11301/11302

PRELIMINARY

SERVICE INFORMATION

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THEORY OF OPERATION

(PRELIMINARY) THEORY OF OPERATION

NOTE

The following information is preliminary in nature and subject to change. Descriptions for some circuitry was not yet available at the time of this printing. Check below under Contents for the names of all circuits discussed in this printing.

Section headings appearing in the following discussion correspond with the titles of related schematic diagrams. The discussion for each circuit is further divided by headings coinciding with the names of major stages or components on the schematic diagrams.

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LINE INVERTER, RECTIFIERS, & CONTROL



The Line Inverter, Rectifiers & Control circuits provide semi-regulated DC voltages to the Regulators circuit.

Line Interface

Power is applied through line filter FL99, line fuse F99, and PRINCIPAL POWER switch S130. Line Filter FL99 prevents power-line interference from entering the instrument and noise (in the range of 1 MHz to 1 GHz) generated within the instrument from entering the line.

Resistor R99 serves to discharge the line capacitors in front of the line-frequency bridge rectifier and prevents a shock hazard from contact with the power connector pins when the power cord is disconnected.

Primary line fuse F99 prevents a fire hazard resulting from an improper setting of the LINE VOLTAGE SELECT switch, or from a major fault in the line-side circuitry.

PRINCIPAL POWER switch S130 disconnects both sides of the line. It is located on the rear panel and is not intended to be the primary means of switching the instrument on and off; this function is performed by the front-panel ON/STANDBY switch.

Capacitors C140 and C230 serve to bypass differential-mode noise generated by the reverse recovery of the line-frequency rectifiers. Thermistors RT130 and RT240 limit the initial surge current when charging line filter capacitors C200, C310, C220, and C320. The thermal time constant of these thermistors is matched to the discharge time of the line filter capacitors and is provided by bleeder resistor R220. This ensures continued surge current limiting when the instrument is switched off and on several times in succession. Once the thermistors warm up, they have negligible effect on the input current.

Spark gaps E231 and E230 prevent over-charging of the line filter capacitors due to improper setting of the LINE VOLTAGE SELECT switch or from high energy differential-mode line transients.

CR340 operates as a full-wave rectifier when S250 is set for 230-volt operation and as a voltage doubler when S250 is set for 115-volt operation. In doing so, 230 to 380 volts DC is maintained across R220 for either setting.

A neon flasher circuit consisting of R640, DS640, and C640 indicates when hazardous voltages are present on the line filter capacitors. R220 discharges these capacitors in about two minutes after power is removed.

Transformer T440 provides the line trigger signal and power for the Standby Power circuit when the front-panel ON/STANBY switch is off and the rear-panel PRINCIPAL POWER switch is on.

Pulse Width Modulator

The primary means of controlling the output voltages from the Low-Voltage Rectifiers is the the Pulse Width Modulator (PWM). PWM transistors Q600 and Q601 are power MOSFET devices. They operate in conjunction with L520 and CR620 to form a negative buck switching regulator, operating at a fixed frequency of 100 kHz. By controlling the conduction time of either transistor, the DC voltage applied to the 50 kHz Inverter (across C630 and C631) can be varied from 0 volts up to the maximum voltage available across the line filter capacitors. Each of the PWM transistors conducts current on alternate switching cycles; they never conduct at the same time. The control voltages for the gates of the PWM transistors are provided by T710. Resistors R600 and R610 set the switching speed of the PWM transistors.

The 100 kHz variable-duty square wave developed at the drains of the PWM transistors is filtered by L520, C630, and C631. CR620 provides a path for the continuous DC current flowing in L520 when neither PWM transistor is conducting current.

Capacitors C400, C401, and C500 provide a return path for common-mode current transients flowing in the chassis. Transients of this type are caused by stray capacitive-coupling of the switching waveforms to the chassis. T410 decouples these noise sources further. The leakage inductance of transformer T410 (appearing as a differential-mode inductance to the PWM), in conjunction with C500, forces a continuous DC current to be drawn from the line storage capacitors.

Primary Current Sense

Primary current-sense transformer T700 samples the instantaneous current flowing in each PWM transistor. Q800 and Q801 clamp the secondaries of T700 to one base-emitter drop, giving true current-transforming operation. Current sense signal +CS is used to control the current flowing in the PWM transistors. It is used for both protection and feedback control.

50 KHz Inverter

The primary function of the inverter is to convert the DC voltage provided by the Pulse Width Modulator into a 50 kHz square wave. The 50 kHz inverter MOSFET devices, Q610 and Q620, are driven by a 10-volt peak, 50 kilohertz square wave from gate drive transformer T720. Cross conduction (i.e., both transistors conducting at the same time) is prevented by R620 and R611 working into the gate-source capacitance of Q620 and Q601. During the 100 nanoseconds when neither transistor is conducting, diodes CR601 and CR620 provide a current path for mutual inductances and leakage current of the transformer. When the transformer primary current decays to zero, the respective MOSFET is biased on, ready to conduct; thus, no initial conduction losses are associated with the half-wave bridge.

In the event of an inverter over-voltage condition, spark gap E630 will fire and clamp the inverter input voltage to a safe level. If the over-voltage is caused by a shorted PWM transistor, the spark gap will continue to conduct current until fuse F410 is opened and inverter capacitors C630 and C631 discharge. If the over-voltage condition is caused by an open feedback path, the control circuit will limit the current to a level below that required to clear F410 and will then initiate a restart cycle, extinguishing the spark gap.

Rectifiers

Four separate sets of power transformer windings in T130 and T240 step the 50 kHz Inverter voltage down to the level required to generate eight semi-regulated outputs: +54, +17, +7, +5.2, -5.2, -7, -17, and -54. Both power transformers operate in parallel but have different volt-

second/turn ratio values in order to establish the proper output voltages.

After rectification and filtering, the semi-regulated outputs pass through current sense resistors which are actually circuit board traces tapped at specific lengths. The voltage across these traces is proportional to the current at the ouput terminals. These voltages (approximately 25 mV at the rated current) are used by the control circuit to limit fault currents in the mainframe or plug-in units and to provide a diagnostic feature. The exception to this type of sensing is the + and -50 volt outputs, whose currents are sensed by R535, R636, and R637. The current is then level-shifted by Q530 and Q630.

Inverter Voltage Sampler

CR250, CR251, C251, R240, and Q103 form a sample and hold circuit that provides a voltage proportional to the inverter input voltage. This voltage provides feedback the the Error Amplifier circuit.

Ramp Injection

The ramp injection circuit consists of Q210 and associated components. The ramp signal is generated by charging C216 through R313. This voltage ramp is converted to a current by Q210, with R312 setting the magnitude of the injected current and, therefore, the loop gain. The ramp generator is reset periodically by either the 100 kHz clock pulse or by the end of the Pulse Width Modulator "on" time, whichever comes first. (Normally, the PWM signal from pin 1 of U200A, acting through CR200 and Q213, occurs first.) CR311 prevents ramp capacitor C216 from discharging completely, leaving a small DC bias current in the ramp signal to hold off the converter during the power-up sequence.

Current Limit Comparator

The primary current sense signal and the injected ramp current are summed and converted to a voltage by R305. The voltage across R305 (proportional to the instantaneous current in the PWM switching transistors) is applied to current-limit comparator U410C. When the current in PWM inductor L520 rises to a level determined

by the error signal, the comparator resets latch U200A and ends the switching cycle. A new switching cycle is initiated by the 100 kHz clock pulse, which sets the latch, turning "on" the alternate PWM transistor until it is again reset by the current limit comparator. The error signal at the noninverting input to the current-limit comparator therefore establishes the magnitude of current flowing in PWM filter inductor L520 by controlling the "on" time of the PWM power switching transistors.

Error Amplifier

The +5.1S and +5.1I error signals are summed by error amplifier U400B. The ouput terminal voltage is set by the +5.2 REF voltage, which is generated by U800 and set with 5.2 Ref Adj adjustment R800

Soft Start

Shutdown of the converter is accomplished by ramping down the reference voltage input to the Error Amplifier. The RST(L) signal discharges soft start capacitor C411 through CR313, Q410, and R324. All supplies will track this signal down to zero, where they will stay until Fault Delay Latch U420C (diagram 3) times out. The RST(L) signal also pulls down the PFSET line, latching the POWERFAIL signal TRUE (high) and turning the LED's on for the duration of the time out. This occurs because the signal from the Current Limit Comparator ends.

After the 200 millisecond time out on the Fault Delay Latch, the clamp is removed from the 5.2 REF input to the Error Amplifier. This allows the ouput voltage to rise at the rate determined by R323, charging Soft-Start capacitor C411. The output voltages will track this rise, which has a time constant of approximately 10 milliseconds. After a delay of 20 milliseconds, as determined by the clamp network of R326, C323, and CR321 (diagram 3), Power Fail Detect comparator U420D (diagram 3) is reset, which turns of the voltage fault LED's and signals the mainframe that the output voltages are stable.

Standby Power

Components CR750 and C850 rectify and filter the secondary voltage of transformer T440, providing 17-30 volts to power the remote line switch and standby control. This voltage is regulated to 16 volts by a series-pass regulator composed of Q840, Q740, VR830, and associated components. Zener VR830 and divider R832-R833 are the positive and negative inputs to differential amplifier Q740. The output of the differential amplifier is the error voltage and is applied to the base of PNP series-pass transistor Q840. Stability compensation is provided by C730.

When the power conversion circuitry is started, power is supplied by the inverter through the +17 V line, acting through CR630. This shuts off Q840 and unloads the line trigger power transformer, which would otherwise cause distortion of the line trigger signal.

Power is applied to the control circuit by grounding the DCPWRSW line, which turns on Q100. This is done by the remote power switch, located on the front panel. Three-terminal regulator U300 sets the control circuit voltage ot +12 volts.

100 KHz Clock

When power is first applied, the fault delay latch is set and prevents start-up of the power conversion circuitry. Meanwhile, the 100 kHz clock pulse generator, made up of comparator U410D and associated components, is allowed to stabilize. The frequency of the clock is set by R300, charging C310 to a voltage set by the divider R316-R301. The pulse duration is set by C312.

Gate Drive

The 100 kHz clock pulse toggles divide-by-two flip-flop U200B. This provides the balanced 50 kHz Inverter. U200 buffers both the PWM and 50 kHz Inverter signals, providing sufficient current to drive the gate transformers as well as the charge pumps formed by CR110, CR111, CR112, CR113, and C212, C213, C214, and C215. These charge pumps establish the +22 V and -10 V supplies. The input logic in Gate Drive IC U200 provides the alternating drive required by the PWM gate

transformer. Dampening and blocking are provided by R212-R111 and C120-C121, respectively. R201 and C200 create a time delay that holds the PWM latch in U200A reset when power is first applied.

Line Trigger

The line trigger signal is applied to differential-to-single-ended amplifier U710A via the + and -LINE signals. R729 and R735 set the output impedance and magnitude of the line trigger signal, LTRIG, (used by the mainframe and plug-in units) to less than 470 ohms and from 1 volt to 3 volts peak to peak.

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FAULT DETECTION 3

The Fault Detection circuit provides protection and diagnostics for the Regulators circuit (diagram 4) and the Line Inverter, Rectifiers and Control circuit (diagram 3). The purpose of the protection circuitry is to prevent single faults in the power supply or mainframe power busses from becoming multiple faults. It accomplishes this by forcing an orderly shutdown of the power conversion circuitry, followed by restart attempts at regular intervals. Since all fault conditions have the same result (i.e., shutdown of the converter), diagnostic features have been added to assist in locating the source and cause of the fault condition. A fault is identified as a persistent condition of excessive current, voltage, or temperature in the power supply, mainframe, plug-in units, or accessories.

Digital Current Sense

The overload fault sequence begins when the voltage drop across one of the current-sense trace resistances exceeds a reference level (about 25 mV) for several switching cycles (20 microseconds), tripping one of the current sensing comparators, U610C, U610A, U610D, U610B, U410A, U620D, or U620B. The reference levels for the comparators are set by zener diode voltage divider networks (e.g., VR630, R635, and R630) which establish the reference and, therefore, the current limit point for the +5.1 outputs.

Once tripped, the first action of the comparator is to pull down the PFSET (Power Fail Set) line, which is an analog OR of all the comparator outputs. This signal trips Power Fail Detect comparator U420D, turning on Q730, which pulls the PWRUP line down to signal to the mainframe that a power failure is imminent. This signal also turns on Q430, supplying current to all diagnostic LED's via the LIGHTS(H) line. Meanwhile, the current sense comparator signal fires one of the PUT devices (e.g., Q721), which bypasses the LED current and extinguishes only the LED associated with the particular fault condition; all other LED's remain on.

Tripping the current sense comparator also begins a time delay, determined individually for the various outputs by discharging capacitor C324 through the individual

resistors in the fault line (e.g., R513). During this delay, the LED's are lit, the PWRUP signal is FALSE (low), and the power conversion circuitry attempts to clear the fault by providing maximum available power to the load. This time delay is approximately one millisecond, allowing time to charge capacitors during transient loads. If the fault is cleared within this time, the LED's are extinguished and the PWRUP line is opened, resuming normal operation without disturbing the output voltages.

Analog Current Sense

The Analog Current Sense circuit operates in the same manner as described for the Digital Current Sense circuit.

Primary Current Limit Detect

The primary current is limited on a cycle-by-cycle basis by simply clamping the output of the error amplifier. VR300 does this by setting the peak current in the switching transistors. The zener clamps current flow through R303, turning on Q400, which, after a ten millisecond delay, trips the Power Fail Detect and Fault Delay Latch, inititing converter shutdown.

Fault Delay Latch

If a fault persists, the Fault Delay Latch formed by C324 and comparator U420C is set, pulling down restart line RST. This signal initiates shutdown of the power conversion circuitry, which will remain off for the duration of time determined by C325, R314, and R305 (approximately 200 milliseconds).

Fault LED Driver

This circuit completes the current path through LED's DS533, DS630, DS530, and DS531. Q720, Q721, Q432, and Q431 respectively determine which LED's are illuminated.

Digital Voltage Sense

Over-voltage and under-voltage faults are detected by the Digital Voltage Sense circuitry. The +5 and -5 volt supplies are sensed by VR700 and VR701, respectively. Exceeding the zener voltages causes Q700 and Q701 to turn on, tripping the DIGVF indicator, DS533. A voltage fault of the post-regulated analog supplies is sensed by a Regulator circuit whose ouput is OR'd with the fault line by CR722 and CR721 to generate a restart.

Thermal Fault Sense

An over-temperature condition, caused by inadequate air flow, is detected when thermal sensor U730 reaches 75°C. This is converted to a fault signal by comparator U710C. Shutdown of the converter will continue until the sensor has cooled to 50°C; only then intitiating a restart cycle.

Power Fail Detect

Power fail detection is accomplished by monitoring the duty cycle of the pulse-width modulator (PWM). The PWM(L) signal is converted to a DC voltage by the integrator formed by R328, R320, R327, C320, and C321. Since the input to the integrator is the logical "NOT" of the PWM signal, the DC output of the integrator is directly proportional to the rectified AC line. When this voltage drops below a level set by divider R330-R329 (corresponding to a duty cycle of 95%), comparator U420D pulls down on the PWRUP signal and lights all diagnostic LED's. Power conversion continues until an under-voltage condition is detected, giving the mainframe time to prepare for a power failure. Once the rectified line voltaged has dropped below the minimum regulation range (190 VDC), the converter is shut down by the under-voltage detect circuit, leaving a substantial stored charge in the line storage capacitors. This prevents large surge currents when the AC line is reapplied and the thermisters are still hot.

Fan Speed Controller

Transistor Q740 and associated components comprise the fan speed modulator. A 10 Hertz pulse-width modulated signal from the fan speed controller (FAN PWM) sets the DC fan speed by pulsing it on, then allowing it to freewheel through diode CR840. Fuse F840 protects these devices from any faults on the fan line.

The fan speed controller, consisting of U730, U710B, and associated components, functions as a limited range feedback control system and attempts to keep the temperature of the exit air stream constant over a specified range of ambient temperatures. The exit air temperature is sensed by U730 and converted to a DC voltage (VTEMP) by R732. This voltage becomes the reference for a 10 hertz pulse width modulator formed by operational amplifier U710B. The frequency of oscillation is set by C821, which with R729, serves as an integrator to convert the fan output back into a DC voltage. This voltage is then compared to VTEMP. The action of the circuit is to maintain the two voltages at the same average DC level. When a temperature rise is sensed by U710B, the pulse width to the fan is increased, and the fan speed increases to decrease the exit air temperature and maintain closed-loop control. To prevent the fan from shutting off entirely at low temperatures, which would defeat the temperature sensing of the air stream, the duty cycle is prevented from dropping below approximately 25%. This is provided by a low gain redundant feedback loop made up of R725 and C820 that takes over control when the fan duty cycle drops low enough to turn on rectifier CR723. This keeps the fan spinning slowly even at very low temperatures.

REGULATORS 4

The Regulators convert semi-regulated voltages into stabilized low-ripple output voltages.

Local Regulator Power

The operational amplifiers used for the +50, +15, +5, -5, -15, and -50 Regulators require that the following special voltages be generated for their operation:

(1) A +20 volt supply generated from the semi-regulated +54 V supply by reference zener diode VR732 and transistor Q720.

(2) A -20 volt supply generated from the semi-regulated -54 V supply by reference zener diode VR720 and transistor Q820.

(3) A +10 volt supply generated from the semi-regulated +54 V supply by zener diode VR730 and transistor Q730.

(4) A -10 volt supply generated from the semi-regulated -17 V supply by zener diode VR731 and transistor Q830.

(5) An adjustable reference supply (REF) generated from the semi-regulated +50 V supply by three-terminal regulator U730 and adjusted with R830.

+50 V Regulator

Semi-regulated +54 volts from the Line Inverter, Rectifier and Control circuit (diagram 2) is the the voltage source for this supply. Differential amplifier U220C compares the feedback voltage at pin 9 against the reference voltage at pin 10. The error output at pin 8 of U220C reflects a difference between these two inputs. A sample of the +50 V output is connected to pin 9 of U220C via divider network R241-R235. Notice that the feedback voltage of this divider is obtained from a line labeled +50 S (sense). If the feedback voltages were obtained at the supply, the voltage at the load would not stay constant, due to the resistance of the interconnecting cable between the supply and its load.

The sense configuration overcomes this problem by sensing the voltage at the load. Because the current in the sense line is small and constant, the load voltage is held constant regardless of the load current.

Regulation of voltage occurs as follows: If the +50 V Regulator output decreases (becomes less positive) due to an increase in load or a decrease in input voltage (as a result of a line voltage change or ripple), the voltage across divider R235-R241 decreases also. This results in a less positive level at pin 9 of U220C than that established by the REF supply at pin 10. This decreases the current through VR510 and causes an increase in current through the base-emitter junction of Q501. The result is increased conduction of Q501, the series regulator device. The load current increases and, therefore, the voltage across the load also increases sufficiently to balance the input to differential amplifier U220C. REF ADJ adjustment R830 sets the ouput level of this supply.

-15 V Regulator

Basic operation of the -15 V Regulator is the same as for the +50 V Regulator. The reference level for this supply is established through R130 at pin 12 of U230D. The divider ratio of R122-R135 sets a level of zero volts at pin 13. Any change at the output of the -15 V supply appears at pin 13 of U230D as an error signal. The output voltage is regulated in the same manner as described for the +50 V Regulator. Diode CR433 keeps the ouput of this supply from going more positive than about -4.4 volts if it gets shorted to one of the more positive supplies.

+5 V Regulator

The operation of the +5 V Regulator is basically the same as described for the previous regulators. Error voltage is provided through R134 to pin 6 of U230B and pin 5 is reference to the REF supply. The divider ration of R138-R139 is 2:1, so pin 5 of U230B is at five volts when the supply is operating normally. Any change at the output of the +5 V Regulator appears at pin 6 of U230B as an error signal. Diode CR431 limits the output of this supply to about -0.6 volt if it gets shorted to one of the negative supplies.

+15 V Regulator

The +15 V Regulator operates in the same manner as the +50 V Regulator. Error feedback voltage to pin 13 of U220D is provided through R236. Pin 12 of U220D is referenced to the REF supply. The divider ratio of R237-R236 sets pin 13 of U220D at +15 volts. Any change in the output level of the +15 V Regulator appears at pin 13 as an error signal. This results in an opposite change at output pin 14, which is conveyed to series regulator transistor Q400 through Q220 and Q311 to correct the error in the ouput voltage of the supply. Diode CR2420 limits the output of this supply to about 4.6 volts if it becomes shorted to one of the negative supplies.

-50 V Regulator

Operation of the -50 V Regulator is basically the same as described for the +50 V Regulator. Error voltage to pin 9 of U230C is provided by divider R224-R223 and is referenced to the -50 S (sense) line. The divider ratio or R224-R223 sets the level at pin 9 of U230C to zero volts when the ouput of this supply is correct. Protection diode CR432 limits the ouput voltage of this supply to -14.4 volts should the supply be shorted to a positive supply.

Voltage Fault Defect

Over-voltage or under-voltage of any regulated supply is detected by the window comparators U220A, U220B, and associated resistors. These resistors set a hysteresis window that is 5% of the regulator sense line voltages. The output of the comparators are analog "OR'd" and sent to the Regulator Fault Indicator circuitry on the Control Rectifier board, where the signal is latched into an LED indicator and initiates an immediate shutdown of the entire power supply.

FRONT PANEL BOARDS 5

The Front Panel Boards schematic includes cicuitry found on the Top Front Panel board, A8 Center Front Panel board, and A5 Bottom Front Panel board. These circuits support the front-panel input devices and are divided into three functional groups : knobs, buttons, and LED's.

Knobs

The knob portion of the circuit consists of three knob encoders, two on the A5 Bottom Front Panel board (S110 Vertical and S810 Horizontal) and one physically attached to the front panel (S58 Intensity). Output from these three encoders is buffered through U700 (diagram 7) for input to Serial Data Interface (SDI) IC U1760 on the A11 Main Processor board (diagram 12).

The SDI IC monitors knob positions with a six-bit up-down counter. Debouncing and conversion from the encoder's quadrature output takes place within the SDI IC to provide the necessary signals to control the internal up-down counters.

Buttons

The front-panel buttons are momentary switches connected in a matrix read by the main processor (U860 on diagram 9). The buttons are arranged in electrical groups based largely on physical location. Each group is read by activating its associated key read signal (KEY0-KEY6), which is generated by address decoder U500 (diagram 7) under processor control. The results of the KEY read are put on the KEY bus (K00-K07), which is buffered by U400 and becomes part of the FD bus (diagram 7). The FD bus eventually becomes part of the ABUS monitoring system and is discussed in more detail under SDI AND ABUS 12.

LED's

The LED's on the Front Panel Boards are driven by shift registers formed by flip-flops A9U200, A8U100, A5U220 and A5U720. Eight successive writes to these shift registers by the processor are necessary to completely

redefine the on-off state of all front-panel LED's. The shift register clock (LEDCLK) is produced by address decoder U401 (diagram 7) under control by the main processor. Each shift register is driven by an input from the FD bus to reflect push button or processor selections.

Sets of LED's representing features that are functional groups and will only be enabled together, such as DS200, DS201, DS220, DS300, and DS400, share a common current source resistor such as R101.

Self test of the LED circuit is provided by current sensing pickoffs on each of the Front Panel Boards, such as FPLED3 for the A9 Top Front Panel board. These lines are multiplexed by U810 (diagram 7) and become part of the ABUS signal (diagram 12).

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TOUCH PANEL 6

The Touch Panel circuit consists of four separate systems located on the A7 Touch Panel board: Touch Panel, Beam Detection, Camera Power, and Graticule Illumination.

Touch Panel

The touch panel system consists of 24 infrared emitting diodes in a common-anode matrix and 24 photo transistors in a common-collector matrix.

Ten pairs of photo devices are arranged along the horizontal axis and fourteen pairs along the vertical axis. These paired devices are scanned sequentially by a shift register driven by the SDI circuit. The main processor can read the resulting pattern of interrupted and non-interrupted pairs and determine finger positions on the screen. The output from the photodetectors is muliplexed and read by the Serial Data Interface (diagram 12). More details on the Touch Panel Drivers and Multiplexer are given later under FRONT PANEL CONTROL 7.

A lens frame of infrared-transparent plastic keeps out large dust particles, concentrates the infrared light "beams", and reduces ambient light and reflections.

Beam Detection

The beam detection circuit consists of four photo transistors (Q100, Q140, Q500, Q540) and a current limiting diode (CR610). The photo transistors are arranged around the CRT graticule to gather light and register fluctuations as the crt beam sweeps across portions of the graticule lines. Current limiting diode CR610 provides the bias for the phototransistors and enhances common mode rejection of noise. The output from this circuit is converted by the Photodector Circuit (diagram 8) and used by the processor to determine beam position on the CRT.

Camera Power

The Bezel Camera Connector, J43, provides power and reset inputs for cameras mounted on the bezel. +15 volts is supplied to the camera on the connector's top pin. A ground closure on the middle pin provides a latched reset signal readable by the main processor from the same place as the front-panel RESET button (KEY3 read signal and KEY06 of the KEY bus). The Camera Reset circuit is explained in the discussion under FRONT PANEL CONTROL 7. The bottom pin of the bezel connector is referenced to the instrument power supply ground.

Graticule Illumination

The Graticule Illumination circuit consists of three parallel incandescent lamps, DS145, DS342, and DS542, connected between ground and a variable voltage source. The variable voltage is controlled by the ACVS circuit (diagram 18), based on the setting of front-panel INTENSITY knob S58 (when assigned to GRAT).

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FRONT PANEL CONTROL 7

The Front Panel Control circuit includes the drivers and output multiplexer for the touch panel, address decoders for the touch panel read process, the Camera Reset latch circuit, and buffers for the front-panel knob and key busses.

Touch Panel

The Touch Panel portion of the circuit is divided into four major functions: SDI Latch, LED Drivers, Photodetector Multiplexers, and Photodetector Digitization.

SDI Latch U221 derives eight control outputs for the Touch Panel circuit under the direction of three inputs from the Serial Data Interface IC (U1760 on diagram 12). U221 shifts in data from the SDI on the TPCNTRL input and is clocked by the TPCLK signal. When all eight bits are in, the TPSTROBE line signals U221 to present the new control state to the Touch Panel circuits.

LED Drivers U320, U321, and U420 are flip-flops connected in a shift register configuration. These registers shift a 0 through a field of 1's to light the corresponding LED in the touch panel. The enable signal for the LED drivers is provided by latch 8 of SDI Latch U221. The enable signal has a 50% duty cycle so that half the time one LED is selected and the other half all three drivers are disabled.

Photodetector Multiplexers U120, U121, and U220 multiplex the output from the phototransistors around the CRT graticule. The three IC's are eight-to-one multiplexers. The outputs from all three are wired together and are sequenced by SDI Latch U221 to create a single output. Sequencing is accomplished with the three chip select inputs on each IC and the 24 inputs are taken from the touch panel phototransistors (14 vertical and 10 horizontal, diagram 6). The output of the multiplexers provide the input signal for the Photodetector Digitization stage.

Photodetector Digitization takes place in the circuit of U110A and B. This circuit determines whether or not there is an adequate increase in detected infrared light (>5mV) to qualify as an unbroken beam when an

photodetector pair is on. If the beam is unbroken, its TPDATA output goes high and if broken, low. Touch panel sensitivity is set by R120, Touch Panel Adjust.

Camera Reset

The Camera Reset circuit uses the center contact of the camera power connector to reset the instrument as if the front-panel RESET button were pressed. U501A and U501C are connected as a latch to store the Camera Reset request until it can be read by the KEY3 output from address decoder U500. KEY3 is the same read line used for the front-panel RESET button. When the latch has been set and the KEY3 line activated, the reset request will appear on KEY06 of the KEY bus. After the reset has been acknowledged, the PHOTORST(L) output from U500 will become activated and the latch will be cleared.

Address Decoders

Address Decoders U401 and U500 provide signals when a memory operation is taking place on a front panel function. These functions include: LED writes, ABUS channel select, photo/camera reset, and button reads.

U500 contains two one- to four-line demultiplexers with the data inputs wired together. Data is supplied by line FA3 from the F bus on the A11 Main Processor board (diagram 10). The enable inputs are also wired together and are activated by either FEN(L), derived from the Chip Select Unit in the CPU, or FA4 from the F bus (diagram 10). Demultiplexer selection is performed with lines FA1 and FA2 of the F bus. The outputs include KEY0 through KEY6, used to read the front-panel buttons, and PHOTORST(L) to reset the Camera Reset latch (U501) and preset the Photodector Circuit flip-flops (U720 and U721).

U401A, B, and C are two-input OR gates receiving data from the CPU via the F bus (diagram 10). the output of U401A provides the enable input to demultiplexer U500 as previously described. U401B creates the ABUSFPEN(L) signal for clocking ABUS input latch U300 (diagram 8) with input from the CPU via FA4 or FEN(L). U401C creates the LEDCLK signal to clock the LED shift registers on the three Front Panel Boards (diagram 5) with input from the CPU via FA6 or FEN(L).

Key Buffer

Key Buffer U400 puts the output of the key matrix on the eight-bit FD data bus when the CPU performs a read on one of the key ports. U400 is an octal line driver with the eight 4.7k resistors in R410 pulling up inactive input lines. The inline resistors of R301 provide impedance matching between the buffer and bus. The buffer is enabled by the same signal from U401A that enables U500 for a key read.

Knob Buffer

Knob Buffer U700 provides a low impedance drive path to the SDI circuit from the high impedance environment of the knobs. The enable inputs are both tied to ground to keep the buffer permanently enabled.

PRELIMINARY
This Information Subject to Change

FRONT PANEL CALIBRATOR AND PHOTODETECTOR CIRCUIT



Front Panel Calibrator

The Front Panel Calibrator circuit provides the FPCAL signal and two types of square-wave signals to the front-panel connector. The square-wave and fast-rise square-wave signals are developed with three input signals: FPACCAL to set the operating level, FCLK as the clock, and FRCALEN(L) to select between square-wave and fast-rise output. The FPCAL signal, from the Calibrator Voltage Reference circuit (diagram 19) via the Kernel (diagram 9), is selected with the DCCALEN(L) signal from the Control, GPIB, and RS232 circuit (diagram 10).

Clock Buffer. The calibrator clock signal, FCLK, is derived from the CPU TMROUT1 signal on diagram 9. When FCLK is high, the calibrator square-wave output will be high.

FCLK drives a level shifter circuit consisting of transistors Q921 and Q1020. Capacitor C920 is connected between the base of Q1020 and the collector of Q921, providing high-frequency feedback to reduce edge transition time. The level-shifted output at the collector of Q1020 drives the input of differential pair Q1022-Q1021, which is biased to pull the voltage at the anode of diode CR930 below ground potential. Diode CR1031 is connected to the output of transistor Q1021 to prevent saturation, which could slow the positive transistion of the fast-rise signal. Series resistor R1024 helps damp ringing in the output signal.

High Level Output Driver. Input signal FPACCAL is used to set the high level of the square-wave signal. FPACCAL originates in the Calibrator Voltage Reference circuit (diagram 19) and arrives at the input of the High Level Output Driver via the Kernel (diagram 9).

IC U910, transistor Q910, and FET Q920 operate as an inverting voltage amplifier with a gain of 0.894. Gain is measured from pin 16 of J78 to R1030 with both FRCALEN(L) and FCLK set low. Gain becomes 0.100 when FRCALEN(L) is low and FCLK is high. U910 acts as the main inverting amplifier, Q910 as a level shifter, and FET Q920 a source follower.

The inverting voltage gain of operational amplifier U910 is set by resistors R912 and R921. Feedback through capacitor C910 helps stabilize U910. Diode CR911 is also connected in a feedback configuration and holds the input of U910 (pin 2) at ground potential when the FPACCAL signal goes positive. This ensures constant loading on the FPACCAL signal. For temperature drift stability, diode CR910 is connected between feedback resistor R921 and the input to U910 to match the diode drop of CR930 in the output circuit.

Resistors R903, R904, R910, R911, and R917 inject some of the switching signal, FRCALEN(L), into U910 to cancel a small step voltage appearing at the source of FET Q920 when transistor Q1021 shuts off. This correction is only applied when square-wave mode is selected as that is when the most signal appears at the source of Q920.

Level shifter Q910 is protected from high reverse bias on its emitter by diode CR912. Capacitor C832, connected to its collector, helps to limit noise.

Resistors R914, R915, R916, and R922 act to reject noise in the +50 volt power supply to FET Q920 by making the source of Q920 appear as ground reference to the noise. The gate of Q920 is protected from excessive voltage by zener diode VR920. Resistor R920 at its collector helps prevent oscillation.

PROBEDIV Signal. Selftest of the square-wave signal is provided by the ABUS system via multiplexer U801. Resistors R1033 and R905 provide the PROBEDIV signal to U801 for this purpose. The PROBEDIV signal is 2/3 the square-wave signal.

50 Ohm Termination. When fast-rise square wave is selected by a low FPCALEN(L) signal, the square-wave signal is coupled through a 50 ohm output for faster rise time. A low FPCALEN(L) level sets the output of U1000C high and turns on FET Q1030. FPCALEN(L) is a TTL level signal and is compared to V[sub]T to set the output of U1000C high or low. V[sub]T is set by voltage divider R1010-R1011 to be +1.4 volts. Q1030 is a low-impedance FET which, when on, serves to short R1032 and make the output impedance 50 ohms. Resistor R1030 and capacitor C1030 reduce the initial overshoot on the fast-rise output signal.

When square-wave output is selected by a high PFCALEN(L) signal, FET Q1030 is off and the output impedance is approximately 450 ohms. FET Q1030 has off-state capacitance which could slow the rise and fall time of the square-wave signal. To ensure that Q1030 remains fully off, resistors R1028 and R1029 set an operating level that prevents the gate-to-drain capacitance from turning the FET on.

Output Selection. Relay K930 selects between FPCAL or square wave (or fast-rise square wave) output as directed by the FPCALEN(L) signal. When FPCALEN(L) is high, the output of operational amplifier U1000D is low. The ouput of U1000D is determined by comparing the TTL-level FPCALEN(L) signal to the 1.4 volt V[sub]T level. The low output from U1000D saturates transistor Q1010 and turns on relay K930. In this condition, square wave (or fast-rise square wave) is selected. When PFCALEN(L) is low, Q1010 is turned off and K930 selects the FPCAL mode of operation.

Output Protection. The front-panel probe hook is protected from static voltages by diodes CR1030 and CR931. The diodes are normally biased by approximately 15 volts each. When a voltage greater than ±15.7 volts is applied to the probe hook, one of the diodes will turn on and clamp the probe hook voltage to ±15.7 volts.

PRELIMINARY This information is preliminary

KERNEL 9

The Kernel consists of the CPU, Kernel Test Circuit, Address Latches, Read Only Memory, Address Decoders, and Emulation Jumpers. The Kernel serves as the control center for the entire oscilloscope system. The CPU uses software instructions stored in PROM memory to processes data, control activity on the bus, and direct the operation of other circuits throughout the instrument.

CPU

CPU U860 contains the Processsor (Execution Unit), as well as Programmable Timers, a Programmable Interrupt Controller, a Bus Interface Unit, a programmable Chip Select Unit, a programmable DMA Unit, and an Internal Oscillator.

Microprocessor. The Microprocessor section is the control element that ultimately controls the entire operation of the oscilloscope.

Programmable Timers. The Timers are variable under the control of software stored in ROM. The external clocking inputs of the timers, TIMEIN0 and TIMEIN1, are not used and are tied high through resistors.

TIMEROUT0 (TMROUT0) is used to set the baud rate for serial communications. The frequency of TIMEROUT0 is user-selectable when setting baud rate at the front panel and sets the clock rate of the Transmit and Recieve Control sections of the RS232 Controller (diagram 10).

TIMEROUT1 (TMROUT1) is inverted by U1170C and becomes the FCLK signal used by the Front Panel Calibrator circuit (diagram 8).

Programmable Interrupt Controller. The Programmable Interrupt Controller section is used to prioritize the interrupts from the power supply, GPIB contoller, RS232 controller, Counter Timer, and Serial Data Interface.

The NMI (Non Maskable Interrupt) has highest priority and is used to alert the processor of a power supply failure. The PWRFAIL[NOT] signal applied to the NMI input is derived from the PWRUP signal produced on the

A3 Control Rectifier board (diagram 3). The NMI input is gated by AND gate U830A, allowing the processor to service the interrupt request over the BA bus (diagram 12).

Chip Select Unit. Three types of Programmable Chip Select outputs are used: Memory Chip Select (MCS0-MCS3) and Peripheral Chip Select (PCS0-PCS6), and Upper/Lower Chip Select (UCS and LCS).

The Memory Chip Select (MCS) outputs are used as follows:
MCS1 is used to control the Ready circuit on diagram 10 and the SDI IC on diagram 12.
MCS2 provides the RAMSEL input to Display Controller U440 on diagram 13.
MCS3 provides one of the select inputs for the Real Time Clock and EEROM on diagram 11.

The Peripheral Chip Selects are used as follows:
PCS0 is used as one of the enable inputs to bus transciever U540 and decoder U760 (diagram 10).
PCS1 provides one of the chip enable inputs to the Sample and Hold A/D Converter, U160 on diagram 12.
PCS2 is one of the two signals that become the FEN(L) signal on diagram 10.
PCS6 is one of two signals to control the DSEL input of Display controller U440 on diagram 13.

LCS is used to select the dynamic (DRAM) portion of memory and UCS for the ROM portion.

Programmable DMA Unit. The Programmable DMA section is not used in the 11301 or 11302 but its capabilities are made available to the circuit board connector.

Internal Oscillator. The Internal Oscillator uses crystal Y870 to develop the 8 MHz clock, which is available at CLKOUT and used extensively within the CPU. The frequency of the crystal is 16 MHz, twice the resulting clock frequency. The timing of all signals originating from the CPU are relative to this clock.

Kernel Test Circuit

The Kernel Test Circuit is manually selected by moving the jumper of P1250 to the TEST position across pins 2 and 3 and by removing Diagnostic Jumpers R1060 and R1072. This forces the CPU to execute an STD instruction

(FD) over and over (this instruction only sets the direction flag--essentially a no op instruction) with the data bus disconnected. A scope loop is thus provided which may be useful for debugging some types of catastrophic kernel failures, such as stuck bus lines.

Address Latches

Address Latches U1062, U1072, and U970 serve to separate the address information from the address/data bus of the CPU and to buffer the address lines for increased fanout.

Read Only Memory

The control software resides in eight 64k ROM IC's on the A11 Main Processor board. The ROM at U1000 contains low (even) bytes at addresses 80000 through 9FFFF, U1100 low bytes at A0000 through BFFFF, U1200 low bytes at C0000 through DFFFF, and U1300 low bytes at E0000 through FFFFF. Likewise, the ROM at U1230 contains high (odd) bytes at addresses 80000 through 9FFFF, U1330 high bytes at A0000 through BFFFF, U1430 high bytes at C0000 through DFFFF, and U1400 high bytes at E0000 through FFFFF.

Address Decoders

Address Decoders U930 and U1170 split programmed UCS (Upper Chip Select) space from the CPU into two individual spaces: C0000 through DFFFF and E0000 through FFFFF. They also provide two non-programmable spaces at 80000 through 9FFFF and A0000 through BFFFF for the individual upper/lower pairs.

Emulation Jumpers

The Emulation Jumpers on P852 function as address straps that allow the removal of ROM from address space for substitution of RAM in its place. The normal configuration for P852 is two jumpers shorting 1 to 2 and 3 to 4.

CONTROL, GPIB, AND RS232 

The CONTROL, GPIB, AND RS232 circuit consists of Input Ports, Output Ports, Address and Data Buffers, GPIB, RS232, and Wait-State Generator.

Input Ports

The input ports at U730 are used by the CPU to sense display status, to determine whether or not EEROM U800 (diagram 11) is finished writing, and read data from the Photodetector Circuit (GRATDET[NOT] from diagram 8).

Output Ports

The output ports at U670 are used to control self test status LED's DS1080 and DS1081, the enable signal for the battery backed up RAM (SRAMEN to U900 and U1130 on diagram 11), front-panel Calibrator mode (DCCALEN and FRCALEN to diagram 8), the rear-panel TRIGGER OUT connector (READY OUT[NOT]), and the internal beeper enable signal.

Address and Data Buffers

Address and Data Buffers U470, U540, and U570 buffer the data bus to allow more widespread distribution.

GPIB

The GPIB interface consists of U520, U600, and U700 and is a straightforward implementation of the IEEE-488 standard.

RS-232-C

The RS232 interface consists of U420, U400, and U402. The baud rate clock is derived from the timer 0 output from the CPU (diagram 9). Maximum baud rate is 9600 baud with this arrangement.

Wait-State Generator and Ready Circuit

The Wait-State Generator and Ready circuit have the capability of inserting wait states (in MCS1 space, diagram 9) and holding off processor execution from the dynamic memory (diagram 11), the display circuit (diagram 15), and the ABUS D/A converter (diagram 12).

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MEMORY AND CLOCK 11

The MEMORY AND CLOCK circuit consists of the Volatile Memory (DRAM), Non-Volatile Memory, and Real Time Clock.

Volatile Memory (DRAM)

The DRAM consists of eight 64k X 4 IC's for a total of 256K bytes. Control is provided by DRAM controller U1500.

Non-Volatile Memory

EEROM. EEROM U800 provides 2K bytes of electrically erasable read mostly memory. The main use for this memory is the storage of calibration constants and instrument identification. An erase or write can take up to 30mS to complete and the EEROM has a limited durability of 10,000 erase/write cycles maximum.

BBRAM. The BBRAM (U900 and U1130) provides 16K bytes for saving data during power-down periods, whether accidental or planned. The main use for this memory is storage of front-panel settings. Special measures have been taken to prevent accidental writing to this memory on power-up and power-down by requiring the Reset signal and an enable signal to be activated before the memory can be accessed.

Reset. The Reset circuit is controlled by U1460 and provides a reset cycle of about 10mS on power up, power interruption, or external activation via P1450.

Battery Retention. The battery retention circuit (Q1268, Q1269, and BT1190) provides standby power to the BBRAM (U900 and U1130), and Real Time Clock (U1260) in the absence of power from the instrument power supply. This is accomplished by pulling the ground pins on the BBRAM and Real Time Clock down below the instrument ground and collapsed power supply. The circuit senses normal power availability from the instrument power supply and pulls the ground pins back near the instrument ground potential

Real Time Clock

The Real Time Clock (U1260) keeps track of the time and date, which are readable over a four bit bus by the CPU. The clock and its mode of operation are also settable over this same bus. A programmable clock output is also available to the Counter-Timer circuit (U1640B on diagram 12).

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SDI AND ABUS 12

The SDI and ABUS circuits on the A11 Main Processor board includes Output Ports, the Counter-Timer Multiplexer, the ON/STANDBY switch, ABUS, SDI, and beeper circuits.

Output Ports

The Output Ports at U770 are used to control the ABUS, the Counter-Timer Multiplexer, NMI/EN (power fail enable), and DISP/EN[NOT] (display enable). U770 uses 3 inputs from the BA bus to control the state of its 8 latches.

Counter-Timer Multiplexer

The Counter-Timer Multiplexer sends either the 2 MHz Clock from the CPU (via U660 on diagram 10) or the Real Time Clock output from U1260 (diagram 11) to the Counter-Timer (U520 on diagram 22), as determined by its assigned output port from U770.

ON/STANBY Switch

Front-panel ON/STANDY switch S60 connects to the power supply via the A11 Main Processor board and A10 Front Panel Interface board.

ABUS

The ABUS system consists of U1280 and U1380 used together as an analog multiplexer, a sample and hold circuit in U1590, and Analog to Digital Converter U1680. This circuit is primarily used to make analog measurements for self test and automatic calibration.

Analog Multiplexer. The two 8x1 multiplexer IC's are controlled by the output ports from U770 and select one of 16 inputs for digitizing. Many of these inputs come from other circuit boards and are previously multiplexed.

Sample and Hold. The muliplexer output is then sampled by Sample and Hold IC U1590 to provide a solid, steady, low impedance source necessary for the A/D Converter.

A/D Converter. The A/D Converter converts the multiplexed signal to an eight or twelve bit digital for the CPU. The CPU is held off during this conversion by the Wait State Generator circuit (diagram 10). R1582 provides offset adjustment and R1580 provides gain adjustment.

Serial Data Interface

Serial Data Interface (SDI) IC U1760 performs several circuit functions. It contains an external microprocessor interface, an Analog Control Voltage System (ACVS) interface, front-panel knobs interface, touch panel interface, serial plug-in interface, and pulse-width modulated outputs for the display and beeper circuits.

External Microprocessor Interface. The External Microprocessor Interface is an eight-bit bi-directional bus with seven control signals.

ACVS Interface. The ACVS interface is a serial interface customized for Controller IC U740 (diagram 18), with data output signal ACVSDATA, clock input ACVSCLK, and a three-byte internal buffer.

Front-Panel Knob Interface. The Front-Panel Knob Interface portion of the SDI IC debounces, decodes, and moniters with a six digit up/down counter the knob position of all three front-panel knobs. These position counters are available for the CPU to read upon demand.

Touch Panel Interface. The Touch Panel Interface section provides control and timing signals to the touch panel, and decodes the data coming back. Decoding is accomplished by storing the data in latches which are readable by the CPU and correspond to the status of photodetector pairs (LED and phototransistor) on the touch panel.

Serial Plug-In Interface. The Serial Plug-In Interface section has a special bi-directional serial interface channel for each of the three plug-in compartments. The pulse-width modulated outputs are filtered to provide programmable analog voltages for controlling display position.

Beeper. The PW5 output is frequency programmable and is used by the circuit of U980A and Q1880 to drive speaker LS1890. The speaker circuit is enabled by BEEP EN signal from U670 (diagram 10).

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VERTICAL AMPLIFIER (11301) 14

The Vertical Amplifier circuit selects and amplifies input signals from the plug-in units under control from the Realtime Oscilloscope Control System (diagram 15).

Vertical Channel Switch

The Vertical Channel Switch hybrid (U220) uses control signals from the Realtime Oscilloscope Control System (U270 on diagram 15) to select vertical signals for display. The control signals VS1, VS2, VS3, and VS4 are applied to pins 42, 43, 15, and 16 of the Channel Switch. These signals direct U220 to connect the selected input signal to the differential output (OUT+, pin 11 and OUT-, pin 1) according to the logic in the following table.

CHANNEL SELECT TABLE

DISPLAY SIGNAL	-VS1	-VS2	-VS3	-VS4
Left PI	0	1	0	1
Right PI	1	0	0	1
Left + Right	0	0	0	1
Counter View	1	1	0	1
Auto Cal	1	1	1	0
Readout	1	1	1	1

The Vertical Channel Switch provides additional common mode and differential outputs for the Left and Center Plug-In channels. For diagnostics, the common mode outputs (pins 32 and 21) are multiplexed through U660 to the ABUS. The negative sides of the differential outputs at pins 39 and 27 have 50 ohm terminations. The positive side of the Left signal (pin 40) goes to the Left Vertical Output BNC on the rear panel. The positive side of the Right signal (pin 28) drives the Horizontal Amplifier in XY mode.

Delay Line

Delay Line DL200 delays vertical deflection signals from the Channel Switch to the Vertical Amplifier by approximately 77 ns, allowing time for the Z-Axis and Sweep circuits to turn on before the CRT beam begins to deflect vertically. Doing so permits the operator to view the triggering event. The bridged T-network, composed of inductors and capacitors built into the circuit board, corrects phase distortion introduced by the delay line.

Dynamic Beam Alignment

The Dynamic Beam Alignment circuit of U600 is a balanced modulator. Its output at pin 6 is an intensity-dependent current. Applied to pin 39 of Vertical Output Hybrid U520, it prevents vertical shifts of the display induced by the CRT when the intensity varies over a wide range. Its input at pin 10 is the Spotshift signal from the Q-Axis output of the Z-Axis hybrid (U720 on diagram 15). U600 functions as an inverting or non-inverting amplifier.

Vertical Dynamic Centering adjustment R600 sets the gain and polarity of the amplifier. R504, connected between pins 2 and 3, determines the sensitivity of this adjustment.

High Speed Schmitt

The differential Counter View signal comes from the Counter Timer (U720 on diagram 22) through delay line DL27. A High Speed Schmitt Trigger (U700) squares it up and level shifts it for application to pins 48 and 13 of the Vertical Amplifier. An RC network with adjustments R700, C700, R605, and C710 balances the effects of the compensation circuit between pins 5 and 8.

Vertical Output Amplifier

The Vertical Output Amplifier hybrid (U520) receives the selected vertical signal from the Delay Line at pins 3 and 10 and increases its amplitude to the level required to drive the CRT deflection plates. The RCL network between pins 5 and 8 of U520 compensates the signal for skin-effect losses in the Delay Line.

On Screen Thermals adjustment R570 minimizes thermal distortion in the Output Amplifier to reduce vertical jitter in the display readout.

Center adjustment R610 allows correction of offsets in both the Amplifier hybrid and the CRT.

The differential output signal of the Vertical Amplifier (OUT+, pin 28 and OUT-, pin 33) drives the vertical deflection plates of the CRT through L630 and L620. A hybrid resistor network, including an adjustable portion for impedance matching, terminates the distributed-deflection structure of the CRT.

Both the differential and common mode signals are picked off at the CRT termination for diagnostics and self-cal. U670B/A converts the differential signal to a single-ended signal. U660 multiplexes the differential and the common mode signals to the ABUS.

Bandwidth Limiting

To make the readout character dots more distinct, high frequency noise is eliminated whenever readout is being displayed. The RCL networks connecting pin 18 to pin 19 and pin 44 to pin 45, along with capacitors integral to U520, form filters to limit the bandwidth of the Vertical Amplifier to 20 MHz. BWL(L), an active LO TTL-compatible signal from ROCS IC U270 on diagram 15, is connected to pin 16 of U520 to control this function.

Beam Find

While the BEAM FIND button on the front panel is depressed, an active HI TTL-compatible signal from the Analog Control Voltage System (diagram 18) is applied to pin 15 of Amplifier U520. This BEAMFIND signal reduces the dynamic range of the output, compressing the display

so that all deflected traces are held within the vertical limits of the CRT graticule.

Output Protection Circuit

If the output of Vertical Amplifier U520 is short-circuited or loses its bias, excessive current flows into pins 30 and 31. Transistors Q650 and Q651 form a protection circuit against either of these fault conditions. Its purpose is to lower the voltage on pin 23 of U520. A fraction of this voltage is picked off and multiplexed through U660 to the ABUS for diagnostics.

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CONTROL SYSTEM AND Z AXIS 15

8 MHz Oscillator

The 8 MHz oscillator provides the clock signal for the Realtime Oscilloscope Control System IC (U270) and the Analog Control Voltage System processor (U740 on diagram 18). The oscillator consists of Q670 and Q680 connected in an emitter-coupled bistable multivibrator (Bose oscillator) configuration, with an input through R684 to dither the clock frequency. Since this oscillator sets the Display Chop frequency, it must vary about 8MHz in a psuedo-random fashion to avoid Vertical Chop synchronization on screen.

The base of transistor Q680 is set at -3.04 V by the resistor divider R681-R682. Capacitor C680 is used to decouple the base of Q680. The base of transistor Q670 is controlled by the collector voltage of Q680, so only one of the two transistors will be conducting at a time. When Q680 is conducting, the base of Q670 is pulled low to turn Q670 off. The collector of Q670 will be pulled high by R671, making the oscillator output high. When Q680 is not conducting, the base of Q670 is pulled up to ground and turns Q670 on. The collector of Q670 will then go low, making the oscillator output low.

The dynamic operation of the oscillator is as follows: At power up, the base of Q680 is set to -3.04 volts and the emitters of Q680 and Q670 are pulled toward -15 volts. Since both transistors are off, the base of Q670 is effectively at ground. As the emitters drop towards -15 volts, Q670 turns on before Q680. The conduction of Q670 pulls its emitter up, which pulls the emitter of Q680 up through C681 and keeps Q680 turned off. This condition constitutes the first of the two states.

With Q670 holding the voltage at R673 and C681 constant, C681 begins to charge (through R680) toward -15 volts. When the voltage at the emitter of Q680 drops one diode drop below the base, Q680 begins to conduct and the voltage at the base of Q670 drops, turning Q670 off. This condition constitutes the second of the two states.

With Q680 now holding its emitter at a constant voltage, C681 begins to charge in the opposite direction through R673. When the voltage at the emitter of Q670 drops one diode drop below the base, Q670 begins to conduct. When

Q670 begins to conduct, the emitter of Q680 is pulled up through C681 along with the emitter of Q670. This rise in emitter voltage turns Q680 off, allowing the base voltage of Q670 to rise toward ground and turn Q670 on harder. The oscillator has now returned to the first of the bistable states and the emitter of Q680 again starts its excursion towards -15 volts to repeat the cycle.

Capacitors C671 and C670 and resistor R670 form a decoupling network for the +5.1 volt power supply. R672 sets the output voltage "low" limit. Inductor L670 and capacitor C672 provide decoupling for the -15 volt power supply.

A TTL signal is applied to the base of Q670 through R674 to provide dithering of the oscillator. This input causes the base voltage to be switched between two levels in both bistable states, making Q670 turn on slightly sooner or later in the second state.

Realtime Oscilloscope Control System

The Realtime Oscilloscope Control System (ROCS) is comprised of ROCS IC U270, 8-bit DAC U630, Programmable Array Logic IC U581, hex latch U580, and a Holdoff Oscillator circuit.

The ROCS IC provides the control signals for coordinating the key elements to create a display on the instrument's CRT. This activity entails: (1) interaction with the Main Sweep, providing Sweep Holdoff at the completion of the sweep, (2) supplying Select signals to the Vertical Channel Switch, Horizontal Output IC, Main and Delayed Trigger ICs, Intensity DAC, and Z-Axis IC on a trace-by-trace basis, (3) supporting the Alternate and Chop modes of trace display, (4) providing Z-axis blanking in Display Chop mode, (5) providing signals to the plug-in units and the Display IC to keep them synchronized with the ROCS.

Microprocessor Interface. Signals ED7-ED0 are an 8-bit latched-address bi-directional data bus from the SDI IC on the Main Processor board (diagram 12). The EAV signal at pin 61 of ROCS IC U270 is pulsed to latch the information on this bus as an address; the ROCSEL signal at pin 38 is pulsed to latch the information as data.

Sweep Control. The SHOA signal at pin 32 of U270 controls the operation of the Main and Delayed Sweeps. During normal sweep operation, SHOA is asserted by U270 upon the completion of a Main Sweep. A high on SGA(L) indicates the end of the sweep to U270. SHOA remains asserted for a time determined by two factors, the rate of the AHOCLK signal produced by the Holdoff Oscillator and the speed of the current Main Sweep. A programmable counter internal to U270 is programmed to release SHOA only after the correct number of AHOCLK pulses have occurred. This is to insure that the Main and Delayed Sweep have sufficient recovery time after they sweep. The main processor may also assert SHOA through U270 by asserting an internal bit, allowing it to inhibit the sweeps when necessary.

Trace Display and Plug-In Control. ROCS IC U270 contains a RAM-Based Sequencer used to support trace-by-trace display of waveforms. The RAM is used as a set of programmable addressable registers, with each register containing a full description of a given trace. The description of a trace includes the vertical and horizontal components, the Z-Axis intensity, Counter-Timer control, and Time Base information. In Display Alt mode, the data from one register is held at the output pins of U270 until the completion of the Main Sweep. Then it is changed to the data held by the register at the next address during holdoff, in preparation for the display of the next sweep. In Display Chop mode, the data from the Time Base Control and the MEASTRG1 and MEASTRG2 signals change in this same fashion, but the remaining signals change at the chop rate of approximately 1MHz.

The blanking circuitry in Programmable Array Logic IC U581 asserts the ROCSBLANK signal to Z-Axis Hybrid U720 as the switching from one trace to the next takes place. In either display mode, the RAM in U270 is accessed in a sequential manner until the last defined trace is displayed; then the first trace in the sequence is displayed again. The PICLK signal supplied by U581 is used to step the plug-in units and Display IC (U440 on diagram 13) as U270 steps through the display traces.

The POSSYNC (PISYNC) signal supplied by U270 synchronizes the plug-in units and the Display IC as the first of the traces is displayed by U270. The VSEL and ASEL signals from U270 to R350 and R354, respectively, are used to indicate to a plug-in unit that it is being displayed.

From the RAM-Based Sequencer, the ROCS provides signals used to control the Vertical Channel Switch, the Horizontal Output IC, the Z-Axis Hybrid, the Time Bases, the Counter-Timer, and the plug-in compartments so that these circuits work together correctly for the proper display of traces. The signals from the Horizontal and Vertical Display Control sections of U270, as well as the signals from the Z-Axis Control section and CVSEL0-2 from the Counter-Timer Control section may be driven synchronous with the Time Base operation or by a 1 MHz chop clock derived from the 8MHz oscillator. These two conditions constitute the Display Alt and Display Chop modes, respectively.

The signals from the Time Base Control section and MEASTRG1 and MEASTRG2 from the Counter-Timer Control section of U270 change only at the completion of the Main and Delayed Sweeps, when SHOA is asserted.

Vertical Display Control. Signals VS1[not] through VS4[not] are used to select the vertical component of a display. the BWO output is used to turn on vertical bandwidth limiting in the Vertical Amplifier circuit (diagram 14). Resistors R165, R470, R471, R472, and R473 slow the edge speed of their associated signals to minimize crosstalk to neighboring signals.

