TEKTRONIX®

DF1
DISPLAY FORMATTER
WITH OPTIONS

OPERATORS

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

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.

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

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NOTE

SERVICE INFORMATION, PARTS REPLACEMENT INFORMATION, AND DIAGRAMS ARE CONTAINED IN THE DF1 INSTRUCTION MANUAL.

LIST OF ILLUSTRATIONS

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OPERATORS SAFETY INFORMATION

The following general safety information is provided to ensure safe operation of this instrument and applies to all operators and service personnel. Specific warnings will be found throughout the manual where they apply and should be followed in each instance.

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

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

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

The following safety symbols may appear on the equipment:


CAUTION—Refer to manual


DANGER—High voltage


Protective ground (earth) terminal

Other warning symbols where they apply.

WARNING

Ground the Instrument

To reduce electric-shock hazard, the mainframe (oscilloscope) chassis must be properly grounded. Refer to the mainframe manual for grounding information.

Do Not Operate in Explosive Atmosphere

Do not operate this instrument in an area where flammable gases or fumes are present. Such operation could cause an explosion.

Do Not Remove Instrument Covers

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

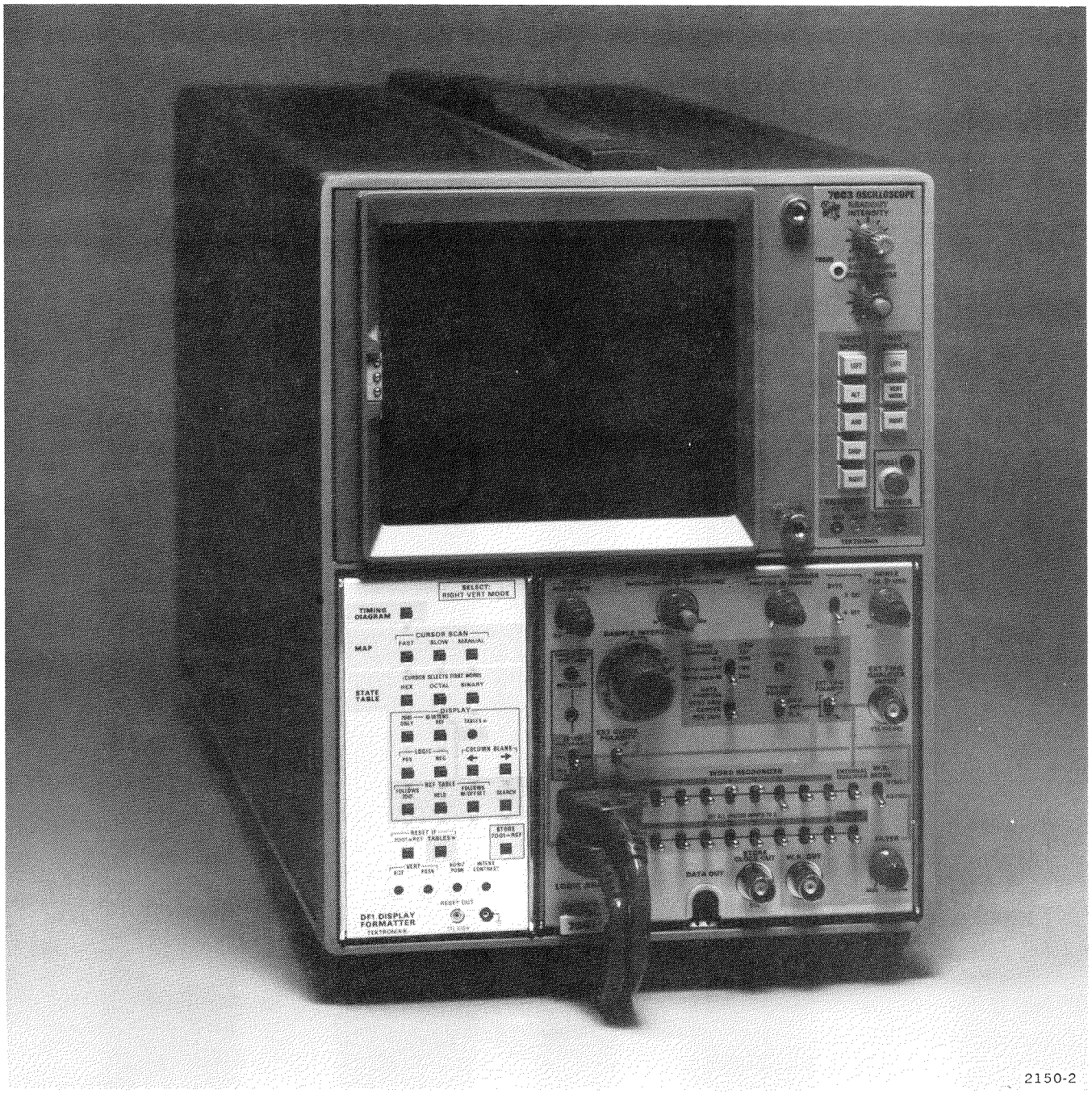
Do Not Service or Adjust Alone

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

CAUTION

Prevent Instrument Damage

To prevent instrument damage, plug-in units should not be installed or removed without first turning off the mainframe power.



DF1 FEATURES

The DF1 Display Formatter provides data-domain display modes in addition to the existing time-domain display of the 7D01 Logic Analyzer. It adds state table displays with a comparison mode, and a map display. The DF1 attaches to the left side of the 7D01, forming a three-wide plug-in assembly. This assembly operates in a 7000-series oscilloscope mainframe to comprise a complete 16-channel logic timing-state analyzer system.

A microprocessor controlled memory system, contained in the DF1, is capable of recording two 7D01 information records. Portions of both information records may be displayed concurrently in a state table presentation.

State tables are displayed in terms of either hexadecimal, octal, or binary formats. This data may be displayed in up to two tables of 17 lines of 16-bit words each. The left-hand table displays data currently stored in the 7D01 memory (7D01 display). The right-hand table displays data that has been transferred from previous 7D01 displays to the DF1 memory (reference display). The DF1 compares the 2 tables and resets the 7D01 when the 7D01 data equals the reference data.

The map function plots a dot display of the 16 data channels in X-Y coordinate points. Each dot location represents one possible combination of up to 16 inputs to the 7D01

GENERAL INFORMATION

INTRODUCTION

The Operator's Manual contains information necessary to effectively operate the DF1 Display Formatter unit and is divided into three sections: Section 1 provides packaging for shipment information, specifications, and a list of standard accessories. Section 2 contains operating information. Information concerning available options is located in Section 3.

The Instruction Manual contains nine sections. Operating information is covered in the first two sections; servicing information is covered in the remaining seven sections. Schematic diagrams are located at the rear of the manual and can be unfolded for reference while reading other parts of the manual. The reference designators and symbols used on the schematic diagrams are defined on the first page of the Diagrams and Circuit Board Illustrations section. Abbreviations used in the manuals, except in the parts list and schematic diagrams, comply with the American National Standards Institute Y1.1-1972 publication. The parts list is a computer printout and uses computer-supplied abbreviations.

GLOSSARY OF TERMS

The following logic terms are used throughout this manual.

Asynchronous Mode—The data is acquired by the 7D01 using its internal clock at a rate selected by its sample interval control.

Bit—The smallest increment of digital information.

Blanked Columns—The columns eliminated from the memory by the COLUMN BLANK function.

Compare—A check between the 7D01 memory and the reference memory for equality (a microprocessor function.)

Data—This is information acquired by the 7D01. Up to 16 channels of data may be acquired, and each data bit is one clock period in the synchronous mode.

Data Record—All of the information stored in the 7D01 memory or the DF1 memory. (A Data Record has 4096 bits of information.)

Data Word—This is Good Data that may be formatted in any of three different ways:

1. A vertical slice of the Timing Diagram display.
2. A coordinate point of the Map display.
3. A horizontal line of characters in a State Table display.

NOTE

Channel 0 is the top-most channel displayed in TIMING DIAGRAM format and is always considered the least significant bit.

Don't Care Data—Invalid Data that is excluded from comparison in all comparison modes.

End Data—Data that fills out the last portion of a table when valid data ends before completion of the table. This is indicated by an "*" in the display.

Good Data—All data which is not Invalid Data.

Indeterminate Data—This is valid data but is considered invalid because its location cannot be defined. This data is indicated by an "X" in the display and occurs during sweep retrace in Timing Diagram. The number of Indeterminate Data bits for each position of the 7D01 bits/channel switch are: Two bits (254 bits/channel position), four bits (508 bits/channel position), and eight bits (1016 bits/channel position).

Invalid Data—This term describes a combination of Indeterminate Data, Old Data (if any), and End Data.

New Data—The most recent acquisition of Good Data into the 7D01.

Old Data—Data which was part of a previous Data Record in the 7D01 memory but is out of sequence. This is caused by the arrival of the trigger before the New Data has completely filled the memory. Old Data is indicated by an "X" in the display.

Reference State Table—A display of DF1 memory data transferred from a previous 7D01 display and displayed on the right half of the crt.

Synchronous Mode—The data is acquired by the 7D01 using an externally supplied clock signal (7D01 sample interval switch set to external, and with the external clock signal connected to the clock input of the channel 0-7 Data Acquisition Probe).

Word—See Data Word.

INSTALLATION

The DF1 Display Formatter attaches to the left side of the 7D01 Logic Analyzer to make a three-wide plug-in system. The two units latch together to provide a rigid instrument that plugs into a 7000-series mainframe. Refer to Figure 1-1 to attach the DF1 to the 7D01.

