

KENWOOD

APU-0008

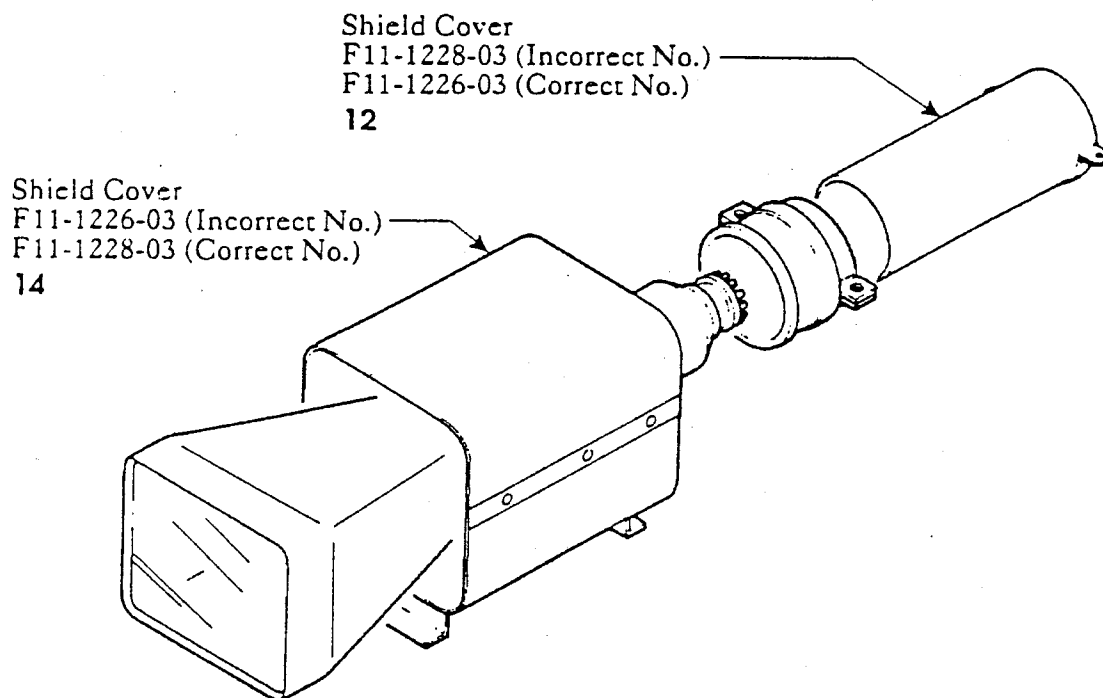
Publication Update

Amateur Radio Division

Subject: SM-230 Service Manual

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The part numbers for item number 12 and 14 are incorrect in the exploded view provided on page number 15 of the service manual (B51-8027-00 ©1989-9). Please make the changes noted below to the **EXPLODED VIEW** on page number 15 of this manual. The part numbers listed in the **PARTS LIST** on pages 7 and 8 of this manual are correct and do not need to be changed.



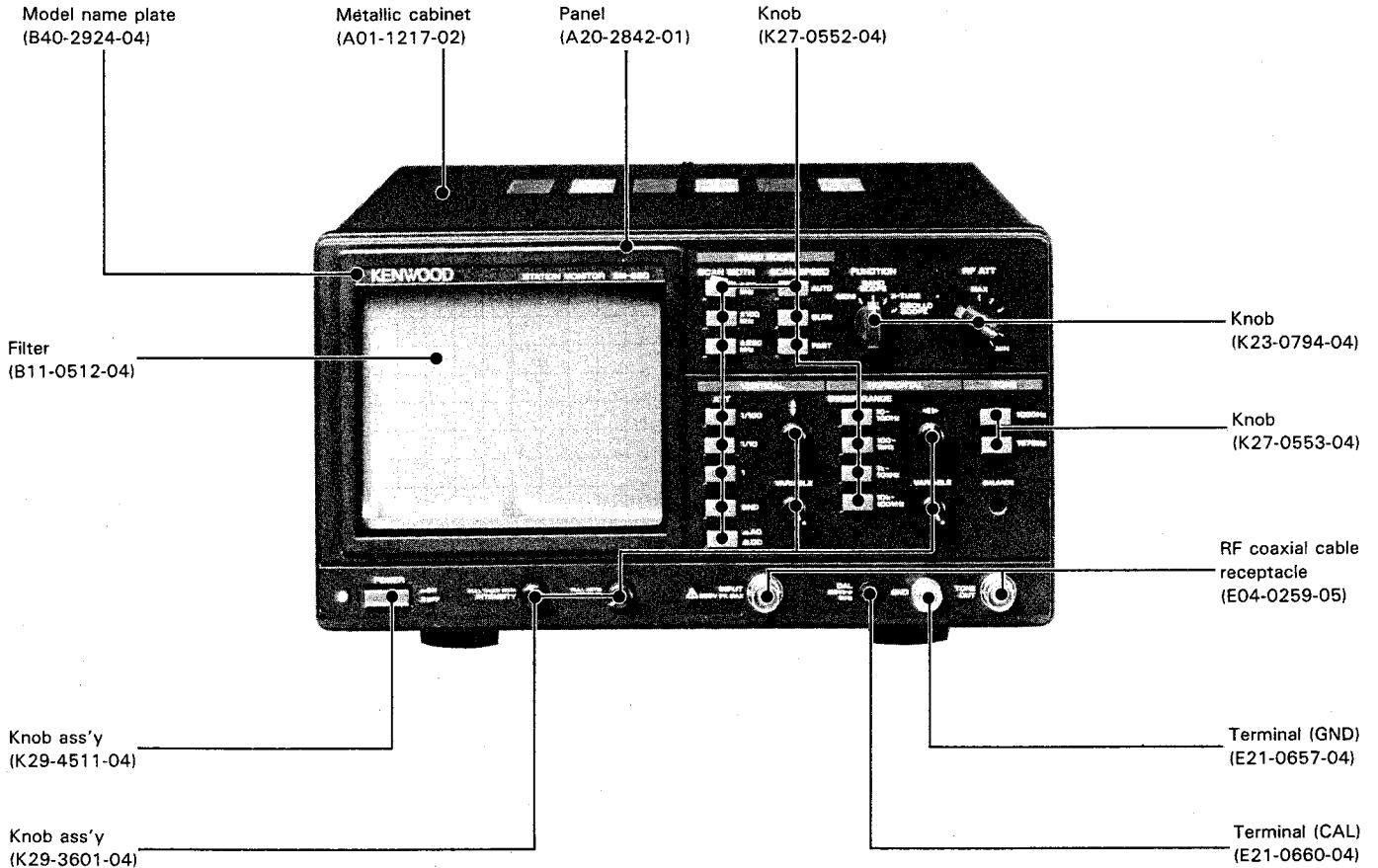
STATION MONITOR

SM-230

SERVICE MANUAL

KENWOOD

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CIRCUIT DESCRIPTION

• Oscilloscope input circuit and preamplifier (X57-1870-00)

When the unit is used as an oscilloscope, the input signal applied to the INPUT BNC socket on the panel is input to the vertical power supply unit (X73-1870-00). The signal passes through the input signal ground circuit, consisting of an AC-DC switching circuit with relays K1 and K2, and is input to the attenuation circuit.

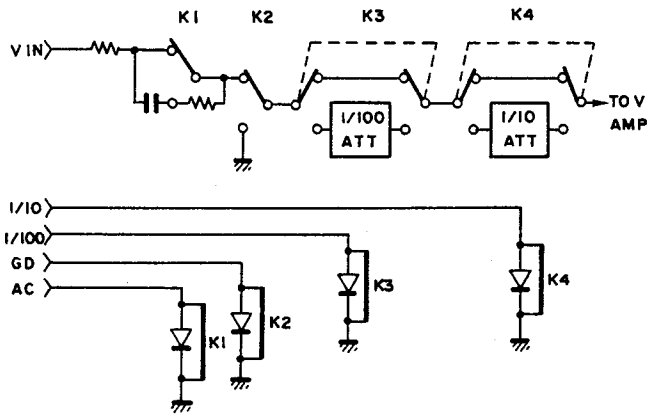


Figure 1

The attenuation circuit has two attenuators connected in series, each with two attenuation ratios. The first attenuator switches between 1/1 and 1/100, and supplies -10 V to the relay only when the ratio is 1/100. The second attenuator switches between 1/1 and 1/10, and supplies -10 V to the relay only when the ratio is 1/10.

After the signal has passed through the attenuation circuit, it is applied to the source follower of U1a. U1 is a constant current load source follower with a dual FET to reduce the DC offset and temperature drift. Q1 is connected to a diode to protect against large negative amplitudes. The signal output from the source follower is attenuated by the vertical potentiometer on the panel and input to the preamplifier, consisting of Q2, Q3, Q5, and U2b, where Q2 is an emitter follower. The high frequency component is amplified by Q3 and the low frequency component is amplified by U2b (feed forward configuration). The signal is output to the final amplifier of the horizontal unit (X74-1510-00) via Q5. U2a used for a band scope, receives signals from the logarithmic amplifier of the horizontal unit. Since relay K2 is forcibly grounded at this time, signals input to the oscilloscope are not transferred to the preamplifier.

• Constant-voltage stabilizing circuit (X73-1870-00)

The stabilizing power supply produces $+5$ V, ± 10 V, and $+140$ V. Each supply consists of an operational amplifier and control transistor. The ± 10 V supply is generated from non-stabilized 13 V, $+140$ V is generated from non-stabilized 170 V, and $+5$ V is generated from non-stabilized $+10$ V. For ± 10 V and $+140$ V, bleeder resistors R101, R107, and R117 are connected in parallel to reduce the power consumption of the control transistors.

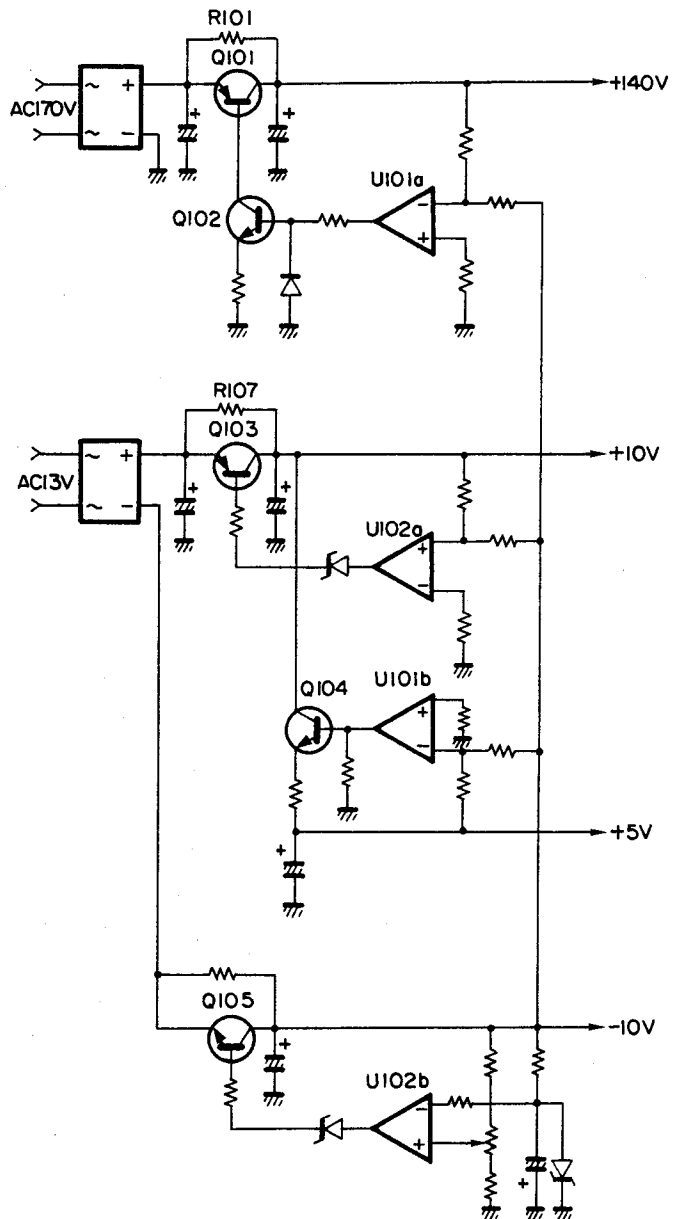


Figure 2

CIRCUIT DESCRIPTION

• High-voltage circuit and blanking (X73-1870-00)

The high-voltage circuit contains an oscillation section consisting of Q153, Q154, and T151, a high voltage generation section consisting of T151 and W151, and a control section consisting of U151b. The negative voltage determined by the ratio of the resistance of R168 and R170 to the resistance of R176 is output to C of W151 for the +10 V supply. W151 is a high-voltage rectification block providing double voltage rectification.

Q151, Q152, and R151 to R162 form a focus circuit. The focus can be adjusted by changing the potential of P1 of the CRT using the focus potentiometer on the panel. The unblanking signal from the sweep gate of the horizontal unit (X74-1510-00) is amplified by Q155, DC-reproduced to the potential based on the CRT cathode potential by C159 to C161, and input to the first grid of the CRT.

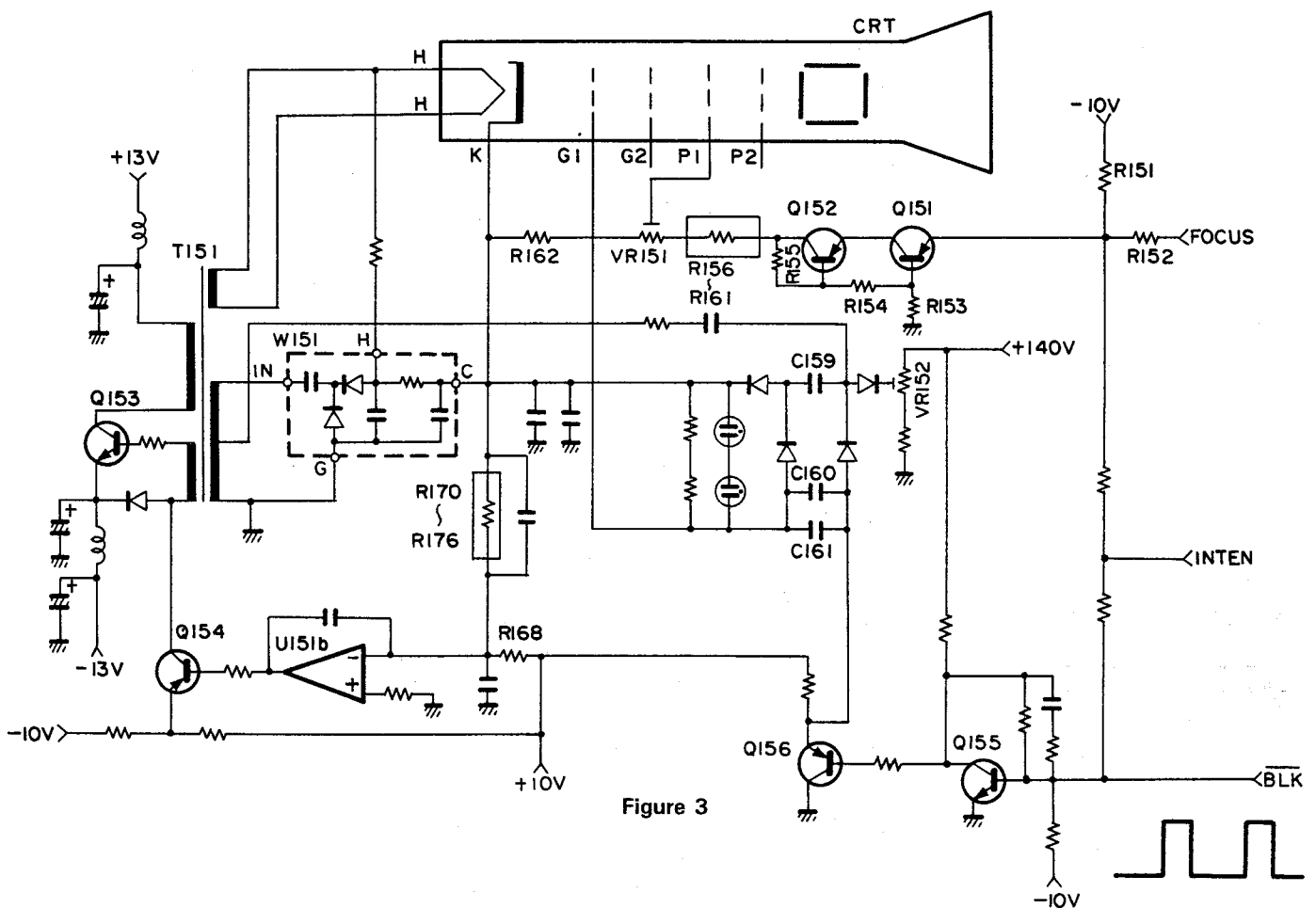


Figure 3

• Vertical final amplifier (X74-1510-00)

The vertical signal of the oscilloscope and band scope is output from the vertical unit, passes through P4, and is input to the base of Q101. Q101 to Q108 have differential configuration, and amplify according to the ratio of resistances between R112 and R113 and the Q101 and Q102 emitters. Q101, Q102, Q105, and Q106 are used for amplification, and Q103 and Q104 are used for impedance conversion.

The output is directed to the $\pm Y$ deflector from P16. In the X-TUNE mode, the SPACE signal selected by the U6b is applied to the base of Q102.

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CIRCUIT DESCRIPTION

• Trigger sweep circuit (X74-1510-00)

The trigger signal for the oscilloscope is taken from the preamplifier and applied to the base of Q1. The trigger signal for the monitor is applied to the base of Q3 via the RF input detection circuit. Either the oscilloscope input or the monitor input is selected as a trigger signal by the switching actions of Q2 and Q4. The selected signal passes through Q5 and Q6 and is applied to the clamp amplifier, Q7. The output is rectified by the Schmit circuit, U1a and b, and further applied to flipflop U2a for sweep gate generation and to the auto circuit Q8 and Q9. This sweep gate uses the output (Q) inverted to the sweep start level by the CK input in the trigger wait state, the auto circuit output which detects whether there is a trigger signal, and the sweep end signal and the hold-off end signal as Set and Reset input; output is from U2a.

This output is directed to U1b. For X-TUNE, U1b stops sweeping. The output from U1b is applied to the base of transistors Q10 and Q20 to discharge the sweep capacitor, running and stopping the saw-tooth waves.

