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Service Manual

Tektronix

CDC250
175 MHz Universal Counter

070-7998-00

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Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to the Safety Summary prior to performing service.

Please check for change information at the rear of this manual.

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WARRANTY

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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General Information

The TEKTRONIX CDC250 175 MHz Universal Counter will count signal frequency of sine, square, and triangle waves from 5 Hz to 175 MHz. It features an eight-digit display with automatic decimal point placement and an LED indicator showing the display measurement unit. The counter also has front-panel OVERRANGE and GATE (measurement in progress) LED indicators. In addition to frequency measurements, the CDC250 provides the following measurement functions.

- Period measurements in microseconds or milliseconds over a 5 Hz to 2 MHz range.
- Frequency ratio measurements comparing two input signals.
- Time interval measurements from a selected edge of one input signal to a selected edge of another.
- Totalize measurements counting individual events.

The CDC250 provides a front-panel check function that enables the user to quickly verify the frequency counter's operation. The front-panel controls also provide selectable gate times (resolution), selectable X10 attenuators, and a selectable low-pass filter for Channel A.

The CDC250 comes with a locking, multiposition carrying handle that also acts as a tilt stand for easy viewing. The carrying handle folds under the instrument to allow stacking with other instruments of the same series.

A power cord and an operators manual are included with the instrument. For part numbers and further information about standard and optional accessories, refer to Replaceable Parts (section 8) in this manual. For additional information, contact your Tektronix Sales Office or distributor and refer to the Tektronix products catalog.

Safety

Please take a moment to review these safety precautions. They are provided for your protection and to prevent damage to the 175 MHz Universal Counter. This safety information applies to all operators and service personnel.

Symbols and Terms

These two terms appear in manuals:

- CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.
- WARNING statements identify conditions or practices that could result in personal injury or loss of life.

These two terms appear on equipment:

- *CAUTION* indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.
- *DANGER* indicates a personal injury hazard immediately accessible as one reads the marking.

This symbol appears in manuals:

This symbol indicates where applicable cautionary or other information is to be found.

Static-Sensitive Devices

These symbols appear on equipment:

DANGER High Voltage

Protective ground (earth) terminal

ATTENTION Refer to manual

Replace fuse as specified Refer to manual

Specific Precautions

Observe all of the following precautions to ensure your personal safety and to prevent damage to either the CDC250 or equipment connected to it.

Do Not Perform Service While Alone – Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

Use Care When Servicing With Power On – Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections or components while power is on. Disconnect power before removing protective panels, soldering, or replacing components.

Power Source – The CDC250 is intended to operate from a power source that will not apply more than 250 V rms between the supply conductors or between either supply conductor and ground. A protective ground connection, through the grounding conductor in the power cord, is essential for safe system operation.

Grounding the 175 MHz Universal Counter – The CDC250 is grounded through the power cord. To avoid electric shock, plug the power cord into a properly wired receptacle where earth ground has been verified by a qualified service person. Do this before making connections to the input or output terminals of the CDC250.

Without the protective ground connection, all parts of the CDC250 are potential shock hazards. This includes knobs and controls that may appear to be insulators.

Use the Proper Power Cord – Use only the power cord and connector specified for your product. Use only a power cord that is in good condition.

Use the Proper Fuse – To avoid fire hazard, use only the fuse specified in the parts list for your product, and which is identical in type, voltage rating, and current rating.

Do Not Remove Covers or Panels – To avoid personal injury, do not operate the CDC250 without the panels or covers.

Do Not Operate in Explosive Atmospheres – The CDC250 provides no explosion protection from static discharges or arcing components. Do not operate the CDC250 in an atmosphere of explosive gasses.

Electric Overload – Never apply a voltage to a connector on the CDC250 that is outside the range specified for that connector.

Specifications

General characteristics are given in Table 1-1. The electrical characteristics given in Table 1-2 are valid when the instrument has been adjusted and is operating at an ambient temperature between 0°C and 40°C (64°F and 82°F), with 75% maximum relative humidity, after a warmup period of at least one hour.

Table 1-1: General Characteristics

Characteristics	Description
	OPERATIONAL
Display	Eight-digit, 0.43-inch, seven-segment LED readout, with OVERRANGE, MHz/ms, kHz/μs, and GATE indicators.
Function Indicators	FREQ, PERIOD, RATIO, TIME, TOTALIZE, and CHECK.
GATE Indicators	1/0.01s, 10/0.1s, 100/1.0s, 1000/10s.
Display Update Time	
FREQ kHz and CHECK Modes	User-selected gate time of 0.01, 0.1, 1.0, or 10 s, plus fixed 200 ms interval.
FREQ MHz Mode	User-selected gate time of 0.02, 0.2, 2.0, or 20 s, plus fixed 400 ms interval.
PERIOD, RATIO	User-selected cycle averaging of 1, 10, 100, 1000 cycles, plus fixed 200 ms interval.
TOTALIZE Mode	Continuous.
Input Voltage Attenuation (selectable for both channels)	
50 mV to 5 V (LO)	1X.
3 V to 42 V (HI)	10X.
Trigger Slope (both channels)	+ or – (selectable).
Channel A Trigger Level	Preset or variable (selectable).
Channel A Filter	Low pass filter -3 dB point at 10 kHz (selectable).
Time Base	Temperature-compensated crystal oscillator.
	PHYSICAL
Width	240 mm (9.5 in).
Height	64 mm (2.5 in).
Depth	190 mm (7.5 in).
Weight	1.9 kg (4.2 lb).

Table 1-1: General Characteristics (Cont.)

Characteristics	Description
ENVIRONMENTAL	
Operating Temperature	0 to 40°C, 75% maximum relative humidity.
Nonoperating Temperature	-20 to +60°C, 80% maximum relative humidity.

Table 1-2: Electrical Characteristics

Characteristics	Performance Requirements
POWER	
Line Voltage Range	90 to 110, 108 to 132, 198 to 242, and 216 to 250 VAC at 50–60 Hz.
Power Consumption	21 VA, 18 W maximum.
FREQUENCY	
Range	
kHz Mode	5 Hz to 10 MHz.
MHz Mode	5 MHz to 175 MHz.
Accuracy	±1 count ± time base error.
Resolution	0.1 Hz to 1 kHz, in decade steps.
Display	kHz or MHz with decimal point.
PERIOD	
Range	0.5 μs to 0.2 s.
Frequency Range	5 Hz to 2 MHz.
Accuracy	±1 count ± time base error ± trigger error.[a]
Resolution	100 ps to 100 ns in decade steps.
Display	ms or μs with decimal point.
RATIO	
Frequency Range	
Channel A	5 Hz to 10 MHz.
Channel B	5 Hz to 2 MHz.

[a]Trigger error is typically ±0.3% of reading divided by the number of cycles averaged, for input signals greater than 100 mV with S/N ratio better than 40 dB.

Table 1-2: Electrical Characteristics (Cont.)

Characteristics	Performance Requirements
Accuracy	± resolution ± ratio × trigger error.[a]
Resolution	$\frac{CH\ B\ frequency}{CH\ A\ frequency \times N^{b}}$
Display	Numerical ratio with decimal point.
	TIME INTERVAL
Range	0.5 μs to 0.2 s.
Frequency Range	5 Hz to 2 MHz, square wave.
Accuracy	±1 count ± time base error ± trigger error[a] ± N[b].
Resolution	100 ps to 100 ns in decade steps.
Display	ms or μs with decimal point.
	TOTALIZE
Range	5 Hz to 10 MHz.
Count Capability	0 to 99,999,999 before OVERRANGE.
Control	Start, stop, and reset controlled by front panel push buttons or rear panel TOTALIZE INPUT START/STOP.
	CHANNNEL A INPUT
Bandwidth	5 Hz to 175 MHz, AC coupled.
Sensitivity	
kHz Mode	
5 Hz to 10 MHz	20 mV rms.
MHz Mode	
5 MHz to 125 MHz	50 mV rms.
125 MHz to 150 MHz	100 mV rms.
150 MHz to 175 MHz	150 mV rms.
Impedance	1 MΩ paralleled by ≤40 pF.
Maximum Input Voltage ⚠	42 Vpk.

[a]Trigger error is typically ±0.3% of reading divided by the number of cycles averaged, for input signals greater than 100 mV with S/N ratio better than 40 dB.

[b]N = number of cycles averaged; 1, 10, 100, or 1000.

Table 1-2: Electrical Characteristics (Cont.)

Characteristics	Performance Requirements
	CHANNEL B INPUT
Bandwidth	5 Hz to 2 MHz, AC coupled.
Sensitivity	30 mV rms.
Impedance	1 MΩ paralleled by ≤40 pF.
Maximum Input Voltage ⚠	42 Vpk.
	TIME BASE
Crystal Frequency	10 MHz.
Line Voltage Stability	Less than ±0.4 ppm with 10% line voltage variation.
Temperature Stability	Less than ±0.0001% (±1 ppm) from 0° to 40°C ambient temperature.
Aging Rate	Less than ±1 ppm per year.

[a] Trigger error is typically ±0.3% of reading divided by the number of cycles averaged, for input signals greater than 100 mV with S/N ratio better than 40 dB.

[b] N = number of cycles averaged; 1, 10, 100, or 1000.

Preparation For Use

Safety

This section of the manual tells how to proceed with the initial start-up of the instrument.

Refer to the Safety in General Information for power source, grounding, and other safety considerations. Before connecting the CDC250 to a power source, read both this section and General Information.

Line Voltage

CAUTION

This instrument may be damaged if operated with the LINE VOLTAGE SELECT switches set for the wrong line voltage.

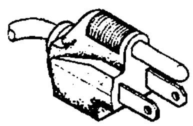
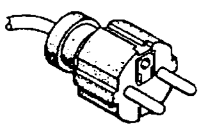
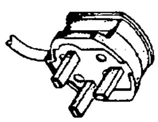
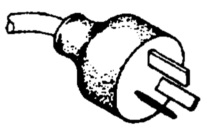
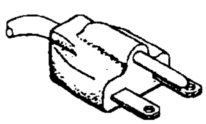
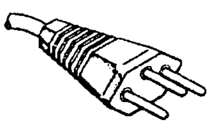
This product is intended to operate from a power source that does not supply more than 250 V rms between the supply conductors or between either supply conductor and ground. Before connecting the power cord to a power-input source, be sure that the LINE VOLTAGE SELECT switches on the rear panel are set to the correct line voltage setting. Figure 2-1 shows the location of the LINE VOLTAGE SELECT switches.

Power Cord

A protective ground connection, the third wire in the power cord, is necessary for safe operation. To avoid electrical shock, plug the power cord into a properly wired receptacle before making any connections to the equipment input terminals. Do not remove the ground lug from the power cord for any reason. Use only the power cord and connector specified for this equipment.

Instruments are shipped with the required power cord as ordered by the customer (see Table 2-1). Contact your Tektronix representative or Tektronix Field Office for additional power-cord information.

Table 2-1: Power Cord and Plug Identification

Plug Configuration	Usage (Max Rating)	Reference Standards & Certification	Option #
	North America 125 V/6 A	[1]ANSI C73.11 [2]NEMA 5-15-P [3]IEC 83 [10]UL [11]CSA	Standard
	Europe 220 V/16 A	[3]ICE 83 [4]CEE (7), II, IV, VII [8]VDE [9]SEMKO	A1
	United Kingdom 240 V/13 A	[3]IEC 83 [5]BSI 1363	A2
	Australia 240 V/10 A	[6]AS C112 [12]ETSA	A3
	North America 240 V/15 A	[1]ANSI C73.20 [2]NEMA 6-15-P [3]IEC 83 [10]UL [11]CSA	A4
	Switzerland 220 V/10 A	[7]SEV	A5

[1]ANSI – American National Standards Institute
[2]NEMA – National Electrical Manufacturers' Association
[3]IEC – International Electrotechnical Commission
[4]CEE – International Commission on Rules for the Approval of Electrical Equipment
[5]BSI – British Standards Institute
[6]AS – Standards Association of Australia
[7]SEV – Schweizevischer Elektrotechischer Verein
[8]VDE – Verband Deutscher Elektrotechniker
[9]SEMKO – Swedish Institute for Testing and Approval of Electrical Equipment
[10]UL – Underwriters Laboratories
[11]CSA – Canadian Standards Association
[12]ETSA – Electricity Trust of South Australia

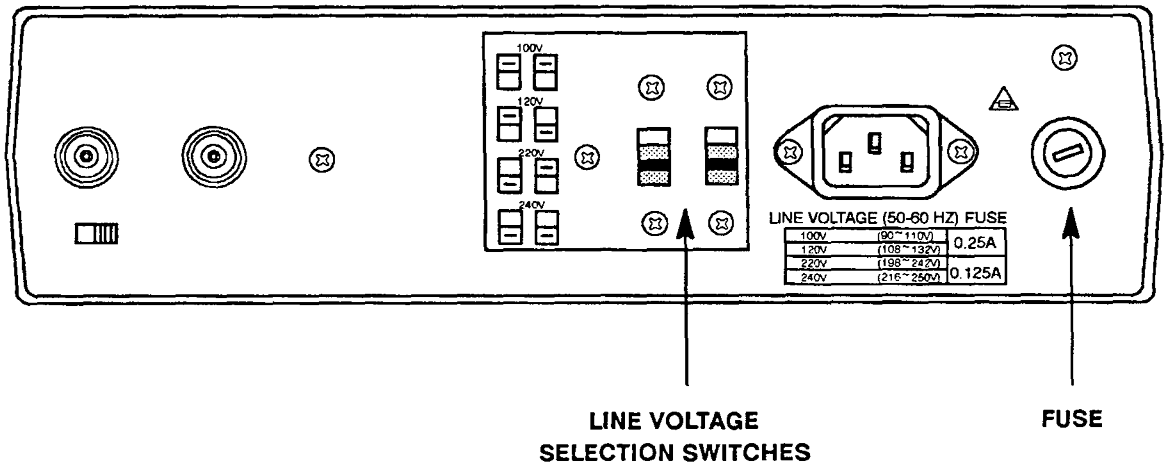


Figure 2-1: Rear Panel

Fuses

CAUTION

This instrument can be damaged if operated with the wrong line fuse installed.

WARNING

Unplug the power cord and disconnect the signal input cable from any signal source before checking or changing the fuse.

Verify the proper value of the fuse with the following procedure. Figure 2-1, Rear Panel, shows the location of the fuse.

1. Disconnect the power cord from the power-input source.
2. Press in the fuse-hold cap and release it with a slight counterclockwise rotation.
3. Pull the cap (with the attached fuse inside) out of the fuse holder.
4. Verify proper fuse value.
5. Install the proper fuse and reinstall the fuse-holder cap.

Operating Information

Before connecting a signal to any CDC250 INPUT connector, be sure to connect the counter to a properly grounded power outlet and check that the signal to be measured does not exceed the limits specified for the INPUT connector you plan to use.

Refer to the Operators manual for this instrument for measurement procedures and more operating information.

Theory Of Operation

This section contains a general description of the CDC250 175 MHz Universal Counter circuitry. General operation of the instrument is described in the section entitled Block Diagram Description. Each functional circuit is described in more detail in the section entitled Detailed Circuit Description.

The schematic diagram and the circuit board illustrations are located in the Diagrams section of this manual. To understand the circuit descriptions in this section, refer to both the Block Diagram, Figure 3-1 in this section, and to the Diagram section.

Digital Logic Conventions

Functions and operation of digital logic circuits are represented by logic symbols and terms. Most logic functions are described using the positive-logic convention. Positive logic uses a system of notation whereby the more positive of two levels is the TRUE (1) state; the more negative level is the FALSE (0) state. In this manual, the TRUE state is referred to as HIGH and the FALSE state as LOW. The voltages that constitute a high or a low state vary between specific devices. For specific device characteristics, refer to the device manufacturer's data book.

Block Diagram Description

Analog Input Circuits

The analog input circuits process the analog input signals in preparation for the digital circuits. The Channel A input circuits include the Attenuator, Input Buffer, Low Pass Filter, Preamplifier, and Amplifier/Schmitt Trigger. Channel B input circuits consist of an Attenuator, Input Buffer, and an Amplifier/Schmitt Trigger.

The Input buffers in both channels provide a high input impedance and a selectable X10 input attenuation. The Channel A signal can be passed through a selectable low-pass filter. The preamplifiers increase the input sensitivity. Channel A has a trigger circuit that can be set to either a preset level or an adjustable trigger level. Signals from both channels are squared by the amplifier/Schmitt trigger circuits, so that digital waveforms of appropriate levels are obtained.

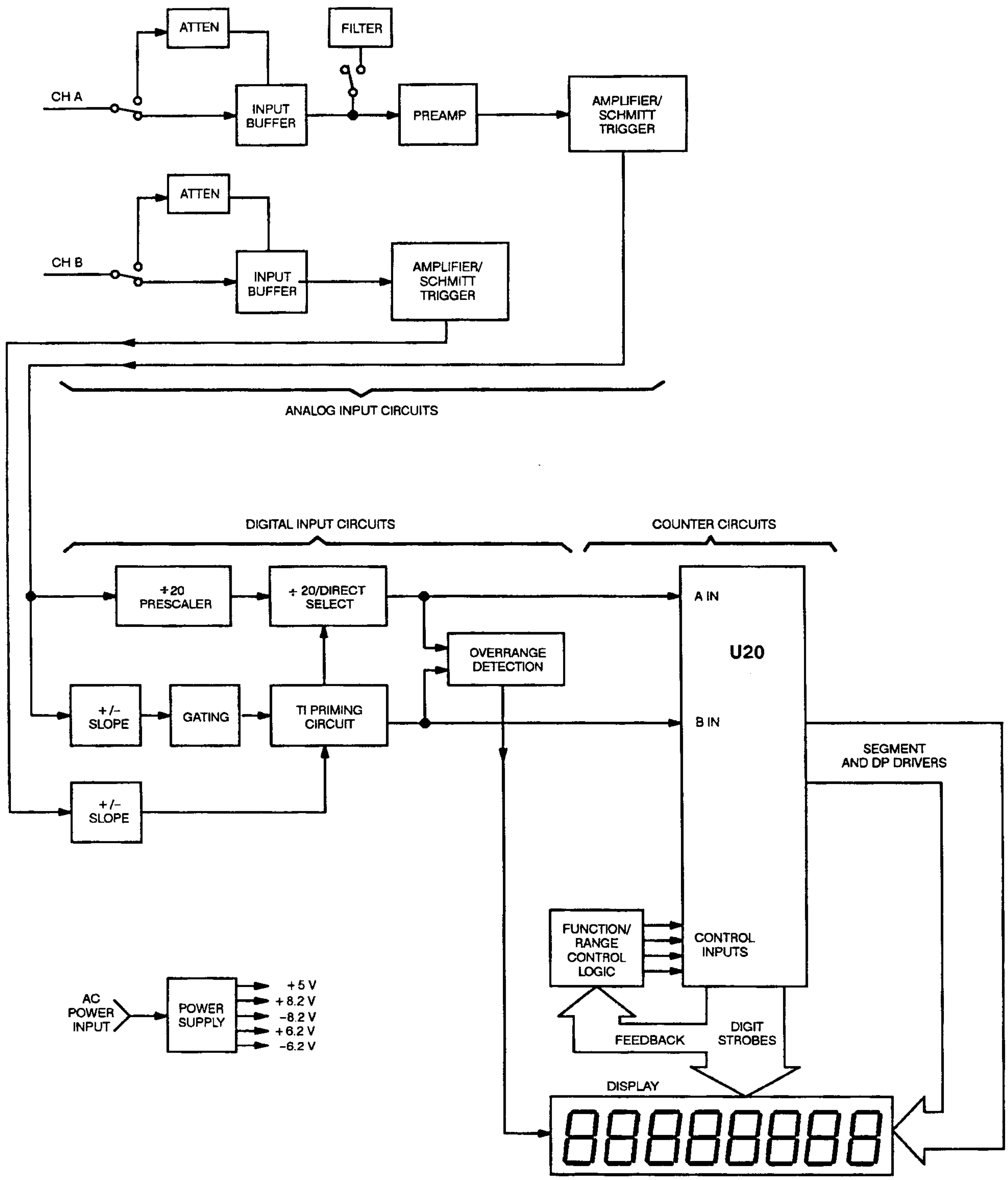


Figure 3-1: Block Diagram

Digital Input Circuits

The digital input circuits process the digital signals before they reach the counter circuits. The MHz/kHz switch determines which of two separate paths the Channel A signal will follow. When in the MHz setting, the signal is applied to a prescaler that divides by 20 to increase the frequency range of the unit. When in the kHz setting, the signal is applied to a slope selector that chooses either the signal or its complement, and a gating circuit that either passes or blocks the signal in response to a control input and a switch. The Channel B signal goes through a slope selector circuit similar to the Channel A slope selector. The Channel A signal, together with the Channel B signal, is then applied to the Time Interval priming circuit which passes both signals.

The two Channel A paths converge in a selection circuit that chooses either the original frequency or the frequency divided by 20, depending on the MHz/kHz switch setting. This signal and the signal from Channel B are applied to the counter circuits.

Counter Circuits

The counter circuits center around U20, a universal counter IC that performs all counting functions. Four control signals to the IC determine operating mode and other factors. The control signals are derived as feedback from the IC's own digit strobes (which are used as multiplex signals for the display). The feedback is selected by the front-panel switches using the control logic.

Power Supply

The power supply provides regulated voltages as shown in the block diagram. The tapped, dual-primary transformer is universal and can be selected as needed for various line voltages.

Detailed Circuit Description

Channel A Input Buffer and Attenuator

The Channel A input signal is capacitively coupled through R101 and C101 to the divider of R102 and R103. The INPUT VOLTAGE switch, S7, selects either the full voltage across the divider (button out) or only the portion of the signal across R103 (approximately one tenth of the full amount). The signal is level-clamped to a maximum of ±1.2 V by transistors Q101, Q102, Q116 and Q117. It is then applied to the high-impedance buffer stage consisting of source-follower, Q103 and Q104, which serve as a current source and level set. Transistor Q105 is used as a current source for successive stages.

Channel A Low Pass Filter

The signal is applied to the Channel A low-pass filter consisting of R112, R113, and C116, whose values set a -3 dB point of approximately 10 kHz. When the LOW PASS FILTER switch, S9, is set to ON, diodes D106 and D107 are biased on. This provides an AC path to ground through D107, and the filter action of R112, R113, and C116 is enabled. When S9 is set to OFF, D106 and D107 are off, isolating C116 from ground and disabling the filter action.

Channel A Preamplifier

The Channel A differential preamplifier consists of transistor-array IC101 and compares the input signal to a variable DC level from the TRIG LEVEL control R124. When the TRIG LEVEL control is pushed in (PUSH PRESET), S13 is closed, bringing the amplifier input at pin 4 of IC101 to approximately ground potential. The other input at pin 1 of IC101 is taken from the output of the Low Pass Filter. This signal, capacitively coupled at the Channel A input by C101, is set to a 0 DC offset in the buffer or filter stages by R111. Therefore, when applied to pin 1 of IC101, its average level remains near ground potential. As a result, when the TRIG LEVEL control is set to PRESET, the quiescent level of the differential amplifier is set at approximately the average level of the input. When the TRIG LEVEL control is not in PRESET (knob out), S13 is open and the input level at pin 4 is controlled by R124, which varies the quiescent level above or below the input average.

Channel A Amplifier

The Channel A amplifier circuit amplifies and shapes the Channel A input signal into a square wave suitable for the digital circuits. The amplifier consists of IC102 (an ECL triple-line receiver), transistors Q106 and Q107, and associated components. Pin 11 of IC102 supplies a voltage reference of 3.8 V. This voltage reference is applied to the inputs of the first amplifier, pins 9 and 10 of IC102B , through R128 and R148. A quiescent voltage difference of approximately 5 mV is set between the two inputs by variable resistor R130. This defines the minimum amount of signal required at these inputs for the waveform to be properly squared.

The second and third amplifiers, IC102A and IC102C, further square the waveform. Inputs to the third amplifier, IC102C, are the complementary outputs of the second amplifier, IC102A.

Transistors Q106 and Q107 are used as ECL-to-TTL level shifters. The waveform obtained across R141 is a 0 to 2.8 V square wave with the same polarity as the input signal.

Channel B Input Buffer and Attenuator

The Channel B input signal is capacitively coupled through C140 to the divider of R151 and R152. The Channel B INPUT VOLTAGE switch S11 selects either the full voltage across the divider or only the portion of the signal across R152 (approximately one-tenth of the Channel B input voltage). The signal is level-clamped to a maximum of ±1.2 V by transistors Q110, Q111, Q118, and Q119 and applied to the high-impedance buffer Q112. The output of Q112 is applied to Q113, which drives the amplifier/schmitt trigger circuit.

Channel B Amplifier/Schmitt Trigger

The Channel B amplifier circuit consists of IC105 (an ECL triple-line receiver), transistors Q114 and Q115, and associated components. Its operation is similar to the Channel A Amplifier.

A positive voltage of +5 V is applied to the inputs of the first amplifier, pins 9 and 10 of IC105B , through R157, R174 and R175 to define the minimum squaring level (about 5 mV). The complementary outputs are applied to the second amplifier, pins 4 and 5 of IC105A, to further square the waveform. The Schmitt trigger at pins 12 and 13 of IC105C provides a noise margin; its trigger threshold is obtained from the reference set by pin 11 through R168. R169 determines the amount of hysteresis. Transistors Q114 and Q115 are the ECL-to-TTL level shifters. The waveform at R172 is a 0–2.8 V square wave having the same polarity as the input.

Channel A/Channel B Slope Select

The positive or negative trigger slope of the Channel A and Channel B signal is selected by applying the signals through the XOR gates contained in U18. The Channel A signal is applied to pin 4 of U18B and S8 (A SLOPE) controls pin 13 to pass either the A signal or its complement to U20. The Channel B signal is applied to pin 9 of U18C and S10 (B SLOPE) controls pin 10 to pass either the B signal or its complement to U20.

Channel A Signal Gating

U1 and the HOLD switch S2 constitute a HOLD flip-flop. The Channel A signal from pin 10 of U15C is gated in U15C with the output of the voltage from the TOTALIZE START/STOP BNC on the rear panel. This permits the input to be gated, either manually or electronically, in TOTALIZE mode. R27 holds the TOTALIZE START/STOP BNC input high when no control signal is connected to the BNC.

Time Interval Priming Circuit

Before any TIME Interval measurement, U20 must be primed by a high-to-low transition of input A, followed by a similar transition of input B. In cases of repetitive input waveforms, U20 is automatically primed; however, when only one time interval is to be measured, a priming circuit is used.

The time interval priming circuit consists of three NAND gates in U8, two XOR gates in U18, two NAND gates in U1, and S1 (RESET).