CAUTION

To prevent instrument damage, plug-in units should not be installed or removed without first turning off the mainframe power.

To install the DF1/7D01, first turn off the power to the oscilloscope mainframe. Then, gently push the 2 plug-in units into the appropriate plug-in compartments until they fit firmly. The front panels of the DF1/7D01 should be flush with the front panel of the oscilloscope mainframe.

NOTE

When installed in a four-compartment mainframe, the DF1/7D01 occupies the left vertical, right vertical, and A horizontal compartments only. The oscilloscope mainframe vertical mode switch must be set to right and the horizontal mode switch must be set to A.

To remove the DF1/7D01, pull the release latch (located on the lower left corner of the 7D01) to disengage the DF1/7D01 from the mainframe. Then, gently slide the plug-in units from the mainframe.

PACKAGING FOR SHIPMENT

If this instrument is to be shipped for long distances by commercial transportation, it is recommended that the instrument be packaged in the original manner for maximum protection. The carton and packaging material in which your instrument was shipped should be saved and used for this purpose.

Also, if this instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag to the instrument showing the following: Owner of the instrument (with address), the name of an individual at your firm that can be contacted, complete instrument type and serial number, and a description of the service required.

If the original packaging is unfit for use or not available, package the instrument as follows:

1. Obtain a carton of corrugated cardboard with at least a 200-pound test strength and at least 6 inches larger than the instrument dimensions to allow for cushioning.

2. Surround the instrument with polyethylene sheeting to protect the instrument.

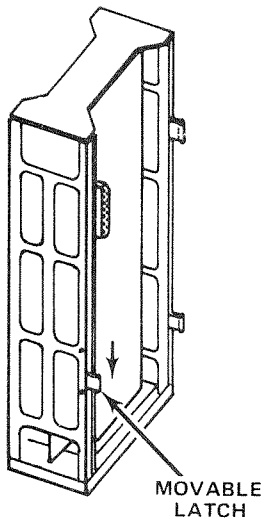
3. Allow a 3-inch cushion on all sides by tightly packing dunnage or urethane foam between the carton and the instrument.

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

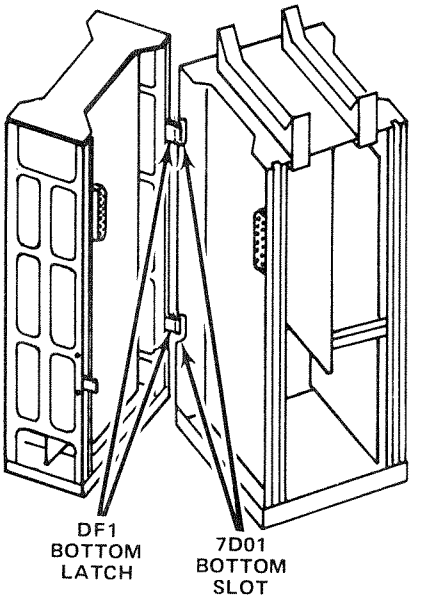
5. Mark the address of the Tektronix Service Center and your return address on the carton in one or more locations.

DF1/7D01 INSTALLATION

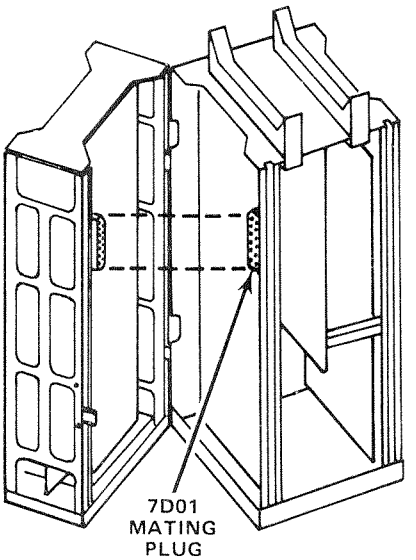
1. Slide the movable latch on the top of the DF1 forward until it stops.



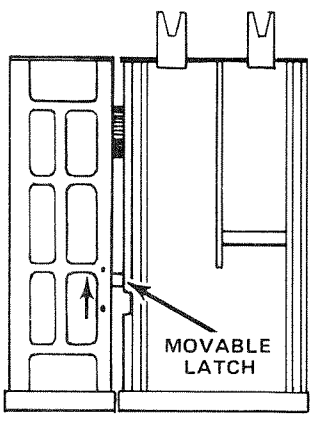
2. Tilt the DF1 and 7D01 slightly and place the bottom two latches on the DF1 into the bottom two slots on the 7D01. Gently slide the DF1 forward to just engage the bottom latches with the bottom track on the 7D01.



3. Continue to slide the DF1 forward until the jack at the top rear of the DF1 lines up with its mating plug on the 7D01.



4. Gently press the units together until the connector is properly mated and the movable latch is inserted into the rail slot on the 7D01.



Make sure the movable latch fits into the 7D01 rail groove and slide the movable latch toward the rear along the rail groove until it stops. The DF1 and 7D01 should now be latched together to form a rigid three-wide plug-in system.

2150-10

Figure 1-1. Attaching the DF1 to the 7D01.

SPECIFICATION

The electrical specifications listed in Table 1-1 apply for the DF1/7D01 system under the following conditions: (1) The instrument must have been adjusted at an ambient temperature between +20° and +30° C (+68° to +86° F), (2) the instrument must be operating in an ambient temperature between 0° and +40° C (+32° and +104° F), and (3) the instrument must have been operating for at least 20 minutes.

TABLE 1-1

Electrical Characteristics

Characteristic	Performance Requirement
External Read Clock	
Frequency Range	100 kHz to 500 kHz.
Duty Cycle	50% within 5%.
Display	
Vertical Size	Adjustable from 6.9 div or less to at least 8.1 div from the top of the first line of DF1 readout to the bottom of the last line of DF1 readout.
Vertical Position	Adjustable to vertical center of display area in any calibrated 7000-series mainframe.
Horizontal Position	Adjustable to horizontal center of display area in any calibrated 7000-series mainframe.
Output Signals	
Reset Logic Voltage Level	LO: +0.4 V or less at 2 mA. HI: at least +2.4 V at 2 mA.
Waveshape	Positive-going rectangular pulse.
Duration	100 μs within 50 μs when used with the 7D01 internal read clock.

TABLE 1-2

Environmental Characteristics

Characteristic	Performance Requirement
Temperature	
Calibration	+20° to +30° C (+68° to +86° F).
Operating	0° to +40° C (+32° to +104° F).
Storage	−55° to +75° C (−67° to +167° F).
Altitude	
Operating	To 15,000 feet.
Storage	To 50,000 feet.
Transportation	Qualified under National Safe Transit Committee Test Procedure 1A, Category II.

TABLE 1-3

Physical Characteristics

Characteristic	Description
Net Weight	Approximately 2 lbs (0.9 kg).
Overall Dimensions	See Figure 1-2, Dimensional Drawing.

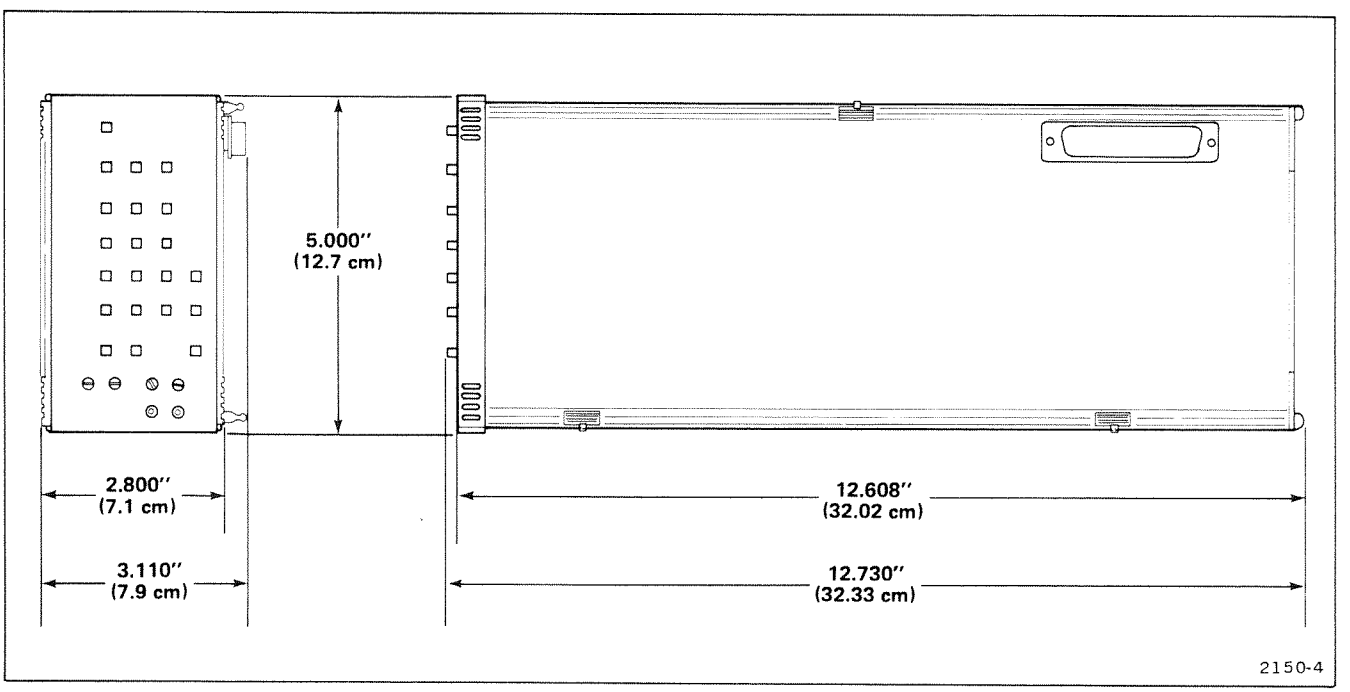


Figure 1-2. DF1 dimensional drawing.

