

# HITACHI

## MODEL V-211/V-212 V-222/V-422 OSCILLOSCOPE

### SERVICE MANUAL



**Hitachi Denshi, Ltd.**

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"WARNING – THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO."

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#### — N O T I C E —

This Service Manual describes the most typical product of this model. If there are any specific differences between this Manual and the servicing unit, please contact Hitachi Denshi sales office in your area.



MODEL V-211/V-212/V-222/V-422  
**OSCILLOSCOPE**  
Service Manual

**1. SPECIFICATIONS**

[     ] : Specifications for V-422

**CRT**

Type

Large 6" screen with internal graticule

Approximate 2kV [12kV] acceleration potential

Screen type

P31 phosphor standard

Useful screen area

8 × 10 div

Graticule

Internal graticule with centimeter divisions and 2 mm subdivisions along the central axis, 10 % and 90 % lines are indicated.

Illumination continuously variable. (For : V-222, V-422)

Focussing

Possible (with automatic focus correction circuit : V-222 and V-422)

Trace rotation                      Provided

Scale illumination                      Variable (For : V-222, V-422)

Intensity control                      Provided

**Z-AXIS INPUT (INTENSITY MODULATION)**

DC-coupled, positive-going signal decreases intensity: 5 Vp-p signal causes noticeable modulation at normal intensity: DC to 2 MHz.

Input impedance                      47 k $\Omega$  (typ.) [33 k $\Omega$  (typ.) ]

Maximum input voltage                      30 V (DC + peak AC)

Coupling                                      DC

**VERTICAL DEFLECTION SYSTEMS (2 Identical Channels)**

Bandwidth and rise time

DC to at least 20 MHz [40 MHz] and rise time 17.5 ns [8.8 ns] or less.

DC to at least 7 MHz and rise time 50 ns or less at magnifier extends.

The AC coupled lower -3 dB point is 10 Hz or less.

#### Deflection factor

5 mV/div to 5 V/div in 10 calibrated steps, in a 1-2-5 sequence.

The uncalibrated continuous control extends deflection factor to at least 12.5 V per division in the 5 volts/div position. The  $\times 5$  magnifier increases sensitivity of each deflection factor setting to 1 mV/div.

#### Accuracy

$\pm 3\%$  (+10 to +35 °C)

Additional error for magnifier  $\pm 2\%$

#### Display modes

CH1, CH2 (normal or invert), Alternate, Chopped (Approx. 250 kHz),  
Added

#### Input impedance

1 M $\Omega$   $\pm 3\%$  in parallel with  $23 \pm 3$  pF

#### Maximum input voltage

300 V (DC + peak AC)

#### Input coupling

AC, GND, DC

### HORIZONTAL DEFLECTION SYSTEM

#### Time base

0.2  $\mu$ s/div to 0.2 s/div in 19 calibrated steps, in a 1-2-5 sequence.

The uncalibrated continuous control extends deflection factor to at least 0.5 seconds per division in the 0.2 sec/div position. The  $\times 10$  magnifier extends maximum sweep rate to 100 ns/div [20 ns/div].

#### Accuracy

$\pm 3\%$  (+10 to +35 °C)

Additional error for magnifier  $\pm 2\%$

### TRIGGERING SYSTEM

#### Trigger modes

Automatic, Normal, TV (TV-H or TV-V)

Trigger source

Internal (CH1, CH2, V.MODE), Line, External : V-212, V-222, V-422

Internal, Line, External, EXT-H : V-211

Trigger slope

+ or -

TV sync polarity

TV (-)

Triggering level

Internal ;  $\pm 6$  div or more

variable range

External ; approx.  $\pm 2$  V

Triggering sensitivity

and frequency

| Frequency                          | Internal (V.MODE) | External |
|------------------------------------|-------------------|----------|
| 20 Hz - 2 MHz<br>[ 20 Hz - 5 MHz ] | 0.5 div (2.0 div) | 200 mV   |
| 2 - 20 MHz<br>[ 5 - 40 MHz ]       | 1.5 div (3.0 div) | 800 mV   |

(Except ; (V.MODE) : V-211)

TV-V, TV-H sensitivity: SYNC level more than 1 div or 1 V

AUTO: Approx. 25 Hz (when time base is 0.1  $\mu$ s/div to 2 ms/div)

Trigger coupling

AC : 25 Hz to full bandwidth

External trigger input impedance

1 M $\Omega$   $\pm 20\%$  in parallel with 25 pF  $\pm 5$  pF

(EXT ☒ ; about 100 k $\Omega$  : V-211)

Maximum input voltage

300 V (DC + AC to 1 kHz or less)

#### X-Y OPERATION

V-INPUT ; Vert, EXT TRIG IN ; Horiz : V-211

CH1 ; Horiz, CH2 ; Vert : V-212, V-222, V-422

Deflection factor

Same as vertical deflection

(X-axis; about 200 mV/div : V-211)

## Accuracy

Y:  $\pm 3\%$  (+10 to +35 °C)

X:  $\pm 5\%$  (+10 to +35 °C)

Additional error for magnifier  $\pm 2\%$

## X-bandwidth

DC to at least 500 kHz

## Phase error

3° or less from DC to 50 kHz : V-212, V-222, V-422

3° or less from DC to 10 kHz : V-211

## CALIBRATOR

An approx. 1 kHz frequency 0.5 V ( $\pm 3\%$ ) square wave.

## POWER SUPPLY

| VOLTAGE (50/60 Hz)   | FUSE |
|----------------------|------|
| 100 V ( 90 - 110 V)  | 2A   |
| 120 V ( 108 - 132 V) | 2A   |
| 220 V ( 198 - 242 V) | 1A   |
| 240 V ( 216 - 264 V) | 1A   |

Nominal voltage  $\pm 5\%$  at 400 Hz

Power supply frequency : 50, 60, 400 Hz

Power consumption : Approximately 30 W

## ENVIRONMENT

Limit of operation temperature 0 - 40 °C

Limit of operation humidity 35 - 85 %

Rated range of use temperature 10 - 35 °C

Rated range of use humidity 45 - 85 %

Storage and transportation temperature -20 - 70 °C

#### DIMENSIONS AND WEIGHT

Approx. 310(W) × 130(H) × 370(D) mm  
(12.4(W) × 5.2(H) × 14.8(D) inch)

Approx. 6 kg (13.5 lbs): for V-211, V-212

Approx. 6.5 kg (14.6 lbs): for V-222, V-422

## 2. ACCESSORIES

This instrument is shipped along with following accessories.

### — V-211 —

- 1 Probe (AT-10AJ 1.5)
- 1 AC power cord
- 1 Operation Manual

### — V-212 —

- 2 Probes (AT-10AJ 1.5)
- 1 AC power cord
- 1 Operation Manual

### — V-222/V-422 —

- 2 Probes (AT-10AK 1.5)
- 1 AC power cord
- 1 Operation Manual

### 3. PREVENTIVE MAINTENANCE

Preventive maintenance, when performed on a regular basis, can prevent instrument breakdown and may improve the reliability of the oscilloscope. The severity of environment to which this instrument is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is just prior to the recalibration of the instrument.

#### Disassembly

Remove all of the screws on the top cover of the instrument, then gently remove the top cover.

Take the same procedure for the bottom cover.

Most of the internal parts of the instrument are now accessible.

(See section 10. Exploded view)

#### Cleaning

The instrument should be cleaned as often as the operating conditions require, since the accumulation of dirt in the instrument may cause the component breakdown.

The covers can provide protection against dust in the interior of the instrument. Loose dust accumulated on these covers can be removed with a soft cloth or small brush.

Dirt that remains can be removed with a soft cloth applying in a mild detergent and water solution. Abrasive cleaners should not be used.

Cleaning the interior should be only occasionally necessary. The best way to clean the interior is to blow off the dust with a dry, low-velocity stream of air. A soft-bristle brush or a cotton-tipped applicator is useful for cleaning narrow spaces or for cleaning more delicate components.

#### Visual inspection

The instrument should be inspected occasionally for such defects as broken connections, improperly seated transistors, damaged circuit boards, and heat-damaged parts. The corrective procedure for most visible defects is apparent; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates

other trouble in the instrument; therefore, correcting the cause of the overheating is important to prevent the recurrence of the damage.

## **4. CALIBRATION**

Hitachi Denshi, Ltd. provides complete instrument repair and recalibration at our office, and authorized dealer. Contact your local Hitachi Denshi sales office or representative.

### **4. 1 Calibration interval**

To maintain instrument accuracy, perform the calibration of the V-211, V-212, V-222, V-422 at least every 1000 hours of operations or every six month if used infrequently.

### **4. 2 Test equipment required**

The following test equipment and accessories, or its equivalent, are required for the complete calibration of the V-211, V-212, V-222, V-422. Specifications given for the test equipment are the minimum necessary for accurate calibration. Therefore, the specifications of any test equipment used must meet or exceed the listed specifications.

All the test equipment is assumed to be correctly calibrated and operated within the listed specification. Operating instructions for the test equipment are not given in this procedure. Refer to the instruction manual for the test equipment if more information is needed.

### **4. 3 Preliminary procedure**

This instrument should be calibrated at an ambient temperature of  $+20^{\circ}\text{C}$  ( $\pm 5^{\circ}\text{C}$ ) for best overall accuracy.

1. Connect the instrument to AC line voltage, 50/60/400 Hz line source.
2. Set the instrument controls as given in the preliminary control settings. Allow at least fifteen minutes of warmup before proceeding.
3. See the adjustment locations in the pullout pages.

Table 4-2  
TEST EQUIPMENT REQUIRED

| Description                            | Minimum specification                                                                   | Usage                                                                   | Example of applicable test equipment |
|----------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------|
| 1. Constant amplitude signal generator | 50kHz reference frequency; maximum frequency 70MHz; variable amplitude                  | Check horizontal, vertical and trigger bandwidth.                       |                                      |
| 2. Standard amplitude calibrator       | Amplitude accuracy: 0.25%, variable amplitude; 5mV to 40V; frequency: 1 kHz square wave | Check horizontal and vertical gain.                                     |                                      |
| 3. Square-wave generator               | Variable frequency: 10Hz to 1MHz; output amplitude; 10mV to 100V                        | Check probe and vertical compensation.                                  |                                      |
| 4. Digital voltmeter                   | 0.1% accuracy                                                                           | Check power supply.                                                     |                                      |
| 5. Time mark generator                 | 0.1% accuracy                                                                           | Check horizontal timing.                                                |                                      |
| 6. Cable                               | Impedance, 50 ohms; type, RG-58/U; length, 42 inches, connectors, BNC                   | External trigger operation check. Horizontal gain check and adjustment. | Hitachi part No.4202                 |
| 7. Termination                         | Impedance, 50 ohms; connectors, BNC                                                     | Vertical amplifier compensation checks and adjustment.                  |                                      |
| 8. Attenuator                          | Ratio, 1/10; connectors, BNC; impedance, 50 ohms                                        | Vertical amplifier bandwidth check.                                     |                                      |
| 9. T-connector                         | Connectors, BNC                                                                         | External trigger operation checks.                                      | Hitachi part No.1301                 |

#### 4. 4 Preliminary control settings

Set the instrument controls as follows, when starting the calibration procedures.

| Controls       | Settings             | Controls    | Settings               |
|----------------|----------------------|-------------|------------------------|
| FOCUS          | Midrange             |             |                        |
| TRACE ROTATION | As desired           |             |                        |
| - VERT -       |                      |             |                        |
| V. POSITION    | Midrange, pushed in  | SWP VAR     | Fully clockwise        |
| V. VARIABLE    | CAL, fully clockwise | CH1 ALT MAG | Normal<br>(Button Out) |
| INPUT COUPLING | GND<br>(AC-GND-DC)   | - TRIG -    |                        |
| VOLTS/DIV      | 5 mV/DIV             |             |                        |
| V.MODE         | CH1                  | LEVEL       | Midrange,<br>Normal    |
| CH2 INV        | Normal, Pushed in    | SLOPE       | + Normal               |
| - HORZ -       |                      |             |                        |
| H. POSITION    | Midrange             | MODE        | AUTO                   |
| PULL x10 MAG   | Normal, Pushed in    | SOURCE      | INT                    |
| TIME/DIV       | 1 ms                 | INT TRIG    | CH1                    |

#### 4. 5 Initial starting procedure

1. Rotate the INTENSity control to the midrange and set the POWER switch to ON.
2. Wait a few seconds for the cathode ray tube (CRT) to warm up. A trace should appear on the CRT.
3. If trace disappears, increase (clockwise) the INTENSity control setting until the trace is easily observed, or roughly check/adjust the DC balance to get a trace as same as ⑬.
4. Adjust the FOCUS control for the best focused display.
5. Readjust the POSITION controls if necessary, to center the trace.

## POWER SUPPLY SYSTEM

### NOTE

Before you start operation, see the adjustment locations in the pullout pages.

### Control settings

Preset the controls as given in the preliminary control setting

- ① Check low-voltage supply, if necessary.
  - a. Connect the digital voltmeter (DVM) between the +8 V line (P1105-2) and ground  
: +7.3 to +8.3 V
  - b. Connect the DVM between the -8 V line (P1105-4) and ground  
: -8.3 to -7.7 V
  - c. Connect the DVM between the +5 V line (P1105-3) and ground  
: +4.8 to +5.2 V
  - d. Connect the DVM from the +120 V/+75 V line (P1105-1) and ground  
: +110 to +130 V (For V-211, V-212, V-222)  
: +67.5 to +82.5 V (For V-422)
- ② Check high voltage supply.
  - a. Connect the DVM to the H.V. test point (P1001-1) with a high voltage probe.
  - b. Check for a reading of -1.995 to 1.805 kV --- V-211, V-212, V-222  
-1.732 to 1.568 kV --- V-422

## DISPLAY

### Control setting

Preset the controls as given in the preliminary control setting.

- ③ Check/adjust CRT bias.

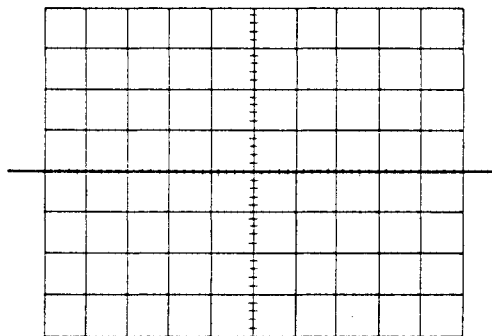
Set the Trig MODE switch to the AUTO, and set the TIME/DIV switch to the 1 ms.

  - a. Connect the digital voltmeter (DVM) to the R904 (or D1022-Ⓐ) and ground.
  - b. Adjust the INTENSITY control so that the DVM indicates 15.0 V.
  - c. Observe the trace of CRT.

d. Adjust the grid bias adjustment RV1021 for the trace makes a just appear.

④ Check/adjust trace rotation.

- a. Position the trace to the center graticule line.
- b. Check that the trace is in parallel with the center horizontal line.
- c. Adjust TRACE ROTATION (screwdriver adjustment on front panel) for a trace that is in parallel with the horizontal graticule lines.

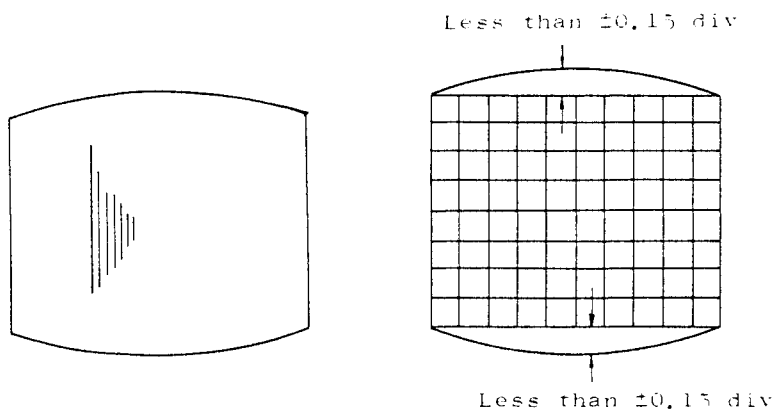


⑤ Check/adjust GEOMetry

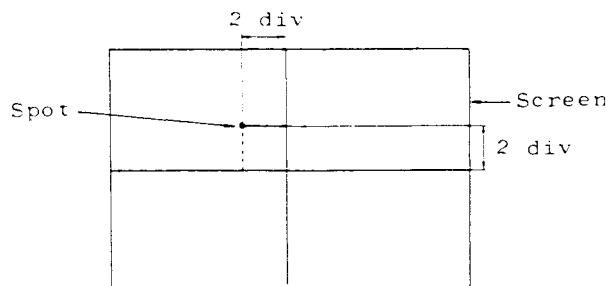
- a. Set the TIME/DIV to the 0.1 ms, and the input coupling switch to DC.
- b. Connect the constant amplitude signal generator to the input.
- c. Set the VOLTS/DIV switch setting for a full-screen (8 division) deflection.
- d. Check that horizontal bowing is less than  $\pm 0.15$  division.

For V-422

- e. Adjust the GEOM adjustment RV1033 for a display so that horizontal bowing is less than  $\pm 0.15$  division.



- ⑥ Check/adjust ASTIGmatism and FOCUS.
- Set the TIME/DIV switch to the X-Y position, and the input coupling switch to GND.
  - Set the INTENSity control for a small spot, as the following figure, using the position controls.



- Check that the spot is round.
- Adjust the FOCUS adjustment and ASTIG adjustment RV1035 for a round spot.

#### HORIZONTAL SYSTEM

##### Control settings

Preset the controls as given in the preliminary control settings.

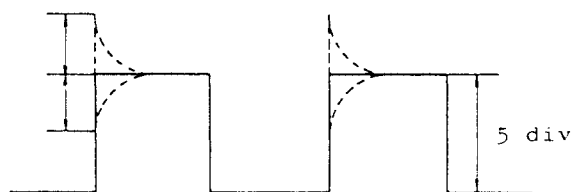
- ⑦ Check/adjust horizontal gain.
  - Set the input AC-GND-DC to DC.
  - Connect the cable to the output of the time mark generator.
  - Set the time mark generator for 1 ms time marks.
  - Check that the time marks align with the graticule lines over the center eight divisions, within 3 %.
  - Adjust the H GAIN adjustment RV824 so that the time marks coincide with the middle eight graticule lines.
- ⑧ Check/adjust Horizontal  $\times 10$  MAG Gain.
  - Set the TIME/DIV switch to 1 ms.
  - Set  $\times 10$  MAG (pull out the knob of the POSITION control).
  - Check that the one-cycle time marks align with the ten-divisions graticule lines, within 5 %.

- d. Adjust the MAG GAIN adjustment RV831 so that one-cycle time marks coincide with the ten-division graticule lines.
  - e. Push in the POSITION control after adjustment and check.
- ⑨ Check/adjust MAG CENT.
- a. Set the TIME/DIV switch to 1 ms.
  - b. So that the knob of H.POSITION is pulled out ( $\times 10$  MAG), the left end of the trace is brought to the center point and then the knob of H.POSITION is depressed.
  - c. Observe the movement of the left end of the trace.
  - d. Adjust the MAG CENT adjustment RV821 for the movement of the left end of the trace within  $\pm 0.2$  div.
- ⑩ Check/adjust low speed sweep accuracy.
- a. Set the time mark generator for 10 ms time marks.
  - b. Set the TIME/DIV switch to 10 ms.
  - c. Check that the time marks align with the graticule lines over the middle eight divisions, within 3 %.
  - d. Adjust the 10 ms/DIV adjustment RV542 so that the time marks coincide with the middle eight graticule lines.
- ⑪ Check/adjust high speed sweep accuracy.
- a. Set the input coupling switch to DC.
  - b. Set the time mark generator for 2  $\mu$ s time marks.
  - c. Set the TIME/DIV switch to 2  $\mu$ s.
  - d. Check that the time marks align with the graticule lines over the middle eight divisions.
  - e. Adjust CV520 so that the time marks coincide with middle eight graticule lines.
- ⑫ Check/adjust high speed  $\times 10$  MAG GAIN
- a. Set the TIME/DIV switch to the 2  $\mu$ s.
  - b. Set  $\times 10$  MAG (pull out the knob of the POSITION control).
  - c. Check that the one-cycle time marks align with the ten-divisions graticule lines, within 5 %.
  - d. Adjust the high speed Mag gain adjustment CV840 so that one-cycle time marks align with the ten-division graticule lines.
  - e. Push in the POSITION control after adjustment and check.

## VERTICAL SYSTEM

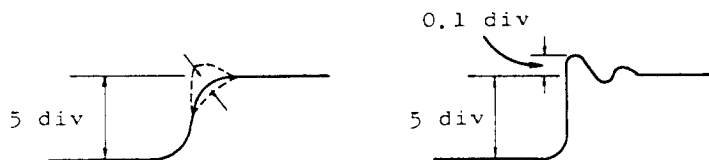
- ⑬ Check/adjust DC balance (Step attenuator balance).
- Set the VOLTS/DIV switch to the 5 mV position.
  - Position the trace to the horizontal center line.
  - Change the VOLTS/DIV switch to the 10 mV position.
  - Check that the trace is within  $\pm 0.05$  division of the center horizontal line.
  - Adjust the CH1 (CH2) DC BAL adjustment, RV22 (CH1) or RV122 (CH2), for a trace at the horizontal center line.
  - Repeat the part (a) through (e) until less than  $\pm 0.05$  division shift is noted when changing the VOLTS/DIV setting.
- ⑭ Check/adjust vertical position center.
- For V-211, V-212
- Confirm the vertical POSITION control at the midrange.
  - Check the trace is within 1 division.
  - Adjust the position center adjustment RV63 (CH1), RV163 (CH2) for a trace at the horizontal center line.
- For V-222, V-422 (CH1 only)
- Pull out the vertical POSITION control (set the DC OFFSET mode).
  - Connect a DVM to the DC OFFSET VOLT OUTput terminal.
  - Adjust the vertical POSITION control so that the DVM indicates 0 V.
  - Adjust the position center adjustment RV63 (CH1 only), for a trace at the horizontal center line.
- For V-222, V-422 (CH2)
- Confirm the vertical POSITION control at the midrange.
  - Check the trace is within 1 division.
  - Adjust the position center adjustment RV163 (CH2) for a trace at the horizontal center line.
- ⑮ Check/adjust  $\times 1$  AC GAIN.
- Set the TIME/DIV switch to the 1 ms position.
  - Set the VOLTS/DIV switch to the 10 mV position.
  - Set the input coupling switch to DC.

- d. Connect the square-wave generator (using 1 kHz output range).
- e. Adjust the output amplitude of that generator for 5 division deflection of screen.
- f. Check the high-voltage level of pulse is flat.



- g. Adjust the  $\times 1$  AC GAIN RV33 (CH1), RV133 (CH2) adjustment for a flat level.
- ①⑥ Check/adjust vertical gain.
- a. Set the VOLTS/DIV switch to the 10 mV position and the input coupling switch to DC.
  - b. Connect the standard amplitude calibrator to the input connector.
  - c. Set the standard amplitude calibrator for a 50 mVp-p (5 divisions for display) signal.
  - d. Check for a display of five divisions.
  - e. Adjust the GAIN adjustment RV62 (CH1), RV162 (CH2) for a display of 5 divisions within 2 %.
  - f. Check all the VOLTS/DIV switch settings.
- ①⑦ Check/adjust input capacity (ATT:  $\div 1$ ).
- a. Set the VOLTS/DIV switch to the 10 mV position.
  - b. Set the input coupling switches to DC.
  - c. Connect the L-C meter to the input terminals.
  - d. Check the input capacity for approx. 23 pF.
- ①⑧ Check/adjust vertical step response.
- a. Set the VOLTS/DIV switch to the 5 mV position.
  - b. Set the TIME/DIV switch to the 0.5  $\mu$ s position.
  - c. Connect the fast-rise, positive output (50 mV, 1 MHz) of the square-wave generator to the input. Use a 50  $\Omega$  termination and cable.
  - d. Adjust the square-wave generator output for a 5-divisions display.

- e. CH1 - Adjust CV336 (and CV355 : V-422 only) so that a square wave is flat. Then, adjust CV337 for overshoot of +0.2 div.  
CH2 - Adjust CV161 for overshoot of +0.2 div.



①9 Check/adjust attenuation compensation.

(ATT :  $\div 10$ ,  $\div 100$  )

- Set the input coupling switch to DC.
- Connect the square-wave generator to the CH1 (CH2) input terminal check for a square wave that is flat (flat top) under the following settings.

| ATT        | VOLTS/DIV | Square-wave generator output |
|------------|-----------|------------------------------|
| $\div 10$  | 0.1 V     | 0.5 V                        |
| $\div 100$ | 1 V       | 5 V                          |

- Adjust the trimmer capacitors (refer to the circuit board illustration with adjustment location - page 27 ) for a square wave that is flat (flat top) under the following settings.

| ATT        | VOLTS/DIV | Square-wave generator output | Adjust CH1 (CH2) |
|------------|-----------|------------------------------|------------------|
| $\div 10$  | 0.1 V     | 0.5 V                        | CV4 (CV104)      |
| $\div 100$ | 1 V       | 5 V                          | CV7 (CV107)      |

②0 Check/adjust input capacity (ATT:  $\div 10$ ,  $\div 100$ ).

- Connect the L-C meter to the input connector.
- Check the input capacity for approximately 23 pF.

- c. Adjust the trimmer capacitors for a 2 pF input capacity under the following settings.

| ATT        | VOLTS/DIV | Adjust<br>CH1 (CH2) |
|------------|-----------|---------------------|
| $\div 1$   | 5 mV      | —                   |
| $\div 10$  | 0.1 V     | CV3 (CV103)         |
| $\div 100$ | 1 V       | CV6 (CV106)         |

②1 X-Y operation

For V-212, V-222, V-422

21-1 Check/adjust X gain.

- Set the TIME/DIV switch to X-Y, the input coupling switch of CH1 to AC, the input coupling switch of CH2 to GND.
- Set the VOLTS/DIV switch to the 10 mV position.
- Connect the standard amplitude calibrator to the CH1 input connector.
- Set the standard amplitude calibrator for 50 mV.
- Check for a display of five divisions.
- Adjust the X GAIN adjustment RV550 for a display of five divisions within 6 %.

For V-211

21-2 Check/adjust X gain.

- Set the TIME/DIV switch to X-Y, the trig SOURCE switch to EXT ☒, the input coupling switch of vertical INPUT to GND.
- Connect the standard amplitude calibrator to the EXT TRIG OR ☒ Input connector.
- Set the standard amplitude calibrator for 1 V.
- Check for a display of five divisions.
- Adjust the X GAIN adjustment RV550 for a display of five divisions within 6 %.

21-3 Check/adjust X position center.

- Set the TIME/DIV switch to the X-Y position, and the horizontal

POSITION control to the midposition, the input coupling switch of CH1 to GND.

- b. Check to see that the round spot is near the center graticule and is within  $\pm 0.2$  division against horizontal line.
- c. Adjust the X CENT adjustment RV85 to the position spot at the center.

#### TRIGGER SYSTEM

##### ②② Check/adjust TRIG CENT.

- a. Set the TRIG SOURCE switch to INT, the INT TRIG switch to CH1, the TRIG SLOPE knob push in, the VOLTS/DIV switch to 50 mV, the TIME/DIV switch to 10  $\mu$ s.
- b. Connect the sine-wave generator to the input connector for a 0.5 div (50 kHz).
- c. Set the TRIG LEVEL knob to the midposition.
- d. Adjust RV420 so that synchronization is effected on the waveform, 0.5 div on the screen.
- e. Next, set the TRIG SLOPE to - (pulled out state) and insure that the waveform is triggered. After confirmation, leave the TRIG SLOPE in depressed state. Readjust when stepped out.

##### ②③ Check/adjust CH2 TRIG BAL.

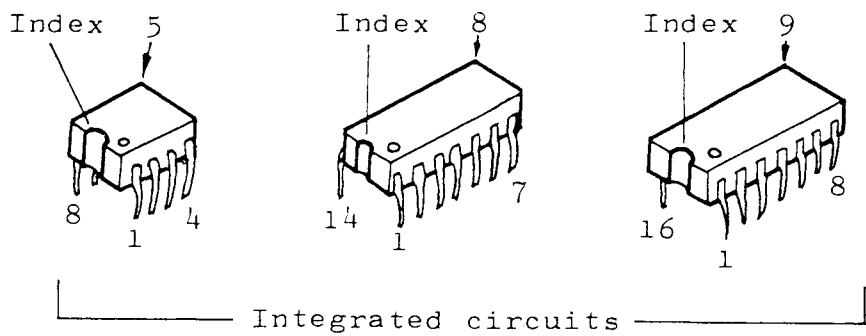
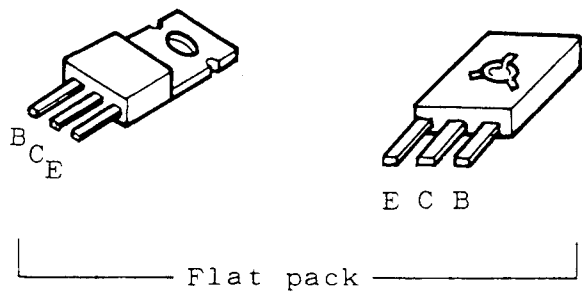
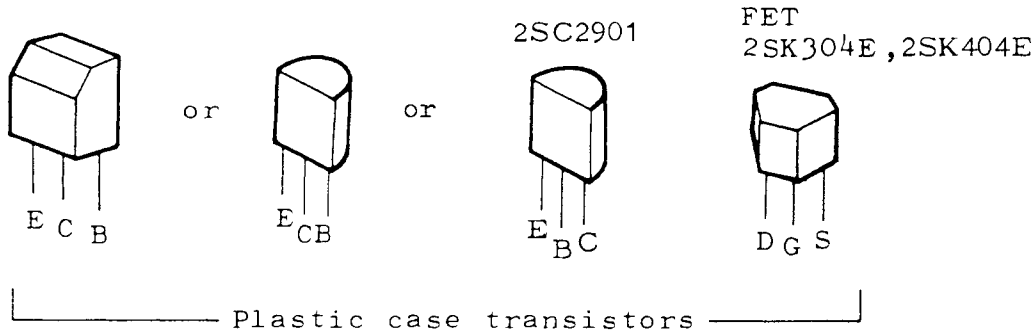
- a. Set the VOLTS/DIV switch to 50 mV (CH1 and CH2), the TIME/DIV switch to 10  $\mu$ s, the TRIG SOURCE switch to INT, the INT TRIG switch to <sup>VERT</sup>MODE, the V.MODE switch to ALT, and the CH1 POSITION knob to the midposition.
- b. Connect the sine-wave generator to the input connectors (CH1 and CH2) for a 5 div (50 kHz).
- c. Adjust CH2 POSITION control so that CH2 waveform comes to CH1.
- d. Next, adjust RV185 so that both waveforms (CH1 and CH2) coincides.

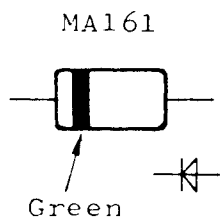
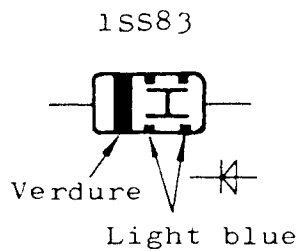
## CALIBRATOR

- ②④ Check/adjust CAL terminal (0.5 Vp-p, 1 kHz).
  - a. Connect the CAL terminal to the digital multimeter, short the terminal 1 to 3 of the connector (P1206).
  - b. Check for the CAL output of 0.5 V, within 1 %.
  - c. Adjust the 0.5 V adjustment RV1201 for the CAL output of 0.495 to 0.505 V.

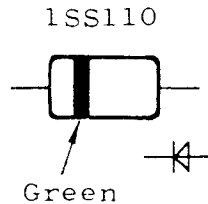
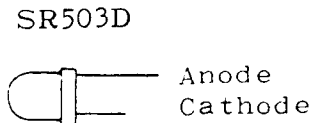
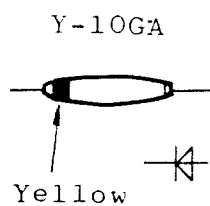
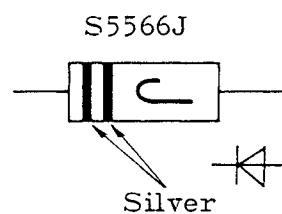
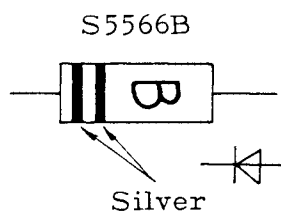
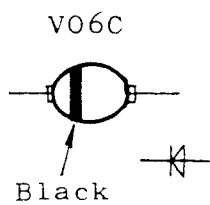
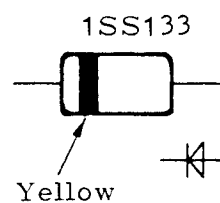
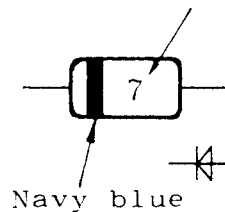
5. SEMICONDUCTOR LEAD CONFIGURATIONS

Lead configurations and case styles are typical, but may vary due to vendor changes or instrument modifications.





HZ3B, 5B, 7B, 12B  
Type No. (Navy blue)



## 6. CIRCUIT DESCRIPTION

### — Introduction —

This section of the manual contains a description of the circuitry used in V-211/V-212/V-222/V-422 Oscilloscope.

The block diagram (p. 31 ) shows the overall relationship between all of the circuits. Complete schematics of each circuit are also given in section Schematic diagrams (p. 51 to 129 ). Refer to these diagrams throughout the following circuit description for electrical values and relationships.

#### CHANNELS 1 and 2 VERTICAL PREAMP

Input signals for vertical deflection on the CRT can be connected to the "CH1 OR X " and (or) "CH2 OR Y " input connectors. In the X-Y mode of operation, CH1 input signal provides the horizontal (X-axis) deflection and CH2 input signal provides the vertical (Y-axis) deflection.

The Channel 1 and 2 Vertical Preamp circuits provide control of input coupling, vertical deflection factor, DC balance, vertical position and vertical gain.

They also contain a stage to provide a sample of the input signal to the Trigger Preamp circuit for internal triggering from the Channel 1 and (or) Channel 2 signal only.

#### VERTICAL SWITCHING CIRCUIT

The vertical switching circuit determines whether the CH1 or CH2 or both Vertical Preamp output signals are connected to the Vertical Output Amplifier circuit (through the Delay Line Driver and Delay Line stages: V-422 only).

In the ALT and CHOP modes, both channels are alternately displayed on a shared time basis.

#### VERTICAL OUTPUT AMPLIFIER

The Vertical Output Amplifier circuit provides the final amplification for the signal before it is applied to the vertical deflection plates of the CRT.

#### TRIGGER PREAMP

The Trigger Preamp circuit amplifies the internal trigger signal to the

level necessary to drive the Trigger Generator circuit.

Input signal for the Trigger Preamplifier circuit is obtained by sampling the signal applied to Channel 1 or the composite vertical signal from the Vertical Switching circuit.

This circuit also provides a signal to the Horizontal Amplifier for X-Y mode operation.

#### TRIGGER GENERATOR

The Trigger Generator circuit produces trigger pulses to start the Sweep Generator circuit. These trigger pulses are derived either from the internal trigger signal from the vertical deflection system, an external signal connected to the EXT TRIG Input connector or a sample of the line voltage applied to the instrument.

Controls are provided in this circuit to select trigger level, slope and source.

The Trigger MODE switch determines the operating mode for the trigger circuit. In the NORM Trig position, a sweep is produced only when a trigger pulse is received from the Trigger Generator circuit. Operation in the AUTO Trig mode is the same mode as NORM Trig mode, except that a free-running trace is displayed when a trigger pulse is not present or when the amplitude of the trigger signal is not adequate.

#### SWEEP GENERATOR

The Sweep Generator circuit produces a sawtooth voltage which is amplified by the Horizontal Amplifier circuit to provide horizontal deflection on the CRT. This sawtooth voltage is generated on command (trigger pulse) from the Trigger Generator circuit.

The Sweep Generator circuit also produces an unblanking gate to unblank the CRT during sweep time.

#### HORIZONTAL AMPLIFIER

The Horizontal Amplifier circuit provides the output signal to the CRT horizontal deflection plates. In all positions of the TIME/DIV select switch except X-Y, the horizontal deflection signal is a sawtooth from the Sweep Generator circuit. In the X-Y position, the horizontal deflection

signal is obtained from the Channel 1 Vertical Preamplifier (or X-SIGNAL PREAMP : V-211 only) through the Trigger Preamplifier circuit. In addition, the horizontal amplifier contains the horizontal magnifier and the horizontal positioning circuits.

#### POWER SUPPLY

The low-voltage Power Supply circuit provides the operating power for this instrument from four regulated supplies and one unregulated supply. The Power Input stage is provided with a Voltage Selector Assembly. This selector allows selection of the nominal operating voltage and regulating range for the instrument.

