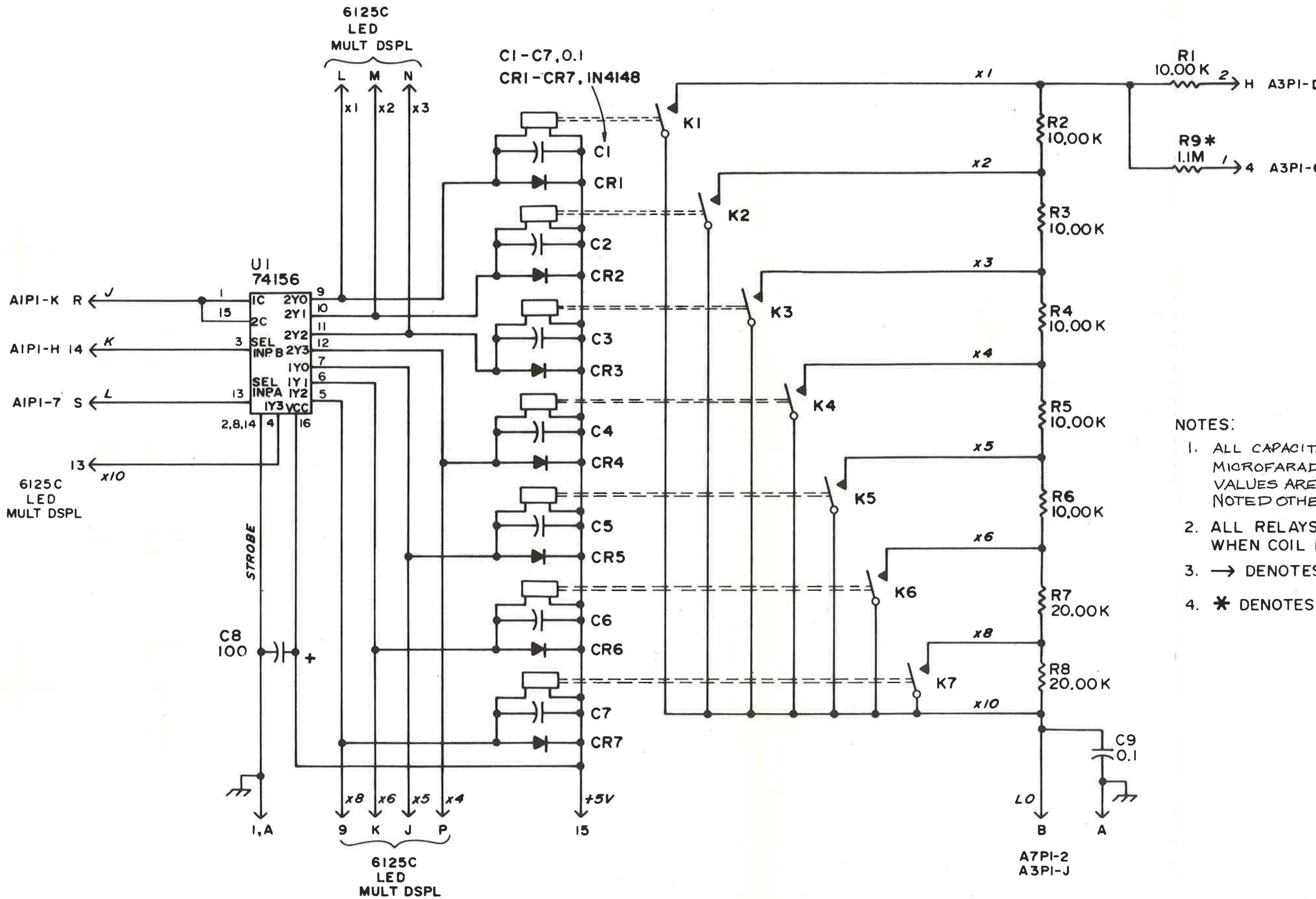
1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS NOTED OTHERWISE.
2. ●— INDICATES A SOLDER CONNECTION WHICH MAY BE REMOVED TO ADJUST R9 CALIBRATION RANGE DURING TEST.
3. → DENOTES CONTACT OF A3P1.
4. ALL RESISTOR VALUES SHOWN ARE FOR 1% RESISTORS.

Figure 6-3. A3 6126M Volts Power Supply Control

PARTS LIST, A3 POWER SUPPLY CONTROL

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10422-0A	CEA1000.0UF 25.0 V -10+50%	80031	MEPCO ET102X025A03
C...2	07-10422-0A	CEA1000.0UF 25.0 V -10+50%	80031	MEPCO ET102X025A03
C...3	07-10373-0A	CCD 10.0NF 25.0 VK -20+80%	56289	SPRAGUE HY-520
C...4	07-10420-0A	CEA 8.0UF 350.0 V-10+50%	80031	MEPCO C436AR/P8
C...7	07-10214-0A	CCD 47. NF 25. VM	56289	SPR C069B250J473M OR EQUV
C...8	07-10223-0A	CYF 100. NF 250. VK	73445	AMPREX C280AE/A100K
CR..1	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..2	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..3	05-10025-0A	DGP 1N 281 75 1A.08	15238	ITT GE D07
CR..4	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR..5	05-10040-0A	DZG 1N 823A 6.2 7.5M .4	4713	MOT SI D07
CR..6	05-10025-0A	DGP 1N 281 75 1A.08	15238	ITT GE D07
Q...1	10-10013-0A	TRQ 2N2643 NPN 2 40 M65407	4713	MOT 1200 40M 100
Q...2	10-10043-0A	TRQ 2N3904 NPN 1 40 PT0-92	4713	MOT 1 300M 40
Q...3	10-10015-0A	TRQ 2N3739 NPN 1 300 MT0-66	4713	MOT 20 10M 30
Q...4	10-10016-0A	TRQ 2N5058 NPN 1 300	7263	FCH 5 10
Q...5	10-10016-0A	TRQ 2N5058 NPN 1 300	7263	FCH 5 10
Q...6	10-10043-0A	TRQ 2N3904 NPN 1 40 PT0-92	4713	MOT 1 300M 40
Q...9	10-10016-0A	TRQ 2N5058 NPN 1 300	7263	FCH 5 10
R...1	12-12284-0A	RFF 750.0 250 MW F+-1%	16299	CGW RN550D 7500 F
R...2	09-10094-0A	RVF 500.0 500.0MW KVERT MT	73138	HELIPOT 72XW 500
R...4	12-12342-0A	RFF 2.74K 250.0MW F+- 1%	16299	CGW RN55D 2741 F
R...5	12-12408-0A	RFF 12.1 K 250.0MW F+- 1%	16299	CGW RN55D 1212 F
R...6	12-12264-0A	RFF 464.0 250 MW F+-1%	16299	CGW RN55D 4640 F
R...7	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R...8	12-12457-0A	RFF 39.2 K 250.0MW F+- 1%	16299	CGW RN55D 3922 F
R...9	09-09956-0A	RVF 50.0 K 750.0MW	32997	BOU TYP 3069P
R..10	12-12233-0A	RFF 221.0 250 MW F+-1%	16299	CGW RN55D 2210 F
R..11	12-12233-0A	RFF 221.0 250 MW F+-1%	16299	CGW RN55D 2210 F
R..12	12-12630-0A	RFP 3.0 K 200.0MW +-.02%	0	VISHAY S102C 3 K .02%
R..15	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
U...1	24-10286-0A	ICP 12V 100MA REG. TO-92	7263	FAIRCHILD UA78L12 TO-92
U...2	24-10302-0A	ICP -12V 100MA REG 5% TO-92	0	MOT MC79L12ACP O/E
U...3	24-10301-0A	ICP 5V 100MA REG TO-92	0	MOT MC78L05ACP O/E





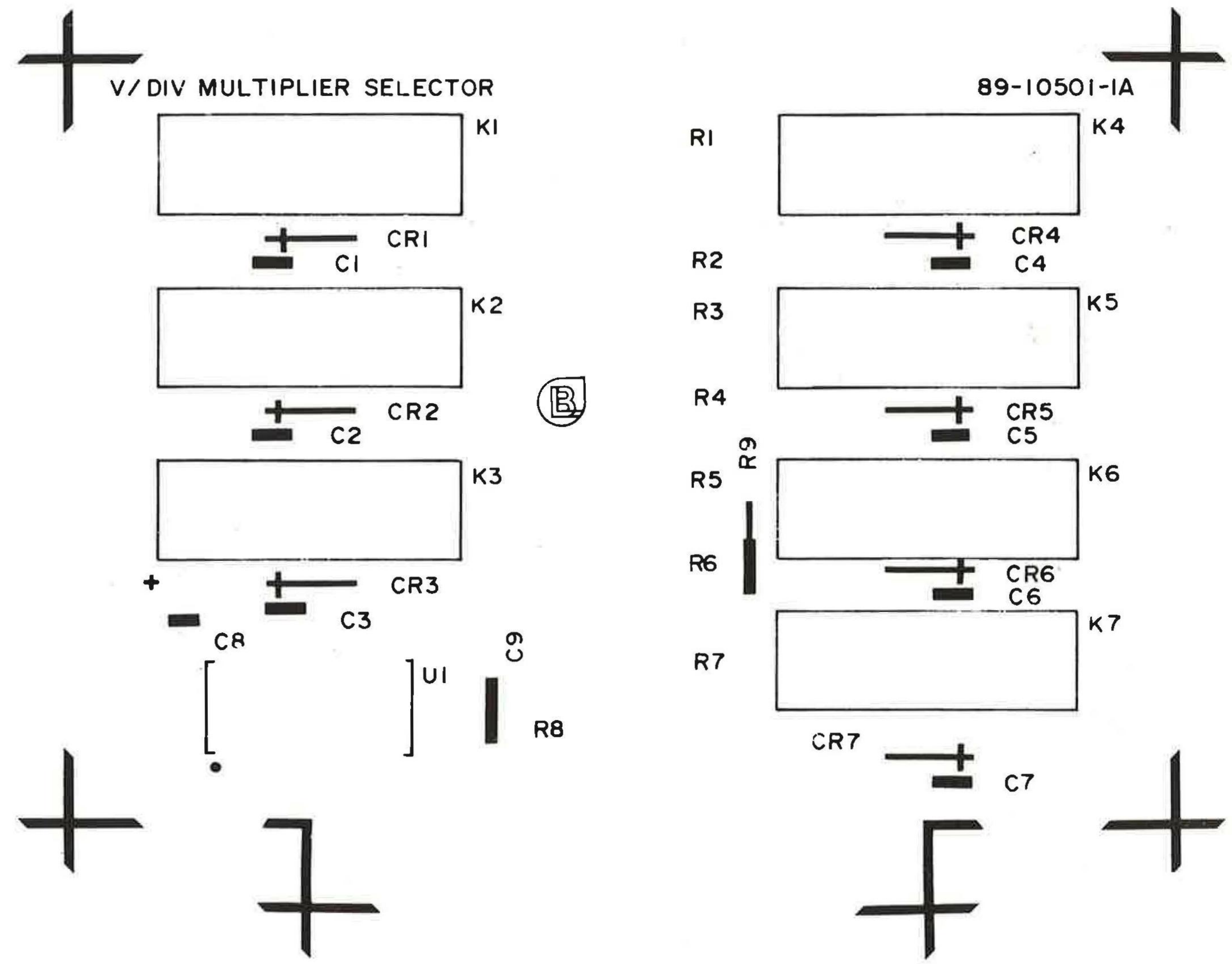
NOTES:

1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS NOTED OTHERWISE.
2. ALL RELAYS SHOWN IN POSITION WHEN COIL IS NOT ENERGIZED.
3. ⟶ DENOTES CONTACT OF A4P1.
4. * DENOTES FACTORY SELECTED

Figure 6-4. A4 6126M Volts Multiplier Select

PARTS LIST, A4 MULTIPLIER SELECT - VOLTS

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...2	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...3	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...4	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...5	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...6	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...7	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...8	07-10184-0A	CET 100.0UF 10.0 VM DIP TAN	56289	SPRAGUE 196D107X0010-LA3
C...9	07-10223-0A	CYF 100. NF 250. VK	73445	AMPREX C280AE/A100K
CR..1	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..2	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..3	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..4	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..5	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..6	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..7	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
K...1	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...2	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...3	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...4	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...5	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...6	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...7	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
R...1	12-12632-0A	RFP 10.0 K 200.0MW +- .02%	0	VISHAY S102C 10K .02%
R...2	12-12632-0A	RFP 10.0 K 200.0MW +- .02%	0	VISHAY S102C 10K .02%
R...3	12-12632-0A	RFP 10.0 K 200.0MW +- .02%	0	VISHAY S102C 10K .02%
R...4	12-12632-0A	RFP 10.0 K 200.0MW +- .02%	0	VISHAY S102C 10K .02%
R...5	12-12632-0A	RFP 10.0 K 200.0MW +- .02%	0	VISHAY S102C 10K .02%
R...6	12-12632-0A	RFP 10.0 K 200.0MW +- .02%	0	VISHAY S102C 10K .02%
R...7	12-12633-0A	RFP 20.0K 200.0MW +-.02%	0	VISHAY S102C 20K .02%
R...8	12-12633-0A	RFP 20.0K 200.0MW +-.02%	0	VISHAY S102C 20K .02%
R...9	12-12604-0A	RFF 1.10M 500 MW F+-1%	16299	CGW RN60D 1104 F
U...1	24-10306-0A	ICP 74156 DEMULTIPLEXER	0	T.I SN74156N OR EQUAL



NOTES:

1. ✳ DENOTES FACTORY SELECTED VALUE.
2. ⟶ DENOTES CONTACT OF A5P1.
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS NOTED OTHERWISE.
4. ALL RELAYS SHOWN IN POSITION WHEN COIL IS NOT ENERGIZED.

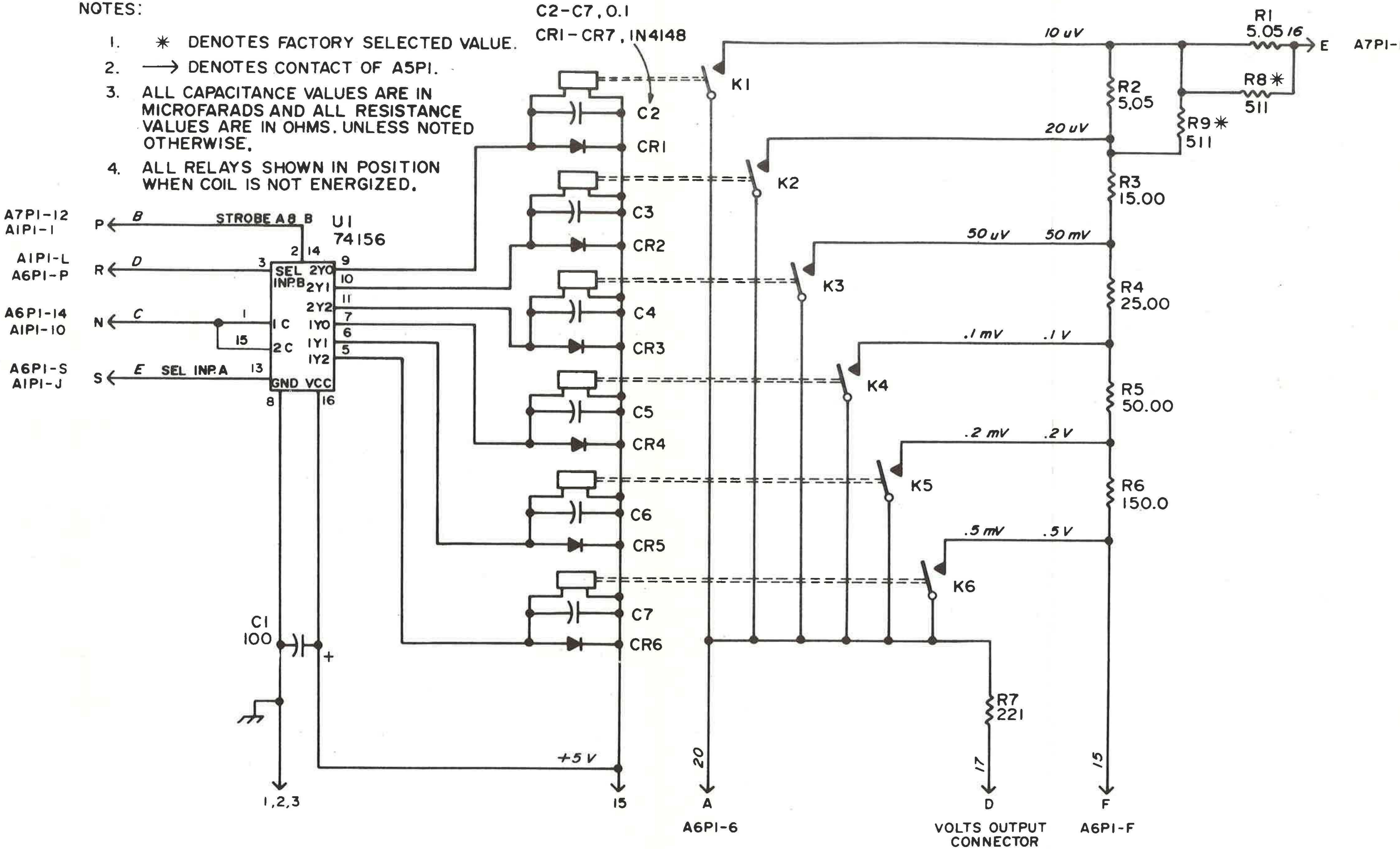
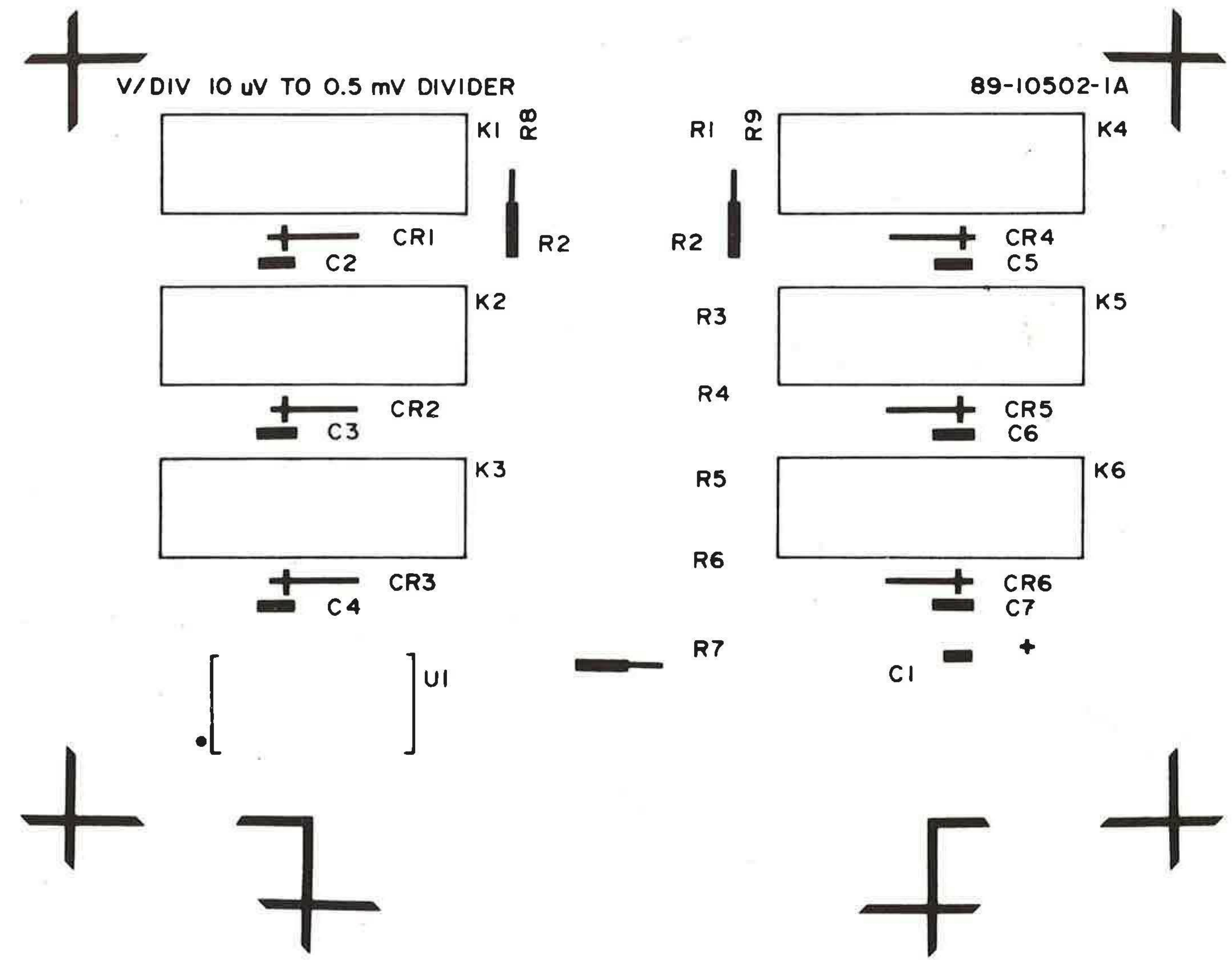


Figure 6-5. A5 6126M 10 uV to .5 mV Select

PARTS LIST, A5 10 uV TO .5 mV SELECT – VOLTS

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10184-0A	CET 100.0UF 10.0 VM DIP TAN	56289	SPRAGUE 196D107X0010-LA3
C...2	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...3	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...4	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...5	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...6	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...7	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
CR..1	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..2	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..3	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..4	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..5	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..6	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
K...1	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...2	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...3	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...4	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...5	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...6	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
R...1	12-12646-0A	RF 5.05 200.0MW +- .1%	0	
R...2	12-12646-0A	RF 5.05 200.0MW +- .1%	0	
R...3	12-12645-0A	RFP 15.0 200.0MW +_ .1%	0	VISHAY S102C 15.0 .1%
R...4	12-12644-0A	RFP 25.0 200.0MW +- .02%	327	VISHAY S102C 25.0 .02%
R...5	12-12643-0A	RFP 50.0 200.0MW +- .02%	327	VISHAY S102C 50 .02%
R...6	12-12642-0A	RFP 150.0 200.0MW +-.02%	327	R VISHAY S102C 150.0 .02%
R...7	12-12233-0A	RFF 221.0 250 MW F+-1%	16299	CGW RN55D 2210 F
R...8	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R...9	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
U...1	24-10306-0A	ICP 74156 DEMULTIPLEXER	0	T.I SN74156N OR EQUAL



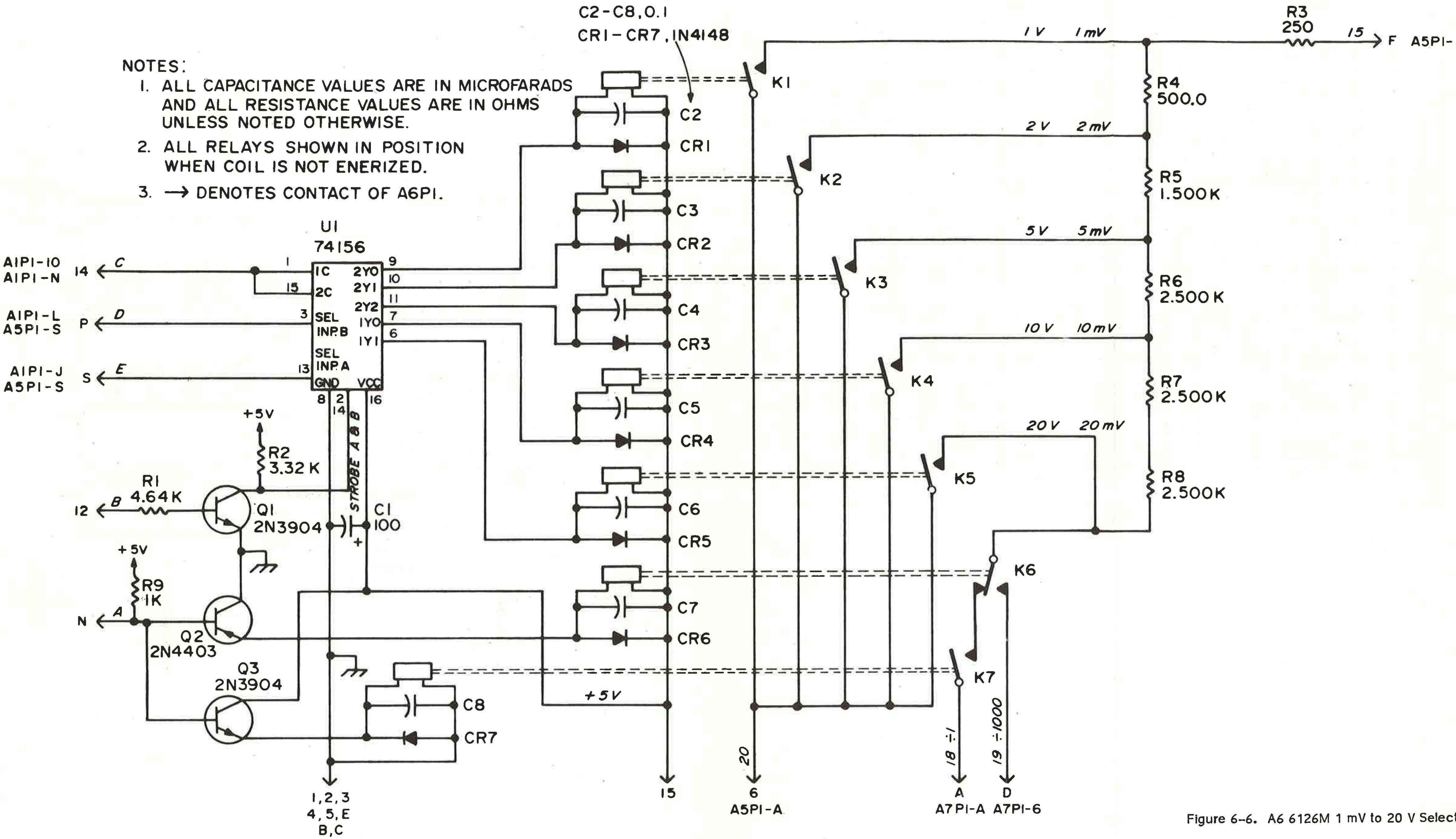
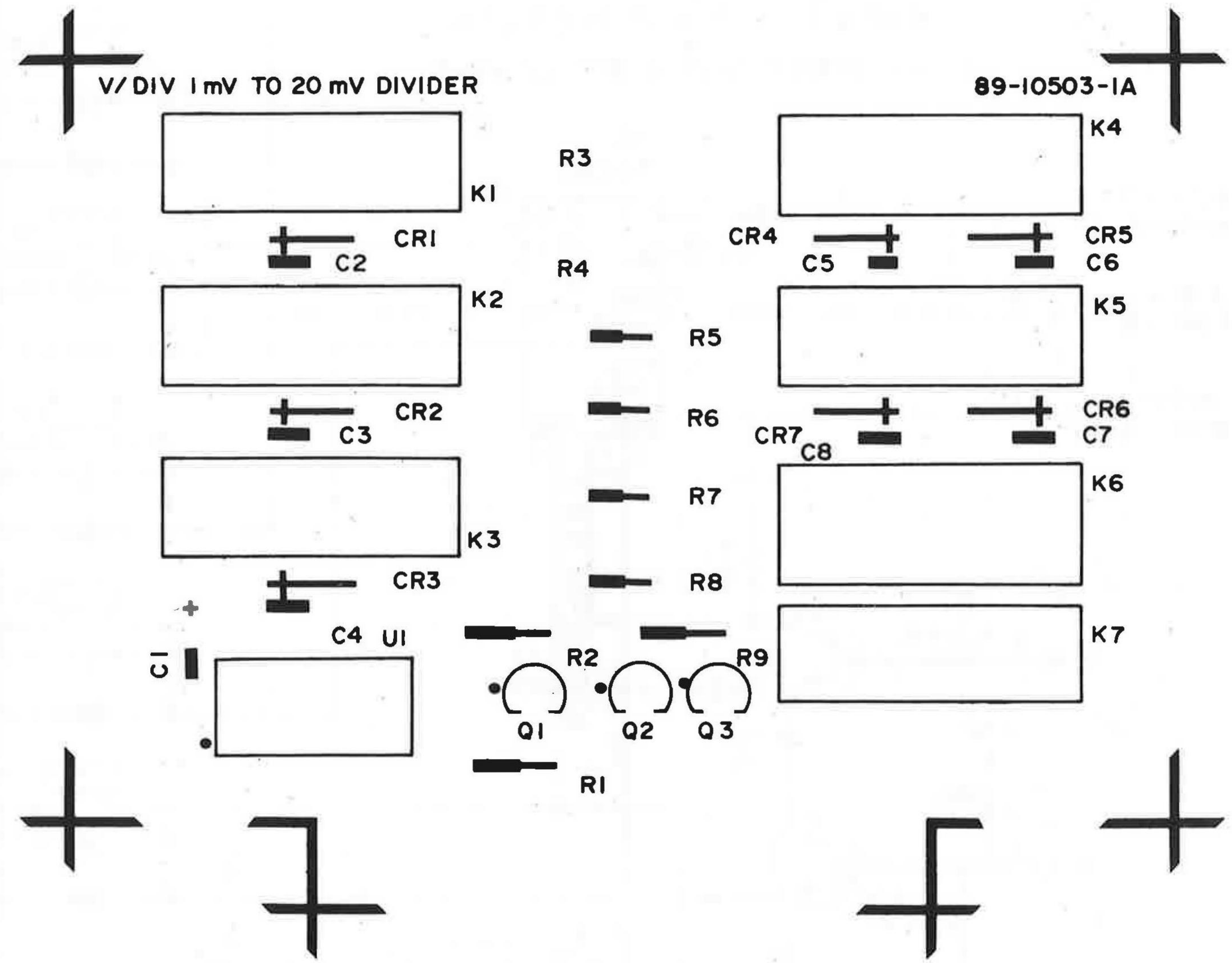


Figure 6-6. A6 6126M 1 mV to 20 V Select

PARTS LIST, A6 1 mV TO 20 V SELECT - VOLTS

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10184-0A	CET 100.0UF 10.0 VM DIP TAN	56289	SPRAGUE 196D107X0010-LA3
C...2	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...3	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...4	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...5	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...6	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...7	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...8	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
CR..1	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..2	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..3	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..4	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..5	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..6	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..7	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
K...1	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...2	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...3	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...4	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...5	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
K...6	14-10016-1A	RLY REED FORM C 6V 175 OHM	0	COTO-COIL E-9025
K...7	14-10015-1A	RLY REED FORM A 6V 300 OHM	0	COTO-COIL E-9040
Q...1	10-10043-0A	TRQ 2N3904 NPN 1 40 PTO-92	4713	MOT 1 300M 40
Q...2	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
Q...3	10-10043-0A	TRQ 2N3904 NPN 1 40 PTO-92	4713	MOT 1 300M 40
R...1	12-12364-0A	RFF 4.64K 250.0MW F+- 1%	16299	CGW RN55D 4641 F
R...2	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R...3	12-12641-0A	RFP 250.0 200.0MW +-.02%	327	VISHAY S102C 250 .02%
R...4	12-12640-0A	RFP 500.0 200.0MW +-.02%	0	VISHAY S102C 500.0 .02%
R...5	12-12639-0A	RFP 1.5 K 1.0 W +-.02%	0	VISHAY S104 1.5K .02%
R...6	12-12638-0A	RFP 2.5 K 1.0 W +-.02%	327	VISHAY S104 2.5K .02%
R...7	12-12638-0A	RFP 2.5 K 1.0 W +-.02%	327	VISHAY S104 2.5K .02%
R...8	12-12638-0A	RFP 2.5 K 1.0 W +-.02%	327	VISHAY S104 2.5K .02%
R...9	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
U...1	24-10306-0A	ICP 74156 DEMULTIPLEXER	0	T.I SN74156N OR EQUAL



NOTES:

1. —●— DENOTES A SOLDER CONNECTION.
2. ✳ DENOTES FACTORY SELECTED VALUE.
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS UNLESS NOTED OTHERWISE.
4. ⟶ DENOTES CONTACT OF A7P1.
5. ALL RELAYS SHOWN IN POSITION WHEN COIL IS NOT ENERGIZED.

