

www.ebaman.com
TEKTRONIX®

**7D12
A/D
CONVERTER**

SERVICE

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97005

Serial Number _____

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.

Copyright © 1974 by Tektronix, Inc., Beaverton, Oregon. Printed in the United States of America. All rights reserved. Contents of this publication may not be reproduced in any form without permission of Tektronix, Inc.

U.S.A. and foreign TEKTRONIX products covered by U.S. and foreign patents and/or patents pending.

TEKTRONIX is a registered trademark of Tektronix, Inc.

TABLE OF CONTENTS





| | Page | | Page |
|---|------|--|------|
| TABLE OF CONTENTS | i | SECTION 3 MAINTENANCE | |
| LIST OF ILLUSTRATIONS | ii | PREVENTIVE MAINTENANCE | 3-1 |
| LIST OF TABLES | iii | Introduction | 3-1 |
| SECTION 1 OPERATING INFORMATION | | Cleaning | 3-1 |
| PRELIMINARY INFORMATION | 1-1 | Visual Inspection | 3-1 |
| 7D12 Features | 1-1 | Recalibration | 3-1 |
| Display Modes | 1-2 | TROUBLESHOOTING | 3-2 |
| 7D12 Installation | 1-2 | Troubleshooting Aids | 3-2 |
| Module Installation | 1-2 | Troubleshooting Equipment | 3-2 |
| SECTION 2 THEORY OF OPERATION | | Troubleshooting Procedure | 3-2 |
| PRELIMINARY INFORMATION | 2-1 | CORRECTIVE MAINTENANCE | 3-4 |
| BLOCK DIAGRAM | 2-1 | General | 3-4 |
| Block Diagram Description | 2-1 | Obtaining Replacement Parts | 3-4 |
| LOGIC TRIGGERING | 2-2 | Soldering Techniques | 3-4 |
| 4-1/2 DIGIT A/D CONVERTER | | Component Replacement | 3-5 |
| AND LOGIC | 2-3 | Circuit Board Replacement | 3-6 |
| READOUT LOGIC | 2-5 | Switch Replacement | 3-7 |
| THE TEKTRONIX READOUT | | SECTION 4 PERFORMANCE CHECK/CALIBRATION | |
| SYSTEM | 2-8 | PRELIMINARY INFORMATION | 4-1 |
| INVERTER POWER SUPPLY | 2-10 | Calibration Interval | 4-1 |
| DUAL-TRACE VERTICAL | | Tektronix Field Service | 4-1 |
| AMPLIFIER | 2-11 | Using This Procedure | 4-1 |
| CIRCUIT OPERATION | 2-11 | Test Equipment Required | 4-1 |
| VERTICAL AMPLIFIER  | 2-12 | PART 1—PERFORMANCE CHECK | 4-5 |
| 4-1/2 DIGIT A/D CONVERTER  | 2-13 | Index to Part 1—Performance | |
| LOGIC  | 2-13 | Check | 4-5 |
| POWER AND CONNECTORS  | 2-14 | Preliminary Procedure for | |
| | | Performance Check | 4-5 |





TABLE OF CONTENTS (cont)

| | Page | |
|---|------|---|
| SECTION 4 PERFORMANCE CHECK/CALIBRATION (cont) | | SECTION 5 ELECTRICAL PARTS LIST |
| VERTICAL DISPLAY | 4-6 | |
| VOLTAGE READOUT DISPLAY AND TRIGGERING | 4-7 | |
| GATE DISPLAY | 4-8 | SECTION 6 DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS |
| PART II—CALIBRATION PROCEDURE | 4-9 | |
| Index to Calibration Procedure | 4-9 | |
| Preliminary Procedure For Calibration | 4-9 | SECTION 7 MECHANICAL PARTS LIST |
| FLOATING POWER SUPPLY | 4-10 | |
| VERTICAL DISPLAY BANDWIDTH | 4-12 | |
| ANALOG TO DIGITAL CONVERTER | 4-14 | |
| | 4-16 | CHANGE INFORMATION |

LIST OF ILLUSTRATIONS

| Figure Number | | Page | Figure Number | | Page |
|---------------|---|------|---------------|---|------|
| 1-1 | Frontispiece. | | 2-4B | Block diagram of the 4-1/2 Digit A/D Converter (cont.) | 2-7 |
| 1-2 | 7D12 Front-panel control and connector functions. | 1-1 | 2-5 | Block diagram of the Readout Logic section. | 2-9 |
| 1-3 | Display mode switch location and functions. | 1-2 | 2-6 | Block diagram of the Inverter Power Supply. | 2-10 |
| 1-4 | 7D12 and module installation. | 1-2 | 2-7 | Block diagram of the Dual-Trace Vertical Amplifier section. | 2-11 |
| 2-1 | Block diagram of module and 7D12 A/D Converter. | 2-1 | 4-1 | 7D12 Calibration Fixture installed. | 4-5 |
| 2-2 | Block diagram of the Logic Triggering section. | 2-2 | 4-2 | Typical Inverter pulse waveform properly neutralized. | 4-11 |
| 2-3 | Timing diagram of the 4-1/2 Digit A/D Converter. | 2-4 | 4-3 | Typical time-slot pulses with relation to the readout display | 4-17 |
| 2-4A | Block diagram of the 4-1/2 Digit A/D Converter. | 2-6 | 4-4 | Typical example of gate pulse neutralization. | 4-19 |

LIST OF ILLUSTRATIONS (cont.)

| Figure Number | | Figure Number | |
|---|---|---|--|
| 6-1 | Semiconductor lead configurations Block Diagram. | 6-5 | (A3) Triggering switch board component locations. |
| 6-2 | (A1) Mainboard component locations. |  3 | Logic. |
|  1 | Vertical Amplifier. | 6-6 | (A2) Floating board component locations. |
| 6-3 | A2) Floating board component locations. |  4 | Power and Connectors. |
|  2 | 4-1/2 Digit A/D Converter. | 6-7 | (A1) Main circuit board adjustment locations. |
| 6-4 | (A1) Mainboard component locations. | 6-8 | (A2) Floating circuit board adjustment locations. |

MECHANICAL PARTS LIST ILLUSTRATIONS

Figure Number

| | |
|-----|------------------------------|
| 1 | Exploded view. |
| 2,3 | Accessories and Repackaging. |
| 4 | Dimensions. |

LIST OF TABLES

| Table Number | | Page |
|--------------|--|------|
| 2-1 | 7D12 Readout Format | 2-8 |
| 2-2 | U148 Input/Output Table for CH 1 and CH 2 Display Modes | 2-12 |
| 3-1 | Fuse Ratings | 3-7 |
| 4-1 | Test Equipment | 4-2 |
| 4-2 | Vertical Display Amplitude and Lower Numerical Readout | 4-6 |
| 4-3 | Floating Power Supply Limits | 4-10 |
| 4-4 | Vertical Display Amplitude and Lower Numerical Readout | 4-13 |

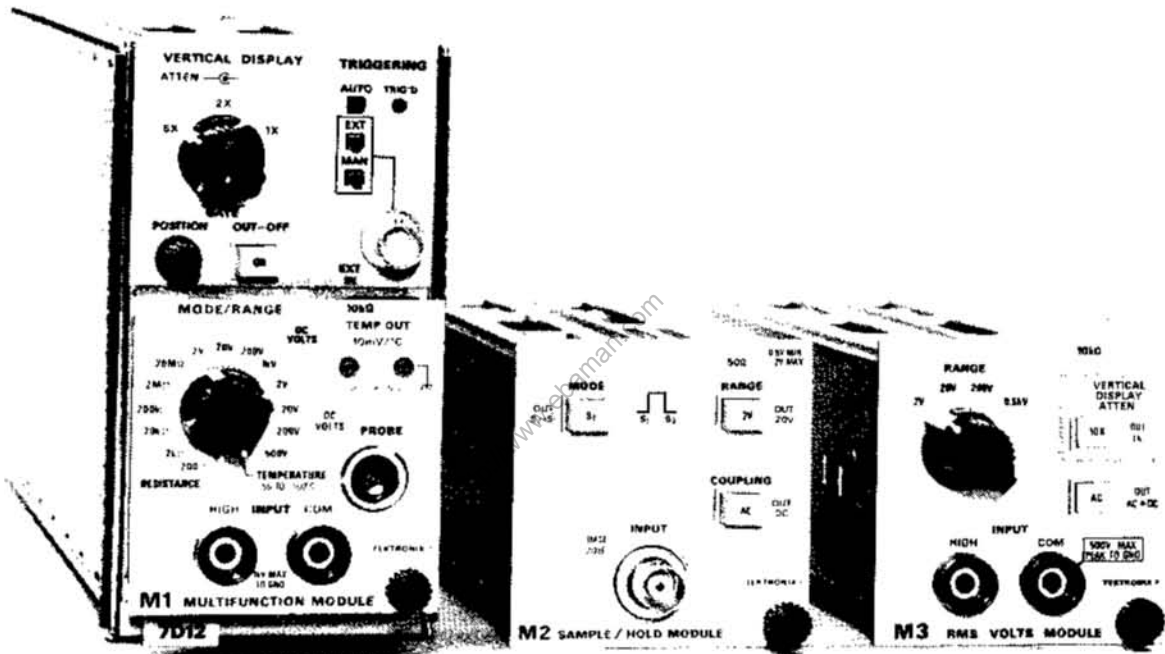


Fig. 1-1. 7D12 A/D Converter with M1 Multi-function Module partially installed, M2 Sample/Hold Module, and M3 RMS Volts Module.

OPERATING INFORMATION

PRELIMINARY INFORMATION

7D12 FEATURES

The 7D12 is an analog to digital converter for use with any 7000-series oscilloscope mainframe that contains readout. Several plug-in modules are available for use with the 7D12. Depending upon the plug-in module used, the 7D12 can supply up to a 4-1/2 digit display with a full scale reading of 20000 on the mainframe crt. When not used, the most significant digit of the display is suppressed. Automatic polarity and overflow indicators are also

contained in the 7D12. The A/D Converter can be triggered internally by the plug-in module, manually by a front-panel switch, or externally from a trigger source such as the 7D15 Period Timer. The 7D12 also contains a vertical display amplifier that displays the signal applied to the module, and a gate display amplifier that displays a representation of the 7D12 internal gate signal.

Since the 7D12 function is dictated by the module installed, instructions for operating the 7D12 are located in the Operating Instructions for each module (i.e., M1, M2 or M3). A brief description of the 7D12 Front-Panel Controls and Connectors is shown in Fig. 1-2.

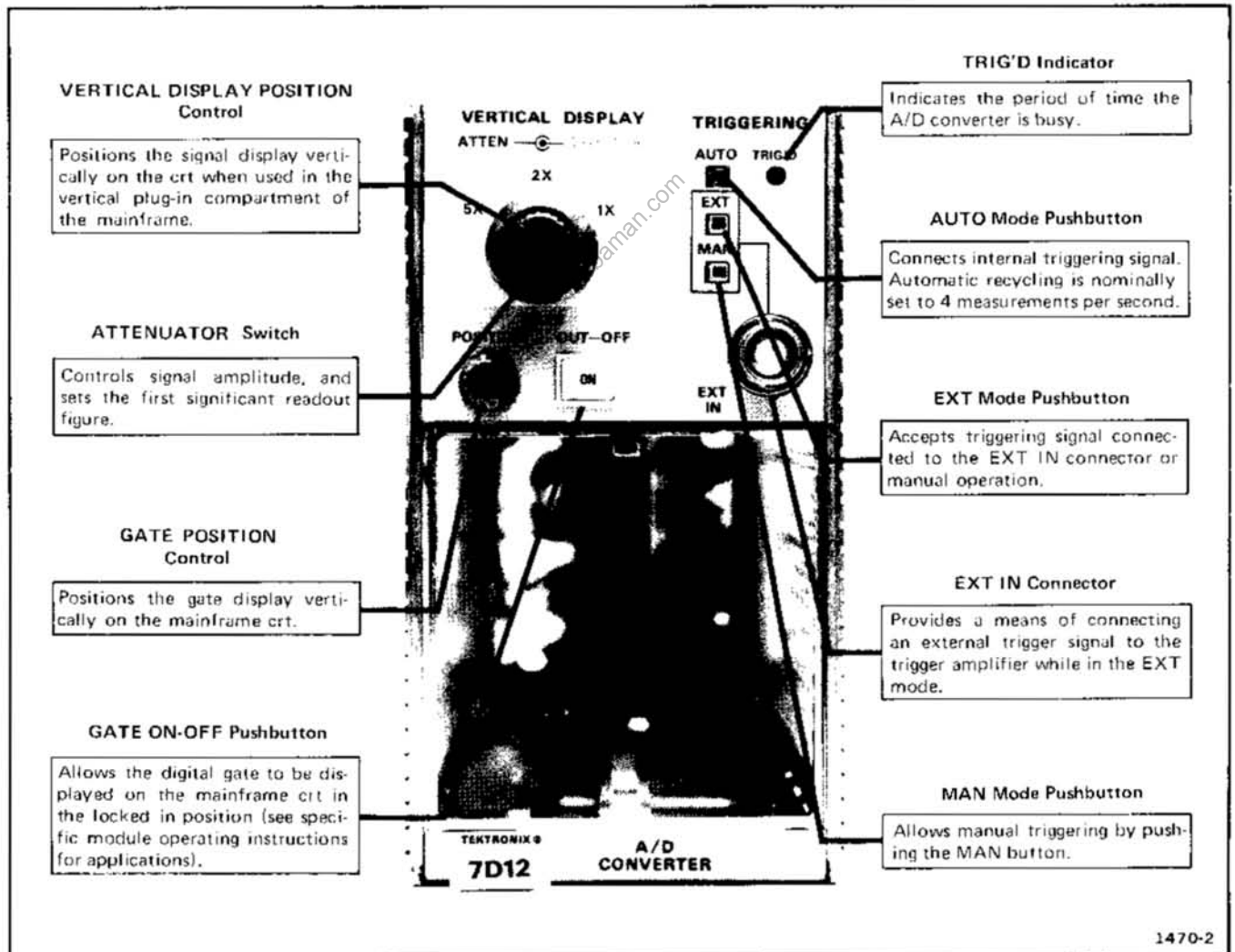


Fig. 1-2. 7D12 Front-panel control and connector functions.

DISPLAY MODES

The vertical display and the internal gate display can be operated in either alternate or chop mode, depending upon the internal Display Mode switch setting; see Fig. 1-3.

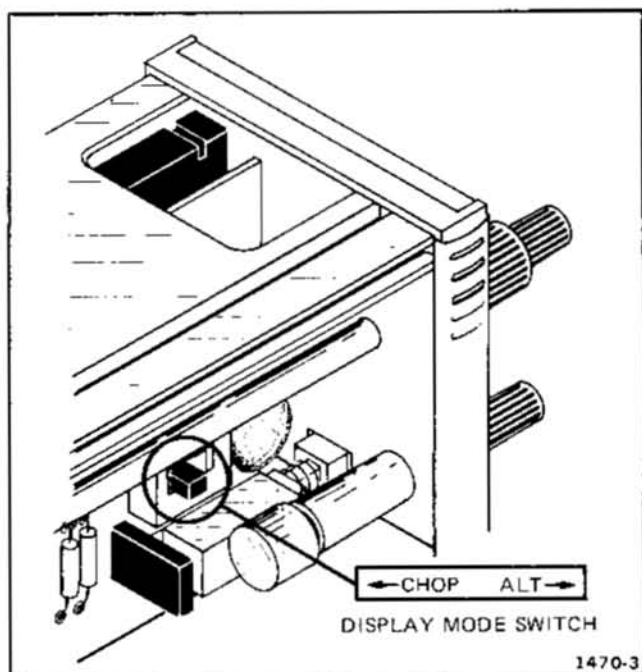


Fig. 1-3. Display mode switch Location and functions.

Alternate Mode

The Alt position (toward front panel) of the Display Mode switch produces a display that alternates between the vertical display and the gate display with each sweep on the crt. Although the Alt mode can be used at all sweep rates, the Chop mode provides a more satisfactory display at sweep rates below about 0.2 millisecond per division. At slow sweep rates, alternate mode switching becomes visually perceptible.

Chop Mode

The Chop position (toward rear) of the Display Mode switch produces a display that is electronically switched between the input display and the trigger gate display at approximately a 500 kilohertz rate (controlled by main-frame). In general, the Chop mode provides the best display at sweep rates slower than about 0.2 millisecond per division.

7D12 INSTALLATION

CAUTION

Extreme care should be exercised when handling the 7D12 to prevent touching any part of the circuit boards. This unit contains several high impedance circuits which can develop inter-leakage if contaminated by body salts or acids. Refer to the Maintenance Section of this manual for recommended cleaning methods and solvents.

The 7D12 is calibrated and ready for use with a module as received. It can be installed in any compartment of Tektronix 7000-series oscilloscopes, but is intended principally for use in vertical plug-in compartments. To install, align the upper and lower rails of the 7D12 with the oscilloscope tracks and fully insert it. The front is flush with the front of the oscilloscope when the 7D12 is fully inserted, and the latch at the bottom-left corner of the 7D12 will be in place against the front panel. See Fig. 1-4.

Set the oscilloscope for a vertical mode to correspond with the vertical compartment used when an analog signal is to be displayed. The digital readout will be displayed regardless of the vertical mode selected.

To remove the 7D12, pull on the latch (which is inscribed with the unit identification "7D12") and the 7D12 will unlatch. Continue pulling on the latch to slide the 7D12 out of the oscilloscope.

MODULE INSTALLATION

All modules are calibrated and ready for use with the 7D12 as received. To install, align the upper and lower rails of the module with the 7D12 module-compartment tracks and fully insert it. The front is flush with the front of the 7D12 when the module is fully inserted. Lock the module securely in position by rotating the retaining knob clockwise until it is finger-tight. See Fig. 1-4. To remove the module, reverse the above procedure.

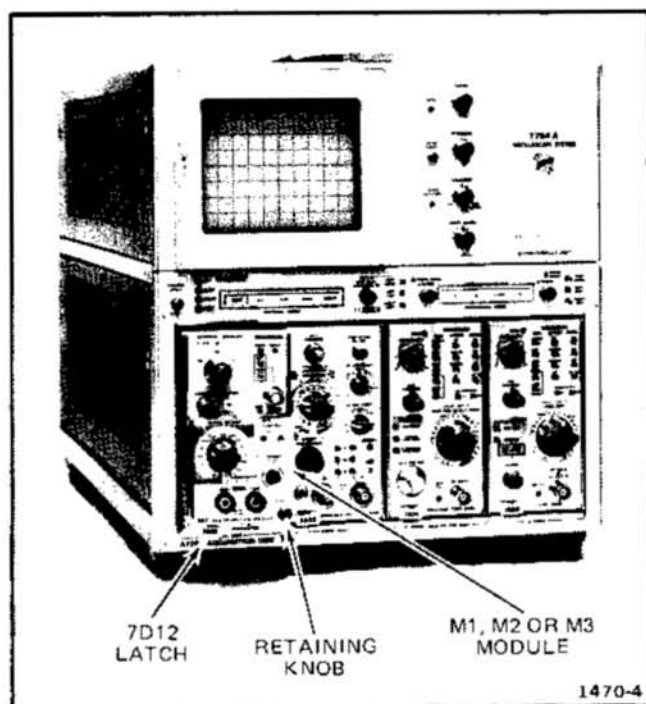


Fig. 1-4. 7D12 and module installation.

THEORY OF OPERATION

PRELIMINARY INFORMATION

INTRODUCTION

This section of the manual describes the circuitry used in the 7D12 A/D Converter. The description begins with a discussion of the instrument, using the basic block diagram shown in Fig. 2-1. Next, each major circuit is described in detail, using detailed block diagrams to show the relationship between stages in each major circuit. Detailed schematics of each circuit are located in the Diagrams Section at the back of this manual; refer to these schematics throughout the following circuit description for specific electrical values and relationships.

BLOCK DIAGRAM

BLOCK DIAGRAM DESCRIPTION

The function of each block in the basic block diagram, Fig. 2-1, is readily apparent except for the Inverter Power Supply. This supply permits floating the A/D Converter section, enabling measurements with the inputs elevated as high as 1 kV. Further, not all modules utilize the Display and Gate amplifier circuits shown. Each block represents a major circuit within the instrument. The numbered diamond in each block refers to the circuit diagram, (located at the back of this manual) which covers that specific part of the instrument.

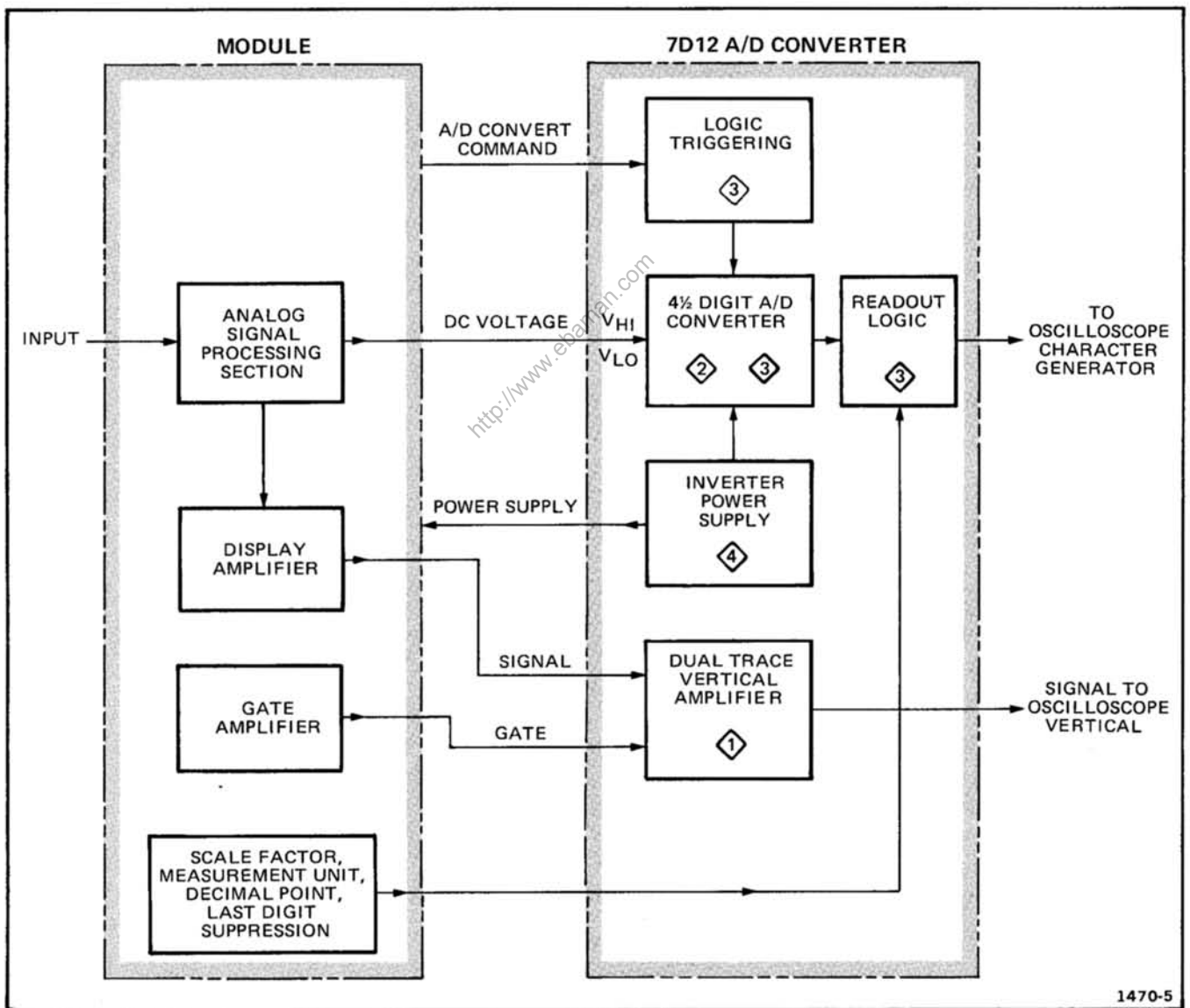


Fig. 2-1. Block diagram of module and 7D12 A/D Converter.

Theory of Operation—7D12 Service

The 7D12 A/D Converter plug-in unit contains a fast, 4-1/2 digit analog-to-digital converter, Inverter Power Supply, Dual-Trace Vertical Amplifier, Readout Logic and Trigger Logic circuit. The modules process various analog signals, such as peak voltage, rms voltage, resistance, temperature, etc. and produce a dc voltage which the 7D12 converts to digital readout information for the 7000-series oscilloscope. The modules also provide an analog signal for display on the crt.

LOGIC TRIGGERING

INTRODUCTION

The block diagram for the Logic Triggering circuitry is shown in Fig. 2-2. The trigger signal is connected internally from the 7D12 A/D Converter to the module. The M1 and M3 modules return the trigger signal directly

to the 7D12 A/D Converter as an A/D Convert Command. The M2 module, however, holds the trigger signal until the M2 sampling process is complete before releasing an A/D Convert Command.

TRIGGERING SWITCH

Auto Mode

Free-Run Oscillator Q610 is connected as the trigger source. The oscillator has a nominal output frequency of 4 hertz.

External Mode

The Free-Run Oscillator and +5 volt sources are disconnected. External trigger signals connected to the 7D12 EXT IN connector are used directly as the trigger source.

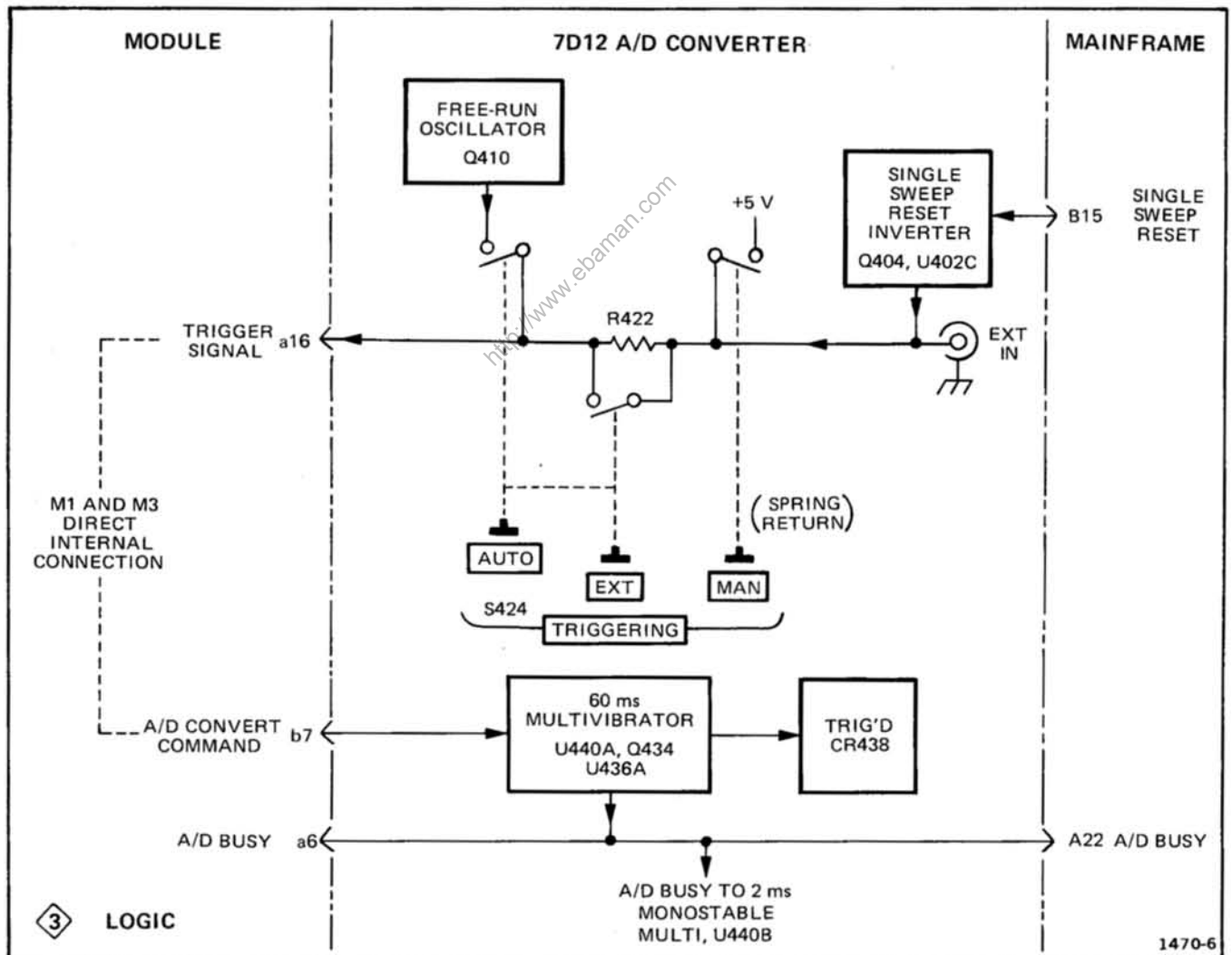


Fig. 2-2. Block diagram of the Logic Triggering section.

Manual Mode

The Free-Run Oscillator is disconnected and the EXT switch is closed, shunting R422. Manual operation provides a +5 volt pulse as the trigger signal.

TRIGGER HOLDOFF

The trigger signal becomes the A/D Convert Command either directly or indirectly, depending upon the module used. The A/D Convert Command switches the state of the 60 mS Multivibrator. The multivibrator rejects all additional A/D Convert Command signals during the 60 millisecond period. The TRIG'D indicator, CR438, is energized during the 60 millisecond period to indicate the measurement circuits are busy.

4-1/2 DIGIT A/D CONVERTER AND LOGIC**INTRODUCTION**

A block diagram of the 4-1/2 Digit A/D Converter and Logic functions is shown in Fig. 2-4. Refer to the timing diagram in Fig. 2-3 and the block diagram in Fig. 2-4 throughout the following discussion. All of the switches shown in Fig. 2-4 are electronic switches such as MOS-FETs, JFET's and diodes. The circuitry enclosed by the dotted lines is a floating section powered by the Inverter Power Supply. Positive logic is assumed to set and reset all circuit shown in the block diagram.

BEFORE TIME ZERO

The following conditions exist before a trigger signal (A/D Busy) is received at the 2 mS Monostable MV (Multivibrator) U440B.

1. The analog output of the module is coupled to the 4-1/2 Digit A/D Converter V_{hi} and V_{lo} electronic input switches.

2. Sw 1 is open and Sw 2 is closed, disconnecting V_{hi} and connecting V_{lo} to the input of the Buffer and $|G_m|$ Converter stages.

3. Sw 3 is closed, connecting the Auto-Zeroing Circuit to the $|G_m|$ Converter. The Auto-Zeroing Circuit automatically produces the same voltage level at Input 2 as that of the offset voltage appearing at Input 1, thereby

holding the $|G_m|$ Converter output at zero volts. Capacitor C302 stores the offset voltage required to hold the $|G_m|$ Converter output at zero volts during integration.

4. Sw 6 is closed, setting the Integrator output to zero volts.

AT TIME ZERO (t_0)

A negative-going trigger pulse (A/D Busy) Sets the 2 ms Monostable MV U440B. The 0 output of the MV holds the Clock Sync ff (flip-flop) Master Reset and the Measurement Period ff, Set on for 2 milliseconds. The 0 output pulse from the Clock Sync ff performs the following functions:

1. Sets the A/D Standby ff changing the electronic switch stages as follows:

a. Sw 1 closes and Sw 2 opens, disconnecting V_{lo} and connecting V_{hi} to the input of the Buffer and $|G_m|$ Converter stages.

b. Sw 3 opens, disconnecting the Auto-Zeroing Circuit from the $|G_m|$ Converter output. The charge on capacitor C302 maintains the offset voltage balance between Input 1 and Input 2; therefore, the $|G_m|$ Converter output remains referenced at zero volts.

c. Sw 6 opens, arming the Integrator circuit.

2. Sets the Measurement Period ff.

3. The 1 output from the 2 ms Monostable MV U440B, Resets the 4 Decade Counter-Latches in U500, thereby clearing any stored information from the previous measurement.

The 2 millisecond delay between t_0 and t_1 allows all switching circuits and the $|G_m|$ Converter to stabilize before starting the measurement.

AT TIME ONE (t_1)

The 2 ms Monostable MV, U440B, returns to its original state, thereby releasing the Clock Sync ff Master Reset. The first negative-going pulse from the 1 mHz Clock Generator, U402, Sets the Clock Sync ff. The 0 output from the Clock Sync ff enables AND gate U436C and U492C, allowing the clock signal to pass and begin counting at the Counters. The 0 output from the Clock

Theory of Operation—7D12 Service

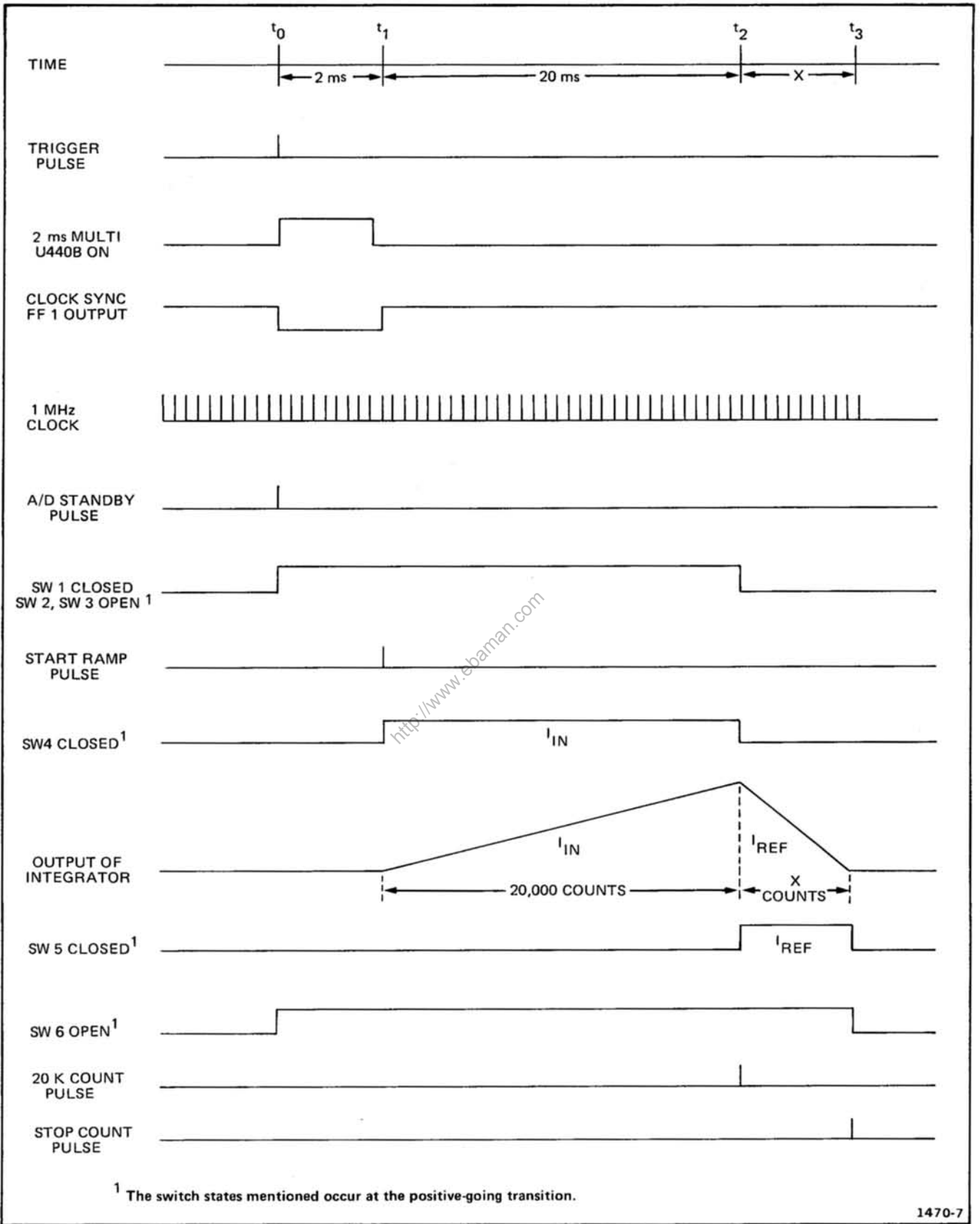


Fig. 2-3. Timing diagram of the 4 1/2 Digit A/D Converter.

Sync ff also enables the Start Ramp ff, closing Sw 4. The rectified input current (I_{in}) from the $|G_m|$ Converter begins to charge capacitor C379 in the Integrator.

The 0 output from the Clock Sync ff Sets the A/D Converting Pulse Generator ff, U436B and D, thereby allowing the 1 output to go hi at t_1 .

AT TIME TWO (t_2)

The 4 decade Counter-Latches and $\div 4$ ff have counted 20,000 clock pulses. At the 20K count, the $\div 4$ ff generates a negative-going pulse to the 20K Count Logic circuit. The output of the 20K Count Logic changes the electronic switch states as follows:

1. Resets the Start Ramp ff that switches:
 - a. Sw 4 open, disconnecting the $|G_m|$ Converter output from the Integrator.
2. Sets Stop Count ff that switches:
 - a. Sw 5 is closed, connecting the Reference Current Generator output to the Integrator.
3. Resets the A/D Standby ff that switches:
 - a. Sw 1 is open and Sw 2 is closed, disconnecting the input signal to the Buffer and $|G_m|$ Converter stages.
 - b. Sw 3 is closed, connecting the Auto-Zeroing Circuit to the $|G_m|$ Converter.
4. Resets the A/D Converting Pulse Generator ff, U436B and D. The 1 output goes hi at t_1 and lo at t_2 . The A/D Converting Pulse is connected to the module gate circuitry, allowing the measured gating time (t_1 - t_2) to be observed on the crt display.

The Reference Current Generator output current (I_{ref}) begins discharging C379, and the 4 Decade Counters-Latches are cleared to measure C379 discharge time.

AT TIME THREE (t_3)

The output of the Integrator (C379) is discharged to zero volts and the Comparator output Resets the Stop Count ff. The 0 output of the Stop Count ff changes the electronic switch states as follows:

1. Sw 5 opens, disconnecting the Reference Current Generator.
2. Sets the Integrator Zeroing Logic circuit, closing Sw 6. Sw 6 holds the Integrator output level at zero volts.
3. Resets the Measurement Period ff. AND gates U436C and U492C are disabled, preventing the 1 MHz clock pulse from reaching the counters. AND gate U492D is enabled, transferring the stored information in the 4 Decade Counters and $\div 4$ ff to the Latches. The output of the Latches is connected to the Readout Control Section in the mainframe.

A 60 millisecond monostable multivibrator in the Trigger Logic circuit prevents another trigger from occurring until one measurement cycle has been completed.

READOUT LOGIC

INTRODUCTION

The Readout Logic circuit encodes the Indicator Oscilloscope readout system to display the measurement made by the 7D12 and module. The Readout Logic circuit also encodes the readout system to display the appropriate measurement units and polarity symbols, along with positioning the display decimal point and indicating an over-range measurement.

