TEKTRONIX®

DL 502
DIGITAL LATCH

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077
070-2397-00

Serial Number ____________

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WARRANTY

This Tektronix instrument is warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your Tektronix Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the Tektronix Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument type number or part number and serial number with all requests for parts or service.

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WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

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SAFETY INFORMATION

GENERAL

The following general safety information applies to all operators and service personnel. Specific warnings will be found throughout the manual where they apply and should be followed in each instance.

WARNING statements identify conditions or practices which could result in personal injury or loss of life.

CAUTION statements identify conditions or practices which could result in damage to the equipment or to other property.

The word DANGER on the equipment identifies areas of immediate hazard which could result in personal injury or loss of life.

NOTES identify procedures, conditions, statements, etc., which may be essential for better understanding.

The following safety symbols may appear on the equipment:

⚠ CAUTION — Refer to manual

ϟ DANGER — High voltage

⏚ Protective ground (earth) terminal

Chassis ground

GROUNDING

To avoid electric shock, plug in the power cord with its grounding (earth) conductor before connecting to the instrument input or output terminals.

Do not defeat the grounding connections.

USE THE PROPER POWER CORD

To avoid electric shock and fire hazard, use only the power cord and connector specified for your instrument. Use only a power cord in good condition.

For detailed information on power connectors, see the appropriate (Operator's, Service) instructions.

USE THE PROPER FUSE

To avoid electric shock and fire hazard, use only fuses specified in parts list for your instrument, and identical in the following respects:

A. Type: Slow blow, fast blow, etc.

B. Voltage rating: 250 V, etc.

C. Current rating

Fuse replacement procedures, requiring qualified service personnel, are described in the Service portion of the appropriate manual.

Disconnect the power input before replacing the fuse.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERE

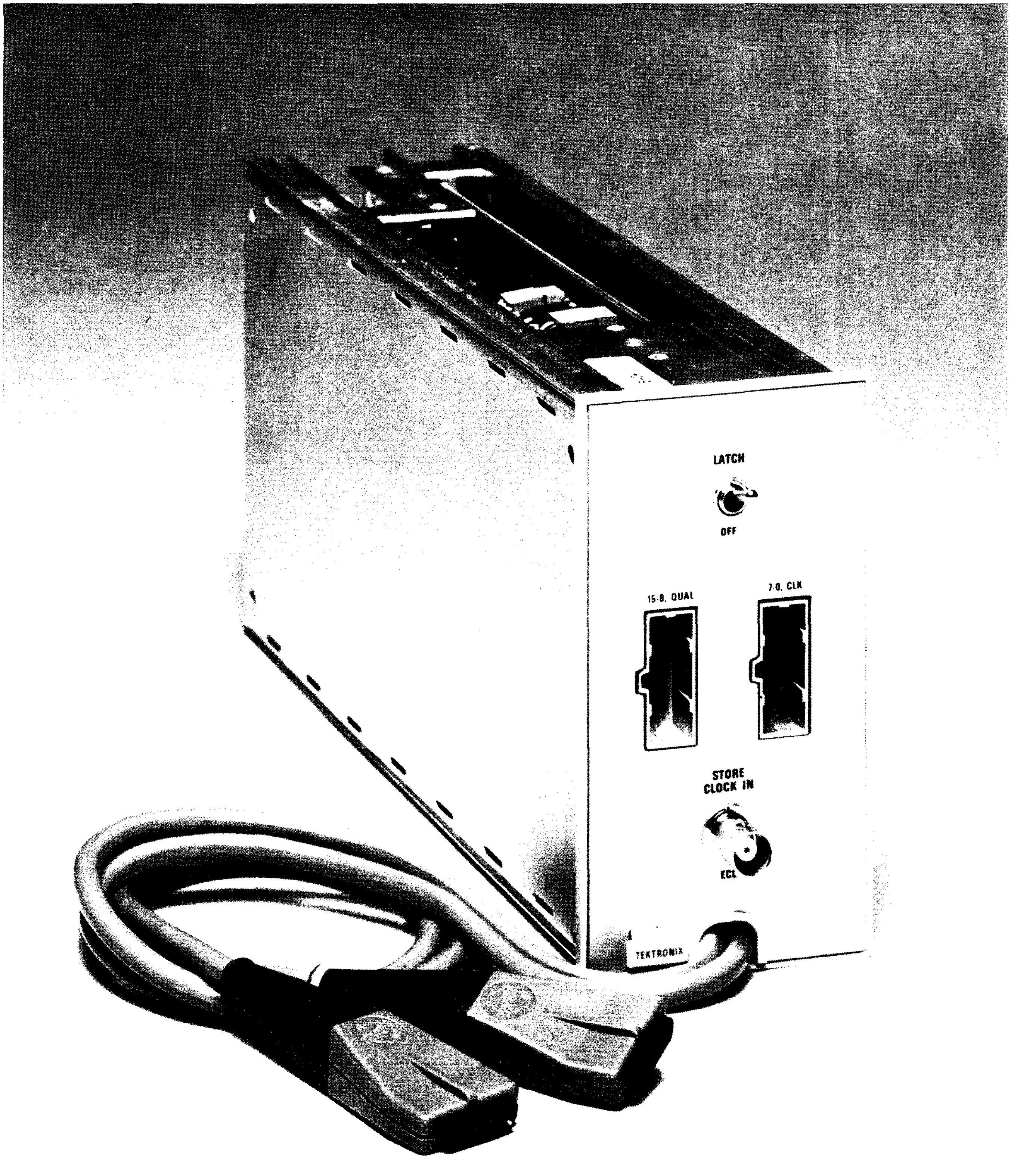
To avoid explosion, do not operate this instrument in an explosive atmosphere unless it has been certified for such operation.

DO NOT REMOVE COVERS OR PANELS

To avoid personal injury, do not operate the instrument without covers or panels installed. Do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

DO NOT SERVICE ALONE

Do not attempt internal service or adjustment unless another person capable of rendering first aid and resuscitation is present.



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DL 502 Digital Latch

GENERAL INFORMATION

INTRODUCTION

This instruction manual contains information that applies to the operation and servicing of the TEKTRONIX DL 502 Digital Latch. The manual is organized into two parts, an Operator's Part and a Service Part.

The Operator's portion of the manual is contained in the first two sections. Section 1 provides a brief description and lists the specifications for the DL 502 Digital Latch. Section 2 contains operating and installation instructions.

The Service portion is included in the remaining sections of the manual. Section 3 comprises a detailed description, performance check, and maintenance instructions for the latch. The parts listings and schematic diagrams are located at the back of the manual. Where provided, the diagrams may be unfolded and used for reference while reading other portions of the manual.

Abbreviations used in the documentation are in accord with ANSI Y1.1-1972, with exceptions and additions explained in parentheses after the abbreviation. Graphic symbols comply with ANSI Y32.3-1975. Logic symbology is based on ANSI Y32.14-1973 and the manufacturer's data description. A copy of ANSI standards may be obtained from the Institute of Electrical and Electronic Engineers, 345 47th Street, New York, N.Y. 10017.

Change information regarding manual corrections and/or additions pending manual reprint and bind is located at the back of the manual in a CHANGE INFORMATION section.

The original and revised pages to this manual are identified at the bottom of each page as follows: original pages by the symbol @, and revised pages by a revision date. The manual may contain revisions that do not apply to your instrument. History information, applicable to previous models with the updated data, is integrated into the text or diagram when the page or diagram is revised.

GENERAL DESCRIPTION

The DL 502 Digital Latch is a TM 500-Series plug-in unit to be used with logic analyzers, such as the TEKTRONIX 7D01 or LA 501W Logic Analyzers. The DL 502 is a 16-channel latch that provides simultaneous latching capability for 16 data channels. Data input signals are supplied to the 16 channels from digital probes, such as the TEKTRONIX P6451 Data Acquisition Probe. The digital latch circuitry in the DL 502 permits asynchronous latching on very short pulses less than one sample interval, but equal to or greater than 5 ns. When the DL 502 is operating in conjunction with a logic analyzer and oscilloscope, these short pulses are stretched and displayed as one full bit or sample period.

Fig. 1-1 depicts two types of pulses that can be detected when passed through the latch circuitry of the DL 502. These pulses would normally not be detected without the aid of a digital latch.

The asynchronous clock signal used to clock the latch circuitry is obtained from the Store Clock Out connector on the 7D01 or the BNC clock connector from the LA 501W. The LATCH switch on the DL 502 permits the selection of either latch OFF mode or LATCH mode for all 16 data channels (the LATCH switch has simultaneous control of all channels). In the OFF mode, the latch circuitry is bypassed and no latching occurs. All input data signals from the P6451 probes are permitted to pass through the DL 502 to the logic analyzer. In the LATCH mode position, the latch functions of the DL 502 are clocked by the asynchronous clock signals from the 7D01 or LA 501W. In this mode, the latch circuitry in the DL 502 is activated when the input data pulse width from the P6451 probes for any of the 16 channels is equal to, or greater than, 5 ns at the center threshold voltage of a 500 mV p-p pulse.

Two P6451 Data Acquisition Probes are required to provide data input signals to the 16 latch channels. Each P6451 probe has 10 probe leads for connecting to the user's circuitry. Eight leads are for data channels, one is for a clock or qualifier signal (labeled C or Q on the probe pod), and one is a common ground lead. The probe leads connecting to the probe pod are EIA color-coded to allow the user to identify the leads. Each probe tip has a retractable hook that grasps a lead or wire.

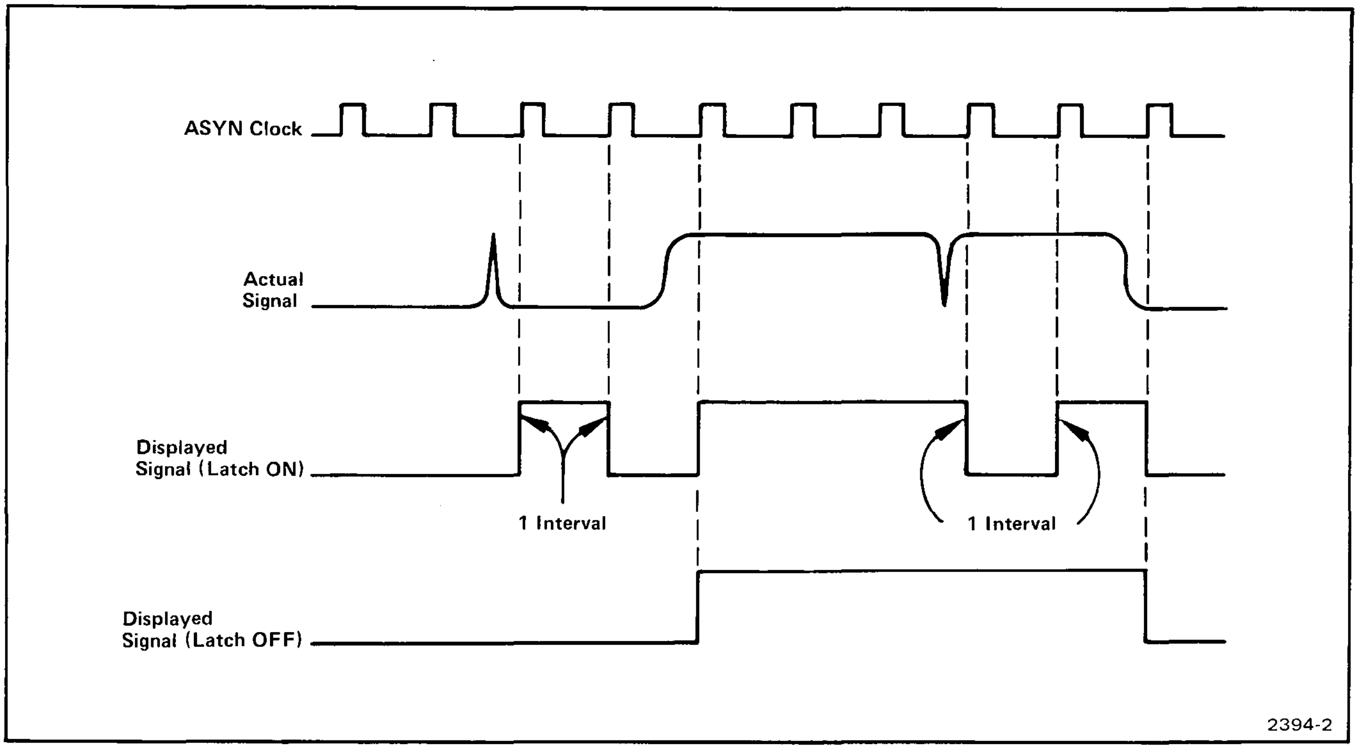

Fig. 1-1. Effects of digital latch on signals of short pulse width.

To use the retractable probe tip, push the base of the probe tip until the hook appears. (See Fig. 1-2.) The hook can be attached to a lead, a wire, or test point in a circuit.

The probe connector is inserted in the right connector on the front panel of the DL 502 for data inputs to channels 7 through 0. The probe connector is inserted in the left connector on the DL 502 for data inputs to channels 15 through 8.

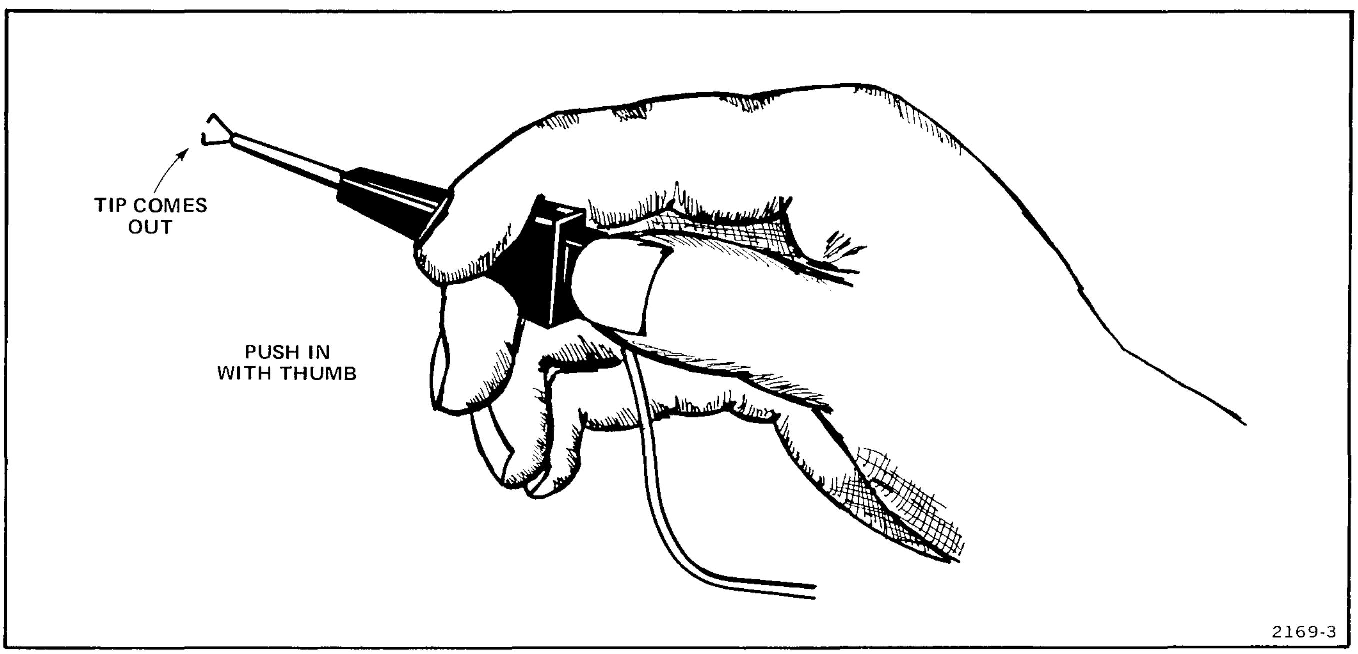

Fig. 1-2. P6451 Data Acquisition Probe retractable probe tip.

SPECIFICATIONS

Performance Requirements can be verified with performance check procedures provided in the Service part of this manual.

ELECTRICAL CHARACTERISTICS

The following electrical characteristics apply when the instrument is operating within an ambient temperature range of 0° to +50°C (+32° to +122°F) for at least 20 minutes.

Table 1-1

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirement
DATA INPUTS	
P6451 Probe Inputs (Data)	
Minimum pulse width to initiate latching for each channel.	5 ns, 500 mV p-p pulse centered at threshold voltage.
CLOCK INPUT	
STORE CLOCK IN	
Minimum clock period	20 ns.

NOTE

The DL 502 Digital Latch imposes an additional 5 ns on the minimum data setup time when the latch switch is in the OFF position (using the synchronous clock with logic analyzer operation). The minimum setup time may be reduced by connecting the P6451 probe connectors directly to the 7D01 or LA 501W.

ENVIRONMENTAL CHARACTERISTICS

Table 1-2

ENVIRONMENTAL CHARACTERISTICS

Characteristics	Description
Temperature	
Operating	0° to +50°C (+32° to +122°F).
Storage	−55° to +75°C (−67° to +167°F).
Altitude	
Operating	To 15,000 feet.
Storage	To 50,000 feet.
Transportation	Qualified under National Safe Transit Committee Test Procedure 1A, Category II.

PHYSICAL CHARACTERISTICS

Table 1-3

PHYSICAL CHARACTERISTICS

Characteristics	Description
Weight (without accessories)	Approximately 1.94 lbs (0.88 kg).
Dimensions	See Fig. 1-3.

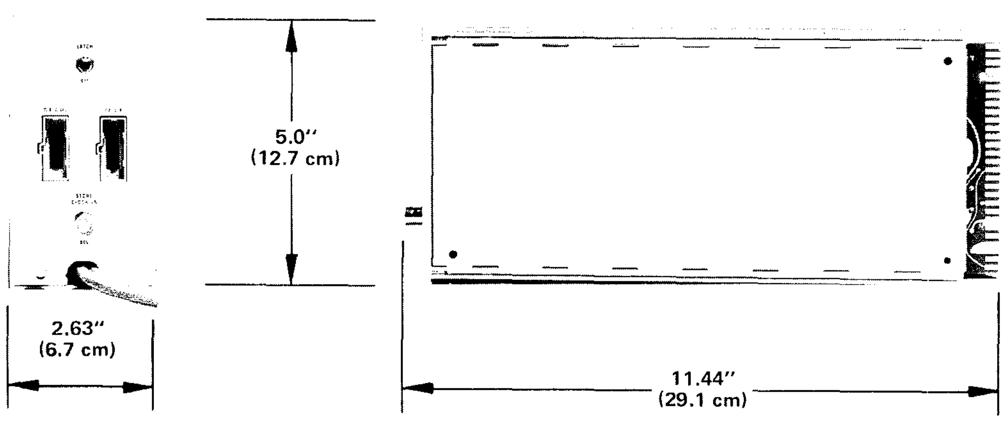

Fig. 1-3. DL 502 Digital Latch dimensions.

OPERATING INSTRUCTIONS

INSTALLATION

ACCESSORIES

The following standard accessories are contained in the shipping carton with the instrument:

DL 502 Digital Latch Instruction Manual

BNC Cable (used with either 7D01 or LA 501W)

LA 501W Clock Access Kit (consisting of: LA 501W Clock Cable, BNC connector, angle brackets and hardware)

UNPACKING

Remove instrument and accessories from the shipping container and visually inspect instrument for physical damages that might have occurred during shipment. Save the shipping container for re-use, in the event the instrument is to be returned for future servicing or replacement. If there is physical damage to the instrument contact your closest Tektronix Service Center or representative.

REPACKAGING FOR SHIPMENT

If the instrument is to be shipped to a Tektronix Service Center for service or replacement, attach a tag showing: name of owner (with address), the name of an individual at your firm that can be contacted, complete instrument serial number, and a description of the service required. If the original shipping container is not available or is unfit for use, repackage the instrument as follows:

1. Obtain a shipping container of heavy corrugated cardboard or wood with inside dimensions at least six inches greater than the instrument dimensions. This will allow room for cushioning. Refer to Table 2-1 for carton test strength requirements.

2. Wrap the instrument in heavy paper or polyethylene sheeting to protect the instrument finish. Protect the front panel with urethane foam or cardboard strips.

3. Cushion the instrument on all sides by packing dunnage or urethane foam between the carton and the instrument, allowing three inches on all sides.

4. Seal the shipping carton with shipping tape or an industrial stapler.

Table 2-1

Gross Weight	Carton Test Strength (lb)
0—10	200
10—30	275
30—120	375
120—140	500
140—160	600

PREPARATION FOR USE

The DL 502 Digital Latch requires no adjustments when received from the factory. It is designed to operate in all standard TEKTRONIX TM 500-Series mainframes in conjunction with the 7D01 or LA 501W.

Install the DL 502 in a TM 500-Series mainframe, aligning the upper and lower rails of the DL 502 with the tracks in the mainframe. Push the unit in firmly. The front panel of the DL 502 should be flush with the front panel of the mainframe when fully seated.

To remove the DL 502, pull the release lever at the lower left corner of the unit and slide the unit out of the mainframe.

INTERFACE WITH 7D01

The DL 502 Digital Latch interfaces with the 7D01 by means of two short Data Interface cable assemblies with 25-pin connectors. The Data Interface cable connectors are plugged into the appropriate data input jacks on the front panel of the 7D01.

Connect the 18-inch coaxial accessory cable, with BNC connectors on each end, from the Store Clock Out connector on the front panel of the 7D01 to the STORE CLOCK IN connector on the front panel of the DL 502. Plug the connectors of the P6451 Data Acquisition Probes into the appropriate input jacks on the front panel of the DL 502.

The Digital Latch is now ready for operation with the 7D01.

OPERATION WITH LA 501W

If the DL 502 is operated with the LA 501W, the clock circuitry in the LA 501W must be modified to bring the clock signal out to a BNC connector. This is accomplished by installing the LA 501W Clock Access Kit, furnished as an accessory to the DL 502. Instructions for the installation of the kit are provided with the kit and are included here for future reference.

Installation of LA 501W Clock Access Conversion Kit

Install the LA 501W Clock Access Kit as follows:

1. Place the LA 501W on its top. Remove the two screws securing the bottom EMI cover. Remove the bottom cover and two side covers.

2. Remove the two screws securing the central bracket (407-1733-00) to the Memory board (A2). Save the hex nuts, but discard the screws. Attach the BNC bracket from the kit, using the two longer screws provided and the hex nuts. The BNC connector should face the front panel.

3. Unlock and remove connector P12Ø, 25-pin subminiature D connector, by using a long screwdriver to slide the locking plate toward the rear of the LA 501W. Remove P12Ø by lifting the connector body with the fingers. Disconnect the four-pin harmonica connector (P446) in the WR 501. Discard P12Ø and cable assembly.

4. Replace P12Ø connector and cable assembly with the new assembly supplied in the kit. The new assembly is the same except for the addition of a 50 Ω coaxial cable that plugs into the rear of the BNC connector installed in step 2 above. Be careful not to bend the center conductor when inserting the coaxial cable into the BNC connector. Route the 4-pin harmonica connector and cable through the slot in the card edge connector in the rear of the WR 501. Lock P12Ø connector by sliding the metal clip toward the front of the instrument.

5. Remove the right cutout cover on the front panel and route the 18-inch BNC cable supplied with the DL 502, through the cutout to the BNC connector on the bracket. Attach and lock the BNC connector. The cutout cover may be stored on the threaded stud at the rear of the central bracket (407-1733-00).

6. Attach the bottom cover with the two screws removed in step 1 above. Attach the two side covers by pressing firmly into place.

