TEKTRONIX®

DL2
DIGITAL LATCH

INSTRUCTION MANUAL

Tektronix, Inc.
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WARRANTY

Tektronix warrants that this product is free from defects in materials and workmanship. The warranty period is one (1) year from the date of shipment. Tektronix will, at its option, repair or replace the product if Tektronix determines it is defective within the warranty period and if it is returned, freight prepaid, to a service center designated by Tektronix.

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a. to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair, or service the product;
b. to repair damage resulting from improper use or from connecting the product to incompatible equipment;
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SAFETY INFORMATION

GENERAL

The following general safety information applies to all operator 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 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 a procedure, condition, statement, etc., which may be essential for better understanding.

The following safety symbols may appear on the equipment.


CAUTION—Refer to manual


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 appropriate (operators, servicing) 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, that require qualified service personnel to perform, are described in the Service portion of the appropriate manual.

Disconnect the power input before replacing the fuse.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERE

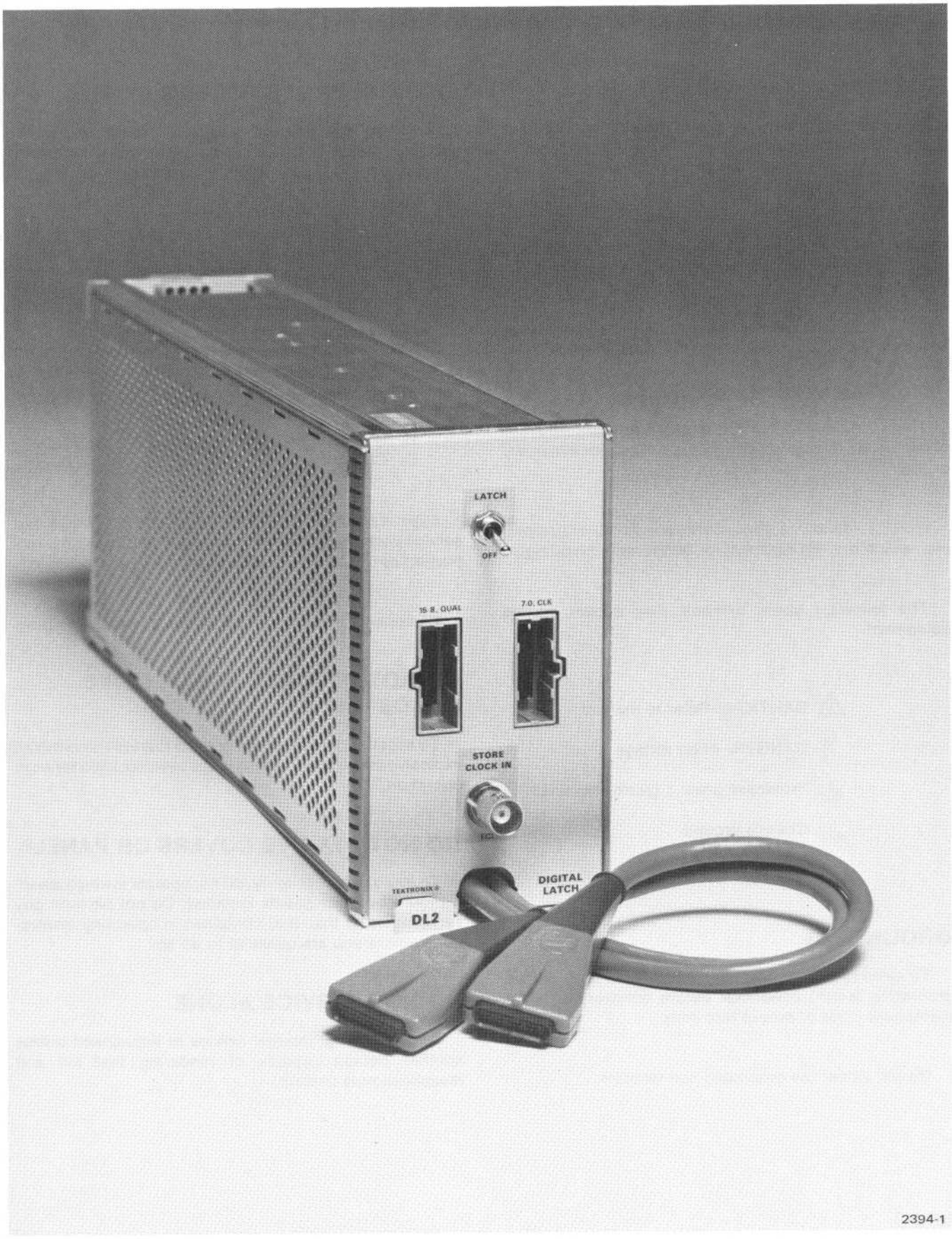
To avoid explosion, do not operate this instrument in an explosive atmosphere unless it has been certified for such operation.

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 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.



DL2 Digital Latch

GENERAL INFORMATION

INTRODUCTION

This instruction manual contains information that applies to the operation and servicing of the TEKTRONIX DL2 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 selections. Section 1 provides a brief description and lists the specifications for the DL2 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, in addition to 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 that involves 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 DL2 Digital Latch is a 7000-Series plug-in unit to be used with logic analyzers; such as, the TEKTRONIX 7D01 Logic Analyzer. The DL2 is a 16 channel latch, providing 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 DL2 permits asynchronous latching on very short pulses that are less than one sample interval, but equal to or greater than 5 ns. When the DL2 is operating in conjunction with the 7D01 and a 7000-Series Oscilloscope, these short pulses are stretched and displayed as one full bit or sample period.

Figure 1-1 depicts two types of pulses that can be detected when passed through the latch circuitry of the DL2. These pulses would normally not be detected without the aid of a digital latch.

The asynchronous clock signal used to control the latch circuitry is obtained from the Store Clock Out connector on the 7D01. The LATCH switch on the DL2 permits the selection of either latch OFF mode or LATCH mode for all 16 data channels (the LATCH switch provides 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 DL2 to the logic analyzer. In the LATCH mode position, the latch functions of the DL2 are clocked by the asynchronous clock signals from the 7D01. In this mode, the latch circuitry in the DL2 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 for a clock or qualifier signal (labeled C or Q on the probe pod) and one 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.

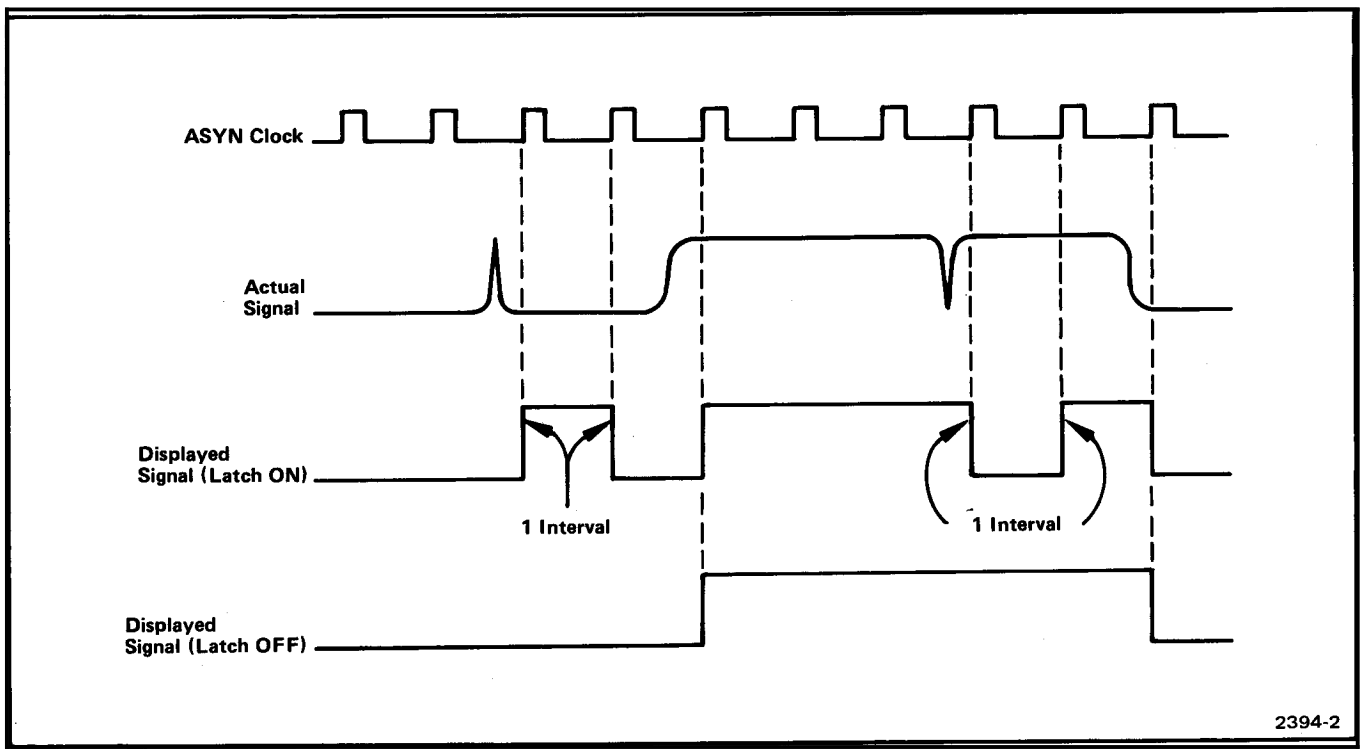


Fig. 1-1. Effects of digital latch on signals of short pulse width.

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, wire, or test point in a circuit.

The probe connector is inserted in the right connector on the front panel of the DL2 for data inputs to channels 7 through Ø. The probe connector is inserted in the left connector on the DL2 for data inputs to channels 15 through 8.

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, 5ØØ mV p-p pulse centered at threshold voltage.
Clock Input	
STORE CLOCK IN	
Minimum clock period.	5Ø ns.

NOTE

The DL2 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 7DØ1 operation). The minimum setup time may be reduced by connecting the P6451 probe connectors directly to the 7DØ1.

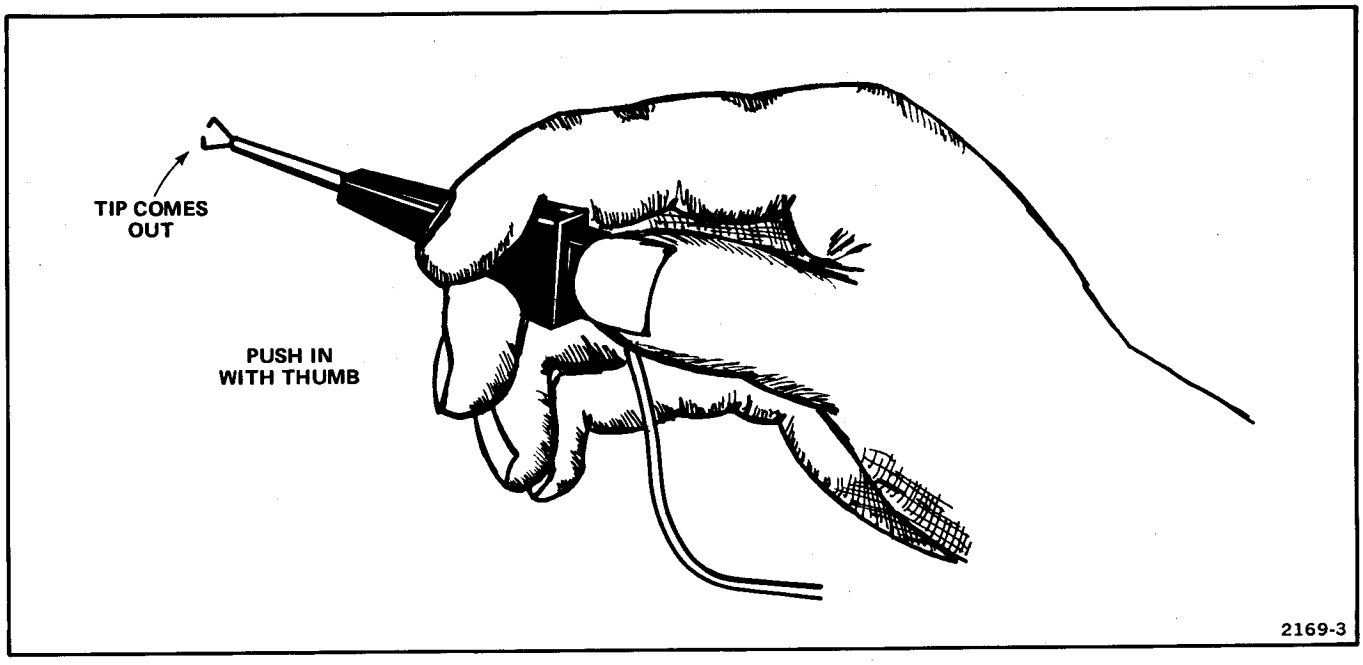


Fig. 1-2. P6451 Data Acquisition Probe retractable probe tip.

ENVIRONMENTAL CHARACTERISTICS

Table 1-2

ENVIRONMENTAL CHARACTERISTICS

Characteristics	Description
Temperature	
Operating	Ø° to +5Ø° C (+32° to +122° F)
Storage	−55° to +75° C (−67° to +167° F)
Altitude	
Operating	To 15,ØØØ feet.
Storage	To 5Ø,ØØØ 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 2.4 lbs (1.1 kg)
Dimensions	See Fig. 1-3

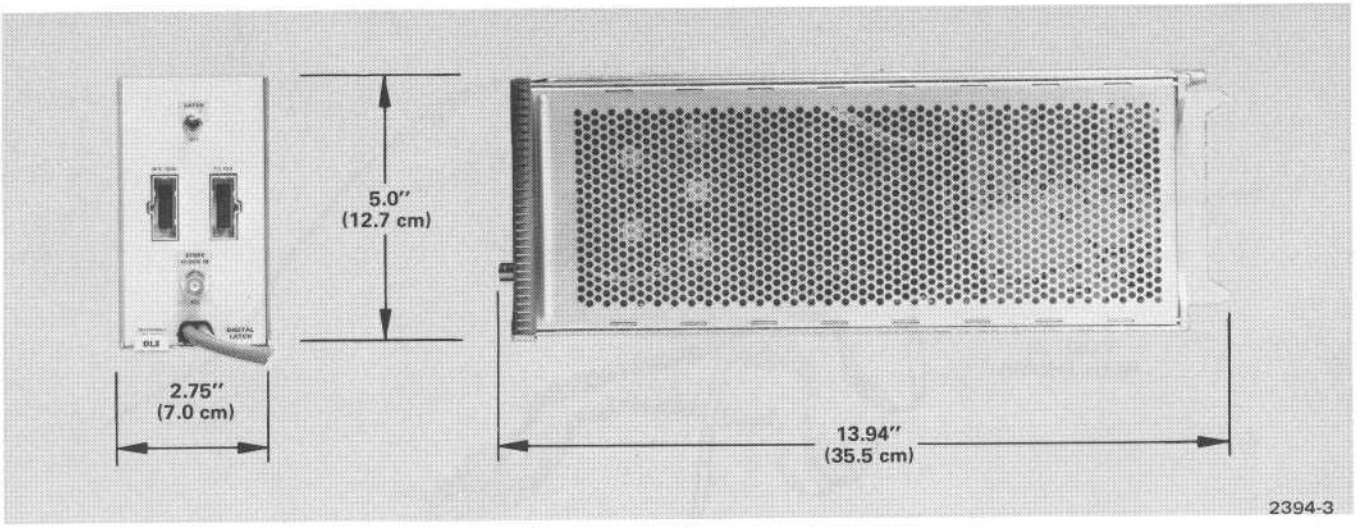


Fig. 1-3. DL2 Latch Dimensions.

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OPERATING INSTRUCTIONS

INSTALLATION

ACCESSORIES

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

DL2 Digital Latch
Instruction Manual

BNC Cable

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: 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 (lb)	Carton Test Strength (lb)
0-10	200
10-30	275
30-120	375
120-140	500
140-160	600

PREPARATION FOR USE

The DL2 Digital Latch requires no adjustments when received from the factory. It is designed to operate in all standard Tektronix 7000-Series oscilloscope mainframes in conjunction with the 7D01 Logic Analyzer.

Install the DL2 in a 7000-Series mainframe next to the 7D01. Align the tracks of the latch with the rails of the Vertical or Horizontal plug-in compartment and push in firmly. The front panel of the DL2 should be flush with the front panel of the mainframe when fully seated.

To remove the DL2, pull the release lever at the lower left corner of the unit and slide the unit out of the mainframe.

The DL2 Digital Latch interfaces with the 7D01 by means of two short cable assemblies with 25 pin connectors. The connectors are plugged into the appropriate data input jacks on the front panel of the 7D01.

Connect the short 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 DL2. Plug the connectors of the P6451 Data Acquisition Probes into appropriate input jacks on the front panel of the DL2.

The Digital Latch is now ready for use.

FRONT PANEL CONTROL AND CONNECTORS

The following briefly describes the functions of the control and connectors on the front panel of the DL2 Digital Latch. Since the DL2 is operated in conjunction with the 7000-Series oscilloscope and 7D01 Logic Analyzer, it may be necessary to refer to the applicable equipment instruction manual, if additional display or operational information is required.

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.

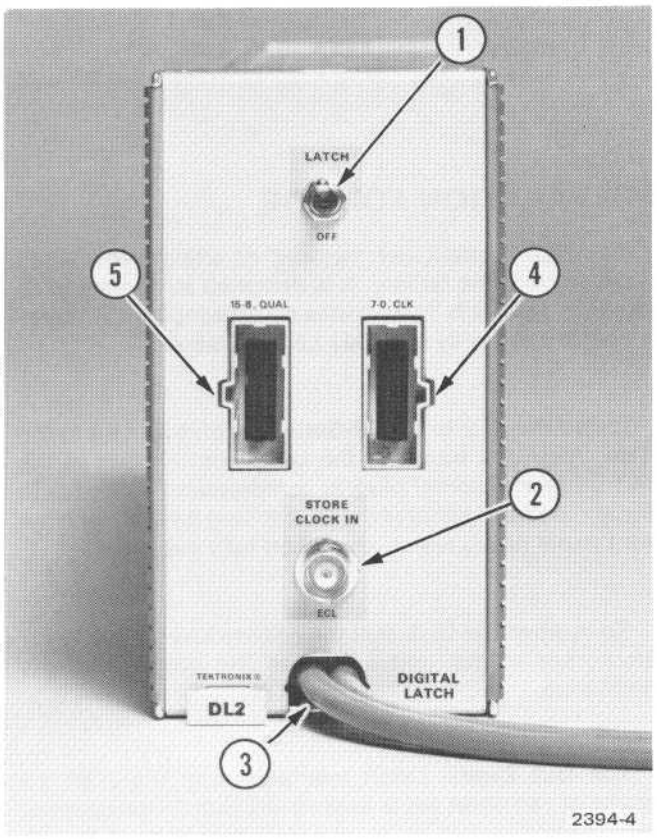

Fig. 2-1. Front Panel Control and Connectors for DL2 Digital Latch.

(1) LATCH switch

In the LATCH position, the latch circuitry is controlled by asynchronous clock pulses from the 7D01. In this mode the latch circuitry is activated when the width of the input data pulses are equal to or greater than 5 ns at the center threshold 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. In the OFF position, the DL2 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.