When preparing to time a single event, pin 12 of U18D and pin 1 of U18A are set low. When TIME mode is selected, pressing RESET causes pin 11 of U1D to go low. When RESET is released, the inverters at pins 1-3 of U8A and pins 11-13 of U8D produce a momentary low at pin 6 of U8B. After this priming sequence of each XOR going low and high, the priming circuit resumes its steady state conditions.

Channel A Prescaler

The maximum guaranteed operating frequency of U20 is 10 MHz. To extend the frequency range to 175 MHz, the counter uses a prescaler consisting of two frequency dividers in the Channel A digital input path.

The output of pin 15 of IC102C is applied to IC103 to divide the signal by a factor of ten. The output of pin 4 of IC103 is then applied to pin 11 of U19B, to divide this signal by a factor of two.

The output of pin 9 of U19B is applied to a circuit consisting of U22B and U26. This circuit selects either the frequency-divided signal or the original-frequency signal from the priming circuit depending on the output of pin 6 of U15B This output goes high only when the MHz mode is selected. In the MHz mode, the frequency-divided signal is applied to the counter circuits.

The effect of the divide-by-two operation on the input by U19B is compensated for by U19A, another divide-by-two circuit. U19A is connected between pins 38 and 33 of U20; whenever the MHz mode is selected, this circuit divides the counter time base by two.

The effect of the divide-by-ten circuit on the input by IC103 is compensated by shifting of the display decimal point. The circuit that shifts the decimal point is discussed later in this section.

Counter U20

IC U20 performs all counting functions and multiplexes and drives the displays. U20 requires an input signal of digital logic levels, a temperature-compensated crystal oscillator (TCXO) for the time base oscillator, and external connections for feedback of display digit strobes.

Digit Strobes and Feedback

U20 multiplexes the display by means of digit strobes D1–D8. Each digit strobe goes high in sequence, as shown in Figure 3-2, turning its display digit on momentarily. As each digit is selected, the proper seven-segment and decimal point information for that digit is sent simultaneously on pins 8–11 and 13–16 of U20.

The digit strobes D1–D8 are also used to control U20 by selective feedback to four control pins: 1, 4, 20, and 21. The operating mode, resolution, and other parameters are determined by the strobe signal present at each control input. Strobe feedback is controlled by the front-panel settings, either directly or through logic.

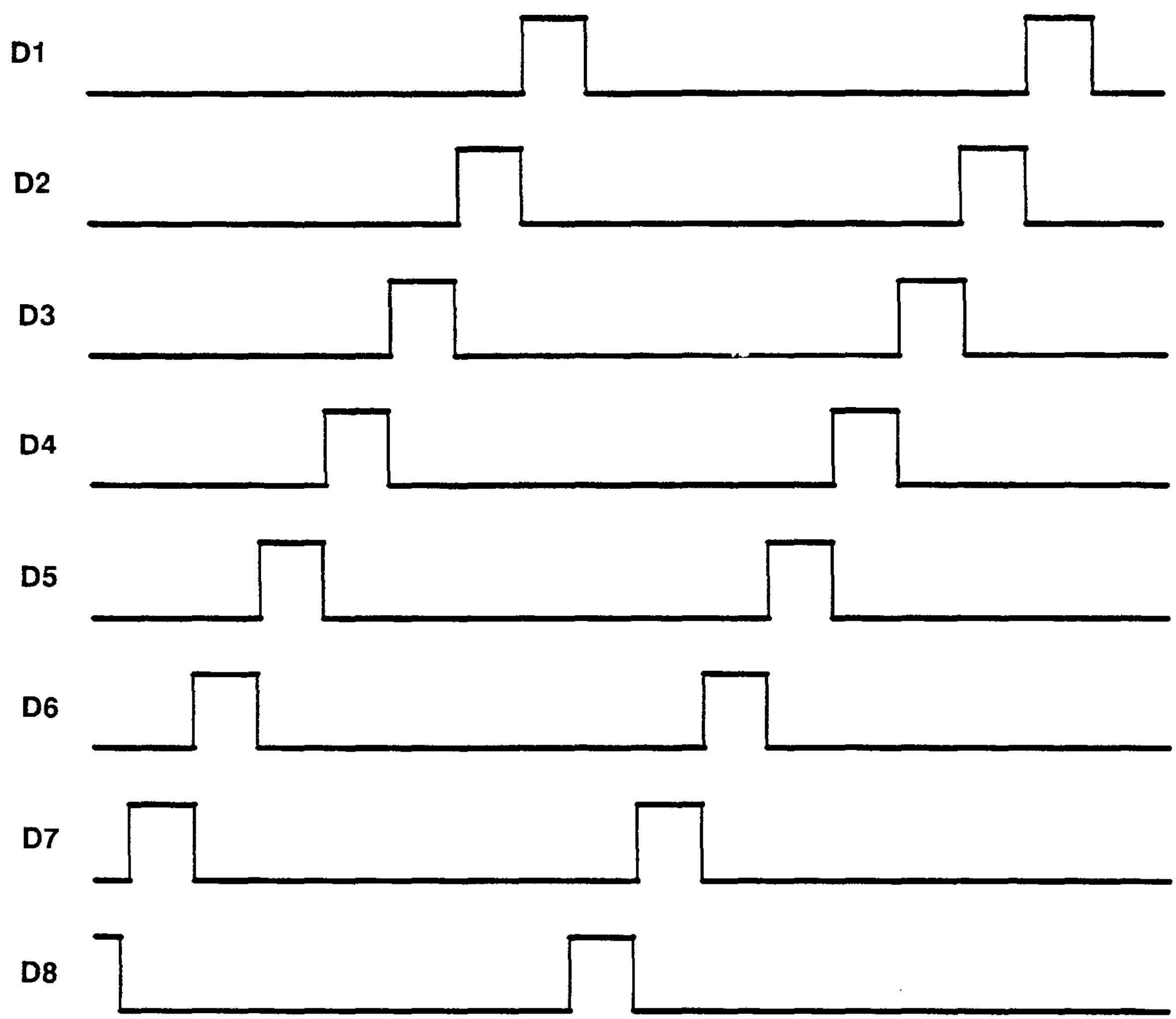


Figure 3-2: U20 Digit Strobes

Operating Mode Selection – Operating mode selection is controlled by pin 4 of U20 (FUNCtion). Figure 3-3 shows how this pin is directly connected to one of the digit strobes (D1–D5 or D8) with bilateral switches U9 and U10.

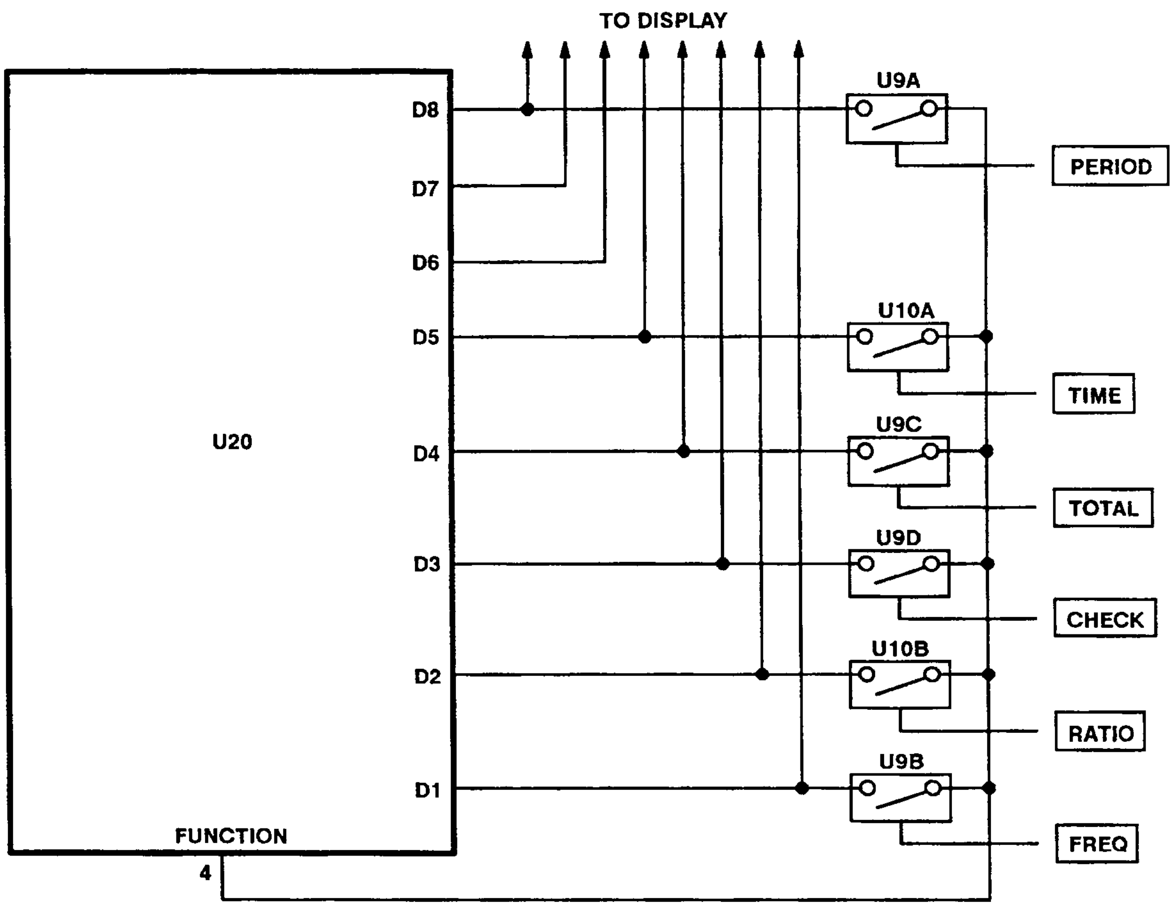


Figure 3-3: Operating Mode Selection

Resolution Selection – Resolution selection is controlled by pin 21 of U20 (RANGE). Figure 3-4 shows how this pin is directly connected to one of the digit strobes (D1–D4) with bilateral switches U7, U11, and U12.

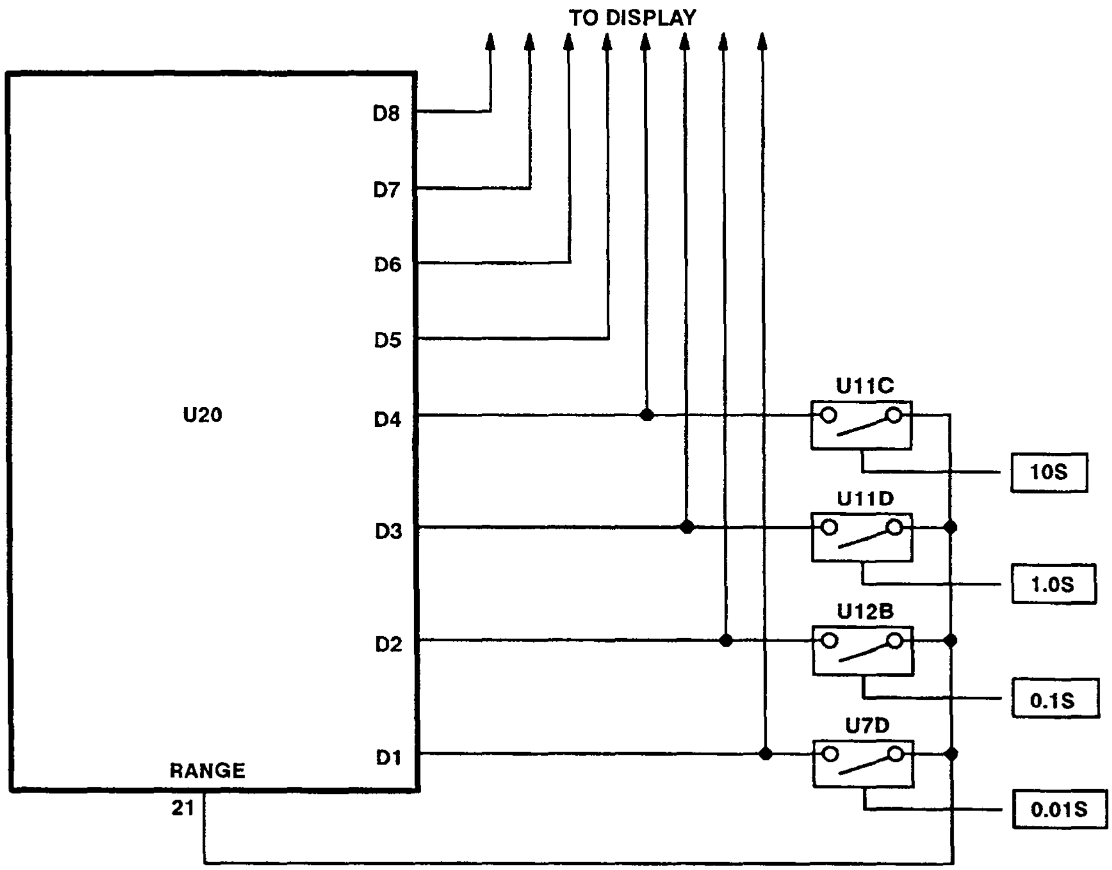


Figure 3-4: GATE (Resolution) Selection

Additional Control – Additional control of U20 is provided by feedback of strobes D1 and D3 to pin 1 of U20 (CONTROL IN). This feedback is determined by the mode selected with the front panel function selector, as shown in Figure 3-5. The outputs are used to gate the strobes to pin 1 of U20 with bilateral switches U13C and U13D.

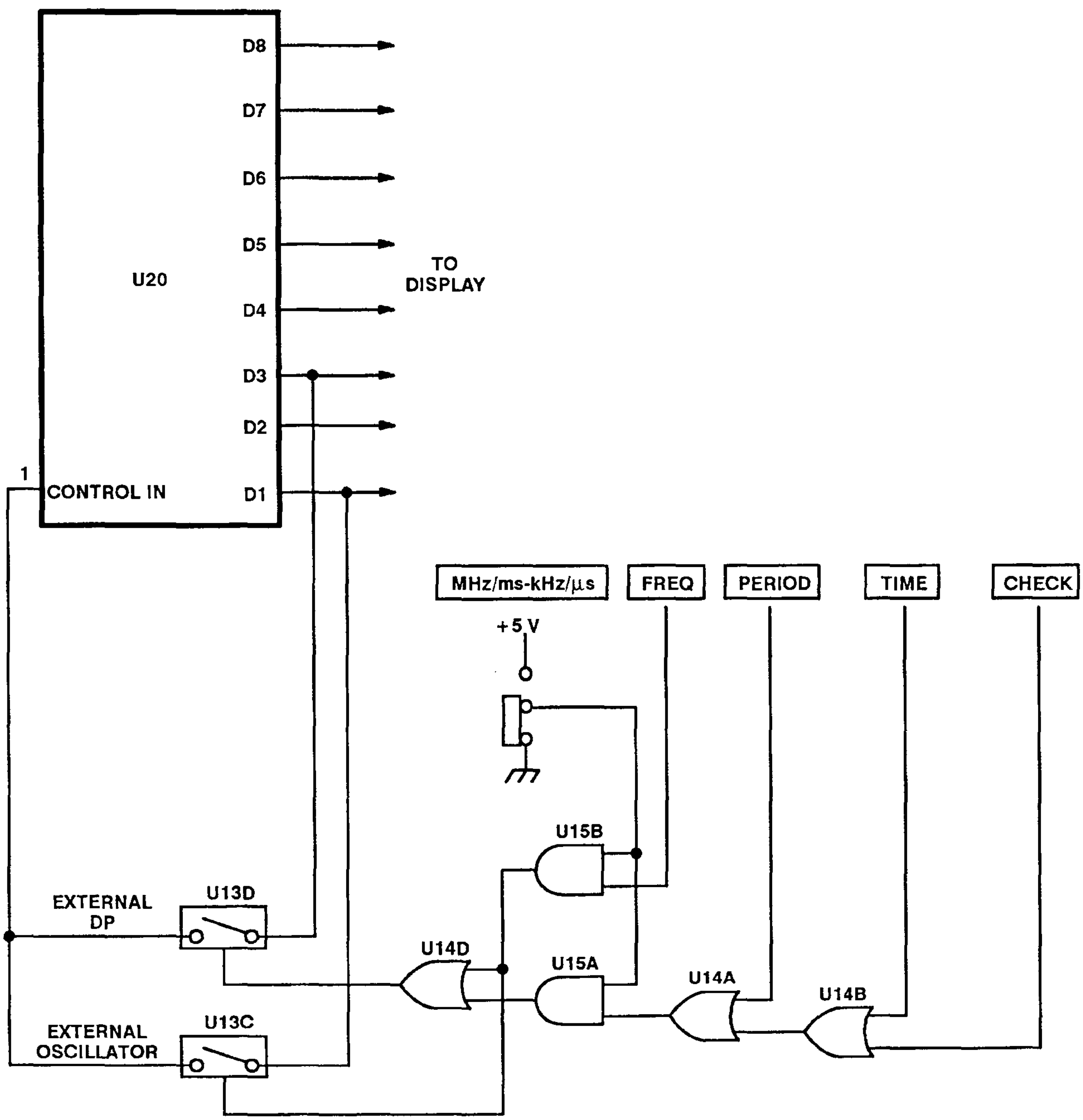


Figure 3-5: Additional Strobe Feedback

D1 is gated whenever the unit is in MHz mode. This instructs U20 to use the signal at pin 33 (EXT OSC IN) as a time base. This signal is the output of U19A, a divide-by-two circuit, whose output is the regular 5 MHz time base (BUFF OSC OUT at pin 38). Thus, whenever MHz mode is used, the time base is divided by two. This division circuit compensates for the divide-by-two circuit used in the input path.

D3 is applied to pin 1 of U20 in all MHz/ms modes except RATIO and TOTALIZE to instruct U20 to use the external decimal point control external to U20.

External Decimal Point – The decimal point is external to U20 and partially controlled by MHz/ms-kHz/µs switch S3. It is enabled in all MHz/ms except RATIO and TOTALIZE. When D3 is applied to pin 1 of U20, U20 disables automatic selection and places a decimal point at the display digit whose strobe is applied to pin 20 of U20 (EXT DP IN). The decimal position is determined by both the GATE setting and the operating mode selected by the function switch. See Figure 3-6.

Time Base

The counter uses an internal 10 MHz temperature-compensated crystal oscillator (TCXO) for increased temperature stability. The TCXO is connected to the oscillator input of pin 35 of U20 through U21A, which amplifies the input signal to a level suitable for U20. For greater stability, an external oscillator (10 MHz only) may be applied to U20 through the EXT INPUT BNC connector. The External Clock can be selected by S12 (OSCILLATOR EXT or INT) by selecting the EXT setting. This external oscillator signal is amplified by U21A, just as the internal oscillator is.

HOLD Switch

The HOLD switch S2 is connected to U20 and U15C through U1B and U1C, that provide switch debounce for S2. The connection to U20 instructs the counter to enter the display HOLD mode whenever the switch is engaged. In TOTALIZE operation, however, U20 would freeze the display and keep on counting. Connecting S2 to U15C prevents this by cutting off the input from U20 and halts the counting process. Applying a low at the TOTALIZE START/STOP BNC has the same effect.

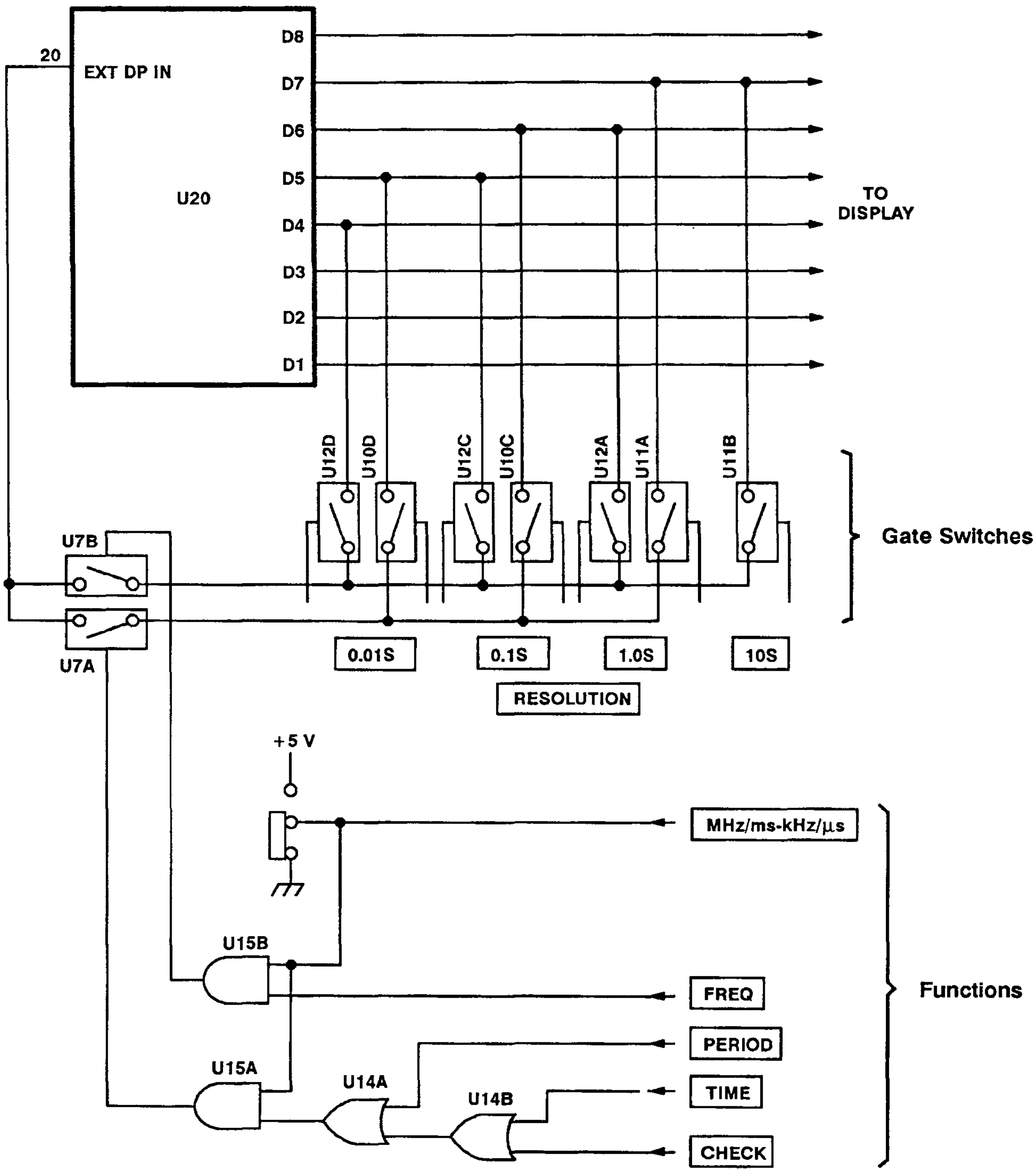


Figure 3-6: External Decimal Point Control

LED Indicators

The MHz/ms and kHz/μs indicators are connected to complementary signals that are a direct function of the setting of S3 (MHz/ms–kHz/μs switch). When in RATIO and TOTALIZE modes, the indicators are disabled when pin 8 of U14 goes high .

The GATE indicator D26 is connected to pin of 3 U20 through inverter U5D. Pin 3 of U20 goes low whenever a measurement is in progress, illuminating D26.

The FREQ, PERIOD, RATIO, TIME, TOTALIZE, and CHECK indicators (LED1-LED6) are driven by U2 using buffers U4A–F. The GATE indicators (LED7–LED10) are driven by U3 using buffers U5A, B, C, and F.

Power Supply

The transformer T1 is a universal type whose primary windings may be selected for various line voltages by the rear panel LINE VOLTAGE SELECT switches S14 and S15 and has two secondary outputs.

The output of one secondary side is rectified by D4, D5, D6, and D7 and filtered by C10 and C11. Zener diodes D10, D11, D13, and D14 provide regulated voltages of +8.2, -8.2, +6.2, and -6.2 V, respectively. Q3 produces the +5 V that provides power to the B Channel Input board.

The secondary output of the other secondary side is rectified by D8 and D9 and filtered by C12. Q1 produces the +5 V that provides power for the digital portion of the instrument.

Performance Check Procedure

This procedure checks many of the electrical characteristics listed in Table 1-2 in Section 1 of this manual. If the instrument fails to meet the requirements given in this performance check, the adjustment procedure in Section 5 should be done. This performance check may also be used as an acceptance test or as a troubleshooting aid.

You do not have to remove the instrument case to do this procedure. All checks can be made using the controls and connectors accessible from the outside of the counter.

To ensure instrument accuracy, check its performance after every 2000 hours of operation, or once each year if used infrequently. If these checks indicate a need for readjustment or repair, refer the instrument to a qualified service person.

Test Equipment Needed

The test equipment listed in Table 4-1 is a complete list of the equipment needed for this performance check and the adjustment procedure in Section 5. All test equipment is assumed to be operating within tolerance. Detailed operating instructions for test equipment are not given in this procedure. If operating information is needed, refer to the appropriate test equipment instruction manual.

Table 4-1: Test Equipment Required

Item	Minimum Specification	Purpose
Oscilloscope	Bandwidth: DC to 20 MHz. (Suitable equipment: TEKTRONIX 2225 50 MHz Oscilloscope or TEKTRONIX 2205 20 MHz Oscilloscope.)	Frequency and sensitivity checks and trigger level adjustment.
Function Generator	Range: 10 Hz to 2 MHz. (Suitable equipment: TEKTRONIX CFG250 2 MHz Function Generator.)	Frequency check and trigger level adjustment.
Leveled Signal Generator[a]	Range: 50 kHz to 175 MHz. (Suitable equipment: TEKTRONIX SG 503 Signal Generator.)	Frequency and sensitivity checks and trigger level adjustment.
Frequency Standard	Accuracy: At least 5 parts in 10 million (0.5 ppm).	Time base accuracy check and time base adjustment.

[a]Requires a TM 500 power module.

Table 4-1: Test Equipment Required (Cont.)

Item	Minimum Specification	Purpose
50 Ω Coaxial Cable (2 required)	50 Ω, BNC. Tektronix part number 012-0057-01.	Signal interconnection.
10X Attenuator	50 Ω, BNC. Tektronix part number 011-0059-02.	Frequency check.
Digital Multimeter[b]	Range: 0 to at least 300V. DC voltage accuracy: ±(0.5% of reading + 1 digit). (Suitable equipment: TEKTRONIX CDM250 Digital Multimeter.)	Channel A sensitivity adjustment.
Dual Input Coupler	BNC female-to-dual-BNC male. Tektronix part number 067-0525-02.	Channel B time interval adjustment.
50 Ω BNC Termination (2 required)	50 Ω, BNC. Tektronix part number 011-0049-01.	Signal interconnection.
Alignment Tool[b]	Length: 1 in. shaft. Bit size: 3/32 in. Tektronix part number 003-0675-00.	Trigger level adjustment.