7. Locate P4 at the back of the LA 501W. Remove P4 to provide easy access to signal selector P3ØØ. P3ØØ is a 12-position selector consisting of a four- and an eight-pin harmonica connector. (Pin 1 of the four-pin connector corresponds to pin 1 of the 12-pin selector, pin 1 of the eight-pin connector corresponds to pin 5 of the 12-pin connector, etc.) Remove P3ØØ.

8. Remove gold pin connector from position 2 of the eight-pin connector and install in position 7 of the eight-pin connector. This corresponds to changing the jumper from pins 2 and 6 of P3ØØ to pins 2 and 11. Reinstall signal selector P3ØØ so that position 1 of the four-pin harmonica corresponds to pin 1 of the 12-position selector. (Pin 1 is on the extreme left when facing the rear of the instrument.) Reinstall P4 in its proper position.

9. Remove the right side cover from the DL 502 and set the clock selector P11 to the LA 501W position. (Refer to Fig. 3-17.) Reinstall the side cover.

Interface with LA 501W

The DL 502 Digital Latch interfaces with the LA 501W by means of two Data Interface cable assemblies. The Data Interface cable connectors are plugged into the appropriate data input jacks on the front panel of the LA 501W.

Connect the BNC accessory cable, egressing from the right cable port on the LA 501W (clock cable), to the STORE CLOCK IN connector on the front panel of the DL 502. Plug the connectors of the P6451 Data Acquisition Probes into the appropriate input jacks on the front panel of the DL 502.

The Digital Latch is now ready for operation with the LA 501W.

FRONT PANEL CONTROL AND CONNECTORS

The following is a brief description of the functions of the control and connectors on the front panel of the DL 502 Digital Latch. Since the DL 502 can be operated in conjunction with either the 7D01/7000-Series oscilloscope or LA 501W/general-purpose oscilloscope, it may be necessary to refer to the applicable equipment instruction manuals if additional display or operational information is required.

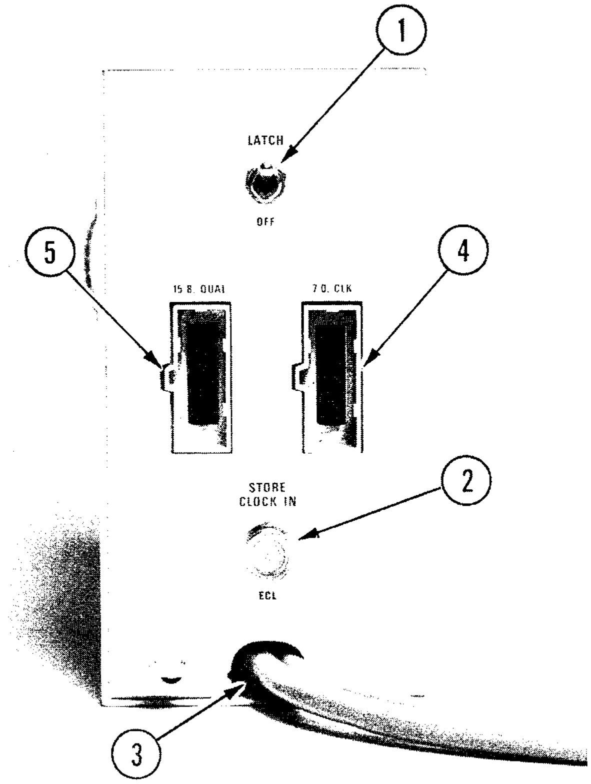

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Fig. 2-1. Front Panel control and connectors for DL 502 Digital Latch.

The front panel control and connectors are shown in Fig. 2-1. The function of each control and connector is numbered to correspond to the identifying number in Fig. 2-1.

(1) LATCH Switch

In the LATCH position the latch circuitry is clocked by asynchronous clock pulses from the 7D01 or LA 501W. In this mode the latch circuitry is activated when the width of any input data pulse is equal to, or greater than, 5 ns at the center threshold voltage of a 500 mV p-p pulse. In the OFF position the latch is disabled, permitting the input data and synchronous clock signals from the P6451 probe to pass through the latch to the 7D01 or LA 501W.

In the OFF position the DL 502 presents an additional 5 ns setup time for synchronous data acquisition. Therefore, the minimum setup time may be reduced by connecting the P6451 probe connectors directly to the 7D01 or LA 501W.

(2) STORE CLOCK IN Connector

This connector provides input to the DL 502 for asynchronous clock pulses from either the Store Clock Out Connector on the front panel of the 7D01 or the LA 501W clock cable. The asynchronous clock controls the latch circuitry of each latch channel when the LATCH switch is in the LATCH position.

(3) Data Interface Cables

Two cable assemblies terminating in 25-pin connectors are used to connect the outputs of each latch channel to the data input connectors in the 7D01 or LA 501W Logic Analyzer. The P6451 probe external clock channel, qualifier channel, and probe dc power lines are also included in these cable assemblies. The right cable assembly contains output data from Channels 7 through 0, external clock signal channel, and probe dc power for one P6451 probe. The left cable assembly contains output data from Channels 15 through 8, qualifier signal channel, and probe dc power for the other P6451 probe. A white plastic ring is attached to the right cable assembly near the connector to identify the cable assembly for Channels 7 through 0.

(4) 7—0 CLK Connector

This connector provides inputs for Channels 7 through 0 and for the external (synchronous) clock channel from the P6451 probe.

(5) 15—8 QUAL Connector

This connector provides inputs for Channels 15 through 8 and for the probe qualifier channel from the P6451 probe.

SERVICE INSTRUCTIONS

INTRODUCTION

Complete schematic drawings of the DL 502 Digital Latch are included at the back of this manual. Refer to these diagrams throughout the following circuit description.

THEORY OF OPERATION

DIGITAL LATCH ⟨1⟩

The DL 502 Digital Latch has two circuit boards: one digital latch circuit board, and one power supply-latch circuit board. The digital latch circuitry for each board contains eight identical latch channels. Therefore, the circuit description that follows describes the operation of only one digital latch channel. Fig. 3-1 is a circuit diagram for Channel 8 of the DL 502.

The push-pull output data signals from the P6451 probe for Channel 8 are connected through the front panel connector J1 to the Input Buffer stage U6Ø1ØC. The push-pull outputs from the input buffer are applied to two feedback paths (U5Ø3ØA and U5Ø3ØB) and two latch bypass paths (U5Ø5ØB and U5Ø5ØC). One output from the input buffer is also applied to the input of the latch circuitry, a D-type flip-flop.

The position of the latch switch, S1, on the front panel determines the mode of operation, OFF mode or LATCH mode. In the OFF mode, one input to each NOR gate (U5Ø5ØA and U5Ø5ØD) in the output circuitry is set high by S1. The outputs of the gates are set low, preventing data signals from the latch circuitry from appearing at Channel 8 output. In the LATCH mode, one input to each NOR gate (U5Ø5ØB and U5Ø5ØC) in the bypass circuitry is set high by S1. The outputs of the gates are set low, preventing data signals from the bypass circuitry from appearing at Channel 8 output.

OFF Mode Operation

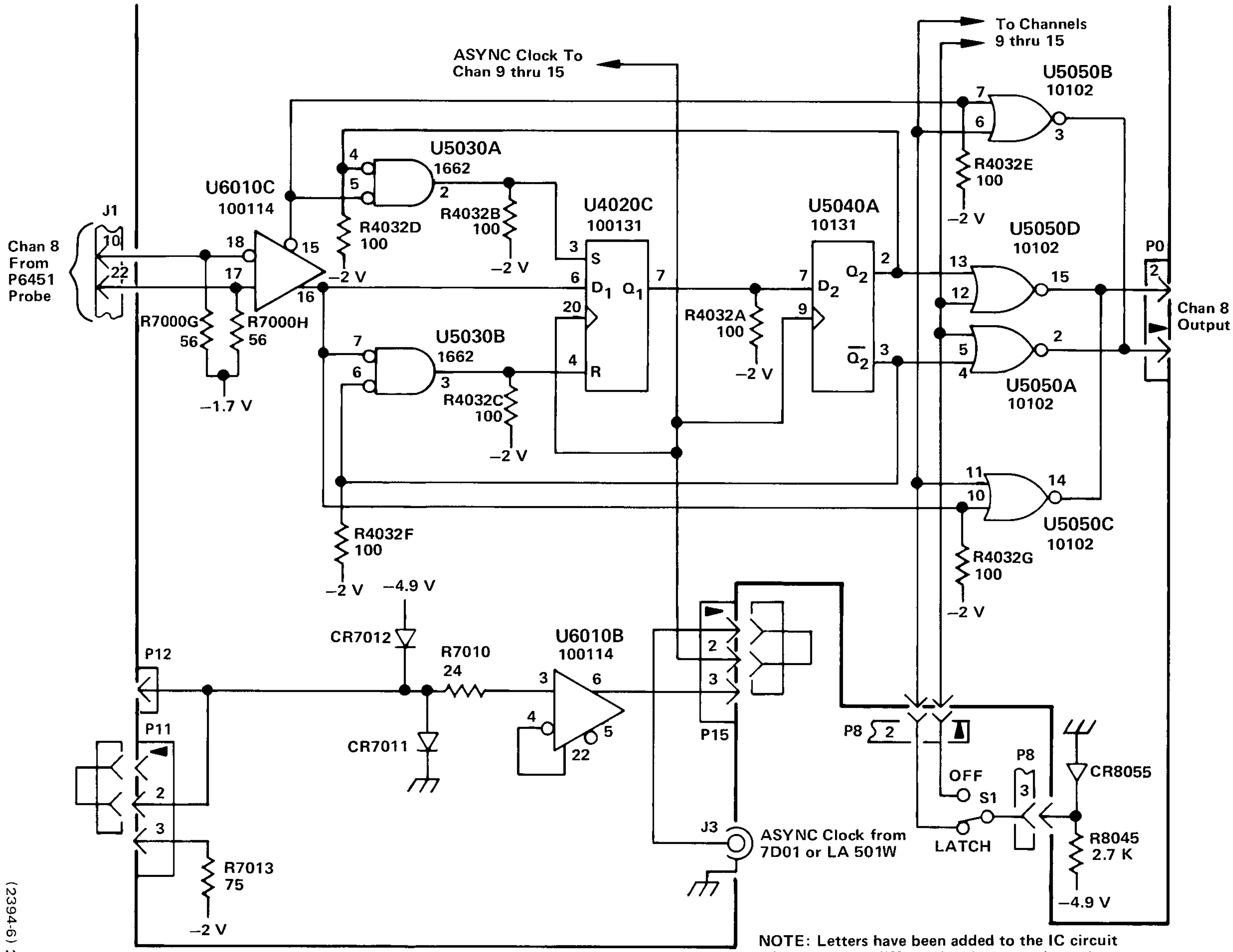
In this mode, the latch circuitry is disabled and the bypass circuitry enabled. The push-pull data signals from the output of the buffer stage U6Ø1ØC are fed via the latch bypass paths to the inputs of U5Ø5ØB and U5Ø5ØC. In the latch OFF mode these signals are gated through the NOR gates (U5Ø5ØB and U5Ø5ØC) to Channel 8 output. Thus, input data signals from the P6451 probe are passed through the latch via the bypass paths to the 7D01 or LA 501W Logic Analyzer. The polarity between the probe signals at Channel 8 input and the signals at Channel 8 output remains the same; however, an additional 5 ns is imposed on the minimum data setup time when using the external (synchronous) clock to store data in the 7D01 or LA 501W. The additional 5 ns data setup time may be eliminated by connecting the P6451 probe connector directly to the 7D01 or LA 501W.

LATCH Mode Operation

In this mode, the bypass circuitry is disabled and the latch circuitry is enabled. The timing sequence of the latch is clocked by the asynchronous clock input from the 7D01 or LA 501W.

Fig. 3-2 shows the timing sequence, for input data pulses of various widths, through the latch circuitry. At time T_0, the static conditions of the latch are: S and R inputs of the first flip-flop U4Ø2ØC are tied low, D_1 input is low and Q_2 of U5Ø4ØA is low.

At time T_{0-1}, the data pulse PW_1 changes D_1 to high. No clock pulse is present; therefore, the high at D_1 has no effect on the output state of U4Ø2ØC or Q_1. The inverse of pulse PW_1 at pin 5 of U5Ø3ØA is low, and Q_2 feedback to pin 4 of U5Ø3ØA is also low; the negated input AND gate (U5Ø3ØA) is enabled, thus switching the S input of U4Ø2ØC high. U4Ø2ØC immediately changes state to Q_1 high. At the next clock pulse (time T_1), since D_1 input is still high, Q_1 output remains high and Q_2 of U5Ø4ØA goes high. At time T_2, the input to D_1 is still high; therefore, Q_1 and Q_2 remain high.



NOTE: Letters have been added to the IC circuit designators to differentiate between the various logic units within an IC package.

Fig. 3-1. Circuit Diagram for Channel 8 of DL 502 Digital Latch.

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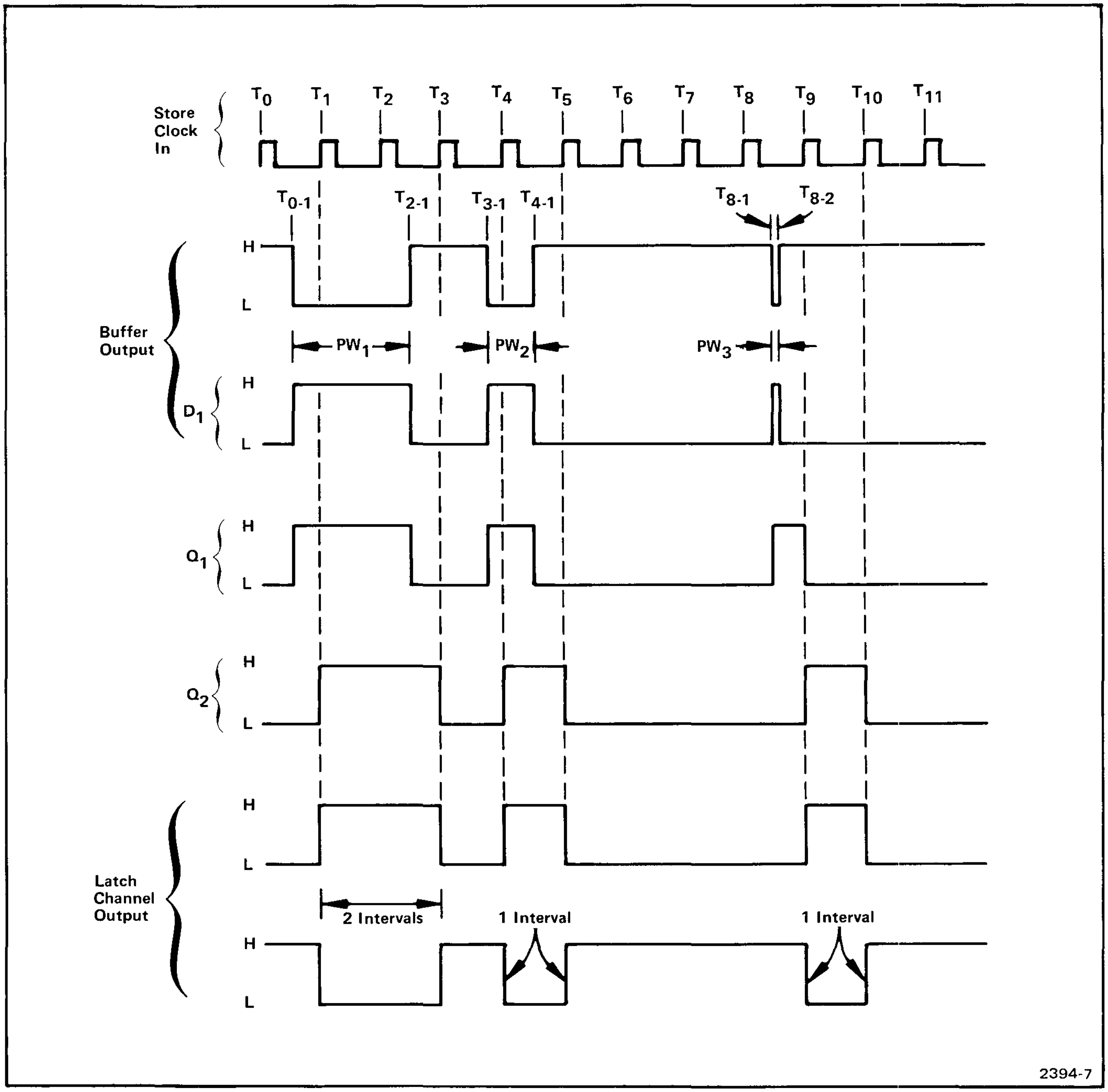

Fig. 3-2. DL 502 Digital Latch timing sequence.

At time T_{2-1} the input signal at D_1 goes low. This low is applied to pin 7 of U5Ø3ØB. The low state of $\overline{Q_2}$ is also fed back to pin 6 of U5Ø3ØB; the negated input AND gate (U5Ø3ØB) is enabled, thus changing the R input of U4Ø2ØC high. U4Ø2ØC immediately changes state, switching Q_1 to low. No clock pulse is present, and the low at D_2 has no effect on the output state of U5Ø4ØA at Q_2, which remains high. At time T_3, the input to D_1 is low and Q_1 of U4Ø2ØC remains low. The low input at D_2 of U5Ø4ØA changes the state of Q_2 to low. The latch circuitry has completed one cycle of events.

At times T_{3-1} and T_{8-1}, the data pulses PW_2 and PW_3 start the latch sequence again. As shown in Fig. 3-2, the latch output pulse widths are stretched to a multiple of the clock interval, dependent on the timing sequence between the input data pulses and the clock pulses. The same basic sequence applies to pulses of the opposite polarity. The minimum input data pulse width to initiate latching is equal to, or greater than, 5 ns at the center threshold voltage of a 500 mV p-p pulse.

USER INTERFACE

Two P6451 Data Acquisition Probes are used as the interface between the DL 502 and the user's logic circuitry. Each P6451 probe is a nine-channel active device. Eight channels are used for data acquisition, with one channel available for either synchronous clock or probe qualifier signals. Fig. 3-3 represents the equivalent circuit of one channel in the P6451 Data Acquisition Probe. The push-pull output signals from the probe comparator feed the inputs of each channel in the DL 502 latch. The synchronous clock channel, qualifier channel, and probe dc power lines are not used within the DL 502. These lines are routed through the DL 502 and terminate in the logic analyzer. Table 3-1 contains a list of these lines and their functions.

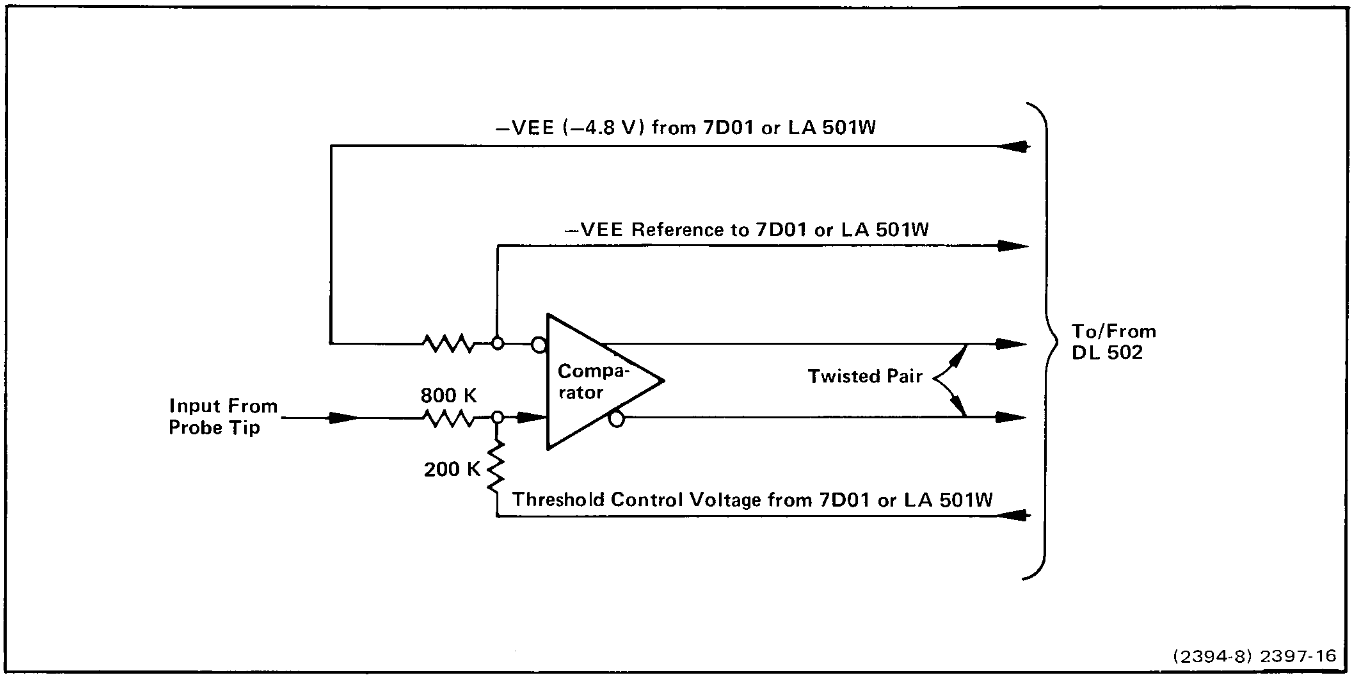

Fig. 3-3. Equivalent circuit of one channel in the P6451 Data Acquisition Probe.

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Table 3-1

P6451 PROBE LINES NOT USED IN THE DIGITAL LATCH

Line Function	Number of Lines in Each Probe		Remarks
	Chan 7—0	Chan 15—8	
Threshold Voltage			
A	1	1	The three threshold voltage lines are paralleled in the Logic Analyzer—only one threshold voltage is supplied by the Logic Analyzer.
B	1	1	
C	1	1	
−VEE	1	1	−4.8 V dc from the Logic Analyzer.
+VCC	1	1	Common ground.
Ground	1	1	Shield.
−VEE Reference Voltage	1	1	Reference voltage returned to the Logic Analyzer.
External Clock	2		One twisted pair — provides synchronous clock signals to the Logic Analyzer.
Probe Qualifier		2	One twisted pair — provides probe qualifier signals to the Logic Analyzer.

−4.9 V POWER SUPPLY 2B

The −4.9 V dc power supply is derived from the 25 V ac supply in the TM 500-Series mainframe. The 25 V ac supply is rectified by CR8Ø01 and filtered by several capacitors and an inductor. The resulting dc voltage is converted by a switching regulator to −4.9 V dc output voltage. Zener diode VR1Ø21 and transistor Q1Ø3Ø maintain a constant current through VR1Ø23 to establish the reference voltage. The reference voltage at the wiper of R2Ø3Ø is connected to the base of Q3Ø31. A differential comparator consisting of Q3Ø31 and Q3Ø3Ø compares the output voltage (pin 3 of T5Ø39) with the reference voltage. If the output voltage is more negative than the reference voltage, Q3Ø3Ø turns on and Q3Ø31, Q4Ø3Ø and Q5Ø2Ø turn off. When Q5Ø2Ø is cut off, CR8Ø4Ø conducts to discharge T5Ø39 and pulls the output voltage positive. The positive transition at the collector of Q5Ø2Ø is coupled through R3Ø23 and C3Ø22 to the base of Q3Ø31. This positive feedback turns Q3Ø31 off faster. With Q3Ø31 off, R4Ø2Ø and R4Ø21 sink the base currents from Q4Ø3Ø and Q5Ø2Ø, resulting in a very fast turn-off time for Q5Ø2Ø. When the output voltage becomes less negative than the reference, Q3Ø3Ø turns off and Q3Ø31, Q4Ø3Ø, and Q5Ø2Ø turn on.

