

Agilent ParBERT 81250 Measurement Software

Fast Eye Mask Measurement User Guide



Agilent Technologies

Important Notice

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Agilent Technologies Herrenberger Straße 130 D-71034 Böblingen Germany Authors: t3 medien GmbH

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Contents

Introduction	5
Example of a Fast Eye Mask Measurement	7
Setting Up and Connecting the DUT	8
Preparing the Measurement	9
Executing a Fast Eye Mask Measurement	11
Changing the Fast Eye Mask Properties	14
Basics of the Fast Eye Mask Measurement	17
Prerequisites for Fast Eye Mask Measurements	17
Fast Eye Mask Measurement Results	18
The Fast Eye Mask Result Display	19
Explanation of the Fast Eye Mask Results	22
Setting the Properties of a Fast Eye Mask Measurement	25
How to Set Up the System to be Used	26
How to Select the Ports to be Measured	28
How to Specify the Measurement Parameters	29
How to Set the Criteria for Moving to the Next Point	31
How to Specify the Measurement Points	32
How to Set Pass/Fail Criteria	38
How to Specify the View	40

Introduction

The Agilent 81250 Part capability of not only r also be used to test opt	BERT Measurement Software p neasuring electrical inputs and tical and optoelectrical devices.	rovides the outputs, it can
For electrical measure For optical measureme (W or dBm).	ments, the threshold is given in ents, the threshold is given in op	Volts. otical power
Because the Fast Eye M this measurement can both simultaneously.	Mask Measurement is related to use either optical or electrical p	the threshold, ports, but not
The fast eye mask mean screening tests. It allow openings seen at the or specifications, that me	surement is first of all meant for vs to determine very quickly wh utput terminals of a device are ans, within certain timing and	r production and nether the eye within voltage limits.
Measuring the eye oper used to be a time-const measurement of the Ag be obtained within sec	nings of several terminals with uming procedure. With the fast gilent 81250 ParBERT, pass/fail onds.	an oscilloscope eye mask information can
This is achieved by means test points.	asuring the bit error rate at a lin	nited number of
Threshold voltage	Measurement points	
	The Agilent 81250 Parl capability of not only r also be used to test opt For electrical measureme (W or dBm). Because the Fast Eye M this measurement can both simultaneously. The fast eye mask meas screening tests. It allow openings seen at the op specifications, that me Measuring the eye open used to be a time-const measurement of the Ag be obtained within sec This is achieved by mea- test points. Threshold voltage	The Agilent 81250 ParBERT Measurement Software p capability of not only measuring electrical inputs and also be used to test optical and optoelectrical devices. For electrical measurements, the threshold is given in op (W or dBm). Because the Fast Eye Mask Measurement is related to this measurement can use either optical or electrical p both simultaneously. The fast eye mask measurement is first of all meant for screening tests. It allows to determine very quickly wh openings seen at the output terminals of a device are specifications, that means, within certain timing and Measuring the eye openings of several terminals with used to be a time-consuming procedure. With the fast measurement of the Agilent 81250 ParBERT, pass/fail be obtained within seconds. This is achieved by measuring the bit error rate at a lin test points.

Up to 32 measurement points can be specified, each defined by a sampling time relative to the actual sampling point (which can be the optimum sampling point) and a threshold voltage (which can be fixed or adaptive). In practice, six measurement points will often suffice. Six measurement points are preset by default.

As the measurement occurs in parallel on all output terminals of the device, its duration is independent of the number of terminals.

This document provides the following information:

- For a quick start, read the example session given in *"Example of a Fast Eye Mask Measurement" on page 7.*
- "Basics of the Fast Eye Mask Measurement" on page 17 provides detailed information on the prerequisites and the parameters shown in the result window.
- "Setting the Properties of a Fast Eye Mask Measurement" on page 25 shows how to specify the measurement parameters.
- **NOTE** It is assumed that you are familiar with the general characteristics of the ParBERT Measurement Software. The general capabilities and operating procedures are documented in the *ParBERT Measurement Software Framework User Guide*.

Example of a Fast Eye Mask Measurement

This chapter shows how to set up and perform a fast eye mask measurement:

- Use the Agilent 81250 User Software for connecting the device under test with the system.
 See "Setting Up and Connecting the DUT" on page 8.
- 2. Prepare a bit error measurement with the Agilent 81250 User Software.

See "Preparing the Measurement" on page 9.

- Use the Agilent 81250 Measurement Software for creating a workspace and measurement and run the measurement.
 See "Executing a Fast Eye Mask Measurement" on page 11.
- 4. Change the measurement properties and see the results. See "Changing the Fast Eye Mask Properties" on page 14.

For this example, we use the following hardware components:

- E4832A generator/analyzer 667 Mbit/s module
- E4843A generator frontend
- E4835A analyzer frontend

Setting Up and Connecting the DUT

Use the *Agilent 81250 User Software* to create a model of the hardware. For a detailed description of the *Agilent 81250 User Software*, refer to the *Agilent 81250 ParBERT System User Guide*.

- **1** Create a DUT output port and a DUT input port.
- **2** Connect the analyzer to the DUT electrical output port and the generator to the DUT electrical input port.

🔆 Agilent 81250 - [Connection Editor]		_ 🗆 ×
<u> </u>	I <u>S</u> ystem <u>W</u> indow <u>H</u> elp		- 8 ×
	🐻 🧖 🦓	🖳 😾 🕨 🗖 Stopped	PLL
Modules	[Device Under Test	
E4805B Frame 1 Slot 5 Frequency	-	General DUT	^
Clock Source / Reference Input		Data Port Area	
External Input	Analyzer	1: Data (OUT)	
	C1 M2 C1	🗲 1: DataO	
E4861A Frame 1 Slot 6 C1 M2 C1	Generator	2: Data (IN)	
C1 M2 C2	C1 M2 C2	1: Data0	
E4861A Frame 1 Slot 7 C1 M3 C1 C1 M3 C2		Pulse/Clock Port Area	
	·		•
Show Error(s) Reset Error(s) S	etting: MUI_DEMO	System : DSRA	- Agilent 💡

3 Using a shielded cable, connect the analyzer frontend physically with the generator. The cable connection will be our device under test.

