



EC14150 Scope Application Manual

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1 | EC14150 Scope Application Software

1.1 | Overview

The EC14150 Scope Application ('Scope App') is an application that is installed as part of the standard EC14150 software installation on Microsoft Windows platforms. This application is used to control one or more Signatec EC14150 data acquisition ExpressCard boards. The EC14150 is a dual channel, 14-bit data acquisition card with acquisition rates up to 150 MHz. Though most systems will only ever have a single EC14150 device, the EC14150 Scope Application and underlying software do support multiple EC14150 devices in one system.

The EC14150 Scope Application is a virtual oscilloscope application that allows the operator to view or edit all EC14150 hardware settings as well as record and display EC14150 acquisition data. For many users, the Scope App is the primary software tool used to record EC14150 acquisition data.

The goal of this document is to provide information for operational use of the EC14150 Scope Application. This manual is not an EC14150 hardware reference or software development reference manual. For more specific details on the EC14150 hardware, functionality, and software development consult the EC14150 Operators Manual. The EC14150 Operators Manual is installed in the "Documentation" folder of the EC14150 installation folder (C:\Program Files or Program Files(x86)\Signatec\EC14150\Documentation by default). There may also be a link in your Start Menu under All Programs -> Signatec -> EC14150.

1.2 | Requirements

Refer to the EC14150 Operators Manual for hardware and system requirements for running EC14150 hardware.

The EC14150 Scope Application is dependent on core libraries and components installed by the EC14150 Windows software setup.

1.3 | Running the EC14150 Scope Application

There are several ways to start the EC14150 Scope Application:

- Via the shortcut installed on the Desktop.
- Via the Start Menu (Start -> All Programs -> Signatec -> EC14150 -> EC14150 Scope Application.
- Directly: C:\Program Files or Program Files (x86)\Signatec\EC14150\EC14Scope.exe

When the Scope Application starts, it will automatically connect to all local EC14150 devices. Note that when the application starts up the EC14150 hardware is not accessed. This allows the Scope Application to run without directly affecting any EC14150 operation that may be in progress with other software.

If no physical EC14150 devices are detected in the system¹, then a single 'virtual EC14150' device will be used. A virtual device is an imaginary device that is not connected to any real hardware. It's implemented mainly as a software debugging tool, but also serves to show what the software can do when the hardware is present.

The Scope Application uses an MDI interface so each managed EC14150 device will have its own window.

¹ If you have EC14150 devices in your system but none are detected by the Scope Application then it's likely that the EC14150 device driver is missing or has not been installed. Consult the EC14150 Operators Manual for details on how to install the EC14150 driver.

The EC14150 Software Installation associates a few different file types with the EC14150 Scope Application. When activated from Windows Explorer, the EC14150 Scope Application will automatically be loaded with the specified file as a startup file. The [Startup Files](#) section describes these file types in more detail.

1.4 | Virtual EC14150 Devices

When the Scope Application starts up, if no physical EC14150 devices are detected, then the application will create a single 'virtual' device. A virtual device is an imaginary device that is not connected to any real hardware. Most application operations may be performed, but since there's no real hardware being controlled it isn't very exciting.

The virtual device mechanization is mainly used as a software debugging tool for application development. It can be used to help differentiate between software and hardware/firmware problems.

When a virtual device is used the board's name will be prefaced with "Virtual". If you have an EC14150 board plugged into your system, yet the EC14150 Scope Application indicates virtual hardware in use; this would indicate that your computer system has not detected the EC14150 hardware.

1.5 | Startup Files

The EC14150 Scope Application understands various file types that are used when operating EC14150 devices. When passed on the command line, these files will automatically be opened up and applied to any or all EC14150 devices. When one of these known files is specified on the command line, this is referred to as a startup file.

During the EC14150 Software Installation, these known file types are associated with the EC14150 Scope Application such that when they are activated (e.g. double-clicked) the EC14150 Scope Application will be opened up with that file. This has the same effect as starting the EC14150 Scope Application with the startup file on the command line.

During EC14150 Scope Application initialization, after all EC14150 devices have been connected to, the application will check to see if a startup file was specified. If so, and there's only a single EC14150 device, it will apply to that device. If more than one EC14150 device is present, a user-interface will be provided to select which EC14150 device(s) the startup file should apply to.

The currently associated file types are listed in the following table:

File Type	Extension	Notes
EC14150 Hardware Settings Files	.ec14set	Files of this type contain previously saved hardware settings. Since loading these settings will affect the hardware, the user will be prompted if they want to continue before the hardware settings are applied.
EC14150 Firmware Update Files	.ec14fw	Files of this type contain EC14150 firmware updates. The firmware update is not immediate; users will have the ability to cancel out.
EC14150 Recorded Data Files	.rd16	Files of this type contain previously recorded data. When loaded into the Scope Application, they are added as a data source in the Scope Panel.

1.6 | User Interface

The Scope Application may be used to modify any of the various hardware settings that affect how the EC14150 behaves. These settings are distributed over the tabbed view at the bottom of the main device form. These settings are described in the subsequent sections.

For all hardware settings, whenever an item in the user-interface is selected, the hardware is immediately updated with the new setting. When editing a user interface item with an edit control (e.g. the segment size parameter on the Trigger tab) the operator will need to press Enter in order for the modification to have effect. On success, the status bar will indicate the successful update. On error, a message box with details on the error will be displayed.

A screenshot of the application is shown in the figure below. The main interface is divided into three resizable panels. These panels are briefly described here in this section, with detailed information provided in subsequent sections.

The top panel is the 'Scope' panel and is used to display EC14150 acquisition data, data recording snapshots, and previously recorded data files. The Scope panel is capable of simultaneously displaying multiple data channels.

The bottom-left panel is the 'Control' panel and is used to start and stop data acquisitions and recordings. The options on this panel have to do with controlling the EC14150 operating mode.

The bottom-right panel is the 'Settings' panel and is a tabbed view with various views that control the various EC14150 hardware settings. Certain tabs are only displayed if the underlying EC14150 device supports those features.

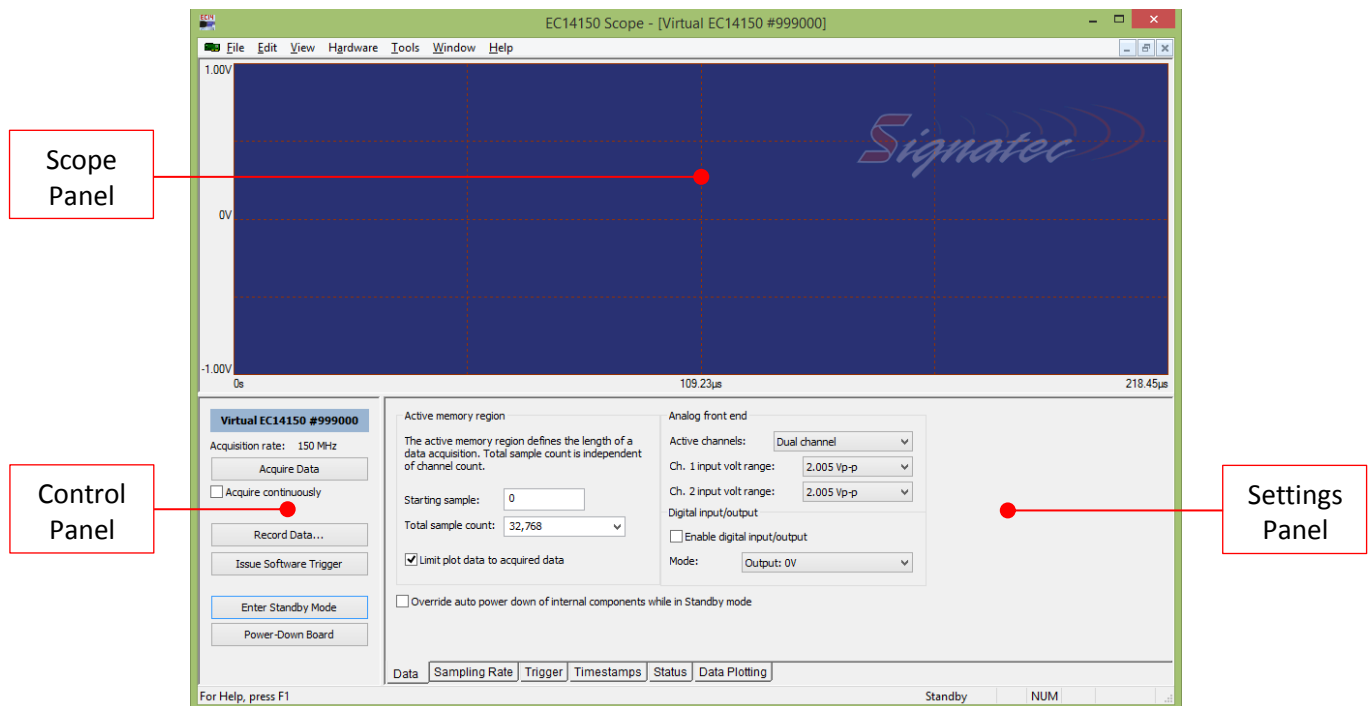


Figure 1: EC14150 Scope Application User Interface

2 | Control Panel

The Control panel is the bottom-left panel of the main application window. This is the main interface for controlling EC14150 operations like starting/stopping data acquisitions and recordings.

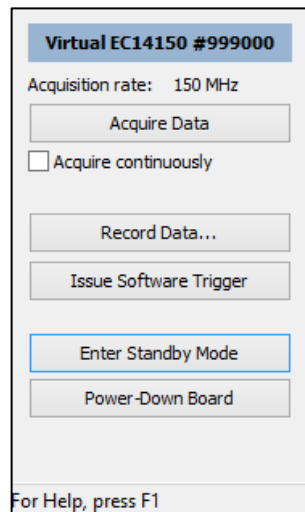


Figure 2: Control Panel of EC14150 Scope Application

2.1 | EC14150 Device Identification

The Control panel identifies the current selected EC14150 device by serial number within the blue shaded highlighted device identification field at the top of the Control panel. Any actions taken on the Control panel will actively apply to the identified EC14150 serial number device.

2.2 | Acquire Data

Clicking this button will do a single data acquisition to the EC14150 sample RAM. The length of the acquisition is defined by the Active Memory region settings on the Data tab of the Settings Area. Note that the current acquisition rate setting is displayed above this button.