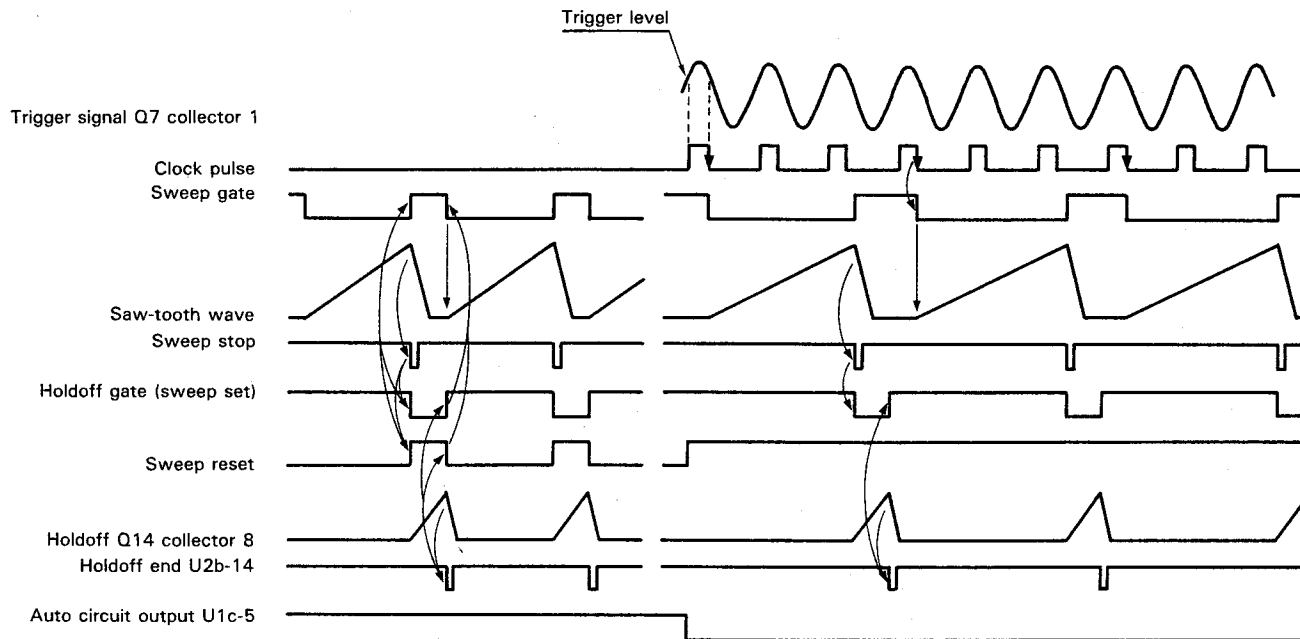
The sweep circuit is based on the constant-current system. The reference generated by R33 and R34 is controlled, and

the power supply in the panel unit and the voltage applied to the resistor for the sweep time constant connected to the above emitter are stabilized to supply a constant current to capacitors C7 and C20.

U5a, Q11, and C7 form a circuit that generates saw-tooth waves for the horizontal axis in the oscilloscope mode, and U5b, Q19, and C20 form a circuit that generates saw-tooth waves for the horizontal axis in the bandscope mode. These circuits are switched by U6a.

The saw-tooth wave output is applied to source follower U3 for impedance conversion from the analog switch U6a.

The output from U3 is applied to the horizontal final amplifier, the VCO for frequency sweeping in the bandscope mode, and the sweep end point detection circuit, Q13. The output from Q13 is passed through U2b, and the sweep end signal is sent to U2a. U2b, Q14, and Q15 form a single stable multi-vibrator to use the holdoff signal to assure the down time of the sweep saw-tooth signals. The sweep gate output (U1d) is directed to the vertical unit as an unblanking signal.



• Horizontal final amplifier (X74-1510-00)

Q16 and Q17 form a differential amplifier circuit. The saw-tooth wave is applied to the base of Q16. In the oscilloscope and bandscope mode, the DC level is applied to the base of Q17 as the horizontal position. In the bandscope mode, Q18 is turned on to suppress the variable amount of the horizontal position. In X-TUNE mode, the MARK signal of the X-TUNE selected by the analog switch U6b is applied to the base of Q17.

• Bandscope VCO (X74-1510-00)

The offset (scan width balance) and gain (scan width) of the saw-tooth wave output from U3 are adjusted by U203a. R204, R205, and R257 are selected by the attenuator for band width selection and analog switching, and the amplitude of the saw-tooth wave is attenuated.

The saw-tooth wave is output as a bias for the varicap diode, U203b. For the oscillation circuit, the oscillation frequency is determined by the varicap diode capacitance, fixed capacity, and coil value.

CIRCUIT DESCRIPTION

● Bandscope mix circuit and logarithmic amplifier (X74-1510-00)

The IF signal of the transmitter is input from P12 and passed through the necessary band (8.83 MHz band) by the tuning coil, T201. This output is applied to G1 of the dual gate FET of Q202, and mixed with the bandscope VCO which is input to G2. Only the 455 kHz component is output. The signal is then passed through the source follower of Q203, logarithmic amplifier Q204 and Q205, emitter follower Q206, and logarithmic amplifier Q207 and Q208.

The signal is passed through the detection diodes D211 and D212 from Q209, and fed to U201a. The output from U201 is ground when the oscilloscope mode is selected by the analog switch. In the bandscope mode, the output from D213 is directed to the vertical power supply unit.

● Intensity marker circuit (X74-1510-00)

The saw-tooth wave output from U3 applied to U202a and U202b with different offsets, and the wind comparator output is obtained. This output is directed to the vertical power supply unit as an unblanking signal.

● X-TUNE amplifier (X74-1510-00)

X-TUNE is applied from the RCA pin on the rear. The MARK signal is passed through the amplifier U302b, converted into a position signal for sweeping by U6b, and applied to the horizontal final amplifier of Q17.

The SPACE signal is passed through the amplifier U302a, converted into a vertical position signal by U6b, and selected and applied to the final unit, Q102.

● TWO-TUNE (X74-1510-00)

A 1000 Hz signal is generated by the Wein bridge oscillator U301b and 1575 Hz is generated by the Wein bridge oscillator U301a.

● CAL circuit (X69-1160-00)

The 1 kHz square wave oscillation circuit contains U1a.

● Panel unit switch and potentiometer (X69-1160-00)

S1 to S3 are scan width selection switches. Signals are output as scan width data by the analog switch U201b of the horizontal unit (X74-1510-00) and the DIN plug from the rear. S4 to S6, S2b, and S3b are scan speed selection switches. Each switch changes the resistance for the sweep time constant, and signals are applied to U5b and Q19 of the horizontal unit. They form a constant-current circuit.

S7 to S9 are attenuators for the oscilloscope mode and are used for switching relays K3 and K4.

S10 is a ground select signal for the oscilloscope mode and is used for relay K2 switching.

S11 is an AC/DC switching signal for the oscilloscope mode and is used for relay K1 switching.

S12 to S15 are sweep speed select switches for the oscilloscope and monitor modes. Each switch selects a resistor, and is applied to U5a and Q11. They form a constant-current circuit. S16 and S17 are on/off switches for 1000 Hz and 1575 Hz TWO-TUNE.

VR1 is a horizontal position potentiometer controlling input to Q102 via the analog switch of the horizontal unit U6b.

VR2 is a vertical potentiometer controlling input to the preamplifier of the vertical power supply unit.

VR3 is a horizontal position potentiometer for signals passed through the horizontal unit U6b and input to Q17.

VR4 is a horizontal potentiometer for signals passed through the buffer of U2a and input to the S12 to S15 switches.

● Monitor circuit

The RF signal is input from the M type plug on the rear, passed through the capacitor and resistor for signal pickup, and input to the rotary switch S1. It is attenuated by the capacitor, input to the CRT as a Y signal, and passed through the detection circuit and input to the trigger input of the horizontal unit.

The RF input has a surge absorber.

PARTS LIST

SEMICONDUCTOR

N: New Parts

| Item | Remarks | Parts NO. |
|-------------|---------|--------------------|
| Diode | | 1S1587 |
| | | 1SR35-200 |
| | | 1SS83 |
| | | 1SS132 |
| | | 1SV50 |
| | N | S1VB20 |
| | N | S1VB60 |
| | N | DSA-102MA MA700 |
| Zener diode | | MTZ10JC |
| | | MTZ5.1JB |
| Thermister | | 112-102-2 |
| | | 112-103-2 |
| Transistor | N | 2SA1091 |
| | N | 2SA1156 |
| | | 2SA1175 |
| | | 2SA1206 |
| | N | 2SA1207 |
| | N | 2SA1209 |
| | | 2SA684 |
| | N | 2SB1133 |
| | | 2SC1384 |
| | N | 2SC2271 |
| | N | 2SC2785 |
| | N | 2SC2909 |
| | N | 2SC3315 |
| | N | 2SC3732 |
| | N | 2SC3779 |
| | | 2SD1666 |
| | 2SD613 | |
| FET | N | 2SK332 |
| | | 2SK389 |
| | N | 2SK404 |
| | | 3SK73 |
| IC | | NJM072BS |
| | | NJM4558D |
| | | SN74LS112AN |
| | | SN74LSOON |
| | N | TC082CP |
| | | TC4053BP |

PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnes dans le Parts No. ne sont pas fournis.


Telle ohne Parts No. werden nicht geliefert.

| Ref. No. | Address | New Parts | Parts No. | Description | Destination | Remarks |
|---------------|---------|-----------|--------------|--------------------------------|-------------|---------|
| 参照番号 | 位置 | 新 | 部品番号 | 部品名 / 規格 | 仕向 | 備考 |
| SM-230 | | | | | | |
| 1 | 1B | * | A01-1217-02 | METALLIC CABINET | | |
| 2 | 2A | * | A20-2842-01 | PANEL | | |
| | | * | B42-3684-04 | LABEL (S/N0) | K | |
| | | * | B42-3685-04 | LABEL (S/N0) | MW | |
| 3 | 2A | * | B11-0512-04 | FILTER | | |
| 4 | 2A | * | B40-2924-04 | MODEL NAME PLATE | | |
| - | | | B46-0410-20 | WARRANTY CARD | K | |
| - | | | B46-0419-00 | WARRANTY CARD | W | |
| - | | * | B50-7706-00 | INSTRUCTION MANUAL | | |
| C1 | | * | CC45SL3D120J | CERAMIC 12PF J | | |
| C2 | | | CC45CH2H050C | CERAMIC 5.0PF C | | |
| C3 | | | CC45CH2H030C | CERAMIC 3.0PF C | | |
| C4 | | | CC45CH2H010C | CERAMIC 1.0PF C | | |
| 5 | 1D | * | D21-0924-04 | EXTENSION SHAFT | | |
| 6 | 2D | * | D21-0925-03 | EXTENSION SHAFT | | |
| 7 | 2D | | D22-0402-05 | JOINT | | |
| | | * | E23-0513-05 | TERMINAL(M TYPE RESEPTACLE GND | | |
| | | * | E23-0577-04 | TERMINAL | | |
| | | | E30-0545-05 | AC POWER CORD | M | |
| | | | E30-0974-05 | AC POWER CORD | K | |
| | | * | E30-1815-05 | AC POWER CORD | W | |
| | | * | E30-1851-05 | AC POWER CORD | M | |
| | | * | E30-1852-05 | AC POWER CORD | W | |
| | | * | E30-1889-05 | CORD (IF INPUT) | | |
| | | * | E30-1890-05 | CORD (8PIN DIN) | | |
| | | * | E30-1891-05 | CORD (X-TUNE) | | |
| | | * | E30-1892-05 | CORD (TWO-TONE) | | |
| | | * | E30-1893-05 | AC POWER CORD | K | |
| | | * | E31-5707-05 | CONNECTING WIRE(P1) | | |
| | | * | E31-5708-05 | CONNECTING WIRE(P11) | | |
| | | * | E31-5709-05 | CONNECTING WIRE(P12-14) | | |
| | | * | E31-5710-05 | CONNECTING WIRE(P15) | | |
| | | * | E31-5711-05 | CONNECTING WIRE(P16) | | |
| | | * | E31-5712-05 | CONNECTING WIRE(P18) | | |
| | | * | E31-5713-05 | CONNECTING WIRE(JW102-105) | | |
| | | * | E31-5715-05 | CONNECTING WIRE(JW101) | | |
| | | * | E31-5717-05 | CONNECTING WIRE | | |
| | | * | E31-5718-05 | CONNECTING WIRE | | |
| 8 | 1F | | E04-0167-05 | RF COAXIAL CABLE RECEPTACLE | | |
| 9 | 2A | * | E04-0259-05 | RF COAXIAL CABLE RECEPTACLE | | |
| 10 | 2A | * | E21-0657-04 | TERMINAL (GND) | | |
| 11 | 2A | * | E21-0660-04 | TERMINAL (CAL) | | |
| P21 | | * | E31-2369-05 | CONNECTING WIRE | K | |
| P21 | | * | E31-2370-05 | CONNECTING WIRE | MW | |
| | | * | F05-3011-05 | FUSE (0.3A) | MW | |
| | | * | F05-4018-05 | FUSE (0.4A) | K | |
| | | * | F10-1615-04 | SHIELDING PLATE | | |
| | | * | F15-0733-04 | FELT | | |
| | | * | F15-0754-04 | FELT | | |
| 12 | 1C | * | F11-1226-03 | SHIELDING COVER | | |
| 13 | 1B | * | F11-1227-03 | SHIELDING COVER | | |

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

 indicates safety critical components.

SM-230

PARTS LIST

× New Parts

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| Ref. No. 参照番号 | Address 位置 | New Parts 新 | Parts No. 部品番号 | Description 部品名 / 規格 | Desti- nation 仕 向 | Re- marks 備考 |
|------------------|---------------|-------------------|-------------------|-------------------------------|-------------------------|--------------------|
| 14 | 1B | * | F11-1228-03 | SHIELDING COVER | | |
| C | | | G09-0405-05 | SPRING | | |
| - | | * | H09-0502-04 | PACKING CASE(OTHERS) | | |
| - | | * | H01-5911-04 | ITEM CARTON BOX | | |
| - | | * | H03-1872-04 | OUTER PACKING CASE | | |
| - | | * | H10-2903-02 | POLYSTYRENE FOAMED FIXTURE(F) | | |
| - | | * | H10-2904-02 | POLYSTYRENE FOAMED FIXTURE(R) | | |
| - | | * | H20-1731-04 | PROTECTION COVER | | |
| | | | J02-0089-05 | FOOT (REAR) | | |
| | | | J19-1313-05 | LEAD HOLDER | KM | |
| | | * | J19-1653-23 | CRT HOLDER | | |
| | | | J42-0021-05 | POWER CORD BUSHING | M | |
| | | | J42-0083-05 | POWER CORD BUSHING | | |
| | | | J42-0085-05 | POWER CORD BUSHING | KW | |
| 15 | 2E | | J02-0423-04 | FOOT | | |
| 16 | 2E | | J02-0424-04 | FOOT | | |
| - | | | J61-0038-05 | WIRE BAND | K | |
| - | | | J61-0408-05 | WIRE BAND | | |
| - | | * | J61-0520-05 | WIRE BAND | | |
| - | | * | J61-0531-05 | WIRE BAND | | |
| A | 2A | | K29-4511-04 | KNOB ASSY | | |
| B | 2A | | K23-0794-04 | KNOB | | |
| C | 2A | | K29-3061-04 | KNOB ASSY | | |
| D | 2A | * | K27-0553-04 | KNOB | | |
| E | 2A | * | K27-0552-04 | KNOB | | |
| 17 | 1F | * | L01-9866-05 | POWER TRANSFORMER | | |
| 18 | 1C | * | L39-0526-25 | ROTATE COIL | | |
| | | | N10-2030-41 | HEXAGON NUT | W | |
| F | 2C | | N09-0623-04 | SCREW (M3X8) | | |
| G | 2E | | N09-0626-04 | SCREW (M3X10) | | |
| H | 1E | | N09-0654-05 | SCREW (M4X8) | | |
| I | 2B, 2E | * | N09-0739-05 | SCREW (M3X8) | | |
| J | 1C | * | N09-0748-04 | SCREW (M3X12) | | |
| K | 1A, 1B | * | N09-0768-05 | SCREW (M3X8) | | |
| L | 2B | | N10-2040-41 | HEXAGON NUT | | |
| M | 2A | * | N14-0602-34 | NUT | | |
| N | 1F | * | N14-0604-05 | NUT | | |
| O | | | N15-1040-41 | FLAT WASHER | | |
| P | | | N16-0040-41 | SPRING WASHER | | |
| Q | | | N30-2608-41 | PAN HEAD MACHINE SCREW | | |
| R | 1E | | N30-4010-41 | PAN HEAD MACHINE SCREW | | |
| S | 1E | | N30-4014-41 | PAN HEAD MACHINE SCREW | | |
| T | 2A | | N33-3008-41 | OVAL HEAD MACHINE SCREW | | |
| U | 1F | | N89-3008-41 | BINDING HEAD TAPTITE SCREW | | |
| R1 , 2 | | | RD14BY2H105J | RD 1.0M J 1/2W | | |
| | | * | S01-2515-05 | ROTARY SWITCH (RF ATT) | | |
| | | * | S01-4504-05 | ROTARY SWITCH (FUNCTION) | | |
| 19 | 1B | * | 150GTM31A | CRT | | |
| | | | W01-0406-14 | ADJ.TOOL | | |
| | | | W03-2309-05 | OSCILLO CARD (ACCY) | | |

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

▲ indicates safety critical components.

