

# SERVICING INFORMATION



## MODEL 2120

# DUAL-TRACE OSCILLOSCOPE

### PARTS LIST

SCHEMATIC SYMBOL	DESCRIPTION	B & K-PRECISION PART NO.
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#### MAIN CHASSIS ASSEMBLY

##### ELECTRICAL PARTS

CRT	150BTB31 Cathode Ray Tube .....	230-038-9-001
	CRT Socket Wire Assembly .....	428-172-9-015
	CRT Socket.....	749-120-9-001
F501	630 mA, 250 V, 5 x 20 mm Fast Acting Fuse (120 V Operation) .....	194-027-9-001
F502	315 mA, 250 V, 5 x 20 mm Fast Acting Fuse (220 V Operation) .....	194-026-9-001
Q503	BUX86 NPN Transistor.....	176-214-9-007
S101	3-Position Lever Switch (CH 1 AC-GND-DC) .....	080-030-9-001
S201	3-Position Lever Switch (CH 2 AC-GND-DC) .....	080-030-9-001
S501	Push-Button Switch (POWER).....	088-173-9-001
T501	Power Transformer.....	065-226-9-001
VR303, 304	500 $\Omega$ Potentiometer (CH 1 POS, CH 2 POS) .....	008-866-9-001
	BNC Connector (CH 1 (Y), CH 2 (X), EXT TRIG, CH 1 OUTPUT).....	772-054-9-001
	Banana Jack (Ground) .....	773-140-9-001
	Test Pin (Cal).....	777-079-9-001
	Trace Rotation Coil.....	047-067-9-001
	AC Power Cord.....	420-042-9-001
	AC Power Cord Receptacle.....	770-029-9-001
	2-Pin Wire Assembly (CH 1 OUTPUT BNC to PG317) .....	428-172-9-002
	2-Pin Wire Assembly (CH 1 VARIABLE to PG205 and CH 2 VARIABLE to PG206).....	428-172-9-003
	2-Pin Wire Assembly (Lower Front PC Board to LED801) .....	428-172-9-004
	2-Pin Wire Assembly (Y+ to CRT) .....	428-172-9-005
	2-Pin Wire Assembly (Y- to CRT) .....	428-172-9-006
	3-Pin Wire Assembly (CH 1 POS to PG306 and CH 2 POS to PG305).....	428-172-9-007
	3-Pin Wire Assembly (PG101 to PG303) .....	428-172-9-008
	3-Pin Wire Assembly (PG111 to Q503).....	428-172-9-009
	4-Pin Wire Assembly (PG102 to PG310) .....	428-172-9-010
	5-Pin Wire Assembly (Upper Front PC Board to PG302) .....	428-172-9-011
	5-Pin Wire Assembly (CRT Socket to PG104) .....	428-172-9-001
	6-Pin Wire Assembly (PG109 PC Board to PG304) .....	428-172-9-012
	6-Pin Wire Assembly (PG202 to PG308 and PG201 to PG309) .....	428-172-9-013
	7-Pin Wire Assembly (PG107 to PG203) .....	428-172-9-014

##### MECHANICAL PARTS

	CRT Bezel.....	380-582-9-001
	CRT Filter.....	753-031-9-001
	CRT Mounting Bracket, Bottom .....	250-252-9-001
	CRT Mounting Bracket, Top .....	250-253-9-001
	CRT Shield .....	256-268-9-003
	CRT Mounting Cushion, Top Front .....	388-114-9-005
	CRT Mounting Cushion, Bottom Front .....	388-114-9-006
	CRT Mounting Cushion, Top Neck Bracket.....	388-114-9-002
	CRT Mounting Cushion, Bottom Neck Bracket.....	388-114-9-003
	CRT Bracket Mounting Cushion (Used Between Upper and Lower Neck Brackets) .....	388-114-9-004
	Case .....	272-197-9-001
	Soft Handle .....	746-084-9-001
	Front Sub Panel, Metal.....	254-123-9-001

**COMPOSITE**  
499-369-9-001

SCHEMATIC  
SYMBOL

DESCRIPTION

B & K-PRECISION  
PART NO.

## MAIN CHASSIS ASSEMBLY (Continued)

## MECHANICAL PARTS (Continued)

Front Panel, Plastic	380-585-9-001
Front Panel Inlay, Nameplate	260-468-9-001
Front Panel Inlay, Controls and Indicators	260-480-9-001
Rear Sub Panel, Metal	254-124-9-001
Rear Panel, Plastic	380-582-9-002
Plastic Foot and Tilt Stand Anchor	380-585-9-002
Metal Tilt Stand	261-210-9-001
Mounting Bracket (For CH 1 and CH 2 POS Controls)	250-254-9-001
Mounting Bracket (For CH 1 and CH 2 VARIABLE Controls)	250-255-9-001
Mounting Bracket (For POWER Switch)	250-256-9-001
Standoff (For Horizontal PC Board)	759-229-9-001
Chassis Support, Center	254-120-9-001
Chassis Support, Right Side	254-121-9-001
Chassis Support, Left Side	254-122-9-001
Shield Cover Plate, CH 1 Attenuator	256-268-9-001
Shield Cover Plate, CH 2 Attenuator	256-268-9-002
Transformer Mounting Plate	261-211-9-001
Metal Rod (X-Y, SLOPE Switch Linkage), 2.5 mm x 75 mm	265-049-9-001
Metal Rod (POWER Switch Linkage), 2.5 mm x 190 mm	265-049-9-004
Metal Rod (NORM/INV Switch Linkage), 2.5 mm x 200 mm	265-049-9-002
Metal Rod (CH 1/CH 2, MONO/DUAL, ALT/CHOP/ADD Switch Linkage), 2.5 mm x 270 mm	265-049-9-003
Plastic Coupler (POWER, SLOPE, and X-Y Switch Connector)	380-567-9-001
Plastic Coupler (VERT MODE Switch Connector)	380-585-9-003
Plastic Shaft (TRIG LEVEL Control Linkage), 6 mm x 55 mm	265-049-9-006
Plastic Shaft (X-POS Control Linkage), 6 mm x 80 mm	265-049-9-007
Plastic Shaft (CH 1, CH 2 VARIABLE Control Linkage), 6 mm x 125 mm	265-049-9-008
Plastic Shaft (INTENSITY, FOCUS Control Linkage), 6 mm x 135 mm	265-049-9-005
Plastic Universal Joint (CH 1 VARIABLE, CH 2 VARIABLE, FOCUS, etc. Control Coupler)	380-585-9-004
Lever Switch Cap (AC-GND-DC Switches)	384-106-9-001
Lever Switch Cap (COUPLING, SOURCE Switches)	384-106-9-002
Pushbutton Knob, Grey (VERT. MODE, SLOPE, X-Y Switches)	384-106-9-003
Pushbutton Knob, Red (POWER Switch)	384-106-9-004
Knob (TIME/DIV)	751-334-9-001
Knob (VAR SWEEP)	751-334-9-002
Knob (VOLTS/DIV)	751-334-9-003
Knob (CH 1 VAR, CH 2 VAR, INTENSITY, FOCUS, etc.)	751-334-9-004
Knob (CH 1 POS, CH 2 POS)	751-334-9-005
Insulating Spacer (For Q503)	347-137-9-001
3 x 6 mm Phillips Round Head Machine Screw (U504, VR103, VR203, etc.)	634-228-9-001
3 x 6 mm Phillips Flat Head Machine Screw (CH 1/CH2 POS, Case, AC Recep, Power Switch)	634-228-9-008
3 x 6 mm Screw (Q503)	634-228-9-010
3 x 8 mm Phillips Round Head Machine Screw (Q501, Q511)	634-228-9-002
3 x 8 mm Phillips Wide Head Machine Screw (PC Board Mounting)	634-228-9-011
3 x 8 mm Phillips Wide Head Machine Screw, Black (Case, CRT Bracket)	634-228-9-012
3 x 10 mm Phillips Round Head Machine Screw (Foot Mounting, Q503, Q808, Q809)	634-228-9-003
3 x 12 mm Phillips Round Head Machine Screw (Rear Panel, Q405, Q406)	634-228-9-004
3 x 12 mm Phillips Head Plastic Machine Screw (U502)	634-228-9-007
3 x 18 mm Phillips Flat Head Machine Screw (Bezel)	634-228-9-009
4 x 6 mm Phillips Round Head Machine Screw (Soft Handle Mounting)	634-228-9-005
4 x 10 mm Phillips Round Head Machine Screw (X-former, CRT Clamp, Ground)	634-228-9-006
M9 x 12 mm Hex Nut (TIME/DIV Control)	653-117-9-001
M3 x 2.4 mm Hex Nut (Q405, Q406, Q511)	653-117-9-002
M4 x 3.2 mm Hex Nut (CAL Jack)	653-117-9-003
3 x 7 mm Steel Washer (Q405, Q406, Q511)	724-092-9-004
3.2 x 8 mm Steel Washer	724-092-9-001
4 x 10 mm Steel Spring Washer (Power Transformer)	724-092-9-005
M4 x 15 mm O.D. Toother Washer (Ground)	731-115-9-001
4.2 x 10 mm Steel Washer (Soft Handle, Ground)	724-092-9-002
5.2 x 12 mm Steel Washer (CAL Jack)	724-092-9-003
Ground Lug	740-050-9-001
Label, Case Bottom (CH 1 DC Balance)	483-680-9-001
Label, Case Bottom (CH 2 DC Balance)	483-680-9-002
Label, Case Bottom (X-Gain)	483-680-9-003
Label, Case Bottom (Y-Gain)	483-680-9-004
Label, Rear Panel, Fuse Rating	483-680-9-005
Label, Rear Panel, Model Number	483-680-9-006
Instruction Manual	480-537-9-001

SCHEMATIC  
SYMBOL

DESCRIPTION

B & K-PRECISION  
PART NO.

## LOWER FRONT PC BOARD ASSEMBLY

## RESISTORS

Unlisted resistors are  $\pm 5\%$ , 1/4 W. See schematic diagram for value.