STANDARD ACCESSORIES

1 ea . . . . . .Operators Manual

1 ea . . . . . .Instruction Manual

Refer to the tabbed Accessories page in the back of this manual for standard accessory part numbers.

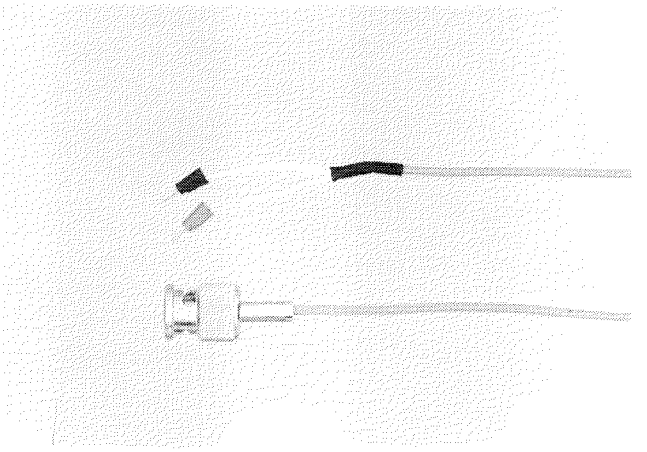
RECOMMENDED ACCESSORIES

The following accessories have been selected from our catalog specifically for your instrument. They are listed as a convenience to help you meet your measurement needs. For detailed information and prices, refer to a Tektronix Products Catalog or contact your local Tektronix Field Representative.

CABLE

TWO-PIN TO BNC: This adapter-cable connects the output gate and ground pin-jacks on the DF1 front panel to an external application.

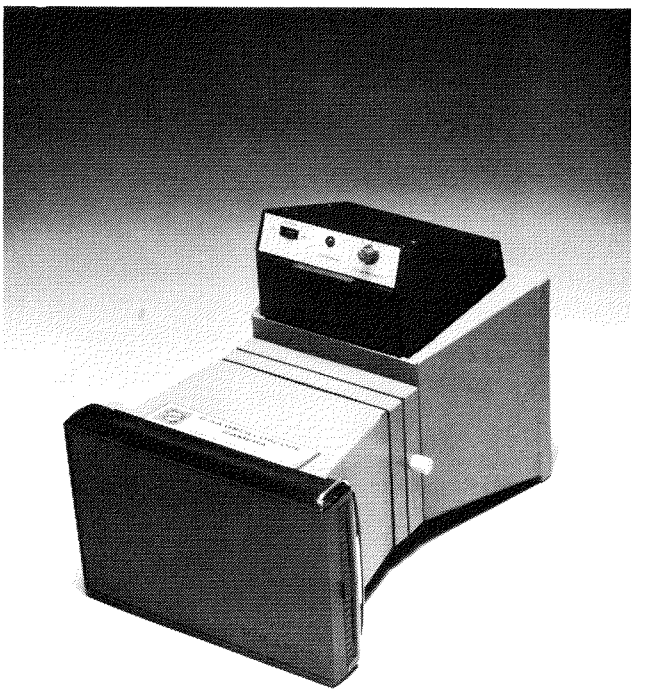
Cable, Order 175-1178-00



CAMERA

C-5A: The C-5A is a low-cost general-purpose camera with a Polaroid Pack-Film Back, pulsed graticule illumination, and a fixed f/16 lens. Magnification may be set at 0.67 or 0.85.

Order C-5A



OPERATING INSTRUCTIONS

To effectively use the DF1 Display Formatter, the capabilities of the DF1 and the companion 7D01 Logic Analyzer must be known. This section briefly describes the operation of the controls and connectors, provides detailed operating instructions, and a functional check procedure for the DF1. The General Information section provides instructions for installation of the DF1 and the 7D01 into a 7000-series oscilloscope mainframe. Refer to the 7D01 Operators or Instruction Manuals for information on the 7D01 Logic Analyzer.

CONTROLS AND CONNECTORS

INTERNAL

The Readout Source jumper is located inside the DF1. When using the Timing Diagram display, readout can be produced either by the DF1 readout system or by the readout system of the associated oscilloscope mainframe (refer to Figure 2-1). We recommend using the DF1 readout unless it is important to have the style of characters produced by the mainframe readout system.

EXTERNAL

The major controls required for operation of the DF1 are located on the front panel of the unit. Figure 2-2 provides a brief description of the front-panel functions. More information is given under Detailed Operating Instructions.

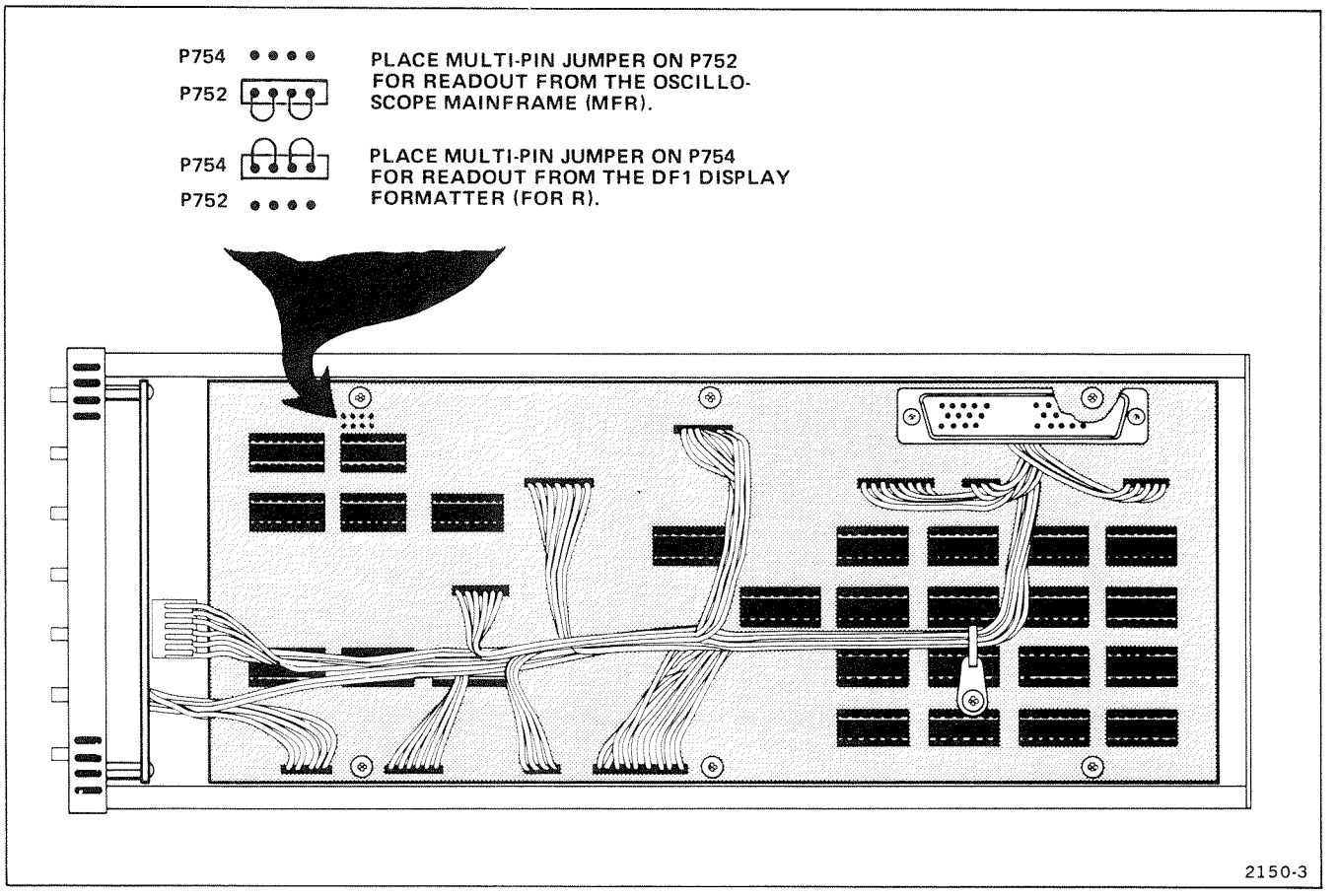
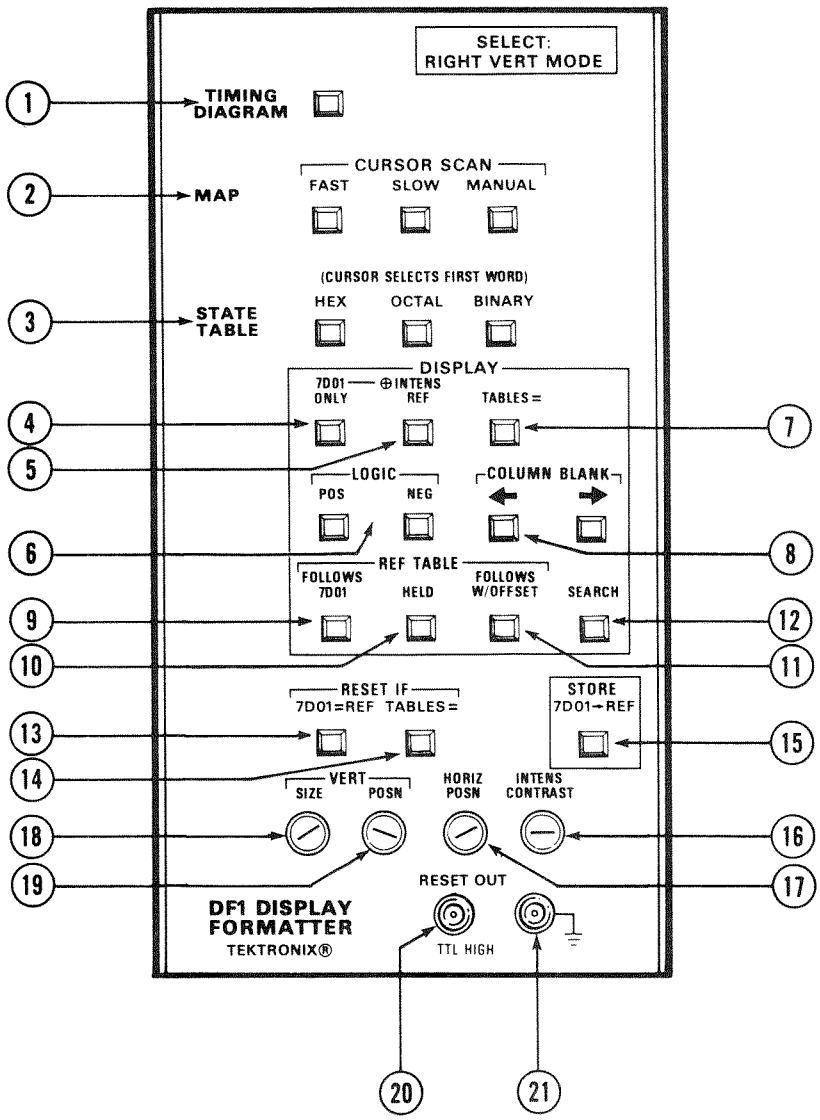