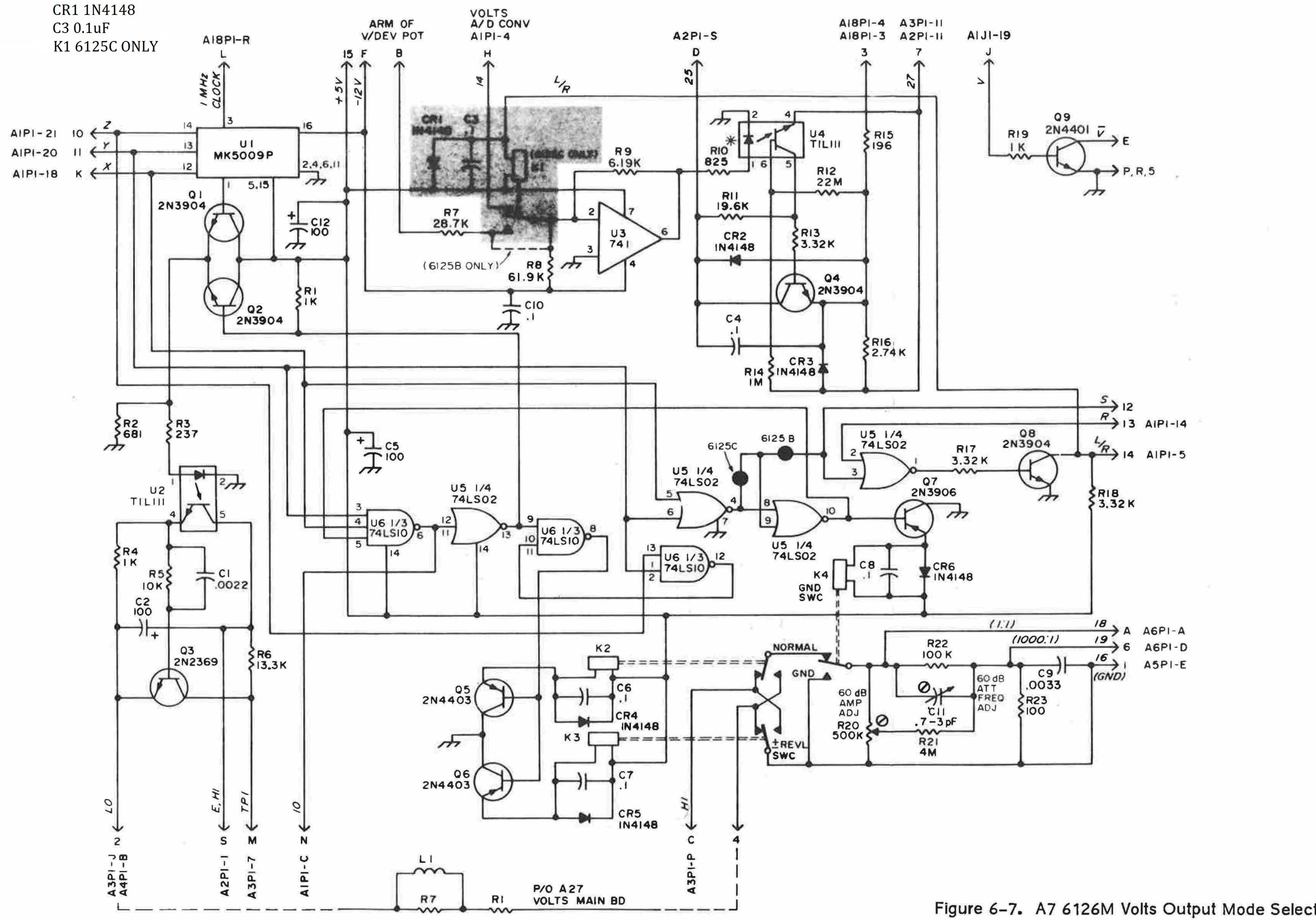
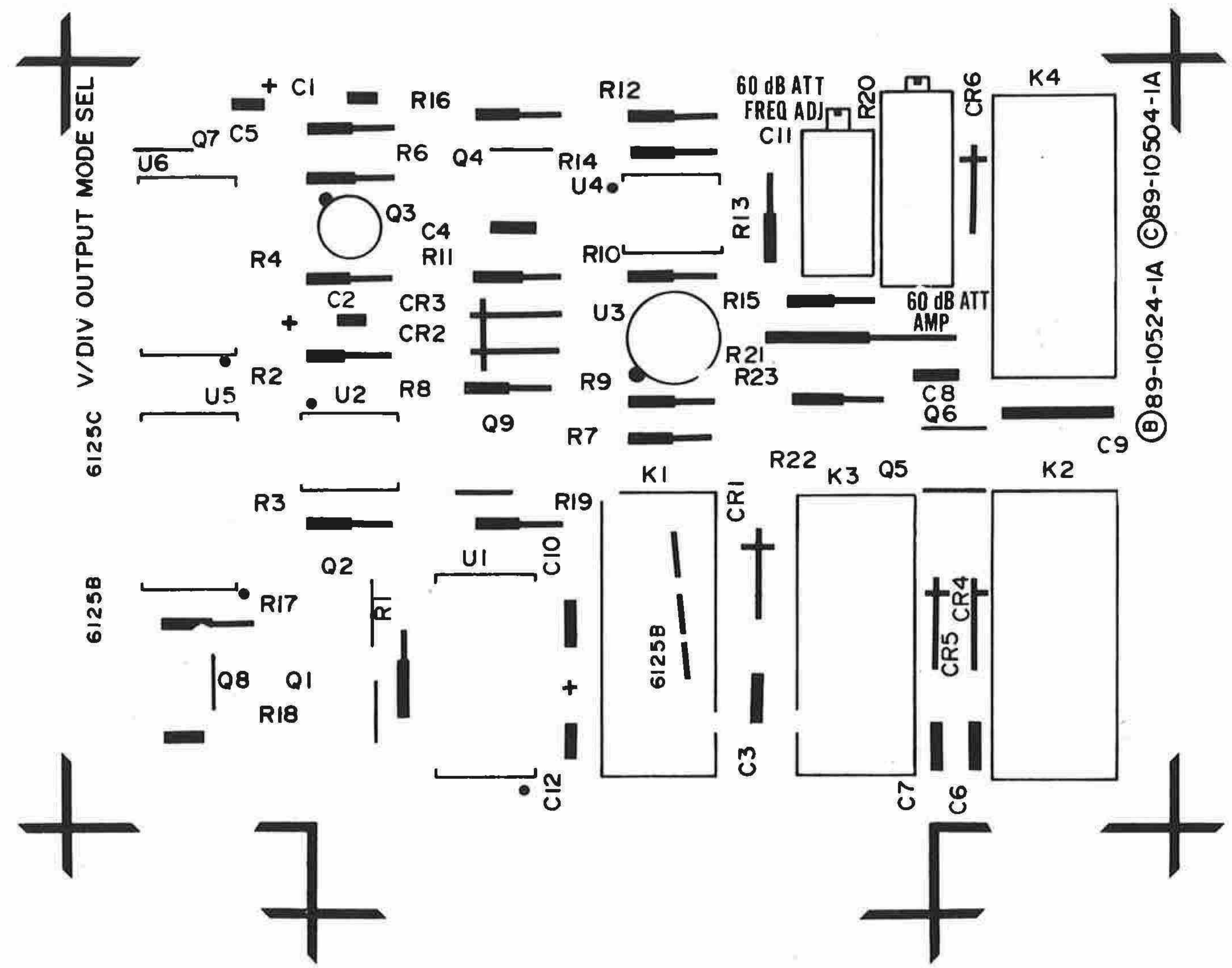


Figure 6-7. A7 6126M Volts Output Mode Select

PARTS LIST, A7 OUTPUT MODE SELECT - VOLTS

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10025-0A	CCD 2.2NF 1.0KV DC	84171	ELMENCO LORCAP TYPECCD222
C...2	07-10184-0A	CET 100.0UF 10.0 VM DIP TAN	56289	SPRAGUE 196D107X0010-LA3
C...4	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...5	07-10184-0A	CET 100.0UF 10.0 VM DIP TAN	56289	SPRAGUE 196D107X0010-LA3
C...6	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...7	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...8	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...9	07-09000-0A	CSM 3.3NF 33.0 VJ 5%	26625	MIAL TYPE 611
C..10	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C..11	07-10427-0A	CVC 7-3PF 250.0 - 0+50%	50423	ST.TR R-TRIKO 122 09
C..12	07-10184-0A	CET 100.0UF 10.0 VM DIP TAN	56289	SPRAGUE 196D107X0010-LA3
CR..2	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR...3	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..4	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..5	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..6	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
K...2	14-10016-1A	RLY REED FORM C 6V 175 OHM	0	COTO-COIL E-9025
K...3	14-10016-1A	RLY REED FORM C 6V 175 OHM	0	COTO-COIL E-9025
K...4	14-10016-1A	RLY REED FORM C 6V 175 OHM	0	COTO-COIL E-9025
Q...1	10-10043-0A	TRQ 2N3904 NPN 1 40 PTO-92	4713	MOT 1 300M 40
Q...2	10-10043-0A	TRQ 2N3904 NPN 1 40 PTO-92	4713	MOT 1 300M 40
Q...3	10-10001-0A	TRQ 2N2369 NPN 1 15 MTO-18	4713	MOT 1.2 500M 20
Q...4	10-10043-0A	TRQ 2N3904 NPN 1 40 PTO-92	4713	MOT 1 300M 40
Q...5	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
Q...6	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
Q...7	10-09473-0A	TRQ 2N3906 PNP 1 40 PTO-92	4713	MOT 1 200M 60
Q...8	10-10043-0A	TRQ 2N3904 NPN 1 40 PTO-92	4713	MOT 1 300M 40
Q...9	10-10154-0A	TRQ 2N4401 NPN 1 40V S TO92	4713	MOT
R...1	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R...2	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R...3	12-12236-0A	RFF 237.0 250 MW F+-1%	16299	CGW RN55D 2370 F
R...4	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R...5	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	16299	CGW RN55D 1002 F
R...6	12-12412-0A	RFF 13.3 K 250.0MW F+- 1%	16299	CGW RN55D 1332 F
R...7	12-12444-0A	RFF 28.7 K 250.0MW F+- 1%	16299	CGW RN55D 2872 F
R...8	12-12476-0A	RFF 61.9 K 250.0MW F+- 1%	16299	CGW RN55D 6192 F
R...9	12-12376-0A	RFF 6.19K 250.0MW F+- 1%	16299	CGW RN55D 6191 F
R..10	12-12288-0A	RFF 825.0 250 MW F+-1%	16299	CGW RN55D 8250 F
R..11	12-12428-0A	RFF 19.6 K 250.0MW F+- 1%	16299	CGW RN55D 1962 F
R..12	12-08044-0A	RFC 22.0 M 250.0MW J+- 5%	1121	A-B TYP CB
R..13	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R..14	12-08029-0A	RFC 1.0 M 250.0MW J+- 5%	1121	A-B TYP CB
R..15	12-12228-0A	RFF 196.0 250 MW F+-1%	16299	CGW RN55D 1960 F
R..16	12-12342-0A	RFF 2.74K 250.0MW F+- 1%	16299	CGW RN55D 2741 F
R..17	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R..18	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R..20	09-10181-0A	RVF 500.0 K 500.0MW K 20TURN	80294	BOURNS 3069P
R..21	12-12939-0A	RFF 4.0 M 500.0MW F1%50PPM	80031	MEPCO MF6C-C-4.0M-F
R..22	12-12635-0A	RFP 100.0 K 200.0MW +_.25%	0	VISHAY S102C 100K .25%
R..23	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
U...1	24-10060-0A	ICP TIMEBASE DIVIDER	50088	MOSTEK MK 5009P
U...2	24-10183-0A	ICP L111 OPT. INSULATOR	1295	T.I TIL111
U...3	24-09420-0A	ICP UA741C FAIRCHILD	7263	#U5B7741393
U...4	24-10183-0A	ICP L111 OPT. INSULATOR	1295	T.I TIL111
U...6	24-10179-0A	ICP 74LS10 TRI.3 IN NAND	1295	T.I.SN74S10
U...8	24-10181-0A	ICP 74LS02 QUAD 2 IN NOR	1295	T.I.SN74LS02



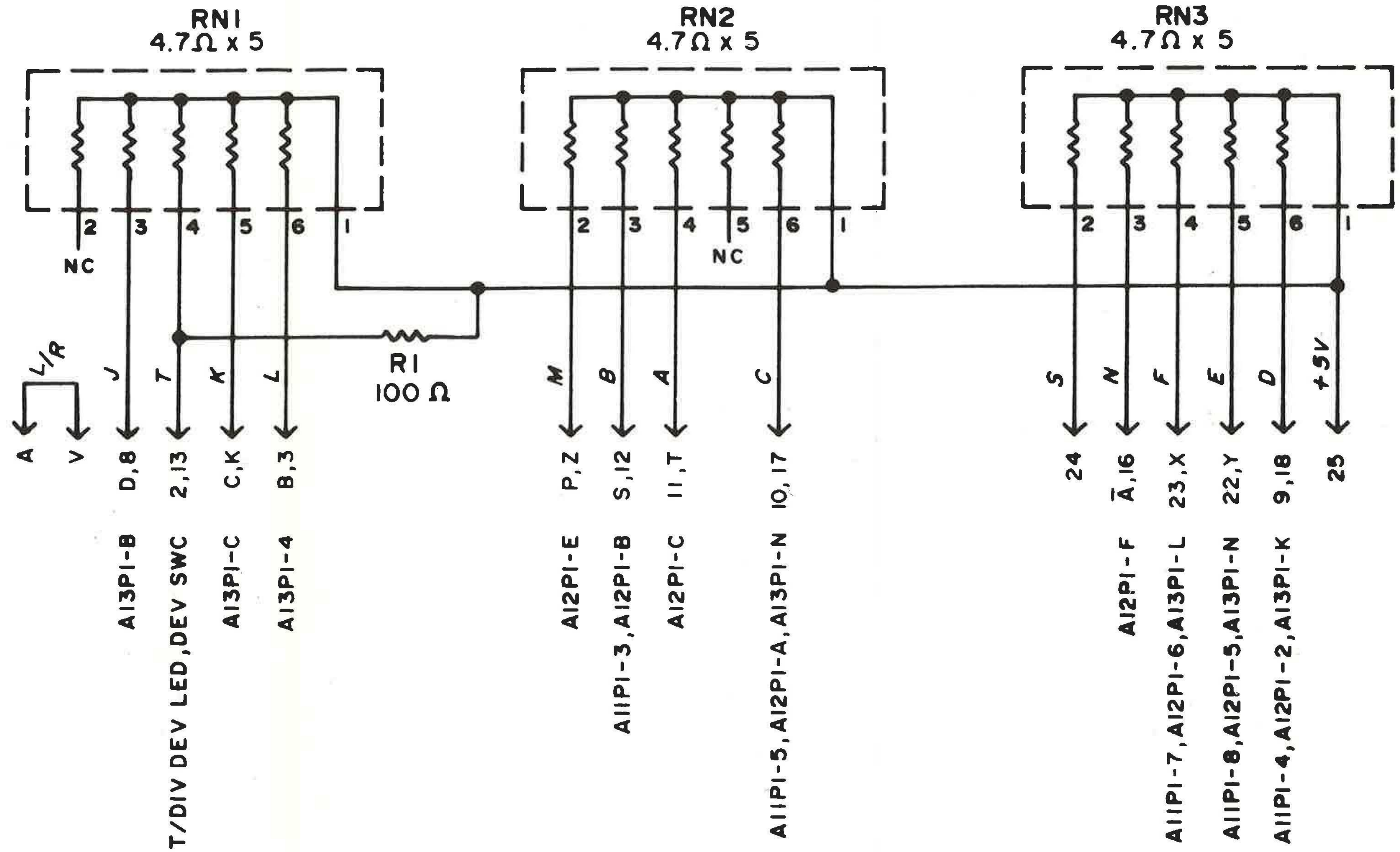
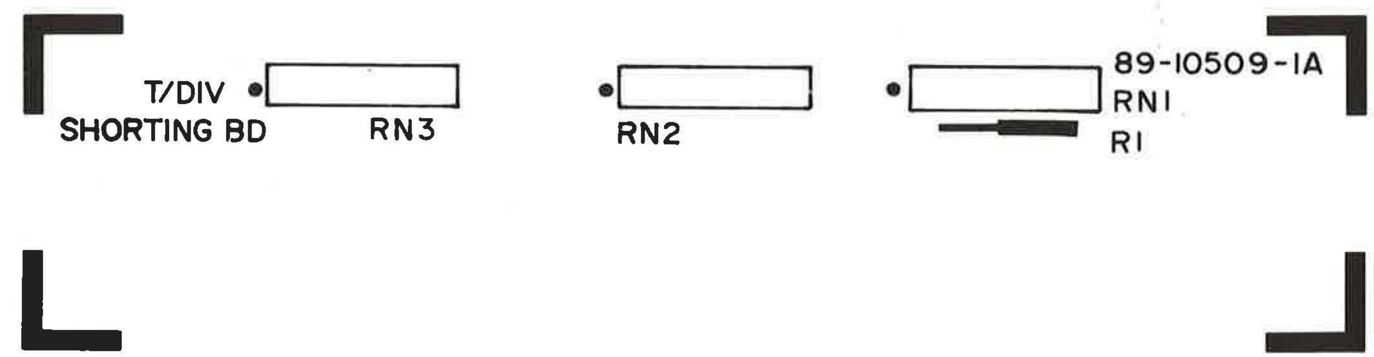
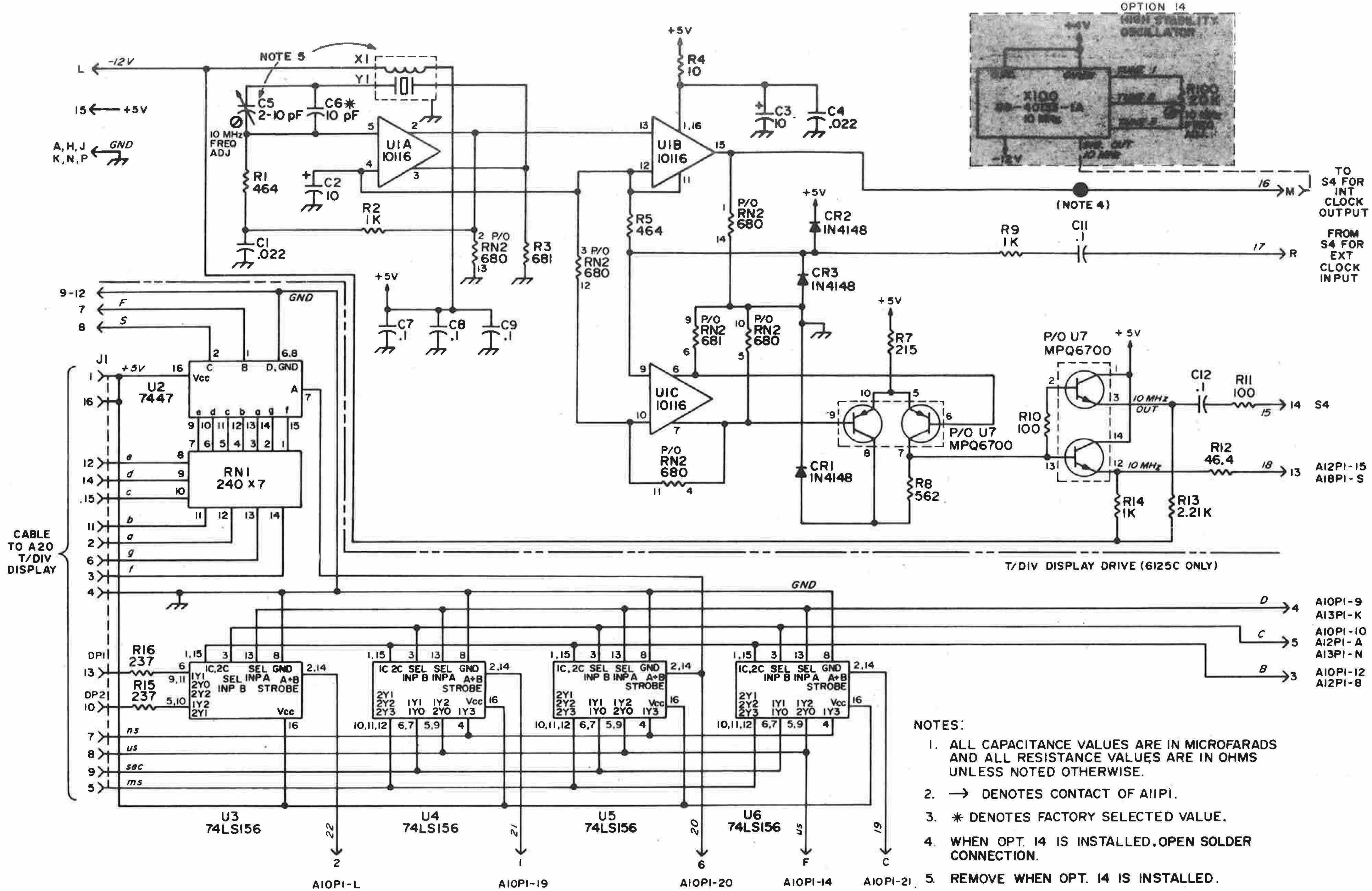


Figure 6-8. A10 6126M Time Shorting Board

PARTS LIST, A10 SHORTING BOARD - TIME

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R...1	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
RN..1	13-10047-0A	RNF 4.7 K 6 PIN SIP 5 RES.	80053	BECKMAN 783-1-R4.7K
RN..2	13-10047-0A	RNF 4.7 K 6 PIN SIP 5 RES.	80053	BECKMAN 783-1-R4.7K
RN..3	13-10047-0A	RNF 4.7 K 6 PIN SIP 5 RES.	80053	BECKMAN 783-1-R4.7K





NOTES:

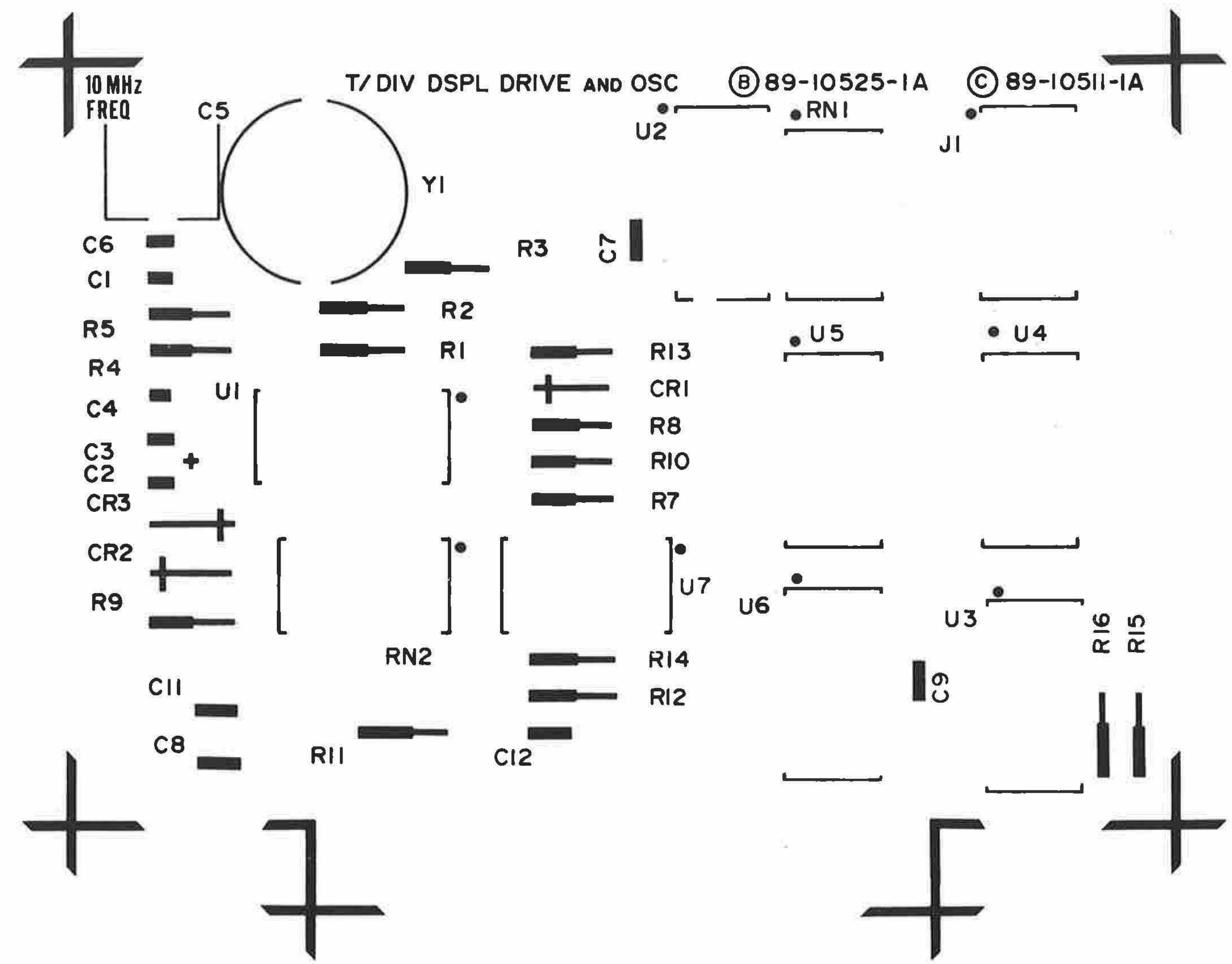
1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS UNLESS NOTED OTHERWISE.
2. ⟶ DENOTES CONTACT OF A11P1.
3. * DENOTES FACTORY SELECTED VALUE.
4. WHEN OPT. 14 IS INSTALLED, OPEN SOLDER CONNECTION.
5. REMOVE WHEN OPT. 14 IS INSTALLED.
6. ADD R101 FOR 6125C AND OPTION 60 ONLY.