Preparing the Measurement

Use the Agilent 81250 User Software to prepare a bit error rate test:

1 Adjust the clock frequency, if desired.

We use a clock rate of 125 MHz in this example. This corresponds to a clock period of 8 ns.

2 Set the high and low voltage levels of the generator frontend and switch the frontend on.

🔆 Parameter	E ditor		_ ×
Resource: C1 M	12 C3 ("	E4832A'' F1 S4	4) 💽 🛧 🖶
Timing Out	put		
	E4843	BA	
Predefined Le	vels	Custom	•
High Level		1	÷ V
Low Level		0	* V
RT V	R _T	Center Tapp	ed (2x50 Ohmi 🔹
	VT	0	÷ v
Out		🖲 On	O Off
Out		• On	O Off

We use a voltage swing of 0 V (*Low Level*) to 1 V (*High Level*) in this example.

3 Set the *Frontend Mode* of the analyzer frontend to *Single-ended Normal*. Set the *Threshold* to 0.5 V and switch the analyzer on.

🔆 Parameter Editor	_ ×
Resource: C1 M2 C1 ('E4832A'' F1 S4) 💽 🛧 🛡
Timing Input	
E483:	5A
Frontend Mode	Single-ended Normal 🔹
Predefined Levels	Custom
Input Range	·2 3V 🔹
Threshold	0.5 V
→ The VT	0 <u>+</u> V
Ŷ ^{v,} В _Т	Single-ended (50 Ohm)
Serial Impedance	0 Ohm
Polarity	Normal C Inverted
Input	⊙ On O Off

Measuring eye openings requires an analyzer threshold voltage. The fast eye mask measurement can therefore not be performed in differential mode.

- **4** Create the test sequence with the *Standard Mode Sequence Editor*. We use the same PRBS segment for the generator and the analyzer.
- 5 Activate Automatic Bit Synchronization with Automatic Phase Alignment. Set the Phase Accuracy to 10 %.

	×
Detail Editor 1: Data (1,out) 2: Data (1,in) Segment Type PRBS Segment Type PRBS Segment Name RANDOM15 Segment Name Mater Enable Sync. Polynom/Data Polynom/Data Polynom/Data Auto. Bit Sync. PRXS Inverted PRxS Inverted PRxS Inverted Auto. Delay Align. PRxS Type Pure PRxS Pure PRxS Bit Error Rate Threshold 10°-6 Phase Accuracy I Pure PRxS Pure PRxS	

Automatic Bit Synchronization with Automatic Phase Alignment ensures that the analyzer will position its sampling point automatically at the optimum, no matter what the total signal delay is.

You could also use *Automatic Delay Alignment*, but this requires that you specify a suitable analyzer start delay with the Parameter Editor.

6 Save the setting as *MUI_DEMO*.

Once you have saved the setting, you may terminate the *Agilent 81250* User Software if you wish to do so.

Executing a Fast Eye Mask Measurement

Use the *Agilent 81250 Measurement Software* to set up and perform the fast eye mask measurement:

1 Start the Agilent 81250 Measurement Software and select the measurement type Fast Eye Mask.

₩orks	pace			×
New	Examples	1		
- Mi	easurement: -			
	Туре:	Fast Eye Mask	-	Electrical
	Name:	Fast Eve Mask5		C Optical
	reamo.	1		O All
_ ⊂ Sy	vstems:			
	Analyzer:	DSRA	•	
	Generator:	Same as Analyzer	•	
			ОК	Cancel Help

NOTE Each time you open the Measurement dialog box, your last settings are displayed.

Only one system (DSRA) is used in this example. In case of two systems you would now select the analyzing and generating systems.

2 Click *OK*. This creates a new measurement and opens the measurement's *Properties* dialog.

The *System* page shows the chosen system(s) and the presently loaded setting of each system.

3 If no setting is loaded or a different setting than *MUI_DEMO*, click the system's check box and choose the setting *MUI_DEMO* from the drop-down list.

Fast Eye Mask4 Properties	×
System Ports Parameters Pass/Fail View	
Load System Settings:	
Delay Start of:	
DSRA <u>r</u> for <u>O</u> Seconds	
	nelp

4 Click *OK*. This terminates the *Properties* dialog. To load a new setting without terminating the *Properties* dialog, you would click *Apply*.

5 In the tool bar, click the *Run* button to execute the measurement. The measurement is run and the result window shows the bit error rates measured at six measurement points. The bit error rates are zero.

ort/Terminal	Copied	1	2	3	4	5	6	7	4
Measurement									
-Relative Time		-0.400 UI	0.400 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI		
-Voltage(abs)		500.000 mV	500.000 mV	700.000 mV	700.000 mV	300.000 mV	300.000 mV		
🔄 [1] Data									
庄 [1:1] Data0		0	0	0	0	0	0		

The result window shows also the positions of the measurement points.



By default, the six measurement points are symmetrically placed, as illustrated in the figure below:

The relative time refers to the actual sampling point. In this example, where *Automatic Bit Synchronization* with *Automatic Phase Alignment* was set, this is the optimum sampling point.

The time unit is UI (Unit Interval). One UI is the period of the current clock frequency. If the system clock frequency is 125 MHz, one UI is 8 ns.

The voltages are derived from the threshold of the first connected analyzer frontend. As we have set an analyzer threshold of 500 mV, the voltages of the measurement points are 500 mV, 300 mV, and 700 mV. By default, these voltages are used for all terminals.

Changing the Fast Eye Mask Properties

The default positions of the six measurement points allow to test many devices under fairly relaxed conditions. However, you may wish to measure more measurement points, to use different voltage levels, or a tighter timing.

- **1** Open the context menu of the result window (right mouse button) and choose *Properties*.
- 2 Click the *Parameters* tab.