Figure 2-1. Location of the Readout Source multi-pin jumper.



2150-1A

Figure 2-2. Front-panel controls, connectors, and indicators.

(1) **Timing Diagram Switch**—Selects the timing diagram display from the 7D01 Logic Analyzer.

(2) **MAP (CURSOR SCAN Switches)**—Select view of the 7D01 memory data in X-Y coordinate points on the oscilloscope mainframe crt. The DF1 automatically sequences the data locations at a FAST or SLOW rate, or data locations are selected manually with the 7D01 Cursor control.

(3) **STATE TABLE Switches**—Select tabular display of the cursor word, the 16 words following the cursor word, and the trigger word. The tabular format can be displayed in HEX (hexadecimal), OCTAL, or BINARY base-number systems.

(4) **7D01 ONLY Switch**—Selects the state table from the 7D01 memory for display on the left-hand side of the crt.

(5) **⊕(Exclusive Or) INTENS REF Switch**—Compares state table display from the 7D01 memory (left-hand column) to a reference state table stored by the DF1 (right-hand column).

(6) **LOGIC Switches**—Determine whether the state table displays are in positive or negative logic.

(7) **TABLE = Indicator**—Lamp turns on when the 7D01 state table and the reference state table are equal.

(8) **COLUMN BLANK Switches**—Provide column blanking for state table displays. The blanked columns are excluded from the data base for all state table comparison and reset functions.

(9) **REF TABLE FOLLOWS 7D01 Switch**—The cursor location (trigger-to-cursor difference) in the reference state table (right-hand column) follows the cursor location in the 7D01 state table (left-hand column).

(10) **REF TABLE HELD Switch**—Locks the cursor location in the reference state table which allows the cursor location in the 7D01 reference state table to be moved independently.

(11) **REF TABLE FOLLOWS W/OFFSET Switch**—Maintains the cursor location offset, between the 7D01 and reference state tables, that was established in the REF TABLE HELD mode.

(12) **SEARCH Switch**—The 7D01 memory is searched for a match of the cursor word (first word) in the reference state table.

(13) **RESET IF 7D01 = REF Switch**—The 7D01 memory is reset when the 7D01 memory equals the DF1 reference memory.

(14) **RESET IF TABLES = Switch**—The 7D01 memory is reset when the 7D01 state table display equals the reference state table display.

(15) **STORE 7D01→REF Switch**—Transfers the 7D01 memory into the DF1 reference memory.

(16) **INTENS CONTRAST Adjustment**—Controls brightness of the intensified characters of the DF1 display.

(17) **HORIZ POSN Adjustment**—Controls horizontal position of the DF1 display.

(18) **VERT SIZE Adjustment**—Varies vertical size of the DF1 display.

(19) **VERT POSN Adjustment**—Controls vertical position of the DF1 display.

(20) **RESET OUT Connector**—Pin-jack connector provides a HIGH TTL level output when the 7D01 memory is reset by the DF1.

(21) **Ground Connector (⏚)**—Pin-jack connector provides a ground return for the RESET OUT gate.

2150-1B

Figure 2-2. Front-panel controls, connectors, and indicators (continued).

DETAILED OPERATING INSTRUCTIONS

POWER-ON MODE

When power is applied to the oscilloscope mainframe (Power-On mode), the DF1 reference memory and the memory which acquires data from the 7D01 are checked for proper operation of the random access memory (RAM) integrated circuits (refer to Error Message Displays in this section). Then, the 7D01 is reset and the DF1 reference memory and the 7D01 memory are cleared. The Display Mode is automatically set to Timing Diagram, the LOGIC is set to POS, and the cursor location (trigger-to-cursor readout) is set to +0. All other DF1 push-button selections are cancelled.

DISPLAY MODES

The DF1 displays digital data in 3 Display Modes: Timing Diagram, Map, and State Table. Figure 2-3 shows the controls required to activate typical DF1 displays.

Timing Diagram Displays

The front-panel TIMING DIAGRAM push button selects the Timing Diagram display (4, 8, or 16 channels) from the companion 7D01 Logic Analyzer (see Fig. 2-3). The cursor function of the 7D01 provides an intensified zone on the data display and a corresponding numerical readout display shows the logic state for each displayed channel of data. The position of the cursor, relative to the trigger, is also displayed on the crt readout. Refer to the 7D01 manual for more information on the 7D01 Logic Analyzer.

The source of the display readout can be from the oscilloscope mainframe readout system (MFR) or the DF1 (FOR R). (Refer to Internal Controls and Connectors, in this section, for more information.) When the Timing Diagram Display Mode is selected (Readout Source jumper set to Formatter Readout) after either the HEX, OCTAL, or BINARY State Table function has been displayed, the cursor word readout is displayed in the same base-number system as displayed previously in the State Table Display Mode. Then, the cursor word readout changes between binary and the base-number system in the previously selected State Table Display Mode, with every other push of the TIMING DIAGRAM push button. However, if the Readout Source jumper is set for mainframe readout (MFR), cursor word readout is displayed only in the binary system.

Map

The Map function provides a view of the 7D01 memory displayed as x-y coordinate dots on the crt. The vertical axis represents the most significant half of the data word and the horizontal axis represents the least significant half (see Figure 2-3).

The map display can be formatted from 4, 8, or 16 channels of input data. Therefore, 4- and 8-channel map displays are plotted over the entire crt display area in the same manner as a 16-channel display. A 16-channel display is capable of 64,000 coordinate points, an 8-channel display is capable of 256 coordinate points, and a 4-channel display is capable of 16 coordinate points.

A map cursor, indicated by a plus symbol (+), sequences automatically through the data locations in the order in which the data was loaded into memory. The cursor scans at a FAST or SLOW rate, as determined by the CURSOR SCAN push buttons. When either the FAST or SLOW push button is held in, the cursor scan is stopped near a desired location on the display and can be positioned to the exact location with the 7D01 cursor position controls. Also, when the MANUAL CURSOR SCAN push button is pressed, the 7D01 cursor position controls are used to manually position the cursor to the exact position desired. The readout display shows the logic state of the cursor word (bottom of crt), and the position of the cursor point, relative to the trigger point, is displayed at the top of the crt.

The map display is particularly useful for a fast overall check of digital systems. First of all, the map display pattern for a particular set of digital inputs must be known. Then, if there is a change in any one of the input signals, the map display pattern will change. A different map display pattern indicates that the circuits are not operating in the normal manner. Figure 2-4 illustrates a map display pattern from 16 signal inputs and shows that the map display pattern changes when input signals are removed.

