B+K PRECISION **1472B**

15 MHz, TRIGGERED SWEEP

Dual-Trace Oscilloscope

B+K PRECISION

A Product of DYNASCAN CORPORATION 1801 West Belle Plaine • Chicago, Illinois 60613

PRICE $2.00

CIRCUIT DESCRIPTION

The block diagram, Fig. 55, outlines the circuit breakdown of the oscilloscope. Circuit details are obtained by reference to the schematic diagram.

GENERAL

Basically, the oscilloscope consists of two identical vertical preamplifiers, each having its own input attenuator network. The outputs of the vertical preamplifiers can be switched, as desired, into the main vertical amplifier. The type of switching of the CH A and CH B preamplifiers is determined by the position of the MODE switch and MODE of OPERATION LOGIC. The main vertical amplifier feeds the VERTICAL OUTPUT AMPLIFIER, which drives the vertical deflection plates of the CRT.

Horizontal deflection is provided by the horizontal amplifier. Drive to the horizontal amplifier is furnished by calibrated sweep speed circuits or by the signal from the CH B preamplifier when X-Y operation is selected.

All supply voltages are fully regulated and a DC-to-DC converter provides a regulated 2kV accelerating potential to the CRT.

VERTICAL PREAMPLIFIERS

Channel A and Channel B preamplifiers contain identical circuitry and circuit operation is the same for both.

The vertical attenuator has two sections. The first section of the attenuator provides ratios of 1:1, 10:1, 100:1, 1000:1. The second section provides ratios of 1:1, 2:1 and 5:1. The combined effect of the two sections is to provide the vertical attenuator ratios in a 1-2-5 sequence.

The vertical preamplifier consists of FET input transistors Q102 and Q103 and transistors Q104 thru Q109. Q102 is designed as a source follower since it receives the signal through high input impedance. Further, the Q102 forms a balanced circuit with the Q103 to reduce thermal drifts and other effects of fluctuation of the power source voltage. VR101 is the front panel DC balance control. The output of Q102 and Q103 is applied to emitter followeres Q104 and Q105 which lower the output impedance to drive conventional amplifier stage Q106 and Q107. VR105 and VR106 are balance pots for the 1/2 and 1/5 attenuator positions. The VARIABLE control adjusts the gain of Q106 and Q107 while VR101 provides a DC component to move the trace vertically across the screen. Amplifier gain is adjusted by VR107 in the emitter circuit of Q108 and Q109 to provide the correct deflection factor for accurate voltage measurements.

The trigger amplifier Q119 and Q120 amplifies the signal at the emitter of Q108 and Q109 and provides a portion of the signal to the trigger circuits.

The only difference between CH A and CH B preamplifiers is that the MODE switch reverses the polarity of the CH B signal when in the A-B position.

MODE LOGIC

The mode of operation (CH A, CH B, A & B, A + B, A – B) is controlled by IC101 and IC102 and diodes D101 – D108 in each of the channel preamplifiers.

When CH A is selected, the output of IC102 Pin 3 is low, which reverse-biases D102 and D103 and forward-biases D101 and D104, allowing the CH A signal into the main vertical amplifier. At the same time IC102 Pin 11 output is high which forward-biases D106 and D107 and reverse-biases D105 and D108 prohibiting CH B signal from the main amplifier. For CH B, the reverse is true. When A & B is selected, both channels are alternately switched by IC101 at a rate equal to the chopping oscillator frequency (200kHz). For A + B and A – B, both channels are simultaneously applied to the main amplifier. When X-Y operation is selected, CH A is turned on and CH B is switched to the horizontal amplifier.

VERTICAL AMPLIFIER

The selected signal from the preamplifiers is then applied to the vertical amplifier which consists of Q123, Q124 and IC103. The signal level is increased to drive the output amplifier.

The output amplifier consists of transistors Q301 thru Q306 where the signal is amplified to the levels required to drive the vertical deflection plates of the CRT.

TRIGGER CIRCUIT

The trigger source, either CH A or CH B, is selected by SW201. Selecting CH A as the source enables trigger amplifier Q119 and Q120 and CH B enables trigger amplifier Q121 and Q122. The trigger amplifier selected is fed thru transistor switch Q219. Q219 is on in all positions of the SWEEP TIME/CM switch except CH B.

SYNC AMPLIFIER AND INVERTER

Transistors Q201, Q202, Q203, and Q204 are connected as a differential amplifier. The trigger signal is applied to emitter follower Q201 and routed to the base of Q202 or Q203 depending upon the position of the SYNC switch, SW202, + or – respectively. Emitter follower Q204 adds a DC level to the trigger signal depending upon the position of the TRIGGER LEVEL control.

When TV+ or TV– is selected, the output of Q203 is routed to the SYNC SEPARATOR circuit consisting of Q205 and Q206. Q205 is biased near cutoff. Q205 is held cutoff by the negative voltage developed across Q205 corresponding to an average value of the input signal. Positive-going pulses drive Q205 out of cutoff. The output of Q205 corresponds to the sync tips of the composite video signal.

When in TVV positions of time base switch (.1mS to .5 SEC), capacitor C207 is switched in by Q206 to filter out the horizontal sync pulses.

The trigger signal passes thru emitter follower Q207 and the SCHMITT TRIGGER circuit consisting of two gates of IC201. The output pulses from IC201 PIN 8 clock the SWEEP CONTROL flip-flop IC202. On the negative edge of the clock waveform, the Q output goes low, turning off Q213 to initiate to sweep.