#### CALIBRATOR

The Calibrator circuit produces a square-wave output with accurate amplitude and frequency. This output is available as a square-wave voltage at the CAL 0.5 V (1 kHz) connector.

#### Z AXIS AMPLIFIER

The Z-Axis Amplifier circuit controls the CRT intensity level from several inputs. The effect of these input signals is to either increase or decrease the trace intensity, or to completely blank portions of the display.

#### CRT CIRCUIT

The CRT Circuit provides the high-voltage and control circuits necessary for operation of the cathode-ray tube (CRT).

# 9. ELECTRICAL PARTS LIST Note; A:V-211/B:V-212/C:V-222/D:V-422

## INPUT AMP

### CH1 and CH2 INPUT

| Symbol  | Part Code | Description                  | Q'ty |   |   |   |
|---------|-----------|------------------------------|------|---|---|---|
|         |           |                              | A    | B | C | D |
| C 1     | CQX0068   | C, Plastic 400V 0.047μF ±10% | 1    | 1 | 1 | 1 |
| C 101   | CQX0068   | C, Plastic 400V 0.047μF ±10% | 1    | 1 | 1 | 1 |
| S 1     | 8393985   | SW, Lever, SLE623            | 1    | 1 | 1 | 1 |
| S 101   | 8393985   | SW, Lever, SLE623            | 1    | 1 | 1 | 1 |
| S 202   | 8398985   | SW, Lever, SLE623            | 1    | 1 | 1 | 1 |
| PEF-622 |           | PCB PB-14                    | R    | R | R | R |

### CH1 1st ATTENUATOR

| Symbol | Part Code | Description                    | Q'ty |   |   |   |
|--------|-----------|--------------------------------|------|---|---|---|
|        |           |                                | A    | B | C | D |
| R 2    | RME0860   | R, MET Chip 1/8W 470Ω ±5%      | 1    | 1 | 1 | 1 |
| R 4    | RMS0043   | R, Metal 1/4W 900kΩ ±0.5%      | 1    | 1 | 1 | 1 |
| R 5    | RME1163   | R, Metal 1/4W 111kΩ ±0.5%      | 1    | 1 | 1 | 1 |
| R 7    | RMS0044   | R, Metal 1/4W 990kΩ ±0.5%      | 1    | 1 | 1 | 1 |
| R 8    | RME1156   | R, Metal 1/4W 10.1kΩ ±0.5%     | 1    | 1 | 1 | 1 |
| R 9    | RME0852   | R, MET, Chip 1/8W 10Ω ±5%      | 1    | 1 | 1 | 1 |
| R 10   | RME0864   | R, MET, Chip 1/8W 100Ω ±5%     | 1    | 1 | 1 | 1 |
| R 12   | RCE0749   | R, Carbon 1/4W 22Ω ±5%         | 1    | 1 | 1 | 1 |
| C 2    | CCG0132   | C, Ceramic Chip 50V 22 pF ±5%  | 1    | 1 | 1 | 1 |
| C 5    | CCG0139   | C, Ceramic Chip 50V 47 pF ±5%  | 1    | 1 | 1 | 1 |
| C 9    | CCG0144   | C, Ceramic Chip 50V 220 pF ±5% | 1    | 1 | 1 | 1 |
| C 10   | CCG0142   | C, Ceramic Chip 50V 82 pF ±5%  | 1    | 1 | 1 | 1 |
| CV 3   | CVE0046   | C, Variable ECR-HA010A11       | 1    | 1 | 1 | 1 |
| CV 4   | CVE0050   | C, Variable ECR-HA007A11       | 1    | 1 | 1 | 1 |
| CV 6   | CVE0046   | C, Variable ECR-HA010A11       | 1    | 1 | 1 | 1 |
| CV 7   | CVE0048   | C, Variable ECR-HA003A11       | 1    | 1 | 1 | 1 |
| ATT 1  | 8398872   | SW, Rotary ADR-255S            | 1    | 1 | 1 | 1 |

### CH1 INPUT AMP and 2nd ATTENUATOR

| Symbol | Part Code | Description               | Q'ty |   |   |   |
|--------|-----------|---------------------------|------|---|---|---|
|        |           |                           | A    | B | C | D |
| R 16   | RME1168   | R, Metal 1/4W 500kΩ ±0.5% | 1    | 1 | 1 | 1 |
| R 17   | RME1168   | R, Metal 1/4W 500kΩ ±0.5% | 1    | 1 | 1 | 1 |
| R 18   | RCE0757   | R, Carbon 1/4W 100Ω ±5%   | 1    | 1 | 1 | 1 |
| R 19   | RCE0793   | R, Carbon 1/4W 100kΩ ±5%  | 1    | 1 | 1 | 1 |
| R 20   | RCE0793   | R, Carbon 1/4W 100kΩ ±5%  | 1    | 1 | 1 | 1 |
| R 21   | RSE0434   | R, Solid 1/4W 10MΩ ±5%    | 1    | 1 | 1 | 1 |
| R 22   | RCE0791   | R, Carbon 1/4W 68kΩ ±5%   | 1    | 1 | 1 | 1 |
| R 23   | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%  | 1    | 1 | 1 | 1 |
| R 25   | RCE0757   | R, Carbon 1/4W 100Ω ±5%   | 1    | 1 | 1 | 1 |

| Symbol | Part Code | Description                  | Q'ty |   |   |   |
|--------|-----------|------------------------------|------|---|---|---|
|        |           |                              | A    | B | C | D |
| R 25   | RCE0755   | R, Carbon 1/4W 68Ω ±0.5%     | 1    | 1 | 1 | 1 |
| R 26   | RME1081   | R, Metal 1/4W 5.6kΩ ±1%      | 1    | 1 | 1 | 1 |
| R 26   | RME1079   | R, Metal 1/4W 3.9kΩ ±1%      | 1    | 1 | 1 | 1 |
| R 30   | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 30   | RCE0775   | R, Carbon 1/4W 3.3kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 32   | RCE0753   | R, Carbon 1/4W 47Ω ±5%       | 1    | 1 | 1 | 1 |
| R 34   | RME1145   | R, Metal 1/4W 60.0Ω ±0.5%    | 1    | 1 | 1 | 1 |
| R 35   | RCE0766   | R, Carbon 1/4W 560Ω ±5%      | 1    | 1 | 1 | 1 |
| R 36   | RME1154   | R, Metal 1/4W 600Ω ±0.5%     | 1    | 1 | 1 | 1 |
| R 33   | RCE0762   | R, Carbon 1/4W 270Ω ±5%      | 1    | 1 | 1 | 1 |
| R 40   | RCE0745   | R, Carbon 1/4W 10Ω ±5%       | 1    | 1 | 1 | 1 |
| R 41   | RCE0745   | R, Carbon 1/4W 10Ω ±5%       | 1    | 1 | 1 | 1 |
| R 42   | RCE0764   | R, Carbon 1/4W 390Ω ±5%      | 1    | 1 | 1 | 1 |
| R 43   | RCE0767   | R, Carbon 1/4W 680Ω ±5%      | 1    | 1 | 1 | 1 |
| R 44   | RCE0767   | R, Carbon 1/4W 680Ω ±5%      | 1    | 1 | 1 | 1 |
| R 44   | RCE0765   | R, Carbon 1/4W 470Ω ±5%      | 1    | 1 | 1 | 1 |
| R 45   | RCE0745   | R, Carbon 1/4W 10Ω ±5%       | 1    | 1 | 1 | 1 |
| R 46   | RME1157   | R, Metal 1/4W 16.0kΩ ±0.5%   | 1    | 1 | 1 | 1 |
| R 47   | RME1162   | R, Metal 1/4W 80.0kΩ ±0.5%   | 1    | 1 | 1 | 1 |
| R 48   | RME1155   | R, Metal 1/4W 4.00kΩ ±0.5%   | 1    | 1 | 1 | 1 |
| RM 43  | 3173846   | R, Block For ATT             | 1    | 1 | 1 | 1 |
| C 16   | CCD0286   | C, Ceramic 500V 1000pF ±100% | 1    | 1 | 1 | 1 |
| C 18   | CCC0996   | C, Ceramic 50V 2 pF ±0.25%   | 1    | 1 | 1 | 1 |
| C 20   | CCC1014   | C, Ceramic 50V 47 pF ±5%     | 1    | 1 | 1 | 1 |
| C 23   | CQA0091   | C, Plastic 50V 0.001μF ±10%  | 1    | 1 | 1 | 1 |
| C 25   | CCC1014   | C, Ceramic 50V 47 pF ±5%     | 1    | 1 | 1 | 1 |
| C 26   | CES0028   | C, Alelyc 10V 47μF ±20%      | 1    | 1 | 1 | 1 |
| C 30   | CES0028   | C, Alelyc 10V 47μF ±20%      | 1    | 1 | 1 | 1 |
| C 32   | CCC1002   | C, Ceramic 50V 10 pF ±0.5%   | 1    | 1 | 1 | 1 |
| C 40   | CES0028   | C, Alelyc 10V 47μF ±20%      | 1    | 1 | 1 | 1 |
| C 42   | CCC1007   | C, Ceramic 50V 22 pF ±5%     | 1    | 1 | 1 | 1 |
| C 44   | CES0028   | C, Alelyc 10V 47μF ±20%      | 1    | 1 | 1 | 1 |
| C 53   | CEX0563   | C, Alelyc 16V 10μF BP        | 1    | 1 | 1 | 1 |
| RV 22  | RNE0057   | VR, Metal EVN49C00YB54 (50K) | 1    | 1 | 1 | 1 |
| RV 33  | RNE0048   | VR, Metal EVN39C00YB22 (200) | 1    | 1 | 1 | 1 |
| TR 24  | HTK0099   | Transistor 2SK404E           | 1    | 1 | 1 | 1 |
| TR 30  | HTC0148   | Transistor 2SC458C           | 1    | 1 | 1 | 1 |
| TR 30  | HTC0557   | Transistor 2SC1674K          | 1    | 1 | 1 | 1 |
| TR 40  | HTA0224   | Transistor 2SA1029D          | 1    | 1 | 1 | 1 |
| L 34   | TLE0107   | Coil ELE-VR47MA              | 1    | 1 | 1 | 1 |
| IC 16  | 8397023   | IC LF411CN                   | 1    | 1 | 1 | 1 |
| D 16   | HDS0437   | Diode 1SS133                 | 1    | 1 | 1 | 1 |
| D 21   | HDS0477   | Diode 1SS110                 | 1    | 1 | 1 | 1 |
| D 51   | HDS0407   | Diode SR503D (RED)           | 1    | 1 | 1 | 1 |

DC OFFSET NETWORK

| Symbol | Part Code | Description                | Q'ty |   |   |   |
|--------|-----------|----------------------------|------|---|---|---|
|        |           |                            | A    | B | C | D |
| R 48   | RME1157   | R, Metal 1/4W 16.0kΩ ±0.5% |      |   | 1 | 1 |
| R 49   | RME1155   | R, Metal 1/4W 4.00kΩ ±0.5% |      |   | 1 | 1 |
| R 50   | RME1157   | R, Metal 1/4W 16.0kΩ ±0.5% |      |   | 1 | 1 |
| R 51   | RCE0769   | R, Carbon 1/4W 1kΩ ±5%     |      |   | 1 | 1 |
| R 52   | RME1069   | R, Metal 1/4W 562Ω ±5%     |      |   | 1 | 1 |
| R 53   | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%   |      |   | 1 | 1 |
| R 54   | RCE0769   | R, Carbon 1/4W 1kΩ ±5%     |      |   | 1 | 1 |
| R 55   | RCE0771   | R, Carbon 1/4W 1.5kΩ ±5%   |      |   | 1 | 1 |
| R 56   | RME1157   | R, Metal 1/4W 16.0kΩ ±0.5% |      |   | 1 | 1 |
| R 57   | RME1155   | R, Metal 1/4W 4.00kΩ ±0.5% |      |   | 1 | 1 |
| RV 61  | 8348452   | VR, Carbon EVH-CCAK20B14   | 1    | 1 |   |   |
| RV 61  | RDE0003   | VR, Carbon EVH-YK3325B14   |      |   | 1 | 1 |

CH2 1st ATTENUATOR

| Symbol  | Part Code | Description                 | Q'ty |   |   |   |
|---------|-----------|-----------------------------|------|---|---|---|
|         |           |                             | A    | B | C | D |
| R 102   | RME0860   | R, MET, Chip 1/8W 47Ω ±5%   |      |   | 1 | 1 |
| R 104   | RMS0043   | R, Metal 1/4W 900Ω ±0.5%    |      |   | 1 | 1 |
| R 105   | RME1163   | R, Metal 1/4W 111kΩ ±0.5%   |      |   | 1 | 1 |
| R 107   | RMS0044   | R, Metal 1/4W 990kΩ ±1%     |      |   | 1 | 1 |
| R 108   | RME1156   | R, Metal 1/4W 10.1kΩ ±0.5%  |      |   | 1 | 1 |
| R 109   | RME0852   | R, MET, Chip 1/8W 10Ω ±5%   |      |   | 1 | 1 |
| R 110   | RME0864   | R, MET, Chip 1/8W 100Ω ±5%  |      |   | 1 | 1 |
| R 112   | RCE0749   | R, Carbon 1/4W 22Ω ±5%      |      |   | 1 | 1 |
| C 102   | CCG0132   | C, CER, Chip 50V 22 pF ±5%  |      |   |   | 1 |
| C 105   | CCG0139   | C, CER, Chip 50V 47 pF ±5%  |      |   | 1 | 1 |
| C 109   | CCG0144   | C, CER, Chip 50V 220 pF ±5% |      |   | 1 | 1 |
| C 110   | CCG0142   | C, CER, Chip 50V 82 pF ±5%  |      |   | 1 | 1 |
| CV 103  | CVE0046   | C, Variable ECR-HA010A11    |      |   | 1 | 1 |
| CV 104  | CVE0050   | C, Variable ECR-HA007A11    |      |   | 1 | 1 |
| CV 106  | CVE0046   | C, Variable ECR-HA010A11    |      |   | 1 | 1 |
| CV 107  | CVE0048   | C, Variable ECR-HA003A11    |      |   | 1 | 1 |
| ATT 101 | 8398872   | SW, Rotary ADR-255S         |      |   | 1 | 1 |

CH2 INPUT AMP and 2nd ATTENUATOR

| Symbol | Part Code | Description                           | Q'ty |   |   |   |
|--------|-----------|---------------------------------------|------|---|---|---|
|        |           |                                       | A    | B | C | D |
| R 116  | RME1168   | R, Metal 1/4W 500kΩ ±0.5%             |      |   | 1 | 1 |
| R 117  | RME1168   | R, Metal 1/4W 500kΩ ±0.5%             |      |   | 1 | 1 |
| R 118  | RCE0757   | R, Carbon 1/4W 100Ω ±5%               |      |   | 1 | 1 |
| R 119  | RCE0793   | R, Carbon 1/4W 100kΩ ±5%              |      |   | 1 | 1 |
| R 120  | RCE0793   | R, Carbon 1/4W 100kΩ ±5%              |      |   | 1 | 1 |
| R 121  | RSE0434   | R, Solid 1/4W 10MΩ ±5%                |      |   | 1 | 1 |
| R 122  | RCE0791   | R, Carbon 1/4W 68kΩ ±5%               |      |   | 1 | 1 |
| R 123  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%              |      |   | 1 | 1 |
| R 125  | RCE0757   | R, Carbon 1/4W 100Ω ±5%               |      |   | 1 | 1 |
| R 125  | RCE0755   | R, Carbon 1/4W 68Ω ±5%                |      |   |   | 1 |
| R 126  | RME1081   | R, Metal 1/4W 5.6kΩ ±1%               |      |   | 1 | 1 |
| R 126  | RME1079   | R, Metal 1/4W 3.9kΩ ±1%               |      |   |   | 1 |
| R 130  | RCE0775   | R, Carbon 1/4W 3.3kΩ ±5%              |      |   | 1 | 1 |
| R 130  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%              |      |   |   | 1 |
| R 132  | RCE0753   | R, Carbon 1/4W 47Ω ±5%                |      |   |   | 1 |
| R 133  | RCE0762   | R, Carbon 1/4W 270Ω ±5%               |      |   | 1 | 1 |
| R 134  | RME1145   | R, Metal 1/4W 60.0Ω ±0.5%             |      |   | 1 | 1 |
| R 135  | RCE0766   | R, Carbon 1/4W 560Ω ±5%               |      |   | 1 | 1 |
| R 136  | RME1154   | R, Metal 1/4W 600Ω ±0.5%              |      |   | 1 | 1 |
| R 140  | RCE0745   | R, Carbon 1/4W 10Ω ±5%                |      |   | 1 | 1 |
| R 141  | RCE0745   | R, Carbon 1/4W 10Ω ±5%                |      |   | 1 | 1 |
| R 142  | RCE0764   | R, Carbon 1/4W 390Ω ±5%               |      |   | 1 | 1 |
| R 143  | RCE0767   | R, Carbon 1/4W 680Ω ±5%               |      |   | 1 | 1 |
| R 144  | RCE0767   | R, Carbon 1/4W 680Ω ±5%               |      |   | 1 | 1 |
| R 144  | RCE0766   | R, Carbon 1/4W 560Ω ±5%               |      |   |   | 1 |
| R 145  | RCE0745   | R, Carbon 1/4W 10Ω ±5%                |      |   | 1 | 1 |
| R 146  | RME1157   | R, Metal 1/4W 16.0kΩ ±0.5%            |      |   | 1 | 1 |
| R 147  | RME1162   | R, Metal 1/4W 80.0kΩ ±0.5%            |      |   | 1 | 1 |
| R 148  | RME1155   | R, Metal 1/4W 4.00kΩ ±0.5%            |      |   | 1 | 1 |
| R 151  | RCE0769   | R, Carbon 1/4W 1kΩ ±5%                |      |   | 1 | 1 |
| RM 143 | 3173846   | R, Block For ATT                      |      |   | 1 | 1 |
| C 116  | CCD0286   | C, Ceramic 500V 1000 pF ±100%<br>- 0% |      |   | 1 | 1 |
| C 118  | CCC0996   | C, Ceramic 50V 2 pF ±0.25%            |      |   | 1 | 1 |
| C 120  | CCC1014   | C, Ceramic 50V 47 pF ±5%              |      |   | 1 | 1 |
| C 123  | CQA0091   | C, Plastic 50V 1000 pF ±10%           |      |   | 1 | 1 |
| C 125  | CCC1014   | C, Ceramic 50V 47 pF ±5%              |      |   | 1 | 1 |
| C 126  | CES0028   | C, Alelyc 10V 47μF ±20%               |      |   | 1 | 1 |
| C 130  | CES0028   | C, Alelyc 10V 47μF ±20%               |      |   | 1 | 1 |
| C 132  | CCC1002   | C, Ceramic 50V 10 pF ±0.5%            |      |   |   | 1 |
| C 140  | CES0028   | C, Alelyc 10V 47μF ±20%               |      |   | 1 | 1 |
| C 142  | CCC1007   | C, Ceramic 50V 22 pF ±5%              |      |   | 1 | 1 |
| C 144  | CES0028   | C, Alelyc 10V 47μF ±20%               |      |   | 1 | 1 |
| RV 122 | RNE0057   | VR, Metal EVN49C00YB54 (50k)          |      |   | 1 | 1 |
| RV 133 | RNE0048   | VR, Metal EVN39C00YB22 (200)          |      |   | 1 | 1 |
| TR 124 | HTK0099   | Transistor 2SK404E                    |      |   | 1 | 1 |
| TR 130 | HTC0148   | Transistor 2SC458C                    |      |   | 1 | 1 |
| TR 130 | HTC0557   | Transistor 2SC1674K                   |      |   |   | 1 |
| TR 140 | HTA0224   | Transistor 2SA1029D                   |      |   | 1 | 1 |
| IC 116 | 8397023   | IC LF411CN                            |      |   | 1 | 1 |
| L 134  | TLE0107   | Coil ELE-VR47MA                       |      |   | 1 | 1 |
| D 116  | HDS0437   | Diode 1SS133                          |      |   | 1 | 1 |
| D 121  | HDS0477   | Diode 1SS110                          |      |   | 1 | 1 |
| D 151  | HDS0407   | Diode SR503D (RED)                    |      |   |   | 1 |

# PANEL and OTHERS

| Symbol | Part Code | Description              | Qty |   |   |   |
|--------|-----------|--------------------------|-----|---|---|---|
|        |           |                          | A   | B | C | D |
| R 13   | RCE0753   | R, Carbon 1/4W 47Ω ±5%   |     |   |   | 1 |
| R 113  | RCE0753   | R, Carbon 1/4W 47Ω ±5%   |     |   |   | 1 |
| C 13   | CCC1004   | C, Ceramic 50V 15 pF ±5% |     |   |   | 1 |
| C 113  | CCC1004   | C, Ceramic 50V 15 pF ±5% |     |   |   | 1 |
| J 1    | JHB0088   | CON, Conn BNC071         | 1   | 1 | 1 | 1 |
| J 5    |           | Jack TJ-10A (RED)        |     |   | 1 | 1 |
| J 101  | JHD0088   | CON, Conn BNC071         | 1   | 1 | 1 | 1 |

2 VERT PREAMP, TRIG PICKOFF CH SW MULTI  
CH1 PREAMP

| Symbol | Part Code | Description |                    |         |         | Q'ty |   |   |   |
|--------|-----------|-------------|--------------------|---------|---------|------|---|---|---|
|        |           |             |                    |         |         | A    | B | C | D |
| R 59   | RCE0761   | R, Carbon   | 1/4W               | 22Ω     | ±5%     | 1    | 1 | 1 |   |
| R 59   | RCE0759   | R, Carbon   | 1/4W               | 150Ω    | ±5%     |      |   |   | 1 |
| R 60   | RCE0797   | R, Carbon   | 1/4W               | 220kΩ   | ±5%     | 1    | 1 | 1 |   |
| R 60   | RCE0795   | R, Carbon   | 1/4W               | 150kΩ   | ±5%     |      |   |   | 1 |
| R 61   | RCE0745   | R, Carbon   | 1/4W               | 10Ω     | ±5%     | 1    | 1 | 1 |   |
| R 61   | RCE0752   | R, Carbon   | 1/4W               | 39Ω     | ±5%     |      |   |   | 1 |
| R 62   | RCE0755   | R, Carbon   | 1/4W               | 68Ω     | ±5%     | 1    | 1 | 1 |   |
| R 62   | RCE0753   | R, Carbon   | 1/4W               | 47Ω     | ±5%     |      |   |   | 1 |
| R 63   | RCE0775   | R, Carbon   | 1/4W               | 3.3kΩ   | ±5%     | 1    | 1 | 1 |   |
| R 63   | RCE0773   | R, Carbon   | 1/4W               | 2.2kΩ   | ±5%     |      |   |   | 1 |
| R 64   | RCE0775   | R, Carbon   | 1/4W               | 3.3kΩ   | ±5%     | 1    | 1 | 1 |   |
| R 64   | RCE0773   | R, Carbon   | 1/4W               | 2.2kΩ   | ±5%     |      |   |   | 1 |
| R 65   | RCE0781   | R, Carbon   | 1/4W               | 10kΩ    | ±5%     | 1    | 1 | 1 | 1 |
| R 66   | RCE0785   | R, Carbon   | 1/4W               | 22kΩ    | ±5%     | 1    | 1 | 1 | 1 |
| R 67   | RCE0758   | R, Carbon   | 1/4W               | 120Ω    | ±5%     | 1    | 1 | 1 | 1 |
| R 68   | RCE0749   | R, Carbon   | 1/4W               | 22Ω     | ±5%     | 1    | 1 | 1 | 1 |
| R 69   | RCE0770   | R, Carbon   | 1/4W               | 1.2kΩ   | ±5%     | 1    | 1 | 1 |   |
| R 69   | RCE0767   | R, Carbon   | 1/4W               | 680Ω    | ±5%     |      |   |   | 1 |
| R 70   | RCE0770   | R, Carbon   | 1/4W               | 1.2kΩ   | ±5%     | 1    | 1 | 1 |   |
| R 70   | RCE0767   | R, Carbon   | 1/4W               | 680Ω    | ±5%     |      |   |   | 1 |
| R 71   | RCE0749   | R, Carbon   | 1/4W               | 22Ω     | ±5%     | 1    | 1 | 1 | 1 |
| R 72   | RCE0753   | R, Carbon   | 1/4W               | 47Ω     | ±5%     | 1    | 1 | 1 | 1 |
| R 73   | RME1070   | R, Metal    | 1/4W               | 681Ω    | ±1%     | 1    | 1 | 1 |   |
| R 73   | RME1191   | R, Metal    | 1/4W               | 432Ω    | ±1%     |      |   |   | 1 |
| R 74   | RME1070   | R, Metal    | 1/4W               | 681Ω    | ±1%     | 1    | 1 | 1 |   |
| R 74   | RME1191   | R, Metal    | 1/4W               | 432Ω    | ±1%     |      |   |   | 1 |
| R 75   | RCE0775   | R, Carbon   | 1/4W               | 3.3kΩ   | ±5%     | 1    | 1 | 1 | 1 |
| R 76   | RCE0765   | R, Carbon   | 1/4W               | 470Ω    | ±5%     | 1    | 1 | 1 | 1 |
| R 77   | RCE0753   | R, Carbon   | 1/4W               | 47Ω     | ±5%     | 1    | 1 | 1 | 1 |
| C 61   | CCC1011   | C, Ceramic  | 50V                | 33pF    | ±5%     |      |   |   | 1 |
| C 61   | CCC1007   | C, Ceramic  | 50V                | 10pF    | ±0.5%   | 1    | 1 | 1 |   |
| C 67   | CQA0099   | C, Plastic  | 50V                | 0.022μF | ±10%    | 1    | 1 | 1 |   |
| C 67   | CQA0097   | C, Plastic  | 50V                | 0.001μF | ±10%    |      |   |   | 1 |
| C 69   | CCC1365   | C, Ceramic  | 50V                | 680pF   | ±10%    | 1    | 1 | 1 | 1 |
| C 71   | CCC1365   | C, Ceramic  | 50V                | 680pF   | ±10%    | 1    | 1 | 1 | 1 |
| C 72   | CCC1030   | C, Ceramic  | 50V                | 10000pF | ±10%    | 1    | 1 | 1 | 1 |
| C 77   | CCC0997   | C, Ceramic  | 50V                | 3pF     | ±0.25pF | 1    | 1 | 1 | 1 |
| RV 62  | RNE0049   | VR, Metal   | EVN39C00YB12 (100) |         |         | 1    | 1 | 1 | 1 |
| RV 63  | RNE0047   | VR, Metal   | EVN39C00YB54 (50K) |         |         | 1    | 1 | 1 | 1 |
| TR 61  | HTC0168   | Transistor  | 2SC535C            |         |         | 1    | 1 | 1 | 1 |
| TR 62  | HTC0168   | Transistor  | 2SC535C            |         |         | 1    | 1 | 1 | 1 |
| TR 63  | HTA0224   | Transistor  | 2SA1029D           |         |         | 1    | 1 | 1 | 1 |
| TR 64  | HTA0224   | Transistor  | 2SA1029D           |         |         | 1    | 1 | 1 | 1 |

| Symbol | Part Code | Description |                    |         |      | Q'ty |   |   |   |
|--------|-----------|-------------|--------------------|---------|------|------|---|---|---|
|        |           |             |                    |         |      | A    | B | C | D |
| R 160  | RCE0797   | R, Carbon   | 1/4W               | 220kΩ   | ±5%  |      |   | 1 | 1 |
| R 160  | RCE0795   | R, Carbon   | 1/4W               | 150kΩ   | ±5%  |      |   |   | 1 |
| R 161  | RCE0745   | R, Carbon   | 1/4W               | 10Ω     | ±5%  |      |   | 1 | 1 |
| R 162  | RCE0753   | R, Carbon   | 1/4W               | 47Ω     | ±5%  |      |   |   | 1 |
| R 162  | RCE0755   | R, Carbon   | 1/4W               | 68Ω     | ±5%  |      |   | 1 | 1 |
| R 163  | RCE0775   | R, Carbon   | 1/4W               | 3.3kΩ   | ±5%  |      |   | 1 | 1 |
| R 163  | RCE0773   | R, Carbon   | 1/4W               | 2.2kΩ   | ±5%  |      |   |   | 1 |
| R 164  | RCE0775   | R, Carbon   | 1/4W               | 3.3kΩ   | ±5%  |      |   | 1 | 1 |
| R 164  | RCE0773   | R, Carbon   | 1/4W               | 2.2kΩ   | ±5%  |      |   |   | 1 |
| R 165  | RCE0781   | R, Carbon   | 1/4W               | 10kΩ    | ±5%  |      |   | 1 | 1 |
| R 166  | RCE0785   | R, Carbon   | 1/4W               | 22kΩ    | ±5%  |      |   | 1 | 1 |
| R 167  | RCE0758   | R, Carbon   | 1/4W               | 120Ω    | ±5%  |      |   | 1 | 1 |
| R 168  | RCE0749   | R, Carbon   | 1/4W               | 22Ω     | ±5%  |      |   | 1 | 1 |
| R 169  | RCE0767   | R, Carbon   | 1/4W               | 680Ω    | ±5%  |      |   |   | 1 |
| R 169  | RCE0770   | R, Carbon   | 1/4W               | 2.2kΩ   | ±5%  |      |   | 1 | 1 |
| R 170  | RCE0770   | R, Carbon   | 1/4W               | 1.2kΩ   | ±5%  |      |   | 1 | 1 |
| R 170  | RCE0767   | R, Carbon   | 1/4W               | 680Ω    | ±5%  |      |   |   | 1 |
| R 171  | RCE0749   | R, Carbon   | 1/4W               | 22Ω     | ±5%  |      |   | 1 | 1 |
| R 172  | RCE0753   | R, Carbon   | 1/4W               | 47Ω     | ±5%  |      |   | 1 | 1 |
| R 173  | RME1070   | R, Metal    | 1/4W               | 681Ω    | ±1%  |      |   | 1 | 1 |
| R 173  | RME1191   | R, Metal    | 1/4W               | 432Ω    | ±1%  |      |   |   | 1 |
| R 174  | RME1070   | R, Metal    | 1/4W               | 681Ω    | ±1%  |      |   | 1 | 1 |
| R 174  | RME1191   | R, Metal    | 1/4W               | 432Ω    | ±1%  |      |   |   | 1 |
| R 175  | RCE0775   | R, Carbon   | 1/4W               | 3.3kΩ   | ±5%  |      |   | 1 | 1 |
| R 176  | RCE0765   | R, Carbon   | 1/4W               | 470Ω    | ±5%  |      |   | 1 | 1 |
| R 177  | RCE0765   | R, Carbon   | 1/4W               | 470Ω    | ±5%  |      |   | 1 | 1 |
| R 178  | RCE0775   | R, Carbon   | 1/4W               | 3.3kΩ   | ±5%  |      |   | 1 | 1 |
| R 179  | RCE0753   | R, Carbon   | 1/4W               | 47Ω     | ±5%  |      |   | 1 | 1 |
| C 167  | CQA0099   | C, Plastic  | 50V                | 0.022μF | ±10% |      |   | 1 | 1 |
| C 167  | CQA0097   | C, Plastic  | 50V                | 0.01μF  | ±10% |      |   |   | 1 |
| C 169  | CCC1365   | C, Ceramic  | 50V                | 680pF   | ±10% |      |   | 1 | 1 |
| C 171  | CCC1365   | C, Ceramic  | 50V                | 680pF   | ±10% |      |   | 1 | 1 |
| C 172  | CCC1030   | C, Ceramic  | 50V                | 10000pF | ±10% |      |   | 1 | 1 |
| C 179  | CCC1030   | C, Ceramic  | 50V                | 10000pF | ±10% |      |   | 1 | 1 |
| RV 161 | RDE0003   | VR, Carbon  | EVH-YK3325B14      |         |      |      |   | 1 | 1 |
| RV 162 | RNE0049   | VR, Metal   | EVN39C00YB12 (100) |         |      |      |   | 1 | 1 |
| RV 163 | RNE0047   | VR, Metal   | EVN39C00YB54 (50K) |         |      |      |   | 1 | 1 |
| CV 161 | CVE0047   | C, Variable | ECR-HA020D11       |         |      |      |   | 1 | 1 |
| CV 161 | CVE0049   | C, Variable | ECR-HA040E11       |         |      |      |   |   | 1 |
| TR 161 | HTC0168   | Transistor  | 2SC535C            |         |      |      |   | 1 | 1 |
| TR 162 | HTC0168   | Transistor  | 2SC535C            |         |      |      |   | 1 | 1 |
| TR 163 | HTA0224   | Transistor  | 2SA1029D           |         |      |      |   | 1 | 1 |
| TR 164 | HTA0224   | Transistor  | 2SA1029D           |         |      |      |   | 1 | 1 |
| TR 165 | HTA0224   | Transistor  | 2SA1029D           |         |      |      |   | 1 | 1 |
| TR 166 | HTA0224   | Transistor  | 2SA1029D           |         |      |      |   | 1 | 1 |

CH2 PREAMP and INVERT SW CKT

| Symbol | Part Code | Description |      |      |     | Q'ty |   |   |   |
|--------|-----------|-------------|------|------|-----|------|---|---|---|
|        |           |             |      |      |     | A    | B | C | D |
| R 159  | RCE0761   | R, Carbon   | 1/4W | 220Ω | ±5% |      |   | 1 | 1 |
| R 159  | RCE0759   | R, Carbon   | 1/4W | 150Ω | ±5% |      |   |   | 1 |

# DIODE GATE and VERTICAL AMP

| Symbol | Part Code | Symbol     |         |               |              | Q'ty |   |   |   |
|--------|-----------|------------|---------|---------------|--------------|------|---|---|---|
|        |           |            |         |               |              | A    | B | C | D |
| R 201  | RCE0773   | R, Carbon  | 1/4W    | 2.2k $\Omega$ | $\pm 5\%$    | 1    | 1 |   |   |
| R 201  | RCE0770   | R, Carbon  | 1/4W    | 1.2k $\Omega$ | $\pm 5\%$    |      |   |   | 1 |
| R 202  | RCE0773   | R, Carbon  | 1/4W    | 2.2k $\Omega$ | $\pm 5\%$    | 1    | 1 |   |   |
| R 202  | RCE0770   | R, Carbon  | 1/4W    | 1.2k $\Omega$ | $\pm 5\%$    |      |   |   | 1 |
| R 203  | RME1066   | R, Metal   | 1/4W    | 332 $\Omega$  | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 203  | RME1063   | R, Metal   | 1/4W    | 182 $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
| R 204  | RME1066   | R, Metal   | 1/4W    | 332 $\Omega$  | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 204  | RME1063   | R, Metal   | 1/4W    | 182 $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
| R 205  | RCE0769   | R, Carbon  | 1/4W    | 1k $\Omega$   | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 205  | RCE0766   | R, Carbon  | 1/4W    | 560 $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
| R 206  | RCE0769   | R, Carbon  | 1/4W    | 1k $\Omega$   | $\pm 5\%$    | 1    | 1 | 1 | 1 |
| R 207  | RCE0785   | R, Carbon  | 1/4W    | 22k $\Omega$  | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 207  | RCE0782   | R, Carbon  | 1/4W    | 12k $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
| R 208  | RME1066   | R, Metal   | 1/4W    | 332 $\Omega$  | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 208  | RME1064   | R, Metal   | 1/4W    | 221 $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
| R 209  | RME1066   | R, Metal   | 1/4W    | 332 $\Omega$  | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 209  | RME1064   | R, Metal   | 1/4W    | 221 $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
| R 210  | RCE0789   | R, Carbon  | 1/4W    | 47k $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
| R 210  | RCE0791   | R, Carbon  | 1/4W    | 68k $\Omega$  | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 211  | RCE0766   | R, Carbon  | 1/4W    | 560 $\Omega$  | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 211  | RCE0768   | R, Carbon  | 1/4W    | 820 $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
| R 212  | RCE0766   | R, Carbon  | 1/4W    | 560 $\Omega$  | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 212  | RCE0768   | R, Carbon  | 1/4W    | 820 $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
| R 213  | RME1107   | R, Metal   | 1/4W    | 86.6 $\Omega$ | $\pm 1\%$    |      |   |   | 1 |
| R 213  | RCE0753   | R, Carbon  | 1/4W    | 47 $\Omega$   | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 214  | RME1107   | R, Metal   | 1/4W    | 86.6 $\Omega$ | $\pm 1\%$    |      |   |   | 1 |
| R 214  | RCE0753   | R, Carbon  | 1/4W    | 47 $\Omega$   | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 215  | RCE0773   | R, Carbon  | 1/4W    | 2.2k $\Omega$ | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 215  | RCE0772   | R, Carbon  | 1/4W    | 1.8k $\Omega$ | $\pm 5\%$    |      |   |   | 1 |
| R 216  | RCE0773   | R, Carbon  | 1/4W    | 2.2k $\Omega$ | $\pm 5\%$    | 1    | 1 | 1 |   |
| R 216  | RCE0772   | R, Carbon  | 1/4W    | 1.8k $\Omega$ | $\pm 5\%$    |      |   |   | 1 |
| R 217  | RCE0761   | R, Carbon  | 1/4W    | 220 $\Omega$  | $\pm 5\%$    |      |   |   | 1 |
|        |           |            |         |               |              |      |   |   |   |
| C 201  | CCC1030   | C, Ceramic | 50V     | 10000 pF      | $\pm 10\%$   | 1    | 1 | 1 |   |
| C 207  | CCC1014   | C, Ceramic | 50V     | 47 pF         | $\pm 5\%$    | 1    | 1 | 1 |   |
| C 207  | CCC1025   | C, Ceramic | 50V     | 100 pF        | $\pm 5\%$    |      |   |   | 1 |
| C 210  | CEX0563   | C, Alelyc  | 16V     | 10 $\mu$ F    | BP           | 1    | 1 | 1 | 1 |
| C 217  | CCC1002   | C, Ceramic | 50V     | 10 pF         | $\pm 0.5$ pF |      |   |   | 1 |
|        |           |            |         |               |              |      |   |   |   |
| TR 201 | HTC0338   | Transistor | 2SC1906 |               |              | 1    | 1 | 1 | 1 |
| TR 202 | HTC0338   | Transistor | 2SC1906 |               |              | 1    | 1 | 1 | 1 |
|        |           |            |         |               |              |      |   |   |   |
| D 201  | HDS0437   | Diode      | 1SS133  |               |              | 1    | 1 | 1 |   |
| D 202  | HDS0437   | Diode      | 1SS133  |               |              | 1    | 1 | 1 |   |
| D 203  | HDS0437   | Diode      | 1SS133  |               |              | 1    | 1 | 1 |   |
| D 204  | HDS0437   | Diode      | 1SS133  |               |              | 1    | 1 | 1 |   |
| D 205  | HDS0437   | Diode      | 1SS133  |               |              | 1    | 1 | 1 |   |
| D 206  | HDS0437   | Diode      | 1SS133  |               |              | 1    | 1 | 1 |   |
| D 207  | HDS0437   | Diode      | 1SS133  |               |              | 1    | 1 | 1 |   |
| D 208  | HDS0437   | Diode      | 1SS133  |               |              | 1    | 1 | 1 |   |

