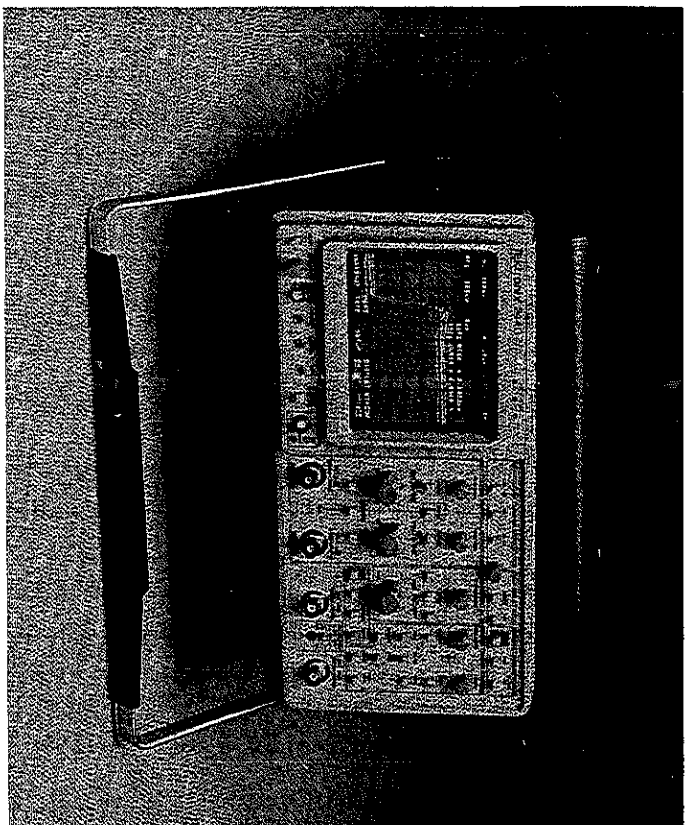


TEK 2440 USER REFERENCE
GUIDE

070-6600-00
Product Group 37

2440

**DIGITAL OSCILLOSCOPE
USER REFERENCE GUIDE**



Tektronix
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TEK

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2440
DIGITAL
OSCILLOSCOPE
USER REFERENCE GUIDE

*Please Check for
CHANGE INFORMATION
at the Rear of This Manual*

First Printing SEP 1987
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Tektronix
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Instrument Serial Numbers

Each instrument manufactured by Tektronix has a serial number on a panel insert or tag, or stamped on the chassis. The first letter in the serial number designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B010000	Tektronix, Inc., Beaverton, Oregon, USA
E200000	Tektronix United Kingdom, Ltd., London
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heeraven, The Netherlands

Instruments manufactured for Tektronix by external vendors outside the United States are assigned a two digit alpha code to identify the country of manufacture (e.g., JP for Japan, HK for Hong Kong, etc.).

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

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SAFETY NOTE

This manual is a quick reference guide to the 2440 features. It does not replace the 2440 Operators manual. The 2440 Operators manual (070-65599-00) contains information related to safe use of this instrument as well as information necessary to prevent damage to the instrument or to other property. Users should refer to the 2440 Operators manual before operating this instrument. In particular, read the Operators Safety Summary at the beginning of the Operators manual, and Preparation for Use in Section 1.

GETTING STARTED

For help in locating the controls, see Figure 1, Front-Panel Buttons and Controls on page 8.

Power On

Press the **POWER** button, located on the front panel below the CRT. Note the following:

- **The power-on test executes:** The screen blanks momentarily as the 2440 runs its internal tests and diagnostics. When the test progresses to the point where messages can be displayed, **RUNNING SELF TEST** appears on the CRT. The 2440 does a power-on test each time it is turned on.
- **The test concludes:** At the end of the self test, the message **RUNNING SELF TEST** is removed. If the test was successful, one of two things happens:

If the scope was actively acquiring when powered down (a live waveform or trace was on screen), it comes up actively acquiring, with the same front-panel setup in effect when it was turned off.

If the scope was in **SAVE** mode (a frozen waveform or trace on screen), it comes up in **SAVE** mode with the message **SCOPE IS NOW IN SAVE MODE PUSH ACQUIRE TO START ACQUIRING NEW WAVEFORM** displayed. (If so, go ahead and press the **STORAGE ACQUIRE** button.)

If the self test was unsuccessful, the 2440 enters the Extended Diagnostics menu (see **MENU OFF/EXTENDED FUNCTIONS** below for explanation). The scope may still be usable if the failed area does not affect the measurements to be made. Press the **MENU OFF/EXTENDED FUNCTIONS** button, located left of the **POWER** button, to exit Extended Diagnostics and enter Scope mode.

Several conditions can cause the power-on Self Diagnostics to fail; some of these are:

- Last power down occurred under abnormal conditions (unexpected power loss, line voltage surges, etc.).
- Last **SELF CAL** was performed at a temperature much higher or lower than the present operating temperature, or before the **NOT WARNMED UP** message disappeared in the **CAL/DIAG** menu.

- Last EXT CAL was unsuccessful or incomplete
- A component(s) failed.

If power-on Self Diagnostics did fail, allow the instrument to warm up and perform a SELF CAL as outlined in the procedure that follows. If afterwards the instrument still enters the Extended Diagnostics menu or displays FAIL or UNCALD status is displayed in the CAL/DIAG menu, read Power-on Self Diagnostic Failure in Appendix A of the Operators manual to determine if the scope can be used to make your measurements. However, even if you can make the measurements, repeated FAIL or UNCALD status means you should have calibration checked by a qualified service person.

NOTE

For certain types of power-on Self Diagnostics failures, the 2440 is intentionally locked up in the Extended Diagnostics menu in order to force the operator to do a SELF CAL. (See Appendix A in the Operators manual.) This is done to prevent loss of internal calibration constants that a SELF CAL can preserve. If such a case, skip Step 1 in the SELF CAL procedure that follows and instead push the CAL/DIAG menu button to get to the SELF CAL menu. Continue with the procedure at Step 2.

SELF CAL

The CAL/DIAG menu found under the Extended Function menu can be used to optimize instrument performance at any time. Do the following:

1. Display the CAL/DIAG menu: If another menu is displayed, press the **MENU OFF/EXTENDED FUNCTIONS** button once to remove that menu and again to display the Extended Functions menu. Press it once if no menu is displayed. Now, select CAL/DIAG.

NOTE

The CAL/DIAG menu displays the message NOT WARNED UP for about ten minutes after each power-on; wait for the message to disappear before performing a SELF CAL.

NOTE

To select a menu item, push the menu button below the item. To turn on an item underline the item by pushing the menu button below the item. To turn off the item, push the menu button again to remove the underline.

2. Execute a SELF CAL: Select SELF CAL. The message RUNNING is displayed while the self calibration executes. When finished, the label PASS or FAIL, depending on the outcome, appears above the SELF CAL menu item and the message RUNNING is removed.
3. Exit the CAL/DIAG menu: Press the **MENU OFF/EXTENDED FUNCTIONS** button to remove the menu.

System Setup

Here we set up certain features that, once set, are not often changed.

1. Display the Extended Function menu: If another menu is displayed, push the **MENU OFF/EXTENDED FUNCTIONS** button once to remove that menu and again to display the Extended Functions menu. Push it once if no menu is displayed.
2. Choose Front-panel Setup for Power-up: Select SYSTEM and, when the menu changes, select INIT PANEL. If you would like the default front-panel settings (see Table B-15 in Appendix B of your Operators manual) implemented every time the scope is powered up, set PWR ON LAST|INIT to INIT. If you would rather have the same settings in effect when the power was turned off, set PWR ON LAST|INIT to LAST.

NOTE

To set a menu item, such as PWR ON LAST|INIT to LAST or INIT, underline the setting you need. To do this, push the menu button below the menu item to toggle between the two settings.

3. Set the Warning Bell: Push the up-arrow (↑) to return to the SYSTEM menu, then select MISC. If you want the bell to ring when SAVE ON A occurs, when a user warning is issued over the GPIB, etc., set BELL ON|OFF to ON; otherwise set it to OFF. (If you're not sure, turn it ON—it doesn't hurt anything.)
4. Set the Trigger-Point Indicator: If you would like a T to mark the point on the waveform where the trigger occurred, set TRIG T ON|OFF to ON; if not, set TRIG T to OFF. (Most often it is left on.)

NOTE

The next step uses the ROLL MENUS ON|OFF feature. This feature allows you to, after pushing a menu button to select certain menus, use repeated pushes of that same button to roll through two or more of the menu choices. When familiar with this feature, you may want to turn it ON in the menu. However, until then, it is recommended it be left OFF so as to avoid accidentally changing the menu. Instead, use the menu to make all menu changes. You can read about ROLL MENUS ON|OFF in Appendix A of your Operators manual.

5. Set ROLL MENUS Option: If you want to be able to roll through menu choices in certain menus by just repeatedly pushing the button that called up the menu, set ROLL MENUS ON|OFF to ON; if not, set ROLL MENUS to OFF. (See NOTE above.)
6. Set up Interpolation Modes: Push the up-arrow (↑) to return to the SYSTEM menu, then select INTERP. Selections in this menu are described in Appendix A of the Operators Manual; unless you've read the descriptions and know that you want to change these menu settings, set INTERPOLATION MODE to SIN/X, PREFILT ON|OFF to ON, and INTENSE REALS ON|OFF to ON. (Interpolation mode must be set to Sine x/x to get specified REPET mode bandwidth.)
7. Exit Extended Functions menu: Push the MENU OFF/EXTENDED FUNCTIONS button to clear menu.

Initialization

Set the front panel to the default settings and get a triggered display on screen. Use this setup to explore the front-panel buttons and menus or as a starting point for setting up measurements.

1. Input the CALIBRATOR Signal: Connect a standard accessory probe to the CH 1 input BNC; then connect the probe tip to the CALIBRATOR loop. Connect the probe ground lead to scope ground.
2. Initialize the Front-Panel: Press SETUP PRGM button to display the AUTOSTEP SEQUENCER menu; then select INIT PANEL.

All the settings listed in Table B-15 in Appendix B of your Operators manual are now in effect. The following are the INIT settings for some of the major controls.