(2) STORE CLOCK IN connector

Provides input to the DL2 for asynchronous clock pulses from the Store Clock Out connector on the front panel of the 7D01. 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. The P6451 probe external clock channel, qualifier channel, and probe dc power 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

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

(5) 15-8 QUAL connector

Provides inputs for Channels 15 through 8 and the probe qualifier channel from the P6451 probe.

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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.

SERVICE INSTRUCTIONS

INTRODUCTION

Complete schematic drawings of the DL2 Digital Latch are included at the back of this manual. Refer to these diagrams throughout the following circuit description.

THEORY OF OPERATION

The DL2 Digital Latch has three circuit boards consisting of two identical digital latch circuit boards and one power supply circuit board. Each digital latch 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 Ø of the DL2.

The push-pull output data signals from the P6451 probe for Channel Ø 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 latch switch S1 on the front panel determines the two modes 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 output of the gates are set low, preventing data signals from the latch circuitry appearing at Channel Ø output. In the LATCH mode one input to each NOR gate U5Ø5ØB and U5Ø5ØC in the bypass circuitry is set high by S1. The output of the gates are set low, preventing data signals from the bypass circuitry appearing at Channel Ø output.

OFF Mode Operation

In this mode the latch circuitry is disabled and the bypass circutry 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 Ø output. Thus, input data signals from the P6451 probe are passed through the latch via the bypass paths to the 7DØ1 Logic Analyzer. The polarity between the probe signals at Channel Ø input and the signals at Channel Ø output remain 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 7DØ1. The additional 5 ns data setup time may be eliminated by connecting the P6451 probe connector directly to the 7DØ1.

LATCH Mode Operation

In this mode the bypass circuitry is disabled and the latch circuitry is enabled. The timing sequency of the latch is controlled by the asynchronous clock input from the 7DØ1.

Figure 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 Q_2 of U5Ø4ØA is low.

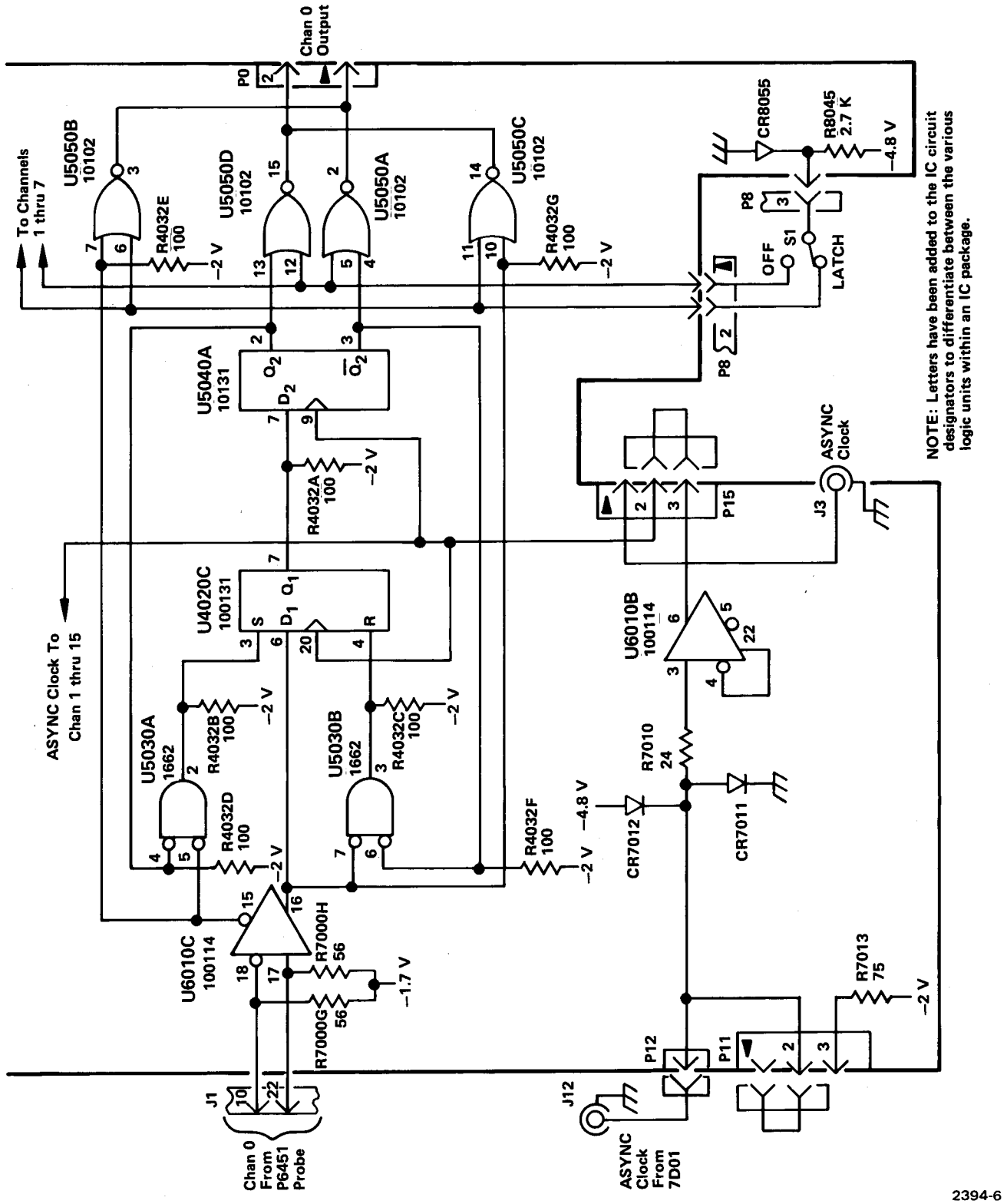

Fig. 3-1. Circuit Diagram for Channel 0 of DL2 Digital Latch.

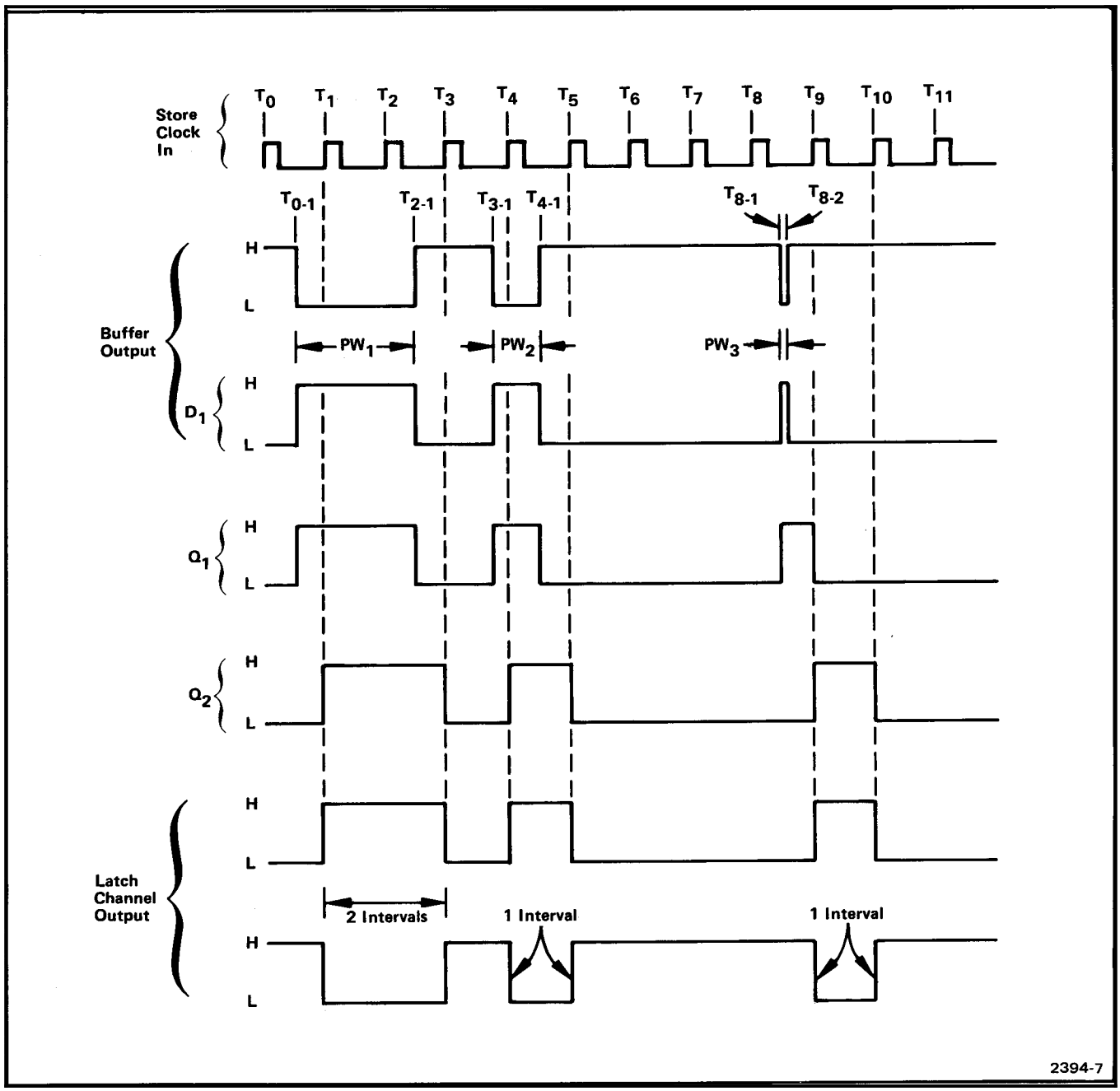

Fig. 3-2. DL2 Digital Latch Timing Sequence.

At time T_{0-1} the data pulse PW_1 changes D_1 to high. No clock pulse is present so the high at D_1 has no effect on the output state of U4020C at Q_1. The inverse of pulse PW_1 at pin 5 of U5030A is low and Q_2 feedback to pin 4 of U5030A is also low, the negated input AND gate (U5030A) is enabled, switching the S input of U4020C high. U4020C 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 U5040A goes high. At time T_2 the input to D_1 is still high keeping Q_1 and Q_2 high.

At time T_{2-1} the input signal at D_1 goes low. This low is applied to pin 7 of U5030B. The low state of $\overline{Q_2}$ is also fed back to pin 6 of U5030B, the negated input AND gate (U5030B) is enabled, changing the R input of U4020C high. U4020C 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 U5040A at Q_2, which remains high. At time T_3 the input to D_1 is low and Q_1 of U4020C remains low. The low input at D_2 of U5040A changes the state of Q_2 to low. The latch circuitry has completed one cycle of events.

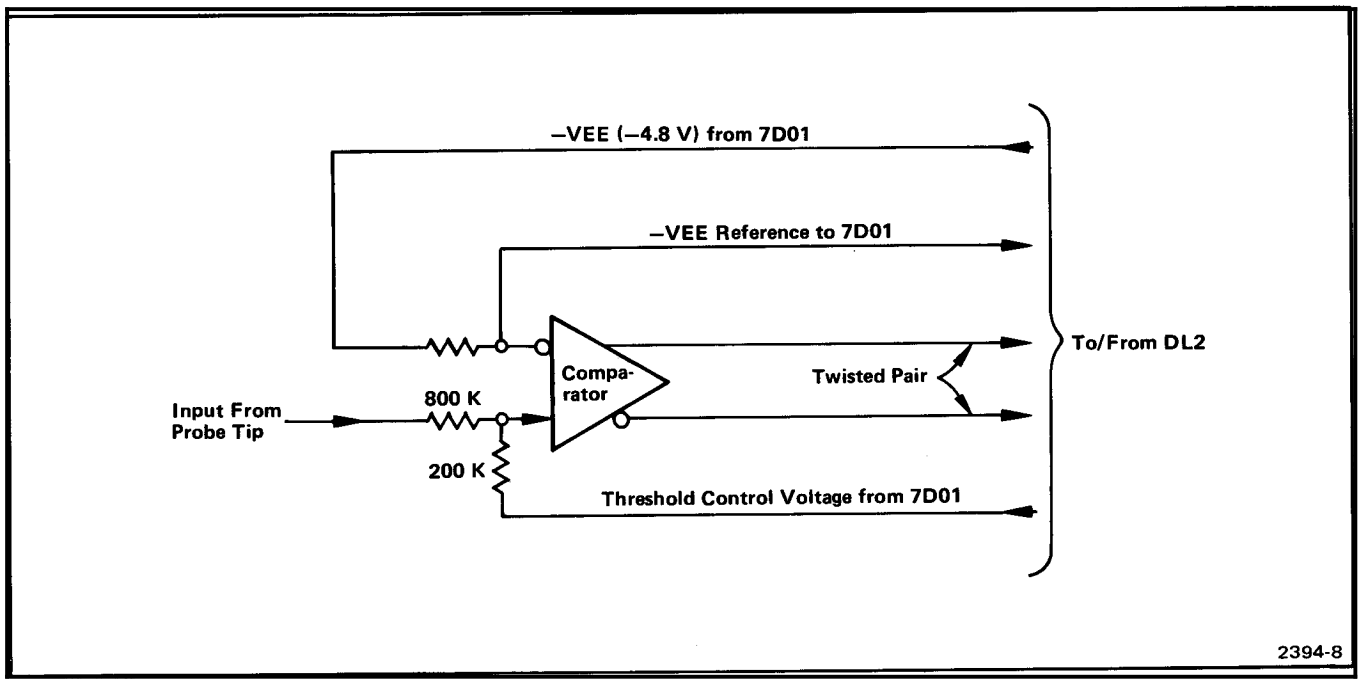

Fig. 3-3. Equivalent circuit of one channel in the P6451 Data Acquisition Probe.

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 DL2 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 is 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 DL2 latch. The synchronous clock channel, qualifier channel and probe dc power lines are not used within the DL2. These lines are routed through the DL2 and terminate in the logic anaylzer. Table 3-1 contains a list of these lines and their function.

Table 3-1

P6451 PROBE LINES NOT USED IN THE DIGITAL LATCH

Line Function	Number of Lines in Each Probe: Chan 7-Ø	Chan 15-8	Remarks
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 Analzyer.
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.

POWER SUPPLIES

The regulated +15, −15 and +5 volt power supplies from the 7ØØØ-Series oscilloscope mainframe are used in the DL2 Digital Latch to derive the −2 and −4.8 volt supplies.

The dc-dc inverter converts the +15 to −15 volt supplies to a high frequency (approximately 25 kHz) square wave. This square wave is amplified and applied to the primary winding of a stepdown transformer. The secondary voltages of the transformer are rectified and filtered to provide the −4.8 volt supply and a regulated −2 volt supply.

U918 is an astable multivibrator providing drive to the inverter. The frequency (approximately 25 kHz) of the multivibrator is determined by R918, R919, and C918. The square wave output of U918 is coupled through R921 and C921 to the primary winding of T922. The two secondary voltages of T922 are amplified by the power transistors, Q926 and Q928 which drive the center-tapped primary winding of stepdown transformer T942.

The secondary windings of T942 are connected to form two center-tapped output voltages. The two outputs are full-wave rectified and filtered. One of the filtered outputs is the −4.8 volt supply. The other filtered output is regulated to −2 volts by Q962, Q964 and Q968.

Overload protection for the −2 and −4.8 volt supplies is provided by Q9Ø3, Q91Ø, Q9Ø8 and multivibrator Q9Ø4—Q914. If the −2 or −4.8 volt supply should fall toward ground, Q9Ø3 (for −2 volt supply) or Q91Ø (for −4.8 volt supply) turns on, turning Q9Ø8 off. When Q9Ø8 is off, multivibrator Q9Ø4—Q914 is activated, disabling U918 for approximately 1/2 second and then allowing it to run approximately 1Ø milliseconds. (Under normal load conditions the −2 and −4.8 volt supplies will stablize in less than 1Ø milliseconds.) When the loads on the −2 and −4.8 volt supplies are returned to normal, Q9Ø3 and Q91Ø are both off and Q9Ø8 is conducting. With Q9Ø8 conducting, multivibrator Q9Ø4—Q914 is disabled and U918 is allowed to run normally.

NOTE

The DL2 Power Supply circuitry is identical to the power supply circuitry used in the 7DØ1. Component numbers assigned to the 7DØ1 Power Supply circuitry have not been changed for the DL2.

PERFORMANCE CHECK

INTRODUCTION

The performance check is intended to verify that the DL2 Digital Latch will meet the specifications listed in Section 1 of this manual.

TEST EQUIPMENT REQUIRED OR RECOMMENDED

The test equipment as listed in Table 3-2 is recommended for this performance check. Test equipment characteristics are the minimum required for accurate checks. Characteristics of substitute equipment must meet or exceed those listed in Table 3-2.

Table 3-2

TEST EQUIPMENT

Equipment/Fixture	Specified Characteristics	Recommended Type/Model
1. Test Oscilloscope System		Tektronix 7ØØØ-Series, 3 or 4 compartment mainframe. TEKTRONIX 76Ø3 or 77Ø4A Oscilloscope system.
2. DC Voltmeter	Range, ±2 V to ±2Ø V; accuracy within 1%.	TEKTRONIX DM 5Ø2 Digital Multimeter.
3. Pulse Generator	Pulse duration, 2 ns to 5Ø ns; pulse period 2Ø ns to 1 μs; output amplitude, Ø V dc to ±3 V dc; risetime, 2 ns or less.	TEKTRONIX PG5Ø2 25Ø MHz Pulse Generator.
4. Cabinet	Cabinet with Power Module for DM 5Ø2 and PG 5Ø2.	TEKTRONIX TM 5Ø3.
5. Oscilloscope	Bandwidth, DC to 35Ø MHz; risetime, 1 ns; sweep rate, 1 ns/div to 2Ø ns/div.	TEKTRONIX 485
6. Logic Analyzer		TEKTRONIX 7DØ1.
7. Data Acquisition Probe	Input resistance, 1 MΩ within 5%; input capacitance, 5 pF within 1 pF.	TEKTRONIX P6451 Data Acquisition Probe.
8. BNC "T" Adapter	BNC male to 2 BNC female connector.	Tektronix part no. 1Ø3-ØØ3Ø-ØØ.
9. 50 Ω BNC Cable		Tektronix part no. Ø12-ØØ76-ØØ.
10. BNC Coupler	BNC male to BNC male	Tektronix part no. 1Ø3-ØØ29-ØØ.
11. Probe Tip Termination	BNC female to BSM male	Tektronix part no. 1Ø3-ØØ36-ØØ.