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| Ref. No. 参照番号 | Address 位置 | New Parts 新 | Parts No. 部品番号 | Description 部品名 / 規格 | Desti- nation 仕 向 | Re- marks 備考 |
|----------------------------------|---------------|-------------------|-------------------|-----------------------------|-------------------------|--------------------|
| 20 | 2B | * | X69-1160-00 | PANEL UNIT | | |
| 21 | 1D | * | X70-1140-00 | FILTER UNIT | | |
| 22 | 2E | * | X73-1870-00 | VERTICAL AMP UNIT | | |
| 23 | 2F | * | X74-1510-00 | HORIZONTAL AMP UNIT | | |
| PANEL UNIT (X69-1160-00) | | | | | | |
| C6 | | | CK45FF1H103Z | CERAMIC 0.010UF Z | | |
| C7 | | * | C91-1308-05 | FIXED CAPACITOR 0.01UF | | |
| C1-5 | | | CE04CW1C220M | ELECTRO 22UF 16WV | | |
| C101 | | * | CC45SL3D120J | CERAMIC 12PF J | | |
| C102 | | | CC45FSL1H561J | CERAMIC 560PF J | | |
| C103 | | * | CK45B2H103K | CERAMIC 0.010UF K | | |
| C104 | | * | CK45FB2H222K | CERAMIC 2200PF K | | |
| | | | E40-3237-05 | PIN CONNECTOR (2P) | | |
| JW3 | | * | E31-5704-05 | CONNECTING WIRE(VARI.) | | |
| JW9 | | * | E31-5705-05 | CONNECTING WIRE | | |
| JW10 | | * | E31-5716-05 | CONNECTING WIRE | | |
| JW22 | | * | E31-5703-05 | CONNECTING WIRE(CAL.) | | |
| JW101-105 | | | E23-0512-05 | TERMINAL | | |
| R10 | | * | R90-0658-05 | MULTI-COMP | | |
| R101 | | * | R92-1420-05 | FIXED RESISTOR 510 7W | | |
| R102 | | | RS14AB3D103J | FL-PROOF RS 10K J 2W | | |
| VR1 | | * | R05-3521-05 | POTENTIOMETER (20K-B) | | |
| VR2 | | * | R05-0503-05 | POTENTIOMETER (500-B) | | |
| VR3 ,4 | | * | R05-3521-05 | POTENTIOMETER (20K-B) | | |
| VR5 | | * | R12-3561-05 | TRIMMING POT. (47K-B) | | |
| S1 -9 | | * | S42-3516-05 | PUSH SWITCH | | |
| S10 ,11 | | * | S42-1502-05 | PUSH SWITCH | | |
| S12 -15 | | * | S42-4515-05 | PUSH SWITCH | | |
| S16 ,17 | | * | S42-1502-05 | PUSH SWITCH | | |
| D1 ,2 | | | 1SS132 | DIODE | | |
| D101 | | * | DSA-102MA | SERGE ABSORBER | | |
| D102,103 | | | MA700 | DIODE | | |
| D104 | | | 1S1587 | DIODE | | |
| U1 | | | NJM4558D | IC(OP AMP X2) | | |
| U2 | | | NJM072BS | IC(OP AMP X2) | | |
| FILTER UNIT (X70-1140-00) | | | | | | |
| C1 | | * | C91-0551-05 | FIXED CAPACITOR 0.22UF 630V | | |
| C3 ,3 | | * | C91-0575-05 | FIXED CAPACITOR 1000PF 4KV | | |
| C301,302 | | | CQ92M1H104K | MYLAR 0.10UF K | | |
| | | * | E01-0103-05 | CRT SOCKET | | |
| | | * | E06-0862-05 | CYLINDRICAL RECEPTACLE | | |
| | | * | E13-0871-05 | PHONE JACK | | |
| JW2A, B | | * | E31-5701-05 | CONNECTING WIRE | | |
| | | * | E31-5699-05 | CONNECTING WIRE | | |
| JW6A, B | | * | E31-5700-05 | CONNECTING WIRE | | |
| P12 -14 | | | E40-5067-05 | PIN CONNECTOR (10PIN) | | |
| P18 | | | E40-3300-05 | PIN CONNECTOR (3PIN) | | |
| P19 ,20 | | * | E40-0803-05 | PIN CONNECTOR (8PIN) | | |
| P21 | | * | E40-7021-05 | PIN CONNECTOR (3PIN) | | |
| | | * | J13-0512-05 | FUSE HOLDER | | |
| L1 | | * | L33-0808-05 | CHOKE COIL | | |

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|--|---------------|-------------------|-------------------|------------------------------|------------------------|--------------------|
| R301 VR201 VR202 | | * | R92-1061-05 | JUMPER REST 0 0HM | | |
| | | * | R23-0501-05 | POTENTIOMETER (FOCUS, ASTIG) | | |
| | | * | R23-3504-05 | POTENTIOMETER (INT, ROT.) | | |
| S1 | | * | S40-1529-05 | PUSH SWITCH (POWER) | | |
| | | | LN222RP | LED | | |
| VERTICAL AMP UNIT (X73-1870-00) | | | | | | |
| | | * | B41-0710-04 | CAUTION LABEL | | |
| C1 | | * | C91-0501-05 | MF 0.047UF 630V | | |
| C2 | | | CC45FSL1H221J | CERAMIC 220PF J | | |
| C3 | | | CC45FCH1H330J | CERAMIC 33PF J | | |
| C4 | | | CK45FB2H102K | CERAMIC 1000PF K | | |
| C6 | | | CC45FSL1H391J | CERAMIC 390PF J | | |
| C7 | | | CC45FCH1H050C | CERAMIC 5.0PF C | | |
| C8 , 9 | | | CC45FCH1H220J | CERAMIC 22PF J | | |
| C10 | | | CE04EW1A331M | ELECTRO 330UF 10WV | | |
| C11 | | * | CQ92FM1H104K | MYLAR 0.10UF K | | |
| C12 | | * | C91-1276-05 | FIXED CAPACITOR | | |
| C16 | | | CC45FCH1H101J | CERAMIC 100PF J | | |
| C18 | | * | CC45FCH1H200J | CERAMIC 20PF J | | |
| C19 | | | CC45FCH1H100D | CERAMIC 10PF D | | |
| C101 | | * | CE04W2E101M | ELECTRO 100UF 250WV | | |
| C102 | | * | CE04W2C3R3M | ELECTRO 3.3UF 160WV | | |
| C103 | | * | CE04EW1E222M | ELECTRO 2200UF 25WV | | |
| C104 | | | CE04EW1C471M | ELECTRO 470UF 16WV | | |
| C105 | | | CE04EW1A221M | ELECTRO 220UF 10WV | | |
| C106 | | * | CE04EW1E222M | ELECTRO 2200UF 25WV | | |
| C107 | | | CE04EW1C471M | ELECTRO 470UF 16WV | | |
| C108 | | * | CE04EW1A330M | ELECTRO 33UF 10WV | | |
| C109, 110 | | | CE04EW1E221M | ELECTRO 220UF 25WV | | |
| C112, 113 | | * | CQ92FM1H104K | MYLAR 0.10UF K | | |
| C117, 118 | | * | CQ92FM1H104K | MYLAR 0.10UF K | | |
| C120-124 | | * | CK45FF1H103Z | CERAMIC 0.010UF Z | | |
| C127 | | * | CK45FB2H472K | CERAMIC 4700PF K | | |
| C130 | | | CK45FF1H103Z | CERAMIC 0.010UF Z | | |
| C140 | | | CK45FF1H103Z | CERAMIC 0.010UF Z | | |
| C141, 142 | | * | CK45FB2H472K | CERAMIC 4700PF K | | |
| C143-147 | | | CK45FF1H103Z | CERAMIC 0.010UF Z | | |
| C151, 152 | | * | CK45FB2H472K | CERAMIC 4700PF K | | |
| C153, 154 | | | CE04EW1E221M | ELECTRO 220UF 25WV | | |
| C155 | | | CC45FSL1H471J | CERAMIC 470PF J | | |
| C156 | | * | CK45E3D102P | CERAMIC 1000PF P | | |
| C157-161 | | * | C91-0571-05 | CERAMIC 0.01UF 2KV | | |
| C162 | | * | CE04W2C010M | ELECTRO 1.0UF 160WV | | |
| C164 | | | CK45FB2H102K | CERAMIC 1000PF K | | |
| C166 | | | CK45FB1H472K | CERAMIC 4700PF K | | |
| TC1 | | * | C05-0066-05 | TRIMMING CAP (10PF) | | |
| TC2 | | | C05-0065-05 | TRIMMING CAP (6PF) | | |
| TC3 | | * | C05-0066-05 | TRIMMING CAP (10PF) | | |
| TC4 | | | C05-0065-05 | TRIMMING CAP (6PF) | | |
| TC5 | | * | C05-0445-05 | TRIMMING CAP (20PF) | | |
| P1 | | | E40-3237-05 | PIN CONNECTOR (2PIN) | | |
| P2 | | | E40-3243-05 | PIN CONNECTOR (8PIN) | | |

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|------------------|---------------|-------------------|-------------------|-------------------------|-------------------------|--------------------|
| P3 | | | E40-3238-05 | PIN CONNECTOR (3PIN) | | |
| P4 | | * | E40-0416-05 | PIN CONNECTOR (4PIN) | | |
| P5 | | | E40-0716-05 | PIN CONNECTOR (7PIN) | | |
| P6 | | * | E40-7016-05 | PIN CONNECTOR (8PIN) | | |
| P7 | | | E40-0273-05 | PIN CONNECTOR (2PIN) | | |
| P8 ,9 | | | E40-3242-05 | PIN CONNECTOR (7PIN) | | |
| | | | F01-0813-05 | HEAT SINK | | |
| | | * | F11-1229-04 | SHIELDING COVER | | |
| | | * | F11-1230-03 | SHIELDING COVER | | |
| | | * | F15-0727-04 | SHADE (FOR NL1,2) | | |
| | | * | F20-0687-04 | INSULATING BOARD | | |
| L151,152 T151 | | | L40-1011-04 | SMALL FIXED INDUCTOR | | |
| | | * | L19-0413-05 | CONV. TRANSFORMER | | |
| | | | N30-2606-41 | PAN HEAD MACHINE SCREW | | |
| | | | N30-3008-41 | PAN HEAD MACHINE SCREW | | |
| R101 | | * | R92-1411-05 | SRP RESISTOR 1.2K 5W | | |
| R107 | | * | R92-1442-05 | SRP RESISTOR 47 1W | | |
| R117 | | * | R92-1442-05 | SRP RESISTOR 47 1W | | |
| R180 | | * | R92-1443-05 | SRP RESISTOR 27 1W | | |
| VR1 | | * | R12-0502-05 | TRIMMING POT. 100-B | | |
| VR2 | | * | R12-2522-05 | TRIMMING POT. 5K-B | | |
| VR101 | | * | R12-1546-05 | TRIMMING POT. 2K-B | | |
| VR151 | | * | R12-8501-05 | TRIMMING POT. 2.2M-B | | |
| VR152 | | * | R12-5530-05 | TRIMMING POT. 100K-B | | |
| K1 ,2 | | * | S51-1526-05 | RELAY | | |
| K3 ,4 | | * | S51-2510-05 | RELAY | | |
| D1 -4 | | | 1SS132 | DIODE | | |
| D5 | | | MTZ5.1JB | ZENER DIODE | | |
| D101 | | * | S1VB60 | DIODE | | |
| D102 | | | 1SS132 | DIODE | | |
| D103 | | * | S1VB20 | DIODE | | |
| D104,105 | | | MTZ10JC | ZENER DIODE | | |
| D106 | | | MTZ5.1JB | ZENER DIODE | | |
| D151 | | | 1SS132 | DIODE | | |
| D152,153 | | | 1SR35-200 | DIODE | | |
| D154,155 | | | 1SS83 | DIODE | | |
| NL1 ,2 | | * | NE-2B | NEON LAMP | | |
| Q1 | | * | 2SC3315(C) | TRANSISTOR | | |
| Q2 | | * | 2SC2785(F) | TRANSISTOR | | |
| Q3 | | * | 2SC3779(D) | TRANSISTOR | | |
| Q5 | | * | 2SC3315(C) | TRANSISTOR | | |
| Q101 | | | 2SA1156(K,L) | TRANSISTOR | | |
| Q102 | | * | 2SC2271(D) | TRANSISTOR | | |
| Q103 | | * | 2SB1133(S) | TRANSISTOR | | |
| Q104 | | * | 2SC2785(F) | TRANSISTOR | | |
| Q105 | | * | 2SD1666(S) | TRANSISTOR | | |
| Q151,152 | | * | 2SA1091(O) | TRANSISTOR | | |
| Q153 | | * | 2SD613(E) | TRANSISTOR | | |
| Q154 | | * | 2SA1175(F) | TRANSISTOR | | |
| Q155 | | * | 2SC2909(S) | TRANSISTOR | | |
| Q156 | | * | 2SC1384(R) | TRANSISTOR | | |
| Q157 | | | 2SA684 | TRANSISTOR | | |

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|--|---------------|-------------------|-------------------|-------------------------|------------------------|--------------------|
| Q158 | | * | 2SA1207 | TRANSISTOR | | |
| TH1 | | | 112-103-2 | THERMISTOR | | |
| U1 | | * | 2SK389(GR) | FET | | |
| U2 | | | NJM4558D | IC(OP AMP X2) | | |
| U101,102 | | | NJM4558D | IC(OP AMP X2) | | |
| U151 | | | NJM4558D | IC(OP AMP X2) | | |
| W151 | | * | W02-0409-05 | HIGH VOLTAGE BLOCK | | |
| HORIZONTAL AMP UNIT (X74-1510-00) | | | | | | |
| C1 | | * | CQ92FM1H104K | MYLAR 0.10UF K | | |
| C2 | | | CE04EW1C100M | ELECTRO 10UF 16WV | | |
| C3 | | | CE04EW1A101M | ELECTRO 100UF 10WV | | |
| C4 | | | CQ92FM1H103K | MYLAR 0.010UF K | | |
| C5 | | | CC45CH1H470J | CERAMIC 47PF J | | |
| C6 | | | CE04EW1C100M | ELECTRO 10UF 16WV | | |
| C7 | | * | C91-0573-05 | FIXED CAPACITOR | | |
| C8 | | | CE04BW1H010M | NP-ELEC 1.0UF 50WV | | |
| C9 | | * | CQ92FM1H102K | MYLAR 1000PF K | | |
| C10 | | | CC45PSL1H331J | CERAMIC 330PF J | | |
| C11,12 | | * | CQ92FM1H104K | MYLAR 0.10UF K | | |
| C13 | | | CE04EW1A221M | ELECTRO 220UF 10WV | | |
| C14,15 | | | CE04EW1C101M | ELECTRO 100UF 16WV | | |
| C16 | | * | CE04W2C100M | ELECTRO 10UF 160WV | | |
| C17 | | | CK45B2H472K | CERAMIC 4700PF K | | |
| C18,19 | | | CQ92FM1H103K | MYLAR 0.010UF K | | |
| C20 | | | CF92V1H105J | MF 1.0UF J | | |
| C21-23 | | * | CQ92FM1H104K | MYLAR 0.10UF K | | |
| C24 | | | CQ92FM1H103K | MYLAR 0.010UF K | | |
| C25 | | | CQ92FM1H222K | MYLAR 2200PF K | | |
| C26 | | | CQ92FM1H103K | MYLAR 0.010UF K | | |
| C27 | | * | CQ92FM1H104K | MYLAR 0.10UF K | | |
| C28 | | | CC45FCH1H050C | CERAMIC 5.0PF C | | |
| C29 | | | CK45B2H472K | CERAMIC 4700PF K | | |
| C30 | | | CC45CH1H200J | CERAMIC 20PF J | | |
| C50 | | | CC45FSL1H181J | CERAMIC 180PF J | | |
| C101 | | | CC45CH1H101J | CERAMIC 100PF J | | |
| C102 | | | CC45FCH1H050C | CERAMIC 5.0PF C | | |
| C103,104 | | | CF93AN2E103K | MF 0.010UF K | | |
| C105,106 | | * | CF93AN2E104K | MF 0.10UF K | | |
| C107 | | | CE04EW1A470M | ELECTRO 47UF 10WV | | |
| C108,109 | | * | CQ92FM1H104K | MYLAR 0.10UF K | | |
| C110 | | | CC45FSL1H151J | CERAMIC 150PF J | | |
| C201,202 | | * | CQ92FM1H102K | MYLAR 1000PF K | | |
| C203 | | | CC45FCH1H330J | CERAMIC 33PF J | | |
| C204 | | | CC45CH1H220J | CERAMIC 22PF J | | |
| C205 | | | CC45CH1H330J | CERAMIC 33PF J | | |
| C206 | | | CC45CH1H101J | CERAMIC 100PF J | | |
| C207 | | | CC45CH1H050C | CERAMIC 5.0PF C | | |
| C208-220 | | | CQ92FM1H103K | MYLAR 0.010UF K | | |
| C221,222 | | | CQ92M1H104K | MYLAR 0.10UF K | | |
| C223 | | | CE04BW1C221M | ELECTRO 220UF 16WV | | |
| C223 | | * | CQ92FM1H104K | MYLAR 0.10UF K | | |
| C224 | | | CQ92M1H104K | MYLAR 0.10UF K | | |
| C225 | | | CE04EW1C101M | ELECTRO 100UF 16WV | | |
| C226 | | | CQ92M1H104K | MYLAR 0.10UF K | | |

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| C228 | | | CE04EW1C470M | ELECTRO 47UF 16WV | | |
| C229 | | * | CQ92FM1H102K | MYLAR 1000PF K | | |
| C231 | | * | CQ92FM1H102K | MYLAR 1000PF K | | |
| C301 | | | CE04BW1H010M | NP-ELEC 1.0UF 50WV | | |
| C302, 303 | | | CF92V1H103J | MF 0.010UF J | | |
| C304 | | | CE04BW1H010M | NP-ELEC 1.0UF 50WV | | |
| C305, 306 | | | CF92V1H103J | MF 0.010UF J | | |
| C307 | | | CQ92FM1H222K | MYLAR 2200PF K | | |
| C308 | | | CC45FCH1H100D | CERAMIC 10PF D | | |
| C309 | | | CC45CH1H680J | CERAMIC 68PF J | | |
| TC201 | | * | C05-0444-05 | TRIMMING CAP | | |
| TC202 | | * | C05-0475-05 | TRIMMING CAP | | |
| | | * | E31-5706-05 | CONNECTING WIRE(B) | | |
| | | * | E33-4148-00 | FINISHED WIRE SET(A) | | |
| P4 | | | E40-0411-05 | PIN CONNECTOR (4P) | | |
| P5 | | | E40-0711-05 | PIN CONNECTOR (7P) | | |
| P10 | | | E40-5067-05 | PIN CONNECTOR (10P) | | |
| P11 | | | E40-3237-05 | PIN CONNECTOR (2P) | | |
| P12 | | | E40-3238-05 | PIN CONNECTOR (3P) | | |
| P13, 14 | | | E40-3239-05 | PIN CONNECTOR (4P) | | |
| P15 | | | E40-3242-05 | PIN CONNECTOR (7P) | | |
| P16 | | | E40-3301-05 | PIN CONNECTOR (4P) | | |
| P17 | | | E40-3300-05 | PIN CONNECTOR (3P) | | |
| | | * | F01-0874-04 | HEAT SINK | | |
| | | * | F11-1231-04 | SHIELDING COVER | | |
| | | * | F11-1232-04 | SHIELDING COVER | | |
| CF201 | | | L72-0401-05 | CERAMIC FILTER | | |
| L101, 102 | | * | L40-3391-70 | SMALL FIXED INDUCTOR | | |
| L201 | | | L33-0801-05 | CHOKE COIL | | |
| L202 | | | L40-1021-03 | SMALL FIXED INDUCTOR | | |
| L203, 204 | | | L40-2701-03 | SMALL FIXED INDUCTOR | | |
| L205 | | * | L40-1211-70 | SMALL FIXED INDUCTOR | | |
| T201 | | | L34-0527-05 | COIL (IFT) | | |
| | | | N30-2606-41 | PAN HEAD MACHINE SCREW | | |
| | | | N30-3008-41 | PAN HEAD MACHINE SCREW | | |
| R61, 62 | | * | R92-1447-05 | SPR RESISTOR 22K 2W | | |
| R112, 113 | | * | R92-1443-05 | SPR RESISTOR 27K 1W | | |
| R120, 121 | | * | R92-1445-05 | SPR RESISTOR 1K 1W | | |
| VR1 | | * | R12-0576-05 | TRIMMING POT. 200-B | | |
| VR101 | | * | R12-2522-05 | TRIMMING POT. 5K-B | | |
| VR201 | | * | R12-5530-05 | TRIMMING POT. 100K-B | | |
| VR202 | | * | R12-3550-05 | TRIMMING POT. 20K-B | | |
| VR203 | | | R12-5025-05 | TRIMMING POT. 100K-B | | |
| VR301, 302 | | * | R12-0577-05 | TRIMMING POT. 500-B | | |
| VR303 | | | R12-0058-05 | TRIMMING POT. 470-B | | |
| VR304 | | | R12-3040-05 | TRIMMING POT. 22K-B | | |
| VR305 | | | R12-3042-05 | TRIMMING POT. 47K-B | | |
| VR306 | | | R12-3040-05 | TRIMMING POT. 22K-B | | |
| VR307 | | * | R12-5501-05 | TRIMMING POT. 150K-B | | |
| D1 | | | 1SS132 | DIODE | | |
| D2, 3 | | | MTZ10JC | ZENER DIODE | | |
| D4, 5 | | | 1SS132 | DIODE | | |

