

TimeView™
Modulation Domain Analyzer Software
User Manual



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Tektronix

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Preface

About This Manual

This manual describes the functions and features of the TimeView™ Modulation Domain Analyzer Software application. The TimeView application supports the following Tektronix instruments:

- FCA3000 Series (FCA3000, FCA3003, and FCA3020)
Timer/Counter/Analyzers
- FCA3100 Series (FCA3100, FCA3103, and FCA3120)
Timer/Counter/Analyzers
- MCA3000 Series (MCA3027 and MCA3040) Microwave Counter/Analyzers

Running TimeView Software and Hardware Connection

You must connect TimeView to the FCA3000, FCA3100, or MCA3000 Series instrument before you can take and analyze measurements in the TimeView application.

NOTE. *You can also view saved data files in TimeView. However, a very limited set of functions is available when viewing a saved data file as opposed to taking and analyzing a live measurement acquisition.*

Connecting the Instrument

Do the following to connect the instrument to TimeView:

1. Open the TimeView application.
2. Use a USB or GPIB cable to connect the instrument to the PC with the TimeView software.
3. Turn on the instrument and wait for about 10 seconds. Verify that the instrument is set for the correct remote connection (USB or GPIB).
4. In TimeView, click **Instrument** > **Connect**. TimeView automatically recognizes the instrument and opens a dialog box listing the instrument.
5. Click **OK**. The main TimeView window changes to enable the tool bar functions.

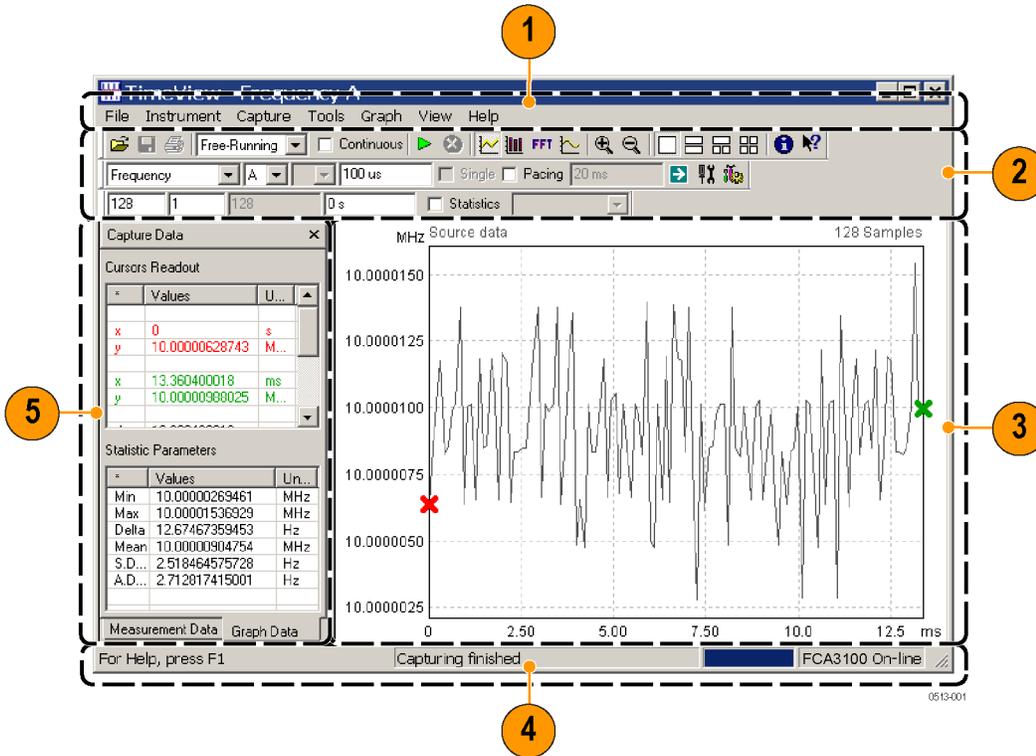
Disconnecting the Instrument from TimeView

To disconnect the instrument from the TimeView software, click **Instrument** > **Disconnect**. You can now disconnect the instrument from the USB or GPIB cable and/or power off the instrument.

NOTE. *You must disconnect the instrument from the TimeView software before powering down the instrument.*

Interface Overview

The following pages describe the TimeView application interface and functions.



The TimeView application window contains the Menu bar, the Toolbar, the Capture Data area, the Graph area, and the Status readout.

1. Menu bar (See page 4, *The Menu Bar*.)
2. Toolbars (See page 8, *The Toolbars*.)
3. Graph area (See page 18, *The Graph Area*.)
4. Status readout (See page 22, *The Status Readout*.)
5. Information tabs (See page 16, *The Capture Data Area*.)