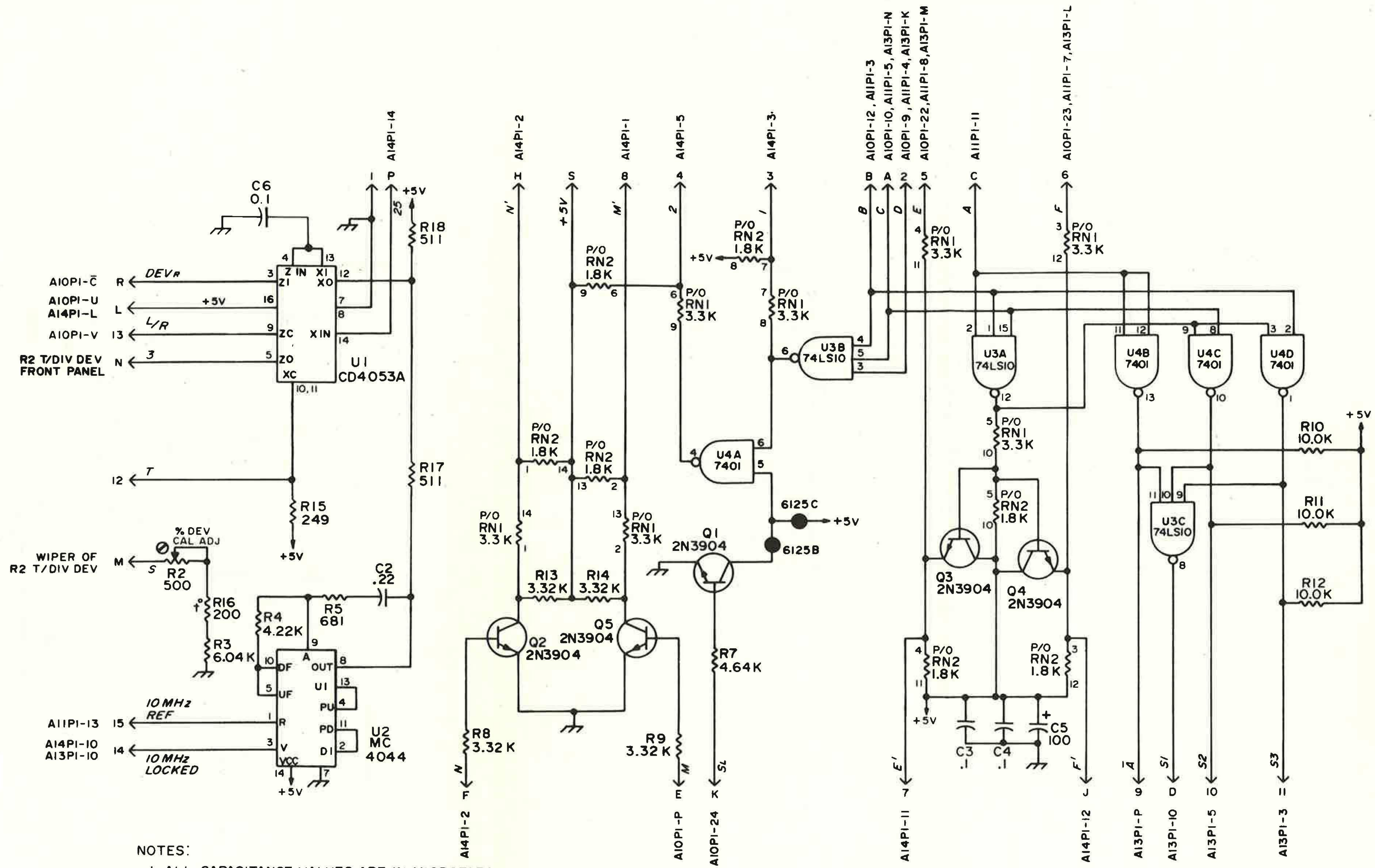
OPTION 14
X100 MST1-2
R100 20K 10 Mhz Freq adjust

Figure 6-9. A11 6126M 10 MHz Clock

PARTS LIST, A11 DISPLAY DRIVE AND 10 MHz OSCILLATOR - TIME

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10120-0A	CCD 22.0NF 25.0 VM	71590	CENTRLB UK25223 OR EQUIV
C...2	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C...3	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C...4	07-10120-0A	CCD 22.0NF 25.0 VM	71590	CENTRLB UK25223 OR EQUIV
C...5	07-10208-0A	CVC 2.0-10PF TRIMMER	50423	TABOR 15005020
C...6	07-10488-0A	CMD 10.0PF 300.0 VJ	84171	ARCO TYPE DM-15-BC10JN1
C...7	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...8	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...9	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C..11	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C..12	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
CR..1	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..2	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..3	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
R...1	12-12264-0A	RFF 464.0 250 MW F+-1%	16299	CGW RN55D 4640 F
R...2	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R...3	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R...4	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R...5	12-12264-0A	RFF 464.0 250 MW F+-1%	16299	CGW RN55D 4640 F
R...7	12-12232-0A	RFF 215.0 250 MW F+-1%	16299	CGW RN55D 2150 F
R...8	12-12272-0A	RFF 562.0 250 MW F+-1%	16299	CGW RN55D 5620 F
R...9	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R..10	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R..11	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R..12	12-12164-0A	RFF 46.4 250.0MW F+- 1%	16299	CGW RN55D 46R4 F
R..13	12-12333-0A	RFF 2.21K 250.0MW F+- 1%	16299	CGW RN55D 2211 F
R..14	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
RN..2	13-10023-0A	RNF 680.0 0.2 W F	0	BECKMAN 899-3R680 -F
U...1	24-10041-0A	ICP LIN DUAL OD AMP 10116	4713	MOTOROLA
U...7	10-10184-0A	TRQ MPQ6700 4 P14 DIP	4713	MOT .2400 200M
X...1	42-10000-0A	OVN OVEN SEMI CON TO-5 20V	1295	ULIXON TEXAS INST. MST1-2
Y...1	04-40003-0A	CRS 10.0MHZ TO-5	50423	TABOR 08000000 ALSO ERC





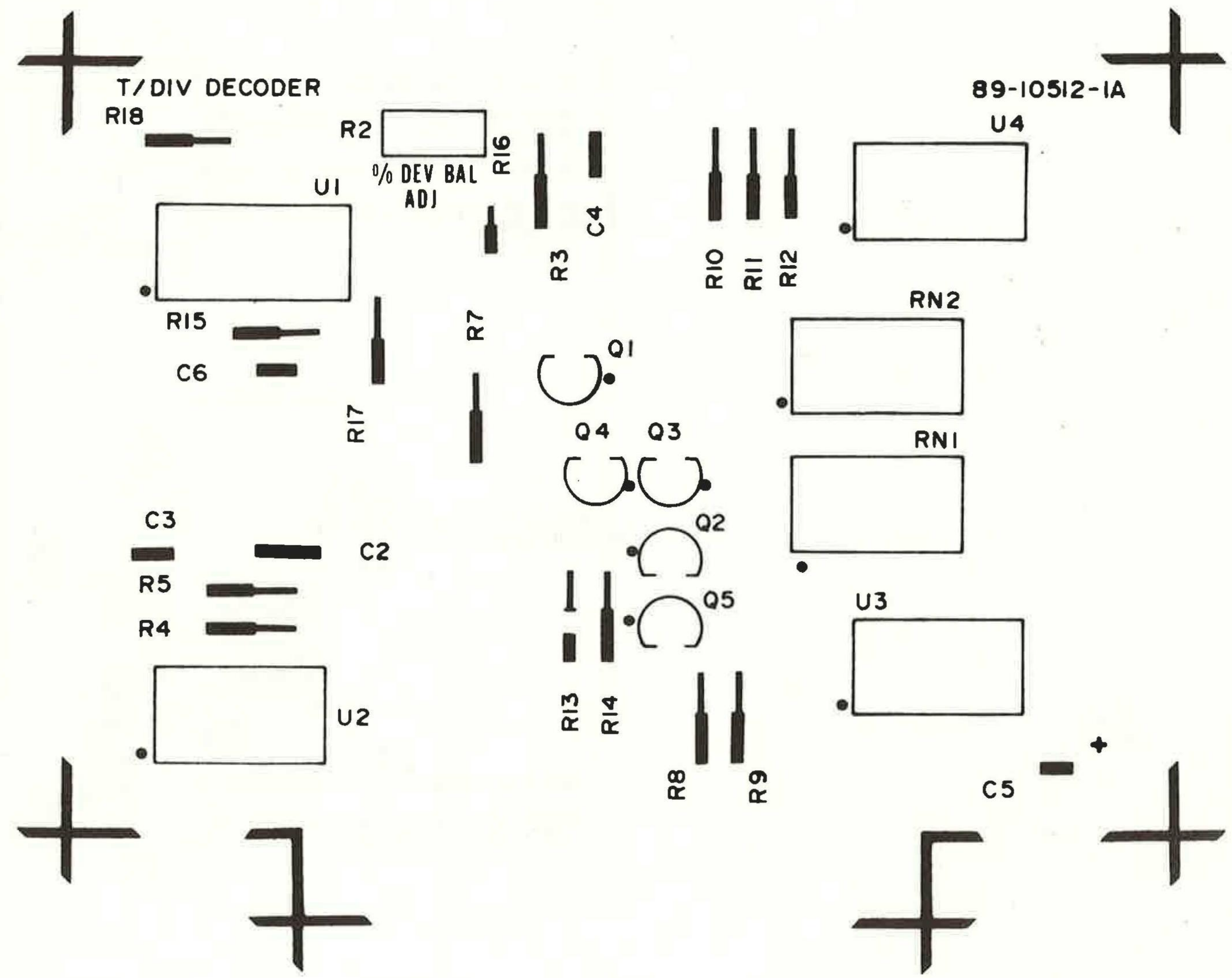
NOTES:

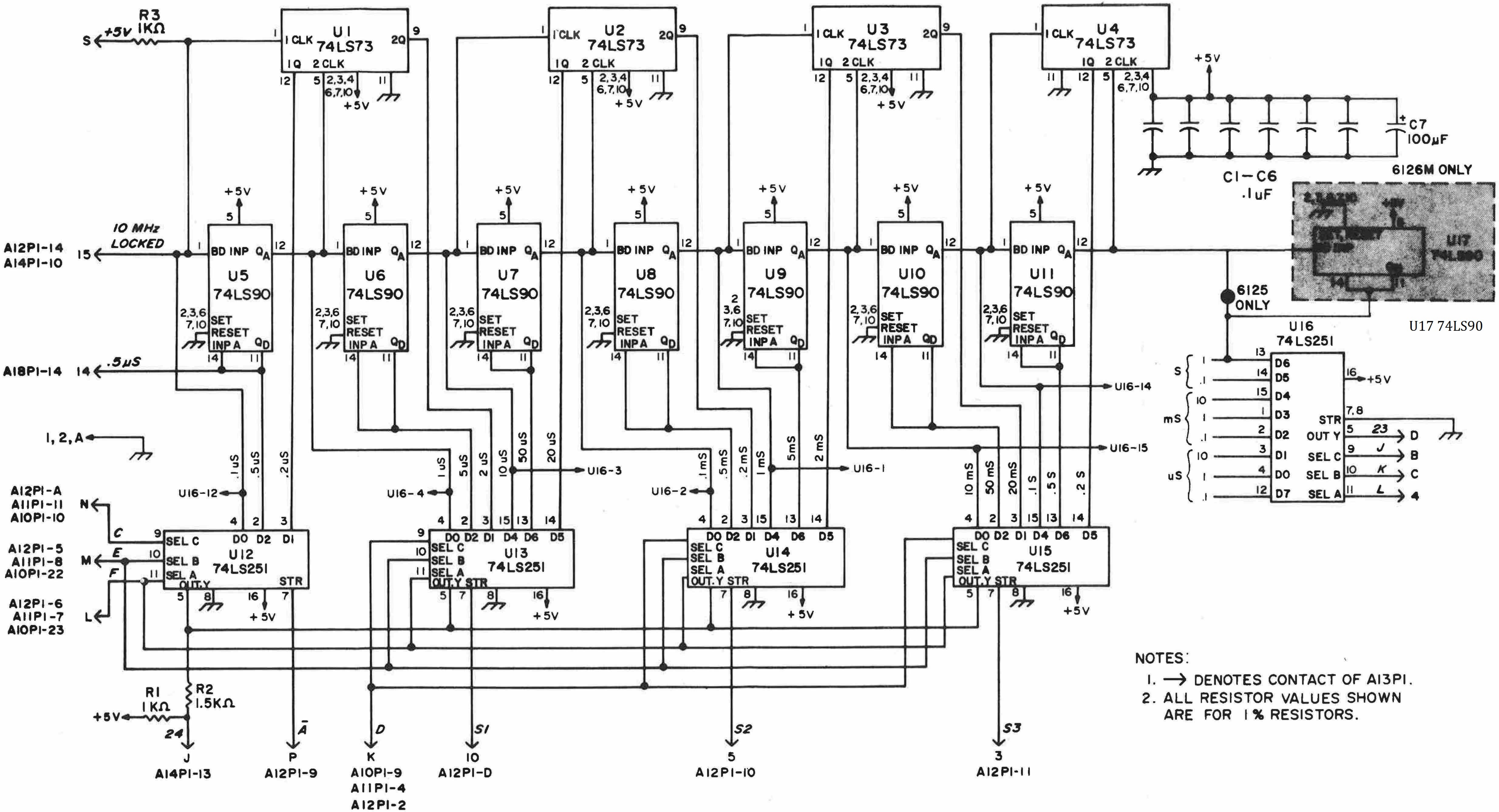
1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS NOTED OTHERWISE.
2. → DENOTES CONTACT OF A12P1.
3. ✱ DENOTES FACTORY SELECTED VALUE.
4. ● DENOTES A SOLDER CONNECTION.

Figure 6-10. A12 6126M Time/Div Decoder

PARTS LIST, A12 TIME/DIV DECODER - TIME

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...2	07-10430-0A	CBM 220.0NF 100.0 VK	80031	MEPCO C280 MAH/A220K
C...3	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C...4	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C...5	07-10184-0A	CET 100.0UF 10.0 VM DIP TAN	56289	SPRAGUE 196D107X0010-LA3
C 6	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
Q...1	10-10043-0A	TRQ 2N3904 NPN 1 40 PT0-92	4713	MOT 1 300M 40
Q...2	10-10043-0A	TRQ 2N3904 NPN 1 40 PT0-92	4713	MOT 1 300M 40
Q...3	10-10043-0A	TRQ 2N3904 NPN 1 40 PT0-92	4713	MOT 1 300M 40
Q...4	10-10043-0A	TRQ 2N3904 NPN 1 40 PT0-92	4713	MOT 1 300M 40
Q...5	10-10043-0A	TRQ 2N3904 NPN 1 40 PT0-92	4713	MOT 1 300M 40
R...2	09-10094-0A	RVF 500.0 500.0MW KVERT MT	73138	HELIPOT 72XW 500
R...3	12-12375-0A	RFF 6.04K 250.0MW F+- 1%	16299	CGW RN55D 6041 F
R 4	12-12360-0A	RFF 4.22K 250.0MW F+- 1%	16299	CGW RN55D 4221 F
R...5	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R...7	12-12364-0A	RFF 4.64K 250.0MW F+- 1%	16299	CGW RN55D 4641 F
R...8	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R...9	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R..10	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	16299	CGW RN55D 1002 F
R..11	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	16299	CGW RN55D 1002 F
R..12	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	16299	CGW RN55D 1002 F
R..13	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R..14	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R..15	12-12238-0A	RFF 249.0 250.0MW F+- 1%	16299	CGW RN55D 2490 F
R..16	27-01153-0A	THR-200 K+-10%	83186	VTE TYPE 22E9
R..17	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R..18	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
RN..1	13-10021-0A	RNF 3.3 K 0.2 W F	0	BECKMAN 899-3R3,3K-F
RN..2	13-10020-0A	RNF 1.8 K 0.2 W F	0	BECKMAN 899-3R1.8K-F
U...1	24-10174-0A	ICP 4053 CMOS MULTIPLEXER	86684	RCA CD4053
U...2	24-10129-0A	ICP MC4044 PHASE LOCK LOOP	4713	MOT MC4044
U...3	24-10179-0A	ICP 74LS10 TRI.3 IN NAND	1295	T.I.SN74S10
U...4	24-10182-0A	ICP 7401 QUAD 2 IN NAND	1295	T.I.SN7401 OR EQUIP.
1	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
1	12-12238-0A	RFF 249.0 250.0MW F+- 1%	16299	CGW RN55D 2490 F





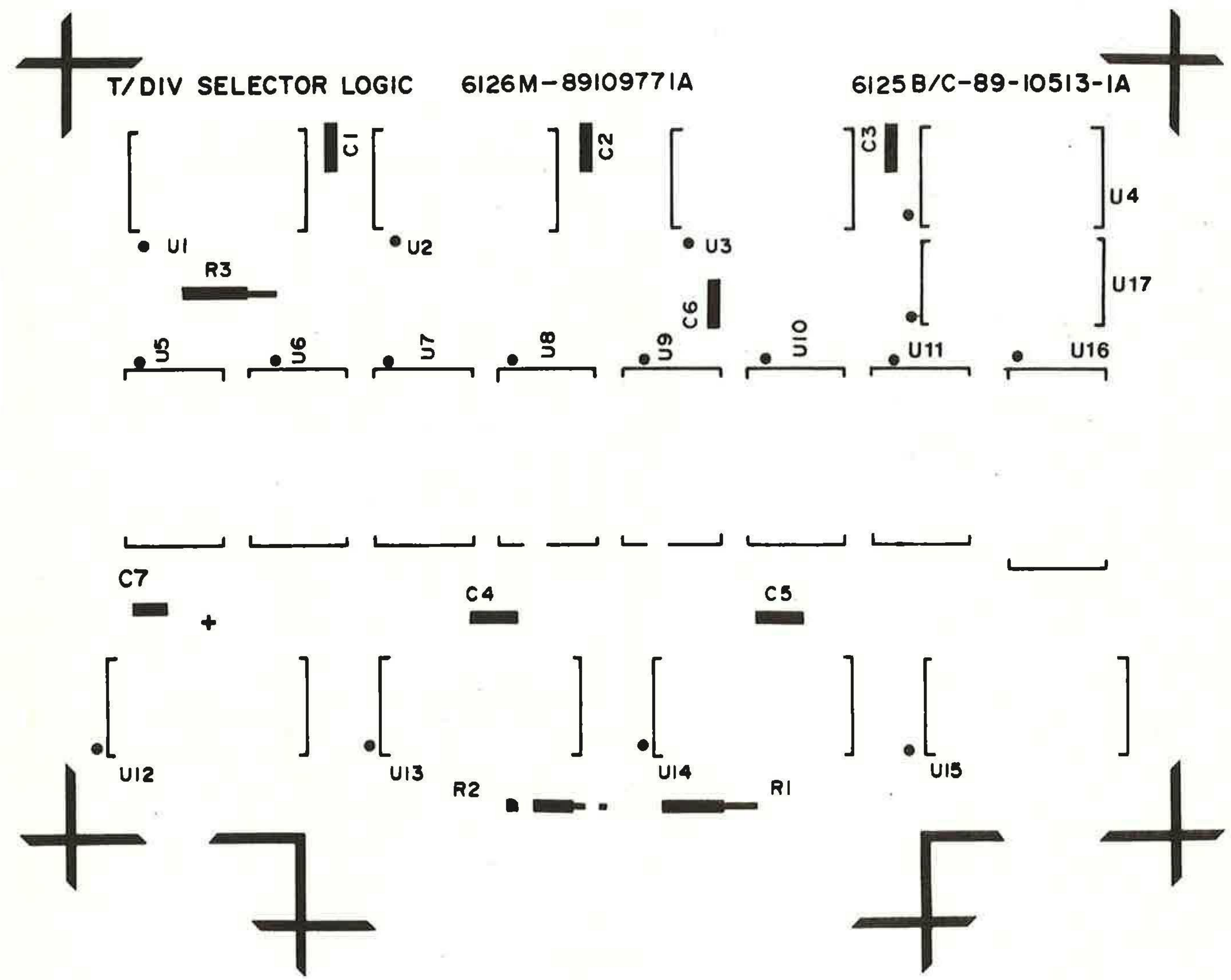
NOTES:

1. → DENOTES CONTACT OF A13P1.
2. ALL RESISTOR VALUES SHOWN ARE FOR 1% RESISTORS.

Figure 6-11. A13 6126M Time/Div Select

PARTS LIST, A13 TIME/DIV SELECT - TIME

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...2	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...3	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...4	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...5	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...6	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...7	07-10184-0A	CET 100.0UF 10.0 VM DIP TAN	56289	SPRAGUE 196D107X0010-LA3
R...1	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R...2	12-12317-0A	RFF 1.50K 250 MW F+-1%	16299	CGW RN55D 1501 F
R...3	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
U...1	24-10169-0A	ICP 74LS73 DUAL JK FL.FL.	1295	T.I.SN74LS73
U...2	24-10169-0A	ICP 74LS73 DUAL JK FL.FL.	1295	T.I.SN74LS73
U...3	24-10169-0A	ICP 74LS73 DUAL JK FL.FL.	1295	T.I.SN74LS73
U...4	24-10169-0A	ICP 74LS73 DUAL JK FL.FL.	1295	T.I.SN74LS73
U...5	24-10171-0A	ICP 74LS90 DIVIDE BY 12	1295	T.I.SN74LS90
U...6	24-10171-0A	ICP 74LS90 DIVIDE BY 12	1295	T.I.SN74LS90
U...7	24-10171-0A	ICP 74LS90 DIVIDE BY 12	1295	T.I.SN74LS90
U...8	24-10171-0A	ICP 74LS90 DIVIDE BY 12	1295	T.I.SN74LS90
U...9	24-10171-0A	ICP 74LS90 DIVIDE BY 12	1295	T.I.SN74LS90
U..10	24-10171-0A	ICP 74LS90 DIVIDE BY 12	1295	T.I.SN74LS90
U..11	24-10171-0A	ICP 74LS90 DIVIDE BY 12	1295	T.I.SN74LS90
U..12	24-10170-0A	ICP 74LS251 DATA SELECTOR	1295	T.I.SN74LS251
U..13	24-10170-0A	ICP 74LS251 DATA SELECTOR	1295	T.I.SN74LS251
U..14	24-10170-0A	ICP 74LS251 DATA SELECTOR	1295	T.I.SN74LS251
U..15	24-10170-0A	ICP 74LS251 DATA SELECTOR	1295	T.I.SN74LS251
U..16	24-10170-0A	ICP 74LS251 DATA SELECTOR	1295	T.I.SN74LS251
U..17	24-10171-0A	ICP 74LS90 DIVIDE BY 12	1295	T.I.SN74LS90



NOTES:

1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS UNLESS NOTED OTHERWISE.
2. ⟶ DENOTES CONTACT OF A14P1.

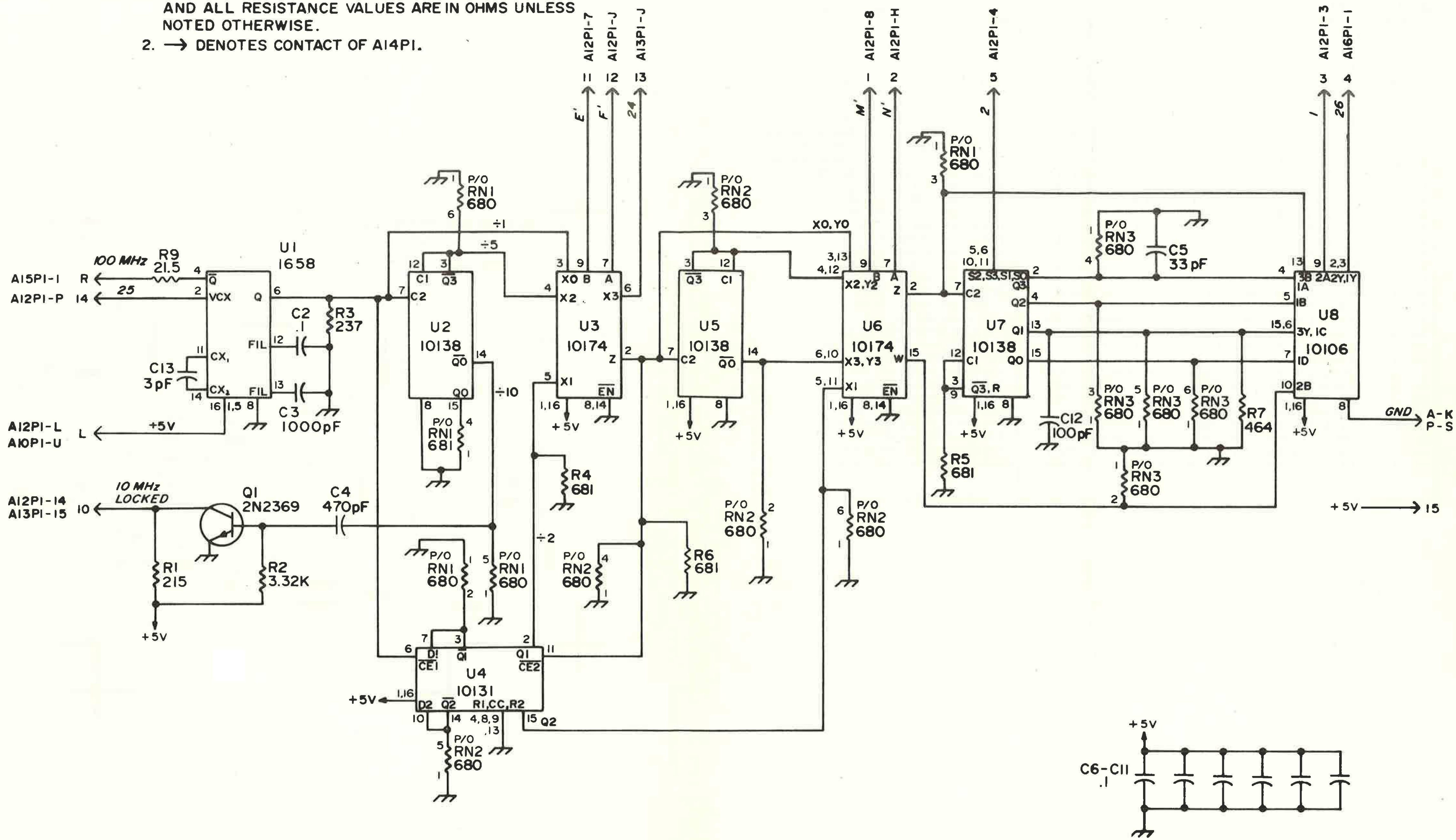
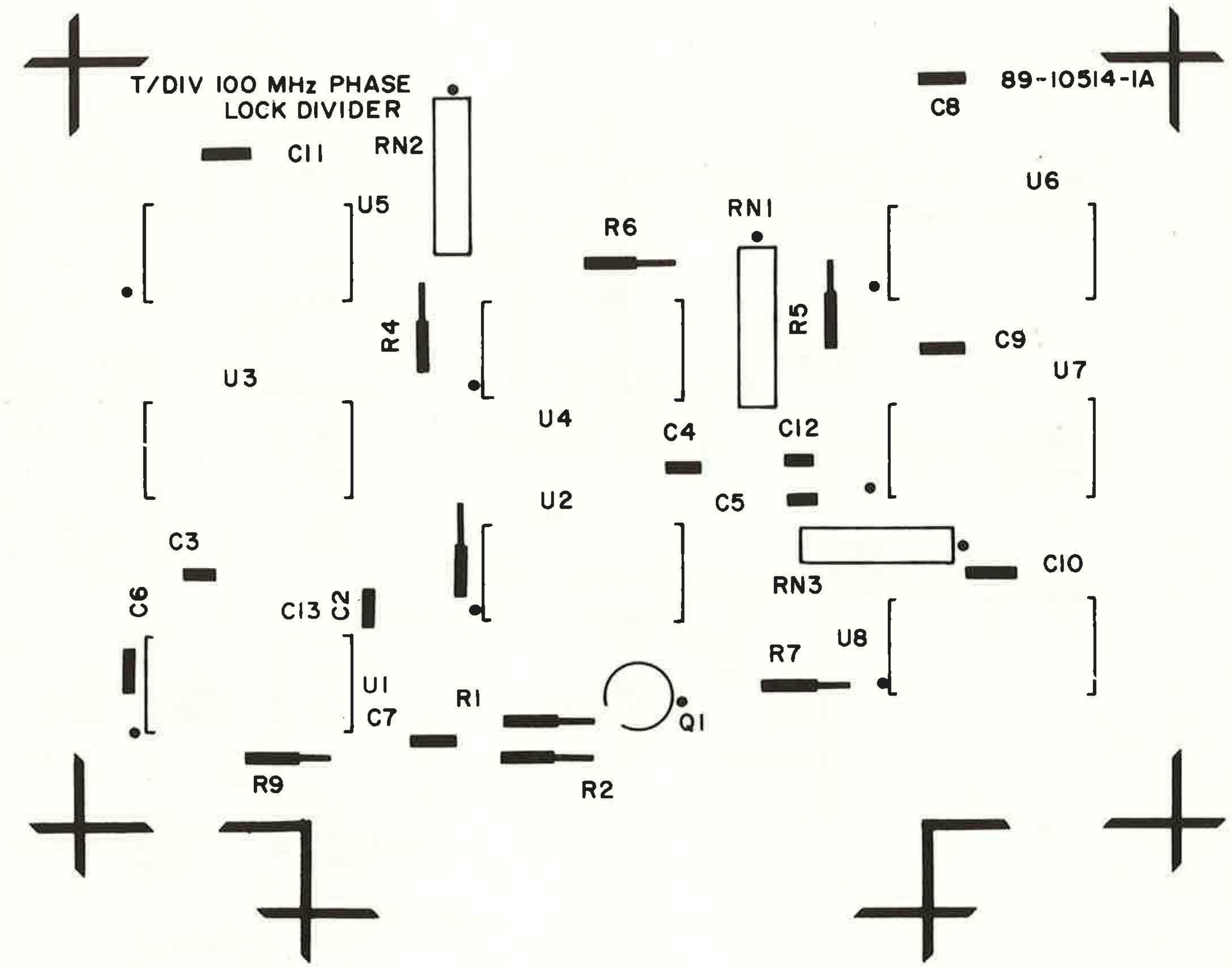


Figure 6-12. A14 6126M 100 MHz Phase Lock Loop and Divider

PARTS LIST, A14 100 MHz PHASE LOCK LOOP - TIME

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...2	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...3	07-02592-0A	CCD 1.0NF 1.0KVK+-10%	84171	ARCO TYPE CCD-102
C...4	07-02292-0A	CMD 470.0PF 500.0 FJ+- 5%	84171	ARCO DM-15-471-J
C...5	07-10197-0A	CCD 33.0PF 1.0KVJ NPO	56289	SPRAGUE C030B102G330J EQV
C...6	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...7	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...8	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...9	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C..10	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C..11	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C..12	07-09552-0A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-1C1
C..13	07-10262-0A	CMD 3.0PF 300.0 +- 1PF	84171	ARCO DM5CC-030A
Q...1	10-10001-0A	TRQ 2N2369 NPN 1 15 MTO-18	4713	MOT 1.2 500M 20
R...1	12-12232-0A	RFF 215.0 250 MW F+-1%	16299	CGW RN55D 2150 F
R...2	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R...3	12-12236-0A	RFF 237.0 250 MW F+-1%	16299	CGW RN55D 2370 F
R...4	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R...5	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R...6	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R...7	12-12264-0A	RFF 464.0 250 MW F+-1%	16299	CGW RN55D 4640 F
R...9	12-12132-0A	RFF 21.5 250.0MW F+- 1%	16299	CGW RN55D 21R5 F
RN..1	13-10019-0A	RNF 680.0 0.3 W F	80053	BECKMAN 783-1-R680
RN..2	13-10019-0A	RNF 680.0 0.3 W F	80053	BECKMAN 783-1-R680
RN..3	13-10019-0A	RNF 680.0 0.3 W F	80053	BECKMAN 783-1-R680
U...1	24-10172-0A	ICP 1658 VOLT. CONTROL MUBR	4713	MOTOROLA MC 1658
U...2	24-10176-0A	ICP 10138 BI QUINARY CONTR	4713	MOTOROLA MC10138
U...3	24-10177-0A	ICP 10174 DUAL R501 MCTPR	4713	MOTOROLA MC10174
U...4	24-10180-0A	ICP 10131 DUAL D FL. FL.	86684	MOTOROLA MC10131
U...5	24-10176-0A	ICP 10138 BI QUINARY CONTR	4713	MOTOROLA MC10138
U...6	24-10177-0A	ICP 10174 DUAL R501 MCTPR	4713	MOTOROLA MC10174
U...7	24-10176-0A	ICP 10138 BI QUINARY CONTR	4713	MOTOROLA MC10138
U...8	24-10178-0A	ICP 10106 TRI.4-3-3 IN.NOR	86684	MOTOROLA MC10106



NOTES:

1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS NOTED OTHERWISE.
2. → DENOTES CONTACT OF A15P1.
3. ALL RESISTOR VALUES ARE FOR 1% RESISTORS.