When the data acquisition completes, a notification is displayed in the status bar and the plot area is updated to display fresh data. Note that the plot area can display data from the entire EC14150 RAM, which may or may not contain the newly acquired data. Checking the "Limit plot data to acquired data" checkbox on the Data tab will only display newly acquired data and ignore the unused portion of the EC14150 RAM.

If the acquisition does not complete within a short time (a few hundred milliseconds or so) the user interface will update to indicate that the acquisition is pending completion. At this point the Acquire Data button will turn into a 'Cancel Acquisition' button. Also, certain hardware settings that cannot be modified while an acquisition is in progress will become disabled.

Hint: If an acquisition does not complete (e.g. because the board is still waiting for a trigger event) you can click the 'Issue Software Trigger' button to force the EC14150 to trigger and start the data collection.

Related EC14150 Software Development C Library Functions:

- `AcquireToBoardRamEC14`

2.3 | Acquire Continuously

If this checkbox is selected when the Acquire Data button is selected, the application will go into a continuous mode where after the data acquisition completes and the data is displayed, another acquisition will begin immediately thereafter. In this mode, the 'Acquire Data' button will be renamed to 'Cancel Continuous Mode'. Pressing this button will stop the continuous data acquisition.

2.4 | Record Data

Clicking the 'Record Data...' button will bring up the Record EC14150 Data window. This window can be used to control data acquisition recordings for one or more EC14150 devices.

See [Recording EC14150 Data](#) section for details on this window.

2.5 | Issue Software Trigger

Clicking the 'Issue Software Trigger' button will issue a software-generated trigger event to the EC14150. This is useful for forcing data collection to begin in situations where a proper trigger is not available.

Related EC14150 Software Development C Library Functions:

- `IssueSoftwareTriggerEC14`

2.6 | Enter Standby Mode

Clicking this button will power up the EC14150 device (if currently powered down) and place the EC14150 device into the Standby operating mode. This button can also be used for troubleshooting purposes as it will have the effect of cancelling the current data acquisition or data transfer, even if another thread or process is controlling the card. If the Scope Application (or custom EC14150 software) ever becomes unresponsive during a recording or acquisition (this should not happen with release firmware) you can open up a new instance of the Scope Application and select this button to abort the pending operation that the stuck application is waiting for.

Related EC14150 Software Development C Library Functions:

- `SetOperatingModeEC14`

2.7 | Power-Down Board

This button is used to put the EC14150 into an 'Off' mode in which the board is powered down to reduce power consumption. When the board is powered down, most of the Scope Application will be disabled. To power the board back up, click the Enter Standby Mode button.

Related EC14150 Software Development C Library Functions:

- `SetOperatingModeEC14`

3 | Settings Panel

The Settings panel contains various tabs that contain interfaces for viewing/modifying the various EC14150 hardware settings. Except where explicitly noted, whenever a setting is changed in the user interface it is applied immediately to the underlying hardware. On success, the application status bar will be updated to indicate that the hardware was updated. On error, the operator will be notified via a message box.

3.1 | Data Tab

The Data tab contains active memory region settings that control how much data to acquire for RAM acquisitions as well as analog front end settings.

Figure 3: Data Tab in Settings Panel of EC14150 Scope Application

3.1.1 | Starting Sample

The starting sample setting defines the EC14150 RAM sample index at which data will be written for subsequent RAM acquisitions.

This value will be aligned down to a multiple of 4 samples and will be clipped to the largest valid starting sample: 268,435,452.

Dual-channel data is stored in RAM in a channel-interleaved format (Ch 1, Ch 2, Ch 1, Ch 2 ...). When dealing with dual channel data, the RAM address of Ch. 1 sample N would be $2*N$ and the RAM address of Ch. 2 sample N would be $2*N + 1$.

Unlike most all other hardware settings, this setting is not applied immediately to the hardware after being edited by the operator. The setting will be applied prior to the next data acquisition operation.

Related EC14150 Software Development C Library Functions:

- `SetStartSampleEC14`

3.1.2 | Total Sample Count

The Total Sample Count setting defines the length, in samples, of subsequent RAM acquisition operations. This count is independent of channel count, so for a total sample count of T :

- A single channel acquisition will result in an acquisition of T samples.
- A dual-channel acquisition will result in an acquisition of T samples, or $T/2$ samples per channel.

This value should be a multiple of 16. This value will be clipped to the largest valid sample count value: 1,073,741,808.

When 0 is specified as the total sample count, the EC14150 Scope Application interprets this as a 'transfer-only' request. This means that no new data acquisition will take place but the Scope area will be updated to display current EC14150 RAM content.

Related EC14150 Software Development C Library Functions:

- `SetSampleCountEC14`

3.1.3 | Limit Plot Data to Acquired Data

If this checkbox is selected then the Scope panel will only display the newly acquired data and ignore the unused portion of the EC14150 RAM. When unchecked, the Scope panel will allow for panning through the entire EC14150 RAM that may or may not contain acquired data.

3.1.4 | Active Channels

This item selects which channels will be digitized by subsequent data acquisitions.

When 'Dual channel' is selected the EC14150 will digitize the incoming data on the Channel 1 and Channel 2 input connectors. Data will be captured in channel-interleaved format: Ch. 1, Ch. 2, Ch. 1, Ch. 2 ...

When 'Single channel - Ch. 1' is selected the EC14150 will digitize the incoming data on the Channel 1 input connector.

Related EC14150 Software Development C Library Functions:

- `SetActiveChannelsEC14`

3.1.5 | Channel Input Voltage

This setting controls the input voltage range for the channel inputs. Each channel can have its own input voltage range. Input voltage range is specified in peak-to-peak voltage (Vp-p). For example, a 6.34Vp-p range starts at -3.17V and extends to +3.17V centered at 0V.

The AC-coupled EC14150A supports 31 unique input voltage ranges for each input channel ranging from 200mVp-p to 6.34Vp-p in roughly 1dB steps. The DC-coupled EC14150D supports full scale input voltage ranges of 250mV_{p-p}, 500mV_{p-p}, 1V_{p-p}, and 2V_{p-p}

Related EC14150 Software Development C Library Functions:

- SetInputVoltRangeCh1EC14
- SetInputVoltRangeCh2EC14

3.1.6 | Digital Input/Output

These controls affect the behavior of the EC14150 digital IO feature. The EC14150 has a digital IO SMA connector that can be configured to drive out certain signals, or accept certain input signals. The 'Enable digital input/output' check box is used to enable the digital IO port. The actual output or input function is selected with the 'Mode' combo box. Currently defined digital IO modes are detailed in the following table:

Digital I/O Mode Setting	Mode Description
Output: 0V	Outputs a 0V signal.
Output: Synchronized trigger	Outputs the trigger signal, synchronized to the acquisition clock.
Output: ADC clock	Outputs the acquisition clock.
Output: 3.3V	Outputs a 3.3V signal.
Input: Timestamp request*	*NOTE: This feature is not yet supported.
5	Reserved for future.
6	Reserved for future.
7	Reserved for future.

Related EC14150 Software Development C Library Functions:

- SetDigitalIoModeEC14
- SetDigitalIoEnableEC14

3.2 | Sampling Rate Tab

The Sampling Rate tab contains settings that affect the EC14150 acquisition clock, which defines the sampling rate.

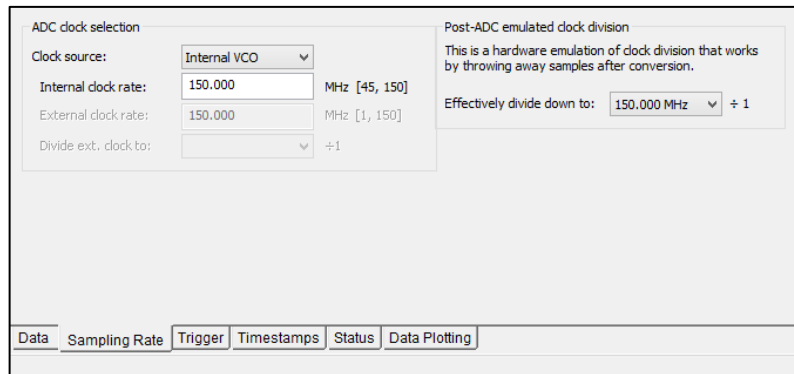


Figure 4: Sampling Rate Tab in Settings Panel of EC14150 Scope Application

3.2.1 | Clock Source

This setting determines which clock will be used to clock the acquisition data. The EC14150 has an internal clock implemented by a voltage controlled oscillator (VCO) and can also be clocked by an external clock device.

Related EC14150 Software Development C Library Functions:

- SetAdcClockSourceEC14

3.2.2 | Internal/External Clock Rate

When the internal VCO clock is selected as the clock source, the 'Internal clock rate' setting is used to select the desired acquisition rate. This can be any value from 45 MHz to 128 MHz and most any value from 128 MHz to 150 MHz and will be aligned to a 20 KHz boundary.

There are a few 'holes' in the frequency ranges that cannot be reached with the internal clock:

- 128.92 to 129.82 MHz (Δ 900 kHz)
- 140.63 to 142.80 MHz (Δ 2.17 MHz)

When the external clock is selected as the clock source, the 'External clock rate' setting is used to tell the software the external clock rate. This can be any rate from 10 MHz to 150 MHz.

IMPORTANT: It's important for the operator to ensure that this setting is kept up to date with the external clock rate. The underlying software needs this information to properly configure the EC14150 for normal operation. If the actual external clock is much slower or faster than what is specified by this setting then the firmware may not be able to synchronize properly which can result in bad acquisition data or acquisitions not finishing.

Related EC14150 Software Development C Library Functions:

- SetInternalClockRateEC14
- SetExternalClockRateEC14

3.2.3 | Divide External Clock To

This setting is used to select the clock division, if any, to apply to the external clock. The external clock may be divided by any integer value from 1 to 32.

Related EC14150 Software Development C Library Functions:

- SetExtClockDividerEC14

3.2.4 | Post-ADC Emulated Clock Division

This setting controls a feature of the EC14150 that emulates clock division by throwing away samples after conversion. This setting can be used with either the internal VCO or external clock source selection. This second effective division can be set from 2 to 32 in factors of 2.