R102	898 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-8-983
R103	111 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-1-113
R104	988 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-9-883
R105	10.1 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-1-012
R106	1 M $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-004
R107	20.5 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-2-052
R108	18.2 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-822
R109	2.03 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-2-031
R111	499 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-4-993
R112	1 M $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-004
R113	750 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-7-503
R114	332 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-3-323
R115	1 M $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-004
R202	898 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-8-983
R203	111 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-1-113
R204	988 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-9-883
R205	10.1 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-1-012
R206	1 M $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-004
R207	20.5 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-2-052
R208	18.2 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-822
R209	2.03 k $\Omega$ $\pm 0.5\%$ , 1/4 W, Metal Film	017-144-2-031
R211	499 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-4-993
R212	1 M $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-004
R213	750 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-7-503
R214	332 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-3-323
R215	1 M $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-004
R808	10 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-002
R809	20 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-2-002
R810	40.2 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-4-022
R811	100 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-1-003
R812	200 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	015-144-2-003
R813	397 k $\Omega$ $\pm 1\%$ , 1/4 W, Metal Film	013-139-9-002
VR101	500 $\Omega$ Trimmer Potentiometer (CH 1 DC Balance)	010-046-9-003
VR102	10 k $\Omega$ Trimmer Potentiometer (CH 1 DC Balance)	010-046-9-002
VR103	500 $\Omega$ Potentiometer (CH 1 VARIABLE)	008-877-9-002
VR201	500 $\Omega$ Trimmer Potentiometer (CH 2 DC Balance)	010-046-9-003
VR202	10 k $\Omega$ Trimmer Potentiometer (CH 2 DC Balance)	010-046-9-002
VR203	500 $\Omega$ Potentiometer (CH 2 VARIABLE)	008-877-9-002
VR801	10 k $\Omega$ Trimmer Potentiometer (Timebase CAL Adjust)	010-032-9-011
VR901	200 $\Omega$ Trimmer Potentiometer (0.2 V p-p Adjust)	010-032-9-002
CAPACITORS		
C101	0.047 $\mu$ F $\pm 10\%$ , 400 V, Polyester	025-278-9-004
C102	18 pF $\pm 5\%$ , 50 V, Ceramic	020-423-9-007
C103	1 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-021
C104	0.5 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-001
C105, 106	3 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-012
C107	1 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-021
C108	18 pF $\pm 5\%$ , 50 V, Ceramic	020-423-9-007
C109	1.3 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-023
C110	100 pF $\pm 5\%$ , 50 V, Ceramic	020-423-9-003
C111	18 pF $\pm 5\%$ , 50 V, Ceramic	020-423-9-007
C112	39 pF $\pm 5\%$ , 50 V, Ceramic	020-423-9-014
C113	68 pF $\pm 5\%$ , 50 V, Ceramic	020-423-9-018
C114	150 pF $\pm 5\%$ , 50 V, Ceramic	020-423-9-006
C115	15 pF $\pm 5\%$ , 50 V, Ceramic	020-423-9-005
C116	0.5 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-001
C117	3 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-012
C118	0.5 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-001
C119	3 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-012
C120	0.01 $\mu$ F $\pm 10\%$ , 400 V, Polyester	025-278-9-003
C121	0.022 $\mu$ F $\pm 80/-20\%$ , 50 V, Ceramic	020-423-9-034
C122	10 $\mu$ F $\pm 50/-10\%$ , 50 V, Electrolytic	022-381-9-004
C123	0.022 $\mu$ F $\pm 80/-20\%$ , 50 V, Ceramic	020-423-9-034
C124	5 pF $\pm 0.25$ pF, 50 V, Ceramic	020-423-9-016
C125	27 pF $\pm 5\%$ , 50 V, Ceramic	020-423-9-011
C126	0.1 $\mu$ F $\pm 5\%$ , 100 V, Polyester	025-278-9-016
C127	0.022 $\mu$ F $\pm 80/-20\%$ , 50 V, Ceramic	020-423-9-034

SCHEMATIC SYMBOL	DESCRIPTION	B & K-PRECISION PART NO.
<b>LOWER FRONT PC BOARD ASSEMBLY (Continued)</b>		
<b>CAPACITORS (Continued)</b>		
C128	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C129	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C130	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C131	7 pF $\pm$ 0.5 pF, 50 V, Ceramic	020-423-9-019
C201	0.047 $\mu$ F $\pm$ 10%, 400 V, Polyester	025-278-9-004
C202	18 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-007
C203	1 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-021
C204	0.5 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-001
C205, 206	3 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-012
C207	1 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-021
C208	18 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-007
C209	1.3 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-023
C210	100 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-003
C211	18 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-007
C212	39 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-014
C213	120 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-004
C214	150 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-006
C215	15 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-005
C216	0.5 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-001
C217	3 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-012
C218	0.5 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-001
C219	3 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-012
C220	0.01 $\mu$ F $\pm$ 10%, 400 V, Polyester	025-278-9-003
C221	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C222	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C223	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C224	5 pF $\pm$ 0.25 pF, 50 V, Ceramic	020-423-9-016
C225	27 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-011
C226	0.1 $\mu$ F $\pm$ 5%, 100 V, Polyester	025-278-9-016
C227	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C228	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C229	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C230	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C231	15 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-005
C801	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C802	0.068 $\mu$ F $\pm$ 5%, 50 V, Polyester	025-278-9-015
C803	0.0056 $\mu$ F $\pm$ 5%, 50 V, Polyester	025-278-9-013
C804, 805	3.3 $\mu$ F $\pm$ 10%, 25 V, Tantalum	027-092-9-001
C806	0.22 $\mu$ F $\pm$ 10%, 35 V, Tantalum	027-092-9-003
C807	200 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-009
C809	0.0022 $\mu$ F $\pm$ 10%, 50 V, Ceramic	020-423-9-030
C810	0.1 $\mu$ F $\pm$ 5%, 50 V, Polyester	025-278-9-007
C811	4.7 $\mu$ F $\pm$ 10%, 25 V, Tantalum	027-092-9-002
C812	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C813	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C901	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C902	0.001 $\mu$ F $\pm$ 10%, 50 V, Ceramic	020-423-9-029
C903	0.01 $\mu$ F $\pm$ 5%, 50 V, Polyester	025-278-9-006
VC102	6 pF Trimmer	028-113-9-001
VC104	6 pF Trimmer	028-113-9-001
VC106	10 pF Trimmer	028-113-9-002
VC107 - 110	6 pF Trimmer	028-113-9-001
VC202	6 pF Trimmer	028-113-9-001
VC204	6 pF Trimmer	028-113-9-001
VC206	10 pF Trimmer	028-113-9-002
VC207 - 210	6 pF Trimmer	028-113-9-001
VC801	50 pF Trimmer	028-113-9-003
<b>DIODES</b>		
D101	FDH333	151-150-9-001
D201	FDH333	151-150-9-001
D801, 802	1N4148	151-038-9-001
LED801	Red LED	158-094-9-001
ZD101	6.8 V, 500 mW Zener	152-180-9-004
ZD201	6.8 V, 500 mW Zener	152-180-9-004
<b>TRANSISTORS</b>		
Q101	2N3958, Dual FET	182-097-9-001
Q201	2N3958, Dual FET	182-097-9-001

SCHEMATIC SYMBOL	DESCRIPTION	B & K-PRECISION PART NO.
<b>LOWER FRONT PC BOARD ASSEMBLY</b>		
<b>TRANSISTORS (Continued)</b>		
Q801, 802	2SC1815Y, NPN	176-089-9-003
Q803	BSX19, NPN	176-214-9-006
Q804	BC557B, PNP	177-105-9-003
Q805	2SC1815Y, NPN	176-089-9-003
<b>INTEGRATED CIRCUITS</b>		
U101	733C Video Amplifier	307-189-9-001
U201	733C Video Amplifier	307-189-9-001
U901	4011B Quad 2-Input NAND Gate	308-114-9-001
<b>MISCELLANEOUS</b>		
LED801	2-Pin Polarized Plug	757-140-9-006
PG203	7-Pin Polarized Plug	757-140-9-011
PG205, 206	2-Pin Polarized Plug	757-140-9-006
S102	Rotary Switch (CH 1 VOLTS/DIV)	083-323-9-001
S202	Rotary Switch (CH 1 VOLTS/DIV)	083-323-9-001
S801	Rotary Switch (TIME/DIV)	083-323-9-002
<b>LOWER REAR PC BOARD ASSEMBLY</b>		
<b>RESISTORS</b>		
Unlisted resistors are $\pm$ 5%, 1/4 W. See schematic diagram for value.		
R415	390 $\Omega$ $\pm$ 5%, 1/2 W, Metal Film	011-102-5-391
R423, 424	2.4 k $\Omega$ $\pm$ 5%, 5 W, Oxide Film	013-139-9-004
R519	1.0 $\Omega$ $\pm$ 5%, 1/2 W, Metal Film	011-102-5-109
VR301, 302	3 k $\Omega$ Trimmer Potentiometer (SYM)	010-046-9-012
VR305 - 308	300 $\Omega$ Trimmer Potentiometer (CH 1 PLATE, CH 2 PLATE, CH 1 Y GAIN, CH 2 Y GAIN)	010-046-9-011
VR309 - 311	1 k $\Omega$ Trimmer Potentiometer (DC TRIG, DC TRIG, X-GAIN)	010-032-9-006
VR401	100 $\Omega$ Trimmer Potentiometer (1 MHz H.F. OFFSET)	010-032-9-001
VR902	500 $\Omega$ Trimmer Potentiometer (CH 1 OUTPUT DC BALANCE)	010-032-9-005
<b>CAPACITORS</b>		
C301, 302	270 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-024
C303	27 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-011
C304	15 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-005
C305	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C306, 307	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C308	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C309	10 pF $\pm$ 0.5 pF, 50 V, Ceramic	020-423-9-002
C310	22 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-010
C311	470 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-027
C312	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C313, 314	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C315	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C318	47 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-015
C401	0.022 $\mu$ F +80/-20%, 50 V, Ceramic	020-423-9-034
C402	10 $\mu$ F +50/-10%, 50 V, Electrolytic	022-381-9-004
C403	0.0047 $\mu$ F $\pm$ 5%, 50 V, Polyester	025-278-9-011
C404	10 pF $\pm$ 0.5 pF, 50 V, Ceramic	020-423-9-002
C405	100 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-003
C407	0.047 $\mu$ F $\pm$ 10%, 250 V, Polyester	025-278-9-002
C506 - 508	1000 $\mu$ F +50/-10%, 35 V, Electrolytic	022-381-9-002
C900	33 pF $\pm$ 5%, 50 V, Ceramic	020-423-9-013
C904	0.01 $\mu$ F $\pm$ 5%, 50 V, Polyester	025-278-9-006
VC401	50 pF Trimmer (1 MHz H.F. OFFSET)	028-113-9-003
<b>INDUCTORS</b>		
L401, 402	12 $\mu$ H Peaking Coil	047-067-9-002
<b>SWITCHES</b>		
S301	Pushbutton (NORM/INV 1)	088-175-9-001
S302 - 304	Pushbutton (CH 1/CH 2, MONO/DUAL, ALT/CHOP/ADD)	088-175-9-002
<b>DIODES</b>		
BD503 - 505	Bridge Rectifier	157-045-9-001
D301 - 322	1N4148	151-038-9-001
ZD901	9.1 V, 500 mW, Zener	152-115-9-002
<b>TRANSISTORS</b>		
Q301 - 304	2SC1906, NPN	176-214-9-008
Q305, 306	2SC1815Y, NPN	176-089-9-003