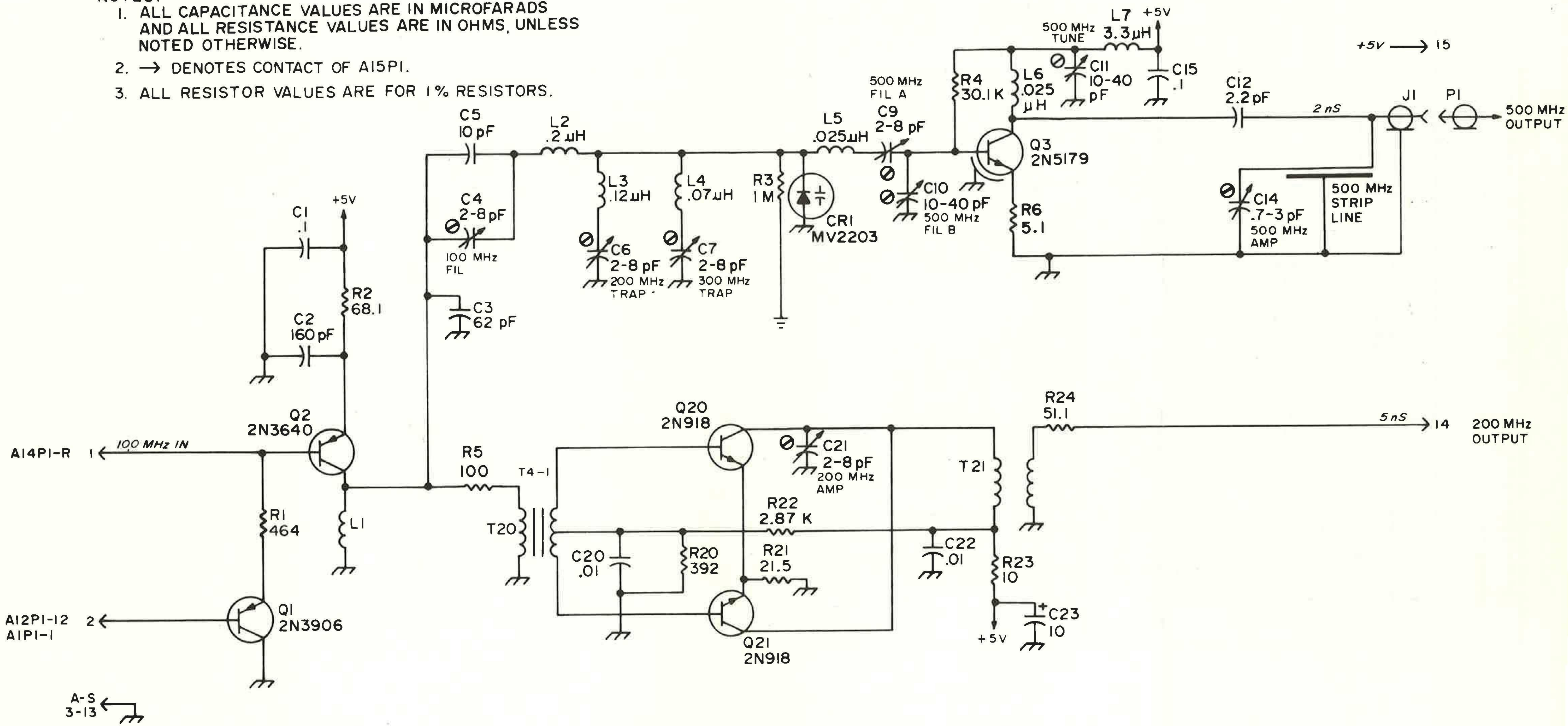
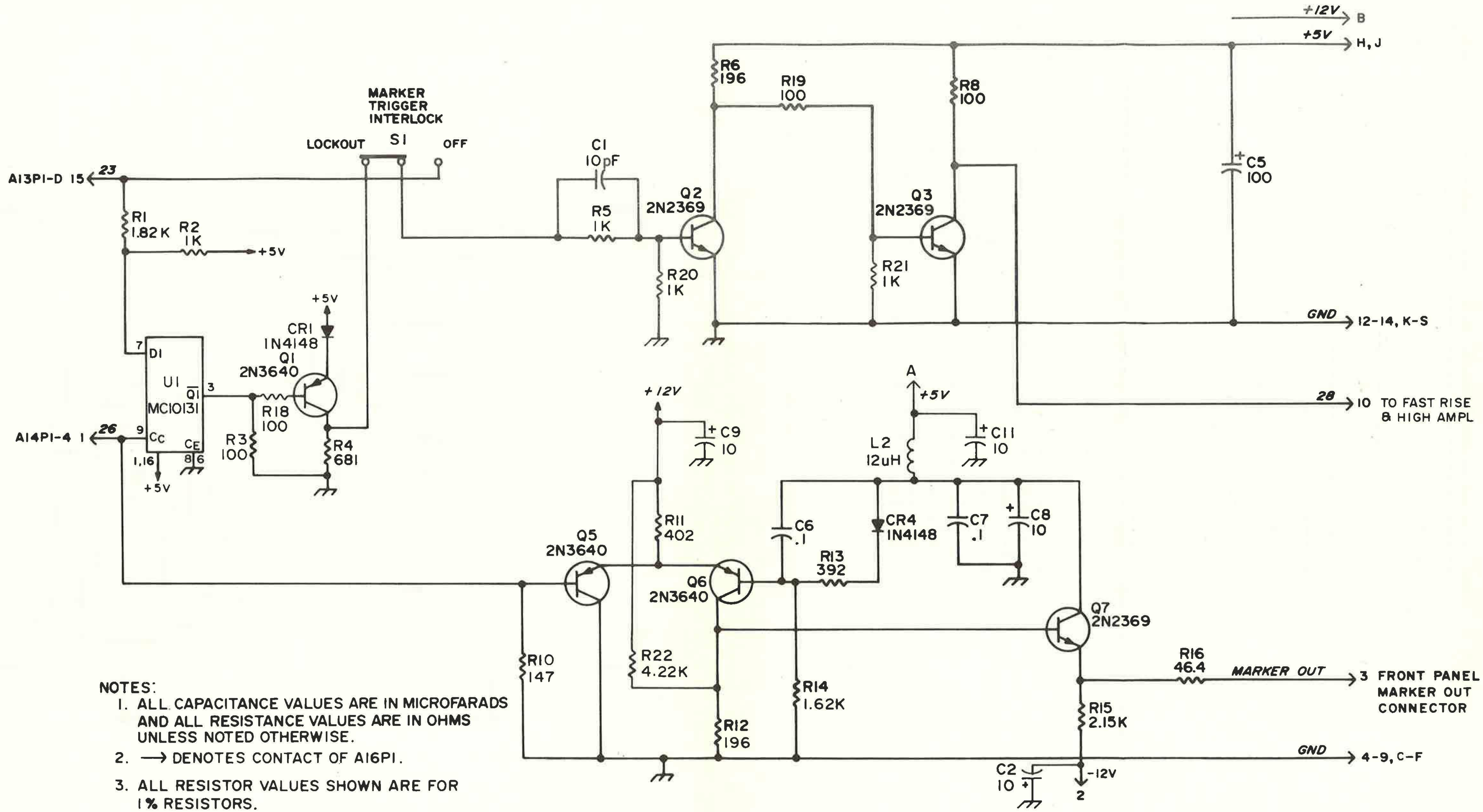


Figure 6-13. A15 6126M T/Div 200-500 MHz Multiplier

PARTS LIST, A15 200 MHz/500 MHz MULTIPLIER - TIME

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...2	07-10137-0A	CMO 160. PF 500. VJ	72136	ELMENCO DM15FD161J03
C...3	07-10317-0A	62.0PF 300.0 VJ	53021	SNAGAMO CM05ED620J03 OR EQ
C...4	07-10429-0A	CVC 2-8PF 250.0 V -10+50%	50423	ST.TR.10STRIKO 24
C...5	07-10488-0A	CMD 10.0PF 300.0 VJ	84171	ARCO TYPE DM-15-BC10JN1
C...6	07-10429-0A	CVC 2-8PF 250.0 V -10+50%	50423	ST.TR.10STRIKO 24
C...7	07-10429-0A	CVC 2-8PF 250.0 V -10+50%	50423	ST.TR.10STRIKO 24
C...9	07-10429-0A	CVC 2-8PF 250.0 V -10+50%	50423	ST.TR.10STRIKO 24
C..10	07-10428-0A	CVC 10-40PF 250.0 V-10+50%	50423	ST.TR.10 STRIKO 24
C..11	07-10428-0A	CVC 10-40PF 250.0 V-10+50%	50423	ST.TR.10 STRIKO 24
C..12	07-02595-0A	CCT 2.2PF K+-10%	95121	QUALITY COMPONENTS TP QC
C..14	07-10427-0A	CVC 7-3PF 250.0 - 0+50%	50423	ST.TR R-TRIKO 122 09
C..15	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C..20	07-10563-0A	CCR 0.01UF 50V .3 SPACE	0	AVX CERAMICS MD015E103ZAA
C..21	07-10429-0A	CVC 2-8PF 250.0 V -10+50%	50423	ST.TR.10STRIKO 24
C..22	07-10563-0A	CCR 0.01UF 50V .3 SPACE	0	AVX CERAMICS MD015E103ZAA
C..23	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 196010 6X0035A3
CR..1	05-10055-0A	DVC MV2203 25 10PF .28	4713	MOT SI VOLT VAR CAP
J...1	31-10174-0A	CON COAX MIN RT ANG CBL PLUG	98291	SEALECTRO 51-028-0000 EQU
J..1A	31-10173-0A	CON COAX MIN PC JACK SNAP ON	98291	SEALECTRO 51-051-0000 EQU
L...1	03-10055-1A	CIL AIR COIL	50423	BLI FOR 6125B
L...2	03-10044-1B	CIL .20 UH AIR COIL	50423	BLI
L...3	03-10043-1A	CIL .12 UH AIR COIL	50423	BLI
L...4	03-10054-1B	CIL 0.07UF AIR COIL	50423	
L...5	03-10045-1A	CIL .025 UH AIR COIL	50423	BLI
L...6	03-10045-1A	CIL .025 UH AIR COIL	50423	BLI
L...7	03-06289-0A	CLF 3.3UH	83125	NYTRONICS, DD-3.3
Q...1	10-09473-0A	TRQ 2N3906 PNP 1 40 PTO-92	4713	MOT 1 200M 60
Q...2	10-07934-0A	TRQ 2N3640 PNP 1 12 TO-106	7263	FCH .500 300M 30
Q...3	10-10037-0A	TRQ 2N5179 NPN 1 12 MTO-72	4713	MOT .300 900M 25
Q..20	10-10104-1A	TRQ 2N 918 2 MATCH FOR BETA	50423	BLI PER 99100375A
Q..21	10-10104-1A	TRQ 2N 918 2 MATCH FOR BETA	50423	BLI PER 99100375A
R...1	12-12264-0A	RFF 464.0 250 MW F+-1%	16299	CGW RN55D 4640 F
R...2	12-12180-0A	RFF 68.1 250.0MW F+- 1%	16299	CGW RN55D 68R1 F
R...3	12-12600-0A	RFF 1.00M 500 MW F+-1%	16299	CGW RN60D 1004 F
R...4	12-12446-0A	RFF 30.1 K 250.0MW F+- 1%	16299	CGW RN55D 3012 F
R...5	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R...6	12-09839-0A	RFC 5.1 250.0MW J+- 5%	75042	IRC TYP
R...7	09-10093-0A	RVF 10.0 K 500.0MW KVERT MT	73138	HELIPOT 72XW 10K
R..20	12-12257-0A	RFF 392.0 250 MW F+-1%	16299	CGW RN55D 3920 F
R..21	12-12132-0A	RFF 21.5 250.0MW F+- 1%	16299	CGW RN55D 21R5 F
R..22	12-12344-0A	RFF 2.87K 205.0MW F+- 1%	16299	CGW RN55D 2871 F
R..23	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R..24	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
T..21	20-10026-1A	TRX RF AIR 6130A 200 MHZ	50423	



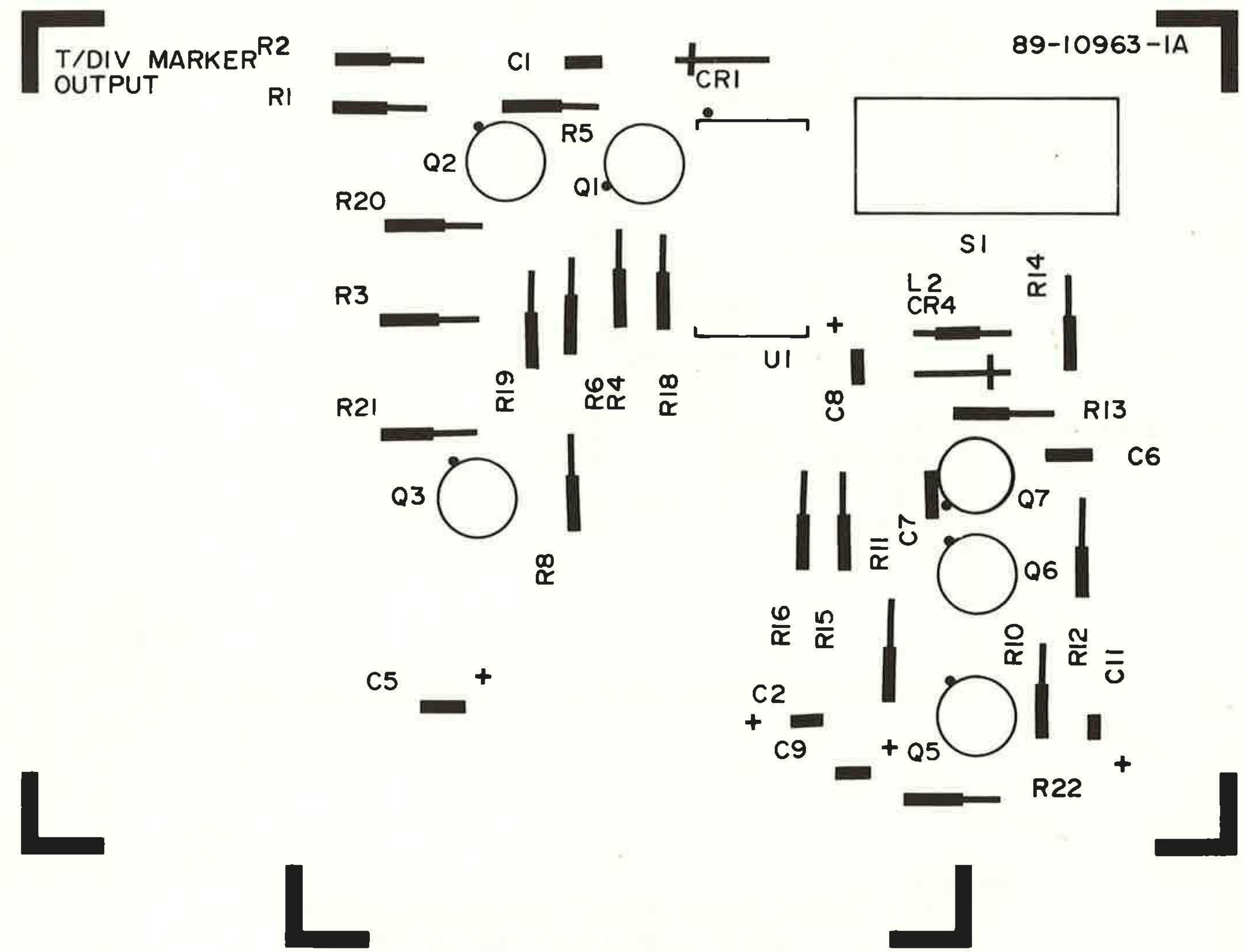
NOTES:

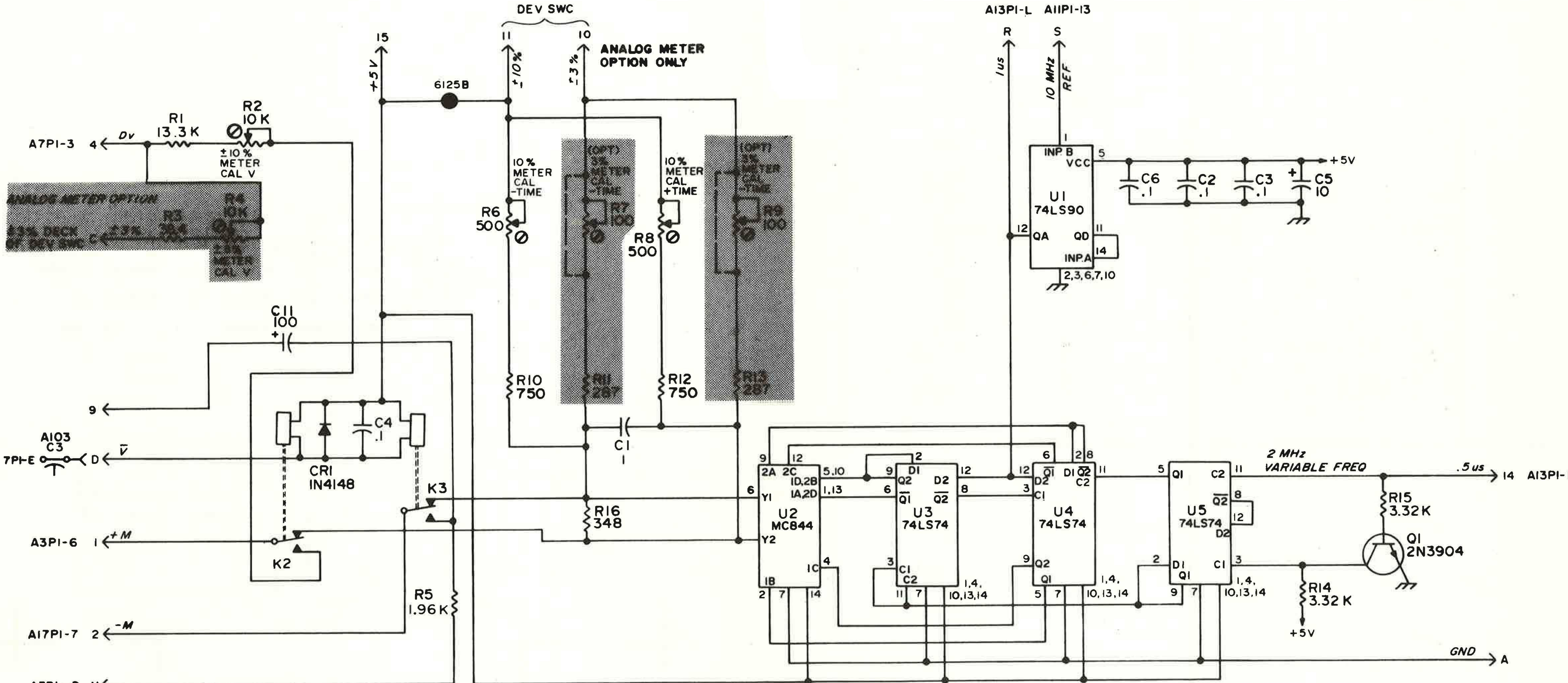
1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS UNLESS NOTED OTHERWISE.
2. ⟶ DENOTES CONTACT OF A16P1.
3. ALL RESISTOR VALUES SHOWN ARE FOR 1% RESISTORS.

Figure 6-14. A16 6126M Time/Div Marker Output

PARTS LIST, A16 MARKER OUTPUT AMPLIFIER - TIME

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10488-0A	CMD 10.0PF 300.0 VJ	84171	ARCO TYPE DM-15-BC10JN1
C...2	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C ..5	07-10106-0A	CTF 100.0UF 10.0 VM DIPTANT	22229	KEMEN T362C107M010AS
C...6	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...7	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...8	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C...9	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C..11	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
CR..1	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
CR..4	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
L...2	03-10006-0A	CRF 12UH MOLDED +- 10%	76493	MILLER #9230-46
Q...1	10-07934-0A	TRQ 2N3640 PNP 1 12 TO-106	7263	FCH .500 300M 30
Q...2	10-10001-0A	TRQ 2N2369 NPN 1 15 MTO-18	4713	MOT 1.2 500M 20
Q...3	10-10001-0A	TRQ 2N2369 NPN 1 15 MTO-18	4713	MOT 1.2 500M 20
Q...5	10-07934-0A	TRQ 2N3640 PNP 1 12 TO-106	7263	FCH .500 300M 30
Q...6	10-07934-0A	TRQ 2N3640 PNP 1 12 TO-106	7263	FCH .500 300M 30
Q...7	10-10001-0A	TRQ 2N2369 NPN 1 15 MTO-18	4713	MOT 1.2 500M 20
R...1	12-12325-0A	1.82K 250.0MW F+- 1%	16299	CGW RN55D 1821 F
R...14	12-12320-0A	RFF 1.62K 250 MW F+-1%	16299	CGW RN55D 1621 F
R...2	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R...3	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R...4	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R...5	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R...6	12-12228-0A	RFF 196.0 250 MW F+-1%	16299	CGW RN55D 1960 F
R...8	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R..10	12-12216-0A	RFF 147.0 250.0MW F+- 1%	16299	CGW RN55D 1470 F
R..11	12-12258-0A	RFF 402.0 250 MW F+-1%	16299	CGW RN55D 4020 F
R..12	12-12228-0A	RFF 196.0 250 MW F+-1%	16299	CGW RN55D 1960 F
R..13	12-12257-0A	RFF 392.0 250 MW F+-1%	16299	CGW RN55D 3920 F
R..15	12-12316-0A	RFF 1.47K 250 MW F+-1%	16299	CGW RN55D 1471 F
R..16	12-12164-0A	RFF 46.4 250.0MW F+- 1%	16299	CGW RN55D 46R4 F
R..18	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R..19	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R..20	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R..21	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R..22	12-12360-0A	RFF 4.22K 250.0MW F+- 1%	16299	CGW RN55D 4221 F
S...1	25-10022-0A	SWC SLIDE MIN DPDT	78488	STACKPOLE SS-91-1
U...1	24-10180-0A	ICP 10131 DUAL D FL. FL.	86684	MOTOROLA MC10131





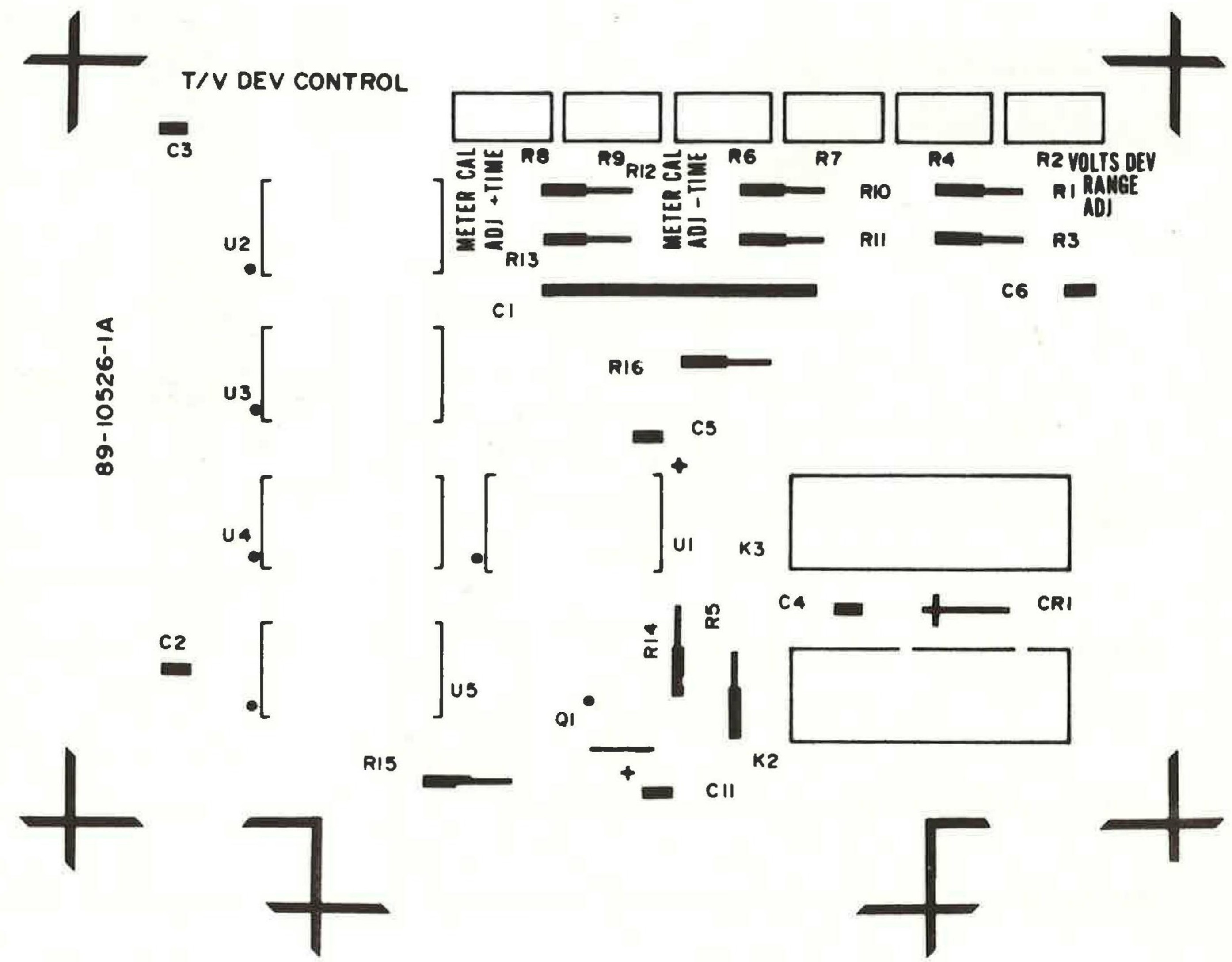
NOTES:

1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND RESISTANCE OHMS UNLESS NOTED OTHERWISE.
2. —●— INDICATES A SOLDER CONNECTION WHICH MAY BE REMOVED TO ISOLATE CIRCUIT.
3. ALL RELAYS SHOWN IN POSITION WHEN COIL IS NOT ENERGIZED.
4. —> DENOTES CONTACT OF A18P1.

Figure 6-15. A18 6126M Time Deviation Board

PARTS LIST, A18 DEVIATION BOARD – TIME

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10128-0A	CYM 1.0UF 50.0 VK	56289	SPRAGUE 431P1059R5 OR EQV
C...2	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C...3	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C...4	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C...5	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C...6	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C..11	07-10184-0A	CET 100.0UF 10.0 VM DIP TAN	56289	SPRAGUE 196D107X0010-LA3
CR..1	05-07920-0A	DGP 1N4148 75 10M	7263	FCH SI D035
K...2	14-10016-1A	RLY REED FORM C 6V 175 OHM	0	COTO-COIL E-9025
K...3	14-10016-1A	RLY REED FORM C 6V 175 OHM	0	COTO-COIL E-9025
Q...1	10-10043-0A	TRQ 2N3904 NPN 1 40 PT0-92	4713	MOT 1 300M 40
R...1	12-12412-0A	RFF 13.3 K 250.0MW F+- 1%	16299	CGW RN55D 1332 F
R...2	09-10093-0A	RVF 10.0 K 500.0MW KVERT MT	73138	HELIPOT 72XW 10K
R...5	12-12328-0A	RFF 1.96K 250.0MW F+- 1%	16299	CGW RN55D 1961 F
R...6	09-10094-0A	RVF 500.0 500.0MW KVERT MT	73138	HELIPOT 72XW 500
R...8	**09-10094-0A**	**RVF 500.0 500.0MW KVERT MT**	**73138**	**HELIPOT 72XW 500**
R..10	12-12284-0A	RFF 750.0 250 MW F+-1%	16299	CGW RN550D 7500 F
R..11	12-12244-0A	RFF 287.0 250 MW F+-1%	16299	CGW RN55D 2870 F
R..12	12-12284-0A	RFF 750.0 250 MW F+-1%	16299	CGW RN550D 7500 F
R..13	12-12244-0A	RFF 287.0 250 MW F+-1%	16299	CGW RN55D 2870 F
R..14	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R..15	12-12350-0A	RFF 3.32K 250.0MW F+- 1%	16299	CGW RN55D 3321 F
R..16	12-12252-0A	RFF 348.0 250 MW F+-1%	16299	CGW RN55D 3480 F
U...1	24-10171-0A	ICP 74LS90 DIVIDE BY 12	1295	T.I.SN74LS90
U...2	24-10201-0A	ICP MC844P DUAL NAND DTL GT	4713	MOT MC844P OR EQUIV.
U...3	24-10143-0A	ICP 74LS74 D FIFL 14 DIP	1295	TI
U...4	24-10143-0A	ICP 74LS74 D FIFL 14 DIP	1295	TI
U...5	24-10143-0A	ICP 74LS74 D FIFL 14 DIP	1295	TI



