

# TEKTRONIX®

This insert is provided as a supplement to the instruction manual furnished with this modified instrument. The information given in this insert supersedes that given in the manual.

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5100-Series

MOD 768X

## MODIFICATION INSERT

This manual insert describes MOD 768X as it applies to the TEKTRONIX 5100-Series Oscilloscope. MOD 768X provides six wide-band, direct-coupled signal output amplifiers with rear-panel, bnc connectors. Internal patching facilities permit use with standard plug-in units for deflection signal outputs, or with modified plug-ins for output of signals existing only within the plug-in, such as gate or sawtooth signals. Output amplitudes are up to  $\pm 10$  V, open circuit, or  $\pm 0.5$  in  $50 \Omega$ .

Connection facilities are provided by connector pins added at the interface board providing quick-change output signal selection in the field, as follows:

COMPARTMENT	CONNECTION*	FUNCTION	
Left Vertical	J601	A13/B13	Plug-In Voltage Signal
	J601	B24	Plug-In Current Signal A
	J601	B23	Plug-In Current Signal B
Right Vertical	J602	A13/B13	Plug-In Voltage Signal
	J602	B24	Plug-In Current Signal A
	J602	B23	Plug-In Current Signal B
Horizontal	J611	7/8**	Deflection Voltage Signal
	J603	A25	Plug-In Current Signal C
	J603	B24	Plug-In Current Signal A
	J603	B23	Plug-In Current Signal B
	J603	A22	Plug-In Current Signal D
	J603	A13/B13	Plug-In Voltage Signal
Vertical	J612	1/2**	Deflection Voltage Signal (Single Beam) or Left Vertical Deflection Voltage Signal for Dual Beam.
	J612	3/4	Right Vertical Deflection Voltage Signal for Dual Beam.

\*Plus Associated Ground Connections.

\*\*Via attenuator network.

Patch cord/connector assemblies for connection of the amplifiers to the various current and voltage sources available are stored internally.

### CHARACTERISTICS

Operating Modes. Each amplifier is connectable for differential voltage input, with common-mode rejection capability of 20 dB or more (dc-100 kHz), or for signal-ended current input with an effective summing point resistance of approximately  $470 \Omega$ .

Sensitivity. As a voltage amplifier, gain is X20,  $\pm 10\%$  unterminated, providing an output of 1 volts/division when driven from a 50 mV/div interface deflection signal. As a current amplifier, 3.7  $\mu$ A input will provide 1 mA (current gain X270),  $\pm 10\%$  output, or approximately 1 V unterminated.

Output Impedance. Each amplifier output impedance is  $1 \text{ k}\Omega$ ,  $\pm 10\%$ , permitting high amplitude ( $\pm 10$  V) unterminated operation for low-frequency applications, and wide-band operation when terminated in 50 or  $100 \Omega$ , 15  $1/20$  or  $1/10$  nominal output amplitude (maximum output swing,  $\pm 0.5$  V into  $50 \Omega$ ).

Bandwidth. As a voltage amplifier, -3dB output bandwidth is 900 kHz or more overall when driven from a deflection amplifier of 2 MHz nominal -3dB bandwidth, and terminated in 50  $\Omega$ .

Polarity. Output polarity is positive for upward (vertical), left-to-right (horizontal) or "on" (Gate) signals.

### Output Amplifiers

Offset. The output dc level of each amplifier is 0 V for "no signal" input. An internal adjustment permits setting a 0 V quiescent output for small input signal imbalances, providing 0 V output for center-screen trace position when used as deflection signal output.

Noise. System noise (primarily chop and alternate drive signals) is less than 0.5 major division equivalent deflection when an amplifier is connected as a differential deflection voltage signal amplifier from a compartment containing a single-trace amplifier (or a dual-trace amplifier operated in a single-trace mode). System noise from a plug-in current-source signal is typically less than 0.4 div equivalent deflection signals. Random noise in either mode is less than 0.2 div equivalent deflection.

Compatibility. The three plug-in compartments are normally compatible with all 5000-Series plug-in units, except as noted below:

Time-Base Units. Installation of a time-base plug-in unit having a Sweep Magnifier in a vertical deflection compartment connected for deflection signal output will not permit normal operation of the Sweep Magnifier. An isolated signal pickoff system permits normal magnifier operation when a time-base unit is installed in the Horizontal compartment.

Amplifier Plug-In Units. Deflection sensitivity changes by approximately 5% when an output amplifier is connected to or disconnected from a vertical plug-in compartment deflection signal line, with typical amplifier plug-in units. Indicator unit gain is initially corrected for normal calibration of typical amplifier plug-in units installed in the vertical compartments, with the output amplifiers connected for deflection signal output.

Plug-In Requirements. No plug-in modifications are required for normal deflection signal outputs. For plug-in signal outputs, modified plug-in units are required: for instance,

5A28N MOD 768V	Ch 1 & Ch 2 independent outputs	3.7 $\mu$ A/div
5B10N MOD 768W	Sawtooth & Gate current outputs	0 to +37 $\mu$ A
5B12N MOD 768W	Sawtooth A & Gate A current outputs	0 to +37 $\mu$ A

CALIBRATION

To set the left vertical, right vertical, and horizontal outputs, proceed as follows:

Equipment Required:

Test Oscilloscope -- vertical volts/div or 0.5 to 2 V  
2 50  $\Omega$  bnc Cable (012-0057-01)  
2 50  $\Omega$  bnc Termination (011-0049-01)  
1 Common Mode Test Cable (035-2042-00)  
2 Vertical Plug-Ins (5A18N MOD 768V)  
1 Time-Base Plug-In (5B10N MOD 768W or 5B12N MOD 768W)  
Standard Amplitude Calibrator (SAC) (067-0502-01)  
Constant Amplitude Signal Generator (CASG) (191 or equivalent)

1. Control Setting

Install the two 5A18N plug-in units in the left and middle plug-in compartments and the 5B10N in the right compartment. Set the plug-in controls as follows:

Left 5A18N

GND	In
AC	In
VOLTS/DIV	50 m
CAL	Fully clockwise
POSITION	Centered
DISPLAY ON	In

Right 5A18N

GND	In
AC	In
VOLTS/DIV	50 m
CAL	Fully clockwise
POSITION	Centered
DISPLAY ON	Out
MODE CH 1	In
TRIG CH 1	In

5A10N

SOURCE LEFT	In
AUTO TRIG	In
AC COUPL	In
+ SLOPE	In
SINGL SWP	Out
SWP MAG	Out
DISPLAY CHOP	Out
TRIG LEVEL	Centered
SECONDS/DIV	.5 m
CAL	Fully clockwise
POSITION	Centered

2. Common Mode Bal and Preliminary Output DC Level

a. Temporarily disconnect the connecting cables and jumpers at pins C and D at the six output amplifier inputs. Connect a 50  $\Omega$  coaxial cable between the left vertical output and the test oscilloscope. Set the test oscilloscope input selector to GND and position the trace to the graticule center. Set the time base to 2 ms/div with AUTO TRIGGER. Set the vertical VOLTS/DIV to 1. Set the Input Selector to DC. Adjust the Output DC Level control on the Output Amplifier Board (the lower adjustment of the pair) to bring the test oscilloscope trace to the graticule center. Connect the Common Mode Test Cable between the output amplifier input (pins C and D) and the front-panel calibrator of the 5100-Series Oscilloscope MOD 768X. Adjust the Common Mode BAL (the upper adjustment of the pair) for a straight line on the test oscilloscope. Use this same procedure to set the Output DC Level and the Common Mode BAL of the right vertical output and the horizontal outputs.

b. Disconnect the Common Mode Test Cable and connect the test oscilloscope to the left vertical output. Connect all the connecting cables and jumpers to the pins of the six output amplifier units again as indicated in Fig. 1.