The Menu Bar



The Menu bar provides access to all TimeView functions. The following sections describe each menu item.

File Menu

Item	Description
Open	Opens a data file created by the TimeView application. *.ssd – Free Running Measurement File *.rsd – Repetitive Sampling Data File *.wad – Waveform Data File *.tsd – Time stamp Data File
Save As	Saves the current captured waveform data (not available with 30-day trial version of software).
Load/Save settings	Loads/Saves the current application configuration to allow easy, quick switching between different types of measurements.
Print	Prints the active graph. If zoomed, only the zoomed part is printed (not available with 30-day trial version of software).
Recent files	Lists recently opened waveform data files. This area remains blank until the first file is opened.

Instrument Menu

Item	Description
Connect/Disconnect	Connects or disconnects a product instrument to the TimeView application. NOTE. Always use this menu item to disconnect the instrument from the TimeView application before disconnecting the USB or GPIB cable from the instrument or computer.
GPIB/USB Timeout	Sets the amount of time the application will wait for data from the instrument before incurring a time-out error. This is an instrument-specific menu item and is only available for particular product equipment.

Item	Description
Settings	Configures connected counter settings. Opens a window with access to all configurable settings available on the instrument. The functions present in the window are instrument dependent, that is, different instruments may have different settings. NOTE. <i>Selecting Default Settings in the Counter Settings dialog box will reset all tabs of the instrument settings to their defaults, not just those settings on the selected tab.</i>
Load Default Settings	Resets the counter to its default configuration. This does not affect TimeView application settings, though the application toolbar will show instrument setting changes.

Capture Menu

Configures settings to control capture and display of waveforms.

Item	Description
Free Running	Captures the selected measurement function in a continuous block of time.
Repetitive Sampling	Captures the selected measurement function, such as frequency at delayed time intervals. Requires external arming.
Waveform	Captures the shape of the waveform in terms of voltage versus time.
Raw Timestamp	Captures trigger level crossings on the measured waveform. The captured data consists of groups each containing four samples. Time marks are displayed by a square wave with its positive and negative transitions corresponding to the positive and negative transitions of the measured waveform.
Totalize (FCA3100 Series only)	Performs different arithmetic combinations of two waveforms measured on the A and B channels. After the measurement is taken the arithmetic combinations are available through the shortcut menu on the graph (right-clicking on the graph area).
Start selected capturing	Captures waveform data as set by the current measurement configuration.
Abort current capturing	Stops a continuous capture.
Continuous	Will continuously capture waveform data per the current measurement configuration until manually interrupted.
Measurement Readout	Displays a real-time readout of a selected measurement function in a separate window. Measurement Readout is only available when Capture Type is set to Free Running.
Signal Readout	Displays a snapshot summary of basic information about the current signal read by the counter. Click Update to refresh the display.

Item	Description
Settings	The settings window mirrors all of the functions available on the toolbar for each of the different Capture Types. (See page 11, <i>Time Stamp</i> .)
Load Default Settings	Loads the TimeView application default settings.

Tools Menu

Item	Description
Source Data	Displays the raw data as collected per the measurement function setting.
Histogram	Displays the data as a histogram.
Spectrum	Displays the data in its frequency spectrum using the FFT.
Smooth	Displays a waveform based on the averaging of a user definable number of coincident points.
Options	Displays additional settings related to the Tools menu items: <p>Bin Units toggles the y-axis to have units of either a percentage of samples per bin, or number of samples per bin.</p> <p>Number of Bins changes the granularity of the range of values associated with each bin, or bar, in the histogram.</p> <p>Auto FFT Size enables the application to determine the ideal number of points to compute the FFT if selected.</p> <p>Rectangular, Hamming, Hanning window sets the type of windowing algorithm to use for FFT measurements.</p> <p>Number of average sets the number of coincident points to use when finding the average value for a particular point. This will affect the total number of points displayed on the graph. For example, with 100 samples, a value of 50 would reduce the total number of points on the graph to 50.</p>

Graph Menu

Item	Description
Cursor Style	Changes the cursors displayed on the graph to a small circle, medium rectangle, or large cross.
Data Draw Style	Sets the line styles to use for data display.
Color Theme	Controls the colors of graphical objects. You can create and save one custom theme, which is automatically saved when you click OK.

Item	Description
Zoom In/Zoom Out	Zooms in and out on the graph; however, a better way to zoom is to click-and-hold on the graph while dragging the dotted rectangular box formed by the click-and-hold action over the desired region.
Clear All	Deletes the collected data, removing the graphs, and numerical data. <i>NOTE. You cannot undo this operation.</i>
Vertical Axis Range, Horizontal Axis Range	Allows manual definition of magnitudes of units and ranges to show on the axes.

