

Reference

**Tektronix**



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**TDS3000 Series  
Digital Phosphor  
Oscilloscopes**

**071-0275-01**



071027501

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

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

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## Battery Power

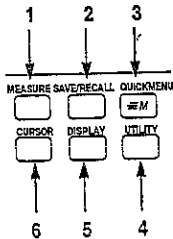
An optional battery pack is available for your oscilloscope. You can operate the oscilloscope continuously for approximately two hours from the battery pack. A triangle icon () and battery icon () show when the oscilloscope is operating from battery power. The battery icon is a gauge that shows the remaining battery capacity.

 **WARNING.** *To avoid electric shock, always connect this instrument to earth ground. Always connect the rear-panel ground terminal to earth ground when operating the instrument from battery power. Refer to the User Manual for additional information.*

When you start to use the battery pack, an on-screen message reminds you to connect the ground wire between the ground terminal on the rear panel and earth ground.

The battery charges automatically when the oscilloscope is connected to AC line power. A power-plug icon () and battery icon () show in the display and indicate the charge level of the battery. You can also charge the battery with the optional external charger (TDS3CHG).

## Menu Buttons

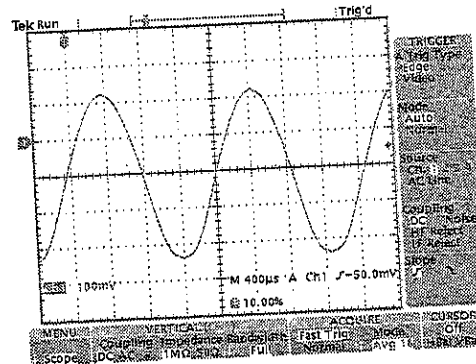


1. **MEASURE.** Performs automatic measurements of waveforms.
2. **SAVE/RECALL.** Saves and recalls setups and waveforms to memory or a floppy disk. Also contains a menu item to recall the factory setup.
3. **QUICKMENU.** Activates QuickMenus such as the built-in QuickScope feature.
4. **UTILITY.** Activates the system utility functions.
5. **DISPLAY.** Changes the appearance of waveforms and the display screen.
6. **CURSOR.** Activates the cursors.

## QuickMenus

The QuickMenu feature simplifies the use of the oscilloscope. When you push the QUICKMENU button, a set of frequently used menu functions show on the display.

Scope is one type of QuickMenu that you can use to control the basic oscilloscope functions. You can perform many tasks without using the regular menu system.



To use a QuickMenu, do these steps

1. Push the QUICKMENU button on the front panel.
2. Push the screen button that corresponds to the control you need to set. Push the screen button repeatedly to choose one of the settings. The small arrow icon indicates that there are additional settings available that are not shown.

You can use most of the front-panel controls at the same time you are using a QuickMenu. For example, if you push a channel button to select a different channel, the QuickMenu changes to show information about that channel.

You can still use the regular menus. For example, if you push the MEASURE button, you can set up and take automatic waveform measurements in the usual way. If you return to the QuickMenu, the measurement is still displayed on the screen.

You may have optional application modules installed that also have QuickMenu displays. To select the QuickMenu you want to use, push the MENU screen button. This menu item is shown only if application modules that contain a QuickMenu are installed.

## Acquire Menu

Bottom	Side	Description
Mode	Sample	Use for normal acquisition.
	Peak Detect	Detects glitches and reduces the possibility of aliasing.
	Envelope N	Captures variations of a signal over a period of time. (Adjust N with the general purpose knob.)
	Average N	Reduces random or uncorrelated noise in the signal display. (Adjust N with the general purpose knob.)
Horizontal Resolution	Fast Trigger (500 points)	Acquires 500 point waveforms at a fast repetition rate.
	Normal (10k points)	Acquires 10,000 point waveforms with more horizontal detail.
Reset Horizontal Delay	Set to 0 s	Resets the horizontal delay to zero.
Autoset	Normal Autoset	Executes the autoset function. (Optional application modules may add choices to execute specialized autoset functions.)
	Undo Autoset	Reverts to the settings before the last autoset.

### Cursor Menu

Bottom	Side	Description
Function	Off	Turns cursors off.
	H Bars	Use to take vertical measurements.
	V Bars	Use to take both vertical and horizontal measurements.
	Bring Selected Cursor to Center Screen	Moves the active cursor to center screen.
	Bring Both Cursors On Screen	Moves any off-screen cursor onto the screen.
Mode	Independent	Sets cursors to move independently.
	Tracking	Sets cursors to move together when cursor 1 is selected.