3. Output DC Level Adjust

a. Connect a 50  $\Omega$  coaxial cable from the Standard Amplitude Calibrator (SAC) to the 5A18N CH 1 input. Set the SAC to .2 volts. Adjust the Output DC Level to bring the test oscilloscope trace to graticule center. Set the 5A18N CH 1 INPUT GND button out.

b. Check the test oscilloscope for a four-division display also. Install the 50  $\Omega$  termination at the test oscilloscope input and set the VOLTS/DIV to .05. Check for a four-division display. Set the VOLTS/DIV to 1 and remove the 50  $\Omega$  termination. Set the 5A18N INPUT GND in. Set the DISPLAY ON out.

c. Connect the test oscilloscope to the right vertical output. Connect the SAC to the right 5A18N CH 1 input. Set the 5A18N DISPLAY ON in. Adjust the Output DC Level to bring the test oscilloscope trace to graticule center. Set the input GND out. Set the 5B10N SOURCE RIGHT in.

d. Repeat step b.

e. To check the sawtooth and gate outputs, a modified time base must be used; either a 5B10N MOD 768W or a 5B12N MOD 768W. Disconnect the test oscilloscope from the 5100-Series Oscilloscope MOD 768X, set the VOLTS/DIV to 2, and position the trace to the bottom graticule line. Now connect the test oscilloscope to the SAWTOOTH output. Set the 5B10N MOD 768W AUTO TRIG out. Set the SOURCE EXT in and the TRIG LEVEL fully clockwise.

f. Adjust the Output DC Level to bring the test oscilloscope trace to the bottom graticule line. Set the AUTO TRIG in. Check the test oscilloscope for a five-division display.

g. Set the AUTO TRIG out and connect the test oscilloscope to the GATE output.

h. Repeat step f.

i. To set up one of the output amplifiers for horizontal deflection, use the jumper and cable position of the horizontal output as indicated on Fig. 1.

j. Connect the test oscilloscope to the sawtooth output. Set the 5B10N VOLTS/DIV (EXT) to 50 mV. Position the spot to the graticule center. Adjust the Output DC Level to bring the test oscilloscope trace to graticule center. Connect the SAC to the 5B10N EXT INPUT. Set the SAC to .5 volts. Set the test oscilloscope VOLTS/DIV to 2. Set the 5B10N AC COUPL out. Set the POSITION control for trace spots at the left and right graticule lines. Check the test oscilloscope for a five-division display. Install the 50  $\Omega$  termination at the test oscilloscope input and set the VOLTS/DIV to 2 and remove the 50  $\Omega$  termination. Set the AC COUPL in and the SECONDS/DIV to .5 m. Set the POSITION control to set the start of the trace at the left graticule line. Check the test oscilloscope for a sawtooth display of at least five divisions.

4. Check Bandwidth

a. Reset the 5A18N and 5B10N controls as given in step 1.

b. Connect a 50  $\Omega$  coaxial cable between the Constant Amplitude Signal Generator (CASG) and the left 5A18N CH 1 input and terminate with 50  $\Omega$ . Set the CASG amplitude range to 50-500 mV. Set the AMPLITUDE to 25. Set the FREQUENCY RANGE to 50 kHz only. Connect the test oscilloscope to the left vertical output and terminate with 50  $\Omega$  at the test oscilloscope input and set the VOLTS/DIV to .05.

c. Set the 5A18N CH 1 input GND out. Adjust the CASG AMPLITUDE and VARIABLE to display six divisions on the test oscilloscope. Set the FREQUENCY RANGE to .75-1.6 MHz and the dial to .9. Check the test oscilloscope for 4.2 divisions or greater display. Set the CASG FREQUENCY RANGE to 50 kHz only. Set the 5A18N input GND in and the DISPLAY ON out.

d. Move the input signal coaxial cable and termination to the right 5A18N CH 1 input and set the DISPLAY ON in. Connect the test oscilloscope to the right vertical output.

e. Repeat step c.

This concludes calibration. Disconnect all cables and terminations.

## PARTS LIST

## Mechanical

Add:

030-0636-01	2	BRIDGE SUPPORT
030-0673-03	3	GUIDE, UPPER PLUG-IN
030-0693-03	1	SUPPORT, LOWER
030-0694-03	1	SUPPORT, UPPER
030-0696-01	1	BRIDGE SUPPORT, FUSEHOLDER
131-0126-00	6	CONNECTOR, RECEPT, ELECT., BNC, FEMALE
131-0589-00	34	TERMINAL, PIN, SQUARE
166-0209-00	2	SPACER, SLEEVE
352-0031-00	1	FUSEHOLDER

Change To:

030-0695-03	1	PANEL, REAR
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## Standard Accessories

Add:

034-0446-00	1	LABEL, ID CONNECTORS
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## DUAL AMPLIFIER Etched Circuit Board Assembly

## Electrical

037-6134-00		COMPLETE ASSEMBLY
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## (Half DUAL AMPLIFIER Board)

