

# BIT<sup>ANALYZER</sup> 1500

## Quick Start Guide



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Patent No. 5,414,713

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BitAlyzer1500 Quick Start Guide  
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# Declaration of Conformity

# SYNTHESYS

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We declare under our sole responsibility that the

**Bit Error Rate Analyzer, Model BitAlyzer 1500  
BA1500 Software Version 2.6 and above**

are in compliance with the intent of EMC Directive 89/336/EEC for  
Electromagnetic Compatibility and the Low Voltage Directive 73/23/EEC.  
Compliance was demonstrated to the following specifications:

EN61326-1	Radiated, Class B Standard
EN61326-1	Conducted, Class B Standard
EN61000-3-2	Harmonics Current Emission
EN61000-3-3	Voltage Fluctuations and Flicker
EN61000-4-2	ESD
EN61000-4-3	RF Fields
EN61000-4-4	Fast Transients
EN61000-4-5	Surge Tests
EN61000-4-6	Conducted Immunity/Susceptibility
EN61000-4-11	Voltage Dips and Short Interruptions
UL3111-1	United States Safety Standard
EN61010-1	European Safety Standard

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# BitAlyzer1500 Quick Start Guide

## Initial Setup

### *Unpacking*

The BitAlyzer1500 is carefully packaged for shipping to ensure against damage. Nonetheless, damage or loss may occur, and so we recommend you verify the contents of the shipping container, inspect the unit mechanically, and perform a quick operational test when you first receive your unit.

A clear indicator of potential damage is a damaged shipping container. Please inspect the exterior of the shipping container(s) to assess any damage. If damage is apparent, we recommend you keep the shipping container and all materials until the unit has been checked out electronically and mechanically. If damage has occurred, we recommend you contact your shipping agent as well as SyntheSys Research as soon as possible to report the situation.

The items that were shipped to you include:

1. BitAlyzer1500 Chassis
2. Keyboard
3. Power Cord
4. PS/2 Splitter Cord
5. Serial Mouse
6. OEM WindowsNT<sup>®</sup> Certificate
7. Registration Card
8. BA1500 Quick Start Guide
9. BA1500 Remote Control Guide

If the shipping container contents are not complete, please notify SyntheSys Research immediately. Other items may be shipped with your unit depending on optional configurations.

## ***Technical Support***

Should your unit require repair in the future, you are responsible for packaging it adequately for return shipment. We recommend you retain the original shipping container and shipping materials for this purpose.

For service or questions, please contact us at:

Service Department  
SyntheSys Research Inc.  
3475-D Edison Way  
Menlo Park, CA 94025 USA  
Voice: 650 364-1853  
Fax: 650 364-5716  
Email: [tech\\_support@synthesysresearch.com](mailto:tech_support@synthesysresearch.com)  
Website: <http://www.synthesysresearch.com>

When you contact SyntheSys Research for service, please have your product model number, serial number, and purchase date information at hand. Our service department is available from 9:00 a.m. to 5:00 p.m. (Pacific Time), Monday through Friday.

## ***Calibration***

SyntheSys Research recommends an annual factory calibration for this equipment. Contact our Technical Support to arrange for factory calibration.

## ***Maintaining Connectors***

Advances in measurement capabilities make the condition of the physical connectors and connection techniques more significant than ever.

- Keep connectors clean.
- Use plastic endcaps during storage. Do not touch mating plane surfaces. Do not set connectors contact-end-down.
- Inspect all connectors before every use. Look for metal particles, scratches, or dents. Do not use damaged connectors.
- Clean the connector threads with compressed air before using. Do not use abrasives. Do not get liquid onto the plastic support beads.
- Align connectors carefully. Make preliminary connection lightly.
- To tighten, turn connector nut only. Do not over tighten. Do not apply bending force to connection. Do not twist or screw in connectors.



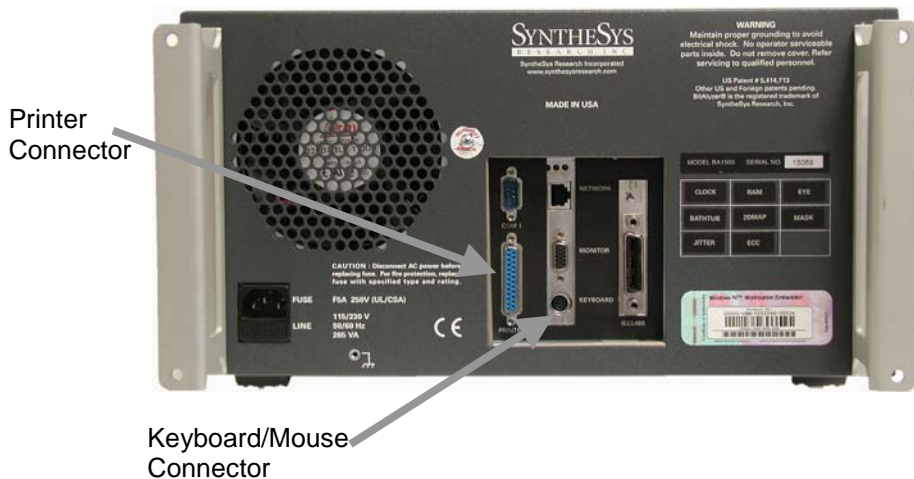
# Connections

## Connect Peripherals

The BA1500 supports a touchscreen as well as a mouse and a keyboard.

If you plan to use a mouse and/or keyboard, it is best to connect them before turning on the power. The connector is located on the rear panel of the BA1500 (a splitter cable is supplied if you wish to connect both the mouse and keyboard).

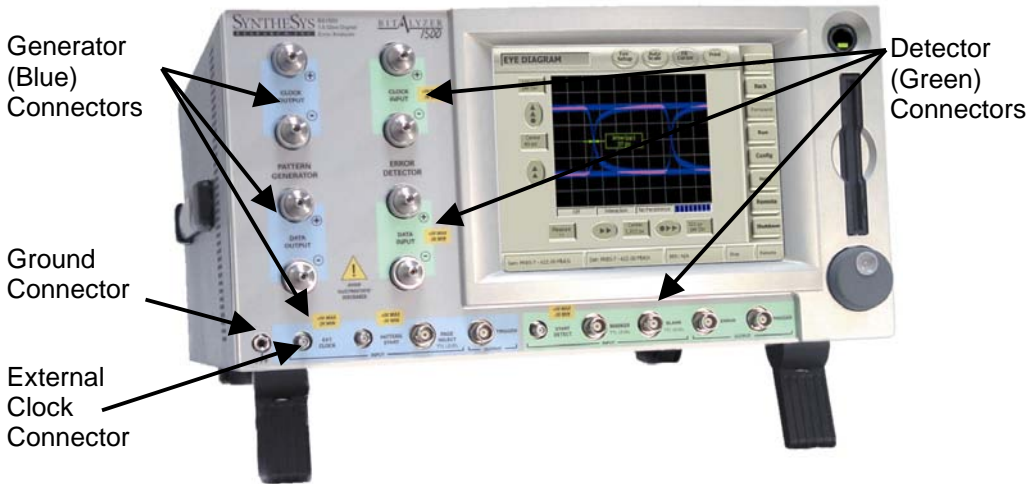
The printer connector is also on the rear panel of the unit.



In addition, the Line Power plug and connectors for Ground, Network, Monitor, Com1, and IEEE-488 (Remote Control) are on the rear panel.

## Connect External Clock Source

The BA1500 Generator uses either its internal clock or an optional external clock source. The Clock connectors are on the front panel. 50-ohm SMA cables and connectors are recommended.



A Ground connector is provided at the lower left corner the front panel.

Note that the connectors for the Data Generator and Error Detector are color-coded for easy identification. The connectors on the front panel are:

### **Generator (Blue)**

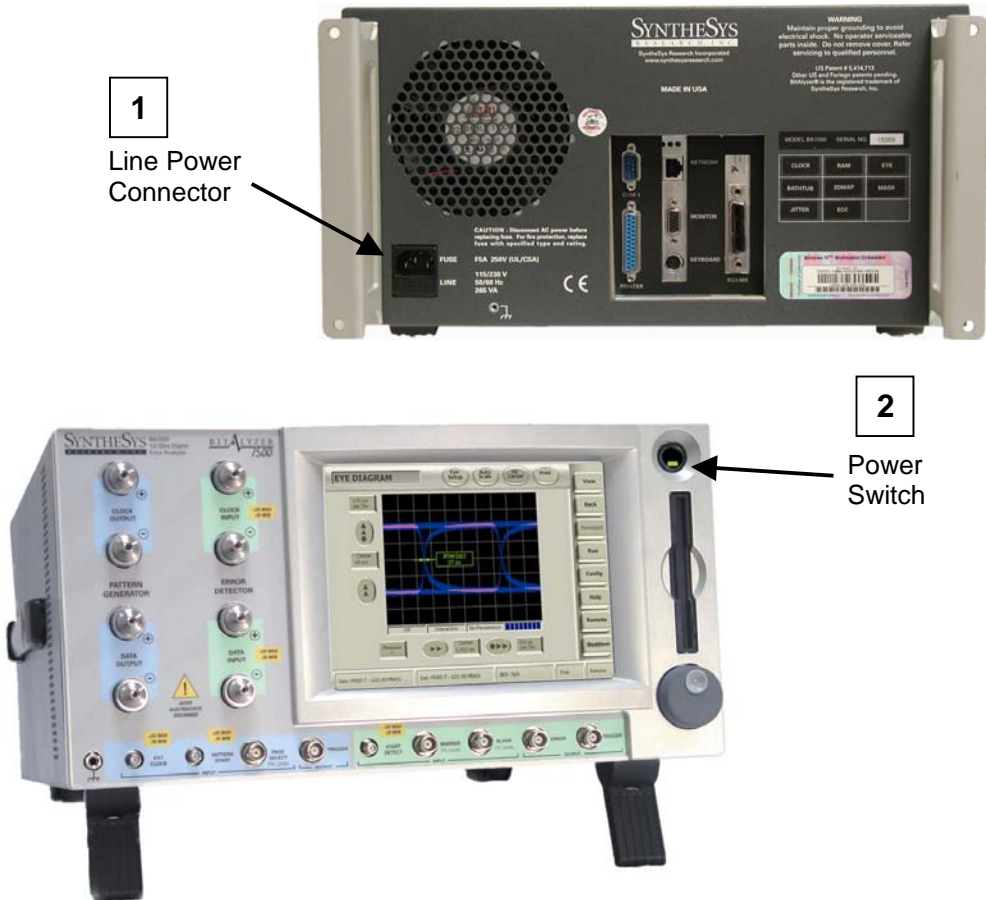
- Clock+ Output
- Clock– Output
- Data+ Output
- Data– Output
- External Clock Input
- Pattern Start Input
- Page Select (TTL Level) Input
- Trigger Output

### **Detector (Green)**

- Clock+ Input
- Clock– Input
- Data+ Input
- Data– Input
- Start Detect Input
- Marker (TTL Level) Input
- Blank (TTL Level) Input
- Error Output
- Trigger Output

## Power On

1. The line power connector is located on the rear panel of the BA1500. Use the included power cord.
2. Turn on the line power using the power switch on the front panel of the unit.



Upon powering up, the system performs a quick self-check and then the operating system loads. This takes a few minutes, and may report errors if the computer or any of its peripherals are damaged. If the keyboard is not plugged in, WindowsNT<sup>®</sup> will report that the driver did not initialize properly. A keyboard is not necessary and this reported error can be ignored if you do not plan to use one.