VERTICAL MODE	CH 1
CH 1 and CH 2 VOLTS/DIV	1 V (with 10X probe)
SEC/DIV	1 ms
TRIGGER MODE	AUTO LEVEL
TRIGGER SOURCE	VERT (CH 1)
CH 1 and CH 2 COUPLING	DC
STORAGE MODE	ACQUIRE
ACQUIRE MODE	NORM

Hints and Helps

- INIT@50%: If, after an Init Panel or an Auto Setup (or anytime), you've got a signal on screen that's not triggered, push INIT@50% to quickly get a stable trigger (assumes adequate trigger source and trigger settings).
- AUTO SETUP: If you've got a signal that you cannot view on screen (too big or small for the screen, or wrong SEC/DIV), press the SETUP AUTO button to quickly get a viewable signal on screen.

NOTE

Connecting a probe to the signal source and pressing the **SETUP AUTO** button will provide a scaled and triggered display. If no vertical channel is selected Auto Setup will default to Channel 1. Auto Setup will not change the channel selected if either or both of the two channels are on. If the display intensity is set too low and the scaled display is not easy to see, Auto Setup boosts intensity so the display can be seen. Auto Setup does not affect readout or graticule intensity.

- **AUTO LEVEL:** If you've removed all trigger inputs from the scope and now it takes a long time to respond to the front-panel (sometimes you have to push a button more than once), press the **TRIGGER MODE** button and turn on **AUTO** instead of **AUTO LEVEL**. That way, the scope won't spend its time trying to trigger on a signal that isn't there.

- **ALIASED DISPLAY:** If you've got a signal that is jittery, unstable, and/or oscillating, but the **TRIG'D** light is on to indicate you are triggered, the display is probably aliased. Try increasing the **SEC/DIV** setting until the display is stable.

- **ACQUIRE:** If the scope is not acquiring, press the **STORAGE ACQUIRE** button. For a continuously acquiring live display on screen, the following must be true:

Storage mode must not be **SAVE**; if so, press the **STORAGE ACQUIRE** button to begin acquiring.

A Vertical mode must be turned on (**CH 1**, **CH 2**, **ADD**, etc.).

The display must not be vertically positioned off screen, either by the **VERTICAL POSITION** control(s) or a large DC offset at the input. The ground (+) and trigger position (T) indicators will be rallied at the top or bottom of the screen if such is the case.

Trigger mode menu must not be set to **SINGLE SEQ**. Neither may the menu be set to **NORMAL** unless an adequate trigger source is input and adequate trigger settings made to trigger on that source.

Intensity must not be set too low. Press the **SELECT** button (next to the **INTENSITY** control), turn **DISP** on, and use the **INTENSITY** control to increase intensity. Or, if display and readout are both not visible on screen, press the **STATUS/HELP** button. This automatically sets the intensity of the readout to a visible level, 35%; then proceed as just described.

FRONT PANEL

Use Figure 1 to locate any front-panel control or button of interest. The figure identifies the front-panel section (Vertical, Storage, etc.) in which each control or button is found. Control number 1 will be described first in this guide (look for a ①) followed by control number 2, etc. When a button calls up a menu, that menu will be shown with the appropriate button.

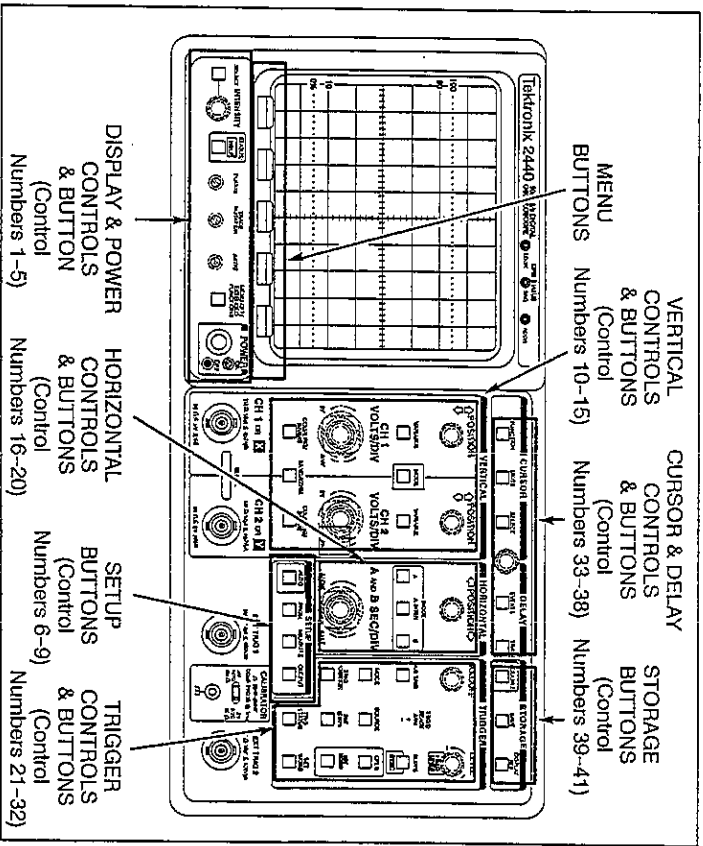


Figure 1: Front Panel buttons and Controls.

CRT READOUT and STATUS MENU Display

Use Figure 2 to locate the various readouts, indicators, etc., that can appear on the front panel for the 2440's many modes and features.

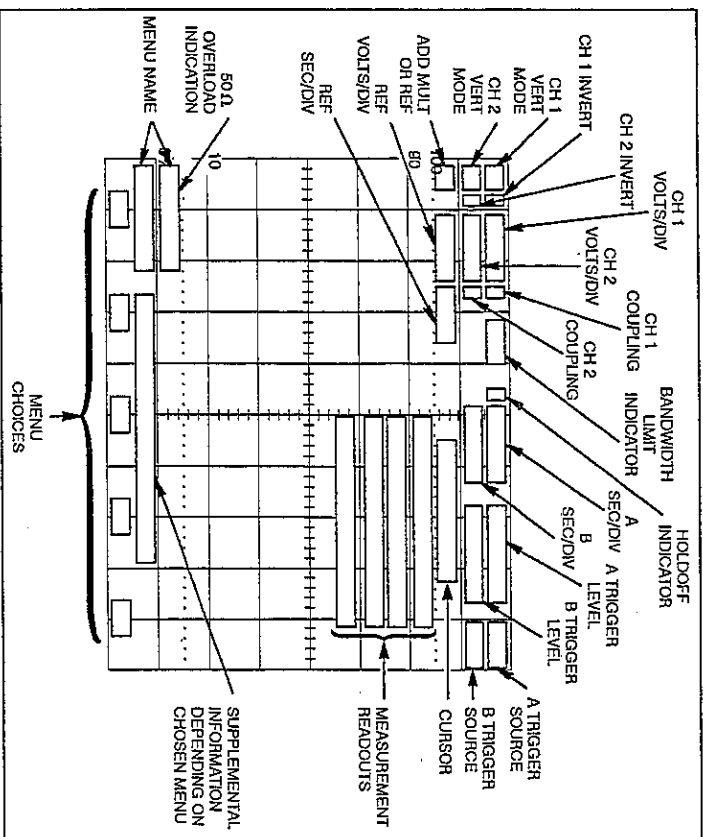


Figure 2: CRT Readout Display.

Figure 3 shows the Status menu display that appears on screen when the STATUS/HELP button is pressed. Use the display to get an overview of the instrument's setup and status at the time the STATUS/HELP button is pressed. Use that information to determine if the scope is operating in the desired mode(s), or if it's set in a conflicting mode, causing the instrument to operate in an unexpected manner. (A conflicting mode might be SAVE acquisition mode when you're expecting the scope to be continuously acquiring.)

IN THE READOUT, ACTIVE SECTIONS ARE UNDERSCORED, IF BOTH A AND B HORIZONTAL MODE ARE UNDERSCORED, THE HORIZONTAL MODE IS A INTEN.

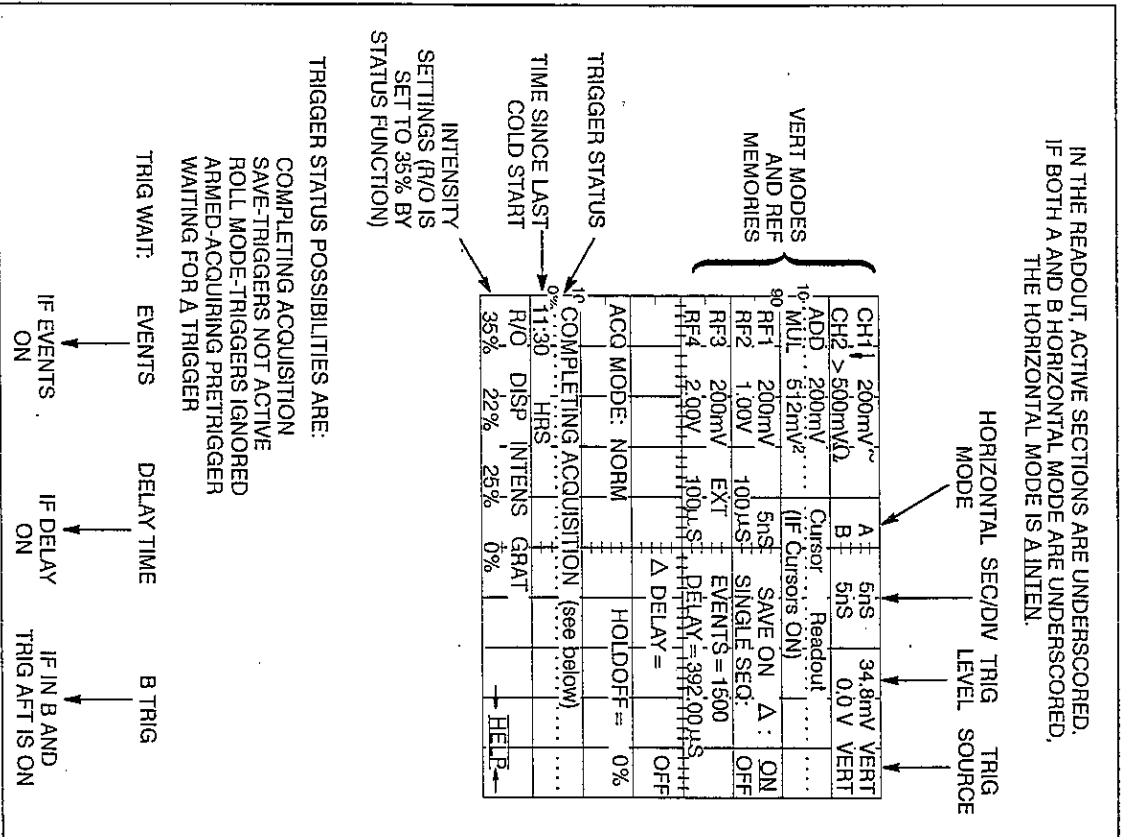


Figure 3: Status Menu Display.