Transistors Q216 and Q216 and the timing capacitors and resistors selected by the SWEEP TIME/CM switch form a MILLER INTEGRATING circuit to provide a linear ramp voltage. The sweep ramp from the collector of Q217 is fed to the RS flip-flop consisting of two gates from IC201 thru transistor Q211 and Q212.

As soon as the Q output of IC202 goes low, the reset of IC202 is held low by Q211 to exclude any new clock pulses until the sweep ramp is terminated. Transistor Q212 turns on and sets pin 13 of IC202 LOW which turns Q213 on and terminates the sweep.

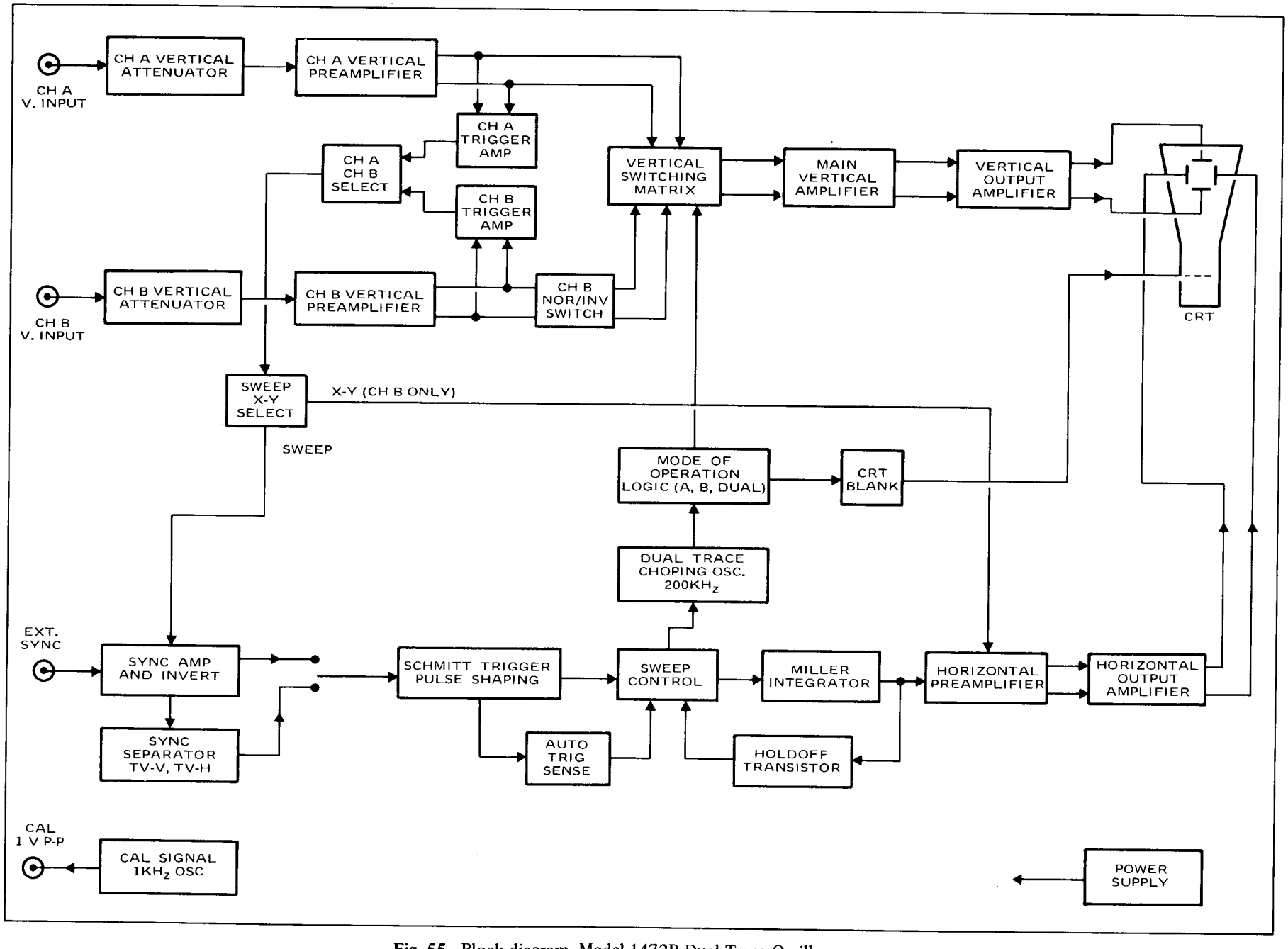


Fig. 55. Block diagram, Model 1472B Dual-Trace Oscilloscope.

Transistors Q208, Q209, and Q210 form the AUTO TRIGGER SENSE switch. When the TRIG LEVEL control is adjusted so that the slope is not triggered, transistor Q208 and Q209 produce pulses which keep Q210 ON. The on condition is applied to the RESET of IC202. A low on the reset of IC202 allows a sweep to recirculate at a rate determined by the resistor and capacitor selected by the TIME/CM switch.

The sweep ramp from the collector of Q217 is applied to the input of the horizontal amplifier consisting of Q218, Q220, Q221 – Q225.

When in the CH B position of SWEEP TIME/CM switch, mode, transistor Q219 is turned off thru IC203 and the CH B signal is applied to Q220 and to the horizontal amplifier. The output of transistors Q226 and Q227 is applied to the horizontal deflection plates of the CRT.