State Table Displays

The State Table function enables the data, recorded in the 7D01, to be displayed in a tabular format. The cursor word, the sixteen words which follow, and the trigger word are

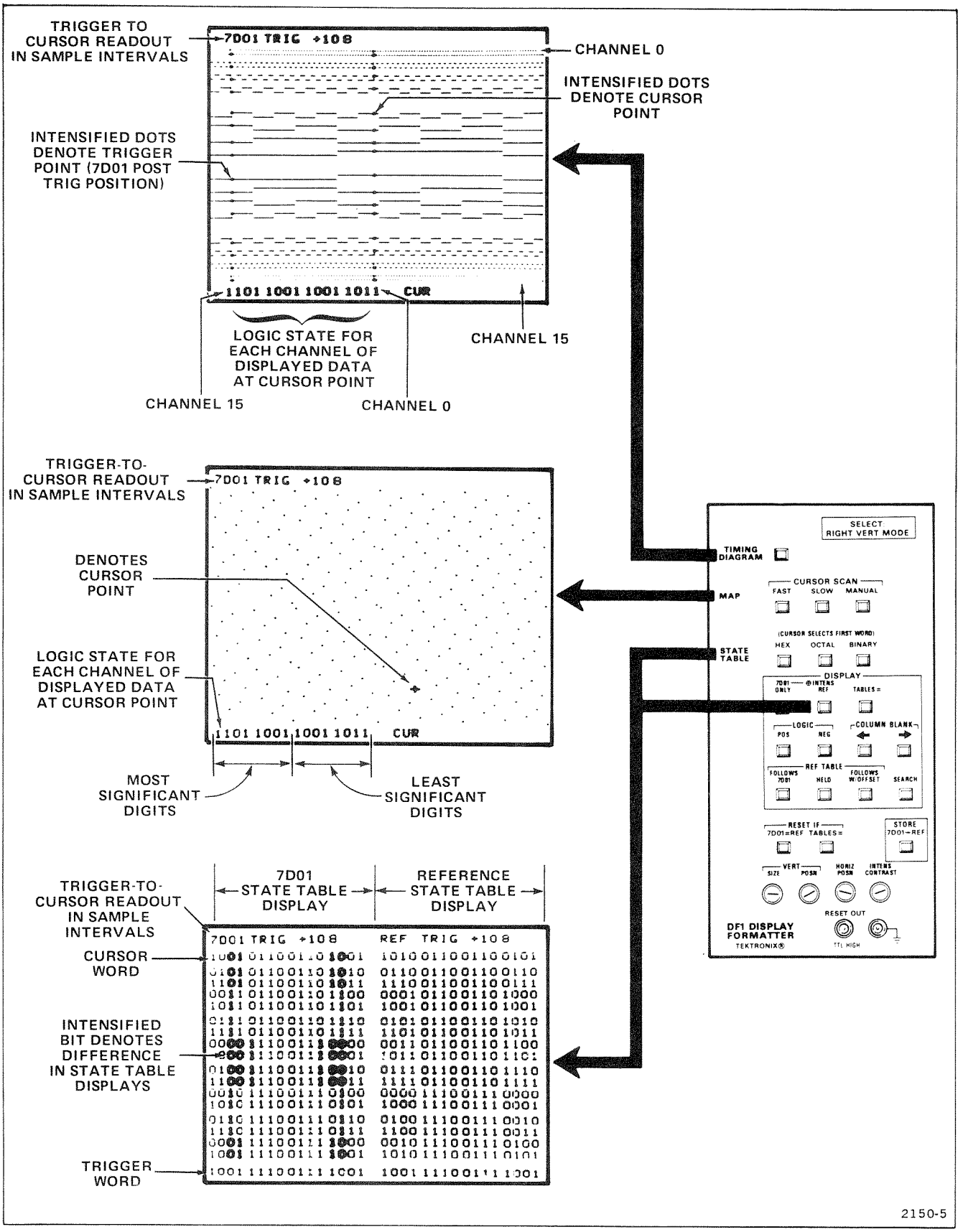


Figure 2-3. Typical DF1 Display Modes.

displayed. If the trigger word is displayed in the first 17 words of the state table, it is indicated by a blinking condition. The position of the cursor, relative to the trigger, is also displayed on the crt readout (see Figure 2-3).

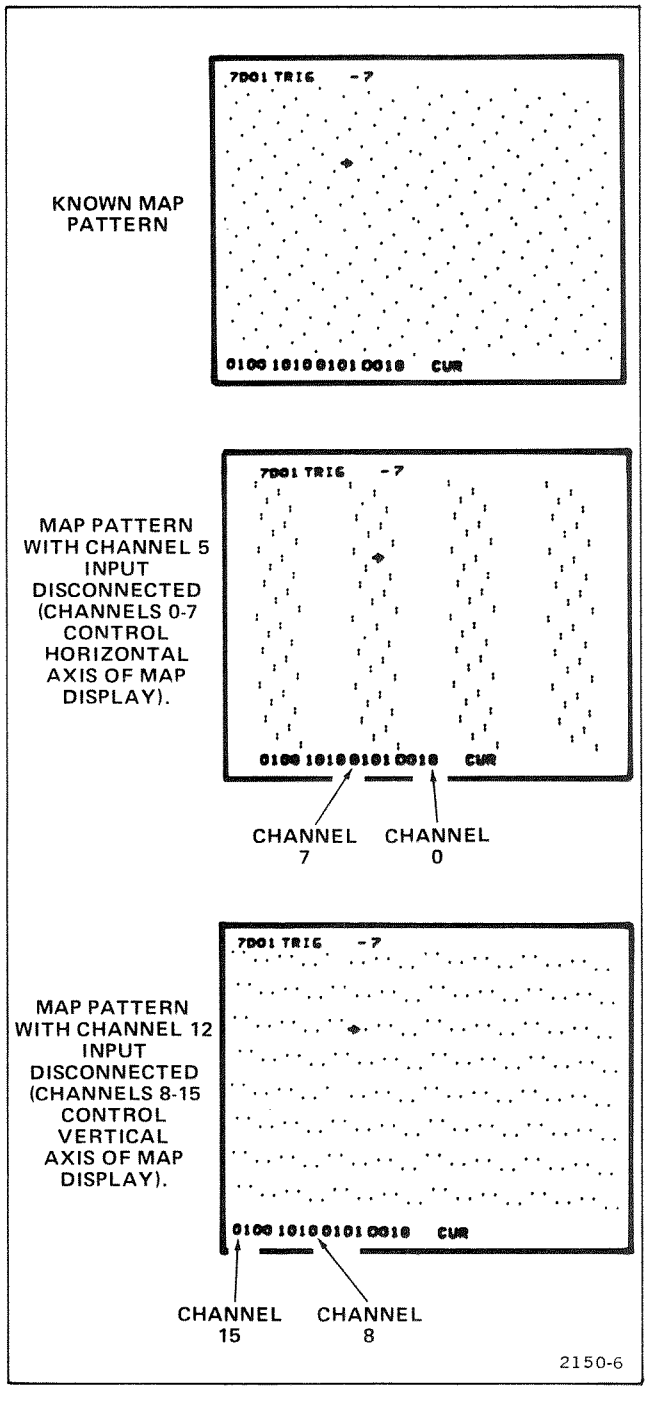


Figure 2-4. Typical map display usage.

Each time the 7D01 cursor position is changed or the 7D01 is reset, the display is updated. If the data ends before 17 words are displayed, the remainder of the display is filled with an asterisk (*) character. Any "old data" from the 7D01 memory is indicated by an "X" character.

Three push-button switches select State Table displays in HEX (hexidecimal, base 16), OCTAL (base 8), or BINARY (base 2) codes. The digits are grouped in threes or fours depending upon the setting of the 7D01 cursor byte switch.

7D01 ONLY. The State Table display from the 7D01 is displayed on the left side of the crt. The ⊖ INTENS REF displays are not functional in the 7D01 ONLY mode.

7D01 ⊖ INTENS REF. Two state tables are displayed simultaneously on the crt. The state table from the 7D01 is displayed on the left half of the crt and a reference state table is displayed on the right half of the crt (see Figure 2-3). When the 7D01 ⊖ INTENS REF is initially selected, the STORE 7D01→REF push button must be pressed to load the reference memory. Any differences between the 7D01 and reference state tables are indicated by intensified bits at the appropriate location in the 7D01 state table. Any differences in the state tables due to old data, indeterminate data, end data, or blanked columns, is interpreted as "don't care" conditions and are not intensified in the 7D01 state table (refer to the Glossary in the General Information section). If there are no differences between state tables, the TABLES= indicator is illuminated.

REF TABLE FOLLOWS 7D01. The FOLLOWS 7D01 mode is functional only when operating in the 7D01 ⊖ INTENS REF mode. The cursor location (trigger-to-cursor readout) in the reference state table is aligned with the cursor location of the 7D01 state table. As the 7D01 location is changed (by means of the 7D01 cursor position or data position controls), the cursor location of the reference state table follows.

REF TABLE HELD. The HELD mode is functional only when operating in the 7D01 ⊖ INTENS REF mode. The reference table cursor location remains at one setting, allowing the cursor location in the 7D01 state table to be moved independently (offset). Refer to Figure 2-5.