Take time to become familiar with Figure 2 — with each readout component's location and its meaning — and with the Status menu display. Knowing where the various display components appear on screen and what the status is for the various operating modes will help you determine the cause of possible operational difficulties. Pay special attention to the TRIGGER STATUS and ACQ MODE lines in the Status menu, since they tell you what the instrument is currently doing.

CRT DISPLAY and POWER

1 POWER Button

Powers the instrument on and off. Does a power-on self test with each turn on. (See Power On in Section 1 for a more detailed description of POWER.)

2 MENU OFF/EXTENDED FUNCTIONS Button

Turns off any displayed menu or turns on the EXTENDED FUNCTIONS menu if a menu is not being displayed. When pressed to remove a menu display, all the scope hardware is reset to match the soft front-panel settings. Messages sent via GPIB will be erased. (See Power On and System Setup in Section 1 for a more detailed description of MENU OFF/EXTENDED FUNCTIONS.)

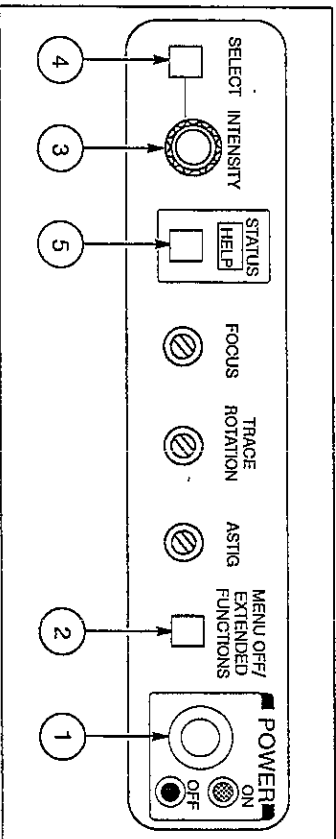


Figure 4: CRT Display Controls and Buttons, and POWER Button.

3 INTENSITY Control

A continuous rotating pot, the **INTENSITY** control adjusts the Intensity of any of four screen elements (READOUT, DISPLAY, INTENS, and GRATTCULE). It always controls the element last selected in the **SELECT** menu. When the **STATUS/HELP** button is pressed, it controls the readout intensity.

4 SELECT Button

Displays the menu for adjusting intensity. Subsequent presses of the **SELECT** button toggles the menu between READOUT and DISPLAY after turning on the menu if ROLL MENU is set to ON (see System Setup in Section 1).

5 STATUS/HELP Button

Displays a Status menu (see page 10) which can help you determine why a display is not seen or triggering is not occurring. (Also, provides access for **HELP**; see CRT Readout and Status Menu Displays on page 9.) In case of unexpected operation (no display, or display frozen and not actively acquiring on screen), look for these common conditions:

- Is a Vertical mode turned on? (Underline one or more of CH 1, CH 2, ADD, etc. in the Vertical mode menu.)
- Is the DISPLAY intensity set high enough? (Set it to above approximately 23% in Intensity menu of the **SELECT** button.)
- Is SINGLE SEQ. on and is the Trigger Status line displaying the message SAVE TRIGGERS NOT ACTIVE? (Change trigger mode or press the **STORAGE ACQUIRE** button to rearm the trigger system and acquire another single-sequence acquisition.)
- Is SINGLE SEQ. on and is the Trigger Status line displaying the message WAITING FOR TRIGGER? (Change trigger mode or set up trigger controls to provide the trigger needed to complete the single sequence acquisition.)

- Is NORMAL mode on in the Trigger mode menu and is the Trigger Status line displaying the message WAITING FOR TRIGGER? (Change trigger mode or set up trigger controls to provide the trigger needed to trigger acquisitions.)
- Is the Trigger Status line displaying the message SAVE - TRIGGERS NOT ACTIVE? (Press the STORAGE ACQUIRE button.)
- Is Events on and is the Trigger Status line displaying the message TRIG WAIT/EVENTS or WAITING FOR A TRIGGER? (If status line is the former, set up the B-Trigger system's controls to provide the events signal; if the latter, set up the A-Trigger system to provide the trigger.)

4

Table 1: Menu Off/Extended Functions Menu (SN B011821 & Above)

2	MENU OFF/EXTENDED FUNCTIONS	Turns off any menu being displayed or, if none is on, calls up the EXTENDED FUNCTIONS menus. See Appendix A in the Operators Manual for the Extended Functions Calibration and Diagnostics menus.
	EXT FUNCT	SYSTEM SPECIAL CAL/DIAG
	PANEL	Second-level menu for SYSTEM. MISC INTERP VIDEO OPT ↑
	LAST INIT	Third-level menu for PANEL. -----TEKSECURE----- PWR ON ERASE MEMORY ↑
	ERASE	Fourth-level menu for --TEKSECURE-- ERASE MEMORY. WARNING: WFM & PRGM MEMORY WILL BE ERASED. ABORT
	BELL ON/OFF	Third-level menu for MISC. TRIG T AUTO ROLL MENUS ON/OFF ON/OFF PROBE ON/OFF ↑

Table 1: Menu Off/Extended Functions Menu (SN B011821 & Above) (Cont.)

	SELECT PROBE IDENTIFY FUNCTION	Fourth-level menu for AUTO PROBE.
	AUTO SETUP	STEP PRGM INT@50% SAVE/ACQUIRE ↑
	INTERPOLATION	Third-level menu for INTERP. -----MODE----- LINEAR SINX/X REALS PREFLT ON/OFF ON/OFF ↑
	TV SYS M/NON/M	Third-level menu for VIDEO OPT. CNT RST BOTH F1 ↑
	START	Second-level menu for SPECIAL. WARNING: SERVICE ONLY - SEE MANUAL (if enabled) DISABLED - SEE MANUAL (if disabled) COLD CCD ADJ CAL PATH FORCE SIDES ADJ ON/OFF DAC
	CAL	Second-level menu for CAL/DIAG. (The status message NOT WARMED UP above menu item EXT DIAG will be displayed for 10 minutes after powering up. The message will be removed after that time.) <status> <status> <status> NOT WARMED UP SELF EXT SELF EXT CAL CAL DIAG DIAG

4

Table 1: Menu Off/Extended Functions Menu
(SN B011820 & Below) (Cont.)

2	MENU OFF/ EXTENDED FUNCTIONS	Turns off any menu being displayed or, if none is on, calls up the EXTENDED FUNCTIONS menus. See Appendix A in the Operators Manual for the Extended Functions Calibration and Diagnostics menus.	
		EXT FUNCT	SYSTEM SPECIAL CAL/DIAG
Second-level menu for SYSTEM.		PANEL MISC	PREFLT ON OFF VIDEO OPT
Third-level menu for PANEL.		PWR ON LAST INIT	ERASE MEMORY
Fourth-level menu for ERASE MEMORY. WARNING: WFM & PRGM MEMORY WILL BE ERASED.		ERASE	ABORT
Third-level menu for MISC.		BELL ON OFF	TRIG T AUTO ON OFF PROBE
Fourth-level menu for AUTO PROBE. SELECT PROBE IDENTIFY FUNCTION		ROLL MENU ON OFF	
AUTO SETUP		STEP PRGM . INIT@50%	SAVE/ ACQUIRE ↑
Third-level menu for SYSTEM VIDEO OPT.		TV SYS M NON/M	CNT RST BOTH F1 ↑

Table 1: Menu Off/Extended Functions Menu
(SN B011820 & Below) (Cont.)

Second-level menu for SPECIAL.		WARNING: SERVICE ONLY --SEE MANUAL (if enabled) DISABLED --SEE MANUAL (if disabled)	
COLD START	CCD SIDES	CCD ADJ	CCD CAL PATH ON OFF FORCE DAC
Second-level menu for CAL/DIAG.		<status > SELF CAL	<status > EXT CAL
		<status > SELF CAL	NOT WARMED UP EXT DIAG

Table 2: CRT Display Menus

4 SELECT	INTENSITY READOUT DISP INTENS GRAT VECTORS ON OFF INTENS: Controls brightness of intensified zone in A Intensified. GRAT: Controls graticule intensity.
5 STATUS/HELP	Displays Instrument Status menu; sets readout intensity to 35% (insures readout is visible); temporarily switches the INTENSITY knob to control readout intensity (switches back to the element last controlled when Status menu is removed). The top three lines of the Status menu update as any of the front-panel controls associated with those lines are changed; the remainder of the display updates when the STATUS/HELP button is pressed. Pressing the MENU OFF/EXTENDED FUNCTIONS button or any front-panel control that displays a menu removes the STATUS display from the CRT. Pushing HELP in the Status menu invokes a mode where operating any front-panel control or button causes a screen full of information about that button or control. If -MORE - appears at the lower-left corner of the screen, pushing MORE causes additional information to be displayed. Press EXIT to return to normal operation.

SETUP: AUTO and PRGM

6

AUTO Button

Pressing the SETUP AUTO button causes the scope to do an Auto Setup, which automatically sets up the vertical, horizontal, and trigger controls to display an input signal on the selected vertical channel or channels.

View

Sets up the display for best overall veiwimg. The vertical scale is determined by the peak value of the waveform, including any DC offset.

Period

Scales the waveform to optimize the display of one period according to the RES HI|LO selection. The trigger POSITION is set to 1/32, and the trigger SLOPE is set to (+).

Pulse

Scales the waveform to optimize the display of the minimum pulse width according to the RES HI|LO selection. The trigger POSITION is set to 1/32, and the trigger SLOPE is set to the polarity of the leading edge of the selected pulse.

Edge (Rising)

Scales the waveform to optimize the display of its rising edge according to the RES HI|LO selection. The trigger POSITION is set to 1/2, and the trigger SLOPE is set to (+) to display the rising edge.

Edge (Falling)

Scales the waveform to optimize the display of its falling edge according to the RES HI|LO selection. The trigger POSITION is set to 1/2, and the trigger SLOPE is set to (-) to display the falling edge.

RES HI|LO

Selects the resolution that Auto Setup targets when scaling the waveform. In LO, the scaling is optimized for user viewing over the ten divisions of the screen; in HI, the scaling is optimized for viewing over the 20 divisions of record length.

RES HI|LO does not effect VIEW mode and is removed from the menu when VIEW is selected. For PULSE, PERIOD, and EDGE modes, the RES HI|LO selection influences both vertical and horizontal scaling.