CALIBRATION ADJUSTMENTS

The calibration adjustments outlined here are those which can be performed with a minimum of specialized test equipment. Additional internal adjustments of frequency compensation and horizontal sweep linearity should not be attempted without complete service information and specified test equipment. Requests for complete service information for this oscilloscope should be addressed to:

SERVICE DEPARTMENT
B&K-PRECISION
DIVISION OF DYNASCAN CORPORATION
2815 W. Irving Park Road
Chicago, Illinois 60618

Internal adjustments outlined in the calibration procedure can be located by reference to Fig. 56 and 57.

CH A AND CH B DC BALANCE

1. Adjust controls to obtain a horizontal trace (CH A or CH B).
2. Adjust CH A or CH B POSITION control to center the trace vertically on the CRT.
3. Rotate the VARIABLE control from maximum CCW to maximum CW while observing the trace.
4. If the trace moves vertically more than 5mm while performing STEP 3, adjust the CH A or CH B DC BAL (front panel screwdriver adjustment) so that the vertical movement of the trace does not exceed 5mm while performing STEP 3.

1/2 & 1/5 ATTENUATOR BALANCE

1. Position trace to vertical center of screen CH A or CH B, with V ATTENUATOR in .01 V/CM and input at GND.
2. Switch to .02 V/CM and adjust VR105 (CH A) or VR108 (CH B) until trace is at vertical center.
3. Switch to .05 V/CM and adjust VR106 (CH A) or VR109 (CH B) until trace is at vertical center.

VERTICAL GAIN ADJUSTMENT

The following adjustments should be attempted *only* if a square wave generator with 1% or better amplitude accuracy is available.

Procedure:

1. Set CH A and CH B VOLTS/CM switches to .01V/CM and set CH A and CH B VARIABLE controls to CAL (fully clockwise).
2. Apply 1 kHz square wave of 50 mV peak-to-peak into CH A input connector. Set mode switch to CH A.
3. Adjust VR107 for exactly 5 CM of deflection on CRT.
4. Repeat steps 2 and 3 for CH B and adjust VR110 for 5 CM deflection.

HORIZONTAL POSITION ADJUSTMENT

1. Set ◄► POSITION control mechanical center.
2. Set SWEEP TIME/CM switch to CHB.
3. Adjust VR205 so that the spot on the scope is horizontally centered on CRT.
4. Turn the ◄► POSITION control full CW and CCW. The amount of deflection in both directions should be a minimum of 4 CM.

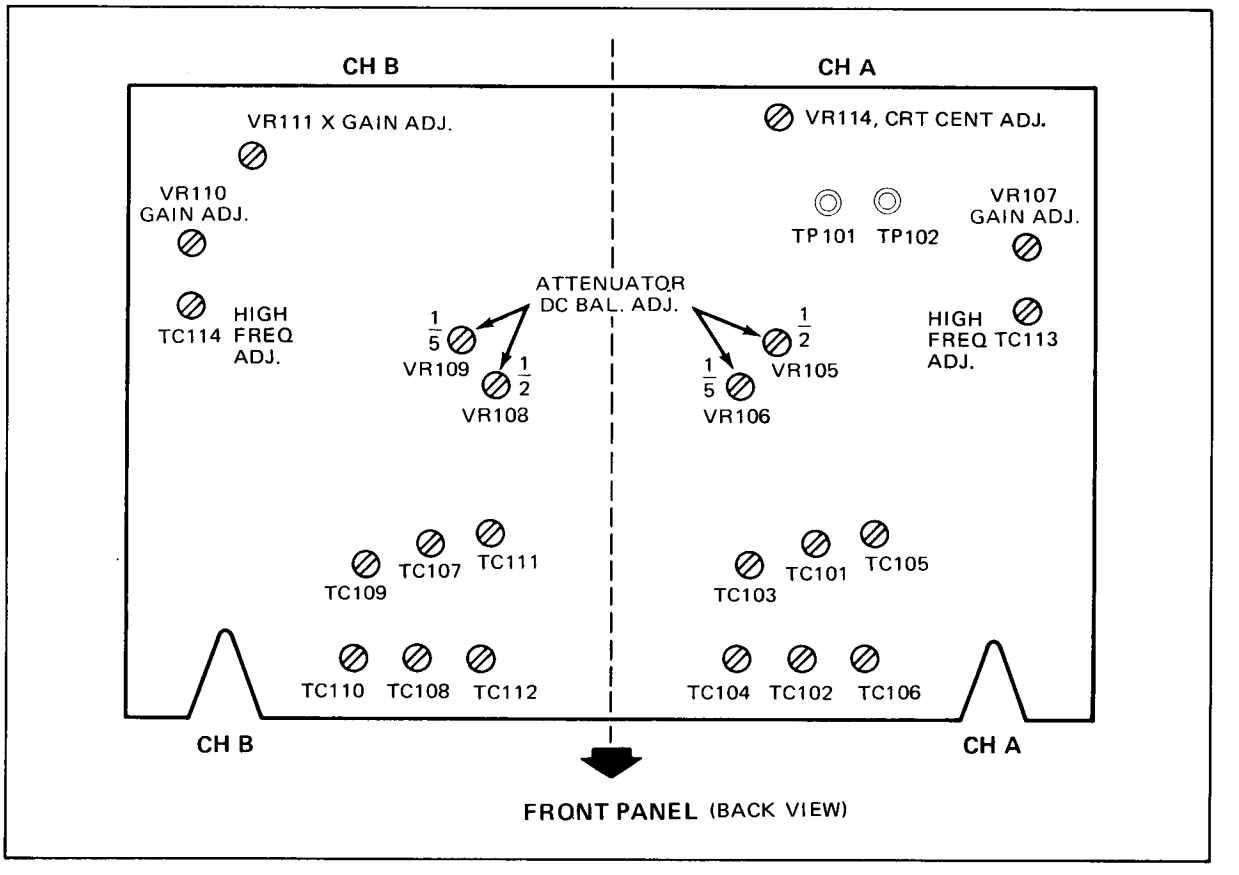


Fig. 56. Calibration diagram, vertical amplifier board.

