Software Timing Analyzer Users Guide

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Introduction

The Software Timing Analyzer is a Microsoft Windows program that provides visibility into the real-time performance of embedded systems software.
The software has the following key features:

- Graphically displays task execution as waveforms
    - Rising edge indicates that a task is running, Falling edge indicates that a task is pending
    - Can display the execution state of multiple tasks simultaneously
- Calculates Statistics
    - Measures task execution interval (how often a task runs) and execution width (how long it takes to run)
    - Measures Min, Max, and Average CPU Utilization.
- Analyzes/searches timing data for user specified conditions.

How Does It Work

Software timing is measured by adding entry and exit function calls, also referred to as Performance Markers, to the targets source code. These Performance Markers time tag entry and exit events as they occur. Each Performance Marker is uniquely identified by a Performance ID which is simply a number associated with some event that you want to measure.

Typically Performance Markers are added to:

- Every application task in the system to measure how much time is spent in each task.
- Interrupt service routines to show when interrupts are occurring.
- Anywhere in the code to measure anything of interest.

Performance Marker data is collected either externally using a logic analyzer or on-board using flight software and is saved to a file that can be imported into the Software Timing Analyzer.

What's New

Version 2.2

- Added plots to the CPU utilization and Statistics dialogs.
- Changed the Show Execution Thread feature to draw idle time as a grey line and running time as a white line.
- Removed the dependency on the Agilent DLL. The Agilent options will be disabled when the Agilent drivers are not installed.
- Added Import options for RNS.

Version 2.1

- Completed or removed prototyped and incomplete options.
- Updated the user interface to make it more user friendly.
- Added Documentation.

- Added new Data Import Options. Now it supports Importing Timing Data files created by the on-board data collection software on SDO and CFE (LRO). This makes it possible to read the downlinked data files directly without the need to preprocess the file using a perl script.

How To ...

Import Timing Data

All new data is loaded into the Software Timing Analyzer by importing. The software supports the following Input File Formats.

1. Text Listing (Space Delimited)
2. Text Listing (Comma Delimited)
3. CFE File (CFE Version 4.2.1+)
4. DTF File (SDO SBC or SDN)
5. Text Listing (SDO EVE SDN)

To Import Timing Data:

- From the File menu, choose Import, then choose the desired Import File Format.

Tip:

- The name of the file is displayed in the applications title bar.
- Once the data is imported, if it is something you want to save for future reference, then it is a good idea to save the data as a Data Collection. See How To: Save a Data Collection for more information.

Text Listing (Space/Comma Delimited)

The Text Listing file format is the most common universal Input File Format and is similar to a logic analyzer listing file. This Input File Format consists of a text file where a single state (Performance ID and Timestamp) all reside on a single line. The file must include the following columns delimited with either spaces or commas. The columns must be listed in the order shown below from left to right. Each entry must be on a separate line. Any data beyond the first three columns will be ignored.

Sample Number	Incrementing count starting a 0
Performance ID	Performance ID in hexadecimal
Relative Time	Relative time (including units in “ps, ns, us, ms, s”) from the previous entry. The first entry should have a time stamp of 0

Lines that do not have data in them (for example text column headings) will be flagged with errors, however this will not prevent the file from being imported. Space delimited files can be delimited by one or more spaces and should have a “.txt” extension. Comma delimited files should have a “.csv” extension.

Example:

```
00000000  00000015  0 us
00000001  80000015  16.920 us
00000002  00000015  982.176 us
00000003  80000015  16.920 us
00000004  00000015  983.760 us
00000005  80000015  16.920 us
00000006  00000015  983.760 us
00000007  80000015  16.920 us
00000008  00000015  982.264 us
00000009  80000015  16.912 us
00000010  00000015  983.432 us
```

CFE File (Version 4.2.1+)

The CFE file format is used specifically for missions using CFE Version 4.2.1 or later. The performance data is collected using the ES on-board data collection software and dumped to the ground as a binary file.

DTF File (SDO SBC or SDN)

The DTF file format is used specifically for the SDO mission. The performance data is collected using the HS on-board data collection software and is dumped to an ASIST ground system as a DTF file. This option will work for data collected on the Single Board Computer or any of the SDN's.

Text Listing (SDO EVE SDN)

The Text Listing for EVE file format is used specifically for data collected using a logic analyzer from the EVE SDN on the SDO Mission. This Input File Format consists of a text file where a single state (Performance ID and Timestamp) are spread across multiple lines. This is used in the case where the data collection method does not support enough data bits to represent the whole Performance ID. The Performance ID is therefore split across multiple lines where each line has its own timestamp. The file must include the following columns delimited with spaces. The columns must be listed in the order shown below from left to right. Each entry must be on a separate line. Any data beyond the first four columns will be ignored.

Sample Number	Incrementing count starting a 0
Performance ID	The Performance ID is spread across 4 lines with 2 bits per line starting with the most significant 2 bits
Sync Flag	Indicates if this state is the first state of a Performance ID (Sync Flag = 1)
Relative Time	Relative time (including units in "ps, ns, us, ms, s") from the previous entry. The first entry should have a time stamp of 0

Lines that do not have data in them (for example text column headings) will be flagged with errors, however this will not prevent the file from being imported. Space delimited files can be delimited by one or more spaces and are expected to have a .txt extension.

Example:

```
00000000 00 1 0 ps
00000001 00 0 1.000,125 us
00000002 10 0 1.499,750 us
00000003 10 0 1.583,375 us
00000004 10 1 83.415,125 us
00000005 00 0 1.000,125 us
00000006 10 0 1.000,000 us
00000007 10 0 999.875 ns
00000008 00 1 74.249,375 us
00000009 00 0 999.875 ns
00000010 10 0 1.000,125 us
00000011 01 0 1.000,000 us
00000012 10 1 971.816,750 us
00000013 00 0 1.000,125 us
00000014 10 0 999.875 ns
00000015 01 0 1.000,000 us
```

View Import Data Errors

If errors are detected when data is Imported, a dialog box will be displayed to notify the user and detailed information about the errors will be written to the file "Software Timing Analyzer/ImportError.log".

Invalid Line Count	The Line Count must be a valid decimal number
Invalid Performance ID	The Performance ID must be a valid hexadecimal number
Invalid Time Stamp	The Time Stamp must be a valid decimal number
Invalid Time Units	The units of the Time Stamp must be in (s, ms, us, ns, or ps)
Missing/Invalid Data	The line does not contain the required number of columns
Invalid Sync Flag	The Sync Flag must be a decimal (0 or 1)
Invalid Number Of States Between Syncs	Since there is 4 states per Performance ID, there must be 4 states between every Sync Flag
Data Count > The Number Of Entries In The File	The number of entries in the data sample is greater than the number of entries in the file. The file may be incomplete.
Data Start Index > Data Count	The Start Index is greater than the number of entries in the data sample.

Data End Index > Data Count	The End Index is greater than the number of entries in the data sample.
Filter/Trigger Mask Is Too Large (> 32)	The Filter/Trigger mask is greater than 32 entries.
Invalid Performance IDs Were Detected (Max ID: XXXX)	Performance IDs greater than the max were detected.

Export Timing Data

Timing Data can be exported into a text file. The software supports the following Export File Formats.

1. Text Listing (Space Delimited)
2. Text Listing (Comma Delimited)

To Export Timing Data:

- From the File menu, choose Export, then choose the desired Export File Format.
- From the File Save dialog, select the drive and folder where the file is to be stored. The default folder is "Software Timing Analyzer/data".
- In the name box, type the filename. The default file extension is ".txt" for space delimited files and ".csv" for comma delimited files.
- Click OK.

Save a Data Collection

Timing Data can be saved to a file referred to as a Data Collection. A Data Collection contains Timing Data, Performance ID Setup, and Notes all combined into a single file. Saving data as a collection makes it more convenient to reload the data at a later time. Data Collections have the added advantage in that since Performance IDs may change over the course of a project, saving the data as a collection stores the matching Performance ID file together with the timing data.

To Save a Data Collection:

- From the File menu, choose Save.
- From the File Save dialog, select the drive and folder where the file is to be stored. The default folder is "Software Timing Analyzer/data".
- In the name box, type the filename. The default file extension is ".sta".
- Click OK.

Toolbar: 

Tip:

- The name of the file is displayed in the applications title bar.

To make it easier to manage a large number of Timing Data files it is a good idea to adopt some sort of standard file naming convention. Consider including the following items in the filename.

- Project Name
- Processor/Development String/Location
- Date (Year, Day, Month)
- Description

Example:

SDO_SBC_070203_Bus_Controller_Problem.sta

Open a Data Collection

When a Data Collection is opened, the previously saved Timing Data, Performance ID Setup, and Notes will be reloaded. Note that the Performance ID Setup information from the Data Collection will replace the currently loaded Performance ID Setup file.

To Open A Data Collection:

- From the File menu, choose Open.
- From the File Open dialog, select the drive and folder where the file is stored. The default folder is "Software Timing Analyzer/data".
- In the name box, type the filename. The default file extension is ".sta".
- Click OK.