A discussion entitled the Tektronix Readout System following the 7D12 Theory of Operation gives a brief description of the readout system used in Tektronix 7000-series Oscilloscopes.

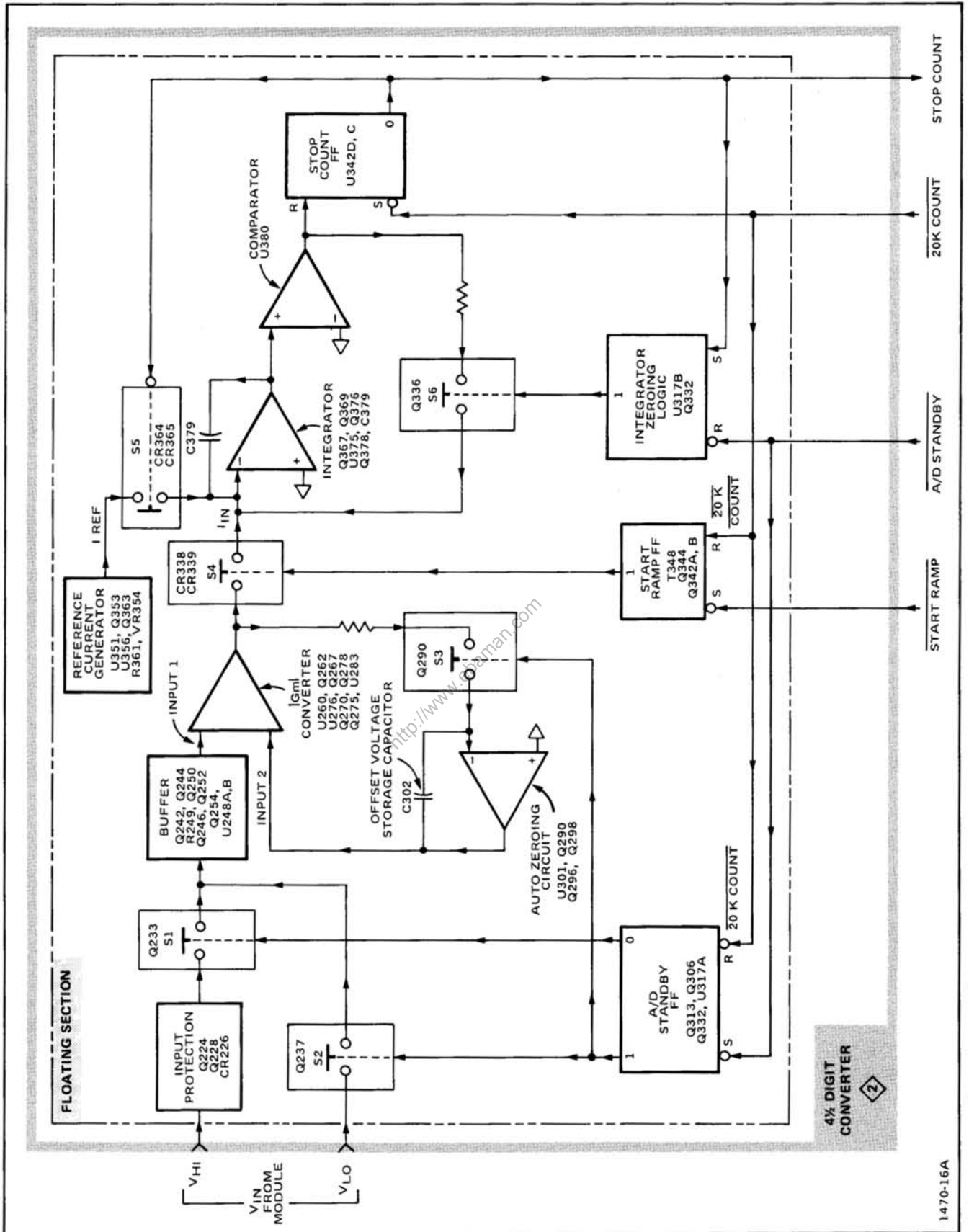


Fig. 2-4A. Block diagram of the 4 1/2 Digit A/D Converter section.

Theory of Operation—7D12 Service

ENCODING FORMAT

The 7D12 Readout Logic circuit encodes the Row and Column output lines (pins B37-A37 respectively of the oscilloscope Interface Connector for channel 1, and pins A38-B38 for channel 2) according to the format given in Table 2-1. The time-slot pulses from the oscilloscope readout system are provided to the Readout Logic circuit through the Interface Connector. Several of the time-slot pulses are also connected to address the Multiplexers.

TABLE 2-1
7D12 READOUT FORMAT

| Time-Slot Number | Function | Programmed By |
|--------------------------|---|---------------------------|
| TS-1 | Determines decimal position | Module |
| TS-2 | Indicates polarity (+ or — symbol) of measurement. | 7D12 (Disabled by Module) |
| | Encodes a > symbol to indicate over-ranging. | 7D12 |
| TS-3 | Encodes 1 or 2, and blanking of the most significant digit of measurement readout. | 7D12 |
| TS-4, TS-5 TS-6, TS-7 | Remaining four digits of measurement readout. | 7D12 |
| | TS-7 also encodes blanking of the least significant digit of the measurement readout. | Module |
| TS-8 | Symbols | Module |
| TS-9 | Symbols | Module |
| TS-10 | Symbols | Module |

DIGITAL-TO-ANALOG CONVERTER

Refer to the Readout Logic block diagram shown in Fig. 2-5 throughout the following discussion.

The Digital-to-Analog Converter circuit includes D-A Converters U500, Q540, Q532 and Q552.

Time-slot pulses TS-4, TS-5 and TS-6 from the mainframe are connected to U500 to drive the Output Enable inputs of the D-A Converters. Time slot pulse TS-3 from the mainframe is connected to the emitters of D-A Converters Q540, Q532, and Q552 to provide Output Enable information of the most significant digit. Time-slot pulse, TS-7, encodes Least Significant Digit Blanking, depending upon the module.

POLARITY AND OVER-RANGE INDICATOR

The Polarity Enable information to Q524 is determined by the module. Time-slot pulse TS-2 is coupled to Q524 (via switching in the module) to provide the Polarity Enable pulse. If the input to the base of Q524 goes to a lo level, current is added to the Column Current output during TS-2. This added current in TS-2 results in the + symbol being changed to —. TS-2 also enables the Over-Range Indicator. When the output of U514A goes to a lo level, current is added to the Column Current in TS-2. This added current in TS-2 changes either polarity symbol to a > symbol display.

SCALE FACTOR DISABLE

The VERTICAL DISPLAY ATTEN switch encodes the module readout system by switching resistors between TS-4 and the module Column output line. The Scale Factor Disable current mixes with the appropriate module time-slot inputs to supply current to the Column output line. The readout system then displays the measurement unit in channel 2 for the combination (7D12 ATTEN switch and module attenuator switch) measurement setting selected.

THE TEKTRONIX READOUT SYSTEM

INTRODUCTION

The following discussion is provided to acquaint the 7D12 user with the Readout System used in Tektronix 7000-series Oscilloscopes. Since the oscilloscope Readout System provides the digital readout for the 7D12, it is necessary to relate the function of the 7D12 to the Readout System to gain a better understanding of the 7D12 operation. A detailed circuit description of the 7000-series Readout System is given in the oscilloscope instruction manual.

THE READOUT SYSTEM

The Readout System in the 7000-series oscilloscopes provides alpha-numeric display of information encoded

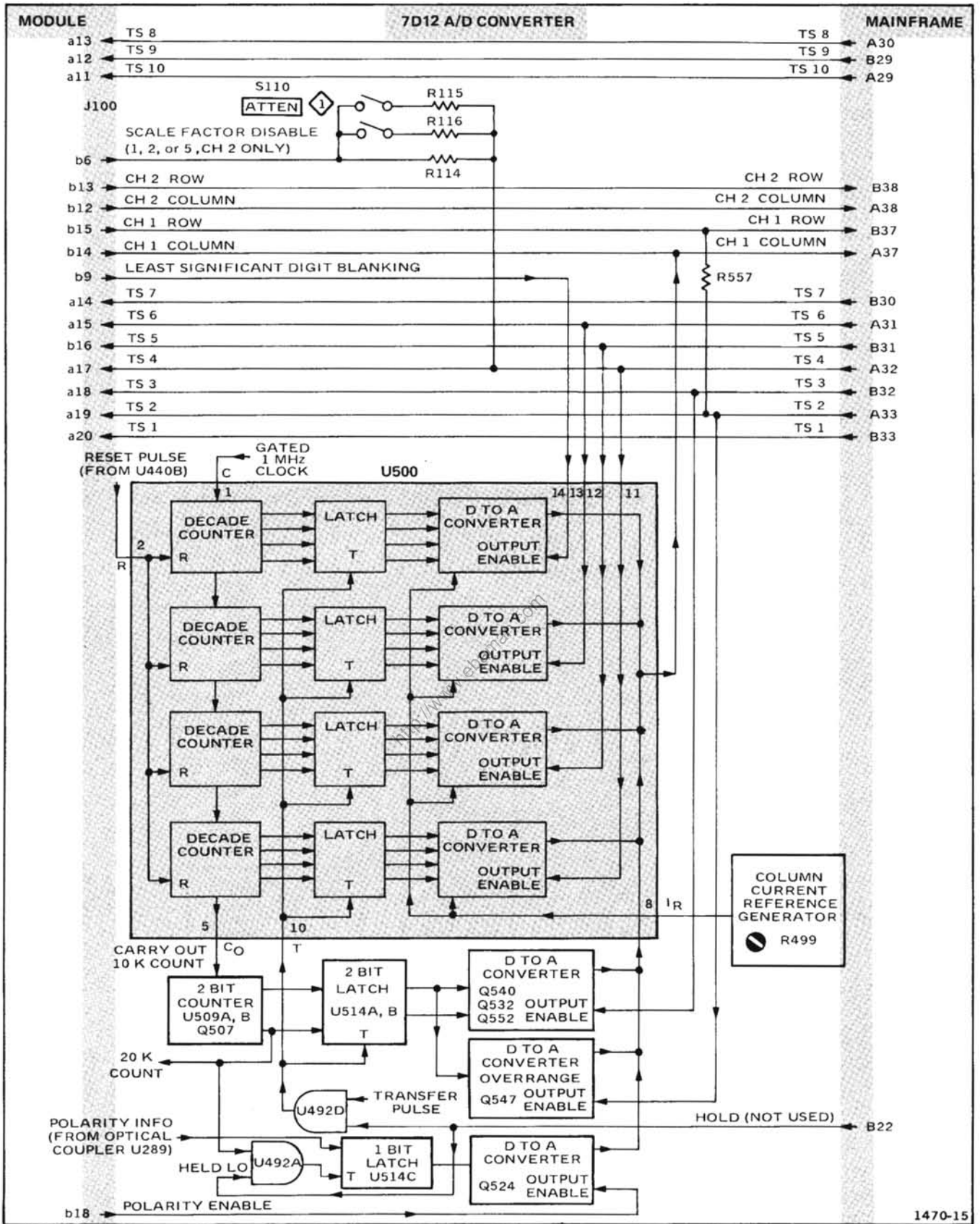


Fig. 2-5. Block diagram of the Readout Logic section.

Theory of Operation—7D12 Service

by the plug-in units. This display is presented on the crt, and is written by the crt beam on a time-shared basis with the analog waveform display.

The Readout System produces a pulse train consisting of 10 negative-going pulses called time-slot pulses. These pulses are assigned time-slot numbers corresponding to their relative position in the pulse train. Each time-slot pulse is directed to one of ten output lines, labeled TS-1 through TS-10 (time-slots one through ten) and are connected to the vertical and horizontal plug-in compartments. Two output lines, row and column, are connected from each channel (two channels per plug-in compartment) back to the Readout System.

Data is encoded on these output lines either by connecting resistors between them and the time-slot input lines or by generating equivalent currents. The resultant output is a sequence of analog current levels on the row and column output lines. The row and column current levels are decoded by the Readout System to address a character matrix during each time-slot pulse, thus selecting a character to be displayed or a special instruction to be followed.

INVERTER POWER SUPPLY

INVERTER

The block diagram of the Inverter Power Supply is shown in Fig. 2-6. The Inverter is driven with divided-down sync pulses from the 1 MHz Clock Generator. The sync pulses switch -15 volts alternately through the transformer primary to the $+15$ volt supply at the center tap. The Inverter side of the transformer is referenced to chassis potential.

FLOATING REGULATORS

The $+15$ and -15 volt regulator voltages are based upon the $+5$ volt Reference voltage. The secondary of the transformer and associated circuitry are referenced to floating ground. Each floating regulator circuit is equipped with short-circuit protection. The floating power supply furnishes all the power for the floating portion of the instrument.

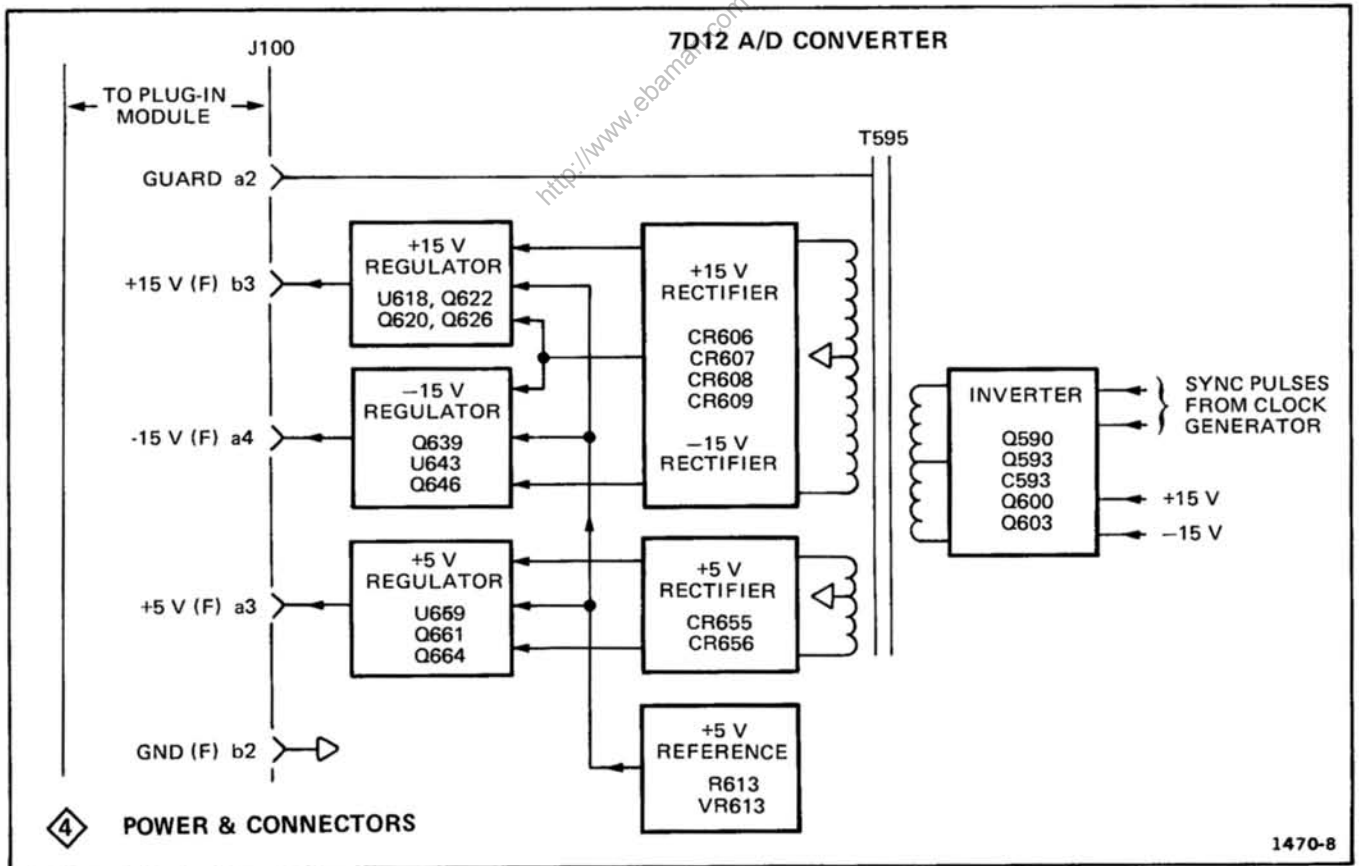


Fig. 2-6. Block diagram of the Inverter Power Supply.

DUAL-TRACE VERTICAL AMPLIFIER

GATE AND SIGNAL DISPLAYS

The block diagram for the amplifier is shown in Fig. 2-7. The Gate Display signal is fed directly to CH 1 of the Channel Switch. The Signal Display information passes through an Attenuator to CH 2 of the Channel Switch. Chop or alternate drive pulses (selected by the internal Mode switch) to the Channel Switch is supplied by the mainframe. The switched Gate and Signal Display information pass through the Signal Amplifier to the mainframe to be displayed on the crt.

TRIGGER PICKOFF

The attenuated Signal Display information passes through a Trigger Amplifier to the mainframe and triggers the time base.

CIRCUIT OPERATION

INTRODUCTION

This section provides a detailed description of the electrical operation and relationship of the circuits in the 7D12. The theory of operation for circuits unique to this instrument is described in detail in this discussion.

Circuits commonly used in the electronics industry are not described in detail. If more information is desired on these commonly used circuits, refer to the following textbooks.

Jacob Millman and Herbert Taub, "Pulse, Digital, and Switching Waveforms", McGraw-Hill, New York, 1965.

Robert C. Baron and Albert T. Piccirilli, "Digital Logic and Computer Operations", McGraw-Hill, New York, 1966.

Thomas C. Bartee, "Digital Computer Fundamentals", McGraw-Hill, 1962.

Yaohan Chum, "Digital Computer Design Fundamentals", McGraw-Hill, 1962.

Neil A Robin, "Analog-To-Pulse-Width Converter Yields 0.1% Accuracy", EDN Journal, Vol. 15, Issue 21, November 1, 1970, page 42.

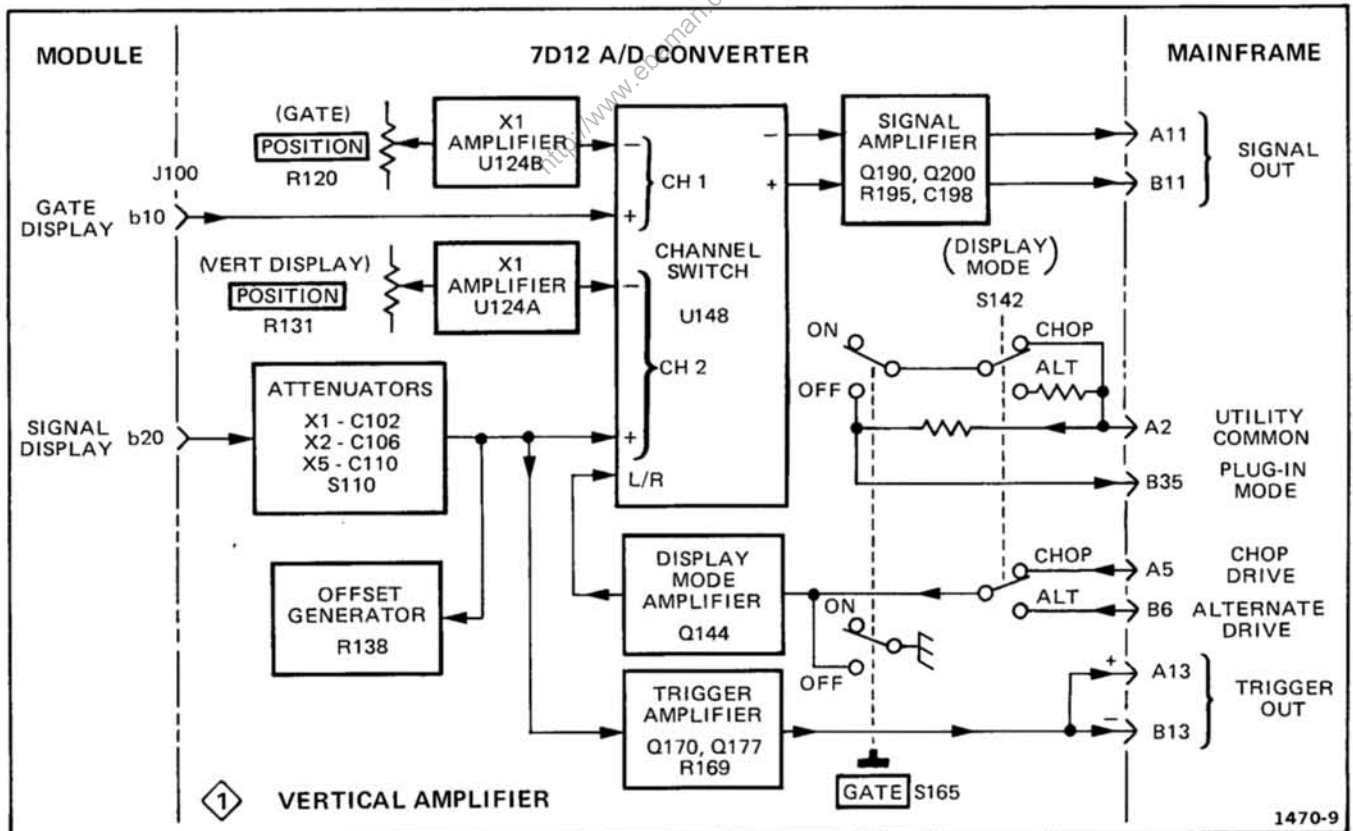


Fig. 2-7. Block diagram of the Dual-Trace Vertical Amplifier section.

VERTICAL AMPLIFIER

VERTICAL DISPLAY ATTENUATOR

Module signal display information is coupled to the 7D12 vertical amplifier through pin b20 on J100. Refer to the Vertical Amplifier diagram 1 in Section 6. The signal display passes through an attenuator network (selected by ATTEN switch S110) to the amplifier circuitry. The ATTEN switch is a rotary-cam type and is shown in the 1X (unity gain) position. Module signal display output voltage to the CH 2 vertical amplifier are standardized in the 1X ATTEN switch position. The 2X and 5X positions are referenced to the 1X attenuator network. Each attenuator network presents a 1 kilohm load to the signal display output in the module. High-frequency compensation adjustments C102, C106 and C110 are adjusted to minimize front corner rolloff and peaking. The CH 2 high-frequency compensation network connects to pins 8 and 9 of U148.

DISPLAY OFFSET

The signal display passes from the attenuator network to one side of the CH 2 differential amplifier (pin 7, U148). The other side of the differential amplifier (pin 10, U148) connects to the VERTICAL DISPLAY POSITION control, R131. The POSITION control, R131, supplies a variable dc voltage to the no-signal side of the differential amplifier, allowing vertical trace positioning. With no-signal input, U148 pin 7 draws a small amount of current through R105, R109 or R112 depending upon the ATTEN switch setting. The resulting voltage drop across these resistors can cause vertical trace shift as the ATTEN switch setting is changed. Display Offset adjustment R138 is set to supply U148 pin 7 with the required current. When properly set, R105, R109 and R112 will have zero voltage drop.

TRIGGER LEVEL

A pickoff of the attenuated signal display information is amplified by Q170 and Q177. The base of Q170 and the collector of Q177 should be zero volts during a no-signal-in condition. The amplifier is balanced by setting the Q177 collector (TP177) to zero volts using the Trig Level adjustment R169. In the balanced condition signal display information to the base of Q170 will have equal amplitude in the positive- and negative-going excursions to internally trigger the time base.

GATE DISPLAY

Gate display information from the module is coupled to the vertical amplifier through pin b10 on J100. The gate display signal passes through voltage divider R128, R127 and transformer T125 to one side of differential amplifier.

The other side of the differential amplifier (pin 2, U148) connects through T125 to the GATE POSITION control R120. GATE POSITION control R120 supplies a variable dc voltage to the no-signal side of the differential amplifier, allowing gate trace positioning. Transformer T125 allows the differential amplifier to operate push-pull at the higher frequencies thereby reducing front-corner degeneration. GATE DISPLAY switch S165 is the ON position couples pin 4 of U148 to the channel switching signals from the mainframe. The CH 1 high-frequency compensation network connects to pins 1 and 16 of U148.

DISPLAY MODES

The GATE switch (S165) ON position connects the internal Display Mode switch, S142, to the mainframe chop and alternate drive signals which couple to pin 4 of U148. The output of U148 (pins 12 and 13) will either chop or alternate between CH 1 (pins 2 and 15) and CH 2 (pins 7 and 10) depending on the Display Mode switch setting. GATE switch S165, in the OUT-OFF position, holds pin 4 of U148 high allowing CH 2 only to pass.

VERTICAL AMPLIFIER OUTPUT

Channel Switch U148, pins 12 and 13, is connected to the output amplifier Q190 and Q200. Voltage dividers R205, R206, and R215, R216 present an output impedance of 50 ohms to the mainframe. Refer to Table 2-2.

TABLE 2-2
U148 INPUT/OUTPUT TABLE FOR
CH 1 AND CH 2 DISPLAY MODES

| INPUT | OUTPUT |
|--------------------------|---|
| DISPLAY MODE SIGNAL 4 | VERTICAL OUTPUT SIGNAL 12, 13 |
| LO | CH 1 and CH 2 Chopped or Alternating |
| HI | CH 2 |

4-1/2 DIGIT A/D CONVERTER

$|G_m|$ CONVERTER

Module analog information to be measured enters the 7D12 A/D Converter through pins J (V_{hi}) and N (V_{lo}) of J100. Refer to the 4-1/2 Digit A/D Converter diagram 2 in Section 6. Dual-diode CR226 protects the $|G_m|$ Converter input transistor Q244 and electronic switches Q233-Q237 from voltage transients. The V_{hi} or V_{lo} input to Q244 is selected by electronic switches Q233 and Q237. The electronic switch gating voltages from Q313 and Q306 are neutralized by capacitor C235, thereby preventing gating noise from entering the $|G_m|$ Converter. The source bias of JFET Q244 is set to +195 mV with Fet Bias adjustment R249 through U248B and Q246. The +195 mV bias level prevents Q244 from conducting during the no-signal-input condition. Transistors Q242-Q250-Q252-Q254-Q246-U248A and B provide the current source for JFETs Q244 and Q262. Q244 and Q262 present a high impedance to the input signal. When the output of U260 goes positive, Q267 turns on, opening a current path through R269-CR279-U276. When the output of U260 goes negative Q270 turns on, opening a current path through CR263-R269-U260. Resistor R269 determines the conversion of voltage to current. The output of the $|G_m|$ Converter (drains of Q267 and Q270) is connected to electronic switch CR338 and CR339.

AUTO-ZEROING CIRCUIT

The output of U260 is amplified by U283 and connects to the input of the Auto-Zeroing Circuit U301. Offset Voltage Storage Capacitor C302 stores the offset voltage of the $|G_m|$ Converter. Refer to the Timing Diagram in Fig. 2-3 for sequence of events. Electronic switch Q290 is open between t_0 and t_2 , allowing C302 to hold the output of U283 and U276 at the predetermined offset level. Q275 provides a high-impedance input to U276.

READOUT POLARITY

The output of U260 couples through R265 to the input of U283. The output of U283 drives the base of Q287, thereby allowing current to flow through the light-emitting diode portion of U289. Current through the diode generates the — polarity information. The + polarity information is generated when the diode is not conducting.

REFERENCE CURRENT GENERATOR

The emitter current of Q353 is held constant by VR350 and U351, thereby holding the input of U356 at a constant

voltage. The output of U356 drives JFET Q363 allowing current to flow through series resistors T362-R361-R360 and R359. A/D Gain adjustment R361 sets the current necessary to discharge C379 in a given period of time; therefore, the A/D Gain adjustment determines the value of readout display for a given input voltage.

INTEGRATOR-COMPARATOR

JFET Q367 provides a high-impedance input to the Integrator amplifier U375. Q369 is the current source for Q367. Q376 and Q378 provide amplification at the higher frequencies. The collector of Q378 connects to the input of Comparator U380. The output of U380 is fed back through R383 to electronic switch Q336. Q336 is on before t_0 , connecting the output of Comparator U380 to the Integrator input, Q367. At t_0 , Q336 turns off allowing the Integrator to start at zero volts. The output of the $|G_m|$ Converter (Q267 and Q270) begins charging capacitor C379 at t_1 . At T_2 the counters send a negative-going 20K Count pulse to T326. The resultant negative-going 20K Count pulse from the collector of Q329 clears U317A, thereby changing the states of electronic switches Q313 and Q306. Q233 turns off and Q237 turns on disconnecting V_{hi} from Q244. Q290 turns on allowing the Auto-Zeroing Circuit, Q296-Q298-U301, to null the $|G_m|$ Converter inputs.

LOGIC

60 MILLISECOND MULTIVIBRATOR

Refer to the Logic diagram 3 in Section 6. A positive-going A/D Convert Command from the module turns on Q434. The result I_o input signal to pin 1, U436A, allows pin 3 to go hi. Monostable multivibrator Q440A output changes state for a period of 60 milliseconds. The measurement rate can be adjusted from one to approximately four measurements per second by the setting of Trig Rate adjustment R441. The negative-going 60 millisecond pulse is coupled to pin 9, U440B, and to TRIG'D indicator CR438.

2 MILLISECOND MULTIVIBRATOR

The negative-going 60 millisecond pulse from pin 4, U440A, is coupled to monostable multivibrator U440B, pin 9. The output of U440B changes state for a period of 2 milliseconds. A positive-going 2 mS pulse from U440B, pin 5, resets U500. A negative-going 2 mS pulse from U440B, pin 12, is coupled to Clock Sync ff U476C.

Theory of Operation—7D12 Service

1 MHz CLOCK

The 1 megahertz clock signal is generated by U402D, F and Y449. U402E is a buffer stage. The clock signal passes through U456A ($\div 2$), U458 ($\div 12$) and U456 ($\div 2$) to synchronize the Floating Power Supply Inverter at a frequency of 20.8 kHz. The clock signal also connects to Clock Sync ff U476B.

CLOCK SYNCHRONIZATION

A negative-going 2 millisecond pulse from U440B, pin 12 is coupled to U476C, pin 10. After 2 milliseconds, the pulse to U476C pin 10 goes positive. The next positive-going pulse to U476B pin 5 changes the output state of U476B and U476C, thus generating a pulse to the Start Ramp and A/D Converting Pulse outputs. U402B inverts the pulse for an A/D Stansby pulse output.

MEASUREMENT PERIOD

At t_1 (refer to Fig. 2-3) a Stop Count pulse through Q480 resets U476A and D which turns of U436C, thereby shutting off the clock pulses to the counters.

COUNTERS AND LATCHES

The clock pulses pass through wave-shaping monostable multivibrator U495 to the counters U500. At t_1 the Stop Count pulse through U476A and D enables AND gate U492D (pin 11, U492D is held lo throughout the timing cycle). The output of U492D generates a pulse to transfer the contents of the counters (10K count carry pulse) through Q507 to enable U509A. The second 10K count carry pulse enables U509B, which generates a 20K count pulse output at pin 8. At t_3 , the output of U492D is coupled to the memories, U514A and B. A Stop Count pulse from pin 13, U492D (through U500), transfers the contents of U509A and B to memories U514A and B. U492B and Q540 will blank the most significant digit when that digit is zero. Q552 provides the first significant digit information, numerals 1 or 2. Q547 provides the overrange (>) information to the column output line.

Column Current adjustment R499 sets the U500, A_0 , output current. The U500, A_0 , output current determines the Column current to the mainframe readout circuit.

At t_2 the 20K Count pulse enables U492A and pin 6 of U514C samples the polarity information. At hi input at U514C pin 6 turns on Q524 and the Polarity Enable goes lo providing a + readout information to the mainframe readout circuit.

LOGIC TRIGGERING

SINGLE SWEEP RESET

The Single Sweep Reset pulse from the mainframe couples through inverter U402C to amplifier Q404. A negative-going input pulse to U402C turns on Q404 providing a single positive trigger pulse to the module.

AUTO TRIGGERING

Free-running oscillator Q410 provides a continuous 4 Hz trigger signal to the module in the AUTO TRIGGERING mode.

EXT AND MAN TRIGGERING

An externally generated trigger signal is allowed to pass directly to the module in the EXT TRIGGERING mode. Manual triggering the 7D12 discharges capacitor C419 through resistor R420 to provide a single trigger pulse.

POWER AND CONNECTORS

FLOATING POWER SUPPLY

Inverter Circuit Q590, Q593 and Q600, Q603 is driven with a 20.8 kHz differential synchronous signal from the Clock Generator. Refer to the Power and Connectors diagram 4 in Section 6. Power to the inverter is supplied by the mainframe +15 and -15 volt supplies.

The differential synchronous clock signals are coupled to the bases of Q590 and Q600 through J587 and J597. The collectors of Q593 and Q603 alternately supply -15 volts to each end of the primary of transformer T595, which returns to +15 volts at the center tap.

Inverter signal noise generated in the power supply circuit is neutralized via feedback capacitors C603, C604 and C594, C593. Inverter Sig Neut adjustment C593 is adjustable to minimize the inverter pulse amplitude on the floating ground.

The square-wave inverter signal is rectified and filtered in the floating section of the power supply. Diodes CR606, CR607, CR608 and CR609 rectify current for the Floating +15 and -15 volt Supplies. CR655 and CR656 rectify current for the Floating +5 Volt Supply.

The +5 volt reference voltage is determined by voltage divider R611-R612-R613, R614, which is connected between floating +15 volts and floating ground. Temperature-compensated zener diode VR613 maintains a constant 9 volt drop across R612, R613 and R614.

The Floating +15 and -15 Volt Regulator voltages are based on the +5 volt reference voltage. The +5 volt reference accuracy is set to +5 volts within 10 mV, with adjustment R613. Each regulator circuit has short-circuit protection.

+15 Volt Regulator

Current flows from the floating +15 volt output through voltage divider R629 and R628 to floating ground. The resultant voltage drop across the divider sets U618 pin 3 at +5 volts. Voltage divider R629 and R628 determine the output voltage accuracy. Any attempted output voltage change in the +15 volt supply appears at U186 pin 3, thus changing the output level at pin 6. The regulator output at pin 6 drives the base of Darlington pair Q620 and Q622 to supply a voltage-regulating current. Q626 provides short-circuit protection for the + volt regulator circuit. Q626 is on, during normal operation, connecting pin 4 of U618 (V_{cc-}) to floating ground. If the output level drops below +3.5 volts, Q626 turns off, thereby disabling the supply.

-15 Volt Regulator

Current flows from the -15 volt output through R640 and R641 to the +5 volt reference voltage. The resultant voltage drop across the divider sets U643 pin 3 at zero volts. Any attempted output voltage change in the -15 volt supply appears at pin 3 of U643, thus changing the output level at pin 6. The regulator output at pin 6 of U643 drives the base of Q646 to supply voltage-regulating current. Q639 and VR637 provide short-circuit protection for the -15 volt supply. Q639 and VR637 are off during normal operation. If the output voltage goes positive to -3 volts or more, VR637 conducts turning on Q639 and reduces the +5 volt reference voltage to about -17 volts. The output level at U643 pin 6 is reduced, turning off current output transistor Q646.

+5 Volt Regulator

Any attempted output voltage change in the floating +5 volt supply appears at pin 3 of U659, thus changing the output level at pin 6. The regulator output at U659 pin 6 drives the base of Q661 to supply voltage-regulating current. Q664 provides short-circuit protection for the +5 volt regulator circuit. Q664 is on during normal operation connecting (V_{cc}) U659 pin 4 to floating ground. If the +5 volt output level drops below +0.7 volt, Q664 turns off to disable the supply.

<http://www.ebaman.com>

MAINTENANCE

INTRODUCTION

This section of the manual contains maintenance information for use in preventive maintenance, corrective maintenance and trouble shooting of the 7D12.

Further maintenance information relating to general maintenance can be found in the instruction manuals for the 7000-series oscilloscopes.

PREVENTIVE MAINTENANCE

INTRODUCTION

Preventive maintenance, consisting of cleaning, visual inspection, etc., performed on a regular basis, will ensure the reliability of this instrument. Periodic checks of the semiconductor devices used in this unit are not recommended as a preventive maintenance measure.

CLEANING

The 7D12 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket and prevents efficient heat dissipation. It also provides an electrical conduction path which may result in instrument failure. The side panels provide protection against dust in the interior of the instrument. Operation without the panels in place necessitates more frequency cleaning.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. In particular, avoid chemicals which contain benzene, toluene, xylene, acetone or similar solvents. Recommended cleaning agents are isopropyl alcohol or Kelite (1 part Kelite, 20 parts water).

Front Panel

Loose dust may be removed with a soft cloth or a dry brush. Water and mild detergent may be used. However, abrasive cleaners should not be used.

Interior

Cleaning the interior of the unit should precede calibration, since the cleaning process could alter the settings of the calibration adjustments. Use low-velocity compressed air to blow off the accumulated dust. Hardened dirt can be removed with a soft dry brush, cotton-tipped swab, or cloth dampened with mild detergent and water solution.

Lubrication

The reliability of potentiometers, switches and other moving parts can be maintained if they are kept properly lubricated. However, over-lubrication is as detrimental as too little lubrication.

Use a cleaning-type lubricant on shaft bushings, interconnecting plug contacts and switch contacts. Lubricate switch detents with a heavier grease. A lubrication kit containing the necessary lubricating materials and instructions is available through any Tektronix Field Office. Order Tektronix Part Number 003-0342-00.

VISUAL INSPECTION

The 7D12 should be inspected occasionally for such defects as broken connections, improperly seated semiconductors, damaged or improperly installed circuit boards and heat-damaged parts.

The corrective procedure for most visible defects is obvious. However, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.

RECALIBRATION

To ensure accurate measurements, check the calibration of this instrument after each 1000 hours of operation or every six months if used infrequently. In addition, replacement of components may necessitate recalibration of the affected circuits. The calibration procedure can also be helpful in localizing certain troubles in the instrument. In some cases, minor troubles may be revealed and/or corrected by recalibration.

TROUBLESHOOTING

INTRODUCTION

The following information is provided to facilitate troubleshooting of the 7D12. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles, particularly where integrated circuits are used.

TROUBLESHOOTING AIDS

Diagrams

Circuit diagrams are given on foldout pages in Section 6. The circuit number and electrical value of each component in this instrument are shown on the diagrams.

Circuit Boards

The circuit boards used in the 7D12 are outlined on the schematic diagrams, and layout drawings of the boards are shown adjacent to the associated schematic diagram. Each board-mounted electrical component is identified on the drawing of its circuit number.

Component and Wiring Color Code

Colored strips or dots on resistors and capacitors signify electrical values, tolerances, etc., according to EIA standard color code. Components not color-coded usually have the value printed on the body.

The insulated wires used for interconnection in the 7D12 are color-coded to facilitate tracing wires from one point to another in the unit.

