User Manual

Tektronix

2430A
Digital Oscilloscope

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E200000	Tektronix United Kingdom, Ltd., London
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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SAFETY NOTE

This manual is a quick reference guide to the 2430A features. It does not replace the 2430A Operators manual. The 2430A Operators manual 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 2430A 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 2430A 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 2430A 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 2430A 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 WARMED 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 2430A 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 WARMED 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 Δ 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 accidently 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 SINX/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 railed 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.

2

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.

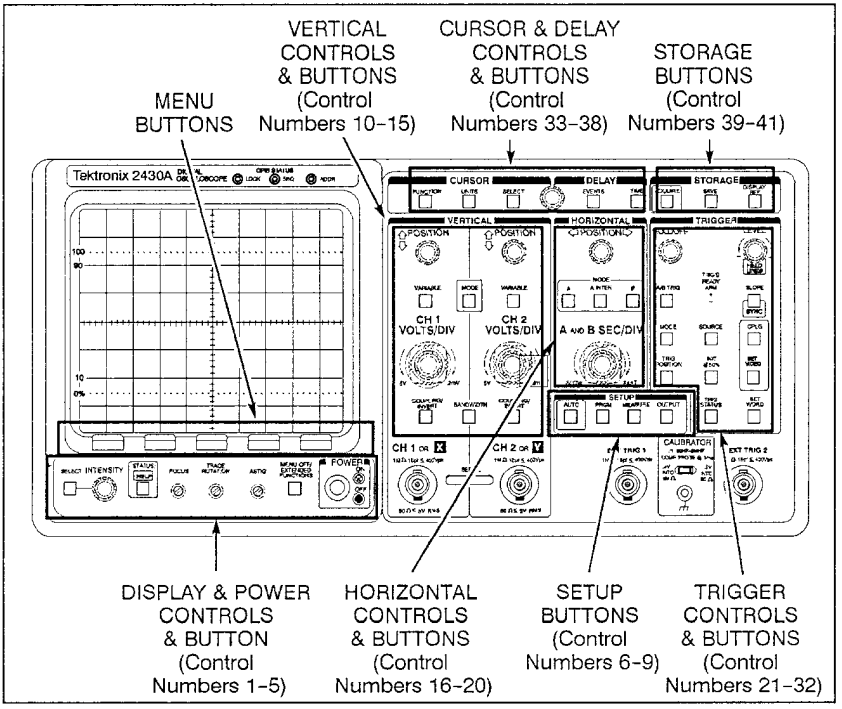

Figure 1: Front Panel buttons and Controls.

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 2430A's many modes and features.

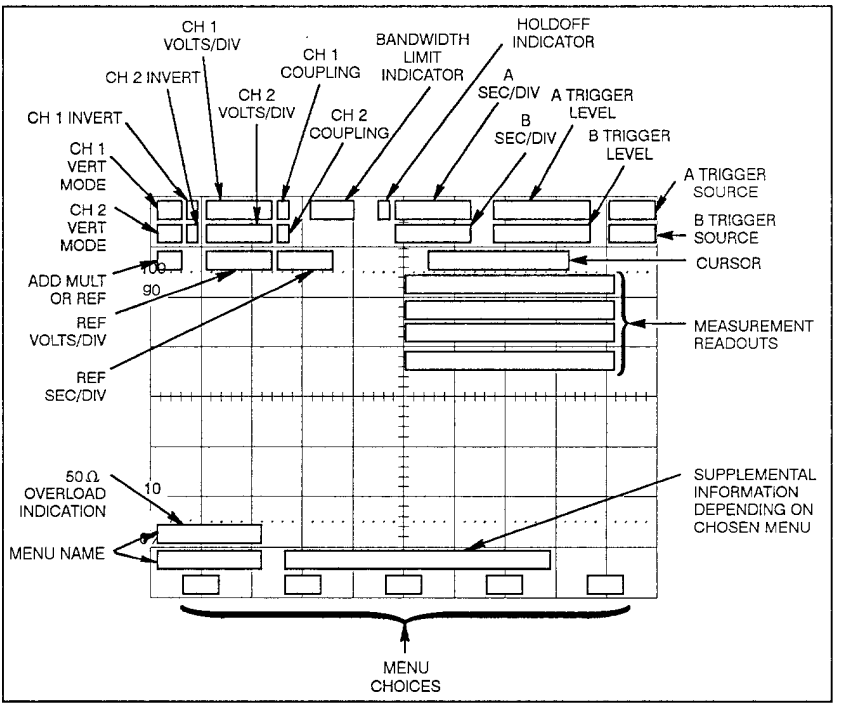

Figure 2: CRT Readout Display.