Fast Eye Mask4 I	Properties				×
System Ports	Parameters	Pass/Fail Vie	ew		
Criteria for mov	ring to next me	asurement poir	nt:		
Number of 0	Compared Bits:	1000000			
🗖 Number	of Errors:	1000000			
Sample Points:					
Timing Unit:	🖲 Unit Ir	nterval 🔿 Sec	conds		
Threshold Ty	ype: 💽 Absolu	ute 🔿 Offi	set C Perce	entage	
Number of V	alid Points:	6			
Points	1	2	3	4	5
Relative Time	-0.4 UI	0.4 UI	-0.16 UI	0.16 UI	-0.1
Voltage(abs)	500.0000 mV	500.0000 mV	700.0000 mV	700.0000 mV	300
					▶
	OK	Cance	Ap	ply	Help

By default, the *Timing Unit* is *Unit Interval* (UI), the *Threshold Type* is *Absolute*. Six measurement points are preset. One UI is equal to one clock period—in this example 8 ns. **3** Set the Number of Valid Points to 8. Enter the relative time and voltage for these points.

Fast Eye Mask4 Properties	×
System Ports Parameters Pass/Fail View	
Criteria for moving to next measurement point:	
Number of Compared Bits: 1000000	
Number of Errors: 1000000	
Sample Points:	
Timing Unit: O Unit Interval O Seconds	
Threshold Type: Absolute C Offset C Percentage	
Number of Valid Points: 8	
4 5 6 7 8 9	10
0.16 UI -0.16 UI 0.16 UI 0 UI 0 UI	I OU
V 700.0000 mV 300.0000 mV 300.0000 mV 900 mV 100 mV 0.00	0.0 V 0.0
OK Cancel Apply	Help

In this example, we will measure the bit error rate at the actual analyzer sampling point, using threshold voltages of 0.1 and 0.9 V.

- 4 Click Apply.
- **5** Click the *Pass/Fail* tab and set a suitable pass/fail limit.

Fast Eye Mask4 Properties		×
System Ports Parameters	Pass/Fail View	
BER Pass/Fail		
BER Threshold	1e-7	
UK	Lancei Apply	Help

6 Click OK to accept your changes and to close the Properties dialog.

🚜 Fast Eye Mask4										
Port/Terminal	1	2	3	4	5	6	7	8	A	
🖃 Measurement										
-Relative Time	-0.400 UI	0.400 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI	0.000 UI	0.000 UI		
-Voltage(abs)	500.000 mV	500.000 mV	700.000 mV	700.000 mV	300.000 mV	300.000 mV	900.000 mV	100.000 mV		
🖃 [1] Data										
亩 [1:1] Data0	0	0	0	0	0	0	0	0		
								•		

7 In the tool bar, click the *Run* button to execute the measurement.

All measurement points have passed.

Critical areas at the analyzer threshold voltage are generally close to ± 0.5 UI.

- 8 Open the *Properties* dialog, click the *Parameters* tab, and set the relative time for the first measurement point to −0.495.
- **9** Close the *Properties* dialog by clicking *OK*.

10 Run the measurement.

📲 Fast Eye Mask4									
Port/Terminal	Copied	1	2	3	4	5	6	7	
🖃 🕺 Measurement		8							
-Relative Time		-0.495 UI	0.497 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI	0.000 UI	0
-Voltage(abs)		500.000 mV	500.000 mV	700.000 mV	700.000 mV	300.000 mV	300.000 mV	900.000 mV	100
📥 🔀 [1] Data									
🔃 🔀 [1:1] Data0		0.0889	0	0	0	0	0	0	
4		•							

The measurement, the port, the terminal, and the measurement point are marked with "failed" symbols. The measured bit error rate is much higher than 10^{-7} .

Basics of the Fast Eye Mask Measurement

In this chapter you find the following information:

- For the preconditions to be met to run the measurement, refer to *"Prerequisites for Fast Eye Mask Measurements" on page 17.*
- For the definitions of the measurement results, refer to "Fast Eye Mask Measurement Results" on page 18.

Prerequisites for Fast Eye Mask Measurements

In order to perform fast eye mask measurements, the following prerequisites have to be met in addition to the global ones (see *Prerequisites* in the *Framework User Guide*):

- · The analyzers should be synchronized to the incoming data stream
 - either manually (specify a valid start delay) or
 - by automatic analyzer sampling point adjustment (Automatic Bit Synchronization or Automatic Delay Alignment).
- If automatic analyzer sampling point adjustment is used, the phase verniers of the analyzers should be in zero position.

Fast Eye Mask Measurement Results

The fast eye mask measurement measures the bit error rate at certain measurement points. These points have to be positioned inside the expected eye opening.



The results of a fast eye mask measurement are displayed in tabular form.

For details see:

- "The Fast Eye Mask Result Display" on page 19
- "Explanation of the Fast Eye Mask Results" on page 22

The Fast Eye Mask Result Display

The result display of the fast eye mask measurement shows a table:

🚜 Fast Eye Mask4									- 🗆 ×
Port/Terminal	Copied	1	2	3	4	5	6	7	
🖃 Measurement									
-Relative Time		-0.400 UI	0.400 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI		
-Voltage(abs)		500.000 mV	500.000 mV	700.000 mV	700.000 mV	300.000 mV	300.000 mV		
白 [1] Data									
庄 [1:1] Data0		0	0	0	0	0	0		
4	Þ								

The left-hand section identifies the rows of the table. The rows *Relative Time* and *Voltage* define the positions of the measurement points.

Ports and associated terminals are identified by numbers and names. The terminal number [1:1] means "port one, terminal one".

The right-hand section shows for each measurement point its position and the bit error rates measured at the terminals. By default, six measurement points are preset, and up to 32 can be specified (for details see *"Explanation of the Fast Eye Mask Results" on page 22*).