The foregoing sequence is reversed until Q5Ø2Ø is saturated. With Q5Ø2Ø saturated, its collector switches to the dc supply voltage at its emitter, pulling the output voltage negative. The waveform at the collector of Q5Ø2Ø is filtered by T5Ø39 and C7Ø4Ø before being compared to the reference voltage. C5Ø4Ø, C5Ø41, and L7Ø45 provide additional filtering for the output voltage. Zener diode VR4Ø4Ø and SCR Q6Ø4Ø provide overload protection for the ICs connected to this supply. As long as the output voltage is less negative than the zener voltage of VR4Ø4Ø (about 6 volts), Q6Ø4Ø is off. If the output voltage exceeds about −6.2 volts, VR4Ø4Ø turns on and switches Q6Ø4Ø on, shorting out the −4.9 V dc supply. This produces a large current drain from the rectifier, CR8ØØ1, which opens fuse F5ØØ1 and prevents damage to the rest of the circuitry.

−2 V POWER SUPPLY 2B

The −2 V dc supply is derived from the −4.9 V supply. Transistor Q6ØØ1 compares the output voltage to the reference (chassis ground). If the output voltage is too positive, Q6ØØ1 conducts less, allowing Q6ØØ2 and the npn power transistor (in the TM 500-Series mainframe) to conduct more, pulling the output voltage negative.

NOTE

The circuitry used in the DL 502 power supplies is identical to that used in the WR 501. Component numbers have been changed in the DL 502.

PERFORMANCE CHECK

INTRODUCTION

The performance check is intended to verify that the DL 502 Digital Latch will meet the specifications listed in Section 1 of this manual, when operating with either the 7D01 or LA 501W Logic Analyzer.

TEST EQUIPMENT REQUIRED OR RECOMMENDED

Since the DL 502 may be operated with either a 7D01 or LA 501W Logic Analyzer, the recommended test equipment for this performance check is listed in three tables. Table 3-2 shows the recommended test equipment peculiar to DL 502/7D01 operation. Table 3-3 shows the recommended test equipment peculiar to DL 502/LA 501W operation. Table 3-4 shows recommended test equipment which is common to either 7D01 or LA 501W operation. The characteristics of substitute test equipment must meet or exceed the characteristics listed in Tables 3-2 through 3-4.

Table 3-2

TEST EQUIPMENT FOR 7D01 OPERATION

Equipment	Specified Characteristics	Recommended Type/Model
1. Test Oscilloscope System		TEKTRONIX 7000-Series 3- or 4-compartment mainframe. TEKTRONIX 7603 or 7704A Oscilloscope System.
2. Logic Analyzer		TEKTRONIX 7D01.
3. Cabinet	Cabinet with Power Module for DL 502.	TEKTRONIX TM 500 Mainframe (1 or more compartments).

Table 3-3

TEST EQUIPMENT FOR LA 501W OPERATION

Equipment	Specified Characteristics	Recommended Type/Model
1. Test Oscilloscope	Bandwidth, dc to 500 kHz; External Z-axis input.	Any general-purpose oscilloscope or monitor that meets the specified characteristics.
2. Logic Analyzer		TEKTRONIX LA 501W.
3. Cabinet	Cabinet with Power Module for LA 501W and DL 502.	TEKTRONIX TM 500 Mainframe (4 or more compartments).

Table 3-4

COMMON TEST EQUIPMENT FOR EITHER 7D01 or LA 501W OPERATION

Equipment/Fixture	Specified Characteristics	Recommended Type/Model
1. DC Voltmeter	Range, ±2 V to ±20 V; accuracy within 1%.	TEKTRONIX DM 502 Digital Multimeter.
2. Pulse Generator	Pulse duration, 2 ns to 50 ns; pulse period, 20 ns to 1 μs; output amplitude, 0 V dc to ±3 V dc; risetime, 2 ns or less.	TEKTRONIX PG 502 250 MHz Pulse Generator.
3. Cabinet	Cabinet with Power Module for DM 502 and PG 502.	TEKTRONIX TM 500 Mainframe (2 or more compartments).
4. Oscilloscope	Bandwidth, DC to 350 MHz; risetime, 1 ns; sweep rate, 1 ns/div to 20 ns/div.	TEKTRONIX 485.
5. Data Acquisition Probe	Input resistance, 1 MΩ within 5%; input capacitance, 5 pF, within 1 pF.	TEKTRONIX P6451 Data Acquisition Probe.
6. BNC "T" Adapter	BNC male to 2 BNC female connectors.	Tektronix Part No. 103-0030-00.
7. 50 Ω BNC Cable		Tektronix Part No. 012-0076-00.
8. BNC Coupler	BNC male to BNC male.	Tektronix Part No. 103-0029-00.
9. Probe Tip Termination	BNC female to BSM male.	Tektronix Part No. 103-0036-00.

PRELIMINARY AND OPERATIONAL CHECK PROCEDURES

The preliminary and operational check procedures for the DL 502 are categorized according to DL 502 operation with either 7D01 or LA 501W.

DL 502 OPERATION WITH 7D01

If the DL 502 is used with the 7D01, preliminary and operational check procedures 1, 3, 4, 5, and 6 (shown below) should be followed. Refer to Fig. 3-4 for the test set-up.

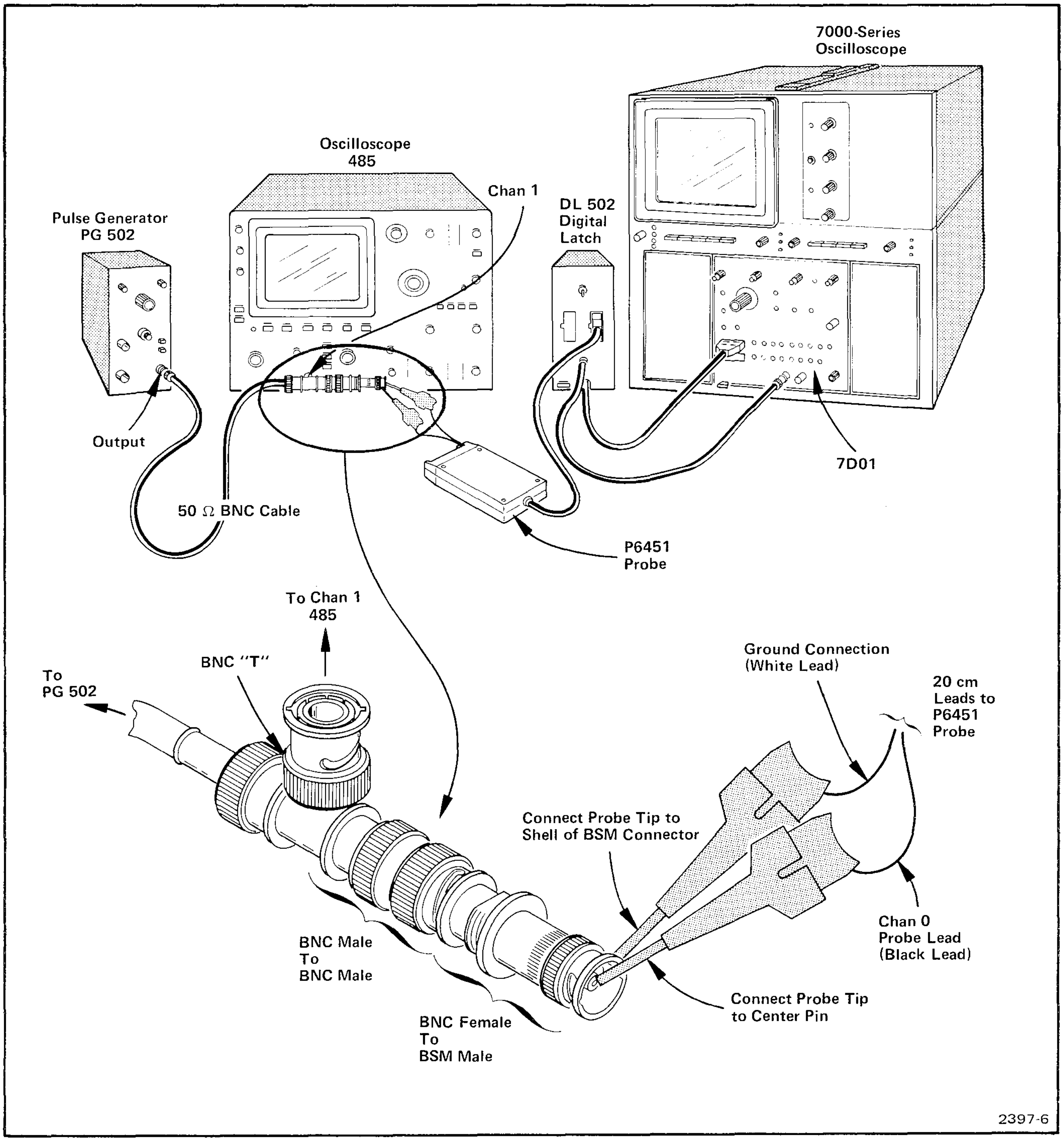

Fig. 3-4. DL 502 Digital Latch operational test setup for 7D01 operation.

DL 502 OPERATION WITH LA 501W

If the DL 502 is used with the LA 501W, preliminary and operational check procedures 2, 3, 4, 5, and 6 (shown below) should be followed. Refer to Fig. 3-5 for the test set-up.

1. Preliminary Procedure for 7D01 Operation

a. Install the DL 502 in the TM 500 mainframe and the 7D01 in the plug-in compartment of the 7000-Series test oscilloscope system mainframe. Refer to Fig. 3-4.

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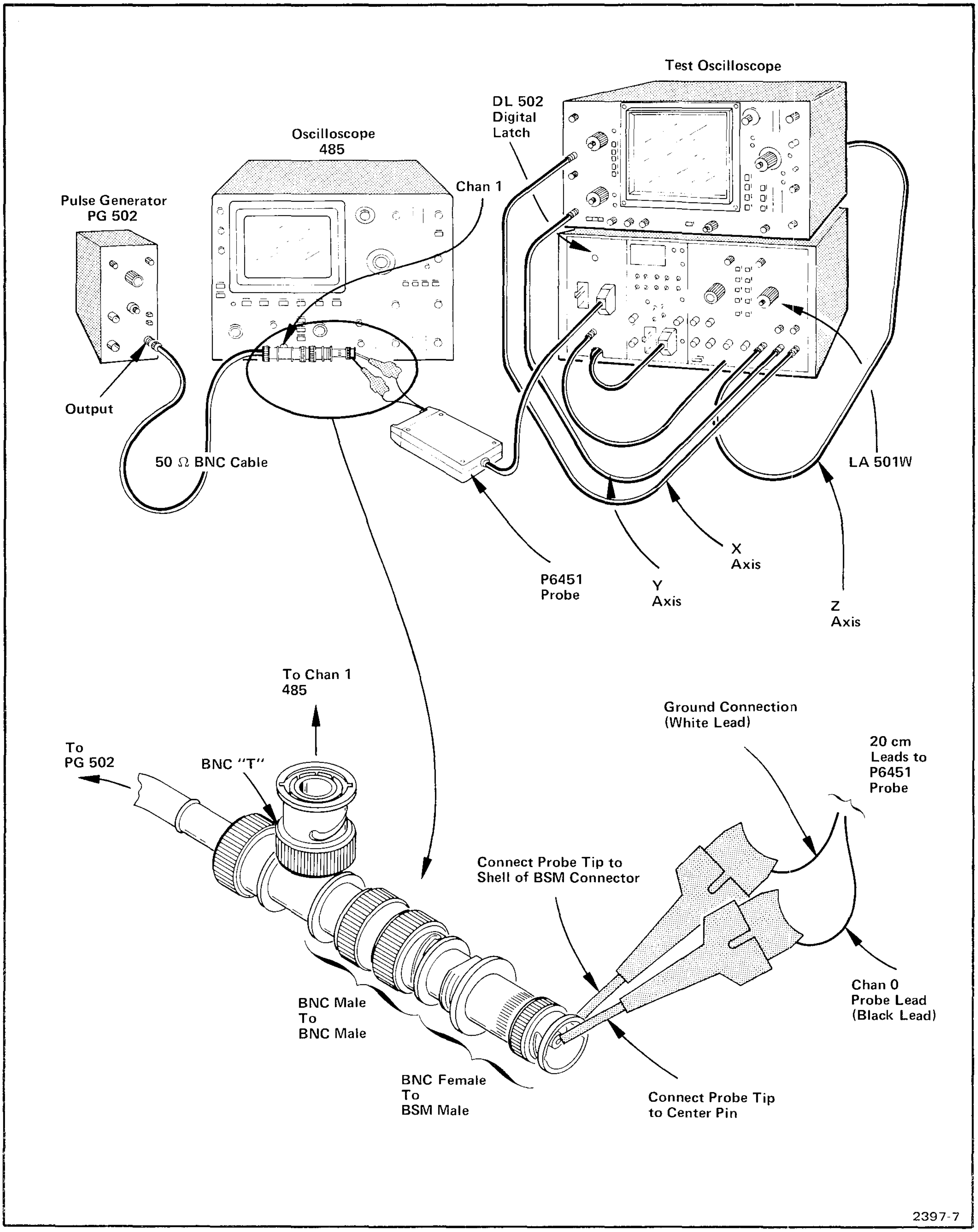


Fig. 3-5. DL 502 Digital Latch operational test setup for LA 501W operation.

b. Connect DL 502 output data interface connector for channels 7 through 0 (right cable assembly, marked with a white plastic ring) to the top data input connector (Channels 0—7 and External Clock) on the front panel of the 7D01.

c. Connect the 50 Ω BNC cable between connectors Store Clock Out (7D01) and STORE CLOCK IN (DL 502). Make sure that the internal selector P11 in the DL 502 is in the proper position for 7D01 operation. See Fig. 3-17 and Table 3-6.

d. Connect P6451 probe connector to 7—0 CLK connector on front panel of DL 502.

e. Connect remaining test instruments in accordance with Fig. 3-4.

f. Set 7D01 front panel controls as follows:

Vert	
Pos	Midrange
Mag	X1
Record	
Display Time	1 s (fully counterclockwise)
Horiz	
Pos	Midrange
Mag	X1
Threshold voltage	Var (−1.3 V)
Sample Interval	20 ns
Data Channels	0—7
Trig Source	W.R.
Word Recognizer	
W.R. Mode	Async
Filter	Min
Ch 0	Hi
Ch 1 through 15	X (center)
External Qualifier	X (center)
Probe Qualifier	X (center)

2. Preliminary Procedure for LA 501W Operation

a. Install the DL 502 and LA 501W in the TM 500 mainframe. Refer to Fig. 3-5.

b. Connect DL 502 output data interface connector for Channels 7 through 0 (right cable assembly, marked with a white plastic ring) to the right clock and data input connector (7—0 CLK) on the front panel of the LA 501W.

c. Connect 50 Ω BNC clock cable from LA 501W to STORE CLOCK IN connector on front panel of DL 502. Make sure that the internal selector P11 in the DL 502 is in the proper position for LA 501W operation. See Fig. 3-17 and Table 3-6.

d. Connect P6451 probe connector to 7—0 CLK connector on front panel of DL 502.

e. Connect remaining instruments in accordance with Fig. 3-5.

f. Set LA 501W front panel controls as follows:

Vert	
Pos	Midrange
Mag	X1
Horiz	
Pos	Midrange
Mag	X1
Channel Position	OFF
Record	
Display Time	1 s (fully counterclockwise)
Sample Interval	20 ns
Format	CH 0—7
Trig Source	WR (button out)
Input	PROBE (button out)
Delay	OFF
Word Selector	
CH 0	HI
CH 1 through 15	X (center)
Word Mode	ASYNC
Filter	Fully counterclockwise
Qualifier	OFF
Threshold Voltage	
7—0 CLK	VAR (−1.3 V)
15—8 QUAL	VAR (−1.3 V)

3. Preliminary Procedures for either 7D01 or LA 501W Operation

a. Set DL 502 front panel LATCH mode switch to LATCH position.

b. Set 485 Oscilloscope front panel controls as follows:

Input Impedance	50 Ω
Input Coupling	Gnd
Ch 1 Volts/Div	.2

c. Set PG 502 Pulse Generator front panel controls as follows:

Back Term	Pull
Pulse Duration	2 ns
Pulse Period	.1 μs
Variable Pulse Period	X1 (fully counterclockwise)

d. Adjust Threshold Voltage

1. Connect dc voltmeter between Threshold Voltage Monitor pin jack on the 7D01 or LA 501W and chassis ground.

2. Adjust threshold voltage to −1.3 V, with screwdriver adjustment on 7D01 or Threshold control knobs on LA 501W.

NOTE

LA 501W has separate control knob and monitor jack for Channels 7—0 and for Channels 15—8.

e. Position the 485 Oscilloscope ground level to the top graticule on oscilloscope. Change input coupling control to dc.

f. Adjust PG 502 pulse generator Output (volts) Hi-Low Level for ±250 mV from a threshold voltage of −1.3 V as displayed on the 485 Oscilloscope. (See Fig. 3-6.)

g. Adjust PG 502 pulse Generator Pulse Duration Variable control for a 5 ns pulse width at the −1.3 V (threshold voltage) level as displayed on 485 Oscilloscope. (See Fig. 3-6.)

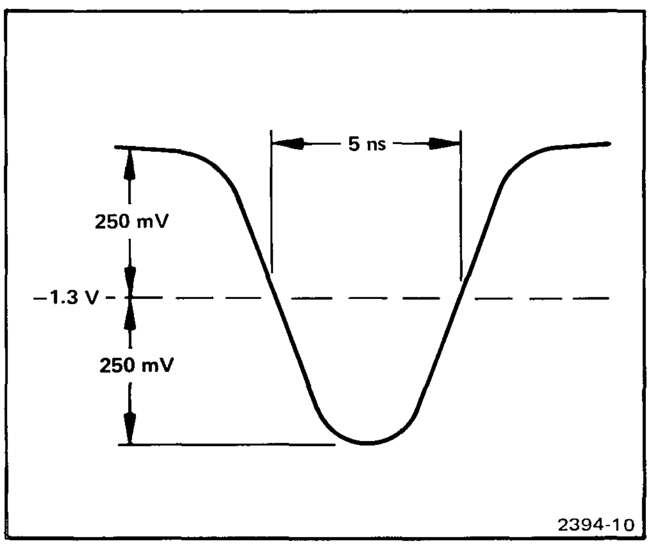


Fig. 3-6. 485 Oscilloscope display.

4. LATCH Operational Check Procedure for Channels 0 through 7

a. Connect P6451 probe ground lead (white) to the shell of the BSM male connector. (See Fig. 3-4 or 3-5. This ground connection should remain connected throughout the test procedure.)

b. Connect P6451 Channel 0 probe lead (black) to the probe tip that is connected to the center pin of the BSM male connector. (See Fig. 3-4 or 3-5.)

c. Observe operation of the latch on the test oscilloscope. Latching action will be a uniform pattern of pulses for the channel under test. (In the latch OFF mode, occasional pulse activity indicates proper operation.)

d. Proceed through the remaining channels (1 through 7), testing one channel at a time. The probe tip can remain connected to the center pin of the BSM connector throughout the test procedure. Change only the P6451 probe channel lead terminating in the back of the probe tip. The Word Recognizer switch on the 7D01 (the Word Selector switch on the LA 501W) is set to HI for the channel under test. Switches for all other channels are on X (center position).

NOTE

Throughout the above procedure maintain the correct display (as shown in Fig. 3-6) on the 485 Oscilloscope.

5. LATCH Operational Check Procedure for Channels 8 through 15

The above procedure checks the performance of channels 0 through 7. The same test setup and test procedure is used for channels 8 through 15, with the following exceptions:

a. Move the P6451 probe connector from 7—0 CLK connector to 15—8 QUAL connector on the DL 502.

b. Disconnect the DL 502 output data interface connector (right cable assembly) from the Logic Analyzer. Connect the DL 502 output data interface connector for Channels 15 through 8 (left cable assembly) to the 7—0 data input connector on the Logic Analyzer. (Same input connector used in performance checks for Channels 7 through 0).

c. The Word Recognizer switch on the 7D01 (the Word Selector switch on the LA 501W) for Channels 7 through 0 is set HI on the corresponding channel being tested. (Example: Ch 0 set HI when testing Channel 8 — Ch 7 set HI when testing Channel 15. All other switches, except channel under test, are set on X, center position.)

NOTE

If normal Channel 8 through 15 connections were made on the 7D01 or LA 501W, the minimum clock period would be 50 ns. This would impose not so stringent a test on Channels 8 through 15.

d. Repeat step 4 parts a through d for LATCH Operational Check Procedures on Channels 8 through 15.

6. Latch OFF Operational Check Procedure

a. Change the pulse duration control on the Pulse Generator (PG 502) to 50 ns.

b. Set the LATCH mode switch on the DL 502 to OFF.

c. Repeat steps 4 and 5 for LATCH OFF Operational Check Procedures on Channels 0 through 15.

MAINTENANCE

INTRODUCTION

This section describes procedures for preventing or reducing equipment malfunction, and includes techniques for troubleshooting and corrective maintenance. Preventive maintenance improves equipment reliability. Should the equipment fail to function properly, corrective measures should be taken immediately; otherwise, additional problems may develop within the equipment.

CAUTION

STATIC DISCHARGE CAN DAMAGE MANY SEMICONDUCTOR COMPONENTS USED IN THIS INSTRUMENT.

Many semiconductor components, especially MOS type, can be damaged by static discharge. The damage may not be catastrophic, and therefore may not be immediately apparent. A "weakening" of the semiconductor characteristics may indicate that damage has occurred. Devices that are particularly susceptible are: MOS, CMOS, J FETs, and high-impedance OP amps. Damage can be significantly reduced by observing the following precautions:

1. Handle static-sensitive components or circuit assemblies on a static-free surface. Work station areas should contain a static-free bench cover or work plane, such as conductive polyethylene sheeting and grounding wrist strap. The work plane should be connected to earth ground.

2. All test equipment, accessories, and soldering tools should be connected to earth ground.

3. Minimize handling by keeping the components in their original containers until ready for use. Minimize the removal and installation of semiconductors from their circuit boards.

4. Hold the IC devices by the body rather than by the terminals.

5. Use containers made of conductive material or filled with conductive material for storage and transportation. Avoid using ordinary plastic containers. Any static-sensitive part or assembly (circuit board) that is to be returned to Tektronix, Inc., should be packaged in its original container or in one with anti-static packaging material.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, lubrication and visual inspection. The preventive maintenance schedule that is established for the instrument should be based on the amount of use, and on the environment in which the instrument is operated.

CLEANING

Clean the instrument often enough to prevent dust or dirt from accumulating in or on it. Dirt acts as a thermal insulating blanket and prevents efficient heat dissipation. It also provides high-resistance electrical leakage paths between conductors or components in a humid environment.

Exterior

Clean the dust from the outside of the instrument by cleaning the surface with a soft cloth or brush. Hardened dirt may be removed with a cloth dampened in water that contains a mild detergent. Abrasive cleaners should not be used.

Interior

Normally the interior of the instrument will not require cleaning unless it has been left uncovered for an extended period of time. Clean the interior by loosening accumulated dust with a dry soft brush, then blow the loosened dirt away with low-pressure air.

