# INSTRUCTION MANUAL

# FOR

# WJ-9188A-18 SIGNAL MONITOR



**WATKINS-JOHNSON COMPANY**

**700 QUINCE ORCHARD ROAD**

**GAITHERSBURG, MARYLAND 20878**



G/R: 9/80 100

# ADDENDUM II

# FOR THE

# WJ-9188A-18 SIGNAL MONITOR

The following changes should be incorporated into the Instruction Manual for the WJ-9188A-18.

1. Page 1-2, Table 1-1. WJ-9188A-18 Signal Monitor Specifications change as follows:

   a. 5 kHz Sweep Width **from:** 235 Hz ±10% **to:** 400 Hz Max.

   b. 30 kHz Sweep Width **from:** 2 kHz ±10% **to:** 3 kHz Max.

   c. Weight **from:** 8 pounds (3.6 kilograms), approximately

      **to:** 17 pounds (7.7 kilograms), approximately

   d. Size **from:** 3.5 inches high, 19 inches wide, and 16 inches deep

      **to:** 3.5 inches high, 19 inches wide, and 18 inches deep

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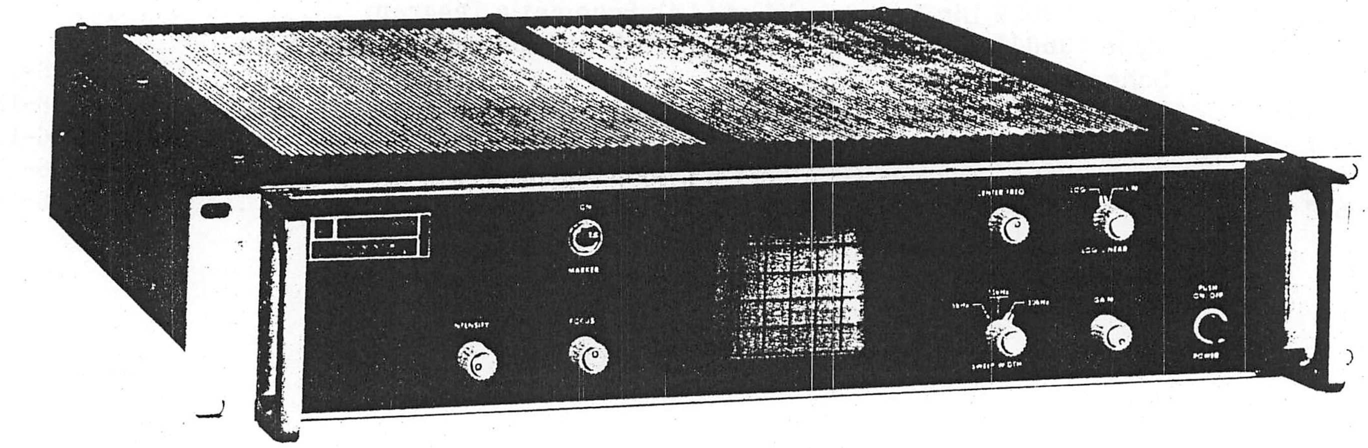


Figure 1-1. WJ-9188A-18 Signal Monitor

# SECTION I

# GENERAL DESCRIPTION

## 1.1 ELECTRICAL CHARACTERISTICS

The WJ-9188A-18 Signal Monitor is a display unit which is designed to accept a 455 kHz IF signal from an external receiver unit, such as a WJ-8718 HF Receiver equipped with the SMO Option. The WJ-9188A-18 Signal Monitor provides selectable sweep widths of 5 kHz, 15 kHz, and 30 kHz. Front panel controls allow the operator to adjust sweep width, gain level, marker, linear or logarithmic detection mode, focus, and intensity. Additional controls are provided for display and monitoring of an internal crystal-controlled 455 kHz oscillator marker signal.

The signal monitor is designed for use over a 60 dB dynamic range and automatically adjusts the sweep rate for optimum resolution in each of the three available sweep widths. Display is linear or logarithmic. A manual gain level control adds 60 dB of range to the 40 dB logarithmic display. A rear panel connector accepts an external marker signal input. The persistence of the cathode ray tube (CRT) display provides high resolution at the low sweep rates and narrow bandwidths. Electrical and physical specifications of the WJ-9188A-18 Signal Monitor are given in Table 1-1.

## 1.2 MECHANICAL CHARACTERISTICS

The WJ-9188A-18 Signal Monitor can be installed in a standard 19-inch wide equipment frame. The unit is 3.5 inches high and 16 inches deep. Front, rear, and side panels, as well as top and bottom covers, are constructed of aluminum.

The front panel of the signal monitor contains a marked graticule and viewing head for the CRT display, four potentiometer controls, an ON/OFF pushbutton with a built-in indicator lamp, a toggle switch, and two rotary switches. The front panel has been finished with grey enamel and covered with a black, anodized bezel etched with control markings.

The rear panel of the signal monitor houses two voltage regulator modules, four BNC connectors, two fuse posts, a screwdriver-actuated line voltage select switch, and a line power filter with a built-in three-prong "international" connector that mates with a detachable line cord.

The main chassis of the signal monitor houses five removable printed circuit (pc) boards, three sealed modules, a power transformer module, and a cathode ray tube.

## 1.3 EQUIPMENT SUPPLIED

The equipment supplied consists of the WJ-9188A-18 Signal Monitor.

## 1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

A 455 kHz IF output from an external receiver unit, such as a WJ-8718 HF Receiver equipped with the SMO Option (or the equivalent), is required to operate the WJ-9188A-18 Signal Monitor.

Table 1-1. WJ-9188A-18 Signal Monitor Specifications

| | |
|---|---|
| Input Center Frequency | 455 kHz |
| Input Impedance | 50 Ω |
| Sweep Widths | 5 kHz, 15 kHz, or 30 kHz |
| Sweep Rate | 20 ±1 Hz sweeps per second in the 15 kHz and 30 kHz sweep widths; 6 ±1 Hz sweeps per second in the 5 kHz sweep width |
| IF Bandwidths: | |
| 5 kHz Sweep Width | 235 Hz ±10% |
| 15 kHz sweep Width | 2 kHz ±10% |
| 30 kHz Sweep Width | 2 kHz ±10% |
| Sensitivity (Maximum Gain Setting): | |
| Linear Mode | 2 μV input produces full scale deflection |
| Logarithmic Mode | 20 μV input produces full scale deflection; a signal 40 dB below full scan produces 20% deflection. |
| Gain Control Range | 60 dB, minimum, in both linear and logarithmic modes |
| Center Frequency Adjust Range | ±2.5 kHz, maximum |
| Marker: | |
| Internal | 455 kHz ±0.005% |
| External | A rear panel 50 Ω impedance, BNC connector allows for external marker input. |
| Size | Greater than 25% of display height in linear or logarithmic modes |
| CRT Phosphor | P31 |
| Display Area | 2.5 inches high by 3 inches wide, approximately |
| Power Requirements | 115/220 Vac ±10%, 48-420 Hz |
| Power Consumption | 23 W, approximately |
| Weight | 8 pounds (3.6 kilograms), approximately |
| Size | 3.5 inches high, 19 inches wide, and 16 inches deep |

# SECTION II

# INSTALLATION AND OPERATION

## 2.1 UNPACKING AND INSPECTION

Examine the shipping carton for damage before unpacking the equipment. If the carton has been damaged, request the presence of the carrier's agent when the equipment is unpacked. If the agent cannot be present, and damage to the equipment is evident, retain the shipping cartons and padding material for the carrier's inspection.

Verify that the equipment is complete as listed on the packing slip. Contact Watkins-Johnson Company, Gaithersburg, Maryland, or your Watkins-Johnson representative with details of any shortage.

The unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. It is, therefore, ready for use upon receipt. After uncrating and checking contents against the packing slip, visually inspect all exterior surfaces for dents and scratches. If external damage is visible, remove the dust covers and inspect the internal components for damage. Check the internal cables for loose connections, and plug-in items such as printed circuit boards, which may have been loosened from their receptacles.

## 2.2 PREPARATION FOR RESHIPMENT AND STORAGE

If the signal monitor must be prepared for reshipment, the packaging methods should follow the pattern established in the original shipment. If retained, the original materials can be reused to a large extent or will, at minimum, provide guidance for the repackaging effort.

Conditions during storage and shipment should normally be limited as follows:

(1) Maximum humidity: 95% (no condensation)

(2) Temperature range: -30°C to 85°C (-20°F to 185°F)

## 2.3 INSTALLATION

All connections to the WJ-9188A-18 Signal Monitor are made at the rear panel, shown in Figure 2-1.

2.3.1 LINE VOLTAGE SELECT SWITCH (S2) - Use a screwdriver to slide the line voltage select switch S2 to the line voltage being used (115/220 Vac, ±10%, 48-420 Hz).

NOTE

The unit can be wired for 230 V where high line voltages are common. To wire the unit for 230 V, disconnect the wire from pin 12 on the power transformer and connect it to the unconnected lug on line voltage select switch S2.

2.3.2 LINE POWER CONNECTOR (FL1J1) - Line power connector FL1J1 provides an input for the line voltage through the detachable power cord.

2.3.3 1/4 AMP FUSE (F1) - Fuse F1 protects the primary of the power transformer when line voltage select switch S2 is in the 115 V position.

2.3.4 1/8 AMP FUSE (F2) - Fuse F2 protects the primary of the power transformer when line voltage select switch S2 is in the 220 V position.

2.3.5 SIG INPUT JACK (J1) - The 455 kHz IF output of an external receiver is connected to SIG INPUT jack J1.

2.3.6 EXT MKR INPUT JACK (J2) - EXT MKR INPUT jack J2 provides an input connection for an external marker signal. J2 has an impedance of 50 Ω. An input signal of -20 dBm ±10 dB at 455 kHz will produce an 80 percent full scale deflection on the CRT display screen.

2.3.7 VERT OUTPUT JACK (J3) - VERT OUTPUT jack J3 provides a 0.4 V peak-to-peak signal across a 10 kΩ load.

2.3.8 HORIZ OUTPUT JACK (J4) - HORIZ OUTPUT jack J4 provides a 10 V peak-to-peak signal across a 10 kΩ load.

## 2.4 OPERATION

The following controls and switches are located on the front panel of the WJ-9188A-18 Signal Monitor, shown in Figure 2-2.

2.4.1 ON/OFF POWER PUSHBUTTON (S1) - Turn on the signal monitor by depressing ON/OFF POWER pushbutton S1. Press the depressed button to turn off the signal monitor and return the button to the OUT position. The pushbutton glows when line voltage is present at the primary of the power transformer.

2.4.2 INTENSITY CONTROL (A8R9) - The INTENSITY control, potentiometer A8R9, varies the brightness of the trace on the display screen. Turn the control clockwise to increase the intensity of the trace.

2.4.3 FOCUS CONTROL (A8R6) - The FOCUS control, potentiometer A8R6, adjusts the sharpness of the trace on the display screen.

2.4.4 GAIN CONTROL (R1) - The GAIN control, potentiometer R1, varies the height of the vertical deflection of the trace for a given signal strength. Noise impulses or "grass" along the baseline of the trace can be eliminated by turning GAIN control R1 counterclockwise until the "grass" disappears. GAIN control R1 shifts the dynamic range of the signal monitor when it is in the Log mode.

2.4.5 SWEEP WIDTH SWITCH (S4) - SWEEP WIDTH switch S4 sets the width of the frequency sweep spectrum shown on the display screen to 5 kHz, 15 kHz, or 30 kHz.

2.4.6 LOG/LINEAR SWITCH (S5) - LOG/LINEAR switch S5 sets the signal monitor for a linear or logarithmic vertical display. The LOG position of switch S5 can be used to display a number of signals that differ widely in amplitude, allowing low amplitude signals to be visible while decreasing the probability that the displays of high amplitude signals will exceed the height of the display screen. With S5 in the LIN position, the vertical display represents approximately the upper 12 dB range of the input signal and varies linearly with changes in input level.

2.4.7 MARKER SWITCH (S3) - Setting MARKER switch S3 to its ON position turns on a 455 kHz crystal controlled marker signal. The signal indicates the center of the signal monitor IF bandpass on the display screen.

2.4.8 CENTER FREQ CONTROL (R2) - CENTER FREQ control, potentiometer R2, sets the horizontal position of the pips on the display screen. Vary the CENTER FREQ control R2 to center the signal of interest on the display screen.

2.4.9 DISPLAY GRATICULE - As shown in Figure 2-3, each vertical display graticule division represents approximately 10 dB of signal strength when LOG/LINEAR switch S5 is in the LOG position, or approximately 0.2 dB of signal strength when S5 is in the LIN position.

Each horizontal graticule division represents approximately 833 Hz of bandwidth when SWEEP WIDTH switch S4 is in the 5 kHz position, approximately 2.5 kHz of bandwidth when S4 is in the 15 kHz position, and approximately 5 kHz of bandwidth when S4 is in the 30 kHz position.

2.4.10 DISPLAY INTERPRETATION - The following list gives the display characteristics of commonly received signals:

1) An unmodulated carrier without noise or other random disturbances appears as a vertical deflection of fixed height.

2) An amplitude-modulated carrier appears as a deflection of variable height. If the modulation rate is high, deflections of lower amplitude representing sidebands may appear around the carrier deflection.

3) A single-tone-modulated FM signal appears as a central vertical deflection representing the center frequency, with a surrounding group of smaller vertical deflections representing the sidebands.

4) Noise appears as random irregularities or "grass" along the base-line.

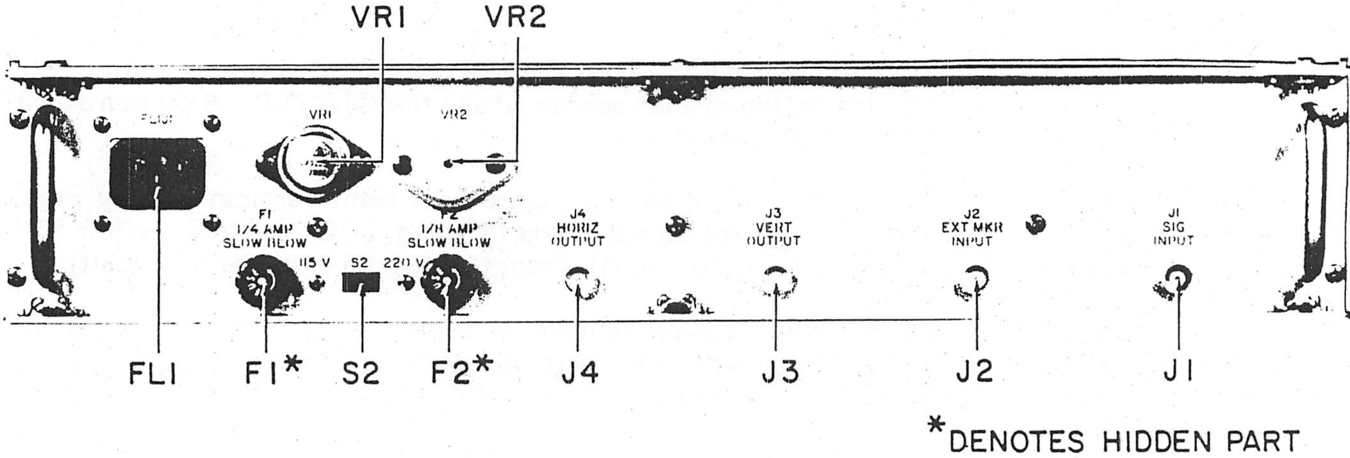



Figure 2-1. WJ-9188A-18 Signal Monitor, Rear Panel

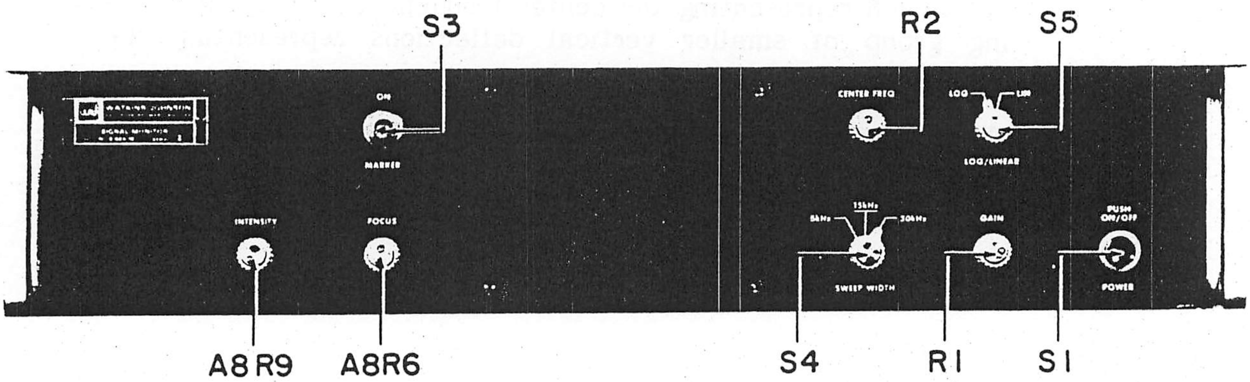



Figure 2-2. WJ-9188A-18 Signal Monitor, Front Panel

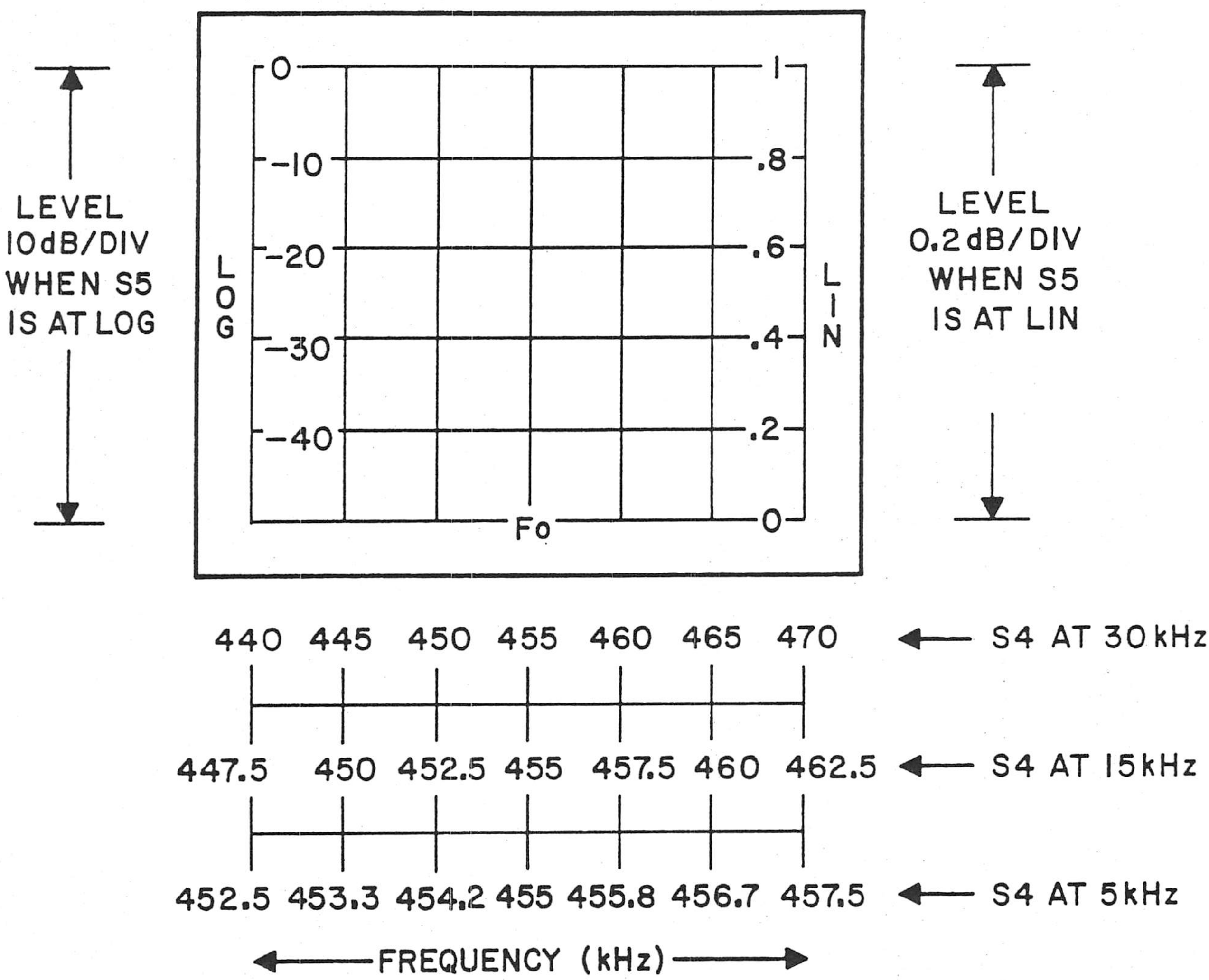



Figure 2-3. Display Graticule Scales

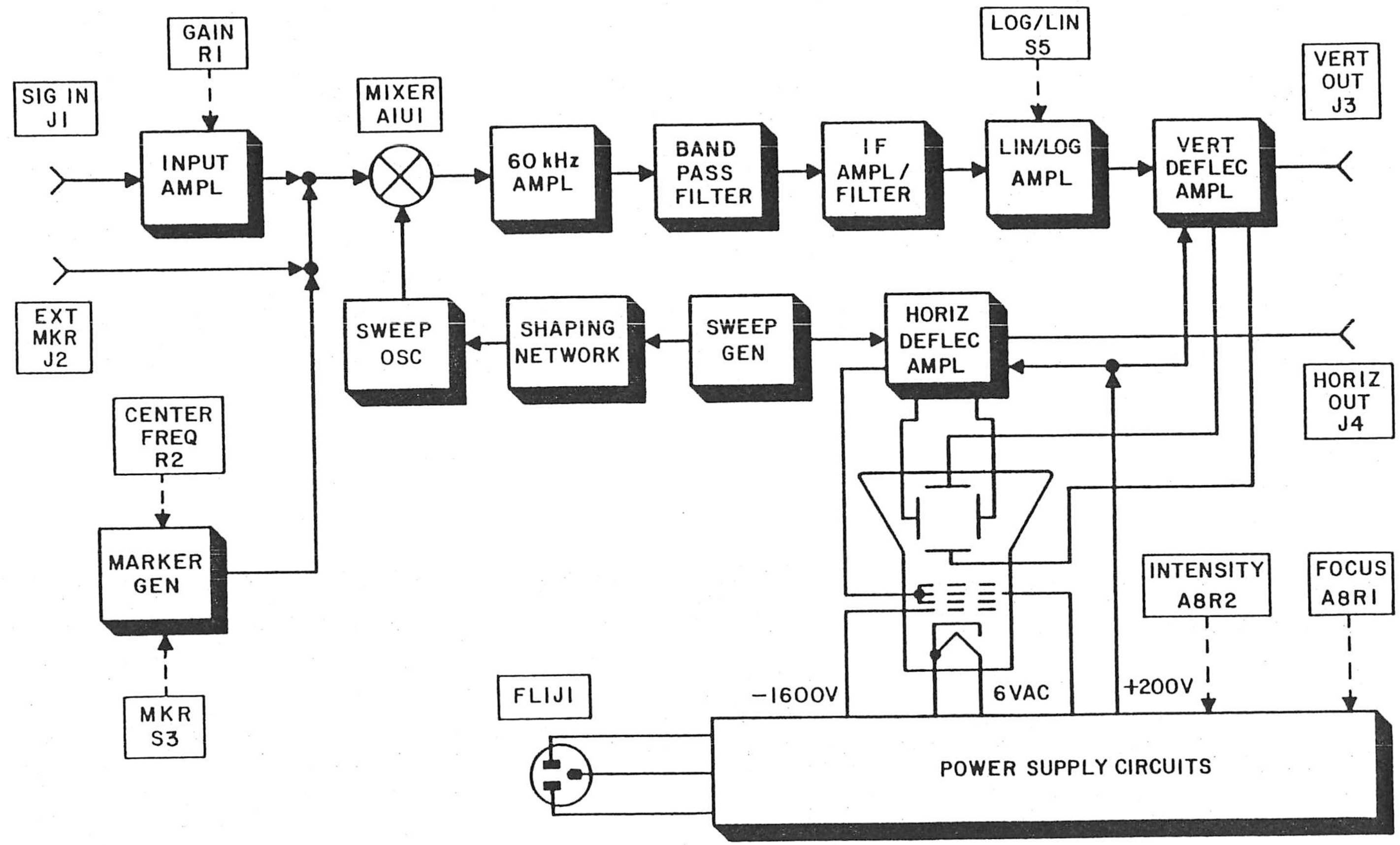



Figure 3-1. WJ-9188A-18 Overall Functional Block Diagram

# SECTION III

# CIRCUIT DESCRIPTION

## 3.1 GENERAL DESCRIPTION (Figures 3-1, 6-9)

The WJ-9188A-18 Signal Monitor is essentially a 455-to-60 kHz converter with the output frequency displayed on a cathode-ray tube (CRT), in selectable sweep widths of 30 kHz, 15 kHz, or 5 kHz. The relationship of the various signal monitor circuits and associated controls is shown in the functional block diagram, Figure 3-1. A general description of the circuits is given in the following paragraphs.

Input signals within a 440 to 470 kHz frequency range are applied through rear panel SIGNAL INPUT jack J1 and pass through an input amplifier to the input of mixer A1U1. These signals are heterodyned with a local sweep oscillator signal to produce a 60 kHz IF signal which is only present during the portion of horizontal sweep time when the local sweep oscillator is 60 kHz above the frequency of the input signal at J1. The 60 kHz output of mixer A1U1 is linearly or logarithmically amplified, filtered for the desired resolution, and applied through a vertical deflection amplifier to the CRT vertical plates. The signal is displayed on the CRT screen behind a marked graticule as a narrow vertical pip with its horizontal position corresponding to the frequency of the input signal at J1 in relation to the 455 kHz center frequency. If the input signal is less than 455 kHz, the vertical pip will appear to the left of the center graticule mark; if the input signal is greater than 455 kHz, the vertical pip will appear to the right of the center graticule mark. The height of the vertical pip is a function of input signal strength and front panel GAIN control R1.

A sweep generator produces a sawtooth voltage to drive the CRT horizontal plates and to linearly increase the local sweep oscillator frequency once during each sweep cycle in ranges of 500 to 530 kHz (30 kHz sweep width), 447.5 to 462.5 kHz (15 kHz sweep width), or 452.5 to 457.5 kHz (5 kHz sweep width). The portion of the sawtooth voltage applied to the sweep oscillator is first passed through a shaping network for acceptance by various oscillator components.

When front panel MARKER switch S3 is set to ON, an internal crystal-controlled marker generator injects a 455 kHz constant amplitude marker signal at the input of mixer A1U1. The center of the pip produced by the marker signal indicates the 455 kHz position along the CRT baseline with a 25 Hz accuracy. The marker pip position can be varied to either side of the CRT display by front panel CENTER FREQ control R2. External marker signals within the frequency range of the input signal (440 to 470 kHz) can be injected into mixer A1U1 through EXT MARKER INPUT jack J2. Because neither marker signal is amplified by the input amplifier, amplitude cannot be varied.

The power supply circuits provide the required voltages for the monitor circuits from a 110 or 220 Vac line voltage through connector FL1J1. Primary power requirements of the signal monitor circuits are satisfied by ±15 V regulated voltages generated by a full-wave rectifier with separate positive and negative regulators. A secondary winding of the power transformer provides 6.3 Vac which is required by the CRT filament. A dc/dc converter transforms ±15 V from the full-wave rectifier into the following voltages: +200 V which is required by the deflection amplifiers and second anode of the CRT, and -1600 V which is required by the cathode, grid, and first anode of the CRT.

The frequency-versus-amplitude display of the WJ-9188A-18 Signal Monitor is presented on the face of an M1519P31 electrostatic deflection cathode-ray tube (CRT). The approximately 2-3/4 inch by 3-1/4 inch rectangular display face is of uniform thickness to minimize parallax error.

## 3.2 DETAILED DESCRIPTION

### 3.2.1 TYPE 796043 AMPLIFIER/MIXER (A1) (Figure 6-1)

Type 796043 Amplifier/Mixer A1 contains a 440 to 470 kHz amplifier stage formed by Q1 and Q2, a 455 kHz bandpass filter, double-balanced mixer U1, 60 kHz amplifier Q3, and emitter-follower Q4.

An IF signal within a 440 to 470 kHz range is applied through rear panel SIGNAL INPUT jack J1 to Amplifier/Mixer A1 at board pin 2. Components C1, R1, and L1 form an impedance matching network to step-up the input impedance from 50 Ω to 800 Ω at the input of FET Q1, the first stage of a two-stage RF amplifier consisting of Q1 and Q2. Components L2, C6, C7, L3, and C8, swamped by resistors R8 and R11, form a double-tuned 455 kHz bandpass filter with a 35 kHz bandwidth. Filter tuning is performed by variable inductors L2 and L3. Second-stage FET Q2 presents a high impedance to the filter. The gain of both RF amplifier stages is established by front panel GAIN control R1. With this control set fully clockwise, overall gain through the RF amplifier and bandpass filter to the input of mixer U1 is approximately 35 dB.