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| D8 -11 | | | 1SS132 | DIODE | | |
| D12 ,13 | | | MA700 | DIODE | | |
| D101 | | | 1SS132 | DIODE | | |
| D201,202 | | | 1SV50 | DIODE | | |
| D203,204 | | | 1SS132 | DIODE | | |
| D205,206 | | | MA700 | DIODE | | |
| D207-210 | | | 1SS132 | DIODE | | |
| D211,212 | | | MA700 | DIODE | | |
| D213-215 | | | 1SS132 | DIODE | | |
| D216 | | | MTZ5.1JB | ZENER DIODE | | |
| D217 | | | 1SS132 | DIODE | | |
| D218 | | | 1SS132 | DIODE | | |
| D301,302 | | | 1SS132 | DIODE | | |
| Q1 -4 | | | 2SC2785(F) | TRANSISTOR | | |
| Q5 | | | 2SA1175(F) | TRANSISTOR | | |
| Q6 | | | 2SC2785(F) | TRANSISTOR | | |
| Q7 | | | 2SA1206 | TRANSISTOR | | |
| Q8 | | | 2SA1175(F) | TRANSISTOR | | |
| Q9 | | | 2SC2785(F) | TRANSISTOR | | |
| Q10 -20 | | * | 2SC3732(L) | TRANSISTOR | | |
| Q11 | | | 2SA1175(F) | TRANSISTOR | | |
| Q12 | | | 2SC2785(F) | TRANSISTOR | | |
| Q13 ,14 | | | 2SA1175(F) | TRANSISTOR | | |
| Q15 | | | 2SC2785(F) | TRANSISTOR | | |
| Q16 ,17 | | * | 2SC2909(S) | TRANSISTOR | | |
| Q18 ,19 | | | 2SA1175(F) | TRANSISTOR | | |
| Q21 | | | 2SA1175(F) | TRANSISTOR | | |
| Q101-104 | | * | 6SC3315(C) | TRANSISTOR | | |
| Q105,106 | | * | 2SC2911(S) | TRANSISTOR | | |
| Q107,108 | | * | 2SA1209(S) | TRANSISTOR | | |
| Q201 | | | 2SK192(GR) | FET | | |
| Q202 | | | 3SK73(GR) | FET | | |
| Q203 | | * | 2SK404(F) | FET | | |
| Q204-209 | | | 2SC2785(F) | TRANSISTOR | | |
| Q301,302 | | * | 2SK404(F) | FET | | |
| TH301-304 | | | 112-102-2 | THERMISTOR | | |
| U1 | | | SN74LS00N | IC | | |
| U2 | | | SN74LS112AN | IC | | |
| U3 | | * | 2SK332(F) | FET | | |
| U5 | | | NJM072BS | IC(OP AMP X2) | | |
| U6 | | | TC4053BP | IC(3-INPUT 2CH MPX/DE-MPX) | | |
| U201 | | | TC4053BP | IC(3-INPUT 2CH MPX/DE-MPX) | | |
| U202,203 | | | NJM4558D | IC(OP AMP X2) | | |
| U301 | | | NJM4558D | IC(OP AMP X2) | | |
| U302 | | | TL082CP | IC(OP AMP X2) | | |

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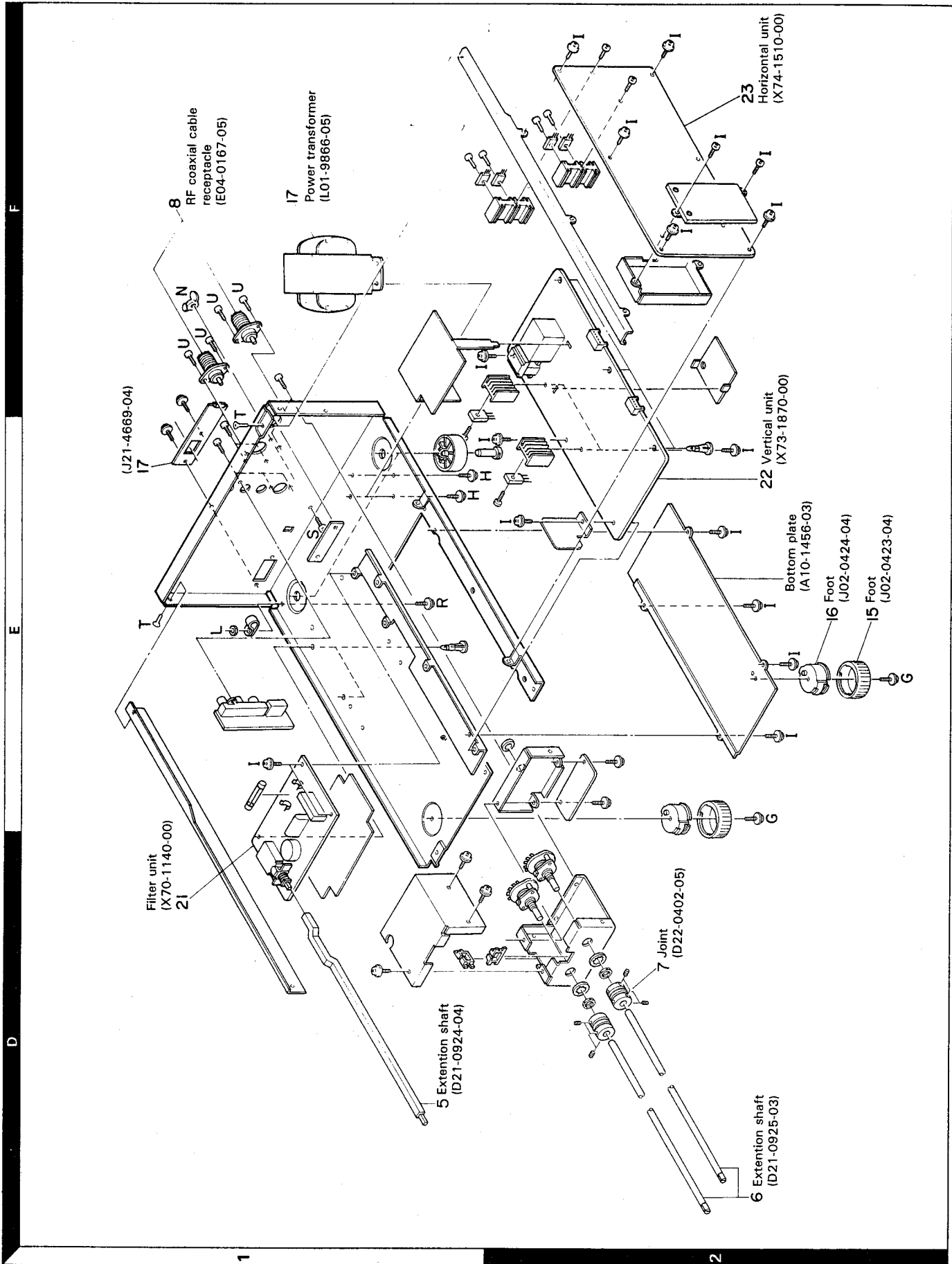
U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

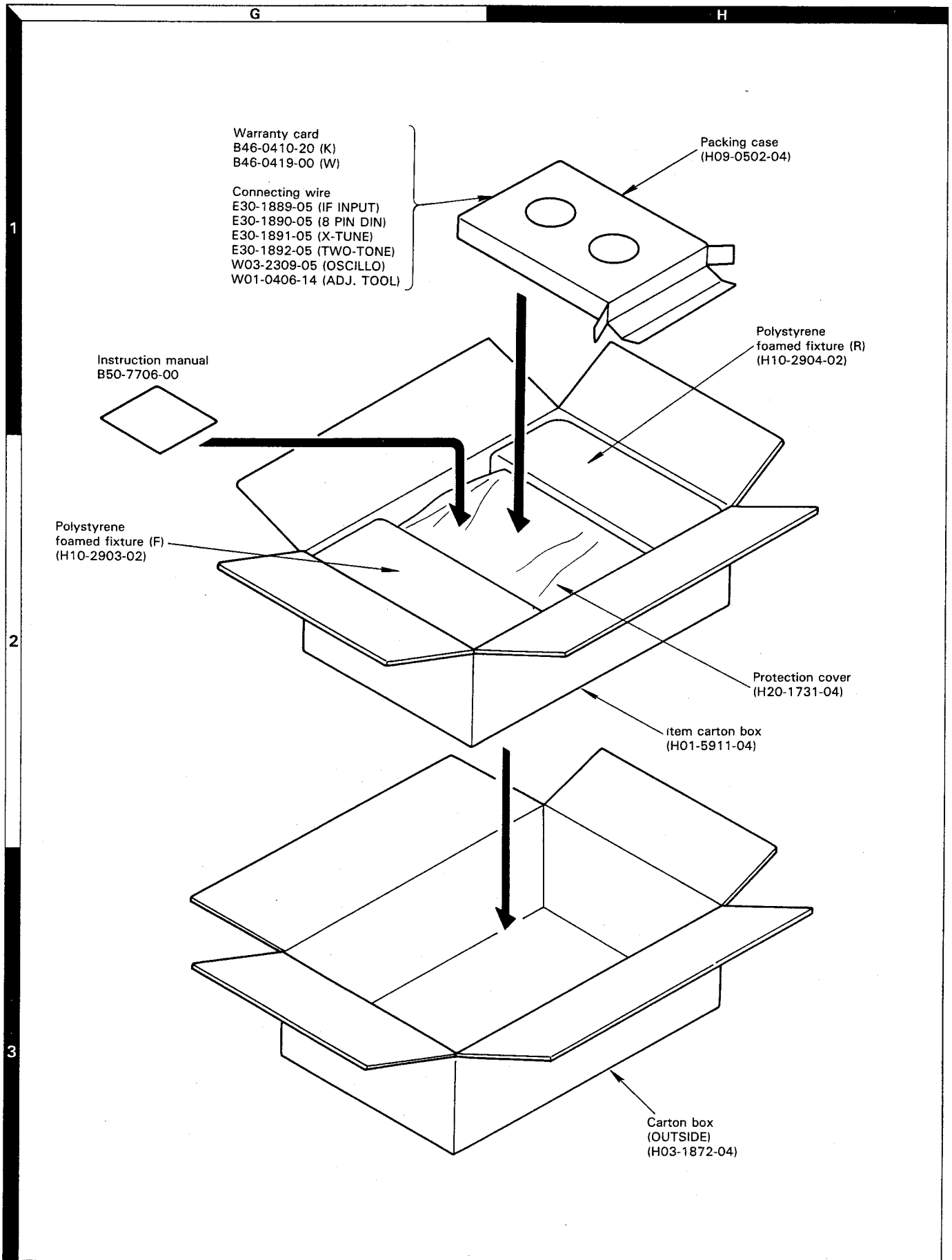
△ indicates safety critical components.

SM-230

EXPLODED VIEW



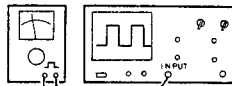
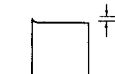
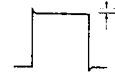
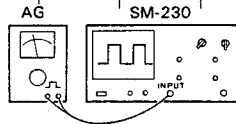
PACKING



SM-230

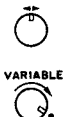

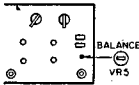
ADJUSTMENT

| Item | Condition | Measurement | | | | Adjustment | | Specification/Remarks | | | |
|---------------------------|--|----------------|----------------------------|----------|----------------------------|------------|---|------------------------|-----|-------|--|
| | | Test equipment | Unit | Terminal | Unit | Part | Method | | | | |
| 1. Supply voltage | | DC volt-meter | Vertical power supply unit | P5-pin3 | Vertical power supply unit | VR101 | + 10.00 V | ± 0.01 V | | | |
| | | | | P5-pin1 | | | Check | $+ 140$ V ± 2.8 V | | | |
| | | | | P5-pin4 | | | | $- 10$ V ± 0.2 V | | | |
| | | | | P5-pin5 | | | | $+ 5$ V ± 0.1 V | | | |
| 2. DC balance | FUNCTION: OSCILLOSCOPE ATTENUATION: 1 INPUT: None | Scope face | | | | VR1 | Adjust so that when the vertical VARIABLE knob setting is changed from MIN to MAX the position of the luminescent line does not vary. | Within ± 0.4 div. | | | |
| 3. Waveform shaping | ① FUNCTION: OSCILLOSCOPE ATTENUATION: 1 INPUT: 1 kHz square wave | Scope face | Vertical power supply unit | | | | | Within ± 0.05 div. | | | |
| | ② INPUT: 100 Hz square wave | | | | | | | | VR2 | | |
| | ③ INPUT: 100 kHz square wave | | | | | | | | | Check | |
| 4. 1/10 waveform shaping | FUNCTION: OSCILLOSCOPE ATTENUATION: 1/10 INPUT: 1 kHz square wave of 6 divisions | | | | | TC4 | | Within ± 0.05 div. | | | |
| 5. 1/100 waveform shaping | FUNCTION: OSCILLOSCOPE ATTENUATION: 1/100, INPUT: 1 kHz square wave of 6 divisions | | | | | TC2 | | | | | |
| 6. 1/10 input capacity | FUNCTION: OSCILLOSCOPE ATTENUATION: 1/10, INPUT: 1 kHz square wave of 6 divisions 10 : 1 probe used | | | | | TC3 | | | | | |
| 7. 1/100 input capacity | FUNCTION: OSCILLOSCOPE ATTENUATION: 1/100, INPUT: 1kHz square wave | Scope face | Vertical power supply unit | | Vertical power supply unit | TC1 | | | | | |



10 : 1 probe

ADJUSTMENT

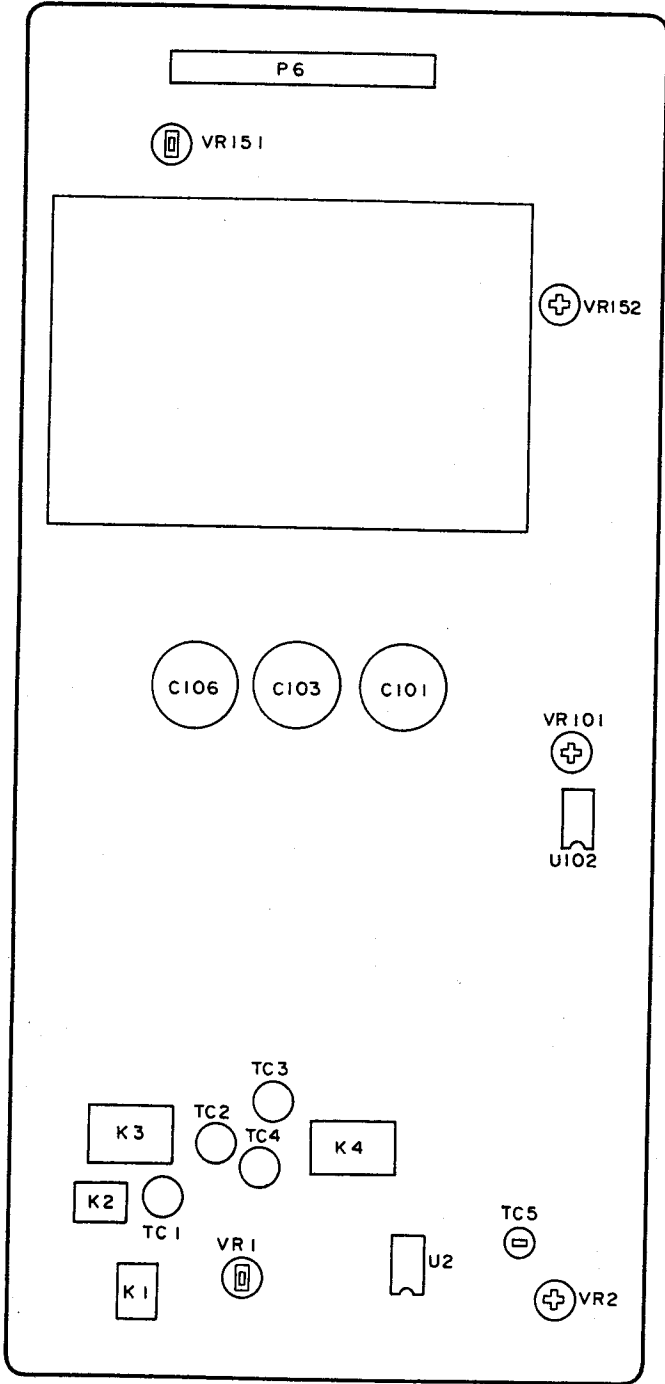
| Item | Condition | Measurement | | | Adjustment | | | Specification/Remarks | |
|---|---|---|---|----------|----------------------------|--|--|---|--|
| | | Test equipment | Unit | Terminal | Unit | Part | Method | | |
| 8. FOCUS | FUNCTION: X-TUNE FOCUS VR: Center | Scope face | Vertical power supply unit | | Vertical power supply unit | VR151 | Adjust the ASTIG VR on the front panel and VR 151 so that the spot is minimized. | Exact focusing should be obtained in 9 o'clock to 3 o'clock position of the FOCUS VR. | |
| 9. Luminescent line disappearance point | FUNCTION: OSCILLOSCOPE INTENSITY VR: 9 o'clock position | | | | | VR152 | Adjust to a point at which the spot disappears. | | Rotating the INTENSITY VR, the spot should be disappear in 8 o'clock to 10 o'clock position. |
| 10. SWEEP TIME | FUNCTION: OSCILLOSCOPE SWEEP RANGE: 100 to 1 kHz, Horizontal VARIABLE VR: Clockwise MAX INPUT: 10 kHz, square wave |  VARIABLE | Horizontal unit | | Horizontal unit | VR1 | Adjust so that a wave of 10 cycles appears on the scope face. | ± 5% | |
| 11. Vertical sensitivity | FUNCTION: OSCILLOSCOPE ATTENUATION: 1 Vertical VARIABLE VR: Clockwise MAX INPUT: 1 kHz, 50 mV | | | | |  VARIABLE | VR101 | | Adjust to 5 divisions on the scale on the scope face. |
| 12. TWO-TONE output | ① Set the VR5 on the panel unit to its mechanical center. 1575 Hz tone switch: ON | AF VM |  | | | Pin 7 of U301 | VR301 | 3.87 V | |
| | ② 1000 Hz tone switch: ON | | | | | Pin 1 of U301 | VR302 | | |
| | ③ 1575 Hz and 1000 Hz tone switches: ON | | | | | BNC connector of TONE OUT | VR303 | 5 mV | |
| 13. Space position | FUNCTION: X-TUNE Input: None | Scope face | | | | VR304 | Adjust to the center of the scope face. | ± 1 div | |
| 14. Mark position | FUNCTION: X-TUNE Input: None | | | | | VR306 | | | |