Changing the Display

Context menus are opened by clicking the right mouse button. They provide a convenient means to change the display or to access the *Properties* dialog (see also *"Setting the Properties of a Fast Eye Mask Measurement" on page 25*). The available options depend on the current cursor position.



Copy and paste You can copy all measurement results or just a few rows to the clipboard and paste them below the present results. This looks as shown below:

Fast Eye Mask4											
Port/Terminal	Copied	1	1 2 3 4 5 6 7								
🖃 Measurement											
 Relative Time 		-0.400 UI	0.400 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI	0.000 UI	0		
−Voltage(abs)		500.000 mV	500.000 mV	700.000 mV	700.000 mV	300.000 mV	300.000 mV	900.000 mV	100		
📥 [1] Data											
🖻 [1:1] Data0		0	0	0	0	0	0	0			
Copied 06/28/01 17:53	Х										
-Relative Time	Х	-0.400 UI	0.400 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI	0.000 UI	0		
-Voltage(abs)	Х	500.000 mV	500.000 mV	700.000 mV	700.000 mV	300.000 mV	300.000 mV	900.000 mV	100		
🔄 [1] Data (Copied)	Х										
亩 [1:1] Data0 (Copi	Х	0	0	0	0	0	0	0			
4	Þ	•							▶		

The copy and paste functions are described in the *ParBERT Measurement Software Framework User Guide*. If copied data is present, the *Clear Copied Data* menu option becomes enabled.

View SettingsYou can display the bit error rate calculated from All Errors (default),
1s Errors (errors where logical 1 was expected, but logical 0 received),
or 0s Errors (errors where logical 0 was expected, but logical 1
received).

You can display the *Relative Time* in *UI* (one *Unit Interval* is equal to one system clock period) or in *Seconds*.

These settings can also be set on the *View* page of the *Properties* dialog.

Show/Hide Part of Calculation You can show or hide the results of selected ports or terminals.

Pass/Fail Indicators

If a bit error rate limit has been set on the *Pass/Fail* page of the *Properties* dialog, failing measurement points, terminals and ports are highlighted as shown below:

🚜 Fast Eye Mask4									- 🗆 ×
Port/Terminal	Copied	1	2	3	4	5	6	7	
🖃 🕺 Measurement		8							
-Relative Time		-0.495 UI	0.497 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI	0.000 UI	0
-Voltage(abs)		500.000 mV	500.000 mV	700.000 mV	700.000 mV	300.000 mV	300.000 mV	900.000 mV	100
🖃 🚫 [1] Data									
🔃 🔀 [1:1] Data0		0.0889	0	0	0	0	0	0	
T	Þ	- I							

Explanation of the Fast Eye Mask Results

By default, the fast eye mask measurement measures the bit error rate at six measurement points. These points are symmetrically placed as illustrated below:



These settings can be changed, and up to 32 measurement points can be defined.

Relative Time The six default measurement points are preset to ± 0.4 UI and ± 0.16 UI from the actual sampling point.

If Automatic Bit Synchronization with Automatic Phase Alignment is enabled (highly recommended) or Automatic Delay Alignment, and the phase vernier is in zero position, the actual sampling point is the optimum sampling point.

If the automatic analyzer delay adjustment is disabled, the actual sampling point is set by the analyzer start delay and the phase vernier.

The absolute positions of the actual sampling point may differ from analyzer to analyzer. The *Relative Time* position, however, is the same for all analyzers. Instead of UI (one *Unit Interval* is equal to one system clock period) the relative time can also be specified in seconds.

Measurement Point VoltageThis is the analyzer threshold voltage for measuring the bit error rate
at this measurement point. The voltages of the measurement points
can be set as absolute voltages, as offset voltages, or as percentages.
This is done on the Parameters page of the Properties dialog (see also
"How to Specify the Measurement Points" on page 32).

The voltages are distinguished as follows:

• *Absolute*: The thresholds for the measurement points are absolute voltages and set to fixed values for all analyzers.

In this mode, the voltages of the six default measurement points are derived from the threshold voltage of the first connected analyzer frontend, as defined in the loaded system setting: Threshold, threshold plus 200 mV, and threshold minus 200 mV.

• *Offset*: The thresholds for the measurement points are specified as voltages to be added to or subtracted from the individual threshold voltages of the analyzers defined in the loaded setting.

In this mode, the offset voltages of the six default measurement points are 0, +300 mV, and -300 mV. If the threshold of an analyzer is set to 500 mV, this would generate measurement point thresholds at 500 mV, 800 mV, and 200 mV.

• *Percentage*: The thresholds for the measurement points are specified as a percentile of the current eye opening voltages of the analyzers.

In this mode, the analyzer frontends automatically determine the height of the eye opening before starting the measurement. Starting from the analyzer threshold defined in the loaded setting, they increment that voltage step by step to find the upper limit, and decrement that voltage step by step to find the lower limit. The limits are reached as soon as a bit error occurs. The error-free voltage range is taken as 100 %.

In this mode, the percentile voltages of the six default measurement points are 10 %, 50 %, and 90 %.

In offset or percentage mode, every analyzer and hence every terminal can have its own voltages for the measurement points. The result window therefore provides an extra button for every terminal which can be clicked to view the absolute voltages that have been used for the measurement.

Port/Terminal Copied 1 2 3 4 5 6 7 ■ Measurement - <t< th=""><th>🚜 Fast Eye Mask4</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>- 🗆 ×</th></t<>	🚜 Fast Eye Mask4									- 🗆 ×
Image: Note of the second s	Port/Terminal	Copied	1	2	3	4	5	6	7	A
-Relative Time -0.400 UI 0.400 UI -0.160 UI 0.160 UI 0.00 W	🖃 Measurement									
-∨otage(%) 50.000 % 50.000 % 95.000 % 50.000 % 5.000 % 5.000 % 6.000	-Relative Time		-0.400 UI	0.400 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI		
Image: Click here	-Voltage(%)		50.000 %	50.000 %	95.000 %	95.000 %	5.000 %	5.000 %		
O O	📥 [1] Data									
Lootage(abs) 489.453 mV 920.161 mV 920.161 mV 58.745 mV 58.745 mV Click here	🛱 🖬 Dataŭ		0	0	0	0	0	0		
Click here	↓ └Voltage(abs)		489.453 mV	489.453 mV	920.161 mV	920.161 mV	58.745 mV	58.745 mV		
	Click here									v

Bit Error Rate You can display the bit error rate calculated from *All Errors* (default), *1s Errors*, or *0s Errors*.