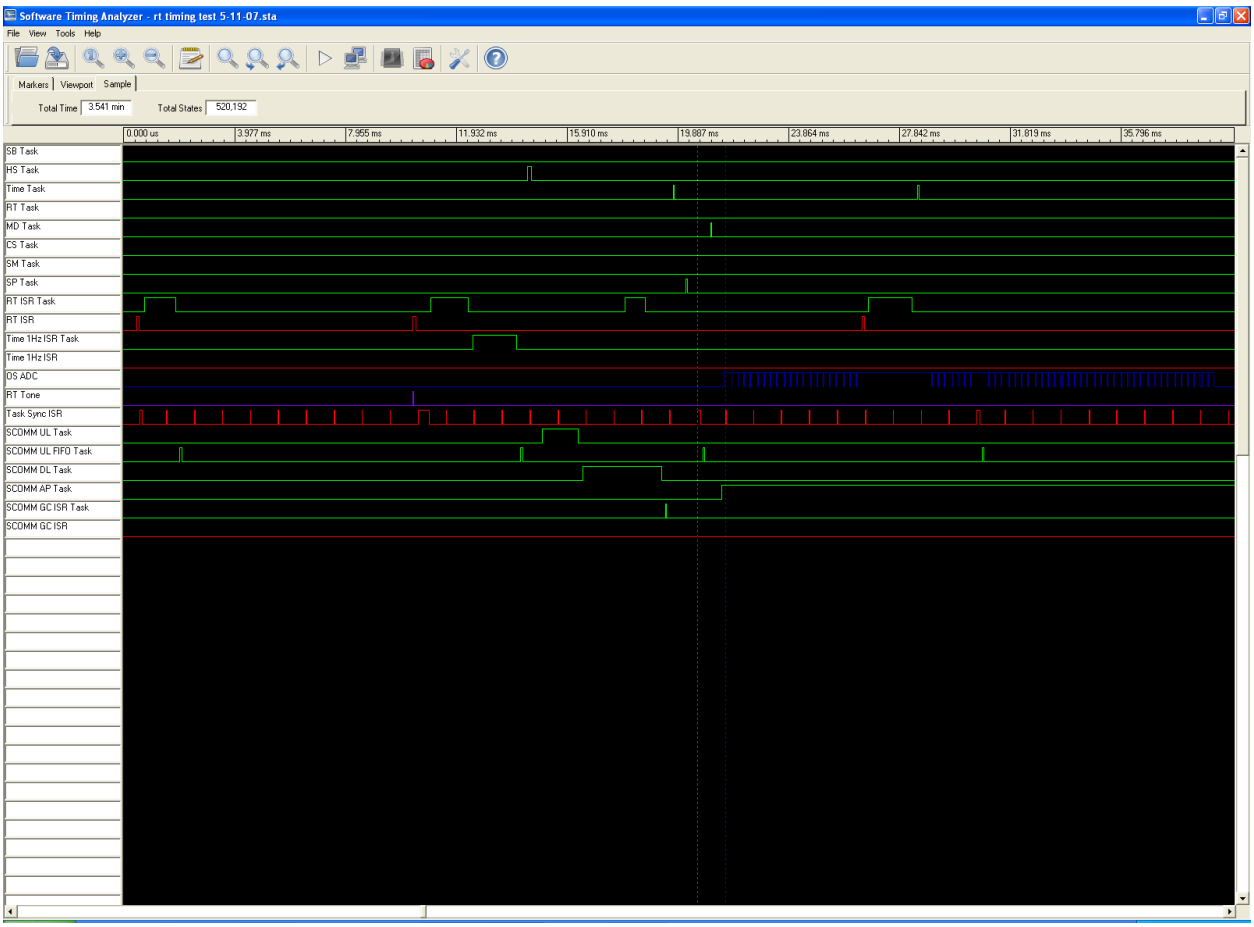
Toolbar: 

Tip:

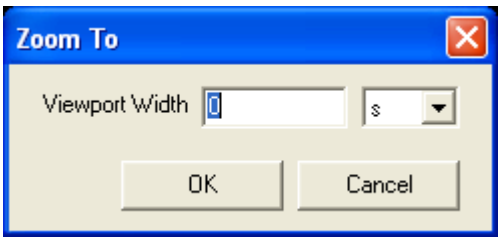
- The name of the file is displayed in the applications title bar.

View Timing Data

Software Timing Data is visually displayed on the Waveform Display. A separate waveform is drawn for each Performance ID where a rising edge represents an Entry Performance Marker and a falling edge represents an Exit Performance Marker. If the Auto Hide option is selected in the Performance ID Setup then Performance IDs that are defined but do not have any entries in the data sample are automatically hidden from view.



Navigate the Waveform Display

Zoom In 	***Mouse***: Press and hold the left mouse button to drag select the area to zoom in to.
	Keyboard: Press the Down Arrow key (Increases magnification by 2x)
	Menu: From the View menu, choose Zoom In (Increases magnification by 2x)
Zoom Out 	***Mouse***: Press and the right mouse button. (Decreases magnification by 2x)
	Keyboard: Press the up arrow key (Decreases magnification by 2x)
	Menu: From the View menu, choose Zoom Out (Decreases magnification by 2x)
Zoom 100% 	***Menu***: From the View menu, choose Zoom 100%
Zoom To Time	To resize the Viewport Width to a specified time: • From the View menu, choose Zoom To. • The following dialog box will open:  • Enter a time in seconds, milliseconds, or microseconds. • Click the OK Button.
Pan Left	***Keyboard***: Press the Left Arrow Key. (Pans left by 1/10th of the display)
Pan Right	***Keyboard***: Press the Right Arrow Key. (Pans right by 1/10th of the display)

Measure The Time Between Two Events

Two markers are available to measure the time between two events. The easiest way to position a marker is to use the snap feature. The snap feature will snap a marker from its current location to the waveform edge closest to the mouse pointer.

Snap Marker1	Position the mouse pointer over the waveform edge that you want to snap to and while holding down the control key click the **Left** mouse button.
Snap Marker2	Position the mouse pointer over the waveform edge that you want to snap to and while holding down the control key click the **Right** mouse button.

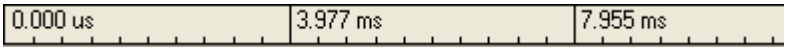
Markers can also be moved by positioning the mouse pointer over the marker, pressing the left mouse button, and dragging the marker to its new position. Note that positioning the markers this way is not as accurate as snapping the marker.

The absolute time of each marker as well as the delta time between the two markers is displayed in the Marker Tab at the top of the screen.

Display Viewport Information

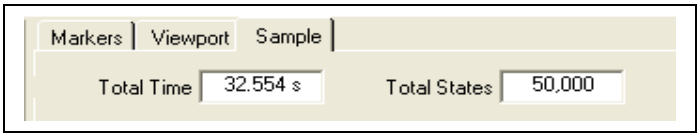
A Viewport is a window into the data sample. As the data sample is zoomed or panned the size and position of the viewport changes. The viewport tab at the top of the screen shows the viewport absolute start and end time within the data sample, the width of the viewport and the time per division.

The ruler at the top of the screen shows the scale of the data being displayed. The time is relative to the start of the viewport, i.e. the time on the ruler represents only what you can see not the whole data sample. The Time Per Division on the viewport tab refers to the tick marks on the Ruler.



Display Data Sample Information

The sample tab at the top of the screen shows the total amount of time in the data sample and the total number of states in the data sample.



Show the Execution Thread

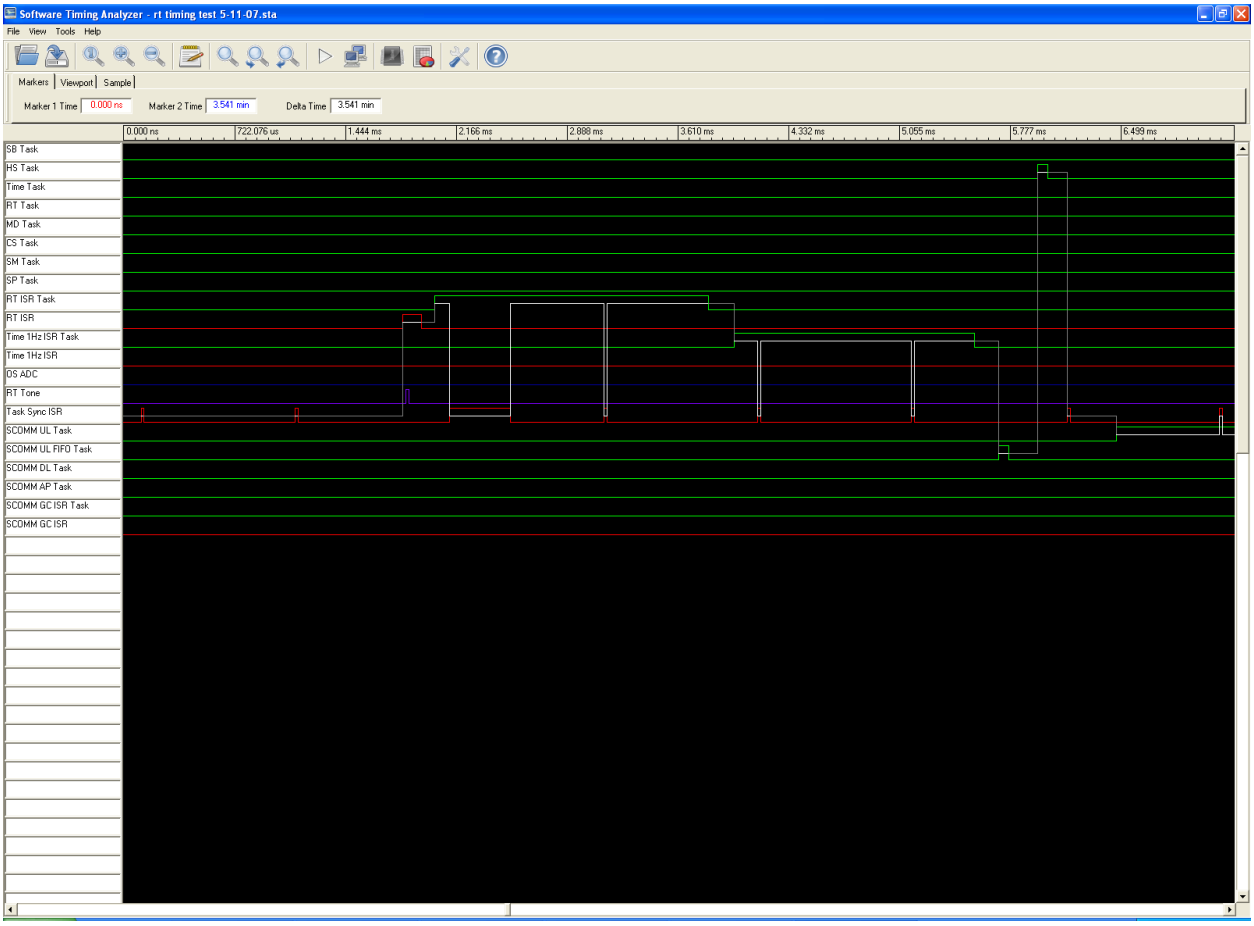
The execution thread is a line that traces the current execution path on the waveform display. This is helpful for following the thread of control i.e. who is executing at any given moment. A white line is drawn on the waveform display through the Performance ID that is currently executing. If no Performance IDs are executing (Idle Time) then a grey line is drawn through the last Performance ID that executed. The Execution Thread is only drawn for Performance IDs that have the Include in CPU Calculations flag checked in the Performance ID setup. This feature is disabled by default.