High-velocity air can damage some components. If the circuit board assemblies need cleaning, remove the circuit board and clean with a dry soft brush. Hardened dirt or grease may be removed with a cotton-tipped applicator dampened with a solution of mild detergent and water. Do not leave detergent on critical memory components. Abrasive cleaners should not be used.

After cleaning, allow the interior to dry thoroughly before applying power to the equipment.

CAUTION

Do not allow water to get inside any enclosed assembly components, such as switch assemblies, memory capacitors, potentiometers, etc. Instructions for removing assemblies for maintenance are provided in the Corrective Maintenance part of this section. Do not clean any plastic materials with organic cleaning solvents such as benzene, toluene, xylene, acetone, or similar compounds, because they may damage the plastic.

LUBRICATION

No assemblies or components in this instrument require lubrication.

VISUAL INSPECTION

After cleaning, carefully check the instrument for such defects as defective connections and damaged parts. The remedy for most visible defects is obvious. If heat-damaged parts are discovered, try to determine the cause of overheating before the damaged part is replaced; otherwise, the damage may be repeated.

TROUBLESHOOTING

The following aids and suggestions may assist in locating a problem. After the defective assembly or component has been located, refer to the Corrective Maintenance part of this section for removal and replacement instructions.

TROUBLESHOOTING AIDS

Diagrams

Circuit diagrams are given on foldout pages in the Diagram section of this manual. The circuit number and electrical value of each component are shown on the diagram (see the first tab page for definition of the reference symbology used to identify components in each circuit). Components on circuit boards are assigned vertical and horizontal grid numbers which correspond to the location of the component on the circuit board. Refer to the Replaceable Electrical Parts list section for a complete description of each component and assembly. Those portions of the circuit that are on circuit boards are enclosed with a black border line with the name and assembly number shown on the border.

NOTE

Corrections and modifications to the manual and equipment are described on inserts bound into the rear of the manual. Check this section for manual or instrument changes and corrections.

Circuit Board Illustrations

Electrical components, connectors, and test points are identified on circuit board illustrations located on the inside fold of the corresponding circuit diagram or on the back of the preceding diagram. This allows cross-reference between the diagram and the circuit board, and shows the physical location of components.

Connectors (Movable and Fixed)

Multiple-terminal (harmonica) connector holders are keyed with a triangle; a matching triangle is found on the circuit board. When a connection is made perpendicular to a circuit board surface, the orientation of the triangle and the slot numbers on the connector holder are determined by the direction of the nomenclature marking (see Fig. 3-7). All harmonica connectors are identified on the schematic and board with the prefix "P".

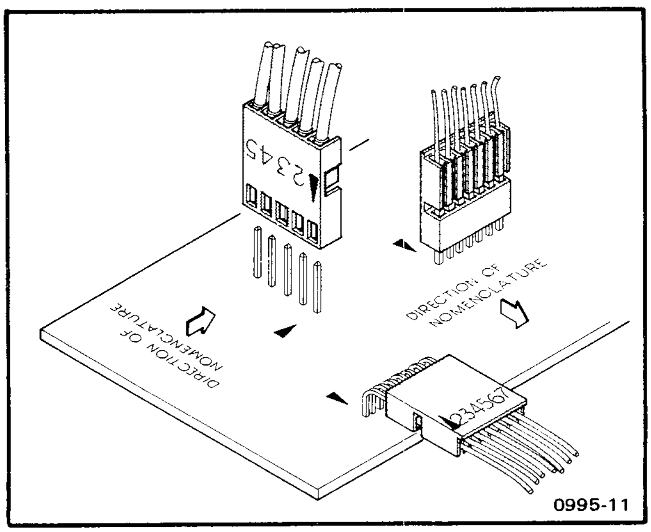
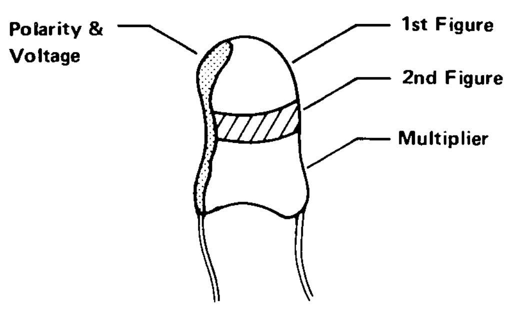


Fig. 3-7. Multipin (harmonica) circuit board connectors.

Square-pin and edge connectors interfacing between circuit boards are identified with alphabetic letters. Interface connectors to the mainframe use an alpha prefix for the left (A) or right(B) side followed by a numeral (e.g., B17, A6).

Capacitor Marking

The capacitance value of common disc capacitors and some electrolytics are marked in microfarads on the side of the component body. The white ceramic capacitors are color-coded in picofarads. Tantalum capacitors are color-coded as shown in Fig. 3-8.



DIPPED TANTALUM CAPACITOR MARKING

A AND B CASE

CAPACITANCE AND VOLTAGE COLOR CODE

Rated Voltage VDC 25°C	Color	CODE FOR CAPACITANCE IN PICOFARADS		
		1st Figure	2nd Figure	Multiplier
3-4	Black	0	0	None
3-6	Brown	1	1	X10
3-10	Red	2	2	$X10^2$
3-15	Orange	3	3	$X10^3$
3-20	Yellow	4	4	$X10^4$
3-25	Green	5	5	$X10^5$
3-35	Blue	6	6	$X10^6$
3-50	Violet	7	7	$X10^7$
	Gray	8	8	
3	White	9	9	

(1733) 1735-9

Fig. 3-8. Color code for tantalum capacitors.

Diode Code

The cathode of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot. Some diodes have a diode symbol printed on one side. Fig. 3-9 illustrates diode types and polarity markings that are used.

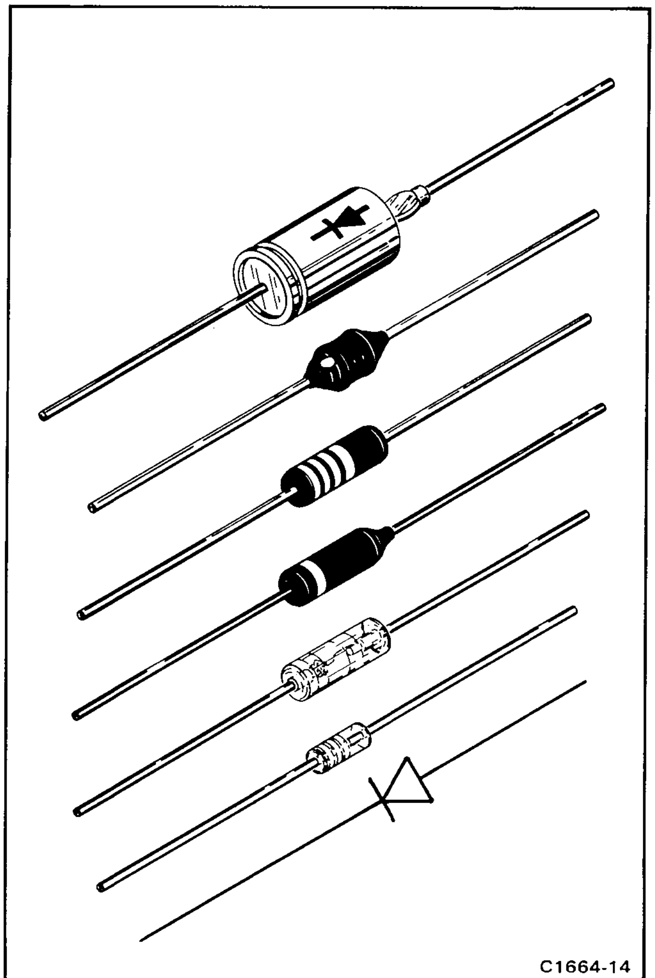


Fig. 3-9. Diode polarity markings.

Diode Checks

Most diodes can be checked in the circuit by taking measurements across the diode and comparing these with voltages listed on the diagram. Forward-to-back resistance ratios can usually be taken by referring to the schematic and pulling appropriate transistors and pin connectors to remove low-resistance loops around the diode.

CAUTION

Do not use an ohmmeter scale with a high external current to check the diode junction.

Integrated Circuit (IC) Checks

When substitution is impossible, check input and output signal states, as described in the Theory of Operation and on the diagrams. Lead configuration and data for the ICs used in this instrument are provided on the inside fold of the schematic or on the back of the previous schematic.

@

CAUTION

To avoid possible damage from static charges, handle all ICs in accordance with the instructions at the beginning of this section.

GENERAL TROUBLESHOOTING TECHNIQUES

The following procedure is recommended to isolate a problem and expedite repairs:

1. Ensure that the malfunction exists in the instrument. Check the operation of associated equipment and review the operating procedure for the DL 502 Digital Latch.

2. Determine and evaluate all trouble symptoms. Try to isolate the problem to a circuit or assembly. The schematic diagram in the Diagrams section can aid in signal tracing and circuit isolation.

CAUTION

Exercise extreme care when placing meter leads or probes for voltage or waveform measurements. An inadvertent movement of the leads or probe in a high-density area or section with limited access could cause a short circuit and produce transient voltages which could destroy many components.

3. By successive electrical checks, locate the problem. At this time an oscilloscope is a valuable test item for evaluating circuit performance.

4. Determine the extent of the repair needed; if complex, we recommend contacting your local Tektronix Field Office or representative. If the damage is minor, such as a component replacement, see the parts list for replacement information. Removal and replacement procedures of the assemblies and sub-assemblies are described under Corrective Maintenance.

CORRECTIVE MAINTENANCE

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

OBTAINING REPLACEMENT PARTS

Most electrical and mechanical parts are available through your local Tektronix Field Office or representative. The Replaceable Parts list section contains information on how to order these replacement parts. Many standard electronic components can be obtained locally in less time than required to order from Tektronix, Inc. It is best to duplicate the original component as closely as possible. Parts orientation and lead dress should be duplicated because orientation may affect circuit interaction.

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

PARTS REPAIR AND EXCHANGE PROGRAM

Tektronix service centers provide replacement or repair service for major assemblies as well as for the unit itself. Return the instrument or assembly to your local Field Office for this service.

Refer to Repackaging For Shipment instructions (in Section 2) before shipping the equipment.

SOLDERING TECHNIQUES

CAUTION

Disconnect the instrument from its power source before replacing or soldering components.

The DL 502 uses multilayer type circuit boards with conductive paths laminated between the board layers. All soldering on these boards should be done with extreme care to prevent breaking the connections to the center conductors. Only experienced maintenance personnel should attempt repair of these boards.

General soldering techniques, that apply to maintenance of any precision electronic equipment, should be used when removing or replacing components that require the use of solder. Use only 60/40 rosin-core, electronic-grade solder and a 15-watt pencil-type soldering iron. Using a soldering iron with a higher wattage rating on the etched circuit boards can cause the etched circuit wiring to separate from the board base material. Keep the tip properly tinned for best heat transfer to the soldered joint. Avoid excessive heat; apply only enough heat to remove the component or to make a good solder joint.

Use the following technique to replace a component on a circuit board. Refer to the component removal and replacement instructions later in this section for circuit board removal instructions.

1. Grip component lead with long-nose pliers. Touch soldering iron to lead at solder connection. Do not lay iron directly on board.

2. When solder begins to melt, gently pull the lead out. If the hole is not clean, a desoldering tool should be used to remove excess solder.

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

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

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

6. Clean the area around the solder connection with flux-remover solvent, and air dry.

COMPONENT REMOVAL AND REPLACEMENT

CAUTION

To prevent electrical shock or damage to the instrument, disconnect the instrument from the power source before removing or replacing components.

Before removing or replacing parts on the circuit boards in the DL 502, you must remove the board from the instrument. Refer to the part in this section on removal and installation of the circuit boards. Be sure you are familiar with the soldering techniques used on multi-layer circuit boards before you attempt to replace components.

Discrete Component Replacement

Because it is easy to damage the plating in the board holes to which the component is soldered, it is recommended to cut the old component free and leave some lead length to solder the new component leads to. If the leads are pulled through the board, use caution when pulling them through the plated hole. Excessive heat or bent leads can damage the plating. Using a 15-watt pencil-type iron, straighten the leads on the back side of the board; then, when the solder melts, gently pull the soldered lead through the hole. A desoldering tool should be used to remove the old solder.

Integrated Circuit Replacement (Soldered)

Some of the ICs within this instrument are soldered into the circuit boards; therefore, extreme care must be taken to prevent damage to the boards if the ICs are removed and replaced. The procedure used to remove ICs from the circuit boards is dependent upon the cost of the IC, the competency of the technician accomplishing the repairs, and the degree of certainty that the IC is defective. One of the following procedures is recommended:

1. **Inexpensive ICs or ICs that are known to be defective.** Cut the defective IC from the board. Cut each pin close to the body of the IC, leaving as much of the pin as possible attached to the board. On the back side of the board use a 15-watt pencil-type soldering iron to melt the solder around the pins. When the solder melts, gently pull the pin out of the hole from the component side of the board. This procedure is repeated for each pin. A desoldering tool should be used to remove the old solder. Use caution when pulling the pins through the plated hole. Excessive heat or bent leads can damage the plating. When all pins have been removed and holes are free of solder, install the new IC (ensure proper orientation of IC pin numbers). Solder each pin from the back side of the board and cut off excess pin length. Visually inspect the board for excess solder or solder bridges before operational testing of the board.

2. **Expensive ICs or ICs that *may* be defective.** On the back side of the board use a 15-watt pencil-type soldering iron to melt the solder around the pins. A desoldering tool should be used to remove the excess solder. Using needle-noise pliers, gently wiggle the pin in the hole while removing the solder. When the pin is free of solder in the hole, repeat the same procedure for each pin on the IC. When all pins are free, use an extracting tool and gently pull the IC from the board. Do not use force if the IC does not come free from the board. Use the soldering iron to remove excessive solder from the pin or pins at the same time the IC is being pulled from the board. When the IC is free of the board, carefully straighten each pin. If the IC is to be replaced or a new IC is to be installed, follow the same procedure as stated above for inexpensive ICs.

NOTE

An extracting tool to remove the ICs is available from Tektronix, Inc. by ordering Tektronix Part No. 003-0619-00. If an extracting tool is not available, use care to avoid damaging the pins. Pull slowly and evenly on both ends of the IC. Try to avoid having one end of the IC disengaged from the board before the other end is free.

Integrated Circuit Replacement (Flat Pack ICs)

There are five flat packaged (pack) ICs on each digital latch circuit board. Replacement of these ICs should be accomplished using the second method described in the preceding paragraph. (Method One may be used if you are sure the IC is defective.) When installing a new flat pack use extreme care in bending the leads to fit the hole pattern in the board. Fig. 3-10 may be used as a template. Turn the flat pack over, the lettering and black dot on the IC facing toward the template. Make sure the black dot on the IC corresponds to the black dot on the template. Using needle-nose pliers, carefully bend each lead upward (90° from the template). The bend in the lead should correspond to the lead length depicted in Fig. 3-10. When all leads are bent, turn the IC over and compare it with the hole pattern in the circuit board. Additional bending of leads will be necessary to line up leads with the hole pattern in the board. Make sure the black dot on the IC is properly oriented. Complete the replacement of the flat pack IC in accordance with previous instructions for soldered ICs.

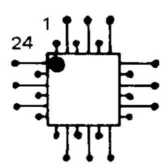


Fig. 3-10. Template for bending flat pack IC leads.

NOTE

After bending the leads on two sides of the IC, it becomes difficult to keep the IC aligned with the template. Use a small amount of rubber cement on the eraser of a new pencil. (Allow time for cement to become tacky.) Place the eraser in the center of the IC and push down on the pencil to keep the IC aligned with the template.

Integrated Circuit Replacement (In Sockets)

ICs should not be replaced unless they are actually defective. When removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement or switching of semiconductor devices may affect the instrument's performance. When an active device is replaced, check the operation of the circuit affected.

An extracting tool should be used to remove the 14- or 16-pin integrated circuits to prevent damage to the pins.

Replacing Square-Pin for Multi-Pin Connectors and Circuit Boards

NOTE

A pin replacement kit (including necessary tools, instructions, and replacement pins) is available from Tektronix, Inc. Order Tektronix Part No. 040-0542-00.

It is important not to damage or disturb the ferrule when removing the old stub of a broken pin. The ferrule is pressed into the circuit board and provides a base for soldering the pin connector.

If the broken stub is long enough, grasp it with needle-nose pliers. Apply heat with a small soldering iron to the pin base of the ferrule, and pull the old pin out. If the broken stub is too short to grasp with pliers, use a small dowel (0.028 inch diameter) to push the pin out. Use a pair of diagonal cutters to remove the ferrule from the new pin, and then insert the pin into the old ferrule and solder to both sides of the ferrule.

The pin sockets on the circuit boards are soldered to the rear of the board. Unsolder the pin, then straighten the tabs on the socket and remove it from the hole in the circuit board. Place the new socket in the circuit board hole and press the tabs down against the board. Solder the tabs of the socket to the circuit board; be careful not to get solder into the socket.

NOTE

The spring tension of the pin sockets ensures a good connection between the circuit board and the pin. This spring tension can be destroyed by using the pin sockets as a connecting point for spring-loaded probe tips, alligator clips, etc.

Interconnecting Cable and Pin Connector Replacement

The interconnecting cable assemblies are factory assembled. They consist of machine-installed pin connectors mounted in plastic holders. The plastic holders are easily replaced as individual items, but if the connectors are faulty the entire cable should be replaced.

It is possible for the pin connectors to become dislodged from the plastic holders. If this happens, the connector can be reinstalled as shown in Fig. 3-11.

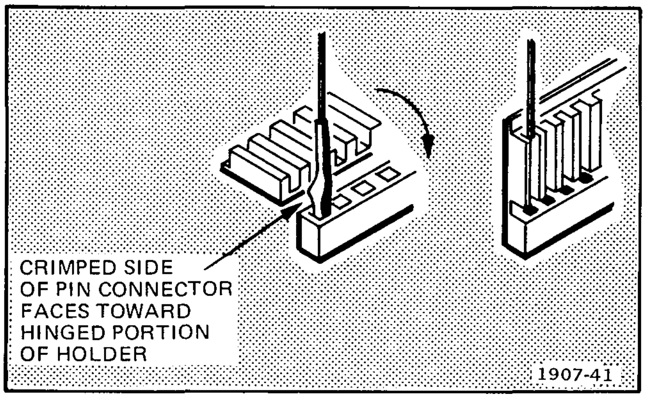


Fig. 3-11. Pin connector replacement.

1. Bend the grooved portion of the holder away from the cable as shown.

2. Re-insert the connector into its hole in the plug-in portion of the holder. Wires are positioned in the holder according to color-code system.

NOTE

Holder positions are numbered (number one is identified with a triangle). The wires are EIA color-coded to match the numbers on the holder. For example; brown stripe for position 1 (triangle), red stripe for position 2, yellow stripe for position 4, etc.

3. Bend the grooved part of the holder so that the connector is inserted into the groove.

4. When plugging connector holders onto the board pins, be sure to match the triangle mark on the holder with the triangle mark on the circuit board.

Removal and Replacement of Circuit Boards

The component side of each circuit board faces the left side of the instrument. The power supply-latch circuit board is mounted to the right of the digital latch circuit board. Therefore, any troubleshooting or maintenance performed on the power supply-latch circuit board requires the removal of the digital latch circuit board.

NOTE

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

Digital Latch Circuit Board. The digital latch circuit board is located on the left side of the DL 502. This board contains the circuitry for channels 8 through 15. Refer to Table 3-5 when replacing the board to ensure correct terminations of the internal connectors and selectors.

1. Remove the left snap-on side cover and place unit on its right side on a flat surface.

2. Disconnect all connectors terminating on the digital latch circuit board. (Refer to Fig. 3-16 for multi-pin connectors and "P" number orientation, when replacing connectors.)

3. Remove the four screws (see Fig. 3-12) securing the digital latch circuit board to the chassis.

4. Remove the circuit board by sliding the board toward the rear of the instrument (disengaging J1 from its adapter), and lift the board away from the chassis. (Slide J1 into its adapter when replacing the board.)

5. Reverse the order of removal to complete the digital latch circuit board replacement.

NOTE

The individual channel data output connectors (harmonica), designated on the circuit board as "P0" through "P7", are EIA color-coded to correspond to the "P" numbers on the board. (For example, P0 is black, P6 is blue, etc.)

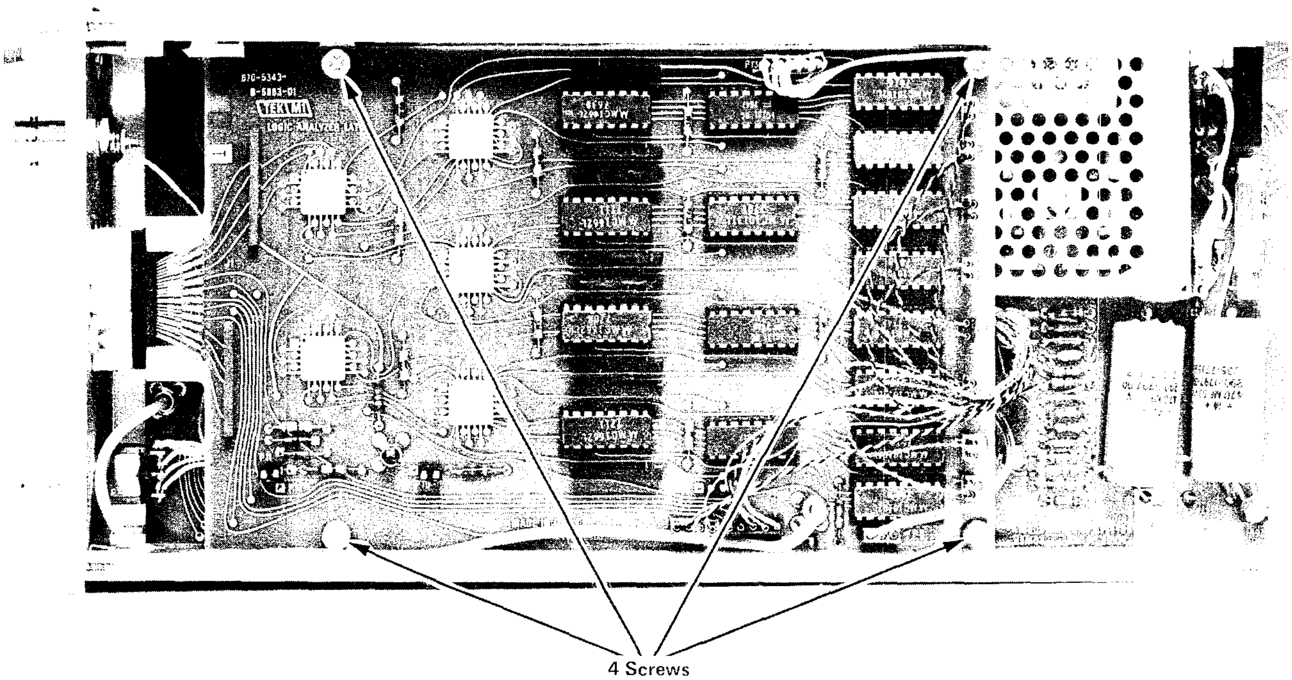


Fig. 3-12. Digital Latch Circuit Board.