Semiconductor Lead Configurations

The lead configurations of most semiconductor devices used in this instrument are shown on the foldout preceding the schematic diagrams. Individual special semiconductor configurations are shown on the schematic diagram adjacent to its component symbol.

TROUBLESHOOTING EQUIPMENT

The following equipment is useful for troubleshooting the 7D12.

1. Semiconductor Tester — Some means of testing the transistors, diodes, fet's used in this instrument is helpful. A transistor-curve tracer such as the Tektronix 576 Curve Tracer will give the most complete information.

2. Multimeter — A voltmeter is required for checking voltages within the circuits, and an ohmmeter for checking fuse continuity, and resistance values.

3. Test Oscilloscope — A test oscilloscope is required to view waveforms at different points in the circuit. A Tektronix 7000-series mainframe equipped with a readout system, 7D13 Digital Multimeter unit, 7B-series Time-Base unit and a 7A-series amplifier unit with a 10X probe will meet the needs of both items 2 and 3.

4. Plug-in Extender — A fixture that permits operation of the unit outside of the plug-in compartment for better accessibility during troubleshooting. Order Tektronix Part Number 067-0589-00.

5. Test Module — A fixture that permits direct signal coupling to the vertical display, gate input or analog-to-digital circuitry in the 7D12. Order Tektronix Part Number 067-0700-00.

TROUBLESHOOTING PROCEDURE

This troubleshooting procedure is arranged in an order which checks the simple trouble possibilities before proceeding with extensive troubleshooting.

1. Check Control Settings

An incorrect setting of the 7D12 controls can indicate a trouble that does not exist. If there is any question about the correct function or operation of a control or front-panel connector, see the Operating Information section.

2. Check Associated Equipment

Before proceeding with troubleshooting of the 7D12 check that the equipment used with this instrument is operating correctly. If possible substitute an A/D Converter unit known to be operating correctly into the indicator unit and see if the problem persists. Check that the input signals are properly connected and that the interconnecting cables are not defective.

3. Visual Check

Visually check the portion of the instrument in which the trouble is suspected. Many troubles can be located by visual indications, such as unsoldered connections, broken wires, damaged circuit boards, damaged components, etc.

4. Check Instrument Performance

Check the calibration of the unit or the affected circuit, by performing Part I-Performance Check of Section 4. The apparent trouble may only be a result of misadjustment, and may be corrected by calibration. Complete calibration instructions are given in Section 4, Part II-Calibration.

5. Check Voltages and Waveforms

Often the defective component can be located by checking for the correct voltage or waveform in the circuit.

6. Check Individual Components

The following procedures describe methods of checking individual components in the 7D12. Components that are soldered in place are best checked by first disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.

CAUTION

Power switch must be turned off before removing or replacing semiconductors.

SEMICONDUCTORS. A good check of transistor operation is actual performance under operating conditions. A transistor can be most effectively checked by substituting a new component for it (or one which has been checked previously). However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions.

IC's (integrated circuits) can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of circuit operation is essential to troubleshooting circuits using IC's. Use care when checking voltages and waveforms around the IC's so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the 14- and 16-pin IC's is

with an IC test clip. This device also doubles as an extraction tool. The lead configuration for the semiconductors used in this instrument are shown on the diagrams preceding the diagrams section.

Diodes can be checked for an open or shorted condition by measuring the resistance between terminals. With an ohmmeter scale having an internal source of between 800 millivolts and 3 volts, the 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 has a high internal current. High currents may damage the diode.

The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes or a dot. For most silicon or germanium diodes with a series of stripes, the color-code identifies the three significant digits of the Tektronix Part Number using the resistor color-code system (e.g., a diode color-code pink-, or blue-, brown-gray-green indicates Tektronix Part Number 152-0185-00). The cathode and anode ends of metal-encased diodes can be identified by the diode symbol marked on the body.

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.

INDUCTORS. Check for open inductors by checking continuity with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit. Partial shorting often reduces high-frequency response (roll-off).

CAPACITORS. A leaky or shorted capacitor can best be detected by checking resistance with an ohmmeter on the highest scale. 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 if the capacitor passes AC signals.

Maintenance—7D12 Service

7. 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 or had any electrical components replaced.

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 electrical and mechanical part replacements for the 7D12 can be obtained through your local Tektronix Field Office or representative. However, many of the electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating and description.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect the performance of the instrument, particularly at high frequencies. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.

Special Parts

In addition to the standard electronic components, some special parts are used in the 7D12. These parts are manufactured or selected by Tektronix, Inc. in accordance with our specifications. See Cross Index Mfr. Code Number to Manufacturer in the Parts List. 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.

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used when repairing or replacing parts. General soldering techniques which apply to maintenance of any precision electronic equipment should be used when working on this instrument. Use only 60/40 rosin-core, electronic-grade solder. The choice of soldering iron is determined by the repair to be made. When soldering on circuit boards, use a 35- to 40-watt pencil-type soldering iron with a 1/8-inch wide, wedge-shaped tip. Keep the tip properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the wiring from the base material. Avoid excessive heat; apply only enough heat to remove the component or to make a good solder joint. Also, apply only enough solder to make a firm solder joint; do not apply too much solder.

CAUTION

The circuit boards in this instrument are multi-layer type boards with a conductive path(s) laminated between the top and bottom board layers. All soldering on these boards should be done with extreme care to prevent breaking the connections to the center conductor(s); only experienced maintenance personnel should attempt repair of these boards.

For metal terminals, (e.g., switch terminals, potentiometers, etc.) a higher wattage-rating soldering iron may be required. Match the soldering iron to the work being done. For example, if the component is connected to the chassis or other large heat-radiating surface, it will require a 75-watt or larger soldering iron. The pencil-type soldering iron used on the circuit board can be used for soldering to switch terminals, potentiometers, or metal terminals mounted in plastic holders.

COMPONENT REPLACEMENT

Semiconductor Replacement

Transistors should not be replaced unless actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement of transistors may effect the calibration of this instrument. When transistors are replaced, check the performance of the part of the instrument which may be affected.

CAUTION

POWER switch must be turned off before removing or replacing semiconductors.

Replacement semiconductors should be of the original type or a direct replacement. The lead configuration of the semiconductors used in this instrument are shown preceding the diagram section. Some plastic case transistors have lead configurations which do not agree with those shown here. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. All transistor sockets in this instrument are wired for the standard basing used for metal-case transistors. Transistors which have heat radiators or are mounted on chassis use silicone grease to increase heat transfer. Replace the silicone grease when replacing these transistors.

WARNING

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

An extracting tool should be used to remove the 14- and 16-pin integrated circuits to prevent damage to the pins. This tool is available from Tektronix, Inc. Order

Tektronix Part Number 003-0619-00. If an extracting tool is not available when removing one of these integrated circuits, pull slowly and evenly on both ends of the device. Try to avoid having one end of the integrated circuit disengage from the socket before the other, as the pins may be damaged.

Interconnecting Pin Replacement

Two methods of interconnection are used in this instrument to connect the circuit boards with other boards and components. When the interconnection is made with a coaxial cable, a special end-lead connector plugs into a socket on the board. Other interconnections are made with a pin soldered onto the board. Two types of mating connections are used for these interconnecting pins. If the mating connector is on the end of a lead, an end-lead pin connector is used which mates with the interconnecting pin. The following information provides the replacement procedure for the various types of interconnecting methods.

COAXIAL-TYPE END LEAD CONNECTORS. Replacement of the coaxial-type, end-lead connectors requires special tools and techniques; only experienced maintenance personnel should attempt replacement of these connectors. It is recommended that the cable or wiring harness be replaced as a unit. For cable or wiring harness part numbers, see the Mechanical Parts List. An alternative solution is to refer the replacement of the defective connector to your local Tektronix Field Office or representative.

NOTE

A circuit-board pin replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order Tektronix Part Number 040-0542-00.

CIRCUIT-BOARD PINS. To replace a pin which is mounted on a circuit board, first disconnect any pin connectors. Then, unsolder the damaged pin and pull it out of the circuit board with a pair of pliers. Be careful not to damage the wiring on the board with too much heat. Ream out the hole in the circuit board with a 0.031-inch drill. Remove the ferrule from the new interconnecting pin and press the new pin into the hole in the circuit board. Position the pin in the same manner as the old pin. Then, solder the pin on both sides of the circuit board. If the old pin was bent at an angle to mate with a connector, bend the new pin to match the associated pins.

CIRCUIT BOARD PIN SOCKETS. The pin sockets on the circuit boards are soldered to the rear of the board. To

Maintenance—7D12 Service

replace one of these sockets, first unsolder the pin (use a vacuum-type desoldering tool to remove excess solder). Then straighten the tabs on the socket and remove it from the hole in the board. Place the new socket in the circuit board hole and press the tabs down against the board. Solder the tabs of the socket to the circuit board; be careful not to get solder into the socket.

NOTE

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

END-LEAD PIN CONNECTORS. The pin connectors used to connect the wires to the interconnecting pins are clamped to the ends of the associated leads. To replace damaged end-lead pin connectors, remove the old pin connector from the end of the lead and clamp the replacement connector to the lead.

Some of the pin connectors are grouped together and mounted in a plastic holder; the overall result is that these connectors are removed and installed as a multi-pin connector. To provide correct orientation of this multi-pin connector when it is replaced, an arrow is stamped on the circuit board and a matching arrow is molded into the plastic house of the multi-pin connector. Be sure these arrows are aligned as the multi-pin connector is replaced. If the individual end-lead pin connectors are removed from the plastic holder, note the color of the individual wires for replacement.

CIRCUIT BOARD REPLACEMENT

If a circuit board is damaged beyond repair, replace the entire assembly including all soldered-on components. Part numbers for completely wired circuit boards are given in the Mechanical Parts List.

The Triggering switch board is mounted on the front panel, and the Floating Board is mounted as a sub-assembly on the back of the mainboard; pin connectors are used for most interconnections with other circuit boards and components. Use the following procedure to remove the subassemblies and panel-mounted circuit boards.

The location of the pin connectors is shown on the circuit board illustrations in the diagrams section. Correct orientation of multi-pin connections is indicated by an

arrow molded into the connector housing (pin 1); a matching arrow is marked on the circuit board. Be sure these arrows are aligned as the multi-pin connector is replaced.

A2—FLOATING BOARD. Remove the Floating circuit board as follows:

1. Disconnect both cable connectors from the Floating circuit board.
2. Remove all four screws holding the Floating board to mounting surface.
3. Remove the board from the unit.
4. Replace the Floating board in reverse order of removal. Match all pins on mounting surface with holes in the Floating board. Cables can be connected to either connector.

A1—MAINBOARD. Remove main circuit board as follows:

1. Remove the Floating board as outlined in previous procedure.
2. Remove all four springs and shield from the backside of the mainboard.
3. Loosen hex-socket screws on the attenuator switch and POSITION control knobs. Remove both knobs.
4. Disconnect all cables and multi-pin connectors from the circuit board. Remove the cable hold-down screw.
5. Remove both screws securing top edge of the circuit board and single screw from lower end of module connector.
6. Remove the four screws securing rear bracket. Lift top plate slightly and pull circuit board out.
7. Remove rear bracket from Main circuit board using small screwdriver to lift retainers.

8. Reassemble in reverse order of removal. Insert rear bracket screw with spacer on upper left corner as viewed from instrument rear.

A3—TRIGGERING SWITCH BOARD. Remove Triggering Switch circuit board as follows:

1. Loosen hex-socket screws on attenuator switch and POSITION control knobs. Remove both knobs.
2. Remove GATE POSITION knob (pull straight back).
3. Remove the two nuts on rear of front panel using a 5/16-inch open-end wrench. Remove front panel.
4. Make a color-code wiring sketch of the eight wires and cables that connect to the Triggering switch circuit board. Unsolder these wires from circuit board.
5. Unscrew Triggering switch securing screws from sub panel. Remove switch and plastic LED (TRIG'D indicator) spacer from sub panel.
6. Replace defective switch by replacing entire board with switch attached. Reverse order of above procedure to re-install Triggering switch board assembly, front panel, knobs and other parts that have been removed.

SWITCH REPLACEMENT

Several types of switches are used in the 7D12. The Triggering or Gate switches should be replaced as a unit if damaged. The following special maintenance information is provided for the cam-type (Attenuator) switch.



Repair of cam-type switches should be undertaken only by experienced maintenance personnel. Switch alignment and spring tension of the contacts must be carefully maintained for proper operation of the switch. For assistance in maintenance of cam-type switches, contact your local Tektronix Field Office or representative.

CAM-TYPE SWITCH. Disassemble VERTICAL DISPLAY ATTEN cam-type switch as follows:

NOTE

A cam-type switch repair kit including necessary tools, instructions, and replacement contacts is available from Tektronix, Inc. Order Tektronix Part Number 040-0541-00.

The VERTICAL DISPLAY ATTEN cam-type switch consists of a rotating cam, which is turned by the front-panel knobs and a set of contacts mounted on an adjacent circuit board. These switch contacts are actuated by lobes on the cam.

1. Remove Floating board, springs and shield as described previously.
2. Loosen setscrews securing potentiometer shaft (VERTICAL DISPLAY POSITION control) to extension rod. Remove extension rod and knob.
3. Loosen setscrews securing Attenuator switch knob. Remove knob.
4. Remove screws in cam-switch cover. Remove cam cover.
5. Remove the four screws securing front and rear support blocks. Remove rear support block. Lift front support block and slide cam with extension shaft from front panel. Be careful not to lose the two shaft grounding springs in front support block.
6. To replace defective switch contacts, follow the instructions given in the switch repair kit.
7. To re-install switch assembly, reverse the above procedure.

Fuse Replacements

The fuses used in this instrument are as follows:

**TABLE 3-1
FUSE RATINGS**

| Circuit Number | Rating | Function | Location |
|----------------|--------|-----------|----------------|
| F581 | 750 mA | +15 volts | Floating Board |
| F585 | 750 mA | -15 volts | Floating Board |

Maintenance—7D12 Service

Recalibration After Repair

After any electrical component has been replaced, the calibration of that particular circuit should be checked, as well as the calibration of other closely related circuits. See Section 4, Part II-Calibration for a complete calibration procedure.

Instrument Repackaging

If this instrument is to be shipped for long distances by commercial transportation, it is recommended that it be

repackaged in the original manner for maximum protection. The original shipping carton can be saved and used for this purpose. An illustration associated with the Mechanical Parts List shows how to repackage the 7D12 and gives the part number for the packaging components. New shipping cartons can be obtained from Tektronix, Inc. Contact your local Tektronix Field Office or representative.

<http://www.ebaman.com>

PERFORMANCE CHECK/CALIBRATION

PRELIMINARY INFORMATION

CALIBRATION INTERVAL

To ensure instrument accuracy, check the calibration of the 7D12 every 1000 hours of operation, or every six months if used infrequently. Before complete calibration, thoroughly clean and inspect this instrument as outlined in the Maintenance section.

TEKTRONIX FIELD SERVICE

Tektronix, Inc. provides complete instrument repair and recalibration at local Field Service Centers and the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

USING THIS PROCEDURE

Index

To aid in locating a step in the Performance Check or Calibration procedures, an index is given preceding Part I-Performance Check and Part II-Calibration.

Performance Check

The performance of this instrument can be checked, without removing the covers or making internal adjustments, by performing only Part I-Performance Check. The procedure checks all the basic functions of the 7D12 for proper operation as a single unit. Actual performance requirements are listed and checked as an integral part of the module(s) Performance Requirements and performance checks. (See module Specification section(s) in Operators manual.)

Calibration Procedure

Completion of each step in Part II-Calibration, ensures that this instrument is correctly adjusted and performing within all given tolerances. Where possible, instrument performance is checked before an adjustment is made. For best overall performance when performing a complete calibration, make each adjustment to the exact setting, even if the CHECK — is in tolerance.

Partial Procedures

A partial performance check or calibration is often desirable after relocating components, or to touch up the adjustment of a portion of the instrument between major recalibrations. To check or adjust only part of the instrument, start with the Equipment Required list preceding the desired portion of the procedure. To prevent unnecessary recalibration of other parts of the instrument, readjust only if the tolerance given in the CHECK — part of the step is not met. If readjustment is necessary, also check any steps listed in the INTERACTION — part of the step.

TEST EQUIPMENT REQUIRED

The test equipment and accessories listed in Table 4-1, or equivalent, is required for complete calibration of the 7D12. Specifications given for the equipment are the minimum necessary for accurate calibration. Therefore, the equipment used must meet or exceed the listed specifications. Detailed operating instructions for the test equipment are not given in this procedure. Refer to the appropriate instruction manual if more information is needed.

If only a Performance Check is to be performed, not all of the listed test equipment is required. Items used only for calibration are indicated by footnote 1. The remaining pieces of equipment are common to both procedures.

Special Calibration Fixtures

Special Tektronix calibration fixtures are used only where they facilitate instrument calibration. These special calibration fixtures are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

Calibration Equipment Alternatives

All of the listed test equipment is required to completely check and calibrate this instrument. However, complete checking or calibration may not always be necessary or desirable. The user may be satisfied with checking only selected characteristics, thereby reducing the amount of test equipment actually required.

The Performance Check and Calibration procedures are based on the first item of equipment given as an example. When other equipment is substituted, control

Performance Check/Calibration—7D12 Service

settings or calibration setup might need to be altered. If the exact item of equipment given as an example in the Test Equipment list is not available, first check the specifications column carefully to see if any other equipment might suffice. Then check the Usage column to see what this item is used for. If used for a check or adjustment that is of little or no importance to your measurement requirements, the item and corresponding step(s) can be deleted.

The following procedure is written to completely check and adjust the 7D12 and to allow interchangeability of M-series module units without the need to completely recalibrate the instrument with each module.

Signal Connections

Detailed signal-connection information is not given in this procedure except where critical for a particular test. In general, the external trigger input connector should be connected to other equipment with 50-ohm BNC cables. The input impedance is determined by the module used. Since the 7D12 is completely calibrated using the 7D12 Calibration Fixture, the external trigger input impedance will remain at 10K ohms throughout the procedure. Use a BNC T connector to simultaneously connect a signal to two inputs. Signal-connection and termination information for the test equipment should be available in the associated instruction manual.

**TABLE 4-1
TEST EQUIPMENT**

| Description | Minimum Specifications | Usage | Examples of Applicable Test Equipment |
|--|--|---|---|
| 1. Indicator Oscilloscope | Tektronix 7000-series oscilloscope equipped with a readout system and a calibrator square-wave output, 0.2 V and 0.4 V into 50Ω. | Used throughout procedure to provide a display and square-wave calibrator signal. | a. Tektronix 7704A Oscilloscope System. b. Tektronix 7904 Oscilloscope System. |
| 2. Calibration Fixture | Tektronix 7D12 Calibration Fixture | Used throughout procedure | a. Tektronix Part 067-0700-00. |
| 3. Time-Base Unit | Tektronix 7-B series | Used throughout procedure to provide sweep. | a. Tektronix 7B53A Dual Time Base. b. Tektronix 7B92 Dual Time Base. c. Tektronix 7B70 Time Base. |
| 4. Amplifier Plug-in Unit ¹ | Compatible with Tektronix 7000-series oscilloscopes. Vertical sensitivity, 10 μV per division. | Column current adjustment. Gate pulse neutralization adjustment. Inverter signal neutralization adjustment. | a. Tektronix 7A22 Differential Amplifier. |
| 5. DC Voltage Calibrator ¹ | Range, 0 to 2V into 1 MΩ; accuracy, within 0.01% | A/D gain adjustment. Column current adjustment. | a. Fluke Model 341A or 343A DC Voltage Calibrator. b. Hewlett Packard Model 740B. |

¹Used for calibration only; NOT used for performance check.

TABLE 4-1 (cont)

| Description | Minimum Specifications | Usage | Examples of Applicable Test Equipment |
|--|--|--|---|
| 6. Medium-Frequency Constant Amplitude Signal Generator ¹ | Frequency, 100 mHz reference frequency equal to, or less than than 50 kHz; output amplitude, variable from 0.5 V to 3 V peak-to-peak into 50 Ω ; amplitude constant within 3% of reference amplitude as output frequency changes. | Vertical display frequency response check. Gate waveform frequency response check. | a. Tektronix Type 191 Constant Amplitude Signal Generator. |
| 7. Plug-in Extender ¹ | Tektronix 7000-series plug-in extender. | Allows access to internal adjustments in the 7D12. | a. Tektronix Part 067-0616-00 (flexible). b. Tektronix Part 067-0589-00 (rigid). |
| 8. Precision DC Voltmeter ¹ | Accuracy within 0.5% range, 0 to 5V; resolution, at least 5 mV. | Floating power supply; vertical display and analog-to-digital converter adjustments. | a. Tektronix 7D13 Digital Multimeter. b. Weston Model 4440 Digital Multimeter. c. Fluke Model 825A Differential DC Voltmeter. |
| 9. Square Wave Generator ¹ | Risetime, greater than 1 nS; output amplitude at least 500 mV into 50 Ω . | Attenuator high frequency compensation adjustment. | a. Tektronix Type 106 Square-Wave Generator. |
| 10. 1X Voltage Probe ¹ | Compatible with Tektronix amplifier units. | Inverter signal neutralization adjustment. Gate pulse neutralization adjustment. | a. Tektronix P6011 Probe. |
| 11. 10X Voltage Probe ¹ (two required). | Compatible with Tektronix amplifier units | Column current adjustment | a. Tektronix P6006 Probe. |
| 12. Cable, Special Purpose | Connectors, pin jack to BNC male; length, 20 inches. | Calibrator pin jack signal coupling. | a. Tektronix Part 175-1178-00. |
| 13. 50 ohm Coaxial Cable | Impedance, 50 Ω ; length, 42 inches; connectors, BNC male. | Used throughout procedure for signal coupling. | a. Tektronix Part 012-0057-01. |
| 14. Adapter | Connectors, dual banana to female BNC | Used throughout procedure for coupling of coaxial cable to banana jacks. | a. Tektronix Part 103-0090-00. |
| 15. Patch Cord ¹ | Connectors, banana; length, 18 inches. | A/D bias adjustment | a. Tektronix Part 012-0031-00 (red). b. Tektronix Part 012-0039-00 (black). |

TABLE 4-1 (cont)

| Description | Minimum Specifications | Usage | Examples of Applicable Test Equipment |
|------------------------------|----------------------------------|--|---------------------------------------|
| 16. Screwdriver ¹ | Three-inch shaft, 3/32-inch bit. | Used throughout procedure to adjust variable resistors. | a. Xcelite R-3323. |
| 17. Tuning Tool ¹ | Low Capacitance. | Used throughout procedure to adjust variable capacitors. | a. Tektronix Part 003-0675-00. |

<http://www.ebaman.com>

PART 1 — PERFORMANCE CHECK

INTRODUCTION

The following procedure checks the performance of the 7D12 as a single unit without making internal adjustment. All tolerances given in this procedure are intended to indicate proper operation only and should not be interpreted as instrument specifications.

INDEX TO PART 1 PERFORMANCE CHECK

| | Page |
|--|------|
| Preliminary Procedure for Performance Check | |
| Vertical Display | |
| 1. Check Display Attenuator Readout and Gain Accuracy. | 4-6 |
| 2. Check Chopped and Alternate Mode. | 4-6 |
| Voltage Readout Display and Triggering | |
| 3. Check Auto, External and Manual Functions. | 4-7 |
| Gate Display | |
| 4. Check Gain Accuracy and Position Control. | 4-8 |

PRELIMINARY PROCEDURE FOR PERFORMANCE CHECK

NOTE

The performance of this instrument can be checked at any temperature within the -15°C to -40°C range unless stated otherwise.

1. Insert the 7D12 calibration fixture into the 7D12 (see Fig. 4-1) and install them in a vertical plug-in compartment of the indicator oscilloscope.

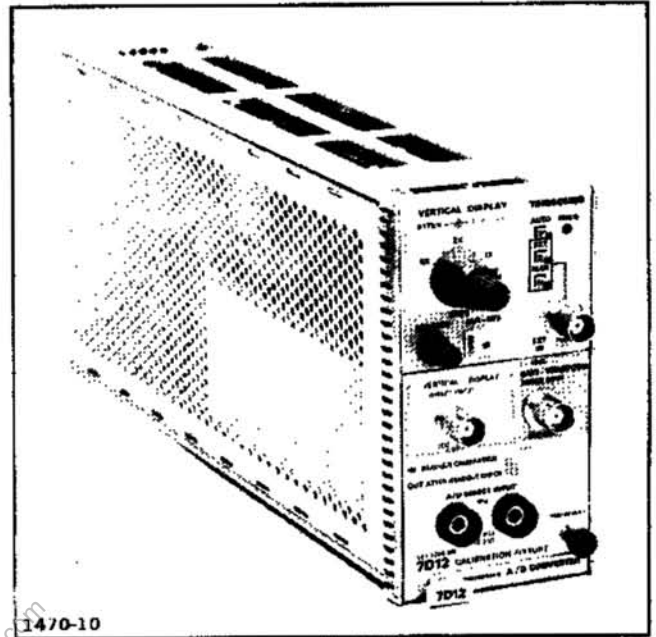


Fig. 4-1. 7D12 Calibration Fixture installed.

2. Install a time-base unit into the horizontal compartment of the indicator oscilloscope.
3. Connect the indicator oscilloscope to a power source which meets the voltage and frequency requirements of the oscilloscope power supply.
4. Turn the indicator oscilloscope on. Allow at least 20 minutes warmup time before checking the 7D12 performance.
5. Set the indicator oscilloscope modes to display the time base and 7D12. Select the 7D12 as the internal trigger source for the time-base unit.
6. Set the indicator oscilloscope readout and intensity controls to obtain a useable readout and sweep display on the crt. The readout display (voltage readout) should appear in the upper graticule division, and the vertical display sensitivity should appear in the lower division in a location corresponding to the plug-in compartment used.

VERTICAL DISPLAY

| | |
|--|---|
| <p>Equipment Required</p> <p>1. Indicator oscilloscope.</p> | <p>2. 7D12 Calibration Fixture.</p> <p>3. 50 ohm coaxial cable.</p> |
|--|---|

1. Check Display Attenuator Readout and Gain Accuracy.

a. Set the controls as follows:

| | |
|------------------------|---------|
| 7D12 | |
| VERTICAL DISPLAY ATTEN | 1X |
| TRIGGERING | AUTO |
| GATE | OUT—OFF |

7D12 Calibration Fixture

Atten Readout Check Out

b. CHECK — Rotate the VERTICAL DISPLAY POSITION control fully clockwise and counterclockwise. The trace should move off the graticule area in both directions.

c. Position the trace 2 divisions below the center graticule line.

d. Connect a 400 millivolt, 1 kilohertz signal from the oscilloscope calibrator to the 7D12 Calibration Fixture Vertical Display Direct Input Connector.

e. CHECK — Set the VERTICAL DISPLAY ATTEN switch to the settings given in Table 4-2. The display amplitude and lower numerical readout display should be within the limits for each switch setting listed in Table 4-2.

f. Disconnect the calibrator signal.

2. Check Chopped and Alternate Mode.

a. Remove the 7D12 from the indicator oscilloscope.

b. Remove the 7D12 left side panel and set the internal Display Mode switch to the Alt position. See Fig. 1-3.

c. Insert the 7D12 into the oscilloscope vertical plug-in compartment.

d. Set the 7D12 GATE switch to ON.

e. Set the time base unit sweep rate to 50 milliseconds per division.

f. CHECK — The Vertical Display trace and the Gate trace should be displayed alternately with each sweep on the crt.

g. Set the 7D12 internal Display Mode switch to the Chop position, and replace the left side panel. Refer to Fig. 1-3.

h. CHECK — The Vertical Display trace and the Gate trace should start at the same time.

**TABLE 4-2
VERTICAL DISPLAY AMPLITUDE
AND LOWER NUMERICAL READOUT**

| 7D12 VERTICAL DISPLAY ATTEN Switch | Display Amplitude (divisions) | | Lower Numerical Readout Display |
|--|----------------------------------|------|------------------------------------|
| | Min. | Max. | |
| 1X | 4.4 | 4.8 | 1 |
| 2X | 2.2 | 2.4 | 2 |
| 5X | 0.87 | 0.97 | 5 |

VOLTAGE READOUT DISPLAY AND TRIGGERING

| Equipment Required | |
|------------------------------|--|
| 1. Indicator oscilloscope. | 3. 50 ohm coaxial cable. |
| 2. 7D12 Calibration Fixture. | 4. Special purpose cable. |
| | 5. Dual-banana-plug to female BNC adapter. |

3. Check Auto, External, and Manual Functions.

a. CHECK — The AUTO, EXT and MAN TRIGGERING buttons light when pushed.

b. Set the controls as follows:

| | | |
|---------------------|--------------------------|---------|
| | 7D12 | |
| TRIGGERING | | AUTO |
| GATE | | OUT—OFF |
| | 7D12 Calibration Fixture | |
| Atten Readout Check | | Out |

Controls not mentioned can be set as desired.

c. CHECK — The TRIG'D indicator light is flashing and the voltage readout display reads approximately zero volts.

d. Connect a 4 volt, 1 kilohertz signal from the oscilloscope calibrator to the 7D12 Calibration-Fixture A/D Direct Input jacks.

e. CHECK — The voltage readout display should read approximately 2 volts (depending upon the accuracy of the oscilloscope calibrator).

f. Set the 7D12 TRIGGERING switch to EXT.

g. CHECK — The TRIG'D indicator light should not be on.

h. Disconnect the calibrator signal.

i. CHECK — The voltage readout obtained in part e should remain displayed on the crt.

j. Connect a 4 volt, 1 kilohertz signal from the oscillator calibrator to the TRIGGERING EXT IN connector.

k. CHECK — The voltage readout display reads zero volts and the TRIG'D indicator light is lit.

l. Disconnect the calibrator signal from the TRIGGERING EXT IN connector and connect it to the 7D12 Calibration Fixture, A/D Direct Input jacks.

m. Push the MAN TRIGGERING button.

n. CHECK — The voltage readout display should read approximately +2 volts.

o. Reverse the polarity to the 7D12 Calibration Fixture, A/D Direct Input jacks.

p. Push the MAN TRIGGERING button.

q. CHECK — The voltage readout display should read approximately —2 volts.

r. Disconnect all connections.

GATE DISPLAY

Equipment Required

- | | |
|------------------------------|---------------------------|
| 1. Indicator oscilloscope. | 3. 50 ohm coaxial cable. |
| 2. 7D12 Calibration fixture. | 4. Special purpose cable. |

4. Check Gain Accuracy and Position Control.

- a. Set the controls as follows:

| | | |
|------|------|----|
| GATE | 7D12 | ON |
|------|------|----|

Any controls not mentioned can be set as desired.

- b. Set the time-base unit sweep rate to 100 microseconds per division.

- c. CHECK — Rotate the GATE POSITION control fully clockwise and counterclockwise. The gate trace should move off the graticule area in both directions.

- d. Set the gate trace 1 division below the center horizontal graticule line.

- e. Connect a 200 millivolt signal from the oscillator calibrator to the 7D12 Calibration Fixture, Gate Waveform Direct Input connector.

- f. CHECK — The gate waveform amplitude to be from 1.5 to 2.5 divisions.

- g. Disconnect the coaxial cable.

This completes the Performance Check of the 7D12.

PART II — CALIBRATION PROCEDURE

7D12, Serial No. _____
 Calibration Date _____
 Calibrated by _____

Analog to Digital Converter

| | |
|--|------|
| 12. Adjust auto Triggering Measurement Rate. | 4-16 |
| 13. Check Manual and External Triggering Measurement Rate. | 4-16 |
| 14. Adjust A/D Bias. | 4-17 |
| 15. Adjust Column Current. | 4-17 |
| 16. Adjust A/D Gain. | 4-18 |
| 17. Adjust Gain Pulse Neutralization. | 4-18 |

INTRODUCTION

The following procedure returns the 7D12 to correct calibration. All limits and tolerances given in this procedure are calibration guides, and should not be interpreted as instrument specifications except as listed as a Performance Requirement in the Operators manual.

INDEX TO CALIBRATION PROCEDURE

| | |
|---------------------------------------|-------------|
| Preliminary Procedure for Calibration | Page 4-9 |
|---------------------------------------|-------------|

FLOATING POWER SUPPLY

- 1. Adjust +5 Volt Supply. 4-10
- 2. Check all Floating Power Supply Voltages. 4-10
- 3. Adjust Inverter Signal Neutralization. 4-10

VERTICAL DISPLAY

- 4. Adjust Trigger Level. 4-12
- 5. Adjust Attenuator Balance. 4-12
- 6. Adjust Amplifier Gain. 4-12
- 7. Check Attenuator and Readout. 4-12
- 8. Check Chop and Alternate Mode. 4-13

BANDWIDTH

- 9. Adjust Attenuator High Frequency Compensation. 4-14
- 10. Check Vertical Display Frequency Response. 4-14
- 11. Check Gate Waveform Frequency Response. 4-15

PRELIMINARY PROCEDURE FOR CALIBRATION

NOTE

This instrument should be calibrated at an ambient temperature of +25°C for best overall accuracy.

- 1. Remove both side panels from the indicator oscilloscope.
- 2. Remove the side covers from the 7D12.
- 3. Insert the 7D12 calibration fixture module into the 7D12. Refer to Fig. 4-1.
- 4. Connect a plug-in extender from the vertical plug-in compartment of the indicator oscilloscope to the 7D12.
- 5. Install a time-base unit in the horizontal compartment of the indicator oscilloscope.
- 6. Connect the indicator oscilloscope to a power source which meets the voltage and frequency requirements of the oscilloscope power supply.
- 7. Turn the indicator oscilloscope on. Allow at least 20 minutes warmup before proceeding with the first section.

NOTE

Titles for external controls of this instrument are capitalized in this procedure (e.g., POSITION). Internal adjustments are initial capitalized only (e.g., Display Gain).

FLOATING POWER SUPPLY

Equipment Required

- | | |
|------------------------------|----------------------|
| 1. Indicator oscilloscope. | 5. Plug-in extender. |
| 2. 7D12 Calibration Fixture. | 6. 1X voltage probe. |
| 3. Precision dc voltmeter. | 7. Screwdriver. |
| 4. Amplifier plug-in unit. | 8. Tuning tool. |

BEFORE YOU BEGIN, see ADJUSTMENT LOCATIONS in the diagrams section.

CONTROL SETTINGS

Set the controls as follows:

| | |
|---------------------------|----------|
| 7D12 | |
| VERTICAL DISPLAY POSITION | midrange |
| GATE | OUT-OFF |

Controls not mentioned can be set as desired.

1. Adjust +5 volt supply.

- a. Connect the precision dc voltmeter between the 5V TP and F GND (floating ground) test points.
- b. CHECK — Meter reading; +5.00 volts \pm 0.01 volt.
- c. ADJUST — +5 Volts adjustment R613 for a meter reading of +5.00 volts.
- d. INTERACTION — Any change in the setting of R613 may affect A/D Gain. Check step 30.

2. Check all Floating Power-Supply Voltages.

- a. CHECK — Table 4-3 lists the floating power supply voltages in the instrument. Check each supply with the precision dc voltmeter for output voltage within the given limits.
- b. Disconnect the voltmeter.

3. Adjust Inverter Signal Neutralization.

- a. Install an amplifier plug-in unit (Tektronix 7A22) into the vacant vertical compartment of the indicator oscilloscope.
- b. Connect a 1X voltage probe from the amplifier plug-in unit input connector to the F GND (floating ground) test point. (Connect the probe ground strap to chassis ground.)

TABLE 4-3
FLOATING POWER SUPPLY LIMITS

| Floating Power Supply | Output Voltage Limits (volts) | | Test Point Location (refer to Adjustment Locator) |
|-----------------------|-------------------------------|--------|---|
| | Min. | Max. | |
| +5 volt | +4.87 | +5.13 | H |
| -15 Volt | -14.62 | -15.38 | G |
| +15 Volt | +14.62 | +15.38 | L |

Performance Check/Calibration—7D12 Service

c. Set the controls as follows:

| | | |
|---------------------|--------------------------|--------|
| | 7D12 | |
| TRIGGERING | | EXT |
| | 7D12 Calibration Fixture | |
| Atten Readout Check | | Out |
| | 7A22 | |
| Volts/div. | | 10 MV |
| HF-3 dB Point | | 1 MHz |
| LF-3 dB Point | | 10 KHz |
| + coupling | | ac |
| - coupling | | Gnd |

Controls not mentioned can be set as desired.

d. Set the time-base unit for a sweep rate of 20 useconds per division.

e. CHECK — That the inverter pulse is neutralized (chopped signal null). Refer to example in Fig. 4-2b.

f. ADJUST — The Inverter Sig Neut adjustment, C593 to neutralize (null) the inverter pulse shown in Fig. 4-2a.

NOTE

The transformer (T595) leads can be dressed to optimize the C593 adjustment if necessary.

g. Disconnect the 1X voltage probe and remove the amplifier plug-in unit from the indicator oscilloscope.

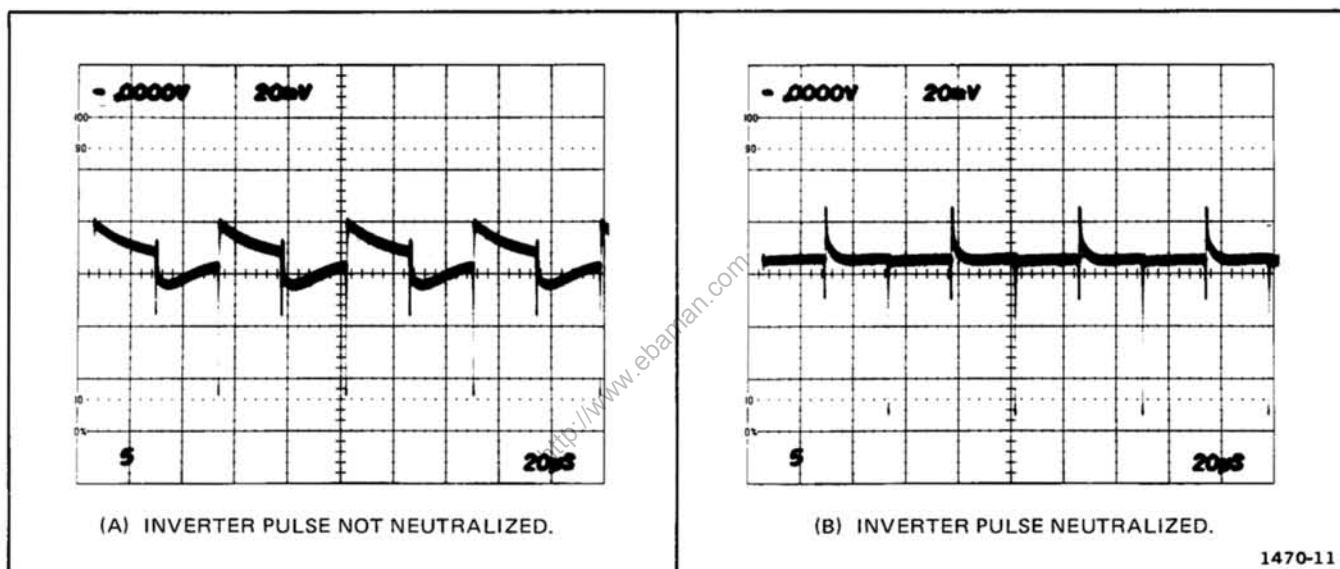


Fig. 4-2. Typical Inverter pulse waveform properly neutralized.