To enable or disable the Execution Thread:

- From the View menu, choose Show Execution Thread.

Tip:

- This feature looks the best when the displayed is zoomed in where the width of the ViewPort is less than 500 ms.
- The CNTRL-E hotkey can be used to toggle this feature on and off.



View Timing Data Errors

Whenever timing data is imported, a data collection is loaded, or the Performance ID setup is changed, the software checks the timing data for errors. If errors are detected a dialog box is displayed to notify the user and detailed information about each error is stored in the Timing Data Errorlog.

It is important to investigate any warning or errors detected in the timing data. Errors will affect the accuracy of the CPU utilization numbers and must be fixed. Warnings are not critical however they should be reviewed and are typically easy to fix.

To view the Timing Data Errorlog:

- From the View menu, choose Timing Data Errorlog.

Tip:

- You can sort the columns by clicking on the column header.
- You can view where the error occurred on the waveform display by selecting the error in the list and clicking on the "Go To" button. Marker 1 will be placed at the time of the error.

The following errors can occur:

Duplicate Edge Found For PerfID XXXX At Time YYYY

Where:

XXXX	The Performance ID in Hex
YYYY	The Absolute Time in microseconds

This message may be a warning or an error depending on whether the Performance ID has the Include in CPU Calculations flag checked or not. If this is logged as an error then it will affect the accuracy of the CPU Utilization Calculations.

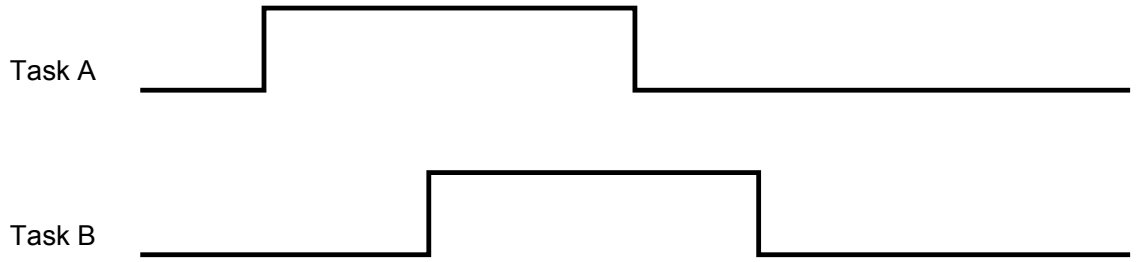
Problem	**Solution**
Either a OS_PerfEntry or a OS_PerfExit function call is missing or is incorrectly placed in the source code.	Fix the source code. Duplicate edges will display as a saw tooth line on the waveform display.

Invalid Falling Edge Found, Expected PerfID XXXX Found PerfID YYYY At Time ZZZZ

Where:

XXXX	The Expected Performance ID in Hex
YYYY	The Found Performance ID in Hex
ZZZZ	The Absolute Time in microseconds

This message is considered an error and will affect the accuracy of the CPU Utilization Calculations. This error is caused by the following scenario, Task A starts running, Task A is interrupted by Task B, Task A then stops running before Task B (see diagram below).



To derive the CPU Utilization numbers I assume that the system is implemented using priority based tasking. Higher priority tasks that interrupt lower priority tasks must finish running first.

Problem	**Solution**
Task A calls a function that causes it to pend, such as a call to get a semaphore.	Add OS_PerfExit and OS_PerfEntry calls around the function call that causes the pend.
Performance ID is not used to measure a single tasks execution.	Performance IDs added to measure something other than a single tasks execution time should not have the Include in CPU Calculations flag checked.
System does not support priority based tasking.	Clear the Include in CPU Calculations flags for all Performance IDs in the Performance ID setup. CPU Utilization calculations are not supported.
System is not implemented as expected.	I have found several software bugs that were identified by this error.

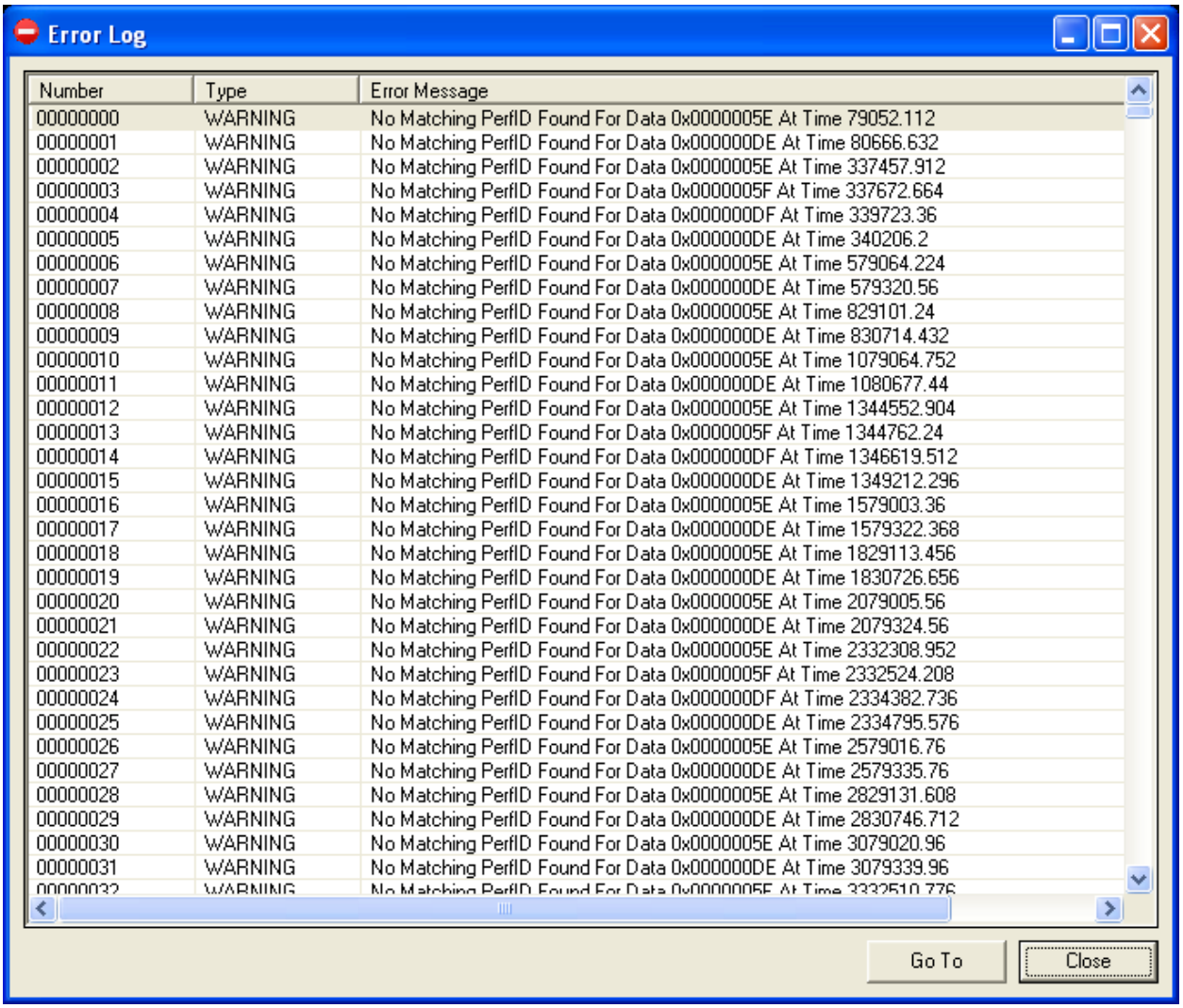
No Matching PerfID Found For Data XXXX At Time YYYY

Where:

XXXX	The Performance ID in Hex
YYYY	The Absolute Time in microseconds

This message is considered a warning.