SCHEMATIC SYMBOL	DESCRIPTION	B & K-PRECISION PART NO.
<b>LOWER REAR PC BOARD ASSEMBLY (Continued)</b>		
<b>TRANSISTORS (Continued)</b>		
Q307	2SA1015Y, PNP .....	177-043-9-002
Q308 - 311	2SA1029C, PNP .....	177-108-9-003
Q312, 313	2SA1015Y, PNP .....	177-043-9-002
Q401 - 404	2SC1906, NPN .....	176-214-9-008
Q405, 406	BF458, NPN .....	176-214-9-001
Q901	2SC1815Y, NPN .....	176-089-9-003
Q902	2N3906, PNP .....	177-035-9-001
<b>INTEGRATED CIRCUITS</b>		
U301	4013B, Dual D Flip-Flop .....	308-377-9-001
U302	4011B, Quad 2-Input NAND Gate .....	308-114-9-001
U502	7812, 1 Amp, 12 V, Voltage Regulator .....	307-164-9-001
U503	7805, 1 Amp, 5 V, Voltage Regulator .....	307-080-9-001
U504	7824, 1 Amp, 24 V, Voltage Regulator .....	307-456-9-001
<b>MISCELLANEOUS</b>		
PG301	6-Pin Polarized Plug .....	757-140-9-005
PG302	5-Pin Polarized Plug .....	757-140-9-009
PG303	3-Pin Polarized Plug .....	757-140-9-007
PG304	6-Pin Polarized Plug .....	757-140-9-010
PG305, 306	3-Pin Polarized Plug .....	757-140-9-007
PG308, 309	6-Pin Right-Angle Polarized Plug .....	757-140-9-013
PG310	4-Pin Polarized Plug .....	757-140-9-008
PG317, Y+, Y-	2-Pin Polarized Plug .....	757-140-9-006
	Insulating Spacer (For U502) .....	347-137-9-001
	Insulating Spacer (For Q405 and Q406) .....	347-137-9-002
	Heat Sink (For Q405 and Q406) .....	747-160-9-001
	Heat Sink (For U503) .....	747-160-9-005
	Heat Sink (For U502 and U504) .....	747-160-9-004
<b>UPPER FRONT PC BOARD ASSEMBLY</b>		
<b>RESISTORS</b>		
Unlisted resistors are ±5%, 1/4 W. See schematic diagram for value.		
R504	100 Ω ±5%, 1/2 W, Carbon .....	002-102-5-101
R507	100 kΩ ±1%, 1/4 W, Metal Film .....	015-144-1-003
R508	115 kΩ ±1%, 1/4 W, Metal Film .....	015-144-1-153
R511	33 Ω ±5%, 1/2 W, Metal Film .....	011-102-5-330
R512	22 kΩ ±5%, 1/2 W, Carbon .....	002-102-5-223
R513	825 kΩ ±1%, 1/4 W, Metal Film .....	015-144-8-253
R514	12.1 kΩ ±1%, 1/4 W, Metal Film .....	015-144-1-212
R516	22 kΩ ±5%, 1/2 W, Carbon .....	002-102-5-223
R517	402 kΩ ±1%, 1/4 W, Metal Film .....	015-144-4-023
R518	43.2 kΩ ±1%, 1/4 W, Metal Film .....	015-144-4-322
R526, 527	1.5 MΩ ±5%, 1/2 W, Carbon .....	002-102-5-155
R528	2.2 MΩ ±5%, 1/2 W, Carbon .....	002-102-5-225
R529	1 MΩ ±5%, 1/2 W, Carbon .....	002-102-5-105
R540	560 Ω ±5%, 1/2 W, Carbon .....	002-102-5-561
R543	1 MΩ ±1%, 1/4 W, Metal Film .....	015-144-1-004
R544	10 kΩ ±1%, 1/4 W, Metal Film .....	015-144-1-002
R545	6.8 MΩ ±5%, 1/2 W, Metal Glaze .....	013-139-9-001
R546	1.5 MΩ ±5%, 1/2 W, Carbon .....	002-102-5-155
R547	71.5 kΩ ±1%, 1/4 W, Metal Film .....	015-144-7-152
R548	18.2 kΩ ±1%, 1/4 W, Metal Film .....	015-144-1-822
R549	47 Ω ±5%, 2 W, Metal Oxide .....	013-139-9-003
R601	1.2 kΩ ±5%, 1/2 W, Carbon .....	002-102-5-122
R835, 836	392 Ω ±1%, 1/4 W, Metal Film .....	015-144-3-920
R837	100 Ω ±1%, 1/4 W, Metal Film .....	015-144-1-000
R838, 839	15 kΩ ±5%, 3 W, Metal Oxide .....	013-139-9-005
VR501, 502	5 kΩ Trimmer Potentiometer (+140 V ADJ, BLKING ADJ) .....	010-046-9-008
VR503	500 kΩ Potentiometer (FOCUS) .....	008-877-9-003
VR504, 504	500 kΩ Trimmer Potentiometer (INTENSITY (MAX), INTENSITY (MIN)) .....	010-046-9-010
VR506	500 kΩ Potentiometer (INTENSITY) .....	008-877-9-003
VR507	50 kΩ Trimmer Potentiometer (ASTIG ADJ) .....	010-046-9-009
VR508	30 kΩ Trimmer Potentiometer (HV ADJ) .....	010-046-9-007
VR601	30 kΩ Trimmer Potentiometer (TRIG SYNC ADJ) .....	010-046-9-007
VR602	1 MΩ Trimmer Potentiometer (TRIG THRESHOLD) .....	010-046-9-005
VR603/S604	10 kΩ Potentiometer with Switch (TRIG LEVEL/PUSH AUTO) .....	008-877-9-001
VR604	5 kΩ Trimmer Potentiometer (TRACE ROTATION) .....	010-046-9-001

SCHEMATIC SYMBOL	DESCRIPTION	B & K-PRECISION PART NO.
<b>UPPER FRONT PC BOARD ASSEMBLY (Continued)</b>		
<b>RESISTORS (Continued)</b>		
VR605	300 Ω Trimmer Potentiometer (SWEEP LENGTH) .....	010-046-9-006
VR606	50 kΩ Trimmer Potentiometer (X CENTER) .....	010-046-9-009
VR803/S802	10 kΩ Potentiometer with Switch (X POS/PULL X10 MAG) .....	008-877-9-001
VR804	5 kΩ Trimmer Potentiometer (X-PLATE) .....	010-046-9-008
VR805	100 Ω Trimmer Potentiometer (X-MAG X 10 ADJ) .....	010-046-9-004
<b>CAPACITORS</b>		
C501	10 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-004
C502	0.1 μF ±5%, 100 V, Polyester .....	025-278-9-016
C503, 504	47 μF +50/-20%, 250 V, Electrolytic .....	022-381-9-005
C505	0.001 μF ±10%, 50 V, Ceramic .....	020-423-9-029
C510	120 pF ±5%, 50 V, Ceramic .....	020-423-9-004
C511, 512	0.22 μF ±10%, 1 kV, Polyester .....	025-278-9-005
C513	0.33 μF ±10%, 100 V, Polyester .....	025-278-9-001
C514 - 516	68 pF ±10%, 2 kV, Ceramic .....	020-423-9-028
C517	0.1 μF ±5%, 100 V, Polyester .....	025-278-9-016
C518	0.047 μF ±10%, 400 V, Polyester .....	025-278-9-004
C519, 520	0.0047 μF +80/-20%, 2 kV, Ceramic .....	020-423-9-032
C521	100 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-001
C522, 523	0.1 μF ±5%, 100 V, Polyester .....	025-278-9-016
C524	10 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-004
C525	0.022 μF +80/-20%, 50 V, Ceramic .....	020-423-9-034
C526	10 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-004
C527	0.022 μF +80/-20%, 50 V, Ceramic .....	020-423-9-034
C528	0.0047 μF +80/-20%, 2 kV, Ceramic .....	020-423-9-032
C529	100 pF ±10%, 2 kV, Ceramic .....	020-423-9-031
C530, 531	0.01 μF +80/-20%, 1.5 kV, Ceramic .....	020-423-9-033
C601	270 pF ±5%, 50 V, Ceramic .....	020-423-9-024
C603, 604	1.0 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-003
C605	0.001 μF ±10%, 50 V, Ceramic .....	020-423-9-029
C606	0.022 μF +80/-20%, 50 V, Ceramic .....	020-423-9-034
C607	0.047 μF ±5%, 50 V, Polyester .....	025-278-9-012
C608	10 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-004
C609	0.022 μF +80/-20%, 50 V, Ceramic .....	020-423-9-034
C610	2 pF ±0.25 pF, 50 V, Ceramic .....	020-423-9-022
C611, 612	6.8 pF ±0.5 pF, 50 V, Ceramic .....	020-423-9-017
C613	1.0 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-003
C614	0.1 μF ±5%, 100 V, Polyester .....	025-278-9-016
C615	10 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-004
C618	100 pF ±5%, 50 V, Ceramic .....	020-423-9-003
C619	1.0 μF ±20%, 50 V, Non-Polarized Electrolytic .....	022-381-9-006
C620	10 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-004
C621	0.022 μF +80/-20%, 50 V, Ceramic .....	020-423-9-034
C622	1.0 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-003
C623	330 pF ±5%, 50 V, Ceramic .....	020-423-9-025
C624	0.022 μF +80/-20%, 50 V, Ceramic .....	020-423-9-034
C625	10 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-004
C626	0.022 μF +80/-20%, 50 V, Ceramic .....	020-423-9-034
C629	0.0022 μF ±10%, 50 V, Ceramic .....	020-423-9-030
C630	0.001 μF ±10%, 50 V, Ceramic .....	020-423-9-029
C815, 816	0.022 μF +80/-20%, 50 V, Ceramic .....	020-423-9-034
C817	0.0068 μF ±5%, 50 V, Polyester .....	025-278-9-014
C818	390 pF ±5%, 50 V, Ceramic .....	020-423-9-026
C820	0.047 μF ±10%, 250 V, Polyester .....	025-278-9-002
C821	0.15 μF ±5%, 50 V, Polyester .....	025-278-9-008
C822	390 pF ±5%, 50 V, Ceramic .....	020-423-9-026
C823	10 μF +50/-10%, 50 V, Electrolytic .....	022-381-9-004
<b>INDUCTORS AND TRANSFORMERS</b>		
L801, 802	680 μH Peaking Coil .....	047-067-9-003
T502	CVT Transformer .....	063-016-9-001
<b>DIODES</b>		
BD501, 502	Bridge Rectifier .....	157-045-9-001
D501, 502	1 Amp, 1 kV .....	151-053-9-001
D503	1N4148 .....	151-038-9-001
D504	1 Amp, 1 kV .....	151-053-9-001
D505 - 507	1N4148 .....	151-038-9-001
D508 - 513	1 Amp, 1 kV .....	151-053-9-001
D601 - 609	1N4148 .....	151-038-9-001

