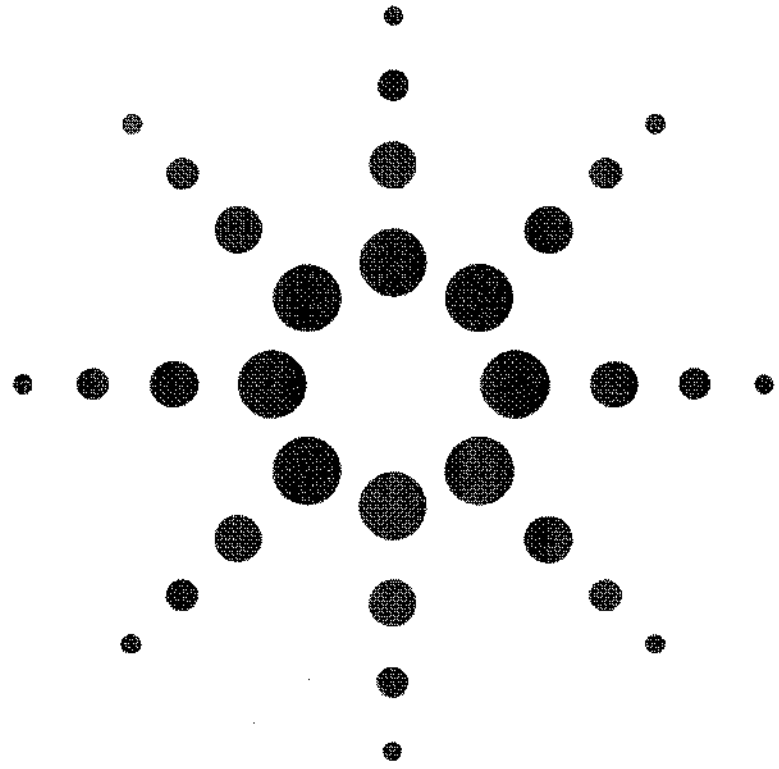


Agilent 81250 Parallel Bit Error Ratio Tester

System User Guide

Agilent Technologies

Important Notice

Authors: t3 medien GmbH

Contents

About this Guide

This user guide provides comprehensive information on the hardware and standard user software of the Agilent 81250 Parallel Bit Error Ratio Tester.

This guide does not cover:

- System installation/update
- System configurations
- Technical specifications
- The Agilent 81250 ParBERT Measurement Software

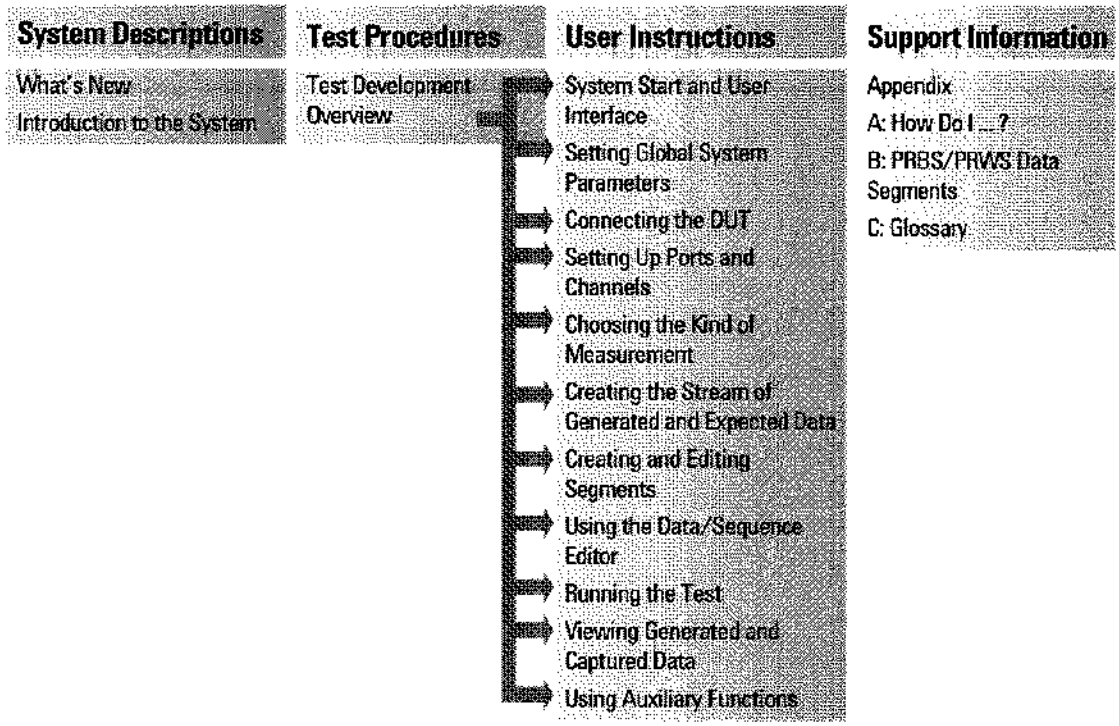
Information on these topics is available in dedicated manuals.

Structure of the System User Guide

As the ParBERT System User Guide comprises quite many chapters, you may wish to have some kind of overview to decide how to make optimum use of this document. This first chapter provides that overview.