Problem	**Solution**
A new Performance ID was added to the system but was not added to the Performance ID setup.	Add the new Performance ID to the Performance ID setup.
Performance ID does not match any Performance IDs currently in the system.	Figure out why the erroneous entry is being added to the Timing Data.



Add or Edit Notes

Notes can be added to the timing data sample to document additional information about the data sample. The Timing Data MUST be saved as a data collection to attach the Notes to the data.

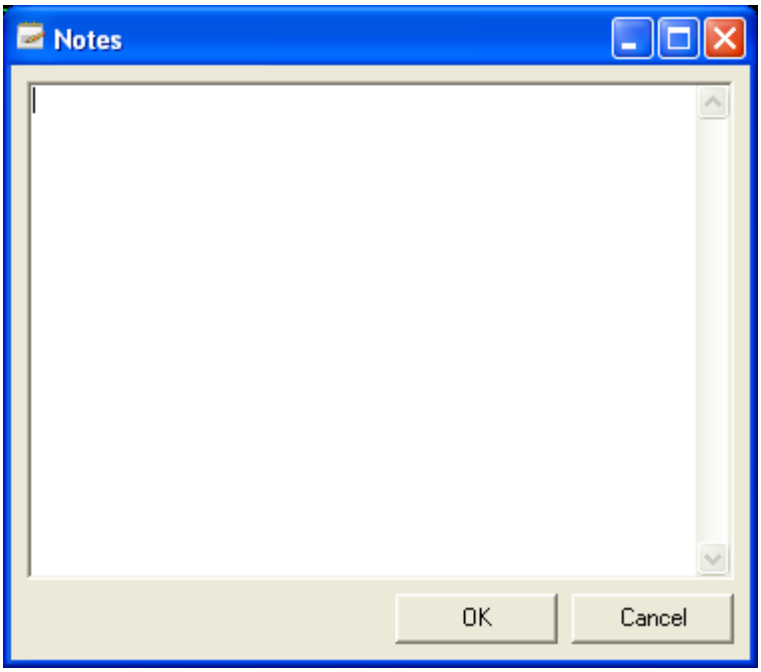
To add or edit Notes:

- From the View menu, choose Notes.

Toolbar: 

Suggested Uses:

- Document any problems found in the data sample
- Document where the sample was collected
- Document the configuration of the test setup when the sample was collected
- Document what is being tested
- Document why the data was collected, i.e. what you are looking for.



Copy The Screen To The Clipboard

To copy the screen to the clipboard:

- From the File menu, choose Screen, then choose Copy To Clipboard. The data is copied as a Bitmap Image.

Save The Screen As A Bitmap Image

To Save The Screen as a Bitmap Image:

- From the File menu, choose Screen, then choose Save As BMP.
- From the File Save dialog, select the drive and folder where the file is to be stored. The default folder is "Software Timing Analyzer/data".
- In the name box, type the filename.
- Click OK.

Print The Screen

To Print the Screen:

- From the File menu, choose Screen, then choose Print.
- From the Print dialog, select the printer to send the file to.
- Click OK.

Collect Data From A Agilent 16700 Series Logic Analyzer

TBS

Search Timing Data

The Software Timing Analyzer provides a search capability to quickly search the Timing Data for specified conditions.

To Search the Timing Data:

- From the Tools menu, choose Find.
- Enter the desired search criteria.
- Click on the Find Next or Find Previous button.
- If the search condition is found then the Waveform Display will centered around the search condition.
- The search can be repeated without revisiting the search dialog by choosing the Find Next or the Find Previous menu items.

Toolbar: 

The Find dialog supports three different types of searches:

Find State 1 One Time

This searches the data set for a single condition.

Example:

Find Task A Rising Edge

Find State 1 Followed by State 2 Within Time Period X

This is useful for searching for cases where the software does not meet its timing requirements.

Example 1: Find where Task A runs for longer than 10 ms:

Find Task A Rising Edge Followed by Task A Falling Edge > 10 ms

Example 2: Find where Interrupt A occurs more than 4 ms apart:

Find Interrupt A Rising Edge Followed by Interrupt A Rising Edge > 4 ms

Example 3: Find where Task A starts running more than 5 ms after Interrupt A occurs:

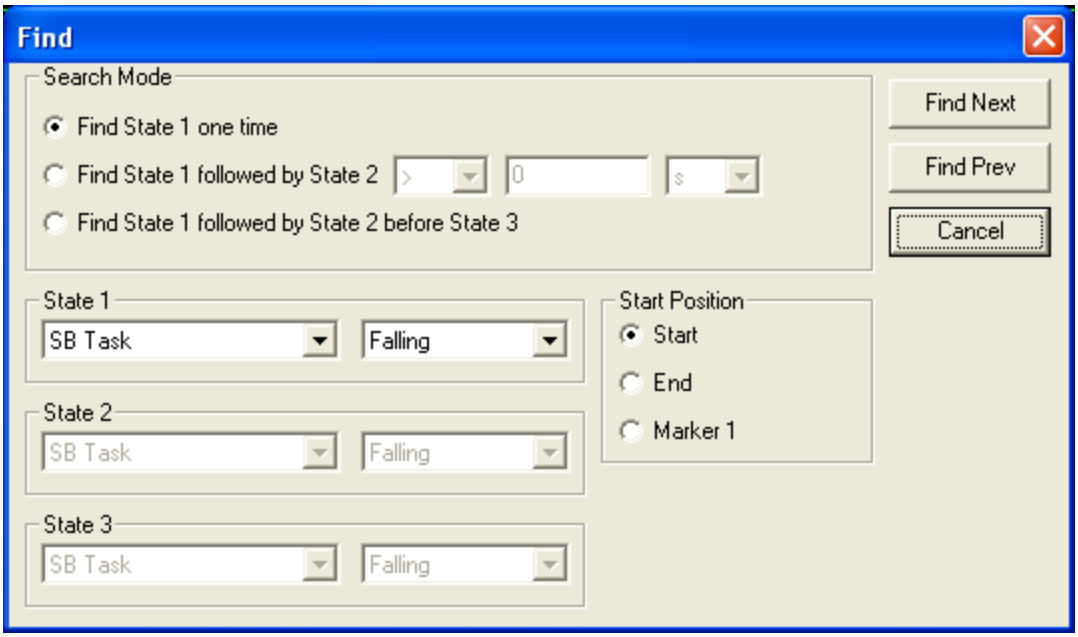
Find Interrupt A Rising Edge Followed by Task A Rising Edge > 5ms

Find State 1 Followed by State 2 Before State 3

This is useful for searching for cases where one event occurs before another event has finished.

Example: Find where Interrupt A occurs while Task B is running.

> Find Task B Rising Edge Followed by Interrupt A Rising Edge Before Task B Falling Edge



View Statistics

The Software Timing Analyzer provides a standard set of statistics for each Performance ID.

To View Statistics:

- From the Tools menu, choose Statistics.

Toolbar: 

Tip:

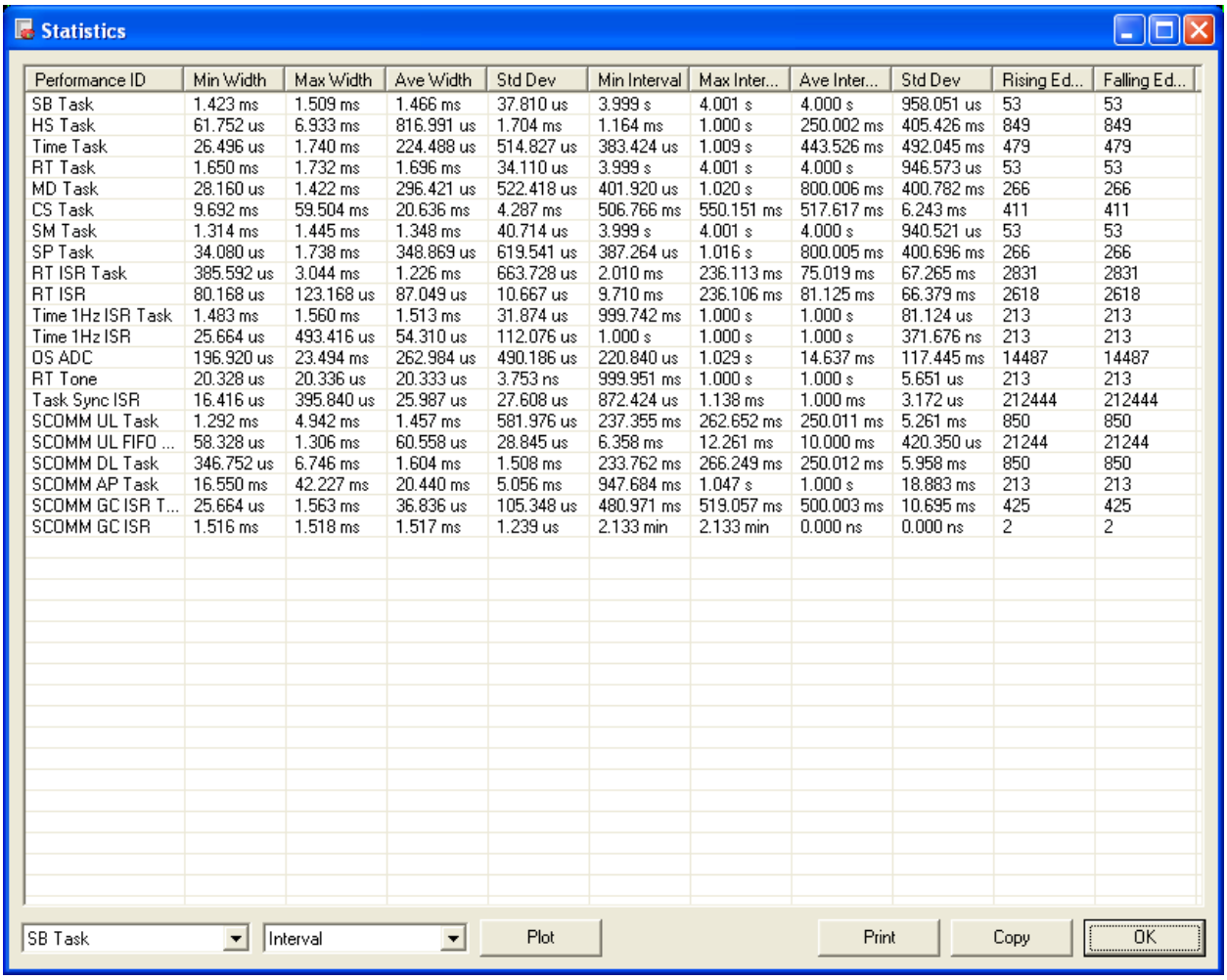
- Select the Print button to print the Statistics Window on a printer
- Select the Copy button to copy the Statistics Window to the clipboard. The data is copied in three different formats.
    1. Bitmap Image
    2. Text
    3. Comma Delimited Text (CSV)
- Select a Performance ID and either the (Interval or Width) and click on the Plot button to create a trending plot. The x axis of the trending plot is absolute time and the y axis is the delta time between two events. For example if the Interval is selected then the delta time would be the time between two rising edges or how often a task runs. If the Width is selected then the delta time would be the time between a rising edge and a falling edge or how long a task runs. Say for example you have a interrupt that is supposed to fire every 4ms however the statistics show that the min and max interval are not within acceptable limits. A trending plot would show how often this occurs and if there is any pattern to its frequency.