[b]**Needed for Calibration only.**

Preparation

1. Ensure that all test equipment and the CDC250 power switches are off.
2. Ensure that all test equipment and the CDC250 are suitably adapted to the line voltage to be applied.
3. Connect the equipment under test and the test equipment to a suitable line voltage source. Turn all equipment on and allow at least one hour for the equipment to warm up and stabilize.
4. Set the CDC250 controls as follows during warm-up time:

CHANNEL A INPUT VOLTAGE	50mV–5V (LO) (button out)
CHANNEL A LOW PASS FILTER	OFF (button out)
MHz/ms–kHz/μs	kHz/μs (button out)
SLOPE (both)	+ (button out)
TRIG LEVEL	PRESET (knob in)

Performance Checks

☐ **Step 1: Check GATE (Resolution) Settings and Display Using CHECK Mode**

a. Set CDC250 function to CHECK and set the GATE to 1/0.01s.

b. *Check* that CDC250 display reads 10000.0 ± 1 (9999.9 to 10000.1) kHz (kHz indicator is on) and the GATE indicator light is flashing on and off.

c. Press CDC250 HOLD (button in) and *Check* that the GATE indicator light remains off. Press HOLD again to release (button out) and *Check* that the GATE indicator resumes flashing.

d. Hold the CDC250 RESET button in and *Check* that the display reads .0 and the GATE indicator light is off. Release the RESET button and *Check* that the display reads 10000.0 and GATE indicator resumes flashing.

e. Set GATE to 10/0.1s.

f. *Check* that the CDC250 display reads 10000.00 ± 1 (9999.99 to 10000.01) kHz (kHz indicator is on) and the GATE indicator is flashing on and off. The rate of flashing should now be slower than it was at the previous GATE setting.

g. Set the CDC250 GATE to 100/1.0s.

h. *Check* that the display reads 10000.000 ± 1 (9999.999 to 10000.001) kHz and the GATE indicator is flashing on and off; flashing should now be slower than it was at the previous GATE setting.

i. Set the GATE to 1000/10s.

j. *Check* that the CDC250 display reads 0000.0000 ± 1 (9999.9999 to 0000.0001) kHz and the OVERRANGE indicator is lit (0000.0000 or 0000.0001). *Check* that the GATE indicator is flashing on and off. The rate of flashing should now be slower than it was at the previous GATE setting.

NOTE

At this slower GATE setting, you will notice a delay after you select the 1000/10s GATE setting and before the display changes.

☐ **Step 2: Check Channel A Frequency Range and Sensitivity**

a. Set:

FUNC	FREQ
MHz/ms-kHz/µs	kHz/µs (button out)
GATE	100/1.0s

b. Connect the function generator to the input of the test oscilloscope using a 50 Ω coaxial cable,10X attenuator, and a 50 Ω termination.

c. Set the function generator to1 kHz.

d. Adjust the function generator output amplitude for 150 mV p-p sine-wave.

e. Disconnect the function generator from the test oscilloscope and connect it to the CDC250 CHANNEL A INPUT connector.

f. Reduce the frequency from the function generator to 10 Hz.

g. *Check* that the CDC250 triggers on 10 Hz.

h. Set the CDC250 MHz/ms-kHz/μs switch to MHz/ms.

i. Disconnect the function generator from the CDC250.

j. Connect the signal generator to the input of the test oscilloscope using a 50 Ω coaxial cable,10X attenuator, and a 50 Ω termination.

k. Adjust the signal generator to produce a 50 kHz, 150 mV p-p output.

l. Disconnect the signal generator from the test oscilloscope and connect it to the CDC250 CHANNEL A INPUT connector.

m. Increase the frequency of the signal generator to 175 MHz.

n. *Check* that the CDC250 will trigger.

o. Decrease the frequency of the signal generator to 1 MHz.

p. Set the Channel A LOW PASS FILTER button to ON (button in).

q. *Check* that the CDC250 does not trigger.

r. Set the Channel A LOW PASS FILTER to OFF (button out) and set the Channel A INPUT VOLTAGE button to 3 V–42 V(HI) (button in).

s. Disconnect the signal generator from the CDC250.

t. Connect the signal generator to the test oscilloscope using a 50 Ω coaxial cable and adjust the output amplitude for 8.4 V p-p.

u. Disconnect the cable from the test oscilloscope and connect it to the CDC250 CHANNEL A INPUT connector.

v. *Check* that the CDC250 triggers on 1 MHz.

w. Disconnect the test setup.

☐ Step 3: Check PERIOD Operation

a. Set:

FUNC	PERIOD
MHz/ms-kHz/μs	kHz/μs (button out)

b. Connect the signal generator to the test oscilloscope using a 50 Ω coaxial cable and a 50 Ω termination.

c. Adjust the signal generator to for a 2 MHz, 150 mV p-p sine-wave output.

d. Disconnect the signal generator from the test oscilloscope and connect it to the CDC250 CHANNEL A input connector.

NOTE

The accuracy of the following check is dependant on the accuracy of the output frequency from the signal generator.

e. *Check* that the CDC250 display reads approximately 0.500 μs.

f. Disconnect the test setup.

☐ **Step 4: Check RATIO Operation**

a. Set the CDC250 function to RATIO.

b. Connect the signal generator to the test oscilloscope using a 50 Ω coaxial cable and a 50 Ω termination.

c. Adjust the signal generator to produce a 10 MHz, 150 mV p-p sine-wave output.

d. Disconnect the signal generator from the test oscilloscope and connect it to the CDC250 CHANNEL A input connector.

e. Connect the function generator to the test oscilloscope using a 50 Ω coaxial cable and 50 Ω termination.

f. Adjust the function generator to produce a 2 MHz, 150 mV p-p sine-wave output.

g. Disconnect the function generator from the test oscilloscope and connect it to the CDC250 CHANNEL B input connector.

NOTE

The accuracy of the following check is dependant on the accuracy of the output frequency from the signal generator and function generator.

h. *Check* that the CDC250 display reads approximately 5.00.

☐ Step 5: Check the TIME operation

NOTE

The accuracy of the following checks are relative to the duty cycle of the period of the square-wave from the function generator. Ideal for this check is 50% high/50% low.

a. Set:

FUNC	TIME
MHz/ms-kHz/μs	kHz/μs (button out)
GATE	1000/10s
SLOPE (both)	+ (buttons out)

b. Connect the function generator to the test oscilloscope using a 50 Ω coaxial cable and a 50 Ω termination.

c. Adjust the function generator to produce a 1 kHz, 150 mV p-p square-wave output.

d. Disconnect the function generator from the test oscilloscope and connect it to the CDC250 CHANNEL A and CHANNEL B input connectors using the 50 Ω coaxial cable, 50 Ω termination, and adding a dual input coupler.

e. *Check* that the CDC250 display reads approximately 1000 μs.

f. Set the CDC250 CHANNEL A SLOPE and CHANNEL B SLOPE to – (minus) (buttons in).

g. *Check* that the CDC250 display reads approximately 1000 μs.

h. Set the CDC250 CHANNEL A SLOPE to + (positive) (button out).

i. *Check* that the CDC250 display reads approximately 500 μs.

j. Disconnect the test setup.

☐ Step 6: Check TOTALIZE Operation

a. Set:

FUNC	TOTALIZE

b. Connect the function generator to the test oscilloscope using a 50 Ω coaxial cable and a 50 Ω termination.

c. Adjust the function generator to produce a 10 Hz, 150 mV p-p square-wave output.

d. Disconnect the function generator from the test oscilloscope and connect it to the CDC250 CHANNEL A input connector.

e. *Check* that the CDC250 display is counting.

f. Press the CDC250 RESET button and check that the display resets to 0.

g. Press in the CDC250 HOLD button and *Check* that the display stops counting.

h. Press the CDC250 HOLD button again (button out) and *Check* that the display continues to count.

i. Disconnect the test setup.

☐ **Step 7: Check Time Base Accuracy**

a. Set:

FUNC	FREQ
MHz/ms-kHz/μs	kHz/μs (button out)
GATE	100/1s

b. Connect a 10 MHz, 150 mV p-p signal from the frequency standard to the CDC250 CHANNEL A INPUT connector.

c. *Check* that the CDC250 display reads 10000.000 kHz ±2 (9999.998 to 10000.002 kHz).

d. Disconnect the test setup.

Adjustment Procedure

There are five calibration adjustments – the Channel A Sensitivity adjustment, the Channel A Trigger Level adjustment, the Channel B Time Interval adjustment, the Channel B Ratio adjustment, and the TCXO Time Base adjustment. To ensure instrument accuracy, the Channel A Sensitivity and Trigger Level adjustments and the Channel B Time Interval and Ratio adjustments should be done every 2000 hours of operation or at least once each year if used infrequently. Do not attempt to do the Time Base adjustment unless you have a standard frequency source with a known accuracy of at least one part in ten million (0.1 ppm).

Preparation for Adjustment

Make the adjustments in this procedure at an ambient temperature of 18°C to 28°C and a relative humidity of 70% of less.

It is necessary to remove the top of the instrument cabinet to access the component side of the Main circuit board. Disconnect the power cord from the CDC250 and follow the cabinet removal instructions in the Maintenance section of this manual.

Test equipment needed for these adjustments is described in Table 4-1 at the beginning of the Performance Check Procedure. Refer to the appropriate test equipment instruction manuals for test equipment operating information.

Connect the test equipment and the CDC250 to a suitable AC-power source and allow a one-hour warm-up period before making adjustments to the CDC250.

Procedures

☐ **Step 1: Adjust Channel A Sensitivity (R111 and R130)**

a. Set the CDC250 front-panel push buttons as follows:

FUNC	FREQ
GATE	1.0s
MHz/ms–kHz/μs	MHz/ms (button in)
TRIG LEVEL	PUSH PRESET (knob in)
INPUT VOLTAGE (both channels)	50mV–5V (LO) (button out)
SLOPE (both channels)	+ (button out)
LOW PASS FILTER	OFF (button out)

b. Connect the signal generator to the vertical input of the test oscilloscope using a BNC cable and a 50 Ω termination.

c. Set the oscilloscope to measure 50 mV per division.

d. *Adjust* the signal generator to display a 50 kHz, 280 mV p-p sine-wave output (5.6 divisions at 50 mV per division).

e. Disconnect the cable from the test oscilloscope and connect it to the CDC250 CHANNEL A INPUT connector.

f. *Adjust* the frequency of the signal generator to 175 MHz and *Check* that the CDC250 displays the correct reading. If the reading is correct, go to part m; if it is not correct, continue with part g.

g. Disconnect the signal generator from the CDC250.

h. Set the digital multimeter to measure DC Voltages and connect the positive lead of the multimeter to test point TP101 on the Main board and connect the negative lead to ground.

i. *Check* for a DC Voltage reading of 0 to 3 mV at TP101. If the reading at TP101 is correct, disconnect the digital multimeter and go to part k. If the reading exceeds 3 mV, continue with part j.

j. *Adjust* R111 on the Main board for a DC voltage reading of 0 to 3 mV.

k. Repeat parts b through f.

l. *Adjust* R130 on the Main board clockwise until the CDC250 starts to display an incorrect reading and note the position of R130. Next, *Adjust* R130 counterclockwise until the CDC250 again starts to display an incorrect reading and note this position of R130. *Adjust* R130 to the mid point between the two positions just determined.

m. Disconnect the signal generator from the CDC250 and connect it to the vertical input of the test oscilloscope.

n. Set the oscilloscope to measure 50 mV per division.

o. *Adjust* the signal generator to display a 50 kHz, 250 mV p-p sine-wave output (5 divisions at 50 mV per division).

p. Disconnect the signal generator from the test oscilloscope and connect it to the CDC250 CHANNEL A INPUT connector.

q. *Adjust* the signal generator to 175 MHz and *Check* that the CDC250 displays the correct reading. If the reading is correct, go to part s; if it is not correct, continue with part r.

r. *Adjust* R130 slightly and, if necessary, *Adjust* R111 slightly for correct readings.

s. Repeat adjustment steps l through r until you get the best sensitivity; increasing the input level from 250 mV to 420 mV p-p.

t. Disconnect the test equipment.

☐ Step 2: Adjust Channel A Trigger Level (B147 and RPS)

a. Set the CDC250 front-panel push buttons as follows:

FUNC	FREQ
MHz/ms–kHz/μs	kHz/μs (button out)
TRIG LEVEL	PUSH PRESET (knob in)
INPUT VOLTAGE (both channels)	50mV–5V (LO) (button out)
SLOPE (both channels)	+ (button out)
LOW PASS FILTER	OFF (button out)

b. Connect the function generator to the vertical input of the test oscilloscope using a 50 Ω BNC cable and a 50 Ω termination.

c. Set the oscilloscope to measure 0.5 V per division.

d. *Adjust* the function generator to display a 10 kHz, 3.9 V p-p sine-wave output (7.8 divisions at 0.5 V per division).

e. Disconnect the cable from the test oscilloscope and connect it to the CDC250 CHANNEL A INPUT connector.

f. Pull out the CDC250 TRIG LEVEL knob (variable mode) and rotate it fully clockwise.

g. Set R147 on the CH B Input board to its counterclockwise position; then *Adjust* R125 on the Main board until the CDC250 displays a reading of 10 kHz.

h. Disconnect the cable from the CDC250 and connect it to the vertical input of the test oscilloscope.

i. *Adjust* the function generator's output to 3.6 V p-p (7.2 divisions at 0.5 V per division). Reconnect the cable from the function generator to the CHANNEL A INPUT connector of the CDC250.

j. *Readjust* R125 for a 10 kHz display while changing the CDC250 TRIG LEVEL control to both its fully clockwise and fully counterclockwise positions.

k. Repeat part j until no further adjustment is possible.

l. Disconnect the cable from the CDC250 and connect it to the vertical input of the test oscilloscope.

m. *Adjust* the function generator to display a 3.1 V p-p sine-wave output (6.2 divisions at 0.5 V per division). Rotate the CDC250 TRIG LEVEL control fully counterclockwise.

n. *Adjust* R147 until the CDC250 displays a reading of 10 kHz.

o. *Check* that CDC250 display still reads 10 kHz when the TRIG LEVEL control is rotated fully clockwise. If not, repeat parts h through n until the display reads 10 kHz in both fully clockwise and fully counterclockwise TRIG LEVEL control settings.

p. Disconnect test equipment.

☐ Step 3: Adjust Channel B TIME Interval Accuracy (R175)

a. Set the CDC250 front-panel push buttons as follows:

FUNC	PERIOD
MHz/ms-kHz/μs	kHz/μs (button out)
GATE	0.01s
TRIG LEVEL	PUSH PRESET (knob in)
INPUT VOLTAGE (both channels)	50mV–5V (LO) (button out)
SLOPE (both channels)	+ (button out)
LOW PASS FILTER	OFF (button out)

b. Connect the function generator to the vertical input of the test oscilloscope using a 50 Ω BNC cable and a 50 Ω termination.

c. Set the test oscilloscope to measure 20 mV per division.

d. *Adjust* the function generator to display a 5 Hz, 80 mV square-wave output (4 divisions at 20 mV per division).

e. Disconnect the function generator from the test oscilloscope.

f. Connect the function generator to both the CHANNEL A and CHANNEL B INPUTS of the CDC250 by adding a dual input coupler to the 50 Ω termination.

g. Note the PERIOD given in the display of the CDC250. Set the function to TIME.

h. *Check* That the TIME interval reading is within 1% of the PERIOD reading noted in part g. *Adjust* R175 on the CH B Input board if needed. Note the TIME reading displayed.

i. Set SLOPE switches of both the A and B channels to – (minus).

j. *Check* that the TIME reading displayed remains within 1% of the PERIOD reading noted in part g. *Adjust* R175 if needed.

k. Set CHANNEL A SLOPE to + (plus).

l. *Check* that the TIME reading displayed is within 1% of one-half of the reading noted in part h. *Adjust* R175 if needed.

m. Set CHANNEL A SLOPE to – (minus) and CHANNEL B SLOPE to + (plus).

n. *Check* that the TIME reading displayed is within 1% of one-half of the reading noted in part h. *Adjust* R175 if needed.

o. Repeat parts g through n until all readings displayed are correct.

p. Disconnect test equipment.

☐ **Step 4: Adjust Channel B RATIO Accuracy (R179)**

a. Set the CDC250 front-panel push buttons as follows:

FUNC	RATIO
MHz/ms-kHz/μs	MHz/ms (button in)
GATE	1.0s
TRIG LEVEL	PUSH PRESET (knob in)
INPUT VOLTAGE (both channels)	50mV-5V (LO) (button out)
SLOPE (both channels)	+ (button out)
LOW PASS FILTER	OFF (button out)

b. Connect the signal generator to the vertical input of the test oscilloscope using a 50 Ω BNC cable and a 50 Ω termination.

c. Set the test oscilloscope to display 10 mV per division.

d. *Adjust* the signal generator to display a 10 MHz, 50 mV sine-wave output (5 divisions at 10 mV per division).

e. Disconnect the cable from the test oscilloscope and connect it to the CDC250 CHANNEL A INPUT connector.

f. Connect the function generator to the vertical input of the test oscilloscope using a 50 Ω BNC cable and a 50 Ω termination.

g. *Adjust* the function generator to produce a 2 MHz, 30 mV sine-wave output (3 divisions at 10 mV per division).

h. Disconnect the function generator from the test oscilloscope and connect it to the CDC250 CHANNEL B INPUT connector.

NOTE

The accuracy of the following check is directly related to the frequency accuracy of the signal generator and function generator outputs.

i. *Check* that the CDC250 display reads 5.00 ±4.3% (4.78 to 5.22).

j. *Adjust* R179 on the CH B Input board until the reading is correct.

k. Disconnect the test equipment.

☐ Step 5: Adjust Time Base (TCXO)

NOTE

Do not attempt to adjust the Time Base unless you have a standard frequency source having a known accuracy of at least one part in ten million (0.1 ppm).

The CDC250 has an accuracy of one part per ten million. This means an error of one cycle when reading a 10 MHz (eight digit) signal. Most signal sources are not stable enough nor accurate enough for this error to be meaningful.

a. Set the CDC250 front-panel push buttons as follows:

FUNC	FREQ
GATE	1.0s
MHz/ms-kHz/µs	kHz/µs (button out)
TRIG LEVEL	PUSH PRESET (knob in)
INPUT VOLTAGE (both channels)	50mV-5V (LO) (button out)
SLOPE (both channels)	+ (button out)
LOW PASS FILTER	OFF (button out)

b. Loosely, place the top cover of the CDC250 back on the instrument.

c. Allow one hour for the CDC250 to warm up.

d. Connect a 10 MHz frequency standard of known accuracy (at least one part in ten million) to the CHANNEL A INPUT connector.

e. *Adjust* TCXO on the PAL board through the time base adjust hole in the TCXO shield, using a non-metallic alignment tool. *Adjust* for a display of 10000.000 ±2 counts.

NOTE

If you wish to adjust the time base for even greater accuracy, set the GATE switch to 10s and Adjust TCXO until the display reads 0000.0000 with the OVERRANGE indicator lit.

f. Disconnect the test equipment.

Maintenance

This section of the manual contains information on static-sensitive components, preventive maintenance, troubleshooting, and corrective maintenance.

Static-Sensitive Components

The following precautions apply when performing any maintenance involving internal access to the instrument.

CAUTION

Static discharge can damage any semiconductor component in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. Table 6-1 lists the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

When performing maintenance, observe the following precautions to avoid component damage:

1. Minimize handling of static-sensitive components.
2. Transport and store static-sensitive components or assemblies in their original containers or on a metal rail. Label any package that contains static-sensitive components or assemblies.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these components. Servicing static-sensitive components or assemblies should be performed only at a static-free work station by qualified service personnel.
4. Keep anything capable of generating or holding a static charge off the work station surface.
5. Keep the component leads shorted together whenever possible.
6. Pick up components by their bodies, never by their leads.
7. Do not slide the components over any surface.
8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.
9. Use a soldering iron that is connected to earth ground.
10. Use only approved antistatic, vacuum-type desoldering tools for component removal.

Table 6-1: Relative Susceptibility to Static-Discharge Damage

Semiconductor Classes	Relative Susceptibility Levels[a]
MOS or CMOS microcircuits or discretes, or linear microcircuits with MOS inputs (Most Sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFET	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (Least Sensitive)	9

[a]Voltage equivalent for levels (voltage discharged from a 100 pF capacitor through resistance of 100 Ω):

1 = 100 to 500 V
2 = 200 to 500 V
3 = 250 V
4 = 500 V
5 = 400 to 600 V
6 = 600 to 800 V
7 = 400 to 1000 V (est.)
8 = 900 V
9 = 1200 V

Preventive Maintenance

Preventive maintenance consists of cleaning, inspection, and checking instrument performance. Preventive maintenance done on a regular basis may prevent some instrument problems and improve reliability. The required frequency of regular maintenance depends on the environment in which the instrument is used. A good time to do preventive maintenance is just before instrument adjustment.

Inspection and Cleaning

Inspect and clean the CDC250 as often as operating conditions require. Dirt inside the instrument can cause overheating and component breakdown because dirt insulates and prevents heat dissipation. It also provides an electrical conduction path that could result in instrument failure, especially under high-humidity conditions.

CAUTION

Do not use chemical cleaning agents which might damage the plastics used in this instrument. Use a nonresidue-type cleaner, preferably isopropyl alcohol or a solution of 1% mild detergent and 99% water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

Exterior Inspection – Inspect the external parts of the instrument for damage, wear, and missing parts; use Table 6-2 as a guide. Instruments that appear to have been dropped or abused should be checked for correct operation. Defects that could cause personal injury or could further damage the instrument should be repaired at once.

CAUTION

Do not allow moisture to get inside the instrument during external cleaning. Use only enough liquid to dampen the cloth or applicator.

Exterior Cleaning – Dust on the outside of the instrument can be removed with a soft cloth or small soft-bristle brush. The brush is useful on and around controls and connectors. Remove remaining dirt with a soft cloth dampened in a mild detergent-and-water solution. Do not use abrasive cleaners.

WARNING

To avoid electrical shock, disconnect the instrument from the AC power source before inspecting or cleaning the internal circuitry.

To clean or inspect the inside of the instrument, first refer to the removal and replacement instructions in the Corrective Maintenance part of this section.

Interior Inspection – Inspect the internal parts of the CDC250 for damage and wear, using Table 6-3 as a guide. Repair any problems immediately. The repair method for most visible defects is obvious, but take particular care if heat-damaged components are found. Since overheating usually indicates other trouble in the instrument, the cause of overheating must be found and corrected to prevent further damage.

CAUTION

To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the instrument.

Interior Cleaning – To clean the interior, blow off dust with dry, low-pressure air (approximately 9 psi). Remove any remaining dust with a soft brush or a cloth dampened with a solution of mild detergent and water. A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.

Semiconductor Checks – Periodic checks of the transistors and other semiconductors in this instrument are not recommended. The best check of semiconductor performance is actual operation in the instrument.

Table 6-2: External Inspection Checklist

Item	Inspect For	Repair Action
Front-Panel Buttons	Missing, damaged, or loose buttons.	Repair or replace missing or defective items.
Front- and Rear-Panel Connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Replace Front- or Rear-Panel assembly or replace defective parts. Clean or wash out dirt.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.	Replace damaged or missing items, frayed cables, and defective parts.

Table 6-3: Internal Inspection Checklist

Item	Inspect For	Repair Action
Circuit Boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Replace circuit board assembly or repair as follows: Clean solder corrosion with an eraser and flush with isopropyl alcohol. Resolder defective connections. Determine cause of burned items and repair. Repair defective circuit runs.
Resistors	Burned, cracked, broken, or blistered.	Replace circuit board assembly or repair as follows: Replace defective resistors. Check for cause of burned component and repair as necessary.
Solder Connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Replace circuit board assembly or repair as follows: Replace defective capacitors. Clean solder connections and flush with isopropyl alcohol.
Semiconductors	Loosely inserted in sockets. Distorted pins.	Firmly seat loose semiconductors. Remove devices having distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack the pins, causing them to break.
Wiring and Cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace defective wires or cables or replace assembly.
Chassis	Dents, deformations, and damaged hardware.	Replace defective assembly or straighten, repair, or replace defective hardware.

Troubleshooting

Preventive maintenance done on a regular basis should reveal most potential problems before an instrument fails. However, should troubleshooting be needed, the following information will help to locate the problem. Also, the Theory of Operation and the Diagrams sections of this manual may help with troubleshooting.

Troubleshooting Aids

Schematic Diagram – A schematic diagram is located in the Diagrams section. Portions of circuitry mounted on each circuit board are enclosed by heavy black lines. The assembly number and name(s) of the circuit(s) are shown near the top or the bottom edge of the diagram.

Functional blocks on the schematic diagram are outlined with a wide line. Components within the outlined area perform the function named by the block label.

Component numbers and electrical values of components in this instrument are shown on the schematic diagram. Refer to the first page of the Diagrams section for the reference designators and symbols used to identify components.

Circuit Board Illustrations – Circuit board illustrations in the Diagrams section show the physical location of each component.

Grid Coordinate System – The schematic diagram and circuit board illustrations have grid borders along their left and top edges. The grid coordinates for the components are given in an accompanying table.

Component Color Coding – An illustration at the beginning of the Diagrams section gives information about color codes and markings on resistors and capacitors.

- **RESISTORS.** Resistors used in this instrument are carbon-film, composition, or precision metal-film types. They are usually color coded with the EIA color code; however, some metal-film type resistors may have the value printed on the body. The color code is interpreted starting with the stripe nearest to one end of the resistor. Composition resistors have four stripes; these represent two significant digits, a multiplier, and a tolerance value. Metal-film resistors have five stripes representing three significant digits, a multiplier, and a tolerance value.
- **CAPACITORS.** Common disc capacitors and small electrolytics have capacitance values marked on the side of the capacitor body. White ceramic capacitors are color coded in picofarads, using a modified EIA code. Dipped tantalum capacitors are color coded in microfarads. The color dot indicates both the positive lead and the voltage rating. Since these capacitors are easily destroyed by reversed or excessive voltage, be careful to observe the polarity and voltage rating when replacing them.

- **DIODES.** The cathode end of each glass-encased diode is indicated by either a stripe, a series of stripes, or a dot. The cathode and anode ends of a metal-encased diode may be identified by the diode symbol marked on its body.

Semiconductor Lead Configurations – The second figure in the Diagrams section shows some typical lead configurations for semiconductor devices that may be used in this instrument. If a semiconductor does not seem to match the configurations shown, consult a manufacturer's data sheet.