If any damage is indicated, contact SyntheSys Research Support at [tech\\_support@synthesysresearch.com](mailto:tech_support@synthesysresearch.com).

To power-down the unit, first allow the operating system to perform its shutdown procedures completely. To do so, touch the **Shutdown** button on the Control Console. The screen will display a dialog asking if you wish to terminate only the BA1500 application or shut down the entire system.

In the event of power failure or accidental power disconnect, the unit is very resilient. You may find that the next time you power up, the boot-up sequence takes a few moments longer to verify the hard disk file system integrity.

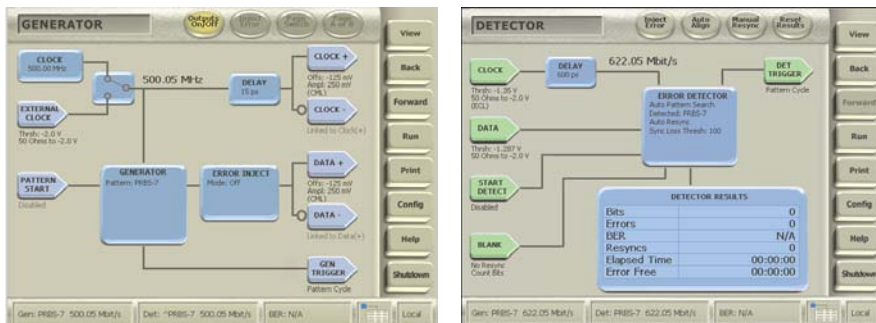
## Display Description

The Control Console is permanently displayed on the right side of the touch-screen. At the bottom of the screen is a Status Bar showing the state of the Generator and Detector, BER statistics, and signal source. The center of the screen will show the selected view. The first example below is the Home View:

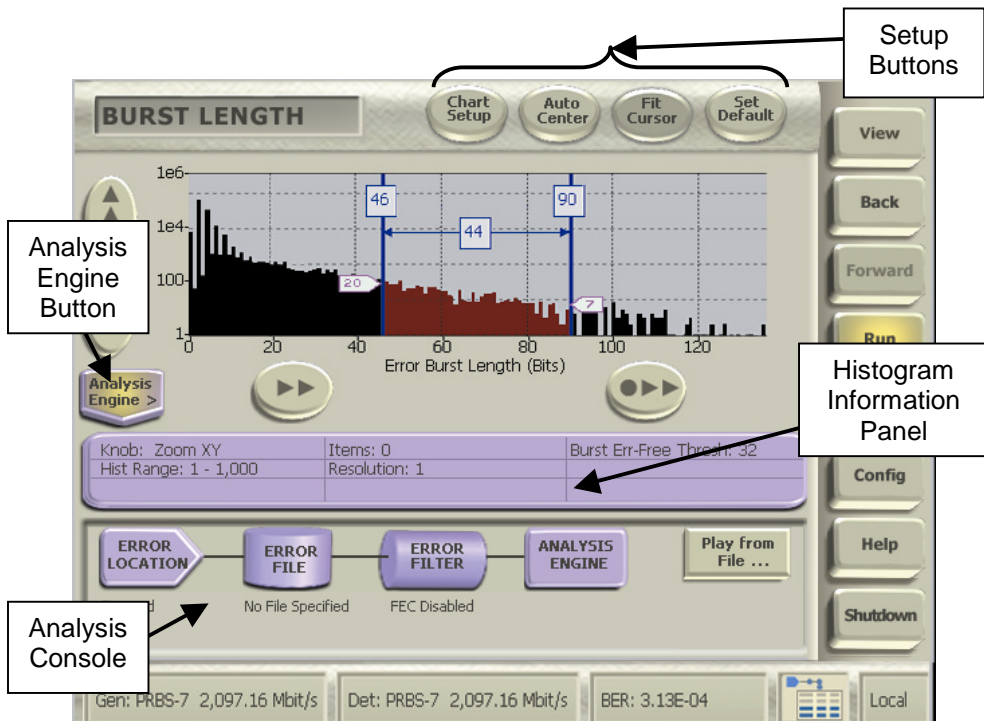


The Control Console and Status Bar remain visible from all views.

The Generator and Detector Views are presented as a schematic of the generation or detection process. Touching any of the icons on the screen accesses settings and help for that element.



In addition to a chart display, Analysis Views include three responsive sections: **Setup** buttons across the top, the violet **Histogram Information Panel**, and access to the **Analysis Console** (which is normally hidden, to allow more room for the chart display). Each of these areas accesses controls used to set up the appearance of the view and the parameters of the analysis.



# Generator Fundamentals

Errors are found by sending a controlled bit stream into a channel and then performing a bit-for-bit compare on what comes out of the channel. The Generator provides this controlled data stream, using either industry-common pseudo-random sequences or a user-defined pattern. The data stream is synchronized to either an internal or an external clock, and both data and clock are then passed to the Detector.

## *Available Settings*

Open the **Generator View** to access the settings. Each icon on the Generator view opens a menu of its associated parameters. You can select a data type, the characteristics of input and output data and clock signals, whether or not to inject errors into the data stream, and the characteristics of those errors. The pop-up menus for these selections also provide direct access to context-sensitive Help.

## *Data Patterns*

The Generator uses two types of patterns, either a selection of pseudo-random sequences defined by a generating polynomial (PRBS), or a user-defined pattern. The user pattern may be a prerecorded file of error information, or a file created using a Pattern Generation Language (PATLING) to embody particular features.

## Creating a Pattern

The Online Help explains the PATLING pattern generation language. Using this language, you can create error data files to match specific criteria for testing. You can also create a pattern by capturing data from the Detector inputs.

## Saving and Playing Back an Error Data File

Open the **Editor View** to create, open, name, rename, save, or delete an error data file. Set the Detector Pattern Mode to User Pattern and select a pattern filename, then touch **Run** to initiate playback of that file.

## Live Signal Generation

Touch the icons on the **Generator View** to set the characteristics of a generated signal. Touch the **Run** button on the Control Console to begin transmitting.

# Detector Fundamentals

The BA1500 Error Detector and Analyzer investigates error statistics present in digital channels. Errors are mismatches between what was expected to be seen and what was seen during detection. By comparing a specific, known pattern bit-for-bit with what is detected on the incoming channel, the Detector can not only count errors, but can pinpoint the exact bit position of errors in the digital channel.

This error location information provides more than just bit error rate testing. Using the exact bit location of errors found in the data stream, the BA1500 measures independent bit and burst error statistics, correlates errors to reveal pattern sensitivities, displays the probability of having error bursts of different lengths, isolates systematic error sources, and much more, clarifying error relationships in addition to error counts. The varied types of analysis can reveal previously undetermined idiosyncrasies of a data channel.

## *Available Settings*

Open the **Detector View** to access the settings. Each icon on the Detector view opens a menu of its associated parameters. You can select the characteristics of input data and clock signals, delay, data patterns, and synchronization parameters. The pop-up menus for these selections also provide direct access to context-sensitive Help.

## *Selecting the Analysis Type*

Touch the **View** button to open the pop-up menu of the available views. Touch **Error Analysis** or **Physical Layer Test** to open second pop-up lists from which to choose. Error Analysis Views include: Basic BER, Block Errors, Burst Length, Correlation, Error Free Interval, Pattern Sensitivity, Strip Chart, and optional views such as FEC Emulation and 2-D Error Map. Physical Layer Tests include Eye Diagram, BER Contour, Mask Test, Jitter Peak, and Q-Factor.

## Setting Up a View

Each Error Analysis View has an **Analysis Engine** button at the bottom left corner that opens an **Analysis Console**, where most parameters can be set or changed. Each view has access to its appropriate settings—certain universal settings affect all views, but can be changed as often as necessary. Touch the violet **Histogram Information Panel** to set the Histogram Chart Range and resolution. The settings are described below under “Important Settings”.

## ***Graph Options***

Touch **Chart Setup** at the top of the screen, and then touch selections to control the appearance of a graph. The menu allows you to enable and select Cursors, Graticule, and Log Scale.

## ***Important Settings to Define Analysis***

### **Integration Period**

The Integration Period is used when calculating error rates. Before dividing the number of errors by the number of bits, you must first wait until enough bits are generated for the division result to have significance. For instance, if you have an error rate of one error in  $1e2$  (100) bits, unless you wait  $1e2$  bits before dividing, you will probably get zero as a division result. In this case, you would want to wait at least  $1e4$  (10,000) bits before dividing so there would be two significant digits in the division result.

If your integration period is too long, you may wait awhile before getting an error rate measurement. If it's too short, you may get "jumpy" error rate measurements. A good rule of thumb is to take the expected error rate, change the sign of the exponent, and add two to the exponent. An expected error rate of  $1e-6$  translates to an integration period of  $1e8$ .

Burst error identification is reset upon integration period boundaries.

### **Burst Minimum Length**

The Burst Minimum Length parameter is used to distinguish errors as either being part of a burst or not. Errors that are not part of bursts are known as bit errors; these are the small, often random, errors.

During basic error analysis, single bit errors are grouped together using the Burst Error Free Threshold definition described below. The resulting group is assigned a group length, which is defined to start at the first error of the group and end at the last error (surrounding error-free segments that are larger than the threshold are not included in the burst length). This length is then compared to the Burst Minimum Length parameter and the group is handled either as a burst or as bits, depending on the outcome.

By incrementing the Burst Minimum Length parameter, you specify that fewer and fewer error groups should qualify as bursts.



## **Burst Error Free Threshold**

Burst errors are characterized as groups of single bit errors that are adjacent to one another. The Burst Error Free Threshold parameter is used to program the degree of adjacency that is required to group single bit errors together to form bursts.

One way to look at the Burst Error Free Threshold is that an error-free segment that exceeds the threshold terminates a burst, and all bursts are surrounded by error-free segments that exceed the threshold.

Changing the Burst Error Free Threshold will change the shape of your burst length profiles because it changes the specification of a burst.

## **Data Block Size**

A Block is a contiguous number of bits for which an error count is calculated. This is useful for channel error correction analysis. In some cases, error correction block sizes are fixed due to pre-existing packet frame sizes, sector sizes, or what-have-you. If you set the BA1500 Block definition to be this physical size, the Block histogram will show you a profile of how many errors occur in all the blocks. The shape of this curve will determine an effective value for the tradeoff between error correction strength and coding overhead.

## **Histogram Data Range**

Each histogram view has a **Setup** button at the top edge. Touch this button to open a setup dialog that sets the Start and End x-values for the currently displayed histogram. These limits define the range of data that will be analyzed.

Changing these values will clear out any existing data in the histogram. The Start value must be zero or greater, and less than the End value.

## ***Histogram Bin Mapping***

The concept of mapping error positions to histogram bins is important to understanding error location analysis.

A histogram bin is a software data structure that is used for every histogram to maintain information. There is a limit of 1000 unique histogram locations that can be maintained by the BitAlyzer. After this limit is exceeded, then histogram locations are mapped two bit locations to one bin, and then three-to-one, four-to-one, etc. This allows you to trade off histogram resolution for range.

For a Histogram Range [Start, End], the Start value is inclusive and the End value is exclusive. For example, if the range is specified as [0,1000], then 1000 bins are established, from Bin 0 to Bin 999. The bin resolution is one. Bin 0 contains data  $[-\infty, 1]$  and Bin 999 contains  $[999, +\infty]$ . When the range is greater than or equal to 1001, the bin resolution will be two, or more, as necessary to include all data within the available bins.