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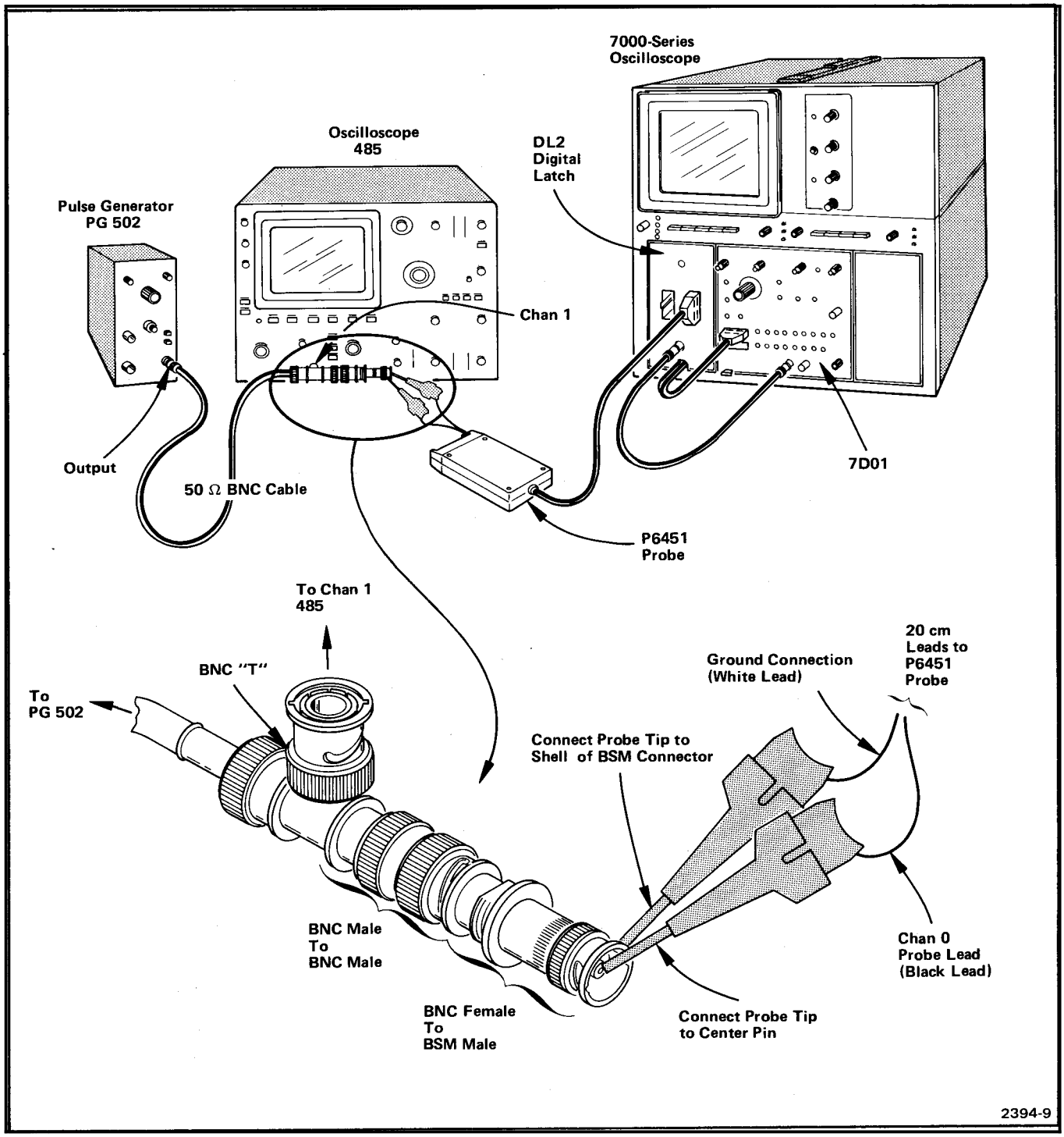


Fig. 3-4. DL2 Digital Latch Operational Test Setup.

1. Preliminary Procedure

a. Install the DL2 and 7DØ1 in the plug-in compartments of the 7ØØØ-Series test oscilloscope system mainframe. Refer to Fig. 3-4.

b. Connect P6451 probe connector to 7-Ø CLK connector on DL2.

c. Connect DL2 data interface connector for Channels 7 through Ø (right cable assembly, marked with a white plastic ring) to the top data input connector (Channels Ø-7 and External Clock) on the front panel of the 7DØ1.

d. Connect 50 Ω BNC cable between connectors Store Clock Out (7D01) and STORE CLOCK IN (DL2).

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

f. Set DL2 latch mode switch to LATCH position.

g. Set 7D01 front panel controls as follows:

Vert

Pos	Midrange
Mag	Midrange

Record

Display Time	1 s (fully counterclockwise)

Horiz

Pos	Midrange
Mag	X1
Threshold voltage	Var (−1.3 V)
Sample Interval	50 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)

h. Set 485 Oscilloscope front panel controls as follows:

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

i. 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)

j. Adjust Threshold Voltage

1. Connect dc voltmeter between Threshold Voltage Monitor pin jack on 7D01 and chassis ground.

2. Adjust threshold voltage to −1.3 V with front panel screwdriver adjustment.

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

l. 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. 3-5.)

m. 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. 3-5.)

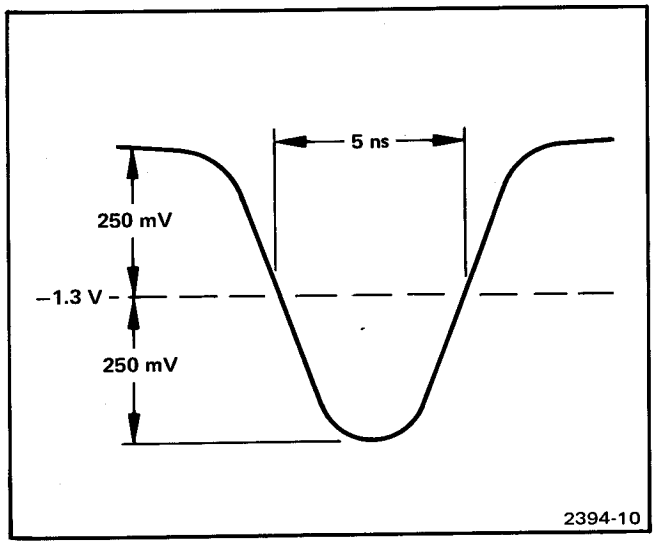


Fig. 3-5. 485 Oscilloscope Display.

2. 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. 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.)

c. Observe operation of the latch on the 7ØØØ-Series 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 channel switches Ø through 7 on the 7DØ1 are set to HI for the channel under test. All others are on X (center position).

NOTE

Throughout the above procedure maintain the correct display (as shown in Fig. 3-5) on the 485 Oscilloscope.

3. LATCH Operational Check Procedure for Channels 8 through 15.

The above procedure checks the performance of channels Ø 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-Ø CLK connector to 15-8 QUAL connector on the DL2.

b. Disconnect the DL2 output data interface connector (right cable assembly) from the 7DØ1. Connect the DL2 output data interface connector for Channels 15 through 8 (left cable assembly) to the 7-Ø data input connector on the 7DØ1. (Same input connector used in performance checks for Channels 7 through Ø.)

c. The Word Recognizer channel switches Ø through 7 on the 7DØ1 are set HI on the corresponding channel being tested. (Example: Channel Ø set HI when testing Channel 8—Channel 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 7DØ1, the minimum clock period is 5Ø ns. This would not impose as stringent a test on channels 8 through 15.

d. Repeat Steps 2a through 2d for LATCH Operational Check Procedures on channels 8 through 15.

4. Latch OFF Operational Check Procedure

a. Change the pulse duration control on the Pulse Generator (PG 5Ø2) to 5Ø ns.

b. Set the latch mode switch on the DL2 to OFF.

c. Repeat steps 2 and 3 for Latch OFF Operational Check Procedures on Channels Ø through 15.

MAINTENANCE

INTRODUCTION

This section describes procedures for reducing or preventing equipment malfunction, plus 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. Damage may not be catastrophic, therefore, not immediately apparent. It usually appears as a "weakening" of the semiconductor characteristics. Devices that are particularly susceptible are: MOS, CMOS, JFETs, 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 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 (circuity board) that is to be returned to Tektronix, Inc. should be packaged in its original container or 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 the environment in which it 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 the 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 corresponds 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; one on the holder and one 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. 3-6). All harmonica connectors are identified on the schematic and board with the prefix "P".

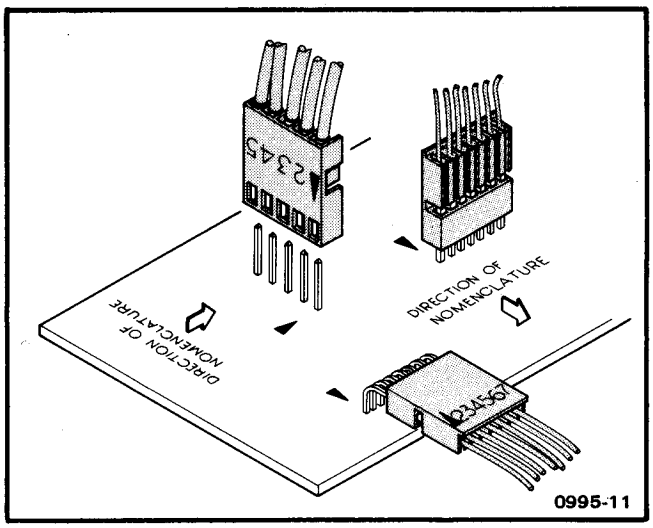
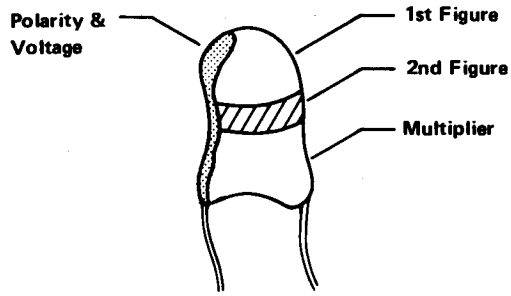


Fig. 3-6. Multipin (harmonica) circuit board connectors.

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 numerial (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. 3-7.



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) 2394-11

Fig. 3-7. 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. 3-8 illustrates diode types and polarity markings that are used.

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.

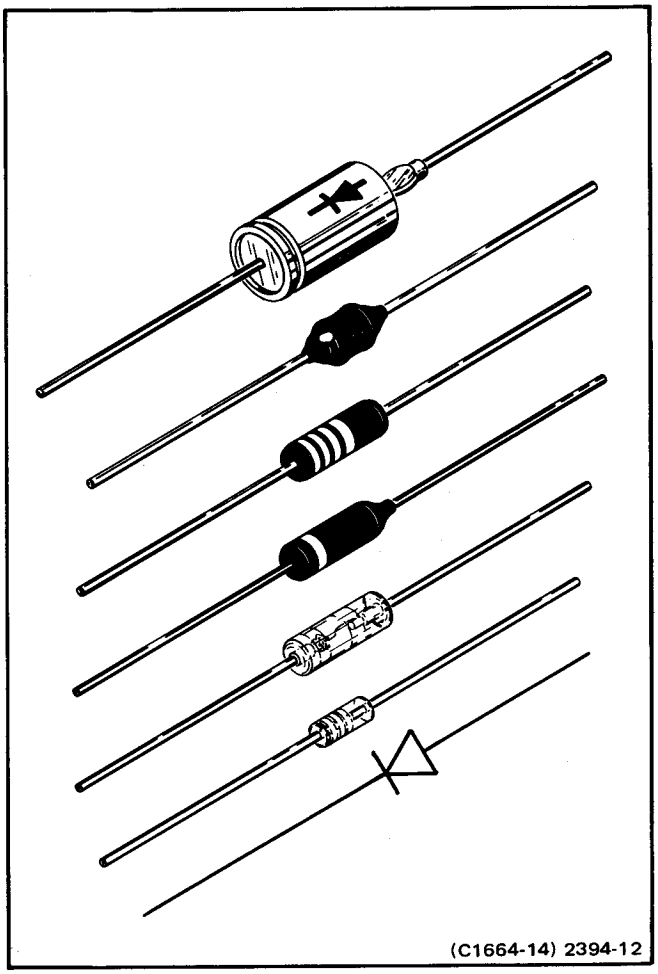


Fig. 3-8. Diode polarity markings.

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 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 the operating procedure for the DL2 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 can 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 on major assemblies as well as the unit. 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 DL2 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 origninally). 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 the 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 DL2, 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 the component is soldered to, 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. Use a 15-watt pencil-type iron, straighten the leads on the back side of the board, then when the solder melts, gently pull the solder 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 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 uncertain if IC is 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-nose 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 availabe, 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.

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. 3-9 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. 3-9. When all leads are bent, turn IC over and compare with the hole pattern in the circuit board. Additional bending of leads will be necessary to line up leads with the hole pattern in board. Make sure black dot on IC is properly orientated. Complete the replacement of the flat pack IC in accordance with previous instruction for soldered ICs.

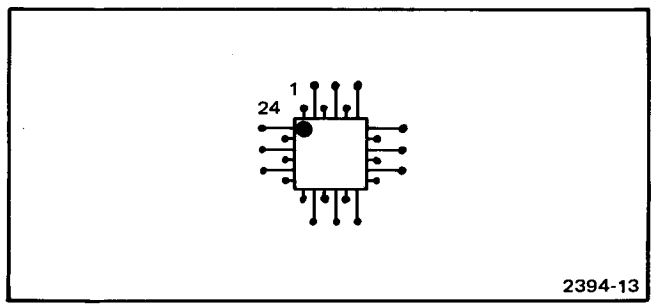


Fig. 3-9. Template for bending flat pack IC leads.

NOTE

After bending the leads on two sides of the IC, it becomes difficult to keep the IC aligned with the template. Recommend using a small amount of rubber cement on the eraser of a new pencil. (Allow time for cement to become tacky.) Place eraser in center of IC and push down on 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 replacment or switching of semiconductor devices may affect the instruments 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.

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Replacing Square-pin for the 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. Ø4Ø-Ø542-ØØ.

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 (Ø.Ø28 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 follows. (See Fig. 3-1Ø.)

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

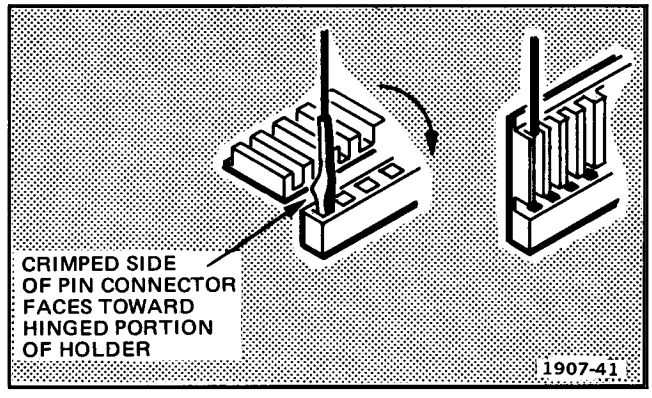


Fig. 3-10. Pin connector replacement.

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

4. When plugging connector holders onto 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

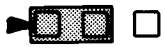
NOTE

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 Boards. The Digital Latch circuit boards are identical; therefore; the removal and replacement procedures are the same except for the internal connectors and selectors described in Table 3-3. Refer to Table 3-3 when replacing circuit boards to ensure correct terminations of the internal connectors and selectors.

Table 3-3

Internal Connectors and Selectors for DL2 Digital Latch

SELECTOR/ CONNECTOR	BOARD USAGE	POSITION/FUNCTION
P11 (A)	CH 7-0	 Clock input from 7D01
		 Clock input from LA 501W
	CH 15-8	 Clock input not used, store selector in this position.
P12 (B)	CH 7-0	 Connected to STORE CLOCK IN connector
	CH 15-8	 P12 not used on CH 15-8 circuit board
P10 (D)	CH 7-0	 Clock output to CH 15-8 circuit board
	CH 15-8	 Terminates clock line in CH 15-8 circuit board
P15 (E)	CH 7-0	 Provides clock for latch circuitry Channels 7-0
	CH 15-8	 Clock input from CH 7-0 circuit board. Provides clock for latch circuitry Channels 15-8
J2 (C)	CH 7-0	Connected to PELTOLA connector J3 on CH 15-8 circuit board Not Used
J3 (F)	CH 15-8	Not Used Connected to PELTOLA connector J2 on CH 7-0 circuit board

NOTE: Refer to Figure 3-12 for location of connectors and selectors.

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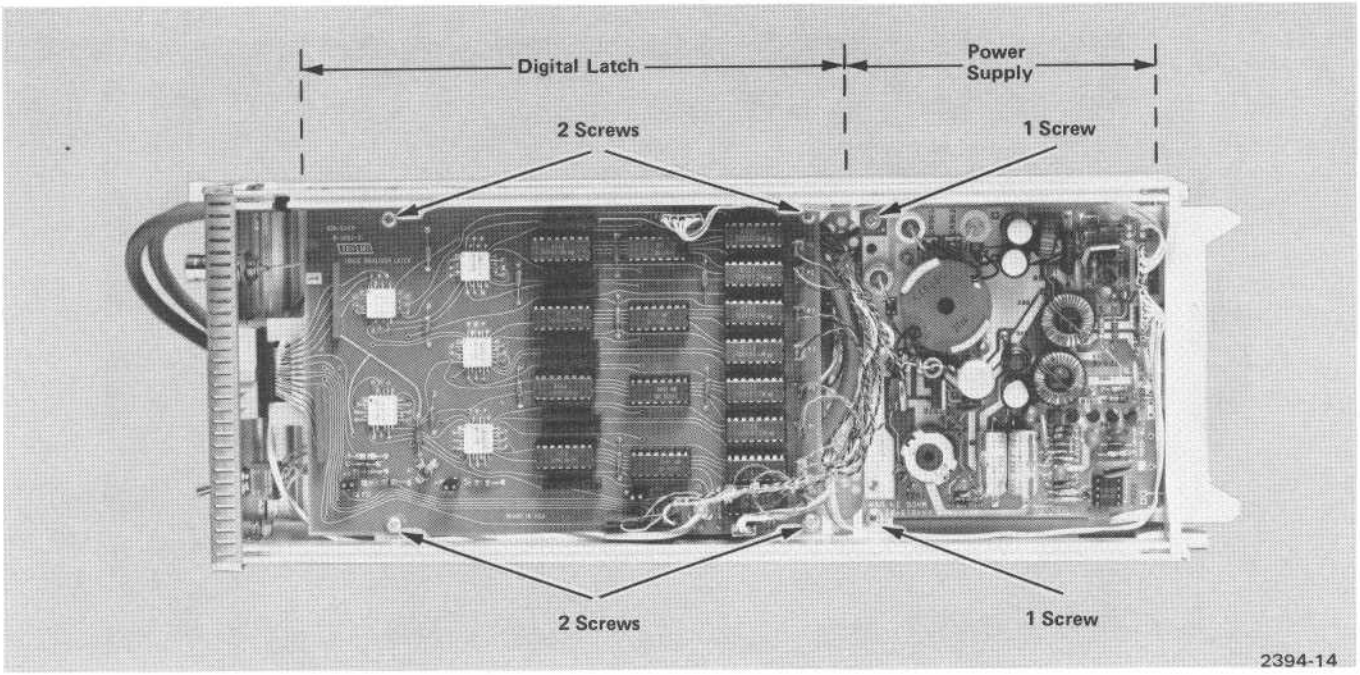

Fig. 3-11. Digital Latch and Power Supply circuit boards.

1. Disconnect all cables that terminate on the Digital Latch circuit board. (Refer to Fig. 3-12 for multi-pin connector and "P" number orientation when replacing boards.)

2. Remove four screws (see Fig. 3-11, from the Digital Latch circuit board, securing the board to the chassis.

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

4. 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 PØ through P7, are EIA color coded to match the "P" numbers on the board (e.g., PØ is black, P6 is blue, etc.)