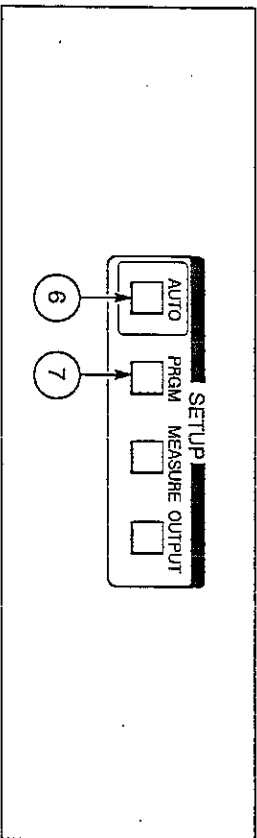


Figure 5: AUTO and PRGM Buttons.

7

PRGM Button

Pressing the SETUP PRGM button displays the AUTOSTEP SEQUENCER menu. This menu lets you save 50 to 200 front-panel setups with associated control and I/O actions under a name you choose. As many as 40 of these test or measurement procedures can be created and named, then saved, and later recalled all from this menu.

To save a single front panel setup as an AutoStep sequence:

1. Press the SETUP PRGM (Program) button.
2. Select SAVE menu button.
3. Select SAVE menu button in second level menu.
4. Set up front panel that you want to save.
5. Press the SETUP PRGM (Program) button.
6. Select SAVE SEQ menu button.

To later recall a front-panel setup or a sequence of front-panel setups previously saved:

1. Press the SETUP PRGM (Program) button.
2. Select RECALL menu button (menu changes to second level).
3. Use the arrow-labeled buttons to underline name of saved front-panel setup.
4. Select RECALL menu button.

Table 3: AUTO and PRGM Menus

6	AUTO	VIEW	PERIOD	PULSE	EDGE RES	HILLO
7	PRGM	-----AUTOSTEP SEQUENCER-----			MEMORY n1%	
		SAVE	RECALL	DELETE	EDIT	INIT PANEL
		Second-level menu for SAVE.				
		USE ARROW KEYS TO CHANGE NAME:				
		ROLL-CHARS		CURSOR	SAVE	EXIT
		↓		<	>	
		Instruction message displayed after pushing SAVE. (This message is displayed any time the user is expected to setup the front-panel controls.)				
		SETUP CONTROLS, PUSH PRGM TO CONTINUE				
		SEQUENCE < name > STEP < num > MEMORY < % >				
		Third-level menu for second-level SAVE. This menu is displayed after pushing PRGM as directed in the instruction message.				
		SEQUENCE < name > STEP < num > MEMORY < % >				
		BEGIN STEP	< N >	PRINT/PLOT	< N >	
		REPEAT	< N >	BELL	< N >	
		SELF-CAL.	< N >	SRQ	< N >	
		LOAD PANEL	< N >	PAUSE	< N >	
		AUTOSETUP	< N >	PROTECT	< N >	
		MEASUREMENTS		END STEP	< N >	
		SET STEP ACTIONS				
		↓		Y/N	NEXT STEP	SAVE SEQ

Table 3: AUTO and PRGM Menus (Cont.)

Second-level menu for RECALL.		
First Labeled Sequence		
Second Labeled Sequence		
nth Labeled Sequence		
↓	SELECT-----	RECALL
↓		EXIT
Second-level menu for DELETE.		
First Labeled Sequence		
Second Labeled Sequence		
nth Labeled Sequence		
↓	SELECT-----	DELETE
↓		EXIT
Second-level menu for EDIT.		
First Labeled Sequence		
Second Labeled Sequence		
nth Labeled Sequence		
↓	SELECT-----	EDIT
↓		COPY
↓		EXIT
Third-level menu for EDIT.		
SELECT-----	DELETE	
↓	TO BUF	ADD
↓		EXIT
Fourth-level menu for ADD.		
LOAD		
BUFFER		EXIT
Third-level menu for COPY.		
USE ARROW KEYS TO CHANGE NAME:		
ROLL-CHARS	CURSOR	SAVE
↓	<	>
↓		EXIT

SETUP: MEASURE and OUTPUT

8 MEASURE Button (Waveform Parameter Extraction)

Displays the MEASURE menu on screen. Two modes are available for extracting parameters. The SNAPSHOT method extracts 20 different parameters, based on the last acquisition and displays the result. The Continuous--Update method extracts up to 4 parameters out of the 21 available can be displayed at any one time and each one displayed is continuously remeasured and updated as new acquisitions are made.

This menu also allows the setup of certain modes that affect how measure operates:

- Setting WINDOW ON lets you use the time cursors to control the area on the waveform that MEASURE uses to extract the parameter it measures.
- Setting MARK ON (SETUP submenu) turns on "X" markers that indicate where on the waveform any time-related parameter selected will be extracted. For instance, they will appear on the 10% and 90% amplitude points when MEASURE is set to extract rise or fall times.
- Setting METHOD and LEVEL (both in submenus) can further tailor the MEASURE function to fit your measurement needs. Read about these and other features in Sections 3 and 5 and in Appendix A of your Operators manual.

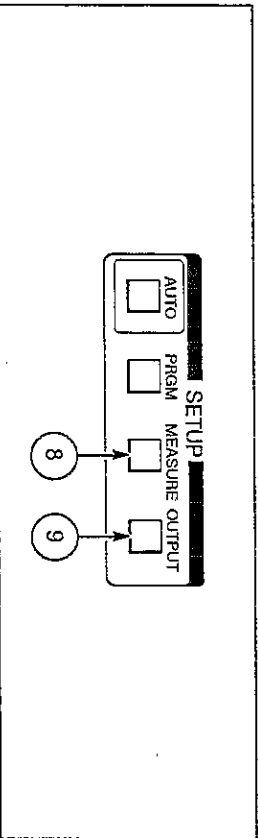


Figure 6: MEASURE and OUTPUT Buttons.

9 OUTPUT Button

Displays the menu used to configure the instrument for GPIB operation. Here, the GPIB mode, terminator, address, encoding, and other GPIB-related operating modes can be set. Select STATUS in this menu to get an overview of the present GPIB configuration. See Section 2 of the Programmers Reference Guide and Section 5 of the Operators manual for more information.

Table 4: Measure and Output Menus

8 MEASURE	MEAS	DISPLAY	WINDOW
SNA	SHOT	TYPE	SETUP ON/OFF ON/OFF
Second-level menu for SNA when more than one display source is displayed.			
TARGET:	CH1	CH2	MULT/ADD REF

Resulting display when either SNA is pressed and only one display source is on screen or when the TARGET waveform is selected.

SNA READOUT:

SNA USING MIN/MAX METHOD:

DIS = 4.35 V	TOP = 5.01 V	WID = 20.3 MS
MES = 2.12V	BASE = 2.00 mV	DUTY = 50%
PRX = -1.23 mV	MEAN = 2.32 V	FREQ = 24.6 KH
MAX = 5.15 V	OVR = 2.0%	PER = 40.6 MS
MID = 2.47 V	UNDS = 1.0%	RISE = 28.4 NS
MIN = 21.4 mV	RMS = 2.65 V	FALL = 18.3 NS
P-P = 5.36 V	AREA = 47.5 nVs	
DIST = 90.0%	MES = 50.0%	PROX = 10.0%
AGAIN PRINT/PLOT		↑

AGAIN: Initiates another snapshot.
 PRINT/PLOT: This menu selection will be displayed if DEVICES is selected in the third-level menu for MODE in the OUTPUT SETUP menu. (For more information, see the output menu section on page 20 of this manual.)

↑: Returns the scope to the MEASURE Menu.

Table 4: Measure and Output Menus (Cont.)

Second-level menu for MEAS TYPE.				
MEAS TYPE: Up to four parameters are measured and displayed when selected in the parameter matrix present in this menu. Use the arrow buttons with ON and OFF to select or deselect the parameters.				
DISTAL	MESIAL	PROX	MAX	MID
MIN	PK-PK	TOP	BASE	MEAN
OVRSHT	UNDRSHT	RMS	AREA	WIDTH
DUTY	FREQ	PERIOD	RISE	FALL
DELAY				
←	→	↓	ON	OFF
Third-level menu for MEAS TYPE when a parameter is set to ON (other than DELAY) and more than one display source is displayed.				
TARGET:				
CH1	CH2	MULT/ADD	REF	
Selection of DELAY as the parameter to be extracted causes a different third-and fourth-level TARGET menu to be displayed:				
Fourth-level menu for MEAS TYPE when CH1, CH2, or ADD/MULT is selected in the DELAY FROM TARGET menu. (The scope must be in HORIZONTAL MODE B with Δ TIME on. This menu does not appear if CH1 or CH2 is selected in the DELAY FROM TARGET menu when both CH1 and CH2 are displayed.)				
DELAY FROM				
TARGET:				
DELAY1	DELAY2			

Table 4: Measure and Output Menus (Cont.)

Fourth-level menu for MEAS TYPE when REF is selected in the TARGET menu.			
TARGET:	REF1	REF2	REF3
	REF1	REF2	REF3
Third-level menu for MEAS TYPE more than one display source is displayed and DELAY is selected in the parameter matrix.			
DELAY FROM			
TARGET:			
CH1	CH2	MULT/ADD	REF
Fourth-level menu for MEAS TYPE when REF is selected in the DELAY FROM TARGET menu.			
DELAY FROM			
TARGET:			
REF1	REF2	REF3	REF4
REF1	REF2	REF3	REF4
Fifth-level menu for MEAS TYPE when more than one display source is displayed and DELAY is selected in the parameter matrix.			
DELAY TO			
TARGET:			
CH1	CH2	MULT/ADD	REF
Sixth-level menu for MEAS TYPE when REF is selected in the DELAY TO TARGET menu.			
DELAY TO			
TARGET:			
REF1	REF2	REF3	REF4
REF1	REF2	REF3	REF4

Table 4: Measure and Output Menus (Cont.)