### Cursor Menu (cont.)

Bottom	Side	Description
V Bar Units	Sec (s) / 1/sec (Hz)	Sets horizontal units to seconds or frequency (Hz).
	Ratio (%)	Sets V Bar measurement units to percent.
	Phase (degrees)	Sets V Bar measurement units to degrees.
	Use cursor positions as %/°	Sets V Bar measurement scale so that 0% or 0° is the current position of left V Bar cursor and 100% or 360° is the current position of right V Bar cursor.
	Use 5 divs as %/°	Sets V Bar measurement scale so that 5 screen major divisions is 100% or 360°, where 0% or 0° is -2.5 divisions and 100% or 360° is +2.5 divisions from center graticule.

### Cursor Menu (cont.)

Bottom	Side	Description
H Bar Units	Base	Sets the H Bar units to be the same as the selected waveform's vertical measurement units (volts, IRE, dB, and so on).
	Ratio (%)	Sets H Bar measurement units to percent.
	Use cursor positions as 100%	Sets the H Bar measurement scale so that 0% is the current position of lowest H Bar cursor and 100% is the current position of highest H Bar cursor.
	Use 5 divs as 100%	Sets H Bar measurement scale so that 5 screen major divisions is 100%, where 0% is -2.5 divisions and 100% is +2.5 divisions from center graticule.

**Cursor Movement.** Use the general purpose knob to move the active cursor. Push the SELECT button to change which cursor is active.

**Faster Cursor Movement.** Push COARSE to set the general purpose knob to make faster cursor movements.

### Display Menu

Bottom	Side	Description
Waveform Display	Dots Only	Set to on to see dots only. Set to off to see dots and vectors.
	Persist Time	Sets persist time.
	Set to Min	Sets the persistence time to zero.
	Clear Persistence	Clears any displayed persistence.
Backlight Intensity	High	Use for bright ambient conditions.
	Medium	Use for dim ambient conditions.
	Low	Use to extend battery-operation time.
Graticule	Full, Grid, Cross Hair, Frame	Selects the graticule type.

Bottom	Side	Description
XY Display	Off (YT)	Turns off an XY display.
	Triggered XY	Turns on triggered XY display.
	Gated XYZ	Displays XY signals when Z-channel signal is above a set level. Only available on 4-channel instruments.
	Ch1 (X) Versus	Sets Ch2, Ch3, or Ch4, as Y versus Ch1 as X.
	Ref1 (X) Versus	Sets Ref2, Ref3, or Ref4 as Y versus Ref1 as X.
	Gated By	Sets Ch2, Ch3, or Ch4 as Z channel (gate) source, and gating channel threshold level.
Color Palette	Normal	Selects the color display.
	Monochrome	Sets all waveforms to high-contrast black and white.

**XY Waveforms.** For XY waveforms, channel 1 or Ref 1 is displayed in the horizontal axis. Use the Vertical POSITION and SCALE controls to adjust the horizontal position and size of the XY waveform.

Another channel or reference waveform is displayed in the vertical axis. Use the Vertical POSITION and SCALE controls for that channel to adjust the vertical position and size of the XY waveform.

**XY Waveform Triggering.** The XY waveform is triggered so you can synchronize periodic input signals to the XY waveform. This feature is useful when only one part of the period contains valid information that you want to see in the XY format. Set the time base and trigger location to acquire just that part of the period.

When you want to see the complete period of the signals regardless of the time base setting, set the trigger source to an unused channel and the trigger mode to Auto.

**Gated XYZ.** Displays XY signals only when the Z (gating) channel is true. Gated XYZ is similar to analog oscilloscope modulated XYZ mode except that the displayed XY signal is either on or off; there is no intensity modulation. Gated XYZ is useful for displaying constellation diagrams.

The general purpose knob sets the Z-channel threshold level.



## Measure Menu

Bottom	Side	Description
Select Measurement		Choose one of 21 automatic measurements for the selected channel.
Remove Measurement	Measurement 1	Removes a specific measurement.
	Measurement 2	
	Measurement 3	
	Measurement 4	
	All Measurements	Removes all measurements.
Gating	Off	Use to take measurements on the full waveform record.
	Screen	Use to take measurements on the portion of the waveform on screen.
	Cursors	Use to take measurements on the portion of the waveform between the V Bar cursors.

