AUTOMATED MEASUREMENT SYSTEMS

1340 DATA COUPLER

SN B040000-up

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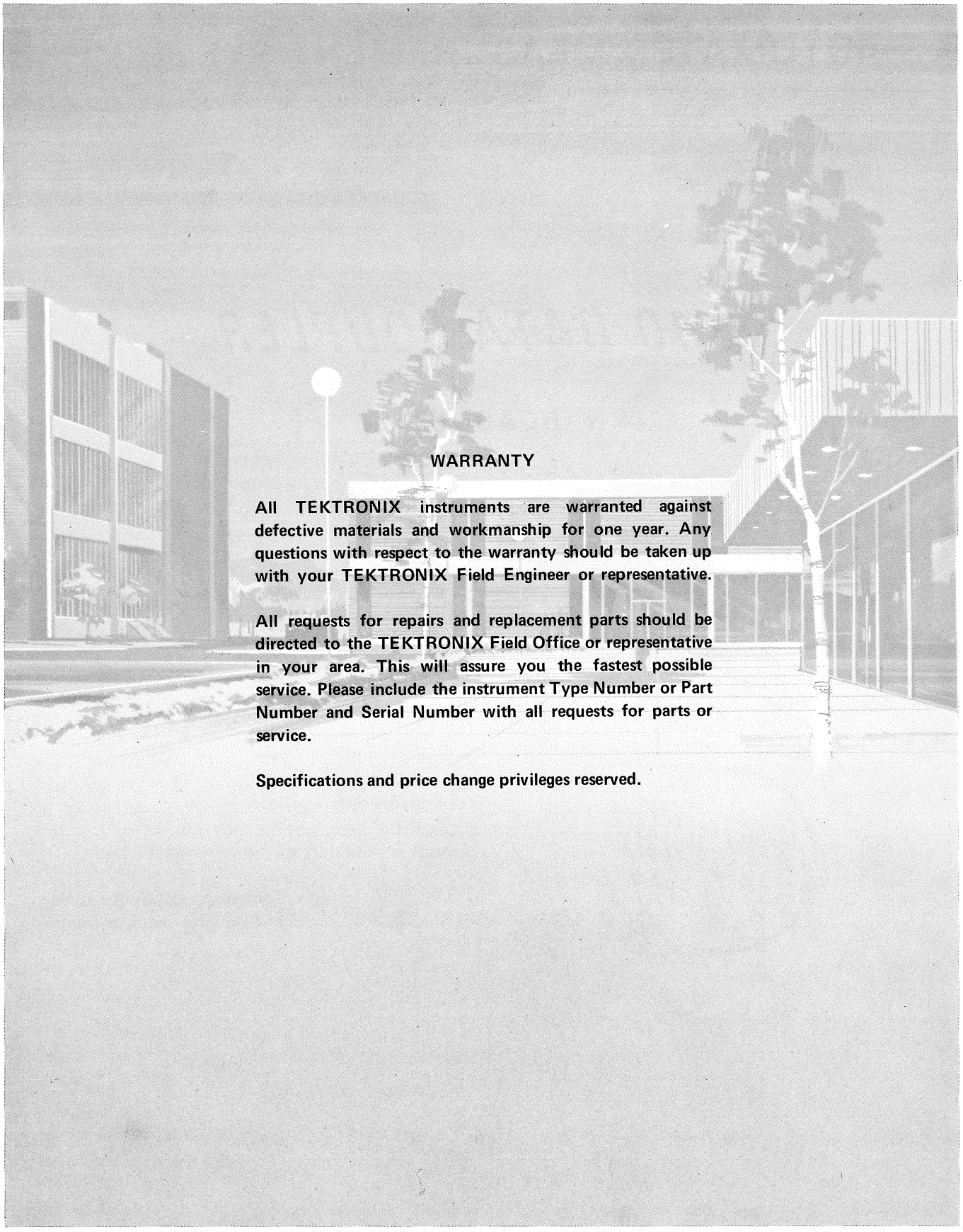
070-3107-00



WARRANTY

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

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

Specifications and price change privileges reserved.

TABLE OF CONTENTS

Fig. 1-1. 1340 Data Coupler

DESCRIPTION AND SPECIFICATIONS

General

The 1340 Data Coupler is intended for use in manual or Automated Measurement Systems. It contains connectors for 12 circuit cards, an etched circuit board (mother-board) that provides electrical access to the circuit card connectors, a power supply for the circuit cards, several rear panel connectors for connecting the 1340 with other system units, and front panel controls and indicators. The circuit cards for the 1340 are provided in optional Interface Packages. The combination of circuit card packages installed in a particular 1340 is determined by the requirements of the system. Examples of circuit card combinations installed in 1340's to satisfy the requirements of typical measurement systems are provided in the APPLICATIONS section of the manual.

1340 Mod 950A

This version of the Data Coupler is intended for use in Systems that have the Type 230 Digital Unit and the Type 240 Program Control Unit. It has a special front panel and includes circuit cards for the operation of the Type 230 and Type 240.

Optional Interface Packages

An interface package consists of one or more circuit cards, an Instruction Manual, and when needed, special cabling. Several Interface Packages are available for system applications. These Interface Packages are listed and described in the APPLICATIONS section. As additional Interface Packages become available, they are included in the TEKTRONIX Catalog. Consult your local TEKTRONIX Field Engineer for current Interface Package listings.

ELECTRICAL CHARACTERISTICS

Power Requirements

90 to 136 VAC or 180 to 272 VAC, 48 to 66 Hz, 102 watts maximum.

Internal DC Supplies

The maximum current listed with each supply voltage is the total current available for all loads combined, whether internally installed assemblies or peripheral devices. The instruction manual for each optional Interface Package lists the current requirement for each assembly of the package.

+19 VDC, 500 mA maximum.

+5 VDC, 8 A maximum, adjustable from <1 A to 8 A.

−1 VDC, 250 mA maximum.

−19 VDC, 500 mA maximum.

ENVIRONMENTAL CHARACTERISTICS

Characteristic	Operating	Non-Operating
Temperature	0°C to +60°C	−40°C to +65°C
Altitude	To 15,000 feet	To 50,000 feet

MECHANICAL CHARACTERISTICS

Finish	
Front-panel	Anodized aluminum.
Cabinet	Blue-vinyl painted aluminum.
Weight	32 lbs. (14.5 kg) with 12 assemblies installed.
Overall Dimensions	
Height	7 inches (17.8 cm)
Depth	
Overall	23.8 inches (60.5 cm)
Rack	20.5 inches (52.2 cm)
Width	19 inches (48.3 cm)

INSTALLATION

Cooling

The 1340 is cooled by convection. For proper circulation of air, the instrument should normally be operated with the top and bottom covers in place. If overheating occurs, check for adequate circulation and ventilation.

Operating Voltage

The 1340 can be operated from either a 115-volt or 230-volt nominal line voltage source. The Line Voltage Selector assembly, located on the rear panel (Fig. 2-1), converts the instrument from one operating range to the other (115 volts or 230 volts). The assembly also allows selection of any one of three regulating ranges and contains the two line fuses. When the instrument is converted from one nominal line voltage source to the other, the assembly connects or disconnects one of the fuses to provide the proper protection for the power transformer.

Use the following procedure to change line voltages or regulating ranges:

1. Disconnect the instrument from the power source.

2. Loosen the two captive screws which hold the cover to the assembly, and remove the cover.

3. To convert to a different line voltage, pull out the Voltage Selector switch bar, reverse it and plug it into the opposite set of holes. The Voltage Selector switch bar will be in the upper position for 115-volt operation, and in the lower position for 230-volt operation.

4. To change regulating ranges, pull out the Range Selector switch bar, slide it to the desired range and plug it back in. Select a range which is centered about the average line voltage to be applied.

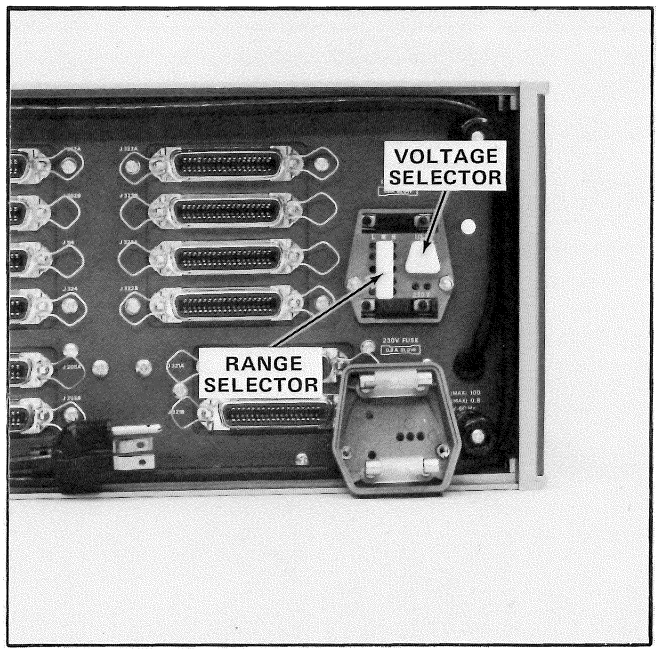


Fig. 2-1. LINE VOLTAGE SELECTOR

5. Re-install the cover with the two captive screws. Be sure the cover fits firmly against the rear panel. This ensures that the line fuses are installed correctly.

6. Before applying power to the instrument, check that the indicating tabs on the switch protrude through the proper holes in the cover for the correct line voltage and regulating ranges.

CAUTION

Operation of the instrument with either the Voltage Selector or Range Selector switch in the wrong position will cause incorrect operation and may damage the instrument.

MAINTENANCE AND ADJUSTMENT

Introduction

This section of the manual contains maintenance information for use in preventive maintenance, corrective maintenance, or troubleshooting of the instrument. It also contains instructions for checking and adjusting the 1340 power supplies.

PREVENTIVE MAINTENANCE

General

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. Regular preventive maintenance may prevent instrument breakdown and improves instrument reliability. Perform preventive maintenance as often as necessary.

The instrument covers protect against dust in the interior. Leave panels in place except when working on the instrument.

CAUTION

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

Exterior. Remove loose dust on the outside of the instrument with a soft cloth or small paint brush. Use the paint brush to dislodge dirt on and around the front panel. Remove the remaining dirt with a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners.

Interior. Keep the interior of the instrument free of dust, since a heavy dust layer combined with high-humidity conditions can cause failure. Clean the interior by blowing off the accumulated dust with dry, low-pressure air. Remove any remaining dirt with a soft paint brush or a cloth dampened with a mild detergent and water solution. Use a cotton-tipped applicator to clean circuit boards.

Lubrication

Proper lubrication increases the reliability of switches and other moving parts. Do not use too much lubrication. A lubrication kit containing the necessary lubricants and instructions is available from Tektronix, Inc. Order TEKTRONIX Part No. 003-0342-01.

Visual Inspection

Occasionally inspect the instrument for defects, such as broken connections, damaged or improperly installed circuit boards, and heat-damaged parts.

If you can see the trouble, the repair procedure is usually obvious. If heat-damaged components are found, be sure to locate and correct the cause of heat damage before replacing the component.

Semiconductor Checks

Periodic checks or replacement of semiconductors is not recommended. The best check of a semiconductor is its performance during instrument operation. See the discussion on troubleshooting for more details.

Recalibration

Check the calibration of this instrument after 500 hours of operation or every six months, whichever occurs first. If a component is replaced you may have to recalibrate the affected circuit.

TROUBLESHOOTING

Introduction

While troubleshooting the instrument, consult other sections of this manual in addition to the following information.

Diagrams. The circuit numbers, electrical parts list, electrical values and connections of all components are shown on the diagrams. Important voltages are also shown.

Parts List. Replacement parts are available through your local TEKTRONIX Field Office or representative. However, many electrical parts are available locally. Before purchasing or ordering replacement parts, consult the Parts List for value, tolerance, and rating.

Circuit Board Replacement. If a circuit board is damaged beyond repair, either the wired assembly or the unwired board can be replaced. Part numbers are given in the Mechanical Parts List for either the completely wired or the unwired board. For Interface Board replacement, refer to the discussion on Interface Board repair.

Resistor Color Code. In addition to the composition resistors, some metal-film resistors are used in this instrument. Nearly all resistors are color-coded for resistance value and tolerance using EIA color code (a metal-film resistor may have the value printed on the body). Composition resistors have four stripes which represent two significant figures, the multiplier and the tolerance value. Metal-film resistors have five stripes which represent three significant figures, the multiplier and the tolerance value.

Capacitor Marking. The capacitance of a disc or electrolytic capacitor is marked in microfarads on the side of the component body. The white ceramic capacitors used in this instrument are color-coded in picofarads using a modified EIA code.

Diode Color Code. The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot. For most striped diodes, the color code indentified the unique portion of the TEKTRONIX Part Number using the EIA color-code system (e.g., a diode color-coded pink-, blue-, or brown-gray-green indicates TEKTRONIX Part Number 152-0185-00).

Semiconductor Lead Configuration. Fig. 3-1 shows the lead configurations of semiconductors used in the 1340.

Troubleshooting Techniques

The following steps are intended as aids in locating a defective component. If a defective component is located, refer to the replacement procedures given under Corrective Maintenance.

1. Check Control Settings. Incorrect control settings can be misleading.

2. Check Associated Equipment. Ensure that associated equipment used with the 1340 is operating correctly. Check for improper signal connections and flaws in interconnecting cables.

3. Check the Power Source.

4. Visual Check. Inspect the trouble area. Possible troubles include unsoldered connections, broken wires, damaged circuit boards, damaged components, etc.

5. Isolate Trouble to a Circuit. The symptom often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check affected circuits by taking voltage and waveform readings.

6. Check Voltages and Waveforms. The defective component can often be located by checking for the correct voltage or waveform in the circuit.

7. Check Individual Components. The following procedures describe methods of checking components. Components which are soldered in place should first be isolated by disconnecting one end.

A. SEMICONDUCTORS

CAUTION

Turn the power off before removing or replacing semiconductors.

To check a transistor, substitute another which is known to be good. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended.

B. DIODES

A diode can be checked for an open or shorted condition by measuring the resistance between terminals. Using an ohmmeter having an internal source of between 800 millivolts and 3 volts, the diode resistance should be very high in one direction and very low when the meter leads are reversed.

CAUTION

Do not use an ohmmeter scale that would supply a relatively large current to the diode. Avoid the lower ranges, such as RX1 and RX10.

C. RESISTORS

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

D. CAPACITORS

Use an ohmmeter (high resistance scale) to check a capacitor for leakage or short-circuit. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacitance meter or by checking whether the capacitor passes AC signals.

8. Repair and Readjust the Circuit. If any defective parts are located, follow the replacement procedures given in this section. Be sure to check the performance of any circuit that has been repaired.

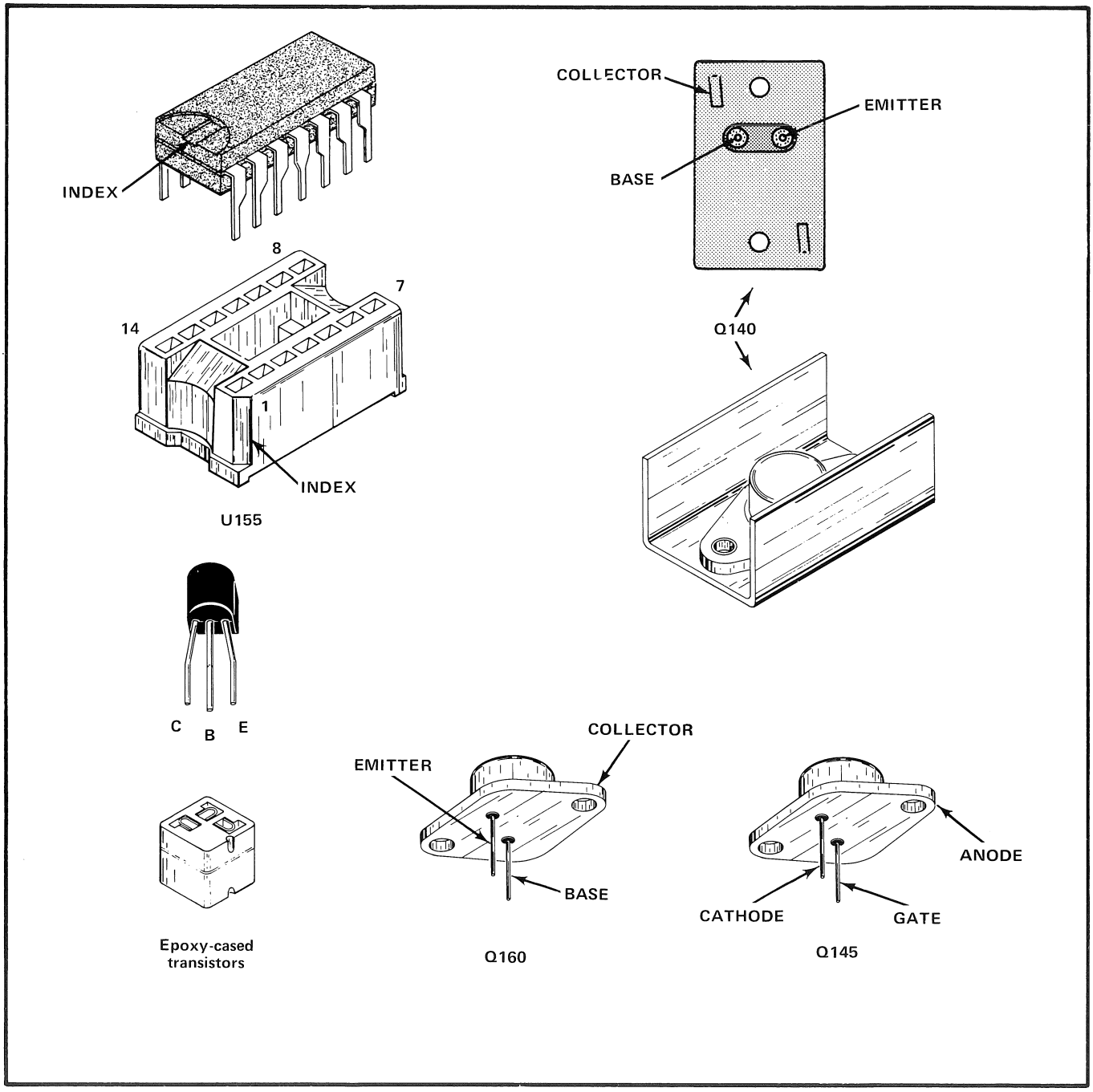


Fig. 3-1. Semiconductor installation information.