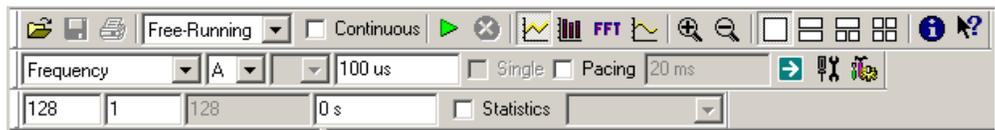
View Menu

Item	Description
Panes Layout	Changes the number of graphs that appear in the graph pane. You can display up to four graphs simultaneously. Each new graph is randomly chosen from the options remaining. To change the graph appearing in one of the new graph sub-panes, click that sub-pane, and select the desired graph from the Tools menu or the toolbar.
Toolbar Standard	Enables or disables displaying the Standard toolbar.
Toolbar Counter	Enables or disables displaying the Counter toolbar.
Toolbar Measuring	Enables or disables displaying the Measuring toolbar.
Information Pane	Enables or disables displaying the data information pane.

Help Menu

Item	Description
Help	Opens the TimeView online help window.
About TimeView	Displays TimeView software version number and PC/instrument configuration information.
Registration	Opens a dialog box that lets you register the TimeView application. Software registration is not available for the 30-day free trial version of the software; you must purchase the TimeView software CD to obtain a registration key.

The Toolbars



The toolbars provide fast access to most of the functions available in the application menus. There are three toolbars:

- The Standard toolbar (See page 8, *The Standard Toolbar.*)
- The Counter toolbar (See page 12, *The Counter Toolbar.*)
- The Measurement toolbar (See page 13, *The Measurement Toolbar.*)

The Standard Toolbar

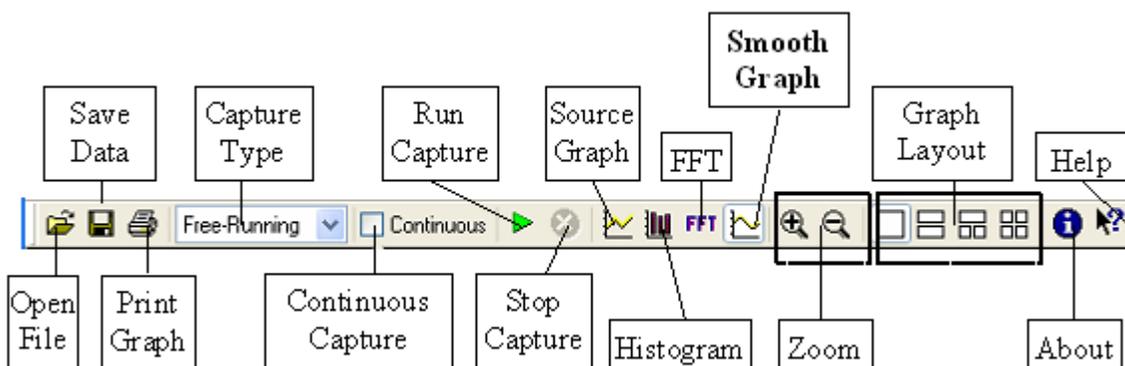


Figure 1: Standard toolbar

Item	Description
Open File	Opens a data file created by the TimeView application. *.ssd – Free Running Measurement File *.rsd – Repetitive Sampling Data File *.wad – Waveform Data File *.tsd – time stamp Data File
Save Data	Saves the current captured waveform data (available with the licensed version of the application) per the types listed in Open File.
Print	Prints the active graph. If zoomed only the zoomed part is printed (available with the licensed version of the application).

Item	Description
Capture Type	<p>The list of types displayed in the menu changes based on connected hardware. Five capture types exist over all hardware lines:</p> <p>Free Running captures the selected measurement function in a continuous block of time.</p> <p>Repetitive Sampling captures the selected measurement function (such as frequency) at delayed time intervals. Requires external arming.</p> <p>NOTE. <i>Once external arming is activated, the instrument uses external arming for all other capture types until it is disabled.</i></p> <p>Time Stamp captures trigger level crossings on the measured waveform. The captured data consists of groups each containing four samples. Time marks are displayed by a square wave with its positive and negative transitions corresponding to the measured waveform and its trigger level crossings with positive and negative slope. Up to 125 kHz (interpolator calibration ON) or 250 kHz (interpolator calibration OFF), all transitions can be time stamped, both positive (+ Slope) and negative (- Slope). Above these limits, there is a certain dead time, 8 μs or 4 μs, before the next group is recorded. Changing the pacing parameter can also extend the sampling interval. (See Figure 2 on page 11.)</p> <p>Totalize (FCA3100 Series only) allows different arithmetic combinations of two waveforms measured on the A and B channels. After the measurement is performed, the arithmetic combinations are available through the shortcut menu on the graph (right-clicking on the graph area).</p> <p>Waveform captures the shape of the waveform in terms of voltage versus time.</p>
Continuous Capture	Continually collects data, and displays each collection until manually stopped, at which point the last collected and displayed data is kept.
Run Capture	Runs the measurement.
Stop Capture	Stops the current measurement.
Source Graph	Displays a graph of the data as collected per the measurement function with no manipulation.
Histogram	Displays a graph of the collected data in a histogram. Uses the Histogram settings available in the Tool Options dialog box.
FFT	Displays a graph of the collected data after application of a FFT. Uses the FFT settings available in the Tool Options dialog box.
Smooth Graph	Applies a smoothing algorithm to the a graph of the collected data. Uses the Smooth settings available in the Tool Options dialog box.