Power Supply Circuit Board. The removal and replacement procedure for the Power Supply circuit board is described as follows:

1. Disconnect P93Ø and P94Ø from the Power Supply circuit board.

2. Remove two screws (see Fig. 3-11), from the front part of the board, securing the board to the chassis.

3. Remove four screws that secures the power supply mainframe plug-in connector to the rear of the chassis.

4. Pull the Power Supply circuit board (with power supply mainframe plug-in connector attached) away from the rear of the instrument.

5. To replace Power Supply circuit board, reverse the order of removal.

NOTE

Make sure the component side of the Power Supply circuit board faces the left side of the instrument.

INTERNAL CONNECTORS AND SELECTORS

The position of internal connectors and selectors on the two identical digital latch circuit boards permits functional and operational changes between the boards. Several internal connectors and selectors on each circuit board are factory set for either Channel 7-Ø or Channel 15-8 operation. Normally these connectors and selectors will not require changing unless the board is removed or replaced. Fig. 3-12 shows the location of the internal connectors and selectors on the circuit board. Table 3-3 lists the correct position of all connectors and selectors for both boards (Channel 7-Ø and Channel 15-8).

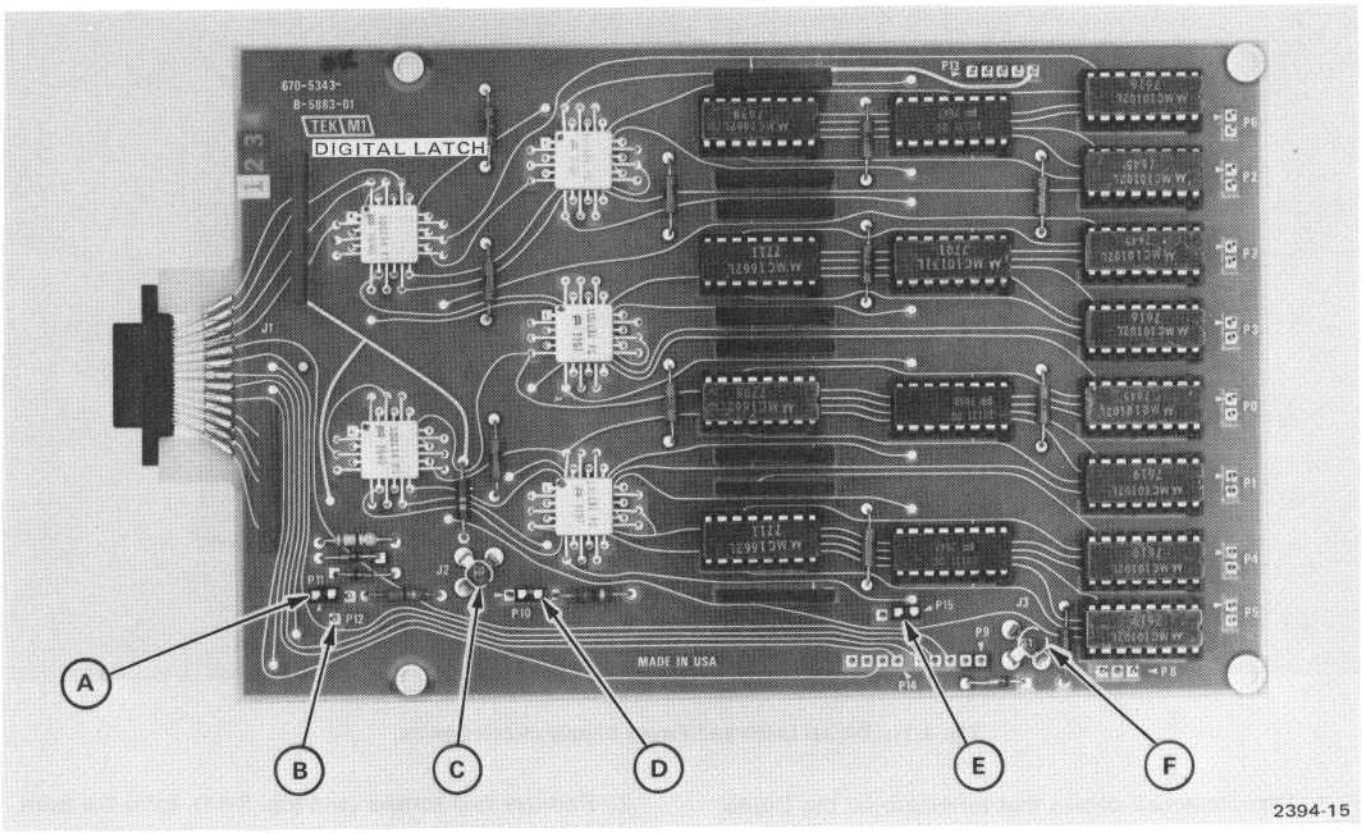

Fig. 3-12. Internal connectors and selectors on latch circuit board.

PIN ASSIGNMENTS FOR INTERCONNECTING CONNECTORS

Input Data Connectors

The pin assignments for the front panel input data connectors are shown in Fig. 3-13 for channels 7 through Ø and Fig. 3-14 for channels 15 through 8.

Output Data Interface Connectors

The pin assignments for the output data interface connectors are shown in Fig. 3-15 for channels 7 through Ø and Fig. 3-16 for channels 15 through 8.

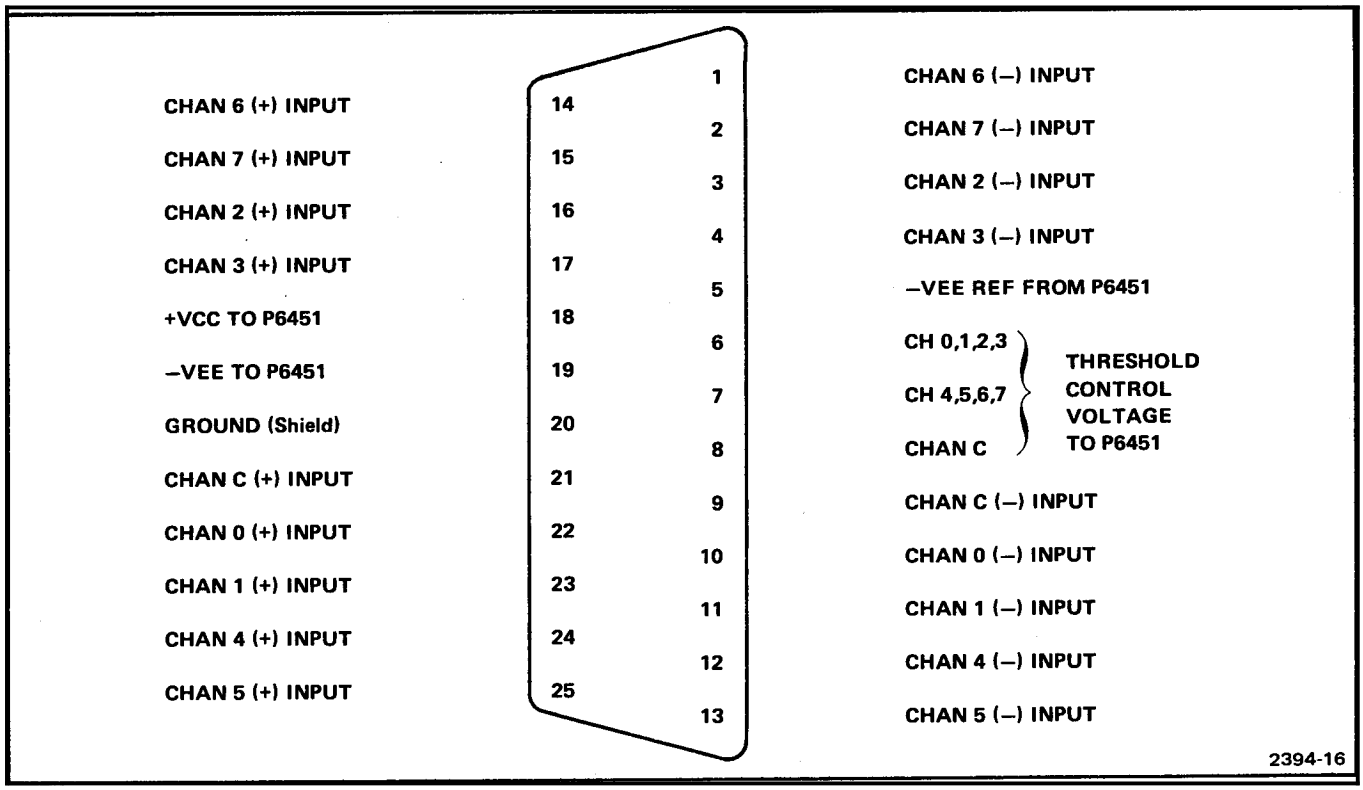

Fig. 3-13. Input data connector for channels 7 thru 0. (Right-hand connector—front view).

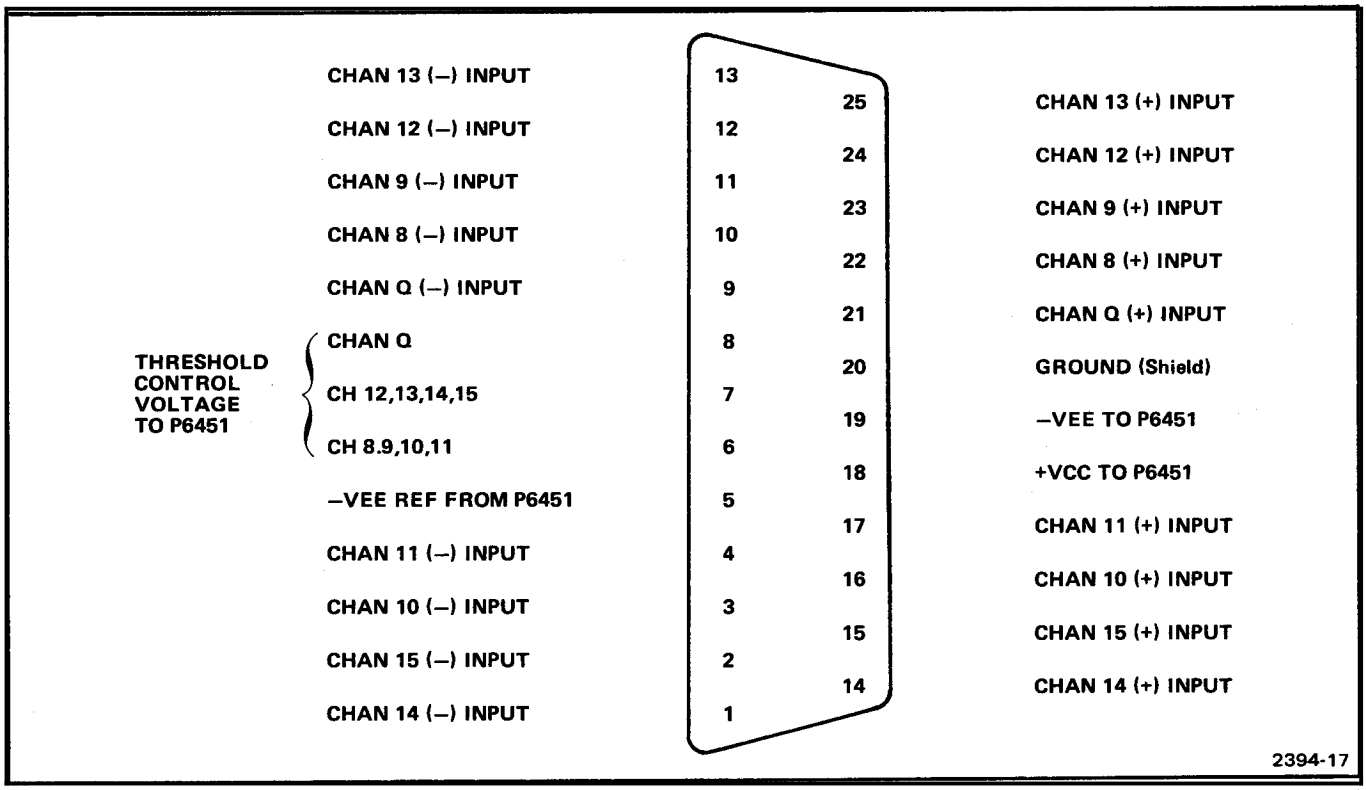

Fig. 3-14. Input data connector for channels 15 thru 8. (Left-hand connector—front view).

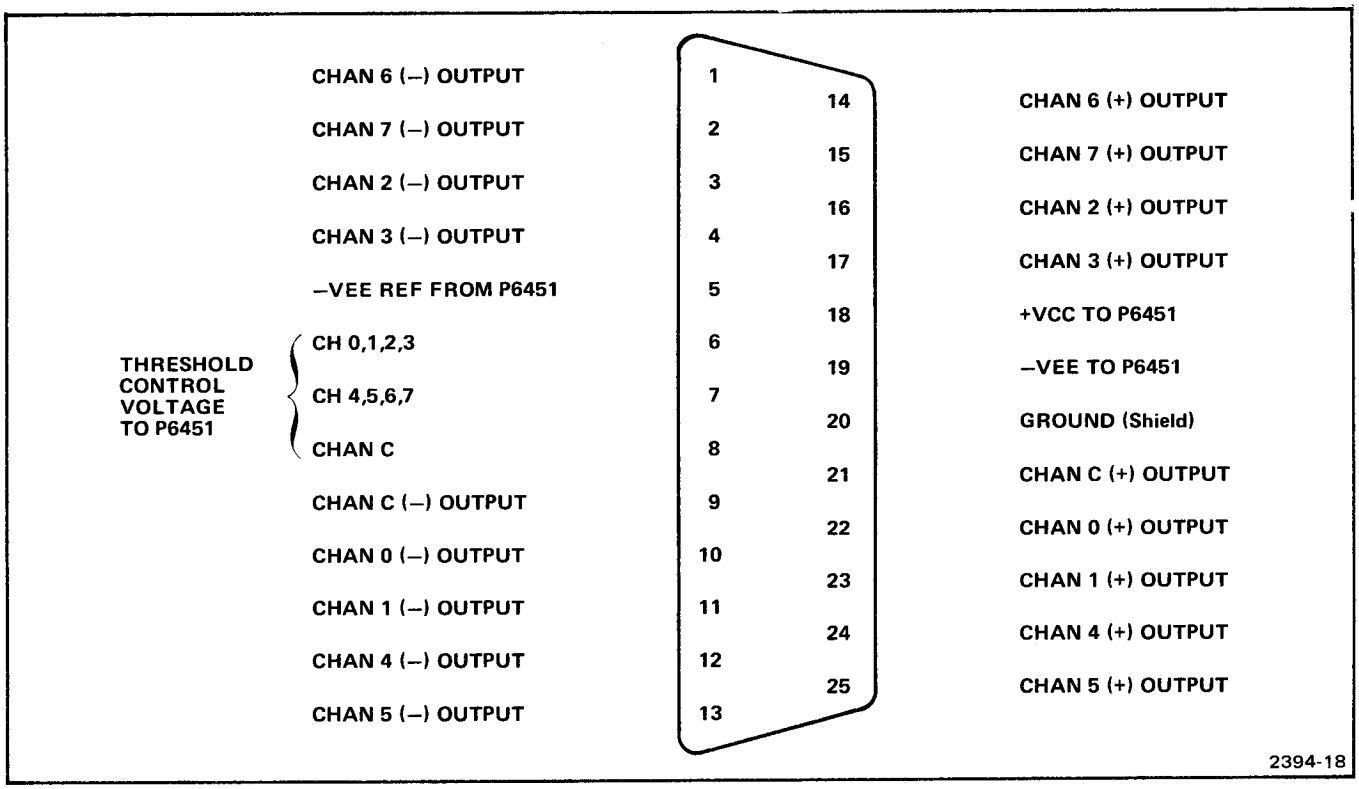

Fig. 3-15. Output data interface cable assembly for channels 7 thru 0. (Right-hand cable assembly—front view).

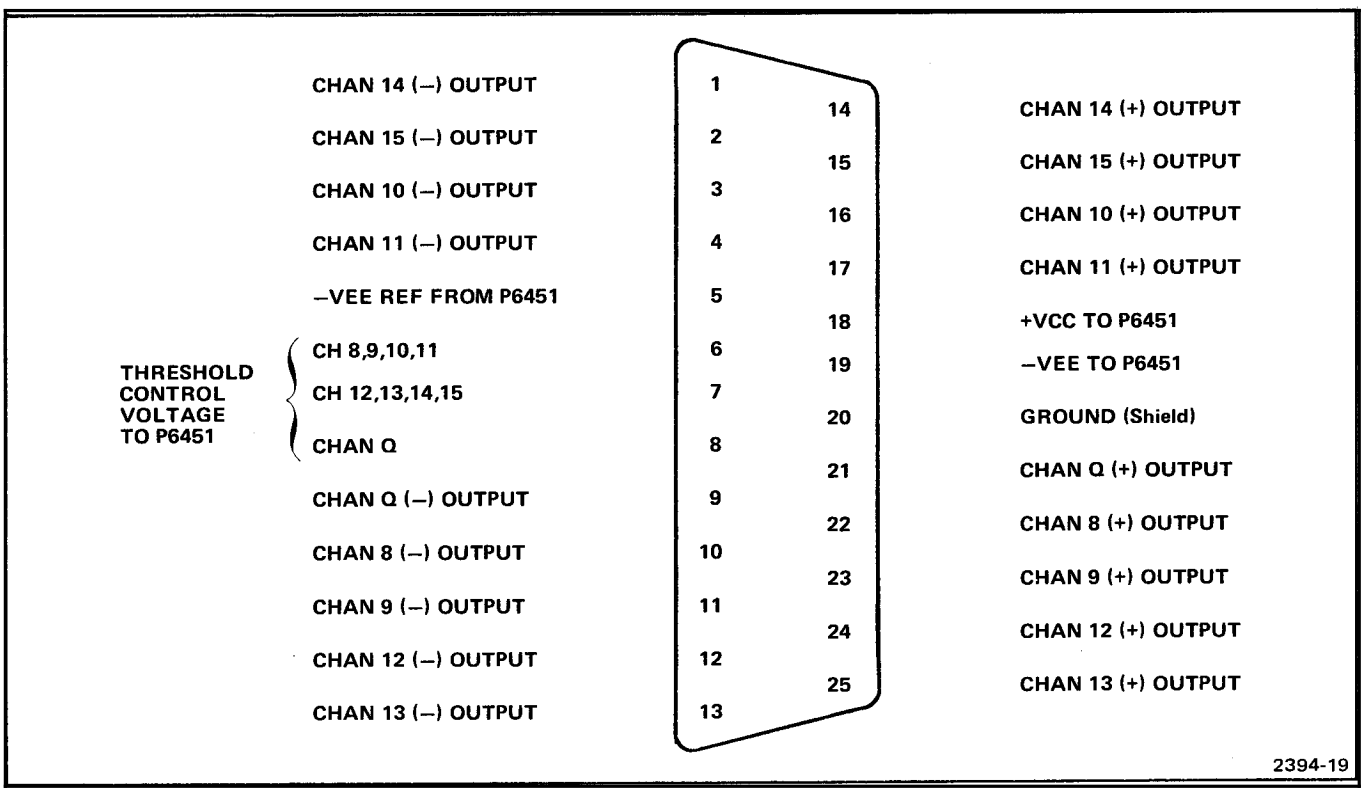

Fig. 3-16. Output data interface cable assembly for channels 15 thru 8. (Left-hand cable assembly—front view).