The Q2 output is coupled through an impedance matching network, consisting of L4 and C13, and a 3 dB attenuator pad, consisting of R16, R17, and R18, to input pin 1 of double-balanced mixer U1. An internal marker signal centered at 455 kHz from Sweep Oscillator/Marker Generator A2 or an external marker signal within the input frequency range and applied through rear panel EXT MKR INPUT jack J2 is injected in the input of mixer U1. The external marker signal can be injected when front panel MARKER switch S3 is set in the OFF position.

A 500 to 530 kHz sweeping signal from Sweep Oscillator/Marker Generator A2 is applied to pin 1 of mixer U1 through A1 board pin 15. The frequency of the sweeping signal varies linearly for each sweep period. Frequency sweep range is established by front panel SWEEP WIDTH switch S4. Table 3-1 below lists the frequency range for each of the three S4 settings.

Table 3-1. S4 Sweep Width Ranges

| S4 Setting | Frequency Range (kHz) |
|---|---|
| 30 kHz | 500 - 530 |
| 15 kHz | 447.5 - 462.5 |
| 5 kHz | 452.5 - 457.5 |

As a result of mixer heterodyning, the U1 output is a 60 kHz IF signal down-converted from the 455 kHz input signal. The 50 Ω U1 output impedance is stepped up to 800 Ω by an impedance matching network consisting of C16, L5, and C17 at the input of FET amplifier Q3. The 60 kHz Q3 output is coupled through another impedance matching network consisting of L6, C20, and R26, to emitter-follower Q4 to provide a 600 Ω low impedance output to IF filter FL2, located on the main chassis deck.

3.2.2 IF FILTER (FL2) (Figure 6-9)

IF Filter FL2 is a 60 kHz, four-pole Gaussian filter with a 3 dB bandwidth of 2 kHz and a 600 Ω input impedance. Filter FL2 provides signal display resolution for wide sweep signals. Insertion loss is typically 2 dB.

3.2.3 TYPE 796039 IF AMPLIFIER (A3) (Figure 6-3)

The 60 kHz IF output signal from FL2 is applied through A3 board pin 22 and coupling capacitor C1 to the input of FET amplifier Q1. Resistor R3 provides 600 Ω impedance to match the output impedance of FL2. A resonant circuit consisting of L1, C6, and C7 steps down the impedance of the Q1 output. Capacitor C6 also couples the Q1 output to two separate IF Amplifier channels.

Signal flow through either channel is established by front panel SWEEP WIDTH switch S4. When S4 is set at the 30 kHz or 15 kHz positions, the signal passes through transistors Q2 and Q3 to A3 board pin 1 through capacitor C17. When S4 is set at the 5 kHz position, the signal path is through transistors Q4 and Q5, external bandpass filter FL3, coupling capacitor C25, emitter-follower Q6, and coupling capacitor C17 to A3 board pin 1. Switch S4 accomplishes channel switching by applying an enabling +15 V to transistors Q2 and Q3 in the 30 kHz and 15 kHz positions, and an enabling +15 V to transistors Q4 and Q5 in the 5 kHz position. Transistor Q6 is active in either channel. In either sweep width channel, the Q6 output is a 60 kHz IF signal which is applied to A3 board pin 1.

Overall selectivity of the IF Amplifier is established by external filters FL2 and FL3. Two low-Q, single-tuned networks provide impedance matching between the amplifier stages in each channel. The network consisting of components L2, R14, C12, C13, and R17 provides coupling and impedance matching between transistors Q2 and Q3. The second network, consisting of components L3, C21, and R25, provides coupling and impedance matching between transistors Q4 and Q5. Potentiometers R13 and R24 are used to equalize the gain of the two signal paths.

3.2.4 IF FILTER (FL3) (Figure 6-9)

When the 5 kHz sweep width channel of IF Amplifier A3 is active, the 60 kHz signal is passed through an external, 60 kHz crystal bandpass filter, FL3. This filter has a 1200 Ω input/output impedance and a 6 dB bandwidth of 235 Hz to provide high display resolution for narrow sweep signals. The FL3 output is applied through A3 board pin 4 to the base of transistor A3Q6.

3.2.5 TYPE 796059 LIN/LOG AMPLIFIER (A4) (Figure 6-4)

Lin/Log Amplifier A4 contains separate linear and logarithmic amplification circuits as well as an output amplifier. Linear or logarithmic amplification of the input signal to establish scaling of the display pip amplitude is determined by front panel LOG/LINEAR switch S5. When switch S5 is set at the LOG position, a disabling -15 V is applied through A4 board pin 11 and resistor R7 to pin 8 of OP AMP U3; simultaneously, OP AMP's U1 and U2 are enabled by the removal of -15 V from pin 4 of U1 and U2.

3.2.5.1 <u>Linear Amplifier</u> (Figure 3-2)

The linear amplification circuit primarily consists of OP AMP U3. The 60 kHz input signal is coupled through capacitors C1 and C5 to non-inverting input pin 3 of U3. The

OP AMP provides an additional 20 dB to the overall signal gain. The output of U3 is coupled through capacitor C12 and linear gain calibration potentiometer R20 to inverting input pin 2 of summing OP AMP U6.

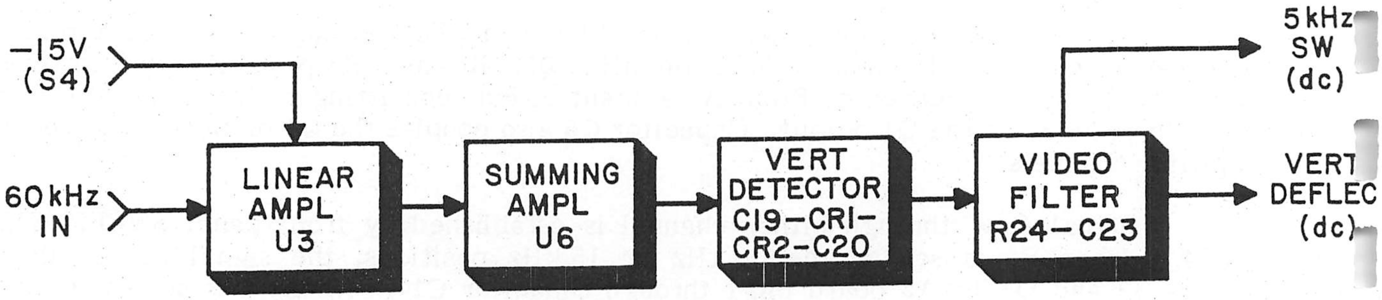



Figure 3-2. Linear Amplification Circuit, Block Diagram

3.2.5.2 Logarithmic Amplifier (Figures 3-3, 3-4)

The logarithmic amplification circuit primarily consists of OP AMPs U1 and U2, emitter-follower drivers Q1 and Q2, logarithmic amplifier U4, and differential OP AMP U5. In the logarithmic mode, the 60 kHz input signal is coupled through capacitor C1 to non-inverting input pin 3 of OP AMP U1. Resistors R2 and R3 bias U1 to provide 15 dB of signal gain. One portion of the U1 output is coupled to the base of emitter-follower Q2 which provides the proper current drive to pin 7 of U4 through components C11 and R14. The other portion of the U1 output is applied through coupling capacitor C4 to non-inverting pin 3 of OP AMP U2. Resistors R5 and R6 bias U2 to provide 15 dB of signal gain. The U2 output is coupled to the base of emitter-follower Q1 which provides the proper current drive to pin 4 of logarithmic amplifier U4 through components C10 and R13.

Logarithmic amplifier U4 is a TL441C monolithic IC containing two 30 dBV log stage pairs of which only one pair is utilized in this application. Two inputs (A1, A2), are fed to a pair of log amplifier stages which provide a gain of 30 dBV per input. The gain of each log stage results in an output that is a logarithmic function of the input. The outputs of both log stages are summed together in a differential common-base stage. The stage provides two logarithmic outputs (Y, $\overline{Y}$), equal in amplitude but opposite in polarity, which are proportional to the logarithmic sums of the log stage pair. Zener diodes VR1 and VR2 along with capacitors C14 and C13, respectively, provide the low supply voltage required by U4.

The outputs of logarithmic amplifier U4 are applied to inverting pin 2 and non-inverting pin 3 of summing OP AMP U5. The OP AMP differentially sums the U4 outputs but provides no additional signal gain. Logarithmic gain calibration potentiometer R21 establishes the slope of the U5 output, which is applied to inverting input pin 2 of OP AMP U6.

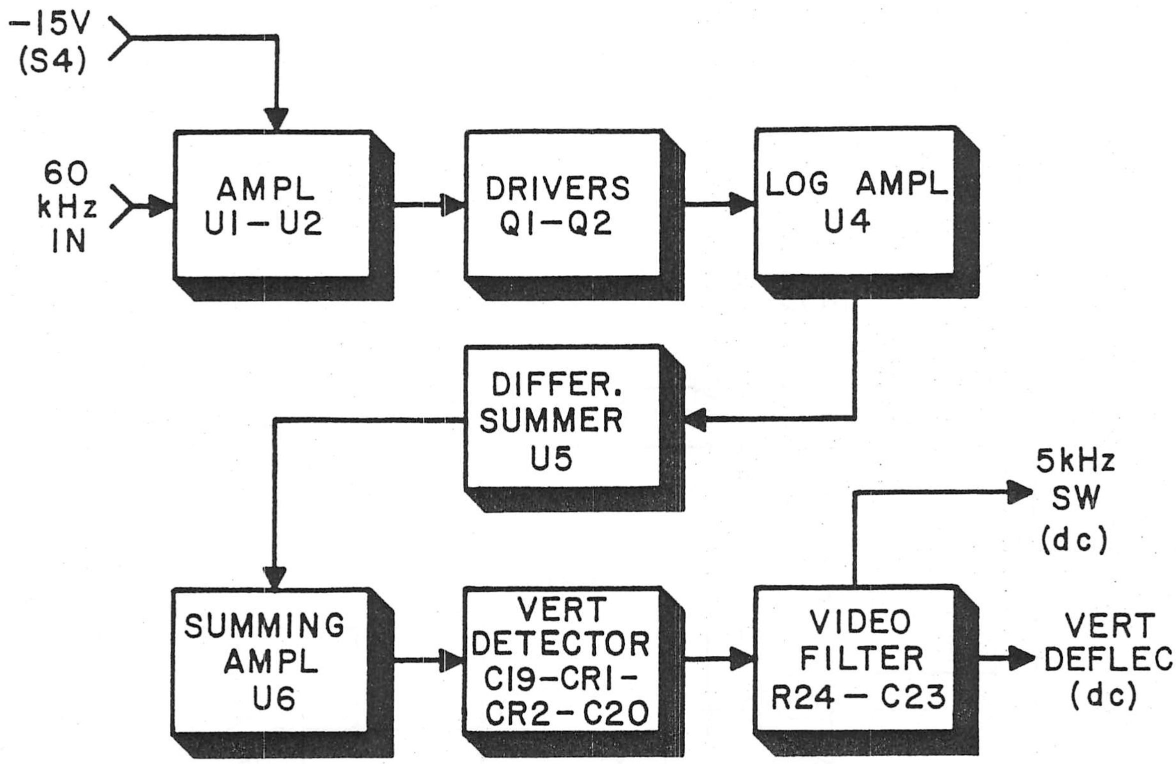



Figure 3-3. Logarithmic Amplification Circuit, Block Diagram

3.2.5.3 Output Amplifier

Output amplifier U6 provides additional gain to drive a vertical detection circuit consisting of components C19, CR1, CR2, C20, and a video filter circuit consisting of components R24 and C23. The output of the vertical detection circuit is a dc voltage proportional to the amplitude of the detector input. The video filter circuit removes any residual 60 kHz IF signal from the dc voltage and couples the voltage through A4 board pin 1 to A5 board pin 20. In the 5 kHz sweep width mode, NPN transistor Q3 and capacitor C26 provide additonal filtering for the dc voltage output.

3.2.6 TYPE 796041 HORIZONTAL SWEEP GENERATOR AND DEFLECTION AMPLIFIER (A5) (Figure 6-5)

3.2.6.1 Sweep Voltage Generator (Figure 3-5)

Operational Amplifiers (OP AMP's) UIA, UIB, and U2A, and cross-coupled PNP transistors Q7 and Q8 comprise the essential circuit elements to generate the sawtooth sweep voltage and associated blanking pulse. Because of the complexity of the sweep voltage generator network, general operating characteristics of the three primary functional areas of the network will be described, followed by an overall discussion. The three primary functional areas are integrator, threshold detector, and one-shot multivibrator (flip-flop). Figure 3-5 (page 3-7) illustrates the sweep voltage generator.

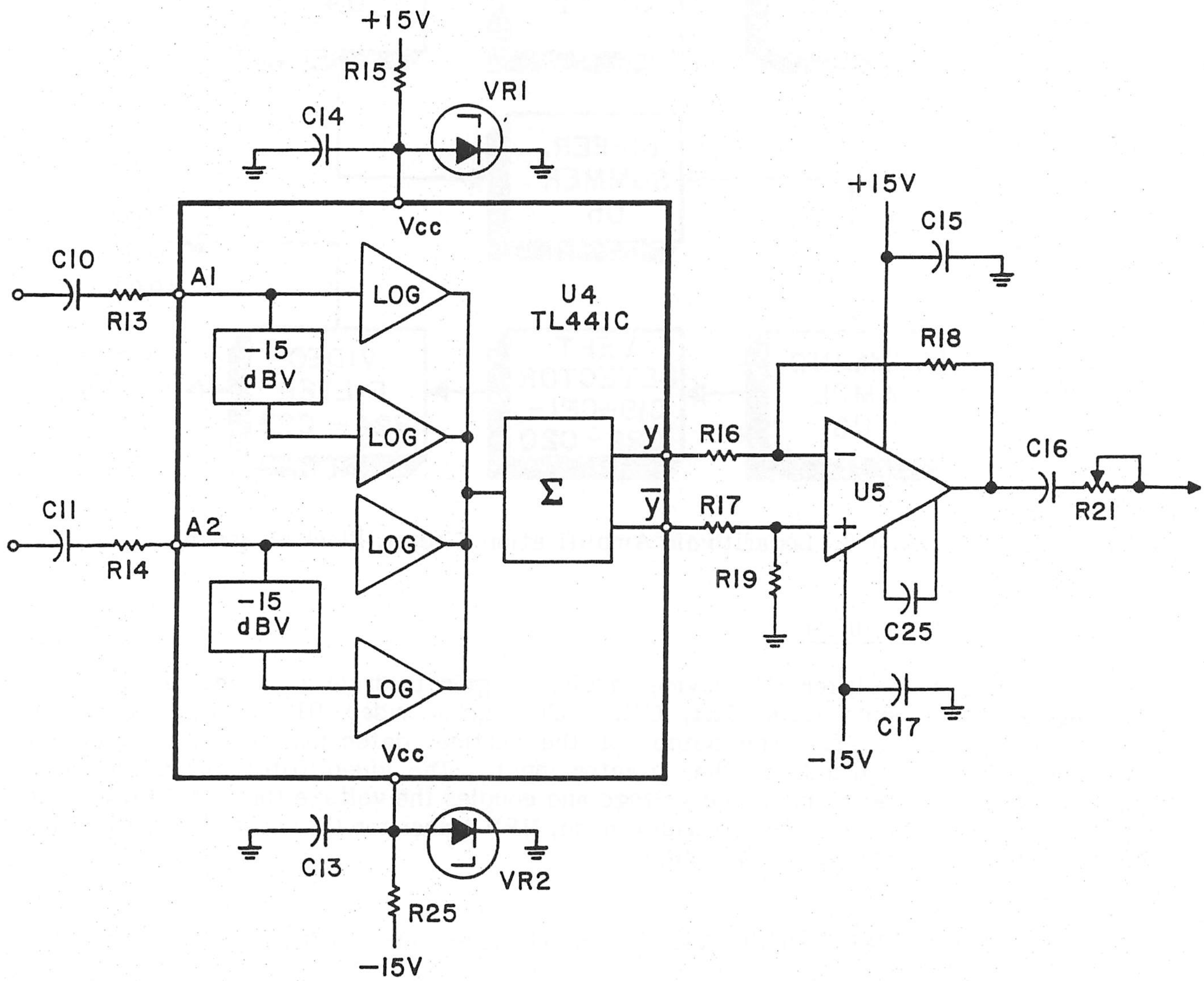



Figure 3-4. Logarithmic Amplifier U4

3.2.6.1.1 Active Integrator (U1B)

U1B is an OP AMP with a capacitive feedback element, C1. There are two resistive paths connected to the inverting input at pin 6, a virtual ground point. If voltage is suddenly applied across either resistive input, C1 will charge in a linear manner. Figure 3-6 illustrates the resultant current flow. C represents the capacitive feedback element; R represents the resistive input path.

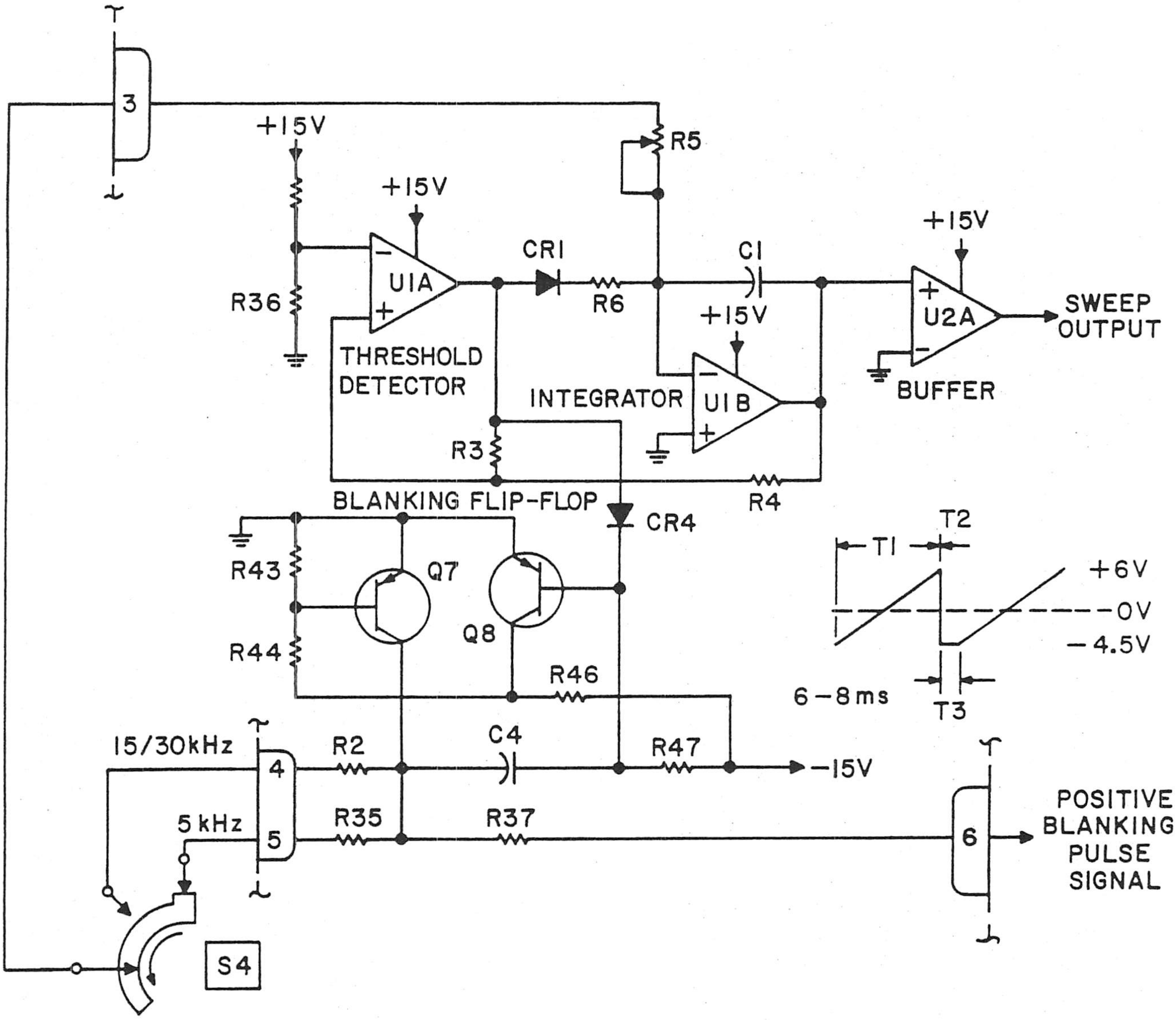



Figure 3-5. Sweep Voltage Generator, Simplified Schematic Diagram

Referring to Figure 3-6, assume that the input voltage, V in, suddenly changes from zero to a value, - V in. Current, which comes from C, flows through R. Current flows for a time (t) corresponding to a charge (q = i x t) which comes from the capacitor. The charge could have come only if V out had increased from zero to a voltage expressed as q = CV out. The result is that V out is a positive-going voltage that increases linearly with time, or a ramp, as shown in Figure 3-6. The inverting property of the OP AMP converts the negative input step voltage to a positive-going ramp.

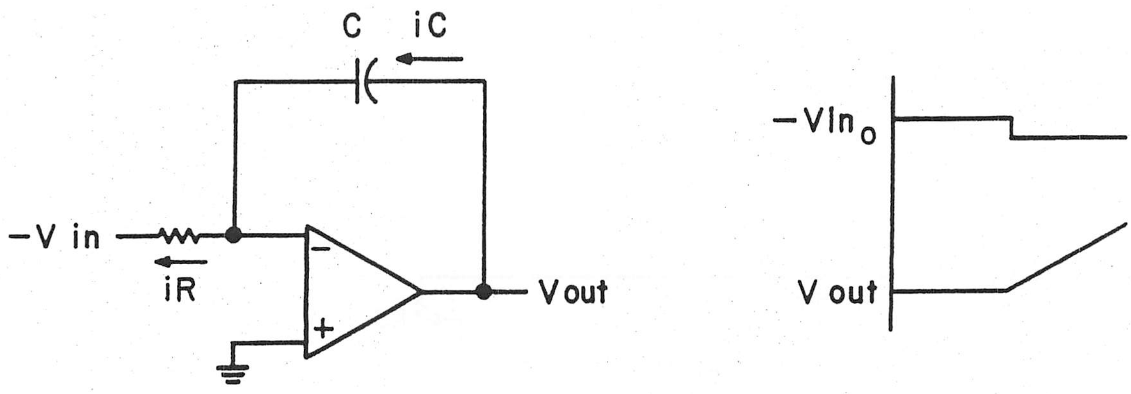



Figure 3-6. Integrator Current Flow

The OP AMP with resistor input and capacitor feedback is an integrating circuit and has an output proportional to the integral of V in. If a square wave is applied to the input at pin 6, the feedback capacitor is alternately charged and discharged to provide a triangul- output, as shown in Figure 3-7.

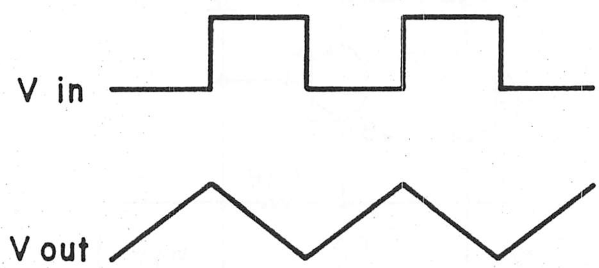



Figure 3-7. Square Wave Integration

If the step voltage input is a chain of narrow pulses, the output will be a sawtooth wave, as shown in Figure 3-8. It is this type of integration that is performed by U1B. Refer to paragraph 3.2.6.1.4 for more details.

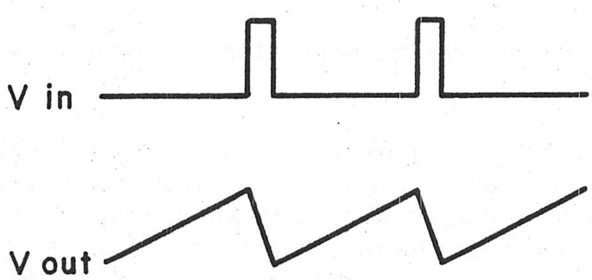



Figure 3-8. Pulse Train Integration

### 3.2.6.1.2 Threshold Detector (U1A)

OP AMP U1A, configured as a threshold detector, senses the voltage at the junction of R3 and R4. The threshold detector is similar to a Schmitt Trigger, in that it is a latch circuit with a timed "dead zone." The threshold detector operates in a saturated state; that is, the output is either in a negative saturated state (near -15 V) or a positive saturated state (near +15 V). The positive feedback network, R3 and R4, provides a voltage at the non-inverting input, pin 3, of U1A which is determined by the resistance ratio of R3 and R4. To cause the threshold detector to change states, the voltage at pin 3 must change polarity by an amount in excess of the offset voltage at the inverting input terminal, pin 2. The ratio of R1 to adjustable R36 is such that the offset voltage is near zero volts. When the voltage at the junction of R3 and R4 approaches zero volts, U1A changes states.

The voltage change at the junction of R3 and R4 is caused by the transitions in voltage level at the output of integrator U1B. When U1A is saturated in a negative direction, the output of U1B is rising. At a level of +6 V, the upper-trip point of U1A is reached and the threshold detector triggers to the positive saturation state, forward biasing CR1 and charging C1 through R6. C1 discharges a positive-going current and the U1B output transitions downward. At a level of -4.5 V, the voltage across R3 reaches the lower-trip point and the threshold detector triggers to the negative saturation state. Refer to paragraph 3.2.6.1.4 for more details.

### 3.2.6.1.3 One-Shot Multivibrator (Q7, Q8)

PNP transistors Q7 and Q8 are configured as a one-shot multivibrator. The output is the collector of Q7. Trigger voltage to change the state of the output is the voltage across CR4; timing is the RC time constant of C4 and R47. To understand the operation of the multivibrator, an output must initially be assumed.

Assume that Q8 is on and Q7 is off. The collector of Q8 is saturated and there is no charge on C4. The output of U1A is high, CR4 is forward biased, and the base of Q8 is high (near zero). U1B suddenly switches to the negative saturation state and Q8 turns off, turning Q7 on. The collector voltage of Q7 transitions high, i.e., zero volts, charging C4. C4 begins to discharge through R47 for a period of five RC time constants, or approximately 6 to 8 milliseconds. At the end of the discharge time, the base-emitter junction of Q8 is forward biased and Q8 turns on, turning Q7 off. The Q7 collector voltage returns to -15 volts (logic low). A positive output from U1A forward biases CR4, triggering the flip-flop to the opposite state, and the cycle repeats.

### 3.2.6.1.4 Blanking Pulse and Sweep Voltage Generation

Assume that the collector of Q7 is at -15 V (Q7 off). The negative voltage is applied across the series resistive network of R2 and R5, or across R35 and R5, determined by the setting of the front panel switch, S4. A negative current flows at the inverting input of U1B, as shown in Figure 3-6. The output of U1B is a positive-going ramp, T1 in Figure 3-5. When the U1B output transitions to +6 V, threshold detector U1A triggers to the positive saturation state causing two simultaneous events.

1. CR4 is forward biased and the one-shot multivibrator is triggered to its opposite state, causing the collector of Q7 to go high (0 volts).

2. The positive voltage output of U1A is applied through CR1 and R6 to the inverting input of U1B, causing the integrator to reverse states and produce a negative-going retrace, T2 in Figure 3-5.

As soon as the integrator output reaches -4.5 V on its downward swing, the threshold detector again reverses states. The integrator remains in a quiescent condition, T3 in Figure 3-5, until the multivibrator changes state (after the discharge time of C4 through R47), when the cycle repeats.

The discharge time of C4 is the blanking pulse period set at 6 to 8 milliseconds by the RC time constant of C4 and R47. The combination of R5 and R2 in conjunction with C1 produces a 20 Hz sweep rate for a sweep width selection of 15 or 30 kHz. The combination of R5, R35, and C1 produces a 6 Hz sweep rate for sweep width selection of 5 kHz. The retrace and blanking pulse times maintain the same values for all sweep widths.

The output of the sweep generator network is buffered with unity gain amplifier U2A to prevent any loading or discharge paths of the integrator.

### 3.2.6.2 Horizontal Deflection Amplifier

Transistors Q1 and Q2 form a differential amplifier to provide the necessary drive for the CRT horizontal deflection plates. Transistor Q3, resistor R16, and a bias network consisting of components R14, R15, and CR2 function as a current source for the differential amplifier. The U2A sweep voltage output is applied to the differential amplifier at the Q1 base through a divider network consisting of resistors R7, R8, and R9. A dc offset voltage derived from a divider network consisting of resistors R19, R20, and R21 is applied to the differential amplifier at the Q2 base to provide centering adjustment of the horizontal sweep trace signal. The overall gain of the amplifier is established by the ratio of collector load resistors R10 and R11, and emitter degeneration resistors R12 and R13. A +200 V supply for the horizontal deflection amplifier and for bias voltage to the second anode of the CRT is derived from a DC/DC Converter (A7).

### 3.2.6.3 Vertical Deflection Amplifier

Transistors Q4 and Q5 form a differential amplifier, identical to the horizontal deflection amplifier described in paragraph 3.2.6.2, to provide the necessary drive for the CRT vertical deflection plates. Transistor Q6, resistor R31, and a bias network consisting of components R29, R30, and CR3 function as a current source for the differential amplifier. The output of A4 board pin 1 is applied to the differential amplifier at the Q5 base through A5 board pin 20 and a divider network consisting of resistors R32 and R33. A dc voltage derived from a divider network consisting of resistors R22 and R23 is applied to the differential amplifier at the Q4 base to establish vertical positioning. A sample of the U2A sweep voltage output is jointly applied to the Q4 and Q5 emitters through potentiometer R34. This application, known as common-mode injection, establishes a variable tilt control of the CRT electron beam by adjusting R34 to apply more of the total voltage to one vertical deflection plate than the other. A +200 V supply for the amplifier and for the cathode, grid and first anode of the CRT is derived from a DC/DC Converter (A7).