ADJUSTMENT

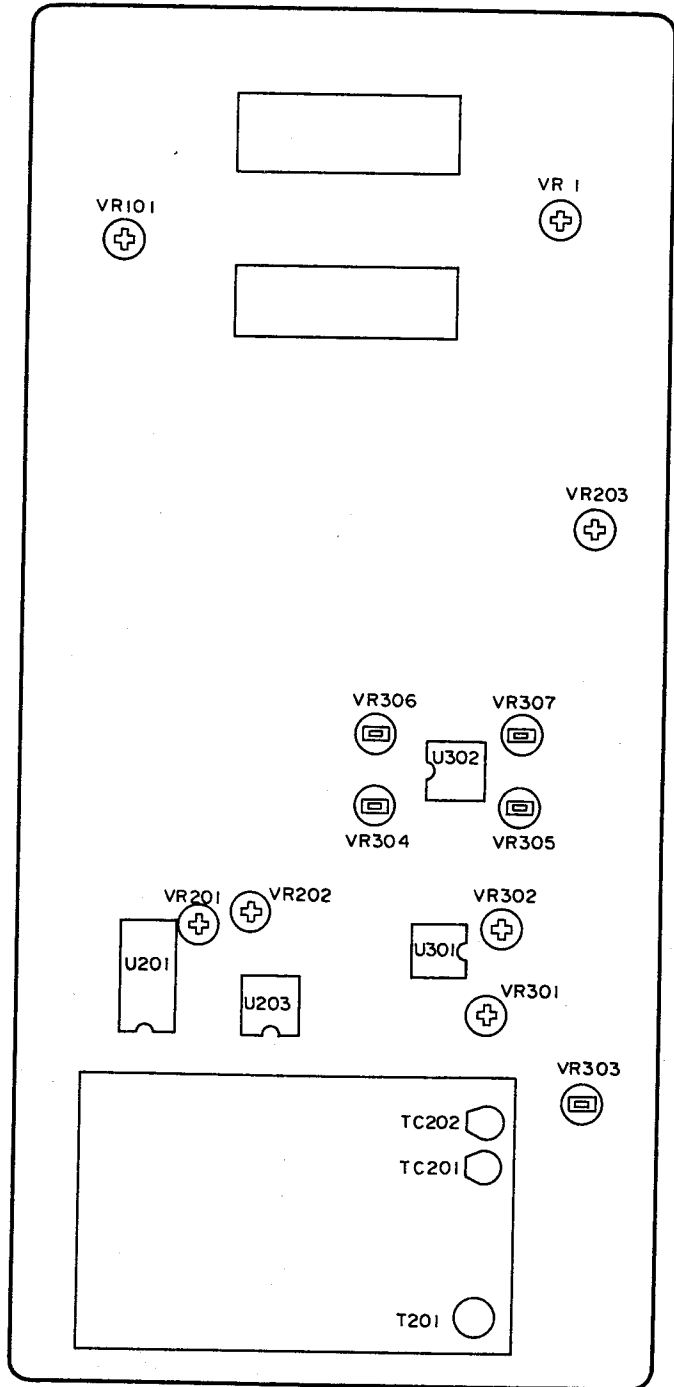
| Item | Condition | Measurement | | | Adjustment | | Specification/Remarks | |
|-----------------------------------|---|----------------|-----------------|----------|-----------------|----------------|---|------------------|
| | | Test equipment | Unit | Terminal | Unit | Part | | Method |
| 15. Band-scope sensitivity | FUNCTION: BAND SCOPE SSG output: 10 μ V Frequency: 8.830 MHz MODE: CW SCAN SPEED: SLOW | Scope face | Horizontal unit | | Horizontal unit | T201 | Adjust so that the amplitude is maximized on the scope face. | More than 1 div. |
| 16. Band-scope band | FUNCTION: BAND SCOPE SSG output: 100 μ V Frequency: 8.830 MHz MODE: AM MOD. frequency: 20 kHz SCAN SPEED: SLOW SCAN WIDTH: \pm 25 kHz | | | | | VR201 | | \pm 10% |
| 17. Band-scope band balance | FUNCTION: BANDSCOPE SSG output: 100 μ V Frequency: 8.830 MHz MODE: CW SCAN SPEED: SLOW | | | | | TC201 TC202 | Adjust so that the \pm 250 kHz and \pm 25 kHz ranges are identical in respect to their centers. | \pm 5 kHz |
| 18. Band-scope frequency position | FUNCTION: BAND SCOPE SSG output: 100 μ V Frequency: 8.830 MHz MODE: CW SCAN SPEED: SLOW | | | | | VR202 | Set the scan start point to the left end on the scope face, and adjust the SSG output waveform to 6 divisions of the scale. | |
| 19. Band scope submarker | FUNCTION: BAND SCOPE SSG output: 100 μ V Frequency: 8.830 MHz MODE: CW SCAN SPEED: SLOW Apply DC 2.5 V to the pin 7 of the DIN connector for the dual watch. | | | | | VR203 | Adjust the luminance marker to the location of the 8.830 MHz waveform. | \pm 0.5 div. |
| 20. SPACE sensitivity | | | | | | VR305 | Normally MAX | |
| 21. MARK sensitivity | | | | | | VR307 | | |

ADJUSTMENT

Part installed face of vertical power supply unit (X73-1870-00)



Part installed face of horizontal unit (X74-1510-00)

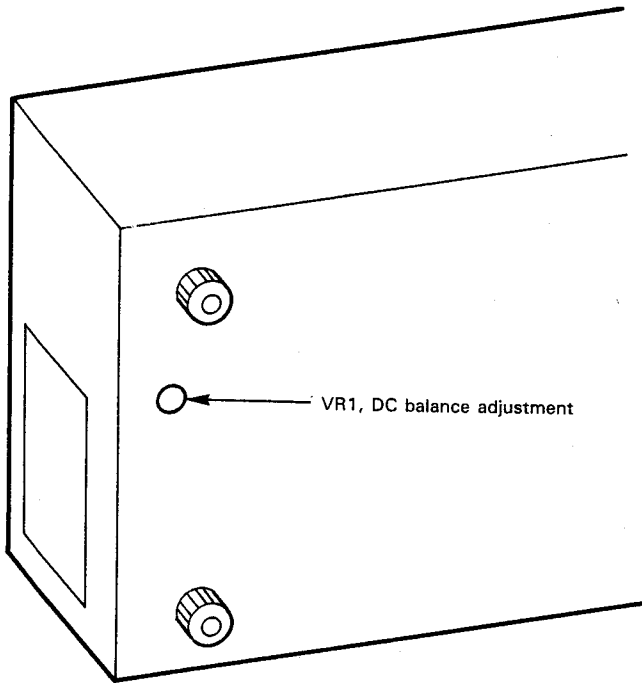


ADJUSTMENT

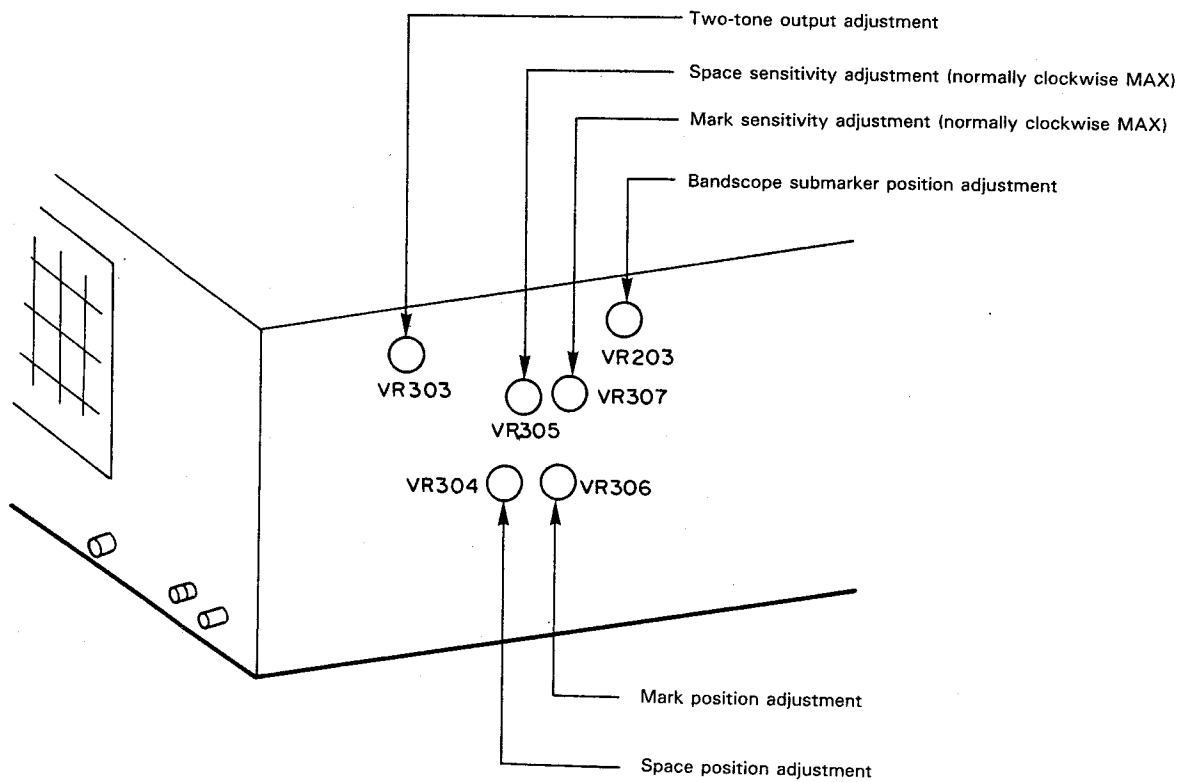
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Bottom



Right side



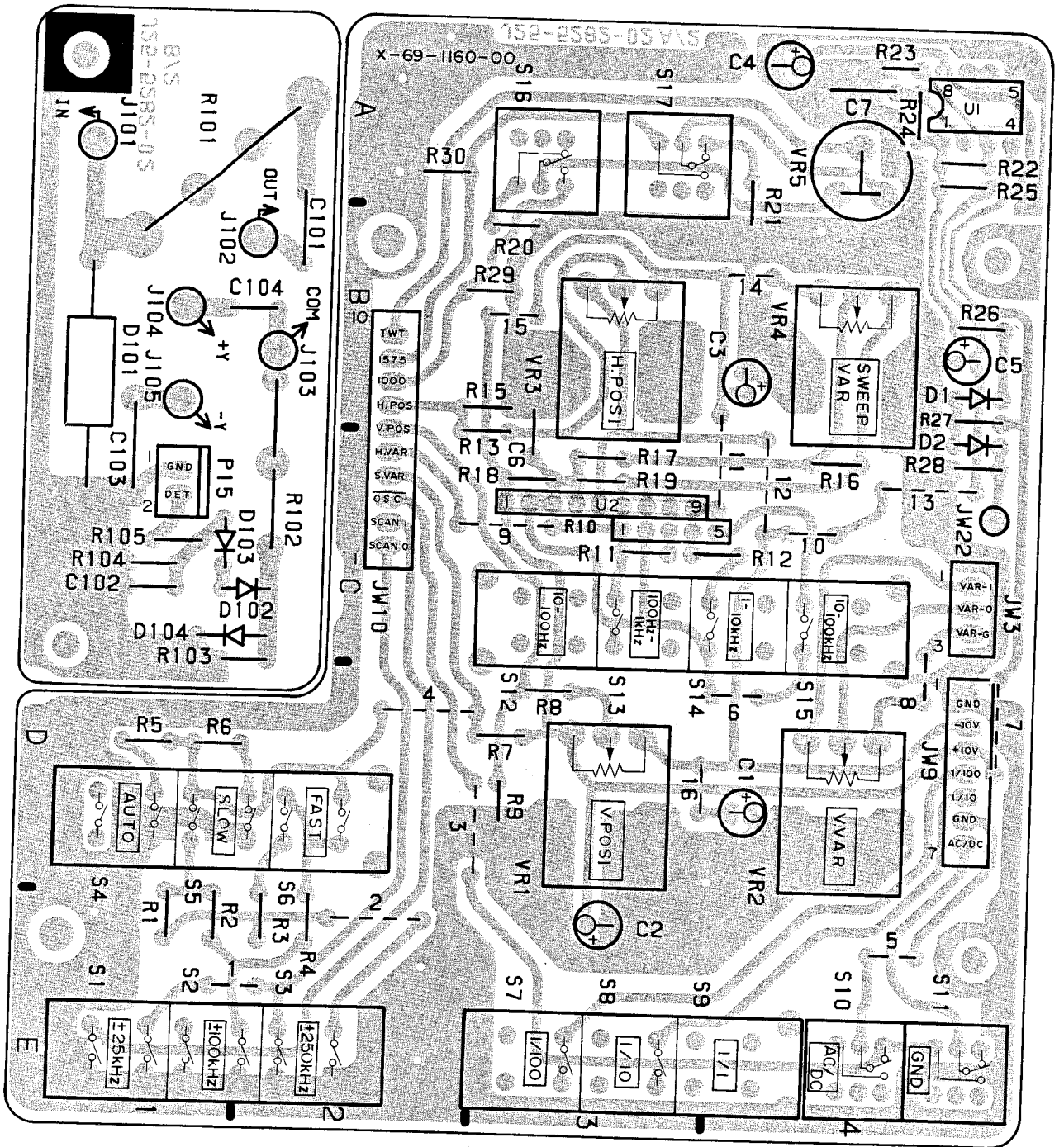
SM-230

PC BOARD VIEW

▼ PANEL UNIT (X69-1160-00)
[Component side view]

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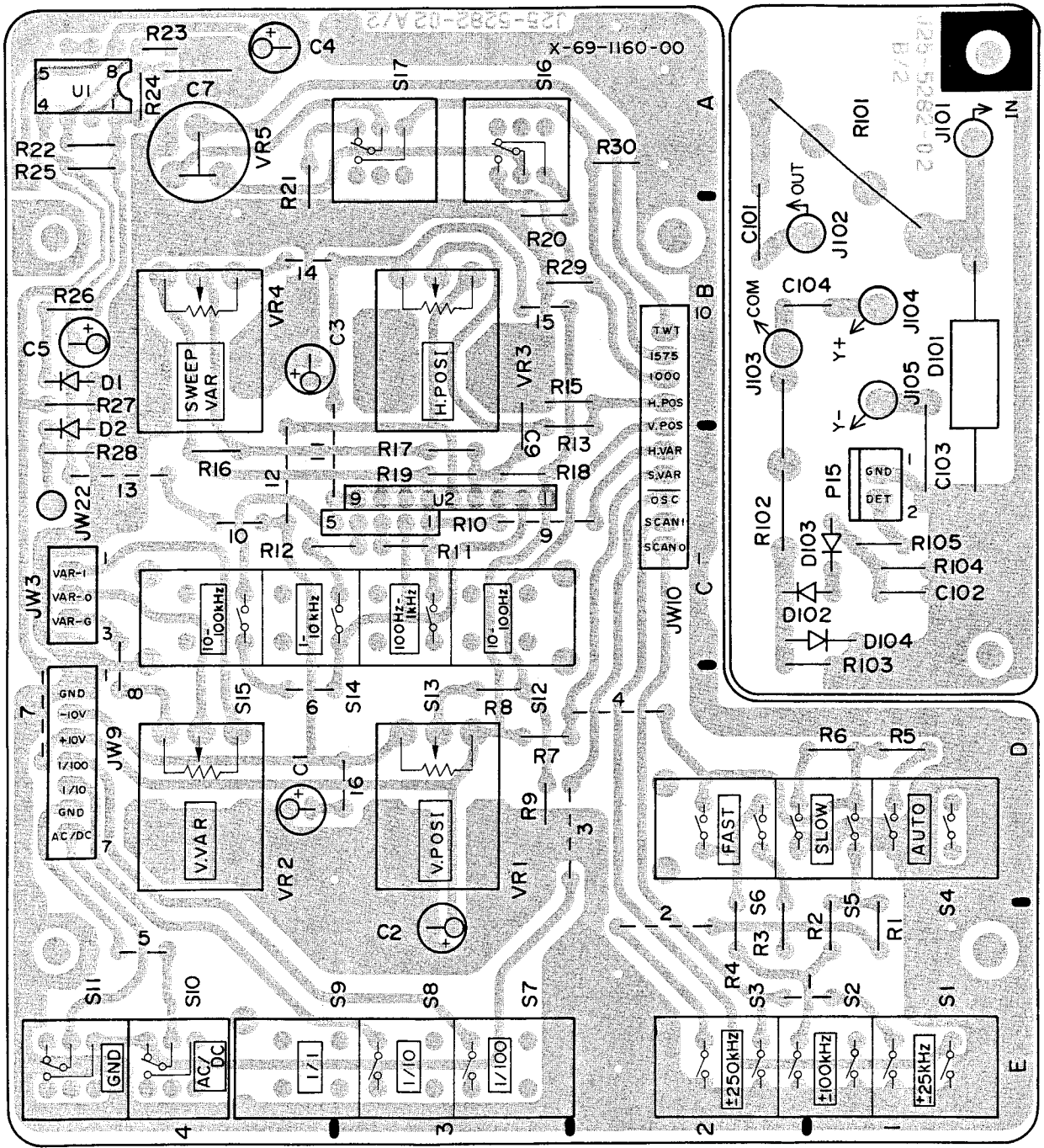
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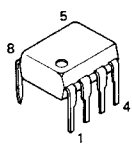
U1: NJM4558D U2: NJM072BS D1, 2: 1S132 D101: DSA-102MA D102, 103: MA700 D104: 1S1587

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▼ PANEL UNIT (X69-1160-00)
[Foil side view]