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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
ASSY	ASSEMBLY
CAP	CAPACITOR
CER	CERAMIC
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
ELCTLT	ELECTROLYTIC
ELEC	ELECTRICAL
INCAND	INCANDESCENT
LED	LIGHT EMITTING DIODE
NONWIR	NON WIREWOUND
PLSTC	PLASTIC
QTZ	QUARTZ
RECP	RECEPTACLE
RES	RESISTOR
RF	RADIO FREQUENCY
SEL	SELECTED
SEMICOND	SEMICONDUCTOR
SENS	SENSITIVE
VAR	VARIABLE
WW	WIREWOUND
XFMR	TRANSFORMER
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
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
09353	C AND K COMPONENTS, INC.	103 MORSE STREET	WATERTOWN, MA 02172
14433	ITT SEMICONDUCTORS	3301 ELECTRONICS WAY P O BOX 3049	WEST PALM BEACH, FL 33402
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
54473	MATSUSHITA ELECTRIC, CORP. OF AMERICA	1 PANASONIC WAY	SECAUCUS, NJ 07094
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
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	670-5392-00	B010100	B010134	CKT BOARD ASSY:POWER	80009	670-5392-00
A2	670-5392-01	B010135	B029999	CKT BOARD ASSY:POWER	80009	670-5392-01
A2	670-5392-02	B030000		CKT BOARD ASSY:POWER	80009	670-5392-02
C904	290-0512-00	B010100	B029999X	CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C907	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C912	290-0121-00	XB030000		CAP.,FXD,ELCTLT:2UF,+75-10%,25V	56289	30D205G025BA9
C913	283-0003-00	XB030000		CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-558Z5U-103Z
C914	283-0003-00	B010100	B029999X	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-558Z5U-103Z
C916	290-0512-00	B010100	B029999X	CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C917	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-558Z5U-103Z
C918	283-0083-00			CAP.,FXD,CER DI:0.0047UF,20%,500V	72982	811-565C472J
C920	283-0238-00	B010100	B010134X	CAP.,FXD,CER DI:0.01UF,10%,50V	72982	8121N075X7R0103K
C921	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C923	283-0077-00	XB010135		CAP.,FXD,CER DI:330PF,5%,500V	56289	40C94A3
C927	283-0065-00			CAP.,FXD,CER DI:0.001UF,5%,100V	72982	805-518-Z5D0102J
C929	290-0159-00			CAP.,FXD,ELCTLT:2UF,+50-10%,150V	56289	30D205F150BB9
C944	290-0800-00			CAP.,FXD,ELCTLT:250UF,+100-10%,20V	56289	672D257H0200M5C
C945	290-0771-00			CAP.,FXD,ELCTLT:220UF,+50-10%,10VDC	54473	ECE-A10V220L
C954	290-0771-00			CAP.,FXD,ELCTLT:220UF,+50-10%,10VDC	54473	ECE-A10V220L
C955	290-0771-00			CAP.,FXD,ELCTLT:220UF,+50-10%,10VDC	54473	ECE-A10V220L
C961	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-558Z5U-103Z
C967	290-0512-00	B010100	B029999	CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C967	290-0534-00	B030000		CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C981	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-558Z5U-103Z
C983	290-0747-00	B010100	B029999	CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	500D148
C983	290-0770-00	B030000		CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	502D230
C984	290-0747-00	XB030000		CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	500D148
C987	290-0747-00	B010100	B029999	CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	500D148
C987	290-0770-00	B030000		CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	502D230
C1015	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
C1035	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
C2025	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
C2045	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
C3015	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
C3035	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
C5025	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
C6025	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
C6045	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
C7035	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
CR904	152-0141-02	B010100	B029999X	SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
CR905	152-0141-02	B010100	B029999X	SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
CR914	152-0141-02	B010100	B029999X	SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
CR915	152-0141-02	XB030000		SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
CR922	152-0075-00	XB010135		SEMICOND DEVICE:GE,25V,40MA	14433	G866
CR924	152-0075-00	XB010135		SEMICOND DEVICE:GE,25V,40MA	14433	G866
CR927	152-0040-00			SEMICOND DEVICE:SILICON,600V,1A	80009	152-0040-00
CR928	152-0040-00			SEMICOND DEVICE:SILICON,600V,1A	80009	152-0040-00
CR942	152-0502-00			SEMICOND DEVICE:SILICON,20V,5A	04713	1N5823
CR943	152-0502-00			SEMICOND DEVICE:SILICON,20V,5A	04713	1N5823
CR952	152-0502-00			SEMICOND DEVICE:SILICON,20V,5A	04713	1N5823
CR953	152-0502-00			SEMICOND DEVICE:SILICON,20V,5A	04713	1N5823
CR968	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
CR984	152-0141-02	XB030000		SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
CR985	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-558Z5U-103Z
CR7011	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
CR7012	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR8055	152-0141-02			SEMICOND DEVICE:SILICON,30V,50NA	01295	1N4152R
L945	108-0554-00			COIL,RF:5UH	80009	108-0554-00
L955	108-0574-00			COIL,RF:30UH	80009	108-0574-00
L982	108-0728-00			COIL,RF:116UF	80009	108-0728-00
L986	108-0728-00			COIL,RF:116UF	80009	108-0728-00
Q903	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q904	151-0192-00	B010100	B029999X	TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q908	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q910	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q914	151-0192-00	B010100	B029999X	TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q922	151-0192-00	XB010135		TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q924	151-0216-00	XB010135		TRANSISTOR:SILICON,PNP	04713	SPS8803
Q926	151-0426-00	B010100	B020233	TRANSISTOR:SILICON,NPN	80009	151-0426-00
Q928	151-0426-00	B010100	B020233	TRANSISTOR:SILICON,NPN	80009	151-0426-00
Q926	153-0649-00	B020234		TRANSISTOR:SILICON,NPN,MATCHED	80009	153-0649-00
Q928 Q962	151-0426-00			TRANSISTOR:SILICON,NPN	80009	151-0426-00
Q964	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q968	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
R902	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R903	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R904	315-0104-00	B010100	B029999X	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R905	315-0152-00	B010100	B029999X	RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R907	321-0320-00			RES.,FXD,FILM:21K OHM,1%,0.125W	91637	MFF1816G21001F
R908	321-0354-00			RES.,FXD,FILM:47.5K OHM,1%,0.125W	91637	MFF1816G47501F
R910	315-0473-00	B010100	B029999	RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R910	315-0223-00	B030000		RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R912	315-0684-00	XB030000		RES.,FXD,CMPSN:680K OHM,5%,0.25W	01121	CB6845
R913	315-0102-00	XB030000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R914	315-0104-00	B010100	B029999X	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R915	315-0152-00	B010100	B029999X	RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R916	315-0101-00	B010100	B029999X	RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R918	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
R919	321-0234-00			RES.,FXD,FILM:2.67K OHM,1%,0.125W	91637	MFF1816G26700F
R920	315-0510-00	B010100	B010134X	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R921	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R923	315-0152-00	XB010135		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R925	315-0152-00	XB010135		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R927	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R961	308-0459-00			RES.,FXD,WW:1.1 OHM,5%,3W	91637	CW2B-D1R100J
R966	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R967	321-0288-00			RES.,FXD,FILM:9.76K OHM,1%,0.125W	91637	MFF1816G97600F
R968	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R1031	307-0489-00			RES,NTWK,FXD,FI:100 OHM,20%,1W	32997	4308R-101-101
R2031	307-0489-00			RES,NTWK,FXD,FI:100 OHM,20%,1W	32997	4308R-101-101
R2032	307-0489-00			RES,NTWK,FXD,FI:100 OHM,20%,1W	32997	4308R-101-101
R3000	307-0525-00			RES.,NETWORK:THK FILM,(9) 56 OHM,2%,0.25W	91637	MSP10A01560G
R4031	307-0489-00			RES,NTWK,FXD,FI:100 OHM,20%,1W	32997	4308R-101-101
R4032	307-0489-00			RES,NTWK,FXD,FI:100 OHM,20%,1W	32997	4308R-101-101
R6015	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R6031	307-0489-00			RES,NTWK,FXD,FI:100 OHM,20%,1W	32997	4308R-101-101
R6032	307-0489-00			RES,NTWK,FXD,FI:100 OHM,20%,1W	32997	4308R-101-101
R7000	307-0525-00			RES.,NETWORK:THK FILM,(9) 56 OHM,2%,0.25W	91637	MSP10A01560G
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

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R7020	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R8031	307-0489-00			RES,NTWK,FXD,FI:100 OHM,20%,1W	32997	4308R-101-101
R8045	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
S1	260-0613-00			SWITCH,TOGGLE:SPDT,115V	09353	7101SHZQ1
T922	120-1062-00			TRANSFORMER,RF:BASE DRIVE POT CORE	80009	120-1062-00
T942	120-1083-00			XFMR,PWR,SDN,RF:POT CORE	80009	120-1083-00
U912	156-0402-00	XB030000		MICROCIRCUIT,LI:TIMER	27014	SL34829
U918	156-0402-00			MICROCIRCUIT,LI:TIMER	27014	SL34829
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
U2050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
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
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
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
U8050	156-0205-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0205-00
VR929	152-0241-00			SEMICOND DEVICE:ZENER,0.4W,33V,5%	80009	152-0241-00

DIAGRAMS

Symbols and Reference Designators

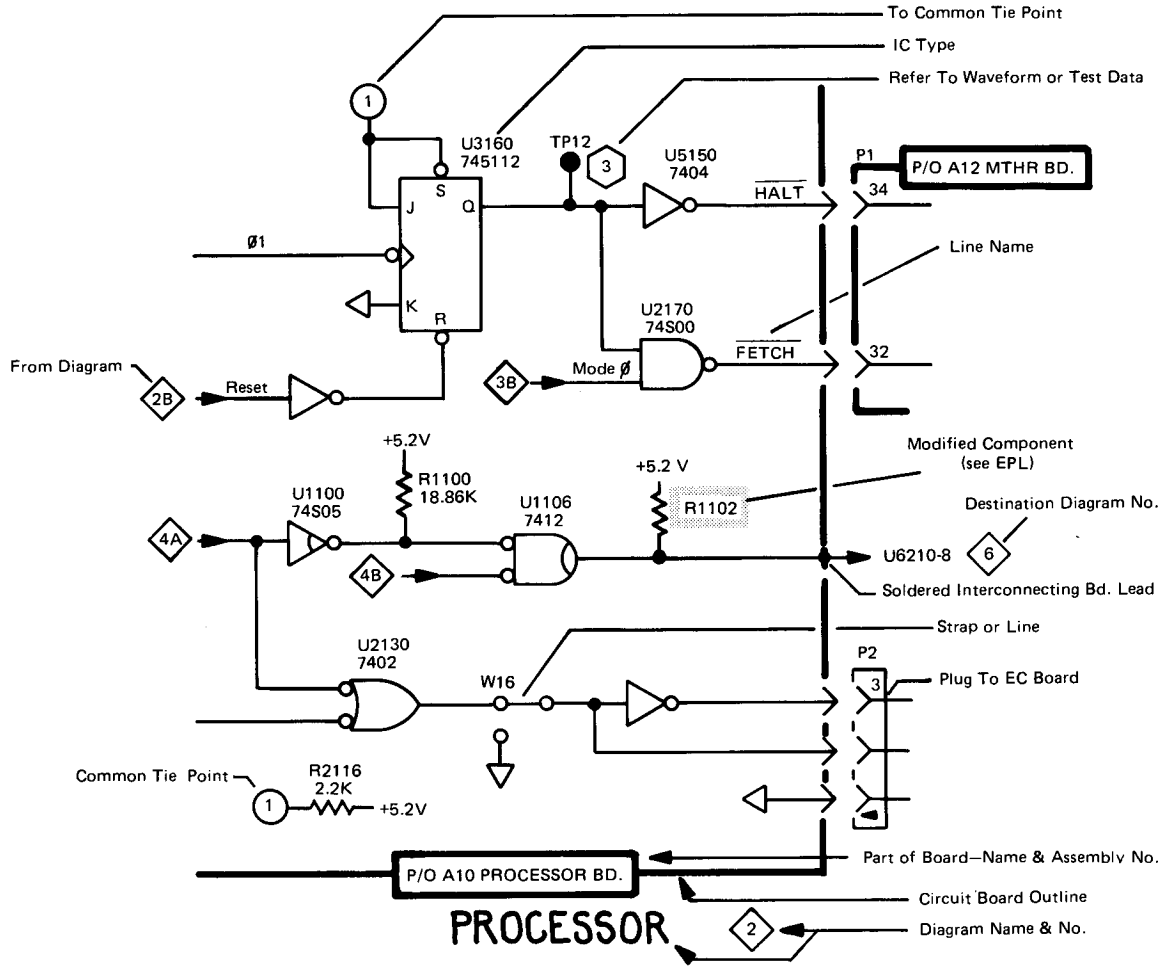
Graphic symbols for electrical and logic symbols, used on the diagrams, are based on ANSI Y32.2, 1975, and ANSI Y32.14, 1973, "American National Standards Institute." Logic symbols depict the logic function of the device in positive logic. Copies of these standards can be obtained from the Institute 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.

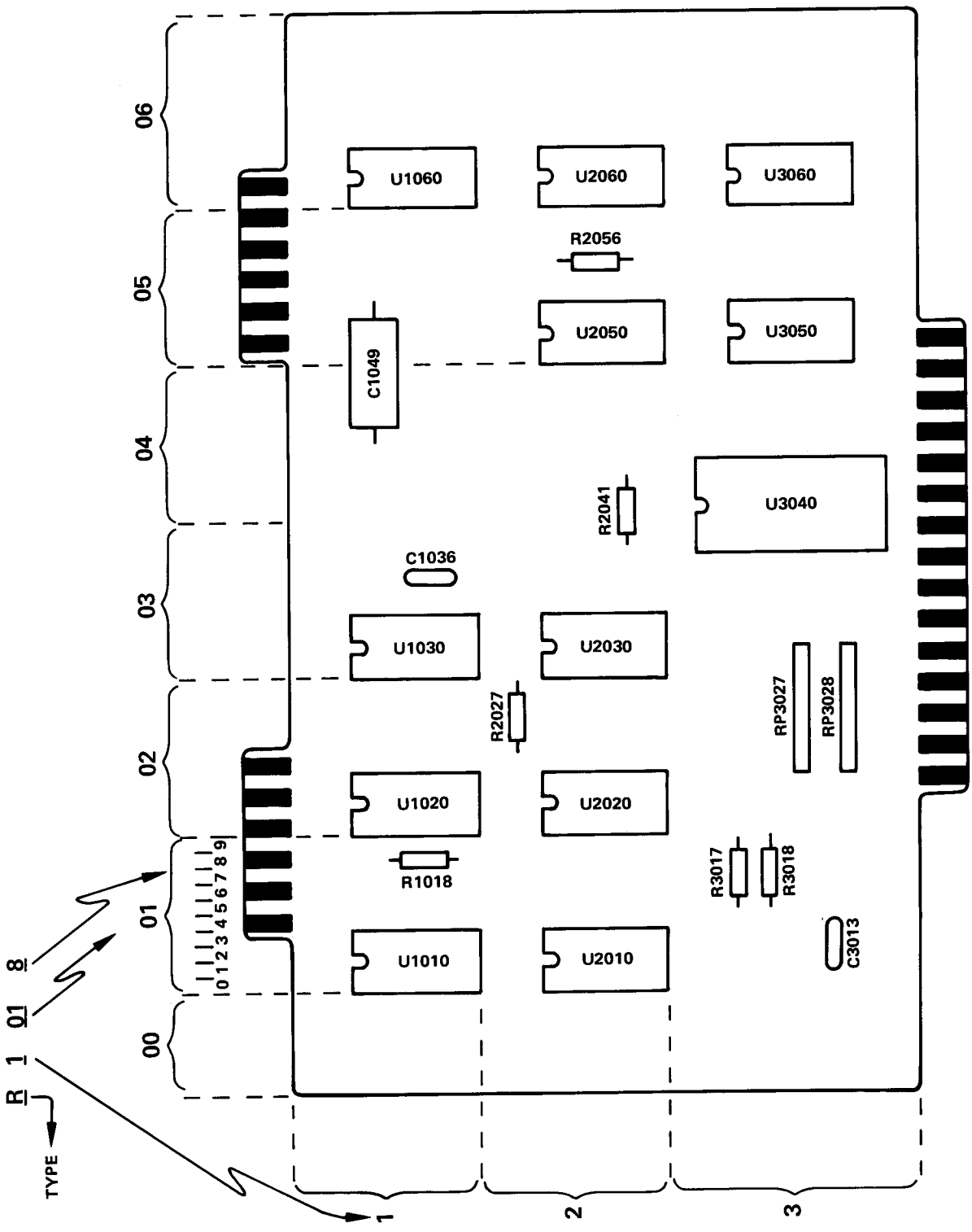
Component Circuit Numbers

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.