C5	290-0177-00	CAPACITOR, FXD, ELCTLT, 1 $\mu$ F, 20%, 50 V
C6	281-0529-00	CAPACITOR, FXD, CER, 1.5 pF, 0.25 pF, 500 V
C7	290-0162-00	CAPACITOR, FXD, ELCTLT, 22 $\mu$ F, 20%, 35 V
C8	290-0177-00	CAPACITOR, FXD, ELCTLT, 1 $\mu$ F, 20%, 50 V
CR2	152-0185-00	SEMICONV DEVICE, DIODE, SILICON, 1N4152
Q6	151-0331-00	TRANSISTOR, NPN, SILICON, D40C5 FAMILY
Q7	151-0192-00	TRANSISTOR, NPN, SILICON, MPS6521
Q8	151-0192-00	TRANSISTOR, NPN, SILICON, MPS6521
Q9	151-0192-00	TRANSISTOR, NPN, SILICON, MPS6521
Q10	151-0134-00	TRANSISTOR, PNP, SILICON, 2N2905A
R25	321-0287-00	RESISTOR, FXD, FILM, 9.53 k $\Omega$ , 1%, 0.125 W
R26	321-0226-00	RESISTOR, FXD, FILM, 2.21 k $\Omega$ , 1%, 0.125 W
R27	321-0287-00	RESISTOR, FXD, FILM, 9.53 k $\Omega$ , 1%, 0.125 W
R28	311-1287-00	RESISTOR, VAR, NONWW, 100 k $\Omega$ , 0.5 W
R29	315-0102-00	RESISTOR, FXD, CMPSN, 1 k $\Omega$ , 5%, 0.25 W
R30	321-0368-00	RESISTOR, FXD, FILM, 66.5 k $\Omega$ , 1%, 0.125 W
R31	321-0315-00	RESISTOR, FXD, FILM, 18.7 k $\Omega$ , 1%, 0.125 W
R32	321-0128-00	RESISTOR, FXD, FILM, 210 $\Omega$ , 1%, 0.125 W
R33	315-0102-00	RESISTOR, FXD, CMPSN, 1 k $\Omega$ , 5%, 0.25 W
R34	321-0284-00	RESISTOR, FXD, FILM, 8.87 k $\Omega$ , 1%, 0.125 W
R35	321-0289-00	RESISTOR, FXD, FILM, 10 k $\Omega$ , 1%, 0.125 W
R36	321-0300-00	RESISTOR, FXD, FILM, 13 k $\Omega$ , 1%, 0.125 W
R37	321-0245-00	RESISTOR, FXD, FILM, 3.48 k $\Omega$ , 1%, 0.125 W

PARTS LIST (CONT)

DUAL AMPLIFIER Etched Circuit Board Assembly (cont)

Electrical (cont)

(Half DUAL AMPLIFIER Board) (cont)

R38	315-0102-00	RESISTOR, FXD, CMPSN, 1 k $\Omega$ , 5%, 0.25 W
R39	321-0510-00	RESISTOR, FXD, FILM, 2 M $\Omega$ , 1%, 0.125 W
R40	315-0562-00	RESISTOR, FXD, CMPSN, 5.6 k $\Omega$ , 5%, 0.25 W
R41	315-0561-00	RESISTOR, FXD, CMPSN, 560 $\Omega$ , 5%, 0.25 W
R42	321-0211-00	RESISTOR, FXD, FILM, 1.54 k $\Omega$ , 1%, 0.125 W
R43	321-0300-00	RESISTOR, FXD, FILM, 13 k $\Omega$ , 1%, 0.125 W
R44	315-0101-00	RESISTOR, FXD, CMPSN, 100 $\Omega$ , 5%, 0.25 W
R45	321-0254-00	RESISTOR, FXD, FILM, 4.32 k $\Omega$ , 1%, 0.125 W
R46	321-0306-00	RESISTOR, FXD, FILM, 15 k $\Omega$ , 1%, 0.125 W
R47	321-0402-00	RESISTOR, FXD, FILM, 150 k $\Omega$ , 1%, 0.125 W
R48	323-0236-00	RESISTOR, FXD, FILM, 2.80 k $\Omega$ , 1%, 0.5 W
U2	156-0067-00	MICROCIRCUIT, LINEAR, OPERATIONAL AMP
VR2	152-0055-00	SEMICONV DEVICE, DIODE, ZENER, SI, 1N962B

(Other Half DUAL AMPLIFIER Board)

C9	281-0557-00	CAPACITOR, FXD, CER, 1.8 pF, $\pm 0.1$ pF, 500 V
C10	290-0162-00	CAPACITOR, FXD, ELCTLT, 22 $\mu$ F, 20%, 35 V
CR3	152-0185-00	SEMICONV DEVICE, DIODE, SILICON, 1N4152
Q11	151-0192-00	TRANSISTOR, NPN, SILICON, MPS6521
Q12	151-0192-00	TRANSISTOR, NPN, SILICON, MPS6521
Q13	151-0192-00	TRANSISTOR, NPN, SILICON, MPS6521
Q14	151-0134-00	TRANSISTOR, PNP, SILICON, 2N2905A
Q15	151-0331-00	TRANSISTOR, NPN, SILICON, D40C5 FAMILY
R49	321-0287-00	RESISTOR, FXD, FILM, 9.53 k $\Omega$ , 1%, 0.125 W
R50	321-0226-00	RESISTOR, FXD, FILM, 2.21 k $\Omega$ , 1%, 0.125 W
R51	321-0287-00	RESISTOR, FXD, FILM, 9.53 k $\Omega$ , 1%, 0.125 W
R52	311-1287-00	RESISTOR, VAR, NONWW, 100 k $\Omega$ , 0.5 W
R53	315-0102-00	RESISTOR, FXD, CMPSN, 1 k $\Omega$ , 5%, 0.25 W
R54	321-0315-00	RESISTOR, FXD, FILM, 18.7 k $\Omega$ , 1%, 0.125 W
R55	321-0284-00	RESISTOR, FXD, FILM, 8.87 k $\Omega$ , 1%, 0.125 W
R56	321-0289-00	RESISTOR, FXD, FILM, 10 k $\Omega$ , 1%, 0.125 W
R57	315-0102-00	RESISTOR, FXD, CMPSN, 1 k $\Omega$ , 5%, 0.25 W
R58	321-0300-00	RESISTOR, FXD, FILM, 13 k $\Omega$ , 1%, 0.125 W
R59	321-0245-00	RESISTOR, FXD, FILM, 3.48 k $\Omega$ , 1%, 0.125 W
R60	321-0510-00	RESISTOR, FXD, FILM, 2 M $\Omega$ , 1%, 0.125 W
R61	315-0562-00	RESISTOR, FXD, CMPSN, 5.6 k $\Omega$ , 5%, 0.25 W
R62	315-0561-00	RESISTOR, FXD, CMPSN, 570 $\Omega$ , 5%, 0.25 W
R63	321-0368-00	RESISTOR, FXD, FILM, 66.5 k $\Omega$ , 5%, 0.125 W
R64	321-0128-00	RESISTOR, FXD, FILM, 210 $\Omega$ , 1%, 0.125 W
R65	311-1280-00	RESISTOR, VAR, NONWW, TRMR, 1 k $\Omega$ , 0.5 W
R66	321-0300-00	RESISTOR, FXD, FILM, 13 k $\Omega$ , 1%, 0.125 W
R67	315-0101-00	RESISTOR, FXD, CMPSN, 100 $\Omega$ , 5%, 0.25 W
R68	321-0254-00	RESISTOR, FXD, FILM, 4.32 k $\Omega$ , 1%, 0.125 W
R69	321-0306-00	RESISTOR, FXD, FILM, 15 k $\Omega$ , 1%, 0.125 W



PARTS LIST (CONT)

DUAL AMPLIFIER Etched Circuit Board Assembly (cont)

