TEKTRONIX®

LA 501 LOGIC ANALYZER

WITH OPTIONS

INSTRUCTION MANUAL

Tektronix, Inc.
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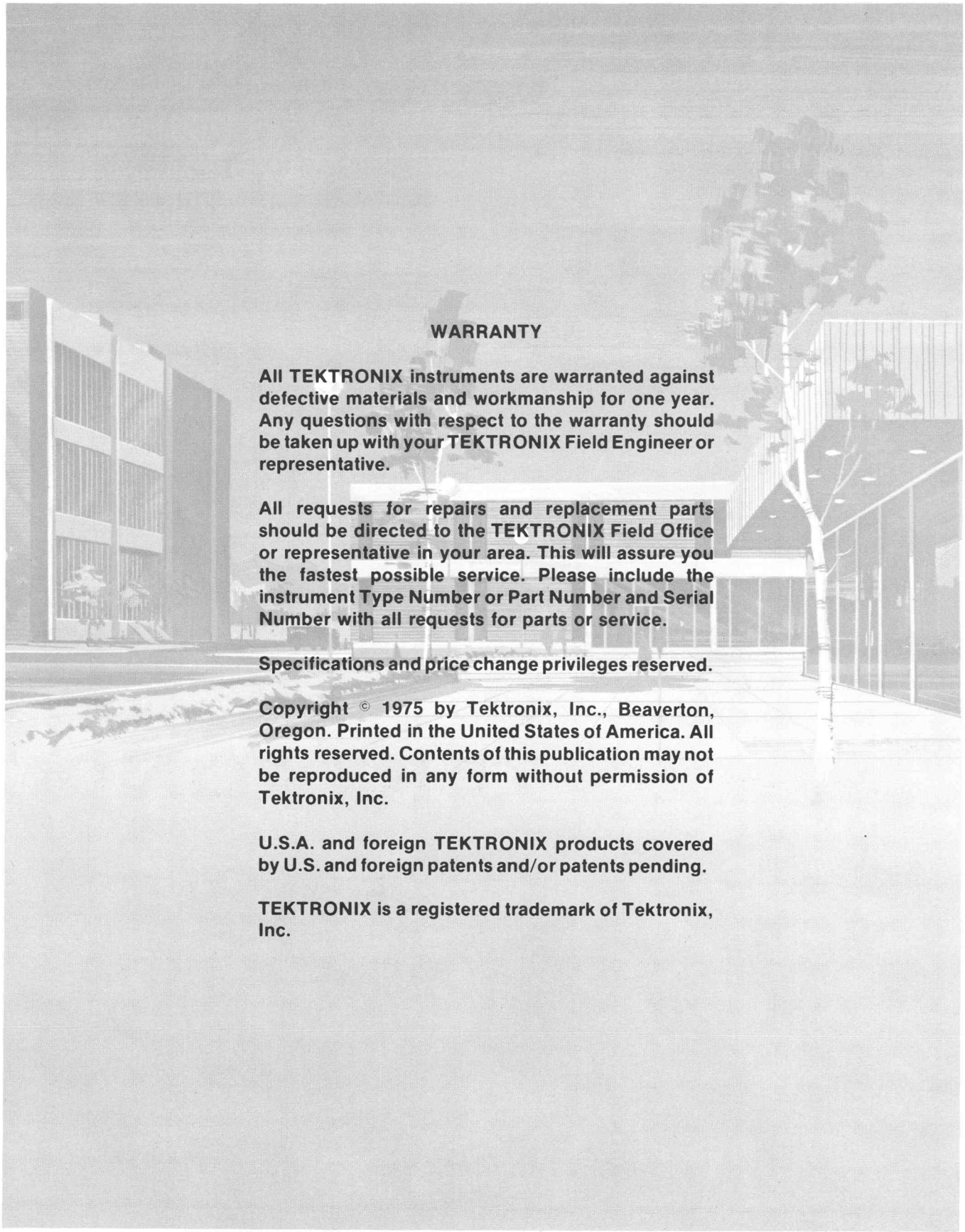

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

U.S.A. and foreign TEKTRONIX products covered by U.S. and foreign patents and/or patents pending.

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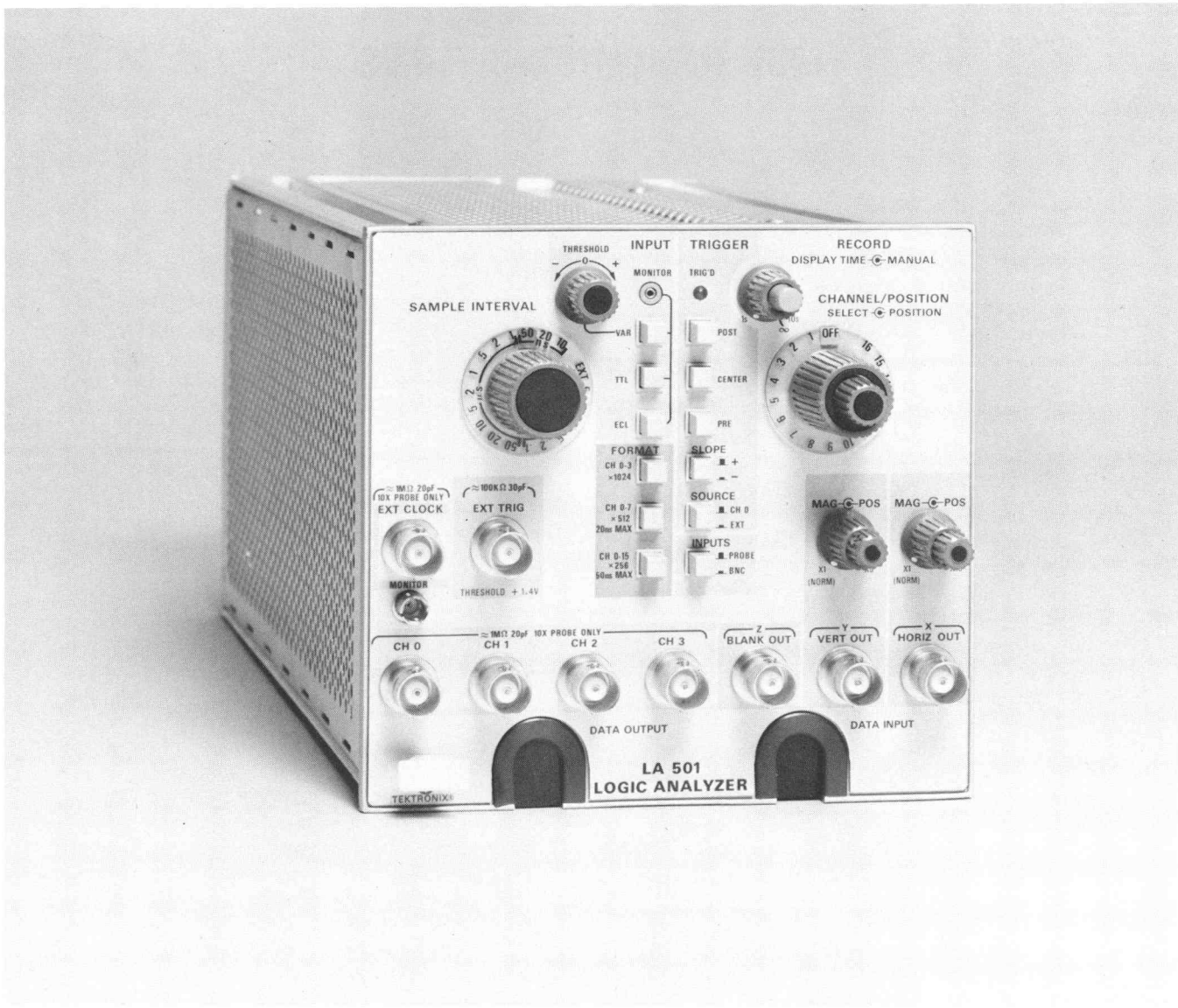

LA 501 Features

The LA 501 Logic Analyzer is designed for rapid troubleshooting of digital equipment. The simultaneous multi-channel raster can be displayed on almost any low-frequency X-Y monitor or oscilloscope.

The 4096-bit memory can be formatted into 4 channels of 1024 data bits, 8 channels of 512 data bits, or 16 channels of 256 data bits, for a wide range of bit serial, byte serial, or word serial data.

The flexible external (synchronous) or internal (asynchronous) sample rate clock capability will accomodate nearly all of the logic family speeds in use.

Three trigger delay modes (PRE, CENTER, and POST) allows selection of the best mode for the application. Negative trigger delay (PRE) allows analysis of the sequence of events that precede a fault trigger.

Digital data outputs provide a serial or parallel format to "loop back" stored data to a computer for quick error checks. This feature allows analysis or logging of data while viewing it, or it can be used without a display device.

Horizontal and vertical magnification, with positioning, provide high resolution. A unique vertical positioning system allows the selection and positioning of any one trace for timing comparisons with other traces in the raster.

The LA 501 can be powered by any TM-500-series power module which has three-unit, or greater, capability.

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LA 501 Logic Analyzer.

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OPERATING INSTRUCTIONS

TM 500-SERIES INSTRUMENTS

The LA 501 Logic Analyzer is a member of Tektronix' growing TM 500 line of Test and Measurement Instruments. This product line consists of both general- and special-purpose instruments such as digital multimeters, counter-timers, variable dc power supplies, pulse generators, function generators, calibration sources, oscilloscopes, signal processors, and others. Each instrument is a plug-in module. Power-module mainframes with 1, 3, 4, 5, and 6 compartments are available. The power module provides power and an overall housing for the plug-in modules, and permits internal signal interconnections between plug-in instruments to reduce clutter or to allow two or more instruments to perform a function which neither could perform alone. Each user can thus select from a broad choice of instrumentation to assemble a multi-function test set to fit his needs. This test set is compact and portable; yet it can be quickly reconfigured by exchanging plug-in instruments when test needs change. TM 500 systems can be configured for benchtop, rackmount, roll-about, and portable applications. For more information on the TM 500 line, please contact your Tektronix Field Office or representative.

SAFETY INFORMATION

The following warnings must be observed during maintenance and adjustment of the LA 501.

Component Replacement

To avoid electrical shock, disconnect the LA 501 from the power source before replacing components.

Soldering

To avoid electrical shock, disconnect the LA 501 from the power source before soldering.

Semiconductor Replacement

Semiconductors that have heat radiators use silicone grease to increase heat transfer. When one of these semiconductors is replaced, the silicone grease must also be replaced. Handle silicone grease with care. Avoid getting silicone grease in eyes. Wash hands thoroughly after use.

FRONT-PANEL CONTROLS, CONNECTORS, AND INDICATORS

The major controls and connectors for operation of the LA 501 are located on the front panel. Figure 1-1 shows and briefly describes the front-panel controls, connectors, and indicators. More information is given under Detailed Operating Information in this section.

Several connectors and switches are located inside the LA 501. These are described under Internal Connectors and Switches in this section.

INTERNAL CONNECTORS AND SWITCHES

Figure 1-2 shows the location of the internal connectors and switches. A brief description of these internal functions is given here. More information is given under Detailed Operating Information in this section.

(A) Data Input Connector

Multi-pin connector for use with the Data Acquisition Probe to provide the following functions:

DATA INPUTS. Provides input for each of the 16 channels (selected when the front-panel INPUTS switch is in the PROBE position).

CLOCK OUT. Provides signal output from the internal clock.

INVALID MODE. Provides an input to indicate an external-source sample interval that is too fast for the selected memory format (selected by jumper-connector P300).

(B) Data Output Connector

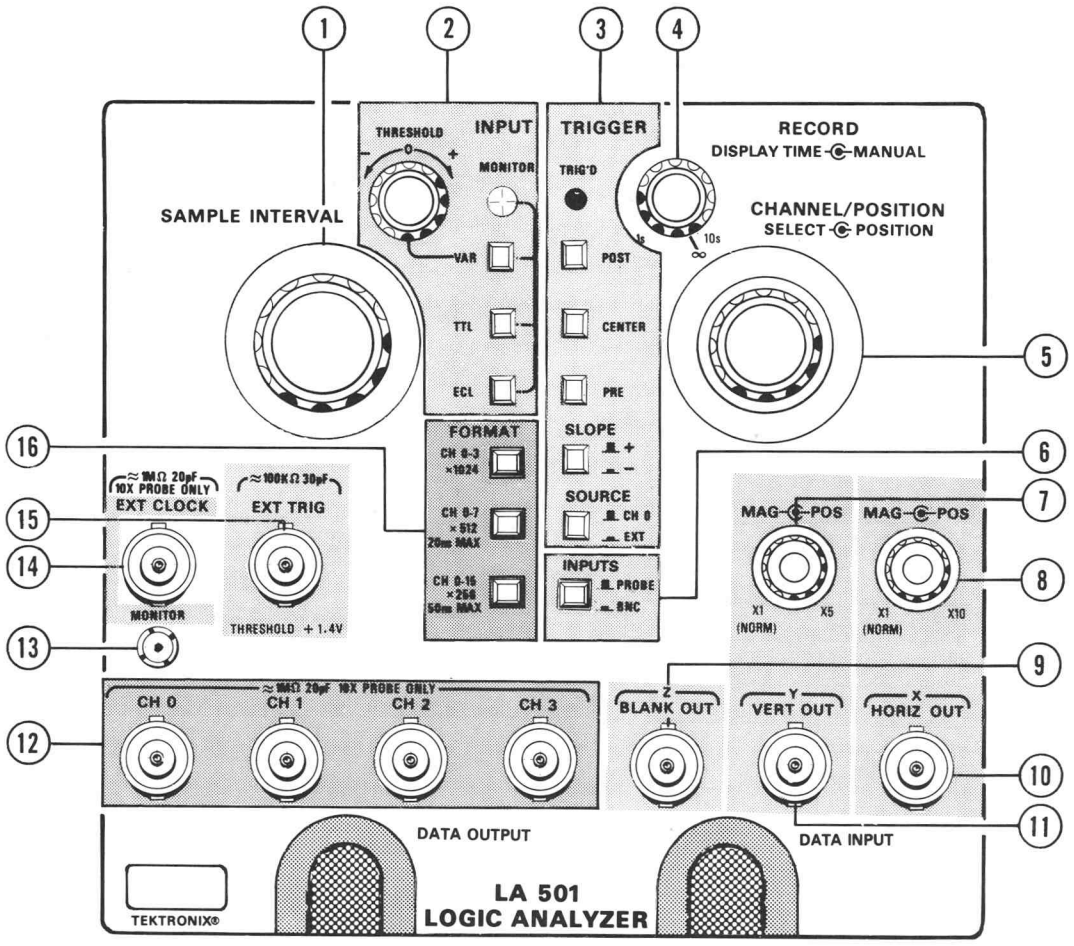
Multi-pin connector with the following functions:

PARALLEL DATA OUTPUT. Provides outputs for each of the 16 memory channels.

SERIAL DATA OUTPUT. Provides an output for serial data from the memory.

FLAG OUTPUT. Provides an output that indicates the start of each channel of data.

FORMAT OUTPUT. Provides an output that indicates memory format (selected by jumper-connector P300).



(1) SAMPLE INTERVAL Switch—Selects data input sample interval. The EXT position selects input from the EXT CLOCK connector. The knob skirt lamp blinks when the sample interval is too fast when in 8 or 16 channel record format.

(2) INPUT—

THRESHOLD Control: Provides a variable threshold voltage level for data input channels (selected by VAR switch).

MONITOR Pin Jack: Provides an output to monitor the dc threshold voltage level of the data input channels.

VAR Switch: Selects the variable THRESHOLD control.

TTL Switch: Selects a preset data input threshold voltage level for TTL logic.

ECL Switch: Selects a preset data input threshold voltage level for negative voltage ECL logic.

Fig. 1-1. Front-panel controls, connectors, and indicators.

(3) TRIGGER—

TRIG'D Indicator: Lights when record circuit has received a trigger signal.

POST Switch: Selects data to be stored after the trigger.

CENTER Switch: Selects data to be stored before and after the trigger.

PRE Switch: Selects data to be stored before the trigger.

SLOPE Switch: Selects the positive or negative-going edge of the record trigger signal.

SOURCE Switch: Selects Channel 0 or EXT TRIG connector for record trigger source.

(4) RECORD—

DISPLAY TIME Control: A variable control sets the time which memory stored data will be held for display before a new record cycle begins.

MANUAL Switch: A push button switch which resets the trigger circuit to start a new record cycle.

(5) CHANNEL/POSITION—

SELECT Switch: Selects any channel for positioning within the raster.

POSITION Control: Vertically positions channel selected by SELECT switch.

(6) INPUTS Switch—Selects data input signals from CH 0 through CH 3 front-panel BNC high impedance connectors or the internal low impedance DATA INPUT connector.

(7) MAG/POS Controls—Provides variable vertical magnification (X1 to X5) and vertical positioning of the displayed raster.

(8) MAG/POS Controls—Provides variable horizontal magnification (X1 to X10) and horizontal positioning of the displayed raster.

(9) Z BLANK OUT Connector—BNC connector for output of crt retrace blanking pulses.

(10) X HORIZ OUT Connector—BNC connector for output of horizontal (X-axis) display signal.

(11) Y VERT OUT Connector—BNC connector for output of Y-axis display signal.

(12) CH 0 Through CH 3 Connectors—BNC connectors for data inputs with 10X probes (selected by INPUTS switch in the BNC position).

(13) MONITOR Probe-Tip Connector—Provides output to monitor the EXT CLOCK connector when compensating high impedance 10X probes.

(14) EXT CLOCK Connector—BNC connector for input of external sampling clock signal (selected by SAMPLE INTERVAL switch in the EXT position).

(15) EXT TRIG Connector—BNC connector for external input to record trigger circuit (selected by SOURCE switch in the EXT position).

(16) FORMAT—

CH 0-3 X 1024 Switch: Selects channel 0 through channel 3 for data recording with 1024 bits of memory per channel.

CH 0-7 X 512 Switch: Selects channel 0 through channel 7 for data recording with 512 bits of memory per channel. Maximum sample interval is 50 nanoseconds.

CH 0-15 X 256 Switch: Selects channel 0 through channel 15 for data recording with 256 bits of memory per channel. Maximum sample interval is 20 nanoseconds.

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Fig. 1-1. Front-panel controls, connectors, and indicators. (Continued)

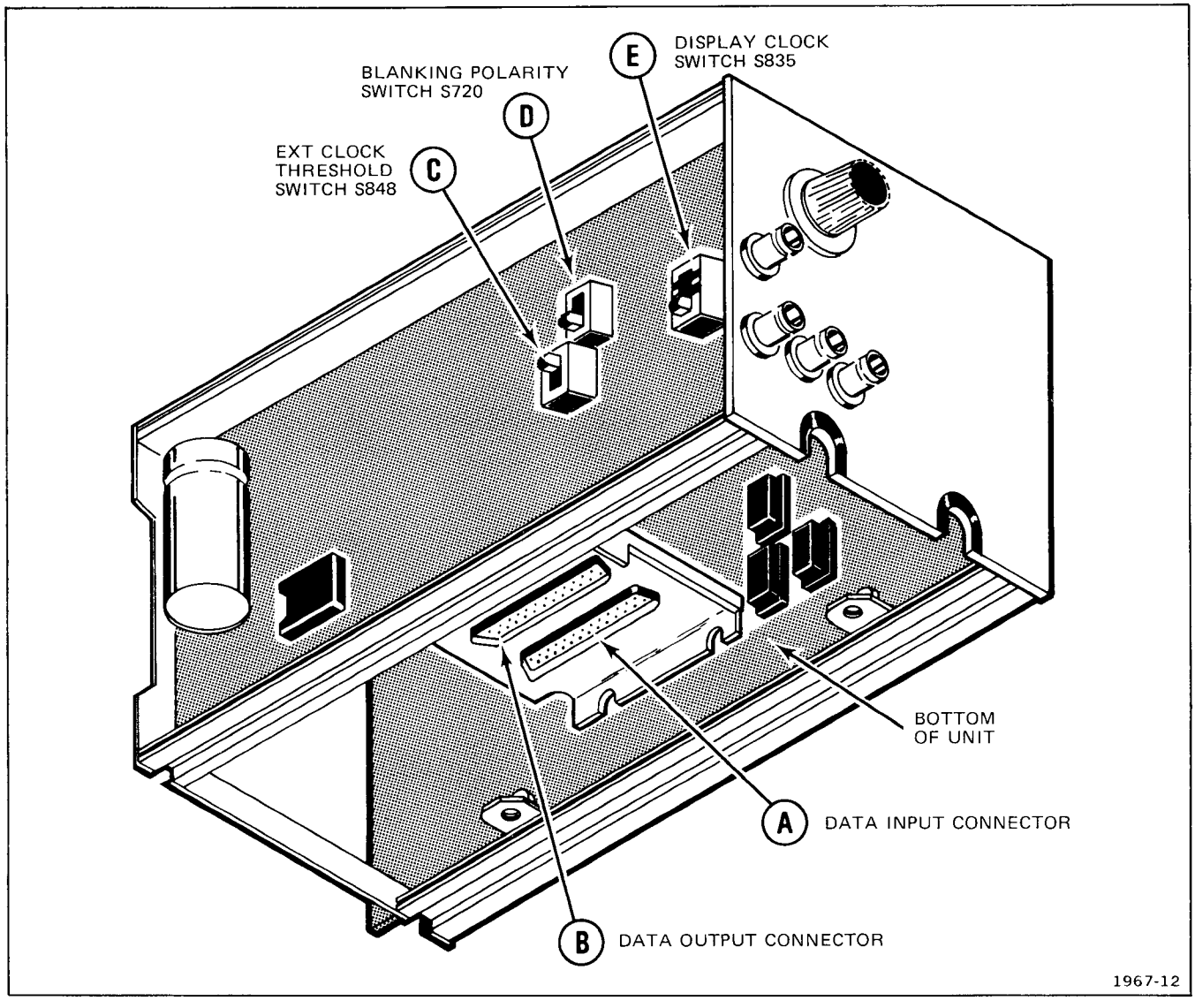


Fig. 1-2. Location of internal connectors and switches.

DISPLAY-STORE MODE OUTPUT. Provides an output to indicate whether the memory is in a Display or Store Mode (selected by jumper-connector P300).

FRAME OUTPUT. Provides an output to show a complete memory scan when reading the memory serially (selected by jumper-connector P300).

DISPLAY-CLOCK OUTPUT. Provides an ECL-level clock output during the Display Mode (selected by jumper-connector P300).

Z-AXIS INPUT. Provides an input to intensify a crt display via the front-panel Z BLANK OUT connector.

RECORD ENABLE. Provides an input to set the memory into a Store Mode.

EXT DISPLAY CLOCK INPUT. Provides an input to read the memory with an external clock signal (ECL level).

(C) External Clock Threshold Switch (S848)

Selects the external clock threshold level source. In the up position, threshold levels are selected by front-panel INPUT switches VAR, TTL, or ECL. In the down position, a fixed ECL threshold level is selected.

(D) Blanking Polarity Switch (S720)

Selects the polarity of the blanking pulses at the Z BLANK OUT connector. In the up position, the blanking pulses are +5 volts (positive blanking signal). In the down position, the blanking pulses are −5 volts (negative blanking signal).

(E) Display Clock Switch (S835)

A three position switch that selects the source of the display clock signal applied to the clock gate. In the up position, an ECL input clock signal from the DATA OUTPUT connector is selected. In the center position, the front-panel EXT CLOCK connector is selected. In the down position, the 500 kHz internal display clock signal is selected.

CAUTION

Turn the power module off before inserting or removing the LA 501; otherwise, damage may occur to the LA 501 circuitry.

INSTALLATION

The LA 501 is calibrated and ready for use when received. It is designed to operate in a TM 500-series power module only. Before proceeding with installation, check that the internal switches and jumpers are set as necessary to operate the LA 501 with the associated equipment. For more information, refer to Internal Connectors and Switches in this section.

To install (refer to Figure 1-3), align the upper and lower rails of the LA 501 with the power module tracks and fully insert it. The front will be flush with the front of the power module when the LA 501 is fully inserted.

To remove the LA 501, pull on the release latch at the bottom of the front panel and the LA 501 will unlatch. Continue pulling on the release latch to slide the LA 501 out of the power module.

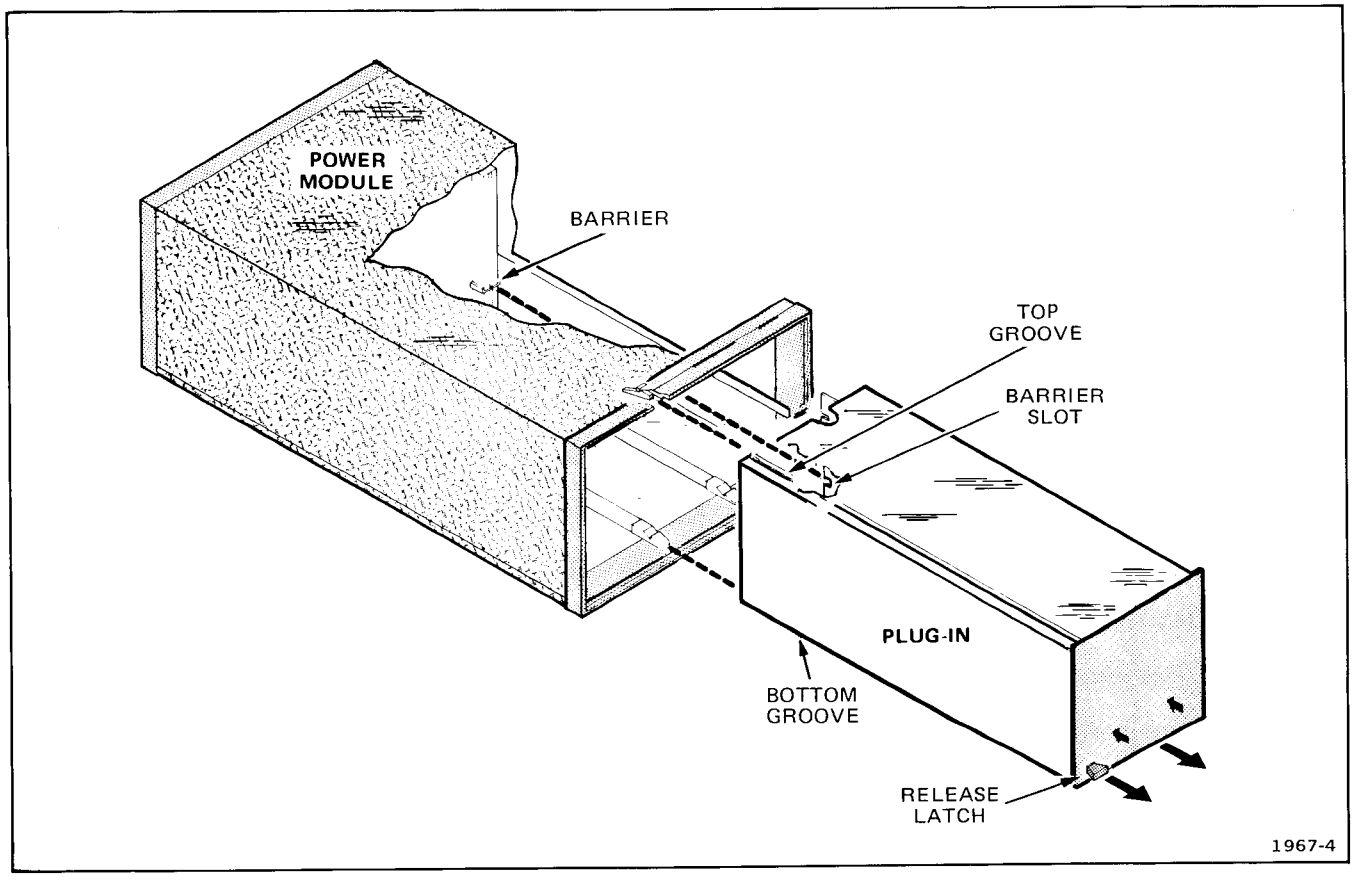


Fig. 1-3. LA 501 installation and removal.

FUNCTIONAL CHECK

The following procedure provides a method to check the basic operation of this instrument. The procedure can be used for incoming inspection to verify proper operation. The procedure can also be used by the operator for instrument familiarization or system troubleshooting.

Functions only are checked in this procedure. Measurement quantities and tolerances are not checked. Therefore, a minimum amount of test equipment is required.

Test Equipment Required

The following test equipment was used as a basis to write the Functional Check procedure. Other test equipment, which meets the requirements, may be substituted. When other equipment is substituted, the control settings or set up might need to be altered.

1. Test Oscilloscope

Description: Frequency response, dc to 500 kilohertz minimum; deflection factor, 50 millivolts to 2 volts/division. Test oscilloscope must have an external Z-axis input. Time base should have an external horizontal amplifier input with deflection factor of 50 millivolts/division.

Type Used: Tektronix 5403/D40 Oscilloscope system with 5A45 Amplifier, and 5B40 Time Base.

2. Power Module

Description: Tektronix TM 500-series power module with 3 or more plug-in compartments.

Type Used: Tektronix TM 503 Power Module (used with the LA 501 and pulse generator).

3. Pulse Generator

Description: Frequency range, 10 kilohertz to 10 megahertz minimum; output amplitude, minus 2 volts to plus 2 volts with 50-ohm output impedance.

Type Used: Tektronix PG 502 Pulse Generator (used with TM 503 Power Module).

4. Cables (5 Required)

Description: Impedance, 50 ohms; length, 18 inches (2 needed), 42 inches (3 needed); connectors, BNC.

Type Used: Type RG-58/U, 50 ohm coaxial, Tektronix Part 012-0076-00 (18 inch), Tektronix Part 012-0057-01 (42 inch).

5. Termination

Description: Impedance, 50 ohms; connectors, BNC.

Type Used: 50-ohm termination with BNC connectors, Tektronix Part 011-0049-01.

6. T Connector

Description: Connectors, BNC-to-BNC.

Type Used: BNC-to-BNC T connector, Tektronix Part 103-0030-00.

Preliminary Set Up

1. Within the LA 501, set the slide switches as follows (see Figure 1-2 for switch locations):

a. Display Clock switch (S835), set to down position for internal Display Clock.

b. External Clock Threshold switch (S848), set to up position for front-panel selection of threshold level.

c. Blanking Polarity switch (S720), set to down position for negative Z-axis blanking.

NOTE

If the Tektronix 5403/D40 test oscilloscope is not used, check the oscilloscope or monitor instruction manual for the required Z-axis blanking polarity.

2. Install the LA 501 in the 2 right side compartments and the pulse generator in the left compartment of power module (see Figure 1-4).

3. Turn on power module and test oscilloscope system.

4. Set pulse generator for 10 kilohertz square wave. Using a 0-volt base-line reference, set output amplitude to +0.25 volts.

5. Connect cables from LA 501 to test oscilloscope as shown in Figure 1-5.

6. Set LA 501 controls as follows:

SAMPLE INTERVAL	1 μs
INPUT	TTL
FORMAT	CH 0-3 X1024
TRIGGER	POST
SLOPE	(+)
SOURCE	CH 0
INPUTS	BNC
DISPLAY TIME	1 s
CHANNEL SELECT	OFF
Vertical MAG	X1 (NORM)
Vertical POS	Midrange
Horizontal MAG	X1 (NORM)
Horizontal POS	Midrange

7. With test oscilloscope inputs grounded, set the display to graticule center, and adjust oscilloscope for well-defined display. If necessary, refer to oscilloscope instruction manual for operating instructions.

8. Set test oscilloscope for vertical deflection factor of 100 millivolts/division with dc input coupling.

9. Set test oscilloscope for external horizontal amplifier operation (horizontal deflection factor of 50 millivolts/division with dc input coupling).

Raster Display

If necessary, perform the Preliminary Set Up procedure. To obtain a raster display, proceed as follows:

1. Connect the +0.25 volt, 10 kilohertz square-wave signal from pulse generator (as set in Preliminary Set Up procedure) to LA 501 CH 0 input connector.

2. Check that TRIG'D indicator is lit.

3. Set the LA 501 vertical and horizontal POS controls for centered display.

4. Set test oscilloscope intensity control at desired viewing level.

5. Check display for one square wave (top trace, channel 0) and 3 trace lines.

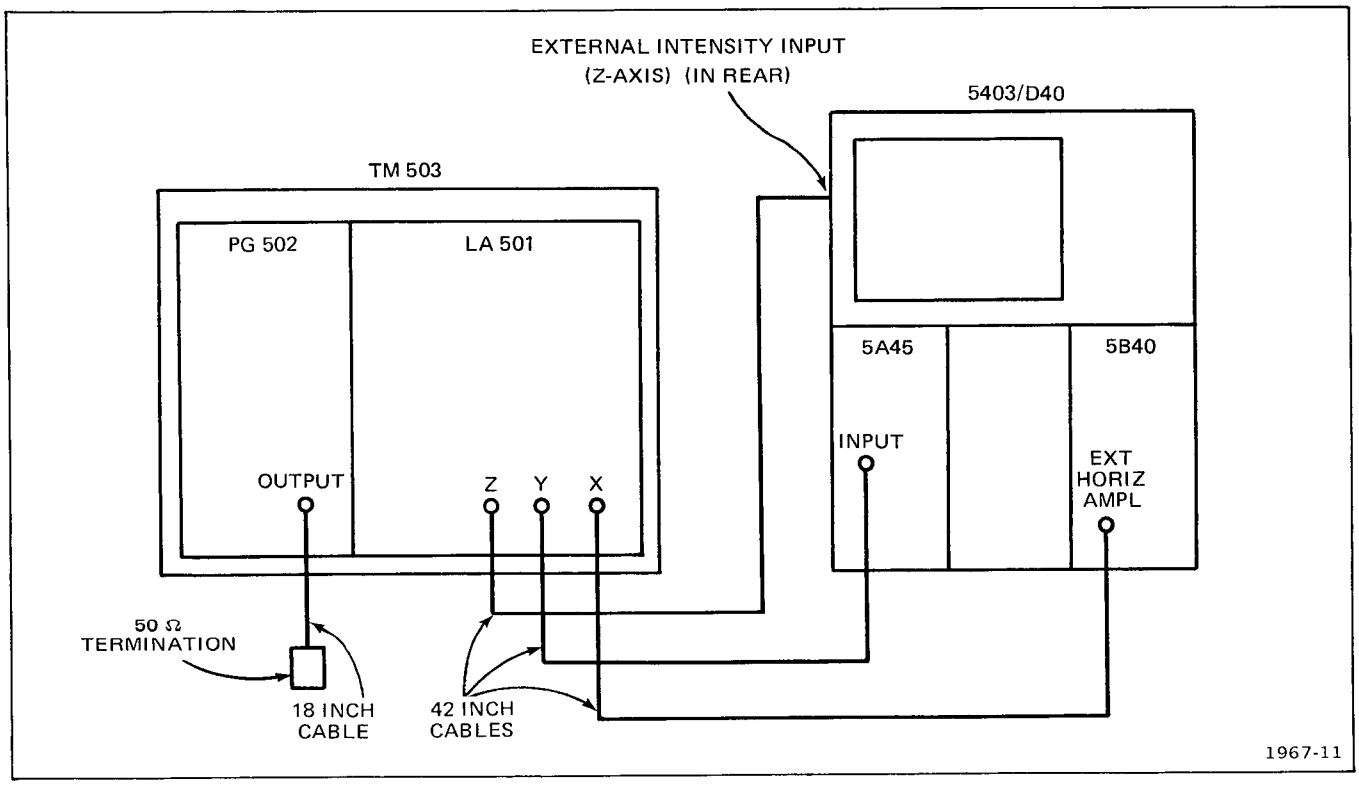


Fig. 1-4. Equipment set up for Functional Check.

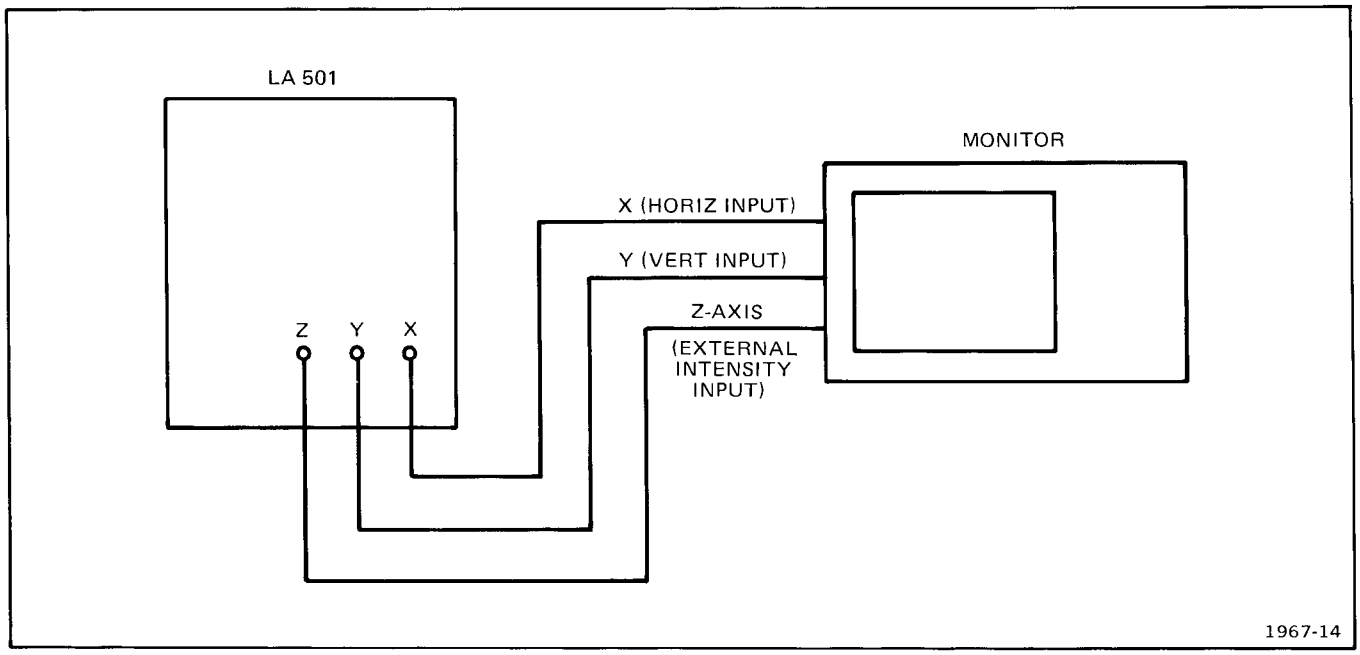


Fig. 1-5. LA 501 and monitor X, Y, and Z signal connections for Functional Check.

Display Functions

If necessary, perform the Preliminary Set Up procedure. Use the following procedure to check the Display Functions:

1. Connect the +0.25 volt, 10 kilohertz square-wave signal from pulse generator (as set in Preliminary Set Up procedure) to CH 0 and CH 1 input connectors with BNC T connector.

2. Check test oscilloscope for a square-wave display on channels 0 and 1.

3. Disconnect pulse generator signal from CH 1, and connect to CH 2 (retain connection to CH 0).

4. Check for square-wave display on channels 0 and 2.

5. Disconnect pulse generator signal from CH 2, and connect to CH 3.

6. Check for square-wave display on channels 0 and 3.

7. Check that display expands vertically as vertical MAG control is rotated to X5.

8. Return vertical MAG control to X1 position.

9. Check that display expands horizontally as horizontal MAG control is rotated to X10.

10. Return MAG control to X1 position.

11. Press in CH 0-7 X512 FORMAT switch.

12. Set the LA 501 Vertical and Horizontal POS controls for centered display.

13. Check display for 8 traces.

14. Press in CH 0-15 X256 FORMAT switch.

15. Set the LA 501 Vertical and Horizontal POS controls for centered display.

16. Check display for 16 traces.

17. Set CHANNEL:SELECT switch to 0.

18. Check that channel 0 trace can be positioned anywhere within raster as POSITION control (CHANNEL/POSITION) is rotated.

19. If desired, repeat step 18 for remainder of channel selections.

20. Return CHANNEL:SELECT switch to OFF.

21. Set RECORD DISPLAY TIME control to ∞ detent position.

22. Disconnect pulse generator from CH 3 connector.

23. Press in RECORD MANUAL switch and release it.

24. Check display for square wave on channel 0 only.

25. Return RECORD DISPLAY TIME control to 1 s.

26. Check that SAMPLE INTERVAL knob skirt lamp blinks as SAMPLE INTERVAL switch is set to 20 ns and 10 ns.

27. Set SAMPLE INTERVAL switch to EXT.

28. Disconnect the pulse generator from CH 0 connector.

29. Press in INPUT:ECL switch.

30. Press in CH 0-3 X1024 FORMAT switch.

31. Set pulse generator for 0-volt base-line reference, and set output amplitude to −0.2 volts.

32. Connect −0.2 volt, 10 kilohertz square-wave signal from pulse generator (as set in step 31) to EXT CLOCK and CH 0 connectors.

33. Check display for 4 traces.

34. Disconnect pulse generator from EXT CLOCK and CH 0 connectors.

Trigger Functions

If necessary, perform the Preliminary Set Up procedure. Use the following procedure to check the Trigger Functions:

1. Set SAMPLE INTERVAL switch to 50 ns.

2. Connect a +0.25 volt, 10 kilohertz square-wave signal from pulse generator (as set in Preliminary Set Up procedure) to CH 0 connector.

3. Check that channel 0 (top trace) has positive-going transition at left side of trace.

4. Press in TRIGGER:CENTER switch.

5. Check that positive-going transition is now near center of trace.

6. Press in TRIGGER:PRE switch.

7. Check that positive-going transition is at right side of trace.

8. Set SLOPE switch to −.

9. Check for negative-going transition at right side of trace.

10. Disconnect pulse generator signal from CH 0 connector.

11. Press in TRIGGER:POST switch.

12. Set SLOPE switch to +.

13. Set SOURCE switch to EXT.

14. Using a 0-volt base-line reference, set pulse generator output amplitude to +2 volts.

15. Connect the +2 volt, 10 kilohertz signal (as set in previous step) to LA 501 EXT TRIG connector.

16. Check that TRIG'D indicator is lit.

17. Check display for 4 traces.

18. Disconnect signal from EXT TRIG connector.

This completes the Functional Check procedure.

DETAILED OPERATING INFORMATION

Signal Connection

Probes offer the most convenient means of connecting signals to the LA 501 inputs. Tektronix probes are shielded to prevent pickup of electrostatic interference, and are designed to monitor the signal source with minimum circuit loading.

10X PROBES. The P6108 (optional accessory), a 10X attenuation probe, offers a high input impedance and allows the circuit under test to perform very close to the normal operating conditions.

When using 10X probes, select a probe with a rise time of less than 2.25 nanoseconds, and which is capable of compensating 20 picofarads of input capacitance.

10X PROBE COMPENSATION. When using 10X probes on the EXT CLOCK and CH 0 to CH 3 front-panel BNC input connectors, the probe capacitance must be compensated to match instrument input capacitance to obtain the best rise-time response. See Figure 1-6 for probe compensation set up and procedure.

DATA ACQUISITION PROBE. The P6450 (standard accessory) is a passive, 5X attenuation probe, which is designed for use with the LA 501. When plugged into the DATA INPUT connector, it offers input connections to all 16 channels.

DATA OUTPUT CABLE. In order to use DATA OUTPUT connector, J120, it is necessary to assemble a special cable. One end of the cable must be terminated with a connector to meet the test requirements. The other end of the cable is terminated with a connector to mate with the DATA OUTPUT connector. Use a type DB-25P, 25-pin, male connector; order Tektronix part 131-0570-00. For further information, contact your Tektronix Field Office or representative.

COAXIAL CABLE. The front-panel output signals, Z BLANK OUT, Y VERT OUT, and X HORIZ OUT, should be connected to other equipment with 50-ohm coaxial cables. Use high-quality, low-loss cables.

Display Monitor

The display monitor may be any oscilloscope or display monitor with X, Y, and Z-axis capabilities with the following characteristics:

Frequency response	dc to 500 kilohertz
Deflection factor	
Horizontal	50 millivolts/division
Vertical	100 millivolts/division
External Z-Axis sensitivity (external intensity input)	plus or minus 5 volts

Connections from the LA 501 X, Y, and Z outputs to the oscilloscope or monitor inputs should be made with coaxial cables. Figure 1-5 shows the proper set up for operation. Check the oscilloscope or monitor instruction manual for the required Z-axis blanking polarity. Set the Blanking Polarity switch (S720) down for negative blanking, or up for positive blanking. See Figure 1-2 for the location of S720. For more information on blanking polarity selection, see Internal Switches in this section.

Sample Interval

The SAMPLE INTERVAL switch selects calibrated sample-interval times from the internal clock. The number of times that the input channels are sampled is determined by the format selected. A 4-channel format is sampled 1024 times; 8-channel format, 512 times; and a 16-channel format, 256 times.

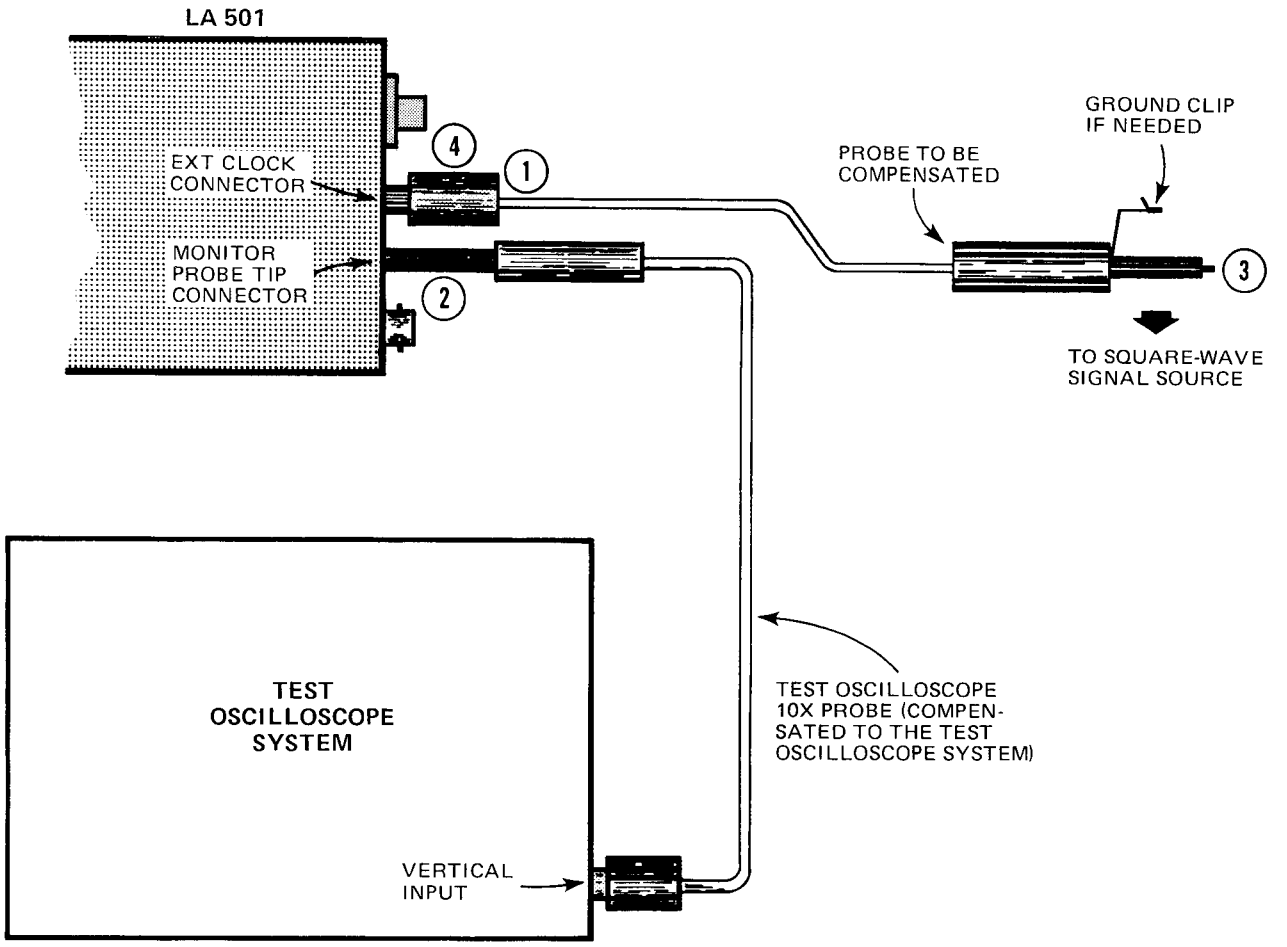
To capture and store the state of a pulse, one or more sample intervals must occur during the pulse. Resolution is determined by the number of samples taken during the pulse.

The lamp that illuminates the SAMPLE INTERVAL knob skirt blinks when the sample interval is too fast for 8 channel (10 nanosecond) or 16 channel (10 or 20 nanosecond) storage. When using an external clock signal, the EXT position of the SAMPLE INTERVAL switch selects the front-panel EXT CLOCK connector.

External Clock Input

The EXT CLOCK input provides a means of using a clock signal from the equipment under test, or any other clock signal that the operator may desire.

EXT CLOCK. This connector allows the connection of external clock signals. The external clock threshold level is selected by an internal switch (S848) that selects a preset



(1) Connect the 10X probe to be compensated to the LA 501 EXT CLOCK connector.

(2) Insert the test oscilloscope 10X probe tip into the EXT CLOCK MONITOR probe-tip jack.

(3) Connect the 10X probe to be compensated to a 600 mV, fast-rise, 1 KHz square-wave signal source (e.g., oscilloscope calibrator) for low-frequency compensation. For high-frequency compensation (if applicable), use a 600 mV square wave with a rise time of 3 ns or less. The test oscilloscope bandwidth should be at least 100 MHz.

(4) Adjust the probe compensation adjustment(s) (see probe instruction manual for adjustment locations) for an optimum square front corner and flat top on the test oscilloscope display.

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Fig. 1-6. 10X probe compensation set up and procedure.

ECL threshold voltage level or the front-panel INPUT THRESHOLD controls. When in the EXT CLOCK mode, either the positive or negative slope may be used for the clock edge. When the negative edge is selected, data sample intervals are stored into memory on the negative edge of the external clock signal. When the positive edge is selected, data sample intervals are stored into memory on the positive edge of the external clock signal. An internal jumper-connector, P831, provides polarity selection. Figure 1-7 shows the location of P831 and the selection positions.

MONITOR. This probe-tip jack allows the operator to view the external clock signal, and is also used for compensating 10X probes. Refer to 10X Probe Compensation in this section for more information.

Input Threshold Controls

The INPUT THRESHOLD controls allow the selection of two fixed threshold levels, or the variable THRESHOLD level control. Fixed threshold levels are for TTL and ECL logic.

TTL. This switch selects a preset TTL input threshold level for each of the data input channels, and for the EXT CLOCK input. When the recommended probes are used, the input threshold level is +1.4 volts.

ECL. This switch selects a preset ECL input threshold level for each of the data input channels and for the EXT CLOCK input. When the recommended probes are used, the input threshold level is −1.25 volts.

VAR. This switch selects the variable THRESHOLD level control.

THRESHOLD. The variable THRESHOLD control allows the selection of a wide range of threshold levels for the data input channels and for the EXT CLOCK input. When the recommended probes are used, the threshold level is adjustable from −10 volts to +10 volts.

MONITOR. The MONITOR pin jack provides an output to monitor the dc threshold voltage level.

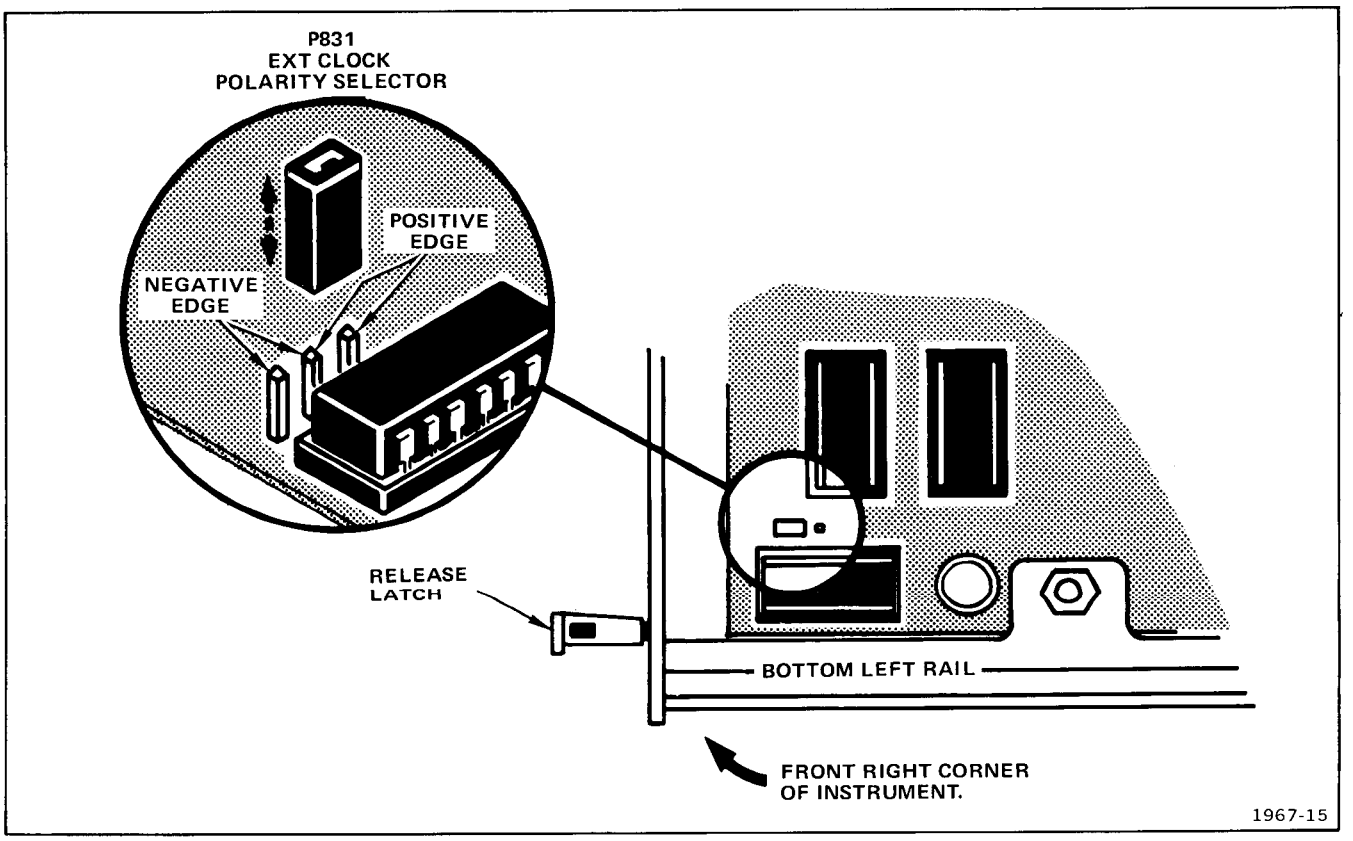


Fig. 1-7. Location of EXT CLOCK polarity selector.

Trigger Controls

The TRIGGER controls provide a means to select the signal source, select the slope on the waveform to stop the storage cycle, and select the point in the storage cycle at which the trigger will occur.

TRIG'D INDICATOR. This light provides a convenient indication of the Trigger circuit condition. If the INPUT THRESHOLD controls are correctly set for the input logic level used and the Trigger circuit has received a trigger, the TRIG'D light is on. If the TRIG'D light is off, the LA 501 is in the storage cycle, but has not yet received a trigger.

POST. This switch selects data for memory storage after the trigger has occurred. The stored data consists of 6 per cent before-trigger data and 94 per cent after-trigger data.

CENTER. This switch selects data for memory storage before and after the trigger has occurred. Half of the stored data is before the trigger, and the other half is data after the trigger.

PRE. This switch selects data for memory storage before the trigger has occurred. The stored data consists of 94 per cent before-trigger data and 6 per cent after-trigger data.

SLOPE. This switch determines whether the Trigger circuit responds to a positive- or a negative-going transition of the trigger signal. When the SLOPE switch is set to −, the Trigger circuit responds to negative-going transitions. When the SLOPE switch is set to +, the Trigger circuit responds to positive-going transitions.

SOURCE. This switch selects the source of the signal for the Trigger circuit. When the switch is set to CH 0, the input signal connected to the channel 0 input is used for the trigger source. When the switch is set to EXT, an external signal connected to the EXT TRIG connector is selected for the trigger source.

EXTERNAL TRIGGER. Trigger signals from the equipment under test, or other equipment the operator may prefer to use, can be connected to the EXT TRIG connector.

Ext Trig. This connector allows the connection of an external TTL logic level trigger signal. The input threshold level is fixed at +1.4 volts. This connector is selected when the SOURCE switch is in the EXT position.

Format Switches

The FORMAT switches select the number of data channels to be used. Three switches allow the operator to select 4, 8, or 16 data channels.

CH 0-3 (X1024). This switch selects the first 4 data channels. In this mode, each channel has a memory storage capacity of 1024 bits. The 4-channel mode has a maximum sample rate of 10 nanoseconds.

CH 0-7 (X512). This switch selects the first 8 data channels. In this mode, each channel has a memory storage capacity of 512 bits. The 8-channel mode has a maximum sample rate of 20 nanoseconds.

CH 0-15 (X256). This switch selects all 16 data channels. In this mode, each channel has a memory storage capacity of 256 bits. The 16-channel mode has a maximum sample rate of 50 nanoseconds.

Record Controls

The RECORD controls allow the operator to select the display time to view stored information, and also allows manual or automatic resetting of the Trigger circuit.

DISPLAY TIME. This variable control sets the time during which stored data will be held for display before a new storage cycle begins. The display time is variable from 1 to 10 seconds, or is held indefinitely when turned to the fully clockwise detent position (∞).

MANUAL. This switch resets the Trigger circuit to start a new storage cycle.

Monitor Output Signals and Controls

Vertical, horizontal, and Z-axis output signals are provided to produce a raster display on the display monitor. The vertical and horizontal outputs each have magnification and positioning controls.

Z BLANK OUT. When connected to a display monitor external Z-axis input, the Z-axis blanking signal performs two functions.

The first function is to blank the crt retrace lines. The second function is, if the new storage cycle fails to go through

a full memory storage cycle before a trigger is received, old data (bad data) is blanked out on the crt display. Positive or negative blanking pulses are selected by Blanking Polarity switch, S720.

Y VERT OUT. When connected to a display monitor Y-axis (vertical) input, this output signal provides an on-screen display of serial data from the memory. Channel separation is accomplished by stepping each channel down with a dc offset voltage. Channel 0 is at the top of the display.

Mag (Y-Axis). This control provides a variable X1 to X5 amplification of the Y VERT OUT signal to permit greater display resolution.

Pos (Y-Axis). This control vertically positions the raster within the display area of the monitor. To obtain maximum use of the Vertical POS control, the display monitor must first be adjusted for a centered spot with the X- and Y-axis inputs grounded. All vertical position adjustments are then made with the LA 501 Vertical POS control.

X HORIZ OUT. When connected to a display monitor X-axis (horizontal) input, this output signal provides the display with an X-axis sweep. The sweep rate is determined by the FORMAT switch setting. If desired, an external clock source may be used to scan the memory; however, any clock rate other than that of the internal clock will affect the sweep length. The external clock signal may be from the front-panel EXT CLOCK connector, or from the Ext Display Clock input at the DATA OUTPUT connector. The display clock source is selected by the internal Display Clock switch (S835).

Mag (X-Axis). This control provides a variable X1 to X10 amplification of the X HORIZ OUT signal to permit greater display resolution.

Pos (X-Axis). This control horizontally positions the data channels within the display area of the monitor. To obtain maximum use of the horizontal control, the display monitor must first be adjusted for a centered spot with the X- and Y-axis inputs grounded. All horizontal position adjustments are then made with the LA 501 Horizontal POS control.

CHANNEL/POSITION. The SELECT and POSITION controls under this title are used for comparison of any one channel with any other channel.

Select. This switch selects any channel (0 through 15) for positioning within the display raster.

Position. This control vertically positions the selected comparison channel within the display.

Data Input Signals

Both low impedance and high impedance inputs are provided for the data channels. Front-panel BNC connectors, CH 0 through CH 3, provide high impedance inputs, and multi-pin DATA INPUT connector, J100, provides low impedance inputs to all 16 channels. The INPUTS switch selects the desired input connector(s). 10X probes are used for connecting signals to the front-panel data input connectors.

INPUTS. This switch selects the desired data input probe connector(s). When in the BNC position, the four front-panel CH 0 through CH 3 connectors are selected. When in the PROBE position, the multi-pin DATA INPUT connector is selected.

CH 0 THROUGH CH 3. The four front-panel BNC connectors provide a means of connecting data signals through 10X probes to the channel 0, 1, 2, and 3 input preamplifiers. The 10X probes must be compensated for use with ECL logic, due to the low signal levels.

DATA INPUT. The internal, multi-pin connector, J100, provides a means of connecting data signals through the Data Acquisition Probe to the inputs of all 16 channels. Figure 1-8 identifies the pin assignments for the DATA INPUT connector. The Clock Out at pin 22 is an unterminated ECL-level output of the internal clock signal. Pin 23 of J100 (probe line A) is connected to Signal Selector jumper, P300. At the factory, P300 is wired to connect pin 23 of J100 to the Invalid Mode Input line. However, this connection can be changed to a different signal line if desired. For further information, see P300 Signal Selector in this section.

Data Output Connector

Internal multi-pin connector, J120, provides several functions. Figure 1-9 identifies the DATA OUTPUT connector pin assignments. As shown in Figure 1-9, three of the pins of J120 are connected to Signal Selector jumper, P300. At the factory, P300 is wired to make signal-line connections to these pins as shown in Figure 1-10. The connections can be changed to different signal lines if desired. For further information, see P300 Signal Selector in this section. The functions provided by the Data Output connector are described as follows:

PARALLEL DATA OUTPUT. Output connections are provided from each of the 16 memory channels to read the memory in parallel data form. The parallel data outputs are ECL-logic level signals.

SERIAL DATA OUTPUT. This connection is provided to read the memory in serial data form. The serial data output is an ECL-logic level signal.

FLAG OUTPUT. This connection provides for the output of an ECL-level pulse. The negative-going edge of the Flag Output pulse indicates the beginning of each channel.

Z-AXIS INPUT. This connection is provided to intensify the display by application of an external signal. A positive 5-volt input will fully intensify the display. As the input voltage is lowered towards zero volts, the display will be intensified less.

RECORD ENABLE. This connection is provided to set the memory into the Store Mode by application of an external

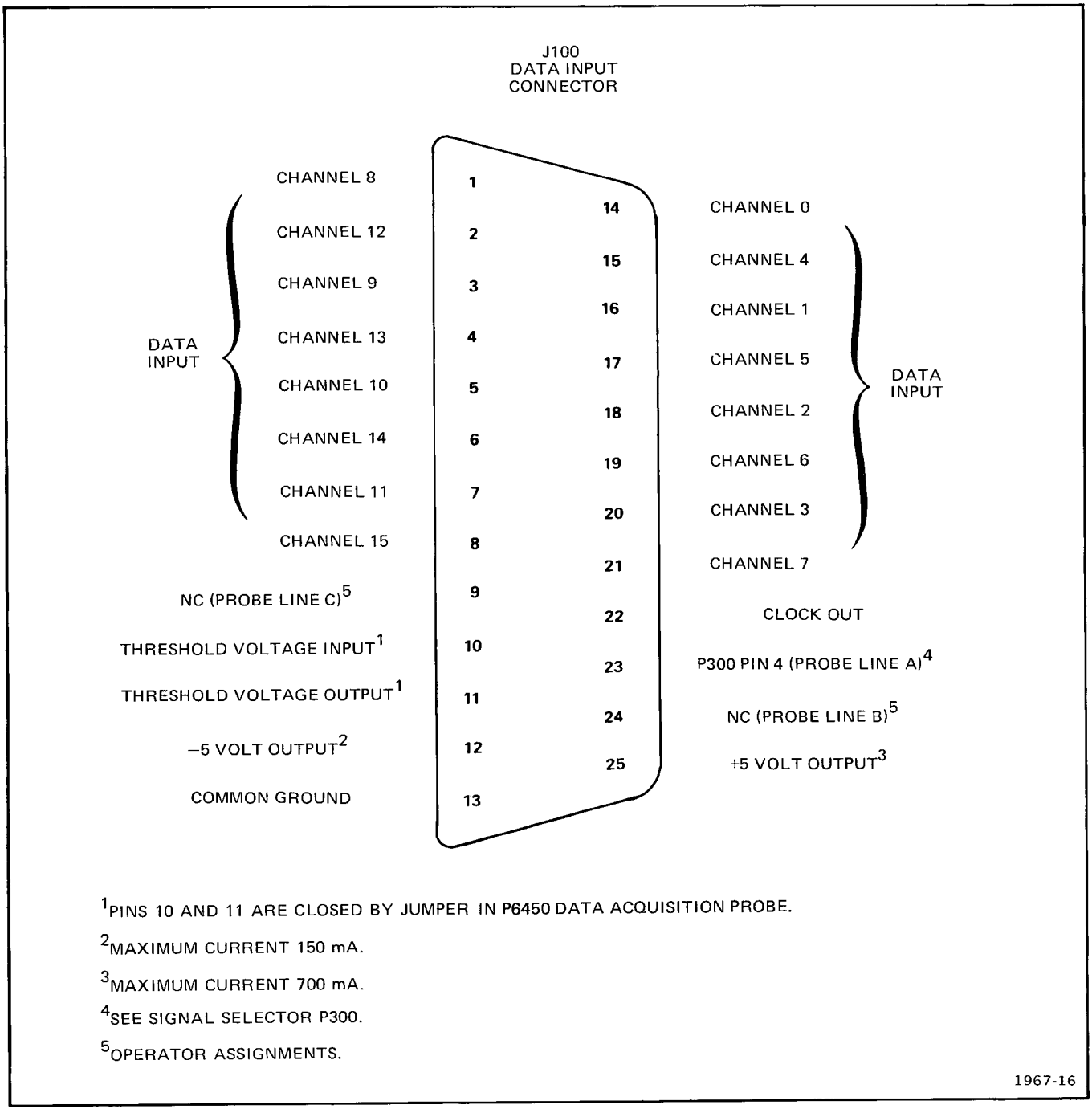


Fig. 1-8. Pin assignments for the DATA INPUT connector, J100.

signal. The Record Enable input is ac coupled, and requires only the negative-going edge of a 1.5-volt pulse to enable the Store Mode.

EXT DISPLAY CLOCK INPUT. This connection is provided for the application of an external, ECL-level, display clock signal. The input is terminated by 100 ohms to −2 volts. The External Display Clock Input signal requirements are: The HI level must be more positive than −1 volt, and the LO level must be more negative than −1.5 volts. The usable frequency range is from less than one hertz to two megahertz.

P300 Signal Selector

Internal multi-pin jumper-connector, P300, provides selection of several input and output signal lines to the DATA INPUT, J100, and DATA OUTPUT, J120, connectors. Figure 1-10 shows the location of P300 and identifies the pin assignments. Figure 1-10 shows the jumpers as they are installed at the factory. To change the connections for different requirements, see Signal Selection with P300 in this section.

DISPLAY CLOCK OUTPUT. This connection provides a display-clock output from the memory. An ECL-level clock output is provided during the Display Mode. During the Store Mode, the output assumes an ECL LO state.

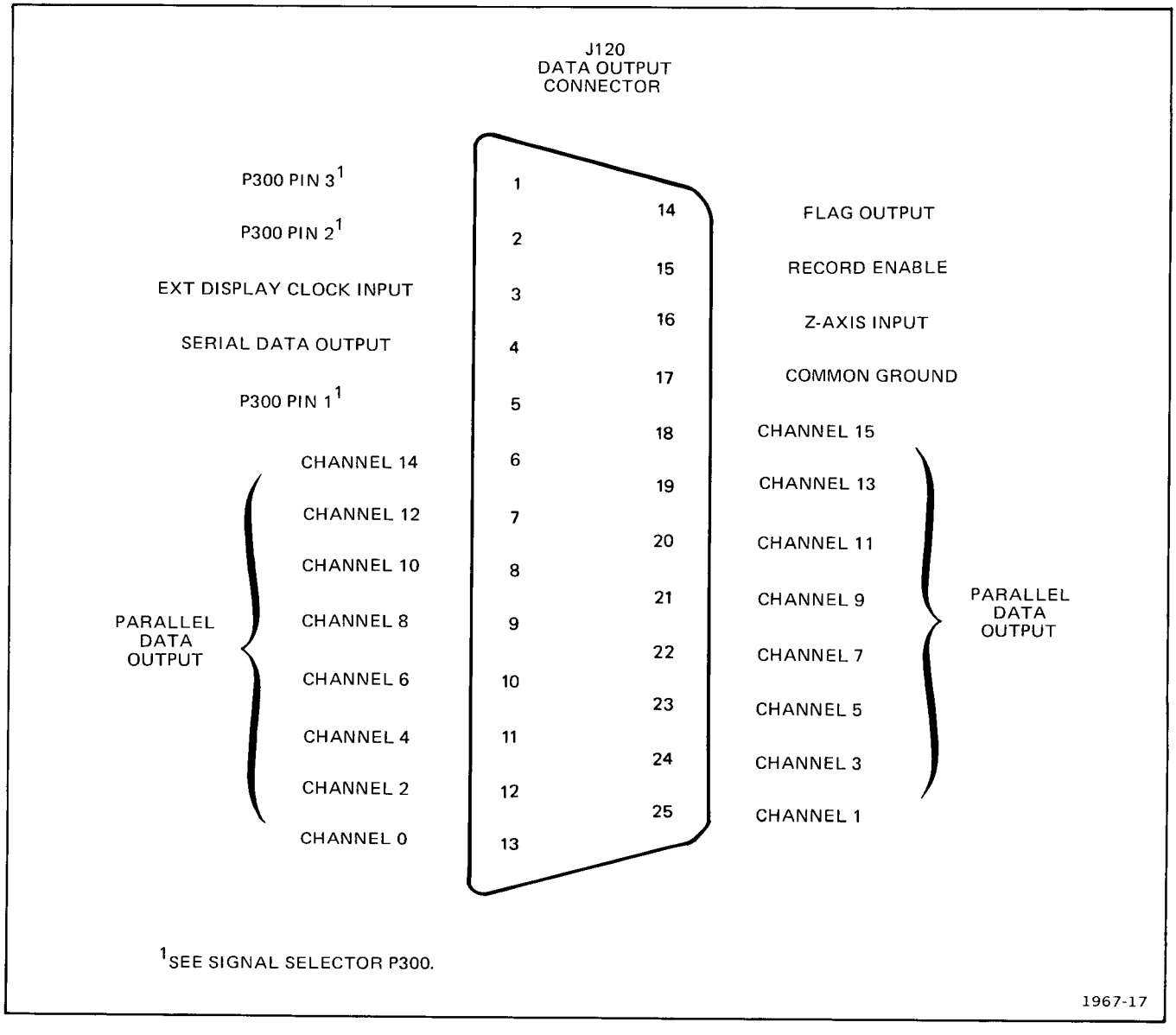


Fig. 1-9. Pin assignments for the DATA OUTPUT connector, J120.

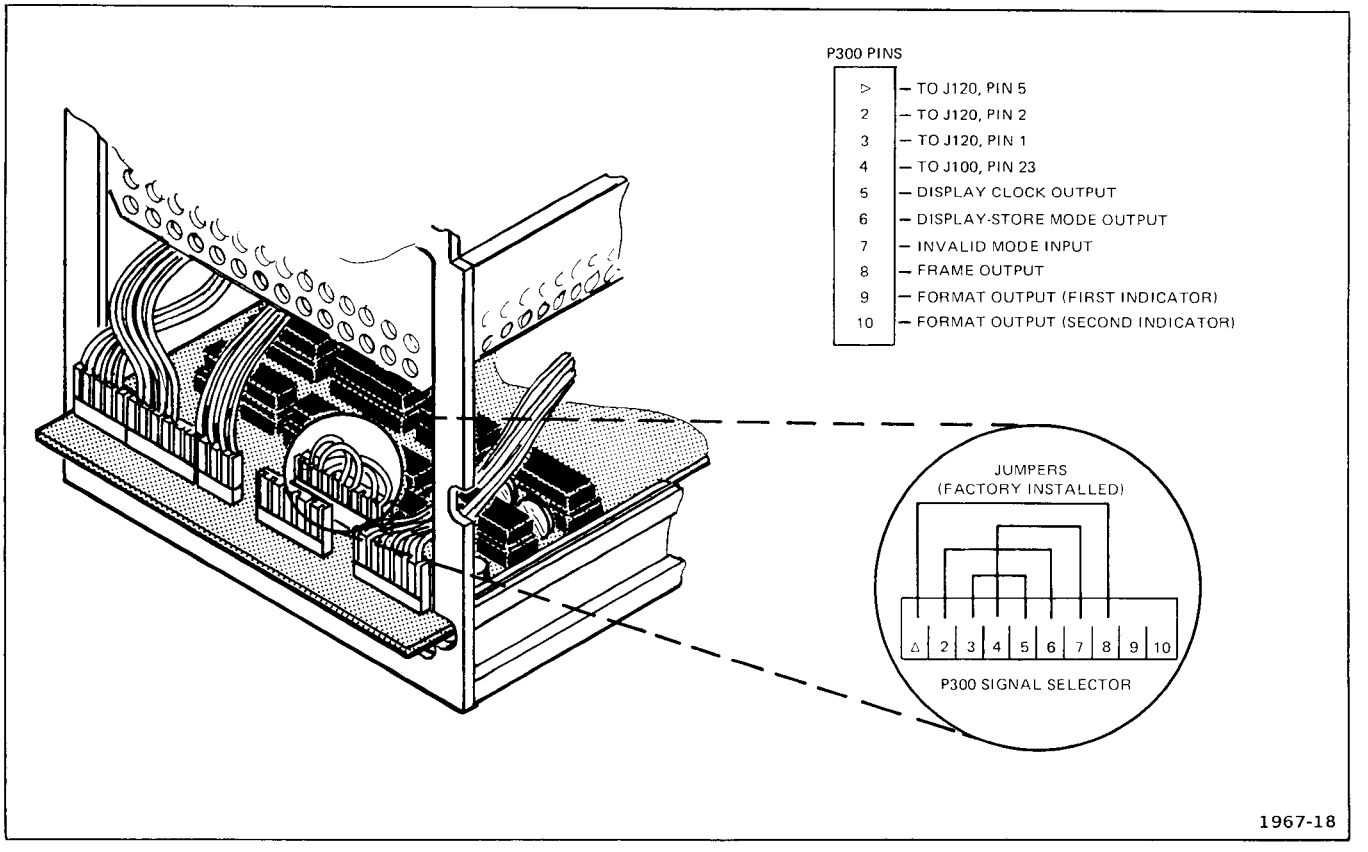


Fig. 1-10. Location of Signal Selector P300, and P300 pin assignments.

DISPLAY-STORE MODE OUTPUT. This output indicates whether the memory is in a Display or a Store Mode. An ECL LO level indicates that the memory is in the Display Mode. An ECL HI level indicates that the memory is in the Store Mode.

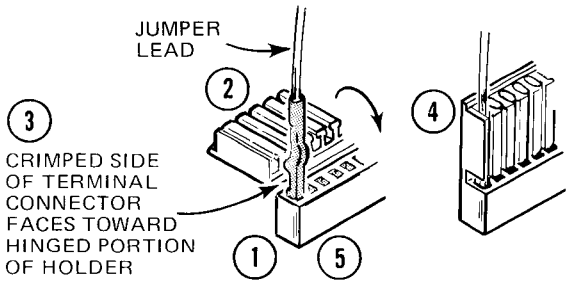
INVALID MODE INPUT. The Invalid Mode Input is used in conjunction with an external clock source. When an external ground is applied to this input, the SAMPLE INTERVAL light blinks to indicate that the sample interval is too fast for the selected memory format.

FRAME OUTPUT. This connection provides for the output of an ECL-level pulse. One complete pulse cycle represents at least one complete serial scan of the data in the memory.

FORMAT OUTPUT. Two connections provide ECL-level outputs which indicate the memory format selected by the front-panel FORMAT switches. Table 1-1 shows the ECL-level output states at pins 9 and 10 of P300 for each of the FORMAT switch positions.

TABLE 1-1
Format Output Levels at P300

FORMAT Switch	P300	
	Pin 9	Pin 10
CH 0-3 X1024	HI	HI
CH 0-7 X512	LO	HI
CH 0-15 X256	LO	LO



1. Remove P300 from instrument (refer to Figure 1-10).
2. Bend grooved portion of holder (part nearest jumper) away from the jumper in direction of its hinged side.
3. Insert the jumper lead connector into the selected hole in the holder. (Refer to Figure 1-10).
4. Bend the grooved part of holder back to its vertical position so connector is inserted into groove.
5. Observe the connector polarity (refer to Figure 1-10), and install P300 back into the instrument.

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Fig. 1-11. P300 jumper placement procedure.

SIGNAL SELECTION WITH P300. To change the signal selections to the DATA INPUT (J100) and DATA OUTPUT (J120) connectors shown in Figure 1-10, perform the procedure shown in Figure 1-11.

Internal Switches

Three switches within the LA 501 provide selection of display Blanking Polarity, EXT CLOCK threshold source, and the Display Clock source. Figure 1-12 shows the location and describes the use of these switches.

LA 501 GLOSSARY

The terms listed in this glossary are used throughout this manual.

Asynchronous—Multiple digital information transferred at non-common clock rates.

Bit—The smallest increment of digital information.

CPU—Central Processing Unit.

ECL—Emitter-Coupled Logic.

Jitter—A form of distortion in asynchronous systems that is due to timing variations of the received data.

Multiplexing—The combining of multiple inputs into a single output.

Parallel Data—Data transferred on multiple lines. Parallel data logic is derived from the multiple lines.

Parallel-to-Serial Conversion—The technique of storing a digital pattern from a parallel bus, then transferring that pattern out to a serial bus.

Parity Bits—Bits added to the data stream which enable the receiver to verify whether the data is correctly or incorrectly received.

PROM—Programmable Read Only Memory.

RAM—Random Access Memory.

Serial Data—Data transferred on a single line. Serial data logic is derived in a sequential mode.

Store Clock—The clock used to store information into the LA 501 memory.

Synchronous—Digital information transferred with the same clock reference.

Threshold Voltage—The comparator input voltage on the inverting input, which is used as a reference. Thus, if the signal on the non-inverting input is more positive than the threshold voltage, the output is HI; if the signal is more negative, the output is LO.

TTL—Transistor-Transistor Logic.

"wired OR"—ECL gate outputs that are connected together to yield the equivalent output of an OR gate.

Blanking Polarity

Switch S720 selects the polarity of the voltage at the Z BLANK OUT connector.

(1) In the up position, the display blanking pulses are +5 volts (positive blanking).

(2) In the down position, the display blanking pulses are −5 volts (negative blanking).

Ext Clock Threshold S848

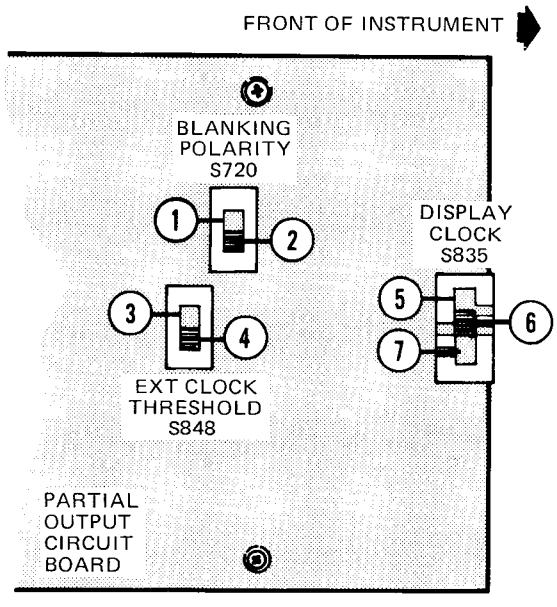
Switch S848 selects the external clock threshold level source.