CORRECTIVE MAINTENANCE

General

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

Obtaining Replacement Parts

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

Special Parts. In addition to the standard electronic components, some special components are used in the 1340. These components are manufactured or selected by Tektronix, Inc., to meet specific performance requirements,

or are manufactured for Tektronix, Inc., in accordance with our specifications. These special components are indicated in the Electrical Parts List by an asterisk preceding the part number. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local TEKTRONIX Field Office or representative.

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

1. Instrument type.

2. Instrument serial number.

3. A description of the part (if electrical, include circuit number).

4. TEKTRONIX Part Number.

Soldering Techniques

WARNING

Disconnect the instrument from the power source before soldering.

Circuit Boards. Use ordinary 60/40 solder and a 35- to 40-watt pencil type soldering iron on the circuit boards. The tip of the iron should be clean and properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the wiring from the base material.

The following technique should be used to replace a component on a circuit board. Use the procedures given under Component Replacement to remove the boards from the instrument before soldering.

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

2. When the solder begins to melt, pull the lead out gently. This should leave a clean hole in the board. If not, insert a sharp object such as a toothpick into the hold to clean it out. A vacuum-type desoldering tool can also be used for this purpose.

3. Bend the leads of the new component to fit the holes in the board. Insert the leads into the holes in the boards so the component is firmly seated against the board, or as positioned originally. If it does not seat properly, heat the solder and gently press the component into place.

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint; do not apply too much solder. To protect heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clip the excess lead that protrudes through the board.

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

Metal Terminals. When soldering metal terminals (e.g., switch terminals, ground lugs, etc.), ordinary 60/40 solder can be used. Use a soldering iron with a 40- to 75-watt rating and a 1/8-inch side wedge-shaped tip.

Observe the following precautions when soldering metal terminals:

1. Apply only enough heat to make the solder flow freely. Use a heat sink to protect heat-sensitive components.

2. Apply only enough solder to form a solid connection. Excess solder may impair the function of the part.

3. If a wire extends beyond the solder joint, clip off the excess.

4. Clean the flux from the solder joint with a flux-remover solvent.

WARNING

Disconnect the instrument from the power source before replacing the components.

General. The exploded-view drawings associated with the Mechanical Parts List may be helpful in the removal or disassembly of components or subassemblies.

Circuit Board Replacement. If a circuit board is damaged beyond repair, either the entire assembly including all soldered components, or the board only, can be replaced. Part numbers are given in the Mechanical Parts List for either the completely wired or the unwired board.

Interface Board Repair

The 1340 uses strip-cabling to connect the Interface Board to the rear-panel connectors. Since the cables are permanently fastened to the Interface Board, we do not recommend replacement of either a cable assembly or the Interface Board. In the event of the failure of a single conductor in a strip cable, the following repair procedure is recommended:

Using a piece of No. 28 wire, strip and tin the ends of the wire. Solder the ends of the wire to the Interface Board and rear panel connector so as to shunt the defective conductor.

In the event of a failure such as a torn or cut cable, consult the nearest TEKTRONIX Field Office or representative. He can make arrangements for factory or service center repair, whichever is appropriate.

CALIBRATION PROCEDURE

Introduction

A complete calibration procedure for the 1340 is given in the following pages. Completing the procedure in sequence, returns the instrument to original performance standards. Limits and tolerances in this procedure are given as calibration guides, and are not instrument specifications.

Performance and calibration of the 1340 should be checked after each 500 hours of operation or at least every 6 months to ensure that the instrument is operating correctly. Recalibration of the instrument may be performed periodically as part of a regular maintenance schedule, or may be done whenever the need is indicated by the performance check procedure. Portions of the instrument may require recalibration if components have been replaced or other electrical repairs have been made to the circuitry.

Any required maintenance should be performed before recalibration. Trouble observed during calibration should be corrected using the techniques discussed earlier in this section.

Test equipment Required

The following test equipment or its equivalent is required for complete calibration of the 1340. Specifications given are the minimum necessary for accurate calibration of this instrument. All test equipment is assumed to be correctly calibrated and operating within the given specifications. If equipment is substituted, it must meet or exceed the specifications given for the recommended equipment.

1. **Variable Autotransformer.** Must be capable of supplying 280 volt-amperes over a range of 90 to 136 volts (180 to 272 volts for 230-volt nominal line). If the autotransformer is not equipped with an output voltmeter, monitor the output with an AC voltmeter having a fullscale reading of at least 136 volts RMS (115-volt operation) or 272 volts RMS (230-volt operation). Suggested equipment: General Radio W10MT3A Variac Autotransformer (115-volt operation) or General Radio W20HMT3A Variac Autotransformer (230-volt operation).

2. **Precision DC Voltmeter.** Accuracy, within ±0.1%; meter resolution, 100 millivolts or less; range, zero to 6 volts. Recommended equipment: Fluke Model 825A Differential DC Voltmeter.

3. **Test Oscilloscope.** Bandwidth, DC to 5 MHz; minimum deflection factor, five millivolts/division; accuracy, within 3%. TEKTRONIX Type 453 recommended.

4. **1X Probe with BNC Connector.** TEKTRONIX P6011 Probe recommended.

5. **DC Ammeter.** Range, zero to 10 amperes; accuracy, 3%. Total resistance including test leads, less than 0.1 ohm. Triplett Model 630-NA recommended.

6. **Adjustment Tool.** Insulated screwdriver, 1-1/2 inch shaft, non-metallic. TEKTRONIX Part Number 003-0000-00.

7. **Test Load.** Obtain a 10 Ω, 5 watt, 10% resistor and two alligator clips. Solder an alligator clip to each lead. This load is used for loading the +5-volt supply.

8. **Circuit Card Extender.** Part No. 670-1263-00.

PROCEDURE

General

Best overall performance is provided if each adjustment is made to the exact setting, even if the "CHECK. . ." step indicates that instrument operation is within the stated tolerance.

The procedure uses the equipment listed under Test Equipment Required. If substitute equipment is used, control settings or test equipment connections may need to be altered to meet the requirements of the equipment used.

Preliminary Procedure

1. If the instrument is rackmounted, extend it to the full length of the rails.

2. Remove the top and bottom covers from the instrument.

3. Remove all plug-in circuit cards from the 1340.

4. Connect the autotransformer and other test equipment to a suitable power source.

5. Connect the 1340 to the autotransformer output.

6. Set the autotransformer output to the center voltage of the range selected by the Line Voltage Selector assembly on the rear panel of the 1340.

7. Turn on the 1340 and the test equipment. Allow at least 20 minutes warmup for the 1340 at 25°C ±5°C before checking the instrument to the listed tolerances.

1. Adjust +5-Volt Regulator

a. Connect the 10 Ω test load across C148 (see Fig. 3-2).

b. Insert the Circuit Card extended in connector J7.

c. Connect the precision DC voltmeter between pin 1A/1B, +5 volts, and pin 50A/50B ground.

d. CHECK—Meter reading; +5 volts ±0.1 volt.

e. ADJUST—R130 for +5 volts.

f. Remove the meter leads.

2. Check +5-Volt Ripple

a. Set the deflection factor of the test oscilloscope to 20 mV/div, and the sweep rate to 5 ms/div, line-triggered.

b. Connect the 1X probe from the vertical input of the test oscilloscope to the +5-volt test point on the Regulator board (see Fig. 3-2). Connect the probe ground lead to a convenient grounding point.

c. CHECK—Test oscilloscope display for 5 divisions or less (100 mV or less) of ripple while varying the autotransformer output voltage throughout the regulating range.

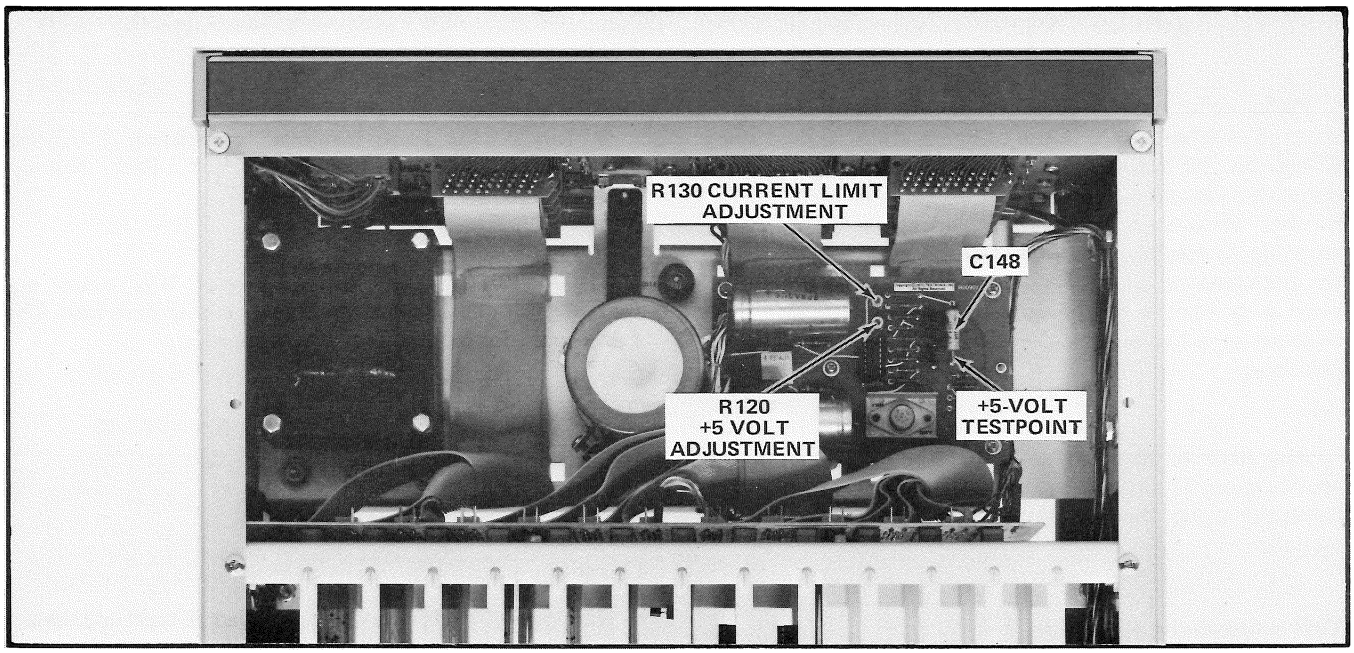


Fig. 3-2. Test points and adjustments on the Regulator board.

d. Remove the test oscilloscope probe from the 1340.

3. Check −1-Volt

a. Connect the precision DC voltmeter leads between extender card pin B43, −1-volt, and pin A50/B50, ground.

b. CHECK—Voltmeter reading of −1 volt ±0.3 volt.

c. Disconnect the voltmeter leads from the extender card.

4. Check −1-Volt Ripple

a. Change the oscilloscope deflection factor to 5 mV/div.

b. Connect the probe to pin B43 of the extender card.

c. Connect the probe ground lead to pin A50/B50.

d. CHECK—Test oscilloscope display of two divisions or less (10 mV or less) of ripple while varying the autotransformer output throughout the regulating range.

e. Remove the oscilloscope probe from the extender card, and set the autotransformer output to the center of the regulating range.

5. Check +5-Volt Current Limiter

a. Turn off the 1340.

b. Remove the 10 Ω test load from across C148.

c. Set the ammeter to the 12 A scale.

d. See Fig. 3-3. Connect the ammeter leads to the + and − ammeter lead connection points.

e. Turn on the 1340.

f. CHECK—Meter reading of less than 5 amperes.

g. ADJUST—R120 for 5 amperes or less, (see Fig. 3-2).

h. Turn off the 1340, and remove the meter leads.

i. Re-install the circuit cards in their proper positions. Re-install the top and bottom covers, then return the 1340 to its normal operating position in the equipment rack. The calibration procedure is complete.

NOTE

After adjustment of the 1340 power supplies, some of the 1340 circuit cards may require adjustment and calibration. Refer to their respective instruction manuals for calibration procedures.

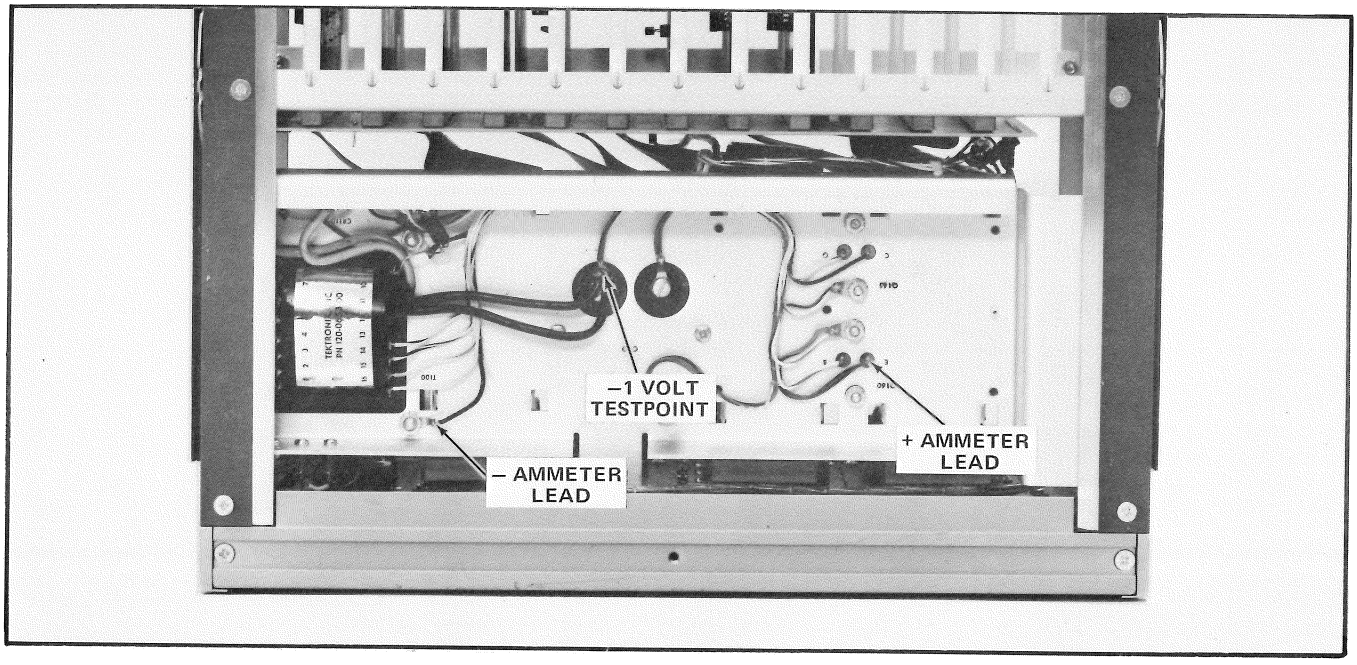


Fig. 3-3. Test points on bottom of chassis.

APPLICATIONS

General

The combination of circuit cards installed in a 1340 Data Coupler is determined by the interface and multiplexing needs of the system. The information in this section is provided as a guide for the selection of appropriate 1340 circuit cards. The information includes: a list of optional interface-packages for typical applications, a description of the purpose and content of each interface-package, a list of design considerations for computer-oriented circuit cards, and examples of typical Data Coupler applications.

NOTE

Circuit cards for a variety of system applications can be obtained by ordering from the list of optional interface-packages in the TEKTRONIX Catalog. If a particular system application has requirements that cannot be accomodated by the available circuit cards, consult your local TEKTRONIX Field representative concerning custom designed circuit cards.

1340 OPTIONAL INTERFACE PACKAGES

An Interface-Package consists of an Instruction Manual, one or more circuit cards, and when required, special 1340 to device cables. The packages are classified according to function; Control, Specific Device, General Purpose, and Special Purpose. The cards of all the Control packages and some of the cards of the other packages must be installed in specific connectors. If a system requires circuit cards that use the same connectors, a second Data Coupler may be connected in parallel to provide the additional facilities. See Typical 1340 Applications for an example of a system using two Data Couplers.

Table 1 lists the Optional Interface-Packages, their part numbers, and their circuit card connector assignments. Part numbers for the individual circuit cards that make up a package are listed under Interface Package Description.

CAUTION

Do not install a circuit card, that is designed for use in connector J1, in any other connector. +19 V is applied to pins A48 and B48 and −19 V is applied to pins A49 and B49 of connectors J2-J12. These pins of connector J1 are usually used for logic levels.

Control Packages

The Control packages are used to direct data exchange between the System's control unit and the other 1340 Interface Package circuit cards. Every 1340 installation requires the use of one Control Interface Package.

PDP-8/L Computer, 021-0008-00. For use with Digital Equipment Corp. PDP-8/L. Permits bi-directional data exchange between computer and any other Interface Package except 021-0079-00 (32-bit Output & Echo). Package consists of:

3 circuit cards; Device Selector (670-1261-00), Data To (670-1271-00), and Data From (670-1272-00).

3 interconnecting cables (012-0260-00, 012-0261-00, and 012-0262-00)

Instruction Manual (070-3099-00).

PDP-11 Computer, 021-0063-00. For use with Digital Equipment Corp. PDP-11. Permits bi-directional data exchange between computer and any other Interface Packages. Both direct memory access and programmed data transfers are allowed. Package consists of:

4 circuit cards; Partial Decoder (670-2159-00), Device Selector (670-2160-00), Data (670-2161-00), and Master (670-2162-00).

Cable (012-0383-00).

Instruction Manual (070-3093-00).

ASCII Data, 021-0061-00. The circuit cards in this package provide bi-directional data exchange between a measurement system and a computer-Teletype system, using the American Standard Code for Information Interchange (ASCII). With the 1340 responsive to the ASCII code, an operator can communicate with the Computer-Measurement-Teletype system using languages such as BASIC, FOCAL or FORTRAN. This package consists of:

2 circuit cards; ASCII Input (670-2163-00), and ASCII Output (670-2164-00).

Instruction Manual (070-3092-00).