Related EC14150 Software Development C Library Functions:

- SetPostAdcClockDividerEC14

3.3 | Trigger Tab

The Trigger tab contains settings that affect the EC14150 trigger. These settings relate how data is collected relative to external events.

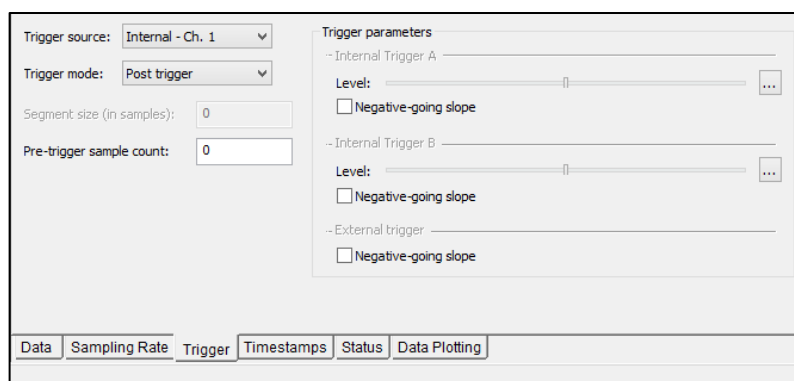


Figure 5: Trigger Tab in Settings Panel of EC14150 Scope Application

In the context of an EC14150, a trigger is an event that commences data collection during a data acquisition operation. When the EC14150 is put into one of the acquisition operating modes, the EC14150 will begin digitizing immediately, but acquisition data will not be stored until the card receives a trigger event.

3.3.1 | Trigger Source

This setting controls the EC14150 trigger source, which defines where trigger events originate. There are two types of trigger sources: internal or external.

The EC14150 can be configured to use one of two internal trigger sources: Internal Channel 1 or Internal Channel 2. Both internal sources operate the same way; the only difference between the two is the data channel that is monitored for the trigger source.

When the external trigger is selected then a trigger event is defined by a TTL level pulse delivered to the EC14150 via the external trigger connector on the back of the card. (The external trigger input is the MMCX connector is labeled 'TRIG'.)

Related EC14150 Software Development C Library Functions:

- SetTriggerSourceEC14

3.3.2 | Trigger Mode

The EC14150 supports two types of triggering modes. The trigger mode defines how much data will be acquired for each trigger event.

The default trigger mode is Post Trigger mode. In this mode, when a trigger event is detected, the EC14150 will digitize samples until the total number of samples (over all channels) has been acquired. The total number of samples is defined by the Total Samples setting. This mode is used to acquire a single stream of continuous data.

The other trigger mode is Segmented Trigger mode. In this mode, when a trigger event is detected, the EC14150 will digitize a static number of samples defined by the Segment Size setting. Then the EC14150 will rearm and wait for another trigger. This is repeated until the total number of samples acquired over all segments hits the Total Samples count. This mode is used to acquire multiple discrete segments of continuous data.

Related EC14150 Software Development C Library Functions:

- SetTriggerModeEC14

3.3.3 | Segment Size

This setting is only relevant when using Segmented trigger mode. This setting defines the number of samples that will be acquired per trigger event. This value will be aligned down to an even sample count.

Related EC14150 Software Development C Library Functions:

- SetSegmentSizeEC14

3.3.4 | Pre-Trigger Sample Count

The Pre-Trigger Samples setting allows the board to keep a specified number of samples that occurred prior to the trigger event. This feature allows the operator to look 'back in time' at data prior to the trigger event.

Related EC14150 Software Development C Library Functions:

- SetPreTriggerSamplesEC14

3.3.5 | Trigger Parameters

The trigger parameters section contains settings that pertain to trigger level and trigger direction.

When using an internal trigger source, a trigger event occurs when the channel's ADC value crosses a particular trigger level value in a particular direction. The EC14150 implements two independent trigger level/direction pairs: A and B. If you only need one trigger-level, you can disable one by setting its level to 0. The default setting for trigger direction is positive-going, meaning that a trigger event will be generated when the ADC value is greater than or equal to the trigger level value and the previous ADC value is less than the trigger level value. The trigger direction can be reversed by selecting the 'Negative-going slope' checkbox.

As an example, suppose the trigger source is Internal Ch. 1, Internal Trigger A Level is 12345, and trigger direction A is positive-going. When the board is placed into acquisition mode, it begins digitizing immediately but does not store sample values until a trigger is detected. In this particular example a trigger condition will be met when the current ADC value is greater than or equal to the trigger level value (12345) and the previous ADC value is less than the trigger level value (i.e. crossing the trigger level in a positive-going fashion).

There are two methods of setting the Internal Trigger A and B levels. The slider control can be used when an exact value isn't necessary. Alternately, clicking the '...' button will open up a window that will allow the operator to enter a specific trigger level value.

When using an external trigger source, a trigger event is defined by the provided external TTL level pulse. By default, the trigger event will be generated on the rising edge of the external TTL signal (a positive-going trigger direction). The trigger direction can be reversed by selecting the 'Negative-going slope' checkbox, in which case the trigger event will be generated on the falling edge of the external TTL signal.

Related EC14150 Software Development C Library Functions:

- SetTriggerLevelAEC14
- SetTriggerLevelBEC14
- SetTriggerDirectionAEC14
- SetTriggerDirectionBEC14
- SetTriggerDirectionExtEC14

3.4 | Timestamps Tab

The Timestamp feature is not yet available and therefore any settings controls within the Timestamps tab can be ignored at this time.

3.5 | Status Tab

The Status tab contains an interface to read EC14150 status flags and EC14150 version information.

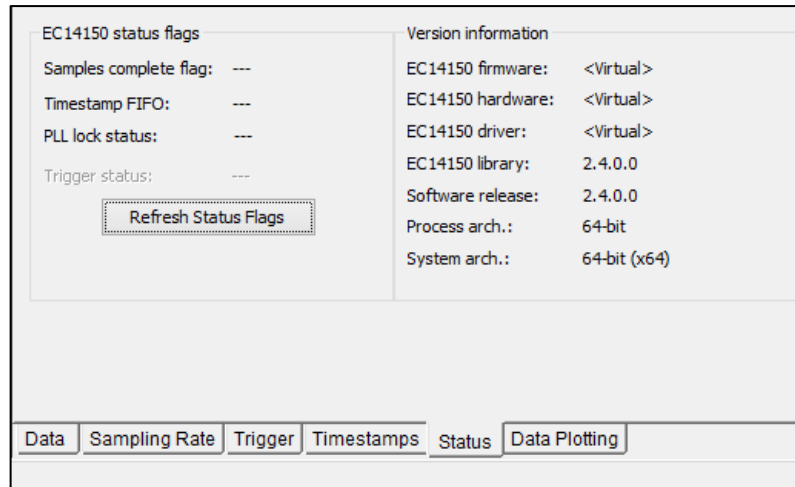


Figure 6: Status Tab in Settings Panel of EC14150 Scope Application

3.5.1 | Samples Complete Flag

The Samples Complete Flag reports the current status to indicate if a transfer/acquisition has completed or not.

3.5.2 | Timestamp FIFO

The Timestamp feature is not yet available and therefore any status information for Timestamp FIFO can be ignored at this time.

3.5.3 | PLL Lock Status

This item displays the state of the phase lock loop (PLL) lock status and is only relevant when using the internal ADC clock. A locked PLL means that the acquisition clock is stable.

Related EC14150 Software Development C Library Functions:

- GetPllLockStatusEC14

3.5.4 | Refresh Status Flags

Clicking this button will result in the EC14150 status hardware register being read which will result in all items in the EC14150 status flags group being updated.

3.5.5 | Version Information

This section displays the version numbers of various EC14150 firmware, hardware, and software components.

The general format used for version numbers by Signatec is:

Major.Minor.Sub-Minor.Package

Where:

- *Major* is the major version number of the entity. This is usually only incremented when the underlying entity goes through a major change.
- *Minor* is the minor version number of the entity. The minor version number is usually incremented whenever the underlying entity is changed.
- *Sub-Minor* is the sub-minor version of the entity is usually used to indicate pre-release state.
- *Package* is the package version and is only incremented when the underlying entity has not changed, but has been rebuilt or repackaged.

The following table details the various reported version information items:

Version Component	Version Component Description
EC14150 firmware:	This is the EC14150 firmware package version number. This item can be updated by uploading EC14150 firmware.
EC14150 hardware:	This is the hardware revision of the current EC14150. This version is assigned during EC14150 hardware initialization and can only be updated by Signatec.
EC14150 driver:	This is the version of the underlying EC14150 kernel-mode driver. This is the sole software entity that communicates directly with the EC14150 hardware. This item can be updated by installing newer EC14150 product software.
EC14150 library:	This is the version of the main EC14150 user-mode shared library. This is the primary interface to the underlying EC14150 device driver. This item can be updated by installing newer EC14150 product software.
Software release:	This is the version of current EC14150 product software installation. This item can be updated by installing newer EC14150 product software.
Process arch.:	This is the current EC14150 software process architecture, which will be reported as '32-bit' if using the 32-bit EC14150 Scope Application software or '64-bit' if using the 64-bit EC14150 Scope Application software.
System arch.:	This is the current PC system platform architecture, which will be reported as '32-bit' if using a 32-bit based CPU/PC platform with 32-bit operating system or '64-bit' if using a 64-bit based CPU/PC platform with 64-bit operating system.

IMPORTANT: In the event that any technical support assistance is required, please provide all of the current reported version information details when contacting Signatec Technical Support; along with detailed information about the applied settings being used in the EC14150 Scope Application and a detailed description of the issue.

Related EC14150 Software Development C Library Functions:

- GetFirmwareVersionEC14
- GetHardwareRevisionEC14
- GetDriverVersionEC14
- GetLibVersionEC14
- GetSoftwareReleaseVersionEC14

- GetVersionTextEC14

3.6 | Data Plotting Tab

The Data Plotting tab contains settings that affect how data is displayed in the Scope panel.