The following statistics are generated:

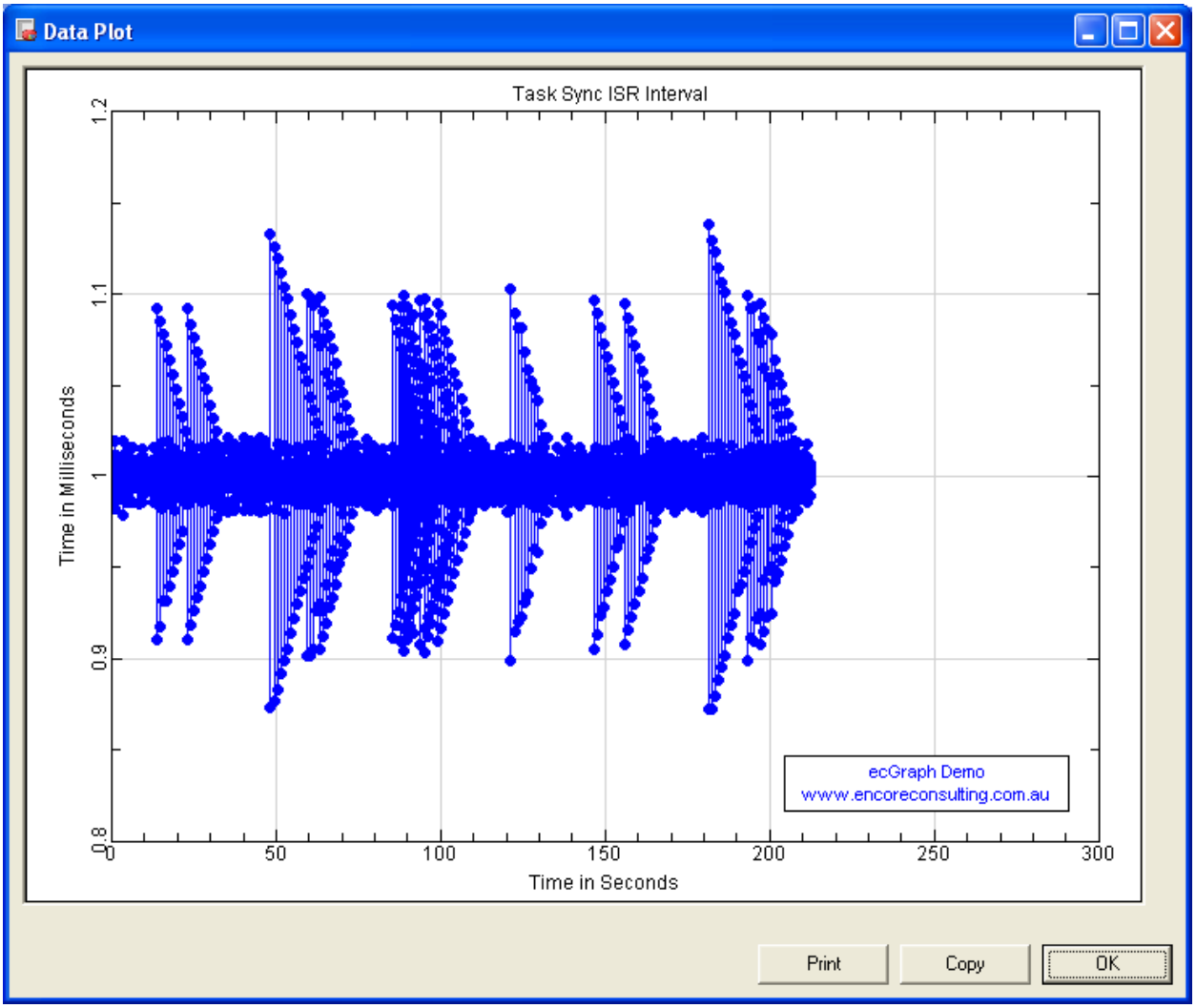
Width (Min, Max, Ave, Standard Deviation):
This number represents the time between a rising edge and the next falling edge. This number is used to see how long a task takes to run. Note that this number is an absolute time and includes any time that the task was held off by other higher priority tasks. This is important in the case where a task has a hard deadline. A large max width may indicate that the task takes a long time to do some sort of processing or it could indicate that another higher priority task interrupted it and held it off for some period of time.

Interval (Min, Max, Ave, Standard Deviation):
This number represents the time between a rising edge and the next rising. This number is used to see how often a task runs. This is useful for verifying that a task or isr is running at the expected rate. The average interval should match the expected rate and the difference between the min and max interval indicates the jitter.

Count of rising and falling edges:
The number of rising edges and falling edges found in the data sample.



Performance ID	Min Width	Max Width	Ave Width	Std Dev	Min Interval	Max Inter...	Ave Inter...	Std Dev	Rising Ed...	Falling Ed...
SB Task	1.423 ms	1.509 ms	1.466 ms	37.810 us	3.999 s	4.001 s	4.000 s	958.051 us	53	53
HS Task	61.752 us	6.933 ms	816.991 us	1.704 ms	1.164 ms	1.000 s	250.002 ms	405.426 ms	849	849
Time Task	26.496 us	1.740 ms	224.488 us	514.827 us	383.424 us	1.009 s	443.526 ms	492.045 ms	479	479
RT Task	1.650 ms	1.732 ms	1.696 ms	34.110 us	3.999 s	4.001 s	4.000 s	946.573 us	53	53
MD Task	28.160 us	1.422 ms	296.421 us	522.418 us	401.920 us	1.020 s	800.006 ms	400.782 ms	266	266
CS Task	9.692 ms	59.504 ms	20.636 ms	4.287 ms	506.766 ms	550.151 ms	517.617 ms	6.243 ms	411	411
SM Task	1.314 ms	1.445 ms	1.348 ms	40.714 us	3.999 s	4.001 s	4.000 s	940.521 us	53	53
SP Task	34.080 us	1.738 ms	348.869 us	619.541 us	387.264 us	1.016 s	800.005 ms	400.696 ms	266	266
RT ISR Task	385.592 us	3.044 ms	1.226 ms	663.728 us	2.010 ms	236.113 ms	75.019 ms	67.265 ms	2831	2831
RT ISR	80.168 us	123.168 us	87.049 us	10.667 us	9.710 ms	236.106 ms	81.125 ms	66.379 ms	2618	2618
Time 1Hz ISR Task	1.483 ms	1.560 ms	1.513 ms	31.874 us	999.742 ms	1.000 s	1.000 s	81.124 us	213	213
Time 1Hz ISR	25.664 us	493.416 us	54.310 us	112.076 us	1.000 s	1.000 s	1.000 s	371.676 ns	213	213
OS ADC	196.920 us	23.494 ms	262.984 us	490.186 us	220.840 us	1.029 s	14.637 ms	117.445 ms	14487	14487
RT Tone	20.328 us	20.336 us	20.333 us	3.753 ns	999.951 ms	1.000 s	1.000 s	5.651 us	213	213
Task Sync ISR	16.416 us	395.840 us	25.987 us	27.608 us	872.424 us	1.138 ms	1.000 ms	3.172 us	212444	212444
SCOMM UL Task	1.292 ms	4.942 ms	1.457 ms	581.976 us	237.355 ms	262.652 ms	250.011 ms	5.261 ms	850	850
SCOMM UL FIFO ...	58.328 us	1.306 ms	60.558 us	28.845 us	6.358 ms	12.261 ms	10.000 ms	420.350 us	21244	21244
SCOMM DL Task	346.752 us	6.746 ms	1.604 ms	1.508 ms	233.762 ms	266.249 ms	250.012 ms	5.958 ms	850	850
SCOMM AP Task	16.550 ms	42.227 ms	20.440 ms	5.056 ms	947.684 ms	1.047 s	1.000 s	18.883 ms	213	213
SCOMM GC ISR T...	25.664 us	1.563 ms	36.836 us	105.348 us	480.971 ms	519.057 ms	500.003 ms	10.695 ms	425	425
SCOMM GC ISR	1.516 ms	1.518 ms	1.517 ms	1.239 us	2.133 min	2.133 min	0.000 ns	0.000 ns	2	2



Drag select an area of the plot with the left mouse button to zoom into. Click the right mouse button to restore the view to 100%.