General Structure

Actually, the information is organized into four sections, though these sections are not explicitly labeled in the manual:



The chapter *Test Development Overview* describes the sequence of steps to be performed when developing, executing, and verifying a device test. It points to the corresponding instructions.

Contents of the Chapters

What's New? If you have already been working with the Agilent 81250 Parallel Bit Error Ratio Tester and received a new software release, you should read this section. It informs you about the changes that have been made and the enhancements that have been added.

Introduction to the System Newcomers should read this chapter in order to find out what they can expect from the Agilent 81250 Parallel Bit Error Ratio Tester, what the hardware components do, and how the system works.

Advanced users will use this chapter as a reference for the terms that appear on the user interface.

Test Development Overview This chapter summarizes the steps which are necessary for testing a device with the Agilent 81250 Parallel Bit Error Ratio Tester—from setup to results. As the system has been designed for ease of use, these steps can be performed by clicking tool bar icons.

System Start and User Interface You can of course start the system and find out yourself how the user interface works and how it is operated. The online help will assist you. But you will probably miss a couple of details which could make your life easier. Such details are discussed in this chapter.

Setting Global System Parameters This and the following chapters provide task-related information. They are sorted according to the step-by-step procedures stated in the *Test Development Overview* chapter.

Global system parameters refer to the setup of the clock module.

Setting the test frequency is easy. But if you wish to explore the system's capabilities, you will also need some general information about the system's timing principles from the *Introduction* chapter.

Connecting the DUT This chapter explains how to use the Connection Editor. The Connection Editor is the first window after starting the Agilent 81250 Parallel Bit Error Ratio Tester User Software.

Setting Up Ports and Channels This chapter explains how to specify the timing, voltages, operating modes and more of the generator and analyzer frontends.

Choosing the Kind of Measurement The Agilent 81250 Parallel Bit Error Ratio Tester User Software allows to capture data, to compare received data in real time with expected data, and to measure the bit error rate. This chapter explains the details.

Creating the Stream of Generated and Expected Data

Testing a device most often requires two data streams—one that is generated, and one that is expected and compared with the DUT output. This chapter explains how these streams can be set up with the Sequence Editor.

To understand this and the following chapters, you will need some basic information about the system's data generation principles from the *Introduction* chapter.

Creating and Editing Segments

The data to be sent to or expected from the DUT is organized as data segments. This chapter describes how to create such segments.

Using the Data/Sequence Editor

The Data/Sequence Editor is a very versatile tool which is described in this chapter.

Running the Test

This chapter explains how a test is started and stopped.

Viewing Generated and Captured Data

Depending on the kind of measurement, the ParBERT user software offers several kinds of result displays. This chapter explains how to enable and operate these displays.

Using Auxiliary Functions

Auxiliary functions like delay compensation, data import/export, or the Command Line Editor are described in this chapter.

Appendix A: How Do I ... ?

This appendix provides answers to frequently asked questions. If you need to perform a special test or need a special function or mode of operation, you should consult this chapter before calling the Agilent support.

Appendix B: PRBS/PRWS Data Segments

This appendix explains the creation and properties of the pseudo random bit/word streams generated or expected by the Agilent 81250 Parallel Bit Error Ratio Tester.

Appendix C: Glossary

All the specific terms used by the user interface are explained in this guide, most of them in the *Introduction* chapter. The glossary in the appendix provides a quick reference.

Index

The alphabetical index register has been prepared to assist you in finding any bit of information as simply and quickly as possible.

About the ParBERT Measurement Software

The Measurement Software for the Agilent 81250 Parallel Bit Error Ratio Tester extends the capabilities of the standard system. It provides additional and unequaled features for R&D and production with regard to both test time and precision.

Measurement user interface

The Agilent 81250 Measurement Software has its own user interface, independent from the user interface of the standard user software.

The user interface of the Agilent 81250 Measurement Software consists of a workspace (a window frame) that holds the windows of one or a number of measurements.

Several types of measurements are available (see *"New and Enhanced Measurements" on page 23*).

Setting

Before you can use the Agilent 81250 Measurement Software you have to create and save a **setting** with the Agilent 81250 User Software.

A setting contains all the system setup information, including the pins of the device to be tested, their connections to the system, the test frequency, the clock source, the timings and levels to be used, the data to be sent or expected, and so on. Once a suitable setting has been stored, the Agilent 81250 User Software does not have to be active for performing the measurements.

Documentation

The Agilent 81250 Measurement Software comes with its own manuals.

There is a general guide for all measurements and there are single guides for the individual measurements.

The general guide is the *Agilent 81250 ParBERT Measurement Software Framework User Guide*. The guides for the measurements are named according to the measurements.

What's New?

This chapter gives an overview of the most important changes and enhancements of the Agilent 81250.

The information is organized as follows:

Major Changes from Rev. 4.0 to 4.1

Revision 4.1 of the Agilent 81250 user software supports the ParBERT 10.8 Gbit/s data generator/analyzer modules. It provides also enhancements of the Segment Editor and a new way to switch the connectors on and off.

New Data Generator/Analyzer Modules

The new modules are:

- E4866A 10.8 Gbit/s data generator module
- E4867A 10.8 Gbit/s data analyzer module

These modules are capable of creating or analyzing data streams at 9.5 Gbit/s up to 10.8 Gbit/s.