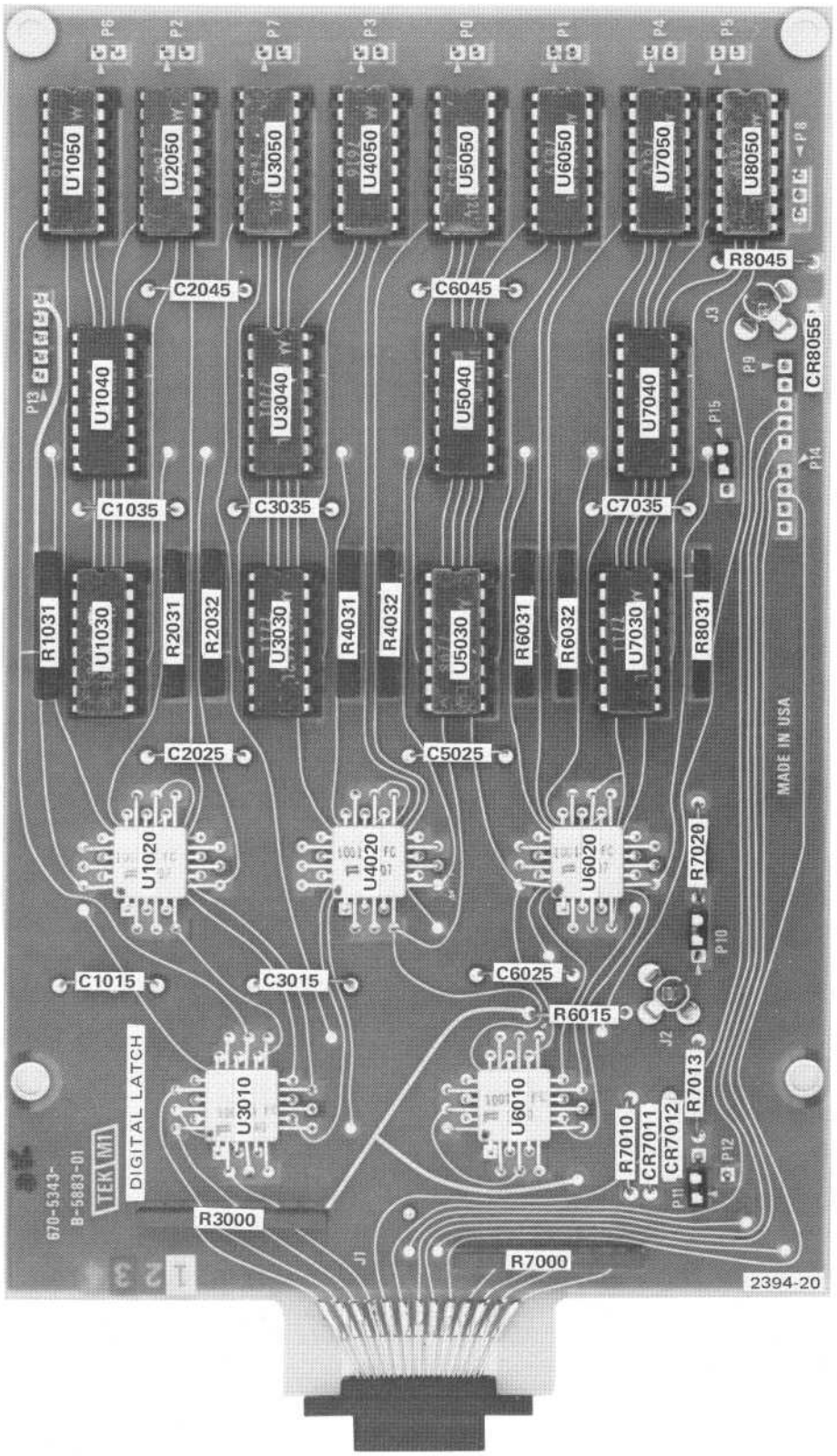


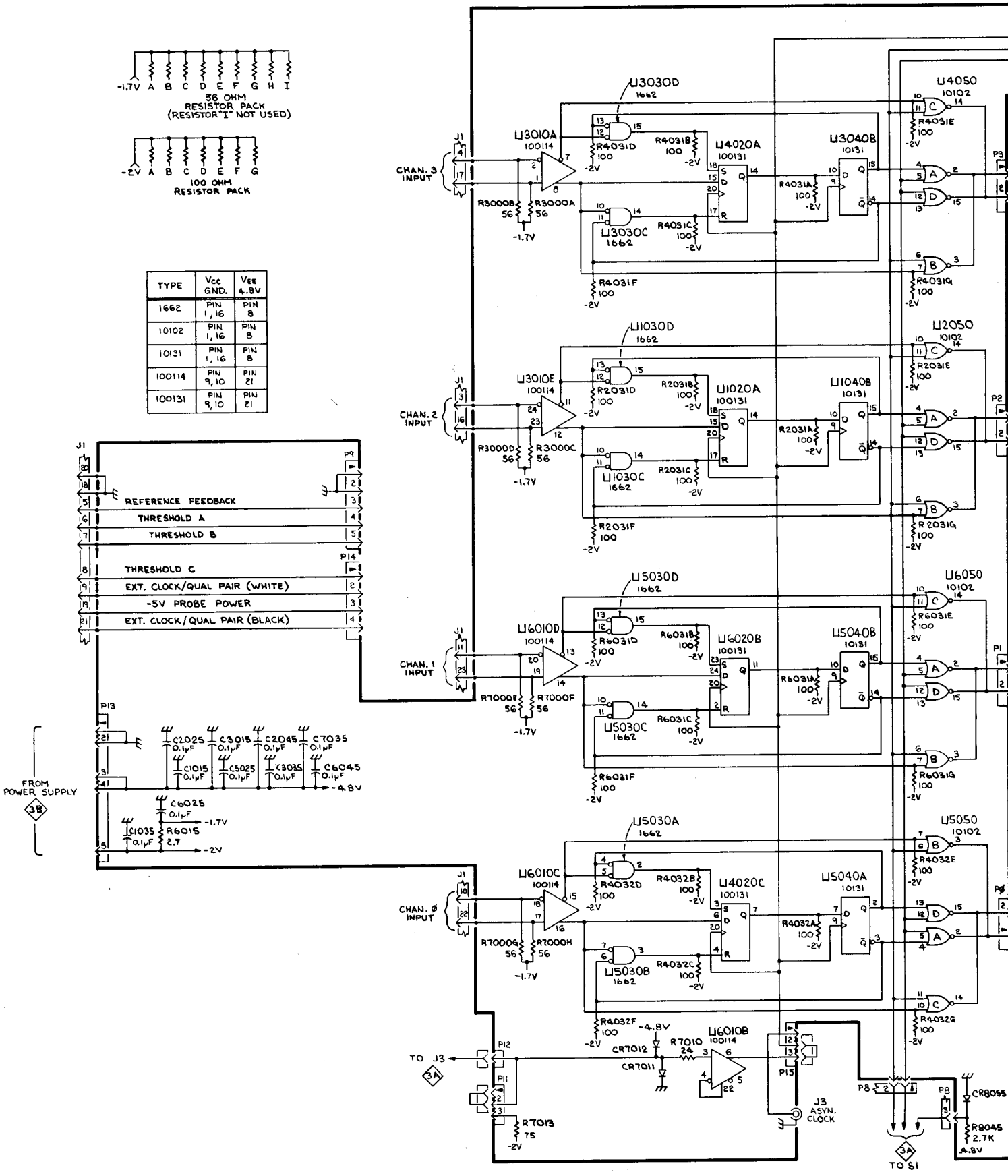
CIRCUIT NUMBER LOCATION GUIDE



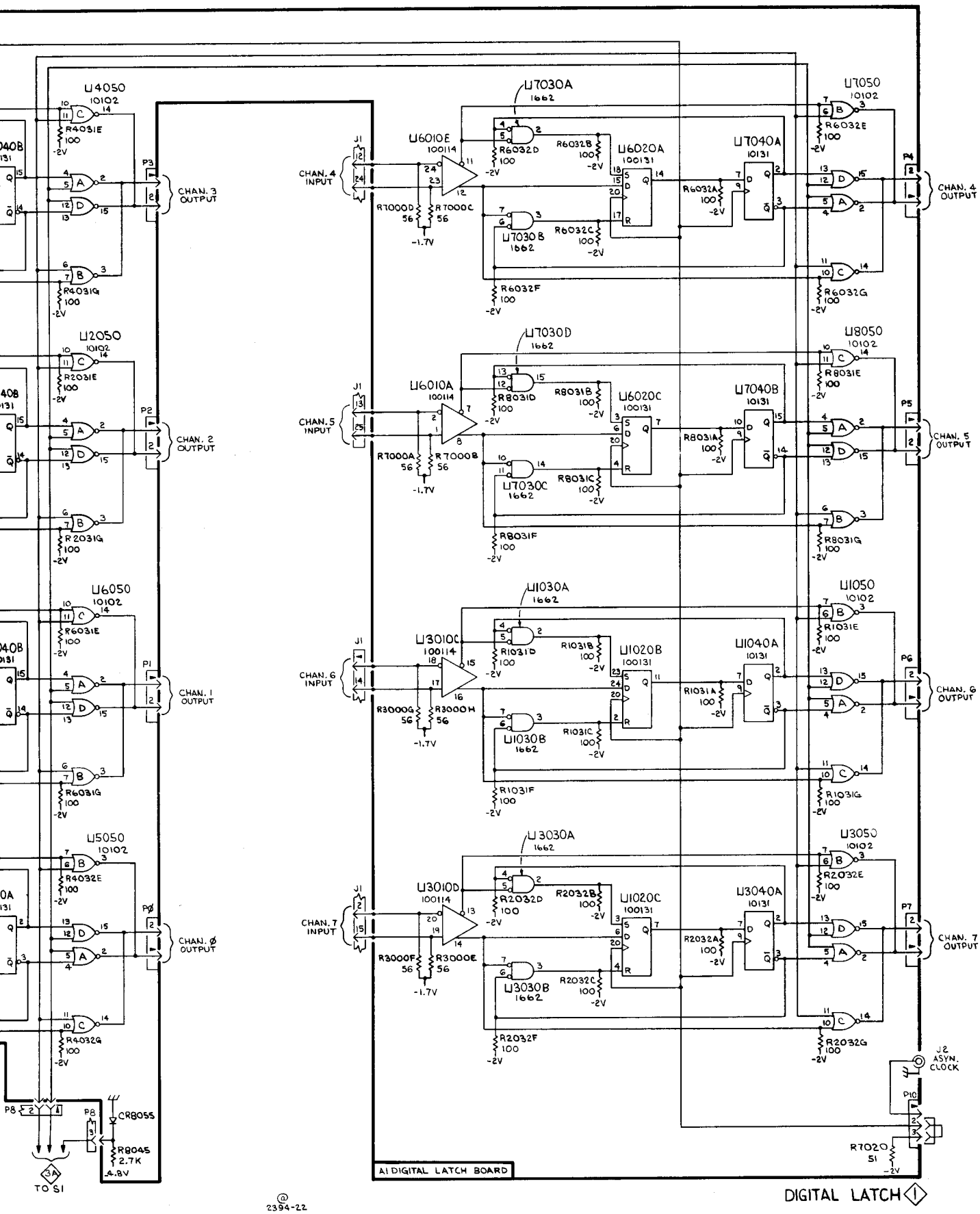
@

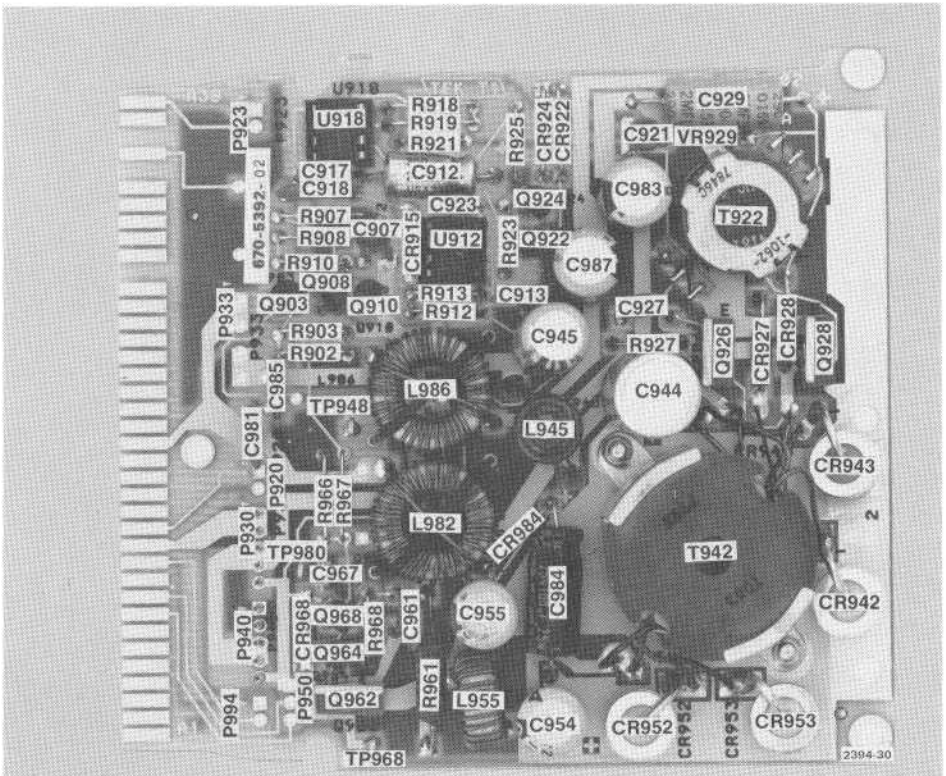
Digital Latch Board.



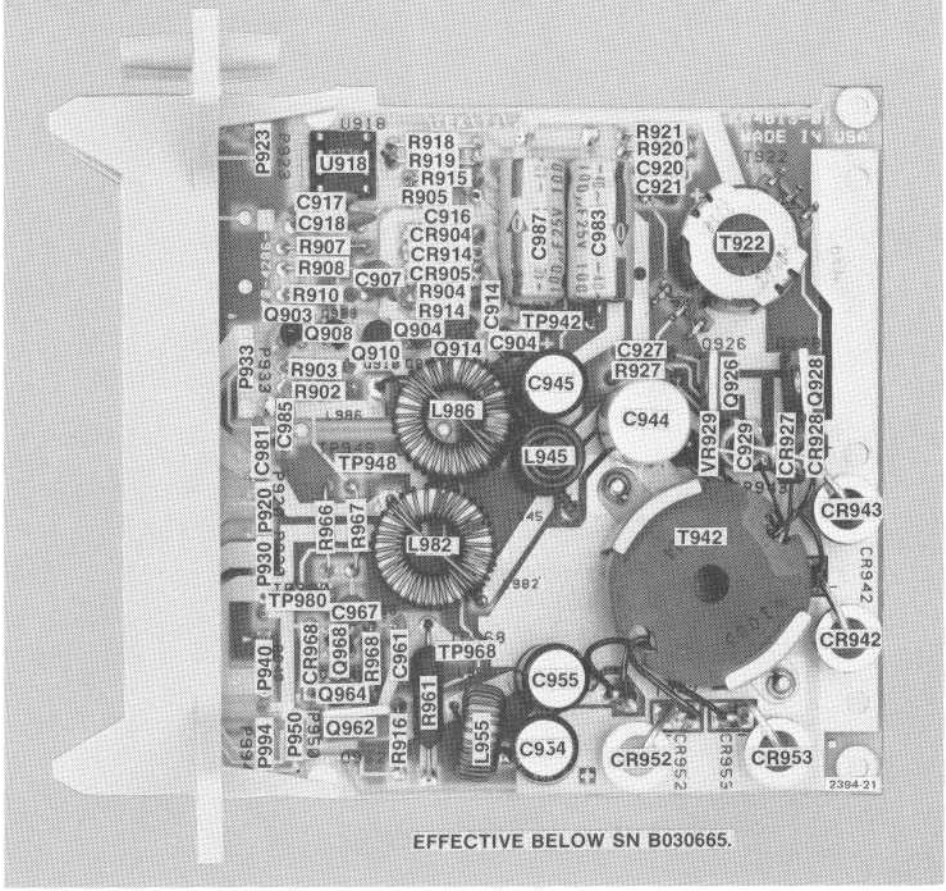


DL 2 DIGITAL LATCH

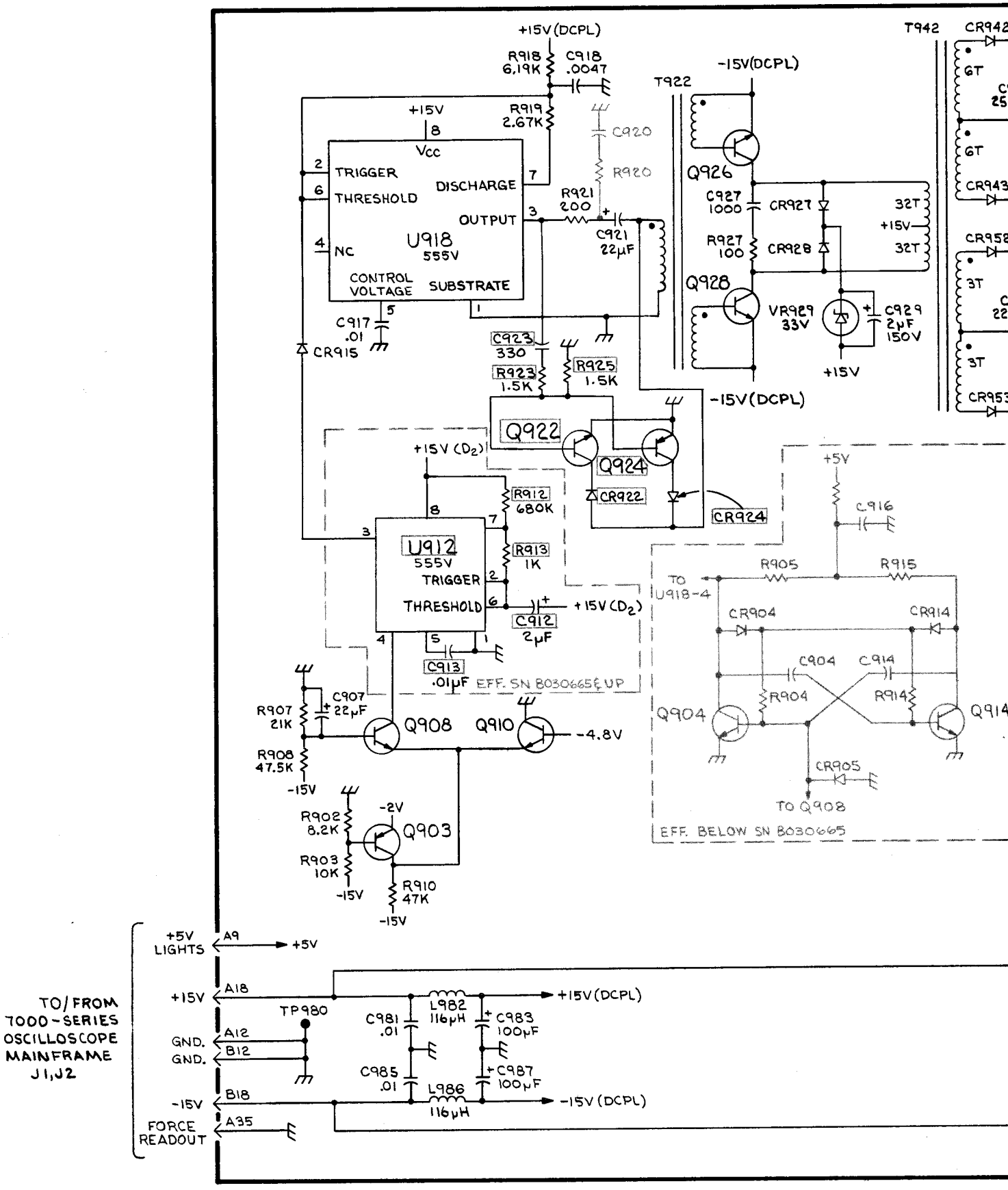

U4050
10102
U2050
10102
U6050
10102
U5050
10102
U7030A
1662
U7030D
1662
U11030A
1662
U3030A
1662
U6010E
100114
U6010A
100114
U30010C
100114
U30010D
100114
U6020A
100131
U6020C
100131
U1020B
100131
U1020C
100131
U7040A
10131
U7040B
10131
U1040A
10131
U3040A
10131
U7050
10102
U8050
10102
U1050
10102
U3050
10102
U7030B
1662
U7030C
1662
U1030B
1662
U3030B
1662
J1
CHAN. 4 INPUT
CHAN. 5 INPUT
CHAN. 6 INPUT
CHAN. 7 INPUT
P3
CHAN. 3 OUTPUT
P2
CHAN. 2 OUTPUT
P1
CHAN. 1 OUTPUT
PØ
CHAN. Ø OUTPUT
P4
CHAN. 4 OUTPUT
P5
CHAN. 5 OUTPUT
P6
CHAN. 6 OUTPUT
P7
CHAN. 7 OUTPUT
J2
ASYN. CLOCK
P10
P8
CR8055
R8045
2.7K
-4.8V
TO SI
R7020
51
-2V
A1 DIGITAL LATCH BOARD
DIGITAL LATCH 1
2394-22