# VERTICAL SWITCHING MULTI

| Symbol | Part Code | Description |            |               |            | Q'ty |   |   |   |
|--------|-----------|-------------|------------|---------------|------------|------|---|---|---|
|        |           |             |            |               |            | A    | B | C | D |
| R 221  | RCE0750   | R, Carbon   | 1/4W       | 27 $\Omega$   | $\pm 5\%$  | 1    | 1 |   |   |
| R 221  | RCE0758   | R, Carbon   | 1/4W       | 120 $\Omega$  | $\pm 5\%$  |      |   |   | 1 |
| R 222  | RCE0761   | R, Carbon   | 1/4W       | 220 $\Omega$  | $\pm 5\%$  | 1    | 1 |   |   |
| R 222  | RCE0758   | R, Carbon   | 1/4W       | 120 $\Omega$  | $\pm 5\%$  |      |   |   | 1 |
| R 223  | RCE0750   | R, Carbon   | 1/4W       | 27 $\Omega$   | $\pm 5\%$  | 1    | 1 |   |   |
| R 223  | RCE0748   | R, Carbon   | 1/4W       | 18 $\Omega$   | $\pm 5\%$  |      |   |   | 1 |
| R 224  | RCE0761   | R, Carbon   | 1/4W       | 220 $\Omega$  | $\pm 5\%$  | 1    | 1 |   |   |
| R 224  | RCE0758   | R, Carbon   | 1/4W       | 120 $\Omega$  | $\pm 5\%$  |      |   |   | 1 |
| R 225  | RCE0789   | R, Carbon   | 1/4W       | 47k $\Omega$  | $\pm 5\%$  | 1    | 1 | 1 |   |
| R 226  | RCE0749   | R, Carbon   | 1/4W       | 10 $\Omega$   | $\pm 5\%$  | 1    | 1 | 1 | 1 |
| R 228  | RCE0789   | R, Carbon   | 1/4W       | 47k $\Omega$  | $\pm 5\%$  | 1    | 1 | 1 |   |
| T 229  | RCE0776   | R, Carbon   | 1/4W       | 3.9k $\Omega$ | $\pm 5\%$  | 1    | 1 | 1 |   |
| R 230  | RCE0777   | R, Carbon   | 1/4W       | 4.7k $\Omega$ | $\pm 5\%$  | 1    | 1 | 1 |   |
| R 231  | RCE0777   | R, Carbon   | 1/4W       | 4.7k $\Omega$ | $\pm 5\%$  | 1    | 1 | 1 |   |
| R 232  | RCE0769   | R, Carbon   | 1/4W       | 1k $\Omega$   | $\pm 5\%$  | 1    | 1 |   |   |
| R 232  | RCE0768   | R, Carbon   | 1/4W       | 820 $\Omega$  | $\pm 5\%$  |      |   |   | 1 |
| R 233  | RCE0781   | R, Carbon   | 1/4W       | 10k $\Omega$  | $\pm 5\%$  | 1    | 1 | 1 |   |
| R 234  | RCE0781   | R, Carbon   | 1/4W       | 10k $\Omega$  | $\pm 5\%$  | 1    | 1 | 1 |   |
| R 235  | RCE0789   | R, Carbon   | 1/4W       | 47k $\Omega$  | $\pm 5\%$  | 1    | 1 | 1 |   |
| R 236  | RCE0789   | R, Carbon   | 1/4W       | 47k $\Omega$  | $\pm 5\%$  | 1    | 1 | 1 |   |
| R 237  | RCE0789   | R, Carbon   | 1/4W       | 47k $\Omega$  | $\pm 5\%$  | 1    | 1 | 1 |   |
| R 390  | RCE0781   | R, Carbon   | 1/4W       | 10k $\Omega$  | $\pm 5\%$  |      |   |   | 1 |
| R 391  | RCE0765   | R, Carbon   | 1/4W       | 740 $\Omega$  | $\pm 5\%$  |      |   |   | 1 |
| R 392  | RCE0778   | R, Carbon   | 1/4W       | 5.6k $\Omega$ | $\pm 5\%$  |      |   |   | 1 |
| R 393  | RCE0767   | R, Carbon   | 1/4W       | 680 $\Omega$  | $\pm 5\%$  |      |   |   | 1 |
| R 394  | RCE0775   | R, Carbon   | 1/4W       | 3.3k $\Omega$ | $\pm 5\%$  |      |   |   | 1 |
| R 395  | RCE0775   | R, Carbon   | 1/4W       | 3.3k $\Omega$ | $\pm 5\%$  | 1    | 1 |   |   |
| R 396  | RCE0785   | R, Carbon   | 1/4W       | 22 $\Omega$   | $\pm 5\%$  |      |   |   | 1 |
|        |           |             |            |               |            |      |   |   |   |
| C 221  | CCC1160   | C, Ceramic  | 50V        | 330 pF        | $\pm 10\%$ | 1    | 1 | 1 |   |
| C 222  | CES0028   | C, Alelyc   | 10V        | 47 $\mu$ F    | $\pm 20\%$ | 1    | 1 | 1 |   |
| C 223  | CCC1160   | C, Ceramic  | 50V        | 330 pF        | $\pm 10\%$ | 1    | 1 | 1 |   |
| C 224  | CES0028   | C, Alelyc   | 10V        | 47 $\mu$ F    | $\pm 20\%$ | 1    | 1 | 1 | 1 |
|        |           |             |            |               |            |      |   |   |   |
| TR 232 | HTA0224   | Transistor  | 2SA1029D   |               |            | 1    | 1 | 1 |   |
| TR 390 | HTC0148   | Transistor  | 2SC458C    |               |            |      |   |   | 1 |
| TR 396 | HTC0148   | Transistor  | 2SC458C    |               |            |      |   |   | 1 |
|        |           |             |            |               |            |      |   |   |   |
| IC 222 | IDH0467   | IC          | HD74LS00P  |               |            | 1    | 1 | 1 |   |
| IC 226 | IDH0586   | IC          | HD74LS74AP |               |            | 1    | 1 | 1 | 1 |
|        |           |             |            |               |            |      |   |   |   |
| D 221  | HDS0437   | Diode       | 1SS133     |               |            | 1    | 1 | 1 |   |
| D 223  | HDS0437   | Diode       | 1SS133     |               |            | 1    | 1 | 1 |   |
| D 224  | HDS0437   | Diode       | 1SS133     |               |            | 1    | 1 | 1 |   |
| D 225  | HDS0437   | Diode       | 1SS133     |               |            | 1    | 1 | 1 |   |
| D 226  | HDS0437   | Diode       | 1SS133     |               |            | 1    | 1 | 1 |   |
| D 230  | HDS0437   | Diode       | 1SS133     |               |            | 1    | 1 | 1 |   |
| D 231  | HDS0437   | Diode       | 1SS133     |               |            | 1    | 1 | 1 |   |
| D 394  | HDS0437   | Diode       | 1SS133     |               |            |      |   |   | 1 |
| D 395  | HDS0437   | Diode       | 1SS133     |               |            |      |   |   | 1 |
|        |           |             |            |               |            |      |   |   |   |
| S 201  | 3165210   | SW, Rotary  | SBU 1025   |               |            | 1    | 1 | 1 |   |
|        |           |             |            |               |            |      |   |   |   |
| D 243  | HDS0437   | Diode       | 1SS133     |               |            | 1    | 1 | 1 |   |
| D 244  | HDS0437   | Diode       | 1SS133     |               |            | 1    | 1 | 1 |   |
| D 245  | HDH0029   | Diode       | HZ5B       |               |            | 1    | 1 | 1 | 1 |

# CH1 TRIG PICKOFF and CH1 OUT

| Symbol | Part Code | Description                  | Q'ty |   |   |   |
|--------|-----------|------------------------------|------|---|---|---|
|        |           |                              | A    | B | C | D |
| R 81   | RCE0693   | R, Carbon 1/2W 100Ω ±5%      |      |   |   | 1 |
| R 82   | RME1107   | R, Metal 1/4W 86.6Ω ±1%      | 1    | 1 | 1 | 1 |
| R 83   | RCE0757   | R, Carbon 1/4W 100Ω ±5%      | 1    | 1 | 1 | 1 |
| R 84   | RCE0759   | R, Carbon 1/4W 150Ω ±5%      | 1    | 1 | 1 | 1 |
| R 85   | RCE0783   | R, Carbon 1/4W 15kΩ ±5%      | 1    | 1 | 1 | 1 |
| R 86   | RCE0771   | R, Carbon 1/4W 1.5kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 87   | RCE0755   | R, Carbon 1/4W 68Ω ±5%       | 1    | 1 | 1 | 1 |
| R 87   | RCE0756   | R, Carbon 1/4W 82Ω ±5%       | 1    | 1 | 1 | 1 |
| R 87   | RCE0751   | R, Carbon 1/4W 33Ω ±5%       | 1    | 1 | 1 | 1 |
| R 88   | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 88   | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 89   | RCE0773   | R, Carbon 1/4W 4.7kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 89   | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 90   | RCE0763   | R, Carbon 1/4W 330Ω ±5%      | 1    | 1 | 1 | 1 |
| R 90   | RCE0745   | R, Carbon 1/4W 10Ω ±5%       | 1    | 1 | 1 | 1 |
| R 91   | RCE0763   | R, Carbon 1/4W 330Ω ±5%      | 1    | 1 | 1 | 1 |
| R 91   | RCE0761   | R, Carbon 1/4W 220Ω ±5%      | 1    | 1 | 1 | 1 |
| R 92   | RCE0787   | R, Carbon 1/4W 33kΩ ±5%      | 1    | 1 | 1 | 1 |
| R 93   | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 93   | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 94   | RME1070   | R, Metal 1/4W 681Ω ±5%       | 1    | 1 | 1 | 1 |
| R 94   | RCE0771   | R, Carbon 1/4W 1.5kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 95   | RCE0753   | R, Carbon 1/4W 47Ω ±5%       | 1    | 1 | 1 | 1 |
| R 96   | RCE0755   | R, Carbon 1/4W 68Ω ±5%       | 1    | 1 | 1 | 1 |
| R 96   | RCE0757   | R, Carbon 1/4W 100Ω ±5%      | 1    | 1 | 1 | 1 |
| R 96   | RCE0753   | R, Carbon 1/4W 47Ω ±5%       | 1    | 1 | 1 | 1 |
| R 97   | RCE0769   | R, Carbon 1/4W 1kΩ ±5%       | 1    | 1 | 1 | 1 |
| R 97   | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 97   | RCE0781   | R, Carbon 1/4W 10kΩ ±5%      | 1    | 1 | 1 | 1 |
| R 98   | RCE0767   | R, Carbon 1/4W 680Ω ±5%      | 1    | 1 | 1 | 1 |
| R 99   | RCE0768   | R, Carbon 1/4W 820Ω ±5%      | 1    | 1 | 1 | 1 |
| R 99   | RCE0767   | R, Carbon 1/4W 680Ω ±5%      | 1    | 1 | 1 | 1 |
| C 83   | CES0028   | C, Alelyc 10V 47μF/LB        | 1    | 1 | 1 | 1 |
| C 86   | CCC1034   | C, Ceramic 50V 68 pF ±5%     | 1    | 1 | 1 | 1 |
| C 86   | CCC1365   | C, Ceramic 50V 680 pF ±10%   | 1    | 1 | 1 | 1 |
| C 90   | CCC1365   | C, Ceramic 50V 680 pF ±10%   | 1    | 1 | 1 | 1 |
| C 91   | CCC1365   | C, Ceramic 50V 680 pF ±10%   | 1    | 1 | 1 | 1 |
| C 94   | CES0028   | C, Alelyc 10V 47μF/LB        | 1    | 1 | 1 | 1 |
| C 96   | CCC1030   | C, Ceramic 50V 10000 pF ±10% | 1    | 1 | 1 | 1 |
| C 97   | CCC1007   | C, Ceramic 50V 22 pF ±5%     | 1    | 1 | 1 | 1 |
| C 97   | CCC1027   | C, Ceramic 50V 220 pF ±10%   | 1    | 1 | 1 | 1 |
| RV 85  | RNE0051   | VR, Metal EVN39C00YB14 (10K) | 1    | 1 | 1 | 1 |
| TR 85  | HTC0168   | Transistor 2SC535C           | 1    | 1 | 1 | 1 |
| TR 86  | HTC0168   | Transistor 2SC535C           | 1    | 1 | 1 | 1 |
| TR 87  | HTC0148   | Transistor 2SC458C           | 1    | 1 | 1 | 1 |
| D 97   | HDH0024   | Diode HZ3B                   | 1    | 1 | 1 | 1 |
| L 98   | TLF0067   | Coil FL-5H101K               | 1    | 1 | 1 | 1 |

# CH2 TRIG PICKOFF

| Symbol | Part Code | Description                  | Q'ty |   |   |   |
|--------|-----------|------------------------------|------|---|---|---|
|        |           |                              | A    | B | C | D |
| R 181  | RCE0757   | R, Carbon 1/4W 100Ω ±5%      | 1    | 1 | 1 | 1 |
| R 184  | RCE0759   | R, Carbon 1/4W 150Ω ±5%      | 1    | 1 | 1 | 1 |
| R 185  | RCE0783   | R, Carbon 1/4W 15kΩ ±5%      | 1    | 1 | 1 | 1 |
| R 186  | RCE0771   | R, Carbon 1/4W 1.5kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 186  | RCE0753   | R, Carbon 1/4W 100Ω ±5%      | 1    | 1 | 1 | 1 |
| R 187  | RCE0755   | R, Carbon 1/4W 68Ω ±5%       | 1    | 1 | 1 | 1 |
| R 187  | RCE0751   | R, Carbon 1/4W 33Ω ±5%       | 1    | 1 | 1 | 1 |
| R 188  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 188  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 189  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 189  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 190  | RCE0763   | R, Carbon 1/4W 330Ω ±5%      | 1    | 1 | 1 | 1 |
| R 190  | RCE0745   | R, Carbon 1/4W 100Ω ±5%      | 1    | 1 | 1 | 1 |
| R 191  | RCE0776   | R, Carbon 1/4W 3.9kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 191  | RCE0775   | R, Carbon 1/4W 3.3kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 192  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 192  | RCE0770   | R, Carbon 1/4W 1.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| RV 185 | RNE0051   | VR, Metal EVN39C00YB14 (10K) | 1    | 1 | 1 | 1 |
| C 186  | CCC1365   | C, Ceramic 50V 680 pF ±10%   | 1    | 1 | 1 | 1 |
| C 186  | CCC1034   | C, Ceramic 50V 68 pF ±5%     | 1    | 1 | 1 | 1 |
| C 190  | CCC1365   | C, Ceramic 50V 680 pF ±10%   | 1    | 1 | 1 | 1 |
| TR 185 | HTC0168   | Transistor 2SC535C           | 1    | 1 | 1 | 1 |
| TR 186 | HTC0168   | Transistor 2SC535C           | 1    | 1 | 1 | 1 |

# TRIG PREAMP

| Symbol | Part Code | Description                  | Q'ty |   |   |   |
|--------|-----------|------------------------------|------|---|---|---|
|        |           |                              | A    | B | C | D |
| R 241  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 242  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 243  | RCE0765   | R, Carbon 1/4W 470kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 244  | RCE0765   | R, Carbon 1/4W 2.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 245  | RCE0766   | R, Carbon 1/4W 560Ω ±5%      | 1    | 1 | 1 | 1 |
| R 245  | RCE0770   | R, Carbon 1/4W 1.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 246  | RCE0768   | R, Carbon 1/4W 560Ω ±5%      | 1    | 1 | 1 | 1 |
| R 246  | RCE0770   | R, Carbon 1/4W 1.2kΩ ±5%     | 1    | 1 | 1 | 1 |
| R 247  | RCE0768   | R, Carbon 1/4W 820Ω ±5%      | 1    | 1 | 1 | 1 |
| R 247  | RCE0765   | R, Carbon 1/4W 470Ω ±5%      | 1    | 1 | 1 | 1 |
| R 248  | RCE0753   | R, Carbon 1/4W 47Ω ±5%       | 1    | 1 | 1 | 1 |
| R 249  | RCE0757   | R, Carbon 1/4W 100Ω ±5%      | 1    | 1 | 1 | 1 |
| C 241  | CCC1030   | C, Ceramic 50V 10000 pF ±10% | 1    | 1 | 1 | 1 |
| C 242  | CES0028   | C, Alelyc 10V 47μF ±20%      | 1    | 1 | 1 | 1 |
| C 243  | CCC1007   | C, Ceramic 50V 22 pF ±5%     | 1    | 1 | 1 | 1 |
| C 244  | CCC1007   | C, Ceramic 50V 22 pF ±5%     | 1    | 1 | 1 | 1 |
| C 245  | CES0028   | C, Alelyc 10V 47μF ±20%      | 1    | 1 | 1 | 1 |
| C 248  | CCC1025   | C, Ceramic 50V 100 pF ±5%    | 1    | 1 | 1 | 1 |
| C 248  | CCC1032   | C, Ceramic 50V 82 pF ±5%     | 1    | 1 | 1 | 1 |
| C 249  | CCC0999   | C, Ceramic 50V 5 pF ±0.25pF  | 1    | 1 | 1 | 1 |
| C 270  | CES0028   | C, Alelyc 10V 47μF ±20%      | 1    | 1 | 1 | 1 |

| Symbol | Part Code | Description | Q'ty       |          |            |            |   |   |   |   |
|--------|-----------|-------------|------------|----------|------------|------------|---|---|---|---|
|        |           |             | A          | B        | C          | D          |   |   |   |   |
| C      | 271       | CES0028     | C, Alelyc  | 10V      | 47 $\mu$ F | $\pm 20\%$ | 1 | 1 | 1 | 1 |
| TR     | 241       | HTC0192     | Transistor | 2SC641K  |            |            |   | 1 | 1 | 1 |
| TR     | 242       | HTC0192     | Transistor | 2SC641K  |            |            |   |   | 1 | 1 |
| TR     | 246       | HTA0224     | Transistor | 2SA1029D |            |            |   | 1 | 1 | 1 |
| TR     | 246       | HTA0099     | Transistor | 2SA781K  |            |            |   |   |   | 1 |

## DELAY LINE

| Symbol  | Part Code | Description      | Q'ty |   |   |   |
|---------|-----------|------------------|------|---|---|---|
|         |           |                  | A    | B | C | D |
| DL 201  | 8311741   | Delay Line CD-3A |      |   |   | 1 |
| PEF-624 |           | PCB PB-14        |      |   |   | R |

## SQUARE WAVE CAL 1kHz

| Symbol | Part Code | Description | Q'ty       |              |                |             |   |   |   |   |
|--------|-----------|-------------|------------|--------------|----------------|-------------|---|---|---|---|
|        |           |             | A          | B            | C              | D           |   |   |   |   |
| R      | 1201      | RME1174     | R, Metal   | 1/4W         | 2.00k $\Omega$ | $\pm 1\%$   | 1 | 1 | 1 | 1 |
| R      | 1202      | RME1065     | R, Metal   | 1/4W         | 267 $\Omega$   | $\pm 1\%$   | 1 | 1 | 1 | 1 |
| R      | 1203      | RCE0783     | R, Carbon  | 1/4W         | 15k $\Omega$   | $\pm 5\%$   | 1 | 1 | 1 | 1 |
| R      | 1204      | RCE0781     | R, Carbon  | 1/4W         | 10k $\Omega$   | $\pm 5\%$   | 1 | 1 | 1 | 1 |
| R      | 1205      | RCE0783     | R, Carbon  | 1/4W         | 15k $\Omega$   | $\pm 5\%$   | 1 | 1 | 1 | 1 |
| R      | 1206      | RCE0789     | R, Carbon  | 1/4W         | 47k $\Omega$   | $\pm 5\%$   | 1 | 1 | 1 | 1 |
| R      | 1207      | RCE0781     | R, Carbon  | 1/4W         | 10k $\Omega$   | $\pm 5\%$   | 1 | 1 | 1 | 1 |
| R      | 1208      | RCE0787     | R, Carbon  | 1/4W         | 33k $\Omega$   | $\pm 5\%$   | 1 | 1 | 1 | 1 |
| R      | 1209      | RCE0781     | R, Carbon  | 1/4W         | 10k $\Omega$   | $\pm 5\%$   | 1 | 1 | 1 | 1 |
| R      | 1210      | RCE0745     | R, Carbon  | 1/4W         | 10 $\Omega$    | $\pm 5\%$   | 1 | 1 | 1 | 1 |
| C      | 1201      | CCC1002     | C, Ceramic | 50V          | 10pF           | $\pm 0.5pF$ | 1 | 1 | 1 | 1 |
| C      | 1202      | CQA0091     | C, Plastic | 50V          | 0.001 $\mu F$  | $\pm 10\%$  | 1 | 1 | 1 | 1 |
| C      | 1208      | CQA0099     | C, Plastic | 50V          | 0.022 $\mu F$  | $\pm 10\%$  | 1 | 1 | 1 | 1 |
| C      | 1210      | CES0028     | C, Alelyc  | 10V          | 47 $\mu F$     | $\pm 20\%$  | 1 | 1 | 1 | 1 |
| RV     | 1201      | RNE0056     | VR, Metal  | EVN39C00YB13 | (1K)           |             | 1 | 1 | 1 | 1 |
| TR     | 1201      | HTA0224     | Transistor | 2SA1029D     |                |             | 1 | 1 | 1 | 1 |
| TR     | 1208      | HTC0148     | Transistor | 2SC458C      |                |             | 1 | 1 | 1 | 1 |
| TR     | 1209      | HTC0148     | Transistor | 2SC458C      |                |             | 1 | 1 | 1 | 1 |

## PANEL and OTHERS

| Symbol | Part Code | Description      | Q'ty |   |   |   |
|--------|-----------|------------------|------|---|---|---|
|        |           |                  | A    | B | C | D |
| J 80   | JHB0088   | CON, Coax BNC071 | 1    | 1 | 1 | 1 |
| J 1201 | JHB0088   | CON, Coax BNC071 | 1    | 1 | 1 | 1 |

# 3 V OUT AMP

| Symbol | Part Code | Description              | Q'ty |   |   |   |
|--------|-----------|--------------------------|------|---|---|---|
|        |           |                          | A    | B | C | D |
| R 331  | RME1062   | R, Metal 1/4W 150Ω ±1%   | 1    | 1 | 1 |   |
| R 331  | RME1060   | R, Metal 1/4W 100Ω ±1%   |      |   |   | 1 |
| R 332  | RME1062   | R, Metal 1/4W 150Ω ±1%   | 1    | 1 | 1 |   |
| R 332  | RME1060   | R, Metal 1/4W 100Ω ±1%   |      |   |   | 1 |
| R 333  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5% |      |   |   | 1 |
| R 336  | RCE0754   | R, Carbon 1/4W 56Ω ±5%   | 1    | 1 | 1 |   |
| R 336  | RCE0758   | R, Carbon 1/4W 120Ω ±5%  |      |   |   | 1 |
| R 337  | RCE0745   | R, Carbon 1/4W 10Ω ±5%   |      |   |   | 1 |
| R 337  | RCE0753   | R, Carbon 1/4W 47Ω ±5%   | 1    | 1 | 1 |   |
| R 338  | RCE0775   | R, Carbon 1/4W 3.3kΩ ±5% |      |   |   | 1 |
| R 338  | RCE0759   | R, Carbon 1/4W 150Ω ±5%  | 1    | 1 | 1 |   |
| R 339  | RCE0765   | R, Carbon 1/4W 470Ω ±5%  |      |   |   | 1 |
| R 339  | RCE0766   | R, Carbon 1/4W 560Ω ±5%  |      | 1 | 1 |   |
| R 339  | RCE0768   | R, Carbon 1/4W 820Ω ±5%  | 1    |   |   |   |
| R 340  | RCE0768   | R, Carbon 1/4W 820Ω ±5%  | 1    |   |   |   |
| R 340  | RCE0766   | R, Carbon 1/4W 560Ω ±5%  |      | 1 | 1 |   |
| R 340  | RCE0765   | R, Carbon 1/4W 470Ω ±5%  |      |   |   | 1 |
| R 341  | RCE0745   | R, Carbon 1/4W 10Ω ±5%   |      |   |   | 1 |
| R 342  | RCE0797   | R, Carbon 1/4W 220kΩ ±5% | 1    | 1 | 1 |   |
| R 343  | RCE0797   | R, Carbon 1/4W 220kΩ ±5% | 1    | 1 | 1 |   |
| R 344  | RCE0757   | R, Carbon 1/4W 100Ω ±5%  | 1    |   |   |   |
| R 344  | RCE0755   | R, Carbon 1/4W 68Ω ±5%   |      | 1 | 1 |   |
| R 345  | RCE0753   | R, Carbon 1/4W 47Ω ±5%   |      |   |   | 1 |
| R 346  | RCE0753   | R, Carbon 1/4W 47Ω ±5%   |      |   |   | 1 |
| R 347  | RCE0759   | R, Carbon 1/4W 150Ω ±5%  |      |   |   | 1 |
| R 348  | RCE0759   | R, Carbon 1/4W 150Ω ±5%  |      |   |   | 1 |
| R 349  | RCE0759   | R, Carbon 1/4W 150Ω ±5%  |      |   |   | 1 |
| R 350  | RCE0759   | R, Carbon 1/4W 150Ω ±5%  |      |   |   | 1 |
| R 355  | RCE0756   | R, Carbon 1/4W 82Ω ±5%   |      |   |   | 1 |
| R 356  | RCE0757   | R, Carbon 1/4W 100Ω ±5%  |      |   |   | 1 |
| R 357  | RCE0745   | R, Carbon 1/4W 10Ω ±5%   |      |   |   | 1 |
| R 360  | RCE0766   | R, Carbon 1/4W 560Ω ±5%  |      |   |   | 1 |
| R 361  | RCE0766   | R, Carbon 1/4W 560Ω ±5%  |      |   |   | 1 |
| R 362  | RCE0781   | R, Carbon 1/4W 10kΩ ±5%  |      |   |   | 1 |
| R 363  | RME1065   | R, Metal 1/4W 267Ω ±1%   | 1    | 1 | 1 |   |
| R 363  | RME1066   | R, Metal 1/4W 332Ω ±1%   |      |   |   | 1 |
| R 364  | RME1065   | R, Metal 1/4W 267Ω ±1%   | 1    | 1 | 1 |   |
| R 364  | RME1066   | R, Metal 1/4W 332Ω ±1%   |      |   |   | 1 |
| R 365  | RCE0765   | R, Carbon 1/4W 470Ω ±5%  | 1    | 1 | 1 |   |
| R 365  | RCE0769   | R, Carbon 1/4W 1kΩ ±5%   |      |   |   | 1 |
| R 366  | RCE0765   | R, Carbon 1/4W 470Ω ±5%  | 1    | 1 | 1 |   |
| R 366  | RCE0769   | R, Carbon 1/4W 1kΩ ±5%   |      |   |   | 1 |
| R 367  | RMR3724   | R, Metal 1W 10kΩ ±5%     | 1    | 1 | 1 |   |
| R 367  | RMR3778   | R, Metal 1W 6.8kΩ ±5%    |      |   |   | 1 |
| R 368  | RMR3724   | R, Metal 1W 10kΩ ±5%     | 1    | 1 | 1 |   |
| R 368  | RMR3778   | R, Metal 1W 6.8kΩ ±5%    |      |   |   | 1 |
| R 369  | RCE0749   | R, Carbon 1/4W 22Ω ±5%   | 1    | 1 | 1 | 1 |
| R 371  | RCE0751   | R, Carbon 1/4W 33Ω ±5%   | 1    | 1 | 1 | 1 |
| R 372  | RCE0751   | R, Carbon 1/4W 33Ω ±5%   | 1    | 1 | 1 | 1 |
| R 373  | RCE0749   | R, Carbon 1/4W 22Ω ±5%   | 1    | 1 | 1 | 1 |
| R 374  | RCE0749   | R, Carbon 1/4W 22Ω ±5%   | 1    | 1 | 1 | 1 |
| R 375  | RCE0751   | R, Carbon 1/4W 33Ω ±5%   | 1    | 1 | 1 | 1 |
| R 376  | RCE0751   | R, Carbon 1/4W 33Ω ±5%   | 1    | 1 | 1 | 1 |
| R 377  | RCE0769   | R, Carbon 1/4W 1kΩ ±5%   | 1    | 1 | 1 | 1 |
| R 378  | RCE0769   | R, Carbon 1/4W 1kΩ ±5%   | 1    | 1 | 1 | 1 |
| R 381  | RCE0715   | R, Carbon 1/4W 6.8kΩ ±5% | 1    | 1 | 1 |   |
| R 381  | RCE0711   | R, Carbon 1/4W 3.3kΩ ±5% |      |   |   | 1 |
| R 382  | RCE0715   | R, Carbon 1/4W 6.8kΩ ±5% | 1    | 1 | 1 |   |
| R 382  | RCE0711   | R, Carbon 1/4W 3.3kΩ ±5% |      |   |   | 1 |
| R 383  | RCE0749   | R, Carbon 1/4W 22Ω ±5%   | 1    | 1 | 1 | 1 |
| R 384  | RCE0749   | R, Carbon 1/4W 22Ω ±5%   | 1    | 1 | 1 | 1 |
| R 385  | RCE0761   | R, Carbon 1/4W 220Ω ±5%  | 1    | 1 | 1 |   |
| R 385  | RCE0763   | R, Carbon 1/4W 330Ω ±5%  |      |   |   | 1 |

| Symbol | Part Code | Description                       | Q'ty |   |   |   |
|--------|-----------|-----------------------------------|------|---|---|---|
|        |           |                                   | A    | B | C | D |
| R 386  | RCE0761   | R, Carbon 1/4W 220Ω ±5%           | 1    | 1 | 1 |   |
| R 386  | RCE0763   | R, Carbon 1/4W 330Ω ±5%           |      |   |   | 1 |
| R 387  | RCE0715   | R, Carbon 1/4W 6.8kΩ ±5%          | 1    | 1 | 1 |   |
| R 387  | RCE0711   | R, Carbon 1/4W 3.3kΩ ±5%          |      |   |   | 1 |
| R 388  | RCE0715   | R, Carbon 1/4W 6.8kΩ ±5%          | 1    | 1 | 1 |   |
| R 388  | RCE0711   | R, Carbon 1/4W 3.3kΩ ±5%          |      |   |   | 1 |
| R 389  | RCE0723   | R, Carbon 1/4W 33kΩ ±5%           | 1    | 1 | 1 |   |
| R 389  | RCE0721   | R, Carbon 1/4W 22kΩ ±5%           |      |   |   | 1 |
| R 398  | RCE0414   | R, Carbon 1/4W 120Ω ±5%           | 1    | 1 | 1 | 1 |
| R 399  | RCE0414   | R, Carbon 1/4W 120Ω ±5%           | 1    | 1 | 1 | 1 |
| C 355  | CCC1002   | C, Ceramic 50V 10pF ±0.5pF        |      |   |   | 1 |
| C 357  | CCC0999   | C, Ceramic 50V 5pF ±0.25pF        |      |   |   | 1 |
| C 365  | CCC1034   | C, Ceramic 50V 68pF ±5%           | 1    | 1 | 1 |   |
| C 365  | CCC1004   | C, Ceramic 50V 15pF ±5%           |      |   |   | 1 |
| C 366  | CCC1014   | C, Ceramic 50V 47pF ±5%           | 1    | 1 | 1 |   |
| C 366  | CCC1002   | C, Ceramic 50V 10pF ±0.5pF        |      |   |   | 1 |
| C 367  | CCD0273   | C, Ceramic 500V 2pF ±0.25pF       | 1    | 1 | 1 |   |
| C 368  | CCD0273   | C, Ceramic 500V 2pF ±0.25pF       | 1    | 1 | 1 |   |
| C 379  | CCD0217   | C, Ceramic 500V 1000pF +100% -0%  | 1    | 1 | 1 | 1 |
| C 380  | CCD0217   | C, Ceramic 500V 1000pF +100% -0%  | 1    | 1 | 1 | 1 |
| C 385  | CCC0591   | C, Ceramic 500V 10000pF +100% -0% | 1    | 1 | 1 | 1 |
| C 386  | CCC0591   | C, Ceramic 500V 10000pF +100% -0% | 1    | 1 | 1 | 1 |
| C 389  | CCD0287   | C, Ceramic 500V 4700pF +100% -0%  | 1    | 1 | 1 | 1 |
| C 363  | CCC1030   | C, Ceramic 50V 10000pF +80% -20%  | 1    | 1 | 1 | 1 |
| C 301  | CET0033   | C, Alelyc 160V 1μF ±20%           | 1    | 1 | 1 | 1 |
| C 302  | CES0028   | C, Alelyc 10V 47μF ±20%           | 1    | 1 | 1 | 1 |
| C 303  | CES0028   | C, Alelyc 10V 47μF ±20%           | 1    | 1 | 1 | 1 |
| C 304  | CES0028   | C, Alelyc 10V 47μF ±20%           | 1    | 1 | 1 | 1 |
| C 305  | CES0028   | C, Alelyc 10V 47μF ±20%           | 1    | 1 | 1 | 1 |
| C 337  | CCC1032   | C, Ceramic 50V 82pF ±10%          | 1    | 1 | 1 | 1 |
| C 338  | CCC1011   | C, Ceramic 50V 33pF ±10%          | 1    | 1 | 1 | 1 |
| C 345  | CCC1029   | C, Ceramic 50V 1000pF +80% -20%   |      |   |   | 1 |
| C 346  | CCC1029   | C, Ceramic 50V 1000pF +80% -20%   |      |   |   | 1 |
| C 364  | CES0028   | C, Alelyc 10V 47μF ±20%           | 1    | 1 | 1 | 1 |
| TR 331 | HTA0099   | Transistor 2SA781K                |      |   |   | 1 |
| TR 331 | HTC0192   | Transistor 2SC641K                | 1    | 1 | 1 |   |
| TR 332 | HTA0099   | Transistor 2SA781K                |      |   |   | 1 |
| TR 332 | HTC0192   | Transistor 2SC641K                | 1    | 1 | 1 |   |
| TR 349 | HTC0721   | Transistor 2SC2901                |      |   |   | 1 |
| TR 350 | HTC0721   | Transistor 2SC2901                |      |   |   | 1 |
| TR 365 | HTC0721   | Transistor 2SC2901                | 1    | 1 | 1 | 1 |
| TR 366 | HTC0721   | Transistor 2SC2901                | 1    | 1 | 1 | 1 |
| TR 376 | HTA0258   | Transistor 2SA1210S               | 1    | 1 | 1 | 1 |
| TR 377 | HTA0099   | Transistor 2SA781K                | 1    | 1 | 1 | 1 |
| TR 378 | HTA0099   | Transistor 2SA781K                | 1    | 1 | 1 | 1 |
| TR 371 | HTC0669   | Transistor 2SC2912S               | 1    | 1 | 1 | 1 |
| TR 372 | HTC0669   | Transistor 2SC2912S               | 1    | 1 | 1 | 1 |
| TR 375 | HTA0259   | Transistor 2SA1210S               | 1    | 1 | 1 | 1 |
| L 385  | TLE0091   | Coil ELE-V 2R2 MA                 | 1    | 1 | 1 |   |
| L 385  | TLE0109   | Coil ELE-V R68 MA                 |      |   |   | 1 |
| L 386  | TLE0091   | Coil ELE-V 2R2 MA                 | 1    | 1 | 1 |   |
| L 386  | TLE0109   | Coil ELE-V R68 MA                 |      |   |   | 1 |
| RV 339 | RNE0050   | VR, Metal EVN39C00YB52 (500)      | 1    | 1 |   |   |
| RV 339 | RNE0048   | VR, Metal EVN39C00YB22 (200)      |      |   |   | 1 |

| Symbol  | Part Code | Description |              | Qty |   |   |   |
|---------|-----------|-------------|--------------|-----|---|---|---|
|         |           |             |              | A   | B | C | D |
| CV 337  | CVE0049   | C, Variable | ECR-HA040E11 | 1   | 1 | 1 | 1 |
| CV 355  | CVE0049   | C, Variable | ECR-HA040E11 |     |   |   | 1 |
| CV 366  | CVE0049   | C, Variable | ECR-HA040E11 | 1   | 1 | 1 |   |
| CV 366  | CVE0047   | C, Variable | ECR-HA020D11 |     |   |   | 1 |
| D 374   | HDH0029   | Diode       | HZ5B         | 1   | 1 | 1 | 1 |
| D 375   | HDH0029   | Diode       | HZ5B         | 1   | 1 | 1 | 1 |
| D 377   | HDH0029   | Diode       | HZ5B         | 1   | 1 | 1 | 1 |
| PEF-620 |           | PCB         | PB-14        | R   | R | R | R |