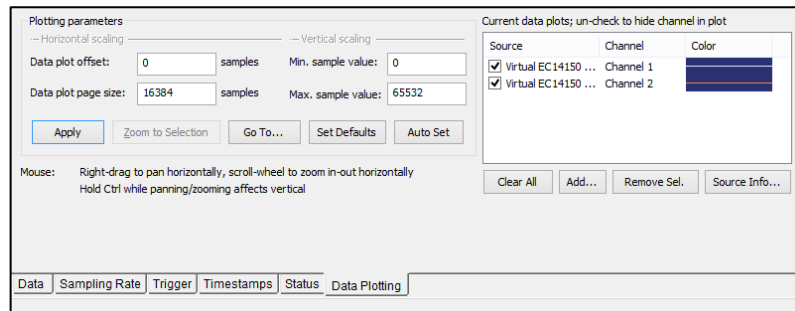


Figure 7: Data Plotting Tab in Settings Panel of EC14150 Scope Application

3.6.1 | Plotting Parameters

Within the plotting parameters section, the operator can enter direct sample values to adjust the horizontal and vertical scaling of the plotted data within the Scope panel.

Horizontal scaling (to effectively zoom-in or zoom-out) of the plotted data can be adjusted by the 'Data plot offset' and 'Data plot page size' sample values entered.

Vertical scaling (to effectively move up or move down) of the plotted data can be adjusted by the 'Min. sample value' and 'Max. sample value' entered.

Clicking on the 'Apply' button after entering any value changes for the Horizontal or Vertical scaling parameters will effectively apply the changes to the plotted data displayed on the Scope Panel.

NOTE: Horizontal and Vertical scaling of plotted data can also be directly modified within the Scope Panel itself using various mouse or keyboard controls. See [Scope Panel](#) section for details.

The 'Zoom to Selection' button will be enabled when an extended selection is made in the plot area within the Scope Panel. When this button is clicked it will zoom in horizontally such that the selected region fills the plot area.

The 'Go To...' button, when clicked, will open up the Go to Sample or Segment in Plot window. This is equivalent to selecting "Go to Sample..." in the View menu.

The 'Set Defaults' button, when clicked, will apply the Scope Application's default plotting settings that will effectively override and reset any current applied plot settings.

The 'Auto Set' button, when clicked, will attempt to automatically adjust vertical scaling such that all data fits into the plot area.

3.6.2 | Plot Source List

The Plot Source List section is used to add or remove data plot sources and to view selected plot source information.

By default, whenever an acquisition is conducted, the newly acquired data will be displayed in the Scope Panel. The Plot Source listing table window will identify:

- The specific EC14150 device used as the source of the acquired data by listing the EC14150 device and Serial Number in the 'Source' column.
- The specific channel number from the corresponding EC14150 device that is the source of the plotted data in the 'Channel' column.
- The specific color identification of the plotted data acquired for the corresponding channel number of the EC14150 device.

The checkboxes listed for each source within the table are used to toggle individual channel visibility of the plotted data. Note that the plotted source data is NOT actually removed by toggling the checkbox selection; only the visibility of the data in the Scope Panel is affected.

The 'Clear All' button, when clicked, will remove all data plot sources from the plot area. This includes displayed EC14150 RAM data, recording snapshots, and external files.

The 'Add...' button, when clicked, will allow the operator to select a data file to plot in the Scope panel. When a file is selected, the Scope Application will check to see if a corresponding SRDC file is available and if present, data type and channel count will be obtained from the SRDC data. See [Signatec Recorded Data Context \(SRDC\) Information](#) section for details on SRDC data.

The 'Remove Sel.' button, when clicked, will remove only the source of the data plot that is currently selected within the Plot Source listing table window.

The 'Source Info...' button, when clicked, will open up a property page that displays information on the currently selected data source within the Plot Source listing table window.

4 | Scope Panel

The Scope panel is where EC14150 acquisition data is displayed. This can be data that is currently in the EC14150 RAM, a data snapshot from the current data recording, or data previously saved to a file. The plot area can display multiple channels of independent or interleaved data of varying sample sizes (8-, 12-, 14-, 16-, 32- bit) and types (signed, unsigned, floating point) simultaneously.

By default, the time-domain data plotting within the Scope panel is set to Time for the x-axis and is set to Voltage for the y-axis. These settings can also be optionally set to display Sample Number for the x-axis and ADC Value for the y-axis by selecting 'Tools->Options...' from the menu bar.

The [Data Plotting](#) tab in the Settings area controls many of the data plotting parameters. This includes scaling parameters, channel visibility, and channel source information. In addition, the mouse may be used to alter the horizontal and vertical scaling of the data as well as panning through the data directly from within the Scope panel.

If the plot area is zoomed in sufficiently, data points will be discretely visible. When in this mode, holding the mouse pointer over the data point should result in a tooltip with the channel identifier and sample value being displayed in a tooltip window.

Plotted data is read-only; there are no facilities to modify data with this interface.

4.1 | Mouse Controls

The mouse may be used to zoom and pan plotted data. In this section 'plot area' represents the blue area in the Scope panel where data is actually plotted and 'outside plot area' represents the margins outside of the blue data plot area.

The following table identifies all mouse controls; some mouse controls are used in combination with keyboard (Key) controls. Note that the plot area in the Scope pane must have mouse focus for these actions to work. If the mouse actions appear to have no effect, click once somewhere on the plot area in the Scope pane to give it focus.

Mouse Action	Mouse Action Result
Left-Click in Plot Area	Sets the main selection point to the sample position closest to where the mouse was clicked. This will also result in a vertical trace being displayed in the plot area. The time and sample position will also be marked under the trace in the lower horizontal axis label area.
Left-Click outside Plot Area	This will remove the current selection.
Shift Key + Left-Click	Extends the selection from the main selection point to the sample position closest to where the mouse was clicked. This will result in a second vertical trace being displayed as well as the highlighting of all samples (inclusively) between the two selection points. The time and sample position will also be marked under the starting trace and the ending trace with a displayed delta value marked in the middle in the lower horizontal axis label area.

Mouse Wheel	Rolling the mouse wheel up/down will zoom in/out horizontally on the data under the sample position closest to the mouse position. Tilting the mouse wheel to the left/right will horizontally pan data left/right starting from the sample position closest to the mouse position.
Control Key + Mouse Wheel	Rolling the mouse wheel up/down while the Control Key is held down will zoom in/out vertically on the data.
Right Click Hold & Drag in Plot Area	This method is useful for operators that don't have a tilting wheel mouse. While holding down the right mouse button, dragging left/right will horizontally pan data left/right starting from the sample position closest to the mouse position. Note: Right click hold and drag panning doesn't work well when already zoomed in real tight on the data. In this case, use the horizontal scroll bar to pan data left/right.
Control Key + Right Click Hold & Drag	Holding down the Control Key while right click hold and dragging will allow data to be vertically panned up or down.

4.2 | Keyboard Controls

When the plot area in the Scope pane has keyboard focus, certain keys have an effect on the scope control, as identified in the following table:

Keyboard Action	Keyboard Action Result
Left/Right Arrow Keys	Scroll one 'line' left/right. This is equivalent to clicking the arrow button on the horizontal scroll bar.
Page Up/Down Keys	Scroll one page up/down. This is equivalent to clicking in the 'open' area of the horizontal scroll bar.
Home Key	Scrolls all the way back to the beginning of the data.
End Key	Scrolls all the way to the end of the data.

5 | Menu Bar

The Scope Application menu bar is located directly under the main application title bar window.

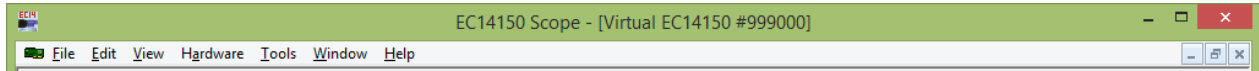


Figure 8: Menu Bar of EC14150 Scope Application

5.1 | File Menu

5.1.1 | New EC14150 Device

This item will only be enabled if there are local EC14150 devices that are not already open in the application. Selecting this item will open up a new local EC14150 device instance.

Related EC14150 Software Development C Library Functions:

- ConnectToDeviceEC14

5.1.2 | Close EC14150 Device

Select this item to close the current EC14150 device. If an acquisition or recording is currently in progress it will be stopped.

Related EC14150 Software Development C Library Functions:

- DisconnectFromDeviceEC14

5.1.3 | Open and Apply Board Settings

Select this item to load EC14150 hardware settings previously saved with the Save Board Settings menu item. Loading board settings will implicitly put the board into Standby mode.

Related EC14150 Software Development C Library Functions:

- LoadSettingsFromFileXmlEC14

5.1.4 | Save Board Settings

Select this item to save all EC14150 hardware settings to a file that can be opened and applied to the hardware at a later time. If a board settings file is currently set, then selecting this menu item will overwrite the current board settings file with current updated settings.

Related EC14150 Software Development C Library Functions:

- SaveSettingsToFileXmlEC14

5.1.5 | Save Board Settings As

Select this item to save all EC14150 hardware settings to a file that can be opened and applied to the hardware at a later time with a specified alternative file name. This menu item should be selected if the operator doesn't want to overwrite the existing board setting file currently in use.

5.1.6 | Save Board Data

Selecting this item will open the 'Save EC14150 RAM Data to File' dialog. This dialog can be used to save data in EC14150 RAM or the current recording snapshot to a file on the local computer. Upon make the desired settings, clicking the 'Save Data' button will initiate the save process with a progress status bar indicator. Click on the 'Close' button to exit this dialog window.

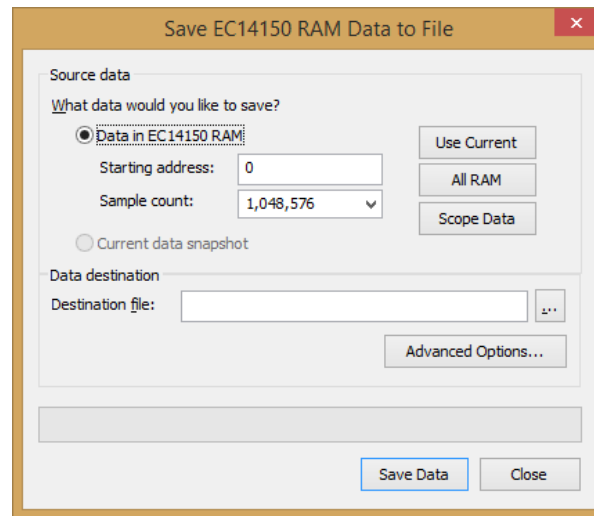


Figure 9: Save EC14150 RAM Data to File Window

5.1.6.1 | Source Data

The data currently residing on the EC14150 onboard RAM can be saved by selecting the option 'Data in EC14150 RAM'. A region of data can be transferred from the EC14150 RAM to the specified file on the host computer by entering a starting address value and selecting a sample count value .