SCHEMATIC SYMBOL	DESCRIPTION	B & K-PRECISION PART NO.
<b>UPPER FRONT PC BOARD ASSEMBLY (Continued)</b>		
<b>DIODES (Continued)</b>		
D803	1N4148.....	151-038-9-001
ZD501	RD33EB, 33 V, 500 mW, Zener.....	152-080-9-002
ZD502	1N4764A, 100 V, 1 W, Zener.....	152-180-9-005
ZD503	RD12EB, 12 V, 500 mW, Zener.....	152-180-9-001
ZD506	RD5.6EB2, 5.6 V, 500 mW, Zener.....	152-180-9-003
ZD601	RD5.6EB2, 5.6 V, 500 mW, Zener.....	152-180-9-003
<b>TRANSISTORS</b>		
Q501	BF459, NPN.....	176-214-9-005
Q502	BF423, PNP.....	177-108-9-001
Q504	BF423, PNP.....	177-108-9-001
Q505	2SA1015Y, PNP.....	177-043-9-002
Q507	2SC1815Y, NPN.....	176-089-9-003
Q508	2SA1029C, PNP.....	177-108-9-003
Q509	2SC535C, NPN.....	176-055-9-001
Q510	BF422, NPN.....	176-214-9-004
Q511	BD237, NPN.....	176-214-9-002
Q601 - 604	2SC1815Y, NPN.....	176-089-9-003
Q605	BC557B, PNP.....	177-105-9-003
Q606, 607	BF450, PNP.....	177-108-9-002
Q608 - 610	BF199, NPN.....	176-214-9-003
Q611	2SC1815Y, NPN.....	176-089-9-003
Q806, 807	2SC1815Y, NPN.....	176-089-9-003
Q808, 809	BF458, NPN.....	176-241-9-001
<b>INTEGRATED CIRCUITS</b>		
U501	431CLP, Programmable Reference.....	307-409-9-001
U505	4N25, Photo Diode.....	158-094-9-002
U506	308N, Operational Amplifier.....	307-423-9-002
U601	710, Differential Comparitor.....	307-017-9-001
U602	7812, 1 Amp, 12 V, Voltage Regulator.....	307-164-9-001
U603	74LS74, Dual D Flip-Flop.....	307-119-9-001
<b>SWITCHES</b>		
S601, 602	4-Position Lever (SOURCE, COUPLING).....	080-030-9-002
S603	Pushbutton (SLOPE).....	088-175-9-001
S605	Pushbutton (X-Y).....	088-175-9-001
<b>MISCELLANEOUS</b>		
PG101	3-Pin Polarized Plug.....	757-140-9-007
PG102	4-Pin Polarized Plug.....	757-140-9-008
PG103	4-Pin Polarized Plug.....	757-140-9-003
PG104	5-Pin Polarized Plug.....	757-140-9-004
PG105	3-Pin Polarized Plug.....	757-140-9-002
PG106	4-Pin Right-Angle Polarized Plug.....	757-140-9-015
PG107	7-Pin Right-Angle Polarized Plug.....	757-140-9-014
PG109	6-Pin Right-Angle Polarized Plug.....	757-140-9-013
PG110	2-Pin Right-Angle Polarized Plug.....	757-140-9-012
PG111	3-Pin Polarized Plug.....	757-140-9-007
	Shield, High Voltage Circuit.....	256-268-9-004
	Insulating Spacer (For Q501).....	347-137-9-001
	Insulating Spacer (For Q808, 809).....	347-137-9-002
	Heat Sink (For Q511).....	747-160-9-001
	Heat Sink (For Q501).....	747-160-9-002
	Heat Sink (For Q808, Q809).....	747-160-9-003
	Test Pin (+5 V, -12 V, +12 V, +24 V, etc.).....	757-140-9-001

**PARTS ORDERING INFORMATION**

There is a minimum charge for each invoice. Orders will be shipped C.O.D. unless previous open account arrangements have been made or remittance accompanies order. Advance remittance must cover handling and postage or express charges. Specify model and serial number when ordering replacement parts.

**ORDER REPLACEMENT PARTS FROM:**

**B & K-Precision**, Factory Service Operations  
Maxtec International Corporation  
6470 West Cortland Street  
Chicago, Illinois 60635  
Telephone: (312) 889-1448

**CALIBRATION PROCEDURE****WARNING**

The following instructions are for use by qualified service personnel only. To avoid electrical shock, do not perform servicing unless qualified to do so.

High voltage up to 2,000 volts is present when covers are removed and the unit is operating. Remember that high voltage may be retained indefinitely on high voltage capacitors. Also remember that ac line voltage is present on line voltage input circuits (including the fuse holder, line cord receptacle, and POWER switch) any time the instrument is plugged into an ac outlet, even if turned off. Unplug the oscilloscope and discharge high voltage capacitors before performing service procedures unless it is necessary to have the unit powered up.

This unit was carefully checked and calibrated at the factory prior to shipment. Readjustment is recommended only if repairs have been made in a circuit affecting calibration. The location of the calibration adjustments is shown in Fig. 1 and Fig. 2. Keep in mind that some calibration adjustments require high precision test instruments. Those adjustments should be attempted only if the proper test equipment is available and you are experienced in its use. Before making adjustments, allow 30 minutes warm-up time (with the case on) and adjust all front panel controls (INTENSITY, FOCUS, TRACE ROTATION, POS, etc) to optimum positions. The following test equipment is required for complete calibration:

B & K-Precision Model 2906 Multimeter or equivalent.

B & K-Precision Model 1400 Oscilloscope Calibrator or equivalent.

B & K-Precision Model 1655 Variable AC Power Supply or equivalent with 120 V, 3 A capability.

B & K-Precision Model HV-6 High Voltage Multiplier Probe or equivalent with capability of measuring at least 2 kV.

**NOTE**

All voltage measurements are to be taken with respect to earth (chassis) ground unless otherwise noted.

**POWER SUPPLY ADJUSTMENTS**

1. Plug the oscilloscope into a variable AC power supply and set the variable AC power supply output to exactly 120 V.
2. Connect the multimeter to TP+140V.
3. If necessary, adjust VR501 for a +140 Vdc  $\pm$ 1 Vdc reading on the multimeter.
4. Connect the multimeter to TP+260V.
5. If necessary adjust VR501 for a +260 Vdc  $\pm$ 5 Vdc reading on the multimeter.
6. Repeat steps two through five until no further adjustment is necessary.
7. Using a high voltage probe, measure the voltage at TP-2kV.
8. If necessary, adjust VR508 for a meter reading of -2000 Vdc  $\pm$ 5 Vdc.
9. Disconnect the oscilloscope from the variable ac power supply and plug it into a regular ac outlet.

**INTENSITY ADJUSTMENT**

1. Set up the oscilloscope for automatic (AUTO) sweep operation with a single-trace displayed at the center of the CRT.
2. Set the INTENSITY control fully counterclockwise.
3. Adjust VR505 until the trace is just barely visible.

**ASTIGMATISM ADJUSTMENT**

1. Set up the oscilloscope for X-Y operation (with no input signals) and set the FOCUS control to mid-range.
2. Adjust VR507 until the spot is as small and round as possible.
3. Release the X-Y switch.

**CH 1 DC BALANCE ADJUSTMENT**

1. With the channel 1 AC-GND-DC switch in the GND position, the AUTO trigger mode selected, and channel 1 single-trace operation selected, set the CH 1 VOLTS/DIV switch to 5 mV.
2. Rotating the channel 1 VAR control should cause no more than 1 minor division change in trace position. If necessary, adjust VR101 and VR102 until trace shift is 1 minor division or less when VAR control is rotated from CAL to fully clockwise.
3. Return the channel 1 VAR control to the CAL position.

**NORMAL/INVERT ADJUSTMENT**

1. Set the channel 1 AC-GND-DC switch to the GND position, select the AUTO trigger mode, set the oscilloscope for channel 1 single-trace display, and use the CH 1 POS control to center the trace.
2. Press and release the NORM/INV 1 switch repeatedly and observe the display. The trace should not move when switched from NORM to INV.
3. If necessary, adjust VR301 until the trace does not move when switched between NORM and INV.

**CH 2 DC BALANCE ADJUSTMENT**

1. With the channel 2 AC-GND-DC switch in the GND position, the AUTO trigger mode selected, and channel 2 single-trace operation selected, set the CH 2 VOLTS/DIV switch to 5 mV.