View CPU Utilization

The Software Timing Analyzer can derive CPU Utilization numbers for any Performance ID that has the Include in CPU Calculations flag set in the Performance ID Setup.

To View CPU Utilization:

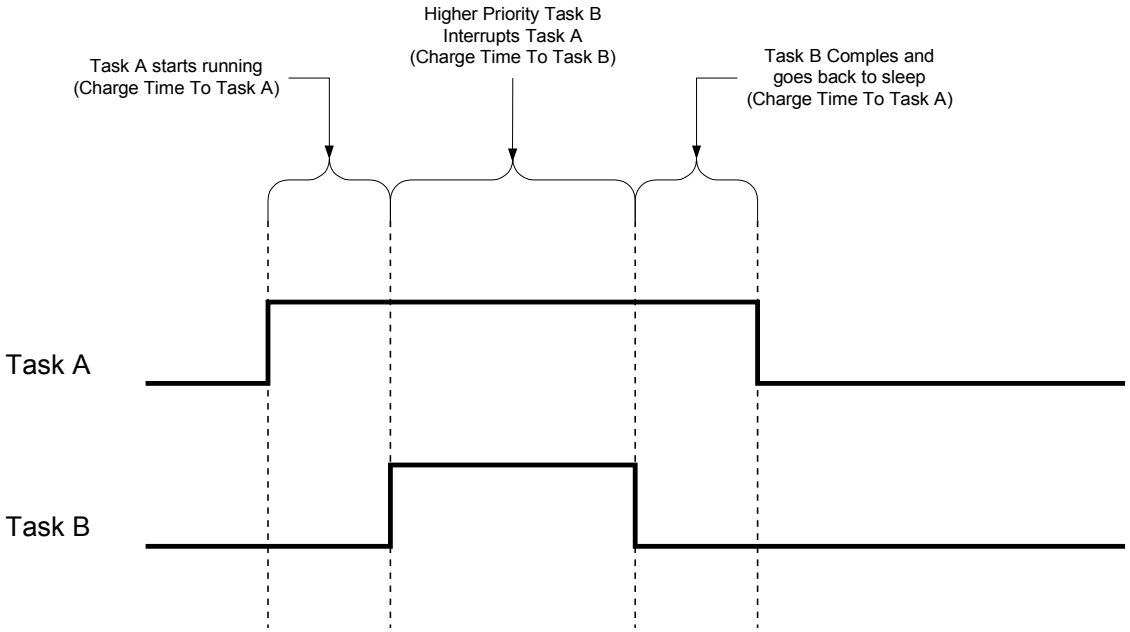
- From the Tools menu, choose CPU Utilization.

Toolbar: 

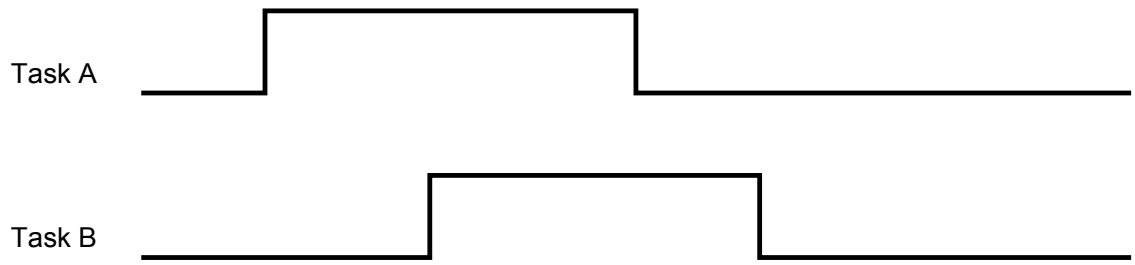
Tip:

- Select the Print button to print the CPU Utilization Window on a printer
- Select the Copy button to copy the CPU Utilization Window to the clipboard. The data is copied in three different formats.
    1. Bitmap Image
    2. Text
    3. Comma Delimited Text
- Select the Plot button to see a plot of CPU utilization averaged over half second intervals

CPU utilization for each Performance ID is defined as the percentage of time that the task is running for a given sample of time. CPU utilization is calculated by adding up the time that each task is running and then dividing that time by the total time in the sample. The software assumes priority based tasking and accounts for higher priority tasks interrupting lower priority tasks. See the diagram below.



Because I assume priority based tasking, CPU utilization cannot be calculated when tasks rising and falling edges overlap. See the diagram below.



The software provides the option for each task to charge it's CPU time to the caller (Include in CPU Calculations Flag). If the Include in CPU Calculations Flag is not checked for a task, then it is excluded from the CPU utilization calculations. This is useful for the following situations:

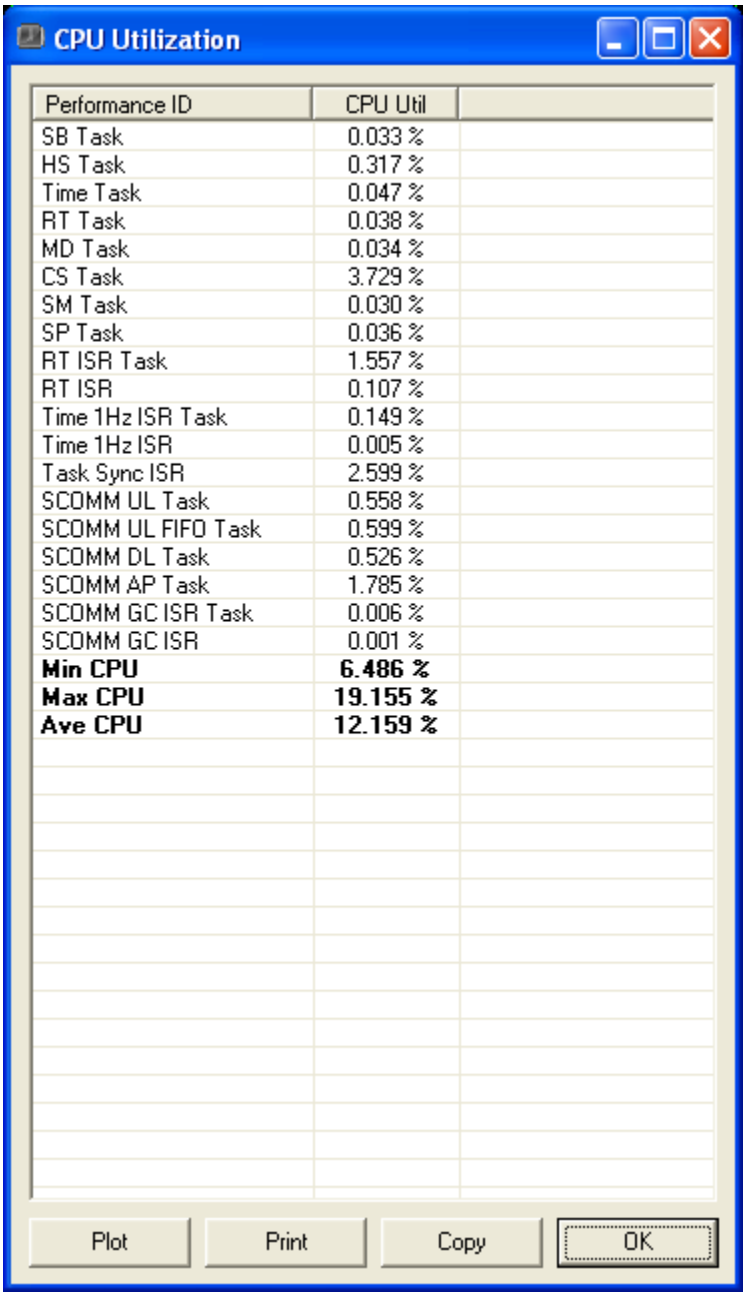
1. If you have a shared library that sometimes you want to see how much time is spent in the shared library (Include in CPU Calculations Flag checked for the shared library) and sometimes you want to see the tasks total CPU utilization including the shared library calls (Include in CPU Calculations Flag not checked for shared library).