(3) In the up position, threshold levels are selected by the front-panel INPUT switches VAR, TTL, or ECL.

(4) In the down position, a fixed ECL threshold level is selected.

Display Clock S835

Switch S835, a three-position switch, selects the source of the display clock signal applied to the display clock gate.



LEFT SIDE, WITH SIDE PANEL REMOVED.

(5) In the up position, an ECL input clock signal from the DATA OUTPUT connector is selected.

(6) In the center position, the front-panel EXT CLOCK connector is selected.

(7) In the down position, the internal 500 kilohertz display clock signal is selected.

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Fig. 1-12. Internal switch locations, and switch selection positions.

APPLICATIONS

Malfunctions in digital equipment systems are difficult to isolate with conventional test equipment, such as oscilloscopes or counters. The following applications describe some typical situations in which the LA 501 Logic Analyzer can be used to make digital equipment troubleshooting relatively easy.

MICROPROCESSORS

A malfunctioning microprocessor system is shown in Figure 1-13. Software had previously worked properly, but was still not free of suspicion. Data was stored in the RAM (random-access read/write memory). The system program was resident in the PROM (programmable read only memory). Restart vectors pointed to the address of the first instruction in the restart routine.

When the restart hardware was exercised, the CPU (central processing unit) should have performed certain initialization routines and then gone to the Wait for Interrupt mode. The terminal would then call up other operating software in the PROM, or provide access to a binary loader. The failure consisted of very erratic operation after restart.

The LA 501 was connected to the system as shown in Figure 1-13 to store and display a large data block from the eight data lines. The display was obtained by triggering the LA 501 on the beginning of the restart cycle and using the system clock as an external data sampling strobe.

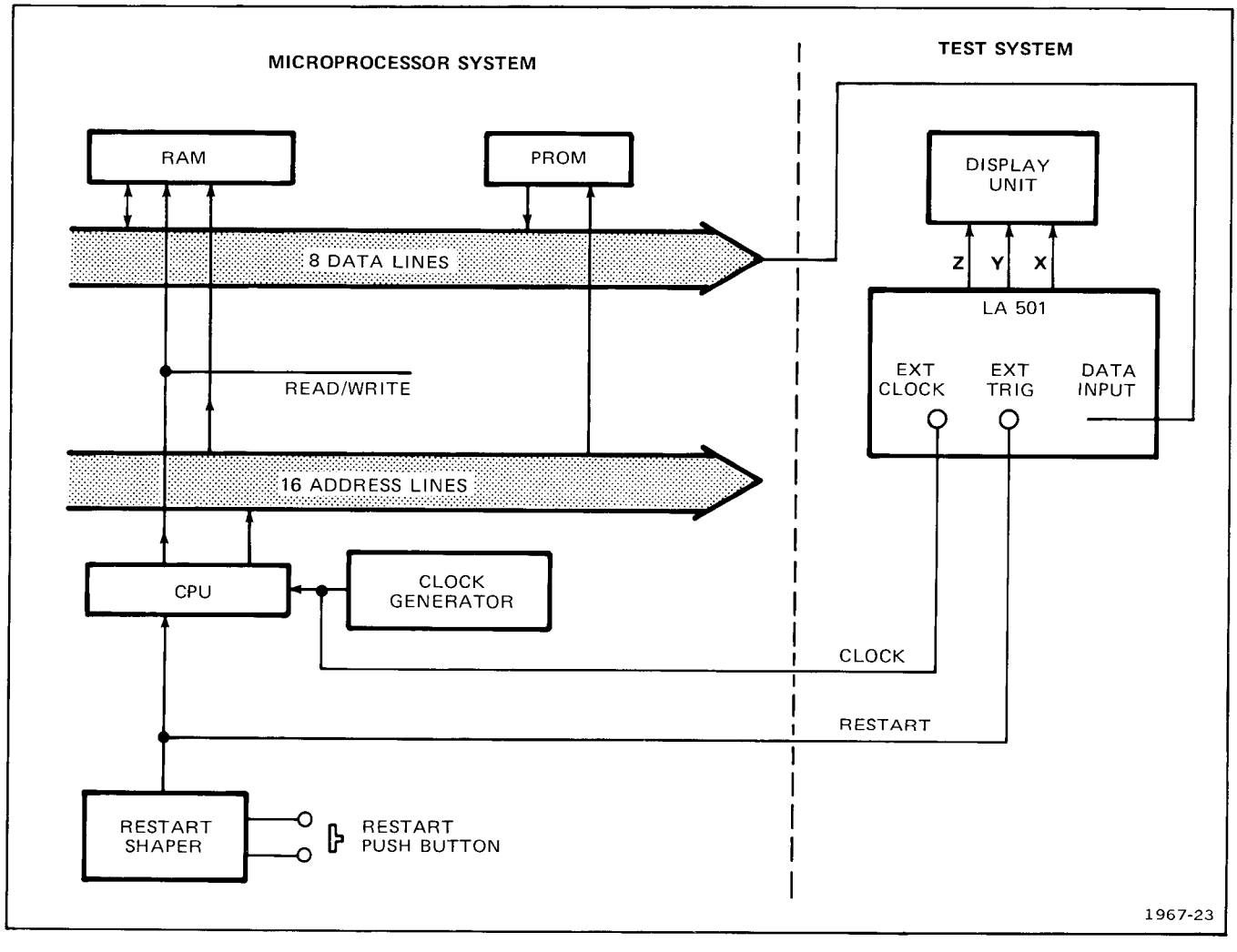


Fig. 1-13. Typical set up for troubleshooting a microprocessor system with the LA 501 Logic Analyzer.

Analysis of the data display showed the problem to be a dropped bit in the portion of the PROM providing the re-start routine. The CPU fetched an invalid restart vector, causing data from the RAM to be executed as instructions.

STORAGE BUFFERS

A multi-input logic analyzer will provide a quick and easy method for checking the performance of a storage buffer. The following application shows how the inputs and outputs of a buffer can be monitored simultaneously and observed for verification of performance or for a malfunction, if it is suspected.

The non-synchronous buffer is a commonly used type, in which data flows continuously from input to output. A quick snapshot of this data flow will show at a glance if all the memory cells are functioning properly.

The LA 501 can take this single shot snapshot of 8 input and 8 output lines simultaneously and display all sixteen data lines on a single display for a quick comparison. A typical set up and display are shown in Figure 1-14. When the LA 501 is clocked asynchronously from the internal clock, a high-resolution timing diagram display will provide timing information as well as reveal malfunctions that would otherwise be difficult to detect with any other type of test equipment such as an oscilloscope or DVM.

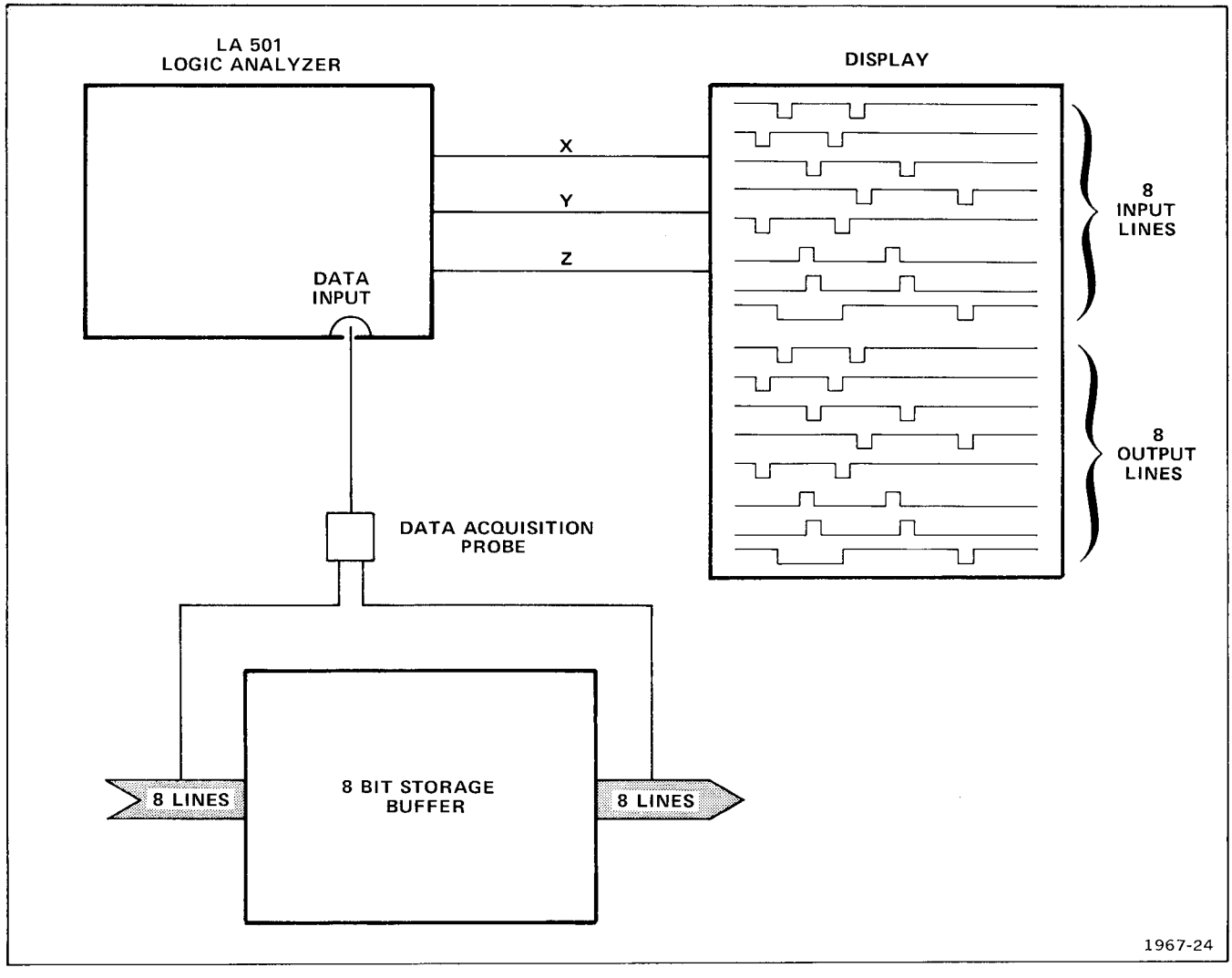


Fig. 1-14. Typical set up and display for troubleshooting a storage buffer with the LA 501 Logic Analyzer.

SPECIFICATION

The electrical specifications listed in Table 2-1 apply when the following conditions are met: (1) The instrument must have been adjusted at an ambient temperature between +20° and +30°C, (2) the instrument must be operating at an ambient temperature between 0° and +50°C, and (3) the instrument must be operating for at least 15 minutes.

TABLE 2-1
Electrical

Characteristic	Performance Requirement		
DATA INPUTS			
Impedance			
Channel 0-3 (High-Impedance Data Input connectors)	1 MΩ within 1% paralleled by approximately 20 pF.		
Channel 0-15 (Low-Impedance Data Input connector)	20 kΩ within 1% paralleled by approximately 20 pF.		
Threshold Level	At Data Input Connectors		At Probe Tip
	P6450 Probe[1]	10X Probe[1]	
VAR (Variable)	At least −2 V to +2 V	At least −1 V to +1 V	At least −10 V to +10 V
TTL	+0.280 V within .05 V	+0.140 V within .025 V	+1.4 V within 0.25 V
ECL	−0.250 V within .010 V	−0.125 V within .006 V	−1.25 V within .06 V
MONITOR Output	Within 3% of threshold level at Data Input connectors.		
Sensitivity (without probes)			
High-Impedance Data Input	At least 60 mV p-p.		
Low-Impedance Data Input	At least 120 mV p-p.		
Minimum Pulse Width	1 sample interval + 5 ns HI or LO to ensure pulse recording.		
Input Delay Between Channels			
High-Impedance Data Input	6 ns or less.		
Low-Impedance Data Input			
Channel 0-7	7 ns or less.		
Channel 0-15	12 ns or less.		
Input Delay Between High-Impedance Data Input Connectors and P6450 Probe Tip	22 ns or less.		

[1] **Probe rise time for high-impedance data and external clock inputs should be 2.25 ns or less with aberrations not to exceed 10% p-p.**

TABLE 2-1 (CONT.)
Electrical

Characteristic	Performance Requirement
DATA INPUTS (CONT.)	
Maximum Input Voltage	
At High-Impedance Data Input Connectors	Clamped at ±2.5 V, protected to ±150 V.
At Low-Impedance Data Input Connector	Clamped at ±2.5 V (no protection).
With P6450 Probe	Clamped at ±12.5 V, protected to ±50 V.
TRIGGER	
Source	
Input Level	
Internal (CH 0)	Set by INPUT controls.
External	Threshold Level: +1.4 V, within 0.2 V, clamped at +2.7 V and −0.6 V, protected to ±15 V.
Input R and C	Approximately 100 kΩ paralleled by approximately 20 pF.
Minimum Pulse Width	10 ns.
Record Display Time Range	Approximately 1 s to 10 s.
TIME BASE	
Internal	
Frequency	100 MHz within 50 parts per million.
Sample Rate	10 ns to 5 ms/sample in 1-2-5 sequence. Maximum sample rate: 4X = 10 ns, 8X = 20 ns, 16X = 50 ns.
External (EXT CLOCK Input)	
Input R and C	1 MΩ within 1% paralleled by approximately 20 pF. Clamped at ±2.5 V, protected to ±150 V.
Sensitivity	At least 60 mV p-p.
Pulse Width	
CH 0-3 X1024	HI for at least 10 ns and LO for at least 10 ns.
CH 0-7 X512	HI for at least 10 ns and LO for at least 10 ns.
CH 0-15 X256	HI for at least 25 ns and LO for at least 25 ns.

TABLE 2-1 (CONT.)
Electrical

Characteristic	Performance Requirement
TIME BASE (CONT.)	
Threshold Level	Same as data inputs, or −0.125 V within .006 V (internal switch).
Slope	Data strobed in on positive or negative edge of external clock.
Data Change With Respect to Clock Edge at EXT CLOCK Connector (internally selectable + or − edge)	
At High-Impedance Data Input Connectors	
Set-Up	2 ns.
Hold	15 ns.
At P6450 Probe Tip	
Channel 0-7	
Set-Up	14 ns.
Hold	3 ns.
Channel 8-15	
Set-Up	20 ns.
Hold	2 ns.
DISPLAY SIGNALS (FRONT PANEL)	
Blanking Output	0 V to +5 V or 0 V to −5 V within 1 V (internal switch)
CRT Retrace Blanking Time	
CH 0-3 X1024	4.2 μs within 20% (4 bits).
CH 0-7 X512	2.2 μs within 20% (2 bits).
CH 0-15 X256	1.2 μs within 20% (1 bit).
Vertical Output	0.1 V/div within 10%.
Magnify	X1 to X5 within 10%.
Horizontal Output	.05 V/div within 10%.
Linearity	Pulse width within 10% from 10% to 100% of sweep.
Magnify	X1 to X10 within 10%.

TABLE 2-1 (CONT.)
Electrical

Characteristic	Performance Requirement
DISPLAY SIGNALS (FRONT PANEL) (CONT.)	
Display Format	
CH 0-3 X1024	1 group of 4 lines.
CH 0-7 X512	2 groups of 4 lines each.
CH 0-15 X256	4 groups of 4 lines each.
Raster Shift With Format Change	1 div or less at X1 magnification.

LOW-IMPEDANCE DATA INPUT

Data Input

Pin	Channel	Pin	Channel
1	8	14	0
2	12	15	4
3	9	16	1
4	13	17	5
5	10	18	2
6	14	19	6
7	11	20	3
8	15	21	7

Clock Out	Pin 22. Unterminated ECL level. The output, when terminated, is a standard negative voltage ECL level.
Invalid Mode	Jumper, P300 pin 7. Ground closure causes blinking of SAMPLE INTERVAL switch light.
Threshold DC	Pin 10.
Comparator Input	Pin 11.
+5 Volts	Pin 25. 700 mA or less.
−5 Volts	Pin 12. 150 mA or less.
Ground	Pin 13.

DATA OUTPUT

Parallel Data Output — Parallel data from memory (ECL level).

Pin	Channel	Pin	Channel
6	14	18	15
7	12	19	13
8	10	20	11
9	8	21	9
10	6	22	7
11	4	23	5
12	2	24	3
13	0	25	1

TABLE 2-1 (CONT.)
Electrical

Characteristic	Performance Requirement
DATA OUTPUT (CONT.)	
Serial Data Output	Pin 4. Serial data from memory (ECL level).
Flag Output	Pin 14. Negative-going edge indicates beginning of each channel (ECL level).
Format Output	Jumper, P300. Indicates memory format.
	Pin 9 / Pin 10
CH 0-3 X1024	1 / 1
CH 0-7 X512	0 / 1
CH 0-15 X256	0 / 0
Z-Axis Input	Pin 16. A positive signal (+5 V or less) intensifies the display.
Record Enable	Pin 15. Negative-going pulse of at least 1.5 V sets memory into Record mode.
Ext Display Clock Input	Pin 3. Terminated by 100 Ω to −2 V.
	Signal Levels: HI = more positive than −1 V. LO= more negative than −1.5 V.
Frequency	From less than 1 Hz to 2 MHz.
Display–Store Mode Output	Jumper, P300 pin 6. A HI indicates memory is in Store mode. A LO indicates memory is in Display mode.
Frame Output	Jumper, P300 pin 8. A positive-going edge indicates the start of channel 0.
Display Clock Output	Jumper, P300 pin 5. LO when memory is in Store mode.
Ground	Pin 17.
POWER SOURCE	
Line Voltage Ranges	Refer to TM 500 power module performance requirements.
Power Consumption	32 W at nominal line voltage.

TABLE 2-2
Environmental

Characteristic	Performance Requirement
Temperature	
Operating	0° to +50°C.
Storage	–40° to +75°C.
Altitude	
Operating	To 15,000 feet.
Storage	To 50,000 feet.
Transportation	Qualified under National Safe Transit Committee Test Procedure 1A, Category II.

TABLE 2-3
Physical

Characteristic	Description
Weight (without accessories)	Approximately 4 lbs (1.8 kg).
Dimensions	See Fig. 2-1.

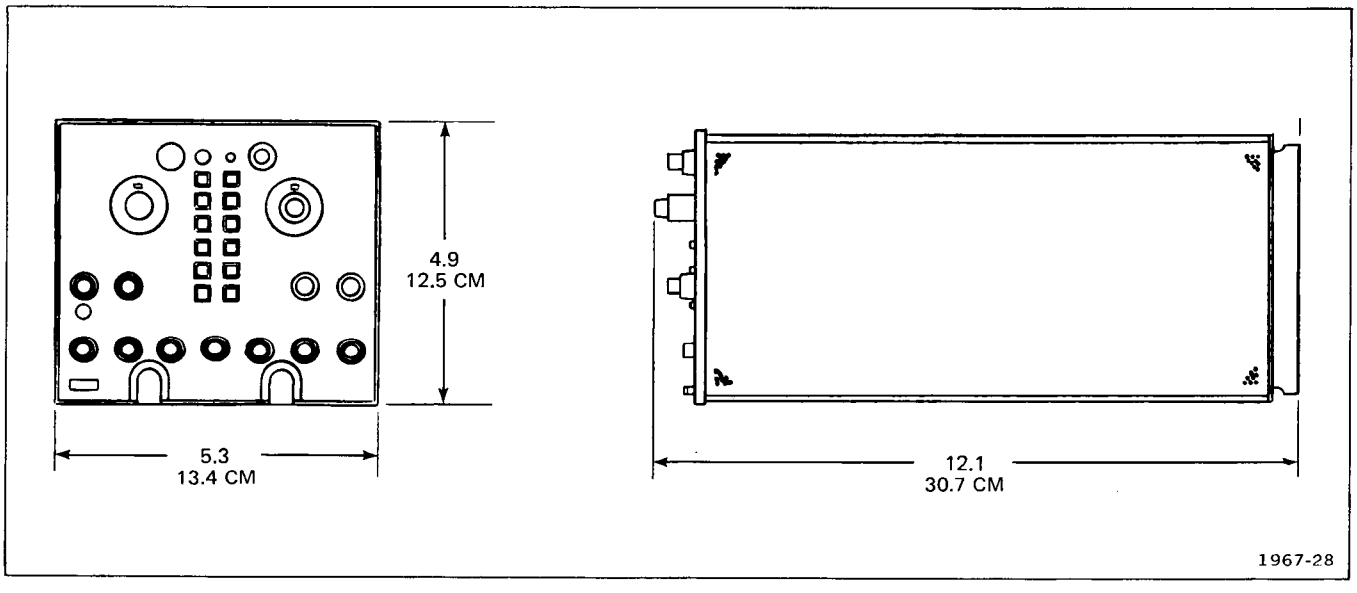


Fig. 2-1. LA 501 dimensional drawing.

STANDARD ACCESSORIES

1 ea	Instruction Manual	070-1967-00
1 ea	Operators Manual	070-2047-00
3 ea	Cables, Coaxial BNC, 50 Ohm, 42 Inch	012-0057-01
1 ea	Probe Package	010-6450-01

Includes:

1 ea P6450 Probe
2 ea Lead Sets, Probe to Hook Tip (10 Leads/Set Color Coded)
2 ea Lead Sets, Probe to :025 Inch, Square Pin (10 Leads/Set Color Coded)
1 ea Data Sheet
1 ea Accessory Pouch

For more detailed information, refer to the tabbed Accessories page in the back of this manual.

RECOMMENDED ACCESSORIES

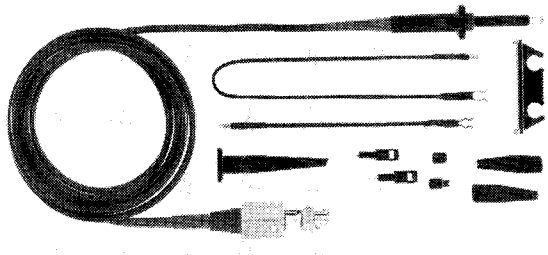
The following accessories have been selected from our catalog specifically for your instrument. They are listed as a convenience to help you meet your measurement needs. For detailed information and prices, refer to a Tektronix Products Catalog or contact your local Tektronix Field Representative.

PROBE

P6108: Miniature passive modular probe. Attenuation, 10X, within 1%. Bandwidth, at least 100 MHz. Input R and C, 10 MΩ with capacitance adjustable from 15 to 47 pF. Maximum input voltage, 500 V (dc + peak ac), derated with frequency.

Cable length:

1 meter (input C, approx. 10.5 pF) Order...010-6108-01
2 meter (input C, approx. 13.0 pF) Order...010-6108-03
3 meter (input C, approx. 15.0 pF) Order...010-6108-05



CARTS

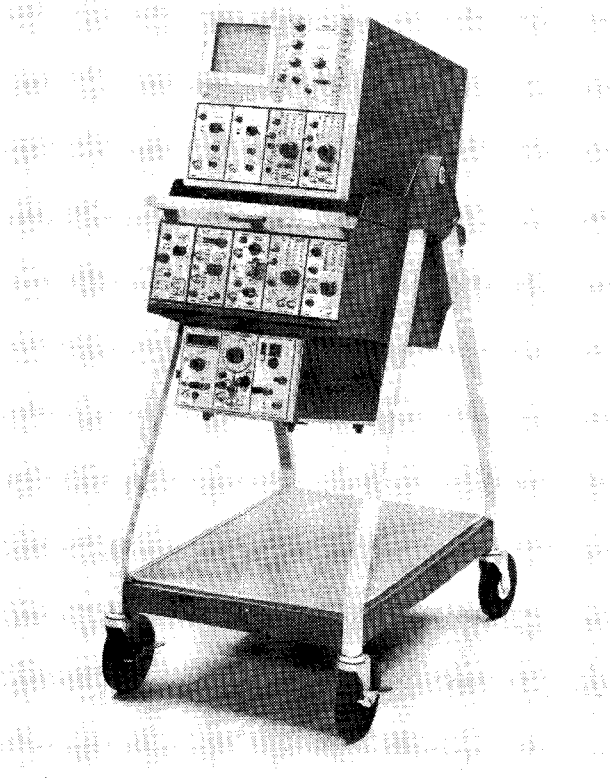
203 Opt. 1: Designed to accommodate a 5000-series or 3-plug-in compartment 7000-series oscilloscope and one TM 503 in a roll-around test-station configuration.

Order . . . . . 203 OPT. 1

204 Opt. 1: Designed to accommodate a 4-plug-in compartment 7000-series oscilloscope and one TM 503 in a roll-around test-station configuration.

Order . . . . . 204 OPT. 1

203 MOD 901R: Designed to accommodate a 400-series (except 455) oscilloscope and two TM 503's in a roll-around test-station configuration. This is a modified item; consult your local Tektronix representative for ordering information.



204 OPTION 1
SCOPE-MOBILE CART

THEORY OF OPERATION

This section of the manual contains a description of the circuitry used in the LA 501 Logic Analyzer. The description begins with a discussion of the instrument using the Block Diagram in the Diagrams section to show the major interconnections between circuits. Each circuit is then described in detail in the Circuit Description.

BLOCK DIAGRAM DESCRIPTION

The Data Inputs circuit provides an interface between the Memory and the actual input signals. The input signals are compared to a fixed or a variable threshold voltage to accommodate any logic signal source from +10 volts dc to −10 volts dc. The 16 output channels from the Data Inputs circuit are connected to the Memory circuit. The channel 0 output is also connected to the Trigger circuit as the internal trigger source.

The Trigger circuit controls the store and display modes of the Memory circuit, the retrace and retrace-blanking functions of the Horizontal and Blanking Signal Outputs circuit, and the time that each display is presented before new data is written into the Memory. Trigger position on the display (POST, CENTER, or PRE trigger) is also controlled by the Trigger circuit.

The Memory circuit stores data from the Data Inputs circuit at a rate controlled by the Time Base circuit. The Memory circuit consists of sixteen 256-bit RAMs (random access memories) and the required control circuits. The 16 RAMs are arranged in groups of four. Each group of 4 RAMs can store 256 bits of data from four different channels, 512 bits from two channels, or 1024 bits from one input channel, depending on the setting of the FORMAT switch.

The Time Base provides an internal store clock (SAMPLE INTERVAL) source of from 5 ms to 10 ns per sample. The Time Base circuit also provides a display clock and inputs for external clock sources.

The Serial Logic and Vertical Signal Outputs circuits provide the parallel-to-serial conversion required to display the stored data on the crt of a display monitor or oscilloscope. The vertical offset between displayed channels is also generated by these circuits.

The Horizontal and Blanking Signal Outputs circuits generate the horizontal sweep-ramp waveform and the crt blanking pulses for the display.

DETAILED CIRCUIT DESCRIPTION

Complete schematic diagrams are given in the Diagrams section of this manual. Refer to these schematics throughout the following circuit description.

FRONT PANEL WIRING ①

The Front Panel Wiring diagram shows the controls, switches, indicators, and connectors mounted on the front panel and the circuit boards to which they are connected. Also shown are the interconnecting cables and pin numbers.

DATA INPUTS ②

Refer to Fig. 3-1 for a detailed block diagram of the Data Inputs circuit. The inputs are separated into four groups of four channels each. As each of these four groups are identical in operation, only the Threshold Level circuit and the first group of input channels (0, 4, 8, and 12) will be discussed.

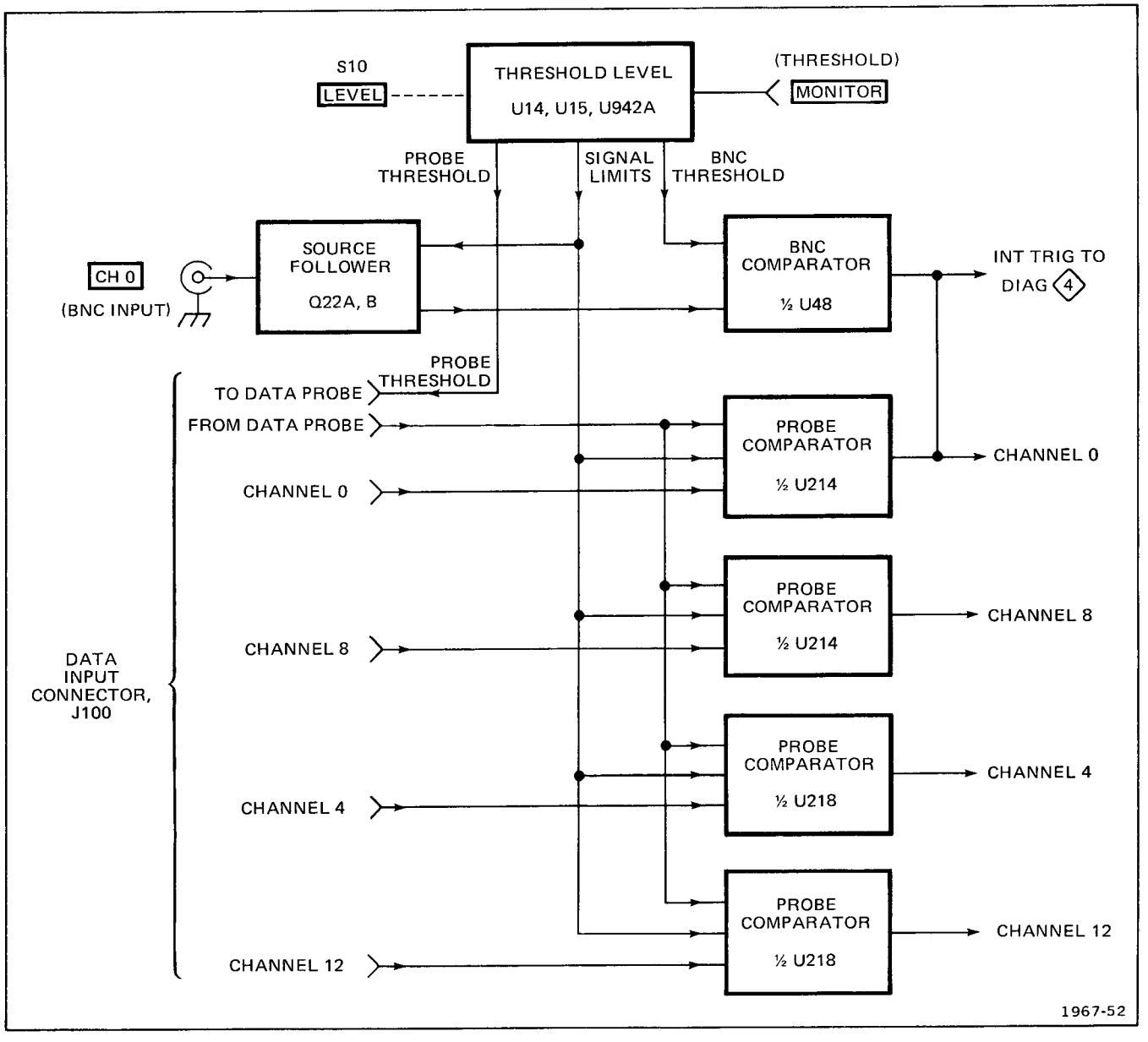


Fig. 3-1. Detailed block diagram of Data Inputs circuit (partial).

Threshold Level

The Threshold Level stage produces six different dc voltages which are used by the Data Inputs circuitry. These voltages are: Upper and lower signal limits, probe threshold, threshold monitor, BNC threshold, and a comparator disable voltage.

SIGNAL LIMITS. The upper and lower signal limits are set by Q16 and Q18, respectively. If the input signal voltage at the data input connector exceeds about 2.5 volts positive or negative, the clamp diode(s) conduct and limit the input signal voltage. For example, if the 10X probe connected to the CH 0 BNC input connector were to accidentally contact the ac power line, CR21 would conduct on the positive half-cycle and CR20 would conduct on the negative half-cycle. With CR20 or CR21 conducting, the excess voltage is dropped across R20 and the 9-megohm resistor in the 10X probe.

PROBE THRESHOLD. The probe threshold voltage is selected by INPUT switch S10 from divider R1, R3, R4, R5, R9, R6, and R8, or from INPUT THRESHOLD control, R10. The selected voltage is connected to the non-inverting input of U14. Operational amplifier, U14, is connected as a unity-gain voltage follower. The output of U14 (probe threshold voltage) is connected through pin 1 of P90 and P9 to pin 11 of Data Input connector, J100.

THRESHOLD MONITOR. The threshold monitor voltage indicates the effective reference voltage for the input signals. The output of U14 is connected to the non-inverting input of U942A. Operational amplifier, U942A, is connected as a X5 amplifier. The output of U942A (threshold monitor voltage) is connected to the INPUT THRESHOLD MONITOR output jack.

BNC THRESHOLD. The voltage level, selected by S10, is also connected to the non-inverting input of U15 through divider R14 and R15. Operational amplifier, U15, is connected as a X2 amplifier; however, because of divider R14 and R15, the overall gain from the output of S10 to the output of U15 is 0.5. The output of U15 (BNC threshold voltage) is connected to the INPUTS switch, S15, and to the Time Base circuit as a reference voltage for the EXT CLOCK input.

COMPARATOR DISABLE. The comparator disable voltage is connected, as the reference voltage, to either the BNC Comparators or the Probe Comparators for channels 0, 1, 2, and 3. When INPUTS switch, S15, is set for PROBE inputs, the reference voltage for the BNC Comparators is switched from the BNC threshold voltage to the comparator disable voltage. The comparator disable voltage is more positive than the upper signal limit; therefore, the output of the BNC Comparator is LO. When S15 is set for BNC inputs, the comparator disable voltage is connected to the reference input of the channel 0, 1, 2, and 3 Probe Comparators.

Source Follower

The Source Follower is a high input impedance (1 megohm) buffer between the front panel BNC connector and the BNC Comparator. Transistor, Q22A, is connected as a source follower. Transistor, Q22B, maintains a constant current through Q22A. The CH 0 Dc Balance adjustment, R25, sets the dc offset voltage for the Source Follower to 0 volts.

BNC Comparator

The BNC Comparator, U48A, compares the input signal (data) from the Source Follower with a reference voltage (BNC threshold voltage) from the Threshold Level stage. If the input signal voltage is more positive than the reference voltage, the output of the comparator is HI. If the input signal is less positive than the reference, the output is LO.

Probe Comparators

The Probe Comparators operate the same as the BNC Comparators described above except the reference voltage (probe threshold) is connected to the comparators through the data probe. The outputs of the Probe Comparators are connected to the Memory circuit. The outputs of the channel 0 BNC Comparator and the channel 0 Probe Comparator are tied together as a "wired OR". If either comparator output is HI, the channel 0 output line will be HI.

MEMORY ◈3

Refer to Figure 3-2 for a detailed block diagram of the Memory circuit. The 16 channels are separated into four groups of four channels each. As each of these four groups are identical in operation, only the control stages (Store/Display Clock Gate, Latch Clock, Memory Selector, $\overline{WE}$ and LF Clock and Address Counter) and the first group of memory channels will be discussed.

Store/Display Clock Gate

The display clock inhibit and store clock inhibit signals from the Trigger circuit control the outputs of the Store/Display Clock Gate. When the display clock inhibit (pin 10-U110) signal is HI, the store clock inhibit (pin 7-U110) signal is LO. The HI signal at pin 10 turns U110A off (pins 12 and 14, LO). The LO signal at pin 7 allows the store clock signal to pass, inverted, through U110B. Pins 4 and 14, and pins 3 and 12 are connected together in "wired-OR" configurations. Therefore, if either the outputs of U110A or the outputs of U110B are HI, the output signal lines will be HI. The other

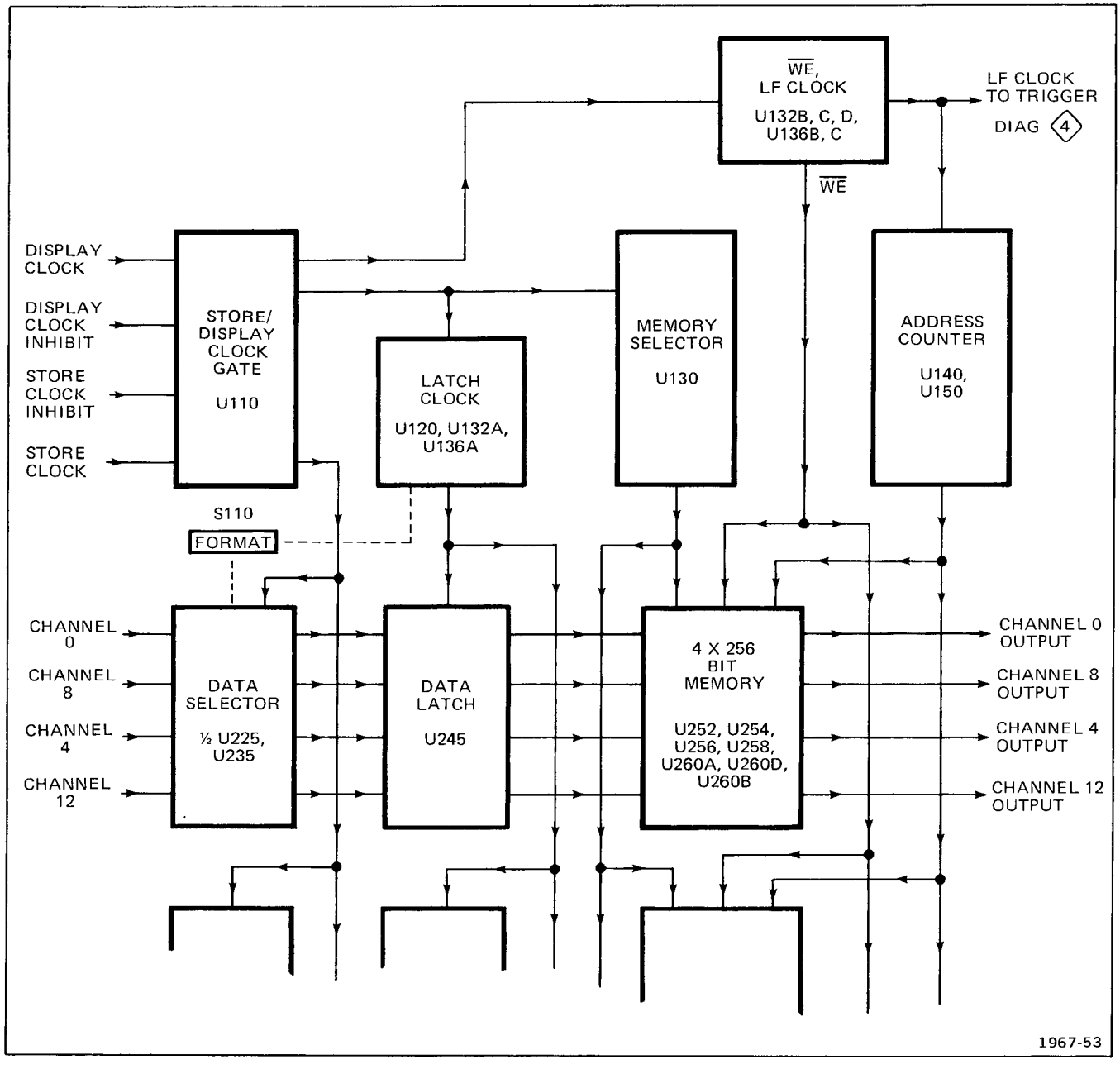


Fig. 3-2. Detailed block diagram of Memory circuit (partial).

output of U110B (pin 2) is not connected to U110A, and is only HI when the store clock and record clock inhibit signals are both LO. Refer to Figure 3-3 for a truth table of the Store/Display Clock Gate.

Latch Clock

The Latch Clock, U120, U132A, and U136A, strobes data into the Data Latch from the Data Selector. The timing of the Latch Clock output depends on the setting of the FORMAT switch.

FOUR CHANNEL. Figure 3-4 shows the timing of the Latch Clock outputs for 4-channel operation. When FORMAT switch, S110, is set for 4-channel operation, pins 12, 11, and 9 of U120 are held HI. When the Q2 output of U120 (also connected to pin 10 function select input) is LO, the next rising edge of the clock transfers the data at the DØ through D3 inputs to the outputs. When the data from the FORMAT switch is transferred to the outputs, the QØ, Q1, and Q2 outputs go HI (the D3 input is open or LO). A HI level at the S1 input (pin 10) sets U120 into the shift left mode. Each rising edge of the clock signal moves the data

at each output of U120 to the next output, until the Q2 output returns to a LO level. This occurs every fourth clock pulse. Gate, U132A, produces a HI output when both the Q3 output of U120 and the clock signal are LO. The output of U132A is connected through U136A to the clock inputs of the Data Latch stages. Buffer, U136A, delays the output of U132A to compensate for propagation delays through the circuitry.

EIGHT CHANNEL. Figure 3-5 shows the timing of the Latch Clock outputs for 8-channel operation. When the FORMAT switch is set for 8-channel operation, pins 12 and 9 (DØ and D2) of U120 are held HI. When the Q2 output of U120 is LO, the rising edge of the next clock pulse transfers the data at the DØ through D3 inputs to the outputs. When the input data is transferred to the outputs, the QØ and Q2 outputs go HI. A HI level at the S1 input (pin 10) sets U120 into the shift left mode. The next rising edge of the clock signal moves the LO level at the Q1 output to the Q2 output. With the S1 input LO, U120 is again ready to transfer data from the inputs to the outputs on the next rising edge of the clock signal. The output of U132A is HI when both the Q3 output of U120 and the clock signal are LO. This occurs every second clock pulse.

SIXTEEN CHANNEL. When the FORMAT switch, S110, is set for 16-channel operation, all of the data inputs of U120 are held LO. With all the outputs of U120 LO, the output of U132A is HI when the clock signal is LO.

Memory Selector

The Memory Selector, U130, enables the output of each memory IC, in sequence, during the display time. When the store clock inhibit signal (pin 10) is HI, U130 operates as a 4-bit shift register. The data from Q2 of U120 is connected to the DL input of U130 (pin 13). Each rising edge of the clock signal at pin 4 shifts the data at the DL input to the QØ output and the data at each output (Qn) to the next output (Qn + 1). A LO level at an output enables the memory ICs driven by that output (e.g., a LO at QØ enables U258, U358, U458, and U558). When the FORMAT switch is set for 4-channel operation, one output at a time is LO (see Figure 3-6). In 8-channel operation, two outputs are

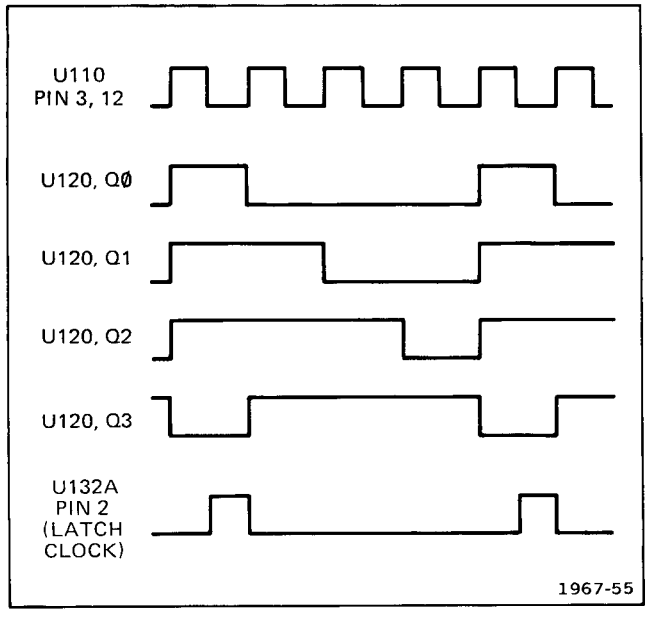


Fig. 3-4. Latch Clock timing for 4-channel operation.

STORE/DISPLAY CLOCK GATE
U110

PIN NUMBER →	INPUTS 11	10	7	5	OUTPUTS 14*	2
	X	HI	LO	HI	LO	LO
	X	HI	LO	LO	HI	HI
	HI	LO	HI	X	LO	LO
	LO	LO	HI	X	HI	LO

* ALSO PINS 12, 3, AND 4
X INDICATES EITHER STATE

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Fig. 3-3. Truth table for Store/Display Clock Gate.

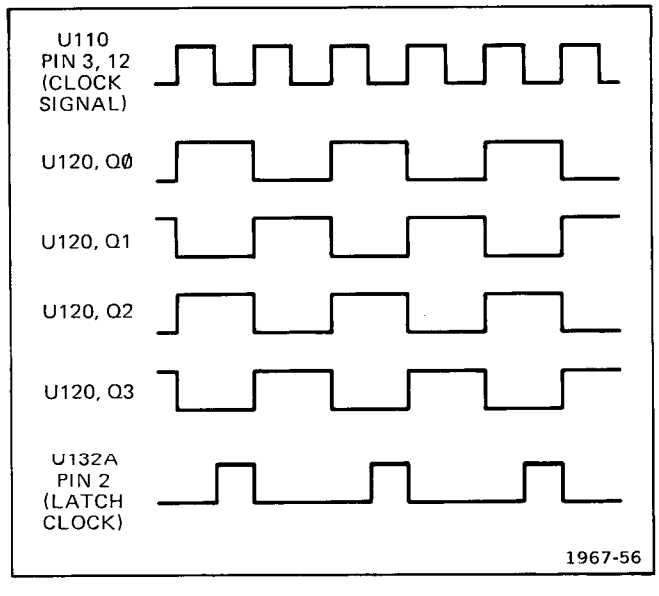

Fig. 3-5. Latch Clock timing for 8-channel operation.

LO at the same time (see Figure 3-7). In 16-channel operation, all four outputs are LO. During the store time, the store clock inhibit signal is LO, and all the outputs of U130 are LO.

$\overline{WE}$ and LF Clock

The $\overline{WE}$ (write enable not) and LF clock signals are the same frequency and polarity; the only difference is that the $\overline{WE}$ signal is only active during the store time (display clock inhibit signal HI).

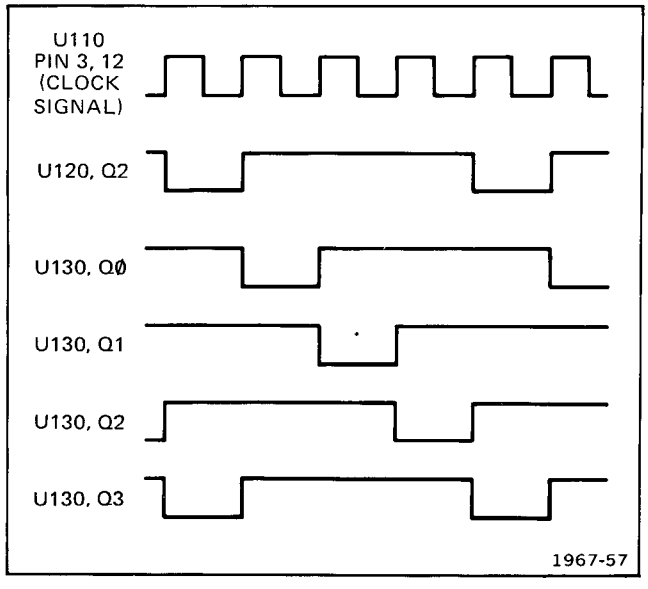

Fig. 3-6. Memory Selector timing for 4-channel operation (display time only).

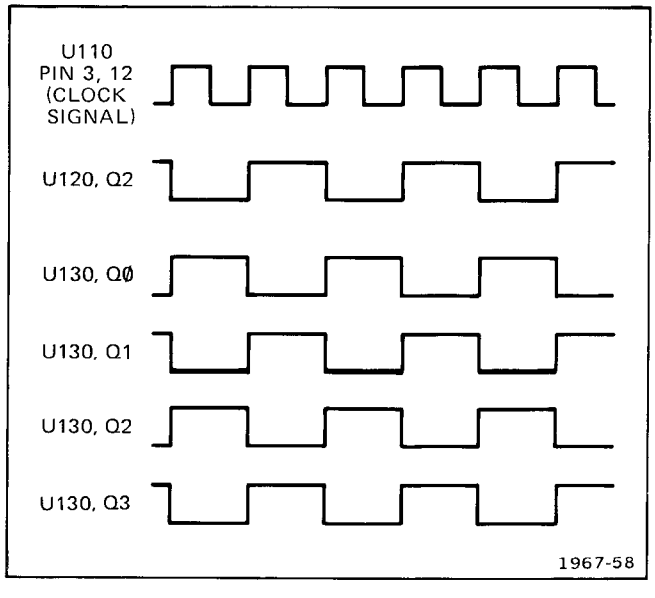

Fig. 3-7. Memory Selector timing for 8-channel operation (display time only).

FOUR CHANNEL. When the FORMAT switch is set for 4-channel operation, pin 7 of U132B and pin 11 of U132C are held HI, driving their outputs LO. The FORMAT switch also allows pin 7 of U136B and pin 14 of U136C to fall to a LO level. When the Q1 output of U120 is HI, the outputs of U136B and U136C are HI. The outputs of U136B, U132C, and U132D and the outputs of U136C and U132B are tied together in "wired-OR" configurations. Therefore, when the outputs of U136B and U136C go HI, the $\overline{WE}$ and LF clock lines go HI, respectively.

EIGHT CHANNEL. When the FORMAT switch is set for 8-channel operation, the WE and LF Clock stage operates the same as in 4-channel operation except that pin 7 of U136B and pin 14 of U136C are held HI. When the Q1 output of U120 is LO, the outputs of U136B and U136C are HI.

SIXTEEN CHANNEL. When the FORMAT switch is set for 16-channel operation, pin 7 of U132B, pin 11 of U132C, pin 7 of U136B, pin 14 of U136C, and the Q1 output of U120 are all LO. With both inputs of U136B and U136C LO, their outputs are LO. With one input of U132B and U132C LO, the $\overline{WE}$ and LF clock lines will be HI when the clock signal (pins 6 and 10) is LO. When the display clock inhibit signal is LO (display mode), the output of U132D is HI, holding the $\overline{WE}$ line HI.

Address Counter

The Address Counter, U140 and U150, selects the memory location where each data bit is stored. The Address Counter is a synchronous 8-bit (÷256) binary counter which is reset to zero at the beginning of each store cycle. The AØ through A7 outputs are connected to each memory IC.

Data Selector

The Data Selector stage selects the channels, and arranges the data to be connected to the memory ICs through the Data Latch. The operation of the Data Selector depends on the setting of the FORMAT switch.

FOUR CHANNEL. When the FORMAT switch is set for 4-channel operation, pin 10 of U235 is held HI. With pin 10 HI, U235 functions as a 4-bit shift register. Channel 0 data connected to pin 13 of U235 is shifted to the QØ output on the first rising edge of the clock signal at pin 4. The data at pin 13 moves through the shift register until the first data bit is at the Q3 output (four clock pulses). The shift register then has four data bits stored in sequence, ready to be read into the Data Latch. In 4-channel operation, U225 is not used.

EIGHT CHANNEL. When the FORMAT switch is set for 8-channel operation, pin 10 of U235 is LO and pin 9 of U225 is HI. With pin 10 held LO, U235 functions as a 4-bit latch. The channel 0 data connected to pin 12 of U235 is transferred to the QØ output at pin 14 on the first rising edge of the clock signal at pin 4. The level at the QØ output

is connected back to the D1 input at pin 11 through pins 6 and 1 of U225. The next rising edge of the clock signal transfers the level at the DØ input to the QØ output, and the level that had been at the QØ output to the Q1 output. The same operations occur with the channel 4 data at pin 9 of U235, resulting in two bits of channel 0 data (QØ and Q1 outputs) and two bits of channel 4 data (Q2 and Q3 outputs) stored in sequence, ready to be read into the Data Latch.

SIXTEEN CHANNEL. When the FORMAT switch is set for 16-channel operation, pin 9 of U225 and pin 10 of U235 are both LO. With pin 10 held LO, U235 functions as a 4-bit latch. With pin 9 of U225 held LO, the data from channel 8 and channel 12 is connected through pins 5 and 3 of U225 to the D1 and D3 inputs of U235, respectively. Each rising edge of the clock signal transfers the data at the inputs of U235 to its outputs.

Data Latch

The Data Latch stage transfers the data from the outputs of the Data Selector to the inputs of the 4 x 256 Bit Memory on the rising edge of the latch clock signal (pin 4).

4 X 256 Bit Memory

The 4 x 256 Bit Memory consists of four RAMs (random access memories) and three gates. The RAMs, U252, U254, U256, and U258, are 256-bit memory units which can store one, two, or four channels of data, depending on how the data is presented by the Data Selector. If the FORMAT switch is set for 4-channel operation, the 4 x 256 Bit Memory stores 1024 bits of data from channel 0. When set for 8-channel operation, the 4 x 256 Bit Memory stores 512 bits of data from channel 0 and 512 bits of data from channel 4. When set for 16-channel operation, the 4 x 256 Bit Memory stores 256 bits each from channels 0, 4, 8, and 12. The memory location where each bit of data is stored is controlled by the Address Counter.

In the display mode, a LO level on pin 5 enables the Q output of each memory IC in sequence. The outputs of the memory ICs are combined by AND-gates U260A, U260D, and U260B, as controlled by the FORMAT switch. In 4-channel operation, pin 5 of U260A, pin 12 of U260D, and pin 6 of U260B are HI. Therefore, the data from all four Q outputs are connected to the channel 0 data output line (J120, pin 13). In 8-channel operation, pins 5 and 6 (U260A and U260B) are HI. With pins 5 and 6 of U260 HI, the outputs of U252 and U254 are connected to pin 13 of J120 and the outputs of U256 and U258 are connected to pin 4 of J120 (channel 4 data output line). In 16-channel operation, pins 5, 12, and 6 of U260 are all LO; therefore, the data at the output of U252 is connected to the channel 0 data output line, the output of U254 is connected to the channel 8 data output line, etc.

TRIGGER ◇4

Refer to Figure 3-8 for a detailed block diagram of the Trigger circuit.

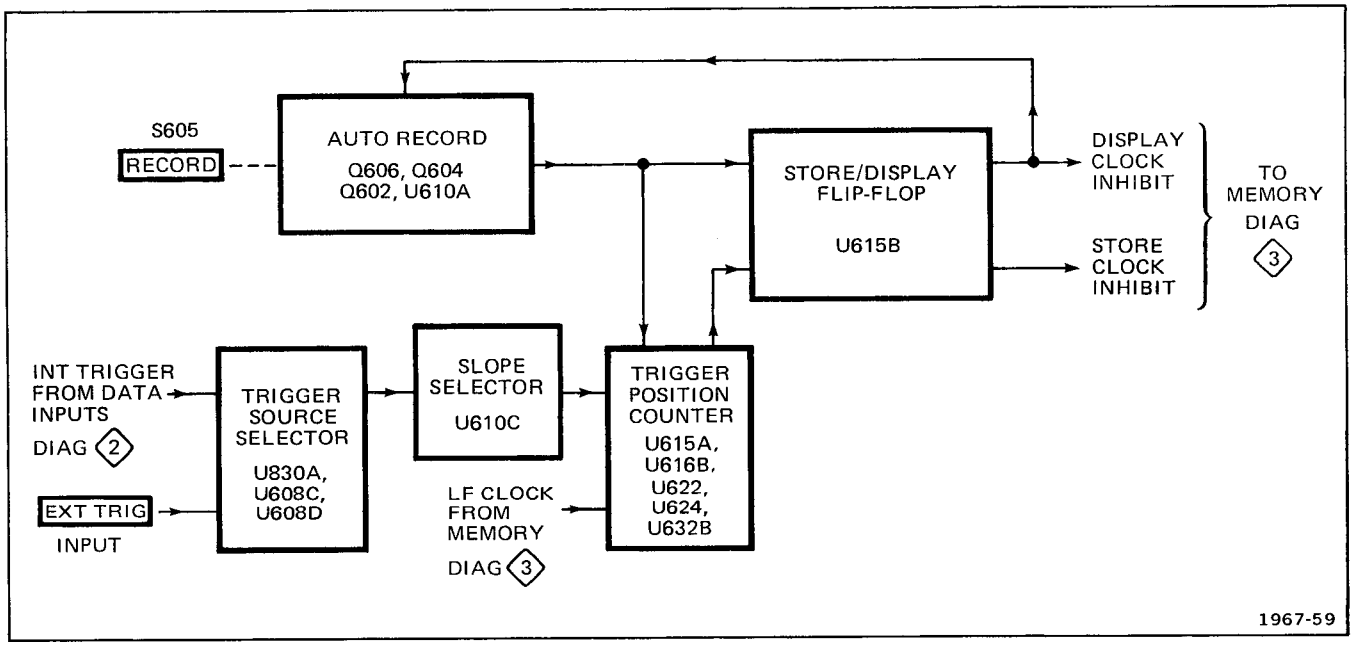

Fig. 3-8. Detailed block diagram of Trigger circuit.

Auto Record

The Auto Record stage controls the time that a display is presented before the Memory returns to the store mode. The display time is set by the DISPLAY TIME control, R605. Capacitor, C606, charges through R604 and R605. After approximately one time constant, Q606 conducts, discharging C606 and pulling pin 4 of U610A LO. When pin 4 of U610A is LO, pin 2 is LO and pin 3 is HI. The HI at pin 3 resets the $\overline{Q}$ output (pin 14) of the Store/Display Flip-Flop, U615B, to a HI level. Pin 14 of U615B is connected to the emitter of Q602. A HI at the emitter of Q602 causes Q602 and Q604 to conduct, disabling the timing circuit for Q606. Therefore, Q606 only operates when the memory is in the display mode (pin 14 of U615B LO). A HI level pulse at pin 3 of U610A can also be obtained by pressing the MANUAL push button, S605A. NOR gates, U608A and B, are connected as a set-reset flip-flop to prevent any contact bounce in S605A from being coupled to the rest of the circuitry. When S605A is pressed, pin 5 of U608A goes LO and pin 7 of U608B goes HI. The resultant LO on pin 3 of U608B is connected to pin 5 of U610A, producing a HI level pulse at pin 3.

Trigger Source Selector

The Trigger Source Selector allows triggering the Logic Analyzer from either the channel 0 data signal or an external signal applied to the EXT TRIG input connector. The EXT TRIG input is intended for TTL signals (the threshold voltage is fixed at approximately +1.4 volts); however, other signal sources of appropriate amplitude may be used. Comparator, U830A, converts the signal at the EXT TRIG input to the ECL signal level used in the Logic Analyzer. If the input signal is more positive than the threshold voltage, the output of the comparator (pin 2) is HI.

The trigger source is selected by SOURCE switch, S608. When the SOURCE switch is set to EXT (button in), a HI level is connected to one input (pin 10) of NOR-gate, U608C. With one input HI, the output of U608C is held LO. At the same time, pin 13 of U608D is LO. With one input LO, U608D inverts the signal from U830A. The outputs of U608C and D are tied together in a "wired-OR" configuration, and connected to one input of exclusive-OR gate, U610C.

Slope Selector

The Slope Selector stage allows the Logic Analyzer to be triggered on either the rising or falling edge of the trigger signal. Exclusive-OR gate, U610C, operates as either an inverting or a non-inverting gate, determined by the setting of SLOPE switch, S610. With S610 closed (+), a HI level is applied to pin 14 of U610C, causing U610C to invert the signal at pin 15. (The trigger signal is inverted by the Trigger Source Selector; therefore, another inversion in the Slope Selector returns the trigger signal to its original state.) With S610 open (—), pin 14 of U610C drops to a LO level, coupling the signal from the Trigger Source Selector to pin 6 of U615A without inverting it.

Trigger Position Counter

The Trigger Position Counter determines the relative position of the triggering event on the display by providing a delay between the triggering event and the time that the Memory stops storing data and switches to the display mode. Flip-flops, U615A and U616B, control the operating modes of counters, U622 and U624. On the rising edge of the trigger signal at pin 6 of U615A, the Q output (pin 2) goes HI. The Q output of U615A is connected to the D input of U616B. The next rising edge of the LF clock signal (pin 11) sets the Q output of U616B HI. The Q output of U616B is connected to the S2 inputs of U622 and U624. With the S1 inputs (pin 9) held LO, the S2 inputs control the function of U622 and U624. When the S2 inputs are LO (before trigger), U622 and U624 load the data at their DØ through D3 inputs to their respective outputs. When the S2 inputs go HI, U622 and U624 start counting LF clock pulses (pin 13). The outputs of U622 and U624 are tied together in a "wired-OR" configuration. The output line at pin 7 of U632B is HI if any of the U622-U624 outputs are HI. When all outputs are LO, pin 7 of U632B is LO. When pin 7 and the LF clock signal are both LO, the output of U632B (frame clock) is HI.

Store/Display Flip-Flop

The Store/Display Flip-Flop, U615B, controls the mode of the Memory circuit. The rising edge of the frame clock signal at pin 11 sets the Q output of U615B HI, and the $\overline{Q}$ output LO. This switches the Memory from the store mode to the display mode.

TIME BASE ⑤

The Time Base circuit generates the store clock and display clock signals. The Time Base circuitry consists of a 100 MHz Oscillator, a series of counters with divide-by-two and divide-by-five outputs, data selectors, and an external clock input. The 100 MHz Oscillator is controlled by crystal Y800. The output of the 100 MHz Oscillator is connected to data selector, U820, and to the input of divide-by-two and divide-by-five counter U810. The store clock signal is selected from the outputs of the frequency-divider counters by the data selectors. The SAMPLE INTERVAL switch sets the "address" of the desired counter output. The display clock signal is taken from the QØ (2 μs) output of counter U814. The external clock input circuitry allows use of an external clock source for the store clock signal, the display clock signal, or both. The jumper at the outputs of U830B allow polarity selection for the external clock signal.

SERIAL LOGIC AND VERTICAL SIGNAL OUTPUTS ◇6

The Serial Logic and Vertical Signal Outputs circuit provides the parallel-to-serial conversion and channel offset required to display the stored data on an oscilloscope or monitor. Figure 3-9 shows a detailed block diagram of this circuit.

Channel Counter

The Channel Counter, U630, U632A, and U632D, determines the data channel to be coupled through the Parallel-to-Serial Converter to the Vertical Output Amplifier. The Channel Counter also controls the Channel Offset stage and enables the Channel Position Selector. Four-bit counter, U630, counts frame clock pulses from the Trigger circuit. The output of the Channel Counter depends on the format selected by the FORMAT switch. When set for 4-channel operation, pin 12 of U632D and pin 4 of U632A are both HI. A HI level on pin 12 of U632D drives pin 9 HI and pin 15 LO. The HI level on pin 4 of U632A drives pin 2 LO. When set for 8-channel operation, only pin 12 of U632D is HI, holding pin 9 HI and pin 15 LO. The Q2 output of U630 is inverted by U632A. When set for 16-channel operation, pin 12 of U632D and pin 4 of U632A are both LO. The Q2 output of U630 is inverted by U632A. The Q3 output is coupled through U632D to pin 9 and is inverted at pin 15.

Parallel-to-Serial Converter

The Parallel-to-Serial Converter, U270 and U570, is actually a 16-channel data selector. The data channel to be connected to the Q output (pin 15) is determined by the binary count on the address (pins 7, 9, and 10) and enable not ($\overline{EN}$) lines. Refer to Figure 3-10 for the relationship between the binary count on U630 and the data channel selected by the Parallel-to-Serial Converter.

Channel Position Selector

The Channel Position Selector allows variable offset for one channel for easier comparison of displayed data between channels. The CHANNEL/POSITION SELECT switch (S565) sets the binary code of the desired channel number on the switched inputs (pins 5, 13, 6, and 11) of U565. The other inputs (pins 4, 12, 7, and 10) are connected to the address lines from the Channel Counter. When the data on the address lines match the data from the CHANNEL/POSITION SELECT switch, the output of U565 goes LO. The LO level at the output of U565 disables the Channel Offset stage and turns Q684 off. With Q684 off, the current from the CHANNEL POSITION control, R565, flows through Q680 and Q682 to the Vertical Output Amplifier. When the inputs to U565 do not match, or if the CHANNEL/POSITION SELECT switch is set to OFF, the output of U565 is held HI, enabling the Channel Offset stage and turning on Q684

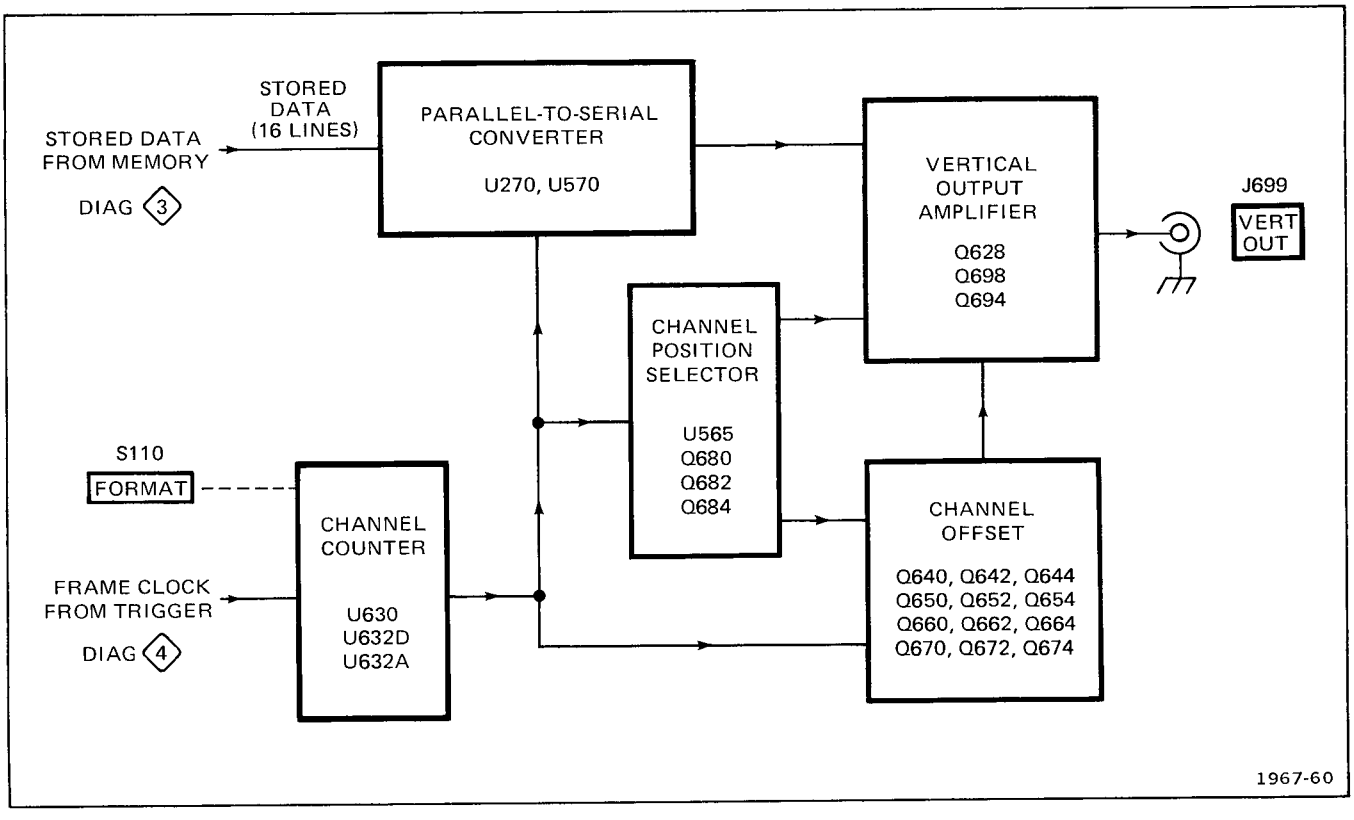

Fig. 3-9. Detailed block diagram of Serial Logic and Vertical Signal Outputs circuit.

and turning off Q682, disconnecting the CHANNEL POSITION control from the Vertical Output Amplifier.

Channel Offset

The Channel Offset stage provides the vertical offset for each channel of data displayed on the crt of the monitor or oscilloscope. The amount of offset is determined by the binary count at the output of the Channel Counter. Each of the four output lines control one of the Channel Offset comparators (e.g., pin 15 of U632D controls comparator Q672, Q674). Each comparator applies a current, determined by its current setting resistor (e.g., R670 sets the current for comparator Q672, Q674), to the Vertical Output Amplifier. The total offset is determined by the number of comparators conducting current to the Vertical Output Amplifier and the amount of current each comparator is conducting.

Vertical Output Amplifier

The Vertical Output Amplifier, Q628, Q698, and Q694, combines the data and offset signals and drives the vertical deflection circuitry of the display monitor or oscilloscope.

Transistor, Q628, inverts and attenuates the output from the Parallel-to-Serial Converter (the gain of Q628 is approximately R628 divided by R627). Current from the Channel Position Selector or the Channel Offset is added, in R628, to the current through Q628 to change the dc level for each channel.

BINARY COUNT (U630)				CHANNEL DISPLAYED		
Q0	Q1	Q2	Q3	4 CH	8 CH	16 CH
0	0	0	0	0	4	8
1	0	0	0	1	5	9
0	1	0	0	2	6	10
1	1	0	0	3	7	11
0	0	1	0	0	0	12
1	0	1	0	1	1	13
0	1	1	0	2	2	14
1	1	1	0	3	3	15
0	0	0	1	0	4	0
1	0	0	1	1	5	1
0	1	0	1	2	6	2
1	1	0	1	3	7	3
0	0	1	1	0	0	4
1	0	1	1	1	1	5
0	1	1	1	2	2	6
1	1	1	1	3	3	7

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Fig. 3-10. Binary count on U630 versus channel displayed.

The combined data and offset signal is applied across R698 by Q698. The load resistance which the collector of Q698 works into can be varied by MAG control, R695, from approximately 100 ohms to approximately 500 ohms, resulting in an approximate gain range of X1 to X5. Additional offset current is added by Q694 to position the display on the crt of the display monitor or oscilloscope.

HORIZONTAL AND BLANKING SIGNAL OUTPUTS ⑦

The Horizontal and Blanking Signal Outputs circuit generate the X-axis (sweep) and Z-axis (blanking) signals needed to produce a display on the crt of a display monitor or oscilloscope. Also shown on this schematic diagram is the Invalid Mode Indicator circuitry.

Sweep Generator

When the frame clock signal from the Trigger circuit goes HI, the collector of Q728 goes LO, turns on Q732, and discharges sweep timing capacitor C732. When Q732 stops conducting, C732 starts to charge, producing a negative-going ramp. The rate of charge is determined by the current flowing through Q716, which is set by FORMAT switch S110. If S110 is set for 4-channel operation, Q712 and Q714 are both turned off; therefore, the emitter current for Q716 must flow through R715, R714, and R717. If S110 is set for 8-channel operation, Q714 turns on, shorting out R715. In 16-channel operation, Q712 also turns on. The negative-going ramp is inverted by Q738 and Q740. The amplitude of the ramp signal at the HORIZ OUT connector is determined by the MAG control, R745. The horizontal position of the display on the crt can be varied by adding a dc offset current to the ramp signal through Q734, Q736, and the POS control, R740.

Blanking

The Blanking stage provides retrace blanking, store blanking, and "bad data" blanking for the display.

RETRACE BLANKING. Retrace blanking occurs when the frame clock pulse from the Trigger circuit goes HI. The frame clock pulse is connected to pin 11 of U632C. A HI level pulse on pin 11 drives pin 14 of U632C LO. If S720 is set to $\overline{Z}$, the LO level pulse from pin 14 of U632C is connected to the bases of Q718 and Q720, and a HI level reference is connected to the emitters of Q718 and Q720. When the base of Q720 goes LO, Q720 conducts, turning on Q724 and pulling the BLANK OUT output level to about −4.5 volts. If S720 is set to Z, pin 14 of U632C is connected to the emitters of Q718 and Q720, and the HI level reference is connected to the bases. When the emitters go LO, Q718 conducts and turns on Q722, pulling the BLANK OUT output level to approximately +5 volts.

STORE BLANKING. While the Memory is storing new data, no useful information is available for display; therefore, the display is blanked during this time. The display clock inhibit signal (U616A, pin 5) is HI during the store time. A HI level at pin 5 sets the Q output (pin 2) HI. Pin 5 of U616A is connected to one input of U632C. (When either input of U632C is HI, the display is blanked.) The Q output of U616A remains HI until the next frame clock pulse after the memory has returned to the display mode. This allows time for the sweep generator to stabilize and reset before the display is presented on the display monitor or oscilloscope.

"BAD DATA" BLANKING. "Bad data" blanking occurs if the LA 501 is triggered and the Memory switches from the store mode to the display mode before a complete store cycle has occurred. (For example, if the FORMAT switch is set to CH 0-3 X1024, and only 1000 bits of new data were stored before the Memory switched to the display mode, the other 24 bits of stored data on each channel would be left over from the previous store cycle. These 24 bits of "bad data" will be blanked out on the display.)

The $\overline{Q}$ output (pin 3) of U628 is set LO at the beginning of the store cycle. Normally, the address count carry signal at pin 9 causes the Q output to go HI, indicating a complete store cycle has occurred and all stored data is "good data". However, if this does not occur, pin 3 remains LO during the display time. With pin 3 LO, the Q output (pin 15) is set HI by the frame clock signal (pin 12) which blanks the display until the address count carry signal switches the Q output (pin 15) LO.

The Q output (pin 15) of U628 is connected to the Q output (pin 2) of U616A. If either Q output is HI, pin 10 of U632C is HI resulting in a blanked display.

Invalid Mode Indicator

The Invalid Mode Indicator causes the light bulb behind the SAMPLE INTERVAL switch to blink on and off if the switch is set to a position which exceeds the maximum operating speed of the Memory circuit. This occurs when the SAMPLE INTERVAL switch is set to 10 ns or 20 ns during 16-channel operation, or is set to 10 ns during 8-channel operation. Either of these switch combinations cause astable multivibrator, Q702 and Q704, to oscillate. Transistor, Q708, is driven by the output at the collector of Q704. When the base of Q708 goes LO, light bulb, DS708, turns off.

POWER SUPPLIES ◈8

The Power Supplies use the unregulated ac and dc voltages provided by the TM 500-series power module. The TM 500-series power module provides two 25 volt (rms) power transformer windings, unregulated positive and negative 33.5 volt dc supplies, and an unregulated +11.5 volt dc supply. The power module also contains two power transistors, one NPN and one PNP, for each plug-in unit. These transistors are used as the series-pass transistors for the +5.1-Volt and −2-Volt supplies.

+5.1-Volt Supply

The +5.1-Volt Supply consists of U942B, Q944, and the PNP power transistor in the power module. Operational amplifier, U942B, compares the output voltage at pin 6 with the +5.1 volt reference at pin 5. If the output voltage is higher than the reference, Q944 and the power transistor conduct less, allowing the output voltage to drop. If the output is lower than the reference, Q944 and the power transistor conduct more, pulling the output voltage higher.

−4.8-Volt Supply

The −4.8-Volt Supply is derived from the 25 volt ac windings. The 25 volts ac supplied by the power module is rectified and filtered by CR904, C904, L905, and C905. The resultant dc source is converted by a switching regulator to −4.8 volts. Zener diode, VR922, and transistor, Q922, maintain a constant current through VR920. The reference voltage at the wiper of R925 is connected to the base of Q914. Transistors, Q914 and Q916, compare the output voltage with the reference. If the output voltage is more negative than the reference, Q916 turns on and Q914, Q910, and Q905 turn off. With Q905 cut off, CR905 conducts to discharge T911 and pull the output voltage positive. The positive transition at the collector of Q905 is coupled through C911, R912, C927, and R927 to the base of Q928. The positive transition saturates Q928, resulting in a very fast turn off time for Q905. When the output voltage becomes less negative than the reference, Q916 turns off and Q914, Q910, and Q905 turn on. With Q905 saturated, its collector switches to the dc supply at its emitter, pulling the output negative. The waveform at the collector of Q905 is filtered by T911 and C912 before being compared to the reference voltage. Zener diode, VR932, and SCR, Q932, provide over-voltage protection for the ICs connected to this supply. If the output voltage exceeds about −6.2 volts, Q932 switches on, shorting out the −4.8-Volt Supply and blowing fuse F905.

−2-Volt Supply

The −2-Volt Supply is derived from the −4.8-Volt Supply. The reference voltage for the −2-Volt Supply is provided by U800A. Transistor, Q934, compares the output voltage to the reference. (The emitter-base voltage drop of Q934 is added to the voltage at pin 2 of U800A, resulting in an output voltage approximately 0.6 volts more negative than the voltage at pin 2.) If the output voltage is too positive, Q934 conducts less and Q936 and the NPN power transistor conduct more, pulling the output voltage negative.

MAINTENANCE

This section of the manual contains information for performing preventive maintenance, troubleshooting, and corrective maintenance for the LA 501.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. Preventive maintenance performed on a regular basis may prevent instrument breakdown and will improve the reliability of the instrument. The severity of the environment to which the LA 501 is subjected determines the frequency of maintenance. A convenient time to perform preventive maintenance is preceding adjustment of the instrument.

CLEANING

The LA 501 should be cleaned as often as operating conditions require. Accumulation of dirt on components acts as an insulating blanket and prevents efficient heat dissipation which can cause overheating and component breakdown.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. In particular, avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Exterior

Loose dust accumulated on the front panel can be removed with a soft cloth or small brush. Dirt that remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

Interior

Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low-pressure air.

Remove any dirt which remains with a soft brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces.

VISUAL INSPECTION

The LA 501 should be inspected occasionally for such defects as broken connections, improperly seated semiconductors, damaged circuit boards, and heat-damaged parts.

The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.

LUBRICATION

Generally, there are no components in the LA 501 that will require lubrication during the life of the instrument.

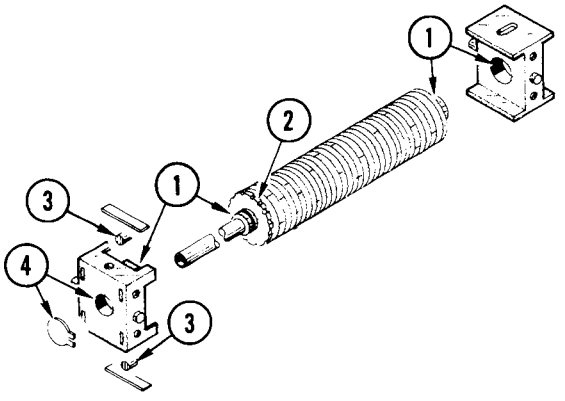
Slide Switches

These switches are lubricated prior to leaving the factory and should not require further lubrication. However, if they become electrically noisy, cleaning and lubricating with Electronic Chemical Corporation No Noise® may solve the problem.

Cam Switches

In most cases, the factory lubrication of these switches should be adequate for the life of the instrument. The switch contacts are designed to operate dry for the life of the switch.

If the switch has been disassembled for replacement of switch sub-parts, a lubrication kit containing the necessary lubricating materials and instructions is available through any Tektronix Field Office. Order Tektronix Part 003-0342-01. General Electric Versilube® silicone grease may be applied sparingly so that the lubricant does not get on the contacts. Refer to Figure 4-1 for lubrication instructions.



(1) Apply lubricant to the drum journals and mating surface in the mounting bearings.

(2) Apply lubricant to the wear surface of the index wheel.

(3) Apply lubricant to the index roller and roller guide in the front bearing. A thin film should be applied to the inner face of the detent springs if more than one spring is replaced.

(4) Ensure that some lubricant is present at the interface between the bearing and retainer clip.

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Figure 4-1. Lubrication procedure for a typical cam switch.

Push-Button Switches

Modular push-button switches are self lubricating. Switch contacts and pads are designed to operate dry for the life of the switch. However, as the switches are not sealed, dust attracted to the contact area may cause switch contacts to become electrically noisy. Cleaning may be accomplished by flushing the contact area with isopropyl alcohol or kelite (1 part kelite to 20 parts water). Do not use chemical cleaning agents that leave a film or that might damage plastic parts.

Should it become necessary to remove a switch for replacement or cleaning, refer to Component Removal and Replacement in this section.

SEMICONDUCTOR CHECKS

Periodic checks of the semiconductors in the LA 501 are not recommended. The best check of semiconductor performance is actual operation in the instrument. More details on checking semiconductor operation are given under troubleshooting.

ADJUSTMENT AFTER REPAIR

After any electrical component has been replaced, the adjustment of that particular circuit should be checked, as well as the adjustment of other closely related circuits. The Performance Check and Adjustment procedure in this manual provides a quick and convenient means of checking instrument operation. In some cases, minor troubles may be revealed or corrected by adjustment.