3.2.6.4 Inverting Voltage Generator (Figure 3-9)

A portion of the sweep voltage output from OP AMP U2A is applied, via front panel SWEEP WIDTH switch S4, through one of three inputs to inverting input pin 6 of OP AMP U2B to produce an inverted sweeping drive voltage for local Sweep Oscillator A2. As shown in Table 3-2, the sweep width setting of S4 determines the particular input to be used.

Table 3-2. Generator Sweep Width Inputs

| S4 Setting | A5 Input |
|---|---|
| 5 kHz | pin 13, R38 |
| 15 kHz | pin 12, R39 |
| 30 kHz | pin 11, R40 |

The U2B output is a negative sawtooth voltage with a peak-to-peak amplitude established by calibration potentiometers R38, R39, or R40 to provide the proper voltage drive required by the Sweep Oscillator varicaps. This voltage is fed through resistor R42 and A5 board pin 10 to Shaping Network A9.

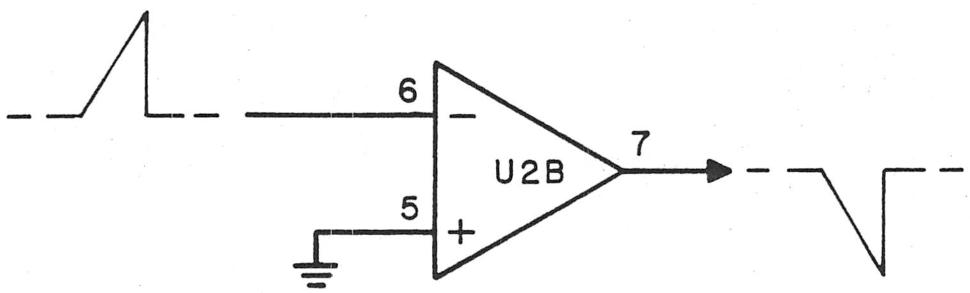



Figure 3-9. Inverting Voltage Generator, U2B

3.2.7 TYPE 796048 SHAPING NETWORK (A9) (Figures 3-10, 6-8)

Shaping Network A9 provides a sweeping nonlinear tuning voltage to drive the varicaps used in Sweep Oscillator A2. The inverted sawtooth voltage output from Horizontal Sweep Generator/Deflection Amplifier A5 is applied to terminal A9E1. When this voltage is positive with respect to ground, it is fed through a divider circuit consisting of potentiometer R2 and fixed resistors R4 and R5. The specific voltage division can be changed by adjusting R2. The output of the divider circuit, at terminal A9E2, remains a linear function of the input with no essential change in slope. When the sawtooth voltage is negative with respect to ground, however, diode CR1 is biased on, allowing a portion of the voltage to be fed through a divider circuit consisting of potentiometer R1 and fixed resistor R3. The output is a combination of the two parallel divider circuits which has a faster rate of change than that of the input, resulting in a non-linear tuning voltage which is applied to Sweep Oscillator/Marker Generator A2 board pin 17.

3.2.8 TYPE 796040 SWEEP OSCILLATOR/MARKER GENERATOR (A2) (Figure 6-2)

3.2.8.1 Sweep Oscillator

The sweep oscillator circuit produces a sweeping 500 - 530 kHz RF signal which is used as the local oscillator input to mixer A1U1. As the CRT electron beam sweeps from the left side to the right side of the screen, the frequency of the sweep oscillator output changes from 500 kHz to 530 kHz. The center of the CRT screen represents a 455 kHz center frequency; therefore, when the electron beam passes the center of the screen, the frequency of the sweep oscillator output is 515 kHz.

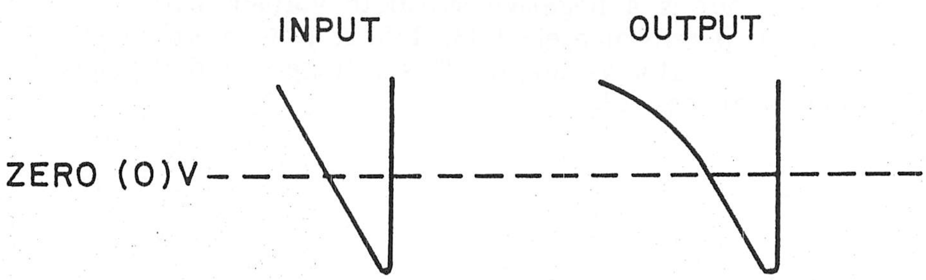



Figure 3-10. Shaping Network (A9) Input and Output Slopes

A variable frequency output signal is produced by a voltage-tuned Colpitts oscillator, consisting of NPN transistor Q1 in conjunction with varicaps CR1 and CR3, variable inductor L1, and capacitors C5, C6, and C7. The tuning voltage for the oscillator is applied through A2 board pin 17 from Shaping Network A9 to the junction of varicaps CR1 and CR3. The precise operating center frequency of the signal is established by feeding a dc voltage from front panel CENTER FREQ control R2, through A2 board pin 14, to an oscillator tank circuit consisting of components L1 and C5. The dc voltage, nominally set at 13 Vdc, provides a fixed operating bias point for varicaps CR1 and CR3. The bias point can be varied over a few millivolts range by adjustment of front panel control R2 to allow a shift in center frequency of the oscillator output relative to the sweep voltage, and to provide alignment of the sweep oscillator in relation to the center of the CRT horizontal deflection.

A portion of the voltage-tuned oscillator output is taken from the junction of capacitors C6 and C7, and fed through coupling capacitor C8 to the base of NPN transistor Q3, which functions as a class A output amplifier. Transistor Q2 and a biasing network consisting of components R7, CR2, R8, and R9 provide active biasing of transistor Q3 to hold the level of its output to a constant value as the oscillator sweeps from 500 kHz to 530 kHz. Any change in the amplitude of the Q3 output signal or in the Q3 collector current will produce a corresponding change in the voltage drop across the combination of resistors R11, R12, and R13. This voltage drop is applied to the emitter-base junction of Q2 as an error input signal to control the base drive current to the Q3 output amplifier. Any change in the Q3 current will be corrected by the active bias and feedback provided by Q2. In addition to regulating the amplifier output, resistors R11, R12, and R13 form a 3 dB pad between the Q2 emitter and A1 board pin 15.

### 3.2.8.2 Marker Generator

The marker signal is generated by a crystal-controlled Colpitts oscillator consisting of NPN transistor Q4, capacitors C20 and C21, and a 2.30 MHz tuned crystal, Y1. The oscillator output is taken from the Q4 emitter and fed through the parallel combination of resistor R19 and speed-up capacitor C22 to the base of NPN transistor Q6, which is paired with PNP transistor Q5 to form a class B push-pull amplifier. Transistor Q6 is alternately biased on and off by the oscillator output, while transistor Q5 acts as an active pull-up amplifier to provide the proper square wave input to divider U1 pin 3. Divide-by-two, D-type flip-flops U1A and U1B are cascaded to produce a divide-by-four function. The frequency of the output appearing at U1B pin 13 is 2.30 MHz 4, or 575 kHz. The U1B output is a square wave signal which is passed through a cascaded RC-LC lowpass filter, consisting of components R20, L3, C23, and C24, to be reconverted to a sine wave signal. The filter also eliminates spurious high-frequency elements from the output. The 575 kHz marker generator output is taken from the wiper of potentiometer R21, which provides a variable adjustment of the marker signal injection level.

The use of a divided and filtered crystal-generated 2.30 MHz signal allows the injection of a 575 kHz marker signal throughout the signal monitor at the image frequency, thereby preventing saturation of the entire signal monitor circuitry by the marker signal. By this means, a 455 kHz marker signal is produced which is identical to the external 455 kHz marker signal except that the former is fed to the RF mixer at the image frequency. This internal marker signal will not feed back to the signal monitor input connector because of the bandpass filter located between the RF amplifier gain stages.

### 3.2.9 PART 280062 FOCUS AND INTENSITY BOARD (A8) (Figure 6-7)

Focus and Intensity Board A8 contains a high-impedance voltage divider consisting of seven resistors, R4 through R10, series connected between ground and a -1600 V high voltage supply. The most negative end of the voltage divider is located at the junction of resistor R11 and the emitter of optical coupler U1. This device acts as a switch while providing isolation between the -15 V applied to the blanking pulse circuitry and -1600 V applied to the CRT display. The U1 switching action produces a rapid change in the CRT cathode voltage as a function of the blanking pulse period. Resistor R12 provides a shunt for U1. Initially, the diode contained in the U1 circuit is biased on, forcing the U1 transistor stage on. The collector-emitter junction, appearing at U1 pins 4 and 5, appears as a short circuit. The required bias voltage for the focus grid of the CRT is taken from the wiper of R6, and the required bias voltage for the CRT cathode is taken from the wiper of R9 in parallel with R8. Potentiometer R8 is an adjustable control which sets the operating voltage drop across the R8-R9 combination, and establishes the proper cathode-to-grid bias voltage for the CRT. Potentiometer R10 is also a part of the overall calibration. The cathode-to-grid voltage is a result of the voltage drop between terminals E1 and E2 as well as the combination of R7, R8, R9, and R10.

Immediately following the retrace of the CRT electron beam, a positive blanking pulse, lasting from 6 to 8 milliseconds, is applied to the Q1 base, causing Q1 to be biased off. In turn, the U1 diode is biased off, forcing the U1 transistor to turn off. When this action occurs, the bias voltage appearing at U1 pin 5 becomes positive with respect to the -1600 V supply. The positive peak of the bias voltage is limited by resistor R12. When the U1 transistor is turned off, the collector-emitter junction at U1 pins 4 and 5 appears as an open circuit. The positive voltage increase at U1 pin 5 causes the CRT cathode voltage at terminal E1 to become positive, producing a larger cathode-to-grid bias voltage which is applied to the CRT. The larger voltage turns the CRT electron beam off during the blanking pulse input. When the blanking pulse is removed, the U1 diode is biased off, causing the U1 transistor to turn off and returning the cathode voltage at terminal E1 to its original value.

3.2.10 CRT DISPLAY (V1) (Figure 6-9)

A signal frequency-versus-amplitude comparison is displayed on the face of an M1519P31 electrostatic deflection cathode ray tube (CRT). The 2.3-inch by 3-inch rectangular face is of uniform thickness to minimize parallax error. The internal surface of the face is coated with a P31 phosphor which has characteristics of long persistence, white florescence (in quiescent state), and yellow-green phosphorescence (in excited state).

3.2.11 POWER SUPPLY CIRCUITS (Figure 6-9)

For signal monitor operation, 115 Vac or 220 Vac, at 50 to 400 Hz, is applied to the primaries of transformer T1 through line filter FL1, fuse F1, PUSH ON/OFF POWER switch S1, and 115 V/220 V slide switch S2. When the primaries of transformer T1 are connected for 220 Vac operation and switch S2 is set in the 220 V position (T1 primaries connected in series instead of parallel), fuse F2 is a part of the power supply circuit. A third primary is not used. The center-tapped secondary of transformer T1 provides a voltage input to the diode rectifier bridge circuit of Rectifier/Filter A6. Another secondary provides 6.3 Vac for a CRT heater current.

3.2.11.1 Type 76241 Rectifier/Filter (A6) and Voltage Regulators (VR1, VR2)

Rectifier/Filter A6 along with rear panel positive and negative voltage regulators VR1 and VR2 form a bipolar power supply which converts the ac input from T1 to ±15 V from which all other dc voltages required by the signal monitor circuits are developed. Rectifier/Filter A6 contains a rectifier bridge circuit consisting of diodes CR1 through CR4, and seven filtering capacitors, C1 through C7. The voltages developed across both halves of the T1 secondary are applied to A6 input pins 16 and 18. The rectified and filtered outputs to regulators VR1 and VR2 are at A6 pin 11 and A6 pin 20.

Positive regulator VR1 and negative regulator VR2 provide current, voltage, and thermal regulation for the Rectifier/Filter circuit. The regulators are sealed, nonrepairable modules which require no adjustment. The regulated positive and negative outputs of VR1 and VR2 are held to a nominal 0.2 Vdc for variations in either line or load.

3.2.11.2 Type 76199 DC/DC Converter (A7)

DC/DC converter A7 translates the ±15 V bipolar voltages from Rectifier/Filter A6 to the higher level required for CRT deflection and biasing. The chopper-type converter is a sealed, nonrepairable module which provides +200 V for both the horizontal and vertical deflection circuits, and -1600 V for the CRT control grid and Focus and Intensity Board A8.

# SECTION IV

# MAINTENANCE

## 4.1 GENERAL

The WJ-9188A-18 Signal Monitor has been designed to operate for extended periods of time with little or no routine maintenance. An occasional cleaning and inspection are the only preventive maintenance operations recommended. The intervals for these operations should be based on the operating environment. Should trouble occur, repair time will be minimized if the maintenance technician is familiar with the circuit descriptions in Section III. Reference should also be made to the overall functional block diagram, Figure 3-1, and the schematic diagrams in Section VI. A complete illustrated parts list showing part locations can be found in Section V.

## 4.2 CLEANING AND LUBRICATION

The unit should be kept free of dust, moisture, grease, and foreign matter to ensure trouble-free operation. If available, use low-velocity compressed air to blow accumulated dust from the exterior and interior of the unit. A clean dry cloth, a soft bristled brush, or a cloth saturated with cleaning compound may also be used. The WJ-9188A-18 Signal Monitor does not require lubrication.

## 4.3 INSPECTION FOR DAMAGE OR WEAR

Many potential or existing problems can be detected by a visual inspection of the unit. For this reason, a complete visual inspection for mechanical and electrical defects should be made on a periodic basis or whenever the unit is inoperative. Electronic components that show signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Damage to parts due to heat is often the result of other less apparent problems in the circuit. It is essential that the cause of overheating be determined and corrected before replacing the damaged parts. Mechanical parts, front panel controls, and switches should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

## 4.4 COMPONENT LOCATION

Every component in the WJ-9188A-18 Signal Monitor can be located by utilizing the component location diagrams in Section V. The component location diagrams are listed according to their reference designation prefixes and can be found by referring to the List of Illustrations in the front of the manual. For further information on reference designation prefixes, refer to paragraph 5.1.

## 4.5 TEST EQUIPMENT REQUIRED

The test equipment listed in Table 4-1 or their equivalent are required for performing the given corrective maintenance. All the equipment, however, is not used in any one test procedure.

Table 4-1. Required Test Equipment

| Instrument | Required Characteristics | Recommended Instrument |
|---|---|---|
| Variable Autotransformer (Variac) | 115 Vac ±10%, 400 Hz | General Radio W5 MT3W |
| Test Oscillator | 10 to 100 kHz range, 3 mV output, 90 dB attenuation, ±10 Hz resolution | Hewlett-Packard 651B |
| Oscilloscope | 50 Hz to 600 kHz range | Tektronix T935 |
| Sweep Generator | Zero to 600 kHz sweeping range | Hewlett-Packard 675A |
| Variable Power Supply | 30 to 260 Vac, 45 Hz to 10 kHz | Elgar 251 (with series 401 V VFO) |
| Frequency Counter | | Fluke 1953A |
| Digital Voltmeter (DVM) | ac and dc capability | Data Precision 1350 |
| Signal Generator | 140 to 600 kHz range 3 to 6 mV output, ±1% accuracy | Hewlett-Packard 606B |
| Extender Board | Standard, 22 pins | Watkins-Johnson 79878 |
| Detector | 50 Ω | Hewlett-Packard 423A |

## 4.6 PERFORMANCE TESTS

The purpose of the following performance test procedures is to determine that the signal monitor is in proper operating condition. Before performing any test procedure, read th procedure instructions thoroughly. The performance tests may be performed in any order.

Test equipment should be allowed a thirty (30) minute warm-up period before beginning any performance test. Unless otherwise specified, the tests should be conducted using the commercially available ac line (115 V, 60 Hz).

Unless otherwise specified, signal monitor control settings should be as follows:

| | |
|---|---|
| GAIN | - maximum clockwise |
| LOG/LINEAR | - LIN |
| SWEEP WIDTH | - 30 kHz |
| MARKER | - OFF |
| FOCUS | - as required |
| INTENSITY | - as required |
| CENTER FREQ | - mid-range |

WARNING

Remove hands and tools from the Type 76199 DC-DC Converter (A7) and Part 280062 Focus and Intensity (A8) Boards before energizing the equipment. Use caution during all test procedures because of the high voltages present on the A7 and A8 boards.

4.6.1 TEST SETUP DIAGRAMS

The test setup diagrams used with the following performance test procedures are shown in Figures 4-1 through 4-4. Refer to the particular test procedure for the corresponding test setup diagram.

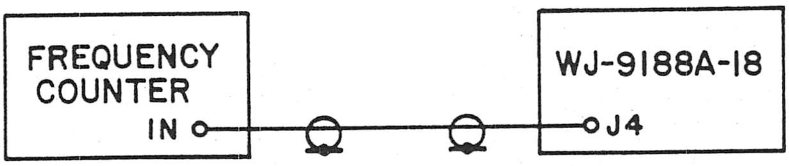



Figure 4-1. Sweep Rate Performance, Test Setup

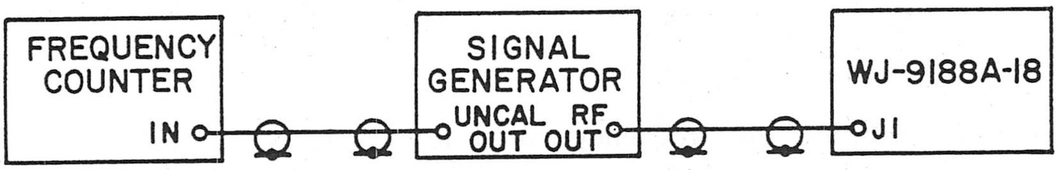



Figure 4-2. General Performance Test Procedures, Test Setup

4.6.2 SWEEP RATE

1. Connect the frequency counter to the signal monitor as shown in Figure 4-1. Energize all equipment.

2. Set SWEEP WIDTH switch S4 to the 30 kHz position.

3. Read and record the sweep rate as indicated on the frequency counter. Limits are 19 Hz minimum and 21 Hz maximum.

4. Set S4 to the 15 kHz position.

5. Read and record the sweep rate as indicated on the frequency counter. Limits are 19 Hz minimum and 21 Hz maximum.

6. Set S4 to the 5 kHz position.

7. Read and record the sweep rate as indicated on the frequency counter. Limits are 5 Hz minimum and 7 Hz maximum.

8. Deactivate the signal monitor and disconnect the frequency counter.

4.6.3 SWEEP WIDTH

1. Connect test equipment as shown in Figure 4-2. Energize all equipment.

2. Set SWEEP WIDTH switch S4 to the 30 kHz position. Turn MARKER switch S3 to ON and position the signal pip behind the center graticule mark using CENTER FREQ control R2. Turn S3 to OFF position. Set LOG/LINEAR switch S5 to the LIN detection mode.

3. Adjust the signal generator controls for a 455 kHz signal. Using signal monitor GAIN control R1, adjust the signal pip for full-scale deflection.

4. Tune the signal generator to position the signal pip behind the third graticule mark to the right of center. Note the frequency counter indication.

5. Tune the signal generator to position the signal pip behind the third graticule mark to the right of center. Note the frequency counter indication.

6. Subtract the frequency noted in step 4 from the frequency noted in step 5 and record difference. Limits are 28.5 kHz minimum and 31.5 kHz maximum.

7. Set S4 to the 15 kHz position. Repeat steps 3, 4, and 5.

8. Calculate the difference frequency as described in step 6. Limits are 14.25 kHz minimum and 15.75 kHz maximum.

9. Set S4 to the 5 kHz position. Repeat steps 3, 4, and 5.

10. Calculate the difference frequency as described in step 6. Limits are 4.8 kHz minimum and 5.2 kHz maximum.

11. Deactivate the signal monitor and disconnect the test equipment.

### 4.6.4 LINEARITY

1. Connect test equipment as shown in Figure 4-2. Activate all equipment.

2. Set SWEEP WIDTH switch S4 to the 30 kHz position and set LOG/LINEAR switch S5 to the LIN detection mode.

3. Tune the signal generator to 455 kHz and position the signal pip at the center graticule.

4. Shift the signal generator frequency to position the signal pip at each graticule mark on both sides of center. The difference between signal generator frequency readings should be 5 kHz ±250 Hz to first mark right or left of center, 10 kHz ±500 Hz to second mark right or left of center, and 15 kHz ±750 Hz to third graticule mark.

5. Reset the signal generator frequency to position the signal pip at the center graticule mark. Set S5 to the LOG detection mode and adjust the signal generator level so that the signal pip is at the top horizontal mark. Note the level of the signal generator.

6. Decrease the signal generator level to exactly 10 dB. Verify that the signal pip drops to the next horizontal mark. Adjust the generator level as required to verify that the deflection change is 10 dB ±1.0 dB.

7. Repeat step 6 for the next lower horizontal mark. Verify that the change in signal generator level from the value noted in step 5 is now 20 dB ±2.0 dB.

8. Repeat step 6 for the next lower horizontal mark. Verify a signal generator level change of 30 dB ±3.0 dB.

9. Repeat step 6 for the next lower horizontal mark. Verify a signal generator level change of 40 dB ±4 dB.

10. Deactivate the signal monitor and disconnect test equipment.

NOTE

Vertical output in LOG mode does not have to meet ±1 dB requirements of display.

### 4.6.5 CENTER FREQUENCY CONTROL RANGE

1. Connect test equipment as shown in Figure 4-2. Activate all equipment.

2. Set SWEEP WIDTH switch S4 to the 5 kHz position. Turn MARKER switch S3 ON and position the signal pip behind the center graticule mark using CENTER FREQ control R2. Turn S3 OFF. Set LOG/LINEAR switch S5 to the LIN detection mode.

3. Adjust the signal generator controls for 455 kHz. Turn signal monitor GAIN control R1 to adjust the signal pip for a full-scale deflection.

4. Turn R2 fully clockwise.

5. Tune the signal generator to position the signal pip behind the center graticule mark. Note the frequency counter indication.

6. Turn R2 fully counterclockwise. Tune the signal generator to position signal pip behind the center graticule mark. Note the frequency counter indication.

7. Subtract the reading noted in step 6 from the reading obtained in step 5 and record difference. Limits are 5 kHz, minimum.

8. Deactivate the signal monitor and disconnect the test equipment.

## 4.6.6 CRYSTAL MARKER

1. Connect test equipment as shown in Figure 4-2. Activate all equipment.

2. Set SWEEP WIDTH switch S4 to the 3 kHz position, and set LOG/LINEAR switch S5 to the LIN detection mode. Turn MARKER switch S3 ON and verify that the marker signal pip is present on the CRT display.

3. Connect the frequency counter input between ground and XA2-pin 1.

4. Note the indicated frequency on the electronic counter. Subtract 120 kHz from the counter reading and record difference as marker frequency.

5. Connect the signal generator to EXT MKR INPUT connector J2. Turn S3 OFF. Set the signal generator for a -15 dBm 455 kHz signal output.

6. Verify that the marker signal indication is present on the CRT display and is at minimum 90% of full-scale. Verify that as signal generator frequency is varied from 440 to 470 kHz, the marker pip is present over the full sweep width.

4.6.7 RESOLUTION

1. Connect test equipment as shown in Figure 4-2. Activate all equipment.

2. Set SWEEP WIDTH switch S4 to the 30 kHz position. Turn MARKER switch S3 ON and position the signal pip behind the center graticule mark using CENTER FREQ control R2. Turn S3 OFF. Set LOG/LINEAR S5 to the LIN detection mode.

3. Adjust the signal generator for 455 kHz. Using signal monitor GAIN control R1, adjust the signal pip for full-scale deflection.

4. Turn S3 ON.

5. Change the frequency of the signal generator until the valley between the signal pip and marker pip is one-half full-scale. Note the frequency of the signal generator as indicated on the frequency counter.

6. Subtract the frequency noted in step 5 from the frequency noted in paragraph 4.6.6, step 4. The difference should be 3.0 kHz maximum.

7. Set S4 to the 5 kHz position.

8. Repeat steps 3 through 5.

9. Record the difference between the signal generator frequency and the frequency recorded in paragraph 4.6.6, step 4. The difference should be 400 Hz maximum.

4.6.8 GAIN CONTROL RANGE

1. Connect test equipment as shown in Figure 4-2. Activate all equipment.

2. Turn signal monitor GAIN control R1 fully clockwise.

3. Set LOG/LINEAR switch S5 to the LIN detection mode.

4. Tune the signal generator to 455 kHz. Set the output level for a full-scale reference on the signal monitor. Note the signal generator RF output level.

5. Set R1 fully counterclockwise. Increase the output level of the signal generator until full-scale reference is again obtained. Note the signal generator RF output level.

6. Subtract the level noted in step 4 from the level noted in step 5. The difference is the signal monitor gain control range and should be 60 dB minimum.

7. Set S5 to the LOG detection mode.
8. Repeat steps 2 through 4.
9. Subtract the two RF levels noted in step 8. The difference should be 60 dB minimum.

## 4.6.9 IMAGE AND IF REJECTION

1. Connect test equipment as shown in Figure 4-2. Activate all equipment.
2. Adjust signal monitor GAIN control R1 fully clockwise.
3. Tune the signal generator to 455 kHz. Adjust the RF output level for a full-scale signal pip on the signal monitor. Note the signal generator RF output level as a reference.
4. Tune the signal generator to 575 kHz. Increase the RF output level until the signal pip on the signal monitor is again full-scale. The RF output should be a minimum of 25 dB above the reference level noted in step 3.
5. Repeat step 3.
6. Tune the signal generator to 60 kHz. Increase the RF output level until the baseline moves up to a full-scale level. The RF output level should be a minimum of 60 dB above the reference noted in step 3.

## 4.6.10 FLATNESS OF RESPONSE

1. Connect test equipment as shown in Figure 4-2. Activate all equipment.
2. Adjust signal monitor GAIN control R1 fully clockwise. Set SWEEP WIDTH switch S4 to the 30 kHz position and LOG/LINEAR switch S5 to the LIN detection mode.
3. Tune the signal generator to 455 kHz. Set RF output level for 80% full-scale deflection of the signal pip on the signal monitor display.
4. Tune the signal generator approximately 455 kHz ±15 kHz to the point where signal pip is at its highest peak. Decrease RF output of the generator to a level for 80% full-scale deflection of signal pip on the signal monitor display. Note generator output level (dBm).
5. Repeat step 4 using the frequency where signal pip is lowest.

6. Increase RF output level of the signal generator until signal pip is again at 80% full-scale deflection. This level should be a maximum of 2 dB above the level set in step 4.

### 4.6.11 SENSITIVITY

1. Connect test equipment as shown in Figure 4-2. Activate all equipment.
2. Adjust GAIN control R1 fully clockwise. Set SWEEP WIDTH switch S4 to the 30 kHz position and LOG/LINEAR switch S5 to the LIN detection mode.
3. Tune the signal generator to 455 kHz. Set the signal generator output level for a full-scale signal pip on the signal generator display.
4. Record RF output level of the signal generator. This reading should be 2.0 μV maximum.
5. Set S5 to the LOG detection mode.
6. Repeat step 3.
7. Record RF output level of the signal generator. This reading should be 20 μV maximum.

### 4.6.12 HORIZONTAL AND VERTICAL OUTPUTS

1. Connect oscilloscope as shown in Figure 4-3a. Energize all equipment.
2. Adjust GAIN control R1 and SWEEP WIDTH switch S4 fully clockwise. Set LOG/LINEAR switch S5 to the LIN detection mode.
3. Tune the signal generator to 455 kHz. Set for carrier wave operation and adjust output level to produce full-scale deflection on signal monitor display.
4. Connect the oscilloscope to VERT OUTPUT connector J3 (Figure 4-3a). Measure and note the vertical output level. Output level should be 0.4 V peak minimum.
5. Connect oscilloscope to HORIZ OUTPUT connector J4 (Figure 4-3b). Measure and note the horizontal output level. Output level should be 8 Vp-p minimum to 12 Vp-p maximum.

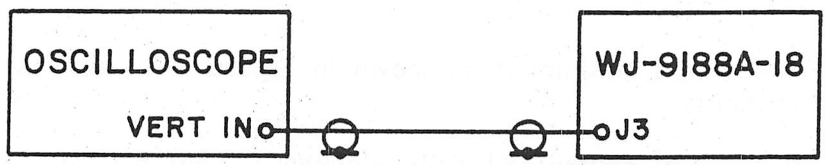



Figure 4-3a

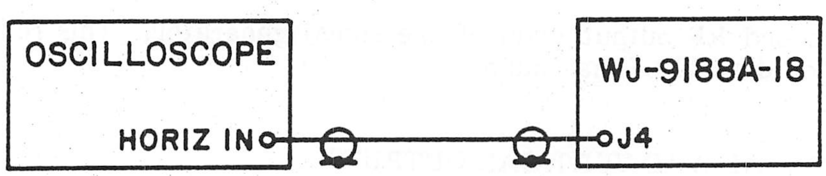



Figure 4-3b

Figure 4-3. Horizontal and Vertical Outputs, Test Setup

4.6.13 POWER SUPPLY PERFORMANCE

WARNING

THE FOLLOWING PROCEDURE REQUIRES WORKING IN AREA OF HIGH VOLTAGE. USE EXTREME CAUTION.