Counter Timer Control. The CVSEL0-CVSEL2 signals select a signal from the Counter-Timer for viewing as a trace. The MEASTRG1 and MEASTRG2 signals indicate to the Counter-Timer which of the two Delayed Sweeps is currently running. The CVENABLE signal is used to enable measurements for Counter-View purposes.

Time Base Control. The Time Base control signals from U270 are used to control the Triggering Slope (SLPSEL), the Triggering Level (TLEVSELB), the Delay Reference (DLYSELA-C), and the Trigger Sources for the Main (SEL0A-SEL2A) and Delayed (SEL0B-SEL2B) Time Bases.

Display Control. The DISPRO signal into U270 is from Display IC U440 (diagram 13) forced U270 to select the readout source as the Vertical and Horizontal components of the display. The IRO(L) signal into U270 is also from the Display IC and is used to force signals IB0-IB7 of U270 to output data corresponding to the intensified state of readout display.

Holdoff Oscillator. The Holdoff Oscillator is a gatable, voltage-controlled oscillator which produces the AHOCLK signal periodically while gated on. The period of the AHOCLK signal is set by the HOADJA input at pin 2 of U650. Resistors R555, R554, R553, R552, and R542, transistor Q541, and op amp U650 act as a variable current source. The current through the emitter of Q541 is mirrored through the emitter of Q540, making the current in the collector of Q540 a function of the HOADJA level. The collector current of Q540 produces a negative-going ramp at C541, which is fed into the inverting input of comparator U640. The slope of the ramp, being a function of the collector current of Q540, is a function of the voltage at HOADJA. U640 is configured as a fed-back comparator with hysteresis, using R641 as the feedback element and R632-R640 as the comparator setpoint divider network. When the ramp voltage drops to the comparison voltage at pin 2 of U640, the output of U640 (AHOCLK) goes high. This increase in output voltage raises the voltage at pin 2 of U640, creating the comparison hysteresis. The AHOCLK signal is fed through CR550 to the divider network R556-R550, which then drives the base of Q542. Q542 is configured as an inverter-buffer with R543 as the collector pull-up resistor. The assertion of AHOCLK turns Q542 on, which turns Q543 on by pulling the base low. The collector of Q543 is pulled towards +5.1 volts, which discharges the ramp capacitor C541. Once the voltage at the collector of Q543 reaches the comparison voltage at pin 2 of U640, the output of U640 returns to a low state and restores the comparison point at pin 2 to its previous value. AHOCLK is now low, turning off Q542 and Q543, so the ramp capacitor is free to charge again for another cycle.

The free-running oscillator behavior described above may be gated off by the assertion of RAMPRST from pin 3 of ROCS IC U270. This signal is used to keep the Holdoff Oscillator in a reset condition when the AHOCLK is not needed (during sweep operation). RAMPRST is pulled high with R551 and is OR'ed into the divider network of R556-R550 by CR551. The assertion of RAMPRST consequently causes the ramp capacitor C541 to be completely discharged in preparation for a holdoff cycle. This insures that the first pulse present on AHOCLK following the de-assertion of RAMPRST will occur after a full transition of the comparison ramp.

Intensity DAC. Bus IB0-IB7 is an 8-bit data bus from U270 feeding only the Intensity Digital-to-Analog converter, U630. The data on this bus will change to correspond to the current horizontal display source at all times. Each of the four horizontal display sources (Main Sweep, Delayed Sweep, X deflection, and Readout) has two associated registers within U270, corresponding to a "high" and "low" intensity setting; therefore, there are a total of eight different registers that may be multiplexed onto the intensity bus. A bit within U270 for each trace may be programmed to select between the two registers.

Programmable Array Logic. Programmable Array Logic IC U581 and Hex Latch U580 are used to realign signals to prevent erroneous displays on screen. U581 is also used to create CTSYNC and to buffer the DITHER signal before it is sent to the 8 MHz oscillator. CTSYNC is asserted during the display of the first in a sequence of traces and is used to synchronize the Counter-Timer IC (U520 on diagram 22) to the display of traces. The DITHER signal is a pseudo-random signal from the Counter-Timer IC used to dither the 8 MHz oscillator frequency.

Hex Latch The HSA[not] and HSB[not] signals are used to select the horizontal component of a display after being delayed through Hex Latch U580. The HGAIN0 and HGAIN1 signals are used to select the horizontal gain of a display, after also being delayed through U580. Resistors RX102 through RX106 provide delay to match the hold time needs of U580, while resistors R571 and R580 slow the edge speed of their associated signals to minimize crosstalk to neighboring signals.

Z-Axis.

The BRIGHT signal ouput from U630 is fed to Z-Axis IC U720 to control the intensity of traces and character readout. The SIZB signal from U270 is supplied to the Z-Axis circuitry through Q730 to suppress the display of a Delayed Sweep or the intensified zone on a Main Sweep. The ROCSBLANK signal supplied by U581 is used to blank the CRT beam between traces in Display Chop mode, and to blank the CRT beam between Sweeps in Display Alt mode. The ROCSTXY signal from U270 is used to support Triggered X-Y waveforms in the instrument. When ROCSTXY is asserted, an X-Y waveform will be displayed only when the Main Sweep is running.

ANALOG CONTROL VOLTAGE SYSTEM 18

The Analog Control Voltage System (ACVS) is located on the A13 Scope Logic board and provides programmable voltage sources to replace the function of front-panel potentiometers and some internal adjustments. A total of 28 programmable voltages are provided, 26 of which have 12 bit resolution and two of which have 14.6 bit resolution.

The ACVS includes a controller, single chip computer U740, which drives 12-bit Digital to Analog Converter (DAC) U750 and four 1x8 analog multiplexers, U1080, U1270, U1570, and U870.

[which are connected to the sample and hold capacitors and op amp buffers which drive the acvs outputs.]

Controller

U740 controls the ACVS system and receives requests for voltage changes from the CPU by a two-line serial port. This serial port is controlled on the A11 Main Processor board by SDI IC U1760 (diagram 12), which buffers all three bytes of an ACVS channel change request for rapid transfer upon demand. The first of the three bytes contains the channel number, from 0 to 31, for the standard analog channels, 32 for the ABUS control port, and 33 for the DAC test channel. The second byte contains the most significant byte of the requested new value (left justified), and the third byte contains the least significant bits of the new value. When a new value is received, a "fast update cycle" is executed to get the new value on the sample and hold capacitors much faster than if normal update cycles were used.

Eight of the controller outputs are used as a latch to control ABUS multiplexers U530 (diagram 19), U1330 (diagram 16), and U1280. This latch is set to the value of the third byte of the channel change request.

Digital to Analog Converter

The DAC is driven by 12 outputs from Ports 1 and 2 of Controller U740. The content of those outputs is determined by the SHDATA signal from the ACVS portion of

SDI IC U1760 (diagram 12), for which the Controller provides the clock (SHCLK).

The DAC output is buffered with op amp U741 to provide a lower impedance source for faster updating of the sample and hold capacitors. ACVS Gain adjustment R854 sets the voltage swing of the ACVS DELYREF outputs to provide 20,000 points between +1.25 V and -1.25 V.

Receiving a channel 33 DAC Test sets DAC U750 to the value of the last two bytes and keeps it there while suspending the normal refresh cycles. The normal refresh cycle takes about 900 microseconds to refresh all 32 sample and hold capacitors when the CPU processor is not actively inputing changes to the ACVS.

Multiplexers

The four 1x8 multiplexers essentially form a 1x32 multiplexer that is controlled by U740 and choses which channel to update or change. When one of the delay reference (DLYREF) signals is changed, three of these multiplexers are enabled at the same time to permit a faster change of the output values.

Sample and Hold Capacitors

The Sample and Hold capacitors on the outputs of the multiplexer store a given DAC voltage without significant change for almost 900 microseconds.

Sample and Hold Buffers

The 32 op amp Sample and Hold Buffers help preserve the high impedance environment for the sample and hold capacitors and provide adequate drive for the ACVS outputs. Some outputs have their voltage ranges adjusted by resistor combinations in the op amp circuits to meet specialized requirements. Outputs with 14.6-bit resolution are formed by summing the outputs of three standard 12-bit resolution channels through weighted resistors and controller algorithms to adjust each output within one LSB of each other in order to retain the monotonic characteristics of the dac. This summing and additional buffering takes place on the A14 Timebase board to reduce noise susceptability.

+10 V Reference

A +10 V Reference is derived from the +15V1 supply by U850. The reference is used by the ACVS DAC in the Gain adjustment and also by the Contol and Z Axis (diagram 15) and High Voltage (diagram 16) circuits.

PRELIMINARY
This Information Subject to Change

DIAGNOSTICS

11301/11302 DIAGNOSTICS

The following discussion is an overview of the 11301/11302 diagnostic system. The three diagnostic levels and their modes of communication are described, along with general hardware conditions dictating their use. Detailed troubleshooting information is not included.

TERMS

The following terms are used throughout this section.

Area	Area describes a partition of hardware that deals with a particular function or operation (e.g., "Touch Panel").
Block	Block generally refers to circuitry within the boundaries of a circuit board.
Kernel	The Kernel includes the processor, ROM, RAM, and interconnecting bus circuitry required for the processor to function. Kernel specifically excludes Battery Backup RAM, ports, and external busses.
Routine	A Routine is the actual test activity performed on any given area. A routine will generally be the smallest selectable unit for testing.

LEVEL 0: KERNEL DIAGNOSTICS

Level 0 diagnostics are used to diagnose a dead or wounded Kernel. The processor cannot execute code correctly with these types of problems so both hardware and software troubleshooting aids are provided. The low diagnostic output at this level limits its purpose to getting the Kernel operational. Once the Kernel is functioning, Level 1 and Level 2 diagnostics can be used to test the remainder of the instrument.

Hardware. For a dead kernel, jumpers are provided to force the processor to continually loop the top memory segment. This loop is then used for Signature Analysis testing of the Diagnostic PROM address and control signals.

Software. For a wounded kernel, software in PROM U1300 and U1400 will test the remainder of the Kernel ROM and RAM. If a fault is detected during this test, an attempt will be made to display an error code on the front-panel LED's.

LEVEL 1: SELFTEST DIAGNOSTICS

Level 1 consists of Power-Up Diagnostic software routines to verify instrument functionality prior to or during normal operation. Once invoked, these routines run automatically without operator intervention. They are invoked (as a unit) automatically at power-up, manually via a front-panel menu, or externally through the RS-232-C and GPIB ports.

KERNEL VERIFICATION

Verification of the Kernel is performed in two different operating conditions, power-up and non power-up (normal).

Power-Up. The instrument's resources may be severely limited in this mode so diagnostic information will be output in very simple terms.

- While the diagnostic tests are running, all LED's on the front panel are off.
- If a fault is detected, a two-LED code will blink on the front-panel Major Menu LED's to identify the device in question. Testing will be halted until any front-panel button is pressed. The two-LED device codes are given in the following diagram, where "*" indicates an activated LED.

POWER UP FAILURE CODES

DEVICE	MAJOR MENU LEDS (top to bottom) WAVEFORM	TRIGGER	MUX	TRIGGER/CLK	DISPLAY	MENU
DRAM U1620	*	*	.	.	.	.
DRAM U1920	*	.	*	.	.	.
DRAM U1600	*	.	.	*	.	.
DRAM U1900	*	.	.	.	*	.
DRAM CTRL U1500	*	.	.	.	.	*
RAM Addr & data line shorts	*	.	.	.	.	.
DRAM U1720	.	.	.	.	.	*
DRAM U1820	.	.	.	.	*	.
DRAM U1700	.	.	.	*	.	.
DRAM U1800	.	*	.	.	.	.
ROM U1200	.	*	*	.	.	.
ROM U1430	.	*	.	*	.	.
ROM U1300	.	*	.	.	*	.
ROM U1400	.	*	.	.	.	*
ROM U1100	.	.	*	*	.	.
ROM U1330	.	.	*	.	*	.
ROM U1000	.	.	*	.	.	*
ROM U1230	.	.	*	.	.	.
BBRAM U1130	.	.	.	*	*	.
BBRAM U900	.	.	.	*	.	*

Non Power Up (Normal). In this mode, the instrument has been through power-up and established that the Kernel is not dead or seriously wounded. A higher level of diagnostic output can therefore be used.

When diagnostics are invoked in non power-up situations, the tests will run as described in the following Instrument Verification section.

INSTRUMENT VERIFICATION

Instrument Verification diagnostics are run with a high level interface which uses all instrument communication facilities as required.

Power-Up.

While the tests are running, all LED's on the front panel will be off except during the portion of the routine that tests their operation.

If a fault is detected, the instrument will halt testing and display the block menu (see Test Menu Examples). The Block that failed will be highlighted in the menu

When all tests are complete and no faults are detected, the instrument will power-up normally with the display prompt, "TEST PASS".

Non Power-Up.

While the diagnostic tests are running, all LED's on the front panel will be off except during the portion of the routine that tests their operation.

When all tests are complete and no faults are detected, the instrument will respond to the invocation source (front panel, RS232, or GPIB). Non power-up Instrument Verification may be invoked in the following ways.

Front Panel. Testing is invoked by touching the ***SELF TEST*** entry in the Utility menu.

If Selftest passes, the prompt message "TEST PASS" will be displayed.

If Selftest fails, the prompt message "TEST FAIL" will be displayed.

GPIB. Selftest will be invoked by sending the "TEST" command to the instrument. The normal GPIB communication protocol of SRQ with status byte will follow when testing is complete.

If the controller requires more information, it may send the "TEST?" query and the instrument will return either "TEST PASS" or "TEST <*index*>". For more detailed information, see Extended Diagnostics, RS-232-C, Normal mode.

RS-232-C. The RS-232-C interface is used in the same manner as the GPIB for Selftest.

LEVEL 2: EXTENDED DIAGNOSTICS

Level 2 diagnostics are used for troubleshooting and consist of all Level 1 routines as well as many additional routines. The additional routines include those requiring operator intervention and those considered too lengthy for the power-up sequence. Level 2 routines are invoked individually or in groups by front-panel menu selections or external control (RS-232-C and GPIB).

The fact that these diagnostics may be invoked from nearly all instrument input/output devices enhances their usefulness in any troubleshooting situation.

FRONT PANEL

Extended Diagnostic menus are accessed by touching the ***EXTENDED DIAGNOSTIC*** entry in the Utility menu. Front Panel Diagnostic control is via the touch panel only. The display will be used for both test menus and test status information. See Test Menu Examples for typical displays.

Knobs and buttons are inactive during diagnostic operation except during the portion of the routine that tests their operation. It must also be noted that display integrity will be intermittent during testing as some tests will disrupt the display.

Test Menu Examples

The following examples show how Block and Area menus appear on the display. The horizontal line numbers, 1 through 16, are given along the right side of each example.

BLOCK MENU

line # ↓

```
|BLOCK=front panel      AREA=                          ROUTINE|  1
|                                                               |  2
|ALL BLOCKS                  INDEX              FAULTS          |  3
|processor                    pass                             |  4
|front panel                 M2410                1           |  5
|scope logic                  pass                             |  6
|timebase                     pass                             |  7
|vertical                     pass                             |  8
|Left llaxxx                  pass                             |  9
|Center llaxxx                pass                             | 10
|Right plugin                R????                             | 11
|                                                               | 12
|                                                               | 13
|                                                               | 14
| on        off         off                            off    | 15
|VERBOSE    LOOP      HALT/ERR                         RUN    | 16
```

AREA MENU

line # ↓

```
|BLOCK=front panel      AREA=touch panel       ROUTINE|  1
|                                                     |  2
|ALL AREAS                   INDEX          FAULTS    |  3
|buttons                      pass                     |  4
|leds                         pass                     |  5
|knobs                        pass                     |  6
|touch panel                 M2410            1       |  7
|photo detector               pass                     |  8
|calibrator                   pass                     |  9
|panel exercise                                        | 10
|test pattern                                          | 11
|                                                      | 12
|                                                      | 13
|                                                      | 14
| on        off         off                      off   | 15
|VERBOSE    LOOP      HALT/ERR                   RUN   | 16
```

PRELIMINARY Information Subject to Change

Test Menu Area

The Test Menu Area is located from line 3 to line 14 on the display. This portion of the screen is used in different ways by the various menus.

Index Code Convention

Test Index codes are provided by the diagnostics for rapid identification of a failed test. This code is then used to reference the appropriate troubleshooting support documentation. The following conventions are used to provide instrument family compatibility.

- To allow the mainframe and plug-in units to use index codes without restrictions, each code is prefaced with a source ID: ***M***, ***L***, ***C***, or ***R***.
- The remaining four-bit index number is a hexidecimal code.
- The first hex digit identifies the test BLOCK.
- The second hex digit identifies the test AREA.
- The third hex digit identifies the test ROUTINE.
- The fourth hex digit may be used by Routines for additional fault information.

Block & Area Menus

In Block and Area menus, each line on the display is broken into the three fields:

1) Title 2) Failure Code 3) Failure Count

These fields are located on the display in the positions shown in Figure 1.

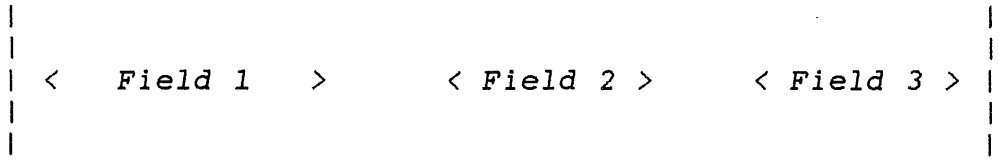


Figure 1. Block and Area menu fields.

Following is a brief summary for each field shown in Figure 1.

Field 1 — Field 1 contains Block and Area titles, which are touch-selectable and become highlighted when touched (selected).

The default selection is at the top of the list (ALL <*tests*>)

Field 2 — Field 2 is blank prior to a test being run. After the tests are complete, pass/fail code information will be displayed.

If no faults are detected, ***pass*** is displayed.

ZNNNN (first index code) is printed if faults are detected. Z will be ***M*** for mainframe and ***L***, ***C***, or ***R*** for the appropriate plugin.

Z???? is displayed for plug-ins or options not installed.

Z---- is printed if a test returns NO pass or fail information.

Field 2 is not touch-selectable and is never highlighted.

Field 3 — A number, ***nnnnn***, is displayed in field 3 to indicate the number of failures. This field is not touch-selectable and is never highlighted.

For Block menus, the displayed number indicates the number of failures in the Block.

For Area menus, the displayed number indicates the number of failures in the Area.

Routine Menus

Routine menus vary according to the tests to be performed, but some common points to all routine menus are:

- Field 1, the title field, is the only touch-selectable field. This field is used to select a routine as in the Block and Area menus. Highlighting only occurs in the title field and indicates selection.
- Fields 2, 3, 4, and 6 will indicate the first error when an error occurs. If no error occurs, the information in these fields will be the last test performed.
- Field 5 is in decimal radix and contains an accumulation of all failures recorded by the test.

Although these menus vary by application, there are four basic configurations: one for analog tests, two for digital tests, and one for memory tests. The unique characteristics for each are given below, along with illustrations showing display layout.

Analog Test and Digital Test Menus (Figures 2 and 3):

- Fields 2, 3, and 4 will either be hex or floating point radix.
- Field 6 contains an index code with the same format used by the block and area menus.

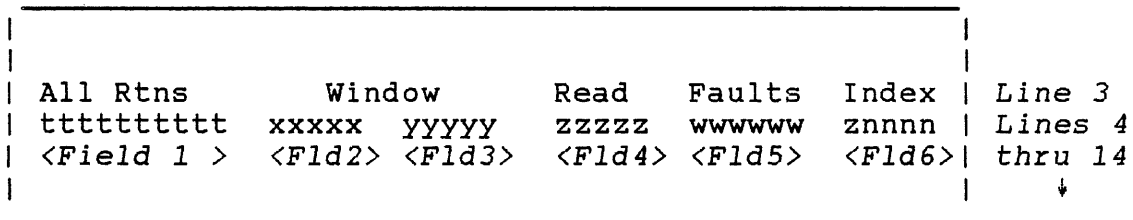


Figure 2. Display of Analog Test Menu showing field names and positions.

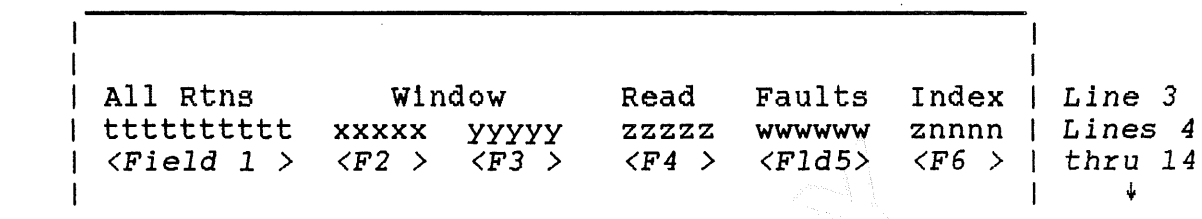


Figure 3. Display of Digital Test Menu showing field names and positions (used by plug-in diagnostics only).

Mainframe Digital Test Menu (Figure 4):

- Field 2 is a hex radix number indicating the desired test results.
- Field 3 is a hex radix number indicating the test tolerance from the desired value (Field 2).
- Field 4 is a hex radix number indicating the actual value read.

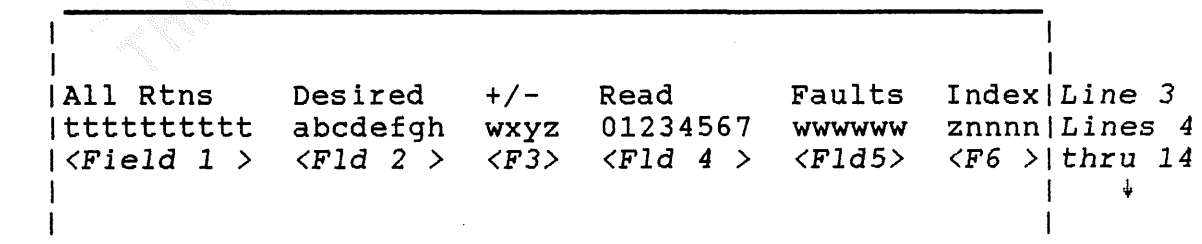


Figure 4. Display of Mainframe Digital Test Menu showing field names and positions.

Memory Test Menu (Figure 5):

- Field 2 is a hex radix number indicating the address of the test.
- Field 3 is a hex radix number indicating the desired value. This is normally the value written
- Field 4 is a hex radix number indicating the actual value read.

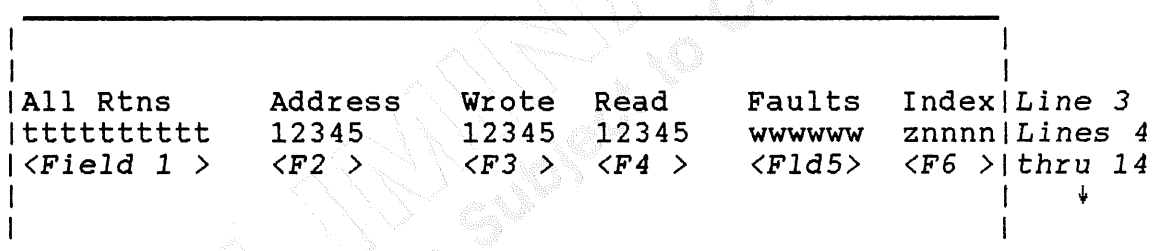


Figure 5. Display of Memory Test Menu showing field names and positions.

Test Status Area

The Test Status Area is located at the top and bottom of the display in lines 1, 15, and 16. This portion of the screen is used consistently by the various diagnostic menus. Figure 6 shows the display location of fields in the Test Status Area.

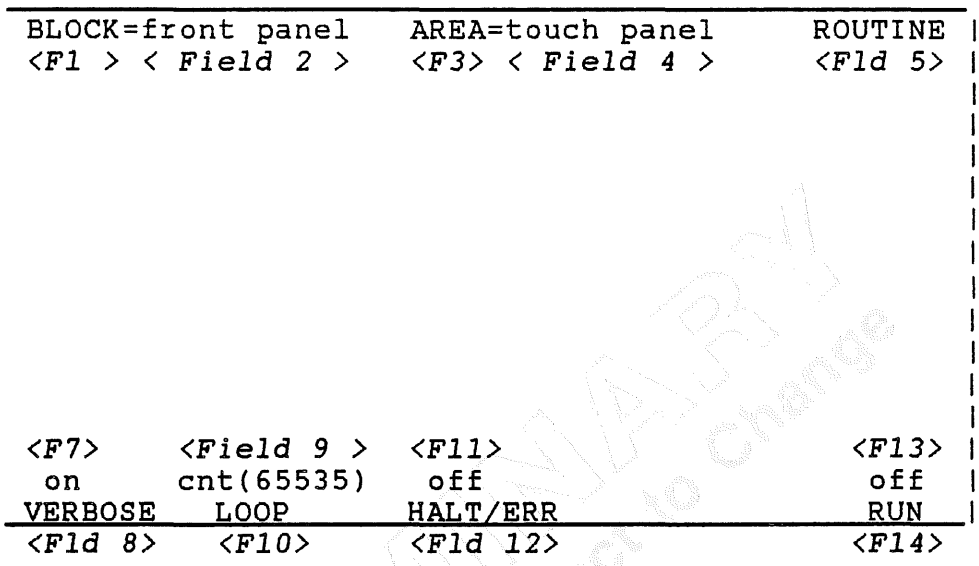


Figure 6. Test Status areas of the display showing field names and positions.

Following are brief summaries for the display fields shown in Figure 6.

Field 1 Touching field 1 will cause its contents to become highlighted and the diagnostic Block menu to be displayed.

Field 2 The currently selected Block within the Block Menu is displayed in field 2. The Block title is truncated if too long for the field.

Field 2 is not touch-selectable and is never highlighted.

Field 3 Touching field 3 will cause the selected Block's diagnostic Area menu to be displayed. If no Block has been previously selected, the first Block in the Block menu will be selected and its Area menu displayed.

When an Area menu is displayed, field 3 will be highlighted.

Field 4 — The currently selected Area within the Area Menu is displayed in field 4. The name is truncated if too long for the field.

The contents of field 4 are not touch-selectable.

Field 5 — Touching field 5 will cause the selected Area's diagnostic Routine menu to be displayed. If no Area has been previously selected, the first Area in the Area menu will be selected and its Routine menu displayed.

NOTE

The Routine Menu may have fields missing until the test has run.

Field 5 is highlighted when a Routine menu is displayed.

Field 7 — Field 7 displays the current selection of VERBOSE ("on" or "off").

Field 8 — Field 8 is touch-selectable and causes VERBOSE to toggle between on and off.

If the current selection is "on", all test information is displayed in the Test Menu Area or output through a port--whichever is applicable.

If the current selection is "off" then NO test information is displayed or output. This is useful when using a test as a scope loop.

Field 9 — Field 9 displays the current selection of LOOP ("off" or "cnt nnnnn"). If the count is larger than 65535, "cnt *****" will be displayed.

Field 10 — Field 10 is touch-selectable and causes LOOP to toggle between on and off.

If "off" is displayed, the currently selected Block Area or Routine will run only once if executed.

If "on" is displayed, the currently selected Block Area or Routine will run repeatedly when directed to run. The loop count will be displayed in field 9.

Field 11 Field 11 displays the current selection of HALT/ERR ("on" or "off").

Field 12 Field 12 is touch-selectable and causes HALT ON ERROR to toggle between on and off.

If "on" is displayed in field 11, the currently selected Block, Area, or Routine will stop running when an error is detected.

If "off" is displayed, the Block, Area, or Routine will flag the error and permit testing to continue.

Field 13 Field 13 displays the current selection of RUN ("on" or "off").

Field 14 Field 14 is touch-selectable and causes RUN to toggle between on and off.

If "on" is displayed in field 13, the currently selected Block, Area, or Routine will run.

If "off" is selected, the currently selected Block, Area, or Routine will stop.

RS-232-C

The RS-232-C interface may be used in one of two modes for Extended Diagnostics. The first is Normal (or System) mode, where the RS-232-C emulates GPIB codes and formats. The second is Diagnostic Terminal mode, where the RS-232-C is used to drive a terminal, providing character echo, cursor control, ect.

Diagnostic Terminal mode provides fully functional diagnostics to the user while Normal mode will exclude all interactive testing.

Normal Mode

Normal mode communication emulates GPIB codes and formats.

All interactive tests have been excluded from Normal operation mode; therefore, a method of aborting a test in progress is not provided.

The following syntax is used in Normal mode:

TEST TERMINAL	Redirects diagnostics menus to the RS-232-C interface.
TEST	Selftest of complete mainframe and plug-in unit combination. (Halt on Error)
TEST LEFT	Extended test of Left plug-in unit. (Non Halt on Error)
TEST CENTER	Extended test of Center plug-in unit. (Non Halt on Error)
TEST RIGHT	Extended test of Right plug-in unit. (Non Halt on Error)
TEST EXTENDED	Extended test of complete instrument. (Non Halt on Error)
TEST "*<id><index>*"	Extended test will be attempted on the indicated test index. *<id>* = M,L,C, or R for Mainframe, Left, Center, or Right. *<index>* = *{hex string}*

EXAMPLES:

TEST will perform system selftest (Halt on Error).

TEST EXTENDED will perform Mainframe Extended test (NO Halt on Error).

TEST "M2410" will perform the single mainframe test indexed by 2410.

TEST?	With this query, one of two ASCII strings will be returned: either TEST PASS or... TEST "M<*index*>","L<*index*>","C<*index*>", "R<*index*>" Index numbers are in the order of occurrence. **EXAMPLE:** TEST "M2345","M2352","M4510","L1234", "R1234"

Diagnostic Terminal Mode

Diagnostic Terminal mode is the primary diagnostic I/O method used by a service technician.

The diagnostic test menus will be displayed on the terminal as they appear on the instrument display. Menu selections are made with the terminal keyboard to simulate display touches.

Terminal Interface. The Terminal Interface uses the ANSI X3.64 standard for cursor control.

Command Language. A parallel function of the menu Test Status Area is required through the RS-232-C interface for Diagnostic Terminal mode. The following command language provides that function.

Invocation Command

TEST TERMINAL	Switches the RS-232-C interface to Diagnostic Terminal mode and places the instrument in Extended Test mode.

Terminal Diagnostic Commands

B|b	Equivalent to touching the BLOCK field on the display menu.
A|a	Equivalent to touching the AREA field on the display menu.
R|r	Equivalent to touching the ROUTINE field on the display menu.
L|l	Equivalent to touching the LOOP field in the status area.
V|v	Equivalent to touching the VERBOSE field in the status area.
H|h	Equivalent to touching the HALT/ERROR field in the status area.
S|s	Equivalent to touching the START/STOP field in the status area.
E	Equivalent to touching the front-panel UTILITY major menu button and takes the instrument out of Extended Test mode.
U|u	Equivalent to sliding your finger UP the Left side of the display's test selection list.
D|d	Equivalent to sliding your finger DOWN the Left side of the display's test selection list.

GPIB

GPIB communication is identical to that of the RS-232-C interface operating in Normal mode.

Menu Test Entries

The following test lists are shown as they appear in the indicated display menus.

Block Menu

1. All Blocks
2. Processor
3. Front Panel
4. Scope Logic
5. Timebase
6. Vertical
7. MF Self Cal
8. Left Plugin
9. Right Plugin
10. Aux Plugin

Processor Area Menu

1. All Areas
2. Ram/Rom
3. SDI
4. NonVolatile Mem
5. I/O Devices
6. A/D Converter
7. Voltage Control
8. FPanel Control
9. Display Memory
10. Display Control
11. Trace Position
12. Storage Supply

Front Panel Area Menu

1. All Areas
2. Buttons
3. Leds
4. Knobs
5. Touch Panel
6. Beam Detector
7. FP Calibrator

Scope Logic Area Menu

1. All Areas
2. Rocs
3. Acvs
4. Cal Volt Ref
5. Z Axis

Timebase Area Menu

1. All Areas
2. Horizontal Mode
3. Triggers
4. Main Trigger
5. Dly Trigger
6. Sweeps
7. Main Sweep
8. Delayed Sweep
9. Horizontal Amp
10. Counter Timer

Vertical Area Menu

1. All Areas
2. Vertical Ch Sw
3. Vertical Amp
4. Vertical System

Left/Center/Right Plugin area Menus

1. All Areas
2. ??????????

PRELIMINARY
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PRELIMINARY
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CORRECTIVE MAINTENANCE

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in the **1130l Oscilloscope mainframe** are given here.

CONTENTS

The following instructions and disassembly procedures will be covered in this section:

Power Supply Voltage Hazard
Selected Components Criteria Table
Obtaining Replacement Parts
Soldering Techniques
Tools Required

REMOVING AND REPLACING PARTS

Power Supply Removal
Access to Components in the Power Supply
Fan Motor Removal
Cathode-ray tube Removal
Cathode-ray tube Replacement
Lithium Battery Handling and Disposal

CIRCUIT BOARD REMOVAL

A1	PLUG IN INTERFACE BOARD
A2	LINE INVERTER BOARD
A3	CONTROL RECTIFIER BOARD
A4	REGULATOR BOARD
A5	BOTTOM FRONT PANEL BOARD
A7	TOUCH PANEL BOARD
A8	CENTER FRONT PANEL BOARD
A9	TOP FRONT PANEL BOARD
A10	FRONT PANEL INTERFACE BOARD
A11	MAIN PROCESSOR BOARD
A12	VERTICAL BOARD
A13	SCOPE LOGIC BOARD
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A15	COUNTER TIMER REFERENCE BOARD (OPTIONAL)
A16	CT PLL/VCO BOARD

Front Panel Module Removal

S110 and S810 Encoder Removal

Rear Panel Plate Removal

Semiconductors

Interconnecting Pins

Coaxial-Type End-Lead Connectors

Circuit Board Pins

Circuit Board Pin Sockets

Multi-Pin Connectors

Arrangement of Pins in Multi-Pin Connectors

Delay Line Removal

Implosion Shield Removal

Graticule Light Bulbs Removal

Plug-In Interface Connectors

Power Transformer Removal

Arcing Prevention

Line Fuse Removal

Adjustment After Repair

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POWER SUPPLY VOLTAGE HAZARD

If you must work inside the power supply with power applied, be careful to **not** touch any metal part on the A2 Line Inverter Board. The metal frame of the power supply chassis itself should be safe to touch. However, a live circuit **could** short to the chassis, under certain conditions, and then the chassis would be dangerous to handle.

WARNING

All metal components, including any metal-faced ones, on the A2 Line Inverter Board should be considered hazardous. This is because these components are at the AC line voltage potential.

Always remove the line power cord before any disassembly is begun.

An electric-shock hazard exists when the 11301 is not grounded. Do not remove the ground wire (green-yellow) which connects the power supply chassis to the mainframe.

Manually discharge the line storage capacitors on the A2 Line Inverter Board before beginning any work inside the power supply. See the "Access to Components in the Power Supply" procedure, in this section.

SELECTED COMPONENTS CRITERIA TABLE

The A12 Vertical Board has L32Ø, a selected component. Its part number is 1Ø8-Ø577-ØØ. The part numbers of the components to replace it are 1Ø8-Ø578-ØØ or 1Ø8-Ø997-ØØ. No other circuit boards in the 113Ø1 have selected components.

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OBTAINING REPLACEMENT PARTS

All electrical and mechanical part replacements for the 11301 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, remember that the size and shape of a component may affect its performance in the instrument. All replacement parts should be direct replacements unless you know a different component will not adversely affect instrument performance.

SPECIAL PARTS

Some parts are manufactured or selected by Tektronix, Inc., to satisfy particular requirements. Some are manufactured for Tektronix, Inc., to satisfy our specifications. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. To determine manufacturer of parts, refer to Parts List, Cross Index Mfr. Code Number to Manufacturer (see Volume III, Diagrams and Parts Lists).

ORDERING PARTS

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 electric-shock hazard and instrument damage, disconnect the instrument from its power source before soldering.

The reliability and accuracy of the 11301 can be maintained only if proper soldering techniques are used when repairing or replacing parts.

The desoldering and removal of parts is especially critical and should be done only with an anti-static vacuum solder extractor; preferably one approved by a Tektronix, Inc., Service Center.

Use wire solder with rosin core, 63% tin, 37% lead. Contact your local Tektronix, Inc., representative or field office for approved solders.

All circuit boards used in the 11301 are multi-layer, with the exception of the A15 Counter/Timer Option Board. Conductive paths between the top and bottom layers may connect with one or any number of inner layers. If this inner conductive path is broken (due mainly to poor soldering practices), the board is unusable and must be replaced. **Damage can void warranty.**

CAUTION

Only an experienced maintenance person, proficient in the use of vacuum-type desoldering equipment, should attempt repair of any board in this instrument.

When soldering on circuit boards or small wiring, use only a 15-watt pencil type soldering iron. A higher wattage soldering iron can cause the etched circuit wiring to separate from the board base material. It can also melt the insulation from small wiring. Always keep the soldering-iron tip properly tinned to ensure the best heat transfer to the solder joint. Apply only enough heat to make a good solder joint. To protect heat-sensitive components, hold the component lead with a pair of long-nose pliers between the component body and the solder joint.

The following technique should be used to replace components on the circuit boards.

Touch the tip of the **vacuum desoldering tool** directly to the solder to be removed.

CAUTION

Excessive heat can cause the etched circuit wiring to separate from the board base material.

Never allow the solder extractor to remain on the board for more than three (3) seconds. Solder wick, spring-actuated or squeeze-bulb solder suckers, and heat blocks for multi-pin components must **not** be used. **Damage can void warranty.**

NOTE

Machine insertion of some components places a bend in both of the leads. These bent leads hold the component in position during a flow-solder manufacturing process which solders all of the components at once. ***Some components are difficult to remove due to their bent leads.*** To make removal of machine-inserted components easier, first remove the solder from the joint. Then straighten the leads of the components on the back of the circuit board, using a small screwdriver or pliers. Next remove the component.

When removing multi-pin components, do not heat adjacent conductors consecutively (see Fig. 6107-301). Pause a moment to allow the circuit board to cool before proceeding to the next pin.

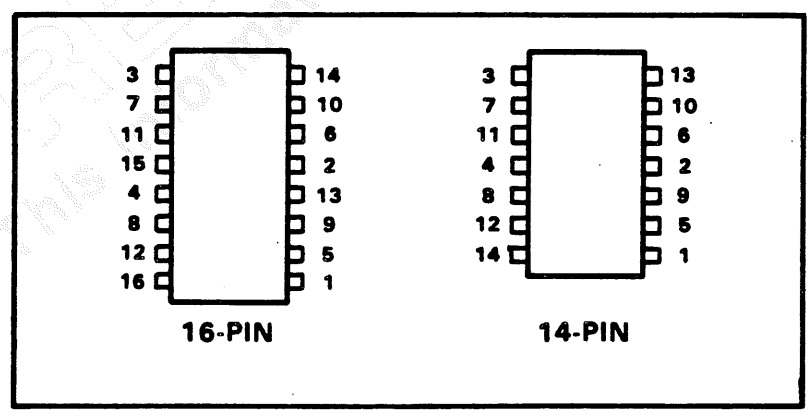


FIGURE 6107-301. RECOMMENDED DESOLDERING SEQUENCE.

Bend the leads of the replacement components to fit the holes in the circuit board. Insert the leads into the holes in the board, or as originally positioned.

Touch the iron to the connection and apply enough solder to make a firm solder joint.

Cut off any excess lead protruding through the board.

Clean the areas around the solder connection with a flux-removing solvent. Be careful not to remove the information printed on the circuit board.

CAUTION

Before cleaning around HYPCON connectors, read the instructions about them. See the "Semiconductors" procedure, in this section.

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TABLE 3-1
REFERENCE FOR SUPPORT ITEMS

Purpose	Item	Qty. Req.	Location
Circuit Board Removal Tools	Straight-slot screwdriver, large	1	Removing and Replacing Parts, Circuit Boards
	Torx screwdriver, No.7	1	
	Torx screwdriver, No.8	1	
	Torx screwdriver, No.10	1	
	Torx screwdriver, No.15	1	
	Allen wrench, 1/16"	1	
	Nutdriver, 3/16"	1	
	Nutdriver, 1/4"	1	
	Nutdriver, 5/16"	1	
	Nutdriver, 7/16"	1	
	Pliers, needle-nose	1	
	Pliers, diagonal side-cutters	1	
	Soldering iron, 15W	1	
	Vacuum solder extractor, anti-static	1	
	Torque wrench, 0-10 inch pound range	1	
	Resistor, shorting (see Fig. 6107-307)	1	
Optional Tools	Flashlight, penlight size	1	Removing and Replacing Parts, Circuit Boards

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REMOVING AND REPLACING PARTS

WARNING

To avoid electric-shock hazard and instrument damage, ***always disconnect the instrument from its power source before removing or replacing components or plug-in units.***

The exploded-view drawings associated with the Replaceable Mechanical Parts List (see Section 12 of Volume III, Diagrams and Parts Lists) may be helpful in the removal or disassembly of individual components or subassemblies.

The top and/or bottom cover will need to be removed for most repairs. These covers fit tightly around the chassis and sometimes will stick. They may have to be pried off.

A small cover fits over the access hole on the side of the plug in compartment. This access hole is for positioning wire cables inside the mainframe. A torx screw secures this cover.

Whenever a specific area is mentioned (such as the right side), it will usually be in reference to the front of the 1130l. If another reference is intended, it will be so described, such as the left side as facing the rear.

NOTE

Refer to the "Adjustment After Repair" procedure, at the end of this section.

POWER SUPPLY REMOVAL

The power supply can be slid out of the rear of the 11301 for maintenance and troubleshooting. It may also be removed to gain better access to the A1 Plug-In Interface Board, the A2 Line Inverter Board, the A3 Control Rectifier Board or the A4 Regulator Board.

To remove the power supply from the mainframe, proceed as follows:

* Turn the mainframe on its left side (as facing the rear panel). The power supply will now be at the bottom of the instrument.

* Remove the eight Torx screws that secure the power supply (see Fig. 6107-302).

PRELIMINARY
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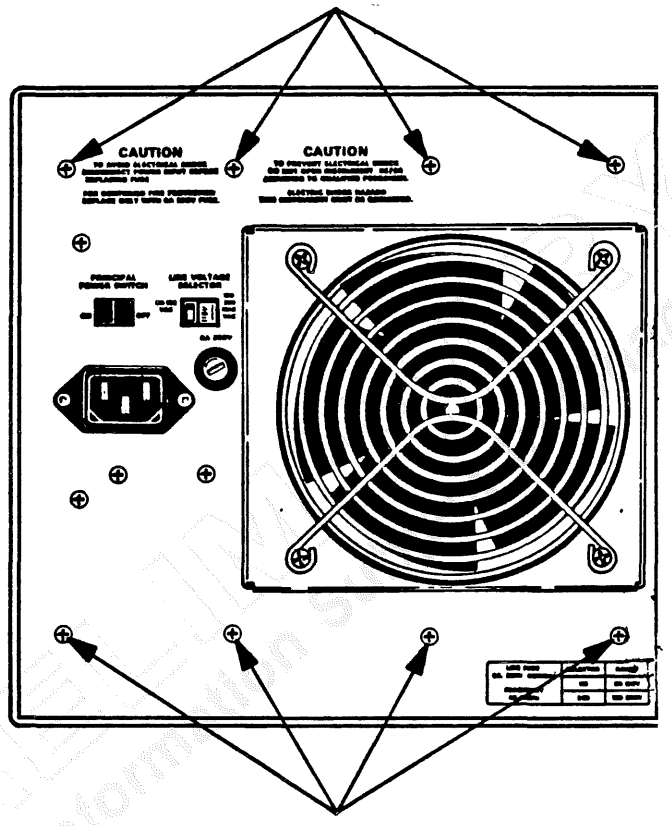


FIGURE 6107-302. SCREWS THAT SECURE THE POWER SUPPLY AND REAR PLATE.

* Carefully pull the power supply part way out of the mainframe. Stop before the wires to the A3 Control Rectifier Board connectors begin to stretch taut or bind.

CAUTION

Excessive pulling on the power supply beyond this point may damage connector pins.

* The wires should be long enough to permit the power supply to be partially removed from the mainframe without disconnecting any wire connectors.

NOTE

Should disconnecting any wires be necessary, record their location. This will help you to replace them correctly. See Fig. 6107-303.

PRELIMINARY
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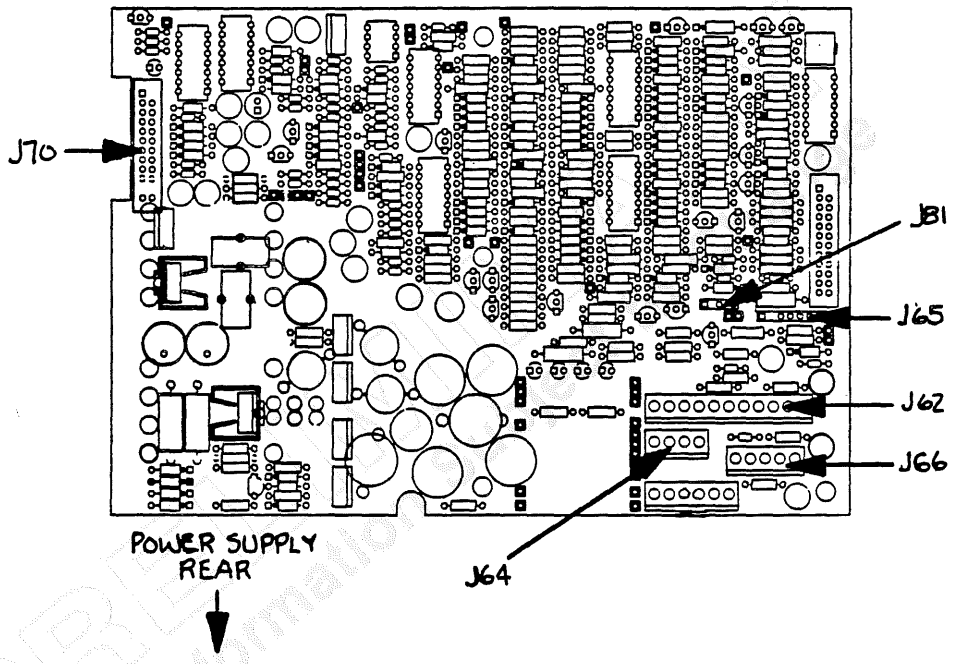


FIGURE 6107-303. BOTTOM VIEW OF A3 CONTROL RECTIFIER BOARD SHOWING CONNECTOR LOCATIONS.

* Do not remove the chassis ground (green-yellow) wire. It should stay attached between the power supply and the mainframe.

The power supply may now be removed from the mainframe. First remove the wire connectors from their pins on the A3 Control Rectifier Board. Depending on the repair work to be done, it may be appropriate to set both the detached power supply and the mainframe right side up.

* To apply power, attach the A.C. power cord to the power plug receptacle.

NOTE

The fan will revolve slightly slower than normal when the instrument is connected this way.

This connection will allow troubleshooting the power supply and/or power-related problems in the mainframe.

NOTE

Before removing any of the power supply covers, read the warnings in the "Access to Components in the Power Supply" procedure of this section.

To replace the power supply follow the previous procedure in reverse order.

NOTE

Check that the plastic cable protector along the left rear side (facing the rear) is out of the way. It should lie flat against the side. There is a hole near its rounded point (towards the rear) that fits over a pem nut. Align this hole before reinstalling the power supply.

Align the metal guides on the top of the power supply with the plastic grooves inside the upper part of the opening in the mainframe.

Be careful not to pinch any wires or interconnecting cables while reinstalling the power supply.

Replace the eight torx screws into the rear plate and tighten them securely.

DIRECTIONS ARE ONLY A REFERENCE
Information subject to change

ACCESS TO COMPONENTS IN THE POWER SUPPLY

To reach the components inside the power supply chassis for maintenance or repair, use the following procedure:

WARNING

Disconnect the 11301 from the power source. ***Allow the line storage capacitors to discharge before removing any cover from the power supply.*** Unless they are manually discharged, these capacitors remain charged with a high dc voltage for several minutes after the line power is disconnected. ***A warning-indicator (neon bulb) located on the A2 Line Inverter Board flashes when this stored voltage exceeds about 80 volts. Do not remove the power supply covers while this light is flashing.***

1. Remove the power supply as previously described.

a. Disconnect the A.C. power cord before proceeding.

2. To reach the A2 Line Inverter board, first remove the protective cover from the power supply chassis. This is done by removing the four screws securing the cover.

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This information is subject to

a. Carefully slide the protective cover off the power supply chassis.

b. The A2 Line Inverter Board is now accessible for maintenance or repair. However, if the 113Ø1 is to be operated with the cover removed, heed this:

WARNING

All metal components on the A2 Line Inverter Board should be considered hazardous.

Such components remain at the AC line voltage potential.

Once the power cord has been disconnected, manually discharge the line storage capacitors. See Fig. 6107-306.

c. Before starting maintenance or taking resistance measurements, manually discharge the line storage capacitors (C2ØØ, C22Ø, C31Ø and C32Ø) as follows:

* Remove the protective cover as previously described.

* Locate the line storage capacitors on the A2 Line Inverter Board. Place a 1ØØ-2ØØ ohm, 4ØØ volt, 1-watt insulated resistor in parallel with R22Ø (47Ø kohm) to discharge these capacitors, see Fig. 6107-3Ø6. For an example of this shorting resistor, see Fig. 6107-3Ø7.

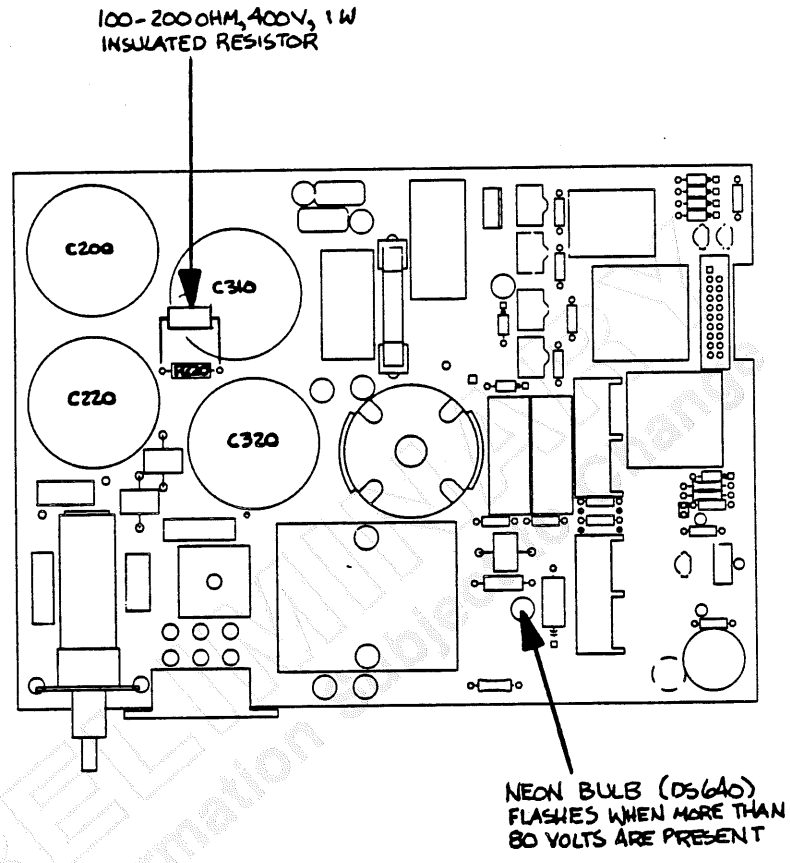


FIGURE 6107-306. A2 LINE INVERTER BOARD SHOWING HOW TO MANUALLY DISCHARGE LINE STORAGE CAPACITORS ACROSS R220.

PRELIMINARY
This information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-307. SHORTING RESISTOR USED TO DISCHARGE LINE STORAGE CAPACITORS ACROSS R220.

3. To replace the power supply protective cover, follow the removal procedure in reverse order.

4. To reach the line voltage circuitry (Principal Power Switch, Line Voltage Selector, fuseholder, etc.), proceed as follows:

a. Remove the two long screws from the right side of the fan housing (as facing the rear panel).

b. Remove the screw above and left of the Principal Power switch. Then remove the screw below and left of the power plug receptacle (the one closest to the left edge).

c. Follow step 3 of the A2 Line Inverter Board Removal procedure, in this section.

* Remove the overall cover from the power supply by lifting it off.

d. To replace the overall cover, reverse this procedure.

5. Complete access to the A3 Control Rectifier Board or to the A2 Line Inverter Board may be obtained by following the procedures to remove these boards. See "Circuit Board Removal" in this section.

6. Replace the power supply as previously described.

NOTE

Check that no wires contact the fan blades.

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FAN MOTOR REMOVAL

Remove and replace the fan motor as follows:

1. Mark the top of the fan motor housing. (It reassembles only one way). Remove the four screws holding the assembly together.

* Hold the housing as the last screws are removed.

2. Separate the grill and the housing from the motor.

3. Remove the two wires at their motor connections.

* Note that the red wire is (+) and the brown wire is (-).

4. Remove the fan motor.

NOTE

Observe the position in which the motor was mounted. Replace it the same way, or the fan wires may not reach.

5. To replace the fan motor, reverse the order of removal.

* Do not pinch the wires under the fan housing.

* Tighten screws securely. Erase the mark from the top of the housing.

* Check that no wires contact the fan blades.

PRELIMINARY
This information subject to change

CATHODE-RAY TUBE REMOVAL

Remove the cathode-ray tube as follows:

WARNING

The crt may retain a dangerous (20 kV) charge. Before removing the crt, the anode must be fully discharged. Short the anode lead to the chassis. Wait approximately ten minutes and again firmly short this lead to the chassis. Then, remove the crt.

Use care when handling. Breakage of the crt causes a high-velocity scattering of glass fragments (implosion). Protective clothing and safety glasses should be worn. Avoid striking the crt on any object which might cause it to crack or implode.

When storing a crt, place it in a protective carton. Otherwise, set it face down in a protected location. Be certain it is on a smooth surface with a soft mat under the crt faceplate.

1. **Position the 1130l with its right side down, as facing the front.** Remove its top and bottom covers. Remove the access hole cover from the inner side of the plug in compartment.

2. Remove the six screws from the rear panel plate. Allow the plate to hang from its wires as shown in Fig. 6107-309.

a. Protect the surfaces underneath the plate from scratches.

3. Loosen the four screws (do not remove) on the crt rear retaining ring. See Fig. 6107-309.

a. Remove the clear plastic protective cover from over the left rear corner of the A13 Scope Logic Board. See Fig. 6107-327.

PRELIMINARY
This Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-309. REAR VIEW OF CRT AND INSIDE VIEW OF REAR PANEL.

b. Remove the J53 connector from the latter area.

4. Open the clasp on the cable retainer which holds the J53 cable, the anode lead, and the crt base-pin socket cables.

a. Remove the J53 cable and the anode lead from the cable retainer.

b. Remove the anode lead from its keyhole recess. The recess is part of the crt support just below the crt base-pin socket.

WARNING

The crt anode voltage is 20kV. Ground the anode to the chassis to discharge any stored charge remaining in the crt.

Wait ten minutes and ground the anode lead again.

5. Disconnect the anode lead from its holder. Ground the anode to the chassis, as in the preceding instructions.

6. Disconnect the crt base-pin socket. Install a protective cap over the pins.

7. Remove the A7 Touch Panel Board, which retains the crt. Refer to "Circuit Board Removal" procedures in this section.

a. **Leave the A5 Bottom Front Panel Board and the encoder knobs attached when removing the Touch Panel Board.**

8. Disconnect all six crt neck pin leads from the crt. Use care to avoid damaging the neck pins.

a. Two leads connect to the A12 Vertical Board.

b. Two leads connect to the passive network (crt termination res.).

c. Two leads connect to the A14 Time Base Board.

9. Remove the crt by sliding it slowly through the front. Check that the anode lead and the J53 cable are trailing the crt.

a. Guide the base-pin socket as far outward as possible.

b. Pull the anode lead and the J53 cable through the grommet inside the crt shield.

NOTE

The rubber pads in the front casting (at the corners of the crt faceplate) may fall out. Reinstall them if necessary. See Fig. 6107-311.

PRELIMINARY
This information Subject to Change

CATHODE-RAY TUBE REPLACEMENT

NOTE

Before replacing the crt, check that the grid scale numbers are on the left and the "Tek" logo is on the right of the faceplate.

Replace the cathode-ray tube as follows:

1. Route the anode lead and the J53 cable through the grommet (at the bottom inside right of the crt shield). Push the crt into place while routing the cables. See Fig. 6107-311.

NOTE

Pull the cables through the rear of the 1130l so that they do not tangle inside the crt shield.

The base-pin socket may need to be moved around to insert the crt base into the retaining ring.

PRELIMINARY
This information subject to change

PRELIMINARY
Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIG. 6107-311. FRONT VIEW OF NECK OF CRT INSIDE CRT SHIELD.

2. Reinstall the Touch Panel. Use the procedure to replace the A7 Touch Panel Board, in the Circuit Board Removal section.

CAUTION

Tighten the Crt Scale Cover screws only with a diagonal method. DO NOT TIGHTEN IN A CLOCKWISE DIRECTION. The latter will damage the corner of the crt faceplate.

For instructions on this diagonal method, read the "CAUTION" notice listed at the end of the A7 Touch Panel Board Removal (and Replacement) procedure, in this section.

NOTE

Check that the implosion shield and the lens frame are correctly seated.

Position the instrument on its right side, as facing the front.