Bottom	Side	Description
Gating	Bring Selected Cursor to Center Screen	Moves the active cursor to center screen.
	Bring Both Cursors On Screen	Moves any off-screen cursor onto the screen.
High-Low Setup	Auto Select	Automatically uses the best measurement method depending on the measurement type.
	Histogram	Use to measure pulses.
	Min-Max	Use to measure other wave shapes.
Reference Levels	Set Levels in % or units	Use to choose custom reference levels in relative or absolute units.
	High Reference	Sets custom high reference level.
	Mid Reference	Sets custom mid reference level.
	Low Reference	Sets custom low reference level.
	Set to Defaults	Sets reference levels to default values.

### Save/Recall Menu

Bottom	Side	Description
Save Current Setup	To File	Saves a setup to disk.
	To Setup 1 ... To Setup 10	Saves a setup to nonvolatile memory.
	From File	Recalls a setup from disk.
Recall Saved Setup	Recall Setup 1 ... Recall Setup 10	Recalls a setup from nonvolatile memory.
	OK Confirm Factory Init	Initializes the setup to a known setup.
	Save Wfm	To File
To Ref1 ... To Ref4		Saves the selected waveform to nonvolatile memory.
Recall Wfm	From File Recall Ref1 ... Recall Ref4	Recalls a waveform from disk and displays it as a reference waveform.

### File Utilities Menu

Bottom	Side	Description
File Utilities	Delete	Deletes a file.
	Rename	Names or renames a file.
	Copy	Copies a file to another directory.
	Print	Prints a file to a printer connected to one of the hard copy ports.
	Create Directory	Creates a new directory.
	Confirm Delete	Turns On or Off a confirmation message before files are deleted.
	Overwrite Lock	Sets file overwrite protection to On or Off.
	Format	Formats a disk (erases all files).
Labels	Create/edit labels for reference waveforms and instrument setups stored in nonvolatile memory.	

## Trigger Menus

### Edge Trigger Menu

Bottom	Side	Description
Source	Ch1 ... Ch4	Sets the trigger source to a specific channel.
	AC Line	Selects the AC line trigger source (for AC line operation only)
	Ext	Selects the external trigger source for two-channel oscilloscopes.
	Ext/10	
	Vert	Sets the trigger source to the lowest-numbered active channel in the display.
	Coupling	DC
HF Reject		Rejects frequencies above 30 kHz in the trigger signal.
LF Reject		Rejects frequencies below 80 kHz in the trigger signal.
Noise Reject		DC coupling with low sensitivity to reject noise in the trigger signal.

Bottom	Side	Description
Slope	/ (rising edge)	Triggers on the rising edge of a signal.
	\ (falling edge)	Triggers on the falling edge of a signal.
Level	Level	Use to set the trigger level with the general purpose knob.
	Set to TTL	Sets the trigger level to +1.4 V for TTL logic.
	Set to ECL	Sets the trigger level to -1.3 V for ECL logic ( $V_{ee} = -5.2$ V).
	Set to 50%	Sets the trigger level to the 50% amplitude level of the signal.
Mode & Holdoff	Auto (untriggered roll)	Enables free-running and roll-mode acquisitions.
	Normal	Triggers only on valid trigger events.
	Holdoff (time)	Sets holdoff to a specific time.
	Holdoff (% of record)	Sets holdoff to a percent of the record duration.
	Set to Min	Sets holdoff to the minimum value.

### Video Trigger Menu

Bottom	Side	Description
Standard	525/NTSC	Triggers on a NTSC signal.
	625/PAL	Triggers on a PAL signal.
	SECAM	Triggers on a SECAM signal.
Source		Selects the trigger source. See <i>Edge Trigger Menu</i> for descriptions of these menu items.
Trigger On	Odd	Triggers on odd or even fields in an interlaced signal.
	Even	
	All Fields	Triggers on any field in an interlaced or noninterlaced signal.
	All Lines	Triggers on all lines.

### B Trigger Menu

Bottom	Side	Description
B Trigger After A	B Trigger After A Time	Sets the oscilloscope to trigger on the next B-trigger event that occurs after a specified period of time from the A trigger. Use the general purpose knob to set the time value.
	Set to Delay Time (B→▼) then Set (B→▼) to 0s	Sets the B Trigger After A Time value to the horizontal B→▼ value, then sets B→▼ to zero seconds. B→▼ is the delay time from the B trigger point to the expansion point (center screen).
	Set to Min	Sets B Trigger After A time to 26.4 ns.
	B Events	Sets the oscilloscope to trigger on the <i>n</i> th B-trigger event after the A trigger. Use the general purpose knob to set the event value.
	Set to Min	Sets the B events count to 1.