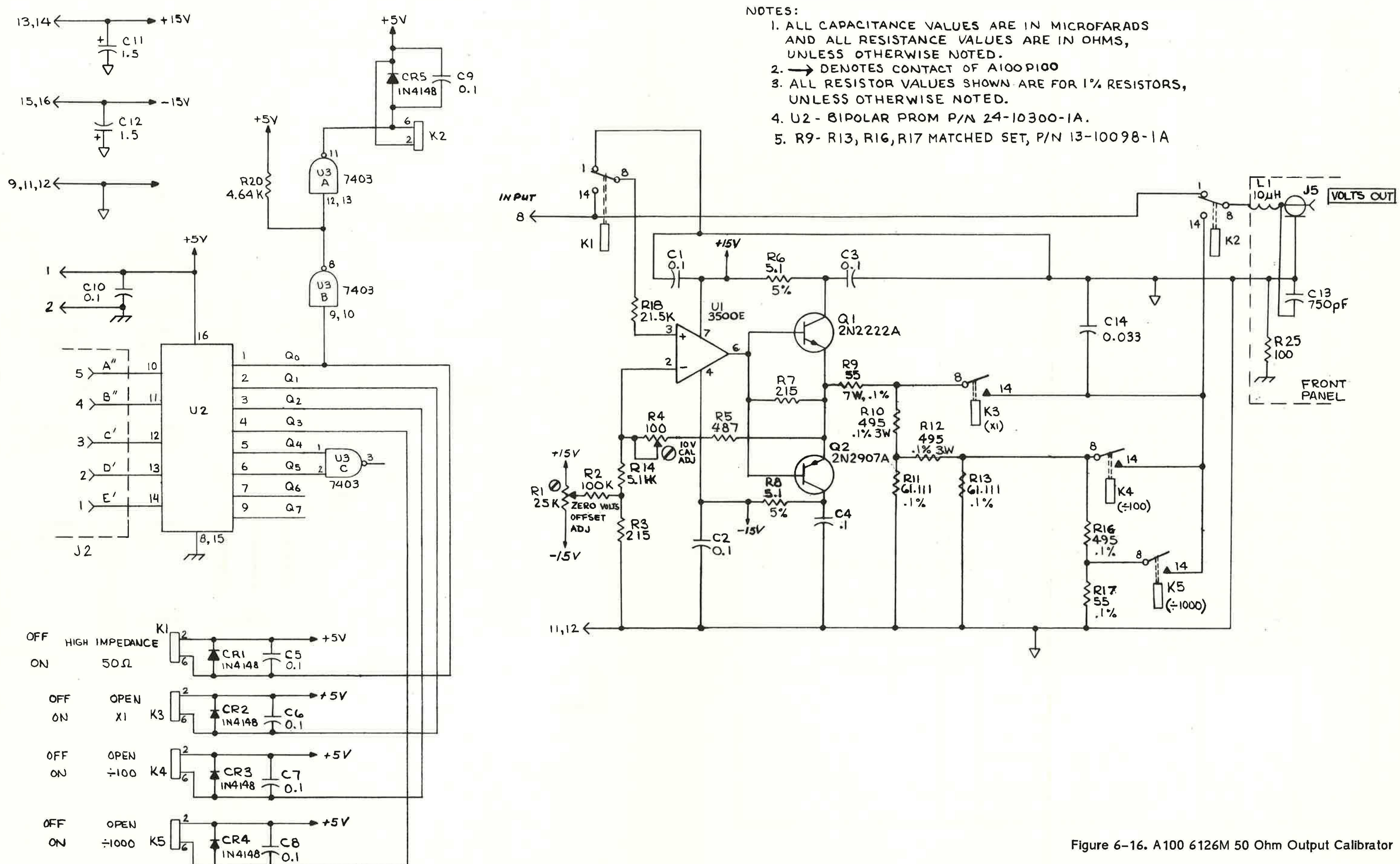
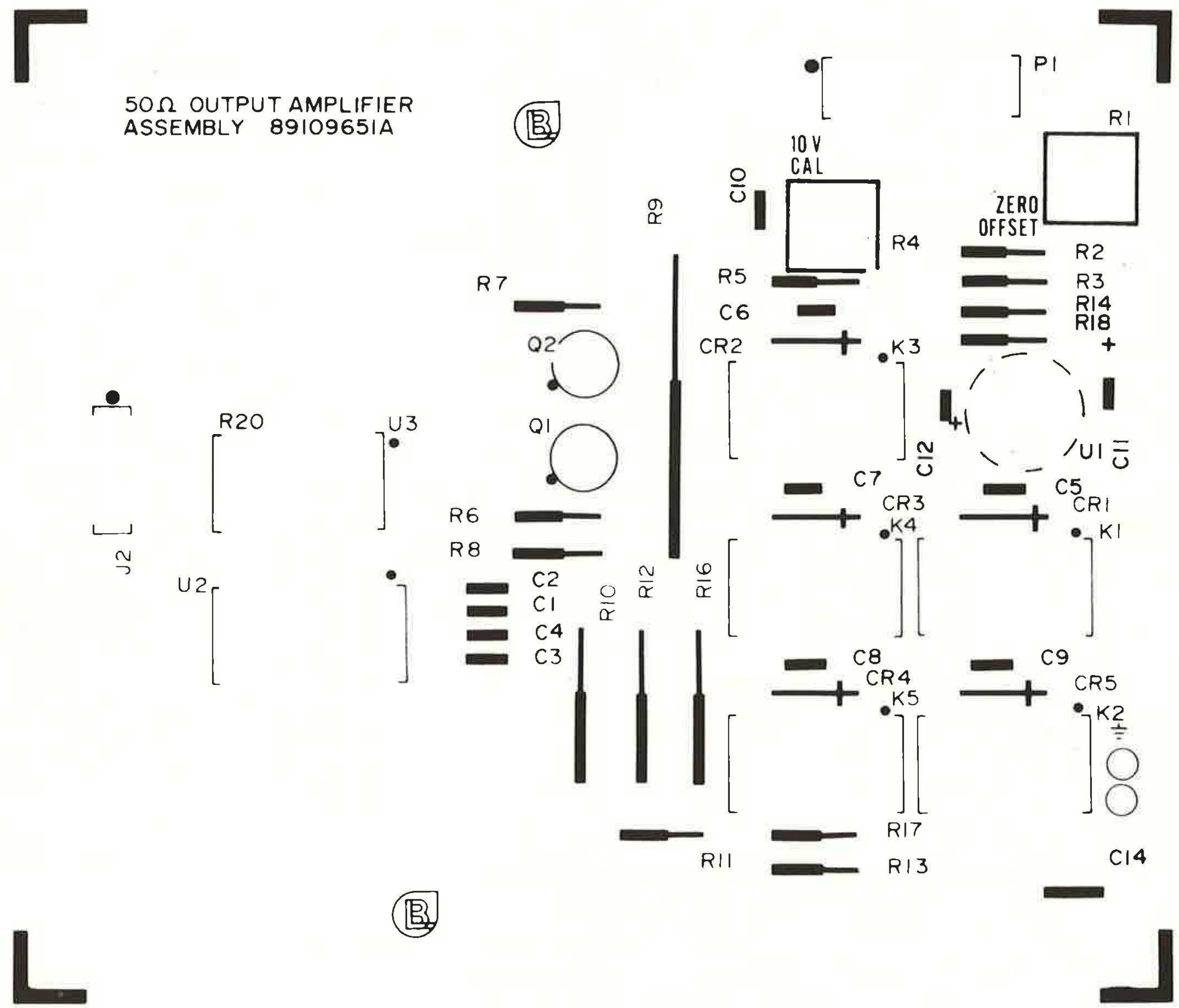


Figure 6-16. A100 6126M 50 Ohm Output Calibrator

PARTS LIST, A100 50 Ω OUTPUT CALIBRATOR - VOLTS

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...2	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...3	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...4	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...5	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...6	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...7	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...8	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...9	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C..10	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C..11	07-10083-0A	CET 1.5UF 35.0 V DISC	56289	SPRAGUE 1960155X0035A3
C..12	07-10083-0A	CET 1.5UF 35.0 V DISC	56289	SPRAGUE 1960155X0035A3
C..13	07-10418-0A	CMD 750.0PF300.0 VJ	53201	SANGAMO CM05E0751J03, EQ
C..14	07-10293-0A	CBM 33.0NF 100.0 VJ	50587	PLESSEY 161 SER MINIBOX
✓CR..1	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR..2	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR..3	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR..4	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR..5	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
K...1	14-10020-0A	RLY REED FORM C 5V 200OHM DI	0	GORDOS 831C-1S
K...2	14-10020-0A	RLY REED FORM C 5V 200OHM DI	0	GORDOS 831C-1S
K...3	14-10021-0A	RLY REED FORM A 5V 500OHMDIP	0	GORDOS 831A-1S
K...4	14-10021-0A	RLY REED FORM A 5V 500OHMDIP	0	GORDOS 831A-1S
K...5	14-10021-0A	RLY REED FORM A 5V 500OHMDIP	0	GORDOS 831A-1S
L...1	03-10064-1A	CRF 10UH INDUCTOR	50423	
P...1	31-10241-0A	CON MIN 16 PIN FEM.0.1"CEN	0	
Q...1	10-10127-0A	TRQ 2N2222A NPN 1 40 MTO-180	40713	MOT .500 300M 100
Q...2	10-10090-0A	TRQ 2N2907A PNP 1 60 MTO-18	4713	MOT .400 200M 75
R...1	09-10146-0A	RVF 25.0 K 500.0MW TRIMPOT	73138	HELIPOT 72PM
R...2	12-12500-0A	RFF 100.0 K 250.0MW F+- 1%	16299	CGW RN55D 1003 F
R...3	12-12232-0A	RFF 215.0 250 MW F+-1%	16299	CGW RN55D 2150 F
R...4	09-10004-0A	RVF 100.0 0.5 W M	73138	HEL TYP 72PM
R...5	12-12266-0A	RFF 487.0 250 MW F+-1%	16299	CGW RN55D 4870 F
R...6	12-09839-0A	RFC 5.1 250.0MW J+- 5%	75042	IRC TYP
R...7	12-12232-0A	RFF 215.0 250 MW F+-1%	16299	CGW RN55D 2150 F
R...8	12-09839-0A	RFC 5.1 250.0MW J+- 5%	75042	IRC TYP
R...9	13-10098-1A	RNF 6126M 50OHM MATCH SET	50423	
R..10	13-10098-1A	RNF 6126M 50OHM MATCH SET	50423	
R..11	13-10098-1A	RNF 6126M 50OHM MATCH SET	50423	
R..12	13-10098-1A	RNF 6126M 50OHM MATCH SET	50423	
R..13	13-10098-1A	RNF 6126M 50OHM MATCH SET	50423	
R..14	12-12368-0A	RFF 5.11K 250.0MW F+- 1%	16299	CGW RN55D 5111 F
R..16	13-10098-1A	RNF 6126M 50OHM MATCH SET	50423	
R..17	13-10098-1A	RNF 6126M 50OHM MATCH SET	50423	
R..18	12-12432-0A	RFF 21.5 K 250.0MW F+- 1%	16299	CGW RN55D 2152 F
R..20	12-12364-0A	RFF 4.64K 250.0MW F+- 1%	16299	CGW RN55D 4641 F
R..25	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
✓U...1	24-10303-0A	OP-07EY OP-AMP 14PINDIP	0	PMI OP-07EY
U...2	24-10300-1A	ICP 6126M PROM 61M1' PROG	50423	
U...3	24-10232-0A	ICP QUAD 2KNP NAND O.C.	1295	TI SN 7403N O/E



NOTES:
1. ALL CAPACITANCE VALUES ARE IN MICROFARADS, AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS NOTED OTHERWISE.
2. → DENOTES CONTACT OF A116P1.
3. ALL RESISTOR VALUES SHOWN ARE FOR 1% RESISTORS, UNLESS NOTED OTHERWISE.

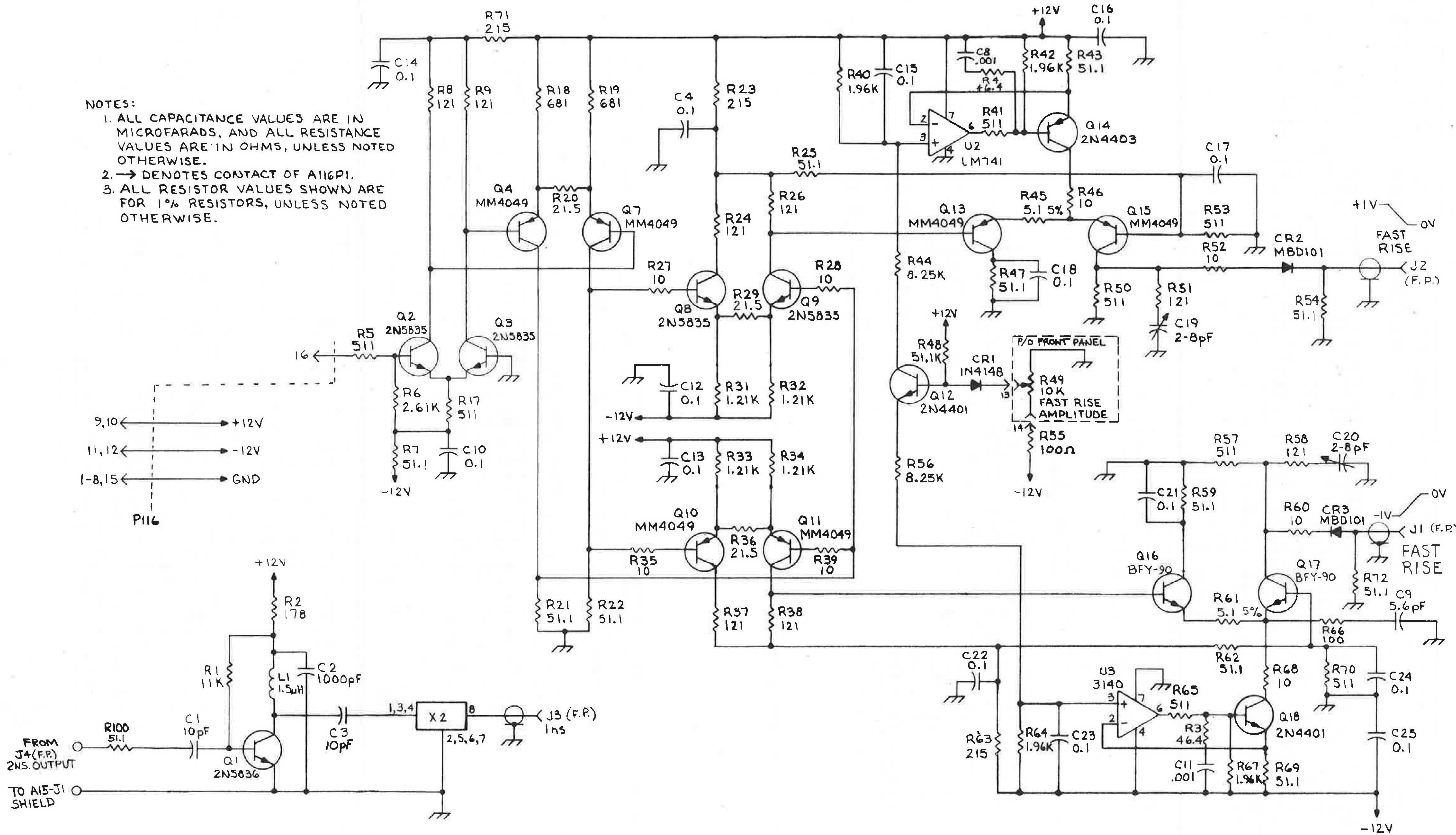


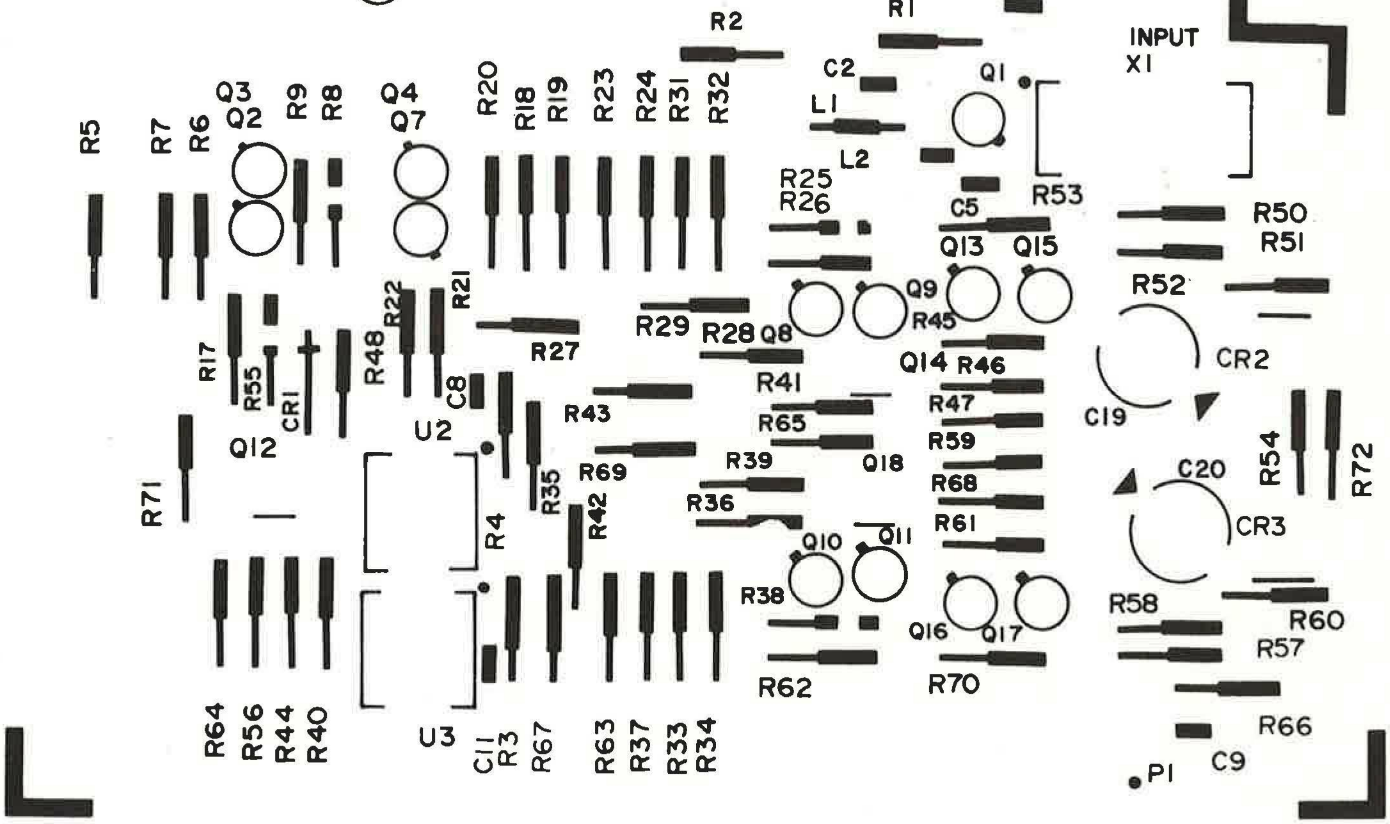
Figure 6-17. A116 6126M 1 GHz Multiplier and Fast Rise

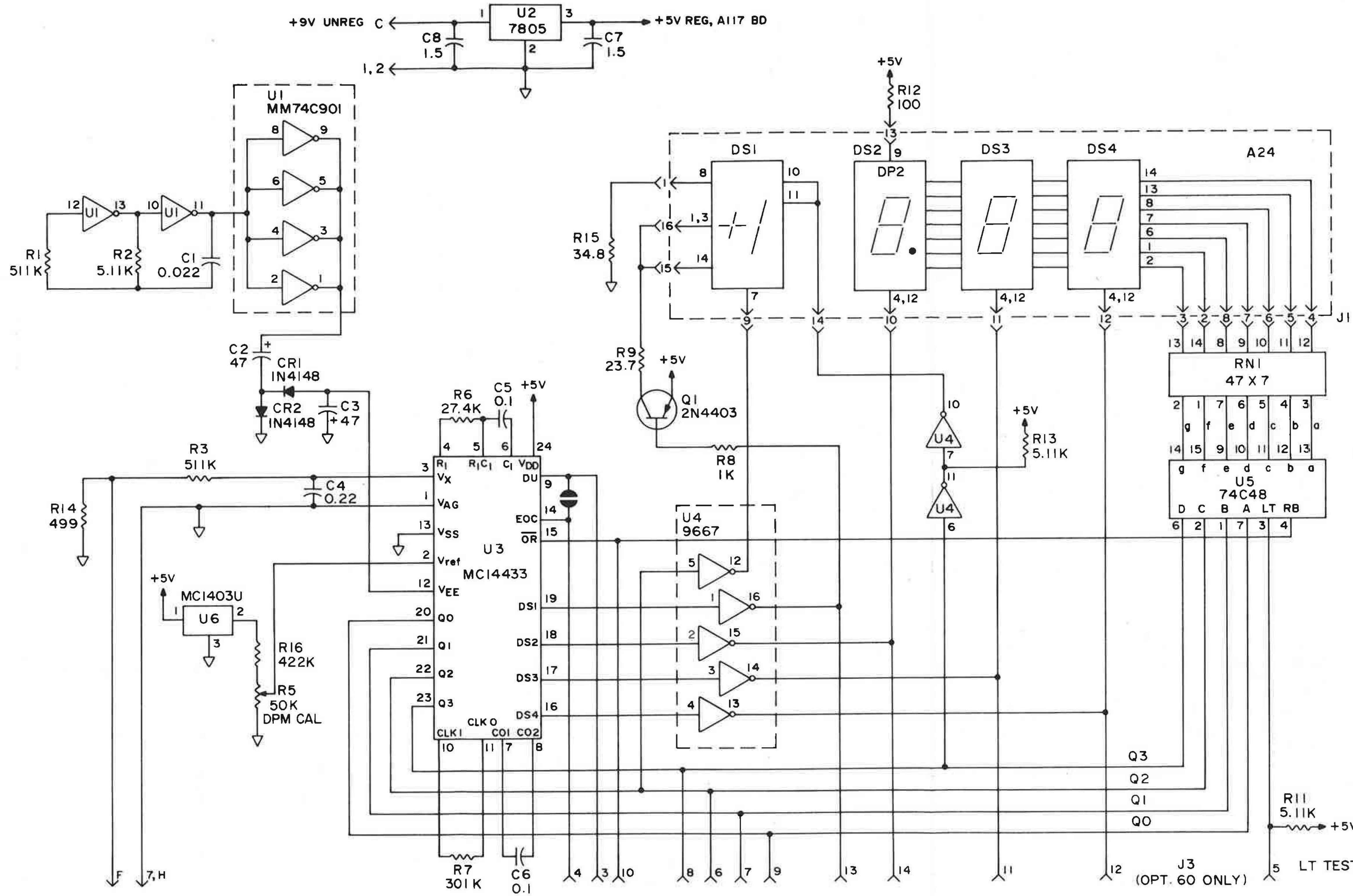
SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10488-0A	CMD 10.0PF 300.0 VJ	84171	ARCO TYPE DM-15-BC10JN1
C...2	07-02592-0A	CCD 1.0NF 1.0KVK+-10%	84171	ARCO TYPE CCD-102
C...3	07-10081-0A	CCD 3.3PF 500. V	90201	RMC TYPE GG
C...4	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C...5	07-10081-0A	CCD 3.3PF 500. V	90201	RMC TYPE GG
C...8	07-02592-0A	CCD 1.0NF 1.0KVK+-10%	84171	ARCO TYPE CCD-102
C...9	07-10152-0A	CCD 5.6PF 500.0 V NPO 10%	72982	ERIE 861 NPC 5.6PF 10%500
C..10	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..11	07-02592-0A	CCD 1.0NF 1.0KVK+-10%	84171	ARCO TYPE CCD-102
C..12	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..13	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..14	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..15	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..16	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..17	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..18	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..19	07-02449-0A	CVC 2.0-8PF 350.0 V	72982	ERIE NPO STYLE 538-011
C..20	07-02449-0A	CVC 2.0-8PF 350.0 V	72982	ERIE NPO STYLE 538-011
C..21	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..22	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..23	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..24	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
C..25	07-10112-0A	CCC 100.0NF 50.0 V CHIP	71590	CENTRLB W005FH104M
CR..1	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR..2	05-10127-0A	DHF MBD101 4V SCHOTTKY	4713	MOT
CR..3	05-10127-0A	DHF MBD101 4V SCHOTTKY	4713	MOT
L...1	03-10068-0A	CRF 1.5UH MIN. +-10%	71895	DELEVAN 1025-24 O/C
L...2	03-10067-1A	CRF COIL RF 6126M 1 GHZ CAL	50423	
P...1	31-10241-0A	CON MIN 16 PIN FEM.0.1"CEN	0	
Q...1	10-10155-0A	TRQ 2N5836 NPN 1 10V S TO46	4713	MOT
Q...2	10-10158-0A	TRQ 2N5835 NPN 1 15V S TO72	4713	MOT
Q...3	10-10158-0A	TRQ 2N5835 NPN 1 15V S TO72	4713	MOT
Q...4	10-10156-0A	TRQ MM4049 PNP 1 10V S TO72	4713	MOT
Q...7	10-10156-0A	TRQ MM4049 PNP 1 10V S TO72	4713	MOT
Q...8	10-10158-0A	TRQ 2N5835 NPN 1 15V S TO72	4713	MOT
Q...9	10-10158-0A	TRQ 2N5835 NPN 1 15V S TO72	4713	MOT
Q..10	10-10156-0A	TRQ MM4049 PNP 1 10V S TO72	4713	MOT
Q..11	10-10156-0A	TRQ MM4049 PNP 1 10V S TO72	4713	MOT
Q..12	10-10154-0A	TRQ 2N4401 NPN 1 40V S TO92	4713	MOT
Q..13	10-10156-0A	TRQ MM4049 PNP 1 10V S TO72	4713	MOT
Q..14	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
Q..15	10-10156-0A	TRQ MM4049 PNP 1 10V S TO72	4713	MOT
Q..16	10-10157-0A	TRQ BFY90 NPN 1 15V S TO72	0	SGS ATES
Q..17	10-10157-0A	TRQ BFY90 NPN 1 15V S TO72	0	SGS ATES
Q..18	10-10154-0A	TRQ 2N4401 NPN 1 40V S TO92	4713	MOT
R...1	12-12404-0A	RFF 11.0 K 250.0MW F+- 1%	16299	CGW RN55D 1102 F
R...2	12-12224-0A	RFF 178.0 250 MW F+-1%	16299	CGW RN55D 1780 F
R...3	12-12164-0A	RFF 46.4 250.0MW F+- 1%	16299	CGW RN55D 46R4 F
R...4	12-12164-0A	RFF 46.4 250.0MW F+- 1%	16299	CGW RN55D 46R4 F
R...5	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R...6	12-12340-0A	RFF 2.61K 250.0MW F+- 1%	16299	CGW RN55D 2611 F
R...7	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
R...8	12-12208-0A	RFF 121.0 250.0MW F+- 1%	16299	CGW RN55D 1210 F
R...9	12-12208-0A	RFF 121.0 250.0MW F+- 1%	16299	CGW RN55D 1210 F
R..17	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R..18	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R..19	12-12280-0A	RFF 681.0 250 MW F+-1%	16299	CGW RN55D 6810 F
R..20	12-12132-0A	RFF 21.5 250.0MW F+- 1%	16299	CGW RN55D 21R5 F
R..21	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R..22	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
R..23	12-12232-0A	RFF 215.0 250 MW F+-1%	16299	CGW RN55D 2150 F
R..24	12-12208-0A	RFF 121.0 250.0MW F+- 1%	16299	CGW RN55D 1210 F
R..25	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
R..26	12-12208-0A	RFF 121.0 250.0MW F+- 1%	16299	CGW RN55D 1210 F
R..27	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R..28	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R..29	12-12132-0A	RFF 21.5 250.0MW F+- 1%	16299	CGW RN55D 21R5 F
R..31	12-12308-0A	RFF 1.21K 250 MW F+-1%	16299	CGW RN55D 17'1 F
R..32	12-12308-0A	RFF 1.21K 250 MW F+-1%	16299	CGW RN55D 1211 F
R..33	12-12308-0A	RFF 1.21K 250 MW F+-1%	16299	CGW RN55D 1211 F
R..34	12-12308-0A	RFF 1.21K 250 MW F+-1%	16299	CGW RN55D 1211 F
R..35	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R..36	12-12132-0A	RFF 21.5 250.0MW F+- 1%	16299	CGW RN55D 21R5 F
R..37	12-12208-0A	RFF 121.0 250.0MW F+- 1%	16299	CGW RN55D 1210 F
R..38	12-12208-0A	RFF 121.0 250.0MW F+- 1%	16299	CGW RN55D 1210 F
R..39	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R..40	12-12328-0A	RFF 1.96K 250.0MW F+- 1%	16299	CGW RN55D 1961 F
R..41	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R..42	12-12328-0A	RFF 1.96K 250.0MW F+- 1%	16299	CGW RN55D 1961 F
R..43	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
R..44	12-12388-0A	RFF 8.25K 250.0MW F+- 1%	16299	CGW RN55D 8251 F
R..45	12-09839-0A	RFC 5.1 250.0MW J+- 5%	75042	IRC TYP
R..46	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R..47	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
R..48	12-12468-0A	RFF 51.1 K 250.0MW F+- 1%	16299	CGW RN55D 5112 F
R..50	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R..51	12-12208-0A	RFF 121.0 250.0MW F+- 1%	16299	CGW RN55D 1210 F
R..52	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R..53	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R..54	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
R..55	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R..56	12-12388-0A	RFF 8.25K 250.0MW F+- 1%	16299	CGW RN55D 8251 F
R..57	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R..58	12-12208-0A	RFF 121.0 250.0MW F+- 1%	16299	CGW RN55D 1210 F
R..59	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
R..60	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R..61	12-09839-0A	RFC 5.1 250.0MW J+- 5%	75042	IRC TYP
R..62	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
R..63	12-12232-0A	RFF 215.0 250 MW F+-1%	16299	CGW RN55D 2150 F
R..64	12-12328-0A	RFF 1.96K 250.0MW F+- 1%	16299	CGW RN55D 1961 F
R..65	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R..66	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R..67	12-12328-0A	RFF 1.96K 250.0MW F+- 1%	16299	CGW RN55D 1961 F
R..68	12-12100-0A	RFF 10.0 250.0MW F+- 1%	16299	CGW RN55D 10R0 F
R..69	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
R..70	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R..71	12-12232-0A	RFF 215.0 250 MW F+-1%	16299	CGW RN55D 2150 F
R..72	12-12168-0A	RFF 51.1 250.0MW F+- 1%	16299	CGW RN55D 51R1 F
U...2	24-10156-0A	ICP LM741CN OP.AMP	12040	NATL.SEMI LM741CN
U...3	24-10212-0A	ICP CA3140E FET OP AM MINDIP	86684	RCA CA3140G FET OPAMP MINIDIP
X...2	24-10305-0A	MOD FREQ DOUBLER 1GHZ	0	MINI-CIRCUITS LAB. RK-2

FAST RISE OUTPUTS & 1 GHz MULT

89-10966-1A





IC	GND PIN	+5V PIN
U1	7	14
U4	8	16
U5	8	5,16

NOTES:

1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS OTHERWISE NOTED.
2. DENOTES LOCAL GROUND.
3. ⟶ DENOTES CONTACT OF A117P1.

