Agilent 86130A BitAlyzer<sup>®</sup> Error Analysis Getting Started





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The following conventions are used in this book:

Key type for keys or text located on the keyboard or instrument.

Softkey type for key names that are displayed on the instrument's screen.

Display type for words or characters displayed on the computer's screen or instrument's display.

**User type** for words or characters that you type or enter.

*Emphasis* type for words or characters that emphasize some point or that are used as place holders for text that you type.

## Why Use Error Analysis?

Although bit error ratio (BER) is the most fundamental measure of system performance, it may not provide enough information to isolate the cause of bit errors. Error analysis uses bit error measurements and error position information to help you isolate and solve bit error problems quickly.

#### What this guide contains

- Part 1 is a tutorial that will get you started using error analysis. Each tutorial lesson can be completed in approximately 20 minutes. To get the most from the tutorial, you should complete one lesson at a time in the order presented.
- Part 2 is a reference section that contains more detailed information.

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Error Analysis Tutorial

# Lesson 1: Strip Chart Analysis

#### The purpose of strip chart analysis

- To see how BER develops over time. You can identify trends that help you understand how the BER of your system is affected. You can see how BER changes in response to temperature extremes or vibration. You can see if problems are localized to certain times or events.
- To see the proportion of bit vs. burst errors. You can see which type of errors dominate and which should be corrected first. The presence of burst errors indicates that there may be a non-random cause of bit errors that warrants further error analysis.





#### **NOTE** The absence of burst errors does not rule out non-random causes of bit errors. Further analysis, such as error-free interval analysis, may be necessary.

#### Settings that affect strip chart results

- Integration period (refer to page 1-8)
- Burst criteria (refer to page 1-11 and page 1-46)

## How to View Strip Chart Results

- **1** Press **Preset**  $\bullet$  on the front panel.
- 2 Open the data set "tutorial.uer."



NOTE

The following critical message will also appear. Because this message is not important for strip chart analysis, you can touch **Close**.



strip1

Error Analysis Tutorial Lesson 1: Strip Chart Analysis

3	Access the	Strip	Chart	results	window	and	touch	Fit	Graph.
---	------------	-------	-------	---------	--------	-----	-------	-----	--------

Eile <u>P</u> attern P <u>G</u>	Setup E <u>D</u> Setu	ip <u>R</u> esults <u>U</u> tili	ty <u>E</u> rror Analysis	Help	
<b>Delta BER: 0</b>	0.000 -6 -5 -4 -3	-2 -1 0	SYNC DATA ED CLK LOSS LOSS		Add Insert B
Pattern	Strip Chart			4	
PG Setup	Auto Scroll	Pan/Zoom	Fit Graph	Print	Properties
		20011	×		
Error Analysis	$\left( \right)$				
	1e-5				
Y-Axis BER	< ⊨□				
	1e-10				
Pattern Sensitivity					
		5.00	10.00	15.00	20.00
Strip Chart	Total Rate	Burst Rate	Seconds		
	Integration: 1.008	+09 Min burs	length: 4 Sym	nbol mode off	Timebase: 1.25 @Hz
	5	4 8888		More	Elapsed 00 00:00
PG: 249-1 PR	P E 223	-I PRBS	PG BIT Rate: 2.4883	SGHZ ED BIT Rate	9. 2.4883 GHZ
			$\neg \gamma$		
			X-Axis seco	nds	sub

- 4 Zoom and pan to see more detail.
  - **a** Select **Zoom Y** from the **Pan/Zoom** list. Touch the display and drag up, or turn the front panel knob clockwise.





**b** Select **Pan Y** from the **Pan/Zoom** list. Touch the display and drag down, or turn the front panel knob counter-clockwise.

5 Turn on and position the Y-Axis cursor to find the highest burst BER.



#### What are the results telling you?

The graph shows that the total BER was consistently high. It also showed that most errors were burst related, meaning that the BER can be improved by removing the non-random cause of errors.