TROUBLESHOOTING

The following information is provided to help troubleshoot the LA 501. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles, particularly where integrated circuits are used.

TROUBLESHOOTING EQUIPMENT

The following equipment, in addition to that listed in the Performance Check and Adjustment section, is useful for troubleshooting the LA 501 Logic Analyzer unit.

Transistor Tester

Description: Dynamic-type tester.

Purpose: Test semiconductors.

Recommended Tektronix types: 576 Curve Tracer, 577/177 Curve Tracer system, 7CT1N Curve Tracer unit and a 7000-series oscilloscope system, or a 5CT1N Curve Tracer unit and a 5000-series oscilloscope.

Multimeter

Description: Voltmeter, 10 megohm input impedance and a range from 0 to at least 50 volts dc; accuracy, within 0.1%. Ohmmeter, 0 to 20 megohms. Test probes should be insulated to prevent accidental shorting.

Purpose: Check voltage and resistance.

Test Oscilloscope

Description: Frequency response, dc to 100 megahertz minimum; deflection factor, 5 millivolts to 5 volts/division. A 10X, 10 megohm voltage probe should be used to reduce circuit loading.

Purpose: Check operating waveforms.

Variable Autotransformer

Description: Output variable from 0 to 140 volts, 2 amperes minimum rating. Must have three-wire power cord, plug, and receptacle.

Purpose: Vary input line voltage when troubleshooting in the power supply.

TROUBLESHOOTING TECHNIQUES

This troubleshooting procedure is arranged to check the simple trouble possibilities before proceeding with extensive troubleshooting. The first few checks ensure proper connection, operation, and adjustment. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, it should be replaced using the replacement procedure given under Corrective Maintenance.

1. CHECK CONTROL SETTINGS. Incorrect control settings can indicate a trouble that does not exist. If there is any question about the control function or operation of any control, see the Operating Instructions section.

2. CHECK ASSOCIATED EQUIPMENT. Before proceeding with troubleshooting of the LA 501, check that the equipment used with this instrument is operating correctly. Check that the signal is properly connected and that the interconnecting cables are not defective. Also, check the power source. If the trouble persists, the LA 501 is probably at fault.

3. VISUAL CHECK. Visually check the portion of the instrument in which the trouble is located. Many troubles can be located by visible indications such as unsoldered connections, broken wires, damaged circuit boards, damaged components, etc.

4. CHECK INSTRUMENT ADJUSTMENT. Check the adjustment of this instrument, or the affected circuit if the trouble appears in one circuit. The apparent trouble may only be a result of misadjustment. Complete adjustment instructions are given in the Performance Check and Adjustment section.

5. ISOLATE TROUBLE TO A CIRCUIT. To isolate trouble to a circuit, note the trouble symptom. The symptom often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by taking voltage and waveform readings. Also check for the correct output signals at the front-panel output connectors with a test oscilloscope. Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct voltages of the individual supplies. However, a defective component elsewhere in the instrument can appear as a power-supply trouble and may also affect the operation of other circuits.

6. CHECK VOLTAGES AND WAVEFORMS. Often the defective component can be located by checking for the correct voltage or waveform in the circuit. Refer to the diagrams section for correct voltages and waveforms.

Power Supply. If incorrect operation of the power supply is suspected, first check that the power-module line selector block is in the M position (99 V AC to 121 V AC). Then, connect the power module to a variable autotransformer. Adjust the autotransformer output for 110 V AC. Load the power supply as follows:

A. Set SAMPLE INTERVAL switch to 10 nanoseconds.

B. Push the INPUT ECL button in for ECL logic.

C. Press the RECORD MANUAL button to reset the trigger circuit.

D. Push the SLOPE button to generate a trigger (TRIG'D indicator should light).

NOTE

Input signals are not required for this test.

Use a dc voltmeter with 0.1% accuracy to check each supply voltage, and check ripple with a test oscilloscope. Voltages are measured between the power supply test points and chassis ground. Power supply test points are shown on the Adjustment and Test Point Locations pullout at the rear of this manual. Vary the autotransformer output from 99 volts ac to 121 volts ac and check that each power supply is within the tolerances given in Table 4-1.

TABLE 4-1
Power Supply Tolerances[1]

Power Supply	Test Point	Output Voltage Range	Maximum Ripple Peak-to-Peak
−4.8 V	TP 933	−4.757 to −4.872	50 mV low freq. 50 mV high freq.
+5.1 V	U942 Pin 6	+4.845 to +5.355	10 mV low freq. 50 mV high freq.

[1] **Checked under full load (refer to text).**

If a power supply is within the tolerance in Table 4-1, the supply can be assumed to be working correctly. If outside the given tolerance, the supply may be misadjusted or operating incorrectly. Use the procedure given in the Performance Check and Adjustment section to adjust the power supply voltage.

7. CHECK INDIVIDUAL COMPONENTS. The following procedures describe methods of checking individual components in the LA 501. Two-lead components that are soldered in place are best checked by first disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.

CAUTION

To avoid component damage, disconnect the power source before removing or replacing semiconductors.

Semiconductors. A good check of transistor operation is actual performance under operating conditions. A transistor can be most effectively checked by substituting a new component or one that has been checked previously. However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions.

IC's (integrated circuits) can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of circuit operation is desirable when troubleshooting circuits using IC's. Use care when checking voltages and waveforms around the IC's so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the 14- and 16-pin IC's is with an IC test clip. This device also serves as an extraction tool. The lead configuration for the semiconductors used in this instrument are shown on a pullout page in the front of the diagrams section.

Diodes. A diode can be checked for an open or shorted condition by measuring the resistance between terminals with an ohmmeter scale having a low internal source current, such as the R X 1K scale. The resistance should be very high in one direction and very low when the meter leads are reversed.

CAUTION

Do not use an ohmmeter scale that has a high internal current. High currents may damage the diode.

The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot. The cathode and anode ends of metal-encased diodes are identified by the diode symbol marked on the case. For most silicon or germanium diodes with a series of stripes, the color code identifies the four significant digits of the JEDEC or vendor number using the resistor color-code system (e.g., a diode color-coded yellow-brown-green-red indicates a 1N-4152 diode).

Resistors. Check the resistors with an ohmmeter. See the Replaceable Electrical Parts list for the tolerance of the resistors used in this instrument. Resistors normally do not need to be replaced unless the measured value varies widely from that specified.

Inductors. Check for open inductors by checking continuity with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit. Partial shorting often reduces high-frequency response (roll off).

Capacitors. A leaky or shorted capacitor can usually be detected by checking resistance with an ohmmeter on the highest scale. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacitance meter or by checking if the capacitor passes ac signals.

8. REPAIR AND ADJUSTMENT. If any defective parts are located, follow the replacement procedures given in Corrective Maintenance. Be sure to check the performance of any circuit that has been repaired or had any electrical components replaced.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in this instrument are given here.

OBTAINING REPLACEMENT PARTS

All electrical and mechanical part replacements for the LA 501 can be obtained through your Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description.

NOTE

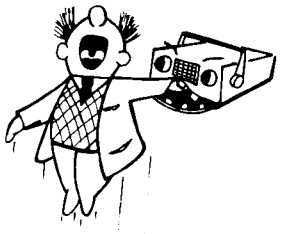
When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance in the instrument, particularly at high frequencies. All parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.

Some parts are manufactured or selected by Tektronix, Inc. to satisfy particular requirements, or are manufactured for Tektronix, Inc. to our specifications. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. To determine the manufacturer of parts, refer to parts list, Cross Index Mfr. Code Number to Manufacturer.

When ordering replacement parts from Tektronix, Inc., include the following information:

1. Instrument type.
2. Instrument serial number.
3. A description of the part (if electrical, include circuit number).
4. Tektronix part number.

SOLDERING TECHNIQUES



WARNING

To avoid electrical shock, disconnect the instrument from the power source before soldering.

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used when repairing or replacing parts. General soldering techniques, which apply to maintenance of any precision electronic equipment, should be used when working on this instrument. Use only 60/40 rosin-core, electronic-grade solder. The choice of soldering iron is determined by the repair to be made. When soldering on circuit boards, use a 15- to 40-watt pencil-type soldering iron with a 1/8-inch wide, wedge-shaped tip. Keep the tip properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the wiring from the base material. Avoid excessive heat; apply only enough heat to remove the component or to make a good solder joint. Also, apply only enough solder to make a firm solder joint; do not apply too much solder.

CAUTION

The Memory and Output circuit boards in this instrument are multilayer type boards with a conductive path(s) laminated between the top and bottom board layers. All soldering on these boards should be done with extreme care to prevent breaking the connections to the center conductor(s); only experienced maintenance personnel should attempt repair of these boards.

For metal terminals, (e.g., switch terminals, potentiometers, etc.) a higher wattage-rating soldering iron may be required. Match the soldering iron to the work being done. For example, if the component is connected to the chassis or other large heat-radiating surface, it will require a 75-watt or larger soldering iron.

The following technique should be used to replace a component on a circuit board:

1. Grip the component lead with long-nose pliers. Touch the soldering iron to the lead at the solder connection. Do not lay the iron directly on the board, as it may damage the board.

2. When the solder begins to melt, gently pull the lead out. If unable to pull the lead without using force, try removing the other end of the component as it may be more easily removed.

NOTE

The reason that some component leads seem troublesome to remove is due to a bend placed on each lead during machine insertion of the component in the manufacturing process. The purpose of the bent leads is to hold the component in place during a flow-soldering manufacturing process that solders all components at one time.

If a component lead is extremely difficult to remove, it may be helpful to straighten the leads on the back side of the board with a small screwdriver or pliers while heating the soldered connection.

Desolder the component from the circuit board using heat on the component lead so that the solder will stay behind on the board. If it is desired to remove solder from a circuit-board hole for easier installation of a new component, a solder-removing wick should be used for this purpose.

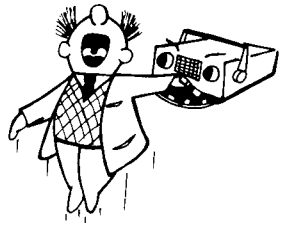
3. Bend the leads of the new component to fit the holes in the board. If the component is replaced while the board is mounted in the instrument, cut the leads so they will just protrude through the board. Insert the leads into the holes in the board so the component is firmly seated against the board (or as positioned originally). If it does not seat properly, heat the solder and gently press the component into place.

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint. To protect heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clip the excess lead that protrudes through the board (if not clipped in step 3).

6. Clean the area around the solder connection with a flux-remover solvent. Be careful not to remove information printed on the board.

COMPONENT REMOVAL AND REPLACEMENT



WARNING

To avoid electrical shock, disconnect the instrument from the power source before replacing components.

The exploded-view drawing associated with the Replaceable Mechanical Parts list may be helpful in the removal or disassembly of individual components or subassemblies. Component locations and circuit board locations are shown in the Diagrams section.

Circuit Boards

If a circuit board is damaged beyond repair, replace the entire board assembly. Part numbers are given in the Replaceable Electrical Parts list for completely wired boards.

MEMORY CIRCUIT BOARD. To remove the circuit board:

1. Remove 6 screws from rear panel and remove rear panel.

2. Remove knobs from CHANNEL/POSITION switch.

3. Note color of multi-pin connectors and P number to which each connects. Note wire color on single-conductor shielded cables and connector to which each is connected.

4. Disconnect all cables that terminate on Memory circuit board.

5. Remove knobs from X MAG-POS controls.

6. Remove hex nut and flat washer from CHANNEL/POSITION switch.

7. Remove hex nut and flat washer from X MAG-POS control.

8. Remove 1 flat-head screw (see Figure 4-2A) from bracket holding Data Input and Data Output jacks.

9. Remove 4 screws (A, B, C, and D on Figure 4-2B) holding circuit board to frame tabs.

10. Push the panel bushing away from the front panel. Lift rear of board away from frame to clear the frame tabs and slide circuit board toward rear until clear of frame and front panel.

To replace the circuit board:

1. Place front-panel bushing and grounding spring on cam-switch shaft and slide circuit-board assembly into place with switch shaft through front panel. With circuit board roughly positioned, hold front-panel bushing in place (flats on bushing must align with panel opening). Place flat washer and hex nut on bushing and tighten.

2. Reverse order of removal to complete circuit-board replacement.

OUTPUT CIRCUIT BOARD. To remove the circuit board:

1. Note color of multi-pin connectors and P number to which each connects. Note wire color on single-conductor shielded cables and connector to which each is attached.

2. Disconnect all cables that terminate on circuit board.

3. Remove 1 screw (A on Figure 4-3) from circuit board and remove power-supply shield.

4. Remove 1 screw (B on Figure 4-3).

5. Remove screw that passes through heat sink on power diode CR905. Remove heat sink. See Figure 4-4.

6. Remove knob from front-panel SAMPLE INTERVAL switch.

7. Remove hex nut and flat washer from SAMPLE INTERVAL switch-shaft bushing.

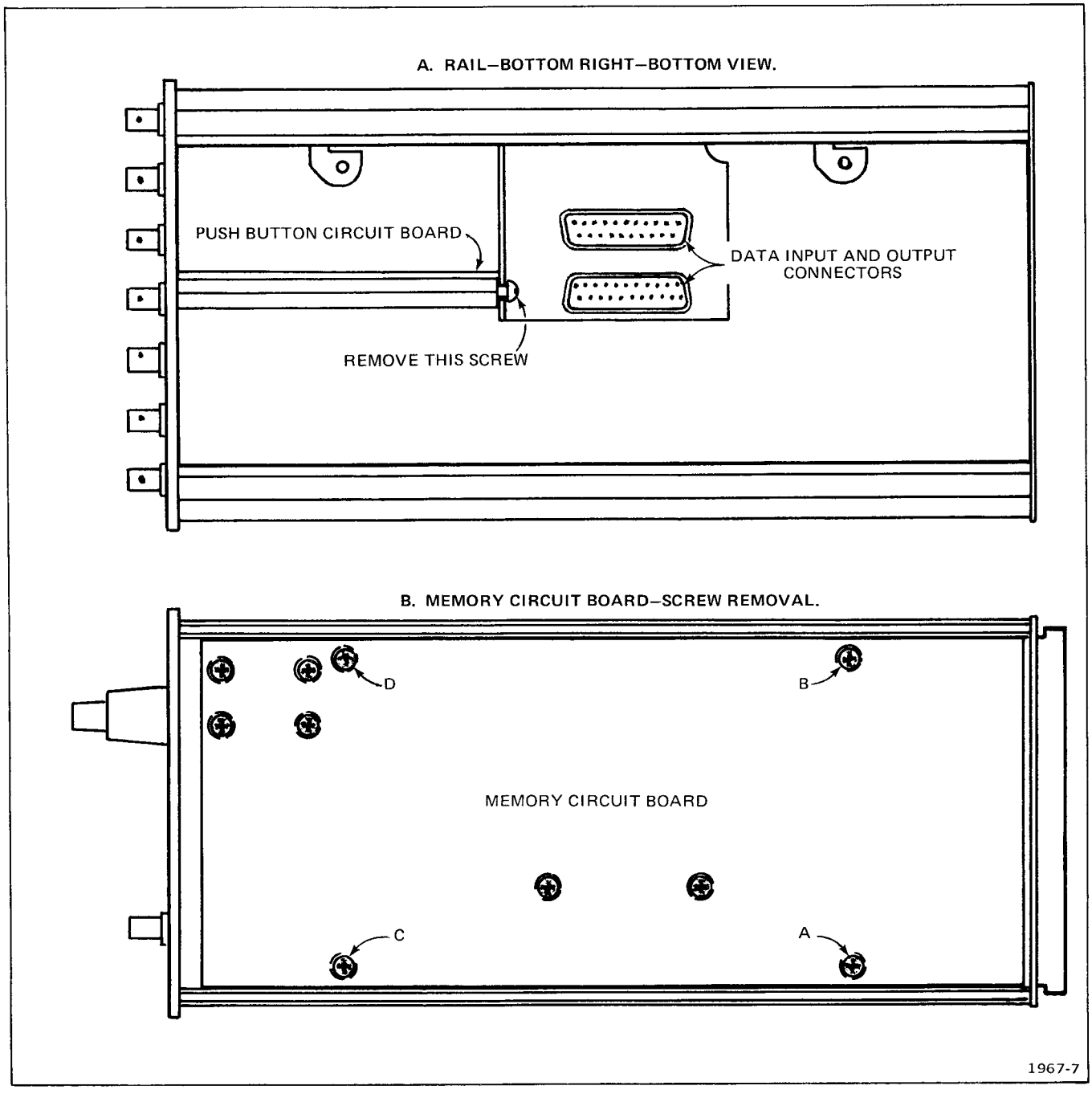


Figure 4-2. (A) Locations of Data Input and Data Output connectors. (B) Locations of securing screws on the Memory circuit board.

8. Remove 2 screws (C and D on Figure 4-3) from circuit board.

9. Lift rear of circuit board away from frame far enough that components mounted near SAMPLE INTERVAL cam switch clear board-mounting tab.

10. Push the panel bushing away from the front panel, and slide the circuit board to the rear far enough to clear the switch shaft.

To replace the circuit board:

1. Place front-panel bushing and grounding spring on cam-switch shaft and slide circuit board assembly into place with switch shaft through front panel. With board roughly positioned, hold bushing in place (flats on bushing must be aligned with panel opening). Place flat washer and hex nut on bushing and tighten.

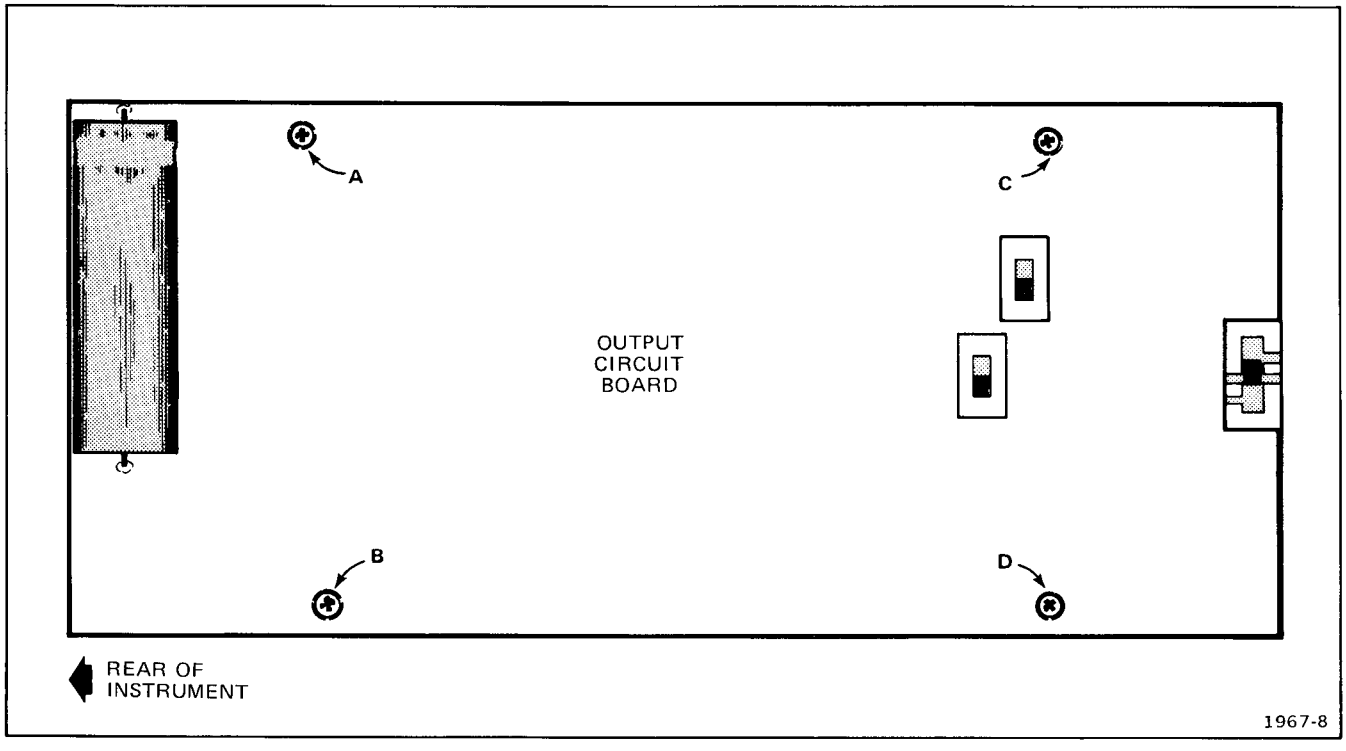


Figure 4-3. Locations of securing screws on the Output circuit board.

2. To complete assembly, reverse order of removal. When replacing heat sink, regrease heat sink with heat-conducting material such as DOW-4[1] silicone grease.

PUSH-BUTTON SWITCH CIRCUIT BOARD.

1. Remove Memory circuit board as outlined previously.

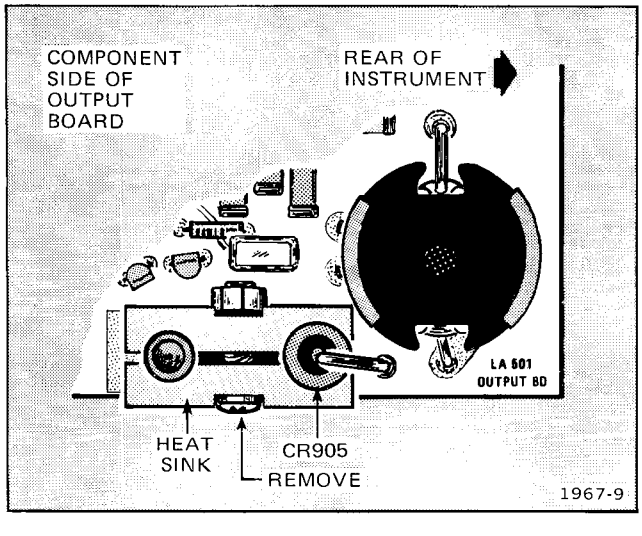


Figure 4-4. Location of CR905 heat sink on the Output circuit board.

2. Loosen 2 screws on THRESHOLD control-shaft coupling.

3. Remove RECORD (DISPLAY TIME-MANUAL) knobs from control-switch shafts. Pull on small, gray, center knob to remove (no set screw).

4. Note color of multi-pin connectors and P number to which each connects and disconnect any cable that terminates on circuit board.

5. Remove 4 screws holding circuit board to square rails. See Figure 4-5.

6. Pull circuit board straight toward rear until switch buttons clear front panel and remove circuit board.

To replace the Push-Button Switch circuit board, reverse the order of removal.

Switches

Several types of switches are used in this instrument. Contact alignment and spacing is critical to the operation of the push-button and cam switches. Therefore, defective switches should be replaced as a unit or repaired only by personnel experienced with these types of switches. Your local Tektronix Field Office or representative can provide additional

[1] Registered trademark of Dow Corning Corporation.

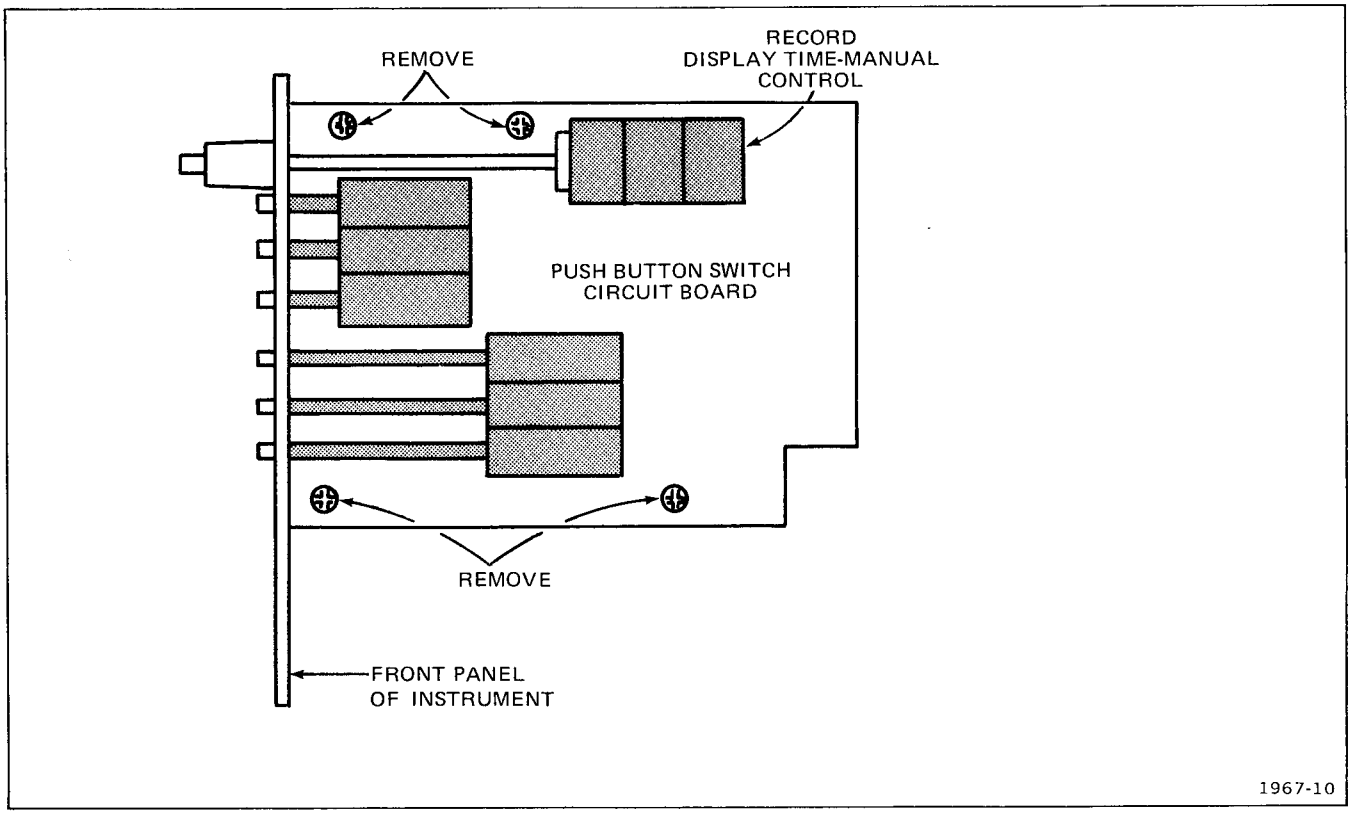


Figure 4-5. Locations of securing screws on the Push-Button Switch circuit board.

repair information. The following special maintenance information is provided for switch replacement.

CAM SWITCHES. The cam switches used in this instrument consist of a rotating cam which mates with contacts on the adjacent circuit board. These contacts are activated by lobes on the cams as the switch is rotated. A cam switch can be disassembled for inspection, cleaning, repair, or replacement; however, it is recommended that the switch be removed and replaced as a unit.

CAUTION

Repair of a cam switch should be undertaken only by experienced maintenance personnel. Switch alignment and contact spacing must be carefully maintained for proper operation. A cam switch repair kit is available (Tektronix part 040-0541-00) which contains special alignment tools for use in repairing or replacing the switch contacts. For information or assistance on maintenance of cam switches, contact your local Tektronix Field Office or representative.

Use the following procedure to remove and replace a cam switch:

1. Remove circuit board following instructions given previously.

2. For CHANNEL/POSITION switch only, unsolder potentiometer contacts from circuit board.

3. Remove four screws that secure switch to circuit board.

4. Remove cam-switch assembly from board.

To replace the cam switch, reverse the order of removal.

PUSH-BUTTON SWITCHES. See Figure 4-6 for removal and replacement instructions of push-button switches.

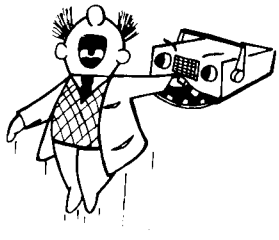
Semiconductors

Semiconductors should not be replaced unless actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement of semiconductors may affect the adjustment of this instrument. When semiconductors are replaced, check the operation of the part of the instrument which may be affected.

CAUTION

To avoid component damage, power must be turned off before removing or replacing semiconductors.

Replacement devices should be of the original type or a direct replacement. Figure 8-1 (located in the diagrams section) shows the lead configurations of the semiconductor devices used in this instrument. When replacing, check the manufacturer's basing diagram for correct basing. Semiconductors which have heat radiators use silicone grease to increase heat transfer. Replace the silicone grease when replacing these semiconductors.



WARNING

Handle silicone grease with care. Avoid getting silicone grease in eyes. Wash hands thoroughly after use.

An extracting tool should be used to remove the 14- and 16-pin integrated circuits to prevent damage to the pins. This tool is available from Tektronix, Inc. Order Tektronix Part 003-0619-00. If an extracting tool is not available when removing one of these integrated circuits, pull slowly and evenly on both ends of the device. Try to avoid having one end of the integrated circuit disengage from the socket before the other, as the pins may be damaged.

Interconnecting Pins

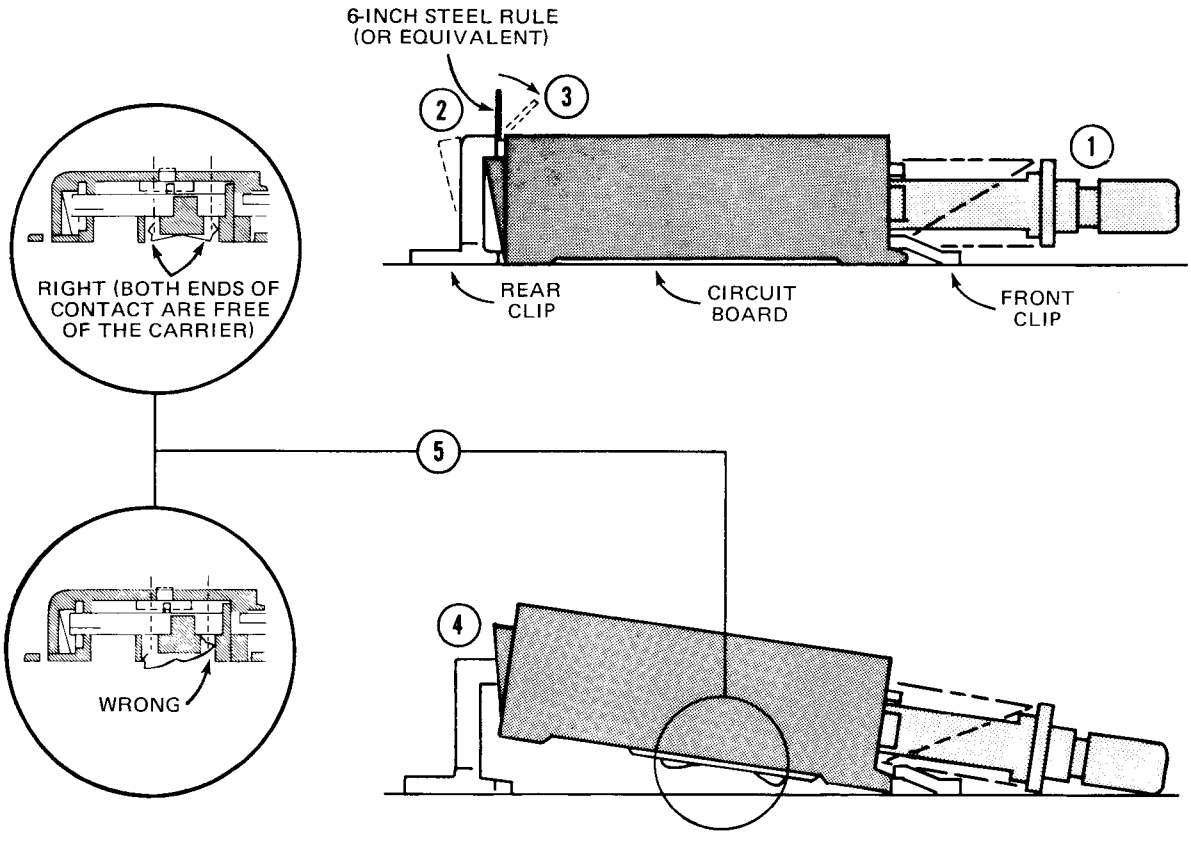
Two methods of interconnection are used to connect the circuit boards with other boards and components. When the interconnection is made with a coaxial cable, a special end-lead connector plugs into a socket on the board. When the interconnection is made with a wire lead, an end-lead connector is used which mates with the interconnecting pin soldered into the board. The following information provides the removal and replacement procedure for the various types of interconnecting methods:

COAXIAL-TYPE END-LEAD CONNECTORS. Replacement of the coaxial-type end-lead connectors requires special tools and techniques; only experienced maintenance personnel should attempt to remove and replace these connectors. It is recommended that the cable be replaced as a unit. For cable part numbers, see the Replaceable Mechanical Parts list. An alternative solution is to refer the replacement of the defective connector to your local Tektronix Field Office or representative.

END-LEAD PIN CONNECTORS. The pin connectors used to connect the wires to the interconnecting pins are clamped to the ends of the associated leads. To remove and replace damaged end-lead pin connectors, remove the old pin connector from the end of the lead and clamp the replacement connector to the lead.

Some of the pin connectors are grouped together and mounted in a plastic holder; the overall result is that these connectors are removed and installed as a multi-pin connector. To provide correct orientation of this multi-pin connector when it is replaced, an arrow is stamped on the circuit board and a matching arrow is molded into the plastic housing of the multi-pin connector. Be sure these arrows are aligned as the multi-pin connector is replaced. If the individual end-lead pin connectors are removed from the plastic holder, note the color of the individual wires for replacement.

CIRCUIT-BOARD PINS. A circuit-board pin replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order Tektronix Part 040-0542-00. Replacement of circuit-board pins on



(1) Make sure that all switch shafts are in the OUT position to clear the rear clip.

(2) Place the long edge of a six-inch rule or similar thin straight edge between the top edge of the rear clip and the switch body.

(3) Carefully pry the rear clip back just far enough to push the steel rule down between the clip and switch body.

CAUTION

When the switch is removed, the contacts may drop free and be damaged or lost. Body salts or acids can contaminate the switch contacts. Wear cotton gloves to prevent touching the contacts in the switch or on the board with bare hands.

(4) Pull the rear of the switch up, remove the steel rule, and pull the switch out of the front clip.

(5) To replace the switch, first check that the slide contacts are properly installed in the carrier. Then, place the front of the switch into the front clip and push the rear of the switch down until the rear clip catches and holds the switch in place.

1967-3

Figure 4-6. Push-button switch removal and replacement instructions.

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multi-layer boards is not recommended; refer such repairs to your local Tektronix Field Office or representative.

CAUTION

Only experienced service personnel should replace circuit-board pins on multi-layer boards. Therefore, refer repairs of the Memory circuit board and the Output circuit board to your local Tektronix Field Office or representative.

To replace a damaged pin which is mounted on a single-layer circuit board, first disconnect any pin connectors. Then (using Soldering Techniques given earlier in this section), unsolder the damaged pin and pull it from the board with a pair of pliers, leaving the ferrule (see Figure 4-7) in the hole, if possible. If the ferrule remains in the circuit board, remove the spare ferrule from the replacement pin and press the new pin into the hole in the circuit board. If the ferrule is removed with the damaged pin, clean out the hole using a solder-removing wick and a scribe. Then press the replacement pin with attached spare ferrule into the hole. Position the replacement pin in the same manner as the old pin. Solder the pin to the circuit board on each side of the board. If the old pin was bent at an angle to mate with a connector, carefully bend the new pin to the same angle. Replace the pin connector.

Fuses

Three fuses are used in this instrument. See the circuit-board illustrations in the Diagrams section for location and the Replaceable Electrical Parts list for values.

Incandescent Bulbs

Light bulbs are mounted on the sub-panel using a plastic sleeve. Unsolder the lead wires and pull the bulb out of the sleeve from the rear of the sub-panel.

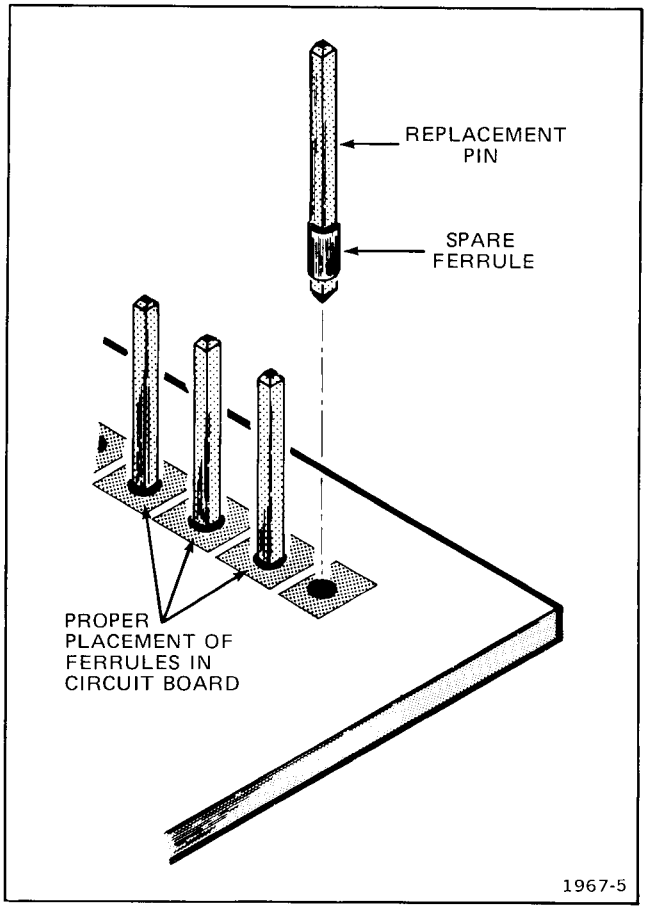

Figure 4-7. Exploded view of circuit-board pin and ferrule.

ADJUSTMENT AFTER REPAIR

After any electrical component has been replaced, the adjustment of that particular circuit should be checked, as well as other closely related circuits. See Section 5 for a complete adjustment procedure.

INSTRUMENT REPACKAGING

If this instrument is to be shipped for long distances by commercial means of transportation, it is recommended that it be repackaged in the original manner for maximum protection. The original shipping carton can be saved and used for this purpose. Should more information be needed, contact your local Tektronix Field Office or representative.

PERFORMANCE CHECK AND ADJUSTMENT

This section contains information necessary to perform a complete instrument performance check and adjustment. Limits given in the procedure are adjustment guides and should not be interpreted as performance requirements unless preceded by a check mark (√). Where possible, instrument performance is checked before an adjustment is made.

PRELIMINARY INFORMATION

Adjustment Interval

To maintain instrument accuracy, check the performance of the LA 501 every 1000 hours of operation, or every 6 months if used infrequently. Before complete adjustment, thoroughly clean and inspect this instrument as outlined in Section 4, Maintenance.

Tektronix Field Service

Tektronix Field Service Centers and the Factory Service Center provide instrument repair and adjustment services. Contact your Tektronix Field Office or representative for further information.

Using This Procedure

This Performance Check and Adjustment procedure can be used either for complete adjustment or as a check of instrument performance. Completion of each step in the procedure ensures that the instrument is correctly adjusted and operating within specified limits. Refer to the following discussion for instructions on a complete or partial check and adjustment.

INDEX. An index precedes the procedure to aid in locating Performance Check and Adjustment steps.

PERFORMANCE CHECK. Instrument performance can be checked by performing the complete Performance Check and Adjustment procedure and omitting only the ADJUST parts of the steps. A check mark (√) preceding a CHECK indicates that the limit given is a performance requirement specified in Section 2, Specification.

ADJUSTMENT. Completion of each step in the Performance Check and Adjustment procedure ensures that the instrument is correctly adjusted and performing within specified limits. Where possible, instrument performance is checked before an adjustment is made. For best overall performance when performing the complete adjustment procedure, make each adjustment to the exact setting indicated.

PARTIAL PROCEDURES. The following procedure is written to completely check and adjust the instrument to the Performance Requirements listed in Section 2, Specification. If the applications for which the instrument is used do not require the full available performance, the procedures and the required equipment list can be shortened accordingly.

A partial performance check and adjustment may be desirable after replacing components, or to touch up the adjustment of a portion of the instrument. To check or adjust only part of the instrument, refer to the Equipment Required list which precedes that portion of the procedure to be performed. To avoid unnecessary adjustment of other parts, adjust only if the tolerance given in each CHECK is not met.

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 5-1 is required for a complete performance check and adjustment of this instrument. The specifications given in Table 5-1 for test equipment are the minimum required to meet the Performance Requirements listed in Section 2, Specification. Detailed operating instructions for test equipment are omitted in this procedure. Refer to the test equipment instruction manual if more information is needed.

Special Fixtures

Special fixtures are used only where they facilitate instrument adjustment. These fixtures are available from Tektronix, Inc. Order by part number from Tektronix Field Offices or representatives.

Test Equipment Alternatives

The test equipment listed in the Examples of Applicable Test Equipment column, Table 5-1, is required to check and adjust this instrument. The Performance Check and Adjustment procedure is based on the first item of equipment given as an example. If other equipment is substituted, control settings or setups may need to be altered. If the exact item of equipment given as an example is not available, refer to the Minimum Specifications column to determine if other equipment may be substituted. Then check the Purpose column. If you determine that your measurement requirements will not be affected, the item and corresponding step(s) can be deleted.

TABLE 5-1
Test Equipment

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
1. Test Oscilloscope[1]	Bandwidth, dc to 100 MHz; minimum deflection factor, 10 mV/div; accuracy, within 3%. Dual-channel with chopped display mode.	Check triggers, display formats, vertical, horizontal, and Z-axis. Check and adjust dc balance and data inputs.	a. Tektronix 7603 Oscilloscope system with 7A26 Amplifier and 7B70 Time Base. b. Tektronix 465 Oscilloscope.
2. Monitor	Bandwidth, dc to 500 kHz; deflection factor, 50 mV/div (vertical) and 100 mV/div (horizontal) both dc coupled. Graticule, 8 x 10 div. External Z-axis input.	Check triggers, display formats, vertical and horizontal, and Z-axis.	a. Any Tektronix 600-series display unit that meets bandwidth requirements.
3. Precision Dc Voltmeter	Range, ±2 V to ±50 V; accuracy, within 0.1%. Digital voltmeter must have at least 4½-digit readout.	Check power supply, threshold voltages, and internal clock. Check and adjust dc balance and data inputs.	a. Tektronix DM 501 Digital Multimeter (operates in Tektronix TM 500-series power module). b. Fluke Model 825A Differential DC Voltmeter.
4. Pulse Generator	Pulse duration, 10 ns to 1 ms; pulse period, 0.1 μs to 10 ms; risetime, 2 ns or less; output amplitude, −3 V to +3 V with dc offset.	Check triggers, display formats, vertical and horizontal, and Z-axis. Check and adjust dc balance and data inputs.	a. Tektronix PG 502 Pulse Generator (operates in Tektronix TM 500-series power module).
5. Frequency Counter	Frequency range, 40 MHz to 55 MHz; accuracy, within 10 parts in 10^6.	Check internal clock.	a. Tektronix DC 501 110 MHz Counter (operates in Tektronix TM 500-series power module). b. Tektronix 7D14 Digital Counter (operates in any Tektronix 7000-series oscilloscope except those without readout).
6. Delay Generator	Delayed events, 0 to 1024; trigger level range and slope, ±1 V; minimum detectable pulse width, 0.5 μs.	Check Z-axis intensify.	a. Tektronix DD 501 Digital Delay (operates in TM 500-series power module. b. Tektronix 7D11 Digital Delay (operates in any Tektronix 7000-series oscilloscope with readout).
7. 10X Probes (4 required)	Compatible with test oscilloscope used.	Check triggers and Z-axis. Check and adjust dc balance and data inputs.	a. Tektronix P6108 or P6054A probes.
8. 1X Probe	Compatible with test oscilloscope used.	Check internal clock.	a. Tektronix P6028 or P6062A probes (3.5 foot).

[1] **Can be used instead of monitor throughout procedure.**

TABLE 5-1 (CONT.)
Test Equipment

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
9. Variable Line Voltage Source	Output, 110 V ac (or 220 V ac) 200 W; accuracy, within 3%.	Adjust −4.8 V supply.	a. General Radio W8MT3 VM Variac Autotransformer.
10. 50-Ohm Termination	Impedance, 50 ohms; accuracy, within 2%; connectors, BNC.	Output termination for signal generators.	a. Tektronix part 011-0049-01.
11. BNC-to-Probe Tip Adapter	Adapt to Tektronix probes used.	Provide connection from pulse generator to probe tip.	a. Tektronix part 013-0084-01.
12. BNC T Connector	BNC to BNC.	Provide cable and probe connection to pulse generator.	a. Tektronix part 103-0030-00.
13. Coaxial Cables (5 required)	Impedance, 50 ohms; type, RG 58/U; length, 42 inches; connectors, BNC.	Provide signal interconnections.	a. Tektronix part 012-0057-01 (3 supplied with LA 501).
14. Flexible Extender Cable	Compatible with TM 500-series plug-ins.	Provide access to test points and adjustments.	a. Tektronix part 067-0645-01.
15. Screwdriver	3-inch shaft, 3/32-inch bit.	Adjust power supply and dc balance.	a. Xcelite R-3323.

INDEX TO PERFORMANCE CHECK AND ADJUSTMENT PROCEDURE

PRELIMINARY PROCEDURE

Perform the following steps before proceeding with the Performance Check and Adjustment procedure.

1. Connect LA 501 to power module with flexible extender cable (Tektronix part 067-0645-01).

2. Remove LA 501 side covers.

3. Pull PWR button on left or right edge of power module to apply power to LA 501. Allow at least 15 minutes warmup.

NOTE

Titles for external LA 501 controls and connectors are capitalized in this procedure (e.g., SAMPLE INTERVAL, EXT CLOCK). Internal controls, connectors, and adjustments are initial capitalized (e.g., Blanking Switch, Ch 0 DC Bal adjustment, Low-Impedance Data Input connector).

A. POWER SUPPLY

Equipment Required

1. Precision dc voltmeter
2. Variable line-voltage source
3. Three-inch screwdriver

BEFORE YOU BEGIN, see TEST POINT AND ADJUSTMENT LOCATIONS in the Diagrams section.

A1. ADJUST −4.8 VOLT SUPPLY (R925)

a. With power module PWR button pushed in, connect power module line cord to variable line voltage source.

b. Set variable line voltage source for 110 (or 220) volts ac and pull PWR button out.

c. Press ECL button and set DISPLAY TIME control fully counterclockwise (1 s).

d. Set SAMPLE INTERVAL switch to 50 ns and press CH 0-15 X256 button.

e. Connect P6450 probe to internal Low-Impedance Data Input connector (J100).

f. Connect precision dc voltmeter between TP933 and chassis ground.

g. CHECK—Voltmeter for reading from −4.796 volts to −4.834 volts.

h. ADJUST—R925, (−4.8 volts adjustment) for a voltmeter reading of exactly −4.800 volts.

i. INTERACTION—Any change in setting of R925 may affect operation of all circuits in instrument.

A2. CHECK −2 VOLT SUPPLY

a. Connect precision dc voltmeter between pin 2 of P5 and chassis ground.

b. CHECK—Voltmeter for reading from −1.90 volts to −2.10 volts.

A3. CHECK +5.1 VOLT SUPPLY

a. Connect precision dc voltmeter between pin 3 of P4 and ground.

b. CHECK—Voltmeter for reading from +4.845 volts to +5.355 volts.

B. THRESHOLD VOLTAGES AND INTERNAL CLOCK

Equipment Required

1. Frequency counter
2. Precision dc voltmeter
3. 1X probe

BEFORE YOU BEGIN, see TEST POINT AND ADJUSTMENT LOCATIONS in the Diagrams section.

√ B1. CHECK 10X PROBE THRESHOLD VOLTAGES

a. Press VAR and INPUTS buttons.

b. Connect precision dc voltmeter between pin 5 of U48 and chassis ground.

√ c. CHECK—Voltmeter reading for a range of at least −1 volt to +1 volt as THRESHOLD control is rotated from fully counterclockwise to fully clockwise.

d. Press TTL button.

√ e. CHECK—Voltmeter for reading from +0.115 volt to +0.165 volt.

f. Press ECL button.

√ g. CHECK—Voltmeter for reading from −0.121 volt to −0.129 volt.

√ B2. CHECK 5X PROBE (P6450) THRESHOLD VOLTAGES

a. Press VAR button and press to release INPUTS button.

b. Connect precision dc voltmeter between pin 1 of J9 and chassis ground.

√ c. CHECK—Voltmeter reading for a range of at least −2 volts to +2 volts as THRESHOLD control is rotated from fully counterclockwise to fully clockwise.

d. Press TTL button.

√ e. CHECK—Voltmeter for reading from +0.230 volt to +0.330 volt.

f. Press ECL button.

√ g. CHECK—Voltmeter for reading from −0.242 volt to −0.258 volt.

√ B3. CHECK THRESHOLD MONITOR OUTPUT

a. Press VAR button.

b. Connect precision dc voltmeter between INPUT MONITOR jack and chassis ground.

√ c. CHECK—Voltmeter reading for a range of at least −10 volts to +10 volts as THRESHOLD control is rotated from fully counterclockwise to fully clockwise.

d. Press TTL button.

√ e. CHECK—Voltmeter for reading from +1.12 volts to +1.70 volts.

f. Press ECL button.

√ g. CHECK—Voltmeter for reading from −1.17 volts to −1.33 volts.

√ B4. CHECK EXTERNAL CLOCK THRESHOLD VOLTAGES

a. Press VAR button and place internal Ext Clock Threshold switch, S848, in Front Panel (up) position.

b. Connect precision dc voltmeter between pin 11 of U830 and chassis ground.

√ c. CHECK—Voltmeter reading for a range of at least −1 volt to +1 volt as THRESHOLD control is rotated from fully counterclockwise to fully clockwise.

d. Press TTL button.

√ e. CHECK—Voltmeter for reading from +0.115 volt to +0.165 volt.

f. Press ECL button.

√ g. CHECK—Voltmeter for reading from −0.121 volt to −0.129 volt.

h. Place internal Ext Clock Threshold switch, S848, to ECL (down) position.

√ i. CHECK—Voltmeter for reading from −0.122 volt to −0.128 volt.

√ B5. CHECK INTERNAL CLOCK

a. Set SAMPLE INTERVAL switch to 20 ns and connect frequency counter to TP138 with a 1X probe.

√ b. CHECK—Counter for readout from 49.99750 to 50.00250 megahertz.

C. TRIGGERS

Equipment Required

1. Test oscilloscope or monitor
2. Pulse generator
3. 10X probe
4. 50-ohm termination
5. BNC-to-probe tip adapter
6. 50-ohm BNC cables (4)

BEFORE YOU BEGIN, see TEST POINT AND ADJUSTMENT LOCATIONS in the Diagrams section.

√ C1. CHECK EXTERNAL TRIGGER LEVEL AND MINIMUM PULSE WIDTH

a. Set controls as follows:

LA 501

INPUT	TTL (button in)
FORMAT	CH 0 - 3 X1024 (button in)
TRIGGER SOURCE	EXT (button in)
DISPLAY TIME	Fully counterclockwise (1 s)
CHANNEL SELECT	OFF
SAMPLE INTERVAL	50 ns
Vertical MAG	Fully counterclockwise
Horizontal MAG	Fully counterclockwise
Display Clock S835 (internal)	Down

Test Oscilloscope or Monitor

Mode	X-Y
Deflection Factor or Gain	
X	50 mV/div
Y	100 mV/div

b. Position a low-intensity spot at the vertical and horizontal center of test oscilloscope or monitor graticule.

c. Connect 50-ohm cables from X HORIZ OUT, Y VERT OUT, and Z BLANK OUT connectors to corresponding test oscilloscope or monitor inputs.

d. Connect 50-ohm termination to EXT TRIG connector.

e. Set pulse generator for a TTL level (approximately 0 to +3 volts), 10-nanosecond duration, 10-millisecond period, pulse output.

f. Connect 50-ohm cable from pulse generator output to 50-ohm termination at EXT TRIG connector.

NOTE

Determine the Z-axis input blanking polarity required by the test oscilloscope or monitor. Place internal Blanking Polarity switch, S720, up for positive blanking, down for negative blanking.

√ g. CHECK—For visible display on test oscilloscope or monitor and that TRIG'D indicator is lit. Note that TRIG'D indicator blinks off momentarily with auto record pulse.

√ C2. CHECK DISPLAY TIME RANGE

√ a. CHECK—That test oscilloscope or monitor display alternately blanks then reappears for approximately 1 second.

b. Set DISPLAY TIME control fully clockwise (not in detent).

√ c. CHECK—That test oscilloscope or monitor display alternately blanks, then reappears for approximately 10 seconds.

d. Set DISPLAY TIME control to ∞ (detent) position.

e. Disconnect pulse generator output from EXT TRIG connector.

√ f. CHECK—For stable display on test oscilloscope or monitor.

√ C3. CHECK TRIGGER HOLDOFF

a. Press and release MANUAL button.

√ b. CHECK—For no display on test oscilloscope or monitor and that TRIG'D indicator is not lit.

c. Connect 50-ohm cable from pulse generator output to EXT TRIG connector.

√ d. CHECK—For display on test oscilloscope or monitor and that TRIG'D indicator is lit.

e. Remove 50-ohm cable between pulse generator output and EXT TRIG connector.

C4. CHECK CHANNEL 0 TRIGGERS

a. Set LA 501 controls as follows:

INPUT	TTL (button in)
FORMAT	CH 0 - 3 X1024 (button in)
TRIGGER SLOPE	+ (button out)
TRIGGER SOURCE	CH 0 (button out)
INPUTS	PROBE (button out)
TRIGGER	CENTER (button in)
DISPLAY TIME	Fully counterclockwise (1 s)

b. Connect P6450 probe to internal Low-Impedance Data Input connector (J100).

c. Set pulse generator for a TTL level (approximately 0 to +3 volts), 1-microsecond duration, 10-millisecond period, pulse output.

d. Connect P6450 channel 0 lead to 50-ohm termination at pulse generator output.

NOTE

To make it easier to connect the P6450 probe to the 50-ohm termination at the pulse generator output, connect a BNC-to-banana plug adapter (such as the Tektronix part 103-0035-00) to the 50-ohm termination. Attach a short length of bus wire to the center conductor terminal and clip the probes to the bus wire.

e. CHECK—Display for 4 lines with generator output pulse displayed near center of channel 0 line.

f. Press POST button.

g. CHECK—That generator output pulse is displayed near left edge of channel 0 line.

h. Press PRE button.

i. CHECK—That generator output pulse is displayed near right edge of channel 0 line.

C5. CHECK TRIGGER SLOPE

a. Press CENTER button.

b. Position left edge of generator output pulse to graticule vertical center line.

c. Press SLOPE button.

d. CHECK—That displayed generator output pulse shifts to left side of graticule vertical center line.

D. DISPLAY FORMATS

Equipment Required

1. Test oscilloscope or monitor
2. Pulse generator
3. 50-ohm termination
4. 50-ohm BNC cables (3)

BEFORE YOU BEGIN, see TEST POINT AND ADJUSTMENT LOCATIONS in the Diagrams section.

√ D1. CHECK LOW-IMPEDANCE DATA INPUT DISPLAY

a. Connect P6450 probe to internal Low-Impedance Data Input connector (J100).

b. Set SAMPLE INTERVAL switch to 50 ns and press CH 0 - 3 X1024 button.

c. Connect 50-ohm cables from X HORIZ OUT, Y VERT OUT, and Z BLANK OUT connectors to corresponding test oscilloscope or monitor inputs.

d. Set pulse generator for a TTL level (approximately 0 to +3 volts) 1-microsecond duration, 10-millisecond period, pulse output.

e. Connect 50-ohm termination to pulse generator output.

f. Connect P6450 probe channel 0 through 7 leads to 50-ohm termination at pulse generator output.

NOTE

The output of the Tektronix PG 502 will feed 8 channels simultaneously without pulse degradation. A BNC-to-banana plug adapter (such as Tektronix part 103-0035-00) with a short length of bus wire attached to the center-conductor terminal can be used to connect the P6450 probe leads to the pulse generator.

√ g. CHECK—Display for 4 lines with no breaks or abnormalities in display pattern. Set Horizontal and Vertical MAG and POS controls to allow close examination of display.

h. Return MAG and POS controls to fully counterclockwise (X1) position.

i. Press CH 0 - 7 X512 button.

√ j. CHECK—Display for 2 groups of 4 lines each with about twice the pulse width noted in part (g). Examine display for no breaks or abnormalities in display pattern. Set Horizontal and Vertical MAG and POS controls to allow close examination of display.

k. Return MAG and POS controls to fully counterclockwise (X1) position.

l. Press CH 0 - 15 X256 button and set THRESHOLD control for stable display.

√ m. CHECK—Display for 4 groups of 4 lines each with about twice the pulse width noted in part (j). Examine display for no breaks or abnormalities in display pattern. Set Horizontal and Vertical MAG and POS controls to allow close examination of display.

n. Return MAG and POS controls to fully counterclockwise (X1) position.

NOTE

When using a Tektronix PG 502 Pulse Generator, check the remaining channels by disconnecting the P6450 probe channel 1 through 7 leads from the pulse generator (do not disconnect the channel 0 lead). Connect the channel 8 through 15 leads and check display as described in part (m).

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E. VERTICAL AND HORIZONTAL

Equipment Required

1. Test oscilloscope or monitor
2. Pulse generator
3. 50-ohm termination
4. 50-ohm cables (3)

BEFORE YOU BEGIN, see TEST POINT AND ADJUSTMENT LOCATIONS in the Diagrams section.

√ E1. CHECK VERTICAL OUTPUT

a. Set LA 501 controls as follows:

SAMPLE INTERVAL	50 ns
INPUT	TTL (button in)
FORMAT	CH 0 - 15 X256 (button in)
TRIGGER SOURCE	CH 0 (button out)
INPUTS	PROBE (button out)
Vertical MAG	Fully counterclockwise (X1)

b. Connect 50-ohm cables from X HORIZ OUT, Y VERT OUT, and Z BLANK OUT connectors to corresponding test oscilloscope or monitor inputs.

c. Connect 50-ohm termination to pulse generator output.

d. Connect P6450 probe channel 0 lead to 50-ohm termination on pulse generator.

e. Set pulse generator for a TTL level (approximately 0 to +3 volts), 1-microsecond duration, 10-millisecond period, pulse output.

√ f. CHECK—For vertical display of from 6.3 to 7.7 divisions.

√ g. CHECK—That Vertical MAG control expands display by 5 times within 10% in fully clockwise (X5) position.

√ h. CHECK—That Vertical POS control positions display smoothly anywhere within graticule area.

i. Set Vertical MAG fully counterclockwise (X1).

√ j. CHECK—That each channel can be selected with SELECT control and positioned with POSITION control from above channel 0 to even with channel 15.

√ E2. CHECK RASTER SHIFT WITH FORMAT

a. Press CH 0 - 3 X1024 button.

b. Move left edge of display to left edge of test oscilloscope or monitor graticule.

c. Press CH 0 - 15 X256 button.

√ d. CHECK—That display shifts to right 1 division or less.

√ E3. CHECK SWEEP LENGTH

a. Set Horizontal MAG control fully counterclockwise (X1).

√ b. CHECK—That displayed sweep length is from 9 to 11 divisions.

√ E4. CHECK HORIZONTAL MAGNIFIER AND POSITION

a. Set LA 501 controls as follows:

TRIGGER	POST (button in)
SAMPLE INTERVAL	10 ns

a. (Continued)

TRIGGER SOURCE	CH 0 (button out)
DISPLAY TIME	∞ (fully clockwise)
FORMAT	CH 0-3 X1024 (button in)

b. Set pulse generator for a symmetrical 1-megahertz, TTL-level (approximately 0 to +3 volts), square-wave output.

c. Press MANUAL button momentarily to obtain a continuous data display on channel 0.

d. Set test oscilloscope or monitor horizontal deflection factor for a 1 division displayed pulse width.

e. Set Horizontal MAG control fully clockwise (X10).

√ f. CHECK—That displayed pulse width is from 9 to 11 divisions.

g. Reset test oscilloscope horizontal deflection factor for 50 millivolts/division.

h. Rotate Horizontal POS control fully counterclockwise.

√ i. CHECK—That right edge of magnified display can be positioned to within 2 divisions of graticule center.

j. Rotate Horizontal POS control fully clockwise.

√ k. CHECK—That left edge of magnified display can be positioned to within 2 divisions of graticule center.

√ E5. CHECK HORIZONTAL LINEARITY

a. Set SAMPLE INTERVAL switch to .1 μs, Horizontal MAG control fully clockwise (X10), and press POST button.

b. Press and release MANUAL button.

c. Disconnect 50-ohm cable from Z BLANK OUT connector.

d. Horizontally position display so that left 10% of display is off screen.

e. Set test oscilloscope or monitor horizontal deflection factor for an even number of data bits displayed in center 6 graticule divisions.

f. Horizontally position right end of display so that it fills center 6 graticule divisions.

√ g. CHECK—That number of data bits in center 6 graticule divisions is within 10% of the number displayed in part (e).

h. Set test oscilloscope or monitor horizontal deflection factor for 50 millivolts/division.

F. DC BALANCE AND DATA INPUTS

Equipment Required

1. Pulse generator
2. Test oscilloscope
3. Precision dc voltmeter
4. 10X probes (4)
5. BNC T connector
6. BNC-to-probe tip adapter
7. 50-ohm termination
8. 50-ohm cables (4)
9. Three-inch screwdriver

BEFORE YOU BEGIN, see **TEST POINT AND ADJUSTMENT LOCATIONS** in the Diagrams section.

√ F1. ADJUST EXTERNAL CLOCK DC BALANCE (R845)

a. Connect 50-ohm termination and BNC-to-probe tip adapter to pulse generator output.

b. Set pulse generator for a symmetrical 50-megahertz, minimum ECL level (−1.55 to −0.95 volts), square-wave output.

c. Connect 10X probe from EXT CLOCK connector to BNC-to-probe tip adapter. (Compensate probe as described in Section 1, Operating Instructions.)

d. Set SAMPLE INTERVAL switch to EXT and press ECL button.

e. Set test oscilloscope sweep rate for 5 nanoseconds/division and connect a 10X probe to test oscilloscope vertical input.

f. CHECK—For waveform at J838 with test oscilloscope probe.

NOTE

If no signal is present at J838, check that internal Clock Polarity selector, P831, is connected to pin 15 of U830.

g. ADJUST—R845 (Ext Clock DC Bal) for a clean, symmetrical, 50-megahertz ECL display.

h. Place internal Ext Clock Threshold switch, S848, in front panel (up) position.

i. Press VAR button and adjust THRESHOLD for same display obtained in part (g).

j. Connect precision dc voltmeter to INPUT MONITOR jack and note voltmeter reading.

k. Position display as shown in Figure 5-1(A). Set test oscilloscope trigger level for stable display.

l. Set THRESHOLD control for a voltmeter reading 60 millivolts above reading noted in part (i).

√ m. CHECK—Display for 5 nanoseconds or less of threshold level uncertainty as shown in Figure 5-1(B).

n. Set THRESHOLD control for a voltmeter reading 60 millivolts below reading noted in part (i).

√ o. CHECK—Display for 5 nanoseconds or less of threshold level uncertainty as shown in Figure 5-1(C).

p. Reset THRESHOLD control for voltmeter reading noted in part (i).

F2. ADJUST CHANNEL 0 DC BALANCE (R25)

a. Disconnect 10X probe from EXT CLOCK connector and connect to CH 0 BNC connector.

b. Press INPUTS button.

c. Set pulse generator for a symmetrical 33-megahertz, minimum ECL level (−1.55 to −0.95 volts), square-wave output.

d. CHECK—For waveform at J24 with test oscilloscope probe.

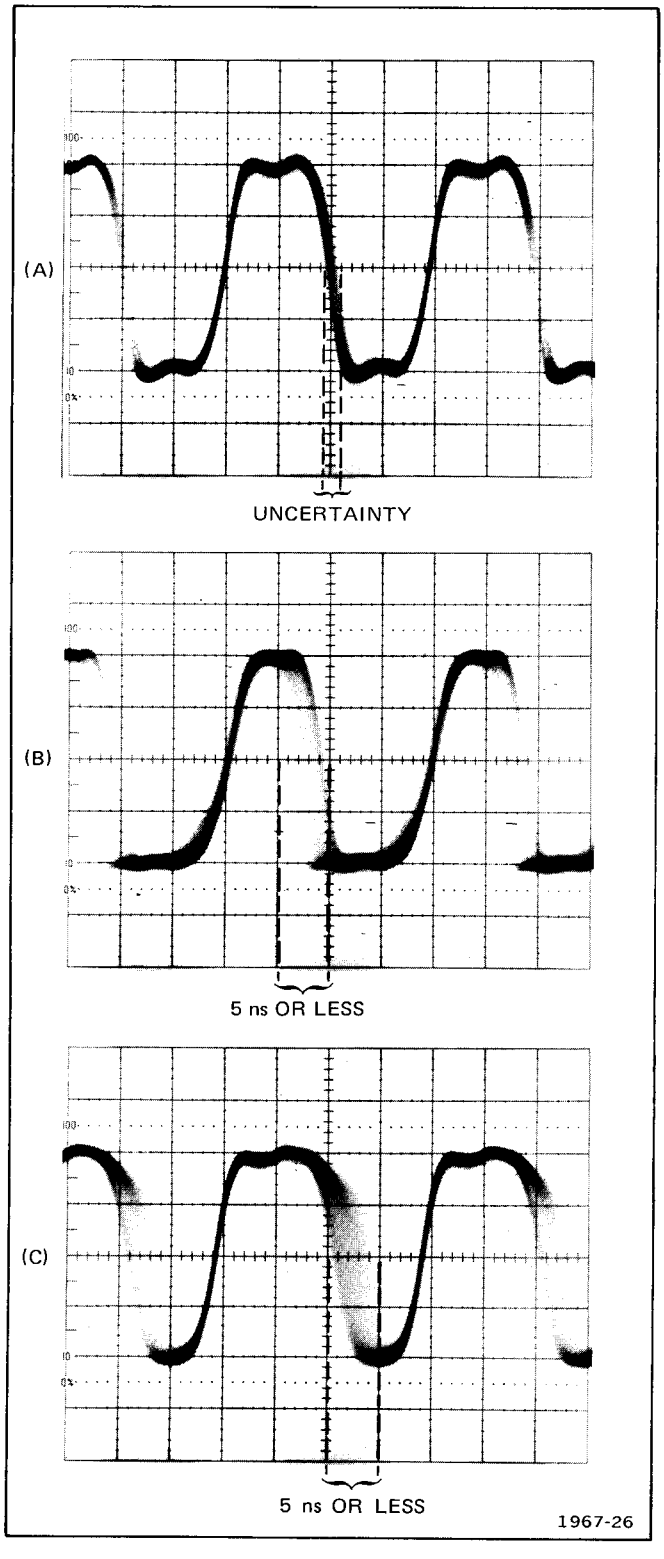

Fig. 5-1. Typical threshold level waveform at J838.

e. ADJUST—R25 (CH 0 DC Bal) for a clean symmetrical 33-megahertz ECL display.

F3. ADJUST CHANNEL 1 DC BALANCE (R45)

a. Disconnect 10X probe from CH 0 BNC connector and connect to CH 1 BNC connector.

b. CHECK—For waveform at J44 with test oscilloscope probe.

c. ADJUST—R45 (CH 1 DC Bal) for a clean, symmetrical, 33-megahertz ECL display.

F4. ADJUST CHANNEL 2 DC BALANCE (R65)

a. Disconnect 10X probe from CH 1 BNC connector and connect to CH 2 BNC connector.

b. CHECK—For waveform at J64 with test oscilloscope probe.

c. ADJUST—R65 (CH 2 DC Bal) for a clean, symmetrical, 33-megahertz ECL display.

F5. ADJUST CHANNEL 3 DC BALANCE (R85)

a. Disconnect 10X probe from CH 2 BNC connector and connect to CH 3 BNC connector.

b. CHECK—For waveform at J84 with test oscilloscope probe.

c. ADJUST—R85 (CH 3 DC Bal) for a clean, symmetrical, 33-megahertz ECL display.

√ F6. CHECK HIGH-IMPEDANCE DATA INPUTS

a. Disconnect 10X probe from CH 3 BNC connector and connect to CH 0 connector.

b. Set pulse generator for a 15-nanosecond duration, 0.5-microsecond period, minimum ECL level (−1.55 to −0.95 volts), pulse output.

c. Connect 50-ohm cable from pulse generator trigger output to EXT TRIG connector.

d. Connect 50-ohm cables from X HORIZ OUT, Y VERT OUT, and Z BLANK OUT connectors to corresponding test oscilloscope or monitor inputs.

@

e. Set SAMPLE INTERVAL switch to 10 ns, DISPLAY TIME control fully counterclockwise (1 s), and press CH 0 - 3 X1024, POST, and SOURCE buttons.

√ f. CHECK—Channel 0 line for data bits spaced evenly across entire display with no holes.

g. Repeat part (e) with 10X probe connected to CH 1, CH 2, and CH 3 BNC connectors respectively.

F7. CHECK LOW-IMPEDANCE DATA INPUTS

a. Connect P6450 probe to internal Low-Impedance Data Input connector (J100).

b. Press to release INPUTS button and connect P6450 probe channel 0 lead to 50-ohm termination at pulse generator output. (Make sure P6450 probe ground lead is connected to suitable ground.)

√ c. CHECK—Channel 0 line for data bits spaced evenly across entire display with no holes.

d. Repeat part (c) with P6450 probe channel 1 through 3 leads connected, one at a time, to 50-ohm termination at pulse generator output.

e. Set pulse generator for a 25-nanosecond duration, 0.5-microsecond period, pulse output.

f. Set SAMPLE INTERVAL switch to 20 ns and press CH 0 - 7 X512 button.

g. Repeat part (c) with P6450 probe channel 4 through 7 leads connected, one at a time, to 50-ohm termination at pulse generator output.

h. Set pulse generator for a 55-nanosecond duration, 0.5-microsecond period, pulse output.

i. Set SAMPLE INTERVAL switch to 50 ns and press CH 0 - 15 X256 button.

i. Repeat part (c) with P6450 probe channel 8 through 15 leads connected, one at a time, to 50-ohm termination at pulse generator output.

k. Disconnect P6450 probe lead from pulse generator output.

l. Disconnect 50-ohm cable from EXT TRIG connector.

√ F8. CHECK LOW-IMPEDANCE DATA INPUT DELAYS

a. Set pulse generator for a 25-nanosecond duration, 0.1-microsecond period, pulse output.

b. Set SAMPLE INTERVAL switch to EXT.

c. Connect P6450 probe channel 0 lead to 50-ohm termination at pulse generator output.

d. Connect a 10X probe from EXT CLOCK connector to 50-ohm termination at pulse generator output.

e. Connect a 10X probe to test oscilloscope channel 1 vertical input.

f. Set test oscilloscope vertical for chopped mode and triggering for channel 1, + slope.

g. Connect a 10X probe with identical delay to probe used in part (e) to test oscilloscope channel 2 vertical input.

√ h. CHECK—Channel 0 through 7 and channel 8 through 15 delays by connecting proper P6450 probe channel leads, one at a time, to pulse generator output and test oscilloscope channel 1 and 2 probes to test points as outlined in Table 5-2. Test oscilloscope channel 2 displayed waveform should be within 8 nanoseconds before, to 9 nanoseconds after, the test oscilloscope channel 1 displayed waveform with pulse generator output applied to P6450 probe channel 0 through 7. Test oscilloscope channel 2 displayed waveform should be within 7 nanoseconds before, to 15 nanoseconds after, the test oscilloscope channel 1 displayed waveform with pulse generator output applied to P6450 probe channel 8 through 15.

i. Disconnect P6450 probe from pulse generator output.

TABLE 5-2
Low-Impedance Data Input Delays

Test Oscilloscope Channel 1 Probe Test Point	Test Oscilloscope Channel 2 Probe Test Point	P6450 Probe Channel Leads Connected to Pulse Generator
U235, Pin 4	U235, Pin 12	0
	U235, Pin 9	4
	U235, Pin 11	8
	U235, Pin 6	12
U335, Pin 4	U335, Pin 12	1
	U335, Pin 9	5
	U335, Pin 11	9
	U335, Pin 6	13
U435, Pin 4	U435, Pin 12	2
	U435, Pin 9	6
	U435, Pin 11	10
	U435, Pin 6	14
U535, Pin 4	U535, Pin 12	3
	U535, Pin 9	7
	U535, Pin 11	11
	U535, Pin 6	15

√ **F9. CHECK HIGH-IMPEDANCE DATA INPUT DELAYS**

a. Press INPUTS button.

√ b. CHECK—Channel 0 through 3 delays by connecting a 10X probe from front-panel High-Impedance Data Input connectors, one at a time, to pulse generator output, and probes from test oscilloscope channel 1 and 2 to test points as outlined in Table 5-3. Test oscilloscope channel 2 displayed waveform should be within 0 to 14 nanoseconds before the test oscilloscope channel 1 displayed waveform.

TABLE 5-3
High-Impedance Data Input Delays

Test Oscilloscope Channel 1 Probe Test Point	Test Oscilloscope Channel 2 Probe Test Point	High-Impedance Data Input Connected to Pulse Generator Output
U235, Pin 4	U235, Pin 12	CH 0
U335, Pin 4	U335, Pin 12	CH 1
U435, Pin 4	U435, Pin 12	CH 2
U535, Pin 4	U535, Pin 12	CH 3

G. Z-AXIS

Equipment Required

1. Test oscilloscope or monitor
2. Pulse generator
3. Delay generator
4. 10X probes (3)
5. 50-ohm termination
6. 50-ohm BNC cables (5)
7. Coaxial cable (BNC on one end)

BEFORE YOU BEGIN, see TEST POINT AND ADJUSTMENT LOCATIONS in the Diagrams section.

G1. CHECK RETRACE BLANKING TIME

a. Connect 50-ohm termination to pulse generator output.

b. Set pulse generator for a TTL level (approximately 0 to +3 volts), 10-nanosecond duration, 10-millisecond period, pulse output.

c. Connect 50-ohm cable from 50-ohm termination at pulse generator output to EXT TRIG connector.

d. Connect 50-ohm cable from Z BLANK OUT connector to test oscilloscope vertical input.

e. Press CH 0 - 3 X1024 burron and set SAMPLE INTERVAL switch to 1 μs.

f. CHECK—Display for + or — 4 to 6 volt pulse (depending on position of internal Blanking Polarity switch, S720) with a duration of 3.5 to 5 microseconds.

g. Press CH 0 - 7 X512 button.

h. CHECK—Display for pulse duration from 1.7 to 2.7 microseconds.

i. Press CH 0 - 15 X256 button.

j. CHECK—Display for pulse duration from 0.9 to 1.5 microseconds.

G2. CHECK BAD-DATA BLANKING

a. Connect 50-ohm cables from X HORIZ OUT, Y VERT OUT, and Z BLANK OUT connectors to corresponding test oscilloscope or monitor inputs.

b. Connect 50-ohm termination to pulse generator output.

c. Connect a 10X probe from CH 0 BNC connector to 50-ohm termination at pulse generator output.

d. Set DISPLAY TIME control fully counterclockwise (1 s).

e. Set pulse generator for a symmetrical 1-megahertz, TTL-level (approximately 0 to +3 volts), square-wave output.

f. Press TTL, CENTER, and CH 0 - 15 X256 buttons.

g. Press to release SOURCE button.

h. CHECK—That bad data on left side of display is blanked.

G3. CHECK Z-AXIS INTENSIFY

a. Set SAMPLE INTERVAL switch to 50 ns.

b. Set pulse generator for a 0.5-microsecond duration, 10-microsecond period, pulse output.

c. Remove bottom cover from LA 501 to gain access to Data Output connector, J120.

d. Connect a 10X probe from delay generator start input to pin 14 of J120.

e. Connect a 10X probe from delay generator events input to pin 1 of J120.

f. Connect coaxial cable from delay generator delayed trigger output to pin 16 of J120. (Use pin 17 of J120 for ground connection.)

g. CHECK—Display for 16 channels with pulse generator output appearing on channel 0.

h. Set delay generator for less than 254 delayed events with + (positive) start and events trigger slope.

i. Set delay generator start and events trigger levels for a delayed trigger output.

j. CHECK—For an intensified spot on each displayed channel.

k. Press CH 0 - 7 X512 button.

l. Set delay generator for less than 511 delayed events and repeat part (i) and (j).

m. Press CH 0 - 3 X1024 button.

n. Set delay generator for less than 1023 delayed events and repeat part (i) and (j).

This completes the Performance Check and Adjustment procedure.