The 'Use Current' button, when clicked, will use the active memory region currently specified on the [Data tab](#).

The 'All RAM' button, when clicked, will select the entire EC14150 RAM. Note that the entire RAM contents may or may not contain valid data depending on the actual amount of active memory specified for the acquisition.

The 'Scope Data' button, when clicked, will select the RAM region that is currently displayed in the Scope panel.

The option to select 'Current data snapshot' is only enabled when a recording snapshot is present in the Scope panel. When this option is selected the application will save the current recording snapshot to the specified file on the host computer.

5.1.6.2 | Data Destination

The 'Destination file:' textbox is used to enter the pathname of the destination file and file name of the data file to be saved to the host computer. Clicking on the "..." button to the right of the destination file text box will open a standard Windows file dialog window allowing the operator to browse the host computer's file directory structure to target a desired folder location and enter a file name for the saved data file. Upon closing the Windows file dialog window, the targeted location and file name will be displayed in the destination file text box.

The application can save EC14150 data in a variety of ways by clicking the 'Advanced Options...' button; see the [Destination File Advanced Options](#) section for complete details.

Related EC14150 Software Development C Library Functions:

- ReadSampleRamFileFastEC14
- ReadSampleRamFileBufEC14

5.1.7 | Plot Data in Scope

Selecting this menu item will allow the operator to select a source data file to be displayed in the Scope panel. This is equivalent to selecting the 'Add...' button on the [Data Plotting](#) tab.

5.1.8 | Recent Settings File

This item will display a listing of the most recently used board settings file. Selecting any one of the listed board setting file will then apply those file boards settings to the EC14150 device.

5.1.9 | Exit

This item will exit out and close the EC14150 Scope Application software.

5.2 | View Menu

5.2.1 | Frequency Domain Window

Selecting this item will toggle the visibility of the Frequency Domain window. See [FFT Analysis of EC14150 Data](#) for details on this window.

5.2.2 | Device Driver Statistics Window

Selecting this item will toggle the visibility of the EC14150 Driver Statistics window. This window displays some EC14150 statistics collected by the EC14150 device driver. An instance of this window is shown below.

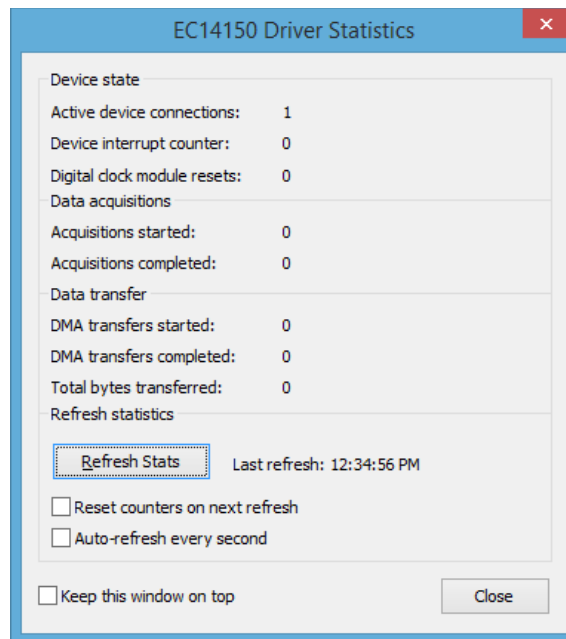


Figure 10: EC14150 Driver Statistics Window

These statistics are for the EC14150 device in general and are aggregated from all threads and processes. This includes custom EC14150 software written by end users. This makes the data displayed on this window useful for troubleshooting EC14150 problems. Using this window you can determine if data is currently being moved, if transfers or acquisitions are not completing, etc.

The following table details the statistics information reported:

Statistic Item	Statistic Item Description
Active device connections	This is the total number of active EC14150 device connections. (The number of open handles to the underlying EC14150 device driver.)
Device interrupt counter	This is the total number of times that the EC14150 device driver interrupt handler is invoked. In most cases, this is the total number of times that the EC14150 has interrupted the system. If the underlying interrupt line is being shared with another device, this value may be greater than the total number of EC14150 interrupts.
Digital clock module resets	This item will not be of interest to most users. This item counts the number of times the software has reset the main digital clock module (DCM).
Acquisitions started	This is the total number of acquisitions started. This includes both RAM and RAM buffered PCI acquisitions.
Acquisitions completed	This is the total number of acquisitions completed. Or more specifically, this is the total number of 'Samples Complete' interrupts generated by the EC14150. Free-run acquisitions (e.g. RAM buffered PCI acquisitions) will never generate a Samples Complete interrupt.

Continued:

Statistic Item	Statistic Item Description
DMA transfers started	This is the total number of DMA transfers started. DMA transfers are the primary method of obtaining EC14150 acquisition data. DMA transfers are used to obtain data in acquisition recordings as well as obtain data for display in the Scope panel.
DMA transfers completed	This is the total number of DMA transfers completed.
Total bytes transferred	This is the total number of bytes transferred (via DMA) between the EC14150 and host PC.

The 'Refresh Stats' button, when clicked, will query the EC14150 driver for fresh data. It is safe to query driver statistics while the EC14150 is in operation. The stated last refresh time will then be displayed to the right of this button.

Selecting the checkbox option to 'Reset counters on next refresh' and then clicking on the 'Refresh Stats' button will zero out all of the counters (except for the active connection count). The stats are zeroed after they are copied for the refresh operation.

Selecting the checkbox option to 'Auto-refresh every second' will then enable the stats to be automatically refreshed every second. Selecting the checkbox option to 'Keep this window on top' will then keep the Driver Stats window to be the topmost window on top of all other application windows (even from other applications) so that the Driver Stats window will not be obscured.

5.2.3 | Go to Sample

Selecting this item will display the Go to Sample or Segment Window. This window is a modeless dialog that can be used to navigate to specific offsets in the plot area. Further, if the scope source is segmented (e.g. data acquired using the segmented triggered mode) the window can be used to jump to specific data segments. An instance of this window is shown below:

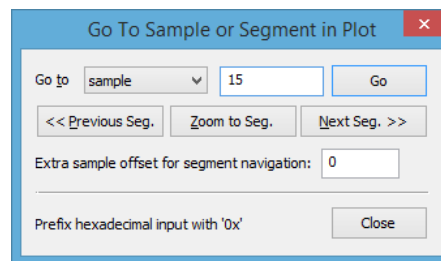


Figure 11: Go To Sample or Segment in Plot Window

The 'Go to' line is used to select the sample or segment to navigate to. The combo box allows for sample or segment selection. The edit box contains the sample/segment value (whichever is selected in the adjacent combo box) to jump to. Both samples and segment counts begin at 0. Decimal input is assumed. Hexadecimal input is allowed, but the number must be prefixed with '0x'.

Click on the 'Go' button to jump to the desired sample or segment.

Click on the '<< Previous Seg.' button to plot to the previous data segment. This button is only enabled when the scope contains segmented data. When this button is clicked the Go to portion of the user interface is updated to display the new segment index.

Click on the 'Next Seg. >>' to plot to the next forward data segment. This button is only enabled when the scope contains segmented data. When this button is clicked the Go to portion of the user interface is updated to display the new segment index.

Click on the 'Zoom to Seg.' button to adjust the horizontal scaling such that a segment fits in exactly one page. This item is only enabled when the scope contains segmented data.

If the 'Extra sample offset for segment navigation' is non zero, it can be used to offset the actual sample jump when navigating between segments. A negative value will display points before the segment and a positive value will display points after the segment. If zero, no offset is applied and the leftmost sample will be the first sample of the segment.

5.2.4 | Toolbar

This menu item feature is not yet available and therefore can be ignored at this time.

5.2.5 | Status Bar

Selecting this item will toggle the visibility of the Status Bar located at the bottom of the application window. The status bar provides various text based notification information for various applicatio operations.

5.3 | Hardware Menu

5.3.1 | Auto Power-Down on Program Exit

Selecting this item will toggle the option to automatically power down the EC14150 device upon exiting the Scope Application software. Selecting this option is useful to ensure system power savings when not using the EC14150 device. If this option is not selected, the EC14150 device will remain powered on if the operator exits the Scope Application software without first selecting to power down the board. In some cases, like troubleshooting custom application development, it is useful to leave the EC14150 device powered on when exiting the Scope Application software.

5.3.2 | Set Power-Up Defaults

Selecting this item will reset all EC14150 hardware settings to their default value. This will implicitly put the board into Standby mode which will cancel any current acquisitions or transfers.

For nearly all hardware settings, the default setting is the 'zero' value. For combo-box items this will be the first selection in the drop down list. An exception to this is that trigger levels are set to midscale.

Related EC14150 Software Development C Library Functions:

- SetPowerupDefaultsEC14

5.3.3 | Rewrite Hardware Settings

Selecting this item will rewrite all EC14150 hardware settings back to the hardware.

Related EC14150 Software Development C Library Functions:

- RewriteHardwareSettingsEC14

5.3.4 | Copy Settings from Other EC14150

Selecting this item will allow the operator to copy the hardware settings of another EC14150 device.

Related EC14150 Software Development C Library Functions:

- CopyHardwareSettingsEC14

5.3.5 | Refresh Local Settings from Driver

Selecting this item will have the EC14150 Scope Application update its current hardware settings from the EC14150 driver cache. This will result in no hardware access; only the driver's hardware register cache is consulted. Often this is all that's necessary to get the current hardware settings. Since all hardware access goes through the EC14150 driver, it will always know the state of the hardware registers. This of course excludes status registers which can change at any time.

Related EC14150 Software Development C Library Functions:

- RefreshLocalRegisterCacheEC14

5.3.6 | Refresh Local Settings from Hardware

Selecting this item will have the EC14150 Scope Application update its current hardware settings by reading the EC14150 hardware registers.

Related EC14150 Software Development C Library Functions:

- RefreshLocalRegisterCacheEC14

5.3.7 | Record

Selecting this item will open the up the Record EC14150 Data window. This window can be used to control data acquisition recordings for one or more EC14150 devices.