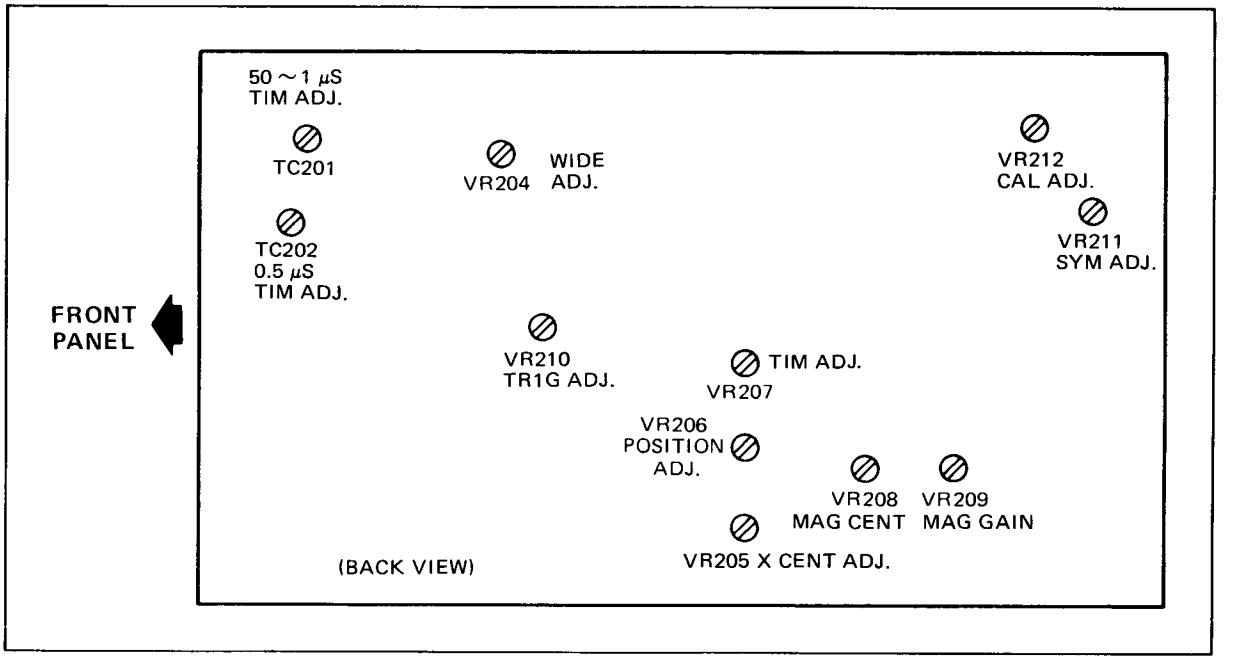


Fig. 57. Calibration diagram, horizontal amplifier board.

DESCRIPTION	B & K PART NO.

MAIN CHASSIS

Bezel	380-234-9-004
CRT 130BRB31 or C535P31B	230-008-9-001
Filter, Gray	380-234-9-001
Fuse, 1A	191-251-3-102
Graticule	380-234-9-002
Instruction Manual	480-166-9-001
Knob, "VOLTS/CM", "SWEEP TIME/CM"	751-120-9-001
Knob, "VARIABLE"	751-120-9-002
Knob, "POSITION/DC BAL"	751-120-9-003
Knob, "INTENSITY"	751-120-9-004
Knob (Lever Switches)	751-120-9-005
Line Cord	420-013-9-001
Lamp assembly	400-037-9-001
Power Transformer	065-109-9-001
Vector Overlay	482-041-9-001

NOTE: Standard value resistors and capacitors are not listed. Values may be obtained from schematic diagram. Minimum charge $5.00 per invoice. Orders will be shipped C.O.D. unless previous open account arrangements have been made or remittance accompanies order. Advance remittance must cover postage or express charges. Specify serial number when ordering replacement parts.

B & K–PRECISION MODEL 1472B PARTS LIST

488-147-9-002

SCHEMATIC SYMBOL	DESCRIPTION	B & K PART NO.