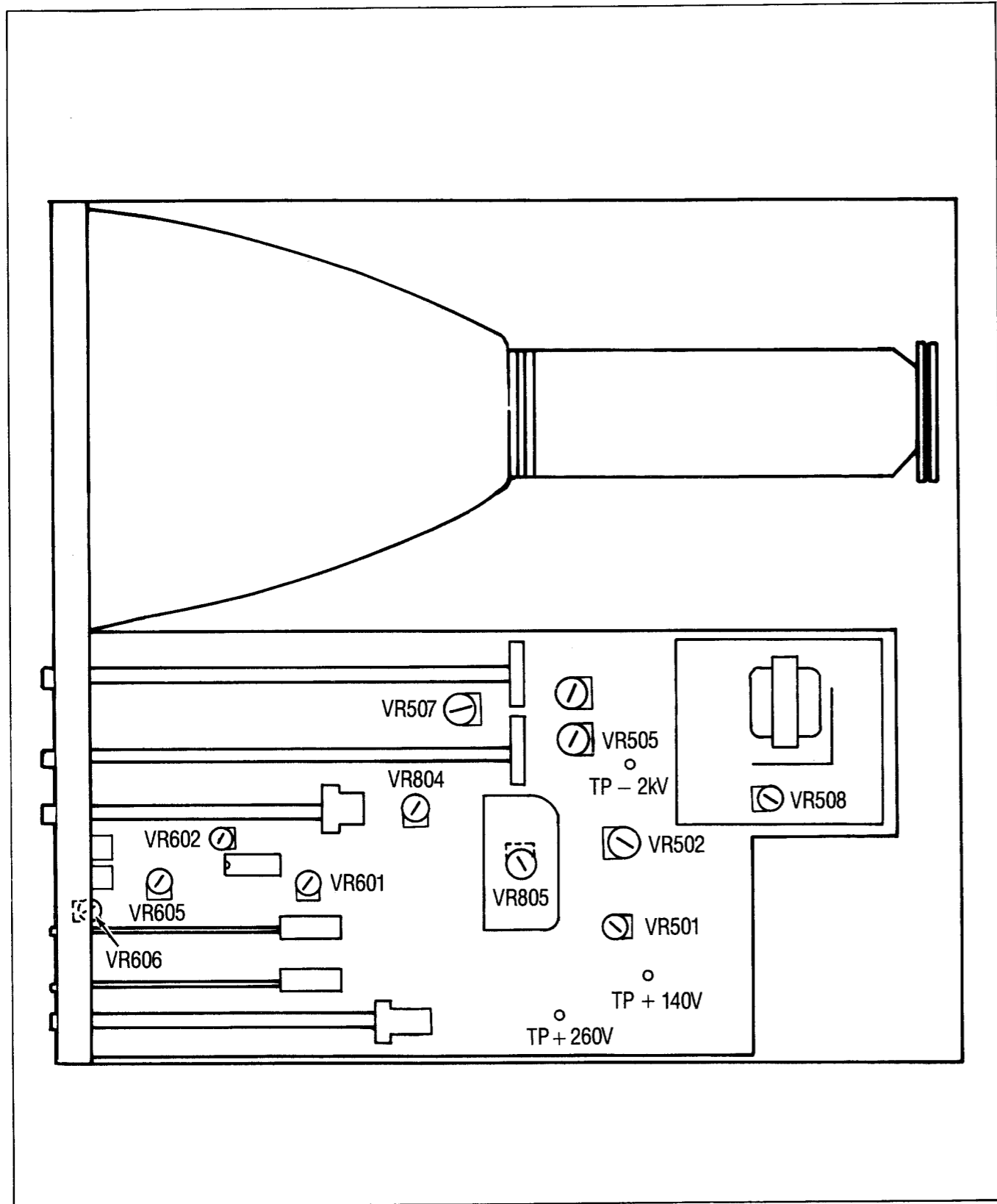


Fig. 1. Adjustment Locations (Top View).

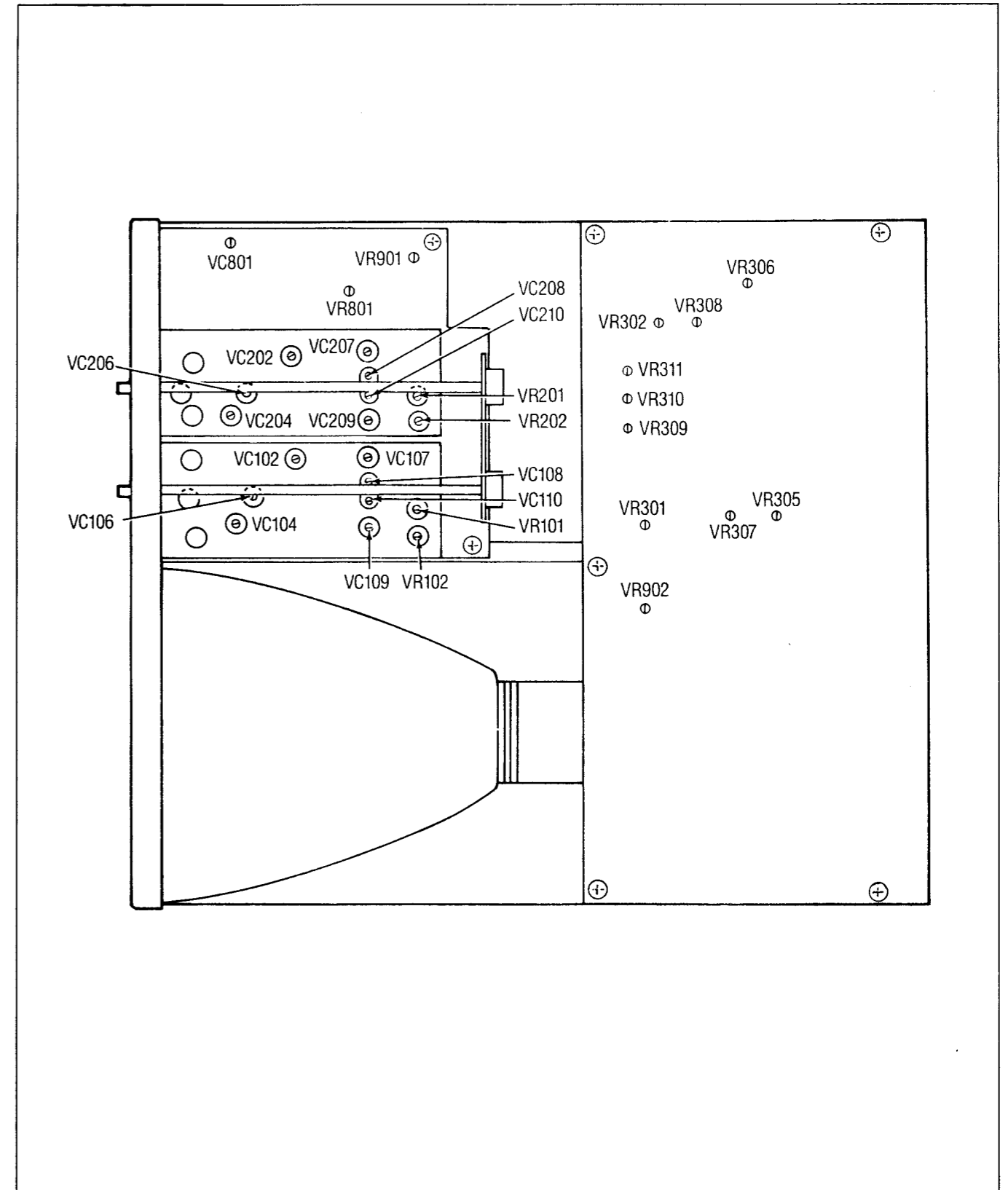


Fig. 2. Adjustment Locations (Bottom View).

- Rotating the channel 2 VAR control should cause no more than 1 minor division change in trace position. If necessary, adjust VR201 and VR202 until trace shift is 1 minor division or less when VAR control is rotated from CAL to fully clockwise.
- Return the channel 2 VAR control to the CAL position.

**VERTICAL CENTERING ADJUSTMENT**

- Set the channel 1 AC-GND-DC switch to the GND position, select the AUTO trigger mode, and set the oscilloscope for channel 1 single-trace display.
- Set the CH 1 POS control to its center.
- If necessary, adjust VR301 so that the trace is at the exact vertical center of the display.
- Switch to channel 2 single-trace display.
- Set the CH 2 POS control to its center.
- If necessary, adjust VR302 so that the trace is at the exact vertical center of the display.

**VERTICAL VOLTAGE ADJUSTMENT**

- Set up the oscilloscope for X-Y operation and set both AC-GND-DC switches to the GND position.
- Be sure that all four vertical mode switches are released and use the channel 1 POS and X POS controls to set the dot at the exact center of the CRT.
- If necessary, adjust VR305 to obtain 95 Vdc ±2 Vdc at the collectors of Q405 and Q406.
- Repeat steps 2 and 3 until no further adjustment is required.
- Press the CH 1/CH 2 switch and use the channel 2 POS and X POS controls to set the dot at the exact center of the CRT.
- If necessary, adjust VR306 to obtain 95 Vdc ±2 Vdc at the collectors of Q405 and Q406.
- Repeat steps 5 and 6 until no further adjustment is required.
- Disconnect the meter from the oscilloscope.

**HORIZONTAL CENTERING ADJUSTMENT**

- With the oscilloscope set up for X-Y operation and the PULL X10 control pushed in, set the X POS control to its center.
- If necessary, adjust VR606 until the dot is as close to the center (horizontally) of the CRT as possible.

**HORIZONTAL VOLTAGE ADJUSTMENT**

- With the oscilloscope still set up for X-Y operation and the PULL X10 control pushed in, set the position controls so that the dot is at the exact center of the CRT.
- If necessary, adjust VR804 to obtain 145 Vdc ±5 Vdc at the collectors of Q808 and Q809.
- Disconnect the meter from the oscilloscope.

**SWEEP LENGTH ADJUSTMENT**

- Set the oscilloscope for a single-trace display of channel 1 (with the channel 1 AC-GND-DC switch set to GND).
- Rotate VR605 fully counterclockwise.
- Use the X POS control to set the left edge of the trace on the left most vertical graduation and observe where the right edge of the trace falls.
- Again using the X POS control, move the right edge of the trace two divisions to the left.

- Rotate VR605 clockwise until the trace reaches the right edge of the CRT. This will allow about 12 divisions of horizontal deflection.

**TIMEBASE ACCURACY ADJUSTMENT**

- Set the oscilloscope calibrator for a 0.5 ms square wave (or markers) and connect it to the oscilloscope channel 1 input. Set the TIME/DIV control to 0.5 ms.
- Adjust the X POS control so that the first rising pulse edge (or marker) falls on the left most vertical graduation.
- If necessary, adjust VR801 so that each rising edge (or marker) falls on a major vertical graduation.
- Check all sweep speeds up to about 20 μs/div for accuracy and repeat adjustment if necessary.
- Set the oscilloscope calibrator for a 0.5 μs square wave (or markers) and set the TIME/DIV control to 0.5 μs.
- Again, adjust the X POS control so that the first rising pulse edge (or marker) falls on the left most vertical graduation.
- If necessary, adjust VC801 so that each rising pulse edge (or marker) falls on a major vertical graduation.
- Check all sweep speeds of 20 μs/div and above for accuracy and repeat adjustment if necessary.
- Recheck all sweep speed settings for accuracy and repeat entire procedure if necessary.