See [Recording EC14150 Data](#) section for details on this window.

5.3.8 | Upload/Verify Firmware

This item is used to upload EC14150 firmware. Signatec periodically updates the EC14150 firmware to add new features or correct minor bugs. Updated firmware is distributed with new EC14150 Windows software releases that can be downloaded from the Signatec website and comes in the form of an .ec14fw file.

Selecting this item will open up a standard file dialog that the operator can use to select the firmware file to upload. EC14150 firmware files are installed by the EC14150 Windows software to the default location C:\Program Files or Program Files (x86)\Signatec\EC14150\Firmware\ folder.

IMPORTANT: Exercise caution when selecting a firmware file to ensure that the correct firmware file is used for the appropriate hardware configuration EC14150 device model. Selecting and uploading an improper firmware file may result in the EC14150 device to become unoperable and thus require a return to the factory to repair. When in doubt, please contact Signatec Technical Support before proceeding with a firmware update attempt.

Once selected, the Upload EC14150 Firmware dialog is displayed.

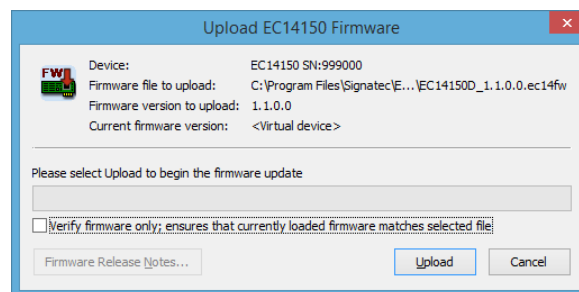


Figure 12: Upload EC14150 Firmware Window

The Upload EC14150 Firmware window will display:

- **Device:** The current EC14150 device selected for the update operation with its displayed serial number.
- **Firmware file to upload:** The current selected firmware file that will be loaded to the EC14150 device.
- **Firmware version to upload:** The version number of the firmware file that will be loaded to the EC14150 device.
- **Current firmware version:** The version number of the current firmware that is presently residing on the EC14150 device before the update operation.

Selecting the checkbox for the option 'Verify firmware only; ensures that currently loaded firmware matches selected file' can be used to only perform a validation of the current firmware on the EC14150 device. When this item is checked and the 'Upload' button is clicked, the update operation will only read the current firmware presently on the EC14150 device and compare it to the selected firmware file and will report a successful validation if the firmware matches. An unsuccessful validation message indicates the the firmware does not match. The current firmware on the EC14150 device is not modified during a validation process.

If a firmware file has a correlating release notes document, then the 'Firmware Release Notes...' button will be enabled. Clicking this button will then display the EC14150 firmware release notes that can be reviewed before proceeding with the firmware update process.

The 'Upload' button, when clicked, will begin the firmware uploading process. The entire operation can take several minutes.

IMPORTANT: Do not interrupt a firmware upload once it has begun. If the firmware upload process is not allowed to finish, the firmware may be lost and the card will not be recognized by the system. In this case, the board will need to be returned to Signatec so that it can have its firmware uploaded via an alternate method that requires additional hardware.

NOTE: During the firmware upload process there may be times where the progress does not update for a while. This is normal. During these long waits, a countdown timer will be displayed on the progress window.

Related EC14150 Software Development C Library Functions:

- UploadFirmwareEC14

5.4 | Tools Menu

5.4.1 | Recorded Data Details

This item is used to view details about an EC14150 acquisition data file. These details are obtained from the auxiliary SRDC file that Signatec software can automatically generate. These details include things like channel count, sampling rate, input voltage range, operator notes, etc. See [Signatec Recorded Data Context \(SRDC\) Information](#) section for details on SRDC data.

Related EC14150 Software Development C Library Functions:

- OpenSrdcFileEC14
- GetRecordedDataInfoEC14

5.4.2 | EC14150 Hot Plug Notify Utility

This item is used to open the EC14150 Hot Plug Notification Utility ,which is a troubleshooting application that can be used to verify that the EC14150 device is being properly detected by the host system upon physical connection and disconnection of the EC14150 device.

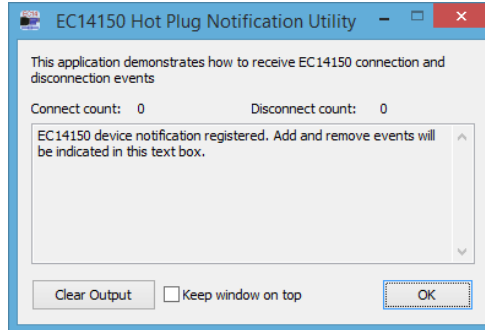


Figure 13: EC14150 Hot Plug Notification Utility

Each time the EC14150 device is inserted into the host system when active, the reported connect count value should increase by 1 indicating a successful detection and connection of the EC14150 device with the host system.

Similarly, each time the EC14150 device is removed from the host system when active, the reported disconnect count value should increase by 1 indicating a successful disconnect of the EC14150 device with the host system.

The text box window within the utility will continue listing each attempted hot plug connect/disconnect event when registered.

The 'Clear Output' button, when clicked, will clear all current reported result events.

Selecting the checkbox option to 'Keep window on top' will then keep the EC14150 Hot Plug Notification Utility window to be the topmost window on top of all other application windows (even from other applications) so that this window will not be obscured.

5.4.3 | Options

Selecting this item will open the Program Options window with Data Plotting setting options.

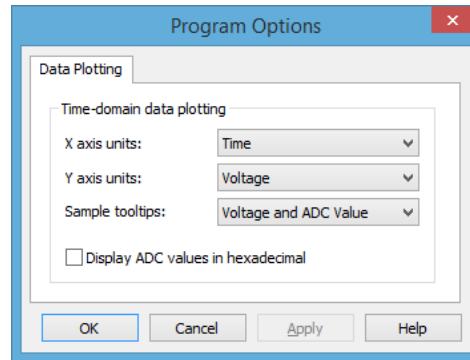


Figure 14: Program Options Window

By default, the time-domain data plotting within the Scope panel is set to Time for the x-axis and is set to Voltage for the y-axis. These settings can be optionally set to display Sample Number for the x-axis and ADC Value for the y-axis from within this window.

The 'Sample tooltips' is set by default to show voltage and ADC value. This setting can be optionally changed to select to show only the voltage value or to show only the ADC value.

ADC values can also be optionally shown in hexadecimal format by selecting the checkbox item to 'Display ADC values in hexadecimal'.

5.5 | Window Menu

5.5.1 | Cascade

Selecting this item will overlap any multiple EC14150 device windows within the Scope Application from left to right in a cascading fashion.

5.5.2 | Tile

Selecting this item will re-arrange and auto-resize any multiple EC14150 device windows within the Scope Application to best fit the display without overlapping each other.

5.5.3 | Arrange Icons

Selecting this item will re-arrange any minimized multiple EC14150 device windows within the bottom portion of Scope Application.

5.5.4 | EC14150 Device Listing

All detected EC14150 devices are listed by serial number within this menu listing. Selecting the specified EC14150 device listed will take the operator directly to that device's window.

5.6 | Help Menu

5.6.1 | Help Topics

The help topics feature is not yet available and therefore this menu item can be ignored at this time.

5.6.2 | Product Manuals Listing

Current EC14150 related product manuals are listed within this menu listing. Selecting the specified manual item will open that product manual for review.

5.6.3 | About EC14Scope

Selecting this item will display the current version release number of the EC14150 Scope Application software.

6 | FFT Analysis of EC14150 Data

The EC14150 Scope Application has the ability to do FFT analysis on EC14150 (or file) data. FFT operations are performed on data sources that are currently displayed in the Scope panel and are displayed on the Frequency Domain (FFT) window. The FFT window is displayed by selecting the 'Frequency Domain Window' option in the View menu. Alternately, pressing Ctrl + Shift + F will display the FFT window. A sample FFT window is shown in the figure below.