Option	Definition
All Errors	BER (All Errors) is defined as the total number of errors,
	divided by the total number of compared bits:
	$BER_{A11Errors} = \frac{(\sum Error1s + \sum Error0s)}{(total \# of Bits)}$
1s Errors	The BER is the number of errors where a 1 is expected, divided
	by the total number of compared bits:
	$BER_{1sErrors} = \frac{\sum Error1s}{(total \# of Bits)}$
Os Errors	The BER is the number of errors where a 0 is expected, divided
	by the total number of compared bits:
	$BER_{0sErrors} = \frac{\sum Error0s}{(\text{total # of Bits})}$

Agilent ParBERT 81250 Measurement Software, June 2002

Setting the Properties of a Fast Eye Mask Measurement

Before you can run a new fast eye mask measurement you have to set the required parameters on the measurement's *Properties* pages:

- "How to Set Up the System to be Used" on page 26
- "How to Select the Ports to be Measured" on page 28
- "How to Specify the Measurement Parameters" on page 29
- "How to Set Pass/Fail Criteria" on page 38
- "How to Specify the View" on page 40

When you create a new measurement the *Properties* dialog will be automatically displayed. To change the parameters of an existing measurement, choose *Measurement – Properties* from the menu bar. Or click the right mouse button and choose *Properties* from the context menu.

If you change the measurement settings after the measurement has been run, please note:

- Changes on the *View* and *Pass/Fail* pages have only an impact on the display of the results. There is no need to repeat the measurement.
- Changes on the *System*, *Ports*, and *Parameters* pages take only effect if you rerun the measurement. To remind you that the present results have not been obtained with the modified settings and that you should repeat the measurement, the result display shows a yellow bar.

How to Set Up the System to be Used

The *System* page of the *Properties* dialog appears automatically if you have set up a new measurement. The *System* page shows one or two systems, depending on your selection when creating the measurement.

Fast Eye Mask8 Properties	×
System Ports Parameters Pass/Fail View	,
- Load System Settings:	
🗖 DSRA 📃	
DSRA_2	
Delay Start of:	
DSRA for O Seconds	
OK Cancel Apply	Help

If you have already loaded a setting with the *Agilent 81250 User Software*, the name of this setting will be displayed, and it will be used by default.

If no setting is indicated, as in the figure above, or if the name of a different setting than required is displayed, you have to load one or two settings.

To load a setting:

1 Click the check box belonging to the system.

This activates the setting name field.

2 Choose a suitable setting from the drop-down list.

When you choose a new system setting, it will be downloaded to the firmware. You have to confirm this action before it will actually be performed.

NOTE On one system only one setting can be loaded at one time. The Agilent 81250 User Software and the Agilent 81250 Measurement Software therefore always refer to the same setting. If the Agilent 81250 User Software is active and you load a different setting from the Agilent 81250 Measurement Software, the Agilent 81250 User Software will be updated, and vice versa.

If you add or delete ports or terminals or change their connections with the *Agilent 81250 User Software*, then the *Agilent 81250 Measurement Software* will detect such changes when you attempt to run the measurement.

- **TIP** If you have changed the current setting with the *Agilent 81250 User Software* and wish to keep your modifications, save the setting with the *Agilent 81250 User Software* before loading a different one. The *Agilent 81250 Measurement Software* does not save settings.
 - **3** In case of two systems, you can specify a start delay for one of the systems.

This may be useful, for instance, to allow a PLL or clock recovery circuit in the DUT to lock onto the incoming data stream.

Fast Eye Mask8 Properties	×
System Ports Parameters Pass/Fail View	
Load System Settings:	1
DSRA COMP_01	
✓ DSRA_2 T09HD1 ▼	
Delay Start of:	
DSRA For O Seconds	
DSRA DSRA 2	
	Hab
	neip

4 Click *Apply* to accept the modifications without leaving the *Properties* dialog. Or click *OK* to accept the modifications and close the *Properties* dialog.

How to Select the Ports to be Measured

After you have specified the measurement system and the related system setting, you may wish to exclude one or several DUT output ports from the measurement.

1 In the *Properties* dialog, select the *Ports* tab.

Fast Eye Mask4 Properties	×
System Ports Parameters Pass/Fail View	
Select Measurement Ports:	
Select Measurement Ports	
☑ Data	
	-
1 · · · · · · · · · · · · · · · · · · ·	
OK Cancel Apply	Help

The *Ports* page lists all the output ports of the device under test, as defined in the loaded setting. In case of two systems, this is the setting loaded on the analyzing system. By default, all these ports are enabled and will be measured.

The display is not automatically updated if you change the loaded setting by means of the *Agilent 81250 User Software*.

- **2** Disable the ports that shall not be measured.
- **3** Click *Apply* to accept the modifications without leaving the *Properties* dialog. Or click *OK* to accept the modifications and close the *Properties* dialog.

How to Specify the Measurement Parameters

The *Parameters* page of the *Properties* dialog allows you to specify the parameters of the fast eye mask measurement.

- **NOTE** If you modify the settings of this page, you have to rerun the measurement to update the results.
 - In the *Properties* dialog, click the *Parameters* tab.