6 Change the X-Axis from time to bits (clear the Use Global Timebase checkbox) and turn off the Y-Axis cursor.



7 To view a longer-term trend in BER, change the Integration Period to 1E10.

#### What is the integration period?

Each measurement point (line segment between tick marks) on the strip chart represents the BER averaged over a specific number of bits. This number of bits is called the integration period, and it affects the total number of points plotted. Smaller integration periods allow you to see short-term trends in BER, while larger periods allow you to see long-term trends.





NOTE

When the critical message box appears, touch Close.

Error Analysis Tutorial Lesson 1: Strip Chart Analysis



 ${f 8}$  Change the Integration Period back to 1E9 (refer to the previous step).

**9** To see how the burst criteria can affect strip chart results, change the **Burst Error-Free Threshold** to 6.

#### What is the burst error-free threshold?

Groups of errors are only classified as bursts if they meet the user-defined burst criteria. The burst criteria are made up of two components: minimum burst length and burst error-free threshold. For the following example, burst error-free threshold = 10.



#### Error Analysis Tutorial Lesson 1: Strip Chart Analysis



NOTE

When the critical message box appears, touch Close.



#### What are the results telling you?

Changing the burst error-free threshold to 6 caused no burst errors to be recorded. Groups of bit errors were no longer classified as bursts because they were all >= 6 bits apart.

- **10** Change the **Burst Error-Free Threshold** back to 16 (refer to the previous step).
- 11 To find out the lengths of the burst errors, continue with "Lesson 2: Burst Length Analysis" on page 1-14.

## Lesson 2: Burst Length Analysis

#### The purpose of burst length analysis

• To see if the distribution of burst lengths fits the profile for a specific cause of errors (error mechanism). There are a number of error mechanisms that have specific burst length profiles. You can compare your burst length results with these known profiles to see if there is any relation.

#### What is burst length?

Burst length is the number of bits from the first error to the last error in a burst. Both the first and last bit error are included in the burst length.

#### Settings that affect burst length results

- Burst error-free threshold (refer to page 1-8)
- Chart range and bin resolution (refer to page 1-27)

### How to View Burst Length Results

- **1** Press **Preset**  $\bullet$  on the front panel.
- 2 Open the previous data set "tutorial.uer" as shown on page 1-3.
- When the critical message box appears, touch **Close**.

NOTE



3 Access the Burst Length results window and touch Fit Graph.

4 Use **Zoom X** to zoom in to the 1-to-30 burst length range.



- **5** Turn on and position X-Axis cursors on the burst length results.
  - a In the **Properties** dialog box, select the **X-Axis Cursors** checkbox and touch **OK**.



- b Select Cursor x1 from the Pan/Zoom list. Touch and drag the cursor, or use the front panel knob to move the cursor to the desired position. Select Cursor x2 and repeat.
- **NOTE** For rough or large changes in cursor position, it may be faster to touch and drag cursors. For fine adjustments of cursor position, it's best to use the front panel knob. If cursors do not respond to the front panel knob, touch any point on the graph and try again.



#### NOTE

Notice that the "Cursor Area" indicator adds up the occurrences of error bursts within the cursor range. The cursor range includes the position of x1 and x2.

#### What are the results telling you?

Burst errors occur at two specific burst lengths (8 and 15). Perfect "spikes" such as these often come from problems inside the signal processing core of a system. Other types of analysis, such as correlation or pattern sensitivity, may provide more information.

6 Save the error signature of the recorded burst length results.

Eturst Loc Error Signature Zoom X Fit Graph Print	Properties
Error Signature Manager	? ×
E:\Bitalyzer\ErrorAnalysis Signature\	
<none> Burst Length Signature.BLH.csv 23</none>	Cancel Closes dialog box.
	Rename
Burst Length Signature	File name should appear below rue
Verify or change file name.	Ы4

7 To compare these recorded results with live results, continue with "How to View Live Burst Length Results."

## How to View Live Burst Length Results

# NOTEYou cannot change settings and use Update And Playback while in live mode.<br/>For example, you cannot change the burst criteria or chart range without losing<br/>your results. For information on recording error data sets, refer to "How to Set<br/>up a Record File" on page 2-6.