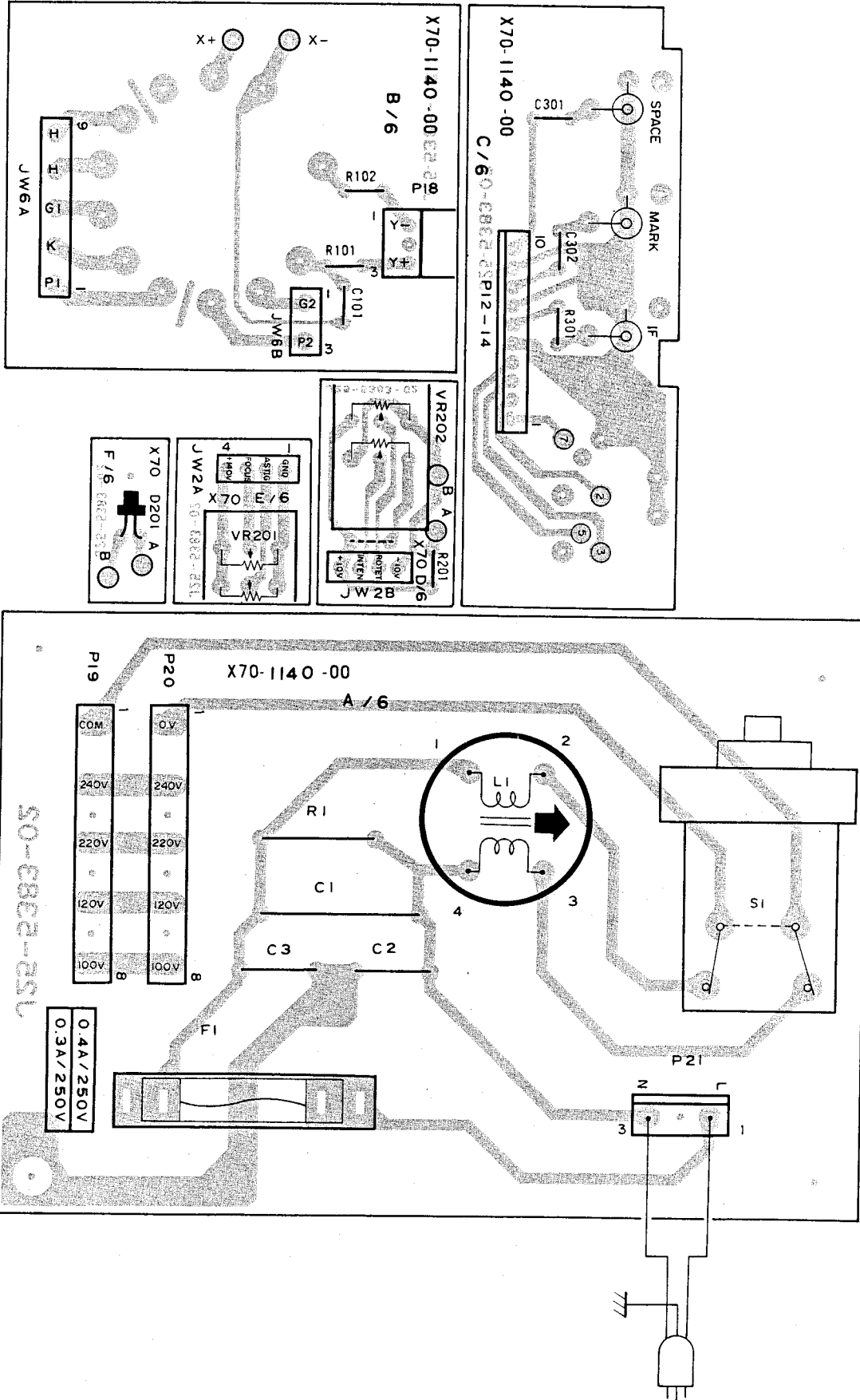


NJM4558D



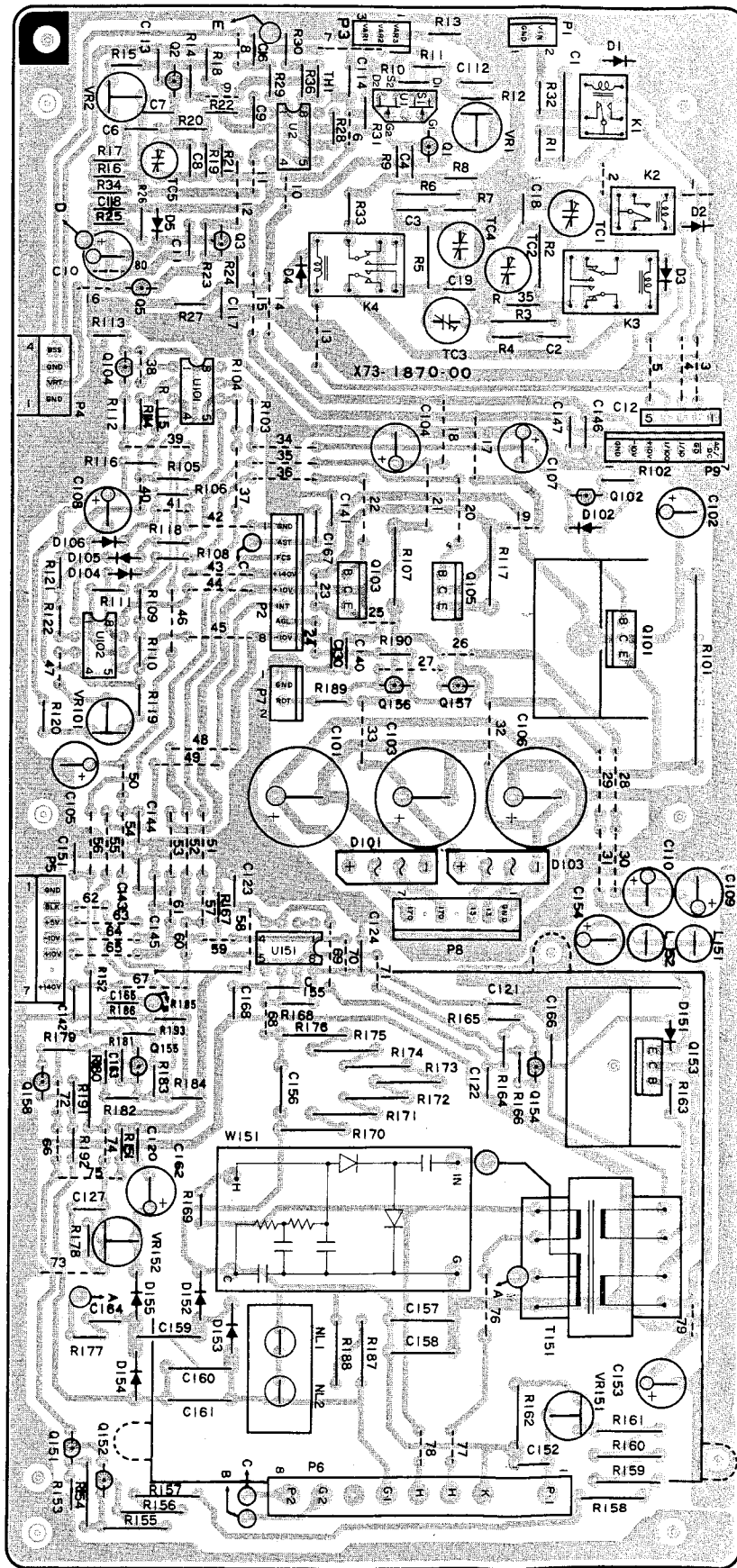
▼ FILTER UNIT (X70-1140-00)
[Component side view]

▼ FILTER
[Foil side]



PC BOARD VIEW

▼ VERTICAL UNIT (X73-1870-00)
[Component side view]



- U1: 2SK389 (GR) U2: NJM4558D U101, 102: NJM4558D U151: NJM4558D Q1: 2SC3315 Q2: 2SC2785 Q3: 2SC3779 Q5: 2SC3315
- Q101: 2SA1156 Q102: 2SC2271 Q103: 2SB1133 Q104: 2SC2785 Q105: 2SD1666 Q151, 152: 2SA1091 Q153: 2SD613
- Q154: 2SA1175 Q155: 2SC2909 Q156: 2SC1384 Q157: 2SA684 Q158: 2SA1207 D1~4: 1SS132 D5: MTZ5.1JB D101: S1VB60
- D102: 1SS132 D103: S1VB20 D104, 105: MTZ10JC D106: MTZ5.1JB D151: 1SS132 D152, 153: 1SR35-200 D154, 155: 1SS83

▼ VE
[Foil s

2SA684
2SC138

2SD613

2SA117
2SC278

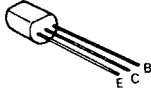
2SK389

2SA115

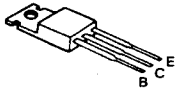
NJM455
TL082C

▼ VERTICAL UNIT (X73-1870-00)
[Foil side view]

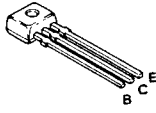
2SA684
2SC1384



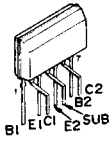
2SD613



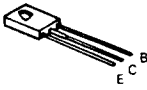
2SA1175
2SC2785



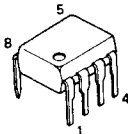
2SK389



2SA1156

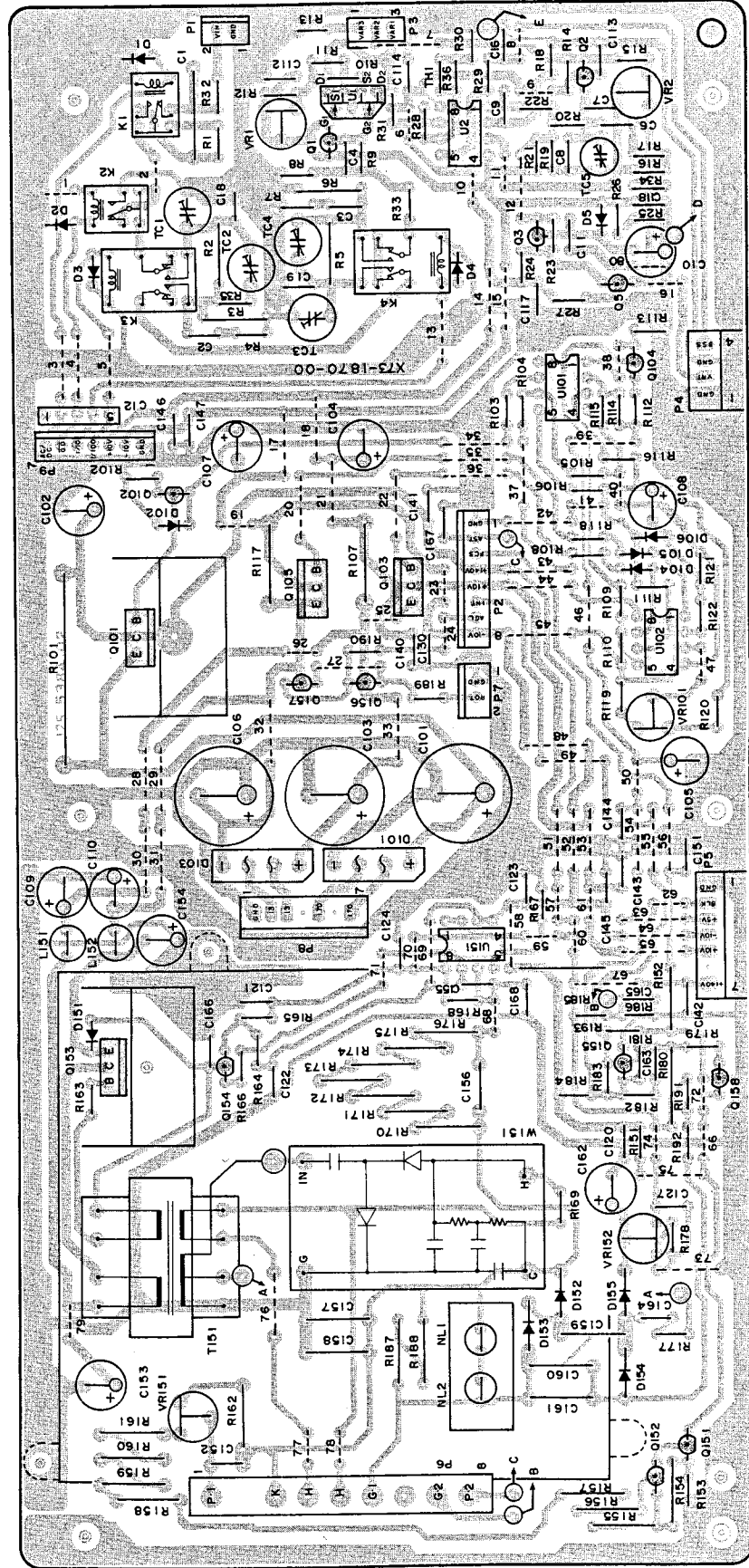


NJM4558D
TL082CP



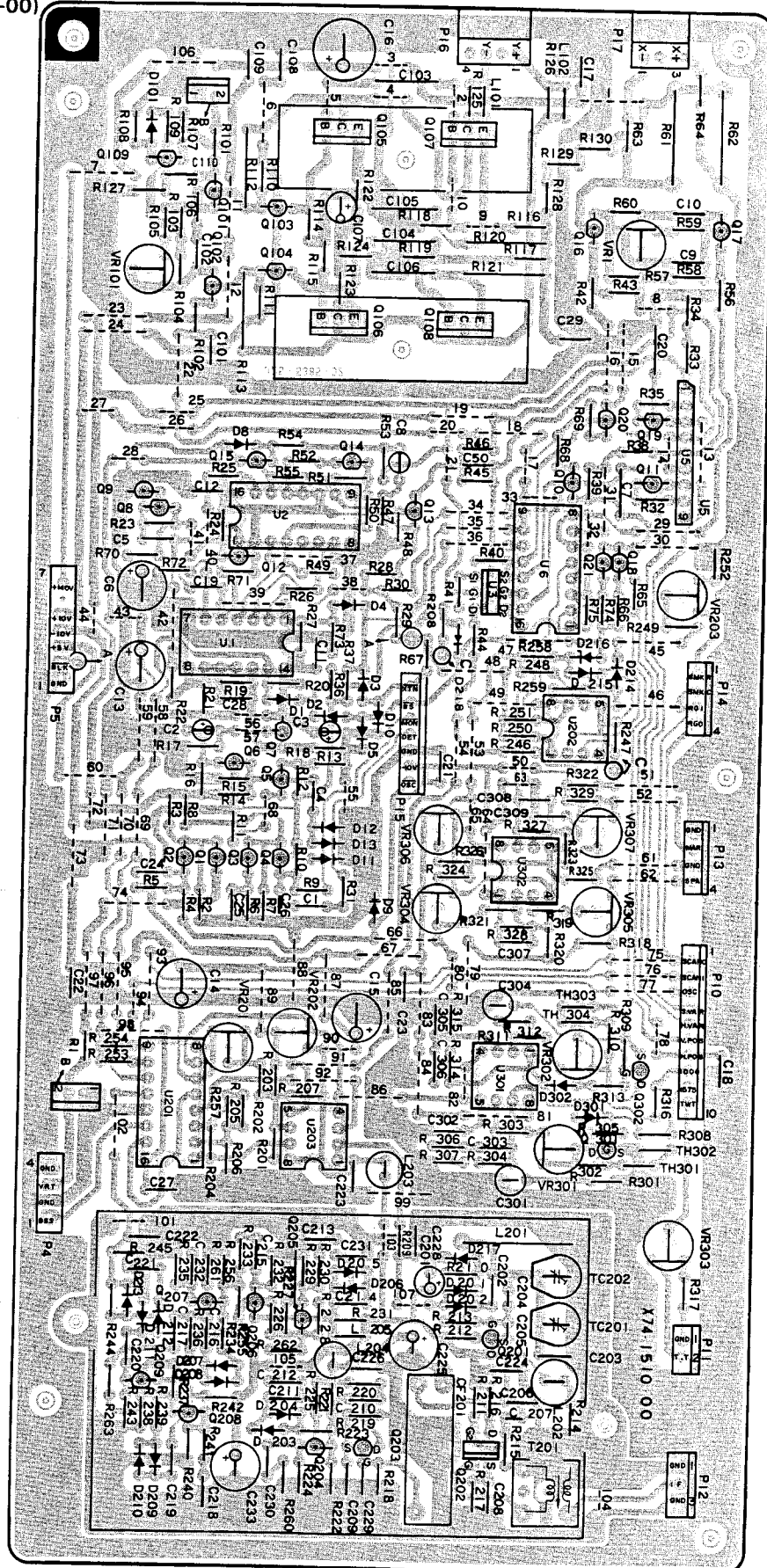
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▼ HORIZONTAL UNIT (X74-1510-00)
 [Component side view]

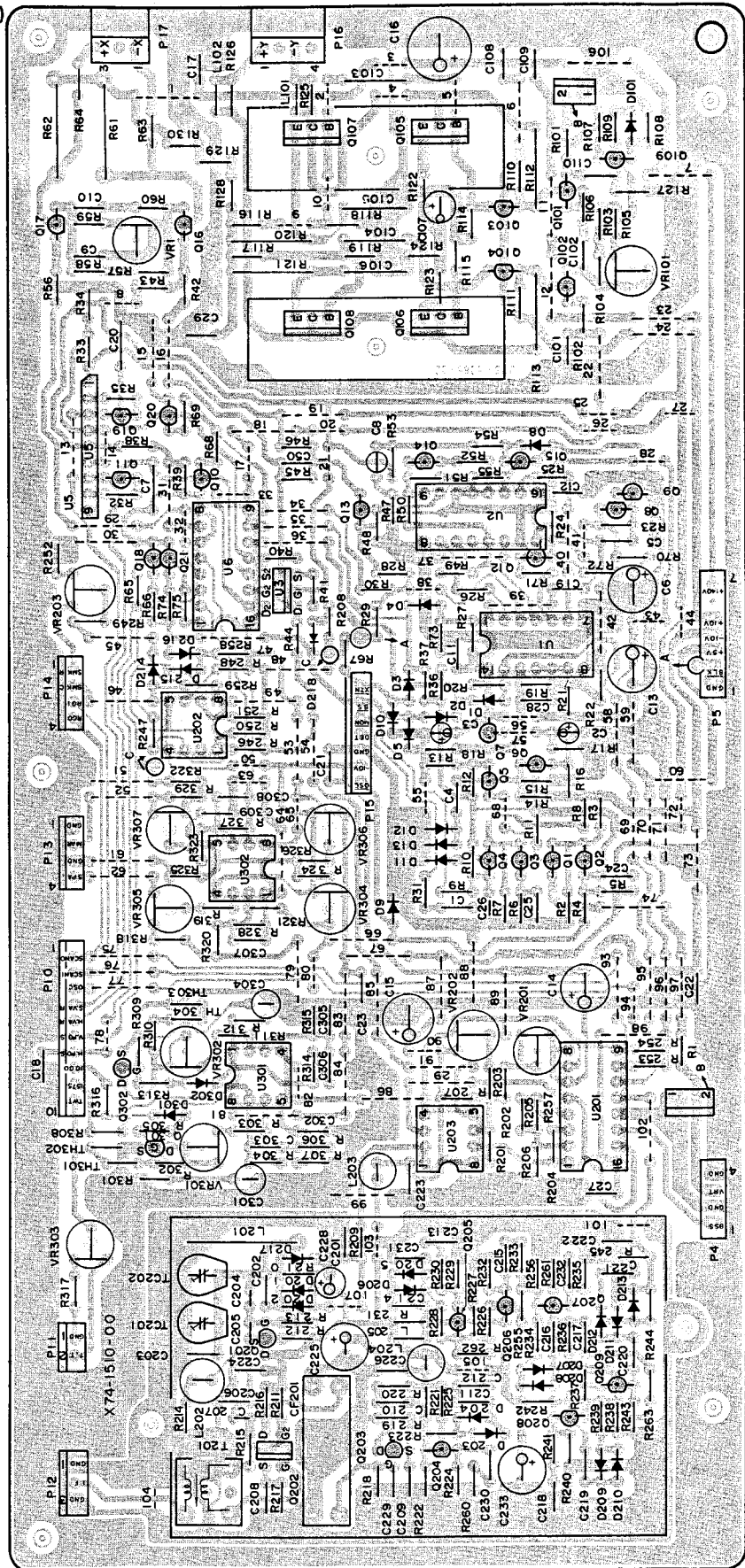
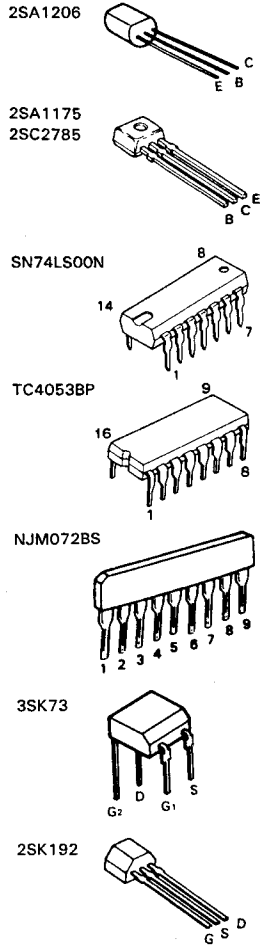
- U1: SN74LS00N U2: SN74LS112AN U3: 2SK332 U5: NJM072BS U6: TC4053BP U201: TC4053BP U202, 203: NJM4558D
- U301: NJM4558D U302: TL082CP O1~4: 2SC2785 O5: 2SA1175 O6: 2SC2785 O7: 2SA1206 O8: 2SA1175 O9: 2SC2785