If you need both a large range and detailed resolution, you may have to perform the analysis in multiple steps. For example, if you want to see error correlation to a block size of one million bits, you can set Start to 0 (zero) and End to 1,000,000 to view the overall result. With this range, each bin in the resulting correlation histogram represents hundreds of correlation bit positions. Once a correlation is found at one bin location, you can refine the Start and End points to effectively redirect all the histogram bin resolution to the one bin of interest. With new settings, you can uniquely resolve each individual bit position.

# How to Use the BitAlyzer1500

The following lessons introduce the basic operation of the BA1500. Lesson 1 steps through configuration of the Generator and Detector in a way that allows you to easily confirm correct E-to-E operation. Lesson 2 presents an example setup for several Error Location Analysis views, and Lesson 3, the Eye Diagram.

## ***Lesson 1: Configure Pattern Generator and Error Detector***

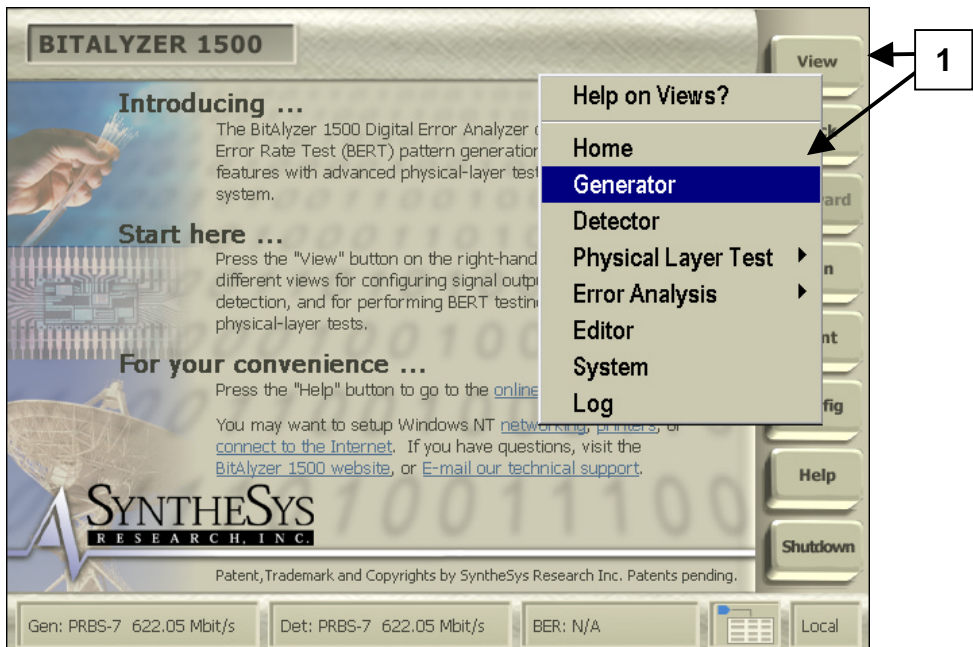
Use four cables to connect the Generator Clock+/- and Data+/- to the Detector Clock+/- and Data+/- on the front panel. Then, to verify that the Generator and Detector are operating correctly, make the following settings:

### **1.1 Generator**

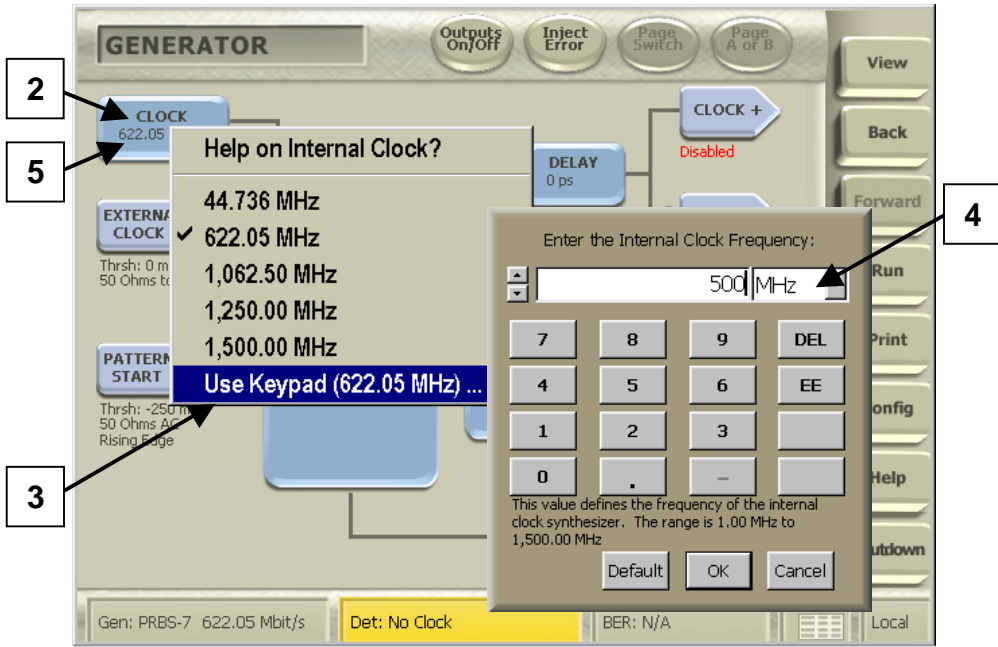
In a few steps, we will set up the Generator to output PRBS-7 data at a specified data rate using differential CML voltage levels.

- Set External Clock frequency:

1. Touch **View** on the Control Console, and select the **Generator** View.

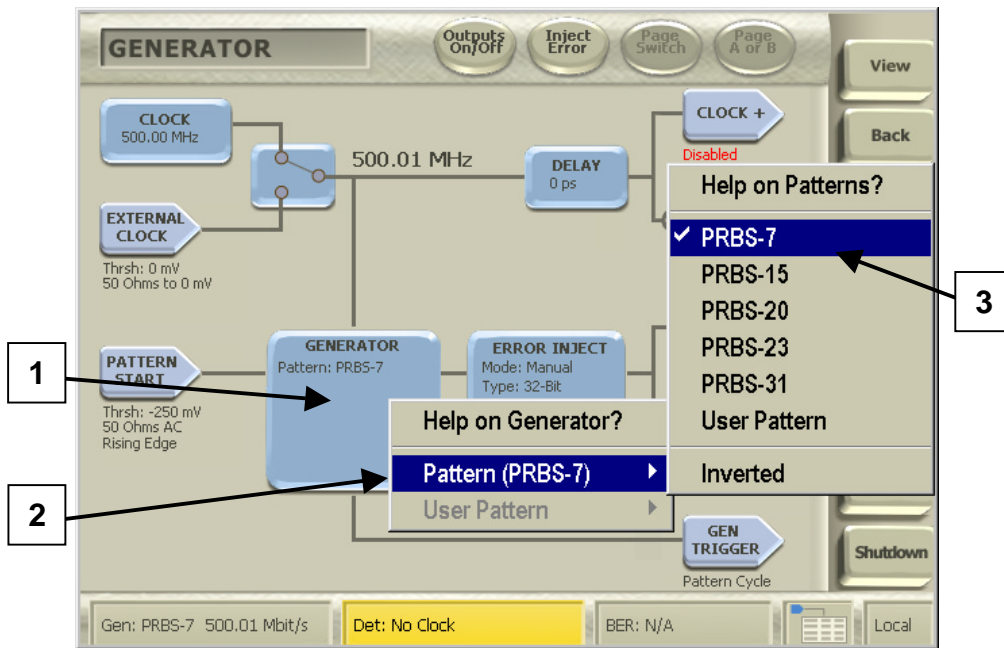


2. Touch the **CLOCK** icon on the Generator View to open the Internal Clock Input settings dialog.
3. Touch **Use Keypad** on the dialog, and
4. Enter 500 MHz in the pop-up keypad, then touch **OK**.
5. Verify that the clock rate displayed next to the icon on the Generator View matches the 500 MHz frequency.



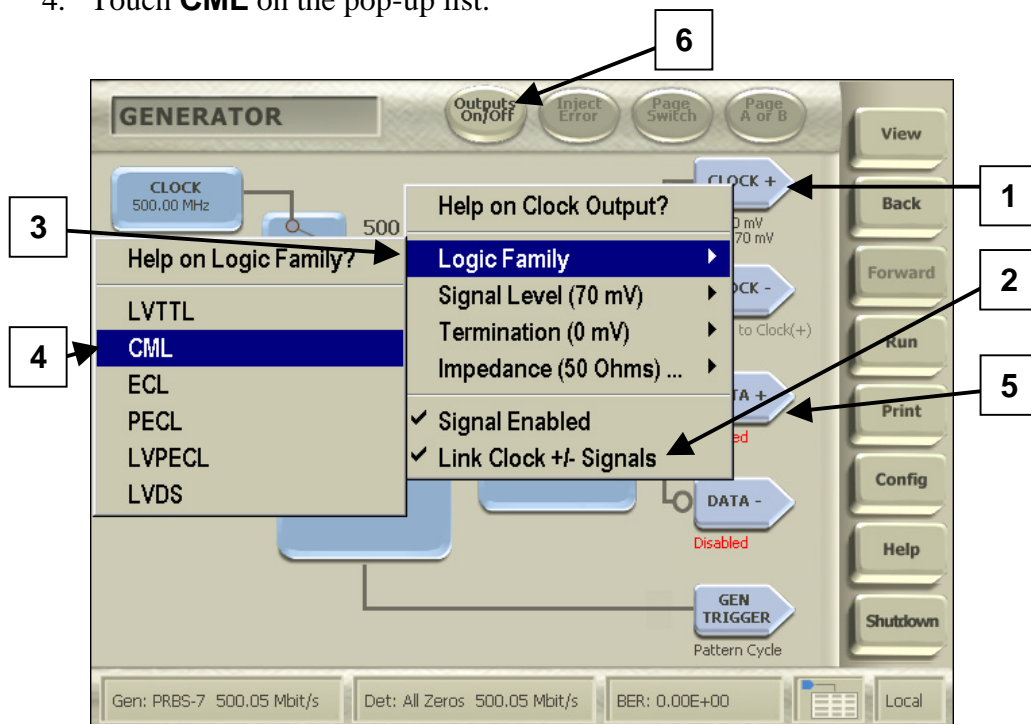
● Set Data Type to PRBS-7:

1. Touch the **GENERATOR** button in the center of the view, to open the Generator settings dialog.
2. Touch **Pattern**, and
3. Select **PRBS-7** from the pop-up list.



● Set logic family to LVDS:

1. Touch the **CLOCK+** Output icon to open the Clock Output setting dialog.
2. Make sure Link Clock +/- Signals is checked.
3. Touch **Logic Family** on the dialog, and
4. Touch **CML** on the pop-up list.