Benefits You may think of testing a multiplexer component, stimulated by four 2.7 Gbit/s generators or eight 1.35 Gbit/s generators. One single E4867A 10.8 Gbit/s analyzer can measure the serial response. Similarly, a demultiplexer can be stimulated by an E4866A 10.8 Gbit/s data generator and analyzed by four, eight, or 16 lower speed analyzers.

You may also think of high-speed applications. For example, four E4866A data generator modules can be used for stimulating an OC-768 4:1 multiplexer. The serial output of this multiplexer with a data rate around 40 Gbit/s can be analyzed by a ParBERT 43G error detector system.

Using a ParBERT 43G pattern generator system, you can send a serial bit stream of up to 43.2 Gbit/s to an OC-768 demultiplexer component. Using four E4867A data analyzer modules, it is now possible to analyze the parallel output of a 1:4 demultiplexer.

Details These high-speed modules do not have frontends. Each has one pair of differential connectors which is identified by the software as one connector. For these modules, one channel means one module.

From the user's point of view, this is the only remarkable difference to the lower speed modules. For the connection and parameter setup, the same functions of the Connection Editor and Parameter Editor are used.

Automatic analyzer sampling delay adjustment and all the measurements provided by the Agilent 81250 Measurement Software can be used with the E4867A 10.8 Gbit/s data analyzer modules.

Enhancements of the Segment Editor

For testing a multiplexer, one needs parallel generated and serial expected data. Testing a demultiplexer requires serial generated and parallel expected data. The data contents is the same on both sides—only the data distribution changes.

To support the setup of data to be generated and expected for multiplexer and demultiplexer tests, three functions have been added to the Segment Editor, and one has been enhanced.

Deserialize The Deserialize function allows you to convert a serial bit stream to parallel format. This is done in the data segment. A segment holding serial data contains just one trace. With the Deserialize function, this data can be split into an arbitrary number of traces.

This, for example, makes it easy to create the data expected from a demultiplexer. To adapt to the characteristics of the demultiplexer, the function provides several alternatives for sorting the data.

Serialize This function is the counterpart of the deserialize function. It is used to convert parallel data to serial. A segment holding multiple traces is converted to a serial segment holding one trace.

Again, several alternatives are provided for sorting the data.

Find Formatted data is generally organized in blocks. Such blocks contain header, control, and payload data. You may wish to pursue the order of these blocks.

This is supported by the Find function. This function allows you to search for a certain bit combination within a segment. You can search for parallel and serial bit patterns.

Enhanced copy and paste When testing n:1 multiplexers or 1:n demultiplexers, you may need separate ParBERT systems on the generating and analyzing sides. This depends on the frequency ratio. Using two ParBERT systems, in turn, means using two user interfaces.

You may, for example, have set up suitable test data for the generator system. But how to transfer that data to the analyzer system, so that it recognizes the expected data?

This is covered by the enhanced copy and paste functions of the Segment Editor.

As soon as the Segment Editors of both user interfaces are open, you can copy and paste memory data from one to the other.

This, combined with the Deserialize/Serialize functions, makes it easy to set up all kinds of multiplexer/demultiplexer tests.

Switching Connectors ON/OFF

The tool bar of the ParBERT user interface has always had a Connectors Off/On button for disconnecting all the frontends and for re-establishing the previous connections. This was done by switching relays in the frontends.

For frontends with data rates above 675 Gbit/s, this behavior can be changed. It is now possible to specify whether the relays shall be switched or whether the frontends shall be disconnected by grounding.

Especially in a production environment, grounding is a way to increase the lifetime of the ParBERT relays.

Major Changes from Rev. 3.5 to 4.0

Revision 4 supports not only all common ParBERT configurations but also the *Agilent 81250 ParBERT 43G Systems*. This is accompanied by enhancements of the Agilent 81250 Configuration Tool and the start procedure of the Agilent 81250 user software.

Agilent ParBERT 43G Systems

The Agilent 81250 ParBERT 43G is a solution for generating and analyzing electrical data streams of 38 Gbit/s up to 43.2 Gbit/s.

It allows you to stimulate and analyze 16:1 multiplexers and 1:16 demultiplexers at data rates of 2.7 Gbit/s and 43.2 Gbit/s, according to the OC-768 and SFI-5 (Serdes Framer Interface 5) data range.

It allows you also to determine the bit error rate of serial devices or transmission lines operated at 43.2 Gbit/s. It supports the investigation of FEC devices at 43.01841 Gbit/s including the FEC rate resulting from 255/236 overhead.

The Agilent 81250 ParBERT 43G systems are offered as bundles—one for pattern generation and one for error detection. But it is also possible to upgrade existing systems.

A setup for testing both multiplexers and demultiplexers would use both bundles. The bundles include also the E4808A clock module which is superior to the well-known E4805B clock module.

For details see *"ParBERT 43G Systems" on page 91*.

Software Enhancements

An Agilent 81250 ParBERT 43G system is automatically recognized and the user software comes up with a Connection Editor which is preconfigured.

Using both Agilent 81250 ParBERT 43G bundles means using two ParBERT user interfaces. This is required for independent clock generation and parameter setup. The capability to run more than one user interfaces has always been there.