# 4 TRIG GENERATOR

| Symbol | Part Code | Description                              | Q'ty |   |   |   |
|--------|-----------|------------------------------------------|------|---|---|---|
|        |           |                                          | A    | B | C | D |
| R 401  | RCE0800   | R, Carbon 1/4W 470k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 402  | RCE0755   | R, Carbon 1/4W 68 $\Omega$ $\pm$ 5%      | 1    | 1 | 1 | 1 |
| R 404  | RCE0764   | R, Carbon 1/4W 390 $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 406  | RCE0800   | R, Carbon 1/4W 470k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 407  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 408  | RCE0757   | R, Carbon 1/4W 100 $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 409  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 409  | RCE0779   | R, Carbon 1/4W 6.8k $\Omega$ $\pm$ 5%    |      |   |   | 1 |
| R 410  | RCE0772   | R, Carbon 1/4W 1.8k $\Omega$ $\pm$ 5%    |      |   |   | 1 |
| R 417  | RCE0769   | R, Carbon 1/4W 1k $\Omega$ $\pm$ 5%      | 1    | 1 | 1 | 1 |
| R 418  | RCE0779   | R, Carbon 1/4W 6.8k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 420  | RCE0781   | R, Carbon 1/4W 10k $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 425  | RCE0745   | R, Carbon 1/4W 10 $\Omega$ $\pm$ 5%      | 1    | 1 | 1 | 1 |
| R 430  | RCE0757   | R, Carbon 1/4W 100 $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 432  | RCE0767   | R, Carbon 1/4W 680 $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 433  | RCE0768   | R, Carbon 1/4W 820 $\Omega$ $\pm$ 5%     |      |   |   | 1 |
| R 433  | RCE0769   | R, Carbon 1/4W 1k $\Omega$ $\pm$ 5%      | 1    | 1 | 1 | 1 |
| R 434  | RCE0689   | R, Carbon 1/2W 47 $\Omega$ $\pm$ 5%      | 1    | 1 | 1 | 1 |
| R 435  | RCE0774   | R, Carbon 1/4W 2.7k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 436  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 437  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 438  | RCE0789   | R, Carbon 1/4W 47k $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 439  | RCE0789   | R, Carbon 1/4W 47k $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 441  | RCE0769   | R, Carbon 1/4W 1k $\Omega$ $\pm$ 5%      | 1    | 1 | 1 | 1 |
| R 443  | RCE0769   | R, Carbon 1/4W 47k $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 444  | RCE0771   | R, Carbon 1/4W 1.5k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 445  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 450  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm$ 5%    | 1    | 1 | 1 | 1 |
| R 452  | RCE0785   | R, Carbon 1/4W 22k $\Omega$ $\pm$ 5%     | 1    | 1 | 1 | 1 |
| R 460  | RCE0745   | R, Carbon 1/4W 10 $\Omega$ $\pm$ 5%      | 1    | 1 | 1 | 1 |
| R 460  | RCE0749   | R, Carbon 1/4W 22 $\Omega$ $\pm$ 5%      |      |   |   | 1 |
| R 470  | RCE0800   | R, Carbon 1/4W 470k $\Omega$ $\pm$ 5%    | 1    |   |   |   |
| R 471  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm$ 5%    | 1    |   |   |   |
| R 472  | RCE0777   | R, Carbon 1/4W 1.5k $\Omega$ $\pm$ 5%    | 1    |   |   |   |
| R 473  | RCE0781   | R, Carbon 1/4W 10k $\Omega$ $\pm$ 5%     | 1    |   |   |   |
|        |           |                                          |      |   |   |   |
| C 402  | CCD0279   | C, Ceramic 500V 22pF $\pm$ 5%            | 1    | 1 | 1 | 1 |
| C 403  | CQX0068   | C, Plastic 400V 0.047 $\mu$ F $\pm$ 10%  | 1    | 1 | 1 | 1 |
| C 404  | CCC1029   | C, Ceramic 50V 1000pF $\pm$ 80%<br>-20%  | 1    | 1 | 1 | 1 |
| C 405  | CQA0101   | C, Plastic 50V 47000pF $\pm$ 10%         | 1    | 1 | 1 | 1 |
| C 407  | CCC0999   | C, Ceramic 50V 5pF $\pm$ 0.25pF          | 1    | 1 | 1 | 1 |
| C 408  | CES0028   | C, AL Elyc 10V 47 $\mu$ F $\pm$ 20%      | 1    | 1 | 1 | 1 |
| C 417  | CEC0176   | C, AL Elyc 25V 10 $\mu$ F $\pm$ 20%      | 1    | 1 | 1 | 1 |
| C 418  | CCC1030   | C, Ceramic 50V 1000pF $\pm$ 80%<br>-20%  | 1    | 1 | 1 | 1 |
| C 425  | CES0028   | C, AL Elyc 10V 47 $\mu$ F $\pm$ 20%      | 1    | 1 | 1 | 1 |
| C 442  | CEX0230   | C, AL Elyc 50V 1BP $\pm$ 80%<br>-20%     | 1    | 1 | 1 | 1 |
| C 444  | CES0028   | C, AL Elyc 10V 47 $\mu$ F $\pm$ 20%      | 1    | 1 | 1 | 1 |
| C 452  | CQA0097   | C, Plastic 50V 10000pF $\pm$ 10%         | 1    | 1 | 1 | 1 |
| C 460  | CES0028   | C, AL Elyc 10V 47 $\mu$ F $\pm$ 20%      | 1    | 1 | 1 | 1 |
| C 470  | CCC1030   | C, Ceramic 50V 10000pF $\pm$ 80%<br>-20% | 1    |   |   |   |
|        |           |                                          |      |   |   |   |
| RV 418 | RDE0003   | VR, Carbon EVH-YK3325B14                 | 1    | 1 | 1 | 1 |
| RV 420 | RNE0051   | VR, Metal EVN39C00YB14 (10K)             | 1    | 1 | 1 | 1 |
| RV 473 | RNE0047   | VR, Metal EVN39C00&B54 (50K)             | 1    |   |   |   |
|        |           |                                          |      |   |   |   |
| TR 401 | HTK0099   | Transistor 2SK404E                       | 1    | 1 | 1 | 1 |
| TR 402 | HTC0148   | Transistor 2SC458C                       |      |   |   | 1 |
| TR 431 | HTC0168   | Transistor 2SC535C                       | 1    | 1 | 1 | 1 |

| Symbol  | Part Code | Description          | Q'ty |   |   |   |
|---------|-----------|----------------------|------|---|---|---|
|         |           |                      | A    | B | C | D |
| TR4 432 | HTC0168   | Transistor 2SC535C   | 1    | 1 | 1 | 1 |
| TR 441  | HTA0224   | Transistor 2SA1029D  | 1    | 1 | 1 | 1 |
| TR 470  | HTK0099   | Transistor 2SK404E   | 1    |   |   |   |
|         |           |                      |      |   |   |   |
| L 432   | TLE0111   | Coil ELE-V 6R8KA     |      |   |   | 1 |
|         |           |                      |      |   |   |   |
| IC 401  | IDH0402   | Digital IC HD74S00   |      |   |   | 1 |
| IC 401  | IDH0467   | Digital IC HD74LS00P | 1    | 1 | 1 |   |
|         |           |                      |      |   |   |   |
| S 401   |           | SW Lever SLR024      | 1    | 1 | 1 | 1 |
| S 403   |           | SW Lever SLR024      | 1    | 1 | 1 | 1 |
|         |           |                      |      |   |   |   |
| D 401   | HDS0437   | Diode 1SS133         | 1    | 1 | 1 | 1 |
| D 444   | HDS0437   | Diode 1SS133         | 1    | 1 | 1 | 1 |

## PANEL and OTHERS

| Symbol | Part Code | Description      | Q'ty |   |   |   |
|--------|-----------|------------------|------|---|---|---|
|        |           |                  | A    | B | C | D |
| J 403  | JHB0088   | CON. Coax BNC071 | 1    | 1 | 1 | 1 |

# 5 SWEEP GEN

| Symbol | Part Code | Description                      | Qty |   |   |   |
|--------|-----------|----------------------------------|-----|---|---|---|
|        |           |                                  | A   | B | C | D |
| R 501  | RCE0745   | R, Carbon 1/4W 10Ω ±5%           | 1   | 1 | 1 | 1 |
| R 502  | RCE0769   | R, Carbon 1/4W 1kΩ ±5%           | 1   | 1 | 1 | 1 |
| R 503  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 504  | RCE0789   | R, Carbon 1/4W 47kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 505  | RCE0775   | R, Carbon 1/4W 3.3kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 506  | RCE0789   | R, Carbon 1/4W 47kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 507  | RCE0781   | R, Carbon 1/4W 10kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 508  | RCE0745   | R, Carbon 1/4W 10Ω ±5%           | 1   | 1 | 1 | 1 |
| R 509  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 510  | RCE0753   | R, Carbon 1/4W 47Ω ±5%           | 1   | 1 | 1 | 1 |
| R 513  | RCE0780   | R, Carbon 1/4W 8.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 514  | RCE0771   | R, Carbon 1/4W 1.5kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 515  | RCE0783   | R, Carbon 1/4W 15kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 519  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 520  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 521  | RCE0789   | R, Carbon 1/4W 47kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 522  | RCE0762   | R, Carbon 1/4W 270Ω ±5%          | 1   | 1 | 1 | 1 |
| R 523  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 524  | RCE0793   | R, Carbon 1/4W 100kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 524  | RCE0789   | R, Carbon 1/4W 47kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 525  | RCE0753   | R, Carbon 1/4W 47Ω ±5%           | 1   | 1 | 1 | 1 |
| R 526  | RCE0779   | R, Carbon 1/4W 6.8kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 529  | RCE0757   | R, Carbon 1/4W 100Ω ±5%          | 1   | 1 | 1 | 1 |
| R 530  | RCE0765   | R, Carbon 1/4W 470Ω ±5%          | 1   | 1 | 1 | 1 |
| R 531  | RME1174   | R, Metal 1/4W 2.00kΩ ±1%         | 1   | 1 | 1 | 1 |
| R 532  | RCE0775   | R, Carbon 1/4W 3.3kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 533  | RCE0776   | R, Carbon 1/4W 3.9kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 533  | RCE0775   | R, Carbon 1/4W 3.3kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 534  | RCE0785   | R, Carbon 1/4W 22kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 535  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 536  | RCE0774   | R, Carbon 1/4W 2.7kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 536  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 537  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 538  | RCE0783   | R, Carbon 1/4W 15kΩ ±5%          | 1   | 1 | 1 | 1 |
| RM 520 | 3173847   | R, Block FOR TIMING              | 1   | 1 | 1 | 1 |
| C 501  | CCC1030   | C, Ceramic 50V 10000pF +80% -20% | 1   | 1 | 1 | 1 |
| C 525  | CCC1133   | C, Ceramic 50V 1pF ±0.25%        | 1   | 1 | 1 | 1 |
| C 508  | CCC1030   | C, Ceramic 50V 10000pF +80% -20% | 1   | 1 | 1 | 1 |
| C 510  | CCC1030   | C, Ceramic 50V 10000pF +80% -20% | 1   | 1 | 1 | 1 |
| C 511  | CES0036   | C, AL Elyc 25V 22μF ±20%         | 1   | 1 | 1 | 1 |
| C 519  | CES0028   | C, AL Elyc 10V 47μF ±20%         | 1   | 1 | 1 | 1 |
| C 520  | CCC1032   | C, Ceramic 50V 82pF ±5%          | 1   | 1 | 1 | 1 |
| C 524  | CCC1001   | C, Ceramic 50V 8pF ±0.5pF        | 1   | 1 | 1 | 1 |
| C 525  | CQE0049   | C, Plastic ECQ-E1105JN(JNB)Type  | 1   | 1 | 1 | 1 |
| C 526  | CQR0048   | C, Plastic ECQ-E1103JN (JNB)     | 1   | 1 | 1 | 1 |
| C 527  | CCC1030   | C, Ceramic 50V 10000pF +80% -20% | 1   | 1 | 1 | 1 |
| C 528  | CES0028   | C, AL Elyc 10V 47μF ±20%         | 1   | 1 | 1 | 1 |
| C 530  | CCC1025   | C, Ceramic 50V 100pF ±10%        | 1   | 1 | 1 | 1 |
| C 538  | CCC1014   | C, Ceramic 50V 47pF ±5%          | 1   | 1 | 1 | 1 |
| C 538  | CCC1011   | C, Ceramic 50V 33pF ±5%          | 1   | 1 | 1 | 1 |
| CV 520 | CVE0049   | C, Variable ECR-HA040E11         | 1   | 1 | 1 | 1 |
| TR 503 | HTA0224   | Transistor 2SA1029D              | 1   | 1 | 1 | 1 |
| TR 514 | HTC0148   | Transistor 2SC458C               | 1   | 1 | 1 | 1 |
| TR 520 | HTK0081   | Transistor 2SK304E               | 1   | 1 | 1 | 1 |
| TR 521 | HTC0148   | Transistor 2SC458C               | 1   | 1 | 1 | 1 |
| TR 522 | HTC0148   | Transistor 2SC458C               | 1   | 1 | 1 | 1 |
| TR 532 | HTC0148   | Transistor 2SC458C               | 1   | 1 | 1 | 1 |

| Symbol | Part Code | Description              | Qty |   |   |   |
|--------|-----------|--------------------------|-----|---|---|---|
|        |           |                          | A   | B | C | D |
| IC 501 | IDH0586   | Digital, IC HD74LS74AP   | 1   | 1 | 1 | 1 |
| IC 501 | IDH0428   | Digital, IC HD74S74      | 1   | 1 | 1 | 1 |
| IC 502 | IDH0469   | Digital, IC HD74LS03P    | 1   | 1 | 1 | 1 |
| D 501  | HDS0437   | Diode 1SS133             | 1   | 1 | 1 | 1 |
| D 520  | HDM0051   | Diode MA161              | 1   | 1 | 1 | 1 |
| D 521  | HDM0051   | Diode MA161              | 1   | 1 | 1 | 1 |
| D 522  | HDM0051   | Diode MA161              | 1   | 1 | 1 | 1 |
| D 530  | HDS0437   | Diode 1SS133             | 1   | 1 | 1 | 1 |
| D 535  | HDM0051   | Diode MA161              | 1   | 1 | 1 | 1 |
| D 536  | HDS0437   | Diode 1SS133             | 1   | 1 | 1 | 1 |
| R 527  | RSE0434   | R, Solid 1/4W 10MΩ ±5%   | 1   | 1 | 1 | 1 |
| R 528  | RCE0936   | R, Carbon 1/2W 1.5MΩ ±5% | 1   | 1 | 1 | 1 |

## HORIZONTAL DISPLAY CKT

| Symbol | Part Code | Description                      | Qty |   |   |   |
|--------|-----------|----------------------------------|-----|---|---|---|
|        |           |                                  | A   | B | C | D |
| R 540  | RCE0766   | R, Carbon 1/4W 560Ω ±5%          | 1   | 1 | 1 | 1 |
| R 541  | RCE0764   | R, Carbon 1/4W 390Ω ±5%          | 1   | 1 | 1 | 1 |
| R 542  | RCE0770   | R, Carbon 1/4W 1.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 543  | RCE0769   | R, Carbon 1/4W 1kΩ ±5%           | 1   | 1 | 1 | 1 |
| R 544  | RCE0783   | R, Carbon 1/4W 15kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 545  | RCE0780   | R, Carbon 1/4W 8.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 546  | RCE0773   | R, Carbon 1/4W 2.2kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 547  | RCE0775   | R, Carbon 1/4W 3.3kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 548  | RCE0778   | R, Carbon 1/4W 5.6kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 549  | RCE0781   | R, Carbon 1/4W 10kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 550  | RCE0778   | R, Carbon 1/4W 5.6kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 551  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 552  | RCE0775   | R, Carbon 1/4W 3.3kΩ ±5%         | 1   | 1 | 1 | 1 |
| R 553  | RCE0781   | R, Carbon 1/4W 10kΩ ±5%          | 1   | 1 | 1 | 1 |
| R 554  | RCE0765   | R, Carbon 1/4W 470Ω ±5%          | 1   | 1 | 1 | 1 |
| R 555  | RCE0765   | R, Carbon 1/4W 470Ω ±5%          | 1   | 1 | 1 | 1 |
| R 556  | RCE0767   | R, Carbon 1/4W 680Ω ±5%          | 1   | 1 | 1 | 1 |
| C 544  | CQA0097   | C, Plastic 50V 10000pF ±10%      | 1   | 1 | 1 | 1 |
| C 545  | CET0031   | C, AL Elyc 50V 1μF               | 1   | 1 | 1 | 1 |
| C 550  | CCC1014   | C, Ceramic 50V 47pF ±5%          | 1   | 1 | 1 | 1 |
| C 551  | CCC1030   | C, Ceramic 50V 10000pF +80% -20% | 1   | 1 | 1 | 1 |
| C 552  | CCC1030   | C, Ceramic 50V 10000pF +80% -20% | 1   | 1 | 1 | 1 |
| C 553  | CES0028   | C, AL Elyc 10V 47μF ±10%         | 1   | 1 | 1 | 1 |
| C 554  | CES0028   | C, AL Elyc 10V 47μF ±10%         | 1   | 1 | 1 | 1 |
| RV 540 | 8397021   | VR, Carbon V16L5(7x6.5)20KC-B2k  | 1   | 1 | 1 | 1 |
| RV 540 | 840074    | VR, Carbon V16L420KC-B2k+B100k   | 1   | 1 | 1 | 1 |
| RV 542 | RNE0052   | VR, Metal 39C00YB23 (2K)         | 1   | 1 | 1 | 1 |
| RV 550 | RNE0058   | VR, Metal 39C00YB13 (1K)         | 1   | 1 | 1 | 1 |
| TR 544 | HTC0148   | Transistor 2SC458C               | 1   | 1 | 1 | 1 |
| TR 545 | HTC0148   | Transistor 2SC458C               | 1   | 1 | 1 | 1 |
| IC 550 | IDH0802   | Digital IC HD14053BP             | 1   | 1 | 1 | 1 |
| D 541  | HDS0437   | Diode 1SS133                     | 1   | 1 | 1 | 1 |
| D 543  | HDS0407   | Diode SR503D with mount(red)     | 1   | 1 | 1 | 1 |

CHOP PULSE GENERATOR

| Symbol | Part Code | Description                      | Qty |   |   |   |
|--------|-----------|----------------------------------|-----|---|---|---|
|        |           |                                  | A   | B | C | D |
| R 571  | RCE0769   | R, Carbon 1/4W 1kΩ ±5%           | 1   | 1 | 1 |   |
| R 572  | RCE0776   | R, Carbon 1/4W 3.9kΩ ±5%         | 1   | 1 | 1 |   |
| R 573  | RCE0765   | R, Carbon 1/4W 470Ω ±5%          | 1   | 1 | 1 |   |
| R 574  | RCE0783   | R, Carbon 1/4W 15kΩ ±5%          | 1   | 1 | 1 |   |
| R 576  | RCE0745   | R, Carbon 1/4W 10Ω ±5%           | 1   | 1 | 1 | 1 |
| R 578  | RCE0776   | R, Carbon 1/4W 3.9kΩ ±5%         | 1   | 1 | 1 |   |
| C 571  | CCC1030   | C, Ceramic 50V 10000pF +80% -20% | 1   | 1 | 1 |   |
| C 572  | CCC1014   | C, Ceramic 50V 47pF ±5%          | 1   | 1 | 1 |   |
| C 573  | CCC1027   | C, Ceramic 50V 220pF ±10%        | 1   | 1 | 1 |   |
| C 575  | CCC1027   | C, Ceramic 50V 220pF ±10%        | 1   | 1 | 1 |   |
| C 576  | CCC1030   | C, Ceramic 50V 10000pF +80% -20% | 1   | 1 | 1 | 1 |
| IC 571 | IDH0646   | Digital, IC HD74LS02P            | 1   | 1 | 1 | 1 |
| L 537  | TLE0138   | Coil ELE-V 681KA                 |     | 1 |   |   |
| L 537  | TLE0092   | Coil ELE-V 331KA                 |     |   |   | 1 |
| L 571  | TLE0128   | Coil ELE-V 330KA                 | 1   | 1 | 1 |   |
| D 571  | HDS0437   | Diode 1SS133                     | 1   | 1 | 1 |   |
| D 572  | HDS0437   | Diode 1SS133                     | 1   | 1 | 1 |   |
| D 573  | HDS0437   | Diode 1SS133                     | 1   | 1 | 1 |   |
| D 574  | HDS0437   | Diode 1SS133                     | 1   | 1 | 1 |   |

| Symbol | Part Code | Description                            | Q'ty |   |   |   |
|--------|-----------|----------------------------------------|------|---|---|---|
|        |           |                                        | A    | B | C | D |
| R 801  | RCE0779   | R, Carbon 1/4W 6.8k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| R 802  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm 5\%$  | 1    | 1 | 1 | 1 |
| R 804  | RCE0781   | R, Carbon 1/4W 10k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 | 1 |
| R 805  | RCE0765   | R, Carbon 1/4W 470 $\Omega$ $\pm 5\%$  | 1    | 1 | 1 | 1 |
| R 806  | RCE0753   | R, Carbon 1/4W 47 $\Omega$ $\pm 5\%$   | 1    | 1 | 1 | 1 |
| R 807  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm 5\%$  | 1    | 1 | 1 | 1 |
| R 811  | RME1076   | R, Metal 1/4W 2.21k $\Omega$ $\pm 1\%$ | 1    | 1 | 1 | 1 |
| R 812  | RME1076   | R, Metal 1/4W 2.21k $\Omega$ $\pm 1\%$ | 1    | 1 | 1 | 1 |
| R 813  | RCE0770   | R, Carbon 1/4W 1.2k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| R 814  | RCE0770   | R, Carbon 1/4W 1.2k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| R 821  | RME1095   | R, Metal 1/4W 82.5k $\Omega$ $\pm 1\%$ | 1    | 1 |   |   |
| R 821  | RCE0773   | R, Carbon 1/4W 2.2k $\Omega$ $\pm 5\%$ |      |   | 1 |   |
| R 821  | RCE0769   | R, Carbon 1/4W 1k $\Omega$ $\pm 5\%$   |      |   |   | 1 |
| R 822  | RME1095   | R, Metal 1/4W 82.5k $\Omega$ $\pm 1\%$ | 1    | 1 |   |   |
| R 822  | RCE0773   | R, Carbon 1/4W 2.2k $\Omega$ $\pm 5\%$ |      |   | 1 |   |
| R 822  | RCE0769   | R, Carbon 1/4W 1k $\Omega$ $\pm 5\%$   |      |   |   | 1 |
| R 823  | RCE0745   | R, Carbon 1/4W 10 $\Omega$ $\pm 5\%$   | 1    | 1 | 1 | 1 |
| R 824  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm 5\%$ | 1    | 1 |   |   |
| R 824  | RCE0779   | R, Carbon 1/4W 6.8k $\Omega$ $\pm 5\%$ |      |   | 1 |   |
| R 824  | RCE0774   | R, Carbon 1/4W 2.7k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 831  | RCE0762   | R, Carbon 1/4W 270 $\Omega$ $\pm 5\%$  |      |   | 1 |   |
| R 831  | RCE0757   | R, Carbon 1/4W 100 $\Omega$ $\pm 5\%$  |      |   |   | 1 |
| R 832  | RCE0749   | R, Carbon 1/4W 22 $\Omega$ $\pm 5\%$   | 1    | 1 | 1 | 1 |
| R 833  | RME1195   | R, Metal 1/4W 110k $\Omega$ $\pm 1\%$  | 1    | 1 |   |   |
| R 833  | RME1076   | R, Metal 1/4W 2.21k $\Omega$ $\pm 1\%$ |      |   | 1 |   |
| R 833  | RME1073   | R, Metal 1/4W 1.21k $\Omega$ $\pm 1\%$ |      |   |   | 1 |
| R 834  | RME1195   | R, Metal 1/4W 110k $\Omega$ $\pm 1\%$  | 1    | 1 |   |   |
| R 834  | RME1076   | R, Metal 1/4W 2.21k $\Omega$ $\pm 1\%$ |      |   | 1 |   |
| R 834  | RME1073   | R, Metal 1/4W 1.21k $\Omega$ $\pm 1\%$ |      |   |   | 1 |
| R 840  | RCE0765   | R, Carbon 1/4W 470 $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 840  | RCE0761   | R, Carbon 1/4W 100 $\Omega$ $\pm 5\%$  |      |   |   | 1 |
| R 841  | RME1079   | R, Metal 1/4W 3.92k $\Omega$ $\pm 1\%$ | 1    | 1 | 1 |   |
| R 841  | RME1074   | R, Metal 1/4W 1.50k $\Omega$ $\pm 1\%$ |      |   |   | 1 |
| R 842  | RME1079   | R, Metal 1/4W 3.92k $\Omega$ $\pm 1\%$ | 1    | 1 | 1 |   |
| R 842  | RME1074   | R, Metal 1/4W 1.50k $\Omega$ $\pm 1\%$ |      |   |   | 1 |
| R 843  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 |   |
| R 843  | RCE0773   | R, Carbon 1/4W 2.2k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 844  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 |   |
| R 844  | RCE0773   | R, Carbon 1/4W 2.2k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 845  | RMR3779   | R, Metal 1/4W 100k $\Omega$ $\pm 1\%$  | 1    | 1 | 1 |   |
| R 845  | RMR3726   | R, Carbon 1W 22k $\Omega$ $\pm 1\%$    |      |   |   | 1 |
| R 846  | RMR3779   | R, Metal 1/4W 100k $\Omega$ $\pm 1\%$  | 1    | 1 | 1 |   |
| R 846  | RMR3726   | R, Carbon 1W 22k $\Omega$ $\pm 1\%$    |      |   |   | 1 |
| R 847  | RCE0757   | R, Carbon 1/4W 100 $\Omega$ $\pm 5\%$  | 1    | 1 |   |   |
| R 847  | RCE0755   | R, Carbon 1/4W 68 $\Omega$ $\pm 5\%$   |      |   | 1 | 1 |
| R 851  | RCE0721   | R, Carbon 1/2W 22k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 851  | RCE0714   | R, Carbon 1/2W 5.6k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 852  | RCE0721   | R, Carbon 1/2W 22k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 852  | RCE0714   | R, Carbon 1/2W 5.6k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 853  | RCE0721   | R, Carbon 1/2W 22k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 853  | RCE0714   | R, Carbon 1/2W 5.6k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 854  | RCE0721   | R, Carbon 1/2W 22k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 854  | RCE0714   | R, Carbon 1/2W 5.6k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 855  | RCE0721   | R, Carbon 1/2W 22k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 855  | RCE0714   | R, Carbon 1/2W 5.6k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 856  | RCE0721   | R, Carbon 1/2W 22k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 856  | RCE0714   | R, Carbon 1/2W 5.6k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 857  | RCE0763   | R, Carbon 1/4W 330 $\Omega$ $\pm 1\%$  | 1    | 1 | 1 | 1 |
| R 858  | RCE0763   | R, Carbon 1/4W 330 $\Omega$ $\pm 5\%$  | 1    | 1 | 1 | 1 |
| R 859  | RZZ0032   | R, Fusing PF-25S 470 $\Omega$          | 1    | 1 | 1 |   |
| R 859  | RZZ0031   | R, Fusing PF-25S 220 $\Omega$          |      |   |   | 1 |
| R 867  | RCE0779   | R, Carbon 1/4W 10k $\Omega$ $\pm 5\%$  | 1    | 1 |   |   |
| R 868  | RCE0778   | R, Carbon 1/4W 8.2k $\Omega$ $\pm 5\%$ | 1    | 1 |   |   |

| Symbol | Part Code | Description                           | Q'ty |   |   |   |
|--------|-----------|---------------------------------------|------|---|---|---|
|        |           |                                       | A    | B | C | D |
| R 871  | RCE0757   | R, Carbon 1/4W 100 $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| R 872  | RCE0757   | R, Carbon 1/4W 100 $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| R 873  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| R 874  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| R 880  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| R 881  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| C 801  | CES0028   | C, AL Elyc 10V 47 $\mu$ F $\pm 10\%$  | 1    | 1 | 1 | 1 |
| C 805  | CCC1030   | C, Ceramic 50V 10000pF $\pm 80\%$     | 1    | 1 | 1 | 1 |
| C 806  | CES0028   | C, AL Elyc 10V 47 $\mu$ F $\pm 10\%$  | 1    | 1 | 1 | 1 |
| C 808  | CES0028   | C, AL Elyc 10V 47 $\mu$ F $\pm 10\%$  | 1    | 1 | 1 | 1 |
| C 811  | CCC1002   | C, Ceramic 50V 10pF $\pm 0.5$ pF      | 1    | 1 | 1 |   |
| C 811  | CCC0996   | C, Ceramic 50V 2pF $\pm 0.25$ pF      |      |   |   | 1 |
| C 812  | CCC1002   | C, Ceramic 50V 10pF $\pm 0.5$ pF      | 1    | 1 | 1 |   |
| C 812  | CCC0996   | C, Ceramic 50V 2pF $\pm 0.25$ pF      |      |   |   | 1 |
| C 832  | CCC1007   | C, Ceramic 50V 22pF $\pm 5\%$         | 1    | 1 | 1 | 1 |
| C 840  | CCC1002   | C, Ceramic 50V 10pF $\pm 0.5$ pF      |      |   |   | 1 |
| C 845  | CCD0273   | C, Ceramic 500V 2pF $\pm 0.25$ pF     | 1    | 1 | 1 | 1 |
| C 846  | CCD0273   | C, Ceramic 500V 2pF $\pm 0.25$ pF     | 1    | 1 | 1 | 1 |
| C 847  | CCC1007   | C, Ceramic 50V 22pF $\pm 5\%$         | 1    | 1 | 1 | 1 |
| C 848  | CCC1007   | C, Ceramic 50V 22pF $\pm 5\%$         | 1    | 1 | 1 | 1 |
| C 857  | CCD0287   | C, Ceramic 500V 4700pF $\pm 100\%$    | 1    | 1 | 1 | 1 |
| C 861  | CCC1030   | C, Ceramic 50V 10000pF $\pm 80\%$     |      |   |   | 1 |
| C 873  | CCC1025   | C, Ceramic 50V 100pF $\pm 10\%$       | 1    | 1 | 1 | 1 |
| C 874  | CCC1025   | C, Ceramic 50V 100pF $\pm 10\%$       | 1    | 1 | 1 | 1 |
| C 823  | CCC1004   | C, Ceramic 50V 15pF $\pm 5\%$         | 1    | 1 | 1 | 1 |
| C 880  | CCC1030   | C, Ceramic 50V 10000pF $\pm 80\%$     | 1    | 1 | 1 | 1 |
| RV 805 | RDE0003   | VR, Carbon EVH-YK3325B14              | 1    | 1 | 1 | 1 |
| RV 821 | RNE0047   | VR, Metal EVN39C00YB54 (50K)          | 1    | 1 |   |   |
| RV 821 | RNE0052   | VR, Metal EVN39C00YB23 (2K)           |      |   | 1 |   |
| RV 821 | RNE0050   | VR, Metal EVN39C00YB52 (500)          |      |   |   | 1 |
| RV 824 | RNE0052   | VR, Metal EVN39C00YB23 (2K)           | 1    | 1 |   |   |
| RV 824 | RNE0051   | VR, Metal EVN39C00YB14 (10K)          |      |   |   | 1 |
| RV 831 | RNE0050   | VR, Metal EVN39C00YB52 (500)          | 1    | 1 | 1 |   |
| RV 831 | RNE0048   | VR, Metal EVN39C00YB22 (200)          |      |   |   | 1 |
| CV 840 | CVE0049   | C, Variable ECR-HA040E11              | 1    | 1 | 1 | 1 |
| TR 811 | HTC0148   | Transistor 2SC458C                    | 1    | 1 | 1 | 1 |
| TR 812 | HTC0148   | Transistor 2SC458C                    | 1    | 1 | 1 | 1 |
| TR 821 | HTA0224   | Transistor 2SA1029D                   | 1    | 1 | 1 | 1 |
| TR 822 | HTA0224   | Transistor 2SA1029D                   | 1    | 1 | 1 | 1 |
| TR 831 | HTA0224   | Transistor 2SA1029D                   | 1    | 1 | 1 | 1 |
| TR 832 | HTA0224   | Transistor 2SA1029D                   | 1    | 1 | 1 | 1 |
| TR 843 | HTA0224   | Transistor 2SA1029D                   | 1    | 1 | 1 | 1 |
| TR 844 | HTA0224   | Transistor 2SA1029D                   | 1    | 1 | 1 | 1 |
| TR 851 | HTC0649   | Transistor 2SC2610                    | 1    | 1 | 1 |   |
| TR 851 | HTC0722   | Transistor 2SC2909S                   |      |   |   | 1 |
| TR 852 | HTC0649   | Transistor 2SC2610                    | 1    | 1 | 1 |   |
| TR 852 | HTC0722   | Transistor 2SC2909S                   |      |   |   | 1 |
| TR 853 | HTC0649   | Transistor 2SC2610                    | 1    | 1 | 1 |   |
| TR 853 | HTC0722   | Transistor 2SC2909S                   |      |   |   | 1 |
| TR 854 | HTC0649   | Transistor 2SC2610                    | 1    | 1 | 1 |   |
| TR 854 | HTC0722   | Transistor 2SC2909S                   |      |   |   | 1 |
| L 852  | TLE0138   | Coil ELE-V 681KA                      |      |   |   | 1 |
| L 852  | TLE0148   | Coil FL-7H 682J                       | 1    | 1 | 1 |   |
| S 501  | 8394003   | SW, Rotary                            | 1    | 1 | 1 | 1 |
| VS 502 | 8376780   | SW PB SPJ222N                         |      |   |   | 1 |

| Symbol | Part Code | Description  | Qty |   |   |   |
|--------|-----------|--------------|-----|---|---|---|
|        |           |              | A   | B | C | D |
| D 851  | HDS0437   | Diode 1SS133 | 1   | 1 | 1 | 1 |
| D 852  | HDS0437   | Diode 1SS133 | 1   | 1 | 1 | 1 |
| D 853  | HDS0437   | Diode 1SS133 | 1   | 1 | 1 | 1 |
| D 854  | HDS0437   | Diode 1SS133 | 1   | 1 | 1 | 1 |