1. Connect test equipment as shown in Figure 4-4 (solid lines). Energize all equipment.

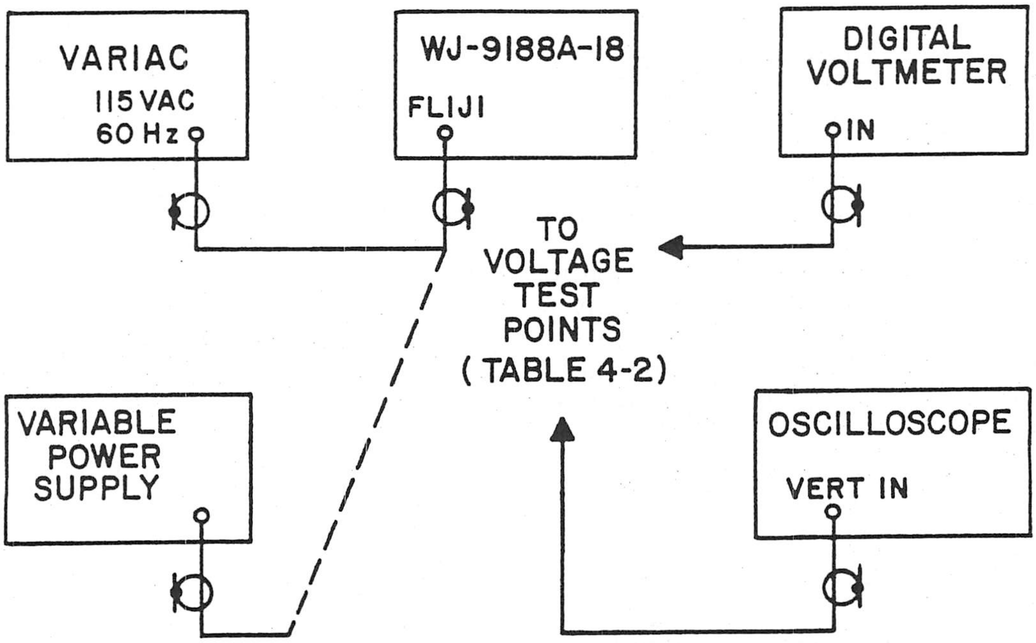



Figure 4-4. Power Supply Performance, Test Setup

2. Set S2 (signal monitor) to the 115 V position.

3. Set variac to 115 Vac, 60 Hz.

4. Measure and record power consumption. Limit is 25 W maximum.

5. Measure and record voltages at test points shown in Table 4-2. Limits for each test point are also shown.

Table 4-2. Test Point Voltage Limits

| Test Point | Limits | |
|---|---|---|
| E1 | +15 V | ±0.75 V |
| E2 | -15 V | ±0.75 V |
| A7-E4 | -1600 V | ±200 V |
| A7-E3 | +200 V | ±20 V |

6. Set the ac input to the signal monitor at 103 Vac, 60 Hz and measure voltages at E1 and E2. Limits are shown in Table 4-2.

7. Repeat step 6 above with ac input at 127 Vac, 60 Hz.

8. Disconnect the variac. Connect power supply to signal monitor as shown in Figure 4-4 (broken lines).

9. Set variable power supply to 115 Vac, 400 Hz.

10. Measure and record voltages as shown in Table 4-2.

11. Set the signal monitor for 220 Vac operation. Adjust the variable power supply to 220 Vac 50 Hz.

12. Decrease ac input until pulses appear at E1 and E2. Record ac input. It should be 198 Vac maximum.

13. Deactivate the signal monitor and disconnect the test equipment. Reset S2 to 115 V position.

## 4.7 ALIGNMENT AND ADJUSTMENT PROCEDURES

The following alignment and adjustment procedures should not be performed on a routine basis, but should instead be used as aids in troubleshooting and post-repair checkout. Before alignment is attempted, the technician should first perform relevant tests to determine which subassemblies require alignment. These procedures may be used to align new and repaired subassemblies. Before performing any alignment procedure, read the procedure instructions thoroughly. The procedures outlined in paragraphs 4.7.2 through 4.7.8 should be completed before the final adjustments in paragraphs 4.7.9 and 4.7.10 are performed.

Test equipment should be allowed a thirty (30) minute warm-up period before beginning any alignment or adjustment procedure. Unless otherwise specified, procedures should be conducted using the commercially available ac line (115 V, 60 Hz).

Unless otherwise specified, signal monitor settings should be as follows:

| | |
|---|---|
| GAIN | - maximum clockwise |
| LOG/LINEAR | - LIN |
| SWEEP WIDTH | - 30 kHz |
| MARKER | - OFF |
| FOCUS | - as required |
| INTENSITY | - as required |
| CENTER FREQ | - mid-range |

WARNING

Remove hands and tools from the Type 76199 DC-DC Converter (A7) and Part 280062 Focus and Intensity (A8) Boards before energizing the equipment. Use caution during all alignment and adjustment procedures because of the high voltages present on the A7 and A8 boards.

## 4.7.1 INTERNAL ADJUSTMENTS

There are twenty-seven internal adjustments in the WJ-9188A-18 Signal Monitor. Table 4-3 lists the adjustments, in sequence according to subassembly reference designation prefix. Because of the interactive nature of some components, readjustments may be required to obtain the desired results.

Table 4-3. Internal Adjustments

| REF DESIG | CIRCUIT | COMPONENT |
|---|---|---|
| A1 | Amplifier/Mixer | L2, L3, L6 |
| A2 | Sweep Oscillator | L1, L2 |
| A2 | Marker Generator | R21 |
| A3 | IF Amplifier | L1, L2, L3, R13, R24 |
| A4 | LIN/LOG Amplifier | R20, R21 |
| A5 | Horizontal Sweep Oscillator/ | R5, R8, R19, R36, R38, |
| | Deflection Amplifier | R39, R40 |
| A5 | Vertical Deflection Amplifier | R23, R32, R34 |
| A8 | Focus and Intensity | R8, R10 |
| A9 | Shaping Network | R1, R2 |

## 4.7.2 HORIZONTAL SWEEP OSCILLATOR AND DEFLECTION AMPLIFIER ADJUSTMENT

1. Remove the protective cover and insert Horizontal Sweep Oscillator and Deflection Amplifier A5 in the signal monitor using an extender card.

2. Connect cable from the rear panel HORIZ OUTPUT connector J4 to the vertical input of the oscilloscope.

3. Set SWEEP WIDTH control S4 to 30 kHz.

4. Connect the DVM between ground and A5U1 pin 2. Adjust A5R36 for a zero (0.0) Vdc indication on DVM.

5. Verify that the horizontal sweep signal displayed on the oscilloscope is the same as shown in Figure 4-5. Letters A, B, and C in the figure indicate references for the separate time functions of the displayed sweep signal. Use dc coupling on the oscilloscope and position the horizontal trace on center line for grounded signal input reference.

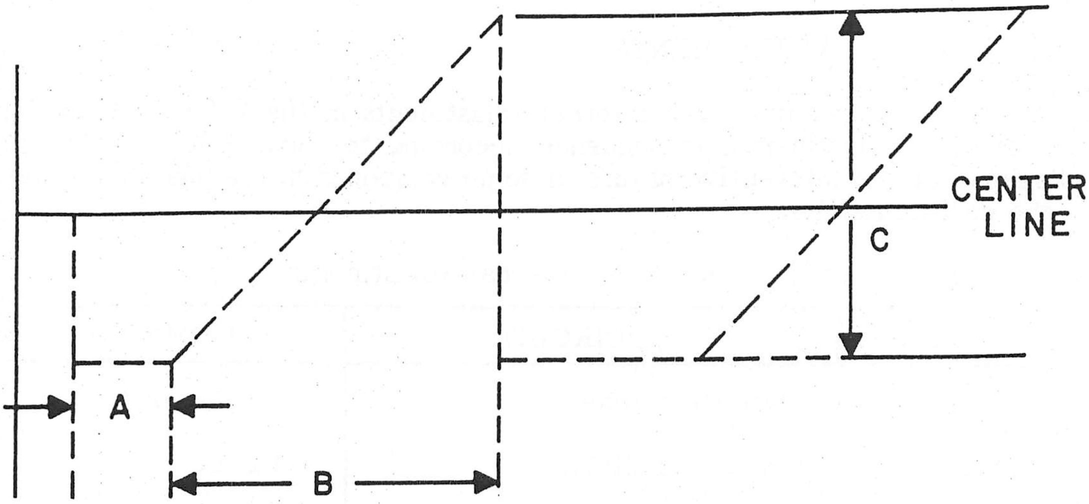



Figure 4-5. Horizontal Sweep Signal

NOTE. In the event that the CRT has been replaced, it may be necessary to adjust the values of A5R13 (for horizontal sweep width adjustment) and A5R16 (to prevent foldover). The final values of the resistors are factory select due to CRT variations.

6. Adjust potentiometer A5R5 to set sweep time (reference B) to a nominal 50 msec. Verify that time reference A is typically 6 to 8 msec.

7. Set S4 to 5 kHz. Verify that sweep time (reference B) changes to 166 msec (nominal), -23/+34 msec.

8. Verify that peak-to-peak amplitude of sweep voltage ramps from -4.5 volts to +6 volts (typically).

9. Connect a jumper wire between ground and the junction of A5R7 and A5R8. Adjust potentiometer A5R19 to position CRT display pip directly behind the center line graticule. Remove jumper wire.

10. Adjust potentiometer A5R8 to produce a full deflection of horizontal trace on the CRT display. Trace deflection should extend beyond graticule markings. Repeat steps 9 and 10 until interaction is reduced.

11. Reset S4 to 30 kHz. Connect the vertical input of the oscilloscope to A5 board pin 10. Oscilloscope display should show inverted duplicate of sweep signal. Adjust potentiometer A5R40 for +9 V peak deflection during time reference A.

12. Reset S4 to 15 kHz and adjust potentiometer A5R39 for peak deflection of +4.5 V peak during time reference A. Final calibration of R39 is described in paragraph 4.7.10.

13. Reset S4 to 5 kHz and adjust potentiometer A5R38 for peak deflection of +1.5 V during time reference A. Final calibration of R38 is described in paragraph 4.7.10.

### 4.7.3 CRT BLANKING VERIFICATION AND INTENSITY ADJUSTMENT

WARNING

THE FOLLOWING PROCEDURE REQUIRES WORKING IN AREA OF HIGH VOLTAGE. USE EXTREME CAUTION.

1. Remove the protective cover from the Focus and Intensity Board (A8).

2. Set the oscilloscope VERT IN at 0.2 V/cm and set HORIZ IN at ms/cm. Connect the 10x probe to the vertical input. Calibrate the oscilloscope so that 0 Vdc is at the top graticule on the oscilloscope display. Attach the probe to A8U1 pin 1 (the top of 1.5 k ohm resistor, R3).

3. On the oscilloscope display, verify the presence of a -14 Vdc shift with a 0.5 volt pulse of approximately 6-8 milliseconds, as shown in Figure 4-6.

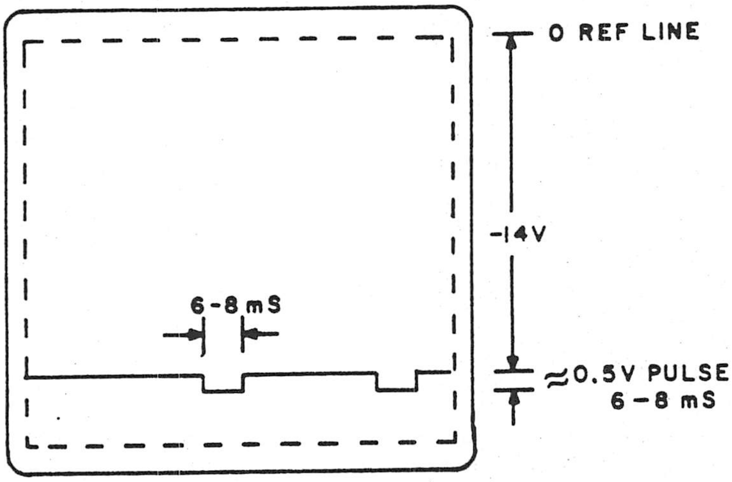



Figure 4-6. Blanking Pulse Display

4. Disconnect the 10x probe.

5. While monitoring the CRT of the signal monitor, turn front panel INTENSITY control fully counterclockwise. Adjust A8R8 for a minimum visible trace.

6. Verify the operation of the front panel FOCUS control.

7. Turn the front panel INTENSITY control fully clockwise. Adjust A8R10 for maximum intensity before "blooming" and/or DC shift of the CRT trace occurs.

8. Verify the operation of the front panel FOCUS control.

9. Repeat steps 5 through 8 until proper operation is assured. Note that the trace must be visible through the entire range of the front panel INTENSITY control.

10. Replace protective cover on A8.

4.7.4 VERTICAL DEFLECTION ALIGNMENT

1. Remove LOG/LIN Amplifier (A4).

2. Connect an external power supply between ground and A5 board pin 20. Apply the positive terminal of the power supply to pin 20. Set the power supply to zero (0) V output.

3. Adjust potentiometer A5R23 to position the CRT trace behind the baseline of graticule.

4. Set the power supply to a +5 V ±0.02 V output. Adjust potentiometer A5R32 to position CRT trace behind the top reference line of graticule. Repeat steps 2 and 3 as required to achieve desired results.

5. Verify that vertical deflection is 1 V per division on the signal monitor CRT display.

6. Adjust A5R34 to correct any trace tilt.

7. Remove power supply connection.

4.7.5 LOG/LIN AMPLIFIER ADJUSTMENT

1. Remove PC module A3 from the signal monitor and insert LOG/LIN Amplifier A4 board in the unit using an extender card.

2. Connect the DVM between ground and test point A4E1.

3. Connect the 600 Ω output of the test oscillator between ground and XA4 pin 21. Set test oscillator frequency to 60 kHz and output level to -30 dBm (7.1 mV).

4. Set LOG/LINEAR switch S5 to the LIN detection mode.

5. Adjust potentiometer A4R20 for a DVM indication of +5 V ±0.01 V.

6. Set S5 to the LOG detection mode.

7. Adjust potentiometer A4R21 for a DVM indication of +3 V ±0.01 V.

8. Repeat steps 4 through 7 several times to verify the correct voltage reading on the DVM as S5 is changed from LIN to LOG detection modes.

9. Verify that vertical deflection of the signal monitor CRT display coincides with full-scale deflection (5 divisions) in the LIN detection mode and a deflection of 3 divisions in the LOG detection mode.

NOTE

This adjustment must be within ±2 dB of CRT deflection versus -30 dBm input level of 60 kHz signal.

10. Remove test oscillator connection from XA4 pin 21.

### 4.7.6 IF AMPLIFIER ALIGNMENT

1. Remove PC module A1 from the signal monitor and insert IF Amplifier A3 in the unit using an extender card.

2. Connect the 600 ohm test oscillator output between ground and IF Filter (Input Terminal) FL2 on the bottom side of the main chassis deck.

3. Set test oscillator frequency to exactly 60 kHz (with frequency counter) at a level of -65 dBm (125 µV).

4. Set SWEEP WIDTH switch S4 to 30 kHz and LOG/LINEAR switch S5 to the LIN detection mode.

5. Adjust inductors A3L1 and A3L2 for the maximum output indication on the DVM. (NOTE: The DVM should be connected to test point A4E1.)

6. After peaking inductors A3L1 and A3L2, adjust gain potentiometer A3R24 for a +5 V reading on the DVM.

7. Set S4 to 5 kHz and adjust inductor A3L3 for the maximum DVM indication.

8. After peaking inductor A3L3, adjust gain potentiometer A3R24 for a DVM indication of +5 V.

9. Repeat any of the above steps as required to produce a +5 V reading on the DVM with a -65 dBm, 60 kHz input to IF Filter FL2, in 5 kHz and 30 kHz sweep widths.

## 4.7.7 SWEEP OSCILLATOR/MARKER GENERATOR ALIGNMENT

### 4.7.7.1 Marker Oscillator Alignment

1. Remove PC module A1 from the signal generator and insert Sweep Oscillator/Marker Generator A2 board in the unit using an extender card.
2. Connect the oscilloscope and frequency counter to marker output on XA2 pin 1.
3. Turn MARKER switch S3 to ON.
4. Verify that the oscilloscope displays a sine wave signal of 0.25 Vp-p amplitude when potentiometer A2R21 is adjusted for full output.
5. Verify that the frequency counter indicates frequency of 575 kHz ±28 Hz.
6. Verify that potentiometer A2R21 enables setting of the output level to any desired value up to 0.25 Vp-p.
7. Turn S3 OFF.

### 4.7.7.2 Sweep Oscillator Alignment

1. Connect a jumper wire between ground and XA2 pin 17 to short out sweep voltage input.
2. Connect the DVM between ground and XA2 pin 14. Set CENTER FREQ control R2 to provide a +14 V reading on the DVM.
3. If the +14 V reading on the DVM does not coincide with the center of adjustment range, set R2 to midpoint.
4. Connect the oscilloscope and frequency counter to XA2 pin 22.
5. Adjust inductor A2L1 for a frequency reading of 515 kHz ±100 Hz.
6. Adjust inductor A2L2 for maximum output on oscilloscope. Output shall be a sine wave signal of 2.25 Vp-p amplitude (nominal), into a 50 ohm load.
7. Remove the sweep voltage input jumper wire short to ground. The oscilloscope should indicate a frequency-modulated output signal.

4.7.8 AMPLIFIER/MIXER ALIGNMENT

1. Insert Amplifier/Mixer A1 board in the signal monitor using an extender card. Sweep Oscillator/Marker Generator A2 should be removed to eliminate LO signal input to mixer A1U1.

2. Connect the sweep generator output to SIGNAL INPUT connector J1 on rear panel of signal monitor.

3. Connect a 50 ohm detector to EXT MARKER connector J2 on the rear panel of signal monitor.

4. Adjust the sweep generator to provide a sweeping RF input to the signal monitor between 420 kHz and 490 kHz. With the front panel GAIN control R1 set fully clockwise, adjust the sweep generator level and oscilloscope gain to display input amplifier bandpass.

5. Adjust inductors A1L2 and A1L3 to produce bandpass response shown in Figure 4-7.

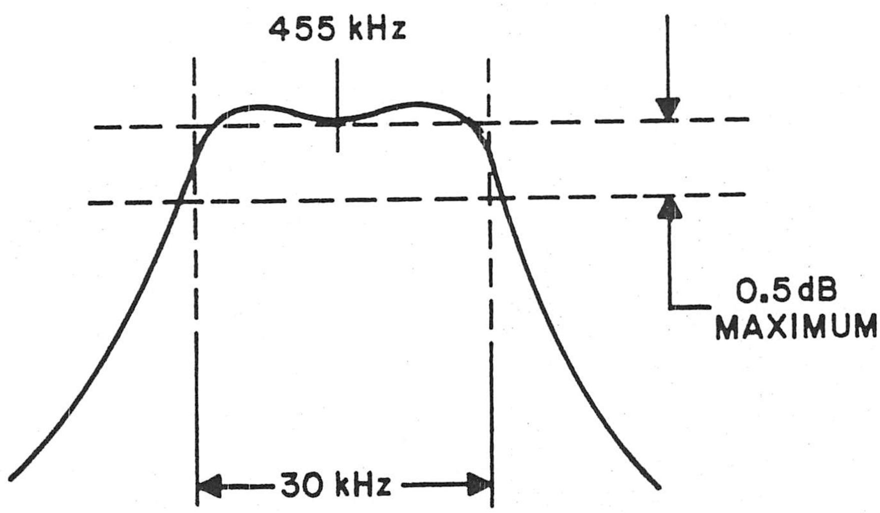



Figure 4-7. Amplifier/Mixer Alignment Bandpass Response

6. Remove the sweep generator and 50 ohm detector. Insert A2 board and turn MARKER switch S3 ON.

7. Adjust inductor A1L6 for the maximum marker indication on the signal monitor CRT. Reduce marker input level by adjustment of potentiometer A2R21 as required to keep marker amplitude on CRT screen.

8. Turn S3 OFF and connect the signal generator to J1. Set frequency to 455 kHz and signal generator output level to -80 dBm. Verify signal pip on signal monitor CRT. Verify that GAIN control R1 will vary displayed pip over a minimum of 60 dB signal input range.

9. Verify that as signal generator frequency is varied from 440 to 470 kHz, the signal pip displayed on the signal monitor CRT moves from left side of screen to right side of screen. Verify that amplitude of signal pip does not change more than 2 dB.

4.7.9 VERTICAL DEFLECTION CALIBRATION (A1, A3, A4, A5)

1. Connect the signal generator to SIGNAL INPUT connector J1 on the signal monitor.

2. Set the signal generator frequency to 455 kHz and adjust output level to -104 dBm (1.4 μV).

3. Set LOG/LINEAR switch S5 to LIN detection mode. Set SWEEP WIDTH switch S4 to 30 kHz. Adjust GAIN control R1 fully clockwise.

4. Observe the signal pip on the signal monitor CRT display. Adjust potentiometer A3R13 for full-scale deflection of signal pip.

5. Set S4 to 5 kHz. Adjust potentiometer A3R24 for full-scale deflection of signal pip.

6. Reset S4 to 30 kHz. Set S5 to the LOG detection mode. Verify that the signal pip is within ±2 dB of -20 dB reference line on CRT graticule.

7. Using GAIN control R1 and varying signal generator output, verify that signal monitor display in LOG detection mode is 10 dB/division and within ±2 dB accuracy.

8. Reset S5 to the LIN detection mode and verify that GAIN control R1 provides 60 dB or more gain control range relative to input signal level.

9. Verify that sweep retrace is not visible on CRT display.

10. Remove signal generator input signal, turn MARKER switch S3 ON, and verify that the marker pip amplitude is 90% minimum deflection in LIN detection mode. Readjust A2R21 as necessary. Vary front panel GAIN control R1 and verify that marker pip amplitude does not change.

### 4.7.10 HORIZONTAL DEFLECTION CALIBRATION (A2, A5, A9)

1. Connect the oscilloscope between ground and XA5 pin 10. Verify that peak value of sweep voltage during blanking period (refer to time reference A in Figure 4-5) is +5 V, referenced to ground. Adjust potentiometer A5R40, if required, to set output to +5 V.

2. Connect the signal generator to SIGNAL INPUT connector J1. Connect the test oscillator to the AM modulation input of the signal generator. Set the signal generator frequency to exactly 455 kHz and test oscillator frequency to exactly 15 kHz. Adjust AM modulation of the signal monitor to 95% modulation.

3. Set SWEEP WIDTH switch S4 to 30 kHz. Set LOG/LINEAR switch S5 to the LIN detection mode. Adjust GAIN control R1 and signal generator output to display input signal pip on the signal monitor CRT. Adjust CENTER FREQ control R2 to position the 455 kHz carrier signal exactly on the center line of CRT graticule.

4. Adjust the horizontal position control, A5R9, to position the 455 kHz carrier signal one-half division to the right of the centerline.

5. Adjust the horizontal width control, A5R8, until the CRT trace (unblanking point), coincides with the left edge of the graticule.

6. Adjust the horizontal position control, A5R19, to reposition the 455 kHz carrier signal exactly on the centerline of the CRT graticule.

7. Adjust potentiometer A9R2 to position the lower 10 kHz sideband signal pip in line with the graticule line two positions to the left of the centerline. If adjustment of A9R2 will not provide correct positioning of lower sideband signal pip, readjustment of potentiometer A5R40 (step 1) may be required.

8. Adjust potentiometer A9R1 to position the upper 10 kHz sideband signal pip in line with the graticule line two positions to the right of the centerline.

9. Repeat steps 7 and 8 above as required to establish 30 kHz sweep calibration. Using the test oscillator, verify that 5 kHz ±250 Hz is the first graticule right or left of center and that 15 kHz ±750 Hz is the extreme right and left lines. Do not proceed until this calibration is completed.

10. Set S4 to 15 kHz and test oscillator frequency to 7.5 kHz. Adjust potentiometer A5R39 to position the ±7.5 kHz sideband pips at extreme left and right graticule lines. Equalize any asymmetrical distortion. The 455 kHz carrier pip must be centered on CRT display.

11. Set S4 to 5 kHz and set test oscillator frequency to 2.5 kHz. Adjust potentiometer A5R38 to position the ±2.5 kHz sideband pips at extreme left and right graticule lines. Equalize any asymmetrical distortion. The 455 kHz carrier pip must be centered on CRT display.

12. Repeat any of the previous steps as required to verify overall horizontal sweep calibration.

13. Replace the protective covers on the A4 and A5 modules.

# SECTION V

# REPLACEMENT PARTS LIST

## 5.1 UNIT NUMBERING METHOD

The unit numbering method of assigning reference designations (electrical symbol numbers) has been used to identify assemblies, subassemblies (and modules), and parts. An example of the unit numbering method follows:

| Subassembly Designation A1 | R1 Class and No. of Item |
|---|---|
| Identify from right to left as: | First (1) resistor (R) of first (1) subassembly (A) |

As shown on the main chassis schematic, components which are an integral part of the main chassis have no subassembly designation.

## 5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Reference designation prefixes are provided on drawings and illustrations in parentheses within the figure titles.

## 5.3 LIST OF MANUFACTURERS

| Mfr. Code | Name and Address |
|---|---|
| 01121 | Allen-Bradley Company<br>1201 South 2nd Street<br>Milwaukee, WI 53204 |
| 01295 | Texas Instruments, Inc.<br>Semiconductor-Components Div.<br>13500 North Central Expressway<br>Dallas, TX 75231 |
| 02735 | RCA Corporation<br>Solid State Division<br>Route 202<br>Somerville, NJ 08876 |
| 03508 | General Electric Company<br>Semiconductor Products Dept.<br>Electronics Park<br>Syracuse, NY 13201 |
| 04099 | Capco, Incorporated<br>Foresight Industrial Park<br>P.O. Box 2164<br>Grand Junction, CO 81501 |
| 04713 | Motorola, Incorporated<br>Semiconductor Products Division<br>5005 East McDowell Road<br>Phoenix, AZ 80058 |
| 05245 | Components Corporation<br>2857 N. Halsted Street<br>Chicago, IL 60657 |
| 08108 | Lamp industry for use with industry designations and abbreviations for lamps |

| Mfr. Code | Name and Address |
|---|---|
| 13103 | Thermalloy Company<br>2021 W. Valley View Lane<br>Dallas, TX 75234 |
| 14632 (WJ 85) | Watkins-Johnson Company<br>700 Quince Orchard Road<br>Gaithersburg, MD 20878 |
| 16428 | Belden Corporation<br>P.O. Box 1101<br>Richmond, IN 47374 |
| 18324 | Signetics Corporation<br>811 East Arques Avenue<br>Sunnyvale, CA 94086 |
| 20183 | General Atronics<br>1200 East Mermaid Lane<br>Philadelphia, PA 19118 |
| 27193 | Cutler-Hammer, Inc.<br>Specialty Products Division<br>402 North 27th Street<br>Milwaukee, WI 53216 |
| 27735 | F-Dyne Electronics<br>499 Howard Avenue<br>Bridgeport, CT 06605 |
| 27956 | Relcom<br>3333 Hillview Ave.<br>Palo Alto, CA 94304 |
| 56289 | Sprague Electric Co.<br>Marshall Street<br>North Adams, MA 01247 |
| 71279 | Cambridge Thermionic Corp.<br>445 Concord Avenue<br>Cambridge, MA 02138 |
| 71400 | Bussman Manufacturing<br>Division of McGraw-Edison Co.<br>2536 W. University Street<br>St. Louis, MO 63107 |
| 71785 | TRW Electronic Components<br>Cinch Connector Operations<br>1501 Morse Avenue<br>Elk Grove Village, IL 60007 |
| 72136 | Electro Motive Mfg. Co., Inc.<br>South Park & John Street<br>Willimantic, CT 06226 |
| 72365 | Fayette and Co. Ltd.<br>N. Montreal, Quebec, Canada |
| 72982 | Erie Tech. Products, Inc.<br>644 West 12th Street<br>Erie, PA 16512 |
| 73138 | Beckman Instr., Inc.<br>Helipot Division<br>2500 Harbor Blvd.<br>Fullerton, CA 92634 |
| 74868 | Bunker Ramo Corporation<br>The Amphenol RF Division<br>33 East Franklin Street<br>Danbury, CT 06810 |
| 75915 | Littlefuse, Incorporated<br>800 E. Northwest Highway<br>Des Plaines, IL 60016 |
| 80103 | Lambda Electronics Corp.<br>Div. of Veeco Instruments, Inc.<br>515 Broad Hollow Road<br>Melville, NY 11746 |
| 80131 | Electronic Industries Association<br>2001 Eye Street, N.W.<br>Washington, DC 20006 |
| 81073 | Grayhill Incorporated<br>561 Hill Grove Avenue<br>LaGrange, IL 60525 |
| 81349 | Military Specifications |

| Mfr. Code | Name and Address |
|---|---|
| 82389 | Switchcraft, Inc.<br>5555 North Elston Avenue<br>Chicago, IL 60630 |
| 84411 | TRW Electric Components<br>TRW Capacitors<br>112 W. First Street<br>Ogallala, NB 69153 |
| 87034 | Marco-Oak Industries, Div. of<br>Oak Electro/Netics Corporation<br>207 South Helena Street<br>Anaheim, CA 92803 |
| 91506 | Augat, Incorporated<br>33 Perry Avenue<br>Attleboro, MA 02703 |
| 92825 | Whitso Incorporated<br>9330 Byron Street<br>Schiller Park, IL 60176 |
| 93332 | Sylvania Electric Products, Inc.<br>Semiconductor Products Division<br>100 Sylvan Road<br>Woburn, MA 01801 |
| 99800 | American Precision Industries<br>Delevan Electronics Division<br>270 Quaker Road<br>East Aurora, NY 14052 |

## 5.4 PARTS LIST

The parts list which follows contains all electrical parts used in the equipment and certain mechanical parts which are subject to unusual wear or damage. When ordering replacement parts from Watkins-Johnson Company, specify the type and serial number of the equipment and the reference designation and description of each part ordered. The list of manufacturers provided in paragraph 5.3 and the manufacturer's part number for components are included as a guide to the user of the equipment in the field. These parts may not necessarily agree with the parts installed in the equipment; however, the parts specified in this list will provide satisfactory operation of the equipment. Replacement parts may be obtained from any manufacturer as long as the physical and electrical parameters of the part selected agree with the original indicated part. In the case of components defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

NOTE

As improved semiconductors become available, it is the policy of Watkins-Johnson to incorporate them in proprietary products. For this reason some transistors, diodes and integrated circuits installed in the equipment may not agree with those specified in the parts list and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.