Fast Eye Mask4	Properties				×				
System Ports	Parameters	Pass/Fail Vie	ew						
Criteria for moving to next measurement point:									
Number of Compared Bits: 1000000									
Number	of Errors:	1000000							
Sample Points:									
Timing Unit:	Timing Unit: C Unit Interval C Seconds								
Threshold Ty	/pe: 💽 Absolu	ute 🔿 Off	set C Perce	entage					
Number of V	alid Points:	6							
[D. i.e.	-	-	2		_				
Points	0.411	2	3	4	01				
Helative I me	-0.4 UI	0.4 01	-0.16 UI	0.16 UI	-0.1				
Voltage(abs)	500.0000 mV	500.0000 mV	700.0000 mV	700.0000 mv	300				
	OK	Cance	l <u>A</u> p	ply	Help				

If you created a measurement for optical ports, the *Parameters* tab looks as follows:

Fast Eye Mask20	Propert	ies						×
System Ports	Paramete	ers Pas	s/Fail) V	/iew				
– Criteria for mov	Criteria for moving to next measurement point							
Number of (
Number or u	Jompared	Bits: J	000000					
🗖 Number	of Errors:	1	000000		_			
- Sample Points	:							1
Timing Unit:		۲	Unit Inte	rval O :	Seconds			
Power Unit:		۲	Watts	0	dBm			
Threshold Typ	pe:	۲	Absolute	0	Offset C	Percen	tage	
Number of Va	ilid Points:	6						
		-			-	-		
Points	1	2	3	4	5	6	7 8	
Relative Time	-0.4 UI	0.4 UI	-0.16 UI	0.16 01	-0.16 UI	0.16 01		
Power(abs)	[500 uW]	500 uW	ImW	ImW	250 uW	250 uW	UWI	
								1
		OK		ancel		loolu	1	

The figures above show the defaults:

- At each measurement point, one million bits will be compared for measuring the bit error rate at this point.
- The Number of Errors is not checked.
- The *Timing Unit* is set to *Unit Interval (UI)*, the *Threshold Type* is set to *Absolute*.
- For optical ports only: The Power Unit is set to Watts.
- Six measurement points are enabled and preset. The figure above shows the defaults for an analyzer threshold voltage of 500 mV.

For details, see "How to Set the Criteria for Moving to the Next Point" on page 31 and "How to Specify the Measurement Points" on page 32.

How to Set the Criteria for Moving to the Next Point

In the upper section of the *Parameters* page, you can control the speed and precision of the fast eye mask measurement.

1 Change the Number of Compared Bits, if desired.

The default number is one million bits.

A smaller number reduces the duration of the whole fast eye mask measurement. A larger number increases the precision of the measured bit error rates.

- **NOTE** If you keep the default setting, the minimum bit error rate you can measure is 10^{-6} (one error per 1,000,000 bits). The pass/fail threshold should be higher. For safety reasons, you would set the pass/fail limit to at least 2e–6 (two errors per million) or higher.
 - **2** If desired, activate the *Number of Errors* and enter a suitable number.

If this check box is active, the software compares the total number of errors from all terminals with this number. If the total is higher, the measurement proceeds to the next measurement point.

This option can be used to reduce the measurement time for points that display many errors.

When you specify a number, you should take the number of terminals and the pass/fail limit into account. You may wish to be informed, if one of the measurement points is critical.

3 Click *Apply* to accept the modifications without leaving the *Properties* dialog. Or click *OK* to accept the modifications and close the *Properties* dialog.

How to Specify the Measurement Points

In the lower section of the *Parameters* page, you can change the defaults and define up to 32 measurement points.

- 1 Change the *Timing Unit*, if desired. Choices are *Unit Interval* or *Seconds*.
 - The *Unit Interval (UI)* is equal to one system clock period. If the system clock period is 10 ns (100 MHz), one UI is also 10 ns. If the system clock period is set to 2.5 ns (400 MHz), one UI is 2.5 ns.

Using the *Unit Interval* is hence a convenient way to set and check timing values independently from the actual test frequency.

The six default measurement points are preset to ± 0.4 and ± 0.16 UI.

- The timing values can be converted to *Seconds* at any time.

Fast Eye Mask4 Pro	operties				×
System Ports Pa	arameters p	Pass/Fail 🛛 Vie	w)		
Criteria for moving	g to next mea	asurement poir	it		
Number of Con	npared Bits:	1000000			
Number of	Errors:	1000000			
Sample Points:					
Timing Unit:	O Unit In	terval 💿 Sec	onds		
Threshold Type	: 🖲 Absolu	ite 🔿 Off:	set 🔿 Perce	entage	
Number of Valid	d Points:	6			
Points 1		2	3	4	5
Relative Time -3.	.2000 ns	3.2000 ns	-1.2800 ns	1.2800 ns	-1.2
Voltage(abs) 50	00.0000 mV	500.0000 mV	700.0000 mV	700.0000 mV	300
	OK	Cance		ply	Help

For the example above, a system clock period of 8 ns (125 MHz) was set.

- 2 For optical ports, change the *Power Unit*, if desired. Choices are *Watts* or *dBm*.
- **NOTE** The Power Unit is only available when optical ports are used for the measurement.

Fas	t Eye Mask20	Properties						×
S	ystem Ports	Parameters	Pass/Fail 🛛 V	ïew				
	- Criteria for mov	ing to next me	easurement po	int: ——				
	Number of C	Compared Bits:	1000000					
	Number	of Errors:	1000000					
	-Sample Points:							
	Timing Unit:		Onit Inter	val 🔿 S	econds			
	Power Unit:		O Watts	• d	Bm			
	Threshold Typ)e:	Absolute	- O ŭ	Iffset C	Percenta	age	
	Number of Va	lid Points:	6					
	Points	1	2	3	4	5	E	
	Relative Time	-0.4 UI	0.4 UI	-0.16 UI	0.16 UI	-0.16 UI	0	
	Power(abs)	-3.0103 dBm	-3.0103 dBm	0 dBm	0 dBm	-6.0206 c	IBm -f	
	•						►	
		OK		ancel	<u> </u>	pply	Н	elp

- **3** Change the *Threshold Type*, if desired. Choices are *Absolute*, *Offset*, or *Percentage*.
 - *Absolute*: You specify the thresholds for the measurement points as absolute voltages.