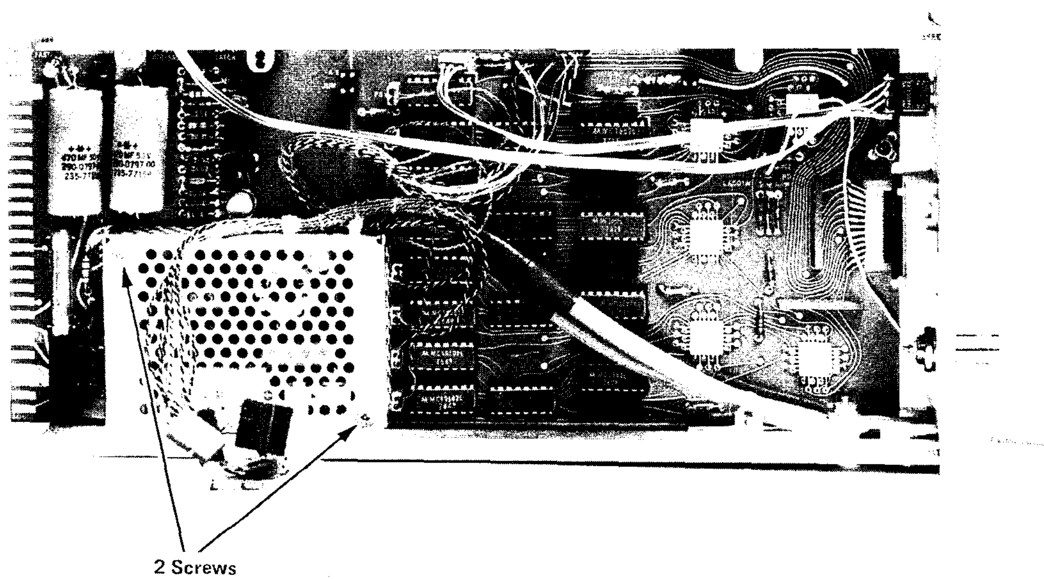


Fig. 3-13. Power Supply—Latch Circuit Board.

Power Supply-Latch Circuit Board. Remove the digital latch circuit board prior to maintenance, troubleshooting or removal of the power supply-latch circuit board. The power supply-latch circuit board contains the circuitry for channels 0 through 7. Refer to Table 3-6 when replacing the board to ensure correct terminations of the internal connectors and selectors.

1. Disconnect all connectors terminating on the power supply-latch circuit board. (Refer to Fig. 3-17 for multi-pin connectors and "P" number orientation when replacing connectors.)

2. Remove the two screws (see Fig. 3-13) securing the EMI shield to the power supply section of the board.

CAUTION

The two output data interface cables are attached to the EMI cover with cable clamps. Do not attempt to remove these cable clamps, unless one or both cables require replacing. When both circuit boards are removed from the chassis, the EMI cover will still be attached to the interface cables.

3. Remove the right snap-on side cover, and replace the left snap-on cover to protect the loose connectors and wires. Place the unit on its left side on a flat surface.

4. Remove the one screw (see Fig. 3-14) in the bottom of the unit securing the heat sink for CR8ØØ4 to the chassis.

5. Remove the four screws on the soldered side of the circuit board (see Fig. 3-15) securing the power supply-latch circuit board to the chassis. Remove the left snap-on side cover.

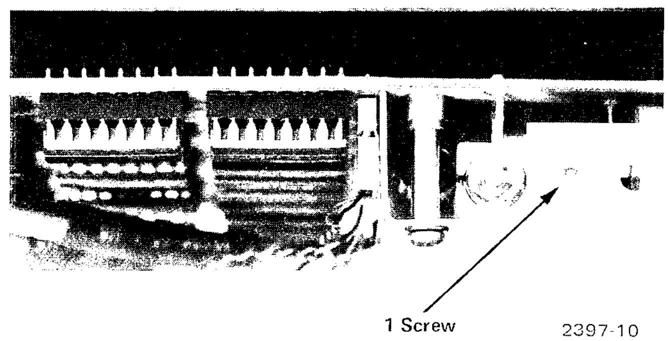


Fig. 3-14. Heat sink for CR8004.

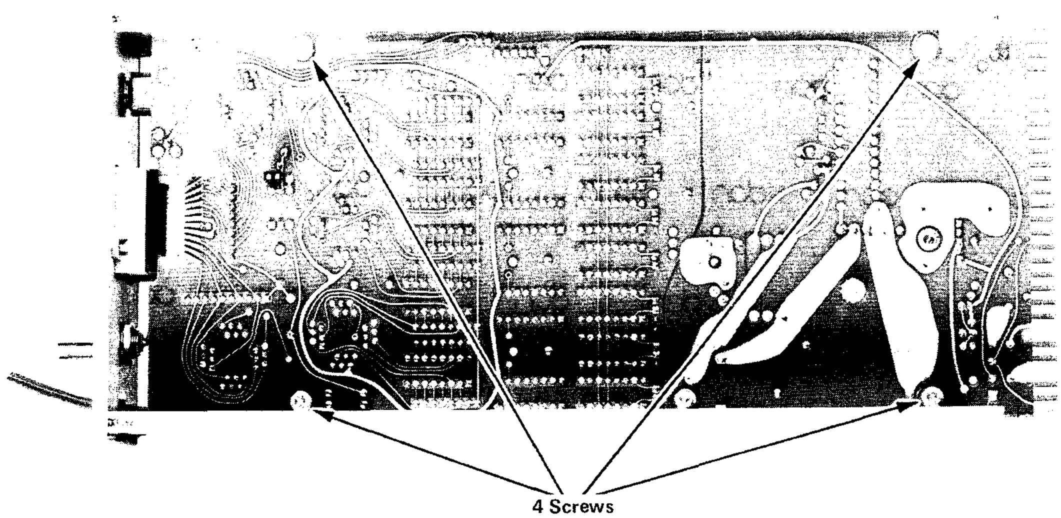


Fig. 3-15. Soldered side of Power Supply—Latch Circuit Board.

6. Remove the circuit board by sliding board toward rear of the instrument (removing J1 from its adapter) and carefully work circuit board free of the chassis. The top and bottom rails may be spread (slightly) at the rear of the instrument to assist in freeing the board from the chassis.

7. Reverse the order of removal to complete the power supply-latch circuit board replacement.

INTERNAL CONNECTORS AND SELECTORS

Functional and operational changes may be made to the DL 502 Digital Latch by changing the position of internal connectors and selectors. Several internal connectors and selectors on each circuit board are set at the factory. Normally these connectors and selectors will not require changing unless the board is removed or replaced. Figs. 3-16 and 3-17 depict the location on the boards for the various internal connectors and selectors. Tables 3-5 and 3-6 show the correct position of all internal connectors and selectors.

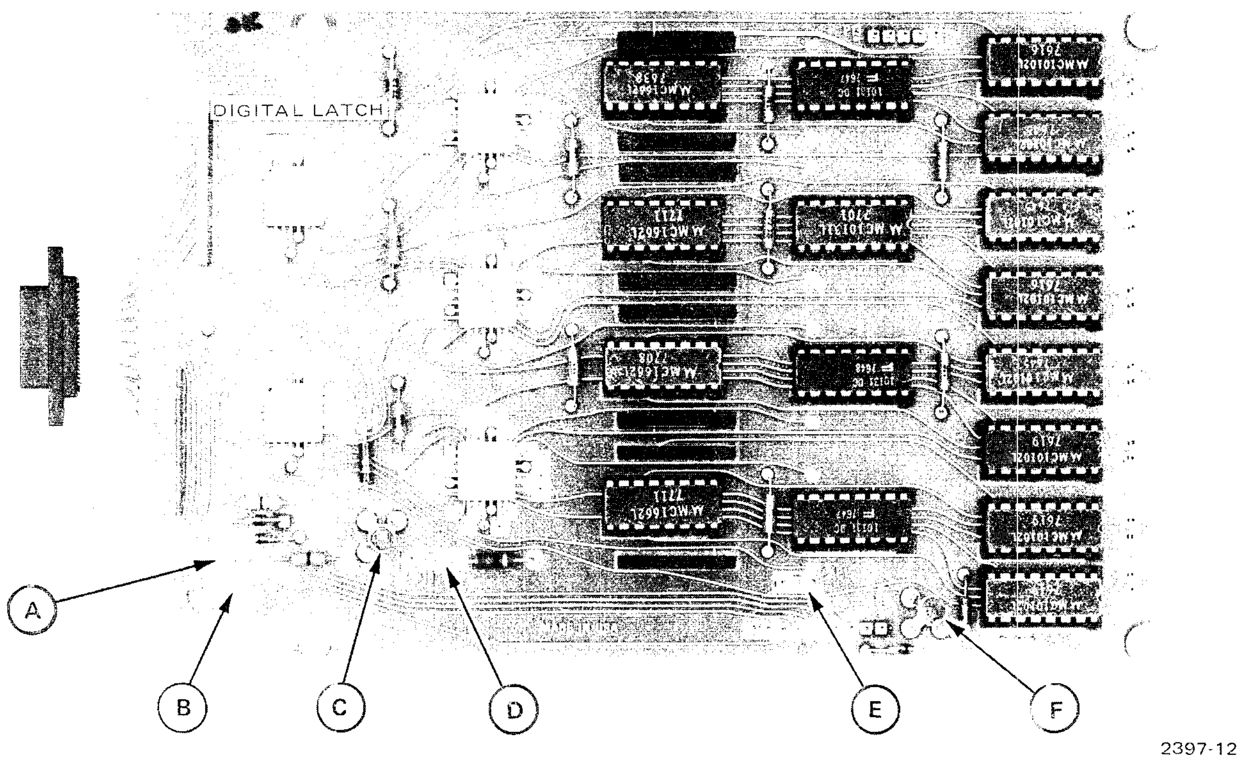


Fig. 3-16. Internal connectors and selectors on Digital Latch Circuit Board — Channels 15 through 8.

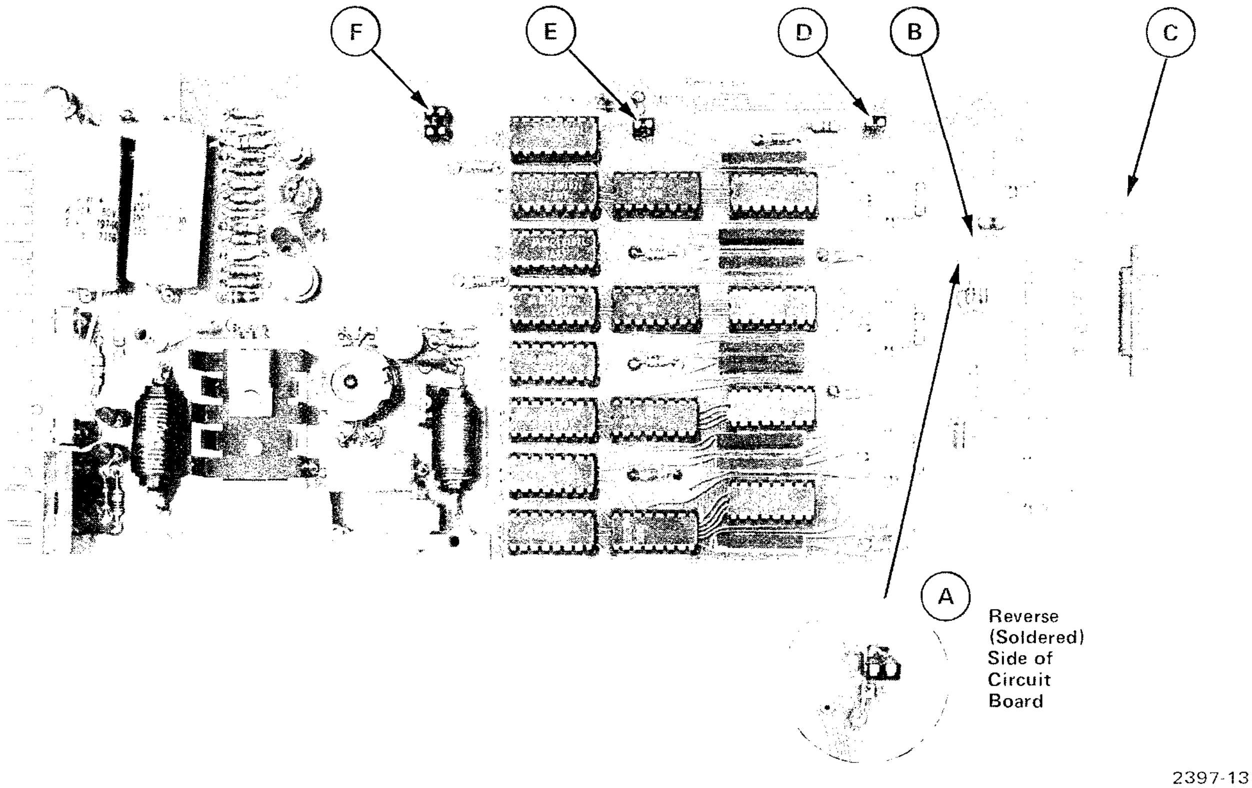


Fig. 3-17. Internal connectors and selectors on Power Supply—Latch Circuit Board — Channels 7 through 0.

Table 3-5

Internal Connectors and Selectors for Digital Latch Circuit Board — Channels 15 through 8. Refer to Fig. 3-16.

Selector/Connector	Position/Function	
P11 (A)		Clock input not used, store selector in this position.
P12 (B)		P12 not used on Chan 15-8 circuit board.
P10 (D)		Terminates clock line on Chan 15-8 circuit board.
P15 (E)		Clock input from Chan 7-0 circuit board. Provides clock for latch circuitry Chan 15-8.
J2 (C)		PELTOLA connector—not used for Chan 15-8.
J3 (F)		PELTOLA connector—Clock input for Chan 15-8. Connected to PELTOLA connector J2 on Chan 7-0 Power Supply—Latch circuit board.

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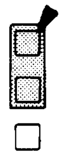
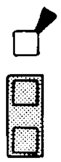
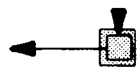
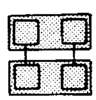
Table 3-6

Internal Connectors and Selectors for Power Supply—Latch Circuit Board — Channels 7 through 0. Refer to Fig. 3-17.

Selector/Connector	Position/Function
P11 (A) (Selector located on soldered side of circuit board.)	 Clock input from 7D01.
	 Clock input from LA 501W.
P12 (B)	 Connected to STORE CLOCK IN connector.
P10 (D)	 Clock output to Chan 15-8 Digital Latch circuit board via J2.
J2 (C)	Clock output to Chan 15-8. Connected to PELTOLA connector J3 on Chan 15-8 Digital Latch circuit board.
−2 V (E)	 Jumper provides −2 V dc to latch portion of Power Supply—Latch circuit board.
−4.9 JUMP (F)	 Parallel jumper provides −4.9 V dc to latch portion of Power Supply—Latch circuit board.

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@

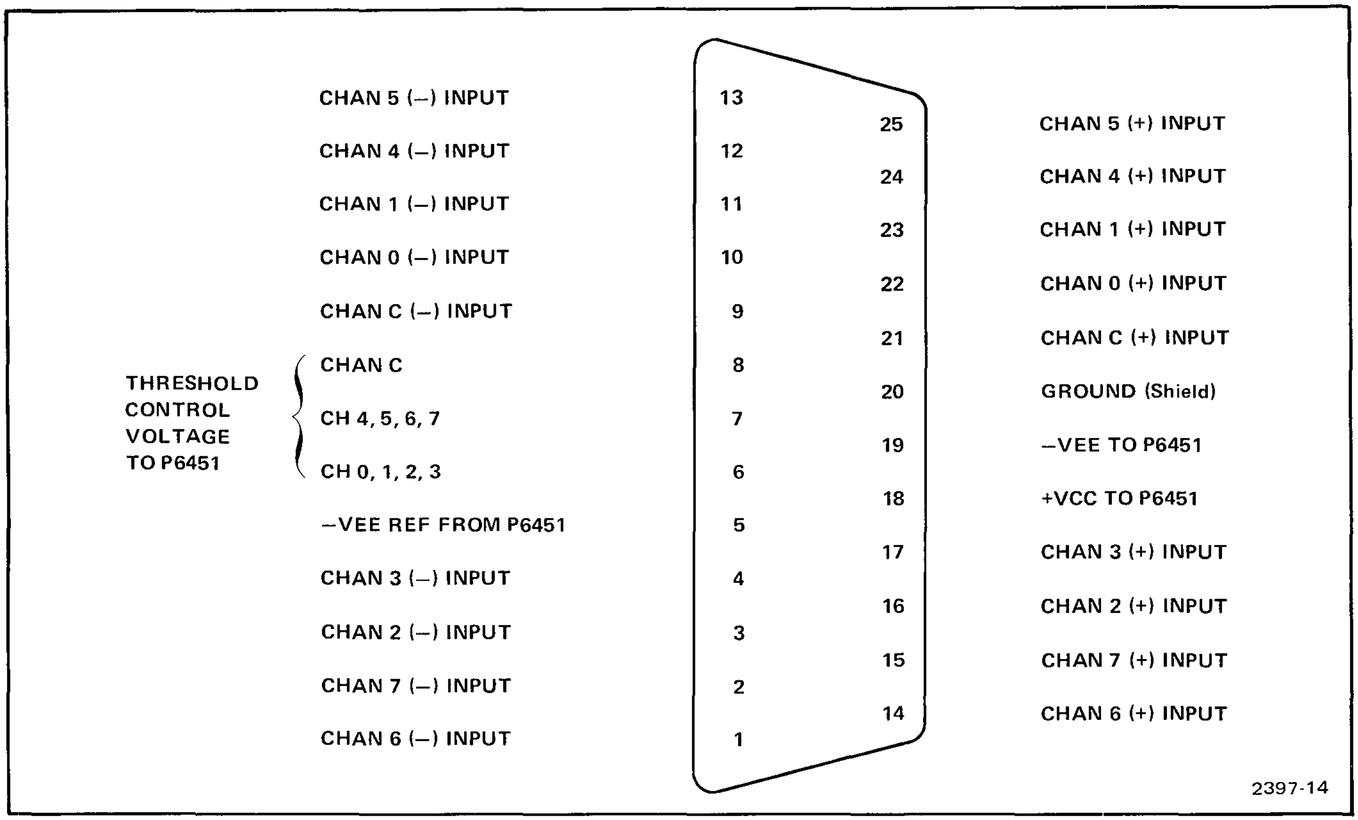


Fig. 3-18. Input data connector for channels 7 through 0.

PIN ASSIGNMENTS FOR INTERCONNECTING CONNECTORS

Input Data Connectors

The pin assignments for the front panel input data connectors are shown in Fig. 3-18 for channels 7 through 0, and Fig. 3-19 for channels 15 through 8.

Output Data Interface Connectors

The pin assignments for the output data interface connectors are shown in Fig. 3-20 for channels 7 through 0, and Fig. 3-21 for channels 15 through 8.

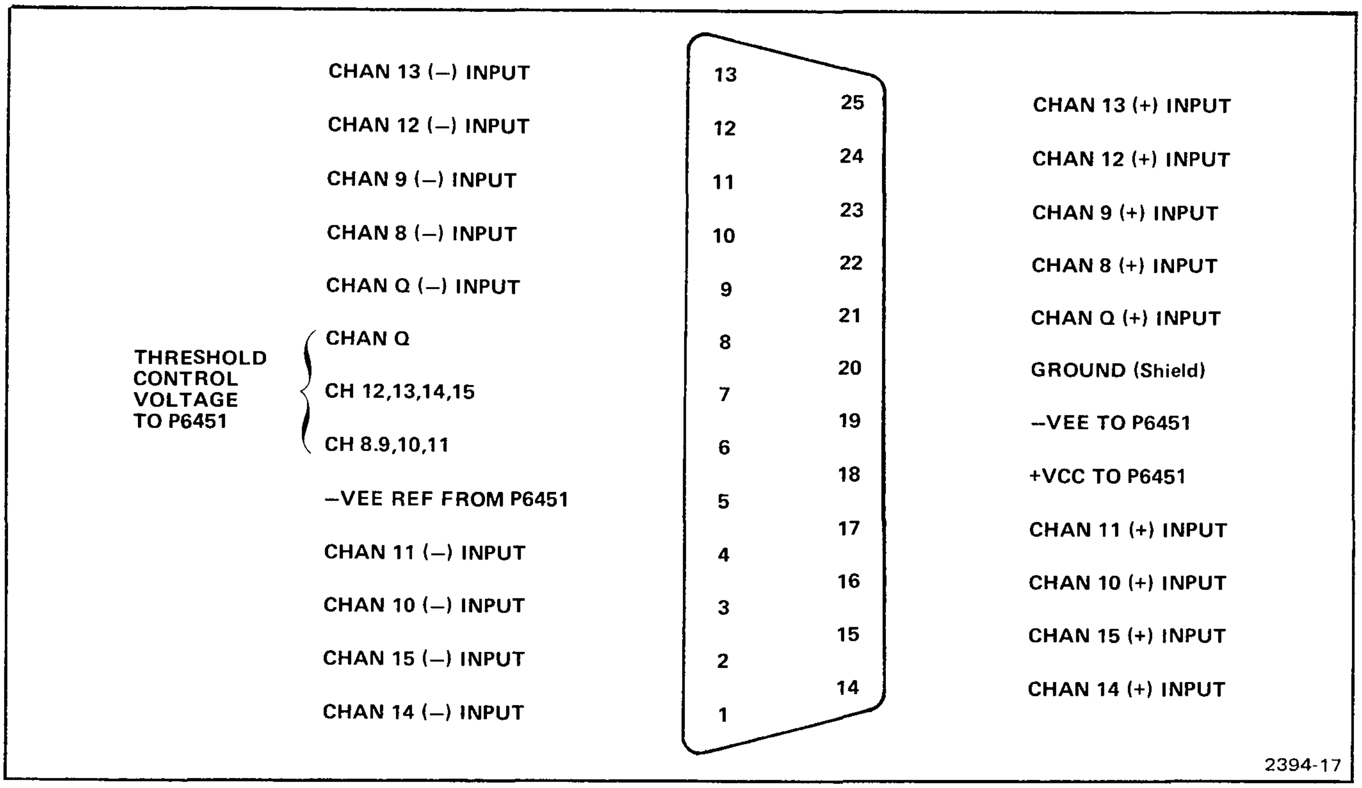


Fig. 3-19. Input data connector for channels 15 through 8.