3. Reconnect all six crt neck pin leads. Do not bend the neck pins.

4. Tighten the four screws around the crt rear retaining ring.

a. Remove the protective cap and reinstall the crt base-pin socket.

b. Reinstall the anode lead and the J53 cable into the cable retainer. See Fig. 6107-309. Close the retainer's clasp.

5. Route the J53 cable through the middle grommet. Dress the J53 cable along the edge of the A13 Scope Logic Board.

a. Reconnect the J53 connector to the Scope Logic Board.

b. Reinstall the clear plastic protective cover.

6. Before reconnecting the anode lead, read this:

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CAUTION

The anode lead may require greasing before it is reconnected. The reason for applying grease is to prevent the anode lead from sticking inside its holder.

The rule of thumb is:

1. If both the crt and the multiplier assembly have been replaced, apply the grease.

2. If only one or the other part is replaced, grease should not be necessary.

If the anode lead should stick inside the holder, the lead can be removed. However, doing so will be difficult and may prove hazardous.

To remove a stuck anode lead, proceed as follows:

Allow sufficient time to elapse for the 20kV anode charge to bleed off. Then, using the thumb and fingertips, slowly work the end of the holder from the lead.

WARNING

This process can be dangerous if a charge still remains on the anode. By removing the lead a portion at a time, it could suddenly emerge without warning and become hazardous to your health!

a. If grease is required, **use General Electric's "Silicone Lubricating Grease".** The Tektronix Part Number for this grease is 006-6949-00.

b. Grease the anode lead lightly.

c. Reconnect the anode lead to its holder.

7. Put the anode lead and holder into the keyhole-shaped recess. See Fig. 6107-309. (The anode lead and holder fit into the round hole while the cable fits into the slot alongside it).

8. Check that all cables are placed inside the grommets.

a. Check that all peltola connectors (inside the rear panel plate) are connected to their BNC sockets.

9. Replace the rear panel plate. Reinstall and tighten all six screws.

1Ø. Reinstall the access hole cover on the side of the plug in compartment. Secure it with a torx screw.

11. Replace the top and bottom covers.

a. Set the instrument right side up.

PRELIMINARY
This information Subject to Change

LITHIUM BATTERY HANDLING AND DISPOSAL

A Lithium battery (BT1190) is mounted on the A11 Main Processor Board. See Fig. 6107-325.

NOTE

Record the polarity before removing the battery.

Remove the battery by grasping it between the thumb and index finger. Pull the battery straight upwards from its mounting bracket.

These batteries require special handling for disposal.

WARNING

To avoid personal injury, observe proper procedures for handling and disposal of Lithium batteries. ***Improper handling may cause fire, explosion, or severe burns. Do not recharge, crush, disassemble, or heat the battery above 212 degrees F, 100 degrees C, incinerate, or expose contents of the battery to water.***

Dispose of battery in accordance with local, state and federal regulations.

Typically, small quantities (less than 20) can be safely disposed of with ordinary garbage in a sanitary landfill.

Larger quantities must be sent by surface transport to a Hazardous Waste Disposal facility. The batteries should be individually packaged to prevent shorting. Pack them in a sturdy container that is clearly labeled, "Lithium Batteries--DO NOT OPEN".

Reinstall the new Lithium battery by reversing the order of removal. Observe that the (+) polarity on the replacement battery agrees with the (+) mark on the circuit board.

CIRCUIT BOARD REMOVAL

Most of the circuit boards used in the 1130l Oscilloscope are multi-layer. (The only single-layer circuit board is the Counter/ Timer Option Board). Conductive paths between the top and bottom layers may connect with one or any number of inner layers. If this inner layer conductive path is broken (due mainly to poor soldering practices), the board is unusable and must be replaced. **Damage can void warranty.**

If a circuit board is damaged beyond repair, replace the entire board module. Part numbers are given in Volume III, Section 10, Replaceable Electrical Parts.

Component grid locator and circuit board locator illustrations are shown on the pages facing each schematic diagram in that section.

All of the circuit boards in the 1130l are mounted on the chassis. Pin connectors are used for electrical interconnection with chassis-mounted components and other circuit boards.

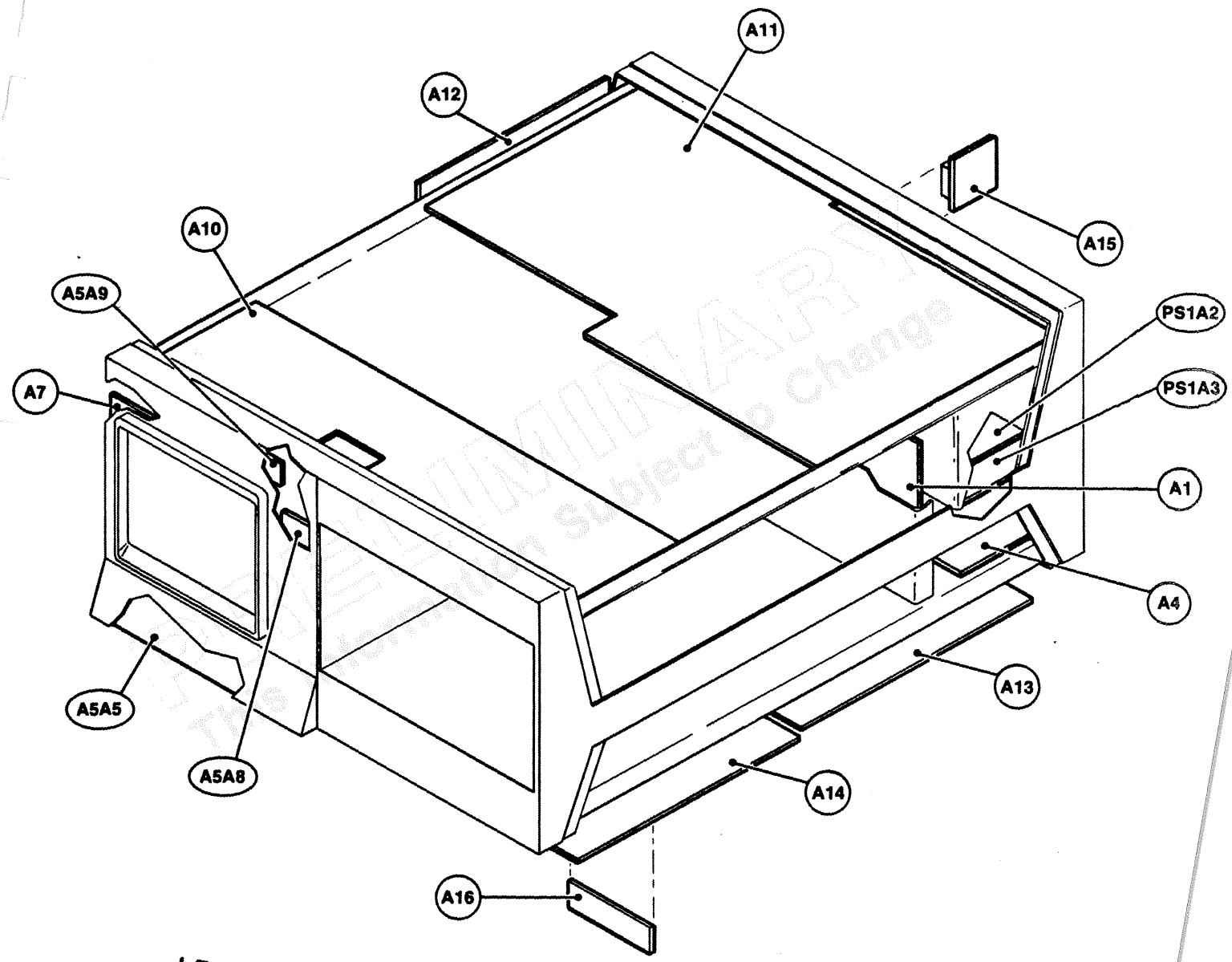
CAUTION

After removing a circuit board from the instrument, place it upon a non-conducting surface. This will minimize the chance of static charge damage to the integrated circuits and/or related circuitry.

Some parts mounted on a board must be retained for use with the new module. These parts might include interconnecting plugs, support posts, and some wiring.

NOTE

Refer to the Adjustment After Repair Procedure, in this section.



LOCATION OF CIRCUIT BOARDS IN THE 11301.

A1 PLUG IN INTERFACE BOARD

Remove and replace the A1 Plug In Interface Board as follows:

1. Set the 11301 right side up. Remove its top cover.

2. Remove the plug in units.

3. Remove the nine torx screws securing the interface connector receptacles to the chassis. See Fig. 6107-312.

4. Disconnect all connectors from the A11 Main Processor Board. See Fig. 6107-325. Record their index triangles and locations so that the connectors can be correctly replaced.

a. Remove the five board-retaining torx screws.

b. Remove the mounting posts from the RS-232 and GPIB connectors on the rear panel. Move the plastic cable protector flange off the right side of the chassis.

c. Gently **remove the A11 Main Processor Board** by lifting it.

NOTE

The J90 interconnecting pins from the A1 Plug In Interface Board hold the board firmly. Lift the board carefully so that neither this connector nor the Main Processor Board are damaged.

A plastic pin guide covers the Plug In Interface connector underneath the Main Processor Board. This guide may come off when the board is removed. Replace the pin guide if it does.

5. **Remove the Power Supply.** See the "Power Supply Removal" procedure in this section.

a. Remove the connectors (except for J81) from the A3 Control Rectifier Board.

PRELIMINARY
Information Subject to Change

NOT AVAILABLE AT THIS TIME

FIGURE 6107-312. SHOWING LOCATION OF THE NINE SCREWS (FASTENING A1 TO THE CHASSIS), RECEPTACLES, AND RAILS.

NOTE

Record the locations of the connectors to replace them correctly.

6. Disconnect the J57 connector from the A4 Regulator Board. See Figure 6107-318.

NOTE

If the (optional) A15 Counter/Timerr Reference Board is installed, the J40 connector needs to be removed. (See Figure 6107-318).

a. Remove the two torx screws from the metal heatsink at the rear of the board. There are holes provided in the chassis, across from these screws to insert a screwdriver.

NOTE

The Regulator Board is now unfastened from the chassis. However, it still remains connected to the Plug In Interface Board.

b. Carefully disconnect the J95 and J96 interconnecting pins from the Plug In Interface Board by pulling the Regulator Board towards the rear.

c. **Remove the A4 Regulator Board.**

7. Position the 11301 on its right side, as facing the front. Remove the bottom cover.

8. **Disconnect the A13 Scope Logic Board,** see "Circuit Board Removal", in this section. The cables from the board to the crt do not need to be completely removed from the rear panel area. Allow the board to remain suspended from the chassis.

9. The Plug In Interface Board can be removed from either side of the chassis. See Fig. 6107-314.

NOTE

Mark each of the wire connectors so that they can be correctly replaced.

PRELIMINARY
This Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-314. TOP AND BOTTOM VIEWS OF THE REMOVAL OF A1 PLUG IN INTERFACE BOARD.

a. Cut the three plastic cable tiedowns attached to the bottom of the board. These tiedowns keep the wires separated between the connector receptacles.

b. Remove the J64 cable (from the A3 Control Rectifier Board) through the chassis opening beside the Plug In Interface Board. Remove the peltola connectors from the Plug In Interface Board.

c. **Remove the Plug In Interface Board.**

To replace the A1 Plug In Interface Board, follow the previous procedure in reverse order. Additional instructions follow:

1. Reconnect the peltola connectors to the board.

NOTE

Replace the three plastic cable tiedowns to the bottom of the Plug In Interface Board.

a. Return the J64 cable through the chassis opening to where the Control Rectifier Board will be installed.

b. Check that the plastic pin guides remain attached to the connectors on each side of the Plug In Interface Board.

c. Reinstall the nine torx screws when the board is replaced into the instrument. Tighten all the screws.

CAUTION

The (black) plug in guide rails (see fig. 6107-312) must touch the chassis by the Plug In Interface Connector receptacles. If these guide rails have been removed or moved out of position, realign them against the chassis. Otherwise the plug ins may not seat fully into the connector receptacles.

The screws holding these rails are located under the A13 Scope Logic Board.

2. **To replace the A13 Scope Logic Board,** see the replacement procedure for that board in this section.

PRELIMINARY
This information subject to change

NOTE

Make certain that the plastic pin guide on P91 is in place before reinstalling the circuit board. The interconnecting pins usually align vertically. However, they may not always align horizontally. Check the pins before reinstalling the board.

3. Inspect the interconnecting pins of J95 and J96 on the A4 Regulator Board. Check that the pin tips are straight and evenly spaced.

a. Reconnect the J57 connector to the board.

b. **Reinstall the Regulator Board** by inserting the J95 and J96 interconnecting pins into their connectors on the A1 Plug In Interface Board.

c. Reinstall the two torx screws to the metal heatsink at the rear of the Regulator Board. There are two holes provided in the chassis, across from these screws, to insert a screwdriver.

4. **Reinstall the Power Supply.** See the "Power Supply Removal" procedure, in this section.

NOTE

If the ground (green-yellow) wire was removed, reconnect it before the power supply re-installation.

The plastic (J71 cable) protector may interfere with the reinstallment of the power supply. Make certain that the cable protector is flat against the chassis. Guide the power supply across the cable protector.

a. Replace the bottom cover on the instrument. Turn the instrument right side up.

5. Check that the plastic pin guide on the Plug In Interface Board connector is installed.

NOTE

The interconnecting pins of J90 usually align in a vertical direction. But, they may not always align horizontally. Check the pins before reinstalling the Main Processor Board.

a. Move the flange of the cable protector out of the way. Move the J60 cable away from the chassis. Check that no wires will be pinched under the board.

b. **Reinstall the A11 Main Processor Board.** Follow the replacement instructions given in the A11 Main Processor Board Removal procedure in this section.

6. Replace the top cover on the instrument.

PRELIMINARY
This Information Subject to Change

A2 LINE INVERTER BOARD

Remove and replace the A2 Line Inverter Board as follows:

1. Remove the power supply. See "Power Supply Removal" in this section.

2. Remove the protective cover from the power supply. See "Access to Components in the Power Supply" in this section. Follow steps 1 through 2a.

3. Remove the two screws that secure the Line Inverter Board. See Fig. 6107-AA. Then remove the screw holding the front of the overall cover to the Line Inverter Board. Remove the two screws from the bottom of that cover.

4. Remove the two screws from the left side of the power supply rear plate, above and below the power plug receptacle.

a. Remove the two long screws from the right side of the fan motor housing. See Fig. 6107-AB.

b. Remove the overall cover from the power supply.

5. Remove the J70 connector from the right front edge of the Line Inverter Board. See Fig. 6107-AA. Gently separate the Line Inverter Board from the A3 Control Rectifier Board. The interconnecting pins of J97 and J98 hold them together.

6. Unsolder the (white) wire connecting the Line Inverter to the fuseholder, at the fuseholder.

NOTE

When removing a wire from a circuit board, always tag the wire and the corresponding connection point on the circuit board.

7. Remove the Line Inverter Board.

To replace the A2 Line Inverter Board, reverse the order of removal. Match the index triangle on the pin connectors with the corresponding triangle on the board. Correct location of the pin connectors is shown in the circuit board illustrations. These are in Volume III, Section 11, Diagrams and Circuit Board Illustrations.

CAUTION

Check that the circuit board is held in place by its plastic guides on both edges. These guides are mounted inside the overall power supply cover.

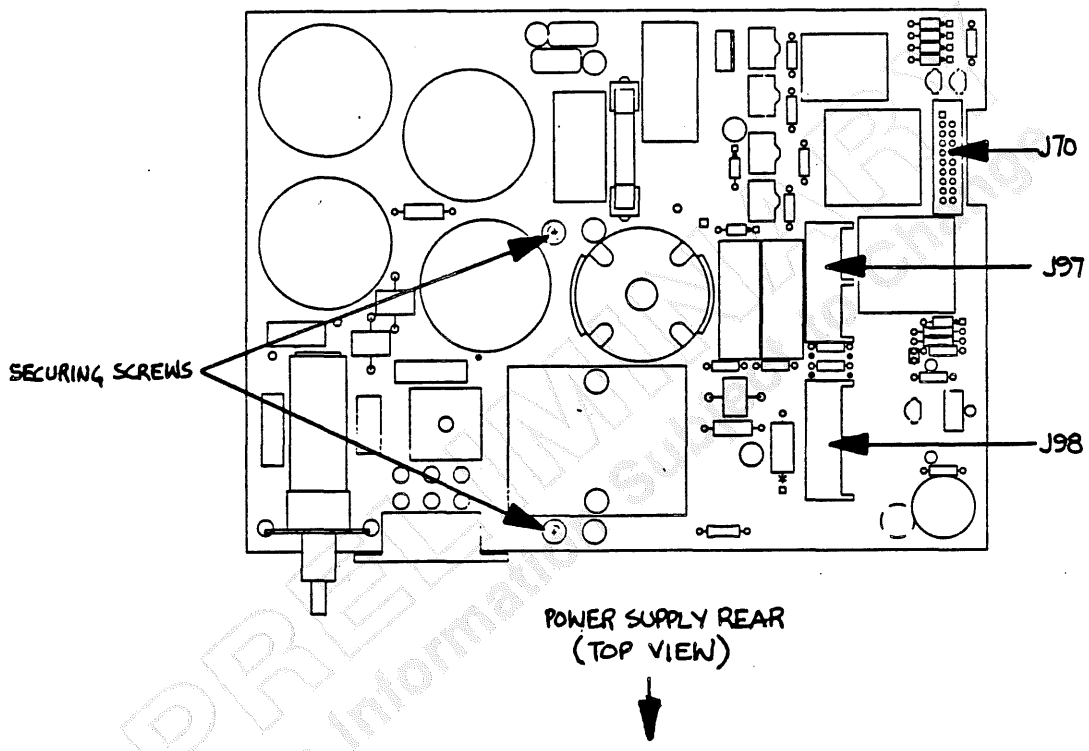


FIGURE 6107-AA. CONNECTOR LOCATIONS FOR REMOVAL OF THE A2 LINE INVERTER BOARD.

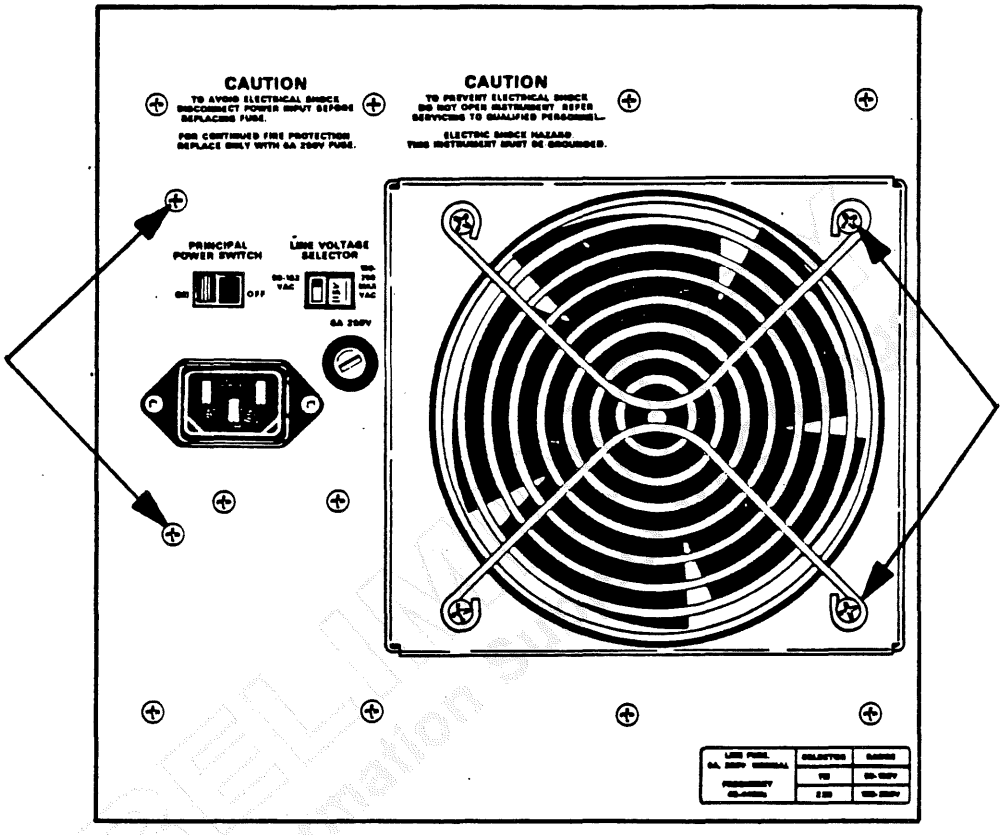


FIGURE 6107-AB. LOCATION OF REAR PANEL SCREWS SECURING THE POWER SUPPLY COVER.

A3 CONTROL RECTIFIER BOARD

Remove and replace the A3 Control Rectifier Board as follows:

1. Remove the power supply. See the "Power Supply Removal" in this section.

2. Remove the protective cover from the power supply. See "Access to Components in the Power Supply" in this section.

3. Follow steps 3 and 4 of the "A2 Line Inverter Board Removal" procedure in this section, to remove the overall cover from the power supply chassis.

4. With reference to Fig. 6107-AC, remove the J70 connector at the upper front edge of the Control Rectifier Board. Remove the J81 connector to the fan motor, which is located near the lower right board area.

5. Remove the two screws below and to the right of the power plug receptacle. See Fig. 6107-AD. Gently separate the Control Rectifier Board from the A2 Line Inverter Board. The interconnecting pins in J97 and J98 on the Line Inverter Board, are holding both boards together.

6. Remove the Control Rectifier Board.

CAUTION

The A2 Line Inverter Board is now unfastened. Support it so that it does not fall and become damaged.

• To replace the A3 Control Rectifier Board, reverse the order of removal. Match the index triangles on the pin connectors with the corresponding triangles on the board. The correct location of the pin connectors is shown in the Circuit board illustrations. See Section 11, Diagrams and Circuit Board Illustrations, of Volume III.

CAUTION

Check that the circuit board is held in place by its plastic guides on both sides. These guides are mounted inside the overall power supply cover.

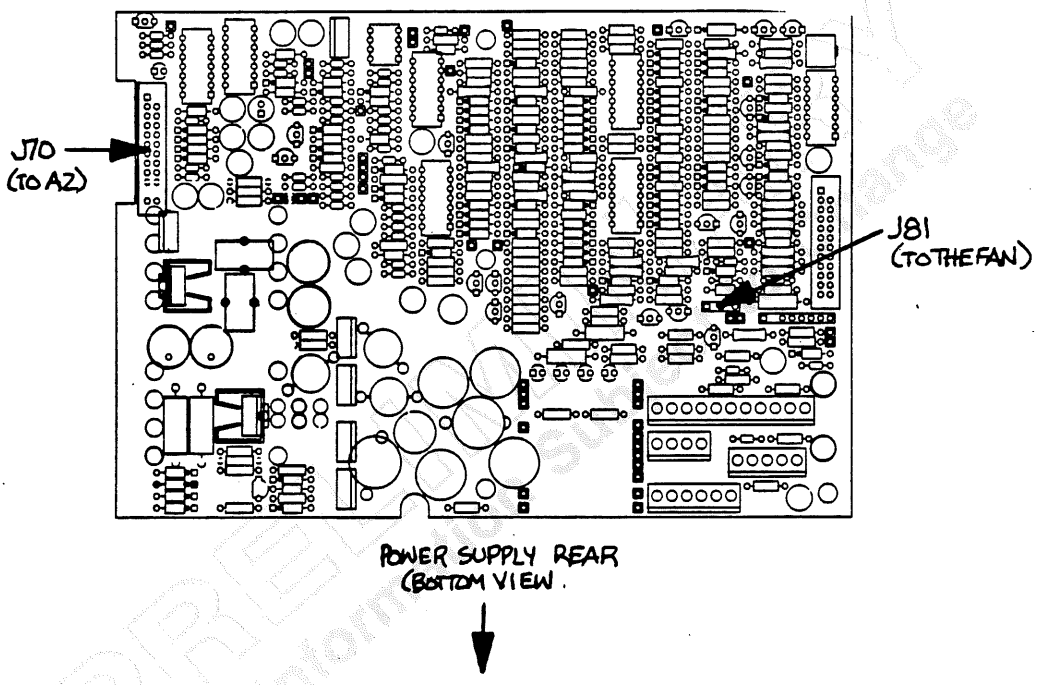


FIGURE 6107-AC. CONNECTOR LOCATIONS FOR REMOVAL OF THE A3 CONTROL RECTIFIER BOARD.

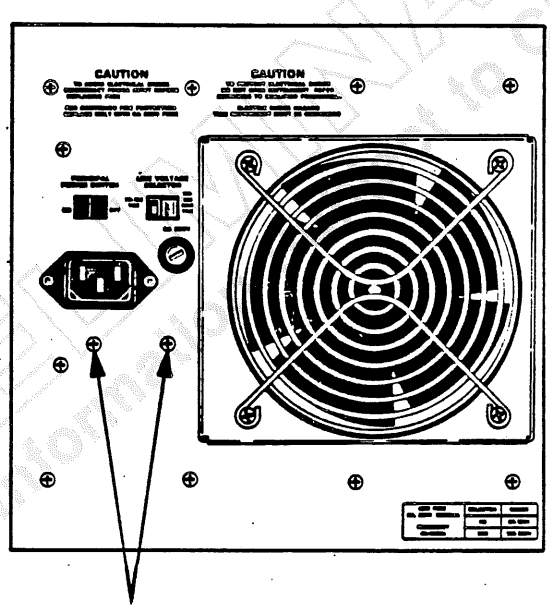


FIGURE 6107-AD. REAR PANEL MOUNTING SCREWS FOR THE A3 CONTROL RECTIFIER BOARD.

A4 REGULATOR BOARD

Remove and replace the A4 Regulator Board as follows:

1. Remove the power supply. See the "Power Supply Removal" in this section.

2. If it is on its side, set the 11301 right side up.

3. Disconnect J57 connector from the Regulator board. See Figures 6107-313 and 6107-318. Note the index triangle locations for correct reconnection.

NOTE

If the (optional) A15 Counter/Timer Reference Board is installed, the J40 connector will need to be removed also. (See Figure 6107-318).

4. Remove the two torx screws from the metal heatsink attached to the rear of the board. See Fig. 6107-318.

NOTE

The Regulator Board is now unfastened from the chassis. However, it remains connected to the A1 Plug In Interface Board through interconnecting pins.

5. Carefully disconnect pins J95 and J96 from the Plug In Interface Board by pulling the Regulator Board towards rear. See Fig. 6107-313.

6. Remove the Regulator Board.

* To replace the A4 Regulator Board, reverse the order of removal.

CAUTION

Use care when reconnecting pins J95 and J96 to the A1 Plug In Interface Board. Should it become necessary, the A13 Scope Logic Board may be removed to view these pins through the mainframe chassis. See "A13 Scope Logic Board Removal" procedure in this section.

NOTE

Match the index triangle on the pin connectors with the corresponding triangle on the circuit board. Correct locations of the pin connectors are shown in the circuit board illustrations. See Section II, Diagrams and Circuit Board Illustrations of Volume III, Diagrams and Parts Lists.

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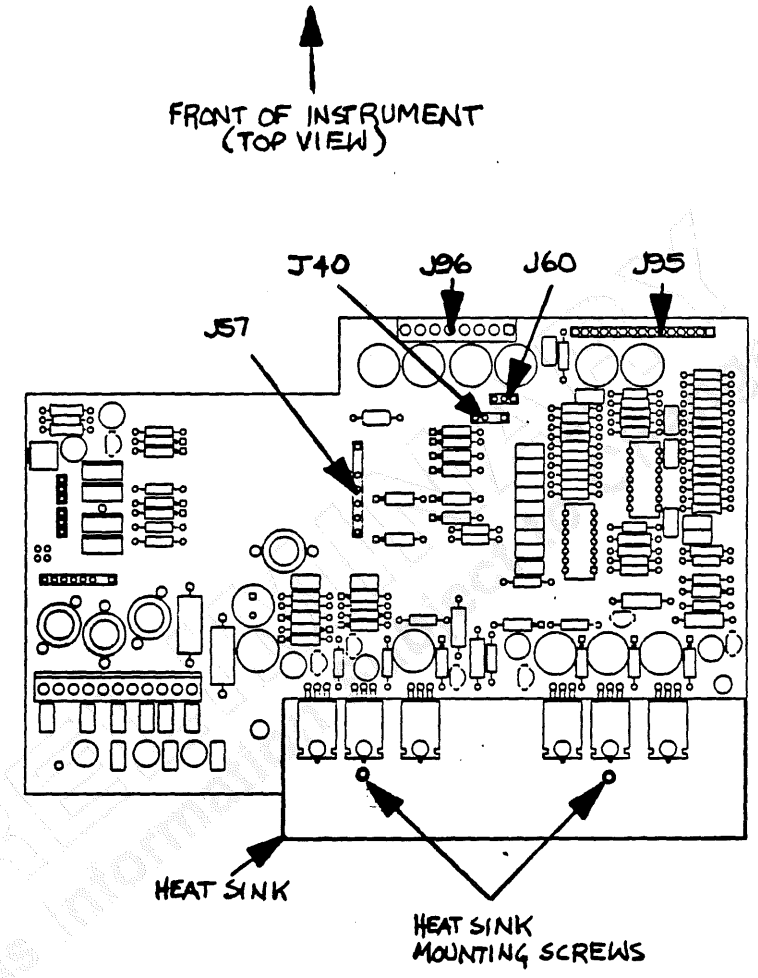


FIGURE 6107-318. REAR VIEW OF THE A4 REGULATOR BOARD INSTALLED IN THE 11301.

A5 BOTTOM FRONT PANEL BOARD

Remove the A5 Bottom Front Panel Board as follows:

1. Follow the procedure to remove the Front Panel Module in this section. Use steps 1 through 9.

CAUTION

The light diffuser parts may fall out when the Bottom Front Panel Board is removed from the front panel. Reinstall any parts that do.

2. Lay the board flat with its pushbuttons on top. Remove the 7/16" nuts from the encoder shafts. Remove the flat washers and the (fluted) ground clips. See Fig. 6107-319.

3. Hold the switch spacer against the board. Invert the board. Remove the A5 Bottom Front Panel Board from the switch spacer. See Fig. 6107-319.

CAUTION

The pushbuttons will fall out if the switch spacer is inverted.

4. Record the location of the J73 cable's red line (#1 wire) on the circuit board.

a. Remove connector J73.

5. Remove the Bottom Front Panel Board.

To replace the A5 Bottom Front Panel Board, follow the previous procedure in reverse order.

PRELIMINARY
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NOTE

Check that all the light diffusers and pushbuttons are inserted into the switch spacer before reattaching the circuit board. See Fig. 6107-319.

Should the pushbuttons ***not*** enter the Front Panel holes evenly, try the following remedy:

Hold the board and switch spacer against the Front Panel.

Stand the Front Panel upright so that its front is visible.

Use a tool, such as a pencil tip, to move the pushbuttons around until they enter their holes.

PRELIMINARY
This Information Subject to Change

PRELIMINARY
Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-319. ASSEMBLED AND DISASSEMBLED VIEWS OF THE A5 BOTTOM FRONT PANEL BOARD.

A7 TOUCH PANEL BOARD

Remove the A7 Touch Panel Board as follows:

1. Set the 1130l on its right side, as facing the front.

a. Remove the top cover.

2. Follow the **removal (or replacement) procedure** for the "Front Panel Module" in this section.

a. **Leave the encoder knobs and the A5 Bottom Front Panel Board attached.**

b. Set the instrument right side up.

3. Disconnect connectors J87 and J88 from the A10 Front Panel Interface Board. See Fig. 610l-324.

a. Do not remove these cable connectors from the Touch Panel Board. The connectors are very difficult to reinstall on the latter board, when it is in the instrument.

4. **Remove the four retaining screws** from the crt scale cover (bezel) **by using a diagonal method.** See Fig. 610l-320.

CAUTION

Do not remove, nor reinstall these screws by using a clockwise method. This will damage the corners of the crt faceplate.

5. Remove the Crt Scale Cover.

NOTE

If the Crt Scale Cover is replaced because of a defect, reinstall the EMI gaskets on each side.

a. **The Crt Implosion Shield can be removed now.** See "Implosion Shield Removal" procedure in this section.

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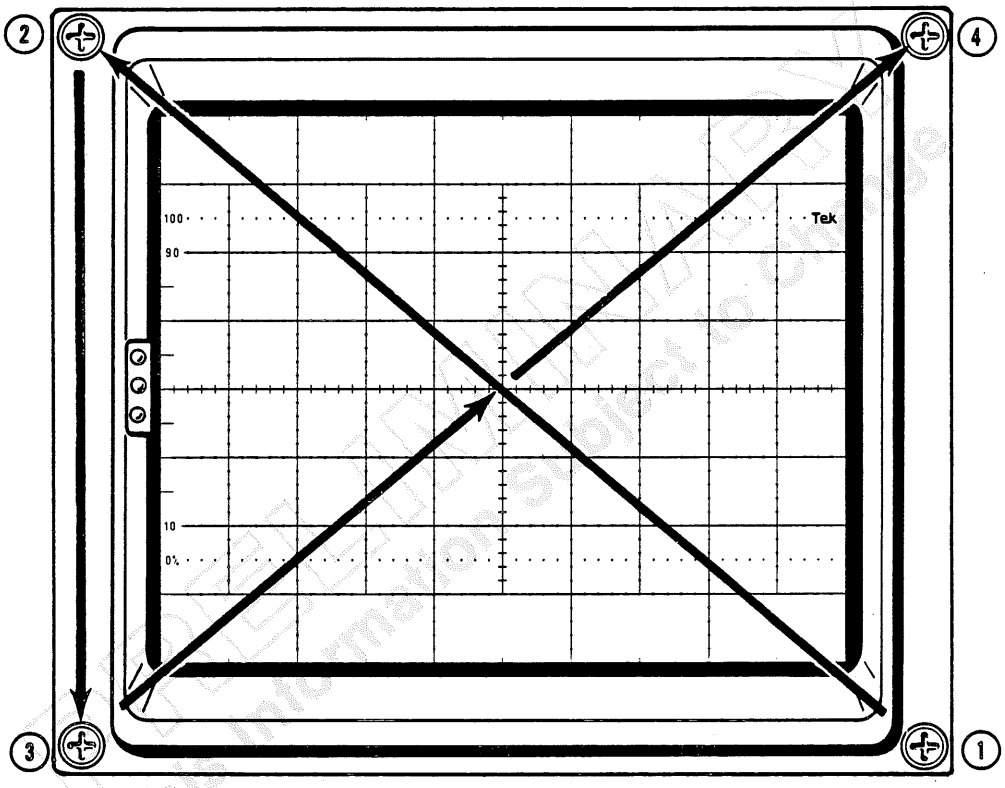


FIGURE 6107-320. THE CORRECT METHOD TO REMOVE (AND TO REINSTALL) THE RETAINING SCREWS ON THE CRT SCALE COVER.

6. Remove the Touch Panel Board.

a. Withdraw cables J87 and J88 through the front casting. See Fig. 6107-321.

CAUTION

The Crt Implosion Shield may be loose and could fall off. Hold it against the Touch Panel Board.

The Implosion Shield can easily be scratched. Protect it while it is removed.

NOTE

Individual graticule bulbs can be removed and replaced. Follow the instructions in the "Graticule Light Bulb Removal" procedure. (This procedure is located near the end of this section.

7. **The lens frame, the graticule light assembly and the Touch Panel make up a single part. They are ordered as such (P/N 670-xxxx-00).**

NOTE

The lens frame is press-fitted to the Touch Panel Board. The two can be separated, if desired.

To remove the lens frame, insert some thin, flat object, such as a metal rule, between the surfaces. Carefully pry the corners apart a little at a time.

To replace the lens frame, match the notched area on its inside edge with the camera power terminal on the Touch Panel Board. See Fig. 6107-321. Press the corner surfaces together.

Replace the A7 Touch Panel Board by following the previous procedure in reverse order. **Read the following "NOTE" and "CAUTION" first.**

PRELIMINARY
This information subject to change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-321. INSIDE VIEWS OF THE A7 TOUCH PANEL BOARD WITH ITS RELATED PARTS.

NOTE

Check to see that the lens frame and implosion shield are mounted correctly. They should be against the crt scale cover (bezel) and crt faceplate respectively.

CAUTION

IMPORTANT:
Reinstall the four retaining screws in the crt scale cover and tighten them diagonally. See Fig. 6107-320.

Begin with the FIRST screw and tighten it lightly until it stops turning. Next, go diagonally across the cover to the SECOND screw. Tighten it lightly until it stops turning. Then drop down to the THIRD screw and tighten it firm. Go diagonally across the cover to the FOURTH screw. Tighten it firm.

Next, to the SECOND screw and tighten it firm. Then return to the FIRST screw and tighten it firm.

Do not use a clockwise method to tighten these crt scale cover screws. That will damage the corners of the crt faceplate. An unnecessary removal and replacement of the crt could be the result.

PRELIMINARY This information is subject to change

A8 CENTER FRONT PANEL BOARD

Remove the A8 Center Front Panel Board as follows:

1. Use the removal procedure for the "Front Panel Module", in this section. Follow steps 1 through 7 **excluding** the removal of the encoder knobs in step 6.

NOTE

The 11301 should be right side up and the Front Panel face down as shown in Fig. 6107-331.

2. Remove the three torx screws from the Center Front Panel Board.

3. Hold the switch spacer against the Front Panel. See Fig. 6107-322. Pull the Center Front Panel Board straight up to remove it.

NOTE

Mark the board beside the red line on cable J74 before removing its connector. This will aid reconnection.

The light diffusers may fall out if the switch spacer is removed. Reinstall any parts that do.

4. Remove connector J74 from the board.

NOTE

When reconnecting J74, attach the end of the cable ***without*** the white pull-tab.

To replace the A8 Center Front Panel Board, follow the previous procedure in reverse order.

NOTE

If the pushbuttons tend to keep the board from seating, they aren't entering the Front Panel holes correctly. To remedy this, hold the board and the switch spacer against the Front Panel. Stand the Front Panel upright so its front is visible. Use some tool, such as a pencil tip, to move the pushbuttons around until they enter their holes.

PRELIMINARY
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PRELIMINARY
Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-322. THE A8 CENTER FRONT PANEL BOARD AND ITS RELATED PARTS.

A9 TOP FRONT PANEL BOARD

To remove the A9 Top Front Panel Board, proceed as follows:

1. Use the "Front Panel Module" removal procedure, in this section. Follow steps 1 through 7, **excluding** the removal of the encoder knobs in step 6.

NOTE

The 11301 should be right side up and the Front Panel face down as shown in Fig. 6107-331.

2. Remove the three torx screws from the Top Front Panel Board.

3. Hold the switch spacer against the Front Panel. See Fig. 6107-323. Pull up on the Top Front Panel Board to remove it.

NOTE

If the switch spacer is removed, its pushbuttons may fall out. Reinstall any that do.

Mark the board beside the red line on cable J76 before removing its connector. This will aid in reconnection.

4. Remove connector J76 from the board.

NOTE

When reconnecting connector J76, attach the end of the cable ***without*** the white pull-tab.

Replace the A9 Top Front Panel Board by following the preceding procedure in reverse order.

NOTE

If the switch spacer was removed, be certain that its pushbuttons are seated when the spacer is reinstalled. If the pushbuttons tend to keep the board from seating, they are not entering the Front Panel holes correctly. To remedy this, hold the board and the switch spacer against the Front Panel. Stand the Front Panel upright so its Front is visible. Use some tool, such as a pencil tip, to move the pushbuttons around until they enter their holes.

PRELIMINARY
This information subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-323. THE A9 TOP FRONT PANEL BOARD AND ITS RELATED PARTS.

A10 FRONT PANEL INTERFACE BOARD

Remove the A10 Front Panel Interface Board as follows:

1. Position the instrument right side up. Remove its top cover.

2. Remove connectors J59, J58, J88, J87, J57, J76, J72, J74, J73 and J78. See Fig. 6107-324 for their locations.

3. A bracket is attached to the right front of the Front Panel Interface Board for the instrument's calibrator connections. Remove the 1/4" nut from this bracket. It is located **behind** the upper right front corner of this instrument.

4. Remove the four board-retaining screws. See Fig. 6107-324.

5. Remove the Front Panel Interface Board.

To replace the A10 Front Panel Interface Board, follow the previous procedure in reverse order.

NOTE

When the circuit board is reinstalled and its retaining screws are reattached, do not tighten the screws yet.

First, reinstall and tighten the nut to the calibrator bracket. Then, tighten all the board-retaining screws.

PRELIMINARY
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PRELIMINARY
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NOT AVAILABLE AT THIS TIME.

FIGURE 6107-324. TOP VIEW OF THE A10 FRONT PANEL INTERFACE BOARD SHOWING CONNECTORS AND SCREWS.

A11 MAIN PROCESSOR BOARD

Remove the A11 Main Processor Board as follows:

1. Set the 11301 right side up. Remove the top cover.

2. Disconnect connectors J78, J66, J72, J56, J24, J25, J41, J42, J60 and J71. See Fig. 6107-325.

3. Remove the hex mounting posts from the connectors on the rear panel as follows:

a. For the RS-232 posts, use a 3/16" nutdriver.

b. For the GPIB posts, use a 1/4" nutdriver.

4. Move the plastic (cable protector) flange off the right side edge of the frame. See 6107-325.

5. Remove the five board-retaining torx screws.

6. Gently remove the Main Processor Board by lifting it from the chassis.

PRELIMINARY
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CAUTION

The J90 interconnecting pins (of the A1 Plug In Interface Board) securely hold the Main Processor Board. The latter board should be lifted cautiously to prevent damage to either the connector or the circuit board.

*A **plastic pin guide*** covers the pins of the Plug In Interface Board connector underneath the Main Processor Board. ***This guide may come off when the Main Processor Board is removed. Replace the guide if it does.***

WARNING

A Lithium battery (BT1190) is mounted on the Main Processor Board. ***This battery requires special handling for disposal.*** Read the instructions for the "Lithium Battery Handling and Disposal" in this section.

To replace the A11 Main Processor Board, follow the previous procedure in reverse order. **Additional instructions follow:**

1. Move the J60 connector cable away from the board's position. Be certain that all wires are out of the way. Check that the plastic flange is moved off the side. See that the pin guide is on the connector of the Plug In Interface Board.

2. Set the board into the 11301 so that the rear panel connectors are installed first. Next, align the pin guides with the holes in the board, at either end of the J90 connector. Press down on the board to connect the pins.

a. Check that all pins entered the J90 connector, and are about the same height.

3. **Loosely** reinstall the five board-retaining torx screws.

a. Reinstall and tighten the hex posts on the rear panel connectors.

NOTE

The RS-232 hex posts have lockwashers which can be used to identify them.

b. **Tighten** the screws.

4. Reconnect the ten connectors. See Fig. 6107-325. Dress their cables.

NOTE

The J41 and J42 peltola cables are unmarked. To reconnect them, put the "outside" (Ready) peltola into the "outside" J41 socket. The "inside" (Reset) peltola plugs into the "inside" J42 socket.

The J60 connector cable is extra long. Dress it along and underneath the Main Processor Board and under the J71 connector.

5. Move the plastic (cable protector) flange towards the inside of the 11301.

6. Reinstall the top cover.

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NOT AVAILABLE AT THIS TIME.

FIGURE 6107-325. TOP VIEW OF THE A11 MAIN PROCESSOR BOARD SHOWING CONNECTORS AND SCREWS.

A12 VERTICAL BOARD

Remove the A12 Vertical Board as follows:

1. Position the instrument on its right side, as facing the front. Remove its top and bottom covers.

2. Remove the torx screws from the (left side) front and rear decorative trim covers. **Read the following information before removing these covers.**

CAUTION

Do not lift the trim covers to remove them, they will break. There is a clip on the back of the cover which slides over the end of the side frame section.

To remove the trim cover, move each cover towards the end of the instrument where it is located. (The front cover moves towards the front and the rear cover moves towards the rear). Moving the cover about 1/8 of an inch will release the clip. Then, the cover can be lifted from the instrument.

3. Remove the single torx screw from the center of the left side frame section. Remove the other two screws from its ends. Remove the frame section.

4. Disconnect all connectors from the board. See Fig. 6107-326.

a. Remove the two crt deflection leads from the **(rear)** neck pin wires.

NOTE

Do not remove the two crt leads from the front neck pin wires.

5. Remove the two board-retaining torx screws.

6. Remove the Vertical Board. Lift the front end of the board outward and slide the rear part past the chassis frame.

NOTE

If the Vertical Board itself is defective and has to be replaced, the delay line (on its reverse side) must be removed. Reinstall the delay line assembly on the replacement Vertical Board before the board is reinstalled in the instrument.

To replace the A12 Vertical Board, proceed as follows:

1. Reinstall the Vertical Board. Insert its rear edge into the circuit board guide mounted on the rear casting. Lower the board into place over its spacer posts. Reinstall and tighten the board-retaining screws.

2. Reconnect all wire connectors. Reconnect the crt deflection leads to the rear neck pin wires.

NOTE

Use care when reconnecting the deflection leads. Do not bend their respective crt neck pins.

3. Reinstall the side frame section. Reinstall its screws and tighten them.

4. Reinstall the decorative trim covers to the front and rear of the side frame section. Slide their retaining clips (on the inside of each cover) into place. Reinstall the cover torx screws and tighten them.

5. Replace the top and bottom covers on the instrument. Return the instrument right side up.

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PRELIMINARY
Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-326. TWO LEFT SIDE VIEWS OF THE A12 VERTICAL BOARD.

A13 SCOPE LOGIC BOARD

Remove the A13 Scope Logic Board as follows:

1. Position the 1130l on its right side, as facing the front. Remove its bottom cover.

2. Remove the screws from the rear panel plate. Allow the plate to hang from its wires as shown in Fig. 6lØ7-3Ø9. Protect the surfaces underneath the plate from scratches.

3. Remove the 4 5/16" x 3 1/4" plastic protective cover from the left rear corner area of the board. Disconnect connector J53 from that corner. Move the connector and cable inside the rear panel area.

a. Remove the remaining connectors from the board. See Fig. 6lØ7-327.

4. Pull the anode lead from its keyhole recess under the crt socket. See Fig. 6lØ7-3Ø9.

WARNING

The crt anode voltage is 2Ø kV. The crt may retain a dangerous electrical charge. The anode lead must be fully discharged upon removal. ***Ground the anode lead to the chassis. Wait approximately ten minutes and again firmly ground this lead to the chassis.***

a. Remove the anode lead from its holder. Discharge it to the chassis via the preceding instructions.

5. Remove the crt base-pin socket from the crt. Remove its three cables held fast by a cable retainer. This retainer is located behind the middle grommet inside the rear panel plate.

a. Turn the 1130l on its top, with the bottom side up.

6. Remove the torx screws from the metal high voltage shield. See Fig. 6lØ7-327. Remove the shield from the Scope Logic Board.

PRELIMINARY
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NOT AVAILABLE AT THIS TIME.

FIGURE 6107-327. BOTTOM VIEW OF THE SCOPE LOGIC BOARD SHOWING CONNECTORS, SCREWS AND OTHER PARTS.

a. Remove the seven board-retaining torx screws and the four 1/4" spacer posts from around the multiplier.

7. Push the plastic (cable protector) flange off the edge of the chassis. It is located over the side edge underneath connector J71. See Fig. 6107-327. If left in place, the flange might catch the side of the circuit board.

CAUTION

The interconnecting pins (from the A1 Plug In Interface Board) firmly hold the Scope Logic Board's P91 connector. Therefore, the board should be lifted cautiously to prevent damage to either the connector or to the circuit board.

8. Remove the Scope Logic Board.

NOTE

*A **plastic pin guide*** covers the Plug In Interface Board connector. This guide ***may come off when the Scope Logic Board is removed. Reinstall the pin guide if it does.***

WARNING

There is a possibility of arcing if the U1010 Multiplier and/or the T1040 transformer has been replaced on the board. See the "Arcing Prevention" procedure for instructions. (It is located near the end of this section.

To replace the A13 Scope Logic Board, proceed as follows:

NOTE

The 11301 should be laying on its top with its bottom side up.

1. Position the board over its approximate location.

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a. Thread the anode holder cable and the base-pin soket cables through their grommets into the rear panel.

b. Check that no wires will be pinched under the board.

c. **Align the pin guides with the board's pin holes at either end of connector P91.**

PRELIMINARY
This Information Subject to Change

NOTE

The interconnecting pins from the Plug In Interface Board usually align vertically. However, they might not always align horizontally. Check the pins before reinstalling the board.

d. Press down on the board to connect the pins. Check that all pins re-enter the connector and are about the same height.

e. Check that cable J71 remains flat against its plastic cable protector.

2. Position the 11301 on its right side, as facing the front.

a. Before reconnecting the anode lead, determine if it needs to be greased.

CAUTION

The anode lead may require greasing before it is reconnected. If both the multiplier and the crt were replaced, grease the anode lead

However, if only the multiplier or the crt is replaced, grease should not be necessary.

The reason for applying grease is to prevent the anode lead from sticking to its holder. Should sticking occur, the lead can be removed. But, doing so will be difficult and could be hazardous.

To remove a sticking anode lead, proceed as follows:

Allow sufficient time for the 20kV anode charge to bleed off. Then, using the thumb and fingertips, slowly work the end of the rubber holder from the lead.

PRELIMINARY
This information is subject to change

WARNING

This removal process can be dangerous if a charge still remains on the anode. By removing the lead a portion at a time, the lead could suddenly emerge without warning and become hazardous to your health!

b. **General Electric's "Silicone Lubricating Grease"** is the recommended grease to use. The Tektronix Part Number is 006-6949-00.

c. Grease the anode lightly.

d. Reconnect the anode lead into its holder. Slide the anode and cable into their keyhole recess of the crt support beneath the crt socket. See Fig. 6107-309. Dress the other end of the anode cable into the uppermost grommet.

3. Reinstall the crt base-pin socket. Replace the three crt socket cables into their cable retainer. See Fig. 6107-309.

a. Reconnect connector J53 to the Scope Logic Board. Route the cable into the center grommet. Dress the cable underneath the socket and anode cables along the edge of the board.

b. Check that all peltola connectors are inserted into their BNC sockets on the rear panel plate.

c. Place all cables into their grommets. Check that there won't be any wires caught behind the plate.

4. Reinstall the rear panel plate. Reinstall the six torx screws to the plate. Tighten the screws.

5. Reinstall the four 1/4" spacer posts around the multiplier on the Scope Logic Board. Tighten the posts.

a. Reinstall the seven board-retaining torx screws and tighten them.

b. Push the flange of the plastic cable protector into place underneath the J71 connector.

6. Reconnect all connectors to the board. See Fig. 6107-327.

NOTE

The J23 and J26 peltola cables (to the A14 Time Base Board) are dressed alongside the J84 and J85 connectors on the front edge of the board. These cables lie near the adjoining edges of the circuit boards. Dress them in between the four holders of the J84 and J85 connectors.

NOTE

If the (optional) A15 Counter/Timer Reference Board is ***not*** installed, the J26 peltola cable will be removed.

7. Replace the metal high voltage shield over the (multiplier) spacer posts.

a. Reinstall the four torx screws into the spacer posts and tighten.

b. Reinstall the plastic protective cover to the left rear corner of the board. Slots are provided in the shield and the chassis for the cover's tabs.

8. Replace the bottom cover. Set the 11301 right side up.

PRELIMINARY
This information subject to change

A14 TIME BASE BOARD

Remove the A14 Time Base Board as follows:

1. Set the 11301 on its right side, as facing the front. Remove the bottom cover.

2. Remove the 1/4" nut which holds the "External Trigger & Counter Inputs" bracket to the front casting. This nut is located behind the lower right front corner. See Fig. 6107-328.

3. Disconnect the two leads from the crt horizontal neck pins. These are located on the upper rear edge of the board.

4. Disconnect all connectors. See Fig. 6107-328.

5. Remove the seven board-retaining torx screws.

6. Remove the Time Base Board.

To replace the A14 Time Base Board, proceed as follows:

1. Check that all wires are out of the way.

2. Replace the Time Base Board.

a. Align the BNC connectors on the "External Trigger and Counter Inputs" bracket with their respective holes in the front casting.

3. **Loosely** reinstall the seven board-retaining torx screws.

a. Reinstall the 1/4" nut to the bracket and tighten it.

b. **Tighten** the torx screws.

4. Reconnect all connectors and the crt neck pin leads.

NOTE

The J23 and J26 peltola cables are dressed alongside the J84 and J85 connectors on the rear edge of the board. These cables lie near the adjoining edges of the circuit boards. Dress them in between the four holders of the J84 and J85 connectors.

NOTE

If the (optional) A15 Counter/Timer Reference Board is ***not*** installed, the J26 peltola cable will be removed.

5. Replace the bottom cover. Set the 11301 right side up.

PRELIMINARY
This information subject to change

A15 COUNTER/TIMER REFERENCE BOARD

The A15 Counter/Timer Reference Board is an 1130l instrument option. If installed, it is mounted on the chassis inside the rear panel.

Remove the Counter/Timer Reference Board as follows:

1. Position the 1130l on its left side, as facing the rear.

2. Remove the six Torx screws from the rear panel plate. (See Figure 6107-332).

3. Ease the rear panel plate away from the rear casting. Allow the plate to hang from its wire connections. (See Figure 6107-309).

a. Protect the surfaces underneath the plate from scratches.

4. As viewed from the rear, the Counter/Timer Reference Board (see Figure 6107-329) is located to the left of the crt socket.

5. Remove the two connectors from the board.

a. J26 originates on the A14 Time Base Board.

b. J40 originates on the A4 Regulator Board.

6. Unfasten the retainers from the three circuit board supports.

7. Remove the Counter/Timer Reference Board.

To replace the A15 Counter/Timer Reference Board, follow the preceding procedure in reverse order.

NOTE

Be certain that all peltola connectors are reinstalled in their BNC sockets before reinstalling the rear panel plate.

PRELIMINARY
This information Subject to change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-329. TOP VIEW OF THE COUNTER/TIMER REFERENCE BOARD (OPTION 1T).

A16 CT PLL/VCO BOARD

The A16 CT PLL/VCO Board is a small "piggy back" circuit board that is soldered into the A14 Time Base Board. It is located near the right rear edge of the board, adjacent to the J84 and J85 connector holders.

Remove the CT PLL/VCO Board as follows:

1. Set the 1130l on its right side, as facing the front. Remove the bottom cover.

2. Remove the Time Base Board. Refer to the removal procedure listed under "Circuit Board Removal" in this section. (Follow steps 2 through 6).

CAUTION

Place the detached circuit board upon a non-conducting surface. This minimizes the chance of static charge damage to the ICs and/or related circuitry.

3. Unsolder the CT PLL/VCO Board's J11Ø and J111 pin connections (see Figure 6107-33Ø) using an anti-static vacuum solder extractor.

NOTE

Refer to the "Soldering Techniques" procedure in this section for desoldering instructions.

4. Remove the CT PLL/VCO Board from the Time Base Board.

To replace the A16 CT PLL/VCO Board, proceed as follows:

1. Reinstall the board into the Time Base Board.

a. **IMPORTANT:** Mount the board as perpendicular and as close as possible to the Time Base Board.

NOTE

Be certain that the components on the A16 Board are facing toward the front of the 1130l.

2. Resolder the J11Ø and J111 pin connections. Turn the Time Base Board over. Cut off any excess pin leads which protrude through the solder connections.

NOTE

Clean the solder connections with a flux-removing solvent. Be careful not to remove any information printed on the circuit board.

3. Reinstall the Time Base Board. Refer to its replacement procedure in the "Circuit Board Removal" part of this section. (Follow steps 1 through 4).

4. Replace the bottom cover. Set the 11301 right side up.

PRELIMINARY
This Information Subject to Change

PRELIMINARY
This information Subject to change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-330. SIDE VIEW OF THE A16 CT PLL/VCO BOARD.

FRONT PANEL MODULE REMOVAL

Remove the Front Panel Module as follows:

1. Set the 11301 up on its right side, as facing the front. Remove the top and bottom covers. Remove the access hole cover from the side of the plug in compartment.

2. Pull off the intensity control knob. Remove the 7/16" nut and washer from its shaft.

3. Disconnect the J57, J74 and J76 connectors from the A10 Front Panel Interface Board. See Fig. 6107-324.

4. Remove the 1/4" nut from **behind** the top left corner of the front casting.

NOTE

Removal of the J72 connector from the Front Panel Interface Board can help to reach this nut.

5. Remove the two torx screws from behind the left bottom of the front casting.

6. Remove the encoder knobs. Use a 1/16" allen wrench to loosen the knob's setscrews.

a. Set the 11301 right side up.

7. Pull the Front Panel Module out until its bottom clears the front casting. Move its top outward about three inches away from the casting.

a. Withdraw the J74 cable, via the access hole, through the upper chassis grommet and its slot in the front casting.

b. Remove the J76 cable through the front casting. Lay the front panel down on its face. See Fig. 6107-331.

8. Remove the two torx screws and the two 1/4" spacer posts from the A5 Bottom Front Panel Board.

PRELIMINARY
This information Subject to Change

CAUTION

The light diffuser parts might fall out when the Bottom Front Panel Board is removed from the front panel. See Fig. 6107-319. Replace any parts that do.

9. Remove the Front Panel Module from the Bottom Front Panel Board.

Replace the Front Panel Module as follows:

1. Hold the Bottom Front Panel Board against the Front Panel Module.

NOTE

Center the pushbuttons of the Bottom Front Panel Board into their respective front panel holes. Use a pencil tip to move any button that does not seat.