**X10 MAGNIFICATION ADJUSTMENT**

- Set the oscilloscope calibrator for a 5 μs square wave (or markers) and connect it to the oscilloscope channel 1 input. Set the oscilloscope TIME/DIV control to 50 μs.
- Pull out the PULL X10 control.
- Adjust the X POS control so that the first rising pulse edge (or marker) falls on the left most vertical graduation.
- If necessary, adjust VR804 until each rising edge (or marker) falls on a major vertical graduation.

**TRIGGER ADJUSTMENT**

- Apply a 1 kHz, 0.5 V p-p sinewave to the channel 1 input of the oscilloscope and set the CH 1 VOLTS/DIV control to 0.1 V.
- Adjust the CH 1 POS control so that the five divisions of waveform are centered vertically (the waveform should extend just beyond the 10 and 90% graticule markings).
- Adjust the TRIG LEVEL control so that the waveform crosses the center horizontal graduation at the leftmost graduation (as shown in Fig. 3).
- Press the SLOPE switch and observe the waveform.
- If necessary, adjust VR601 so the waveform again crosses the center horizontal graduation at the leftmost vertical graduation.
- Repeat steps three through five until no further adjustment is necessary.
- Reduce the 1 kHz sinewave level to 50 mV p-p and pull out the TRIG LEVEL/PUSH AUTO control.
- Adjust the TRIG LEVEL control to obtain as stable a display as possible.
- If necessary, adjust VR602 until the display can be stabilized (it may be necessary to readjust the TRIG LEVEL control to obtain a stable display).

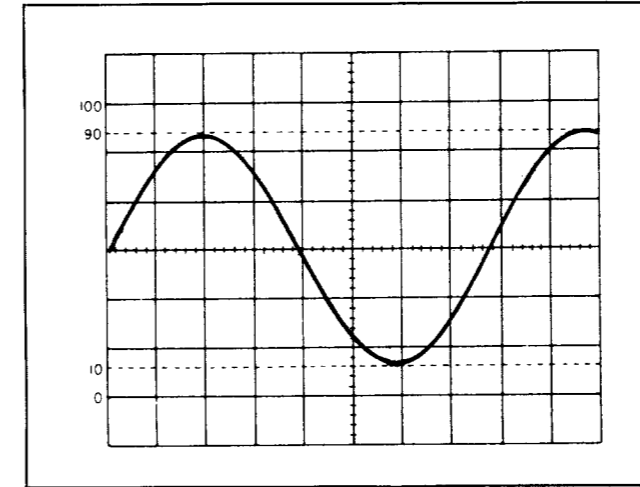


Fig. 3. Adjusting Trigger Point.

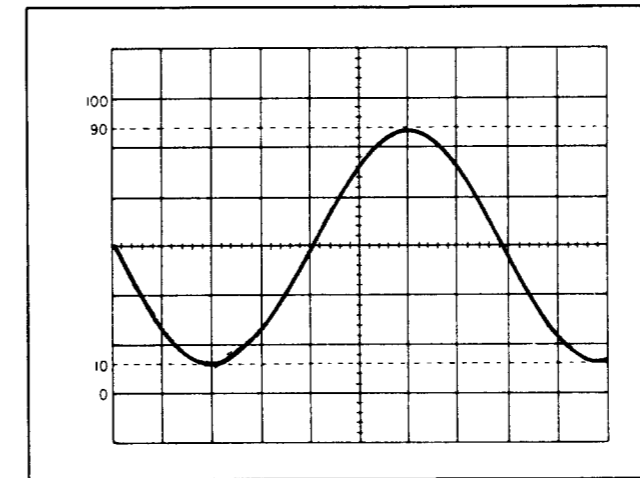


Fig. 4. Adjusting Trigger Point.

- Remove the input signal, set both AC-GND-DC switches to GND, and push in the TRIG LEVEL/PUSH AUTO control.
- With the oscilloscope set for channel 1 single-trace operation, use the CH 1 POS control to set the waveform at the vertical center of the display.
- Connect the multimeter to the collector of Q610 and if necessary, adjust VR309 for a reading of 0 Vdc ±10 mVdc on the multimeter.
- Set the oscilloscope for channel 2 single-trace operation.
- With the multimeter still connected to the collector of Q610, adjust VR310 for a reading of 0 Vdc ±10 mVdc on the multimeter.
- Disconnect the multimeter from the oscilloscope.

**ATTENUATOR COMPENSATION ADJUSTMENTS**

- Using the input circuit shown in Fig. 5, connect an oscilloscope calibrator to the channel 1 input. Set the calibrator for a 1 kHz square wave at 50 mV p-p and set the oscilloscope CH 1 VOLTS/DIV control to 5 mV. Adjust the oscilloscope controls for a stable display of about three cycles of the channel 1 signal.
- Adjust Cin (in the input circuit shown in Fig. 5) for optimum wave shape as shown in Fig. 6.

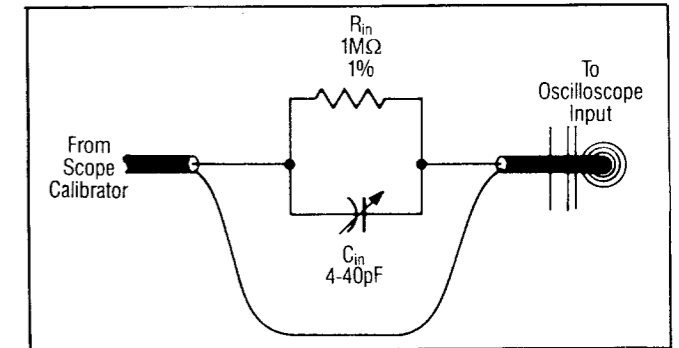


Fig. 5. Network for Input Attenuator Adjustment.

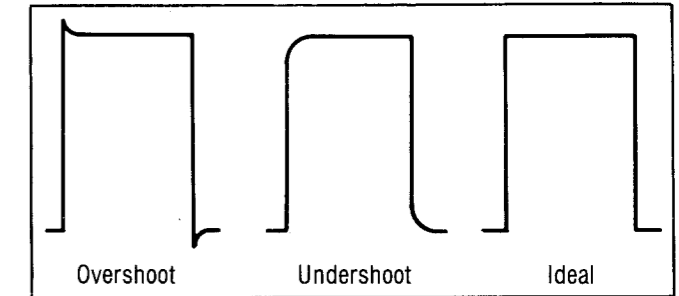


Fig. 6. Adjusting 1 kHz Square Wave Characteristics.

- Use the following table as a guide for setting the attenuator compensation.

CALIBRATOR INPUT LEVEL	OSCILLOSCOPE RANGE	TRIMMER
100 mV	10 mV/Div	VC108
200 mV	20 mV/Div	VC110
500 mV	50 mV/Div	VC102
1 V	0.1 V/Div	VC107
2 V	0.2 V/Div	VC109
5 V	0.5 V/Div	VC104
50 V	5 V/Div	VC106

- Again using the input circuit shown in Fig. 5, connect an oscilloscope calibrator to the channel 2 input. Set the calibrator for a 1 kHz square wave at 50 mV and set the oscilloscope CH 2 VOLTS/DIV control to 5 mV. Adjust the oscilloscope controls for a stable display of about three cycles of the channel 2 signal.
- Adjust Cin (in the input circuit shown in Fig. 5) for optimum wave shape as shown in Fig. 6.
- Use the following table as a guide for setting the attenuator compensation.

CALIBRATOR INPUT LEVEL	OSCILLOSCOPE RANGE	TRIMMER
100 mV	10 mV/Div	VC208
200 mV	20 mV/Div	VC210
500 mV	50 mV/Div	VC202
1 V	0.1 V/Div	VC207
2 V	0.2 V/Div	VC209
5 V	0.5 V/Div	VC204
50 V	5 V/Div	VC206

**ATTENUATOR GAIN ADJUSTMENT**

- Using the oscilloscope calibrator, connect a 1 kHz, 20 V p-p square wave to the channel 1 input and set the oscilloscope **CH 1 VOLTS/DIV** control to 5 V. Adjust the oscilloscope for a stable display of about three cycles of the channel 1 signal.
- If necessary, adjust VR307 for exactly four divisions of amplitude.
- Connect the calibrator (still set at 20 V p-p) to the channel 2 input and set the oscilloscope **CH 2 VOLTS/DIV** control to 5 V. Adjust the oscilloscope for a stable display of about three cycles of the channel 2 signal.
- If necessary, adjust VR308 for exactly four divisions of amplitude.

**X GAIN ADJUSTMENT**

- Set up the oscilloscope for X-Y operation and apply a 1 kHz, 20 mV signal (from the oscilloscope calibrator) to the oscilloscope's channel 2 (X) input. Set the **CH 2 VOLTS/DIV** control to 5 mV.
- If necessary, adjust VR311 so that the signal provides exactly 4 divisions of horizontal deflection.

**VERTICAL FINAL AMPLIFIER ADJUSTMENT**

- Apply a 1 MHz, 20 mV p-p square wave to the oscilloscope's channel 1 input and set the oscilloscope **CH 1 VOLTS/DIV** control to 5 mV. Adjust the oscilloscope for a stable display of about three cycles of the channel 1 signal and center the waveform so that it goes two divisions above and two divisions below the center horizontal graduation.

- Adjust VR401 and VC401 for optimum flatness of the squarewave (minimum ringing and overshoot).