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P. O. BOX 128	PICKENS, SC 29671
01121	ALLEN-BRADLEY CO.	1201 2ND ST. SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P. O. BOX 5012	DALLAS, TX 75222
02735	RCA CORP., SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
04222	AVX CERAMIC CORP.	P.O. BOX 867	MURTLE BEACH, SC 29577
04239	GENERAL ELECTRIC CO., CHEMICAL AND METALLURGICAL VENTURES, OPN MAGNETIC MATERIALS PRODUCT	P. O. BOX 72	EDMORE, MI 48829
04713	MOTOROLA, INC., SEMICONDUCTOR PRODUCTS DIV.	5005 E. MCDOWELL RD.	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS ST.	MOUNTAIN VIEW, CA 94042
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
08806	GENERAL ELECTRIC CO., MINIATURE LAMP PRODUCTS DEPT.	NELA PK.	CLEVELAND, OH 44112
12040	NATIONAL SEMICONDUCTOR CORP.	COMMERCE DRIVE	DANBURY, CT 06810
12697	CLAROSTAT MFG. CO., INC.	LOWER WASHINGTON ST.	DOVER, NH 03820
12954	DICKSON ELECTRONICS CORP.	8700 E. THOMAS RD.	SCOTTSDALE, AZ 85252
12969	UNITRODE CORP.	580 PLEASANT ST.	WATERTOWN, MA 02172
13715	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	4300 REDWOOD HWY.	SAN RAFAEL, CA 94903
14433	ITT SEMICONDUCTORS, A DIV. OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORP.	3301 ELECTRONICS WAY	WEST PALM BEACH, FL 33401
15818	TELEDYNE SEMICONDUCTOR	1300 TERRA BELLA AVE.	MOUNTAIN VIEW, CA 94040
21845	SOLITRON DEVICES, INC., TRANSISTOR DIV.	1177 BLUE HERON BLVD.	RIVIERA BEACH, FL 33404
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SAN YSIDRO WAY	SANTA CLARA, CA 95051
28480	HEWLETT-PACKARD CO., CORPORATE HQ.	1501 PAGE MILL RD.	PALO ALTO, CA 94304
37138	RIETMAR CHEMICAL INDUSTRIES, LTD.	300 ARRAN AVENUE	ST. LAMBERT, QUEBEC, CANADA
50157	N. L. INDUSTRIES, INC., ELECTRONICS DEPT.	P. O. BOX 787	MUSKEGON, MI 49443
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	5757 N. GREEN BAY AVE.	MILWAUKEE, WI 53201
72042	CLINTON, E AND CO., INC.	3916 POWELTON AVENUE.	PHILADELPHIA, PA 19104
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
74970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	WASECA, MN 56093
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
80009	TEKTRONIX, INC.	P. O. BOX 500	BEAVERTON, OR 97077
80294	BOURNS, INC., INSTRUMENT DIV.	6135 MAGNOLIA AVE.	RIVERSIDE, CA 92506
81483	INTERNATIONAL RECTIFIER CORP.	9220 SUNSET BLVD.	LOS ANGELES, CA 90069
83003	VARO, INC.	800 W. GARLAND AVE.	GARLAND, TX 75040
86684	RCA CORP., ELECTRONIC COMPONENTS	415 S. 5TH ST.	HARRISON, NJ 07029
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NB 68601
91929	HONEYWELL, INC., MICRO SWITCH DIV.	CHICAGO & SPRING STS.	FREEPORT, IL 61032
93410	ESSEX INTERNATIONAL, INC., CONTROLS DIV. MANSFIELD PLANT	P. O. BOX 1007	MANSFIELD, OH 44903

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-4054-00	B010100	B010249	CKT BOARD ASSY:PUSH BUTTON SWITCH	80009	670-4054-00
A1	670-4054-01	B010250		CKT BOARD ASSY:PUSH BUTTON SWITCH	80009	670-4054-01
A2	670-3867-00	B010100	B010249	CKT BOARD ASSY:MEMORY	80009	670-3867-00
A2	670-3867-01	B010250		CKT BOARD ASSY:MEMORY	80009	670-3867-01
A3	670-3908-00	B010100	B010249	CKT BOARD ASSY:OUTPUT	80009	670-3908-00
A3	670-3908-01	B010250		CKT BOARD ASSY:OUTPUT	80009	670-3908-01
C7	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C11	283-0023-00	XB010250		CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C12	283-0164-00			CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
C13	283-0023-00	XB010250		CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C14	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C15	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C16	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C17	281-0783-00			CAP.,FXD,CER DI:0.1UF,20%,100V	72982	8045-D-Z5U104M
C18	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C19	281-0783-00			CAP.,FXD,CER DI:0.1UF,20%,100V	72982	8045-D-Z5U104M
C20	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C22	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C27	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C29	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C40	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C42	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C60	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C62	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C67	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C68	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C80	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C82	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C132	281-0564-00	XB010275		CAP.,FXD,CER DI:24PF,5%,500V	72982	301-000C0G0240J
C136	283-0051-00	XB010250		CAP.,FXD,CER DI:0.0033UF,5%,100V	72982	8131N145 A 332J
C137	283-0167-00	XB010250		CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C211	283-0023-00	XB010250		CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C212	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C213	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C214	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C215	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C216	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C561	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C562	283-0023-00	B010100	B010249	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C562	283-0164-00	B010250		CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
C563	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C564	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C565	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C566	283-0023-00	B010100	B010249	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C566	283-0164-00	B010250		CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
C568	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C569	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C571	290-0746-00			CAP.,FXD,ELCTLT:47UF,+50-10%,16V	0000W	16VBSL47
C572	283-0023-00	B010100	B010249	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C572	283-0164-00	B010250		CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
C573	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C574	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C575	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C576	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C577	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C578	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0

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C579	283-0023-00	B010100	B010249	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C579	283-0164-00	B010250		CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
C602	290-0527-00	B010100	B010249X	CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C606	290-0724-00	B010100	B010249	CAP.,FXD,ELCTLT:330UF,20%,6V	56289	196D337X0006TE3
C609	283-0023-00	XB010405		CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C606	290-0519-00	B010250		CAP.,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C610	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C611	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C625	290-0530-00			CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C680	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C686	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C692	290-0530-00			CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C702	290-0524-00			CAP.,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL
C704	290-0524-00			CAP.,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL
C731	285-0882-00			CAP.,FXD,PLSTC:0.047UF,10%,100V	56289	LP66A1B473K001
C732	285-1134-00			CAP.,FXD,PLSTC:0.1UF,0.5%,100V	50558	ECT 285-1134-00
C733	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C736	290-0524-00			CAP.,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL
C800	281-0634-00			CAP.,FXD,CER DI:10PF,+/-0.25PF,500V	72982	374-011C0G0100C
C801	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C825	283-0023-00	XB010250		CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C826	283-0023-00	XB010250		CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C830	281-0783-00			CAP.,FXD,CER DI:0.1UF,20%,100V	72982	8045-D-Z5U104M
C844	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C845	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C846	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C847	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C904	290-0714-00			CAP.,FXD,ELCTLT:2000UF,+75-10%,40V	56289	39D641
C905	285-1120-00			CAP.,FXD,PLSTC:20UF,10%,200V	50558	ECT285-1120-00
C911	283-0150-00			CAP.,FXD,CER DI:650PF,5%,200V	72982	835-515B651J
C912	290-0759-00			CAP.,FXD,ELCTLT:290UF,+75-10%,15V	90201	TTX291U015C1A3
C925	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C926	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C927	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	81314147 C 104K
C928	290-0573-00	B010100	B010324	CAP.,FXD,ELCTLT:2.7UF,20%,50V	56289	196D275X0050JA1
C928	283-0212-00	B010325		CAP.,FXD,CER DI:2UF,20%,50V	72982	8141N064Z5U0205M
C929	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C932	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C933	290-0759-00			CAP.,FXD,ELCTLT:290UF,+75-10%,15V	90201	TTX291U015C1A3
C934	283-0023-00	B010100	B010249	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C934	283-0164-00	B010250		CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
C936	281-0783-00	XB010250		CAP.,FXD,CER DI:0.1UF,20%,100V	72982	8045-D-Z5U104M
C942	290-0726-00			CAP.,FXD,ELCTLT:220UF,20%,10V	56289	196D227X0010TE3
C943	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C944	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C950	283-0164-00			CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
C951	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C952	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C953	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C954	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C955	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	91418	MX104Z1201R0
C956	283-0164-00			CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
CR20	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01
CR21	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01
CR40	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01
CR41	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01

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CR60	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01
CR61	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01
CR68	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR80	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01
CR81	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01
CR136	152-0071-00	XB010250		SEMICOND DEVICE:GERMANIUM,15V,40MA	14433	G865
CR137	152-0071-00	XB010250		SEMICOND DEVICE:GERMANIUM,15V40MA	14433	G865
CR212	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR213	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR214	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR215	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR216	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR217	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR218	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR219	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR220	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR312	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR313	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR314	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR315	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR316	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR317	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR318	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR319	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR412	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR413	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR414	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR415	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR416	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR417	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR418	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR419	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR512	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR513	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR514	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR515	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR516	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR517	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR518	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR519	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR563	152-0071-00			SEMICOND DEVICE:GERMANIUM,15V,40MA	14433	G865
CR564	152-0071-00			SEMICOND DEVICE:GERMANIUM,15V,40MA	14433	G865
CR566	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR567	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR607	152-0141-02	B010100	B010249X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR608	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR609	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR610	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR611	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR615	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR620	150-1029-00			LAMP,LED:LIGHT-EMITTING DIODE,20V	53184	XC2096
CR693	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR694	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152

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CR726	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR727	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR728	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR732	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR734	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR736	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR737	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR843	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01
CR844	152-0323-01			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-01
CR904	152-0462-00			SEMICOND DEVICE:SILICON,200V,2.5A	04713	MDD970-3
CR905	152-0636-00			SEMICOND DEVICE:RECT,SI,SCHOTTKY,35V,5A	80009	152-0636-00
CR928	152-0141-02	XB010250		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
DS565	150-0093-01			LAMP,INCAND:5V,0.06A,0.05 MSCP,SEL	87034	9AS15
DS708	150-0093-01			LAMP,INCAND:5V,0.06A,0.05 MSCP,SEL	87034	8AS15
F510	159-0056-00			FUSE,CARTRIDGE:0.1A,125V,FAST-BLOW	75915	279-100
F520	159-0116-00			FUSE,CARTRIDGE:1A,125V,0.4 SEC 0.17 LEADS	75915	273001
F905	159-0126-00			FUSE,CARTRIDGE:3AG,2.5A,250V,0.65 SEC	71400	AGC2-1/2
J22	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J24	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J42	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J44	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J62	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J64	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J82	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J84	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J100	131-0569-00			CONN,RCPT,ELEC:25 PIN FEMALE	71468	DB25S
J120	131-0569-00			CONN,RCPT,ELEC:25 PIN FEMALE	71468	DB25S
J138	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J214	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J314	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J414	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J514	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J609	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J698	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J699	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J730	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J731	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J738	131-1003-00			CONNECTOR,BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J739	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J829	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J830	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J838	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J846	131-0258-00			CONNECTOR,RCPT,:JACK ASSEMBLY	80009	131-0258-00
L800	108-0182-00			COIL,RF:0.3UH	80009	108-0182-00
L841	108-0550-00			COIL,RF:110NH,10%	80009	108-0550-00
L905	108-0337-00			COIL,RF:25UH	80009	108-0337-00
L932	108-0556-00			COIL,RF:12UH,20%	80009	108-0556-00
Q16	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q18	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q22A,B	151-1090-02			TRANSISTOR:FE,DUAL,N-CHANNEL,SI	80009	151-1090-02
Q42A,B	151-1090-02			TRANSISTOR:FE,DUAL,N-CHANNEL,SI	80009	151-1090-02

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Q62A,B	151-1090-02			TRANSISTOR:FE,DUAL,N-CHANNEL,SI	80009	151-1090-02
Q82A,B	151-1090-02			TRANSISTOR:FE,DUAL,N-CHANNEL,SI	80009	151-1090-02
Q136	151-0220-00	XB010250		TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q602	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q604	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q606	151-0504-00	B010100	B010324	TRANSISTOR:SILICON,N-CHAN,UNIJUNCTION	04713	2N4851
Q606	151-0504-01	B010325		TRANSISTOR:SILICON,N-CHAN,UNIJUNCTION,CHKD	80009	151-0504-01
Q620	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q628	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q629	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q640	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q642	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q644	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q650	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q652	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q654	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q660	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q662	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q664	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q670	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q672	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q674	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q680	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q682	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q684	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q694	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q698	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q702	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q704	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q708	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q712	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q714	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q716	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q718	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q720	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q722	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q724	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q728	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q732	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q733	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q734	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q736	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q738	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q740	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q846A,B	151-1090-02			TRANSISTOR:FE,DUAL,N-CHANNEL,SI	80009	151-1090-02
Q905	151-0603-00			TRANSISTOR:SILICON,NPN	02735	2N5039
Q910	151-0183-00			TRANSISTOR:SILICON,NPN	12040	NS12063
Q914	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q916	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q922	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q928	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q932	151-0506-00			TRANSISTOR:SILICON,CONTROLLED RECTIFIER	03508	C106B2
Q934	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q936	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q944	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
R1	321-0145-00			RES.,FXD,FILM:316 OHM,1%,0.125W	75042	CEAT0-3160F
R2	321-0127-00			RES.,FXD,FILM:205 OHM,1%,0.125W	75042	CEAT0-2050F
R3	321-0134-00			RES.,FXD,FILM:243 OHM,1%,0.125W	75042	CEAT0-2430F
R4	321-0119-00			RES.,FXD,FILM:169 OHM,1%,0.125W	75042	CEAT0-1690F
R5	321-0062-01			RES.,FXD,FILM:43.2 OHM,0.5%,0.125W	91637	MFF1816G43R20D
R6	321-0800-02			RES.,FXD,FILM:184.6 OHM,0.5%,0.125W	75042	CEAT2-184R6D
R7	321-0131-00			RES.,FXD,FILM:226 OHM,1%,0.125W	75042	CEAT0-2260F
R8	321-1166-01			RES.,FXD,FILM:530 OHM,0.5%,0.125W	75042	CEAT0-5300D
R9	321-0782-03			RES.,FXD,FILM:40 OHM,0.25%,0.125W	75042	CEAT2-40R0C
R10	311-1311-00			RES.,VAR,NONWIR:1K OHM,20%,1W	01121	10M155A
R11	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R12	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R14	321-1170-03			RES.,FXD,FILM:583 OHM,0.25%,0.125W	91637	MFF1816D583R0C
R15	321-1216-03			RES.,FXD,FILM:1.76K OHM,0.25%,0.125W	91637	MFF1816D1761R0C
R16	321-1645-03			RES.,FXD,FILM:841 OHM,0.25%,0.125W	91637	MFF18160841R0C
R17	321-0195-02			RES.,FXD,FILM:1.05K OHM,0.5%,0.125W	75042	CEAT2-105ID
R18	321-0770-03			RES.,FXD,FILM:4.204K OHM,0.25%,0.125W	75042	CEAT2-42040C
R19	321-1645-03			RES.,FXD,FILM:841 OHM,0.25%,0.125W	91637	MFF18160841R0C
R20	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R21	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R22	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	75042	CEAT0-20R0F
R23	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R24	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R25	311-1501-00			RES.,VAR,NONWIR:20 OHM,10%,0.50W	73138	72X-37-0-200
R26	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R27	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R28	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R29	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R40	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R41	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R42	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	75042	CEAT0-20R0F
R43	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R44	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R45	311-1501-00			RES.,VAR,NONWIR:20 OHM,10%,0.50W	73138	72X-37-0-200
R60	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R61	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R62	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	75042	CEAT0-20R0F
R63	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R64	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R65	311-1501-00			RES.,VAR,NONWIR:20 OHM,10%,0.50W	73138	72X-37-0-200
R68	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R80	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R81	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R82	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	75042	CEAT0-20R0F
R83	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R84	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R85	311-1501-00			RES.,VAR,NONWIR:20 OHM,10%,0.50W	73138	72X-37-0-200
R100	317-0471-00	XB010250		RES.,FXD,CMPSN:470 OHM,5%,0.125W	01121	BB4715
R101	317-0471-00	XB010250	B010404X	RES.,FXD,CMPSN:470 OHM,5%,0.125W	01121	BB4715
R102	317-0471-00	XB010250		RES.,FXD,CMPSN:470 OHM,5%,0.125W	01121	BB4715
R110	315-0510-00	B010100	B010404	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R110	315-0820-00	B010405		RES.,FXD,CMPSN:82 OHM,5%,0.25W	01121	CB8205

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R111	315-0510-00	XB010250	B010404	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R111	315-0750-00	B010405		RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R112	315-0510-00	XB010250		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R120	315-0680-00	XB010250		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R136	315-0510-00	XB010250		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R137	315-0750-00	XB010250		RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R150	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R213	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R214	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R217	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R218	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R220	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R270	315-0750-00	XB010250		RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R313	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R314	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R317	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R318	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R413	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R414	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R417	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R418	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R435	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R513	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R514	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R517	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R518	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R545	315-0101-00	XB010250		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R565	311-1815-00			RES.,VAR,NONWIR:50K OHM,20%,0.50W	01121	13M813
R567	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R571	301-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.50W	01121	EB2025
R601	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R602	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R603	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R604	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R605[1]	311-1827-00			RES.,VAR,NONWIR:100K OHM,20%,1W	01121	13M874
R606	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R607	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R608	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R609	315-0753-00	B010100	B010249X	RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R610	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R611	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R612	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R613	315-0330-00	XB010250		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
R614	315-0101-00	XB010250		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R615	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R620	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R624	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R625	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R626	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R627	321-0269-00	B010100	B010249	RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
R627	315-0512-00	B010250		RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R628	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F
R629	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R631	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R632	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R640	321-0343-00			RES.,FXD,FILM:36.5K OHM,1%,0.125W	91637	MFF1816G36501F

[1]Furnished as a unit with S605.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R642	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R650	321-0314-00			RES.,FXD,FILM:18.2K OHM,1%,0.125W	75042	CEAT0-1822F
R652	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R660	321-0276-00			RES.,FXD,FILM:7.32K OHM,1%,0.125W	75042	CEAT0-7321F
R662	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R670	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	75042	CEAT0-3651F
R672	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R680	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R681	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R682	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R683	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R684	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R685	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R686	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R688	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R689	315-0102-00	XB010250		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R690[1]	311-1831-00			RES.,VAR,NONWIR:DUAL,2.5K X 1K OHM,10%,0.5W	12697	388CM40965
R691	315-0221-00	B010100	B010124	RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R691	315-0241-00	B010125		RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R692	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R693	315-0431-00	B010100	B010124	RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R693	315-0331-00	B010125		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R694	315-0221-00	B010100	B010124	RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R694	315-0431-00	B010125		RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R695[2]	311-1831-00			RES.,VAR,NONWIR:DUAL,2.5K X 1K OHM,10%,0.5W	12697	388CM40965
R696	321-0104-00			RES.,FXD,FILM:118 OHM,1%,0.125W	75042	CEAT0-1180F
R697	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
R698	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R702	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R703	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R704	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R705	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R706	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R708	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R710	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R711	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R712	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R713	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R714	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	75042	CEAT0-8251F
R715	321-0310-00			RES.,FXD,FILM:16.5K OHM,1%,0.125W	75042	CEAT0-1652C
R716	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R717	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	75042	CEAT0-8251F
R720	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R721	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R722	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R723	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R727	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R729	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R730	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R731	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R732	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R733	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R734	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R735	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015

[1]Furnished as a unit with R695
[2]Furnished as a unit with R690

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R736	321-0158-00			RES.,FXD,CMPSN:432 OHM,1%,0.125W	75042	CEAT0-4320F
R737	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R738	321-0139-00			RES.,FXD,FILM:274 OHM,1%,0.125W	75042	CEAT0-2740F
R740[1]	311-1831-00			RES.,VAR,NONWIR:DUAL,2.5K X 1K OHM,10%,0.5W	12697	388CM40965
R741	321-0173-00			RES.,FXD,FILM:619 OHM,1%,0.125W	75042	CEAT0-6190F
R742	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R743	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R744	321-0072-00			RES.,FXD,FILM:54.9 OHM,1%,0.125W	75042	CEAT0-54R90F
R745[2]	311-1831-00			RES.,VAR,NONWIR:DUAL,2.5K X 1K OHM,10%,0.5W	12697	388CM40965
R800	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R829	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R830	321-0219-00			RES.,FXD,FILM:1.87K OHM,1%,0.125W	75042	CEAT0-1871F
R833	315-0101-00	B010100	B010249X	RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R841	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R842	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R843	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R844	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R845	311-1007-00			RES.,VAR,NONWIR:20 OHM,20%,0.50W	80294	3329HG48-200
R846	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	75042	CEAT0-20R0F
R847	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R905	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R910	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R911	307-0111-00			RES.,FXD,CMPSN:3.6 OHM,5%,0.25W	01121	CB36G5
R912	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R914	321-0143-00			RES.,FXD,FILM:301 OHM,1%,0.125W	75042	CEAT0-3010F
R916	315-0121-00			RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
R920	315-0243-00			RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
R921	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R922	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R923	321-0132-00			RES.,FXD,FILM:232 OHM,1%,0.125W	75042	CEAT0-2320F
R925	311-1244-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	80294	3386X-T07-101
R926	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	75042	CEAT0-9090F
R927	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R928	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R929	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R932	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R934	315-0430-00			RES.,FXD,CMPSN:43 OHM,5%,0.25W	01121	CB4305
R936	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4705
R942	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R943	301-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.50W	01121	EB2025
R944	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
S10	263-0013-03			ACTR ASSY,PB:3 LATCHING,10MM,3 CONTACTS	80009	263-0013-03
S15	263-0011-01			ACTR ASSY,PB:1 PUSH,10MM,W/2 CONTACTS	80009	263-0011-01
S110	263-0013-01			ACTR ASSY,PB:3 LATCHING,10MM,3 CONTACTS	80009	263-0013-01
S565	263-1132-00			ACTR ASSY,CAM S:SELECTOR	80009	263-1132-00
S605[3]	311-1827-00			RES.,VAR,NONWIR:100K OHM,20%,1W DPST/SW	80009	311-1827-00
S608	263-0011-01			ACTR ASSY,PB:3 LATCHING,10MM,3 CONTACTS	80009	263-0011-01
S610	263-0011-03			ACTR ASSY,PB:1 PUSH,10MM,1 CONTACT	80009	263-0011-03
S625	263-0013-02			ACTR ASSY,PB:3 LATCHING,10MM,4 CONTACT	80009	263-0013-02
S720	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
S825	263-1133-00			ACTR ASSY,CAM S:TIME BASE	80009	263-1133-00
S835	260-0984-00			SWITCH,SLIDE:DP3POSN,0.5A,125VAC-DC	79727	G-128SPC/7140

[1]Furnished as a unit with R745
[2]Furnished as a unit with R740
[3]Furnished as a unit with R605

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
S848	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
T911	120-1034-00			TRANSFORMER,RF:POT CORE	80009	120-1034-00
U14	156-0067-05			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	80009	156-0067-05
U15	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U48	156-0705-00			MICROCIRCUIT,DI:DUAL A/D COMPARATOR	04713	SC62438L
U68	156-0705-00			MICROCIRCUIT,DI:DUAL A/D COMPARATOR	04713	SC62438L
U110	156-0757-00			MICROCIRCUIT,DI:DUAL 3-IN,3-OUT OR NOR GATE	04713	MC10103L0RP
U111	307-0488-00			RES NTWK,THK FI:100 OHM,20%,0.75W	32997	4406R001101
U120	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U121	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U130	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U132	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	04713	MC10102L
U136	156-0295-00	B010100	B010249	MICROCIRCUIT,DI:MECL 10K OHM,TRIPLE 2-INPUT	04713	MC10107L
U136	156-0687-00	B010250		MICROCIRCUIT,DI:QUAD EXCLUSIVE OR COMPARATOR	04713	MC10113
U140	156-0641-00			MICROCIRCUIT,DI:UNIVERSAL HEXIDECIMAL CNTR	04713	MC10136L
U141	307-0501-00			RES NTWK,THK FI:(5) 50 OHM,5%,0.125W	91637	CSP06E01500J
U150	156-0641-00			MICROCIRCUIT,DI:UNIVERSAL HEXIDECIMAL CNTR	04713	MC10136L
U151	307-0493-00			RES NTWK,THK FI:(7) 50 OHM,5%,0.125W	32997	4408R001500
U214	156-0333-00			MICROCIRCUIT DI:DUAL A/D COMPARATOR	04713	MC1650L
U218	156-0333-00			MICROCIRCUIT DI:DUAL A/D COMPARATOR	04713	MC1650L
U225	156-0632-00			MICROCIRCUIT DI:QUAD 2 INPUT MUX/LATCH	04713	MC10173L
U231	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U235	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U241	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4405R0011010
U245	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U251	307-0488-00			RES NTWK,THK FI:100 OHM,20%,0.75W	32997	4406R0011010
U252	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U254	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U256	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U258	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U260	156-0458-00			MICROCIRCUIT,DI:ECL 10K QUAD AND GATE	04713	MC10104L
U261	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U270	156-0650-00			MICROCIRCUIT,DI:8 LINE MULTIPLEXER	04713	MC10164L
U314	156-0333-00			MICROCIRCUIT DI:DUAL A/D COMPARATOR	04713	MC1650L
U318	156-0333-00			MICROCIRCUIT DI:DUAL A/D COMPARATOR	04713	MC1650L
U335	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U341	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U345	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U351	307-0488-00			RES NTWK,THK FI:100 OHM,20%,0.75W	32997	4406R001101
U352	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U354	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U356	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U358	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U361	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U414	156-0333-00			MICROCIRCUIT DI:DUAL A/D COMPARATOR	04713	MC1650L
U418	156-0333-00			MICROCIRCUIT DI:DUAL A/D COMPARATOR	04713	MC1650L
U425	156-0632-00			MICROCIRCUIT,DI:QUAD 2 INPUT MUX/LATCH	04713	MC10173L
U431	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U435	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U441	307-0488-00			RES NTWK,THK FI:100 OHM,20%,0.75W	32997	4406R001101
U445	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U451	307-0487-00			RES NTWK,THK FI:100 OHM,20%,0.5W	32997	4304R001101
U452	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U454	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U456	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U458	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U460	156-0458-00			MICROCIRCUIT,DI:ECL 10K QUAD AND GATE	04713	MC10104L

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U461	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U514	156-0333-00			MICROCIRCUIT DI:DUAL A/D COMPARATOR	04713	MC1650L
U518	156-0333-00			MICROCIRCUIT DI:DUAL A/D COMPARATOR	04713	MC1650L
U531	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U535	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U541	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U545	156-0638-00			MICROCIRCUIT,DI:FOUR-BIT UNIV SHIFT RGTR	04713	MC10140L
U551	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U552	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U554	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U556	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U558	156-0657-00			MICROCIRCUIT DI:256 BIT RAM	80009	156-0657-00
U560	156-0458-00			MICROCIRCUIT,DI:ECL 10K QUAD AND GATE	04713	MC10104L
U561	307-0488-00			RES NTWK,THK FI:100 OHM,20%,0.75W	32997	4406R001101
U565	156-0687-00			MICROCIRCUIT DI:QUAD EXCLUSIVE-OR COMPARATOR	04713	MC10113
U570	156-0640-00			MICROCIRCUIT,DI:8 LINE MULTIPLEXER	04713	MC10164L
U601	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U608	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	04713	MC10102L
U610	156-0295-00	B010100	B010249	MICROCIRCUIT,DI:MECL 10K OHM,TRIPLE 2-INPUT	04713	MC10107L
U610	156-0687-00	B010250		MICROCIRCUIT,DI:QUAD EXCLUSIVE OR COMPARATOR	04713	MC10113
U611	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U615	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	04713	MC10131L
U616	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	04713	MC10131L
U621	307-0487-00			RES NTWK,THK FI:100 OHM,20%,0.5W	32997	4304R001101
U622	156-0641-00			MICROCIRCUIT,DI:UNIVERSAL HEXIDECIMAL CNTR	04713	MC10136L
U624	156-0641-00			MICROCIRCUIT,DI:UNIVERSAL HEXIDECIMAL CNTR	04713	MC10136L
U628	156-0688-00			MICROCIRCUIT,DI:DUAL J-K MASTER-SLAVE FF	04713	MC10135L
U630	156-0641-00			MICROCIRCUIT,DI:UNIVERSAL HEXIDECIMAL CNTR	04713	MC10136L
U631	307-0488-00			RES NTWK,THK FI:100 OHM,20%,0.75W	32997	4406R001101
U632	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	04713	MC10102L
U800	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	04713	MC10102L
U801	307-0493-00			RES NTWK,THK FI:(7)50 OHM,5%,0.125W	32997	4408R001500
U810	156-0642-00			MICROCIRCUIT,DI:BI-QUINARY CNTR	04713	MC10138L
U811	307-0489-00			RES NTWK,THK FI:100 OHM,20%,1.0W	32997	4408R0011010
U812	156-0642-00			MICROCIRCUIT,DI:BI-QUINARY CNTR	04713	MC10138L
U814	156-0642-00			MICROCIRCUIT,DI:BI-QUINARY CNTR	04713	MC10138L
U816	156-0642-00			MICROCIRCUIT,DI:BI-QUINARY CNTR	04713	MC10138L
U818	156-0642-00			MICROCIRCUIT,DI:BI-QUINARY CNTR	04713	MC10138L
U820	156-0640-00			MICROCIRCUIT,DI:8 LINE MULTIPLEXER	04713	MC10164L
U821	307-0488-00			RES NTWK,THK FI:100 OHM,20%,0.75W	32997	4406R001101
U824	156-0637-00			MICROCIRCUIT,DI:DUAL 4 TO 1 MULTIPLEXER	04713	MC10174P
U828	156-0642-00			MICROCIRCUIT,DI:BI-QUINARY CNTR	04713	MC10138L
U830	156-0705-00			MICROCIRCUIT,DI:DUAL A/D COMPARATOR	04713	SC62438L
U831	307-0492-00			RES NTWK,THK FI:(3)50 OHM,5%,0.125	32997	4304R001500
U838	156-0637-00			MICROCIRCUIT,DI:DUAL 4 TO 1 MULTIPLEXER	04713	MC10174P
U942	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
VR571	152-0243-00			SEMICOND DEVICE:ZENER,0.4W,15V,5%	81483	1N965B
VR688	152-0243-00			SEMICOND DEVICE:ZENER,0.4W,15V,5%	81483	1N965B
VR716	152-0195-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	80009	152-0195-00
VR903	152-0309-00	XB010275		SEMICOND DEVICE:ZENER,1W,6.2V,5%	04713	1N3828A
VR920	152-0461-00	B010100	B010159	SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	1N821
VR920	153-0060-00	B010160		SEMICOND DEVICE:ZENER,6.2V,2%,7.5MA,SEL	80009	153-0060-00
VR922	152-0514-00			SEMICOND DEVICE:ZENER,0.4W,10V	99942	R4763
VR926	152-0195-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6512
VR932	152-0175-00			SEMICOND DEVICE:ZENER,0.4W,5.6V,5%	04713	1N752A
VR942	152-0195-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6512
VR943	152-0243-00			SEMICOND DEVICE:ZENER,0.4W,15V,5%	81483	1N965B
Y800	158-0106-00			XTAL UNIT,QTZ:100HMZ,+/-0.0025%,SERIES	13571	TEK158-0106-00

INSTRUMENT OPTIONS

No options were available for this instrument at the time of this printing.

Information on any subsequent options may be found in the CHANGE INFORMATION section in the back of this manual.

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).

Resistors = Ohms (Ω).

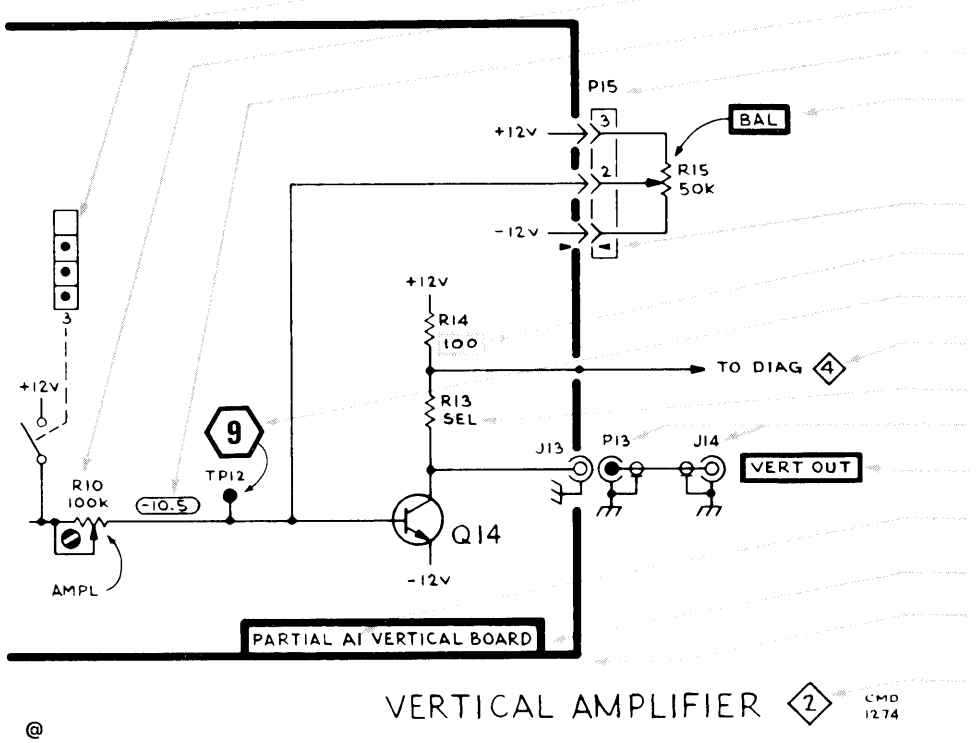
Symbols used on the diagrams are based on ANSI Standard Y32.2-1970.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	H	Heat dissipating device (heat sink, heat radiator, etc.)	RT	Thermistor
AT	Attenuator, fixed or variable	HR	Heater	S	Switch
B	Motor	HY	Hybrid circuit	T	Transformer
BT	Battery	J	Connector, stationary portion	TC	Thermocouple
C	Capacitor, fixed or variable	K	Relay	TP	Test point
CB	Circuit breaker	L	Inductor, fixed or variable	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	V	Electron tube
DL	Delay line	M	Meter	VR	Voltage regulator (zener diode, etc.)
DS	Indicating device (lamp)	P	Connector, movable portion	Y	Crystal
E	Spark Gap	Q	Transistor or silicon-controlled rectifier	Z	Phase shifter
F	Fuse	R	Resistor, fixed or variable		
FL	Filter				

The following special symbols are used on the diagrams:



VERTICAL AMPLIFIER 2 CMD 1274

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Cam Switch Closure Chart

Internal Screwdriver Adjustment

Test Voltage

Plug to E.C. Board

Panel Adjustment

Plug Index

Modified Component—See Parts List

Refer to Waveform

Refer to Diagram Number

SEL Value Selected at Factory

Coaxial Connector

Panel Connector

Assembly Number

Board Name

Etched Circuit Board Outlined in Black

Schematic Name and Number

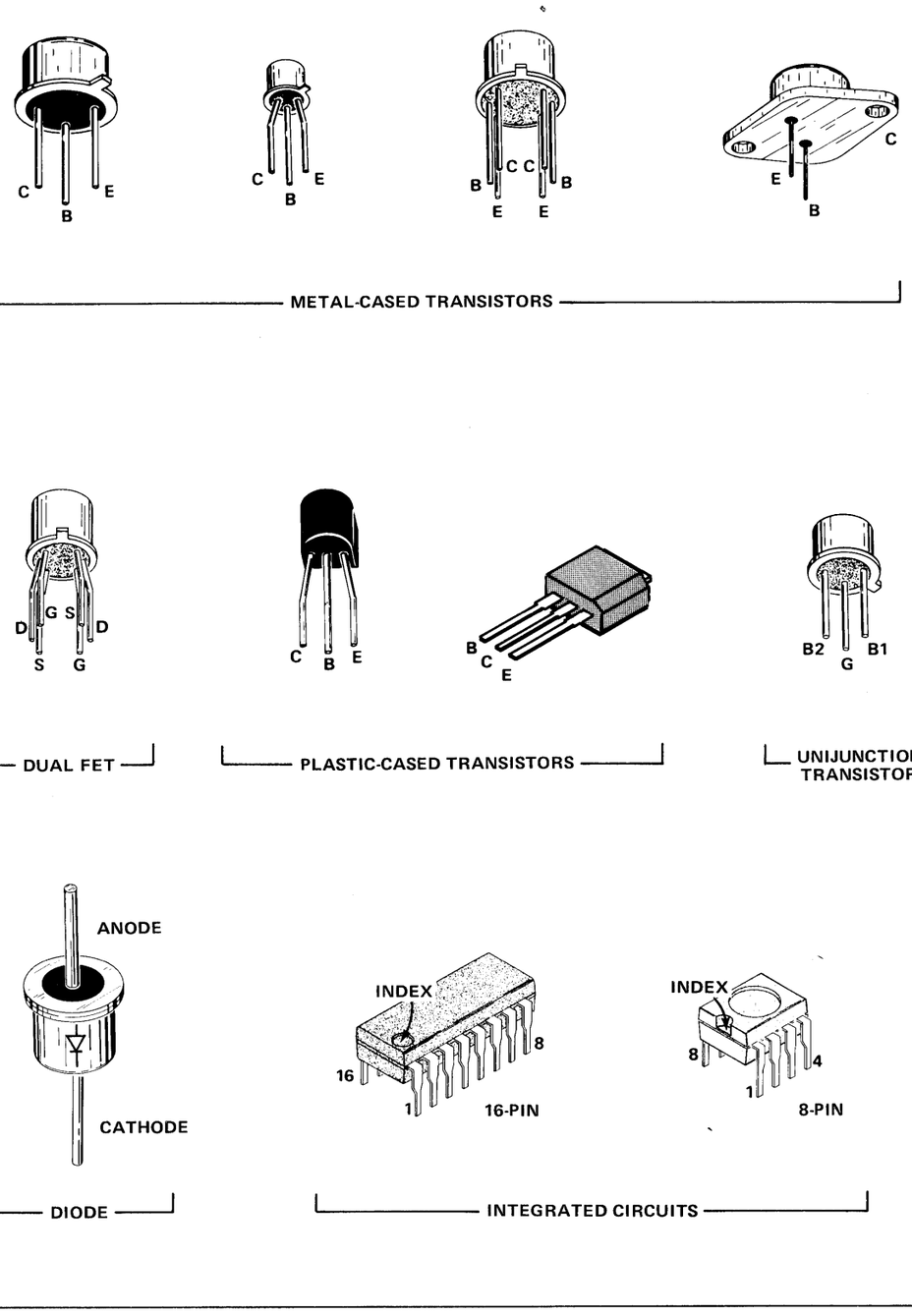


Fig. 8-1. Semiconductor lead configuration.

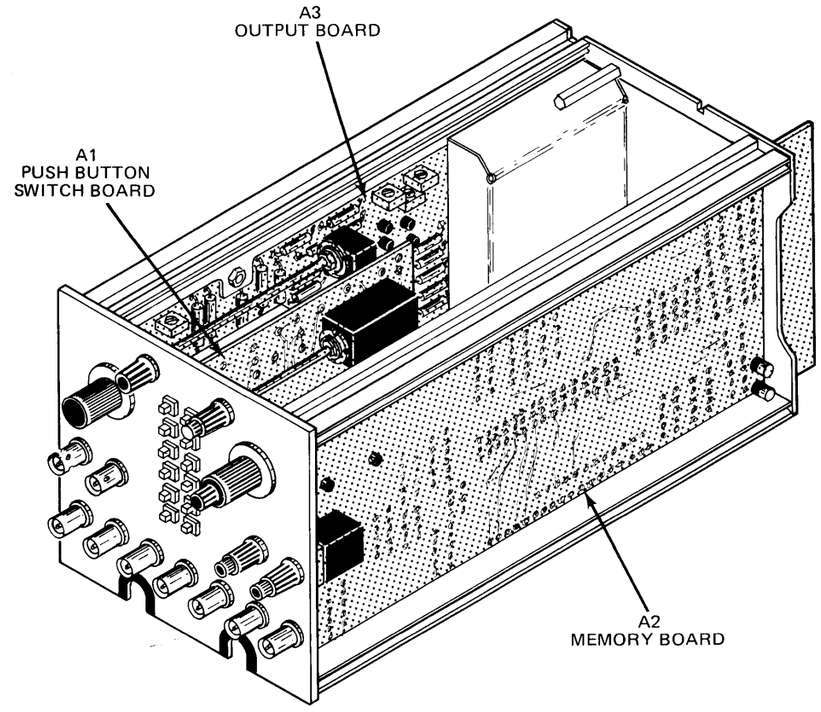


Fig. 8-2. Circuit board locations.

LA 501

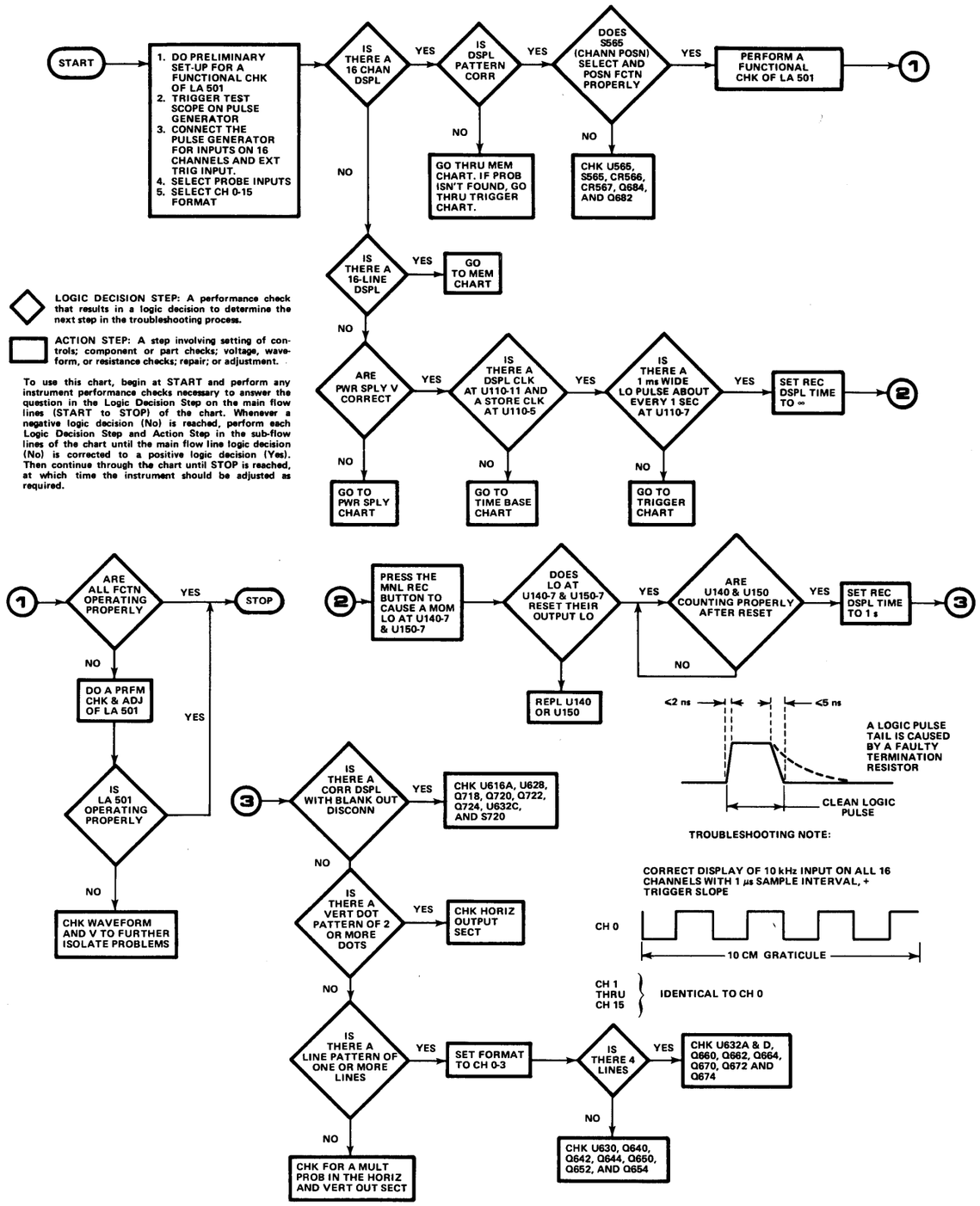


Fig. 8-3. Main troubleshooting chart for LA 501.

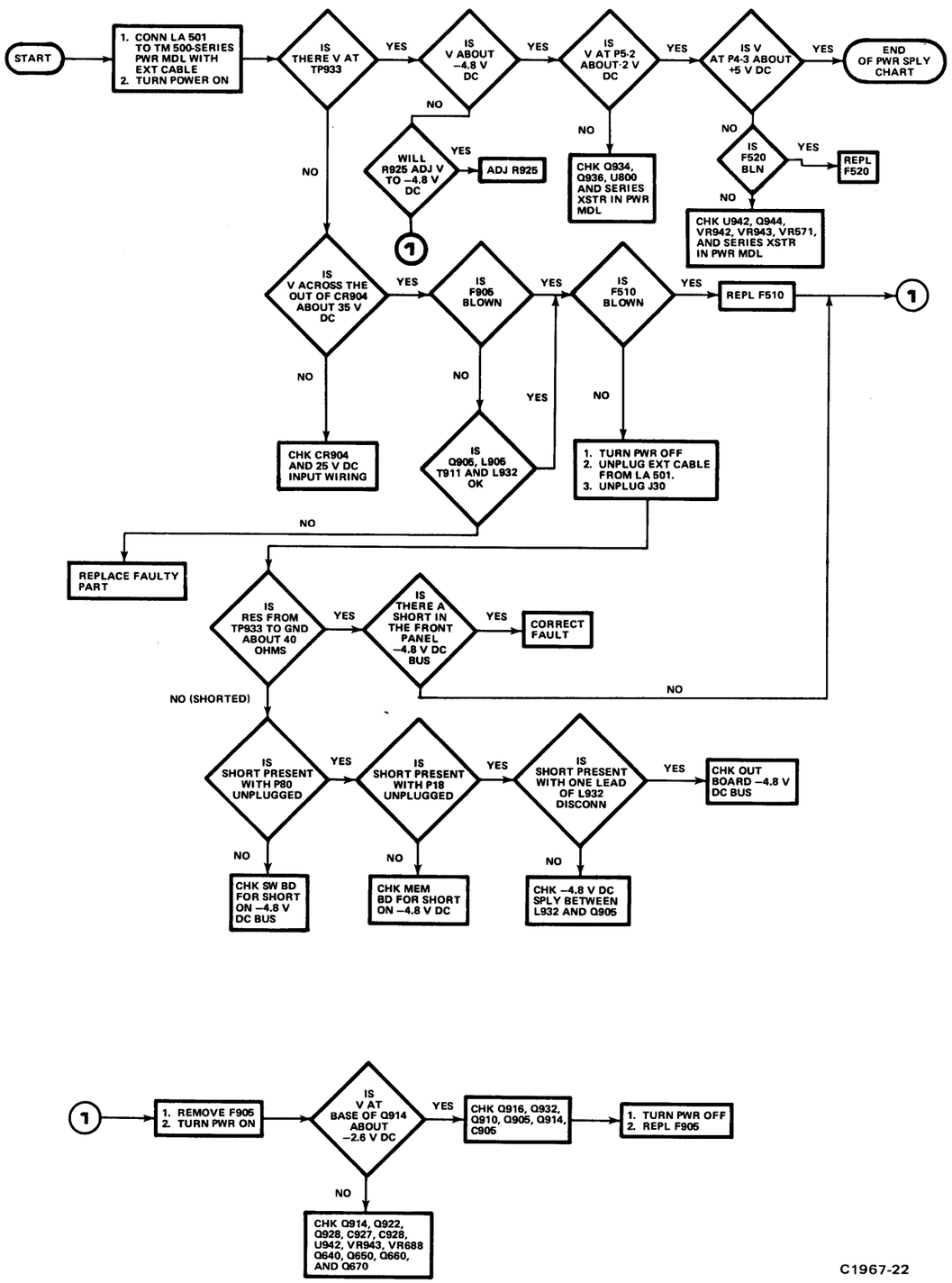
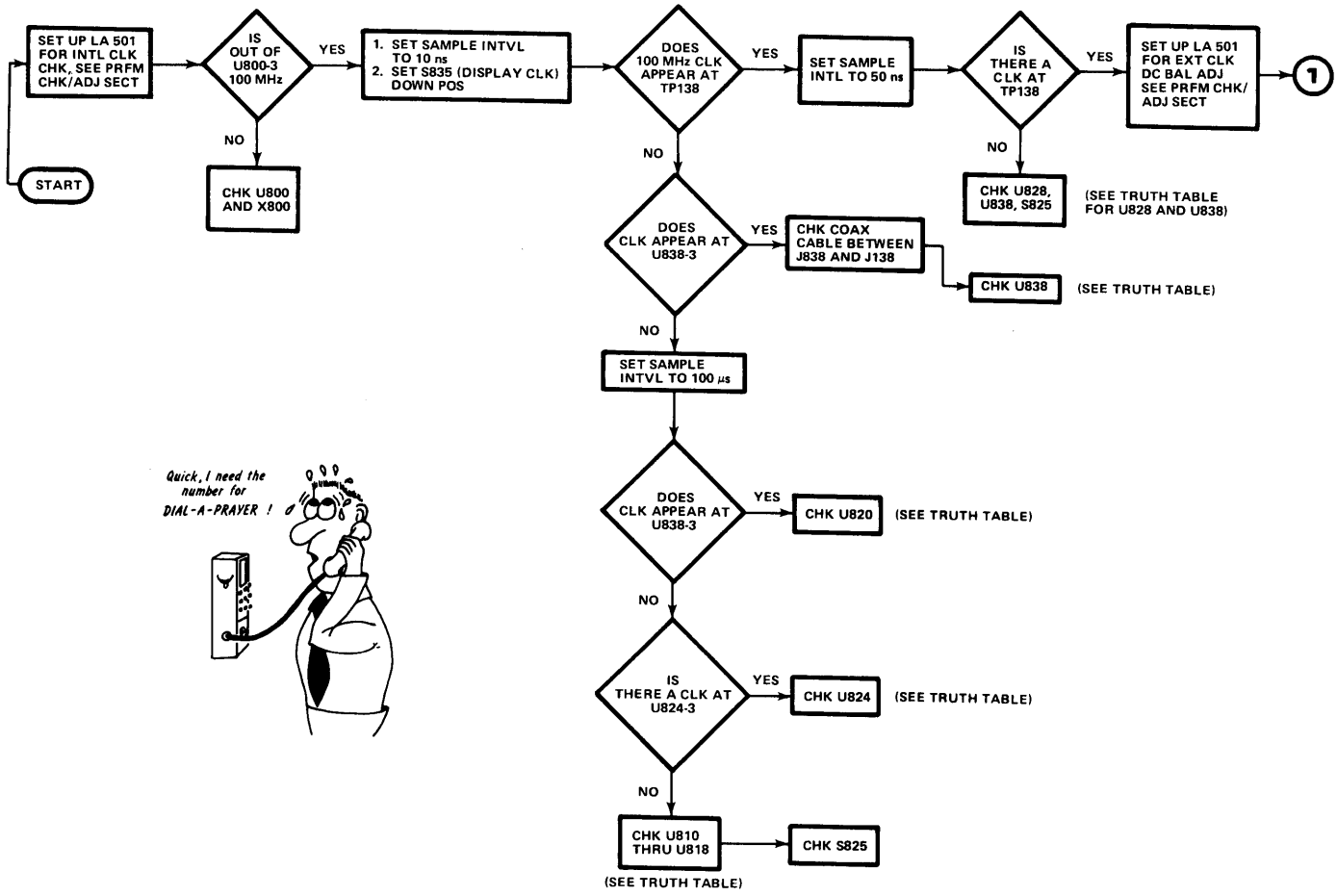


Fig. 8-4. Troubleshooting chart for Power Supplies.



U820

TRUTH TABLE

ENABLE	ADDRESS INPUTS A2	A1	A0	Z
L	L	L	L	D0
L	L	L	H	D1
L	L	H	L	D2
L	L	H	H	D3
L	H	L	L	D4
L	H	L	H	D5
L	H	H	L	D6
L	H	H	H	D7
H	Ø	Ø	Ø	L

Ø — Don't Care.

U828

COUNTER TRUTH TABLES

BI-QUINARY

(CLOCK CONNECTED TO C2 AND Q3 CONNECTED TO C1)

COUNT	Q1	Q2	Q3	Q0
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	L	L	L	H
6	H	L	L	H
7	L	H	L	H
8	H	H	L	H
9	L	L	H	H

U810 THRU U818

BCD

(CLOCK CONNECTED TO C1 AND Q0 CONNECTED TO C2)

COUNT	Q0	Q1	Q2	Q3
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H

U838, U824

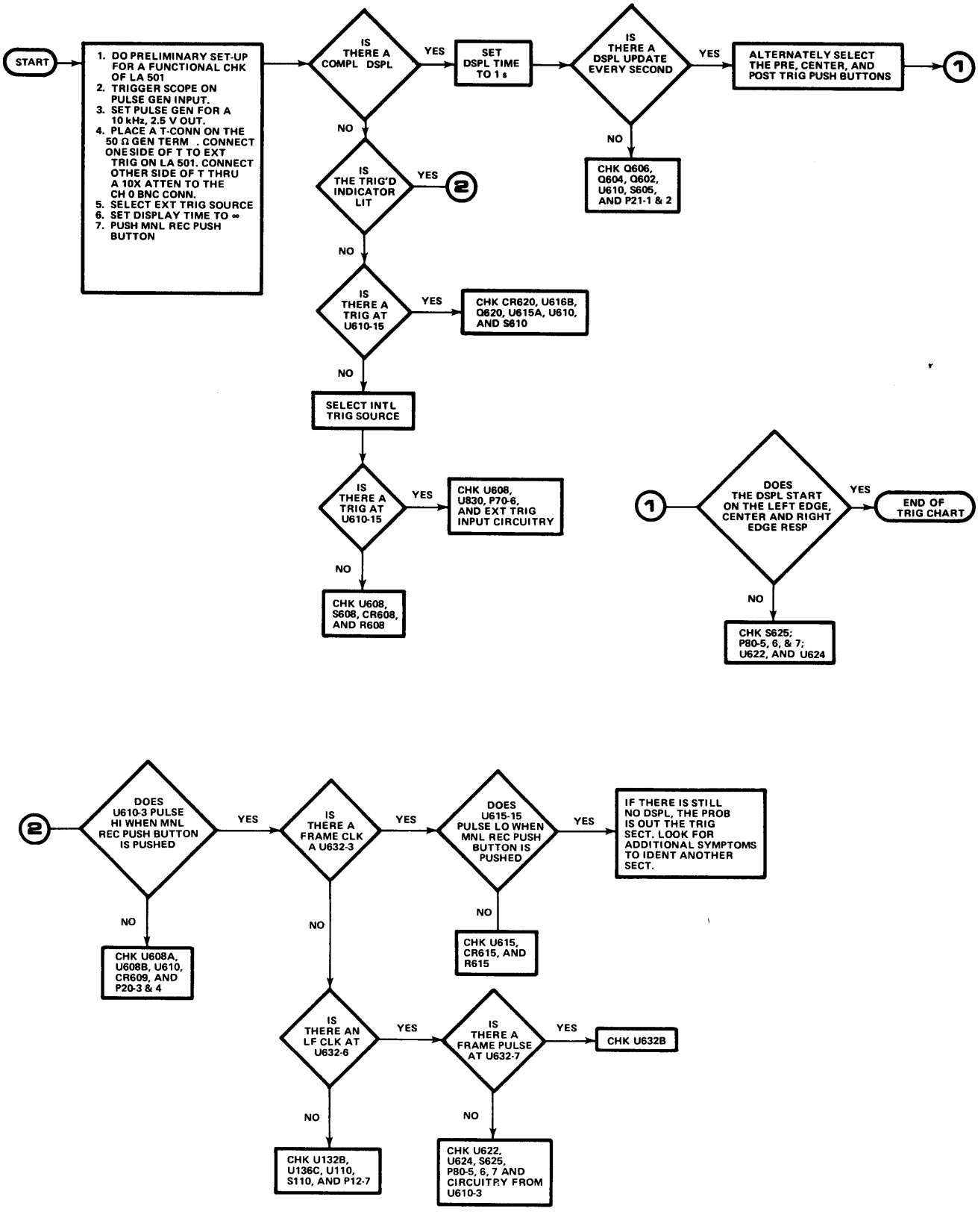
TRUTH TABLE

ENABLE	INPUTS A1	A0	OUTPUTS Z
H	Ø	Ø	L
L	L	L	X0
L	L	H	X1
L	H	L	X2
L	H	H	X3

Ø — Don't Care.

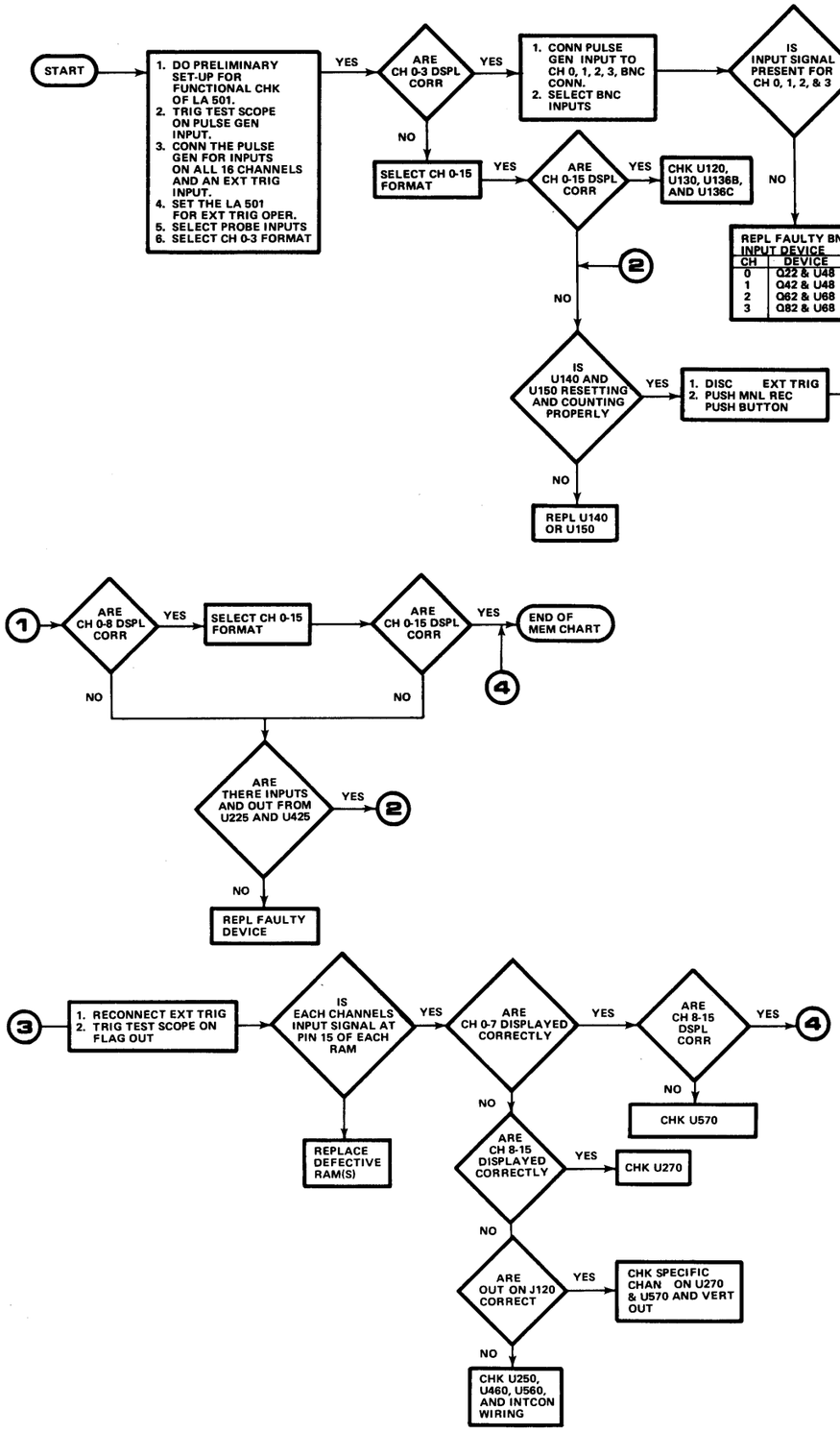
C1967-21

Fig. 8-5. Troubleshooting chart for Time Base circuit.



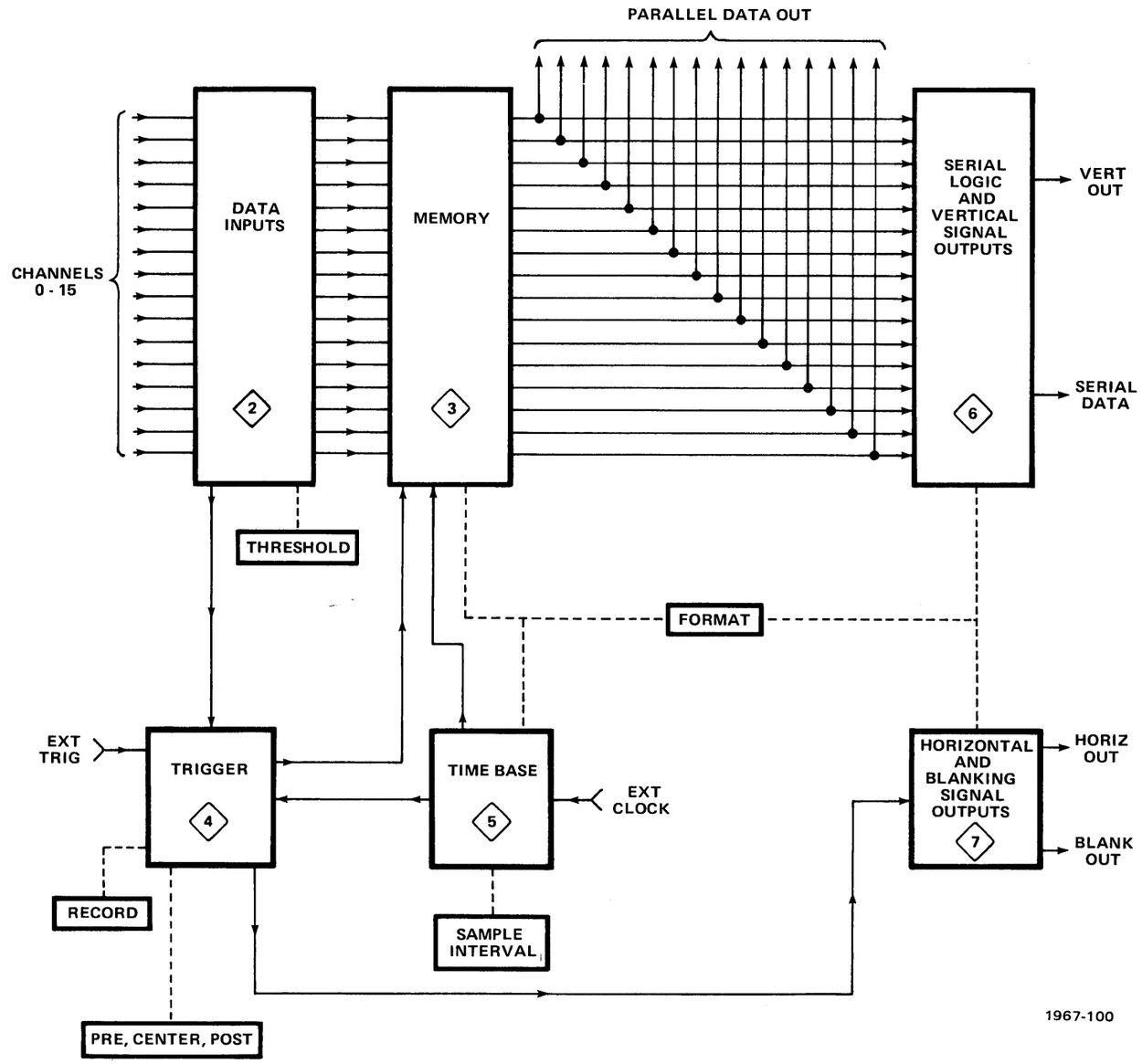
C1967-98

Fig. 8-6. Troubleshooting chart for Trigger circuit.



C1967-25

Fig. 8-7. Troubleshooting chart for Memory circuit.



1967-100

BLOCK DIAGRAM

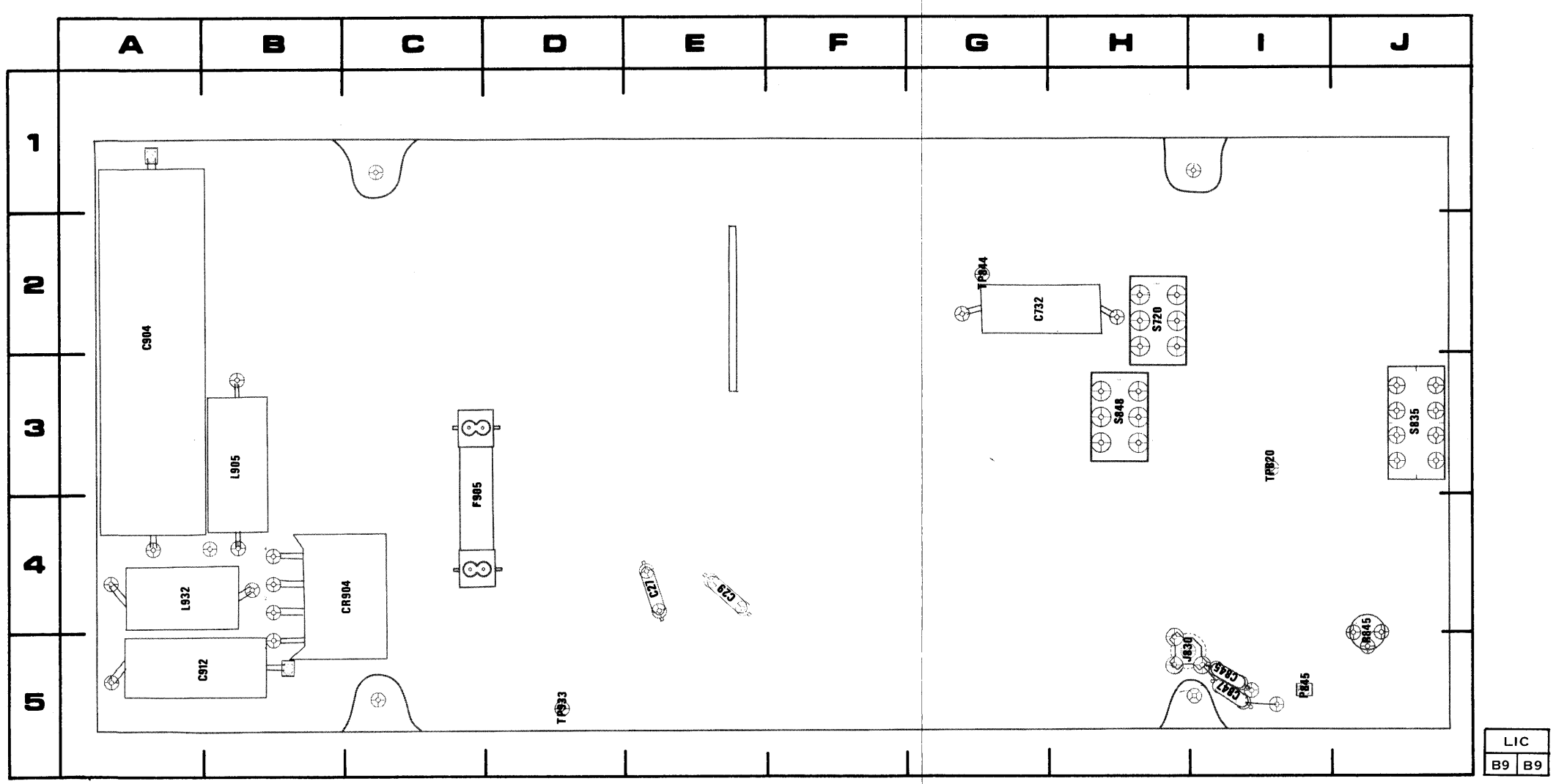
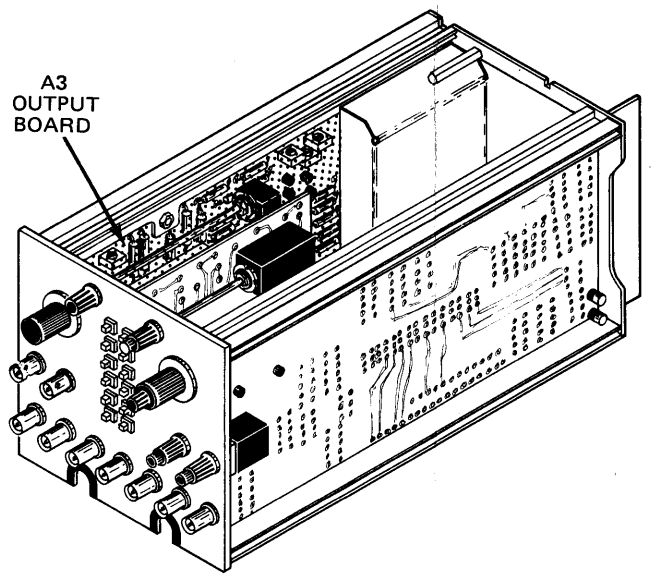
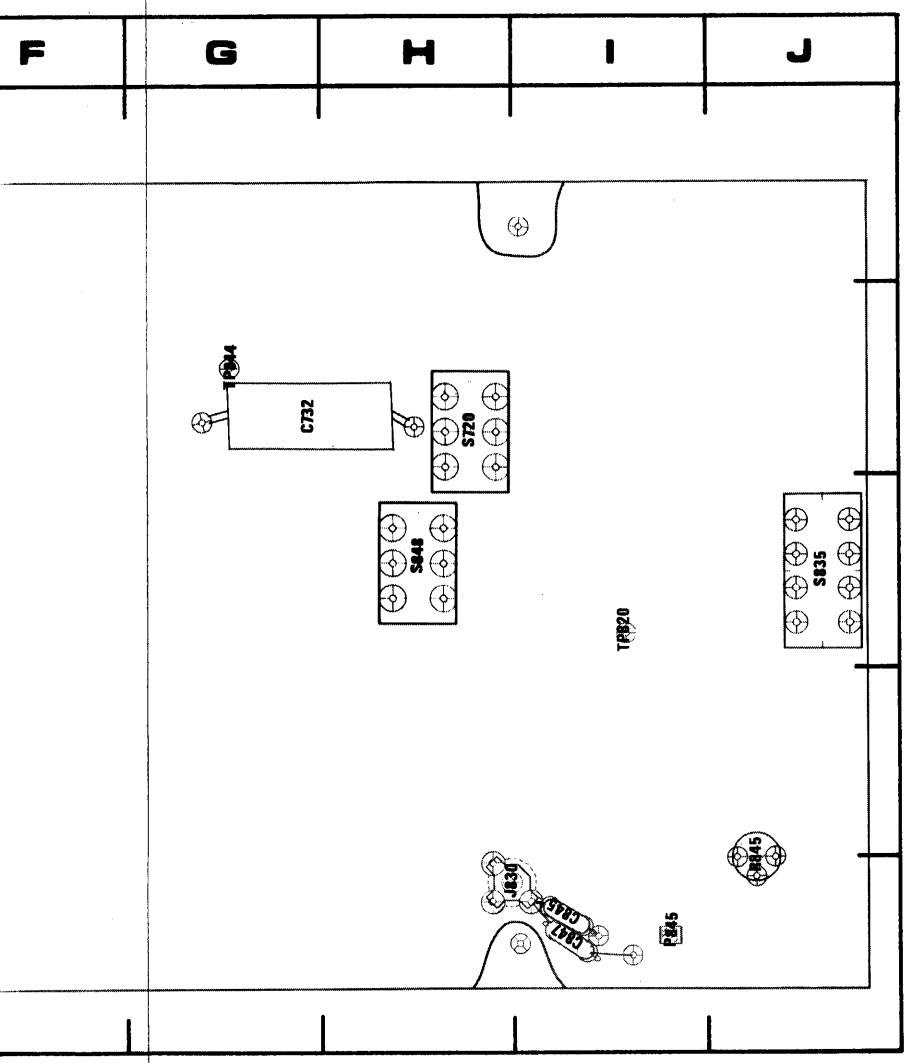


Fig. 8-8. A3—Output circuit board, components mounted on back of board.

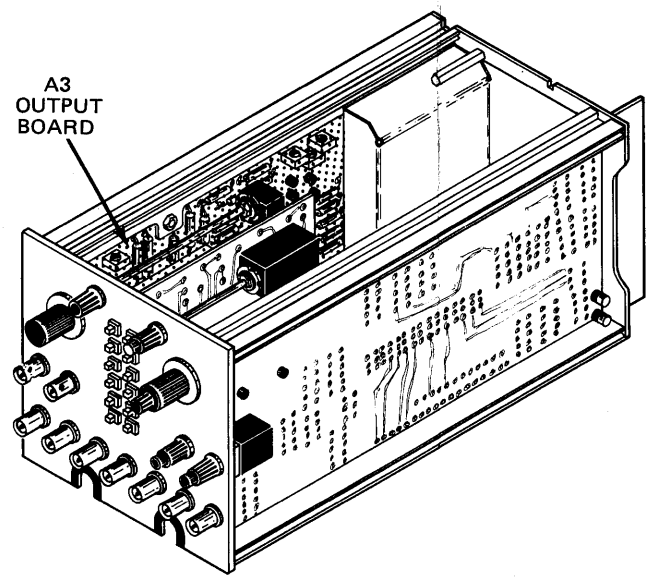


CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C27	4E	C847	5I	CR904	4C	J830	5H	P845	5I	S720	2H	TP820	3I
C29	4E	C904	2A							S835	3J	TP844	2G
C732	2G	C912	5A	F905	4C	L905	3B	R845	5J	S848	3H	TP933	5D
C845	5I					L932	4A						



1967-79

nts mounted on back of board.



D ORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
	P845	5I	S720	2H	TP820	3I
			S835	3J	TP844	2G
	R845	5J	S848	3H	TP933	5D

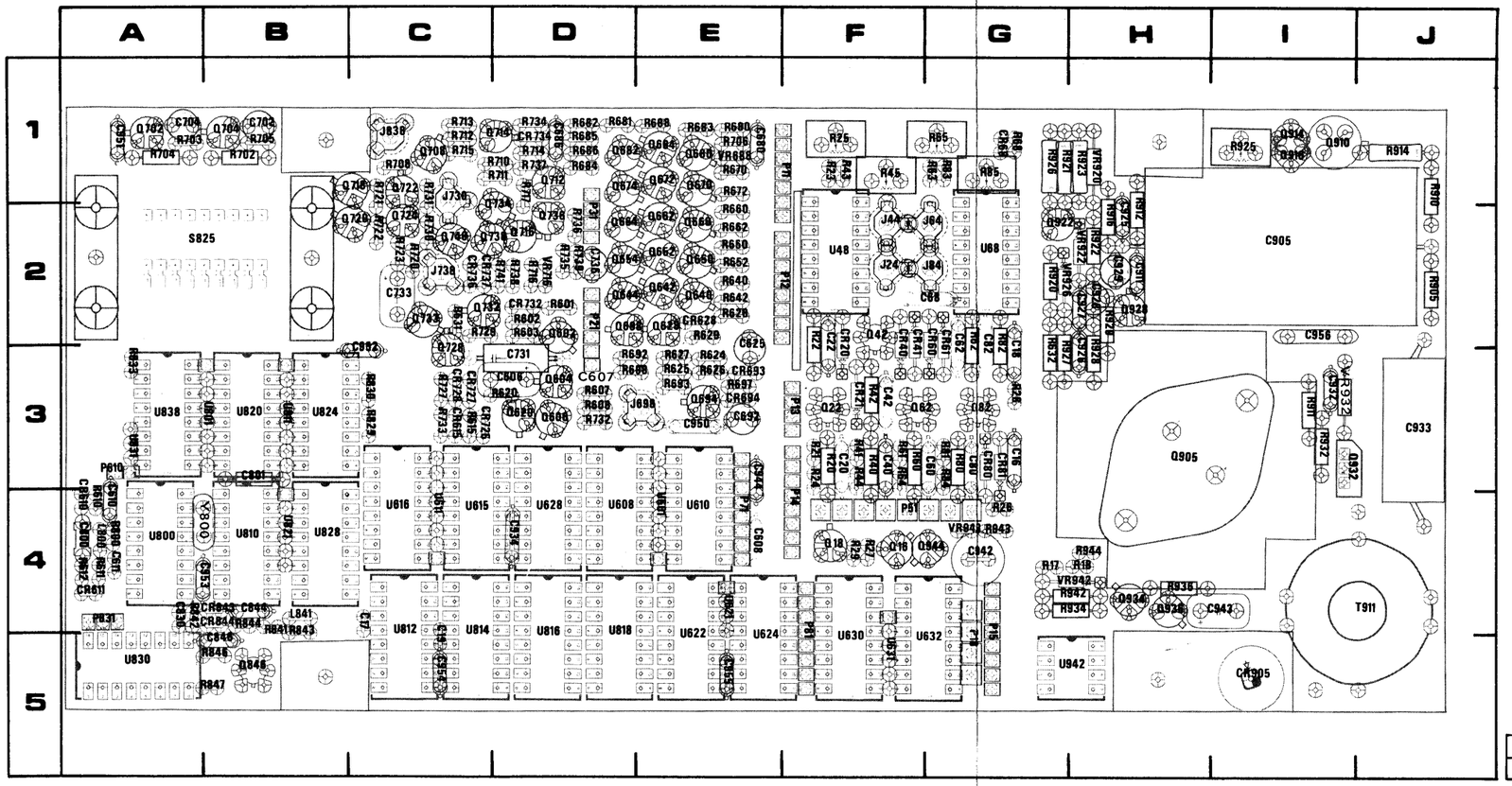
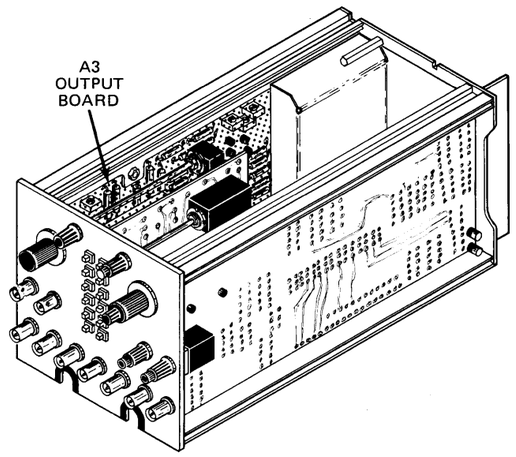


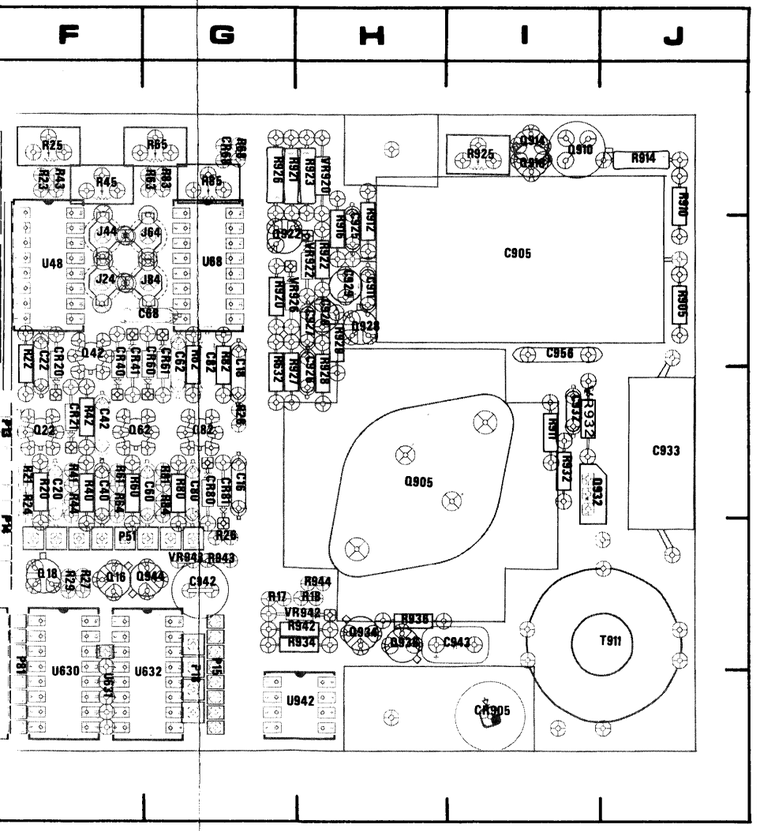
Fig. 8-9. A3—Output circuit board, component side.

1967-78



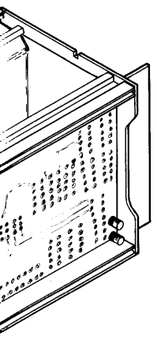
CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C16	3G	C702	1B	C944	3E	CR628	2E
C17	4C	C704	1A	C950	3E	CR693	3E
C18	3G	C731	3D	C951	1A	CR694	3E
C19	5C	C733	2C	C952	3C	CR726	3C
C20	3F	C736	2D	C953	4A	CR727	3C
C22	2F	C801	3B	C954	5C	CR728	3C
C40	3F	C830	4A	C955	5E	CR732	2D
C42	3F	C844	4B	C956	2I	CR734	1D
C60	3G	C846	5B			CR736	2C
C62	2G	C905	2I	CR20	2F	CR737	2C
C68	2G	C911	2H	CR21	3F	CR843	4B
C80	3G	C925	2H	CR40	2F	CR844	4B
C82	2G	C926	3H	CR41	2F	CR905	5I
C606	3D	C927	2H	CR60	2G		
C607	3D	C928	2H	CR61	2G	J24	2F
C608	4E	C929	2H	CR68	1G	J44	2F
C610	4A	C932	3I	CR80	3G	J64	2G
C611	4A	C933	3J	CR81	3G	J84	2G
C625	3E	C934	4D	CR610	4A	J698	3E
C680	1E	C942	4G	CR611	4A	J730	1C
C686	1D	C943	4I	CR615	3C	J738	2C

CKT NO	GRID COORD	CKT NO	GRID COORD
R652	2E	R706	1E
R660	2E	R708	1C
R662	2E	R710	1D
R670	1E	R711	1D
R672	1E	R712	1C
R680	1E	R713	1C
R681	1D	R714	1D
R682	1D	R715	1C
R683	1E	R716	2D
R684	1D	R717	1D
R685	1D	R720	2C
R686	1D	R721	1C
R688	1E	R722	2C
R692	3E	R723	2C
R693	3E	R727	3C
R697	3E	R729	2C
R698	3E	R730	2C
R702	1B	R731	1C
R703	1A	R732	3D
R704	1A	R733	3C
R705	1B	R734	1D



t board, component side.