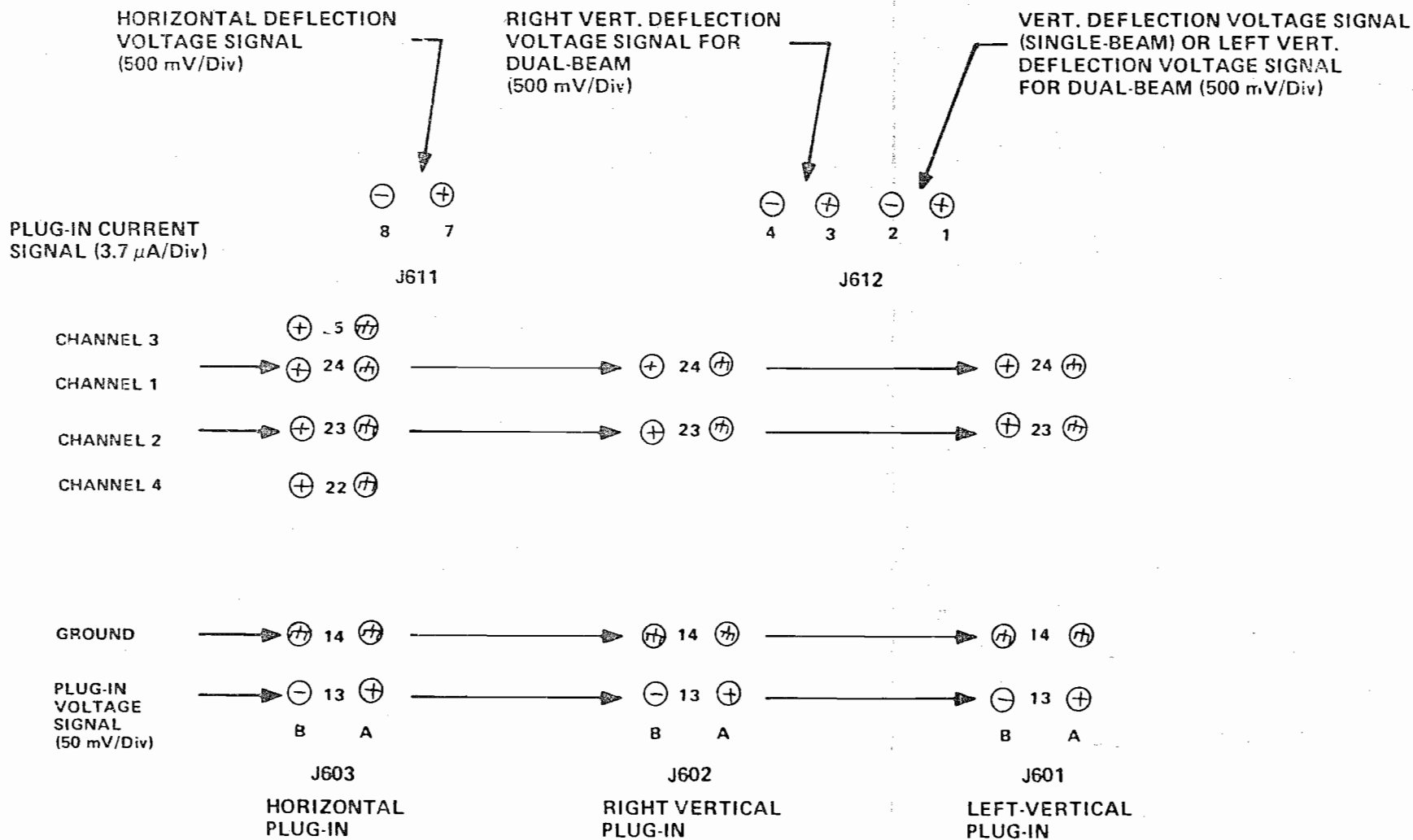
Electrical (cont)

(Other Half DUAL AMPLIFIER Board) (cont)

R70	321-0402-00	RESISTOR, FXD, FILM, 150 k $\Omega$ , 1%, 0.125 W
R71	321-0211-00	RESISTOR, FXD, FILM, 1.54 k $\Omega$ , 1%, 0.125 W
R72	323-0236-00	RESISTOR, FXD, FILM, 1.80 k $\Omega$ , 1%, 0.5 W
U3	156-0067-00	MICROCIRCUIT, LINEAR, OPERATIONAL AMP
VR3	152-0055-00	SEMICONV DEVICE, DIODE, ZENER, SI, 1N962B

Mechanical (cont)

030-0643-01	6	SHIELD, EC BOARD
131-0589-00	72	TERMINAL, PIN, SQUARE
136-0252-04	72	SOCKET, PIN CONNECTOR
136-0514-00	6	SOCKET, PLUG-IN, ELECT., MICROCKT, 8 DIP
200-0715-00	6	COVER, TRANSISTOR