TABLE 1

Function	Package	Part Number	Circuit Card Connector Assignment J1 J2 J3 J4 J5 J6 J7 J8 J9 J10 J11 J12
Control	PDP-8/L Computer	021-0008-00	X X X
	PDP-11 Computer	021-0063-00	X X X*
	ASCII Data	021-0061-00	X X
	Data Logging	021-0011-00	X X
Specific-Device Data Exchange	Paper Tape Rdr/ Punch	021-0083-00	J2-12, (except when used with 021-0007-00;then use J4)
	3S5 or 3S6 Program Control	021-0084-00	J2-12
	3T5 or 3T6 Program Control	021-0085-00	J2-12
	R1140 Program Control	021-0086-00	J2-12
	R230 Program & Data	021-0087-00	J2-12
	R230/R240 Program	021-0007-00	X X X X X
	HP-DMA Data Link	021-0089-00	X
General-Purpose Data Exchange	16-bit Input & Output	021-0014-00	J2-12
	32-bit Input	021-0028-00	J2-12
	32-bit Output	021-0013-00	J2-12
	32-bit Output & Echo Check	021-0079-00	J2-12
Special Purpose	Waveform Digitizing	021-0029-00	X X
	Reference-Signal	021-0052-00	X X

*DMA OPTION

Options:

ASCII Interface to PDP-8 Cable (012-0368-00)

ASCII Interface to PDP-11 Cable (012-0378-00)

ASCII Interface to HP-2100 Series Cable (012-0388-00)

Data Logging, 021-0011-00. For use with either Peripheral Equipment Corp. Model 1807-9 Incremental-Write Tape Transport or Remex paper tape Reader-Reperforator Combination Model RAR-2075 (020-0058-00). Accepts and logs data, from any General Purpose Package, or 021-0007-00 (R230/R240 Interface Package) or 021-0087-00 (R230 Interface Package). Package consists of:

2 circuit cards; Data Formatter (670-1335-00) and Data Multiplexer (670-1336-00).

Instruction Manual (070-3053-00).

For magnetic tape data logging order 021-0011-00 and Interconnecting Cable 012-0308-00.

For paper tape data logging and duplicating order 021-0011-00 and Paper Tape Reader/Punch Interface 021-0083-00.

Specific Device Packages

The Interface Packages designed for specific system instrument or Device applications are described as follows:

Paper Tape Reader/Punch, 021-0083-00. For use with a Remex Reader/Punch (020-0058-00). This package is compatible with any Control Interface Package. Performs all paper tape functions controlled by R240 when used with 021-0007-00 (R230/R240 Interface Package). Permits paper tape duplication without other interface circuitry. Package consists of:

Circuit card, Paper Tape Reader/Punch (670-2158-00)

Cable (012-0131-15)

Instruction Manual (070-3095-00).

3S5 or 3S6 Program Interface Package, 021-0084-00. For control of all programmable functions of the 3S5 or 3S6 Sampling Unit. Package consists of:

Circuit card 3S5 or 3S6 program (670-2117-00)

Cable (012-0131-16)

Instruction Manual (070-3096-00).

3T5 or 3T6 Program Interface Package, 021-0085-00. For control of all programmable functions of the 3T5 or 3T6 Sampling Sweep. Package consists of:

Circuit card 3T5 or 3T6 program (670-2117-00)

Cable (012-0389-00)

Instruction Manual (070-3097-00).

R1140A Program Interface Package, 021-0086-00. For control for all programmable functions of the R1140 Programmable Power Supply. Allows all five supplies within the R1140 to be programmed independently. Package consists of:

Circuit card, R1140 program, (670-2117-00)

Cable (012-0390-00)

Instruction Manual (070-3098-00).

R230 Program and Data Interfacing Package, 021-0087-00. For read-out of measurement data and control of all programmable functions of the R230, except Limits. Package consists of:

3 circuit cards; Reference Zone (670-2117-00), Comparator & Trigger (670-2117-00), and Measurement Result (670-1419-01).

4 cables (012-0131-17, 021-0131-18, 012-0131-19, and 012-0131-20).

Instruction Manual (070-3099-00).

NOTE

Limits may be programmed if desired by adding an additional Output & Echo check and 670-2117-00 and cable 012-0131-17.

R230/R240 Program and Data Interface Package, 021-0007-00. For use with measurement systems controlled by the R240 Program Control Unit. Selects R240 test address and reads out R230 measurement-result data including limit lights. Header information may be read from a separate source. R240 test address is read out for use by computer when test sequence is controlled by paper tape or disc. The 1340 front-panel MODE control allows the R240 to operate with a paper tape reader/punch through the 021-0083-00 (Paper Tape Reader/Punch Interface). Package consists of:

5 circuit cards; Test Number (670-1260-00), Test Address (670-1265-00), 230 Data (670-1267-00), Header (670-1268-00), and R240 Test I/O (670-1269-00).

4 Interconnecting cables; (012-0131-08, 012-0131-09, 012-0131-10, and 012-0131-11).

Instruction Manual (070-3050-00).

HP-2100-Series DMA Interface Package, 021-0089-00. For transmitting high-speed data from the 021-0029-00 (Digitizing circuit card) to Hewlett Package 2100-series computers. Requires the 021-0061-00 (ASCII Interface) in the 1340 and HP Microcircuit Interface, TTY Interface, and DMA Interface cards in the HP computer. Package consists of:

Circuit card, HP DMA (670-2147-00).

Interconnecting cable (012-0385-00).

Instruction Manual (070-3100-00).

General Purpose Packages

The following Interface Packages are for general-purpose data-exchange applications. Some circuits on the general purpose circuit cards are connected with straps to increase the cards adaptability.

16-Bit Input/16-Bit Output Interface Package, 021-0014-00. For two-way data exchange—16 bits each way. Hard-wired choice of logic levels. Package consists of:

Circuit card, 16-Bit I/O (670-1333-00)

Instruction Manual (070-3056-00).

32-Bit Input Interface Package, 021-0028-00. For use with data sources such as counters, register, DVM's, etc. Hard-wired choice of logic levels. Package consists of:

Circuit card, 32-Bit In (670-1419-00)

Instruction Manual (070-3054-00).

32-Bit Output Interface Package, 021-0013-00. For computer control of programmable instruments, test fixtures, systems, etc. Hard-wired choice of logic levels. Package consists of:

Circuit card, 32-Bit Out (670-1334-00)

Instruction Manual (070-3055-00).

32-Bit Output and Echo Check Interface Package, 021-0079-00. For computer control of programmable instruments, test fixtures, systems, etc. Open collector NPN output provided. Output latches, once set, may be read back to verify program data. Package consists of:

Circuit card, 32-Bit Out/Echo (670-2117-00)

Instruction Manual (070-3094-00).

Special Purpose

The Waveform Digitizer and Reference Frequency packages extend a 1340's applications beyond the interface dimension. The Waveform Digitizer package converts analog information to digital information to permit computer analysis of a measurement. The Reference Frequency package provides a means of using a computer to generate correction factors for the measurement system's signal path errors.

Waveform Digitizing Package, 021-0029-00. This package consists of the following:

2 circuit cards; Digital to Analog Converter (670-1420-00), and Analog to Digital Converter (670-2107-00).

Interconnecting cable (021-0309-00).

Instruction manual (070-3057-00).

The use of this package requires the installation of Field Modification Kit, 040-0577-00, in the system's Type 3T5 or Type 3T6.

The Waveform Digitizing circuit cards can be operated in three modes:

1. Scan, Free Run. This is a non-digitizing mode. It can be selected with the 1340 front panel MODE switch or by activating the CLEAR programming line to these circuit cards.

2. Scan, Sample and Hold. This mode is used to digitize vertical signal magnitudes at a series of sequential horizontal sweep time-points (up to 1024 per sweep). Relating the horizontal sweep to an oscilloscope display that is calibrated for 100 time- points per centemeter, the 1024 time-points occur from 0 to 10.23 cm. The signal magnitudes of both vertical channels (A and B) can be digitized at each of the 1024 time-points of a complete sweep.

3. Park, Sample and Hold. This mode implies equivalent time sampling oscilloscope operation. It is used to make repeated digital conversions of the vertical signal magnitude at a single horizontal time-point. It is also used for sweep initializing prior to using the Scan mode.

NOTE

See Instruction Manual 070-3057-00 for detailed programming instructions.

Reference Signal Package, 021-0052-00. This package contains the following items:

2 circuit cards, Vertical Reference (670-1767-00), and Horizontal Reference (670-1768-00).

Interconnecting cable (021-0367-00).

Instruction manual (070-3091-00).

The Vertical and Horizontal reference circuit cards provide accurate amplitude and timing reference signals. These signals are used to derive the systems signal path error and enable the computer to produce corrected measurement readouts that are accurate to within 1%. The correction factor that must be applied to a measurement to produce the desired readout accuracy is the calibration coefficient for the deflection factor or sweep rate used in making the measurement.

If a system uses the 3S5-3T5 or 3S6-3T6 instrument combinations, a calibration coefficient can be established for each deflection factor and the sweep rates from 500 ms/div to 1 ns/div. Establishing a calibration coefficient does not involve deflection factor gain or sweep timing current adjustments. A calibration coefficient is derived by using the computer to compute the ratio of a reference signal value at the input to the signal path as compared to the measured value at the output of the signal path. When the calibration coefficients for the deflection factors and sweep have been derived, they may be stored by the computer and applied to every measurement.

CIRCUIT CARD DESIGN CONSIDERATIONS

Special system applications can be accommodated with custom-designed circuit cards. The following items are listed as design considerations for computer-oriented circuit cards.

1. Reserved Connectors. Connector J1 is reserved for the Device Selector Card, J2 for the Data Out card, and J3 for the Data In card. In applications where the computer has a bi-directional data bus, a Data In and Out card is used in J2, making J3 available for other uses.

2. READY LINES. 22 lines, 2 for each card, connect J1 with all the other circuit card connectors, J2-12, for the purpose of ascertaining a circuit card's READY state. A low logic level is usually used to indicate that a card is ready to send or receive data. Computer programs can be written to require a READY response to an interrogation signal before proceeding with the program. If a circuit cards function is such that the card is always ready for activation, that cards ready line may be wired to constantly indicate a READY state. For those cards with functions that involve not-ready periods, circuitry must be provided to indicate the cards ready and not-ready states.

In applications where the computer is INTERRUPT programmed, the 1340 Ready Signals can be used to generate the necessary Interrupt signals.

3. SELECT Lines. After the computer has determined that a circuit card is in a READY state, the desired circuit-card function is enabled with a Select signal, usually a low-logic level signal from the circuit card in connector J1. Circuit cards J2 through J12 are each provided with two select lines that are connected to Device Selector J1. The selector lines from J1 are designated Select 1 (J2), Select 2 (J2), Select 1 (J3), Select 2 (J3), etc. A pair of the select lines can be used in conjunction with the Data Out and Data In strobe lines to enable four individual functions on a single card. For example; Select 1 (J2) ANDED with Data Out, enables function 1; Select 1 (J2) ANDED with Data In, enables function 2; Select 2 (J2) ANDED with Data Out, enables function 3; and Select 2 (J2) ANDED with Data In, enable function 4.

4. DATA OUT LINES are 16 lines, $\overline{\text{DO 1-1}}$ thru $\overline{\text{DO 4-8}}$, bussed to all card connectors except J1; "data out" means data from the computer or other controller. These lines are usually used as a unidirectional data bus between a system control data card in J2 or J3 and all other cards in the 1340. Line activation is usually with low-logic levels.

5. DATA IN LINES are 16 lines, $\overline{\text{DI 1-1}}$ thru $\overline{\text{DI 4-8}}$, bussed to all card connectors except J1; "data in" means data to the computer or other system controller. These lines are usually used as a unidirectional data bus between data source cards in the 1340 and the system control data card in J2 or J3. Line activation is usually with low-logic levels. The DATA IN LINES must be driven with open collector devices.

6. DATA OUT STROBE is a single line, $\overline{\text{DO STROBE}}$, bussed to all circuit card connectors. This line is usually activated with a low-logic level to indicate that the computer output data is on the DATA OUT LINES. The computer interface circuitry must provide enough delay between the start of a SELECT signal and the start of a $\overline{\text{DO STROBE}}$ to allow adequate settling time for the data lines and the instrument being activated. To minimize the effects of Gate propagation and transmission line delays, the DATA OUT STROBE line should be gated to a latching circuit at or near the instrument be controlled.

7. DATA IN STROBE is a single line, $\overline{\text{DI STROBE}}$, bussed to all circuit card connectors. This line is usually activated with a low-logic level to indicate that the computer is accepting data from the 1340 DATA IN LINES. With the PDP-8 L Interface Package 021-0008-00, $\overline{\text{DI STROBE}}$ indicates that the computer is outputing the least significant 8 bits of a 16 bit word. The DATA IN STROBE line should be ANDED with the DATA IN LINES as near (electrically) the computer as possible.

8. INITIALIZE is a single line, $\overline{\text{INITIALIZE}}$, bussed to all circuit card connectors in the 1340. The line is usually activated with a low logic level and is used to set all circuits to their beginning or initial condition. The activating signal is generated by power up of the 1340, by the computer, or by rotating the 1340 mode switch.

9. CLEAR is a single line, $\overline{\text{CLEAR}}$, bussed to all circuit card connectors in the 1340. This line is usually activated with a low-logic level that is generated under program control to indicate that a data sequence is complete. It can be generated by some 1340 interface circuit cards or by rotating the 1340 mode switch.

10. MODE A, B, C are three lines, $\overline{\text{MODE A}}$, $\overline{\text{MODE B}}$, and $\overline{\text{MODE C}}$ which are bussed to all circuit card connectors in the 1340. These lines are activated with low-logic levels generated by the Mode switch of the 1340. Usually the Mode A position of the Mode switch is used as the normal mode, i.e., Computer control. Modes B and C are used for special functions i.e., disconnecting the computer from the 1340.

11. +19 VOLTS, and −19 VOLTS are two lines bussed to all 1340 circuit card connectors except J1. These two lines provide unregulated power supplies that can be regulated by any of the 1340 circuit cards. Each supply will provide up to 19 VDC at up to 500 mA (total for all cards). Manuals for the Interface Packages using these supplies indicate current requirements. System designers should assume that the total current available is less than 500 mA from each supply.

12. COUPLER BUSY is a line which when grounded will cause the 1340 front panel BUSY lamp to light.

13. MISCELLANEOUS. Most circuit card connectors have six uncommitted lines terminated at square pins on the rear of the mother board. These may be used with appropriate cabling to obtain additional connections between cards. Some circuit cards also have connections to adjacent card sockets on pins A45, A46, B45, and B46. Refer to the 1340 Interconnecting board schematic.

14. SPARE BUS. Pins A40, A43, A44 on J2 thru J12 are bussed to all card sockets, and are usually uncommitted.

15. SYSTEM CONTROL or COMPUTER INTERFACE assemblies. When designing circuit cards for this type of functions, ensure that the circuitry will:

a. Generate $\overline{\text{INITIALIZE}}$ on power up of the 1340.

b. Terminate each $\overline{\text{DATA OUT BUS}}$, $\overline{\text{DATA IN BUS}}$, $\overline{\text{INITIALIZE}}$, $\overline{\text{CLEAR}}$, $\overline{\text{DO STROBE}}$, and $\overline{\text{DI STROBE}}$ line with a 620 ohm resistor to +5 V, (36 total).

c. Drive all $\overline{\text{DATA OUT BUS}}$, $\overline{\text{INITIALIZE}}$, $\overline{\text{DO STROBE}}$ and $\overline{\text{DI STROBE}}$ (also $\overline{\text{CLEAR}}$ if used) with open collector devices capable of sinking 40 mA or more. When the 8 mA for the pull up resistors is subtracted, the remaining 32 mA is available for the bus. This provides an average of 3.2 mA for each card.

d. Load the $\overline{\text{DATA IN BUS}}$ lines with no more than 2 TTL loads.

e. Inhibit data exchanges with the computer when the 1340 Mode switch is not in Mode A position.

16. DATA EXCHANGE or SPECIAL PURPOSE circuit card assemblies should be designed to ensure that they will:

a. Drive the $\overline{\text{DATA IN BUS}}$ lines with open collector devices capable of sinking 16 mA (10 TTL loads).

b. If used, drive the $\overline{\text{DATA OUT BUS}}$, $\overline{\text{DI STROBE}}$, $\overline{\text{DO STROBE}}$, $\overline{\text{INITIALIZE}}$, and $\overline{\text{CLEAR}}$ with open collector devices capable of sinking 40 mA (25 TTL loads).

c. Load $\overline{\text{DATA OUT BUS}}$, $\overline{\text{DI STROBE}}$, $\overline{\text{DO STROBE}}$, $\overline{\text{INITIALIZE}}$, and $\overline{\text{CLEAR}}$ with no more than 2 TTL loads. When there is more than one card in an assembly, an average of 2 TTL loads should be maintained.

d. If meaningful, drive the 1340 BUSY lamp when the condition of the peripheral to which the assembly is connected, is liable to interfere with normal operation of the computer. Each card may have a BUSY lamp of its own.

e. Do not load the +5 V supply with more than 660 mA. When there is more than one card in an assembly, an average of 660 mA per card should be maintained. If a

system uses fewer than twelve 1340 circuit cards, and will not be expanded, 8 Amps total may be used for all cards.

TYPICAL 1340 APPLICATIONS

The circuit cards used in the following examples of 1340 applications are from the Interface Packages listed in Table 1. Detailed circuit descriptions, circuit diagrams, etc, of these circuit cards are given in the Instruction Manuals that are provided as part of each Interface Package.

The examples of 1340 Data Coupler applications include:

1. Computer Controlled System. (Fig. 4-1.)

2. Data Logging. (Fig. 4-2.)

3. System with Waveform Digitizing. (Fig. 4-3.)

4. System with Vertical and Horizontal Reference. (Fig. 4-3.)

5. System with two 1340 Data Couplers. (Fig. 4-4.)

Computer Controlled System

A S-3150 TEKTRONIX Automated Measurement System is used for this example. Fig. 4-1 is a Data Coupler oriented block diagram of the System. The function of each circuit card in this example is described as follows:

Device Selector (P1), interfaces the system's controlling unit (computer) with the other circuit cards of the 1340.

NOTE

The "P" number-associated-with a circuit card, signifies the circuit cards connector assignment.

Data Out (P2), connects the computer output data lines to the data bus lines in the 1340. The bus connection circuitry consists of parallel gates, which are enabled by the Data Coupler Mode Switch.

Data In (P3), furnishes data from the Data Coupler interface bus to the computer. It may also divide the data (totalling 16 parallel bits) into two eight-bit bytes suitable for use by small computers such as the PDP-8/L. The circuit (in this case) consists of two sets of parallel gates, each set enabled by separate signals from the computer via P2.

Tape Punch/Reader (P4), controls data exchange between the interface bus and the tape reader or the tape punch. The circuit card contains the necessary control and gating circuitry for data exchange.

240 Test I/O (P5), connects the Type 240 Tape input and output lines to the 1340. Data can be sent from the Tape Reader via the interface bus to the Type 240, or from the Type 240 via the interface bus to the Tape Punch. A data exchange can also occur between the Type 240 and the computer or other peripheral device. This card makes it possible for the computer to have access to the disc memory (accessory to the Type 240) or to modify a test in the Type 240 output register.

240 Disc Address (P6), permits control of the Type 240 Disc Test Address by the interface bus. Data can be obtained from either the computer or from other interface cards, via the interface bus, to generate a disc test address for the Type 240. A storage register on the circuit card holds the address until the Type 240 is ready to accept new address data.