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.)

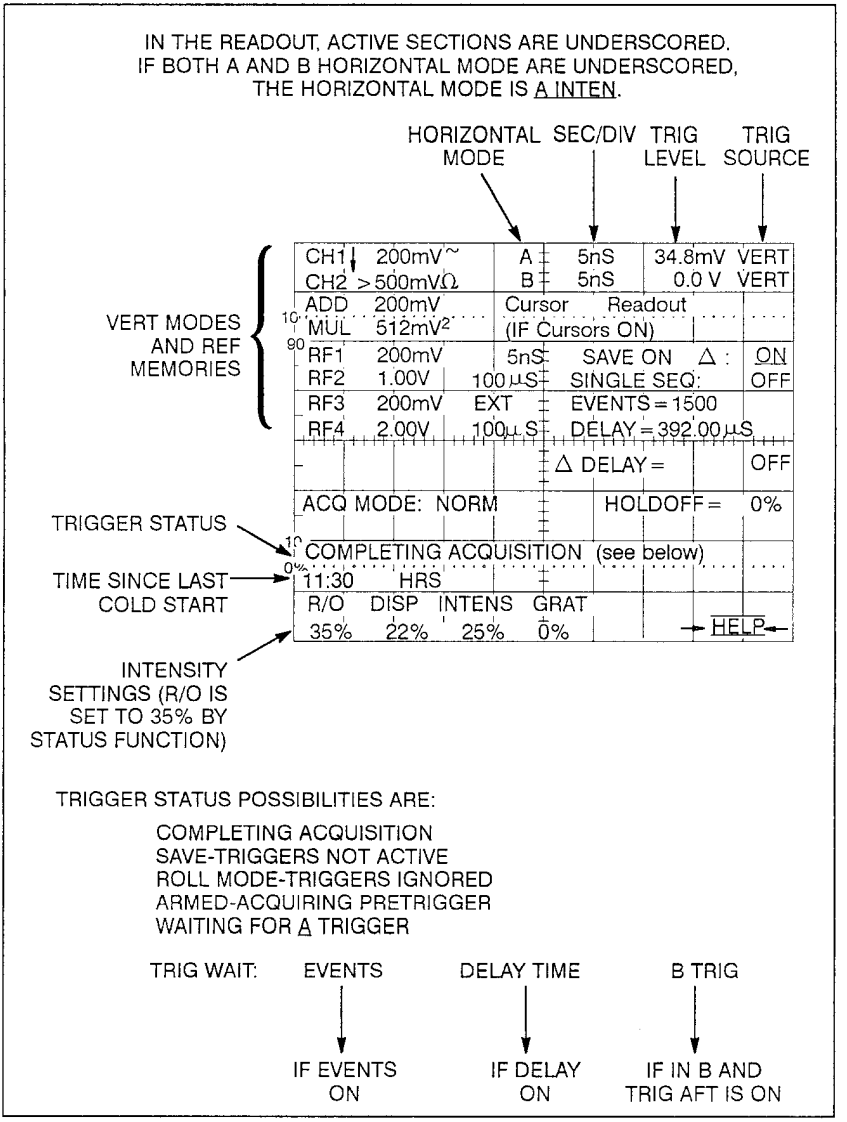

Figure 3: Status Menu Display.

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 STAUTS 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.)

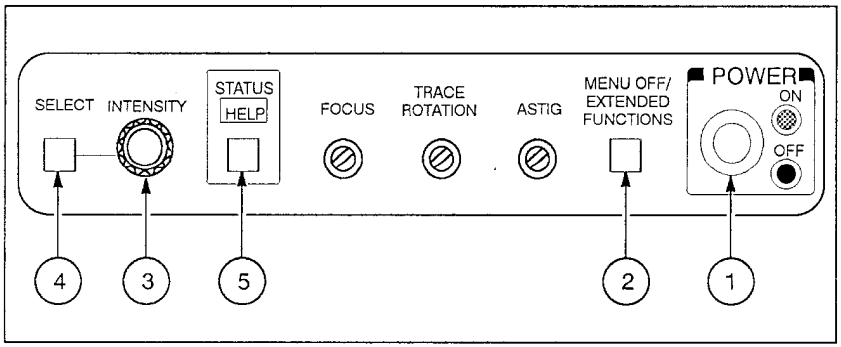

Figure 4: CRT Display Controls and Buttons, and POWER Button.