1 Connect the PG clock and data ports directly to the ED clock and data ports.



4 Select alternate pattern "burst\_19.ptrn" as the PG and ED pattern.

Eile	Pattern	P <u>G</u> Setup	E <u>D</u> Setup	Results	Utility	Error Analysis	Help	)			
Patt	eita Br 10 -9 em		ern C		attern	PG Triager )		3	)	?×	
Patt	ern Selec	t ©[	ser Patte	s SS	۲Pa	attern Size –	Bro Sel	wse	ttern:		
Ed	it Pattern on File	⊂ 2 ⊂ M 1	n <b>PRBS</b> lark Dens /2	sity PRB	is		Defa	aultPattern			1
PG ED : Viev Erro	Setup Setup v Results r Analysia		ror Dete	ctor Pat	tern t <u>O</u> K	7) ie Patti <u>C</u> ancel		Generator Apply	Patter	n elp	p:00
Sel	ect User F	attern					_	ED Bit R	ate: 2.48	83 GHz	
	Back I	New List	1con								
	Addre	5) <sup>EAQ</sup>	uick Starl	t Guide			•				
	atter burst_1 burst_2 sensitive	EA Bit	alyzer Patterns Dem S E/	: os A Quick	Start (	<b>4</b> ∂uide ▼					
Fi	nd Files	that mate	h these c	riteria:							
Fi	le Name	burst,	_19.ptrn			<u> </u>	-				
Fi	les of typ	be:  8613	0A Patter	m Files I	(*.ptrn)						
	Descripti	ion —	r —	6	)						
			<u>0</u> k		<u>C</u> ance	I <u>H</u> elp			blê	i	

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- Eile Pattern PG Setup ED Setup Results Utility Error Analysis Help Delta BER: 0.000 Error Add Pattern 1 🕂 Pattern Sync Criteria ? | X | Auto Align ED Setup Sync Mode: m Clock/Data /1 THR Normal Center Center Trigger Outp 2 Sync Type: Automatic Sync R Threshold: 凡 Sync Now 3 O Manual E-3 1 Pattern Sync Avg. 0/1 Threshold 무엇 Sync Th old: 1E-2 Ŧ Data Inverted 4 Accumulation Clock Inverted Edge Setup a Termination: ОK <u>C</u>ancel Apply <u>H</u>elp I) / SCFL  $\checkmark$ Aliya Clock Termination: Audio 🖃 0/1 Threshold: -451 mV Data Input Delay: 14 ps OV SCFL 1 View Results <u>E</u>rror Analysis More. Elapsed 00:00:00 PG: burst\_19 ED: burst\_19 PG Bit Rate: 2.4883 GHz ED Bit Rate: 2.4883 GHz
- **5** Change the **Sync Threshold** to 1E-2.

6 Select the Alternate AB alternate pattern control.



7 Access the **Burst Length** results window and accumulate for 5 to 10 seconds.



#### What does squelch mean?

Notice that the squelch indicator appeared on the lower right corner of the chart. This means that the error event rate was so high that there were periods when the analysis software was not able to process the number of errors that occurred.

Error analysis results are no longer accurate after squelching occurs. However, they are still useful in indicating that there is some type of non-random error mechanism.



8 Overlay the error signature of the recorded results.

# NOTEOverlaying signatures is a quick way of matching or excluding known error<br/>mechanisms. To turn off the error signature, select "<none>" in the Error<br/>Signature Manager (refer to the previous step).

#### What are the results telling you?

There is a definite contrast between the live and recorded results. For the live results, there was a distribution of burst lengths (17 to 23) that centered around a peak (19). This fits the profile for a problem that is outside the signal processing core of a system.

**9** For recorded results: to find out if there are signal processing errors related to the test pattern, continue with "Lesson 3: Pattern Sensitivity Analysis" on page 1-25.