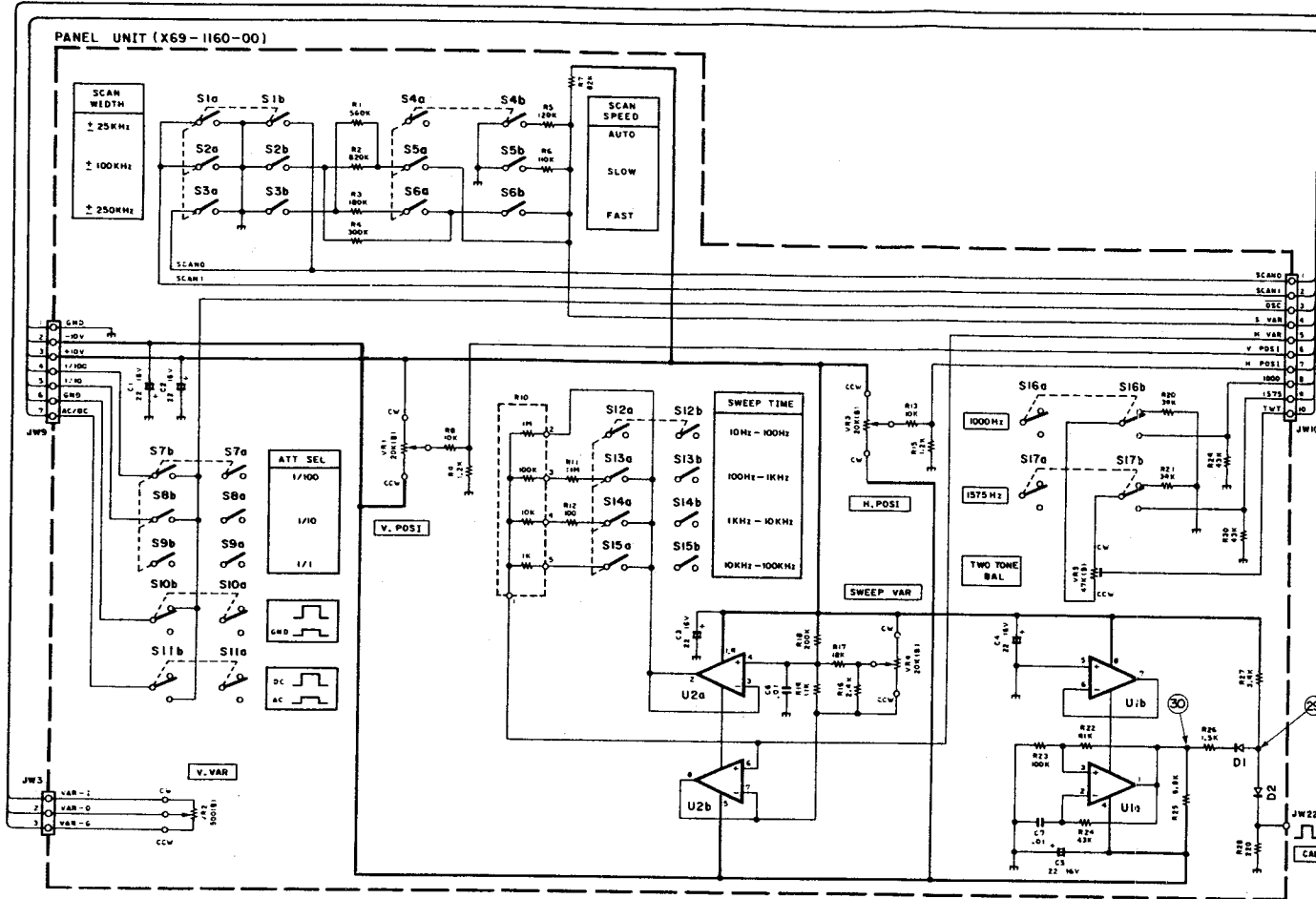


▼ HORIZONTAL UNIT (X74-1510-00)
 [Foil side view]

- 2SA1206
- 2SA1175
- 2SC2785
- SN74LS00N
- TC4053BP
- NJM072BS
- 3SK73
- 2SK192

▼ HORIZONTAL UNIT (X74-1510-00)
[Foil side view]





(X69-1160-00)

- U1 : NJM4558D
- U2 : NJM072BS
- D1, 2 : ISS132
- D101 : DSA-102MA
- D102, 103 : MA700
- D104 : IS1587

(X73-1870-00)

- U1 : 2SK389(GR)
- U2, 101, 102, 151 : NJM4558D
- Q1, 5 : 2SC3315(C, D)
- Q2, 104 : 2SC2785(F)
- Q3 : 2SC3779(D)
- Q101 : 2SB1156(L)
- Q102 : 2SC227(IID)
- Q103 : 2SB1133(S)
- Q105 : 2SD1666(S)
- Q151, 152 : 2SA109(IIO)
- Q153 : 2SD613(E)
- Q154 : 2SA1175(F)
- Q155 : 2SC2909(S, T)
- Q156 : 2SC1348(R)
- Q157 : 2SC1384(R)
- Q158 : 2SA1207
- D1~4, 102, 151 : ISS132
- D5, 106 : MTZ-5.1JB
- D101 : SIVB60
- D103 : SIVB20
- D104, 105 : MTZ-10JC
- D152, 153 : ISR35-200
- D154, 155 : ISSB3
- TH1 : I12-103-2

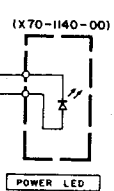
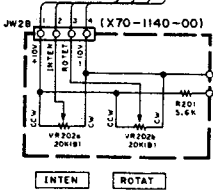
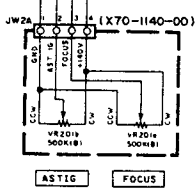
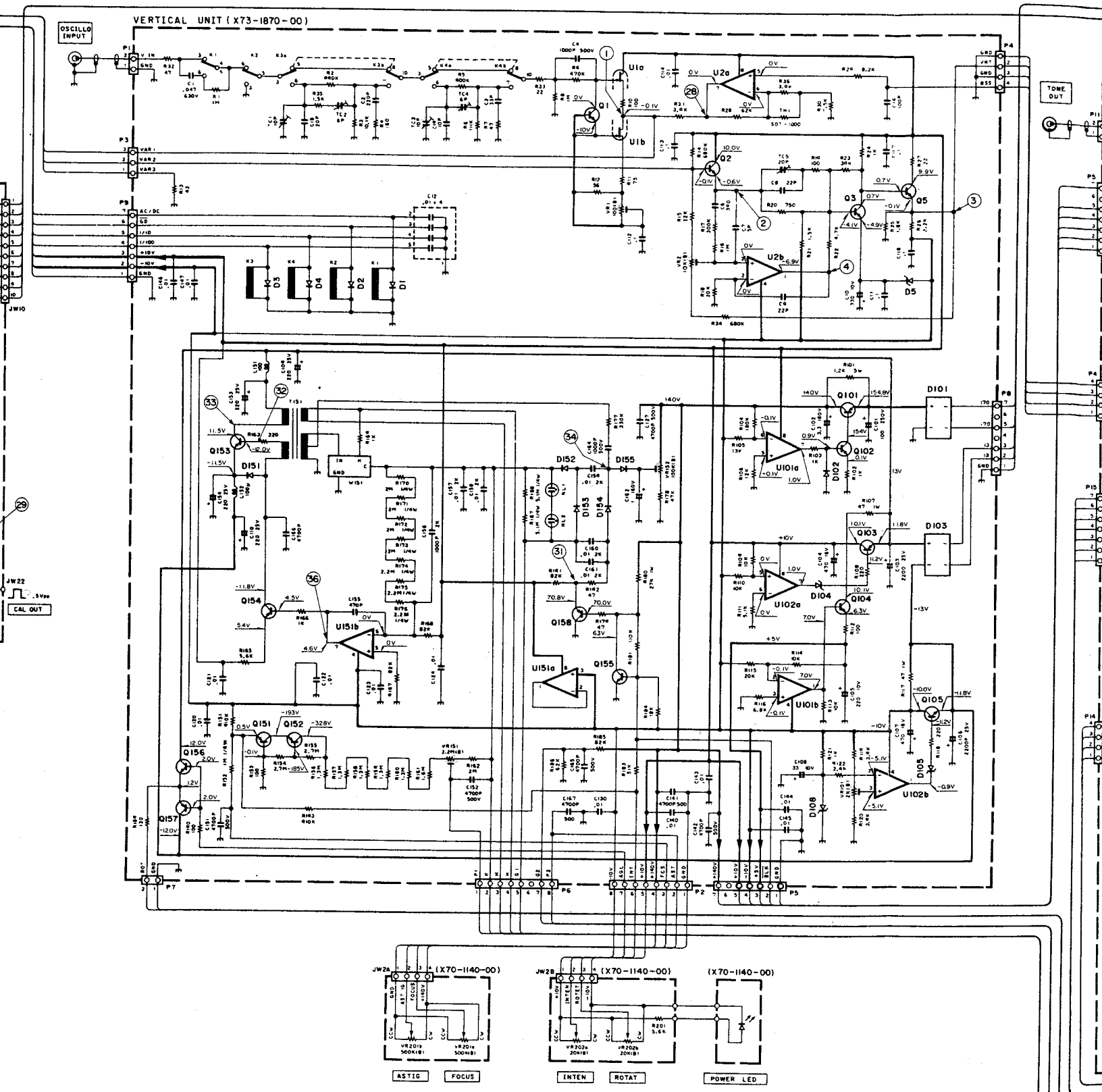
(X74-1510-00)

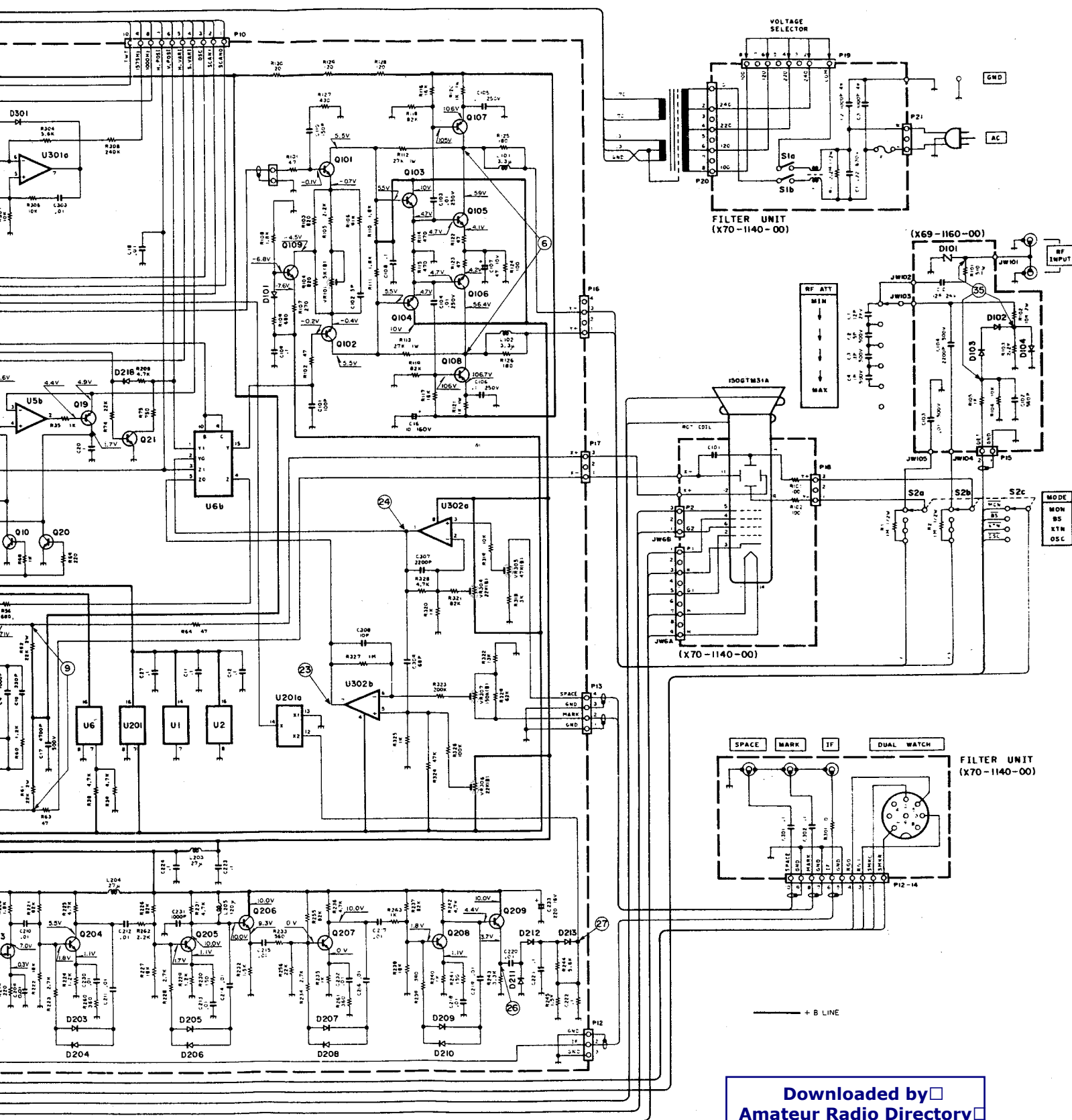
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- U2 : SN74LS112AN
- U3 : 2SK332(F)
- U5 : NJM072BS
- U6, 201 : TC4053BP
- U202, 203, 301 : NJM4558D
- U302 : TL082CP
- Q1~4, 6, 9, 12, 15, 204~209 : 2SC2785(F)
- Q5, 8, 11, 13, 14, 18, 19, 21 : 2SA1175(F)
- Q7 : 2SA1206
- Q10, 20 : 2SC3732(L)
- Q16, 17 : 2SC2909(S)
- Q101~104, 109 : 2SC3315(C)
- Q105, 106 : 2SC2911(S)
- Q107, 108 : 2SA1209(S)
- Q201 : 2SK192(GR)
- Q202 : 3SK73(GR)
- Q203, 301, 302 : 2SK404(F)
- D1, 4, 5, 8~11, 101, 203, 204, 207~210 : ISS132
- D2, 3 : MTZ10JC
- D12, 13, 205, 206, 211, 212 : MA700
- D201, 202 : ISV50
- D216 : MTZ5.1JB
- TH301~304 : I12-102-2

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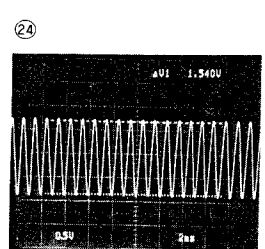
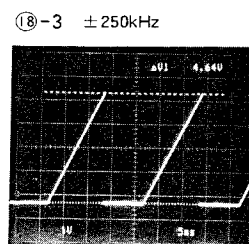
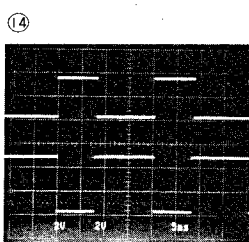
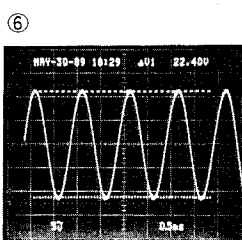
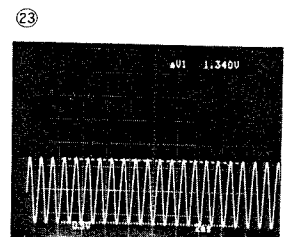
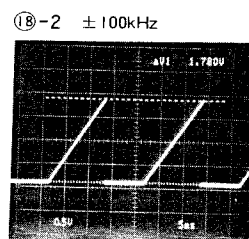
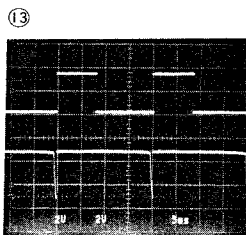
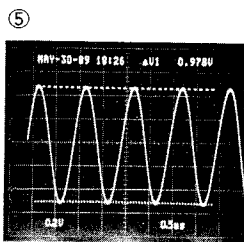
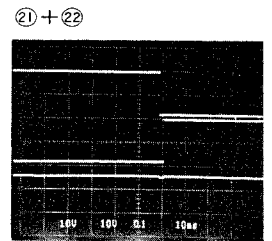
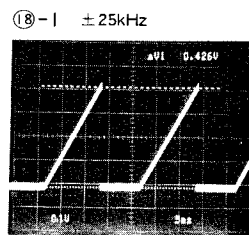
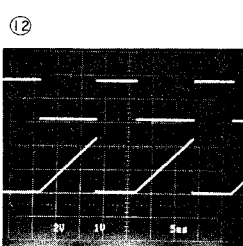
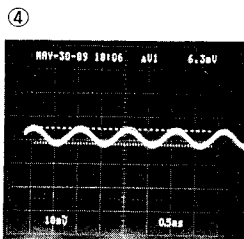
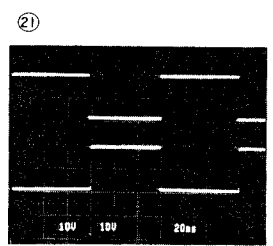
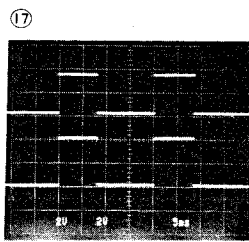
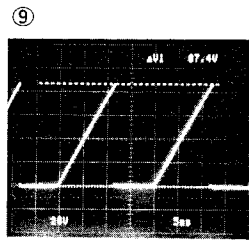
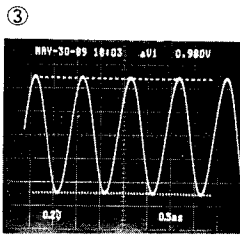
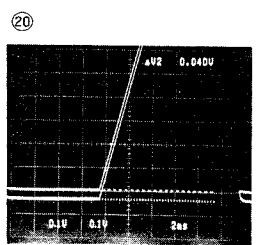
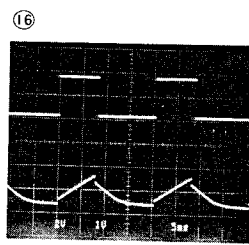
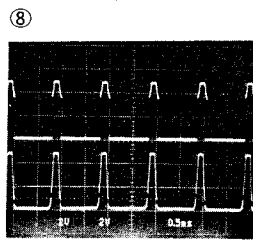
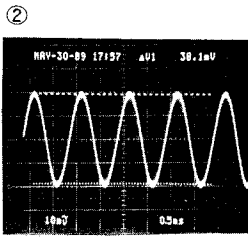
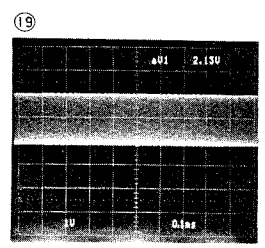
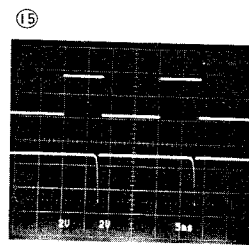
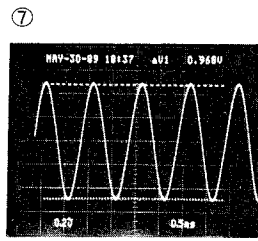
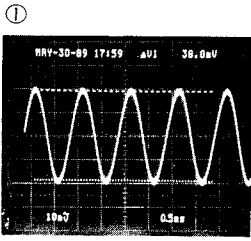
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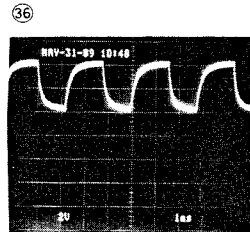
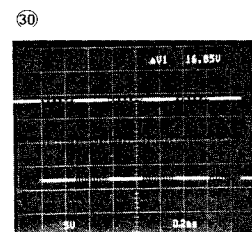
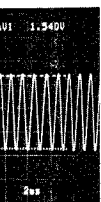
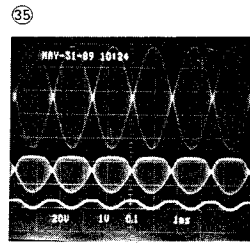
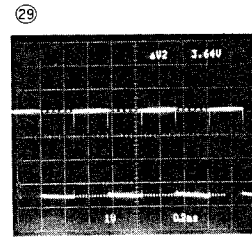
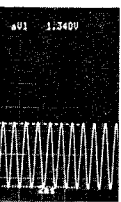
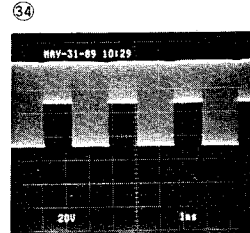
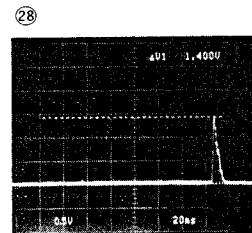
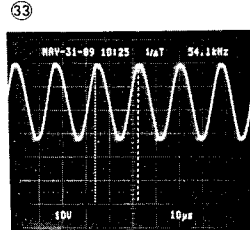
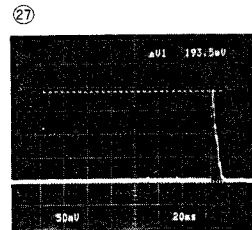
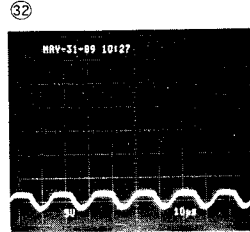
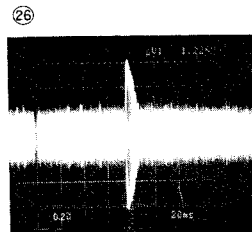
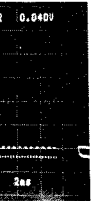
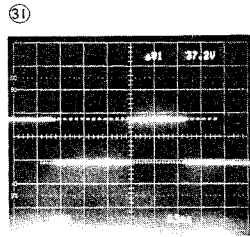
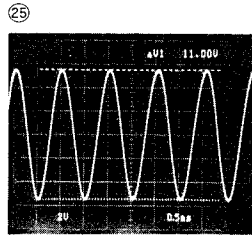
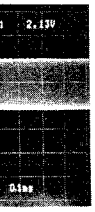
VERTICAL UNIT (X73-1870-00)