# ALT MAG SWITCHING

| Symbol | Part Code | Description                           | Qty |   |   |   |
|--------|-----------|---------------------------------------|-----|---|---|---|
|        |           |                                       | A   | B | C | D |
| R 860  | RCE0770   | R, Carbon 1/4W 1.2k $\Omega$ $\pm$ 5% |     |   |   | 1 |
| R 860  | RME1192   | R, Metal 1/4W 24.3k $\Omega$ $\pm$ 1% |     |   | 1 |   |
| R 861  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm$ 5% |     |   | 1 | 1 |
| R 862  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm$ 5% |     |   | 1 | 1 |
| R 863  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm$ 5% |     |   | 1 | 1 |
| R 864  | RCE0765   | R, Carbon 1/4W 470 $\Omega$ $\pm$ 5%  |     |   | 1 | 1 |
| R 865  | RCE0765   | R, Carbon 1/4W 470 $\Omega$ $\pm$ 5%  |     |   | 1 | 1 |
| R 866  | RME1085   | R, Metal 1/4W 12.1k $\Omega$ $\pm$ 1% |     |   |   | 1 |
| R 861  | RME1090   | R, Metal 1/4W 33.2k $\Omega$ $\pm$ 1% |     |   | 1 |   |
| R 869  | RCE0745   | R, Carbon 1/4W 10 $\Omega$ $\pm$ 5%   |     |   | 1 | 1 |
| TR 860 | HTA0224   | Transistor 2SA1029D                   |     |   | 1 | 1 |
| TR 861 | HTA0224   | Transistor 2SA1029D                   |     |   | 1 | 1 |
| IC 801 | IDH0586   | Digital IC HD74LS74AP                 |     |   | 1 | 1 |

# HV Z AMP HIGH VOLTAGE CKT

| Symbol  | Part Code | Description                                   | Q'ty |   |   |   |
|---------|-----------|-----------------------------------------------|------|---|---|---|
|         |           |                                               | A    | B | C | D |
| R 1001  | RMS0023   | R, Metal 1/4W 1.43M $\Omega$ $\pm 0.5\%$      | 1    | 1 | 1 |   |
| R 1001  | RMS0018   | R, Metal 1/4W 1M $\Omega$ $\pm 1\%$           |      |   |   | 1 |
| R 1002  | RCE0789   | R, Carbon 1/4W 47k $\Omega$ $\pm 5\%$         | 1    | 1 | 1 | 1 |
| R 1003  | RCE0797   | R, Carbon 1/4W 220k $\Omega$ $\pm 5\%$        | 1    | 1 | 1 | 1 |
| R 1004  | RCE0769   | R, Carbon 1/4W 1k $\Omega$ $\pm 5\%$          | 1    | 1 | 1 | 1 |
| R 1005  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm 5\%$        | 1    | 1 | 1 |   |
| R 1005  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm 5\%$        |      |   |   | 1 |
| R 1006  | RCE0757   | R, Carbon 1/4W 100 $\Omega$ $\pm 5\%$         | 1    | 1 | 1 | 1 |
| R 1012  | RCE0789   | R, Carbon 1/4W 47k $\Omega$ $\pm 5\%$         |      |   |   | 1 |
| R 1014  | RCE0715   | R, Carbon 1/2W 6.8k $\Omega$ $\pm 5\%$        | 1    | 1 | 1 | 1 |
| R 1017  | RMV0004   | R, Metal 1/2W 22.1M $\Omega$ $\pm 1\%$        | 1    | 1 | 1 | 1 |
| R 1016  | RCE0800   | R, Carbon 1/4W 470k $\Omega$ $\pm 5\%$        | 1    | 1 | 1 | 1 |
| R 1016  | RCE0745   | R, Carbon 1/4W 10 $\Omega$ $\pm 5\%$          |      |   |   | 1 |
| R 1020  | RCE0798   | R, Carbon 1/4W 330k $\Omega$ $\pm 5\%$        | 1    | 1 | 1 | 1 |
| R 1021  | RCE0785   | R, Carbon 1/4W 22k $\Omega$ $\pm 5\%$         | 1    | 1 | 1 | 1 |
| R 1021  | RCE0773   | R, Carbon 1/4W 2.2k $\Omega$ $\pm 5\%$        |      |   |   | 1 |
| R 1023  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm 5\%$        | 1    | 1 | 1 | 1 |
| R 1024  | RSE0434   | R, Solid ERC14G 10M $\Omega$                  | 1    | 1 | 1 | 1 |
| R 1033  | RCE0781   | R, Carbon 1/4W 10k $\Omega$ $\pm 5\%$         |      |   |   | 1 |
| R 1034  | RCE0785   | R, Carbon 1/4W 22k $\Omega$ $\pm 5\%$         |      |   |   | 1 |
| R 1038  | RCE0793   | R, Carbon 1/4W 100k $\Omega$ $\pm 5\%$        |      |   |   | 1 |
| R 1038  | RCE0798   | R, Carbon 1/4W 330k $\Omega$ $\pm 5\%$        | 1    | 1 | 1 | 1 |
| R 1350  | RCE0749   | R, Carbon 1/4W 22 $\Omega$ $\pm 5\%$          | 1    | 1 | 1 | 1 |
| C 1001  | CQA0099   | C, Plastic 50V 0.022 $\mu$ F $\pm 10\%$       | 1    | 1 | 1 | 1 |
| C 1002  | CES0035   | C, AL Elyc 50V 47 $\mu$ F $\pm 10\%$          | 1    | 1 | 1 | 1 |
| C 1005  | CQA0101   | C, Plastic 50V 0.047 $\mu$ F $\pm 10\%$       | 1    | 1 | 1 | 1 |
| C 1012  | CCD0231   | C, Ceramic 2000V 4700pF $\pm 80\%$ $\pm 20\%$ | 1    | 1 | 1 | 1 |
| C 1013  | CCD0231   | C, Ceramic 2000V 4700pF $\pm 80\%$ $\pm 20\%$ | 1    | 1 | 1 | 1 |
| C 1014  | CCD0231   | C, Ceramic 2000V 4700pF $\pm 80\%$ $\pm 20\%$ | 1    | 1 | 1 | 1 |
| C 1016  | CCD0245   | C, Ceramic 2000V 100pF $\pm 10\%$             | 1    | 1 | 1 | 1 |
| C 1020  | CCD0286   | C, Ceramic 500V 1000pF $\pm 100\%$ $\pm 0\%$  | 1    | 1 | 1 | 1 |
| C 1021  | CEC0213   | C, AL Elyc 160V 1 $\mu$ F                     | 1    | 1 | 1 | 1 |
| C 1023  | CCD0246   | C, Ceramic 2kV 1000pF $\pm 10\%$              | 1    | 1 | 1 | 1 |
| C 1025  | CCD0231   | C, Ceramic 2000V 4700pF $\pm 80\%$ $\pm 20\%$ | 1    | 1 | 1 | 1 |
| C 1034  | CCD0287   | C, Ceramic 500V 4700pF $\pm 100\%$ $\pm 0\%$  |      |   |   | 1 |
| C 1035  | CCD0287   | C, Ceramic 500V 4700pF $\pm 100\%$ $\pm 0\%$  | 1    | 1 | 1 | 1 |
| C 1038  | CCD0287   | C, Ceramic 500V 4700pF $\pm 100\%$ $\pm 0\%$  | 1    | 1 | 1 | 1 |
| RV 1021 | RNE0054   | VR, Metal EVN39C00YB15 (100K)                 | 1    | 1 | 1 | 1 |
| RV 1033 | RNE0054   | VR, Metal EVN39C00YB15 (100K)                 |      |   |   | 1 |
| RV 1035 | RNE0055   | VR, Metal EVN39C00YB25 (200K)                 | 1    | 1 | 1 |   |
| RV 1035 | RNE0054   | VR, Metal EVN39C00YB15 (100K)                 |      |   |   | 1 |
| RV 1348 | 8348450   | VR, Metal CR29R 22k $\Omega$                  | 1    | 1 | 1 | 1 |
| TR 1001 | HTK0081   | Transistor 2SK304E                            | 1    | 1 | 1 | 1 |
| TR 1002 | HTA0224   | Transistor 2SA1029D                           | 1    | 1 | 1 | 1 |
| TR 1006 | HTD0155   | Transistor 2SD313E                            | 1    | 1 | 1 | 1 |
|         | HYX0010   | 30F-TO-220                                    | 1    | 1 | 1 | 1 |
| TR 1348 | HTC0148   | Transistor 2SC458C                            | 1    | 1 | 1 | 1 |
| TR 1349 | HTA0224   | Transistor 2SA1029D                           | 1    | 1 | 1 | 1 |
| D 1012  | HDY0031   | Diode Y10GA                                   | 1    | 1 | 1 |   |
| D 1013  | HDY0031   | Diode Y10GA                                   |      |   |   | 1 |
| D 1020  | HDH0072   | Diode HZ22                                    |      |   |   | 1 |
| D 1021  | HDS0250   | Diode 1SS83                                   | 1    | 1 | 1 | 1 |
| D 1022  | HDS0250   | Diode 1SS83                                   | 1    | 1 | 1 | 1 |
| D 1023  | HDS0250   | Diode 1SS83                                   | 1    | 1 | 1 | 1 |
| D 1024  | HDS0250   | Diode 1SS83                                   | 1    | 1 | 1 | 1 |
| D 1038  | HDH0072   | Diode HZ22                                    | 1    | 1 | 1 | 1 |

| Symbol  | Part Code | Description                 | Q'ty |   |   |   |
|---------|-----------|-----------------------------|------|---|---|---|
|         |           |                             | A    | B | C | D |
| T 1001  | 3180008   | XFMR FOR V-211,212,222, 422 | 1    | 1 | 1 | 1 |
| F 1001  |           | Fuse TSCR UL 125V 0.25A     | 1    | 1 | 1 |   |
| MUT1001 | 3180009   | Multiplier 10KV X5          |      |   |   | 1 |
| NL 1024 | ELL0019   | Lamps NE-2                  | 1    | 1 | 1 | 1 |
| NL 1025 | ELL0019   | Lamps NE-2                  | 1    | 1 | 1 | 1 |
| F 1001  | EFL0147   | Fuse TSCR UL 125V 0.5A      |      |   |   | 1 |

## PANEL and OTHERS

| Symbol | Part Code | Description         | Q'ty |   |   |   |
|--------|-----------|---------------------|------|---|---|---|
|        |           |                     | A    | B | C | D |
| V 1001 | DPX0076   | CRT 150BTB31 (IG)   | 1    | 1 | 1 |   |
| V 1001 | DPX0077   | CRT 297TB31         |      |   |   | 1 |
|        | 8338351   | Terminal Z-048      | 1    | 1 | 1 | 1 |
| J 9    | JHB0088   | CON. Coax BNC071    | 1    | 1 | 1 | 1 |
| L 1350 |           | Coil Trace Rotation | 1    | 1 | 1 | 1 |

## Z AXIS AMP

| Symbol | Part Code | Description                            | Q'ty |   |   |   |
|--------|-----------|----------------------------------------|------|---|---|---|
|        |           |                                        | A    | B | C | D |
| R 901  | RCE0789   | R, Carbon 1/4W 47k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 901  | RCE0787   | R, Carbon 1/4W 33k $\Omega$ $\pm 5\%$  |      |   |   | 1 |
| R 902  | RCE0776   | R, Carbon 1/4W 3.9k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 | 1 |
| R 903  | RCE0784   | R, Carbon 1/4W 18k $\Omega$ $\pm 5\%$  |      |   |   | 1 |
| R 903  | RCE0779   | R, Carbon 1/4W 6.8k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 |   |
| R 904  | RCE0725   | R, Carbon 1/2W 47k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 904  | RCE0723   | R, Carbon 1/2W 33k $\Omega$ $\pm 5\%$  |      |   |   | 1 |
| R 906  | RCE0793   | R, Carbon 1/4W 100k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 906  | RCE0793   | R, Carbon 1/4W 100k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 |   |
| R 907  | RCE0757   | R, Carbon 1/4W 100 $\Omega$ $\pm 5\%$  | 1    | 1 | 1 | 1 |
| R 908  | RCE0771   | R, Carbon 1/4W 1.5k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 908  | RCE0773   | R, Carbon 1/4W 2.2k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 |   |
| R 909  | RCE0798   | R, Carbon 1/4W 330k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 |   |
| R 909  | RCE0797   | R, Carbon 1/4W 220k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 910  | RCE0783   | R, Carbon 1/4W 15k $\Omega$ $\pm 5\%$  |      |   |   | 1 |
| R 910  | RCE0793   | R, Carbon 1/4W 100k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 |   |
| R 911  | RCE0781   | R, Carbon 1/4W 10k $\Omega$ $\pm 5\%$  | 1    | 1 | 1 |   |
| R 911  | RCE0769   | R, Carbon 1/4W 1k $\Omega$ $\pm 5\%$   |      |   |   | 1 |
| R 912  | RCE0745   | R, Carbon 1/4W 10 $\Omega$ $\pm 5\%$   | 1    | 1 | 1 |   |
| R 912  | RCE0745   | R, Carbon 1/4W 10 $\Omega$ $\pm 5\%$   |      |   |   | 1 |
| R 915  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm 5\%$  | 1    | 1 | 1 | 1 |
| R 930  | RCE0776   | R, Carbon 1/4W 3.9k $\Omega$ $\pm 5\%$ |      |   |   | 1 |
| R 930  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm 5\%$ | 1    | 1 | 1 |   |
| R 931  | RCE0787   | R, Carbon 1/4W 33k $\Omega$ $\pm 5\%$  |      |   |   | 1 |
| R 905  | RCE0795   | R, Carbon 1/4W 150k $\Omega$ $\pm 5\%$ |      |   |   | 1 |

| Symbol | Part Code | Description                         | Q'ty |   |   |   |
|--------|-----------|-------------------------------------|------|---|---|---|
|        |           |                                     | A    | B | C | D |
| C 901  | CES0028   | C, AL Elyc 10V 47μF ±10%            | 1    | 1 | 1 | 1 |
| C 904  | CCD0272   | C, Ceramic 500V 1 pF ±0.25pF        | 1    | 1 | 1 | 1 |
| C 908  | CCD0287   | C, Ceramic 500V 4700pF +100%<br>-0% | 1    | 1 | 1 | 1 |
| C 912  | CET0033   | TC 04SM 160V 1μ                     | 1    | 1 | 1 | 1 |
| TR 901 | HTC0192   | Transistor 2SC641K-C                | 1    | 1 | 1 | 1 |
| TR 906 | HTC0148   | Transistor 2SC458C                  | 1    | 1 | 1 | 1 |
| TR 910 | HTA0277   | Transistor 2SA1207S                 | 1    | 1 | 1 | 1 |
| TR 912 | HTC0722   | Transistor 2SC2909S                 | 1    | 1 | 1 | 1 |
| TR 931 | HTA0104   | Transistor 2SA778AK                 |      |   | 1 | 1 |
| D 901  | HDS0437   | Diode 1SS133                        | 1    | 1 | 1 | 1 |
| D 902  | HDS0437   | Diode 1SS133                        | 1    | 1 | 1 | 1 |
| D 910  | HDS0437   | Diode 1SS133                        | 1    | 1 | 1 | 1 |

## CRT

| Symbol  | Part Code | Description              | Q'ty |   |   |   |
|---------|-----------|--------------------------|------|---|---|---|
|         |           |                          | A    | B | C | D |
| R 1018  | RCE0738   | R, Carbon 1/2W 2.2MΩ ±5% | 1    | 1 | 1 |   |
| R 1030  | RCE0781   | R, Carbon 1/4W 10kΩ ±5%  | 1    | 1 | 1 |   |
| R 1031  | RCE0793   | R, Carbon 1/4W 100kΩ ±5% | 1    | 1 | 1 |   |
| J 1001  | 8390152   | Socket 1339 (CRT)        | 1    | 1 | 1 |   |
| PEF-626 |           | PCB PB-14                | R    | R | R |   |

## CRT

| Symbol  | Part Code | Description              | Q'ty |   |   |   |
|---------|-----------|--------------------------|------|---|---|---|
|         |           |                          | A    | B | C | D |
| R 1018  | RCE0738   | R, Carbon 1/2W 2.2MΩ ±5% |      |   |   | 1 |
| R 1030  | RCE0777   | R, Carbon 1/4W 4.7kΩ ±5% |      |   |   | 1 |
| R 1031  | RCE0793   | R, Carbon 1/4W 100kΩ ±5% |      |   |   | 1 |
| R 1032  | RCE0757   | R, Carbon 1/4W 100Ω ±5%  |      |   |   | 1 |
| J 1001  | 8390152   | Socket 1339 (CRT)        |      |   |   | 1 |
| PEF-627 |           | PCB PE-14                |      |   |   | R |

# POWER SUPPLY

| Symbol  | Part Code | Description                            | Qty |   |   |   |
|---------|-----------|----------------------------------------|-----|---|---|---|
|         |           |                                        | A   | B | C | D |
| R 1101  | RCE0793   | R, Carbon 1/4W 100k $\Omega$ $\pm$ 5%  | 1   | 1 | 1 | 1 |
| R 1102  | RCE0769   | R, Carbon 1/4W 1.0k $\Omega$ $\pm$ 5%  | 1   | 1 | 1 | 1 |
| R 1103  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm$ 5%  | 1   | 1 | 1 | 1 |
| R 1103  | RCE0774   | R, Carbon 1/4W 2.7k $\Omega$ $\pm$ 5%  | 1   | 1 | 1 | 1 |
| R 1104  | RME1096   | R, Metal 1/4W 100k $\Omega$ $\pm$ 1%   | 1   | 1 | 1 | 1 |
| R 1104  | RME1091   | R, Metal 1/4W 39.2k $\Omega$ $\pm$ 5%  | 1   | 1 | 1 | 1 |
| R 1105  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm$ 5%  | 1   | 1 | 1 | 1 |
| R 1105  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm$ 5%  | 1   | 1 | 1 | 1 |
| R 1106  | RME1086   | R, Metal 1/4W 15.0k $\Omega$ $\pm$ 1%  | 1   | 1 | 1 | 1 |
| R 1106  | RME1084   | R, Metal 1/4W 10.0k $\Omega$ $\pm$ 1%  | 1   | 1 | 1 | 1 |
| R 1107  | RCE0785   | R, Carbon 1/4W 22k $\Omega$ $\pm$ 5%   | 1   | 1 | 1 | 1 |
| R 1109  | RCE0769   | R, Carbon 1/4W 1k $\Omega$ $\pm$ 5%    | 1   | 1 | 1 | 1 |
| R 1110  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm$ 5%   | 1   | 1 | 1 | 1 |
| R 1110  | RCE0767   | R, Carbon 1/4W 220 $\Omega$ $\pm$ 5%   | 1   | 1 | 1 | 1 |
| R 1121  | RCE0761   | R, Carbon 1/4W 220 $\Omega$ $\pm$ 5%   | 1   | 1 | 1 | 1 |
| R 1124  | RCE0783   | R, Carbon 1/4W 15k $\Omega$ $\pm$ 5%   | 1   | 1 | 1 | 1 |
| R 1125  | RCE0753   | R, Carbon 1/4W 47 $\Omega$ $\pm$ 5%    | 1   | 1 | 1 | 1 |
| R 1131  | RCE0685   | R, Carbon 1/2W 22 $\Omega$ $\pm$ 5%    | 1   | 1 | 1 | 1 |
| R 1131  | RCE0689   | R, Carbon 1/2W 47 $\Omega$ $\pm$ 5%    | 1   | 1 | 1 | 1 |
| R 1132  | RCE0689   | R, Carbon 1/2W 47 $\Omega$ $\pm$ 5%    | 1   | 1 | 1 | 1 |
| R 1141  | RCE0800   | R, Carbon 1/4W 470k $\Omega$ $\pm$ 5%  | 1   | 1 | 1 | 1 |
| R 1142  | RCE0787   | R, Carbon 1/4W 33k $\Omega$ $\pm$ 5%   | 1   | 1 | 1 | 1 |
| C 1101  | CES0201   | C, AL Elyc 160V 47 $\mu$ F             | 1   | 1 | 1 | 1 |
| C 1102  | CES0203   | C, AL Elyc 250V 47 $\mu$ F             | 1   | 1 | 1 | 1 |
| C 1109  | CES0201   | C, AL Elyc 160V 47 $\mu$ F             | 1   | 1 | 1 | 1 |
| C 1110  | CQA0092   | C, Plastic 50V 0.0015 $\mu$ F          | 1   | 1 | 1 | 1 |
| C 1111  | CES0204   | C, AL Elyc 25V 2200 $\mu$ F            | 1   | 1 | 1 | 1 |
| C 1112  | CES0028   | C, AL Elyc 10V 47 $\mu$ F/LB           | 1   | 1 | 1 | 1 |
| C 1121  | CES0204   | C, AL Elyc 25V 2200 $\mu$ F            | 1   | 1 | 1 | 1 |
| C 1121  | CES0028   | C, AL Elyc 10V 47 $\mu$ F/LB           | 1   | 1 | 1 | 1 |
| C 1124  | CQA0101   | C, Plastic 50V 0.047 $\mu$ F $\pm$ 10% | 1   | 1 | 1 | 1 |
| C 1131  | CES0036   | C, AL Elyc 25V 22 $\mu$ F/LB           | 1   | 1 | 1 | 1 |
| C 1138  | CES0028   | C, AL Elyc 10V 47 $\mu$ F/LB           | 1   | 1 | 1 | 1 |
| TR 1102 | HTC0671   | Transistor 2SC1505L                    | 1   | 1 | 1 | 1 |
| TR 1101 | HTA0104   | Transistor 2SA778AK                    | 1   | 1 | 1 | 1 |
| TR 1103 | HTA0224   | Transistor 2SA1029D                    | 1   | 1 | 1 | 1 |
| TR 1104 | HTC0148   | Transistor 2SC458C                     | 1   | 1 | 1 | 1 |
| IC 1111 | ILH0109   | Digital IC HA17808P                    | 1   | 1 | 1 | 1 |
| IC 1121 | ILM0342   | Digital IC M PC7808                    | 1   | 1 | 1 | 1 |
| IC 1131 | ILH0108   | Digital IC HA17805P                    | 1   | 1 | 1 | 1 |
| D 1101  | HDS0476   | Diode S5566J                           | 1   | 1 | 1 | 1 |
| D 1102  | HDS0476   | Diode S5566J                           | 1   | 1 | 1 | 1 |
| D 1103  | HDS0476   | Diode S5566J                           | 1   | 1 | 1 | 1 |
| D 1104  | HDS0476   | Diode S5566J                           | 1   | 1 | 1 | 1 |
| D 1105  | HDS0476   | Diode S5566J                           | 1   | 1 | 1 | 1 |
| D 1106  | HDS0476   | Diode S5566J                           | 1   | 1 | 1 | 1 |
| D 1111  | HDS0475   | Diode S5566B                           | 1   | 1 | 1 | 1 |
| D 1112  | HDS0475   | Diode S5566B                           | 1   | 1 | 1 | 1 |
| D 1113  | HDS0475   | Diode S5566B                           | 1   | 1 | 1 | 1 |
| D 1114  | HDS0475   | Diode S5566B                           | 1   | 1 | 1 | 1 |
| P 1101  | JBX0703   | Connector 1-171825-0                   | 1   | 1 | 1 | 1 |
| PEF-621 |           | PCB PB-15                              | R   | R | R | R |

# SCALE, ILLUM LAMP

| Symbol  | Part Code | Description | Qty |   |   |   |
|---------|-----------|-------------|-----|---|---|---|
|         |           |             | A   | B | C | D |
| PL 1401 | 8400068   | Lamp 8V     | 1   | 1 | 1 | 1 |
| PL 1402 | 8400068   | Lamp 8V     | 1   | 1 | 1 | 1 |
| PL 1403 | 8400068   | Lamp 8V     | 1   | 1 | 1 | 1 |
| PEF-623 |           | PCB PE-15   | R   | R | R | R |

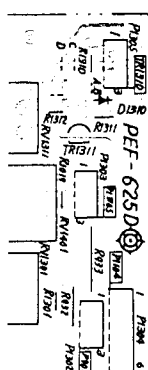
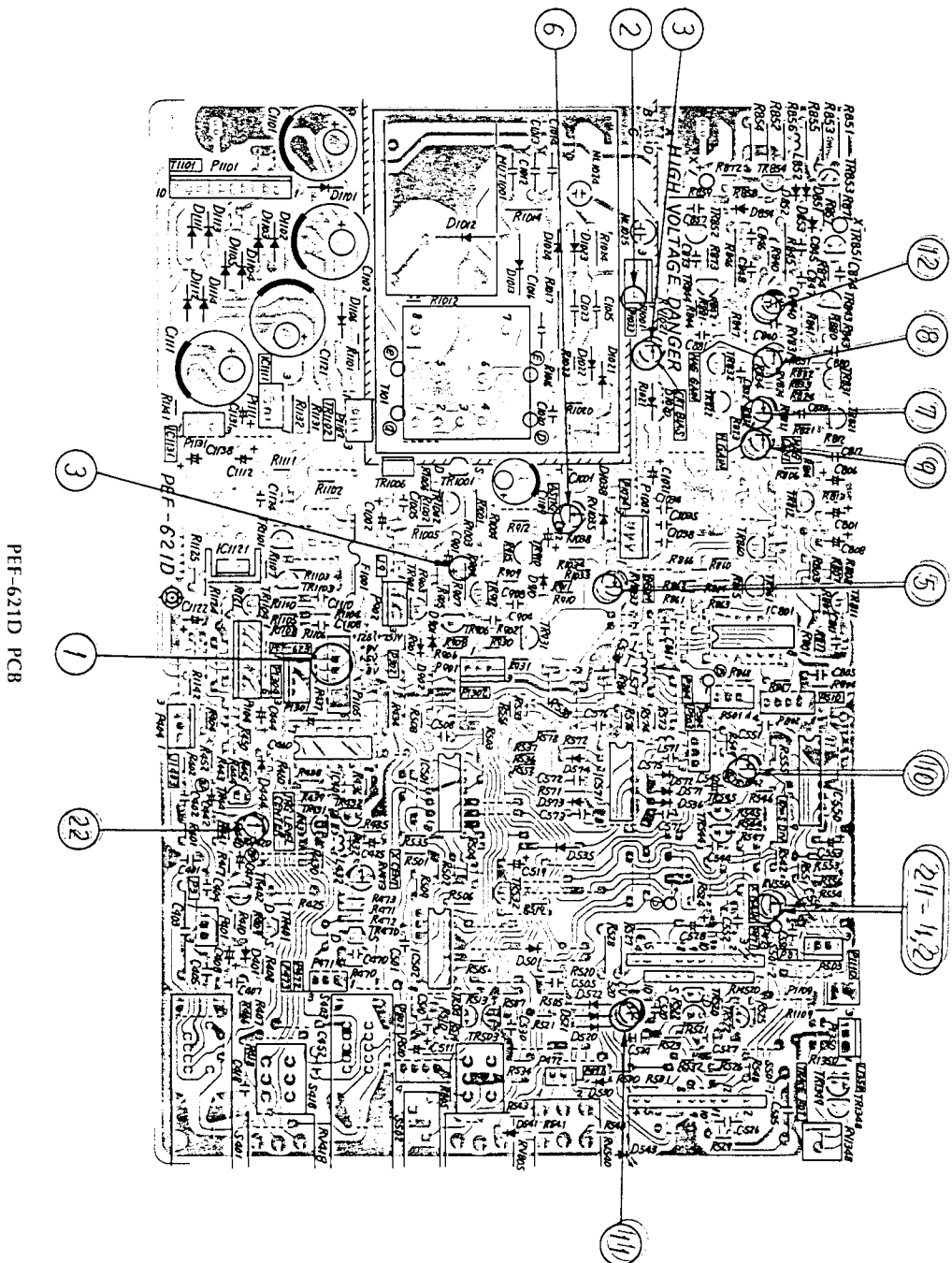
# PANEL and OTHERS

| Symbol  | Part Code | Description                         | Qty |   |   |   |
|---------|-----------|-------------------------------------|-----|---|---|---|
|         |           |                                     | A   | B | C | D |
| J 1102  | JJC0026   | Connector CM3 (C-170)               | 1   | 1 | 1 | 1 |
| J 1103  | 3142147   | Unit PWP S-17221 (100/120/220/240V) | 1   | 1 | 1 | 1 |
| S 1101  | 8400067   | SW, PB SDV 3P                       | 1   | 1 | 1 | 1 |
| T 1101  | 3173880   | XFMR For V-211, 212, 222, 422       | 1   | 1 | 1 | 1 |
| D 1110  | HDS0408   | Diode SR503D with mount(red)        | 1   | 1 | 1 | 1 |
| TR 1310 | HTD0155   | Transistor 2SD313E                  | 1   | 1 | 1 | 1 |

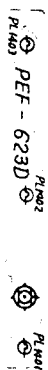
9 RV/LAMP

| Symbol  | Part Code | Description                           | Qty |   |   |   |
|---------|-----------|---------------------------------------|-----|---|---|---|
|         |           |                                       | A   | B | C | D |
| R 932   | RCE0737   | R, Carbon 1/2W 1.8M $\Omega$ $\pm$ 5% |     |   | 1 |   |
| R 932   | RCE0738   | R, Carbon 1/2W 2.2M $\Omega$ $\pm$ 5% |     |   |   | 1 |
| R 933   | RMW0008   | R, Metal VR37-15M $\Omega$ $\pm$ 5%   | 1   | 1 | 1 | 1 |
| R 1019  | RCE0793   | R, Carbon 1/4W 100k $\Omega$ $\pm$ 5% |     |   | 1 |   |
| R 1019  | RCE0798   | R, Carbon 1/4W 330k $\Omega$ $\pm$ 5% |     |   |   | 1 |
| R 1301  | RCE0773   | R, Carbon 1/4W 2.2k $\Omega$ $\pm$ 5% |     |   |   | 1 |
| R 1301  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm$ 5% | 1   | 1 | 1 |   |
| R 1310  | RCE0777   | R, Carbon 1/4W 4.7k $\Omega$ $\pm$ 5% |     |   | 1 | 1 |
| R 1311  | RCE0775   | R, Carbon 1/4W 3.3k $\Omega$ $\pm$ 5% |     |   | 1 | 1 |
| R 932   | RCE0715   | R, Carbon 1/2W 6.8k $\Omega$ $\pm$ 5% | 1   | 1 |   |   |
| R 1019  | RCE0800   | R, Carbon 1/4W 470k $\Omega$ $\pm$ 5% | 1   | 1 |   |   |
| R 1312  | RCE0773   | R, Carbon 1/4W 2.2k $\Omega$ $\pm$ 5% |     |   | 1 | 1 |
| RV 1301 | 8348452   | VR, Carbon EVH-CCAK20B14              | 1   | 1 | 1 | 1 |
| RV 1311 | 8348452   | VR, Carbon EVH-CCAK20B14              |     |   | 1 | 1 |
| RV 1401 | RNE0059   | VR, Metal EVHNDGK20B26                | 1   | 1 | 1 | 1 |
| TR 1311 | HTA0224   | Transistor 2SA1029D                   |     |   | 1 | 1 |
| D 1310  | HDS0437   | Diode 1SS133                          |     |   | 1 | 1 |
| PEF-625 |           | PCB PB-15                             |     |   | R | R |

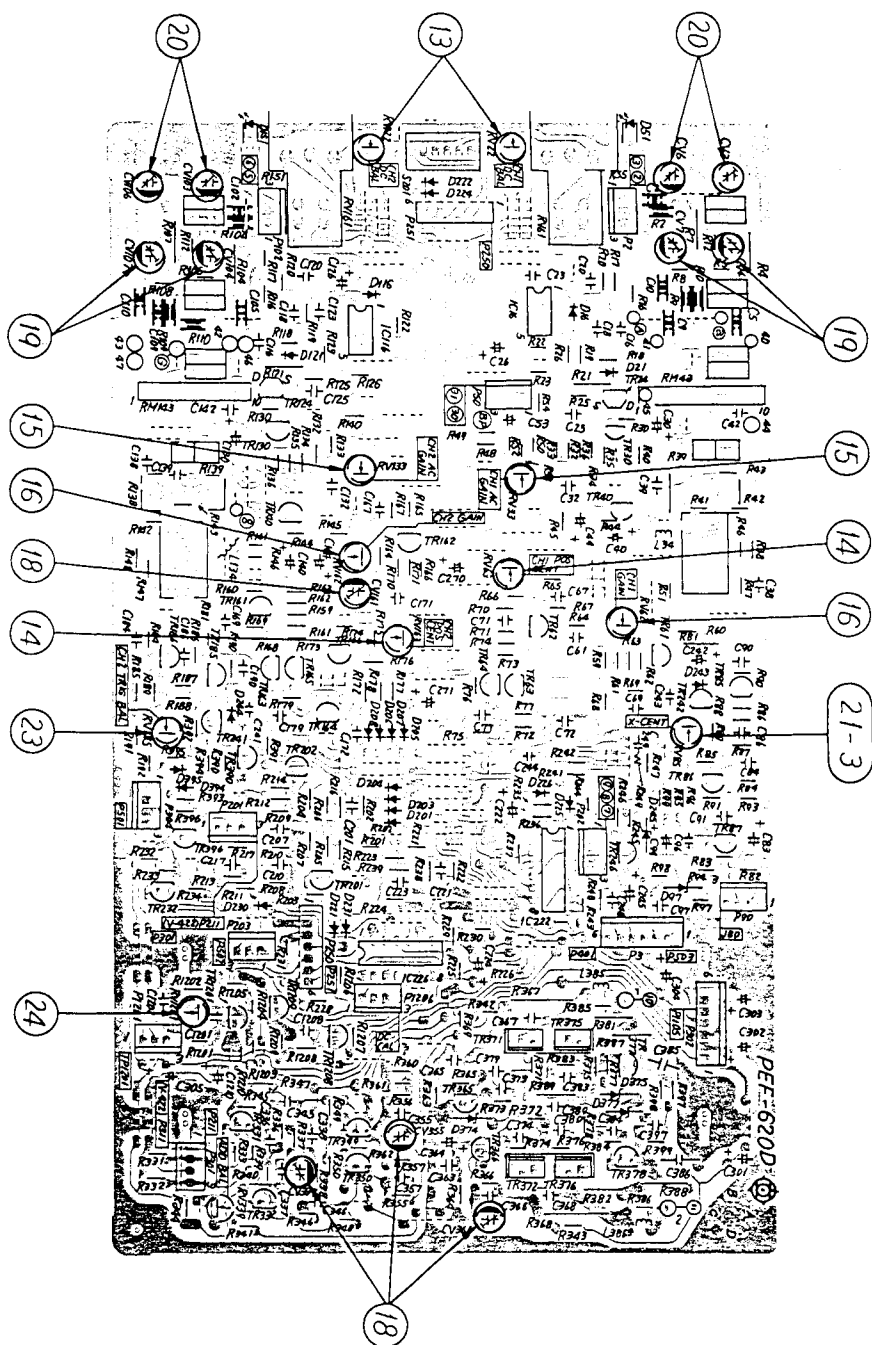
7. ELECTRICAL PARTS ARRANGEMENT  
(WITH ADJUSTMENT LOCATIONS)