Bottom	Side	Description
Source		Sets Source, coupling, slope, and level for the B trigger.
Coupling		These settings are independent of similar settings for the A trigger. See <i>Edge Trigger Menu</i> for descriptions of these menu items.
Slope		
Level		

## Utility Menus

### Configuration System Menu

Bottom	Side	Description
Language	English	Use to choose your native language. Most on-screen text appears in the language you choose.
	Français	
	Deutsch	
	Italiano	
	Español	
	Portugués	
	(Russian)	
	(Japanese)	
	(Korean)	
	(Simplified Chinese)	
(Traditional Chinese)		

Bottom	Side	Description
Set Date & Time	Display Date/Time	Use to turn the date/time display On or Off.
	Hour Min	Use to set the internal clock with the current hour and minute.
	Month Day	Use to set the internal clock with the current month and day.
	Year	Use to set the internal clock with the current year.
	OK Enter Date/Time	Sets the date and time of the internal clock.
Battery Time-Outs	Power Off Time-Out	Use to set the time before an automatic shut down.
	Backlight Time-Out	Use to set the time before the backlight automatically turns off.
Tek Secure Erase Memory		Erases all nonvolatile waveform and setup memory.
Version		Use to see the firmware version.

### I/O System Menu

Bottom	Side	Description
GPIB (TDS3GM only)	Talk/Listen Address	Sets the GPIB address.
	Hard Copy (Talk Only)	Sets the GPIB port to talk only for making hard copies.
	Off Bus	Disables the GPIB port.
	Debug	Enables and disables a mes- sage window to help you debug GPIB problems.
RS-232	Baud Rate	Sets the baud rate in steps from 1200 to 38400.
	Flagging	Use to enable hard flagging (RTS/CTS) or turn flagging off.
	EOL	Selects end-of-line terminator.
	Debug	Enables and disables a mes- sage window to help you debug RS-232 problems.
	Set RS-232 Parameters to Default Values	Sets baud rate = 9600, hard flagging = on, and EOL = LF.

Bottom	Side	Description
Ethernet Net- work Settings (TDS3EM only)	Change Instrument Settings	Displays a list of fields in which you set oscilloscope Ethernet parameters such as address, instrument name, domain name, and so on. Refer to the <i>TDS3000 Digital Phosphor Oscilloscope Programmer Manual</i> for procedures to set these fields.
	DHCP/ BOOTP	
	Debug	Enables and disables a mes- sage window to help you debug Ethernet problems.
Ethernet Print- er Settings (TDS3EM only)	Add Printer	Adds, renames, or deletes an Ethernet network printer from the oscilloscope printer list. Refer to the <i>TDS3000 Digital Phosphor Oscilloscope Pro- grammer Manual</i> for proce- dures to set these fields.
	Rename Printer	
	Delete Printer	
	Confirm Delete	Enables or disables displaying a confirmation message before deleting a printer from the oscilloscope printer list.

### Hard Copy System Menu

Bottom	Side	Description
Format		Choose the correct hard copy format for your printer.
Options	Portrait	Prints in a portrait orientation.
	Landscape	Prints in a landscape orientation.
	Compression	Turn on or off hard copy file .gz compression format.
Ink Saver	Off	Prints the display colors.
	On	Prints colors optimized for printing on white paper.
	Preview	Shows a preview of the hard copy colors on the display.
Port	Centronics	Uses the parallel printer port.
	GPIB	Uses the GPIB port.
	RS-232	Uses the RS-232 port.
	File	Saves the hard copy to the floppy disk.
	Ethernet	Uses the Ethernet LAN port.
Clear Spool		Stops a hard copy in progress. Clears the print spooler.

### Calibration System Menu

Bottom	Side	Description
System Cal		
Signal Path		Compensates the signal paths to obtain best measurement accuracy.
Factory Cal		Used to calibrate the oscilloscope. This is a service function only.
Cal Due Control	Notify After Hours of Operation	Sets the number of hours of operation before notifying you that a calibration is due.
	Notify After Years of Elapsed Time	Sets the number of years before notifying you that a calibration is due.

**Signal Path Compensation.** You can run the Signal Path Compensation routine anytime but you should always run the routine if the ambient temperature changes by 10 °C or more.

### Diagnostic System Menu

Bottom	Side	Description
System Diags		
Execute		Starts diagnostics.
Loop	Once	Executes the diagnostic loop once.
	Always	Executes the diagnostic loop continuously.
	Until Fail	Executes until a failure occurs.
Error Log	Page Up	Use to see the previous error log page.
	Page Down	Use to see the next error log page.