3 INTENSITY Control

A continuous rotating pot, the **INTENSITY** control adjusts the intensity of any of four screen elements (READOUT, DISPlay, INTENS, and GRATicule). 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 MENUS 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.)

Table 1: Menu Off/Extended Functions Menu (SN B020000 & 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
		Second-level menu for SYSTEM. PANEL MISC INTERP VIDEO OPT ↑
		Third-level menu for PANEL. ----TEKSECURE---- PWR ON ERASE LAST|INIT MEMORY ↑
		Fourth-level menu for --TEKSECURE-- ERASE MEMORY. WARNING: WFM & PRGM MEMORY WILL BE ERASED. ERASE ABORT
		Third-level menu for MISC. BELL TRIG T AUTO ROLL MENUS ON|OFF ON|OFF PROBE ON|OFF ↑

Table 1: Menu Off/Extended Functions Menu (SN B020000 & Above) (Cont.)

	Fourth-Level menu for AUTO PROBE. SELECT PROBE IDENTIFY FUNCTION AUTO SETUP | STEP PRGM | INIT@50% | SAVE/ ACQUIRE | ↑
	Third-level menu for INTERP. INTERPOLATION ----MODE---- LINEAR SINX/X | INTENSE REALS ON|OFF | PREFLT ON|OFF | ↑
	Third-level menu for VIDEO OPT. TV SYS M|NON/M | CNT RST BOTH|F1 | ↑
	Second-level menu for SPECIAL. WARNING: SERVICE ONLY—SEE MANUAL (if enabled) DISABLED—SEE MANUAL (if disabled) COLD START | CCD SIDES | CCD ADJ | CAL PATH ON|OFF | FORCE DAC
	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> SELF CAL | <status> EXT CAL | <status> SELF DIAG | NOT WARMED UP EXT DIAG

Table 1: Menu Off/Extended Functions Menu (SN B019999 & 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 ON|OFF AUTO PROBE ROLL MENU ON|OFF
		Fourth-Level menu for AUTO PROBE. SELECT PROBE IDENTIFY FUNCTION 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 B019999 & 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 | CAL PATH ON | OFF | FORCE DAC
	Second-level menu for CAL/DIAG. <status> SELF CAL | <status> EXT CAL | <status> SELF DIAG | NOT WARMED UP EXT DIAG

Table 2: CRT Display Menus

4	SELECT	INTENSITY VECTORS READOUT DISP INTENS GRAT ON|OFF 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 veiwing. 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.

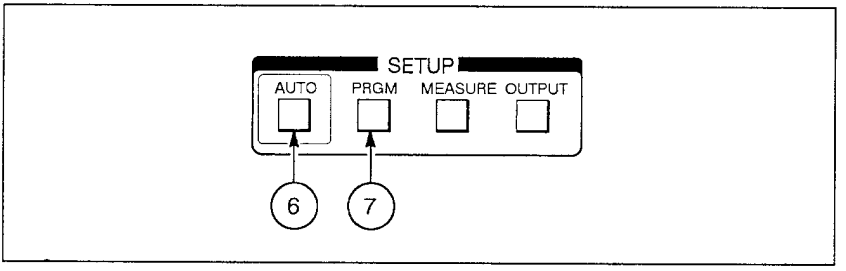

Figure 5: AUTO and PRGM Buttons.

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 HI|LO
7 PRGM	-----AUTOSTEP SEQUENCER----- MEMORY nn% INIT SAVE RECALL DELETE EDIT 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 REPEAT <N> PRINT/PLOT <N> SELF-CAL <N> BELL <N> SELF-TEST <N> SRQ <N> LOAD PANEL PAUSE <N> AUTOSETUP <N> PROTECT <N> MEASUREMENTS END STEP SET STEP ACTIONS NEXT SAVE ↑ ↓ Y|N STEP 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.