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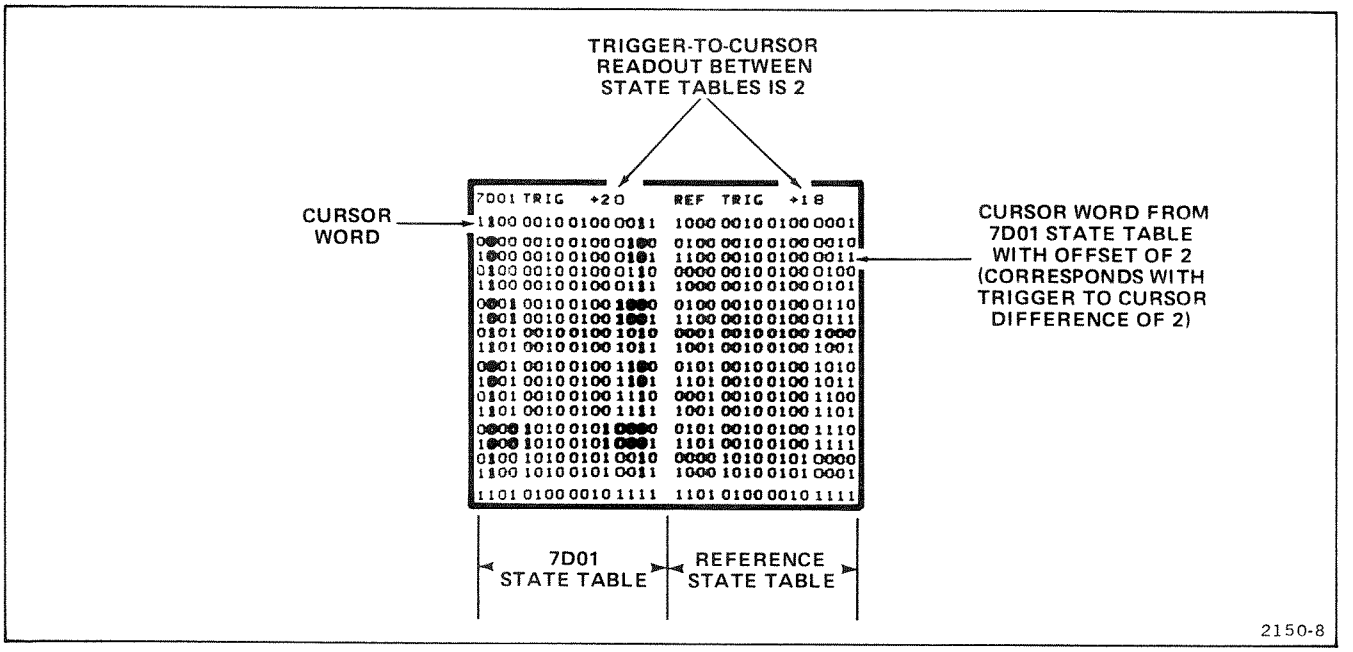

Figure 2-5. Typical state-table display showing offset between the 7D01 and reference state tables.

REF TABLE FOLLOWS WITH/OFFSET. The FOLLOWS WITH/OFFSET mode is functional only when operating in the 7D01 ⊕ INTENS REF mode. The difference in cursor location (offset) between the 7D01 state table and the reference state table, is maintained at the time the FOLLOWS W/OFFSET push button is pressed (see Figure 2-5). The offset between the 7D01 and reference state tables remains constant as the 7D01 cursor is moved. To delete the trigger-to-cursor offset, select REF TABLE FOLLOWS 7D01.

SEARCH. The SEARCH mode is functional when operating in the 7D01 ⊕ INTENS REF mode. When the SEARCH push button is pressed, the 7D01 memory is searched for a match of the reference cursor word. When a match of the reference cursor word is found, the REF TABLE mode is automatically set to HELD and the matching word is moved to the 7D01 cursor word position (first word) of the 7D01 state table.

If a match for the cursor word is not found in the 7D01 memory, the state table display remains unchanged. Also, if the first word in the reference memory is not valid, or a comparison is presently being made in the RESET IF 7D01=REF mode, a search of the 7D01 memory is not made.

RESET IF TABLES=. This mode is functional only when operating in the 7D01 ⊖INTENS REF mode. When the RESET IF TABLES= push button is pressed, the 7D01 resets and compares the data in the 7D01 state table to the data in the reference state table. If there are no differences, the 7D01 resets, acquires new data, and repeats the comparison. The number of resets is displayed on the crt readout. If there are differences, the acquisition, compare, and reset cycle stops. The differences between state-table displays are intensified in the 7D01 state table. To cancel the RESET IF TABLES= function, a second push of the RESET IF TABLES= push button is required.

RESET IF 7D01=REF. This mode is functional when operating in all DF1 display modes. When the RESET IF 7D01=REF push button is pressed, the data in the 7D01 memory is compared to the data in the reference memory. If there are no differences, the 7D01 resets, acquires new data, and repeats the comparison. The number of resets is displayed on the crt readout. If there are differences, the acquisition, compare, and reset cycle stops. The cursor word is moved to the first difference and the RESET IF 7D01=REF function is canceled. The RESET IF 7D01=REF function may also be canceled with a second push of the RESET IF 7D01=REF push button.

STORE 7D01→REF. This mode is functional in all DF1 display modes (Timing Diagram, Map, and State Table). When the STORE 7D01→REF push button is engaged, the 7D01 memory is transferred into the DF1 reference memory. When the trigger-to-cursor readout is the same in both state table displays, the 7D01 state table is transferred into the reference state table with no intensified bits. However,

if the trigger-to-cursor readout of the state table displays is offset, the 7D01 state table will be transferred to the reference state table with that offset (intensified bits may appear). The tables are equal but offset by the trigger-to-cursor readout (see Figure 2-5). To make the tables equal, either set the 7D01 cursor position controls so that the trigger-to-cursor readout is the same for both state tables or press the REF TABLE FOLLOWS 7D01 push button.

COLUMN BLANKING. Column blanking is functional when operating in any State Table mode. Undesired vertical columns of data can be blanked from the state-table displays (COLUMN BLANK→ push button). The blanked columns are interpreted as "don't care" information for state table comparisons and reset functions (refer to the Glossary in the General Information section). To restore a blanked column, press the COLUMN BLANK← push button. The column blanking function is automatically reset to display or compare all columns when the TIMING DIAGRAM, MAP, STATE TABLE (HEX, OCTAL, BINARY), 7D01 ONLY, or 7D01⊕ INTENS REF push buttons are pressed.

LOGIC STATES. When POS LOGIC is selected, the most positive voltage level is interpreted as a logic HI and the most negative level is interpreted as a logic LO. When NEG LOGIC is selected, the most negative level is displayed as a logic HI and the most positive level is interpreted as a logic LO.

Size and Position Adjustment

The controls used to adjust the size and position of DF1 displays depend on the Display Mode selected.

When operating in the Timing Diagram Display Mode, positioning of the timing diagram display is controlled by the 7D01 vertical and horizontal position controls. The size of the timing diagram display is determined by the 7D01 vertical and horizontal magnification controls. Vertical positioning of the display readout is controlled by the DF1 front-panel VERT SIZE and VERT POSN adjustments and horizontal positioning is controlled by the DF1 HORIZ POSN adjustment.

When operating in the Map or State Table Display Modes, vertical and horizontal positioning of the entire display (data and readout displays) is controlled by the DF1 front-panel VERT POSN and HORIZ POSN adjustments. Vertical height of the entire display is controlled by the DF1 front-panel VERT SIZE adjustment.

Error Message Displays

Two error messages are provided on the crt readout to identify operator error and instrument failures.

SEE MANUAL CUR CAN'T MOVE. This error message generally occurs when the 7D01 cursor control is set between switch detents. When the error message appears on the crt, move the 7D01 cursor control into a switch detent and the error message should disappear. If the error message does not disappear, refer to the error message discussion in the Maintenance section of the DF1 Instruction Manual.

SEE MANUAL BAD RAM. This error message indicates that a random access memory (RAM) integrated circuit has failed. To test the DF1 for a bad RAM: Turn off power to oscilloscope mainframe, wait a short time, and turn power on (Power-On Mode). Then check the crt readout for an error message. If the error message appears on the crt readout, refer to the error message discussion in the Maintenance section of the DF1 Instruction Manual.

FUNCTIONAL CHECK

The following procedure is provided for familiarization and for checking basic instrument functions of the DF1 Display Formatter. Refer to the Controls and Connectors discussion while performing this procedure. If a malfunction or possible improper adjustment is revealed while performing this procedure, first check the operation of the 7D01 and associated oscilloscope mainframe, then refer to the DF1 Instruction Manual for troubleshooting and adjustment procedures.

The functions are checked without removing the covers or making internal connections. Performance requirements, functions which require removal of side panels, and detailed checks of the DF1 memory are provided in the Performance Check and Adjustment procedures in the DF1 Instruction Manual.

SETUP PROCEDURE

1. Attach the DF1 Display Formatter to the 7D01 Logic Analyzer and install the three-wide plug-in assembly into the oscilloscope mainframe (refer to Installation, in the General Information section, for assembly instructions). Set the oscilloscope mainframe to display the right vertical and A horizontal compartments.

2. Connect the Interface Test Fixture to the 7D01 as shown in Figure 2-6.

3. Set the 7D01 Logic Analyzer controls as follows:

Sample Interval	Ext
Record Display Time	∞
Data Position	Post Trig
Data Channels	0-15
Trigger Source	W.R.
Word Recognizer	CH 0 through CH 6—LO CH 7—HI CH 8 through CH 15—X External Qualifier—X Probe Qualifier—X
W.R. Mode	Sync
Threshold Voltage	TTL (+1.4 V)

4. Perform the Power-On function (turn mainframe power off, wait a short time, then turn power on).

TIMING DIAGRAM DISPLAY

1. Perform the Setup Procedure.

2. Check crt display for a 16-channel timing diagram (refer to Fig. 2-3). It may be necessary to adjust the mainframe intensity and the 7D01 vertical and horizontal position/magnification controls.