### Vertical Menus

#### Channel Menu

Bottom	Side	Description
Coupling	DC	Sets input coupling to DC.
	AC	Sets input coupling to AC.
	GND	Provides a 0 V signal reference. The input BNC disconnects from internal circuits.
	$\Omega$	Sets input resistance to 50 $\Omega$ or 1 M $\Omega$ .
Invert	Invert Off	Use for normal operation.
	Invert On	Inverts the polarity of the signal in the display.
Bandwidth	Full Bandwidth	Sets bandwidth to the full oscilloscope bandwidth.
	150 MHz	Sets the bandwidth to 150 MHz (not available on some models).
	20 MHz	Sets the bandwidth to 20 MHz.
Fine Scale		Enables fine scale adjustment with the general purpose knob.



Bottom	Side	Description
Position	Vertical Position	Enables numerical vertical position adjustment.
	Set to 0 divs	Sets vertical position to center screen.
Offset	Vertical Offset	Enables vertical offset adjustment with the general purpose knob.
	Set to 0 V	Sets vertical offset to 0 V.
Probe Setup	Voltage Probe	Use to set probe gain or attenuation for probes that do not have the TekProbe II interface.
	Current Probe	
	Deskew	Use to adjust the time skew correction for each probe.
	Set to 0	Use to set probe skew correction to zero.

### Math Menu

Bottom	Side	Description
Dual Wfm Math	Set 1st Source to	Selects the first source waveform.
	Set Operator to	Selects the math operator: +, -, ×, or ÷
	Set 2nd Source to	Selects the second source waveform.

### Ref Menu

Bottom	Side	Description
Ref 1	Save Ch1 to Ref1	Saves channel 1 to reference waveform Ref 1.
	Save Ch2 to Ref1	Saves channel 2 to reference waveform Ref 1.
	Save Ch3 to Ref1	Saves channel 3 to reference waveform Ref 1.
	Save Ch4 to Ref1	Saves channel 4 to reference waveform Ref 1.
	Save Math to Ref1	Saves the math waveform to reference waveform Ref 1.
Ref 2 Ref 3 Ref 4		Identical settings for reference waveforms Ref 2, Ref 3, and Ref 4.

## Automatic Measurements

Measurement	Definition
Amplitude	Measured over the entire waveform. $Amplitude = High (100\%) - Low (0\%)$
Burst Width	The duration of a burst. Measured over the entire waveform.
Cycle Mean	The arithmetic mean over the first cycle in the waveform.
Cycle RMS	The true Root Mean Square voltage over the first cycle in the waveform.
Fall Time	Time that the falling edge of the first pulse in the waveform takes to fall from 90% to 10% of its amplitude.
Frequency	Reciprocal of the period of the first cycle in the waveform. Measured in Hertz (Hz).
High	The value used as 100%. Calculated using either the min/max or the histogram method. Measured over the entire waveform.
Low	The value used as 0%. Calculated using either the min/max or the histogram method. Measured over the entire waveform.

Measurement	Definition
Max	The maximum amplitude. The most positive peak voltage measured over the entire waveform.
Mean	The arithmetic mean over the entire waveform.
Min	The minimum amplitude. The most negative peak voltage measured over the entire waveform.
Negative Duty Cycle	Measurement of the first cycle in the waveform. $Negative\ Duty\ Cycle = \frac{Negative\ Width}{Period} \times 100\%$
Negative Overshoot	Measured over the entire waveform. $Negative\ Overshoot = \frac{Low - Min}{Amplitude} \times 100\%$
Negative Pulse Width	Measurement of the first negative pulse in the waveform. The time between the 50% amplitude points.
Pk-Pk	Measured over the entire waveform. $Peak-to-peak = Max - Min$
Period	Time it takes for the first complete signal cycle to complete in the waveform. Measured in seconds.

Measurement	Definition
Positive Duty Cycle	Measurement of the first cycle in the waveform. $\text{Positive Duty Cycle} = \frac{\text{Positive Width}}{\text{Period}} \times 100\%$
Positive Overshoot	Measured over the entire waveform. $\text{Positive Overshoot} = \frac{\text{Max-High}}{\text{Amplitude}} \times 100\%$
Positive Width	Measurement of the first positive pulse in the waveform. The time between the 50% amplitude points.
Rise Time	Time that the leading edge of the first pulse in the waveform takes to rise from 10% to 90% of its amplitude.
RMS	The true Root Mean Square voltage over the entire waveform.