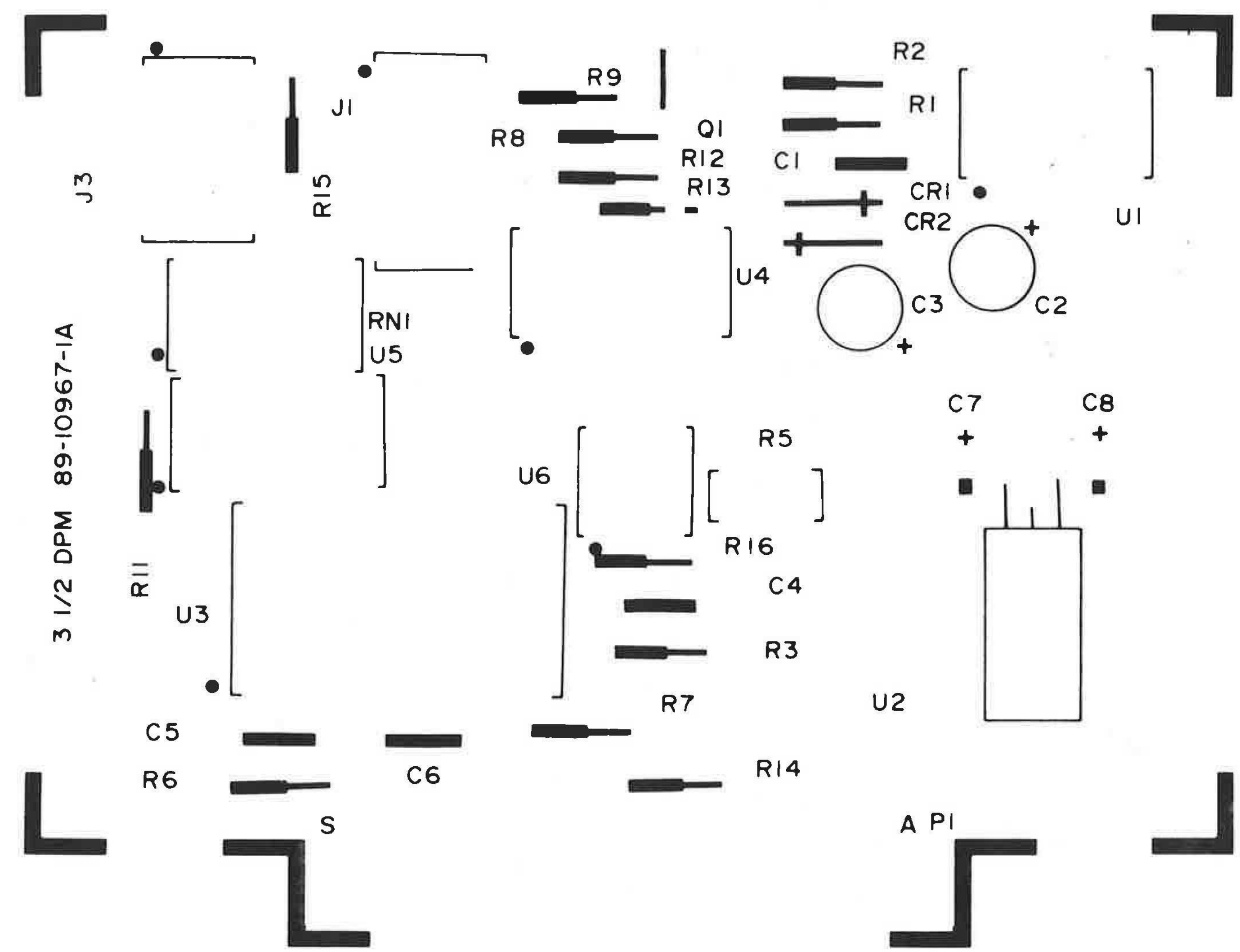
Figure 6-18. A117 6126M Display Driver Board

PARTS LIST, A117 DISPLAY DRIVER

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10340-0A	CBM 22.0NF 400.0 V +-10%	80031	MEPCO C280MCF/A22K
C...2	07-10492-0A	CEA 47.0UF 16.0 V	0	CAPAR CRE SERIES 47UF 16V
C...3	07-10492-0A	CEA 47.0UF 16.0 V	0	CAPAR CRE SERIES 47UF 16V
C....4	07-10430-0A	CBM 220.0NF 100.0 VK	80031	MEPCO C280 MAH/A220K
C...5	07-10339-0A	CBM 100.0NF 100.0 V +-10%	80031	MEPCO C280MCH/A100K
C...6	07-10339-0A	CBM 100.0NF 100.0 V +-10%	80031	MEPCO C280MCH/A100K
C...7	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C...8	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
CR..1	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR..2	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
Q...1	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
R...1	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R...2	12-12368-0A	RFF 5.11K 250.0MW F+- 1%	16299	CGW RN55D 5111 F
R...3	12-12268-0A	RFF 511.0 250 MW F+-1%	16299	CGW RN550 5110 F
R....5	09-10092-0A	RVF 50.0 K 500.0MW KVERT MT	73138	HELIPOT 72XW 50K
R...6	12-12442-0A	RFF 27.4 K 250.0MW F+- 1%	16299	CGW RN55D 2742 F
R...7	12-12546-0A	RFF 301.0 K 250.0MW F+- 1%	16299	CGW RN55D 3013 F
R...8	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R...9	12-12136-0A	RFF 23.7 250.0MW F+- 1%	16299	CGW RN55D 23R7 F
R..11	12-12368-0A	RFF 5.11K 250.0MW F+- 1%	16299	CGW RN55D 5111 F
R..12	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R..13	12-12368-0A	RFF 5.11K 250.0MW F+- 1%	16299	CGW RN55D 5111 F
R..14	12-12267-0A	RFF 499.0 250.0MW F+- 1%	16299	CGW RN55D 4990 F
R..15	12-12152-0A	RFF 34.8 250.0MW F+- 1%	16299	CGW RN55D 34R8 F
R..16	12-12572-0A	RFF 562.0 K 500.0MW F+- 1%	16299	CGW RN60D 5623 F
RN..1	13-10046-0A	RNF 47.0 14 PIN DIP 7 RES.	80053	BECKMAN 899-3-R47
U...1	24-10249-0A	ICP 74C90L HEX INV TT2 BUFFE	12040	NATIONAL MM74C901N
U...2	24-10153-0A	ICP UA7805 5V REG.	7263	FCH UGH7805393
U...3	24-10304-0A	ICP MC14433P 3 1/2 DGT A/D	0	MOT CMOS LSI
U...4	24-10188-0A	ICP 9667 7 DARLINGTON DRIVE	7263	FAIRCHILD 9667PC
U...5	24-10186-0A	ICP 74C48 7 SEGMENT DRIVE	0	NATIONAL MM74048N
U...6	24-10313-0A	ICP MC1403U V REF	0	MOTOROLA 1403U

PARTS LIST, A24 DPM DISPLAY

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R.400	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R.401	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R.402	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F



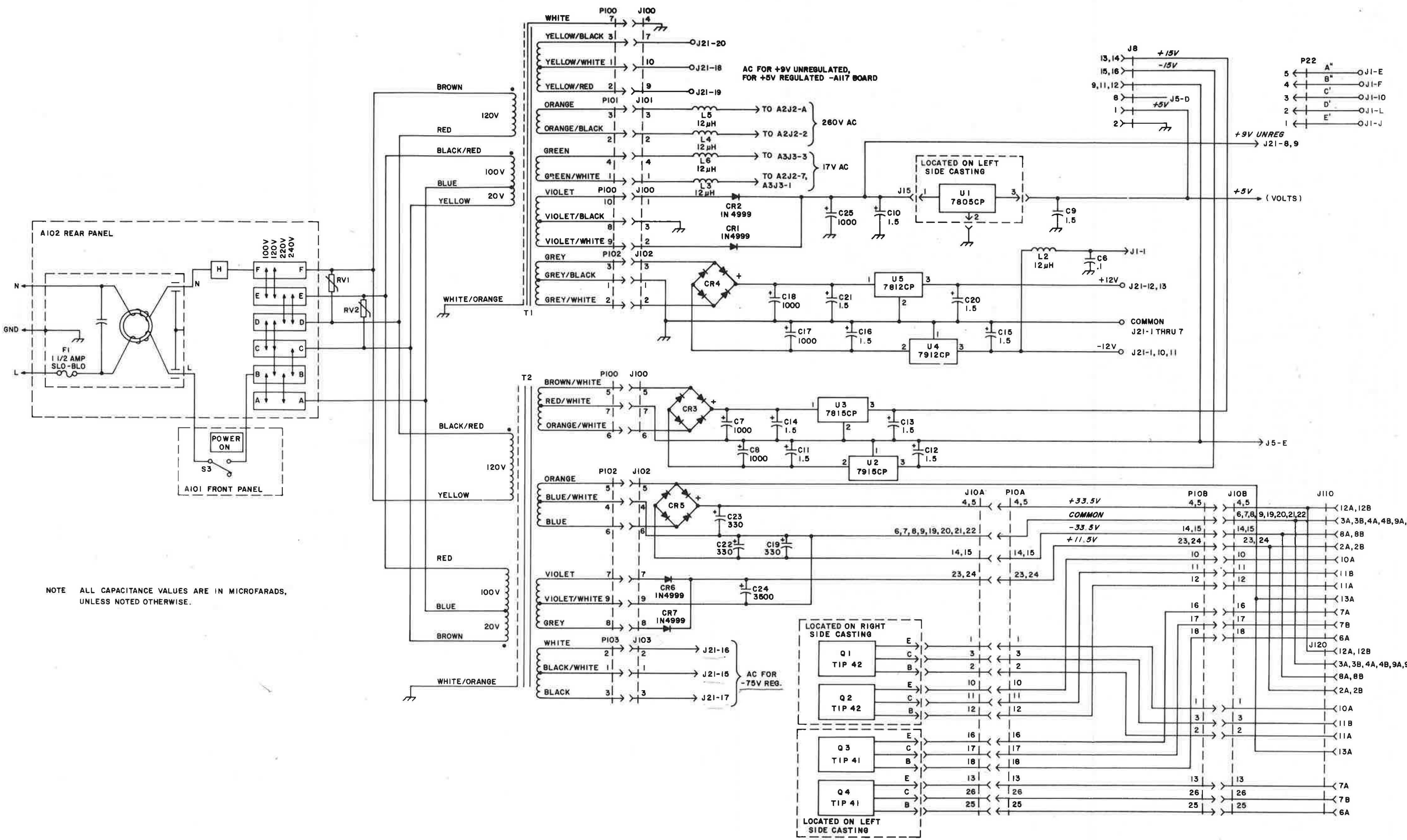
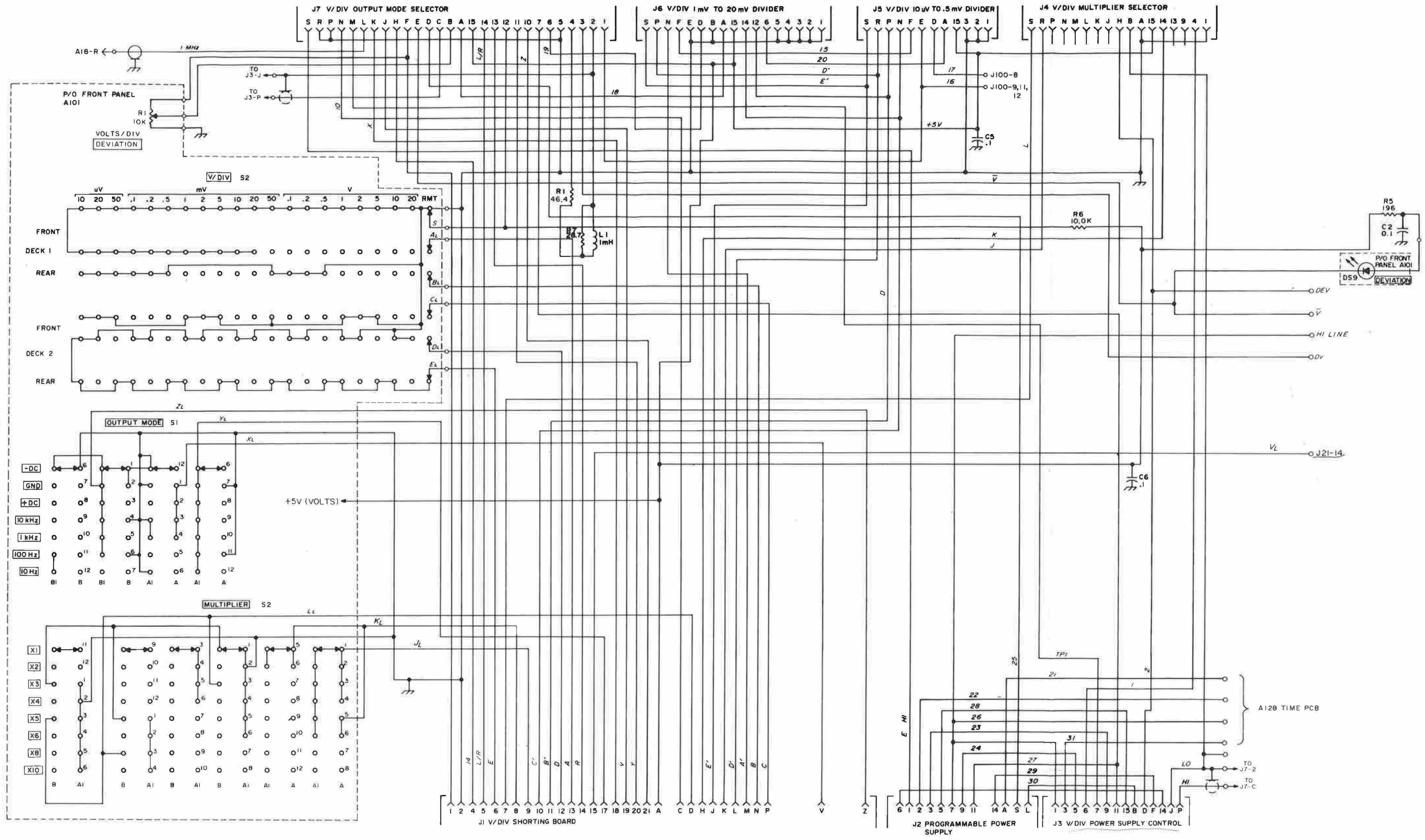


Figure 6-19. A126-1 6126M Interconnect, Volts


C25
U1
C9
C10
CR1
CR2
CR3
J100
C8
C11
C12
U3
U2
C13
C14
C7
C15
C16
U4
C17
C18
J101
L2 THRU L6
L2
C6
C1
A1
J1
C20
C21
U5
CR4
CR5
J102
C19
C23
C22
CR6
CR7
C24
Q4
Q3
J10
Q1
Q2
J103
A2
J2
A3
J3
A4
J4
C5
A5
J5
A6
J6
L1
R1
R7
A7
J7
V/DIV MOTHER BOARD INTERCONNECTION
ASS'Y NO 89-10968-1A
A8
J8
R5
R6
C3
J9
S1
C2
S2

PARTS LIST, A126 INTERCONNECT – VOLTS

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...2	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...3	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...5	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...6	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C...6	07-20094-0A	CCD .1UF 25.0 V +-20%	91418	M25-1
C...7	07-10422-0A	CEA1000.0UF 25.0 V -10+50%	80031	MEPCO ET102X025A03
C...8	07-10422-0A	CEA1000.0UF 25.0 V -10+50%	80031	MEPCO ET102X025A03
C...9	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..10	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..11	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..12	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..13	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..14	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..15	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..16	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..17	07-10422-0A	CEA1000.0UF 25.0 V -10+50%	80031	MEPCO ET102X025A03
C..18	07-10422-0A	CEA1000.0UF 25.0 V -10+50%	80031	MEPCO ET102X025A03
C..19	07-10252-0A	CEA 330.0UF 63.0 V -10+50%	73445	AMPEREC ET331X063AD3
C..20	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..21	07-10083-0A	CET 1.5UF 35.0 V	56289	SPRAGUE 1960155X0035A3
C..22	07-10252-0A	CEA 330.0UF 63.0 V -10+50%	73445	AMPEREC ET331X063AD3
C..23	07-10252-0A	CEA 330.0UF 63.0 V -10+50%	73445	AMPEREC ET331X063AD3
C..24	07-10263-0A	CEA 3.5MF 25.0 V -10+100	73445	MEPCO 23C25TS352
C..25	07-10440-0A	CEA1000.0UF 16.0 V	0	CAPAR CRE 1000UF/16V
CR..1	05-10027-0A	DRP 1N4999 200 3A	4713	MOT SI
CR..2	05-10027-0A	DRP 1N4999 200 3A	4713	MOT SI
CR..3	05-10006-0A	DGP WO4M 4000 1.5A	4713	GIC
CR..4	05-10006-0A	DGP WO4M 4000 1.5A	4713	GIC
CR..5	05-10006-0A	DGP WO4M 4000 1.5A	4713	GIC
CR..6	05-10027-0A	DRP 1N4999 200 3A	4713	MOT SI
CR..7	05-10027-0A	DRP 1N4999 200 3A	4713	MOT SI
J...1	31-10162-0A	CON 22 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-22221-110
J...2	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J...3	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J...4	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J...5	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J...6	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J...7	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J..10	31-10213-0A	CON SLIM LINE 26 PIN MALE	0	BERG SLIM # 65692-014
J.100	31-10242-0A	CON MIN 16 PIN MALE 0.1"CEN	29587	AMP 87227-8
L...1	03-10053-0A	CIL 1.0 MH INDUCTOR	71895	DELAVAN #3500-32
L...2	03-10006-0A	CRF 12UH MOLDED +- 10%	76493	MILLER #9230-46
L...3	03-10006-0A	CRF 12UH MOLDED +- 10%	76493	MILLER #9230-46
L...4	03-10006-0A	CRF 12UH MOLDED +- 10%	76493	MILLER #9230-46
L...5	03-10006-0A	CRF 12UH MOLDED +- 10%	76493	MILLER #9230-46
L...6	03-10006-0A	CRF 12UH MOLDED +- 10%	76493	MILLER #9230-46
R...1	12-12164-0A	RFF 46.4 250.0MW F+- 1%	16299	CGW RN55D 46R4 F
R...2	12-12228-0A	RFF 196.0 250 MW F+-1%	16299	CGW RN55D 1960 F
R...3	12-12228-0A	RFF 196.0 250 MW F+-1%	16299	CGW RN55D 1960 F
R...4	12-12228-0A	RFF 196.0 250 MW F+-1%	16299	CGW RN55D 1960 F
R...5	12-12228-0A	RFF 196.0 250 MW F+-1%	16299	CGW RN55D 1960 F
R...6	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	16299	CGW RN55D 1002 F
R...7	12-12144-0A	RFF 28.7 250.0MW F+- 1%	16299	CGW RN55D 28R7 F
S...1	25-10131-1A	SWC 6125B FUNCTION-VOLTS	50423	
S...2	25-10132-1A	SWC 6125B MULTIPLIER-VOLTS	50423	
U...1	24-10153-0A	ICP UA7805 5V REG.	7263	FCH UGH7805393
U...2	24-10228-0A	ICP 7915 15V NEG REG TO-220	4713	MOT MC7915CP O/E
U...3	24-10052-0A	ICP LM340T-15 15 VOLT REG	27014	NATL SEMI LM30T-15 OR EQV
U...4	24-10258-0A	ICP 7912 -12V REG 1 AMP	12040	NAT LM7912 OR EQUAL
U...5	24-10147-0A	ICP MC7812CP 12V 1AM REG	4713	MOT MC78126



NOTE: ALL RESISTANCE VALUES ARE IN OHMS, AND ALL CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS NOTED OTHERWISE.

Figure 6-20. A126-2 6126M Interconnect, Volts

NOTES:

1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS OTHERWISE NOTED.
2. ⟶ DENOTES CONTACT OF A127 P1.
3. ALL RESISTOR VALUES ARE FOR 1% RESISTORS, UNLESS OTHERWISE NOTED.

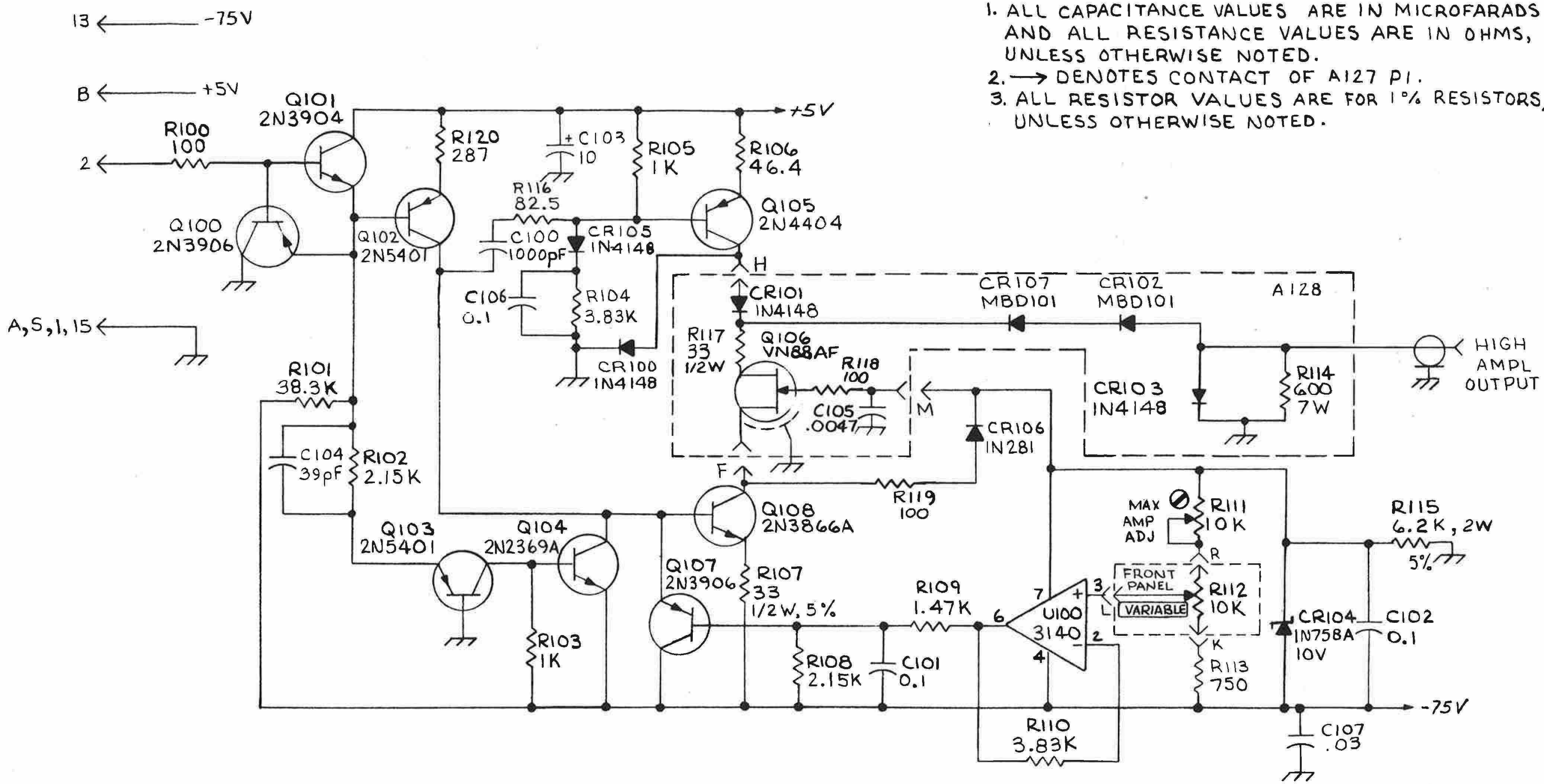
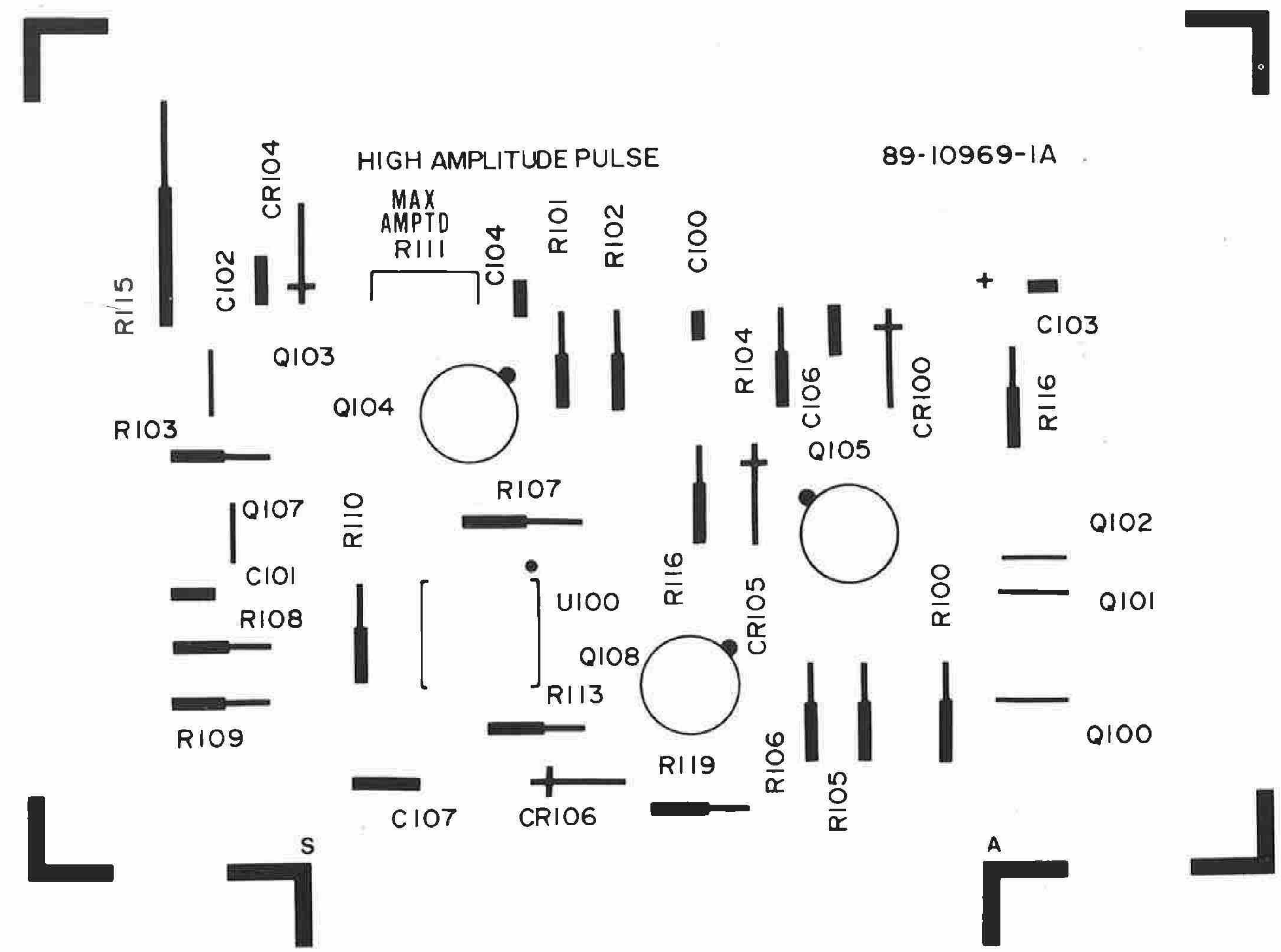
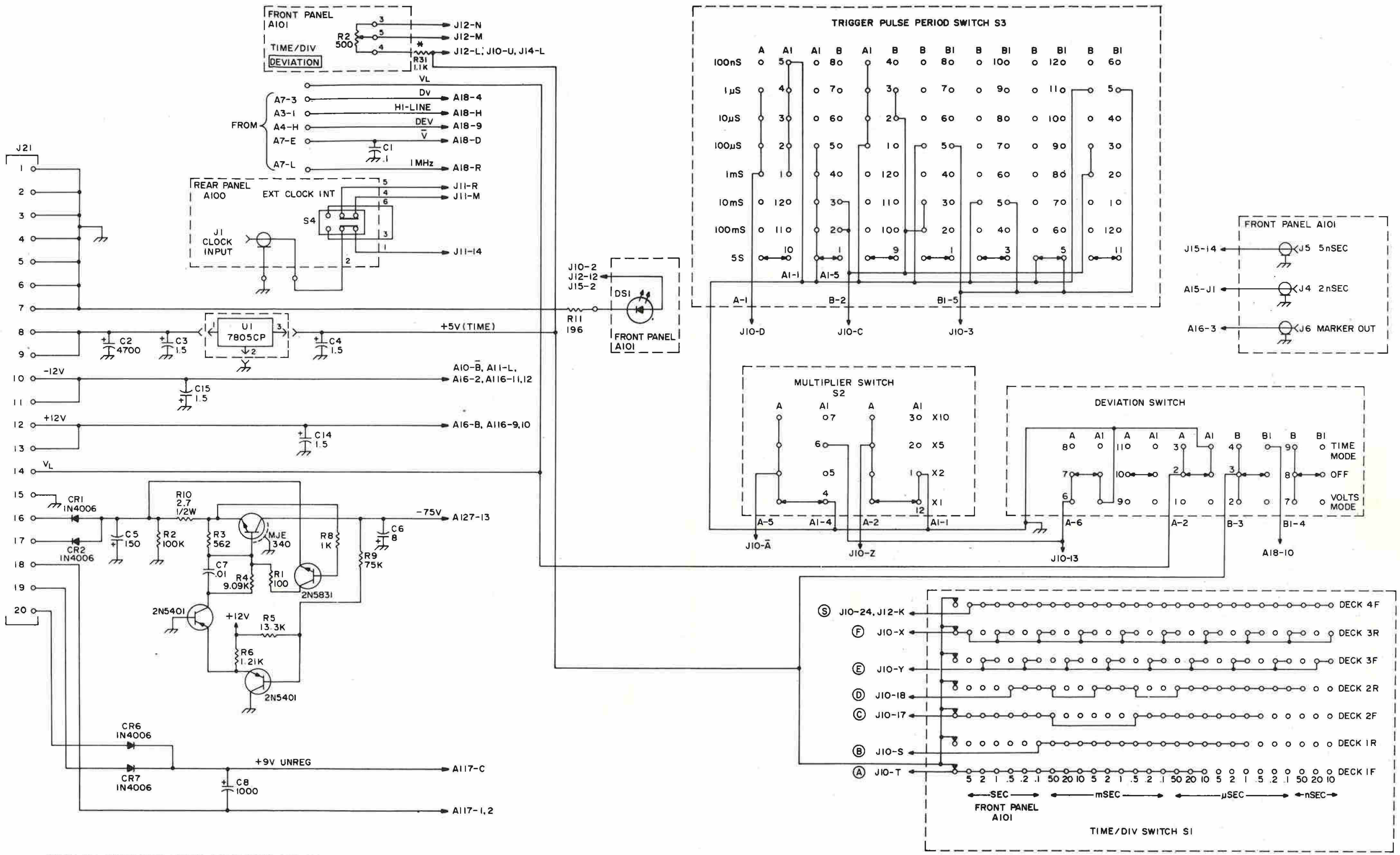