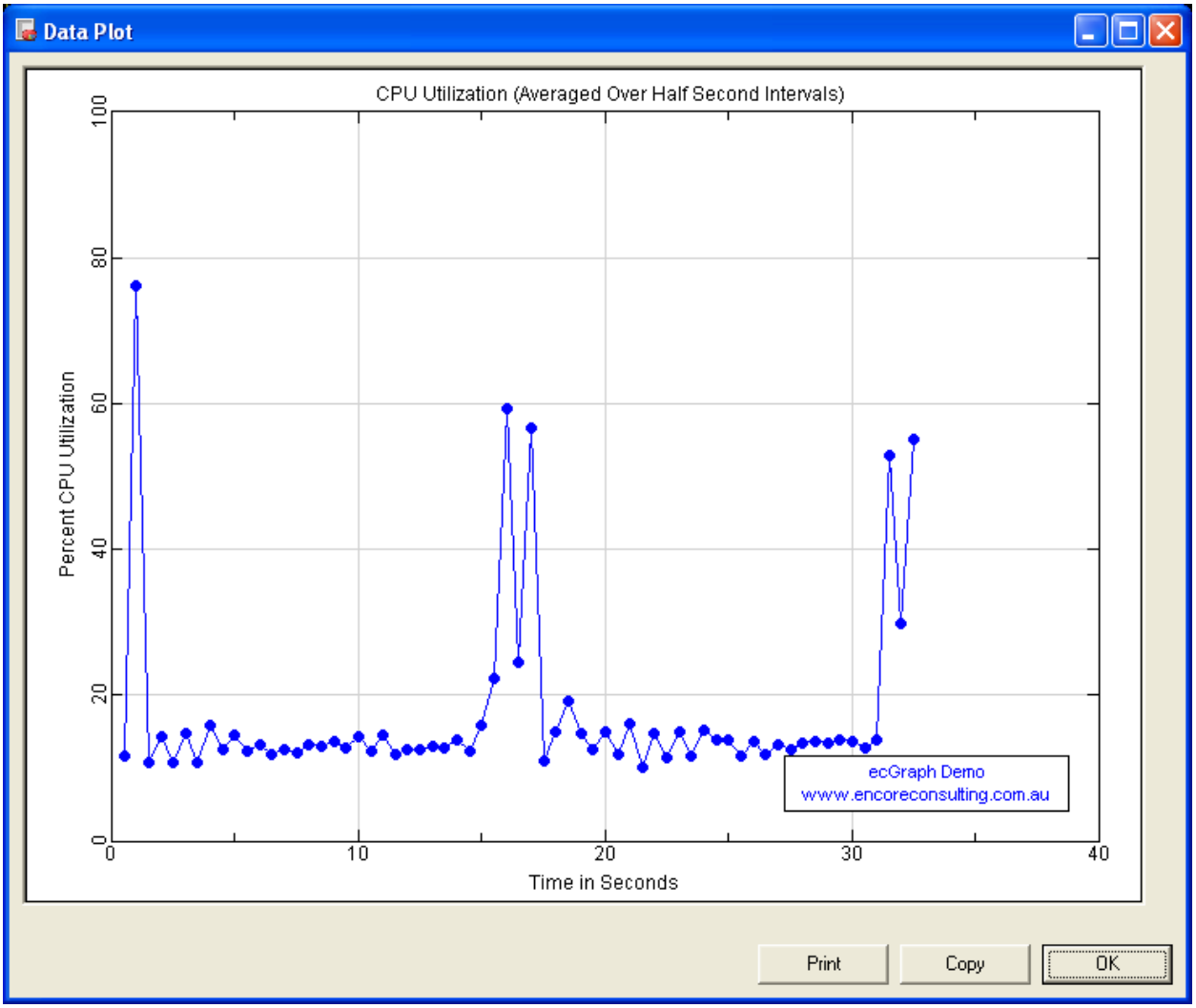
2. If an event variable is used to provide some other timing information and does not follow the priority based tasking scheme. On the GLAS project we used a Performance ID as a point of reference to show frame boundaries. The Include in CPU Calculations Flag was not checked for this Performance ID because it toggled between 0 and 1 every second on a frame boundary.

3. If separate Performance IDs are set up to measure total task time as well as a specific operation that the task performs. On the GLAS project the AD task executed a compression algorithm. It was useful to see how long it took to perform the compression in addition to the total task run time so two separate Performance IDs were used. The Include in CPU Calculations Flag was checked for the compression algorithm Performance ID because we were only interested in the total CPU utilization for the task.

The Min and Max CPU utilization numbers are calculated by dividing the data sample into half second periods. The total CPU utilization is calculated for each half second period and the period with the highest and lowest CPU utilization is reported.

Note that the total CPU utilization may not represent the total CPU utilization for the system. It will only represent the total CPU utilization for the tasks being measured. So if the timing data does not represent every piece of code that can run in the system, it will not reflect the true total CPU utilization.


CPU Utilization
Performance ID
CPU Util
SB Task 0.033 %
HS Task 0.317 %
Time Task 0.047 %
RT Task 0.038 %
MD Task 0.034 %
CS Task 3.729 %
SM Task 0.030 %
SP Task 0.036 %
RT ISR Task 1.557 %
RT ISR 0.107 %
Time 1Hz ISR Task 0.149 %
Time 1Hz ISR 0.005 %
Task Sync ISR 2.599 %
SCOMM UL Task 0.558 %
SCOMM UL FIFO Task 0.599 %
SCOMM DL Task 0.526 %
SCOMM AP Task 1.785 %
SCOMM GC ISR Task 0.006 %
SCOMM GC ISR 0.001 %
Min CPU 6.486 %
Max CPU 19.155 %
Ave CPU 12.159 %
Plot
Print
Copy
OK



Drag select an area of the plot with the left mouse button to zoom into. Click the right mouse button to restore the view to 100%.

View Properties

The properties dialog is used to customize the Performance ID and Agilent Logic Analyzer setup.

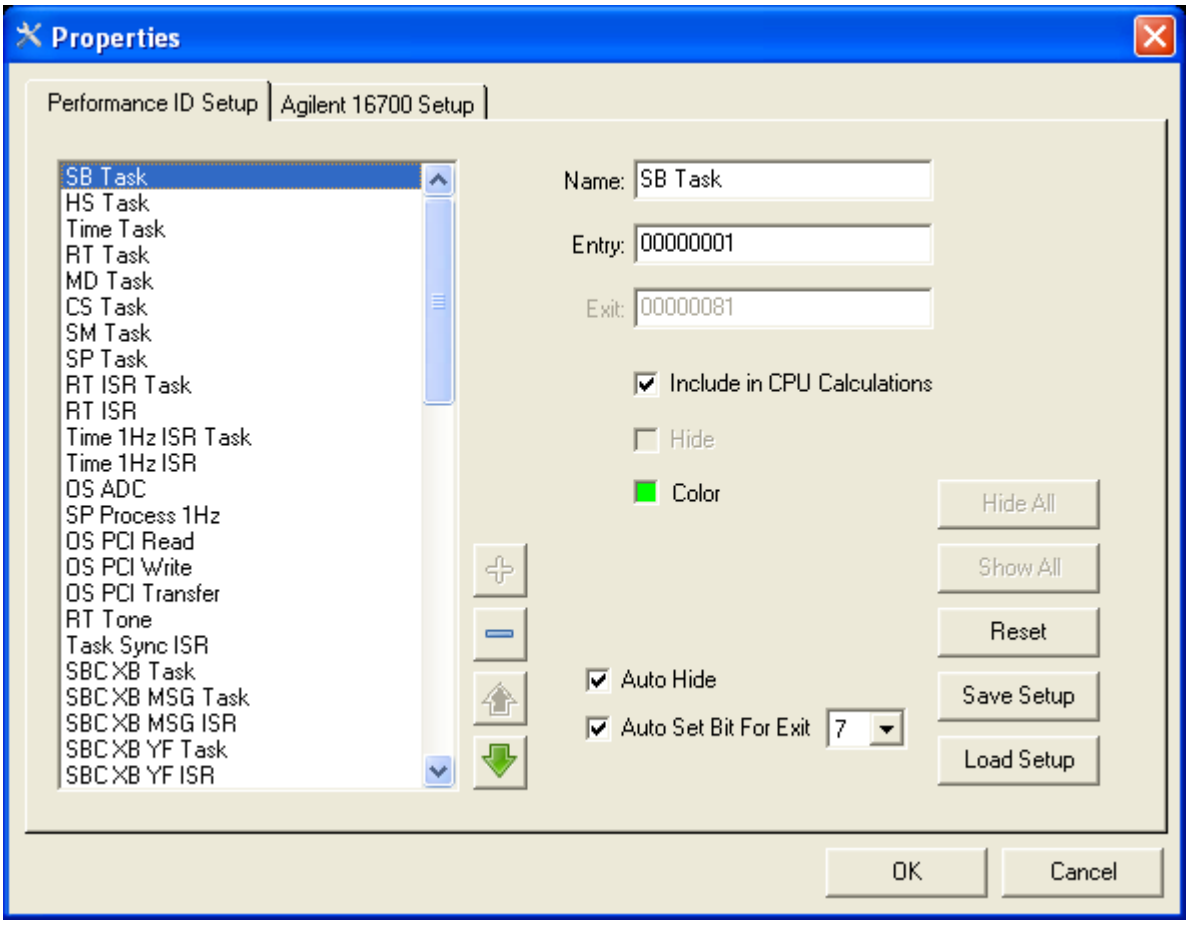
To View Properties:

- From the View menu, choose Properties.

Toolbar: 

Performance ID Setup Tab

The Performance ID setup tab lets you add, delete, and configure options for Performance IDs. All Performance IDs are listed to the left of the dialog. The maximum number of Performance IDs that can be defined at one time is limited to 64. Different Performance ID configurations can be saved into Performance ID setup files.