Support of multiple user interfaces

The Agilent 81250 Configuration Tool and the ParBERT user software now greatly support the use of several user interfaces:

- More than one user interface can be automatically started.
- Every user interface can be individually configured.

  The configuration parameters for each user interface include: Location of the firmware server (local or LAN address), name of the system to be operated, name of the setting to be automatically downloaded to the system.
- Every user interface can easily be switched to operate one of the configured systems.
- Tests can be started an stopped simultaneously on two or more user interfaces and hence systems.

  For this purpose, the software includes the utilities "System Starter for 2 Systems" and "System Starter for n Systems":

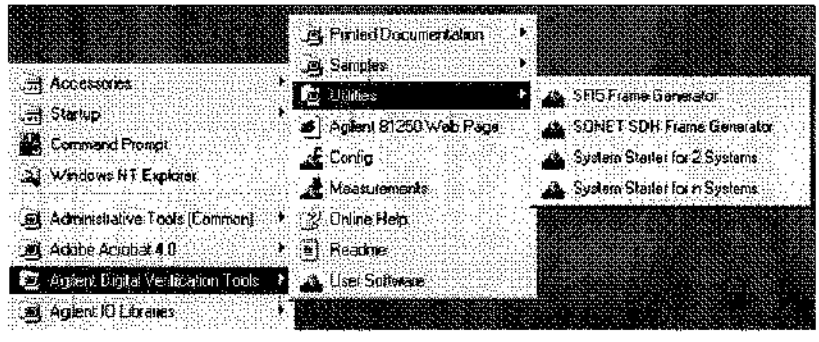


Figure 1 ParBERT Utilities

For example, "System Starter for 2 Systems" provides the following capabilites:

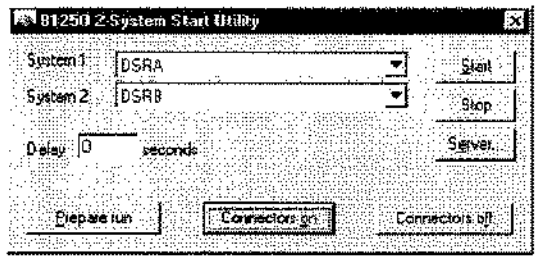


Figure 2 Two Systems Test Start Utility

You can prepare the run, switch all the connectors off and on, start/stop the test, and even control remote systems connected via the LAN.

Data generation for SONET and SFI-5

The Utilities panel provides also the access to two tools used for generating data segments for the ParBERT 43G.

- The SONET SDH Frame Generator generates data that is formatted according to SONET standards (STS 3 to STS 768) or SDH (STM 1 to STM 256). This tool includes its own online help.
- The SFI5 Frame Generator generates data that is formatted according to SFI-5 standards. For details see *"How to Use the SFI5 Frame Generator" on page 323*.

External clock sources

If an external clock source is connected to the master clock module, then this source determines the system clock frequency. The software now provides not only the clock multiplier but also a clock divider.

This means, you can, for example, set the system clock frequency to 3/5 of the external clock frequency, or to any other arbitrary value.

PLL lock indicator

When an external clock source is used, the phase locked loop of the master clock module locks onto that source. The PLL lock indicator informs you in case the clock system could not lock or has lost its synchronization.

Automatic Rewiring of Demultiplexer Terminals

When testing demultiplexers, you apply serial data to one terminal and analyze parallel data from a number of terminals. Pure PRBS and PRWS data are generally well suited for testing demultiplexers.

But if you are using memory-based data, you may encounter the problem that the data from the DUT is correct, but does not start with the first terminal—the one numbered "1". This, however, is required for comparing the received data with the stored data segment. Trace 1 of the segment is expected from the first terminal, trace 2 from the next, etc.

The ParBERT now provides a means to fully automatically check the incoming data and rearrange the sequence of the terminals. As a result, the first terminal is the one that delivers the first bit of every word, the second terminal delivers the second bit, and so on, and the incoming data can be compared with the expected.

For details see *"Automatic Rewiring of Demultiplexer Terminals" on page 102.*

Major Changes from Rev. 3.0 to 3.5

The *Agilent 81250 ParBERT Measurement Software* now provides four measurements:

- DUT Output Timing/Jitter Measurement
- Eye Opening Measurement
- Bit Error Rate Measurement
- Fast Eye Mask Measurement

All these measurements are based on measuring the bit error rate at many points in time and many voltage levels. They are meant for characterizing data transmitting devices.

An important feature of the Agilent 81250 Parallel Bit Error Tester is the automatic analyzer sampling point adjustment. This feature is used to place the initial sampling point at the optimum.

New and Enhanced Measurements

The existing measurements—DUT Output Timing/Jitter Measurement and Eye Opening Measurement—have been enhanced.

New measurements have been added:

Bit Error Rate Measurement The Bit Error Rate Measurement of the measurement software provides more and enhanced capabilities than provided by the standard user software: Stop criteria can be defined to obtain comparable results in minimum time, automatic repetition can be specified for long-term studies.

Fast Eye Mask Measurement The Fast Eye Mask Measurement is first of all meant for production and screening tests. It is used to determine whether the eye openings of a device are within specifications. It allows to obtain pass/fail information within a few seconds.