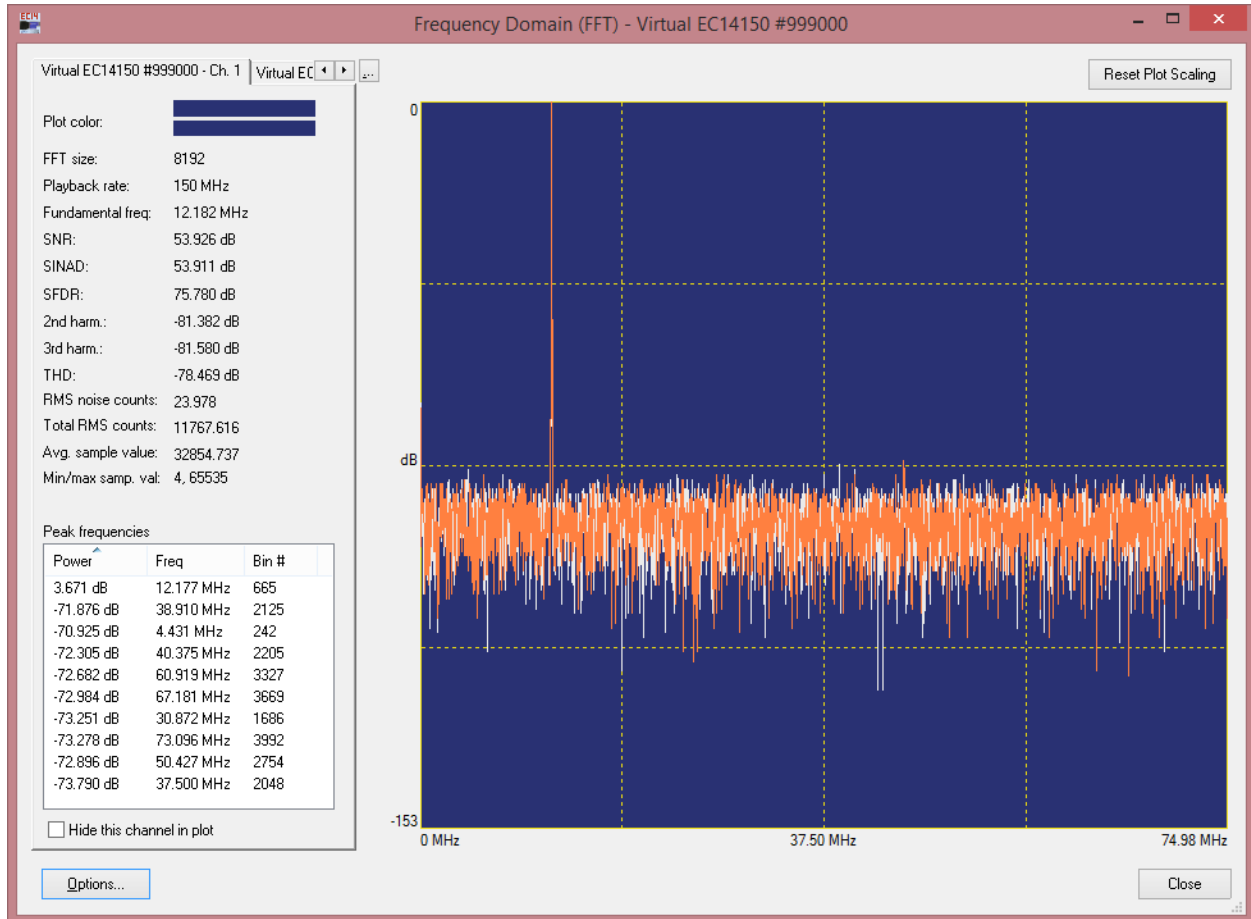


Figure 15: Frequency Domain (FFT) Window

The FFT window is divided up into two regions. The left side is a tab control that contains various FFT and time-domain statistics. There is one tab for each channel of data. The right side contains the frequency domain plots of all channels.

6.1 | Frequency and Time Domain Statistics

The following table details the frequency and time domain statistics information displayed:

Statistic Item	Statistic Item Description
Plot color	Identifies the current plot color of the data for the FFT statistics information displayed associated with the EC14150 device channel number shown in the top tab control.
FFT size	The number of time-domain samples used in the FFT operation. The FFT size can be changed on the FFT Options dialog window.
Playback rate	This is the underlying acquisition rate, in MHz, used to obtain the time domain data. When the EC14150 is the data source, the current acquisition rate is used. When an external file is the data source, this information is obtained from SRDC data. If acquisition rate information is not available this item will be 0.
Fundamental frequency	This is the frequency component with the highest power. In order for this to be calculated properly, the underlying acquisition rate must be known.
SNR	This is the signal-to-noise ratio and is a ratio of the signal power to the noise power.
SINAD	This is the signal to noise and distortion ratio and is a ratio of the signal power to the sum of the noise, 2nd, and 3rd harmonic power.
SFDR	This is the spurious free dynamic range and is a ratio between the fundamental power and the next highest spur power.
2nd harm.	This is the power of the second harmonic.
3rd harm.	This is the power of the third harmonic.
THD	This is the total harmonic distortion and is a ratio of the sum of the 2nd and 3rd harmonics to the fundamental signal power.
RMS noise counts	This is the root mean square of the noise power.
Total RMS counts	This is the root mean square of the signal power.
Avg. sample value	This is the average time-domain sample value in the data used for the FFT operation.
Min/max sample value	This is the minimum and maximum time-domain sample values from the data used for the FFT operation.
Peak frequencies	The Peak Frequencies table can be displayed by selecting the peak tracking feature in the FFT Options dialog window. This table listing tracks the highest power spurs in the current frequency domain data. Double clicking on any of these items will move the marker selection in the frequency domain plot to that peak.

Selecting the checkbox item to 'Hide this channel in plot' will remove the visibility of the currently selected data channel (relative to the tab) from the FFT plot.

6.2 | FFT Options

Clicking on the ‘Options...’ button in the tab control region of the Frequency Domain (FFT) window will open the FFT Options dialog window that contains various settings that affect FFT operations. An instance of this dialog is shown in the figure below.

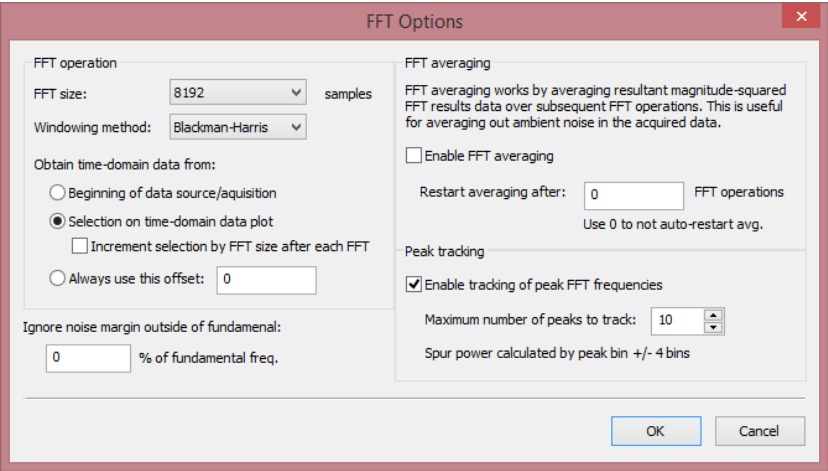


Figure 16: FFT Options Window

The following table details the FFT option control settings:

Statistic Item	Statistic Item Description
FFT size	This item controls the size of the FFT operation
Windowing method	This item defines how the time-domain data will be windowed prior to the FFT operation with options of Rectangular, Hanning, Hamming, and Blackman-Harris.
Obtain time-domain data from	<p>This item controls where the source time-domain data will be obtained:</p> <ul style="list-style-type: none">Beginning of data source/acquisition - Time-domain data is obtained from the start of channel's data. For EC14150 sources this will be the start of the acquisition or recording snapshot. For file sources this will be the start of the time-domain data in the file.Selection on time-domain plot - Time-domain data is obtained starting at the location of the current selection in the time-domain data plot in the Scope panel. If no selection has been made, the start of the data source will be used. You can also optionally select to ‘Increment selection by FFT size after each FFT’ by selecting this checkbox item.Always use this offset - Time-domain data will be obtained from the specific given offset into the data source.
Ignore noise margin outside of fundamental	This item allows entry of a specified percentage value of the fundamental frequency for which any noise outside of this margin can be ignored.

Continued:

Statistic Item	Statistic Item Description
Enable FFT averaging	<p>When this item is checked, the EC14150 Scope Application will average and track the resultant magnitude-squared FFT results. As FFT operations are performed, this will average out any ambient noise in the frequency-domain. When enabled, this will result in a new tab being added to the Frequency Domain (FFT) window and a new plot added.</p> <p>Restart averaging after - This item specifies the number of FFT operations after which FFT averaging will be reset. If this value is 0 then the average will never reset.</p>
Enable tracking of peak FFT frequencies	<p>When enabled, the EC14150 Scope Application will track a number of the highest energy spurs. These peaks are displayed in the 'Peak Frequencies' list of each channel's tab. The number of peaks to track is defined by the adjacent edit control.</p>

6.3 | Frequency Domain Plots

The frequency domain data plots can be zoomed and panned like the time domain data in the Scope panel of the main application window.

The 'Reset Plot Scaling' button, when clicked, will reset the horizontal and vertical scaling of the frequency domain data.

7 | Recording EC14150 Data

The EC14150 Scope Application has the ability to record acquisition data from one or more EC14150 devices to a file. Data recordings are controlled by clicking the 'Record Data...' button in the Control panel, which will open the 'Record EC14150 Data' window.

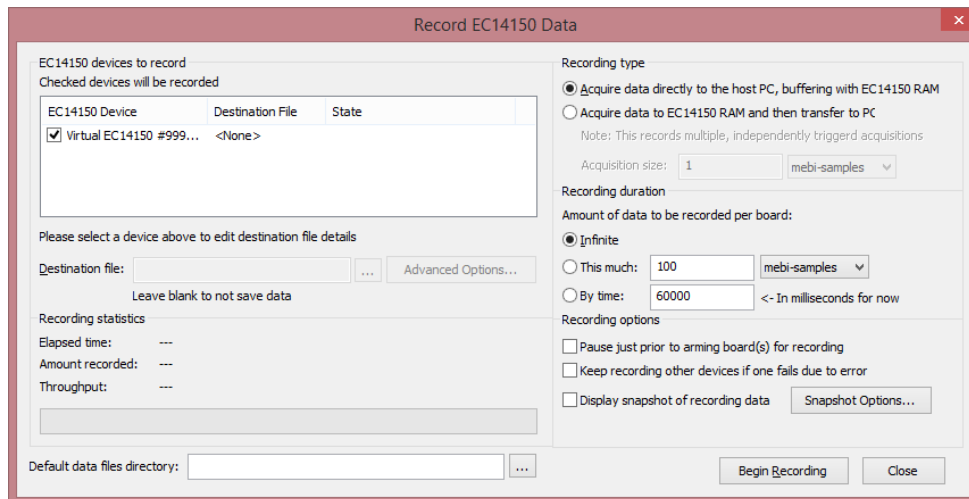


Figure 17: Record EC14150 Data Window

7.1 | Device and Destination File Selection

To select the device(s) to record, check the desired device in the list control. To specify a destination file for the recorded data, select the device in the list control and specify the pathname in the 'Destination file' edit box. (The '...' button will open up a file dialog to browse for the destination file.)

If no destination file is specified then acquisition data will not be saved. This can be useful in determining if the host system can sustain recordings of a particular acquisition rate without considering the underlying file IO limitations of the targeted data storage device.

The native file format for recorded EC14150 acquisition data is the RD16 file format. The RD16 moniker is derived from "Raw Data 16-bit". RD16 files are identified by the '.rd16' file extension. RD16 files are binary files that contain only acquisition data. There is no file header or additional information in the file. The first two bytes of the file are the first data sample. Samples in .rd16 files are 16-bits in size; however, for recorded 14-bit data, only the lower 14-bits are relevant (the upper two bits will always be zero).

This simple file format has two big advantages. First, it's very fast to write these files since data is written to the file exactly as it is received from the EC14150. The second advantage is that this file format is very generic which makes it easy for other software to use the data. This includes custom software, or other software environments such as MATLAB.

See the EC14150 Operators Manual for more details on the EC14150 Acquisition Data Format.