Figure 6-21. A127 6126M High Amplitude Pulse Generator

PARTS LIST, A127 HIGH AMPLITUDE PULSE GENERATOR – TIME

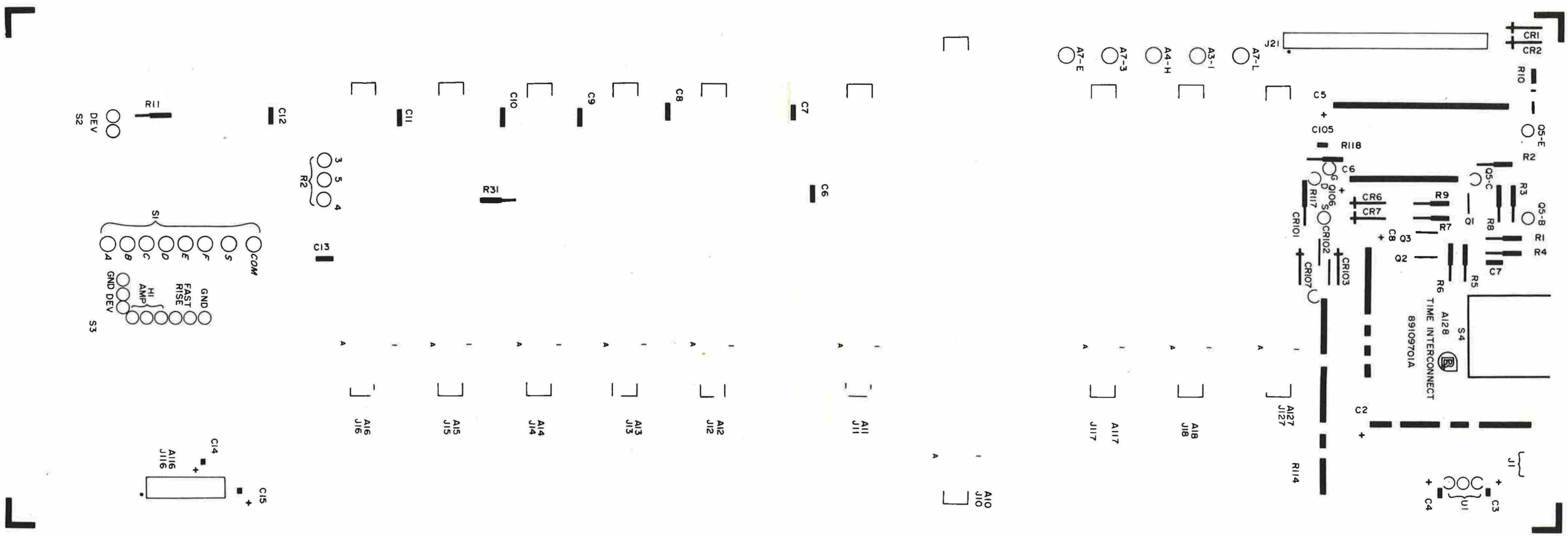
SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C.100	07-02592-0A	CCD 1.0NF 1.0KVK+-10%	84171	ARCO TYPE CCD-102
C.101	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C.102	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C.103	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C.104	07-10366-0A	CMD 39.0PF 500.0 VF	5301	SANGAMO CM05ED390F03
C.106	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	0	AVX CERAMICS MD015E104ZAA
C.107	07-09588-0A	CCD 30 NF 100 V M 20%	56289	SPG TYP TG-530
CR100	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR104	05-10035-0A	DZG 1N 758A 10 20M .4	4713	MOT SI
CR105	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR106	05-10025-0A	DGP 1N 281 75 1A.08	15238	ITT GE D07
Q.100	10-09473-0A	TRQ 2N3906 PNP 1 40 PTO-92	4713	MOT 1 200M 60
Q.101	10-10043-0A	TRQ 2N3904 NPN 1 40 PTO-92	4713	MOT 1 300M 40
Q.102	10-1[illegible]42-0A	TRQ 2N5401 PNP 1 160 TO-920	4713	MOTOROLA
Q.103	10-10142-0A	TRQ 2N5401 PNP 1 160 TO-920	4713	MOTOROLA
Q.104	10-10001-0A	TRQ 2N2369 NPN 1 15 MTO-18	4713	MOT 1.2 500M 20
Q.105	10-10160-0A	TRQ 2N4404 PNP 1 80V S TO-5	4713	MOT
Q.107	10-09473-0A	TRQ 2N3906 PNP 1 40 PTO-92	4713	MOT 1 200M 60
Q.108	10-10159-0A	TRQ 2N3866ANPN 1 55V S TO-5	4713	MOT
R.100	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R.100	24-10212-0A	ICP CA3140E FET OP AM MINDIP	86684	RCA CA3140G FET OPAMP MINIDIP
R.101	12-12456-0A	RFF 38.3 K 250.0MW F+- 1%	16299	CGW RN55D 3832 F
R.102	12-12332-0A	RFF '2.15K 250.0MW F+- 1%	16299	CGW RN55D 2151 F
R.103	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R.104	12-12356-0A	RFF 3.83K 250.0MW F+- 1%	16299	CGW RN55D 3831 F
R.105	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R.106	12-12164-0A	RFF 46.4 250.0MW F+- 1%	16299	CGW RN55D 46R4 F
R.107	12-01073-0A	RFC 33.0 500.0MW J+- 5%	1121	A-B TYP EB
R.108	12-12332-0A	RFF 2.15K 250.0MW F+- 1%	16299	CGW RN55D 2151 F
R.109	12-12316-0A	RFF 1.47K 250 MW F+-1%	16299	CGW RN55D 1471 F
R.110	12-12356-0A	RFF 3.83K 250.0MW F+- 1%	16299	CGW RN55D 3831 F
R.111	09-10008-0A	RVF 10.0 K 0.5 W K+-10%	73138	HEL TYP 72PM
R.113	12-12284-0A	RFF 750.0 250 MW F+-1%	16299	CGW RN550D 7500 F
R.115	12-13217-0A	"RFC 6.2K 2.0 W +-5%	0	ALLEN BRADLEY TYPE HB
R.116	12-12188-0A	RFF 82.5 250.0MW F+- 1%	16299	CGW RN55D 82R5 F
R.119	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R.120	12-12244-0A	RFF 287.0 250 MW F+-1%	16299	CGW RN55D 2870 F





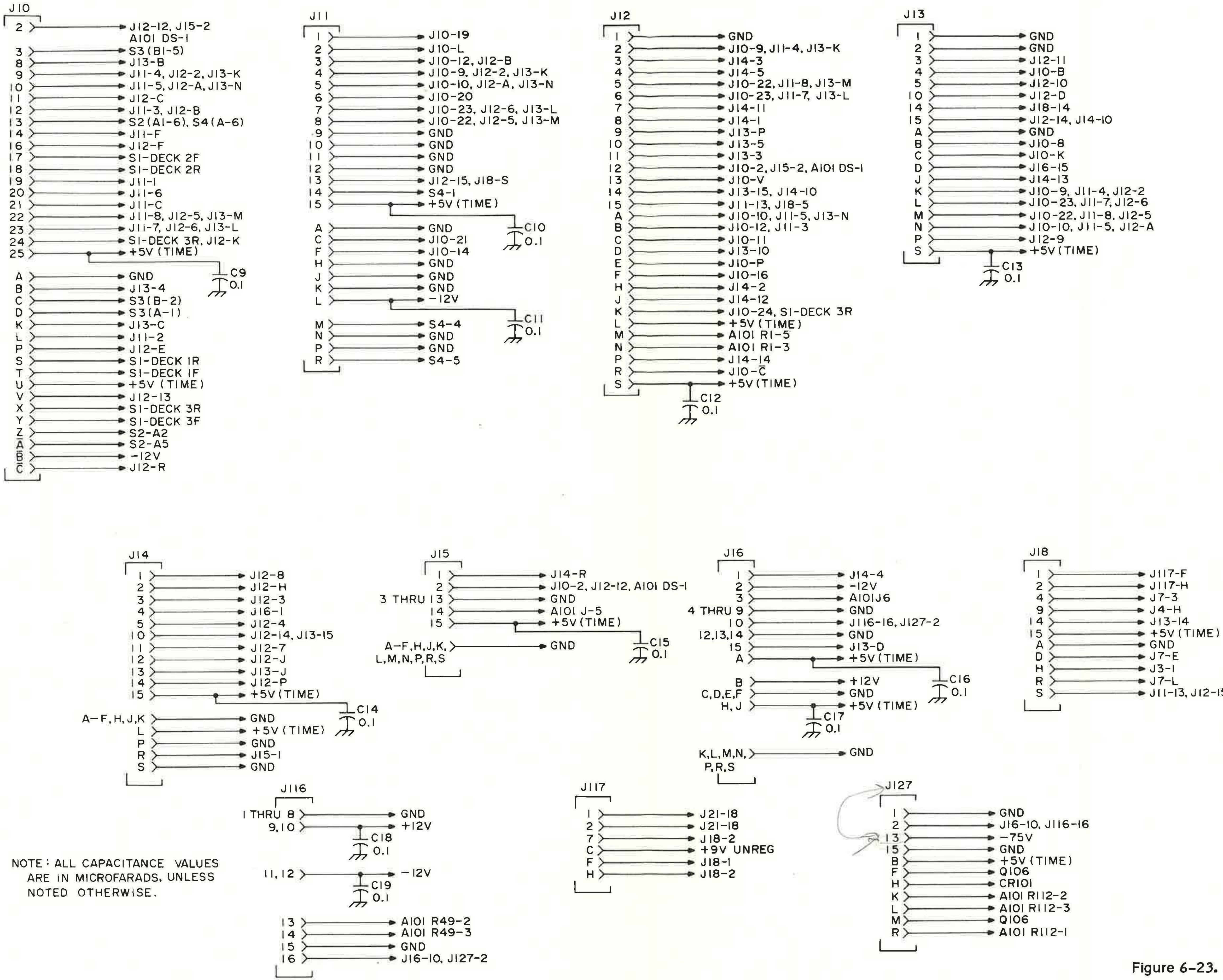
NOTE: ALL RESISTANCE VALUES ARE IN OHMS, AND ALL CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS NOTED OTHERWISE.

Figure 6-22. A128-1 6126M Interconnect, Time


A128
TIME INTERCONNECT
89109701A
J21
CR1
CR2
R10
C5
C105
R118
C6
Q106
R117
CR101
CR102
CR103
CR107
CR6
CR7
R9
R7
Q1
Q2
Q3
C8
R6
R5
R8
R3
R2
R1
R4
C7
Q5-E
Q5-C
Q5-B
S4
C2
R114
J1
U1
C3
C4
A7-E
A7-3
A4-H
A3-I
A7-L
A127
J127
A18
J18
A117
J117
A10
J10
A11
J11
A12
J12
A13
J13
A14
J14
A15
J15
A16
J16
C6
C7
C8
C9
C10
C11
C12
C13
R31
R2
R11
S2
DEV
S1
A
B
C
D
E
F
S
COM
S3
GND DEV
HI AMP
FAST RISE
GND
A116
J116
C14
C15

PARTS LIST, A128 INTERCONNECT – TIME

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C...2	07-10425-0A	CEA4700.0UF 16.0 V -10+50%	50423	
C...3	07-10254-0A	CET 1.5UF 35.0 VK	56289	SPRAG 196D155X9035JA1 EQV
C...4	07-10254-0A	CET 1.5UF 35.0 VK	56289	SPRAG 196D155X9035JA1 EQV
C...5	07-10568-0A	CEA 150.0UF 150.0 V +50%-10%	80031	MEPCO #3050JJ151T150
C...6	07-10420-0A	CEA 8.0PF 350.0 V-10+50%	80031	MEPCO C436AR/P8
C...7	07-10123-0A	CCR 10. NF 500. VM	56289	SPRAGUE 5GAB-S10
C...8	07-10422-0A	CEA1000.0UF 25.0 V -10+50%	80031	MEPCO ET102X025A03
C...9	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C..10	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C..11	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C..12	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C..13	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C..14	07-10254-0A	CET 1.5UF 35.0 VK	56289	SPRAG 196D155X9035JA1 EQV
C..15	07-10254-0A	CET 1.5UF 35.0 VK	56289	SPRAG 196D155X9035JA1 EQV
C..16	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C..17	07-09589-0A	CCD 100 NF 12 V M 20%	90201	RMC TYP M-12-0.1
C.105	07-10037-0A	CCD 4.7NF 1.0 KV DC	84171	ELMENCO TYPE CCD472
CR..1	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..2	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..6	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR..7	05-08058-0A	DGP 1N4006 400 1A	15238	ITT SI D046
CR101	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR102	05-10127-0A	DHF MBD101 4V SCHOTTKY	4713	MOT
CR103	05-10049-0A	DGP 1N4148 100 10M	1295	TI SI D035 4 5 JAN
CR107	05-10127-0A	DHF MBD101 4V SCHOTTKY	4713	MOT
J..10	31-10161-0A	CON 25 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-22521-110
J..11	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J..12	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J..13	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J..14	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J..15	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J..16	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J..17	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J..18	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
J..21	79-10052-0A	CBL FLEX STRIP 10 LINES 2IN	15912	ANSLEY FST -22A-10
J.127	31-10163-0A	CON 15 PIN CARD EDGE PC TYPE	2260	AMPHENOL 225-21521-110
Q...1	10-10011-0A	TRQ 2N5831 NPN 1 140 PT0-9	7263	FCH 1 100M 80
Q...2	10-10142-0A	TRQ 2N5401 PNP 1 160 TO-920	4713	MOTOROLA
Q...3	10-10142-0A	TRQ 2N5401 PNP 1 160 TO-920	4713	MOTOROLA
Q...5	10-09478-0A	TRQ MJE340 NPN 1 300 P	4713	MOT 20.8 30
Q...6	10-10161-0A	TRQ VN88AF VMOS 1 80V S TO20	0	SILICONIX
R...1	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
R...2	12-01026-0A	RFC 100.0 K 500.0MW J+- 5%	1121	A-B TYP EB
R...3	12-12272-0A	RFF 562.0 250 MW F+-1%	16299	CGW RN55D 5620 F
R...4	12-12392-0A	RFF 9.09K 250.0MW F+- 1%	16299	CGW RN55D 9091 F
R...5	12-12412-0A	RFF 13.3 K 250.0MW F+- 1%	16299	CGW RN55D 1332 F
R...6	12-12308-0A	RFF 1.21K 250 MW F+-1%	16299	CGW RN55D 1211 F
R...7	12-12476-0A	RFF 61.9 K 250.0MW F+- 1%	16299	CGW RN55D 6192 F
R...8	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R...9	12-12484-0A	RFF 75.0 K 250.0MW F+- 1%	16299	CGW RN55D 7502 F
R..10	12-12936-0A	RFC 2.7 500.0MW J+- 5%	1121	AB-EB
R..11	12-12228-0A	RFF 196.0 250 MW F+-1%	16299	CGW RN55D 1960 F
R.114	12-13211-0A	RFW 600.0 10.0W NI	0	RCD 175X-00-600-1%
R.117	12-01073-0A	RFC 33.0 500.0MW J+- 5%	1121	A-B TYP EB
R.118	12-12200-0A	RFF 100.0 250.0MW F+- 1%	16299	CGW RN55D 1000 F
S...1	25-10130-1A	SWC 6125B MULTIPLIER-TIME	50423	
S...2	25-10134-1A	SWC 6125C DEVIATION 10%	50423	
S...3	25-10129-1A	SWC 6125B TRIG.PERIOD-TIME	50423	
S...4	25-10062-0A	SWC SLIDE PC RT ANGLE DPDT	78488	SS-70-5PN785040
U...1	24-10153-0A	ICP UA7805 5V REG.	7263	FCH UGH7805393



NOTE: ALL CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS NOTED OTHERWISE.

Figure 6-23. A128-2 6126M Interconnect, Time

SECTION 7

ACCESSORIES

7-1. GENERAL

7-2. This section contains information regarding the accessories that are supplied with the 6126M. Included are specifications and operating instructions for the Model 10800C High Voltage Probe and the Model 61252A Tunnel Diode Pulser.

7-3. DC HIGH VOLTAGE PROBE MODEL 10800C

7-4. General. The Ballantine Model 10800C Dc High Voltage Probe, shown in Figure 7-1, is used to provide capability to ±40,000 volts. The probe has a division ratio of 1000:1 and features a ±5% adjustment range for precise calibration at any voltage input.

7-5. SPECIFICATIONS

Voltage Range: ± 1 kV to ± 40 kV

Input Resistance: 1000 megohms

Division Ratio: 1000:1

*Accuracy: ± 4% @ 1 kV
± 3% @ 10 kV
± 2% @ 20 kV
± 1% @ 25 kV
± 2% @ 30 kV
± 4% @ 40 kV

Maximum Input: ± 40 kV peak

*Total Accuracy of DMM and Probe (From 0 to 80% Relative Humidity.)

WARNING

BEFORE CONNECTING THE HV PROBE, CONNECT THE GROUND-LEAD CLIP OF THE PROBE SECURELY TO THE GROUND (LO) OF THE CIRCUIT UNDER TEST. FAILURE TO OBSERVE THIS PRECAUTION WILL APPLY FULL HIGH VOLTAGE TO THE INSTRUMENT WHICH MAY CAUSE SHOCK AND INSTRUMENT DAMAGE. THE GROUND-LEAD VOLTAGE MUST NOT EXCEED ± 1200 VOLTS PEAK TO THE POWERLINE EARTH GROUND. HANDLE THE PROBE ONLY AT ITS BLACK HANDLE AND AVOID CONTACT WITH THE FLASH GUARD AND TIP AREA.

7-6. OPERATING PROCEDURE

a. Turn the 6126M POWER switch to ON and select the 2 V DC position of the RANGE/FUNCTION switches on the DM501A, DMM for operation to ±2 kV; the 20 V range for operation to ±20 kV; or the 200 V range for operation up to ±40 kV.

b. Plug the termination of the 10800C probe into the VOLTS/Ω and LOW connectors of the instrument, making sure that the red marked banana plug of the termination mates with the VOLTS/Ω connector of the instrument.

c. Connect the ground-lead clip of the probe to the ground (Low) of the circuit under test.

d. Connect the probe tip to the circuit under test.

e. Turn the equipment on to apply the signal and read the instrument display.

7-7. CALIBRATION

a. Turn the 6126M POWER switch to ON and select the 2 V DC position of the RANGE/FUNCTION switches.

b. Plug the 10800C probe termination into the VOLTS/Ω and LOW connectors of the instrument, making sure that the red marked banana plug of the termination mates with the VOLTS/Ω connector of the instrument.

c. Remove the four screws from the cover of the probe termination box and remove the cover to gain access to the potentiometer, R1.

d. Connect the ground-lead clip of the probe to the ground of the Fluke Model 332B Dc Voltage Standard.

e. Connect the probe tip to the HI output of the Model 332B.

f. Apply ±1000.00 Volts.

g. Use an insulated screwdriver and adjust R1 for a DMM display of .999 to 1.001.

NOTE

Calibration may be performed at any voltage to 40 kV using other voltage standards and DMM ranges.

h. Replace the cover of the probe termination box and secure it with the four screws.

7-8. Schematic Diagram. A schematic diagram of the Model 10800C Dc High Voltage Probe is shown in Figure 7-2.

TABLE 7-1. PARTS LIST, MODEL 10800C DC HIGH VOLTAGE PROBE

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 1	09101640A	RVF 500.0 K 250 MW K CERMET	73138	HELIPOT 72XW VERT MT
R 2	12125950A	RFF 976.0 K 500 MW F+-1%	16299	CGW RN60D9763F
---	85100570A	PROBE BODY AND RESISTOR ASS'Y	50423	
---	79071410A	CBL 20-1 CONDUCTOR PLASTIC	92194	ALPHA NO. 1706
---	79045230A	WIRE, TEST LEAD, BLK	50423	
---	49044360A	ALLIGATOR CLIP	76545	MUELLER NO. 60

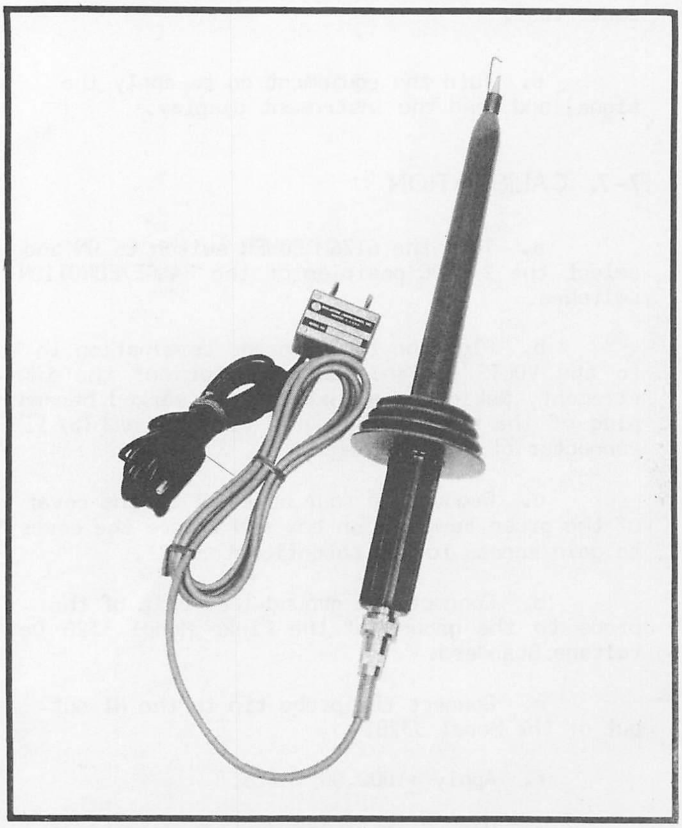


Figure 7-1. Model 10800C DC High Voltage Probe

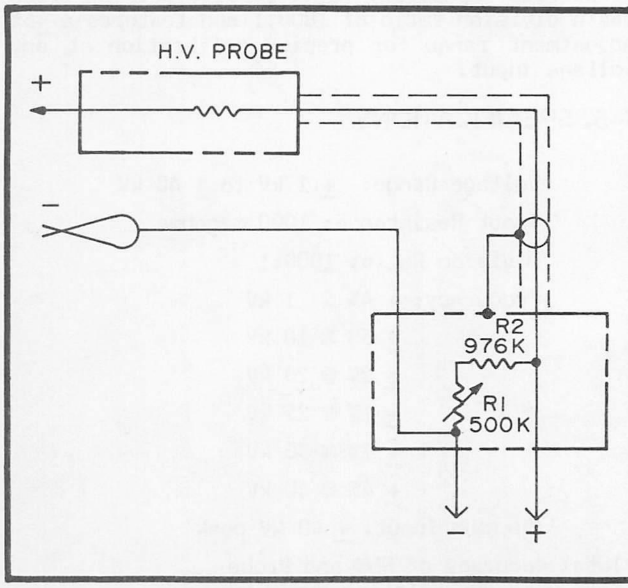


Figure 7-2. Model 10800C DC High Voltage Probe, Schematic Diagram

7-9. MODEL 61252A TUNNEL DIODE PULSER

7-10. The Model 61252A Tunnel Diode Pulser, shown in Figure 7-3, when connected to the VOLTS OUT connector of the 6126M, provides a clean fast-rise pulse for checking the transient response of oscilloscopes up to 1 GHz bandwidth.

7-11. SPECIFICATIONS

a. Input Signal

Amplitude: ± 60 to 100 Volt wave at 11 mA min.

Min. Freq.: 50 Hz

Max. Freq.: Approx. 100 kHz

b. Output Signal

Amplitude: Approx. 250 mV pulses into 50 Ω .

Risetime: ≲ 125 ps

Abberations: < 1% in 1 GHz system

7-12. Refer to Figure 7-4 for a schematic diagram of the Model 61252A Tunnel Diode (TD) Pulser. See Table 7-2 for a list of replaceable parts.

7-13. OPERATING PROCEDURE

7-14. Always set the TRIGGERED LEVEL control (R1) to the minimum position that will provide a fast-rise output. If the control is adjusted above this minimum triggering position, it will cause the step to deviate as much as 5% from the ideal.

7-15. When checking oscilloscopes having a 1 Megohm input impedance, terminate the TD Pulser into a 50 Ω Feed-thru such as the Ballantine 12630A.

7-16. Connect the Model 61252A Tunnel Diode Pulser OUTPUT to the oscilloscope, either directly or through a 50 Ω termination. Connect the TD Pulser INPUT to the VOLTS OUT BNC of the 6126M via a coax cable such as the Ballantine Type 12249D.

7-17. Adjust the VOLTS/DIV and MULTIPLIER switches to provide an output level between 60 and 100 V. Select a squarewave of 100 Hz, 1 kHz or 10 kHz using the OUTPUT MODE switch.

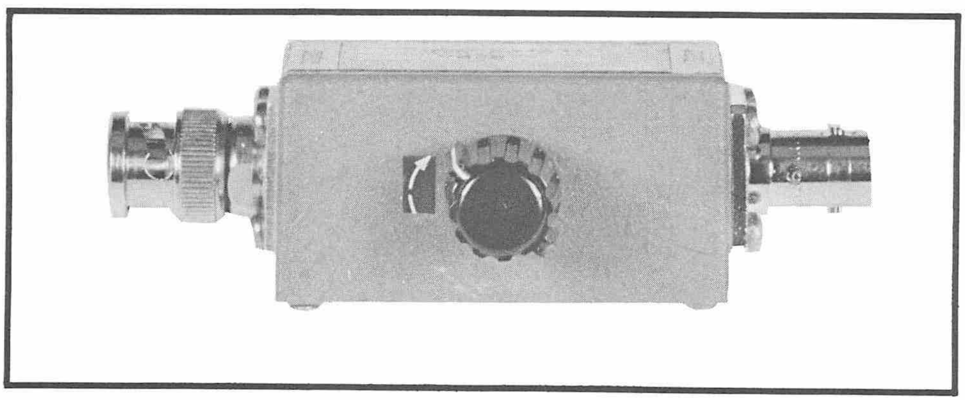
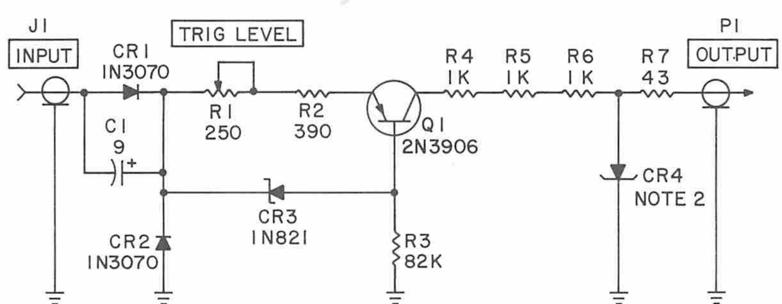


Figure 7-3. Tunnel Diode Pulser



NOTES:

1. ALL RESISTANCE VALUES ARE IN OHMS, AND ALL CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS NOTED OTHERWISE.
2. BLI P/N 05101290A.

Figure 7-4. Tunnel Diode Pulser, Schematic Diagram

TABLE 7-2. PARTS LIST, 61252A TUNNEL DIODE PULSER

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C...1	07-10569-0A	CEA 9.0UF 125.0 V +20-10	56289	SPRAGUE CL65CP090MP3 OR EQ
CR..1	05-10128-0A	DGP 1N3070 175V 100MA	0	FAIRCHILD
CR..2	05-10128-0A	DGP 1N3070 175V 100MA	0	FAIRCHILD
CR..3	05-10041-0A	DZG 1N 821 6.2 7.5M	4713	MOT SI D07
CR..4	05-10129-0A	TDU TUNNEL DIODE/PULSER	0	GE TD263B
J...1	31-10228-0A	CON BNC FEM	91836	KINGS KC79-92, POMONA 2451
Q...1	10-09473-0A	TRQ 2N3906 PNP 1 40 PTO-92	4713	MOT 1 200M 60
R...1	09-10224-0A	RVC 250.0 500MW	80294	BOURNS 3862C-122-251A
R...2	12-08041-0A	RFC 390.0 250.0MW J+- 5%	1121	A-B TYP CB
R...3	12-13212-0A	RFC 82.0K 125.0MW +-5%	0	ALLEN BRADLEY TYPE BB
R...4	12-08016-0A	RFC 1.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R...5	12-08016-0A	RFC 1.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R...6	12-08016-0A	RFC 1.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R...7	12-13213-0A	RFC 43.0 125.0MW +-5%	0	ALLEN BRADLEY TYPE BB

Ballantine Laboratories, Inc.

ADDENDUM

TO INSTRUCTION MANUAL: **MODEL No.** 6126M

Units thru Serial Prefix 021

INSTRUCTION MANUAL

Page 1-2. MARKER AMPLITUDE.

Change 1 nanosecond to read 1 nanosecond; 200 millivolts into 50 ohms.

Page 4-5. Paragraph 4-47.

Change to read:

The 100 MHz locked signal also operates frequency multiplier circuits in A15 and A116. Frequency multiplier drive is disabled when the DEVIATION switch is in the TIME position. A15 Q1 cuts off 100 MHz amplifier A15 Q2 when a high logic signal on (line T) is applied to the base of A15 Q1. Frequency doubler A15 Q20 and A15 Q21 doubles the 100 MHz input to 200 MHz and provides the 5 ns time marker. Voractor A15 CR1 and associated tuned circuits act as a quintupler to provide a 500 MHz signal at the output of amplifier A15 Q3. A15 R7 provides adjustment for the operating bias of A15 Q3. A15 C12 and the tuned stripline coupled the 500 MHz sinewave to the input of buffer amplifier A116 Q1. This buffer provides the drive dor doubler A116 X2 and front panel BNC J4 which is the 2 nanosecond time mark OUTPUT. The output of doubler A116 X2 is the 1 GHz OUTPUT at J3 on the front panel.

Page 5-12.