	<p>Fourth-level menu for MEAS TYPE when CH1, CH2, or ADD/MULT is selected in the DELAY FROM TARGET menu. (The scope must be in HORIZONTAL MODE B with Δ TIME on. This menu does not appear if CH1 or CH2 is selected in the DELAY FROM TARGET menu when both CH1 and CH2 are displayed.)</p> <p>DELAY TO TARGET: DELAY1 DELAY2</p>
<p>Second-level menu for SETUP:</p> <p>-----METHOD----- MARK MIN/MAX HIST CURSOR LEVEL ON/OFF</p> <p>Settings under METHOD choose the method MEASURE uses to define the TOP and BASE of a waveform. Pushing LEVEL displays a third level menu for adjusting where the DISTAL, MESIAL, and PROXIMAL levels on the waveform are set.</p>	<p>Second-level menu for SETUP:</p> <p>-----METHOD----- MARK MIN/MAX HIST CURSOR LEVEL ON/OFF</p> <p>Settings under METHOD choose the method MEASURE uses to define the TOP and BASE of a waveform. Pushing LEVEL displays a third level menu for adjusting where the DISTAL, MESIAL, and PROXIMAL levels on the waveform are set.</p>
<p>Third-level menu for LEVEL.</p> <p>ADJUST LEVELS WITH CURSOR/DELAY KNOB</p> <p>nr% nr% nr% nr% DISTAL MESIAL PROXIMAL MESIAL2 % VOLT</p>	<p>Third-level menu for LEVEL.</p> <p>ADJUST LEVELS WITH CURSOR/DELAY KNOB</p> <p>nr% nr% nr% nr% DISTAL MESIAL PROXIMAL MESIAL2 % VOLT</p>
<p>9 OUTPUT</p> <p>STATUS SETUP DEBUG TRANSMIT/ (PRINT)/PLOT)</p> <p>STATUS calls up an on-screen display of most GPIB parameters in which a system user might be interested. TRANSMIT/PRINT/PLOT switches to ABORT when transmitting, printing, or plotting. TRANSMIT/PRINT/PLOT disappears in OFF BUS mode.</p> <p>Second-level menu for SETUP:</p> <p>OUTPUT SETUP MODE TERM ADDR ENCDG</p>	<p>9 OUTPUT</p> <p>STATUS SETUP DEBUG TRANSMIT/ (PRINT)/PLOT)</p> <p>STATUS calls up an on-screen display of most GPIB parameters in which a system user might be interested. TRANSMIT/PRINT/PLOT switches to ABORT when transmitting, printing, or plotting. TRANSMIT/PRINT/PLOT disappears in OFF BUS mode.</p> <p>Second-level menu for SETUP:</p> <p>OUTPUT SETUP MODE TERM ADDR ENCDG</p>

Table 4: Measure and Output Menus (Cont.)

<p>Third-level menu for MODE.</p> <p>T/ONLY L/ONLY T/L DEVICES OFF BUS</p> <p>Selecting DEVICES changes TRANSMIT to PRINT (or PLOT) in the OUTPUT control menu. Selecting OFF BUS turns off the TRANSMIT/PRINT/PLOT choice.</p>	<p>Third-level menu for MODE.</p> <p>T/ONLY L/ONLY T/L DEVICES OFF BUS</p> <p>Selecting DEVICES changes TRANSMIT to PRINT (or PLOT) in the OUTPUT control menu. Selecting OFF BUS turns off the TRANSMIT/PRINT/PLOT choice.</p>
<p>Fourth-level menu for DEVICES.</p> <p>HPGL THINKJET PLOTTER PRINTER SETUP</p>	<p>Fourth-level menu for DEVICES.</p> <p>HPGL THINKJET PLOTTER PRINTER SETUP</p>
<p>Fifth-level menu for SETUP:</p> <p>SETTINGS TEXT GRAT WFM PGSIZE ON/OFF ON/OFF ON/OFF ON/OFF US A4</p>	<p>Fifth-level menu for SETUP:</p> <p>SETTINGS TEXT GRAT WFM PGSIZE ON/OFF ON/OFF ON/OFF ON/OFF US A4</p>
<p>Fourth-level menu for GPIB T/ONLY.</p> <p>-----SEND CURVE----- ONLY W/WFMPRE SEND PRGM</p>	<p>Fourth-level menu for GPIB T/ONLY.</p> <p>-----SEND CURVE----- ONLY W/WFMPRE SEND PRGM</p>
<p>Third-level menu for GPIB TERM.</p> <p>EOI LF/EOI</p>	<p>Third-level menu for GPIB TERM.</p> <p>EOI LF/EOI</p>
<p>Third-level menu for GPIB ADDR.</p> <p>GPIB ADDRESS = nn ↑ ↓</p>	<p>Third-level menu for GPIB ADDR.</p> <p>GPIB ADDRESS = nn ↑ ↓</p>
<p>Third-level menu for GPIB ENCDG.</p> <p>-----WHOLE WFMS----- PARTIAL WFMS ASCII RP RI RP RI</p> <p>RI encoding is a two's-complement format. RP is positive-integer format. At power-on the scope assumes that the data is formatted RI. The user must select RP (or send ENCDG RP via GPIB) to get positive-integer formats interpreted correctly.</p>	<p>Third-level menu for GPIB ENCDG.</p> <p>-----WHOLE WFMS----- PARTIAL WFMS ASCII RP RI RP RI</p> <p>RI encoding is a two's-complement format. RP is positive-integer format. At power-on the scope assumes that the data is formatted RI. The user must select RP (or send ENCDG RP via GPIB) to get positive-integer formats interpreted correctly.</p>
<p>Second-level menu for GPIB DEBUG.</p> <p>DEBUG ----MONITOR ---- ON/OFF BUS SCOPE IN OUT SLOW PAUSE</p>	<p>Second-level menu for GPIB DEBUG.</p> <p>DEBUG ----MONITOR ---- ON/OFF BUS SCOPE IN OUT SLOW PAUSE</p>

VERTICAL

10 VERTICAL POSITION Controls

Positions the Vertical Mode displayed according to the following rules:

- CH 1 control positions CH 1; CH 2 control positions CH 2.
- Both controls position ADD and MULT displays.
- In XY mode, the CH 1 control positions the display horizontally; the CH 2 control positions it vertically.

11 VARIABLE Buttons

Displays the VARIABLE menu for CH 1 or CH 2, whichever channel it addresses. Uncalibrates (varies) the vertical attenuation for that channel as follows:

- Pushing and holding the down arrow (↓) menu button continuously increases attenuation (decrease amplitude on screen); pushing and holding the up arrow (↑) decreases attenuation. Selecting CAL returns attenuation to the current calibrated VOLTS/DIV setting. A "greater than" sign (>) is displayed next to the VOLTS/DIV readout for the channel being varied to indicate it is no longer calibrated.
- Lower limit of attenuation is the current VOLTS/DIV setting set by the VOLTS/DIV control; i.e., at 1 V, the lower limit is 1 V per division.
- Upper limit is 2.5 times the current VOLTS/DIV setting; i.e., at 1 V, the upper limit is 2.5 V per division.
- For ADD Vertical Mode, CH 1 **VARIABLE** uncalibrates both the CH 1 and the ADD mode VOLTS/DIV readout (a > is displayed next to both), but the CH 2 **VARIABLE** uncalibrates only its own readout. This feature lets you input a sample of an unwanted signal into CH 2 and adjust the CH 2 **VARIABLE** to cancel the unwanted signal in the ADD display. See Section 3 of your Operators manual for use of this feature.

12 VOLTS/DIV Controls

Sets the VOLTS/DIV of the Vertical Modes as follows:

- CH 1 control sets CH 1 volts/division factor; CH 2 control sets CH 2.
- Both controls adjust the factors for ADD and MULT mode displays.
- Readouts in the upper-left quarter of the screen indicate the VOLTS/DIV setting of any Vertical Mode turned on in the Vertical mode menu. These readouts automatically adjust to the correct volts/division setting when 1X, 10X, 100X, and 1000X TEK coded-attenuator probes are attached.
- Both controls can vertically expand a stored waveform on screen when in the Storage mode SAVE, and both can be used to extend the most sensitive setting, 2 mV/div to 200 μ V/div, when Storage Acquire menu is set to AVG (average).

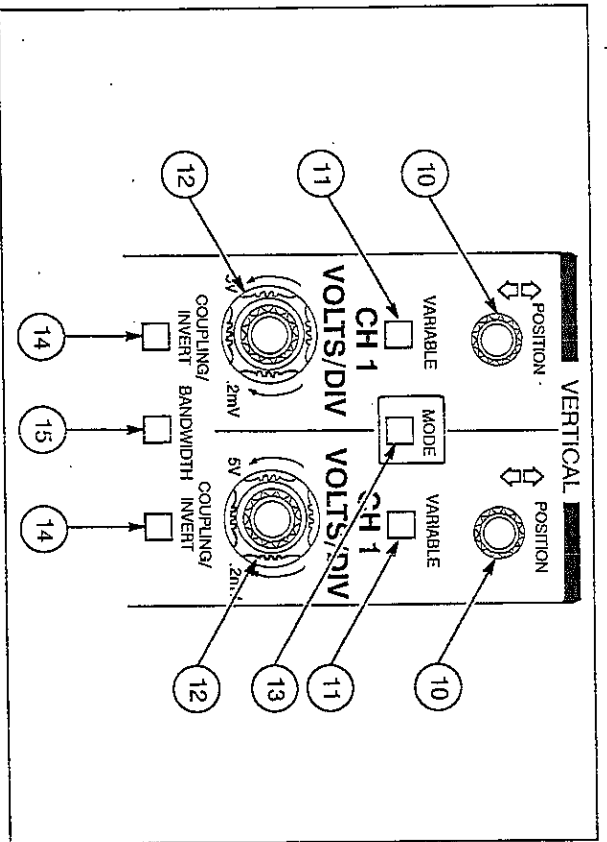


Figure 7: Vertical Buttons and Controls.

13 MODE Button

Display the Vertical Mode menu on screen for displaying one or more Vertical Modes as follows:

- CH 1, CH 2, ADD and MULT buttons are push/push; one push turns the mode on, another turns it off. Selected modes are underscored in the menu.
- Only one of either ADD (CH 1 + CH 2) or MULT (CH 1 X CH 2) can be displayed at one time; selecting ADD turns MULT off and vice versa. The multiplied waveform obtained in MULT is scaled down by a factor of 5. 12 to maintain the display within the graticule area.

14

COUPLING/INVERT Buttons

- Pushing YT|XY toggles the mode between YT and XY, the selected mode is underscored. XY mode automatically turns on the CH 1 and CH 2 signals. REF 1 vs REF 2, may be displayed as XY REF from the DISPLAY REF menu.

Displays the Input coupling menu for whichever channel it addresses. AC, DC, or GND (ground) may be selected. Also, the input signal can be inverted and the input resistance for the channel can be selected in this menu. Setting 50 Ω to ON sets the input resistance to 50 Ω ; setting 50 Ω to OFF sets it to 1 M Ω . AC coupling cannot be used with 50 Ω input resistance: selecting AC switches 50 Ω to OFF if it's ON; setting 50 Ω to ON when AC is selected switches the menu to DC coupling.

If ROLL MENU is set to ON, subsequent pushes of this button switches the menu through the AC, DC, and GND coupling selections.