Hardware Enhancements

Enhanced modules and frontends now provide extended frequency ranges:

- From formerly 667 MHz to now 675 MHz
- From formerly 1.33 GBit/s to now 1.35 GBit/s
- From formerly 2.67 GBit/s to now 2.7 GBit/s

These frequencies are the new G.709 and SFI5 standard data rates.

On from revision 3.5, the modules and frontends to be used with the Agilent 81250 Parallel Bit Error Ratio Tester are:

VXI modules

- E4805B, 2.7 GHz, clock module
- E4832A, 675 Gbit/s, data generator/analyzer module
- E4861A, 1.35/2.7 Gbit/s, data generator/analyzer module

Generator frontends

- E4838A, 675 Mbit/s, differential output, low voltage amplitude/offset and variable slopes generator frontend
- E4843A, 675 Mbit/s, NRZ/RZ, differential generator frontend
- E4864A, 1.35 Gbit/s, NRZ differential generator frontend
- E4862A, 2.7 Gbit/s, NRZ differential generator frontend

Analyzer frontends

- E4835A, 675 MSa/s, a pair of two differential or single-ended high sensitivity analyzer frontends
- E4865A, 1.35 GSa/s, differential input high sensitivity analyzer frontend
- E4863A, 2.7 GSa/s, differential input high sensitivity analyzer frontend

NOTE The enhanced modules and frontends have the same part numbers as their predecessors. They are identified by stickers stating their maximum data rates.

The extended data rates can be used on a system that comprises **only** enhanced modules and frontends. If a system includes older and newer components, for example 2.67 GHz **and** 2.7 GHz modules or frontends, then it will be still restricted to 2.67 GHz.

So, you may think of joining Agilent's 81250 ParBERT 2.67G to 2.70G Upgrade Program and update all your older components.

Older Modules and Frontends

Important features of the Agilent 81250 Parallel Bit Error Ratio Tester are the functions for automatic analyzer sampling point adjustment and the ParBERT Measurement Software.

There are older modules and frontends that do not support these features.

The following modules and frontends may be present in a system but cannot be used for typical ParBERT applications, such as measurements derived from the bit error rate or high-speed multiplexer testing:

VXI Modules

- E4805A clock module
- E4831A clock and data generator module
- E4841A data generator/analyzer module

Generator frontends

- E4842A, 330 Mbit/s, NRZ/RZ, single ended, variable transitions, 3.5 V amplitude
- E4846A, 200 Mbit/s, dual output single-ended frontend

Analyzer frontends

- E4837A, 667 MSa/s, differential input high sensitivity analyzer
- E4844A, 667 MSa/s, single input frontend
- E4845A, 330 MSa/s, dual input frontend
- E4847A, 330 MSa/s, high-Z, dual input frontend

These modules and frontends are no longer described in this user guide.

Major Changes from Rev. 1.1 to 3.0

Revision 3.0 of the ParBERT software provides organizational enhancements as well as the new *Agilent 81250 ParBERT Measurement Software*.

Agilent 81250 Measurement Software

Revision 3.0 provides the new *Agilent 81250 ParBERT Measurement Software*. This software gives you a fast and easy-to-use access to complex bit error measurements for the Agilent 81250 Parallel Bit Error Tester (ParBERT). The following two measurement types are supported:

- DUT Output Timing/Jitter Measurement
- Eye Opening Measurement

DUT Output Timing/Jitter Measurement

The DUT Output Timing/Jitter Measurement allows to measure the time differences between the pins of a data bus. It allows also to measure the timing stability and provides a means for analyzing the jitter.

Eye Opening Measurement

The Eye Opening Measurement is used to measure the eye opening of a signal over time and voltage fully automatically and with adjustable precision. Tools are provided for comprehensive and exact analysis of the borders.

Measurement user interface

The measurement software comes with its own graphical user interface, but you can also embed the measurements into any programming environment that supports the ActiveX Component Object Model. In addition, a wrapper.dll allows to include the measurements into programs written in C/C++.

Organizational Enhancements

Just a summary:

- The software installation has been completely revised.
- The ParBERT user software is no longer restricted to the Windows NT operating system but can also be installed and run under Windows 2000.

- The software now supports multiple IEEE 1394 PC-to-VXI interfaces (opt. #013). Two or more independent ParBERT systems can be controlled from one workstation.

Pseudo Random Bit Streams

The PRBS polynomials $2^9 - 1$, $2^{11} - 1$, and $2^{31} - 1$ have been changed to standard polynomials (refer to *"Pure and Distorted PRBS" on page 358*).

Major Changes from Rev. 1.0 to 1.1

In addition to the E4861A 2.67 GHz data generator/analyzer module, the Agilent 81250 system software now supports also the E4832A module.

New Module and Frontend

Module E4832A The 667 MHz data generator/analyzer module E4832A has four slots for four frontends. It can accommodate the frontends:

- E4838A, 667 Mbit/s, differential output, low voltage amplitude/offset and variable slopes generator frontend
- E4843A, 667 Mbit/s, NRZ/RZ, differential generator frontend
- New E4835A frontend, a pair of 667 Msa/s, differential or single-ended input high sensitivity analyzer frontends

Compared with the E4841A data generator/analyzer module, the E4832A has twice the memory capacity and supports Compare and Capture or Compare and Acquire Around Error tests at double speed (clock rates up to 667 MHz).

It supports also the automatic analyzer sampling point adjustment.