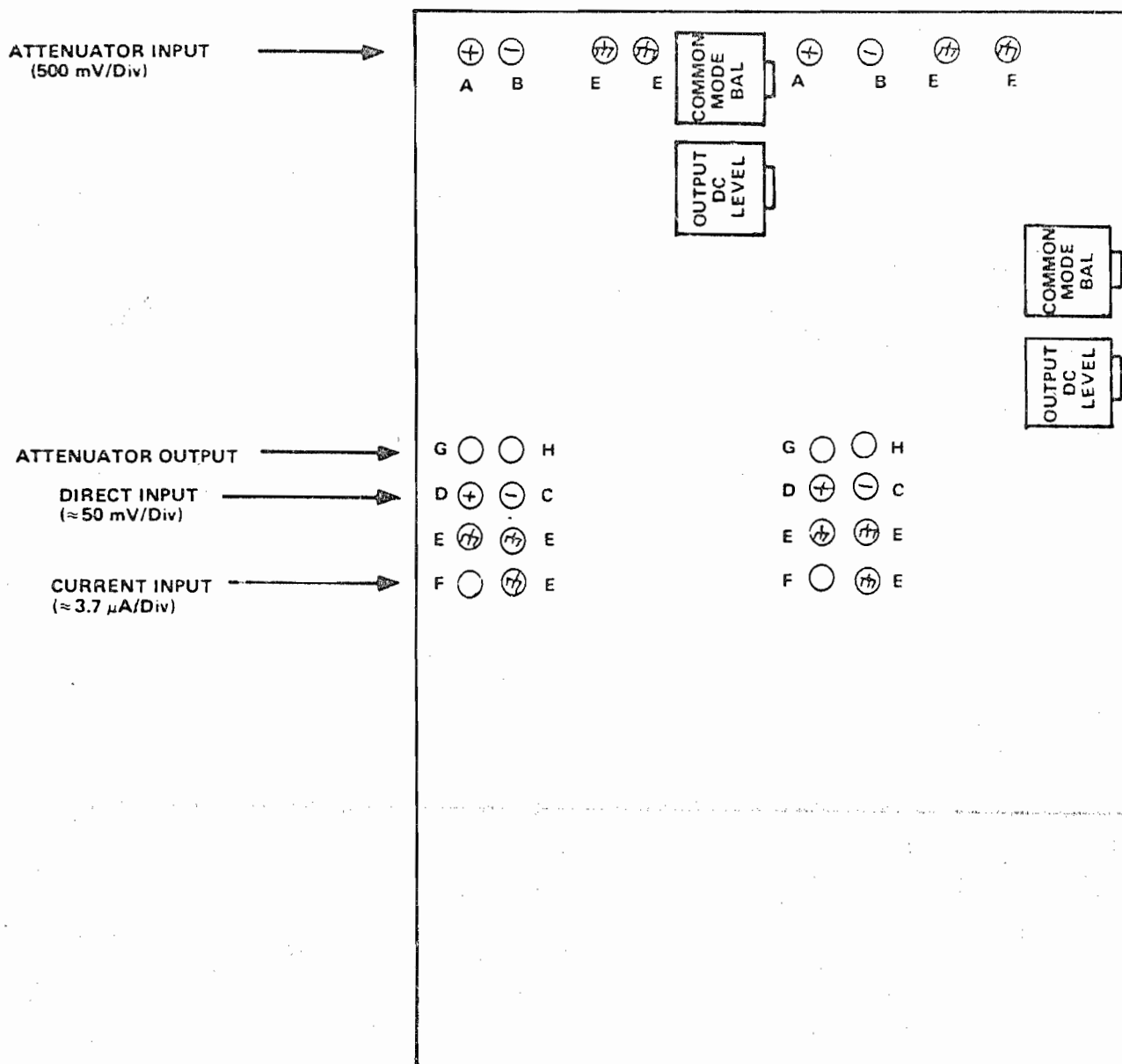


REAR SIDE OF PLUG-IN INTERFACE BOARD

5100-Series  
MOD 768X

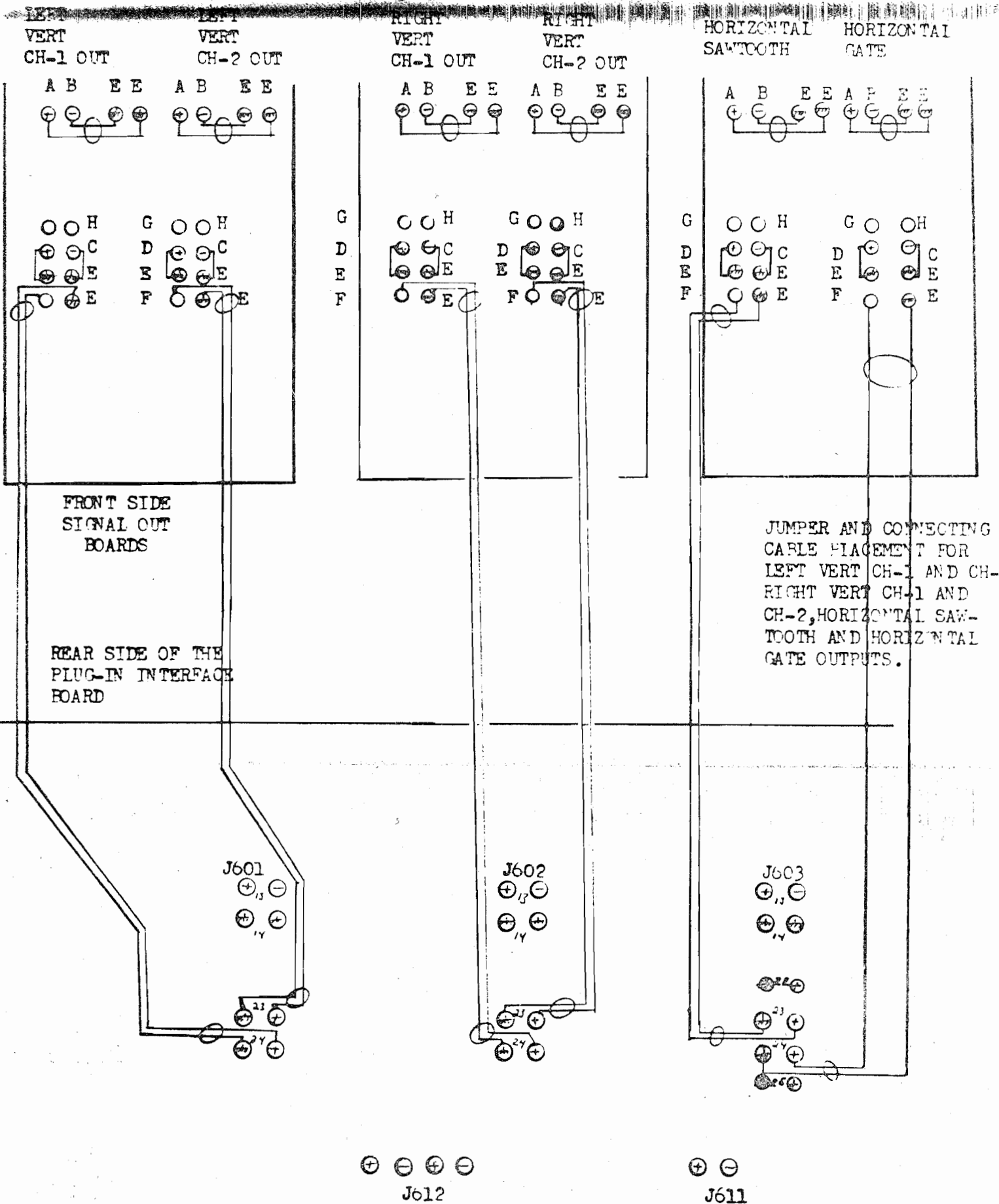
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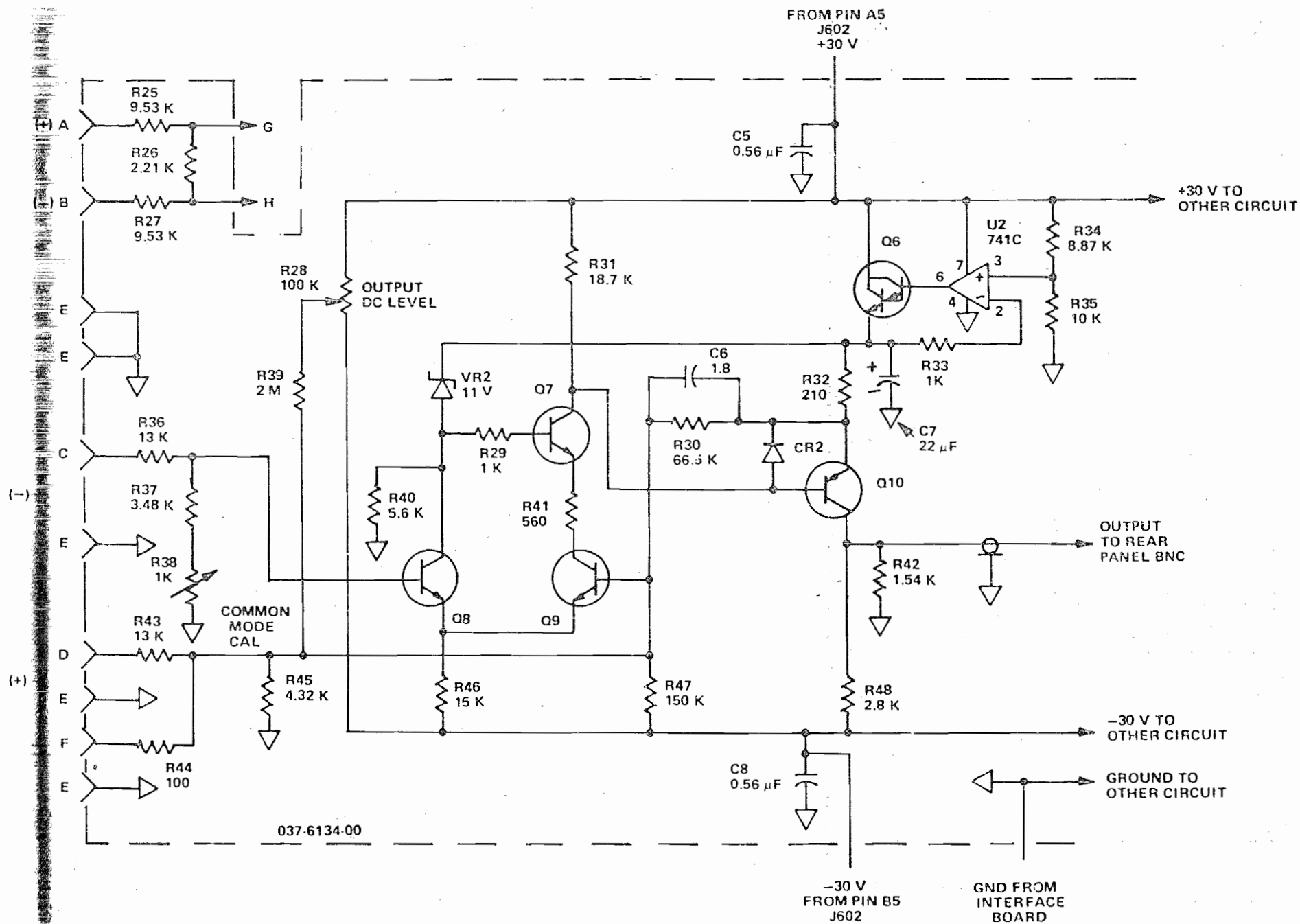
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DUAL OUTPUT AMPLIFIER BOARD