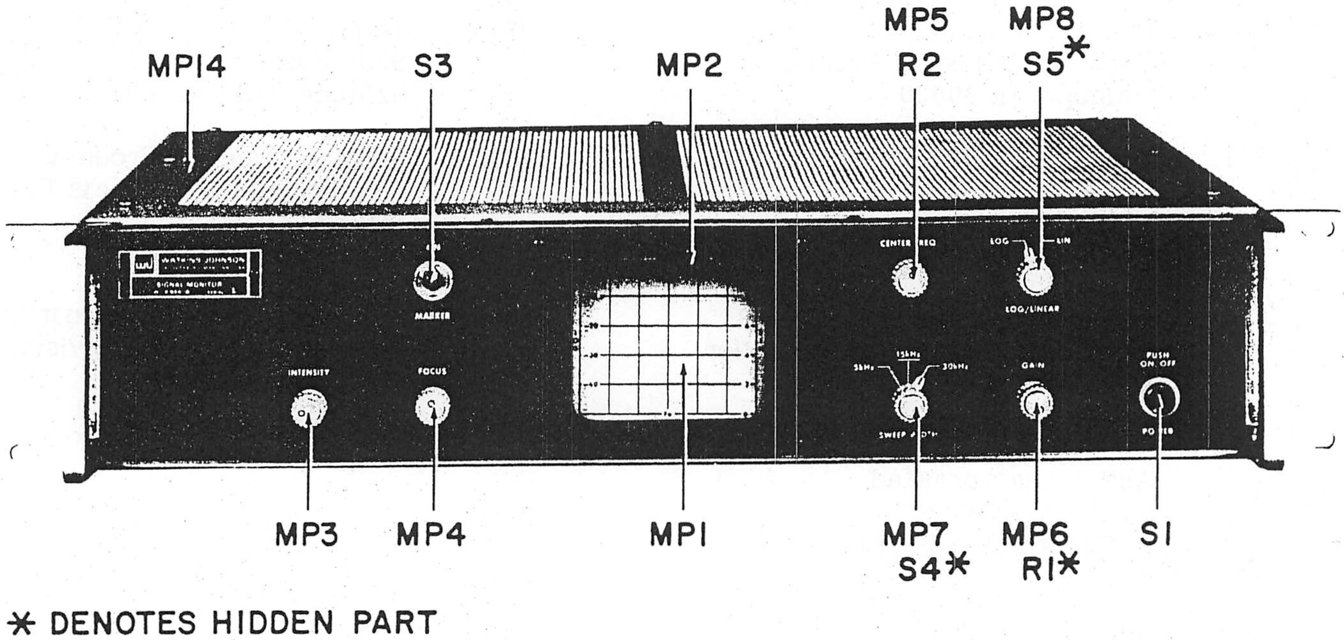



Figure 5-1. WJ-9188A-18 Signal Monitor, Main Chassis, Front View

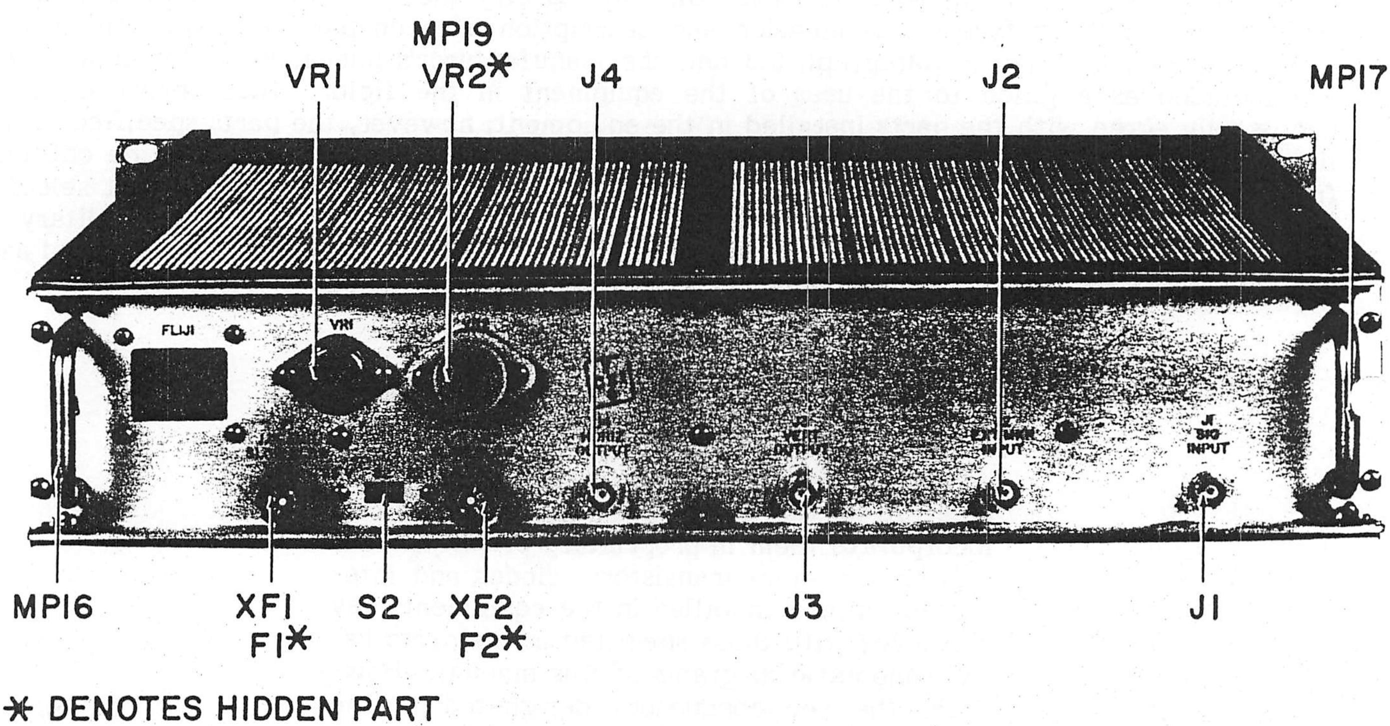



Figure 5-2. WJ-9188A-18 Signal Monitor, Main Chassis, Rear View

5.5 TYPE WJ-9188A-18 SIGNAL MONITOR, MAIN CHASSIS

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| A1 | Amplifier/Mixer | 1 | 796043 | 14632 | |
| A2 | Sweep Oscillator/Marker Generator | 1 | 796040 | 14632 | |
| A3 | IF Amplifier | 1 | 796039 | 14632 | |
| A4 | Lin/Log Amplifier | 1 | 796059 | 14632 | |
| A5 | Horizontal Sweep Generator and Deflection Amplifier | 1 | 796041 | 14632 | |
| A6 | Rectifier/Filter | 1 | 76241 | 14632 | |
| A7 | DC/DC Converter (Nonrepairable) | 1 | 76199 | 14632 | |
| A8 | Focus and Intensity Board | 1 | 280062 | 14632 | |
| A9 | Shaping Network | 1 | 796048 | 14632 | |
| C1 | Capacitor, Ceramic, Disc: 0.4 μF, 20%, 100 V | 2 | 8131M100-651-474M | 72982 | |
| C2 | Same as C1 | | | | |
| DS1 | Lamp, Neon | 1 | A1H | 08108 | |
| E1 | Header Board Assembly | 2 | 22625 | 14632 | |
| E2 | Same as E1 | | | | |
| F1 | Fuse, Cartridge: 1/4 A, 3AG, Slow-Blow | 1 | MDL 1/4 | 71400 | |
| F2 | Fuse, Cartridge: 1/8 A, 3AG, Slow-Blow | 1 | MDL 1/8 | 71400 | |
| FL1 | Filter, Power Line | 1 | 3EF2 | 05245 | |
| FL2 | Filter: BP, 60 kHz CF, 2 kHz BW | 1 | 92183 | 14632 | |
| FL3 | Filter: BP, 60 kHz CF, 235 Hz BW | 1 | 92135 | 14632 | |
| J1 | Connector, Jack: BNC Series | 4 | 17825-1002 | 74868 | |
| J2 | Same as J1 | | | | |
| J3 | Same as J1 | | | | |
| J4 | Same as J1 | | | | |
| MP1 | CRT Filter Marking | 1 | 280058 | 14632 | |
| MP2 | Tube Hood | 1 | 380035 | 14632 | |
| MP3 | Knob, Round, Indicator Dot | 4 | PS50D1/LG | 21604 | |
| MP4 | Same as MP3 | | | | |
| MP5 | Same as MP3 | | | | |
| MP6 | Same as MP3 | | | | |
| MP7 | Knob, Round, Indicator Point | 2 | PS50PL1/LG | 21604 | |
| MP8 | Same as MP7 | | | | |
| MP9 | Shield, Pot (Not Shown) | 1 | 280095 | 14632 | |
| MP10 | Handle, PC Board | 1 | 15689-1 | 14632 | |
| MP11 | Wrench | 1 | GGGW0652-1/16AF | 81349 | 72365 |
| MP12 | Alignment Tool | 1 | 5284 | 73899 | |
| MP13 | Alignment Tool | 1 | 8196 | 72653 | |
| MP14 | Cover Plate (Not Shown) | 2 | 34265-1 | 14632 | |
| MP15 | Same as MP14 (Not Shown) | | | | |
| MP16 | Handle, Round | 2 | 415-1250-01-02 | 71279 | |
| MP17 | Same as MP16 | | | | |

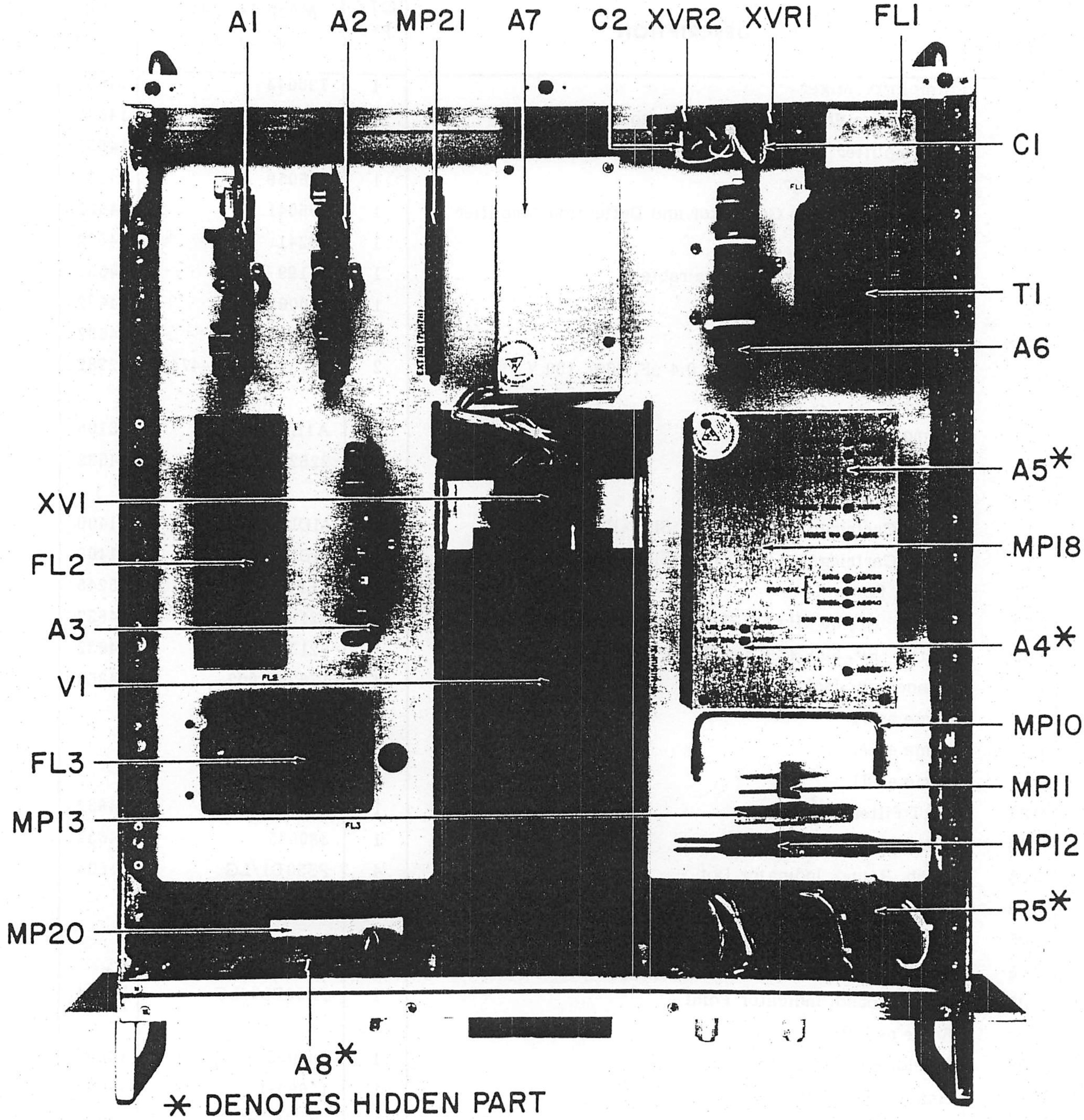



Figure 5-3. WJ-9188A-18 Signal Monitor Main Chassis, Top View

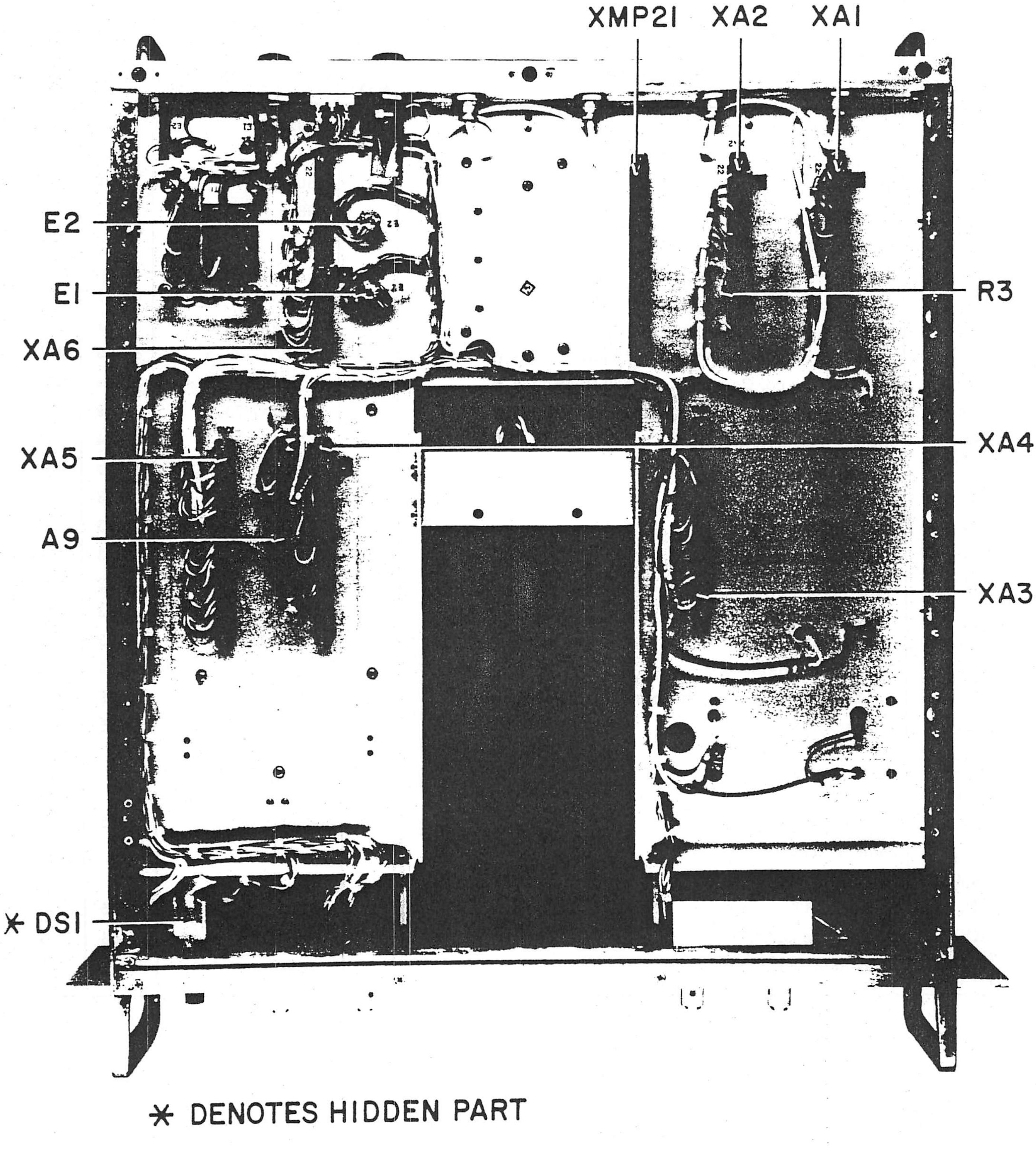



Figure 5-4. WJ-9188A-18 Signal Monitor Main Chassis, Bottom View

MAIN CHASSIS

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| MP18 | Protective Cover | 1 | 22822-3 | 14632 | |
| MP19 | Transistor Cover | 1 | 4632 | 91833 | |
| MP20 | PC Shield | 1 | 380045 | 14632 | |
| MP21 | Extender Board | 1 | 79878 | 14632 | |
| P1 | Part of W1 (Not Shown) | | | | |
| P2 | Part of W1 (Not Shown) | | | | |
| R1 | Resistor, Variable, Composition: 10 kΩ, 10%, 1 W | 1 | 70A3N056L103U | 01121 | |
| R2 | Resistor, Variable, Composition: 1 kΩ, 10%, 1 W | 1 | 70A3N056L102U | 01121 | |
| R3 | Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W | 1 | RCR07G103JS | 81349 | 01121 |
| R4 | Resistor, Fixed, Composition: 620 Ω, 5%, 1/4 W | 1 | RCR07G621JS | 81349 | 01121 |
| R5 | Resistor, Fixed, Composition: 27 kΩ, 5%, 1/2 W | 1 | RCR20G273JS | 81349 | 01121 |
| S1 | Switch, Pushbutton: SPDT | 1 | 671-6-1 | 87034 | |
| S2 | Switch, Slide | 1 | 11A1211 | 82389 | |
| S3 | Switch, Toggle | 1 | 8280K16 | 27193 | |
| S4 | Switch, Rotary | 1 | 71AD30-01-3AJN | 81073 | |
| S5 | Switch, Rotary | 1 | 71AD30-01-1AJN | 81073 | |
| T1 | Transformer Assembly | 1 | 16829 | 14632 | |
| V1 | Tube, CRT | 1 | M1519P31 | 20183 | |
| VR1 | Voltage Regulator | 1 | LAS-1515 | 80103 | |
| VR2 | Voltage Regulator | 1 | LAS-1815 | 80103 | |
| W1 | Cord, Line Power: 3-Conductor, 6 ft. (Not Shown) | 1 | 17250 | 16428 | |
| XA1 | Connector, PC | 7 | 251-22-30-160 | 71785 | |
| XA2 Thru XA6 | Same as XA1 | | | | |
| XF1 | Fuseholder | 2 | 342004 | 75915 | |
| XF2 | Same as XF1 | | | | |
| XMP21 | Same as XA1 | | | | |
| XV1 | Socket, CRT | 1 | 3B14 | 71785 | |
| XVR1 | Socket, Transistor | 2 | 8080-1G1 | 91506 | |
| XVR2 | Same as XVR1 | | | | |

5.5.1 TYPE 796043 AMPLIFIER/MIXER REF DESIG PREFIX A1

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| C1 | Capacitor, Mica, Dipped: 1800 pF, 2%, 500 V | 1 | CM06FD182G03 | 81349 | 72136 |
| C2 | Capacitor, Ceramic, Disc: 0.1 µF, 20%, 100 V | 9 | 8131M100-651-104M | 72982 | |
| C3 | Same as C2 | | | | |
| C4 | Same as C2 | | | | |
| C5 | Same as C2 | | | | |
| C6 | Capacitor, Mica, Dipped: 1500 pF, 2%, 500 V | 2 | CM06FD152G03 | 81349 | 72136 |
| C7 | Capacitor, Mica, Dipped: 120 pF, 2%, 500 V | 1 | CM05FD121G03 | 81349 | 72136 |
| C8 | Same as C6 | | | | |
| C9 Thru C12 | Same as C2 | | | | |
| C13 | Capacitor, Polyester, Foil: 0.015 µF, 2%, 100 V | 1 | PE51-.015-100-2 | 27735 | |
| C14 | Not Used | | | | |
| C15 | Capacitor, Ceramic, Disc: 0.01 µF, 20%, 200 V | 1 | 8131A200ZU103M | 72982 | |
| C16 | Capacitor, Polyester, Metallic: 0.12 µF, 2%, 100 V | 1 | MPE51-.12-100-2 | 27735 | |
| C17 | Capacitor, Plastic, Tubular: 0.033 µF, 10%, 100 V | 1 | 663UW333-9-1W | 84411 | |
| C18 | Capacitor, Ceramic, Disc: 0.47 µF, 20%, 100 V | 5 | 8131M100-651-474M | 72982 | |
| C19 | Same as C18 | | | | |
| C20 | Capacitor, Polyester, Foil: 6800 pF, 5%, 100 V | 1 | PE51-.0068-100-2 | 27735 | |
| C21 | Same as C18 | | | | |
| C22 | Same as C18 | | | | |
| C23 | Capacitor, Electrolytic, Tantalum: 15 µF, 20%, 15 V | 1 | 196D156X0015JA1 | 56289 | |
| C24 | Same as C18 | | | | |
| C25 | Capacitor, Electrolytic, Tantalum: 27 µF, 10%, 35 V | 1 | 196D276X9035TE4 | 56289 | |
| C26 | Same as C2 | | | | |
| L1 | Coil, Fixed: 68 µH, 10% | 2 | 553-3635-23 | 71279 | |
| L2 | Coil, Variable: 73.8 - 90.2 µH | 2 | 558-7107-36 | 71279 | |
| L3 | Same as L2 | | | | |
| L4 | Same as L1 | | | | |
| L5 | Coil, Fixed, Mold: 270 µH | 1 | 2500-00 | 99800 | |
| L6 | Coil, Variable | 1 | 558-7107-49 | 71279 | |
| MP1 | Transipad | 3 | 7717-89DAP | 13103 | |
| Q1 | Transistor (3N187) | 3 | 841001-1 | 14632 | |
| Q2 | Same as Q1 | | | | |
| Q3 | Same as Q1 | | | | |
| Q4 | Transistor | 1 | 2N2222A | 80131 | 04713 |
| R1 | Resistor, Fixed, Composition: 820 Ω, 5%, 1/4 W | 2 | RCR07G821JS | 81349 | 01121 |
| R2 | Resistor, Fixed, Composition: 820 kΩ, 5%, 1/4 W | 2 | RCR07G824JS | 81349 | 01121 |
| R3 | Resistor, Fixed, Composition: 150 kΩ, 5%, 1/4 W | 3 | RCR07G154JS | 81349 | 01121 |
| R4 | Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W | 2 | RCR07G104JS | 81349 | 01121 |
| R5 | Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W | 1 | RCR07G473JS | 81349 | 01121 |
| R6 | Resistor, Fixed, Composition: 270 Ω, 5%, 1/4 W | 3 | RCR07G271JS | 81349 | 01121 |

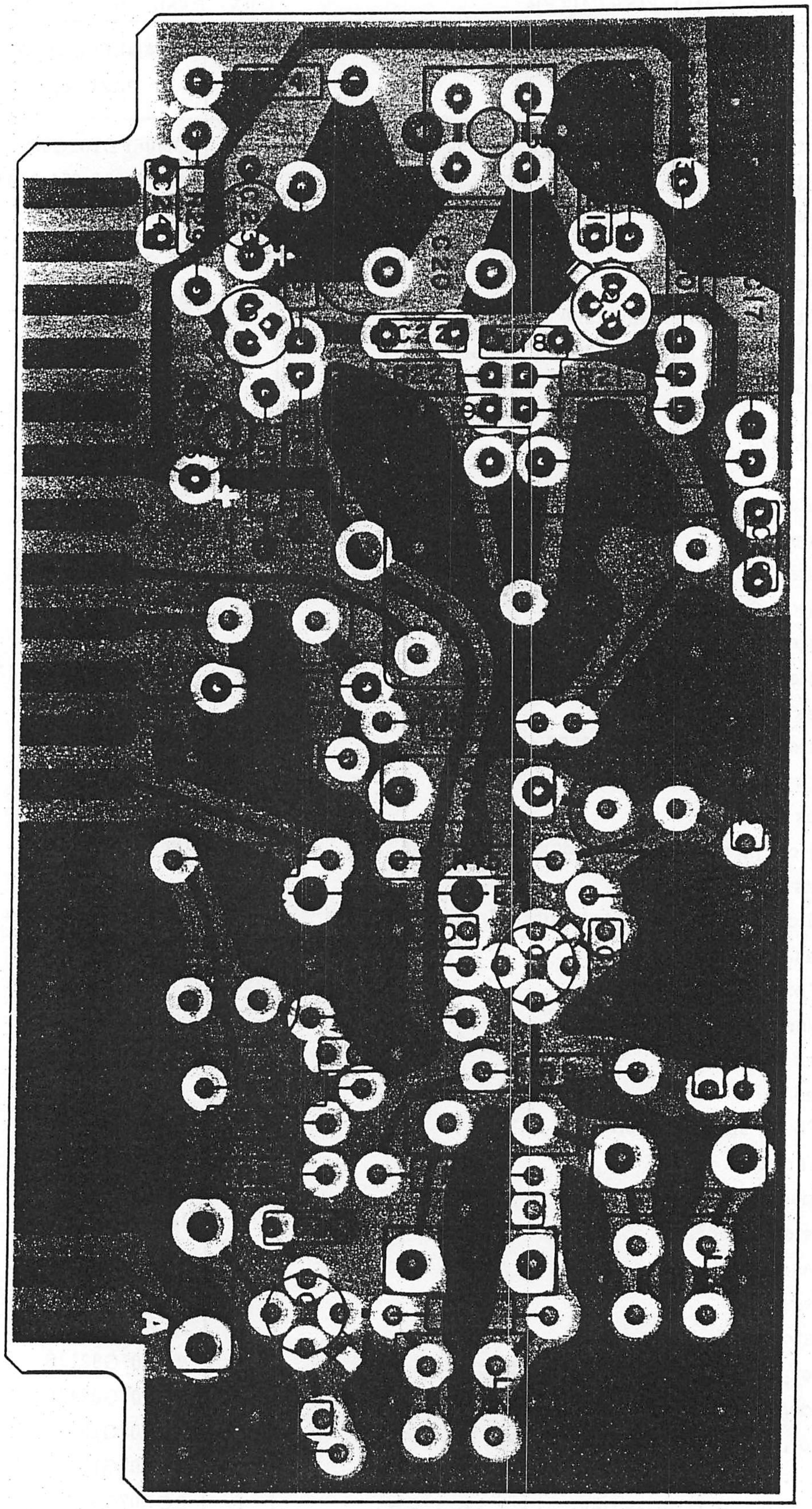


Figure 5-5. Type 796043 Amplifier/Mixer (A1), Location of Components

REF DESIG PREFIX A1

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| R7 | Resistor, Fixed, Composition: 24 Ω, 5%, 1/4 W | 2 | RCR07G240JS | 81349 | 01121 |
| R8 | Resistor, Fixed, Composition: 5.1 kΩ, 5%, 1/4 W | 1 | RCR07G512JS | 81349 | 01121 |
| R9 | Same as R2 | | | | |
| R10 | Same as R3 | | | | |
| R11 | Not Used | | | | |
| R12 | Same as R4 | | | | |
| R13 | Resistor, Fixed, Composition: 91 kΩ, 5%, 1/4 W | 1 | RCR07G913JS | 81349 | 01121 |
| R14 | Same as R6 | | | | |
| R15 | Same as R7 | | | | |
| R16 | Resistor, Fixed, Composition: 300 Ω, 5%, 1/4 W | 2 | RCR07G301JS | 81349 | 01121 |
| R17 | Resistor, Fixed, Composition: 18 Ω, 5%, 1/4 W | 1 | RCR07G180JS | 81349 | 01121 |
| R18 | Same as R16 | | | | |
| R19 | Not Used | | | | |
| R20 | Resistor, Fixed, Composition: 560 kΩ, 5%, 1/4 W | 1 | RCR07G564JS | 81349 | 01121 |
| R21 | Resistor, Fixed, Composition: 300 kΩ, 5%, 1/4 W | 1 | RCR07G304JS | 81349 | 01121 |
| R22 | Same as R3 | | | | |
| R23 | Same as R1 | | | | |
| R24 | Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W | 1 | RCR07G470JS | 81349 | 01121 |
| R25 | Same as R6 | | | | |
| R26 | Resistor, Fixed, Composition: 6.2 kΩ, 5%, 1/4 W | 1 | RCR07G622JS | 81349 | 01121 |
| R27 | Resistor, Fixed, Composition: 4.3 kΩ, 5%, 1/4 W | 1 | RCR07G432JS | 81349 | 01121 |
| R28 | Resistor, Fixed, Composition: 1.8 kΩ, 5%, 1/4 W | 1 | RCR07G182JS | 81349 | 01121 |
| R29 | Resistor, Fixed, Composition: 560 Ω, 5%, 1/4 W | 1 | RCR07G561JS | 81349 | 01121 |
| R30 | Resistor, Fixed, Composition: 62 kΩ, 5%, 1/4 W | 1 | RCR07G623JS | 81349 | 01121 |
| U1 | Mixer, Balanced: 0.05-200 MHz | 1 | M9A | 27956 | |