Introduction to the System

This chapter makes you familiar with the Agilent 81250 Parallel Bit Error Ratio Tester—its components, operating principles, and terms.

The information is organized as follows:

- *"System Capabilities" on page 30*—a summary of the system's purpose and technical highlights
- *"System Components" on page 32*—the description of the ParBERT hardware components
- *"Operating Principles" on page 45*—the philosophy of virtual systems and setup models and its impact on the software structure
- *"Timing Principles" on page 53*—about clock sources and how the system clock is generated by frequency multiplication
- *"Data Generation Principles" on page 64*—the characteristics of data sequences, data blocks, and data segments
- *"Principles of Analyzer Sampling Point Adjustment" on page 73*—the three methods for adjusting the analyzer sampling delay
- *"Data Capturing and Analysis Principles" on page 85*—a description of the four standard functional tests and their result displays
- *"Event Handling Principles" on page 88*—the explanation how the system can be influenced by internal and external events
- *"ParBERT 43G Systems" on page 91*—an introduction to the ParBERT 43G that allows to create and analyze data streams at rates of up to 43.2 Gbit/s.
- *"Automatic Rewiring of Demultiplexer Terminals" on page 102*—an overview and more of special features for testing demultiplexers.

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If it has been installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial*.
If not, you can download it from the web through
http://www.agilent.com/find/81250demo

System Capabilities

The Agilent 81250 Parallel Bit Error Ratio Tester is first of all meant for testing high-speed data communication equipment (DCE), but can also be used as a multi-purpose digital stimulus/response (DSR) system.

The system can be operated from the graphical user interface or controlled via LAN or GPIB, for example in an automated test rack. It can also control other GPIB instruments. It has programming interfaces to VEE, C/C++, and others.

Verify and Characterize Digital Devices

The device under test (DUT) and its test setup are mirrored in the software.

The graphical user interface shows a raw DUT template in the Connection Editor window. In this window it is possible to define groups of signals for the DUT—these groups of signals are called "ports". The DUT template offers two types of ports:

- Data ports are used for data signals such as stimulus data and expected response data.
- Pulse ports are used for pure parametric signals such as clock signals.

All signal parameters can be set up conveniently for a group of pins (a port) as well as separately for single DUT pins (terminals).

The system has data generating and analyzing frontends.

Cable delays and signal skew in the test setup can be compensated by using the deskew feature.

Key Features

The following list summarizes the most important features:

- Stimulus as required, real-time error analysis and margin test.
- Parallel data rates of generator and analyzer channels up to 10.8 Gbit/s.
- Serial data rates up to 43.2 Gbit/s (ParBERT 43G).
- Up to 32 Mbit data memory per channel.
- Up to 128 generator/analyzer channels at 675 Mbit/s. Up to 64 channels at 1.35 or 2.7 Gbit/s. Up to 32 channels at 10.8 Gbit/s.
- 2 ps timing resolution.
- Logical XOR addition of two or four 675 MHz generator channels.
- Analog voltage addition of two 675 MHz generator channels.
- Pattern formats NRZ, DNRZ, RZ, R1.
- Pseudo random bit and word streams (PRBS/PRWS) up to $2^{15}-1$ plus $2^{23}-1$ and $2^{31}-1$.
- Automatic analyzer sampling delay adjustment.
- Sequencing with up to five loop levels (nested loops).
- Variable delay, width, transition times, voltage levels—individually adjustable for each frontend.
- Semi-automatic signal delay compensation (deskew).
- Event recognition and reactions upon events.
- Tabular and graphical result presentation.
- Automated measurements based on measuring the bit error rate at many points in time and voltage: Eye Opening, Fast Eye Mask, DUT Output Timing.
- Pass/fail measurements.
- Modular hardware structure—mix of low and high-speed channels.
- Frontends for differential and low voltage signals.
- Comprehensive support for testing multiplexers/demultiplexers—multiple frequencies, internal and external clocks, DEMUX rewiring, data deserialize and serialize functions.

For details please refer to the *Agilent 81250 Technical Specifications*.

System Components

The Agilent 81250 Parallel Bit Error Ratio Tester is available in several configurations.

Standard configurations include:

"Mainframes and Controllers" on page 32

"Modules" on page 35

"Frontends" on page 40

"Trigger Pod" on page 42

NOTE This section describes the basic components. For information on the ParBERT 43G systems please refer to *"ParBERT 43G Systems" on page 91*.

Mainframes and Controllers

An Agilent 81250 Parallel Bit Error Ratio Tester consists of a VXI mainframe, a controller, and modules plugged into the mainframe.

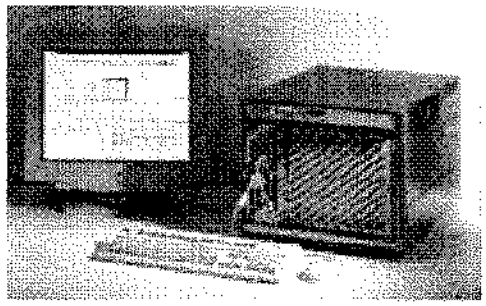


Figure 3 E4860A System Configuration

Mainframes

13-slot Mainframe

The standard mainframe is the E4803A VXI mainframe with 13 VXI slots.