1967-78



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C16	3G	C702	1B	C944	3E	CR628	2E	J838	1C	Q22	3F	Q680	1E	Q740	2C	R26	4G	R84	3G
C17	4C	C704	1A	C950	3E	CR693	3E			Q42	3F	Q682	1D	Q846	5B	R27	4F	R85	1G
C18	3G	C731	3D	C951	1A	CR694	3E	L800	4A	Q62	3F	Q684	1E	Q905	3H	R28	3G	R601	2D
C19	5C	C733	2C	C952	3C	CR726	3C	L841	4B	Q82	3G	Q694	3E	Q910	1I	R29	4F	R602	2D
C20	3F	C736	2D	C953	4A	CR727	3C			Q602	2D	Q698	2D	Q914	1I	R40	3F	R603	2D
C22	2F	C801	3B	C954	5C	CR728	3C	P11	1F	Q604	3D	Q702	1A	Q916	1I	R41	3F	R606	3D
C40	3F	C830	4A	C955	5E	CR732	2D	P12	2F	Q606	3D	Q704	1B	Q922	2G	R42	3F	R607	3D
C42	3F	C844	4B	C956	2I	CR734	1D	P13	3F	Q620	3D	Q708	1C	Q928	2H	R43	1F	R610	4A
C60	3G	C846	5B			CR736	2C	P14	4F	Q628	2E	Q712	1D	Q932	3I	R44	3F	R611	4A
C62	2G	C905	2I	CR20	2F	CR737	2C	P15	5G	Q640	2E	Q714	1D	Q934	4H	R45	1F	R615	3C
C68	2G	C911	2H	CR21	3F	CR843	4B	P18	5G	Q642	2E	Q716	2D	Q936	4H	R60	3F	R620	3D
C80	3G	C925	2H	CR40	2F	CR844	4B	P21	2D	Q644	2D	Q718	1C	Q944	4G	R61	3F	R624	3E
C82	2G	C926	3H	CR41	2F	CR905	5I	P31	2D	Q650	2E	Q720	2C			R62	2G	R625	3E
C606	3D	C927	2H	CR60	2G			P51	4F	Q652	2E	Q722	1C	R17	4G	R63	1G	R626	3E
C607	3D	C928	2H	CR61	2G	J24	2F	P71	4E	Q654	2D	Q724	2C	R18	4H	R64	3F	R627	3E
C608	4E	C929	2H	CR68	1G	J44	2F	P81	4F	Q660	2E	Q728	3C	R20	3F	R65	1G	R629	2E
C610	4A	C932	3I	CR80	3G	J64	2G	P610	3A	Q662	2E	Q732	2C	R21	3F	R68	1G	R631	2C
C611	4A	C933	3J	CR81	3G	J84	2G	P831	4A	Q664	2D	Q733	2C	R22	2F	R80	3G	R632	3G
C625	3E	C934	4D	CR610	4A	J698	3E			Q670	1E	Q734	2D	R23	1F	R81	3G	R640	2E
C680	1E	C942	4G	CR611	4A	J730	1C	Q16	4F	Q672	1E	Q736	2D	R24	3F	R82	2G	R642	2E
C686	1D	C943	4I	CR615	3C	J738	2C	Q18	4F	Q674	1D	Q738	2D	R25	1F	R83	1G	R650	2E

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
R652	2E	R706	1E	R735	2D	R920	2G	U68	2G	U818	5D
R660	2E	R708	1C	R736	2D	R921	1G	U601	4E	U820	3B
R662	2E	R710	1D	R737	1D	R922	2H	U608	4D	U821	4B
R670	1E	R711	1D	R738	2D	R923	1H	U610	4E	U824	3B
R672	1E	R712	1C	R739	2D	R925	1I	U611	4C	U828	4B
R680	1E	R713	1C	R741	2D	R926	1G	U615	4C	U830	5A
R681	1D	R714	1D	R829	3C	R927	3G	U616	4C	U831	3A
R682	1D	R715	1C	R830	3C	R928	3H	U621	4E	U838	3A
R683	1E	R716	2D	R833	3A	R929	2H	U622	5E	U932	3I
R684	1D	R717	1D	R841	5B	R932	3I	U624	5E	U942	5G
R685	1D	R720	2C	R842	4A	R934	4H	U628	4D		
R686	1D	R721	1C	R843	5B	R936	4H	U630	5F	VR688	1E
R688	1E	R722	2C	R844	4B	R942	4H	U631	5F	VR716	2D
R692	3E	R723	2C	R846	5B	R943	4G	U632	5G	VR920	1H
R693	3E	R727	3C	R847	5B	R944	4H	U800	4A	VR922	2H
R697	3E	R729	2C	R905	2J			U801	3B	VR926	
R698	3E	R730	2C	R910	1J	S825	2A	U810	4B	VR942	4H
R702	1B	R731	1C	R914	1J			U811	3B	VR943	4G
R703	1A	R732	3D	R911	3I	T911	4J	U812	5C		
R704	1A	R733	3C	R912	2H			U814	5C	Y800	4B
R705	1B	R734	1D	R916	2H	U48	2F	U816	5D		

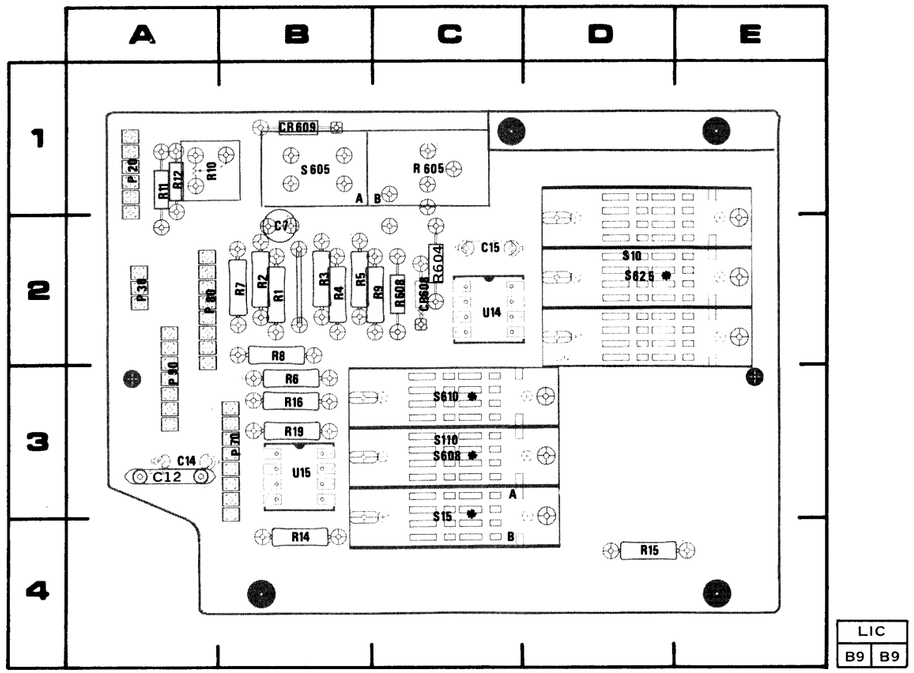
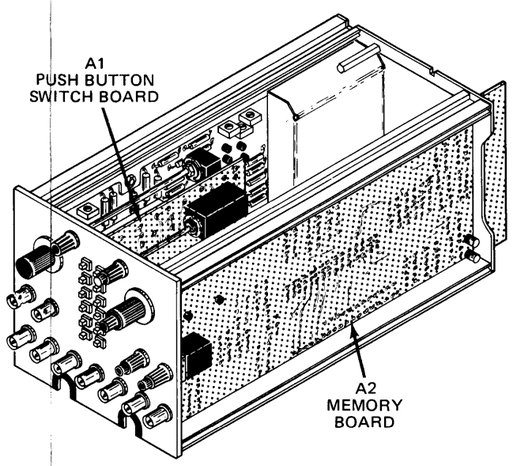


Fig. 8-10. A1—Push Button Switch board assembly. 1967-76

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C7	2B	P30	2A	R5	2B	R15	4D	S110	3C
C12	3A	P70	3B	R6	3B	R16	3B	S605	1B
C14	3A	P80	2A	R7	2B	R19	3B	S608	3C
C15	2C	P90	3A	R8	2B	R604	2C	S610	3C
				R9	2C	R605	1C	S625	2D
CR608	2C	R1	2B	R10	1A	R608	2C		
CR609	1B	R2	2B	R11	1A			U14	2C
		R3	2B	R12	1A	S10	2D	U15	3B
P20	1A	R4	2B	R14	4B	S15	3C		



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CK NO
C214	4E	CR213	4E	CR416	5G	J214	5D	P110	3G	R4
C215	4E	CR214	5E	CR417	5G	J314	5D	P111	3G	R4
C561	1E	CR215	5E	CR418	5G	J414	3H	P112	3G	R4
C562	3K	CR216	5E	CR512	5H	J514	3H	P113	3G	R4
C563	5C	CR217	5E	CR513	5H			P114	3H	R5
C564	5K	CR218	5E	CR514	4G	P1	1A	P115	3H	R5
C565	1H	CR219	5F	CR515	4G	P2	2A	P300	4B	R5
C566	4E	CR220	4E	CR516	4H	P3	3A			R5
C568	5B	CR312	5F	CR517	4H	P4	4A	R110	2E	R5
C569	4B	CR313	5F	CR518	5H	P5	5A	R150	2B	R5
C571	5B	CR314	5F	CR519	5H	P8	5B	R213	4E	S5
C572	3C	CR315	5F	CR561	1I	P9	2I	R214	5E	
C573	2C	CR316	4F	CR563	4J	P102	3F	R217	5E	TP
C574	2E	CR317	4F	CR564	4J	P103	3F	R218	5F	
C575	4E	CR318	4G	CR566	2I	P104	3F	R220	4E	U1
C576	3D	CR319	4G	CR567	1K	P105	3F	R313	5F	U1
C577	4C	CR412	5G	F510	5G	P106	3F	R314	5F	U1
C578	4I	CR413	5F	F520	5B	P107	3F	R317	4F	U1
C579	4K	CR414	5G			P108	3G	R318	4G	U1
C580	2H	CR415	5G	J138	1E	P109	3G	R413	5G	U1
CR212	4E									

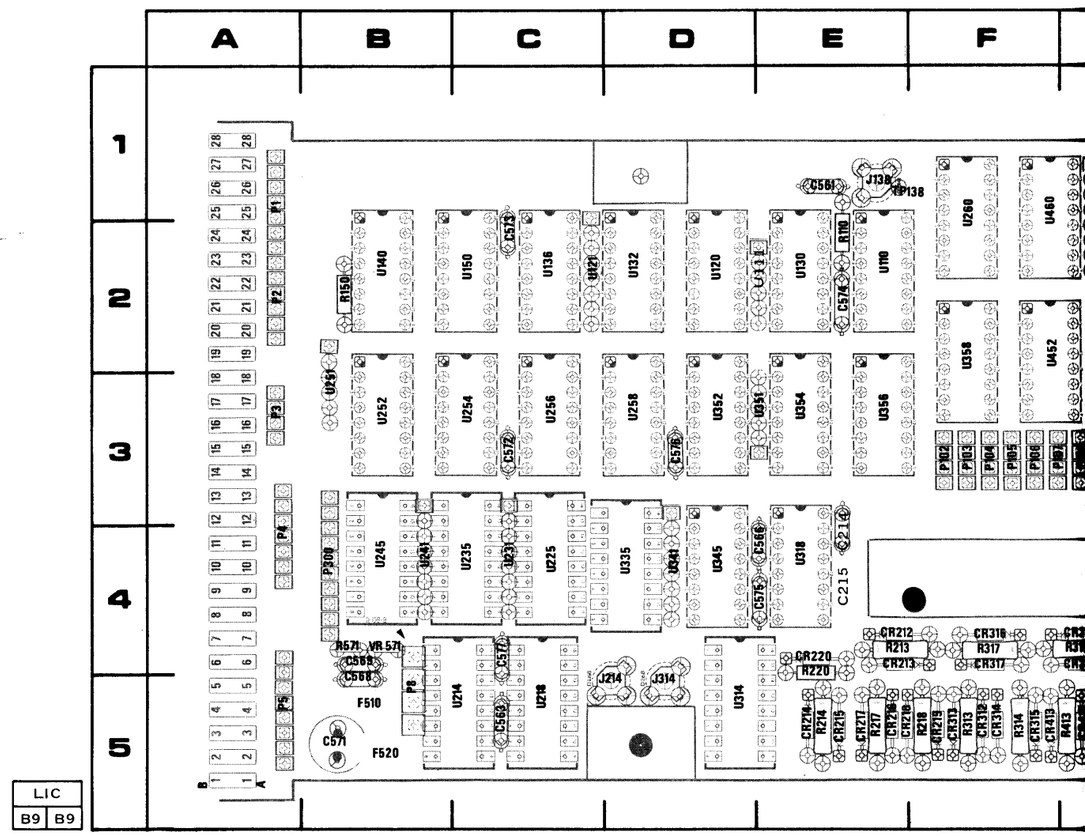
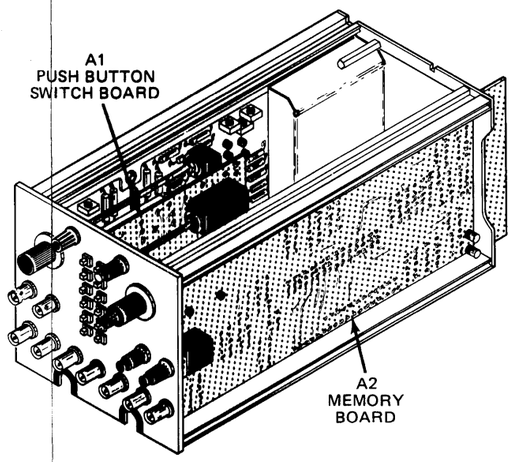


Fig. 8-11. A2—Memory circuit board, com



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C214	4E	CR213	4E	CR416	5G	J214	5D	P110	3G	R414	5G	U140	2B	U318	4E	U456	2H
C215	4E	CR214	5E	CR417	5G	J314	5D	P111	3G	R417	5G	U141	4J	U335	4D	U458	3H
C561	1E	CR215	5E	CR418	5G	J414	3H	P112	3G	R418	5G	U150	2C	U341	4D	U460	1F
C562	3K	CR216	5E	CR512	5H	J514	3H	P113	3G	R435	4J	U151	3J	U345	4D	U461	1H
C563	5C	CR217	5E	CR513	5H			P114	3H	R513	5H	U214	5C	U351	3E	U514	5J
C564	5K	CR218	5E	CR514	4G	P1	1A	P115	3H	R514	4G	U218	5C	U352	3D	U518	5K
C565	1H	CR219	5F	CR515	4G	P2	2A	P300	4B	R517	4H	U225	4C	U354	3E	U531	4J
C566	4E	CR220	4E	CR516	4H	P3	3A			R518	5H	U231	4C	U356	3E	U535	4J
C568	5B	CR312	5F	CR517	4H	P4	4A	R110	2E	R565	2I	U235	4C	U358	2F	U541	4K
C569	4B	CR313	5F	CR518	5H	P5	5A	R150	2B	R567	1K	U241	4B	U361	1G	U545	4K
C571	5B	CR314	5F	CR519	5H	P8	5B	R213	4E	R571	4B	U245	4B	U411	2E	U551	2I
C572	3C	CR315	5F	CR561	1I	P9	2I	R214	5E	S565	2K	U251	3B	U414	5H	U552	3I
C573	2C	CR316	4F	CR563	4J	P102	3F	R217	5E	TP138	1E	U252	3B	U418	5I	U554	3I
C574	2E	CR317	4F	CR564	4J	P103	3F	R218	5F			U254	3C	U425	4I	U556	3J
C575	4E	CR318	4G	CR566	2I	P104	3F	R220	4E	U110	2E	U256	3C	U431	4I	U558	3J
C576	3D	CR319	4G	CR567	1K	P105	3F	R313	5F	U111	2D	U258	3D	U435	4I	U560	2H
C577	4C	CR412	5G	F510	5G	P106	3F	R314	5F	U120	2D	U260	1F	U441	4H	U561	1I
C578	4I	CR413	5F	F520	5B	P107	3F	R317	4F	U121	2C	U261	1G	U445	4H	U565	2I
C579	4K	CR414	5G			P108	3G	R318	4G	U130	2E	U270	1G	U452	2F	U570	1H
C580	2H	CR415	5G	J138	1E	P109	3G	R413	5G	U132	2D	U314	5D	U454	2F	VR571	4B
CR212	4E									U136	2C			U456	2G		

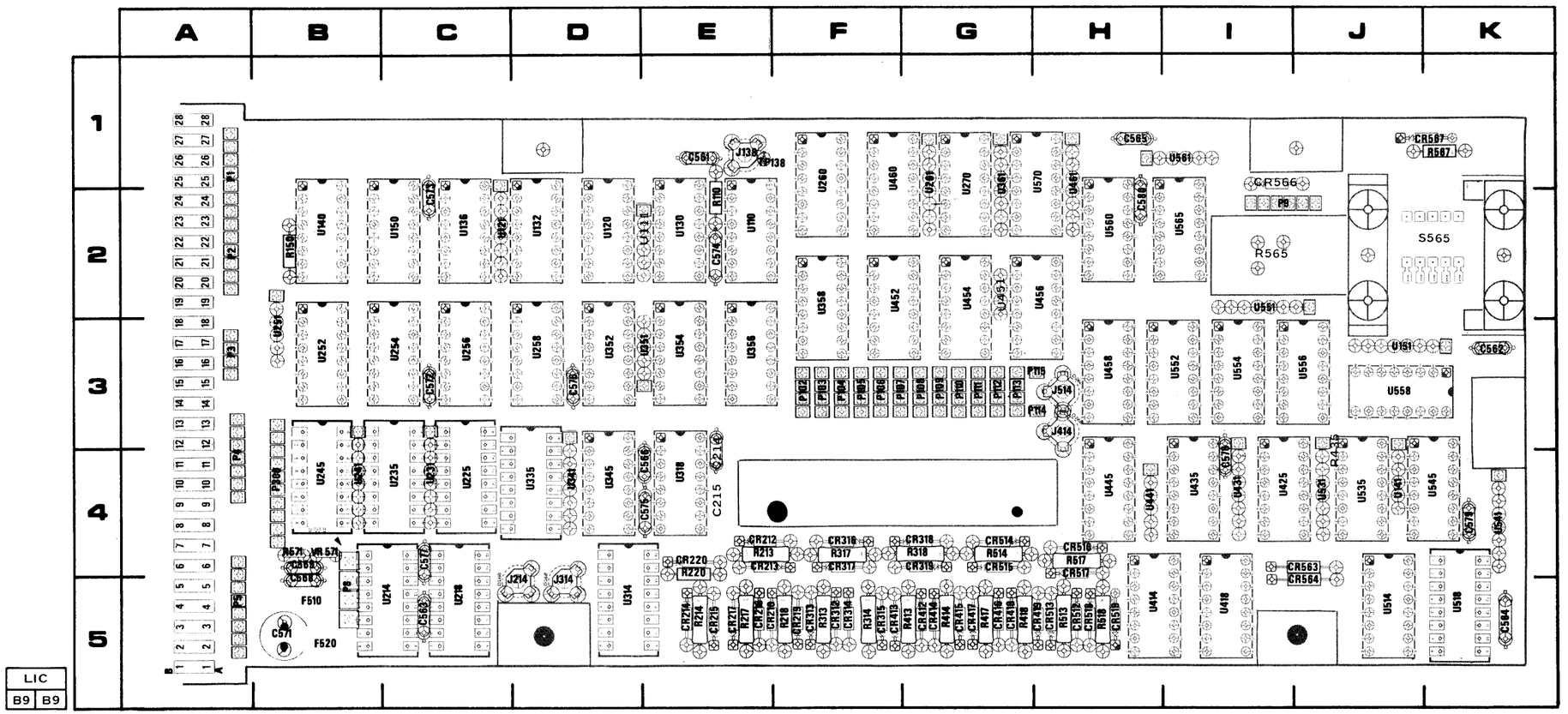
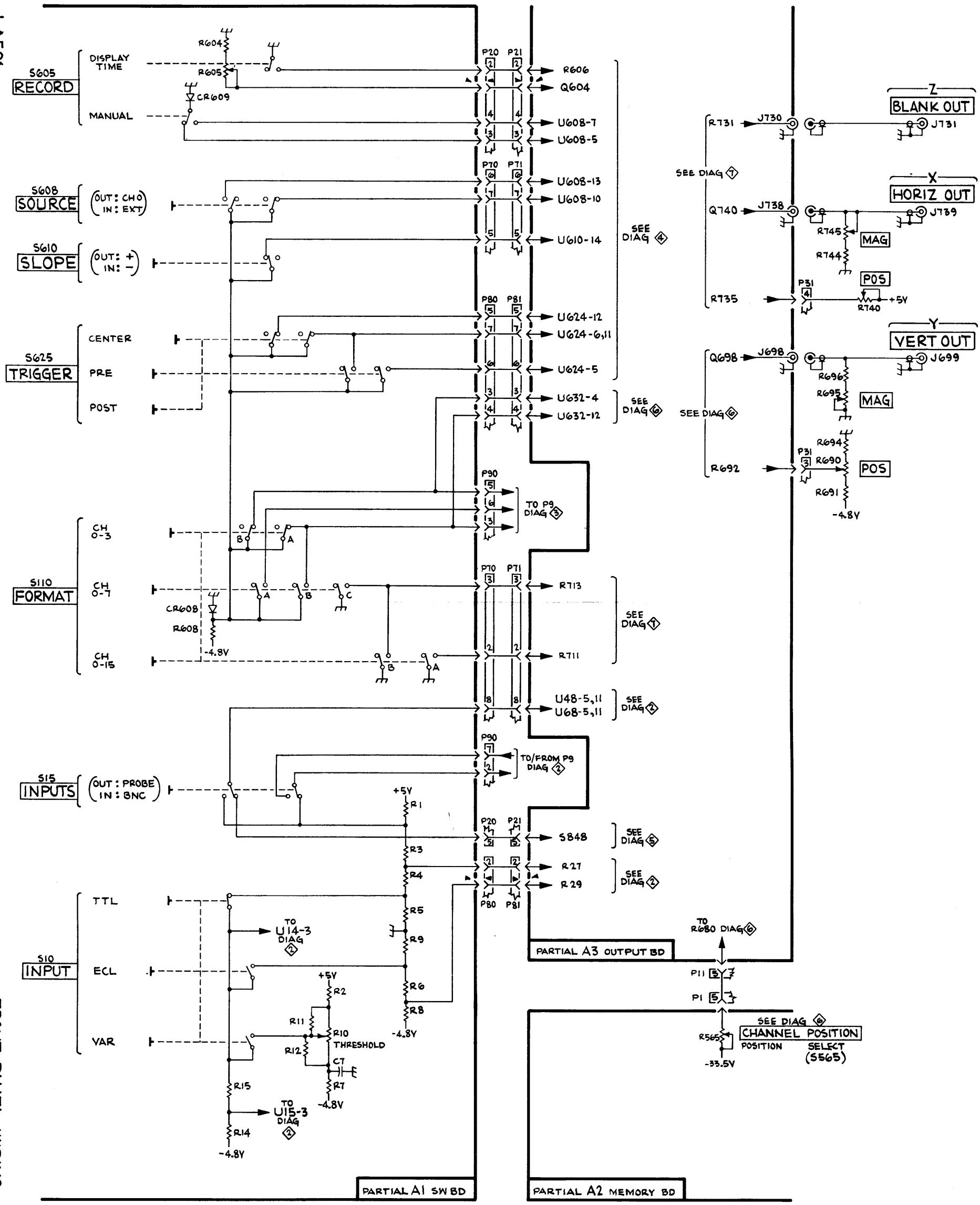
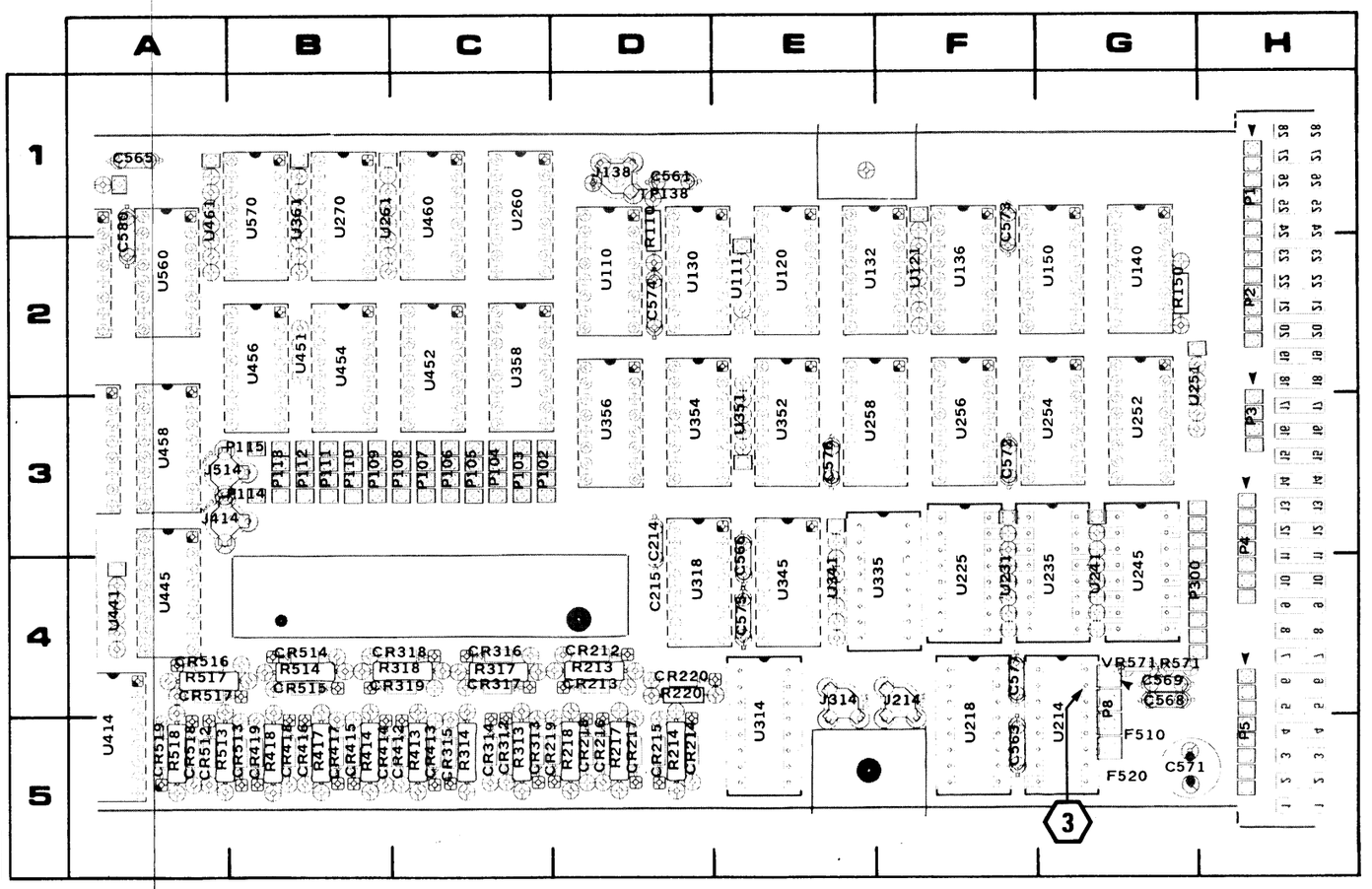


Fig. 8-11. A2—Memory circuit board, component side.

1967-77


S605
RECORD
DISPLAY TIME
MANUAL
R604
R605
CR609
S608
SOURCE
(OUT: CH 0 IN: EXT)
S610
SLOPE
(OUT: + IN: −)
S625
TRIGGER
CENTER
PRE
POST
CH 0-3
CH 0-15
S110
FORMAT
CH 0-7
CR608
R608
-4.8V
S15
INPUTS
(OUT: PROBE IN: BNC)
S10
INPUT
TTL
ECL
VAR
TO U14-3 DIAG 2
TO U15-3 DIAG 2
+5V
R1
R2
R3
R4
R5
R6
R8
R9
R10 THRESHOLD
R11
R12
R14
R15
C7
R7
-4.8V
P20 P21
P70 P71
P80 P81
P90
R606
Q604
U608-7
U608-5
U608-13
U608-10
U610-14
U624-12
U624-6,11
U624-5
U632-4
U632-12
SEE DIAG 4
SEE DIAG 6
TO P9 DIAG 3
R713
R711
SEE DIAG 1
U48-5,11
U68-5,11
SEE DIAG 2
TO/FROM P9 DIAG 2
S848
SEE DIAG 5
R27
R29
SEE DIAG 2
PARTIAL A1 SW BD
PARTIAL A3 OUTPUT BD
PARTIAL A2 MEMORY BD
TO R680 DIAG 6
P11
P1
SEE DIAG 6
CHANNEL POSITION
POSITION
SELECT (S565)
R565
-33.5V
Z
BLANK OUT
R731
J730
J731
SEE DIAG 7
X
HORIZ OUT
Q740
J738
J739
R745
MAG
R744
POS
R735
P31
+5V
R740
Y
VERT OUT
Q698
J698
J699
R696
R695
MAG
SEE DIAG 6
R694
R690
POS
R692
R691
-4.8V

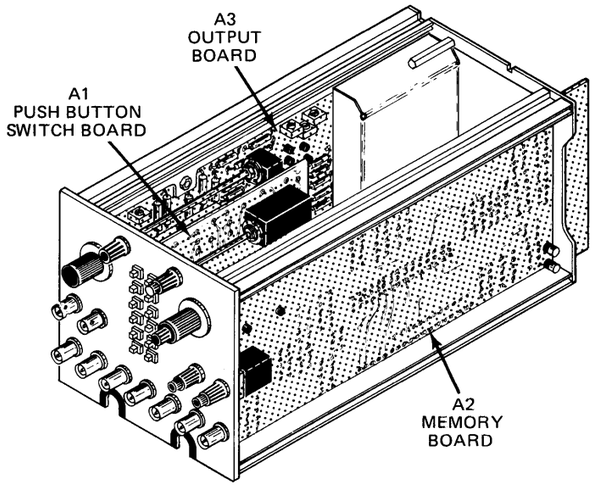
Refer to Figure 8-10 for locations of components mounted on Push Button Switch board.



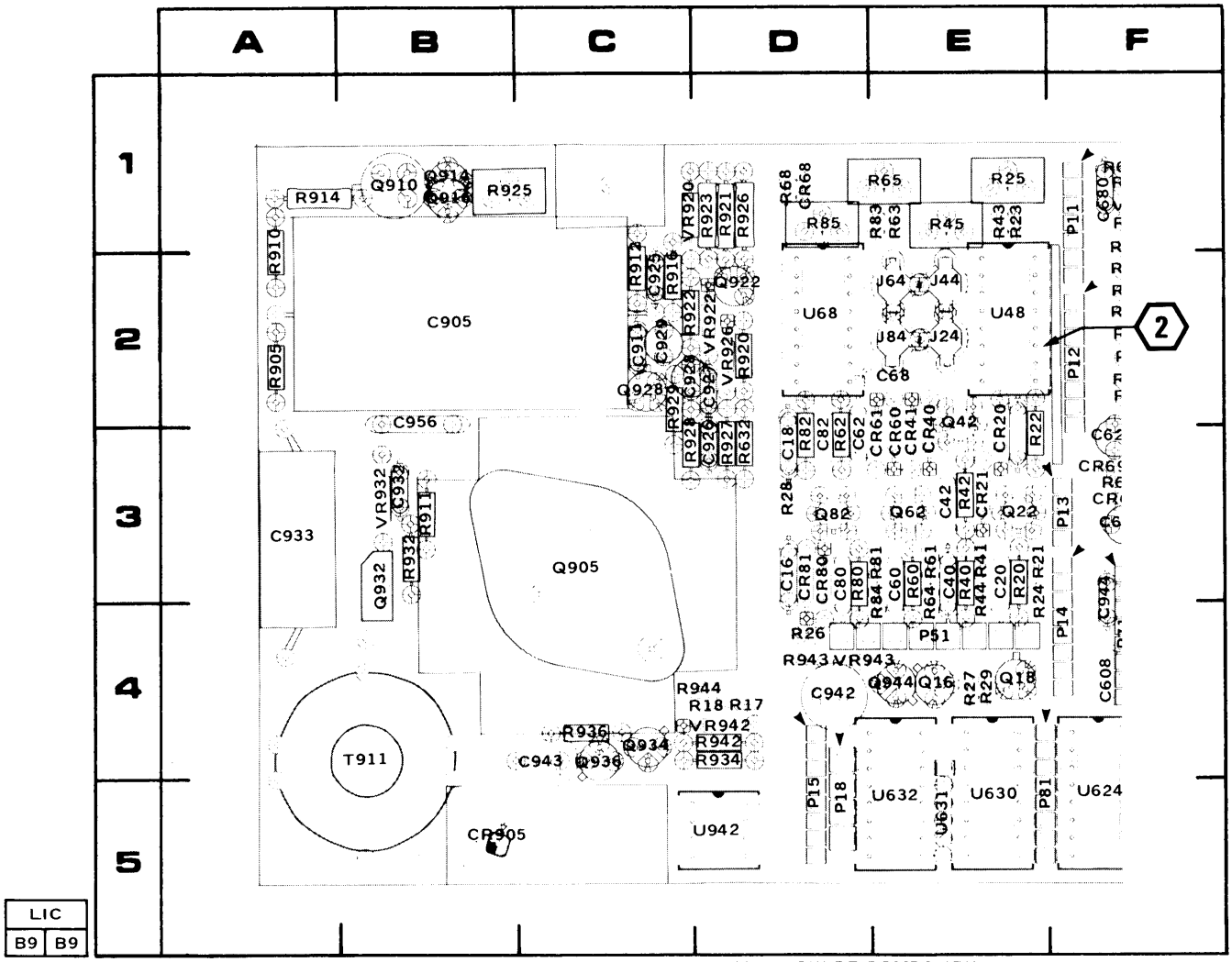
COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-11 IN THIS SECTION.

1967-81

Fig. 8-12. A2—Memory circuit board. Component locations as viewed with board installed.



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C214	4D	CR216	5D	CR419	5B	P2	2H	R110	1D			U256	3F	U452	2C
C215	4D	CR217	5D	CR512	5A	P3	3H	R150	2G	U110	2D	U258	3E	U454	2B
C318	3D	CR218	5D	CR513	5B	P4	3H	R213	4D	U111	2E	U260	1C	U456	2B
C561	1D	CR219	5D	CR514	4B	P5	5H	R214	5D	U120	2E	U261	1B	U458	3A
C563	5F	CR220	4D	CR515	4B	P8	4G	R217	5D	U121	2F	U270	1B	U460	1C
C565	1A	CR312	5C	CR516	4A	P102	3C	R218	5D	U130	2D	U314	5E	U461	1A
C566	3E	CR313	5C	CR517	4A	P103	3C	R220	4D	U132	2E	U318	4D	U560	2A
C568	4G	CR314	5C	CR518	5A	P104	3C	R313	5C	U136	2F	U335	4F	U570	1B
C569	4G	CR315	5C	CR519	5A	P105	3C	R314	5C	U140	2G	U341	4E		
C571	5G	CR316	4C			P106	3C	R317	4C	U150	2G	U345	4E	VR571	4G
C572	3F	CR317	4C	F510	5G	P107	3C	R318	4C	U214	5G	U351	3E		
C573	1F	CR318	4C	F520	5G	P108	3C	R413	5C	U218	5F	U352	3E		
C574	2D	CR319	4C			P109	3B	R414	5B	U225	4F	U354	3D		
C575	4E	CR412	5C	J138	1D	P110	3B	R417	5B	U231	4F	U356	3D		
C576	3E	CR413	5C	J214	4F	P111	3B	R418	5B	U235	4G	U358	2C		
C577	4F	CR414	5B	J314	4E	P112	3B	R513	5A	U241	4G	U361	1B		
C580	1A	CR415	5B	J414	3A	P113	3B	R514	4B	U245	4G	U414	5A		
CR212	4D	CR416	5B	J514	3A	P114	3B	R517	4A	U251	2G	U441	4A		
CR213	4D	CR417	5B			P115	3B	R518	5A	U252	3G	U445	4A		
CR214	5D	CR418	5B	P1	1H	P330	4G	R571	4G	U254	3G	U451	2B		
CR215	5D														



COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-9. FOR LOCATION OF COMPONENTS MOUNTED ON REAR OF BOARD, SEE FIGURE 8-8 IN THIS SECTION.

1967-82

Fig. 8-13. A3—Output circuit board. Component locations as viewed with board installed.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C16	3D	C944	3F	P15	5D	R20	3E	R65	1E	R929	2C
C18	3D	C956	2B	P18	5D	R21	3E	R68	1D	R934	4D
C20	3E			P81	5E	R22	3E	R80	3D	R936	4C
C40	3E	CR20	3E			R23	1E	R81	3E	R942	4D
C42	3E	CR21	3E	Q16	4E	R24	3E	R82	3D	R943	4D
C60	3E	CR40	3E	Q18	4E	R25	1E	R83	1E	R944	4D
C62	3D	CR41	3E	Q22	3E	R26	4D	R84	3E		
C68	2E	CR60	3E	Q42	2E	R27	4E	R85	1D	T911	4B
C80	3D	CR61	3E	Q62	3E	R28	3D	R632	3D		
C82	3D	CR68	1D	Q82	3D	R29	4E	R905	2A	U48	2E
C608	4F	CR80	3D	Q905	3C	R40	3E	R910	1A	U68	2D
C680	1F	CR81	3D	Q910	1B	R41	3E	R911	3B	U624	5F
C905	2B	CR905	5B	Q914	1B	R42	3E	R912	2C	U630	5E
C911	2C			Q916	1B	R43	1E	R914	1A	U631	5E
C925	2C	J24	2E	Q922	2D	R44	3E	R916	2C	U632	5E
C926	3D	J44	2E	Q928	2C	R43	1E	R920	2D	U932	3B
C927	2D	J64	2E	Q932	3B	R45	1E	R921	1D	U942	5D
C928	2C	J84	2E	Q934	4C	R51	4E	R922	2C		
C929	2C			Q936	4C	R60	3E	R923	1D	VR920	1C
C932	3B	P11	1F	Q944	4E	R61	3E	R925	1B	VR922	2D
C933	3A	P12	2F			R62	3D	R926	1D	VR926	2D
C942	4D	P13	3F	R17	4D	R63	1E	R927	3D	VR942	4D
C943	4C	P14	4F	R18	4D	R64	4E	R928	3C	VR943	4D

VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the LA 501 controls set as follows:

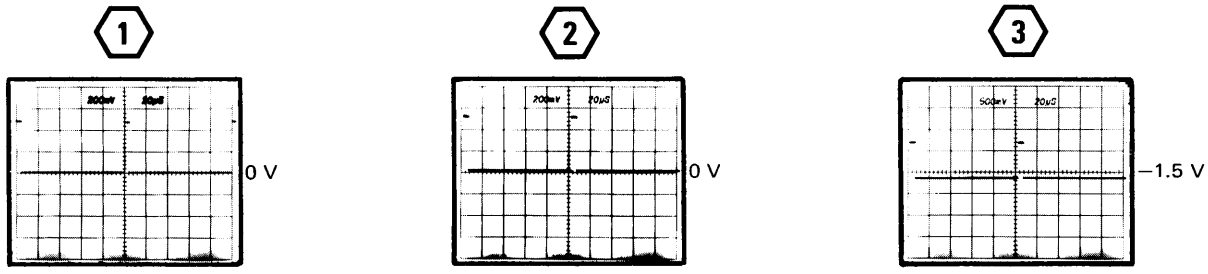
SAMPLE INTERVAL, 50 ns; INPUT THRESHOLD, TTL; FORMAT, CH 0-3 X1024; TRIGGER, CENTER; SLOPE, +; SOURCE, CH 0; INPUTS, BNC; RECORD (DISPLAY TIME), 1 s; CHANNEL/POSITION (SELECT), channel 0; CHANNEL/POSITION (POSITION), fully counterclockwise. A 10X probe was connected from the front panel CH 0 BNC input connector to a +5 volt pulse (5 microsecond duration, 100 microsecond period).

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with 10 MΩ input impedance (Tektronix DM 501 Digital Multimeter or 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

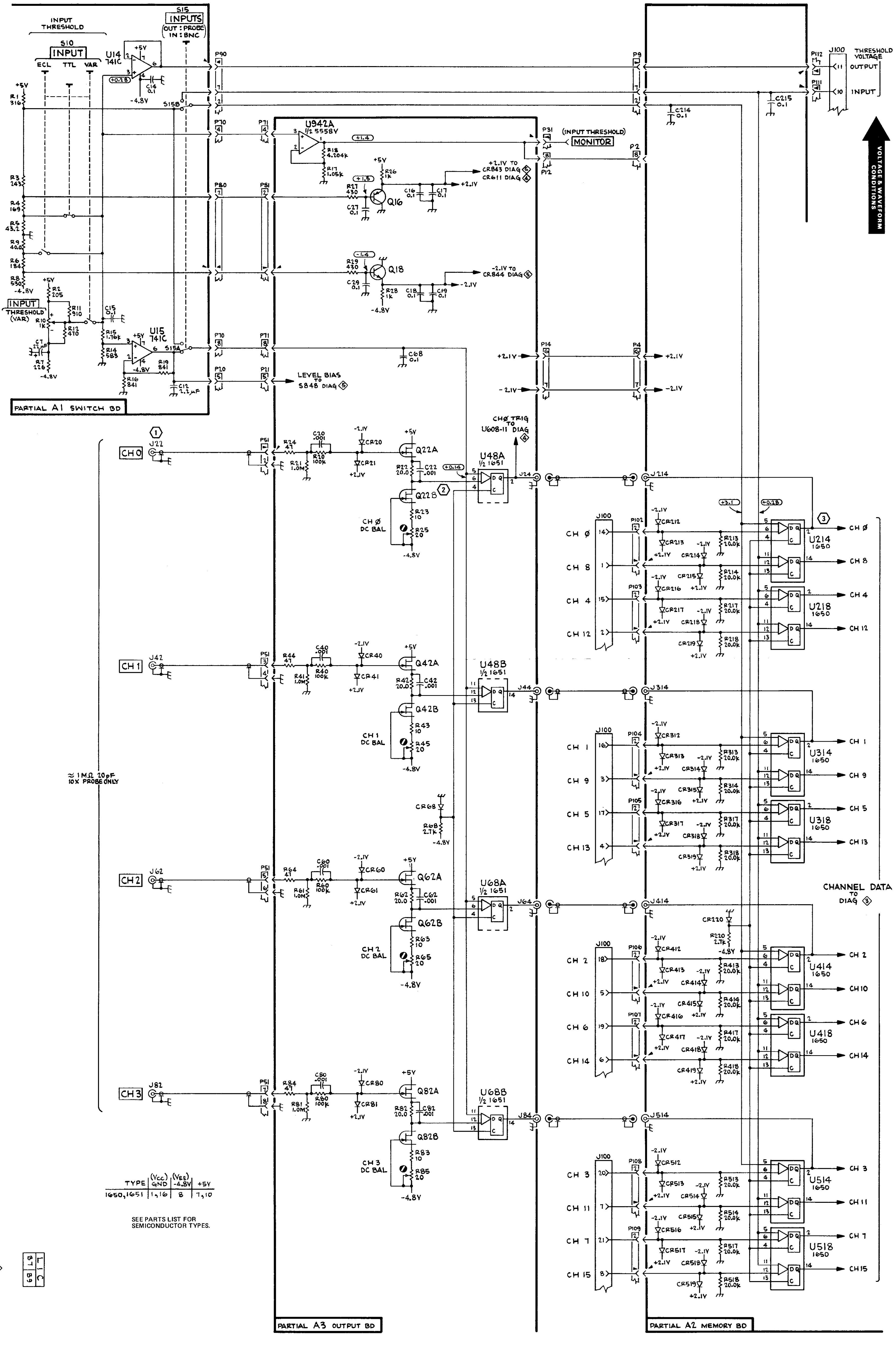
Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 MΩ input impedance and at least 60 MHz bandwidth (Tektronix 465 Oscilloscope equipped with 10X probe, or 7603 Oscilloscope, 7B53A Time Base, and 7A15A Amplifier equipped with 10X probe). A 7A13 Differential Comparator with 10X probe was used to obtain the calibrated offset voltage.

NOTE

Voltages and waveforms are not absolute and may vary between instruments.

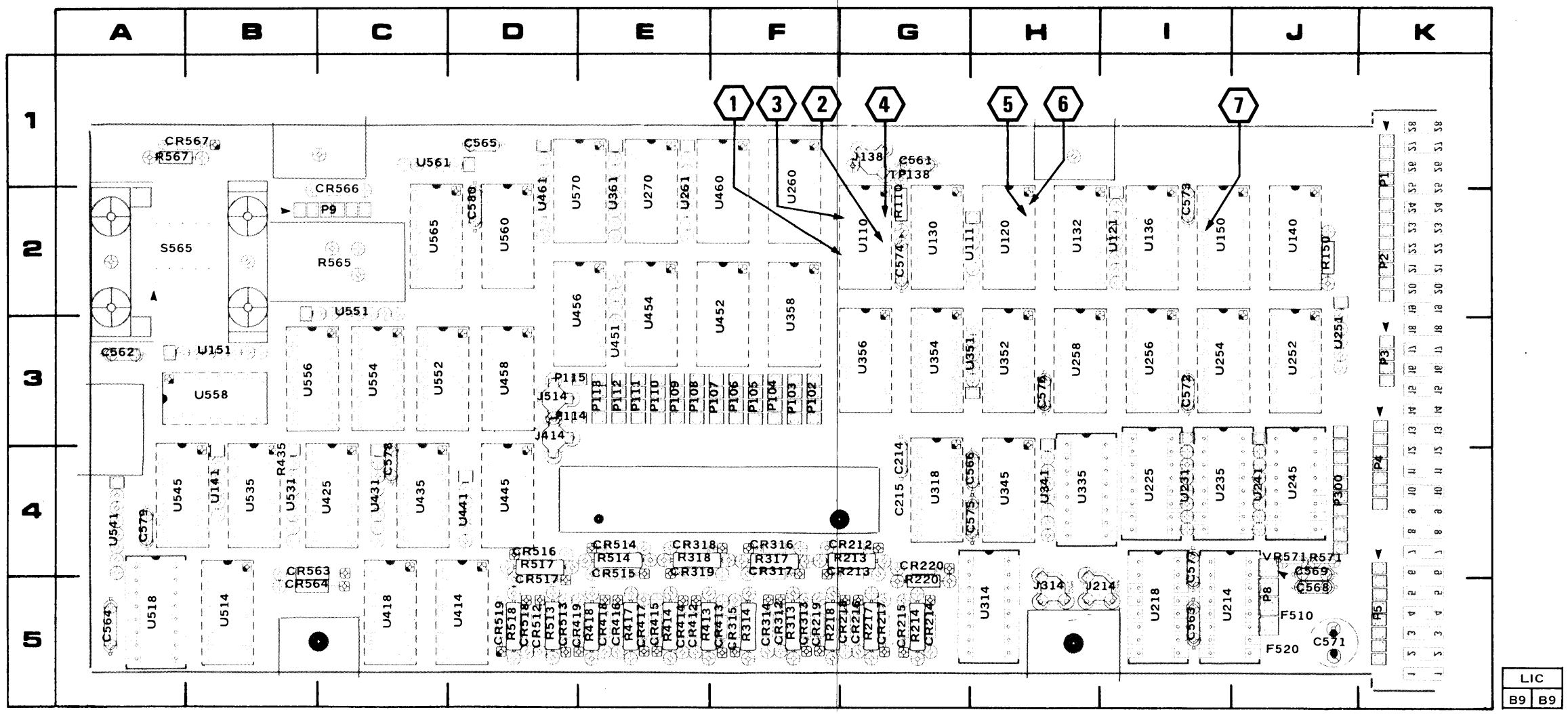


LA501



TYPE	(Vcc) GND	(VEE) -4.8V	+5V
1650,1651	1,16	8	7,10

DATA INPUTS ②



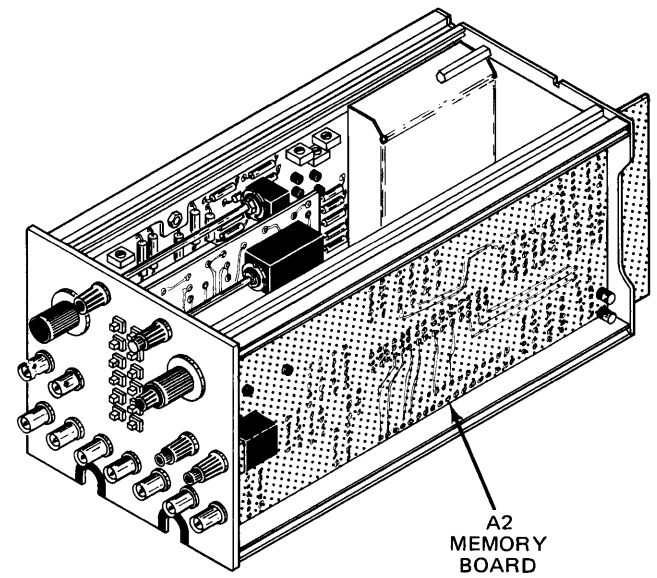
COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-11 IN THIS SECTION.

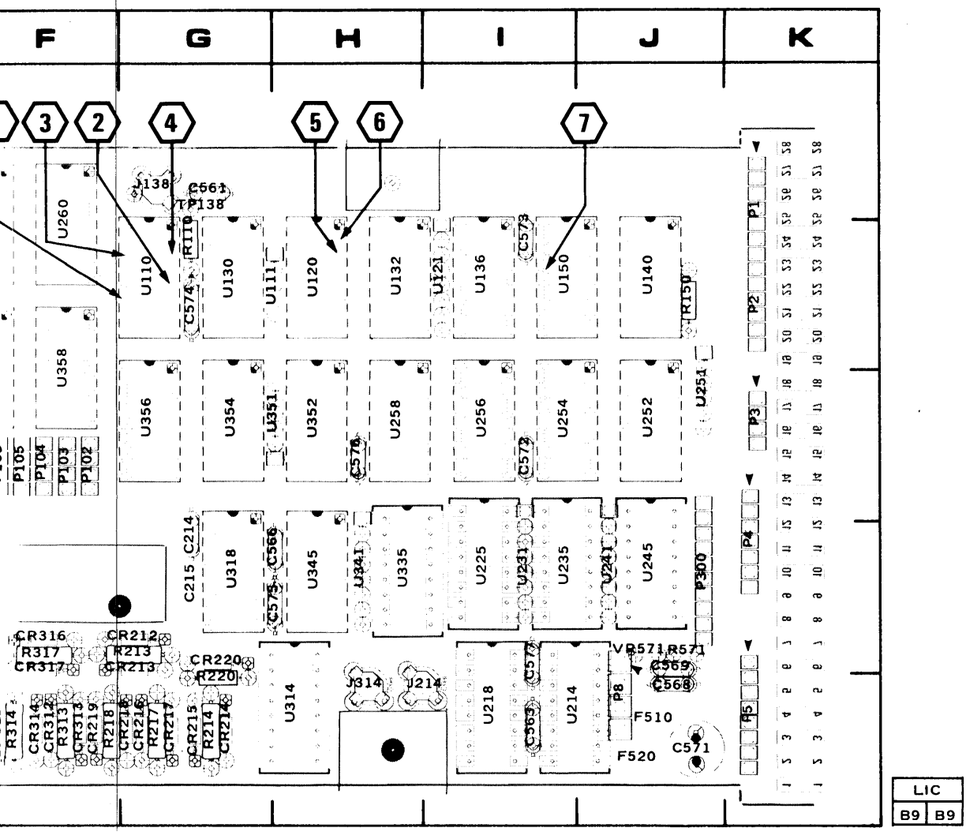
1967-83

Fig. 8-14. A2—Memory circuit board. Component locations as viewed with board installed.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO
C214	4G	CR212	4G	CR4
C215	4G	CR213	4G	CR4
C561	1G	CR214	5G	CR4
C562	3A	CR215	5G	CR4
C563	5I	CR216	5G	CR4
C564	5A	CR217	5G	CR4
C565	1D	CR218	5G	CR5
C566	4H	CR219	5F	CR5
C568	5J	CR220	5G	CR5
C569	4J	CR312	5F	CR5
C571	5J	CR313	5F	CR5
C572	3I	CR314	5F	CR5
C573	2I	CR315	5F	CR5
C574	2G	CR316	5F	CR5
C575	4H	CR317	4F	CR5
C576	3H	CR318	4E	CR5
C577	4I	CR319	4E	CR5
C578	4C	CR412	5E	CR5
C579	4A	CR413	5F	F51
C580	2D			

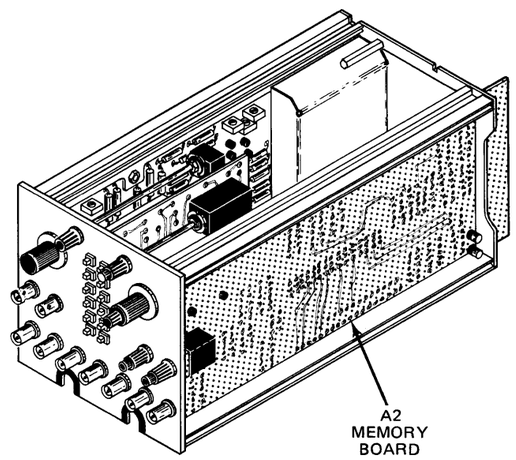
CKT NO
U25
U25
U26
U26
U27
U31
U31
U33
U34
U34
U35
U35
U35
U35
U35
U36
U41
U41
U41





1967-83

Component locations as viewed with board installed.



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C214	4G	CR212	4G	CR414	5E	F520	5J	P106	3F	R313	5F	U120	2H
C215	4G	CR213	4G	CR415	5E			P107	3F	R314	5F	U121	2I
C561	1G	CR214	5G	CR416	5E	J138	1G	P108	3E	R317	4F	U130	2G
C562	3A	CR215	5G	CR417	5E	J214	5H	P109	3E	R318	4E	U132	2H
C563	5I	CR216	5G	CR418	5E	J314	5H	P110	3E	R413	5E	U136	2I
C564	5A	CR217	5G	CR419	5D	J414	3D	P111	3E	R414	5E	U140	2J
C565	1D	CR218	5G	CR512	5D	J514	3D	P112	3E	R417	5E	U141	4B
C566	4H	CR219	5F	CR513	5D			P113	3E	R418	5E	U150	2I
C568	5J	CR220	5G	CR514	4E	P1	1K	P114	3D	R435	4B	U151	3B
C569	4J	CR312	5F	CR515	4E	P2	2K	P115	3D	R513	5D	U214	5I
C571	5J	CR313	5F	CR516	4D	P3	3K	P300	4J	R514	4E	U218	5I
C572	3I	CR314	5F	CR517	5D	P4	4K			R517	4D	U225	4I
C573	2I	CR315	5F	CR518	5D	P5	5K	R110	2G	R518	5D	U231	4I
C574	2G	CR316	4F	CR519	5D	P8	5J	R150	2J	R565	2C	U235	4I
C575	4H	CR317	4F	CR563	4B	P9	2C	R213	4G	R567	1A	U241	4J
C576	3H	CR318	4E	CR564	5B	P102	3F	R214	5G	R571	4J	U245	4J
C577	4I	CR319	4E	CR566	2C	P103	3F	R217	5G	S565	2A	U251	3J
C578	4C	CR412	5E	CR567	1A	P104	3F	R218	5F	TP138	1G	U252	3J
C579	4A	CR413	5F	F510	5J	P105	3F	R220	5G	U110	2G	U254	3I
C580	2D									U111	2G		

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
U256	3I	U425	4C	U554	3C
U258	3H	U431	4C	U556	3B
U260	2F	U435	4C	U558	3B
U261	2E	U441	4D	U560	2D
U270	2E	U445	4D	U561	1C
U314	5H	U451	3E	U565	2C
U318	4G	U452	3F	U570	2E
U335	4H	U454	2E		
U341	4H	U456	2E	VR571	4J
U345	4H	U458	3D		
U351	3H	U460	2F		
U352	3H	U461	2D		
U354	3G	U514	5B		
U356	3G	U518	5A		
U358	3F	U531	4B		
U361	2E	U535	4B		
U411	2H	U541	4A		
U414	5D	U545	4A		
U418	5C	U551	2C		
		U552	3C		

VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the LA 501 controls set as follows:

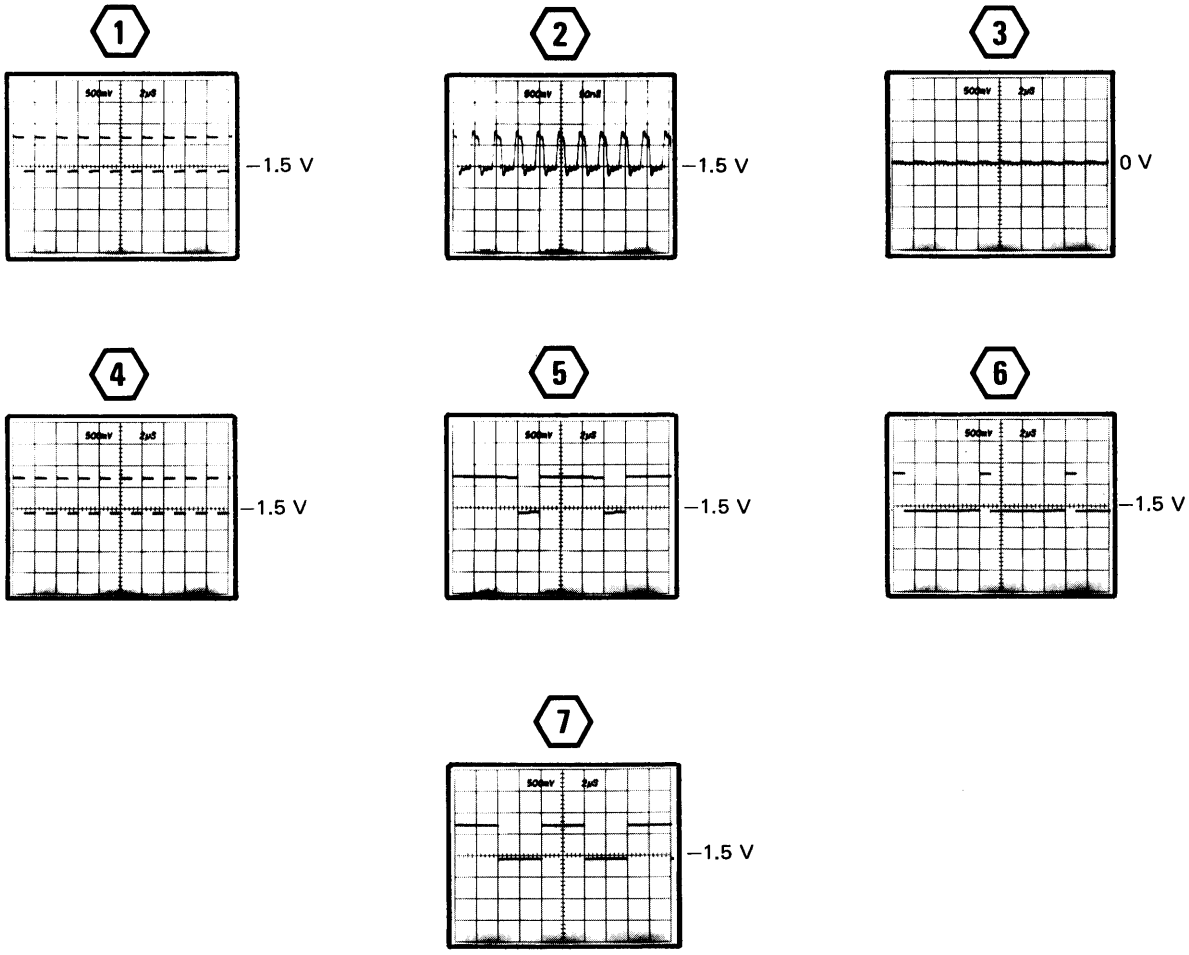
SAMPLE INTERVAL, 50 ns; INPUT THRESHOLD, TTL; FORMAT, CH 0-3 X1024; TRIGGER, CENTER; SLOPE, +; SOURCE, CH 0; INPUTS, BNC; RECORD (DISPLAY TIME), 1 s; CHANNEL/POSITION (SELECT), channel 0; CHANNEL/POSITION (POSITION), fully counterclockwise. A 10X probe was connected from the front panel CH 0 BNC input connector to a +5 volt pulse (5 microsecond duration, 100 microsecond period).

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with 10 MΩ input impedance (Tektronix DM 501 Digital Multimeter or 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 MΩ input impedance and at least 60 MHz bandwidth (Tektronix 465 Oscilloscope equipped with 10X probe, or 7603 Oscilloscope, 7B53A Time Base, and 7A15A Amplifier equipped with 10X probe). A 7A13 Differential Comparator with 10X probe was used to obtain the calibrated offset voltage.

NOTE

Voltages and waveforms are not absolute and may vary between instruments.



LA501

MEMORY

PARTIAL A2 MEMORY BD

CHANNEL DATA

STORED DATA U270 TO U510 DIAG 9

STORED DATA U270, U510 DIAG 9

DISPLAY CLOCK FROM P12-5 DIAG 6

FROM P13 DISPLAY INHIBIT

STORE CLOCK FROM J838 DIAG 6

PARTIAL A1 SM BD

PARTIAL SIIO FORMAT CH 0-3 CH 0-7

FORMAT CODE TO DIAG 6

ALSO SAMPLE ON DIAG 6

SEE ALSO DIAG 6

U110 10111

U130 10141 SR

U120 10141 SR

U140 10136 4-BIT COUNTER

U150 10136 4-BIT COUNTER

U425 DATA SELECTOR 10173

U225 DATA SELECTOR 10173

U535 10141 SR/LATCH

U435 10141 SR/LATCH

U335 10141 SR/LATCH

U235 10141 SR/LATCH

U245 10141 4-BIT LATCH

U345 10141 4-BIT LATCH

U445 10141 4-BIT LATCH

U545 10141 4-BIT LATCH

U552 RAM 10144

U452 RAM 10144

U352 RAM 10144

U252 RAM 10144

U554 RAM 10144

U454 RAM 10144

U354 RAM 10144

U254 RAM 10144

U556 RAM 10144

U456 RAM 10144

U356 RAM 10144

U256 RAM 10144

U558 RAM 10144

U458 RAM 10144

U358 RAM 10144

U258 RAM 10144

U136 ¼ 10102 NAND

U136 ⅓ 10107 NAND

U136 ½ 10107 NAND

U260 ¼ 10104 NAND

U460 ¼ 10104 NAND

U560 ¼ 10104 NAND

U260 ¼ 10204 NAND

U460 ¼ 10204 NAND

U560 ¼ 10204 NAND

TYPE	(Vcc) GND	(VEE) -4.5V
10104	1,16	8
10107	1,16	8
10111	1,5,16	8
10136	1,16	8
10141	1,16	8
10144	16	8
10173	16	8
10102	1,16	8

NOTES:

* P300 1,2,3,4,5,6,7,8,9,10 SIGNAL SELECTOR

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

SEE NOTE *

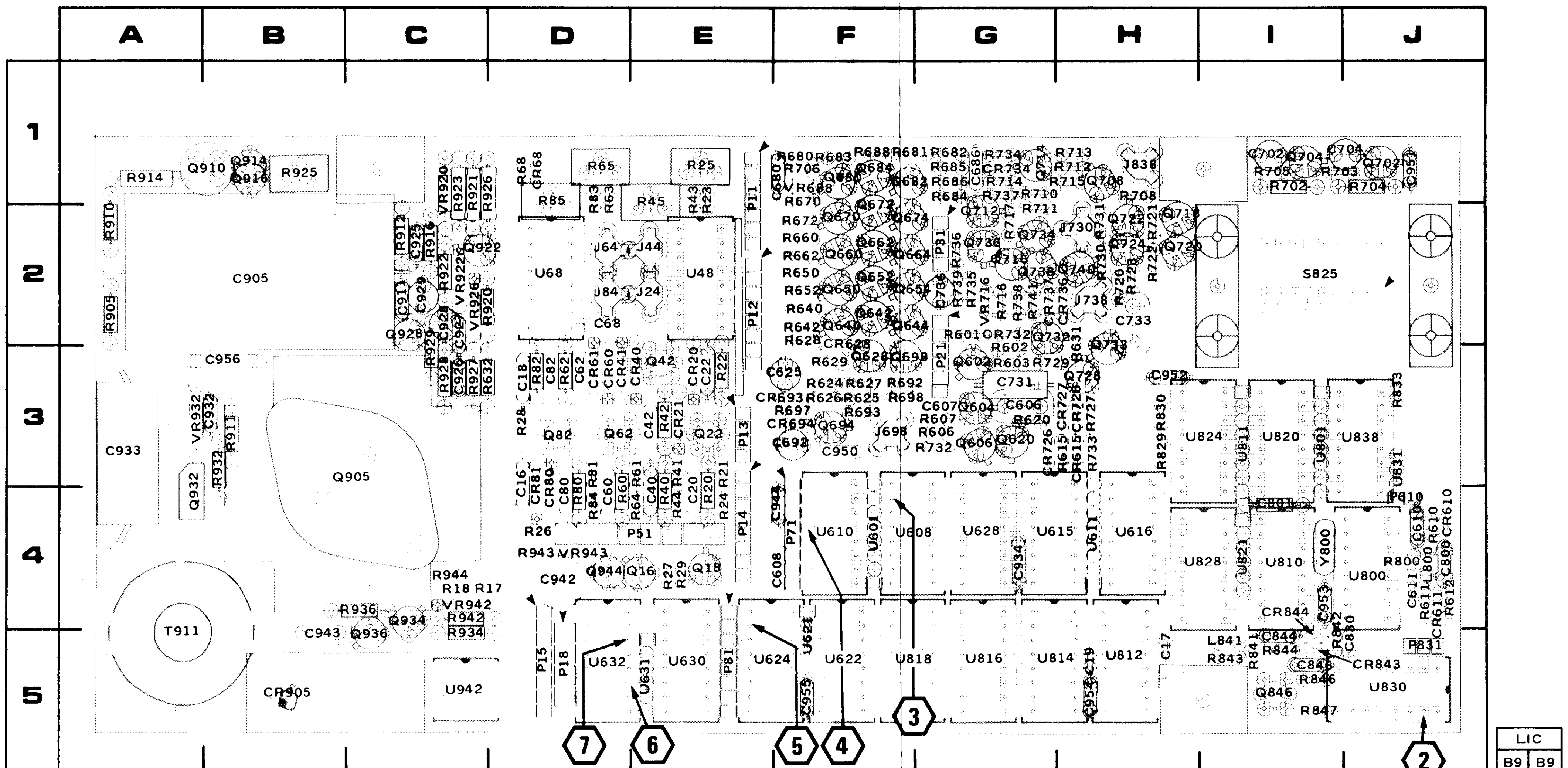
P300 * SEE NOTE

VOLTAGE & WAVEFORM CONDITIONS

CLOCK OUT J120

LF CLOCK TO P19-7 DIAG 6

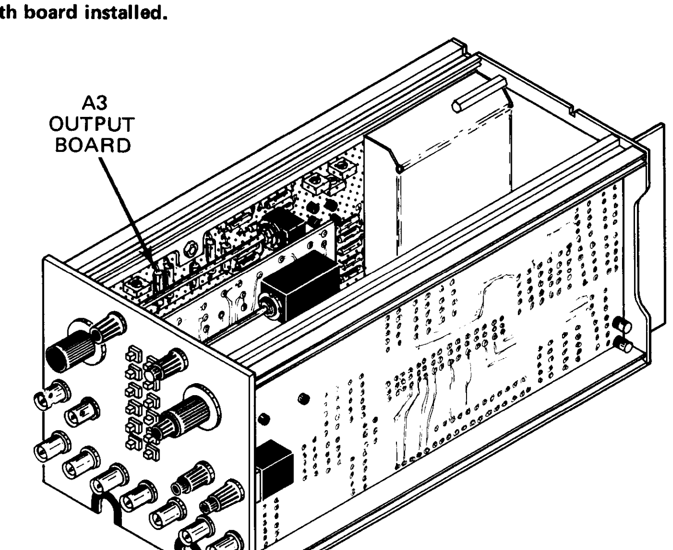
ADDRESS COUNT CARRY TO P19-3 DIAG 6



COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-9. FOR LOCATION OF COMPONENTS MOUNTED ON REAR OF BOARD, SEE FIGURE 8-8 IN THIS SECTION.

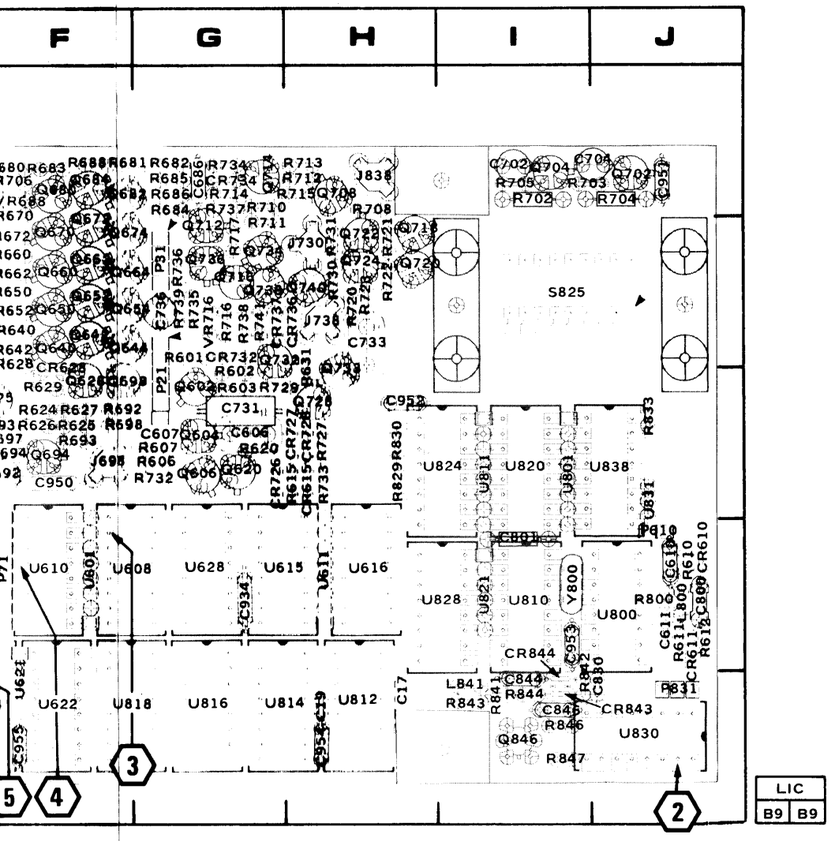
1967-84

Fig. 8-15. A3—Output circuit board. Component locations as viewed with board installed.



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	[illegible]
C16	3D	C704	1J	C950	[illegible]
C17	5H	C731	3G	C951	[illegible]
C18	3D	C733	2H	C952	[illegible]
C19	5H	C736	2G	C953	[illegible]
C20	4E	C800	4J	C954	[illegible]
C40	4E	C801	4I	C955	[illegible]
C42	3E	C830	5J	C956	[illegible]
C60	4D	C844	5I		
C62	3D	C846	5I	CR20	[illegible]
C68	2D	C905	2B	CR21	[illegible]
C80	4D	C911	2C	CR40	[illegible]
C82	3D	C925	2C	CR41	[illegible]
C606	3G	C926	3C	CR60	[illegible]
C607	3G	C927	2C	CR61	[illegible]
C608	4F	C928	2C	CR68	[illegible]
C610	4J	C929	2C	CR80	[illegible]
C611	4J	C932	3B	CR81	[illegible]
C625	3F	C933	3A	CR610	[illegible]
C650	3F	C934	4G	CR611	[illegible]
C666	1G	C942	4D	CR615	[illegible]
C680	1F	C943	5B	CR628	[illegible]
C692	3F	C944	4F	CR693	[illegible]
C702	1I				

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	[illegible]
R42	3E	R611	4J	R682	[illegible]
R43	1E	R612	4J	R683	[illegible]
R44	4E	R615	3H	R684	[illegible]
R45	1E	R620	3G	R685	[illegible]
R60	4D	R624	3F	R686	[illegible]
R61	3E	R625	3F	R688	[illegible]
R62	3D	R626	3F	R692	[illegible]
R63	1D	R627	3F	R693	[illegible]
R64	4E	R628	2F	R697	[illegible]
R65	1D	R629	3F	R698	[illegible]
R68	1D	R631	3H	R702	[illegible]
R80	4D	R632	3D	R703	[illegible]
R82	3D	R640	2F	R704	[illegible]
R83	1D	R642	2F	R705	[illegible]
R84	4D	R650	2F	R706	[illegible]
R85	1D	R652	2F	R708	[illegible]
R601	2G	R660	2F	R710	[illegible]
R602	3G	R662	2F	R711	[illegible]
R603	3G	R670	1F	R712	[illegible]
R606	3G	R672	2F	R713	[illegible]
R607	3G	R680	1F	R714	[illegible]
R610	4J	R681	1F	R715	[illegible]



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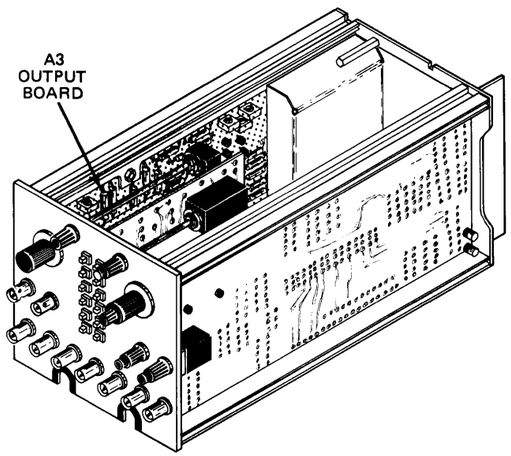
nent locations as viewed with board installed.



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C16	3D	C704	1J	C950	3F	CR694	3F	L841	5I	Q602	3G	Q702	1J	Q922	2C
C17	5H	C731	3G	C951	1J	CR726	3G			Q604	3G	Q704	1I	Q928	2C
C18	3D	C733	2H	C952	3H	CR727	3H	P11	1E	Q606	3G	Q708	1H	Q932	4A
C19	5H	C736	2G	C953	4I	CR728	3H	P12	2E	Q620	3G	Q712	2G	Q934	4C
C20	4E	C800	4J	C954	5H	CR732	2G	P13	3E	Q628	3F	Q714	1G	Q936	5C
C40	4E	C801	4I	C955	5F	CR734	1G	P14	4E	Q640	2F	Q716	2G	Q944	4D
C42	3E	C830	5J	C956	3B	CR736	2H	P15	5D	Q642	2F	Q718	2H		
C60	4D	C844	5I			CR737	2G	P18	5D	Q644	2G	Q720	2H	R17	4C
C62	3D	C846	5I	CR20	3E	CR843	5I	P21	3G	Q650	2F	Q722	2H	R18	4C
C68	2D	C905	2B	CR21	3E	CR844	5I	P31	2G	Q652	2F	Q724	2H	R20	4E
C80	4D	C911	2C	CR40	3E	CR905	5B	P51	4E	Q654	2G	Q728	3H	R21	3E
C82	3D	C925	2C	CR41	3D			P71	4F	Q660	2F	Q732	2G	R22	3E
C606	3G	C926	3C	CR60	3D	J24	2E	P81	5E	Q662	2F	Q733	3H	R23	1E
C607	3G	C927	2C	CR61	3D	J44	2E	P610	4J	Q664	2G	Q734	2G	R24	4E
C608	4F	C928	2C	CR68	1D	J64	2D	P831	5J	Q670	2F	Q736	2G	R25	1E
C610	4J	C929	2C	CR80	3D	J84	2D			Q672	2F	Q738	2G	R26	4D
C611	4J	C932	3B	CR81	3D	J698	3F	Q16	4E	Q674	2G	Q740	2H	R27	4E
C625	3F	C933	3A	CR610	4J	J730	2H	Q18	4E	Q680	1F	Q846	5I	R28	3D
C650	3F	C934	4G	CR611	4J	J738	2H	Q22	3E	Q682	1F	Q905	3C	R29	4E
C666	1G	C942	4D	CR615	3H	J838	1H	Q42	3E	Q684	1F	Q910	1B	R31	3D
C680	1F	C943	5B	CR628	2F			Q62	3D	Q694	3F	Q914	1B	R40	4E
C692	3F	C944	4F	CR693	3F	L800	4J	Q82	3D	Q698	3F	Q916	1B	R41	3E

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
R42	3E	R611	4J	R682	1G	R716	2G	R833	3J	R934	5C	U630	5E	VR716	2G
R43	1E	R612	4J	R683	1F	R717	2G	R841	5I	R936	4C	U631	5E	VR920	1C
R44	4E	R615	3H	R684	1G	R720	2H	R842	5J	R942	4C	U632	5D	VR922	2C
R45	1E	R620	3G	R685	1G	R721	2H	R843	5I	R943	4D	U800	4J	VR926	2C
R60	4D	R624	3F	R686	1G	R722	2H	R844	5I	R944	4C	U801	3I	VR942	4C
R61	3E	R625	3F	R688	1F	R723	2H	R846	5I			U810	4I	VR943	4D
R62	3D	R626	3F	R692	3F	R727	3H	R847	5I	S825	2I	U811	3I		
R63	1D	R627	3F	R693	3F	R729	3G	R905	2A			U812	5H	Y800	4I
R64	4E	R628	2F	R697	3F	R730	2H	R910	2A	T911	5A	U814	5H		
R65	1D	R629	3F	R698	3F	R731	2H	R911	3B			U816	5G		
R68	1D	R631	3H	R702	1I	R732	3G	R912	2C	U48	2E	U818	5G		
R80	4D	R632	3D	R703	1J	R733	3H	R914	1A	U68	2D	U820	3I		
R82	3D	R640	2F	R704	1J	R734	1G	R916	2C	U601	4F	U821	4I		
R83	1D	R642	2F	R705	1I	R735	2G	R920	2D	U608	4G	U824	3I		
R84	4D	R650	2F	R706	1F	R736	2G	R921	1C	U610	4F	U828	4I		
R85	1D	R652	2F	R708	1H	R737	1G	R922	2C	U611	4H	U830	5J		
R601	2G	R660	2F	R710	1G	R738	2G	R923	1C	U615	4G	U831	3J		
R602	3G	R662	2F	R711	2G	R739	2G	R925	1B	U616	4H	U838	3J		
R603	3G	R670	1F	R712	1H	R741	2G	R927	3C	U621	5F	U932	3A		
R606	3G	R672	2F	R713	1H	R800	4J	R928	3C	U622	5F	U942	5C		
R607	3G	R680	1F	R714	1G	R829	3H	R929	3C	U624	5F				
R610	4J	R681	1F	R715	1H	R830	3H	R932	3B	U628	4G	VR688	1F		

@

VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the LA 501 controls set as follows:

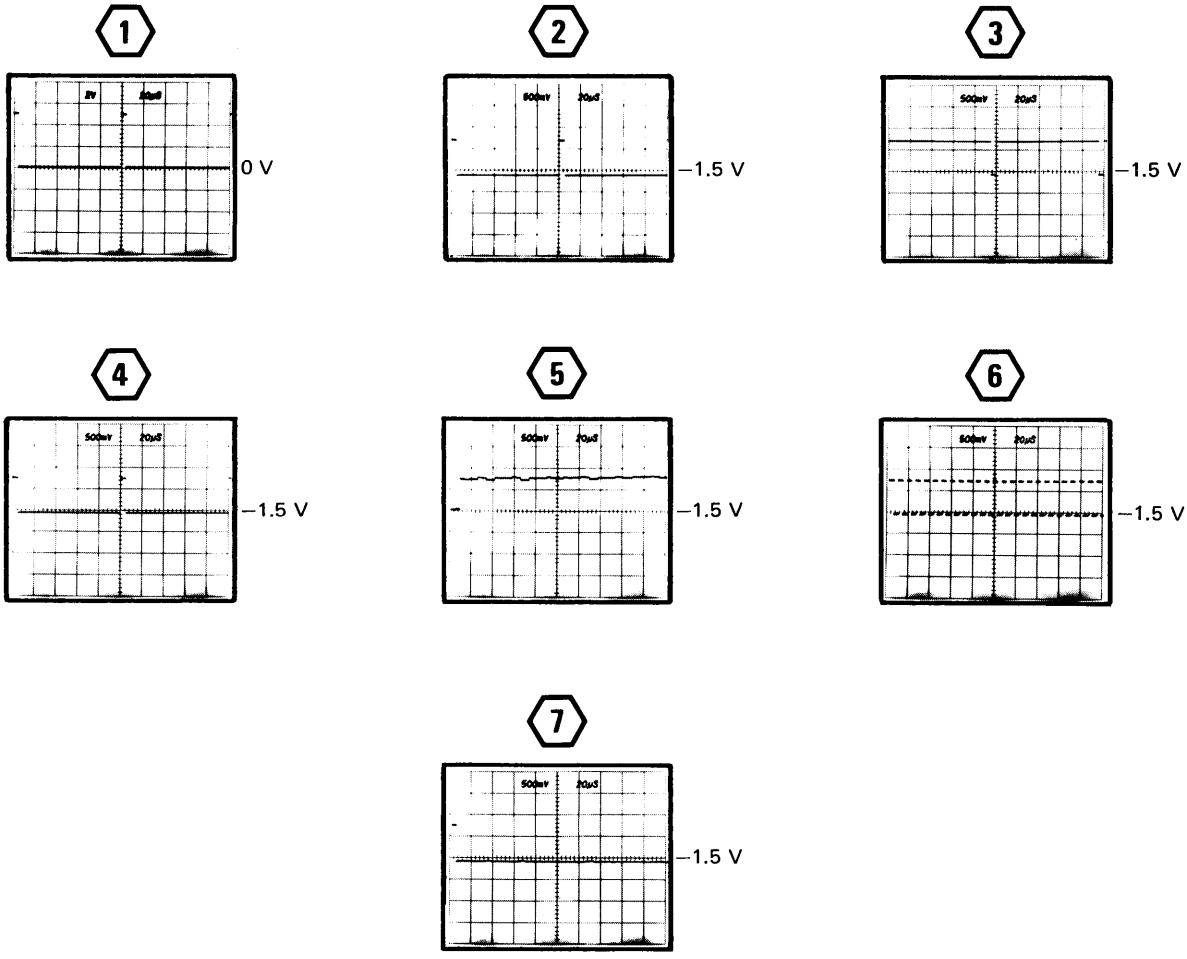
SAMPLE INTERVAL, 50 ns; INPUT THRESHOLD, TTL; FORMAT, CH 0-3 X1024; TRIGGER, CENTER; SLOPE, +; SOURCE, EXT; INPUTS, BNC; RECORD (DISPLAY TIME), 1 s; CHANNEL/POSITION (SELECT), channel 0; CHANNEL/POSITION (POSITION), fully counterclockwise. A 50 Ω cable was connected from the EXT TRIG input connector to a +5 volt pulse (5 microsecond duration, 100 microsecond period).