5-44. Change to read:

5 nS (200 MHz) ADJUSTMENT

a) Interconnect the generator and the required test equipment as shown in Figure 5-10. Connect a sampling oscilloscope, such as the Tektronix 547 with 1S1 plug-in, to the 5 ns H.F. OUTPUT connector. Set the sampling oscilloscope time base to 5 ns/cm. Connect the positive + FAST RISE OUTPUT to the external trigger input of the sampling oscilloscope thru a 20 dB 50 ohm attenuator (Ballantine 12626A). Set the TRIGGER PULSE PERIOD to 100 ns. Set the oscilloscope to external positive trigger and adjust the sweep triggering for a stable triggered display.

ref: December 1981

b) Set the sampling oscilloscope vertical sensitivity to 20 mV/dm. The oscilloscope is then calibrated to 200 mV/cm since the input signal from the generator is reduced by a 20 dB coaxial attenuator. Set DEVIATION to OFF. Observe a 5 ns (200 MHz) sine wave on the oscilloscope.

c) Adjust A15 C21 for maximum sine-wave amplitude on the oscilloscope. This amplitude must exceed 780 mV p-p (3.9 cm on scope). If no tuning or too little tuning is noted, check A15 Q20, A15 Q21, and A15 Q2, as well as their associated components. If more amplitude is required, carefully spread or compress coil A15 L1 for best performance.

d) Sine-wave cycle-to-cycle amplitude modulation should not exceed 10% at 25°C. If the intermodulation is excessive, replace A15 Q20 and A15 Q21 with transistors whose beta (current gain) is matched within 25%, and carefully adjust A15 T21 no more than one-half turn for optimum amplitude flatness of the 5 ns H.F. OUTPUT sine-wave. It may be necessary to check 5 ns (200 MHz) cycle-to-cycle flatness after the following 2 ns (500 MHz) adjustment since A15 C1 (200 MHz trap) may affect the 5 ns output. The cycle-to-cycle amplitude modulation tolerance is for reference only and is not a specification.

e) Again touch up A15 C21 for maximum peak-to-peak amplitude which must exceed 780 mV p-p at 25°C.

NOTE

> If 0.78 V p-p amplitude is not obtainable, check A15 Q20 and A15 Q21 and associated components. Check A15 L1 and A15 T21 and replace if damaged or misshaped.

Page 5-12. Pagragraph 5-45.

Change to read:

2 ns H.F. OUTPUT Adjust and 1 GHz Check (A15 C7, A15 C9, A15 C11, A15 C14, A15 R7)

a) Interconnect the generator and test equipment as shown in Figure 5-10. Change the sampling oscilloscope time base to 2 ns per division and change the cable at the 6126M from the 5 ns H.F. OUTPUT connector to the 2 ns OUTPUT connector. Observe a stable 500 MHz (2 ns) sine-wave on the oscilloscope.

NOTE

Do not use the PC card extender when making 2 ns H.F. OUTPUT adjustments. Do not extend the 50 ohm output cable within the instrument. Use an insulated alignment tool and allow the instrument to be fully warmed up before making adjustment. The 5 ns adjustment must be properly aligned before starting the 2 ns calibration.

b) Observe that the 2 ns frequency output provides one sine-wave per division on the scope graticule and that the sine-wave displayed is at least 0.78 VOLT (3.9 divisions) peak-to-peak.

c) Adjust A15 C4, A15 C9, A15 C10, A15 C11 and A15 R7 for maximum signal amplitude.

d) Adjust A15 C6 and A15 C7 for good flatness and maximum amplitude.

NOTE

The adjustment of A15 C4 (100 MHz filter), A15 C6 (200 MHz trap), A15 C9 (500 MHz Filter A) interact. Repeat steps c and d as necessary for best tuning. Also, do not make any of the capacitor adjustments randomly or too far removed from the original settings. The controls interact and a number of combinations may produce a 500 MHz (2 ns) output; however, only one combination produces maximum amplitude and flatness.

e) If a 0.78 volt amplitude is not achievable, check A15 Q3, A15 CR1, and the associated components, including all transformers and inductors in the 500 MHz quintupler. Since the 500 MHz output from A15 is buffered by buffer A116 Q1, always check this untuned amplifier on A116 to be certain that it and its associated components is functioning properly. Check that the printed circuit board and components are clean and free of flux or other contaminants which may lower the Q of tank circuits and the strip line filter so as to cause a reduction of the 2 ns output signal amplitude.

f) Connect the sampling scope to the 1 ns OUTPUT. Remove the X10 attenuator (200 dB pad) from the connecting cable. The cable should be no longer than 30 cm (one foot) and must be 50 ohm impedance with minimal losses at 1 GHz (use RG58A/U or equivalent). Set the sampling scope to 50 mV/DIV and to 1 ns/DIV. Observe a 1 GHz sine wave having at least 2.8 divisions (142 mV) of amplitude across the greater peaks. (Note that the Tek 151 1 GHz sampler is approximately 3 dB down at 1 GHz so that all indications must be multiplied by 1.41 to read true peak-to-peak amplitude). i.e. 1.75 millivolts peak-to-peak displayed is actually the specified (142 x 1.41) 200 millivolts peak-to-peak). The 1 GHz output is affected by the drive to buffer A116 Q1) and its output loading. Slight readjustments of A15 C11 and A15 C14 will optimize the 1 GHz amplitude with only moderate effect on the amplitude and waveshape of the 2 ns (500 MHz) output connector when observing the 1 GHz output signal. Further optimization of the 1 GHz output may be achieved by selecting A116 C3 in the range of 2.2 pF to 12 pF.

CAUTION

Never tamper with the coils on A15 since these are carefully adjusted at the factory. Always use the proper test equipment and good quality interconnects when attempting these adjustments.

NOTE

Because of the interaction between adjustments, the calibration of the 5 ns H.F. OUTPUT (paragraph 5-45) should be re-verified.

Page 5-10. Paragraph 5-40.

Range to read:

5-40 VOLTS DEVIATION RANGE ADJ.
A18 R2 and A18 R251

Change subparagraph d) to read:

If necessary, adjust A18 R2, the DEV RANGE ADJ control and A18 R25 the DEV CENTERING ADJ control so that the reading of the DEVIATION meter indicating >11.00 at both extreme positioning of the VOLTS/DIV deviation control. The overrange counts on each side should be approximately balanced after these interacting adjustments are completed.

Page 6-2. Table 6-1. Replaceable Assemblies.

Add: Delay line - 89-11046-1A - complete delay line assembly.

Page 6-7. Figure 6-3

A3 Schematic.

Add: C9 from U1 pin 2 to pin 3.
C10 from U2 pin 1 to pin 3
C11 from U3 pin 3 to junction of R5 and CR4

Page 6-8.

A3 Parts List.

Add:

C9, C10, C11 0710562-0A CCR 0.1 µF 50V 50423 AVX MD015E104ZAA

Page 6-15. Figure 6-7.

A7 Schematic.

Effective on units with Serial Prefix above 021.

Delete: K3, C6, C7, CR4, Q5

Connect: Q6 to activate new DPDT relay K2.

Change: R10 from 825 to 316 ohms.

Add: R25 in series with R10 VOLTS DEVIATION CENTERING ADJ.

Change: C9 from 0.0033 to 0.0047

Page 6-15. Figure 6-7.

A7 Schematic.

Delete: Q9, R19

Page 6-15.

A7 Parts List.

Delete: Q9

Page 6-16.

A7 Parts List.

Delete: K2, K3, C6, C7, CR4, Q5, R10, C9.

Add:

K2	14-10023-0A	RLY	4PDT 5V 140 ohms	50423	BLI
R10	12-12248-0A	RFF	316 ohm 1/4W 1%	16299	RN-55D
R25	09-10094-0A	RVF	500 ohm	73138	Helipot 72YW500
C9	07-10037-0A	CCD	4.7 nF 1kV	84171	CCD472

Page 6-21. Figure 6-10.

A12 Schematic.

Change: R17 to read 301 ohms
R18 to read 301 ohms

Page 6-22.

A12 Schematic.

Delete: R17 and R18

Add:

R17, R18 12-12246-0A RFF 301 250 mW 1% 16299 RN55D

Page 6-27. Fig. 6-13. Change A15 Schematic as attached.

Page 6-28. Delete from Parts List for A15 L3, L4, Q2, Q3, C5, R4, C12, C20.

Add to A15 Parts List:

L3, L4	03-10083-1A	CIL	0.07 - .12 UH Air Coil	50423	Ballantine
Q2	10-10168-0A	TRQ	2N5771	07263	Fairchild or eq. 2N5771
Q3	10-10157-0A	TRQ	BFY90 NPN 15V S T072	0	SGS ATLS
C30	07-10488-0A	CMD	10.0 pF 300.0V J	84171	ARCO Type DM-15-BC 10JN1
C5	07-10534-0A	CMD	12.0 pF 500.0V $\pm5\%$	84171	ARCO CM04FD120 J03 or equal.
R30	12-08046-0A	RFC	10.0 250.0MW J $\pm5\%$	1121	A-B TYPE CB
R4	12-12400-0A	RFF	10.0K 250.0MW F $\pm1\%$	16299	CGW RN55D1002F
R7	09-10202-0A	RVF	5.0K 500mW CER	73138	HLL TYPE 72XW
C12	07-10081-0A	CCD	3.3 pF 500.0V	90201	RMS TYPE CG.
C20, C32	07-10112-0A	CCC	100.0 NF 50V CHIP	71590	CENTRALAB W050FH104M
Heat Sink	49-10039-0A	HTS	FOR .16 DIA PLSTC XS15T	05820	WAKEFIELD 256-ST

Page 6-31. Figure 6-15.

A18 Schematic

Change: U2 MC844 to 7422

Add:	R17	196 Ω
Add:	R18	14.7 Ω
Add:	C12	0.1 μF

Page 6-32.

A18 Parts List.

Delete: U2

Add:

U2	24-10353-0A	ICP 7422 Dual 4 Input NAND	01295	SN7422
R17	12-12228-0A	RFF 196 250 mW 1%	16299	RN55D
R18	12-12116-0A	RFF 14.7 250 mW 1%	16299	RN55D
C12	07-20094-0A	CCD 0.1 25V 20%	91418	1425-1

Page 6-35. Fig. 6-17. Change A116 Schematic as attached.

Page 6-36. Parts List for A116

Delete: C1, C3

Add:

C1, C3	07-10081-0A	CCD	3.3PF 500.0V	90201	RMS TYPE CG.
C50	07-10488-0A	CMD	10.0 PF 300.0V J	84171	ARCO TYPE DM-15-BC 10JN1

Page 6-36.

A116 Parts List.

Delete: L3, C5

Add:

R100	12-12168-0A	RFF	51.1	250 mW 1%	16299	RN55D

Page 6-38.

A117 Parts List.

Delete: R1 and R3 and R16

Add:

R1, R3	12-12568-0A	RFF	511K	250 mW 1%	16299	RN55D
R16	12-12560-0A	RFF	422K	500 mW 1%	16299	RN60D

Page 6-39. Figure 6-19.

A126 Schematic.

Change: Q1 and Q2 to TIP 42B
Q3 and Q4 to TIP 41B

Page 6-40.

A126 Parts List.

Add:

Q1, Q2	10-10166-0A	TRQ	TIP42B PNP 80V	84713	Motorola TIP42B
Q3, Q4	10-10165-0A	TRQ	TIP41B NPN 80V	04713	Motorola TIP41B

Page 6-44.

A127 Parts List

Delete: R111

Add:

R11	09-10093-0A	RVF	10K 500 mW	73138	72XW

Page 6-45. Fig. 6-22. A128 Schematic (upper right corner).

Change A15-11 to A116 C50.
Change R3 to 1.96K

Page 6-46.

A128 Parts List

Delete: R3 and R7

Add:

R3	12-12328-0A	RFF	1.96K 250 mW 1%	16299	RN55D
C18	07-10011-0A	CMD	24pF 100V	84171	RDM-15240J

Page 2-1. Paragraph 2-14.

Add after...on the instrument. Always maintain at least 1-3/4 inches of free air space on all sides of the instrument. Do not mouunt near heat radiating instruments. When rack mounting is employed, forced filtered air ventilation is recommended.

Paragraph 2-16. Change second sentence to read:

Option 15 provides 2 each rack-mount side brackets, P/N 89107531 and two rack slides P/N 69100340. These may be bolted to the side castings of the 6126 with the screws provided.

Page 5-1. Add the following note between paragraph 5-6e and 5-6f.

NOTE

The following tolerances on the 10 MHz crystal clock of the 6126M are tightened by ±20 Hz. The tolerance bands assume 23°C ±2°C free air ambient, midline main voltage, and provide no allowance for recycle offset of aging which is ±100 Hz per month. It is suggested that any frequency within ±1200 Hz is satisfactory, but re-calibration may be advisable at the time of checking performance. See Paragraph 5-43.

Page 5-5. Paragraph 5-12e.

Change: (±.003) to (±.03)

Paragraph 5-12f.

Change: (±.003) to (±.03)

Paragraph 5-13c.

Change: ±50 mV to ±500

Page 5-6. Paragraph 5-22. Delete in its entirety and add:

5-22. Turn OFF power before removing or replacing Tektronix plug-in modules. Refer to Tektronix instruction manuals for additional information. To remove the plug-ins, remove top and bottom covers. Gently pull on the plug-in latch bar and grasp the plug-in to gently ease it out of the 6126M. To replace the plug-ins, gently slide them on to the guide tracks and ease them into the edge connector mounted within the 6126M. Either plug-in may be mounted in any of the two spaces provided. Replace top and bottom covers and turn power ON.

Page 5-6. Paragraph 5-26b.

Change: ±4.8V and +5.2V to +4.7V and +5.3V.

Paragraph 5-27.

Change: ±5 volts to +5 volts.

Paragraph 5-27a.

Change: All P1-15 to All P1-5.

Paragraph 5-27b.

Change: +4.8V and +5.2V to +4.7V and +5.3V.

Page 5-8. Paragraph 5-28b.

Change: +11.5V abd +12.5V to +11.4V and +12.6V

Paragraph 5-28d.

Change: -11.5V and -12.5V to -11.4V and -12.6V

Page 5-17. Paragraph 5-54a.

700F should read 700°F.

Page 6-23. Figure 6-11. A13 Schematic.

Add +5V to junction of 5 ← and R3.

Page 6-29. Figure 6-14. A16 Schematic.

Change Q7 2N2369 to Q7 2N5179.

Page 6-30. A16 Parts List.

Delete: Q7

Add: Q7 10-10037-0A TRQ 2N5179 NPN 4713 MOT 2N5179

Page 6-35. Fig. 6-17. A116 Schematic
Change R43 and R69 from 51.1 to 47.5 ohm.

Page 6-36. A116 Parts List.

Delete R43 and R69

Add: R43, R69 RFF 12-12165-0A RFF 47.5Ω 250 mW ±1% 16299
RN550 47R5F.

Page 6-15. A7 Output Volts Select

Figure 6-7. Schematic A7.

Delete: C3, C8, C11

Add: R25 in series with R10.

Page 6-16. A7 Parts List.

Add: Before ordering new relays for A7K2 and A7K4, check the relay you are replacing and order one of the following replacement parts:

Red plastic molded Reed Relay (Coto-Coil), P/N 11410016-1A
High profile plastic leaf spring relay (Potter & Brumfield) P/N 1410023-0A
Low profile plastic leaf spring relay (Aromat), P/N 1410034-0A (preferred part).

R25 Potentiometer P/N 09-10094-0A

Delete: C3, C8, C11.

Page 6-32. A18 Parts List. Time Deviation Board.

Some A18 assemblies use molded plastic red reed relays (Coto-Coil) for A18K2 and A18K3, P/N 14-10016-1A. Later A18 assemblies use a 2 pole low profile plastic leaf spring relay (Aromat), P/N 14-10034-0A. Order the part applicable for your A18 assembly.

Page 6-39. A126 Volts Interconnect Assembly Board.

Figure 6-19. Schematic A126-1.

Add: R8 across C19
R9 across C23
R10 across C24
C1 from Pin 6A to Pin 7A on J110
C2 from Pin 6A to Pin 7A on J120

Page 6-40. A126 Parts List.

Add only on units where T2 is P/N 2010068-1N

C1, C2 0710116-0A CYF .47 µF, 63V, ±10%

Add on all units:

R8, R9, R10 1212400-0A RFF 10K 1/2W, 1% RN55

Delete: T2 2010068-1N TRX 6125M

Add: T2 2010068-10 TRX 6125M

When replacing T2 with 2010068-10, change A126C19 and A126C22 from 330 µF to 1000 µF, 50V, P/N 1710586-0A and delete C1 and C2 .47 µF P/N 0710116-0A These five parts are affected and must be updated as a group for proper operation and lower operating temperature. All new instruments with serial prefix above 040 incorporate this change.

Page 6-43. A127 Schematic - High Amplitude Pulse Generator.

Add: C108 33 pF from junction of R100 and base of Q100 to ground.

Page 6-43. A127 High Amplitude Pulse Generator Assembly.

Figure 6-21. Schematic.

Add: A127 C108 from the base of A127 Q100 to ground.

Page 6-44.

Add: C108 07-10530-0A CCD 33 pF 100 Volts 20% ARCO 84171

Page 6-44. A127 Parts List.

Add: C108 07-10530-0A CCD 33 pF ±30% 100V

Page 1-2. Paragraph 1-14. DELAY LINE SPECIFICATION.

Risetime

Change: 195 picoseconds to read typically 285 picoseconds, always less than 350 picoseconds.

Page 5-10.

Delete: Paragraph 5-40. VOLTS DEVIATION RANGE ADJ.

Add: Paragraph 5-40. VOLTS DEVIATION RANGE ADJ. (A7R25 and A18R2)

a. Set the DEVIATION switch to VOLTS.

b. Rotate the VOLT/DIV DEVIATION control to maximum counter clockwise position and note the DEVIATION % reading.

c. Rotate the VOLT/DEVIATION control to maximum clockwise position and note the DEVIATION % reading.

d. Adjust A18R2 and A7R25 until the DEVIATION % reading at each of the limits is in the range of +12.00 to +14.00% and -12.00 to -14.00%. Be sure the instrument is fully temperature stabilized when making these adjustments.

Page 4-6. Add the following tab.e between table 4-1 and table 4-2.

TABLE 4-1a.

INPUT FROM S2					OUTPUT FROM A1-U1						
E	D	C	B	A	B"	A"	E'	D'	C'	B'	A'
0	0	0	0	0	0	0	0	0	1	1	0
0	0	0	1	0	0	0	0	0	0	1	1
0	0	0	1	1	1	0	0	0	0	1	1
0	0	1	0	0	0	0	0	0	1	0	1
0	0	1	0	1	1	0	0	0	1	0	1
0	0	1	1	0	0	1	0	0	0	1	1
0	0	1	1	1	1	1	0	0	1	1	1
0	1	0	0	0	0	0	0	1	0	0	1
0	1	0	0	1	1	0	0	1	0	0	1
0	1	0	1	0	0	1	0	1	1	0	1
0	1	0	1	1	1	1	0	1	0	1	1
0	1	1	0	0	0	0	0	1	1	0	1
0	1	1	0	1	1	0	0	1	1	0	1
1	0	0	0	0	0	0	1	0	1	1	0
1	0	0	1	0	0	1	1	0	1	0	1
1	0	0	1	1	1	1	1	0	0	1	1
1	0	1	0	0	0	0	1	0	1	0	1
1	0	1	0	1	1	0	1	0	1	0	1
1	0	1	1	0	1	0	1	0	1	1	0
1	0	1	1	1	1	1	1	0	1	1	1

PROM CODING A1-U1

X = DONT'T CARE

1 = LOGIC HIGH

0 = LOGIC LOW

NOTES:

1. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS NOTED OTHERWISE.
2. → DENOTES CONTACT OF A15P1.
3. ALL RESISTOR VALUES ARE FOR 1% RESISTORS.

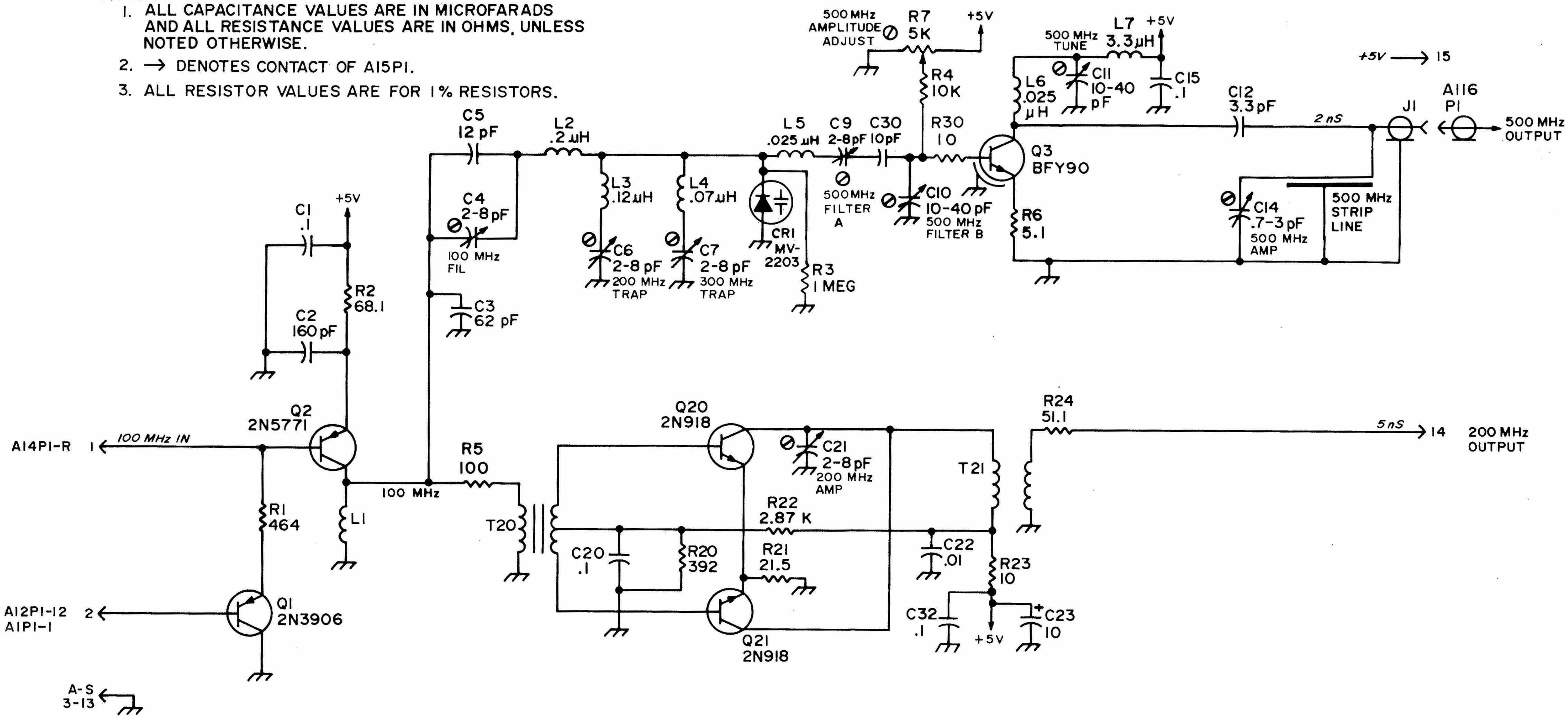
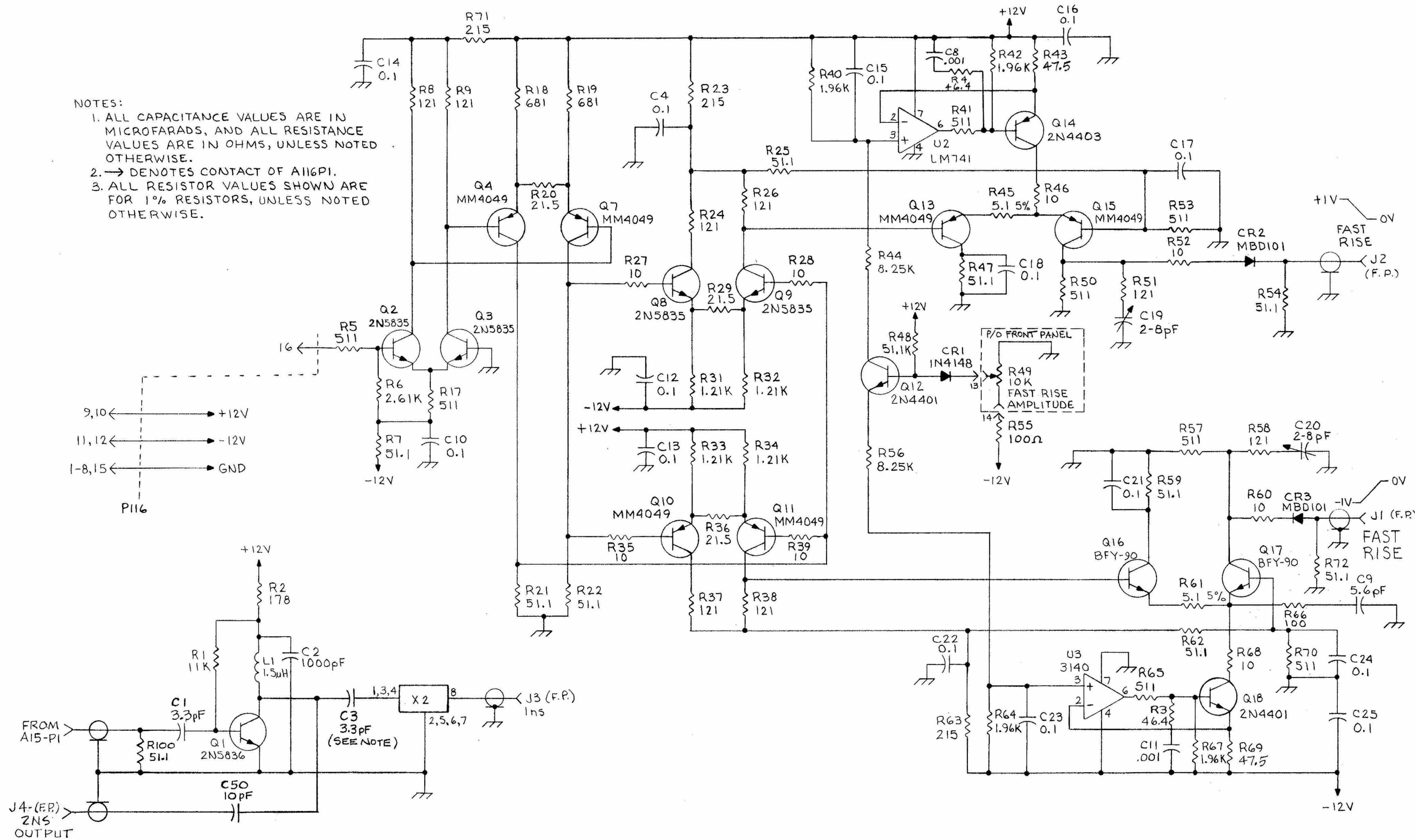


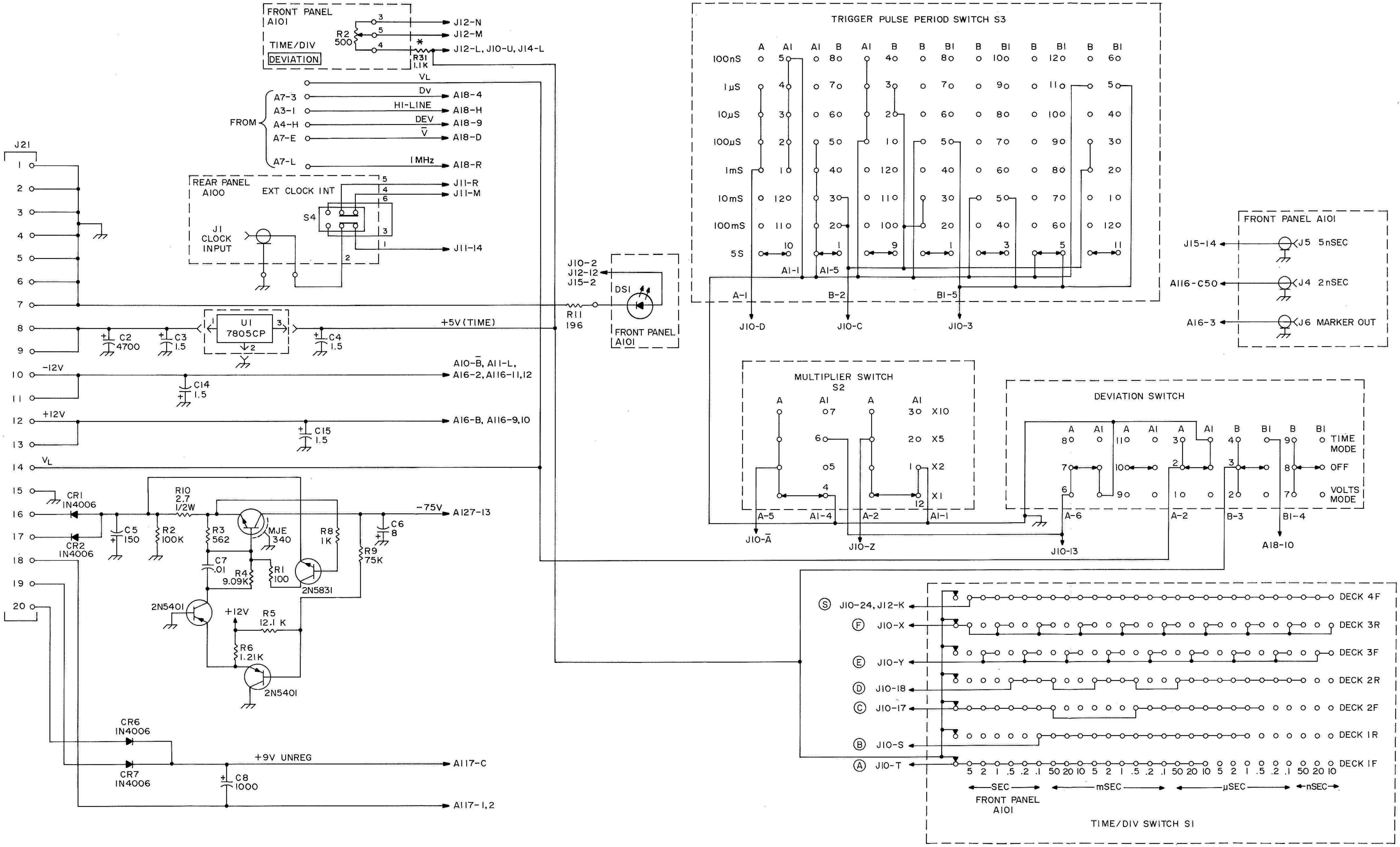
Figure 6-13. A15 6126M T/DIV 200-500 MHz Multiplier

NOTES:
1. ALL CAPACITANCE VALUES ARE IN MICROFARADS, AND ALL RESISTANCE VALUES ARE IN OHMS, UNLESS NOTED OTHERWISE.
2. → DENOTES CONTACT OF A116P1.
3. ALL RESISTOR VALUES SHOWN ARE FOR 1% RESISTORS, UNLESS NOTED OTHERWISE.



NOTE:
C3 HAS A FACTORY SELECTED VALUE.

Figure 6-17. A116 6126M 1 GHZ Multiplier and Fast Rise



NOTE: ALL RESISTANCE VALUES ARE IN OHMS, AND ALL CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS NOTED OTHERWISE.

Figure 6-22. A128-1 6126M Interconnect, Time

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