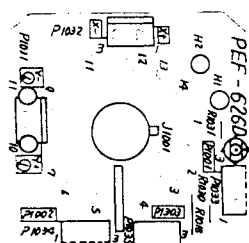
PEF-625D PCB



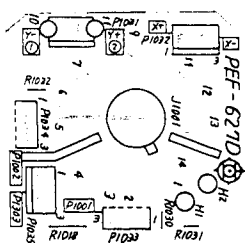
PEF-623D PCB



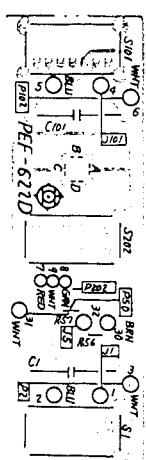
PEF-620D PCB



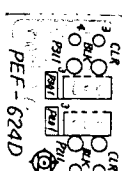
PEF-626D PCB



PEF-627D PCB

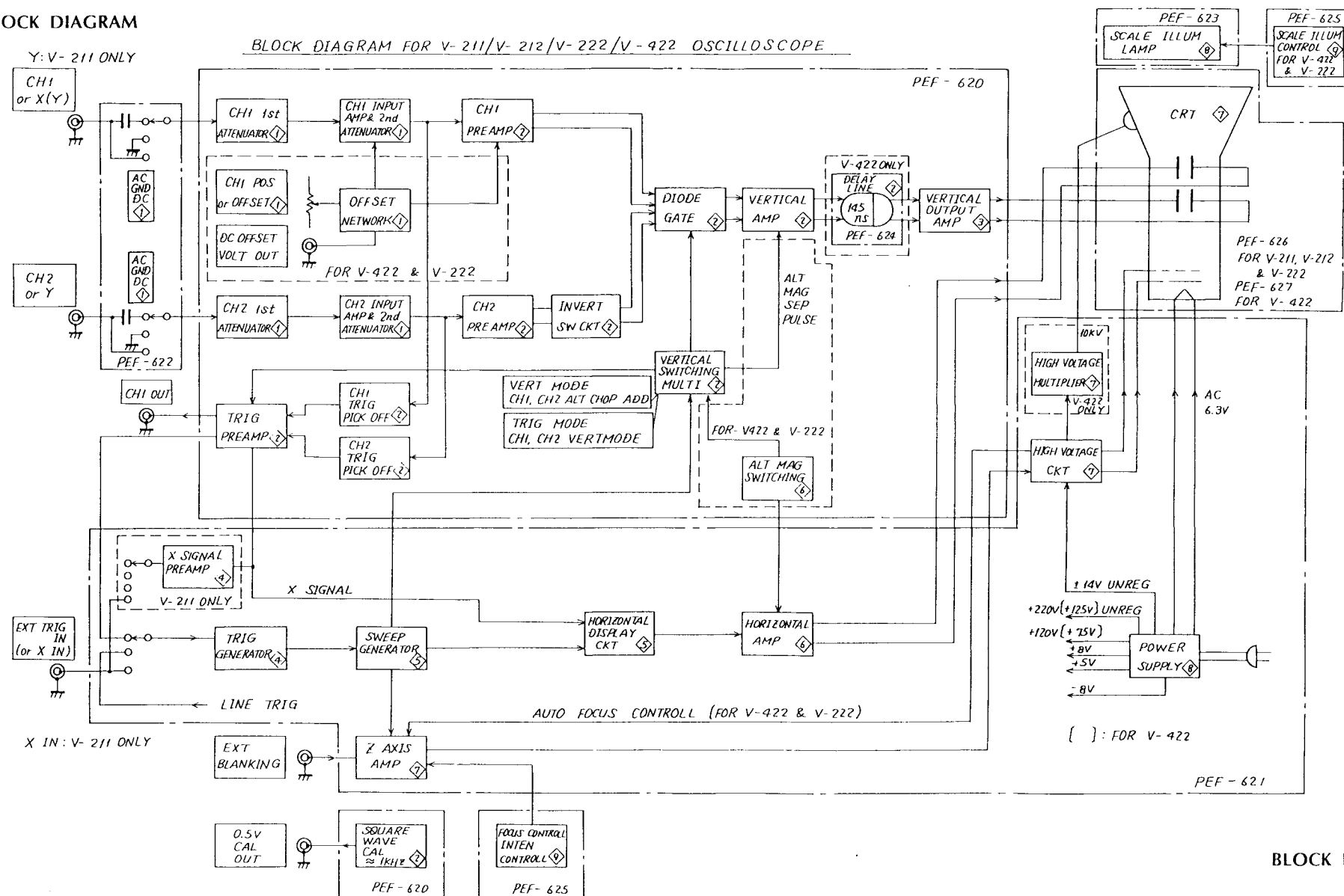


PEF-622D PCB



PEF-624D PCB

## 8. BLOCK DIAGRAM



BLOCK DIAGRAM

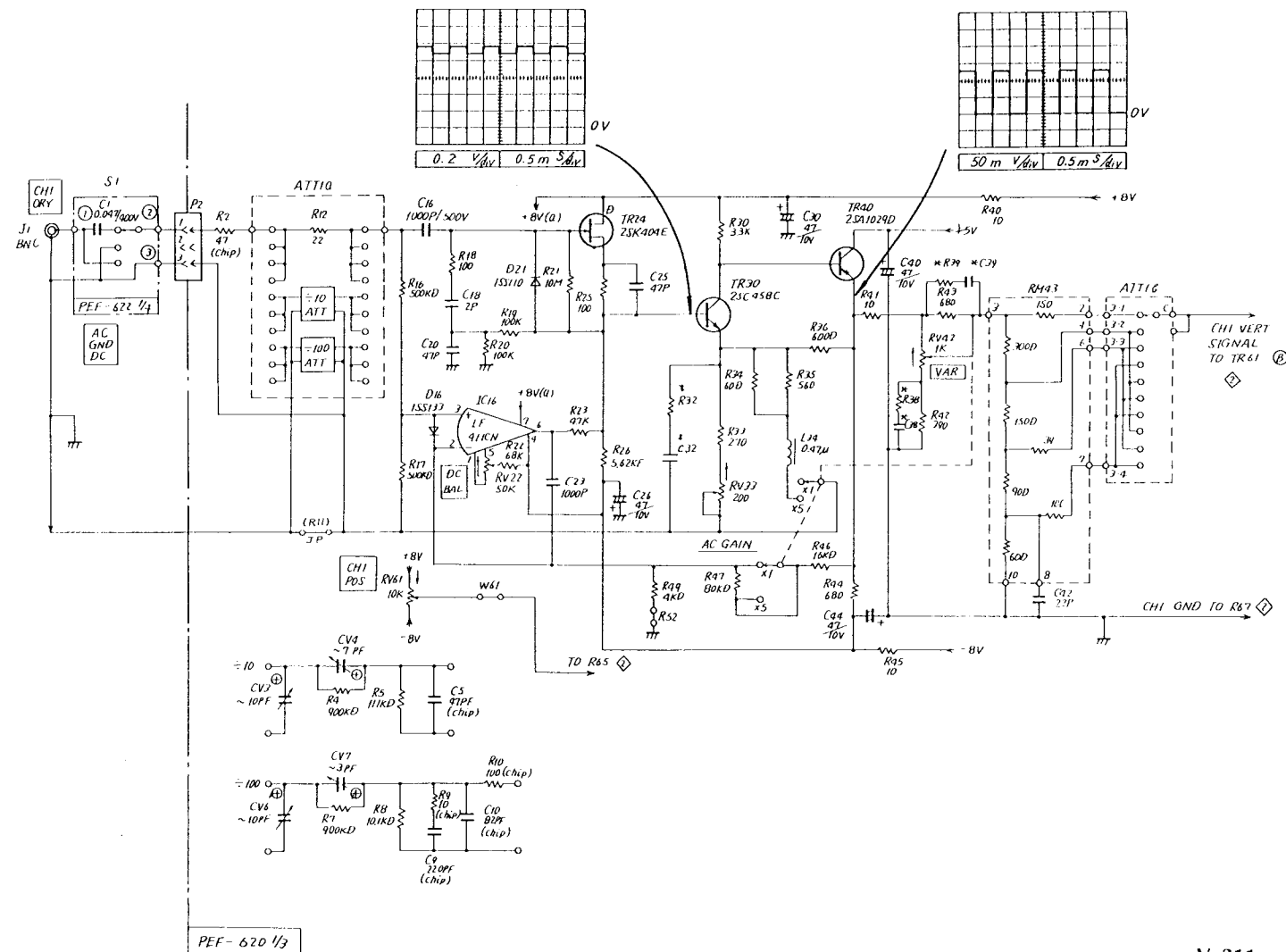
## 10. SCHEMATIC DIAGRAMS

Note

1. This basic circuit diagram is subject to change without notice.
2. All resistor values in ohm: 1/4W and all capacitor values in microfarad unless indicated.
3. \* Factory selected values.

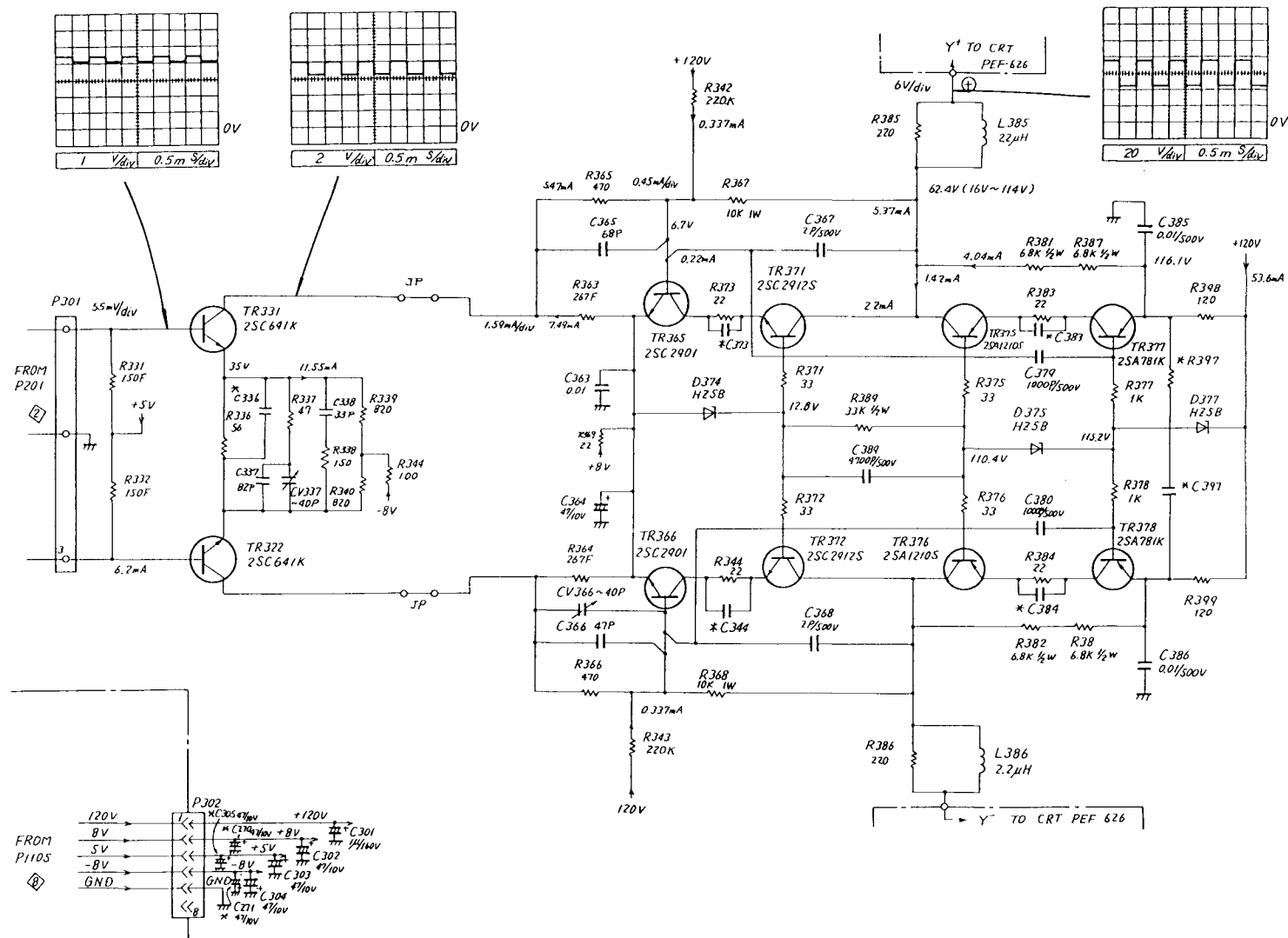
### DC VOLTAGE MEASUREMENT CONDITIONS

TRIG LEVEL : CENTER  
 AC-GND-DC : DC  
 VOLTS/DIV : 10 mV  
 INPUT : CH1  
 TRIG MODE : AUTO  
 TRIG SOURCE : INT  
 INT TRIG : CH1  
 SWEEP TIME : 0.5 ms  
 PROBE : 10 : 1