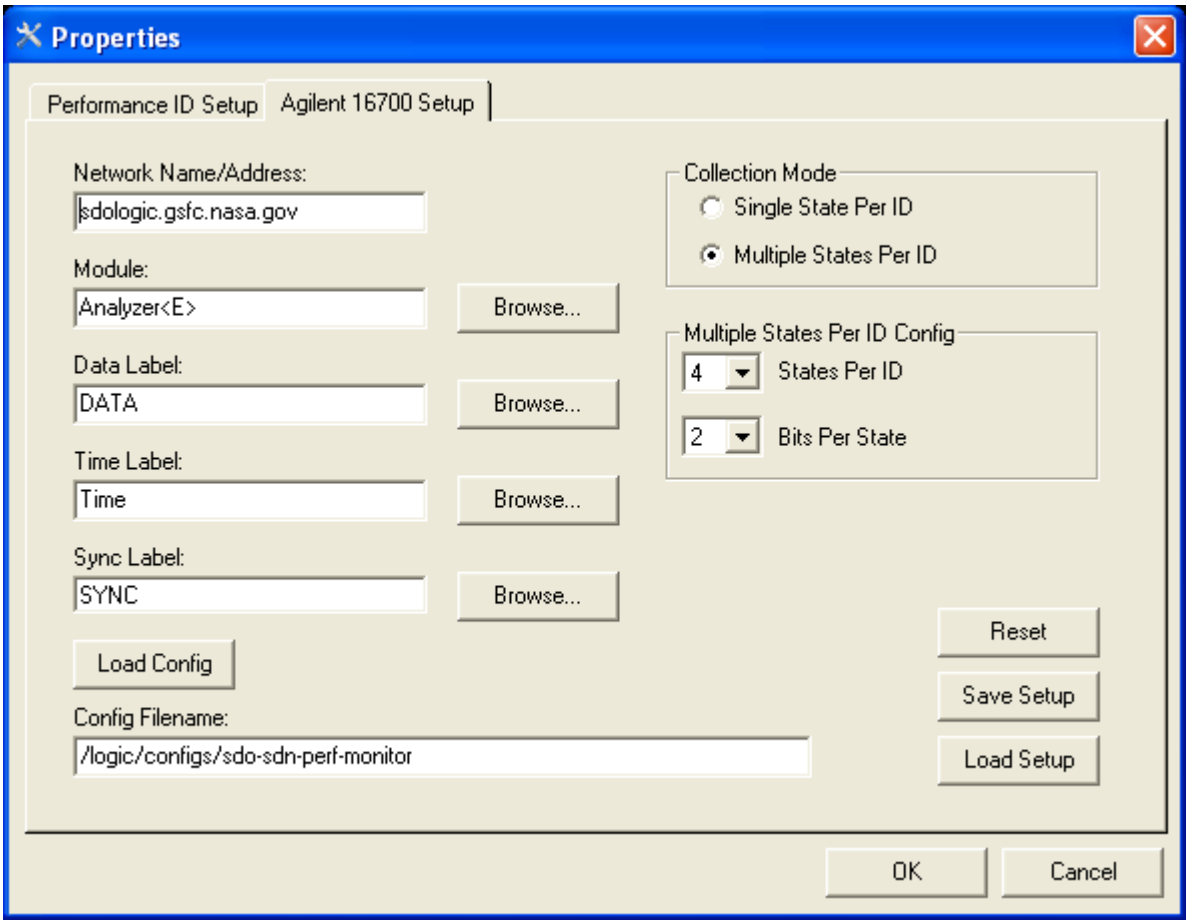


Name	Text name that describes the purpose of the Performance ID.	
Entry	The Entry Performance ID specified in hex.	
Exit	The Exit Performance ID specified in hex. This field is automatically generated when Auto Set Bit For Exit is enabled.	
Include In CPU Calculations	The Include In CPU Calculations flag determines if this Performance ID will be included in CPU utilization calculations. Since Performance IDs can be added for any purpose, not all Performance IDs should be included in CPU calculations.	
Hide	Determines whether this Performance ID is visible or hidden from view. Performance IDs that are hidden will not be included on the waveform display, the statistics display, or the CPU utilization display. This option cannot be changed when Auto Hide is enabled.	
Color	Determines the color to be used for this Performance ID on the waveform display. Different colors can be used for different classes of Performance IDs to make the display easier to read. For example tasks could be green, isrs could be red, and other Performance IDs could be blue. To select the color click on the color button and a color picker dialog will be displayed.	
Add Performance ID		Creates a new Performance ID. The new Performance ID will be inserted in the list after the selected Performance ID. The number of Performance IDs is limited to 64.
Delete Performance ID		Deletes the selected Performance ID.
Move Performance ID Up		Moves the selected Performance ID up one entry in the list. The order in the list determines the order that the Performance IDs are shown on the waveform display, the statistics display, and the CPU utilization display
Move Performance ID Down		Moves the selected Performance ID down one entry in the list. The order in the list determines the order that the Performance IDs are shown on the waveform display, the statistics display, and the CPU utilization display
Auto Hide	Auto Hide automatically hides Performance IDs that do not have any associated Performance Markers in the current data sample.	
Auto Set Bit For Exit	Auto Set Bit For Exit automatically formats the Exit Performance ID by setting the specified bit in the Entry Performance ID. Typically the Entry or Exit state of a Performance ID is denoted by setting a specified bit for exit. For example if bit 31 is chosen to be reserved for Exit Performance IDs then an Entry Performance ID of 0x00000001 will have an Exit Performance ID of 0x80000001.	
Hide All	Hides all Performance IDs. This option is only available when Auto Hide is disabled.	
Show All	Shows all Performance IDs. This option is only available when Auto Hide is disabled.	

Reset	Resets the Performance ID list, effectively deleting all Performance IDs. This is useful for creating a new Performance ID Setup file.
Save Setup	Saves the Performance ID Setup to a setup file. By default all setup files are stored in the "Software Timing Analyzer\setup" directory. All Performance ID Setup files have the ".PerfIDSetup" file extension. The last Performance ID Setup file that is saved or loaded is automatically reloaded the next time the application is started.
Load Setup	Loads a Performance ID Setup file. By default all setup files are stored in the "Software Timing Analyzer\setup" directory. All Performance ID Setup files have the ".PerfIDSetup" file extension. The last Performance ID Setup file that is saved or loaded is automatically reloaded the next time the application is started.

Agilent 16700 Setup Tab

The Agilent 16700 setup Tab configures all of the options to communicate with a Agilent Logic Analyzer over a network.



The Logic Analyzer needs to be configured to collect data from the target prior to configuring this setup. Browse buttons are available to help retrieve information about the logic analyzer setup. In order for the browse button to work the Logic Analyzer needs to be powered up, connected to the network, and have the proper configuration loaded.

Network Name/Address	Name or IP Address of Logic Analyzer
Module	Module name. Click on the Browse button to bring up a list of modules.
Data Label	Label used for Data. Click on the Browse button to bring up a list of labels.
Time Label	Label used for Time. Click on the Browse button to bring up a list of labels.
Sync Label	Label used for Sync. The Sync Bit is set to 1 for the first state of a Multi State Performance ID. Click on the Browse button to bring up a list of labels. This option is only available when Multiple States Per ID is selected.
Config Filename	Directory path and name of a logic analyzer configuration file to be loaded. Clicking the "Load Config" button commands the logic analyzer to load the specified configuration.
Single State Per ID	The Performance ID is clocked out in one state.
Multiple States Per ID	The Performance ID is clocked out across multiple states.
States Per ID	Number of states required to assemble a complete Performance ID. This option is only available when Multiple States Per ID is selected.
Bits Per State	Number of bits output per state. On SDO the SDN output Performance IDs that were 8 bits wide, 2 bits at a time. So in this case the states per id would be 4 and the bits per state would be 2. This option is only available when Multiple States Per ID is selected.
Reset	Resets the Agilent 16700 Setup file, effectively deleting all setup information. This is useful for creating a new Agilent 16700 Setup file.
Save Setup	Saves the Agilent 16700 Setup to a setup file. By default all setup files are stored in the "Software Timing Analyzer\setup" directory. All Agilent 16700 Setup files have the ".Agt16700Setup" file extension. The last Agilent 16700 Setup file that is saved or loaded is automatically reloaded the next time the application is started.
Load Setup	Loads an Agilent 16700 Setup file. By default all setup files are stored in the "Software Timing Analyzer\setup" directory. All Agilent 16700 Setup files have the ".Agt16700Setup" file extension. The last Agilent 16700 Setup file that is saved or loaded is automatically reloaded the next time the application is started.

Reference Information

Agilent Interface

TBS

Frequently Asked Questions

How do I extract a Performance ID setup file from a Data Collection?

Open the Data Collection.
View the Performance ID Setup on the Properties dialog.
Click on the Save Setup Button.
From the Save File dialog, enter a filename and click OK.

I Imported new data, why don't I see anything drawn on the waveform display?

The most common cause of this problem is the wrong Performance ID Setup file is loaded.

Why does the waveform display look like a saw tooth?

The waveform display will look like a saw tooth whenever duplicate rising or falling edges are detected. This can be caused by improperly placing the Performance Markers in the source code or the wrong Performance ID Setup file could be loaded. See How To: View Timing Data Errors for more information.

How do I update the Performance ID file embedded in a Data Collection?

Open the Data Collection.
View the Performance ID Setup on the Properties dialog.
Click on the Load Setup Button.
From the Load File dialog, enter a filename and click OK.
Click OK to exit the Properties dialog.
Save the Data Collection.

How do I move a marker that is off the screen?

The best way to position markers is to use the snap feature. See How To: Measure The Time Between Two Events for more information.

Acknowledgments

The Software Timing Analyzer includes source code obtained from vbAccelerator.com.

Version 1.0