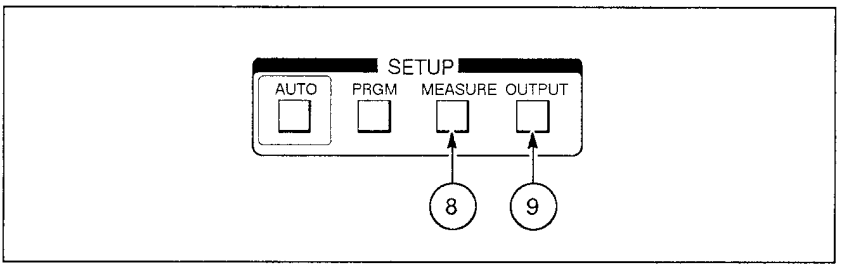

Figure 6: MEASURE and OUTPUT Buttons.

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 TYPE SETUP DISPLAY ON|OFF WINDOW ON|OFF
	Second-level menu for SNAPSHOT when more than one display source is displayed. TARGET: CH1 CH2 MULT/ADD REF
	Resulting display when either SNAPSHOT is pressed and only one display source is on screen or when the TARGET waveform is selected.
	SNAPSHOT READOUT: SNAPSHOT OF CHx 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 OVRS = 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 REF4
	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
	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

Table 4: Measure and Output Menus (Cont.)

		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 TO TARGET: DELAY1 DELAY2
		Second-level menu for SETUP. ---------METHOD--------- MARK MIN/MAX HIST CURSOR LEVEL ON|OFF 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.
		Third-level menu for LEVEL. ADJUST LEVELS WITH CURSOR/DELAY KNOB nn% nn% n.nV nn% DISTAL MESIAL PROXIMAL MESIAL2 %|VOLT
9	OUTPUT	STATUS SETUP DEBUG TRANSMIT/(PRINT)/(PLOT) 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.
		Second-level menu for SETUP. OUTPUT SETUP MODE TERM ADDR ENCDG

Table 4: Measure and Output Menus (Cont.)

	Third-level menu for MODE. T/ONLY L/ONLY T/L DEVICES OFF BUS Selecting DEVICES changes TRANSMIT to PRINT (or PLOT) in the OUTPUT control menu. Selecting OFF BUS turns off the TRANSMIT/PRINT/PLOT choice.
	Fourth-level menu for DEVICES. HPGL THINKJET PLOTTER PRINTER SETUP
	Fifth-level menu for SETUP. SETTINGS TEXT GRAT WFM PGSIZE ON|OFF ON|OFF ON|OFF ON|OFF US|A4
	Fourth-level menu for GPIB T/ONLY. -----SEND CURVE----- ONLY W/WFMPRE SEND PRGM
	Third-level menu for GPIB TERM. EOI LF/EOI
	Third-level menu for GPIB ADDR. GPIB ADDRESS = nn ↑ ↓
	Third-level menu for GPIB ENCDG. ----WHOLE WFMS---- PARTIAL WFMS ASCII RP RI RP RI 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.
	Second-level menu for GPIB DEBUG. DEBUG ----MONITOR ---- -SCREEN UPDATE- ON|OFF BUS|SCOPE IN|OUT SLOW PAUSE

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 μV/div, when Storage Acquire menu is set to AVG (average).

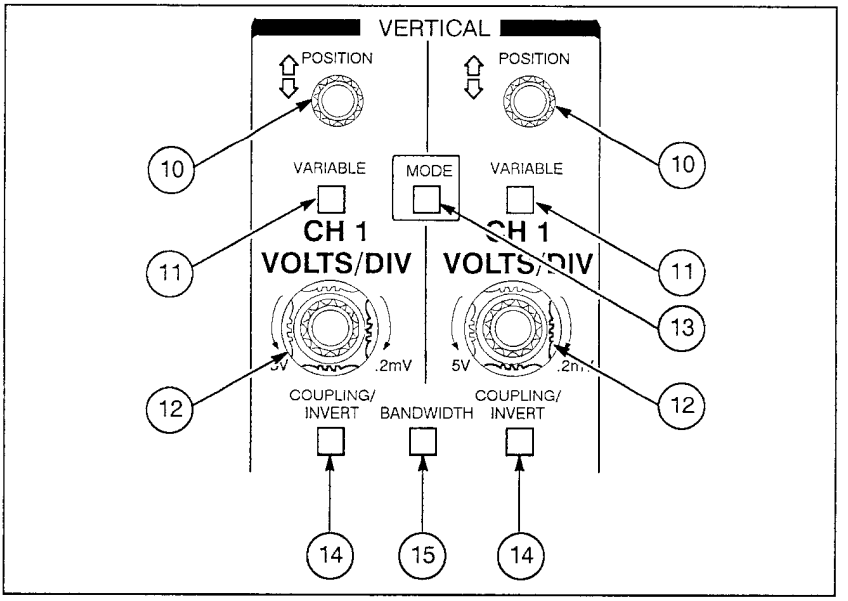

Figure 7: Vertical Buttons and Controls.