15

BANDWIDTH Button

Displays the menu for selecting 20 MHz, 100 MHz, or FULL vertical bandwidth. Readouts of usable storage bandwidth, usable storage rise time, and the sample rate are also displayed.

If ROLL MENU is set to ON, subsequent pushes of this button switches the menu through the 20 MHz, 100 MHz, and FULL bandwidth selections.

Table 5: Vertical Menus

11 VARIABLE	CH1 VARIABLE CAL	↓	↑		
	CH2 VARIABLE CAL	↓	↑		
13 MODE	In YT Mode.				
	VERTICAL MODE CH1	CH2	ADD	MULT	YT XY
	In XY Mode.				
14 COUPLING/ INVERT	VERTICAL MODE CH1 vs CH2				
	CH1 COUPLING AC	DC	GND	50 Ω ON OFF	INVERT ON OFF
	CH2 COUPLING AC	DC	GND	50 Ω ON OFF	INVERT ON OFF
15 BANDWIDTH	USB = xxxx Hz / USR = xxxx s / SR = xxxx S/sec				
	20 MHz	100 MHz	FULL	SMOOTH ON OFF	
The number xxxx depends on the Acquisition Mode, the SEC/DIV setting, and the bandwidth selected.					
-----BANDWIDTH----- SR = EXT CLOCK SMOOTH					
20 MHz 100 MHz FULL ON OFF					
If B TRIG MODE is set to External Clock.					

HORIZONTAL

16

A Button

Selects A Horizontal Mode. Waveforms are acquired at the A SEC/DIV setting.

17

A AND B SEC/DIV Control

Sets the acquisition rate of the acquisition system. The following considerations apply when using the SEC/DIV control:

- The slowest acquisition rate is 5 sec/div; the fastest is 2 ns/div.
- This control is used when Storage mode is SAVE to horizontally expand the display.
- If SEC/DIV is set to 100 ms/div or slower, ROLL mode replaces AUTO mode in the A TRIGGER mode menu. Selecting ROLL results in a continuously scrolling strip recorder type display. ROLL mode is only allowed with NORMAL Acquire mode: selecting ENVELOPE or AVG (Average) switches the A TRIGGER mode menu to NORMAL Trigger mode if ROLL is on; selecting ROLL switches to NORMAL Acquire mode if ENVELOPE or AVG is on.

18

A INTEN Button

Selects A INTENSIFIED Horizontal mode. Waveforms are acquired at the A SEC/DIV setting, but an Intensified zone on the waveform marks the portion of the trace that can be displayed at the B SEC/DIV setting if the MODE is changed to B. It is also possible for the waveform to have two intensified zones.

19 **B Button**

Selects B Delayed sweep operation and changes the acquisition rate to the B SEC/DIV setting.

20 **POSITION Control**

Position any live- or SAVE-mode waveforms horizontally on screen. There are 20 horizontal divisions available for all waveforms displayed; use the **POSITION** control to see any 10 on screen at any one time.

Also positions stored waveforms displayed from the Storage REF memories, either in unison with the live- and SAVE-mode waveforms or independent of them. Investigate the Storage DISPLAY REF menu and the HORIZ POS submenu to see how this works.

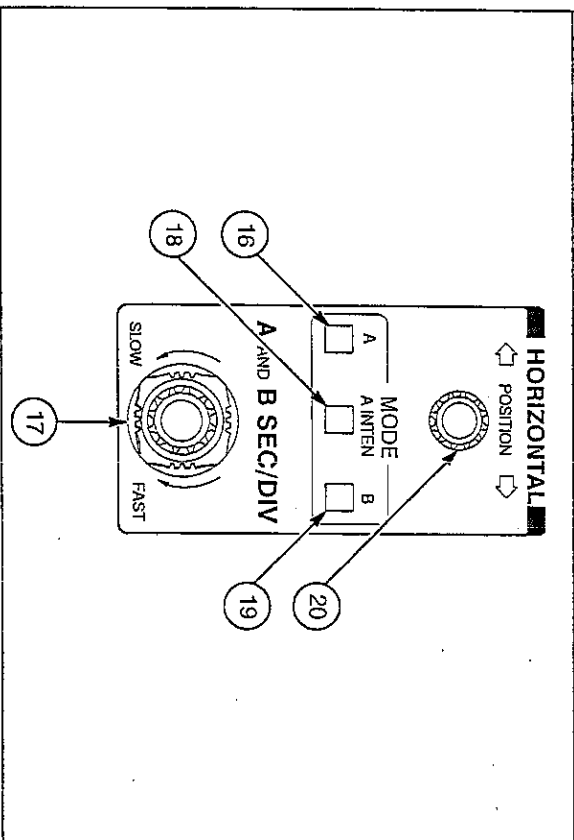


Figure 8: Horizontal Buttons and Controls.

TRIGGER

21 **CPLG Button**

Displays the A or B Trigger CPLG (coupling) menu, whichever corresponds to the Trigger system that is currently selected. The menu is used to select how (AC-coupled, DC-coupled, etc.) the trigger source is connected to the selected Trigger system.

When VIDEO coupling is selected (A CPLG menu only), the trigger signal is conditioned by the SET VIDEO menu (see below). (Instrument must be equipped with the Video Trigger Option.)

22 **SET VIDEO Button**

Displays A VIDEO COUPLING menu (on scopes equipped with Video trigger only). Video coupling is selected via the A TRIGGER COUPLING menu; mode (or type) of video coupling is selected via the A VIDEO COUPLING menu.

Video signal must be interlaced for Field 2 to appear in on-screen readout.

23 **SET WORD Button**

Displays the Word Recognizer Probe configuration menu.

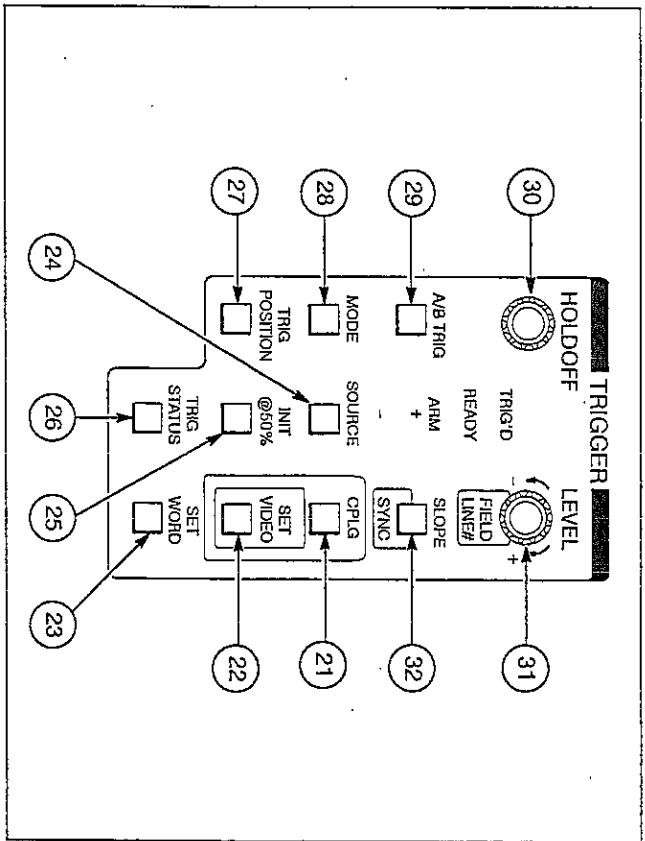


Figure 9: Trigger Buttons and Controls.

Table 6: Trigger Menus

23 SET WORD	WORD RECOGNIZER SETUP	SET BITS
RADIX	-----CLOCK-----	
OCT/HEX	✓ ASYNC	
Second-level menu for SET BITS.		
In Hexadecimal:		
TRIG WORD:	???? X	XXXX XXXX XXXX XXXX
CLK = *	0 X	← →
*Setting for clock in the first-level menu appears here.		
In Octal:		
TRIG WORD:	????? X X	XXX XXX XXX XXX
CLK = *	0 X	← →
*Setting for clock in the first-level menu appears here.		
26 TRIG STATUS	TRIG STATUS	
A*B MODE	SOURCE	CPLG TRIG POS
A (Setup conditions for the A Trigger Controls.)		
B (Setup conditions for the B Trigger Controls.)		

24

SOURCE Button

Displays the A or B Trigger SOURCE menu, whichever corresponds to the trigger system that is currently selected. The menu is used to specify what input connector, vertical mode, etc., will supply a signal for input to the selected trigger system.

When A*B source (A logic-AND B) is on in the A Trigger SOURCE menu, both A and B triggering conditions must be met to trigger acquisition; i.e., both trigger system's LEVEL, SOURCE, CPLG, control settings must provide a trigger. The last source selected in the A SOURCE menu before A*B is selected provides the A trigger input to the A*B source; the current setting in the B SOURCE menu provides the B trigger input to A*B.

25 **INIT @50% Button**

Sets the trigger level to approximately one half of the peak-to-peak amplitude of the trigger source signal for whichever trigger system is selected, A or B.

26 **TRIG STATUS Button**

Displays the TRIGGER STATUS menu, which shows the current Trigger mode, Source, Coupling and Trigger position selection for the A and B triggers.

27 **TRIG POSITION Button**

Displays the A or B Trigger POSITION menu.

28 **MODE Button**

Displays the TRIG Mode menu for whichever trigger system is selected, A or B.

29 **A/B TRIG Button**

Selects which of two trigger systems, A and B, are addressed by the LEVEL control, and the TRIGGER MODE, SOURCE, CPLG, POSITION, and INIT@50% buttons. The LEVEL control and INIT@50% function affect whichever trigger system the A/B TRIG button selects. The control menus displayed when buttons for the remaining functions are pushed are for whichever trigger system is selected.

30 **HOLDOFF Control**

Varies the amount of time from the A Trigger until the A Trigger system will accept another Triggering event. Use of this control often helps obtain stable triggering on aperiodic signals. A small HO appears on screen (see Figure 2) whenever holdoff is set to other than zero.

31 **LEVEL Control**

Sets the amplitude LEVEL at which a signal from the selected trigger source is to produce triggers. Adjusts the level setting for whichever trigger system is selected, A or B.

32 **SLOPE Button**

Toggles the trigger system for the trigger system that is currently selected by the TRIGGER A/B TRIG button. The two choices are triggering on the positive-going edge of the trigger signal (+) or the negative-going edge (-).