Item	Description
Zoom	<p>Zooms the current graph in or out about the midpoint of the x-axis by dividing or multiplying the total time displayed on the x-axis by 2.</p> <p>You can use the cursors to zoom on an area of interest. Position the cursors on the graph (See page 19, <i>Cursors</i>.) Then right-click the graph and select Zoom In To Cursors.</p> <p>You can also click and hold on the graph to zoom in on the area of interest on the graph.</p> <p>NOTE. <i>Auto Range must be selected in the Define Axis window to enable the toolbar zoom functions. The Define Axis window is accessed in the graph shortcut menu. (See page 19, The Graph Shortcut Menus.)</i></p>
Graph Layout	<p>Controls how many graphs (up to four) are displayed in the graph pane.</p> <p>You can configure each new sub-pane in the graph pane to display a different type of graph by clicking in the desired sub-pane and selecting one of the four different types of graphs (Source, Histogram, FFT, Smooth) from the toolbar.</p>
About	Displays information about the TimeView application.
Help	Opens the TimeView help documentation to information about that specific piece of the application if it exists.

Time Stamp

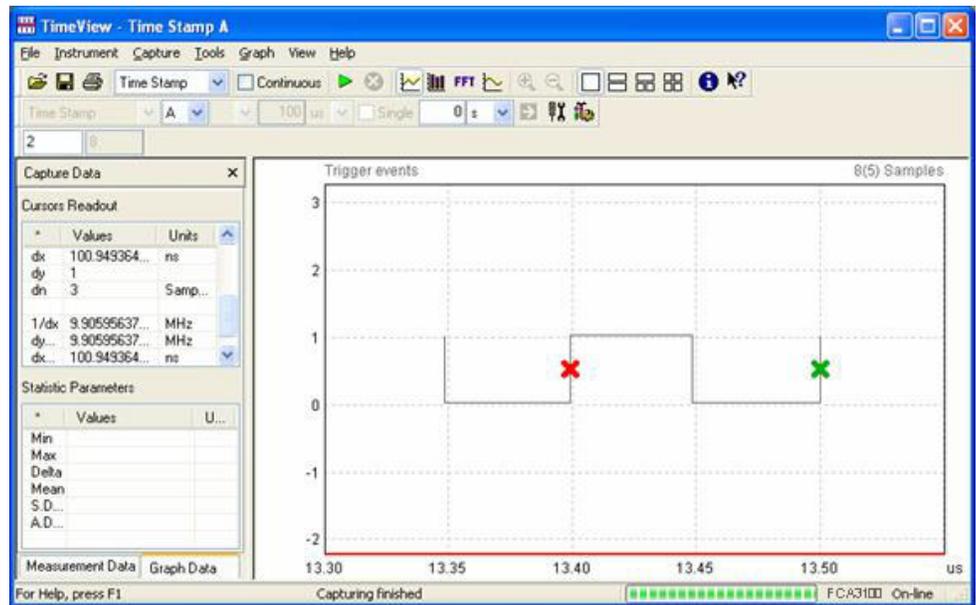


Figure 2: Raw time stamp example

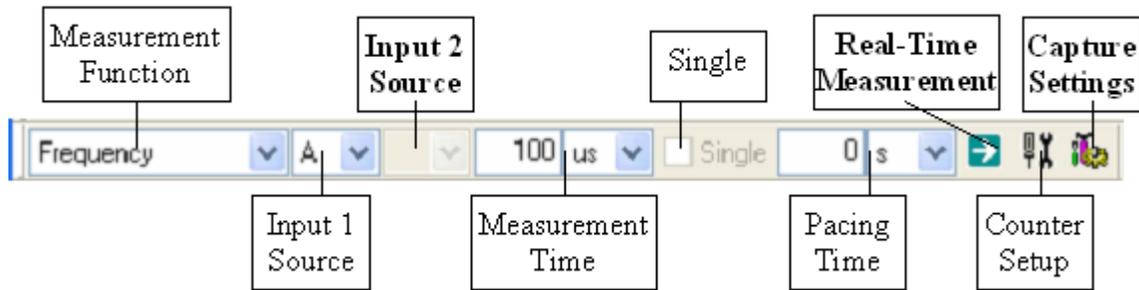
The preceding figure displays the result of a raw time stamp function on a 10 MHz periodic input signal, zoomed to show only one group. The group consists of four time stamps taken on consecutive trigger level crossings, without dead time. So the time stamps in this case are recorded every 50 ns. The time to the next group of time stamps is set by the pacing parameter. Its setting range is 0 to 500 seconds, but the real minimum time is 4 μ s or 8 μ s, the latter value being valid if the interpolator calibration is ON. You can see the influence of the pacing by zooming out the graph.

However, the counter that accumulates clock ticks every 10 ns is not interrupted but read off at the pacing intervals. From there the basic 10 ns resolution can be improved to 100 ps (FCA3000 Series) or 50 ps (FCA3100 Series) by the analog interpolators that are continually calibrated, if this function is activated. The trade-off is the longer dead time. The cursors (red and green X's) are positioned to measure one period of the input waveform from one zero crossing to the next with positive slope.