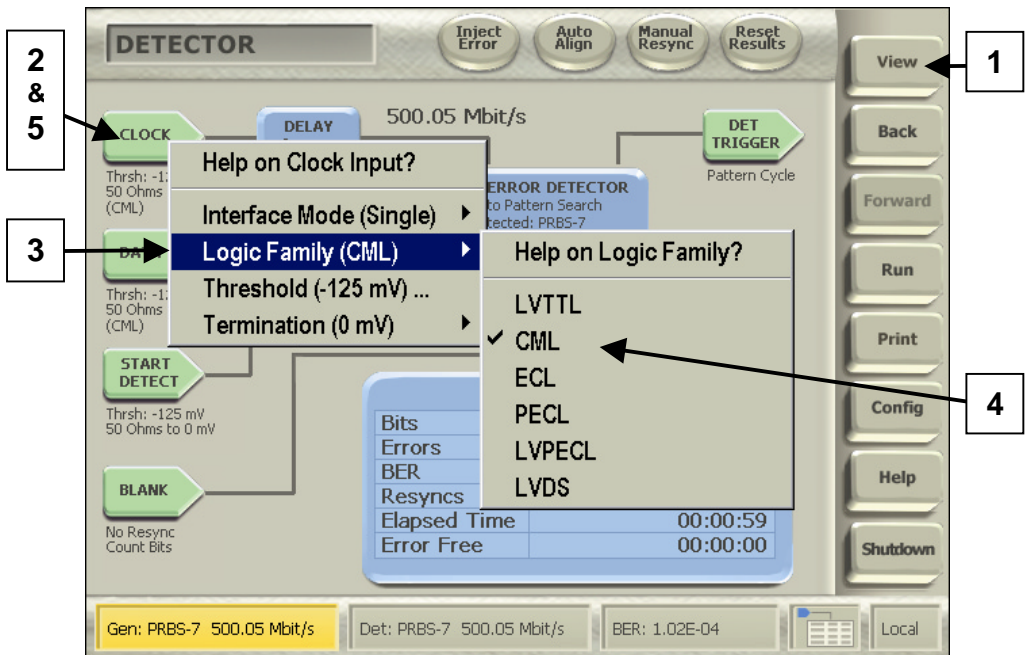
5. Repeat the same steps using the **DATA+** Output icon.
6. Touch **Outputs On/Off** to enable the Clock and Data outputs.

At this moment, the Pattern Generator is transmitting PRBS-7 data at 500 Mbit/sec on the differential clock and data outputs set to industry-standard CML levels.

## 1.2 Detector

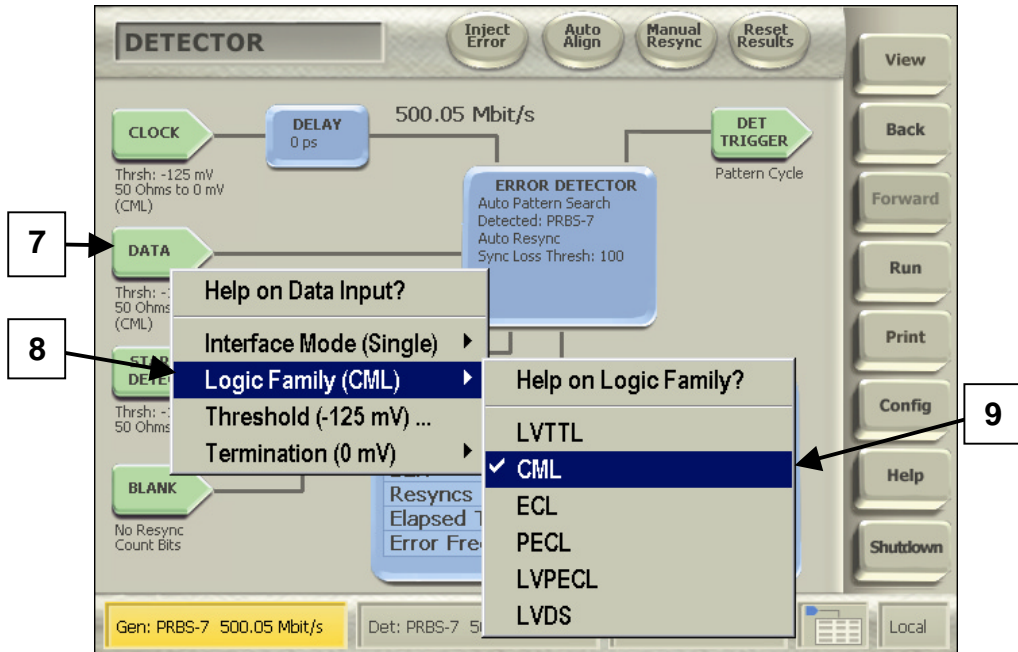
Next, we will set up the Detector to accept differential CML signals and make a bit error rate measurement.

1. Touch the **View** button and select the **Detector** View.
2. On the **Detector View**, touch the **CLOCK** Input icon to open the Clock Input settings dialog.
3. Touch **Interface Mode** on the dialog, and
4. Touch **Differential** on the pop-up list.



5. Touching **CLOCK** again, touch **Logic Family** on the dialog, and
6. Touch **CML** on the pop-up list.

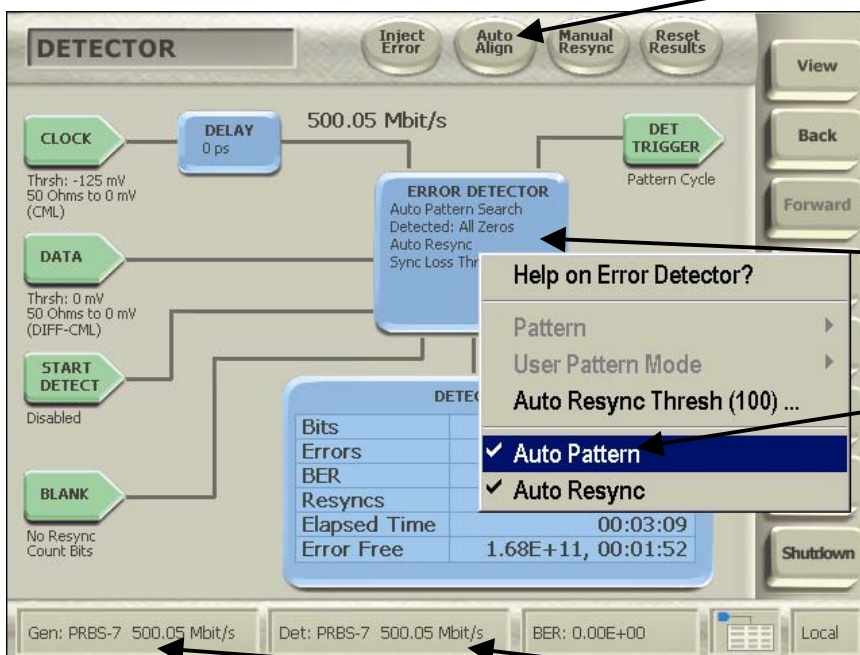
7. In the same way, set the Data Input Logic Family. Begin by touching the **DATA** Input icon to open the Data Input settings dialog.
8. After setting the Interface Mode to Differential, Touch **DATA** again and then **Logic Family**.
9. Touch **CML** on the pop-up list.





Set Data Type to Automatic Pattern Detect:

1. Touch the **ERROR DETECTOR** icon.
2. Select **Auto Pattern** from the pop-up list. This enables the Detector to search all its known PRBS data patterns when acquiring synchronization.



3. Touch **Auto Align** to optimize the data measurement point with the incoming data signal. This moves the delay timing and voltage threshold to find the optimum sampling point in the received eye for making BER measurements\*.
4. Verify the data pattern type and data rate, displayed on the Status Bar at the bottom of the screen for both the Generator and Detector.

\* You may be asked to recalibrate the delay element when you touch **Auto Align**. The instrument monitors changes in data frequency and temperature and can automatically recalibrate its built-in variable delay element in less than one second.

## **1.3 If Synchronization is Not Achieved**

● If the Generator and Detector are not in sync, there is no sense in going on until the situation is remedied. There are certain things that can cause a no-sync condition.

1. Carefully examine cable connections and polarity, making any corrections needed.

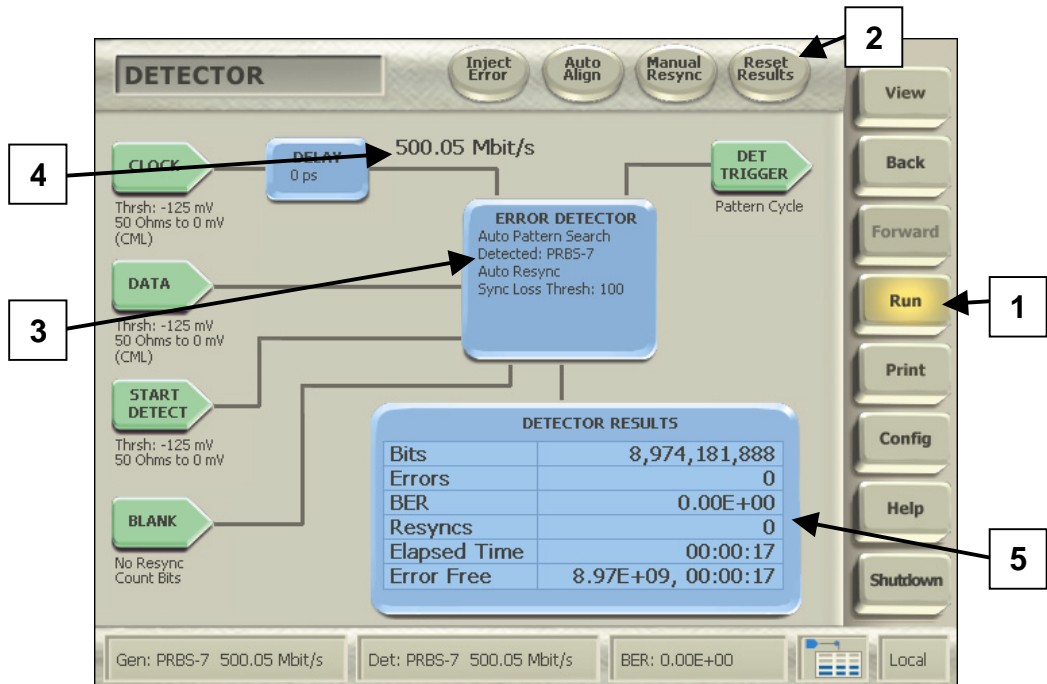
● Examine the Generator and Detector views to confirm:

2. Status Bar indicates Sync. When sync is achieved, the status bar will show the data type and data rate for both the Generator and Detector. Otherwise, the bar will be bright yellow, displaying a “No Sync” error message.
3. Data Type is PRBS-7. If not: Check for correct Data Type setting on Generator and, if necessary, reset to PRBS-7. Check for correct Data Type setting on Detector and, if necessary, reset to Auto Detect.
4. Generator Clock Rate is 500 MHz. If not: Check for correct Generator Clock setting. If necessary, reset to 500 MHz.
5. Clock+/- and Data+/- Output and Input Logic Family configurations match. If not: Check Logic Family configurations (both Logic Type and Single-Ended or Differential) for the Generator: External Clock, Clock+ Output, and Clock– Output, Data+ Output and Data– Output. If necessary, set to the same configuration as the Detector inputs. Check Logic Family configurations for the Detector: Clock Input and Data Input. If necessary, set to the same configuration as the Generator outputs.
6. Retry for synchronization.

## 1.4 Reset to Zero

Reset BER and Resyns to zero:

1. Press **Run** on the Control Console; press **Run** a second time to stop.
2. Touch the **Reset Results** button at the top of the screen.



Verify Zero BER/Zero Resyns:

3. Verify that the Detector is showing a data type of PRBS-7, and
4. The input clock rate matches the 500 MHz rate being transmitted by the Generator.
5. The Detector Results box indicates a BER of zero and no resyns.