Another way to seat the pushbuttons is to invert the board and shake it.

2. When the pushbuttons are in place, reinstall the two spacer posts and the two torx screws on the Bottom Front Panel Board.

3. Reinstall both encoder knobs.

4. Route the J74 and J76 cables through the front casting to the A10 Front Panel Interface Board.

a. Use the access hole to **neatly** dress the J73 cable slack underneath the crt shield and between the delay line and the crt shield.

PRELIMINARY
This Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-331. INTERIOR VIEW OF THE FRONT PANEL MODULE.

b. Keep the J73 cable as flat as possible where it passes through the front casting. The tubing around the cable helps to keep it flat.

NOTE

Check that the key on the intensity control encoder is put into its keyway in the front casting.

Check that the cables behind the front panel do not get trapped or pinched.

5. Reinstall the Front Panel Module.

a. Reinstall the washer and 7/16" nut on the shaft of the intensity control. Tighten the nut. Replace the knob.

b. Set the 113Ø1 upon its right side.

6. Reinstall the 1/4" nut on the top left **inside** corner of the front casting.

a. Reconnect the J72 connector, if it was removed.

7. Reinstall the two screws on the inside bottom of the front casting.

8. Reconnect the J57, J74 and J76 connectors to the A1Ø Front Panel Interface Board.

a. Dress the J57 cable between the board and the chassis.

9. Reinstall the access hole cover.

a. Replace the 113Ø1 top and bottom covers.

b. Set the instrument right side up.

ENCODER REMOVAL

To remove and replace the S110 (vertical) and/or the S810 (horizontal) encoders, proceed as follows:

1. Remove the Front Panel Module. Follow the "Front Panel Module Removal" procedure in this section. Use steps 1 through 9.

CAUTION

The light diffuser parts may fall out when the A5 Bottom Front Panel Board is removed from the Front Panel. Reinstall any parts that do.

2. Lay the Bottom Front Panel Board flat with its pushbuttons on top. Remove both 7/16" nuts from the encoder shafts. Remove both flat washers and (fluted) ground clips from these shafts.

3. Hold the board against the switch spacer. See Fig. 6107-319. Invert the board. Remove the Bottom Front Panel Board from the switch spacer.

CAUTION

The pushbuttons will fall out if the switch spacer is inverted.

4. Unsolder the three connections of the encoder. Pull the retaining ring up over the shaft. See Fig. 6107-319.

5. Remove the encoder.

To replace the S110 and/or the S810 Encoders, follow the previous procedure (up to removing the Front Panel Module) in reverse order.

1. Replace the Front Panel Module. Refer to the Front Panel Module **Replacement Procedure.** Follow steps 1 through 9.

PRELIMINARY
This information subject to change

REAR PANEL PLATE REMOVAL

Remove the rear panel plate as follows:

1. Remove the six torx screws from the rear panel plate. See Fig. 6107-332.

2. Place the 11301 on its right side, as facing the front.

3. Ease the rear panel plate away from the rear casting. Allow it to hang from its wire connections. See Fig. 6107-309.

a. Protect the surfaces underneath the plate from scratches.

4. Remove the 5/16" nut from the ground wire connection. See Fig. 6107-309.

a. Remove the ground wire.

NOTE

Record the locations of the peltola wires so that they can be correctly reconnected.

5. Remove the peltola connectors.

6. Remove the rear panel plate.

To replace the rear panel plate, follow the previous instructions in reverse order.

NOTE

Be certain that all wires are out of the way before reinstalling the rear panel plate.

Check that all peltola connectors are reinstalled into their BNC sockets.

PRELIMINARY
This Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-332. SCREWS SECURING THE REAR PANEL PLATE.

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 the instrument. When semiconductors are replaced, check the operation of circuits which may be affected.

WARNING

To avoid an electric-shock hazard, always disconnect the instrument from its power source before removing or replacing components.

Replacement semiconductors should be of the original type or a direct replacement. The lead configurations of semiconductors used in this instrument are shown in Fig. 6107-333. Some plastic-case transistors have lead configurations which differ from those shown. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. When removing soldered-on transistors or integrated circuits, use an anti-static vacuum solder extractor (see "Soldering Techniques" procedure in this section) to remove the solder from the circuit board pads. Transistors which have heat radiators or are mounted on the chassis use silicone grease to increase heat transfer. Replace the silicone grease on both sides of the insulating washer when replacing these transistors.

WARNING

Handle silicone grease with care. Avoid getting the silicone grease in your eyes. Wash hands thorougly after use.

To replace one of the power transistors mounted on the metal heat-sink at the rear of the power supply (A4 Regulator Board), first remove the board. See the "A4 Regulator Board" removal procedure in this section. Then unsolder the transistor leads, remove the mounting screw from its heat radiator, and remove the transistor and its insulating washer. When replacing the transistor, be sure to reinstall the insulating washer between the transistor and the heat sink (use silicone grease as previously described). Reinstall the mounting screw and tighten it just enough to hold the transistor in place. Then solder the replacement transistor to the A4 Regulator Board. Replace the board by reversing the order of removal.

PRELIMINARY
This Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-333. SEMICONDUCTOR LEAD CHART.

An extracting tool should be used to remove in-line integrated circuits to prevent damaging the pins. This tool is available from Tektronix, Inc. Order Tektronix Part 003-0619-00. If an extracting tool is not available, use care to avoid damaging the pins. Pull slowly and evenly on both ends of the integrated circuit. Try to avoid disengaging one end from the socket before the other end. **Most ICs will be soldered into the circuit board, rather than in sockets.**

CAUTION

Do not remove stickers affixed to the top of EPROMs. Removing such stickers will admit light into the chip, and may cause partial erasure of its data.

PRELIMINARY
This Information Subject to Change

HYPCON CONNECTORS

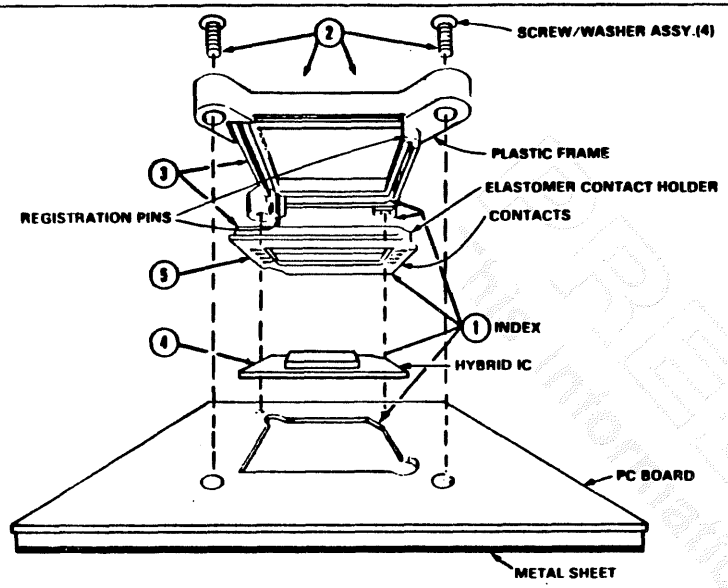
The **hypcon** (**hy**brid-**p**rinted **con**nector) is a precision made connector designed to provide low loss electrical and thermally efficient connection between the printed circuit board and hybrid integrated circuits. An exploded view of the hypcon connector is shown in Fig. 6107-334. When replacing the hybrid ICs, be careful not to touch the elastomer gold-plated contacts with your fingers, or to use a cleaner which will degrade contact reliability. **If it becomes necessary to use a cleaning solvent near the connector when replacing adjacent (within 1/2") circuit board components, the hypcon connector and hybrid IC should be removed.**

IMPORTANT:
Remove all traces of solder flux or foreign material contamination from the circuit board contact area before replacing the connector. **Contamination usually takes place during the soldering and cleaning process.** Even when the soldering is done carefully, flux, oil, or other contaiminants can be carried under the connector during the cleaning operation. When the solvent evaporates, nonconductive contaminants may remain on or near the contact interfaces.

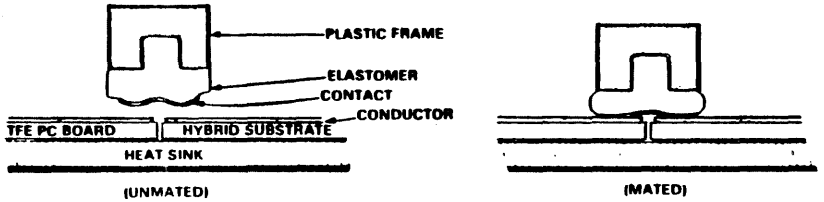
The cleaning process (either hand cleaning with a solvent or machine cleaning in an automatic detergent wash) is not recommended for boards containing hypcon connectors.

If a component near a hypcon connector must be replaced, the following steps are recommended:

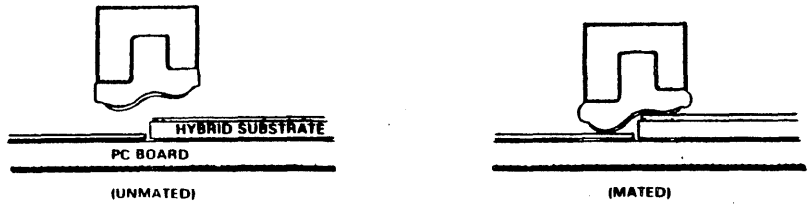
1. Remove the hybrid IC and hypcon connector (see Disassembly and Removal Instructions) before any soldering or cleaning, and store in a dirt-free covered container. When several hybrids and hypcon connectors are to be removed, keep parts together and replace as set; do not interchange parts.



EXPLODED VIEW OF HYPCON CONNECTOR



FLUSH HYPCON



STEPPED HYPCON

FIGURE 6107-334. HYPCON ASSEMBLY REMOVAL AND REPLACEMENT

DISASSEMBLY AND REMOVAL

1. Note index on circuit board (arrow, triangle, or dot) and HYPCON plastic frame (pointed mounting ear).
2. Unscrew and remove the 4 screw/washer assemblies. Where the HYPCON connector serves to heatsink the hybrid to the chassis, 2 of the 4 screws are longer. Note the location of the yellow tinted screws for proper replacement.
3. Lift HYPCON connector from board.
4. Note index location of hybrid and remove from board with tweezers.
5. Note index location of elastomer contact holder and remove by grasping a corner of the contact holder with tweezers and lifting up. Do not touch the gold-plated contacts with your fingers.

REASSEMBLY AND REPLACEMENT

Grasp corner of elastomer contact holder with tweezers and place in plastic frame slot being careful to match the flat contact holder with the flat frame corner. Place a clean plastic envelope over finger and press with finger to seat contact holder into the frame. The contact holder must be evenly seated on all four sides.

Flush HYPCON: Match hybrid flat corner with board receptable flat corner and place hybrid in receptable. Match pointed mounting ear of HYPCON connector with flat corner of receptacle and guide registration pins into the board hold.

Stepped HYPCON: Using tweezers, match the hybrid corner index with the elastomer contact holder index and insert between the registration pins. Turn the assembly over, grasp the hybrid "hat" with the tweezers, and guide the registration pins into the board holes. Match the plastic frame pointed mounting ear with the circuit board arrow.

Insert mounting hardware and apply 2 inch-pounds of torque to secure the connector assembly.

RELEASED
Information subject to change

2. Hand Soldering:

a. Use small diameter solder (0.030" - 0.040").

b. Use low wattage soldering irons (15-20 watts).

c. Use care with solder and placement.

3. Remove solder flux and contact contamination with isopropyl alcohol, denatured ethyl alcohol, or a FREON TF cleaner such as SPRAY-ON #2002.

4. Flush the hybrid and Hypcon connector mounting area with isopropyl alcohol. Do not scrub with a cotton-tipped applicator, as cotton fibers will adhere to edges and surfaces of contact area and cause open or intermittent connections. The elastomer should be examined under light for dust, hair, etc., before it is reinstalled. If the etched circuit board surfaces require more cleaning, scrub with a soft rubber eraser and blow or vacuum clean while dusting the surface with a small clean brush.

5. If the hybrid IC and elastomer contact holder are contaminated, clean by flushing or spraying with alcohol and oven dry at 50 degrees C. Do not scrub with a cotton-tipped applicator or similar device. If the contact holder is excessively contaminated, replace it with a new one.

Tighten the hypcon mounting screws to two-inch pounds of torque.

Make sure that the elastomer is properly seated in the contact holder before remounting the assembly to the circuit board. Exercise care when mounting the frame-elastomer contact holder-hybrid IC assembly to the circuit board to prevent misalignment between the connector and board.

CAUTION

Because of the close tolerances involved, special care must be taken to ensure correct index alignment of each hypcon part during reassembly. Failure to do so can crack the hybrid substrate. See Fig. 6107-334 for index locations.

If your instrument contains both the flush and stepped type of hypcon connectors, be careful not to mix the elastomer contact holders during reassembly. Flush hypcon connectors have green elastomer contact holders and the plastic frame is marked FLUSH. Stepped hypcons have neutral-colored elastomer contact holders with a slight ridge or step on the contact surface, the large frames are marked STEPPED. The registration pins on the stepped plastic frame are slightly longer than those on the flush frame. The elastomer contact holder in the small stepped connectors is indexed differently than the large connectors. Look for a small gold arrow in one corner of the holder instead of a flat corner. Match this corner arrow with the pointed corner of the plastic frame. Give close attention to this indexing, because elastomer contact holders can easily be inserted incorrectly.

Differences also exist between the large flush and the large stepped hypcon circuit board receptacles. Fig. 6107-334 shows the cross-sectional differences which must be observed when working with an instrument that contains both types of hypcon connectors.

CAUTION

Damage to the elastomer contact holder can result if the connectors are not mated properly with the board receptacle.

When replacing the hybrid, insert it into the board opening and then position the hypcon connector in the board registration holes for perfect alignment. The outer portion of the hypcon frame should be flush with the circuit board before the four mounting screws are tightened. Avoid touching the hybrid and elastomer contact with your fingers, finger oils can degrade reliability.

A procedure for removal and replacement is included in Fig. 6107-334.

HYBRID INTEGRATED CIRCUITS

Hybrid ICs are located on the A12 Vertical Board, the A13 Scope Logic Board, and the A14 Time Base Board.

The IC is mounted on the inside of its heatsink cover. The cover is orientated to the circuit board in two ways. First, two of the socket screws are offset. This allows the cover to be reinstalled only one way. Second, one corner of the cover is flat rather than rounded as the others are. This flat corner matches an etched design on the board.

To remove a Hybrid IC, proceed as follows:

1. Remove the four 1/4" retaining nuts from the heatsink cover.

2. Lift the cover (and the attached IC) from the socket.

CAUTION

Avoid toucing the IC or the socket contacts with your fingers. Ringer oils can degrade reliability.

Replace the Hybrid IC as follows:

1. Align the flat corner of the cover with the flat corner design on the board. Set the cover down over the screws.

2. Press the cover toward the board to feel the spring tension of the contacts. **Move the cover around until the IC seats flush against the socket.**

3. While holding the IC in place, reinstall the four retaining nuts. Tighten them finger-tight.

4. **Tighten the nuts using a diagonal method only.** See the following warning for diagonal tightening instructions.

a. Use a torque wrench to tighten the nuts to 3 1/2 - 4" pounds.

PRELIMINARY
Information subject to change

CAUTION

Do not tighten these retaining nuts clockwise. That will crack the heatsink cover.

Use this diagonal method to tighten the nuts. Begin at the lower right nut and tighten it. Go diagonally across the cover to the upper left nut. Tighten it. Next, drop down to the lower left nut and tighten it. Then go diagonally across the cover to the upper right nut. Tighten it.

Check that all four nuts are diagonally tightened to the recommended torque. See step 4a.

PRELIMINARY
This Information Subject to Change

CHIP CARRIER "SLAM-PACK" INTEGRATED CIRCUITS

Chip Carrier ICs are located on the A11 Main Processor Board, the A13 Scope Logic Board and the A14 Time Base Board.

Some of the IC covers have raised, ridged heatsinks. Others have flat covers without heatsinks. The IC is orientated to its socket by a flat corner. The other corners are notched to fit the edges of the socket. The flat-edged corner of the IC aligns with a "spring" (small metal tab) at one corner of the socket.

To remove a Chip Carrier IC, proceed as follows:

1. While holding the cover in place, unfasten its holding clip by pushing it aside. It may help to push down slightly on the cover.

2. Remove the cover slowly to prevent the IC from falling out.

NOTE

Observe the index of the IC before removing it.

3. Remove the IC with tweezers.

CAUTION

Avoid touching the IC or the socket contacts with your fingers. Finger oils can degrade reliability.

Replace the Chip Carrier as follows:

1. Using tweezers put the flat edge of the replacement IC against its index spring.

CAUTION

Check that the spring does not get bent by the flat corner.

2. Arrange the other corners with tweezers to fit evenly at the edges of the socket.

PRELIMINARY
Information subject to change

3. Push the end tabs of the cover into the holders at one end of the socket.

4. Push down on the cover. Hold it there while moving the holding clip over the tabs on the opposite end of the cover.

5. Check that the cover is secure.

PRELIMINARY
This information Subject to Change

INTERCONNECTING PINS

Two methods of interconnection are used to electrically connect 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. Other interconnections are made with a pin soldered into the board. Two types of connectors are used for these interconnecting pins. If the connector is mounted on a plug-on board, a special socket is soldered into the board. If the connector is on the end of a lead, an end-lead pin connector is used which mates with the interconnecting pin. The following information provides the removal and replacement procedure for the various types of interconnecting methods.

PRELIMINARY
This Information Subject to Change

COAXIAL-TYPE END-LEAD CONNECTORS (PELTOLAS)

The last digit (of Jxxx) is same as the color, or the color stripe of the wire insulation.

Replacing of the coaxial-type end-lead connectors requires special tools and techniques. Only experienced maintenance personnel should attempt to remove or replace these connectors. We recommend that the damaged cable or wiring harness be replaced as a unit. For cable or wiring harness part numbers, see Section 12, Replaceable Mechanical Parts of Volume III, Diagrams and Parts Lists. An alternative solution is to refer the replacement of the defective connector to your local Tektronix Field Office or representative. Fig. 6107-335 gives an exploded view of a coaxial end-lead connector assembly.

PRELIMINARY
This information Subject to Change

CIRCUIT-BOARD PINS

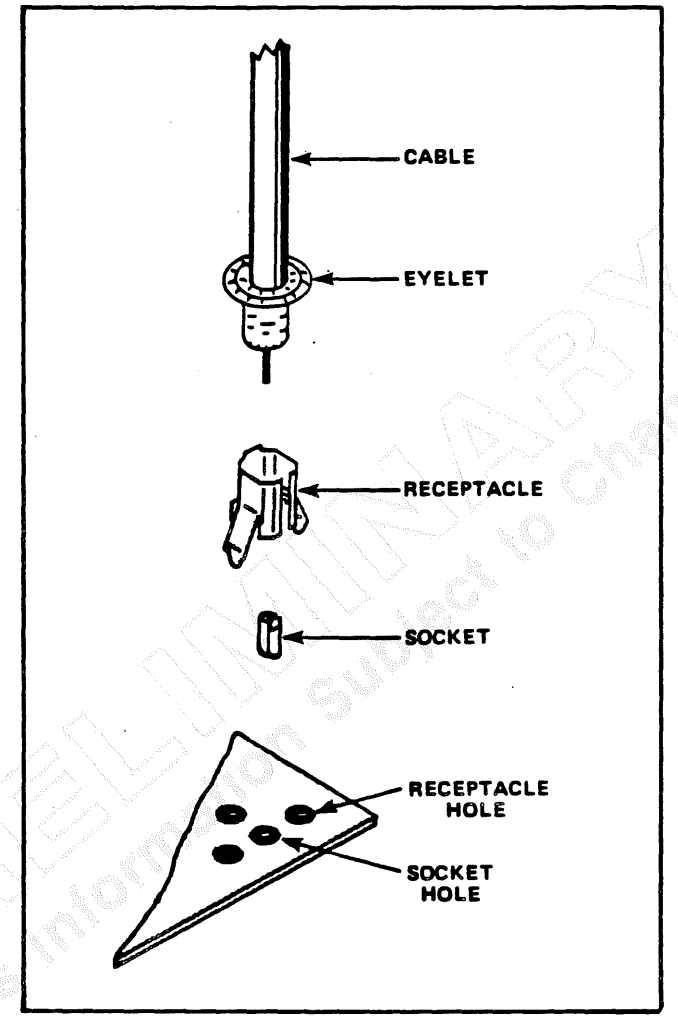
Replacing circuit-board pins on multi-layer boards is not recommended. All circuit boards in the 11301 are multi-layer boards, with the exception of the Counter/Timer Option Board.

PRELIMINARY
This Information Subject to Change

CIRCUIT-BOARD PIN SOCKETS

The pin sockets on the circuit boards are soldered to the back of the board. To remove or replace one of these sockets, first unsolder the pin (use an anti-static vacuum-type desoldering tool to remove excess solder). Then straighten the tabs on the socket and remove the socket from the board. Place the new socket in the circuit board hole and press the tabs down against the board. Solder the tabs of the socket to the circuit board; be careful not to get solder inside the socket.

PRELIMINARY
This information Subject to Change



PRELIMINARY
This Information Subject to Change

FIGURE 6107-335. COAXIAL END-LEAD CONNECTOR ASSEMBLY.

CAUTION

The spring tension of the pin sockets ensures a good connection between the circuit board and the pin. This spring tension can be destroyed by using the pin sockets as a connecting point for spring-loaded probe tips, alligator clips, etc.

PRELIMINARY
This information Subject to change

MULTI-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 or replace damaged multi-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. If the individual end-lead pin connectors are removed from the plastic holder, note the order of the individual wires for correct replacement into the holder.

PRELIMINARY
This Information Subject to Change

ARRANGEMENT OF PINS IN MULTI-PIN CONNECTORS

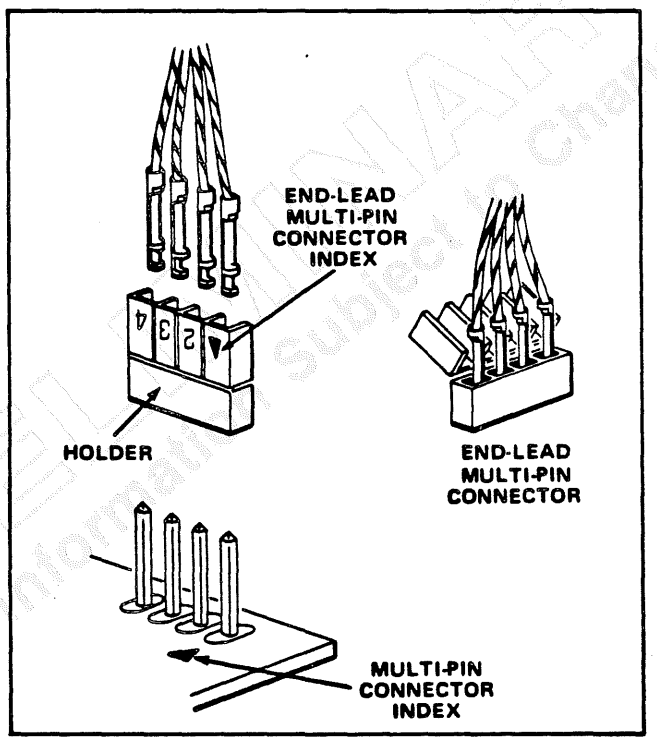
Pin 1 on multi-pin connectors is designated with a triangle (or arrowhead). A triangle, dot or square printed on circuit boards denotes pin 1. When a connection is made to a circuit board, the orientation of the triangle on the multi-pin holder is determined by the index (triangle, dot or square) printed on the circuit board. See Fig. 6107-336. Most circuit-board mounted connectors have a triangle index mark.

NOTE

Some multi-pin connectors are keyed by a gap between the pin 1 and 3 positions in the holder. A small plastic plug covers the pin 2 position on the end of the holder. There is a corresponding gap between pins 1 and 3 on the circuit board.

Align the gap in the multi-pin holder with the gap between the circuit board pins. The connector is then ready to be installed.

RELEASED
This Information Subject to Change



PRELIMINARY
This information is Subject to change

FIGURE 6107-336. ORIENTATION OF MULTI-PIN CONNECTORS

Many of the larger, gray-colored multi-pin ribbon connectors have a red line along one side of their attached wire cables. This red line indicates the location of pin 1 and 2 or the location of the triangle index mark.

Some of the gray-colored ribbon cables may have the number of their connectors stamped on them.

The ribbon connectors have two functions. The first is to provide a strain release for the wire connections. The ribbon is wrapped around a bar in between the wire connections and the top of the connector. Strain is then felt between the ribbon wires and the top of the connector. This releases most of the strain which would be felt on the wire connections.

The second function on most of the ribbon connectors is to provide a pull-tab to ease disconnection. A white-colored pull-tab is attached inside the connector. When the tab is pulled, even pressure is applied across the connector. The connector separates from its holder easily.

NOTE

To remove these gray-colored ribbon connectors, grasp the white pull-tab (fastened into the connector, if there) and pull it loose from the socket.

If there isn't a white pull-tab present in the connector, grasp the ends of the connector instead. Pull it straight out from the connector socket.

If a ribbon connector is found with an open or shorted wire, individual wires cannot be removed or replaced. The ribbon connector and cable must be replaced.

DELAY LINE REMOVAL

Remove the Delay Line as follows:

1. Set the 11301 on its right side, as facing the front.

a. Remove the top and bottom covers and the access hole cover.

2. Disconnect the J27 (purple-white) and the J28 (gray-white) wire connectors from both the A12 Vertical and the A14 Time Base circuit boards. (These wires may be colored solid white with the numbers marked on bands around them).

3. Remove the torx screws that hold the rear panel. Allow the rear panel plate to hang from its wires. See Fig. 6107-309. Cover the surfaces underneath the plate to protect them from scratches.

a. Remove the Vertical Board wires from their cable retainer. This retainer is located inside the rear panel.

NOTE

If a Counter Timer Option Board (Tektronix Part Number 670-9124-00) is installed, remove it. The delay line will not clear this option board. (Use the A15 Circuit Board Removal procedure, in this section).

4. Remove the delay line torx mounting screw. It is on the inner side of the plug in compartment, directly behind the access hole.

a. Locate the tab which holds the delay line to the upper chassis frame.

5. Grasp the delay line from the rear of the 11301. Slide its tab from the slot in the frame.

6. Remove the delay line cautiously through the rear of the 11301.

a. Pull the slack of the J73 and J74 cables, connected to the A10 Front Panel Interface Board, through the grommet on top of the chassis. This will keep these cables out of the way when the delay line is replaced.

Replace the Delay Line as follows:

NOTE

Start with the tab on the delay line facing the top of the 1130l.

1. Reinstall the delay line through the rear panel. Watch its travel through the opening along the rear edge of the Main Processor Board.

a. **The J27 and J28 wires (to the Vertical and Time Base Boards) can be difficult to route through the chassis.**

NOTE

A tool with a hook at one end, or a piece of line would be helpful to route the wires through the chassis openings. Guide the wires through the openings while placing the delay line in position.

b. Extract both pairs of wires **before** attaching the delay line.

2. Reconnect the J27 and J28 connectors to the Vertical and Time Base Boards.

a. Reinstall the vertical wires into their cable retainer. Close the retainer's clasp.

b. Reattach the delay line tab into its slot in the chassis.

3. Reinstall the torx mounting screw to the delay line through the inner side of the plug in compartment. Move the delay line around to seat the screw.

NOTE

Replace the Counter/Timer Option Board, if it was removed. Reattach its wires.

a. Dress the slack of the J73 and J74 cables between the delay line and the crt shield. Use the side access hole to maneuver them.

4. Check that the peltola connectors are installed into their BNC connector sockets on the rear panel plate. Move all wires away from the plate.

a. Reinstall the rear panel plate. Reinsert and tighten its torx screws.

5. Replace the 11301 top and bottom covers and the access hole cover.

a. Set the instrument right side up.

NOTE

A small-sized delay line is mounted on the back side of the A12 Vertical Board. For removal information, see the NOTE in the "Vertical Board Removal" procedure, in this section.

PRELIMINARY
This Information Subject to Change

IMPLOSION SHIELD REMOVAL

Remove the Implosion Shield as follows:

1. Follow steps 1 through 5 of the "A7 Touch Panel Board Removal" procedure, in this section.

2. Tilt the Touch Panel outward at its bottom. Do **not** remove the J87 or J88 cables through the front casting. See Fig. 6107-321 for parts locations.

3. Remove the Implosion Shield from the bottom. No further disassembly of the Touch Panel is required.

CAUTION

Use care when handling the Implosion Shield. It can easily be scratched or marred. Protect the surfaces of the shield while it is out of the instrument.

To replace the Implosion Shield, proceed as follows:

NOTE

The Implosion Shield can be reinstalled either side out. But, it must align with the Touch Panel Board.

1. Reinstall the Implosion Shield to the Touch Panel Board.

2. Follow the procedure to replace the Touch Panel Board, in this section. After reading the replacement instructions, begin at step 5.

a. **Be certain to heed the CAUTION regarding the instructions to reinstall the "Crt Scale Cover Screws".** It is located at the end of the "Touch Panel Board" replacement procedure.

GRATICULE LIGHT BULBS REMOVAL

Remove the graticule light bulbs as follows:

1. Follow the A7 Touch Panel Board Removal procedure in this section. (Use steps 1 through 6).

NOTE

The lens frame need not be removed from the Touch Panel Board to change a graticule bulb.

2. Use a Torx screwdriver to remove the small screws which hold the light diffuser to the Touch Panel board. (See Figure 6107-321(A)). Remove the nuts and screws from the diffuser and circuit board.

3. Remove the light diffuser from the board.

4. Unsolder the leads of the defective bulb. Remove the bulb from the circuit board.

To replace a graticule light bulb, proceed as follows:

1. Pre-form the leads of the replacement bulb. Insert the bulb into the circuit board. Resolder the leads.

2. Reinstall the light diffuser. Reinstall and tighten its screws and nuts.

3. Follow the procedure to replace the Touch Panel Board, in this section.

CAUTION

Do not tighten the crt scale cover (bezel) screws in a clockwise direction. Instead read and follow the screw replacement instructions. (See the Touch Panel Board Replacement procedure).

PRELIMINARY
This information subject to change

PLUG IN INTERFACE CONNECTORS

The individual contacts of the plug in interface connectors can be replaced. If several contacts are damaged, Tektronix, Inc. recommends replacing the entire A1 Plug In Interface Board. An alternative solution is to have your local Tektronix Field Office repair or replace the damaged board.

Use the following procedure to remove and replace an individual contact of the Plug In Interface Connector:

1. Remove the A1 Plug In Interface Board. Refer to the "Circuit Board Removal" procedures in this section.

NOTE

The board can be withdrawn far enough to repair individual contacts, without removing its connectors.

The board can be pulled out either side of the chassis to reach the contacts. See Fig. 6107-314.

2. If removal of the Plug In Interface Board is necessary, record the location of all wire connectors. Remove all connectors.

a. Remove the plastic wire fasteners from the holes at the bottom of the circuit board.

b. Ease connector J64 from the A3 Control Rectifier Board through the chassis. Remove the board.

3. Snap the white plastic connector cover off the side of the plug in connector receptacle.

a. Unsolder and remove the damaged contact.

CAUTION

Do not melt the connector with the soldering iron while unsoldering or soldering the contact.

b. Install the replacement contact. Carefully position it to fit against the connector body. Resolder the new contact.

4. Place the white plastic cover over the side of the receptacle. Snap the cover on.

a. Check that the replaced contact is aligned with the other contacts.

5. Replace the plastic wire fasteners at the bottom of the Plug In Interface Board. These fasteners keep the connector wires separated between the connector receptacles.

NOTE

If the board was replaced, be certain that the plastic pin guides were reinstalled on both the upper and lower connectors. See Fig. 6107-314.

6. Replace the A1 Plug In Interface Board by following its removal directions in reverse order.

PRELIMINARY
This Information Subject to Change

POWER TRANSFORMER REMOVAL

Replace the power transformer only with a direct replacement Tektronix transformer. Remove and replace the power transformer as follows:

1. Remove the A3 Control Rectifier Circuit Board as described under "Circuit Board Removal" in this section. See Fig. 6107-338.

NOTE

Record the position of the transformer leads so they may be correctly replaced.

2. Unsolder the transformer leads from the A3 Control Rectifier Board. Remove any excess solder from the circuit-board pads. See "Soldering Techniques" in this section.

3. Remove the transformer.

To replace the Power Transformer, proceed as follows:

1. Place the new transformer in position and solder the leads to the A3 Control Rectifier circuit-board pads.

2. Replace the A3 Control Rectifier in the power supply as described under "Circuit Board Removal" in this section.

NOTE

Refer to the "Adjustment After Repair Procedure", at the end of this section.

PRELIMINARY
This Information Subject to Change

NOT AVAILABLE AT THIS TIME.

FIGURE 6107-338. THE LOCATION OF THE POWER TRANSFORMER ON THE CONTROL RECTIFIER BOARD.

ARCING PREVENTION (A13 SCOPE LOGIC BOARD)

Arcing can occur between a lead on the U1010 Multiplier and the Scope Logic Board and/or its components. Application of a dope compound to this lead, and its connection, will prevent this problem.

The number 8 lead from the multiplier is soldered to a contact on the T1040 Transformer. (See Figure 6107-339). This connection must be coated with dope.

If the multiplier or the transformer has been replaced, the B.T. (Corona) Dope must be re-applied. The dope must completely surround the joint where the lead connects to the transformer. Apply some dope around the lead's insulation to insure overall coverage.

The B.T. Dope may be ordered by its Tektronix, Inc. Part Number 006-0541-00.

PRELIMINARY
This Information Subject to Change

SCOPE LOGIC BOARD

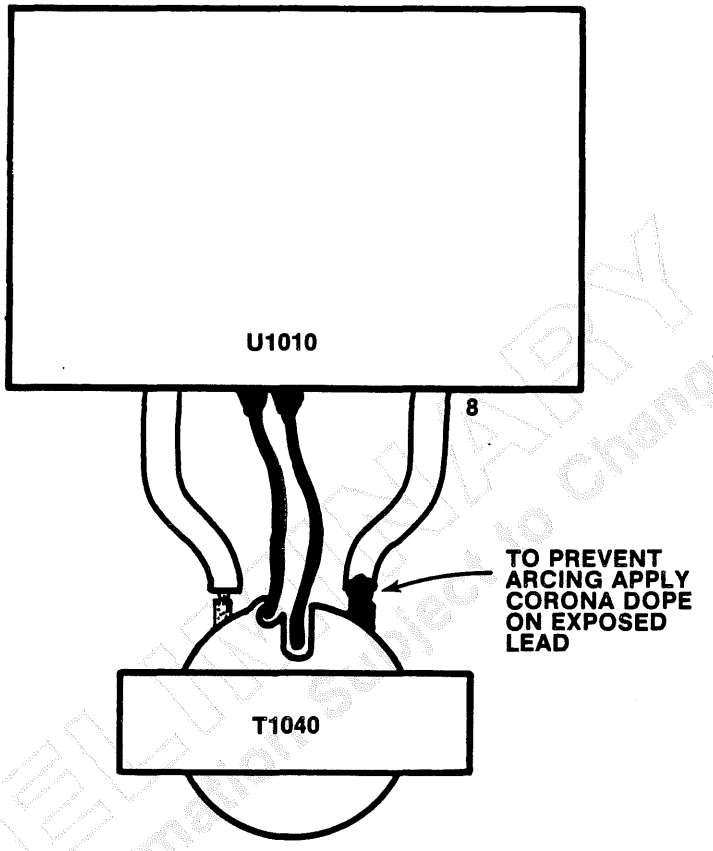


FIGURE 6107-339. BOTTOM VIEW OF SCOPE LOGIC BOARD SHOWING LOCATION OF LEAD CONNECTION TO BE DOPED. (DOTTED LINE SHOWS WHERE H.V. SHIELD IS MOUNTED.

PRELIMINARY
Information Subject to Change

LINE FUSE REMOVAL

The Line Fuse used in the 11301 is located on the rear panel of the power supply. Replace the Line Fuse (F99) with one of proper type and rating.

NOTE

Line voltage fuse (F99) is used for both 110- and 220-volt operation. No change in the fuse is necessary when switching the LINE VOLTAGE SELECTOR switch between 110 volts and 220 volts.

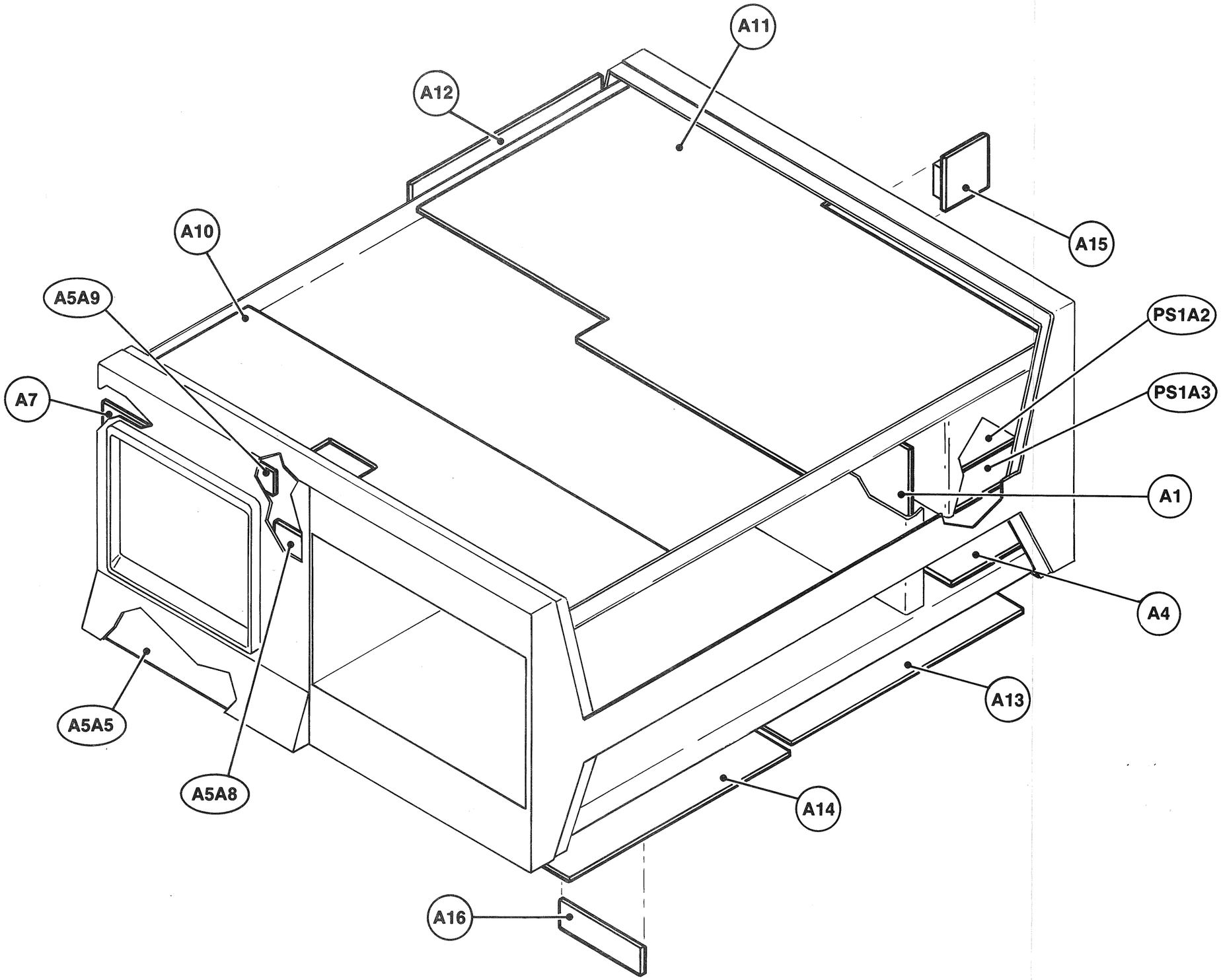
PRELIMINARY
This information Subject to Change

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 any closely related circuits. Because the low-voltage supplies affect all circuits, adjustment of the entire instrument should be checked if component replacements have been made in these supplies or if the power transformer has been replaced. See Section 4, "Checks and Adjustments" in this volume, for the complete adjustment procedure.

PRELIMINARY
This Information Subject to Change

CIRCUIT BOARD LOCATION ILLUSTRATION


A11
A12
A10
A15
A5A9
PS1A2
PS1A3
A7
A1
A4
A13
A5A5
A5A8
A14
A16

11301 REPLACEABLE ELECTRICAL ASSEMBLIES LIST

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-8830-00			CIRCUIT BD ASSY:PLUG-IN INTERFACE	80009	670-8830-00
A4	670-8840-00			CIRCUIT BD ASSY:REGULATOR	80009	670-8840-00
A5	614-0722-00			SUBPANEL ASSY:FRONT	80009	614-0722-00
A5A5	670-8836-00			CIRCUIT BD ASSY:BOTTOM FRONT PANEL	80009	670-8836-00
A5A8	670-8834-00			CIRCUIT BD ASSY:CENTER FRONT PANEL	80009	670-8834-00
A5A9	670-8833-00			CIRCUIT BD ASSY:TOP FRONT PANEL	80009	670-8833-00
A7	670-8835-00			CIRCUIT BD ASSY:TOUCH PANEL	80009	670-8835-00
A10	670-8832-00			CIRCUIT BD ASSY:FRONT PANEL INTERFACE	80009	670-8832-00
A11	670-8831-00			CIRCUIT BD ASSY:MAIN PROCESSOR	80009	670-8831-00
A12	670-8829-00			CIRCUIT BD ASSY:VERTICAL	80009	670-8829-00
A13	670-8828-00			CIRCUIT BD ASSY:SCOPE LOGIC	80009	670-8828-00
A14	670-8827-00			CIRCUIT BD ASSY:TIMEBASE	80009	670-8827-00
A15	670-9124-00			CIRCUIT BD ASSY:COUNTER/TIMER REFERENCE (OPTION 1T ONLY)	80009	670-9124-00
A16	670-9975-00			CIRCUIT BD ASSY:COUNTER/TIMER PLL/VCO	80009	670-9975-00
PS1	620-0022-00			POWER SUPPLY:ET MAINFRAME	80009	620-0022-00
PS1A2	670-9326-00			CIRCUIT BD ASSY:LINE INVERTER 388-8656-XX	80009	670-9326-00
PS1A3	670-8839-00			CIRCUIT BD ASSY:CONTROL RECTIFIER	80009	670-8839-00

Preliminary
This information Subject to Change

11302 REPLACEABLE ELECTRICAL ASSEMBLIES LIST

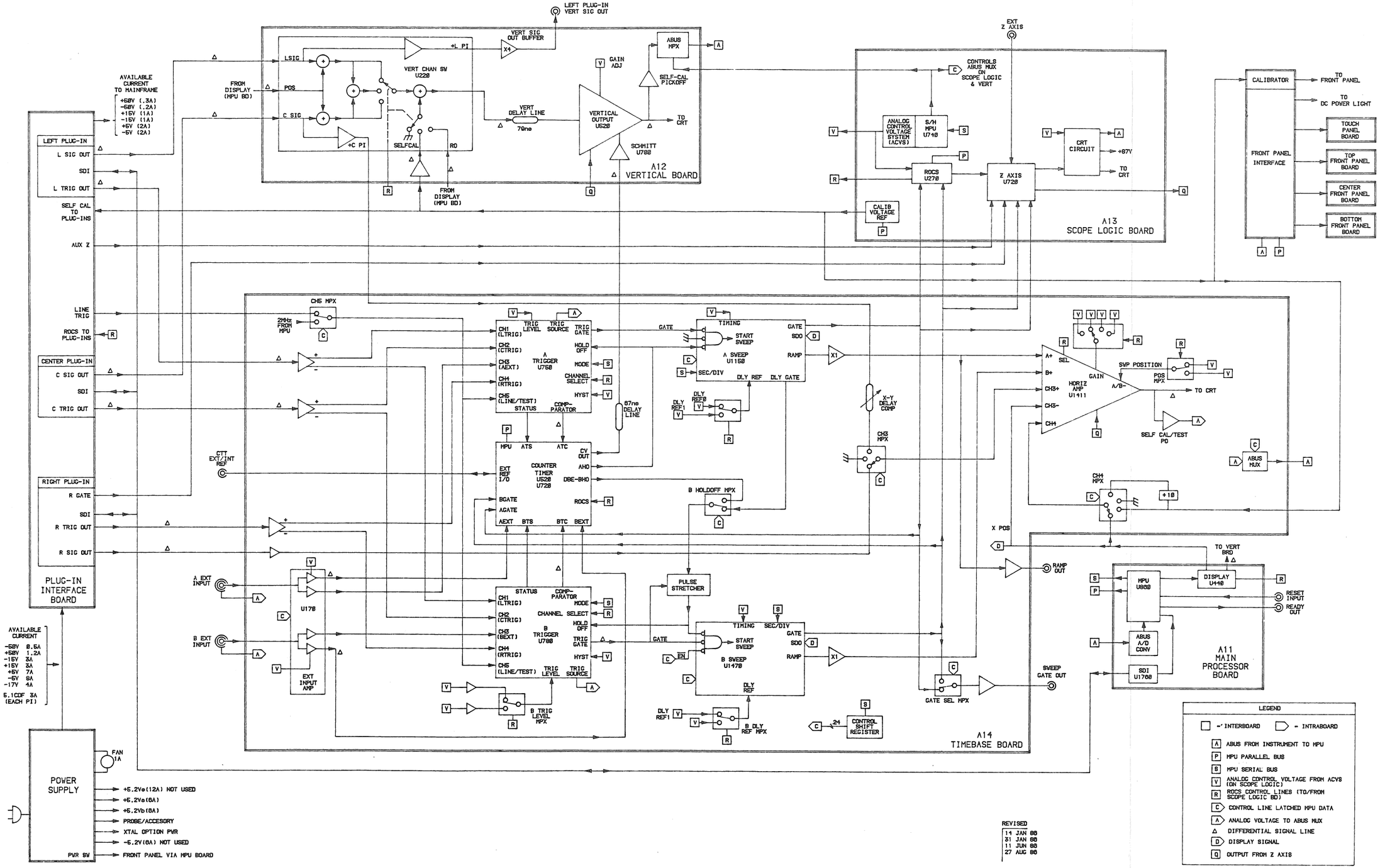
Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-8830-00			CIRCUIT BD ASSY:PLUG-IN INTERFACE	80009	670-8830-00
A4	670-8840-00			CIRCUIT BD ASSY:REGULATOR	80009	670-8840-00
A5	614-0777-00			FRONT PNL ASSY:	80009	614-0777-00
A5A5	670-8836-00			CIRCUIT BD ASSY:BOTTOM FRONT PANEL	80009	670-8836-00
A5A8	670-8834-00			CIRCUIT BD ASSY:CENTER FRONT PANEL	80009	670-8834-00
A5A9	670-8833-00			CIRCUIT BD ASSY:TOP FRONT PANEL	80009	670-8833-00
A7	670-9297-00			CIRCUIT BD ASSY:MCP TOUCH PANEL	80009	670-9297-00
A10	670-8832-00			CIRCUIT BD ASSY:FRONT PANEL INTERFACE	80009	670-8832-00
A11	670-8831-00			CIRCUIT BD ASSY:MAIN PROCESSOR	80009	670-8831-00
A12	670-9547-00			CIRCUIT BD ASSY:VERTICAL	80009	670-9547-00
A13	670-9546-00			CIRCUIT BD ASSY:SCOPE LOGIC	80009	670-9546-00
A14	670-8827-00			CIRCUIT BD ASSY:TIMEBASE	80009	670-8827-00
A14A16	670-9975-00			CIRCUIT BD ASSY:COUNTER/TIMER PLL/VCO	80009	670-9975-00
A15	670-9124-00			CIRCUIT BD ASSY:COUNTER/TIMER REFERENCE (OPTION 1T ONLY)	80009	670-9124-00
PS1	620-0022-00			POWER SUPPLY:ET MAINFRAME	80009	620-0022-00
PS1A2	670-9326-00			CIRCUIT BD ASSY:LINE INVERTER 388-8656-XX	80009	670-9326-00
PS1A3	670-8839-00			CIRCUIT BD ASSY:CONTROL RECTIFIER	80009	670-8839-00

PRELIMINARY
This information Subject to Change

SCHEMATIC DIAGRAMS

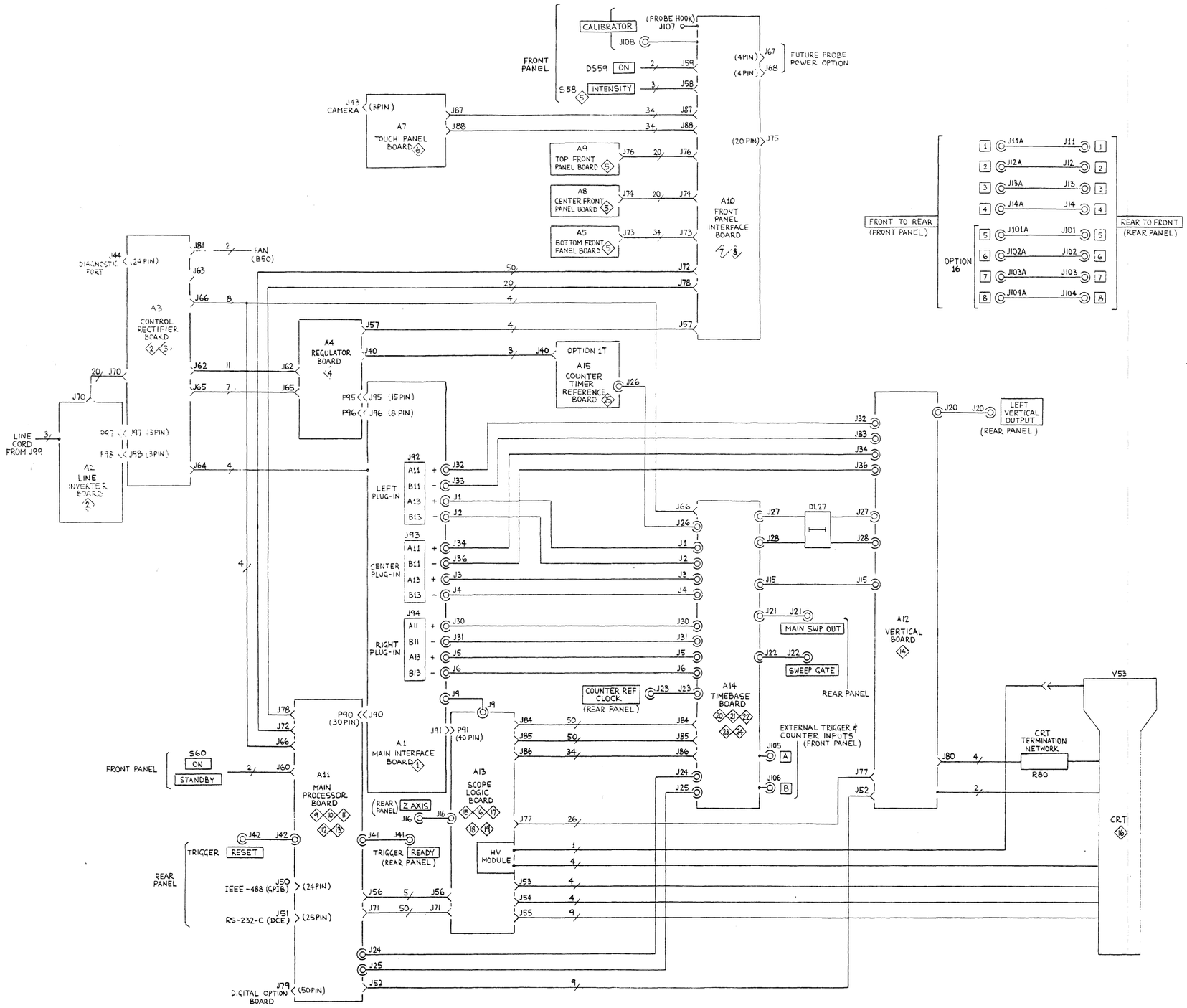
COMMON TO

THE 11301 AND 11302



11301

BLOCK DIAGRAM



RT

INTERCONNECTIONS

A B C D E F G

1 2 3 4 5

TO P98-13 MAIN PROCESSOR BOARD 9

TO/FROM P98 MAIN PROCESSOR BOARD 12

J98 13 26 27 | 1 5 9 15 18 21 24 | 10 14 16 7 | 25 20 1 2 9 11 3 5 | 12 28 17 29 | 30 22 19 25

PVRFAIL DCPVRSV PVRCOM

+5V POWER -5V POWER +15V POWER -15V POWER +50V POWER -50V POWER

LEFT SDI CLOCK
LEFT DATA IN PI TO MF
LEFT DATA OUT PI TO MF
LEFT 11K DETECTOR

CENTER SDI CLOCK
CENTER DATA IN PI TO MF
CENTER DATA OUT PI TO MF
CENTER 11K DETECTOR

RIGHT 11K DETECTOR
RIGHT DATA OUT PI TO MF
RIGHT DATA IN PI TO MF
RIGHT SDI CLOCK

LAYER 8=A1
GRID 8=-17000,12000
GRID SPACING=5000
DRAWING=1

J02 LEFT A B

GROUND
CH1 AUXILIARY TRIGGER OUT+ — TO J04-A32 *
GROUND
CH1 AUXILIARY TRIGGER OUT- — TO J04-A31 *
CH2 AUXILIARY TRIGGER OUT+ — TO J04-A23 *
CALIBRATION VOLTAGE
CH2 AUXILIARY TRIGGER OUT- — TO J04-A24 *
CALIBRATION GROUND SENSE
GROUND
CH3 AUXILIARY TRIGGER OUT+ — TO J04-A30 *
GROUND
CH3 AUXILIARY TRIGGER OUT- — TO J04-A35 *
CH4 AUXILIARY TRIGGER OUT+ — TO J04-A27 *
GROUND
CH4 AUXILIARY TRIGGER OUT- — TO J04-A28 *
GROUND
-5V POWER — -5V POWER FROM J06-1
-5V POWER

SHIELD
GROUND
SDI CLOCK
SDI DATA PI TO MF
SDI DATA MF TO PI
11K DETECTOR
+50V POWER — -50V POWER FROM J05-3
-50V POWER — -50V SENSE FROM J05-5
+15V POWER — +15V POWER FROM J06-2
-15V POWER — -15V POWER FROM J06-3
AUX Z AXIS
GROUND
MAINFRAME MODE INFO — +5V

GROUND
+5.1V POWER
+TRIGGER — J1 +TRIGGER — TO TIMEBASE BOARD 21
-TRIGGER — J2 -TRIGGER
GROUND
GROUND
+DISPLAY
-DISPLAY
+5.1V POWER — J32 +SIGNAL — TO VERTICAL BOARD 14
J33 -SIGNAL
+5.1V POWER
LOADSTOP
+5V POWER — +5V POWER FROM J06-4

MAINFRAME CHAN SWITCH
GROUND
SEQUENCE SYNC
SEQUENCE CLOCK
SAMPLE CLOCK
LINE TRIGGER

GROUND
SWEEP GATE

C108 0.1 — MOUNTING SCREW

J03 CENTER A B

TO J04-B29 *
TO J04-B30 *
TO J04-B26 *
TO J04-B25
TO J04-B37 *
TO J04-B38 *
TO J04-B34 *
TO J04-B33 *
-5V POWER FROM J06-1
-5V SENSE FROM J05-1

NOTE
* 50 Ω LINES

+50V POWER FROM J05-2 — -50V POWER FROM J05-3
+15V POWER FROM J06-2 — -15V POWER FROM J06-3
+15V SENSE FROM J05-6 — -15V SENSE FROM J05-7

REFCOM FROM J05-9 — J3 +TRIGGER — TO TIMEBASE BOARD 21
J4 -TRIGGER
J31 +SIGNAL — TO VERTICAL BOARD 14
J32 -SIGNAL
+5 POWER FROM J06-4
+5V SENSE FROM J05-8

C208 0.1 — MOUNTING SCREW

J04 RIGHT A B

GROUND
R CH3 AUXILIARY TRIGGER IN- — FROM J03-B33 *
GROUND
R CH3 AUXILIARY TRIGGER IN+ — FROM J03-B34 *
L CH3 AUXILIARY TRIGGER IN+ — FROM J02-B34 *
CALIBRATION VOLTAGE
L CH3 AUXILIARY TRIGGER IN- — FROM J02-B33 *
CALIBRATION GROUD SENSE
GROUND
R CH4 AUXILIARY TRIGGER IN+ — FROM J03-A32 *
GROUND
R CH4 AUXILIARY TRIGGER IN- — FROM J03-A31 *
L CH1 AUXILIARY TRIGGER IN+ — FROM J02-B38 *
GROUND
L CH1 AUXILIARY TRIGGER IN- — FROM J02-B37 *
GROUND
-5V POWER — -5V POWER FROM J06-1
R CH1 AUXILIARY TRIGGER IN- — FROM J03-B37 *
-5V POWER
R CH1 AUXILIARY TRIGGER IN+ — FROM J03-B38 *
L CH4 AUXILIARY TRIGGER IN- — FROM J02-A31 *
GROUND
L CH4 AUXILIARY TRIGGER IN+ — FROM J02-A32 *
SHIELD
GROUND
R CH2 AUXILIARY TRIGGER IN+ — FROM J03-A36 *
GROUND
R CH2 AUXILIARY TRIGGER IN- — FROM J03-A35 *
L CH2 AUXILIARY TRIGGER IN- — FROM J02-A35 *
GROUND
L CH2 AUXILIARY TRIGGER IN+ — FROM J02-A36 *
GROUND
SHIELD
GROUND
SDI CLOCK
SDI DATA PI TO MF
SDI DATA MF TO PI
11K DETECTOR
+50V POWER — +50V POWER FROM J05-2
-50V POWER — -50V POWER FROM J05-3
+15V POWER — +15V POWER FROM J06-2
-15V POWER — -15V POWER FROM J06-3
AUX Z AXIS
GROUND
MAINFRAME MODE INFO — +5V