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 × 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.

- 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.

14 COUPLING/INVERT Buttons

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 MΩ. 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 MENUS 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, 50 MHz, or FULL vertical bandwidth. Readouts of usable storage bandwidth, usable storage rise time, and the sample rate are also displayed.

If ROLL MENUS is set to ON, subsequent pushes of this button switches the menu through the 20 MHz, 50 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. VERTICAL MODE CH1 vs CH2 YT|XY
14 COUPLING/ INVERT	CH1 COUPLING 50 Ω INVERT AC DC GND ON|OFF ON|OFF
	CH2 COUPLING 50 Ω INVERT AC DC GND ON|OFF ON|OFF
15 BANDWIDTH	USB = xxxx Hz / USR = xxxx s / SR = xxxx S/sec -----BANDWIDTH----- SMOOTH 20 MHz 50 MHz FULL ON|OFF The number xxxx depends on the Acquisition Mode, the SEC/DIV setting, and the bandwidth selected.
	SR = EXT. CLOCK -----BANDWIDTH----- SMOOTH 20 MHz 50 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 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.

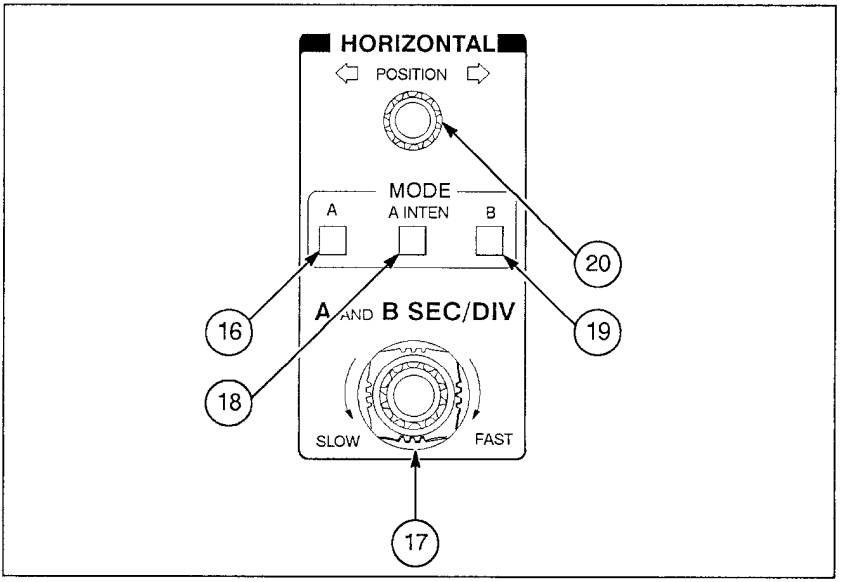

Figure 8: Horizontal Buttons and Controls.

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.