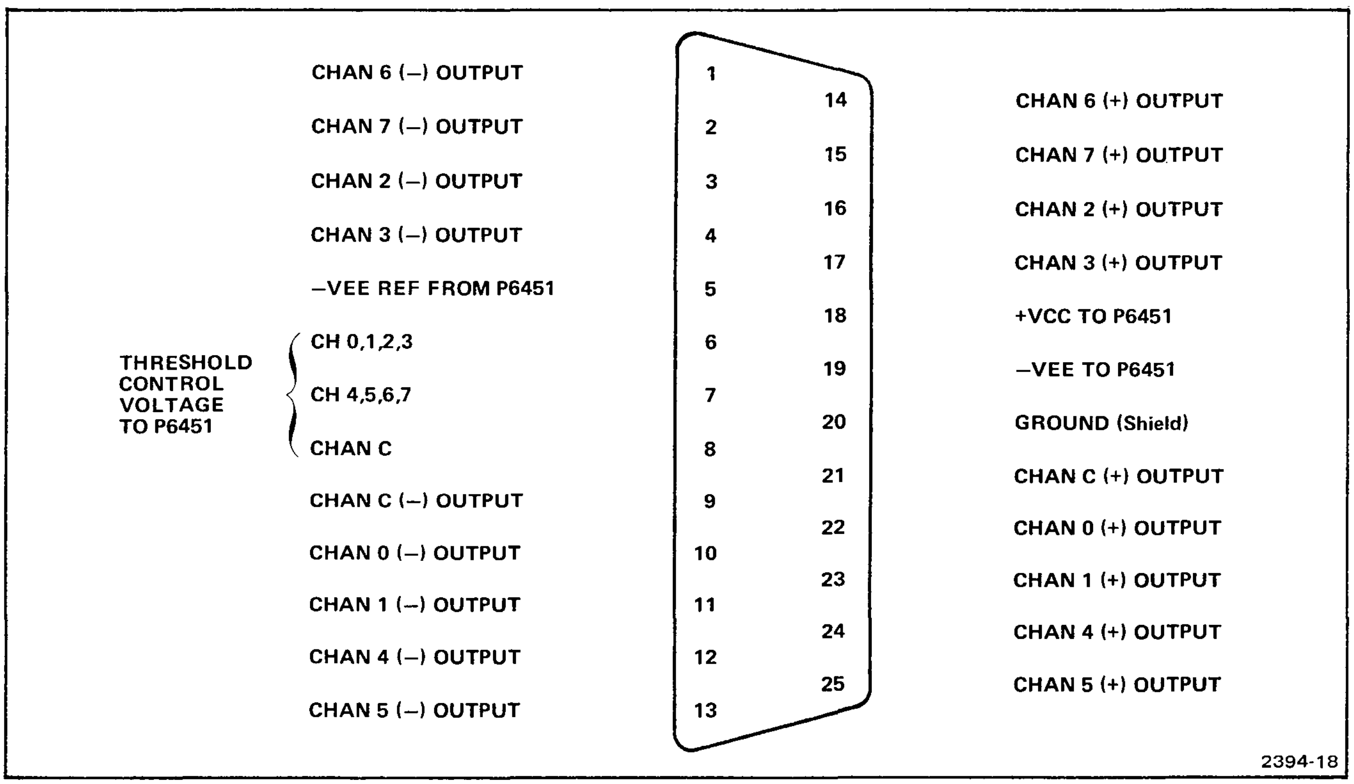


Fig. 3-20. Output data interface cable assembly for channels 7 through 0.

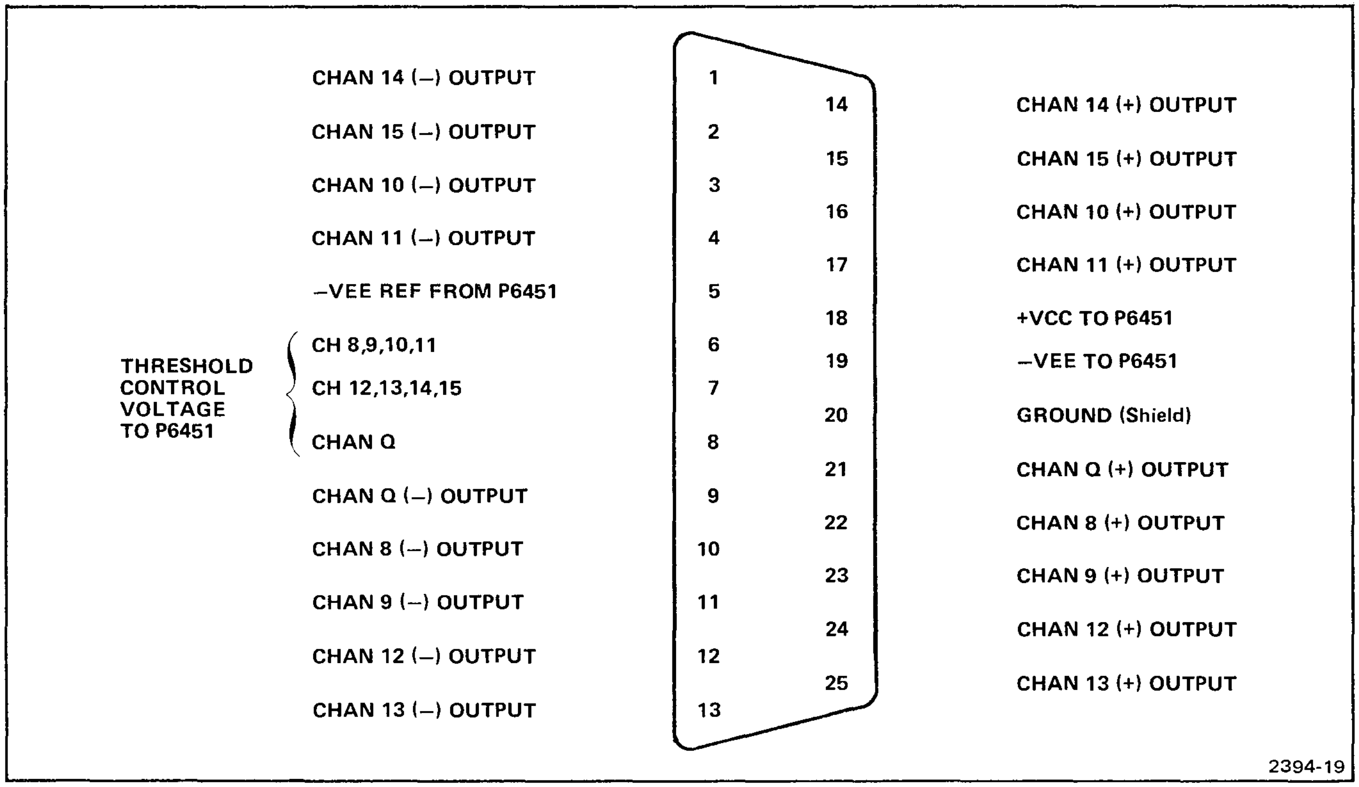


Fig. 3-21. Output data interface cable assembly for channels 15 through 8.

INSTRUMENT OPTIONS

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

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

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

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

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
09353	C AND K COMPONENTS, INC.	103 MORSE STREET	WATERTOWN, MA 02172
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
81483	INTERNATIONAL RECTIFIER CORP.	9220 SUNSET BLVD.	LOS ANGELES, CA 90069
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-5343-00			CKT BOARD ASSY:DIGITAL LATCH	80009	670-5343-00
A2	670-5406-00			CKT BOARD ASSY:POWER	80009	670-5406-00
C1015	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C1035	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C1040	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C1071	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2023	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2025	281-0775-00			CAP.,FXD,CER DI:0. UF,20%,50V	72982	8005H9AABZ5U104M
C2045	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C3000	290-0797-00			CAP.,FXD,ELCTLT:470UF,+50%-10%,50V	56289	D73403
C3010	290-0797-00			CAP.,FXD,ELCTLT:470UF,+50%-10%,50V	56289	D73403
C3015	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C3022	281-0786-00			CAP.,FXD,CER DI:150PF,10%,100V	72982	390049X5P0151K
C3035	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C3040	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C3060	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C3075	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C4015	283-0203-00			CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131N075 E474M
C5001	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C5025	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C5040	290-0755-00			CAP.,FXD,ELCTLT:100UF,+50-10%,10V	56289	502D223
C5041	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	72982	8131N075 E224M
C5042	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C5060	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C5090	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C6025	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C6045	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C6080	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C7001	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C7035	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C7040	290-0299-01			CAP.,FXD,ELCTLT:330UF,20%,10V	56289	OBD
C7060	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C8020	285-1153-00			CAP.,FXD,PLSTC:10UF,20%,100V	14752	230B1B106M
C8080	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C8081	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
CR1055	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4090	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4091	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR7011	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR7012	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR8001	152-0556-01			SEMICOND DEVICE:RECT BRIDGE,SI,50V,2.5A	80009	152-0556-01
CR8040	152-0636-00			SEMICOND DEVICE:RECT,SI,SCHOTTKY,35V,5A	80009	152-0636-00
CR8055	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
F1001	159-0056-00			FUSE,CARTRIDGE:0.1A,125V,FAST-BLOW	75915	279-100
F5001	159-0016-00			FUSE,CARTRIDGE:3AG,1.5A,250V,FAST-BLOW	71400	AGC 1 1/2
L7010	108-0337-00			COIL,RF:25UH	80009	108-0337-00
L7045	108-0336-00			COIL,RF:100UH	80009	108-0336-00
Q1030	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q3030	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q3031	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q4030	151-0183-00			TRANSISTOR:SILICON,NPN	80009	151-0183-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q5020	151-0621-01			TRANSISTOR:SILICON,NPN	80009	151-0621-01
Q6001	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q6002	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q6040	151-0506-00			TRANSISTOR:SILICON,SCR	03508	C106B2
R1020	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R1022	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	91637	MFF1816G909R0F
R1031	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R1052	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R1070	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R1072	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2020	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R2021	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R2022	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R2030	311-1564-00			RES.,VAR,NONWIR:500 OHM,20%,0.50W	73138	91A R500
R2031	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R2032	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R2090	315-0240-00			RES.,FXD,CMPSN:24 OHM,5%,0.25W	01121	CB2405
R3000	307-0525-00			RES.,NETWORK:THK FILM,(9) 56 OHM,2%,0.25W	91637	CSP10G01560G
R3020	315-0121-00			RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
R3021	315-051 -00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R3023	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R3070	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R3071	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R4020	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R4021	315-0430-00			RES.,FXD,CMPSN:43 OHM,5%,0.25W	01121	CB4305
R4031	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R4032	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R4041	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R4089	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R5002	321-0104-01			RES.,FXD,FILM:118 OHM,0.5%,0.125W	91637	MFF1816G118R0D
R5070	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R5071	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R5095	307-0525-00			RES.,NETWORK:THK FILM,(9) 56 OHM,2%,0.25W	91637	CSP10G01560G
R6015	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R6031	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R6032	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R6071	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R6072	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R6090	307-0525-00			RES.,NETWORK:THK FILM,(9) 56 OHM,2%,0.25W	91637	CSP10G01560G
R7000	307-0525-00			RES.,NETWORK:THK FILM,(9) 56 OHM,2%,0.25W	91637	CSP10G01560G
R7002	315-0300-00			RES.,FXD,CMPSN:30 OHM,5%,0.25W	01121	CB3005
R7003	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R7010	315-0240-00			RES.,FXD,CMPSN:24 OHM,5%,0.25W	01121	CB2405
R7013	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R7020	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R7089	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R8031	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
R8045	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R8070	307-0489-00			RES,NTWK,FXD,FI:THICK FILM,100 OHM,20%,1W	32997	4408R0011010
S1	260-0613-00			SWITCH,TOGGLE:SPDT,115V	09353	7101N
T5039	120-1086-00			TRANSFORMER,RF:SWITCHING REGULATOR	80009	120-1086-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U1020	156-1031-00			MICROCIRCUIT,DI:TRIPLE D FLIP-FLOP	07263	F100131FC
U1030	156-0226-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0226-00
U1040	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	80009	156-0230-00
U1050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
U1090	156-1033-00			MICROCIRCUIT,DI:QUINT DIFF LINE RECEIVER	07263	F100114FC
U2050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
U2050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
U2060	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	80009	156-0230-00
U2070	156-0226-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0226-00
U2080	156-1031-00			MICROCIRCUIT,DI:TRIPLE D FLIP-FLOP	07263	F100131FC
U3010	156-1033-00			MICROCIRCUIT,DI:QUINT DIFF LINE RECEIVER	07263	F100114FC
U3030	156-0226-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0226-00
U3040	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	80009	156-0230-00
U3050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
U4020	156-1031-00			MICROCIRCUIT,DI:TRIPLE D FLIP-FLOP	07263	F100131FC
U4050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
U4060	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	80009	156-0230-00
U4070	156-0226-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0226-00
U4080	156-1031-00			MICROCIRCUIT,DI:TRIPLE D FLIP-FLOP	07263	F100131FC
U5030	156-0226-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0226-00
U5040	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	80009	156-0230-00
U5050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
U6010	156-1033-00			MICROCIRCUIT,DI:QUINT DIFF LINE RECEIVER	07263	F100114FC
U6020	156-1031-00			MICROCIRCUIT,DI:TRIPLE D FLIP-FLOP	07263	F100131FC
U6050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
U6060	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	80009	156-0230-00
U6070	156-0226-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0226-00
U7030	156-0226-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0226-00
U7040	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	80009	156-0230-00
U7050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
U7070	156-0226-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0226-00
U7080	156-1031-00			MICROCIRCUIT,DI:TRIPLE D FLIP-FLOP	07263	F100131FC
U7090	156-1033-00			MICROCIRCUIT,DI:QUINT DIFF LINE RECEIVER	07263	F100114FC
U8050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
U8060	156-0230-00			MICROCIRCUIT,DI:DUAL D MA-SLAVE FLIP-FLOP	80009	156-0230-00
VR1021	152-0514-00			SEMICOND DEVICE:ZENER,0.4W,10V	80009	152-0514-00
VR1023	152-0317-00			SEMICOND DEVICE:ZENER,0.25W,6.2V,5%	81483	1N3497
VR4040	152-0175-00			SEMICOND DEVICE:ZENER,0.4W,5.6V,5%	80009	152-0175-00

Scan by Zenith

DIAGRAMS

Symbols and Reference Designators

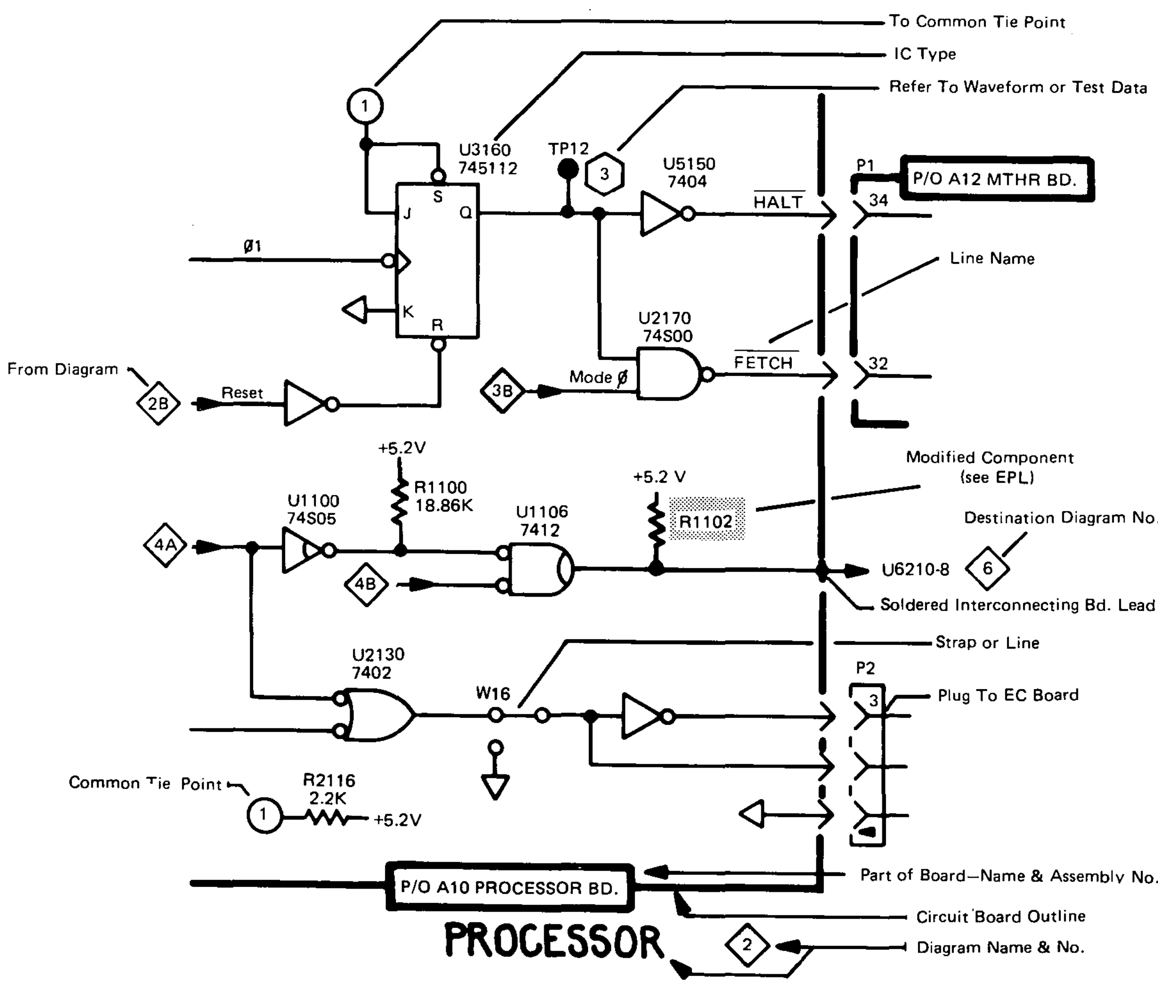
Graphic symbols for electrical and logic symbols, used on the diagrams, are based on ANSI Y32.2, 1975, and ANSI Y32.14, 1973, "American National Standards Institute." Logic symbols depict the logic function of the device in positive logic. Copies of these standards can be obtained from the Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, N.Y., 11017. Exceptions and additions are shown on this sample diagram. These conform or are based on the manufacturers data sheet and industry trends.

Resistor values are in ohms, unless noted otherwise, and the Ω symbol is omitted. Capacitor values ⩽ 1 (e.g. 10) are in picofarads (pF) and values < 1 (e.g. 0.01) are in micofarads unless otherwise noted.

Component Circuit Numbers

Circuit numbers for the components (resistors, IC's, etc.) on the μProcessor Lab modules (boards) are assigned according to their physical location. Some circuit boards have a grid of alphanumeric notation screened or etched on the board. The letters denote row (horizontal) position, the numerals column (vertical) position. Circuit numbers for the schematics or other documentation convert the alpha notation to a number. The letter A converts to 1, B to 2, etc. Thus, a circuit number of R3082 denotes row C column 08; or 8 and position 2 within a box of 10 expander numbers, at row 03 column 8 location.

The following partial diagram illustrates special symbology and practices used on the diagrams with a description of the meaning.



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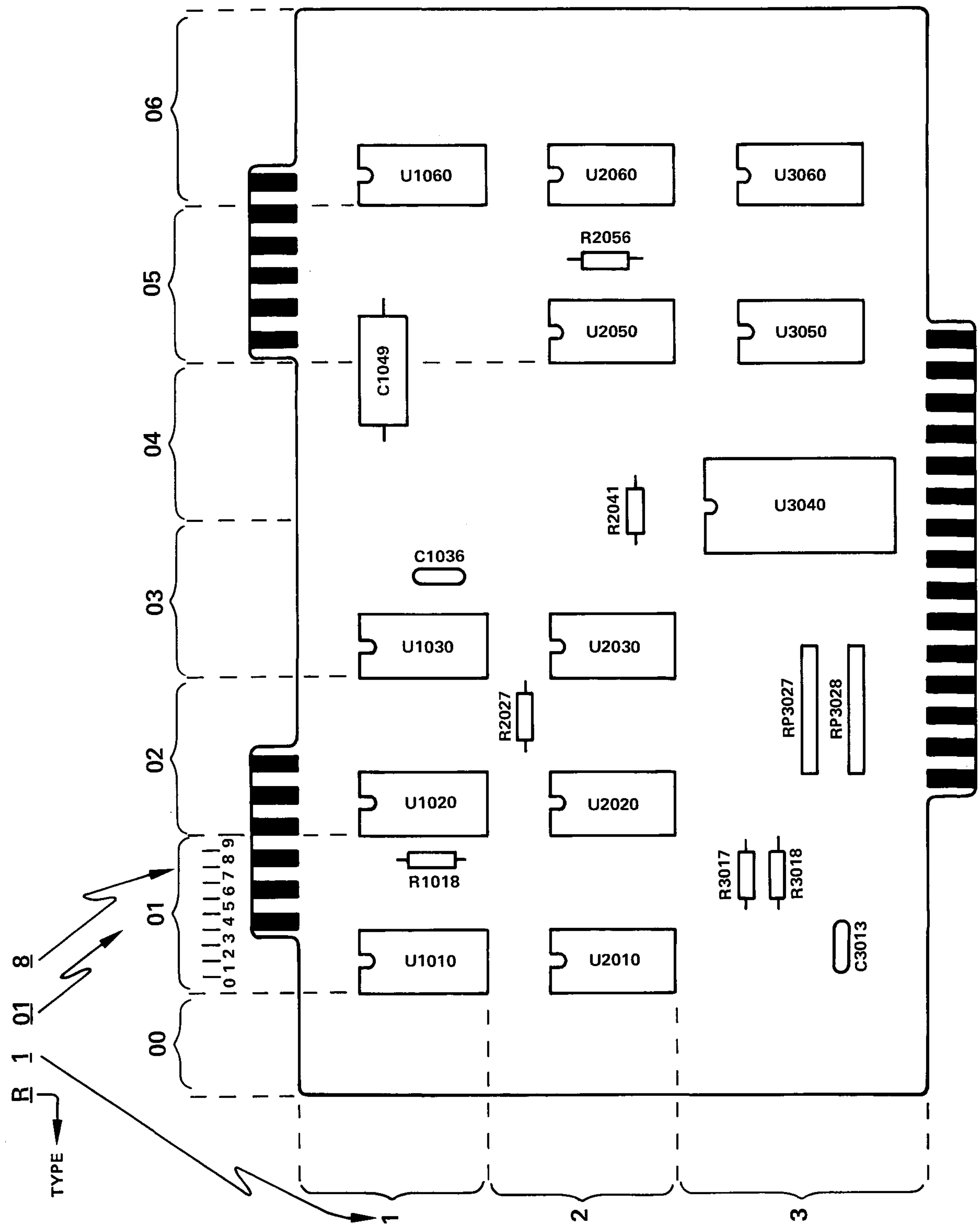
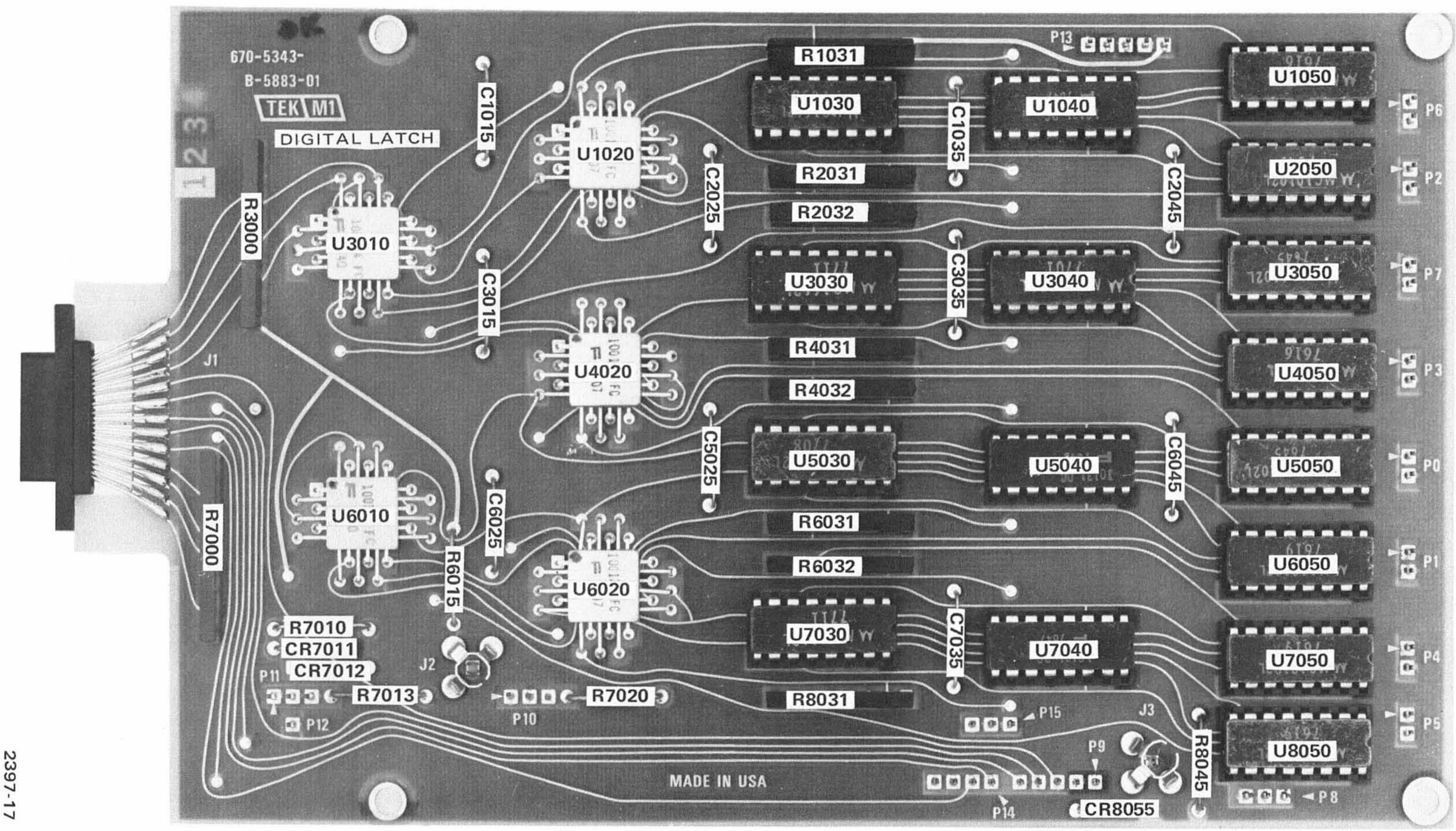
CIRCUIT NUMBER LOCATION GUIDE