VERTICAL DISPLAY

Equipment Required

- | | |
|------------------------------|----------------------------|
| 1. Indicator oscilloscope. | 4. Time-base unit. |
| 2. 7D12 Calibration Fixture. | 5. Precision dc voltmeter. |
| 3. Plug-in extender. | 6. 50 ohm coaxial cable. |
| | 7. Screwdriver. |

BEFORE YOU BEGIN, see ADJUSTMENT LOCATIONS in the diagrams section.

CONTROL SETTINGS

Set the controls as follows:

| | | |
|------|------|---------|
| GATE | 7D12 | OUT-OFF |
|------|------|---------|

Controls not mentioned can be set as desired.

4. Adjust Trigger Level.

- Position the trace to the horizontal center line of the graticule using the VERTICAL DISPLAY POSITION control.
- Connect the precision dc voltmeter between TP 177 and chassis ground.
- CHECK — Meter reading; 0.000 volt \pm 0.020 volt.
- ADJUST — Trig Level adjustment R169 for a meter reading of 0.000 volt.
- Disconnect the voltmeter.

5. Adjust Attenuator Balance.

- Set the VERTICAL DISPLAY ATTEN switch to 5X.
- Position the trace to the horizontal center line of the graticule using the VERTICAL DISPLAY POSITION control.
- Set the VERTICAL DISPLAY ATTEN switch to 1X.

d. CHECK — For no vertical trace shift.

e. ADJUST — Display Offset adjustment R138 to return the trace to the horizontal center line of the graticule.

f. INTERACTION — Repeat parts a through e several times to minimize vertical trace shift.

g. CHECK — Rotate the VERTICAL DISPLAY POSITION control fully clockwise and counterclockwise. The trace should move off the graticule area in both directions.

6. Adjust Amplifier Gain.

a. Set the controls as follows:

| | |
|--------------------------|-----|
| 7D12 | |
| VERTICAL DISPLAY ATTEN | 1X |
| 7D12 Calibration Fixture | |
| Attenuator Readout Check | Out |

b. Connect a 400 millivolt, 1 kilohertz signal from the oscilloscope calibrator to the 7D12 Calibration Fixture Vertical Display Direct Input Connector.

c. CHECK — The display amplitude should be within the limits of 4.4 to 4.8 divisions.

d. ADJUST — Display Gain adjustment R195, for exactly 4.6 divisions in amplitude.

7. Check Attenuation and Readout.

a. CHECK — Set the VERTICAL DISPLAY ATTEN switch to the settings given in Table 4-4. The display

Performance Check/Calibration—7D12 Service

amplitude and lower numerical readout should be within the limits for each switch setting listed in Table 4-4.

b. Disconnect the oscilloscope calibrator signal.

8. Check Chop and Alternate Mode.

a. Set the GATE switch to ON.

b. Set the internal Display Mode switch to Alt. (See Fig. 1-3 in the Operating Information section.)

c. Adjust the VERTICAL DISPLAY POSITION and the GATE POSITION controls to separate the two traces approximately 4 division.

d. Set the time-base sweep rate to 50 milliseconds per division.

e. CHECK — The vertical display trace and the gate trace should be displayed alternately with each sweep on the crt.

f. Set the internal Display Mode switch to the Chop position.

g. CHECK — The vertical display trace and the gate trace should start at the same time.

h. Set the time-base unit sweep rate to 50 microseconds per division.

i. CHECK — Rotate the GATE POSITION control fully clockwise and counterclockwise. The trace should move off the graticule area in both directions.

TABLE 4-4
VERTICAL DISPLAY AMPLITUDE
AND LOWER NUMERICAL READOUT

| 7D12 VERTICAL DISPLAY ATTEN Switch | Display Amplitude (divisions) | | Lower Numerical Readout Display |
|--|----------------------------------|------|------------------------------------|
| | Min. | Max. | |
| 1X | adjusted | 1 | |
| 2X | 2.2 | 2.4 | 2 |
| 5X | 0.87 | 0.97 | 5 |

BANDWIDTH

Equipment Required

- | | |
|------------------------------|--------------------------------|
| 1. Indicator oscilloscope. | 4. Time-base unit. |
| 2. 7D12 Calibration Fixture. | 5. Medium-frequency generator. |
| 3. Square wave generator. | 6. Tuning tool. |
| | 7. 50 ohm coaxial cable. |

BEFORE YOU BEGIN, see **ADJUSTMENT LOCATIONS** in the diagrams section.

CONTROL SETTINGS

Set the controls as follows:

| | | |
|------------------------|------|---------|
| | 7D12 | |
| VERTICAL DISPLAY ATTEN | | 1X |
| GATE | | OUT-OFF |

Controls not mentioned can be set as desired.

9. Adjust Attenuator High Frequency Compensation.

- a. Disconnect the plug-in extender. Install the 7D12 directly into the indicator oscilloscope vertical plug-in compartment.
- b. Connect a 100 kilohertz fast-rise signal from the square-wave generator to the 7D12 Calibration Fixture Vertical Display Direct Input connector.
- c. Set the time-base unit to obtain a triggered display at a sweep rate of 10 nonoseconds per division.
- d. Adjust the square-wave generator controls to display 5 divisions of amplitude on the crt.
- e. Position the top of the square wave to the horizontal center line of the graticule.
- f. CHECK — Abberations should not exceed ± 0.25 division.
- g. ADJUST — 1X HF Comp. and Display HF Comp adjustments, C102 and C198, alternately for best front corner and flat top.
- h. Set the VERTICAL DISPLAY ATTEN switch to 2X.
- i. Adjust the square-wave generator controls to display 2.8 divisions of signal amplitude on the crt.

j. Position the top of the square wave to the horizontal center line of the graticule.

k. CHECK — Abberations should not exceed ± 0.14 division.

l. ADJUST — 2X HF Comp adjustment C106 for best front corner and abberations within ± 0.14 division.

m. Set the VERTICAL DISPLAY ATTEN switch to 5X.

n. Adjust the square-wave generator controls to display 1.1 divisions of amplitude on the crt.

o. Position the top of the square wave to the horizontal center line of the graticule.

p. CHECK — Abberations should not exceed ± 0.006 division.

q. ADJUST — 5X HF Comp adjustment C110 for best front corner and abberations within ± 0.06 division.

r. Disconnect the square-wave signal.

10. Check Vertical Display Frequency Response.

- a. Set the VERTICAL DISPLAY ATTEN switch to 1X.
- b. Set the time-base unit for a sweep rate of 500 microseconds per division.
- c. Connect the medium-frequency generator output to the 7D12 Calibration Fixture Vertical Display Direct Input connector.
- d. Set the medium-frequency generator for 6 divisions of vertical deflection at its reference frequency (50 kilohertz).

Performance Check/Calibration—7D12 Service

- e. Without changing the output amplitude, increase the output frequency of the generator to 100 megahertz.
 - f. CHECK — crt display for 4.2 divisions or more vertical deflection.
 - g. Set the VERTICAL DISPLAY ATTEN switch to 2X.
 - h. Repeat parts d through f.
 - i. Set the VERTICAL DISPLAY ATTEN switch to 5X.
 - j. Repeat parts d through f.
 - k. Disconnect the medium-frequency generator.
- 11. Check Gate Waveform Frequency Response.**
- a. Position the vertical display trace off the graticule area.
 - b. Set the GATE switch to ON.
 - c. Connect the medium-frequency generator output to the 7D12 Calibration Fixture Gate Waveform Direct Input connector.
 - d. Set the medium frequency generator for 6 divisions of vertical deflection at its reference frequency (50 kilohertz).
 - e. Without changing the output amplitude, increase the output frequency of the generator to 100 megahertz.
 - f. CHECK — crt display for 4.2 divisions or more vertical deflection.
 - g. Disconnect the medium-frequency generator.

<http://www.ebaman.com>

ANALOG TO DIGITAL CONVERTER

Equipment Required

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Indicator oscilloscope. 2. 7D12 Calibration Fixture 3. Time-Base unit. 4. Plug-in extender. 5. DC Voltage calibrator. 6. Precision dc voltmeter. 7. Amplifier plug-in unit. | <ol style="list-style-type: none"> 8. Special purpose cable. 9. Patch Cord. 10. 10X probe (two required). 11. 1X probe. 12. 50 ohm coaxial cable. 13. Dual-banana-plug to female BNC adapter. 14. Screwdriver. 15. Tuning tool. |
|--|---|

BEFORE YOU BEGIN, see ADJUSTMENT LOCATIONS in the diagrams section.

12. Adjust Auto Triggering Measurement Rate.

- a. Connect a plug-in extender between the 7D12 and indicator oscilloscope.
- b. CHECK — The AUTO EXT and MAN TRIGGERING buttons light when pushed.
- c. Set the 7D12 TRIGGERING switch to AUTO.
- d. Connect a 4 volt, 1 kilohertz signal from the oscilloscope calibrator to the 7D12 Calibration Fixture, A/D Direct Input jacks.
- e. CHECK — The TRIG'D indicator light is flashing and the crt readout display is updating about four times per second.
- f. ADJUST — Trig Rate adjustment, R441 to the desired measurement rate. See the following note.

NOTE

The measurement rate can be adjusted from one to approximately four measurements per second determined by the setting of Trig Rate adjustment R441. This is factory preset to approximately four measurements per second. The Trig Rate range can be adjusted to 12 measurements per second by changing the value of R407 to 30 KΩ.

13. Check Manual and External Triggering Measurement Rate.

- a. CHECK — The voltage readout display should read approximately 2 volts (depending upon the accuracy of the oscilloscope calibrator).
- b. Set the TRIGGERING switch to EXT.
- c. CHECK — The TRIG'D indicator light should not be on.
- d. Disconnect the calibrator signal.
- e. CHECK — The voltage readout obtained in part a should remain displayed on the crt.
- f. Connect a 4 volt, 1 kilohertz signal from the oscilloscope calibrator to the TRIGGERING EXT IN connector.
- g. CHECK — The voltage readout display reads 0 volts and the TRIG'D indicator light is lit.
- h. Disconnect the calibrator signal.
- i. Connect a 4 volt, 1 kilohertz signal from the oscilloscope calibrator to the 7D12 Calibration Fixture, A/D Direct Input jacks.
- j. Push the MAN TRIGGERING button.

Performance Check/Calibration—7D12 Service

- k. CHECK — The voltage readout display should read approximately +2 volts.
- l. Reverse the polarity to the Calibration Fixture, A/D Direct Input Jacks.
- m. Push the MAN TRIGGERING button.
- n. CHECK — The voltage readout display should read approximately -2 volts.
- o. Disconnect all connections.

14. Adjust A/D Bias.

- a. Short the 7D12 Calibration Fixture, A/D Direct Input jacks with a patch cord.
- b. Connect a precision dc voltmeter plus and minus leads between TP 244 and F GND (floating ground) respectively.
- c. CHECK — Meter reading; +0.195 volt \pm 0.010 volt.
- d. ADJUST — FET Bias adjustment R249 for a meter reading of +0.195 volt.
- e. Disconnect all connections.

15. Adjust Column Current.

- a. Install an amplifier plug-in unit into the vacant vertical compartment of the indicator oscilloscope.

- b. Connect a 10X probe from the amplifier plug-in unit input to the indicator oscilloscope column data switch IC (integrated circuit) pin 7, located on the oscilloscope readout circuit board.
- c. Connect a 10X probe from the time-base unit external trigger input to the indicator oscilloscope row data switch IC (integrated circuit) pin 3, located on the oscilloscope readout circuit board.
- d. Connect a dc voltage calibrator output to the 7D12 Calibration Fixture A/D Direct Input jacks.
- e. Set the controls as follows:

7D12

TRIGGERING AUTO

7D12 Calibration Fixture

Readout Calibration In

- f. Set the time-base unit controls to trigger on the negative slope of the external trigger signal.

- g. Set the amplifier plug-in unit controls to display a signal amplitude (dc coupled) of 4.5 divisions. See Fig. 4-3a.

- h. Adjust the dc voltage calibrator voltage slowly between zero and two volts. Push the EXT TRIGGERING button the instant any numeral 8 appears in the readout display (refer to Fig. 4-3a). It may be necessary to repeat this step several times in order to hold the display on a 8 readout.

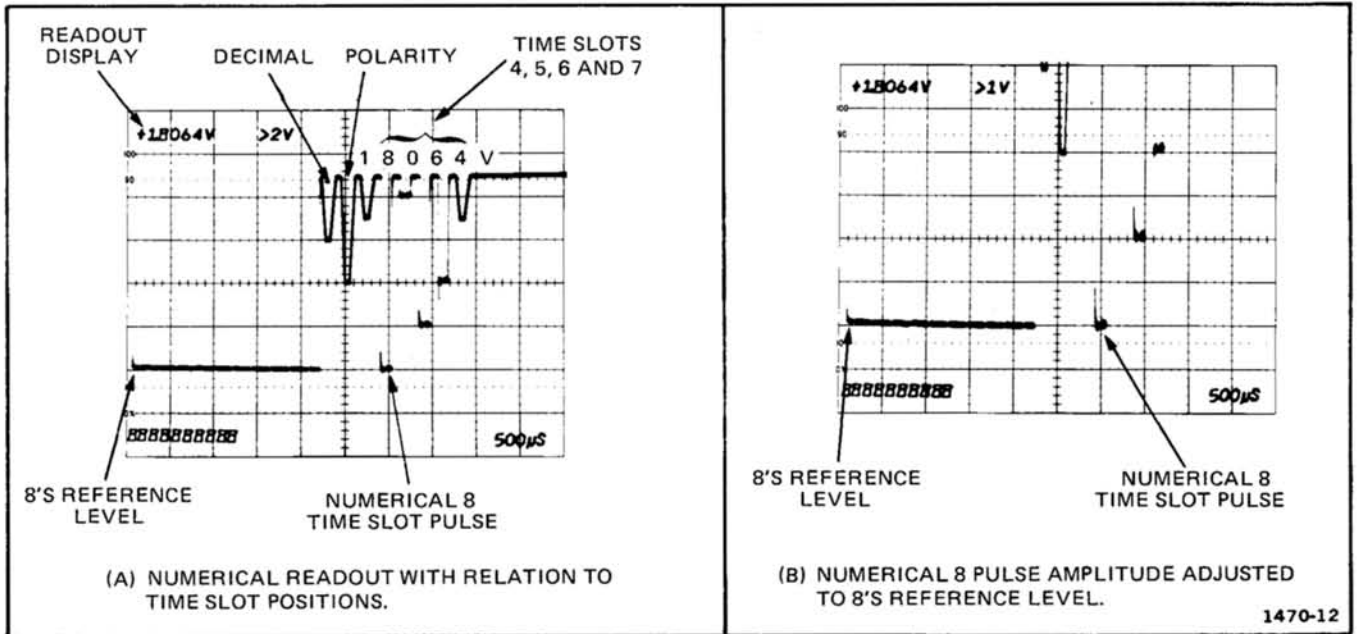


Fig. 4-3. Typical time-slot pulses with relation to the readout display.

Performance Check/Calibration—7D12 Service

NOTE

The example in Fig. 4-3a shows the numeral 8 located in time slot four, and the pulse amplitude approximately equal to the 8's reference level (8's pulses amplitude standard).

- i. Set the amplifier plug-in unit controls to display a signal amplitude of approximately 9 divisions (upper half of display off graticule area).
- j. Position the 8's reference level to a horizontal graticule line. See Fig. 4-3b.
- k. CHECK — The numeral 8 time-slot pulse amplitude should be equal to the 8's reference level.
- l. ADJUST — Column Current adjustment, R499 to position the numeral 8 time slot pulse amplitude to the 8's reference level. See example in Fig. 4-3b.
- m. Set the TRIGGERING switch to AUTO.
- n. CHECK — Adjust the dc voltage calibrator output amplitude slowly from 0 through 2 volts. The tens readout (first digit right of decimal) should be able to display all numerals, from 0 through 9. See note below.

NOTE

If all numerals can be displayed in the tens readout, disregard the following portions this check. However, if any numeral from 0 through 7 is omitted repeat parts h, o, p and s; if the numeral 8 or 9 is omitted, repeat parts, h, q, r and s.

- o. ADJUST — Column Current adjustment, R499, to position the numeral 8 time slot pulse amplitude down to the numeral 7 level (the digital readout display 8 will change to 7).
- p. Repeat parts m and n. If all numerals are displayed in the tens readout, repeat parts h through n.
- q. ADJUST — Column Current adjustment, R499, to position the numeral 8 time slot pulse amplitude up to the numeral 9 level (the digital readout display 8 will change to 9).
- r. Repeat parts m and n. If all numerals are displayed in the tens readout, repeat parts h through n.
- s. Disconnect all connections.

16. Adjust A/D Gain.

- a. Set the TRIGGERING switch to AUTO.
- b. Connect +2.0000 volts from the dc voltage calibrator output to the 7D12 Calibration Fixture, A/D Direct Input connector.
- c. CHECK — The readout display should read >2.0000V within the limits of +1.9966V to >2.0034V.
- d. ADJUST — A/D Gain adjustment, R361 for a readout display of >2.0000V. See note below.

NOTE

It may be necessary to add or remove shunt straps across R359 and R360 in order to perform part d.

- e. Disconnect all connections.

17. Adjust Gate Pulse Neutralization.

- a. Install an amplifier plug-in unit (Tektronix 7A22) into the vertical compartment of the indicator oscilloscope.
- b. Set the controls as follows:

| | | |
|---------------------|--------------------------|------------|
| | 7D12 | |
| TRIGGERING | | EXT |
| | 7D12 Calibration Fixture | |
| Atten Readout Check | | Out |
| | 7A22 | |
| Volts/div | | 10 μ V |
| HF —3dB Point | | 3 KHz |
| LF —3dB Point | | dc |
| + coupling | | ac |
| —coupling | | gnd |

Controls not mentioned can be set as desired.

- c. Connect a 1X voltage probe from the amplifier plug-in unit plus (+) input connector to the VHI test point. (Connect the probe ground strap to the F GND test point.)
- d. Connect a cable from the indicator oscilloscope gate output connector to the TRIGGERING input connector.
- e. Set the indicator oscilloscope and time-base controls for a stable amplifier plug-in unit display.

f. CHECK — For the absence of the gate pulse. See Fig. 4-4b.

g. ADJUST — The gate HF Comp adjustment C235 to neutralize the gate pulse. The gate pulse is shown in Fig. 4-4a.

h. Disconnect all connections.

This completes the Calibration Procedure for the 7D12. Disconnect all test equipment and replace the oscilloscope side panels and the 7D12 side covers.

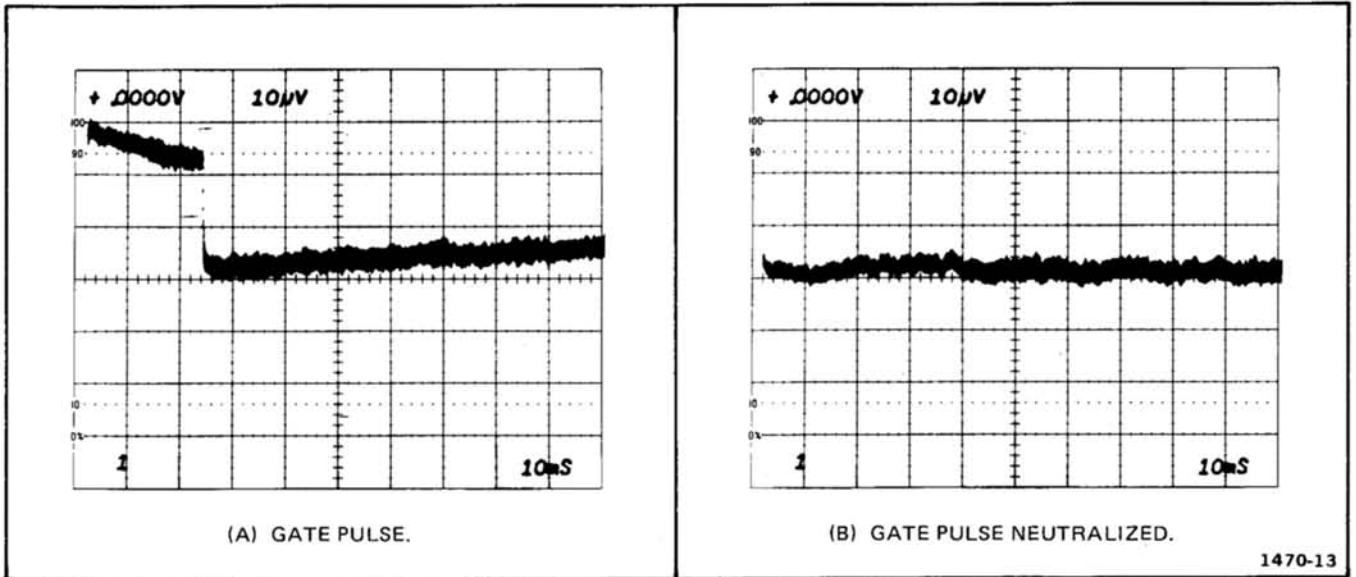


Fig. 4-4. Typical example of gate pulse neutralization.

ELECTRICAL REPLACEABLE PARTS LIST

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

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

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

| MFR.CODE | MANUFACTURER | ADDRESS | CITY,STATE,ZIP |
|----------|--|------------------------|-------------------------|
| 01121 | Allen-Bradley Co. | 1201 2nd St. | Milwaukee, WI 53212 |
| 01295 | Texas Instruments, Inc., Components Group | P. O. Box 5012 | Dallas, TX 75222 |
| 01884 | Dearborn Electronics, Inc. | P. O. Box 530 | Orlando, FL 32802 |
| 02735 | RCA Corp., Solid State Division | Route 202 | Somerville, NY 08876 |
| 03508 | General Electric Co., Semi-Conductor Products Dept., Electronics Park | | Syracuse, NY 13201 |
| 04713 | Motorola, Inc., Semiconductor Products Div. | 5005 E. McDowell Rd. | Phoenix, AZ 85008 |
| 07263 | Fairchild Semiconductor, A Div. of Fairchild Camera and Instrument Corp. | 464 Ellis St. | Mountain View, CA 94040 |
| 07910 | Teledyne Semiconductor | 12515 Chadron Ave. | Hawthorne, CA 90250 |
| 12040 | National Semiconductor Corp. | Commerce Drive | Danbury, CT 06810 |
| 12697 | Clarostat Mfg. Co., Inc. | Lower Washington St. | Dover, NH 03820 |
| 15818 | Teledyne Semiconductor | 1300 Terra Bella Ave. | Mountain View, CA 94040 |
| 17856 | Siliconix, Inc. | 2201 Laurelwood Rd. | Santa Clara, CA 95050 |
| 18324 | Signetics Corp. | 811 E. Arques | Sunnyvale, CA 94086 |
| 18612 | Vishay Resistor Products Div. Vishay Intertechnology Inc. | 68 Lincoln Hwy | Malvern, PA 19355 |
| 19701 | Electra/Midland Corp., A North American Phillips Co. | P. O. Box 760 | Mineral Wells, TX 76067 |
| 24931 | Specialty Connector Co., Inc. | 3560 Madison Ave. | Indianapolis, IN 46227 |
| 26483 | Monsanto Co., Electronics Test and Measurement Department | 620 Passaic Ave. | West Caldwell, NJ 07006 |
| 27014 | National Semi-Conductor Corp. | 2950 San Ysidro Way | Santa Clara, CA 95051 |
| 56289 | Sprague Electric Co. | | North Adams, MA 01247 |
| 72982 | Erie Technological Products, Inc. | 644 W. 12th St. | Erie, PA 16512 |
| 73138 | Beckman Instruments, Inc., Helipot Div. | 2500 Harbor Blvd. | Fullerton, CA 92634 |
| 75042 | TRW Electronic Components, IRC Philadelphia Div. | 401 N. Broad St. | Philadelphia, PA 19108 |
| 75915 | Littelfuse, Inc. | 800 E. Northwest Hwy | Des Plaines, IL 60016 |
| 76493 | Miller, J. W., Co | P. O. Box 5825 | Compton, CA 90224 |
| 80009 | Tektronix, Inc. | P. O. Box 500 | Beaverton, OR 97005 |
| 80294 | Bourns, Inc. | 1200 Columbia Ave. | Riverside, CA 92507 |
| 81483 | International Rectifier Corp. | 9220 Sunset Blvd. | Los Angeles, CA 90069 |
| 90201 | Mallory Capacitor Co. | 3029 E. Washington St. | Indianapolis, IN 46206 |
| 91418 | Radio Materials Co. | 4242 W. Bryn Mawr | Chicago, IL 60646 |
| 91637 | Dale Electronics, Inc. | P. O. Box 609 | Columbus, NB 68601 |

http://www.electricalparts.com

| Ckt No. | Tektronix Part No. | Serial/Model No. | | Name & Description | Mfr Code | Mfr Part Number |
|---------|--------------------|------------------|---------|--------------------------------------|----------|-----------------|
| | | Eff | Dscont | | | |
| A1 | 670-2174-00 | B010100 | B019999 | CKT BOARD ASSY:--MAIN | 80009 | 670-2174-00 |
| A1 | 670-2174-01 | B020000 | B039999 | CKT BOARD ASSY:--MAIN | 80009 | 670-2174-01 |
| A1 | 670-2174-03 | B040000 | | CKT BOARD ASSY:--MAIN | 80009 | 670-2174-03 |
| A2 | 670-2176-00 | | | CKT BOARD ASSY:--FLOATING | 80009 | 670-2176-00 |
| A3 | 670-2175-00 | | | CKT BOARD ASSY:--TRIG MODE SWITCH | 80009 | 670-2175-00 |
| C102 | 281-0184-00 | | | CAP.,VAR,PLSTC:2-18PF,500VDC | 34553 | 2222-809-05003 |
| C103 | 281-0592-00 | | | CAP.,FXD,CER DI:4.7PF,+/-0.5PF,500V | 72982 | 301-023C0H0479D |
| C106 | 281-0064-00 | | | CAP.,VAR,PLSTC:0.25-1.5PF,600V | 72982 | 530-002 |
| C107 | 281-0619-00 | | | CAP.,FXD,CER DI:1.2PF,+/-0.1PF,200V | 72982 | 374-000C0K0129B |
| C110 | 281-0064-00 | | | CAP.,VAR,PLSTC:0.25-1.5PF,600V | 72982 | 530-002 |
| C112 | 281-0659-00 | | | CAP.,FXD,CER DI:4.3PF,+/-0.25PF,500V | 72982 | 301-000C0H0439C |
| C123 | 283-0017-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,3V | 91418 | MX105Z0304R0 |
| C125 | 283-0081-00 | | | CAP.,FXD,CER DI:0.1UF,+80-20%,25V | 56289 | 36C600 |
| C128 | 281-0618-00 | | | CAP.,FXD,CER DI:4.7PF,+/-0.5PF,200V | 72982 | 374-001C0H0479D |
| C134 | 283-0017-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,3V | 91418 | MX105Z0304R0 |
| C136 | 283-0081-00 | | | CAP.,FXD,CER DI:0.1UF,+80-20%,25V | 56289 | 36C600 |
| C148 | 283-0177-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,25V | 72982 | 8131N039651105Z |
| C152 | 281-0612-00 | | | CAP.,FXD,CER DI:5.6PF,+/-0.5PF,500V | 72982 | 374-001C0H0569D |
| C158 | 281-0670-00 | | | CAP.,FXD,CER DI:1.8PF,+/-0.1PF,500V | 72982 | 374-005C0K0189B |
| C159 | 281-0645-00 | | | CAP.,FXD,CER DI:8.2PF,+/-0.25PF,500V | 72982 | 374-011C0H0829C |
| C177 | 281-0550-00 | | | CAP.,FXD,CER DI:120PF,10%,500V | 72982 | 301-000X5P0121K |
| C196 | 281-0564-00 | | | CAP.,FXD,CER DI:24PF,5%,500V | 72982 | 301-000C0G0240J |
| C197 | 281-0540-00 | | | CAP.,FXD,CER DI:51PF,5%,500V | 72982 | 301-000U2J0510J |
| C198 | 281-0184-00 | | | CAP.,VAR,PLSTC:2-18PF,500VDC | 34553 | 2222-809-05003 |
| C203 | 281-0605-00 | | | CAP.,FXD,CER DI:200PF,10%,500V | 72982 | 301-000Y5D0201K |
| C213 | 281-0605-00 | | | CAP.,FXD,CER DI:200PF,10%,500V | 72982 | 301-000Y5D0201K |
| C235 | 281-0064-00 | | | CAP.,VAR,PLSTC:0.25-1.5PF,600V | 72982 | 530-002 |
| C236 | 283-0167-00 | | | CAP.,FXD,CER DI:0.1UF,10%,100V | 72982 | 8131N147W5R104K |
| C240 | 283-0003-00 | | | CAP.,FXD,CER DI:0.01UF,+80-20%,150V | 72982 | 855-547E103Z |
| C245 | 290-0535-00 | | | CAP.,FXD,ELCTLT:33UF,20%,10V | 56289 | 196D336X0010KA1 |
| C250 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C264 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C269 | 283-0078-00 | | | CAP.,FXD,CER DI:0.001UF,20%,500V | 56289 | 20C114A8 |
| C272 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C274 | 281-0512-00 | | | CAP.,FXD,CER DI:27PF,+/-2.7PF,500V | 72982 | 308-000C0G0270K |
| C290 | 281-0580-00 | | | CAP.,FXD,CER DI:470PF,10%,500V | 72982 | 301-000Z5D0471K |
| C294 | 281-0580-00 | | | CAP.,FXD,CER DI:470PF,10%,500V | 72982 | 301-000Z5D0471K |
| C302 | 285-0809-00 | | | CAP.,FXD,PLSTC:1UF,10%,50V | 01884 | LP88A1A105K |
| C304 | 281-0529-00 | | | CAP.,FXD,CER DI:1.5PF,0.25PF,500V | 72982 | 301-000C0K0159C |
| C309 | 281-0626-00 | | | CAP.,FXD,CER DI:3.3PF,1%,500V | 72982 | 301-000C0J0339B |
| C310 | 281-0626-00 | | | CAP.,FXD,CER DI:3.3PF,1%,500V | 72982 | 301-000C0J0339B |
| C311 | 281-0626-00 | | | CAP.,FXD,CER DI:3.3PF,1%,500V | 72982 | 301-000C0J0339B |
| C354 | 290-0535-00 | | | CAP.,FXD,ELCTLT:33UF,20%,10V | 56289 | 196D336X0010KA1 |
| C371 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C373 | 290-0535-00 | | | CAP.,FXD,ELCTLT:33UF,20%,10V | 56289 | 196D336X0010KA1 |
| C376 | 281-0620-00 | | | CAP.,FXD,CER DI:21PF,1%,500V | 72982 | 301-000C0G0210F |
| C379 | 285-1031-00 | | | CAP.,FXD,PLSTC:0.56UF,10%,50V | 84411 | TEK-116 |
| C380 | 283-0081-00 | | | CAP.,FXD,CER DI:0.1UF,+80-20%,25V | 56289 | 36C600 |
| C381 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C386 | 283-0000-00 | | | CAP.,FXD,CER DI:0.001UF,+100-0%,500V | 72982 | 831-516E102P |
| C390 | 281-0524-00 | | | CAP.,FXD,CER DI:150PF,+/-30PF,500V | 72982 | 301-000X5U0151M |
| C407 | 290-0136-00 | | | CAP.,FXD,ELCTLT:2.2UF,20%,20V | 56289 | 162D225X0020CD2 |
| C409 | 290-0512-00 | | | CAP.,FXD,ELCTLT:22UF,20%,15V | 56285 | 196D226X0015KA1 |
| C419 | 283-0000-00 | | | CAP.,FXD,CER DI:0.001UF,+100-0%,500V | 72982 | 831-516E102P |
| C430 | 281-0612-00 | | | CAP.,FXD,CER DI:5.6PF,+/-0.5PF,500V | 72982 | 374-001C0H0569D |
| C440 | 290-0530-00 | | | CAP.,FXD,ELCTLT:68UF,20%,6V | 90201 | TDC686M006FL |
| C444 | 283-0198-00 | | | CAP.,FXD,CER DI:0.22UF,20%,50V | 72982 | 8131N075651224M |
| C453 | 283-0028-00 | | | CAP.,FXD,CER DI:0.0022UF,20%,50V | 56289 | 19C606 |
| C466 | 281-0524-00 | | | CAP.,FXD,CER DI:150PF,+/-30PF,500V | 72982 | 301-000X5U0151M |
| C467 | 281-0524-00 | | | CAP.,FXD,CER DI:150PF,+/-30PF,500V | 72982 | 301-000X5U0151M |
| C470 | 281-0525-00 | | | CAP.,FXD,CER DI:470PF,+/-94PF,500V | 72982 | 301-000X5U0471M |
| C471 | 290-0523-00 | | | CAP.,FXD,ELCTLT:2.2UF,20%,20V | 56289 | 196D225X0025HA1 |

Electrical Parts List-7D12

| Ckt No. | Tektronix Part No. | Serial/Model No. Eff | Dscont | Name & Description | Mfr Code | Mfr Part Number |
|---------|--------------------|----------------------|---------|-------------------------------------|----------|-----------------|
| C477 | 281-0524-00 | | | CAP.,FXD,CER DI:150PF,+/-30PF,500V | 72982 | 301-000X5U0151M |
| C483 | 281-0579-00 | | | CAP.,FXD,CER DI:21PF,5%,500V | 72982 | 301-050C0G0210J |
| C485 | 281-0525-00 | B010100 | B029999 | CAP.,FXD,CER DI:470PF,+/-94PF,500V | 72982 | 301-000X5U0471M |
| C485 | 283-0003-00 | B030000 | | CAP.,FXD,CER DI:0.01UF,+80-20%,150V | 72982 | 855-547E103Z |
| C488 | 281-0525-00 | B010100 | B029999 | CAP.,FXD,CER DI:470PF,+/-94PF,500V | 72982 | 301-000X5U0471M |
| C488 | 283-0065-00 | B030000 | | CAP.,FXD,CER DI:0.001UF,5%,100V | 72982 | 805-505B102J |
| C493 | 283-0068-00 | | | CAP.,FXD,CER DI:0.01UF,+100-0%,500V | 56289 | 19C241 |
| C495 | 281-0605-00 | | | CAP.,FXD,CER DI:200PF,10%,500V | 72982 | 301-000Y5D0201K |
| C497 | 281-0524-00 | | | CAP.,FXD,CER DI:150PF,+/-30PF,500V | 72982 | 301-000X5U0151M |
| C500 | 283-0028-00 | | | CAP.,FXD,CER DI:0.0022UF,20%,50V | 56289 | 19C606 |
| C505 | 281-0524-00 | | | CAP.,FXD,CER DI:150PF,+/-30PF,500V | 72982 | 301-000X5U0151M |
| C511 | 281-0524-00 | | | CAP.,FXD,CER DI:150PF,+/-30PF,500V | 72982 | 301-000X5U0151M |
| C517 | 281-0524-00 | | | CAP.,FXD,CER DI:150PF,+/-30PF,500V | 72982 | 301-000X5U0151M |
| C561 | 283-0177-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,25V | 72982 | 8131N039651105Z |
| C563 | 283-0177-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,25V | 72982 | 8131N039651105Z |
| C566 | 283-0177-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,25V | 72982 | 8131N039651105Z |
| C569 | 283-0081-00 | | | CAP.,FXD,CER DI:0.1UF,+80-20%,25V | 56289 | 36C600 |
| C571 | 283-0081-00 | | | CAP.,FXD,CER DI:0.1UF,+80-20%,25V | 56289 | 36C600 |
| C573 | 283-0081-00 | | | CAP.,FXD,CER DI:0.1UF,+80-20%,25V | 56289 | 36C600 |
| C575 | 283-0081-00 | | | CAP.,FXD,CER DI:0.1UF,+80-20%,25V | 56289 | 36C600 |
| C577 | 283-0081-00 | | | CAP.,FXD,CER DI:0.1UF,+80-20%,25V | 56289 | 36C600 |
| C579 | 283-0177-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,25V | 72982 | 8131N039651105Z |
| C581 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C583 | 290-0162-00 | | | CAP.,FXD,ELCTLT:22UF,20%,35V | 56289 | 150D226X0035R2 |
| C585 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C588 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C593 | 281-0064-00 | | | CAP.,VAR,PLSTC:0.25-1.5PF,600V | 72982 | 530-002 |
| C594 | 281-0661-00 | | | CAP.,FXD,CER DI:0.8PF,+/-0.1PF,500V | 72982 | 301-000C0G0808B |
| C598 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C603 | 281-0557-00 | | | CAP.,FXD,CER DI:1.8PF,10%,500V | 72982 | 301-000C0K0189B |
| C604 | 281-0529-00 | | | CAP.,FXD,CER DI:1.5PF,0.25PF,500V | 72982 | 301-000C0K0159C |
| C609 | 290-0135-00 | | | CAP.,FXD,ELCTLT:15UF,20%,20V | 06751 | TS2K20-156 |
| C612 | 290-0135-00 | | | CAP.,FXD,ELCTLT:15UF,20%,20V | 06751 | TS2K20-156 |
| C613 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C630 | 290-0134-00 | | | CAP.,FXD,ELCTLT:22UF,20%,15V | 56289 | 150D226X0015B2 |
| C631 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C633 | 290-0512-00 | | | CAP.,FXD,ELCTLT:22UF,20%,15V | 56285 | 196D226X0015KA1 |
| C635 | 290-0135-00 | | | CAP.,FXD,ELCTLT:15UF,20%,20V | 06751 | TS2K20-156 |
| C647 | 290-0134-00 | | | CAP.,FXD,ELCTLT:22UF,20%,15V | 56289 | 150D226X0015B2 |
| C648 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| C649 | 290-0135-00 | | | CAP.,FXD,ELCTLT:15UF,20%,20V | 06751 | TS2K20-156 |
| C650 | 290-0512-00 | | | CAP.,FXD,ELCTLT:22UF,20%,15V | 56285 | 196D226X0015KA1 |
| C652 | 290-0512-00 | | | CAP.,FXD,ELCTLT:22UF,20%,15V | 56285 | 196D226X0015KA1 |
| C657 | 290-0297-00 | | | CAP.,FXD,ELCTLT:39UF,10%,10V | 56289 | 150D396X9010B2 |
| C658 | 290-0297-00 | | | CAP.,FXD,ELCTLT:39UF,10%,10V | 56289 | 150D396X9010B2 |
| C666 | 290-0114-00 | | | CAP.,FXD,ELCTLT:47UF,20%,6V | 56289 | 150D476X0006B2 |
| C667 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8131N075651104M |
| CR172 | 152-0075-00 | | | SEMICOND DEVICE:GE,25V,40MA | 72982 | ED48 |
| CR226 | 152-0321-00 | | | SEMICOND DEVICE:SILICON,35V,100MA | 07263 | FSA1480 |
| CR263 | 152-0324-00 | | | SEMICOND DEVICE:SILICON,35V,100MA | 03508 | SE416 |
| CR279 | 152-0324-00 | | | SEMICOND DEVICE:SILICON,35V,100MA | 03508 | SE416 |
| CR338 | 152-0324-00 | | | SEMICOND DEVICE:SILICON,35V,100MA | 03508 | SE416 |
| CR339 | 152-0324-00 | | | SEMICOND DEVICE:SILICON,35V,100MA | 03508 | SE416 |
| CR364 | 152-0324-00 | | | SEMICOND DEVICE:SILICON,35V,100MA | 03508 | SE416 |
| CR365 | 152-0324-00 | | | SEMICOND DEVICE:SILICON,35V,100MA | 03508 | SE416 |
| CR385 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR386 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR417 | 152-0071-00 | | | SEMICOND DEVICE:GERMANIUM,15V,40MA | 14433 | G865 |
| CR432 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR438 | 150-1004-00 | | | LAMP,LED:RED,2.5V,15MA | 03508 | SSL-12 |
| CR440 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR460 | 152-0075-00 | | | SEMICOND DEVICE:GE,25V,40MA | 72982 | ED48 |