Troubleshooting Techniques

When troubleshooting the CDC250, be sure to read the troubleshooting techniques given here before going on to CDC250 Troubleshooting Tips. The troubleshooting methods described in this procedure are general techniques that should be used together with the more specific CDC250 Troubleshooting Tips.

This procedure is arranged to check simple trouble possibilities before doing more extensive troubleshooting.

When a defective component is located, either replace the assembly containing the defective part or replace the component by using the appropriate replacement procedure given in Corrective Maintenance. Replacement assemblies are available through Tektronix and are shown in an exploded-view drawing in Replaceable Parts (section 8) and are described in the parts list in that section.

CAUTION

Before using any test equipment to make measurements on static-sensitive, current-sensitive, or voltage-sensitive components or assemblies, ensure that any voltage or current supplied by the test equipment does not exceed the limits of the component to be tested.

☐ **Step 1: Check Control Settings**

Incorrect control settings can give a false indication of instrument malfunction. If there is any question about the correct function or operation of any control, refer to the CDC250 Operators Manual.

☐ **Step 2: Check Associated Equipment**

Before proceeding, ensure that any equipment used with the CDC250 is operating correctly. Verify that input signals are properly connected and that the interconnecting cables are not defective. Check that the AC-power-source voltage to all equipment is correct.

☐ **Step 3: Visual Check**

WARNING

To avoid electrical shock, disconnect the instrument from the AC power source before inspecting the internal circuitry.

Look for broken connections or wires, damaged components, semiconductors not firmly mounted, damaged circuit boards, or other clues to the cause of a malfunction.

☐ **Step 4: Check Instrument Performance and Adjustment**

Check the performance of either those circuits where you suspect trouble or the entire instrument. An apparent trouble may be the result of misadjustment. The Performance Check is in Section 4 of this manual, and the Adjustment Procedure in Section 5.

☐ **Step 5: Isolate Trouble to a Circuit**

To isolate problems, use any symptoms noticed when checking the instrument's operation to help localize the trouble to a particular circuit. The CDC250 Troubleshooting Tips, following this procedure, may help in locating a problem.

☐ **Step 6: Check Individual Components**

WARNING

To avoid electrical shock, always disconnect the instrument from the AC power source before removing or replacing components.

The following procedures describe methods of checking individual components. Two-lead components that are soldered in place are most accurately checked by first disconnecting one end from the circuit board. This isolates the measurement from the effects of the surrounding circuitry. See Figure 9-1 for component value identification and Figure 9-2 for semiconductor lead configurations.

CAUTION

When checking semiconductors, observe the static-sensitivity precautions given at the beginning of this section.

- **TRANSISTORS.** A good check of a transistor is actual performance under operating conditions. A transistor can most effectively be checked by substituting a known-good component. However, be sure that circuit conditions are not such that a replacement transistor will also be damaged. If substitute transistors are not available, use a dynamic-type transistor checker for testing. Static-type transistor checks are not recommended, since they do not check operation under simulated operating conditions.

  When troubleshooting transistors in the circuit with a voltmeter, measure both the emitter-to-base and emitter-to-collector voltages to find out if they are consistent with normal circuit voltages. Voltages across a transistor may vary with the type of device and its circuit function.

  Some of these voltages are predictable. The emitter-to-base voltage for a conducting silicon transistor will normally range from 0.6 V to 0.8 V. The emitter-to-collector voltage for a saturated transistor is about 0.2 V. Because these values are small, the best way to check them is by connecting a sensitive voltmeter across the junction rather than comparing two voltages taken with respect to ground. If the former method is used, both leads of the voltmeter must be isolated from ground.

  If voltage values measured are less than those just given, either the device is shorted or no current is flowing in the external circuit. If values exceed the emitter-to-base values given, either the junction is reverse biased or the device is defective. Voltages exceeding those given for typical emitter-to-collector values could indicate either a nonsaturated device operating normally or a defective (open-circuited) transistor. If the device is conducting, voltage will be developed across the resistors in series with it; if open, no voltage will be developed across the resistors unless current is being supplied by a parallel path.

CAUTION

When checking emitter-to-base junctions, do not use an ohmmeter range that has a high internal current. High current may damage the transistor. Reverse biasing the emitter-to-base junction with a high current may degrade the current-transfer ratio (Beta) of the transistor.

  A transistor emitter-to-base junction also can be checked for an open or shorted condition by measuring the resistance between terminals with an ohmmeter set to a range having a low internal source current, such as the R × 1 kΩ range. The junction resistance should be very high in one direction and much lower when the meter leads are reversed.

When troubleshooting a field-effect transistor (FET), the voltage across its elements can be checked in the same manner as previously described for other transistors. However, remember that in the normal depletion mode of operation, the gate-to-source junction is reverse biased; in the enhanced mode, the junction is forward biased.

- **INTEGRATED CIRCUITS.** An integrated circuit (IC) can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of circuit operation is essential when troubleshooting a circuit having IC components. Use care when checking voltages and waveforms around the IC so that adjacent leads are not shorted together. An IC test clip provides a convenient means of clipping a test probe to an IC.

CAUTION

When checking a diode, do not use an ohmmeter scale that has a high internal current. High current may damage a diode. Checks on diodes can be performed in much the same manner as those on transistor emitter-to-base junctions.

- **DIODES.** A diode can be checked for either an open or a shorted condition by measuring the resistance between terminals with an ohmmeter set to a range having a low internal source current, such as the R × 1 kΩ range. The diode resistance should be very high in one direction and much lower when the meter leads are reversed.

  Silicon diodes should have 0.6 V to 0.8 V across their junctions when conducting; Schottky diodes about 0.2 V to 0.4 V. Higher readings indicate that they are either reverse biased or defective, depending on polarity.

- **RESISTORS.** Check resistors with an ohmmeter. Refer to the Replaceable Electrical Parts list for the tolerances of resistors used in this instrument. A resistor normally does not require replacement unless its measured value varies widely from its specified value and tolerance.

- **INDUCTORS.** Check for open inductors by checking continuity with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit.

- **CAPACITORS.** A leaky or shorted capacitor can be detected by checking resistance with an ohmmeter set to one of the highest ranges. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after the capacitor is charged to the output voltage of the ohmmeter. An open capacitor can be detected with a capacitance meter or by checking whether the capacitor passes AC signals.

☐ **Step 7: Repair and Adjust the Circuit**

If any defective parts are located, follow the replacement procedures given under Corrective Maintenance in this section. After any electrical component has been replaced, the performance of that circuit and any other closely related circuit should be checked. Since the power supplies affect all circuits, performance of the entire instrument should be checked if work has been done on the power supplies. Refer to the Performance Check Procedure and the Adjustment Procedure, sections 4 and 5 in this manual.

CDC250 Troubleshooting Tips

NOTE

Refer to the schematic diagrams in section 9 component values when troubleshooting. Component values and resistor tolerances are given in the Replaceable Parts list. Also refer to Troubleshooting Techniques in this section for more detailed troubleshooting methods.

The following troubleshooting steps provide a logical procedure for fault isolation. While the procedure cannot pinpoint every possible problem, in most cases it will localize the problem to an area of circuitry.

Most of these troubleshooting steps require removal of the instrument case. See Removal and Replacement Instructions in the Corrective Maintenance part of this section.

General Fault Isolation – Test each operating mode by applying a 1 MHz sine wave to both the CHANNEL A and CHANNEL B INPUT connectors. The frequency accuracy of the signal isn't critical, but the amplitude should be adequate for a stable reading (around 150 mV, p-p). Use caution not to exceed the maximum input ratings. Use the INPUT VOLTAGE, LOW PASS FILTER , and TRIGGER LEVEL controls as necessary to stabilize the display. If the CDC250 does not show the "Normal Display" given in Table 6-4, go to the appropriate troubleshooting step. Display faults and indicated troubleshooting steps are as follows:

1. If no display can be obtained, go to **Step 1: No Display**.
2. If the display is abnormal (missing decimal points or unlit segments or digits), go to **Step 2: Abnormal Display**.
3. If the display appears normal, but the value is incorrect or unstable), go to **Step 3: Incorrect or Unstable Display Value**.

   If the problem was not described in 1, 2, or 3, start troubleshooting at **Step 1: No Display** and proceed through each of the steps until the problem is isolated.

Table 6-4: Normal CDC250 Displays

Input Frequency	Operating Mode	GATE Setting	Normal (Ideal) Display
1 MHz	Frequency kHz	0.01s	1000.0
		0.1s	1000.00
		1.0s	1000.000
		10s	1000.0000[a]
1 MHz	Frequency MHz	0.01s	1.000
		0.1s	1.0000
		1.0s	1.00000
		10s	1.000000[b]
1 MHz	PERIOD (μs)	0.01s	1.0
		0.1s	1.00
		1.0s	1.000
		10s	1.0000
1 MHz	PERIOD (ms)	0.01s	.0010
		0.1s	.00100
		1.0s	.001000
1 MHz	RATIO	0.01s	1.
		0.1s	1.0
		1.0s	1.00
		10s	1.000
1 MHz	TIME (μs) (Both SLOPE switches set to +, TRIG LEVEL set to PRESET.)	0.01s	1.0
		0.1s	1.00
		1.0s	1.000
		10s	1.0000
1 MHz	TIME (ms) (Both SLOPE switches set to +, TRIG LEVEL set to PRESET.)	0.01s	.0010
		0.1s	.00100
		1.0s	.001000
1 MHz	TOTALIZE	N/A	Display accumulates, with second digit from left changing at approximately 1 Hz.
No input needed	CHECK	0.01s	10000.0
		0.1s	10000.00
		1.0s	10000.000
		10s	0000.0000 with OVERRANGE lit[a]
Less than 100 Hz	PERIOD	10s	OVERRANGE lit[a]

[a] Measurement delay of 10 seconds.
[b] Measurement delay of 20 seconds.

☐ **Step 1: No Display**

Check supply voltage at pin 25 of U20 for approximately +5 V. If this voltage is not present, check AC input, fuse, and power supply circuits. If supply voltages are okay, proceed to **Step 2: Abnormal Display**.

☐ **Step 2: Abnormal Display**

DIGIT STROBES AND TIME BASE. Set the unit to any operating mode and check pins 22–24 and 26–30 of U20 for all of the digit strobe waveforms shown in Figure 6-1 (D1 through D8). If all of these waveforms are normal, proceed to "Display Test." If the waveforms are not as shown in Figure 6-1, check the output of the time base oscillator at pin 38 of U20 for a 10 MHz square wave having peaks of 0 and 2 V. If the waveform at pin 38 is okay, check U20 and display digits; if no output is obtained, check oscillator components, TCXO, U21, and power supplies.

DISPLAY TEST. Enable the display self-test by connecting pins 1 and 22 of U20 to each other using a 1N4148 diode (anode to pin 22). The display should be all "eights" with all of the decimal points and the OVERRANGE indicator on. If not, check displays and segment-driver pins 8–11 and 13–16 of U20. Waveforms at each of these pins should approximate a DC level of about 1.0 V, with negative spikes of about 4 kHz.

DECIMAL POINTS. If the problem involves decimal points in MHz mode, check the "Mode Selection Logic" described in **Step 3: Incorrect or Unstable Display Value**.

MHz/ms OR kHz/µs INDICATORS. If a problem involves these indicators, check the "Mode Selection Logic" described in **Step 3: Incorrect or Unstable Display Value**.

GATE INDICATOR. If the GATE Indicator, D26, does not function properly, check D26, U5D, and pin 3 of U20. D26 is connected to pin 3 of U20, through U5D, which goes low whenever a measurement is being taken. If pin 3 of U20 shows no activity, check the "Mode Selection Logic" described in **Step 3: Incorrect or Unstable Display Value**..

FUNC INDICATORS. If the function indicators (FREQ, PERIOD, RATION, TIME, TOTALIZE, and CHECK) do not function properly, check LED1–LED6, U4 and U2.

GATE INDICATORS. If the GATE indicators (1/0.01s, 10/0.1s, 100/1.0s, and 1000/10s) do not function properly, check LED7–LED10, U5 and U3.

RESET. Check that all readings are cleared to zero when the RESET switch is pushed. If not, check S1.

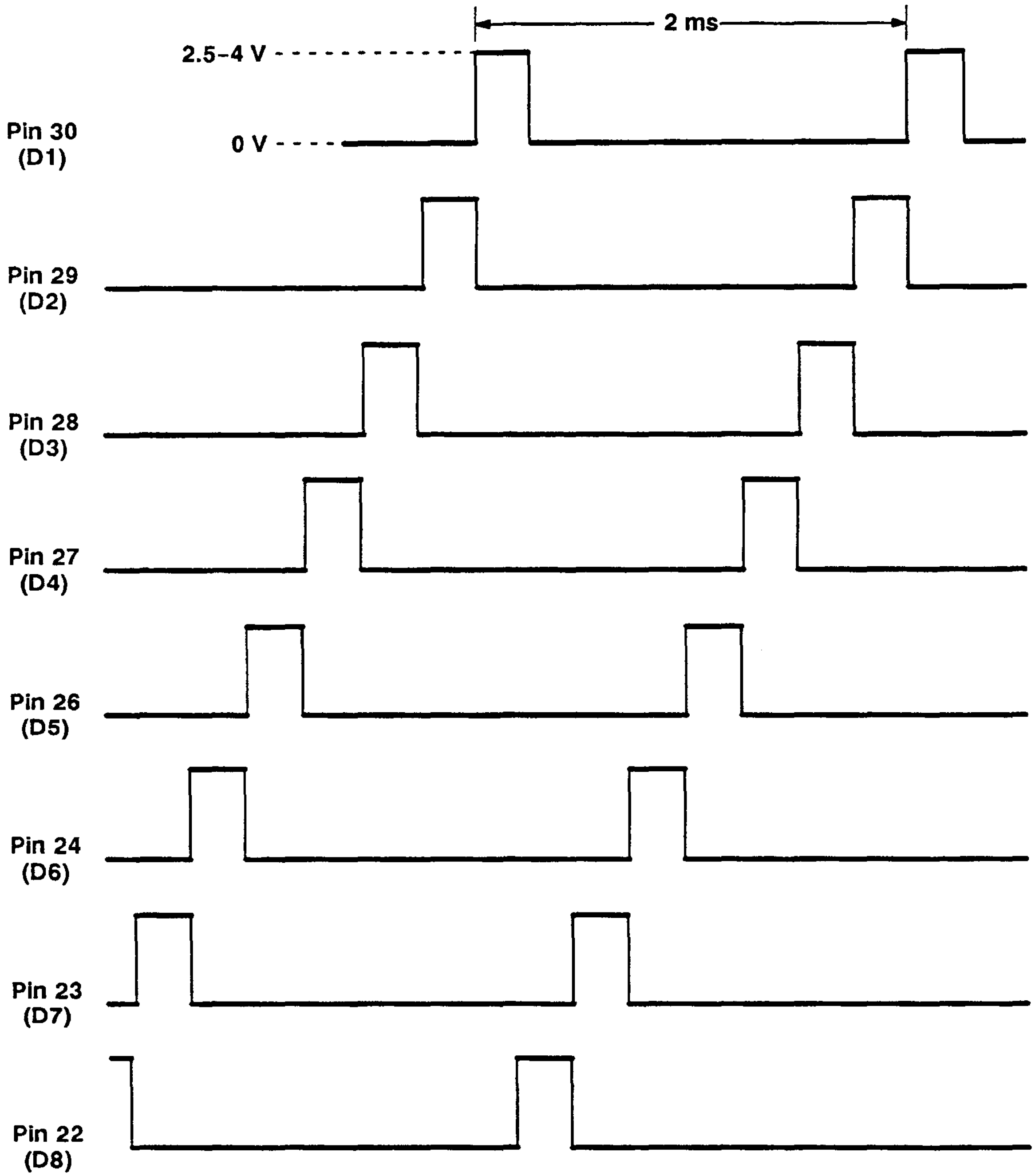


Figure 6-1: Digit Strobe Waveforms from U16

☐ **Step 3: Incorrect or Unstable Display Value**

CHANNEL A AND CHANNEL B FAULT ISOLATION. Apply a 1 MHz square wave to both the Channel A and Channel B input connectors and check the waveform at the collectors of Q106 (Channel A) and Q115 (Channel B). The waveform should be a square wave (0–2.8 V) of the same frequency and polarity as the input signal. If the waveforms are abnormal, go to "Power Supplies." If the waveform is normal, go to "Slope Selection Gates."

POWER SUPPLIES. CHECK THAT ALL THE POWER SUPPLIES ARE PRESENT (+5 V_2, +8.2 V, +6.2 V, -8.2 V, -6.2 V, +5 V_1, +5 V_{1A}). If any of these voltages are not present, troubleshoot the power supply circuitry.

CHANNEL A AND CHANNEL B ANALOG CIRCUITS. Tables 6-5 and 6-6 give waveform descriptions for the input circuits, along with the input conditions for each waveform. Apply a 10 kHz sine wave signal to both the Channel A and Channel B input connectors and follow the instructions in the tables.

SLOPE SELECTION GATES. Set the function to TIME and set both the Channel A and Channel B SLOPE switches to + (buttons out). Check pin 6 of U18 for a TTL waveform of opposite polarity compared to the waveform at the collector of Q106. Change the Channel A SLOPE to − (button in) and check that the waveform at pin 6 of U18 has the same polarity as the waveform at the collector of Q106. The same checks apply to the Channel B circuit, comparing pin 8 of U18 to the collector of Q115.

CHANNEL A GATING. Check that pin 8 of U15 has a TTL waveform that is the same as the waveform at pin 10 of U15. Press in the HOLD button and check that there is a constant low at pin 8 of U15. Also, applying a low signal to the TOTALIZE START/STOP input connector should result in a low signal at pin 8 of U15. If these conditions are not present, check U15, S2, U1, U17, and the TOTALIZE circuit.

TIME PRIMING CIRCUIT. With the RESET button out, check that the waveforms at pin 6 of U18 is the same as pin 8 of U15 and pin 3 of U18 is the same as pin 8 of U18. If these signals are abnormal, use Table 6-7 as a guide to troubleshoot the TIME Priming circuit. This table will also aid in troubleshooting problems with single time interval measurements.

PRESCALER. Apply a 1 MHz signal to the Channel A INPUT connector. Check pin 4 of IC103 for a 100 kHz, non-symmetrical waveform. Check pin 9 of U19 for a 50 kHz, symmetrical waveform. If either of these are abnormal, check IC103 and U19.

PRESCALE/DIRECT SELECTION CIRCUIT. Apply a 1 MHz signal to the Channel A INPUT connector. Check pin 13 of U26 for a 1MHz signal when the MHz/ms kHz/µs switch is in KHz/µs mode. The waveform at pin 13 of U26 should change 50 kHz when MHz/ms mode is selected. If these are abnormal, check that pin 6 of U15 goes high when MHz mode is selected. If not, check U16 and U17, and the "Mode Selection Logic."

TIME BASE DIVIDER. Check that the waveform at pin 5 of U19 is one-half the frequency at pin 3 of U19 (10 MHz). Check U19 if the signal at pin 5 is not correct.

MODE SELECTION LOGIC. Operating mode, resolution, and other factors are determined by feedback of the U20 digit strobes D1-D8 to various control pins of this same IC. This feedback is controlled, either directly or through logic, by the front panel switches. Tables 6-8, 6-9, and 6-10 give normal logic conditions in these feedback connections.

Table 6-5: CH A Analog Circuit Waveforms

NOTE

Except where noted otherwise, connect a 10 kHz, 1 V p-p sine wave to the CH A input and set the INPUT VOLTAGE switch to LO (button out) and the LOW PASS FILTER switch to ON (button in).

Test Point	Waveform
Gate of Q103	Identical to input.
Gate of Q103 with INPUT VOLTAGE set to HI (button in)	1/10 amplitude of input.
Base of Q105	1 V p-p 10 kHz sine wave centered at +1.2 V.
IC101 pin 1 (Channel A LOW PASS FILTER off)	0.9 V p-p, 10 kHz sine wave centered at 0 V, in phase with input.
IC101 pin 1 (Channel A LOW PASS FILTER on)	0.5 V p-p, 10 kHz sine wave centered at 0 V, 45° out of phase with input.
IC101 pin 4	With the TRIG LEVEL knob pulled out (variable), pin 4 should vary from -1.2 V to +1.2 V while rotating the variable control. The voltage should be zero with the knob pushed in (PRESET).
IC101 pin 13 (TRIG LEVEL in PRESET)	0.6 V p-p, 10 kHz square wave (slightly rounded) centered at 5.0 V. Rotating the TRIG LEVEL control should have no effect.
IC101 pin 13 (TRIG LEVEL variable)	Rotating the control completely counter-clockwise increased the duty cycle toward a DC level of +6 V. Rotating the control completely clockwise decreases the duty cycle toward a DC level of +4 V.
IC102 pins 9, 10, and 11 with no input	DC level of +3.8 V.
IC102 pin 10 with input connected	0.6 V p-p 10 kHz square wave (slightly rounded) centered at +3.8 V.
IC102 pins 5 and 7	1 V p-p, 10 kHz square wave centered at +3.8 V. Polarity opposite of pins 9 and 10 of IC102.
IC102 pins 2, 6, 13, 15, and base of Q106	Same as pins 5 and 7 of IC102, but inverted.
IC102 pins 3, 12, 14, and base of Q107	Same as pins 5 and 7 of IC102.

Table 6-6: CH B Analog Circuit Waveforms

NOTE

Except where noted otherwise, connect a 10 kHz, 1 V p-p sine wave to the CH B input and set the INPUT VOLTAGE switch to LO (button out).

Test Point	Waveform
Gate of Q112	Identical to input.
Gate of Q112 with INPUT VOLTAGE set to HI (button in)	1/10 amplitude of input.
Base of Q113	1 V p-p,10 kHz sine wave centered at +2.3 V.
IC105 pin 11 with no input	DC level of +3.8 V.
IC105 pin 9 with no input	DC level of +3.0 V.
IC105 pin 10 with no input	DC level of +3.0 V.
IC105 pin 10 with input connected	0.4 V p-p, 10 kHz sine wave centered at +3.8 V.
IC105 pins 4 and 7	1 V p-p square wave (slightly rounded), centered at +3.8 V.
IC105 pins 2, 13, and 15	Same as pins 4 and 7 of IC105 but the square wave has squarer corners.
IC105 pin 14	Same as pins 2, 13, and 15 of IC105 but inverted.
Base of Q114 and Q115	1 V p-p, 10 kHz square wave but polarity is inverted compared to the input.

Table 6-7: TIME Priming Circuit

Function Setting	Test Points	Waveform
TIME mode selected and RESET switch out	U1 pins 1, 2, 11, and 13. U1 pins 3 and 12. U8 pins 3, 6, and 11. U8 pins 1, 2, 4, 5, 12, and 13. U18 pin 3. U18 pin 6.	Logic high. Logic low. Logic low. Logic high. Same as pin 2 of U18. Opposite of pin 4 of U18.
TIME mode selected and RESET switch engaged	Pin 6 of U8 goes high as long as the RESET button is held in. Pin 4 should go low when the RESET button is released. Pin 3 of U8 will have a 5 ms pulse when the RESET button is released.	

Table 6-8: GATE Time Logic Check

NOTE

See Figure 6-1, Digit Strobe Waveforms from U20, for the waveforms listed in this table.

GATE Switch Setting	Test Points	Waveform
0.01 s	U20 pin 21. U7 pin 4. U7 pin 1.	U20 strobe D1 (pin 30). U20 strobe D4 (pin 27). U20 strobe D3 (pin 26).
0.1 s	U20 pin 21. U7 pin 4. U7 pin 1.	U20 strobe D2 (pin 29). U20 strobe D5 (pin 26). U20 strobe D4 (pin 24).
1.0 s	U20 pin 21. U7 pin 4. U7 pin 1.	U20 strobe D3 (pin 28). U20 strobe D6 (pin 24). U20 strobe D5 (pin 23).
10 s	U20 pin 21. U7 pin 4.	U20 strobe D4 (pin 27). U20 strobe D7 (pin 23).

Table 6-9: Function Logic Check

NOTE

See Figure 6-1, Digit Strobe Waveforms from U20, for the waveforms listed in this table.

FUNC Setting	Test Points	Waveform
FREQ	U20 pin 4. U15 pin 5.	U20 strobe D1 (pin 30). Logic high.
PERIOD	U20 pin 4. U14 pins 2 and 3. U15 pin 1.	U20 strobe D8 (pin 22). Logic high. Logic high.
RATIO	U20 pin 4. U14 pins 8, 9, and cathodes of D24 and D25.	U20 strobe D2 (pin 29). Logic high.
TIME	U20 pin 4. U14 pins 1, 3, 4, and 6. U15 pin 1.	U20 strobe D5 (pin 26). Logic high. Logic high.
TOTALIZE	U20 pin 4. U14 pins 8, 10, and cathodes of D24 and D25.	U20 strobe D4 (pin 27). Logic high.
CHECK	U20 pin 4. U14 pins 1, 3, 5, and 6. U15 pin 1.	U20 strobe D3 (pin 28). Logic high. Logic high.

Table 6-10: External Decimal Point

FUNC Setting	Test Points	Waveform
FREQ mode selected, MHz/ms kHz/μs (button in)	U15 pin 6.	Logic high.
	U1 pins 4 and 8.	Logic high.
	U13 pin 8.	Same as pin 9 of U13.
	U20 pin 1.	Same as pin 9 of U13.
MHz/ms kHz/μs (button in), and any function except RATIO or TOTALIZE	U14 pin 8.	Logic low.
	Anode of D24.	Logic high. MHz/ms LED lit.
	Anode of D25.	Logic low. kHz/μs LED unlit.
MHz/ms kHz/μs (button out), and any function except RATIO or TOTALIZE	U14 pin 8.	Logic low.
	Anode of D24.	Logic low. MHz/ms LED unlit.
	Anode of D25.	Logic high. kHz/μs LED lit.

Corrective Maintenance

Replacement assemblies (i.e., circuit boards, Front Panel, etc.) can be obtained from Tektronix. Many of the standard electrical components in this instrument can be obtained from your local electrical parts supplier. Corrective maintenance, therefore, consists of either complete assembly replacement or component replacement with locally obtained parts.

Maintenance Precautions

To avoid personal injury or damage to equipment, observe the following precautions:

- Disconnect the instrument from the AC-power source before removing or installing components.
- Verify that any line-rectifier filter capacitors are discharged before doing any servicing.
- Use care not to interconnect instrument grounds which may be at different potentials (cross grounding).
- When soldering on circuit boards or small insulated wires, use only a 15-watt, pencil-type soldering iron.

Obtaining Replacement Parts

Replacement assemblies for this instrument (Cabinet, circuit boards, Front Panel, and Rear Panel) can be obtained through your local Tektronix Field Office or representative. The CDC250 assemblies and their Tektronix part numbers are shown in the exploded-view drawing in Section 8 of this manual.