You also need an event counter to keep track of the total number of periods of the input signal at the time stamps recorded for the positive transitions. You can see the contents of this counter as a new graph by right-clicking in the graph and then selecting Event Count from the pop-up menu.

By combining event and time stamp data in a postprocessing block, you can calculate the statistics functions ADEV and MADEV, also by right-clicking in the Trigger Event graph and selecting the desired function from the pop-up menu.

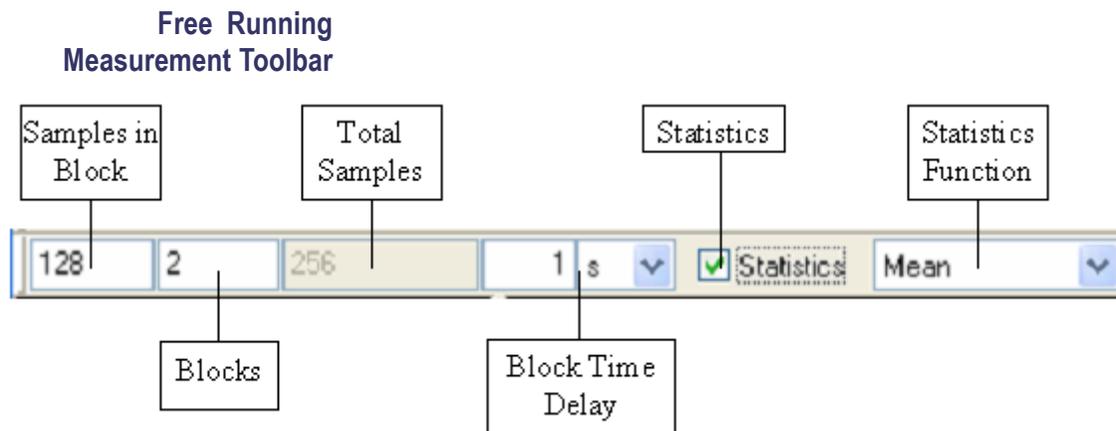
The Counter Toolbar



Item	Description
Measurement Function	Allows selection of the different measurements possible on the connected counter. See the instrument user manual for descriptions of the available measurements.
Input 1 Source	Selects the source input on the counter to use as input 1 in the application.
Input 2 Source	Selects the source input on the counter to use as input 2 in the application. This input is only used with particular Measurement Functions. If the Measurement Function requires this input it will become available in the application when that function is selected.
Measurement Time (for frequency and period average measurements only)	<p>Sets the time interval between samples. For Burst measurements the time interval should be shorter than the burst.</p> <p>See the <i>Single-Cycle Measurement</i> description that follows for more measurement information.</p>
Single-Cycle Measurement	The FCA3000, FCA3100, and MCA3000 Series instruments are single-cycle measurement instruments. In the TimeView application, the Single-Cycle Measurement check box is grayed out.
Pacing (Interval Between Measurements)	<p>Sets the time between individual measurements.</p> <p>See the <i>Single-cycle Measurement</i> description above for more measurement information.</p>
Real-Time Measurement Readout	Opens a window that displays a real-time readout of whichever Measurement Function is selected.
Counter Settings	See the instrument user manual for information on how to configure these settings.
Capture Settings	(See page 5, <i>Capture Menu</i> .)