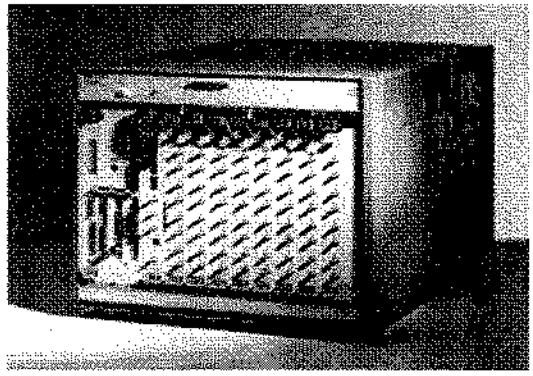


Figure 4 E4803A VXI Mainframe with Modules

Up to two expander frames can be added. An E4848B expander frame consists of an E8403A mainframe, two E1482B VXI bus extender modules, and connection cables.

The VXI bus extender modules require one slot in both the basic and the added frame. A second expander frame needs only one E1482B VXI bus extender module.

If an external controller is used (see *"Controller Options" on page 33*), the E8491B IEEE 1394 PC link to VXI replaces the VXI bus extender modules.

Controller Options

Two options are available for controlling the system:

External Controller

- The E8491B IEEE 1394 PC link to VXI (opt. #013)

  This option allows to use an external PC running under Windows NT or Windows 2000 as the system controller. The option includes a PCI board to be installed in the computer, a 1-slot VXI module to be installed in the mainframe, and all required software.

  Opt. #013 leaves 12 mainframe slots for modules.

Embedded Controller

- The built-in 2-slot VXI controller E9850A (opt. #012)

  This controller is a PC that includes harddisk, diskette drive, a serial and a parallel interface, SCSI controller, GPIB and LAN interface. Operating system and ParBERT software are readily installed.

  Opt. #012 leaves 11 mainframe slots for modules.

  A system with built-in controller requires a monitor, keyboard and mouse (Opt. #010).

Open VXI Configurations

The Agilent 81200 Data Generator/Analyzer Platform supports also Open VXI configurations. Open VXI enables you to set up your test equipment as compact as required.

As long as free slots are available, VXI modules of other systems can be plugged into the Agilent 81250 mainframe. You need only take care that the Agilent 81250 modules start from the leftmost slot and remain in contiguous slots. Additional software can be installed on the built-in harddisk or the external PC to operate these modules.

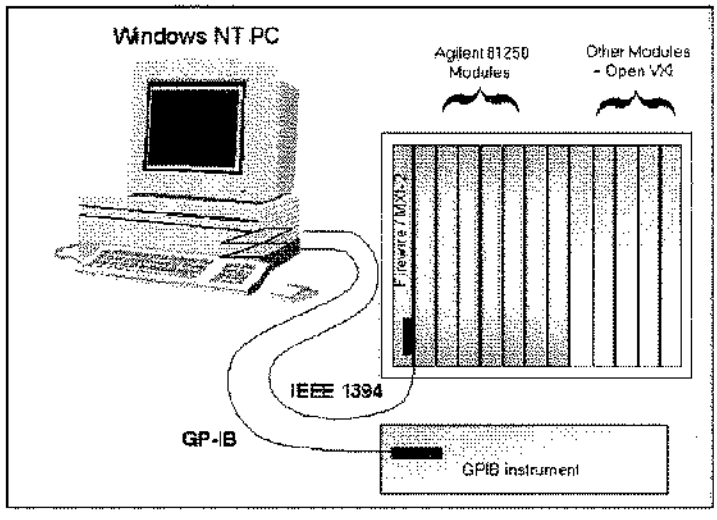


Figure 5 IEEE 1394 PC Link and Open VXI Configuration

For details please refer to the *Installation Guide* and the *Configuration Guide.*

Modules

An Agilent 81250 Parallel Bit Error Ratio Tester comprises at least one clock module and one data generator/analyzer module with frontends.

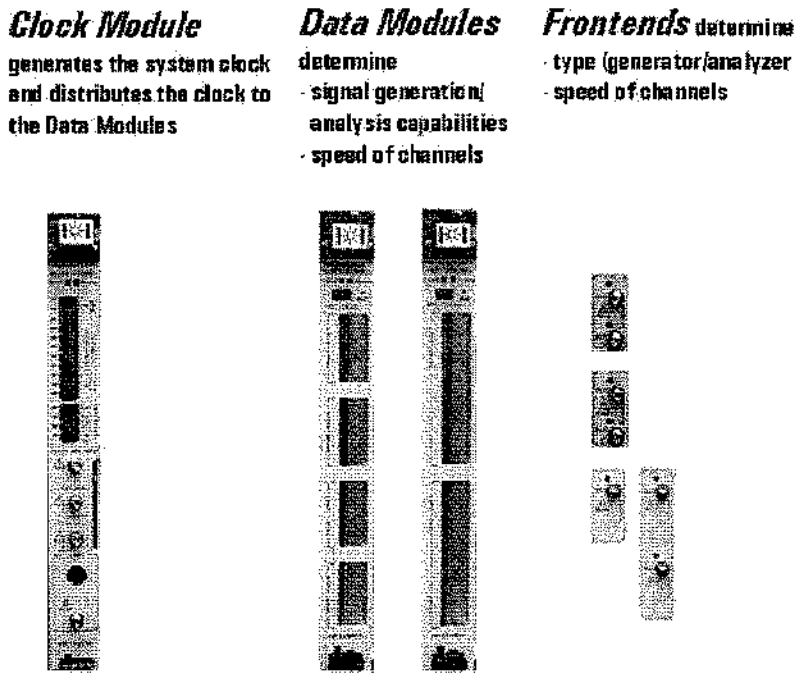


Figure 6 Modules and Frontends

Clock Modules

The master clock module generates the system clock and synchronizes all data generator and analyzer channels of a system.