| Ckt No. | Tektronix Part No. | Serial/Model No. | | Name & Description | Mfr Code | Mfr Part Number |
|---------|--------------------|------------------|----------|---|----------|-----------------|
| | | Eff | Dscont | | | |
| CR462 | 152-0075-00 | | | SEMICON D DEVICE:GE,25V,40MA | 72982 | ED48 |
| CR500 | 152-0322-00 | | | SEMICON D DEVICE:SILICON,10V,100NA | 01295 | A1108 |
| CR526 | 152-0141-02 | | | SEMICON D DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR535 | 152-0141-02 | | | SEMICON D DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR542 | 152-0141-02 | | | SEMICON D DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR549 | 152-0141-02 | | | SEMICON D DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR554 | 152-0141-02 | | | SEMICON D DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR587 | 152-0141-02 | | | SEMICON D DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR589 | 152-0141-02 | | | SEMICON D DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR597 | 152-0141-02 | | | SEMICON D DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR599 | 152-0141-02 | | | SEMICON D DEVICE:SILICON,30V,150MA | 07910 | CD8220 |
| CR606 | 152-0426-00 | | | SEMICON D DEVICE:SILICON,400V,400MA | 80009 | 152-0426-00 |
| CR607 | 152-0426-00 | | | SEMICON D DEVICE:SILICON,400V,400MA | 80009 | 152-0426-00 |
| CR608 | 152-0426-00 | | | SEMICON D DEVICE:SILICON,400V,400MA | 80009 | 152-0426-00 |
| CR609 | 152-0426-00 | | | SEMICON D DEVICE:SILICON,400V,400MA | 80009 | 152-0426-00 |
| CR655 | 152-0413-00 | | | SEMICON D DEVICE:SILICON,400V,750MA | 04713 | MR814 |
| CR656 | 152-0413-00 | | | SEMICON D DEVICE:SILICON,400V,750MA | 04713 | MR814 |
| DS416 | 150-0048-01 | | | LAMP, INCAND:NO.683,SELECTED | 80009 | 150-0048-01 |
| F581 | 159-0094-00 | | | FUSE,WIRE LEAD:0.75A,125V,FAST-BLO | 75915 | 273750 |
| F585 | 159-0094-00 | | | FUSE,WIRE LEAD:0.75A,125V,FAST-BLO | 75915 | 273750 |
| J181 | 131-1003-00 | | | CONN,RECP,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| J183 | 131-1003-00 | | | CONN,RECP,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| J207 | 131-1003-00 | | | CONN,RECP,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| J209 | 131-1003-00 | | | CONN,RECP,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| J217 | 131-1003-00 | | | CONN,RECP,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| J219 | 131-1003-00 | | | CONN,RECP,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| J415 | 131-0955-00 | | | CONN,RECP,ELEC:BNC,FEMALE | 24931 | 28JR200-1 |
| J426 | 131-1003-00 | | | CONN,RECP,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| J587 | 131-1003-00 | | | CONN,RECP,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| J597 | 131-1003-00 | | | CONN,RECP,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| L563 | 108-0245-00 | | | COIL,RF:3.9UH | 76493 | B6310-1 |
| L566 | 108-0245-00 | | | COIL,RF:3.9UH | 76493 | B6310-1 |
| L579 | 108-0245-00 | | | COIL,RF:3.9UH | 76493 | B6310-1 |
| L581 | 108-0406-00 | | | COIL,RF:80UH,TOROIDAL | 80009 | 108-0406-00 |
| L585 | 108-0406-00 | | | COIL,RF:80UH,TOROIDAL | 80009 | 108-0406-00 |
| L609 | 108-0016-00 | B010100 | B049999 | COIL,RF:29UH | 80009 | 108-0016-00 |
| L609 | 108-0406-00 | B050000 | | COIL,RF:80UH,TOROIDAL | 80009 | 108-0406-00 |
| L635 | 108-0406-00 | | | COIL,RF:80UH,TOROIDAL | 80009 | 108-0406-00 |
| L657 | 108-0406-00 | | | COIL,RF:80UH,TOROIDAL | 80009 | 108-0406-00 |
| Q144 | 151-0190-00 | B010100 | B039999X | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q170 | 151-0402-00 | | | TRANSISTOR:SILICON,NPN | 80009 | 151-0402-00 |
| Q177 | 151-0434-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N4261 |
| Q190 | 151-0221-00 | | | TRANSISTOR:SILICON,PNP | 07263 | S24849 |
| Q200 | 151-0221-00 | | | TRANSISTOR:SILICON,PNP | 07263 | S24849 |
| Q224 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q228 | 151-0342-00 | | | TRANSISTOR:SILICON,PNP | 07263 | 2N4249 |
| Q233 | 151-1067-00 | | | TRANSISTOR:SILICON,MOSFE | 80009 | 151-1067-00 |
| Q237 | 151-1067-00 | | | TRANSISTOR:SILICON,MOSFE | 80009 | 151-1067-00 |
| Q242 | 151-0342-00 | | | TRANSISTOR:SILICON,PNP | 07263 | 2N4249 |
| Q244 | 151-1068-00 | | | TRANSISTOR:JFE,N CHANNEL | 17856 | 2N4340 |
| Q246 | 151-0254-00 | | | TRANSISTOR:SILICON,NPN | 03508 | 2N5308 |
| Q250 | 151-0342-00 | | | TRANSISTOR:SILICON,PNP | 07263 | 2N4249 |
| Q252 | 151-0342-00 | | | TRANSISTOR:SILICON,PNP | 07263 | 2N4249 |
| Q254 | 151-0254-00 | | | TRANSISTOR:SILICON,NPN | 03508 | 2N5308 |
| Q262 | 153-0549-00 | | | TRANSISTOR:SILICON,JFE,N CHANNEL,SELECTED | 80009 | 153-0549-00 |
| Q267 | 151-1004-00 | | | TRANSISTOR:SILICON,JFE,N CHANNEL | 17856 | FN684 |
| Q270 | 151-1004-00 | | | TRANSISTOR:SILICON,JFE,N CHANNEL | 17856 | FN684 |
| Q275 | 153-0549-00 | | | TRANSISTOR:SILICON,JFE,N CHANNEL,SELECTED | 80009 | 153-0549-00 |
| Q278 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |

Electrical Parts List-7D12

| Ckt No. | Tektronix Part No. | Serial/Model No. | | Name & Description | Mfr Code | Mfr Part Number |
|---------|--------------------|------------------|---------|---|----------|-----------------|
| | | Eff | Dscont | | | |
| Q287 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q290 | 151-1005-00 | | | TRANSISTOR:SILICON,JFE,N CHANNEL | 15818 | U1490 |
| Q296 | 153-0549-00 | | | TRANSISTOR:SILICON,JFE,N CHANNEL,SELECTED | 80009 | 153-0549-00 |
| Q298 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q306 | 151-0188-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N3906 |
| Q313 | 151-0188-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N3906 |
| Q321 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q329 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q332 | 151-0188-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N3906 |
| Q336 | 151-1005-00 | | | TRANSISTOR:SILICON,JFE,N CHANNEL | 15818 | U1490 |
| Q344 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q353 | 151-0254-00 | | | TRANSISTOR:SILICON,NPN | 03508 | 2N5308 |
| Q363 | 151-1045-00 | | | TRANSISTOR:SILICON,JFE,P CHANNEL | 04713 | 2N5460 |
| Q367 | 153-0549-00 | | | TRANSISTOR:SILICON,JFE,N CHANNEL,SELECTED | 80009 | 153-0549-00 |
| Q369 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q376 | 151-0188-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N3906 |
| Q378 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q404 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q410 | 151-0504-00 | | | TRANSISTOR:SILICON,UNIUNCTION | 04713 | 2N4851 |
| Q434 | 151-0225-00 | | | TRANSISTOR:SILICON,NPN | 07910 | CS23366 |
| Q480 | 151-0367-00 | | | TRANSISTOR:SILICON,NPN,SEL FROM 3571TP | 80009 | 151-0367-00 |
| Q507 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q524 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q532 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q540 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q547 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q552 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q590 | 151-0347-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S35939 |
| Q593 | 151-0426-00 | | | TRANSISTOR:SILICON,NPN | 03508 | 044H11 |
| Q600 | 151-0347-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S35939 |
| Q603 | 151-0426-00 | | | TRANSISTOR:SILICON,NPN | 03508 | 044H11 |
| Q620 | 151-0342-00 | | | TRANSISTOR:SILICON,PNP | 07263 | 2N4249 |
| Q622 | 151-0235-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N4890 |
| Q626 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q637 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| Q646 | 151-0260-00 | | | TRANSISTOR:SILICON,NPN | 02735 | 2N5189 |
| Q661 | 151-0235-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N4890 |
| Q664 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 04713 | 2N3904 |
| R102 | 315-0431-00 | | | RES.,FXD,COMP:430 OHM,5%,0.25W | 01121 | CB4315 |
| R104 | 321-0172-00 | | | RES.,FXD,FILM:604 OHM,1%,0.125W | 75042 | CEAT0-6040F |
| R105 | 321-0155-00 | | | RES.,FXD,FILM:402 OHM,1%,0.125W | 75042 | CEAT0-4020F |
| R106 | 315-0511-00 | | | RES.,FXD,COMP:510 OHM,5%,0.25W | 01121 | CB5115 |
| R106 | 315-0751-00 | B010100 | B039999 | RES.,FXD,COMP:750 OHM,5%,0.25W | 01121 | CB7515 |
| R108 | 321-0184-00 | B040000 | | RES.,FXD,FILM:806 OHM,1%,0.125W | 75042 | CEAT0-8060F |
| R109 | 321-0126-00 | | | RES.,FXD,FILM:200 OHM,1%,0.125W | 75042 | CEAT0-2000F |
| R110 | 315-0301-00 | | | RES.,FXD,COMP:300 OHM,5%,0.25W | 01121 | CB3015 |
| R111 | 321-0190-00 | | | RES.,FXD,FILM:931 OHM,1%,0.125W | 75042 | CEAT0-9310F |
| R112 | 321-0087-00 | | | RES.,FXD,FILM:78.7 OHM,1%,0.125W | 75042 | CEAT0-78R70F |
| R114 | 315-0753-00 | | | RES.,FXD,COMP:75K OHM,5%,0.25W | 01121 | CB7535 |
| R115 | 315-0154-00 | | | RES.,FXD,COMP:150K OHM,5%,0.25W | 01121 | CB1545 |
| R116 | 321-0344-00 | | | RES.,FXD,FILM:37.4K OHM,1%,0.124W | 75042 | CEAT0-3742F |
| R120 | 311-0642-00 | | | RES.,VAR,NONWIR:20K OHM,10%,0.5W | 12697 | 382-CM39820 |
| R122 | 315-0204-00 | | | RES.,FXD,COMP:200K OHM,5%,0.25W | 01121 | CB2045 |
| R123 | 315-0562-00 | | | RES.,FXD,COMP:5.6K OHM,5%,0.25W | 01121 | CB5625 |
| R125 | 315-0300-00 | | | RES.,FXD,COMP:30 OHM,5%,0.25W | 01121 | CB3005 |
| R127 | 321-0072-00 | | | RES.,FXD,FILM:54.9 OHM,1%,0.125W | 75042 | CEAT0-54R90F |
| R128 | 321-0025-00 | | | RES.,FXD,FILM:17.8 OHM,1%,0.125W | 75042 | CEAT0-17R80F |
| R129 | 321-0050-00 | | | RES.,FXD,FILM:32.4 OHM,1%,0.125W | 75042 | CEAT0-32R40F |
| R131 | 311-0881-00 | | | RES.,VAR,NONWIR:20K OHM,10% | 01121 | W7674 |
| R133 | 315-0204-00 | | | RES.,FXD,COMP:200K OHM,5%,0.25W | 01121 | CB2045 |

| Ckt No. | Tektronix Part No. | Serial/Model No. | | Name & Description | Mfr Code | Mfr Part Number |
|---------|--------------------|------------------|---------|------------------------------------|----------|-----------------|
| | | Eff | Dscont | | | |
| R134 | 315-0822-00 | | | RES.,FXD,COMP:8.2K OHM,5%,0.25W | 01121 | CB8225 |
| R136 | 315-0300-00 | | | RES.,FXD,COMP:30 OHM,5%,0.25W | 01121 | CB3005 |
| R138 | 311-1230-00 | | | RES.,VAR,NONWIR:20K OHM,20%,0.50W | 80294 | 3389F-P31-203 |
| R139 | 315-0753-00 | | | RES.,FXD,COMP:75K OHM,5%,0.25W | 01121 | CB7535 |
| R140 | 315-0201-00 | | | RES.,FXD,COMP:200 OHM,5%,0.25W | 01121 | CB2015 |
| R142 | 315-0512-00 | B010100 | B039999 | RES.,FXD,COMP:5.1K OHM,5%,0.25W | 01121 | CB5125 |
| R142 | 315-0272-00 | B040000 | | RES.,FXD,COMP:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R143 | 315-0512-00 | B010100 | B039999 | RES.,FXD,COMP:5.1K OHM,5%,0.25W | 01121 | CB5125 |
| R143 | 315-0272-00 | B040000 | | RES.,FXD,COMP:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R145 | 315-0432-00 | B010100 | B039999 | RES.,FXD,COMP:4.3K OHM,5%,0.25W | 01121 | CB4325 |
| R145 | 315-0272-00 | B040000 | | RES.,FXD,COMP:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R146 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R150 | 321-0217-00 | | | RES.,FXD,FILM:1.78K OHM,1%,0.125W | 75042 | CEAT0-1781F |
| R152 | 315-0201-00 | | | RES.,FXD,COMP:200 OHM,5%,0.25W | 01121 | CB2015 |
| R154 | 315-0430-00 | | | RES.,FXD,COMP:43 OHM,5%,0.25W | 01121 | CB4305 |
| R155 | 315-0430-00 | | | RES.,FXD,COMP:43 OHM,5%,0.25W | 01121 | CB4305 |
| R156 | 315-0911-00 | | | RES.,FXD,COMP:910 OHM,5%,0.25W | 01121 | CB9115 |
| R158 | 315-0152-00 | | | RES.,FXD,COMP:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| R160 | 321-0059-00 | | | RES.,FXD,FILM:40.2 OHM,1%,0.125W | 75042 | CEAT0-40R20F |
| R161 | 321-0059-00 | | | RES.,FXD,FILM:40.2 OHM,1%,0.125W | 75042 | CEAT0-40R20F |
| R162 | 323-0189-00 | | | RES.,FXD,FILM:909 OHM,1%,0.50W | 75042 | CECT0-9090F |
| R164 | 315-0392-00 | | | RES.,FXD,COMP:3.9K OHM,5%,0.25W | 01121 | CB3925 |
| R165 | 315-0241-00 | | | RES.,FXD,COMP:240 OHM,5%,0.25W | 01121 | CB2415 |
| R167 | 315-0431-00 | | | RES.,FXD,COMP:430 OHM,5%,0.25W | 01121 | CB4315 |
| R169 | 311-1264-00 | | | RES.,VAR,NONWIR:1.5K OHM,10%,0.50W | 80294 | 3329P-L58-152 |
| R170 | 315-0361-00 | | | RES.,FXD,COMP:360 OHM,5%,0.25W | 01121 | CB3615 |
| R172 | 315-0222-00 | | | RES.,FXD,COMP:2.2K OHM,5%,0.25W | 01121 | CB2225 |
| R173 | 315-0121-00 | | | RES.,FXD,COMP:120 OHM,5%,0.25W | 01121 | CB1215 |
| R177 | 315-0510-00 | | | RES.,FXD,COMP:51 OHM,5%,0.25W | 01121 | CB5105 |
| R178 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R179 | 315-0431-00 | | | RES.,FXD,COMP:430 OHM,5%,0.25W | 01121 | CB4315 |
| R181 | 315-0510-00 | | | RES.,FXD,COMP:51 OHM,5%,0.25W | 01121 | CB5105 |
| R184 | 321-0091-00 | | | RES.,FXD,FILM:86.6 OHM,1%,0.125W | 75042 | CEAT0-86R60F |
| R186 | 322-0173-00 | | | RES.,FXD,FILM:619 OHM,1%,0.25W | 75042 | CEBT0-6190F |
| R187 | 321-0126-00 | | | RES.,FXD,FILM:200 OHM,1%,0.125W | 75042 | CEAT0-2000F |
| R188 | 322-0173-00 | | | RES.,FXD,FILM:619 OHM,1%,0.25W | 75042 | CEBT0-6190F |
| R191 | 322-0612-00 | | | RES.,FXD,FILM:500 OHM,1%,0.25W | 75042 | CEBT0-5000F |
| R193 | 321-0075-00 | | | RES.,FXD,FILM:59 OHM,1%,0.125W | 75042 | CEAT0-59R00F |
| R195 | 311-1263-00 | | | RES.,VAR,NONWIR:1K OHM,10%,0.50W | 73138 | 62PT-347-0 |
| R196 | 315-0751-00 | | | RES.,FXD,COMP:750 OHM,5%,0.25W | 01121 | CB7515 |
| R197 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R198 | 315-0330-00 | | | RES.,FXD,COMP:33 OHM,5%,0.25W | 01121 | CB3305 |
| R201 | 322-0612-00 | | | RES.,FXD,FILM:500 OHM,1%,0.25W | 75042 | CEBT0-5000F |
| R203 | 315-0201-00 | | | RES.,FXD,COMP:200 OHM,5%,0.25W | 01121 | CB2015 |
| R205 | 321-0068-00 | | | RES.,FXD,FILM:49.9 OHM,1%,0.125W | 75042 | CEAT0-49R90F |
| R206 | 301-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.50W | 01121 | EB1025 |
| R213 | 315-0201-00 | | | RES.,FXD,COMP:200 OHM,5%,0.25W | 01121 | CB2015 |
| R215 | 321-0068-00 | | | RES.,FXD,FILM:49.9 OHM,1%,0.125W | 75042 | CEAT0-49R90F |
| R216 | 301-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.50W | 01121 | EB1025 |
| R221 | 315-0302-00 | | | RES.,FXD,COMP:3K OHM,5%,0.25W | 01121 | CB3025 |
| R222 | 315-0273-00 | | | RES.,FXD,COMP:27K OHM,5%,0.25W | 01121 | CB2735 |
| R225 | 315-0203-00 | | | RES.,FXD,COMP:20K OHM,5%,0.25W | 01121 | CB2035 |
| R227 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R228 | 315-0203-00 | | | RES.,FXD,COMP:20K OHM,5%,0.25W | 01121 | CB2035 |
| R230 | 315-0153-00 | | | RES.,FXD,COMP:15K OHM,5%,0.25W | 01121 | CB1535 |
| R231 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R236 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R239 | 315-0302-00 | | | RES.,FXD,COMP:3K OHM,5%,0.25W | 01121 | CB3025 |
| R240 | 315-0123-00 | | | RES.,FXD,COMP:12K OHM,5%,0.25W | 01121 | CB1235 |
| R242 | 315-0241-00 | | | RES.,FXD,COMP:240 OHM,5%,0.25W | 01121 | CB2415 |
| R248 | 315-0821-00 | | | RES.,FXD,COMP:820 OHM,5%,0.25W | 01121 | CB8215 |
| R249 | 311-1227-00 | | | RES.,VAR,NONWIR:5K OHM,20%,0.50W | 80294 | 3389F-P31-502 |
| R252 | 315-0474-00 | | | RES.,FXD,COMP:470K OHM,5%,0.25W | 01121 | CB4745 |

Electrical Parts List-7D12

| Ckt No. | Tektronix Part No. | Serial/Model No. | | Name & Description | Mfr Code | Mfr Part Number |
|-------------------|--------------------|------------------|--------|---|----------|-----------------|
| | | Eff | Dscont | | | |
| R257 | 315-0272-00 | | | RES.,FXD,COMP:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R265 | 315-0562-00 | | | RES.,FXD,COMP:5.6K OHM,5%,0.25W | 01121 | CB5625 |
| R266 | 315-0242-00 | | | RES.,FXD,COMP:2.4 OHM,5%,0.25W | 01121 | CB2425 |
| R269 ¹ | 307-0380-00 | | | RES.,FXD,FILM:6.66K OHM,0.1%,0.125W | 18612 | V-53-1-311054 |
| R271 | 315-0242-00 | | | RES.,FXD,COMP:2.4 OHM,5%,0.25W | 01121 | CB2425 |
| R279 | 315-0242-00 | | | RES.,FXD,COMP:2.4 OHM,5%,0.25W | 01121 | CB2425 |
| R281 | 315-0104-00 | | | RES.,FXD,COMP:100K OHM,5%,0.25W | 01121 | CB1045 |
| R285 | 315-0622-00 | | | RES.,FXD,COMP:6.2K OHM,5%,0.25W | 01121 | CB6225 |
| R286 | 315-0153-00 | | | RES.,FXD,COMP:15K OHM,5%,0.25W | 01121 | CB1535 |
| R289 | 315-0391-00 | | | RES.,FXD,COMP:390 OHM,5%,0.25W | 01121 | CB3915 |
| R290 | 315-0474-00 | | | RES.,FXD,COMP:470K OHM,5%,0.25W | 01121 | CB4745 |
| R291 | 315-0273-00 | | | RES.,FXD,COMP:27K OHM,5%,0.25W | 01121 | CB2735 |
| R293 | 315-0123-00 | | | RES.,FXD,COMP:12K OHM,5%,0.25W | 01121 | CB1235 |
| R299 | 315-0242-00 | | | RES.,FXD,COMP:2.4 OHM,5%,0.25W | 01121 | CB2425 |
| R307 | 315-0203-00 | | | RES.,FXD,COMP:20K OHM,5%,0.25W | 01121 | CB2035 |
| R309 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R310 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R312 | 315-0203-00 | | | RES.,FXD,COMP:20K OHM,5%,0.25W | 01121 | CB2035 |
| R314 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R315 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R319 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R321 | 315-0302-00 | | | RES.,FXD,COMP:3K OHM,5%,0.25W | 01121 | CB3025 |
| R322 | 315-0223-00 | | | RES.,FXD,COMP:220K OHM,5%,0.25W | 01121 | CB2235 |
| R323 | 315-0152-00 | | | RES.,FXD,COMP:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| R327 | 315-0152-00 | | | RES.,FXD,COMP:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| R328 | 315-0223-00 | | | RES.,FXD,COMP:220K OHM,5%,0.25W | 01121 | CB2235 |
| R329 | 315-0202-00 | | | RES.,FXD,COMP:2K OHM,5%,0.25W | 01121 | CB2025 |
| R331 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R332 | 315-0202-00 | | | RES.,FXD,COMP:2K OHM,5%,0.25W | 01121 | CB2025 |
| R333 | 315-0112-00 | | | RES.,FXD,COMP:1.1K OHM,5%,0.25W | 01121 | CB1125 |
| R335 | 315-0203-00 | | | RES.,FXD,COMP:20K OHM,5%,0.25W | 01121 | CB2035 |
| R341 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R344 | 315-0302-00 | | | RES.,FXD,COMP:3K OHM,5%,0.25W | 01121 | CB3025 |
| R346 | 315-0223-00 | | | RES.,FXD,COMP:220K OHM,5%,0.25W | 01121 | CB2235 |
| R347 | 315-0152-00 | | | RES.,FXD,COMP:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| R350 | 321-0197-02 | | | RES.,FXD,FILM:1.1K OHM,0.5%,0.125W | 75042 | CEAT2-1101D |
| R353 | 321-0911-02 | | | RES.,FXD,FILM:829 OHM,0.5%,0.125W | 75042 | CEAT2-8290D |
| R357 | 315-0202-00 | | | RES.,FXD,COMP:2K OHM,5%,0.25W | 01121 | CB2025 |
| R359 | 321-0799-02 | | | RES.,FXD,FILM:146.8 OHM,(NOM VALUE),SEL | 75042 | CEAT2-146R8D |
| R360 | 321-0799-02 | | | RES.,FXD,FILM:146.8 OHM,(NOM VALUE),SEL | 75042 | CEAT2-146R8D |
| R361 | 311-1167-00 | | | RES.,VAR, NONWIR:200 OHM,20%,0.5W | 80294 | 3009P-1-201 |
| R362 ¹ | 307-0380-00 | | | RES.,FXD,FILM:20.9K OHM,0.1%,0.125W | 18612 | V-53-1-311054 |
| R369 | 315-0242-00 | | | RES.,FXD,COMP:2.4 OHM,5%,0.25W | 01121 | CB2425 |
| R371 | 315-0122-00 | | | RES.,FXD,COMP:1.2K OHM,5%,0.25W | 01121 | CB1225 |
| R372 | 315-0153-00 | | | RES.,FXD,COMP:15K OHM,5%,0.25W | 01121 | CB1535 |
| R373 | 315-0512-00 | | | RES.,FXD,COMP:5.1K OHM,5%,0.25W | 01121 | CB5125 |
| R377 | 315-0361-00 | | | RES.,FXD,COMP:360 OHM,5%,0.25W | 01121 | CB3615 |
| R379 | 315-0132-00 | | | RES.,FXD,COMP:1.3K OHM,5%,0.25W | 01121 | CB1325 |
| R381 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R383 | 315-0622-00 | | | RES.,FXD,COMP:6.2K OHM,5%,0.25W | 01121 | CB6225 |
| R385 | 315-0821-00 | | | RES.,FXD,COMP:820 OHM,5%,0.25W | 01121 | CB8215 |
| R386 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R388 | 315-0821-00 | | | RES.,FXD,COMP:820 OHM,5%,0.25W | 01121 | CB8215 |
| R390 | 315-0821-00 | | | RES.,FXD,COMP:820 OHM,5%,0.25W | 01121 | CB8215 |
| R401 | 315-0432-00 | | | RES.,FXD,COMP:4.3K OHM,5%,0.25W | 01121 | CB4325 |
| R404 | 315-0391-00 | | | RES.,FXD,COMP:390 OHM,5%,0.25W | 01121 | CB3915 |
| R407 | 315-0913-00 | | | RES.,FXD,COMP:91K OHM,5%,0.25W | 01121 | CB9135 |
| R409 | 315-0101-00 | | | RES.,FXD,COMP:100 OHM,5%,0.25W | 01121 | CB1015 |
| R410 | 315-0221-00 | | | RES.,FXD,COMP:220 OHM,5%,0.25W | 01121 | CB2215 |
| R412 | 307-0110-00 | | | RES.,FXD,COMP:3 OHM,5%,0.25W | 01121 | CB30G5 |

¹Furnished as a unit.

| Ckt No. | Tektronix Part No. | Serial/Model No. | | Name & Description | Mfr Code | Mfr Part Number |
|---------|--------------------|------------------|---------|------------------------------------|----------|-----------------|
| | | Eff | Dscont | | | |
| R419 | 315-0396-00 | | | RES.,FXD,COMP:39M OHM,5%,0.25W | 01121 | CB3965 |
| R420 | 315-0391-00 | | | RES.,FXD,COMP:390 OHM,5%,0.25W | 01121 | CB3915 |
| R422 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R430 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R432 | 315-0473-00 | | | RES.,FXD,COMP:47K OHM,5%,0.25W | 01121 | CB4735 |
| R434 | 315-0512-00 | | | RES.,FXD,COMP:5.1K OHM,5%,0.25W | 01121 | CB5125 |
| R437 | 315-0471-00 | | | RES.,FXD,COMP:470 OHM,5%,0.25W | 01121 | CB4715 |
| R440 | 321-0247-00 | | | RES.,FXD,FILM:3.65K OHM,1%,0.125W | 75042 | CEAT0-3651F |
| R441 | 311-1556-00 | B010100 | B019999 | RES.,VAR, NONWIR:50K OHM,20%,0.50W | 73138 | 91A-50001M |
| R441 | 311-1271-00 | B020000 | | RES.,VAR, NONWIR:50K OHM,10%,0.50W | 73138 | 62PT-354-0 |
| R442 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R444 | 321-0335-00 | | | RES.,FXD,FILM:30.1K OHM,1%,0.125W | 75042 | CEAT0-3012F |
| R446 | 315-0272-00 | | | RES.,FXD,COMP:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R448 | 315-0272-00 | | | RES.,FXD,COMP:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R450 | 315-0272-00 | | | RES.,FXD,COMP:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R452 | 315-0272-00 | | | RES.,FXD,COMP:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R455 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R460 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R462 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R465 | 315-0681-00 | | | RES.,FXD,COMP:680 OHM,5%,0.25W | 01121 | CB6815 |
| R466 | 315-0681-00 | | | RES.,FXD,COMP:680 OHM,5%,0.25W | 01121 | CB6815 |
| R467 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R468 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R470 | 315-0203-00 | | | RES.,FXD,COMP:20K OHM,5%,0.25W | 01121 | CB2035 |
| R471 | 315-0202-00 | | | RES.,FXD,COMP:2K OHM,5%,0.25W | 01121 | CB2025 |
| R477 | 315-0681-00 | | | RES.,FXD,COMP:680 OHM,5%,0.25W | 01121 | CB6815 |
| R478 | 315-0681-00 | | | RES.,FXD,COMP:680 OHM,5%,0.25W | 01121 | CB6815 |
| R480 | 315-0302-00 | | | RES.,FXD,COMP:3K OHM,5%,0.25W | 01121 | CB3025 |
| R482 | 315-0223-00 | | | RES.,FXD,COMP:220K OHM,5%,0.25W | 01121 | CB2235 |
| R483 | 315-0152-00 | | | RES.,FXD,COMP:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| R485 | 315-0432-00 | | | RES.,FXD,COMP:4.3K OHM,5%,0.25W | 01121 | CB4325 |
| R486 | 315-0432-00 | | | RES.,FXD,COMP:4.3K OHM,5%,0.25W | 01121 | CB4325 |
| R488 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R489 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R491 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R493 | 315-0203-00 | | | RES.,FXD,COMP:20K OHM,5%,0.25W | 01121 | CB2035 |
| R497 | 315-0622-00 | | | RES.,FXD,COMP:6.2K OHM,5%,0.25W | 01121 | CB6225 |
| R499 | 311-1137-00 | | | RES.,VAR, NONWIR:5K OHM,20%,0.5W | 73138 | 72PX-67-0-502M |
| R500 | 321-0302-00 | | | RES.,FXD,FILM:13.7K OHM,1%,0.125W | 75042 | CEAT0-1372F |
| R502 | 315-0104-00 | | | RES.,FXD,COMP:100K OHM,5%,0.25W | 01121 | CB1045 |
| R505 | 315-0512-00 | | | RES.,FXD,COMP:5.1K OHM,5%,0.25W | 01121 | CB5125 |
| R506 | 315-0203-00 | | | RES.,FXD,COMP:20K OHM,5%,0.25W | 01121 | CB2035 |
| R507 | 315-0512-00 | | | RES.,FXD,COMP:5.1K OHM,5%,0.25W | 01121 | CB5125 |
| R509 | 315-0102-00 | | | RES.,FXD,COMP:1K OHM,5%,0.25W | 01121 | CB1025 |
| R511 | 315-0681-00 | | | RES.,FXD,COMP:680 OHM,5%,0.25W | 01121 | CB6815 |
| R512 | 315-0681-00 | | | RES.,FXD,COMP:680 OHM,5%,0.25W | 01121 | CB6815 |
| R517 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R518 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R520 | 315-0752-00 | | | RES.,FXD,COMP:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| R522 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R523 | 315-0154-00 | | | RES.,FXD,COMP:150K OHM,5%,0.25W | 01121 | CB1545 |
| R526 | 315-0154-00 | | | RES.,FXD,COMP:150K OHM,5%,0.25W | 01121 | CB1545 |
| R527 | 321-0335-00 | | | RES.,FXD,FILM:30.1K OHM,1%,0.125W | 75042 | CEAT0-3012F |
| R530 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R531 | 315-0154-00 | | | RES.,FXD,COMP:150K OHM,5%,0.25W | 01121 | CB1545 |
| R534 | 315-0154-00 | | | RES.,FXD,COMP:150K OHM,5%,0.25W | 01121 | CB1545 |
| R538 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R539 | 315-0154-00 | | | RES.,FXD,COMP:150K OHM,5%,0.25W | 01121 | CB1545 |
| R541 | 315-0154-00 | | | RES.,FXD,COMP:150K OHM,5%,0.25W | 01121 | CB1545 |
| R544 | 315-0103-00 | | | RES.,FXD,COMP:10K OHM,5%,0.25W | 01121 | CB1035 |
| R546 | 315-0154-00 | | | RES.,FXD,COMP:150K OHM,5%,0.25W | 01121 | CB1545 |

Electrical Parts List-7D12

| Ckt No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Name & Description | Mfr Code | Mfr Part Number |
|-------------------|--------------------|-----------------------------|---|----------|-----------------|
| R548 | 315-0133-00 | | RES.,FXD,COMP:13K OHM,5%,0.25W | 01121 | CB1335 |
| R553 | 315-0683-00 | | RES.,FXD,COMP:68K OHM,5%,0.25W | 01121 | CB6835 |
| R557 | 315-0154-00 | | RES.,FXD,COMP:150K OHM,5%,0.25W | 01121 | CB1545 |
| R578 | 301-0241-00 | | RES.,FXD,COMP:240 OHM,5%,0.50W | 01121 | EB2415 |
| R581 | 315-0300-00 | | RES.,FXD,COMP:30 OHM,5%,0.25W | 01121 | CB3005 |
| R585 | 315-0300-00 | | RES.,FXD,COMP:30 OHM,5%,0.25W | 01121 | CB3005 |
| R587 | 315-0751-00 | | RES.,FXD,COMP:750 OHM,5%,0.25W | 01121 | CB7515 |
| R588 | 315-0302-00 | | RES.,FXD,COMP:3K OHM,5%,0.25W | 01121 | CB3025 |
| R591 | 315-0470-00 | | RES.,FXD,COMP:240 OHM,5%,0.25W | 01121 | CB4705 |
| R597 | 315-0751-00 | | RES.,FXD,COMP:750 OHM,5%,0.25W | 01121 | CB7515 |
| R598 | 315-0302-00 | | RES.,FXD,COMP:3K OHM,5%,0.25W | 01121 | CB3025 |
| R601 | 315-0470-00 | | RES.,FXD,COMP:47 OHM,5%,0.25W | 01121 | CB4705 |
| R611 | 315-0681-00 | | RES.,FXD,COMP:680 OHM,5%,0.25W | 01121 | CB6815 |
| R612 | 321-0666-00 | | RES.,FXD,FILM:3.04K OHM,0.5%,0.125W | 75042 | CEAT2-3041D |
| R613 | 311-1225-00 | | RES.,VAR,NONWIR:2.5K OHM,20%,0.5W | 73138 | 72PM-07-0-102K |
| R614 | 321-0668-00 | | RES.,FXD,FILM:4.63K OHM,0.5%,0.125W | 75042 | CEAT2-4631D |
| R616 | 315-0203-00 | | RES.,FXD,COMP:20K OHM,5%,0.25W | 01121 | CB2035 |
| R619 | 315-0243-00 | | RES.,FXD,COMP:24K OHM,5%,0.25W | 01121 | CB2435 |
| R621 | 308-0075-00 | | RES.,FXD,WW:100 OHM,5%,3W | 91637 | RS2B-B100R0J |
| R624 | 315-0162-00 | | RES.,FXD,COMP:1.6K OHM,5%,0.25W | 01121 | CB1625 |
| R625 | 315-0361-00 | | RES.,FXD,COMP:360 OHM,5%,0.25W | 01121 | CB3615 |
| R628 | 321-0685-00 | | RES.,FXD,FILM:30K OHM,0.5%,0.125W | 75042 | CEAT2-3002D |
| R629 | 321-0720-03 | | RES.,FXD,COMP:60K OHM,0.25%,0.125W | 91637 | MFF1816D60001C |
| R633 | 317-0200-00 | | RES.,FXD,COMP:20 OHM,5%,0.125W | 01121 | BB2005 |
| R637 | 315-0301-00 | | RES.,FXD,COMP:300 OHM,5%,0.25W | 01121 | CB3015 |
| R638 | 315-0302-00 | | RES.,FXD,COMP:3K OHM,5%,0.25W | 01121 | CB3025 |
| R640 | 321-0653-00 | | RES.,FXD,FILM:102K OHM,0.5%,0.125W | 91637 | MFF1816D10202D |
| R641 | 321-0679-00 | | RES.,FXD,FILM:34K OHM,0.5%,0.125W | 75042 | CEAT2-3402D |
| R643 | 315-0243-00 | | RES.,FXD,COMP:24K OHM,5%,0.25W | 01121 | CB2435 |
| R648 | 308-0075-00 | | RES.,FXD,WW:100 OHM,5%,3W | 91637 | RS2B-B100R0J |
| R650 | 317-0100-00 | | RES.,FXD,COMP:10 OHM,5%,0.125W | 01121 | BB1005 |
| R652 | 315-0202-00 | | RES.,FXD,COMP:2K OHM,5%,0.25W | 01121 | CB2025 |
| R660 | 315-0511-00 | | RES.,FXD,COMP:510 OHM,5%,0.25W | 01121 | CB5115 |
| R663 | 315-0202-00 | | RES.,FXD,COMP:2K OHM,5%,0.25W | 01121 | CB2025 |
| R667 | 303-0560-00 | | RES.,FXD,COMP:56 OHM,5%,1W | 01121 | GB5605 |
| S110 | 105-0372-00 | | ACTUATOR,ASSY:ATTEN | 80009 | 105-0372-00 |
| S142 | 260-0723-00 | | SWITCH,SLIDE:DPDT,0.5A,125VAC | 80009 | 260-0723-00 |
| S165 | 260-1132-00 | | SWITCH,PUSH:GATE | 80009 | 260-1132-00 |
| S424 ¹ | 670-2175-00 | | SWITCH,PUSH BUTTON:MAN-EXT-AUTO | 80009 | 670-2175-00 |
| T125 | 120-0445-00 | | XFMR,TOROID:8 TURNS BIFILAR | 80009 | 120-0445-00 |
| T184 | 120-0487-00 | | XFMR,TOROID:5 TURNS BIFILAR | 80009 | 120-0487-00 |
| T324 | 120-0697-00 | | XFMR,TOROID:TWO 20 TURN WINDINGS | 80009 | 120-0697-00 |
| T326 | 120-0697-00 | | XFMR,TOROID:TWO 20 TURN WINDINGS | 80009 | 120-0697-00 |
| T348 | 120-0697-00 | | XFMR,TOROID:TWO 20 TURN WINDINGS | 80009 | 120-0697-00 |
| T391 | 120-0697-00 | | XFMR,TOROID:TWO 20 TURN WINDINGS | 80009 | 120-0697-00 |
| T595 | 120-0849-00 | | XFMR,POWER:POT CORE | 80009 | 120-0849-00 |
| U124 | 156-0158-00 | | INTEGRATED CKT:DUAL OPERATIONAL AMPLIFIER | 18324 | S5558V |
| U148 | 155-0022-00 | | INTEGRATED CKT:ML,CHANNEL SWITCH | 80009 | 155-0022-00 |
| U248 | 156-0158-00 | | INTEGRATED CKT:DUAL OPERATIONAL AMPLIFIER | 18324 | S5558V |
| U260 | 156-0067-04 | | INTEGRATED CKT:OPERATIONAL AMPLIFIER,SEL | 80009 | 156-0067-04 |
| U276 | 156-0067-04 | | INTEGRATED CKT:OPERATIONAL AMPLIFIER,SEL | 80009 | 156-0067-04 |
| U283 | 156-0067-00 | | INTEGRATED CKT:OPERATIONAL AMPLIFIER | 07263 | UA741 |
| U289 | 156-0109-00 | | INTEGRATED CKT:GAAS,LED,NPN,PHOTO XSTR | 26483 | MCT2 |
| U301 | 156-0067-00 | | INTEGRATED CKT:OPERATIONAL AMPLIFIER | 07263 | UA741 |
| U317 | 156-0039-00 | | INTEGRATED CKT:DUAL 15MHZ J-K M/S FF | 04713 | MC7473P |
| U342 | 156-0030-00 | | INTEGRATED CKT:QUAD 2-INPUT POS NAND GATE | 01295 | SN7400N |
| U351 | 156-0067-00 | | INTEGRATED CKT:OPERATIONAL AMPLIFIER | 07263 | UA741 |
| U356 | 156-0067-02 | | INTEGRATED CKT:OPERATIONAL AMPLIFIER,SEL | 80009 | 156-0067-02 |
| U375 | 156-0067-00 | | INTEGRATED CKT:OPERATIONAL AMPLIFIER | 07263 | UA741 |