R200 51 R300 51

GROUND
+5.1V POWER
+TRIGGER — J5 +TRIGGER — 21
-TRIGGER — J6 -TRIGGER
GROUND
GROUND
+DISPLAY
-DISPLAY
+5.1V POWER — J38 +SIGNAL — 24 — TO TIMEBASE BOARD
J31 -SIGNAL
+5.1V POWER
LOADSTOP
+5V POWER — +5V POWER FROM J06-4

MAINFRAME CHAN SWITCH
GROUND
SEQUENCE SYNC
SEQUENCE CLOCK
SAMPLE CLOCK
LINE TRIGGER

GROUND
SWEEP GATE

MOUNTING SCREW

C308 0.1

J9 AUX Z-AXIS TO J9 SCOPE LOGIC BOARD 16

P95 J95

PWRUP 11 — PVRFAIL
DCPVRSV 12 — DCPVRSV
PVRCOM 13 — PVRCOM
-5S 1 — -5V SENSE TO J03-A29
+50V 2 — +50V POWER — C202 2.2 µF — C201 2.2 µF
-50V 3 — -50V POWER
+50S 4 — +50V SENSE
-50S 5 — -50V SENSE TO J02-B19
+15S 6 — +15V SENSE TO J03-A18
-15S 7 — -15V SENSE TO J03-B18
+5S 8 — +5V SENSE TO J03-A8
REFCOM 9 — REFCOM TO J3,J34
GND 10
LTRIG 14 — LTRIG
GND 15

TO/FROM P95 REGULATOR BOARD 4

P96 J96

-5V 1 — -5V POWER — C181 1 µF
+15V 2 — +15V POWER — C182 1 µF
-15V 3 — -15V POWER — C183 1 µF
+5V 4 — +5V POWER — +5V — C184 1 µF
GND 5
GND 6
GND 7
-17F 8 — -17V

FROM P96 REGULATOR BOARD 4

TO/FROM P64 CONTROL RECTIFIER BOARD 2

+5.1C — +5.1 LEFT
+5.1D — +5.1 CENTER
+5.1F — +5.1 RIGHT
5.1R

A1 PLUG-IN INTERFACE BOARD

J91 | +50V POWER 29 | -50V POWER 30 | +15V POWER 33 34 | -15V POWER 35 36 | 4 3 | +5V POWER 23 25 26 | -5V POWER 27 28 30 | -17V 39 | 16 17 15 | 12 28 21 | 2 1 | 32 37 38 40 | 24 | 6 13 14 | 8 9

LEFT CLOCK — 15
LEFT SYNC
+50V POWER, -50V POWER, +15V POWER, -15V POWER — 18
LEFT CAL CON — 19
LEFT CAL
+5V POWER, -5V POWER, -17V — 16
CENTER CLOCK — 15
CENTER SYNC
VERT CH SW
GND GND GND GND — 18
CENTER CAL CON — 19
RIGHT CAL CON
GND GND GND GND — 18
LINE TRIG — 15
RIGHT MF CH SW
RIGHT SYNC
RIGHT CLOCK — 15
RIGHT GATE
SAMPLE CLOCK — 15
DLY GATE/LGSTR

TO/FROM SCOPE LOGIC BOARD

NOTE
* 50 Ω LINES

11301

PLUG-IN INTERFACE 1

LAYER 0=A3
LAYER 27=A2
LAYER 28=A0
GRID 0=-18400,10300
GRID SPACING=5000
DRAWING=2

PULSE WIDTH MODULATOR

60KHz INVERTER

INVERTER VOLTAGE SAMPLER

PRIMARY CURRENT SENSE

ISOLATION BARRIER

LOCAL POWER

STANDBY POWER

GATE DRIVE

RAMP INJECTION

CURRENT LIMIT COMPARATOR

ERROR AMPLIFIER

LINE TRIGGER

SOFT START

PRINCIPAL POWER

LINE VOLTAGE SELECT

GROUNDED AT MAINFRAME CHASSIS

* SENSE RESISTORS ARE INTEGRAL PART OF ETCHED CIRCUIT BOARD

TYPE	+22V	+12V	GND	-17S
4013		14	7	
LM324		4		11
LM339	3		12	
LM358		8	4	

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

TO/FROM TIMEBASE AND MAIN PROCESSOR BOARD 22

TO/FROM PLUG-IN INTERFACE BOARD 1

NOT USED

TO/FROM REGULATOR BOARD 4

TO/FROM REGULATOR BOARD 4

A2 LINE INVERTER BOARD

PARTIAL A3 CONTROL RECTIFIER BOARD

11301

LINE INVERTER, RECTIFIERS & CONTROL 2

ANALOG CURRENT SENSE

DIGITAL CURRENT SENSE

DIGITAL VOLTAGE SENSE

PRIMARY CURRENT LIMIT DETECT

FAULT DELAY LATCH

FAULT LED DRIVER

REGULATOR FAULT INDICATOR

FAN SPEED CONTROL

POWER FAIL DETECT

J44 DIAGNOSTIC PORT

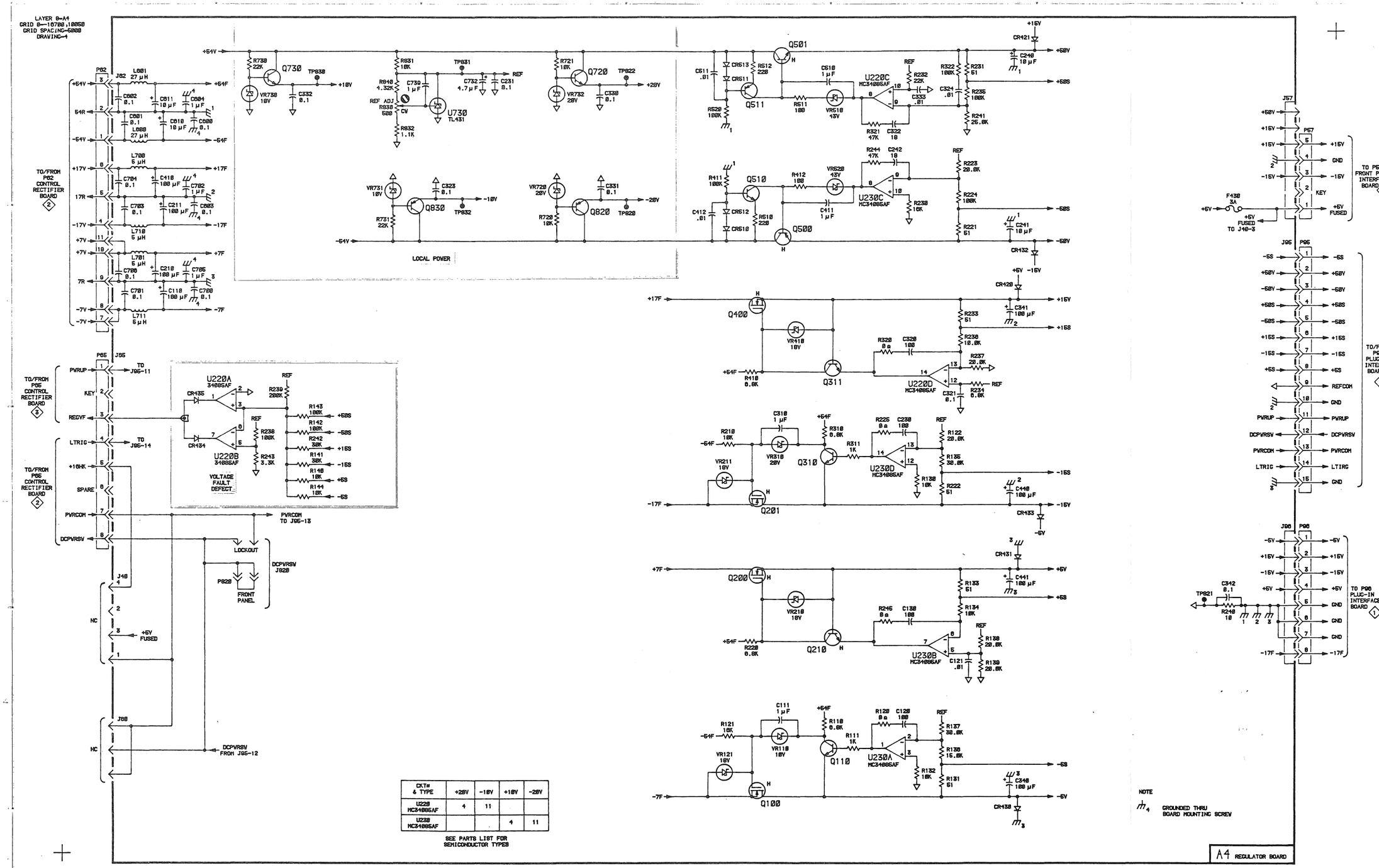
CKT# & TYPE	+22V	+12V	GND	-18V	-17S
U14Ø LM339	3		12		
U42Ø LM339		3		12	
U61Ø LM339		3	12		
U62Ø LM339		3		12	
U81Ø LM324		4			11

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

LAYER 8=A3
LAYER 27=A8
GRID 8=17100,10000
GRID SPACING=6000
DRAWING=3

PARTIAL A3 CONTROL RECTIFIER BOARD

LAYER 8=A4
GRID 8=.10700,.10650
GRID SPACING=5000
DRAWING=4

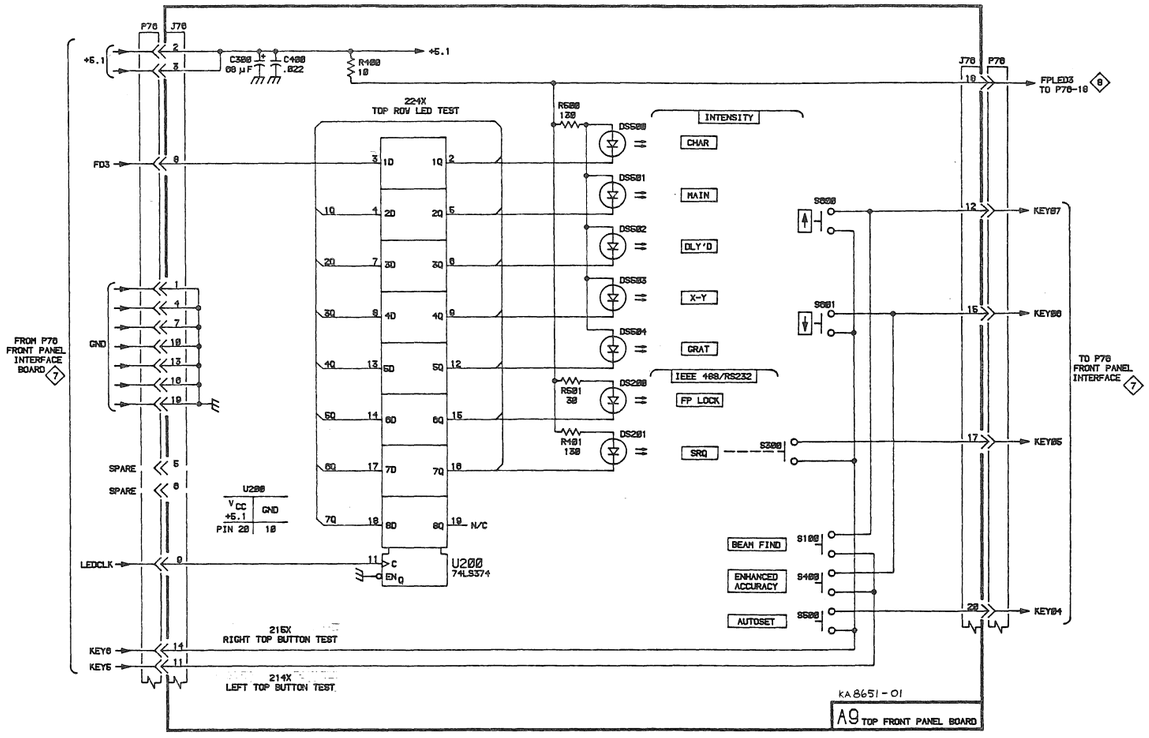


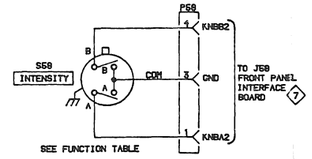
CKT# & TYPE	+28V	-18V	+18V	-28V
U220 MC3408SAF	4	11		
U230 MC3408SAF			4	11

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

NOTE
m_4 GROUNDED THRU BOARD MOUNTING SCREW

A4 REGULATOR BOARD

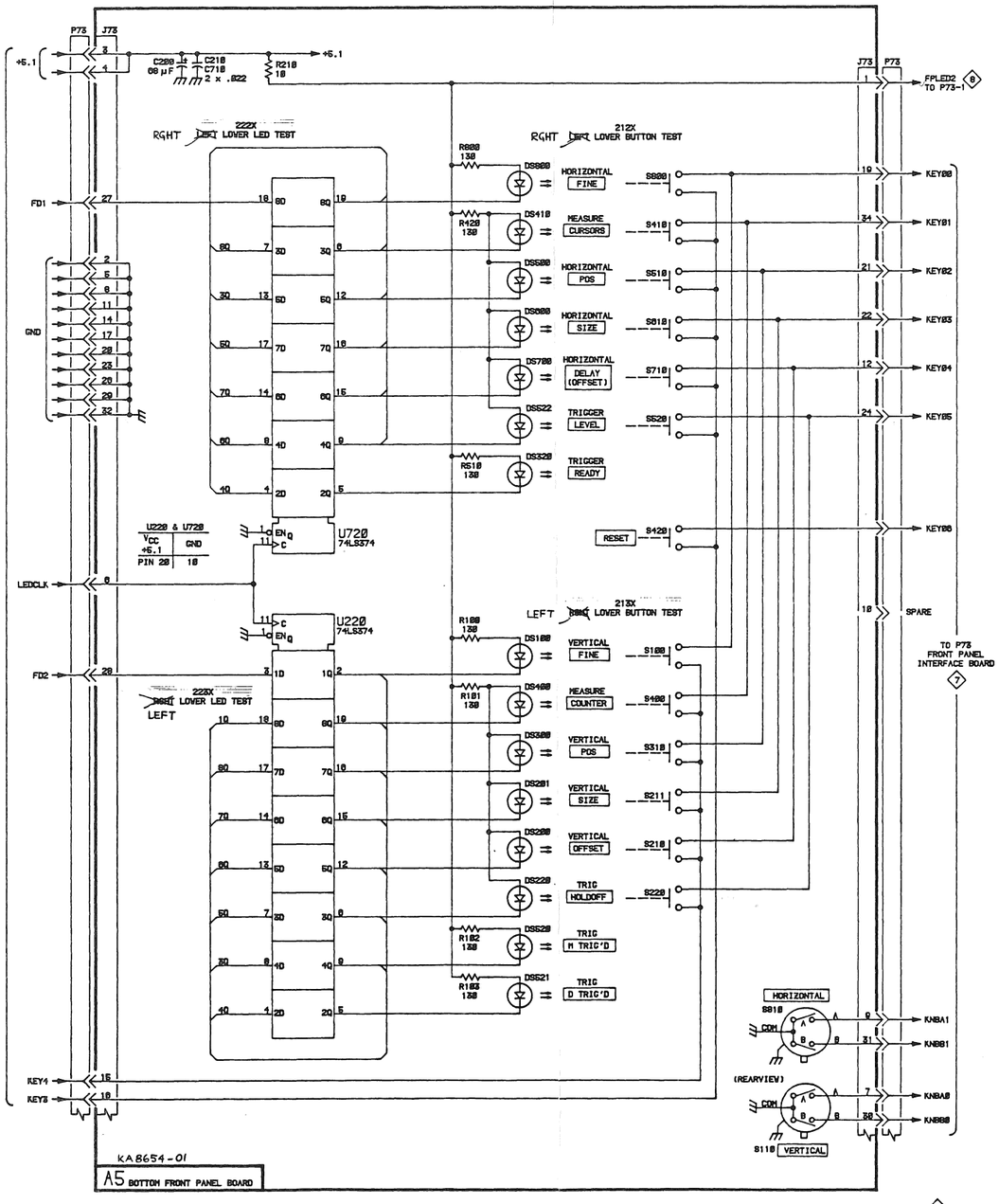


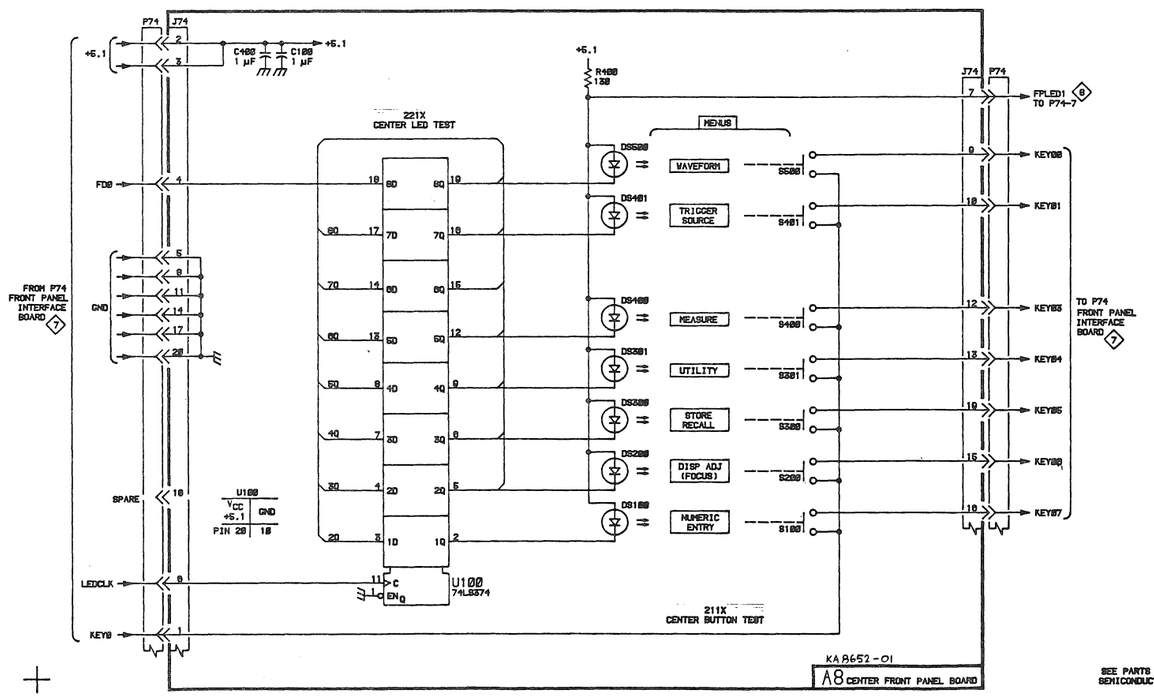


S58, S118, S918
FUNCTION TABLE

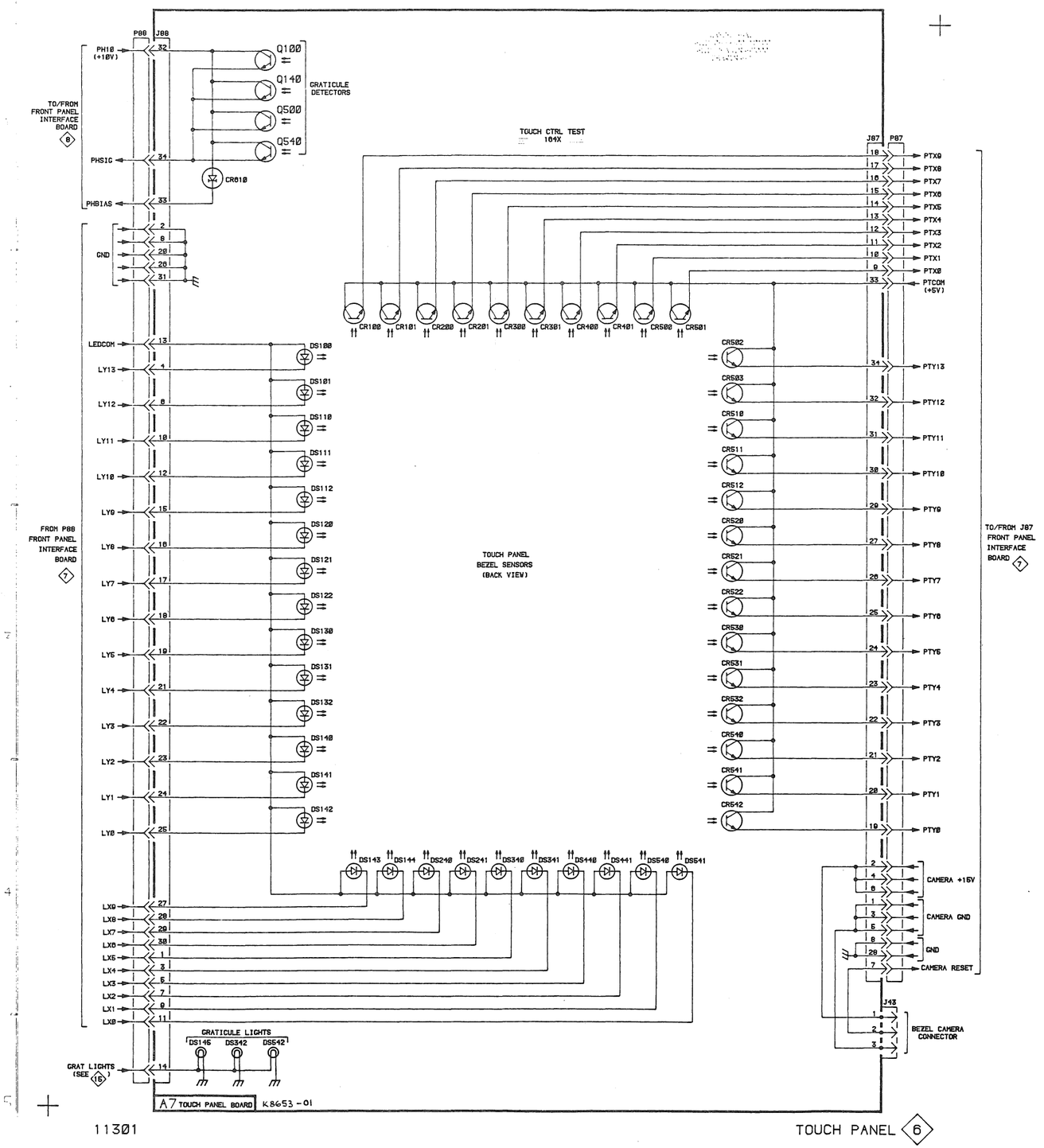
	A	B	DETENT
	1	1	
	0	1	
	0	0	
	1	0	
CW (INCREASE)	1	1	DETENT

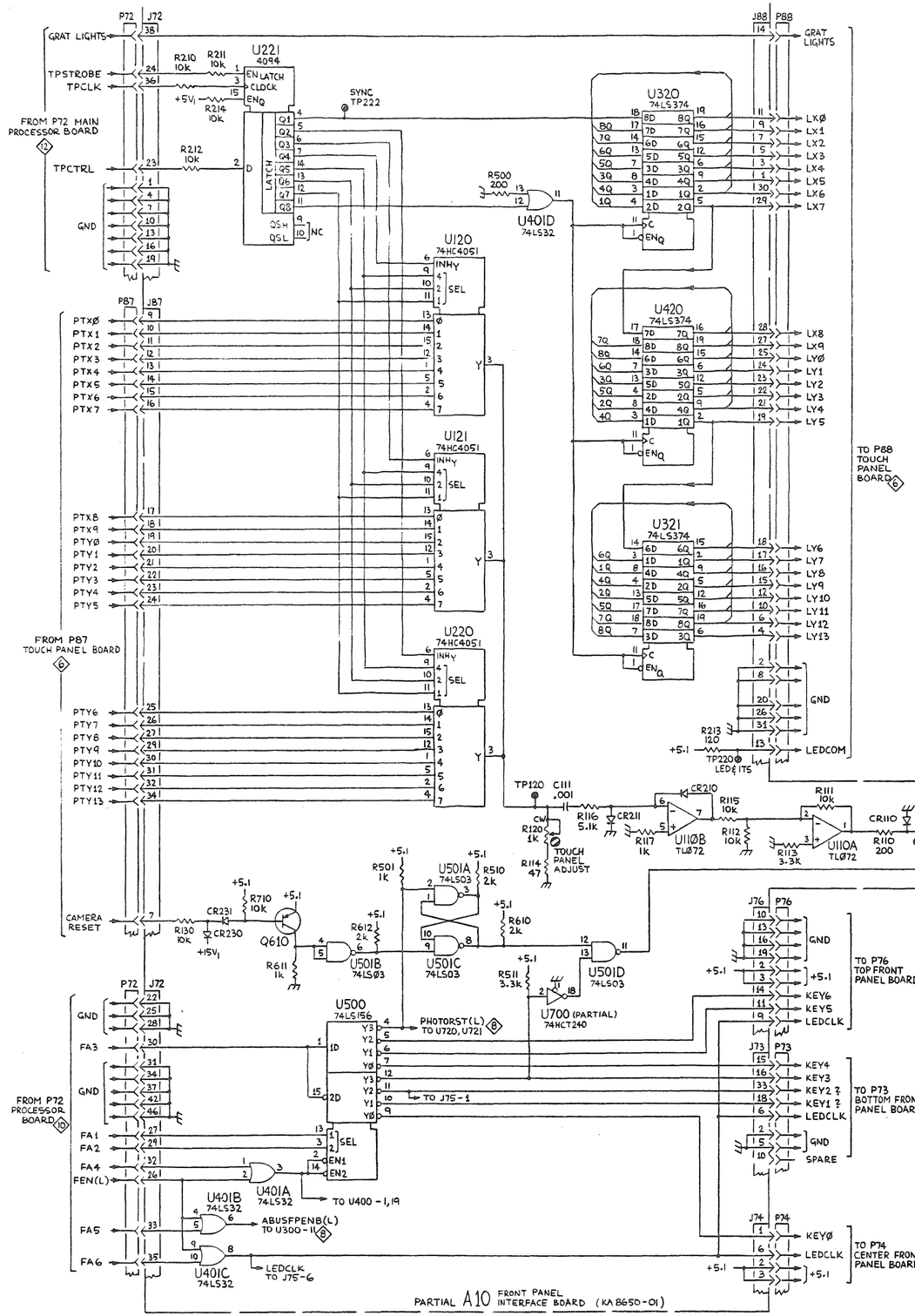
NOTE: 1=H=OPEN





SEE PARTS LIST FOR SEMICONDUCTOR TYPES


P88
J88
PH10 (+10V)
PHSIC
PHBIAS
GND
TO/FROM FRONT PANEL INTERFACE BOARD 8
Q100
Q140
Q500
Q540
GRATICULE DETECTORS
CR010
TOUCH CTRL TEST 104X
J87
P87
PTX9
PTX8
PTX7
PTX6
PTX5
PTX4
PTX3
PTX2
PTX1
PTX0
PTCOM (+5V)
CR100
CR101
CR200
CR201
CR300
CR301
CR400
CR401
CR500
CR501
CR502
CR503
CR510
CR511
CR512
CR520
CR521
CR522
CR530
CR531
CR532
CR540
CR541
CR542
PTY13
PTY12
PTY11
PTY10
PTY9
PTY8
PTY7
PTY6
PTY5
PTY4
PTY3
PTY2
PTY1
PTY0
TO/FROM J87 FRONT PANEL INTERFACE BOARD 7
LEDCOM
LY13
LY12
LY11
LY10
LY9
LY8
LY7
LY6
LY5
LY4
LY3
LY2
LY1
LY0
DS100
DS101
DS110
DS111
DS112
DS120
DS121
DS122
DS130
DS131
DS132
DS140
DS141
DS142
FROM P88 FRONT PANEL INTERFACE BOARD 7
TOUCH PANEL BEZEL SENSORS (BACK VIEW)
DS143
DS144
DS240
DS241
DS340
DS341
DS440
DS441
DS540
DS541
LX9
LX8
LX7
LX6
LX5
LX4
LX3
LX2
LX1
LX0
CAMERA +15V
CAMERA GND
GND
CAMERA RESET
J43
BEZEL CAMERA CONNECTOR
GRATICULE LIGHTS
DS145
DS342
DS542
GRAT LIGHTS (SEE 15)
A7 TOUCH PANEL BOARD
K8653-01



RT

FRONT PANEL CONTROL 7

(FRONT PANEL)

ON DS59 P59 J59 +5.1

FRONT PANEL CALIBRATOR

+50V R922 182k 1% VR920 6.2V R921 45k 1% CR910 CR911 C910 0.1 U910 LF351 R916 14.3k 1% C832 .0015 Q910 R914 100k 1% CR912 R915 8.87K 1%

+50V R920 100 C931 .0015 Q920 R925 1.65k 1% R924 1.74k 1% CR930

FPACCAL P78 J78 16 R912 6.65k 1% R911 66.5k 1% +5V R910 732k 1% R904 10k 1%

FCLK 11 R918 1k Q921 Q1020 C920 470 +5V C1010 .022 R1013 866 1% +5V R1020 1.4k 1% TPX101 R1021 1% 536

FRCALEN(L) 7 U1000B LM339 R903 698k 1% R917 18k R923 1.0k 1% -5V2 R1022 2.32k 1% R1023 1.54k 1% -5V2

Q1022 Q1021 CR1031 R1024 43 SUB R1027 182 1% R1026 274 1% R1025 113 1% -5V2 -5V2

R1030 51 C1030 5.6 50Ω

R1031 44.5 0.5% R1032 480 0.1% T9 R1033 4.455k 0.1% PROBEDIV CR1032 +15V R905 12.5k 0.25%

R900 27K R901 15K

U801 74HC4051 FROM R430 FPLED1 FROM R802 FPLED2 FROM R804 FPLED3 FROM R803 FPLED4 FROM J75-7 Y SEL INHY

FD0 FD1 FD2 FD3 FD4 FD5 FD6 FD7 NC

FD BUS FROM R301 R300 4.7k +5.1 ABUSFPENB(L) FROM U401 B-6 U300 74LS273

U1000C LM339 +15V R1029 20K R1028 2K Q1030

FPCAL FROM J78-14 C824 0.1

DCCALEN(L) FROM J78-8 U1000D LM339 R1001 1.3k +5.1 R1000 1.3k Q1010 CR1010 K930

-15V C831 1µF R831 3k C1031 .022 CR1030 GND J107 (PROBE HOOK) CR931 C930 .022 R830 3k C830 1µF +15V

CALIBRATOR (FRONT PANEL) J108 50Ω

J78 P78 13 FPCALCOM 4 ABUSFP 10

TO MAIN PROCESSOR BOARD

FROM P78 MAIN PROCESSOR BOARD

DCCALEN(L) 10 8 TO U900D-10

FPCAL 9 11 14 TO R700, R800

+50V 18 +50V

CALDACLO(L) 17

GND 2 4 6 9 12 15

CALDACHI(L) 10

NOT USED 1

PHOTODETECTOR CIRCUIT

PHOTORST(L) FROM U402-4 7

U720A 74LS112 U721A 74LS112 U720B 74LS112 +5V3

U621 HC4053 INH

U620C TL074 U620B TL074 U620D TL074 CR720 R630 3.3K C623 0.1 C621 0.1 NC NC

U700 (PARTIAL) 74HCT240 GRATDET(L) 10

R721 1.3K TP720

U421 TL074 +5V4 -5V4

U1000 LM339 +15V -5V R1010 3.6K R1011 1.3K -VT

U910 LF351 +15V -15V

U300 74LS273 C300 .022 +5.1

U801 74HC4051 C801 .022 +5V -5V

U421B TL074 R432 1k C422 .01 R430 10k TO U801-13 R431 1k +15V R433 1k C430 100µF 10V VR430

U421A TL074 R420 1k R421 9.1k C421 .01 R423 11k R422 68k

U421D TL074 R522 1.0k R521 9.53k R523 620 C523 .01 C522 .001 R520 12k

U421C TL074 C530 0.22 R531 1K R532 51k R720 15k C524 .01 R530 24k

TO/FROM P88 TOUCH PANEL BOARD 6 P88 J88 34 PHSIG 33 PHBIAS 32 PH10 (+10V)

FPLED1 FROM CENTER FRONT PANEL BOARD 6 P74 J74 7 R802 3.3K FPLED1

FPLED2 FROM BOTTOM FRONT PANEL BOARD 5 P73 J73 1 R804 3.3K FPLED2 TO U

FPLED3 FROM TOP FRONT PANEL BOARD 5 P76 J76 18 R803 3.3K FPLED3

+5.1 FROM J72 PIN 43,44,45 7 +5.1

+5V FROM J72 PIN 47,48 7 E720 C721 47µF C720 0.1 +5V3 R524 10 C520 100µF C423 0.1 +5V4

TP820 -5V FROM J72 PIN 49,50 7 C810 .022 R1012 10 E1010 C1020 100µF C1021 .022 -5V2 E620 C620 100µF C622 0.1 -5V3 C521 100µF C424 0.1 -5V4 R525 10

E821 +15V FROM J72 PIN 41 7 C821 47µF C823 0.1 +15V3 -15V FROM J72 PIN 39 7 C820 47µF C822 0.1 E820 -15V3

R526 10k U620A (SPARE) TL074 R527 10k

TYPE	+5V3	GND	-5V3
74LS112	16	8	7
HC4053	16	8	11
TL074 (U620)	4		

(KA8650-01)

PARTIAL A10 FRONT PANEL INTERFACE BOARD

7-2-85
7-15-85
9-12-85
LIC #61

A# 69	B#139
A# 75	B#149
A# 107	B#158
A# 133	B#192
A# 148	B#207
A# 149	B#215
B# 54	B#229
B#64	
B#80	
B#81	
B#128	

RT

FRONT PANEL CALIBRATOR AND PHOTODETECTOR CIRCUIT 8

KERNEL TEST CIRCUIT

FROM J90 (12): +15V PIN 9 → +15V; +5V PIN 25,26 → +5V; −5V PIN 1,2 → −5V; −15V PIN 11 → −15V

PWRFAIL FROM P90 PLUG-IN INTERFACE BD (1) — J90 P90 — R1280 3.3K — U1170F 74LS04

NMI/EN FROM U770-11 (13) — U830A 74LS11

CTINT FROM P71 SCOPE LOGIC BOARD (15) — P71 J71 — TP860 CTINT — U830A 74LS11

SDIINT FROM U1760-26 (12)

U860 8D186 — +5.1 — 9,43 (HEAT SINK) — Vcc

R857 3.3K — TIMER IN1 — +5.1

R854 3.3K — TIMER IN0 — +5.1

PROGRAMMABLE TIMERS

TIMEROUT1 → TMROUT1 TO U1170-5

TIMEROUT0 → TMROUT0 TO U420-9,-25 (10)

PROGRAMMABLE INTERRUPT CONTROLLER

NMI — U630-6 → INT0; U562-11 → INT1; INT2; INT3

TEST

RD (62) → RD(L)

ALE (61) → ALE

WR (63) → WR(L) (10)

DEN (39) → DEN(L) TO J79-39, TO (10)

DT/R (40) → DT/R TO J79-38, TO (10)

LOCK (48) NC

HLDA (51) NC

S0 (52) NC

S1 (53) NC

S2 (54) NC

RESET (57) — R880 2.2K

BUS INTERFACE UNIT

A15 A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1 A0 (1–20)

AD15 AD14 AD13 AD12 AD11 AD10 AD9 AD8 AD7 AD6 AD5 AD4 AD3 AD2 AD1 AD0 (65–68, 13–16)

BHE/S7 (64)

ARDY FROM UB30C-8 (10) → 55 ARDY

49 SRDY

50 HOLD

RESET(L) (11) → 24 RES

CHIP SELECT UNIT

MCS3 (35) → MCS3 (L) (11)

MCS2 (36) → MCS2(L) (13)

MCS1 (37) → MCG1 (L) (10)

MCS0 (38) → MCS0 (L) (11)

PCS0 (25) → PCS0(L) (10)

PCS1 (27) → PCS1(L) (12)

PCS2 (28) → PCS2(L) (10)

PCS3 (29) — R858 3.3K — +5.1

PCS4 (30) — R852 3.3K — +5.1

PCS5/A1 (31) NC

PCS6/A2 (32) → PCS6(L) (13)

LCS (33)

UCS (34)

U630A 74LS04 — FROM U520-1 GPIB/DRQ(L) (10) — R730 2.2K

J79 (50) — R856 2.2K — DRQ0 (18), DRQ1 (19) — PROGRAMMABLE DMA UNIT

DQ/DRQ FROM DIGITAL OPTION BOARD

X1 (59) — C872 15 — Y870 16 MHZ — C870 15 — X2 (58)

OSCILLATOR

CLKOUT (56) → TO U640-2 U750D-13 (10)

Vss 26,60

P1250 RUN / TEST — +5 — R1252 3.3K — R1254 3.3K — U1160D 74LS03

U1160B 74LS03 — +5.1 — R1150 3.3K — R1152 3.3K — U1160C 74LS03 — U1160A 74LS03

R960 3.3K — R970 3.3K — +5.1 — R1050 3.3K — R1070 3.3K

DIAGNOSTIC JUMPERS

R1060 .005 — RAD0 RAD1 RAD8 RAD2 RAD9 RAD3 RAD10 RAD11 — AD0 AD1 AD8 AD2 AD9 AD3 AD10 AD11

R1072 .005 — RAD12 RAD4 RAD13 RAD5 RAD14 RAD6 RAD15 RAD7 — AD12 AD4 AD13 AD5 AD14 AD6 AD15 AD7

P850 — UROMHSEL(L) — BRD(L) (10) — SIGSTART (10) — TEST POINT (FOR SIG. ANALYSIS)

U860 SOCKET TOP VIEW

U860 SOCKET BOTTOM VIEW

TYPE	+5.1	GND
74LS03	14	7
74LS04	14	7
74LS32	14	7
74LS373	20	10
27512	28	14

+5.1 FROM J66 (13) → +5.1

J71 P71 — FPACCAL, FPCAL, FPCALCOM — TO P71 SCOPE LOGIC BOARD (15)

J78 P78 — FPCALCOM, FPCAL, FPACCAL, FCLK — TO/FROM P78 FRONT PANEL INTERFACE BD (8)

TMROUT1 FROM U860-23 (5) — U1170C 74LS04 — R1670 51

R780 2.2K — J79 DO/INT (49)

BHE(L) (32)

DEN(L) (39)

DT/R(L) (38)

BA BUS

BA19 (26) BA18 (27) BA17 (29) BA16 (30)

TO/FROM DIGITAL OPTION BOARD

AD BUS

BALE FROM U640-12 (10) — U1062 74LS373 — RAD1 RAD8 RAD2 RAD9 RAD3 RAD10 RAD11 — BA1 BA2 BA3 BA4 BA5 BA6 BA7 BA8 BA9 BA10 BA11 — RADBUS 16

U1072 74LS373 — RAD4 RAD5 RAD6 RAD7 RAD15 RAD14 RAD13 RAD12 — BA4 BA5 BA6 BA7 BA15 BA14 BA13 BA12

U970 74LS373 — RAD0 RAD15 RAD14 RAD13 RAD12 RAD11 RAD9 RAD8 — BA0 BA15 BA14 BA13 BA12 BA11 BA9 BA8

U1230 27512 — MROMLSEL(L) — BRD(L) (10) — BA1 BA2 BA3 BA4 BA5 BA6 BA7 BA8 BA9 BA10 BA11 BA12 BA13 BA14 BA15 — A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 — D7 D6 D5 D4 D3 D2 D1 D0 — AD15 AD14 AD13 AD12 AD11 AD10 AD9 AD8

U1330 27512 — BRD(L) (10) — BA1 — AD15 AD7 AD6 AD5 AD4 AD3 AD2 AD1 AD0

U1430 27512 — BRD(L) (10) — BA1 — AD15 AD7 AD6 AD5 AD4 AD3 AD2 AD1 AD0

U1900 27512 — BRD(L) (10) — BA1 — AD15 AD7 AD6 AD5 AD4 AD3 AD2 AD1 AD0

U1000 27512 — BRD(L) (10) — BA1 — AD7 AD6 AD5 AD4 AD3 AD2 AD1 AD0

U1100 27512 — BRD(L) (10) — BA1 — AD7 AD6 AD5 AD4 AD3 AD2 AD1 AD0

U1200 27512 — BRD(L) (10) — BA1 — AD7 AD6 AD5 AD4 AD3 AD2 AD1 AD0

U1300 27512 — BRD(L) (10) — BA1 — AD7 AD6 AD5 AD4 AD3 AD2 AD1 AD0

+5.1 — CUT STRAP PIN#2 FOR 27512 — BA16

HWR(L) (11) — U940D 74LS32 — WR(L) FROM UB60-63

BHE(L) TO J79-32, TO (10,11)

U842B 74LS32 — LWR(L) (12,10,11) — U930B 74LS32 — BA0 — WR(L) FROM U860-63

* EMUL / * NORM — P852 — +5.1 — R850 3.3K — DRAMSEL(L) (11)

+5.1 — R853 3.3K — UROMSEL(L)

U1170B 74LS04 — BA19 — BA18 — U870C 74LS32 — U930C 74LS32 — MROMHSEL(L)

U1170D 74LS04 — BA17 — U930D 74LS32 — UROMHSEL(L)

U930A 74LS32 — UROMSEL(L)

UROMHSEL(L) TO P850-3

U1170E 74LS04 — BA14 — BA14(L) (11)

16 AD BUS

NOTE: POWER SUPPLY SOURCES AND ISOLATION JUMPERS ARE SHOWN ON (12)

REVISIONS: A#71 A#128

(K 8649-01)

PARTIAL A11 MAIN PROCESSOR BOARD

RT

KERNEL (9)

GPIB BUS
F BUS
CD BUS

U540 74LS245 — DEN(L), PCS0(L), DT/R → ENA/B, CE
U940A 74LS32
AD7–AD0 → CD7–CD0
AD BUS

U562B 74LS32 — PCS2(L), DEN(L), DT/R(L) → CE, ENA/B
U470 74LS245
AD7–AD0 → FD7–FD0
R372 100

U572 74LS244 — PCS2(L) → EN
BA1–BA3 → FA1–FA3
R570 100
DAT(L), PCS2(L) → U562A 74LS32 → FEN(L) via R572 51

U1740B 74LS04 — R1530 3.3K, +5.1
TRIGGER RESET J42 (REAR PANEL) — RESET IN J42 — CR630, CR632, R531 51, +5.1
U1540B 74LS74
U730 74LS251 — GRATDET, ARDY, EERROM_BSY(L), DSPSTAT → D7–D0, Y → CD7
P71 J71 28 SERTEST — FROM P71 SCOPE LOGIC BOARD 15
BRD(L) → U842C 74LS32 → ENY, BA1, BA2, BA3, SEL → U420-12

BA BUS
U760 74LS138 — BA4, BA5, BA6 → Y0–Y7
Y0 → UARTSEL(L) TO U420-11
Y1 → GPIBSEL(L)
Y2 → LATCH1SEL(L) TO U870A-2
Y3 → LATCH2SEL(L) TO U870D-12
U650A 74LS32 — BRD(L)
DAT, PCS0(L) → G1Y
R760 2.2K
U1840 74LS251 — BA BUS → BA1, BA2, BA3 → SEL
+5.1, R1742 3.3K, R1740 3.3K, S1740 → D7–D0, Y → CD7
J79 48 DO_RDY TO U830-10 — FROM DIGITAL OPTION BOARD
P78 J78 3 GRATDET(L) TO U730-14 — FROM P78 FRONT PANEL INTERFACE BOARD 8

GPIB CONTROLLER
U520 TMS9914A
CD0–CD7 → TO U670-13, TO U770-13 12
DATA LINES (I/O) — D7 (LSB) … D0 (MSB)
GPIB DATA LINES (I/O) — (MSB) DIO8 … (LSB) DIO1
GPIB MANAGEMENT LINES (I/O) — SRQ, ATN, EOI, DAV, NRFD, NDAC, IFC, REN
OPERATION CONTROL — TE, CONT, INT, TR, ACCRQ
REGISTER ADDRESS DECODE — RS0 (LSB), RS1, RS2 (MSB)
R520 2K — +5.1, ACCGR
RESET(L) 11 → RESET
GPIB CLK → Ø (CLK)
BWR(L) → WE
BRD(L) → U630B 74LS04 → DBIN
R620 2K — +5.1, GPIB INT @ TP630, U630C 74LS04 → INTØ TO U860-45 9
ACCRQ → GPIB/DRQ(L) 9 TO U630-1
CE ← GPIBSEL(L)

GPIB DATA BUFFER AND CONTROL DRIVER
U700 75160A — D = DRIVER, R = RECEIVER
DIO8–DIO1 ↔ D8–D1
END D/R, END
U600 75161A — SRQ, ATN, EOI, DAV, NRFD, NDAC, IFC, REN, TE, DIRECTION, NC

U640 74LS244 — EN1, EN2
CLKOUT, WR(L), RD(L), ALE → BWR(L) TO J79-35, TO 11; BCLK TO J79-41 11 12 13
U740B 74LS04 — DAT(L) TO U562A-1, TO U650D-13 8, U540A-1
DAT TO U760-6 8
U750A 74LS00 — BRD(L) TO J79-36 TO 11 12 13
BALE TO J79-33 TO 9 12 13

U660B 74LS393 — WAIT-STATE GENERATOR
R660 2.2K, +1
GPIB CLK, NC
R440 2K, +5.1
2MHz TO COUNTER-TIMER MUX 12
U842A 74LS32 — DO_RDY FROM J79-48
U830C 74LS11 — R840 3.3K, +5.1
U740E 74LS04 — DS846 READY, R844 1K
ARDY TO U730-2 TO U860-55 9
U940C 74LS32 — MCS1(L) 9
U830B 74LS11 — R842 3.3K, +5.1
DRDY 13, DRAM_RDY 11, ADC_RDY 12

U670 74LS259 — LATCH1SEL(L) 2, LWR(L) 9, RESET(L) 11
BA1–BA3 → SEL; CD0 13 → D
Q0 4, Q1 5, Q2 → SRAMEN TO R1042 4, Q3 7, Q4 9, Q5 10 → SIGSTART 9, Q6 11, Q7 12 → BEEP_EN 12
U870A 74LS32
R990 1K, DS1081; R991 1K, DS1080 — +5.1

RS232 CONTROLLER
U420 8251A — CD0–CD7 → D0–D7 (DATA BUS BUFFER (I/O))
WR 10, CS UARTSEL(L) 11 + BRD(L) 13, RD, RESET 21 (RESET 11), BA1 12, C/D̄, CLOCK 20
READ/WRITE CONTROL LOGIC
MODEM CONTROL — DSR(L) 22, CTS(L) 17, DTR 24 DTR(L), RTS 23 RTS(L)
TRANSMIT CONTROL AND TRANSMIT BUFFER — TMROUTØ FROM U860-22 9, TXC, TXRDY 15, TXE 18, NC, TXD 19 TXD(L)
RECEIVE CONTROL AND RECEIVE BUFFER — RXC 25, RXRDY 14, BRKDET 16, RXD 3 RXD(L)
U750D 74LS00 — CLKOUT 13
U750C 74LS00 — DWR(L) 12 13
U740C 74LS04 — 5 6
U562C 74LS32 — USART INT TP562, INT1 TO U860-44 9
U562D 74LS32
FROM J90 12 → +15V, -15V
+5.1 FROM J66 13 → +5.1

TYPE	+5.1	⏚
1489	14	7
74LS00	14	7
74LS04	14	7
74LS32	14	7
74LS74	14	7
74LS11	14	7
74LS138	16	8
74LS245	20	10
74LS244	20	10
74LS251	16	8
74LS259	16	8
74LS393	14	7
75160A	20	10
75161A	20	10
8251A	26	4
TMS9914A	40	20

C504 .047 — FROM CR400 V+ — R400 3.3K
U402 1489 — RTS 13, TXD 1, NC 2, DTR 10 → CTS(L) 11, RXD(L) 3, DSR(L) 8
C506 .047
RS 232 INTERFACE DRIVERS
U400 1488 — V+ 14 → V+ TO R4-00
DCD 3, RXD 6, CTS 8, DSR 11
TXD(L) 4, RTS(L) 9, DTR(L) 12, GND 7
+15V: CR322, CR320, CR400
-15V: CR324, CR326, CR327

J50 — DIO1–DIO8, EOI, DAV, NRFD, NDAC, IFC, SRQ, ATN, SHIELD, DIO5–DIO7, REN, GND, LOGIC GND — IEEE-488 (REAR PANEL)
J72 P72 — FD0–FD7, FEN(L), FA1–FA6, GRATLIGHTS 138 (SEE 13) — TO/FROM P72 7 (FRONT PANEL INTERFACE BOARD)
J79 — BALE, BWR(L) 35, BRD(L) 36, BCLK 41 — TO DIGITAL OPTION BOARD
J71 46 P71 — GRATLIGHTS — TO/FROM P71 8 SCOPE LOGIC
J51 — FRAME GROUND, TXD, RXD, RTS, CTS, DSR, DCD, DTR — RS-232-C (REAR PANEL)
DATA TERMINAL READY
J78 8 DCCAL EN (L), 7 FRCAL EN (L) — TO FRONT PANEL INTERFACE BOARD 8
READY OUT — U740A 74LS04, CR500, CR502, R320 51, +5.1 — J41 TRIGGER READY (REAR PANEL)

NOTE:
POWER SUPPLY SOURCES AND ISOLATION JUMPERS ARE SHOWN ON 12

(K8649-01)
PARTIAL A11 MAIN PROCESSOR BOARD

REVISIONS:
7-10-85
7-30-85
8-7-85
9-11-85
LIC# 61

A# 71, A# 105, A# 106, A# 121, A# 122, A# 128, B# 7
B# 19, B# 43, B# 129, B# 148

RT

CONTROL, GPIB AND RS-232-C 10

U1640A 74LS32
U1500 TMS4500A
U1640D 74LS32
U1640C 74LS32
U1540A 74LS74
U1740A 74LS04
U1460 TL7705
U1260 6242
U940B 74LS32
U740F 74LS04
U1920 41464
U1900 41464
U1820 41464
U1800 41464
U1620 41464
U1600 41464
U1720 41464
U1700 41464
U900 NEC4464
U1130 NEC4464
U800 2817A
U842D 74LS32
Q1360
Q1269
Q1268
Q1040
CR1540
CR1350
CR1364
CR1262
CR1292
VR1364 3.6V
VR1260 3.6V
Y1350 32.768kHz
BT1190 3V
DRAMSEL(L)
BWR(L)
RWR(L)
ACW
ACR
BRD(L)
BCLK
CLK
TWST
REFREQ (I/O)
DAT
RESET(L)
FS1
FS0
RDY
DRAM RDY TO U830B-3
CAS
RAS1
RAS0
MULTIPLEXER
TIMING AND CONTROL
REFRESH RATE GENERATOR AND ARBITER
BALE
REN1
COLUMN ADDRESS LATCH AND SELECT LATCH
ROW ADDRESS LATCH
BHE(L)
BA0
HCAS(L)
LCAS(L)
RAS1(L)
RAS0(L)
MA BUS
AD BUS
BA BUS
FROM J90
+15V PIN9
+5V PIN25,26
-5V PIN1,2
-15V PIN11
NOTE: POWER SUPPLY SOURCES AND ISOLATION JUMPERS ARE SHOWN ON 12
REAL TIME CLOCK
BBRAM
EEROM
NON VOLATILE MEMORY
RESET TO J71-46
RESET TO U420-21 U1760-19
+BAT TO U1380-5
CLOCK CALENDAR ON TO U1640B-4
SRAMEN FROM U670-10
MCS0 TO 9
FROM J66
RESET TO P71
TO P71 SCOPE LOGIC BOARD
EEROM/BSY(L) TO U730-3
FROM U842B-6
BAT RET

TYPE	+5.1	GND
2817A	28	14
74LS04	14	7
74LS32	14	7
74LS74	14	7
TL7705	8	4
TMS4500A	40	20
TI4464 OR NEC41254	9	18

REVISIONS:
A=82
A=122
B=148

(K 8649-01)
PARTIAL A11 MAIN PROCESSOR BOARD

RT

MEMORY AND CLOCK 11

TP420 TP560 TP1630 TP1570

J90 P90

-50V NC

+15V W1281 R1480 10 C1580 47µF C1582 0.1 → +15V1

+5V +5V W1350 R1380 10 C1380 47µF C1490 0.1 → +5V1

FROM P90 (PLUG-IN INTERFACE BOARD) 1

-5V -5V W1280 R1282 10 C1280 47µF C1390 0.1 → -5V1

R1482 10 C1482 47µF C1590 0.1 → -15V1

-15V W1282 -15V

J79 P79

+15V -15V +5.1 FROM J66 13

TO P79 DIGITAL OPTION BOARD

J72 P72

+15V -15V +5V -5V +5.1 FROM J66 13

TO P72 FRONT PANEL INTERFACE 7

TO/FROM P71 (SCOPE LOGIC BOARD) 19

P71 J71 R1860 100

ED7 ED6 ED5 ED4 ED3 ED2 ED1 EDØ

SHCLK 18

U1760 SDI (HEAT SINK) +5.1

ED7 ED6 ED5 ED4 ED3 ED2 ED1 EDØ

ACVSCLK

FROM P72 (FRONT PANEL INTERFACE BD) 7

P72 J72

KNBAØ KNBBØ KNBA1 KNBB1 KNBA2 KNBB2 TPDATA

KNBAØ KNBBØ KNBA1 KNBB1 KNBA2 KNBB2 TPDATA

FROM P90 (PLUG-IN INTERFACE BOARD) 1

J90 P90

RIGHT SDI PI TO MF CENTER SDI PI TO MF LEFT SDI PI TO MF

PARTIAL R1564 3.3k +5

PARTIAL R1660 100

A TOMF SDI R TOMF SDI L TOMF SDI

SEE NOTE

SEE NOTE

PARTIAL R1564 3.3k +5.1

PARTIAL R1660 100

MFTOL SDI MFTORSDI MFTOASDI SDICLK CLK10UT

2MHz FROM R670

R1850 100

J71 P71

2MHz EAV CTRLDATA EXTSEL CALDACHI CALDACLO CALRANGE ROCSEL ACVSDATA

TO P71 SCOPE LOGIC BOARD 19

U1560F 74LS04

J78 P78

CALDACHI(L) CALDACLO(L) 8

TO FRONT PANEL INTERFACE BOARD

J72 P72

TPCLK TPCTRL TPSTROBE

TPCLK TPCTRL TPSTROBE 7

SHDATA 18

R1752 100

U1560A 74LS04

U1560B 74LS04 R1562 200 RIGHT SDI CLK

U1560E 74LS04 R1464 200 LEFT SDI CLK

U1560C 74LS04 R1466 200 CENTER SDI CLK

TO P90 (PLUG-IN INTERFACE BOARD) 1

+50V DCPWRSW PWRCOM

J60 P60 ON STANDBY S60 (FRONT PANEL)

W1480

AD7 AD6 AD5 AD4 AD3 AD2 AD1 ADØ

AD BUS

J78 P78 +50V GND 8

BA BUS

U770 74LS259 BA1 BA2 BA3 SEL

RESET(L) 11 R

LATCH2SEL(L) 10 LWR(L) 9 EN

U870D 74LS32

CDØ 10 D

Q0 Q1 Q2 Q3 Q4 Q5 Q6 Q7

AMUX0 AMUX1 AMUX2 AMUX3

NMI/EN TO 9

DISP/EN TO U650B-4 13

U980B 74LS00 INHY

U1280 74HC4051 AMUX0 AMUX1 AMUX2 SEL

COUNTER-TIMER MUX

2MHz FROM U660-4 10

U870B 74LS32

U1740C 74LS04

CLOCK CALENDAR ON FROM U1260-1, R1253 11

U1640B 74LS32

U980D 74LS00 R670 100 2MHz TO J71-50

SAMPL HLD TP1590

A/D CONVERTER

U1680 AD574 +15V1 BA1 BA2 A0 R/C VLOGIC 12/8 CS CE VDD STS

U1560D 74LS04 R1780 3.3k ADC RDY TO U830B-5 10

R1782 3.3k

CONTROL

PCS1(L) 9 DAT(L) 10 U650D 74LS32 U1170A 74LS04

(LSB) DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7 DB8 DB9 DB10 (MSB) DB11