The Replaceable Parts list in Section 8 gives the Tektronix part number, name, and description of each of the CDC250 assemblies. A generic list (no Tektronix part numbers) is also supplied and includes the value, rating, tolerance, and description of the electrical parts on the circuit boards. As CDC250 parts can be ordered from Tektronix only at the assembly or kit level, this additional list may be useful if parts are obtained from your local supplier.

NOTE

Physical size and shape of a component may affect instrument performance, particularly at high frequencies. Always use direct replacement components, unless you know that a substitute will not degrade performance.

Ordering Parts – When ordering parts from Tektronix, Inc., be sure to include the following information:

- Instrument type (include all modification and option numbers).
- Instrument serial number.

- A description of the part (if electrical, include its full circuit component number).
- Tektronix part number.

Repackaging for Shipment

Save the original carton and packing material for reuse if the instrument should have to be reshipped on a commercial transport carrier. If the original materials are unfit or not available, repackage the instrument as follows:

1. Use a corrugated cardboard shipping carton with a test strength of at least 200 pounds and with an inside dimension at least six inches greater than the instrument dimensions.
2. If the instrument is being shipped to a Tektronix Service Center, enclose the following: the owner's address, name and phone number of a contact person, type and serial number of the instrument, reason for returning, and a complete description of the service needed.
3. Completely wrap the instrument with polyethylene sheeting or equivalent to protect the outside finish and prevent entry of foreign material into the instrument.
4. Cushion the instrument on all sides, using three inches of padding material or urethane foam tightly packed between the carton and the instrument.
5. Seal the shipping carton with an industrial stapler or strapping tape.
6. Mark the address of the Tektronix Service Center and also your own return address on the shipping carton.

Maintenance Aids

The maintenance aids recommended in Table 6-11 include items that may be needed for instrument maintenance and repair. Equivalent products may be substituted if their characteristics are similar.

Table 6-11: Maintenance Aids

Description	Specification	Usage
Soldering Iron	15 to 25 W.	General soldering and desoldering.
Phillips Screwdriver		Assembly and disassembly.
Long-nose Pliers		Component removal and replacement.
Open-end wrench	7/16 in.	Assembly and disassembly.
Vacuum Solder Extractor	No static charge retention.	Unsoldering static sensitive devices and components.
Contact Cleaner	No-Noise.®	Switch and pot cleaning.
IC-removal Tool		Removing DIP IC packages.
Isopropyl Alcohol	Reagent grade.	Cleaning.

Interconnections

Pin connectors used to connect the wires to the interconnect pins are factory assembled. They consist of machine-inserted pin connectors mounted in plastic holders. If the connectors are faulty, the entire wire assembly should be replaced.

Transistors and Integrated Circuits

Transistors and integrated circuits should not be replaced unless they are actually defective. If one is removed from its socket or unsoldered from the circuit board during routine maintenance, return it to its original board location. Unnecessary replacement or transposing of semiconductor devices may affect the adjustment of the instrument. When a semiconductor is replaced, check the performance of any circuit that may be affected.

Any replacement component should be of the original type or a direct replacement. Bend component leads to fit their circuit board holes, and cut the leads to the same length as the original component. See Figure 9-2 in the Diagrams section for the semiconductor lead configurations.

CAUTION

After replacing a power transistor, check that the collector is not shorted to the chassis before applying power to the instrument.

To remove socketed dual-in-line packaged (DIP) integrated circuits, pull slowly and evenly on both ends of the device. Avoid disengaging one end of the integrated circuit from the socket before the other, since this may damage the pins.

To remove a soldered DIP IC for replacement, clip all the leads of the device and remove the leads from the circuit board one at a time. If the device must be removed intact for possible reinstallation, do not heat adjacent conductors consecutively. Apply heat to pins at alternate sides and ends of the IC as solder is removed. Allow a moment for the circuit board to cool before proceeding to the next pin.

Soldering Techniques

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used to remove or replace parts. General soldering techniques that apply to maintenance of any precision electronic equipment should be used when working on this instrument.

WARNING

To avoid an electrical shock hazard, observe the following precautions before attempting any soldering: turn the instrument off, disconnect it from the AC power source, and wait at least three minutes for line-rectifier filter capacitors to discharge.

Use rosin-core wire solder containing 63% tin and 37% lead. Contact your local Tektronix Field Office or representative to obtain the names of approved solder types.

When soldering on circuit boards or small insulated wires, use only a 15-watt, pencil-type soldering iron. A higher wattage soldering iron may cause etched circuit conductors to separate from the board base material and melt the insulation on small wires. Always keep the soldering iron tip properly tinned to ensure the best heat transfer from the tip to the solder joint. Apply only enough solder to make a firm joint. After soldering, clean the area around the solder connection with an approved flux-removing solvent (such as isopropyl alcohol) and allow it to air dry.

CAUTION

Only a maintenance person experienced in the use of vacuum-type desoldering equipment should attempt repair of any circuit board in this instrument. Many integrated circuits are static sensitive and may be damaged by solder extractors that generate static charges. Perform work involving static-sensitive devices only at a static-free work station while wearing a grounded antistatic wrist strap. Use only an antistatic vacuum-type solder extractor approved by a Tektronix Service Center.

CAUTION

Attempts to unsolder, remove, and resolder leads from the component side of a circuit board may cause damage to the reverse side of the circuit board. The following techniques should be used to replace a component on a circuit board:

1. Touch the vacuum desoldering tool tip to the lead at the solder connection. Never place the tip directly on the board; doing so may damage the board.

NOTE

Some components are difficult to remove from the circuit board due to a bend placed in the component leads during machine insertion. To make removal of machine-inserted components easier, straighten the component leads on the reverse side of the circuit board.

2. When removing a multipin component, especially an IC, do not heat adjacent pins consecutively. Apply heat to the pins at alternate sides and ends of the IC as solder is removed. Allow a moment for the circuit board to cool before proceeding to the next pin.

CAUTION

Excessive heat can cause the etched circuit conductors to separate from the circuit board. Never allow the solder extractor tip to remain at one place on the board for more than three seconds. Solder wick, spring-actuated or squeeze-bulb solder suckers, and heat blocks (for desoldering multipin components) must not be used. Damage caused by poor soldering techniques can void the instrument warranty.

3. Bend the leads of the replacement component to fit the holes in the circuit board. If the component is replaced while the board is installed in the instrument, cut the leads so they protrude only a small amount through the reverse side of the circuit board. Excess lead length may cause shorting to other conductive parts.
4. Insert the leads into the holes of the board so that the replacement component is positioned the same as the original component. Most components should be firmly seated against the circuit board.
5. Touch the soldering iron tip to the connection and apply enough solder to make a firm solder joint. Do not move the component while the solder hardens.
6. Cut off any excess lead protruding through the circuit board (if not clipped to the correct length in step 3).
7. Clean the area around the solder connection with an approved flux-removing solvent. Be careful not to remove any of the printed information from the circuit board.

Removal and Replacement Instructions

WARNING

To avoid electrical shock, disconnect the instrument from the power input source before removing or replacing any component or assembly.

The exploded-view drawings in the Replaceable Parts list may be helpful during removal and replacement of assemblies. Component locations are shown in the Diagrams section.

Read these instructions before attempting to remove or install any components.

Cabinet Assembly – To remove the cabinet:

1. Unplug the power cord from its rear-panel connector.
2. Place the instrument upside down on a clean, flat surface.
3. Remove the four case-securing screws from the bottom of the instrument. The two rear screws also hold the rear rubber pads (feet) in place. The front screws to be removed are separate from and to the outside of the front pads.
4. Carefully turn the instrument right side up, while holding together the top and bottom of the case.
5. Remove the top half of the case and the handle.

WARNING

Potentially dangerous voltages exist at several points throughout this instrument. If it is operated with the cabinet removed, do not touch exposed connections or components. Before replacing parts, disconnect the AC-power source from the instrument.

NOTE

Removal of the top half of the instrument cabinet and the handle will access the component side of the circuit boards and allow access to the adjustments without further disassembly. See the Adjustment Procedure in section 5.

To continue to remove the cabinet:

6. Remove the two screws securing the Main board to the cabinet bottom; one screw is near TP1 and the other near TP101.
7. Pull off the front panel TRIG LEVEL knob and remove the nut with a 7/16 in. open-end wrench.
8. Lift the Main board (with attaching Channel B and PAL boards) along with the attached front and rear panels, away from the bottom of the cabinet.

To replace the cabinet, do the reverse of the preceding steps.

Channel B Input Assembly – The Channel B board is located inside a covered metal shield case and is attached to the Front Panel CHANNEL B INPUT connector. The assembly includes the Channel B board, the metal shield, and the attached wires.

To remove the Channel B Input assembly:

1. Remove the top of the instrument cabinet.
2. Unsolder the wire to the Channel B Input BNC.
3. Disconnect the Channel B board from the Main board by unplugging J101 and J105 from the Main board.
4. Pull off the front panel TRIG LEVEL knob and remove the nut from the TRIG LEVEL shaft with a 7/16 in open-end wrench.
5. Remove the two screws located at the rear of the Channel B Input board.
6. Slide the Channel B Input board back to clear the front panel and lift the board out of the instrument.
7. To access the board, unsolder the metal shield cover from the board and remove the cover.

NOTE

When installing the Channel B Input board, be sure to replace the washer over the TRIG LEVEL shaft before sliding it through the front panel.

To replace the Channel B Input board, do the reverse of the preceding steps.

PAL Board – The PAL board is located on the right side of the instrument, attached to the Main board.

To remove the PAL board:

1. Remove the top of the instrument cabinet.
2. Unplug the three multiwire connectors from the Main board at J117, JG, and JH.

3. Remove the three screws from the board and lift the board out of the instrument.

To replace the PAL board, do the reverse of the preceding steps.

DISPLAY Board – The Display board is attached to the Front Panel assembly.

To remove the Display board:

1. Remove the top of the instrument cabinet.
2. Unplug the four multiwire connectors from the Main board at JA, JB, JC, and JD. Note the location of each of these for reassembly.
3. Unplug the single connector from the Main board labeled GND.
4. Remove the three screws from the Display board and lift the board out of the instrument.

To replace the Display board, do the reverse of the preceding steps.

Front Panel Assembly – The Front Panel assembly includes the Front Panel, Display board, and the BNC connectors.

To remove the front panel assembly:

1. Remove the top of the instrument cabinet.
2. Remove the Channel B Input assembly.
3. Remove the ground-wire screw at the top left corner of the Front Panel.
4. Unplug the single connector that goes from the Display board to the Main board; unplug at Main board GND.
5. Unplug the four multiwire connectors from the Display board. The wires are from JA, JB, JC, and JD on the Main board. Note the location of these for reassembly.
6. Unsolder the wires from the CH A input BNC.
7. Remove the two Main board screws located near TP1 and TP101.
8. Lift the front of the Main board and slide the Front Panel assembly over the pushbuttons until free.

To replace the Front Panel assembly, reverse the preceding steps.

Rear Panel Assembly – To remove the Rear Panel assembly:

1. Remove the top of the instrument cabinet.
2. Remove the ground-wire screw at the top left corner of the Front Panel.
3. Unplug the multiwire connector from JF on the Main board.
4. Unsolder the two wires from both of the Rear Panel BNCs.

5. Unsolder the four wires from the Power switch located on the Main board. The two blue wires go to the two contacts nearest the edge of the unit, and the red wires go towards the unit's center.

NOTE

For reinstallation: The Power switch just opens and closes the line; so either red wire or either blue wire can be replaced on the rear-most contacts of the switch. Both blues have to be towards the outside edge, and both reds towards the center of the unit. Make sure to insulate the solder connections with heat shrink tubing.

6. Lift the Rear Panel assembly up out of the slots in the cabinet.

To replace the Rear Panel assembly, reverse the preceding steps.

Main Board Assembly – The Main Board assembly includes the Main board, the Front Panel switches, and two board shields.

To remove the Main Board assembly:

1. Remove the top of the cabinet.
2. Remove the two screws attaching the Main Board to the cabinet bottom, one near TP1 and the other near TP101.
3. Lift the entire contents of the instrument out of the instrument cabinet (including attaching boards and Front and Rear assemblies).
4. Remove the Rear Panel assembly.
5. Remove the Front Panel assembly.
6. Remove the PAL board.
7. Remove the Channel B Input board.

To replace the Main Board assembly, reverse the preceding steps.

NOTE

When replacing assemblies in the instrument, be sure to use new wire ties to replace any that were clipped during disassembly.

Options

International Power Cords

Instruments are shipped with the detachable power cord option ordered by the customer. Descriptive information about international power cord options is given in Section 2. The following list describes the power cords available for this instrument.

Standard	North American, 120 V
Option A1	Universal Euro, 220 V
Option A2	UK, 240 V
Option A3	Australian, 240 V
Option A4	North American, 240 V
Option A5	Switzerland, 220 V

Replaceable Parts

This section contains a list of the components that are replaceable for the CDC250. As described below, use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available from or through your local Tektronix, Inc. service center 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. Therefore, when ordering parts, it is important to include the following information in your order:

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If a part you order has been replaced with a different or improved part, your local Tektronix service center or representative will contact you concerning any change in the part number.

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

Module Replacement

The CDC250 is serviced by module replacement so there are three options you should consider:

- **Module Exchange.** In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEKWIDE, ext. BVJ5799.
- **Module Repair.** You may ship your module to us for repair, after which we will return it to you.
- **New Modules.** You may purchase new replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

The tabular information in the Replaceable Parts List is arranged for quick retrieval. Understanding the structure and features of the list will help you find the all the information you need for ordering replacement parts.

Item Names

In the Replaceable 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, U.S. Federal Cataloging Handbook H6-1 can be used where possible.

Indentation System

This parts list is indented to show the relationship between items. The following example is 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 at 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

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1

Mfr. Code	Manufacturer	Address	City, State, Zip Code
	ESCORT	2ND FLOOR NO. 37 POA HSIN RD SHIN TIEN	TAI PEI, TAIWAN
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97707-0001

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description	Mfr. Code	Mfr. Part No.
Figure 8-1							
(1)	118-8686-00			1	CABINET ASSEMBLY	80009	118-8686-00
				1	.CASE,TOP		15-25585-6
				1	.CASE,BOTTOM		15-25585-6A
				1	.HANDLE		15-25598-4
				2	.FOOT: RUBBER (REAR)		16-25593-6
				2	.FOOT: RUBBER (FRONT)		16-25593-5
				2	.SCREW,PLASTIC: 6-32 X 16		15-25047-1
				4	.SPACER,POST: 6-32 X 6.5MM		3-25595-1
				4	.SCREW,MACHINE: 6-32 X 18		4-1113R5-1802
				1	.SHIELD: FOIL PAPER		11-25005-2
				1	.INSULATOR: SHEET		11-25006-1A

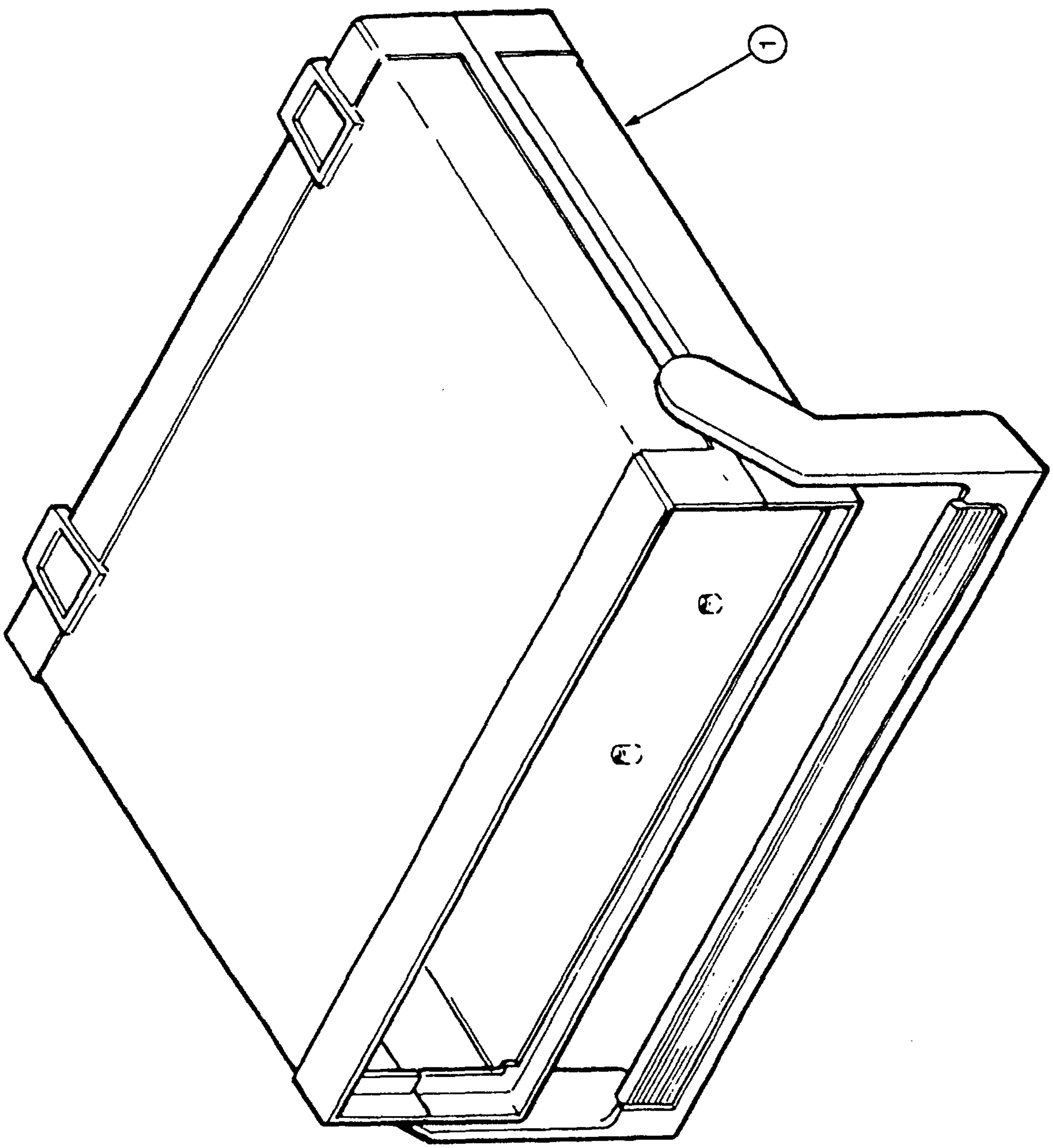


Figure 8-1. Cabinet

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description		Mfr. Code	Mfr. Part No.
Figure 8-2								
①	118-8684-00			1	FRONT PANEL ASSEMBLY		80009	118-8684-00
				1	.FRONT PANEL			1-25128-1
				1	.OVERLAY			24-25375-1
				2	.BNC: W/HARDWARE			30-25437-1
				2	.GROUND LUG(BNC)			30-13109-08
				1	.GROUND LUG			6-13103-02A
				1	.SCREW,MACHINE,M3.5 X 6			4-1113R5-0602
②	118-8685-00			1	REAR PANEL ASSEMBLY		80009	118-8685-00
				1	.REAR PANEL			1-25162-1
				2	.BNC: W/HARDWARE			30-25437-1
				8	.WASHER,FLAT			6-11103-02
				2	.GROUND LUG			30-13109-08
				1	.AC SOCKET			30-25625-1
				2	.SCREW,MACHINE,M3 X 8 (BLACK)(AC SOCKET)			4-16103-0804
				8	.SPRING WASHER,M3			6-12103-02
				2	.SCREW,MACHINE,M3 X 8 (TRANSFORMER)			4-11103-0802
				4	.SCREW,MACHINE,M3 X 6			4-11103-0602
				4	.NUT,M3			5-14203-02
				3	.NUT,M3.5			5-1423R5-02
				1	.SCREW,MACHINE,HEX,M3.5 X 12			4-1413R5-1202
				1	.FUSE CARRIER			62-25604-1
				1	.FUSE BASE			62-25604-3
				1	.GROUND LUG			6-13103-02A
				1	.GROUND LUG: 4 EAR			1-25071-1
					.T1	TRANSFORMER		63-1923-915A
					.S14	SLIDE SWITCH		80-25605-1
					.S15	SLIDE SWITCH		80-25605-1
③	118-8683-00			1	DISPLAY BOARD ASSEMBLY		80009	118-8683-00
				3	.SCREW,MACHINE			4-1112R6-0602
				3	.WASHER,SPRING			6-1212R6-02
					.D24	LED LAMP; ORANGE		64-25254-10
					.D25	LED LAMP; ORANGE		64-25254-10
					.D26	LED LAMP; ORANGE		64-25254-10
					.D27	LED LAMP; ORANGE		64-25254-10
					.D116	DIODE 1N4148		35-25111-1
					.D117	DIODE 1N4148		35-25111-1
					.DS1	LED DISPLAY; 7 SEG CSS-416E		57-25020-20
					.DS2	LED DISPLAY; 7 SEG CSS-416E		57-25020-20
					.DS3	LED DISPLAY; 7 SEG CSS-416E		57-25020-20
					.DS4	LED DISPLAY; 7 SEG CSS-416E		57-25020-20
					.DS5	LED DISPLAY; 7 SEG CSS-416E		57-25020-20
					.DS6	LED DISPLAY; 7 SEG CSS-416E		57-25020-20
					.DS7	LED DISPLAY; 7 SEG CSS-416E		57-25020-20
					.DS8	LED DISPLAY; 7 SEG CSS-416E		57-25020-20
					.JA	8 PIN WAFER		30-25739-8
					.JB	8 PIN WAFER		30-25739-8
					.JC	9 PIN WAFER		30-25739-9
					.JD	8 PIN WAFER		30-25739-8
					.LED1	LED LAMP; SQUARE, ORANGE		64-25250-10
					.LED2	LED LAMP; SQUARE, ORANGE		64-25250-10
					.LED3	LED LAMP; SQUARE, ORANGE		64-25250-10
					.LED4	LED LAMP; SQUARE, ORANGE		64-25250-10
					.LED5	LED LAMP; SQUARE, ORANGE		64-25250-10

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description	Mfr. Code	Mfr. Part No.
					.LED6 LED LAMP; SQUARE, ORANGE		64-25250-10
					.LED7 LED LAMP; SQUARE, ORANGE		64-25250-10
					.LED8 LED LAMP; SQUARE, ORANGE		64-25250-10
					.LED9 LED LAMP; SQUARE, ORANGE		64-25250-10
					.LED10 LED LAMP; SQUARE, ORANGE		64-25250-10
④	118-8681-00			1	MAIN BOARD ASSEMBLY	80009	118-8681-00
				1	.HEATSINK (Q1)		1-25436-4
				1	.SHIELD CASE		1-25020-2B
				2	.HEX POST		3-25032-1
				2	.TAPPING SCREW,M3.5 X 6		4-1143R5-0602
				8	.FUSE CLIP		1-25658-1A
				2	.SCREW,MACHINE,M3 X 8		4-11103-0802
				8	.KNOB,PUSH,IVORY GRAY		15-25426-5
				1	.KNOB,PUSH,RED		15-25426-8
					.C1 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C2 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C3 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C4 E/CAP. 47 uF, +80/-20%, 16V		31-476Z16-2
					.C5 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C9 E/CAP. 47 uF, +80/-20%, 16V		31-476Z16-2
					.C10 E/CAP. 1000 uF, +80/-20%, 35V VENT		31-108Z35-2
					.C11 E/CAP. 1000 uF, +80/-20%, 35V VENT		31-108Z35-2
					.C12 E/CAP. 4700 uF, +80/-20%, 25V VENT		31-478Z25-2
					.C14 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C15 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C17 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C18 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C19 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C20 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C21 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C22 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C23 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C24 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C25 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C26 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C27 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C28 C/CAP. 100 pF, +/-10%, 500V		31-101K500-3
					.C29 C/CAP. 39 pF, +/-10%, 500V NPO		31-390K500-3N
					.C33 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C34 C/CAP. 0.001 pF, +/-10%, 500V		31-102K500-3
					.C38 E/CAP. 47 uF, +80/-20%, 16V		31-476Z16-2
					.C101 MPE/CAP. 0.47 uF, +/-10%, 400V		31-474K400-4M
					.C102 C/CAP. 2 pF, +/-0.5 pF, 500V NPO		31-2R0Y500-3N
					.C103 C/CAP. 12 pF, +/-5%, 500V NPO		31-120J500-3N
					.C104 C/CAP. 150 pF, +/-5%, 500V		31-151J500-3
					.C105 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C106 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C107 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C108 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C109 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C110 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C111 C/CAP. 62 pF, +/-5%, 100V NPO		31-620J100-3N
					.C112 E/CAP. 47 uF, +80/-20%, 16V		31-476Z16-2
					.C113 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C114 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C115 C/CAP. 100 pF, +/-10%, 500V		31-101K500-3

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description		Mfr. Code	Mfr. Part No.
					.C116	MULTILAYER/CAP. 0.1 uF, +/-10%, 50V		31-104K50-7
					.C117	E/CAP. 3.3 uF, +80/-20%, 63V		31-335Z63-2
					.C118	E/CAP. 220 uF, +80/-20%, 10V		31-227Z10-2
					.C119	E/CAP. 220 uF, +80/-20%, 10V		31-227Z10-2
					.C120	C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C121	C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C122	C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C123	C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C124	E/CAP. 220 uF, +80/-20%, 10V		31-227Z10-2
					.C125	C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C126	E/CAP. 47 uF, +80/-20%, 16V		31-476Z16-2
					.C127	C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C128	C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C129	C/CAP. 0.001 pF, +/-10%, 500V		31-102K500-3
					.C130	C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C131	C/CAP. 0.001 pF, +/-10%, 500V		31-102K500-3
					.C132	E/CAP. 470 uF, +80/-20%, 16V		31-477Z16-2
					.C133	E/CAP. 470 uF, +80/-20%, 16V		31-477Z16-2
					.C134	E/CAP. 3.3 uF, +80/-20%, 63V		31-335Z63-2
					.C135	E/CAP. 3.3 uF, +80/-20%, 63V		31-335Z63-2
					.C103	C/CAP. 12 pF, +/-5%, 500V NPO		31-120J500-3N
					.C137	C/CAP. 1 pF, +/-5%, 500V NPO		31-100J500-3N
					.D1	DIODE 1N4148		35-25111-1
					.D2	DIODE 1N4148		35-25111-1
					.D3	DIODE 1N4148		35-25111-1
					.D4	DIODE 1N4002		35-25112-2
					.D5	DIODE 1N4002		35-25112-2
					.D6	DIODE 1N4002		35-25112-2
					.D7	DIODE 1N4002		35-25112-2
					.D8	DIODE 1N4002		35-25112-2
					.D9	DIODE 1N4002		35-25112-2
					.D10	ZENER DIODE 1N4738A +/-5%, 8.2V, 1W		35-25395-8R2
					.D11	ZENER DIODE 1N4738A +/-5%, 8.2V, 1W		35-25395-8R2
					.D12	DIODE 1N4148		35-25111-1
					.D13	ZENER DIODE 1N4735A +/-5%, 6.2V, 1W		35-25391-6R2
					.D14	ZENER DIODE 1N4735A +/-5%, 6.2V, 1W		35-25391-6R2
					.D15	DIODE 1N4148		35-25111-1
					.D16	DIODE 1N4148		35-25111-1
					.D17	DIODE 1N4148		35-25111-1
					.D18	DIODE 1N4148		35-25111-1
					.D19	DIODE 1N4148		35-25111-1
					.D20	DIODE 1N4148		35-25111-1
					.D21	DIODE 1N4148		35-25111-1
					.D22	DIODE 1N4007		35-25112-7
					.D23	DIODE 1N4007		35-25112-7
					.D28	DIODE 1N4148		35-25111-1
					.D29	DIODE 1N4148		35-25111-1
					.D103	DIODE 1N4148		35-25111-1
					.D104	DIODE 1N4148		35-25111-1
					.D105	DIODE 1N4148		35-25111-1
					.D106	DIODE 1N4148		35-25111-1
					.D107	DIODE 1N4148		35-25111-1
					.D108	DIODE 1N4148		35-25111-1
					.FS1	FUSE D5x20mm AC250V 0.5A,S/B		62-25620-1U
					.FS2	FUSE D5x20mm AC250V 0.5A,S/B		62-25620-1U
					.FS3	FUSE D5x20mm AC250V 0.5A,S/B		62-25620-1U
					.FS4	FUSE D5x20mm AC250V 0.5A,S/B		62-25620-1U