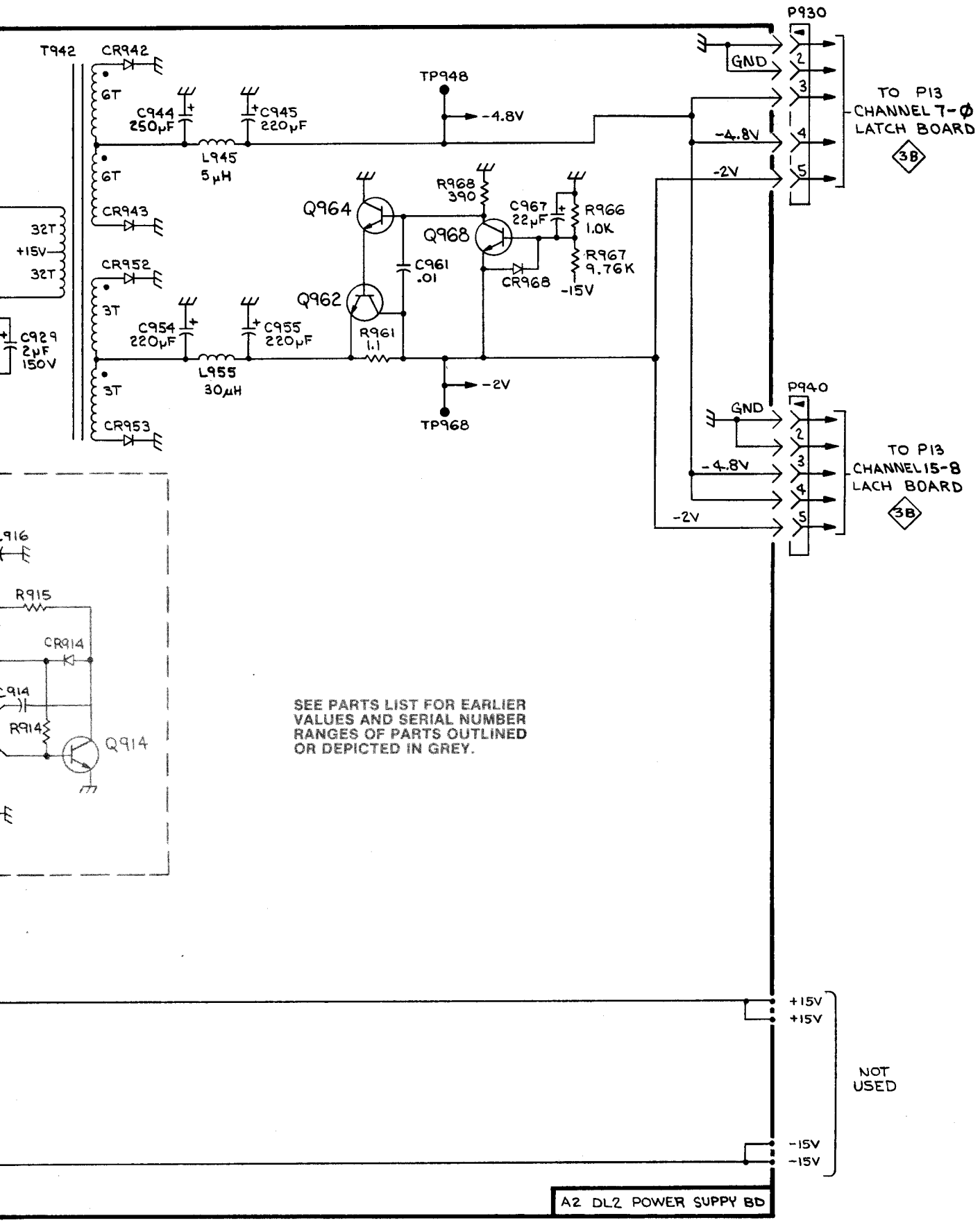
EFFECTIVE SN B030665 & UP.



EFFECTIVE BELOW SN B030665.



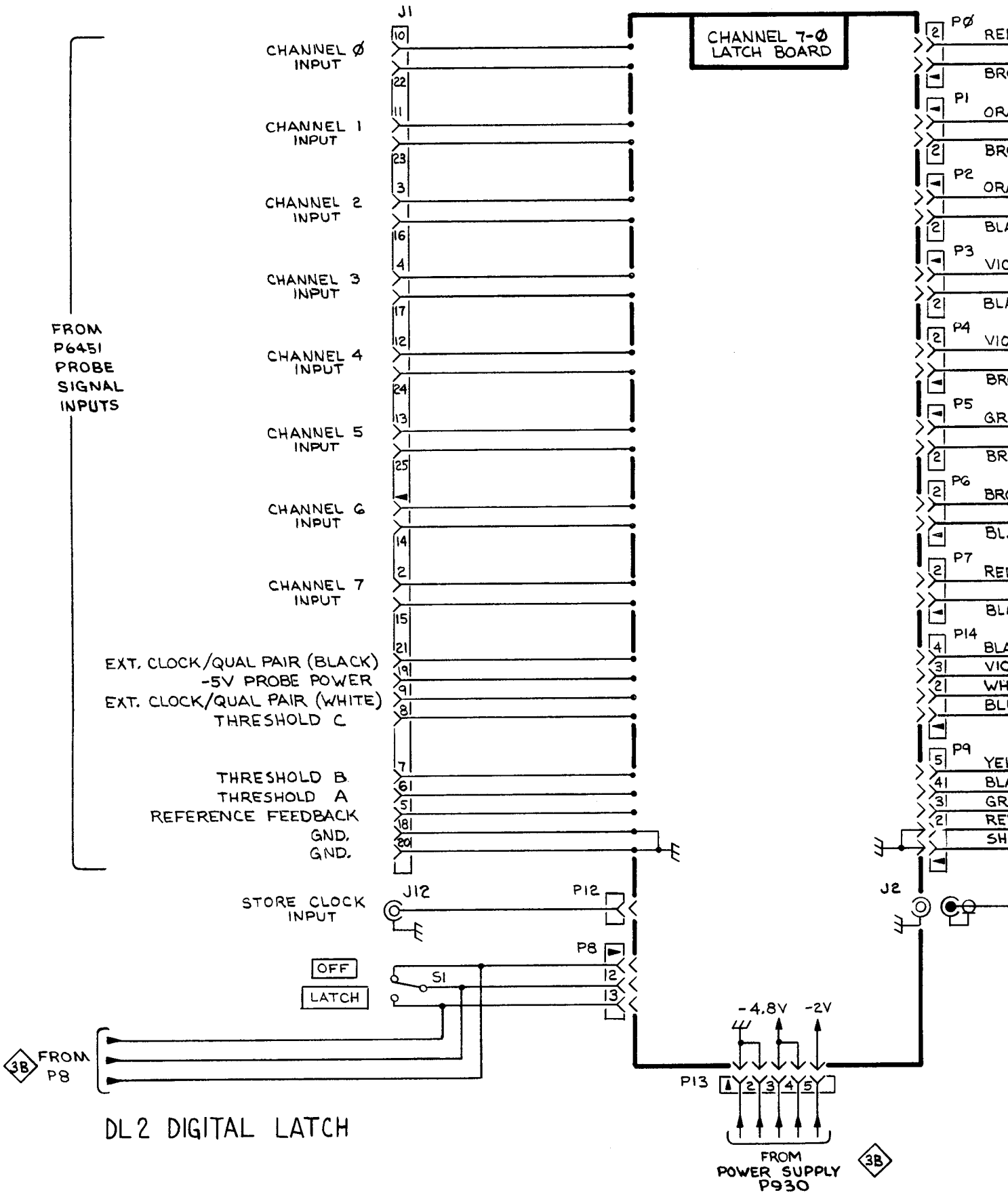
DL2 DIGITAL LATCH



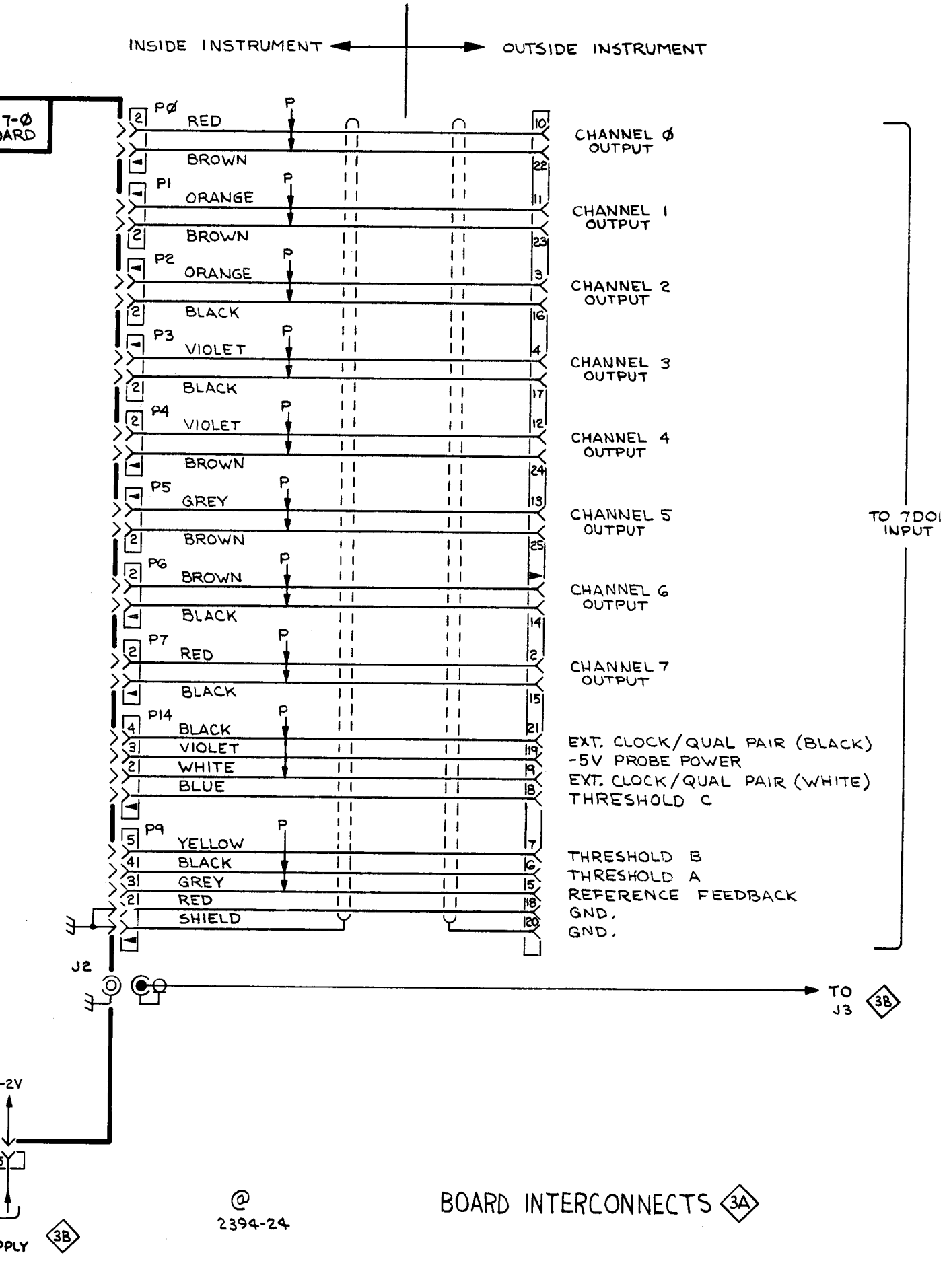
POWER SUPPLY 2

2394-23
REV A JUL 1979

POWER SUPPLY 2

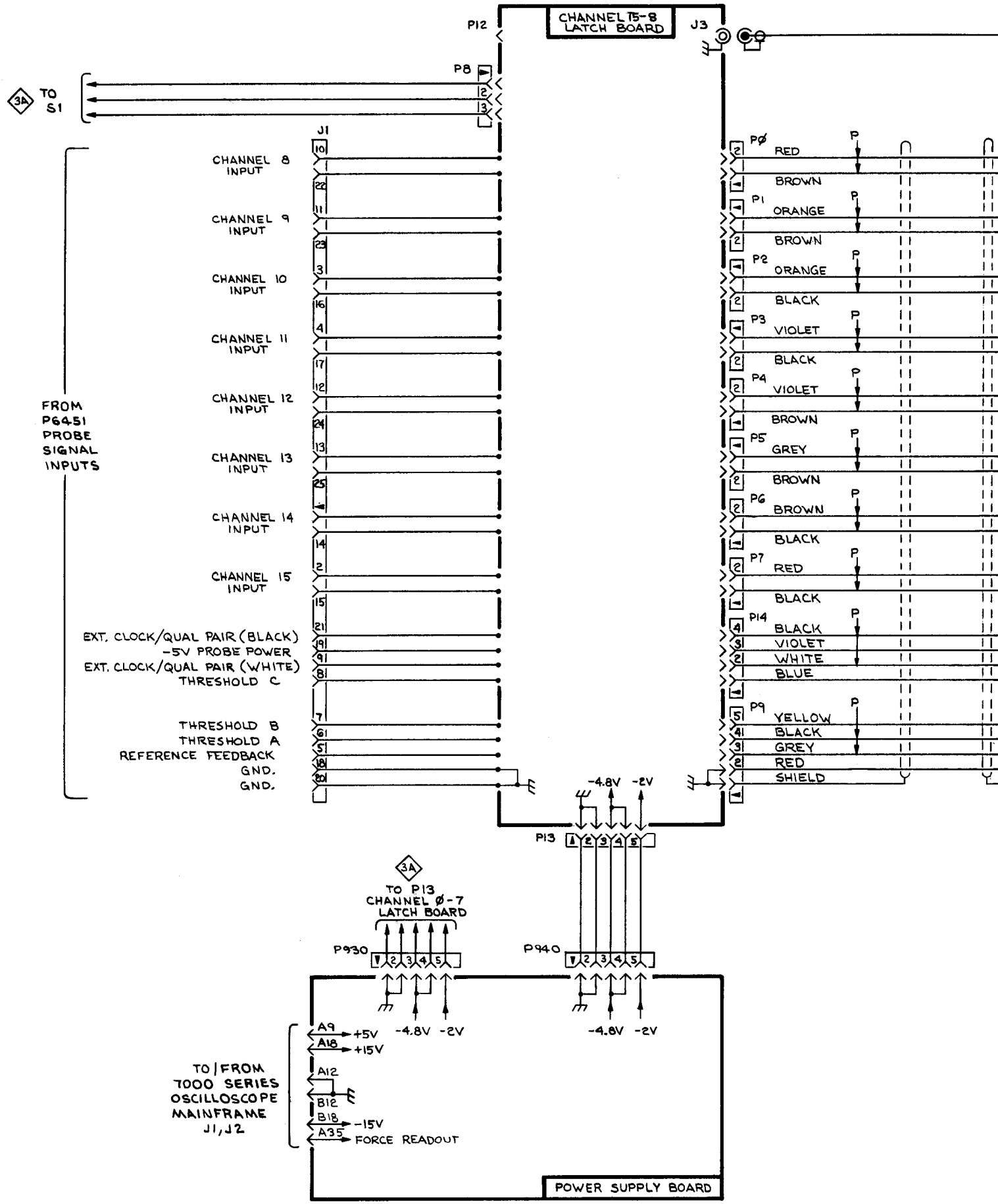


DL2 DIGITAL LATCH



@ 2394-24

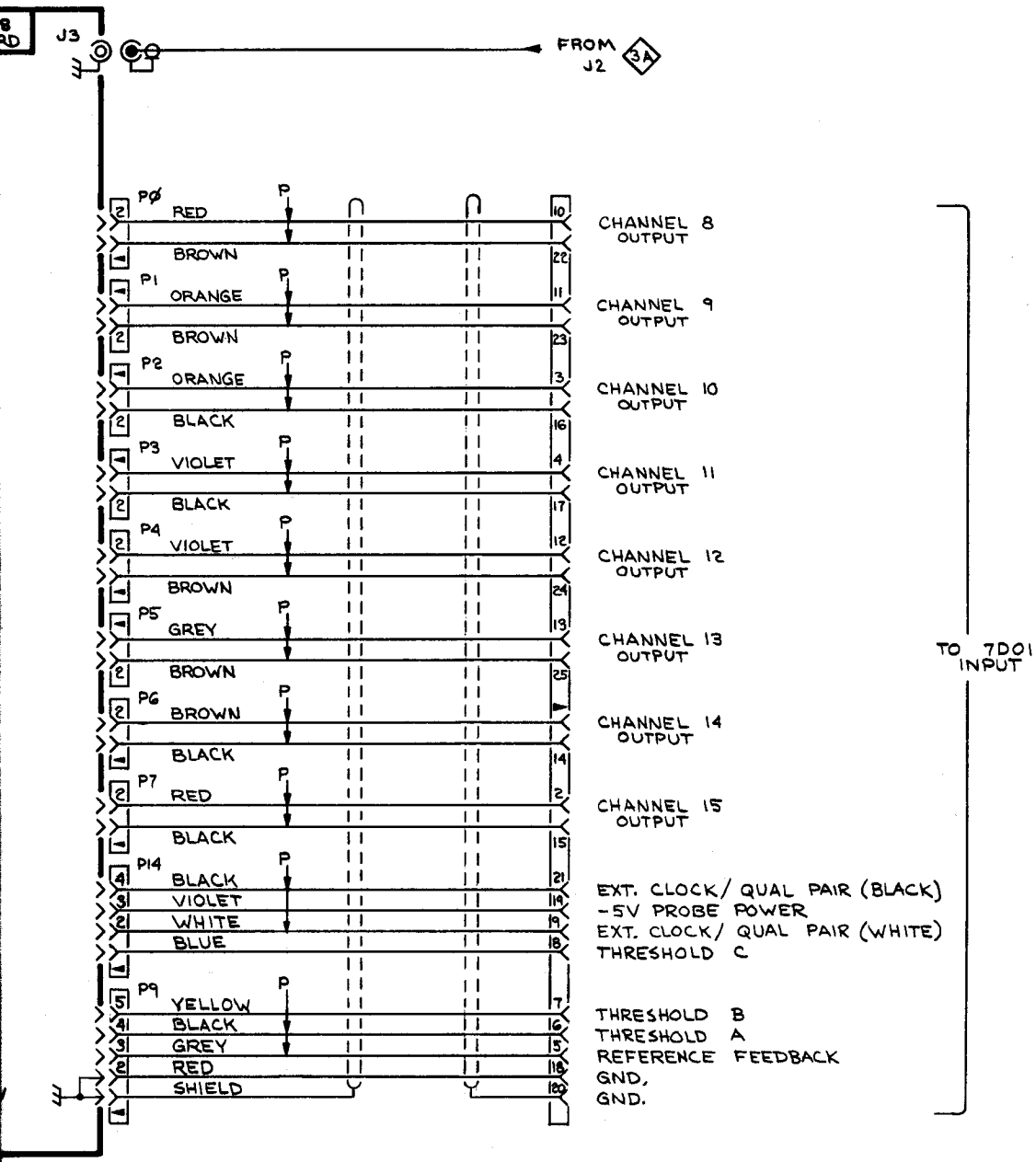
BOARD INTERCONNECTS 3A



DL2 DIGITAL LATCH

@ 2394-25

BOARD INT


J3
FROM J2 3A
P0 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 8 OUTPUT
CHANNEL 9 OUTPUT
CHANNEL 10 OUTPUT
CHANNEL 11 OUTPUT
CHANNEL 12 OUTPUT
CHANNEL 13 OUTPUT
CHANNEL 14 OUTPUT
CHANNEL 15 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
Y BOARD