VERTICAL AMPLIFIER P.C. BOARD

RESISTORS & CONTROLS

VR101, VR103	Potentiometer, Dual 1K, 5K; "POSITION", "DC Bal"	008-226-9-001
VR105, 106, 108, 109, 114	Trimpot, 47KΩ, 0.15W, 25%	008-169-9-008
VR107, 110, 111	Trimpot, 33OΩ, 0.15W, 25%	008-155-9-006

CAPACITORS

C101, 113	.1MF, 600V	033-018-9-002
C108, 120	1pF, 50V, 0.25pF Ceramic Disc	020-142-9-001
C110, 112, 122, 124	47MF, 16V Electrolytic	022-090-9-003
C126, 128, 131	.01MF, 50V, Ceramic Disc	020-142-9-005
C107, 119	10pF, 50V, 0.5pF Ceramic Disc	020-142-9-003
C134	220MF, 10V, Electrolytic	022-126-9-001
C136, 138	100MF, 16V, Electrolytic	022-073-9-002
TC101, 103, 105, 107, 109, 111, 113, 114	10pF Trimmer	028-032-9-001
TC102, 104, 106, 108, 110, 112	20pF Trimmer	028-032-9-002

SEMICONDUCTORS

IC101	Integrated Circuit SN7472	307-069-9-003
IC102	Integrated Circuit SN7403	307-069-9-002
IC103	Integrated Circuit RC733T	307-069-9-001
Q101-103, 110-112	FET Transistor 2SK30A-0	182-026-9-001
Q104-109, 113-124	Transistor, Silicon 2SC535-B	176-036-9-001
D101-108, 111-115	Diode, Silicon IS1555	151-030-9-001
D109, 110	Diode, Silicon IS1587	151-048-9-001
TH101	Thermistor SDT-1000	013-083-9-001

SWITCHES & CONTROLS

S101, 105	Lever Switch, "AC-GND-DC"	080-003-9-001
S102a, b, c, VR104 S104a, b, c, VR102	Rotary Switch/500Ω "Volts/CM, Variable"	083-181-9-001
S103	Lever Switch, "MODE"	080-003-9-002