3-STATE OUTPUT BUFFERS

DAC AND VOLTAGE REFERENCE

10V IN 20V IN ANALOG COMMON DIGITAL COMMON BIP OFF REF IN REF OUT VSS

R1580 100 R1581 100 R1588 100 -15V1

AD BUS

BALE DWR(L) BCLK MCS1(L) 9 RESET 11

ALE WR RD CLK SEL RESET

BA12 BA11 BA10 BA9 BA8

A12 A11 A10 A9 A8

INT 26 SDINT TP1760 SDINT TO U860-41 9

PW1 PW2 PW3 PW4 PW5 13

35

BEEP EN 10 U980A 74LS00 R1880 1K C1880 0.1 Q1880 R1890 10k +5.1 LS1890 CR1890

J90 P90

LEFT 11K DETECTOR CENTER 11K DETECTOR RIGHT 11K DETECTOR L11KDET C11KDET R11KDET

FROM P90 PLUG-IN INTERFACE BOARD 1 GND

XPOS XRO PLUS POS MINUS POS 13

R1290 1K

R1494 10k

SAMPLE AND HOLD

+15V1 R1592 510 R1594 24k R1592 10 C1492 .047 TP1390

U1590 LF398AN V+ V- VOFF IN LREF C1690 1000

R1596 130K R1598 10K

U1380 74HC4051

P71 J71 ABUSTB ABUSCAL ABUSCRT

FROM P71 SCOPE LOGIC BOARD 6 ABUSCAL 16

P78 J78 NOT USED ABUSFP

FROM P78 (FRONT PANEL INTERFACE BD) 8

P52 J52 ABUSV

ABUSV FROM PS2 (VERTICAL BOARD) 4

+BAT FROM R1294 11

+5.1 FROM J66 13 C1570 0.1

TYPE	+5.1	
74LS00	14	7
74LS04	14	7
74LS32	14	7
74LS259	16	8

U1380 +5V1 74HC4051 VDD VEE VSS -5V1

U1280 +5V1 C1282 0.1 74HC4051 VDD VEE VSS C1294 0.1 -5V1

J72 P72 GND 7

TO/FROM FRONT PANEL INTERFACE BOARD

U1760 SOCKET TOP VIEW

U1760 SOCKET BOTTOM VIEW

REVISIONS:

A# 11 B# 110
A# 121 B# 148
A# 122
A# 128
A# 136
A# 151
A# 167

B# 1
B# 10
B# 58

NOTE *

U1760 +5.1

U1760 PIN 20 : CR1860, CR1861
21 : CR1870, CR1871
22 : CR1862, CR1863
23 : CR1872, CR1873
24 : CR1880, CR1881
25 : CR1882, CR1883

(KB649-01) PARTIAL A11 MAIN PROCESSOR BOARD

RT

SDI AND ABUS 12

U440
DISPLAY (HEAT SINK)

AD BUS

DF6
DF7
DF8
DISPRDY → DRDY
DISPSTAT → DSPSTAT

J56 P56
DYNFOØ
DYNFO1
DYNFO2
GND
GND
TO P56 SCOPE LOGIC BOARD

dynamic Comm

ADØ–AD11
DSEL
RAMSEL
ALE
RD
CLK

U650C 74LS32
DWR(L)
PCS6(L)
MCS2(L)
BALE
(BRD(L)
BCLK(L)
R445 100

+5.1
R560 4.7k
WDØ–WD11
RAS
CAS

U460 4416
U362 4416
U560 4416
I/OØ–I/O3
A6–AØ
RAS
CAS

DISP/EN FROM U770-12

U650B 74LS32

XØ–X9
YØ–Y9
XØ TO U730-15
YØ TO U730-13

U340 DAC1Ø
B1(MSB)–B1Ø(LSB)
IOUT
VREF+
VREF-
COMP

+15
R344 7.5k
R258 7.5k
C344 0.1

PW1 U370F 74HCØ4
R360 29.4k
R270 10k
C360 0.1
C268 0.1

PW2 U370E 74HCØ4
R274 20k
R272 29.4k
R171 10k
C270 0.1
C171 0.1
C330 0.1

PW3 U370C 74HCØ4
R360 10k
R280 10k
C380 0.1
C280 0.1

U170A TL072
R256 16.9k
R253 2.80k

U242 LM318
R255 1.3k
C245 .022
C249 5.6
C247 33
R251 1.43k

U370D 74HØ4
R382 10k
R282 10k
C382 0.1
C282 0.1

U170B TL072
R212 1M
R214 2M.
C212 .01
C215 .01
R223 200k
R222 13k
C127 .022
U220A TL072

R215 200k
R213 2M
R227 33k
R224 1.5k
R226 619
R225 619
R125 33k
Q127
Q128
Q125
R210 8.2k
C126 .022
R228 12k
R230 1.0M
R231 1.0M
R327 510k
C226 .01
U220B TL072
R211 1.5k

PLUS POS
MINUS POS
R132 1.37k
R133 1.37k
R330 6.65k

U370B 74HCØ4
U370A 74HCØ4
R263 499
Q172
C166 1000

U160B LM319
R268 430
R182 1k
R183 3k
R264 845
C264 .022
R266 1.21k
C248 5.6
U240 LM318
R250 1.3k
C242 .022
R252 100
C246 33
R254 1.33k

U160A LM319
R262 430
R259 1.21k
C260 .022
R260 845

U360B 74LS00
U360C 74LS00
U360A 74LS00
U360D 74LS00
VECT FROM U440-68
C174 10
R174 3.57k
R175 3.74k
R170 3.57k
C170 10
R165 510
R164 240
R184 3k
R176 499
Q160
Q161 -188
R160 100
R180 499
C181 .022
R172 499
R173 3.74k
Q163
Q162
R161 100
R181 2k
R163 510
R162 510

U140 LM318
U240 LM318
U170 TL072
U220 TL072
U330 DAC1Ø
C142 .022
C244 .022
C175 .022
C209 .022
C327 .022
C190 .022 -15V
C250 .022 -15V
C180 .022 -15V
C224 .022 -15V
C328 .022 -15V

U130 74HC4053
C130 .022
C140 .022 -5V
U105 U205 SN5534
C120 .022
C220 .022 -15V
C100 C200
U242 LM318
C251 .022 -15V
C243 .022
U160 LM319
C164 .022 -15V
C262 .022
U340 DAC1Ø
C342 .022 -15V
C340 .022

FROM J90
+15V C172 .022
+5V
C184 .022
-5V
-15V
NOTE: POWER SUPPLY SOURCES AND ISOLATION JUMPERS ARE SHOWN ON

REVISIONS
LIC #61
A# 95
A# 173
B# 2
B# 5
B# 8
B# 9
B# 22
B# 43
B# 79
B# 113
B# 137

TYPE	+5.1	GND	+15V	-15V
DISPLAY	1	36		
4416	9	18		
74LS02	14	7		
74LS32	14	7		
74HC04	14	7		

U440 SOCKET TOP VIEW
U440 SOCKET BOTTOM VIEW

P71 J71
FROM P71 SCOPE LOGIC BOARD
GND
PICLK
POSSYNC
IRO(L)
R444 2k
R442 100
R443 2k
RODIS
POSCLK
POSSYNC
IRO
VECT → VECT TO U130-9,-10,-11
ROBLANK
~DISPRO

P66 J66
FROM P66 CONTROL RECTIFIER BOARD
+5.1A
5.1R
5.1R
+5.1A
KEY
E880
E980
C1090 220μF
C350 C370 C420 C460 C520 C680 C700 C750 C850 C1000 C1072 C1330 C1750 C1752 C1840
C1570 0.1
+5.1

U1740D 74LS04
R1750 200
(K 8649-01)
MAIN
PARTIAL A11 PROCESSOR BOARD
J71 P71
DISPRO
ROBLANK
TO SCOPE LOGIC BOARD

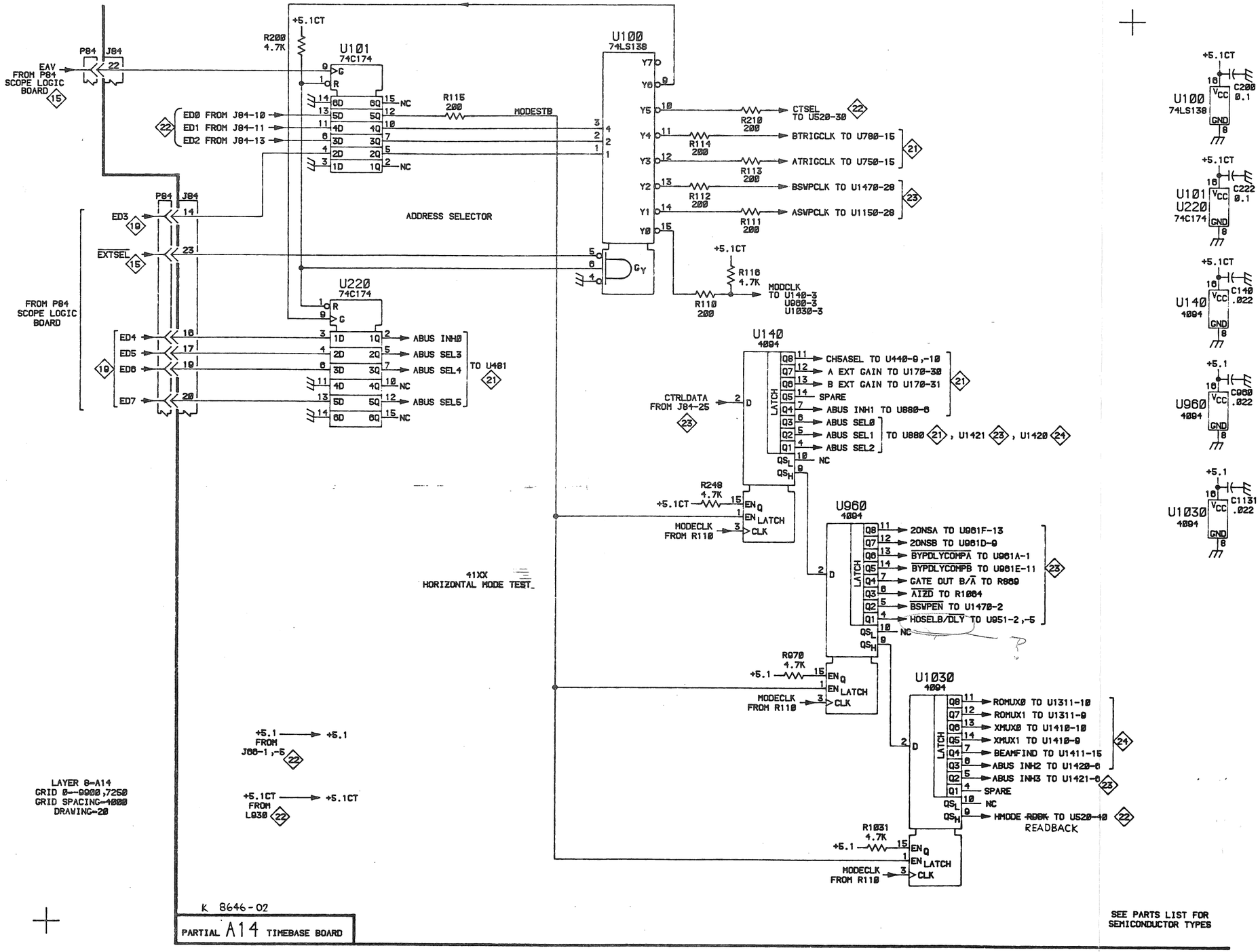
RT

HRO

U230D SD5000
U230C SD5000
U230B SD5000
U230A SD5000
SUB
S D G
C225 10
C231 2.2
C234 2.2
C237 10
R236 1.96k
L230 820μH
C230 51
C232 200
R234 1.96k
L234 820μH
C236 51
C233 200
R229 51
R232 51
U130B 74HC4053
U130C 74HC4053
SEL X/Y
U205 SN5534
U105 SN5534
R130 10k
R122 402
R120 402
R131 10k
R221 402
R220 402
PLUS POS TO U1280-5
MINUS POS TO U1280-2
VECT FROM U440-68
TO P52 VERTICAL BOARD
+POSITION
+RO
-RO
-POSITION
R235 360k
R238 1M
R240 2.26k
C240 51
C238 10
C152 51
C151 200
U140 LM318
U130A 74HC4053
INH
SEL X/Y
R233 1.5M
C241 .022
R152 20k
XRO TO U1280-1
XPOS TO U1280-12
R150 20k
J25 XRO
J24 XPOS
TO TIMEBASE BOARD

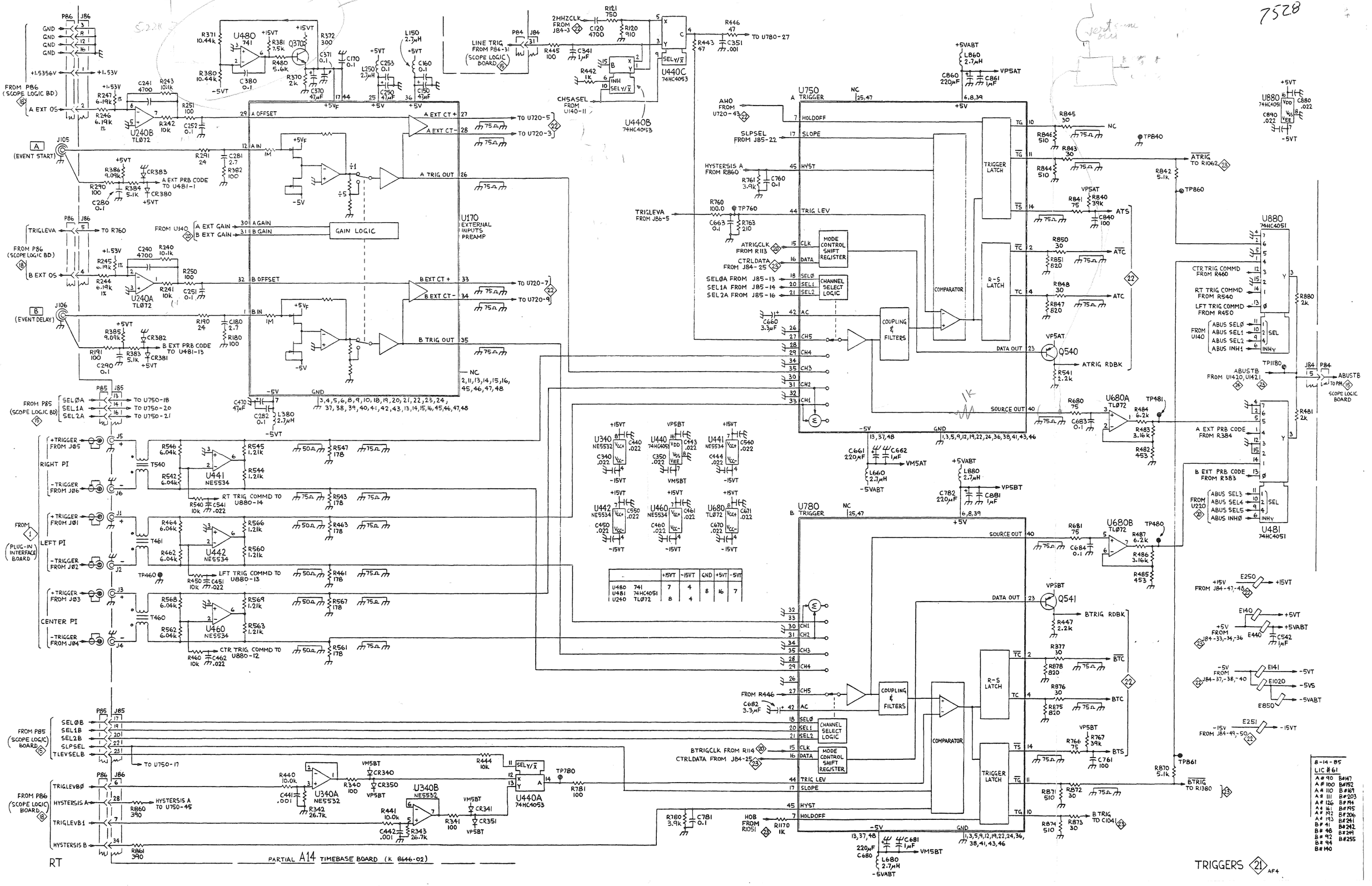
J52 P52
GND

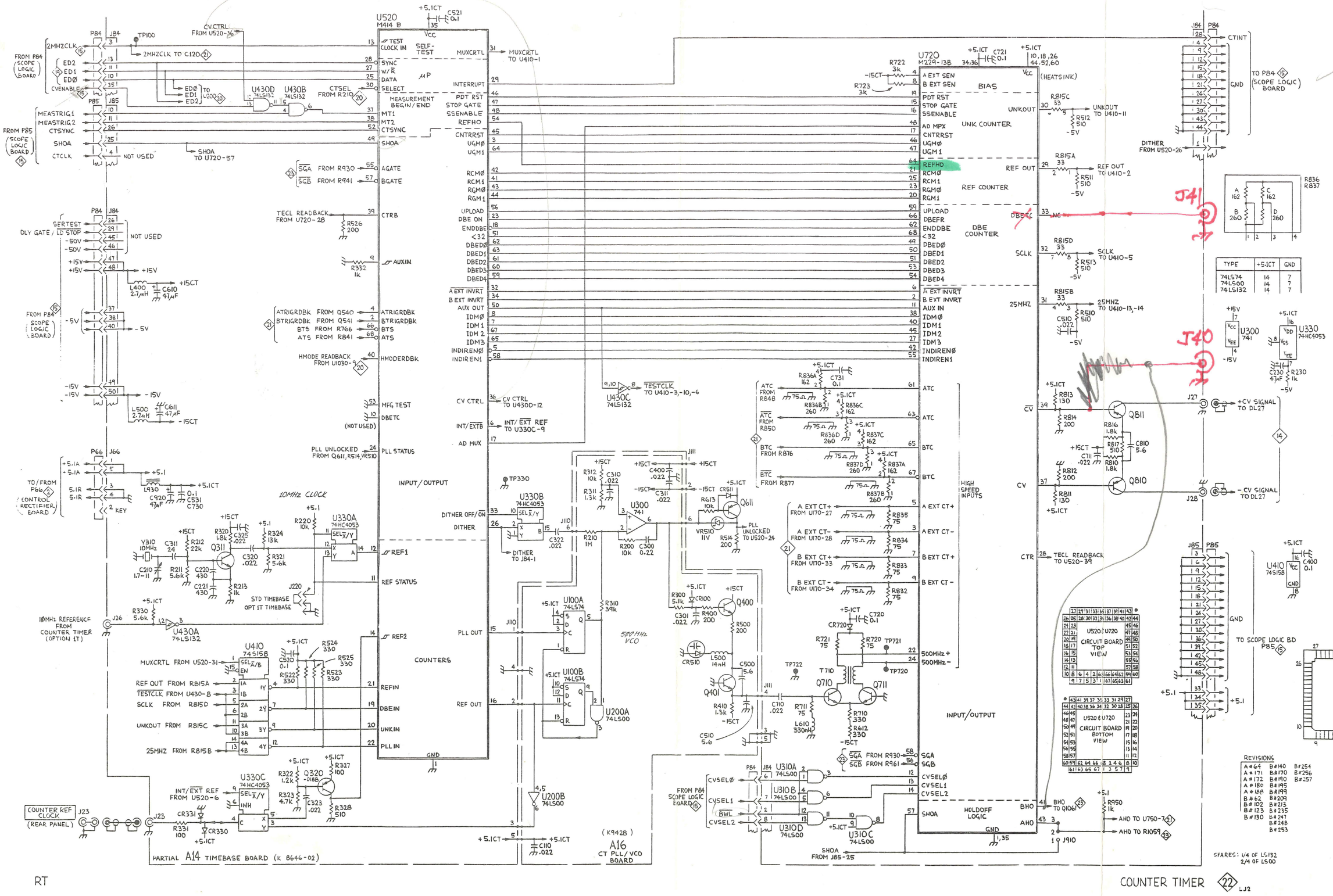
READOUT



11301

TIMEBASE MODE CONTROL 20


PARTIAL A14 TIMEBASE BOARD (K 8646-02)
RT
TRIGGERS 21 AF4
U750 A TRIGGER
U780 B TRIGGER
U170 EXTERNAL INPUTS PREAMP
GAIN LOGIC
MODE CONTROL SHIFT REGISTER
CHANNEL SELECT LOGIC
COUPLING & FILTERS
COMPARATOR
R-S LATCH
TRIGGER LATCH
U880 74HC4051
U481 74HC4051
U440C 74HC4053
U440B 74HC4053
U440A 74HC4053
RIGHT PI
LEFT PI
CENTER PI
A EXT PRB CODE TO U481-1
B EXT PRB CODE TO U481-13
RT TRIG COMMD TO U880-14
LFT TRIG COMMD TO U880-13
CTR TRIG COMMD TO U880-12
ATRIG RDBK
BTRIG RDBK
ATRIG TO R1062
BTRIG TO R1380
A TRIG TO C104
B TRIG TO C104
8-14-85
LIC # 61


U520
M414 B
+5.1CT
C521 0.1
TEST
CLOCK IN
SELF-TEST
MUXCRTL
SYNC
W/R
DATA
SELECT
INTERRUPT
MEASUREMENT BEGIN/END
PDT RST
STOP GATE
SSENABLE
REFHO
CNTRRST
UGMØ
UGM1
RCMØ
RCM1
RGMØ
RGM1
UPLOAD
DBE ON
ENDDBE
<32
DBEDØ
DBED1
DBED2
DBED3
DBED4
A EXT INVRT
B EXT INVRT
AUX OUT
IDMØ
IDM1
IDM2
IDM3
INDIRENØ
INDIREN1
CV CTRL
INT/EXTB
AD MUX
AGATE
BGATE
CTRB
AUXIN
ATRIGRDBK
BTRIGRDBK
BTS
ATS
HMODERDBK
MFG TEST
DBETC
PLL STATUS
REF1
REF STATUS
REF2
COUNTERS
REFIN
DBEIN
UNKIN
PLL IN
GND
INPUT/OUTPUT
PLL OUT
REF OUT
MUXCRTL TO U410-1
CV CTRL TO U430D-12
INT/EXT REF TO U330C-9
TESTCLK TO U410-3,-10,-6
SGA FROM R930
SGB FROM R941
TECL READBACK FROM U720-28
ATRIGRDBK FROM Q540
BTRIGRDBK FROM Q541
BTS FROM R766
ATS FROM R841
HMODE READBACK FROM U1030-9
PLL UNLOCKED FROM Q611,R514,VR510
U720
M229-13B
+5.1CT
C721 0.1
A EXT SEN
B EXT SEN
BIAS
PDT RST
STOP GATE
SSENABLE
AD MPX
CNTRRST
UGMØ
UGM1
UNK COUNTER
REFHO
RCMØ
RCM1
RGMØ
RGM1
REF COUNTER
UPLOAD
DBEFR
ENDDBE
<32
DBEDØ
DBED1
DBED2
DBED3
DBED4
DBE COUNTER
A EXT INVRT
B EXT INVRT
AUX IN
IDMØ
IDM1
IDM2
IDM3
INDIRENØ
INDIREN1
25MHZ
ATC FROM R848
ATC FROM R850
BTC FROM R876
BTC FROM R877
A EXT CT+ FROM U170-27
A EXT CT- FROM U170-28
B EXT CT+ FROM U170-33
B EXT CT- FROM U170-34
500MHz+
500MHz-
HIGH SPEED INPUTS
SHOA
HOLDOFF LOGIC
BHO TO Q1061
AHO TO U750-7
AHO TO R1059
(HEATSINK)
UNKOUT TO U410-11
REF OUT TO U410-2
NC
SCLK TO U410-5
25MHZ TO U410-13,-14
CV SIGNAL TO DL27
-CV SIGNAL TO DL27
TECL READBACK TO U520-39
CTINT
GND
TO P84 (SCOPE LOGIC BOARD)
DITHER FROM U520-26
R836 R837
TYPE | +5.1CT | GND
74LS74 | 14 | 7
74LS00 | 14 | 7
74LS132 | 14 | 7
U300 741
U330 74HC4053
U410 74S158
U520 & U720 CIRCUIT BOARD TOP VIEW
U520 & U720 CIRCUIT BOARD BOTTOM VIEW
U520 SOCKET TOP VIEW
TO SCOPE LOGIC BD P85
SPARES: 1/4 OF LS132
2/4 OF LS00
REVISIONS
A#64 B#140 B#254
A#171 B#170 B#256
A#172 B#190 B#257
A#180 B#195
A#188 B#199
B#62 B#209
B#102 B#213
B#123 B#235
B#130 B#247
B#248
B#253
FROM P84 (SCOPE LOGIC BOARD)
FROM P85 (SCOPE LOGIC BOARD)
TO/FROM P66 CONTROL RECTIFIER BOARD
2MHZCLK
ED2
ED1
ED0
CVENABLE
MEASTRIG1
MEASTRIG2
CTSYNC
SHOA
CTCLK
NOT USED
2MHZCLK TO C120
CV CTRL FROM U520-36
ED0 TO ED1 TO ED2 TO U200-10
CTSEL FROM R210
SHOA TO U720-57
SERTEST
DLY GATE / LD STOP
-50V
+15V
-15V
L400 2.7μH
C610 47μF
L500 2.7μH
C611 47μF
+5.1A
+5.1R
KEY
L930
C920 47μF
C530 0.1
C531
C730
10MHz CLOCK
Y310 10MHz
C210 1.7-11
C311 24
R212 22k
R211 5.6k
C220 430
C221 430
R213 1k
Q311
C320 .022
C325 .022
R321 5.6k
R324 13k
R220 10k
U330A 74HC4053
J220
STD TIMEBASE
OPT 1T TIMEBASE
10MHz REFERENCE FROM COUNTER TIMER (OPTION 1T)
R330 5.6k
U430A 74LS132
U410 74S158
MUXCRTL FROM U520-31
REF OUT FROM R815A
TESTCLK FROM U430-8
SCLK FROM R815D
UNKOUT FROM R815C
25MHZ FROM R815B
C520 0.1
R524 330
R525 330
R522 330
R523 330
U330C 74HC4053
INT/EXT REF FROM U520-6
R331 100
CR330
R322 1.2k
Q320
C323 .022
R323 4.7k
R327 100
R328 510
COUNTER REF CLOCK (REAR PANEL)
J23
CR331
U330B 74HC4053
TP330
DITHER OFF/ON
DITHER
DITHER TO J84-1
J110
R210 1M
C322 .022
R312 10k
C310 .022
R311 1.3k
U300 741
C400 .022
C311 .022
R200 10k
C300 0.22
J111
U100A 74LS74
U100B 74LS74
R310 39k
500MHz VCO
U200A 74LS00
U200B 74LS00
C110 .022
U430C 74LS132
R836A 162
R836B 260
R836C 162
R836D 260
R837C 162
R837D 260
R837A 162
R837B 260
75Ω
C731 0.1
R835 75
R834 75
R833 75
R832 75
CR511
Q611
R613 10K
VR510 11V
R514 200
CR100
R300 5.1k
R400 200
Q400
R500 200
CR510
L500 14nH
C500 5.6
Q401
R410 1.3k
CR720
C720 0.1
R721 75
R720 75
TP721
TP720
TP722
T710
Q710
Q711
C710 .022
R711 75
L610 330nH
R710 330
R612 330
C510 5.6
U310A 74LS00
U310B 74LS00
U310C 74LS00
U310D 74LS00
CVSELØ
CVSEL1
CVSEL2
BWL
FROM P84 SCOPE LOGIC BOARD
R815C 33
R512 510
R815A 33
R511 510
R815D 33
R513 510
R815B 33
R510 510
C510 .022
R813 130
R814 200
Q811
R816 1.8k
R817 510
C810 5.6
C711 .022
R810 1.8k
R812 200
Q810
R811 130
R950 1k
J41
J40
J27
J28
J85 P85
U410 74S158
C400 0.1
R836 R837
A#64 B#140 B#254
A#171 B#170 B#256
A#172 B#190 B#257
A#180 B#195
A#188 B#199
B#62 B#209
B#102 B#213
B#123 B#235
B#130 B#247
B#248
B#253
PARTIAL A14 TIMEBASE BOARD (K 8646-02)
(K9428) A16 CT PLL/VCO BOARD
RT
COUNTER TIMER 22 LJ2

TIMREFA
SPARE
DLYREFØ-M
DLYREFØ-L
DLYREFØ-K
DLYREF1-M
DLYREF1-L
DLYREF1-K
CTRLDATA
DLYSELA
TIMREFB
REFCOM2
REFCOM1
DLYSELB
DLYSELC
+50V
+5V
+5V$_I$
-5VS
-1.25V
-1.25VI
GND
NC
TO U1421-12
TO U1421-4
TO U1421-13
TO U1421-5
CTRLDATA TO U1470-29 TO U750-16, U780-16 U140-2
+5V FROM E1020
+15VT FROM E250
-15VT FROM E251
-15VMI FROM L1100
PARTIAL A14 TIMEBASE BOARD (K 8646-02)
U1540A TLØ72
U1540B TLØ72
U1530A TLØ74
U1530B TLØ74
U1350A 74HC4053
U1350B 74HC4053
U1350C 74HC4053
U1370A TLØ72
U1370B TLØ72
U1150 A SWEEP
U1470 B SWEEP
DAC
RAMP OFFSET
DELAY COMPARATOR
COMPARATOR LOGIC
RAMP START/STOP CONTROL
MODE CONTROL SHIFT REGISTER
LOGIC BIAS
A RAMP TO Q1308
B RAMP TO Q1450
XPOS FROM J24
20NSA FROM U960-11
20NSB FROM U960-12
AHO FROM J410-2, R950
BHO FROM U720-41
ATRIG FROM R843
BTRIG FROM R872
BYPDLYCOMPA FROM U960-13
BYPDLYCOMPB FROM U960-14
ATZD FROM U960-6
BTZD FROM U960-5
ASWPCLK FROM R111
BSWPCLK FROM R112
HOLDOFF
TRIG
AUX TRIG
SWEEP START REF
DATA
CLOCK
RAMP
DOR
SDO
DLY REF
IZD
BYPASS DLY COMP
RDA
CTO
ITRR
ITR
ITF
TCS
CT2
DGB
VBBI
VBBO
U961A 74F04
U961B 74F04
U961C 74F04
U961D 74F04
U961E 74F04
U961F 74F04
U962A 74F08
U962B 74F08
U962C 74F08
U962D 74F08
U950A 74FØ2
U950B 74FØ2
U950C 74FØ2
U950D 74FØ2
U951A TLØ72
U951B TLØ72
U950 74FØ2
U951 TLØ72
U962 74F08
U1421 74HC4051
U1350 74HC4053
U1530C TLØ74
U1530D TLØ74
HOSELB/DLY FROM U960-4
B TRIG FROM R873
HOB TO R1382, TO R1170
GATE OUT B/A FROM U960-7
HSA FROM J85-43
+5.1 FROM J66-1, -2
+15VPI FROM E900
ABUS SEL0
ABUS SEL1
ABUS SEL2
ABUS INH3 FROM U1030-5
FROM U140
FROM R1444, R1443
FROM R1543, R1542
FROM R1430
FROM R1115, R1113
FROM R1432
ABUST8 TO J84-5
TPI530
SWEEP GATE (REAR PANEL)
TO P85 SCOPE LOGIC BOARD
SGZA
SGA
SGB
SGZB
TO U720-55 U720-58
TO U720-56
TO U1420-4
TO U520-55
TO U520-57
TPI350
TPI370
TPI371
CHANGE ORDERS CONT.
B# 216
B# 222
B# 231
B# 246
B# 260
CHANGE ORDER
A#62 B#40
A#76 B#53
A#80 B#84
A#90 B#90
A#100 B#104
A#109 B#105
A#125 B#108
A#126 B#140
A#127 B#144
A#152 B#146
A#157 B#171
A#175 B#178
A#190 B#208
RT
SWEEPS AND HOLDOFF CONTROL
23

HGAIN1 FROM SCOPE LOGIC BOARD
HGAIN1 TO R900, U1310-9
+87V
SPOTSHIFT
SPOTSHIFT TO U1520-10
TP910
B RAMP FROM U1470-35
A RAMP FROM U1150-35
TP1410
TP1120
TO U1420-14
TO U1420-15
XPOS FROM J24 (MAIN PROCESSOR BOARD)
XPOS TO R1040 R1535
TO U1420-12
HSB
HSA
FROM P85 (SCOPE LOGIC BD)
HSA TO U961C-5
HGAINØ
HORPOSB
HORPOSA
FROM P86 (SCOPE LOGIC BOARD)
X10 HOR GAIN
X10 SWP GAIN A
X1 SWP GAIN
X10 SWP GAIN B
RIGHT PI + SIGNAL FROM J7
RIGHT PI - SIGNAL FROM J8
PLUG-IN INTERFACE BOARD
T1600
TO U1420-2
CENTER PI +SIG FROM J15 (VERTICAL BOARD)
XY PHASING
XRO FROM J25 (MAIN PROCESSOR BOARD)
TO U1420-1
FROM SCOPE LOGIC BOARD
XCAL COM
XCAL
TO U1420-5
U1111A NE5532
U1111B NE5532
U1110A NE5532
U1110B NE5532
U1020B NE5532
U1020A NE5532
U1230B TL072
U1230A TL072
U1210 74HC4052
U1310 74HC4052
U1410 74HC4052
U1311 74HC4052
TO U1420-4
TO U1420-3
TO U1420-6
TO UH21-2
HGAIN1 FROM J85-47
TO J85-49
FROM U1030 XMUXØ XMUX1
FROM U1030 ROMUXØ ROMUX1
U1411 HORIZONTAL AMP
BOOT STRAP
CHANNEL SELECT LOGIC
BEAMFIND FROM U1030-7
HI-SPEED TIMING
MAG REG
MREG
HORIZ READOUT JITTER R1302 200k
40VOLTS COMMON MODE 3.69V/DIV
WIRE LEADS
CRT1
CRT2
PARTIAL CRT (V53)
SEE 16
U1500A TL072
U1500B TL072
U1420 74HC4051
FROM R1130
FROM R1442
FROM R1325, R1435
FROM R1322, R1337
FROM R1225
FROM R1502, R1512
FROM R1080
ABUS SELØ
ABUS SEL1
ABUS SEL2
ABUS INH2
FROM U1030-6
ABUSTB TO J84-5
FROM U140
U1520 1496
SPOTSHIFT FROM J86-9
HORIZONTAL DYNAMIC CENTERING
VR1520 6.2V
NC 7,9,11,13
Q1130 RCA 3046
Q1450 CA3127E
L600 2.7μH
TP900
E900
FROM J84-47,48
L1100 2.7μH
TP901
FROM J84-49,-50
FROM J84-33,-34,-36
FROM J66-1,-5
FROM E1020
FROM U1150
FROM U1470
J85 P85
FROM U1410-3
TO P85-49 (SCOPE LOGIC BOARD)
MAIN SWP OUT (REAR PANEL)
U1531 LF351
-15VMI

	+15VPI	-15VMI	GND	+5V	-5VS
74HC4052			8	16	7
NE5532	8	4			
LF351	7	4			
NE5534	7	4			
TL072	8	4			

8-14-85
8-28-85
4-9-85

LIC # 61

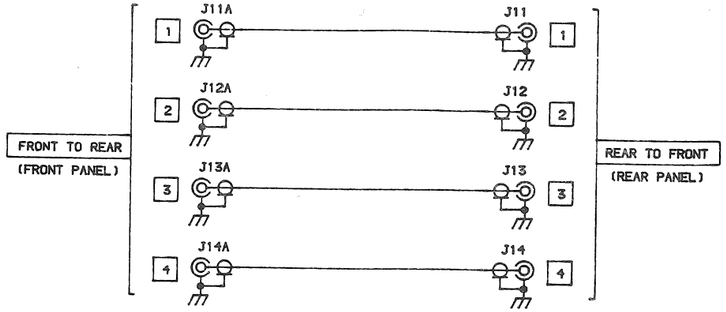
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(K 8646-02)

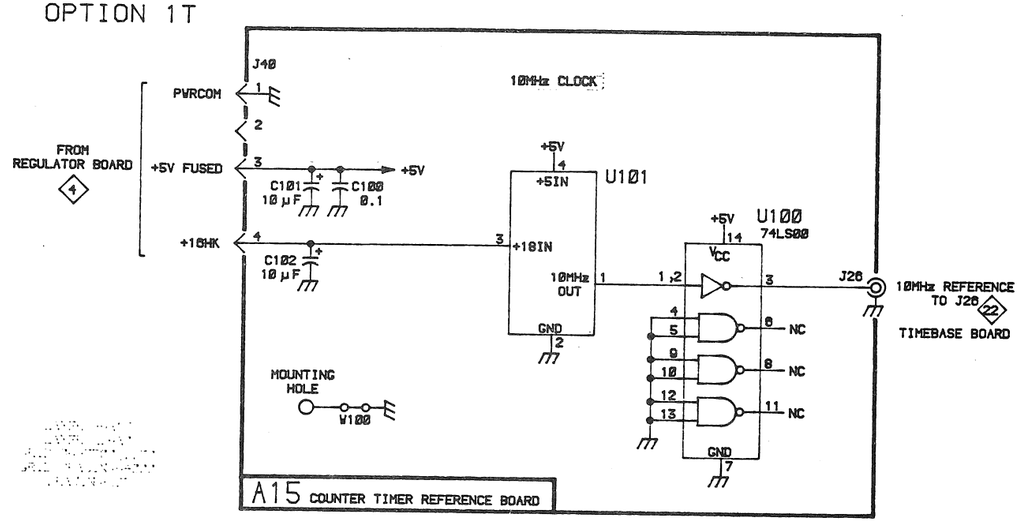
PARTIAL A14 TIMEBASE BOARD

RT

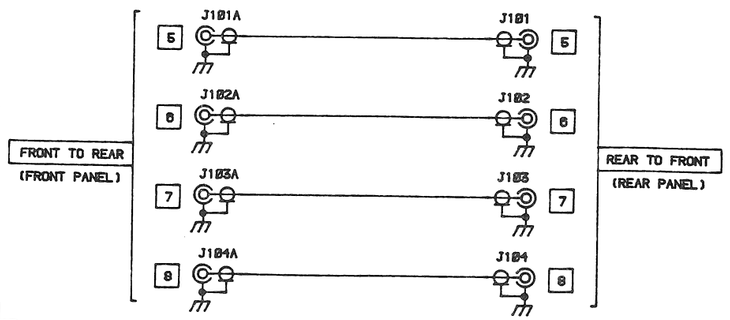
HORIZONTAL AMPLIFIER 24 LM2



OPTION 1T



OPTION 16



REVISION
B#217

FRONT TO REAR PANEL CABLING
AND OPTION 1T & OPTION 16

SCHEMATIC DIAGRAMS

UNIQUE TO THE 11301

CHANNEL SELECT TABLE				
	$\overline{VS1}$	$\overline{VS2}$	$\overline{VS3}$	$\overline{VS4}$
L	0	1	0	1
R	1	0	0	1
L+R	0	0	0	1
CV	1	1	0	1
AUTO CAL	1	1	1	0
READ OUT	1	1	1	1

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

TYPE	+15V	+5V	GND	-5V	-15V
NE5532	8				4
1458	8				4
HC4051		16	8	7	

NOTE
* 0.1%,TC RESISTORS
** CIRCUIT ELEMENT IS INTEGRAL PART OF ECB

K8648-01

A12 VERTICAL BOARD

11301

VERTICAL AMPLIFIER 14

Z AXIS

REALTIME OSCILLOSCOPE CONTROL SYSTEM

TYPE	-5V	GND	+5V	+5.1
74HC4051	7	8	16	
7-832		7		14

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

PARTIAL A13 SCOPE LOGIC BOARD

PARTIAL A11 MAIN PROCESSOR BD

PARTIAL A10 FRONT PANEL INTERFACE BD

PARTIAL A7 TOUCH PANEL BD

11301

CONTROL SYSTEM AND Z AXIS 15

FROM 15: +5O FROM W660 → +50V; +15 FROM W460 → +15V; +5V FROM W350 → +5V; −5V FROM W351 → −5V; −15V FROM W451 → −15V

17: +15V4 FROM R1251 → +15V4; −15V4 FROM R1253 → −15V4

+5V, R1151 100, C1331 .022, U1330 74HC4051 (VDD, VEE, VSS), C1340 .022, R1152 100, −5V

+15V4, U1340 MC34083, C1345 .022, C1350 .022, −15V4

+87V UNFILTERED, R1340 990k, R1341 54.9k 1%

17: A.Q3− FROM R1424,R1440; A.Q3+ FROM R1433,R1602,R1504; A.Q2− FROM R1314,R1432; A.Q1− FROM R1420,R1441; A.Q1+ FROM R1332,R1001

FROM U740 18: ABUSA, ABUSB, ABUSC, ABUSCRTI; SEL, INHy

U1330 74HC4051: R1333 49.9k 1%, R1334 52.3k 1%

J71 P71 5 → ABUSCRT TO P71 (MAIN PROCESSOR BOARD) 12

V53, L53

TRACE ROTATION TO/FROM 18: J54 P54

VO → SLOT LENS

SEE HORIZONTAL AMP 24

+10V REF FROM U850-6 18 → +10V REF

C941 2.2µF, CR941, C940 2.2µF, CR940, CR942, C1040 10µF, C950 10µF, C1502 2.2µF −1171, L940 620µH 108-1089-00, L930 150µH 108-0959-00, C803 2.2µF → +170V, +87V

R920 800k, R1200 1.43M 1%, R1103 4M 1%, C1100 270 HV

+15V4, R1326 5k CW Y AXIS, R1410 1.2k, −15V4

J53 P53: Y ROT; Q3++ FROM R1500; Q3+− FROM R1501

17: J55 P55: VO FROM R1304; Q3− FROM R1303; Q3+ FROM R1300 → Q3−, Q3+

T1040

Z AXIS FROM U720-16 15: R911 100, R912 200, 118-0430 E900, CR920, R921 200

R1140 15k, C1140 1000, CR1140, R1141 39k

+50V, GRID BIAS, R1330 100k, R1232 100k, R1350 620k, CR921, CR930, C931 2200, C1030 .022, R930 150k, Q930, C932 .022

C1352 0.01, R1346 100, R1344 330, R1342 75.0M, C1341 2.2µF, U1340B MC34083, +15V4

U1010

+50V, STIGMATOR CW R1331 100k, R1233 20k, R1230 20k, R1231 12k, VR1230 30V, R1310 100, C1221 .022, R1311 100, C1220 .022 HV

SEE VERTICAL AMPLIFIER 14

Q2− FROM R1302 17 → Q2−; R1100 100 → Q2+; Q1− FROM R1301 17 → Q1−; R1101 100 → Q1+

Q AXIS FROM U720-22 15: R1001 800k 1%, A.Q1+ TO U1330-1, R1332 49.9k 1%, C1000 15, R1000 7.15k 1%, R1102 2.87k 1%, GND

STIGMATOR, 1 ANODE, GRID

MOUNTING SCREW, HV

VR1310 180V, VR1311 180V, C1230 .022, C1231 .022, CR1230, CR1231 → −330V

H HV, Q1150, C1150 820

DS100, DS200, R200 2.4k, C920 .015

P91 39: −17V FROM J91-39 PLUG-IN INTERFACE BOARD 1; F560 2A, L1050 80µH, C1051 470µF, L1150 80µH

−17V TO U170-2 15

C1050 4.7µF, CR1051, CR1052 −0141, C951 4.7µF, R1240 100, R1236 100, Q1240 −0622, R1244 330, C1240 .047, R1243 270, C1232 .047

C1052 0.22, R1150 22

+87V UNFILTERED, R1235 60k 0.5%, R1234 1.68K 0.5%, U1241 TL431

CR1240, C1242 1µF, R1242 430, C1243 15, CR1340, R1241 22k, C1250 4.7µF, R1355 47, Q1250, −15V4

+10V REF, W1341, C1342 100, R1345 560, U1340A MC34083, C1343 0.1, R1343 120k, R1443 100k 0.25%, C1241 0.1

J85 P85 50: +87V → +87V TO P85-50 TIMEBASE BOARD 24

NOTE

VR FROM C843AND (BY U850 +10V REGULATOR) 18

HV FROM A MOUNTING SCREW BY REAR SHIELD MOUNTING PADS

POWER SUPPLY SOURCES AND ISOLATION JUMPERS ARE SHOWN ON 16

(K 8647-03)

PARTIAL A13 SCOPE LOGIC BOARD

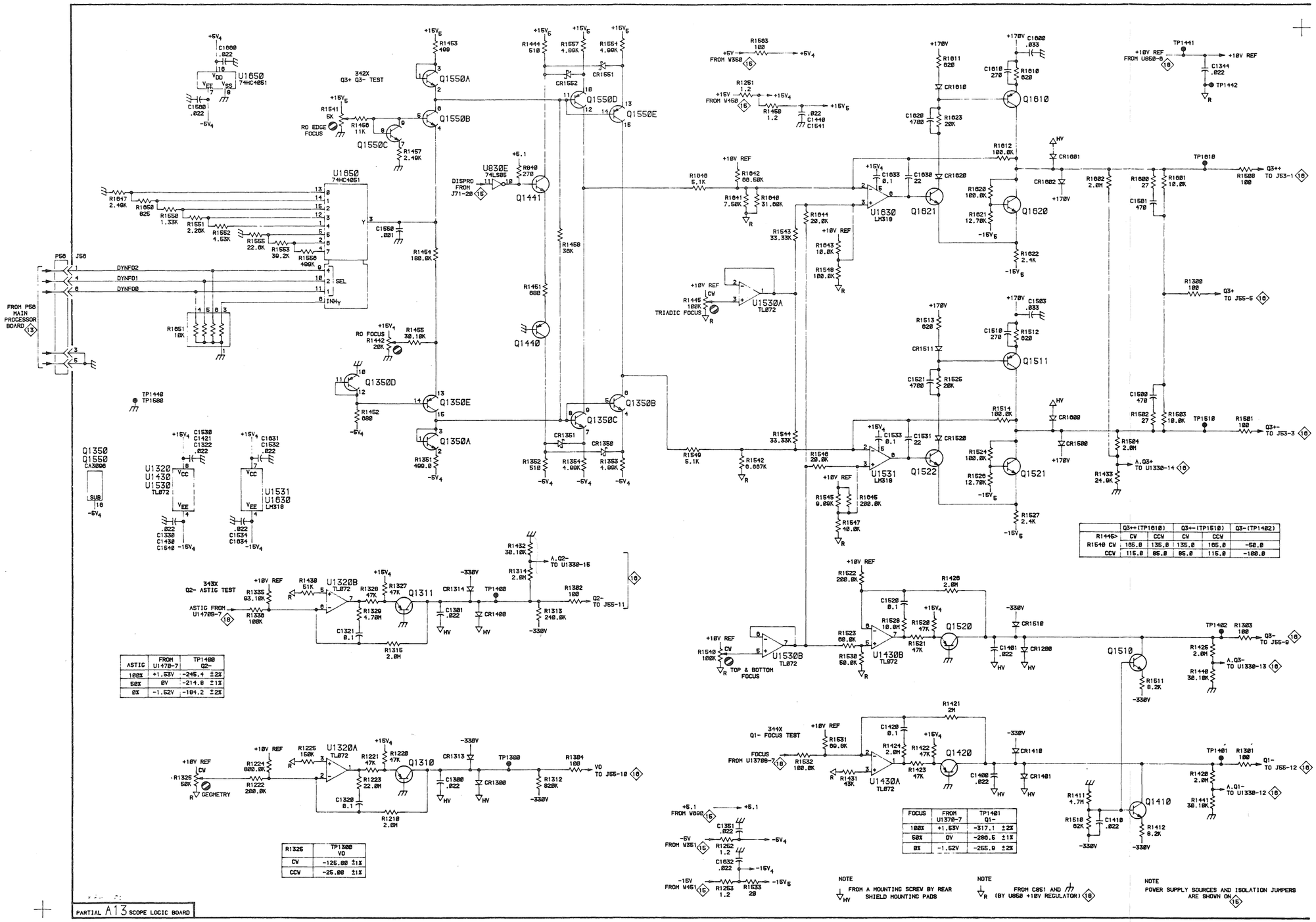
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6-4-85
7-2-85
7-15-86
9-4-85
LIC # 61

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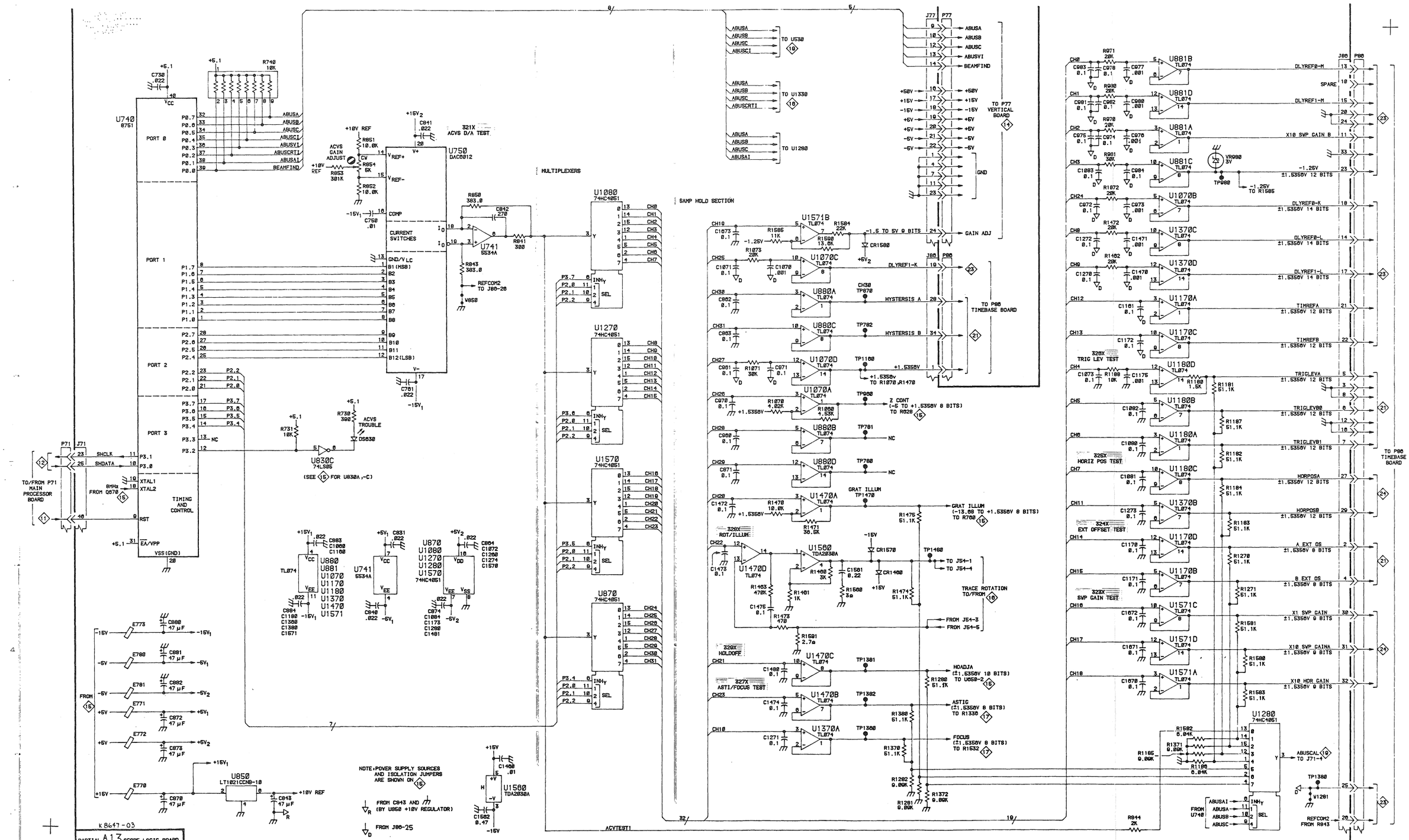
RT

HIGH VOLTAGE 16

DB1



PARTIAL A13 SCOPE LOGIC BOARD


U740 8751
PORT 0
PORT 1
PORT 2
PORT 3
TIMING AND CONTROL
U750 DAC0812
MULTIPLEXERS
U1080 74HC4051
U1270 74HC4051
U1570 74HC4051
U870 74HC4051
U741 5534A
SAMP HOLD SECTION
U1571B TL074
U1070C TL074
U880A TL074
U880C TL074
U1070D TL074
U1070A TL074
U880B TL074
U880D TL074
U1470A TL074
U1580 TDA2030A
U1470D TL074
U1470C TL074
U1470B TL074
U1370A TL074
U881B TL074
U881D TL074
U881A TL074
U881C TL074
U1070B TL074
U1370C TL074
U1370D TL074
U1170A TL074
U1170C TL074
U1180D TL074
U1180B TL074
U1180A TL074
U1180C TL074
U1370B TL074
U1170D TL074
U1170B TL074
U1571C TL074
U1571D TL074
U1571A TL074
U1280 74HC4051
U830C 74LS85
U850 LT1021CCN8-10
U1580 TDA2030A
TO P77 VERTICAL BOARD
TO P86 TIMEBASE BOARD
TO/FROM P71 MAIN PROCESSOR BOARD
ACVS GAIN ADJUST
ACVS TROUBLE
321X ACVS D/A TEST
326X ROT/ILLUM
329X HOLDOFF
327X ASTI/FOCUS TEST
326X HORIZ POS TEST
324X EXT OFFSET TEST
325X SVP GAIN TEST
320X TRIG LEV TEST
NOTE: POWER SUPPLY SOURCES AND ISOLATION JUMPERS ARE SHOWN ON 15
FROM C843 AND (BY U850 +10V REGULATOR)
FROM J80-25
K8647-03
PARTIAL A13 SCOPE LOGIC BOARD
ACVTEST1
REVISIONS: B # 202
11301
ANALOG CONTROL VOLTAGE SYSTEM 18