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«Conditions»

OSC MODE

Input : 50 mVp-p, 1 kHz \sin
 ATT : 1/1
 V-Vari : NORM \curvearrowright
 Horizontal : Any position

X-TUNE MODE

Input : 300 mVp-p 1 kHz \sin

Band-Scope MODE

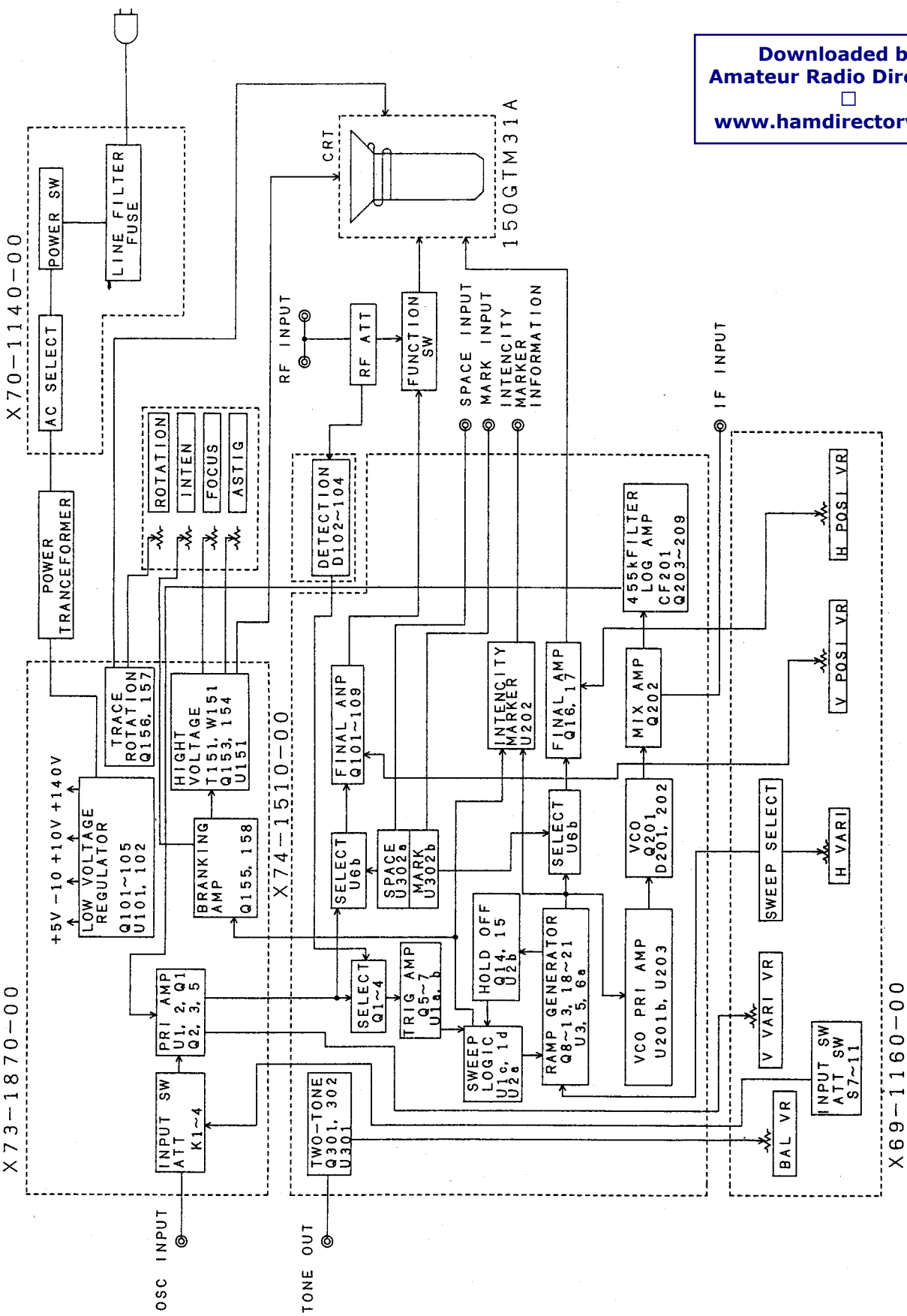
Input : 1 mVrms 8.83 MHz

Monitor MODE

Input : Approx. 10 W 7 MHz Two Tone

BLOCK DIAGRAM

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C. R. T
 TRANS
 Frequen
 Maxim
 PAN DI
 Input c
 Input s
 Scan w
 TWO-T
 Oscillat
 Output
 Output
 VERTIC
 Deflect
 Input in
 Frequen
 Max. in
 SWEEP
 Sweep
 Sync. s
 POWER
 OPERA
 DIMENS
 Project
 Project
 Weight

SM-230

SPECIFICATIONS

| | |
|---|---|
| C. R. T. | 150GTM31A 6 inch square |
| TRANSMIT SIGNAL MONITOR TERMINAL | |
| Frequency range | 1.8 ~ 150 MHz |
| Maximum power | 1.8 ~ 30 MHz 2 KW PEP MAX. 5MIN. at ATT MAX 30 ~ 150 MHz 100 W PEP |
| PAN DISPLAY | |
| Input center frequency | 8.830 MHz |
| Input sensitivity | More than 20 dB μ /DIV |
| Scan width | \pm 25 KHz, \pm 100 KHz, \pm 250 KHz selectable |
| TWO-TONE GENERATOR | |
| Oscillator frequency | 1000 Hz, 1575 Hz \pm 10% |
| Output voltage | 5 mVrms \pm 20% |
| Output impedance | 600 Ω |
| VERTICAL AMPLIFIER | |
| Deflection sensitivity | 10 mV ~ 10 V/DIV (In 3 ranges, variable) |
| Input impedance/capacity | 1M Ω Less than 50 pF |
| Frequency response | DC ~ 10 MHz (-3 dB) |
| Max. input voltage | 500 Vp-p or 250 V (DC-AC peak) |
| SWEEP CIRCUIT | |
| Sweep frequency | 10 Hz ~ 100 KHz (In 4 ranges, variable) |
| Sync. system | Synchronized sweep |
| POWER SUPPLY | |
| | 120 V (K) \pm 10% |
| | 220 V (W) \pm 10% |
| | 120-220-240 V (-10% ~ 250 V) (M) |
| OPERATING TEMPERATURE | 0 $^{\circ}$ C ~ 50 $^{\circ}$ C |
| DIMENSIONS (W x H x D) | |
| Projections not included (mm) | 260 x 141 x 400 |
| Projections included (mm) | 260 x 155 x 427 |
| Weight | 7.5 Kg |

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KENWOOD ELECTRONICS BENELUX N.V.

Mechelsesteenweg 418 B-1930 Zaventem, Belgium

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13, Boulevard Ney, 75018 Paris, France

KENWOOD LINEAR S.P.A.

20125, Milano-via Arbe, 50, Italy

KENWOOD ELECTRONICS AUSTRALIA PTY. LTD.

(INCORPORATED IN N.S.W.)

4E, Woodcock Place, Lane Cove, N.S.W. 2066, Australia

KENWOOD & LEE ELECTRONICS, LTD.

Wang Kee Building, 5th Floor, 34-37, Connaught Road, Central, Hong Kong

KENWOOD ELECTRONICS CANADA INC.

P.O. BOX 1075, 959 Gana Court, Mississauga, Ontario, Canada L4T 4C2

KENWOOD

SERVICE BULLETIN AMATEUR RADIO

| | |
|---|------------------|
| SUBJECT SM-230 BANDSCOPE ATTENUATION | DATE 05/29/90 |
|---|------------------|

When the SM-230 is used as a bandscope, the attenuator circuit is bypassed. Sometimes it is necessary to use the attenuator during strong signal reception or high noise conditions. The following modification will allow the attenuator circuit to function in the bandscope mode.

REQUIRED PARTS:

W05-0309-00 ATT SUB-UNIT

1. Disconnect the power cord and patch cords.
2. Remove the top cover (6 screws).
3. Remove the Horizontal unit's mounting screw and secure the ATT sub-unit with the supplied 2.6mm screw and washer.
4. Remove connector P12 from the Horizontal unit and insert it into jack P1 on the ATT sub-unit.
5. Insert connector JA from the ATT sub-unit into jack P12 on the Horizontal unit.
6. Insert the two wire plug, supplied in the kit, into jack P2 on the ATT sub-unit.
7. Solder the exposed ends of the red and the brown wires to the Panel unit as shown in figure 2.
8. Solder the two jumper wires (they look like resistors) as shown in figure 2.

PAGE 1 OF 2

This modification may be covered under warranty.
Time required to perform the modification is 0.5 hrs. or less.
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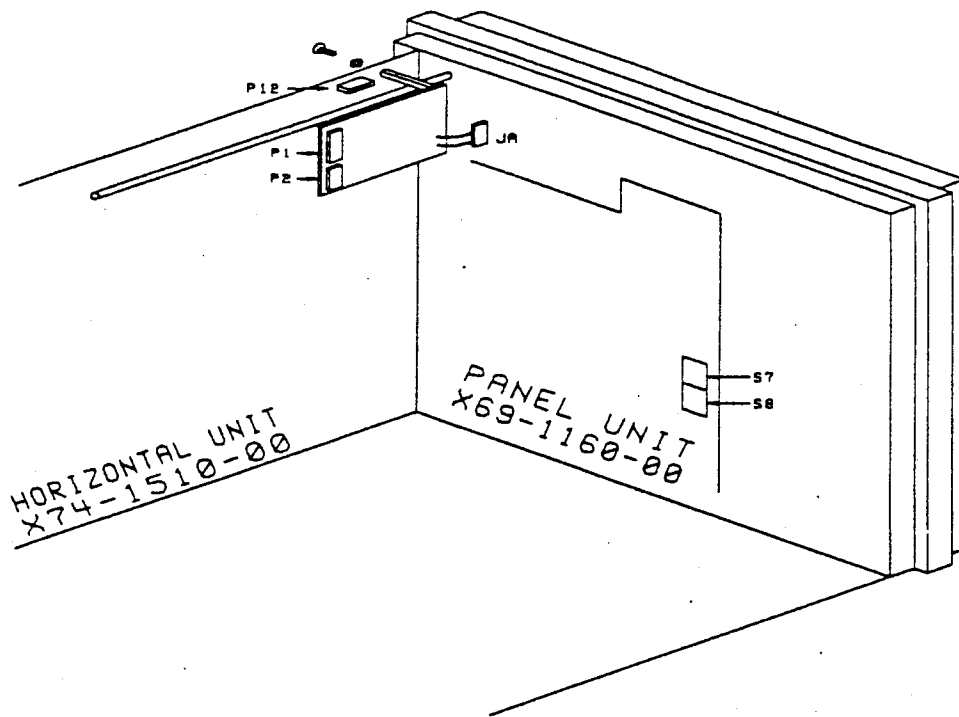
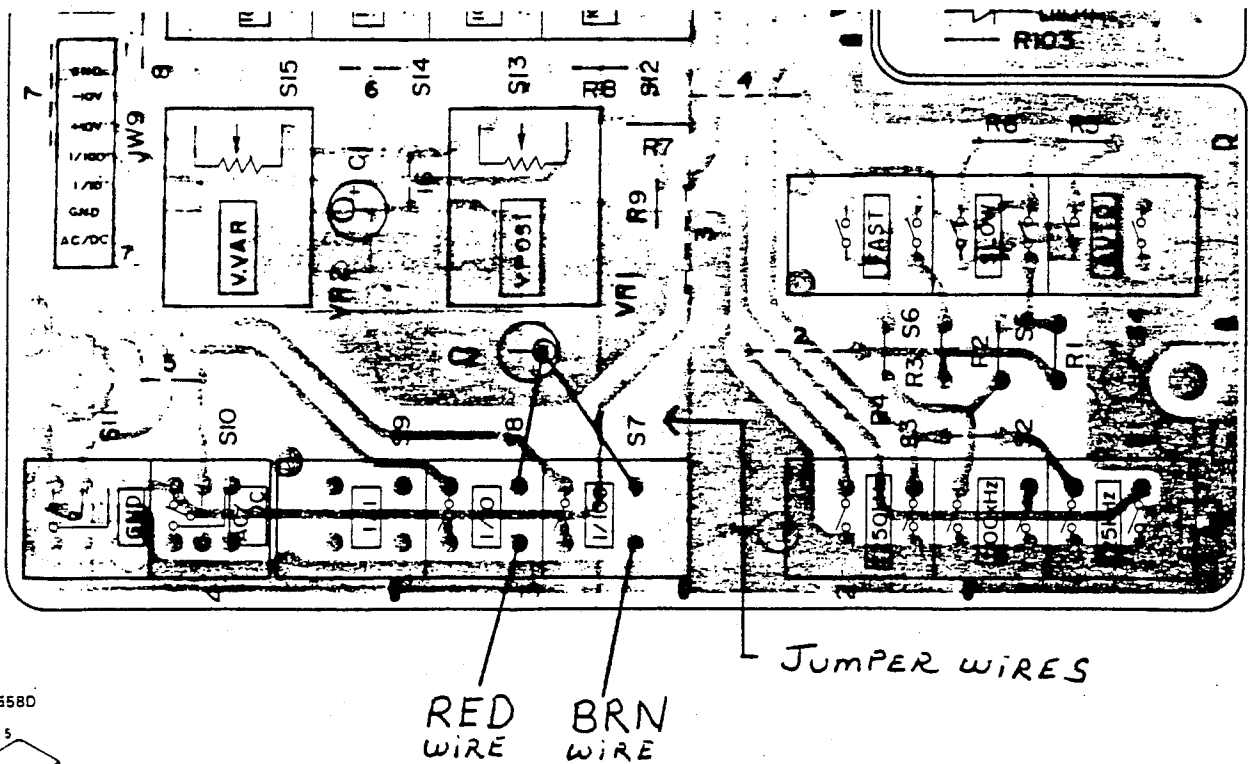


FIGURE 1



NJM4558D



PANEL UNIT (X69-1160-00) FOIL SIDE VIEW

FIGURE 2

KENWOOD

SB-975

SERVICE BULLETIN AMATEUR RADIO

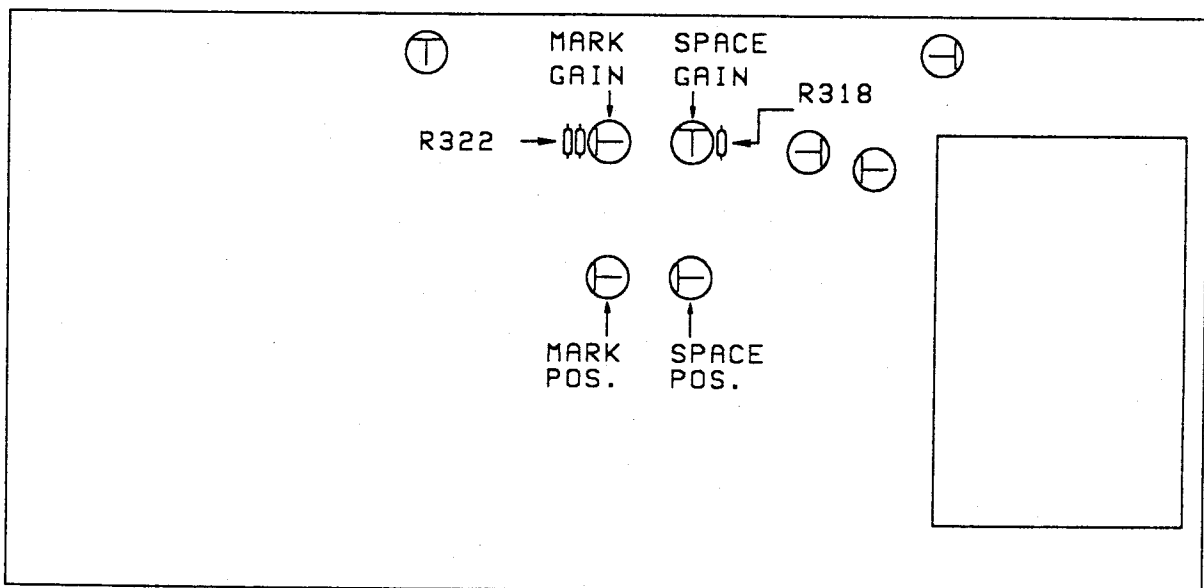
| | |
|--|------------------|
| SUBJECT SM-230 RTTY CROSS PATTERN ATTENUATION | DATE 08/08/90 |
|--|------------------|

Some users of the SM-230 have reported that the MARK and SPACE gain adjustments do not sufficiently reduce the signals to display them on the CRT. The following modification will correct this condition.

REQUIRED PARTS:

680 OHM 1/8W RESISTOR RD14CB2B681J QTY. 2

1. Disconnect the power cord and control cables.
2. Remove the top cover (6 screws).
3. Locate the Horizontal unit. This board is vertically mounted on the right side of the SM-230.
4. Locate resistors R318 and R322 on the Horizontal unit.
5. Replace R318 and R322 with 680 ohm resistors.
6. Assemble the SM-230.
7. Adjust the MARK and SPACE gain adjustments as necessary to obtain the correct cross pattern.



Time required to perform this modification is 1 hr. or less.
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