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

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

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

1 2 3 4 5 *Name & Description*

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

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

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
13257	AMERACE, LTD.	10 ESNA PARK DRIVE	MARKHAM, ONTARIO, CANADA
13511	AMPHENOL CARDRE DIV., BUNKER RAMO CORP.		LOS GATOS, CA 95030
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
73803	TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV.	34 FOREST STREET	ATTLEBORO, MA 02703
77250	PHEOLL MANUFACTURING CO., DIVISION OF ALLIED PRODUCTS CORP.	5700 W. ROOSEVELT RD.	CHICAGO, IL 60650
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
82647	TEXAS INSTRUMENTS, INC., CONTROL PRODUCTS DIV.	34 FOREST ST.	ATTLEBORO, MA 02703
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
87308	N. L. INDUSTRIES, INC., SOUTHERN SCREW DIV.	P. O. BOX 1360	STATESVILLE, NC 28677
98159	RUBBER TECK, INC.	19115 HAMILTON AVE., P O BOX 389	GARDENA, CA 90247

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	337-1064-04			1		SHIELD,ELEC:SIDE PLUG-IN UNITS	80009	337-1064-00
-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	2X20317-402
-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	131-0955-00			1		CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	13511	31-279
-7	348-0555-00			1		GROMMET,PLASTIC:SIL GY,U SHAPE,0.52 ID	80009	348-0555-00
-8	366-1058-78			1		KNOB:LATCH,MARKED DL2	80009	366-1058-78
						(ATTACHING PARTS)		
-9	214-1095-00			1		PIN,SPG,SPLIT:0.094 OD X 0.187 INCH LONG	13257	52-022-094-0187
						- - - * - - -		
-10	105-0076-02			1		REL BAR,LATCH:PLUG-IN UNIT	80009	105-0076-02
-11	214-1280-00			1		SPRING,HLCPS:0.14 OD X 1.126"L,0.16"DIA W	80009	214-1280-00
-12	348-0235-00			2		SHLD GSKT,ELEC:4.734 INCH LONG	80009	348-0235-00
-13	333-1213-16			1		PANEL,FRONT:	80009	333-1213-16
-14	386-1447-91			1		SUBPANEL,FRONT:	80009	386-1447-91
						(ATTACHING PARTS)		
-15	213-0192-00			4		SCR,TPG,THD FOR:6-32 X 0.50 INCH,PNH STL	87308	OBD
-16	211-0101-00			4		SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
						- - - * - - -		
-17	352-0472-00			2		HOLDER,SOCKET:	80009	352-0472-00
-18	----- -----			1		CKT BOARD ASSY:DIGITAL LATCH(SEE A1 EPL)		
						(ATTACHING PARTS)		
-19	213-0088-00			4		SCR,TPG,THD CTG:4-24 X 0.25 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		. BUS,CONDUCTOR:2 WIRE BLACK	00779	530153-2
-22	131-0608-00			43		. TERMINAL,PIN:0.365 L X 0.25 PH,BRZ,GOLD PL	22526	47357
-23	131-1003-00			2		. CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
-24	136-0252-04			2		. SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-25	136-0260-02			16		. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	82647	C9316-18
-26	----- -----			1		CKT BOARD ASSY:DIGITAL LATCH(SEE A1 EPL)		
						(ATTACHING PARTS)		
-27	213-0088-00			4		SCR,TPG,THD CTG:4-24 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
-28	131-1897-01			1		. CONN,RCPT,ELEC:MICROMINIATURE,25 CONT MALE	80009	131-1897-01
-29	131-0993-00			3		. BUS,CONDUCTOR:2 WIRE BLACK	00779	530153-2
-30	131-0608-00			43		. TERMINAL,PIN:0.365 L X 0.25 PH,BRZ,GOLD PL	22526	47357
-31	131-1003-00			2		. CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
-32	136-0252-04			2		. SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-33	136-0260-02			16		. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	82647	C9316-18
-34	----- -----			1		CKT BOARD ASSY:POWER(SEE A2 EPL)		
						(ATTACHING PARTS)		
-35	211-0088-00			2		SCREW,MACHINE:2-56 X 0.281"82 DEG,FLH STL	77250	OBD
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
-36	----- -----			1		. TRANSFORMER:(SEE T942 EPL)		
						(ATTACHING PARTS)		
-37	211-0007-00			2		. SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
						- - - * - - -		
-38	214-0579-00			4		. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-39	136-0252-04			21		. SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-40	136-0514-00	B010100	B029999	1		. SKT,PL-IN ELEC:MICROCIRCUIT,8 DIP	73803	CS9002-8
	136-0514-00	B030000		2		. SKT,PL-IN ELEC:MICROCIRCUIT,8 DIP	73803	CS9002-8
	346-0032-00	XB030000		2		. STRAP,RETAINING:0.075 DIA X 4.0 L,MLD RBR	98159	2859-75-4
-41	131-0608-00			10		. TERMINAL,PIN:0.365 L X 0.25 PH,BRZ,GOLD PL	22526	47357
-42	386-1402-00			1		PANEL,REAR:	80009	386-1402-00
						(ATTACHING PARTS)		
-43	213-0192-00			4		SCR,TPG,THD FOR:6-32 X 0.50 INCH,PNH STL	87308	OBD
-44	361-0326-00			1		SPACER,SLEEVE:0.18 ID X 0.25 OD X 0.10"L	80009	361-0326-00
						- - - * - - -		

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	214-1061-00			1		SPRING,GROUND:FLAT	80009	214-1061-00
-46	426-1471-01			1		FR SECT,PLUG-IN:TOP,W/BRACKET	80009	426-1471-01
-47	214-1054-00			1		SPRING,FLAT:0.825 X 0.322,SST	80009	214-1054-00
-48	105-0075-00			1		BOLT,LATCH:7A & 7B SER PL-IN	80009	105-0075-00
-49	343-0717-00			2		CLAMP,CABLE:ALUMINUM	80009	343-0717-00
						(ATTACHING PARTS)		
-50	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	211-041800-00
						- - - * - - -		
-51	426-1472-01			1		FR SECT,PLUG-IN:BOTTOM,W/BRACKET	80009	426-1472-01
	175-1835-05			1		CA ASSY,SP,ELEC:24,28 AWG,36.0 L	80009	175-1835-05
-52	175-1835-03			1		. CA ASSY,SP,ELEC:24,28 AWG,36.0 L	80009	175-1835-03
-53	334-2794-01			1		. BAND,MARKER:0.371 DIA,WHITE,PLASTIC	80009	334-2794-01
-54	352-0169-00			1		. HLDR,TERM CONN:2 WIRE BLACK	80009	352-0169-00
	352-0169-01			1		. HLDR TERM CONN: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
-55	352-0162-01			1		. CONN BODY,PL,EL:4 WIRE BROWN	80009	352-0162-01
-56	352-0163-00			1		. CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0163-00
-57	175-1835-03			1		CA ASSY,SP,ELEC:24,28 AWG,36.0 L	80009	175-1835-03
	352-0169-00			1		. HLDR,TERM CONN:2 WIRE BLACK	80009	352-0169-00
	352-0169-01			1		. HLDR TERM CONN: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
	352-0162-01			1		. CONN BODY,PL,EL:4 WIRE BROWN	80009	352-0162-01
	352-0163-00			1		. CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0163-00
	198-3789-00			1		WIRE SET,ELEC:	80009	198-3789-00
-58	175-0826-00			FT		. WIRE,ELECTRICAL:3 WIRE RIBBON	80009	175-0826-00
-59	175-0828-00			FT		. WIRE,ELECTRICAL:5 WIRE RIBBON	08261	OBD
-60	131-0707-00			27		. CONNECTOR,TERM.:22-26 AWG,BRS& CU BE GOLD	22526	47439
-61	352-0171-02			1		. CONN BODY,PL,EL:1 WIRE RED	80009	352-0171-02
-62	352-0161-08			2		. CONN BODY,PL,EL:3 WIRE GRAY	80009	352-0161-08
	352-0163-03			4		. CONN BODY,PL,EL:5 WIRE ORANGE	80009	352-0163-03

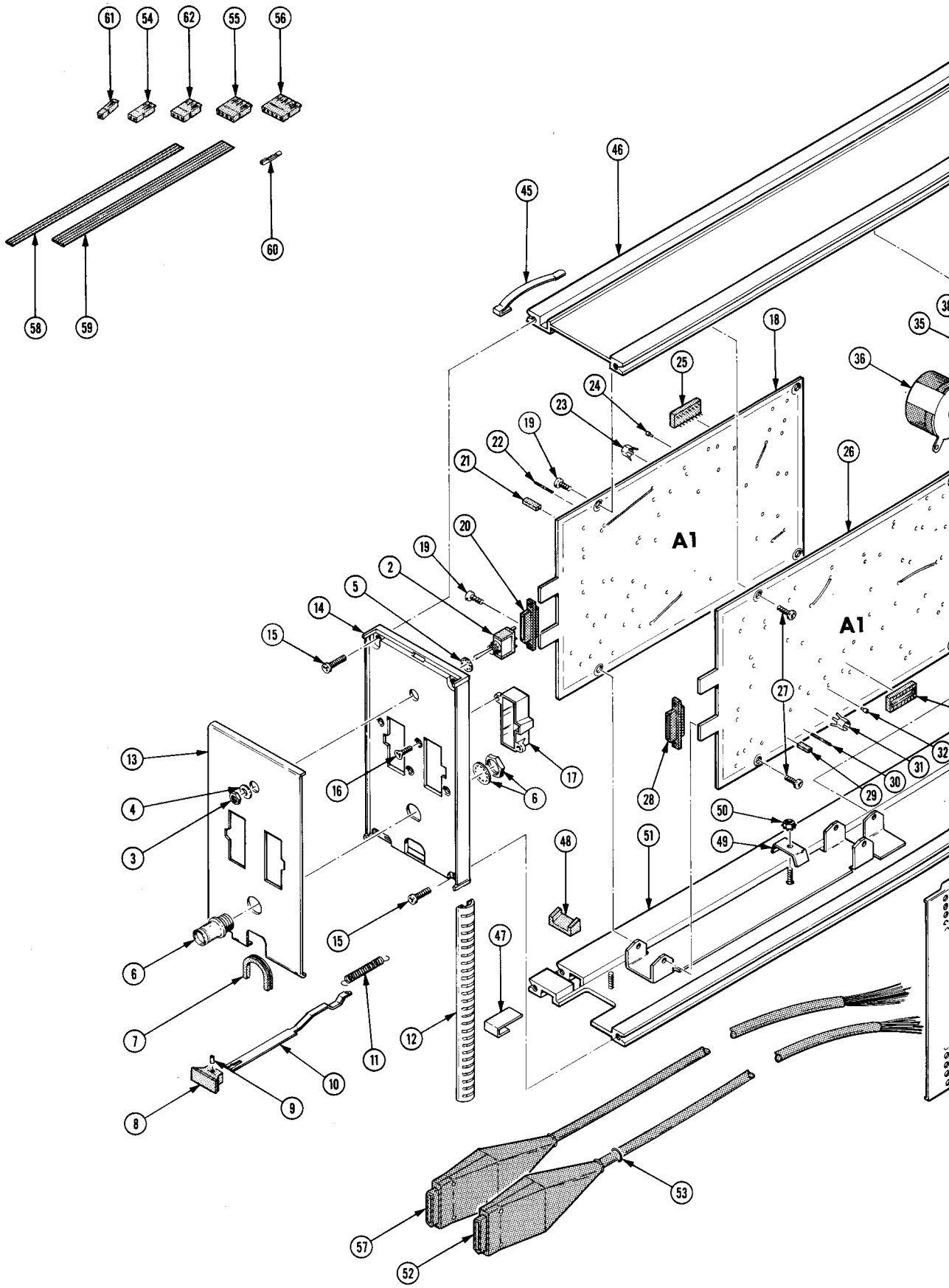
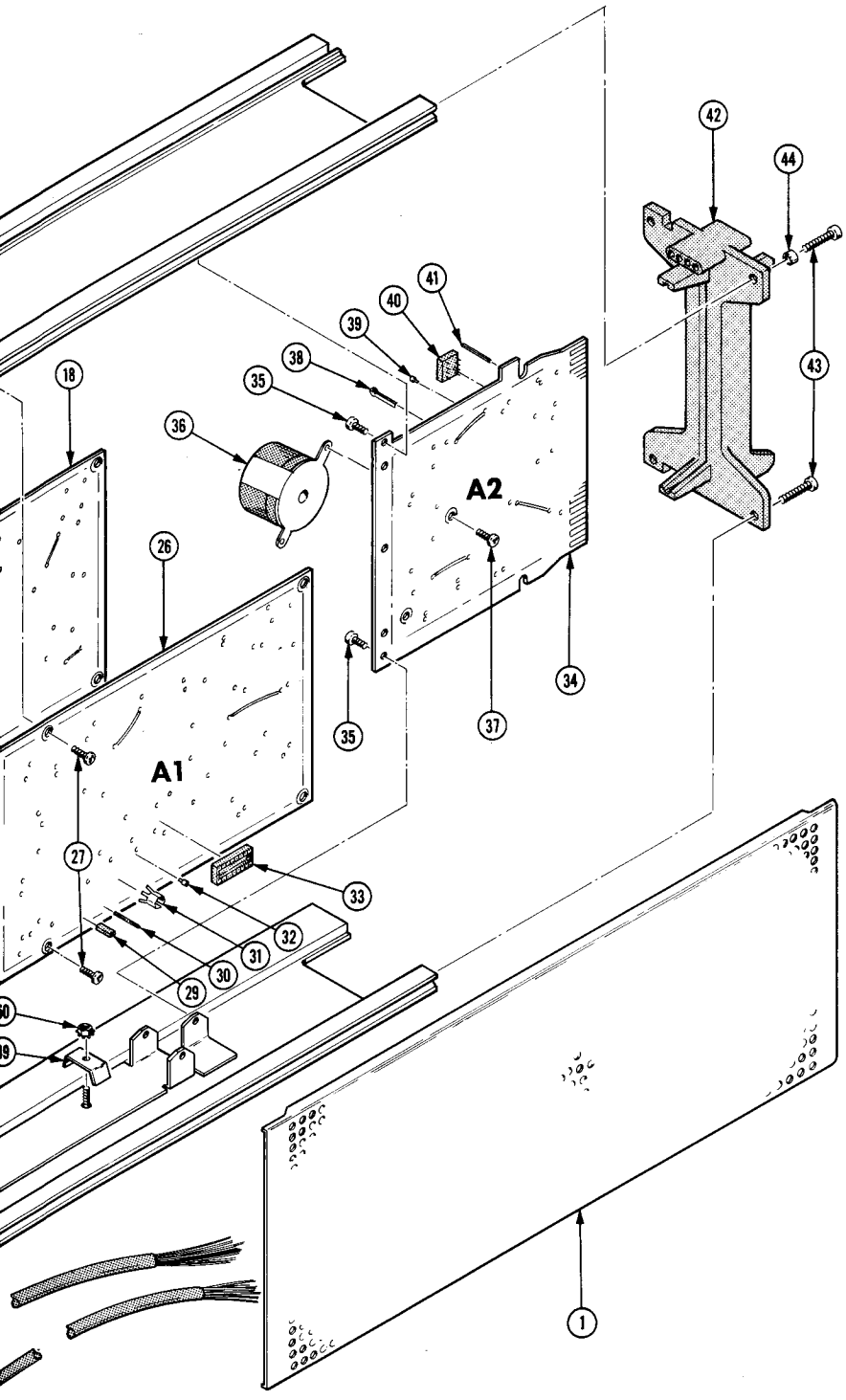

A1
A1

FIG 1 EXPLODED



DL2 DIGITAL LATCH

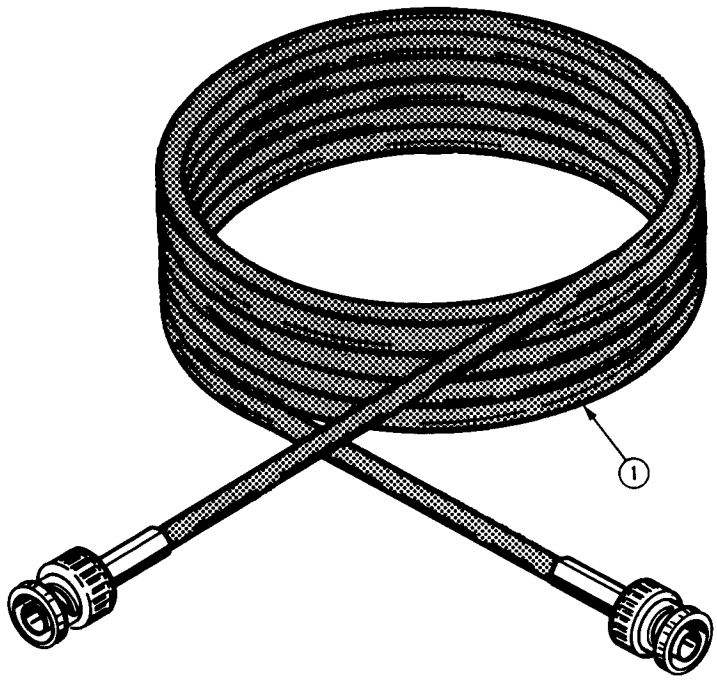


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-						STANDARD ACCESSORIES		
-1	012-0118-00			1		CABLE,ASSY,RF:50 OHM COAX, 8.0 L	80009	012-0118-00
	070-2394-00			1		MANUAL,TECH:INSTRUCTION	80009	070-2394-00

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur, are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

Comparison of Main Characteristics

DM 501 replaces 7D13		
PG 501 replaces 107	PG 501 - Risetime less than 3.5 ns into 50 Ω.	107 - Risetime less than 3.0 ns into 50 Ω.
108	PG 501 - 5 V output pulse; 3.5 ns Risetime	108 - 10 V output pulse 1 ns Risetime
PG 502 replaces 107		
108	PG 502 - 5 V output	108 - 10 V output
111	PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay
PG 508 replaces 114	Performance of replacement equipment is the same or better than equipment being replaced.	
115		
2101		
PG 506 replaces 106	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V.
067-0502-01	PG 506 - Does not have chopped feature.	0502-01 - Comparator output can be alternately chopped to a reference voltage.
SG 503 replaces 190, 190A, 190B	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
191		
067-0532-01	SG 503 - Frequency range 250 kHz to 250 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
SG 504 replaces 067-0532-01	SG 504 - Frequency range 245 MHz to 1050 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
067-0650-00		
TG 501 replaces 180, 180A	TG 501 - Trigger output-slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously.
181		181 - Multiple time-marks
184	TG 501 - Trigger output-slaved to market output from 5 sec through 100 ns. One time-mark can be generated at a time.	184 - Separate trigger pulses of 1 and 0.1 sec; 10, 1, and 0.1 ms; 10 and 1 μs.
2901	TG 501 - Trigger output-slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	2901 - Separate trigger pulses, from 5 sec to 0.1 μs. Multiple time-marks can be generated simultaneously.

NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.