HORIZONTAL AMP/SWEEP P.C. BOARD

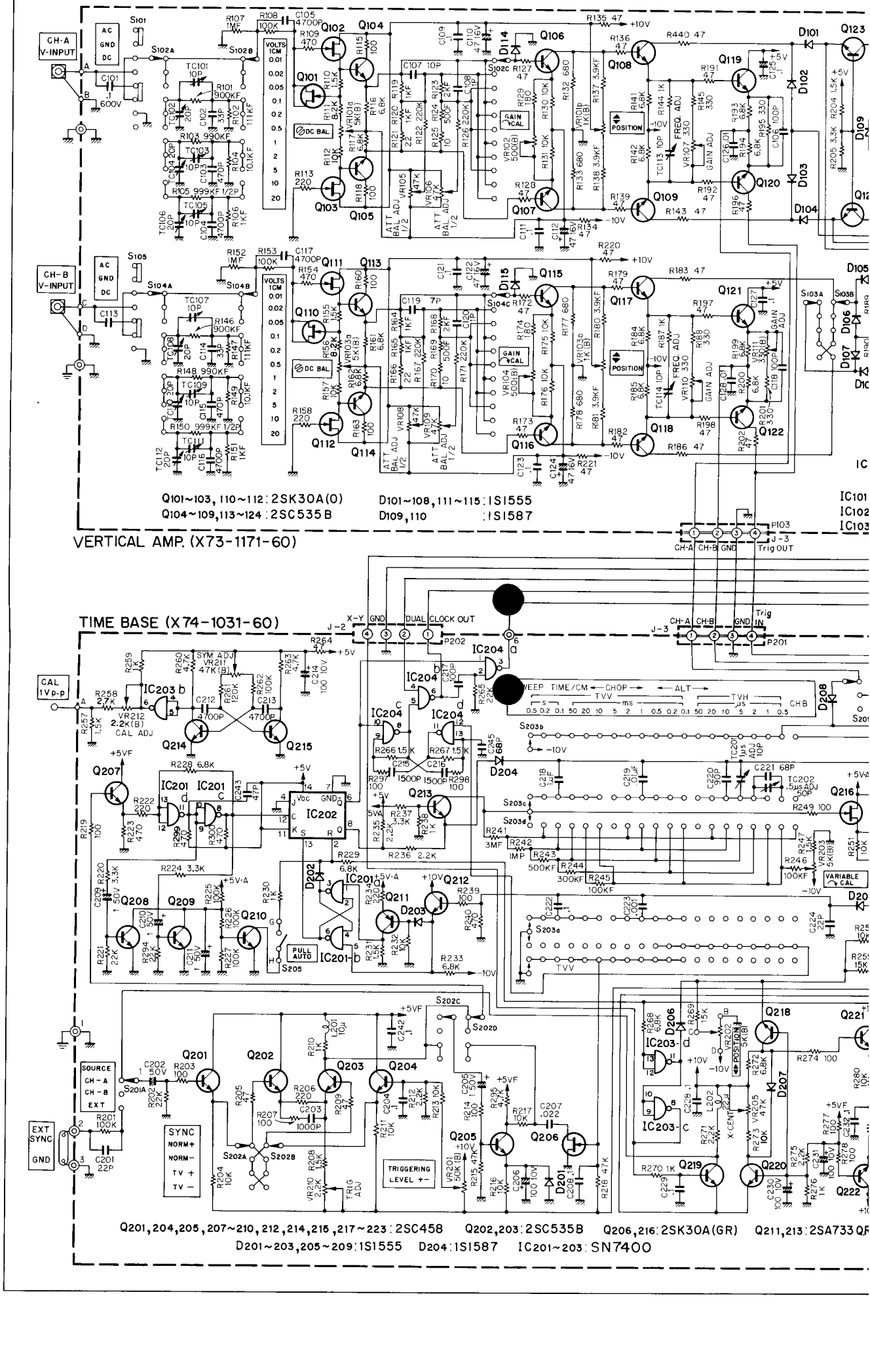
RESISTORS & CONTROLS

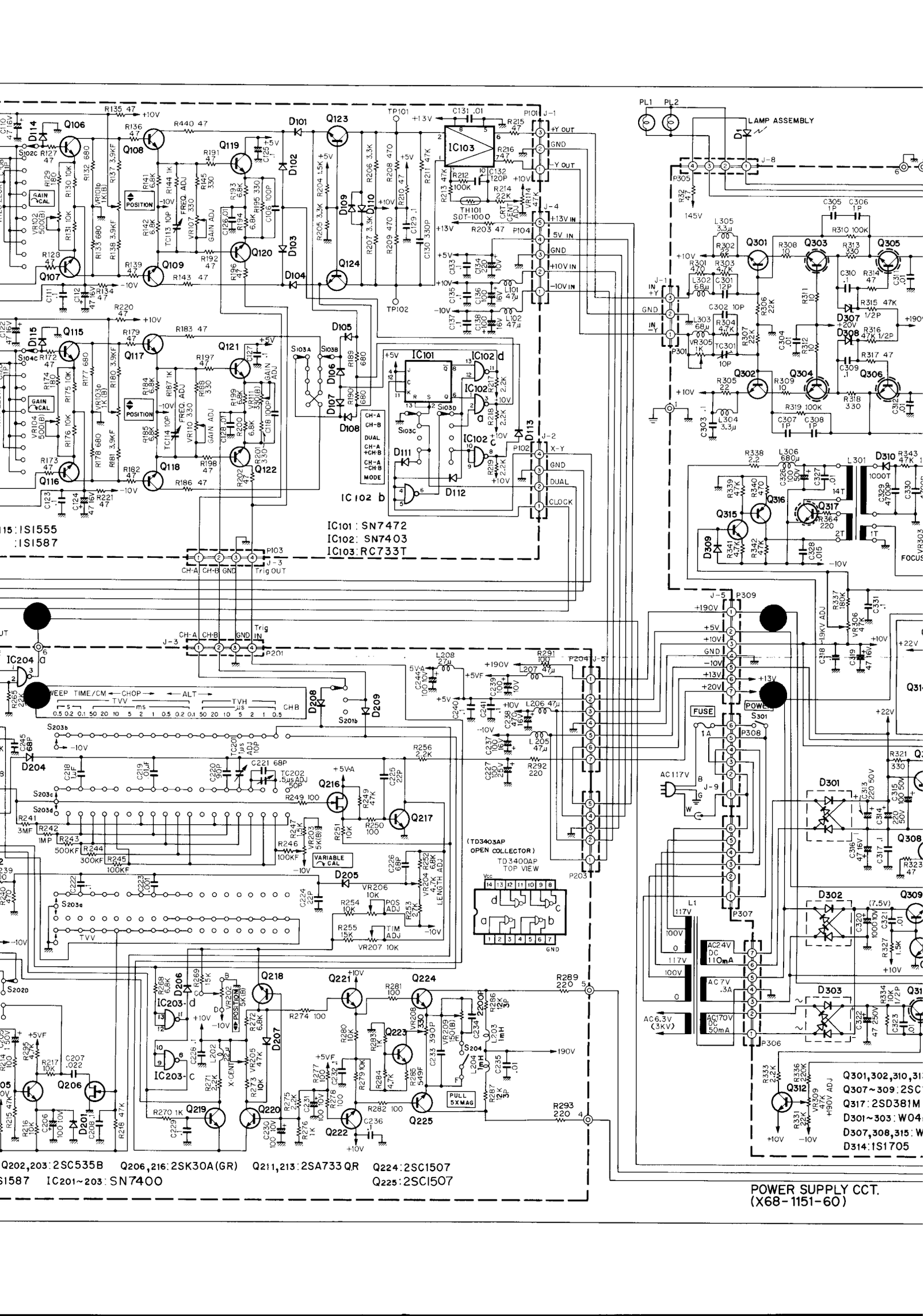
R286, 287	12K, 3W, 5% Metal Film Resistor	011-084-9-001
VR201/S205	50K, .2W, 20%, Potentiometer/Switch, "Trig Level"	008-226-9-003
VR202/S204	5K, .2W, 20%, Potentiometer/Switch, "◀▶POSITION"	008-226-9-002
VR 204	4.7K, 0.15W, 20%, Trimpot	008-155-9-002