Table 7: A Trigger Menus

21 CPLG	Without the Video Option.							
	A COUPLING	DC	AC	NOISE	HF	LF	REJECT	
22 SET VIDEO	With the Video Option Installed.							
	A COUPLING	DC	AC	VIDEO	NOISE	HF	LF	REJECT
24 SOURCE	Video Option only (for interlaced signals).							
	A VIDEO COUPLING	FIELD 1	FIELD 2	ALT	TVLINE	CLAMP	ON/OFF	
	A VIDEO COUPLING	FIELD 1			TVLINE	CLAMP	ON/OFF	
27 TRIG POSITION	Second-level menu for A EXT.							
	A EXT SOURCE	-----A AND B EXT GAIN-----						
	1/2	EXT 1	EXT 1 ÷ 5	EXT 2	EXT 2 ÷ 5			
28 MODE	A TRIGGER POSITION				SINGLE			
	1/8	1/4	1/2	3/4	7/8			

NOTE

If a position other than 1/8, 1/4, 1/2, 3/4, 7/8 is selected over GPIB, then no on-screen selection will be underlined.

Table 8: B Trigger Menus

21 CPLG	In B TRIG AFTER Delay Mode.							
	B COUPLING	B, EXT CLK CPLG (with EXT CLOCK ON)	B, EVENTS CPLG (with DELAY by EVENTS ON)	B, CLK, EVENTS (with both ON)				
24 SOURCE	In B RUNS AFTER Delay Mode.							
	B COUPLING	EXT CLK CPLG (with EXT CLOCK ON)	EVENTS COUPLING (with DELAY by EVENTS ON)	EVENTS, CLK (with both ON)				
28 MODE	B TRIG RUNS AFTER TRIG AFTER				EXT CLK ON/OFF			
	1/8	1/4	1/2	3/4	7/8			
27 TRIG POSITION	In B TRIG AFTER Delay Mode.							
	B TRIG SOURCE	B, EXT CLOCK SOURCE (with EXT CLOCK ON)	B, EVENTS SOURCE (with DELAY by EVENTS ON)	B, EXT CLK, EVNT SOURCE (with both ON)				
28 MODE	B TRIG SOURCE				WORD			
	1/8	1/4	1/2	3/4	7/8			

Table 8: B Trigger Menus (Cont.)

In B RUNS AFTER Delay Mode.			
B TRIG SOURCE			
EXT CLK SOURCE (with EXT CLOCK ON)			
EVENTS SOURCE (with DELAY by EVENTS ON)			
EVENTS, EXT CLK SOURCE (with both ON)			
SOURCE			
VERT	CHAN	EXT	
CH1	1 2	1 2	WORD
CH2			
ADD			
Second-Level menu for B EXT.			
B EXT	-----A AND B EXT GAIN-----		
SOURCE	EXT 1	EXT 1-5	EXT 2
1 2			EXT 2-5

CURSOR and DELAY

33

FUNCTION Button

- Displays CURSOR FUNCTION menu on screen for selecting one of five cursor types for use in making measurements. The following considerations pertain to cursor use:
 - Measurements made with cursors appear on screen in the cursor readout. See Figure 2 to locate that readout.
 - You select a function by pushing its menu button to underline it in the menu; pushing the button again turns it off (removes underline). Selecting a function turns off any other function previously selected in the menu.
 - Turning on a cursor function (VOLTS, etc.) automatically displays a second-level ATTACH cursors menu if more than one display source is on screen. (A display source is any Vertical Mode or any DISPLAY REF memory displayed on screen.) This is because waveforms in these display sources may be acquired at different VOLTS/DIV and SEC/DIV settings; therefore, you need to specify which display source the cursors are to measure, so that they can match the VOLTS/DIV and SEC/DIV settings for that source. You select that display source in the ATTACH cursors menu.
 - You can also display the ATTACH cursor menu by turning a cursor function off, then back on (again, more than one display source must be on), or by pressing the FUNCTION button twice if you are not in the CURSOR FUNCTIONS menu nor the ATTACH menu. (In this last case, you don't need to have more than one display source on screen.)

34 UNITS Button

Displays UNITS menu on screen. Each cursor UNITS menu provides a choice between absolute units (VOLTS, SEC, SLOPE, or Hz) and ratiometric units (% and dB or DEGREES). Ratiometric measurements require a reference for comparison. Two cursor modes are available, delta (Δ) and absolute (ABS). In Δ mode, measurements are made with two cursors. In ABS mode, measurements are made between the single cursor and the ground reference for VOLTS and V@T; or between the cursor and the record trigger point for TIME and 1/TIME.

35 SELECT Button

Selects which cursor the CURSOR/DELAY control (4) moves. Cursors movement is bound by the following rules:

- No cursor, regardless of type, can be positioned off screen; all cursors are bound at the screen perimeter.
- For cursor functions displaying time cursors, attempting to move either cursor past either edge of the screen causes the display to horizontally reposition. Pressing the CURSOR SELECT button moves the bound cursor to center screen.

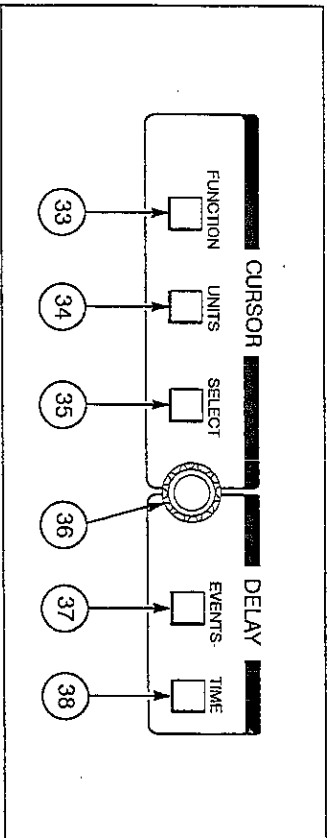


Figure 10: Cursor and Delay Buttons and Controls.

36 CURSOR/DELAY Control

The CURSOR/DELAY control is a shared control. It operates according to the following rules:

- If Delay EVENTS menu is on screen it sets the events count.
- If the MEASURE SETUP/LEVEL submenu is on screen, it adjusts various amplitude reference levels that MEASURE uses to extract waveform parameters.
- If cursors are on screen and neither the Delay EVENTS menu nor the MEASURE SETUP/LEVEL submenu is displayed, it positions whichever cursor is selected by the CURSOR SELECT button.

37 EVENTS Button

Displays the Delay EVENTS menu which is used to specify how many events are counted from the time the A Trigger occurs to when the A Record trigger is forced. The CURSOR/DELAY control is used to set time delay.

The events counted must be supplied via the B Trigger system; therefore, the trigger control settings for that system must be set so the instrument gets valid B triggers. (See Trigger Controls in Section 9.)

38 TIME Button

Selects DELAY by TIME, and switches between Main Delay and Delta Delay functions. CURSOR/DELAY control knob (1) is used to set time delay.

Triggers must be supplied via the B trigger circuitry to obtain Event triggering when EVENTS is on. A delayed by B events and B delayed by time may be used sequentially.

Table 9: Cursor and Delay Menus

33 FUNCTION	CURSOR FUNCTION	VOLTS	TIME	V@T	SLOPE	1/TIME
	Second-level menu for a CURSOR FUNCTION selection.					
	In YT Mode.					
	ATTACH CURSORS TO:					
	CH1	CH2	(func)	REFn		
	No Δ delay					
	CH1	CH2	(func)	(func) Δ	REF n	
	Δ delay—CH1 on					
	CH1	CH1Δ	(func)	(func) Δ	REF n	
	Δ delay—CH1 and CH2 on					
	CH1	CH2Δ	(func)	(func) Δ	REF n	
	Function is either ADD or MULT; they are mutually exclusive. Pressing REF rolls through the displayed reference waveforms. Only waveforms called up for display are included in the ATTACH CURSORS menu.					
	In XY Mode (with CH1 vs CH2 and XYREF selected).					
	ATTACH CURSORS TO:					
	CH1 vs CH2	XYREF				
34 UNITS	In VOLTS or V@T.					
	UNITS	VOLTS CURS REF = xxxxxx				
	VOLTS	% DB	NEW REF	Δ ABS		
	In SLOPE.					
	UNITS	SLOPE CURS REF = xxxxxx				
	SLOPE	% DB	NEW REF			
	In 1/TIME.					
	UNITS	1/TIME CURS REF = xxxxxx				
	Hz	%	DEGREES NEW REF	Δ ABS		
	In TIME.					
	UNITS	TIME CURS REF = xxxxxx				
	SEC	%	DEGREES NEW REF	Δ ABS		

Table 9: Cursor and Delay Menus (Cont.)

37 EVENTS	EVENTS START AT A TRIG EVENTS COUNT = xxxxx B TRIGS	EVENTS ON OFF
	Events count may be changed using the CURSOR/DELAY control.	
38 TIME	With Δ TIME OFF. DELAY TIME = xxxxxx B	ΔTIME ON OFF
	With ΔTIME ON. DELAY TIME = xxxxxx B ΔDELAY TIME = xxxxxx B	ΔTIME ON OFF
	DELAY by TIME button is pressed to switch the CURSOR/DELAY position knob between the Main DELAY TIME and the Δ (delta) DELAY TIME when ΔTIME is ON.	

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ACQUIRE Button

Starts/restarts the scope acquiring from SAVE mode (see SAVE button). Also displays the ACQUIRE menu for setting up the various acquisition modes. The following considerations apply to the ACQUIRE button and its menu:

- Pushing the NORMAL menu button selects a continuously acquiring mode that produces a live display similar to that of an analog oscilloscope.
- Pushing the ENVELOPE menu button selects a mode that displays the amount of change in the waveform (in short, its envelope) over a selected number of acquisitions. It does so by capturing minimum and maximum values for each data point sampled. Repeated pushes of ENVELOPE selects the number of acquisitions per envelope.
- Pushing the AVG (average) menu button selects a mode that averages the selected number of acquisitions together, updating the average as each acquisition is made. Repeated pushes of AVG selects the number of acquisitions per average.
- Setting REPEAT ON/OFF to ON in the menu extends the maximum available bandwidth to 300 MHz.
- Setting SAVE ON Δ ON/OFF to ON, puts the scope in a mode where, if a live waveform exceeds boundary limits set by a reference envelope waveform, SAVE Storage mode is entered (SAVE ON Δ switches to OFF). Regarding GPIB use, the following will also happen:

If the Setup OUTPUT submenu is setup to output to a printer, the screen data will be output via the GPIB for printing.