Test Number (P7), during the time the Type 240 has a particular test in its register, the address (i.e., test number) is available at J302. The Test Number card (P7) stores this data and furnished it to the interface bus. With each successive test, a new number is stored in the Test Number registers.

Header (P8), is a 32-line to 16-line converter. It accepts header (test identification and descriptive information) data from an external source, such as a test station control unit, divides it into two 16-bit parallel bytes, and upon command, presents the bytes to the interface bus. The header data is typically used by such receivers as the computer, tape punch, etc.

32-Bit General Input (P9), accepts up to 32 parallel bits and converts this data to two 16-bit bytes for application to the interface bus. In this example, the card is used to convert readout data from a digital voltmeter having connections for measurement result readout. The card may be used for a variety of input interface applications.

230 Data (P10), contains the necessary control and gating circuitry for converting the 28 Type 230 Readout lines into two bytes, one of 16 bits, the other of 12 bits. The data so arranged may then be sent to the computer, punched on tape, or sent to another peripheral device, all via the coupler interface bus.

Fig. 4-1. Computer-controlled automated measurement system; block diagram.

Fig. 4-2. Data logging; block diagram.

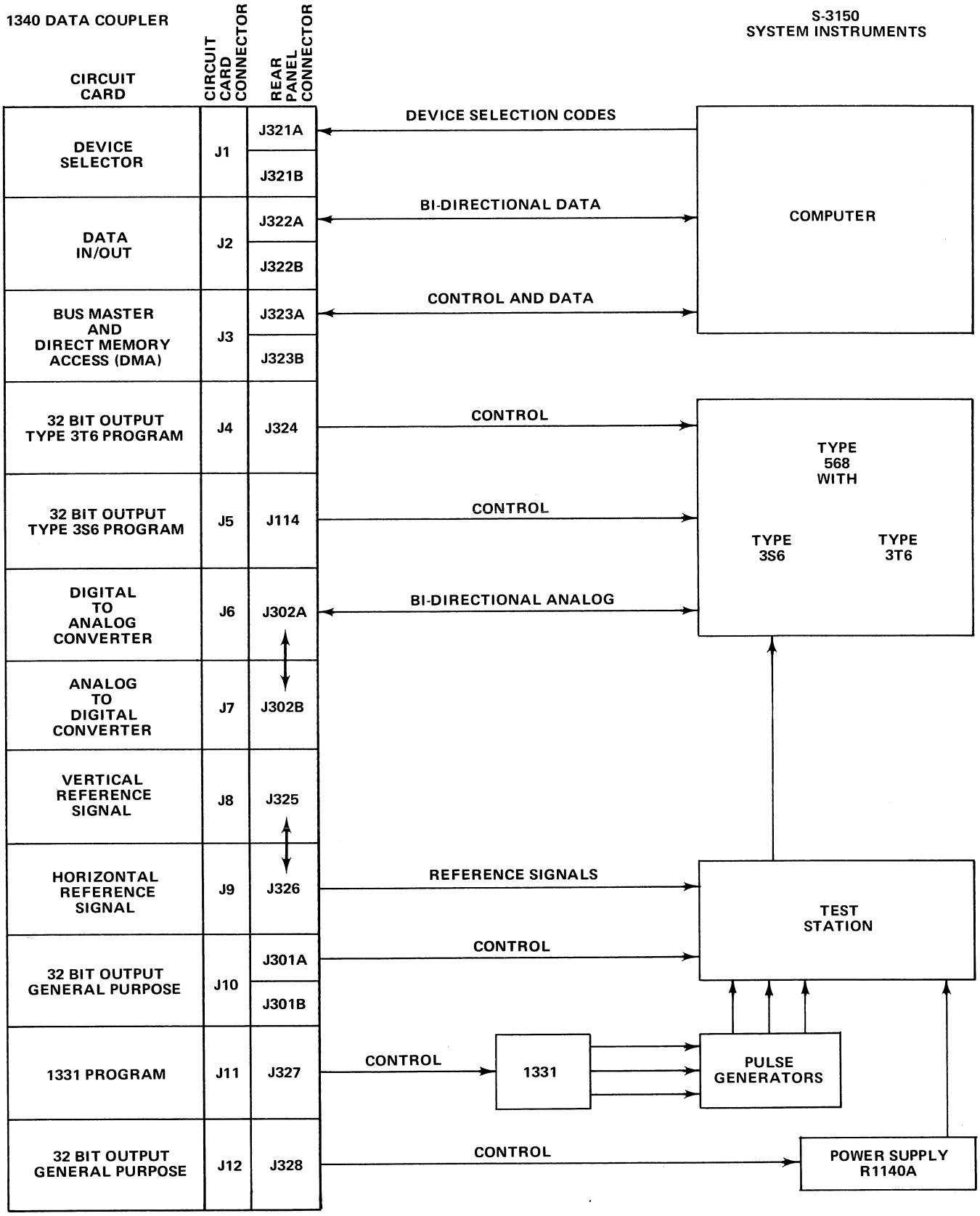


Fig. 4-3. Computer-controlled system with the Waveform Digitizing and Reference Signal options.

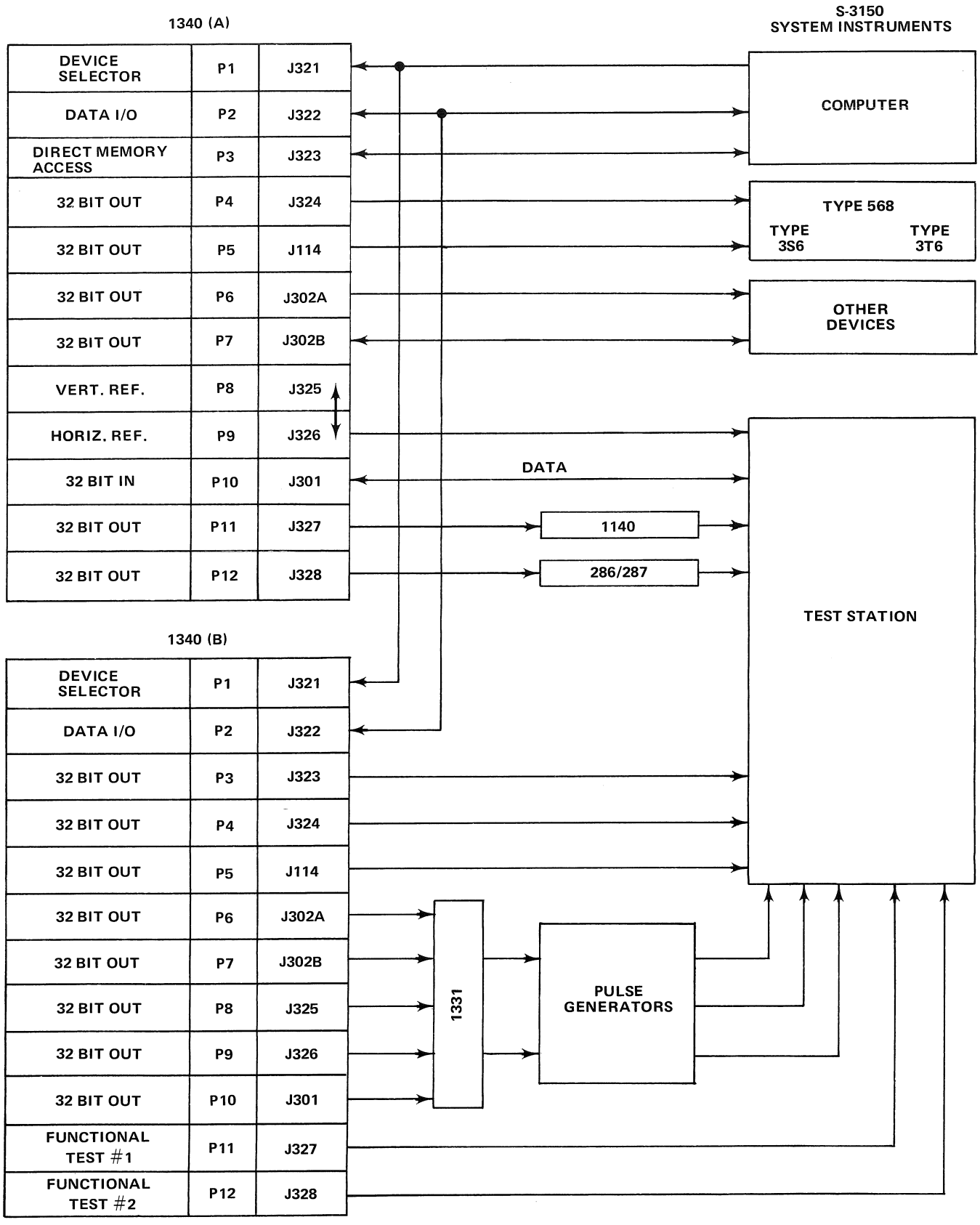


Fig. 4-4. Automated Measurement System using Two Data Couplers.

Functional Test I (P11), this card is one of the two interface cards used to control functional testing of integrated circuits under test by the S-3150. The computer-generated test word is transmitted via this card to the 1801 (or 1802).

Functional Test II (P12), this card is used to control the fixturing of the Test Station during functional testing. It also transmits (under computer control) the output word from the device under test to the computer.

Operation

System Control Mode. Setting the 1340 MODE switch to System Control gives the computer master control over the coupler. When the computer sends a device code (a numerical instruction) designating which device is to be selected, the Device Selector decodes the instruction and activates the appropriate SELECT line. Typically the first instruction activates P6, causing it to be connected to the DO bus permitting the computer data on the bus to control the disc test address. After the Type 240 receives the address, the computer sends a start command to the Type 240. This initiates the measurement or measurement sequence.

When a measurement is completed, the Type 240 sends a Gated Print Command to the coupler. The signal is sent to the Device Selector to notify the computer that the measurement data is ready.

The first device selected after PRINT COMMAND is usually the Header Control. The header data identifies the Device type and can include other information. The next device code can then be generated, transferring the Type 230 readout data to punched tape, the computer, or both.

During this time, the DVM may have been required to make a measurement. If a measurement has been made, similar operations should occur to transfer the DVM readout data to the appropriate receiver via the 32-bit input card.

240 Control Mode. When the 1340 Mode switch is set to 240 Control, the computer is functionally disconnected from the coupler. The measurement system acts as though the coupler did not exist.

Tape Duplicate

When the 1340 Mode switch is set to Tape Duplicate, and the Tape Reader has a tape installed, the Tape Punch is activated and it duplicates the tape installed in the Tape Reader. The operation stops at the end of the tape.

DATA LOGGING

Introduction

Fig. 4-2 is a block diagram showing the data coupler configured to provide DATA LOGGING for a System that does not have a computer.

Only two of the assemblies (P1 and P2) in this system differ from those shown in Fig. 4-1.

Data Multiplexer (P1). The Data Multiplexer is the master control for the data coupler in this system. It contains sequencing circuitry that enables the other assemblies for the transmission of data to the 16 line DATA IN bus.

Data Formatter (P2). This assembly is similar to the P3 Data In circuit card discussed previously. Its purpose is to change the 16 bits of data to two eight-bit bytes suitable for an Incremental Write Tape Transport or a Tape Punch.

Operation

System Control Mode. The Data Multiplexer circuit card (P1) has master control of the coupler. P1 selects P8, P9, P7, P10, P11, P12, and P3, in this order.

When a Print Command signal from the Type 230 (via the Type 240) is applied to the coupler, and Log Header signal is applied to P8, P8 is selected. (A case where the Log Header signal does not occur is discussed later.) P8 furnishes test identification, which is transmitted via the coupler data bus to the Data Formatter card (P2). P2 then sends the data to the mag-tape unit for recording. The Data Multiplexer selects the next data source (P9, in this case) and causes its data to be recorded. The Data Multiplexer then successively enables P7, P10, P11, P12 and P3 (the last three are optional). As each assembly is enabled, its data is applied to the interface bus and transmitted by P2 to the Incremental Tape Transport for recording. In the case where the Log Header signal does not occur, the counter in the Data Multiplexer is preset to skip the P8 and P9 data sources. If the system program does not activate the Log Data bit, the sequence stops after P9.

The Data Multiplexer assembly has a selector switch pair for recorder selection. If both switches are set to P (two selections: M and P), recording is on punched tape instead of magnetic tape. The data is now transmitted through the Data Formatter circuits via the interface bus to P4, which interfaces to the tape punch. System operation is identical to that described previously, except for the different recording medium.

240 Control Mode. When the 1340 MODE switch is set to 240 CONTROL, the Data Coupler is functionally disconnected from the 240 except that Tape punch and read operations are conducted via the circuit cards P4 and P5.

Tape Duplicate Mode. When the 1340 MODE switch is set to TAPE DUPLICATE, the Tape Punch will duplicate a tape that is loaded in the Tape Reader. This operation stops with the end of the tape in the Tape Reader.

WAVEFORM DIGITIZER

The Waveform Digitizer package converts analog measurement information to digital information to permit computer analysis. Fig. 4-3 is a block diagram of a measurement system with the waveform digitizing option. As shown in the diagram, the Digital to Analog converter circuit card (D-A) must be installed in connector J6, and the Analog to Digital circuit card (A-D) must be installed in connector J7. These two circuit cards are electrically and functionally interdependent. Connections to the system's Vertical amplifier and Horizontal sweep units are via circuit card connector J6.

A measured waveform is digitized by converting the Vertical amplifiers output magnitude at a series of Horizontal sweep time-points to digital equivalents. The magnitudes of two vertical amplifier channels can be converted at a given time-point. The D-A circuitry converts control logic from the DO bus to sweep control instructions that are compatable with the 3T6 Sampling Sweep Unit. The A-D circuitry converts the A channel and B channel outputs of a 3S6 Sampling Unit to digital equivalents for application to the DI bus.

Operation

The Waveform Digitizer package can be operated in three modes:

1. Scan Free Run. This is a non-digitizing mode. It can be selected by a front panel switch or by program control instructions from a computer.

2. Scan, Sample and Hold. This mode is used to digitize the systems vertical amplifiers output amplitudes at a series of horizontal sweep time points.

3. Park, Sample and Hold. This mode is used to make repeated digital conversions of the vertical amplifiers output at a single time-point.

Vertical and Horizontal Reference

The Vertical and Horizontal reference circuit cards are parts of an optional interface package that provides accurate amplitude and timing reference signals for Automated Measurement Systems. An example of a system with the Vertical and Horizontal Reference option is shown in Fig. 4-3. With this option, it is possible for a system to account for signal path errors and correct its measurements to produce readouts that are accurate to within 1%. The correction factor applied to a measurement for readout accuracy is the calibration coefficient for the deflection factor or sweep rate used to make the measurement.

If a system uses the 3S5-3T5 or 3S6-3T6 instrument combinations, a calibration coefficient can be established for each deflection factor and the sweep rates from 500 ms/div to 1 ns/div. Establishing a calibration coefficient does not involve deflection factor gain or sweep timing current adjustments. A calibration coefficient is derived by using the computer to compute the ratio of a reference signal value at the input to the signal path as compared to the measured value at the output of the signal path. When the calibration coefficients for the deflection factors and sweep have been derived, they may be stored by the computer and applied to every measurement.

Automated Measurement System With Two Data Couplers

A 1340 Data Coupler has connectors for 12 circuit cards. If a system has more instruments than one Data Coupler can accommodate, a second Data Coupler can be connected as shown in Fig. 4-4. Circuit cards P1 and P2 of both Data Couplers are used for computer interface. The other 20 circuit cards are available for assignment to system instruments.

WIRING LISTS

CIRCUIT CARD CONNECTORS

J1 through J12

and

REAR PANEL CONNECTORS

J1

A		
1	+5 VOLTS	BUS
2	J3A READY	J3-A2
3	J3B READY	J3-B2
4	J2A READY	J2-A2
5	J2B READY	J2-B2
6	J9B READY	J9-B2
7	J8A READY	J8-A2
8	J7B READY	J7-B2
9	J9A READY	J9-A2
10	J7A READY	J7-A2
11	J12A READY	J12-A2
12	J8B READY	J8-B2
13		
14		
15		
16		J321-19
17		-20
18		-21
19		-22
20		-23
21		-24
22		-25
23		-26
24		-27
25		-28
26		-29
27		-30
28		-31
29		-32
30		-33
31		-34
32		-18
33	DI STROBE	J2-A39
34		J2-A40
35	MODE A	J2-A41
36	CLEAR	J2-A42
37		J2-A43
38	COUPLER STROBE	J2-A44
39	SELECT J4B	J4-B47
40	SELECT J4A	J4-A47
41	SELECT J5B	J5-B47
42	SELECT J5A	J5-A47
43	SELECT J6B	J6-B47
44	SELECT J6A	J6-A47
45	SELECT J7B	J7-B47
46	SELECT J7A	J7-A47
47	SELECT J8B	J8-B47
48	SELECT J3B	J3-B47
49	SELECT J2A	J2-A47
50	Ground	BUS

J1

B		
1	+5 VOLTS	BUS
2	J4B READY	J4-B2
3	J4A READY	J4-A2
4	J5B READY	J5-B2
5	J5A READY	J5-A2
6	J6B READY	J6-B2
7	J6A READY	J6-A2
8	J10B READY	J10-B2
9	J10A READY	J10-A2
10	J11B READY	J11-B2
11	J11A READY	J11-A2
12	J12B READY	J12-B2
13		
14		
15		
16		J321-1
17		-2
18		-3
19		-4
20		-5
21		-6
22		-7
23		-8
24		-9
25		-10
26		-11
27		-12
28		-13
29		-14
30		-15
31		-16
32		-17
33	DO STROBE	J2-B39
34	MODE C	J2-B40
35	MODE B	J2-B41
36	INITIALIZE	J2-B42
37	−1 VOLT	J2-B43
38	COUPLER BUSY	J2-B44
39	SELECT J12A	J12-A47
40	SELECT J12B	J12-B47
41	SELECT J11A	J11-A47
42	SELECT J11B	J11-B47
43	SELECT J10A	J10-A47
44	SELECT J10B	J10-B47
45	SELECT J9A	J9-A47
46	SELECT J9B	J9-B47
47	SELECT J8A	J8-A47
48	SELECT J3A	J3-A47
49	SELECT J2B	J2-B47
50	Ground	BUS

J2

A		
1	+5 VOLTS	BUS
2	J2A READY	J1-A4
3		
4		
5		
6		J322-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22	INITIALIZE	-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		J3-B45
46		J3-B46
47	SELECT J2A	J1-A49
48	+19 VOLTS UNREG.	BUS
49	−19 VOLTS UNREG.	BUS
50	Ground	BUS