## ***Lesson 2: Perform Error Location Analysis***

This lesson will introduce Error Location Analysis with three examples from the views available. Our goal is to turn on the error injector for 32-bit bursts at the default interval of 312,512 bits, then measure the bit and burst error rates using the Basic BER View, the Burst Length profile (you should see a spike at 32 bits), and then the Error Free Interval profile (you should see a spike at error free intervals of 312,480).

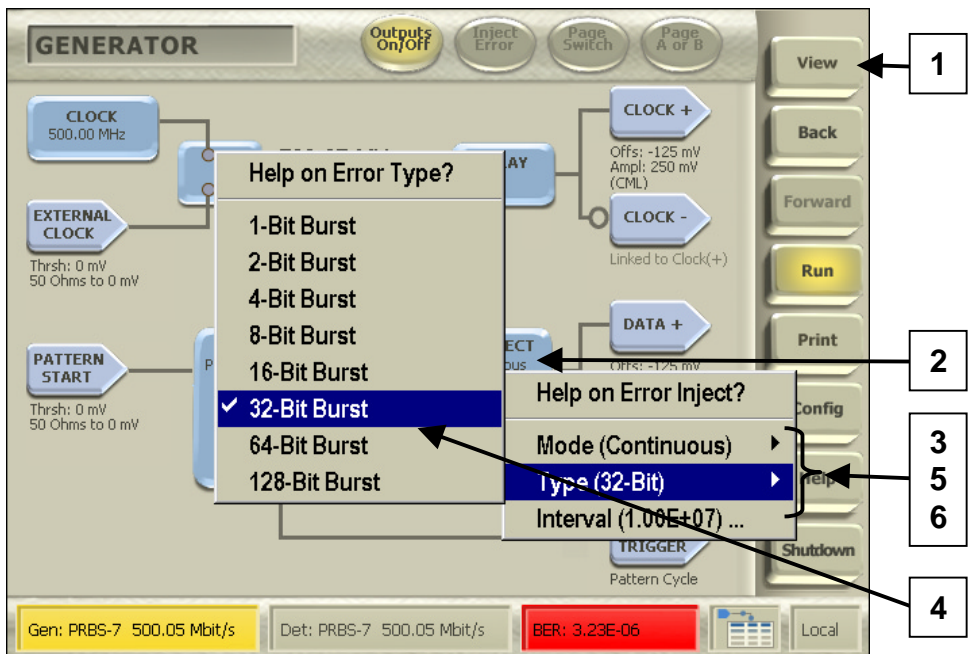
Following these step-by-step processes will familiarize you with most of parameters, settings, and controls involved in using the BitAlyzer1500. After completing the lesson, you will be able to make use of Error Location Analysis without difficulty.

## 2.1 Set Up a Test Case

### ● Set up Error Injection:

Let's generate some error bursts, to see what shows up on the analysis histograms. By enabling the Error Injector in the Generator, you can set a specific burst error length and interval, and then observe exactly what the Detector finds.

1. Using either the Control Console **View** button, or touching the Generator field in the Status Bar, open the **Generator** View.
2. Touch the **ERROR INJECT** button
3. Touch **Mode**.
4. Select **Continuous** from the pop-up list.
5. Touching Error Inject again, touch **Type**, and select **32-Bit Burst**.
6. Touch Error Inject, and check the value displayed as **Interval** (the number of bits between error injections). The default value is 312,512 bits. If a different interval is displayed, touch **Interval** and select **Default** on the pop-up dialog. This will reset the default interval of 312,512 bits.

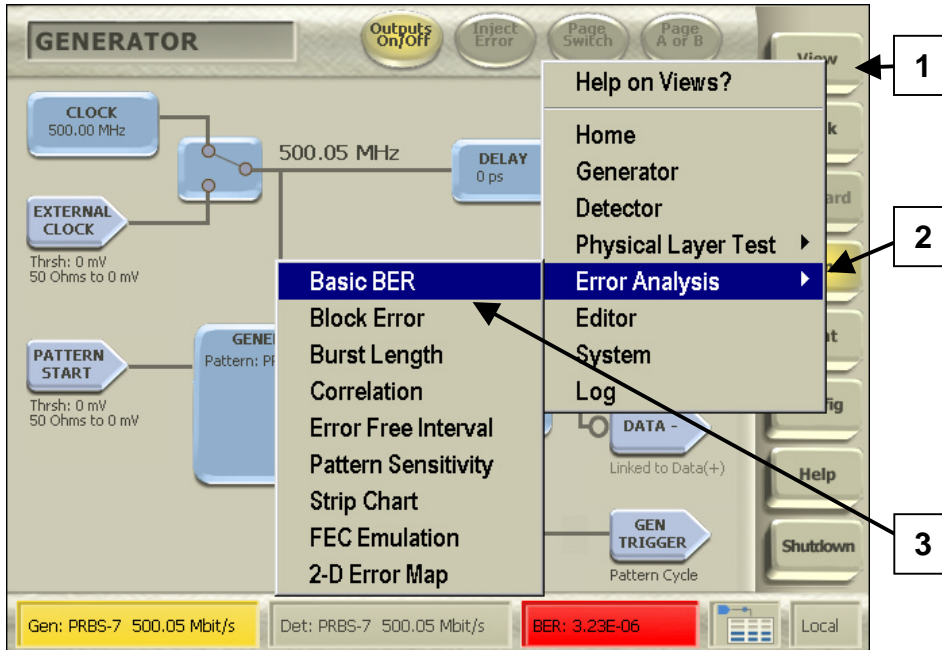


## 2.2 Select Basic BER View



Select the Basic BER View:

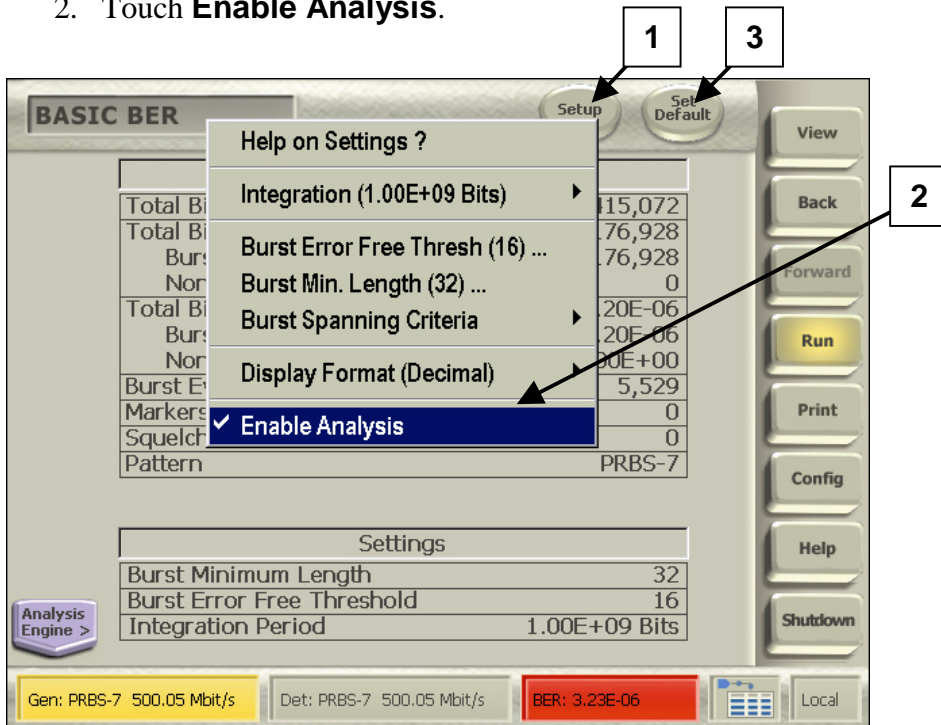
1. On the BA1500 Control Console, touch the **View** button.
2. Touch **Error Analysis**.
3. Touch **Basic BER** on the second pop-up menu.



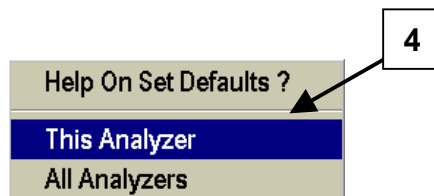
## 2.3 Choose the Parameters

● For this case, use the Default settings:

1. Touch **Setup**.
2. Touch **Enable Analysis**.

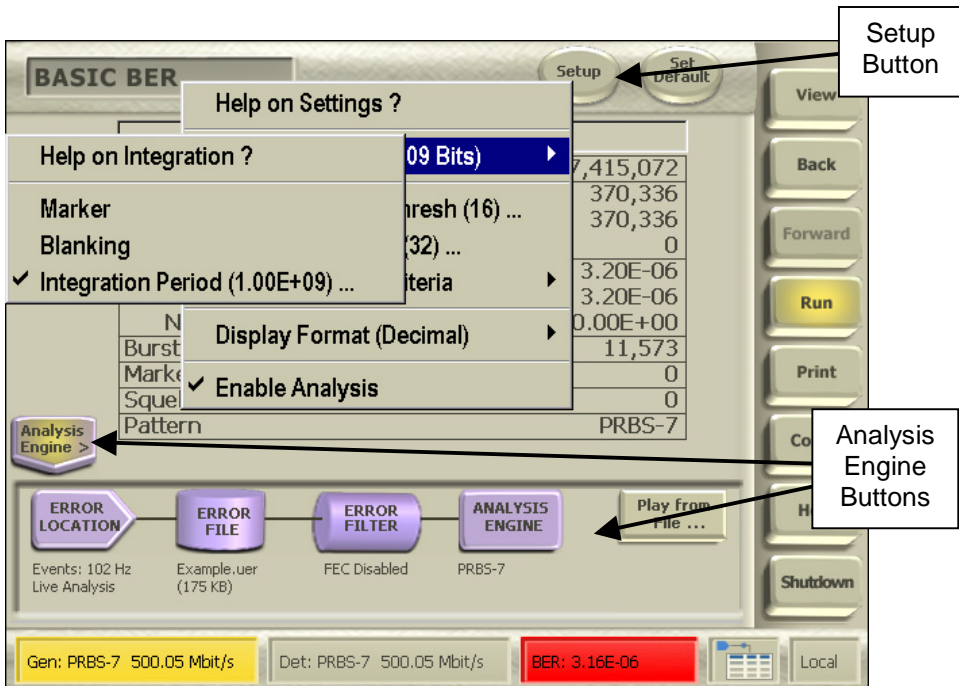


3. Touch the **Set Default** button.
4. Touch **This Analyzer**.



If you wanted to change these settings, you would touch **Setup**, touch the name of a parameter, and then set it using the pop-up keypad. These settings are also available from the **Analysis Console** (touch the violet **Analyzer Engine** button to open it, and then touch the **Analysis Engine** button inside the console).

For our test case, we will leave all of these parameters at their default settings.