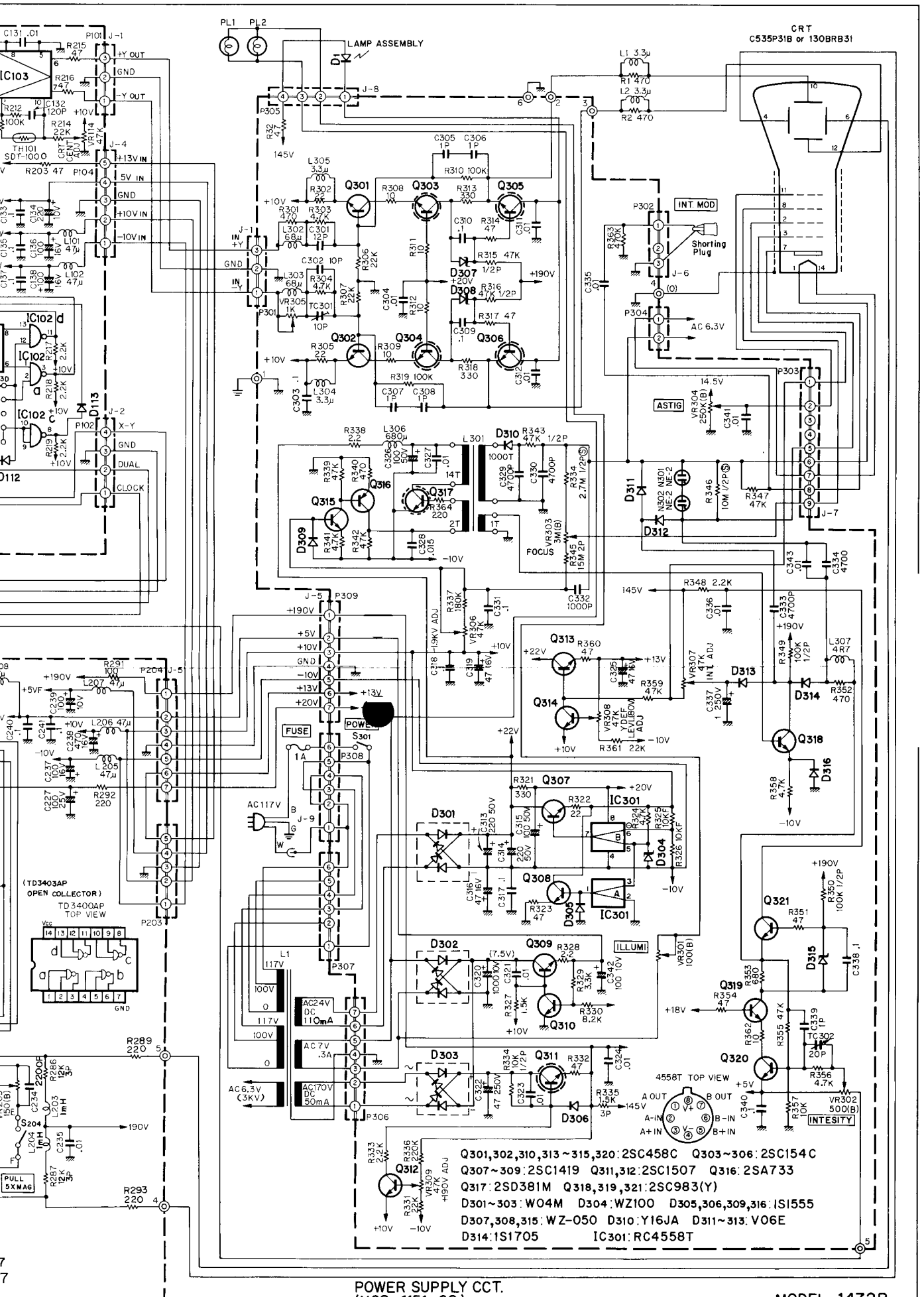
SCHEMATIC SYMBOL	DESCRIPTION	B & K PART NO.
	RESISTORS & CONTROLS, cont'd.	
VR205, 211	47K, 0.15W, 20%, Trimpot	008-169-9-008
VR206, 207	10K, 0.15W, 20%, Trimpot	008-155-9-004
VR208	470Ω, 0.15W, 20%, Trimpot	008-163-9-008
VR209	150Ω, 0.15W, 20%, Trimpot	008-174-9-002
VR210, 212	2.2K, 0.15W, 20%, Trimpot	008-169-9-007
	CAPACITORS	
C202	1MF, 50V, Non-Polar	034-006-9-001
C205, 209, 210, 211	1MF, 50V, Electrolytic	022-086-9-004
C206, 214, 230, 231, 239, 244	100MF, 10V, Electrolytic	022-086-9-004
C218	1MF, 100 V, Film	033-018-9-003
C219	.01MF, 100V, Film	033-018-9-004
C227	100MF, 25V, Electrolytic	022-123-9-001
C237	100MF, 16V, Electrolytic	022-073-9-002
C238	470MF, 16V, Electrolytic	022-073-9-003
TC201	10pF, Trimmer	028-032-9-001
TC202	50pF, Trimmer	028-032-9-003
	COILS	
L201	10μH,	041-068-9-003
L202	22μH	041-068-9-004
L203	1500μH	041-068-9-006
L204	680μH	041-068-9-005
L205, 206, 207	47μH	041-068-9-002
	SEMICONDUCTORS	
IC201, 203, 204	Integrated Circuit SN7400	307-069-9-004
IC202	Integrated Circuit SN7472	307-069-9-003
Q201, 204, 205 207-210, 212, 214, 215, 217-223	Transistor, Silicon 2SC458-C	176-016-9-001
Q202, 203	Transistor, Silicon 2SC535-B	176-036-9-001
Q206, 216	FET, 2SK30A-GR	182-029-9-002
Q211, 213	Transistor, Silicon 2SA733Q or R	177-016-9-001
Q224, 225	Transistor, Silicon 2SC1507	176-053-9-001
D201-203, 205-209	Diode, Silicon 1S1555	151-028-9-007
D204	Diode, Silicon 1S1587	151-048-9-001
	SWITCHES	
S201	Lever Switch, "Source"	080-003-9-004
S202	Lever Switch, "Sync"	080-003-9-003
S203/VR203	Rotary Switch/Pot, "Sweep Time/CM"	083-181-9-002