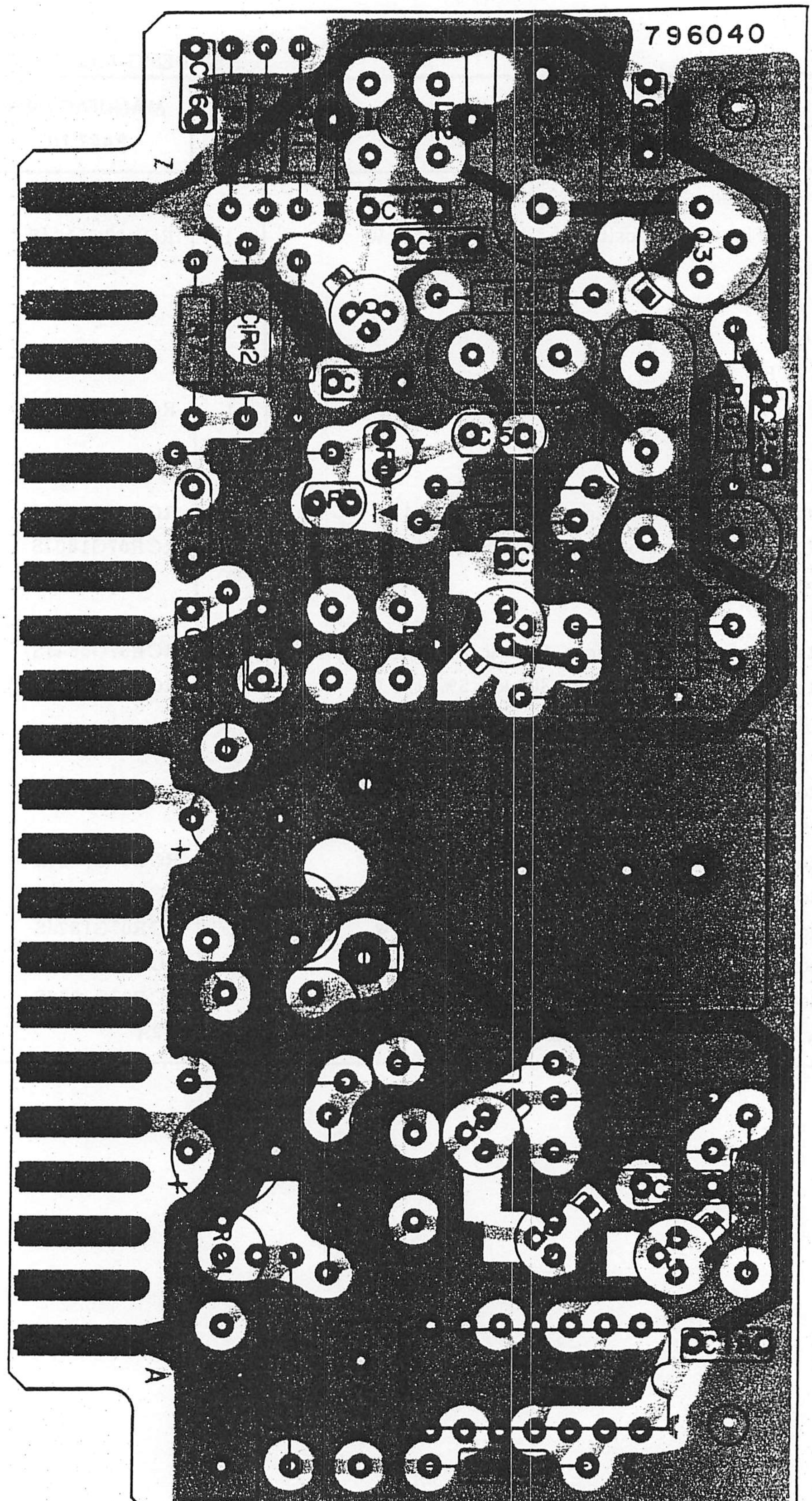



Figure 5-6. Type 796040 Sweep Oscillator/Marker Generator (A2), Location of Components

5.5.2 TYPE 796040 SWEEP OSCILLATOR/MARKER GENERATOR REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| C1 | Capacitor, Ceramic, Disc: 0.01 μF, 20%, 200 V | 2 | 8131A200Z5U103M | 72982 | |
| C2 | Not Used | | | | |
| C3 | Capacitor, Ceramic, Disc: 0.47 μF, 20%, 100 V | 5 | 8131M100-651-474M | 72982 | |
| C4 | Same as C3 | | | | |
| C5 | Capacitor, Mica, Dipped: 47 pF, 2%, 500 V | 1 | CM04ED470G03 | 81349 | 72136 |
| C6 | Capacitor, Mica, Dipped: 390 pF, 2%, 500 V | 1 | CM05FD391G03 | 81349 | 72136 |
| C7 | Capacitor, Mica, Dipped: 430 pF, 2%, 500 V | 1 | DM15-431J | 72136 | |
| C8 | Capacitor, Mica, Dipped: 100 pF, 2%, 500 V | 1 | CM05CD101G03 | 81349 | 72136 |
| C9 | Capacitor, Electrolytic, Tantalum: 27 μF, 10%, 35 V | 2 | 196D276X9035TE4 | 56289 | |
| C10 | Same as C3 | | | | |
| C11 | Capacitor, Ceramic, Disc: 0.1 μF, 20%, 100 V | 5 | 8131M100-651-104M | 72982 | |
| C12 | Same as C11 | | | | |
| C13 | Same as C1 | | | | |
| C14 | Same as C3 | | | | |
| C15 | Capacitor, Mica, Dipped: 2200 pF, 2%, 500 V | 1 | CM06FD222G03 | 81349 | 72136 |
| C16 | Same as C11 | | | | |
| C17 | Same as C9 | | | | |
| C18 | Same as C3 | | | | |
| C19 | Same as C11 | | | | |
| C20 | Capacitor, Mica, Dipped: 27 pF, 2%, 500 V | 2 | CM05ED270G03 | 81349 | 72136 |
| C21 | Same as C20 | | | | |
| C22 | Capacitor, Mica, Dipped: 51 pF, 2%, 500 V | 1 | CM05ED510G03 | 81349 | 72136 |
| C23 | Capacitor, Polyester, Foil: 6800 pF, 2%, 100 V | 1 | PE51-.0068-100-2 | 27735 | |
| C24 | Capacitor, Polyester, Foil: 0.012 μF, 2%, 100 V | 1 | PE51-.012-100-2 | 27735 | |
| C25 | Same as C11 | | | | |
| CR1 | Diode, Varicap | 2 | MV2303 | 04713 | |
| CR2 | Diode | 1 | 1N462A | 80131 | 93332 |
| L1 | Coil, Variable | 1 | 558-7107-41 | 71279 | |
| L2 | Coil, Variable | 1 | 558-7107-33 | 71279 | |
| L3 | Coil, Fixed: 27 μH | 1 | 1537-48 | 99800 | |
| MP1 | Transipad (Not Shown) | 5 | 7717-46DAP | 13103 | |
| MP2 Thru MP5 | Same as MP1 | | | | |
| MP6 | Transipad (Not Shown) | 1 | 7717-44DAP | 13103 | |
| Q1 | Transistor | 3 | 2N2222A | 80131 | 04713 |
| Q2 | Transistor | 2 | 2N3251 | 80131 | 04713 |
| Q3 | Transistor | 1 | 2N5109 | 80131 | 02735 |
| Q4 | Same as Q1 | | | | |
| Q5 | Same as Q2 | | | | |
| Q6 | Same as Q1 | | | | |

REF DESIG PREFIX A2

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| R1 | Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W | 1 | RCR07G473JS | 81349 | 01121 |
| R2 | Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W | 1 | RCR07G103JS | 81349 | 01121 |
| R3 | Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W | 3 | RCR07G104JS | 81349 | 01121 |
| R4 | Resistor, Fixed, Composition: 300 Ω, 5%, 1/4 W | 3 | RCR07G301JS | 81349 | 01121 |
| R5 | Resistor, Fixed, Composition: 2.7 kΩ, 5%, 1/4 W | 2 | RCR07G272JS | 81349 | 01121 |
| R6 | Resistor, Fixed, Composition: 5.1 kΩ, 5%, 1/4 W | 1 | RCR07G512JS | 81349 | 01121 |
| R7 | Resistor, Fixed, Composition: 1.3 kΩ, 5%, 1/4 W | 1 | RCR07G132JS | 81349 | 01121 |
| R8 | Resistor, Fixed, Composition: 13 kΩ, 5%, 1/4 W | 1 | RCR07G133JS | 81349 | 01121 |
| R9 | Resistor, Fixed, Composition: 22 kΩ, 5%, 1/4 W | 1 | RCR07G223JS | 81349 | 01121 |
| R10 | Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W | 1 | RCR07G101JS | 81349 | 01121 |
| R11 | Same as R4 | | | | |
| R12 | Resistor, Fixed, Composition: 18 Ω, 5%, 1/4 W | 1 | RCR07G180JS | 81349 | 01121 |
| R13 | Same as R4 | | | | |
| R14 | Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/4 W | 1 | RCR07G152JS | 81349 | 01121 |
| R15 | Resistor, Fixed, Composition: 510 Ω, 5%, 1/4 W | 2 | RCR07G511JS | 81349 | 01121 |
| R16 | Resistor, Fixed, Composition: 620 kΩ, 5%, 1/4 W | 1 | RCR07G624JS | 81349 | 01121 |
| R17 | Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W | 1 | RCR07G102JS | 81349 | 01121 |
| R18 | Same as R5 | | | | |
| R19 | Same as R3 | | | | |
| R20 | Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/4 W | 1 | RCR07G122JS | 81349 | 01121 |
| R21 | Resistor, Variable, Film: 200 Ω, 10%, 1/2 W | 1 | 62PR200 | 73138 | |
| R22 | Same as R3 | | | | |
| U1 | Integrated Circuit | 1 | CD4013AE | 02735 | |
| Y1 | Crystal: 2.30 MHz | 1 | 91809-5 | 14632 | |

5.5.3 TYPE 796039 IF AMPLIFIER REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| C1 | Capacitor, Ceramic, Disc: 0.1 μF, 20%, 100 V | 15 | 8131M100-651-104M | 72982 | |
| C2 Thru C5 | Same as C1 | | | | |
| C6 | Capacitor, Polyester, Foil: 0.012 μF, 2%, 100 V | 2 | PE51-.012-100-2 | 27735 | |
| C7 | Capacitor, Polyester, Foil: 0.015 μF, 2%, 100 V | 2 | PE51-.015-100-2 | 27735 | |
| C8 | Capacitor, Ceramic, Disc: 0.47 μF, 20%, 100 V | 3 | 8131M100-651-104M | 72982 | |
| C9 | Capacitor, Electrolytic, Tantalum: 4.7 μF, 20%, 35 V | 2 | 196D475X0035JE3 | 56289 | |
| C10 | Same as C1 | | | | |
| C11 | Same as C1 | | | | |
| C12 | Same as C6 | | | | |
| C13 | Same as C7 | | | | |
| C14 | Same as C8 | | | | |
| C15 | Same as C1 | | | | |
| C16 | Capacitor, Electrolytic, Tantalum: 27 μF, 10%, 35 V | 1 | 196D276X9035TE4 | 56289 | |
| C17 | Same as C1 | | | | |
| C18 | Same as C9 | | | | |
| C19 | Same as C1 | | | | |
| C20 | Same as C1 | | | | |
| C21 | Capacitor, Polyester, Foil: 6800 pF, 2%, 100 V | 1 | PE51-.0068-100-2 | 27735 | |
| C22 | Same as C1 | | | | |
| C23 | Not Used | | | | |
| C24 | Same as C8 | | | | |
| C25 | Same as C1 | | | | |
| C26 | Same as C1 | | | | |
| C27 | Same as C1 | | | | |
| L1 | Coil, Variable | 3 | 558-7107-49 | 71279 | |
| L2 | Same as L1 | | | | |
| L3 | Same as L1 | | | | |
| MP1 | Transipad | 6 | 7717-46DAP | 13103 | |
| MP2 Thru MP6 | Same as MP1 | | | | |
| Q1 | Transistor (3N187) | 1 | 841001-1 | 14632 | |
| Q2 | Transistor | 2 | 2N3251 | 80131 | 04713 |
| Q3 | Transistor | 3 | 2N2222A | 80131 | 04713 |
| Q4 | Same as Q2 | | | | |
| Q5 | Same as Q3 | | | | |
| Q6 | Same as Q3 | | | | |
| R1 | Resistor, Fixed, Composition: 150 kΩ, 5%, 1/4 W | 1 | RCR07G154JS | 81349 | 01121 |
| R2 | Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W | 1 | RCR07G103JS | 81349 | 01121 |
| R3 | Resistor, Fixed, Composition: 620 Ω, 5%, 1/4 W | 1 | RCR07G621JS | 81349 | 01121 |

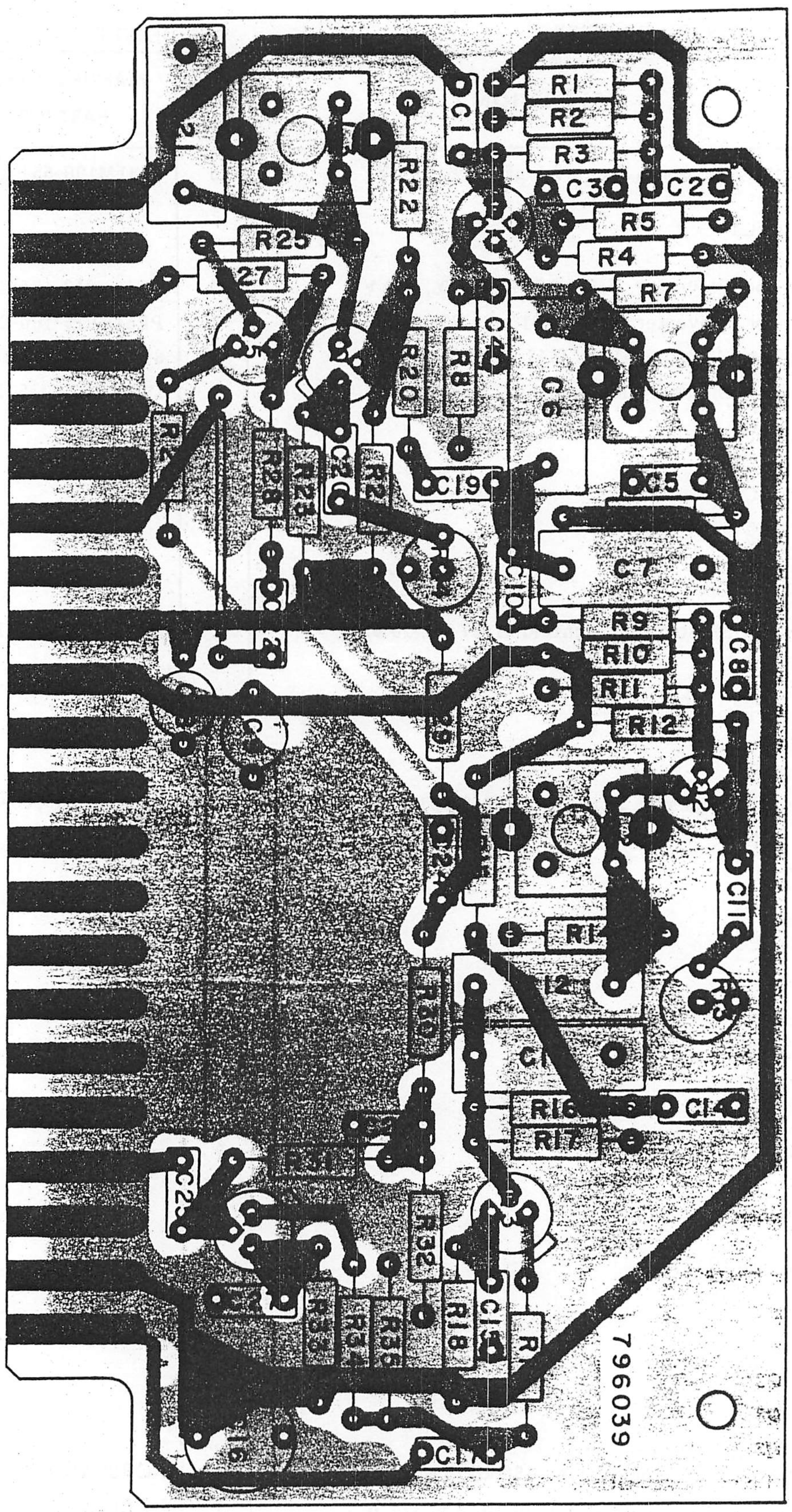



Figure 5-7. Type 796039 IF Amplifier (A3), Location of Components

REF DESIG PREFIX A3

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| R4 | Resistor, Fixed, Composition: 120 kΩ, 5%, 1/4 W | 1 | RCR07G124JS | 81349 | 01121 |
| R5 | Resistor, Fixed, Composition: 33 kΩ, 5%, 1/4 W | 1 | RCR07G333JS | 81349 | 01121 |
| R6 | Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W | 8 | RCR07G101JS | 81349 | 01121 |
| R7 | Resistor, Fixed, Composition: 6.2 kΩ, 5%, 1/4 W | 1 | RCR07G622JS | 81349 | 01121 |
| R8 | Resistor, Fixed, Composition: 330 Ω, 5%, 1/4 W | 1 | RCR07G331JS | 81349 | 01121 |
| R9 | Same as R6 | | | | |
| R10 | Resistor, Fixed, Composition: 3.6 kΩ, 5%, 1/4 W | 4 | RCR07G362JS | 81349 | 01121 |
| R11 | Resistor, Fixed, Composition: 12 kΩ, 5%, 1/4 W | 4 | RCR07G123JS | 81349 | 01121 |
| R12 | Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/4 W | 2 | RCR07G152JS | 81349 | 01121 |
| R13 | Resistor, Variable, film: 500 Ω, 10%, 1/2 W | 2 | 62PR500 | 73138 | |
| R14 | Resistor, Fixed, Composition: 62 kΩ, 5%, 1/4 W | 1 | RCR07G623JS | 81349 | 01121 |
| R15 | Same as R6 | | | | |
| R16 | Same as R11 | | | | |
| R17 | Same as R10 | | | | |
| R18 | Same as R6 | | | | |
| R19 | Resistor, Fixed, Composition: 39 Ω, 5%, 1/4 W | 2 | RCR07G390JS | 81349 | 01121 |
| R20 | Same as R6 | | | | |
| R21 | Same as R10 | | | | |
| R22 | Same as R11 | | | | |
| R23 | Same as R12 | | | | |
| R24 | Same as R13 | | | | |
| R25 | Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W | 1 | RCR07G470JS | 81349 | 01121 |
| R26 | Same as R6 | | | | |
| R27 | Resistor, Fixed, Composition: 3 kΩ, 5%, 1/4 W | 1 | RCR07G302JS | 81349 | 01121 |
| R28 | Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W | 1 | RCR07G222JS | 81349 | 01121 |
| R29 | Same as R6 | | | | |
| R30 | Same as R11 | | | | |
| R31 | Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/4 W | 1 | RCR07G122JS | 81349 | 01121 |
| R32 | Same as R10 | | | | |
| R33 | Same as R6 | | | | |
| R34 | Same as R19 | | | | |
| R35 | Resistor, Fixed, Composition: 1 kΩ, 5%, 1/4 W | 1 | RCR07G102JS | 81349 | 01121 |

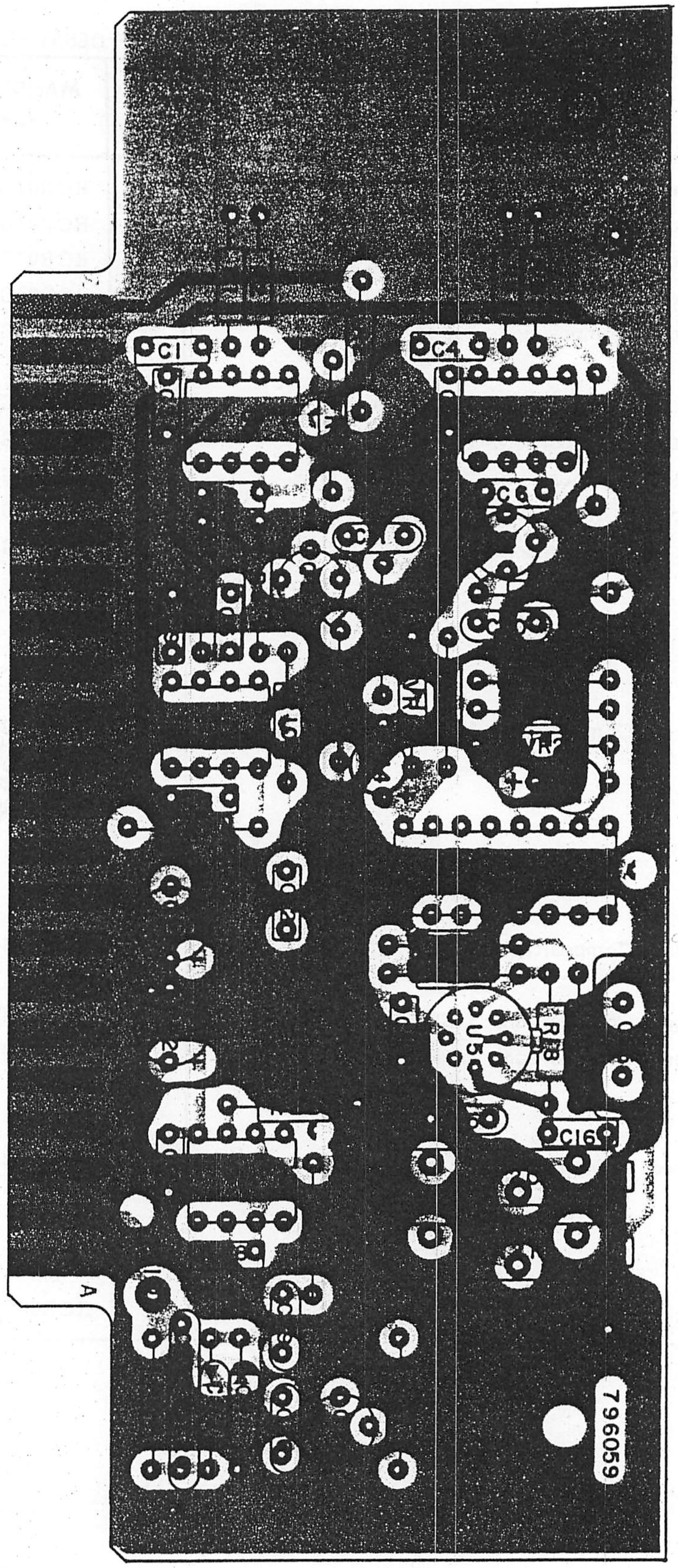



Figure 5-8. Type 796059 Lin/Log Amplifier (A4),
Location of Components

5.5.4 TYPE 796059 LIN/LOG AMPLIFIER REF DESIG PREFIX A4

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| C1 | Capacitor, Ceramic, Disc: 0.47 µF, 20%, 100 V | 1 | 8131M100-651-474M | 72982 | |
| C2 | Capacitor, Ceramic, Disc: 0.1 µF, 20%, 100 V | 16 | 8131M100-651-104M | 72982 | |
| C3 Thru C12 | Same as C2 | | | | |
| C13 | Capacitor, Electrolytic, Tantalum: 1 µF, 20%, 35 V | 2 | 196D105X0035HE3 | 56289 | |
| C14 | Same as C13 | | | | |
| C15 Thru C18 | Same as C2 | | | | |
| C19 | Capacitor, Ceramic, Disc: 0.01 µF, 20%, 200 V | 1 | 8131A200Z5U103M | 72982 | |
| C20 | Capacitor, Ceramic, Disc: 2200 pF, 10%, 200 V | 1 | CK06BX222K | 81349 | 56289 |
| C21 | Same as C2 | | | | |
| C22 | Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V | 2 | 196D475X0035JE3 | 56289 | |
| C23 | Capacitor, Ceramic, Disc: 6800 pF, 10%, 200 V | 1 | CK06BX682K | 81349 | 56289 |
| C24 | Same as C22 | | | | |
| C25 | Capacitor, Mica, Disc: 24 pF, 2%, 500 V | 1 | CM05ED240J03 | 81349 | 72136 |
| C26 | Capacitor, Ceramic, Disc: 0.047 µF, 10%, 100 V | 1 | CK06BX473K | 81349 | 56289 |
| CR1 | Diode | 2 | 1N198A | 80131 | 93332 |
| CR2 | Same as CR1 | | | | |
| MP1 | Transipad (Not Shown) | 3 | 7717-44DAP | 13103 | |
| MP2 | Same as MP1 | | | | |
| MP3 | Same as MP1 | | | | |
| Q1 | Transistor | 3 | 2N2222A | 80131 | 04713 |
| Q2 | Same as Q1 | | | | |
| Q3 | Same as Q1 | | | | |
| R1 | Resistor, Fixed, Composition: 1 kΩ, 5%, 1/4 W | 1 | RCR07G102JS | 81349 | 01121 |
| R2 | Resistor, Fixed, Composition: 430 Ω, 5%, 1/4 W | 1 | RCR07G431JS | 81349 | 01121 |
| R3 | Resistor, Fixed, Composition: 2 kΩ, 5%, 1/4 W | 6 | RCR07G202JS | 81349 | 01121 |
| R4 | Resistor, Fixed, Composition: 3.9 kΩ, 5%, 1/4 W | 2 | RCR07G392JS | 81349 | 01121 |
| R5 | Resistor, Fixed, Composition: 6.8 kΩ, 5%, 1/4 W | 2 | RCR07G682JS | 81349 | 01121 |
| R6 | Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W | 2 | RCR07G221JS | 81349 | 01121 |
| R7 | Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W | 3 | RCR07G103JS | 81349 | 01121 |
| R8 | Same as R4 | | | | |
| R9 | Same as R6 | | | | |
| R10 | Same as R3 | | | | |
| R11 | Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/4 W | 2 | RCR07G152JS | 81349 | 01121 |
| R12 | Same as R11 | | | | |
| R13 | Resistor, Fixed, Composition: 2.4 kΩ, 5%, 1/4 W | 2 | RCR07G242JS | 81349 | 01121 |
| R14 | Same as R13 | | | | |
| R15 | Resistor, Fixed, Composition: 270 Ω, 5%, 1/4 W | 1 | RCR07G271JS | 81349 | 01121 |

REF DESIG PREFIX A4

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| R16 Thru R19 | Same as R3 | | | | |
| R20 | Resistor, Variable, Film: 10 kΩ, 10%, 3/4 W | 2 | 89PR10K | 73138 | |
| R21 | Same as R20 | | | | |
| R22 | Resistor, Fixed, Composition: 5.1 kΩ, 5%, 1/4 W | 1 | RCR07G512JS | 81349 | 01121 |
| R23 | Resistor, Fixed, Composition: 20 kΩ, 5%, 1/4 W | 1 | RCR07G203JS | 81349 | 01121 |
| R24 | Same as R7 | | | | |
| R25 | Resistor, Fixed, Composition: 330 Ω, 5%, 1/4 W | 1 | RCR07G331JS | 81349 | 01121 |
| R26 | Same as R7 | | | | |
| R27 | Same as R5 | | | | |
| U1 | Integrated Circuit | 4 | CA3140AE | 02735 | |
| U2 | Same as U1 | | | | |
| U3 | Same as U1 | | | | |
| U4 | Integrated Circuit | 1 | TL441CN | 01295 | |
| U5 | Integrated Circuit | 1 | CA3100T | 02735 | |
| U6 | Same as U1 | | | | |
| VR1 | Diode, Zener: 8.2 V | 2 | 1N756A | 80131 | 04713 |
| VR2 | Same as VR1 | | | | |