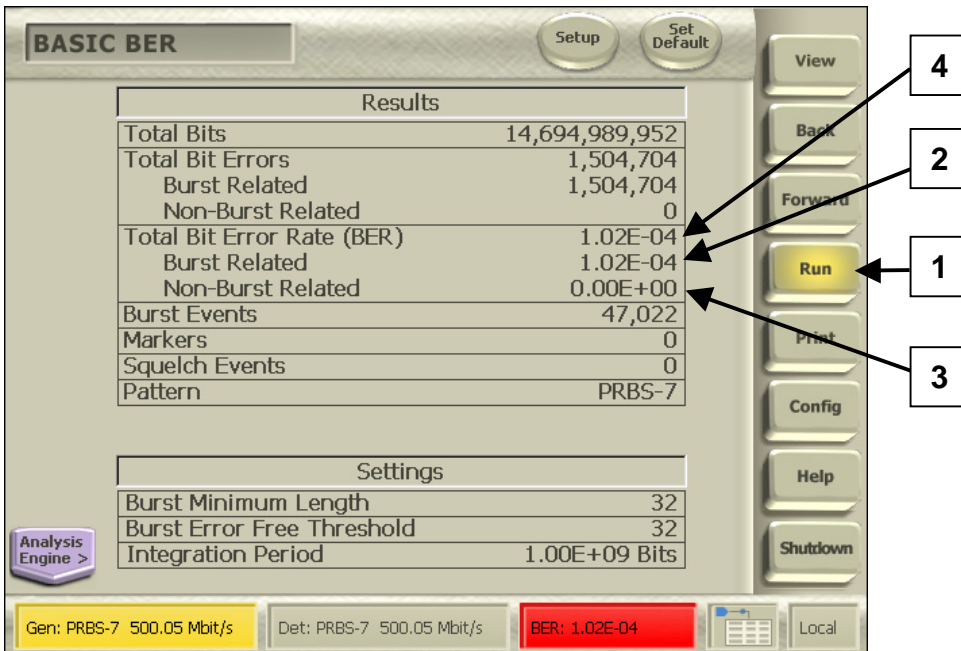




## 2.4 Basic BER Data

This selection will analyze live data transmission from a Generator.

1. Touch **Run** on the Control Console.



The Basic BER display includes Total Bits, Total Errors (Burst Related and Non-Burst Related), Total Bit Error Rate (Burst Related and Non-Burst Related), Burst Events, Markers, Pattern, Starting Mode, and Settings for Burst Minimum Length, Burst Error Free Threshold, and Integration Period. The BER calculations depend upon your values for Burst Minimum Length, Burst Error Free Threshold, and Integration Period.

Because we have set a Burst Length of 32 bits, injected every 312,512 bits, and left Burst Error Free Threshold and Integration Period at their default settings (32 bits and 1.00E+09 bits, respectively), the error rates can be predicted:

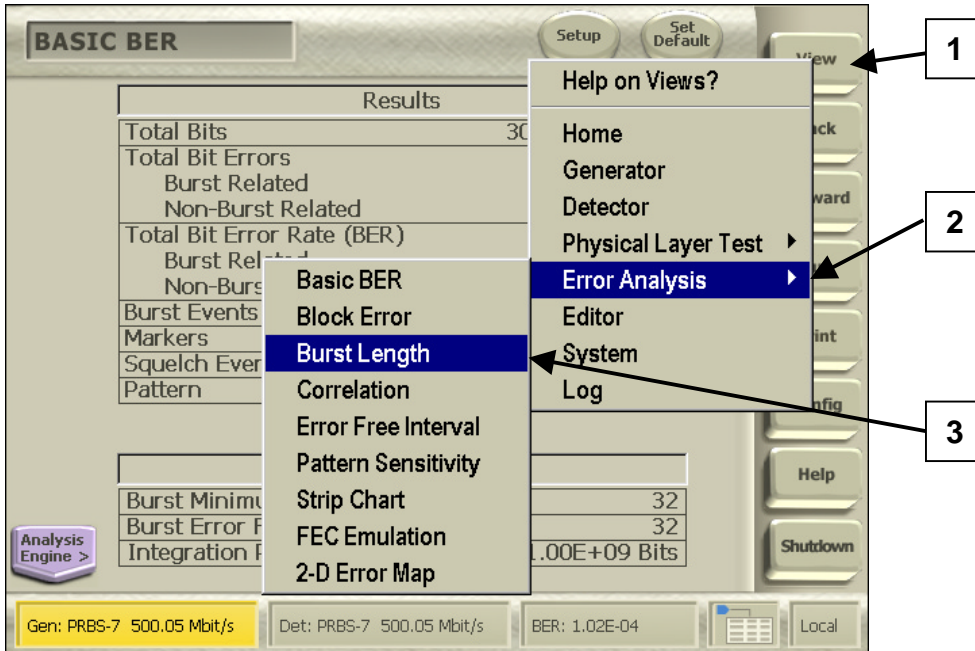
2. A Burst Related Error Rate of 1.02E-04.
3. A Non-Burst Related Error Rate of 0.00E+00 (zero), and
4. A Total Error Rate equaling the Burst Related Error Rate.

Note that the Basic BER view does indeed show these measurements.

## 2.5 Select Burst Length View

To select the Burst Length View:

1. Touch the **View** button.
2. Touch **Error Analysis**.
3. Touch **Burst Length** on the second pop-up menu.



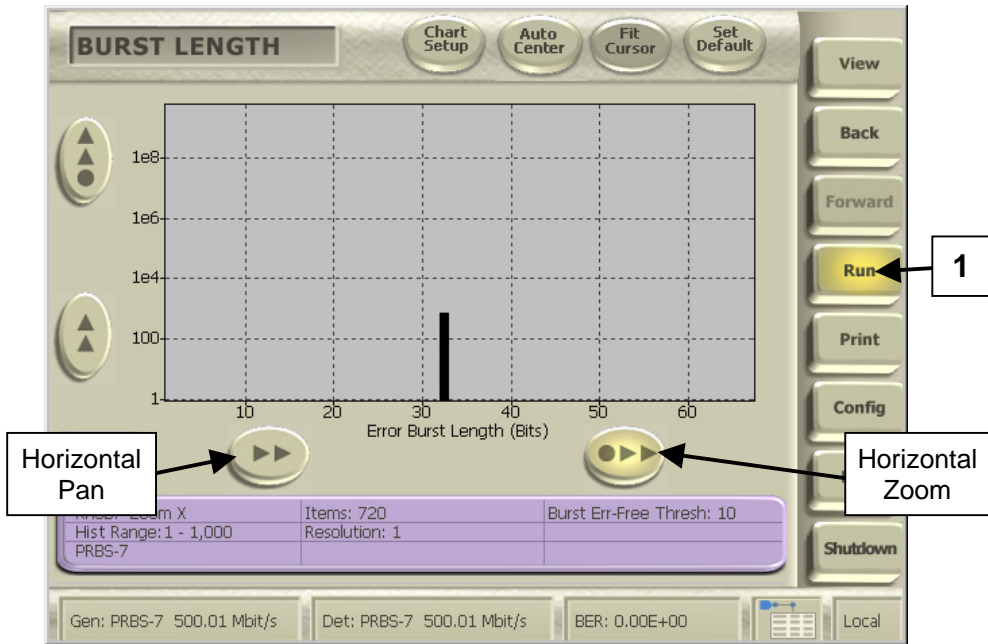
## 2.6 Burst Length Parameters

Using the same parameters already set (a 32-bit error injected into the PRBS-7 pattern every 312,512 bits), you would expect to see an error burst length corresponding to the 32 bits of the injected error.

## 2.7 Burst Length Data

This selection will analyze live data transmission from a Generator.

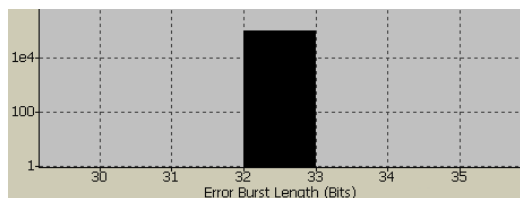
1. Make sure that the Detector is in **Run** mode.



As expected, you can clearly see the spike of error bursts on the histogram. To verify the length of 32 bits, zoom in on the spike.

Touch the Zoom button below the chart, then touch anywhere inside the histogram chart and drag to zoom. To pan, touch the pan button, and then touch and drag on the chart. You can also bring up cursors by touching **Chart Setup** and selecting the cursor(s) you want displayed. To position a cursor, touch its "handle" (the box showing its position), then drag it into place.

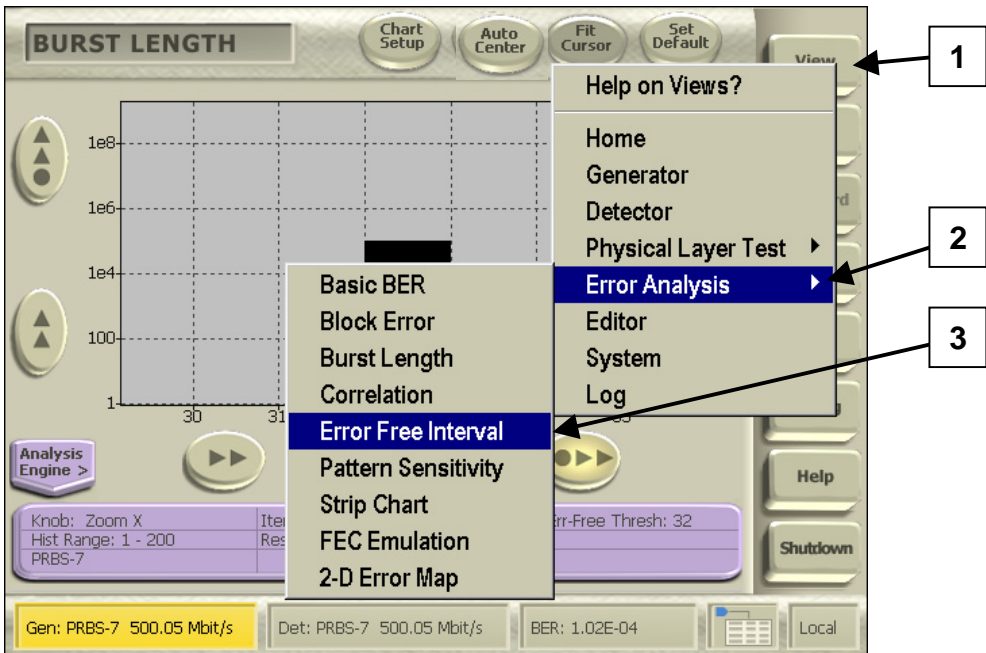
Once you have zoomed in on the data, you can see that the spike of bursts in the data is at a length of 32 bits.