B & K–PRECISION MODEL 1472B PARTS LIST

SCHEMATIC SYMBOL	DESCRIPTION	B & K PART NO.
	POWER SUPPLY P.C. BOARD	
	RESISTORS & CONTROLS	
R335	1:5K, 3W, 5%, Metal Film	011-084-9-002
R345	15M, 2W, 10%, Carbon	004-152-9-003
VR301/S301	100Ω, Potentiometer, "Illumination"	008-226-9-006
VR302	500Ω, Potentiometer, "Intensity"	008-226-9-004
VR303	3MΩ, Potentiometer, "Focus"	008-226-9-007
VR304	250KΩ, Potentiometer, "Astig"	008-226-9-005
VR305	1KΩ, Trimpot	008-155-9-005
VR306, 307	47KΩ, Trimpot	008-169-9-008
VR308, 309	4.7KΩ, Trimpot	008-155-9-002
	CAPACITORS	
C313, 314	220MF, 50V, Electrolytic	022-073-9-006
C315, 326	100MF, 50V, Electrolytic	022-073-9-007
C316, 319, 325	47MF, 16V, Electrolytic	022-090-9-003
C320	1000MF, 10V, Electrolytic	022-126-9-002
C322	47MF, 250V, Electrolytic	021-057-9-001
C329, 330, 333, 334	4700pF, 2000V, Ceramic Disc	020-142-9-011
C332	1000pF, 2000V, Ceramic Disc	020-142-9-010
C337	1MF, 250V, Electrolytic	021-041-9-001
C342	100MF, 10V, Electrolytic	022-123-9-002
TC301	10pF, Trimmer	028-032-9-004
TC302	20pF, Trimmer	028-032-9-005
	COILS & TRANSFORMERS	
L301	DC-DC Oscillator Transformer	064-014-9-001
L302, 303	68μH Coil	041-068-9-009
L304, 305	3.3μH Coil	041-068-9-007
L306	680μH Coil	041-068-9-005
L307	4R7 Coil	041-068-9-008
	SEMICONDUCTORS	
IC301	Integrated Circuit RC4558T	307-069-9-005
Q301, 302, 310, 313, 314, 315, 320	Silicon Transistor 2SC458-C	176-016-9-001
Q303, 304, 305, 306	Silicon Transistor 2SC154-C	176-053-9-003
Q307, 308, 309	Silicon Transistor 2SC1419-B	176-053-9-004
Q311, 312	Silicon Transistor 2SC1507	176-053-9-001
Q316	Silicon Transistor 2SA733-Q or R	177-016-9-001
Q317	Silicon Transistor 2SD381-M	174-004-9-001
Q318, 319, 321	Silicon Transistor 2SC983-Y	176-053-9-002
D301-303	Silicon Bridge WO4M	157-005-9-001
D304	Zener Diode WZ100	152-050-9-003
D305, 306, 309, 316	Silicon Diode IS1555	151-030-9-001
D307, 308, 315	Zener Diode WZ050	152-067-9-001
D310	Diode Y16JA	151-048-9-003
D311-313	Silicon Diode VO6E	151-048-9-002
D314	Silicon Diode IS1705	151-021-9-001
N301, 302	Neon Lamp NE-2	401-002-9-003


VERTICAL AMP. (X73-1171-60)
TIME BASE (X74-1031-60)
CH-A V-INPUT
CH-B V-INPUT
Q101~103, 110~112: 2SK30A(O)
Q104~109, 113~124: 2SC535B
D101~108, 111~115: 1S1555
D109, 110: 1S1587
Q201, 204, 205, 207~210, 212, 214, 215, 217~223: 2SC458
Q202, 203: 2SC535B
Q206, 216: 2SK30A(GR)
Q211, 213: 2SA733QR
D201~203, 205~209: 1S1555
D204: 1S1587
IC201~203: SN7400
IC101
IC102
IC103


IC101 : SN7472
IC102: SN7403
IC103:RC733T
IC102 b
IC102 c
IC102 d
IC101
IC102
IC103
IC204 d
IC203- d
IC203- c
LAMP ASSEMBLY
PL1 PL2
D1
P101 J-1
+Y OUT
GND
-Y OUT
P104 J-4
+13V IN
5V IN
GND
+10V IN
-10V IN
P102 J-2
X-Y
GND
DUAL
CLOCK
P103
CH-A CH-B GND Trig OUT
J-3
CH-A CH-B GND IN
P201
P204 J-5
P309 J-5
P305 J-8
P301 J-1
IN +Y
GND
IN -Y
P307
P308
P306
TP101 +13V
TP102
TH101 SDT-1000
CRT CENT ADJ VR114 47K
CH-A
CH-B
DUAL
CH-A +CH-B
CH-A -CH-B
MODE
SWEEP TIME/CM CHOP ALT
TVV TVH
CHB
POSITION
GAIN CAL
FREQ. ADJ
GAIN ADJ
VARIABLE CAL
POS ADJ
TIM ADJ
LENGTH ADJ
X-CENT ADJ
PULL 5XMAG
FUSE
POWER
S301
AC117V
AC24V DC 110mA
AC 7V .3A
AC170V DC 50mA
AC6.3V (3KV)
FOCUS
(TD3403AP OPEN COLLECTOR)
TD3400AP TOP VIEW
Vcc
GND
Q202,203:2SC535B Q206,216:2SK30A(GR) Q211,213:2SA733 QR Q224:2SC1507
Q225:2SC1507
IC201~203: SN7400
Q301,302,310,31
Q307~309:2SC
Q317:2SD381M
D301~303: W04
D307,308,315: W
D314:1S1705
POWER SUPPLY CCT.
(X68-1151-60)



POWER SUPPLY CCT.
(X68-1151-60)

MODEL 1472B
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