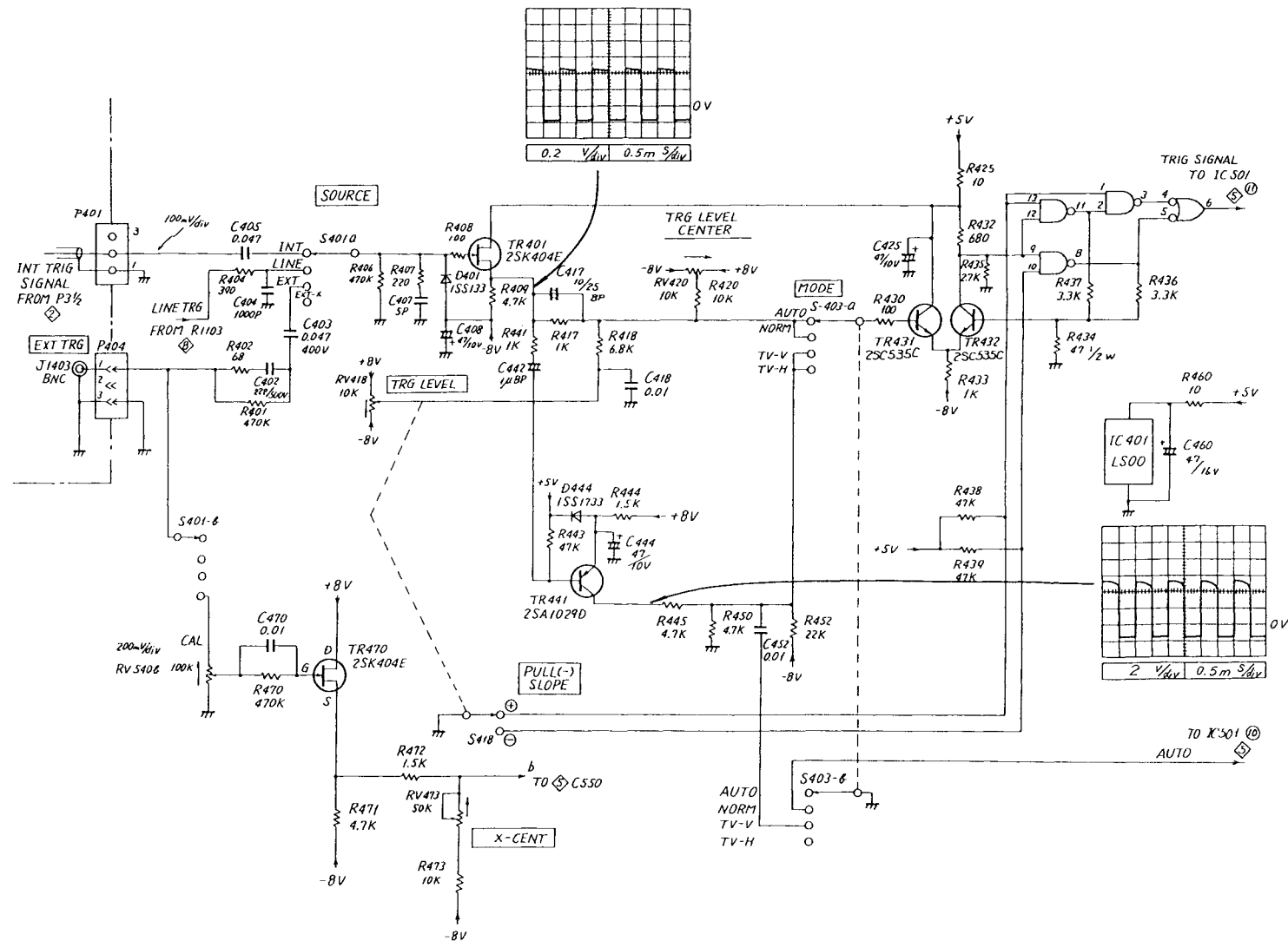


V-211  
 INPUT AMP

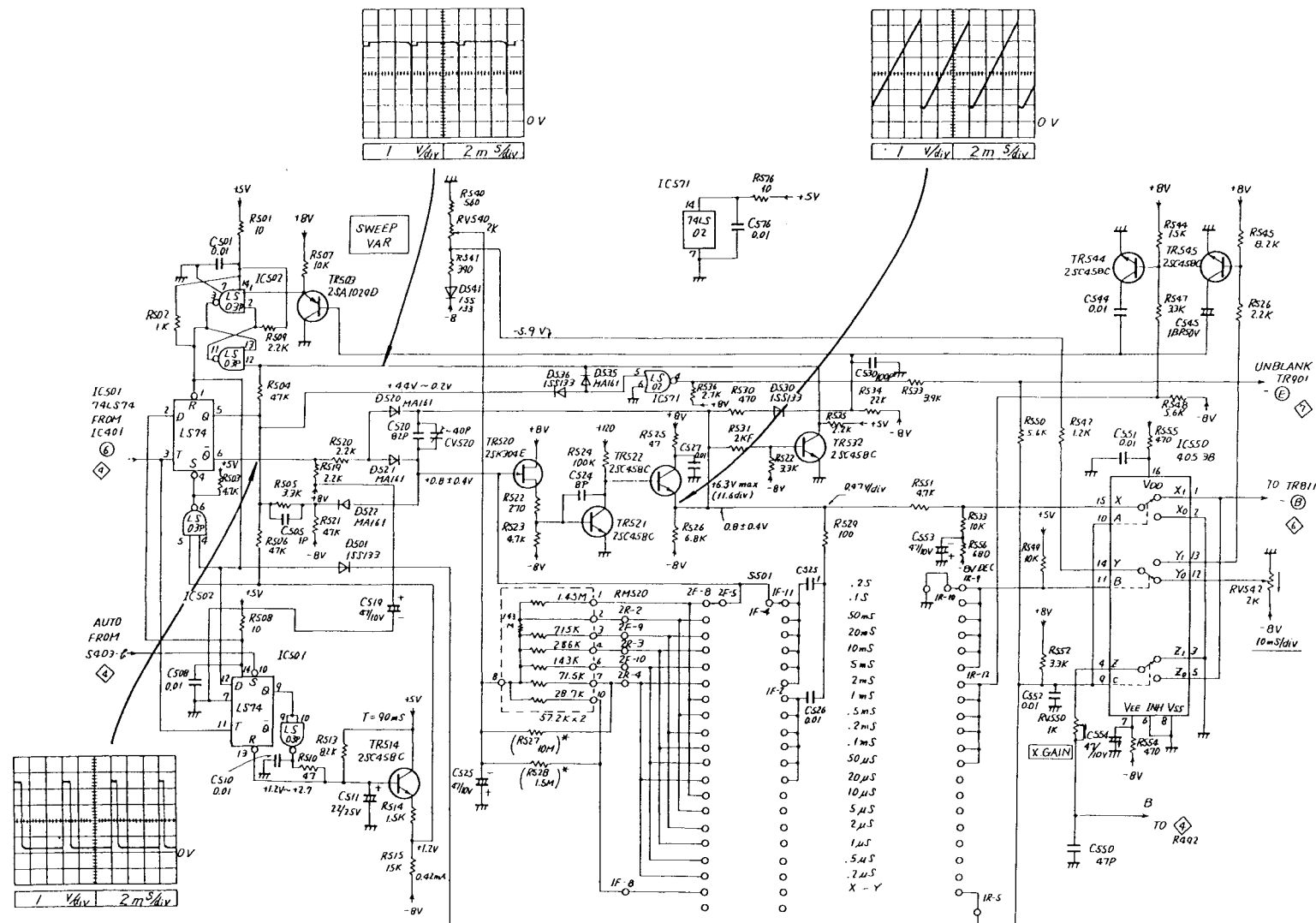




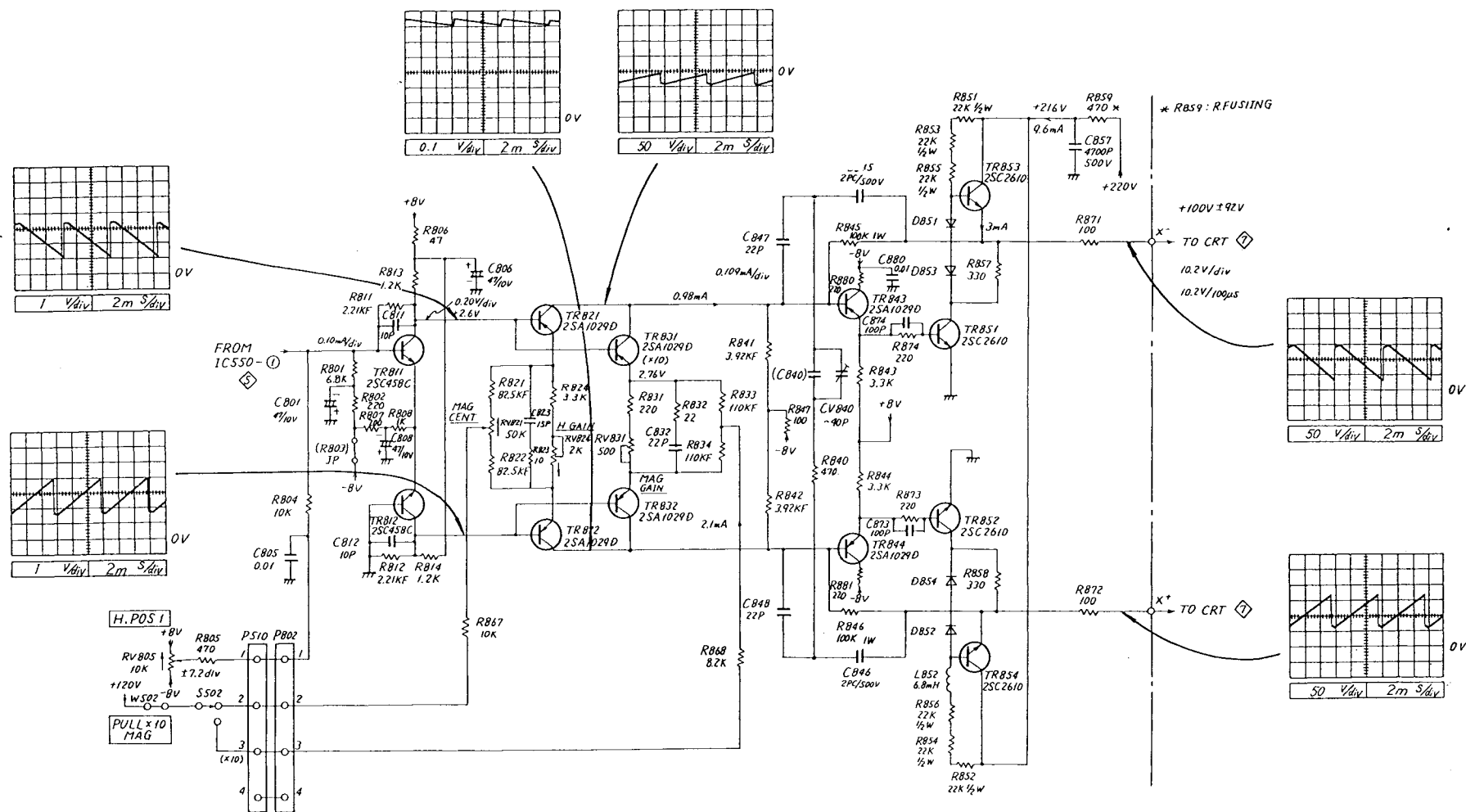
V-211  
V OUT



V-211  
TRIG GEN



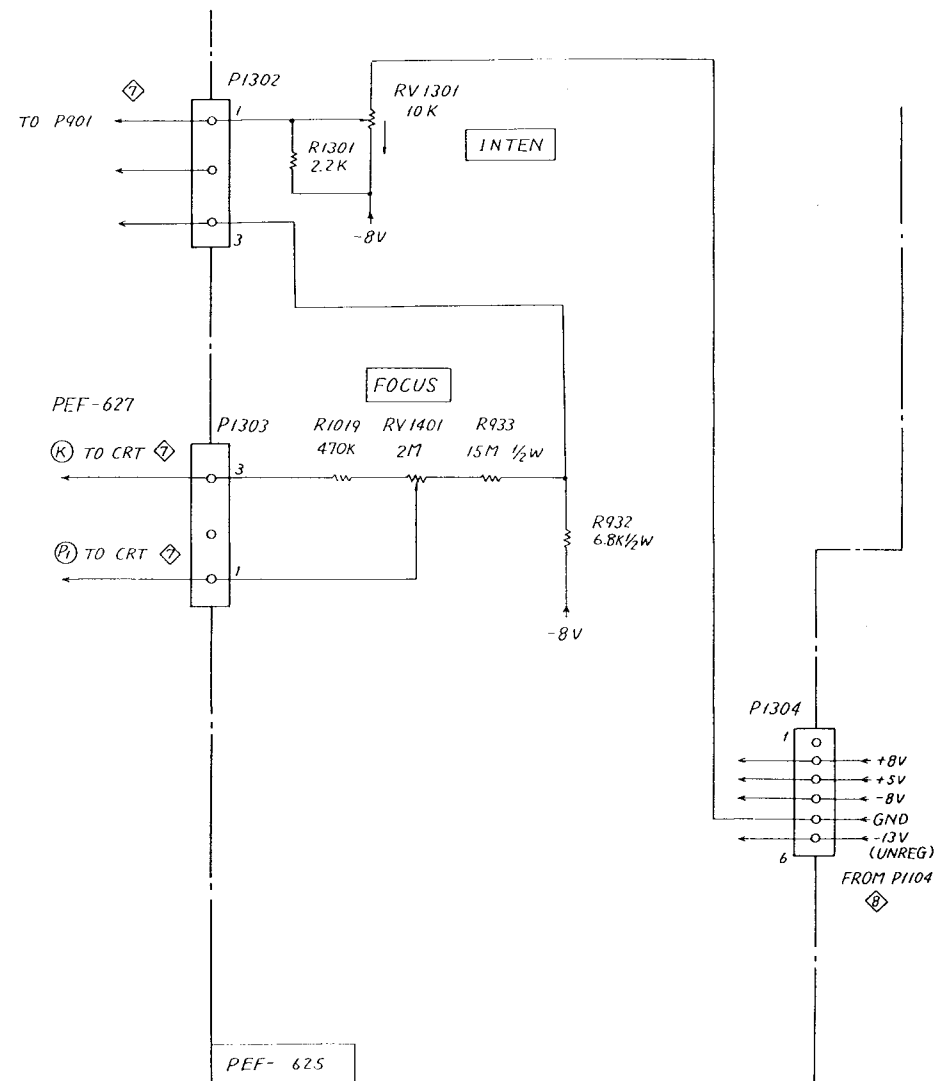
V-211  
SWEEP GEN



V-211  
H AMP

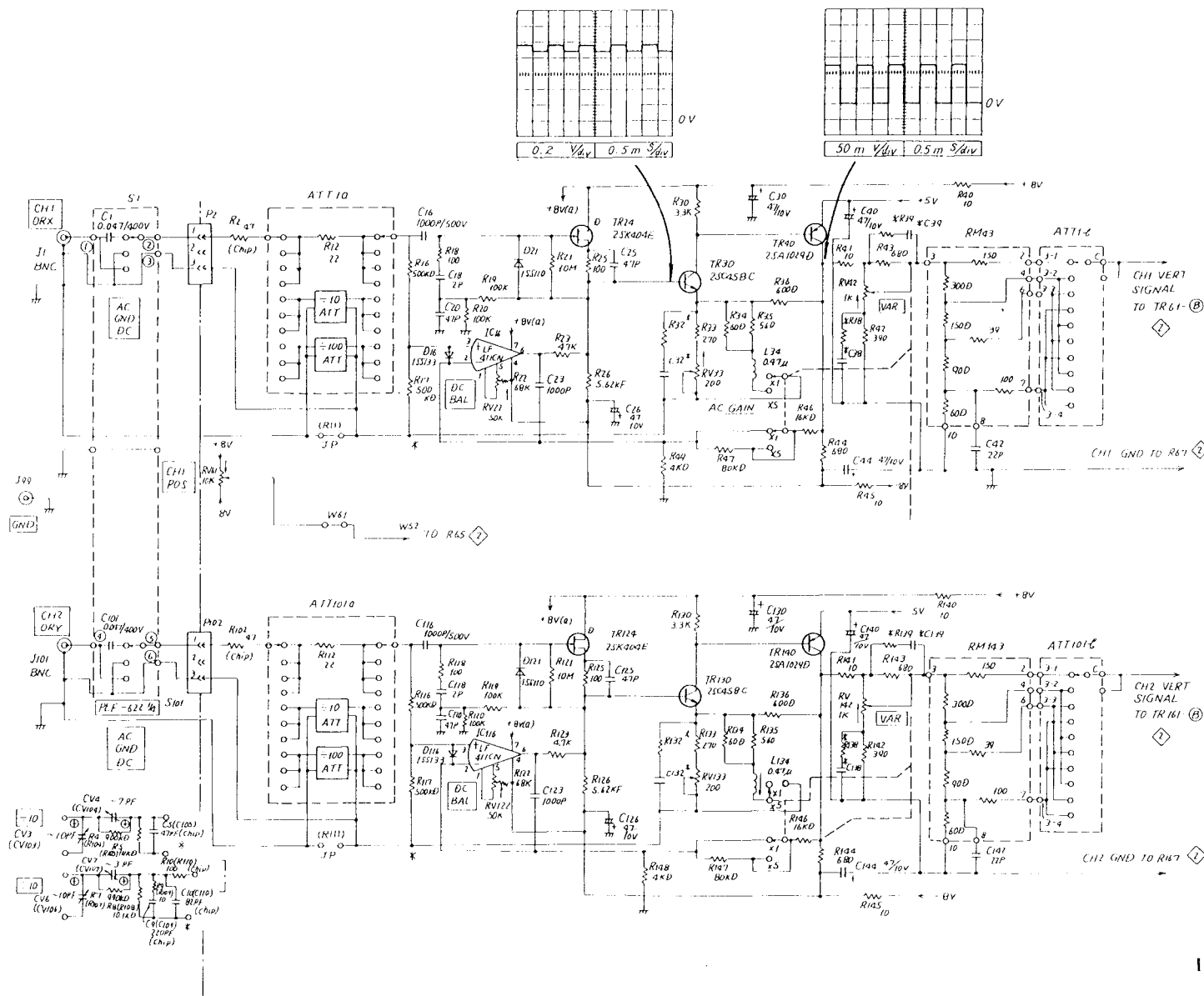






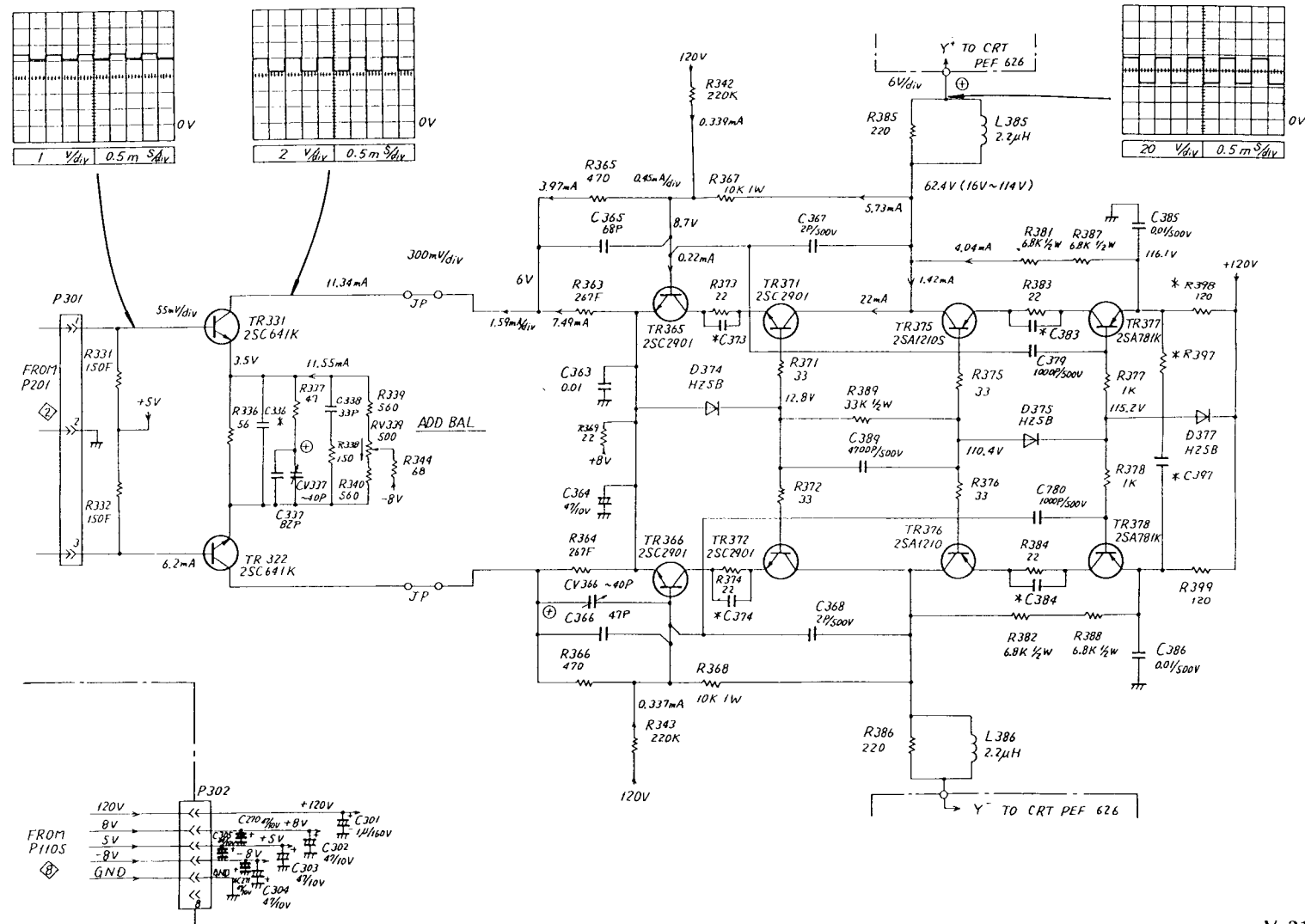
V-211  
RV/LAMP ⑨



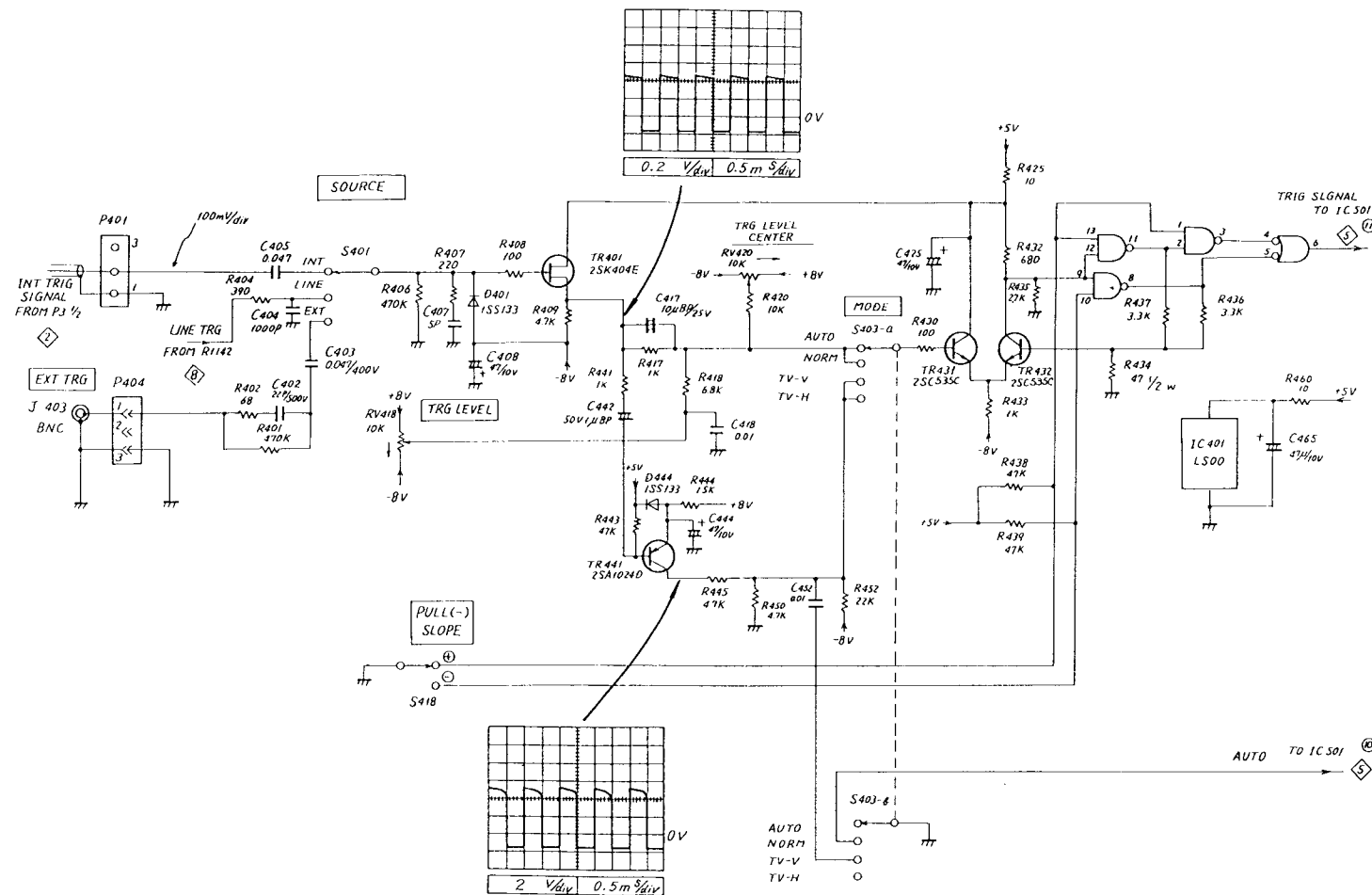


V-212  
INPUT AMP

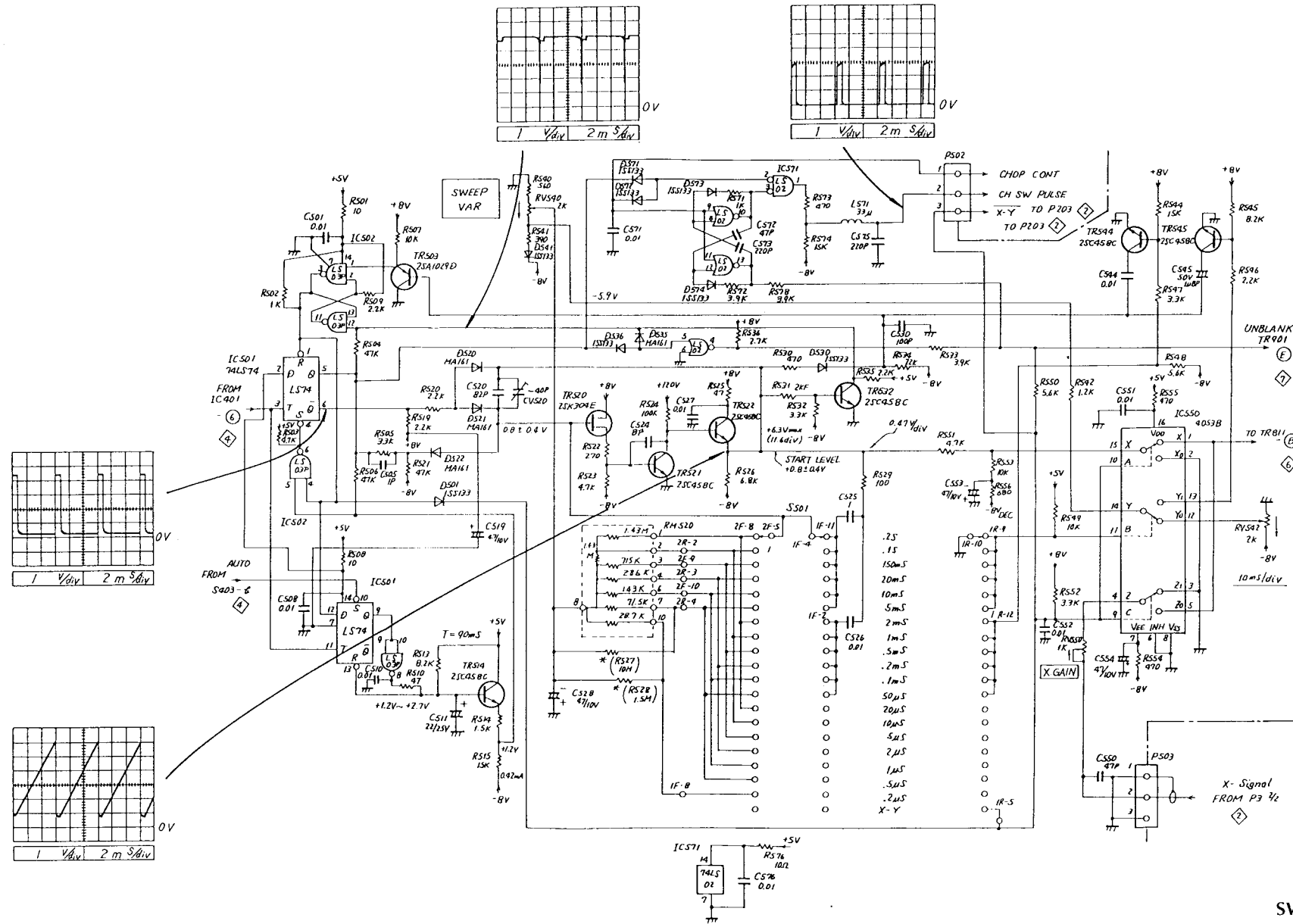




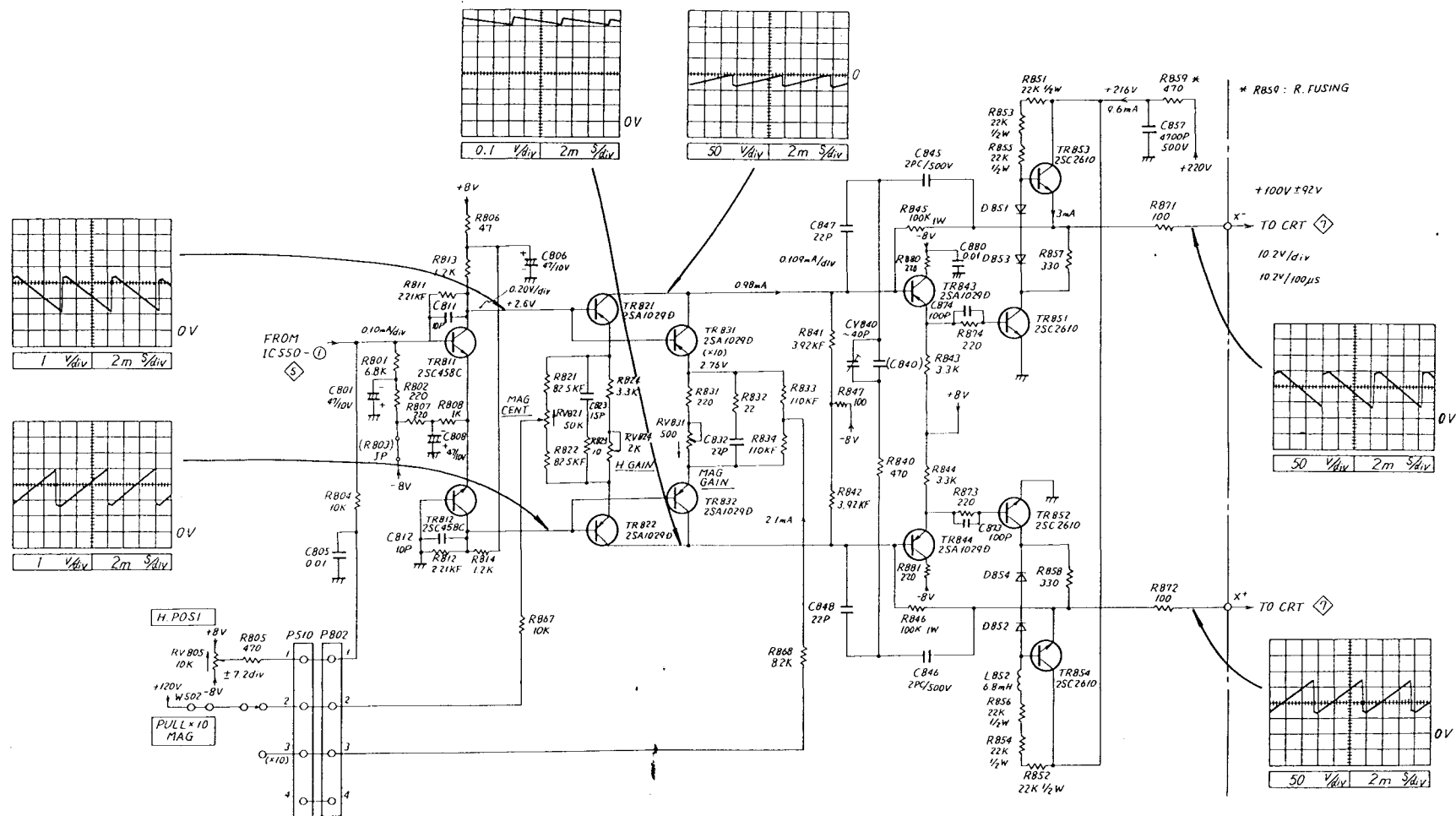
V-212  
V OUT



V-212  
TRIG GEN



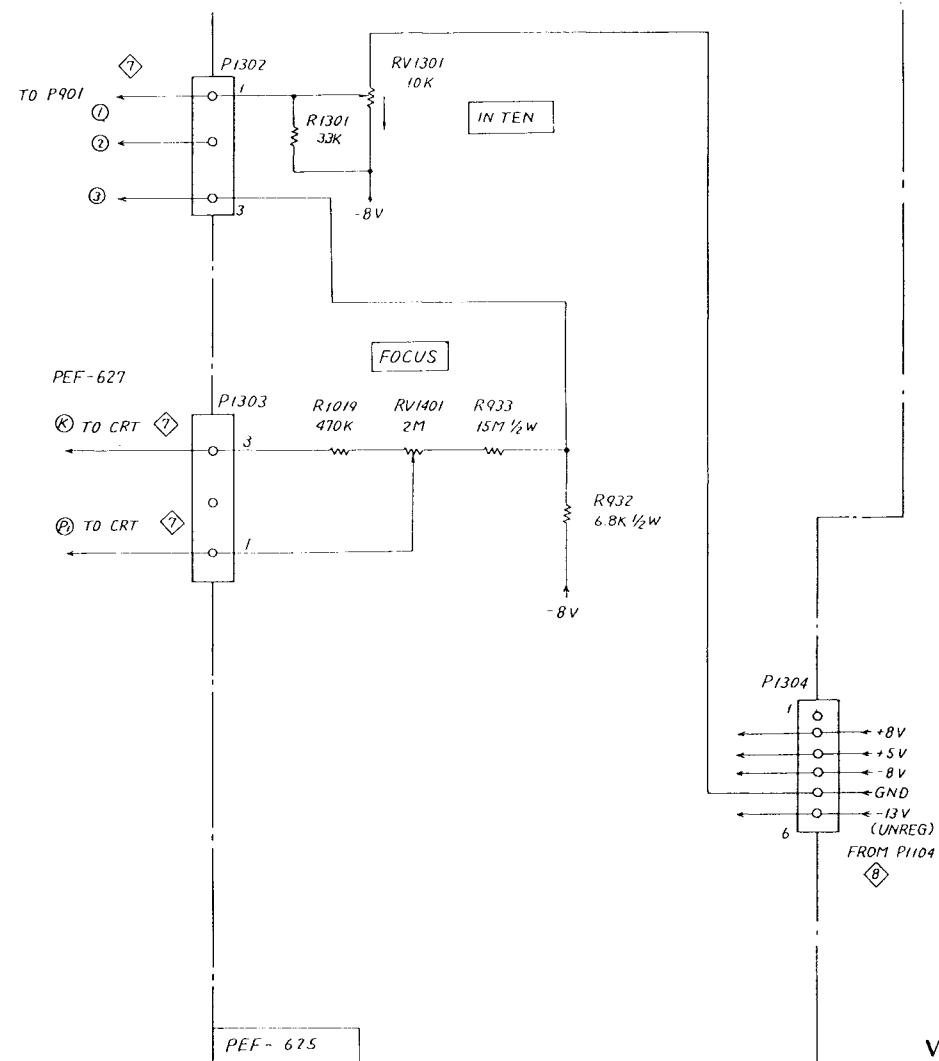
V-212  
SWEEP GEN



V-212  
H AMP

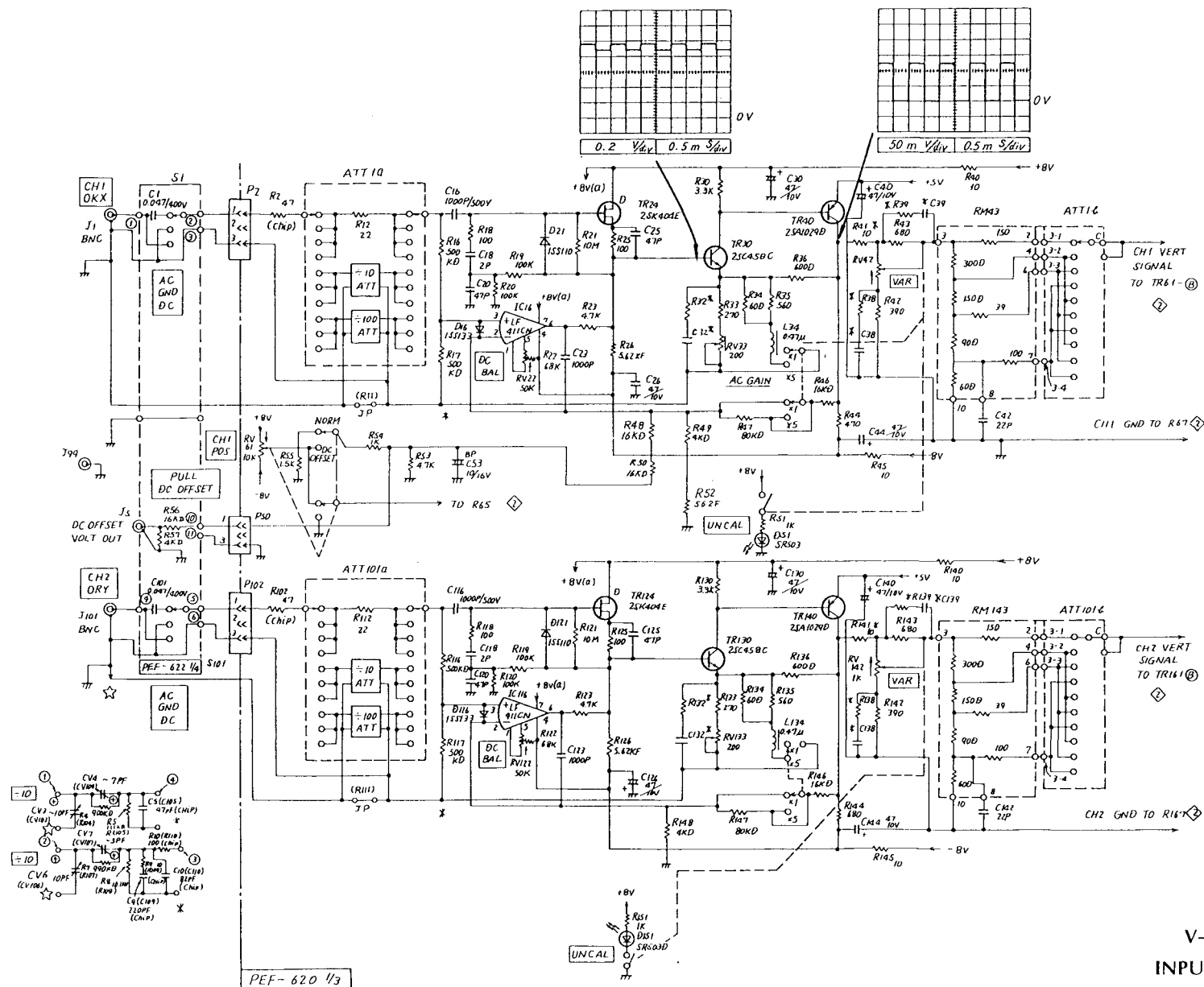




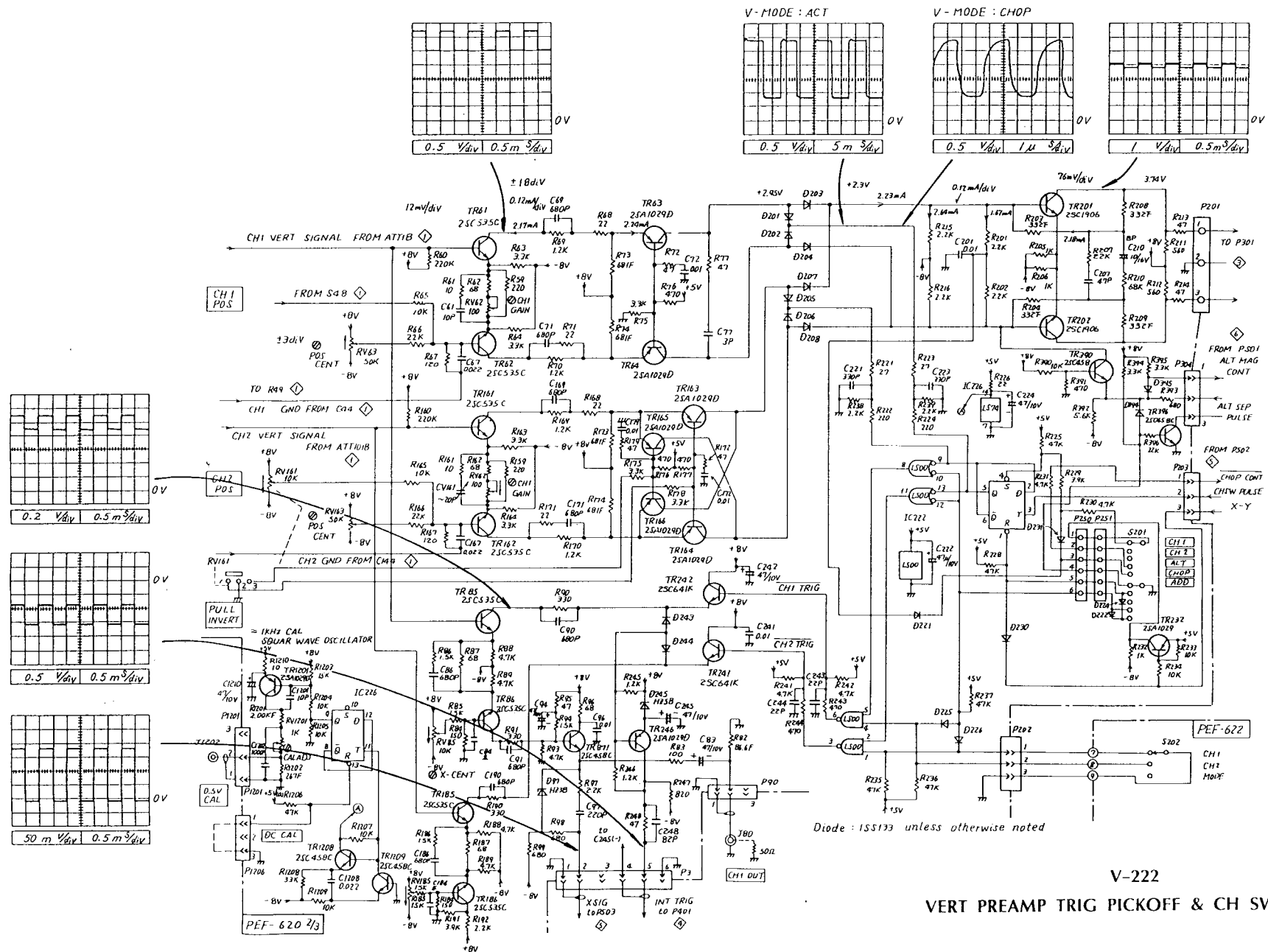


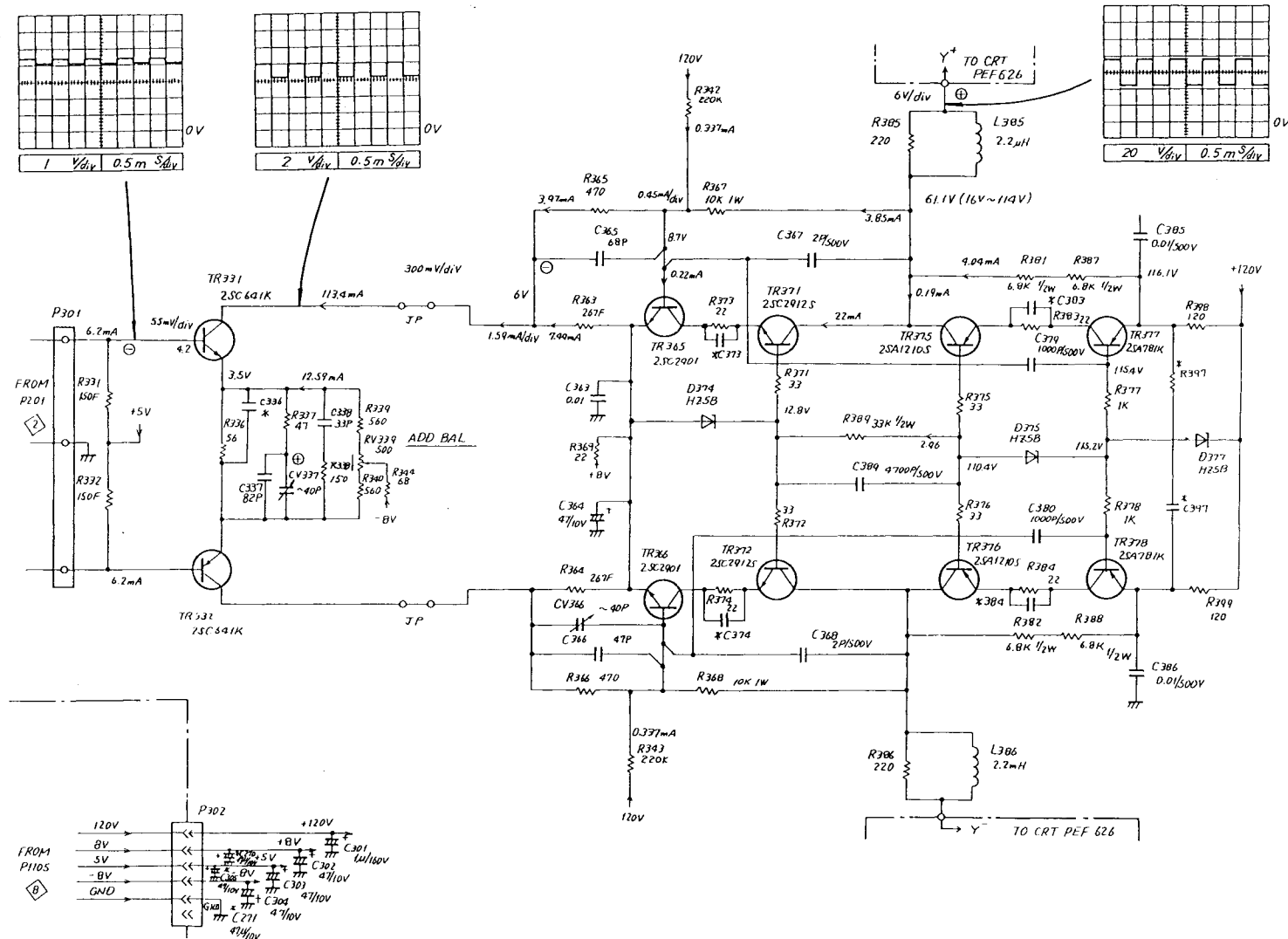
V-212  
RV/LAMP 9



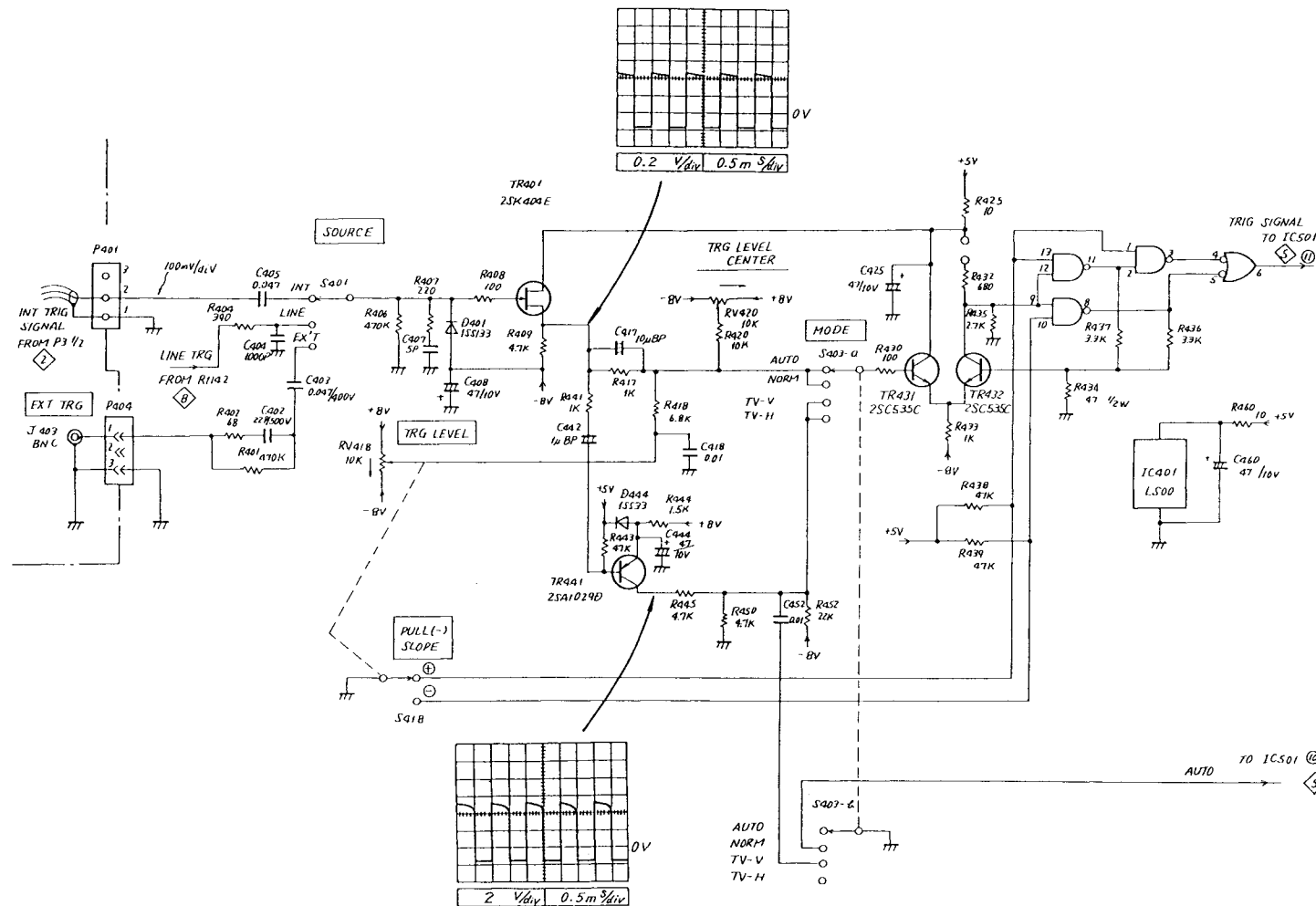


V-222  
INPUT AMP



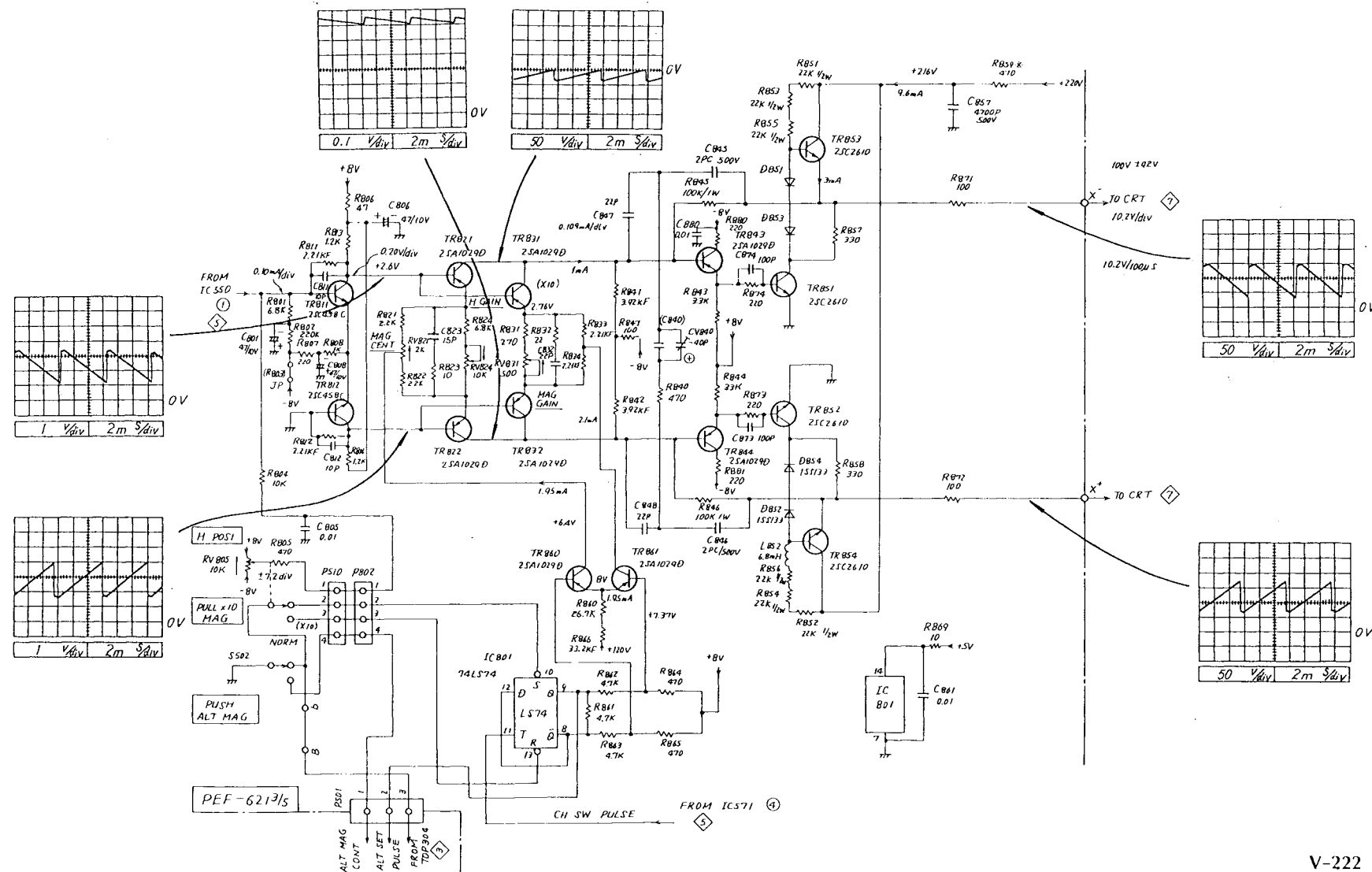


V-222  
V OUT



V-222  
TRIG GEN

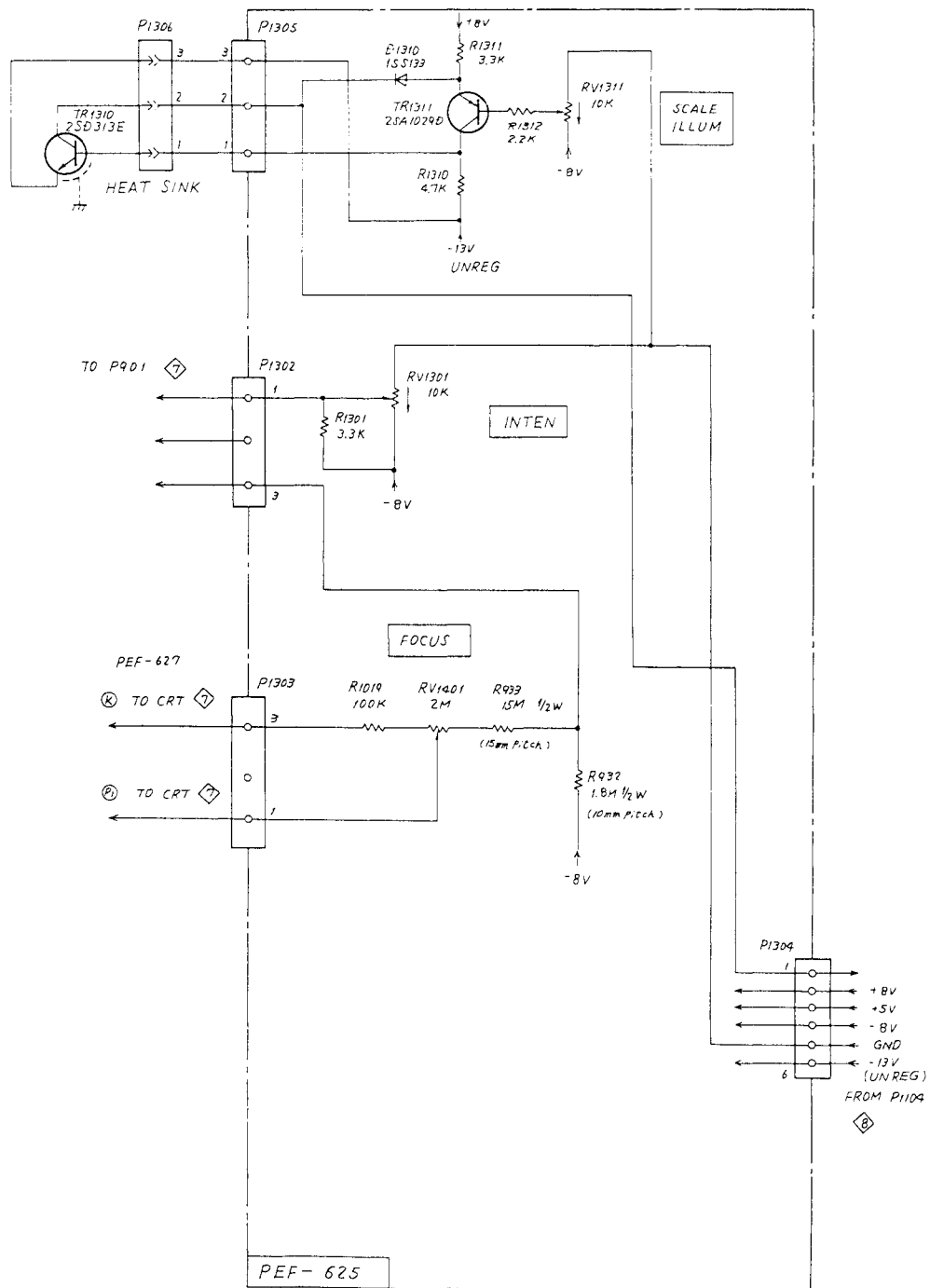




V-222  
H AMP



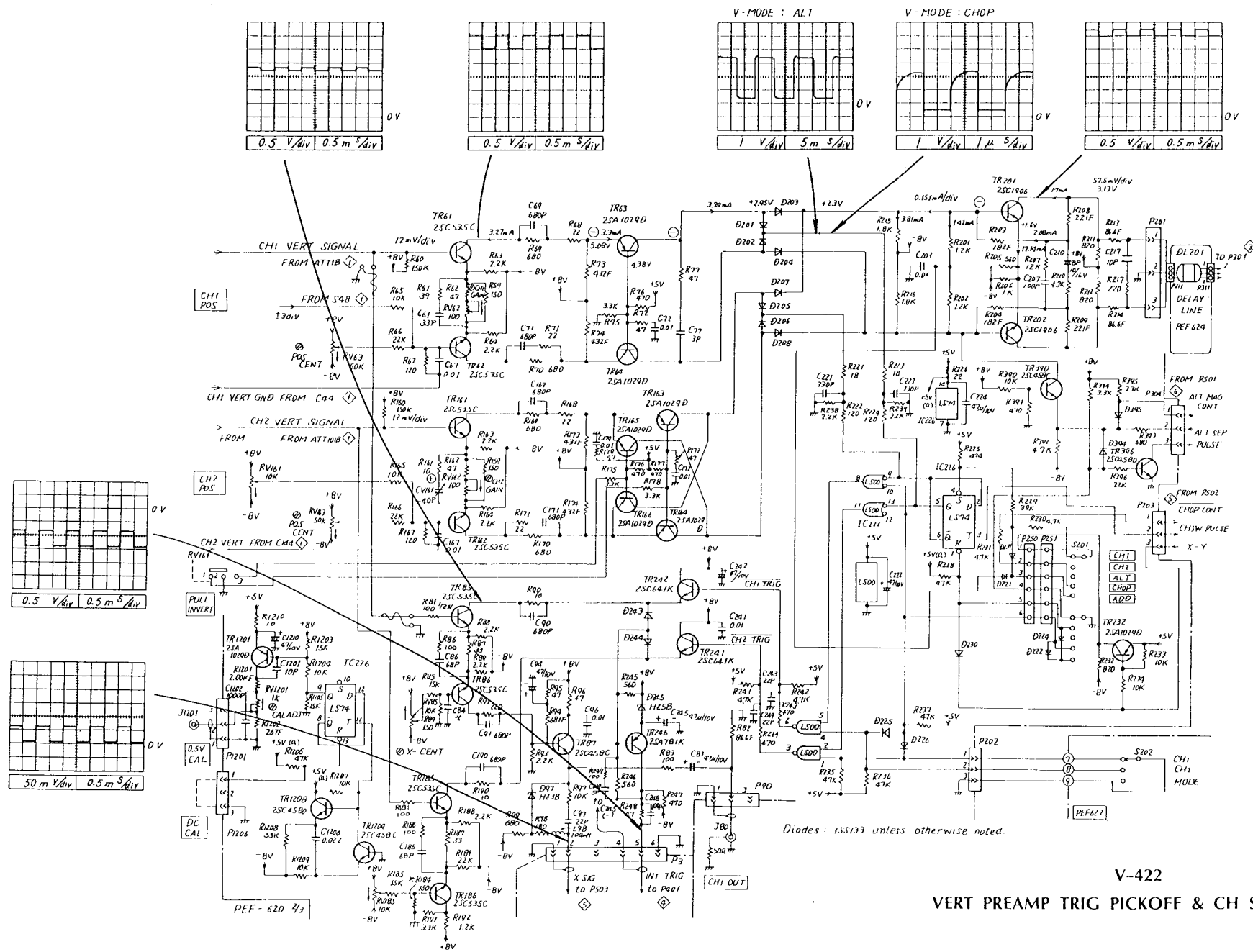




V-222  
RV/LAMP

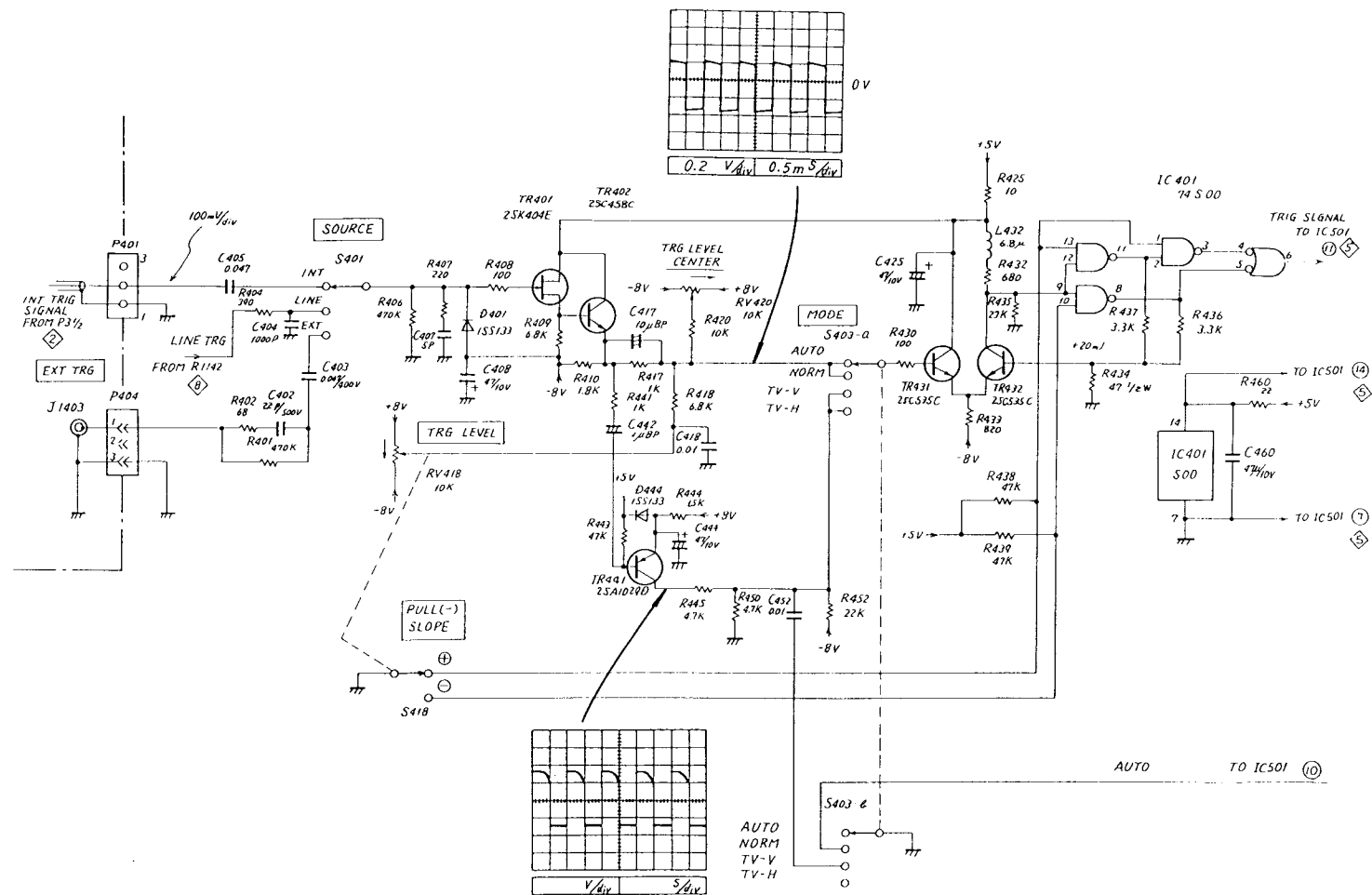




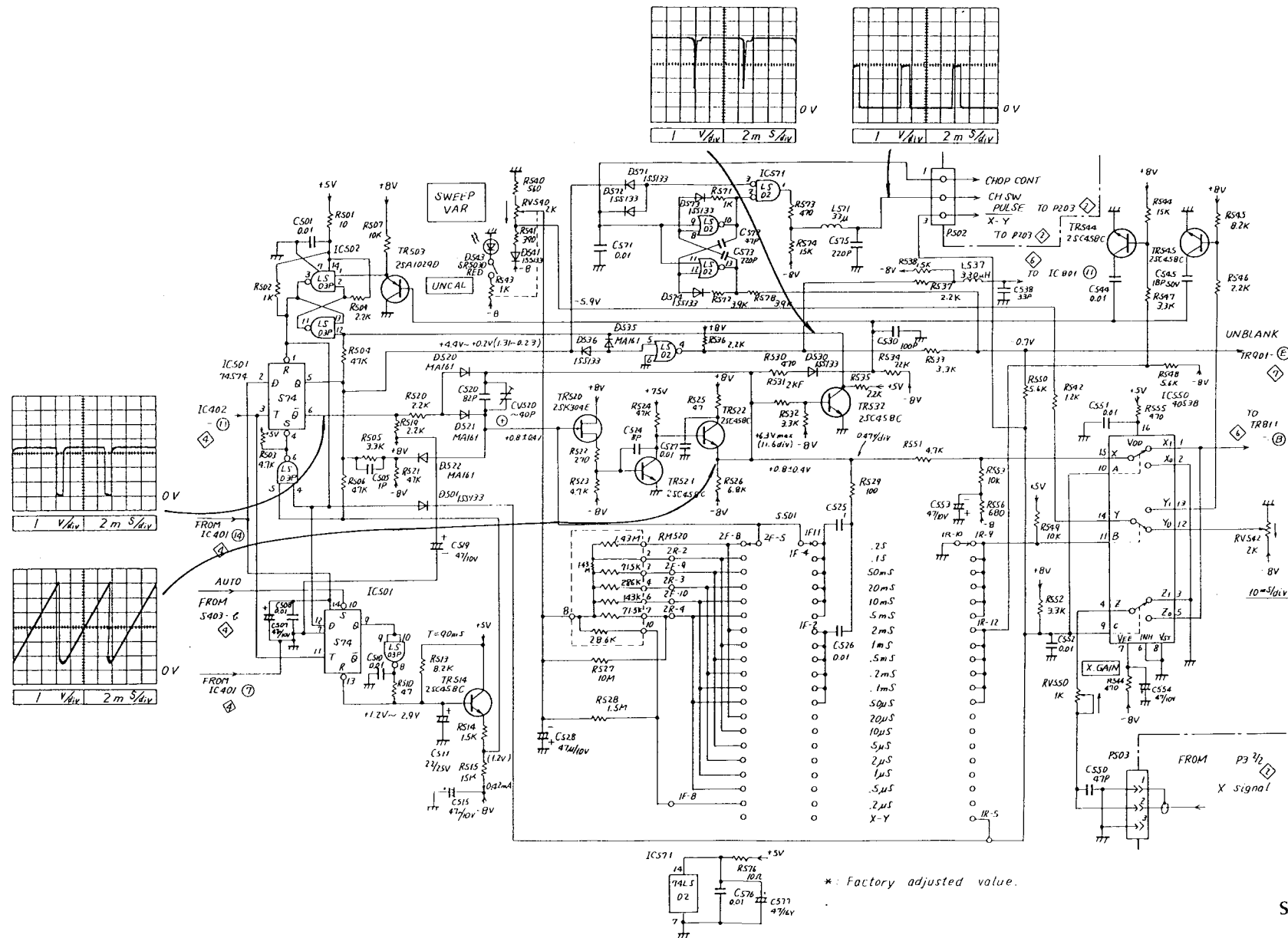


V-422  
VERT PREAMP TRIG PICKOFF & CH SW MULTI

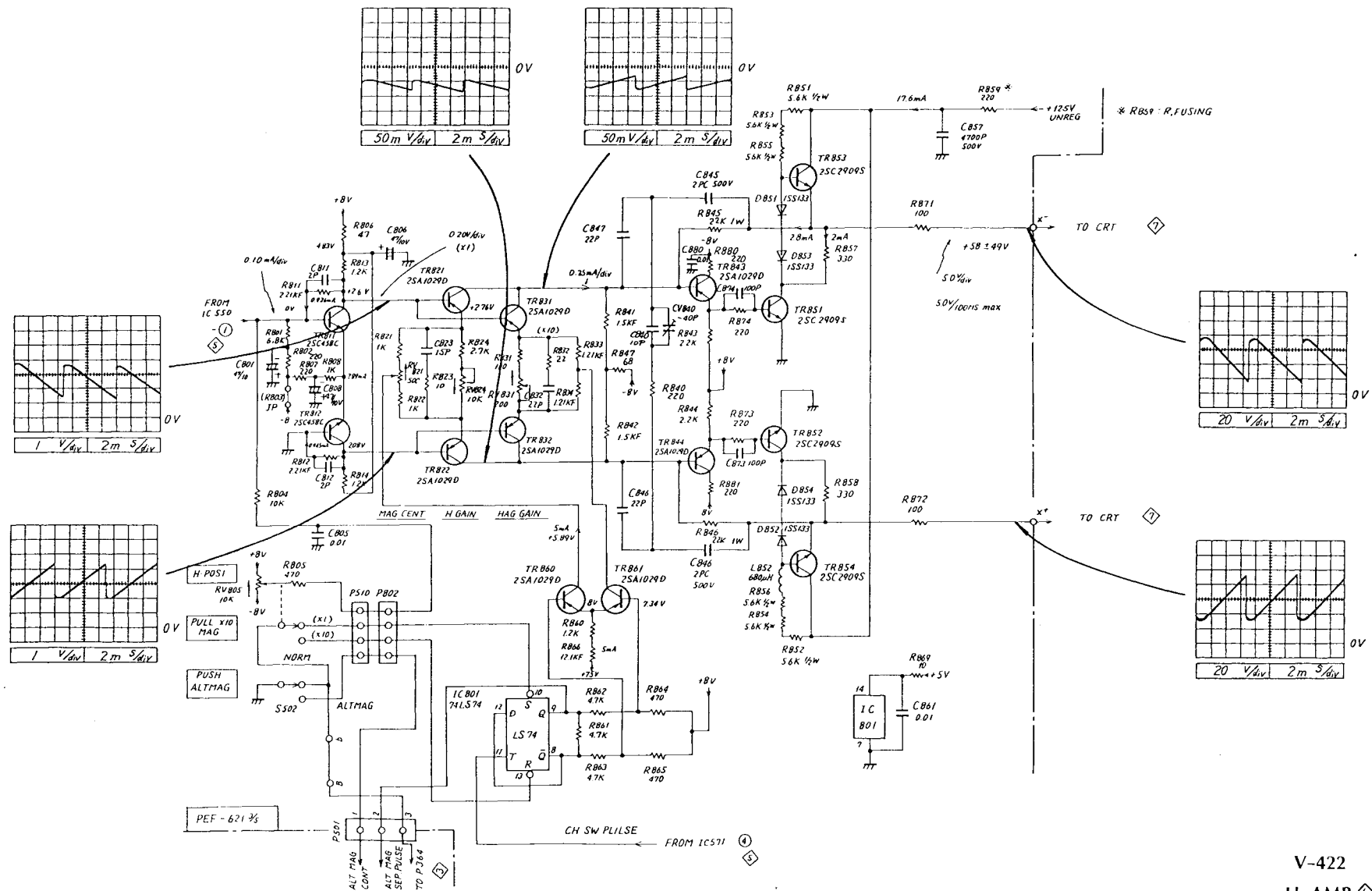




V-422  
TRIG GEN

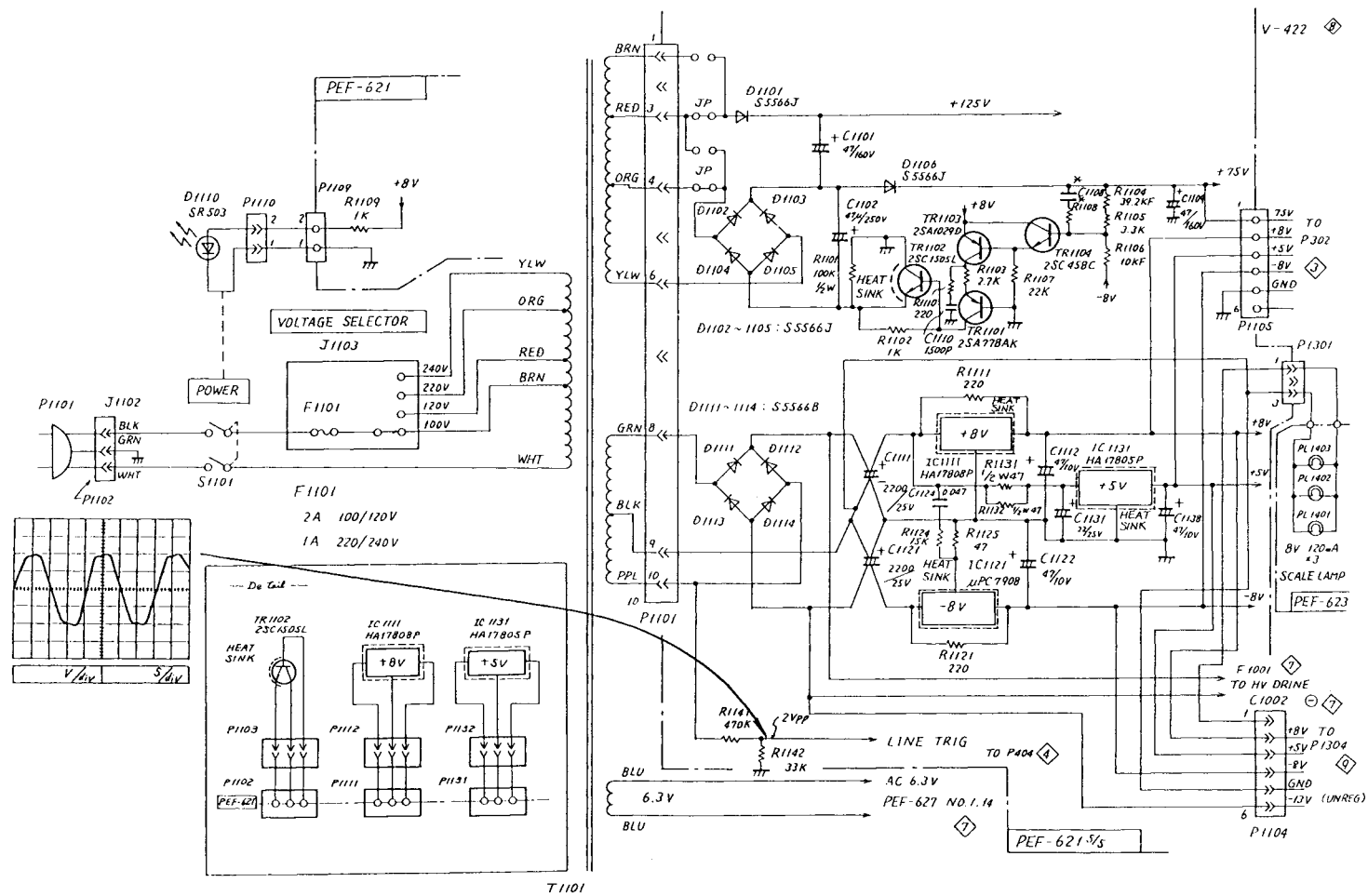


V-422  
SWEEP GEN

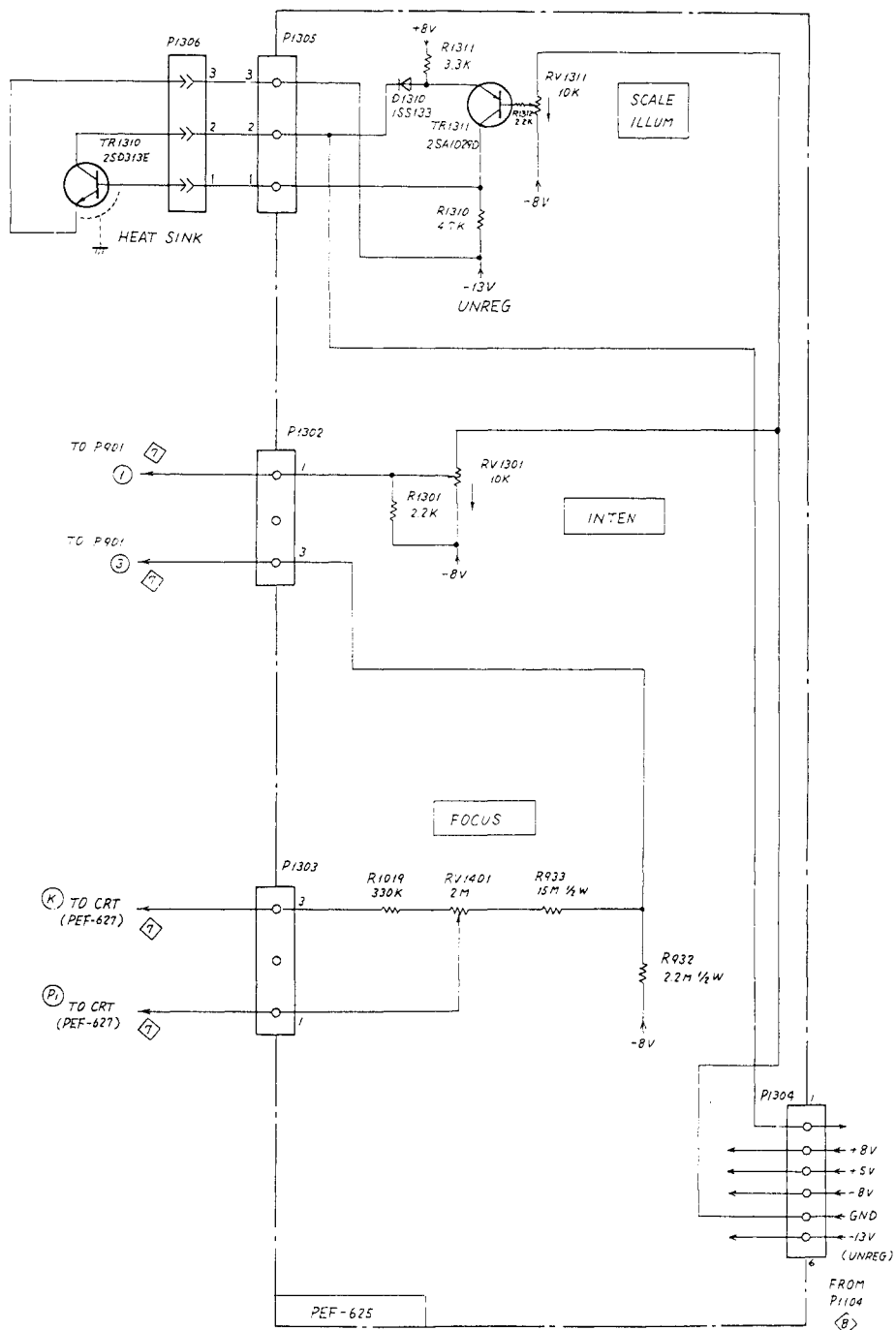


V-422  
H AMP





V-422  
POWER SUPPLY



V-422

RV/LAMP



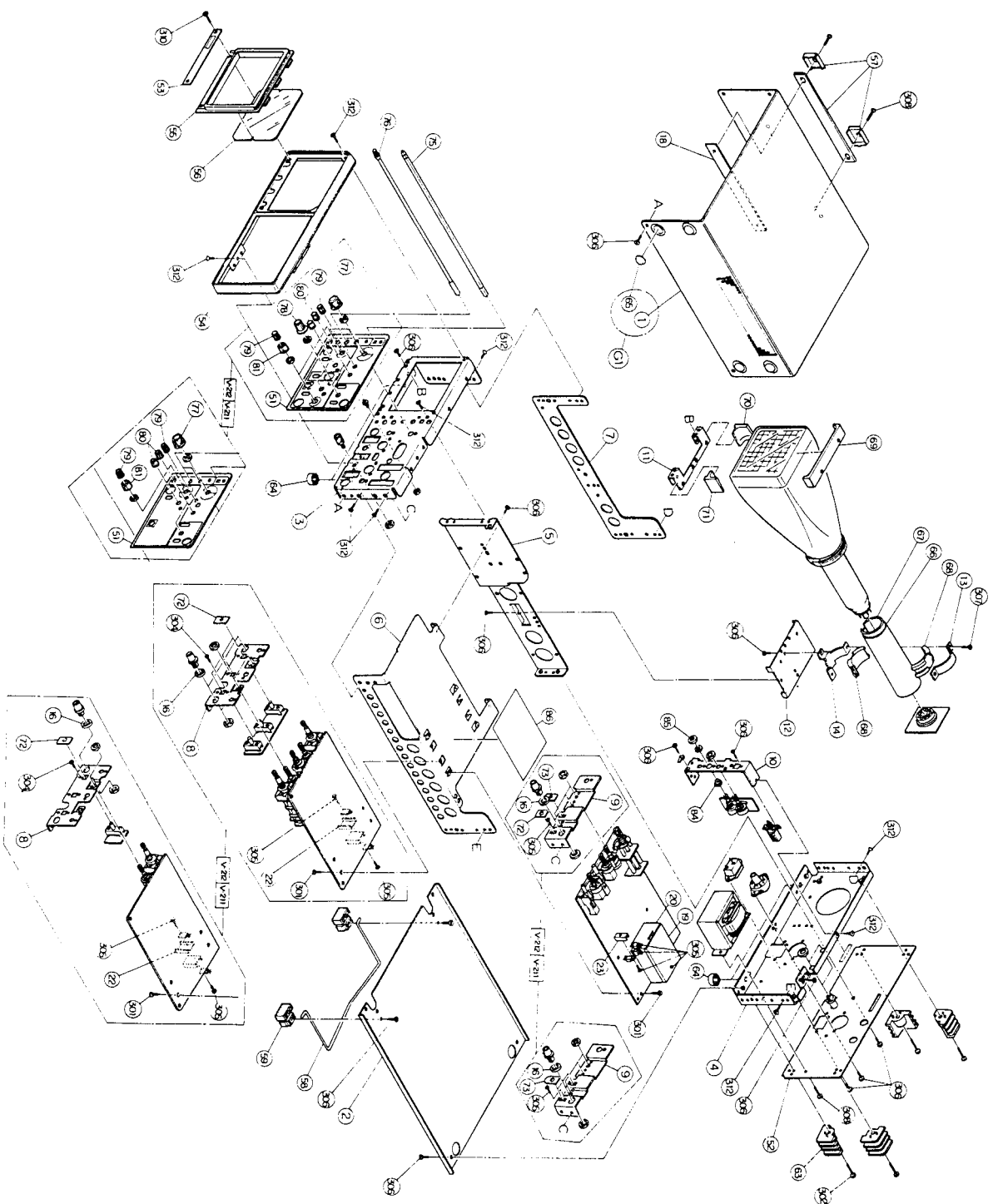
| Part Code   | Symbol | Description       | Qty   |       |
|-------------|--------|-------------------|-------|-------|
|             |        |                   | V-211 | V-212 |
| 8403435A    | G 1    | COVER ASSY        | 1     | 1     |
| 3177955A    | 1      | COVER             | 1     | 1     |
| 3177957A    | 2      | COVER BOTTOM      | 1     | 1     |
| 2105416A    | 3      | CHASSIS FRONT     | 1     | 1     |
| 2105417AA   | 4      | CHASSIS REAR      | 1     | 1     |
| 2105418AA   | 5      | CHASSIS C         | 1     | 1     |
| 2105419AA   | 6      | CHASSIS P         | 1     | 1     |
| 3177958AA   | 7      | CHASSIS L         | 1     | 1     |
| 3177959A    | 8      | BRACKET           | 1     | 1     |
| 3177960A    | 9      | BRACKET           | 1     | 1     |
| 8398471A    | 10     | BRACKET           | 1     | 1     |
| 8398472A    | 11     | BRACKET CRT       | 1     | 1     |
| 8398473A    | 12     | BRACKET CRT       | 1     | 1     |
| 8398474A    | 13     | CRT BAND          | 1     | 1     |
| 8398475A    | 14     | CRT BAND          | 1     | 1     |
| 8398476A    | 15     | NUT PLATE         | 2     | 2     |
| 8398477A    | 16     | SPACER BNC        | 2     | 2     |
| 8399593A    | 18     | PLATE             | 1     | 1     |
| 3180079A    | 19     | SHIELD CASE HV    | 1     | 1     |
| 8400305A    | 20     | SHIELD COVER HV   | 1     | 1     |
| 8405457-59A | 22     | HEAT SINK         | 2     | 2     |
| 8405460A    | 23     | HEAT SINK         | 1     | 1     |
| 3179394A    | 51     | PANEL FRONT       | 1     | -     |
| 3179392A    | 51     | PANEL FRONT       | -     | 1     |
| 3179396A    | 52     | PANEL REAR        | 1     | 1     |
| 8399592A    | 53     | NAME PLATE        | 1     | -     |
| 8399592B    | 53     | NAME PLATE        | -     | 1     |
| 121381A     | 54     | FRONT MASK        | 1     | 1     |
| 2105423A    | 55     | BEZEL             | 1     | 1     |
| 8395445A    | 56     | FILTER            | 1     | 1     |
| 4053616A    | 57     | HANDLE            | 1     | 1     |
| 8398478A    | 58     | STAND             | 1     | 1     |
| 3175129A    | 59     | STAND STOPPER     | 1     | 1     |
|             |        |                   | 1     | 1     |
| 3149317A    | 63     | FOOT              | 4     | 4     |
| 3140755A    | 64     | FOOT              | 4     | 4     |
| 8396865A    | 65     | FOOT              | 4     | 4     |
| 8395432A    | 66     | SHIELD BAND       | 1     | 1     |
| 8396867A    | 67     | RUBBER PLATE      | 1     | 1     |
| 3144055A    | 68     | RUBBER            | 2     | 2     |
| 8395443A    | 69     | RUBBER            | 1     | 1     |
| 8395444A    | 70     | RUBBER            | 1     | 1     |
| 8395444B    | 71     | RUBBER            | 1     | 1     |
| 8396868A    | 72     | SPACER            | 1     | 3     |
| 8396868B    | 73     | SPACER            | 2     | 2     |
| 3180083AA   | 75     | KNOB-PW           | 1     | 1     |
| 3180084AA   | 76     | KNOB-L            | 2     | 2     |
| 3140804B    | 77     | KNOB-S22          | 1     | 1     |
| 3149321B    | 78     | KNOB-S18          | -     | 1     |
| 3149324C    | 79     | KNOB-S18B         | 2     | 3     |
| 3149324D    | 80     | KNOB-S18B         | 3     | 4     |
| 3122681C    | 81     | KNOB-0016         | 1     | 2     |
| 8393786A    | 83     | LABEL             | 1     | 1     |
| 8401613A    | 84     | INSULATOR         | 1     | 1     |
| 8401614A    | 85     | INSULATOR         | 1     | 1     |
| 8401625A    | 86     | PLATE INSULATOR   | 1     | 1     |
| 8383455B    | 87     | SADDLE            | 6     | 6     |
| XCA0661     | 301    | SCREW SEMS 3 x 8  | 10    | 10    |
| 8340167C    | 302    | SCREW SEMS 4 x 20 | 4     | 4     |
| XCA6005     | 304    | SCREW 2.6 x 5     | 2     | 1     |