## 2.8 Select Error Free Interval View

To select the Error Free Interval View:

1. Touch the **View** button.
2. Touch **Error Analysis**.
3. Touch **Error Free Interval** on the second pop-up menu.



## 2.9 Error Free Interval Parameters

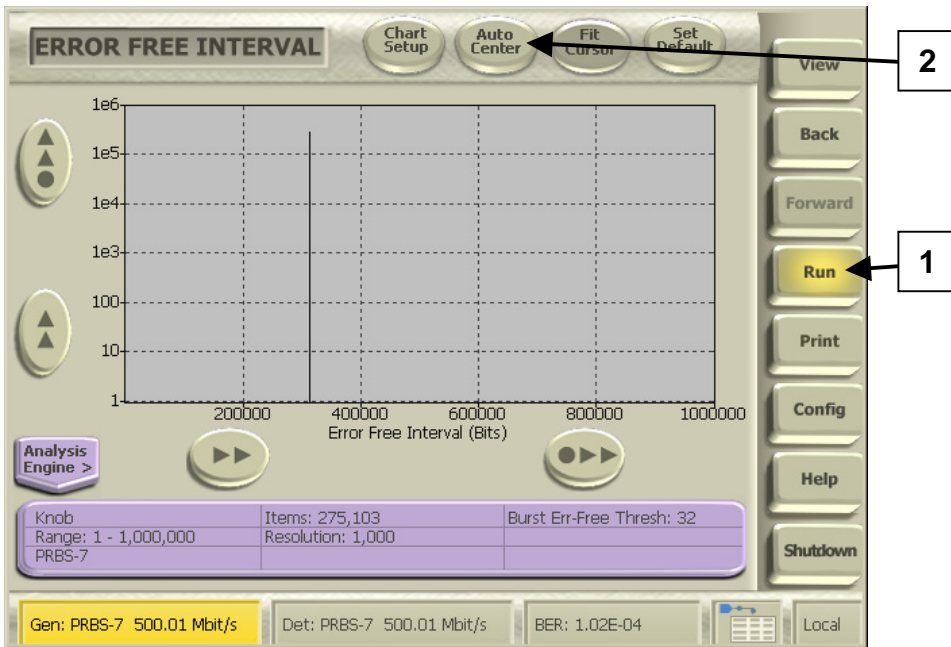
Using the same parameters already set (a 32-bit error injected into the PRBS-7 pattern every 312,512 bits), you would expect to see an error free interval corresponding to that 312,512 number:

$$[(312,512\text{-bit interval}) - (32\text{-bit burst error})] = 312,480\text{-bit Error Free Interval.}$$

## 2.10 Error Free Interval Data

● This selection will analyze live data transmission from a Generator

1. Make sure that the Detector is in **Run** mode.
2. Touch **Auto Center** to scale the chart to the data, or touch anywhere inside the histogram chart and drag your finger to the left to zoom out so that the anticipated range of data is shown.

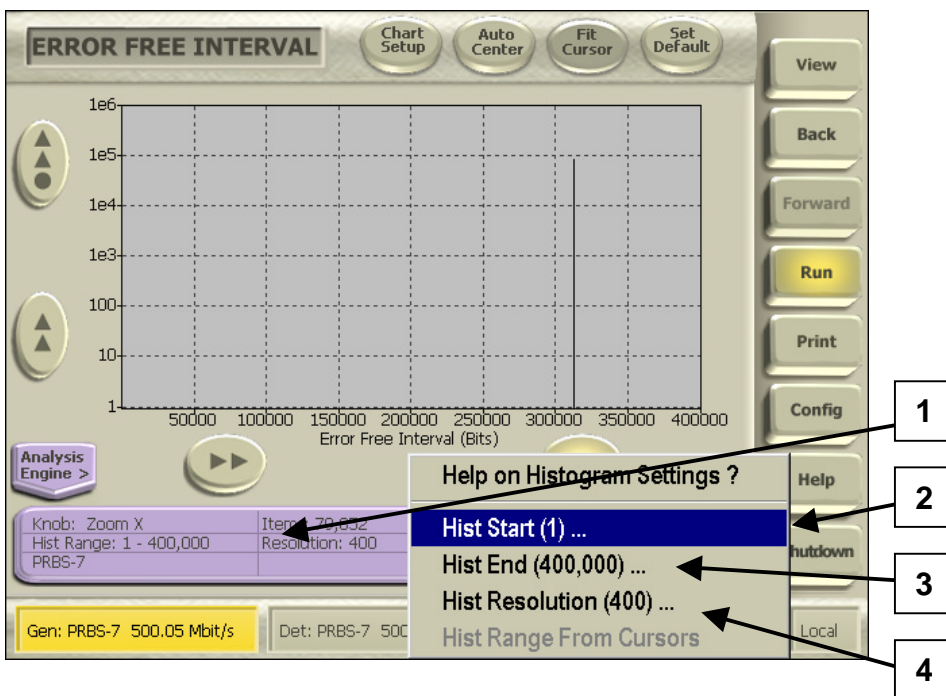


There is an obvious spike in the vicinity of 300,000. To verify the precise location, the next section will explain how you can adjust the histogram range and resolution to see an exact bit-for-bit representation of the EFI.

## Adjust Histogram Range and Resolution

Once you have seen the “rough” data, you can change the histogram range to get one-bit resolutions and show the exact error free interval value. Each histogram contains 1000 bins, each representing  $1/1000^{\text{th}}$  of the data contained in the histogram range. By adjusting the range start and end values, you can narrow the parameters until the chart reveals the precise location of your data.

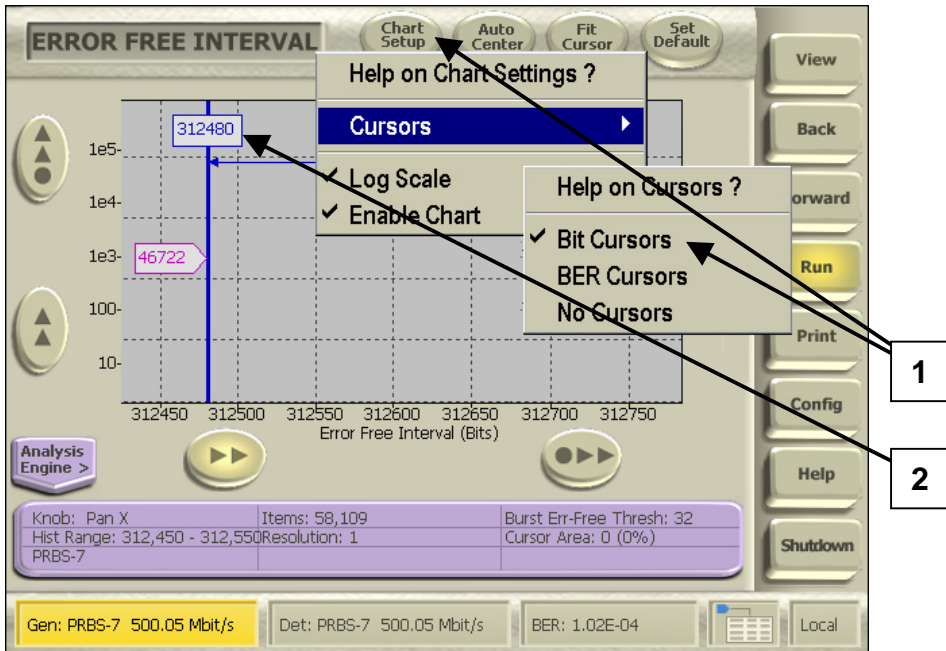
1. Touch anywhere on the violet **Histogram Information Panel** to open the Histogram Settings dialog.
2. Touch **Hist(ogram) Start**. In this case, we know where the interval should appear, so we can shortcut the trial-and-error method. Enter 312,450 bits on the keypad, and touch **OK**.
3. Touch **Hist End**, and enter 312,550 bits.
4. If the Resolution does not already show “1”, touch **Hist Resolution** and enter 1.



● The EFI chart will zoom in precisely on the range specified.

1. Another way to get an exact bit-count is to touch **Chart Setup** and enable the Bits cursors.
2. Touch a cursor label and drag the cursor onto the spike. The cursor label will display its exact bit location, thus verifying the Error Free Interval of 312,480 bits:

$[(312,512\text{-bit interval}) - (32\text{-bit burst error})] = 312,480\text{-bit Error Free Interval.}$





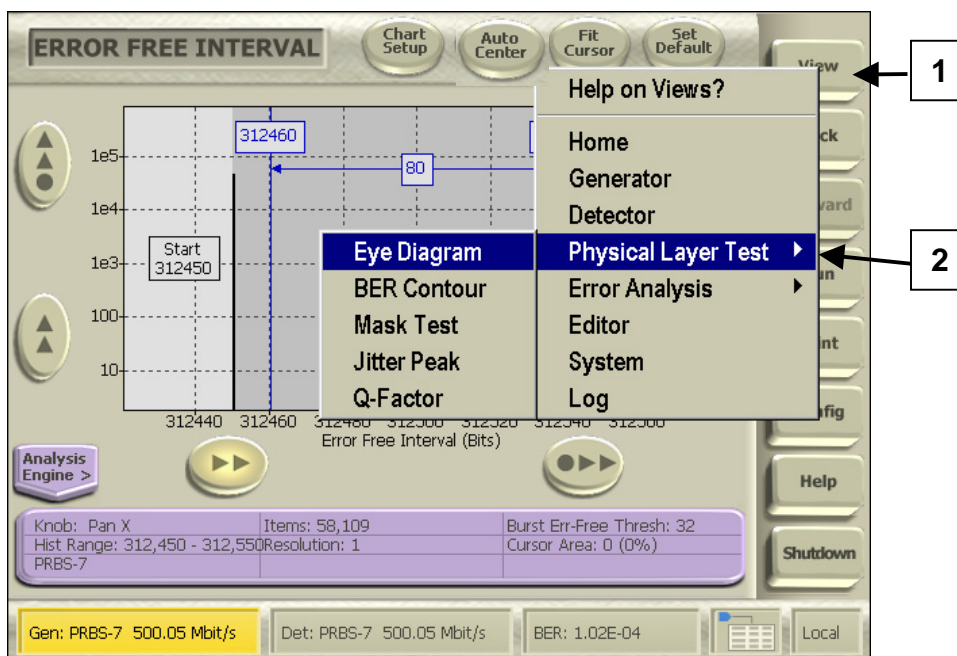
## Lesson 3: Eye Diagram

### 3.1 Select Eye Diagram View



To select the Eye Diagram View:

1. Touch **View**.
2. Touch **Eye Diagram** on the pop-up menu (if you have purchased the Optional Physical Layer Testing capability, a **Physical Layer Tests** item will appear on the View menu. Touch this, and then select **Eye Diagram** from the second pop-up menu).

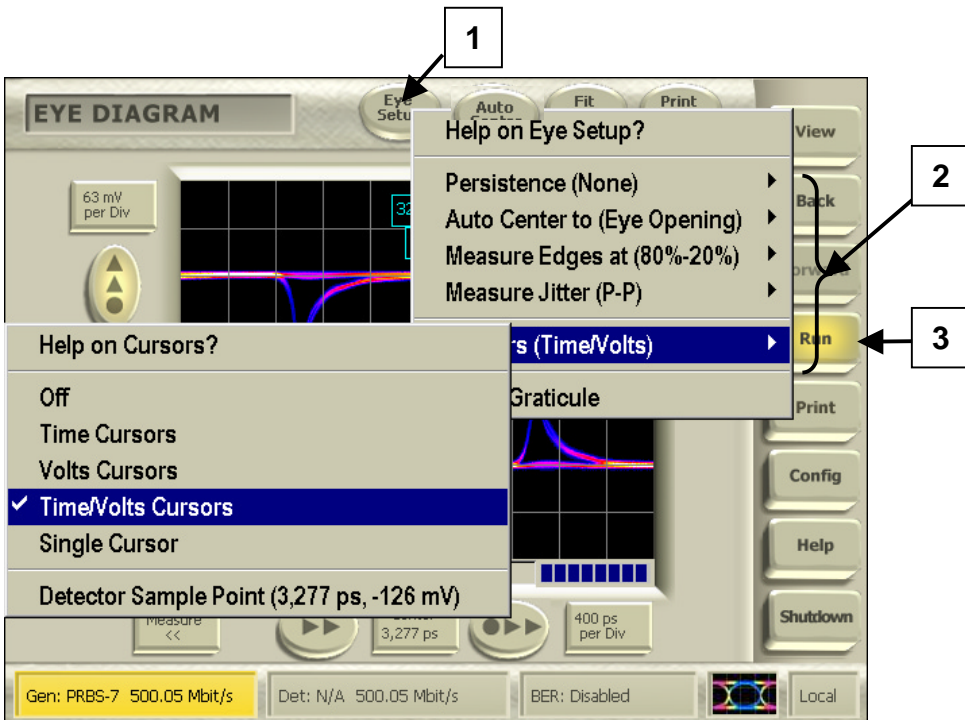




## 3.2 Choose Eye Diagram Parameters

- Set up the Eye Diagram to show the areas of most interest:

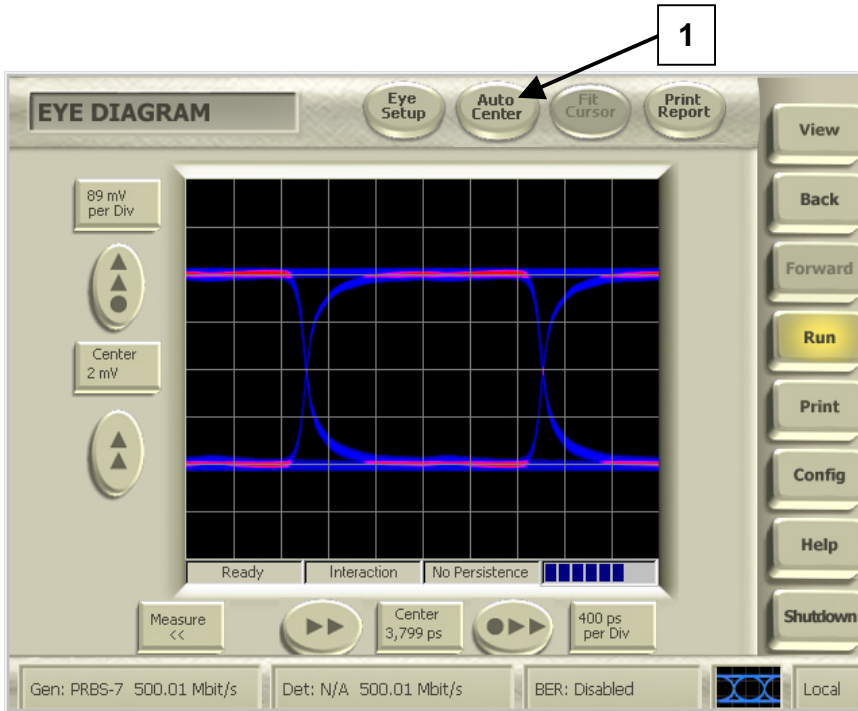
1. Touch **Eye Setup**.
2. Select cursors, set Persistence, and select whether to Measure Edges at 80%-20% or 90%-10%. Other than turning on the cursors, you can leave these settings at their defaults for the purpose of our illustration.
3. Touch **Run** on the Control Console.



### 3.3 View Eye Diagram

● Display all of the data on one screen:

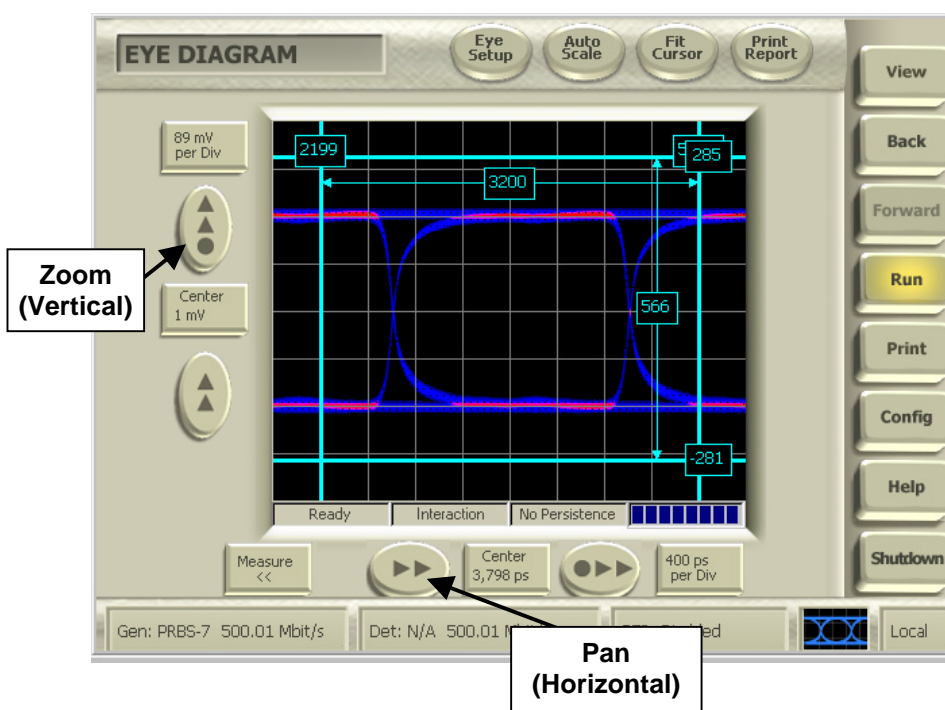
1. Touch **Auto Center** at the top of the screen, to scale the chart so that a complete eye can be seen.



● Examine your data more closely:

1. Zoom and pan to see more detail.

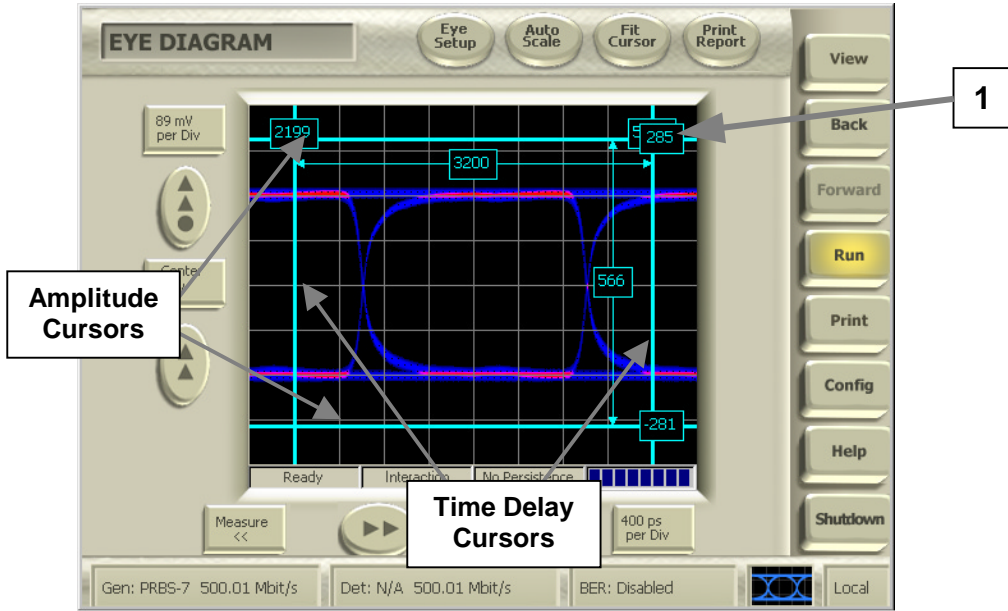
- Touch the Vertical **Zoom** button at the left edge of the chart. Touch the display and drag up, or turn the front panel knob clockwise.
- Touch Horizontal **Pan** at the bottom of the chart. Touch the display and drag down, or turn the front panel knob counter-clockwise.



### 3.4 Make Eye Measurements

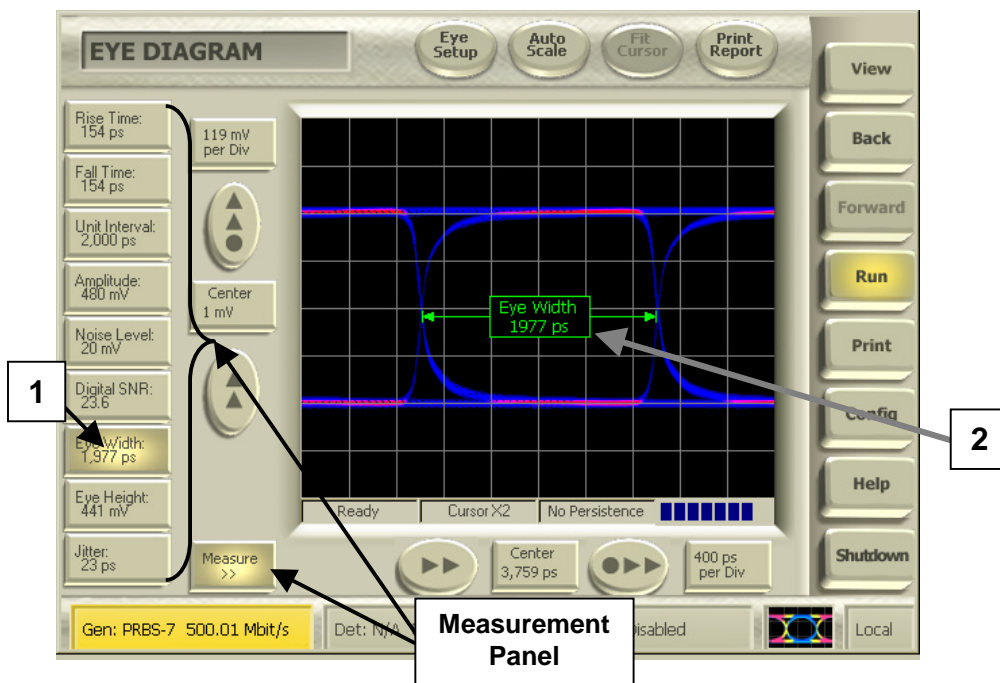
- Use the cursors to make measurements:

1. Touch a cursor “handle” (the measurement box) and drag the cursor into position to measure a feature of the eye. The measurement shown in the box will update automatically.



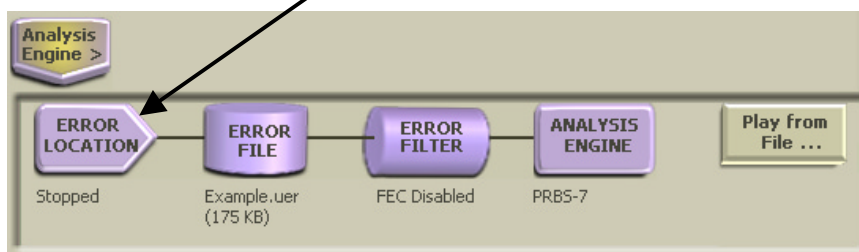
Or, touch **Measure** to use the Measurement Panel:

1. Touch the **Measure** button at the lower left of the screen to open a Measurement Panel. Touch a labeled button on the panel to enable that measurement. The measurement can be displayed on the eye diagram.
2. In the illustration, green arrows indicate measurement of the Eye Width at 1977 picoseconds.



## Conclusion

To learn more about your BitAlyzer, visit the Error Location Analysis™ section of the Help system on your unit. This help topic includes a tutorial that introduces the diagnostic creativity of the patented Error Location Analysis process. You will find a link to Error Location Analysis on the **Home View** page of Help, or you can touch **Error Location** in the **Analysis Console**, and then “Help on Error Analysis.”



Visit the SyntheSys Research, Inc., website to view a video demonstration of the BitAlyzer1500. The Error Analysis tutorial is also available on our website:

[www.synthesysresearch.com/BA1500.htm](http://www.synthesysresearch.com/BA1500.htm).

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