¹See Mechanical Parts List for replacement parts.

| Ckt No. | Tektronix Part No. | Serial/Model No. | | Name & Description | Mfr Code | Mfr Part Number | |
|-------------------|--------------------|------------------|--------|--|----------|-----------------|--|
| | | Eff | Dscont | | | | |
| U380 | 156-0096-00 | | | INTEGRATED CKT:VOLTAGE COMPARATOR | 27014 | LM311H | |
| U402 | 156-0058-00 | | | INTEGRATED CKT:HEX. INVERTER | 04713 | MC7404P | |
| U436 | 156-0030-00 | | | INTEGRATED CKT:QUAD 2-INPUT POS NAND GATE | 01295 | SN7400N | |
| U440 | 156-0172-00 | | | INTEGRATED CKT:DUAL RETRIGGERABLE SS | 01295 | SN74123N | |
| U456 | 156-0039-00 | | | INTEGRATED CKT:DUAL 15MHZ J-K M/S FF | 04713 | MC7473P | |
| U458 | 156-0032-00 | | | INTEGRATED CKT:4-BIT BINARY COUNTER | 01295 | SN7493N | |
| U476 | 156-0030-00 | | | INTEGRATED CKT:QUAD 2-INPUT POS NAND GATE | 01295 | SN7400N | |
| U492 | 156-0043-00 | | | INTEGRATED CKT:2-INPUT NOR GATE | 01295 | SN7402N | |
| U495 | 156-0072-00 | | | INTEGRATED CKT:MONOSTABLE MULTIVIBRATOR | 12040 | DM71421N | |
| U500 ¹ | 155-0090-00 | | | INTEGRATED CKT:MONOLITHIC,4 DECADE COUNTER | 80009 | 155-0090-00 | |
| U509 | 156-0039-00 | | | INTEGRATED CKT:DUAL 15MHZ J-K M/S FF | 04713 | MC7473P | |
| U514 | 156-0040-00 | | | INTEGRATED CKT:DUAL 2-BIT BISTABLE LATCH | 01295 | SN7475N | |
| U618 | 156-0067-00 | | | INTEGRATED CKT:OPERATIONAL AMPLIFIER | 07263 | UA741 | |
| U643 | 156-0067-00 | | | INTEGRATED CKT:OPERATIONAL AMPLIFIER | 07263 | UA741 | |
| U659 | 156-0067-00 | | | INTEGRATED CKT:OPERATIONAL AMPLIFIER | 07263 | UA741 | |
| VR245 | 152-0227-00 | | | SEMICONV DEVICE:ZENER,6.2V,5%,0.4W | 80009 | 152-0227-00 | |
| VR250 | 152-0168-00 | | | SEMICONV DEVICE:ZENER,12V,5%,0.4W | 04713 | 1N963B | |
| VR264 | 152-0226-00 | | | SEMICONV DEVICE:ZENER,5.1V,5%,0.4W | 80009 | 152-0226-00 | |
| VR272 | 152-0226-00 | | | SEMICONV DEVICE:ZENER,5.1V,5%,0.4W | 80009 | 152-0226-00 | |
| VR281 | 152-0278-00 | | | SEMICONV DEVICE:ZENER,3V,5%,0.4W | 07910 | 1N4372A | |
| VR282 | 152-0278-00 | | | SEMICONV DEVICE:ZENER,3V,5%,0.4W | 07910 | 1N4372A | |
| VR284 | 152-0280-00 | | | SEMICONV DEVICE:ZENER,6.2V,5%,0.4W | 04713 | 1N753A | |
| VR350 | 152-0317-00 | | | SEMICONV DEVICE:ZENER,6.2V,5%,0.25W | 81483 | 1N3497 | |
| VR354 | 152-0526-00 | | | SEMICONV DEVICE:ZENER,6.35V,1%,7.5MA | 80009 | 152-0526-00 | |
| VR357 | 152-0226-00 | | | SEMICONV DEVICE:ZENER,5.1V,5%,0.4W | 80009 | 152-0226-00 | |
| VR371 | 152-0227-00 | | | SEMICONV DEVICE:ZENER,6.2V,5%,0.4W | 80009 | 152-0227-00 | |
| VR577 | 152-0279-00 | | | SEMICONV DEVICE:ZENER,5.1V,5%,0.4W | 07910 | 1N751A | |
| VR613 | 152-0123-00 | | | SEMICONV DEVICE:ZENER,9V,5%,0.5W | 80009 | 152-0123-00 | |
| VR619 | 152-0226-00 | | | SEMICONV DEVICE:ZENER,5.1V,5%,0.4W | 80009 | 152-0226-00 | |
| VR637 | 152-0508-00 | | | SEMICONV DEVICE:ZENER,12.6V,5%,0.4W | 80009 | 152-0508-00 | |
| VR645 | 152-0226-00 | | | SEMICONV DEVICE:ZENER,5.1V,5%,0.4W | 80009 | 152-0226-00 | |
| VR652 | 152-0226-00 | | | SEMICONV DEVICE:ZENER,5.1V,5%,0.4W | 80009 | 152-0226-00 | |
| Y449 | 158-0014-00 | | | XTAL UNIT,QTZ:1000KC | 80009 | 158-0014-00 | |

¹155-0090-02 may be used.

DIAGRAMS AND 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 (μ F).
- Resistors = Ohms (Ω).

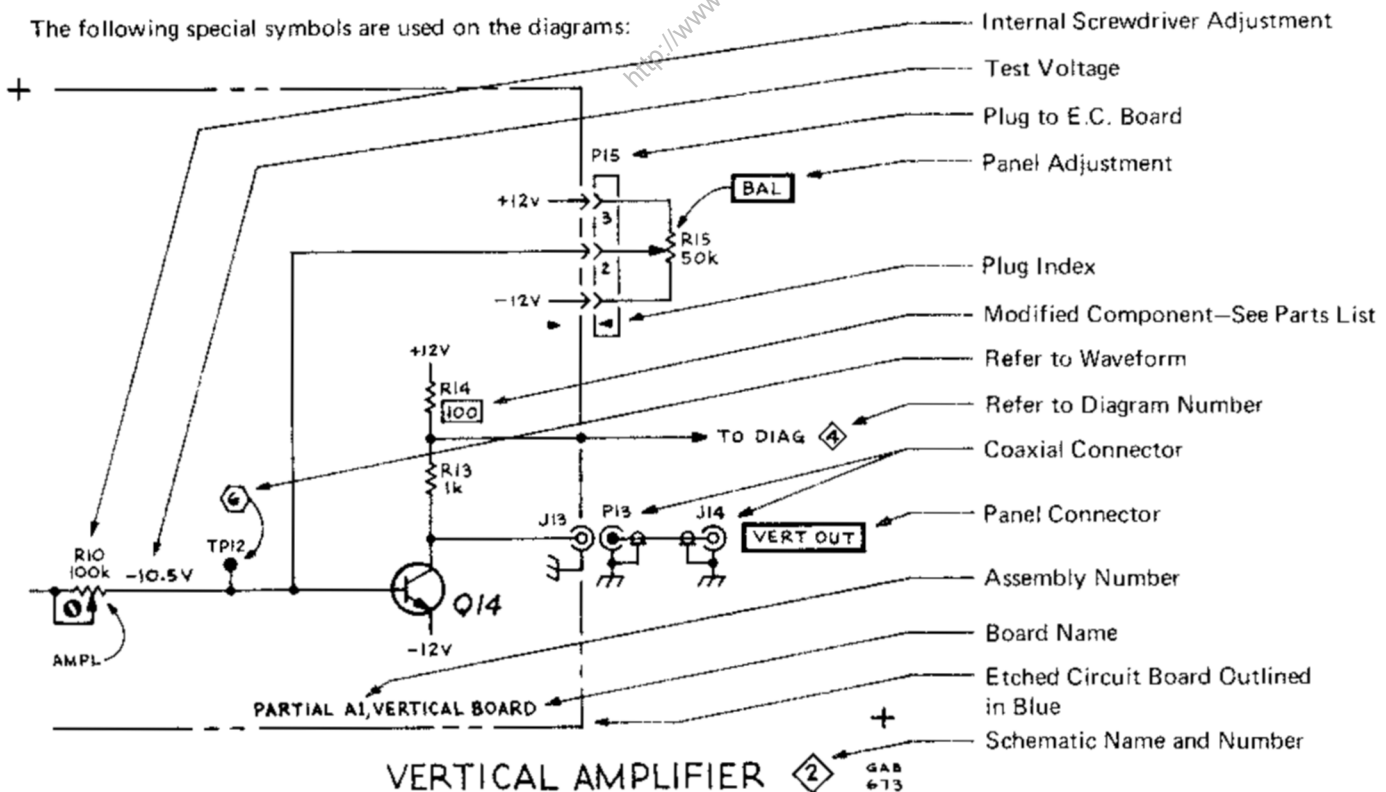
Symbols used on the diagrams are based on USA Standard Y32.2-1967.

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

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

The following special symbols are used on the diagrams:



7D12 Service

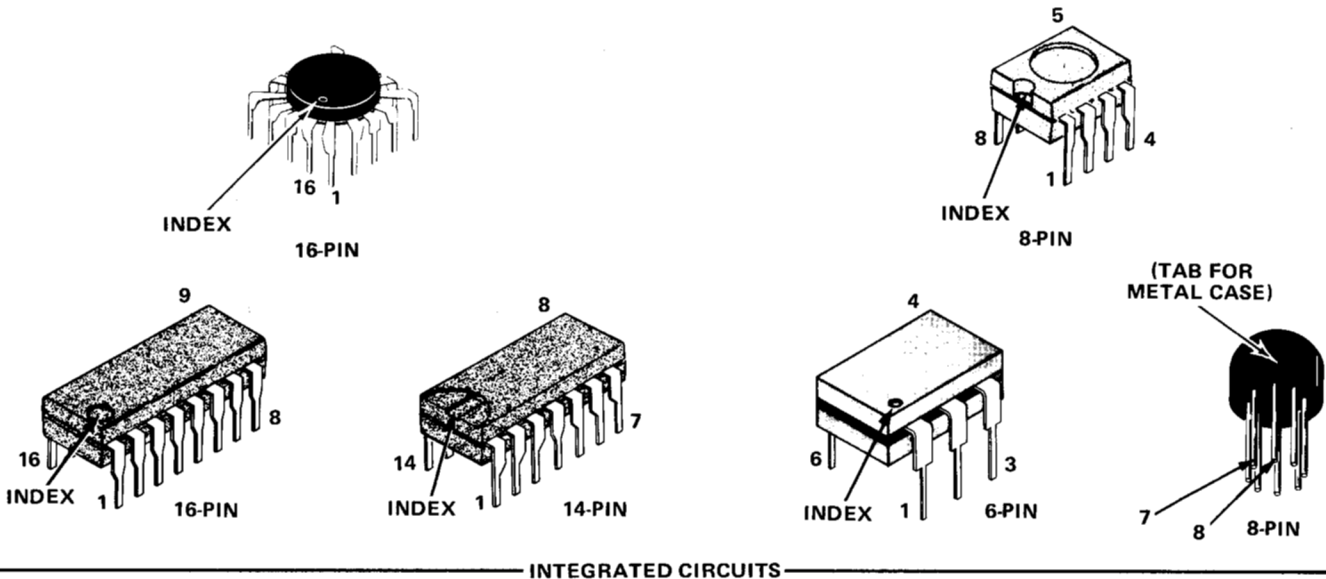
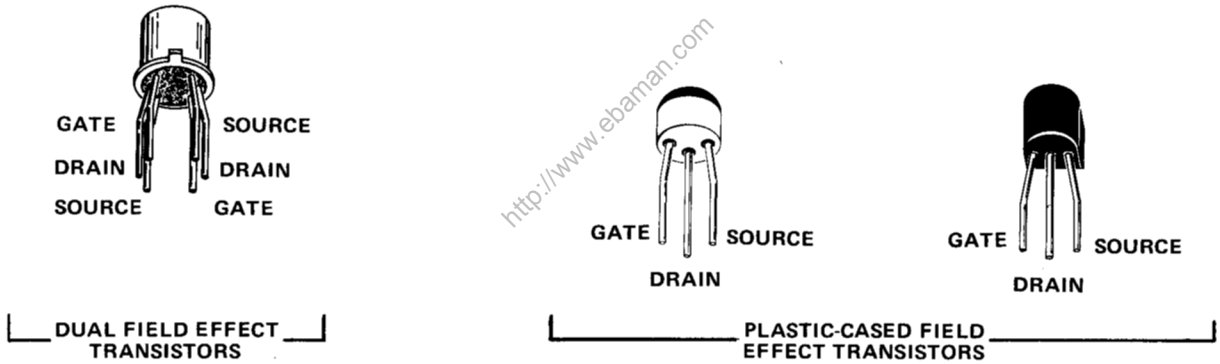
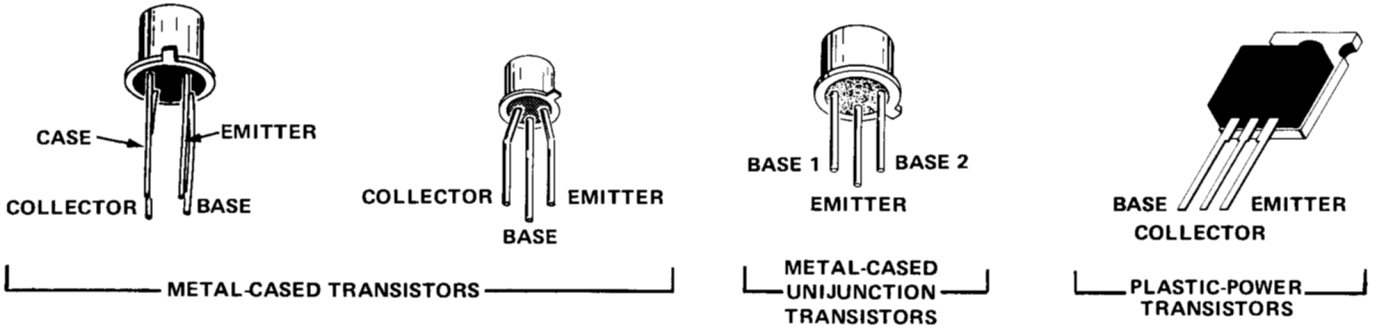
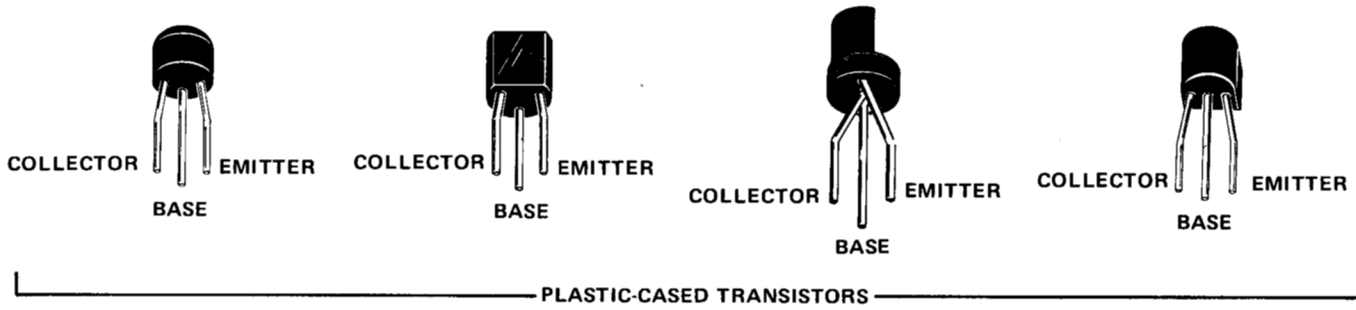
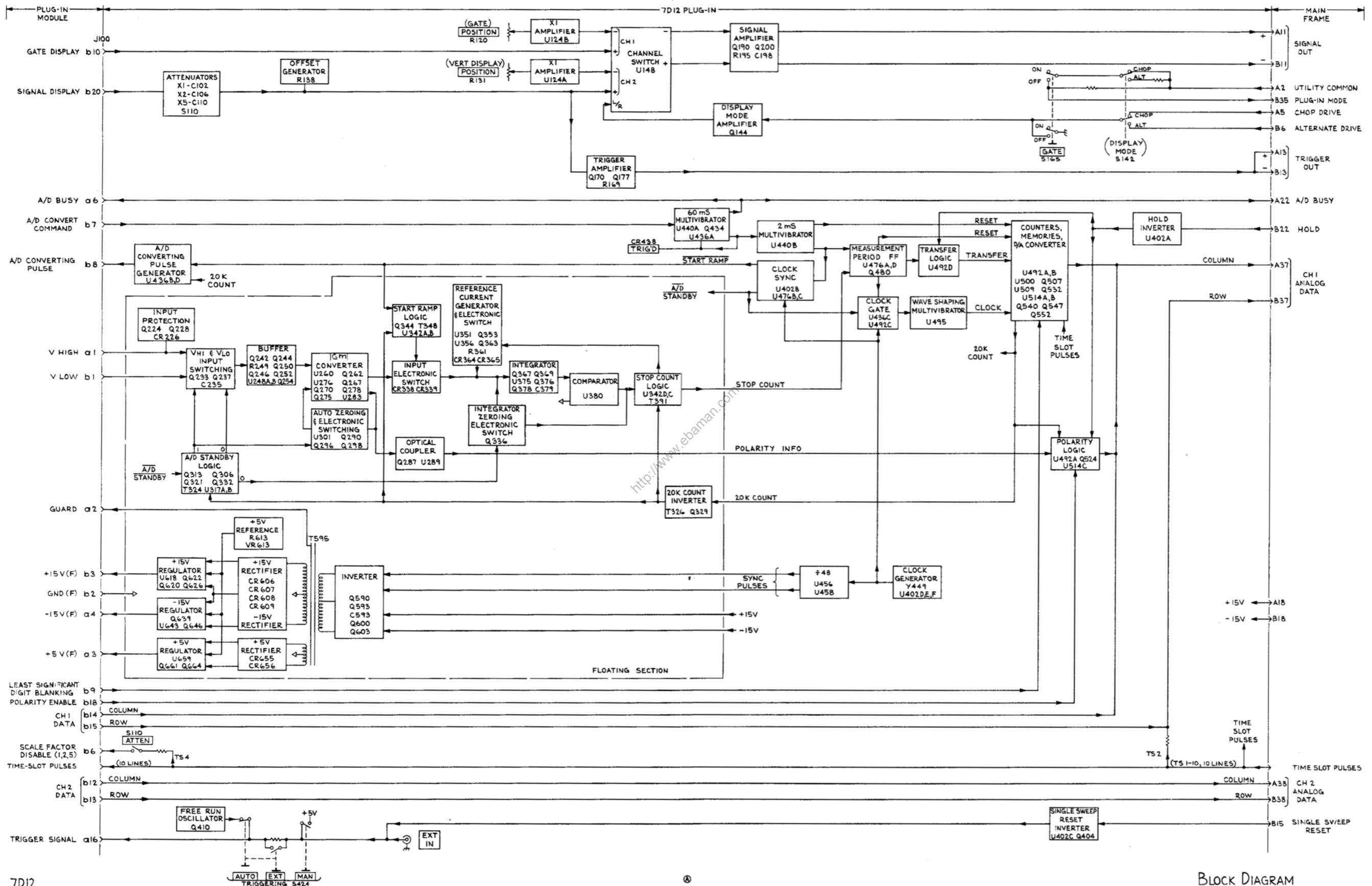


Fig. 6-1. Semiconductor lead configurations.



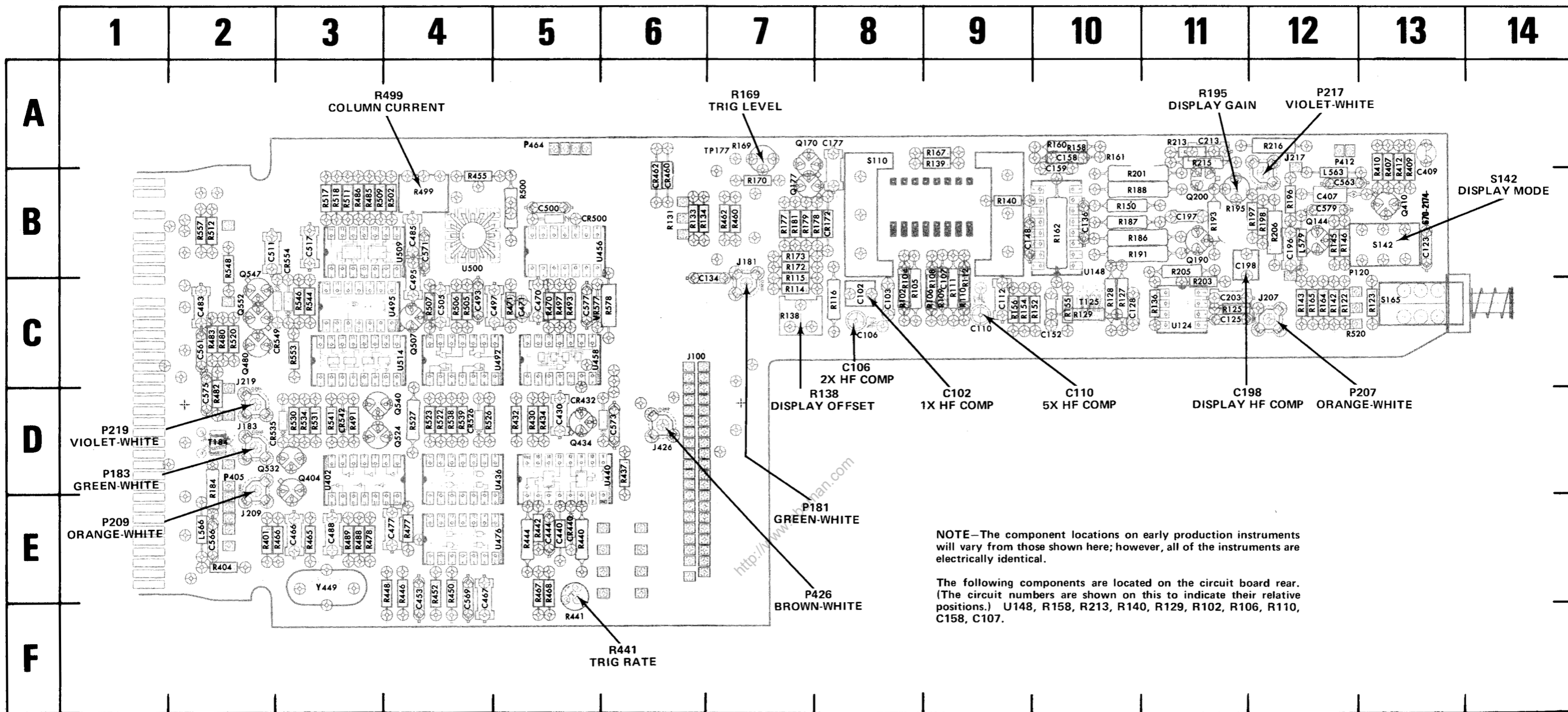


Fig. 6-2. (A1) Main board component locations.

| CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | | | |
|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|------|-----|-------|
| C102 | 8C | C197 | 11B | C488 | 3E | CR172 | 8B | J217 | 12A | Q190 | 11B | R108 | 9C | R136 | 11C | R167 | 9A | R197 | 12B | R430 | 5D | R467 | 5E | R500 | 5B | R534 | 3D | TP177 |
| C103 | 8C | C198 | 11B | C493 | 5C | CR432 | 5D | J219 | 2C | Q200 | 11B | R109 | 9C | R138 | 7C | R169 | 7A | R198 | 12B | R432 | 5D | R468 | 5E | R502 | 4B | R538 | 4D | |
| C106 | 8C | C203 | 11C | C495 | 4C | CR440 | 5E | J426 | 6D | Q404 | 3D | R110 | 9C | R139 | 9A | R170 | 7B | R201 | 10B | R434 | 5D | R470 | 5C | R505 | 4C | R539 | 4D | U124 |
| C107 | 9C | C213 | 11A | C497 | 5C | CR460 | 6B | | | Q410 | 13B | R111 | 9C | R140 | 9B | R172 | 7B | R203 | 11C | R437 | 6D | R471 | 5C | R506 | 4C | R541 | 3D | U148 |
| C110 | 9C | C407 | 12B | C500 | 5B | CR462 | 6B | | | Q434 | 5D | R112 | 9C | R142 | 12C | R173 | 7B | R205 | 11B | R440 | 5E | R477 | 4E | R507 | 4C | R544 | | U402 |
| C123 | 13B | C430 | 5D | C511 | 2B | CR526 | 4D | | | L563 | 12B | R114 | 7C | R143 | 12C | R177 | 7B | R206 | 12B | R441 | 5F | R478 | 3E | R509 | 3B | R546 | 3C | U436 |
| C125 | 11C | C440 | 5E | C517 | 3B | CR535 | 2D | | | L566 | 2E | R115 | 7C | R150 | 10B | R178 | 7B | R213 | 11A | R442 | 5E | R480 | 2C | R511 | 3B | R548 | 2B | U440 |
| C128 | 10C | C444 | 5E | C561 | 2C | CR542 | 3D | | | L579 | 12B | R116 | 8C | R152 | 10C | R179 | 7B | R215 | 11A | R444 | 5E | R482 | 2D | R512 | 2B | R553 | 3C | U458 |
| C134 | 7B | C467 | 4E | C563 | 12B | CR549 | 3C | P120 | 13B | Q524 | 4D | R122 | 12C | R154 | 9C | R181 | 7B | R216 | 12A | R446 | 4E | R483 | 2C | R517 | 3B | R557 | 2B | U476 |
| C136 | 10B | C453 | 4E | C566 | 2E | CR554 | 3B | | | Q540 | 4D | R123 | 13C | R155 | 10C | R184 | 2D | R401 | 2E | R448 | 4E | R485 | 4B | R518 | 3B | R578 | 6C | U492 |
| C148 | 9B | C466 | 3E | C569 | 4E | | | P405 | 2D | Q547 | 2B | R125 | 11C | R156 | 9C | R186 | 10B | R404 | 2E | R450 | 4E | R486 | 3B | R520 | 2C | | | U495 |
| C152 | 10C | C470 | 5C | C571 | 4B | | | P412 | 12A | Q552 | 2C | R127 | 10C | R158 | 10A | R187 | 10B | R407 | 13A | R452 | 4E | R488 | 3E | R522 | 4D | S110 | 8A | U500 |
| C158 | 10A | C471 | 5C | C573 | 6D | J100 | 6C | | | | | R128 | 10C | R160 | 10A | R188 | 10B | R409 | 13A | R455 | 4B | R489 | 3E | R523 | 4D | S142 | 13B | U509 |
| C159 | 10A | C477 | 4E | C575 | 2D | J181 | 7B | | | R102 | 8C | R129 | 10C | R161 | 10A | R191 | 10B | R410 | 13A | R460 | 7B | R491 | 3D | R526 | 4D | S165 | 13C | U514 |
| C177 | 8A | C483 | 2C | C577 | 5C | J183 | 2D | Q144 | 12B | R104 | 8C | R131 | 6B | R162 | 10B | R193 | 11B | R412 | 13A | R462 | 7B | R493 | 5C | R527 | 4D | | | U546 |
| C196 | 12B | C485 | 4B | C579 | 12B | J207 | 12C | Q170 | 7A | R105 | 8C | R133 | 6B | R164 | 12C | R195 | 11B | R415 | 12B | R465 | 3E | R497 | 5C | R530 | 3D | T125 | 10C | VR577 |
| | | | | | | J209 | 2E | Q177 | 7B | R106 | 9C | R134 | 6B | R165 | 12C | R196 | 12B | R416 | 12B | R466 | 2E | R499 | 4B | R531 | 3D | T184 | 2D | Y449 |

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below, except as noted.

RECOMMENDED TEST EQUIPMENT

| ITEM | SPECIFICATIONS | RECOMMENDED TYPE |
|--|--|--|
| Oscilloscope system | Deflection factor 10 mV to 2 V/div. Input impedance 10 Megohms Frequency response dc to 25 MHz | a. Tektronix 7000-series oscilloscope equipped with readout, 7B-series Time-Base, 7A15A Amplifier, and a 1X probe. (7A13 Differential Comparator used in place of 7A15A for calibrated offset voltages.) |
| Voltmeter (Non-loading digital multimeter) | Input impedance 10 Megohms Range (full scale) 2 V to 20 V | a. Tektronix 7D13 Digital Multimeter (oscilloscope system must have readout). b. Fairchild Model 7050, or equivalent. |
| Plug-in extender | Capable of extending the 7D12 from the oscilloscope plug-in compartment | a. Tektronix Part No. 067-0589-00 (rigid) or Tektronix Part No. 067-0616-00 (flexible). |

7D12 AND 067-0700-00 CONTROL SETTINGS

| | |
|------------------------------------|----------------------------|
| VERTICAL DISPLAY ATTEN | 1X |
| TRIGGERING | AUTO |
| GATE | ON |
| VERTICAL DISPLAY and GATE POSITION | Center traces on graticule |
| Readout Mode Switch | Out-atten readout check |
| Internal Display Mode Switch | Chop |

VOLTAGE CONDITIONS

Voltage measurements are taken with no signal applied and the trace centered on the graticule. The voltmeter common is connected to chassis ground. The 7D12 is connected to one of the vertical compartments of the oscilloscope mainframe through the plug-in extender. The 7D13, if used, is inserted into the other vertical compartment.

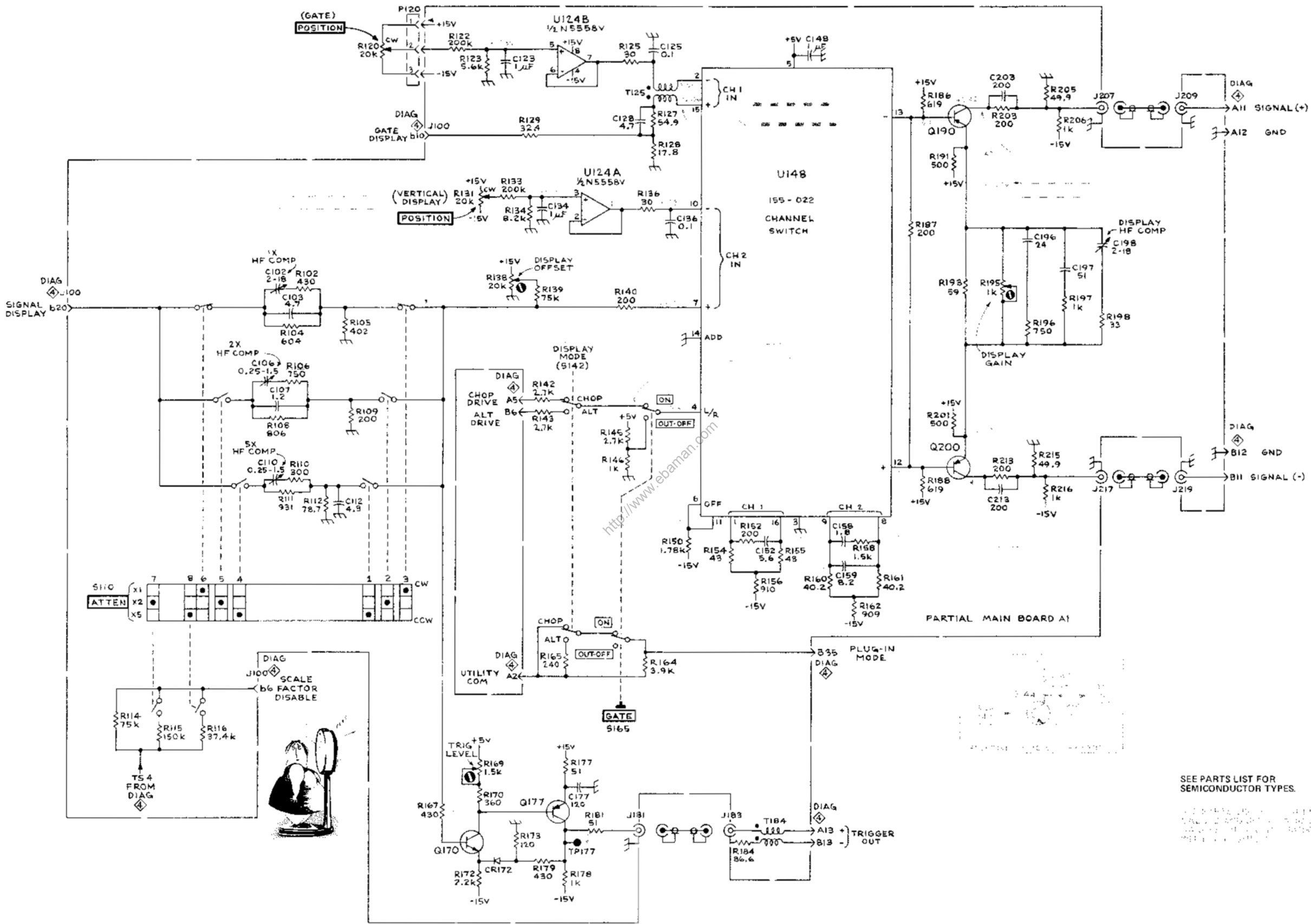
WAVEFORM CONDITIONS

The 7D12 is connected to one of the vertical compartments of the oscilloscope mainframe through the plug-in extender. The amplifier plug-in, 7A15A or 7A13 is inserted into the other vertical compartment. A 1-kilohertz, 400 millivolt (200 mV, into 50 Ω) signal is applied to the Vertical Display Direct Input connector and the Gate Waveform Direct Input connector of the 7D12 Calibration Fixture, 067-0700-00. The oscilloscope Trigger Source is set to trigger the time-base unit from the 7D12 output.

The waveform measurements are taken after the VERTICAL DISPLAY trace and the GATE trace are centered on the graticule (with no signal input).

If the 7A15A Amplifier plug-in is used, the input should be ac coupled.

Tolerances of the voltages and waveforms shown are $\pm 20\%$.



SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

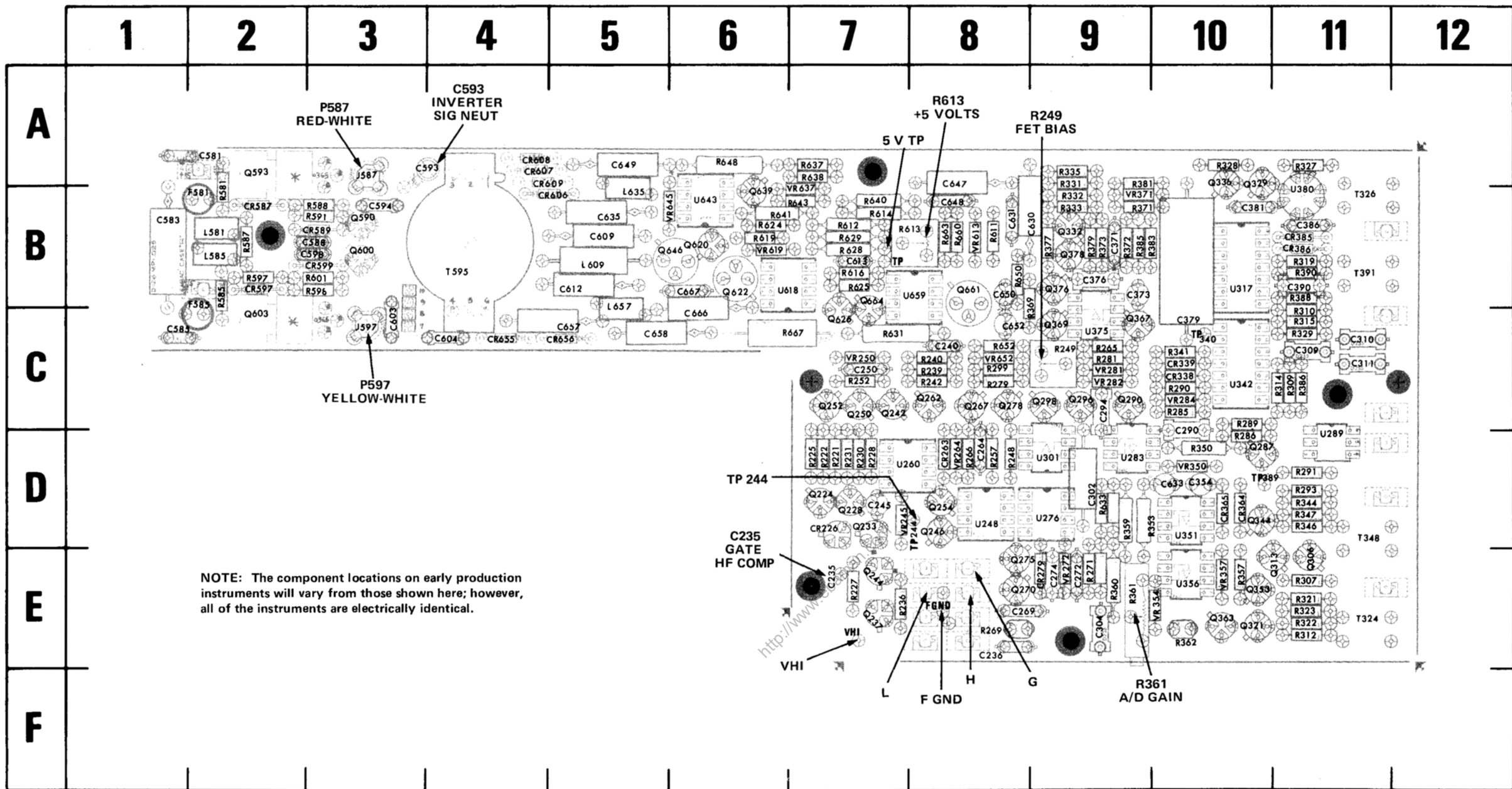


Fig. 6-3. (A2) Floating board component locations.

| CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC |
|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|
| C235 | 7E | C373 | 9B | C613 | 7B | CR279 | 9E | F581 | 2B | Q244 | 7E | Q329 | 10A | Q626 | 7C | R310 | 11C | R344 | 11D | R553 | 9D | | |
| C236 | 8E | C376 | 9B | C630 | 8B | CR338 | 10C | F585 | 2B | Q246 | 8D | Q332 | 9B | Q646 | 6B | R252 | 7C | R312 | 11E | R346 | 11D | R581 | 2B |
| C240 | 8C | C379 | 10C | C631 | 8B | CR339 | 10C | | | Q250 | 7C | Q336 | 10A | Q661 | 8C | R257 | 8D | R314 | 11E | R347 | 11D | R585 | 2B |
| C245 | 7D | C381 | 10B | C633 | 10D | CR364 | 10D | J587 | 3A | Q252 | 7C | Q344 | 10D | Q664 | 7B | R266 | 8D | R315 | 11C | R350 | 10D | R588 | 3B |
| C250 | 7C | C386 | 11B | C635 | 5B | CR365 | 10D | J597 | 3C | Q254 | 8D | Q353 | 10E | | | R269 | 8E | R319 | 11B | R357 | 10E | R587 | 2B |
| C264 | 8D | C390 | 11B | C647 | 8A | CR385 | 11B | | | Q262 | 8C | Q367 | 9C | R221 | 7D | R271 | 9E | R321 | 11E | R359 | 9D | R591 | 3B |
| C269 | 8E | C581 | 2A | C648 | 8B | CR386 | 11B | L581 | 2B | Q267 | 8C | Q369 | 9C | R222 | 7D | R279 | 8C | R322 | 11E | R360 | 9E | R596 | 3B |
| C272 | 9E | C585 | 1B | C649 | 5A | CR587 | 2B | L585 | 2B | Q268 | 8C | Q376 | 9B | R225 | 7D | R281 | 9C | R323 | 11E | R361 | 9E | R597 | 2B |
| C274 | 9E | C585 | 1C | C650 | 8B | CR589 | 3B | L609 | 5B | Q270 | 8E | Q378 | 9B | R227 | 7E | R285 | 10C | R326 | 7E | R362 | 10E | R601 | 3B |
| C290 | 10D | C588 | 3B | C652 | 8C | CR597 | 2B | L635 | 5B | Q275 | 8E | Q378 | 9B | R228 | 7D | R286 | 10D | R327 | 11A | R369 | 9B | R611 | 8B |
| C294 | 9C | C593 | 4A | C657 | 5C | CR599 | 3B | L657 | 5B | Q287 | 10D | Q590 | 3B | R230 | 7D | R289 | 10C | R328 | 10A | R371 | 9B | R612 | 7B |
| C302 | 9D | C504 | 3B | C658 | 5C | CR606 | 4B | | | Q290 | 9C | Q593 | 2A | R231 | 7D | R290 | 10C | R329 | 11C | R377 | 9B | R613 | 8B |
| C304 | 9E | C598 | 3B | C666 | 6C | CR607 | 4A | Q224 | 7D | Q296 | 9C | Q600 | 3B | R239 | 8C | R291 | 11D | R331 | 9A | R381 | 9A | R614 | 7B |
| C309 | 11C | C603 | 3C | C667 | 6B | CR608 | 4A | Q228 | 7D | Q298 | 9C | Q603 | 2C | R240 | 8C | R293 | 11D | R332 | 9B | R383 | 10B | R616 | 7B |
| C310 | 11C | C604 | 4C | | | CR609 | 4A | Q233 | 7D | Q306 | 11E | Q620 | 6B | R242 | 8C | R299 | 8C | R333 | 9B | R386 | 11C | R619 | 6B |
| C311 | 11C | C609 | 5B | CR226 | 7D | CR655 | 4C | Q237 | 7E | Q313 | 10E | Q622 | 6B | R248 | 8D | R307 | 11E | R335 | 9A | R388 | 11B | R624 | 6B |
| C354 | 10D | C612 | 5B | CR263 | 8D | CR656 | 5C | Q242 | 7C | Q321 | 10E | Q639 | 6A | R249 | 9C | R309 | 11C | R341 | 10C | R390 | 11B | R625 | 7B |

| CKT NO | GRID LOC |
|--------|----------|
| R628 | 7B |
| R629 | 7B |
| R631 | 7C |
| R633 | 9D |
| R637 | 7A |
| R638 | 7A |
| R640 | 7B |
| R641 | 6B |
| R643 | 7B |
| R648 | 6A |
| R650 | 8B |
| R652 | 8C |
| R660 | 8B |
| R663 | 8B |
| R667 | 7C |
| T324 | 11E |
| T326 | 11B |
| T348 | 11D |
| T391 | 11B |
| T595 | 4B |
| TP224 | 8D |
| TP340 | 10C |
| TP389 | 10D |
| U248 | 8D |
| U260 | 8D |
| U276 | 9D |
| U283 | 9D |
| U289 | 11D |
| U301 | 9D |
| U317 | 10B |
| U342 | 10C |
| U351 | 10D |
| U356 | 10E |
| U375 | 9C |
| U380 | 11A |
| U618 | 7B |
| U643 | 6B |
| U659 | 8B |
| VR245 | 7D |
| VR250 | 7C |
| VR264 | 8D |
| VR272 | 9E |
| VR272 | 9E |
| VR281 | 9C |
| VR282 | 9C |
| VR284 | 10C |
| VR350 | 10D |
| VR354 | 10E |
| VR357 | 10E |
| VR371 | 9B |
| VR613 | 8B |
| VR619 | 6B |
| VR645 | 6B |
| VR652 | 8C |

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below, except as noted.

RECOMMENDED TEST EQUIPMENT

| ITEM | SPECIFICATIONS | RECOMMENDED TYPE |
|--|--|--|
| Oscilloscope system | Deflection factor 10 mV to 2 V/div. Input impedance 10 Megohms Frequency response dc to 25 MHz | a. Tektronix 7000-series oscilloscope equipped with readout, 7B-series Time-Base, 7A15A Amplifier, and a 1X probe. (7A13 Differential Comparator used in place of 7A15A for calibrated offset voltages.) |
| Voltmeter (Non-loading digital multimeter) | Input impedance 10 Megohms Range (full scale) 2 V to 20 V | a. Tektronix 7D13 Digital Multimeter (oscilloscope system must have readout). b. Fairchild Model 7050, or equivalent. |
| Plug-in extender | Capable of extending the 7D12 from the oscilloscope plug-in compartment | a. Tektronix Part No. 067-0589-00 (rigid) or Tektronix Part No. 067-0616-00 (flexible). |

7D12 AND 067-0700-00 CONTROL SETTINGS

| | |
|------------------------------|---------------------------|
| VERTICAL DISPLAY ATTEN | 1X |
| TRIGGERING | AUTO |
| GATE | OUT-OFF |
| VERTICAL DISPLAY POSITION | Center trace on graticule |
| Readout Mode Switch | Out-atten readout check |
| Internal Display Mode Switch | Chop |

VOLTAGE CONDITIONS

Voltage measurements are taken with no signal applied and the trace centered on the graticule. The voltmeter common is connected to floating ground. The 7D12 is connected to one of the vertical compartments of the oscilloscope mainframe through the plug-in extender. The 7D13, if used, is inserted into the other vertical compartment.

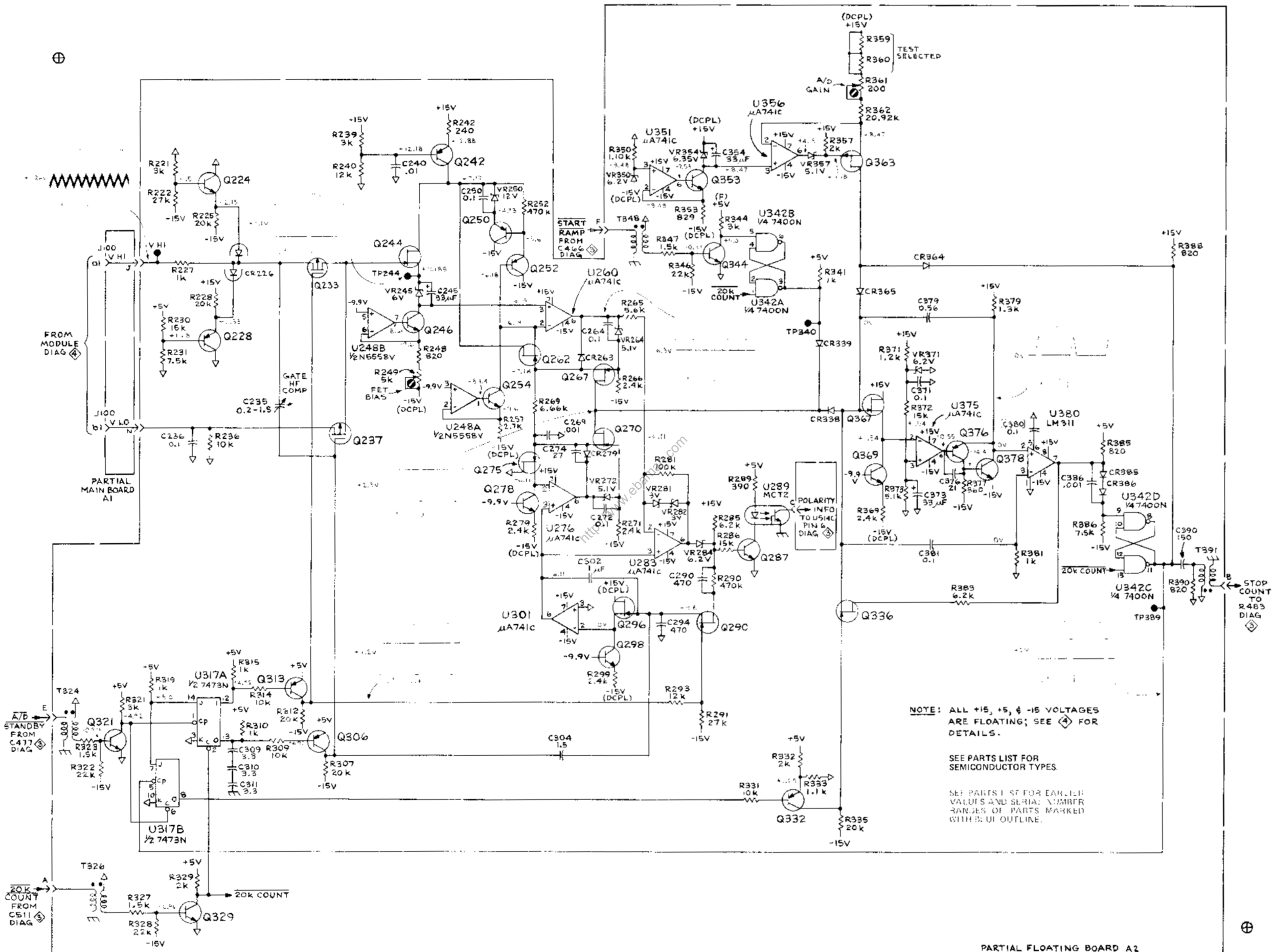
WAVEFORM CONDITIONS

The 7D12 is connected to one of the vertical compartments of the oscilloscope mainframe through the plug-in extender. The amplifier plug-in, 7A15A or 7A13 is inserted into the other vertical compartment. A 1-kilohertz, 4 volt (400 mV, into 50 Ω) signal is applied to the A/D DIRECT INPUT connectors of the 7D12 Calibration Fixture, 067-0700-00. The oscilloscope Trigger Source is set to trigger the time-base unit from the 7D12 output.

The 1X probe ground strap is connected to the floating ground (FGND) test point.

If the 7A15A Amplifier plug-in is used, the input should be ac coupled.

Tolerances of the voltages and waveforms shown are $\pm 20\%$.



NOTE: ALL +15, +5, & -15 VOLTAGES ARE FLOATING; SEE [Symbol] FOR DETAILS.

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH B: IN OUTLINE.

PARTIAL FLOATING BOARD A2

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below, except as noted.

RECOMMENDED TEST EQUIPMENT

| ITEM | SPECIFICATIONS | RECOMMENDED TYPE |
|--|--|---|
| Oscilloscope system | Deflection factor 10 mV to 2 V/div. Input impedance 10 Megohms Frequency response dc to 25 MHz | a. Tektronix 7000-series oscilloscope equipped with readout, 7B-series Time-Base, 7A15A Amplifier, and a 1X probe. (7A13 Differential Comparator used in placed of 7A15A for calibrated offset voltages.) |
| Voltmeter (Non-loading digital multimeter) | Input impedance 10 Megohms Range (full scale) 2 V to 20 V | a. Tektronix 7D13 Digital Multimeter (oscilloscope system must have readout). b. Fairchild Model 7050, or equivalent. |
| Plug-in extender | Capable of extending the 7D12 from the oscilloscope plug-in compartment | a. Tektronix Part No. 067-0589-00 (rigid) or Tektronix Part No. 067-0616-00 (flexible). |

7D12 AND 067-0700-00 CONTROL SETTINGS

| | |
|------------------------------|---------------------------|
| VERTICAL DISPLAY ATTEN | 1X |
| TRIGGERING | AUTO |
| GATE | OUT-OFF |
| VERTICAL DISPLAY POSITION | Center trace on graticule |
| Readout Mode Switch | Out-atten readout check |
| Internal Display Mode Switch | Chop |

VOLTAGE CONDITIONS

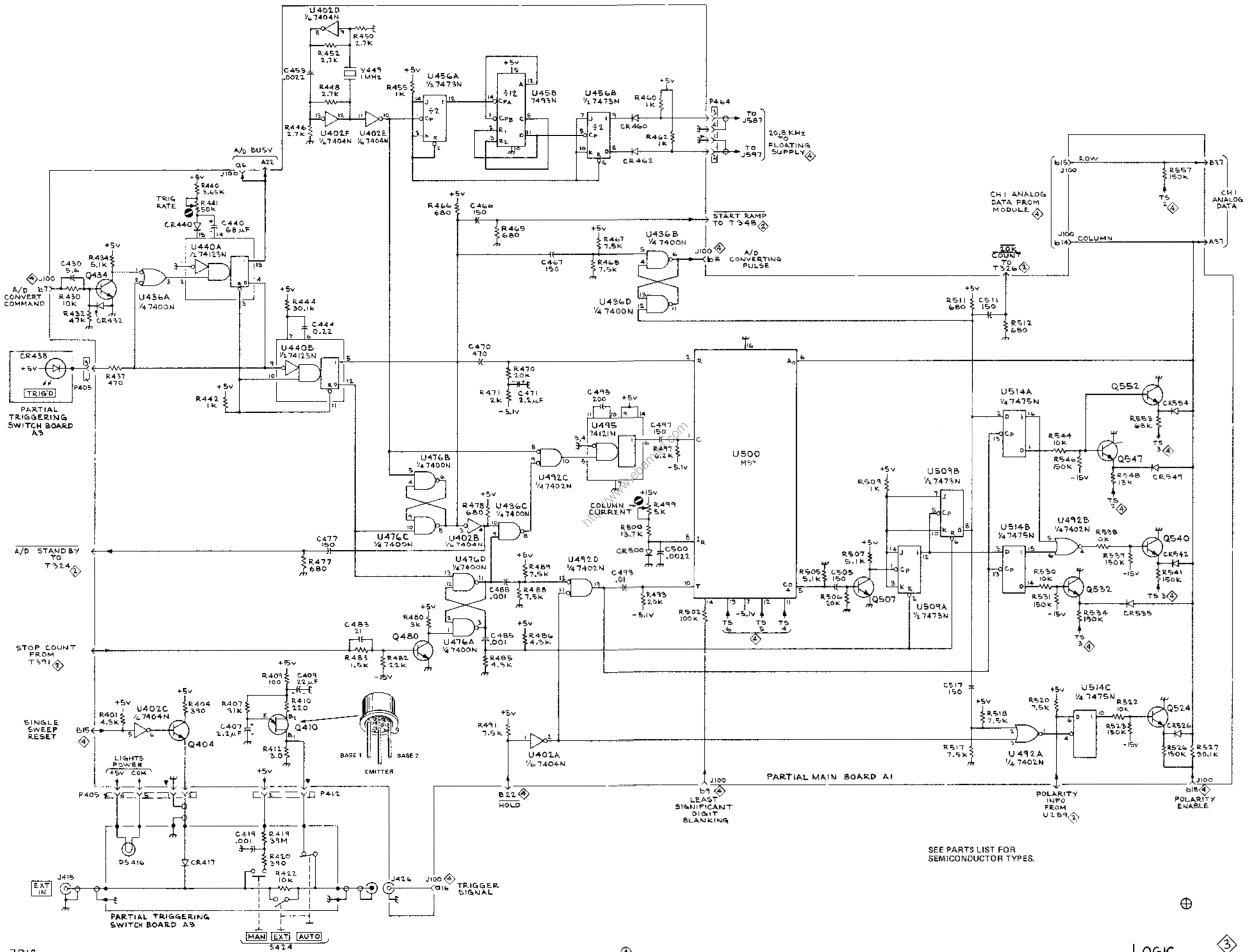
Voltage measurements are taken with no signal applied and the trace centered on the graticule. The voltmeter common is connected to chassis ground. The 7D12 is connected to one of the vertical compartments of the oscilloscope mainframe through the plug-in extender. The 7D13, if used, is inserted into the other vertical compartment.

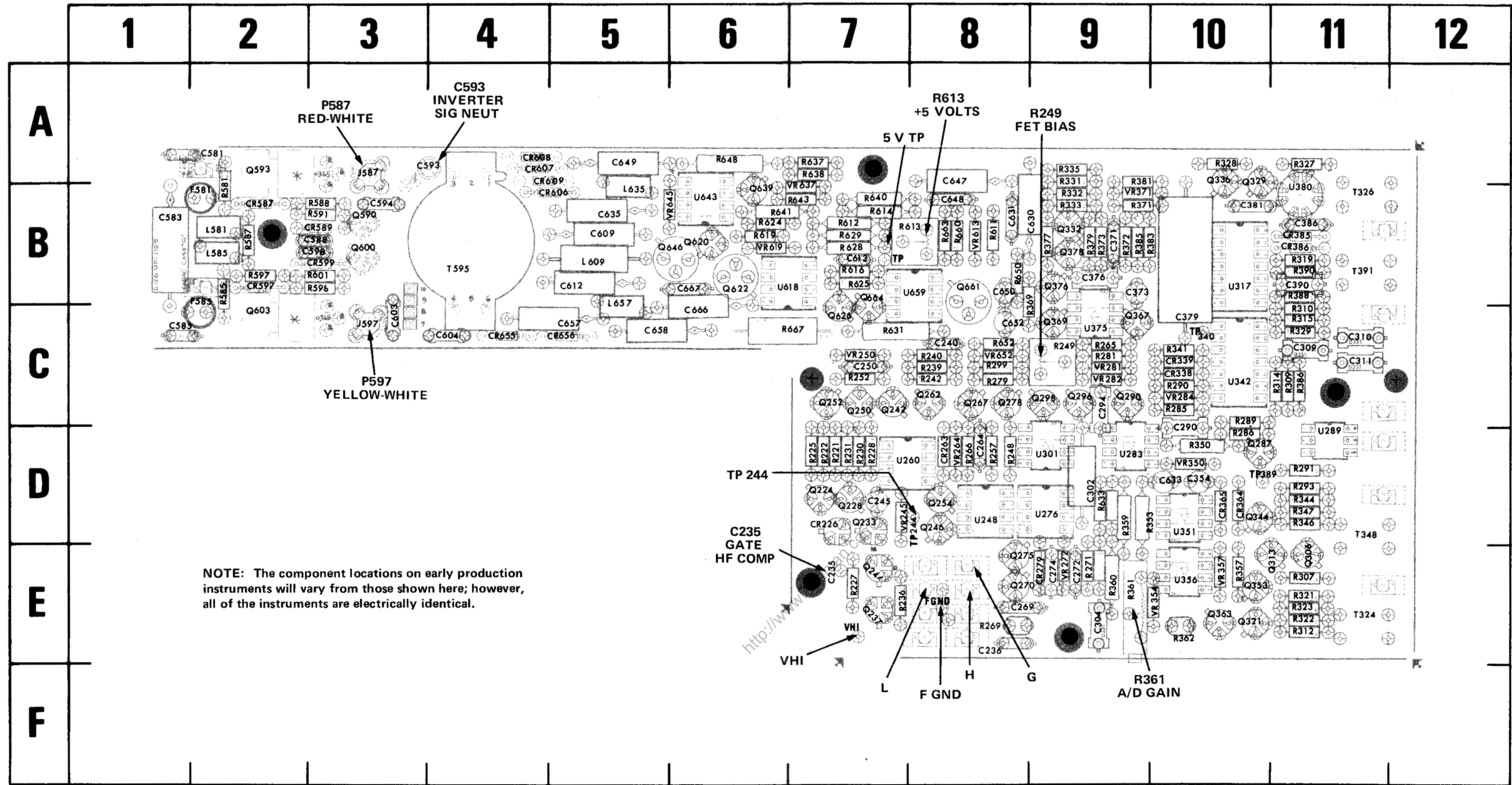
WAVEFORM CONDITIONS

The 7D12 is connected to one of the vertical compartments of the oscilloscope mainframe through the plug-in extender. The amplifier plug-in, 7A15A or 7A13 is inserted into the other vertical compartment. A 1-kilohertz, 4 volt (400 mV, into 50 Ω) signal is applied to the A/D DIRECT INPUT connectors of the 7D12 Calibration Fixture, 067-0700-00. The oscilloscope Trigger Source is set to trigger the time-base unit from the 7D12 output.

If the 7A15A Amplifier plug-in is used, the input should be ac coupled.

Tolerances of the voltages and waveforms shown are $\pm 20\%$.





| CKT NO | GRID LOC |
|--------|----------|
| R628 | 7B |
| R629 | 7B |
| R631 | 7C |
| R633 | 9D |
| R637 | 7A |
| R638 | 7A |
| R640 | 7B |
| R641 | 6B |
| R643 | 7B |
| R648 | 6A |
| R650 | 8B |
| R652 | 8C |
| R660 | 8B |
| R663 | 8B |
| R667 | 7C |
| T324 | 11E |
| T326 | 11B |
| T348 | 11D |
| T391 | 11B |
| T595 | 4B |
| TP224 | 8D |
| TP340 | 10C |
| TP389 | 10D |
| U248 | 8D |
| U260 | 8D |
| U276 | 9D |
| U283 | 9D |
| U289 | 11D |
| U301 | 9D |
| U317 | 10B |
| U342 | 10C |
| U351 | 10D |
| U356 | 10E |
| U375 | 9C |
| U380 | 11A |
| U618 | 7B |
| U643 | 6B |
| U659 | 8B |
| VR245 | 7D |
| VR250 | 7C |
| VR264 | 8D |
| VR272 | 9E |
| VR272 | 9E |
| VR281 | 9C |
| VR282 | 9C |
| VR284 | 10C |
| VR350 | 10D |
| VR354 | 10E |
| VR371 | 9B |
| VR613 | 8B |
| VR613 | 8B |
| VR619 | 8B |
| VR624 | 8B |
| VR637 | 7A |
| VR645 | 6B |
| VR652 | 8C |

Fig. 6-6. (A2) Floating board component locations.

| CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC |
|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|--------|----------|
| C235 | 7E | C373 | 9B | C613 | 7B | CR279 | 9E | F581 | 2B | Q244 | 7E | Q329 | 10A | Q626 | 7C | R252 | 7C | R310 | 11C | R344 | 11D | R553 | 9D |
| C236 | 8E | C376 | 9B | C630 | 8B | CR338 | 10C | F585 | 2B | Q246 | 8D | Q332 | 9B | Q646 | 6B | R257 | 8D | R312 | 11E | R346 | 11D | R581 | 2B |
| C240 | 8C | C379 | 10C | C631 | 8B | CR339 | 10C | J587 | 3A | Q250 | 7C | Q336 | 10A | Q661 | 8C | R265 | 9C | R314 | 11C | R347 | 11D | R585 | 2B |
| C245 | 7D | C381 | 10B | C633 | 10D | CR364 | 10D | J597 | 3C | Q252 | 7C | Q344 | 10D | Q664 | 7B | R266 | 8D | R315 | 11C | R350 | 10D | R588 | 3B |
| C250 | 7C | C386 | 11B | C635 | 5B | CR365 | 10D | J597 | 3C | Q254 | 8D | Q353 | 10E | Q664 | 7B | R269 | 8E | R319 | 11B | R357 | 10E | R587 | 2B |
| C264 | 8D | C390 | 11B | C647 | 8A | CR385 | 11B | J597 | 3C | Q262 | 8C | Q363 | 10E | Q664 | 7B | R271 | 9E | R321 | 11E | R359 | 9D | R591 | 3B |
| C269 | 8E | C581 | 2A | C648 | 8B | CR386 | 11B | L581 | 2B | Q267 | 8C | Q367 | 9C | Q664 | 7B | R277 | 9E | R322 | 11E | R360 | 9E | R596 | 3B |
| C272 | 9E | C385 | 1B | C649 | 5A | CR587 | 2B | L585 | 2B | Q268 | 8C | Q369 | 9C | Q664 | 7B | R221 | 7D | R323 | 11E | R361 | 9E | R597 | 2B |
| C274 | 9E | C585 | 1C | C650 | 8B | CR589 | 3B | L609 | 5B | Q270 | 8E | C376 | 9B | Q664 | 7B | R222 | 7D | R281 | 9C | R326 | 7E | VR281 | 9C |
| C290 | 10D | C588 | 3B | C652 | 8C | CR597 | 2B | L635 | 5B | Q275 | 8E | Q378 | 9B | Q664 | 7B | R225 | 7D | R285 | 10C | R327 | 7E | VR282 | 9C |
| C294 | 9C | C593 | 4A | C657 | 5C | CR599 | 3B | L657 | 5B | Q287 | 10D | Q590 | 3B | Q664 | 7B | R227 | 7E | R286 | 10D | R327 | 11A | VR284 | 10C |
| C302 | 9D | C504 | 3B | C658 | 5C | CR606 | 4B | L657 | 5B | Q290 | 9C | Q593 | 2A | Q664 | 7B | R228 | 7D | R289 | 10C | R328 | 10A | VR350 | 10D |
| C304 | 9E | C598 | 3B | C666 | 6C | CR607 | 4A | L657 | 5B | Q299 | 9C | Q599 | 3B | Q664 | 7B | R230 | 7D | R290 | 10C | R329 | 11C | VR354 | 10E |
| C309 | 11C | C603 | 3C | C667 | 6B | CR608 | 4A | L657 | 5B | Q298 | 9C | Q600 | 3B | Q664 | 7B | R231 | 7D | R291 | 11D | R331 | 9A | VR371 | 9B |
| C310 | 11C | C604 | 4C | C667 | 6B | CR609 | 4A | L657 | 5B | Q298 | 9C | Q603 | 2C | Q664 | 7B | R239 | 8C | R293 | 11D | R332 | 9B | VR613 | 8B |
| C311 | 11C | C609 | 5B | C667 | 6B | CR609 | 4A | L657 | 5B | Q306 | 11E | Q620 | 6B | Q664 | 7B | R240 | 8C | R299 | 8C | R333 | 9B | VR619 | 6B |
| C354 | 10D | C612 | 5B | C667 | 6B | CR655 | 4C | L657 | 5B | Q313 | 10E | Q622 | 6B | Q664 | 7B | R242 | 8C | R307 | 11E | R335 | 9A | VR624 | 6B |
| | | | | | | CR656 | 5C | L657 | 5B | Q321 | 10E | Q639 | 6A | Q664 | 7B | R248 | 8D | R309 | 11C | R341 | 10C | VR637 | 7A |
| | | | | | | | | L657 | 5B | | | | | Q664 | 7B | R249 | 9C | | | R390 | 11B | VR645 | 6B |
| | | | | | | | | | | | | | | Q664 | 7B | | | | | | | VR652 | 8C |

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below, except as noted.

RECOMMENDED TEST EQUIPMENT

| ITEM | SPECIFICATIONS | RECOMMENDED TYPE |
|--|--|---|
| Oscilloscope system | Deflection factor 10 mV to 2 V/div. Input impedance 10 Megohms Frequency response dc to 25 MHz | a. Tektronix 7000-series oscilloscope equipped with readout, 7B-series Time-Base, 7A15A Amplifier, and a 1X probe. (7A13 Differential Comparator used in placed of 7A15A for calibrated offset voltages.) |
| Voltmeter (Non-loading digital multimeter) | Input impedance 10 Megohms Range (full scale) 2 V to 20 V | a. Tektronix 7D13 Digital Multimeter (oscilloscope system must have readout). b. Fairchild Model 7050, or equivalent. |
| Plug-in extender | Capable of extending the 7D12 from the oscilloscope plug-in compartment | a. Tektronix Part No. 067-0589-00 (rigid) or Tektronix Part No. 067-0616-00 (flexible). |

7D12 AND 067-0700-00 CONTROL SETTINGS

| | |
|------------------------------|---------------------------|
| VERTICAL DISPLAY ATTEN | 1X |
| TRIGGERING | AUTO |
| GATE | OUT-OFF |
| VERTICAL DISPLAY POSITION | Center trace on graticule |
| Readout Mode Switch | Out-atten readout check |
| Internal Display Mode Switch | Chop |

VOLTAGE CONDITIONS

Voltage measurements are taken with no signal applied and the trace centered on the graticule. The voltmeter common is connected to floating ground. The 7D12 is connected to one of the vertical compartments of the oscilloscope mainframe through the plug-in extender. The 7D13, if used, is inserted into the other vertical compartment.

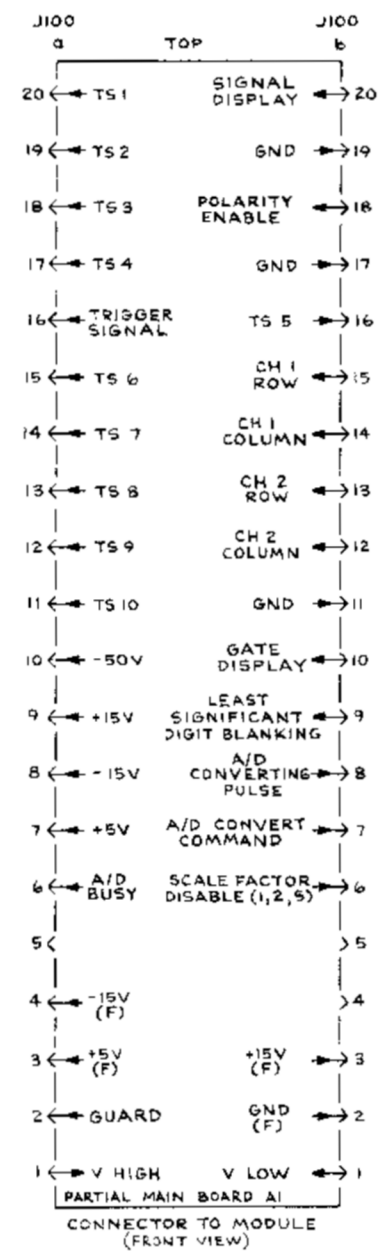
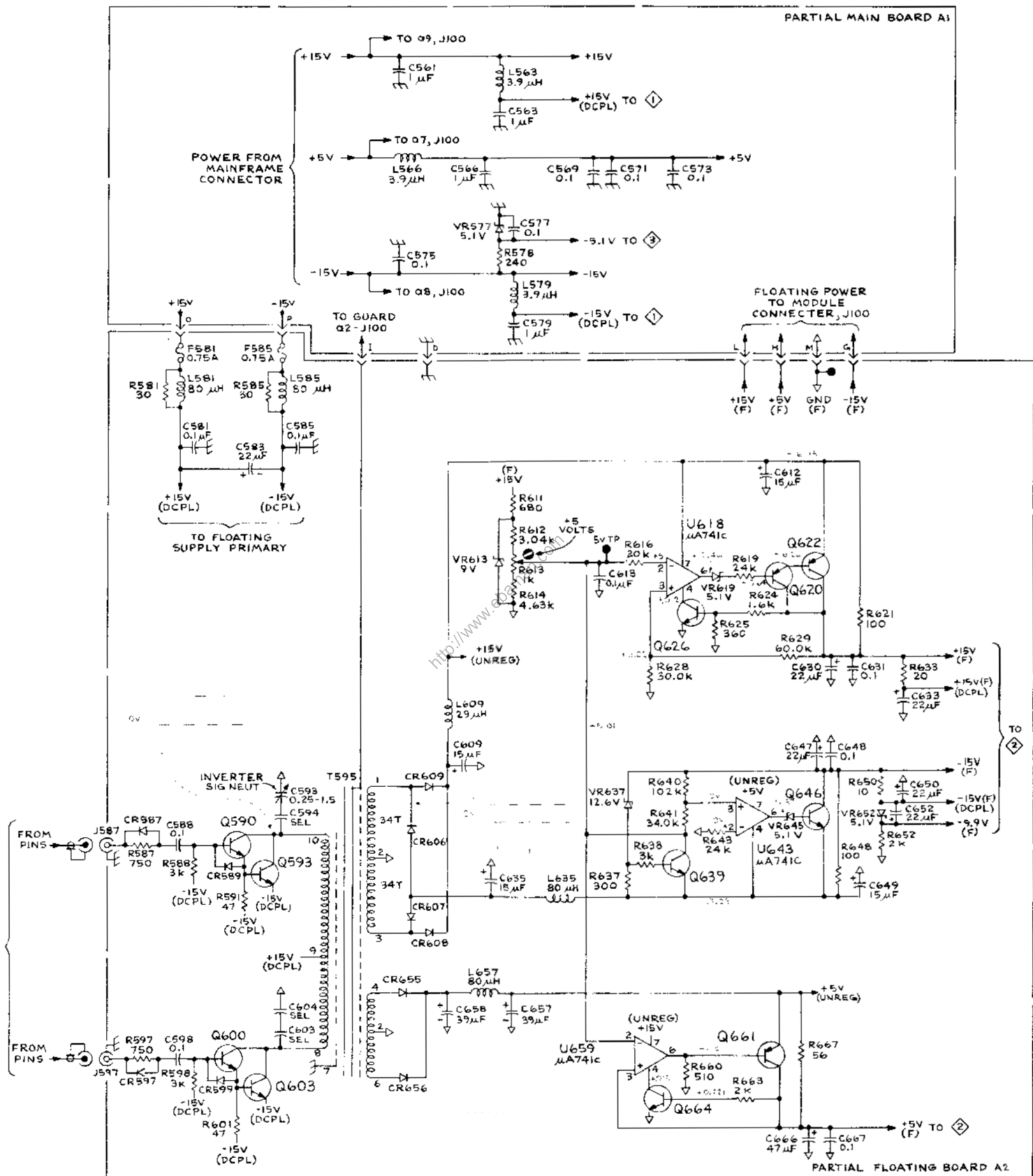
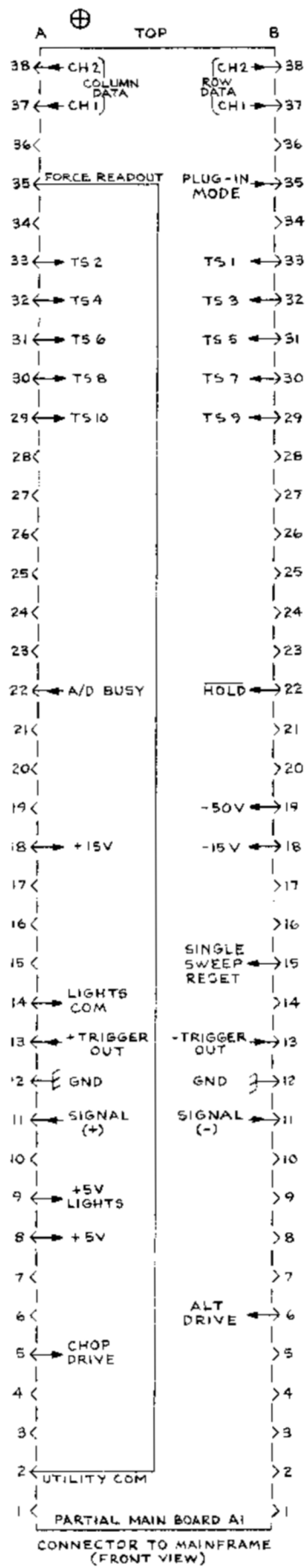
WAVEFORM CONDITIONS

The 7D12 is connected to one of the vertical compartments of the oscilloscope mainframe through the plug-in extender. The amplifier plug-in, 7A15A or 7A13 is inserted into the other vertical compartment.

The 10X probe ground strap is connected to the floating ground (FGND) test point.

If the 7A15A Amplifier plug-in is used, the input should be ac coupled.

Tolerances of the voltages and waveforms shown are $\pm 20\%$.