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description		Mfr. Code	Mfr. Part No.
					.FS5	FUSE D6.3x31mm AC250V 0.25A,S/B (FOR 100/120VAC LINE VOLTAGE)		62-25596-1U
					.FS5	FUSE D6.3x31mm AC250V 0.125A,S/B (FOR 220/240VAC LINE VOLTAGE)		62-25596-2U
					.G101	CABLE; COAX,85MM		30-25630-6U
					.G102	CABLE; COAX,85MM		30-25630-6U
					.IC101	IC CA3102E(RCA)		39-25564-1
					.IC102	IC MC10216P(MOTOROLA)		39-25565-1
					.IC103	IC SP8660(PLESSEY)		39-25566-1
					.JA	CABLE,FLAT; 8 WIDE/HOUSING		30-25738-8
					.JB	CABLE,FLAT; 8 WIDE/HOUSING		30-25738-8
					.JC	CABLE,FLAT; 9 WIDE/HOUSING		30-25738-9
					.JD	CABLE,FLAT; 8 WIDE/HOUSING		30-25738-8
					.JG	CABLE,FLAT; 7 WIDE/HOUSING		30-25738-7
					.JH	CABLE,FLAT; 7 WIDE/HOUSING		30-25738-7
					.J101	WAFER 4P, 180' WITH LOCK		30-25663-4
					.J102	JUMP WIRE		30-25708-10
					.J105	WAFER 4P, 180' WITH LOCK		30-25663-4
					.J106	WAFER 6P, 180' WITH LOCK		30-25663-6
					.J107	RESISTOR 0 OHM, +/-5%, 1/8W		33-000J8T-7
					.J110	WAFER 2P, 180' WITH LOCK		30-25663-2
					.J2	WIRE,ORANGE		30-25484-5B
					.J3	WIRE,RED		30-25481-4B
					.J4	SEE J2		
					.J5	WIRE,BLACK		30-25482-3B
					.J6	WIRE,RED & COAX (J11)		30-00757-1
					.J11	SEE J6		
					.Q1	IC LM2940CT-5.0(N.S)		41-25423-P5J
					.Q2	TRANSISTOR 2N2369(MOTOROLA)		36-25345-1
					.Q3	IC MC7805CT (MOTOROLA), HA17805P(HITACHI)		41-25410-P5J
					.Q101	TRANSISTOR 2SC1674K(NEC), LC1674K(MOTOROLA)		36-25340-1
					.Q102	TRANSISTOR 2SC1674K(NEC), LC1674K(MOTOROLA)		36-25340-1
					.Q103	FET 2N5486(MOTOROLA)		37-25519-3
					.Q104	FET 2N5486(MOTOROLA)		37-25519-3
					.Q105	TRANSISTOR 2SC535C(HITACHI)		36-25346-3
					.Q106	TRANSISTOR MPS3640(MOTOROLA)		36-25352-1
					.Q107	TRANSISTOR MPS3640(MOTOROLA)		36-25352-1
					.Q108	FET 2N5486(MOTOROLA)		37-25519-3
					.Q109	TRANSISTOR 2SC1815GR		36-25238-3
					.Q116	TRANSISTOR 2SC1674K(NEC), LC1674K(MOTOROLA)		36-25340-1
					.Q117	TRANSISTOR 2SC1674K(NEC), LC1674K(MOTOROLA)		36-25340-1
					.R1	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R2	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R3	RESISTOR 470K OHM, +/-5%, 1/8W		33-474J8T-7
					.R4	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R5	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R6	RESISTOR 470K OHM, +/-5%, 1/8W		33-474J8T-7
					.R7	RESISTOR 100K OHM, +/-5%, 1/8W		33-104J8T-7
					.R8	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R9	RESISTOR 100K OHM, +/-5%, 1/8W		33-104J8T-7
					.R10	RESISTOR 100K OHM, +/-5%, 1/8W		33-104J8T-7
					.R11	RESISTOR 100K OHM, +/-5%, 1/8W		33-104J8T-7
					.R14	RESISTOR 330 OHM, +/-5%, 1/8W		33-331J8T-7

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description		Mfr. Code	Mfr. Part No.
					.R15	RESISTOR 1K OHM, +/-5%, 1/8W		33-102J8T-7
					.R16	RESISTOR 330 OHM, +/-5%, 1/8W		33-331J8T-7
					.R17	RESISTOR 1K OHM, +/-5%, 1/8W		33-102J8T-7
					.R18	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R19	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R20	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R21	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R22	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R23	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R24	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R25	RESISTOR 51 OHM, +/-5%, 1/2W		33-510J2T-3
					.R26	RESISTOR 33 OHM, +/-5%, 1W		33-330J1-3
					.R27	RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.R28	RESISTOR 100 OHM, +/-5%, 1/2W		33-101J2T-3
					.R29	RESISTOR 100 OHM, +/-5%, 1/2W		33-101J2T-3
					.R30	RESISTOR 100 OHM, +/-5%, 1/8W		33-101J8T-7
					.R31	RESISTOR 470K OHM, +/-5%, 1/8W		33-474J8T-7
					.R32	RESISTOR 470K OHM, +/-5%, 1/8W		33-474J8T-7
					.R33	RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R34	RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R35	RESISTOR 1M OHM, +/-5%, 1/8W		33-105J8T-7
					.R36	RESISTOR 220 OHM, +/-5%, 1/8W		33-221J8T-7
					.R38	RESISTOR 1M OHM, +/-5%, 1/8W		33-105J8T-7
					.R39	RESISTOR 1.5K OHM, +/-5%, 1/8W		33-152J8T-7
					.R41	RESISTOR 4.7K OHM, +/-5%, 1/8W		33-472J8T-7
					.R42	RESISTOR 1M OHM, +/-5%, 1/8W		33-105J8T-7
					.R45	RESISTOR 220 OHM, +/-5%, 1/8W		33-221J8T-7
					.R100	RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R101	RESISTOR 5.1 OHM, +/-5%, 1/8W		33-5R1J8T-7
					.R102	RESISTOR 1.1M OHM, +/-1%, 1/8W		33-1104F8T-6DT
					.R103	RESISTOR 137K OHM, +/-1%, 1/8W		33-1373F8T-6DT
					.R104	RESISTOR 100 OHM, +/-5%, 1W		33-101J1-3
					.R105	RESISTOR 10K OHM, +/-5%, 1W		33-103J1-3
					.R106	RESISTOR 8.2K OHM, +/-5%, 1/8W		33-822J8T-7
					.R107	RESISTOR 330 OHM, +/-5%, 1/8W		33-331J8T-7
					.R108	RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R109	RESISTOR 8.2K OHM, +/-5%, 1/8W		33-822J8T-7
		TW10001	TW10201		.R110	RESISTOR 100 OHM, +/-5%, 1/8W		33-101J8T-7
		TW10201			.R110	RESISTOR 22 OHM, +/-5%, 1/8W		33-220J8T-7
					.R111	SVR 1K OHM, +/-20%		33-1021-08E
					.R112	RESISTOR 120 OHM, +/-5%, 1/8W		33-121J8T-7
					.R113	RESISTOR 33 OHM, +/-5%, 1/8W		33-330J8T-7
					.R114	RESISTOR 1.5K OHM, +/-5%, 1/8W		33-152J8T-7
					.R115	RESISTOR 470 OHM, +/-5%, 1/8W		33-471J8T-7
					.R116	RESISTOR 51 OHM, +/-5%, 1/8W		33-510J8T-7
					.R117	RESISTOR 4.7K OHM, +/-5%, 1/8W		33-472J8T-7
					.R118	RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R119	RESISTOR 330 OHM, +/-5%, 1/8W		33-331J8T-7
					.R120	RESISTOR 51 OHM, +/-5%, 1/8W		33-510J8T-7
					.R121	RESISTOR 150 OHM, +/-5%, 1/8W		33-151J8T-7
					.R122	RESISTOR 2.67K OHM, +/-1%, 1/8W		33-2671F8T-6DT
					.R123	RESISTOR 3.3K OHM, +/-5%, 1/8W		33-332J8T-7
					.R125	SVR 1K OHM, +/-20%		33-1021-08E
					.R126	RESISTOR 2K OHM, +/-1%, 1/8W		33-2001F8T-6DT
					.R127	RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R128	RESISTOR 3.3K OHM, +/-5%, 1/8W		33-332J8T-7
					.R129	RESISTOR 3.3K OHM, +/-5%, 1/8W		33-332J8T-7

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description	Mfr. Code	Mfr. Part No.
					.R130 SVR 10K OHM, +/-20%		33-1031-08E
					.R131 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R132 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R133 RESISTOR 330 OHM, +/-5%, 1/8W		33-331J8T-7
					.R134 RESISTOR 270 OHM, +/-5%, 1/8W		33-271J8T-7
					.R135 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R136 RESISTOR 1M OHM, +/-5%, 1/8W		33-105J8T-7
					.R137 RESISTOR 4.7K OHM, +/-5%, 1/8W		33-472J8T-7
					.R138 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R139 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R140 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R141 RESISTOR 75 OHM, +/-5%, 1/8W		33-750J8T-7
					.R142 RESISTOR 130 OHM, +/-5%, 1/8W		33-131J8T-7
					.R143 RESISTOR 2.2K OHM, +/-5%, 1/8W		33-222J8T-7
					.R144 RESISTOR 39K OHM, +/-5%, 1/8W		33-393J8T-7
					.R145 RESISTOR 3.3 OHM, +/-5%, 1/8W		33-3R3J8T-7
					.R148 RESISTOR 3.3K OHM, +/-5%, 1/8W		33-332J8T-7
					.R149 RESISTOR 1.2M OHM, +/-1%, 1/8W		33-1204F8T-6DT
					.R176 RESISTOR 22K OHM, +/-5%, 1/8W		33-223J8T-7
					.R177 RESISTOR 1K OHM, +/-5%, 1/8W		33-102J8T-7
		TW10201			.R180 RESISTOR 470 OHM, +/-5%, 1/8W		33-471J8T-7
		TW10201			.R181 RESISTOR 470 OHM, +/-5%, 1/8W		33-471J8T-7
		TW10201			.R182 RESISTOR 100 OHM, +/-5%, 1/8W		33-101J8T-7
					.S1 PUSH SWITCH, 5 KEY		80-25634-1
					.S2 PUSH SWITCH, 5 KEY		80-25634-1
					.S3 PUSH SWITCH, 5 KEY		80-25634-1
					.S4 PUSH SWITCH, 5 KEY		80-25634-1
					.S5 PUSH SWITCH, 5 KEY		80-25634-1
					S6 POWER SWITCH SDS3P(ALPS)		80-25618-1
					.S7 PUSH SWITCH, 3 KEY		80-25633-1
					.S8 PUSH SWITCH, 3 KEY		80-25633-1
					.S9 PUSH SWITCH, 3 KEY		80-25633-1
					.S12 SLIDE SWITCH		80-25596-1
					.U1 IC SN74LS00N(TI),SN74LS00(MOTORLA)		39-25402-2
					.U2 IC MC14017BCP (MOTOROLA),HD14017BP(HITACHI)		39-25196-1
					.U3 IC MC14017BCP (MOTOROLA),HD14017BP(HITACHI)		39-25196-1
					.U4 IC MC140497BCP (MOTOROLA),HD40497B(HITACHI)		39-25559-1
					.U5 IC MC140497BCP (MOTOROLA),HD40497B(HITACHI)		39-25559-1
					.U6 MC14069UBCP(MOTOROLA), HD14069UBP(HITACHI)		39-25237-1
					.U7 IC MC14066BCP(MOTOROLA), HD14066BP(HITACHI)		39-25548-1
					.U8 IC MC74HC00(MOTOROLA), CD74HC00(RCA)		39-25616-1
					.U9 IC MC14066BCP(MOTOROLA), HD14066BP(HITACHI)		39-25548-1
					.U10 IC MC14066BCP(MOTOROLA), HD14066BP(HITACHI)		39-25548-1
					.U11 IC MC14066BCP(MOTOROLA), HD14066BP(HITACHI)		39-25548-1
					.U12 IC MC14066BCP(MOTOROLA), HD14066BP(HITACHI)		39-25548-1
					.U13 IC MC14066BCP(MOTOROLA), HD14066BP(HITACHI)		39-25548-1
					.U14 IC HD74LS32P(HITACHI),SN74LS32N(TI)		39-25560-2

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description	Mfr. Code	Mfr. Part No.
					.U15 IC HD74LS11P(HITACHI)		39-25563-2
					.U17 IC CD74HCT00(RCA)		39-25633-1
					.U18 IC CD74HCT86E(RCA)		39-25634-1
					.U19 IC SN74LS744AN(TI), HD74LS74(HITACHI)		39-25558-2
					.U20 IC ICM7226AIJL(INTERSIL)		40-25419-1
					.XU20 IC SOCKET,40 PIN		15A25129-40
					.U21 IC MC74HC00(MOTOROLA), CD74HC00(RCA)		39-25616-1
⑤	118-8680-00			1	CHANNEL B INPUT ASSEMBLY	80009	118-8680-00
				1	.CASE,SHIELD		1-25134-1
				2	.POST,COPPER		3-25032-1
				2	.SCREW,MACHINE,M3 X 6		4-11103-0602
				2	.WASHER,SPRING,M3		6-12103-02
				2	.KNOB,PUSH,IVORY GRAY		15-25426-5
				1	.KNOB,ROTARY,DOVE GRAY		15-25713-4A
					.C140 MPE/CAP. 1 uF, +/-10%, 250V		31-105K250-4M
					.C141 C/CAP. 1 pF, +/-0.5pF, 500V, NPO		31-1R0Y500-3N
					.C142 C/CAP. 20 pF, +/-5%, 500V, NPO		31-200J500-3N
					.C143 E/CAP. 47 uF, +80/-20%, 16V		31-476Z16-2
					.C144 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C146 E/CAP. 47 uF, +80/-20%, 16V		31-476Z16-2
					.C147 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C148 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C149 C/CAP. 470 pF, +/-5%, 50V		31-471J50-3
					.C150 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C151 E/CAP. 47 uF, +80/-20%, 16V		31-476Z16-2
					.C152 E/CAP. 220 uF, +80/-20%, 10V		31-227Z10-2
					.C153 E/CAP. 220 uF, +80/-20%, 10V		31-227Z10-2
					.C154 C/CAP. 150 pF, +/-5%, 500V		31-151J500-3
					.D30 DIODE, 1N4148		35-25111-1
					.G151 CABLE,COAX(CH B INPUT BNC)		30-25630-6U
					.G152 CABLE,COAX W/2 WIDE CONNECTOR		30-07040-1
					.IC105 IC, MC10116P(MOTOROLA)		39-25572-1
					.J152 RESISTOR 0 OHM		33-000J8T-7
					.J153 RESISTOR 0 OHM		33-000J8T-7
					.J154 RESISTOR 0 OHM		33-000J8T-7
					.J155 RESISTOR 0 OHM		33-000J8T-7
					.J156 RESISTOR 0 OHM		33-000J8T-7
					.JE WAFER,4 WIDE		30-25663-4
					.JF WAFER,4 WIDE		30-25663-4
					.Q110 TRANSISTOR, 2SC1674K(NEC), LC1674K(MOTOROLA)		36-25340-1
					.Q111 TRANSISTOR, 2SC1674K(NEC), LC1674K(MOTOROLA)		36-25340-1
					.Q112 FET, 2N5486(MOTOROLA)		37-25519-3
					.Q113 TRANSISTOR, MPS3640(MOTOROLA)		36-25352-1
					.Q114 TRANSISTOR, MPS3640(MOTOROLA)		36-25352-1
					.Q115 TRANSISTOR, MPS3640(MOTOROLA)		36-25352-1
					.Q118 TRANSISTOR, 2SC1674K(NEC), LC1674K(MOTOROLA)		36-25340-1
					.Q119 TRANSISTOR, 2SC1674K(NEC), LC1674K(MOTOROLA)		36-25340-1
					.R124 VR+SW, 2K OHM, +/-20%, L-15mm Part of S13		34-2023-03D
					.R146 RESISTOR 3.3K OHM, +/-5%, 1/8W		33-332J8T-7
					.R147 SVR, 10K OHM, +/-20%		34-1031-08E

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description	Mfr. Code	Mfr. Part No.
					.R150 RESISTOR 5.1 OHM, +/-5%, 1/8W		33-5R1J8T-7
					.R151 RESISTOR 1.1M OHM, +/-1%, 1/8W		33-1104F8T-6DT
					.R152 RESISTOR 121K OHM, +/-1%, 1/8W		33-1213F8T-6DT
					.R153 RESISTOR 10K OHM, +/-5%, 1W		33-103J1-3
					.R154 RESISTOR 100 OHM, +/-5%, 1/8W		33-101J8T-7
					.R156 RESISTOR 2.2K OHM, +/-5%, 1/8W		33-222J8T-7
					.R157 RESISTOR 3.3K OHM, +/-5%, 1/8W		33-332J8T-7
					.R159 RESISTOR 330 OHM, +/-5%, 1/8W		33-331J8T-7
					.R162 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R163 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R164 RESISTOR 180 OHM, +/-5%, 1/8W		33-181J8T-7
					.R165 RESISTOR 330 OHM, +/-5%, 1/8W		33-331J8T-7
					.R166 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R167 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R168 RESISTOR 270 OHM, +/-5%, 1/8W		33-271J8T-7
					.R169 RESISTOR 100 OHM, +/-5%, 1/8W		33-101J8T-7
					.R170 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R171 RESISTOR 510 OHM, +/-5%, 1/8W		33-511J8T-7
					.R172 RESISTOR 130 OHM, +/-5%, 1/8W		33-131J8T-7
					.R173 RESISTOR 43 OHM, +/-5%, 1/8W		33-430J8T-7
					.R174 RESISTOR 3.3K OHM, +/-5%, 1/8W		33-332J8T-7
					.R175 SVR, 10K OHM, +/-20%		34-1031-08E
					.R178 RESISTOR 15K OHM, +/-5%, 1/8W		33-153J8T-7
					.R179 SVR, 100K OHM, +/-20%		34-1041-08E
					.S10 PUSH SWITCH, 2 KEY		80-25592-1
					.S11 PUSH SWITCH, 2 KEY		80-25592-1
					.S13 VR/SW, 2K OHM, +/-20%, L-15mm Part of R124		34-2023-03D
⑥	118-8682-00			1	PAL BOARD ASSEMBLY	80009	118-8682-00
				3	.SCREW		4-11102-0602
				3	.SCREW		4-11102-0602
				3	.POST,COPPER,D3 X 17		5-25117-01
					.C13 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C16 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C30 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C31 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C32 C/CAP. 0.1 uF, +80/-20%, 50V		31-104Z50-3
					.C35 C/CAP. 470 pF, +/-5%, 50V		31-471J50-3
					.C36 C/CAP. 0.01 uF, +/-10%, 100V		31-103K100-3
					.C37 E/CAP. 47 uF, +80/-20%, 16V		31-476Z16-2
					.D31 DIODE 1N4148		35-25111-1
					.J117 WAFER, 3P, 180' WITH LOCK		30-25663-3
					.JG WAFER,7 WIDE		30-25739-7
					.JH WAFER,7 WIDE		30-25739-7
					.R24 RESISTOR 10K OHM, +/-5%, 1/8W		33-103J8T-7
					.TCXO 10MHZ,+/-1PPM		58-25128-2
					.U16 IC 74HC11		39-25644-1
					.U22 IC 74HC393		39-25645-1
					.U23 IC 74HC393		39-25645-1
					.U24 IC 74HC574		39-25641-1
					.XU24 IC SOCKET,14 PIN		15A-25129-14
					.U25 IC 74HC574		39-25641-1
					.XU25 IC SOCKET,14 PIN		15A-25129-14
					.U26 IC PAL (16L8)		39-25643-1
					.XU26 IC SOCKET, 20 PIN		15A-25129-20

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty.	Name & Description	Mfr. Code	Mfr. Part No.
					ACCESSORIES		
	070-7999-00			1	MANUAL, CDC250 OPERATOR	80009	070-7999-00
				1	AC POWER CORD (EUROPE)		30-25635-4
				1	AC POWER CORD (UNITED STATES)		30-25635-1
					OPTIONAL ACCESSORIES		
	070-7998-00			1	MANUAL, CDC250 SERVICE	80009	070-7998-00

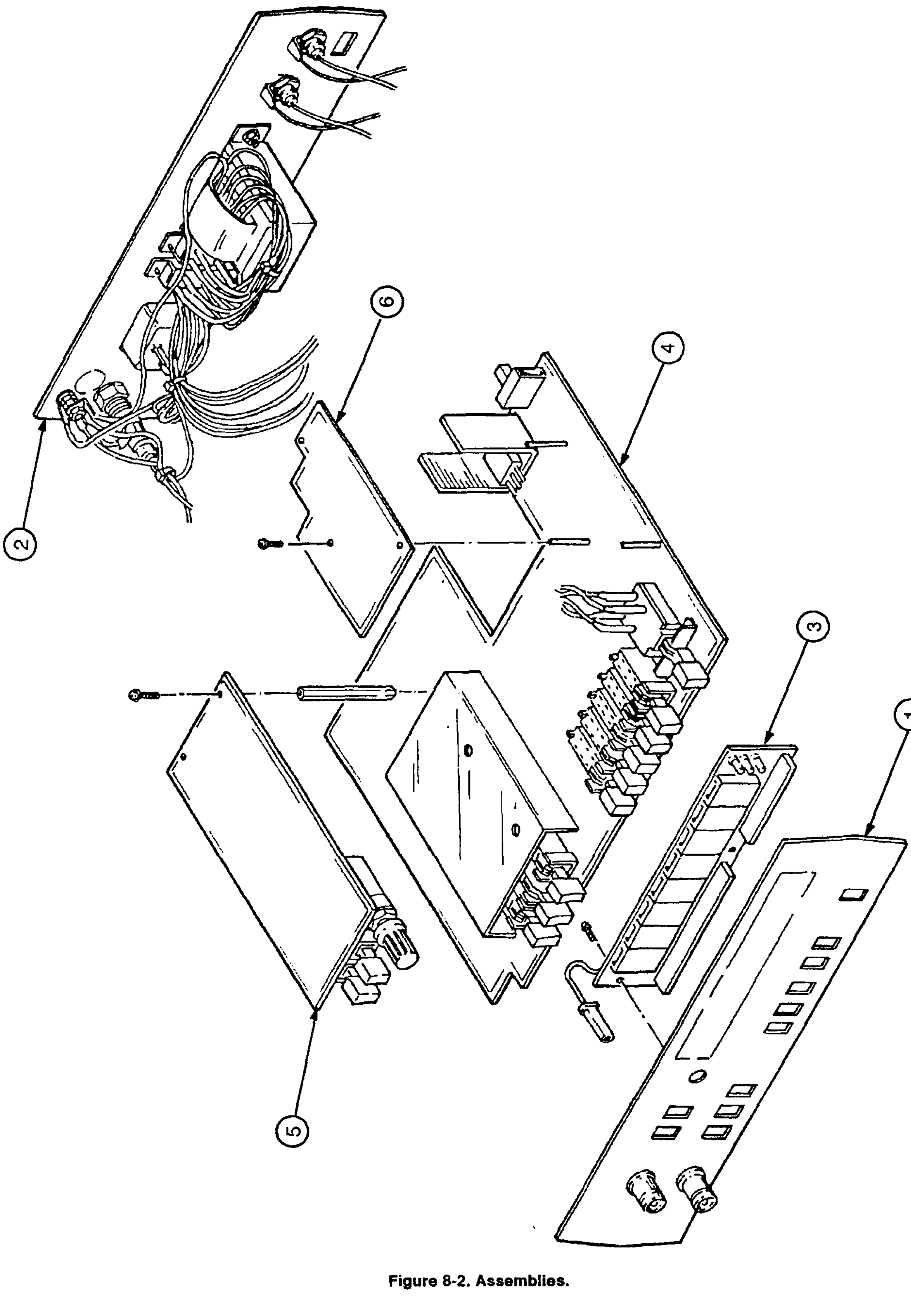


Figure 8-2. Assemblies.

Diagrams

Diagram and Circuit Board Illustrations

Symbols. Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

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

The overline on a signal name indicates that the signal performs its intended function when it is in the low state.

Abbreviations are based on ANSI Y1.1-1972.

Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

- Y14.15, 1966. Drafting Practices.
- Y14.2, 1973. Line Conventions and Lettering.
- Y10.5, 1968. Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

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

- Capacitors—Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
- Resistors—Ohms (Ω).

Symbols. Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Information and Symbols Appearing in this Section

The schematic diagrams and circuit board component location illustration have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagram on which it was illustrated; the lookup table will list the diagram number of other diagrams that the circuitry of the circuit board appears on.