5.5.5 HORIZONTAL SWEEP GENERATOR AND TYPE 796041 DEFLECTION AMPLIFIER — REF DESIG PREFIX A5

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| C1 | Capacitor, Metallized Polycarbonate, Tubular: 0.47 µF, 2%, 50 V | 1 | MPCW-474-.5-2 | 04099 | |
| C2 | Capacitor, Electrolytic, Tantalum: 27 µF, 10%, 35 V | 2 | 196D276X9035TE4 | 56289 | |
| C3 | Same as C2 | | | | |
| C4 | Capacitor, Ceramic, Disc: 0.1 µF, 20%, 100 V | 2 | 8131M100-651-104M | 73138 | |
| C5 | Same as C4 | | | | |
| CR1 | Diode | 4 | 1N462A | 80131 | 93332 |
| CR2 | Same as CR1 | | | | |
| CR3 | Same as CR1 | | | | |
| CR4 | Same as CR1 | | | | |
| MP1 | Transipad (Not Shown) | 4 | 7717-22DAP | 13103 | |
| MP2 Thru MP4 | Same as MP1 | | | | |
| MP5 | Transipad (Not Shown) | 2 | 7717-46DAP | 13103 | |
| MP6 | Same as MP5 | | | | |
| MP7 | Transipad (Not Shown) | 2 | 7717-44DAP | 13103 | |
| MP8 | Same as MP7 | | | | |
| Q1 | Transistor | 4 | 2N3440 | 80131 | 04713 |
| Q2 | Same as Q1 | | | | |
| Q3 | Transistor | 2 | 2N929 | 80131 | 04713 |
| Q4 | Same as Q1 | | | | |
| Q5 | Same as Q1 | | | | |
| Q6 | Same as Q3 | | | | |
| Q7 | Transistor | 2 | 2N3251 | 80131 | 04713 |
| Q8 | Same as Q7 | | | | |
| R1 | Resistor, Fixed, Composition: 36 kΩ, 5%, 1/4 W | 1 | RCR07G363JS | 81349 | 01121 |
| R2 | Resistor, Fixed, Composition: 91 kΩ, 5%, 1/4 W | 1 | RCR07G913JS | 81349 | 01121 |
| R3 | Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W | 1 | RCR07G104JS | 81349 | 01121 |
| R4 | Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W | 4 | RCR07G473JS | 81349 | 01121 |
| R5 | Resistor, Variable, Film: 50 kΩ, 10%, 3/4 W | 2 | 89PR50K | 73139 | |
| R6 | Resistor, Fixed, Composition: 820 Ω, 5%, 1/4 W | 1 | RCR07G821JS | 81349 | 01121 |
| R7 | Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W | 5 | RCR07G103JS | 81349 | 01121 |
| R8 | Resistor, Variable, Film: 100 kΩ, 10%, 3/4 W | 4 | 89PR100K | 73138 | 01121 |
| R9 | Same as R4 | | | | |
| R10 | Resistor, Fixed, Composition: 270 kΩ, 5%, 1/4 W | 4 | RCR07G274JS | 81349 | 01121 |
| R11 | Same as R10 | | | | |
| R12 | Resistor, Fixed, Composition: 6.8 kΩ, 5%, 1/4 W | 4 | RCR07G682JS | 81349 | 01121 |
| R13* | Same as R12 | | | | |
| R14 | Same as R7 | | | | |
| R15 | Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/4 W | 4 | RCR07G472JS | 81349 | 01121 |
| | *Nominal Value: Final Value Factory Select | | | | |

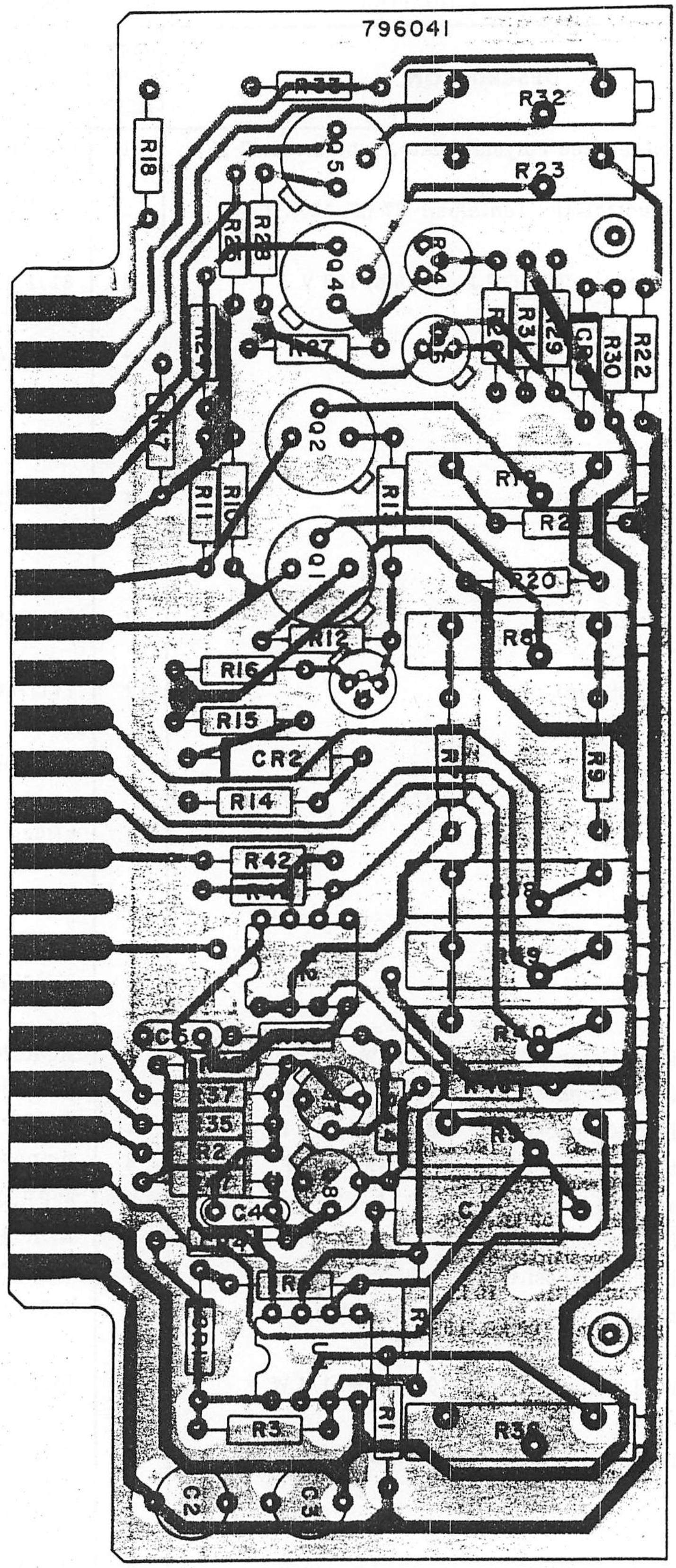



Figure 5-9. Type 796041 Horizontal Sweep Generator and Deflection Amplifier (A5), Location of Components

REF DESIG PREFIX A5

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| R16* | Same as R15 | | | | |
| R17 | Resistor, Fixed, Composition: 330 kΩ, 5%, 1/4 W | 2 | RCR07G334JS | 81349 | 01121 |
| R18 | Same as R17 | | | | |
| R19 | Same as R8 | | | | |
| R20 | Same as R4 | | | | |
| R21 | Same as R4 | | | | |
| R22 | Resistor, Fixed, Composition: 20 kΩ, 5%, 1/4 W | 1 | RCR07G203JS | 81349 | 01121 |
| R23 | Resistor, Variable, Film: 10 kΩ, 10%, 3/4 W | 1 | 89PR10K | 73138 | |
| R24 | Same as R10 | | | | |
| R25 | Same as R10 | | | | |
| R26 | Resistor, Fixed, Composition: 200 kΩ, 5%, 1/4 W | 1 | RCR07G204JS | 81349 | 01121 |
| R27 | Same as R12 | | | | |
| R28 | Same as R12 | | | | |
| R29 | Same as R7 | | | | |
| R30 | Same as R15 | | | | |
| R31 | Same as R15 | | | | |
| R32 | Same as R8 | | | | |
| R33 | Same as R7 | | | | |
| R34 | Resistor, Variable, Film: 100 kΩ, 10%, 1/2 W | 1 | 62PR100K | 73138 | |
| R35 | Resistor, Fixed, Composition: 430 kΩ, 5%, 1/4 W | 1 | RCR07G433JS | 81349 | 01121 |
| R36 | Resistor, Variable, Film: 2 kΩ, 10%, 3/4 W | 1 | 89PR2K | 73138 | |
| R37 | Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W | 1 | RCR07G222JS | 81349 | 01121 |
| R38 | Same as R8 | | | | |
| R39 | Same as R5 | | | | |
| R40 | Resistor, Variable, Film: 20 kΩ, 10%, 3/4 W | 1 | 89PR20K | 73138 | |
| R41 | Same as R7 | | | | |
| R42 | Resistor, Fixed, Composition: 1 kΩ, 5%, 1/4 W | 1 | RCR07G102JS | 81349 | 01121 |
| R43 | Resistor, Fixed, Composition: 30 kΩ, 5%, 1/4 W | 1 | RCR07G303JS | 81349 | 01121 |
| R44 | Resistor, Fixed, Composition: 22 kΩ, 5%, 1/4 W | 1 | RCR07G223JS | 81349 | 01121 |
| R45 | Resistor, Fixed, Composition: 3.3 kΩ, 5%, 1/4 W | 2 | RCR07G332JS | 81349 | 01121 |
| R46 | Same as R45 | | | | |
| R47 | Resistor, Fixed, Composition: 110 kΩ, 5%, 1/4 W | 1 | RCR07G114JS | 81349 | 01121 |
| U1 | Integrated Circuit | 2 | MC1458N | 18324 | |
| U2 | Same as U1 | | | | |

*Nominal Value: Final Value Factory Select

5.5.6 TYPE 76241 RECTIFIER/FILTER REF DESIG PREFIX A6

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| C1 | Capacitor, Electrolytic, Aluminum: 1000 μF, -10+75%, 40 V | 1 | 39D108G040GP4 | 56289 | |
| C2 | Capacitor, Electrolytic, Aluminum: 200 μF, -10+75%, 50 V | 1 | 39D207G050FJ4 | 56289 | |
| C3 | Capacitor, Electrolytic, Aluminum: 450 μF, -10+75%, 25 V | 1 | 39D457G025FJ4 | 56289 | |
| C4 | Capacitor, Ceramic, Disc: 0.1 μF, 20%, 100 V | 4 | 8131M100-651-104M | 72982 | |
| C5 | Same as C4 | | | | |
| C6 | Same as C4 | | | | |
| C7 | Same as C4 | | | | |
| CR1 | Diode | 4 | 1N4004 | 80131 | 04713 |
| CR2 | Same as CR1 | | | | |
| CR3 | Same as CR1 | | | | |
| CR4 | Same as CR1 | | | | |

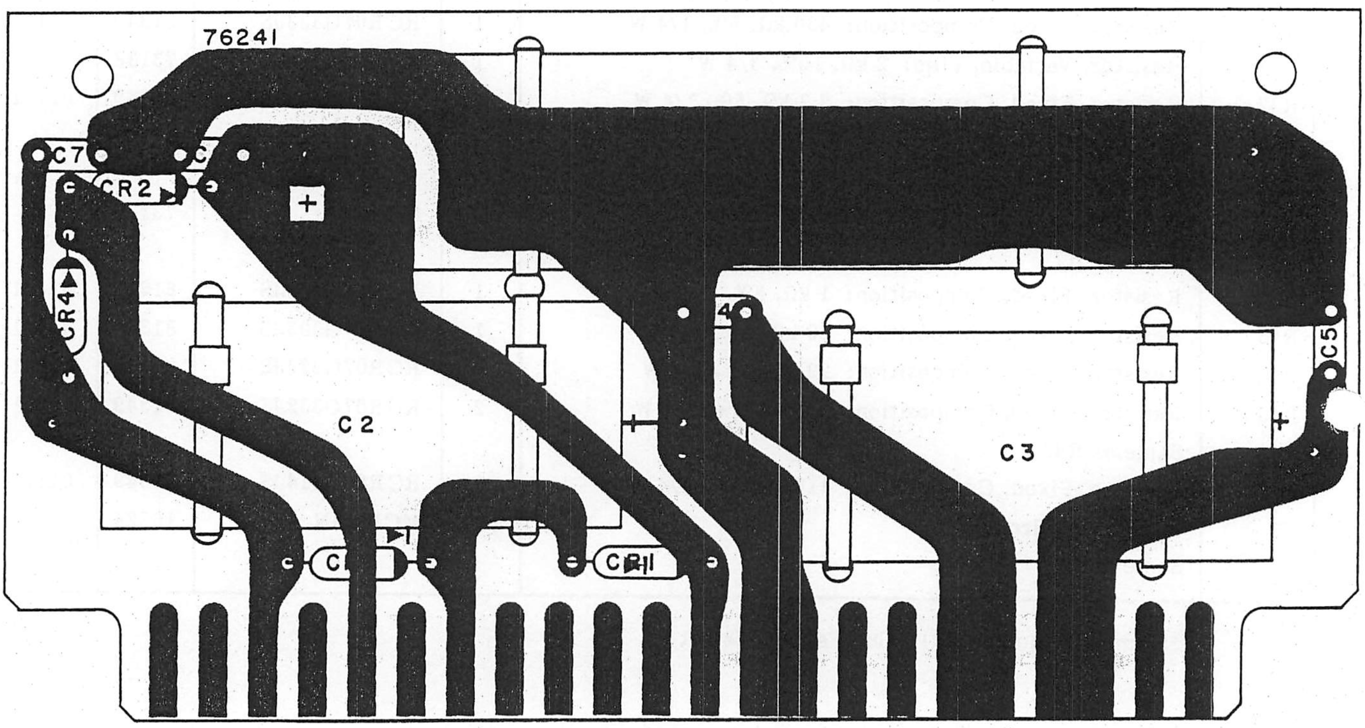



Figure 5-10. Type 76421 Rectifier/Filter (A6), Location of Components

5.5.7 TYPE 76199 DC/DC CONVERTER

REF DESIG PREFIX A7

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| A1 | DC/DC Converter PC Board (Nonrepairable) | 1 | 16533 | 14632 | |

5.5.8 TYPE 280062 FOCUS AND INTENSITY BOARD REF DESIG PREFIX A8

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| MP1 | Transipad (Not Shown) | 1 | 7717-44DAP | 13103 | |
| Q1 | Transistor | 1 | 2N3251 | 80131 | 04713 |
| R1 | Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W | 1 | RCR07G103JS | 81349 | 01121 |
| R2 | Resistor, Fixed, Composition: 20 kΩ, 5%, 1/4 W | 1 | RCR07G203JS | 81349 | 01121 |
| R3 | Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/4 W | 1 | RCR07G152JS | 81349 | 01121 |
| R4 | Resistor, Fixed, Composition: 4.7 MΩ, 5%, 1/2 W | 1 | RCR20G475JS | 81349 | 01121 |
| R5 | Resistor, Fixed, Composition: 3.9 MΩ, 5%, 1/2 W | 1 | RCR20G395JS | 81349 | 01121 |
| R6 | Resistor, Variable, Composition: 2.5 MΩ, 20%, 1 W | 1 | 70A3N056L255M | 01121 | |
| R7 | Resistor, Fixed, Composition: 1.8 MΩ, 5%, 1/2 W | 1 | RCR20G185JS | 81349 | 01121 |
| R8* | Resistor, Variable, Film: 2 MΩ, 10%, 1/2 W | 1 | A4B205 | 01121 | |
| R9 | Resistor, Variable, Composition: 500 kΩ, 10%, 1 W | 1 | 70A3N056L504U | 01121 | |
| R10* | Resistor, Variable, Film: 200 kΩ, 10%, 1/2 W | 1 | 62PAR200K | 73138 | |
| R11 | Resistor, Fixed, Composition: 150 kΩ, 5%, 1/4 W | 1 | RCR07G154JS | 81349 | 01121 |
| R12 | Resistor, Fixed, Composition: 330 kΩ, 5%, 1/4 W | 1 | RCR07G334JS | 81349 | 01121 |
| U1 | Integrated Circuit | 1 | 4N38A | 03508 | |
| *NOTE: | Earlier versions of the Type 280062 Board use fixed resistors for R8 and R10 as listed below: | | | | |
| R8 | Resistor, Fixed, Composition: 750 kΩ, 5%, 1/4 W | 1 | RCR20G754JS | 81349 | |
| R10 | Resistor, Fixed, Composition: 27 kΩ, 5%, 1/4 W | 1 | RCR07G273JS | 81349 | |

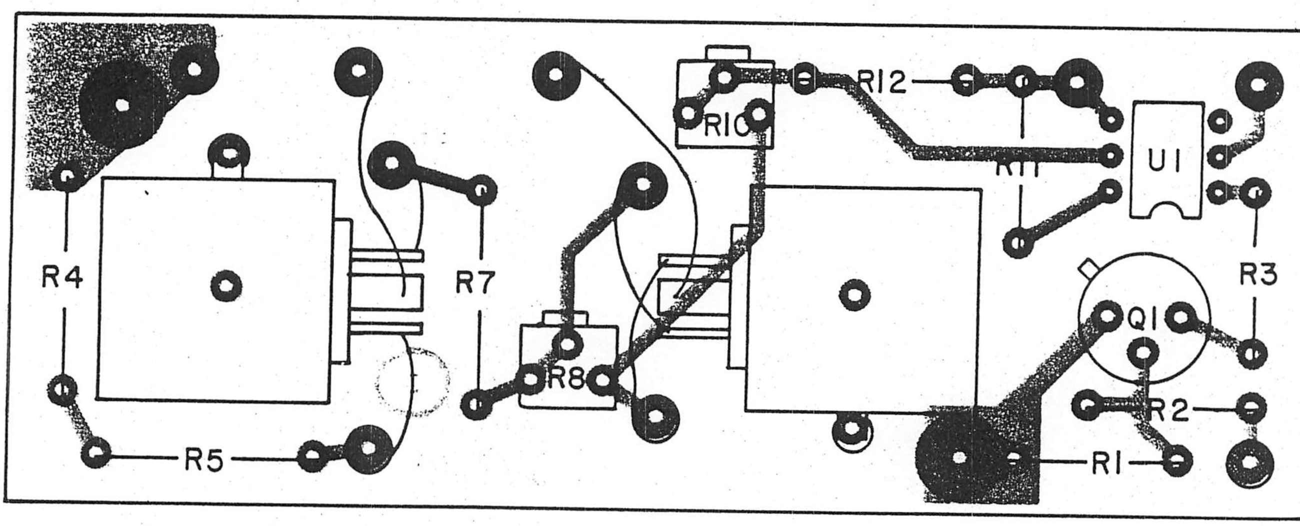



Figure 5-11. Type 280062 Focus and Intensity Board (A8), Location of Components

5.5.9 TYPE 796048 SHAPING NETWORK

REF DESIG PREFIX A9

| REF DESIG | DESCRIPTION | QTY. PER ASSY. | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|---|---|---|---|---|---|
| CR1 | Diode | 1 | 1N4446 | 80131 | 93332 |
| R1 | Resistor, Variable, Film: 20 kΩ, 10%, 3/4 W | 2 | 89PR10K | 73138 | |
| R2 | Same as R1 | | | | |
| R3 | Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W | 2 | RCR07G101JS | 81349 | 01121 |
| R4 | Same as R1 | | | | |
| R5 | Resistor, Fixed, Composition: 12 kΩ, 5%, 1/4 W | 1 | RCR07G123JS | 81349 | 01121 |

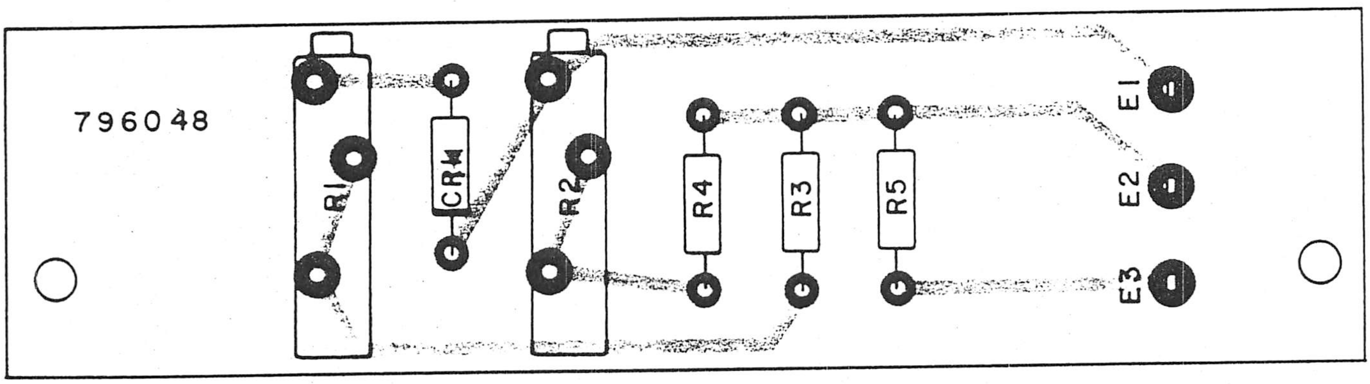
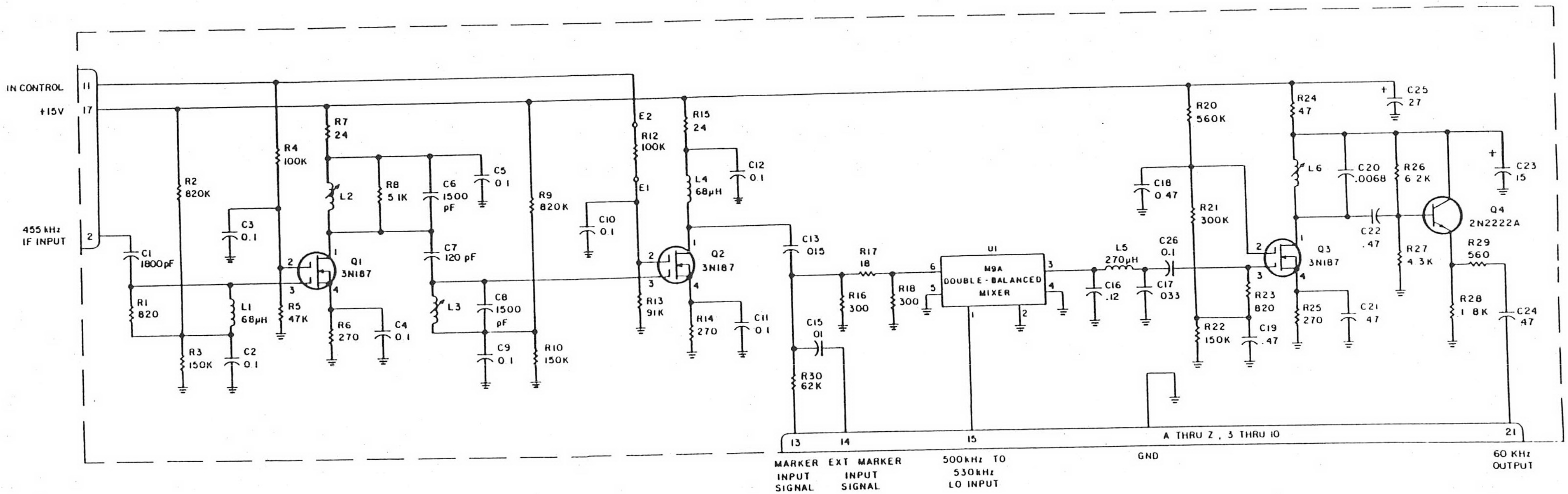



Figure 5-12. Type 796048 Shaping Network (A9), Location of Components

WJ-9166A-16

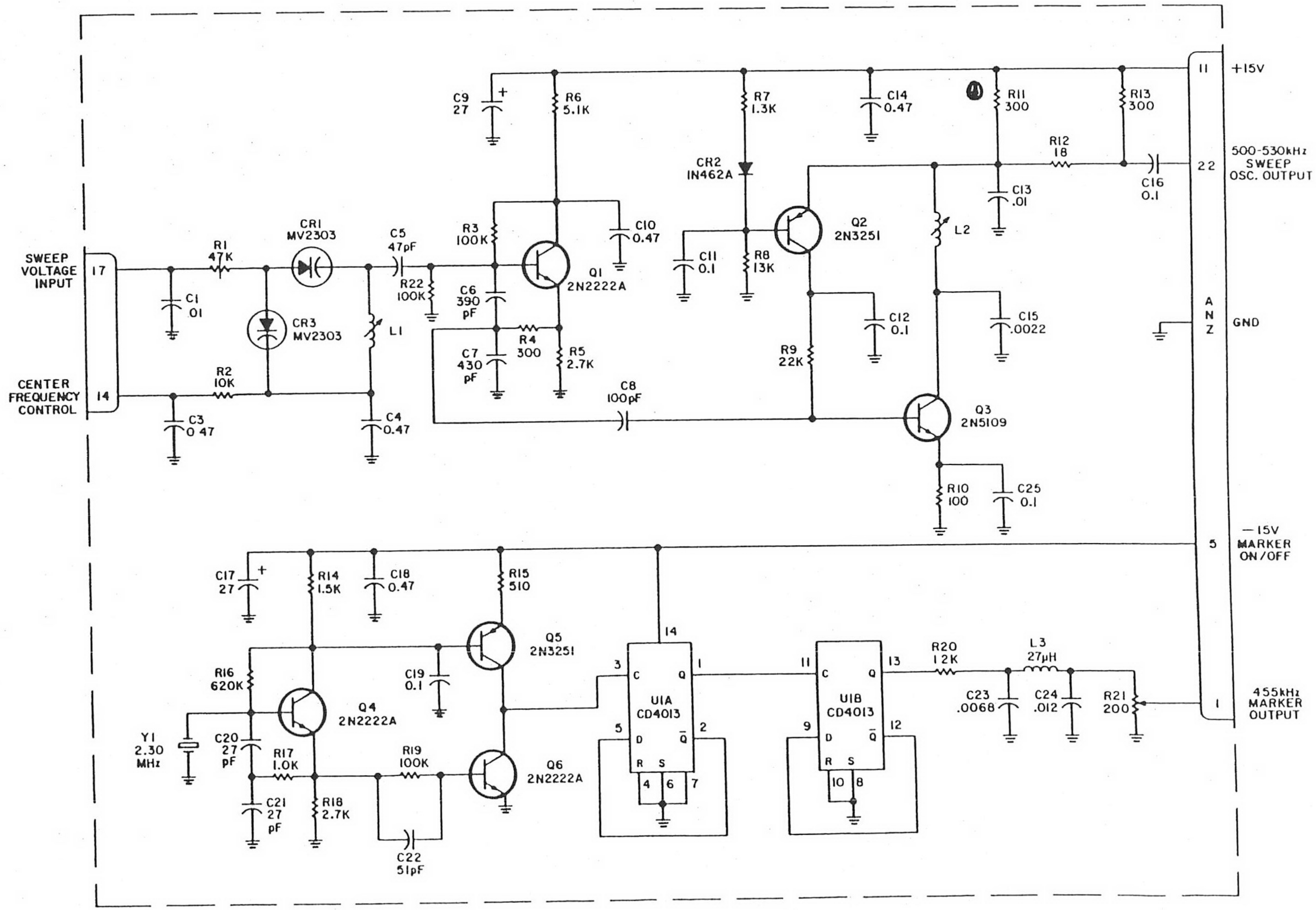



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ± 5%, 1/4 W.
   b) CAPACITANCE IS μF.

3. 3N187 TRANSISTORS ARE PROVISIONED AS NO 841001-1

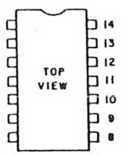
Figure 6-1. Type [illegible] Amplifier Mixer Schematic Diagram

A1




NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. SEE DETAIL A FOR PIN ARRANGEMENT OF U1.