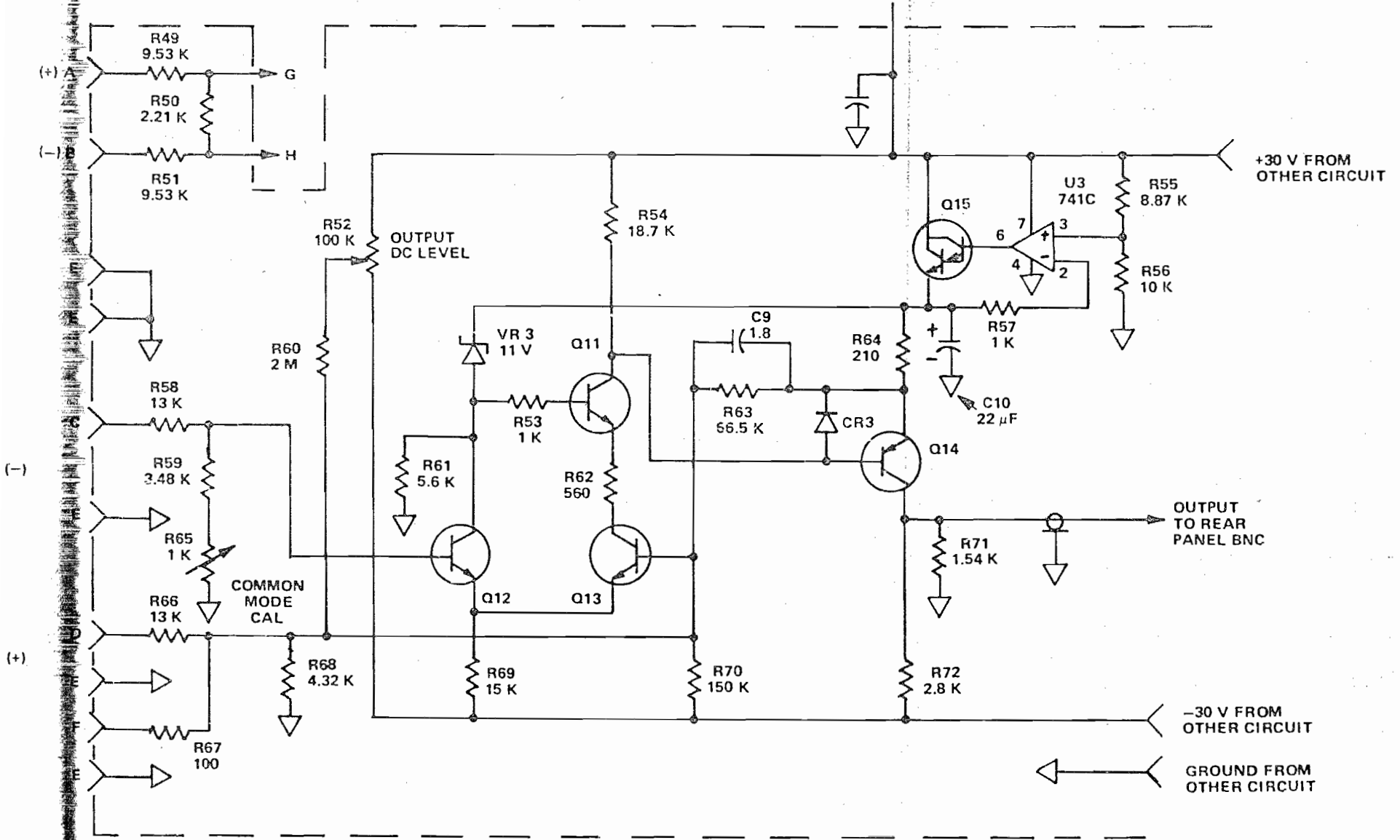
JUMPER AND CONNECTING CABLE PLACEMENT FOR LEFT VERT CH-1 AND CH-2, HORIZONTAL SAWTOOTH AND HORIZONTAL GATE OUTPUTS.