The main disadvantage of the RD16 file format is that no context information is stored in the file and the details of the data may not be apparent. Important details such as channel count, voltage range selection and sampling rate are unknown by looking at the raw data alone. To get around this problem, Signatec software can also be configured to generate a small auxiliary context file that sits in the same directory as the RD16 file. This auxiliary

file can contain information such as channel count, input voltage range, sampling rate, source board, operator notes, or any other user-defined data. These auxiliary files are referred to as Signatec Recorded Data Context (SRDC) files and are identified by the .srdc file extension. SRDC files are written in XML format and are easily read by any XML-aware software.

See the EC14150 Operators Manual for more details on SRDC file contents.

7.2 | Advanced Data Destination Options

Clicking on the 'Advanced Options...' button will open the Advanced Data Destination Options window that contains various settings for alternate methods of saving recording data. An instance of this dialog is shown in the figure below.

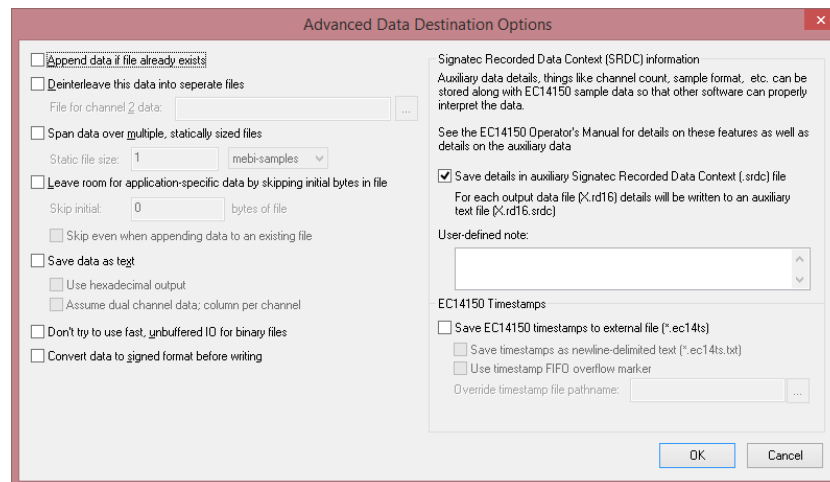


Figure 18: Advanced Data Destination Options Window

7.2.1 | Append Data If File Already Exists

If this item is selected then data will be appended to the end of the file destination file if it already exists. By default, files are overwritten if they exist.

7.2.2 | Deinterleave This Data Into Separate Files

If this item is selected then the data will be de-interleaved into two separate files. Channel 1 data will be written to the primary pathname specified on the parent window. Channel 2 data will be written to the file specified in the adjacent edit box. The '...' button will open up a file dialog to browse for the destination file.

Note that that software is responsible for de-interleaving the data. This means that if data is being saved as part of a data acquisition recording, this option may decrease the overall data throughput. The processing involved in de-interleaving data at high rates can be very demanding. Signatec cannot guarantee that de-interleaved data recordings can be sustained on all recording platforms and for all data recording rates.

7.2.3 | Span Data Over Multiple, Statically Sized Files

This item is used to span acquisition data over multiple files instead of a single file. This can be useful in situations where multiple, smaller files are preferred over a single large file. When this item is checked, the specified destination file name is used as a template. The software will take the template filename and append a ‘_#’ (number) for each file generated where # is an incrementing value starting with 0.

The size of the file segment is defined by the ‘Static file size’ item. For acquisition recordings, it is recommended to use an integer number of mebi-samples (1 mebi-sample = 2^{20} = 1048576 samples) and to not create new data files anymore frequent than about once per gigabyte when recording at very high data rates.

7.2.4 | Leave Room For Application-Specific Data

This option applies when writing binary files.

If this item is checked then a number of bytes will be set aside for user-defined header data. The bytes are reserved by advancing the file pointer prior to writing file data; this will result in zeroes being written. Other software can then write application-specific data to the front of the file at a later time.

If the ‘Skip even when appending data to an existing file’ option is selected then the user-defined header data will always be reserved, regardless of whether a new file is being created or an existing file is being appended to. By default, if this item is not checked, the user-defined data region will only be used when creating a new file.

7.2.5 | Save Data As Text

If this item is checked then data will be saved in ASCII text format instead of the default binary format. This option can be demanding on the CPU and might not be sustainable for high data rate recordings.

When saving as text, sample values will be written to the file in decimal format, one sample per line. That is, each sample will be newline (“\r\n”) delimited.

Use hexadecimal output - If this item is checked then samples will be written in hexadecimal.

Assumed dual channel data; column per channel - If this item is checked then data will be written two samples per line: *Channel 1* <tab> *Channel 2* <newline>.

7.2.6 | Don't Try To Use Fast, Unbuffered IO For Binary Files

If this item is checked then the software will not try to use unbuffered file writes. Unbuffered file writes can be performed faster than normal, buffered writes at the expense of having to align file write sizes and offsets to integer multiples of the underlying file system's sector size. By default, the software will analyze all file write parameters and determine if unbuffered writes are allowed and, if so, will use unbuffered writes.

7.2.7 | Convert Data to Signed Format Before Writing

If this item is checked then all EC14150 data will be converted to signed format prior to writing.

At the time of this writing, the EC14150 can only acquire unsigned data, so this conversion is done entirely in the software. Enabling this feature for acquisition recordings can result in decreased data throughput.

7.2.8 | Signatec Recorded Data Context (SRDC) Information

SRDC files are described in the recording [Device and Destination File Selection](#) section.

Note: The SRDC options below are not mutually exclusive.

Save details in auxiliary Signatec Recorded Data Context (.srdc) file - If this checkbox is selected then SRDC information will be written to an external file. The pathname of the SRDC file will be the full pathname of the recording destination file appended with a '.srdc' extension. If, for example, the recording destination file is named "C:\My Data\Recording.rd16" then the generated SRDC file will be "C:\My Data\Recording.rd16.srdc".

Operator notes - This is an optional note that will be saved in the SRDC file. This is intended for user-defined notes that are relevant to the recording.

7.2.9 | EC14150 Timestamps

The Timestamp feature is not yet available and therefore any settings controls within this Timestamps section can be ignored at this time.

7.3 | Recording Type

The EC14150 Scope application supports two types of data recordings which are described in the following sections.

7.3.1 | Acquire Data Directly To The Host PC, Buffering With EC14150 RAM

This type of recording, also called a RAM-buffered PCI recording, is used to record one long continuous stream of data (or one long continuous stream of discrete data segments if in segmented mode) in which the EC14150 RAM is used to buffer the data during recording. This is the most common type of data recording.

In RAM-buffered PCI recording, the underlying destination disk drive(s) must be able to sustain the acquisition data rate. If the acquisition rate is too fast (or the disk write speed is too slow) then the EC14150 RAM FIFO will overflow and data will be lost. In this case, the EC14150 software will catch this condition and end the recording with a FIFO Overflow error message.

7.3.2 | Acquire Data To EC14150 RAM And Then Transfer To PC

This type of recording is used to record a series of non-contiguous acquisitions. First, new data is acquired to RAM and then when the acquisition has completed, the data is transferred to the host system. It's important to note here that while data is being transferred to the system no new data is being acquired.

This type of recording is good for recording at the full acquisition rate which may be too fast for a RAM-buffered PCI recording.

7.4 | Recording Duration

The duration of the recording is determined by the settings in the 'Recording duration' group box. There are currently three types of duration supported.

- Infinite - Recording goes on indefinitely until manually stopped by the operator.
- This much - Records the amount of data specified, per-board. Note: gibi-, mebi-, and kibi- prefixes denote $1073741824 (2^{30})$, $1048576 (2^{20})$, and $1024 (2^{10})$ respectively.
- By time - Converts the given time into an equivalent sample count (which is a function of acquisition rate) and then records that much data. It should be noted that this time is entire time of recorded data, not including the time to wait for a trigger event.

Regardless of the recording duration type selected, a recording may be manually stopped by clicking the 'Stop Recording' button the Recording window.

7.5 | Recording Options

7.5.1 | Pause Just Prior To Arming Board(s) For Recording

Checking this item will result in the Scope Application displaying a message box after setting everything up for the recording and just prior to actually arming the boards for recording.

7.5.2 | Keep Recording Other Devices If One Fails Due To Error

If this item is checked then the recording will continue if one device fails in a multiple device recording. By default, if one device fails, the entire recording is halted.

7.5.3 | Display Data Snapshot Of Recording Data

Checking this item will result in a snapshot of the current recording data being displayed in the plot area. By default, an 8192 point snapshot will be obtained roughly once a second.

7.5.3.1 | Snapshot Options

Clicking this button will open up the Recording Snapshot Options dialog. This dialog can be used to control the size and frequency of the recording data snapshot.

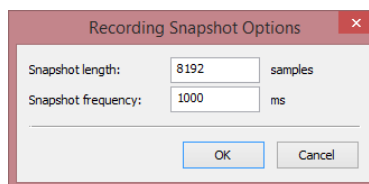


Figure 19: Recording Snapshot Options Window

7.5.4 | Default Data Files Directory

This item specifies the default directory that will be used for data files when no path is specified in the 'Destination file' textbox.

7.6 | Running a Recording

Once all recording parameters have been set, a recording is started by clicking the 'Begin Recording' button. The Scope application and underlying EC14150 library/driver code will manage all aspects of the recording.

The 'Recording statistics' group contains current recording statistics that include:

- Elapsed time – The current total amount of time that has occurred since the start of the recording.
- Amount recorded – The current total amount of data that has been recorded from all active devices and all active number of channels since the start of the recording. Note that the individual device amount recorded is detailed in the 'State' column in the device listing table.
- Throughput – The current total averaged data throughput per second from all active devices and all active number of channels since the start of the recording. Note that the individual device data throughput is detailed in the 'State' column in the device listing table.
- Recording progress bar for concrete-length recordings.

Related EC14150 Software Development C Library Functions:

- CreateRecordingSessionEC14
- ArmRecordingSessionEC14
- GetRecordingSessionProgressEC14
- GetRecordingSnapshotEC14
- AbortRecordingSessionEC14
- DeleteRecordingSessionEC14

8 | Appendix A – Revision History

Revision 1.3 (Initial public release)

Revision 1.4

- Updated all references to timestamps feature as not yet available.
- Updated screen captures and documentation content throughout to match current EC14150 Scope Application software release.