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with 10 MΩ input impedance (Tektronix DM 501 Digital Multimeter or 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 MΩ input impedance and at least 60 MHz bandwidth (Tektronix 465 Oscilloscope equipped with 10X probe, or 7603 Oscilloscope, 7B53A Time Base, and 7A15A Amplifier equipped with 10X probe). A 7A13 Differential Comparator with 10X probe was used to obtain the calibrated offset voltage.

NOTE

Voltages and waveforms are not absolute and may vary between instruments.



VOLTAGE & WAVEFORM CONDITIONS

PARTIAL A1 SW BD

S605 RECORD — DISPLAY TIME / MANUAL — R604 10K, R605 100K, CR609

P20, P21 — U608B 1/4 10102 — U601B 100 -2V — U601G 100 -2V — U608A 1/4 10102 — U601D 100 -2V — -0.7G

C608 .1 — P14 P4 — P13 P3 — STORE START TO U140-7, U150-7 DIAG 3

P112 — J120 — 15 RECORD ENABLE

PARTIAL A2 MEMORY BD

C607 .01 — R607 1K — U610A 1/3 10107 — U601B 100 -2V — STORE START TO U628-5 DIAG 7

U615B 1/2 10131 — -4.8V, -0.7V — -1.5T — -0.7G

P13 — DISPLAY CLOCK INHIBIT TO P3-1 — STORE CLOCK INHIBIT TO P3-2 — DIAG 3

DISPLAY CLOCK INHIBIT TO U616-5 DIAG 7

STORE CLOCK INHIBIT TO U628-6 DIAG 7

R606 330 — Q606 — Q604 — Q602 — R601 820 — R602 1.8K — R603 10K — C606 100μF — -4.8V

LF CLOCK FROM P2-7 DIAG 3 — P12

6 — U632B 1/4 10102 — 7 — FRAME CLOCK TO U628-12, U616-6, U632-11, CRT26 DIAG 7 & U630-13 DIAG 6

U631C 100 -2V

U616B 1/2 10131

U622 10136 — CARRY IN — CARRY OUT

CR615 — R615 2.7K — -4.8V — -0.7V — -0.7V TO U830B-13 DIAG 5, U630-7 DIAG 6, S720B DIAG 7

EXT TRIG — J609 — 1 — P610

C610 .001 — R610 1K — CR610 — CR611 — +2.1V — C611 .01 — +5V — R612 750 — R611 300 — -0.7V

U830A 1/2 1651 — 2

U608D 1/4 10102 — 3 — U601K 100 -2V — U601F 100 -2V — U610C 1/3 10107 — 4 — U611C 100 -2V

CHØ TRIG FROM U48-2 DIAG 2 — U608C 1/4 10102

U615A 1/2 10131 — -4.8V, -0.7V

Q620 — U611A 100 -2V — R620 510 -4.8V — P21 P20 — +5V — CR620 TRIG'D

5

U621B 100 -2V

U624 10136 — CARRY IN

U601A 100 -2V

U631D 100 -2V

PARTIAL A3 OUTPUT BD

P71, P70

S608 SOURCE (OUT: CH0, IN: EXT) — S610 SLOPE (OUT: −, IN: +)

S625 TRIGGER — POST, CENTER, PRE

P80 P81

ALSO SHOWN ON DIAG 3 — CR608 — R608 2.7K — -4.8V

PARTIAL A1 SW BD

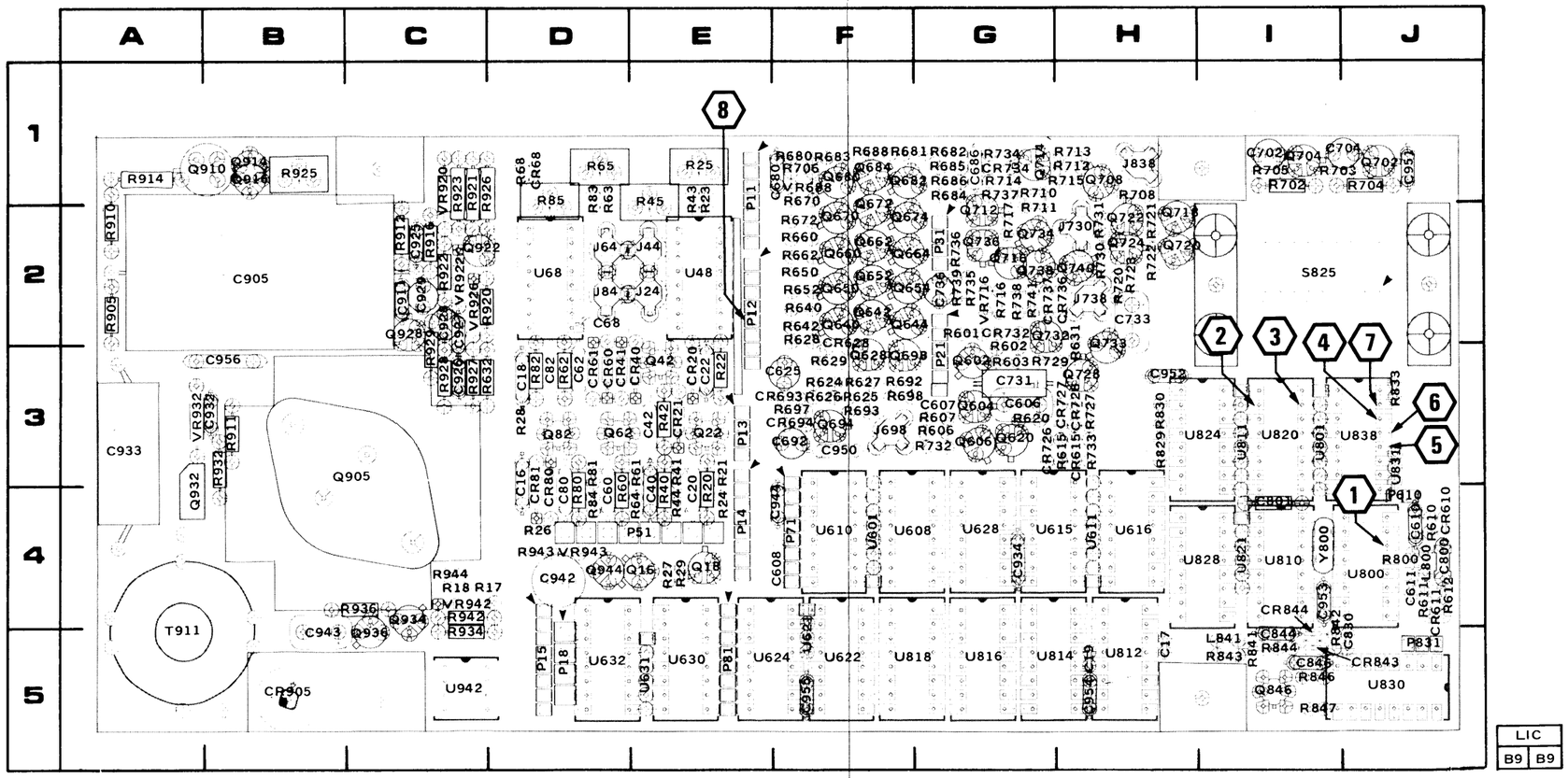
TYPE	(Vcc) GND	(VEE) -4.8V	+5V
1651	1,16	8	7,10
10102	1,16	8	
10107	1,16	8	
10131	1,16	8	
10136	1,16	8	

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

L	I	C
B7		B9

LA501 @ TRIGGER 4

TRIGGER



COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-9 IN THIS SECTION. FOR LOCATION OF COMPONENTS MOUNTED ON REAR OF BOARD, SEE FIGURE 8-8.

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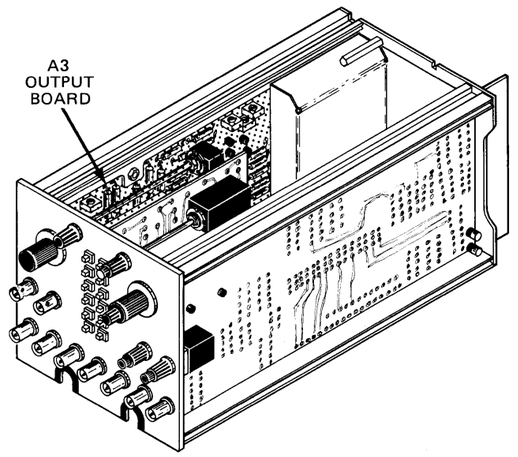
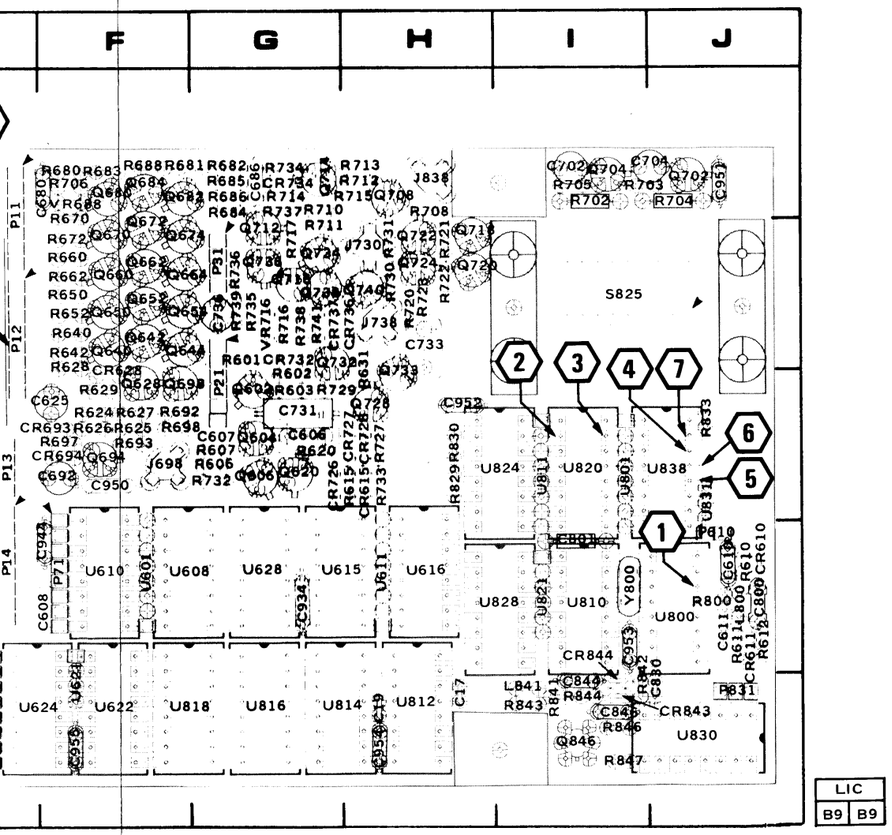
Fig. 8-16. A3—Output circuit board. Component locations as viewed with board installed.



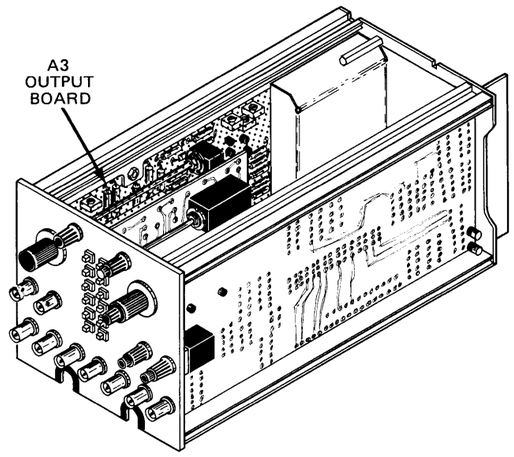
CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C16	3D	C704	1J	C950	3G
C17	5H	C731	3G	C951	1I
C18	3D	C733	2H	C952	1I
C19	5H	C736	2G	C953	4F
C20	4E	C800	4J	C954	4F
C40	4E	C801	4I	C955	4F
C42	3E	C830	5J	C956	4F
C60	4D	C844	5I		
C62	3D	C846	5I	CR20	4E
C68	2D	C905	2B	CR21	4E
C80	4D	C911	2C	CR40	4E
C82	3D	C925	2C	CR41	4E
C606	3G	C926	3C	CR60	4D
C607	3G	C927	2C	CR61	4D
C608	4F	C928	2C	CR68	1D
C610	4J	C929	2C	CR80	4D
C611	4J	C932	3B	CR81	4D
C625	3F	C933	3A	CR610	4J
C660	3F	C934	4G	CR611	4J
C666	1G	C942	4D	CR615	3H
C680	1F	C943	5B	CR628	3F
C692	3F	C944	4F	CR693	3F
C702	1I				

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
R42	3E	R611	4J	R682	1F
R43	1E	R612	4J	R683	1F
R44	4E	R615	3H	R684	1F
R45	1E	R620	3G	R685	1F
R60	4D	R624	3F	R686	1F
R61	3E	R625	3F	R688	1F
R62	3D	R626	3F	R692	3F
R63	1D	R627	3F	R693	3F
R64	4E	R628	2F	R697	3F
R65	1D	R629	3F	R698	3F
R68	1D	R631	3H	R702	1I
R80	4D	R632	3D	R703	1I
R82	3D	R640	2F	R704	1I
R83	1D	R642	2F	R705	1I
R84	4D	R650	2F	R706	1I
R85	1D	R652	2F	R708	1I
R601	2G	R660	2F	R710	1I
R602	3G	R662	2F	R711	1I
R603	3G	R670	1F	R712	1I
R606	3G	R672	2F	R713	1I
R607	3G	R680	1F	R714	1I
R610	4J	R681	1F	R715	1I



1967-85

omponent locations as viewed with board installed.



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C16	3D	C704	1J	C950	3F	CR694	3F	L841	5I	Q602	3G	Q702	1J	Q922	2C
C17	5H	C731	3G	C951	1J	CR726	3G			Q604	3G	Q704	1I	Q928	2C
C18	3D	C733	2H	C952	3H	CR727	3H	P11	1E	Q606	3G	Q708	1H	Q932	4A
C19	5H	C736	2G	C953	4I	CR728	3H	P12	2E	Q620	3G	Q712	2G	Q934	4C
C20	4E	C800	4J	C954	5H	CR732	2G	P13	3E	Q628	3F	Q714	1G	Q936	5C
C40	4E	C801	4I	C955	5F	CR734	1G	P14	4E	Q640	2F	Q716	2G	Q944	4D
C42	3E	C830	5J	C956	3B	CR736	2H	P15	5D	Q642	2F	Q718	2H		
C60	4D	C844	5I			CR737	2G	P18	5D	Q644	2G	Q720	2H	R17	4C
C62	3D	C846	5I	CR20	3E	CR843	5I	P21	3G	Q650	2F	Q722	2H	R18	4C
C68	2D	C905	2B	CR21	3E	CR844	5I	P31	2G	Q652	2F	Q724	2H	R20	4E
C80	4D	C911	2C	CR40	3E	CR905	5B	P51	4E	Q654	2G	Q728	3H	R21	3E
C82	3D	C925	2C	CR41	3D			P71	4F	Q660	2F	Q732	2G	R22	3E
C606	3G	C926	3C	CR60	3D	J24	2E	P81	5E	Q662	2F	Q733	3H	R23	1E
C607	3G	C927	2C	CR61	3D	J44	2E	P610	4J	Q664	2G	Q734	2G	R24	4E
C608	4F	C928	2C	CR68	1D	J64	2D	P831	5J	Q670	2F	Q736	2G	R25	1E
C610	4J	C929	2C	CR80	3D	J84	2D			Q672	2F	Q738	2G	R26	4D
C611	4J	C932	3B	CR81	3D	J698	3F	Q16	4E	Q674	2G	Q740	2H	R27	4E
C625	3F	C933	3A	CR610	4J	J730	2H	Q18	4E	Q680	1F	Q846	5I	R28	3D
C660	3F	C934	4G	CR611	4J	J738	2H	Q22	3E	Q682	1F	Q905	3C	R29	4E
C666	1G	C942	4D	CR615	3H	J838	1H	Q42	3E	Q684	1F	Q910	1B	R31	3D
C680	1F	C943	5B	CR628	2F			Q62	3D	Q694	3F	Q914	1B	R40	4E
C692	3F	C944	4F	CR693	3F	L800	4J	Q82	3D	Q698	3F	Q916	1B	R41	3E

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
R42	3E	R611	4J	R682	1G	R716	2G	R833	3J	R934	5C	U630	5E	VR716	2G
R43	1E	R612	4J	R683	1F	R717	2G	R841	5I	R936	4C	U631	5E	VR920	1C
R44	4E	R615	3H	R684	1G	R720	2H	R842	5J	R942	4C	U632	5D	VR922	2C
R45	1E	R620	3G	R685	1G	R721	2H	R843	5I	R943	4D	U800	4J	VR926	2C
R60	4D	R624	3F	R686	1G	R722	2H	R844	5I	R944	4C	U801	3I	VR942	4C
R61	3E	R625	3F	R688	1F	R723	2H	R846	5I			U810	4I	VR943	4D
R62	3D	R626	3F	R692	3F	R727	3H	R847	5I	S825	2I	U811	3I		
R63	1D	R627	3F	R693	3F	R729	3G	R905	2A			U812	5H	Y800	4I
R64	4E	R628	2F	R697	3F	R730	2H	R910	2A	T911	5A	U814	5H		
R65	1D	R629	3F	R698	3F	R731	2H	R911	3B			U816	5G		
R68	1D	R631	3H	R702	1I	R732	3G	R912	2C	U48	2E	U818	5G		
R80	4D	R632	3D	R703	1J	R733	3H	R914	1A	U68	2D	U820	3I		
R82	3D	R640	2F	R704	1J	R734	1G	R916	2C	U601	4F	U821	4I		
R83	1D	R642	2F	R705	1I	R735	2G	R920	2D	U608	4G	U824	3I		
R84	4D	R650	2F	R706	1F	R736	2G	R921	1C	U610	4F	U828	4I		
R85	1D	R652	2F	R708	1H	R737	1G	R922	2C	U611	4H	U830	5J		
R601	2G	R660	2F	R710	1G	R738	2G	R923	1C	U615	4G	U831	3J		
R602	3G	R662	2F	R711	2G	R739	2G	R925	1B	U616	4H	U838	3J		
R603	3G	R670	1F	R712	1H	R741	2G	R927	3C	U621	5F	U932	3A		
R606	3G	R672	2F	R713	1H	R800	4J	R928	3C	U622	5F	U942	5C		
R607	3G	R680	1F	R714	1G	R829	3H	R929	3C	U624	5F				
R610	4J	R681	1F	R715	1H	R830	3H	R932	3B	U628	4G	VR688	1F		

VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the LA 501 controls set as follows:

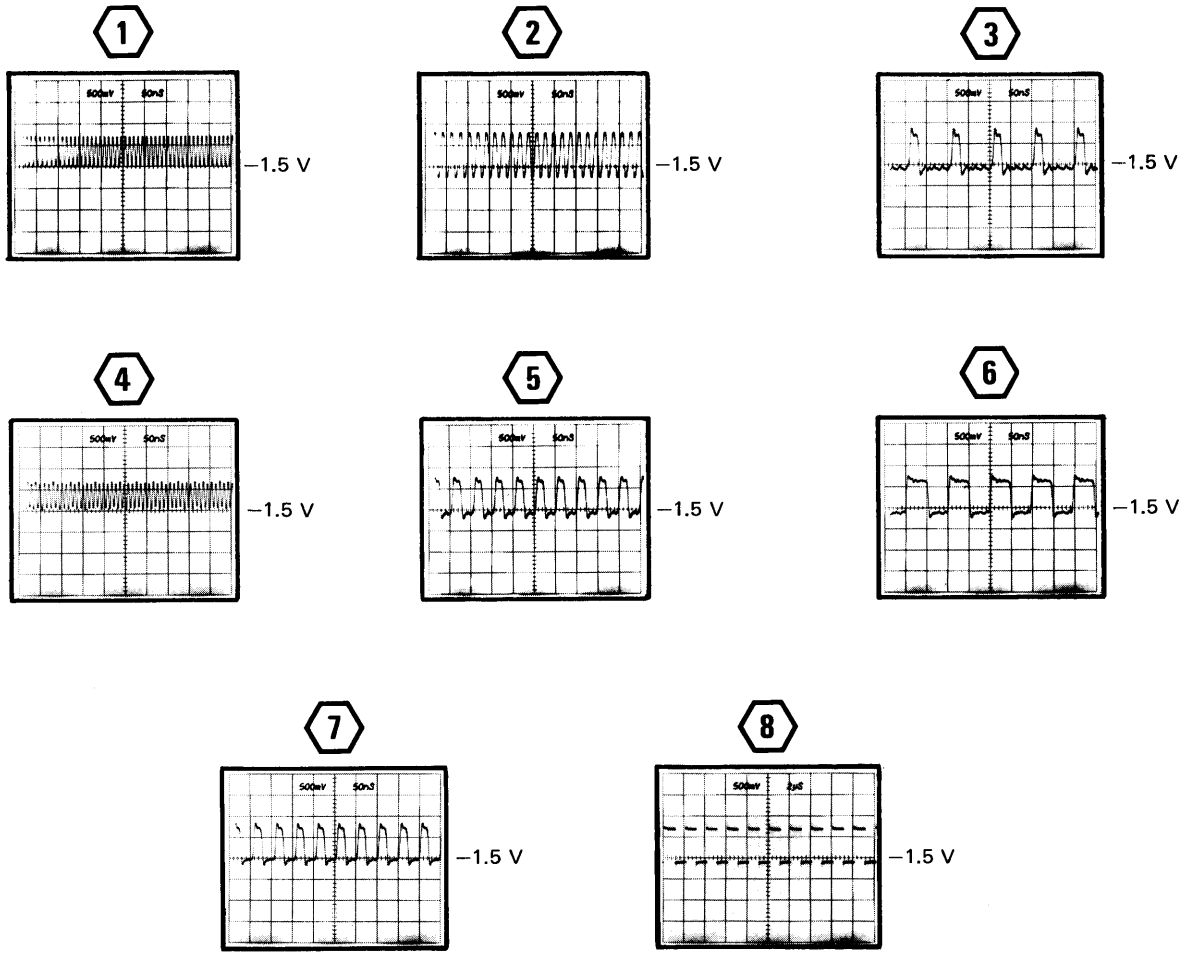
SAMPLE INTERVAL, 50 ns; INPUT THRESHOLD, TTL; FORMAT, CH 0-3 X1024; TRIGGER, CENTER; SLOPE, +; SOURCE, CH 0; INPUTS, BNC; RECORD (DISPLAY TIME), 1 s; CHANNEL/POSITION (SELECT), channel 0; CHANNEL/POSITION (POSITION), fully counterclockwise. A 10X probe was connected from the front panel CH 0 BNC input connector to a +5 volt pulse (5 microsecond duration, 100 microsecond period).

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with 10 MΩ input impedance (Tektronix DM 501 Digital Multimeter or 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 MΩ input impedance and at least 60 MHz bandwidth (Tektronix 465 Oscilloscope equipped with 10X probe, or 7603 Oscilloscope, 7B53A Time Base, and 7A15A Amplifier equipped with 10X probe). A 7A13 Differential Comparator with 10X probe was used to obtain the calibrated offset voltage.

NOTE

Voltages and waveforms are not absolute and may vary between instruments.



VOLTAGE & WAVEFORM CONDITIONS

TYPE	(Vcc) GND	(VEE) -4.8V	+5V
1651	1, 16	8	7, 10
10102	1, 16	8	
10138	1, 16	8	
10164	1, 16	8	
10174	1, 16	8	

PARTIAL A2 MEMORY BD

PARTIAL A3 OUTPUT BD

TO S825 POS

PIN 7 PIN 9 U824

S825 SAMPLE INTERVAL SHOWN IN 50 nS POSITION

EXT, 5, 2, 1, 500, 200, 100, 50, 20, 10, 5, 2, 1, 500, 200, 100, 50, 20, 10 — nSEC / μSEC / mSEC

PIN 2, PIN 7, PIN 10, PIN 9 TO U820

SEE DIAG 7

L800 285 nH

C800 10

U800D 1/4 10102

U800B 1/4 10102

C801 0.1

U821C 100

U800C 1/4 10102

R800 5.1k

Y800

U801F 50

U801G 50

-2V

-4.8V

TP 820

U810 10138

U812 10138

U814 10138

U816 10138

U818 10138

U820 10164 DATA SELECTOR

U801E 50

U801D 50

U801C 50

U801B 50

U811G 100

U811E 100

U811D 100

U811B 100

U811A 100

U811F 100

U811C 100

FROM S825 POS 3, POS 6

U824 10174 DATA SELECTOR

U828 10138

U821B 100

U821D 100

U821E 100

U831C 50

U831A 50

U831B 50

U838 10174 DATA SELECTOR

STORE CLOCK TO J138

DISPLAY CLOCK TO P2-5

DIAG 3

DISPLAY CLOCK S835

INT DISPLAY

EXT DISPLAY/RECORD

EXT DISPLAY

EXT DISPLAY CLOCK INPUT J120 P112 P2 P12

LEVEL BIAS FROM P21-5 DIAG 4

R833 100

S848

R829 49.9

R830 1.87k

C830 0.1

U830B 1/2 1651

-0.7V FROM R615 DIAG 4

P831 CLOCK POLARITY

EXT CLOCK J829 J830

L841 110 nH

R841 47

R843 1.00M

R844 100k

C844 .001

CR844

CR843

+5V

C845 0.1

R846 20.0

C846 .001

Q846A

Q846B

EXT CLOCK THRESHOLD SW

EXT CLOCK DC BAL

R842 10

R845 20

R847 10

C847 0.1

MONITOR J846 P845

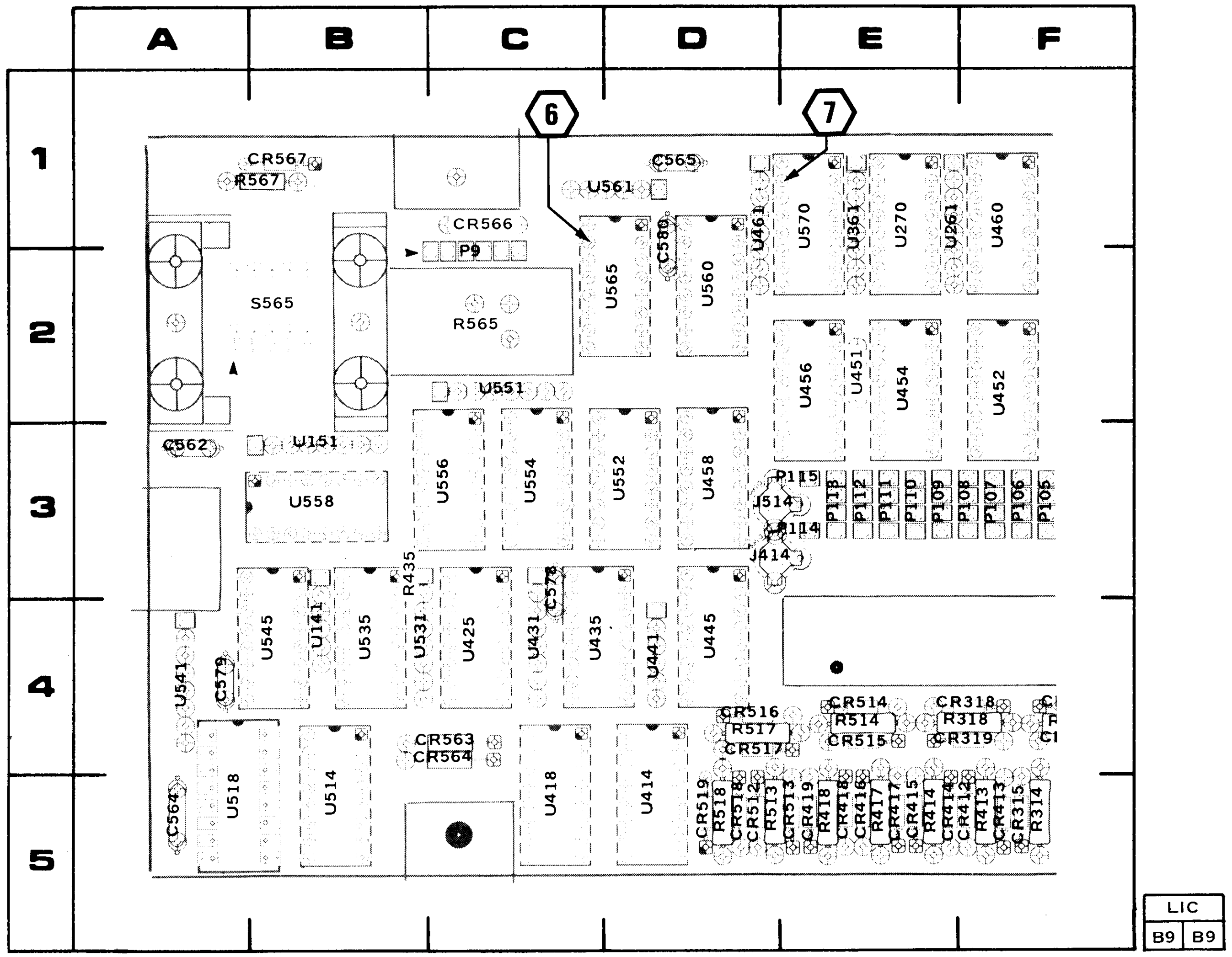
0.0V

+2.1V

-2.1V

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

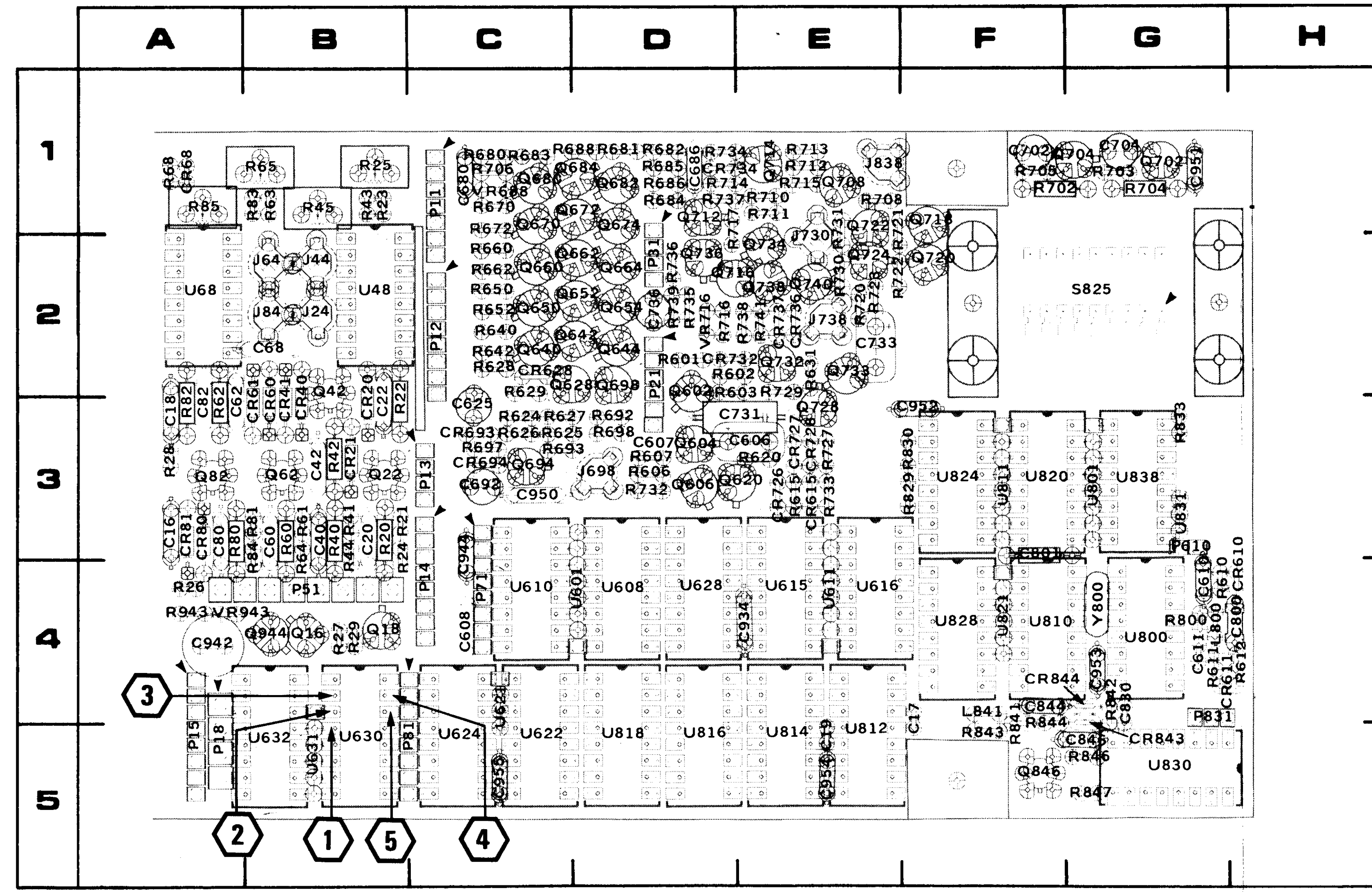
L	I	C
B7	B9	



COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-11 IN THIS SECTION.

1967-86

Fig. 8-17. A2—Memory circuit board. Component locations as viewed with board installed.

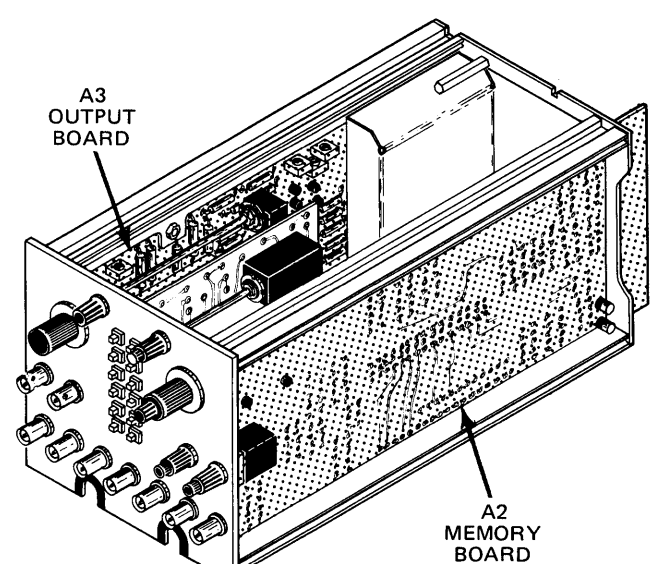


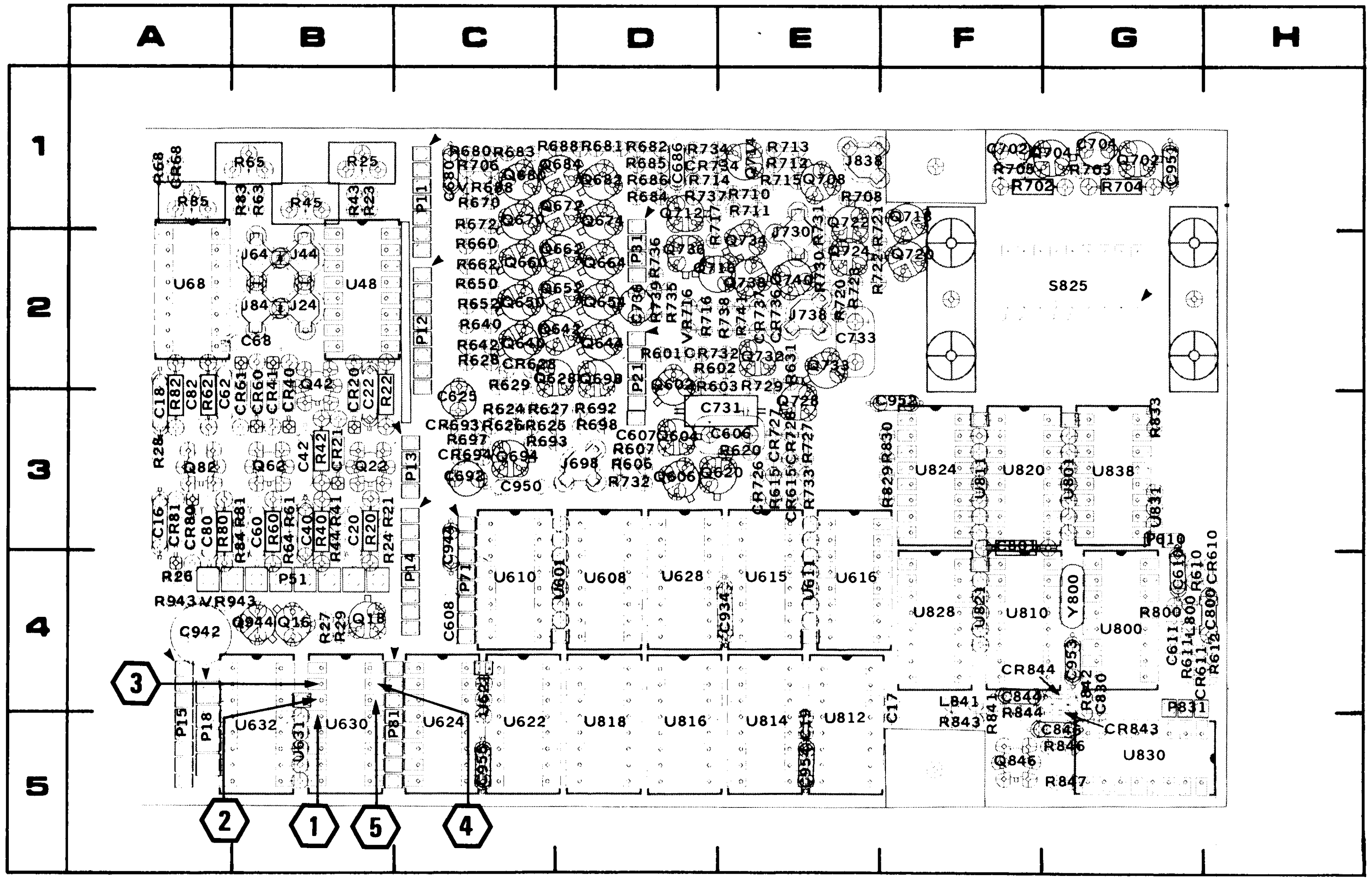
COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-9 IN THIS SECTION. FOR LOCATION OF COMPONENTS MOUNTED ON REAR OF BOARD, SEE FIGURE 8-4.

1967-87

Fig. 8-18. A3—Output circuit board. Component locations as viewed with board installed.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C562	3A	CR513	5E	P108	3F	S565	2B	U461	1D
C564	5A	CR514	4E	P109	3E			U514	5B
C565	1D	CR515	4E	P110	3E	U141	4B	U518	5A
C578	3C	CR516	4D	P111	3E	U151	3B	U531	4B
C579	4A	CR517	4D	P112	3E	U261	1E	U535	4B
C580	1D	CR518	5D	P113	3E	U270	1E	U541	4A
		CR519	5D	P114	3E	U361	1E	U545	4B
CR315	5F	CR563	4C	P115	3E	U414	5D	U551	2C
CR318	4F	CR564	4C	R314	5F	U418	5C	U552	3D
CR319	4F	CR566	1C	R318	4F	U425	4C	U554	3C
CR412	5F	CR567	1B	R413	5F	U431	4C	U556	3C
CR413	5F			R414	5E	U435	4C	U558	3B
CR414	5E	J414	3D	R418	5E	U441	4D	U560	2D
CR415	5E	J514	3D	R435	3C	U445	4D	U561	1D
CR416	5E			R513	5D	U451	2E	U565	2D
CR417	5E	P9	2C	R514	4E	U452	2F	U570	1E
CR418	5E	P105	3F	R517	4D	U454	1E		
CR419	5E	P106	3F	R518	5D	U456	2E		
CR512	5D	P107	3F	R565	2C	U458	3D		
				R567	1B	U460	1F		





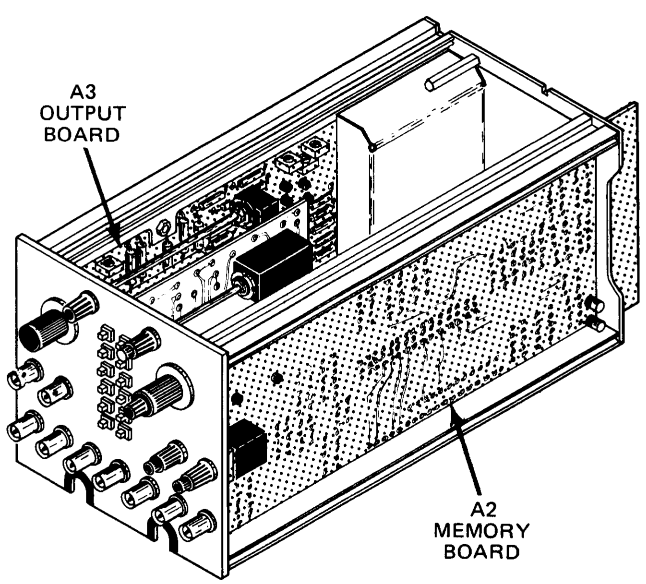
COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-9 IN THIS SECTION. FOR LOCATION OF COMPONENTS MOUNTED ON REAR OF BOARD, SEE FIGURE 8-4.

LIC	
B9	B9

1967-87

Fig. 8-18. A3—Output circuit board. Component locations as viewed with board installed.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C16	3A	CR610	4H	Q604	3D	R28	3A	R684	1D	R943	4A
C17	4F	CR611	4G	Q606	3D	R29	4B	R685	1D		
C18	3A	CR615	3E	Q620	3E	R40	3B	R686	1D	S825	2G
C19	5E	CR628	2C	Q628	2D	R41	3B	R688	1D		
C20	3B	CR693	3C	Q640	2C	R42	3B	R692	3D	U48	2B
C40	3B	CR694	3C	Q642	2D	R43	1B	R693	3C	U68	2A
C42	3B	CR726	3E	Q644	2D	R44	3B	R697	3C	U601	4D
C60	3B	CR727	3E	Q650	2C	R45	1B	R698	3D	U608	4D
C62	3A	CR728	3E	Q652	2D	R60	3B	R702	1F	U610	4C
C68	2B	CR732	2D	Q654	2D	R61	3B	R703	1G	U611	4E
C80	3A	CR734	1D	Q660	2C	R62	3A	R704	1G	U615	4E
C82	3A	CR736	2E	Q662	2D	R63	1B	R705	1F	U616	4E
C606	3E	CR737	2E	Q664	2D	R64	3B	R706	1C	U621	4C
C607	3D	CR843	5G	Q670	1C	R65	1B	R708	1E	U622	5C
C608	4C	CR844	4G	Q672	1D	R68	1A	R710	1E	U624	5C
C610	4G			Q674	1D	R80	3A	R711	1E	U628	4E
C611	4G	J24	2B	Q680	1C	R81	3B	R712	1E	U630	5B
C625	3C	J44	2B	Q682	1D	R82	3A	R713	1E	U631	5B
C666	1D	J64	2B	Q684	1D	R83	1B	R714	1D	U632	5B
C680	1C	J84	2B	Q694	3C	R85	1A	R715	1E	U800	4G
C692	3C	J698	3D	Q698	2D	R601	2D	R716	2D	U801	3G
C702	1F	J730	2E	Q702	1G	R602	2D	R717	1D	U810	4F
C704	1G	J738	2E	Q704	1G	R603	2D	R720	2E	U811	3F
C731	3E	J838	1E	Q708	1E	R606	3D	R721	1E	U812	5E
C733	2E			Q712	1D	R607	3D	R722	2E	U814	5E
C736	2D	L800	4G	Q714	1E	R610	4G	R723	2E	U816	5D
C800	4H	L841	4F	Q716	2D	R611	4G	R727	3E	U818	5D
C801	3F			Q718	1F	R612	4H	R729	2E	U820	3F
C830	4G	P11	1C	Q720	2F	R615	3E	R730	2E	U821	4F
C844	4F	P12	2C	Q722	1E	R620	3E	R731	1E	U824	3F
C846	5G	P13	3C	Q724	2E	R624	3C	R732	3D	U828	4F
C934	4E	P14	4C	Q728	3E	R625	3C	R733	3E	U830	5G
C942	4A	P15	5A	Q732	2E	R626	3C	R734	1D	U831	3G
C944	3C	P18	5A	Q733	2E	R627	3C	R735	2D	U838	3G
C950	3C	P21	2D	Q734	2E	R628	2C	R736	2D		
C951	1G	P31	2D	Q736	2D	R629	2C	R737	1D	VR688	1C
C952	3F	P51	4B	Q738	2E	R631	2E	R738	2E	VR712	2D
C953	4G	P71	4C	Q740	2E	R640	2C	R739	2D	VR943	4B
C954	5E	P81	5C	Q846	5F	R642	2C	R741	2E		
C955	5C	P610	3G	Q944	4B	R650	2C	R800	4G	Y800	4G
		P831	4G			R652	2C	R829	3F		
CR20	2B			R20	3B	R660	2C	R830	3F		
CR21	3B	Q16	4B	R21	3B	R662	2C	R833	3G		
CR40	3B	Q18	4B	R22	3B	R670	1C	R841	5F		
CR41	3B	Q22	3B	R23	1B	R672	1C	R842	4G		
CR60	3B	Q42	2B	R24	3B	R680	1C	R843	5F		
CR61	3B	Q62	3B	R25	1B	R681	1D	R844	5F		
CR68	1A	Q82	3A	R26	4A	R682	1D	R846	5G		
CR80	3A	Q602	2D	R27	4B	R683	1C	R847	5G		
CR81	3A										



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VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the LA 501 controls set as follows:

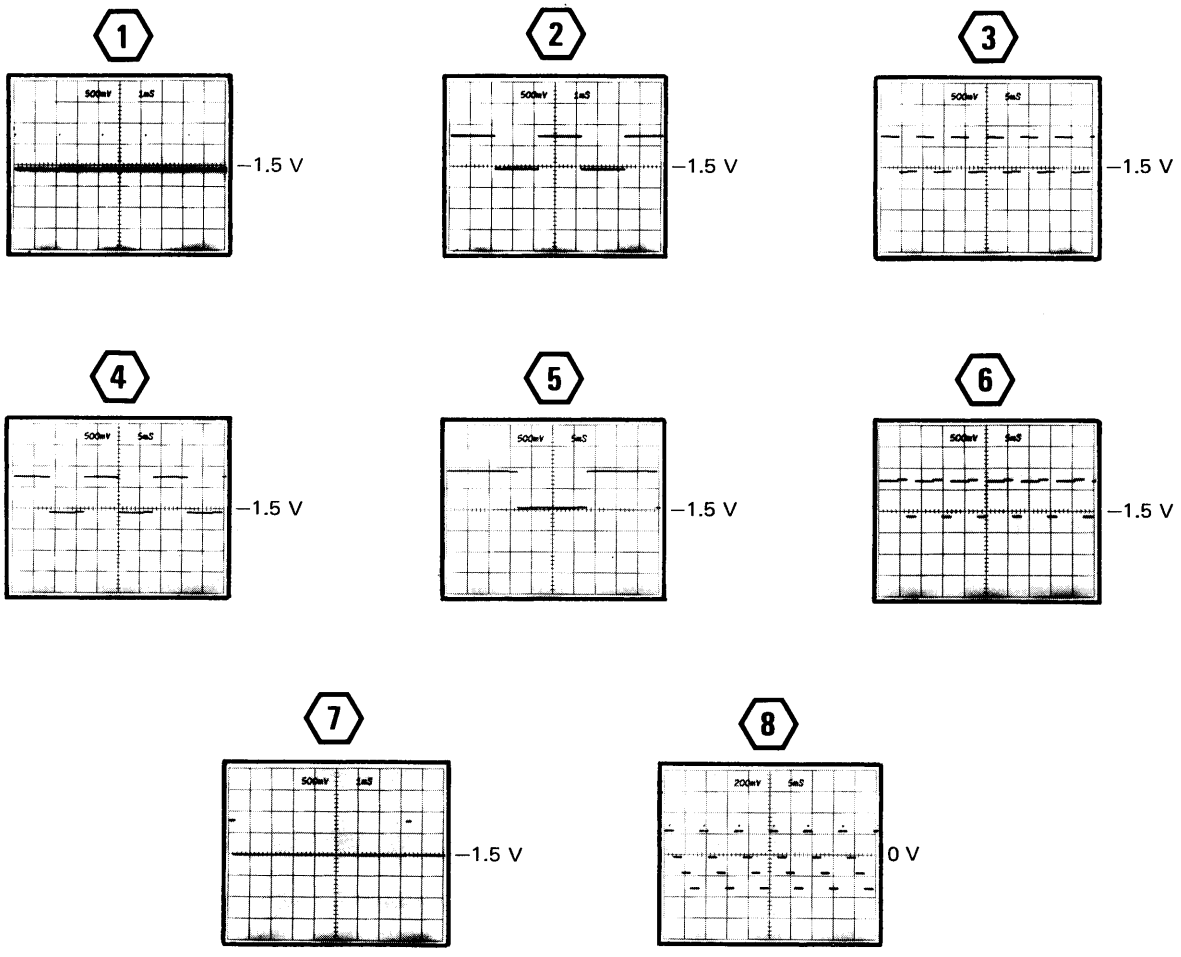
SAMPLE INTERVAL, 50 ns; INPUT THRESHOLD, TTL; FORMAT, CH 0-3 X1024; TRIGGER, CENTER; SLOPE, +; SOURCE, CH 0; INPUTS, BNC; RECORD (DISPLAY TIME), 1 s; CHANNEL/POSITION (SELECT), channel 0; CHANNEL/POSITION (POSITION), fully counterclockwise. A 10X probe was connected from the front panel CH 0 BNC input connector to a +5 volt pulse (5 microsecond duration, 100 microsecond period).

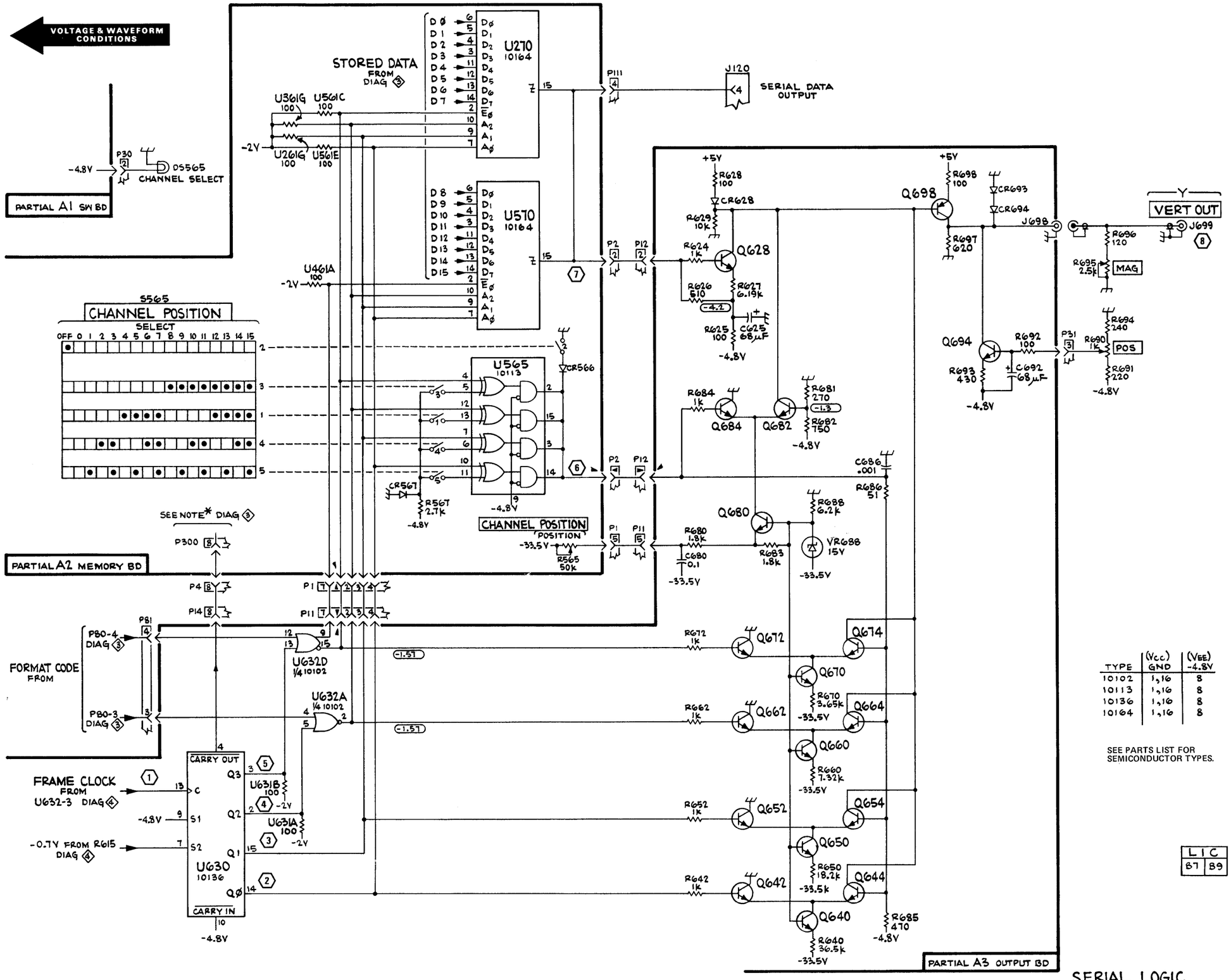
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with 10 MΩ input impedance (Tektronix DM 501 Digital Multimeter or 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 MΩ input impedance and at least 60 MHz bandwidth (Tektronix 465 Oscilloscope equipped with 10X probe, or 7603 Oscilloscope, 7B53A Time Base, and 7A15A Amplifier equipped with 10X probe). A 7A13 Differential Comparator with 10X probe was used to obtain the calibrated offset voltage.

NOTE

Voltages and waveforms are not absolute and may vary between instruments.





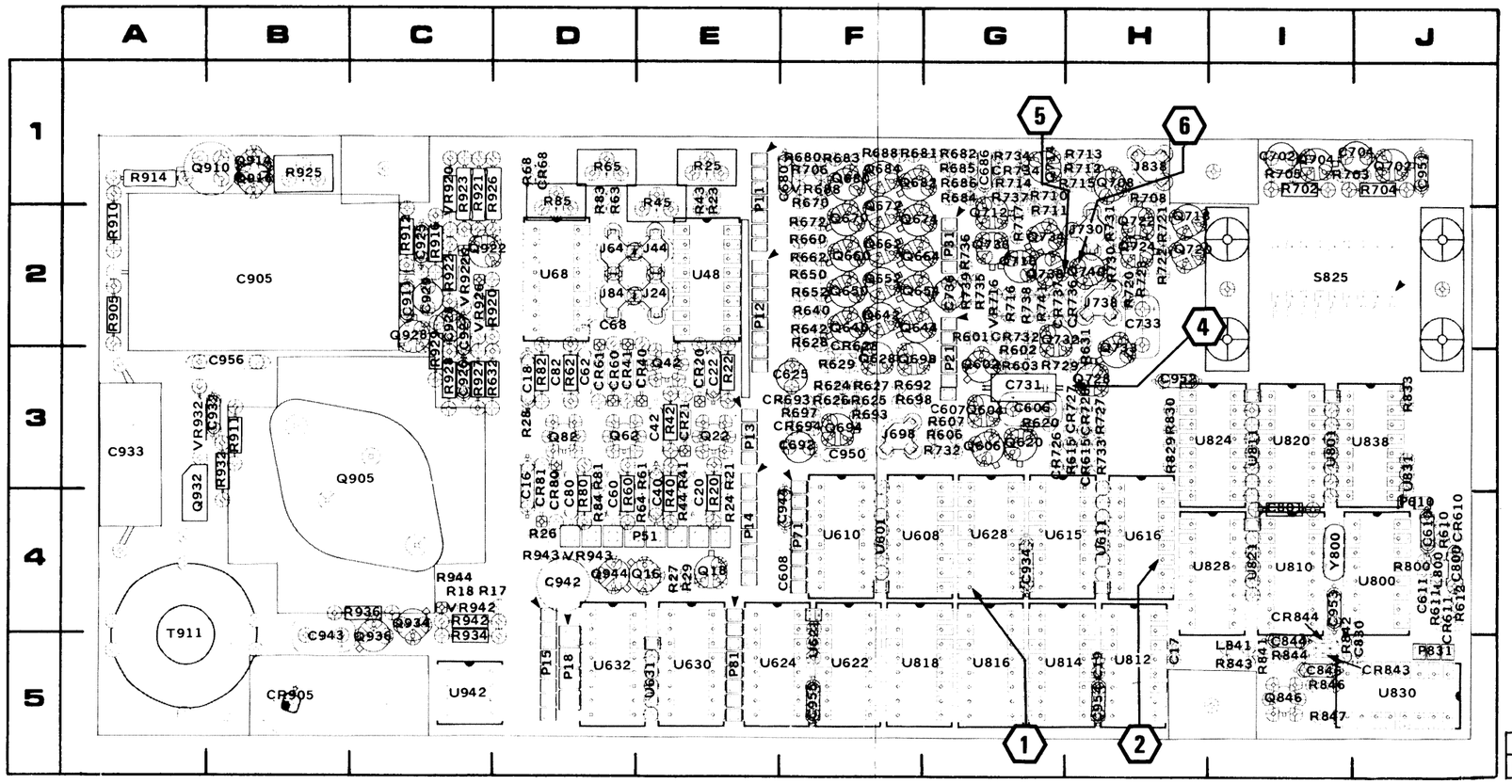
TYPE	(Vcc) GND	(VEE) -4.8V
10102	1,16	8
10113	1,16	8
10136	1,16	8
10164	1,16	8

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

L	I C
B7	B9

LA501

SERIAL LOGIC AND VERTICAL SIGNAL OUTPUTS 6



COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-9 IN THIS SECTION. FOR LOCATION OF COMPONENTS MOUNTED ON REAR OF BOARD, SEE FIGURE 8-8.

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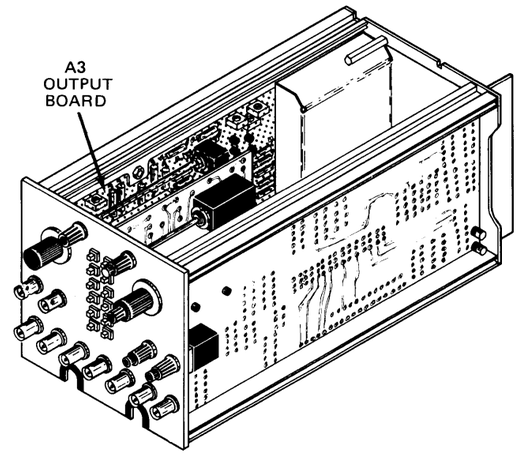
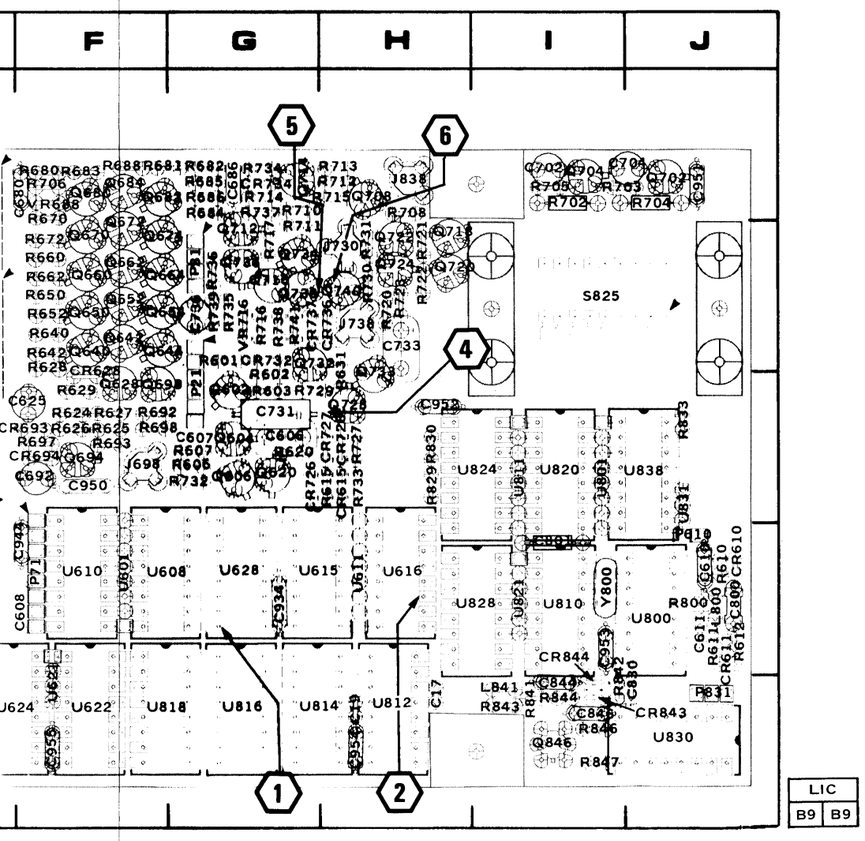
Fig. 8-19. A3—Output circuit board. Component locations as viewed with board installed.



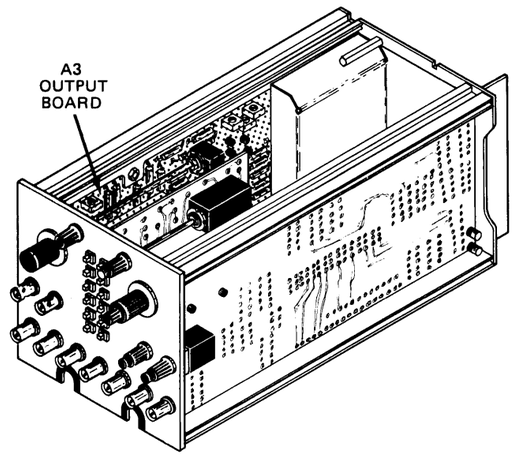
CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	G
C16	3D	C704	1J	C950	3
C17	5H	C731	3G	C951	1
C18	3D	C733	2H	C952	3
C19	5H	C736	2G	C953	4
C20	4E	C800	4J	C954	5
C40	4E	C801	4I	C955	5
C42	3E	C830	5J	C956	3
C60	4D	C844	5I		
C62	3D	C846	5I	CR20	3
C68	2D	C905	2B	CR21	3
C80	4D	C911	2C	CR40	3
C82	3D	C925	2C	CR41	3
C606	3G	C926	3C	CR60	3
C607	3G	C927	2C	CR61	3
C608	4F	C928	2C	CR68	1
C610	4J	C929	2C	CR80	3
C611	4J	C932	3B	CR81	3
C625	3F	C933	3A	CR610	4
C650	3F	C934	4G	CR611	4
C666	1G	C942	4D	CR615	4
C680	1F	C943	5B	CR628	3
C692	3F	C944	4F	CR693	3
C702	1I				

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	G
R42	3E	R611	4J	R682	1
R43	1E	R612	4J	R683	1
R44	4E	R615	3H	R684	1
R45	1E	R620	3G	R685	1
R60	4D	R624	3F	R686	1
R61	3E	R625	3F	R688	1
R62	3D	R626	3F	R692	3
R63	1D	R627	3F	R693	3
R64	4E	R628	2F	R697	3
R65	1D	R629	3F	R698	3
R68	1D	R631	3H	R702	1
R80	4D	R632	3D	R703	1
R82	3D	R640	2F	R704	1
R83	1D	R642	2F	R705	1
R84	4D	R650	2F	R706	1
R85	1D	R652	2F	R708	1
R601	2G	R660	2F	R710	1
R602	3G	R662	2F	R711	2
R603	3G	R670	1F	R712	1
R606	3G	R672	2F	R713	1
R607	3G	R680	1F	R714	1
R610	4J	R681	1F	R715	1



1967-88

nent locations as viewed with board installed.



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C16	3D	C704	1J	C950	3F	CR694	3F	L841	5I	Q602	3G	Q702	1J	Q922	2C
C17	5H	C731	3G	C951	1J	CR726	3G			Q604	3G	Q704	1I	Q928	2C
C18	3D	C733	2H	C952	3H	CR727	3H	P11	1E	Q606	3G	Q708	1H	Q932	4A
C19	5H	C736	2G	C953	4I	CR728	3H	P12	2E	Q620	3G	Q712	2G	Q934	4C
C20	4E	C800	4J	C954	5H	CR732	2G	P13	3E	Q628	3F	Q714	1G	Q936	5C
C40	4E	C801	4I	C955	5F	CR734	1G	P14	4E	Q640	2F	Q716	2G	Q944	4D
C42	3E	C830	5J	C956	3B	CR736	2H	P15	5D	Q642	2F	Q718	2H		
C60	4D	C844	5I			CR737	2G	P18	5D	Q644	2G	Q720	2H	R17	4C
C62	3D	C846	5I	CR20	3E	CR843	5I	P21	3G	Q650	2F	Q722	2H	R18	4C
C68	2D	C905	2B	CR21	3E	CR844	5I	P31	2G	Q652	2F	Q724	2H	R20	4E
C80	4D	C911	2C	CR40	3E	CR905	5B	P51	4E	Q654	2G	Q728	3H	R21	3E
C82	3D	C925	2C	CR41	3D			P71	4F	Q660	2F	Q732	2G	R22	3E
C606	3G	C926	3C	CR60	3D	J24	2E	P81	5E	Q662	2F	Q733	3H	R23	1E
C607	3G	C927	2C	CR61	3D	J44	2E	P610	4J	Q664	2G	Q734	2G	R24	4E
C608	4F	C928	2C	CR68	1D	J64	2D	P831	5J	Q670	2F	Q736	2G	R25	1E
C610	4J	C929	2C	CR80	3D	J84	2D			Q672	2F	Q738	2G	R26	4D
C611	4J	C932	3B	CR81	3D	J698	3F	Q16	4E	Q674	2G	Q740	2H	R27	4E
C625	3F	C933	3A	CR610	4J	J730	2H	Q18	4E	Q680	1F	Q846	5I	R28	3D
C650	3F	C934	4G	CR611	4J	J738	2H	Q22	3E	Q682	1F	Q905	3C	R29	4E
C666	1G	C942	4D	CR615	3H	J838	1H	Q42	3E	Q684	1F	Q910	1B	R31	3D
C680	1F	C943	5B	CR628	2F			Q62	3D	Q694	3F	Q914	1B	R40	4E
C692	3F	C944	4F	CR693	3F	L800	4J	Q82	3D	Q698	3F	Q916	1B	R41	3E

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
R42	3E	R611	4J	R682	1G	R716	2G	R833	3J	R934	5C	U630	5E	VR716	2G
R43	1E	R612	4J	R683	1F	R717	2G	R841	5I	R936	4C	U631	5E	VR920	1C
R44	4E	R615	3H	R684	1G	R720	2H	R842	5J	R942	4C	U632	5D	VR922	2C
R45	1E	R620	3G	R685	1G	R721	2H	R843	5I	R943	4D	U800	4J	VR926	2C
R60	4D	R624	3F	R686	1G	R722	2H	R844	5I	R944	4C	U801	3I	VR942	4C
R61	3E	R625	3F	R688	1F	R723	2H	R846	5I			U810	4I	VR943	4D
R62	3D	R626	3F	R692	3F	R727	3H	R847	5I	S825	2I	U811	3I		
R63	1D	R627	3F	R693	3F	R729	3G	R905	2A			U812	5H	Y800	4I
R64	4E	R628	2F	R697	3F	R730	2H	R910	2A	T911	5A	U814	5H		
R65	1D	R629	3F	R698	3F	R731	2H	R911	3B			U816	5G		
R68	1D	R631	3H	R702	1I	R732	3G	R912	2C	U48	2E	U818	5G		
R80	4D	R632	3D	R703	1J	R733	3H	R914	1A	U68	2D	U820	3I		
R82	3D	R640	2F	R704	1J	R734	1G	R916	2C	U601	4F	U821	4I		
R83	1D	R642	2F	R705	1I	R735	2G	R920	2D	U608	4G	U824	3I		
R84	4D	R650	2F	R706	1F	R736	2G	R921	1C	U610	4F	U828	4I		
R85	1D	R652	2F	R708	1H	R737	1G	R922	2C	U611	4H	U830	5J		
R601	2G	R660	2F	R710	1G	R738	2G	R923	1C	U615	4G	U831	3J		
R602	3G	R662	2F	R711	2G	R739	2G	R925	1B	U616	4H	U838	3J		
R603	3G	R670	1F	R712	1H	R741	2G	R927	3C	U621	5F	U932	3A		
R606	3G	R672	2F	R713	1H	R800	4J	R928	3C	U622	5F	U942	5C		
R607	3G	R680	1F	R714	1G	R829	3H	R929	3C	U624	5F				
R610	4J	R681	1F	R715	1H	R830	3H	R932	3B	U628	4G	VR688	1F		

@

VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the LA 501 controls set as follows:

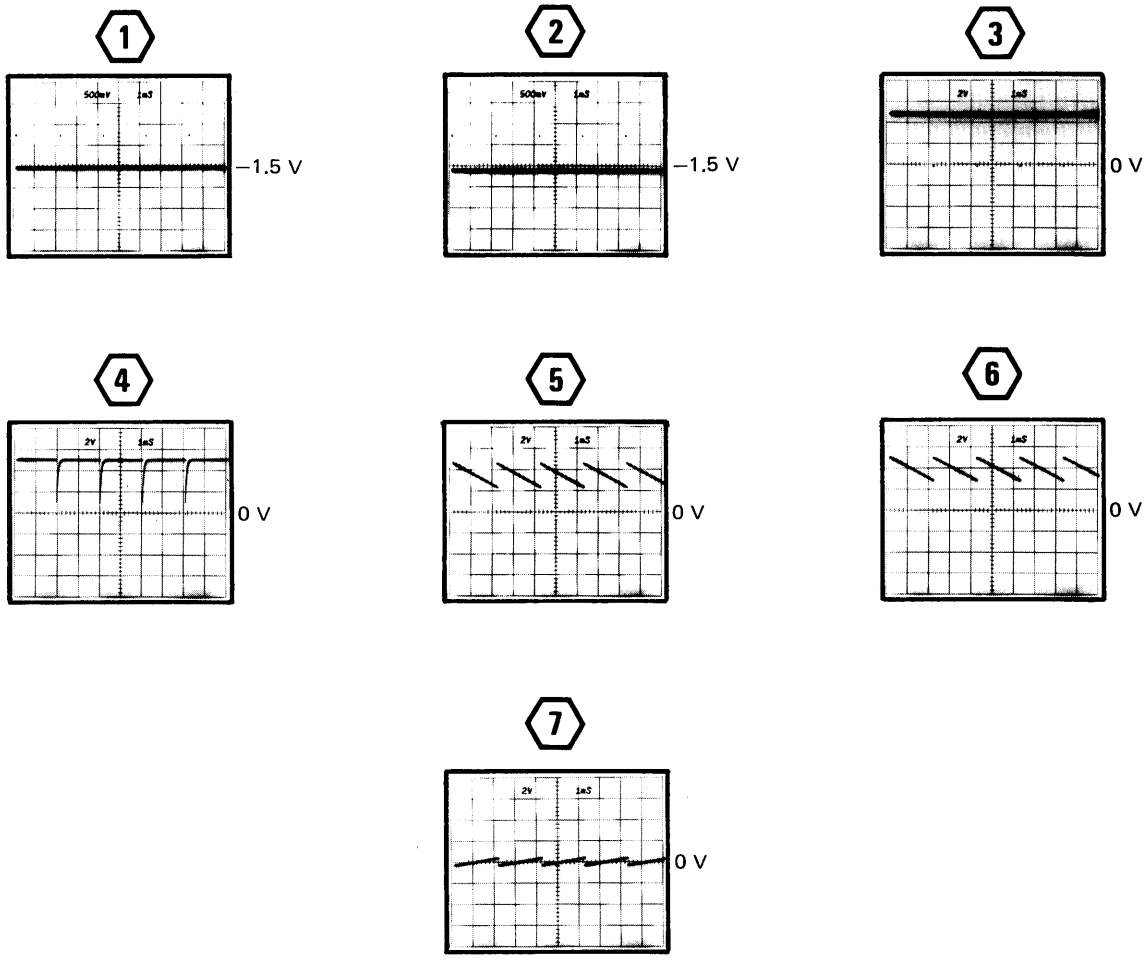
SAMPLE INTERVAL, 50 ns; INPUT THRESHOLD, TTL; FORMAT, CH 0-3 X1024; TRIGGER, CENTER; SLOPE, +; SOURCE, CH 0; INPUTS, BNC; RECORD (DISPLAY TIME), 1 s; CHANNEL/POSITION (SELECT), channel 0; CHANNEL/POSITION (POSITION), fully counterclockwise. A 10X probe was connected from the front panel CH 0 BNC input connector to a +5 volt pulse (5 microsecond duration, 100 microsecond period).

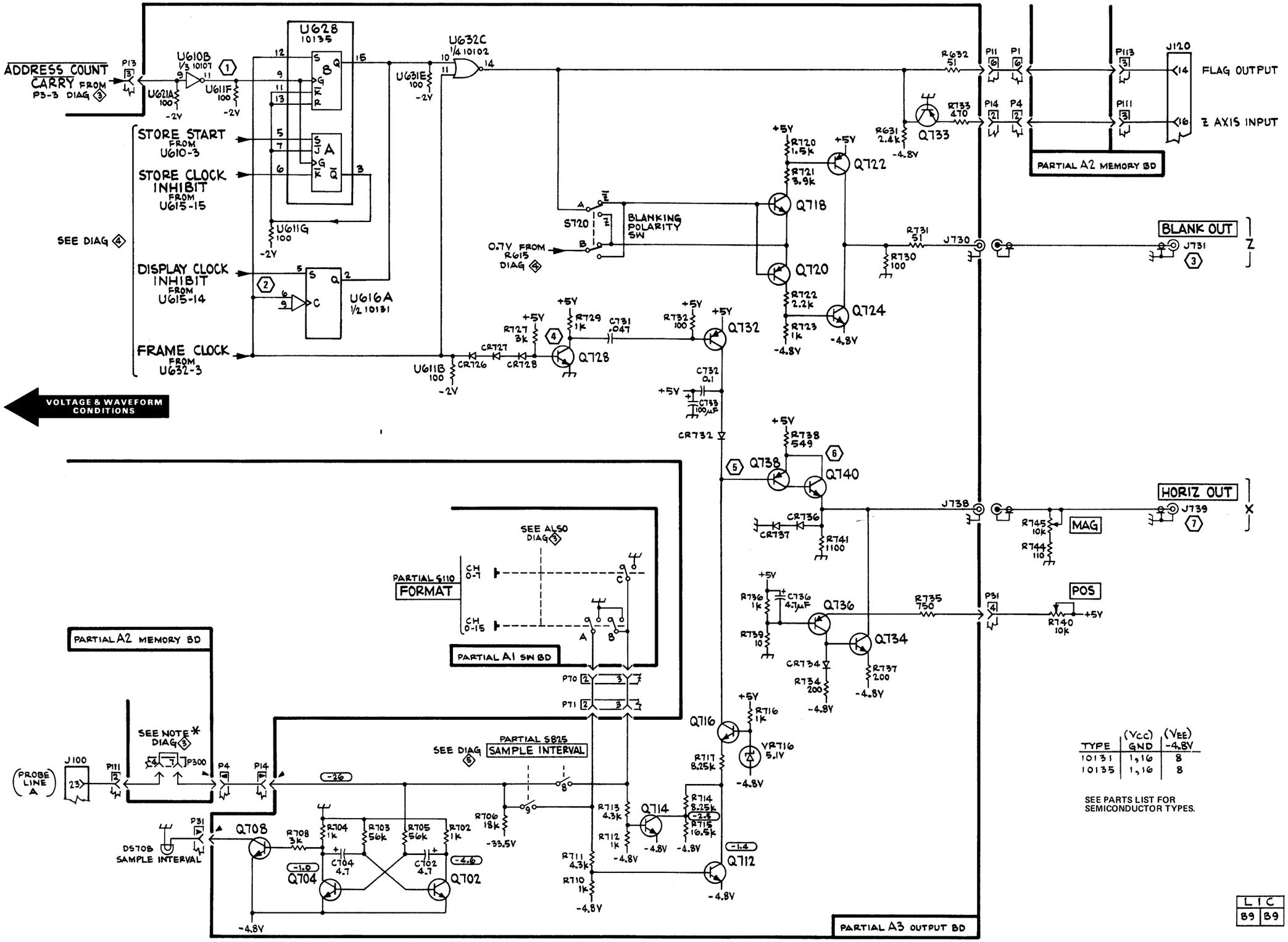
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with 10 MΩ input impedance (Tektronix DM 501 Digital Multimeter or 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 MΩ input impedance and at least 60 MHz bandwidth (Tektronix 465 Oscilloscope equipped with 10X probe, or 7603 Oscilloscope, 7B53A Time Base, and 7A15A Amplifier equipped with 10X probe). A 7A13 Differential Comparator with 10X probe was used to obtain the calibrated offset voltage.

NOTE

Voltages and waveforms are not absolute and may vary between instruments.