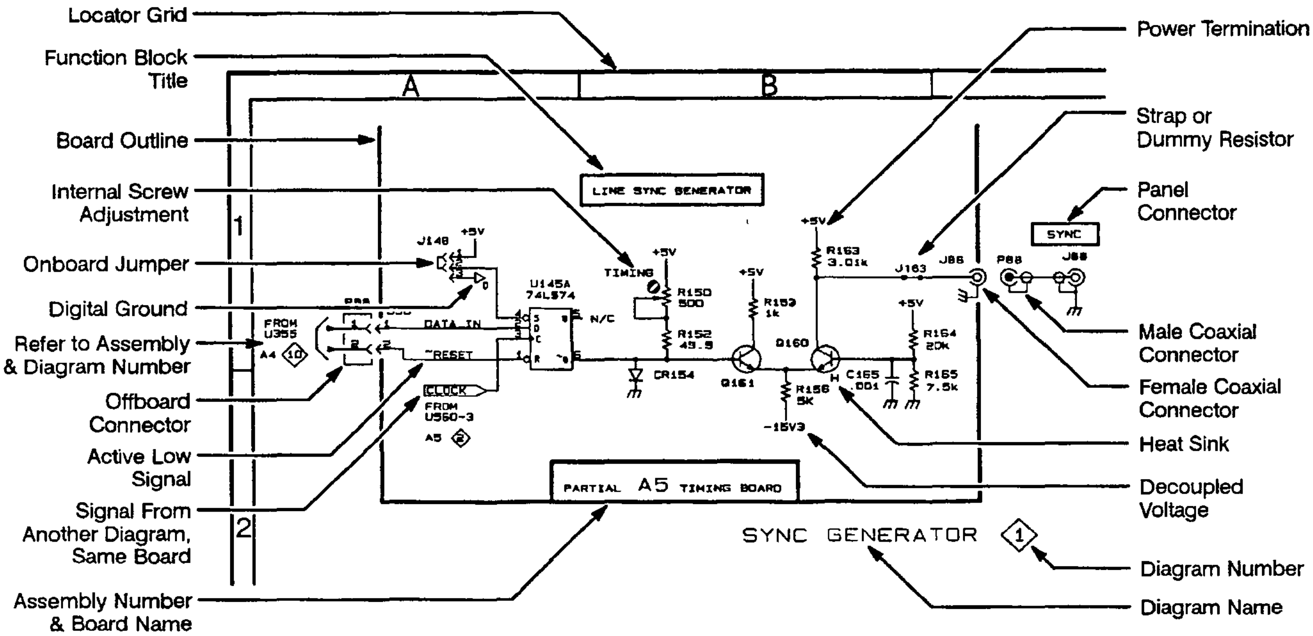
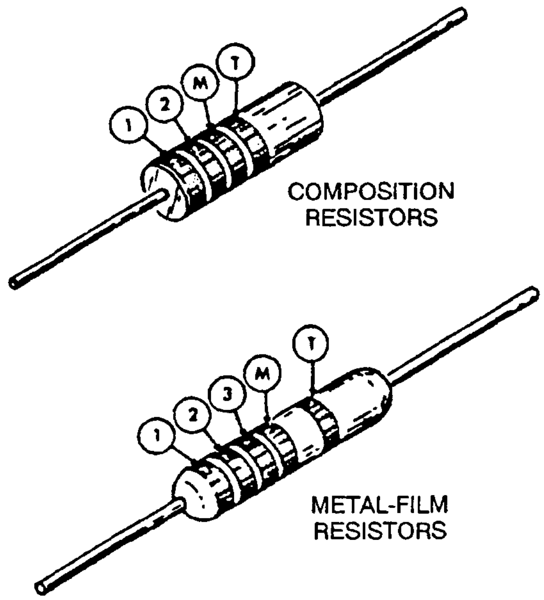


Figure 9-1: Schematic Illustration Example.



(1) (2) and (3) – 1st, 2nd, and 3rd significant figures.
(M) – Multiplier (T) – Tolerance

COLOR	SIGNIFICANT FIGURES	MULTIPLIER	TOLERANCE
BLACK	0	1	---
BROWN	1	10	±1%
RED	2	10^2 or 100	±2%
ORANGE	3	10^3 or 1 K	±3%
YELLOW	4	10^4 or 10 K	±4%
GREEN	5	10^5 or 100 K	±1/2%
BLUE	6	10^6 or 1 M	±1/4%
VIOLET	7	---	±1/10%
GRAY	8	---	---
WHITE	9	---	---
GOLD	---	10^{-1} or 0.1	±5%
SILVER	---	10^{-2} or 0.01	±10%
NONE	---	---	±20%

Figure 9-2: Color Codes For Resistors.

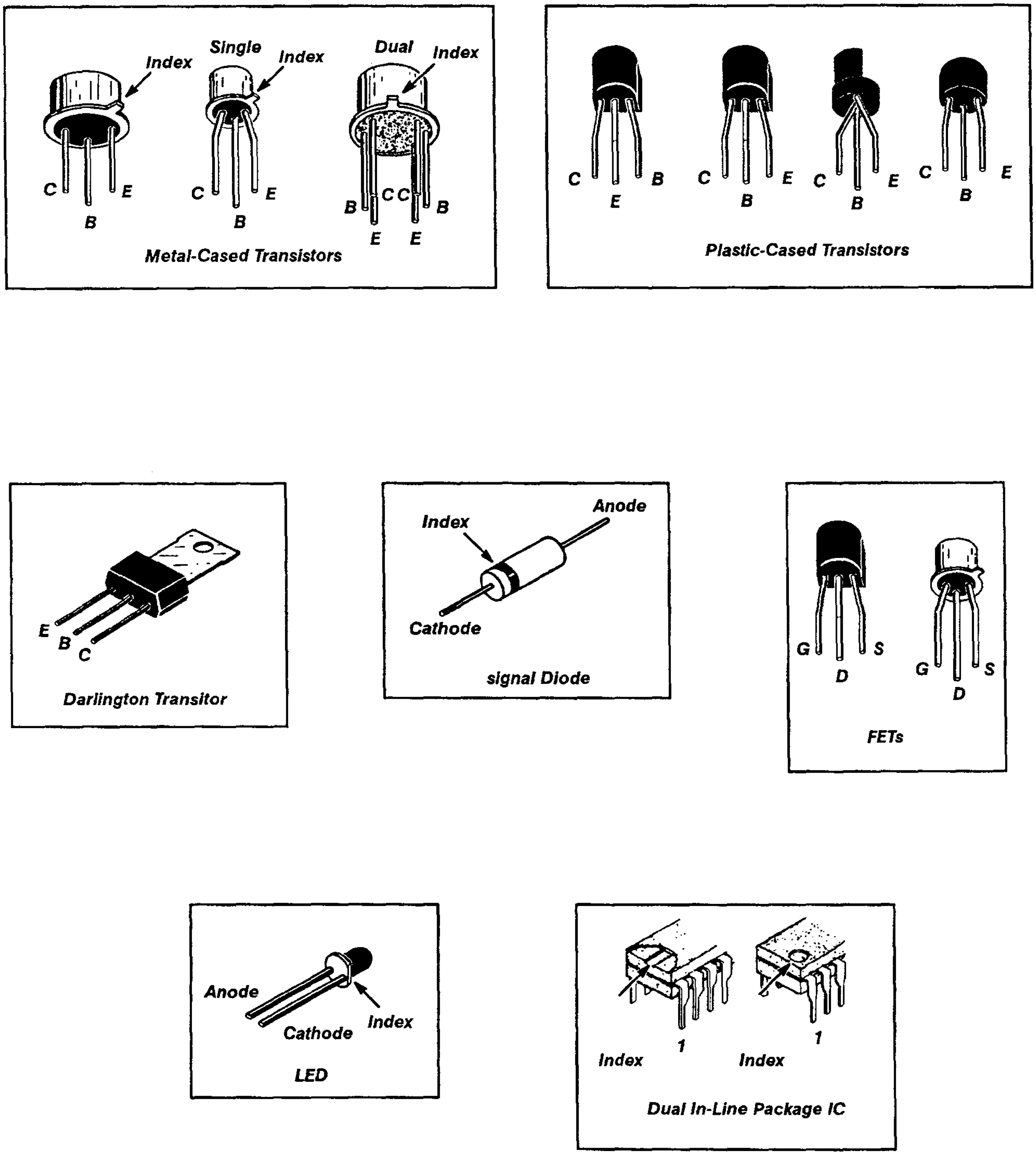


Figure 9-3: Semiconductor Lead Configurations.

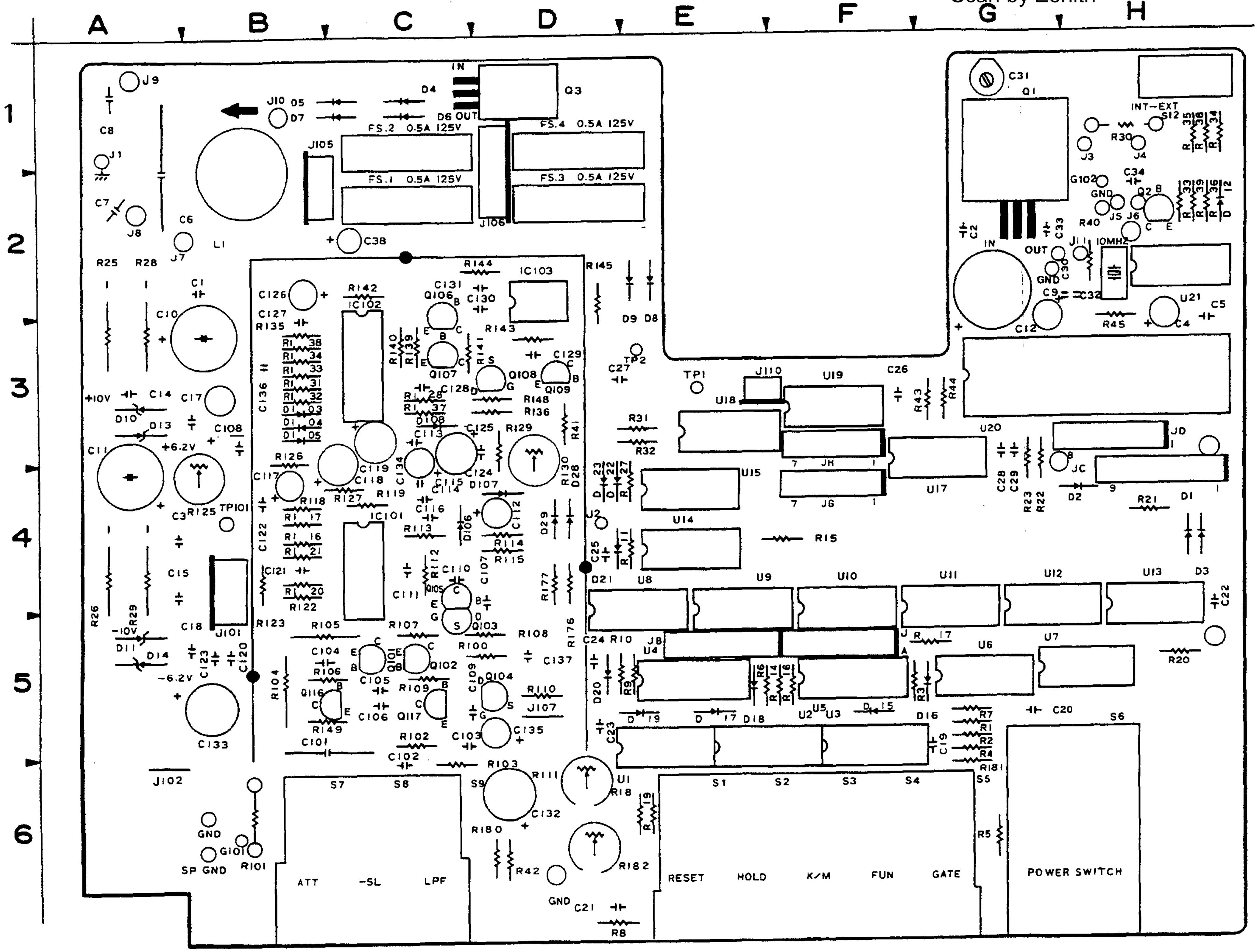


Figure 9-4: Main Board.

A1 – Main Board

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C1	1	C136	1			R108	1	U4B	4
C2	1	C137	1	Q1	1	R109	1	U4C	4
C3	1			Q2	1	R110	1	U4D	4
C4	1	D1	3	Q3	1	R111	1	U4E	4
C5	1	D2	4	Q101	1	R112	1	U4F	4
C9	1	D3	3	Q102	1	R113	1	U5A	4
C10	1	D4	1	Q103	1	R114	1	U5B	4
C11	1	D5	1	Q104	1	R115	1	U5C	4
C12	1	D6	1	Q105	1	R116	1	U5D	4
C14	1	D7	1	Q106	1	R117	1	U5F	4
C15	1	D8	1	Q107	1	R118	1	U6B	4
C17	1	D9	1	Q108	1	R119	1	U6C	1
C18	1	D10	1	Q109	1	R120	1	U6D	1
C19	1	D11	1	Q116	1	R121	1	U6E	1
C20	4	D12	1	Q117	1	R122	2	U6F	1
C21	3	D13	1			R123	2	U7A	3
C22	1	D14	1	R1	1	R125	2	U7B	3
C23	3	D15	4	R2	1	R126	2	U7D	3
C24	3	D16	4	R3	4	R127	1	U8A	3
C25	3	D17	4	R4	1	R128	1	U8B	3
C26	1	D18	4	R5	1	R129	1	U8C	4
C27	1	D19	3	R6	4	R130	1	U8D	3
C28	3	D20	3	R7	4	R131	1	U9A	4
C29	4	D21	3	R8	3	R132	1	U9B	4
C33	1	D22	1	R9	3	R133	1	U9C	4
C34	1	D23	1	R10	3	R134	1	U9D	4
C38	1	D28	4	R11	3	R135	1	U10A	4
C101	1	D29	4	R14	4	R136	1	U10B	4
C102	1	D103	1	R15	4	R137	1	U10C	3
C103	1	D104	1	R16	4	R138	1	U10D	3
C104	1	D105	1	R17	3	R139	1	U11A	3
C105	1	D106	1	R18	1	R140	1	U11B	3
C106	1	D107	1	R19	1	R141	1	U11C	3
C107	1	D108	1	R20	3	R142	1	U11D	3
C108	1			R21	3	R143	1	U12A	3
C109	1	FS1	1	R22	3	R144	1	U12B	3
C110	1	FS2	1	R23	4	R145	1	U12C	3
C111	1	FS3	1	R25	1	R148	1	U12D	3
C112	1	FS4	1	R26	1	R149	1	U13C	3
C113	1			R27	1	R176	4	U13D	3
C114	1	G101	1	R28	1	R177	4	U14A	4
C115	1	G102	1	R29	1	R180	1	U14B	4
C116	1			R30	1	R181	4	U14C	4
C117	1	IC101	1	R31	1	R182	1	U14D	3
C118	1	IC102A	1	R32	2			U15A	4
C119	1	IC102B	1	R33	1	S1	3	U15B	4
C120	1	IC102C	1	R34	1	S2	1	U15C	1
C121	1	IC102D	1	R35	1	S3	4	U17A	1
C122	2	IC103	1	R36	1	S4	1	U17B	1
C123	2			R38	1	S5	1	U17C	3
C124	1	J1	1	R39	1	S7	1	U17D	2
C125	1	J2	1	R41	1	S8	1	U18A	3
C126	1	J3	1	R42	1	S9	1	U18B	1
C127	1	J4	1	R45	3	S12	1	U18C	2
C128	1	J5	1	R100	1			U18D	1
C129	1	J6	3	R101	1	U1A	3	U19A	3
C130	1	J101	2	R102	1	U1B	1	U19B	1
C131	1	J102	1	R103	1	U1C	1	U20	3
C132	1	J105	2	R104	1	U1D	3	U21A	1
C133	1	J106	1	R105	1	U2	4	U21B	1
C134	1	J107	1	R106	1	U3	4	U21C	1
C135	1	J110	2	R107	1	U4A	4	U21D	1

Off Board Components

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
FS5	1	S6	1	S15	1
JF	1	S14	1	T1	1

INPUT DIAGRAM 1

Main Board

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C1	2H	2B
C2	3H	2G
C3	2H	4A
C4	3L	3H
C5	3K	3H
C9	3L	2G
C10	1J	2A
C11	2H	3A
C12	3J	3G
C14	1J	3A
C15	2J	4A
C17	2K	3B
C18	2K	5B
C19	3K	5G
C22	3K	5H
C26	3K	3F
C27	3K	3D
C33	3K	2G
C36	3J	2B
C38	4B	2C
C101	4B	5C
C102	4B	5C
C103	4C	5C
C104	4C	5B
C105	3D	5C
C106	5D	5C
C107	1K	4C
C108	2K	3B
C109	2K	5C
C110	2K	4C
C111	4E	4C
C112	4E	4B
C113	2K	3C
C114	2K	4C
C115	2K	4C
C116	4E	4C
C117	5E	4B
C118	4F	4C
C119	4G	4C
C120	2K	5B
C121	4F	4B
C124	4G	4D
C125	5H	3D
C126	3K	2B
C127	3K	2B
C128	5G	3C
C129	3L	3D

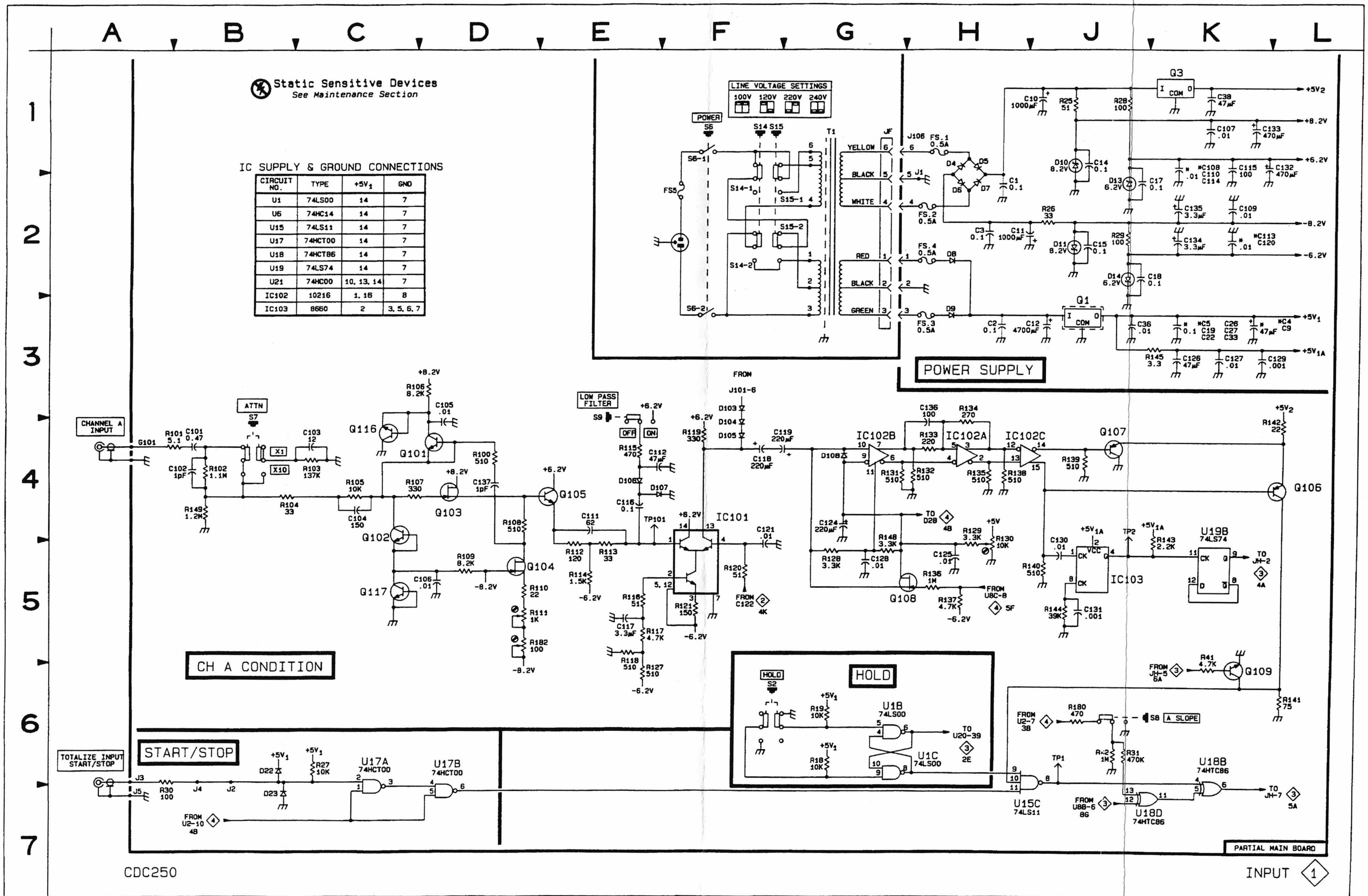
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C130	4J	2D
C131	5J	2C
C132	2L	6D
C133	1K	5B
C134	2K	4C
C135	2K	5D
C136	3H	3B
C137	4D	5D
D4	1H	1C
D5	1H	1B
D6	2H	1C
D7	2H	1B
D8	2H	3E
D9	3H	3E
D10	1J	3A
D11	2J	5A
D13	2J	3A
D14	2J	5A
D22	6B	4D
D23	7B	4D
D103	3F	3B
D104	4F	3B
D105	4F	3B
D106	4E	4C
D107	4E	4D
D108	4G	3C
FS1	1H	2C
FS2	2H	1C
FS3	3H	2D
FS4	2H	1D
G101	4A	6B
IC101	4F	4C
IC102A	4H	5C
IC102B	4G	5C
IC102C	4H	5C
IC103	5J	2D
J1	2H	1A
J2	6B	4E
J3	6B	2H
J4	7B	2H
J5	7B	2H

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
J106	1H	2D
J107	5D	5D
Q1	3J	1G
Q3	1K	1D
Q101	4D	5C
Q102	4C	5C
Q103	4D	5C
Q104	5E	5D
Q105	4E	4C
Q106	4L	2C
Q107	4J	3C
Q108	5G	3D
Q109	6J	3D
Q116	4C	5B
Q117	5C	5C
R18	6G	6D
R19	6G	6E
R25	1J	2A
R26	2J	4A
R27	6C	4E
R28	1J	2A
R29	2J	4A
R30	7A	1H
R31	6J	3E
R41	6K	3D
R42	6J	6D
R100	4D	5D
R101	4A	6B
R102	4B	5C
R103	4C	6D
R104	4B	5B
R105	4C	5C
R106	3D	5C
R107	4C	5C
R108	4D	5D
R109	5D	5C
R110	5D	5D
R111	5D	6D
R112	5E	4C
R113	5E	4C
R114	5E	4D
R115	4E	4D
R116	5E	4B
R117	5E	4B

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
R118	5E	4B
R119	4F	4C
R120	5F	4B
R121	5F	4B
R127	6E	4C
R128	5G	3C
R129	4H	3D
R130	4H	4D
R131	4G	3B
R132	4H	3B
R133	4H	3B
R134	3H	3B
R135	4H	3B
R136	5H	3D
R137	5H	3C
R138	4H	3B
R139	4J	3C
R140	5J	3C
R141	6L	3D
R142	4L	2C
R143	5K	3D
R144	5J	2D
R145	3K	2D
R148	5G	3D
R149	4B	5B
R180	6J	6D
R182	5D	6E
S2	6G	6F
S7	4B	6C
S8	6K	6C
S9	3E	6D
TP1	6J	3E
TP2	4J	3E
TP101	4E	4B
U1B	6G	6E
U1C	6H	6E
U15C	7J	4E
U17A	6C	4G
U17B	6D	4G
U18B	6K	3E
U18D	7K	3E
U19B	4K	3F

CHASSIS MOUNTED

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
FS5	2F	CHASSIS
S6	1F	CHASSIS
S14	1F	CHASSIS
S15	1F	CHASSIS
T1	1G	CHASSIS



IC SUPPLY & GROUND CONNECTIONS

CIRCUIT NO.	TYPE	$+5V_1$	GND
U1	74LS00	14	7
U6	74HC14	14	7
U15	74LS11	14	7
U17	74HCT00	14	7
U18	74HCT86	14	7
U19	74LS74	14	7
U21	74HC00	10, 13, 14	7
IC102	10216	1, 16	8
IC103	8660	2	3, 5, 6, 7

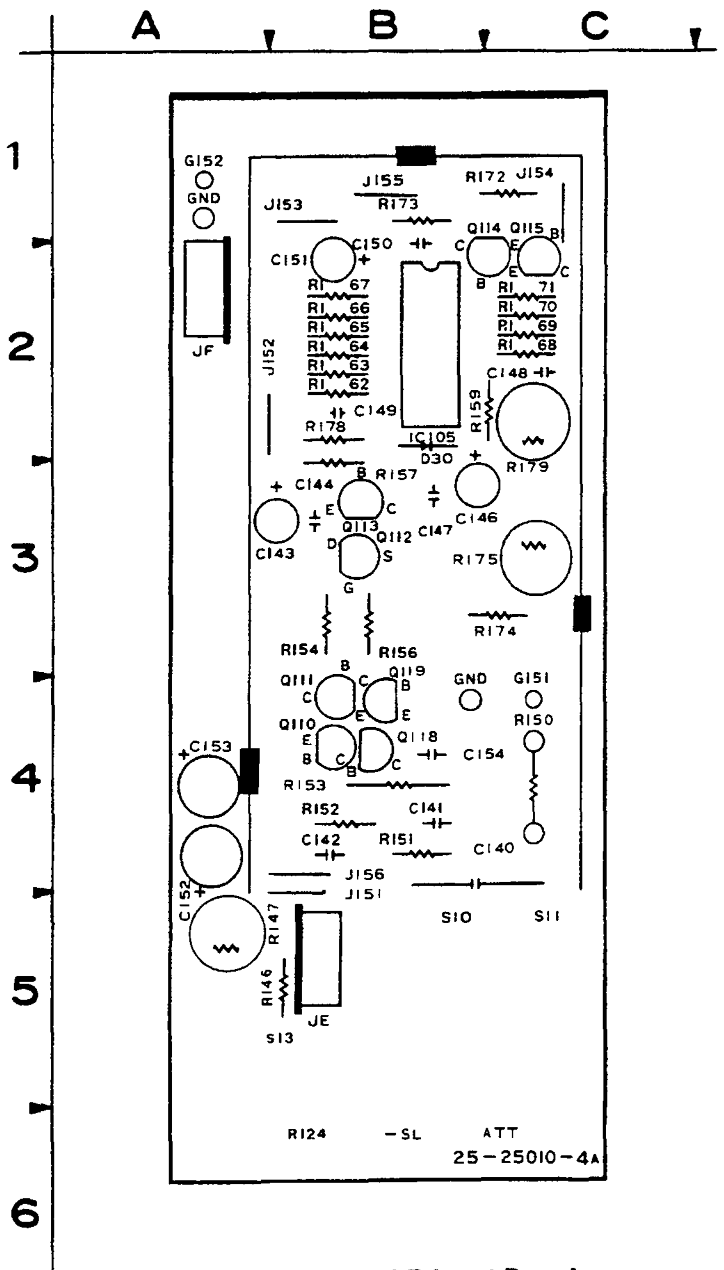


Figure 9-5: CH B Input Board.