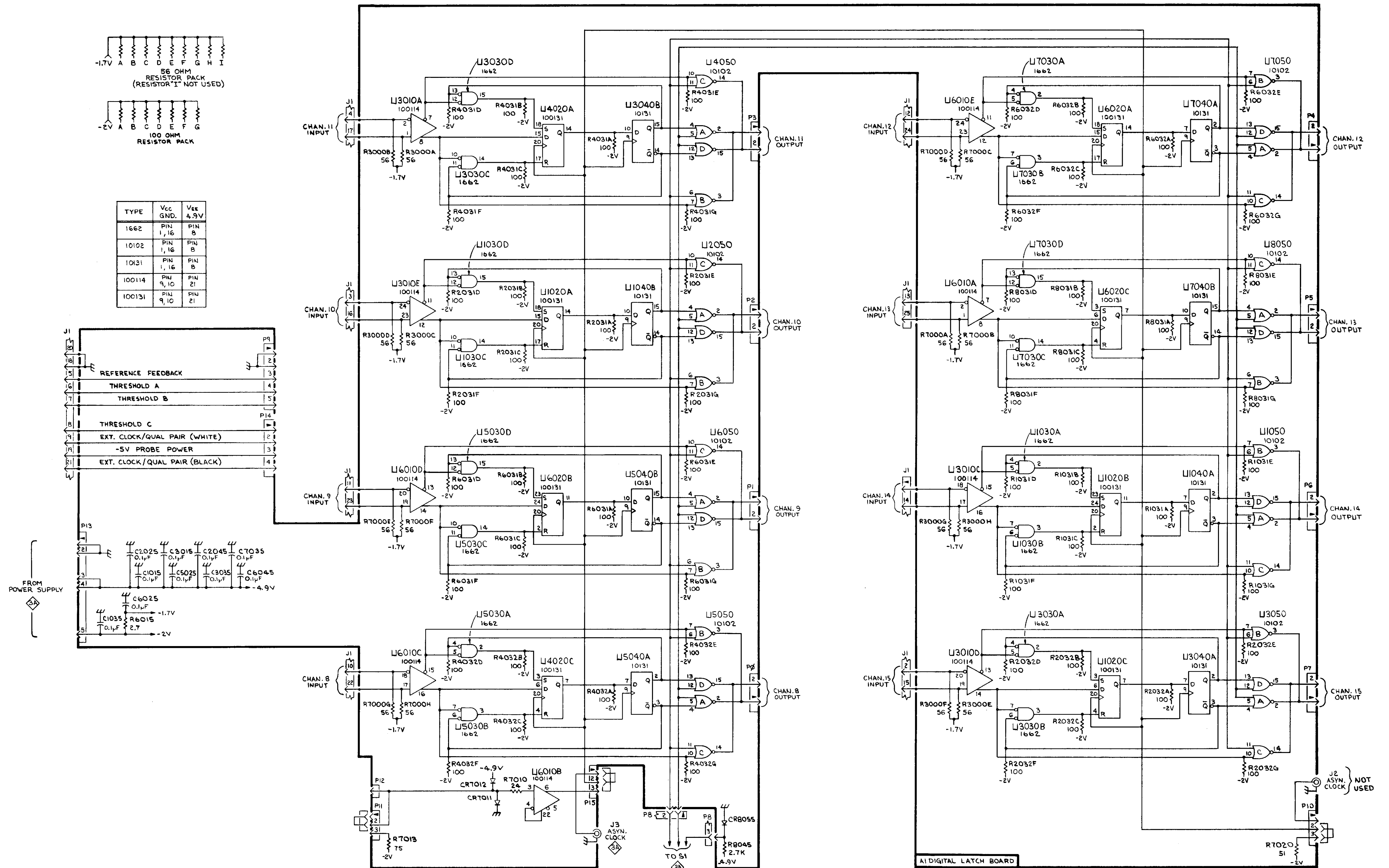
@



2397-17

Digital Latch Board

Scan by Zenith



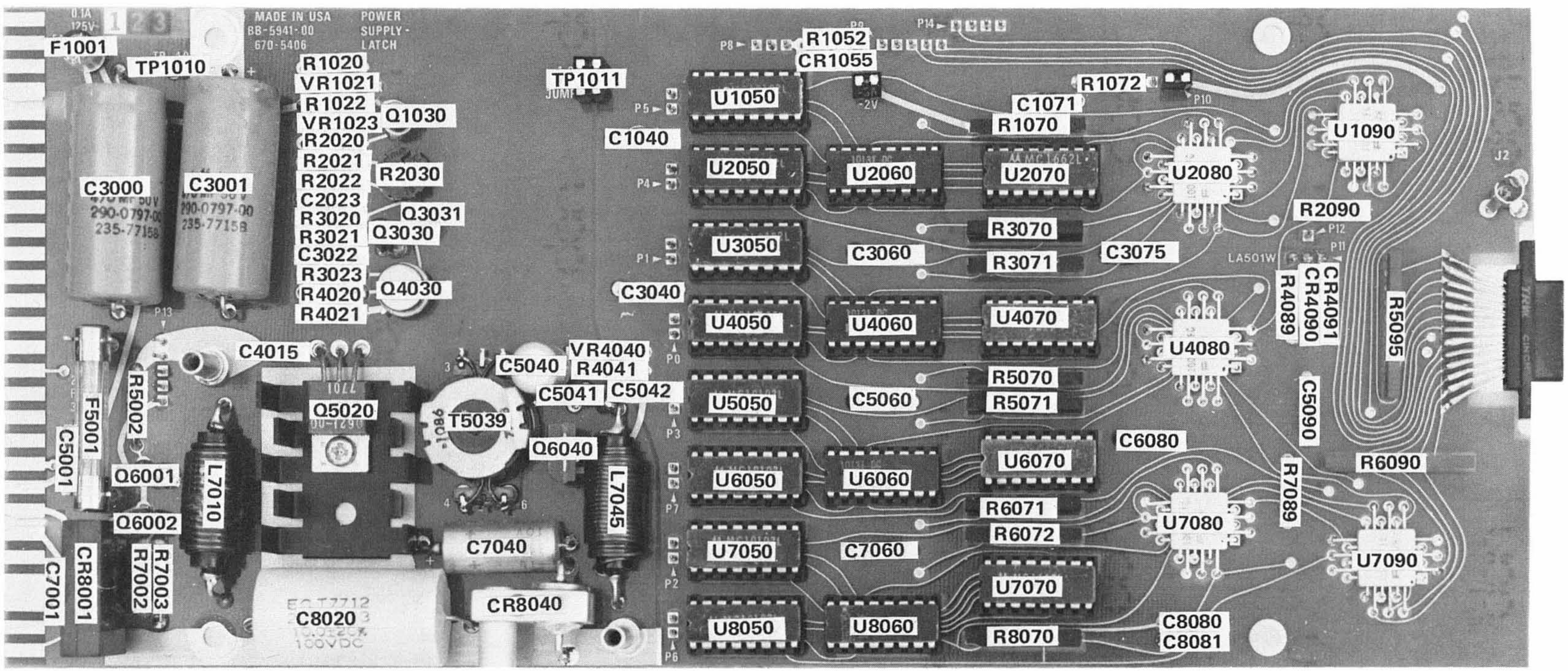
TYPE	Vcc GND.	Vee 4.9V
1662	PIN 1, 16	PIN 8
10102	PIN 1, 16	PIN 8
10131	PIN 1, 16	PIN 8
100114	PIN 9, 10	PIN 21
100131	PIN 9, 10	PIN 21

DIGITAL LATCH

2397-20

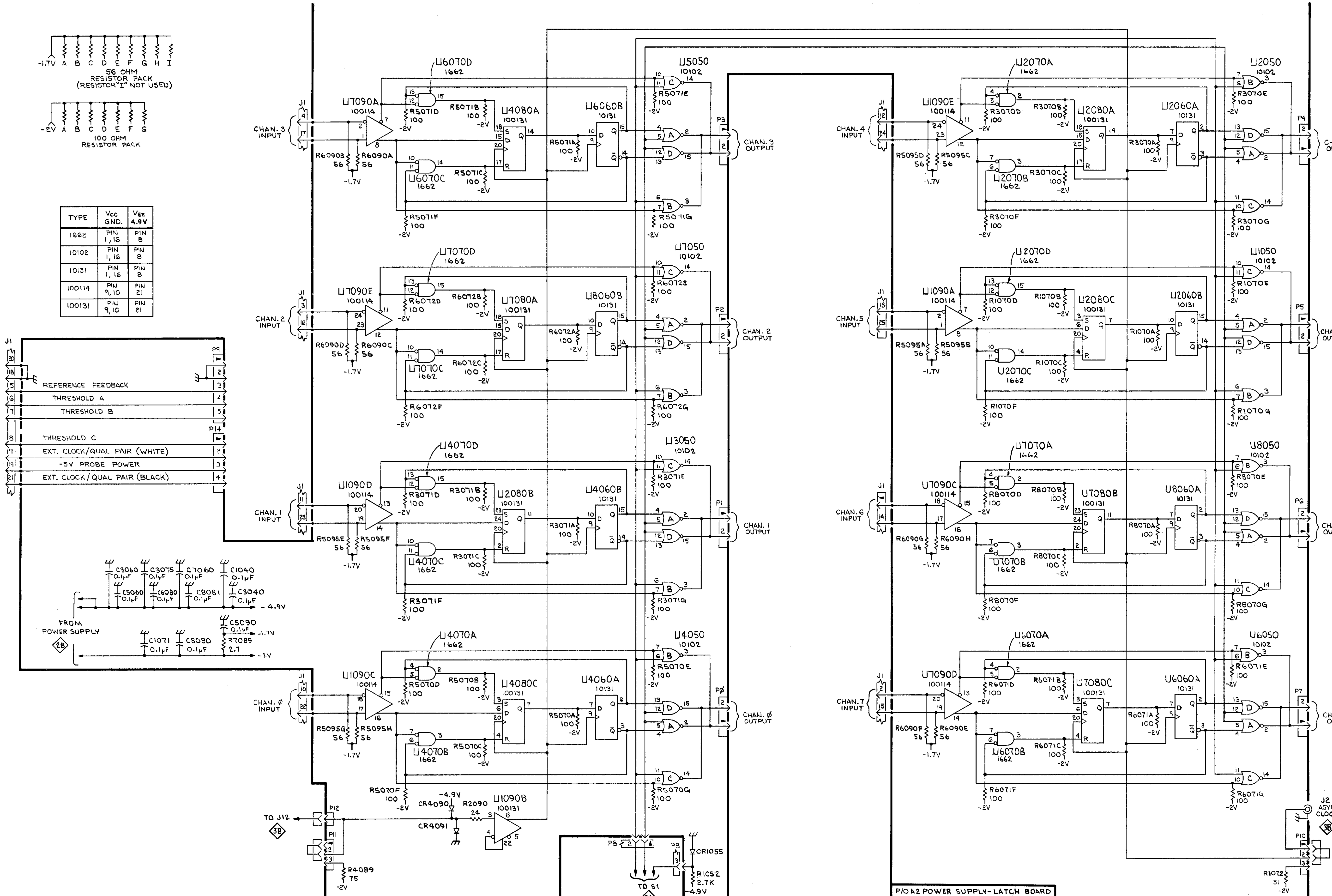
DL 502 DIGITAL LATCH

DIGITAL LATCH ①



2397-18

Power Supply Latch Board



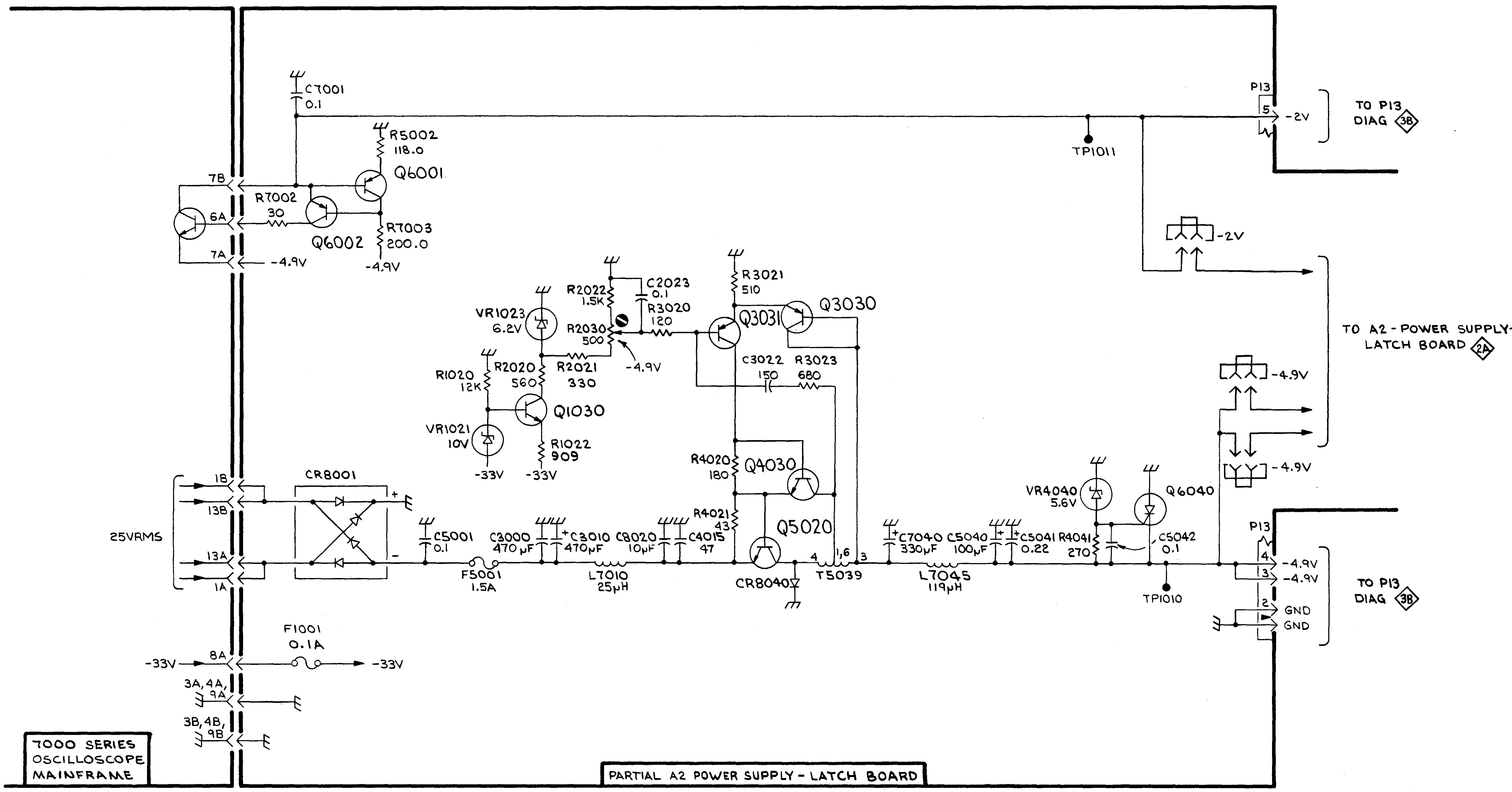
TYPE	Vcc GND.	Vee 4.9V
1662	PIN 1,16	PIN 8
10102	PIN 1,16	PIN 8
10131	PIN 1,16	PIN 8
100114	PIN 9,10	PIN 21
100131	PIN 9,10	PIN 21