Fig. 1



5100-Series  
MOD 768X

HALF DUAL-AMPLIFIER BOARD



5100-Series  
MOD 768X

OTHER HALF DUAL-AMPLIFIER BOARD

OUTPUT AMPLIFIER CONNECTION CABLE BASIC CONSIDERATIONS

Each output amplifier has three input options for connecting to the 5100-Series MOD 768X. It has two differential voltage inputs and a current input. Pins D and C are the direct voltage input and pins A and B are the attenuator voltage input. Pins G and H are the attenuator output and must be connected to the direct voltage input when using the attenuator, pin D connected to pin G and pin C connected to pin H. All pins E are ground. Pin F is the current input.

The direct differential input voltage is .48 volts for 10 volts output. The input resistance with differential input is approximately 10.5 k $\Omega$  at pin D and 17.1 k $\Omega$  at pin C.

The attenuator differential input voltage is 5 volts for 10 volts output. The input resistance with differential input is approximately 10.5 k $\Omega$  at pins A and B.

To use the current input, pin F, pins D and C must be grounded, jumpers between D and E and between pins C and E. The input current is approximately 37  $\mu$ A for 10 volts output. The equivalent input resistance at pin F is approximately 470  $\Omega$ .

There are 30 pins soldered to the rear side of the interface board to make connections with the output amplifier connection cables. Each plug-in compartment has provisions for three connections. Pins A13 and B13 are the differential plug-in voltage signals. Pin B24 is the first plug-in current signal and pin B23 is the second plug-in current signal. Ground pin A24 is paired with pin B24 and ground pin A23 is paired with pin B23. With a modified dual-trace amplifier plug-in, the first plug-in current is Channel 1, and the second plug-in current is Channel 2. The Channel 1 and Channel 2 current is set up to provide an output amplifier signal of approximately 1 volts per crt display division with the plug-in variables in the CAL position. The plug-in position and variable controls do not affect the plug-in current signals. With a modified Time Base plug-in, the first plug-in current is the Time Base sawtooth signal, and the second plug-in current is the Time Base gate signal. The Channel 1 and Channel 2 current is set up to provide an output amplifier signal of approximately 10 volts of Time Base sawtooth and gate. The plug-in position control and sweep magnifier switch do not affect the plug-in current signals. When only one plug-in current signal is used from a plug-in, the other plug-in current signal should be grounded to minimize crosstalk.

The differential plug-in voltage signals are set up to provide an output amplifier signal of approximately 1 volt per crt display division. Connecting the output amplifiers to the plug-in voltage signals loads the plug-in amplifiers, and the gain of the crt deflection amplifiers need to be readjusted to bring the display back into calibration.

Differential deflection voltage signals are available at J612, pins 1 and 2 for vertical signals in single-beam displays or left vertical signals in dual-beam displays. Pins 3 and 4 have right vertical signals for dual-beam displays. The horizontal deflection voltage signals are available at J611, pins 7 and 8. The amplitudes of these deflection voltage signals (horizontal and vertical) are such that the attenuators on the output amplifier board must be used, pins A and B. The attenuator is set up to provide an output amplifier signal of approximately 1 volts per crt display division.

Whenever the input connections to the output amplifiers are changed, the Output DC Level control should be reset so that the no signal output level of zero volts corresponds to the center graticule line of the crt display. The Output DC Level control is the lower control of the pair of controls on the Output Amplifier board.

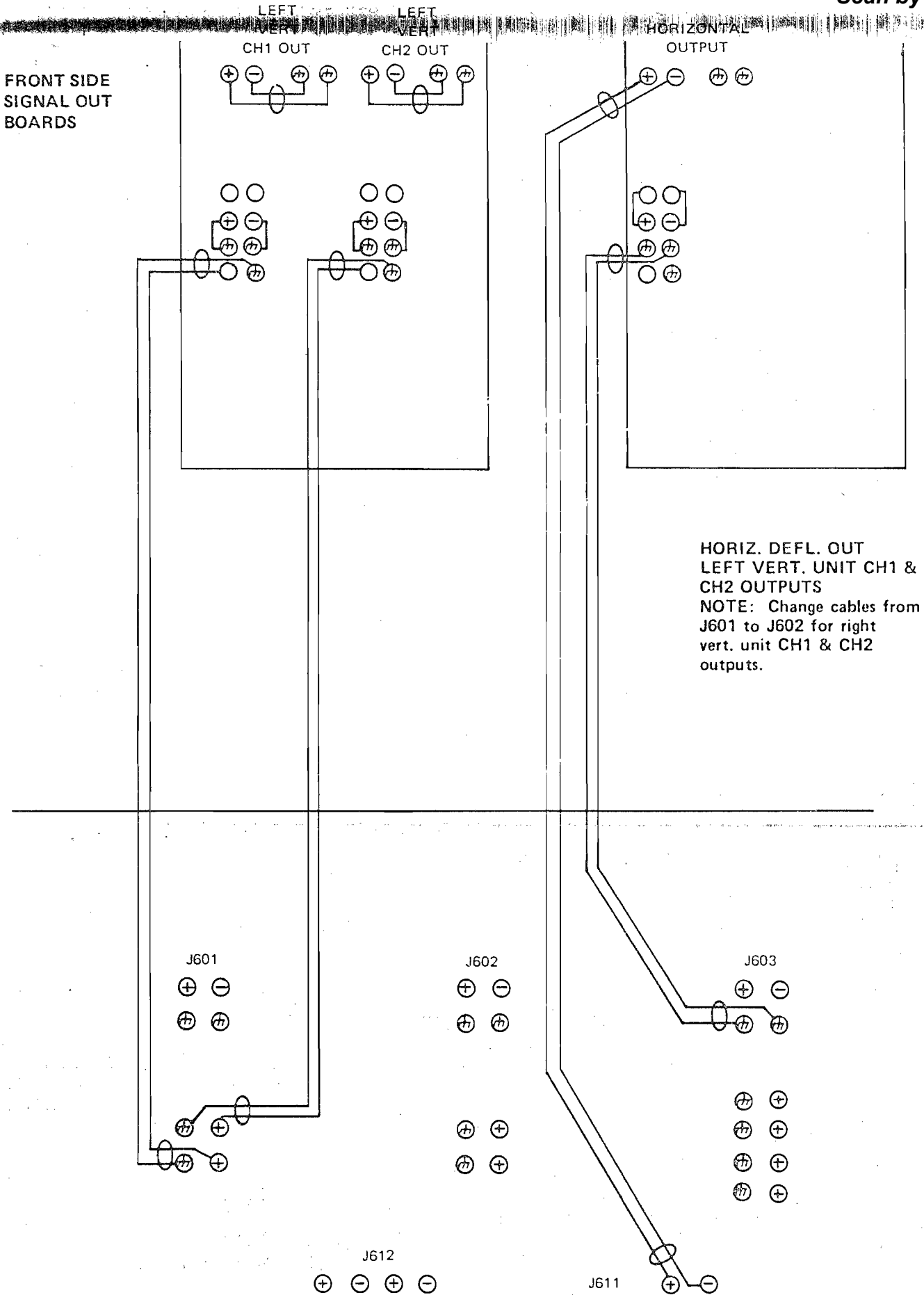
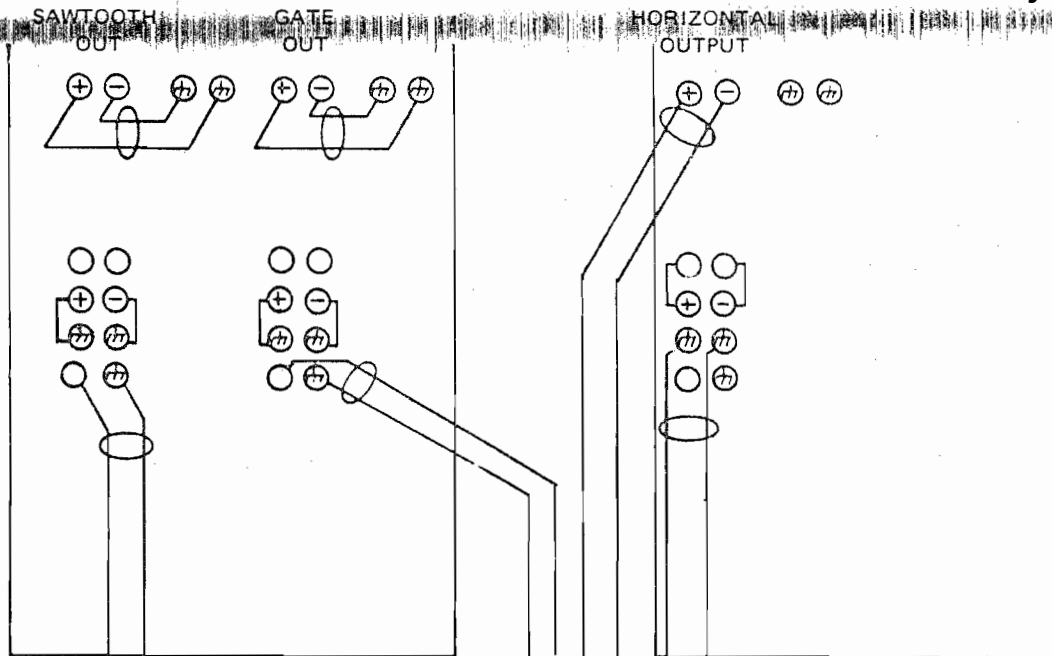