STORAGE

If the Trigger mode is not ROLL, SAVE mode will switch to ACQUIRE mode after outputting to the printer, and SAVE ON Δ set back to ON to continue monitoring incoming waveforms.

If the OUTPUT submenu is set to configure the scope for TALK/LISTEN GPIB mode, it will issue a SRQ to notify the controller of the SAVE ON Δ event.

The following considerations apply to using the ACQUIRE button to start/restart acquisitions when scope is in SAVE mode:

- Pressing the ACQUIRE button stops the acquisition in progress, whether the mode is NORMAL, ENVELOPE, or AVG, and restarts the acquisition. The following controls, when changed, also stop and restart acquisitions in progress:
 - Changing any setting in the Vertical MODE menu and BANDWIDTH menu, in either channel's COUPLING/INVERT menu, or for either channel's VOLTS/DIV control.
 - Changing the Vertical Position of either channel (AVG only, not NORMAL and ENVELOPE).
 - Changes to the Trigger MODE menu or to the SLOPE setting.
 - Pressing the MENU OFF/EXTENDED FUNCTIONS button to turn off menus.
 - Setting EVENTS on in the DELAY EVENTS menu (AVG mode only).
 - To display the ACQUIRE mode menu when A Trigger mode is set to SINGLE SEQ.
- If, when in SAVE Storage mode, pressing the ACQUIRE button momentarily switches the instrument to the ACQUIRE menu, but then it is immediately switched back to the SAVE menu, you may be in SINGLE SEQ mode. In this mode, the scope makes a single sequence acquisition, switches to SAVE mode to display the single-sequence acquisition, and displays the SAVE menu. Since ACQUIRE rearms the SINGLE SEQ mode to make another single sequence acquisition, a fast-completing single sequence will switch it back to SAVE menu before the ACQUIRE menu can be used. Change SINGLE SEQ in the TRIGGER MODE menu to AUTO before pressing the ACQUIRE button to use ACQUIRE menu.

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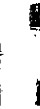
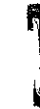
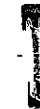
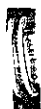
SAVE Button

Displays the SAVE menu and enters the SAVE Storage mode, which "freezes" waveforms on screen. The scope enters SAVE mode whenever the following occurs:

- The STORAGE SAVE button is pressed.
- A single-sequence acquisition completes (Trigger MODE menu set to SINGLE SEQ).
- A waveform that is bounded by a reference envelope waveform exceeds the limits set by that reference when SAVE ON Δ has been turned ON in the Storage Acquire menu. (See button number 39.)
- On-screen information is being output to a printer or plotter via the GPIB. (In this case, it switches back to ACQUIRE mode when the print or plot is complete.)

To store an on-screen waveform in a DISPLAY REF memory, do the following:

1. **Enter SAVE and select a waveform:** Press the STORAGE SAVE button, and in the SAVEREF SOURCE menu, select the display source (CH 1, CH 2, or ADD/MULT) that is displaying the waveform that you want to store. The menu will switch when you select a source.
2. **Select a storage memory:** From the SAVEREF DESTINATION menu now displayed, select one of REF 1 - REF 4, whichever memory you want to store the waveform in.



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DISPLAY REF Button

3. **Continue or quit:** If you have more waveforms to store, push the SAVEREF SOURCE menu button to return to that menu, and repeat the process of selecting a source and selecting a destination until all the waveforms (up to four) are saved in a REF memory. Press the STORAGE ACQUIRE when finished to resume actively acquiring waveforms.

To copy a waveform from one DISPLAY REF memory to another, repeat Steps 1 and 2 above, but instead of selecting a Vertical mode (Step 1) as a display source, push REF in the SAVEREF SOURCE menu to display the SAVEREF SOURCE-REF submenu. Select the REF memory containing the waveform that you want to copy to another memory from that menu, then proceed to Step 2 to select the REF you want to copy it into. When finished, the waveform will be in both REF memories.

The STACK REF choice in the SAVEREF SOURCE menu stores each on-screen waveform displayed from a Vertical mode (CH 1, ADD, etc.) into a REF memory. Where each source is stored depends on which ones are displayed. See Table B-13 in your Operators manual for more information.

The first press displays the DISPLAY REF menu; subsequent presses toggle between that menu and the HORIZONTAL POSITION menu.

To display a saved reference waveform, press the DISPLAY REF button to display that menu and select as many of the REF 1 - REF 4 memories as you want to display. Each REF is underlined on screen as it is selected and the waveform it contains appears on screen.

To simultaneously horizontally position all the REF-memory and Vertical-mode waveforms on screen, display the HORIZONTAL POSITION menu: either toggle to that menu using the DISPLAY REF button or push HORIZ POS REF in the DISPLAY REF menu to switch to it. Next, set REF HPOS IND/LOCK to LOCK. This action aligns the trigger points (T) of all the waveforms to the same horizontal position. Now, use the HORIZONTAL POSITION control to position all displayed waveforms as desired. While menu is set to LOCK, the HORIZONTAL POSITION control positions all waveforms in unison, whether the HORIZONTAL POSITION menu is displayed or not.

To independently horizontally position any REF-memory, display the HORIZONTAL POSITION menu as just described. Next, set REF HPOS IND LOCK to IND (for independent) and select in the menu which REF memory you wish to position, REF1P .. REF4P. Now, use the HORIZONTAL POSITION control to position that waveform as desired. (To return all waveforms to their original horizontal positions relative to each other, switch back to LOCK.) While menu is set to IND and the menu is displayed, the HORIZONTAL POSITION control only positions the selected reference; if the menu is not on screen, the control positions only non-REF waveforms (CH 1, etc.).

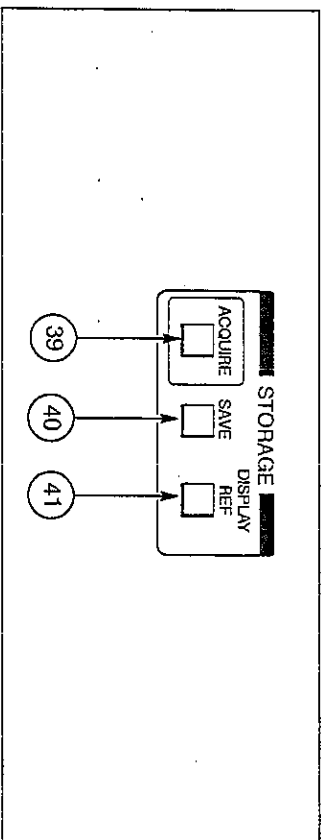


Figure 11: Storage Buttons.

Table 10: Storage Menus

<p>39 ACQUIRE</p>	<p>ACQUIRE nnn nnn REPET SAVE ON Δ NORMAL ENVELOPE AVG ON/OFF ON/OFF nnn selections ENVELOPE—1,2,4,8,16,32,64,128,256,CONT AVG—2,4,8,16,32,64,128,256</p>
<p>40 SAVE</p>	<p>xxxxx ACQUISITIONS xxxxxHRS SAVEREF SOURCE STACK CH1 CH2 (function) REF REF</p> <p>Second-level menu for a SAVEREF SOURCE selection (except REF or STACK REF). If REF is selected, or Δ DELAY TIME is turned on while B is the HORIZONTAL MODE setting, this menu becomes a third-level menu. -----SAVEREF DESTINATION----- SAVEREF REF1 REF2 REF3 REF4 SOURCE</p> <p>Second-level menu for SAVEREF SOURCE in Δ (delta) DELAY by TIME: SAVEREF SOURCE—(channel) DELAY 1 DELAY 2</p> <p>Second-Level menu if REF is selected. SAVEREF SOURCE—REF SAVEREF REF1 REF2 REF3 REF4 SOURCE</p>
<p>41 DISPLAY REF</p>	<p>In YT Mode. DISPLAY REF REF1 REF2 REF3 REF4 POS REF EMPTY appears above reference menu choice if no valid waveform is stored.</p> <p>In XY Mode. XYREF HORIZ POS REF</p>

Table 10: Storage Menus (Cont.)

Second-level menu for HORIZ POS REF. (In YT Mode.)			
-----HORIZONTAL POSITION-----	REF HPOS		
REF1P	REF2P	REF3P	REF4P
IND LOCK			
Second-level menu for HORIZ POS REF. (In XY Mode.)			
-----HORIZONTAL POSITION-----	REF HPOS		
XY REFP			IND LOCK

GPIB STATUS

CH1	100mV	A	tms	36.2mV	EXT1
100
ADDR	3	BQS	ON	START = 256	
MODE	THINKJET	OPC	ON	STOP = 512	
TERM	EOI	CER	ON	EVENTS	
FASTXMIT		EXR	ON	++++	
OFF		EXW	ON	NONE	
		INR	ON		
1	WFMS REQSTD	PID	OFF		
	RIBINARY	USER	OFF		
0	SOURCE CH1	PATH	ON		
	TARGET REF1	LONG	ON
ENDG	RIBINARY	DEBUG	OFF		
BINWEM	SCOPE	RI	DEVDER	ON	

Figure 12: GPIB Status On-Line Screen

The GPIB Status menu is displayed on screen when STATUS is selected from the OUTPUT menu. Each underscored item is a GPIB-related function and the adjacent non-underlined item(s) is the setting(s) for the function. The listing "ADDR 3" means the scope's address (a function) is set to 3. The remaining listings at the top of the screen vary with current instrument setup.

Interpretation of GP1B STATUS menu listings:

ADDR =	ADDRESS SELECTION	RQS =	ASSERT SRQ IF PENDING EVENT
MODE =	MODE SELECTION	OPC =	ASSERT SRQ ON OPERATION COMPLETE
TERM =	TERMINATION	CER =	ASSERT SRQ ON COMMAND ERROR
SOURCE =	WAVEFORM DATA SOURCE	EXR =	ASSERT SRQ ON EXECUTION ERROR
TARGET =	WAVEFORM DATA TARGET	EXW =	ASSERT SRQ ON EXECUTION WARNING
ENCDG. =	ENCODING	INR =	ASSERT SRQ ON INTERNAL ERROR
BINWFM =	INCOMING BINARY WAVEFORM INTERPRETATION MODE	PID =	ASSERT SRQ ON PROBE IDENTIFICATION
		USER =	ASSERT SRQ ON BEZEL BUTTON PUSH
		PATH =	SEND COMPLETER PATH IN QUERY RESPONSE
		LONG =	USE LONG FORM IN QUERY RESPONSE
		DEBUG =	TURN ON DEBUG MODE
		DEVDEP =	ASSERT SRQ IF TRANSMIT PUSHED
		401 =	POWER ON SRQ (TYPICAL EVENT)

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with the 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.