2397-21

DL 502 DIGITAL LATCH

POWER SUPPLY & LATCH 2A

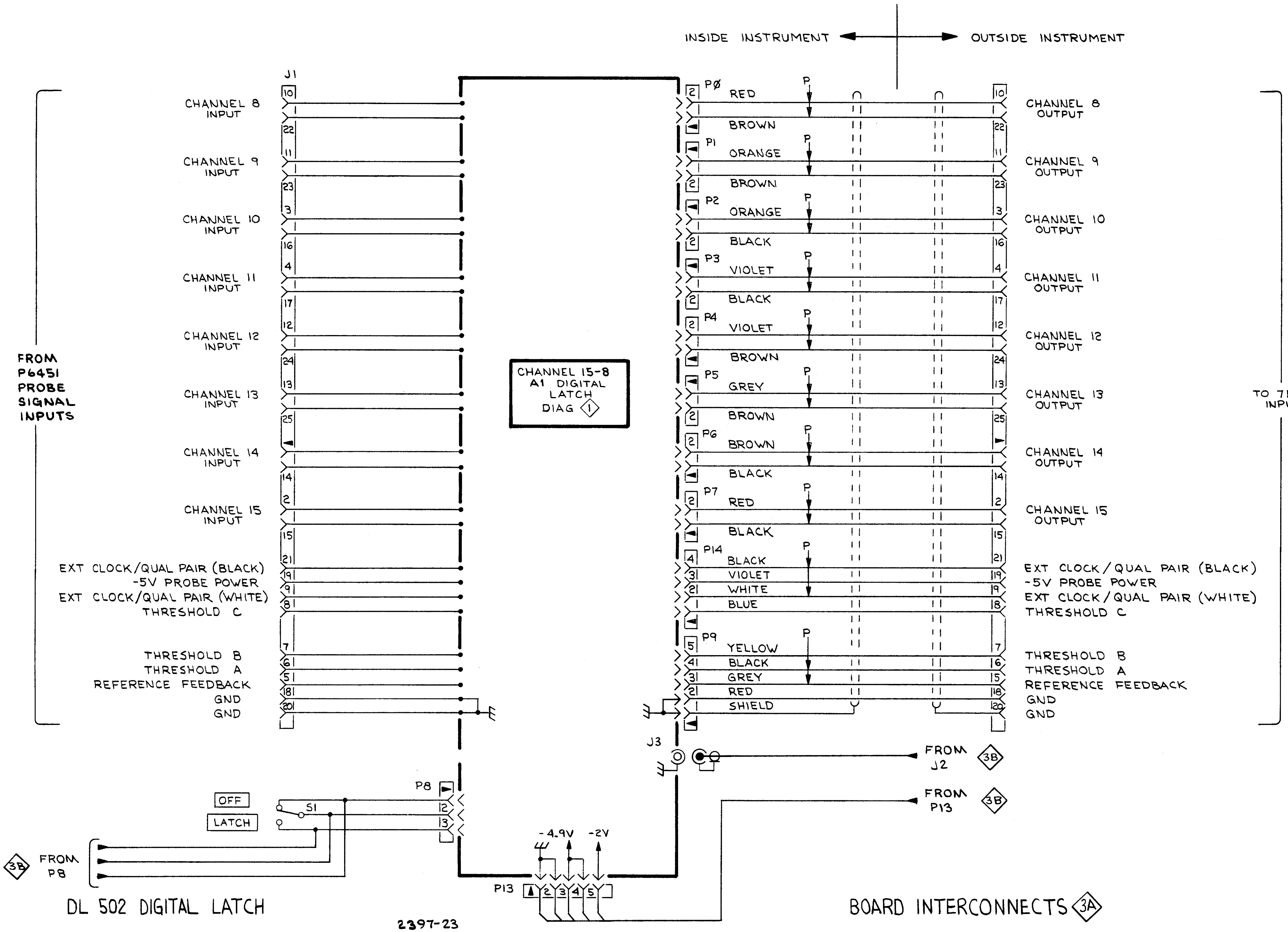
POWER SUPPLY LATCH 2A



DL 502 DIGITAL LATCH

2397-22

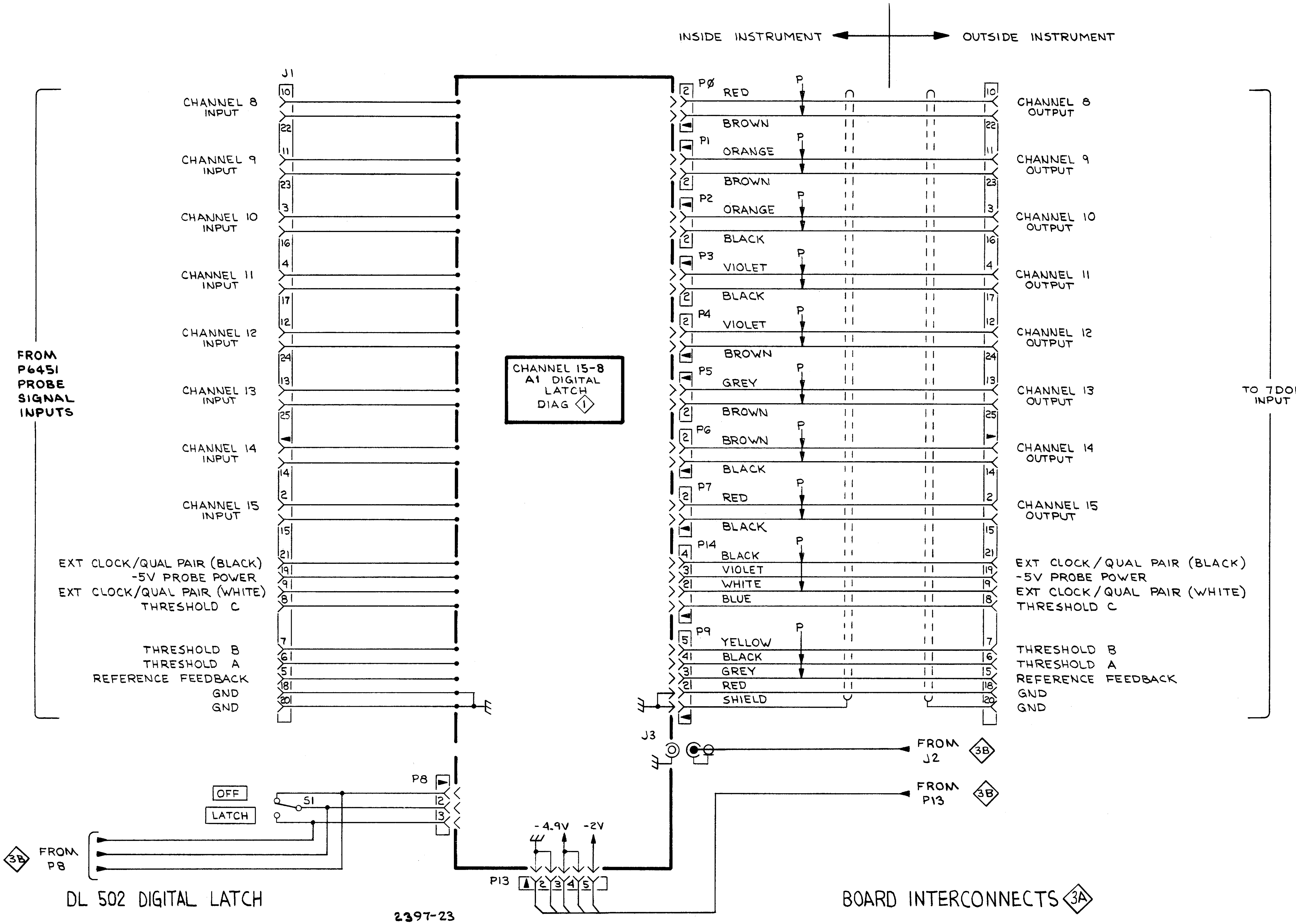
POWER SUPPLY 2B



DL 502 DIGITAL LATCH

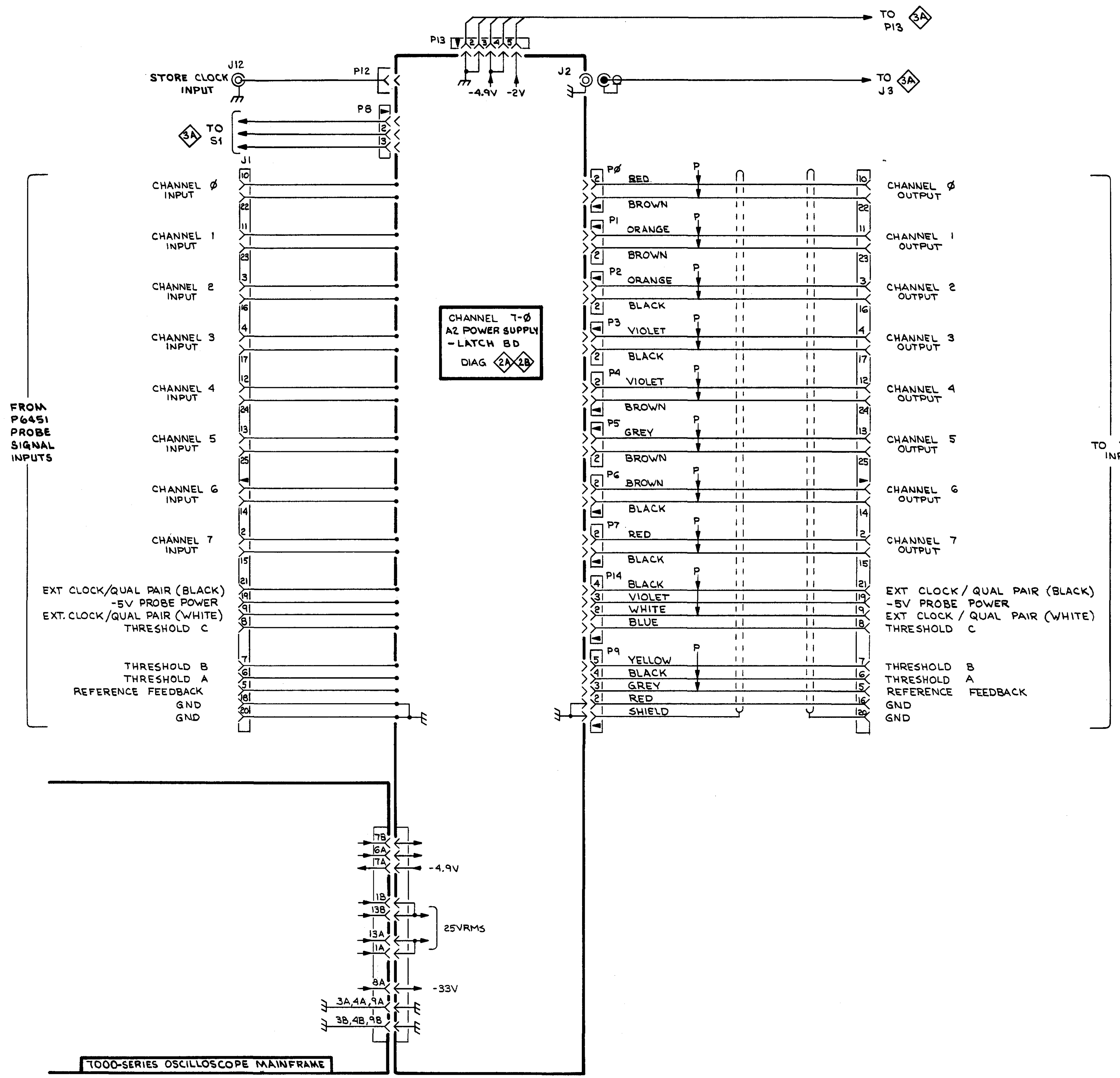
BOARD INTERCONNECTS 3A

Scan by Zenith



DL 502 DIGITAL LATCH

BOARD INTERCONNECTS 3A


TO P13 3A
P13
J12
STORE CLOCK INPUT
P12
J2
-4.9V -2V
TO J3 3A
P8
TO S1 3A
J1
FROM P6451 PROBE SIGNAL INPUTS
CHANNEL Ø INPUT
CHANNEL 1 INPUT
CHANNEL 2 INPUT
CHANNEL 3 INPUT
CHANNEL 4 INPUT
CHANNEL 5 INPUT
CHANNEL 6 INPUT
CHANNEL 7 INPUT
EXT CLOCK/QUAL PAIR (BLACK)
-5V PROBE POWER
EXT. CLOCK/QUAL PAIR (WHITE)
THRESHOLD C
THRESHOLD B
THRESHOLD A
REFERENCE FEEDBACK
GND
GND
CHANNEL 7-Ø A2 POWER SUPPLY -LATCH BD
DIAG 2A 2B
PØ RED BROWN
P1 ORANGE BROWN
P2 ORANGE BLACK
P3 VIOLET BLACK
P4 VIOLET BROWN
P5 GREY BROWN
P6 BROWN BLACK
P7 RED BLACK
P14 BLACK VIOLET WHITE BLUE
P9 YELLOW BLACK GREY RED SHIELD
CHANNEL Ø OUTPUT
CHANNEL 1 OUTPUT
CHANNEL 2 OUTPUT
CHANNEL 3 OUTPUT
CHANNEL 4 OUTPUT
CHANNEL 5 OUTPUT
CHANNEL 6 OUTPUT
CHANNEL 7 OUTPUT
EXT CLOCK / QUAL PAIR (BLACK)
-5V PROBE POWER
EXT CLOCK / QUAL PAIR (WHITE)
THRESHOLD C
THRESHOLD B
THRESHOLD A
REFERENCE FEEDBACK
GND
GND
TO 7D01 INPUT
-4.9V
25VRMS
-33V
3A,4A,9A
3B,4B,9B
7000-SERIES OSCILLOSCOPE MAINFRAME

2397-29

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number

00X Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
--- * ---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
--- * ---
Parts of Detail Part
Attaching parts for Parts of Detail Part
--- * ---

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol --- * --- indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

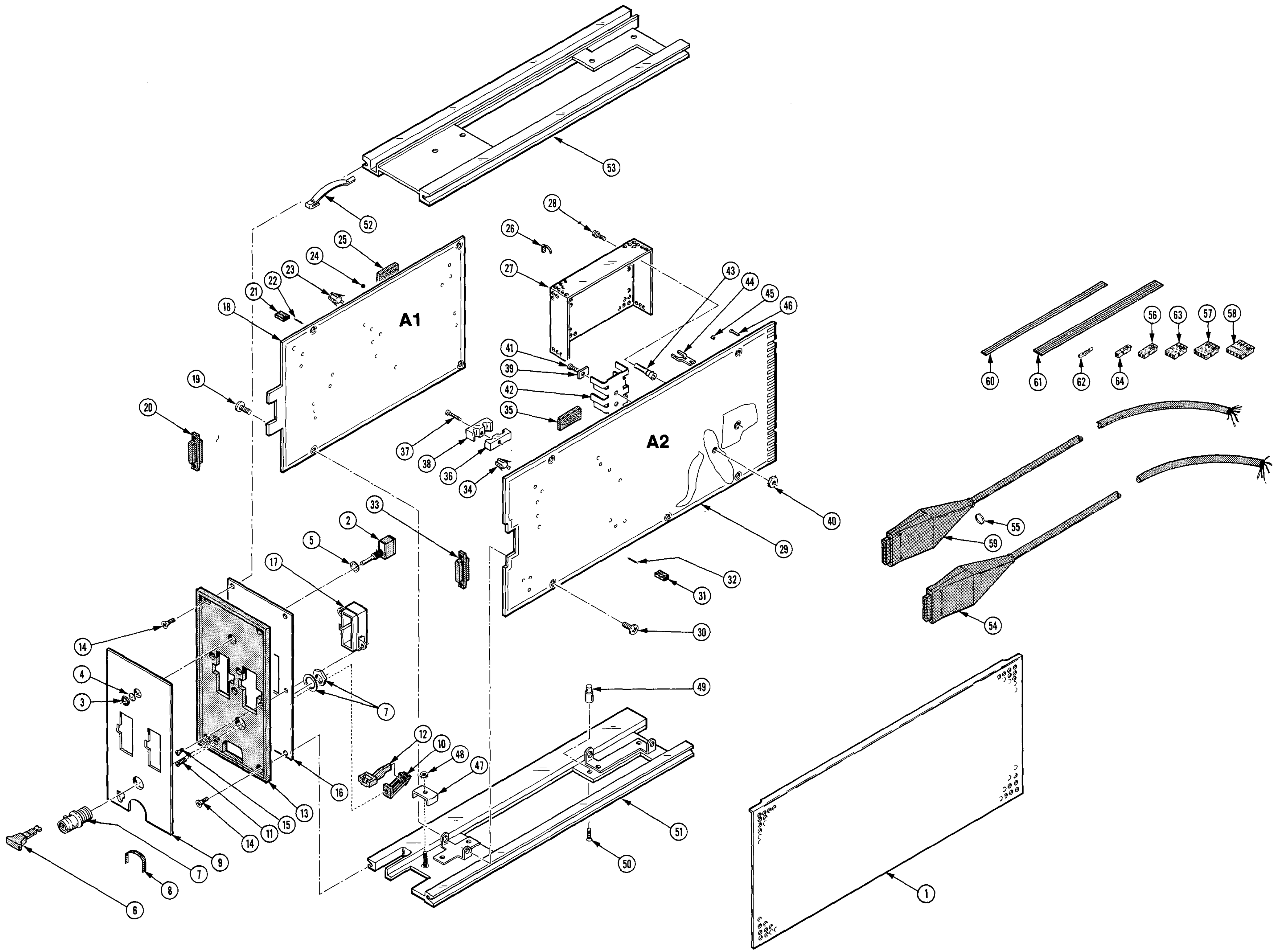
CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
05091	TRI-ORDINATE CORPORATION	343 SNYDER AVENUE	BERKELEY HEIGHTS, NJ 07922
07111	PNEUMO DYNAMICS CORPORATION	4800 PRUDENTIAL TOWER	BOSTON, MA 02199
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
98978	INTERNATIONAL ELECTRONIC RESEARCH CORP.	135 W. MAGNOLIA BLVD.	BURBANK, CA 91502

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-1	337-1399-04			2	SHIELD,ELEC:SIDE	80009	337-1399-04
-2	----- -----			1	SWITCH,TOGGLE:(SEE S1 EPL)		
					(ATTACHING PARTS)		
-3	210-0583-00			1	NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-4	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
-5	210-0046-00			1	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
					- - - * - - -		
-6	366-1690-00			1	KNOB,LATCH:	80009	366-1690-00
-7	131-0955-00			1	CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	05091	31-279
-8	348-0555-00			1	GROMMET,PLASTIC:0.52 ID,U SHAPE	80009	348-0555-00
-9	333-2403-00			1	PANEL,FRONT:	80009	333-2403-00
-10	105-0719-00			1	LATCH,RETAINING:PLUG-IN	80009	105-0719-00
					(ATTACHING PARTS)		
-11	213-0113-00			1	SCR,TPG,THD FOR:2-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-12	105-0718-00			1	RELEASE,LATCH:	80009	105-0718-00
-13	386-3856-00			1	SUBPANEL,FRONT:PLASTIC	80009	386-3856-00
					(ATTACHING PARTS)		
-14	213-0229-00			4	SCR,TPG,THD FOR:6-20 X0.375"100 DEG,FLH STL	83385	OBD
-15	211-0101-00			4	SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-16	337-2505-00			1	SHIELD,ELEC:FRONT SUBPANEL	80009	337-2505-00
-17	352-0472-00			2	HOLDER,SOCKET:	80009	352-0472-00
-18	----- -----			1	CKT BOARD ASSY:DIGITAL LATCH(SEE A1 EPL0		
					(ATTACHING PARTS)		
-19	213-0146-00			4	SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-20	131-1897-01			1	. CONN,RCPT,ELEC:MICROMINIATURE,25 CONT MALE	80009	131-1897-01
-21	131-0993-00			3	. LINK,TERM.CONNE:2 WIRE BLACK	00779	530153-2
-22	131-0608-00			43	. CONTACT,ELEC:0.365 L X 0.25 PH BRZ GOLD PL	22526	47357
-23	131-1003-00			2	. CONNECTOR BODY,:CKT CD MT,3 PRONG	80009	131-1003-00
-24	136-0252-04			2	. SOCKET,PIN TERM:0.188 INCH LONG	22526	75060
-25	136-0260-02			16	. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-26	343-0088-00			2	CLAMP,LOOP:0.062 INCH DIA	80009	343-0088-00
-26	343-0088-00			2	CLAMP,LOOP:0.062 INCH DIA	80009	343-0088-00
-27	337-2513-00			1	SHIELD,ELEC:POWER SUPPLY	80009	337-2513-00
					(ATTACHING PARTS)		
-28	213-0113-00			2	SCR,TPG,THD FOR:2-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-29	----- -----			1	CKT BOARD ASSY:POWER/LATCH(SEE A2 EPL)		
					(ATTACHING PARTS)		
-30	213-0146-00			4	SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-31	131-0993-00			5	. LINK,TERM.CONNE:2 WIRE BLACK	00779	530153-2
-32	131-0608-00			46	. CONTACT,ELEC:0.365 L X 0.25 PH BRZ GOLD PL	22526	47357
-33	131-1897-01			1	. CONN,RCPT,ELEC:MICROMINIATURE,25 CONT MALE	80009	131-1897-01
-34	131-1003-00			1	. CONNECTOR BODY,:CKT CD MT,3 PRONG	80009	131-1003-00
-35	136-0260-02			16	SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-36	200-1153-00			1	. COV HALF,HT STA:	80009	200-1153-00
					(ATTACHING PARTS)		
-37	211-0185-00			1	. SCREW,MACHINE:2-56 X 0.438",PNH,STL	07111	OBD
					- - - * - - -		
-38	200-1155-00			1	. COV HALF,HT STA:	80009	200-1155-00
-39	----- -----			1	. TRANSISTOR:(SEE Q5020 EPL)		
					(ATTACHING PARTS)		
-40	210-0586-00			1	. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
-41	211-0097-00			1	. SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-42	214-1914-00			1	. HEAT SINK,ELEC:	98978	PB1-ZCB
-43	351-0187-00			2	. GUIDE-POST LOCK:0.072 INCH LONG	80009	351-0187-00
-44	344-0154-00			2	. CLIP,ELECTRICAL:FOR 0.25 INCH DIA FUSE	80009	344-0154-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-45	136-0252-04			19	. SOCKET,PIN TERM:0.188 INCH LONG	22526	75060
	136-0352-00			2	. CONTACT,ELEC:FOR 0.02 INCH DIAMETER PIN	00779	50872-2
-46	214-0579-00			2	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-47	343-0717-00			1	CLAMP,CABLE:ALUMINUM	80009	343-0717-00
					(ATTACHING PARTS)		
-48	210-0586-00			1	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-49	129-0683-00			1	SPACER,POST:0.69 L X 0.25 DIA	80009	129-0683-00
					(ATTACHING PARTS)		
-50	211-0101-00			1	SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
					- - - * - - -		
-51	426-1482-00			1	FR SECT,PLUG-IN:BOTTOM,W/BRACKET	80009	426-1482-00
-52	214-1061-00			1	SPRING,GROUND:FLAT	80009	214-1061-00
-53	426-1481-00			1	FR SECT,PLUG-IN:TOP,W/BRACKET	80009	426-1481-00
	175-1835-05			1	CA ASSY,SP,ELEC:36.0 INCH LONG,W/BAND	80009	175-1835-05
-54	175-1835-03			1	. CA ASSY,SP,ELEC:36.0 INCH LONG	80009	175-1835-03
-55	334-2794-01			1	. BAND,MARKER:0.371 DIA,WHITE,PLASTIC	80009	334-2794-01
-56	352-0169-00			1	. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
	352-0169-01			1	. CONN BODY,PL,EL:2 WIRE BROWN	80009	352-0169-01
	352-0169-02			1	. CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
	352-0169-03			1	. CONN BODY,PL,EL:2 WIRE ORANGE	80009	352-0169-03
	352-0169-04			1	. CONN BODY,PL,EL:2 WIRE YELLOW	80009	352-0169-04
	352-0169-05			1	. CONN BODY,PL,EL:2 WIRE GREEN	80009	352-0169-05
	352-0169-06			1	. CONN BODY,PL,EL:2 WIRE BLUE	80009	352-0169-06
	352-0169-07			1	. CONN BODY,PL,EL:2 WIRE PURPLE	80009	352-0169-07
	352-0169-08			1	. CONN BODY,PL,EL:2 WIRE GRAY	80009	352-0169-08
-57	352-0162-01			1	. CONN BODY,PL,EL:4 WIRE BROWN	80009	352-0162-01
-58	352-0163-00			1	. CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0163-00
-59	175-1835-03			1	CA ASSY,SP,ELEC:36.0 INCH LONG	80009	175-1835-00
	352-0169-00			1	. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
	352-0169-01			1	. CONN BODY,PL,EL:2 WIRE BROWN	80009	352-0169-01
	352-0169-02			1	. CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
	352-0169-03			1	. CONN BODY,PL,EL:2 WIRE ORANGE	80009	352-0169-03
	352-0169-04			1	. CONN BODY,PL,EL:2 WIRE YELLOW	80009	352-0169-04
	352-0169-05			1	. CONN BODY,PL,EL:2 WIRE GREEN	80009	352-0169-05
	352-0169-06			1	. CONN BODY,PL,EL:2 WIRE BLUE	80009	352-0169-06
	352-0169-07			1	. CONN BODY,PL,EL:2 WIRE PURPLE	80009	352-0169-07
	352-0169-08			1	. CONN BODY,PL,EL:2 WIRE GRAY	80009	352-0169-08
	352-0162-00			1	. CONN BODY,PL,EL:4 WIRE BLACK	80009	352-0162-00
	352-0163-01			1	. CONN BODY,PL,EL:5 WIRE BROWN	80009	352-0163-01
	198-3824-00			1	WIRE SET,ELEC:	80009	198-3824-00
-60	175-0826-00			FT	. WIRE,ELECTRICAL:3 WIRE RIBBON	80009	175-0826-00
-61	175-0828-00			FT	. WIRE,ELECTRICAL:5 WIRE RIBBON	08261	OBD
-62	131-0707-00			17	. CONTACT,ELEC:48.0" L,22-26 AWG WIRE	22526	75691-005
-63	352-0161-08			2	. CONN BODY,PL,EL:3 WIRE GRAY	80009	352-0161-08
	352-0163-03			2	. CONN BODY,PL,EL:5 WIRE ORANGE	80009	352-0163-03
-64	352-0171-02			1	. CONN BODY,PL,EL:1 WIRE RED	80009	352-0171-02

FIG. 1 EXPLODED



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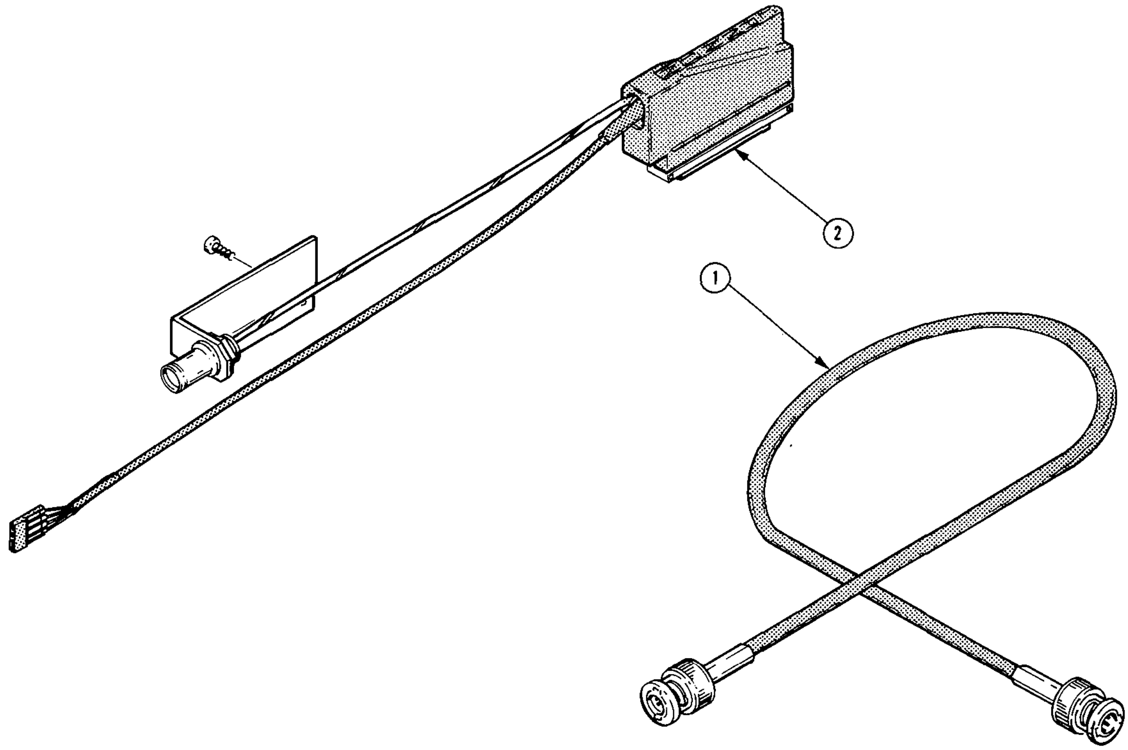

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-					STANDARD ACCESSORIES		
-1	012-0076-00			1	CABLE ASSY,RF:50 OHM COAX,20.0 LONG	80009	012-0076-00
-2	012-0725-01			1	CABLE,INTCON:10.0 INCH LONG	80009	012-0725-01
	070-2397-00			1	MANUAL,TECH:INSTRUCTION	80009	070-2397-00