VOLTAGE & WAVEFORM CONDITIONS

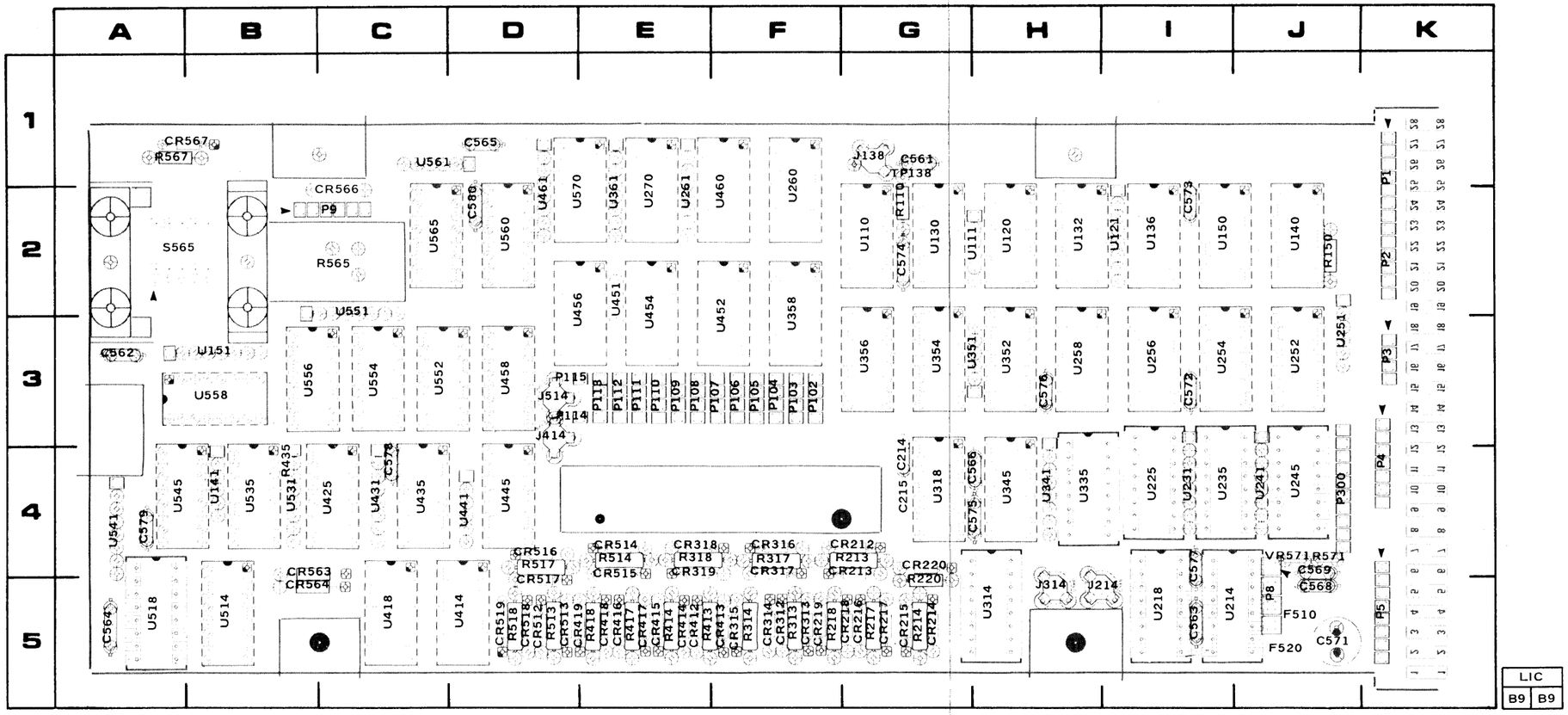
TYPE	(Vcc) GND	(VEE) -4.8V
10131	1,16	8
10135	1,16	8

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

L	I	C
B9	B9	

LA501

HORIZONTAL AND BLANKING SIGNAL OUTPUTS 7



COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED. FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-11 IN THIS SECTION.

1967-89

Fig. 8-20. A2—Memory circuit board. Component locations as viewed with board installed.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C214	4G	CR212	4G	CR414	5E	F520	5J	P106	3F	R313	5F	U120	2H
C215	4G	CR213	4G	CR415	5E			P107	3F	R314	5F	U121	2I
C561	1G	CR214	5G	CR416	5E	J138	1G	P108	3E	R317	4F	U130	
C562	3A	CR215	5G	CR417	5E	J214	5H	P109	3E	R318	4E	U132	2H
C563	5I	CR216	5G	CR418	5E	J314	5H	P110	3E	R413	5E	U136	2I
C564	5A	CR217	5G	CR419	5D	J414	3D	P111	3E	R414	5E	U140	2J
C565	1D	CR218	5G	CR512	5D	J514	3D	P112	3E	R417	5E	U141	4B
C566	4H	CR219		CR513	5D			P113	3E	R418	5E	U150	2I
C568	5J	CR220		CR514	4E	P1	1K	P114	3D	R435	4C	U151	3B
C569	4J	CR312	5F	CR515	4E	P2	2K	P115	3D	R513	5D	U214	5I
C571	5J	CR313	5F	CR516	4D	P3	3K	P300	4J	R514	4E	U218	5I
C572	3I	CR314	5F	CR517	5D	P4	4K			R517	4D	U225	4I
C573	2I	CR315	5F	CR518	5D	P5	5K	R110	2G	R518	5D	U231	4I
C574		CR316	4F	CR519	5D	P8	5J	R150	2J	R565	2C	U235	4I
C575	4H	CR317	4F	CR563	4B	P9	2C	R213	4G	R567	1A	U241	4J
C576	3H	CR318	4E	CR564	5B	P102	3F	R214	5G	R571	4J	U245	4J
C577	4I	CR319	4E	CR566	2C	P103	3F	R217	5G	S565	2A	U251	3J
C578	4C	CR412	5E	CR567	1A	P104	3F	R218	5F			U252	3J
C579	4A	CR413		F510	5J	P105	3F	R220	5G	U110	2G	U254	3I
C580	2D									U111	2H		

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
U256	3I	U425	4C	U554	3C
U258	3H	U431	4C	U556	3B
U260	2F	U435	4C	U558	3B
U261	2E	U441	4D	U560	2D
U270	2E	U445	5D	U561	1C
U314	5H	U451	2E	U565	2C
U318		U452	3F	U570	2E
U335	4H	U454	2E		
U341	4H	U456	2E	VR571	4J
U345	4H	U458	3D		
U351	3H	U460	2F		
U352	3H	U461	2D		
U354		U514	4B		
U356		U518	5A		
U358		U531	4B		
U361	2E	U535	4B		
U411	2H	U541	4A		
U414	5D	U545	4A		
U418	5C	U551	2C		
		U552	3C		

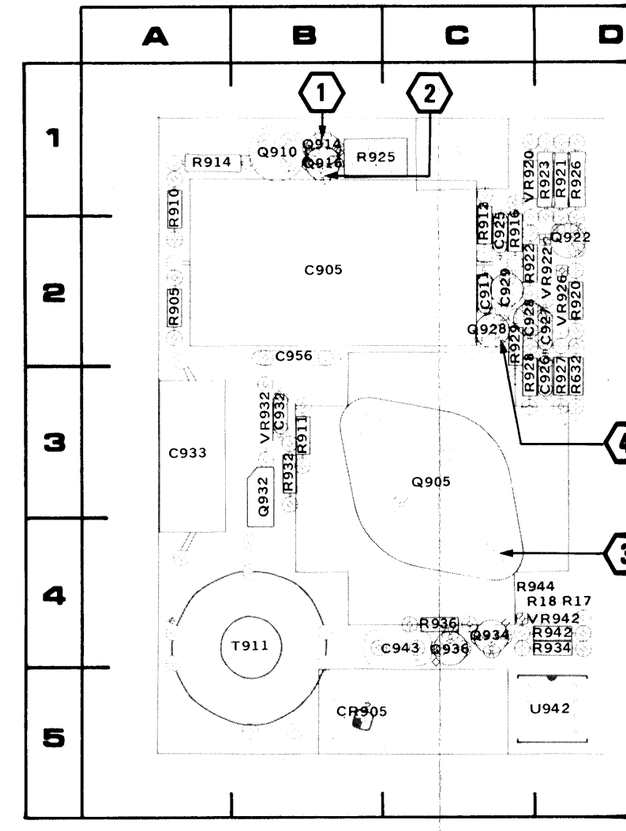
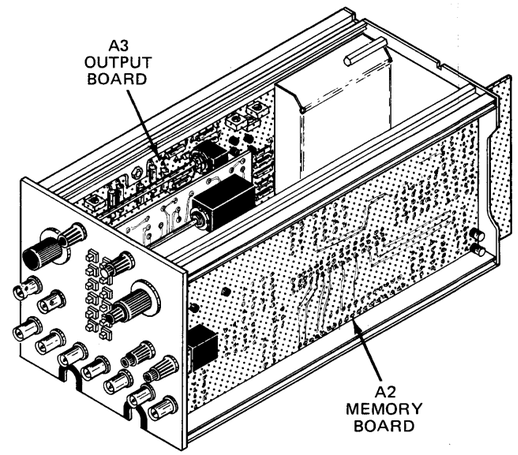
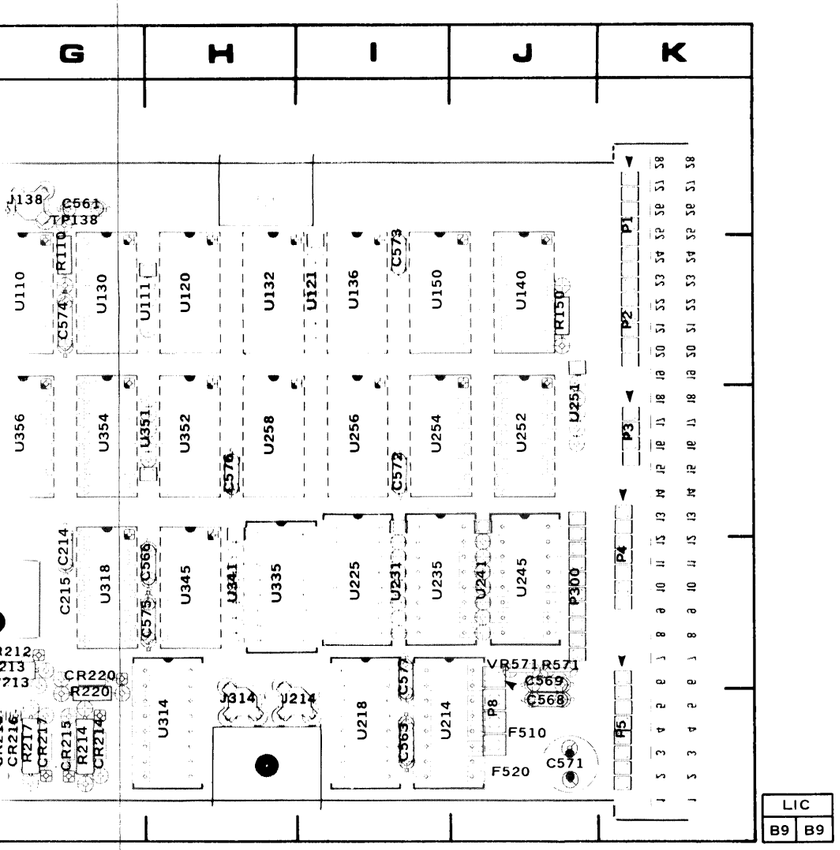


Fig. 8-21. A3—Output circuit board. Component locations as viewed with board





1967-89

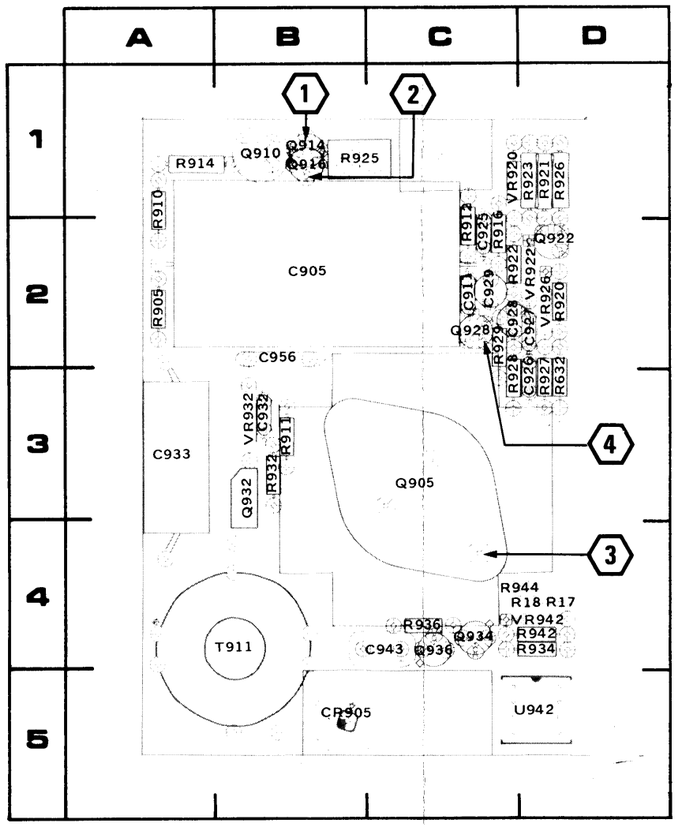


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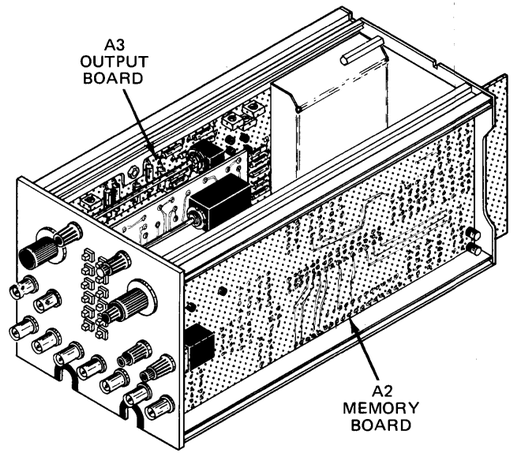
Fig. 8-21. A3—Output circuit board. Component locations as viewed with board installed.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C905	2B	Q932	3B	R928	3C
C911	2C	Q934	4C	R929	2C
C925	2C	Q936	4C	R932	3B
C926	3D			R934	4D
C927	2D	R17	4D	R936	4C
C928	2C	R18	4D	R942	4D
C929	2C	R632	3D	R944	4D
C932	3B	R905	2A		
C933	3A	R910	1A	T911	4B
C943	4C	R911	3B		
C956	2B	R912	2C	U932	3B
		R914	1A	U942	5D
CR905	5B	R916	2C		
		R920	2D	VR920	1C
Q905	3C	R921	1D	VR922	2D
Q910	1B	R922	2C	VR926	2D
Q914	1B	R923	1D	VR942	4D
Q916	1B	R925	1B		
Q922	2D	R926	1D		
Q928	2C	R927	3D		

COMPONENT LOCATIONS AS VIEWED WITH BOARD INSTALLED: FOR VIEW OF COMPONENT SIDE OF BOARD, SEE FIGURE 8-5 IN THIS SECTION. FOR LOCATION OF COMPONENTS MOUNTED ON REAR OF BOARD, SEE FIGURE 8-4.

tions as viewed with board installed.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
U120	2H	U256	3I	U425	4C	U554	3C
U121	2I	U258	3H	U431	4C	U556	3B
U130		U260	2F	U435	4C	U558	3B
U132	2H	U261	2E	U441	4D	U560	2D
U136	2I	U270	2E	U445	5D	U561	1C
U140	2J	U314	5H	U451	2E	U565	2C
U141	4B	U318		U452	3F	U570	2E
U150	2I	U335	4H	U454	2E		
U151	3B	U341	4H	U456	2E	VR571	4J
U214	5I	U345	4H	U458	3D		
U218	5I	U351	3H	U460	2F		
U225	4I	U352	3H	U461	2D		
U231	4I	U354		U514	4B		
U235	4I	U356		U518	5A		
U241	4J	U358		U531	4B		
U245	4J	U361	2E	U535	4B		
U251	3J	U411	2H	U541	4A		
U252	3J	U414	5D	U545	4A		
U254	3I	U418	5C	U551	2C		
				U552	3C		



VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the LA 501 controls set as follows:

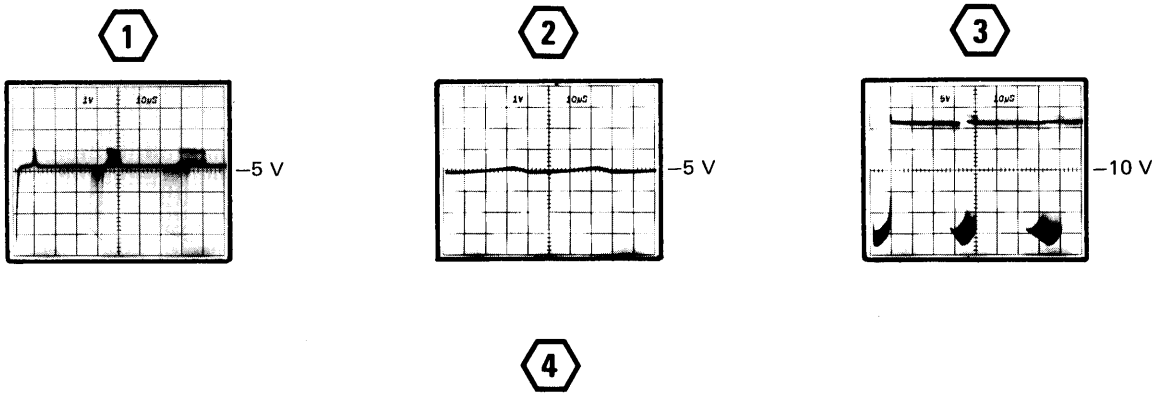
SAMPLE INTERVAL, 50 ns; INPUT THRESHOLD, TTL; FORMAT, CH 0-3 X1024; TRIGGER, CENTER; SLOPE, +; SOURCE, CH 0; INPUTS, BNC; RECORD (DISPLAY TIME), 1 s; CHANNEL/POSITION (SELECT), channel 0; CHANNEL/POSITION (POSITION), fully counterclockwise. A 10X probe was connected from the front panel CH 0 BNC input connector to a +5 volt pulse (5 microsecond duration, 100 microsecond period).

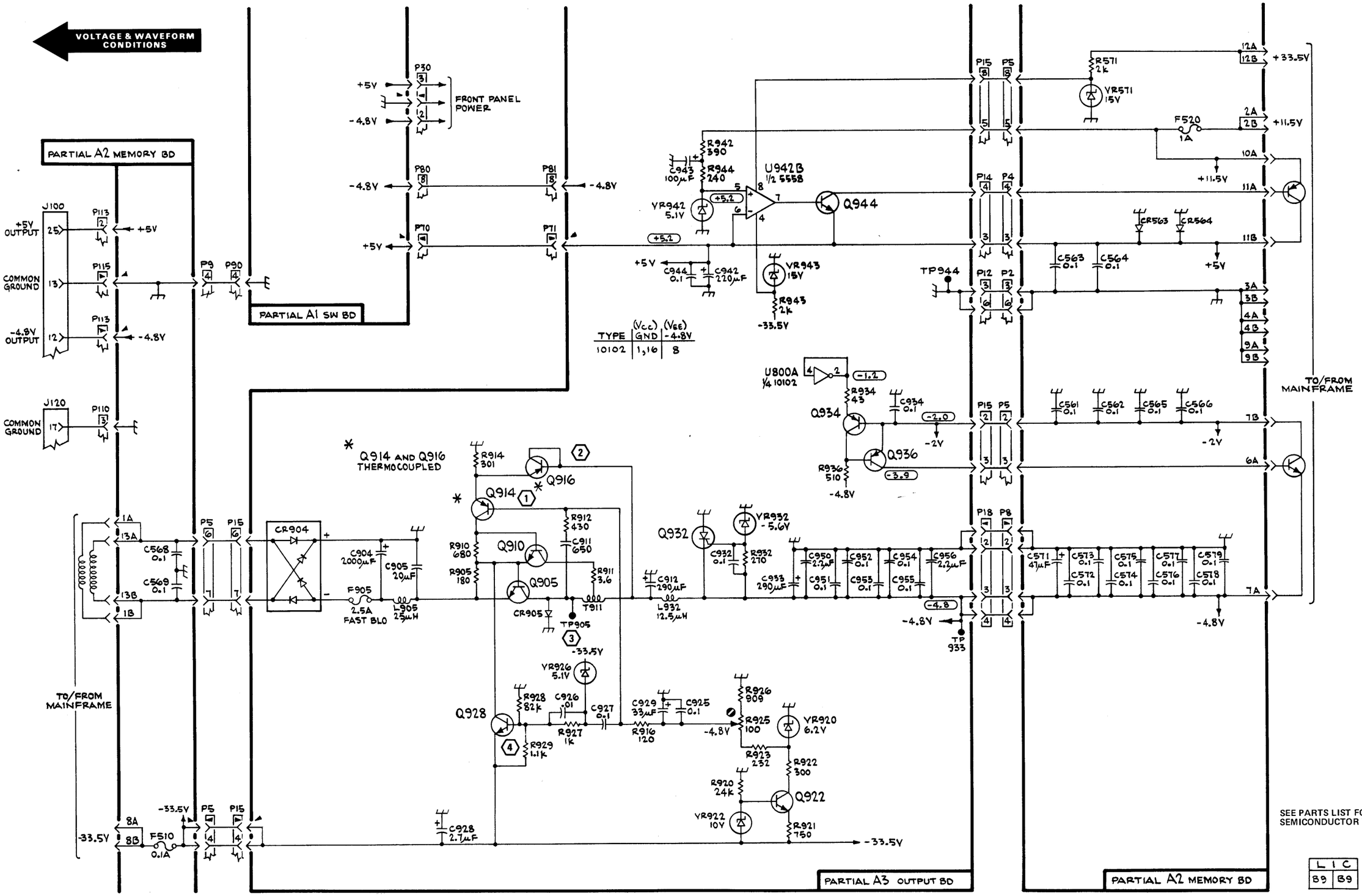
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with 10 MΩ input impedance (Tektronix DM 501 Digital Multimeter or 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

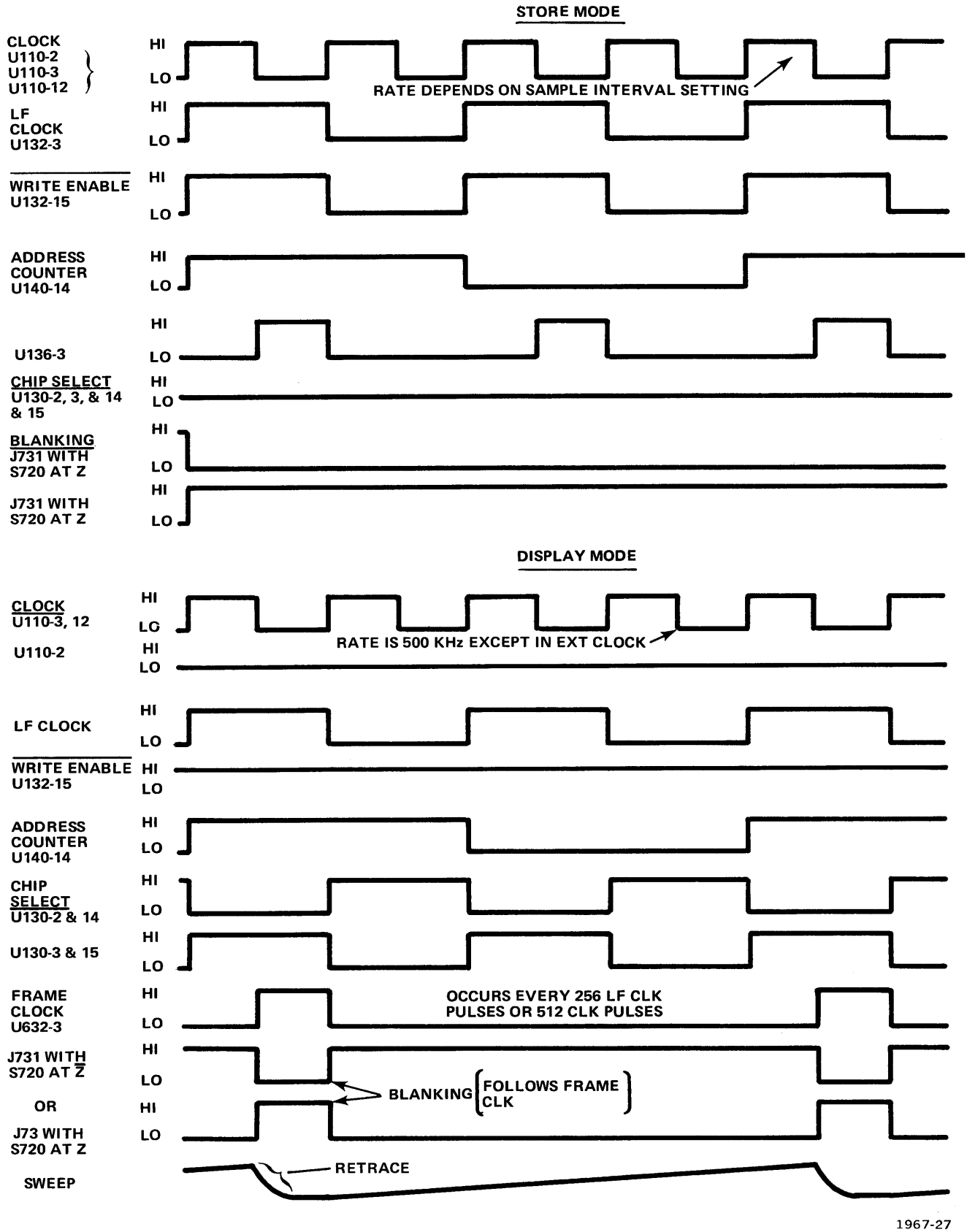
Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 MΩ input impedance and at least 60 MHz bandwidth (Tektronix 465 Oscilloscope equipped with 10X probe, or 7603 Oscilloscope, 7B53A Time Base, and 7A15A Amplifier equipped with 10X probe). A 7A13 Differential Comparator with 10X probe was used to obtain the calibrated offset voltage.

NOTE

Voltages and waveforms are not absolute and may vary between instruments.




VOLTAGE & WAVEFORM CONDITIONS
PARTIAL A2 MEMORY BD
PARTIAL A1 SW BD
PARTIAL A3 OUTPUT BD
PARTIAL A2 MEMORY BD
FRONT PANEL POWER
+5V
-4.8V
J100
P113
P115
P110
J120
COMMON GROUND
+5V OUTPUT
-4.8V OUTPUT
P9
P90
P30
P80
P81
P70
P71
TYPE (Vcc) GND (VEE) -4.8V
10102 1,16 8
R942 390
R944 240
C943 100µF
U942B 1/2 5558
VR942 5.1V
Q944
C944 0.1
C942 220µF
VR943 15V
R943 2k
-33.5V
TP944
R571 2k
VR571 15V
F520 1A
+33.5V
+11.5V
CR563
CR564
C563 0.1
C564 0.1
+5V
U800A 1/4 10102
R934 43
Q934
C934 0.1
-2.0
-2V
Q936
R936 510
-4.8V
C561 0.1
C562 0.1
C565 0.1
C566 0.1
TO/FROM MAINFRAME
Q914 AND Q916 THERMOCOUPLED
R914 301
Q916
Q914
R912 430
C911 650
R910 680
Q910
R905 180
Q905
R911 3.6
T911
CR905
TP905
-33.5V
C912 290µF
L932 12.5µH
Q932
YR932 - 5.6V
C932 0.1
R932 270
C933 290µF
C950 2.2µF
C952 0.1
C954 0.1
C956 2.2µF
C951 0.1
C953 0.1
C955 0.1
-4.8
TP 933
C571 47µF
C573 0.1
C575 0.1
C577 0.1
C579 0.1
C572 0.1
C574 0.1
C576 0.1
C578 0.1
CR904
C904 2000µF
C905 20µF
F905 2.5A FAST BLO
L905 25µH
C568 0.1
C569 0.1
YR926 5.1V
R928 82k
C926 .01
C927 0.1
R927 1k
R929 1.1k
Q928
C929 33µF
C925 0.1
R916 120
R926 909
R925 100
YR920 6.2V
R923 232
R922 300
R920 24k
Q922
YR922 10V
R921 750
C928 2.7µF
F510 0.1A
-33.5V
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
L I C
B9 B9



1967-27

Fig. 8-22. Composite logic timing for CH 0-7 X512 format.

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WIRING INTERCONNECTIONS

LA501

CH 0 · CH 1 · CH 2 · CH 3 · MONITOR (INPUT THRESHOLD) · EXT TRIG · VERT OUT · HORIZ OUT · BLANK OUT · EXT CLOCK · MONITOR

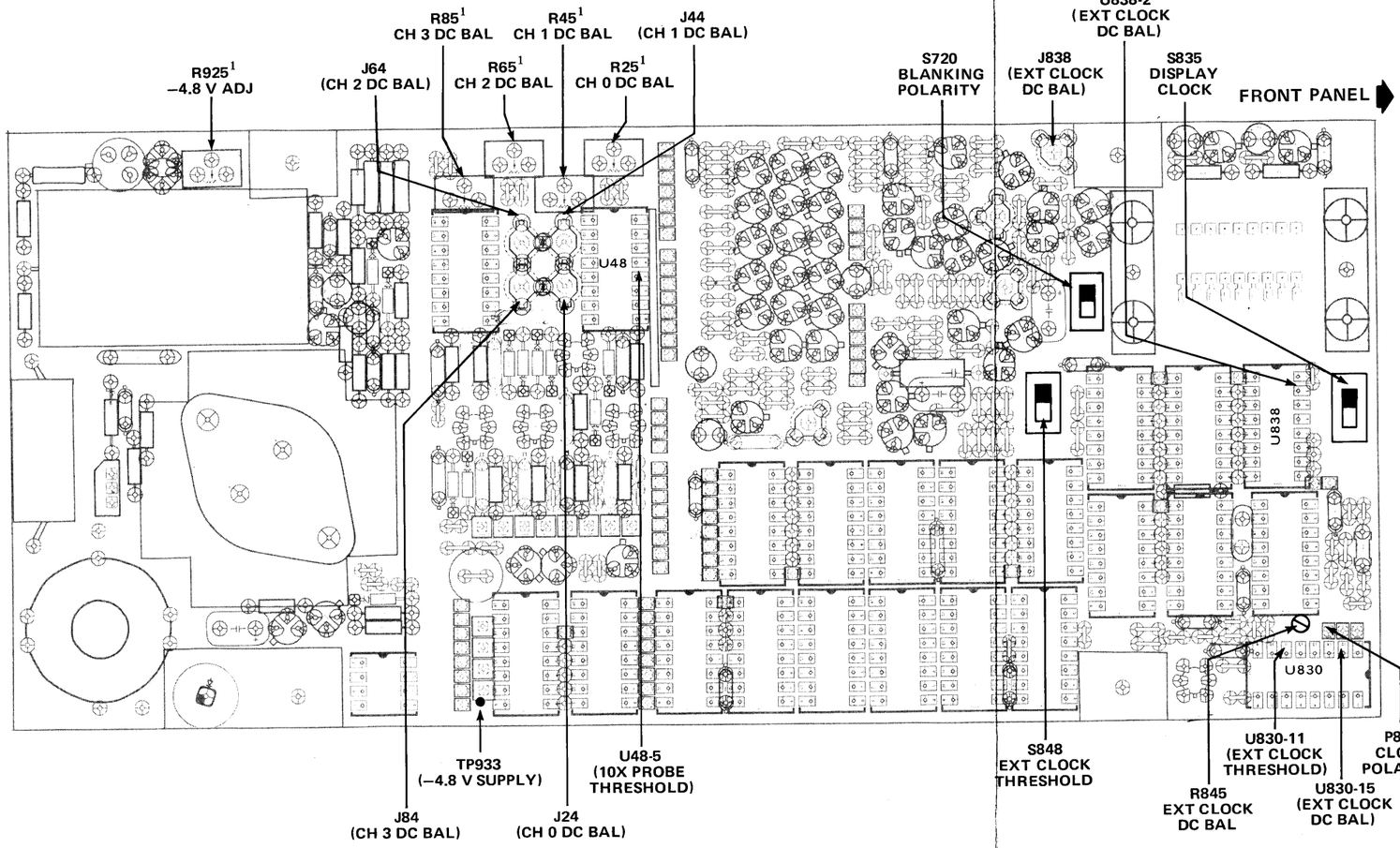
FRONT PANEL POWER

TO/FROM MAINFRAME

A1 SWITCH BD · A2 MEMORY BD · A3 OUTPUT BD

SIGNAL SELECTOR

J100 · J120



[1] Accessible from top of instrument on opposite side of board.

Fig. 8-23. Test point and adjustment locations (Output board).

1967-91

NOTE

The test point and adjustment locations are viewed from the back of an installed circuit board.

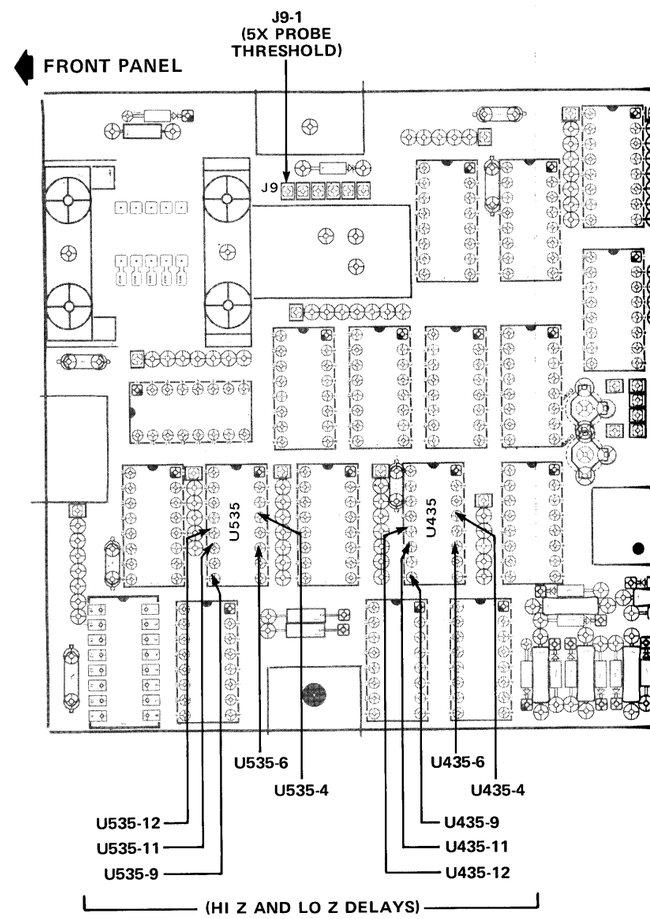
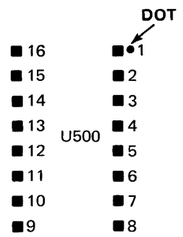
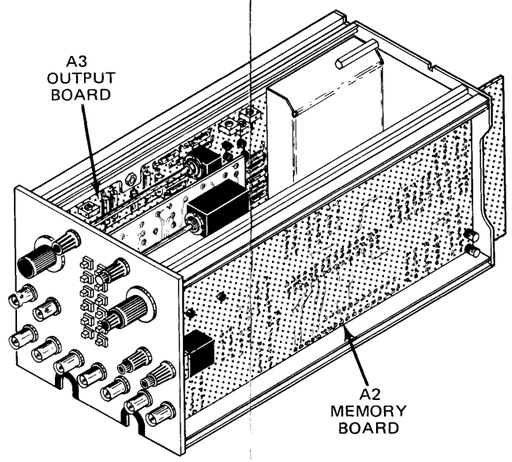
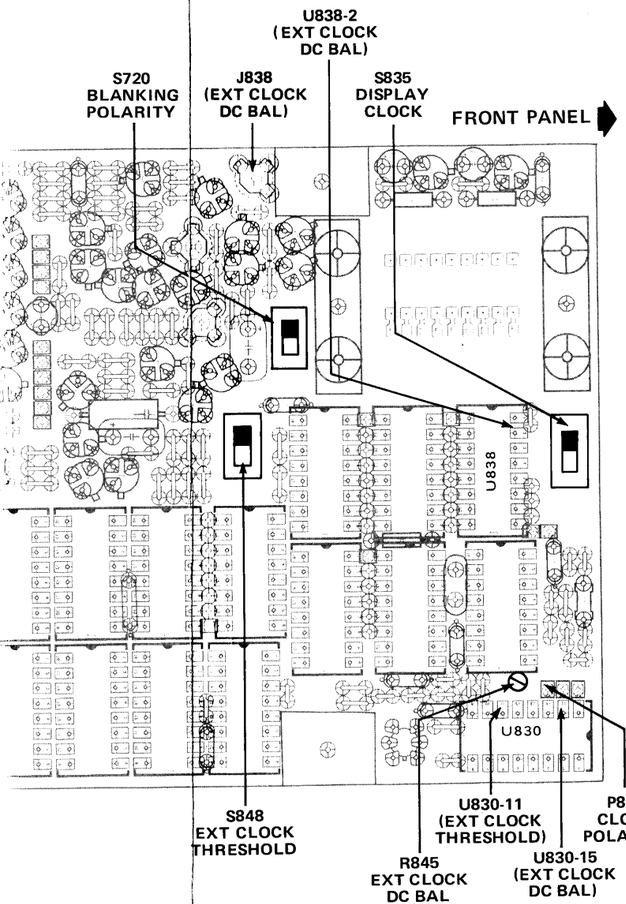


Fig. 8-24. Te



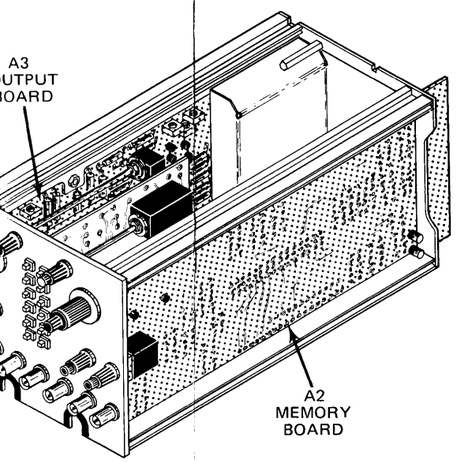
Typical integrated circuit pin numbering sequence as viewed from back of boards. Pin 1 is coded with an adjacent dot.





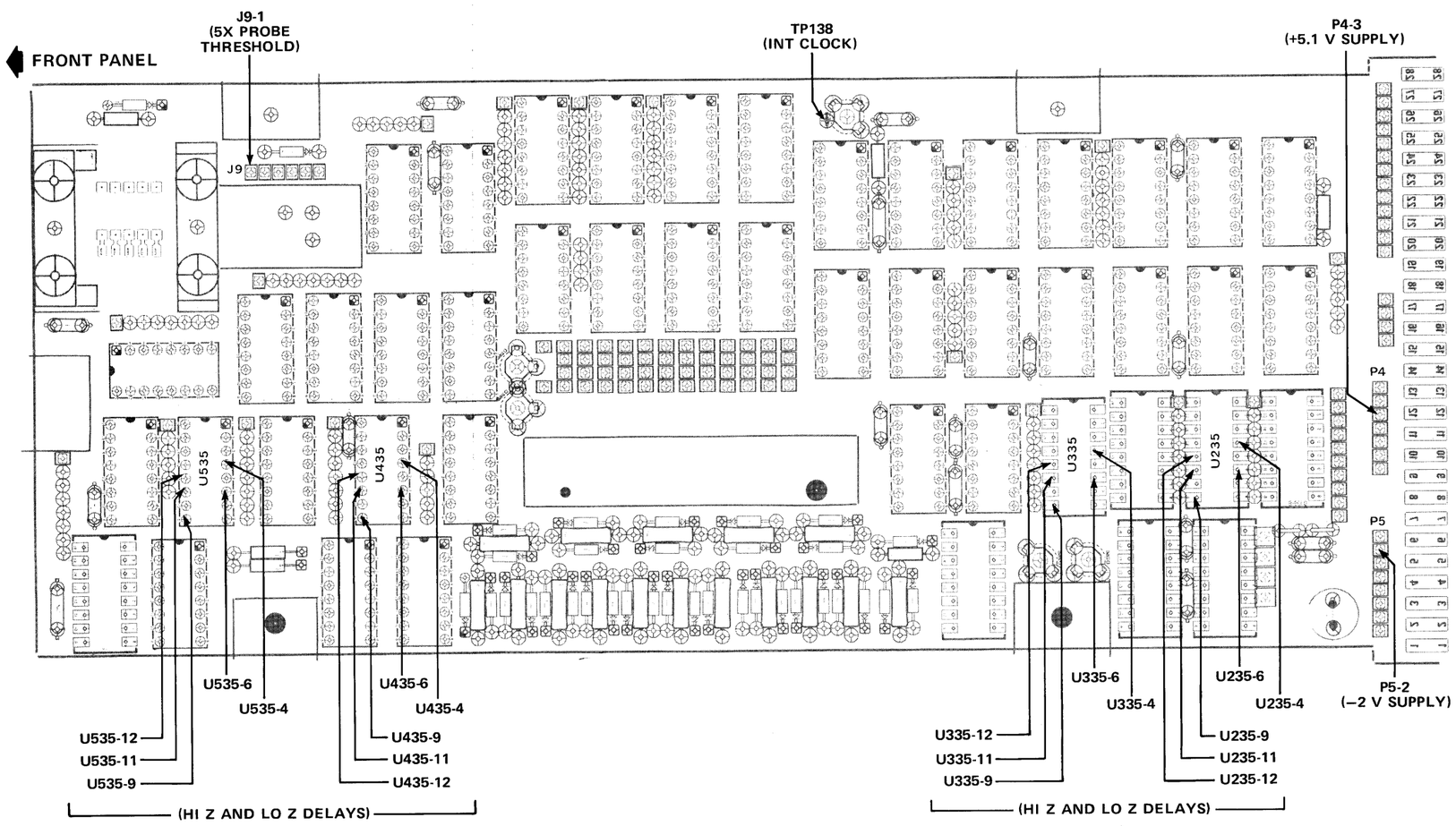
1967-91

(Output board).



NOTE

The test point and adjustment locations are viewed from the back of an installed circuit board.



1967-92

Fig. 8-24. Test point and adjustment locations (Memory board).

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
0000C	GETTIG ENGINEERING AND MANUFACTURING CO.		SPRINGMILL, PA 16875
00779	AMP, INC.	P. O. BOX 3608	HARRISBURG, PA 17105
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P. O. BOX 5012	DALLAS, TX 75222
06982	MOORE, HOWARD J., CO.	105 E. 16TH ST.	NEW YORK, NY 10003
07707	USM CORP., USM FASTENER DIV.	510 RIVER RD.	SHELTON, CT 06484
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
12327	FREEWAY CORP.	9301 ALLEN DR.	CLEVELAND, OH 44125
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
23499	GAVITT WIRE AND CABLE, DIVISION OF RSC INDUSTRIES, INC.	455 N. QUINCE ST.	ESCONDIDO, CA 92025
24931	SPECIALTY CONNECTOR CO., INC.	3560 MADISON AVE.	INDIANAPOLIS, IN 46227
71159	BRISTOL SOCKET SCREW, DIV. OF AMERICAN CHAIN AND CABLE CO., INC.	40 BRISTOL ST.	WATERBURY, CT 06720
71279	CAMBRIDGE THERMIONIC CORP.	445 CONCORD AVE.	CAMBRIDGE, MA 02138
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
74445	HOLO-KROME CO.	31 BROOK ST. WEST	HARTFORD, CT 06110
77969	RUBBERCRAFT CORP. OF CALIF., LTD.	1800 W. 220TH ST.	TORRANCE, CA 90507
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P. O. BOX 500	BEAVERTON, OR 97077
82647	TEXAS INSTRUMENTS, INC., CONTROL PRODUCTS DIV.	34 FOREST ST.	ATTLEBORO, MA 02703
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
86445	PENN FIBRE AND SPECIALTY CO., INC.	2032 E. WESTMORELAND ST.	PHILADELPHIA, PA 19134
87308	N. L. INDUSTRIES, INC., SOUTHERN SCREW DIV.	P. O. BOX 1360	STATESVILLE, NC 28677
89663	REESE, J. RAMSEY, INC.	71 MURRAY ST.	NEW YORK, NY 10007
97464	INDUSTRIAL RETAINING RING CO.	57 CORDIER ST.	IRVINGTON, NJ 07111
98159	RUBBER TECK, INC.	19115 HAMILTON AVE.	GARDENA, CA 90247

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	337-1399-04			2		SHIELD,ELEC:SIDE	80009	337-1399-04
-2	200-1931-00			2		COVER,SCOPE:TOP AND BOTTOM	80009	200-1931-00
						(ATTACHING PARTS FOR EACH)		
-3	211-0038-00			2		SCREW,MACHINE:4-40 X 0.312"100 DEG,FLH STL	83385	OBD
						- - - * - - -		
-4	366-1023-00			1		KNOB:GRAY	80009	366-1023-00
	213-0246-00			1		. SETSCREW:5-40 X 0.093 INCH L,HEX SOC	71159	OBD
-5	366-1630-00			1		KNOB:GRAY,0.252 ID,1.125 OD,0.79 H	80009	366-1630-00
	213-0153-00			2		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-6	366-1631-00			1		KNOB:GRAY,0.252 ID,1.25 OD,0.79 H	80009	366-1631-00
	213-0153-00			2		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-7	366-0494-00			1		KNOB:GRAY	80009	366-0494-00
	213-0153-00			1		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-8	366-1059-00			1		PUSH BUTTON:GRAY	80009	366-1059-00
-9	366-1319-00			2		KNOB:GRAY	80009	366-1319-00
	----- -----			-		. EACH KNOB INCLUDES:		
	213-0725-00			1		. SETSCREW:3-48 X 0.095 INCH,HEX SOC STL	74445	OBD
-10	366-1334-00			3		KNOB:GRAY	80009	366-1344-00
	----- -----			-		. EACH KNOB INCLUDES:		
	213-0153-00			1		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-11	366-1520-01	B010100	B010424	1		KNOB:LATCH	80009	366-1520-01
	366-1520-02	B010425		1		KNOB:LATCH	80009	366-1520-02
						(ATTACHING PARTS)		
-12	214-1840-00			1		PIN,KNOB SECRG:0.094 OD X 0.120 INCH LONG	80009	214-1840-00
						- - - * - - -		
-13	366-1559-00			12		PUSH BUTTON:GRAY	80009	366-1559-00
-14	131-0955-00			9		CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
-15	210-0255-00			4		TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
-16	179-2200-00			1		WIRING HARNESS,:CHASSIS	80009	179-2200-00
-17	131-0622-00			4		. CONTACT,ELEC:0.577"L,28-32 AWG WIRE	22526	46241
-18	131-0792-00			4		. CONTACT,ELEC:0.577"L,18-20 AWG WIRE	22526	46221
	131-0707-00			40		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-19	210-0255-00			4		. TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
-20	210-0774-00			3		. EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
-21	210-0775-00			3		. EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00
-22	352-0204-00			1		. CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0204-00
	352-0166-07			2		. CONN BODY,PL,EL:8 WIRE VIOLET	80009	352-0166-07
	352-0166-08			2		. CONN BODY,PL,EL:8 WIRE GRAY	80009	352-0166-08
-23	352-0161-03			1		. CONN BODY,PL,EL:3 WIRE ORANGE	80009	352-0161-03
	352-0162-00			1		. CONN BODY,PL,EL:4 WIRE BLACK	80009	352-0162-00
-24	358-0342-00			1		BSHG,MACH.THD:0.25 X 32 X 0.352 INCH LONG	80009	358-0342-00
						(ATTACHING PARTS)		
-25	210-0583-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
						- - - * - - -		
-26	210-0223-00			1		TERMINAL,LUG:0.25 INCH DIA,SE	78189	2101-14-03-2520N
-27	348-0031-00			1		GROMMET,PLASTIC:0.156 INCH DIA	80009	348-0031-00
-28	----- -----			1		RESISTOR,VAR:(SEE R740,R745 EPL)		
						(ATTACHING PARTS)		
-29	210-0583-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-30	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
						- - - * - - -		
-31	----- -----			1		RESISTOR,VAR:(SEE R690,R695 EPL)		
						(ATTACHING PARTS)		
-32	210-0583-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-33	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
						- - - * - - -		
-34	358-0363-00			2		BUSHING,SLEEVE:CAM SWITCH MTG	80009	358-0363-00
						(ATTACHING PARTS FOR EACH)		
-35	220-0495-00			1		NUT,PLAIN,HEX.:0.375-32 X 0.438 INCH BRS	73743	OBD
-36	210-0840-00			1		WASHER,FLAT:0.39 ID X 0.562 INCH OD,STL	89663	644R
						- - - * - - -		
-37	344-0195-01			2		CLIP,ELECTRICAL:CAM SHAFT	80009	344-0195-01
-38	426-1072-00			12		FRAME,PUSH BTN:PLASTIC	80009	426-1072-00

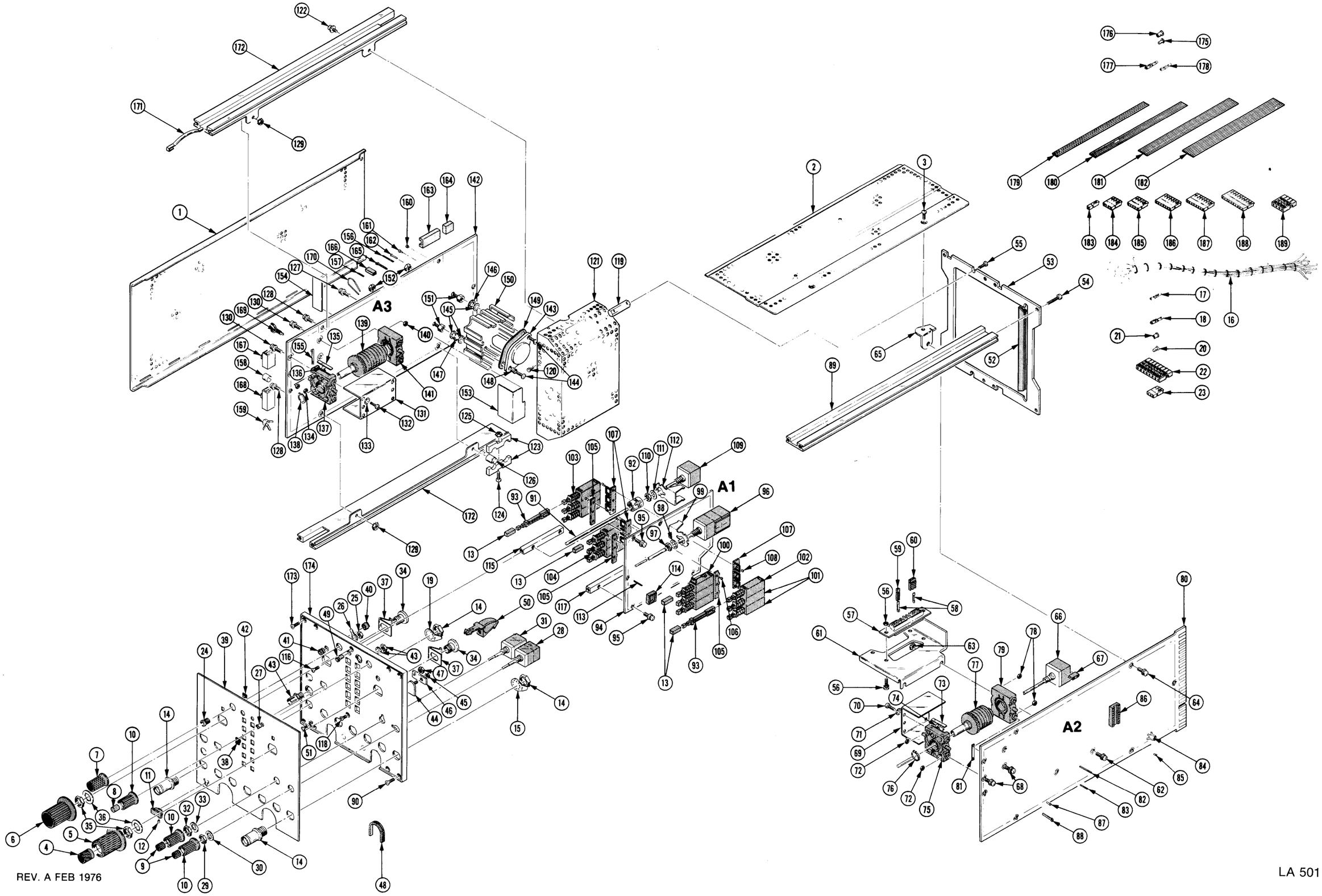
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-39	333-2037-00	B010100	B020486	1		PANEL,FRONT:	80009	333-2037-00
	333-2037-01	B020487		1		PANEL,FRONT:	80009	333-2037-01
-40	200-0935-00			2		BASE,LAMPHOLDER:0.29 OD X 0.19 CASE	80009	200-0935-00
-41	352-0360-00			2		HOLDER,LED:0.086 ID X 0.20 I OD,PLSTC	80009	352-0360-00
-42	378-0635-00			2		LENS,LIGHT:WHITE	80009	378-0635-00
-43	----- -----			1		CONNECTOR,RCPT:(SEE J138 EPL)		
-44	200-1929-00			2		CABLE,R AND L:	80009	200-1929-00
						(ATTACHING PARTS FOR EACH)		
-45	210-0586-00			1		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-46	386-3493-00			2		PLATE,SECURING:	80009	386-3493-00
						(ATTACHING PARTS FOR EACH)		
-47	210-0586-00			1		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-48	348-0145-00	B010100	B010249	2		GROMMET,PLASTIC:U-SHP,1.0 X 0.42 INCH	80009	348-0145-00
	348-0145-01	B010250		1		GROMMET,PLASTIC:	80009	348-0145-01
-49	131-0809-00			1		TERMINAL,STUD:PNL MT,4-40 TAP 1 END	71279	1510-1-05.19
-50	214-1513-01			1		LCH,PLUG-IN RET:	80009	214-1513-01
						(ATTACHING PARTS)		
-51	213-0113-00			1		SCR,TPG,THD FOR:2-32 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
-52	252-0571-00			FT		RUB.SPL SHAPED:CHANNEL,0.334 INCH LONG	77969	1353
-53	386-2464-00	B010100	B020486	1		PANEL,REAR:	80009	386-2464-00
	386-3620-00	B020487		1		PANEL,REAR:	80009	386-3620-00
						(ATTACHING PARTS)		
-54	213-0192-00			4		SCR,TPG,THD FOR:6-32 X 0.50 INCH,PNH STL	87308	OBD
-55	211-0507-00			2		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
	337-2315-00	B010100	B010249	1		SHIELD,ELEC:CONNECTORS	80009	337-2315-00
	337-2315-01	B010250		1		SHIELD,ELEC:CONNECTORS	80009	337-2315-01
						(ATTACHING PARTS)		
	211-0008-00			2		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
	220-0449-00			2		NUT,SLEEVE:4-40 X 0.188 X 0.50" LONG	80009	220-0449-00
						- - - * - - -		
	175-1823-00			1		CA ASSY,SP ELEC:50,26 AWG,2.625 L	80009	175-1823-00
						(ATTACHING PARTS)		
-56	131-0976-00	B010100	B010249	4		POST,SIDE LOCK:	80009	131-0976-00
	131-0976-00	B010250		2		POST,SIDE LOCK:	80009	131-0976-00
						- - - * - - -		
	----- -----			-		. CABLE ASSY INCLUDES:		
-57	----- -----	B010100	B010249	2		. CONN,RCPT,ELEC:(SEE J100 EPL)		
	----- -----	B010250		1		. CONN,RCPT,ELEC:(SEE J100 EPL)		
-58	131-0707-00	B010100	B010249	50		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	131-0707-00	B010250		25		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-59	352-0171-09	B010100	B010249	2		. CONN BODY,PL,EL:1 WIRE WHITE	80009	352-0171-09
	352-0171-09	B010250		1		. CONN BODY,PL,EL:1 WIRE WHITE	80009	352-0171-09
-60	352-0162-09	B010100	B010249	24		. CONN BODY,PL,EL:4 WIRE WHITE	80009	352-0162-09
	352-0169-09	B010250		12		. CONN BODY,PL,EL:2 WIRE WHITE	80009	352-0169-09
	175-1892-00	XB010250		1		CA ASSY,SP ELEC:50,26 AWG,2.625 L	80009	175-1892-00
						(ATTACHING PARTS)		
	131-0976-00			2		POST,SIDE LOCK:	80009	131-0976-00
						- - - * - - -		
	----- -----			-		. CABLE ASSY INCLUDES:		
	----- -----			1		. CANN,RCPT,ELEC:(SEE J120 EPL)		
	131-0707-00			25		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	352-0171-02			1		. CONN BODY,PL,EL:1 WIRE RED	80009	352-0171-02
	352-0169-02			12		. CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
-61	407-1733-00			1		BRACKET,CONN:	80009	407-1733-00
						(ATTACHING PARTS)		
-62	211-0097-00			2		SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
-63	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
	211-0012-00			1		SCREW,MACHINE:4-40 X 0.375 INCH,PNH STL	83385	OBD
						- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-	672-0528-00			1	CKT BOARD ASSSY:MEMORY W/CAM SWITCH	80009	672-0528-00
					(ATTACHING PARTS)		
-64	211-0097-00			4	SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
-65	407-1773-00			4	BRACKET,COVER:	80009	407-1773-00
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-66	----- -----			1	. RESISTOR,VAR:(SEE R563 EPL)		
-67	361-0515-00			1	. SPACER,SWITCH:PLASTIC	80009	361-0515-00
	----- -----			-	. ACTR CAM ASSY:(SEE S565 EPL)		
					(ATTACHING PARTS)		
-68	211-0207-00	B010100	B010544	4	. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	83385	OBD
	211-0244-00	B010545		4	. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH SST	78189	OBD
					- - - * - - -		
	----- -----			-	. . ACTR ASSY INCLUDES:		
-69	200-1858-00			1	. . COVER,CAM SW:1.4 L,ALUMINUM	80009	200-1858-00
					(ATTACHING PARTS)		
-70	211-0008-00			4	. . SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-71	210-0004-00			4	. . WASHER,LOCK:INTL,0.12 ID X 0.26"OD,STL	78189	1204-00-00-0541C
					- - - * - - -		
-72	210-0406-00			4	. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-73	214-1139-00			1	. . SPRING,FLAT:GOLD COLORED	80009	214-1139-00
	214-1139-02			1	. . SPRING,FLAT:GREEN COLORED	80009	214-1139-02
-74	214-1127-00			2	. . ROLLER,DETENT:0.125 DIA X 0.125 INCH L	80009	214-1127-00
-75	401-0081-00			1	. . BEARING,CAM SW:FRONT	80009	401-0081-00
					(ATTACHING PARTS)		
-76	354-0391-00			1	. . RING,RETAINING:0.395"FREE ID X 0.025" STL	97464	3100-43-CD
					- - - * - - -		
-77	105-0692-00			1	. . ACTUATOR,CAM SW:SELECTOR	80009	105-0692-00
-78	210-0406-00			4	. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-79	401-0115-00			1	. . BEARING,CAM SW:CENTER	80009	401-0115-00
-80	----- -----			1	. CKT BOARD ASSY:MEMORY(SEE A2 EPL)		
	----- -----			-	. . CKT BOARD ASSY INCLUDES:		
-81	131-0604-00			5	. . CONTACT,ELEC:0.025 SQ X 0.365 INCH LONG	80009	131-0604-00
-82	131-0589-00			4	. . CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0993-00	XB010250		4	. . LINK,TERM.CONNE:2 WIRE BLACK	00779	530153-2
-83	131-0608-00	B010100	B010249	102	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
	131-0608-00	B010250		127	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
-84	131-1003-00			5	. . CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-85	136-0252-04	B010100	B010249	5	. . CONTACT,ELEC:0.188 INCH LONG	22526	75060
	136-0252-04	B010250		8	. . CONTACT,ELEC:0.188 INCH LONG	22526	75060
-86	136-0260-02			47	. . SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-87	136-0352-00			4	. . CONTACT,ELEC:FOR 0.02 INCH DIAMETER PIN	00779	50872-2
-88	214-0579-00			1	. . TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
	131-0566-00			1	. . LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000C	L-2007-1
-89	426-1246-00			2	FR SECT,PLUG-IN:RIGHT SIDE,TOP AND BOTTOM	80009	426-1246-00
					(ATTACHING PARTS FOR EACH)		
-90	213-0229-00			2	SCR,TPG,THD FOR:6-20 X0.375"100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-91	384-1394-00			1	EXTENSION SHAFT:3.4 L X 0.125 DIA,AL,CRM	80009	384-1394-00
-92	376-0051-00	B010100	B010124	1	CPLG,SHAFT,FLEX:FOR 0.125 INCH DIA SHAFTS	80009	376-0051-00
	213-0022-00	B010100	B010124	4	. SETSCREW:4-40 X 0.188 INCH,HEX SOC STL	74445	OBD
	376-0051-01	B010125		1	CPLG,SHAFT,FLEX:FOR 0.125 INCH DIA SHAFTS	80009	376-0051-01
	213-0048-00	B010125		4	. SETSCREW:4-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-93	384-1099-00			6	EXTENSION SHAFT:PUSH BUTTON,1.54 INCH LONG	80009	384-1099-00
-94	----- -----			1	CKT BOARD ASSY:(SEE A1 EPL)		
					(ATTACHING PARTS)		
-95	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
					- - - * - - -		
-96	----- -----			-	. RESISTOR VAR:(SEE R605 EPL)		
					(ATTACHING PARTS)		
-97	210-0583-00			1	. NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-98	210-0940-00			1	. WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
					- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-99	407-1707-00			1		. BRACKET,VAR RES:	80009	407-1707-00
-100	----- -----			1		. ACTR ASSY,PB:(SEE S625 EPL)		
-101	----- -----			2		. ACTR ASSY,PB:(SEE S15,S608 EPL)		
-102	----- -----			1		. ACTR ASSY,PB:(SEE S610 EPL)		
-103	----- -----			1		. ACTR ASSY,PB:(SEE S10 EPL)		
-104	----- -----			1		. ACTR ASSY:(SEE S110 EPL)		
-105	343-0497-03			4		. CUP,SWITCH:REAR,10 MM X 3 UNIT	80009	343-0497-03
						(ATTACHING PARTS FOR EACH)		
-106	210-3050-00			3		. EYELET,METALLIC:0.218 L X 0.059 OD,BRS	07707	SE-27
						- - - * - - -		
-107	343-0496-03			2		. CLIP,SWITCH:FRONT,10 MM X 3 UNIT	80009	343-0496-03
						(ATTACHING PARTS FOR EACH)		
-108	210-3050-00			3		. EYELET,METALLIC:0.218 L X 0.059 OD,BRS	07707	SE-27
						- - - * - - -		
-109	----- -----			1		. RESISTOR,VAR:(SEE R10 EPL)		
						(ATTACHING PARTS)		
-110	210-0583-00			1		. NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-111	210-0940-00			1		. WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
						- - - * - - -		
-112	407-1707-00			1		. BRACKET,VAR RES:	80009	407-1707-00
-113	131-0608-00	B010100	B010249	34		. CONTACT,ELEC:0.365 INCH LONG	22526	47357
	131-0608-00	B010250		38		. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-114	136-0514-00			2		. SOCKET,PLUG-IN:MICROCIRCUIT,8 CONTACT	82647	C930802
-115	386-3376-00			1		SUPPORT,CKT BD:	80009	386-3376-00
						(ATTACHING PARTS)		
-116	211-0038-00			1		SCREW,MACHINE:4-40 X 0.312"100 DEG,FLH STL	83385	OBD
						- - - * - - -		
-117	386-3410-00			1		SUPPORT,CKT BD:	80009	386-3410-00
						(ATTACHING PARTS)		
-118	211-0038-00			1		SCREW,MACHINE:4-40 X 0.312"100 DEG,FLH STL	83385	OBD
						- - - * - - -		
-119	129-0589-00			2		SPACER,POST:0.25 HEX X 0.95 L	80009	129-0589-00
						(ATTACHING PARTS FOR EACH)		
-120	211-0008-00			2		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-121	337-2261-00			1		SHIELD,ELEC:POWER SUPPLY	80009	337-2261-00
						(ATTACHING PARTS)		
-122	211-0097-00			1		SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
-123	214-2322-00			2		HEAT SINK,DIODE:	80009	214-2322-00
						(ATTACHING PARTS)		
-124	211-0016-00			1		SCREW,MACHINE:4-40 X 0.625 INCH,PNH STL	83385	OBD
-125	210-0586-00			1		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-126	129-0429-00			1		POST,ELEC-MECH:0.25 OD X 0.31 " LONG	80009	129-0429-00
						(ATTACHING PARTS)		
-127	211-0207-00			1		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
	672-0529-00			1		CKT BOARD ASSY:OUTPUT W/CAM SWITCH	80009	672-0529-00
						(ATTACHING PARTS)		
-128	211-0207-00			2		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	83385	OBD
-129	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
	----- -----			1		. ACTR ASSY,CAM S:(SEE S825 EPL)		
						(ATTACHING PARTS)		
-130	211-0207-00	B010100	B010544	4		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	83385	OBD
	211-0244-00	B010545		4		. SCR ASSEM WSHR:4-40 X 0.312 INCH,PNH SST	78189	OBD
						- - - * - - -		
	----- -----			-		. . ACTR. ASSY INCLUDES:		
-131	200-1859-00			1		. . COVER,CAM SW:1.8 L,ALUMINUM	80009	200-1859-00
						(ATTACHING PARTS)		
-132	211-0008-00			4		. . SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-133	210-0004-00			4		. . WASHER,LOCK:INTL,0.12 ID X 0.26"OD,STL	78189	1204-00-00-0541C
						- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-	131-0963-00	XB010405		1	. . CONTACT,ELEC:GROUNDING	80009	131-0963-00
-134	210-0406-00			4	. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-135	214-1139-02			2	. . SPRING,FLAT:GREEN COLORED	80009	214-1139-02
-136	214-1127-00			2	. . ROLLER,DETENT:0.125 DIA X 0.125 INCH L	80009	214-1127-00
-137	401-0081-02			1	. . BEARING,CAM SW:FRONT	80009	401-0081-02
					(ATTACHING PARTS)		
-138	354-0391-00			1	. . RING,RETAINING:0.395"FREE ID X 0.025" STL	97464	3100-43-CD
					- - - * - - -		
-139	105-0693-00			1	. . ACTUATOR,CAM SW:TIME BASE	80009	105-0693-00
-140	210-0406-00			4	. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-141	401-0115-00			1	. . BEARING,CAM SW:CENTER	80009	401-0115-00
-142	----- -----			1	. CKT BOARD ASSY:OUTPUT(SEE A3 EPL)		
	----- -----			-	. . CKT BOARD ASSY INCLUDES:		
-143	----- -----			1	. . TRANSISTOR:(SEE Q905 EPL)		
					(ATTACHING PARTS)		
-144	211-0012-00			2	. . SCREW,MACHINE:4-40 X 0.375 INCH,PNH STL	83385	OBD
-145	210-0004-00			3	. . WASHER,LOCK:INTL,0.12 ID X 0.26"OD,STL	78189	1204-00-00-0541C
-146	210-0812-00			1	. . WASHER,NONMETAL:#10,FIBER	06982	OBD
-147	210-1133-00			1	. . WASHER,NONMETAL:0.142 ID X 0.25"OD FIBER	86445	OBD
					- - - * - - -		
-148	348-0031-00			2	. . GROMMET,PLASTIC:0.156 INCH DIA	80009	348-0031-00
-149	386-0978-00			1	. . INSULATOR,PLATE:0.002 INCH MICA,FOR TO-3	80009	386-0978-00
-150	214-0559-02			1	. . HEAT SINK,XSTR:	80009	214-0559-02
-151	129-0370-00			2	. . POST,ELEC-MECH:0.25 HEX X 0.16 INCH LONG	80009	129-0370-00
					(ATTACHING PARTS FOR EACH)		
-152	210-0586-00			1	. . NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
	210-0802-00	XB010200		2	. . WASHER,FLAT:0.15 ID X 0.312 INCH OD	12327	OBD
					- - - * - - -		
-153	337-2298-00			1	. . SHIELD,ELEC:CIRCUIT BOARD,1.34 L	80009	337-2298-00
-154	337-2297-00			1	. . SHIELD,ELEC:CIRCUIT BOARD,1.1 L	80009	337-2297-00
-155	131-0604-00			9	. . CONTACT,ELEC:0.025 SQ X 0.365 INCH LONG	80009	131-0604-00
-156	131-0589-00			12	. . CONTACT,ELEC:0.46 INCH LONG	22526	47350
-157	131-0608-00	B010100	B010124	66	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
	131-0608-00	B010125	B010249	63	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
	131-0608-00	B010250		84	. . CONTACT,ELEC:0.365 INCH LONG	22526	47357
-158	214-0973-00			1	. . HEAT SINK,ELEC:0.28 X 0.18 OVAL X 0.187"H	80009	214-0973-00
-159	131-1003-00			9	. . CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
-160	136-0252-04			186	. . CONTACT,ELEC:0.188 INCH LONG	22526	75060
-161	136-0254-00			2	. . CONTACT,ELEC:0.088 OD X 0.145 INCH LONG	00779	1-331892-5
-162	136-0254-01			2	. . CONTACT,ELEC:0.145 INCH LONG	00779	1-331892-8
-163	136-0260-02			22	. . SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-164	136-0514-00			1	. . SOCKET,PLUG-IN:MICROCIRCUIT,8 CONTACT	82647	C930802
-165	214-0579-00			4	. . TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-166	131-0993-00	B010100	B010249	1	. . LINK,TERM.CONNE:2 WIRE BLACK	00779	530153-2
	131-0993-00	B010250		3	. . LINK,TERM.CONNE:2 WIRE BLACK	00779	530153-2
	131-0566-00	XB010250		1	. . LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000C	L-2007-1
-167	----- -----			2	. . SWITCH,SLIDE:(SEE S720,S848 EPL)		
-168	----- -----			1	. . SWITCH,SLIDE:(SEE S835 EPL)		
-169	344-0154-00			2	. . CLIP,ELECTRICAL:FOR 0.25 INCH DIA FUSE	80009	344-0154-00
-170	346-0032-00			1	. . STRAP,RETAINING:	98159	2829-75-4
-171	214-1061-00			1	SPRING,GROUND:FLAT	80009	214-1061-00
-172	426-1245-00			2	FR SECT,PLUG-IN:LEFT SIDE,TOPAND BOTTOM	80009	426-1245-00
					(ATTACHING PARTS FOR EACH)		
-173	213-0229-00			2	SCR,TPG,THD FOR:6-20 X0.375"100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-174	386-3385-01	B010100	B020486	1	SUBPANEL,FRONT:	80009	386-3385-01
	386-3385-02	B020487		1	SUBPANEL,FRONT:	80009	386-3385-02
-175	210-0774-00			11	EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
-176	210-0775-00			11	EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00
-177	131-0792-00			8	CONTACT,ELEC:0.577"L,18-20 AWG WIRE	22526	46221
-178	131-0707-00			106	CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-179	175-0827-00			FT	WIRE,ELECTRICAL:4 WIRE RIBBON	08261	TEK-175-0827-00
-180	175-0828-00			FT	WIRE,ELECTRICAL:5 WIRE RIBBON	23499	TEK-175-0828-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-181	175-0830-00			FT		WIRE,ELECTRICAL:7 WIRE RIBBON	08261	TEK-175-0830-00
-182	175-0831-00			FT		WIRE,ELECTRICAL:8 WIRE RIBBON	08261	TEK-175-0831-00
-183	352-0171-03			1		CONN BODY,PL,EL:1 WIRE ORANGE	80009	352-0171-03
	352-0171-09			1		CONN BODY,PL,EL:1 WIRE WHITE	80009	352-0171-09
-184	352-0162-03			2		CONN BODY,PL,EL:4 WIRE ORANGE	80009	352-0162-03
-185	352-0163-02			4		CONN BODY,PL,EL:5 WIRE RED	80009	352-0163-02
-186	352-0165-01			2		CONN BODY,PL,EL:7 WIRE BROWN	80009	352-0165-01
	352-0165-09			2		CONN BODY,PL,EL:7 WIRE WHITE	80009	352-0165-09
-187	352-0166-02			2		CONN BODY,PL,EL:8 WIRE RED	80009	352-0166-02
	352-0166-04			2		CONN BODY,PL,EL:8 WIRE YELLOW	80009	352-0166-04
	352-0166-05			2		CONN BODY,PL,EL:8 WIRE GREEN	80009	352-0166-05
-188	352-0168-00			1		CONN BODY,PL,EL:10 WIRE BLACK	80009	352-0168-00
-189	352-0200-08			2		CONN BODY,PL EL:8 WIRE GRAY	80009	352-0200-08



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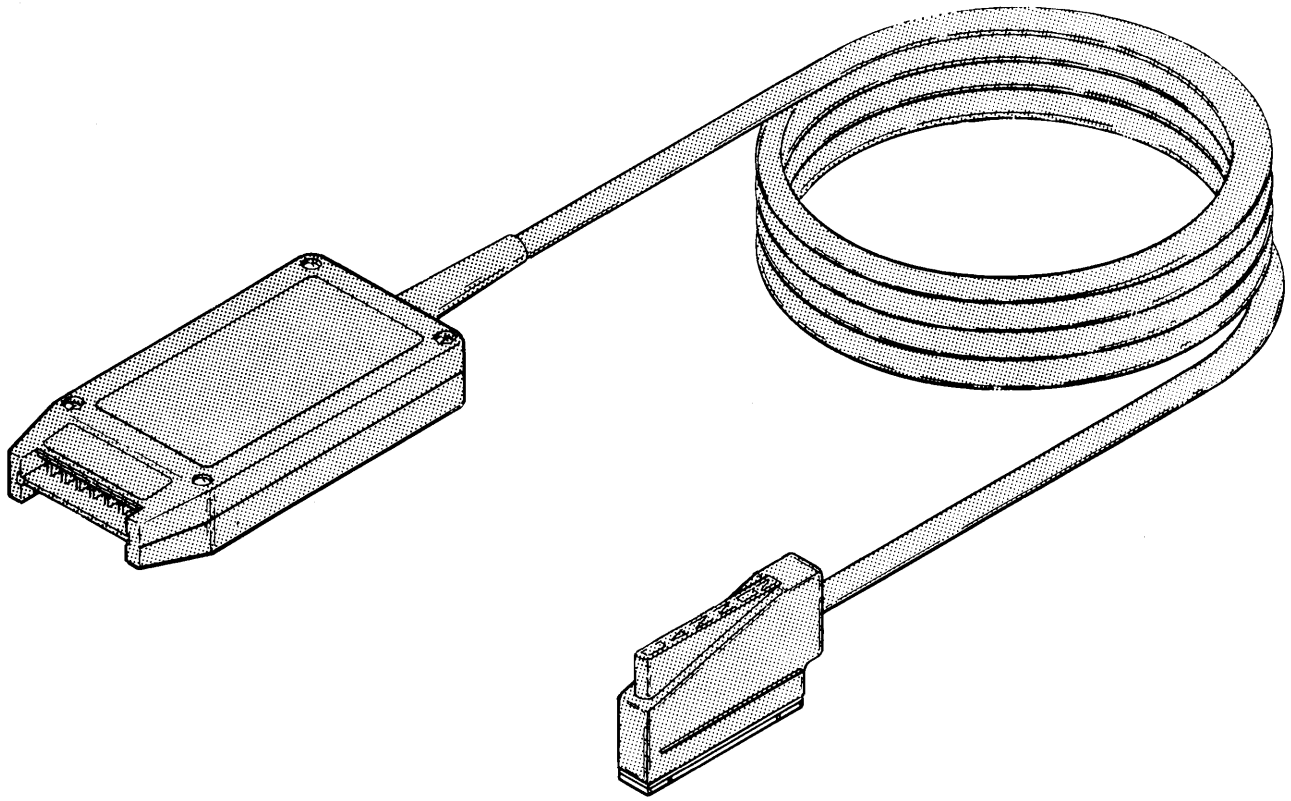

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
	010-6450-01			1		PROBE,DIGITAL:MULTI LEAD,W/ACCESSORY	80009	010-6450-01
	070-1967-00			1		MANUAL,TECH:INSTRUCTION(NOT SHOWN)	80009	070-1967-00
	070-2047-00			1		MANUAL,TECH:OPERATORS(NOT SHOWN)	80009	070-2047-00

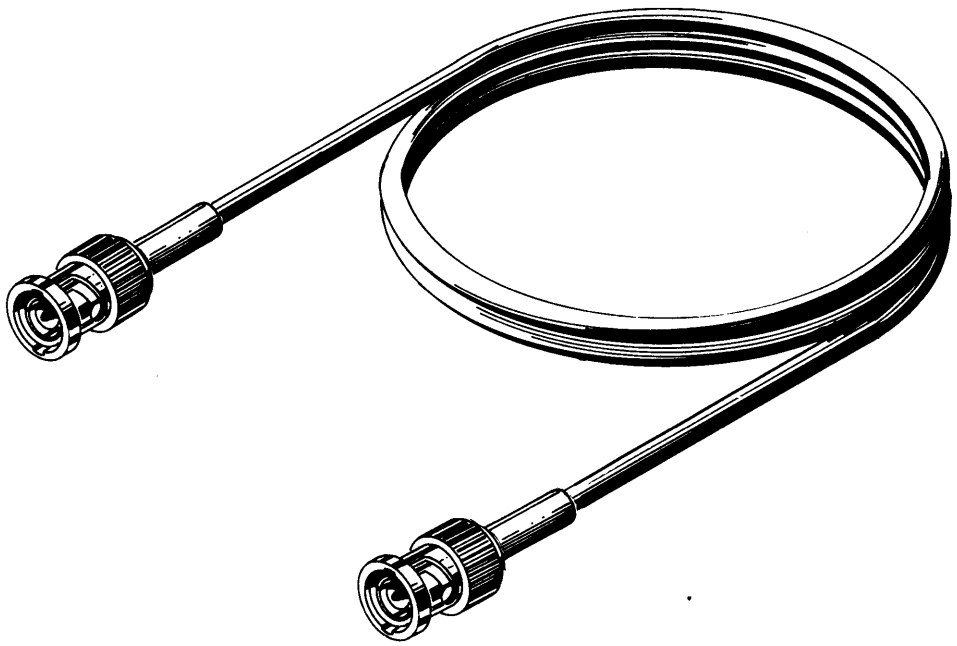

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
	012-0057-01			3		CABLE ASSY,RF:	80009	012-0051-01

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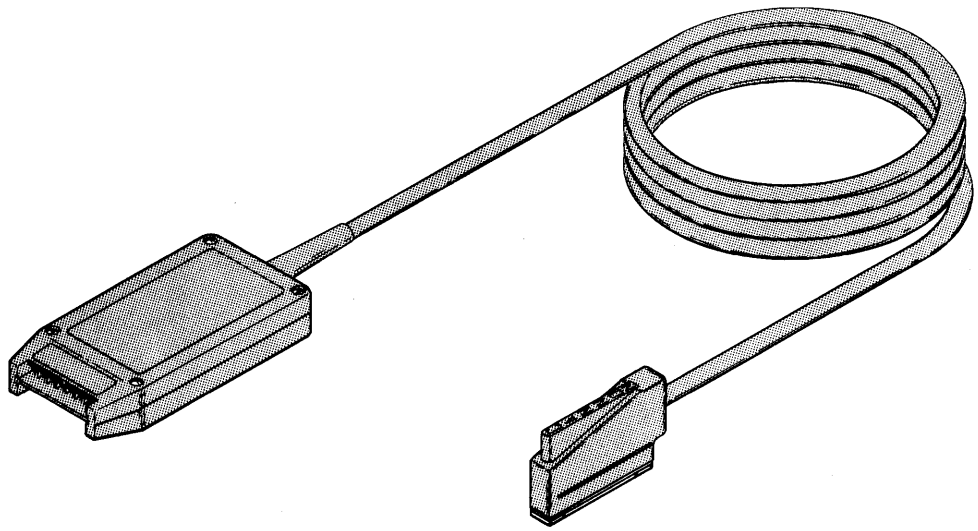
data sheet

PARTS PUBLICATION

P6450
PROBE ASSY, DATA ACQUISITION



The P6450 is a multiple input, 5X, passive probe for use with digital circuit analysis instruments, such as the LA501. The probe has 16 independent 5X attenuation inputs, 3 straight through connectors (A, B, and C) for customer assignment, and one ground. The 5X attenuation is compatible with instruments having an input resistance of 20KΩ and an input capacitance of approximately 20 pf.