ED BUS

ED BUS TO U270 <15>

CAL VOLTAGE REFERENCE D TO A

TO P84 TIMEBASE BOARD <22>

U250 74LS273

CAL VOLTAGE REFERENCE ATTENUATORS

CALRANGE

+5V3 R240 4.7K

331X DAC TEST

U230 DAC811

U110B 74LS139

332X 1ST ATTEN TEST

U210 DC211

U110A 74LS139

333X CAL OUT TEST

U310 DC211

U220 HA5315

U311A OP-227

U230 DAC811

U311 OP-227

U220 HA5135

U430 74HC4051

FROM MAIN PROCESSOR BOARD

SPARE

CALDACLO

CALDACHI

FPCALCOM <9>

R221 1K

TP221

10V RANGE

VOUT

TP228

TP310

R329 909

R331 51

C431 .01

R430 10K

L430 820 µH

TP421

CR320

CR220

TP320

R220 4.53K

R225 50.8

R224 3.32K

C121 .022

C120 .001

FPCAL

FPACCAL

TO P71 MAIN PROCESSOR BOARD <9>

CAL TO J91-3 PLUG-IN INTERFACE BOARD <1>

R431 150

R323 51

Q421

R321 1K

R322 51

Q420

R332 150

R211

R222 909

R223 28K

R228 28K

R522 10K

R523 10K

C210 .01

R411 3.3K

ACOM

R421 28K

R420 10K

R521 10K

U500 AD592

TEMP SENSE

GND REF

U530 74HC4051

ACOM

DAC OUT

PROG AMP OUT

CALOUT1

ABUSCI

ABUSA

ABUSB

ABUSC

FROM U740 <16>

ABUSCAL FROM U1280-3 <16>

ABUSCAL TO P71 MAIN PROCESSOR BOARD <12>

R530 8K

R227 8K

C533 .047

R228 4.53K

C540 .047

R540 4.53K

TO P77 VERTICAL BOARD <14>

YCAL COM

YCAL

TO P86 TIMEBASE BOARD <24>

XCAL

XCAL COM

FROM J91 PLUG-IN INTERFACE BOARD <1>

LEFT CAL COM

CENTER CAL COM

RIGHT CAL COM

R446 1K

R433 1K

R432 1K

R422 1K

TP420

U430 74HC4051

CR418

R418 1M

C412 .01

TP210

U311B OP-227

R231 1M

R338 25K OFFSET CV -15V3

R234 3.0M

R333 25K GAIN CV -15V3

R233 2K

C230 .01

CR231

R232 100

CR230

DCOM

SJ

BPO

VOLTAGE REFERENCE

REFOUT

GAIN ADJUST

ACOM

FROM U250 GSEL0 GSEL1 GSEL2

TO U430

NOTE
POWER SUPPLY SOURCES AND ISOLATION JUMPERS ARE SHOWN ON <15>

TP510

L450 15 µH

C440 100 µF

C442 0.1

C443 100 µF

C432 0.1

L461 15 µH

L350 15 µH

C340 47 µF

C341 0.1

C240 .022

C342 47 µF

C441 0.1

L351 15 µH

TYPE	+5V3	GND	+15V3	-15V3	-5V3
DC211	12	5	13	4	
74LS139	16	8			
74LS273	20	10			
74HC4051	16	8			7

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

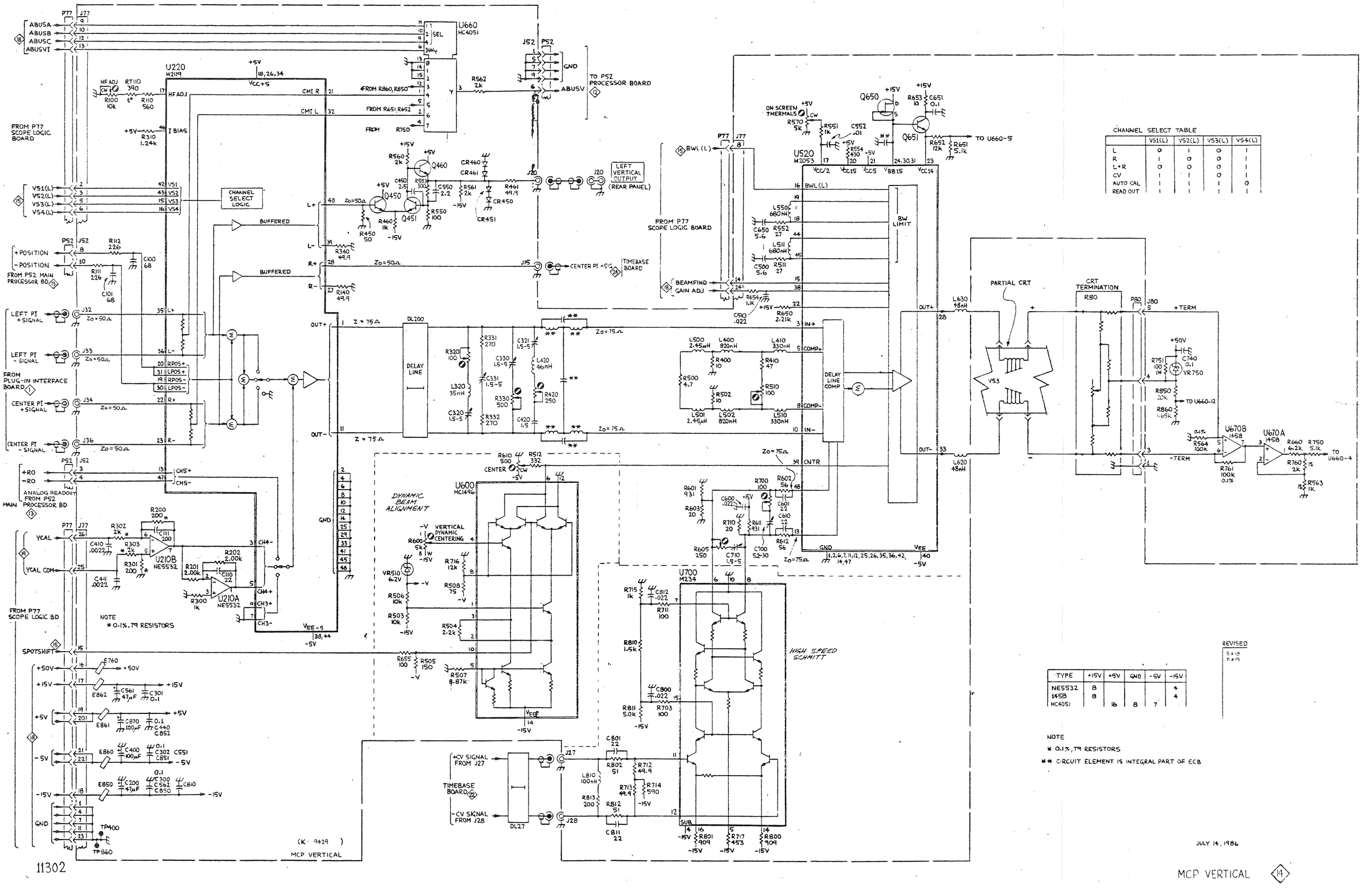
NOTE
± 0.1% TC RESISTOR

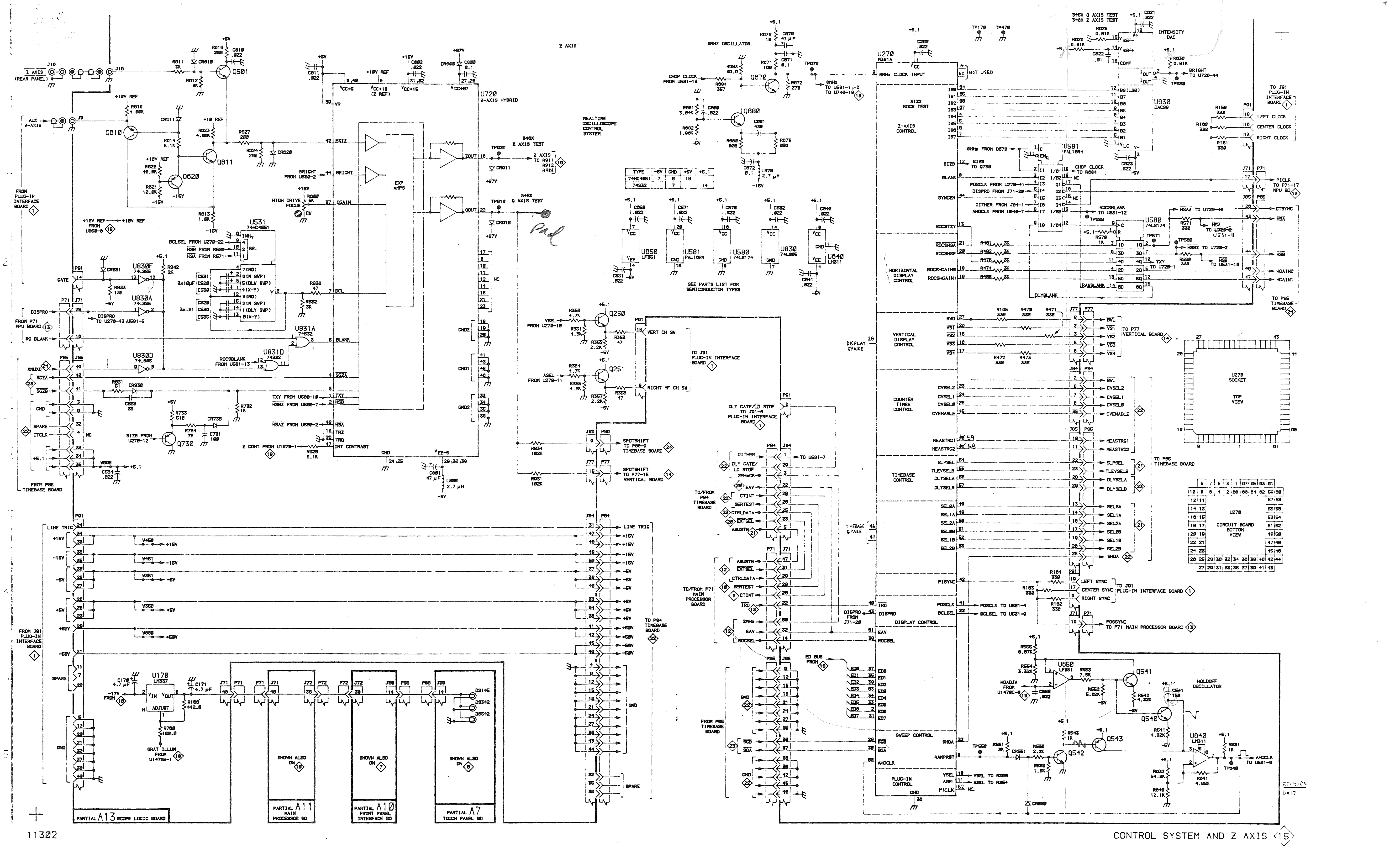
K 8647-03

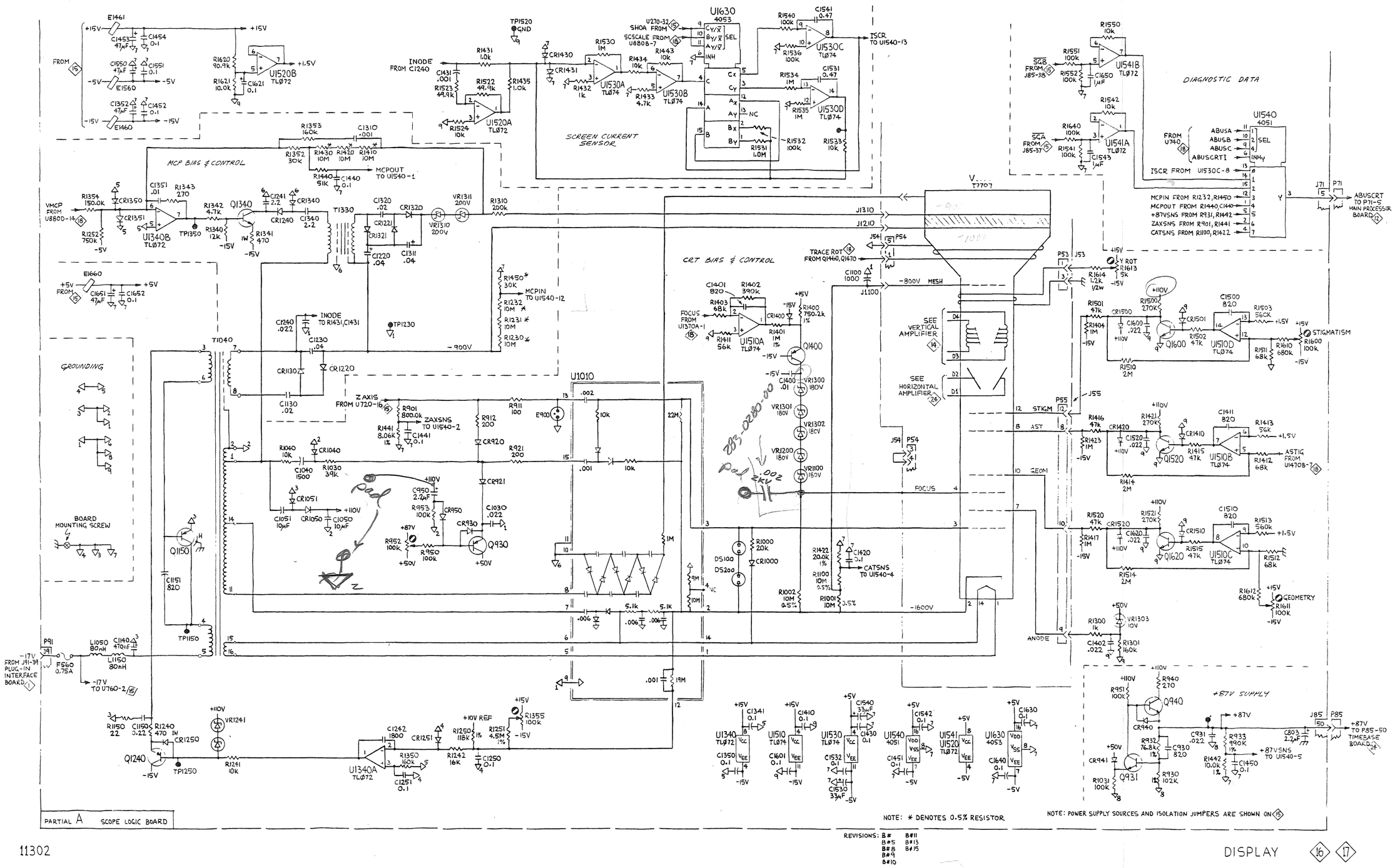
PARTIAL A13 SCOPE LOGIC BOARD

SCHEMATIC DIAGRAMS

UNIQUE TO THE 1130-2


P77 J77
ABUSA
ABUSB
ABUSC
ABUSVI
U660 HC4051
SEL
INH
U220 M2119
+5V
18,26,34
Vcc+5
HF ADJ
RT110 390
R100 10k
R110 560
CMI R
CMI L
I BIAS
R310 1.24k
FROM R860, R850
FROM R651, R652
FROM R750
R562 2k
J52 P52
GND
ABUSV
TO P52 PROCESSOR BOARD
FROM P77 SCOPE LOGIC BOARD
+15V
R560 2k
Q460
CR460
CR461
C450 2.5
R553 300
C550 2.2
R561 2k
R461 49.9
J20
LEFT VERTICAL OUTPUT (REAR PANEL)
Q450
Q451
R460 1k
R550 100
CR450
CR451
R450 50
-15V
VS1(L)
VS2(L)
VS3(L)
VS4(L)
CHANNEL SELECT LOGIC
L+
L-
R+
R-
Zo=50Ω
BUFFERED
R340 49.9
R140 49.9
J15
CENTER PI +SIG
TIMEBASE BOARD
+POSITION
-POSITION
FROM P52 MAIN PROCESSOR BD
R112 226
R111 226
C100 68
C101 68
LEFT PI +SIGNAL
LEFT PI -SIGNAL
CENTER PI +SIGNAL
CENTER PI -SIGNAL
J32
J33
J34
J36
FROM PLUG-IN INTERFACE BOARD
RPOS+
RPOS-
LPOS+
LPOS-
ANALOG READOUT FROM P52 MAIN PROCESSOR BD
+RO
-RO
CH5+
CH5-
47k
P77 J77
YCAL
YCAL COM
R200 200 *
R302 2k *
R303 2k *
R301 200 *
C111 200
C410 .0022
C411 .0022
U210B NE5532
R202 2.00k
R201 2.00k
C110 22
U210A NE5532
R300 1k
CH4-
CH4+
CH3+
CH3-
VEE-5
38,44
-5V
GND
NOTE
* 0.1%, T9 RESISTORS
SPOTSHIFT
+50V
+15V
+5V
-5V
-15V
GND
E760
E862
E861
E860
E850
C561 47µF
C301 0.1
C870 100µF
C440 0.1
C852
C400 100µF
C302 0.1
C551
C851
C200 47µF
C300 0.1
C562
C850
C810
TP400
TP860
(K-9429)
MCP VERTICAL
11302
OUT+
OUT-
Z=75Ω
DL200
DELAY LINE
R320 100
R331 270
C321 1.5-5
C330 1.5-5
L420 46nH
C331 1.5-5
L320 35nH
R330 500
R420 250
C320 1.5-5
R332 270
C420 1.5
Zo=75Ω
R610 500
R512 332
CENTER
DYNAMIC BEAM ALIGNMENT
U600 MC1496
-V VERTICAL DYNAMIC CENTERING
R600 5k
VR510 6.2V
R716 12k
R508 75
R506 10k
R503 10k
R504 2.2k
R655 100
R505 150
R507 8.87k
U700 M234
HIGH SPEED SCHMITT
R715 1k
C812 .022
R711 100
R810 1.5k
C800 .022
R703 100
R811 5.0k
C801 22
R802 51
R712 44.9
L810 100nH
R713 44.9
R714 590
R813 200
R812 51
C811 22
+CV SIGNAL FROM J27
-CV SIGNAL FROM J28
TIMEBASE BOARD
DL27
J27
J28
SUB
R801 909
R717 453
R800 909
L500 2.45µH
L400 820nH
L410 330nH
R400 10
R410 47
R500 4.7
R502 10
R510 100
L501 2.45µH
L502 820nH
L510 330nH
DELAY LINE COMP
COMP+
COMP-
IN+
IN-
Zo=75Ω
CNTR
R601 931
R603 20
R710 20
R611 931
R605 250
C600 .022
C710 1.5-5
R700 100
R602 56
C601 22
C610 22
R612 56
C700 52-30
GND
VEE
-5V
Q650
Q651
R653 10
C651 0.1
ON SCREEN THERMALS
R570 5k
R551 1k
C552 .01
R554 430
R652 12k
R651 5.1k
TO U660-5
U520 M2053
Vcc/2
Vcc15
Vcc5
V88B15
Vcc14
BWL(L)
FROM P77 SCOPE LOGIC BOARD
L550 680nH
C650 5.6
R552 27
L511 680nH
C500 5.6
R511 27
BW LIMIT
BEAMFIND
GAIN ADJ
R654 1.1k
C510 .022
R650 2.21k
L630 +8nH
L620 48nH
OUT+
OUT-
PARTIAL CRT
VS3
CRT TERMINATION
R80
P80 J80
+TERM
-TERM
+50V
C740 0.1
VR750
R751 100 1W
R850 20k
R860 1.65k
TO U660-12
U670B 1458
U670A 1458
R564 100k
R761 100k 0.1%
R660 6.2k
R750 5.1k
R760 2k
R563 1k
TO U660-4
CHANNEL SELECT TABLE
VS1(L)
VS2(L)
VS3(L)
VS4(L)
L
R
L+R
CV
AUTO CAL
READ OUT
TYPE
+15V
+5V
GND
-5V
-15V
NE5532 8 4
1458 8 4
HC4051 16 8 7
REVISED
NOTE
* 0.1%, T9 RESISTORS
** CIRCUIT ELEMENT IS INTEGRAL PART OF ECB
JULY 14, 1986
MCP VERTICAL
14


Z AXIS
REALTIME OSCILLOSCOPE CONTROL SYSTEM
U720 Z-AXIS HYBRID
EXP AMPS
346X Z AXIS TEST
345X Q AXIS TEST
8MHZ OSCILLATOR
U270 M381A
31XX ROCS TEST
Z-AXIS CONTROL
HORIZONTAL DISPLAY CONTROL
VERTICAL DISPLAY CONTROL
COUNTER TIMER CONTROL
TIMEBASE CONTROL
DISPLAY CONTROL
SWEEP CONTROL
PLUG-IN CONTROL
U830 DAC08
INTENSITY DAC
U581 PAL16R4
U580 74LS174
U531 74HC4051
HOLDOFF OSCILLATOR
SEE PARTS LIST FOR SEMICONDUCTOR TYPES
U270 SOCKET TOP VIEW
U270 CIRCUIT BOARD BOTTOM VIEW
TO J91 PLUG-IN INTERFACE BOARD
FROM J91 PLUG-IN INTERFACE BOARD
TO P84 TIMEBASE BOARD
TO P85 TIMEBASE BOARD
FROM P85 TIMEBASE BOARD
TO/FROM P84 TIMEBASE BOARD
TO/FROM P71 MAIN PROCESSOR BOARD
TO P77 VERTICAL BOARD
PARTIAL A13 SCOPE LOGIC BOARD
PARTIAL A11 MAIN PROCESSOR BD
PARTIAL A10 FRONT PANEL INTERFACE BD
PARTIAL A7 TOUCH PANEL BD
11302
CONTROL SYSTEM AND Z AXIS (15)


SCREEN CURRENT SENSOR
MCP BIAS & CONTROL
CRT BIAS & CONTROL
DIAGNOSTIC DATA
GROUNDING
BOARD MOUNTING SCREW
SEE VERTICAL AMPLIFIER
SEE HORIZONTAL AMPLIFIER
+87V SUPPLY
STIGMATISM
GEOMETRY
ASTIG
FOCUS
ANODE
MCPIN FROM R1232,R1450
MCPOUT FROM R1440,C1440
+87VSNS FROM R931,R942
ZAXSNS FROM R901,R1441
CATSNS FROM R1100,R1422
ABUSCRT TO P71-5 MAIN PROCESSOR BOARD
-17V FROM J91-39 PLUG-IN INTERFACE BOARD
+87V TO P85-50 TIMEBASE BOARD
+87VSNS TO U1540-5
CATSNS TO U1540-4
INODE FROM C1240
INODE TO R1431,C1431
MCPOUT TO U1540-1
MCPIN TO U1540-12
ISCR TO U1540-13
ISCR FROM U1530C-8
ZAXSNS TO U1540-2
ZAXIS FROM U720-16
TRACE ROT FROM Q1460,Q1470
FOCUS FROM U1370A-1
VMCP FROM U880D-14
SCSCALE FROM U880B-7
U270-32 SHOA FROM
-17V TO U760-2
PARTIAL A SCOPE LOGIC BOARD
NOTE: * DENOTES 0.5% RESISTOR
NOTE: POWER SUPPLY SOURCES AND ISOLATION JUMPERS ARE SHOWN ON
REVISIONS: B# B#5 B#8 B#9 B#10 B#11 B#13 B#15
11302
DISPLAY

U740 8751 — PORT Ø (P0.7–P0.Ø: ABUSA, ABUSB, ABUSC, ABUSCI, ABUSVI, ABUSCRTI, ABUSAJ, BEAMFIND); PORT 1 (P1.7–P1.Ø: B1 (MSB) … B12 (LSB)); PORT 2 (P2.7–P2.4); PORT 3 (P3.7–P3.4); P3.3; P3.2 → U830C (SEE 15 FOR U830A,-C); P3.1 SHCLK, P3.Ø SHDATA → P71 J71 (FROM P71 MAIN PROCESSOR BOARD); XTAL1, XTAL2 8MHz FROM Q670 (15); TIMING AND CONTROL; RESET 46; RST 9; EA/VPP 31; VSS(GND) 20; VCC 40; +5.1B

R740 10k

U750 DAC6Ø12 — +10V REF; ACVS GAIN ADJUST; R851 10k 0.1%; R854 5k; R853 301k; R852 10k 0.1%; VREF+, VREF−, COMP, CURRENT SWITCHES, GND/VLC, V+, V−; C841 .022; C850 .01; C761 .022 −15V1; R850 383 1%; C842 270; R841 300; R843 383 0.1%; REFCOM2 TO J86-26; W850

U74 5534A

U1080 74HC4051 — CH8–CH15; U1270 74HC4051 — CH8–CH15; U1570 74HC4051 — CH16–CH23; U870 74HC4051 — CH24–CH31; P3.7–P3.4 P2.Ø P2.1 P2.2 INHY SEL

+5.1 R731 10k; R730 390 ACVS TROUBLE DS630

U741 5534A — C831 .022 +5V1; C840 .022 −5V1

U870 74HC4051 — C864 C1072 C1260 C1274 C1570 +5V2; C874 C1084 C1173 C1280 C1481 −5V2

U880 U881 U1070 U1170 U1180 U1370 U1470 U1571 TL074 — C880 C881 C882 C872 C873 C883 C1060 C1160 C884 C1180 C1360 C1380 C1571

U850 LT1021CCN8-10 — E773 E780 E781 E771 E772 E770 C870 C843 TP850 +10V REF; TP851

NOTE POWER SUPPLY SOURCES AND ISOLATION JUMPERS ARE SHOWN ON (16)

FROM (15)

FROM C843 AND (BY U850 +10V REGULATOR)

FROM J86-25

ABUSA ABUSB ABUSC ABUSCI → TO U530 (19)

ABUSA ABUSB ABUSC ABUSCRTI → TO U1640 (16)

ABUSA ABUSB ABUSC ABUSAJ → TO U1280

J77 P77 — ABUSA, ABUSB, ABUSC, ABUSVI, BEAMFIND, +50V, +15V, −15V, +5V, +5V, −5V, −5V, GND → TO P77 VERTICAL BOARD (14)

U1571B TL074 — CH19 C1673 0.1; −1.25V R1585 11k; R1584 22k; R1590 13.6k; CR1580 +5V2; GAIN ADJ (−1.5 TO 5V 9BITS)

U1070C TL074 — CH25 C1071 0.1; R1073 20k; C1070 .001; J86 P86 DLYREF1-K TO P86-A

U1470C TL074 — CH21 C1480 0.1; +15V; R1460 10; Q1460; R1280 51.1k; TP1381 +OADJA (±.5356V 10 BITS) TO U650-2 (15)

U1470D TL074 — CH22 C1473 0.1; R1561 750; Q1470; R1461 10; −15V; R1570 2k; R1562 6.81k; R1560 51.1k; TP1480 TRACE ROT (±13V 5BITS) TO J54-3 (16)

U1470B TL074 — CH23 C1474 0.1; TP1382; R1380 51.1k; ASTIG (±1.5356V 8BITS) TO R1412 (17)

U1370A TL074 — CH10 C1271 0.1; TP1360; R1370 51.1k; FOCUS (±1.5356V 8BITS) TO R1403 (17)

U1470A TL074 — CH20 C1472 0.1; R1470 10.0k ±1.5356V; R1471 402k; GRAT ILLUM TP1470; R1473 51.1k; GRAT ILLUM (−15.68 TO +1.5356V 8BITS) TO R761 (15)

U1070A TL074 — CH26 C970 0.1; R1070 4.02k ±1.5356V; R1060 4.53k; TP960; Z CONT (−5 TO +1.5356V 8BITS) TO R628 (15)

U1070D TL074 — CH27 C961 0.1; R1071 30k; C971 0.1; TP1160; +1.5356V TO R1070, R1470, J86-1

U880B TL074 — CH28 C960 0.1; R782 56k; R781 18k −5V; R780 10k; TP781; SCSCALE TO U1630-10 (2 TO +5V) (17)

U880D TL074 — CH29 C871 0.1; TP780; YMCP TO R1354 (±1.5356) (17)

U880A TL074 — CH30 C862 0.1; TP870; HYSTERSIS A TO J86-28

U880C TL074 — CH31 C865 0.1; TP782; HYSTERSIS B TO J86-34

R1372 4.09k; R1281 4.09k; R1282 4.09k

ACVTEST1

U881B TL074 — CH0 C983 0.1; C978 0.1; C977 .001; R971 20k; DLYREFØ-M

U881D TL074 — CH1 C981 0.1; C982 0.1; C980 .001; R980 20k; SPARE; DLYREF1-M

U881A TL074 — CH2 C975 0.1; C974 0.1; C976 .001; R970 20k; DLYREF2

U881C TL074 — CH3 C1083 0.1; C984 0.1; R981 30k; VR980 3V; TP980; −1.25V TO R1585; −1.25V ±1.5356V 12BITS

U1180D TL074 — CH4 C1073 0.1; C1175 .001; R1188 10k; R1180 10k; R1181 51.1k; TRIGLEVA ±1.5356V 12BITS

U1180B TL074 — CH5 C1082 0.1; R1187 51.1k; TRIGLEVBØ ±1.5356V 12BITS

U1180A TL074 — CH6 C1080 0.1; R1182 51.1k; TRIGLEVB1 ±1.5356V 12BITS

U1180C TL074 — CH7 C1081 0.1; R1184 51.1k; HORPOSA ±1.5356V 12BITS

U1370C TL074 — CH8 C1272 0.1; R1472 20k; C1471 .001; DLYREFØ-L ±1.5356V 14BITS

U1370D TL074 — CH9 C1270 0.1; R1462 20k; C1470 .001; DLYREF1-L ±1.5356V 14BITS

U1070B TL074 — CH24 C972 0.1; R1072 20k; C973 .001; DLYREFØ-K ±1.5356V 14BITS

U1370B TL074 — CH11 C1273 0.1; R1183 51.1k; HORPOSB ±1.5356V 12BITS

U1170A TL074 — CH12 C1161 0.1; TIMREFA ±1.5356V 12BITS

U1170C TL074 — CH13 C1172 0.1; TIMREFB ±1.5356V 12BITS

U1170D TL074 — CH14 C1170 0.1; R1270 51.1k; A EXT OS ±1.5356V 8BITS; HYSTERSIS A FROM U680A-1

U1170B TL074 — CH15 C1171 0.1; R1271 51.1k; B EXT OS ±1.5356V 8BITS

U1571C TL074 — CH16 C1672 0.1; R1581 51.1k; x1 SWP GAIN ±1.5356V 9BITS

U1571D TL074 — CH17 C1671 0.1; R1580 51.1k; x10 SWP GAIN ±1.5356V 9BITS

U1571A TL074 — CH18 C1670 0.1; R1583 51.1k; x10 HOR GAIN ±1.5356V 9BITS

U1280 74HC4051 — R1582 6.04k; R1371 9.09k; R1186 6.04k; R1185 9.09k; +1.5356V FROM U1070D-14; HYSTERSIS B FROM U680C-8; ABUSCAL TO J71-4 (6); FROM U740 ABUSAI ABUSA ABUSB ABUSC → INHY SEL

TPI380 W1281 REFCOM2 FROM RB43 (26)

R844 2k

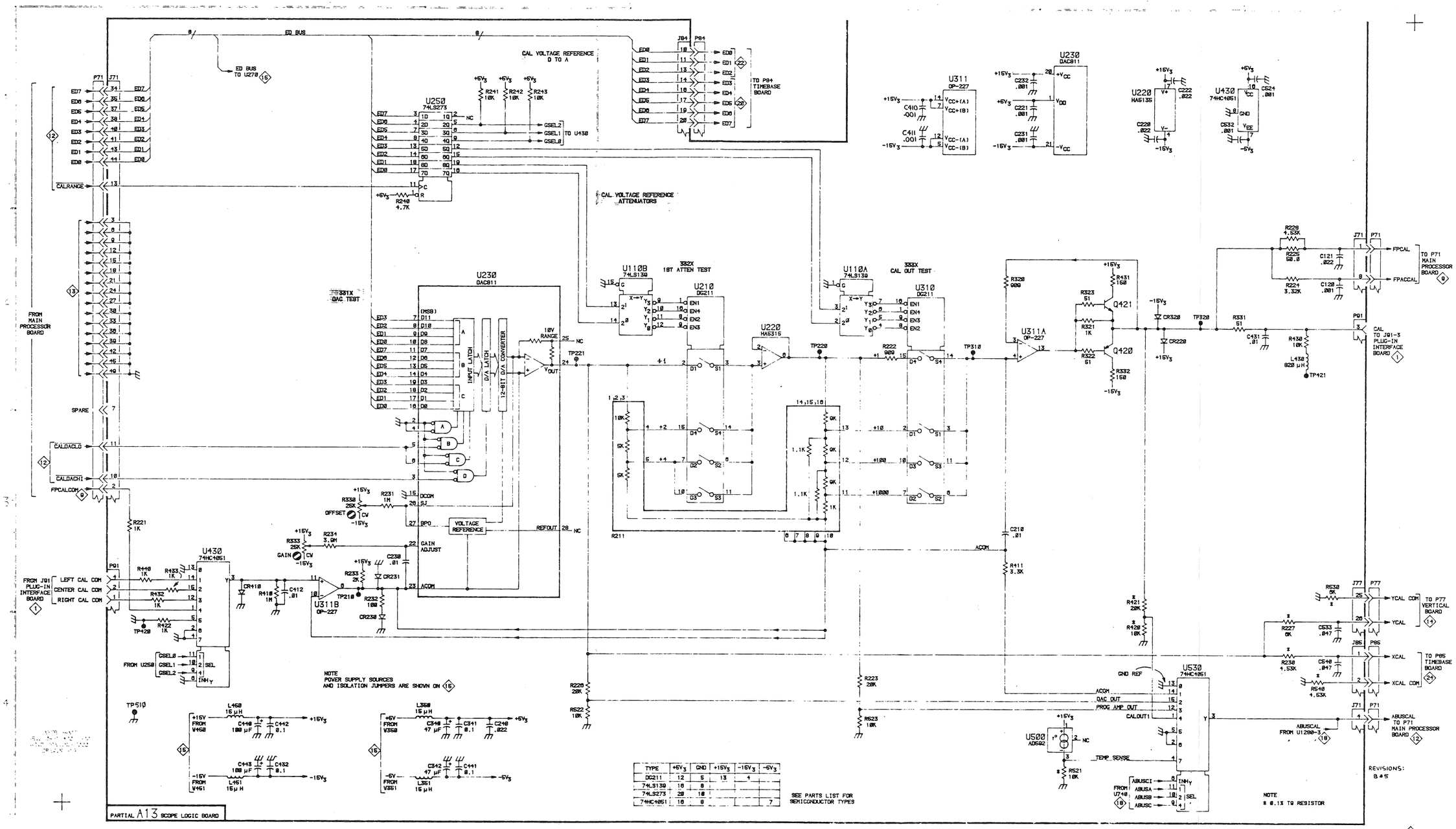
TO TIMEBASE BOARD

PARTIAL A13 SCOPE LOGIC BOARD

11302

REVISIONS
B #15
B #17

ANALOG CONTROL VOLTAGE SYSTEM (18) CT1, CT2



11302

CALIBRATOR VOLTAGE REFERENCE 19

11301 REPLACEABLE MECHANICAL PARTS LIST

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.

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.

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	
**** END ATTACHING PARTS ****	
Detail Part of Assembly and/or Component	
Attaching parts for Detail Part	
**** END ATTACHING PARTS ****	
Parts of Detail Part	
Attaching parts for Parts of Detail Part	
**** END ATTACHING PARTS ****	

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.

Attaching parts must be purchased separately, unless otherwise specified.

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

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CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00261	GENERAL ELECTRIC CO FOOD SERVICE EQUIPMENT BUSINESS DEPT	14TH AND ARNOLD STS	CHICAGO HEIGHTS IL 60411
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
04348	LAWRENCE ENGINEERING AND SUPPLY INC	500 S FLOWER ST P O BOX 30	BURBANK CA 91503
06383	PANDUIT CORP	17301 RIDGELAND	TINLEY PARK IL 60477
06915	RICHCO PLASTIC CO	5825 N TRIPP AVE	CHICAGO IL 60646
09772	WEST COAST LOCKWASHER CO INC	16730 E JOHNSON DRIVE P O BOX 3588	CITY OF INDUSTRY CA 91744
11897	PLASTIGLIDE MFG CORP	2701 W EL SEGUNDO BLVD	HAWTHORNE CA 90250
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125
13103	THERMALLOY CO INC	2021 W VALLEY VIEW LANE P O BOX 34829	DALLAS TX 75234
13511	AMPHENOL CADRE DIV BUNKER RAMO CORP		LOS GATOS CA
16428	BELDEN CORP ELECTRONIC DIV	2200 US HWY 27 SOUTH P O BOX 1980	RICHMOND IN 47374
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054
18677	SCANBE MFG CO	3445 FLETCHER AVE	EL MONTE CA 91731
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS	30 HUNTER LANE	CAMP HILL PA 17011
24931	SPECIALTY CONNECTOR CO INC	2620 ENDRESS PLACE P O BOX D	GREENWOOD IN 46142
28520	HEYCO MOLDED PRODUCTS	147 MICHIGAN AVE P O BOX 160	KENILWORTH NJ 07033
30161	AAVID ENGINEERING INC	30 COOK COURT	LACONIA NH 03246
31785	ISOTEMP RESEARCH INC	916 PRESTON AVE P O BOX 3389	CHARLOTTESVILLE VA 22901
53387	MINNESOTA MINING AND MFG CO ELECTRONIC PRODUCTS DIV	3M CENTER	ST PAUL MN 55101
55285	BERGQUIST CO INC THE	5300 EDINA INDUSTRIAL BLVD	MINNEAPOLIS MN 55435
70903	BELDEN CORP	2000 S BATAVIA AVE	GENEVA IL 60134
73743	FISCHER SPECIAL MFG CO	446 MORGAN ST	CINCINNATI OH 45206
75915	LITTELFUSE INC	800 E NORTHWEST HWY	DES PLAINES IL 60016
77900	SHAKEPROOF DIV OF ILLINOIS TOOL WORKS	SAINT CHARLES RD	ELGIN IL 60120
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
81041	HOWARD INDUSTRIES DIV OF WSL INDUSTRIES INC	P O BOX 287	MILFORD IL 60953
81483	INTERNATIONAL RECTIFIER	9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX	LOS ANGELES CA 90069
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
83553	ASSOCIATED SPRING BARNES GROUP INC	15001 S BROADWAY P O BOX 231	GARDENA CA 90248
85471	BOYD INDUSTRIAL RUBBER DIV OF A B BOYD CO	2527 GRANT AVE	SAN LEANDRO CA 94579
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201
93410	HAMILTON STANDARD CONTROL ESSEX GROUP INC	45-55 PLYMOUTH ST P O BOX 1007	LEXINGTON OH 44904
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61101
95987	WECKESSER CO INC	4444 WEST IRVING PARK RD	CHICAGO IL 60641
S3109	FELLER ASA ADOLF AG C/O PANEL COMPONENTS CORP	355 TESCONI CIRCLE	SANTA ROSA CA 95401
S3629	SCHURTER AG H C/O PANEL COMPONENTS CORP	2015 SECOND STREET	BERKELEY CA 94170
S4307	SCHAFFNER ELECTRONIK AG		LUTERBACH,SWITZERLAND
TK0861	H SCHURTER AG DIST PANEL COMPONENTS	2015 SECOND STREET	BERKELEY CA 94170
TK1373	PATELEC-CEM (ITALY)	10156 TORINO	VAICENTALLO 62/455 ITALY
TK1456	PAPST	AQUIDNECK INDUSTRIAL PARK	NEWPORT RI 02840
TK1493	MEMORY PROTECTION DEVICES INC	320 BROAD HOLLOW ROAD	FARMINGDALE NY 11735
TK1869	ALPS	100 N CNTRE AVE	ROCKVILLE CENTRE NY 11570

PRELIMINARY
This information is subject to change

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	348-0875-00			1	FLIPSTAND,CAB.:	80009	348-0875-00
-2	200-3133-00			1	COVER,TOP:	80009	200-3133-00
-3	214-0603-02			4	.PIN ASSY,SECRG:M/SPRING WASHER	80009	214-0603-02
-4	386-1151-00			4	.CLAMP,RIM CLENC:	83553	ORDER BY DESCR
-5	386-0227-00			4	.STOP,CLP,RIM CL:	80009	386-0227-00
-6	200-3134-00			1	COVER,BOTTOM:	80009	200-3134-00
-7	214-0603-02			4	.PIN ASSY,SECRG:M/SPRING WASHER	80009	214-0603-02
-8	386-1151-00			4	.CLAMP,RIM CLENC:	83553	ORDER BY DESCR
-9	386-0227-00			4	.STOP,CLP,RIM CL:	80009	386-0227-00
-10	348-0596-00			4	PAD,CAB.FOOT:0.69 X 0.255 X 0.06,PU	80009	348-0596-00
-11	348-0879-00			4	FOOT,CABINET:BOTTOM,BLUE,POLYCARBONATE (ATTACHING PARTS)	80009	348-0879-00
-12	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL (END ATTACHING PARTS)	80009	211-0722-00
-13	101-0106-00			2	TRIM,DECORATIVE:LEFT SIDE,FRONT CASTING (ATTACHING PARTS)	80009	101-0106-00
-14	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL (END ATTACHING PARTS)	80009	211-0722-00
-15	101-0107-00			2	TRIM,DECORATIVE:RIGHT SIDE,FRONT CASTING (ATTACHING PARTS)	80009	101-0107-00
-16	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL (END ATTACHING PARTS)	80009	211-0722-00
-17	426-2099-00			1	FRAME SECT,CAB.:RIGHT SIDE (ATTACHING PARTS)	80009	426-2099-00
-18	211-0718-00			1	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	83486	ORDER BY DESCR
-19	212-0685-00			2	SCREW,MACHINE:10-32 X 0.281,PNH,STL (END ATTACHING PARTS)	93907	ORDER BY DESCR
-20	348-0886-00			4	SHLD GSKT,ELEK:FINGER TYPE,18.310 L	80009	348-0886-00
-21	200-2191-00			2	CAP,RETAINER:PLASTIC	80009	200-2191-00
-22	367-0248-01			1	HANDLE,CARRYING:16.341 L,M/CLIP	80009	367-0248-01
-23	426-2098-00			1	FRAME SECT,CAB.:LEFT SIDE (ATTACHING PARTS)	80009	426-2098-00
-24	211-0718-00			1	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	83486	ORDER BY DESCR
-25	213-0685-00			2	SCREW,MACHINE:6BA X 1.0,MUSHROOM HD,STL (END ATTACHING PARTS) FRAME SECTION INCLUDES:	80009	213-0685-00
-26	343-0752-00			2	.RETAINER,HANDLE:STAINLESS STEEL	80009	343-0752-00

PRELIMINARY
This Information Subject to Change

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-1	366-0582-00			2	KNOB:ENCODER	80009	366-0582-00
-2	366-0586-01			1	KNOB:ENCODER,GRAY,M/RETAINING RING	80009	366-0586-01
-3	333-3223-00			1	PANEL,FRONT:LEFT (ATTACHING PARTS)	80009	333-3223-00
-4	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL (END ATTACHING PARTS)	78189	211-041800-00
-5	----- -----			1	CIRCUIT BD ASSY:BOTTOM FRONT PANEL (SEE A5A5 REPL) (ATTACHING PARTS)		
-6	211-0409-00			2	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
-7	129-1088-00			2	SPACER,POST:0.64 L,4-40 THD ONE END,BRS, NI PL (END ATTACHING PARTS)	80009	129-1088-00
-8	----- -----			2	BOTTOM FRONT PANEL BOARD ASSY INCLUDES: .ENCODER,DIGITAL:INCREMENTAL,50PPR,50 . DETENT,QUAD OUTPUT,LOC LUG AT 9 O'CLOCK .(SEE A5A5S110,S810 REPL)		
-9	366-0578-00			13	.PUSH BUTTON:SILVER GRAY,ABS	80009	366-0578-00
-10	344-0403-00			2	.CLIP,GROUND:STAINLESS STEEL	80009	344-0403-00
-11	361-1328-01			1	.SPACER,PUSH SW:M/LIGHT DIFFUSER BOTTOM	80009	361-1328-01
-12	----- -----			1	CIRCUIT BD ASSY:CENTER FRONT PANEL (SEE A5A8 REPL) (ATTACHING PARTS)		
-13	211-0409-00			3	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL (END ATTACHING PARTS)	93907	ORDER BY DESCR
-14	366-0580-00			7	PUSH BUTTON:ENTER	80009	366-0580-00
-15	361-1326-01			1	SPACER,PUSH SW:M/LIGHT DIFFUSER CENTER	80009	361-1326-01
-16	348-0967-00			1	SHLD GSKT,ELEK:SOLID TYPE,5.8 L	80009	348-0967-00
-17	361-1327-01			1	SPACER,PUSH SW:M/LIGHT DIFFUSER	80009	361-1327-01
-18	366-0578-00			6	PUSH BUTTON:SILVER GRAY,ABS	80009	366-0578-00
-19	----- -----			1	CIRCUIT BD ASSY:TOP FRONT PANEL (SEE A5A9 REPL) (ATTACHING PARTS)		
-20	211-0409-00			3	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL (END ATTACHING PARTS)	93907	ORDER BY DESCR
-21	348-0939-00			4	GASKET:EMI,4.62 X 0.212,SST	80009	348-0939-00
-22	200-3135-02			1	COVER,CRT:SCALE,FINISHED (ATTACHING PARTS)	80009	200-3135-02
-23	211-0752-00			4	SCREW,MACHINE:6-32 X 0.75,PNH,TORX (END ATTACHING PARTS)	80009	211-0752-00
-24	----- -----			1	CIRCUIT BD ASSY:TOUCH PANEL (SEE A7 REPL)		
-25	426-2118-00			1	.FRAME,LENS:TOUCH PANEL	80009	426-2118-00
-26	204-1006-00			1	.BODY,TERMINAL:POLYETHYLENE	80009	204-1006-00
-27	386-5274-00			1	.DIFFUSER,LIGHT:GRATICULE . (ATTACHING PARTS)	80009	386-5274-00
-28	211-0391-00			2	.SCREW,MACHINE:2-56 X 0.437,P4,STL CD PL	80009	211-0391-00
-29	210-0405-00			2	.NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL . (END ATTACHING PARTS)	73743	12157-50
-30	337-3281-00			1	SHLD,IMPLOSION:5.97 X 4.78 X 0.062	80009	337-3281-00
-31	131-1315-01			15	CONN,RCPT,ELEC:BNC,FEMALE (FRONT AND BACK)	80009	131-1315-01
	131-1315-01			23	CONN,RCPT,ELEC:BNC,FEMALE (FRONT AND BACK,OPTION 1C ONLY)	80009	131-1315-01
	174-0252-00			1	CABLE ASSY,RF:(4),50 OHM COAX,30.5 L W/ CONNECTORS (FROM FRONT BNC'S TO REAR BNC'S) (OPTION 1C ONLY)	80009	174-0252-00
-32	333-3221-00			1	PANEL,FRONT:LOWER	80009	333-3221-00
	333-3314-00			1	PANEL,FRONT:LOWER,11302 (OPTION 1C ONLY) (ATTACHING PARTS)	80009	333-3314-00
-33	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL (END ATTACHING PARTS)	78189	211-041800-00
-34	348-0878-00			1	SHLD GSKT,ELEK:SOLID TYPE,7.646 L	80009	348-0878-00
-35	348-0877-00			1	SHLD GSKT,ELEK:SOLID TYPE,1.860 L	80009	348-0877-00
-36	348-0876-00			2	SHLD GSKT,ELEK:SOLID TYPE,2.480 L	80009	348-0876-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-37	386-5332-00			4	SUPPORT,CRT:FRONT	80009	386-5332-00
-38	333-3222-00			1	PANEL,FRONT:UPPER	80009	333-3222-00
					(ATTACHING PARTS)		
-39	210-0586-00			3	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-40	129-0103-00			1	POST,BDG,ELEC:ASSEMBLY	80009	129-0103-00
					(ATTACHING PARTS)		
-41	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
-42	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL	77900	1214-05-00-0541C
					(END ATTACHING PARTS)		
-43	386-5275-02			1	SUBPANEL,FRONT:FINISHED	80009	386-5275-02
					(ATTACHING PARTS)		
-44	211-0718-00			4	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	83486	ORDER BY DESCR
-45	211-0409-00			2	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
-46	211-0718-00			2	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	83486	ORDER BY DESCR
					(END ATTACHING PARTS)		
-47	----- -----			1	ENCODER,DIGITAL:INCREMENTAL,50PPR,50 DETENT,QUAD OUTPUT,LOC LUG AT 9 O'CLOCK (SEE S58 REPL)		
-48	214-0291-00			1	CONTACT,ELEC:CRT CONNECTOR,CU BE SIL PL	80009	214-0291-00
					(ATTACHING PARTS)		
-49	211-0408-00			1	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
-50	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-51	337-3307-00			1	SHIELD,CRT:	80009	337-3307-00
	334-1379-00			1	MARKER,IDENT:MKD HI VACUUM	80009	334-1379-00
-52	358-0566-00			1	GROMMET,PLASTIC:BLACK,ROUND,0.625 ID	28520	2103 (SB 812-10)
-53	358-0566-00			3	GROMMET,PLASTIC:BLACK,ROUND,0.625 ID	28520	2103 (SB 812-10)
-54	351-0744-00			3	GUIDE,PLUG-IN:POLYAMIDE	80009	351-0744-00
					(ATTACHING PARTS)		
-55	211-0722-00			3	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-56	200-3295-00			1	COVER,HOLE:CABLE,4.0 X 3.5	80009	200-3295-00
					(ATTACHING PARTS)		
-57	211-0722-00			1	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-58	358-0166-00			1	GROMMET,PLASTIC:BLACK,U-SHAPE,0.656 ID	80009	358-0166-00
-59	348-0158-00			1	GROMMET,PLASTIC:BLACK,U-SHAPE,2.91 ID	80009	348-0158-00
-60	343-1301-00			3	CLAMP,SADDLE:0.715,NYLON	80009	343-1301-00
-61	343-1302-00			5	CLAMP,SADDLE:0.695,NYLON	80009	343-1302-00
-62	255-0334-00			1	PLASTIC CHANNEL:12.75 X 0.175 X 0.155	11897	122-37-2500
-63	348-0253-00			1	GROMMET,PLASTIC:BLACK,OBLONG,3.0 X 0.925	80009	348-0253-00
-64	385-0013-00			1	SPACER,POST:0.75 L W/6-32 THD THRU,NYL	80009	385-0013-00
-65	119-2344-00			1	DELAY LINE,ELEC:50 OHM COAX ASSY W/COUNTER VIEW & TRIGGER DELAY	80009	119-2344-00
					(ATTACHING PARTS)		
-66	211-0722-00			1	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-67	131-0799-00			4	CONTACT,ELEC:PLUG-IN GND,BE NI CD PL	80009	131-0799-00
					(ATTACHING PARTS)		
-68	211-0408-00			4	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-69	131-0800-03			2	CONTACT,ELEC:PLUG-IN GND,BE NI HT TR	80009	131-0800-03
					(ATTACHING PARTS)		
-70	211-0408-00			4	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-71	210-0457-00			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(ATTACHES GROUND WIRE)		
-72	348-0966-00			1	GROMMET,PLASTIC:BLACK,ROUND,0.625 ID	80009	348-0966-00
-73	343-1303-00			1	CLAMP,CABLE:ROUND,0.437,NYLON	80009	343-1303-00
					(ATTACHING PARTS)		
-74	210-0457-00			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
-75	210-0863-00			1	WSHR,LOOP CLAMP:0.187 ID U/W 0.5 W CLP	95987	C191
					(END ATTACHING PARTS)		
-76	358-0215-00			2	GROMMET,PLASTIC:BLACK,U-SHAPED,0.524ID	80009	358-0215-00
-77	386-5271-00			1	SPRT,CRT SHIELD:REAR	80009	386-5271-00
					(ATTACHING PARTS)		

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.

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.

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
	**** END ATTACHING PARTS ****
	Detail Part of Assembly and/or Component
	Attaching parts for Detail Part
	**** END ATTACHING PARTS ****
	Parts of Detail Part
	Attaching parts for Parts of Detail Part
	**** END ATTACHING PARTS ****

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.

Attaching parts must be purchased separately, unless otherwise specified.

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 Code
00261	GENERAL ELECTRIC CO FOOD SERVICE EQUIPMENT BUSINESS DEPT	14TH AND ARNOLD STS	CHICAGO HEIGHTS IL 60411
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
04348	LAWRENCE ENGINEERING AND SUPPLY INC	500 S FLOWER ST P O BOX 30	BURBANK CA 91503
06383	PANDUIT CORP	17301 RIDGELAND	TINLEY PARK IL 60477
06915	RICHCO PLASTIC CO	5825 N TRIPP AVE	CHICAGO IL 60646
09772	WEST COAST LOCKWASHER CO INC	16730 E JOHNSON DRIVE P O BOX 3588	CITY OF INDUSTRY CA 91744
11897	PLASTIGLIDE MFG CORP	2701 W EL SEGUNDO BLVD	HAWTHORNE CA 90250
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125
13103	THERMALLOY CO INC	2021 W VALLEY VIEW LANE P O BOX 34829	DALLAS TX 75234
13511	AMPHENOL CADRE DIV BUNKER RAMO CORP		LOS GATOS CA
16428	BELDEN CORP ELECTRONIC DIV	2200 US HWY 27 SOUTH P O BOX 1980	RICHMOND IN 47374
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054
18677	SCANBE MFG CO	3445 FLETCHER AVE	EL MONTE CA 91731
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS	30 HUNTER LANE	CAMP HILL PA 17011
24931	SPECIALTY CONNECTOR CO INC	2620 ENDRESS PLACE P O BOX D	GREENWOOD IN 46142
28520	HEYCO MOLDED PRODUCTS	147 MICHIGAN AVE P O BOX 160	KENILWORTH NJ 07033
30161	AAVID ENGINEERING INC	30 COOK COURT	LACONIA NH 03246
31785	ISOTEMP RESEARCH INC	916 PRESTON AVE P O BOX 3389	CHARLOTTESVILLE VA 22901
53387	MINNESOTA MINING AND MFG CO ELECTRONIC PRODUCTS DIV	3M CENTER	ST PAUL MN 55101
55285	BERGQUIST CO INC THE	5300 EDINA INDUSTRIAL BLVD	MINNEAPOLIS MN 55435
70903	BELDEN CORP	2000 S BATAVIA AVE	GENEVA IL 60134
73743	FISCHER SPECIAL MFG CO	446 MORGAN ST	CINCINNATI OH 45206
75915	LITTELFUSE INC	800 E NORTHWEST HWY	DES PLAINES IL 60016
77900	SHAKEPROOF DIV OF ILLINOIS TOOL WORKS	SAINT CHARLES RD	ELGIN IL 60120
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
81041	HOWARD INDUSTRIES DIV OF HSL INDUSTRIES INC	P O BOX 287	MILFORD IL 60953
81483	INTERNATIONAL RECTIFIER	9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX	LOS ANGELES CA 90069
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
83553	ASSOCIATED SPRING BARNES GROUP INC	15001 S BROADWAY P O BOX 231	GARDENA CA 90248
85471	BOYD INDUSTRIAL RUBBER DIV OF A B BOYD CO	2527 GRANT AVE	SAN LEANDRO CA 94579
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201
93410	HAMILTON STANDARD CONTROL ESSEX GROUP INC	45-55 PLYMOUTH ST P O BOX 1007	LEXINGTON OH 44904
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61101
95987	WECKESSER CO INC	4444 WEST IRVING PARK RD	CHICAGO IL 60641
S3109	FELLER ASA ADOLF AG C/O PANEL COMPONENTS CORP	355 TESCONI CIRCLE	SANTA ROSA CA 95401
S3629	SCHURTER AG H C/O PANEL COMPONENTS CORP	2015 SECOND STREET	BERKELEY CA 94170
S4307	SCHAFFNER ELECTRONIK AG		LUTERBACH,SWITZERLAND
TK0861	H SCHURTER AG DIST PANEL COMPONENTS	2015 SECOND STREET	BERKELEY CA 94170
TK1373	PATELEC-CEM (ITALY)	10156 TORINO	VAICENTALLO 62/45S ITALY
TK1456	PAPST	AQUIDNECK INDUSTRIAL PARK	NEWPORT RI 02840
TK1493	MEMORY PROTECTION DEVICES INC	320 BROAD HOLLOW ROAD	FARMINGDALE NY 11735
TK1869	ALPS	100 N CNTRE AVE	ROCKVILLE CENTRE NY 11570

PRELIMINARY
This information is subject to change

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	348-0875-00			1	FLIPSTAND,CAB.:	80009	348-0875-00
-2	200-3133-00			1	COVER,TOP:	80009	200-3133-00
-3	214-0603-02			4	.PIN ASSY,SECRG:W/SPRING WASHER	80009	214-0603-02
-4	386-1151-00			4	.CLAMP,RIM CLENC:	83553	ORDER BY DESCR
-5	386-0227-00			4	.STOP,CLP,RIM CL:	80009	386-0227-00
-6	200-3134-00			1	COVER,BOTTOM:	80009	200-3134-00
-7	214-0603-02			4	.PIN ASSY,SECRG:W/SPRING WASHER	80009	214-0603-02
-8	386-1151-00			4	.CLAMP,RIM CLENC:	83553	ORDER BY DESCR
-9	386-0227-00			4	.STOP,CLP,RIM CL:	80009	386-0227-00
-10	348-0596-00			4	PAD,CAB.FOOT:0.69 X 0.255 X 0.06,PU	80009	348-0596-00
-11	348-0879-00			4	FOOT,CABINET:BOTTOM,BLUE,POLYCARBONATE	80009	348-0879-00
					(ATTACHING PARTS)		
-12	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-13	101-0106-00			2	TRIM,DECORATIVE:LEFT SIDE,FRONT CASTING	80009	101-0106-00
					(ATTACHING PARTS)		
-14	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-15	101-0107-00			2	TRIM,DECORATIVE:RIGHT SIDE,FRONT CASTING	80009	101-0107-00
					(ATTACHING PARTS)		
-16	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-17	426-2099-00			1	FRAME SECT,CAB.:RIGHT SIDE	80009	426-2099-00
					(ATTACHING PARTS)		
-18	211-0718-00			1	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	83486	ORDER BY DESCR
-19	212-0685-00			2	SCREW,MACHINE:10-32 X 0.281,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-20	348-0886-00			4	SHLD GSKT,ELEK:FINGER TYPE,18.310 L	80009	348-0886-00
-21	200-2191-00			2	CAP,RETAINER:PLASTIC	80009	200-2191-00
-22	367-0248-01			1	HANDLE,CARRYING:16.341 L,W/CLIP	80009	367-0248-01
-23	426-2098-00			1	FRAME SECT,CAB.:LEFT SIDE	80009	426-2098-00
					(ATTACHING PARTS)		
-24	211-0718-00			1	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	83486	ORDER BY DESCR
-25	213-0685-00			2	SCREW,MACHINE:6BA X 1.0,MUSHROOM HD,STL	80009	213-0685-00
					(END ATTACHING PARTS)		
					FRAME SECTION INCLUDES:		
-26	343-0752-00			2	.RETAINER,HANDLE:STAINLESS STEEL	80009	343-0752-00

PRELIMINARY
This Information Subject to Change

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-1	366-0582-00			2	KNOB:ENCODER	80009	366-0582-00
-2	366-0586-01			1	KNOB:ENCODER,GRAY,M/RETAINING RING	80009	366-0586-01
-3	333-3223-00			1	PANEL,FRONT:LEFT	80009	333-3223-00
					(ATTACHING PARTS)		
-4	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-5	----- -----			1	CIRCUIT BD ASSY:BOTTOM FRONT PANEL		
					(SEE A5A5 REPL)		
					(ATTACHING PARTS)		
-6	211-0409-00			2	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
-7	129-1088-00			2	SPACER,POST:0.64 L,4-40 THD ONE END,BRS, NI PL	80009	129-1088-00
					(END ATTACHING PARTS)		
					BOTTOM FRONT PANEL BOARD ASSY INCLUDES:		
-8	----- -----			2	.ENCODER,DIGITAL:INCREMENTAL,50PPR,50		
					. DETENT,QUAD OUTPUT,LOC LUG AT 9 O'CLOCK		
					.(SEE A5A5S110,S810 REPL)		
-9	366-0578-00			13	.PUSH BUTTON:SILVER GRAY,ABS	80009	366-0578-00
-10	344-0403-00			2	.CLIP,GROUND:STAINLESS STEEL	80009	344-0403-00
-11	361-1328-01			1	.SPACER,PUSH SW:M/LIGHT DIFFUSER BOTTOM	80009	361-1328-01
-12	----- -----			1	CIRCUIT BD ASSY:CENTER FRONT PANEL		
					(SEE A5A8 REPL)		
					(ATTACHING PARTS)		
-13	211-0409-00			3	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-14	366-0580-00			7	PUSH BUTTON:ENTER	80009	366-0580-00
-15	361-1326-01			1	SPACER,PUSH SW:M/LIGHT DIFFUSER CENTER	80009	361-1326-01
-16	348-0967-00			1	SHLD GSKT,ELEK:SOLID TYPE,5.8 L	80009	348-0967-00
-17	361-1327-01			1	SPACER,PUSH SW:M/LIGHT DIFFUSER	80009	361-1327-01
-18	366-0578-00			6	PUSH BUTTON:SILVER GRAY,ABS	80009	366-0578-00
-19	----- -----			1	CIRCUIT BD ASSY:TOP FRONT PANEL		
					(SEE A5A9 REPL)		
					(ATTACHING PARTS)		
-20	211-0409-00			3	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-21	348-0939-00			4	GASKET:EMI,4.62 X 0.212,SST	80009	348-0939-00
-22	200-3135-02			1	COVER,CRT:SCALE,FINISHED	80009	200-3135-02
					(ATTACHING PARTS)		
-23	211-0752-00			4	SCREW,MACHINE:6-32 X 0.75,PNH,TORX	80009	211-0752-00
					(END ATTACHING PARTS)		
-24	----- -----			1	CIRCUIT BD ASSY:TOUCH PANEL		
					(SEE A7 REPL)		
-25	426-2118-00			1	.FRAME,LENS:TOUCH PANEL	80009	426-2118-00
-26	204-1006-00			1	.BODY,TERMINAL:POLYETHYLENE	80009	204-1006-00
-27	386-5274-00			1	.DIFFUSER,LIGHT:GRATICULE	80009	386-5274-00
					. (ATTACHING PARTS)		
-28	211-0391-00			2	.SCREW,MACHINE:2-56 X 0.437,P4,STL CD PL	80009	211-0391-00
-29	210-0405-00			2	.NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
					. (END ATTACHING PARTS)		
-30	337-3281-00			1	SHLD,IMPLOSION:5.97 X 4,78 X 0.062	80009	337-3281-00
-31	131-1315-01			15	CONN,RCPT,ELEC:BNC,FEMALE	80009	131-1315-01
					(FRONT AND BACK)		
	131-1315-01			23	CONN,RCPT,ELEC:BNC,FEMALE	80009	131-1315-01
					(FRONT AND BACK,OPTION 1C ONLY)		
	174-0252-00			1	CABLE ASSY,RF:(4),50 OHM COAX,30.5 L W/	80009	174-0252-00
					CONNECTORS		
					(FROM FRONT BNC'S TO REAR BNC'S)		
					(OPTION 1C ONLY)		
-32	333-3221-00			1	PANEL,FRONT:LOWER	80009	333-3221-00
	333-3314-00			1	PANEL,FRONT:LOWER,11302	80009	333-3314-00
					(OPTION 1C ONLY)		
					(ATTACHING PARTS)		
-33	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-34	348-0878-00			1	SHLD GSKT,ELEK:SOLID TYPE,7.646 L	80009	348-0878-00
-35	348-0877-00			1	SHLD GSKT,ELEK:SOLID TYPE,1.860 L	80009	348-0877-00
-36	348-0876-00			2	SHLD GSKT,ELEK:SOLID TYPE,2.480 L	80009	348-0876-00