## Lesson 3: Pattern Sensitivity Analysis

#### The purpose of pattern sensitivity analysis

To find out if a specific bit sequence in a pattern causes errors. Pattern sensitivity is a very common source of bit errors in communications systems. This often happens because of bandwidth limited channels.

#### Settings that affect pattern sensitivity results

- ED pattern
- Chart range and bin resolution (refer to page 1-27)

## How to View Pattern Sensitivity Results

- **1** Press **Preset**  $\bullet$  on the front panel.
- **2** Select 2<sup>10</sup> PRBS as the PG and ED pattern.



**3** Open the previous data set "tutorial.uer" as shown on page 1-3.

**NOTE** Because the correct pattern has been selected, the critical message box should not appear.

#### 4 Access the Pattern Sensitivity results window.



**NOTE** Notice that the peak on the right-most side of the chart is thicker in appearance. A peak such as this can appear on the left-most or right-most side of any analyzer chart, indicating that there are more results beyond the current chart range.

**5** To see results for all bit positions in the pattern, change the chart end range to 1023. Notice that the bin resolution changed to 2.



#### What is bin resolution?

Each point on the x-axis of a results graph is called a bin, and there are a maximum of 1000 bins available. The bin resolution for pattern sensitivity indicates how many bits are represented by one bin. Chart ranges greater than 1000 cause bin resolutions to be greater than 1.

#### Error Analysis Tutorial Lesson 3: Pattern Sensitivity Analysis



6 Position the X-Axis cursors on two of the smaller results (refer to page 1-16).



#### NOTE

The position of cursor x1 corresponds to the highlighted bin (containing one or more bits) below the chart. This allows you to see where bits are located in the pattern.

#### What are the results telling you?

Because bin resolution is 2, the highlighted bin contains 2 bits. This means that one or both of the highlighted bits is errored.

Notice that the results beyond position 127 (the default chart range) are insignificant in comparison with the larger results. To illustrate this further, continue with step 7.

7 To view results in a different way, change the chart scale from log to linear.

Pattern Sensitivity Error Pan/Zoom Fit Graph Print Properties	
Analyzer Properties ?X Select a Category	
Block Errors         Ø Burst Length         Correlation         Error Statistics         ✓ Pattern Sensitivity         Strip Chart         Image         Save         Range         Save         Range         Save         Range         Save         Range         Save         Chart Pange         Save         Range         Save         Save         Save         Range         Save	
Cursor     Curso	
	tt5

8 Touch Fit Graph and position the cursors to their previous locations. (X1 cursor: 238-239. X2 cursor: 600-601.)





9 Position X-Axis cursors to "surround" the larger results (refer to page 1-16).

Pattern Sensitivity Error Signature Cursorx1	n Fit Graph	Print	
186         12           184         12           184         100           100         20           1101110010001110001111         1024 b           Curs Area: 96386         >           Confirm Updates         Analyzer Properties           Pheters Resultivity         Paters Servicity	Analyzer Properties Select a Category Block Errors Block Errors Error Free Interval Error Statistics Error Statistics Error Statistics Strip Chart	Chart Range (bits/symbols) from to 66 213 Save Recall Range Recall	for a bin resolution of 1 Set From Cursors 66 to 213 Use Global F Log Scale
Chart Range Start from 0 to 66 Chart Range End: from 1023 to 2	13 Disable All Res		patt8

10~ Set the chart range to the cursor range, and change the chart scale back to log.

- 11 Position cursor x1 on the 3 largest peaks and make note of the results.
- **NOTE** To see the results more clearly, decrease the zoom of the y-axis. The quickest way to do this is to touch the display and drag down.



#### What are the results telling you?

The results indicate a high occurrence of pattern sensitivity to isolated 1's among long strings of 0's.

The results also indicate that pattern sensitivity is the origin of the burst length results as seen on page 1-15. If bit errors occurred simultaneously in positions 87 and 94, a burst length of 8 would result. If bit errors occurred simultaneously in positions 87 and 101, a burst length of 15 would result.