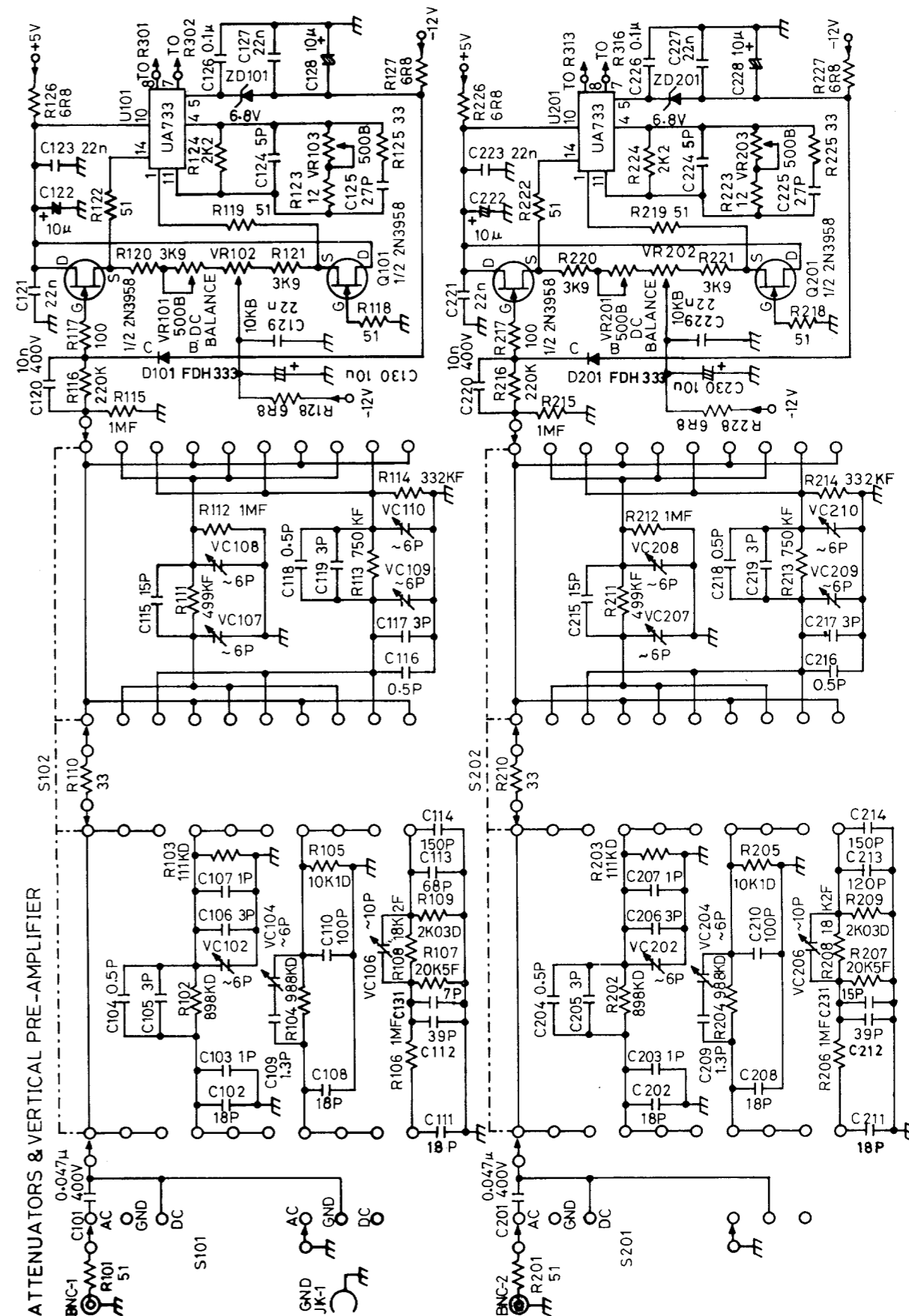
**CH 1 OUTPUT DC OFFSET ADJUSTMENT**

- Set the oscilloscope for single-trace channel 1 display with the channel 1 **AC-GND-DC** switch set to **GND**.
- Use the **CH 1 POS** control to set the waveform at the exact vertical center of the display.
- Connect the multimeter to the rear panel **CH 1 OUTPUT** jack.
- Adjust VR902 for a reading as close to 0 Vdc (on the multimeter) as possible.

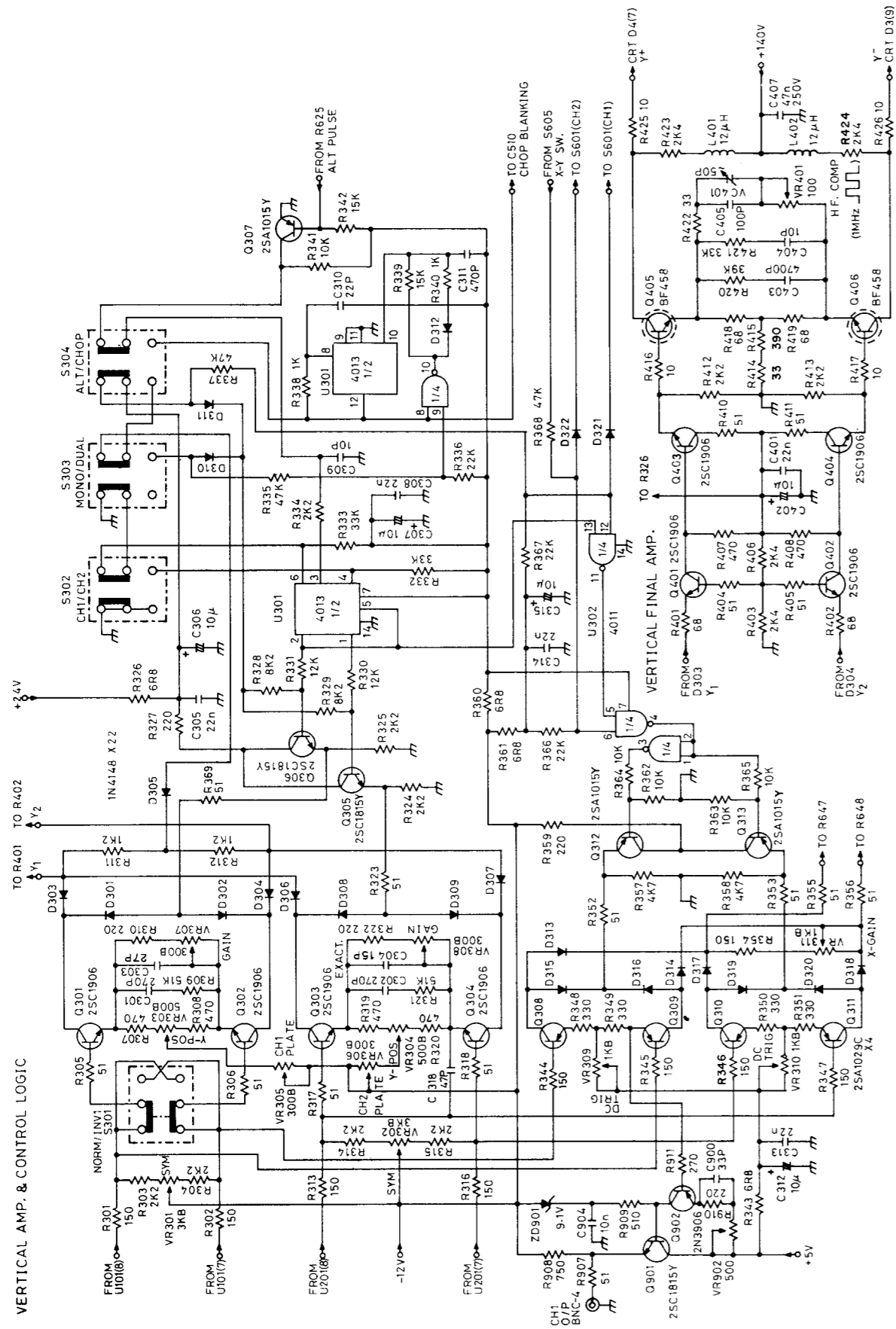
**CAL 0.2 V P-P OUTPUT ADJUSTMENT**

- Connect the oscilloscope calibrator to the channel 1 input of the oscilloscope and set the calibrator for a 0.2 V p-p output. Adjust the oscilloscope controls to obtain a stable display of about three cycles of the channel 1 signal.
- Use the oscilloscope's channel 1 **VAR** control to adjust the waveform so that it occupies **exactly** six vertical divisions of display.
- Disconnect the calibrator from the oscilloscope and connect the **CAL 0.2 V p-p** terminal to the channel 1 input. Be sure not to disturb the channel 1 **VAR** control setting.
- If necessary, adjust VR901 so that the **CAL 0.2 V p-p** signal occupies **exactly** six vertical divisions of display.

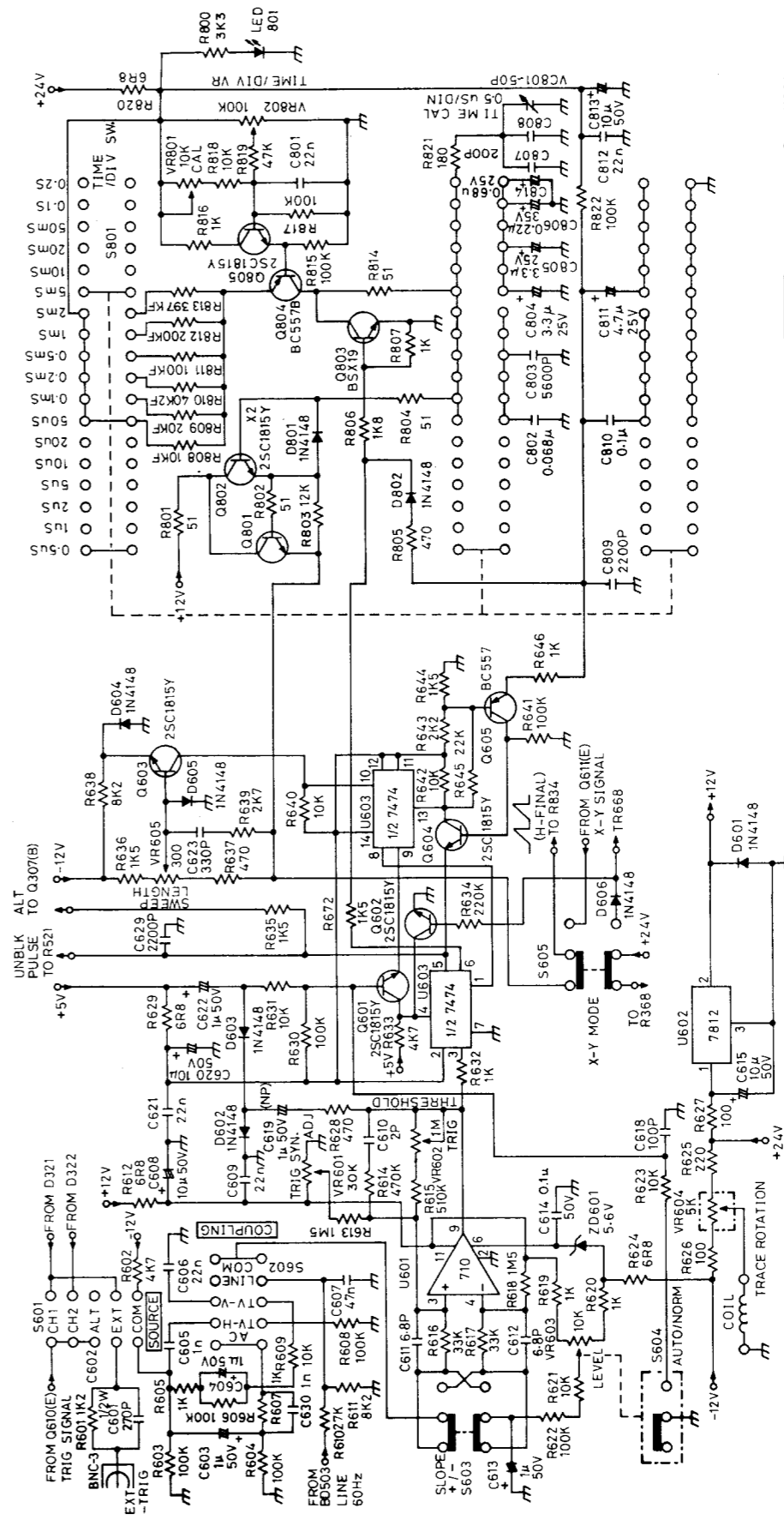
**ATTENUATORS & VERTICAL PRE-AMPLIFIER**