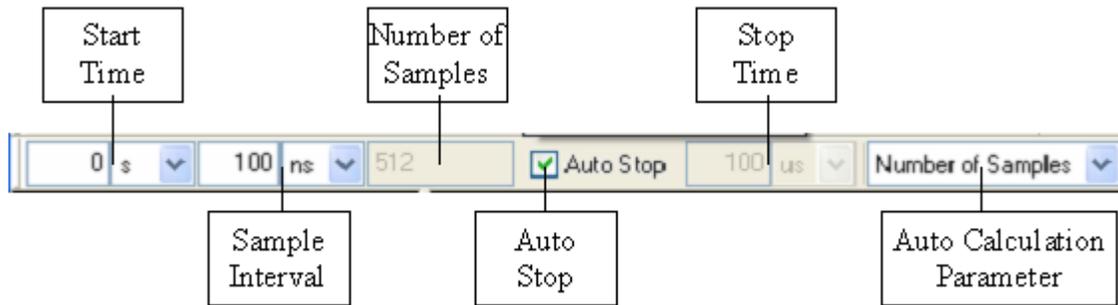
The Measurement Toolbar

Unlike the other Toolbars, which activate or deactivate fields based on choice of Capture Type, but maintain the same layout, the Measurement Toolbar changes its layout based on the Capture Type selected. A different Measurement toolbar is shown for each Capture Type.



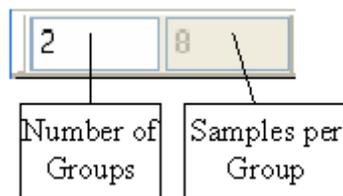
Item	Description
Samples in Block	The number of samples per block.
Blocks	The number of blocks of samples to collect.
Total Samples	Total number of samples = samples in block x blocks
Block Time Delay	The time interval to wait between capturing each block of samples.
Statistics	Collects the data based on measurement settings, then calculates and displays the value associated with the selected Statistics Function.
Statistics Function	The selected statistics algorithm is applied to the collected data, and the result displayed in the graph pane.

Repetitive Sampling Measurement Toolbar



Item	Description
Start Time	Sets a delay from the arming signal to the start of data collection.
Sample Interval	The interval at which samples are collected.
Number of Samples	Stops the data collection after a given number of samples.
Auto Stop	Automatically chooses a stop time. Stop Time in the Auto Calculation Parameter performs the same function as this function.
Stop Time	Stops the collection of data after a given time, or displays the stop time that was automatically selected if Auto Stop is set up correctly.
Auto Calculation Parameter	The TimeView application automatically selects the value for this parameter. If Stop Time is the selected parameter, then Auto Stop is superfluous.

Time Stamp Measurement Toolbar



Number of groups. This is the only time stamp parameter that you can select. Each group contains four samples. See *Time Stamp* for more information. (See page 11.)

Waveform Measurement Toolbar



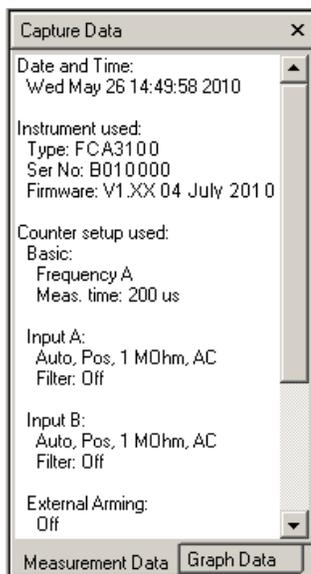
Item	Description
Waveform Time Resolution	<p>The minimum time between successive samples at a voltage resolution level.</p> <p>Setting the resolution higher than the period of the input wave can cause only one cycle of the wave to be displayed even if Stop Time is set so it would display multiple cycles.</p> <p>As an example, assume a 10 MHz sine wave input signal with a period of 100 ns. If the resolution is set at 100 ns, the expected number of cycles is based on the Stop Time. For a Stop Time = 300 ns, the application selects 3 cycles.</p> <p>If everything remains set the same, except the resolution is changed to 150 ns, the middle cycle of the 3 expected cycles is missing.</p>
Start Time	Sets a delay to start the data collection.
Auto Stop Time	The application sets the stop time.
Stop Time	Manually set the stop time of data collection.
Auto Voltage Resolution	The application sets the trigger step interval between voltage levels to a value resulting in approximately 50 steps between peak-to-peak voltage levels.
Voltage Resolution	Manually set the step interval voltage between trigger events.

The Capture Data Area

The Capture Data area displays information about the measurement setup and detailed information about values associated with the graph cursors. There are two tabs in the Capture Data area: the Measurement Data tab and the Graph Data tab.