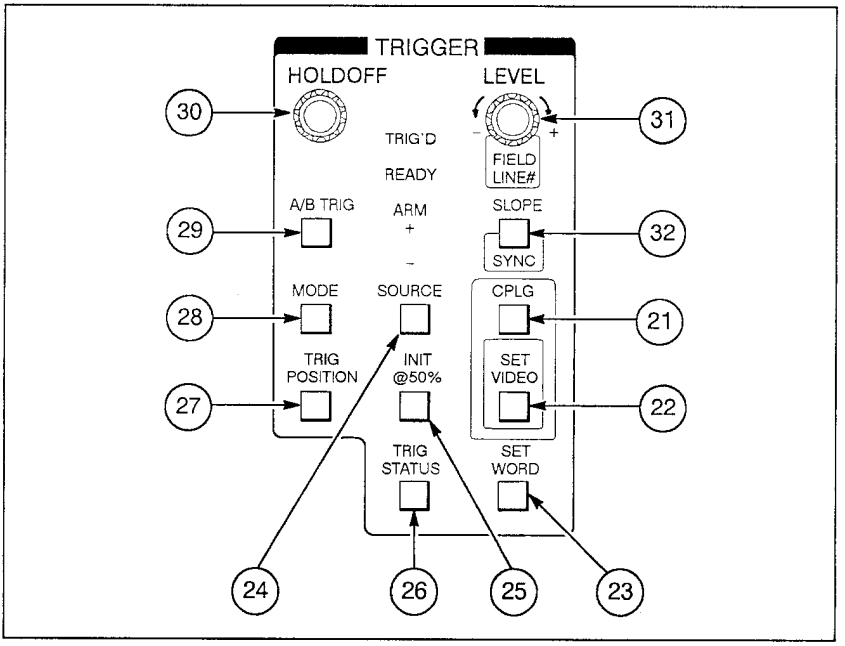

Figure 9: Trigger Buttons and Controls.

9

Table 6: Trigger Menus

23 SET WORD	WORD RECOGNIZER SETUP RADIX -----CLOCK----- SET OCT|HEX _/‾ ‾_ ASYNC BITS
	Second-level menu for SET BITS. In HEXadecimal: TRIG WORD: CLK=* ???? X XXXX XXXX XXXX XXXX 1 0 X ← → *Setting for clock in the first-level menu appears here.
	In OCTal: TRIG WORD: CLK=* ?????? X X XXX XXX XXX XXX XXX 1 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 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.

9

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 -------REJECT------- DC AC NOISE HF LF
	With the Video Option installed. A COUPLING -------REJECT------- DC|AC VIDEO NOISE HF LF
22 SET VIDEO	Video Option only (for interlaced signals). A VIDEO COUPLING CLAMP FIELD 1 FIELD 2 ALT TVLINE ON|OFF
	Video Option only (for non-interlaced signals). A VIDEO COUPLING CLAMP FIELD 1 TVLINE ON|OFF
24 SOURCE	A TRIG SOURCE VERT CHAN EXT CH1 1|2 1|2 LINE A*B CH2 ADD MULT
	Second-level menu for A EXT. A EXT SOURCE --------A AND B EXT GAIN-------- 1|2 EXT 1 EXT 1÷5 EXT 2 EXT2÷5
27 TRIG POSITION	A TRIGGER POSITION 1/8 1/4 1/2 3/4 7/8
28 MODE	A TRIG MODE AUTO SINGLE LEVEL AUTO NORMAL SEQ AUTO switches to ROLL at 100 ms/div and slower.

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) --REJECT-- DC AC NOISE HF LF 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) --REJECT-- DC AC NOISE HF LF
28	MODE	B TRIG RUNS AFTER TRIG AFTER EXT CLK ON|OFF
27	TRIG POSITION	B TRIGGER POSITION 1/8 1/4 1/2 3/4 7/8
24	SOURCE	B TRIG SOURCE B, EVENTS SOURCE (with DELAY by EVENTS ON) SOURCE VERT CHAN EXT CH1 1|2 1|2 CH2 ADD

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 SOURCE ------A AND B EXT GAIN------ 1|2 EXT 1 EXT 1÷5 EXT 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.

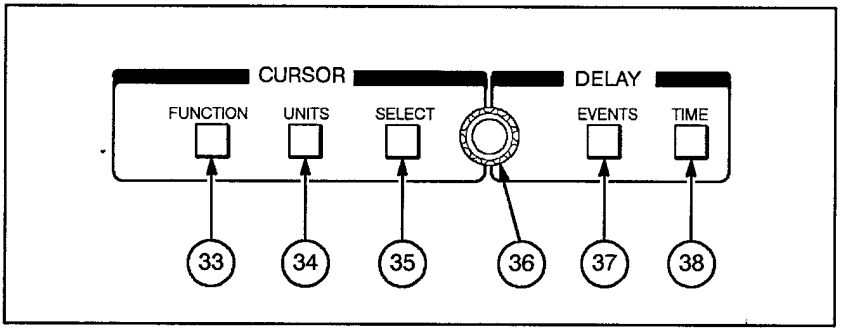

Figure 10: Cursor and Delay Buttons and Controls.