The probe leads lock into the probe head. They will not pull out if the probe lead is accidently pulled. To remove a probe lead, place your fingernail on the connector and pull. To insert a probe lead, push the connector into the probe head as shown in Figure 1, page 4. Be sure the correct side of the connector is facing upward.

The probe leads come in 4 sets of 10 leads. There are 10 different colored leads in each set. Two sets of leads are terminated with retractable hook. The other two sets of leads are terminated in square-pin connectors.

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

U.S.A. and foreign TEKTRONIX products covered by U.S. and foreign patents and/or patents pending.

TEKTRONIX is a registered trademark of Tektronix, Inc.

SPECIFICATIONS

ELECTRICAL

All electrical specifications apply to channels 0 through 15 only.

Attenuation: 5X within 3% (when instrument input resistance is 20 kΩ within 1%). Series resistor 81 kΩ within 1.1%

Input Resistance: 100 kΩ within 3% (when instrument resistance is 20 kΩ within 1%).

Input Capacitance: (without test leads) approximately 45 pF (with probe connected to instrument).

Risetime (Probe Only): 9 ns (channels, 0, 1, 2, 3,); 15 ns (channels 4-15).

Maximum Input Voltage: 50 V (dc + peak ac).

Probe delay time (from end of signal input lead to multi-pin connector):

Approximately, 15 nsec.

ENVIRONMENTAL

Probe operates within specifications over the following ranges:

Temperature; 0 C to +75 C (32 F to 167 F).

Altitude: To 15,000 ft.

PHYSICAL

Net Weight: 377 gms (13.3 oz).

Length: Probe; 1.5 m (4.9 ft).

Input Leads; 40 cm (15.7 in).

MAINTENANCE

The P6450 contains only passive components. These components are located on 2 circuit boards, one in the probe head and one in the multipin cable connector body.

PROBE HEAD COMPONENT ACCESS

1. Remove 4 screws from the probe head.
2. While pulling apart the 2 halves of the probe head body, make note of which half of the body covers which side of the circuit board.
3. Replace the defective components.
4. When reinstalling the circuit board be sure the correct half of the body covers the correct side of the circuit board. Verify by tracing ground braid connection to the ground input.

MULTIPIN CONNECTOR COMPONENT ACCESS

1. Set the connector locking flange to gain access to the 3 screws (see Figure 2).
2. Remove 2 screws and loosen 1 screw.

CAUTION

The leads from the cable to the circuit board are fragile. Be careful not to damage them.

3. Carefully push the cable into the plastic body while pulling out the connector.
4. Replace the defective component.
5. To reassemble, carefully pull on the cable while guiding the connector and circuit board back into the plastic body.
6. Replace the 3 screws.

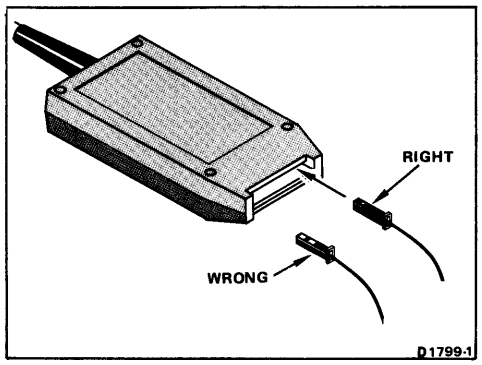


FIGURE 1

TABLE I

PROBE INPUTS	CONNECTOR PINS
1	16
2	18
3	20
4	15
5	17
6	19
7	21
8	1
9	3
10	5
11	7
12	2
13	4
14	6
15	8
	12 N.C.
	22 N.C.
	25 N.C.

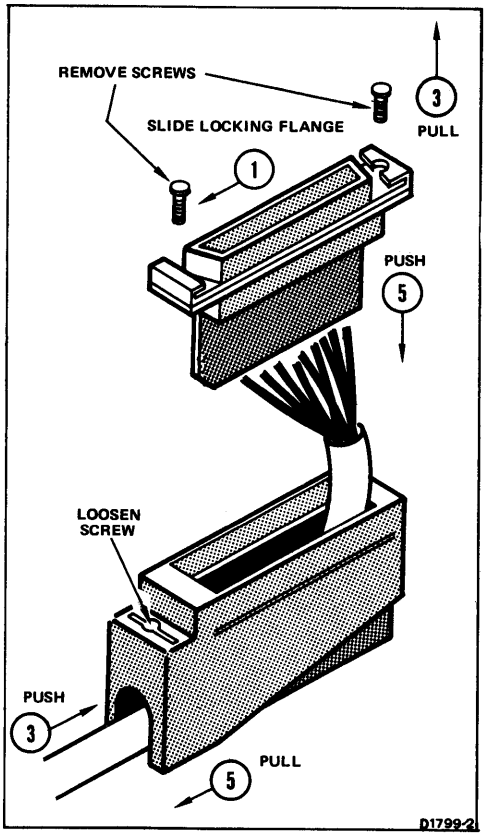
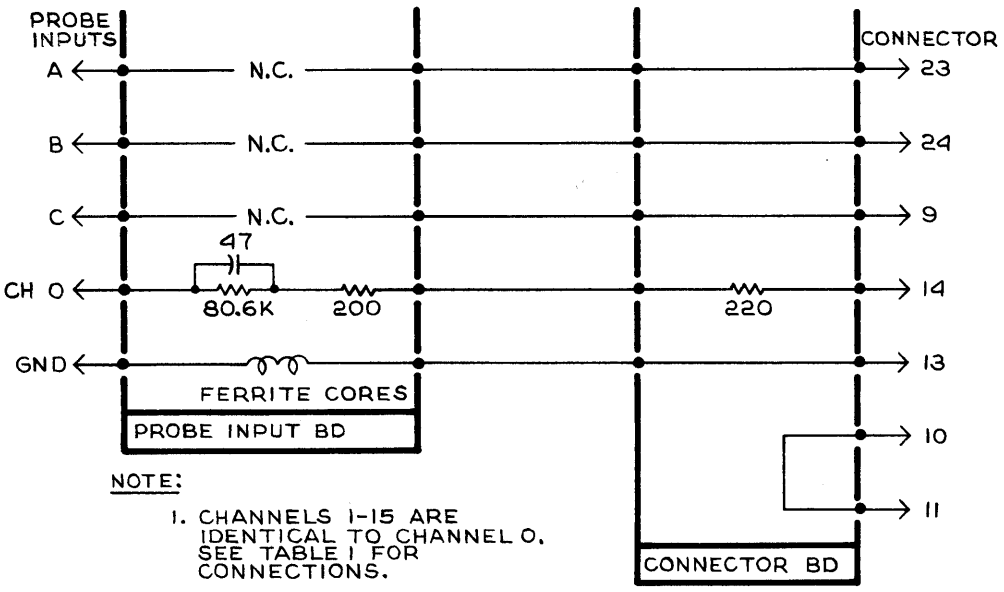


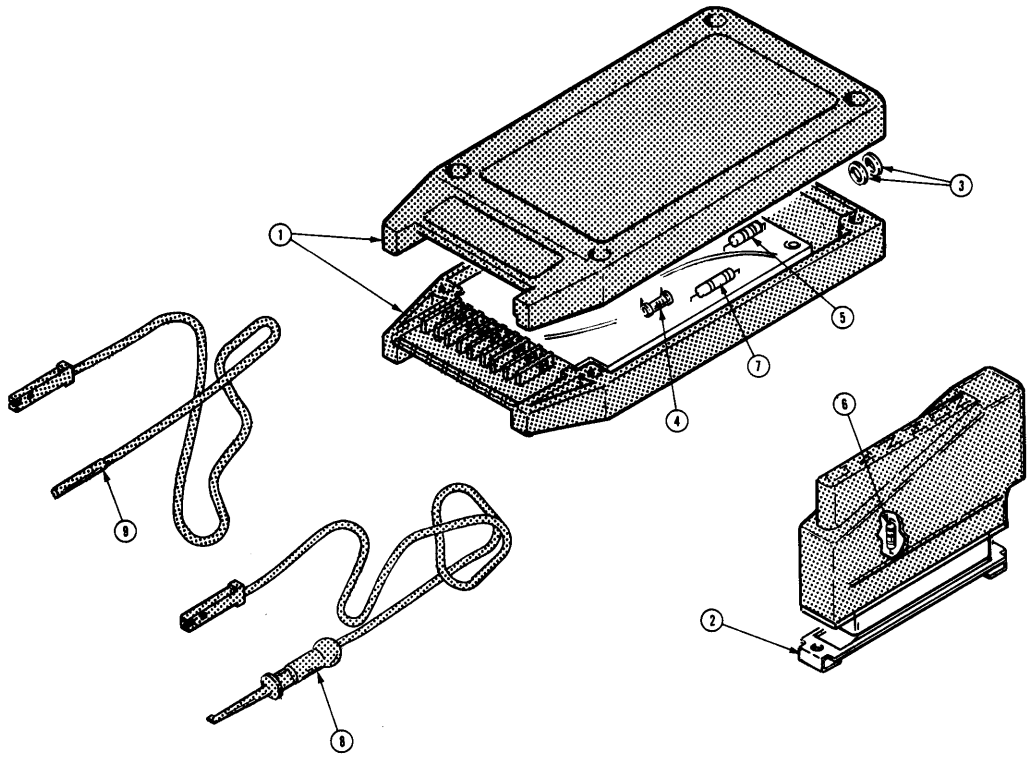
FIGURE 2

SCHEMATIC



NOTE:

1. CHANNELS 1-15 ARE IDENTICAL TO CHANNEL 0. SEE TABLE I FOR CONNECTIONS.



Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
						MECHANICAL PARTS LIST		
	010-6450-01			1		PROBE,DATA ACQ:MULTI LEAD,W/ACCESSORIES	80009	010-6450-01
	010-6450-00			1		. PROBE,DATA ACQ:MULTILEAD,20	80009	010-6450-00
-1	380-0463-01			1		. . HOUSING,PROBE:W/IDENTIFICATION MARKERS	80009	380-0463-01
-2	343-0323-00			1		. . RETAINER,CONN:25 PIN D CONN,SLIDE LOCK	09133	DB51221-1
						ELECTRICAL PART LIST		
-3	276-0596-00			2		. . CORE,TOROID,FER:0.09 ID X 0.19 OD X 0.08"H	78488	56-1657
-4	281-0651-00			16		. . CAP.,FXD,CER DI:47PF,5%,200V	72982	374-001T2H0470J
-5	315-0201-00			16		. . RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
-6	317-0221-00			16		. . RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	CB2215
-7	321-0376-00			16		. . RES.,FXD,FILM:80.6K OHM,1%,0.125W	75042	CEATO-8062F
						ACCESSORIES		
-8	012-0670-00			2		. LEAD SET,TEST:W/10 15.748L WIRES W/CONNECTORS	80009	012-0670-00
-9	012-0655-01			2		. LEAD SET,TEST:INPUT,W/10 15.748L WIRES	80009	012-0655-01
	016-0537-00			1		. POUCH,ACCESSORY:6" X 9" W/ZIPPER	80009	016-0537-00
	062-1799-00			1		. DATA SHEET:P6450(not shown)	80009	062-1799-00

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
01121	ALLEN-BRADLEY CO.	1201 2ND ST. SOUTH	MILWAUKEE, WI 53204
09133	KIERULFF ELECTRONICS, INC.	2585 COMMERCE WAY	LOS ANGELES, CA 90015
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
78488	STACKPOLE CARBON CO.		ST. MARYS, PA 15857
80009	TEKTRONIX, INC.	P. O. BOX 500	BEAVERTON, OR 97077

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MANUAL CHANGE INFORMATION

PRODUCT LA 501
070-1967-00

CHANGE REFERENCE C1/1175
DATE 11-6-75

CHANGE:	DESCRIPTION

TEXT CORRECTIONS

Page 1-7, step 7, re-word as follows:

7. Set the oscilloscope for X - Y mode and ground the inputs. Position the resulting dot display to center screen and adjust the oscilloscope for a well-defined display. If necessary, refer to the oscilloscope instruction manual for operating instructions.

Page 1-10, insert the following NOTE between the paragraphs titled "DATA OUTPUT CABLE" and "COAXIAL CABLE" in the lower left column:

NOTE

When inputting ECL on a P6450 probe, complete shielding between the input and output connectors is needed. Therefore, the cable connected to output connector J120 must be a shielded cable.

Page 1-11, delete the last two sentences of Step 3 so that Step 3 reads as follows:

Connect the 10X probe to be compensated to a 600 mV, fast-rise, 1 KHz square-wave signal source (e.g., oscilloscope calibrator) for low-frequency compensation.

Page 1-11, change Step 4 to read:

Adjust the probe compensation adjustment(s) (see probe instruction manual for adjustment locations) for an optimum flat top on the test oscilloscope display.

Page 1-12. The illustration for P831 EXT CLOCK POLARITY SELECTOR is in error. The callout that reads NEGATIVE EDGE should read POSITIVE EDGE and vice versa.

Page 1-13, under "Z BLANK OUT" at the bottom of the right hand column, add the following:

For Serial No.s B010245 and below, the only function of the Z-axis blanking signal is to blank the crt retrace lines.

CHANGE:	DESCRIPTION

Page 1-15, top of the right column, under "Z-AXIS INPUT", change to read as follows:

Z-AXIS INPUT. This connection permits control of display intensity with an externally generated signal. As the external signal goes positive (5 volts maximum) the display intensifies.

Page 1-15, right column, under "RECORD ENABLE", change to read as follows:

RECORD ENABLE. This connection is provided to set the memory into the Store Mode by application of an external signal. A high pulse at ECL level is required.

Page 2-3, in the lower part of Table 2-1, the CRT Retrace Blanking Time Performance Requirement should read as follows:

4.2 µs within 20% (2 bits)
2.2 µs within 20% (1 bit)
1.2 µs within 20% (1/2 bit)

Page 2-3, in the lower part of Table 2-1, the Horizontal Output-Linearity Performance Requirement should read:

Pulse width within 10% from 1% to 100% of sweep.

Page 2-5, in the middle of Table 2-1, the Record Enable Performance Requirement should read:

Pin 15. A positive-going pulse (high) from a low ECL level sets memory into Record mode.

From the end of Section 2 throughout the rest of the manual, the following signal names are to be changed:

1. Display Clock Inhibit is changed to Display Clock Enable.
2. Store Clock Inhibit is changed to Store Clock Enable.
3. Frame Clock is changed to Flag.

Page 3-8, left column, first paragraph. For SN B010245 and below, change to read as follows:

Auto Record

The Auto Record stage controls the time that a display is presented before the Memory returns to the store mode. The display time is set by DISPLAY TIME control R605. Capacitor C606 charges through

CHANGE:	DESCRIPTION

R604, R605, and R609. After approximately one time constant, Q606 conducts, discharging C606 and pulling pin 4 of U610A LO. When pin 4 of U610A is LO, pin 3 is HI. The HI at pin 3 resets the Q output (pin 14) of Store/Display Flip-Flop U615B to a HI level. Pin 14 of U615B is connected to the emitter of Q602. A HI at the emitter of Q602 causes Q602 and Q604 to conduct, disabling the timing circuit for Q606. Therefore, Q606 only operates when the memory is in the display mode (pin 14 of U615B is LO). C602 ensures that the conduction of Q606 is always longer than 20 ms. A HI level pulse at pin 3 of U610A can also be obtained by pressing MANUAL pushbutton S605A. NOR gates U608A and B are connected as a set-reset flip-flop to prevent any contact bounce in S605A from being coupled to the rest of the circuitry. When S605A is pressed, pin 5 of U608A goes LO and pin 7 of U608B goes HI. The resultant LO on pin 3 of U608B is connected to pin 5 of U610A, producing a HI level pulse at pin 3. U610A pin 3 is wired through U608B to produce the load command for the address counter.

Page 3-8, right column. Add the following sentence at the end of the second paragraph.

U628 pin 2 is connected to U615A pin 6 to produce trigger holdoff which requires the memory to cycle once before a trigger is accepted.

Page 3-11, left column, first paragraph, fifth line should read:

"at pin 5 sets the Q output (pin 2) HI. Pin 2 of U616A is"

Page 3-11, left column, second paragraph. The three paragraphs headed "BAD DATA" BLANKING, do not apply to instruments serial number B010245 and below.

Page 3-11, right column, third paragraph. The circuit description for the -4.8-Volt Supply should read as follows:

-4.8-Volt Supply

The -4.8-Volt Supply is derived from the 25-volt ac windings of the transformer in the power module. The ac input is rectified by CR904, then filtered by C904, L905, and C905. The resultant dc source is converted by a switching regulator to -4.8 volts. Zener diode VR922 and transistor Q922 maintain a constant current through VR920 to establish a reference voltage. The reference

CHANGE:	DESCRIPTION

-4.8-Volt Supply (cont.)

voltage at the wiper of R925 is applied to the base of Q914.

Q905 is a series switching regulator that produces a rectangular power waveform whose energy is stored in T911. The negative transition of Q905 is coupled through C911 and R912 to the base of Q914 to control the on Time of Q914. The positive transition of Q905 is coupled through C911, R912, C927, and R927 to the base of Q928, resulting in a fast turn-off time for Q905.

Transistors Q914 and Q916 compare the output voltage with the reference voltage from R925. If the output voltage is more negative than the reference, the on time of Q914 becomes less, reducing the on time of Q910 and Q905. The amount of energy stored in T911 is thereby reduced, pulling the output voltage positive. When the output voltage becomes less negative than the reference voltage, Q914 conducts longer, increasing the on time of Q910 and Q905. The amount of energy stored is thereby increased and the output goes more negative.

Zener diode VR932 and SCR Q932 provide over-voltage protection for the IC's connected to this supply. If the output voltage exceeds about -6.2 volts, Q932 switches on, shorting the -4.8-Volt Supply and blowing fuse F905.

Page 4-3, left column, last paragraph, should read as follows:

The Trouble shooting Charts in the Diagrams section (or the following procedure) can be used as a guide for troubleshooting the LA 501. Both the charts and the procedure check the simple trouble possibilities before proceeding with extensive trouble-shooting. The first few checks ensure proper connection, operation, and adjustment. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, it should be replaced using the replacement procedure given under Corrective Maintenance.

CHANGE:	DESCRIPTION

Page 4-3, right column, following the last paragraph, add the following:

NOTE

If the selector block is in the H position (108 V AC to 132 V AC) adjust the autotransformer for 120 V ac.

Page 4-4, Table 4-1. Change the Maximum Ripple Peak-to Peak specification for high freq. to 100 mV in both cases.

Page 5-13, right column

Delete Steps F1 j through p.

Change Step F1 i to read:

i. Check for a clean, symmetrical 50 MHz ECL display.

Page 5-15, left column, at Step F7 g, add the following material:

Set SAMPLE INTERVAL to EXT. Connect 10X probe to the EXT CLOCK BNC connector. Connect the probe tip to Test Point TP820 and repeat part c again for Channel 7.

Page 5-17, right column: Delete all of Step G2 for instruments with serial numbers B010245 and below.

SCHEMATIC CORRECTIONS

Schematic 3 The terminating resistor on pin 13 of U258 is U121F instead of U351F.

Delete U431F from U535 pin 10.

Schematic 4 Terminate U615 pin 4 with termination resistor U611D (100 ohm to -2V supply).

U615B Q and $\overline{Q}$ are labeled backwards.

Terminate U616-pin 11, 100 ohm to -2V supply with U611E.

Schematic 7 DS 708 should be P31 - Pin 2.

CHANGE:	DESCRIPTION

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGE

Pilot Change #1 - #10 EFF SN B010100-up

CHANGE TO:

C606	290-0724-00	CAP.,FXD,ELCTLT:330 UF,20%,6V
R604	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
R628	321-0097-00	RES.,FXD,FILM:100 OHM,1%,0.125W
R629	315-0822-00	RES.,FXD,CMPSN:8.2K OHM,5%,0.25W
R632	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
R688	315-0432-00	RES.,FXD,CMPSN:4.3K OHM,5%,0.25W
R694	315-0221-00	RES.,FXD,CMPSN:220 OHM,5%,0.25W
R696	321-0104-00	RES.,FXD,FILM:118 OHM,1%,0.125W
R698	321-0097-00	RES.,FXD,FILM:100 OHM,1%,0.125W
R734	321-0126-00	RES.,FXD,FILM:200 OHM,1%,0.125W
R735	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
R736	321-0158-00	RES.,FXD,FILM:432 OHM,1%,0.125W
R737	321-0126-00	RES.,FXD,FILM:200 OHM,1%,0.125W
R738	321-0139-00	RES.,FXD,FILM:274 OHM,1%,0.125W
R740	311-1831	RES.,VAR,NONWIR:DUAL,2.5K OHM X 1K
R741	321-0173-00	RES.,FXD,FILM:619 OHM,1%,0.125W
R744	321-0072-00	RES.,FXD,FILM:54.9 OHM,1%,0.125W
R925	311-1244-00	RES.,VAR,NONWIR:100 OHM,10%,0.50W
U14	156-0067-05	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER(SELECTED)
U110	156-0757-00	MICROCIRCUIT,DI:DUAL 3-INP,3-OUT NOR GATE,10211
U252	156-0657-01	MICROCIRCUIT DI:256 BIT RAM,CHECKED
U254	"	" " " " "

CHANGE:	DESCRIPTION

CHANGE TO:

U256	156-0657-01	MICROCIRCUIT DI:256 BIT RAM,CHECKED
U258	"	"
U352	" "	"
U354	"	"
U356	"	"
U358	"	"
U452	"	"
U454	"	"
U456	"	"
U458	"	"
U552	"	"
U554	"	"
U556	"	"
U558	"	"

REMOVE:

C607	281-0773-00	CAP.,FXD,CER DI:0.01UF,10%,100V
C608	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V
CR628	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA,1N4152
R739	315-0100-00	RES.,FXD,CMPSN:10 OHM,5%,0.25W

ADD:

C67	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V
C213	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V
C216	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V
C602	290-0527-00	CAP.,FXD,ELCTLT:15UF,20%,20V
CR607	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA,1N4152
Q629	151-0188-00	TRANSISTOR:SILICON,PNP,2N3906

CHANGE:	DESCRIPTION

ADD:

R609	315-0753-00	RES.,FXD,CMPSN:75K OHM,5%,0.25W
R742	315-0151-00	RES.,FXD,CMPSN:150 OHM,5%,0.25W
R743	315-0823-00	RES.,FXD,CMPSN:82K OHM,5%,0.25W

Pilot Change #11 EFF SN B010125-up

CHANGE TO:

R691	315-0241-00	RES.,FXD,CMPSN:240 OHM,5%,0.25W
R693	315-0331-00	RES.,FXD,CMPSN:330 OHM,5%,0.25W
R694	315-0431-00	RES.,FXD,CMPSN:430 OHM,5%,0.25W

Pilot Change #12 EFF SN B010160-up

CHANGE TO:

VR920	153-0060-00	SEMICOND DEVICE:ZENER,0.4W,6.2V,2% SELECTED FROM 1N3497

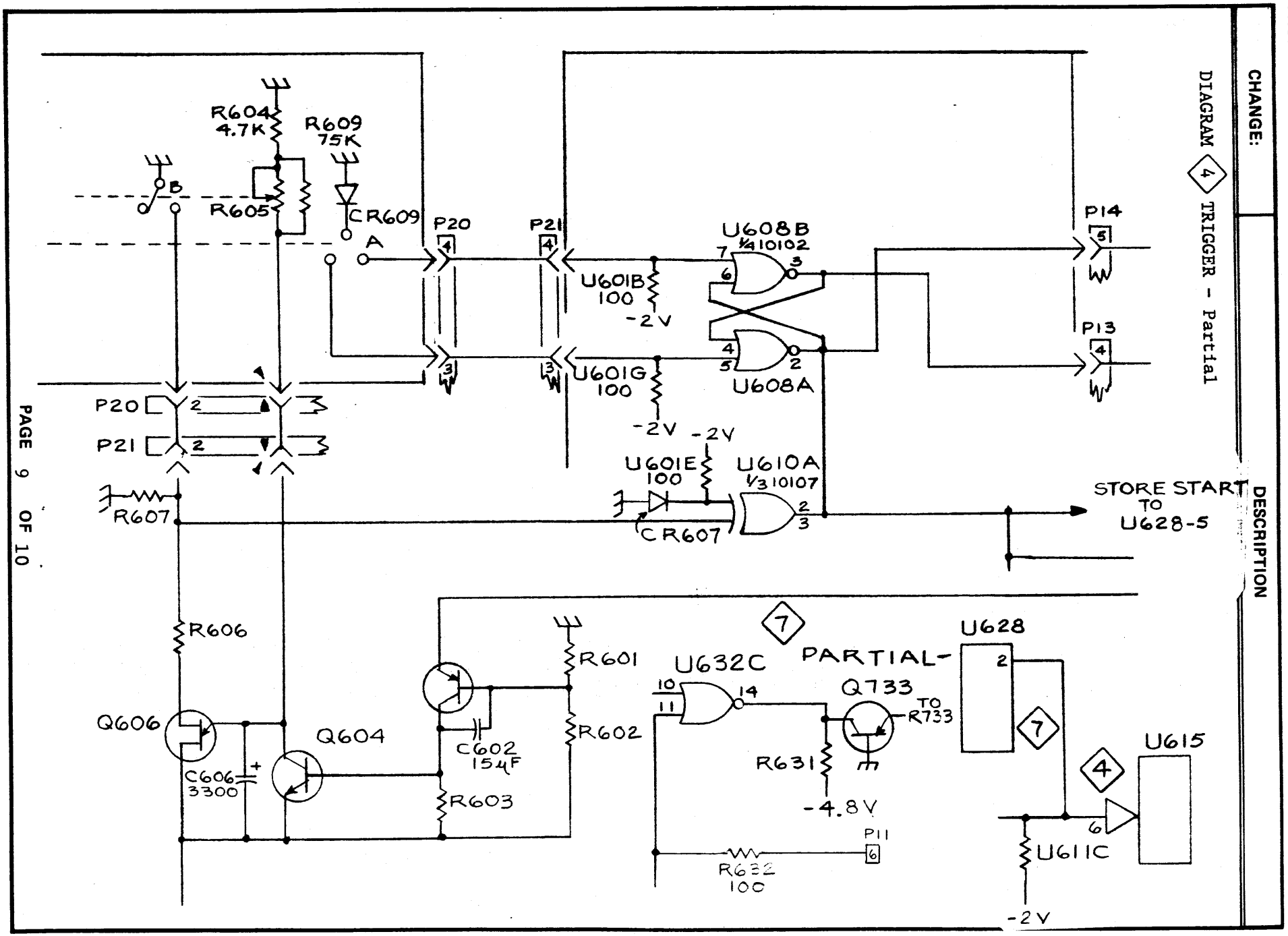


DIAGRAM 4 TRIGGER - Partial
CHANGE:
DESCRIPTION
R604 4.7K
R609 75K
R605
CR609
B
A
P20
P21
U608B 1/4 10102
U608A
U601B 100
U601G 100
U601E 100
U610A 1/3 10107
-2V
P14
P13
STORE START TO U628-5
CR607
R607
R606
R601
R602
R603
Q606
Q604
C606 3300
C602 154F
U632C
PARTIAL-
Q733
TO R733
R631
-4.8V
R632 100
P11
U628
U615
U611C
7
4

CHANGE:	DESCRIPTION

DIAGRAM 6 SERIAL LOGIC AND VERTICAL SIGNAL OUTPUTS - Partial

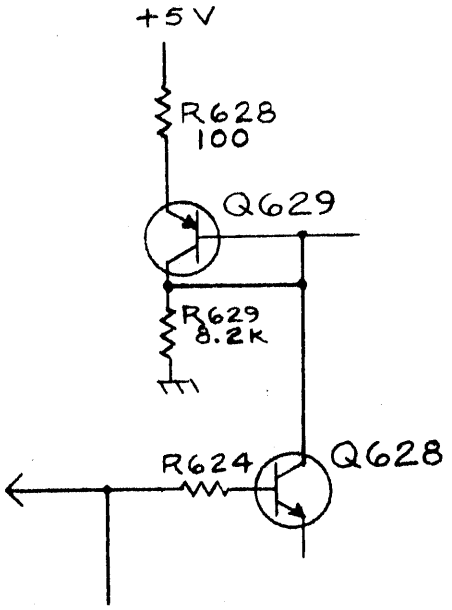
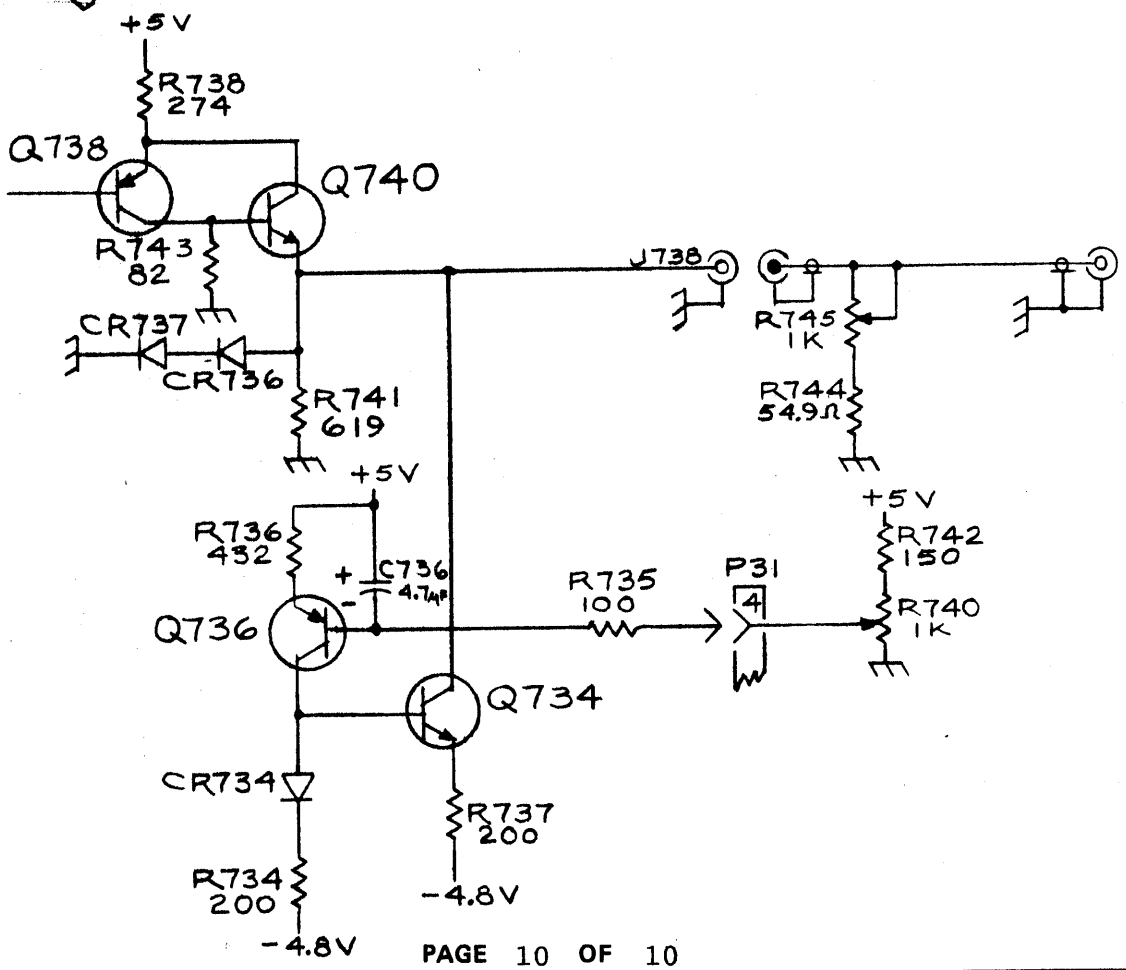


DIAGRAM 7 HORIZONTAL & BLANKING SIGNAL OUTPUTS - Partial



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MANUAL CHANGE INFORMATION

PRODUCT LA 501
EFF SN B010250-up

CHANGE REFERENCE C2/276
DATE 2-26-76

CHANGE:	DESCRIPTION

070-1967-00

TEXT CORRECTIONS

Page 1-1, right column

CHANGE: Delete the CLOCK OUT heading and accompanying text. Insert the following:

1 MHz CLOCK OUT: Provides an unterminated (negative voltage ECL level) 1 MHz clock from an internal time base.

CHANGE: Delete the INVALID MODE heading and accompanying text. Replace it with the following:

AUX CLOCK INPUT. Provides for an external ECL level Store/Display Clock signal input.

AUX CLOCK INPUT. Provides an input for ECL level trigger signal.

Page 1-3, item 16, FORMAT

CHANGE: The third line should read "Maximum sample interval is 20 nanoseconds." The fifth line should read "Maximum sample interval is 50 nanoseconds."

Page 1-6, right column, just ahead of the "Preliminary Set Up" heading

CHANGE: Insert the following text.

Setting The Internal Jumpers

The internal jumpers should be set to the positions that will give the desired operation. The jumpers and their functions are as follows:

P831-Clock Polarity (positive - pin 1 to pin 2*; negative - pin 2 to pin 3) and Variable Threshold Trigger (pin 3 to pin 4).

P629-Trigger Lockout (pin 1 to pin 2)* and Bad Data Blanking (pin 2 to pin 3).

P608-CH 0 Trigger (pin 2 to pin 3)*, Auxiliary Trigger (pin 3 to pin 4).

P136-Clock Ticks (pin 1 to pin 2)* and No Clock Ticks (pin 2 to pin 3).

P120-Trigger Sync Output (pin 1 to pin 2)* and Trigger Sync Input (pin 2 to pin 3).

P101-Auxiliary Clock (pin 2 to pin 3)* and Ext Store/Display Clock (pin 1 to pin 2).

Note: * indicates jumper position when shipped from the factory.

CHANGE:	DESCRIPTION

P100-Display Clock (pin 1 to pin 2)* and Ext Store/Display Clock (pin 2 to pin 3).

Page 1-7, left column, step 7.

CHANGE: Re-word Step 7 as follows:

7. Set the oscilloscope for X-Y mode and ground the inputs. Position the resulting dot display to center screen and adjust the oscilloscope for a well-defined display. If necessary, refer to the oscilloscope instruction manual for operating instructions.

Page 1-10, left column, between the paragraphs title DATA OUTPUT CABLE and COAXIAL CABLE.

CHANGE: Insert the following note.

NOTE

When inputting ECL data on a P6450 probe and outputting parallel data on J120, complete shielding between connectors and cables is needed. Therefore, shielded cables and connectors should be used on J120.

Page 1-11, Steps 3 and 4.

CHANGE: Delete the last two sentences of Step 3. In Step 4, delete the words "square front corner and".

Page 1-12, left column, top paragraph

CHANGE: Delete the last two sentences in the paragraph and insert the following headings and text before the paragraph titled "MONITOR".

INTERNAL JUMPERS:

P831-External Clock Polarity Selector.

In the first two positions, P831 selects external clock polarity. In the third position, it provides a means to use the EXT CLOCK connector on the front panel as a Variable Threshold Trigger source.

P629-Bad Data Blanking Selector.

This jumper is used to select either Trigger Lockout or Bad Data Blanking triggering mode.

CHANGE:	DESCRIPTION

P608-Internal Trigger Selector.
This jumper permits selection of CH 0 or Auxiliary Trigger Input as the trigger source when the front panel SOURCE pushbutton is in CH 0 position.

P136-Clock Tick Selector.
Allows positive or negative Clock Ticks to be added to each channel of displayed data. Each Clock Tick represents the active edge of the Store Clock signal; moving the jumper disables the Clock Ticks.

P100-Display Clock Selector.
In a master/slave configuration (cascaded LA 501's), P100 provides the means to connect the Ext/Store/Display Clock from the master unit to the display clock circuitry in the slave unit.

P101-Ext Store/Display Clock Selector.
This jumper selects the Auxiliary Clock for the Store Clock. In a master/slave configuration, P101 connects the Ext Store/Display Clock to both the Store Clock and P100.

P120-Trigger Sync Selector.
Selects master or slave mode of operation. In master/slave configuration, synchronizes the memory multiplexers in the slave unit to the master unit.

Page 1-12, Fig. 1-7

Figure 1-7 is in error. The callout that reads negative edge should read positive edge and vice versa.

Page 1-14, right column, under the "DATA INPUT" heading, fifth line.
CHANGE: Delete all text under the foregoing head following the word "connector" in the fifth line.

Page 1-15, top of the right column, under "Z-AXIS INPUT", change to read as follows:

Z-AXIS INPUT. This connection permits control of display intensity with an externally generated signal. As the external signal goes positive (5 volts maximum) the display intensifies.

Page 1-15, right column, under "RECORD ENABLE", change to read as follows:

RECORD ENABLE. This connection is provided to set the memory into the Store Mode by application of an external signal. A HI pulse at ECL level is required.

CHANGE:	DESCRIPTION

Page 1-15, Fig. 1-8.

CHANGE: Delete superscripts 3, 4, and 5. Change the nomenclature describing pin functions of J100 as follows:

9. AUX TRIGGER INPUT
22. AUX CLOCK INPUT
23. CLOCK STATUS
24. CLOCK STATUS
25. 1 MHz CLOCK OUTPUT

Page 1-16, Fig. 1-9.

CHANGE: Change the nomenclature describing pin functions of J120 as follows:

2. P300 PIN 1'
5. P300 PIN 2'

Page 1-17, left column.

CHANGE: Delete the paragraph entitled "INVALID MODE INPUT".

Page 1-17, Fig. 1-10

CHANGE: Change the nomenclature describing the pin functions of P300 as follows:

1 -TO J120, PIN 2
2 -TO J120, PIN 5
4 -TRIGGER SYNC
7 -MASTER RECORD ENABLE
11 -EXT STORE/DISPLAY CLOCK OUTPUT
12 -EXT STORE/DISPLAY CLOCK INPUT

Pins not listed retain their original nomenclature. Pins 11 and 12 are additions. In the detail circle showing the jumper positions, remove the jumper between 4 and 7, and add pins 11 and 12.

Page 1-17, left column, change the text under the FRAME OUTPUT heading as follows:

CHANGE: This connection provides for the output of an unterminated ECL level pulse. The negative edge of the frame output pulse indicates the start of channel 3 data. One complete pulse cycle represents one complete serial scan of data in the memory in 16-channel operation, two scans in 8-channel operation, and four scans in 4-channel operation.

CHANGE:	DESCRIPTION

Page 2-3, in the lower part of Table 2-1, the CRT Retrace Blanking Time Performance Requirement should read as follows:

4.2 µs within 20% (2 bits)

2.2 µs within 20%,(1 bit)

1.2 µs within 20% (1/2 bit)

Page 2-3, in the lower part of Table 2-1, the Horizontal Output-Linearity Performance Requirement should read:

Pulse width within 10% from 1% to 100% of sweep.

Page 2-4 Following the title "Low-Impedance Data Input",

INSERT: (J100)

Page 2-4, under Low-Impedance Data Input

CHANGE: Clock Out, and its Performance Requirement to:

1 MHz Clock Output	Pin 25. Unterminated ECL level. When terminated, the output is a standard, negative voltage ECL 1 MHz signal.

DELETE: Invalid Mode and its Performance Requirement.

DELETE: + 5 Volts and its Performance Requirement.

Page 2-4, following the last characteristic under Low-Impedance Data Input:

ADD: Aux Clock Input	Pin 22. Input to Store/Display clock gate. (Negative level ECL.) Selected by P101.
ADD: Clock Status Output	Pins 23,24. Both pins are HI (gnd.) when SAMPLE INTERVAL switch is in EXT position.
ADD: Aux Trigger Input	Pin 9. Provides trigger signal input from J100. (Negative level ECL.)

Pages 2-4 & 2-5, following the title "DATA OUTPUT",

INSERT: J(120)

Pages 2-4 & 2-5, under Data Output

CHANGE: The Performance Requirement of Record Enable to read as follows:

Positive going pulse at ECL levels sets memory into record mode.

CHANGE: The Performance Requirement of Frame Output

Jumper,P300 pin 8. A negative going edge indicates the start of Channel 3.

Page 2-5, following the last characteristic under Data Output:

CHANGE:	DESCRIPTION
ADD: Trigger Sync Output	Jumper, P300 pin 4. Permits synchronous displayed data from two or more units (master-slave operation).
ADD: Master Store Enable Output	Jumper, P300 pin 7. Sets slave unit(s) to Store mode (master-slave operation).
ADD: Ext Store/Display Clock Output	Jumper, P300 pin 11. Master unit clock signal output for use by slave units (s).
ADD: Ext Store/Display Clock Input	Jumper, P300 pin 12. Clock signal input for slave unit (s) from master unit.

Page 2-5, following the last newly added characteristics under Data Output add a new major title 'REAR INTERFACE CONNECTOR'.

ADD: Display Clock Input	B21 (same as J120-3)
ADD: Serial Data Output	B19 (same as J120-4)
ADD: Display-Store Mode Output	B20 (same as P300-6)
ADD: Frame Output	B12 (same as P300-8)
ADD: CHANNEL/POSITION SELECT OUTPUT	B25 Indicates channel selected by CHANNEL/POSITION SELECT switch.

From the end of Section 2 throughout the rest of the manual the signal referred to as Frame Clock is to be changed to Flag.

Page 3-3, paragraph Store/Display Clock Gate
CHANGE: Replace all U110A's with U110B and replace all U110B's with U110A.

Page 3-4, second sentence: Replace words "record clock" with "store clock".

Page 3-6, right hand column, first paragraph
CHANGE: on line 4 change pin 14 to pin 11

Page 3-6, right hand column, second paragraph
CHANGE: on line 4 change pin 14 to pin 11

Page 3-6, under paragraph labeled "Sixteen Channel".
CHANGE: on line 3 change pin 14 to pin 11

CHANGE:	DESCRIPTION

Page 3-6, right column, just ahead of the "Data Selector" heading

INSERT: The following heading and text.

Clock-Tick Generator

The Clock-Tick Generator provides a clock reference for the display, in the form of small pulses superimposed on the displayed waveforms. The clock ticks are positive pulses when the displayed signal level is LO, and negative when the displayed signal level is HI.

When the FORMAT switch, S110, is set for 4- or 8-channel operation, pin 13 of U136D is held HI. With pin 13 HI, the display clock signal at pin 12 is inverted by exclusive-OR gate U136D. When the FORMAT switch is set for 16-channel operation, pin 13 of U136D is LO and the display clock signal is passed, uninverted, by U136D. The output of U136D is connected by P136 to the anode of CR136 and the base of Q136 through C136.

The operation of the circuit depends on the logic state of the displayed signal (from R270, diagram 6) during the positive transition of the clock signal at the output of U136D. If the displayed signal is LO, the positive transition of the clock signal is coupled through C136 and CR136 to the vertical output stage on diagram 6. This produces a LO level signal displayed with a positive pulse indicating the active edge of the clock signal. If the displayed signal is HI, the positive transition of the clock signal is coupled through C136 to the base of Q136. The positive pulse at the base cuts off Q136 (Q136 is normally saturated), producing a negative pulse at the collector. This negative pulse is coupled through CR137 to the vertical output stage, resulting in a HI level signal displayed with a negative pulse indicating the active edge of the clock signal.

Page 3-8, left column, first paragraph, the sentence starting in the sixth line.

CHANGE: Lines 6 through 9 should read as follows:

When pin 4 of U610A is LO, pin 2 is HI, setting the Q output (pin 2) of U616A HI. The HI at pin 2 of U616 resets the $\overline{Q}$ output (pin 14) of Store/Display flip-flop U615B to a HI level.

Page 3-8, left column, first paragraph

CHANGE: In lines 14 and 21 replace "pin 3" with "pin 2".

CHANGE:	DESCRIPTION

Page 3-8, under paragraph "Trigger Source Selector".

CHANGE: On line 15 change "pin 13 of U608D" to read, pin 6 of U632B.

CHANGE: On line 16 change "U608D" to U632B.

CHANGE: On line 17 change "D" to U632B.

Page 3-8, under paragraph "Trigger Position Counter"

DELETE: Sentence in line 18, starting with "The output line".....

CHANGE: Last two sentences to read as follows:

When all outputs are LO pin 13 of U608D is LO. When pin 13 and the LF Clock signal are both LO the NOR Output of U608D goes HI and the OR Output goes LO.

Page 3-10, Fig. 3-10

CHANGE: Column labeled "16 CH" to read as follows:

12
13
14
15
8
9
10
11
4
5
6
7
0
1
2
3

Page 3-11, left column, first paragraph, third line.

CHANGE: Starting with the words 'The display clock inhibit', replace the paragraph with the following:

The display clock inhibit signal on U610D, pin 12 is HI during the store time. A HI at pin 12 makes pin 15 HI, which drives U632C, pin 14 LO to blank the display. The output of U610D is HI as long

CHANGE:	DESCRIPTION

Page 3-6, right column, just ahead of the "Data Selector" heading

INSERT: The following heading and text.

Clock-Tick Generator

The Clock-Tick Generator provides a clock reference for the display, in the form of small pulses superimposed on the displayed waveforms. The clock ticks are positive pulses when the displayed signal level is LO, and negative when the displayed signal level is HI.

When the FORMAT switch, S110, is set for 4- or 8-channel operation, pin 13 of U136D is held HI. With pin 13 HI, the display clock signal at pin 12 is inverted by exclusive-OR gate U136D. When the FORMAT switch is set for 16-channel operation, pin 13 of U136D is LO and the display clock signal is passed, uninverted, by U136D. The output of U136D is connected by P136 to the anode of CR136 and the base of Q136 through C136.

The operation of the circuit depends on the logic state of the displayed signal (from R270, diagram 6) during the positive transition of the clock signal at the output of U136D. If the displayed signal is LO, the positive transition of the clock signal is coupled through C136 and CR136 to the vertical output stage on diagram 6. This produces a LO level signal displayed with a positive pulse indicating the active edge of the clock signal. If the displayed signal is HI, the positive transition of the clock signal is coupled through C136 to the base of Q136. The positive pulse at the base cuts off Q136 (Q136 is normally saturated), producing a negative pulse at the collector. This negative pulse is coupled through CR137 to the vertical output stage, resulting in a HI level signal displayed with a negative pulse indicating the active edge of the clock signal.

Page 3-8, left column, first paragraph, the sentence starting in the sixth line.

CHANGE: Lines 6 through 9 should read as follows:

When pin 4 of U610A is LO, pin 2 is HI, setting the Q output (pin 2) of U616A HI. The HI at pin 2 of U616 resets the $\overline{Q}$ output (pin 14) of Store/Display flip-flop U615B to a HI level.

Page 3-8, left column, first paragraph

CHANGE: In lines 14 and 21 replace "pin 3" with "pin 2".

CHANGE:	DESCRIPTION

Page 3-8, under paragraph "Trigger Source Selector".

CHANGE: On line 15 change "pin 13 of U608D" to read, pin 6 of U632B.

CHANGE: On line 16 change "U608D" to U632B.

CHANGE: On line 17 change "D" to U632B.

Page 3-8, under paragraph "Trigger Position Counter"

DELETE: Sentence in line 18, starting with "The output line".....

CHANGE: Last two sentences to read as follows:

When all outputs are LO pin 13 of U608D is LO. When pin 13 and the LF Clock signal are both LO the NOR Output of U608D goes HI and the OR Output goes LO.

Page 3-10, Fig. 3-10

CHANGE: Column labeled "16 CH" to read as follows:

12
13
14
15
8
9
10
11
4
5
6
7
0
1
2
3

Page 3-11, left column, first paragraph, third line.

CHANGE: Starting with the words 'The display clock inhibit', replace the paragraph with the following:

The display clock inhibit signal on U610D, pin 12 is HI during the store time. A HI at pin 12 makes pin 15 HI, which drives U632C, pin 14 LO to blank the display. The output of U610D is HI as long

CHANGE:	DESCRIPTION

as the memory is storing data, which ensures that the display is blanked during the store cycle.

Page 3-11, left column, third and fourth paragraphs

REPLACE: The third and fourth paragraphs with the following:

In the Bad Data Blanking mode, P629 disables the Q output of U628A. At the beginning of the store cycle, the $\overline{Q}$ output at U628A, pin 3 is set LO by the Store Start signal on U628, pin 5. If a trigger is present at U615A, pin 6 (Diagram 4) before the memory has time to cycle once, the $\overline{Q}$ output of U628A remains LO and the Flag pulse sets the Q output at U628B, pin 15 HI, which blanks the display. Since the Flag signal occurs at the start of the sweep, the first part of the display is blanked. The $\overline{\text{Address Count Carry}}$ signal then clocks the Q output at U628, pin 15 LO, which unblanks the display.

If P629 is selected for the Trigger Lockout mode, the Store Start signal sets the Q output of U628A HI at the beginning of the store cycle. This HI will lockout any triggers by holding U615B, pin 6 (Diagram 4) HI. The HI at the Q output of U628A remains until the memory is full, which is signified by the $\overline{\text{Address Count Carry}}$ signal at U610B, pin 6 going LO. The $\overline{\text{Address Count Carry}}$ signal is inverted by U610B, and the positive edge of the inverted signal clocks the Q output of U628A LO, therby enabling the trigger circuits.

Page 3-11, left column, third paragraph, second sentence.

CHANGE: Normally, the address count carry signal at pin 9 causes the Q output (pin 15) to go HI, indicating a complete store cycle has occurred and all stored data is "good data".

Page 3-11, right column, third paragraph. The circuit description for the -4.8-Volt Supply should read as follows:

-4.8-Volt Supply

The -4.8-Volt Supply is derived from the 25-volt ac windings of the transformer in the power module. The ac input is rectified by CR904, then filtered by C904, L905, and C905. The resultant dc source is converted by a switching regulator to -4.8 volts. Zener diode VR922 and transistor Q922 maintain a constant current through VR920 to establish a reference voltage. The reference voltage at the wiper of R925 is applied to the base of Q914.

CHANGE:	DESCRIPTION

Q905 is a series switching regulator that produces a rectangular power waveform whose energy is stored in T911. The negative transition of Q905 is coupled through C911 and R912 to the base of Q914 to control the on-time of Q914. The positive transition of Q905 is coupled through C911, R912, C927, and R927 to the base of Q928, resulting in a fast turn-off time for Q905.

Transistors Q914 and Q916 compare the output voltage with the reference voltage from R925. If the output voltage is more negative than the reference, the on-time of Q914 becomes less, reducing the on-time of Q910 and Q905. The amount of energy stored in T911 is thereby reduced, pulling the output voltage positive. When the output voltage becomes less negative than the reference voltage, Q914 conducts longer, increasing the on time of Q910 and Q905. The amount of energy stored is thereby increased and the output goes more negative.

Zener diode VR932 and SCR Q932 provide over-voltage protection for the IC's connected to this supply. If the output voltage exceeds about -6.2 volts, Q932 switches in, shorting the -4.8-Volt Supply and blowing fuse F905.

Page 4-3, left column, last paragraph, should read as follows:

The Trouble shooting Charts in the Diagrams section (or the following procedure) can be used as a guide for troubleshooting the LA 501. Both the charts and the procedure check the simple trouble possibilities before proceeding with extensive trouble-shooting. The first few checks ensure proper connection, operation, and adjustment. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, it should be replaced using the replacement procedure given under Corrective Maintenance.

CHANGE:	DESCRIPTION

Page 4-3, right column, following the last paragraph, add the following:

NOTE

If the selector block is in the H position (108 V AC to 132 V AC) adjust the autotransformer for 120 V AC.

Page 4-4, Table 4-1. Change the Maximum Ripple Peak-to-Peak specification for high frequency to 100 mV in both cases.

Page 5-4, right column.

CHANGE: Add the following Step 4.

4. Check that the positions of the internal jumpers are as follows:
   a. P831 jumper from pin 1 to pin 2.
   b. P629 jumper from pin 1 to pin 2.
   c. P608 jumper from pin 2 to pin 3.
   d. P136 jumper from pin 1 to pin 2.
   e. P100 jumper from pin 1 to pin 2.
   f. P101 jumper from pin 2 to pin 3.
   g. P120 jumper from pin 1 to pin 2.

Page 5-12, right column, under heading E5. CHECK HORIZONTAL LINEARITY.

CHANGE: Part d should read as follows:

d. Horizontally position display so that left 1.0% of display is off screen.

Page 5-12, right column, bottom of the page.

CHANGE: Add the following text.

E6. CHECK CLOCK TICKS

a. Check the display in full vertical and horizontal magnified position for usable bipolar Clock Ticks on all four displayed channels.

b. Check that the clock ticks are negative ticks for a logic 1 and positive ticks for a logic 0.

CHANGE:	DESCRIPTION

Page 5-13, right column.

CHANGE: Delete Steps F1 j through p.

Change Step F1 i to read:

i. Check for a clean, symmetrical 50 MHz ECL display.

Page 5-15, left column, at Step F7 g,

CHANGE: Add the following material:

Set SAMPLE INTERVAL to EXT. Connect 10X probe to the EXT CLOCK BNC connector. Connect the probe tip to Test Point TP820 and repeat part c again for Channel 7.

Page 5-17, right column, Step G2.

CHANGE: Insert the following text between the heading and part a:

a. Change P629 jumper position to pins 2 and 3.

CHANGE: Re-letter the parts a through h to b through i.

CHANGE: Add the following text at the end of G2:

j. Return P629 jumper position to pins 1 and 2.

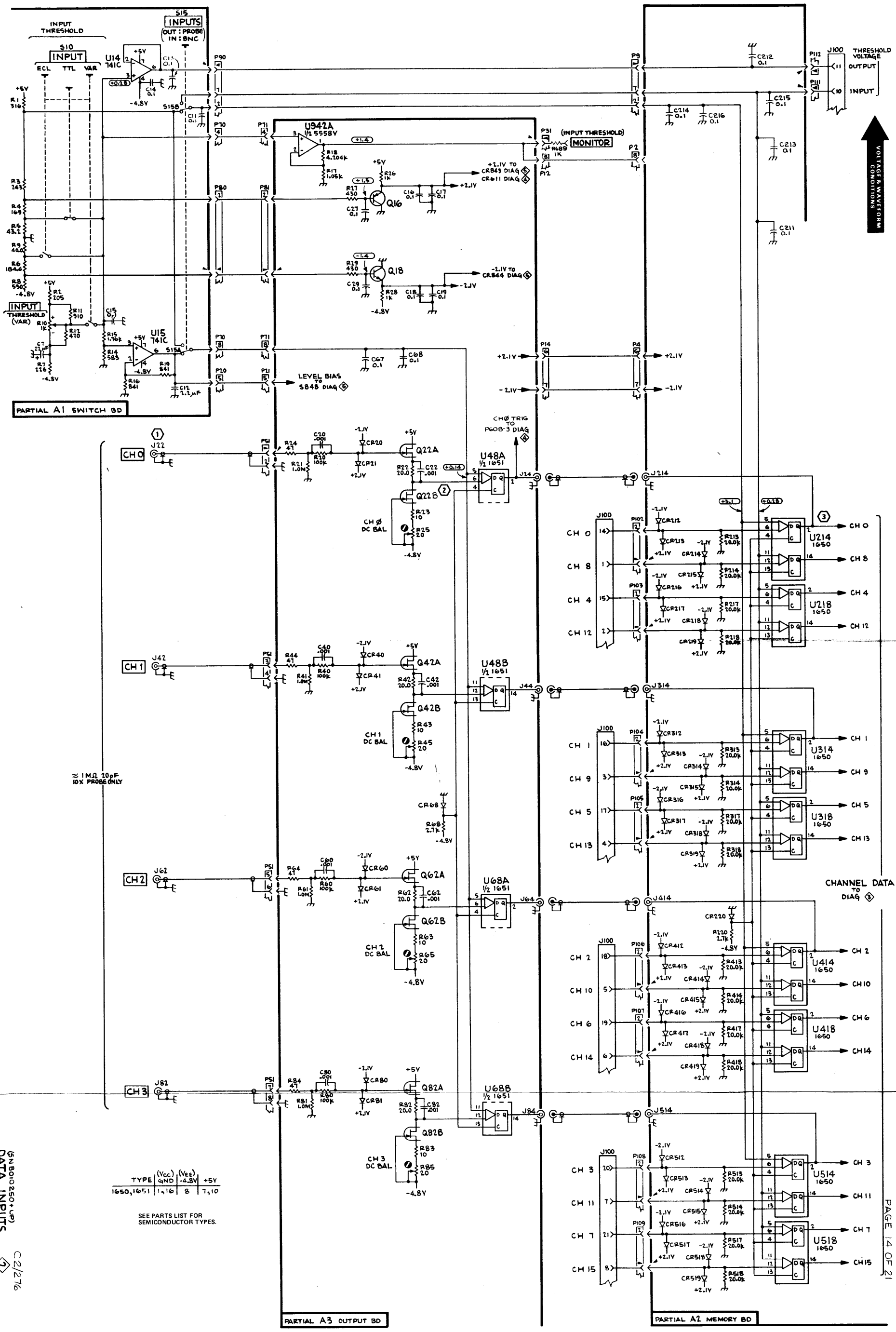
LA501

FRONT PANEL WIRING
(SN B010250+UP)

C2/27G

PAGE 13 OF 21

LA501

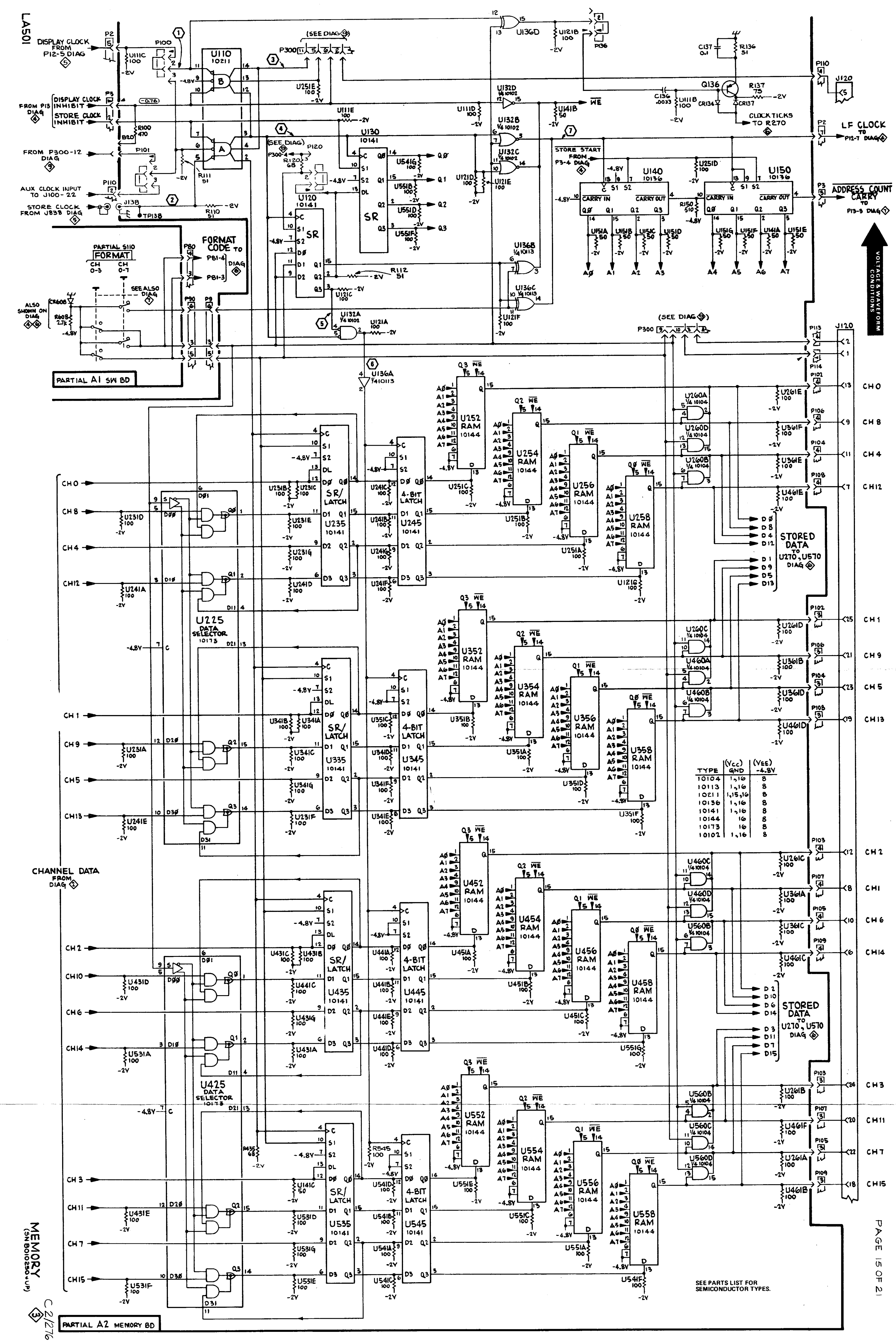


TYPE	(Vcc) GND	(VEE) -4.8V	+5V
1650,1651	1,16	8	7,10

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

DATA INPUTS (5NB010250+UP)

◇2 C2/276



TYPE	(Vcc) GND	(VEE) -4.8V
10104	1,16	8
10113	1,16	8
10211	1,15,16	8
10136	1,16	8
10141	1,16	8
10144	16	8
10173	16	8
10102	1,16	8

MEMORY (SN B010250-UP)

C 2/276

VOLTAGE & WAVEFORM CONDITIONS

PARTIAL A1 SW BD

S605 RECORD — DISPLAY TIME / MANUAL

CR609, R604 10K, R605 100K, CR608, R608 2.7K, -4.8

P20, P21

U608B 1/4 10102, U608A 1/4 10102, -0.7G

U601D 100, -2V

U601E, -2V

U610A 1/4 10113

R607 1K

PARTIAL A2 MEMORY BOARD

SEE NOTE 5 DIAG 5

P300

P4, P14

R606 330, Q606, Q604, Q602, R601 820, R602 1.8K, R603 10K, C606 100µF

-4.8V

LF CLOCK FROM P2-7 DIAG 3

P12

PARTIAL A2 MEMORY BD

P14, P4, P13, P3

STORE START TO U140-7, U150-7 DIAG 3

P112, J120, 15 RECORD ENABLE

STORE START TO U628-5 DIAG 7

U616A 1/2 10131, U611B 100, -2V

U615B 1/2 10131

-4.8V, -0.7V, -1.5T, -0.7G

P13 DISPLAY CLOCK INHIBIT TO P3-1

STORE CLOCK INHIBIT TO P3-2

DIAG 3

DISPLAY CLOCK INHIBIT TO U610B & U610D DIAG 7

STORE CLOCK INHIBIT TO U628-6 DIAG 7

R614 100, -2V

U601B,C 100, -2V

U608D 1/4 10102

FLAG TO U628-12, R632 U632-11, CR726 DIAG 7 & U630-13 DIAG 6

CARRY IN, U622 10136, CARRY OUT

U621B 100, -2V

U624 10136

U631D 100, -2V

U601A 100, -2V

CR615, R615 2.7K, -4.8V, -0.7V, -0.7V TO U830B-13 DIAG 5, U630-7 DIAG 6, S720B DIAG 6

VARIABLE THRESHOLD TRIGGER FROM DIAG 5 P831-4

U631C 100, -2V

U830A 1/2 1651

C610 .001, R610 1K, CR610, CR611, +2.1V, C611 .01, +5V, R612 750, R611 300, -0.7V

U632B 1/4 10102

U610C 1/4 10113, U611C 100, -2V

U601F 100, -2V

U608C 1/4 10102

TRIGGER LOCKOUT FROM DIAG 7 P629-2

U616B 1/2 10131

U615A 1/2 10131

Q620, U611A 100, -2V, R620 510, -4.8V

P21, P20, +5V, CR620 TRIG'D

EXT TRIG J609, P610, 1

R613 33, CH0 TRIG FROM U48-2 2

AUX TRIG FROM P553 DIAG 5

P608

PARTIAL A3 OUTPUT BD

P71, P70

S608 SOURCE (OUT: CH0, IN: EXT)

S610 SLOPE (OUT, IN: +, -)

S625 TRIGGER — POST, CENTER, PRE

P80, P81

ALSO SHOWN ON DIAG 3 — CR608, R608 2.7K, -4.8V

PARTIAL A1 SW BD

TYPE	(Vcc) GND	(VEE) -4.8V	+5V
1651	1,10	8	7,10
10102	1,16	8	
10107	1,16	8	
10113	1,16	8	
10131	1,16	8	
10136	1,16	8	

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

LA501

TRIGGER (SN B010250+ UP)

C2/276

4

VOLTAGE & WAVEFORM CONDITIONS

TYPE	(Vcc) GND	(VEE) -4.8V	+5V
1651	1,16	8	7,10
10102	1,16	8	
10138	1,16	8	
10164	1,16	8	
10174	1,16	8	

TO S825

PIN7 PIN9 U824

S825 SAMPLE INTERVAL SHOWN IN 50 nS POSITION

EXT, nSEC, μSEC, mSEC

PIN 2, PIN 7, PIN 10, PIN 9 TO U820

SEE DIAG 3

L800 285 nH

C800 10

U800D 1/4 10102

U800B 1/4 10102

U800C 1/4 10102

C801 0.1

U821C 100 -2V

R800 5.1K

Y800

U801F 50 -2V

U801G 50 -2V

-4.8V

U810 10138

U812 10138

U814 10138

U816 10138

U818 10138

U820 10164 DATA SELECTOR

U801E 50 -2V

U801D 50 -2V

U801C 50 -2V

U801B 50 -2V

U811G 100 -2V

U811E 100 -2V

U811D 100 -2V

U811B 100 -2V

U811A 100 -2V

U811F 100 -2V

U811C 100 -2V

TP 820

DISPLAY CLOCK S835

INT DISPLAY

EXT DISPLAY/RECORD

EXT DISPLAY

DIAG 4 U830-2

P831

CLOCK POLARITY

U824 10174 DATA SELECTOR

FROM S825 POS 3, POS 6

U828 10138

U821B 100 -2V

U821C 100 -2V

U821E 100 -2V

U831C 50 -2V

U831A 50 -2V

U831B 50 -2V

U838 10174 DATA SELECTOR

P16

C825 0.1

C826 0.1

P825

CLOCK STATUS TO MEMORY BOARD P555 DIAG. 9

STORE CLOCK TO J138

DISPLAY CLOCK TO P2-5

DIAG 3

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

PARTIAL A2 MEMORY BD

1 MHz CLOCK TO MEMORY BOARD P555 9

EXT DISPLAY CLOCK INPUT J120 P112 P1 P12

LEVEL BIAS FROM P21-5 DIAG 4

S848

R829 49.9

R830 1.87K -4.8V

C830 0.1

EXT CLOCK THRESHOLD SW

U830B 1/2 1651

-0.7V FROM R615 DIAG 4

EXT CLOCK J829

J830

L841 83 nH

R841 47

R843 1.00M

R844 100K

C844 .001

C845 0.1

-2.1V

CR844 0.0V

Q846A

CR845 +2.1V

R846 20.0

C846 .001

0.0V

Q846B

EXT CLOCK DC BAL

R842 10

R845 20

R847 10

C847 0.1

-4.8V

+5V

MONITOR J846 P845

PARTIAL A3 OUTPUT BD

LA501

C 2/276

TIME BASE (SN B0102.50+ UP) 5

VOLTAGE & WAVEFORM CONDITIONS

PARTIAL A1 SW BD

-4.8V → P30 → DS565 CHANNEL SELECT

STORED DATA FROM DIAG 9

U270 10164

U261G 100 · U561C 100 · U361G 100 · U561E 100 · -2V

U570 10164

U461A 100 · -2V

R102 470 · R270 75 · R101 470 · R567 2.7k · CR567 · CR566

CLOCK TICKS FROM CR136 3

SHOWN IN OFF POSITION

5565 CHANNEL POSITION SELECT

OFF 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

2 3 1 4 5

U565 10113

SEE NOTE* DIAG 9

P300

PARTIAL A2 MEMORY BD

P4 P14 P1 P11

CHANNEL POSITION 'POSITION'

-33.5 R565

P80-4 DIAG 3 · P80-3 DIAG 3 · P81

FORMAT CODE FROM

U632D 1/4 10102 · U632A 1/4 10102 · -1.5T

FLAG FROM U632-3 DIAG 4

-0.7V FROM R615 DIAG 4

U630 10136 CARRY OUT / CARRY IN

U631B 100 · U631A 100 · -2V · -4.8V

J120 SERIAL DATA OUTPUT

Q629 · Q628 · Q698 · Q694 · Q684 · Q682 · Q680 · Q672 · Q670 · Q662 · Q660 · Q652 · Q650 · Q642 · Q640 · Q674 · Q664 · Q654 · Q644

R628 100 · R629 8.2k · R624 1k · R626 510 · R627 5.1k · R625 100 · C625 68µF · -4.2

R698 100 · CR693 · CR694 · R697 620 · J698 · J699 · Y VERT OUT · R696 118 · R695 2.5k MAG · R694 430 · R690 1k POS · R691 240

R692 100 · C692 68µF · R693 330

R684 1k · R681 270 · -1.3 · R682 750

C686 .001 · R686 51 · R688 4.3k · VR688 15V · -33.5V

R680 1.5k · C680 0.1 · R683 1.8k

R672 1k · R662 1k · R652 1k · R642 1k

R670 3.65k · R660 7.32k · R650 18.2k · R640 36.5k

R685 470 · -4.8V

PARTIAL A3 OUTPUT BD

TYPE	(Vcc) GND	(VEE) -4.8V
10102	1,16	8
10113	1,16	8
10136	1,16	8
10164	1,16	8

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

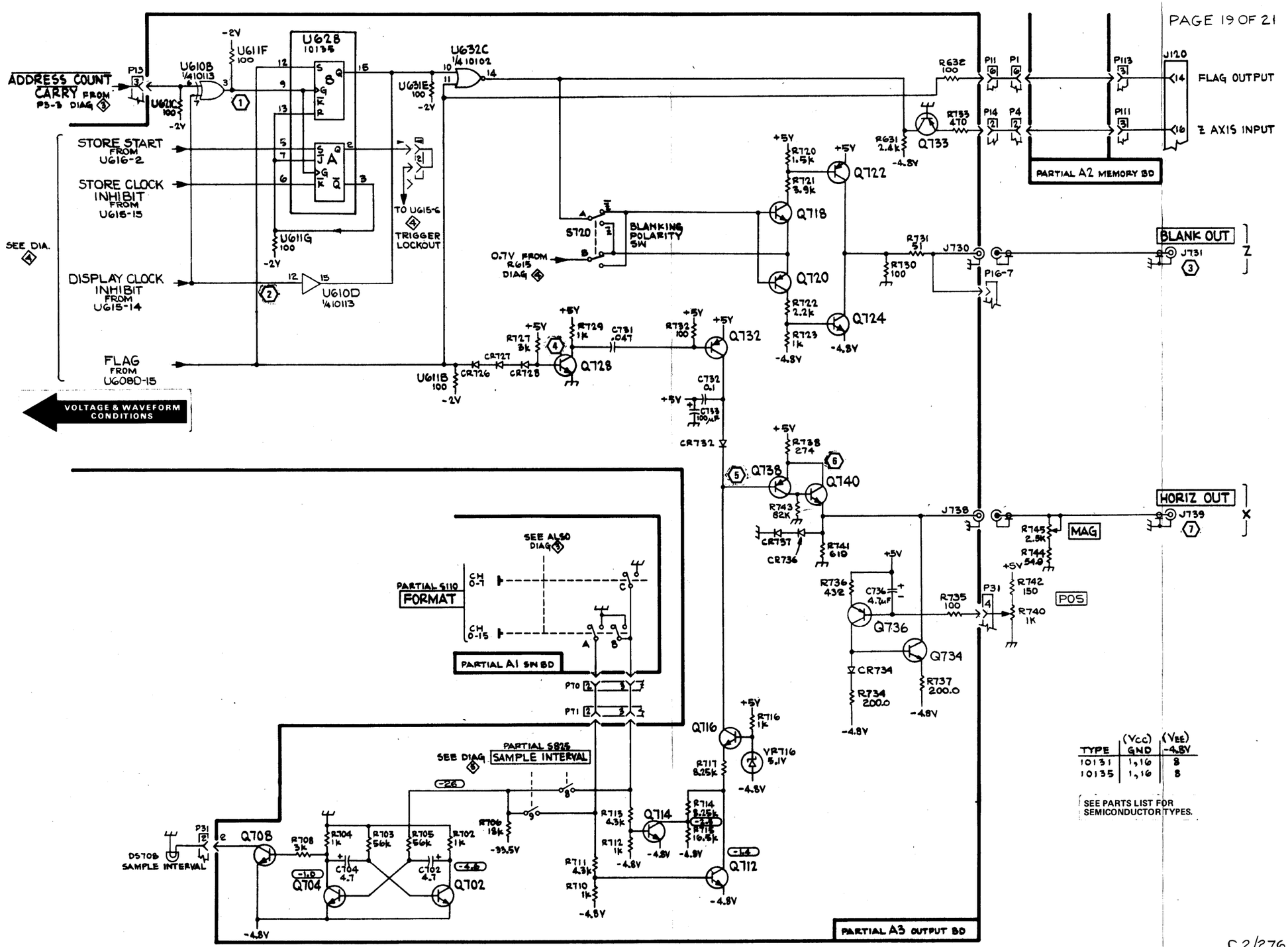
(SN B010250 + UP)

C2/276

SERIAL LOGIC AND VERTICAL SIGNAL OUTPUTS 6

LA501

55% R75-9



TYPE	(Vcc) GND	(VEE) -4.8V
10131	1,16	8
10135	1,16	8

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

C2/276

HORIZONTAL AND BLANKING SIGNAL OUTPUTS (SN B010280 & UP) 7

LA501

VOLTAGE & WAVEFORM CONDITIONS

PARTIAL A2 MEMORY BD

PARTIAL A1 SW BD

J100 COMMON GROUND 13 — P115 — P9 — P90

-4.8V OUTPUT 12 — P113 — -4.8V

J120 COMMON GROUND 17 — P110

P30: +5V, -4.8V — FRONT PANEL POWER

P80: -4.8V — P81: -4.8V

P10: +5V — P11: +5.2

TYPE	(Vcc) GND	(VEE) -4.8V
10102	1,16	8

U942B 1/2 5558

R942 390, R944 240, C943 100µF, VR942 5.1V, Q944, C944 0.1, C942 220µF, VR943 15V, R943 2k, -33.5V

R571 2k, VR571 15V

F510 1A

+33.5V, +11.5V, +5V, -2V, -4.8V, -33.5V

CR563, CR564

C563 0.1, C564 0.1

TP944

U800A 1/4 10102 (-1.4)

Q934 (-2.9), Q936 (-3.9), R934 43, R936 470, C934 2.2µF, C936 0.1

C561 0.1, C562 2.2, C565 0.1, C566 2.2

TP 933

TO/FROM MAINFRAME

* Q914 AND Q916 THERMOCOUPLED

Q914, Q916, R914 301, R912 430, R910 680, Q910, R905 180, Q905, R911 3.6, C911 650, CR905, T911, TP905 (3), CR928

Q932, VR932 5.6V, R932 210, C932 0.1, C933 290µF, C950 2.2µF, C951 0.1, C952 0.1, C953 0.1, C954 0.1, C955 0.1, C956 2.2µF

C912 290µF, L932 12µH

CR904, C904 2000µF, C905 20µF, F905 2.5A FAST BLO, L905 2.5µH

C568 0.1, C569 0.1

C571 47µF, C572 2.2, C573 0.1, C574 0.1, C575 0.1, C576 0.1, C577 0.1, C578 0.1, C579 2.2

Q928, VR926 5.1V, R928 82k, C926 .01, C927 0.1, R927 1k, R929 1.1k

C929 33µF, C925 0.1, R926 909, R925 100, R923 232, VR920 6.2V, R922 300, R920 24k, Q922, VR922 10V, R921 750, C928 2.7µF

TO/FROM MAINFRAME

8A, 8B — -33.5V — F510 0.1A

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

PARTIAL A3 OUTPUT BD

PARTIAL A2 MEMORY BD

C2/276

LA501

@

POWER SUPPLIES (8)
(SN B010250+ UP)

60% R76-9

WIRING INTERCONNECTIONS (SN B010280 & UP)

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MANUAL CHANGE INFORMATION

PRODUCT LA 501
EFF SN B010250-up

CHANGE REFERENCE C3/576
DATE 5-18-76

CHANGE:	DESCRIPTION

070-1967-00

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO: (Pilot Change #22, EFF SN B010250-up)

R270	315-0750-00	RES.,FXD,CMPSN:75 OHM,5%,0.25W
R627	315-0512-00	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W

ADD:

C11	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V (C276/Dia 2)
C13	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V (C276/Dia 2)
C211	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V (C276/Dia 2)
C825	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V (C276/Dia 5)
C826	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V (C276/Dia 5)
R545	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W (C276/Dia 3)
R689	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W (C276/Dia 2)

MECHANICAL PARTS LIST CHANGES

ADD:

	210-0004-00	1	LOCKWASHER,#4

REMOVE:

	131-0608-00	3	CONNECTOR,TERMINAL PIN

(Pilot Change #24 EFF SN B010275-up)

ADD:

C132	281-0564-00	CAP.,FXD,CER DI:24PF,5%
VR903	152-0309-00	SEMICOND DEVICE:ZENER,1 W,6.2V, 1N3828A

(Pilot Change #25 EFF SN B010325-up)

CHANGE TO:

C928	283-0212-00	CAP.,FXD,CER DI:2UF,20%,50V
Q606	151-0504-01	TRANSISTOR:SILICON, N-CHAN,UNIJUNCTION,CHECKED

CHANGE:	DESCRIPTION

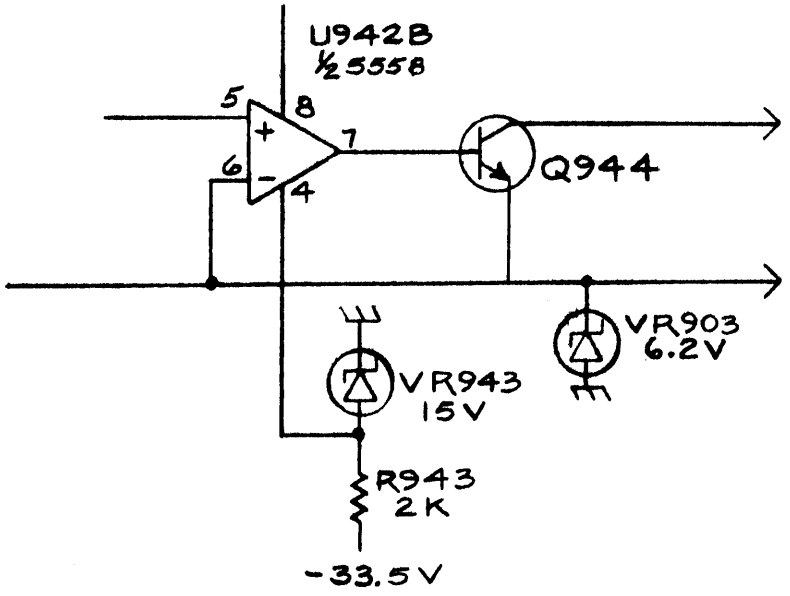
SCHEMATIC CHANGES

DIAGRAM 3 (C2/276)

C132 is added between pins 2 and 4 of U132A on the Memory board.

DIAGRAM 8 (C2/276)

VR903 is added from ground to the +5V supply on the OUTPUT board.



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MANUAL CHANGE INFORMATION

PRODUCT LA 501
EFF SN B010405-up

CHANGE REFERENCE C4/676
DATE 6-2-76 REV. 6-8-76

CHANGE:	DESCRIPTION

070-1967-00 Pilot Change #29

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO:

R110	315-0820-00	RES.,FXD,CMPSN:82 OHM,5%,0.25W
R111	315-0750-00	RES.,FXD,CMPSN:75 OHM,5%,0.25W

REMOVE:

R101	317-0471-00	RES.,FXD,CMPSN:470 OHM,5%,0.125W

ADD:

C609	283-0023-00	CAP.,FXD,CER DI:0.1UF,+80-20%,12V

Add C609 from pin 11, U610 to ground shown on diagram 4 on insert C2/276.