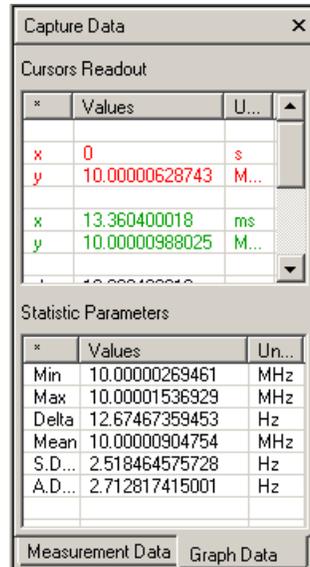
Measurement Data Tab

The Measurement Data tab provides a brief summary of high-level settings for the current measurement.



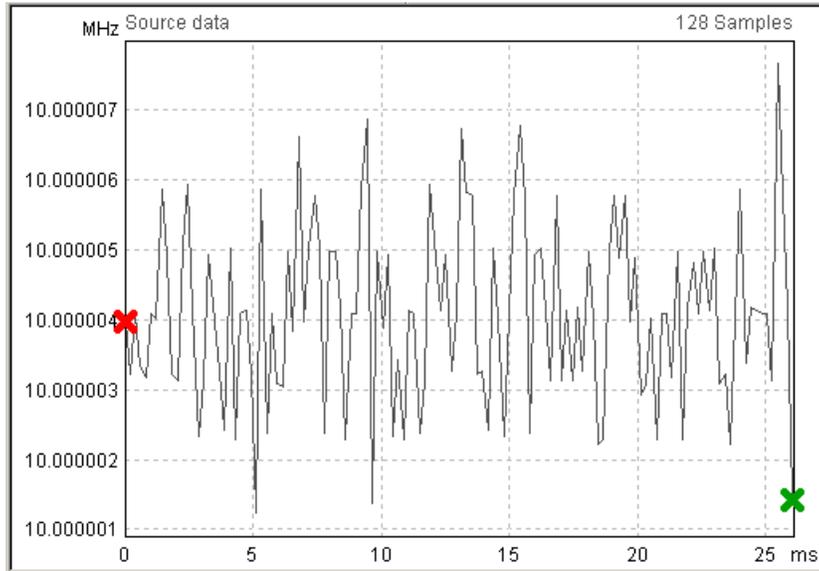
Graph Data Tab

The Measurement Data tab provides detailed information about values associated with the graph cursors.



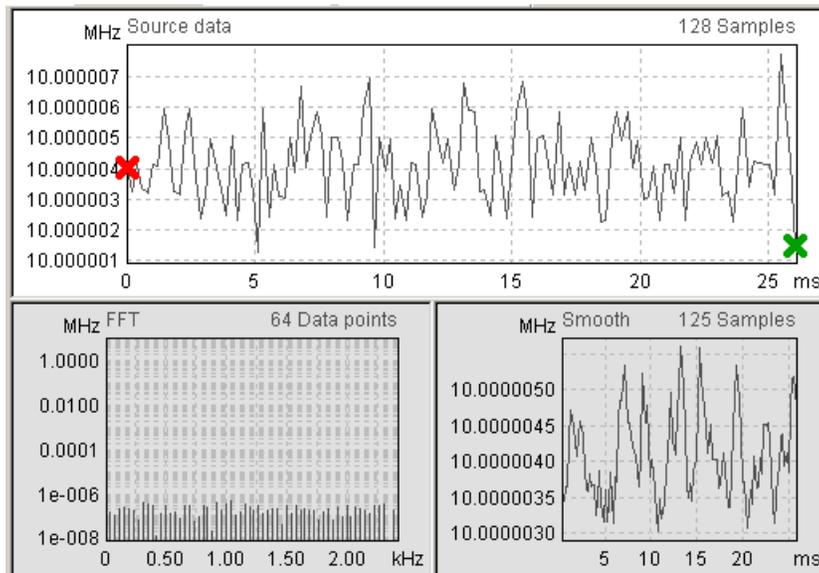
Item	Description
Cursors Readout	Displays information about the cursors including absolute position, distance of separation, and the associated units. These values automatically update as you move the cursors in the graph pane.
Statistic Parameters	Displays all of the statistics for the measurement without requiring an individual run for each desired statistic. The statistics also appear for some capture types without a statistics option on their toolbar.

The Graph Area



The Graph area displays the information collected from the measurement in visual form.

You can use the Graph Layout buttons to split the Graph area into the selected screen layout. (See page 8, *The Standard Toolbar*.) Each sub-pane contains a different graph type. Click a pane to activate it and update the Graph Data tab with values from that pane.



To change the type of graph shown in the graph area or sub-pane, click in the graph area and click one of the graph types from the Standard Toolbar. (See page 8, *The Standard Toolbar*.)