To find out what caused this pattern sensitivity, continue with "Lesson 4: Error-Free Interval Analysis" on page 1-34.



#### What is an error-free interval?

An error-free interval is an error-free gap between errors. An error-free interval distance is measured in bits or time.

#### The purpose of error-free interval analysis

• To find out if there are repetitive errors in your system by viewing the number of occurrences of error-free intervals. If certain error-free intervals occur more often than others, then your errors are not random. The error-free interval distance in bits can also be translated into a time period.

#### Settings that affect error-free interval results

• Chart range and bin resolution (refer to page 1-27)

### How to View Error-Free Interval Results

	1 Press <b>Preset</b> $\bullet$ on the front panel.
	<b>2</b> Open the previous data set "tutorial.uer" as shown on page 1-3.
NOTE	When the critical message box appears, touch <b>Close</b> .



**3** Access the **Error-Free Interval** results window.

**4** To see more data, change the chart range to 500,000 (refer to page 1-27).

**5** Turn on and position X-Axis cursors to surround two peaks (refer to page 1-16).



#### What are the results telling you?

The distribution of error-free intervals indicates that there is repetitive, external interference. The interference is inducing pattern sensitivity in the test device.

**6** Set the chart range to the cursor range (refer to page 1-32) and position the cursors on the two peaks.



- 7 Change the X-Axis from bits to time.
  - **a** Make sure that the global timebase is set to 1.25 GHz (this was the bit rate used while recording "tutorial.uer").



ΝΟΤΕ

To ensure accurate results, the global timebase must be set to the bit rate used during your measurement.

**b** In the **Properties** dialog box, select the **Use Global Timebase** checkbox (refer to page 1-7).



#### X-Axis in nanoseconds.

8 Invert the time period between peaks to find the frequency of the interference.

#### What are the results telling you?

The inverse of 167,210 ns is 5.98 kHz. Knowing the frequency of interference may help you isolate the cause of errors in your system.

## How to Save and Recall Chart Ranges

If you don't want to lose your current range settings, you can use the save and recall range functions.

**1** Position the X-Axis cursors to surround one peak.

Error Free Interventer Error Signature	/al Pan/Zoom rsor x2	it Graph	Print	Properties
1e6 151195-18 151402 18 1e4 • 32323	3518- 13725			
100				
1 <b>4 4</b> 150000	200000 Nar	250000 ioseconds	300000	350000
Bin Res: 259	Err free thresh: 16	Symbol mode	off	Timebase: 1.25 GHz
Curs Area: 37604	X1: 151195-151402	X2: 183518-18	3725	DX: 32323
			More	Elapsed 00:00:00

efi5

2 In the **Properties** dialog box, save your current chart range, then set the chart range to the cursor range.

Error Free Interval Error Pan/2 Signature	Fit Graph Print.	Properties
Analyzer Properties Select a Category Block Errors Burst Length Correlation Error Free Interval Error Statistics Pattern Sensitivity Strip Chart	Chart Range (bits/symbols) from to 182001 (2) 441000 Save Recall Range	for a bin resolution of 259 Set From Cursors 188994 to 229656
Analyzer Properties Select a Category □ Block Errors □ Burst Length □ Correlation □ Error Free Interval □ Error Statistics □ Pattern Sensitivity □ Strip Chart	Chart Range (bits/symbols) from to 188994 229666 Save Recall Range Range	for a bin resolution of 41 Set From Cursors 186994 to 229656
Disable All Beset	T Y-Axis  Current  C	se Global IF Log Scale ancel Help

**NOTE** When the critical message box appears, touch **Close**.



**3** You can go back to your saved chart range at any time: Open the **Properties** dialog box and and touch **Recall Range**.



NOTE

When the critical message box appears, touch Close.

## Lesson 5: Error Statistics Analysis

Error statistics can be used as a numeric summary of the total, burst, and nonburst related errors covering your entire experiment. Error counts and ratios are included. In addition, the key settings that effect statistics results are shown.