3. Check that the trigger-to-cursor readout is zero and that the intensified cursor point is superimposed on the intensified trigger point (left-hand side of the crt display).

4. Set the 7D01 Data Position switch to Center and press the Record Manual Reset push button. Check that the trigger point (intensified dots) is near the center of the crt display and that the trigger-to-cursor readout is approximately −112. Rotate the 7D01 Cursor Fine Position control and note that the cursor point (indicated by intensified dots on the left side of the 16-channel display) moves in 1-bit increments as shown by the trigger-to-cursor readout. Rotate the 7D01 Cursor Coarse Position control and note that the cursor point moves in 16-bit increments. Note that the logic state for each channel of displayed data (16-bit readout at bottom of crt) changes corresponding to the cursor position. Set the 7D01 Cursor Position controls for a trigger-to-cursor readout of zero. Check that the intensified cursor point is superimposed on the intensified trigger point (center of crt).

5. Set the 7D01 Data Position switch to Pre Trig and press the Record Manual Reset push button. Check that the trigger point (intensified dots) is at the right-hand side of the display and that the trigger-to-cursor readout is approximately −112. Set the 7D01 Cursor Position controls for a trigger-to-cursor readout of zero. Check that the intensified cursor point is superimposed on the intensified trigger point (right-hand side of crt display).

MAP DISPLAYS

1. Perform the Setup Procedure.

2. Press the MANUAL MAP push button. Check crt display for a diagonal line on the crt (see Fig. 2-7).

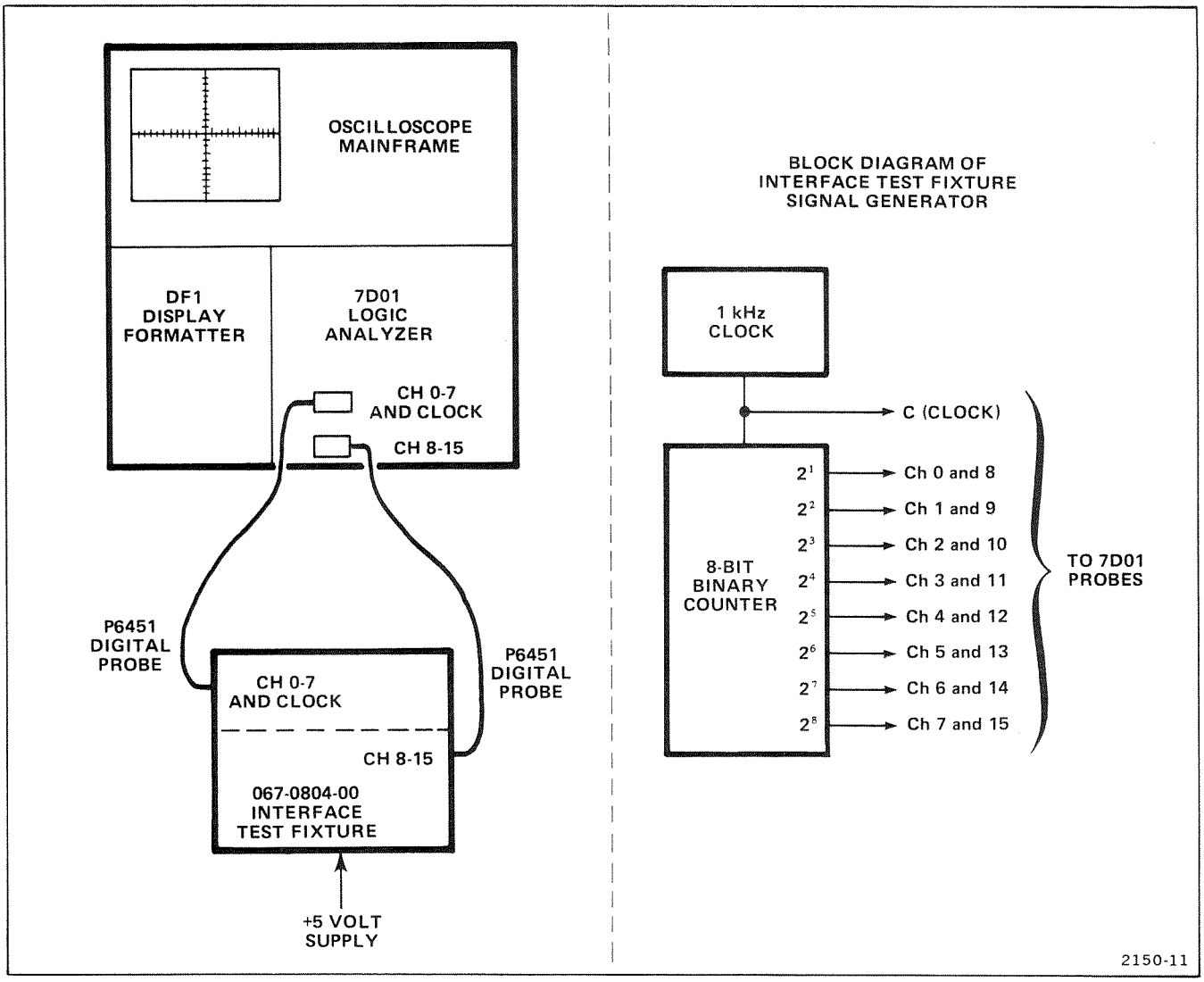

Figure 2-6. Test setup for Functional Check procedure.

3. Rotate the 7D01 Cursor Position controls and note that the cursor point (indicated by a + symbol) can be manually sequenced through the Data as indicated by the trigger-to-cursor readout.

4. Press the SLOW MAP push button and check that the cursor symbol sequences automatically through the data at a slow rate. Press the FAST MAP push button and check that the cursor sequences through the data at a fast rate.

5. Disconnect the channel 5 input from the Interface Test Fixture. Press the 7D01 Record Manual Reset push button and check that the Map display changes to 2 broken diagonal lines (see Fig. 2-8). Reconnect the channel 5 input signal.

STATE TABLE DISPLAYS

1. Perform the Setup Procedure.

2. Press the STATE TABLE HEX push button. Then, press the TIMING DIAGRAM push button and check for 16 channels of data on the crt. Note the logic-state readout of the cursor word, in hexadecimal code, at the bottom of the crt.

3. Press the STATE TABLE HEX and 7D01 ONLY push buttons. Check for a State Table display on left side of the crt in hexadecimal code (base 16). Note that the cursor word (top word in state table) is the same as the cursor word in the Timing Diagram display noted in step 2 and

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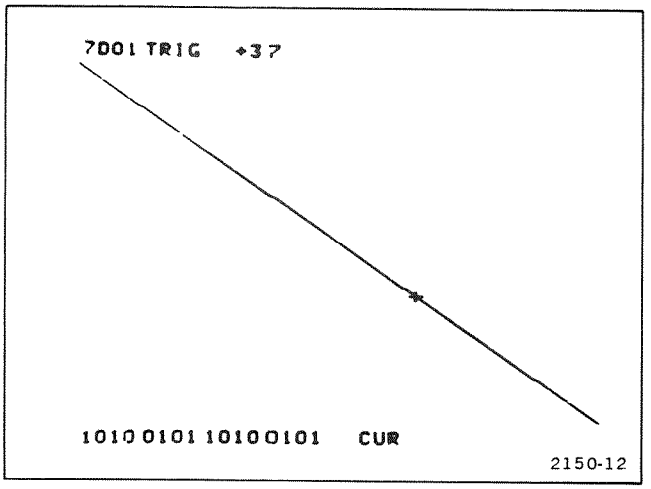


Figure 2-7. Typical map display of 16 channels from the 067-0804-00 Interface Test Fixture.

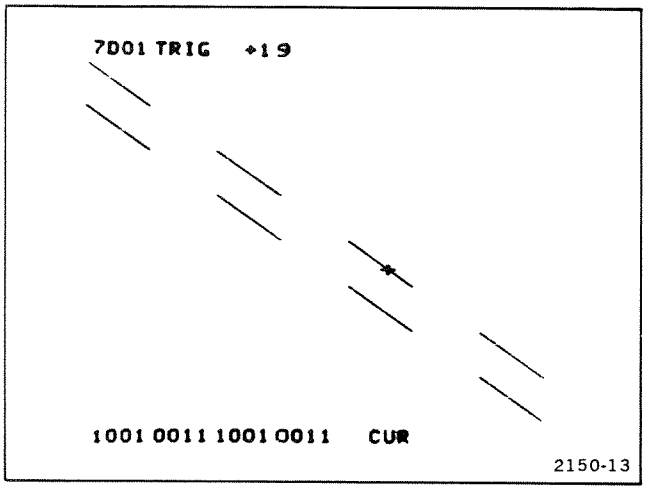


Figure 2-8. Typical map display of 15 channels from the 067-0804-00 Interface Test Fixture (channel 5 input disconnected).

that the trigger-to-cursor readout is +0. Check that the cursor word is blinking and that the trigger word (bottom) is the same as the cursor word. (Ignore the *'s displayed in the bottom two lines of data.)

4. Rotate the 7D01 Cursor Fine Position control counter-clockwise, 1 bit at a time, until the trigger-to-cursor readout is −16. Check that the blinking word is the seventeenth word in the State Table display.

5. Press the STATE TABLE OCTAL push button. Check that the State Table display is given in the octal (base 8) code.

6. Press the STATE TABLE BINARY push button. Check that the State Table display is given in the binary (base 2) code. Press the NEG LOGIC push botton and check that all zeros become ones and that all ones become zeros.