CD4013

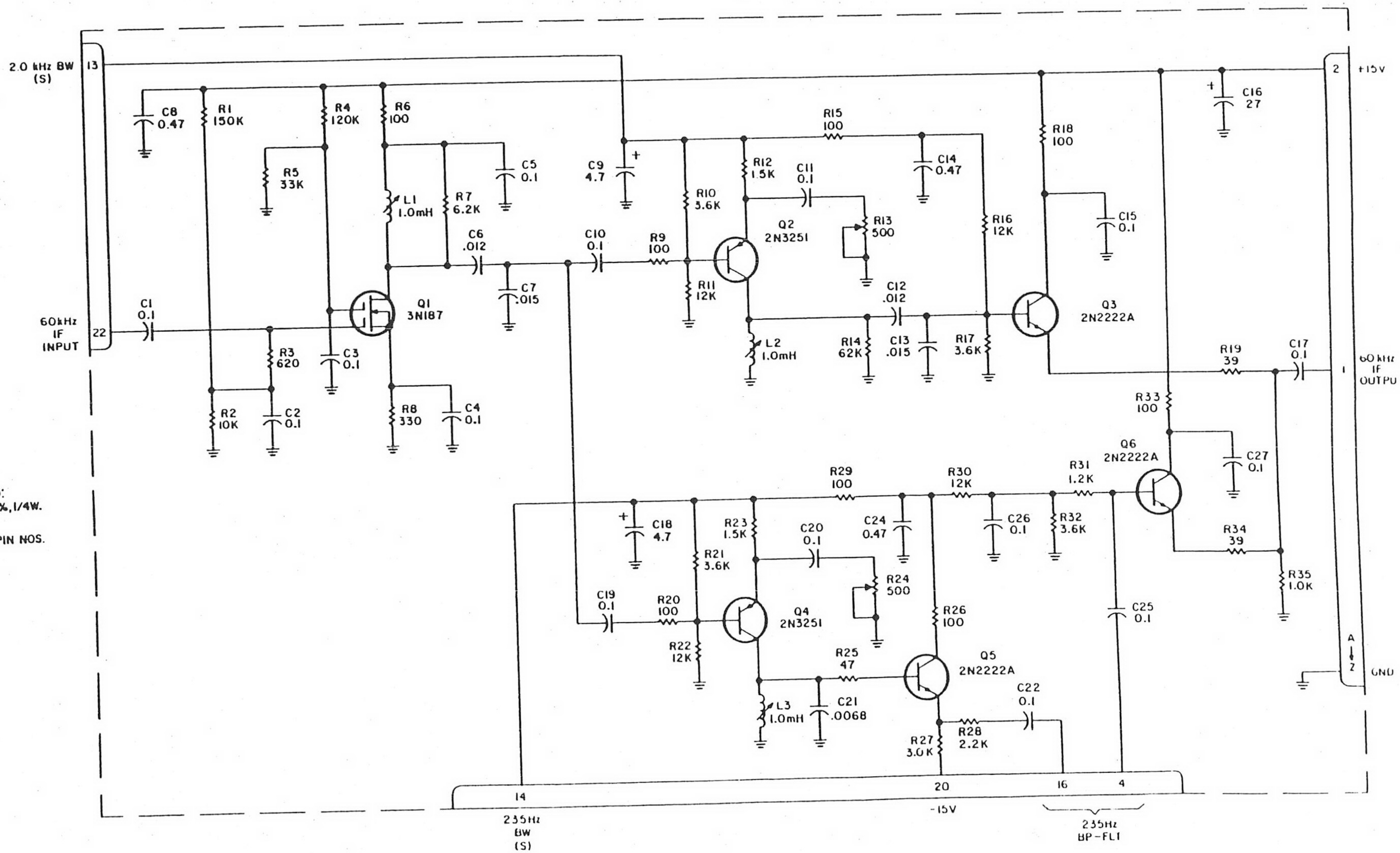



DETAIL A

Figure 6-2. Type 796040 Sweep Oscillator/Marker Generator (A2), Schematic Diagram



A2

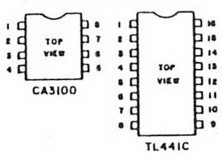


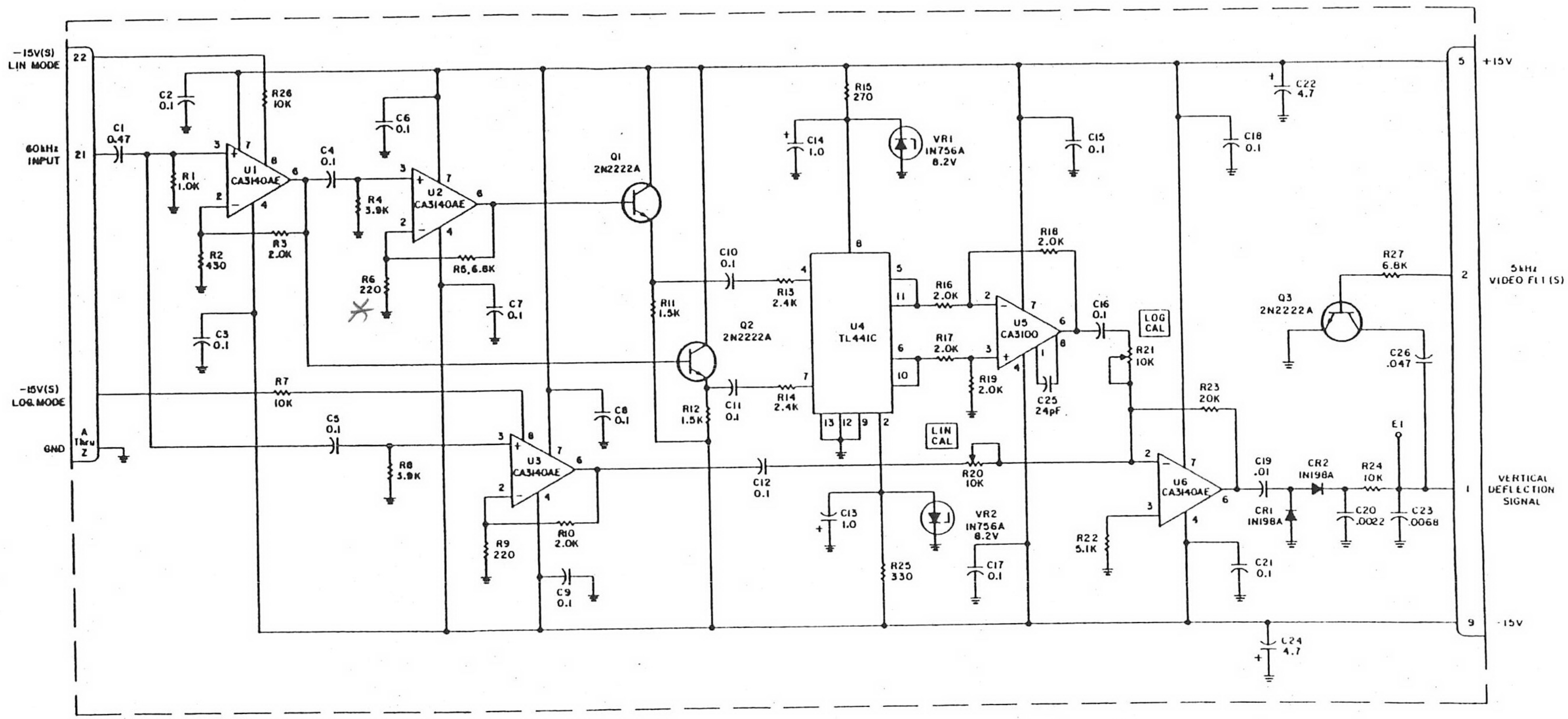

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NOS. ARE MODULE PIN NOS.

Figure 6-3. Type 796039 IF Amplifier (A3), Schematic Diagram

A3

DETAIL A




TES
UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
b) CAPACITANCE IS IN μF.
SEE DETAIL A FOR I/C PIN ARRANGEMENT.

Figure [illegible] Lin Log Amplifier [illegible]
Schematic Diagram

*R6 2.2K

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS IN μF.
2. PIN ARRANGEMENT FOR U1 & U2 IS SHOWN IN DETAIL A.
3. NOMINAL VALUE; FINAL VALUE FACTORY SELECT.

WJ-9188A-18

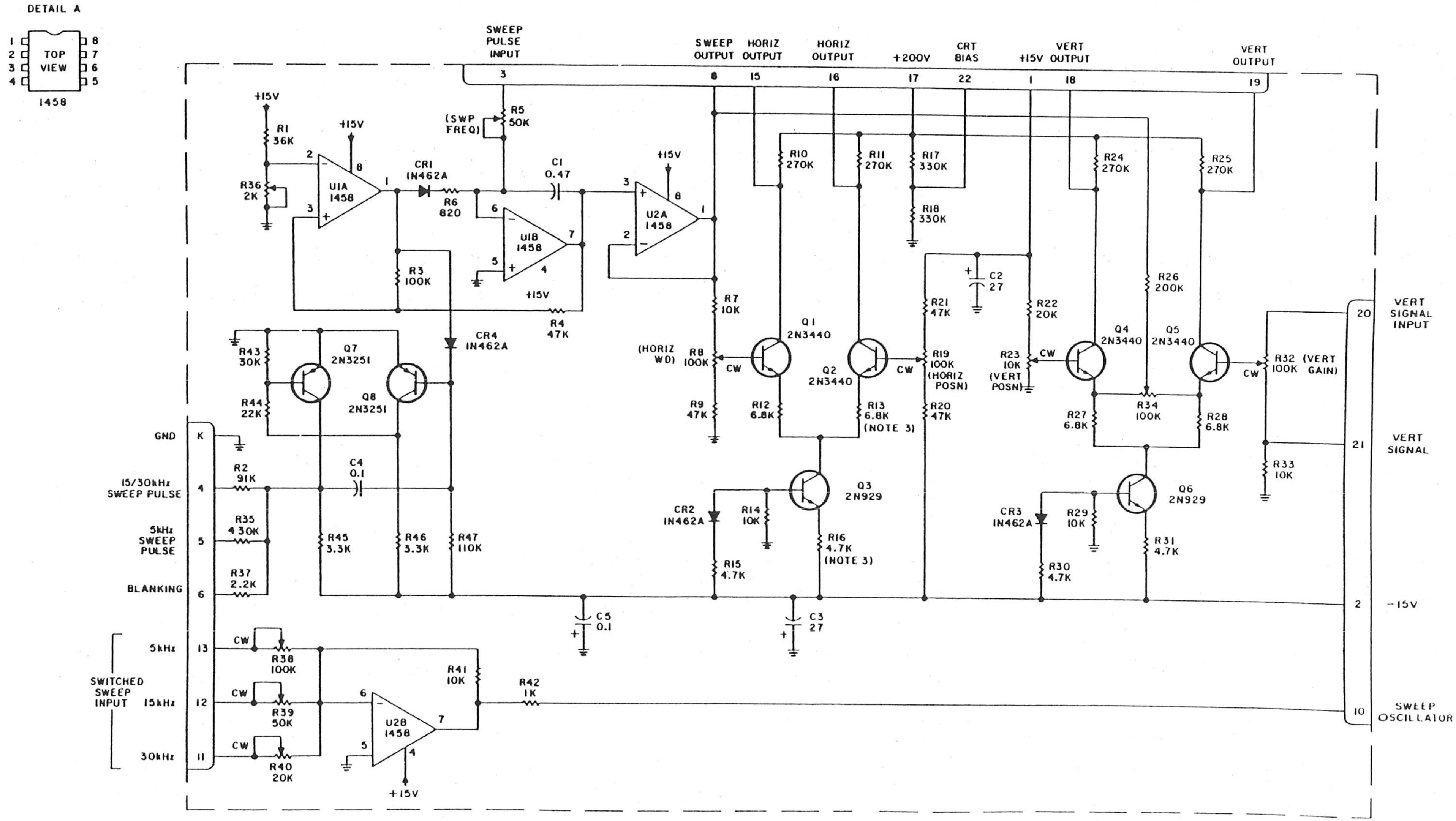
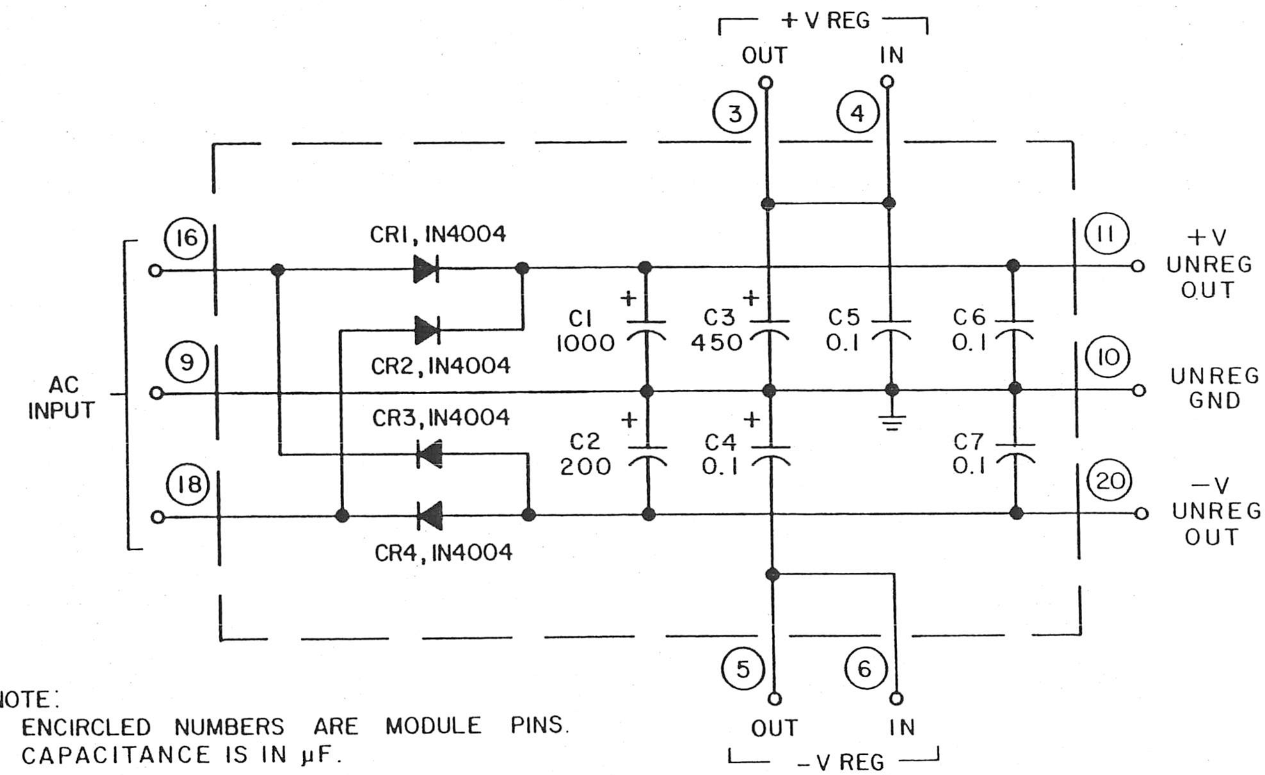



Figure 6-5. Type 796011 Horizontal Sweep Generator/Deflection Amplifier (A5) Schematic Diagram



A5



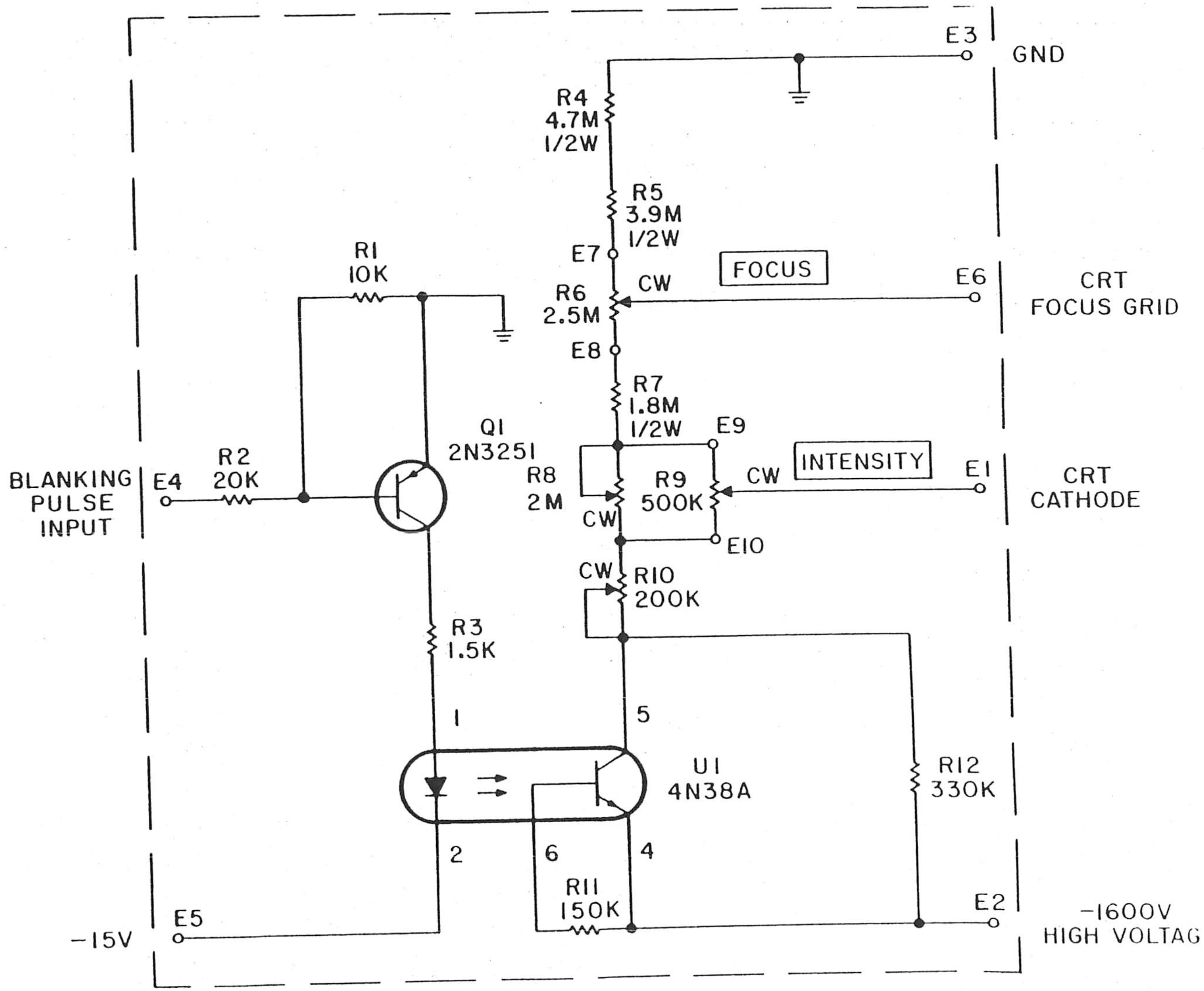

NOTE:
ENCIRCLED NUMBERS ARE MODULE PINS.
CAPACITANCE IS IN µF.

Figure 6-6. Type 621 Rectifier Filter Assy, Schematic Diagram



A6

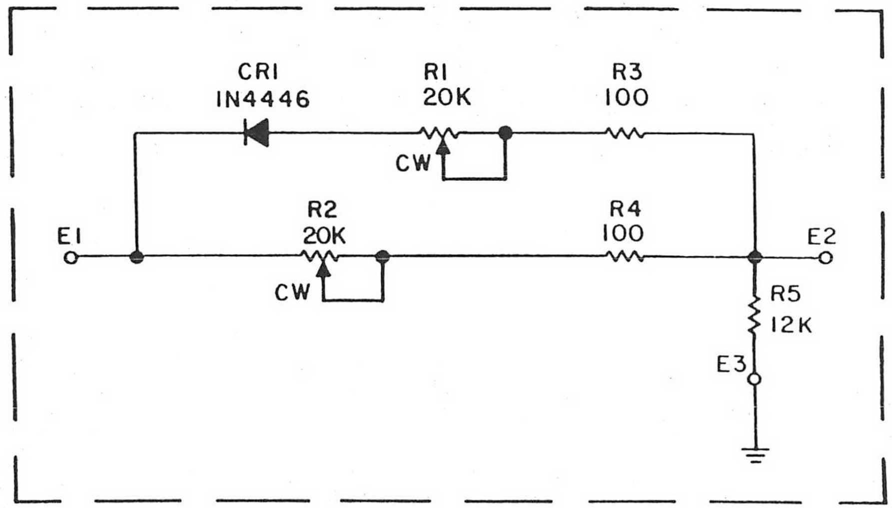
WJ-9188A-16




NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. CW INDICATES CLOCKWISE ROTATION OF CONTROL KNOBS.
3. ▭ INDICATES FRONT PANEL CONTROL.

Figure 6-7. Part 280062 Focus and Intensity Board [illegible] Schematic Diagram

A8

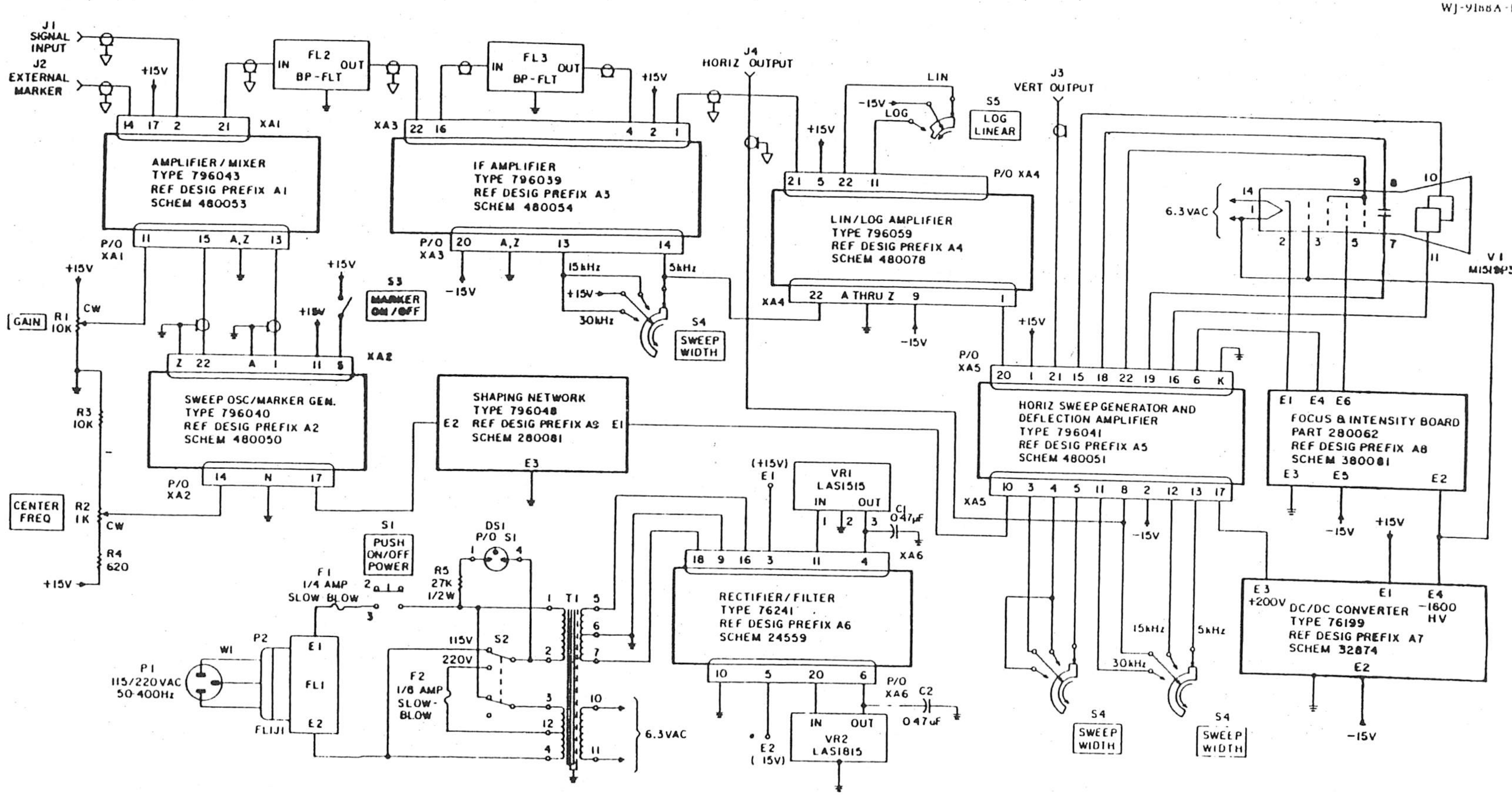



NOTE:
1. UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS,±5%, 1/4W.

Figure 6-8. Type 796018 Shaping Network (A9), Schematic Diagram

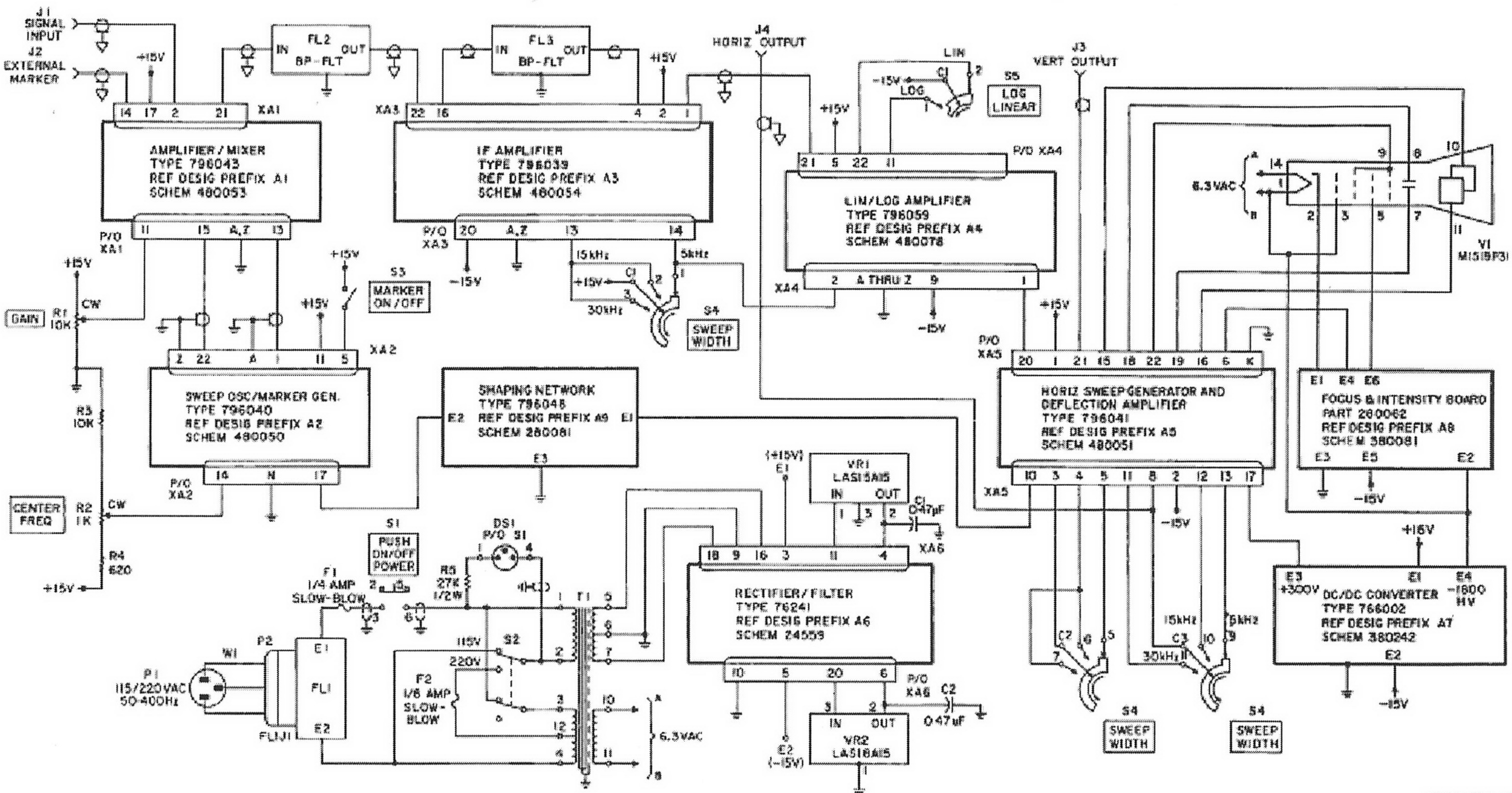


A9




NOTES:
1 ▭ INDICATES FRONT PANEL CONTROL
2: UNLESS OTHERWISE SPECIFIED
a) RESISTANCE IS IN OHMS, ±5%, 1/4W

Figure 6-9. WJ-9168A-18 Signal Monitor Main Chassis, Schematic Diagram


J1 SIGNAL INPUT
J2 EXTERNAL MARKER
FL2 BP-FLT
FL3 BP-FLT
J4 HORIZ OUTPUT
J3 VERT OUTPUT
S5 LOG LINEAR
AMPLIFIER / MIXER TYPE 796043 REF DESIG PREFIX A1 SCHEM 480053
IF AMPLIFIER TYPE 796039 REF DESIG PREFIX A3 SCHEM 480054
LIN/LOG AMPLIFIER TYPE 796059 REF DESIG PREFIX A4 SCHEM 480078
6.3VAC
V1 M151BP31
GAIN
S3 MARKER ON/OFF
S4 SWEEP WIDTH
SWEEP OSC/MARKER GEN. TYPE 796040 REF DESIG PREFIX A2 SCHEM 480050
SHAPING NETWORK TYPE 796048 REF DESIG PREFIX A9 SCHEM 280081
HORIZ SWEEP GENERATOR AND DEFLECTION AMPLIFIER TYPE 796041 REF DESIG PREFIX A5 SCHEM 480051
FOCUS & INTENSITY BOARD PART 280062 REF DESIG PREFIX A8 SCHEM 380081
CENTER FREQ
VR1 LA515AI5
S1 PUSH ON/OFF POWER
DS1 P/O S1
F1 1/4 AMP SLOW-BLOW
R5 27K 1/2W
RECTIFIER/FILTER TYPE 76241 REF DESIG PREFIX A6 SCHEM 24559
DC/DC CONVERTER TYPE 766002 REF DESIG PREFIX A7 SCHEM 380242
+300V
-1600 HV
P1 115/220VAC 50-400Hz
F2 1/8 AMP SLOW-BLOW
115V
220V
S2
T1
VR2 LA518AI5
C2 0.47µF
6.3VAC
15kHz
5kHz
30kHz

WJ-9188A-18