Fig. 2  
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FRONT SIDE  
SIGNAL OUT  
BOARDS



HORIZ. DEFL. OUT  
TIMEBASE, SAWTOOTH &  
GATE OUTPUTS

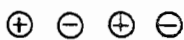
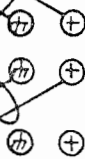
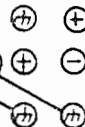
J601



J602



J603

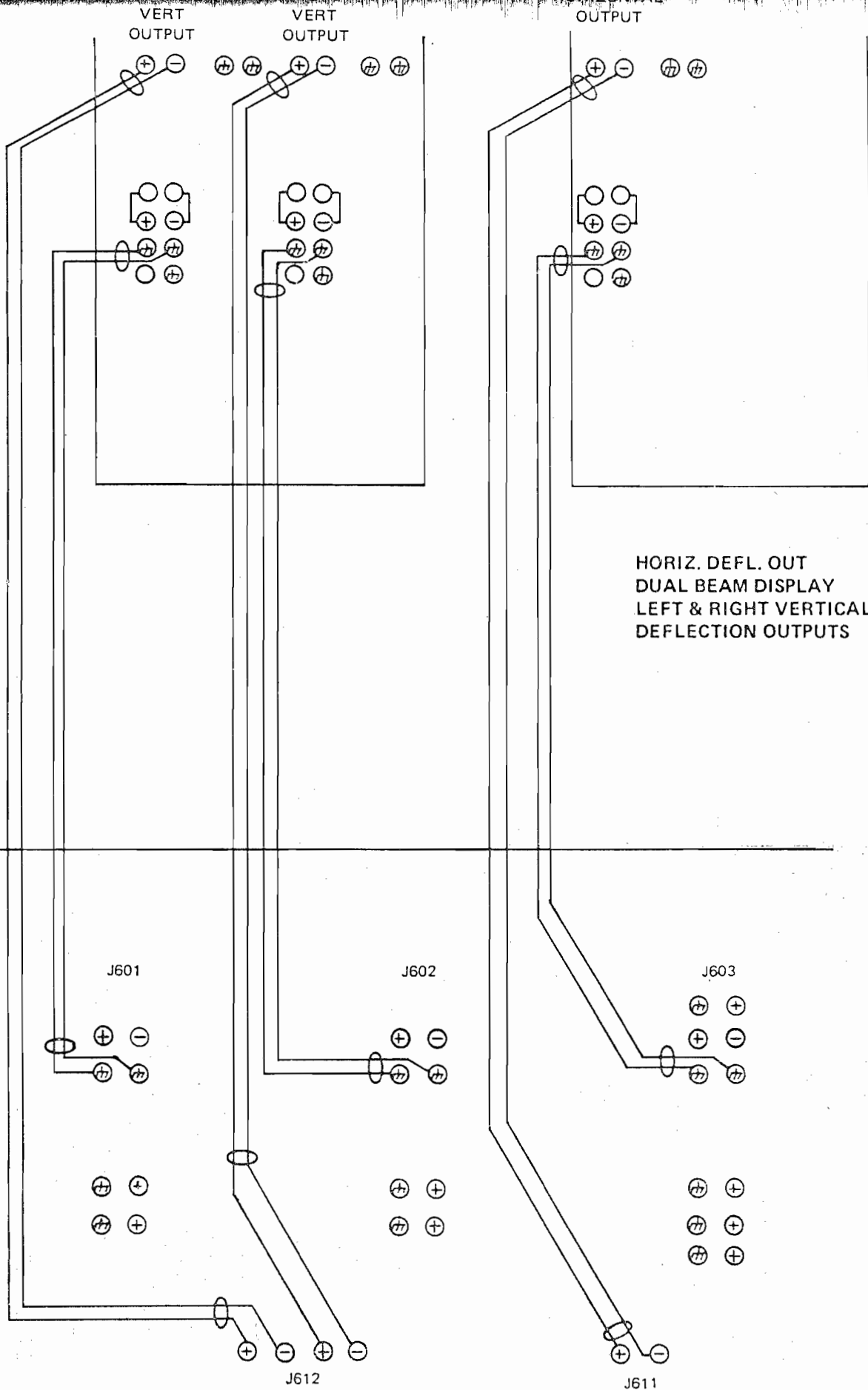


J612



J611

FRONT SIDE  
SIGNAL OUT  
BOARDS



HORIZ. DEFL. OUT  
DUAL BEAM DISPLAY  
LEFT & RIGHT VERTICAL  
DEFLECTION OUTPUTS