7. Turn off power to the oscilloscope mainframe, wait a short time, and turn power on (Power-On mode). Check crt for Timing Diagram display with trigger-to-cursor readout of zero.

8. Press the STATE TABLE BINARY push button and note the State Table display on the left half of the crt. Press the 7D01 ⊖ INTENS REF push botton and check for a reference state table on the right side of the crt, in addition to the 7D01 state table. Note that the reference state table is all zeros and that the ones in the 7D01 state table are intensified.

9. Press the SEARCH push botton and check that a match of the cursor word in the reference state table (all zeros) is found in the 7D01 memory and transferred to the 7D01 cursor word position (first word in the 7D01 state table). Note that the trigger-to-cursor readout in the 7D01 state table represents the position in memory of the matching word.

10. Set the 7D01 Cursor Position controls for a trigger-to-cursor readout of +0. Press the STORE 7D01→REF push button and check that the 7D01 display is transferred into the reference memory. Note that the trigger-to-cursor readout is +0 for both state tables displayed, and that there are no intensified characters in the 7D01 state table.

11. Press the REF TABLE FOLLOWS 7D01 push button. Rotate the 7D01 Cursor Position controls and check that the trigger-to-cursor readout of the reference state table follows the trigger-to-cursor readout of the 7D01 state table.

12. Press the REF TABLE HELD push button. Rotate the 7D01 Cursor Position controls. Check that the trigger-to-cursor readout in the 7D01 state table changes and the trigger-to-cursor readout in the reference state table remains fixed. Note that intensified bits in the 7D01 state table indicate differences between the displayed state tables.

13. Rotate the 7D01 Cursor Position controls to set the 7D01 trigger-to-cursor readout to +5 and press the REF TABLE FOLLOWS W/OFFSET push button. Rotate the 7D01 Cursor Position controls and check that the

trigger-to-cursor offset between state tables is maintained (offset is obtained in REF TABLE HELD mode).

14. Press the COLUMN BLANK→ push button and check that columns of data are blanked from the State Table displays. The blanked columns are interpreted as "don't care" information for state table comparisons. Press the COLUMN BLANK← push button and check that the blanked columns of data are restored.

15. Press the REF TABLE FOLLOWS 7D01 push button. Check that both state tables have the same trigger-to-cursor readout and that there are no intensified characters in the 7D01 state table. Check that the TABLES= indicator is illuminated.

16. Press the RESET IF TABLES= push button. Check that the state tables are displayed and then reset. The number of resets is displayed below the reference state table. Disconnect channel 0 from the 067-0804-00 Interface Test Fixture. Check that the state tables are not reset and that the number of resets, before the difference, is displayed on the crt. Check that intensified characters in the 7D01 state table are all in the right-hand column (channel 0). Reconnect the channel 0 input to the Interface Test Fixture.

17. Press the RESET IF 7D01=REF push button. Then press the 7D01 Record Manual Reset push button. The 7D01 is reset each time the 7D01 memory and the DF1 reference memory are equal. Check that the number of resets is displayed on the crt readout. Disconnect channel 0 from the 067-0804-00 Interface Test Fixture. Check that both state tables are displayed and that the intensified characters in the 7D01 state table are all in the right-hand column (channel 0). Check that the number of resets, before the difference, is displayed below the reference state table. Reconnect channel 0 to the Interface Test Fixture.

FRONT-PANEL ADJUSTMENTS

1. Perform the Setup Procedure.

2. Rotate the 7D01 Horizontal Position control and note that it horizontally positions the Timing Diagram display. Rotate the 7D01 Horizontal Magnification control and note that it controls the horizontal size of the Timing Diagram display.

3. Rotate the 7D01 Vertical Position control and note that it vertically positions the Timing Diagram display. Rotate the 7D01 Vertical Magnification control and note that it controls the vertical size of the Timing Diagram display.

4. Rotate the DF1 VERT POSN screwdriver adjustment and check that it controls the vertical position of the display readout. Rotate the DF1 VERT SIZE screwdriver adjustment and check that it controls the vertical size of the readout display.

5. Rotate the DF1 HORIZ POSN screwdriver adjustment and check that it horizontally positions the readout display.

6. Rotate the DF1 INTENS CONTRAST screwdriver adjustment and note that it controls the brightness of the readout display.

7. Press the MAP SLOW push button. Rotate the DF1 VERT SIZE screwdriver adjustment and check that it controls the vertical size of the entire Map display. Rotate the DF1 VERT POSN screwdriver adjustment and check that it controls the vertical position of the entire Map display.

8. Rotate the DF1 HORIZ POSN screwdriver adjustment and check that it horizontally positions the entire Map display.

9. Rotate the DF1 INTENS CONTRAST screwdriver adjustment and note that it controls the brightness of the readout display.

10. Press the STATE TABLE BINARY and 7D01 ⊖ INTEN REF push buttons. Rotate the DF1 VERT SIZE screwdriver adjustment and note that it controls the vertical size of the entire State Table display. Rotate the DF1 VERT POSN screwdriver adjustment and note that it vertically positions the entire State Table display.

11. Rotate the DF1 HORIZ POSN screwdriver adjustment and check that it horizontally positions the entire State Table display.

12. Rotate the DF1 INTENS CONTRAST screwdriver adjustment and check that it controls the brightness of the intensified characters in the 7D01 State Table display.

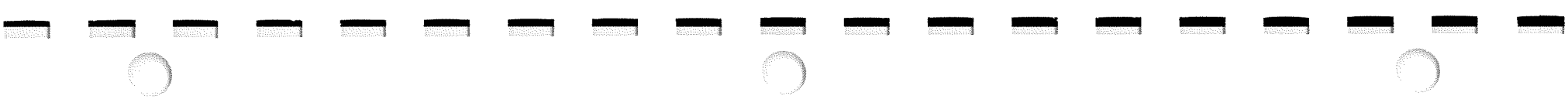
NOTE

The Functional Check procedure is provided for familiarization and for checking basic functions of the DF1 Display Formatter. These functions are checked without removing the covers or making internal connections. Performance requirements, functions which require removal of side panels, and detailed checks of the DF1 memory are provided in the Performance Check and Adjustment procedures in the DF1 Instruction Manual. Only qualified service personnel should perform checks given in the Instruction Manual.

INSTRUMENT OPTIONS

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

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



MANUAL CHANGE INFORMATION

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

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

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

SERVICE NOTE

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

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

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

Comparison of Main Characteristics

DM 501 replaces 7D13		
PG 501 replaces 107	PG 501 - Risetime less than 3.5 ns into 50 Ω.	107 - Risetime less than 3.0 ns into 50 Ω.
108	PG 501 - 5 V output pulse; 3.5 ns Risetime.	108 - 10 V output pulse; 1 ns Risetime.
111	PG 501 - Risetime less than 3.5 ns; 8 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger Pulse delay.
114	PG 501 - ±5 V output.	114 - ±10 V output. Short proof output.
115	PG 501 - Does not have Paired, Burst, Gated, or Delayed pulse mode; ±5 V dc Offset. Has ±5 V output.	115 - Paired, Burst, Gated, and Delayed pulse mode; ±10 V output. Short-proof output.
PG 502 replaces 107		
108	PG 502 - 5 V output	108 - 10 V output.
111	PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay.
114	PG 502 - ±5 V output	114 - ±10 V output. Short proof output.
115	PG 502 - Does not have Paired, Burst, Gated, Delayed & Undelayed pulse mode; Has ±5 V output.	115 - Paired, Burst, Gated, Delayed & Undelayed pulse mode; ±10 V output. Short-proof output.
2101	PG 502 - Does not have Paired or Delayed pulse. Has ±5 V output.	2101 - Paired and Delayed pulse; 10 V output.
PG 506 replaces 106	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V.
067-0502-01	PG 506 - Does not have chopped feature.	0502-01 - Comparator output can be alternately chopped to a reference voltage.
SG 503 replaces 190, 190A, 190B	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
191	SG 503 - Frequency range 250 kHz to 250 MHz.	191 - Frequency range 350 kHz to 100 MHz.
067-0532-01	SG 503 - Frequency range 250 kHz to 250 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
TG 501 replaces 180, 180A	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Marker outputs, 5 sec to 1 μs. Sinewave available at 20, 10, and 2 ns. Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously.
181	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns.	181 - Marker outputs, 1, 10, 100, 1000, and 10,000 μs, plus 10 ns sinewave.
184	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	184 - Marker outputs, 5 sec to 2 ns. Sinewave available at 50, 20, 10, 5, and 2 ns. Separate trigger pulses of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs. Marker amplifier provides positive or negative time marks of 25 V min. Marker intervals of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs.
2901	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	2901 - Marker outputs, 5 sec to 0.1 μs. Sinewave available to 50, 10, and 5 ns. Separate trigger pulses, from 5 sec to 0.1 μs. Multiple time-marks can be generated simultaneously.

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

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MANUAL CHANGE INFORMATION

PRODUCT DF1
070-2149-00

CHANGE REFERENCE C1/1276
DATE 12-14-76

CHANGE:	DESCRIPTION

TEXT CORRECTION

Page 2-9 FUNCTIONAL CHECK

SETUP PROCEDURE, Step 3, Word Recognizer

CHANGE TO READ:

Word Recognizer.....CH 0 through CH 6 - LO

CH 7 HI

CH 8 through CH 15 - X

External Qualifier - X

Probe Qualifier - X