Cursors

Two cursors appear on a graph, or on the sub-pane of the selected graph if the graph area is split. Use the mouse to click and drag a cursor to a desired position. You can also use the keyboard arrow keys to move the left cursor (red by default), or press and hold the Shift key and use the arrow keys to move the right cursor (green by default).

The Graph Shortcut Menus

A shortcut menu is available for each graph by right-clicking with the cursor positioned within the graph area. The shortcut menu content changes depending on the graph type.

Free Running, FFT, and Smooth Graph Shortcut Menus

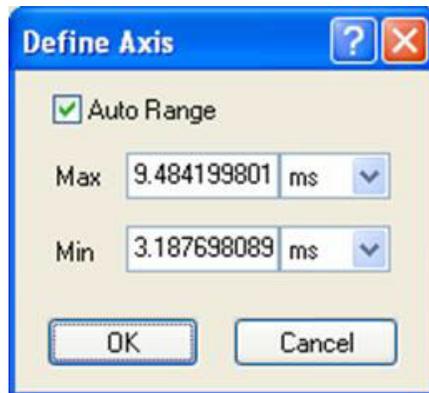
The following menu items are available on Free Running, FFT, and Smooth graph types:

Zoom In/Out. Provides the same functionality as the zoom functions on the standard toolbar.

Zoom in to cursors. This is the best way to zoom into a particular region of a graph. By setting the cursors to the desired range using the techniques described in *Cursors*, and then selecting this function, the graph zooms the data between the cursors.

Zoom out full graph. Zooms out to the extent necessary to display all of the collected data. This is the fastest way to return the graph to its furthest zoom.

Horizontal/Vertical axis. Manually sets the range of the x or y axis. To manually set the range, deselect Auto Range, and enter the desired values into the Max/Min fields.



NOTE. Deselecting the Auto Range check box will disable the ability to zoom. The Auto Range check box must be checked to zoom.

The Vertical Axis has an AutoZoom option. This automatically adjusts the vertical range to create some space between min/max points and the edges of the graph. It is recommended to leave this option selected.

Histogram Context Menu

Limited Histogram. Acts similar to a zoom. Based on the position of the cursors, selecting this option zooms the histogram to only display the range necessary to contain the data between the cursors.

Full Histogram. Returns the histogram to the necessary range to display all of the collected data.

Limit Statistics to Data Between Cursors. Recalculates the statistics based on the values between the cursors, and places lines on the source graph representing the new range of data used to calculate the statistical values.

NOTE. The application calculates the statistics based on sampled points. Even though the Source Graph may display lines connecting those points, and the new limited range may include those lines, the lines themselves do not contain data that can be used in the statistical calculation. This may result in an inability to compute the statistics due to lack of data.

Reset Limits. Resets the Limit to include the entire range of data.

**Source Graph Shortcut
Menu**

The Source Graph shortcut menu contains the Free Running, FFT, and Smooth Graph shortcut menu items, and also the following menu items:

Limit Tools to Data Between Cursors. Changes the range of data used in the calculation of the other graph types, updating those graphs to reflect their calculations based on the newly defined data range.

Reset Limits. Resets the Limit to include the entire range of data.

The Status Readout



The Status readout displays text messages relevant to the current measurement task, the data capture completion status, and the instrument connection status.

Taking a Quick Measurement

This section shows you how to take a very quick measurement in the TimeView application using the instrument 10 MHz signal output as the source. The TimeView application must be running and the instrument connected to TimeView. (See page 1, *Connecting the Instrument*.)

1. On the FCA3000, FCA3100, or MCA3000 Series instrument, connect a 50 Ω BNC cable from the 10 MHz output on the rear panel of the instrument to the Input A connector.
2. In TimeView, click **Instrument > Settings**.
3. Click the **Basic** tab, click the **Default Settings** button, and click **OK**. This sets the instrument to its default settings.
4. Click **Capture > Load Default Settings** and click **Yes**.
5. Click **Tools > Source Data**.
6. Click the green arrow button on the toolbar to capture the instrument data and display it in the TimeView application. A complete measurement (data capture) takes about 26 seconds. Use the toolbar buttons and functions to explore the user interface with the newly generated capture, or recapture data using a different capture or measurement type. (See page 8, *The Toolbars*.)

Viewing Example Data Captures

TimeView software includes a file of examples for different types of data capture. The examples are in the C:\Program Files\Tektronix\TimeView 2\Samples folder (default installation location). Use these capture sample files to explore TimeView features.

Do the following to view a sample file (or any saved file):

1. Click **File > Open** in the TimeView application.
2. Navigate to the **Samples** folder.
3. Select a sample file and click **OK**.