| XCA6306     | 305    | SCREW 3 x 6       | 2     | 6     |
| XCA6308     | 306    | SCREW x 8         | 32    | 32    |
| XCA6316     | 307    | SCREW 3 x 16      | 2     | 2     |

| Part Code | Symbol | Description      | Qty   |       |
|-----------|--------|------------------|-------|-------|
|           |        |                  | V-211 | V-212 |
| XCA6412   | G 308  | SCREW 4 x 12     | 4     | 4     |
| XCA1820   | 310    | SCREW 3 x 10     | 2     | 2     |
| XCA7306   | 312    | SCREW FLAT 3 x 6 | 19    | 19    |

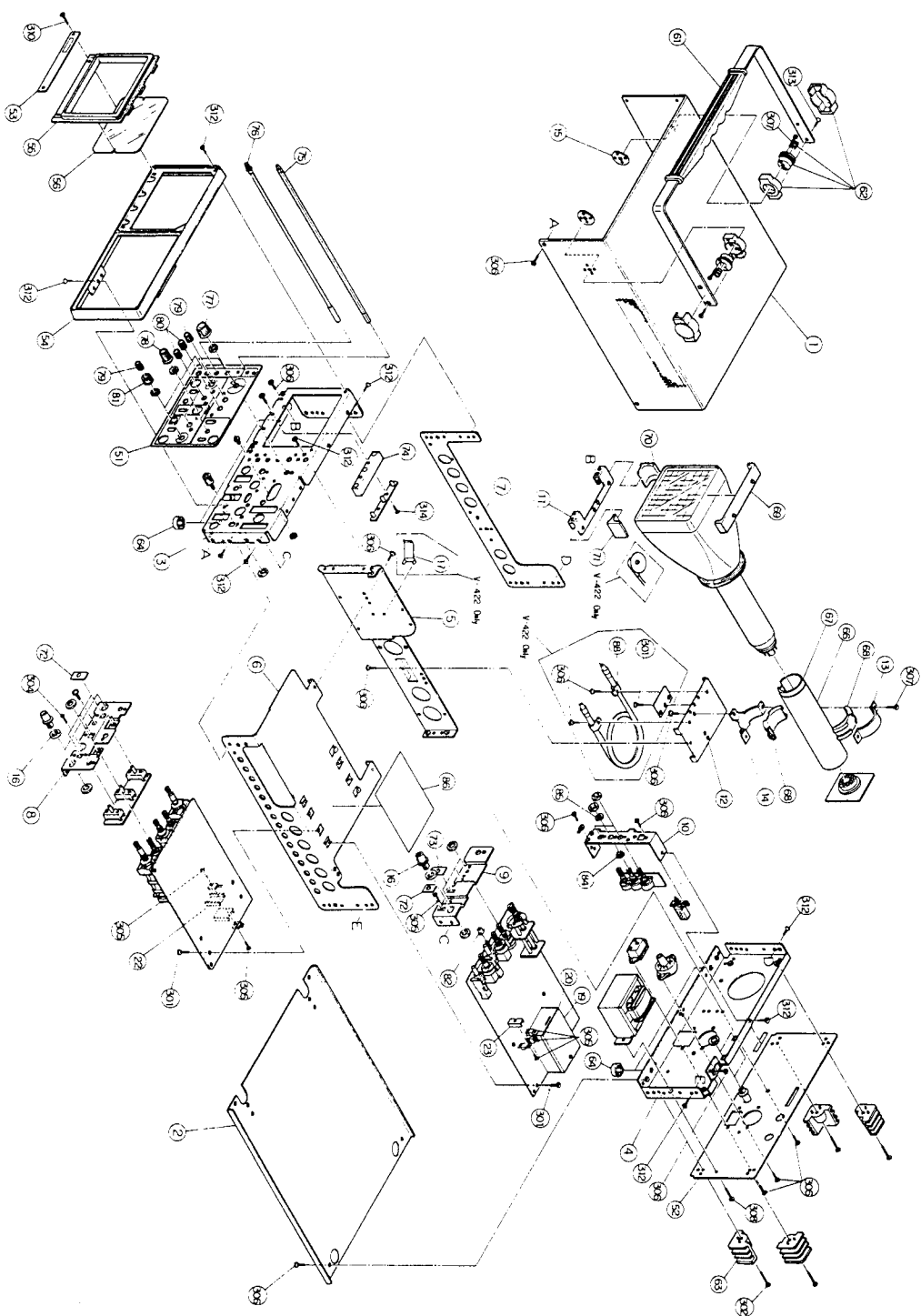
# V-222/V-422

| Part Code   | Symbol | Description       | Qty   |       |
|-------------|--------|-------------------|-------|-------|
|             |        |                   | V-422 | V-222 |
| 3177956A    | 1      | COVER             | 1     | 1     |
| 3177957A    | 2      | COVER BOTTOM      | 1     | 1     |
| 2105416A    | 3      | CHASSIS FRONT     | 1     | 1     |
| 2105417AA   | 4      | CHASSIS REAR      | 1     | 1     |
| 2105418AA   | 5      | CHASSIS C         | 1     | 1     |
| 2105419AA   | 6      | CHASSIS P         | 1     | 1     |
| 3177958AA   | 7      | CHASSIS L         | 1     | 1     |
| 3177959A    | 8      | BRACKET           | 1     | 1     |
| 3177960A    | 9      | BRACKET           | 1     | 1     |
| 8398471A    | 10     | BRACKET           | 1     | 1     |
| 8398472A    | 11     | BRACKET CRT       | 1     | 1     |
| 8398473A    | 12     | BRACKET CRT       | 1     | 1     |
| 8398474A    | 13     | CRT BAND          | 1     | 1     |
| 8398475A    | 14     | CRT BAND          | 1     | 1     |
| 8398476A    | 15     | NUT PLATE         | 2     | 2     |
| 8398477A    | 16     | SPACER BNC        | 3     | 3     |
| 8398479A    | 17     | EARTH SPRING      | 1     | -     |
| 3180079A    | 19     | SHIELD CASE HV    | 1     | 1     |
| 8400305A    | 20     | SHIELD COVER HV   | 1     | 1     |
| 8405457-59A | 22     | HEAT SINK         | 2     | 2     |
| 8405460A    | 23     | HEAT SINK         | 1     | 1     |
| 3179392C    | 51     | PANEL FRONT       | 1     | -     |
| 3179392B    | 51     | PANEL FRONT       | -     | 1     |
| 3179396A    | 52     | PANEL REAR        | 1     | 1     |
| 8399592D    | 53     | NAME PLATE        | 1     | -     |
| 8399592C    | 53     | NAME PLATE        | -     | 1     |
| 121381A     | 54     | FRONT MASK        | 1     | 1     |
| 2105423A    | 55     | BEZEL             | 1     | 1     |
| 8395445A    | 56     | FILTER            | 1     | 1     |
| 3177922A    | 61     | HANDLE            | 1     | 1     |
| 8377076A    | 62     | HANDLE STOPPER    | 1     | 1     |
| 3149317A    | 63     | FOOT              | 4     | 4     |
| 3140755A    | 64     | FOOT              | 4     | 4     |
| 8395432B    | 66     | SHIELD BAND       | 1     | -     |
| 8395432A    | 66     | SHIELD BAND       | -     | 1     |
| 8396867B    | 67     | RUBBER PLATE      | 1     | -     |
| 8396967A    | 67     | RUBBER PLATE      | -     | 1     |
| 3144055A    | 68     | RUBBER            | 2     | 2     |
| 8395443A    | 69     | RUBBER            | 1     | 1     |
| 8395444A    | 70     | RUBBER            | 1     | 1     |
| 8395444B    | 71     | RUBBER            | 1     | 1     |
| 8396868A    | 72     | SPACER            | 3     | 3     |
| 8396868B    | 73     | SPACER            | 2     | 2     |
| 8395431A    | 74     | PLATE LAMP GUIDE  | 1     | 1     |
| 3180083AA   | 75     | KNOB-PW           | 1     | 1     |
| 3180084AA   | 76     | KNOB-L            | 3     | 3     |
| 3140804B    | 77     | KNOB-S22          | 1     | 1     |
| 3149321B    | 78     | KNOB-S18          | 1     | 1     |
| 3149324C    | 79     | KNOB-S18B         | 3     | 3     |
| 3149324D    | 80     | KNOB-S18B         | 4     | 4     |
| 3122681C    | 81     | KNOB-0016         | 2     | 2     |
| 8383451A    | 82     | KNOB-SW           | 1     | 1     |
| 8393786A    | 83     | LABEL             | 1     | 1     |
| 8401613A    | 84     | INSULATOR         | 1     | 1     |
| 8401614A    | 85     | INSULATOR         | 1     | 1     |
| 8401625A    | 86     | PLATE INSULATOR   | 1     | 1     |
| 8383455B    | 87     | SADDLE            | 7     | 6     |
| 4124935C    | 88     | CLIP              | 2     | -     |
| XCA0661     | 301    | SCREW SEMS 3 x 8  | 10    | 10    |
| 8340167C    | 302    | SCREW SEMS 4 x 20 | 4     | 4     |
| XCA6005     | 304    | SCREW 2.6 x 5     | 1     | 1     |
| XCA6306     | 305    | SCREW 3 x 6       | 6     | 6     |
| XCA6308     | 306    | SCREW 3 x 8       | 28    | 28    |

| Part Code | Symbol | Description             | Qty   |       |
|-----------|--------|-------------------------|-------|-------|
|           |        |                         | V-422 | V-222 |
| XCA6316   | 307    | SCREW 3 x 16            | 6     | 6     |
| XCA6412   | 308    | SCREW 4 x 12            | 2     | 2     |
| XCA1820   | 310    | SCREW 3 x 10            | 2     | 2     |
| XCA7306   | 312    | SCREW FLAT 3 x 6        | 19    | 19    |
| XCA7410   | 313    | SCREW FLAT 4 x 10       | 4     | 4     |
| XCA0251   | 314    | SCREW PAN 3 x 8 PLASTIC | 2     | 2     |



V-211/V-212  
EXPLODED VIEW



V-222/V-422  
EXPLODED VIEW