A2 CHANNEL B Input Board

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C140	2	C153	2	J154	2	Q119	2	R157	2	R171	2
C141	2	C154	2	J156	2			R159	2	R172	2
C142	2			JE	2	R124	2	R162	2	R173	2
C143	2	D30	2	JF	2	R146	2	R163	2	R174	2
C144	2					R147	2	R164	2	R175	2
C146	2	G151	2	Q110	2	R150	2	R165	2	R178	2
C147	2	G152	2	Q111	2	R151	2	R166	2	R179	2
C148	2			Q112	2	R152	2	R167	2		
C149	2	IC105	2	Q113	2	R153	2	R168	2	S10	2
C150	2			Q114	2	R154	2	R169	2	S11	2
C151	2	J153	2	Q115	2	R156	2	R170	2	S13	2
C152	2	J153	2	Q118	2						

Scan by Zenith

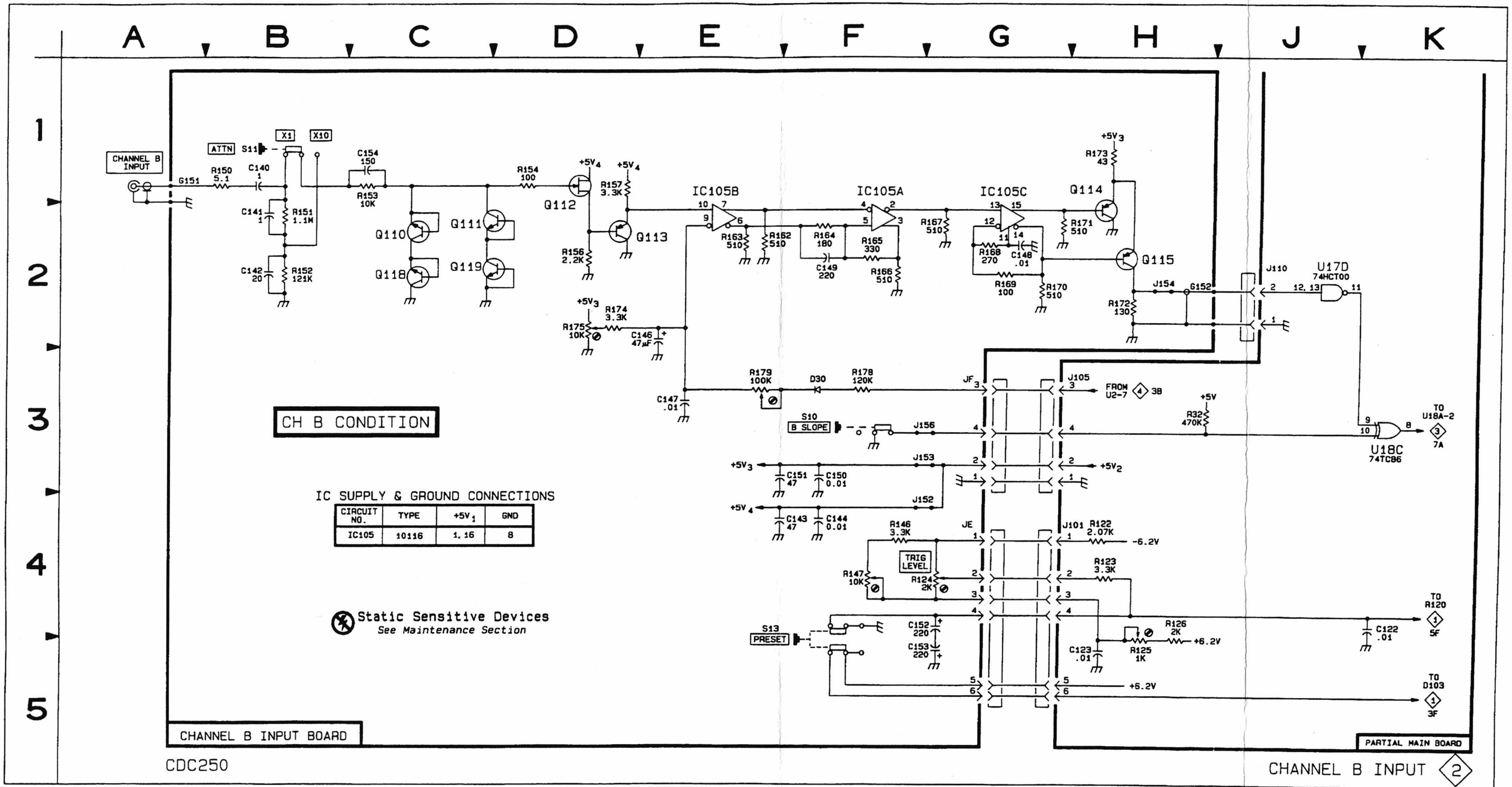
CHANNEL B INPUT DIAGRAM 2

Main Board

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C122	4K	4B	J105	3H	1B	R122	4H	4B	U17D	2J	4G
C123	5H	5B	J110	2J	3E	R123	4H	5B	U18C	3K	3E
						R125	5H	4B			
J101	4H	5B	R32	3H	3E	R126	4H	3B			

CHB Input Board

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C140	2B	4C	G152	2H	1A	Q115	2H	1C	R165	2F	2B
C141	2B	4B				Q118	2C	4B	R166	2F	2B
C142	2B	4B	IC105A	1F	2B	Q119	2C	3B	R167	2G	2B
C143	4F	3B	IC105B	1E	2B				R168	2G	2C
C144	4F	3B	IC105C	1G	2B	R124	5G	6B	R169	2G	2C
C146	2E	3B				R146	4F	5B	R170	2G	2C
C147	3E	3B	J152	3G	2A	R147	4F	5B	R171	2H	2C
C148	2G	2C	J153	3G	1B	R150	1B	4C	R172	2H	1C
C149	2F	2B	J154	2H	1C	R151	2B	4B	R173	1H	1B
C150	3E	2B	J156	3F	4B	R152	2B	4B	R174	2D	3B
C151	3E	2B	JE	4G	5B	R153	2C	4B	R175	2D	3C
C152	5E	5A	JF	3G	2A	R154	1D	3B	R178	3F	2B
C153	5E	4A				R156	2D	3B	R179	3E	3C
C154	1C	4C	Q110	2C	4B	R157	1D	3B			
			Q111	2C	4B	R162	2E	2B	S10	3F	5B
D30	3F	3B	Q112	2D	3B	R163	2E	2B	S11	1B	5C
			Q113	2E	3B	R164	2F	2B	S13	4F	5B
G151	1A	4C	Q114	1H	1C						



IC SUPPLY & GROUND CONNECTIONS

CIRCUIT NO.	TYPE	$+5V_1$	GND
IC105	10116	1, 16	8

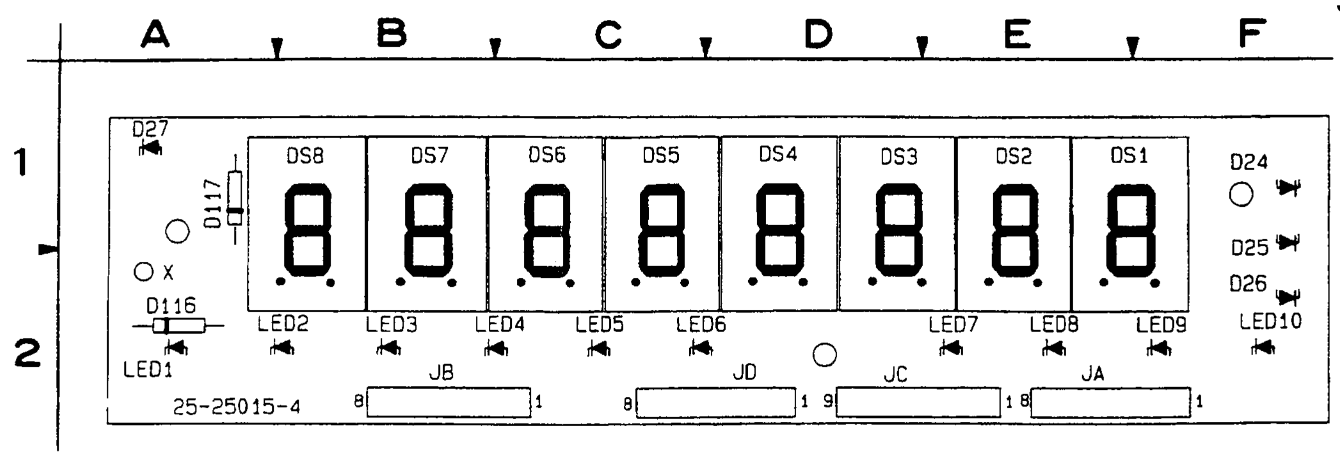


Figure 9-6: Display Board.

A4—Display Board											
CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
D24	4	D117	3	DS4	3	JA	4	LED1	4	LED6	4
D25	4			DS5	3	JB	4	LED2	4	LED7	4
D26	3	DS1	3	DS6	3	JC	3	LED3	4	LED8	4
D27	3	DS2	3	DS7	3	JD	3	LED4	4	LED9	4
D116	3	DS3	3	DS8	3			LED5	4	LED10	4

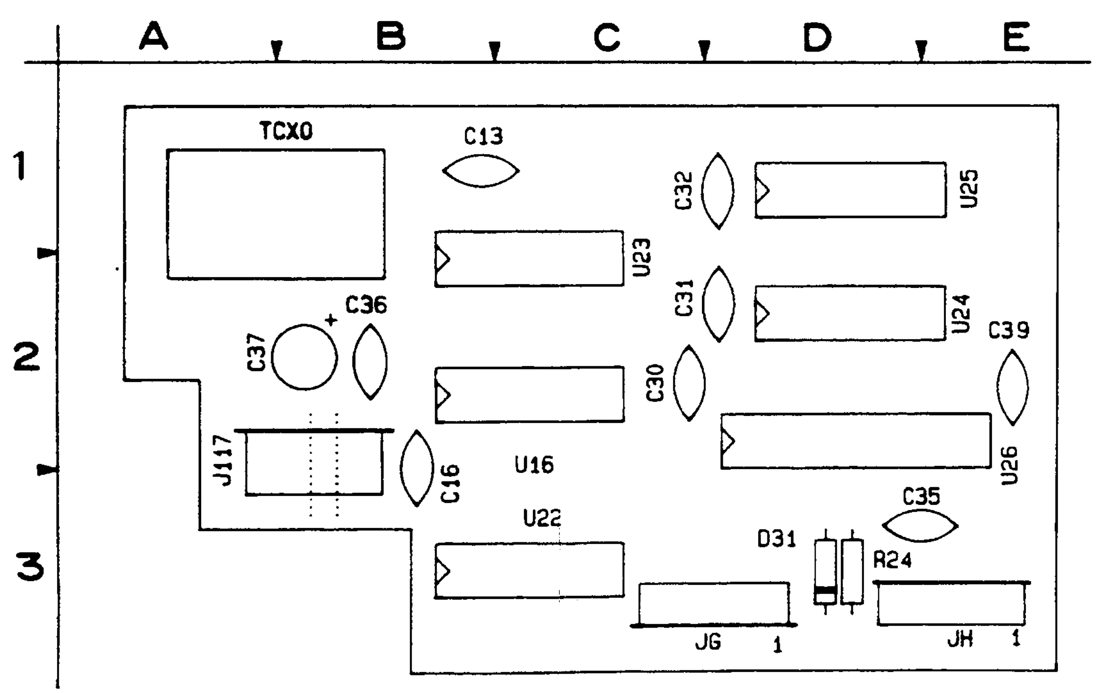


Figure 9-7: PAL Board.

A3—PAL Board											
CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C13	3	C35	3	J117	3	R24	3	U22A	3	U24B	3
C16	3	C36	3					U22B	3	U25A	3
C30	3	C37	3	JG	4	U16A	3	U23A	3	U25B	3
C31	3			JH	4	U16B	3	U23B	3	U26	3
C32	3	D31	3			U16C	4	U24A	3		

DISPLAY DIAGRAM 3

Main Board

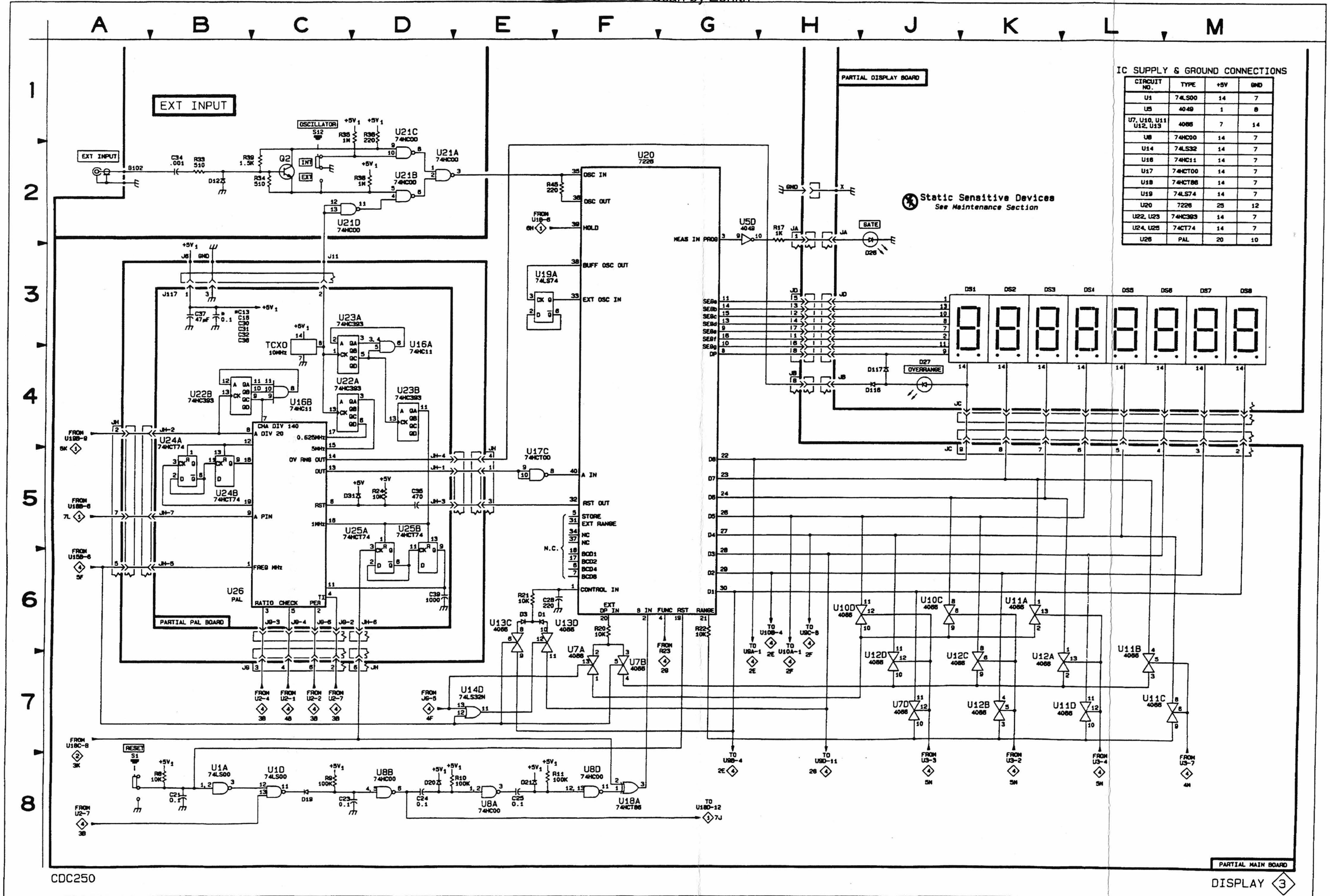
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C21	8B	6D	JH	4B	4F	R38	2C	1H	U11B	7L	4G
C23	8D	5E	JH	6D	4F	R39	2B	2H	U11C	7M	4G
C24	8D	5E	JH	5D	4F	R45	2E	3H	U11D	7L	4G
C25	8E	4D	JG	6C	4F	S1	8A	6E	U12A	7K	4G
C28	6E	4G	Q2	2C	2H	U1A	8B	6E	U12B	7K	4G
C34	2B	2H	R8	8B	6D	U1D	8C	6E	U12C	7K	4G
D1	6E	4H	R9	8C	5E	U5D	2G	5F	U12D	7J	4G
D3	6E	4H	R10	8E	5D	U7A	7F	5G	U13C	6E	4H
D12	2B	2H	R11	8F	4E	U7B	7F	5G	U13D	6F	4H
D19	8C	5E	R17	2H	5G	U7D	7J	5G	U14D	7D	4H
D20	8D	5E	R20	6F	5H	U8A	8E	4E	U17C	5E	4G
D21	8E	4D	R21	6E	4H	U8B	8D	4E	U18A	8F	3E
G102	2A	2H	R22	6G	4G	U8D	8F	4E	U19A	3E	3F
J6	3B	2H	R33	2B	2H	U10C	6J	4F	U20	2F	4G
J11	3C	2H	R34	2B	1H	U10D	6J	4F	U21B	2D	3H
JD	3H	3H	R35	2C	1H	U11A	6K	4G	U21C	2D	3H
			R36	2C	2H				U21D	3C	3H

Display Board

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
D26	3J	1F	DS1	3K	1F	DS6	3M	1C	JB	2H	2B
D27	3J	1A	DS2	3K	1E	DS7	3M	1B	JC	4K	2D
D116	4J	2A	DS3	3K	1D	DS8	3M	1B	JD	3H	2D
D117	4J	1A	DS4	3L	1D	JA	2H	2E	X	2H	2A
			DS5	3L	1C						

PAL Board

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C13	3B	1B	C39	6D	2E	TCXO	3C	1B	U23B	4D	2C
C16	3B	3B	D31	5D	3D	U16A	4D	2C	U24A	5B	2E
C30	3B	2C	J117	3B	2A	U16B	4C	2C	U24B	5B	2E
C31	3B	2D	R24	5D	3D	U22A	[illegible]	3C	U25A	5D	1E
C32	3B	1D				U22B	4B	3C	U25B	5D	1E
C35	5D	3E				U23A	3D	2C	U26	6B	2E
C36	3B	2B									
C37	3B	2A									



IC SUPPLY & GROUND CONNECTIONS

CIRCUIT NO.	TYPE	+5V	GND
U1	74LS00	14	7
U5	4049	1	8
U7, U10, U11 U12, U13	4066	7	14
U8	74HC00	14	7
U14	74LS32	14	7
U16	74HC11	14	7
U17	74HCT00	14	7
U18	74HCT86	14	7
U19	74LS74	14	7
U20	7226	25	12
U22, U23	74HC393	14	7
U24, U25	74CT74	14	7
U26	PAL	20	10

FUNCTION AND GATE DISPLAY LOGIC DIAGRAM 4

Main Board

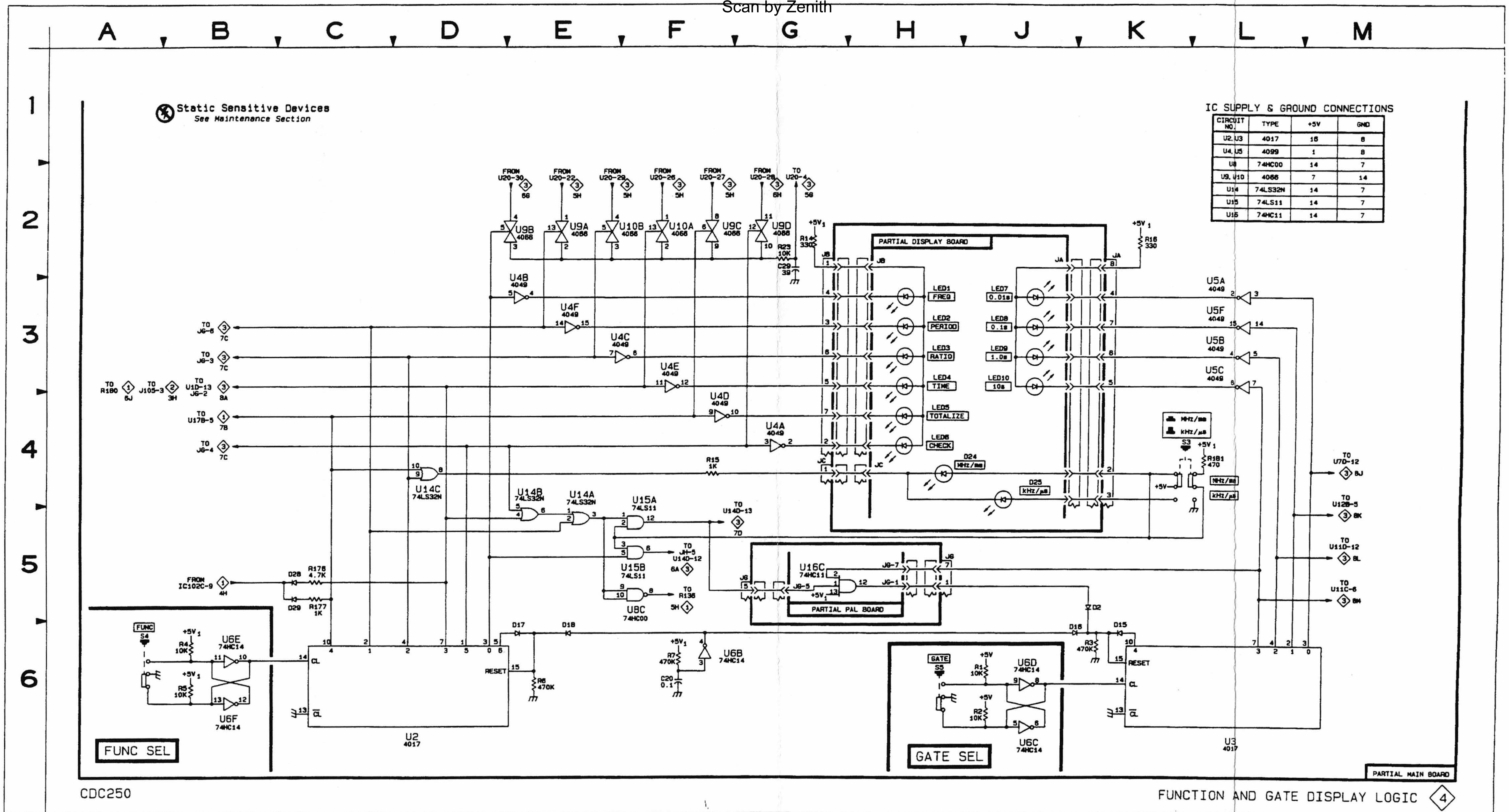
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C20	6F	5H	R5	1B	6G	U2	6D	5F	U6E	1B	6E
C29	2G	4G	R6	6E	5E	U3	6L	5F	U6F	2B	6E
			R7	6F	5G	U4A	4G	5E	U8C	5F	4E
D2	5K	4H	R14	2G	5F	U4B	3E	5E	U9A	2E	4E
D15	6K	5F	R15	4F	4F	U4C	3F	5E	U9B	2E	4E
D16	6K	5G	R16	2K	4F	U4D	4F	5E	U9C	2F	4E
D17	6E	5E	R23	2G	4G	U4E	3F	5E	U9D	2G	4E
D18	6E	5E	R176	5C	5D	U4F	3E	5E	U10A	2F	4F
D28	5C	4D	R177	5C	4D	U5A	3L	5F	U10B	2F	4F
D29	5C	4D	R181	4C	6G	U5B	3L	5F	U14A	4E	4E
						U5C	3L	5F	U14B	4E	4E
R1	1D	5G	S3	4K	6F	U5F	3L	5F	U14C	4D	4E
R2	1D	5G	S4	1C	6F	U6B	6F	5G	U15A	4F	4E
R3	6K	5G	S5	2C	6G	U6C	2D	6E	U15B	5F	4E
R4	1B	6G				U6D	1D	6E			

Display Board

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
D24	4J	1F	JC	4H	2D	LED3	3H	2B	LED7	3J	2E
D25	4J	1F				LED4	3H	2C	LED8	3J	2E
			LED1	3H	2A	LED5	4H	2C	LED9	3J	2F
JA	2J	2E	LED2	3H	2B	LED6	4H	2C	LED10	3J	2F
JB	2H	2B									

PAL Board

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
JG	5H	3D	U16C	5G	2C						



IC SUPPLY & GROUND CONNECTIONS

CIRCUIT NO.	TYPE	+5V	GND
U2, U3	4017	16	8
U4, U5	4099	1	8
U8	74HC00	14	7
U9, U10	4066	7	14
U14	74LS32N	14	7
U15	74LS11	14	7
U16	74HC11	14	7

CDC250

FUNCTION AND GATE DISPLAY LOGIC ⟨4⟩

Tektronix®

REVISION INFORMATION

Manual Part No. 070-7998-00 First Printing Apr 1991

Product: CDC250 Service Manual Revised Jan 1992

Manual Insert Status

DATE	CHANGE REFERENCE	STATUS
APR 94	C1/0494	Effective

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MANUAL CHANGE INFORMATION

Date: 4-14-94 Change Reference: C1/0494

Product: CDC250 Service Manual Manual Part Number: 070-7998-00

DESCRIPTION Product Group 46

EFFECTIVE ALL SERIAL NUMBERS

TEXT CHANGES

Pages 1-6 and 1-7

Table 1-2: Electrical Characteristics

Add equivalent peak-to-peak values for the specifications that have only rms:

CHANNEL A INPUT

Sensitivity			
kHz Mode			
	5 Hz to 10 MHz	20 mV rms	(57 mV_{p-p})
MHz Mode			
	5 MHz to 125 MHz	50 mV rms	(141 mV_{p-p})
	125 MHz to 150 MHz	100 mV rms	(283 mV_{p-p})
	150 MHz to 175 MHz	150 mV rms	(424 mV_{p-p})

CHANNEL B INPUT

Sensitivity	30 mV rms	(85 mV_{p-p})

Pages 4-4

Performance Checks

Change incorrect peak-to-peak to new values as per table above. The corrected steps appear below.

Step 2: Check Channel A Frequency Range and Sensitivity

Replace steps d and k with the following:

d. Adjust the function generator output amplitude for 57 mV_{p-p} sine wave.

k. Adjust the signal generator to produce a 50 kHz, 424 mV_{p-p} sine wave.