J2

B		
1	+5 VOLTS	BUS
2	J2B READY	J1-A5
3		
4		
5		
6		J322-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	–1 VOLT	BUS
44	COUPLER BUSY	BUS
45		
46		
47	SELECT J2B	J1-B49
48	+19 VOLTS UNREG.	BUS
49	–19 VOLTS UNREG.	BUS
50	Ground	BUS

J3

A		
1	+5 VOLTS	BUS
2	J3A READY	J1-A2
3		
4		
5		
6		J323-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		
46		
47	SELECT J3A	J1-B48
48	+19 VOLT UNREG.	BUS
49	–19 VOLT UNREG.	BUS
50	Ground	BUS

J3

B		
1	+5 VOLTS	BUS
2	J3B READY	J1-A3
3		
4		
5		
6		J323-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	–1 VOLT	BUS
44	COUPLER BUSY	BUS
45		J2-A45
46		J2-A46
47	SELECT J3B	J1-A48
48	+19 VOLTS UNREG.	BUS
49	–19 VOLTS UNREG.	BUS
50	Ground	BUS

J4

A		
1	+5 VOLTS	BUS
2	J4A READY	J1-B3
3		
4		
5		
6		J324-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		J5-A45
46		J5-A46
47	SELECT J4A	J1-A40
48	+19 VOLTS UNREG.	BUS
49	−19 VOLTS UNREG.	BUS
50	Ground	BUS

J4

B		
1	+5 VOLTS	BUS
2	J4B READY	J1-B2
3		
4		
5		
6		J324-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	−1 VOLT	BUS
44	COUPLER BUSY	BUS
45		J5-B45
46		J5-B46
47	SELECT J4B	J1-A39
48	+19 VOLTS UNREG.	BUS
49	−19 VOLTS UNREG.	BUS
50	Ground	BUS

J5

A		
1	+5 VOLTS	BUS
2	J5A READY	J1-B5
3		
4		
5		
6		J114-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		J4-A45
46		J4-A46
47	SELECT J5A	J1-A42
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J5

B		
1	+5 VOLTS	BUS
2	J5B READY	J1-B4
3		
4		
5		
6		J114-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	−1 VOLT	BUS
44	COUPLER BUSY	BUS
45		J4-B45
46		J4-B46
47	SELECT J5B	J1-A41
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J6

A		
1	+5 VOLTS	BUS
2	J6A READY	J1-B7
3		
4		
5		
6		J302-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		J7-B45
46		
47	SELECT J9A	BUS
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J6

B		
1	+5 VOLTS	BUS
2	J6B READY	J1-B6
3		
4		
5		
6		J302-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	−1 VOLT	BUS
44	COUPLER BUSY	BUS
45		
46		
47	SELECT J6B	J1-A43
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J7

A		
1	+5 VOLTS	BUS & SENSE
2	J7A READY	J1-A10
3		
4		
5		
6		J302-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45	SPARE	J8-B45
46		J8-B46
47	SELECT J7A	J1-A46 J6-A46
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS & SENSE

J7

B		
1	+5 VOLTS	BUS
2	J7B READY	J1-A8
3		J205-27
4		J205-28
5		J205-32
6		J302-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	−1 VOLT	BUS
44	COUPLER BUSY	BUS
45	SPARE	J6-A45
46		
47	SELECT J7B	J1-A45
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J8

A		
1	+5 VOLTS	BUS
2	J8A READY	J1-A7
3		
4		
5		
6		J325-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		J9-B45
46		J9-B46
47	SELECT J8A	J1-B47
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J8

B		
1	+5 VOLTS	BUS
2	J8B READY	J1-A12
3		
4		
5		
6		J325-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	−1 VOLT	BUS
44	COUPLER BUSY	BUS
45		J7-A45
46		J7-A46
47	SELECT J8B	J1-A47
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J9

A		
1	+5 VOLTS	BUS
2	J9A READY	J1-A9
3		
4		
5		
6		J326-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		J10-A46
46		J10-B46
47	SELECT J9A	J1-B45
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J9

B		
1	+5 VOLTS	BUS
2	J9B READY	J1-A6
3		
4		
5		
6		J326-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	−1 VOLT	BUS
44	COUPLER BUSY	BUS
45		J8-A45
46		J8-A46
47	SELECT J9B	J1-B46
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J10

A		
1	+5 VOLTS	BUS
2	J10A READY	J1-B9
3		
4		
5		J11-B3
6		J301-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		J12-B45
46		J12-B46
47	SELECT J10A	J1-B41
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J10

B		
1	+5 VOLTS	BUS
2	J10B READY	J1-B8
3		
4		
5		
6		J301-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	−1 VOLT	BUS
44	COUPLER BUSY	BUS
45		J9-A45
46		J9-A46
47	SELECT J10B	J1-B44
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J11

A		
1	+5 VOLTS	BUS
2	J11A READY	J1-B11
3		
4		
5		
6		J327-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		J12-B45
46		J12-B46
47	SELECT J11A	J1-B41
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J11

B		
1	+5 VOLTS	BUS
2	J11B READY	J1-B10
3		J10-A5
4		
5		
6		J327-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DO 1-1	BUS
24	DO 1-2	BUS
25	DO 1-4	BUS
26	DO 1-8	BUS
27	DO 2-1	BUS
28	DO 2-2	BUS
29	DO 2-4	BUS
30	DO 2-8	BUS
31	DO 3-1	BUS
32	DO 3-2	BUS
33	DO 3-4	BUS
34	DO 3-8	BUS
35	DO 4-1	BUS
36	DO 4-2	BUS
37	DO 4-4	BUS
38	DO 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	−1 VOLT	BUS
44	COUPLER BUSY	BUS
45		J10-A45
46		J10-A46
47	SELECT J11B	J1-B42
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J12

A		
1	+5 VOLTS	BUS
2	J12A READY	
3		
4		
5		
6		J328-19
7		-20
8		-21
9		-22
10		-23
11		-24
12		-25
13		-26
14		-27
15		-28
16		-29
17		-30
18		-31
19		-32
20		-33
21		-34
22		-18
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DI STROBE	BUS
40		BUS
41	MODE A	BUS
42	CLEAR	BUS
43		BUS
44	COUPLER STROBE	BUS
45		
46		
47	SELECT J12A	J1-B39
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J12

B		
1	+5 VOLTS	BUS
2	J12B READY	
3		
4		
5		
6		J328-1
7		-2
8		-3
9		-4
10		-5
11		-6
12		-7
13		-8
14		-9
15		-10
16		-11
17		-12
18		-13
19		-14
20		-15
21		-16
22		-17
23	DI 1-1	BUS
24	DI 1-2	BUS
25	DI 1-4	BUS
26	DI 1-8	BUS
27	DI 2-1	BUS
28	DI 2-2	BUS
29	DI 2-4	BUS
30	DI 2-8	BUS
31	DI 3-1	BUS
32	DI 3-2	BUS
33	DI 3-4	BUS
34	DI 3-8	BUS
35	DI 4-1	BUS
36	DI 4-2	BUS
37	DI 4-4	BUS
38	DI 4-8	BUS
39	DO STROBE	BUS
40	MODE C	BUS
41	MODE B	BUS
42	INITIALIZE	BUS
43	−1 VOLT	BUS
44	COUPLER BUSY	BUS
45		J11-A45
46		J11-A46
47	SELECT J12B	J1-B40
48	+19 VOLTS UNREG	BUS
49	−19 VOLTS UNREG	BUS
50	Ground	BUS

J321 A & B

		J1
1		B16
2		B17
3		B18
4		B19
5		B20
6		B21
7		B22
8		B23
9		B24
10		B25
11		B26
12		B27
13		B28
14		B29
15		B30
16		B31
17		B32
18		A32
19		A16
20		A17
21		A18
22		A19
23		A20
24		A21
25		A22
26		A23
27		A24
28		A25
29		A26
30		A27
31		A28
32		A29
33		A30
34		A31
35		
36		

J322 A & B

		J2
1		B6
2		B7
3		B8
4		B9
5		B10
6		B11
7		B12
8		B13
9		B14
10		B15
11		B16
12		B17
13		B18
14		B19
15		B20
16		B21
17		B22
18		A22
19		A6
20		A7
21		A8
22		A9
23		A10
24		A11
25		A12
26		A13
27		A14
28		A15
29		A16
30		A17
31		A18
32		A19
33		A20
34		A21
35		
36		

J323 A & B

		J3
1		B6
2		B7
3		B8
4		B9
5		B10
6		B11
7		B12
8		B13
9		B14
10		B15
11		B16
12		B17
13		B18
14		B19
15		B20
16		B21
17		B22
18		A22
19		A6
20		A7
21		A8
22		A9
23		A10
24		A11
25		A12
26		A13
27		A14
28		A15
29		A16
30		A17
31		A18
32		A19
33		A20
34		A21
35		
36		

J324

		J4
1		B6
2		B7
3		B8
4		B9
5		B10
6		B11
7		B12
8		B13
9		B14
10		B15
11		B16
12		B17
13		B18
14		B19
15		B20
16		B21
17		B22
18		A22
19		A6
20		A7
21		A8
22		A9
23		A10
24		A11
25		A12
26		A13
27		A14
28		A15
29		A16
30		A17
31		A18
32		A19
33		A20
34		A21
35		
36		

J114

		J5
1		B6
2		B7
3		B8
4		B9
5		B10
6		B11
7		B12
8		B13
9		B14
10		B15
11		B16
12		B17
13		B18
14		B19
15		B20
16		B21
17		B22
18		A22
19		A6
20		A7
21		A8
22		A9
23		A10
24		A11
25		A12
26		A13
27		A14
28		A15
29		A16
30		A17
31		A18
32		A19
33		A20
34		A21
35		
36		

J302 A & B

		J6	J7
1		B6	B6
2		B7	B7
3		B8	B8
4		B9	B9
5		B10	B10
6		B11	B11
7		B12	B12
8		B13	B13
9		B14	B14
10		B15	B15
11		B16	B16
12		B17	B17
13		B18	B18
14		B19	B19
15		B20	B20
16		B21	B21
17		B22	B22
18		A22	A22
19		A6	A6
20		A7	A7
21		A8	A8
22		A9	A9
23		A10	A10
24		A11	A11
25		A12	A12
26		A13	A13
27		A14	A14
28		A15	A15
29		A16	A16
30		A17	A17
31		A18	A18
32		A19	A19
33		A20	A20
34		A21	A21
35			
36			

J205

		J6	J7
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27	$\overline{\text{240 P.C.}}$		B3
28	$\overline{\text{EXT HOLD}}$		B4
29			
30			
31			
32	$\overline{\text{240 READY}}$	A3	B5
33			
34			
35			
36			

J325

		J8
1		B6
2		B7
3		B8
4		B9
5		B10
6		B11
7		B12
8		B13
9		B14
10		B15
11		B16
12		B17
13		B18
14		B19
15		B20
16		B21
17		B22
18		A22
19		A6
20		A7
21		A8
22		A9
23		A10
24		A11
25		A12
26		A13
27		A14
28		A15
29		A16
30		A17
31		A18
32		A19
33		A20
34		A21
35		
36		

J326

		J9
1		B6
2		B7
3		B8
4		B9
5		B10
6		B11
7		B12
8		B13
9		B14
10		B15
11		B16
12		B17
13		B18
14		B19
15		B20
16		B21
17		B22
18		A22
19		A6
20		A7
21		A8
22		A9
23		A10
24		A11
25		A12
26		A13
27		A14
28		A15
29		A16
30		A17
31		A18
32		A19
33		A20
34		A21
35		
36		

J301 A & B

		J10
1		B6
2		B7
3		B8
4		B9
5		B10
6		B11
7		B12
8		B13
9		B14
10		B15
11		B16
12		B17
13		B18
14		B19
15		B20
16		B21
17		B22
18		A22
19		A6
20		A7
21		A8
22		A9
23		A10
24		A11
25		A12
26		A13
27		A14
28		A15
29		A16
30		A17
31		A18
32		A19
33		A20
34		A21
35		
36		

J327

		J11
1		B6
2		B7
3		B8
4		B9
5		B10
6		B11
7		B12
8		B13
9		B14
10		B15
11		B16
12		B17
13		B18
14		B19
15		B20
16		B21
17		B22
18		A22
19		A6
20		A7
21		A8
22		A9
23		A10
24		A11
25		A12
26		A13
27		A14
28		A15
29		A16
30		A17
31		A18
32		A19
33		A20
34		A21
35		
36		

J328

		J12
1		B6
2		B7
3		B8
4		B9
5		B10
6		B11
7		B12
8		B13
9		B14
10		B15
11		B16
12		B17
13		B18
14		B19
15		B20
16		B21
17		B22
18		A22
19		A6
20		A7
21		A8
22		A9
23		A10
24		A11
25		A12
26		A13
27		A14
28		A15
29		A16
30		A17
31		A18
32		A19
33		A20
34		A21
35		
36		

SECTION 6
ELECTRICAL PARTS LIST

Replacement parts should be ordered from the Tektronix Field Office or Representative in your area. Changes to Tektronix products give you the benefit of improved circuits and components. Please include the instrument type number and serial number with each order for parts or service.

ABBREVIATIONS AND REFERENCE DESIGNATORS

A	Assembly, separable or repairable	FL	Filter	PTM	paper or plastic, tubular molded
AT	Attenuator, fixed or variable	H	Heat dissipating device (heat sink, etc.)	R	Resistor, fixed or variable
B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CAPACITOR				
C110	290-0482-00			65,000 µF, Elect., 12 V, +75%-10%
SCD, DIODES				
CR110	152-0274-00			Silicon, selected from 1N1200
CR112	152-0274-00			Silicon, selected from 1N1200
CR118	152-0274-00			Silicon, selected from 1N1200
BULBS				
DS104	150-0045-00			Incandescent, #685
DS105	150-0045-00			Incandescent, #685
FUSES				
F100	159-0041-00	B010100	B029999	1 1/4 A, 3 AG, slo-blo
F100	159-0023-00	B030000		2 A, 3 AG, slo-blo
F105	159-0018-00	B010100	B029999	4/5 A, 3 AG, slo-blo
F105	159-0019-00	B030000		1 A, 3 AG, slo-blo
F110	159-0011-00			6 1/4 A, 3 AG, slo-blo
CONNECTORS				
J114	131-0294-04			Receptacle, electrical, 36 contact, female
J205A	131-0294-05			Receptacle, electrical, 36 contact, female
J205B	131-0294-05			Receptacle, electrical, 36 contact, female
J301A	131-0294-06			Receptacle, electrical, 36 contact, female
J301B	131-0294-06			Receptacle, electrical, 36 contact, female
J302A	131-0294-06			Receptacle, electrical, 36 contact, female
J302B	131-0294-06			Receptacle, electrical, 36 contact, female
J321A	131-0294-06			Receptacle, electrical, 36 contact, female
J321B	131-0294-06			Receptacle, electrical, 36 contact, female
J322A	131-0294-06			Receptacle, electrical, 36 contact, female

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CONNECTORS (cont)				
J322B	131-0294-06			Receptacle, electrical, 36 contact, female
J323A	131-0294-06			Receptacle, electrical, 36 contact, female
J323B	131-0294-06			Receptacle, electrical, 36 contact, female
J324	131-0294-04			Receptacle, electrical, 36 contact, female
J325	131-0294-06			Receptacle, electrical, 36 contact, female
J326	131-0294-06			Receptacle, electrical, 36 contact, female
J327	131-0294-06			Receptacle, electrical, 36 contact, female
J328	131-0294-06			Receptacle, electrical, 36 contact, female
TRANSISTORS				
Q145	151-0507-00			Silicon, SCR, replaceable by 2N3669
Q160	151-0275-00			Silicon, NPN, replaceable by 2N3771
RESISTORS				
R104	315-0121-00			120 Ω, 1/4 W, 5%
R106	315-0102-00			1 kΩ, 1/4 W, 5%
R107	315-0102-00			1 kΩ, 1/4 W, 5%
R108	315-0102-00			1 kΩ, 1/4 W, 5%
R117	308-0643-00			0.1 Ω, 3 W, WW, 3%
R118	308-0643-00			0.1 Ω, 3 W, WW, 3%
R119	308-0643-00			0.1 Ω, 3 W, WW, 3%
SWITCHES				
S100[1]	260-0276-00			Toggle, POWER
S103[1]				
S104[1]				
S105	260-1191-00			Rotary, MODE
TK1	260-0879-00			Thermostatic, open 88.3°C, close 71.7°C
TRANSFORMER				
T100	120-0653-00			Power
ASSEMBLY				
A2	670-1264-01			REGULATOR Circuit Board Assembly
CAPACITORS				
C115	290-0218-00			500 µF, Elect., 30 V
C132	290-0536-00			10 µF, Elect., 25 V, 20%
C134	283-0110-00			0.005 µF, Cer, 150 V
C148	290-0248-01			150 µF, Elect., 15 V, 20%
C162	290-0218-00			500 µF, Elect., 30 V
DIODES				
CR115	152-0462-00			Silicon, replaceable by MDA960-3
CR162	152-0462-00			Silicon, replaceable by MDA960-3
VR152	152-0175-00			Zener, replaceable by 1N752A, 0.4 W, 5.6 V, 5%
TRANSISTORS				
Q120	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
~~Q125~~ 124	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q140	151-0217-00			Silicon, NPN, selected from V1/40250
Q155	151-0188-00			Silicon, PNP, replaceable by 2N3906

[1]See Mechanical Parts List. Line Voltage Selector.

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS				
R115	301-0472-00			4.7 kΩ, 1/2 W, 5%
R120	311-0634-00			500 Ω Var
R122	315-0682-00			6.8 kΩ, 1/4 W, 5%
R124	315-0102-00			1 kΩ, 1/4 W, 5%
R125	315-0682-00			6.8 kΩ, 1/4 W, 5%
R128	321-0181-00			750 Ω, 1/8 W, 1%
R130	311-0634-00			500 Ω, Var
R132	321-0226-00			2.21 kΩ, 1/8 W, 1%
R148	315-0332-00			3.3 kΩ, 1/4 W, 5%
R150	315-0271-00			270 Ω, 1/4 W, 5%
R152	315-0271-00			270 Ω, 1/4 W, 5%
R155	315-0470-00			47 Ω, 1/4 W, 5%
R158	315-0102-00			1 kΩ, 1/4 W, 5%
R162	301-0472-00			4.7 kΩ, 1/4 W, 5%
INTEGRATED CIRCUIT				
U135	156-0071-00			Voltage regulator, replaceable by UA723C

DIAGRAMS & CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

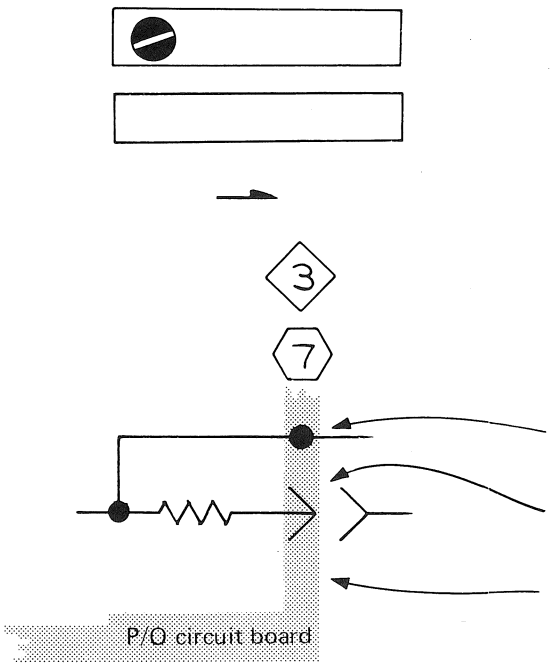
Electrical components shown on the diagrams are in the following units unless noted otherwise:

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

Symbols used on the diagrams are based on USA Standard Y32.2-1967.

Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following special symbols are used on the diagrams:



External Screwdriver adjustment.

External control or connector.

Clockwise control rotation in direction of arrow.

Refer to diagram number indicated in diamond.

Refer to waveform number indicated in hexagon.

Connection soldered to circuit board.

Connection made to circuit board with interconnecting pin.

Blue tint encloses components located on circuit board.

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

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

J1 J2 J3 J4 J5 J6 J7 J8 J9 J10 J11 J12 (A B)

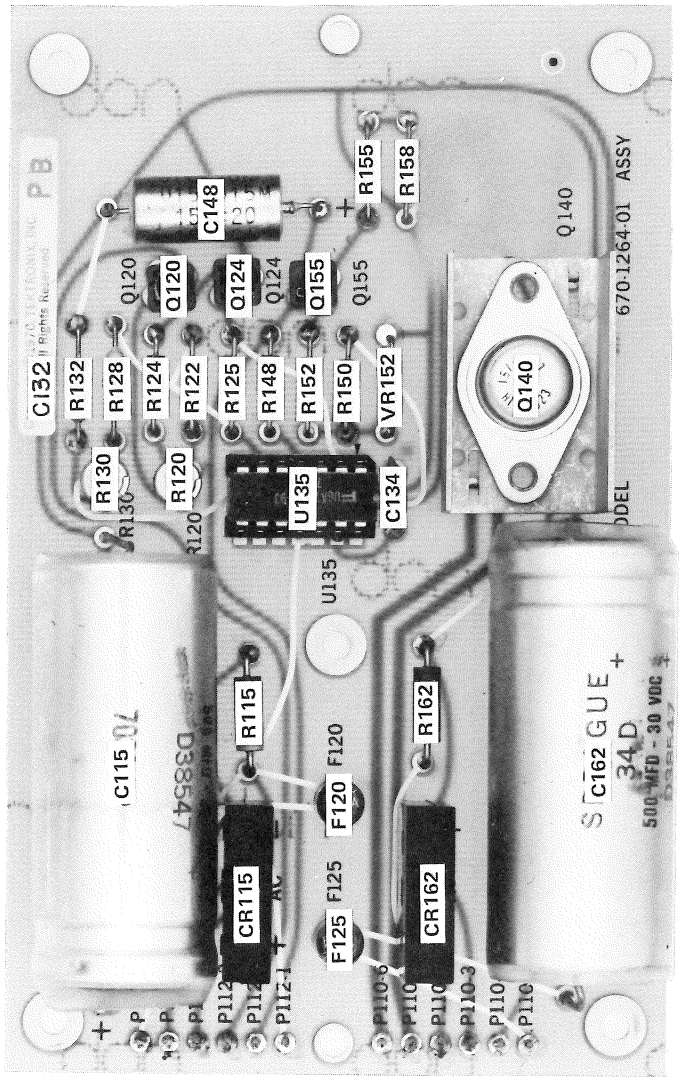
READY
READY A
READY B
SELECT
SELECT 1
SELECT 2
DO STROBE
DI STROBE
COUPLER STROBE
INITIALIZER
CLEAR
MODE A
MODE B
MODE C
COUPLER BUSY
SPARE BUS
+19 V (P45-4)
-19 V (P45-3)
+5V (P43-3)
-1V (P44 PIN 1)
GND (P43-1, TO POWER SUPPLY CHASSIS GROUND)
P112-2 +5V SENSE (2)
P112-7 GROUND SENSE (2)
16-LINE DATA OUTPUT BUS
16-LINE DATA INPUT BUS
SPARE LINES

TO J321A AND J321B
TO J322A AND J322B
TO J323A AND J323B
TO J324
TO J114
TO J302A AND J302B
TO J325
TO J326
TO J301A AND J301B
TO J327
TO J328

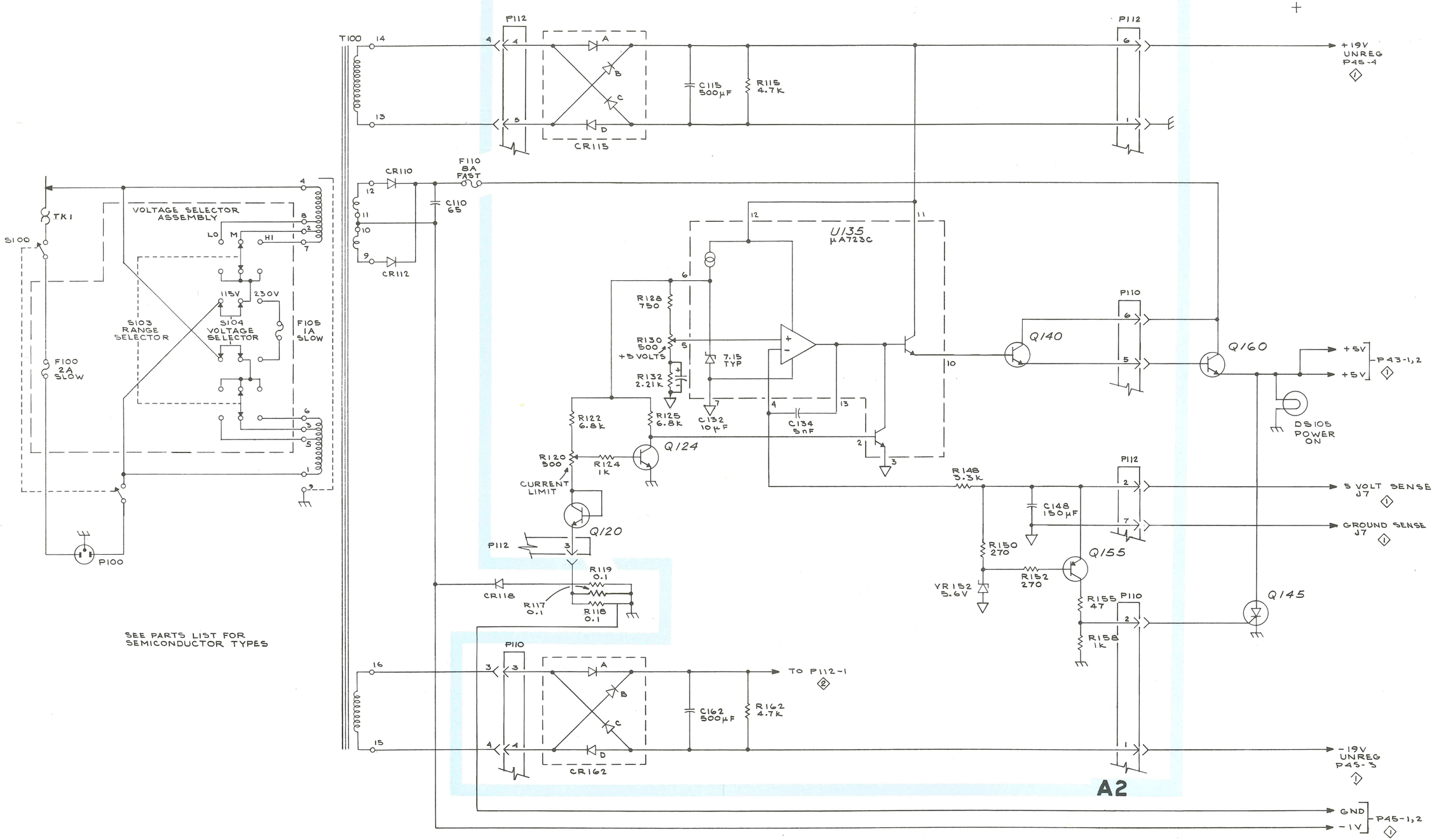
P23 P22 P25 P24 P27 P26 P29 P28 P31 P30 P33 P32 P35 P34 P37 P36 P39 P38 P41 P40 P43 P42

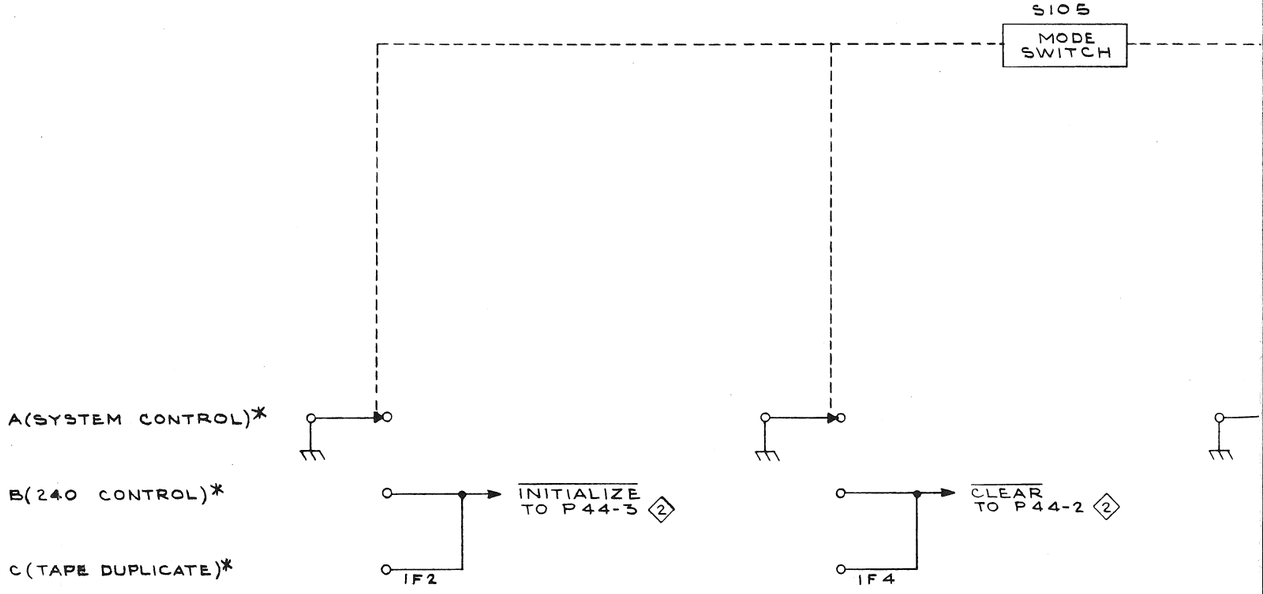
(A)

(1) INTERCONNECTING BOARD
B040000-UP

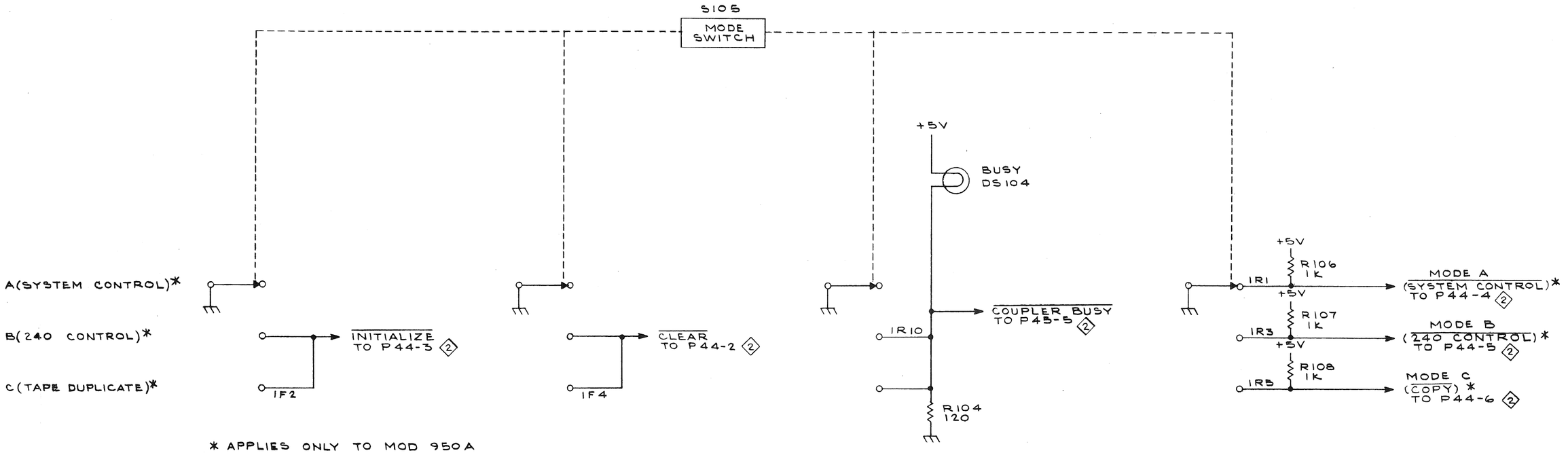


Regulator Circuit Card Assembly


T100
P112
CR115
C115 500µF
R115 4.7K
+19V UNREG P45-4
CR110
CR112
C110 65
F110 8A FAST
U135 µA723C
R128 750
R130 500 +5 VOLTS
R132 2.21K
7.15 TYP
C132 10µF
R122 6.8K
R125 6.8K
C134 5nF
Q124
R120 500 CURRENT LIMIT
R124 1K
Q120
R119 0.1
R117 0.1
R118 0.1
CR118
P110
Q140
Q160
+5V P43-1,2
DS105 POWER ON
R148 3.3K
C148 150µF
R150 270
R152 270
VR152 5.6V
Q155
R155 47
R158 1K
Q145
5 VOLT SENSE J7
GROUND SENSE J7
C162 500µF
R162 4.7K
TO P112-1
CR162
-19V UNREG P45-3
GND
-1V
P45-1,2
A2
S100
TK1
VOLTAGE SELECTOR ASSEMBLY
LO
M
HI
115V
230V
S103 RANGE SELECTOR
S104 VOLTAGE SELECTOR
F105 1A SLOW
F100 2A SLOW
P100
SEE PARTS LIST FOR SEMICONDUCTOR TYPES



* APPLIES ONLY TO MOD 950A



* APPLIES ONLY TO MOD 950A

hq
0171

MODE SWITCH 3
B040000 - UP

SECTION 8
MECHANICAL PARTS LIST

FIGURE 1 FRONT

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
1-1	214-0553-00			2		LATCH SCREW, 1.388 inches long
-2	358-0255-00			2		BUSHING, plastic, latch screw
-3	366-0322-01			1		KNOB, charcoal--MODE
	- - - - - -			-		knob includes:
	213-0153-00			1		SETSCREW, 5-40 x 0.125 inch, HSS
-4	260-1191-00			1		SWITCH, rotary--MODE, unwired
	- - - - - -			-		mounting hardware: (not included w/switch)
-5	210-0590-00			1		NUT, hex., 0.375-32 x 0.438 inch
-6	210-0978-00			1		WASHER, flat, 0.375 ID x 0.50 inch OD
-7	260-0276-00			1		SWITCH, toggle--POWER
	- - - - - -			-		switch includes:
-8	210-0414-00			1		NUT, hex., 0.469-32 x 0.562 inch
-9	210-0473-00			1		NUT, dodecagon, 0.469-32 x 0.638 inch
-10	210-0902-00			1		WASHER, flat, 0.47 ID x 0.656 inch OD
-11	210-0241-00			1		LUG, solder, 0.515 ID x 0.625 inch OD
-12	136-0382-00			1		LIGHT, indicator, white lens, w/hardware
	- - - - - -			-		mounting hardware: (not included w/light)
-13	210-0217-00			1		LUG, solder, 0.312 inch, SE
-14	136-0279-00			1		LIGHT, indicator, green lens, w/hardware
-15	333-1363-02			1		PANEL, front
-16	386-1870-00			1		SUBPANEL, front
-17	386-1401-00			1		PLATE, support, panel
	- - - - - -			-		mounting hardware: (not included w/plate)
-18	210-0457-00			6		NUT, keps, 6-32 x 0.312 inch
-19	343-0013-00			1		CLAMP, cable, plastic, 0.375 inch diameter
	- - - - - -			-		mounting hardware: (not included w/clamp)
-20	212-0039-00			1		SCREW, 8-32 x 0.375 inch, PHS
-21	210-0863-00			1		WASHER, D shape, 0.191 ID x 0.515 inch
-22	210-0458-00			1		NUT, keps, 8-32 x 0.344 inch

FIGURE 1 FRONT (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5	Description
1-23	351-0145-00			1		GUIDE, door
	- - - - - -			-		mounting hardware: (not included w/guide)
-24	210-0586-00			2		NUT, keps, 4-40 x 0.25 inch
-25	214-0905-00			1		RETAINER, circuit card
	- - - - - -			-		mounting hardware: (not included w/retainer)
-26	212-0023-00			2		SCREW, 8-32 x 0.375 inch, PHS
-27	210-0458-00			2		NUT, keps, 8-32 x 0.344 inch
-28	348-0102-00			1		PAD, cushioning
	- - - - - -			-		mounting hardware: (not included w/pad)
-29	213-0055-00			4		SCREW, thread forming, 2-32 x 0.188 inch, PHS
-30	386-1436-00			2		PLATE, retaining
-31	426-0343-08			1		FRAME SECTION, bottom
-32	367-0076-00			2		HANDLE
	- - - - - -			-		mounting hardware for each: (not included w/handle)
-33	212-0559-00			2		SCREW, 10-32 x 0.625 inch, 100° csk, FHS
-34	407-0296-00			1		BRACKET, angle, left
	- - - - - -			-		mounting hardware: (not included w/bracket)
-35	212-0574-00			2		SCREW, 10-32 x 0.434 inch, 100° csk, FHS
-36	407-0296-10			1		BRACKET, angle, right
	- - - - - -			-		mounting hardware: (not included w/bracket)
-37	212-0574-00			2		SCREW, 10-32 x 0.434 inch, 100° csk, FHS
-38	377-0151-00			1		INSERT, corner frame section
	- - - - - -			-		mounting hardware: (not included w/insert)
-39	212-0507-00			2		SCREW, 10-32 x 0.375 inch, PHS
-40	426-0325-01			1		FRAME SECTION, left front or right rear
	- - - - - -			-		mounting hardware: (not included w/frame section)
-41	212-0574-00			2		SCREW, 10-32 x 0.434 inch, 100° csk, FHS
-42	220-0465-00			2		NUT, block
	- - - - - -			-		mounting hardware for each: (not included w/nut)
-43	212-0043-00			1		SCREW, 8-32 x 0.50 inch, 100° csk, FHS
-44	426-0326-01			1		FRAME SECTION, right front or left rear
	- - - - - -			-		mounting hardware: (not included w/frame section)
-45	212-0574-00			2		SCREW, 10-32 x 0.434 inch, 100° csk, FHS