7D12 Service

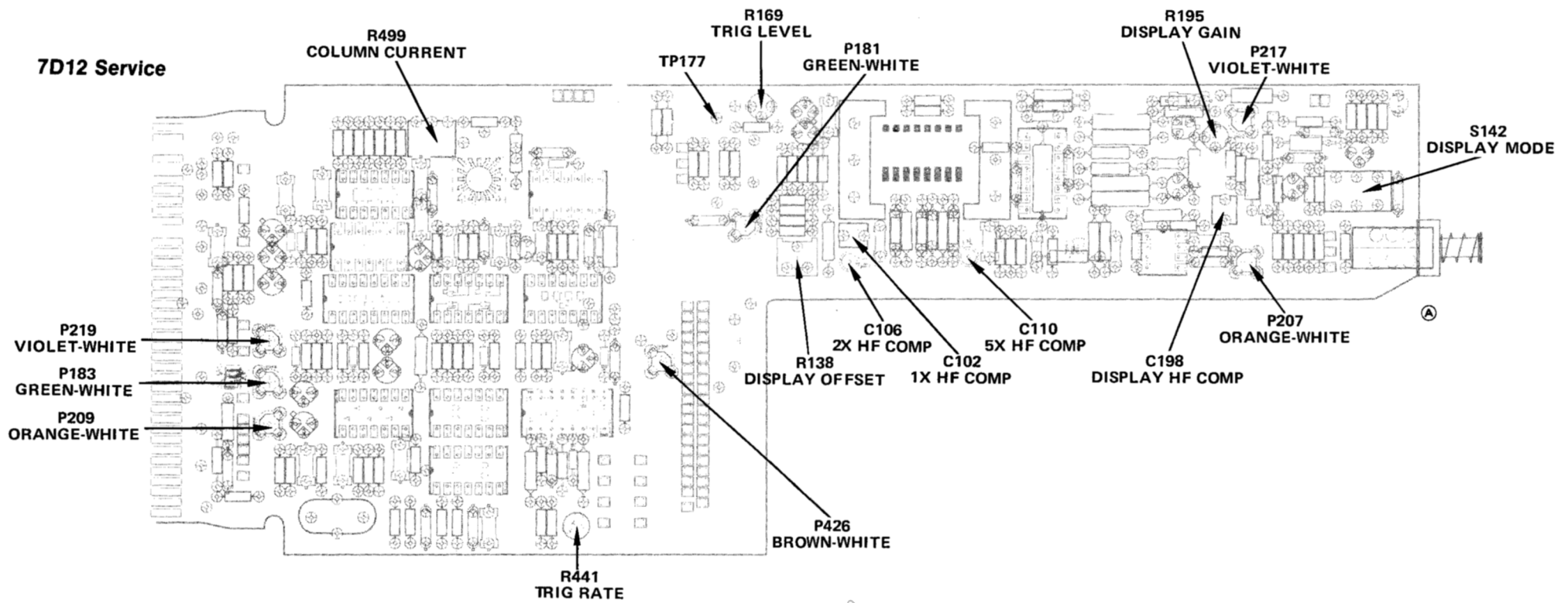


Fig. 6-7. (A1) Main circuit board adjustment locations.

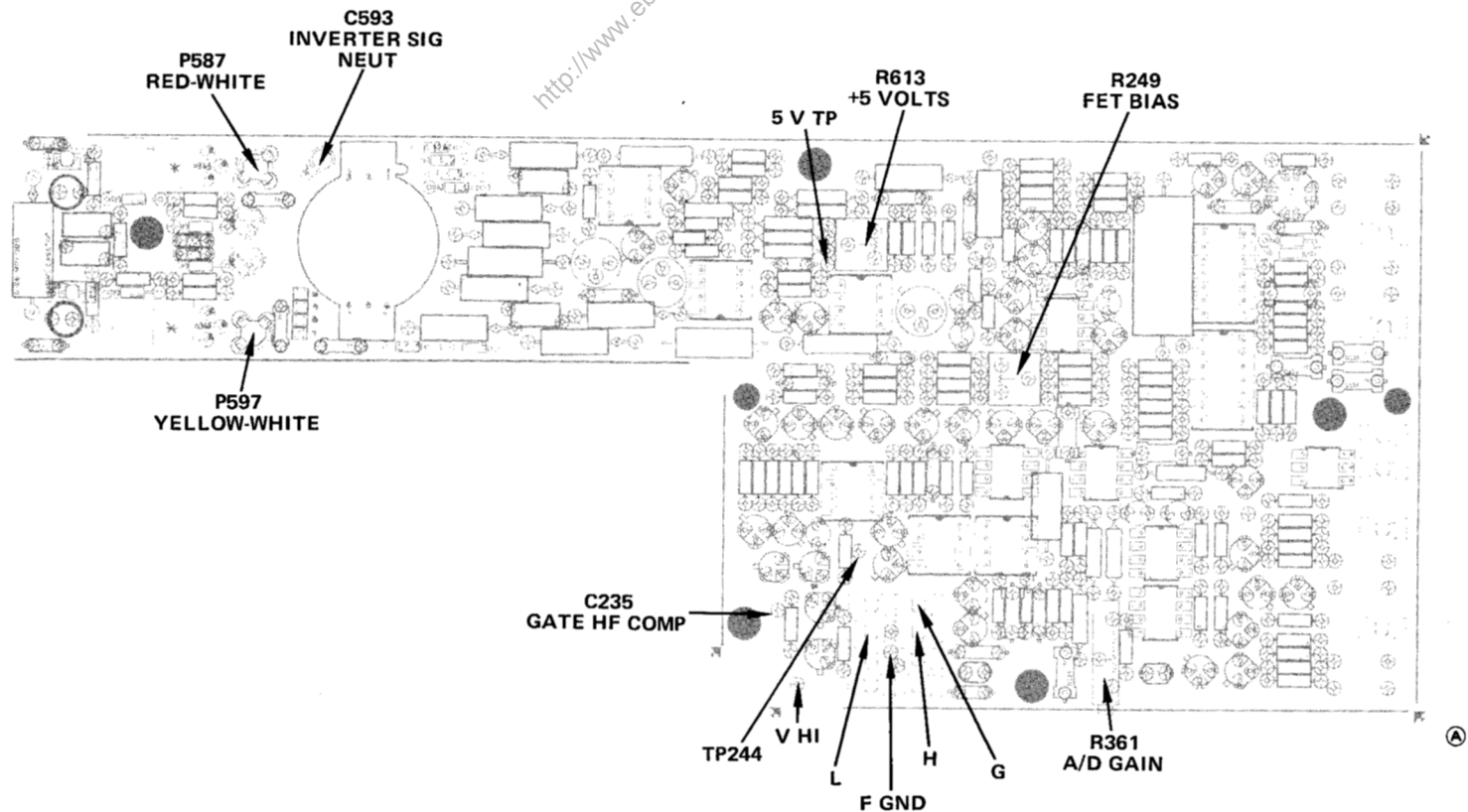


Fig. 6-8. (A2) Floating circuit board adjustment locations.

MECHANICAL REPLACEABLE PARTS LIST

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

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

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

| 1 | 2 | 3 | 4 | 5 | <i>Name & Description</i> |
|---|---|---|---|---|--|
| | | | | | <i>Assembly and/or Component</i> |
| | | | | | <i>Attaching parts for Assembly and/or Component</i> |
| | | | | | ---*--- |
| | | | | | <i>Detail Part of Assembly and/or Component</i> |
| | | | | | <i>Attaching parts for Detail Part</i> |
| | | | | | ---*--- |
| | | | | | <i>Parts of Detail Part</i> |
| | | | | | <i>Attaching parts for Parts of Detail Part</i> |
| | | | | | ---*--- |

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

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

| MFR.CODE | MANUFACTURER | ADDRESS | CITY,STATE,ZIP |
|----------|---|-----------------------|-----------------------------|
| 0000C | Gettig Engineering and Manufacturing Co. | | Springmill, PA 16875 |
| 00779 | AMP, Inc. | P. O. Box 3608 | Harrisburg, PA 17105 |
| 05574 | Viking Industries, Inc. | 21001 Nordhoff | Chatsworth, CA 91311 |
| 05820 | Wakefield Engineering, Inc. | Audubon Rd. | Wakefield, MA 01880 |
| 13257 | Esna, Ltd. | 10 Esna Park Dr. | Markham, Ontario, Canada |
| 22526 | Berg Electronics, Inc. | Youk Expressway | New Cumberland, PA 17070 |
| 24931 | Specialty Connector Co., Inc. | 3560 Madison Ave. | Indianapolis, IN 46227 |
| 70276 | Allen Mfg. Co. | P. O. Drawer 570 | Hartford, CT 06101 |
| 71785 | TRW Electronic Components, Cinch Connector Operations | 1501 Morse Ave. | Elk Grove Village, IL 60007 |
| 73743 | Fischer Special Mfg. Co. | 446 Morgan St. | Cincinnati, OH 45206 |
| 73803 | Texas Instruments, Inc., Metallurgical Materials Div. | | Attleboro, MA 02703 |
| 74445 | Holo-Krome Co. | 31 Brook St. West | Hartford, CT 06110 |
| 77250 | Pheoll Manufacturing Co., Division of Allied Products Corp. | 5700 W. Roosevelt Rd. | Chicago, IL 60650 |
| 78189 | Illinois Tool Works, Inc. Shakeproof Division | St. Charles Road | Elgin, IL 60126 |
| 80009 | Tektronix, Inc. | P. O. Box 500 | Beaverton, OR 97005 |
| 83385 | Central Screw Co. | 2530 Crescent Dr. | Broadview, IL 60153 |
| 87308 | N. L. Industries, Inc., Southern Screw Div. | P. O. Box 1360 | Statesville, NC 28677 |
| 97464 | Industrial Retaining Ring Co. | 57 Cordier St. | Irvington, NJ 07111 |

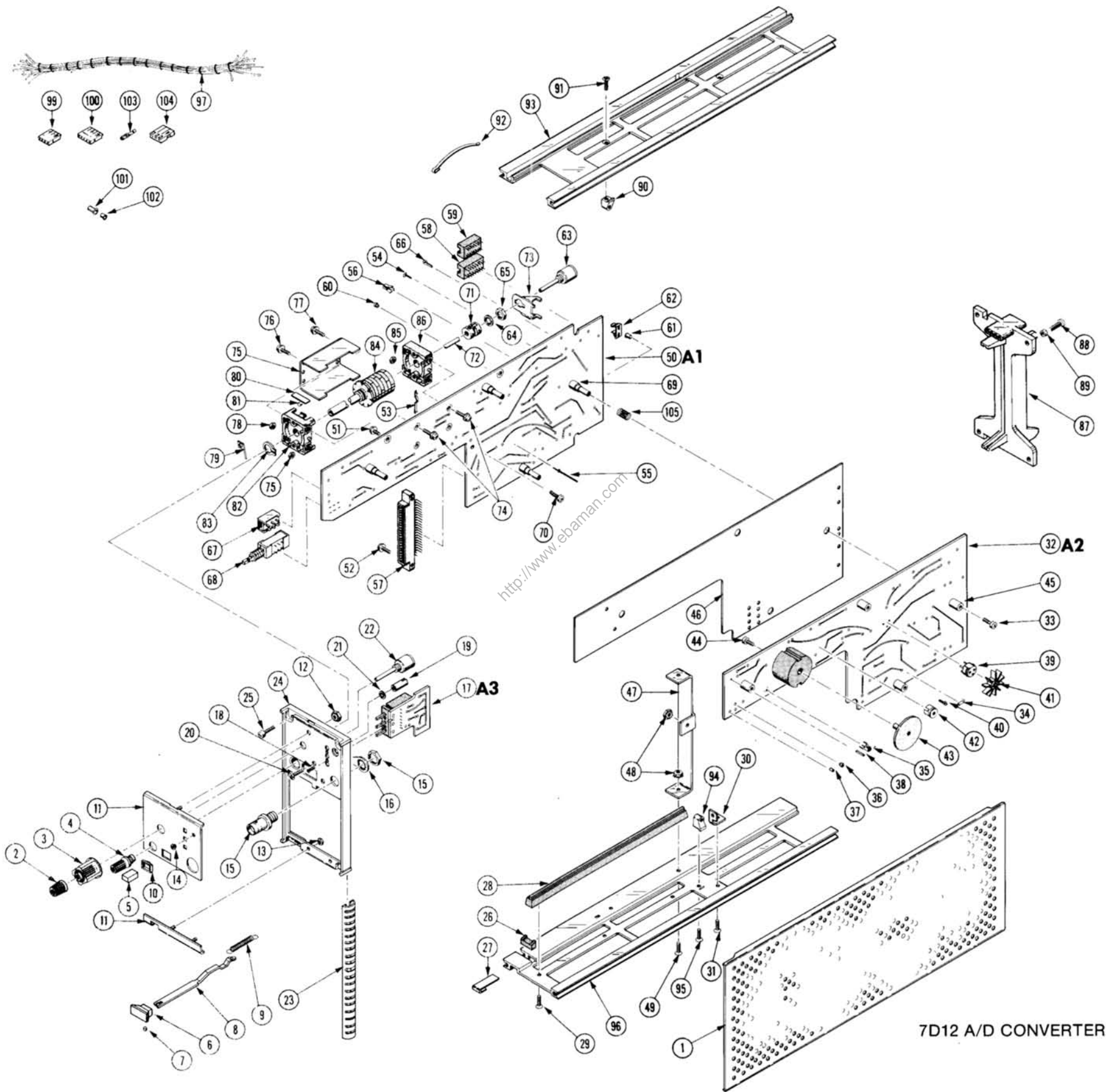
| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Qty | Name & Description | | | | | Mfr Code | Mfr Part Number |
|------------------|--------------------|-----------------------------|-----|--|---|---|---|---|----------|-----------------|
| | | | | 1 | 2 | 3 | 4 | 5 | | |
| 1-1 | 337-1064-00 | | 2 | SHLD, SIDE, ELEC: PLUG-IN | | | | | 80009 | 337-1064-00 |
| -2 | 366-1023-01 | | 1 | KNOB: GRAY W/ SETSCREW | | | | | 80009 | 366-1023-01 |
| | 213-0153-00 | | 1 | . SETSCREW: 5-40 X 0.125 INCH, HEX SOC STL | | | | | 74445 | OBD |
| -3 | 366-1408-00 | | 1 | KNOB: GRAY WITH SETSCREW | | | | | 80009 | 366-1408-00 |
| | 213-0153-00 | | 2 | . SETSCREW: 5-40 X 0.125 INCH, HEX SOC STL | | | | | 74445 | OBD |
| -4 | 366-0392-00 | | 1 | KNOB: GRAY | | | | | 80009 | 366-0392-00 |
| -5 | 366-1257-14 | | 1 | PUSH BUTTON: GRAY--ON | | | | | 80009 | 366-1257-14 |
| -6 | 366-1058-25 | | 1 | KNOB: LATCH, 7D12 | | | | | 80009 | 366-1058-25 |
| | | | | (ATTACHING PARTS) | | | | | | |
| -7 | 214-1095-00 | | 1 | PIN, SPG, SPLIT: 0.094 OD X 0.187 INCH LONG | | | | | 13257 | 52-022-094-018 |
| | | | | - - - * - - - | | | | | | |
| -8 | 105-0076-00 | | 1 | REL BAR, LATCH: PLUG-IN UNIT | | | | | 80009 | 105-0076-00 |
| -9 | 214-1280-00 | | 1 | SPRING, HLCPS: 0.14 OD X 1.126" L, 0.16" DIA W | | | | | 80009 | 214-1280-00 |
| -10 | 426-0681-00 | | 1 | FR, PUSH BUTTON: GRAY PLASTIC | | | | | 80009 | 426-0681-00 |
| -11 | 333-1634-00 | | 1 | PANEL, FRONT: | | | | | 80009 | 333-1634-00 |
| | | | | (ATTACHING PARTS) | | | | | | |
| -12 | 210-0457-00 | | 2 | NUT, PLAIN, EXT W: 6-32 X 0.312 INCH, STL | | | | | 83385 | OBD |
| -13 | 210-0405-00 | | 2 | NUT, PLAIN, HEX. : 2-56 X 0.188 INCH, BRS | | | | | 73743 | 2X12157-402 |
| | | | | - - - * - - - | | | | | | |
| -14 | 352-0324-00 | | 1 | HOLDER, SEMICOND: | | | | | 80009 | 352-0324-00 |
| -15 | 131-0955-00 | | 1 | CONNECTOR, RCPT, : BNC, FEMALE | | | | | 24931 | 28JR200-1 |
| -16 | 210-0255-00 | | 1 | TERMINAL, LUG: 0.391" ID INT TOOTH | | | | | 80009 | 210-0255-00 |
| -17 | ----- | | 1 | CKT BOARD ASSY: TRIG MODE SW (SEE A3 EPL) | | | | | | |
| | | | | (ATTACHING PARTS) | | | | | | |
| -18 | 211-0156-00 | | 2 | SCREW, MACHINE: 1-72 X 0.25", 82 DEG, FLH STL | | | | | 77250 | OBD |
| | | | | - - - * - - - | | | | | | |
| -19 | 386-2444-00 | | 1 | SUPPORT, CKT BD: | | | | | 80009 | 386-2444-00 |
| | | | | (ATTACHING PARTS) | | | | | | |
| -20 | 211-0101-00 | | 1 | SCREW, MACHINE: 4-40 X 0.25" 100 DEG, FLH STL | | | | | 83385 | OBD |
| -21 | 210-0003-00 | | 1 | WASHER, LOCK: EXT #4 | | | | | 78189 | 1104-00-00-054 |
| | | | | - - - * - - - | | | | | | |
| -22 | ----- | | 1 | RES., VAR: (SEE R120 EPL) | | | | | | |
| | | | | (ATTACHING PARTS) | | | | | | |
| | 213-0020-00 | | 1 | SETSCREW: 6-32 X 0.125 INCH, HEX SOC STL | | | | | 70276 | OBD |
| | | | | - - - * - - - | | | | | | |
| -23 | 348-0235-00 | | 2 | SHLD GSKT, ELEC: 4.734 INCH LONG | | | | | 80009 | 348-0235-00 |
| -24 | 386-2444-00 | | 1 | SUPPORT, CKT BD: | | | | | 80009 | 386-2444-00 |
| | | | | (ATTACHING PARTS) | | | | | | |
| -25 | 213-0192-00 | | 4 | SCR, TFG, THD FOR: 6-32 X 0.50 INCH, PNH STL | | | | | 87308 | OBD |
| | | | | - - - * - - - | | | | | | |
| -26 | 105-0075-00 | | 1 | BOLT, LATCH: 0.475 X 0.21 X 0.184", PLSTC | | | | | 80009 | 105-0075-00 |
| -27 | 214-1054-00 | | 1 | SPRING, DETENT: LATCH | | | | | 80009 | 214-1054-00 |
| -28 | 351-0347-00 | | 1 | GUIDE, MODULE: BOTTOM | | | | | 80009 | 351-0347-00 |
| | | | | (ATTACHING PARTS) | | | | | | |
| -29 | 211-0101-00 | | 3 | SCREW, MACHINE: 4-40 X 0.25" 100 DEG, FLH STL | | | | | 83385 | OBD |
| | | | | - - - * - - - | | | | | | |
| -30 | 407-1130-00 | | 1 | BRACKET, MODULE: RETAINING | | | | | 80009 | 407-1130-00 |
| | | | | (ATTACHING PARTS) | | | | | | |
| -31 | 211-0101-00 | | 1 | SCREW, MACHINE: 4-40 X 0.25" 100 DEG, FLH STL | | | | | 83385 | OBD |
| | | | | - - - * - - - | | | | | | |
| -32 | ----- | | 1 | CKT BOARD ASSY: FLOATING (SEE A2 EPL) | | | | | | |
| | | | | (ATTACHING PARTS) | | | | | | |
| -33 | 211-0155-00 | | 4 | SCREW, EXT, RLV B: 4-40 X 0.375 INCH, SST | | | | | 80009 | 211-0155-00 |
| | | | | - - - * - - - | | | | | | |
| | | | - | . CKT BOARD ASSY INCLUDES: | | | | | | |
| -34 | 131-0566-00 | | 2 | . LINK, TERM. CONNE: 0.086 DIA X 2.375 INCH L | | | | | 0000C | L-2007-1 |
| -35 | 131-1003-00 | | 2 | . CONNECTOR BODY, : CKT BD MT, 3 PRONG | | | | | 80009 | 131-1003-00 |
| -36 | 136-0252-04 | | 126 | . CONTACT, ELEC: 0.188 INCH LONG | | | | | 22526 | 75060 |
| -37 | 136-0261-00 | | 4 | . CONTACT, ELEC: FOR 0.22 INCH PIN | | | | | 00779 | 1-331677-6 |
| -38 | 136-0263-03 | | 16 | . CONTACT, ELEC: FOR 0.025 INCH SQUARE PIN | | | | | 00779 | 86250-2 |
| -39 | 136-0183-00 | | 1 | . SOCKET, PLUG-IN: 3 PIN | | | | | 80009 | 136-0183-00 |
| -40 | 214-0579-00 | | 6 | . TERM., TEST PT: 0.40 INCH LONG | | | | | 80009 | 214-0579-00 |
| -41 | 214-1292-00 | | 1 | . HEAT SINK, ELEC: TRANSISTOR | | | | | 05820 | 205-AB |
| -42 | 214-1611-00 | | 2 | . HEAT SINK, XSTR: TO 5 CUP CLIP, 500VAC | | | | | 05820 | 260-4TSE-C4631 |
| -43 | 342-0172-00 | | 1 | . INSULATOR, XFMR: | | | | | 80009 | 342-0172-00 |
| | | | | (ATTACHING PARTS) | | | | | | |
| -44 | 211-0008-00 | | 1 | . SCREW, MACHINE: 4-40 X 0.25 INCH, PNH STL | | | | | 83385 | OBD |
| | | | | - - - * - - - | | | | | | |

Mechanical Parts List—7D12

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff Dscont | Qty | 1 | 2 | 3 | 4 | 5 | Name & Description | Mfr Code | Mfr Part Number |
|------------------|--------------------|-----------------------------|-----|---|---|---|---|---|---|----------|-----------------|
| 1-45 | 361-0238-00 | | 4 | . | | | | | SPACER,SLEEVE:0.25 OD X 0.34 INCH LONG | 80009 | 361-0238-00 |
| -46 | 337-1684-00 | | 1 | | | | | | SHIELD,ELEC:CKT BD | 80009 | 337-1684-00 |
| -47 | 407-1516-00 | | 1 | | | | | | BRACKET,ANGLE:MAIN CKT BD (ATTACHING PARTS) | 80009 | 407-1516-00 |
| -48 | 210-0586-00 | | 3 | | | | | | NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL | 78189 | OBD |
| -49 | 211-0101-00 | | 2 | | | | | | SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL - - - * - - - | 83385 | OBD |
| -50 | ----- | | 1 | | | | | | CKT BOARD ASSY:MAIN(SEE A1 EPL) (ATTACHING PARTS) | | |
| -51 | 211-0116-00 | | 2 | | | | | | SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS | 83385 | OBD |
| -52 | 211-0154-00 | | 1 | | | | | | SCR,ASSEM WSHR:4-40 X 0.562 INCH,PNH BRS | 83385 | OBD |
| | ----- | | - | . | | | | | CKT BOARD ASSY INCLUDES: | | |
| -53 | 131-0604-00 | | 8 | . | | | | | CONTACT,ELEC:0.025 SQ X 0.365 INCH LONG | 80009 | 131-0604-00 |
| -54 | 131-0589-00 | | 3 | . | | | | | CONTACT,ELEC:0.46 INCH LONG | 22526 | 47350 |
| | 131-0608-00 | | 11 | . | | | | | CONTACT,ELEC:0.365 INCH LONG | 22526 | 47357 |
| -55 | 131-0591-00 | | 16 | . | | | | | CONTACT,ELEC:0.835 INCH LONG | 22526 | 47352 |
| -56 | 131-1003-00 | | 7 | . | | | | | CONNECTOR BODY,:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| -57 | 131-1262-00 | | 1 | . | | | | | CONNECTOR,RCPT,:20/40 CONTACT,RIGHT ANGLE | 05574 | 3VH20/1JKC15 |
| -58 | 136-0260-01 | | 2 | . | | | | | SOCKET,PLUG-IN:16 CONTACT,RECT SHAPE | 71785 | 133-51-02-075 |
| -59 | 136-0269-02 | | 8 | . | | | | | SOCKET,PLUG-IN:14 CONTACT,RECT SHAPE | 73803 | IC-014ST-7559 |
| -60 | 136-0252-04 | | 89 | . | | | | | CONTACT,ELEC:0.188 INCH LONG | 22526 | 75060 |
| -61 | 136-0234-00 | | 2 | . | | | | | CONTACT,ELEC:0.088 OD X 0.247 INCH L | 00779 | 380598-1 |
| -62 | 352-0096-00 | | 1 | . | | | | | CLIP,SPR,TNSN:CRYSTAL | 80009 | 352-0096-00 |
| -63 | ----- | | 1 | . | | | | | RES.,VAR:(SEE R131 EPL) (ATTACHING PARTS) | | |
| -64 | 210-0046-00 | | 1 | . | | | | | WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL | 78189 | 1214-05-00-05 |
| -65 | 210-0583-00 | | 1 | . | | | | | NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS - - - * - - - | 73743 | 2X20319-402 |
| -66 | 214-0579-00 | | 1 | . | | | | | TERM.,TEST PT:0.40 INCH LONG | 80009 | 214-0579-00 |
| -67 | 260-0723-00 | | 1 | . | | | | | SWITCH,SLIDE:DPDT,0.5A,125VAC | 80009 | 260-0723-00 |
| -68 | 260-1132-00 | | 1 | . | | | | | SWITCH,PUSH:1 BUTTON,DOUBLE POLE | 80009 | 260-1132-00 |
| -69 | 351-0225-00 | | 4 | . | | | | | GUIDE,CKT CARD: | 80009 | 351-0225-00 |
| -70 | 355-0518-02 | | 1 | . | | | | | STUD,SELF LOCK:4-40 X 0.625 INCH L,BRS | 80009 | 355-0518-02 |
| -71 | 376-0051-01 | | 1 | . | | | | | CPLG,SHAFT,FLEX:FOR 0.125 INCH,W/SETSCREW | 80009 | 376-0051-01 |
| | 213-0075-00 | | 4 | . | | | | | SETSCREW:4-40 X 0.094 INCH,HEX SOC STL | 70276 | OBD |
| -72 | 384-1127-00 | | 1 | . | | | | | EXTENSION SHAFT:7.5 INCH L X 0.125 INCH OD | 80009 | 384-1127-00 |
| -73 | 407-0803-00 | | 1 | . | | | | | BRKT,COMPONENT: | 80009 | 407-0803-00 |
| | ----- | | 1 | . | | | | | ACTR ASSY,CAM S:ATTEN(SEE S110 EPL) (ATTACHING PARTS) | | |
| -74 | 211-0116-00 | | 4 | | | | | | SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS - - - * - - - | 83385 | OBD |
| -75 | 200-1428-00 | | 1 | . | | | | | ACTUATOR ASSY INCLUDES: COVER,CAM SW: (ATTACHING PARTS) | 80009 | 200-1428-00 |
| -76 | 211-0008-00 | | 4 | . | | | | | SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL | 83385 | OBD |
| -77 | 210-0004-00 | | 4 | . | | | | | WASHER,LOCK:INTL,0.12 ID X 0.26"OD,STL - - - * - - - | 78189 | 1204-00-00-05 |
| -78 | 210-0406-00 | | 2 | . | | | | | NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS | 73743 | 2X12161-402 |
| -79 | 131-0963-00 | | 2 | . | | | | | CONTACT,ELEC:GROUNDING | 80009 | 131-0963-00 |
| -80 | 214-1139-02 | | 2 | . | | | | | SPRING,FLAT:GREEN COLORED | 80009 | 214-1139-02 |
| -81 | 214-1127-00 | | 2 | . | | | | | ROLLER,DETENT:0.125 DIA X 0.125 INCH L | 80009 | 214-1127-00 |
| -82 | 401-0081-02 | | 1 | . | | | | | BEARING,CAM SW:FRONT (ATTACHING PARTS) | 80009 | 401-0081-02 |
| -83 | 354-0391-00 | | 1 | . | | | | | RING,RETAINING:0.395"FREE ID X 0.025"STL - - - * - - - | 97464 | 3100-43-CD |
| -84 | 105-0370-00 | | 1 | . | | | | | DRUM,CAM SWITCH: | 80009 | 105-0370-00 |
| -85 | 210-0406-00 | | 4 | . | | | | | NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS | 73743 | 2X12161-402 |
| -86 | 401-0115-00 | | 1 | . | | | | | BEARING,CAM SW:CENTER | 80009 | 401-0115-00 |

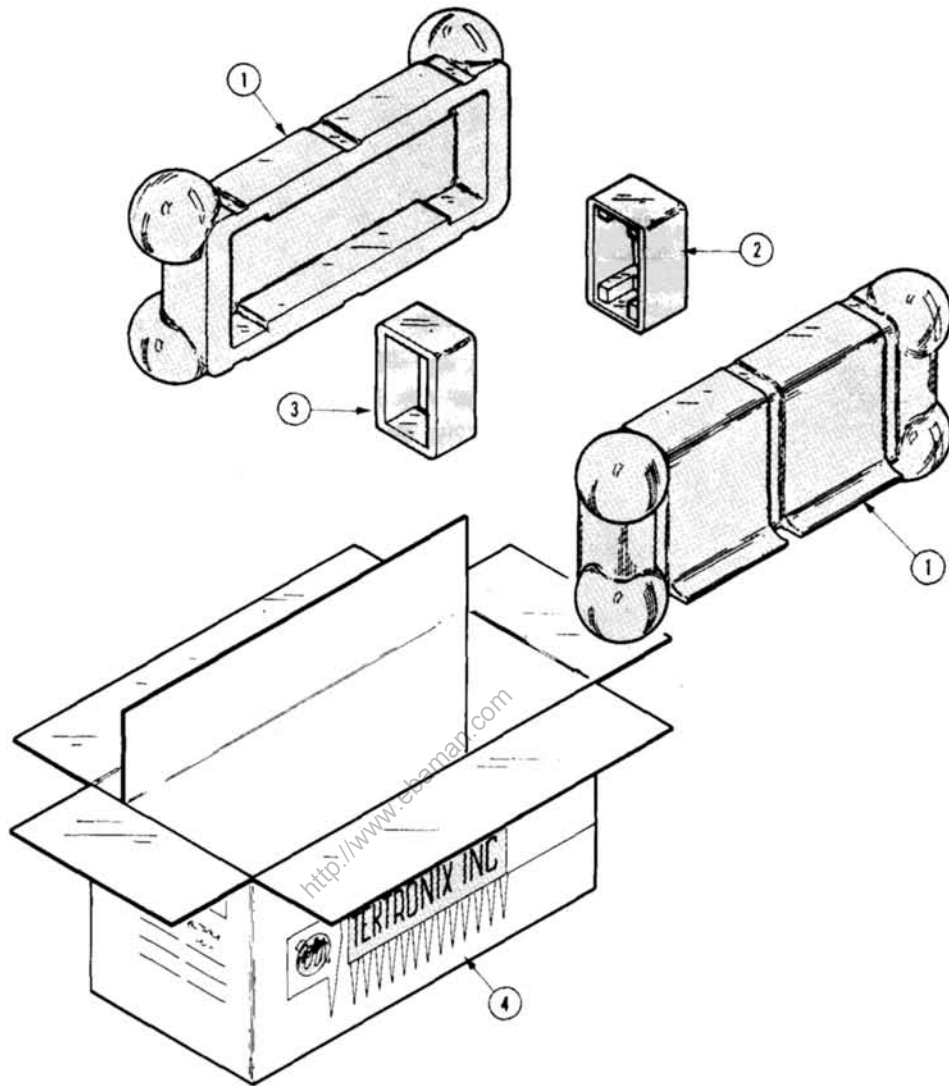
| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff | Dscnt | Qty | 1 2 3 4 5 | | | | | Name & Description | Mfr Code | Mfr Part Number |
|------------------|--------------------|----------------------|-------|-----|-----------|--|--|--|--|---|----------|-----------------|
| | | | | | | | | | | | | |
| 1-87 | 386-1402-00 | | | 1 | | | | | | PANEL, REAR: (ATTACHING PARTS) | 80009 | 386-1402-00 |
| -88 | 213-0192-00 | | | 4 | | | | | | SCR, TPG, THD FOR: 6-32 X 0.50 INCH, PNH STL | 87308 | OBD |
| -89 | 361-0326-00 | | | 1 | | | | | | SPACER, SLEEVE: 0.18 ID X 0.25 OD X 0.10" L - - - * - - - | 80009 | 361-0326-00 |
| -90 | 220-0547-00 | | | 2 | | | | | | NUT, BLOCK: 0.38 X 0.25 X 0.282 INCH OA (ATTACHING PARTS FOR EACH) | 80009 | 220-0547-00 |
| -91 | 211-0105-00 | | | 1 | | | | | | SCREW, MACHINE: 4-40 X 0.188" 100 DEG, FLH STL - - - * - - - | 83385 | OBD |
| -92 | 214-1061-00 | | | 1 | | | | | | SPRING, GROUND: FLAT | 80009 | 214-1061-00 |
| -93 | 426-0505-19 | | | 1 | | | | | | FR SECT, PLUG-IN: TOP | 80009 | 426-0505-19 |
| -94 | 220-0547-00 | | | 1 | | | | | | NUT, BLOCK: 0.38 X 0.25 X 0.282 INCH OA (ATTACHING PARTS) | 80009 | 220-0547-00 |
| -95 | 211-0105-00 | | | 1 | | | | | | SCREW, MACHINE: 4-40 X 0.188" 100 DEG, FLH STL - - - * - - - | 83385 | OBD |
| -96 | 426-0499-15 | | | 1 | | | | | | FR SECT, PLUG-IN: BOTTOM | 80009 | 426-0499-15 |
| -97 | 179-1882-00 | | | 1 | | | | | | WIRING HARNESS: - . WIRING HARNESS INCLUDES: | | |
| -98 | 131-0707-00 | | | 8 | | | | | | . CONTACT, ELEC: 0.48" L, 22-26 AWG WIRE | 22526 | 47439 |
| -99 | 352-0162-00 | | | 1 | | | | | | . HOLDER, TERM. CON: 4 WIRE BLACK | 80009 | 352-0162-00 |
| -100 | 352-0163-00 | | | 1 | | | | | | . HOLDER, TERM. CON: 5 WIRE BLACK | 80009 | 352-0163-00 |
| -101 | 210-0774-00 | | | 9 | | | | | | . EYELET, METALLIC: 0.152 OD X 0.245 INCH L, BRS | 80009 | 210-0774-00 |
| -102 | 210-0775-00 | | | 9 | | | | | | . EYELET, METALLIC: 0.126 OD X 0.23 INCH L, BRS | 80009 | 210-0775-00 |
| -103 | 131-0707-00 | | | 3 | | | | | | CONTACT, ELEC: 0.48" L, 22-26 AWG WIRE | 22526 | 47439 |
| -104 | 352-0199-00 | | | 1 | | | | | | HOLDER, TERM. CON: 3 WIRE BLACK | 80009 | 352-0199-00 |
| -105 | 214-1140-00 | | | 4 | | | | | | SPRING, HLCPS: 0.251 OD X 0.375 INCH LONG | 80009 | 214-1140-00 |

<http://www.ebaman.com>



7D12 A/D CONVERTER

REPACKAGING



| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff | Dscnt | Qty | 1 | 2 | 3 | 4 | 5 | Name & Description | Mfr | |
|------------------|--------------------|----------------------|-------|-----|---|---|---|---|---|--------------------|-------|-----------------|
| | | | | | | | | | | | Code | Mfr Part Number |
| 3- | 065-0125-00 | | | 1 | | | | | | CARTON ASSY: | 80009 | 065-0125-00 |
| -1 | 004-0241-00 | | | 2 | | | | | | . CASE HALF: | 80009 | 004-0241-00 |
| -2 | 004-0242-00 | | | 1 | | | | | | . END CAP: REAR | 80009 | 004-0242-00 |
| -3 | 004-0243-00 | | | 1 | | | | | | . END CAP: FRONT | 80009 | 004-0243-00 |
| -4 | 004-0748-00 | | | 1 | | | | | | . CARTON: | 80009 | 004-0748-00 |

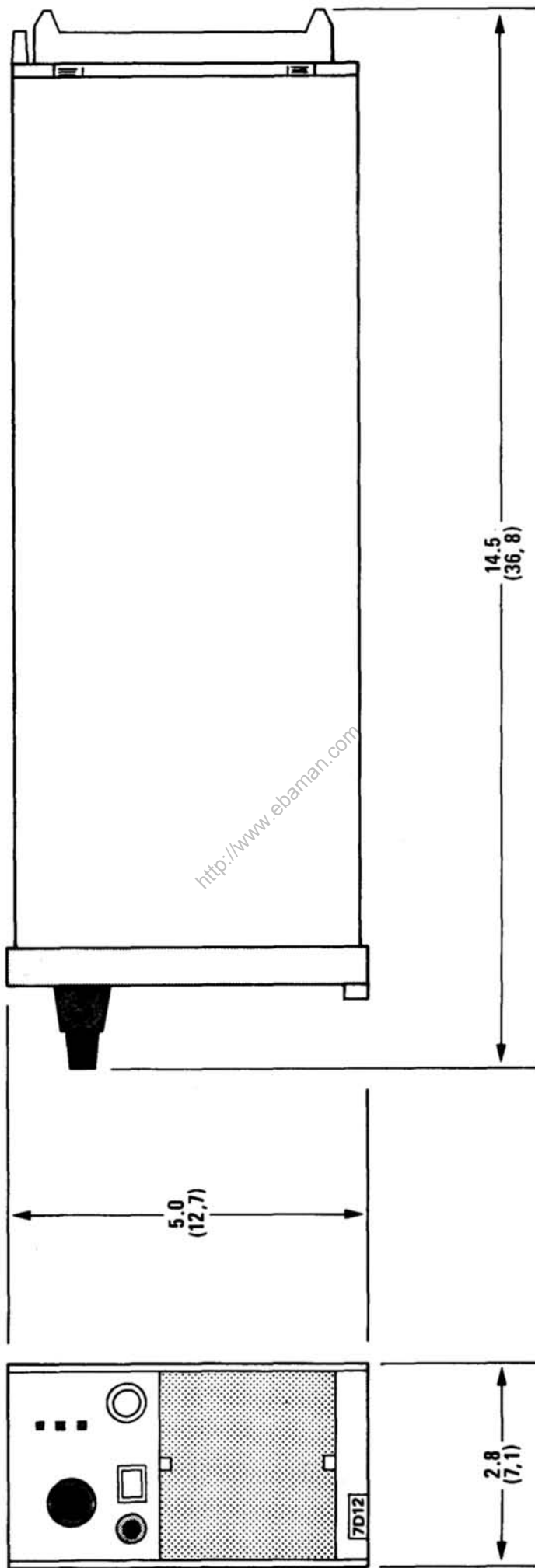
ACCESSORIES

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. | | Qty | | | | | | Name & Description | Mfr Code | Mfr Part Number |
|------------------------|-----------------------|------------------|--------|-----|---|---|---|---|---|---------------------------------------|-------------|-----------------|
| | | Eff | Dscont | | 1 | 2 | 3 | 4 | 5 | | | |
| 2 - | 070-1470-00 | | | 1 | | | | | | MANUAL, TECH: INSTRUCTION (NOT SHOWN) | 80009 | 070-1470-00 |

<http://www.ebaman.com>

7D12 A/D CONVERTER

**OVERALL DIMENSIONS
(MEASURED AT MAXIMUM POINTS)**



Weight: \approx 2.2 lbs. (\approx .992 kg.)

Note: Top figures are in inches and lower figures in centimeters.