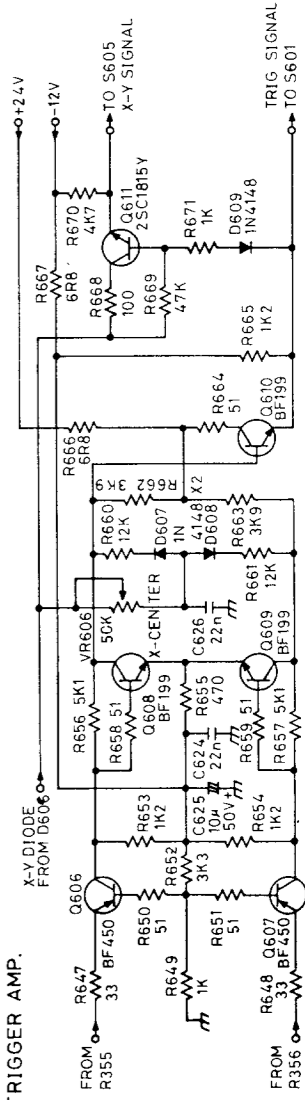




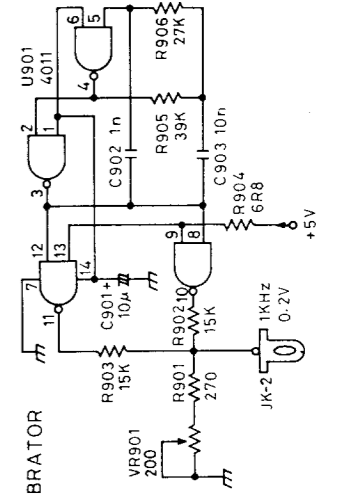
TRIG & SWEEP GENERATOR



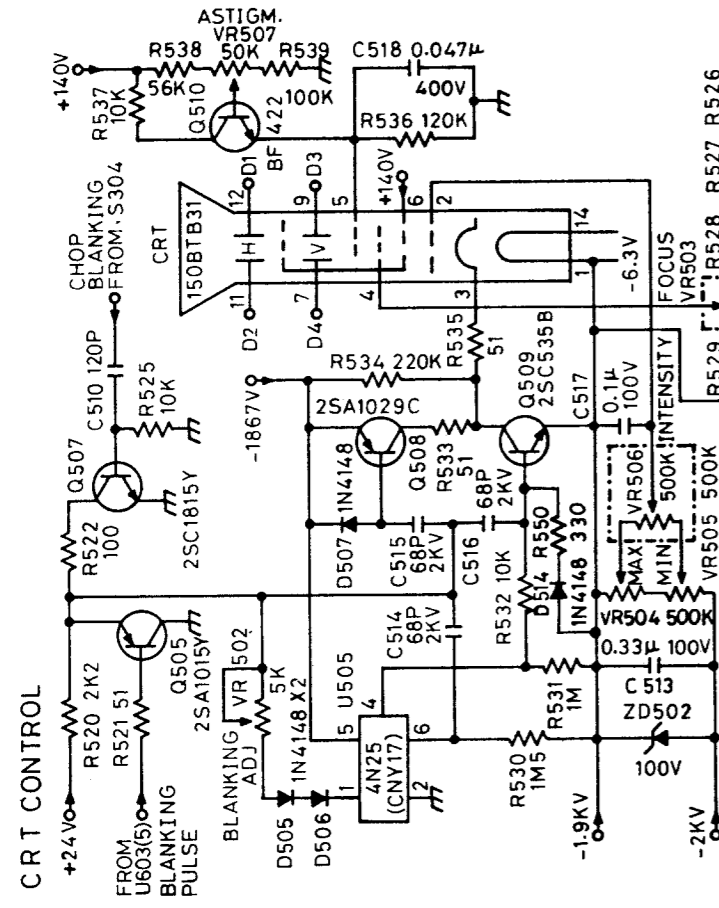
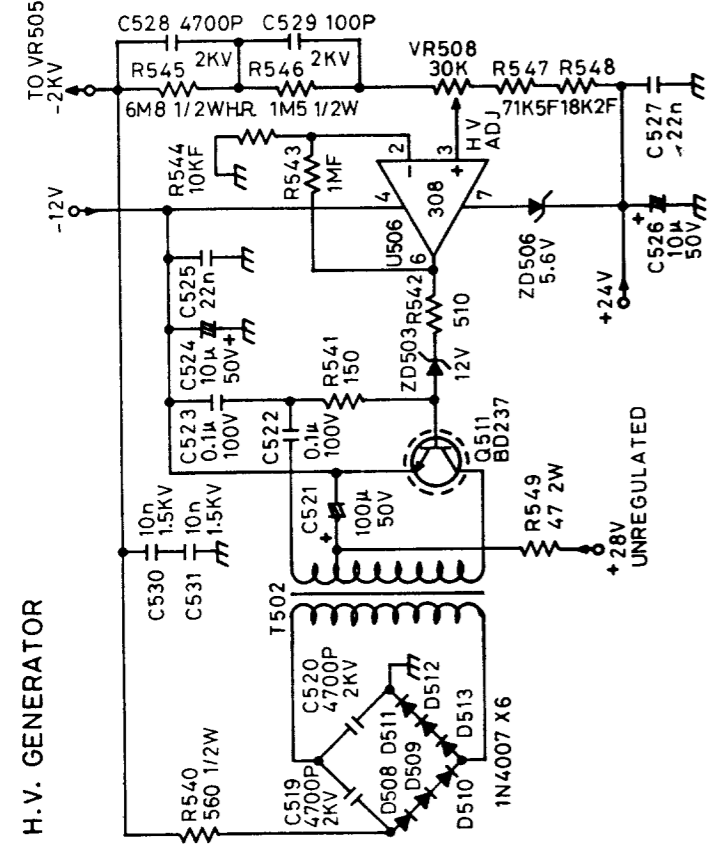
TRIGGER AMP.



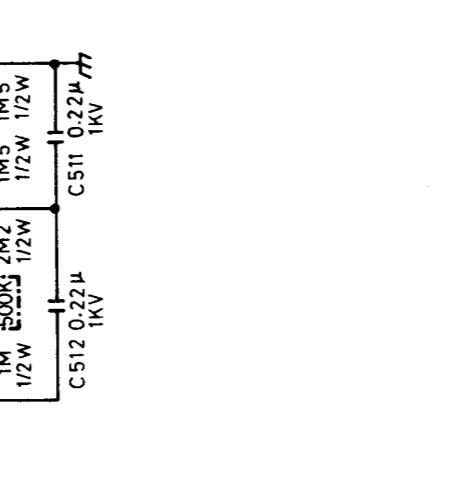
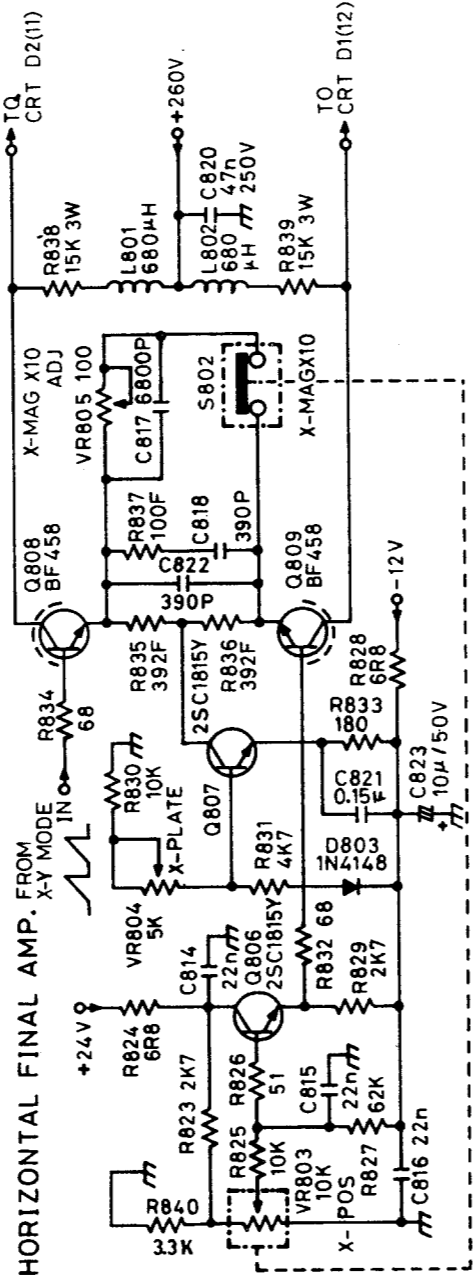
CALIBRATOR



H.V. GENERATOR



HORIZONTAL FINAL AMP. FROM X-Y MODE



POWER SUPPLY T501