Defaults: The three voltages of the six default measurement points are derived from the threshold voltage of the first connected analyzer frontend after the clock module, as defined in the loaded system setting: Threshold, threshold plus 200 mV, and threshold minus 200 mV. - *Offset*: You specify the thresholds for the measurement points as values to be added to or subtracted from the individual analyzer threshold voltages defined in the loaded setting.

Defaults: The three offset voltages of the six default measurement points are: 0, +300 mV, -300 mV.

Fast Eye Mask4 I	Propertie	s			×
System Ports	Paramete	rs Pass/	Fail View		
Criteria for mov	ing to nex	t measurer	ment point:		
Number of C	Compared B	Bits: 100	00000		
Number	of Errors:	100	00000		
Sample Points:					
Timing Unit:	ΟU	nit Interval	C Seconds		
Threshold Ty	ipe: 🔿 Al	osolute	⊙ Offset (O Percentage	
Number of V	alid Points:	6			
Points	1	2	3	4	5
Relative Time	-0.4 UI	0.4 UI	-0.16 UI	0.16 UI	-0.16 UI
Voltage(offs)	0.0000 V	0.0000 V	300.0000 mV	300.0000 mV	-300.0000 m
	OK		Cancel	Apply	Help

Percentage: You specify the thresholds for the measurement points as a percentile of the current eye opening voltages of the analyzers.

In this mode, every analyzer frontend automatically determines the height of the eye opening before starting the measurement. Thresholds given as percentiles adapt themselves to the received signals.

Starting from the analyzer threshold defined in the loaded setting, the analyzers increment that voltage step by step to find the upper limit, and decrement that voltage step by step to find the lower limit. The limits are reached as soon as a bit error occurs. The error-free voltage range is taken as 100 %.



Defaults: The percent voltages of the six default measurement points are: 10 %, 50 %, and 90 %, as illustrated in the figure below.

Depending on the quality and characteristics of the eye opening, the resulting 50 % threshold may deviate from the analyzer threshold defined in the loaded setting.

The defaults in percentage mode are shown below.

Fast Eye Mask4 F	Properties						×
System Ports	Parameters	Pass	:/Fail	View			
Criteria for movi	ing to next r	neasure	emen	t point:			
Number of C	ompared Bi	ts: 10	0000	00			
Number	of Errors:	10	0000	00			
Sample Points:							
Timing Unit:	🖲 Uni	t Interv	al C	Seconds			
Threshold Ty	pe: 🔿 Abs	olute	C	Offset (Percenta	ge	
Number of Va	alid Points:	6					
Points	1	2		3	4	5	6
Relative Time	-0.4 UI	0.4 UI		-0.16 UI	0.16 UI	-0.16 UI	0.1
Voltage(%)	50.0000 %	50.000	0 %	90.0000 %	90.0000 %	10.0000 %	10.
1	OK		С	ancel	Apply		Help

TIP If your analyzers have been configured to use different threshold levels, you should use the options *Offset* or *Percentage*. These options consider the settings of the individual analyzers.

In offset or percentage mode, every analyzer and hence every terminal can have its own threshold voltages for the measurement points.

The result window therefore provides an extra button for every terminal which can be clicked to view the absolute voltages that have been used for the measurement.

🚜 Fast Eye Mask4									_ 🗆 ×
Port/Terminal	Copied	1	2	3	4	5	6	7	A
🖃 Measurement									
-Relative Time		-0.400 UI	0.400 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI		
-Voltage(%)		50.000 %	50.000 %	95.000 %	95.000 %	5.000 %	5.000 %		
🔄 [1] Data									
📥 🛄 Uni Destad		0	0	0	0	0	0		
		489.453 mV	489.453 mV	920.161 mV	920.161 mV	58.745 mV	58.745 mV		
Click here									Y
4	Þ	•							Þ

Particularly in percentage mode, this makes it easy to check whether the height and absolute voltage position of the eye opening received by a terminal are within specifications.

- **4** Change the *Number of Valid Points*, if you wish to use less or more measurement points for the measurement.
- **5** Change or add measurement points. Enter the *Relative Time* and *Voltage*.
 - *Relative Time*: This positive or negative time value refers to the actual sampling point of the individual analyzer frontend. It has to be entered according to the chosen *Timing Unit*.

If Automatic Bit Synchronization with Automatic Phase Alignment is enabled (highly recommended) or Automatic Delay Alignment, and the phase vernier is in zero position, the actual sampling point is the optimum sampling point.

If the automatic analyzer delay adjustment is disabled, the actual sampling point is set by the analyzer start delay and the phase vernier. - *Voltage*: This is the analyzer threshold voltage for measuring the bit error rate at this measurement point. It has to be entered according to the chosen *Threshold Type*.

Fast Eye Mask4 P	roperties					×
System Ports F	arameters P	ass/Fail Viev				
Criteria for movir	ng to next meas	surement point:				
Number of Co	mpared Bits:	1000000				
🗖 Number o	f Errors:	1000000				
Sample Points: -						
Timing Unit:	Unit Inte	erval 🔿 Seco	inds			
Threshold Typ	e: 💽 Absoluti	e 🔿 Offse	t O P	ercentag	e	
Number of Val	id Points:	8				
4	5	6	7	8	9	10
0.16 UI	-0.16 UI	0.16 UI	0 UI	0 UI	0 UI	0 U
V 700.0000 mV	300.0000 mV	300.0000 mV	900 mV	100 mV	0.0000 V	0.0
	OK	Cancel		Apply		Help

In the figure above, two measurement points have been added at 0 UI as absolute voltages.

6 Click *Apply* to accept the modifications without leaving the *Properties* dialog. Or click *OK* to accept the modifications and close the *Properties* dialog.

How to Set Pass/Fail Criteria

The *Pass/Fail* page of the *Properties* dialog allows you to specify the criteria which determine whether the DUT has passed or failed the test.