You can use error statistics to separate out burst and non-burst related errors, and to nominally check the overall BER of your measurement.

## How to View Error Statistics

- **1** Press **Preset** on the front panel.
- **2** Open the previous data set "tutorial.uer" as shown on page 1-3.

When the critical message box appears, touch Close.

NOTE

Error Analysis Tutorial Lesson 5: Error Statistics Analysis

**3** Enable the error statistics analyzer.



**NOTE** When the critical message box appears, touch **Close**.

<u>Eile P</u> attern P <u>G</u> S	Setup E <u>D</u> Setup <u>R</u> e	sults <u>U</u> tility <u>E</u> rror	Analysis <u>H</u> elp			
Delta BER: 0.	000 -8 -5 -4 -3 -2 -	Errors SYNC D/ 1 0 LOSS LC	ATA ED CLK PG CLK RM ISS LOSS LOSS	Error /	Add Insert	в
Pattern PG Setup	Frror Statistics			Print	Propertie	s
Error Analysis Burst Length	Counts Total Bits Total Errors Non-Burst Related Burst Related Markers Removed Errors Pates	25,845,048,032 96,628 94,725 1,903 0 disabled	Properties Burst Err Free T Minimum Burst Integration Perio Symbol Mode	hresh Length Id	16 4 1.00E+09 Bits	
Error Statistics	Total Errors Non-Burst Related Burst Related Markers	3.74E-06 3.67E-06 7.36E-08 0 Hz				
Error Fi Intervi PG: 2 <sup>23</sup> -1 PRBS	ED: 2 <sup>23</sup> -1 PRE	3S PG Bit F	ate: 2.4883 GHz E	More	Elapsed 00:( 2.4883 GHz	00:00

4 Access the Error Statistics results window.

#### NOTE

The **Total Bits** count will vary slightly from the accumulated results **Bit Count**. This is due to differences in hardware and software accumulation startup times. The hardware responds immediately when **Start Accumulation** is pressed, whereas software startup procedures introduce a small indeterminate lag time before software accumulation begins. Error Analysis Tutorial Lesson 5: Error Statistics Analysis

**5** To see how the burst criteria can change error statistics results, change the **Minimum Burst Length** to 10 (refer to page 1-11).



#### 1-46

# Part 2

Analyzer Control 2-2 Applications for Burst Criteria 2-9 Applications for Cursor Area 2-11 Where to Go for More Information 2-13

Error Analysis Reference

# Analyzer Control

The **Analyzer Control** window gives you an overall view of error analysis settings. It also provides access to analyzer and global properties, where you can view more settings and make changes.

Eile Pattern	PG Setup ED Setup Resu	ults <u>U</u> tility Error Ana	alysis <u>H</u> elp			
Delta BER: 0.000 Errors SYNC DATA BOCK POCK RMT Error Add Insert B						
Pattern	Analyzer Control					
PG Setup	1	Analyze	er Status			
ED Setup	Block Errors	Error Free Interval				
View Results	🕘 Burst Length	Error Statistics		Analyzer		
Error Analysis	Correlation	Strip Chart		Propentes		
Analyzer Control	O Pattern Sensitivity	Operating Status				
	Event rate	Ũ	Synchronizer	Clobal		
BE	Marker rate	0	Cumbel Mede	Properties		
	Squelch events	8				
BIOCK Errors	File name	<none></none>	Error Removal			
IXXXX	File size	0 Bytes				
Burst Longth		Data Acquisition / File Management				
	Open Previous Error Data Set	Save Properties	Start Accumulation	Stop Accumulation		
Correlation			More	Elapsed 00:00:00		
PG: 223-1 PRE	ED: 2 <sup>23</sup> -1 PRBS	S PG Bit Rate:	2.4883 GHz ED Bit Rate	2.4883 GHz		

## Analyzer Status

The **Analyzer Status** area contains a status indicator for each analyzer. A green indicator means that an analyzer is on; a gray indicator means that an analyzer is off.