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-37	386-5332-00			4	SUPPORT,CRT:FRONT	80009	386-5332-00
-38	333-3222-00			1	PANEL,FRONT:UPPER	80009	333-3222-00
					(ATTACHING PARTS)		
-39	210-0586-00			3	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-40	129-0103-00			1	POST,BDG,ELEC:ASSEMBLY	80009	129-0103-00
					(ATTACHING PARTS)		
-41	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
-42	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL	77900	1214-05-00-0541C
					(END ATTACHING PARTS)		
-43	386-5275-02			1	SUBPANEL,FRONT:FINISHED	80009	386-5275-02
					(ATTACHING PARTS)		
-44	211-0718-00			4	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	83486	ORDER BY DESCR
-45	211-0409-00			2	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
-46	211-0718-00			2	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	83486	ORDER BY DESCR
					(END ATTACHING PARTS)		
-47	----- -----			1	ENCODER,DIGITAL:INCREMENTAL,50PPR,50 DETENT,QUAD OUTPUT,LOC LUG AT 9 O'CLOCK (SEE S58 REPL)		
-48	214-0291-00			1	CONTACT,ELEC:CRT CONNECTOR,CU BE SIL PL	80009	214-0291-00
					(ATTACHING PARTS)		
-49	211-0408-00			1	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
-50	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-51	337-3307-00			1	SHIELD,CRT:	80009	337-3307-00
	334-1379-00			1	MARKER,IDENT:MKD HI VACUUM	80009	334-1379-00
-52	358-0566-00			1	GROMMET,PLASTIC:BLACK,ROUND,0.625 ID	28520	2103 (SB 812-10)
-53	358-0566-00			3	GROMMET,PLASTIC:BLACK,ROUND,0.625 ID	28520	2103 (SB 812-10)
-54	351-0744-00			3	GUIDE,PLUG-IN:POLYAMIDE	80009	351-0744-00
					(ATTACHING PARTS)		
-55	211-0722-00			3	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-56	200-3295-00			1	COVER,HOLE:CABLE,4.0 X 3.5	80009	200-3295-00
					(ATTACHING PARTS)		
-57	211-0722-00			1	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-58	358-0166-00			1	GROMMET,PLASTIC:BLACK,U-SHAPE,0.656 ID	80009	358-0166-00
-59	348-0158-00			1	GROMMET,PLASTIC:BLACK,U-SHAPE,2.91 ID	80009	348-0158-00
-60	343-1301-00			3	CLAMP,SADDLE:0.715,NYLON	80009	343-1301-00
-61	343-1302-00			5	CLAMP,SADDLE:0.695,NYLON	80009	343-1302-00
-62	255-0334-00			1	PLASTIC CHANNEL:12.75 X 0.175 X 0.155	11897	122-37-2500
-63	348-0253-00			1	GROMMET,PLASTIC:BLACK,OBLONG,3.0 X 0.925	80009	348-0253-00
-64	385-0013-00			1	SPACER,POST:0.75 L W/6-32 THD THRU,NYL	80009	385-0013-00
-65	119-2344-00			1	DELAY LINE,ELEC:50 OHM COAX ASSY W/COUNTER VIEW & TRIGGER DELAY	80009	119-2344-00
					(ATTACHING PARTS)		
-66	211-0722-00			1	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-67	131-0799-00			4	CONTACT,ELEC:PLUG-IN GND,BE NI CD PL	80009	131-0799-00
					(ATTACHING PARTS)		
-68	211-0408-00			4	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-69	131-0800-03			2	CONTACT,ELEC:PLUG-IN GND,BE NI HT TR	80009	131-0800-03
					(ATTACHING PARTS)		
-70	211-0408-00			4	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-71	210-0457-00			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(ATTACHES GROUND WIRE)		
-72	348-0966-00			1	GROMMET,PLASTIC:BLACK,ROUND,0.625 ID	80009	348-0966-00
-73	343-1303-00			1	CLAMP,CABLE:ROUND,0.437,NYLON	80009	343-1303-00
					(ATTACHING PARTS)		
-74	210-0457-00			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
-75	210-0863-00			1	WSHR,LOOP CLAMP:0.187 ID U/W 0.5 W CLP	95987	C191
					(END ATTACHING PARTS)		
-76	358-0215-00			2	GROMMET,PLASTIC:BLACK,U-SHAPED,0.524ID	80009	358-0215-00
-77	386-5271-00			1	SPRT,CRT SHIELD:REAR	80009	386-5271-00
					(ATTACHING PARTS)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-78	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-79	386-5331-00			1	SUPPORT RING:CRT,REAR,POLYCARBONATE	80009	386-5331-00
					(ATTACHING PARTS)		
-80	211-0721-00			4	SCREW,MACHINE:6-32 X 0.375,PHN,STL	83486	ORDER BY DESCR
-81	210-0949-00			4	WASHER,FLAT:0.141 ID X 0.5 OD X 0.062,BRS	12327	ORDER BY DESCR
					(END ATTACHING PARTS)		
-82	351-0702-00			1	GUIDE,CKT BOARD:MOLDED NYLON,4.5 L	18677	11633-22
-83	210-0457-00			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(ATTACHES GROUND WIRE)		
	196-3074-00			1	LEAD,ELECTRICAL:18 AWG,12.0 L,5-4	80009	196-3074-00
					(FROM REAR PANEL TO CHASSIS)		
-84	333-3224-00			1	PANEL,REAR:	80009	333-3224-00
	333-3315-00			1	PANEL,REAR:	80009	333-3315-00
					(OPTION 1C ONLY)		
					(ATTACHING PARTS)		
-85	211-0721-00			6	SCREW,MACHINE:6-32 X 0.375,PHN,STL	83486	ORDER BY DESCR
					(END ATTACHING PARTS)		
-86	386-5273-02			1	SUBPANEL,REAR:FINISHED	80009	386-5273-02
					(ATTACHING PARTS)		
-87	211-0718-00			8	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	83486	ORDER BY DESCR
					(END ATTACHING PARTS)		
-88	386-5283-00			2	SUPPORT,CHASSIS:POWER SUPPLY,POLYCARBONATE	80009	386-5283-00
-89	343-0549-00			1	STRAP,TIEDOWN,E:0.091 W X 4.0 L,ZYTEL	06383	PLT1M
-90	337-3340-00			1	SHIELD,ELEC:CABLE,POLYCARBONATE	80009	337-3340-00
-91	211-0721-00			1	SCREW,MACHINE:6-32 X 0.375,PHN,STL	83486	ORDER BY DESCR
-92	210-0006-00			1	WASHER,LOCK:#6 INTL,0.018 THK,STL	77900	1206-00-00-0541C
					(2-91 AND 2-92 ATTACHES GROUND WIRE)		
-93	610-0752-00			1	CHASSIS ASSY:	80009	610-0752-00

PRELIMINARY
This Information Subject to Change

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-1	337-3341-00			1	SHIELD,ELEC:HV,POLYCARBONATE	80009	337-3341-00
-2	----- -----			1	CIRCUIT BD ASSY:TIMEBASE (SEE A14 REPL) (ATTACHING PARTS)		
-3	211-0711-00			7	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,TORX	01536	ORDER BY DESCR
-4	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL (END ATTACHING PARTS) TIMEBASE BOARD ASSEMBLY INCLUDES:	78189	211-041800-00
-5	----- -----			1	.CIRCUIT BD ASSY:COUNTER/TIMER PLL/VCO .(SEE A14A16 REPL)		
-6	210-0586-00			20	.NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-7	344-0406-00			2	.CLIP,RETAINING:CHIP CARRIER	80009	344-0406-00
-8	136-0252-07			17	.SOCKET,PIN CONN:M/O DIMPLE	22526	75060-012
-9	386-5329-00			6	.SUPPORT,CKT BD:0.385 L,WHITE POLYAMIDE	80009	386-5329-00
-10	210-0586-00			2	.NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-11	210-0994-00			1	.WASHER,FLAT:0.125ID X 0.250D X 0.022	86928	A371-283-20
-12	210-0003-00			2	.WASHER,LOCK:#4 EXT,0.015 THK,STL	78189	1104-00-00-0541C
-13	348-0631-00			1	.PAD,CUSHIONING:0.375 X 0.5 X 0.062	85471	ORDER BY DESCR
-14	131-0679-02			2	.CONN,RCPT,ELEC:BNC,MALE,3 CONTACT . (ATTACHING PARTS)	24931	28JR270-1
-15	220-0947-00			2	.NUT,PLAIN,HEX:6-32 X 0.312 HEX,NYLON,94V-0	80009	220-0947-00
-16	210-1039-00			2	.WASHER,LOCK:0.521 ID,INT,0.025 THK,SST . (END ATTACHING PARTS)	24931	ORDER BY DESCR
-17	407-3356-00			1	.BRKT,TRIG INPUT:0.062,AL 5005 H34 . (ATTACHING PARTS)	80009	407-3356-00
-18	211-0409-00			2	.SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL . (END ATTACHING PARTS)	93907	ORDER BY DESCR
-19	337-3396-00			1	.SHIELD,ELEC:TRIGGER INPUT . (ATTACHING PARTS)	80009	337-3396-00
-20	211-0409-00			1	.SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL . (END ATTACHING PARTS)	93907	ORDER BY DESCR
-21	214-3853-00			1	.HEAT SINK,ELEC:MICROCKT,ALUMINUM	80009	214-3853-00
	196-3091-01			1	.LEAD,ELEC:26 AWG,3.5 L W/POLYCOVERING .(FROM TIMEBASE BOARD MARKED CRT1,CRT2 .TO THE CRT)	80009	196-3091-01
-22	337-3244-00			1	SHIELD,ELEC:HIGH VOLTAGE (ATTACHING PARTS)	80009	337-3244-00
-23	211-0711-00			4	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,TORX (END ATTACHING PARTS)	01536	ORDER BY DESCR
-24	129-1074-00			4	SPACER,POST:1.350 L,6-32 ONE END,BRS,HEX NI PL	80009	129-1074-00
-25	----- -----			1	CIRCUIT BD ASSY:SCOPE LOGIC (SEE A13 REPL) (ATTACHING PARTS)		
-26	211-0711-00			7	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,TORX (END ATTACHING PARTS) SCOPE LOGIC BOARD ASSEMBLY INCLUDES:	01536	ORDER BY DESCR
-27	344-0326-00			2	.CLIP,ELECTRICAL:FUSE,BRASS	75915	102071
-28	136-0252-07			2	.SOCKET,PIN CONN:M/O DIMPLE	22526	75060-012
-29	344-0406-00			1	.CLIP,RETAINING:CHIP CARRIER	80009	344-0406-00
-30	343-0549-00			1	.STRAP,TIEDOWN,E:0.091 W X 4.0 L,ZYTEL	06383	PLT1M
-31	162-0435-00			1	.INSUL SLVG,ELEC:0.5 ID,BLACK,0.562 OD	80009	162-0435-00
-32	210-0586-00			4	.NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-33	386-5329-00			5	.SUPPORT,CKT BD:0.385 L,WHITE POLYAMIDE	80009	386-5329-00
-34	214-3841-00			3	.HEAT SINK,XSTR:TO-220 W/SOLDERABLE TABS,AL . (ATTACHING PARTS)	13103	6021PB
-35	211-0410-00			3	.SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL	93907	ORDER BY DESCR
-36	210-0586-00			3	.NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-37	210-1178-00			2	.WASHER,SHLDR: . (END ATTACHING PARTS)	13103	7721-7PPS
-38	342-0355-00			3	.INSULATOR,PLATE:TRANSISTOR,SILICONE RUBBER	55285	7403-09FR-51
-39	----- -----			1	CIRCUIT BD ASSY:FRONT PANEL INTERFACE (SEE A10 REPL) (ATTACHING PARTS)		
-40	211-0711-00			4	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,TORX	01536	ORDER BY DESCR
-41	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL (END ATTACHING PARTS)	78189	211-041800-00

PRELIMINARY
This Information Is Subject To Change

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-					FRONT PANEL INTERFACE BOARD ASSY INCLUDES:		
-42	386-5329-00			6	.SUPPORT,CKT BD:0.385 L,MHITE POLYAMIDE	80009	386-5329-00
-43	407-3358-00			1	.BRKT,CALIBRATOR:0.062 AL,5005 H34	80009	407-3358-00
					. (ATTACHING PARTS)		
-44	211-0409-00			2	.SCR,ASSEM MSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
					. (END ATTACHING PARTS)		
-45	131-2716-01			1	.TERMINAL,CAL:	80009	131-2716-01
-46	131-0955-00			1	.CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
					. (ATTACHING PARTS)		
-47	220-0495-00			1	.NUT,PLAIN,HEX:0.375-32 X 0.438 HEX,BRS	73743	ORDER BY DESCR
-48	210-0012-00			1	.MASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	09772	ORDER BY DESCR
					. (END ATTACHING PARTS)		
	196-3117-00			1	.LEAD,ELECTRICAL:18 AMG,1.5 L,0-N	80009	196-3117-00
					.(FROM BNC TO FRONT PANEL INTERFACE BOARD)		
-49	361-0348-00			1	.SPACER,RING:0.12 L X 0.375 ID,AL	80009	361-0348-00
-50	----- -----			1	CIRCUIT BD ASSY:VERTICAL		
					(SEE A12 REPL)		
					(ATTACHING PARTS)		
-51	211-0711-00			2	SCR,ASSEM MSHR:6-32 X 0.25,PNH,STL,TORX	01536	ORDER BY DESCR
					(END ATTACHING PARTS)		
					VERTICAL BOARD ASSEMBLY INCLUDES:		
-52	136-0252-07			8	.SOCKET,PIN CONN:M/O DIMPLE	22526	75060-012
-53	210-0586-00			8	.NUT,PL,ASSEM MA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-54	----- -----			1	.DELAY LINE:77NS		
					.(SEE A12DL200 REPL)		
					. (ATTACHING PARTS)		
-55	211-0409-00			2	.SCR,ASSEM MSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
					. (END ATTACHING PARTS)		
-56	----- -----			1	RES NTMK,FXD,FI:CRT TERMINATOR(ASSEMBLED)		
					H2091		
					(SEE R80 REPL)		
					(ATTACHING PARTS)		
-57	211-0711-00			2	SCR,ASSEM MSHR:6-32 X 0.25,PNH,STL,TORX	01536	ORDER BY DESCR
					(END ATTACHING PARTS)		
-58	----- -----			1	CIRCUIT BD ASSY:COUNTER/TIMER REFERENCE		
					(SEE A15 REPL)		
-59	386-5366-00			3	.SUPPORT,CKT BD:NYLON	06915	TEHCBS-4R
					. (ATTACHING PARTS)		
-60	211-0711-00			3	.SCR,ASSEM MSHR:6-32 X 0.25,PNH,STL,TORX	01536	ORDER BY DESCR
					. (END ATTACHING PARTS)		
-61	136-0252-07			1	.SOCKET,PIN CONN:M/O DIMPLE	22526	75060-012
-62	119-0894-01			1	.OSCILLATOR,RF:10MHZ,18V	31785	OCXO-44-12
					. (ATTACHING PARTS)		
-63	211-0409-00			2	.SCR,ASSEM MSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
					. (END ATTACHING PARTS)		
-64	361-0122-00			2	.SPACER,SLEEVE:0.125 L X 0.12 ID,BRS	80009	361-0122-00
-65	----- -----			1	CIRCUIT BD ASSY:MAIN PROCESSOR		
					(SEE A11 REPL)		
					(ATTACHING PARTS)		
-66	211-0711-00			5	SCR,ASSEM MSHR:6-32 X 0.25,PNH,STL,TORX	01536	ORDER BY DESCR
-67	129-1003-00			2	SPACER,POST:0.705 L,6-32 EXT/M3.5 X 6-6G	80009	129-1003-00
					INT,BRS,0.25 HEX		
-68	214-3106-00			2	HARDMARE KIT:JACK SOCKET	53387	3341-1S
					(END ATTACHING PARTS)		
					MAIN PROCESSOR BOARD ASSEMBLY INCLUDES:		
-69	211-0396-00			4	.SCREM,MACHINE:4-40 X 0.312 PNH,TORX	93907	829-06893
-70	210-0586-00			2	.NUT,PL,ASSEM MA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-71	136-0252-07			4	.SOCKET,PIN CONN:M/O DIMPLE	22526	75060-012
-72	386-5329-00			7	.SUPPORT,CKT BD:0.385 L,MHITE POLYAMIDE	80009	386-5329-00
-73	348-0631-00			1	.PAD,CUSHIONING:0.375 X 0.5 X 0.062	85471	ORDER BY DESCR
-74	352-0742-00			1	.HOLDER,BATTERY:2/3A LITHIUM,94V-0 POLYEST	TK1493	BH2/3A
-75	214-3637-01			3	.HT SK,MICROCKT:ALUMINUM,BLACK ANODIZE	80009	214-3637-01
-76	----- -----			1	CIRCUIT BD ASSY:PLUG-IN INTERFACE		
					(SEE A1 REPL)		
					(ATTACHING PARTS)		
-77	211-0408-00			9	SCR,ASSEM MSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-					PLUG-IN INTERFACE BOARD ASSY INCLUDES:		
-78	----- -----			3	.CONN,RCPT,ELEC:HEADER,2 X 38		
					.(SEE A1J94,J92,J93 REPL)		
					. (ATTACHING PARTS)		
-79	213-0984-00			3	.SCREW,TPG,TR:2-28 X 0.312 PNH,STL	80009	213-0984-00
-80	211-0396-00			3	.SCREW,MACHINE:4-40 X 0.312 PNH,TORX	93907	829-06893
					. (END ATTACHING PARTS)		
-81	136-0252-07			13	.SOCKET,PIN CONN:M/O DIMPLE	22526	75060-012
-82	343-0549-00			3	.STRAP,TIEDOWN,E:0.091 W X 4.0 L,ZYTEL	06383	PLT1M
-83	351-0766-00			2	.GUIDE,PIN:2.65 X 0.3	80009	351-0766-00
	179-2968-00			1	.WIRING HARNESS:PLUG-IN INTERFACE	80009	179-2968-00
-84	----- -----			1	CIRCUIT BD ASSY:REGULATOR		
					(SEE A4 REPL)		
					(ATTACHING PARTS)		
-85	211-0721-00			2	SCREW,MACHINE:6-32 X 0.375,PHN,STL	83486	ORDER BY DESCR
					(END ATTACHING PARTS)		
					REGULATOR BOARD ASSEMBLY INCLUDES:		
-86	386-5289-00			2	.SUPPORT,CKT BD:POLYMIDE,WHITE	80009	386-5289-00
-87	386-5286-00			1	.SUPPORT,ECB:REGULATOR	80009	386-5286-00
					. (ATTACHING PARTS)		
-88	211-0408-00			2	.SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
					. (END ATTACHING PARTS)		
-89	211-0408-00			6	.SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
-90	210-1171-00			6	.WASHER,SHLDR:0.12 ID X 0.143 OD,NYLON	00261	A7148516P2
-91	342-0755-00			2	.INSULATOR,FILM:THERMAL CONDUCTIVE SILICONE	80009	342-0755-00
					. RUBBER LAMINATE		

PRELIMINARY
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Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
4-1	200-3237-00			1	COVER,PWR SPLY:TOP,AL 5005-H34	80009	200-3237-00
					(ATTACHING PARTS)		
-2	211-0722-00			2	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
-3	211-0734-00			2	SCREW,MACHINE:6-32 X 0.25,FLH,100 DEG,STL	83486	ORDER BY DESCR
					(END ATTACHING PARTS)		
-4	200-3236-00			1	COVER,PWR SPLY:ALUMINUM	80009	200-3236-00
					(ATTACHING PARTS)		
-5	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					(END ATTACHING PARTS)		
-6	351-0702-00			4	GUIDE,CKT BOARD:MOLDED NYLON,4.5 L	18677	11633-22
-7	----- -----			1	CIRCUIT BD ASSY:CONTROL RECTIFIER		
					(SEE PS1A3 REPL)		
					(ATTACHING PARTS)		
-8	211-0408-00			4	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
-9	211-0722-00			2	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
-10	211-0408-00			1	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
					CONTROL RECTIFIER BOARD ASSEMBLY INCLUDES:		
-11	386-5285-00			1	.SUPPORT,CHASSIS:POWER SUPPLY,LEFT	80009	386-5285-00
-12	214-3796-00			2	.HEAT SINK,XSTR:ALUMINUM,TO-220	30161	5968B
-13	129-1086-00			1	.SPACER,POST:1.505 L,M 4-40 THD BOTH ENDS,	80009	129-1086-00
					.NYLON,0.312		
-14	----- -----			4	.SEMICOND DVC,DI:RECT,SI,10A,30V,TO-220		
					.(SEE PS1A3CR330,CR331,CR340,CR350 REPL)		
					. (ATTACHING PARTS)		
-15	211-0411-00			4	.SCR,ASSEM WSHR:4-40 X 0.5,PNH,STL	93907	ORDER BY DESCR
-16	210-0586-00			4	.NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-17	210-1171-00			4	.WASHER,SHLDR:0.12 ID X 0.143 OD,NYLON	00261	A7148516P2
					. (END ATTACHING PARTS)		
-18	342-0755-00			1	.INSULATOR,FILM:THERMAL CONDUCTIVE SILICONE	80009	342-0755-00
					. RUBBER LAMINATE		
-19	214-3827-00			1	.HEAT SINK,ELEC:POWER SUPPLY	80009	214-3827-00
					. (ATTACHING PARTS)		
-20	211-0722-00			2	.SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
					. (END ATTACHING PARTS)		
-21	407-3492-00			1	BRACKET,ANGLE:ALUMINUM	80009	407-3492-00
					(ATTACHING PARTS)		
-22	211-0734-00			1	SCREW,MACHINE:6-32 X 0.25,FLH,100 DEG,STL	83486	ORDER BY DESCR
					(END ATTACHING PARTS)		
-23	----- -----			1	CIRCUIT BD ASSY:LINE INVERTER 388-8656-XX		
					(SEE PS1A2 REPL)		
					(ATTACHING PARTS)		
-24	211-0408-00			1	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
-25	211-0409-00			1	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
					LINE INVERTER BOARD ASSEMBLY INCLUDES:		
-26	214-3796-00			2	.HEAT SINK,XSTR:ALUMINUM,TO-220	30161	5968B
-27	344-0326-00			2	.CLIP,ELECTRICAL:FUSE,BRASS	75915	102071
-28	----- -----			4	.TRANSISTOR:FE PAIR		
					.(SEE PS1A2Q600,Q601,Q610,Q620 REPL)		
					. (ATTACHING PARTS)		
-29	211-0411-00			4	.SCR,ASSEM WSHR:4-40 X 0.5,PNH,STL	93907	ORDER BY DESCR
-30	342-0536-00			4	.INSULATOR,XSTR:TO-220,POLYENELENE	80009	342-0536-00
					. (END ATTACHING PARTS)		
-31	342-0755-00			1	.INSULATOR,FILM:THERMAL CONDUCTIVE SILICONE	80009	342-0755-00
					. RUBBER LAMINATE		
-32	214-3784-00			1	.HT SK,PWR SPLY:ALUMINUM	80009	214-3784-00
					. (ATTACHING PARTS)		
-33	211-0408-00			2	.SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
					. (END ATTACHING PARTS)		
-34	----- -----			1	.SWITCH,THRMSTC:NC OPEN 97.8,15A,125VAC		
					.(SEE PS1A2S99 REPL)		
					. (ATTACHING PARTS)		
-35	211-0408-00			2	.SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
-36	210-0586-00			2	.NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					. (END ATTACHING PARTS)		
-37	200-2222-00			1	GUARD,FAN:	81041	6-182-033

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
4-						(ATTACHING PARTS)		
-38	211-0744-00			4		SCREW,MACHINE:6-32 X 2.0,PNH,TORX,STL,CD (END ATTACHING PARTS)	04348	ORDER BY DESCR
-39	407-3362-00			1		BRACKET,FAN:0.050 5005 H-34	80009	407-3362-00
-40	----- -----			1		FAN,TUBEAXIAL:8 TO 14.5VDC,6W,3200RPM, 106CFM (SEE PS1B50 REPL)		
-41	200-2264-00			1		CAP,FUSEHOLDER:3AG FUSES	S3629	FEK 031 1666
-42	204-0832-00			1		BODY,FUSEHOLDER:3AG & 5 X 20MM FUSES	TK0861	031 1673
-43	----- -----			1		FILTER,RFI:6A,115-230V,48-440HZ (SEE PS1FL99 REPL) (ATTACHING PARTS)		
-44	211-0721-00			2		SCREW,MACHINE:6-32 X 0.375,PHN,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-45	358-0216-00			1		GROMMET,PLASTIC:GRAY,ROUND,0.257 ID	80009	358-0216-00
-46	----- -----			2		LEAD,ELECTRICAL:18 AWG,12.0 L,5-4 (SEE PS1M97,M99 REPL) (ATTACHING PARTS)		
-47	210-0457-00			2		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL (END ATTACHING PARTS)	78189	511-061800-00
-48	386-5287-00			1		PLATE,REAR:AL (ATTACHING PARTS)	80009	386-5287-00
-49	211-0721-00			8		SCREW,MACHINE:6-32 X 0.375,PHN,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR

PRELIMINARY
This Information Subject to Change

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
5-1	161-0066-00			1	CABLE ASSY,PWR,:3,18AWG,115V,98.0 L	16428	CH8481, FH8481
-2	161-0066-09			1	CABLE ASSY,PWR,:3,0.75MM SQ,220V,99.0 L (OPTION A1 ONLY)	S3109	86511000
-3	161-0066-10			1	CABLE ASSY,PWR,:3,0.75MM SQ,240V,96.0 L (OPTION A2 ONLY)	TK1373	24230
-4	161-0066-11			1	CABLE ASSY,PWR,:3,0.75MM,240V,96.0 L (OPTION A3 ONLY)	S3109	ORDER BY DESCR
-5	161-0066-12			1	CABLE ASSY,PWR,:3,18 AWG,250V,99.0 L (OPTION A4 ONLY)	70903	CH-77893
-6	161-0154-00			1	CABLE ASSY,PWR,:3,0.75MM SQ,240V,6A,2.5M L (OPTION A5 ONLY)	S3109	86515000
	070-6104-00			1	MANUAL,TECH:OPERATORS,11301	80009	070-6104-00
	070-6105-00			1	MANUAL,TECH:OPERATORS,11301	80009	070-6105-00
	070-6106-00			1	MANUAL,TECH:USERS REFERENCE,11301 & 11302	80009	070-6106-00
	070-6274-00			1	MANUAL,TECH:INSTR,11401/11402 (OPTION 1R ONLY)	80009	070-6274-00
					OPTIONAL ACCESSORIES		
	016-0154-00			1	VISOR,CRT:GENERAL USAGE	80009	016-0154-00
	016-0260-00			1	VISOR,CRT:	80009	016-0260-00
	070-6107-00			1	MANUAL,TECH:SVCE VOL 1,11301 THEORY,CHK ADJ /MAINT	80009	070-6107-00
	070-6108-00			1	MANUAL,TECH:SVCE VOL II,11301	80009	070-6108-00
	070-6109-00			1	MANUAL,TECH:SVCE VOL 3,11301	80009	070-6109-00

PRELIMINARY This Information Subject to Change

PRELIMINARY
This Information Subject to Change

11302 REPLACEABLE MECHANICAL PARTS LIST

REPLACEABLE MECHANICAL PARTS LIST

The following items are the only differences in the 11302 and 11301 Replaceable Mechanical Parts Lists.

CHANGES:

A 200-3256-02 CRT SCALE COVER is used for the 11302, rather than a 200-3135-02.

A 204-1-15-00 TERMINAL BODY is used for the 11302, rather than a 204-1006-00.

A 333-3351-00 FRONT PANEL is used for the 11302, rather than a 333-3223-00.

A 337-3304-00 CRT SHEILD is used for the 11302, rather than a 337-3307-00.

A 426-2128-00 LENS FRAME is used for the 11302, rather than a 426-2118-00.

A 337-3359-00 HIGH VOLTAGE SHIELD is used for the 11302, rather than a 337-3244-00.

ADDITIONS:

A 337-3399-00 ELECTRICAL SHIELD is added for the 11302 Vertical Amplifier board.

A 337-3304-00 EMI SHIELD is added between the CRT faceplate and implosion shield.

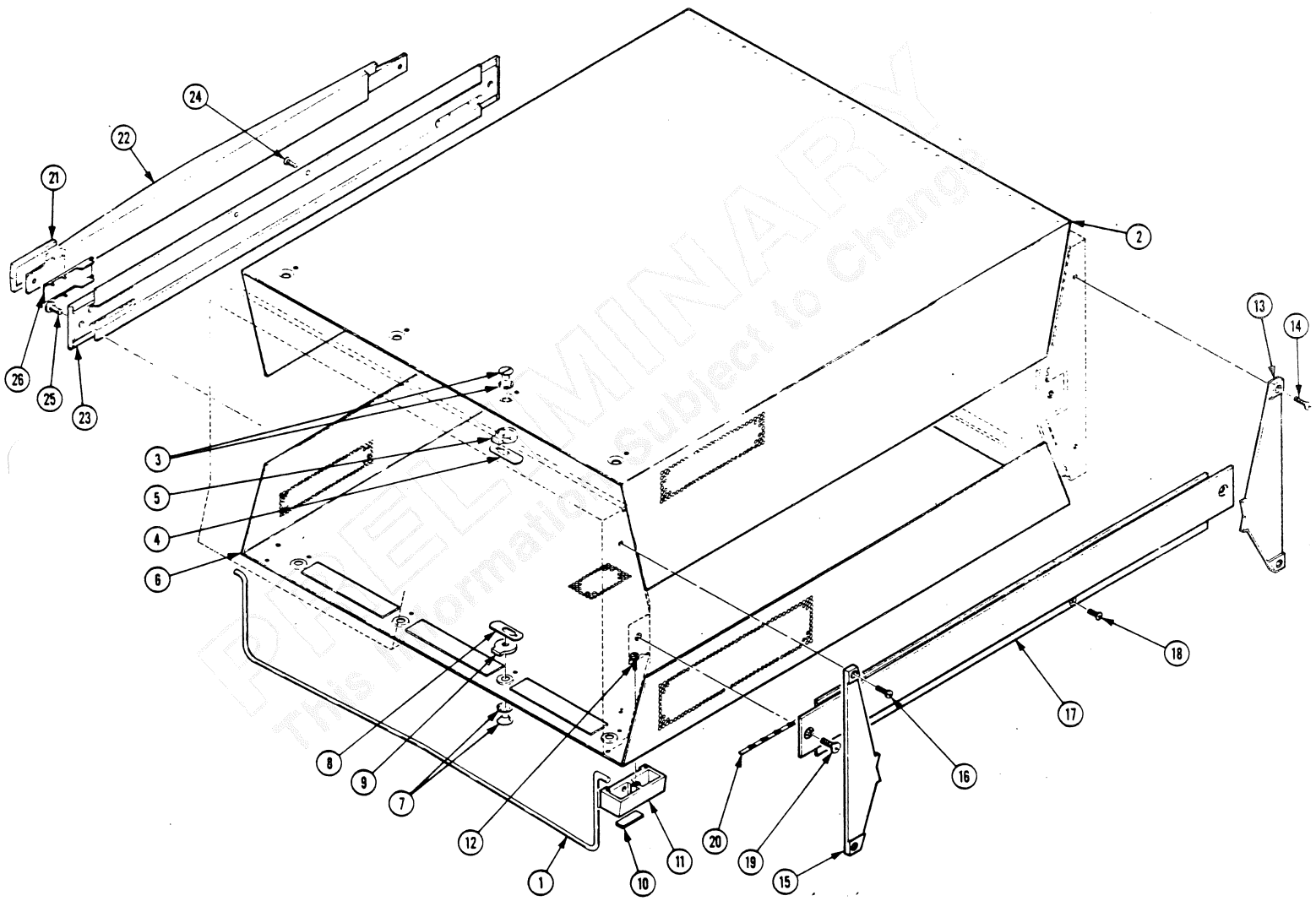
DELETIONS:

The 337-3341-00 PLASTIC HIGH VOLTAGE SHIELD is used on the 11301 only.

PRELIMINARY
This Information Subject to Change

EXPLODED VIEW ILLUSTRATIONS

FIG. 1 CABINE



PRELIMINARY
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FIG. 2(A) FRONT, CHASSIS, REAR

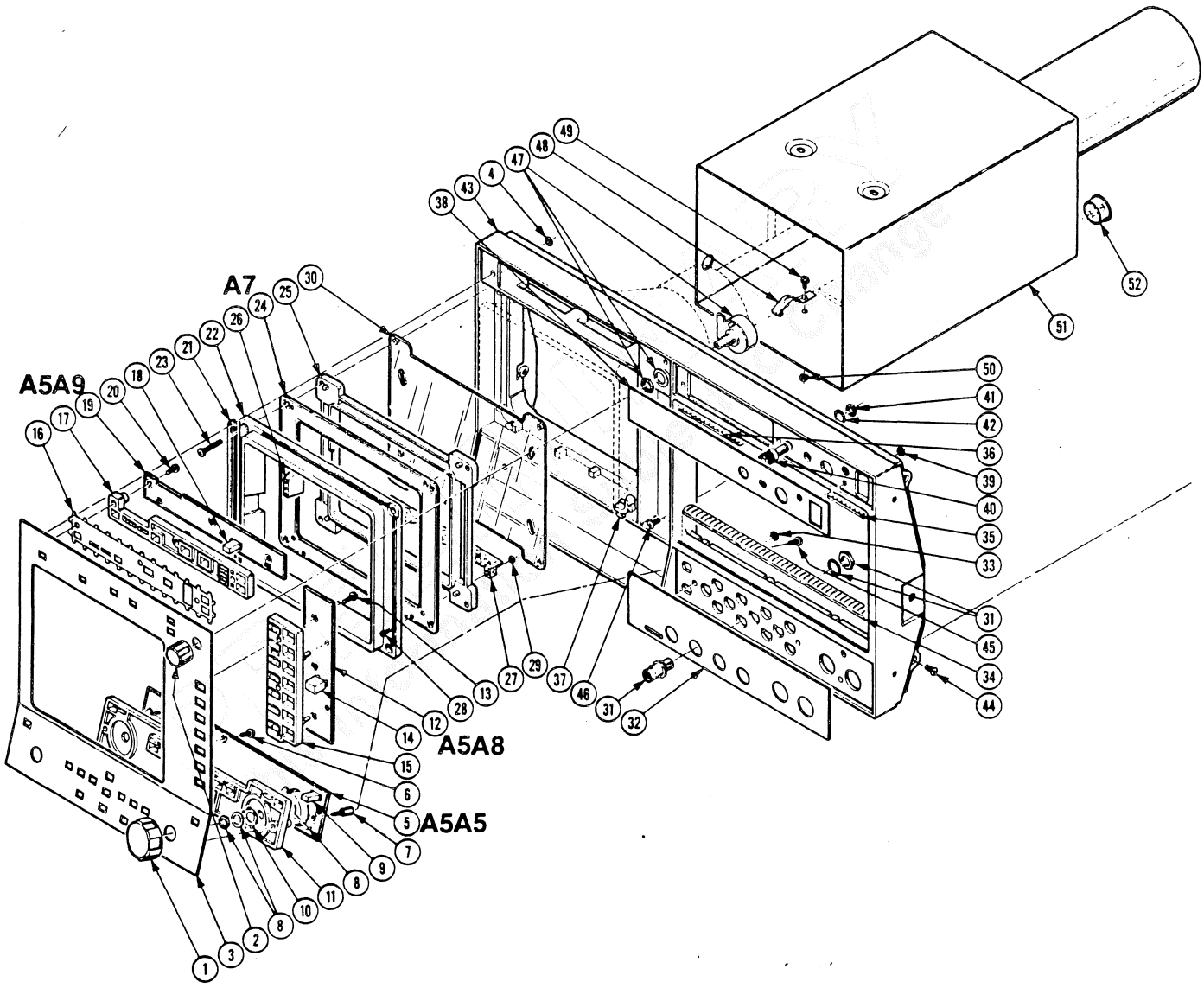


FIG. 2(B) FRONT, CHASSIS, REAR

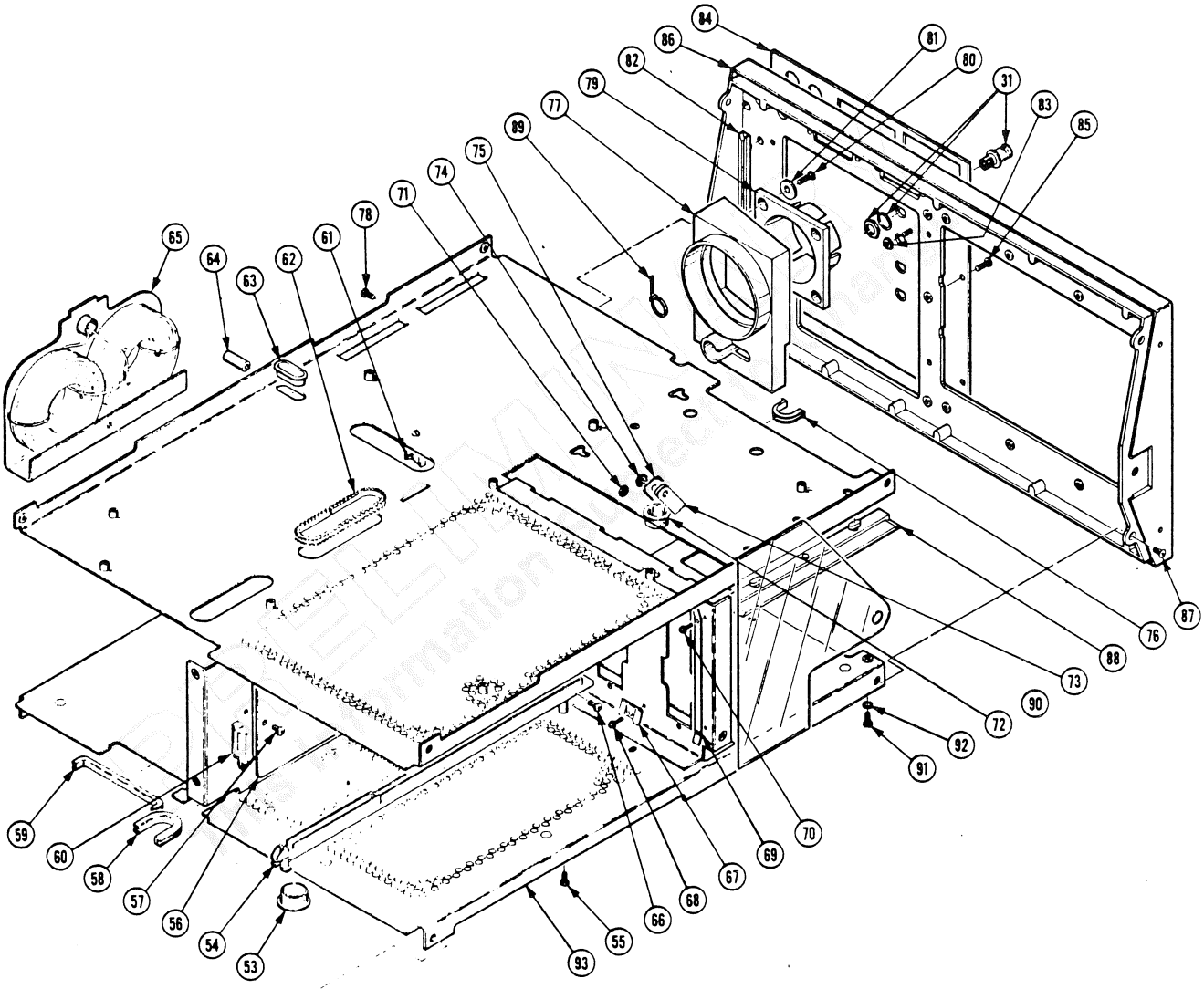


FIG. 3 CIRCUIT BOARDS

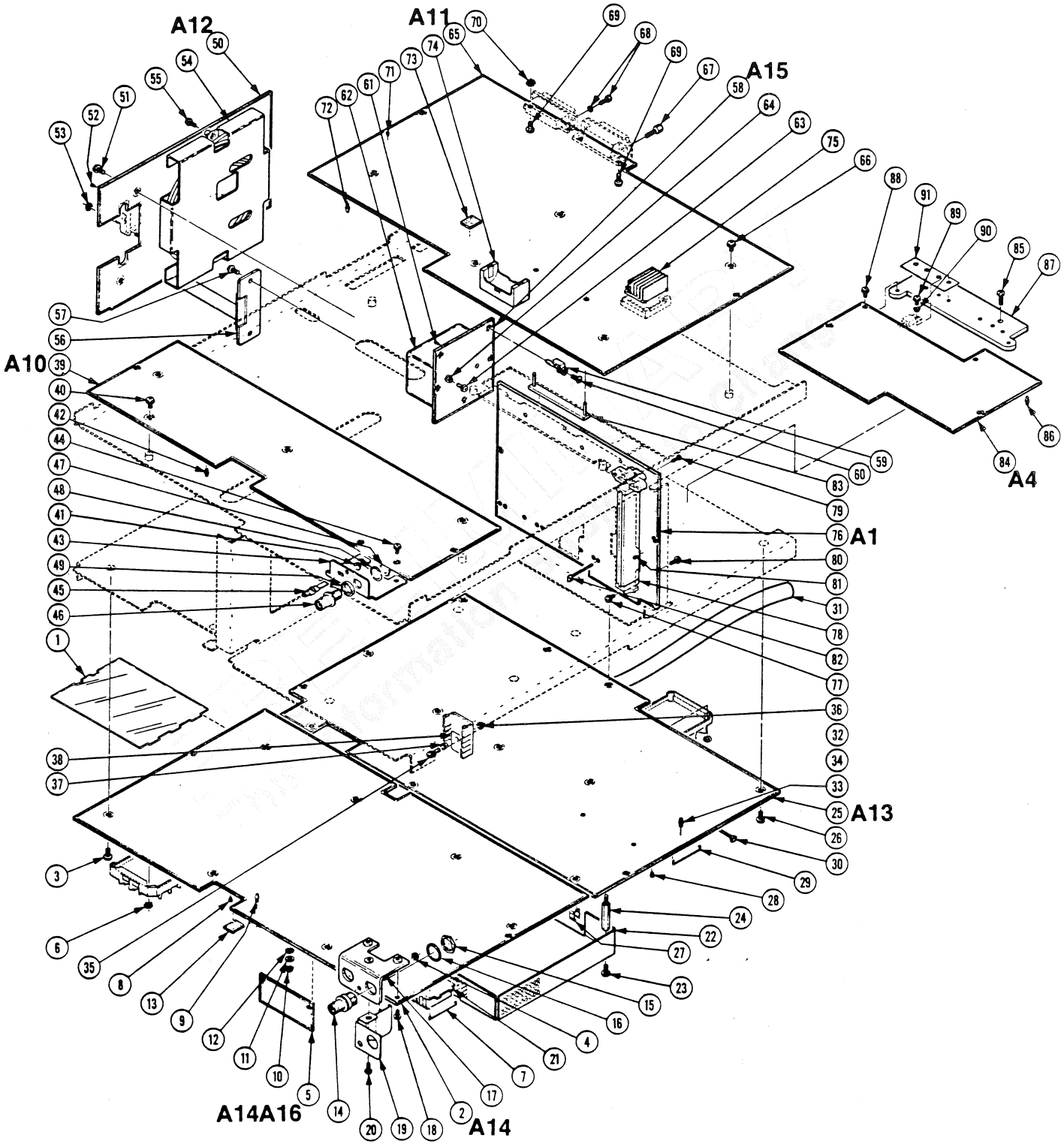
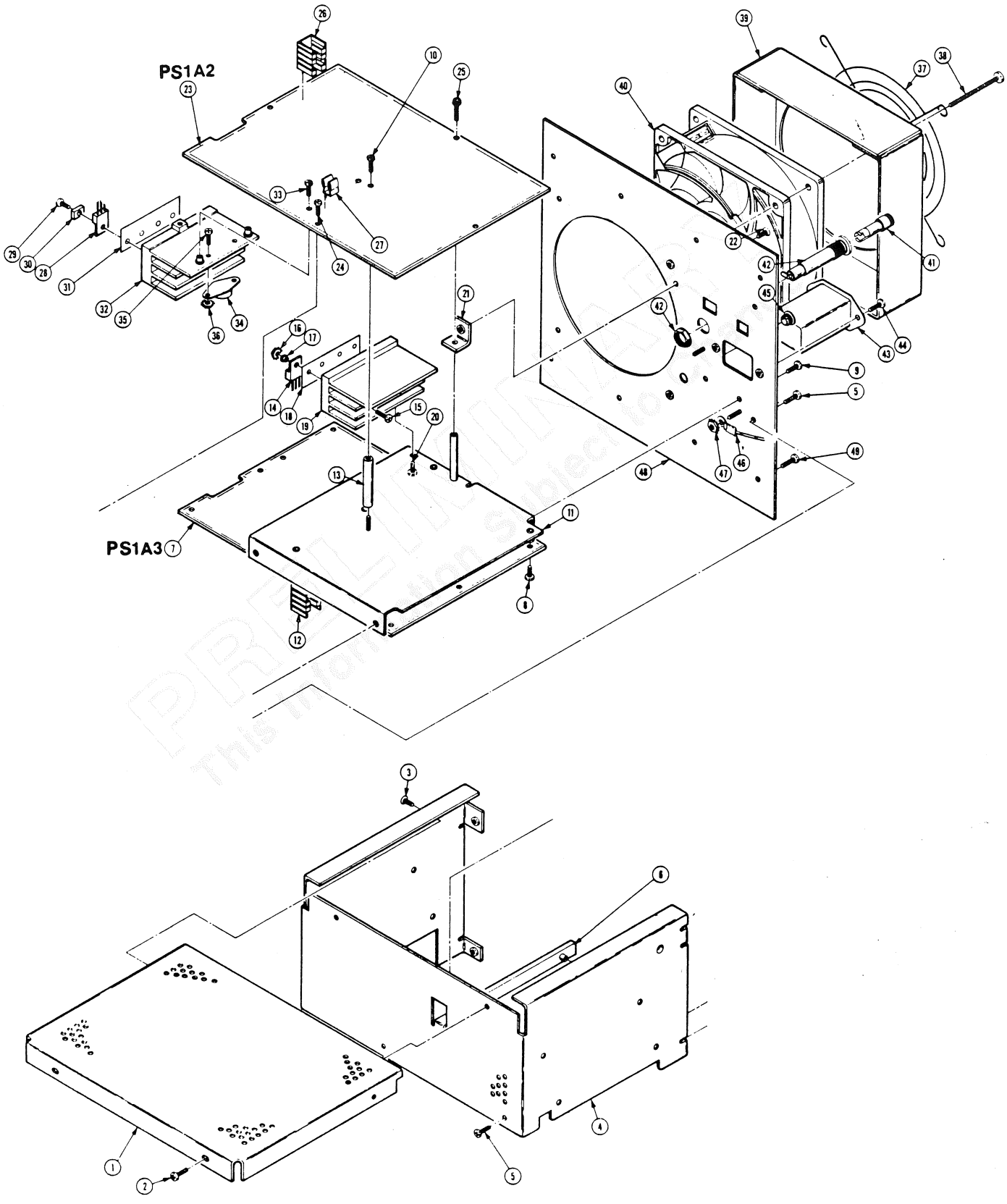
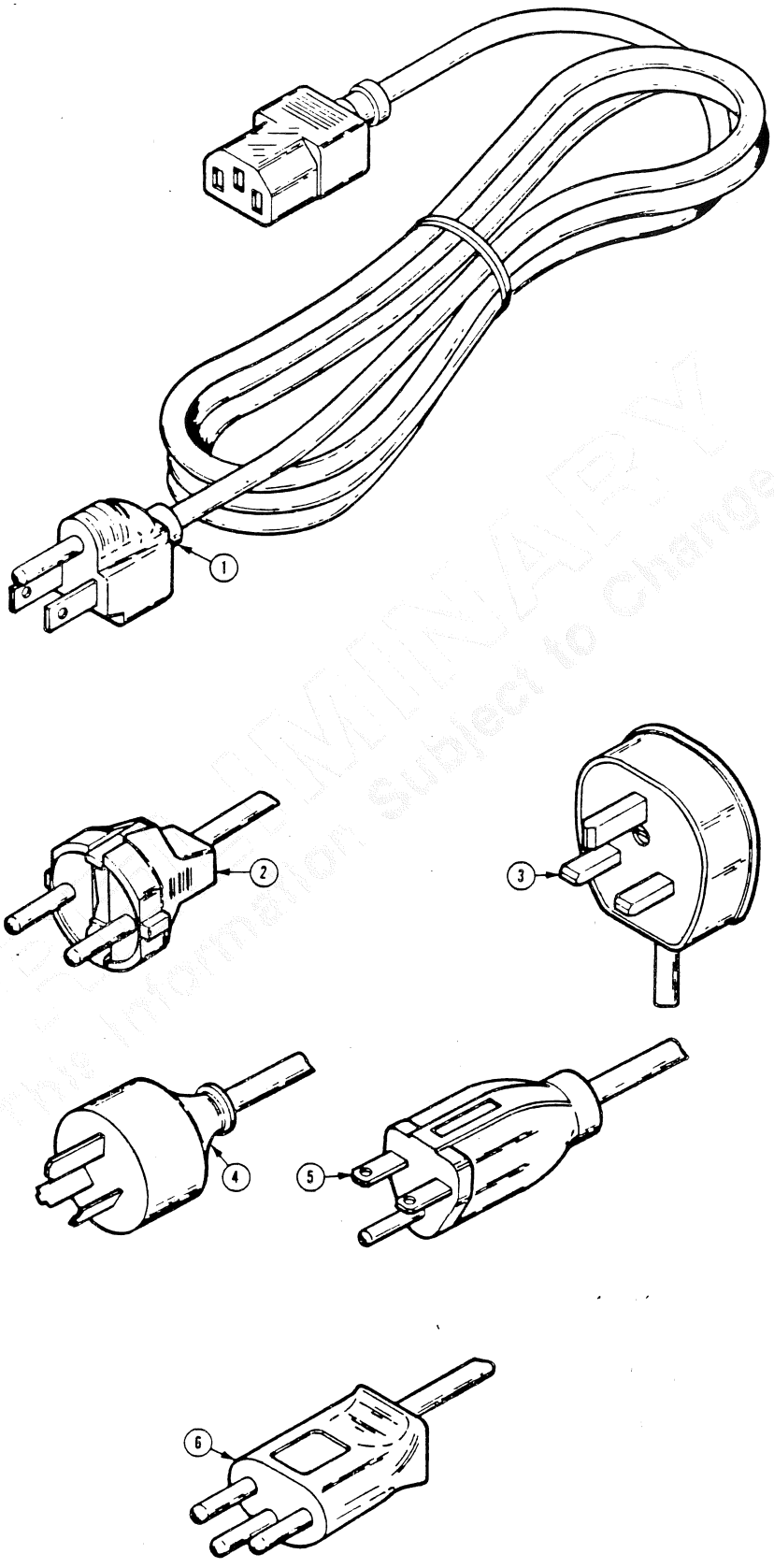


FIG. 4 POWER SUPPLY



DRAFT UNDER
This Information Subject to

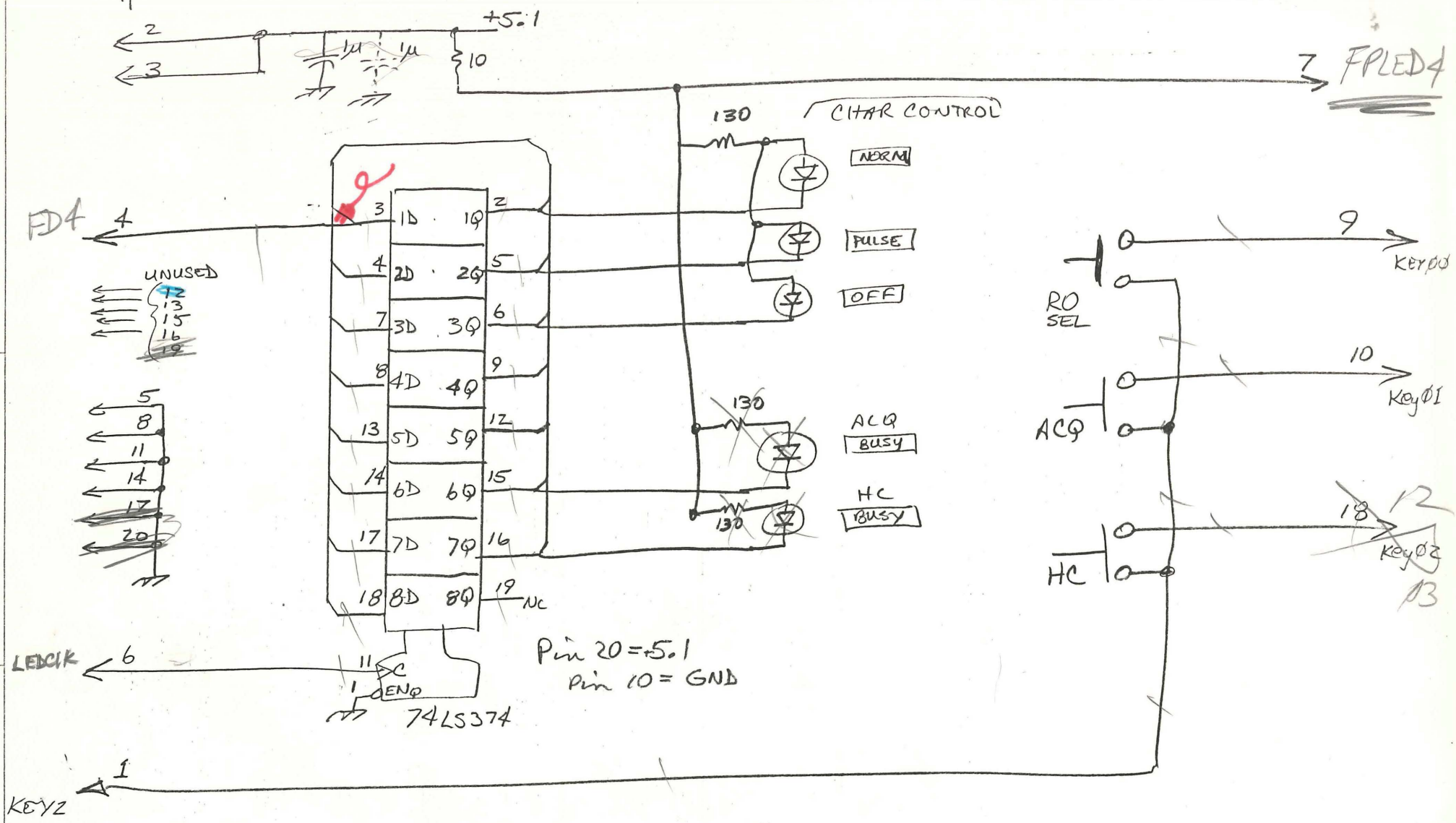
FIG. 5 ACCESSORIES



TEKTRONIX
Preliminary
Subject to Change

P/J 75

P/J 75



RIGHT FRONT PANEL

3-12-88

NATIONAL
42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
MADE U.S.A.