You can change the pass/fail criteria without rerunning the measurement. The software compares the results with the limit after the measurement has finished.

1 In the Properties dialog, click the Pass/Fail tab.

The fast eye mask measurement has only one pass/fail condition: The bit error rate.

2 If desired, enable the *BER Threshold* and set a suitable threshold.

ast Eye Mask4 Properties		×
System Ports Parameters	Pass/Fail View	
BER Pass/Fail		
BER Threshold	1e-7	
		Hala
	Lancei <u>A</u> pply	Help

The minimum useful threshold is determined by the *Number of Compared Bits* (see *"How to Set the Criteria for Moving to the Next Point" on page 31*).

3 Click *Apply* to accept the modifications without leaving the *Properties* dialog. Or click *OK* to accept the modifications and close the *Properties* dialog.

The pass/fail threshold applies to all measurement points, ports and terminals. All measurements where the bit error rate is higher than this threshold will be marked as "failed", as shown in the figure below:

🚜 Fast Eye Mask4	Fast Eye Mask4								
Port/Terminal	Copied	1	2	3	4	5	6	7	
🖃 🕺 Measurement		8							
-Relative Time		-0.495 UI	0.497 UI	-0.160 UI	0.160 UI	-0.160 UI	0.160 UI	0.000 UI	0
-Voltage(abs)		500.000 mV	500.000 mV	700.000 mV	700.000 mV	300.000 mV	300.000 mV	900.000 mV	100
🖃 🔕 [1] Data									
亩 区 [1:1] Data0		0.0889	0	0	0	0	0	0	
4	Þ	•							

How to Specify the View

The *View* tab of the *Properties* dialog allows you to modify the display of the measurement results.

1 In the *Properties* dialog, click the *View* tab.

Fast Eye Mask4 Properties	×
System Ports Parameters Pass/Fail View	
Analyze: C All Errors C Errors if 0s Expected C Errors if 1s Expected Grid: Timing Unit: C Unit Interval C Seconds	
Table Number Format Decimal Places: 3	
OK Cancel Apply Help	

If you created a measurement for optical ports, the *View* tab looks as follows:

Fast Eye Mask20 Properties	×
System Ports Parameters Pass/Fail View	
Analyze: C All Errors C Errors if 0s Expected Errors if 1s Expected	
Grid: Timing Unit: © Unit Interval © Seconds Power Unit: © Watts © dBm	
Table Number Format: Decimal Places: 3	
OK Cancel Apply Help	

These figures show the default settings.

Agilent ParBERT 81250 Measurement Software, June 2002

- **2** Set the kind of bit error rate you wish to be displayed. Choices are: *All Errors, Errors if 0 expected, Errors if 1 expected.*
 - *All Errors*: Shows the bit error rate as calculated by dividing the number of errored bits by the total number of received bits.
 - *Errors if 0 expected*: Shows the bit error rate as calculated by dividing the number of bits where 0 was expected, but 1 received, by the total number of received bits.
 - *Errors if 1 expected*: Shows the bit error rate as calculated by dividing the number of bits where 1 was expected, but 0 received, by the total number of received bits.
- **3** Set the *Timing Unit* for the display. Choices are: *Unit Interval* or *Seconds*.
 - *Unit Interval*: Shows the relative time of the measurement points in Timing Units (UI), independent of the current clock frequency.
 - *Seconds*: Shows the relative time of the measurement points in seconds, calculated from the current clock frequency.
- **4** For optical ports, choose the *Power Unit* for the display of the threshold. Choices are *Watts* or *dBm*.
- **NOTE** The Power Unit is only available when optical ports are used for the measurement.
 - 5 Choose the number of *Decimal Places*.By default, numbers are displayed with three digits. You can increase or decrease that number.
 - **6** Click *Apply* to accept the modifications without leaving the *Properties* dialog. Or click *OK* to accept the modifications and close the *Properties* dialog.

Index

A

Absolute threshold 33 Absolute voltage 23 Actual sampling point 22 Apply button 27

В

BER definition 24

С

Clear Copied Data 20Pass/Fail tab 38Copy and paste 20Paste 20Criteria for Moving to the Next MeasurementPercentage threshold 34Point 31Percentage voltage 23

Ε

Errors 0s 24 1s 24 all 24 Example of a Fast Eye Mask Measurement Changing Properties 14 Connecting the DUT 8 Frontends and Levels 9 Running the measurement 11

F

Fail criteria 38 Fast Eye Mask Measurement Explanation of the results 22 Result Display 19 results 18

L

Loading a setting 26

М

Measurement parameters 29 Measurement point relative time 22 Voltage 22 Measurement points defaults 22, 32

Ν

Number of Compared Bits 31 Number of Errors 31 Number of Valid Points 36

0

Offset threshold 34 Offset voltage 23 Optimum sampling point 22 Ρ Part of Calculation 20 Pass criteria 38 Pass/fail criteria 38 Pass/Fail Indicators 21 Pass/Fail tab 38 Paste 20 Percentage voltage 23 Ports tab 28 Ports to be tested 28 Prerequisites for Fast Eye Mask Measurements 17 Properties dialog Apply button 27 Pass/Fail tab 38 Ports tab 28 System tab 26 View tab 40 Properties of a Fast Eye Mask Measurement 25

R

Relative Time 22, 36 Results explanation 22 Results of fast eye mask measurements 18

\mathbf{S}

Selecting the ports to be tested 28 the system to be used 26 Setting loading a setting 26 saving a setting 27 Setting pass/fail criteria 38 Specifying the display 40 Specifying the measurement parameters 29 Start delay 27 System tab 26 System to be used 26 Т

Test points 5 Threshold absolute 33 offset 34 percentage 34 Threshold Types 33 Timing Unit 32

U

Unit Interval (UI) 13, 32

V

View options 40 View Settings menu 20 View tab 40 Voltage absolute 23 of measurement point 37 offset 23 percentage 23 Voltage of measurement point 22

Y

Yellow bar in result window 25