O Block Errors	Analyzer Status	
Ourst Length	Error Statistics     Strip Chort	Analyzer Properties
<ul> <li>Pattern Sensitivity</li> </ul>		

The **Analyzer Properties** button/dialog box provides access to all the settings used by the individual analyzers. For example, some analyzer properties are chart range, chart scale, and cursors. In this dialog box, you can also enable or disable analyzers.

**NOTE** Each analyzer requires processing time from the computer system, which impacts overall performance. If you are not using an analyzer, it is best to disable it.

## **Operating Status**

The **Operating Status** area displays information about the current analysis, and displays the status of error filters.

	Opera	ting Status	
Event rate	0	Synchronizer	Global
Marker rate	0	Symbol Modo	Properties
Squelch events	0		
File name	<none></none>	Error Removal	
File size	0 Bytes		

#### Analysis information

- Event rate: The number of error events per second being analyzed.
- Marker rate: The measured frequency of the marker signal.
- **Squelch events**: The number of times that the event rate was too high for the software to process the number of errors. Error analysis results are no longer accurate after squelching occurs.
- **File name**: The filename associated with the present error data set file operation.
- **File size**: The size of the error data set file associated with the present file operation.

#### Error filter status

- **Synchronizer**: If this filter is on, all error events are removed until the analyzer receives a marker signal, gating signal, or PRBS trigger signal. Once this starting signal is received, all errors are counted. This allows error analysis to begin precisely in alignment with a data sequence or external input.
- **Symbol Mode**: If this filter is on, the interpretation of error data is changed from single-bit error statistics to symbol-wide error statistics.
- **Error Removal**: If this filter is on, errors will be removed that belong to bursts with lengths above or below a user-defined threshold. In this way, you can analyze error statistics from errors that come from bursts of particular lengths or within a range of lengths.

#### NOTE

A green indicator means that a filter is on; a gray indicator means that a filter is off. These filter settings can be accessed within the **Global Properties** dialog box.

#### **Global Properties**

This button/dialog box provides access to the following global settings that can affect all analyzers:

- Burst Criteria (Burst Error-Free Threshold and Minimum Burst Length)
- Error Removal
- General Settings (Record File)
- Integration Period
- Symbol Size
- Synchronizer
- Timebase

**NOTE** An important step before starting error analysis is to set up a record file. Refer to "How to Set up a Record File" on page 2-6

## How to Set up a Record File

Before you can use error analysis, you must first accumulate measurement data. By default, the measurement data for error analysis is temporary, being overwritten at the start of the next accumulation. In addition, this temporary data can only be analyzed with the current analyzer and global property settings.

If you would like to save error analysis data, and have the option to re-analyze it with different properties settings, then you must set up a record file before accumulating.

Recording an error data set records the raw error position information directly and is not affected by the settings of any given error analysis view. You can change analysis settings and use the same captured error data set to view the results. This is very useful when you capture long measurements and want to examine "what if?" scenarios using the different analysis techniques. Recorded error data sets can also be used as documentation that defines precisely how and where errors happened during your measurement.

Analyzer Control	
	Analyzer Status
Ø Block Errors	O Error Free Interval
🔘 Burst Length	C Error Statistics Analyzer Properties
O Correlation	Strip Chart
🚫 Pattern Sensitivity	
	Operating Status
Event rate	0 Synchronizer Global
Marker rate	O Symbol Mode Properties
File name	<none> Error Removal</none>
File Global Proper	ties ? 🗙
Select a Category	General Settings
Burst Criteria	Record File
2 Error Removal	File Name <none></none>
General Settin	gs
Integration Per	riod File Limit No Limit 🔽 Reve Preparties
Symbol Size	- Directorios
Timehase	Error Signature Folder
	E:\Bitalyzer\ErrorAnalysis Signature
	Browse
	Etror Data Folder
	Browse
	Reset OK Cancel Help
	Defaults <u>Cancer</u> <u>Heip</u>

1 Touch Global Properties and General Settings.

- 2 In the File Name box, enter a file name.
- **3** Optional: Choose other record file settings.
  - a From the File Limit list, select a file limit.
  - **b** Select or clear the **OK to Overwrite** checkbox.