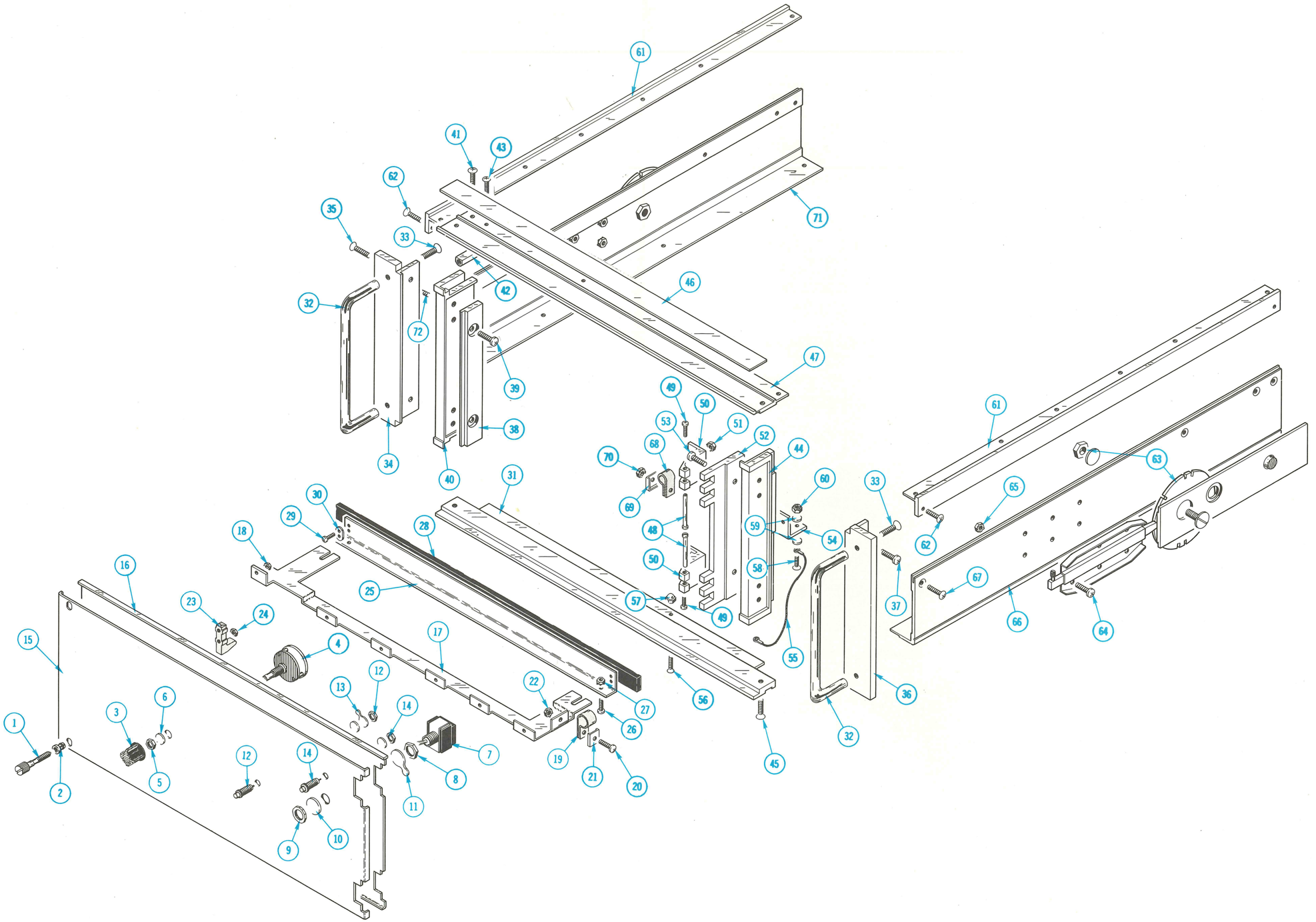
FIGURE 1 FRONT (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
1-46	124-0188-00			1		STRIP, trim, 0.876 x 16.30 inches long
-47	426-0344-00			1		FRAME SECTION, top
-48	214-0864-00			2		PIN, hinge, 3-48 x 1.363 inches long
	- - - - - -			-		mounting hardware for each: (not included w/pin)
-49	213-0159-00			1		SCREW, 3-48 x 0.375 inch, PHS
-50	214-1034-02			2		HINGE, inner half
	- - - - - -			-		mounting hardware: (not included w/hinge)
-51	210-0457-00			2		NUT, keps, 6-32 x 0.312 inch
-52	214-0866-00			1		HINGE, outer half
	- - - - - -			-		mounting hardware: (not included w/hinge)
-53	212-0507-00			2		SCREW, 10-32 x 0.375 inch, PHS
-54	407-0451-01			1		BRACKET, angle
-55	105-0177-00			1		CABLE, latch, 5.75 inches long
	- - - - - -			-		mounting hardware: (not included w/cable)
-56				1		SCREW, 6-32 x 0.375 inch, 100° csk, FHS
-57	210-0401-00			1		NUT, hex., cap, 6-32 x 0.312 inch
-58				1		SCREW, 6-32 x 0.375 inch, PHS
-59	210-0803-00			2		WASHER, flat
	358-0358-00			1		SLEEVE, bushing
-60	210-0457-00			1		NUT, keps, 6-32 x 0.312 inch
-61	426-0349-00			2		FRAME SECTION, left & right
	- - - - - -			-		mounting hardware from each: (not included w/frame section)
-62	212-0574-00			4		SCREW, 10-32 x 0.375 inch, PHS
-63	351-0082-00			1		TRACK, slideout, w/hardware (pair)
	- - - - - -			-		mounting hardware: (not included w/track)
-64	212-0507-00			12		SCREW, 10-32 x 0.375 inch, PHS
-65	220-0410-00			12		NUT, keps, 10-32 x 0.375 inch
-66	426-0348-00			1		FRAME SECTION, bottom right
	- - - - - -			-		mounting hardware: (not included w/frame section)
-67	212-0562-00			1		SCREW, 10-32 x 0.875 inch, 100° csk, FHS
-68	343-0005-00			3		CLAMP, cable, plastic, 0.438 inch diameter
-69	210-0863-00			3		WASHER, D shape, 0.191 ID x 0.515 inch
-70	220-0410-00			4		NUT, keps, 10-32 x 0.375 inch
	212-0559-00			3		SCREW, 10-32 x 0.625 inch, 100° csk, FHS (not shown)
	212-0574-00			1		SCREW, 10-32 x 0.438 inch, 100° csk, FHS (not shown)

FIGURE 1 FRONT (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
1-71	426-0347-00			1		FRAME SECTION, bottom left
	- - - - - -			-		mounting hardware: (not included w/frame section)
-72	212-0574-00			2		SCREW, 10-32 x 0.438 inch, 100° csk, FHS
	212-0559-00			3		SCREW, 10-32 x 0.625 inch, 100° csk, FHS (not shown)
	210-0410-00			1		NUT, keps, 10-32 x 0.375 inch

FIG. 1 FRONT



1340 DATA COUPLER SN B040000-up

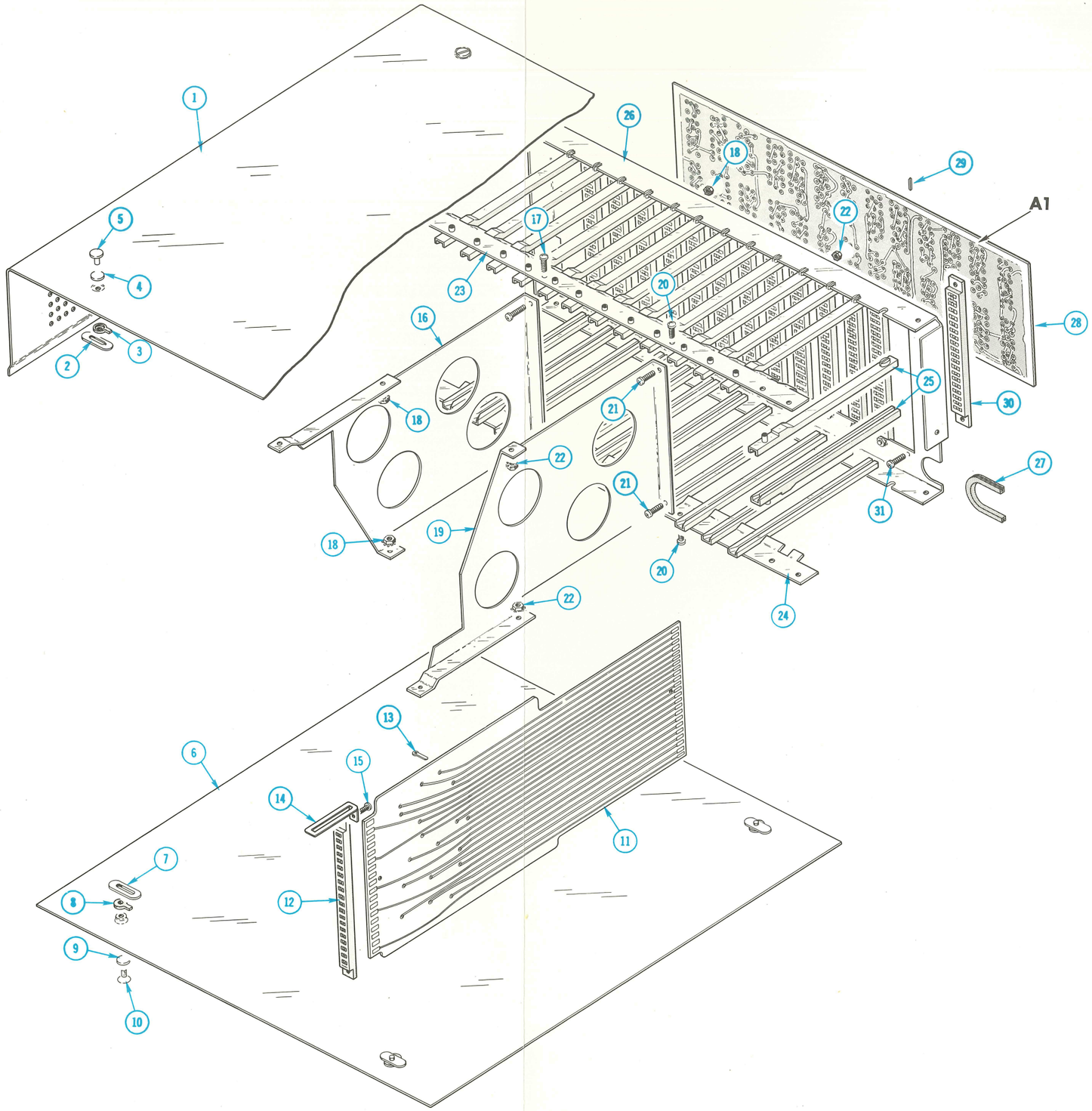

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FIGURE 2 GUIDES & CABINET

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5 Description
2-1	386-1139-01			1	CABINET TOP
	- - - - - -			-	cabinet top includes:
	214-0812-00			4	LATCH ASSEMBLY
	- - - - - -			-	each latch assembly includes:
-2	386-0226-00			1	PLATE, locking
-3	386-0227-00			1	PLATE, plastic, index
-4	214-0604-00			1	SPRING
-5	214-0603-01			1	PIN, securing
-6	386-1138-00			1	CABINET BOTTOM
	- - - - - -			-	cabinet bottom includes:
	214-0812-00			4	LATCH ASSEMBLY
	- - - - - -			-	each latch assembly includes:
-7	386-0226-00			1	PLATE, locking
-8	386-0227-00			1	PLATE, plastic, index
-9	214-0604-00			1	SPRING
-10	214-0603-01			1	PIN, securing
-11	670-1263-00			1	CIRCUIT CARD ASSEMBLY--EXTENDER
	- - - - - -			-	circuit card assembly includes:
	388-1764-00			1	CIRCUIT CARD
-12	131-0931-00			1	CONNECTOR, receptacle, 50/100 contact
-13	214-0579-00			100	PIN, test point
-14	344-0101-00			1	CLIP, retainer
	- - - - - -			-	mounting hardware: (not included w/clip)
-15	211-0130-00			1	SCREW, 4-40 x 0.25 inch, HHS
-16	386-1293-00			1	SUPPORT, bracket
	- - - - - -			-	mounting hardware: (not included w/support)
	211-0538-00			1	SCREW, 6-32 x 0.312 inch, 100° csk, FHS (not shown)
	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch, (not shown)
-17	212-0039-00			2	SCREW, 8-32 x 0.375 inch, THS
	212-0023-00			2	SCREW, 8-32 x 0.375 inch, PHS
-18	210-0458-00			4	NUT, keps, 8-32 x 0.344 inch
-19	386-1294-00			1	SUPPORT, bracket
	- - - - - -			-	mounting hardware: (not included w/support)
-20	212-0039-00			2	SCREW, 8-32 x 0.375 inch, THS
-21	212-0023-00			2	SCREW, 8-32 x 0.375 inch, PHS
-22	210-0458-00			4	NUT, keps, 8-32 x 0.344 inch

FIGURE 2 GUIDES & CABINET (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
2-23	407-0391-00			1	BRACKET, circuit card guide, top
	- - - - - -			-	mounting hardware: (not included w/bracket)
	212-0039-00			2	SCREW, 8-32 x 0.375 inch, THS (not shown)
	210-0458-00			2	NUT, keps, 8-32 x 0.344 inch (not shown)
-24	407-0392-00			1	BRACKET, circuit card guide, bottom
	212-0574-00			2	SCREW, 10-32 x 0.434 inch, 100° csk, FHS (not shown)
	220-0410-00			2	NUT, keps, 10-32 x 0.375 inch (not shown)
-25	351-0113-00			26	GUIDE, plastic, circuit card
-26	386-1872-00			1	SUPPORT, circuit board connector
	- - - - - -			-	mounting hardware: (not included w/support)
	212-0559-00			2	SCREW, 10-32 x 0.625 inch, 100° csk, FHS (not shown)
	220-0410-00			2	NUT, keps, 10-32 x 0.375 inch (not shown)
	212-0039-00			2	SCREW, 8-32 x 0.375 inch, THS (not shown)
	210-0458-00			2	NUT, keps, 8-32 x 0.344 inch (not shown)
-27	358-0166-00			1	BUSHING, plastic, 1.086 x 1.219 inches
-28	670-1262-00			1	CIRCUIT BOARD ASSEMBLY--INTERFACE A1
	- - - - - -			-	circuit board assembly includes:
	388-1763-00			1	CIRCUIT BOARD
-29	131-0589-00			90	TERMINAL, pin, 0.50 inch long
-30	131-0931-01			12	CONNECTOR, receptacle, 50/100 contact
	- - - - - -			-	mounting hardware: (not included w/circuit board assembly)
-31	211-0008-00			24	SCREW, 4-40 x 0.25 inch, PHS

FIGURE 3 REAR

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
3-1	441-0965-00			1	CHASSIS, power
	- - - - - -			-	mounting hardware: (not included w/chassis)
	212-0559-00			2	SCREW, 10-32 x 0.625 inch, 100° csk, FHS (not shown)
-2	212-0023-00			2	SCREW, 8-32 x 0.375 inch, PHS
-3	210-0458-00			2	NUT, keps, 8-32 x 0.344 inch
-4	- - - - - -			2	TRANSISTOR
	- - - - - -			-	mounting hardware for each: (not included w/transistor)
-5	211-0578-00			2	SCREW, 6-32 x 0.875 inch, PHS
-6	386-0978-00			1	PLATE, insulator, mica
-7	210-0935-00			2	WASHER, fiber, 0.14 ID x 0.375 inch OD
-8	210-0803-00			2	WASHER, flat, 0.15 ID x 0.375 inch OD
-9	210-0202-00			1	LUG, solder, SE #6
-10	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-11	348-0070-01			12	CUSHION, 0.69 x 2.03 inches long
-12	343-0213-00			1	CLAMP, cable, snap on
-13	343-0088-00			1	CLAMP, cable, snap on
-14	348-0064-00			1	GROMMET, plastic, 0.625 inch diameter
-15	352-0093-00			1	HOLDER, fuse, storage, 5 fuse
	- - - - - -			-	mounting hardware: (not included w/holder)
-16	211-0062-00			2	SCREW, 2-56 x 0.312 inch, RHS
	210-0001-00			2	WASHER, lock, internal, 0.09 ID x 0.18 inch OD
-17	210-0405-00			2	NUT, hex., 2-56 x 0.188 inch
-18	352-0076-00			1	HOLDER, fuse, w/hardware
	- - - - - -			-	mounting hardware: (not included w/holder)
-19	210-0873-00			1	WASHER, rubber, 0.50 ID x 0.682 inch OD
-20	200-0237-00			1	COVER, fuse holder, plastic
-21	- - - - - -			3	DIODE
	- - - - - -			-	mounting hardware for each: (not included w/diode)
-22	220-0410-00			1	NUT, keps, 10-32 x 0.375 inch
-23	210-0910-00			1	WASHER, plastic, 0.188 ID x 0.312 inch OD
-24	210-0805-00			1	WASHER, flat, 0.204 ID x 0.438 inch OD
-25	210-0909-00			2	WASHER, mica, 0.196 ID x 0.625 inch OD
-26	210-0224-00			1	LUG, solder, SE #10, long
-27	210-0202-00			1	LUG, solder, SE #6
	- - - - - -			-	mounting hardware: (not included w/lug)
-28	210-0507-00			1	SCREW, 6-32 x 0.312 inch, PHS
-29	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch

FIGURE 3 REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
3-30	131-0761-00			2	TERMINAL POST, screw mounted
	- - - - - -			-	mounting hardware for each: (not included w/terminal post)
-31	211-0504-00			1	SCREW, 6-32 x 0.25 inch, PHS
-32	- - - - - -			1	CAPACITOR
	- - - - - -			-	mounting hardware: (not included w/capacitor)
-33	343-0064-00			1	CLAMP, capacitor, large
-34	212-0509-00			1	SCREW, 10-32 x 0.625 inch, PHS
-35	220-0410-00			1	NUT, keps, 10-32 x 0.375 inch
-36	212-0023-00			3	SCREW, 8-32 x 0.375 inch, PHS
-37	210-0458-00			3	NUT, keps, 8-32 x 0.344 inch
-38	670-1264-00			1	CIRCUIT BOARD ASSEMBLY--REGULATOR A2
	- - - - - -			-	circuit board assembly includes:
	388-1765-00			1	CIRCUIT BOARD
-39	131-0589-00			12	TERMINAL, pin, 0.50 inch long
-40	136-0220-00			3	SOCKET, transistor, 3 pin, square
-41	136-0269-00			1	SOCKET, integrated circuit, 14 pin
	- - - - - -			-	mounting hardware: (not included w/circuit board assembly)
-42	211-0116-00			5	SCREW, 4-40 x 0.312 inch, PHB
-43	- - - - - -			1	TRANSFORMER
	- - - - - -			-	transformer includes:
-44	212-0522-00			4	SCREW, 10-32 x 2.50 inches HHS
-45	210-0812-00			4	WASHER, fiber, 0.188 ID x 0.375 inch OD
-46	166-0434-00			4	TUBE, bolt insulating, plastic
	- - - - - -			-	mounting hardware: (not included w/transformer)
-47	210-0206-00			2	LUG, solder, SE #10
-48	220-0410-00			4	NUT, keps, 10-32 x 0.375 inch
-49	346-0077-00			6	STRAP, cable, plastic
-50	175-1244-00			1	CABLE ASSEMBLY, electrical, 14 inches long
	175-1245-00			1	CABLE ASSEMBLY, electrical, 14.75 inches long
	175-1246-00			1	CABLE ASSEMBLY, electrical, 16.50 inches long
	175-1247-00			1	CABLE ASSEMBLY, electrical, 16.25 inches long
	175-1248-00			1	CABLE ASSEMBLY, electrical, 31.75 inches long
	175-1249-00			1	CABLE ASSEMBLY, electrical, 13.25 inches long
	175-1250-00			1	CABLE ASSEMBLY, electrical, 12.50 inches long
	175-1251-00			1	CABLE ASSEMBLY, electrical, 15.25 inches long
	175-1252-00			1	CABLE ASSEMBLY, electrical, 12.75 inches long
	175-1253-00			1	CABLE ASSEMBLY, electrical, 13.25 inches long
	175-1254-00			1	CABLE ASSEMBLY, electrical, 2 inches long
-51	388-1809-00			8	CIRCUIT BOARD, connector adapter, left
-52	388-1808-00			10	CIRCUIT BOARD, connector adapter, right

FIGURE 3 REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
3-53	386-1245-00			3		PLATE, 2 connector mounting
	- - - - - -			-		mounting hardware for each: (not included w/plate)
-54	211-0504-00			3		SCREW, 6-32 x 0.25 inch, PHS
-55	210-0006-00			3		WASHER, lock, internal, 0.146 ID x 0.283 inch OD
-56	386-1244-00			3		PLATE, 4 connector mounting
	- - - - - -			-		mounting hardware for each: (not included w/plate)
-57	211-0504-00			4		SCREW, 6-32 x 0.25 inch, PHS
-58	210-0006-00			4		WASHER, lock, internal, 0.146 ID x 0.283 inch OD
-59	131-0817-00			18		CONNECTOR, receptacle
	- - - - - -			-		mounting hardware for each: (not included w/connector)
-60	211-0062-00			2		SCREW, 2-56 x 0.312 inch, RHS
-61	210-0001-00			2		WASHER, lock, internal, 0.09 ID x 0.18 inch OD
-62	210-0405-00			2		NUT, hex., 2-56 x 0.188 inch
-63	426-0329-00			1		FRAME SECTION, bottom rear
-64	124-0201-00			2		STRIP, trim 1.01 x 6.48 inches long
-65	426-0325-01			1		FRAME SECTION, left front or right rear
	- - - - - -			-		mounting hardware: (not included w/frame section)
-66	212-0574-00			2		SCREW, 10-32 x 0.434 inch, 100° csk, FHS
-67	124-0188-00			1		STRIP, trim, 0.876 x 16.30 inches long
-68	426-0330-00			1		FRAME SECTION, top rear
-69	426-0326-01			1		FRAME SECTION, right front or left rear
	- - - - - -			-		mounting hardware: (not included w/frame section)
-70	212-0574-00			2		SCREW, 10-32 x 0.434 inch, 100° csk, FHS
-71	348-0190-00			4		FOOT, cabinet
	- - - - - -			-		mounting hardware for each: (not included w/foot)
-72	212-0082-00			1		SCREW, 8-32 x 1.25 inches, PHS
-73	210-0458-00			1		NUT, keps, 8-32 x 0.344 inch
-74	161-0049-00			1		CABLE ASSEMBLY, power
-75	358-0161-00			1		BUSHING, strain relief
-76	200-0762-00			1		COVER, line voltage selector
	- - - - - -			-		cover includes:
-77	352-0102-00			2		HOLDER, fuse
	- - - - - -			-		mounting hardware for each: (not included w/fuse)
-78	213-0088-00			2		SCREW, thread forming, 4-40 x 0.25 inch, PHS
-79	204-0279-00			1		BODY, line voltage selector
	- - - - - -			-		mounting hardware: (not included w/body)
-80	210-0407-00			2		NUT, hex., 6-32 x 0.25 inch
-81	210-0006-00			2		WASHER, lock, internal, 0.146 ID x 0.283 inch OD

FIGURE 3 REAR & STANDARD ACCESSORIES

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
3-82	386-1871-00			1		PANEL, rear
	- - - - - -			-		mounting hardware: (not included w/panel)
-83	212-0507-00			4		SCREW, 10-32 x 0.375 inch, PHS
-84	211-0507-00			10		SCREW, 6-32 x 0.312 inch, PHS
-85	210-0457-00			10		NUT, keps, 6-32 x 0.312 inch
-86	179-1600-00			1		WIRING HARNESS, AC, w/connectors
	179-1601-00			1		WIRING HARNESS, power
	- - - - - -			-		wiring harness includes:
-87	131-0621-00			6		CONNECTOR, terminal
	131-0792-00			1		CONNECTOR, terminal
	179-1602-00			1		WIRING HARNESS, connector
	- - - - - -			-		wiring harness includes:
	131-0621-00			3		CONNECTOR, terminal
	179-1603-00			1		WIRING HARNESS, chassis
	- - - - - -			-		wiring harness includes:
	131-0621-00			8		CONNECTOR, terminal
	352-0199-02			1		HOLDER, terminal connector, 3 wire (red)
-88	352-0201-05			1		HOLDER, terminal connector, 5 wire (green)
-89	352-0202-00			2		HOLDER, terminal connector, 6 wire (black)
	352-0202-03			1		HOLDER, terminal connector, 6 wire (orange)
	352-0202-04			1		HOLDER, terminal connector, 6 wire (yellow)
						STANDARD ACCESSORIES
	670-1263-00			1		CIRCUIT CARD ASSEMBLY--EXTENDER
	- - - - - -			-		see figure 2, ref. #11
	070-3034-01			1		MANUAL, instruction (not shown)

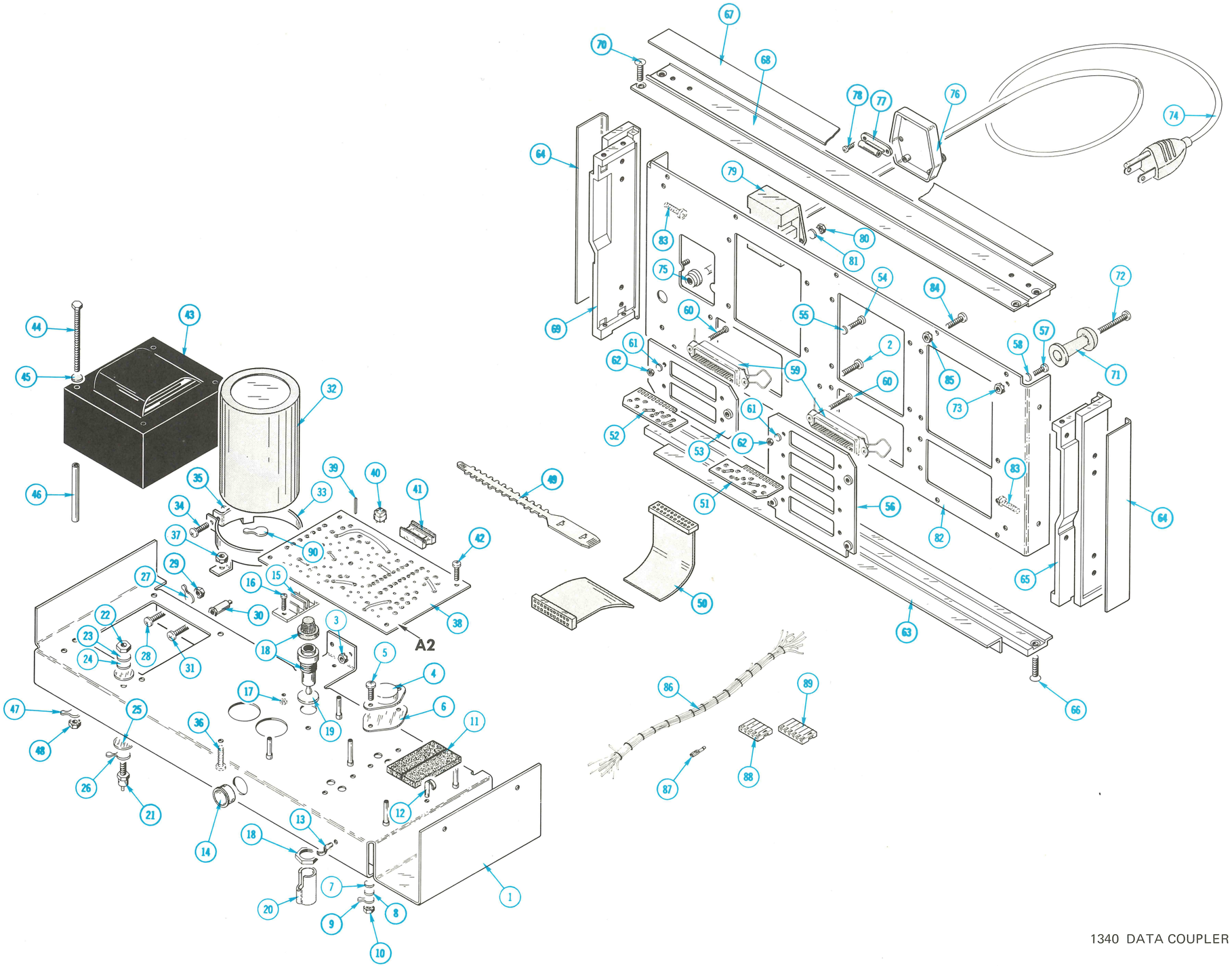

A2

FIG. 4 REPACKAGING

CARTON ASSEMBLY
(Part No. 065-0132-00)

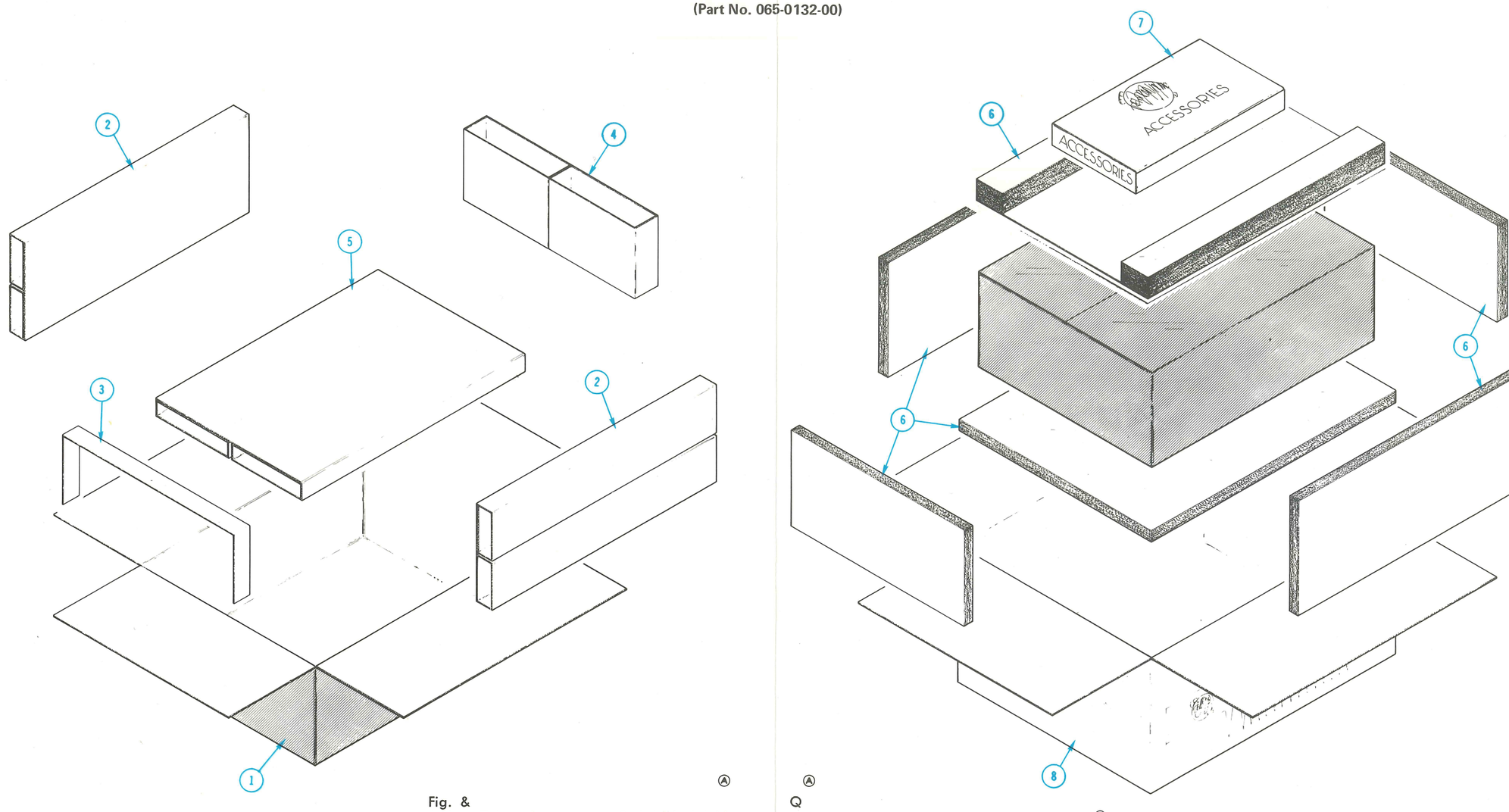


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty 1 2 3 4 5	Description
	065-0132-00			1	ASSEMBLY, carton
	- - - - - -			-	assembly includes:
1	004-0460-00			1	CARTON, inner
2	004-0360-00			1	PAD SET, 2 piece
3	004-0359-00			1	PAD, front
4	004-1027-00			1	PAD, end
5	004-0357-00			1	PAD, bottom
6	004-0361-00			1	PAD SET, 6 piece
7	004-0462-00			1	CARTON, accessory
8	004-0461-00			1	CARTON, outer

R1340 EFF SN B050000-up

ELECTRICAL PARTS LIST CORRECTION

ADD:

B100	119-0147-01	Fan, 115 V, 14 W

MECHANICAL PARTS LIST CORRECTION

Page 8-1

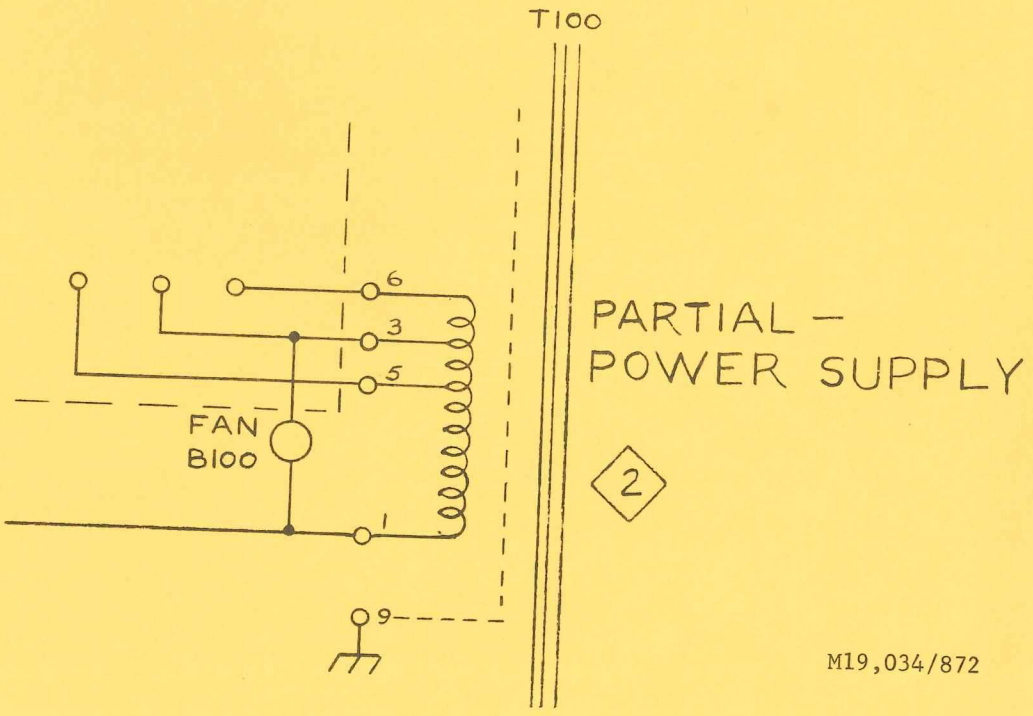
CHANGE TO:

Fig. 1-15	333-1363-03	1	PANEL, front
-16	386-2523-00	1	SUBPANEL, front
-17	386-2522-00	1	PLATE, support, panel

ADD:

119-0147-01	1	FAN, motor 115 V, 14 W
210-0457-00	2	NUT, assembly
214-0762-00	1	GRILL, fan
378-0029-00	1	FILTER, dust
380-0313-00	1	HOUSING, filter

SCHEMATIC CORRECTION



CHANGE INFORMATION