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 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 count may be changed using the CURSOR/DELAY control.	EVENTS ON|OFF
38 TIME	With Δ TIME OFF. DELAY TIME = xxxxxx B	ΔTIME ON|OFF
	With ΔTIME ON. DELAY TIME = xxxxxx B ΔDELAY TIME = xxxxxx B 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.	ΔTIME ON|OFF

39 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 REPET ON|OFF to ON in the menu extends the maximum available bandwidth to 150 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.

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.

40 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.

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.

DISPLAY REF Button

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.).

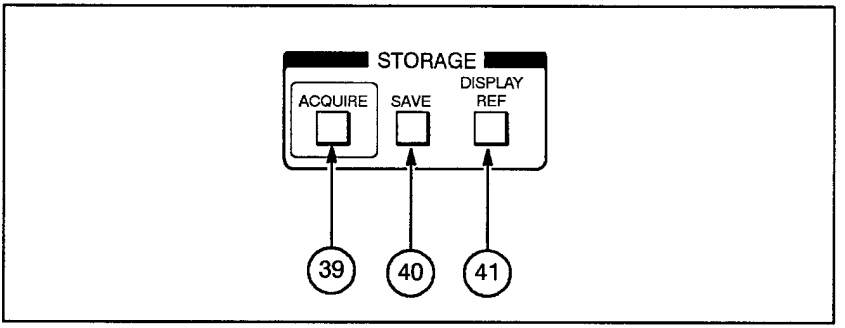

Figure 11: Storage Buttons.

Table 10: Storage Menus

39 ACQUIRE	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
40 SAVE	xxxxx ACQUISITIONS xxxxxHRS ----------SAVEREF SOURCE---------- STACK CH1 CH2 (function) REF REF
	Second-level menu for a SAVEREF SOURCE selection (except REF or STACK REF). --------SAVEREF DESTINATION-------- SAVEREF REF1 REF2 REF3 REF4 SOURCE
	Second-Level menu for SAVEREF SOURCE in Δ (delta) DELAY by TIME. SAVEREF SOURCE—(channel) DELAY 1 DELAY 2
	Second-Level menu if REF is selected. SAVEREF SOURCE—REF SAVEREF REF1 REF2 REF3 REF4 SOURCE
41 DISPLAY REF	In YT Mode. DISPLAY REF REF1 REF2 REF3 REF4 POS REF EMPTY appears above reference menu choice if no valid waveform is stored.
	In XY Mode. HORIZ XYREF POS REF

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

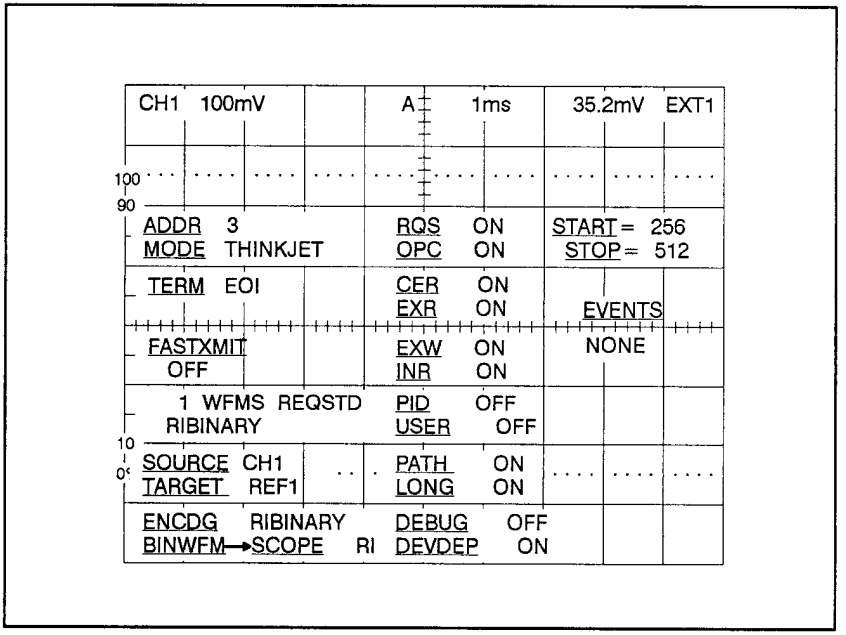

Figure 12: GPIB Status On-Line Screen

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 GPIB 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)