# **CAUTION** If **OK to Overwrite** is selected, the record file name can be overwritten, with measurement results lost.

- c Select or clear the Save Properties checkbox.
- 4 Touch OK.

## Data Acquisition/File Management

The Data Acquisition/File Management area allows you to accumulate measurement data, save properties settings, or open previously recorded error data sets.



#### CAUTION

If **Prompt for Filename** is selected in **Accumulation Setup** (located in the ED Setup active list), touching the Start/Stop Accumulation softkeys on the touchscreen will not provide a filename prompt. This may result in writing over a previous file.

To avoid this, use Start Accum and Stop

on the front panel.

## Applications for Burst Criteria

In the tutorial, you learned how burst criteria settings affects analysis results. This section explains how these settings may be useful for specific applications.

## Minimum Burst Length



Different physical phenomena cause different concentrations of errors. For instance, if a channel is affected by small amounts of noise, it generally experiences very small errors that are randomly distributed. The same channel may also be affected by interferences from strong electromagnetic fields pulsating at characteristic interference frequencies. These errors typically cause a greater number of neighboring bits to be in error every so often. By setting the **Minimum Burst Length** to be somewhere above the 1- or 2-bit burst lengths produced by the random error noise phenomena, and somewhere below the typical burst length produced by the interference phenomena, then the nonburst error rates will represent the errors from the noise and the burst error rates will represent the ability to further diagnose errors, and to distinguish their source.

#### Example: Minimum burst length = 4.

## Burst Error Free Threshold

Example: Burst error-free threshold = 10.



The **Burst Error Free Threshold** setting is used to customize how closely consecutive errors have to follow one another in order to be included in one burst. This is useful because measurements are often made on the output of a particular communication system architecture that may be built to concentrate errors using particular factors. For instance, if a forward error correction system is being used and a particular error correction block is saturated with too many incoming errors to be corrected, the results may be a complete error correction block containing garbage. In this case, if you set the Burst Error Free Threshold to be the length of the error correction block, individual errors from one garbage block will be grouped together and reported as a single burst representing an FEC block failure. On the burst length view, this configuration would clearly show a distribution of error bursts centered roughly at the size of the error correction block. Interestingly, you would also see a second, less-populated distribution centered at roughly two times the size of the error correction block - resulting from occurrences of two consecutive uncorrectable error correction blocks.



# Applications for Cursor Area

Histograms distinguish event occurrences by some metric. Cursor area measurements allow further quantifications of how many occurrences fall within some range of that metric. This is especially important when histogram entries may be shaped as a distribution of events, centered about some value, rather than one single, precise spike. Using the cursor area function, it is easy to "add-up" all the entries in a distribution surrounded by the cursors.

One example of using the cursor area function is to quantify different populations of histogram entries. In the Burst Length view, for instance, a particular communications channel may have been built to withstand bursts of a given length by adding interleaving circuitry. Typically, bursts of the specified length or below would be corrected without problems, whereas bursts beyond that length would trigger another sort of error protection strategy, for instance, retransmission of a packet. By using the cursor area on the Burst Length view, one might distinguish the number of bursts that are within the protected range, and the number that are not. This can shed light on the amount of retransmissions that would be required under those circumstances. What's

#### Error Analysis Reference Applications for Cursor Area

better, is the original designer of such a system might make these measurements on a typical physical-layer and specifically design the length of the interleaver to achieve a certain ratio of re-transmissions.

## Where to Go for More Information

There are more error analysis techniques to learn, such as block error analysis and correlation analysis. You can refer to the online Help for more information – it explains error analysis concepts and includes step-by-step instructions.

You can also use the context-sensitive **Help On** ... or **What's This?** Help to get help on any item in a dialog box or window.



Error Analysis Reference Where to Go for More Information

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