The master clock module provides the sequencing capability of a system and can use either its internal synthesized clock source or an external clock source. The internal clock synthesis can be locked to a common frequency standard using the PLL reference input.

The following clock modules are supported:

E4805B Clock Module

- E4805B Clock Module

  This module synchronizes up to 11 data analyzer/generator modules. It can additionally control up to two slave clock modules. An expander frame requires a slave clock module.

  A deskew probe can be connected and the Agilent 81200 Trigger Pod can be attached to the master clock module.

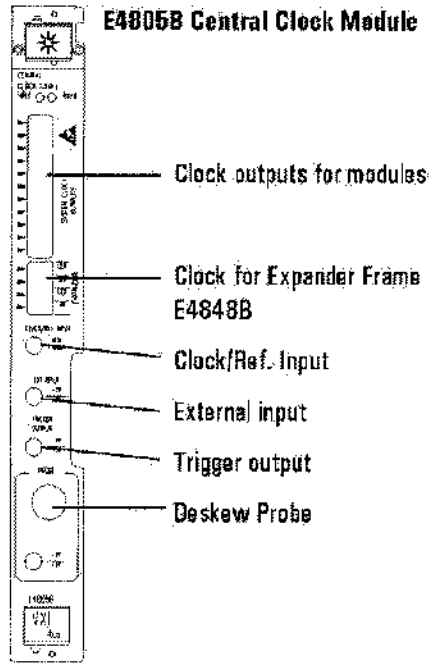


Figure 7 E4805B Clock Module

The E4805B clock module permits to use up to 5 loop levels within generated data sequences.

It is also possible to install two or more master clock modules in one mainframe. This results in mutually independent systems which share only the housing (see also *"Virtual Systems" on page 45*).

E4808A Clock Module

- E4808A High Performance Clock Module

This clock module has the same properties as the E4805B clock module, but superior jitter and noise characteristics.

It is required for the ParBERT 43G systems. It is also required for systems containing E4866A/E4867A 10.8 data generator/analyzer modules.

Data Generator/Analyzer Modules

A data generator/analyzer module houses 2 or 4 frontends. There are frontends for generating and sourcing signals to the DUT and others for capturing and analyzing signals from the DUT.

Any combination of generator and analyzer frontends within a module is possible. However, it is generally recommended to install the generator and analyzer frontends in separate modules. This supports the concept of grouping output and input signals into "ports" and generating or expecting pseudo random word stream signals (PRWS).

The following data generator/analyzer modules are used:

E4832A Module

- E4832A Data Generator/Analyzer Module (up to 675 MHz):

  This module provides four slots for four frontends, with one or two channels each.

  The E4832A module has a memory capacity of up to 2 Mbit per channel and supports Compare and Capture or Compare and Acquire Around Error tests at clock rates up to 675 MHz. It supports also the delay vernier that can be used for moving the sampling point of an analyzer.

E4861A Module

- E4861A Data Generator/Analyzer Module (up to 2.7 GHz):

  This module provides two slots for two frontends with maximum data rates of up to 1.35 Gbit/s or 2.7 Gbit/s. It supports also the delay vernier that can be used for moving the sampling point of an analyzer.

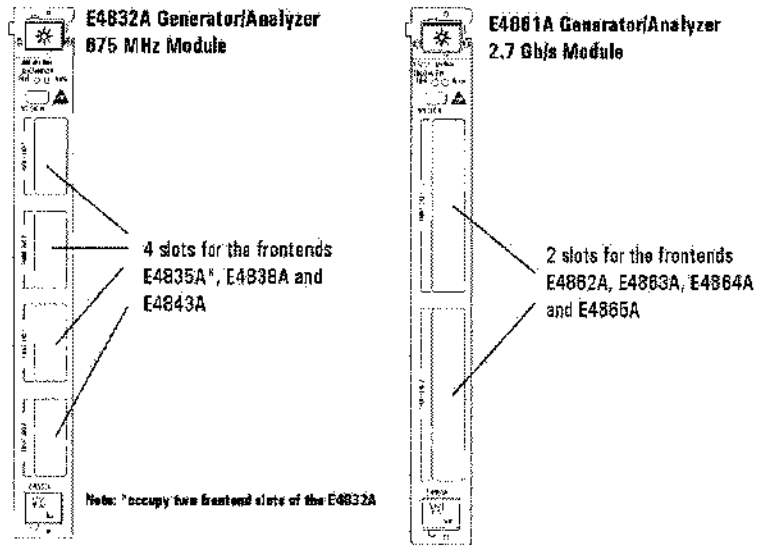


Figure 8 Data Generator/Analyzer Modules

NOTE Your system may include older data generator/analyzer modules, marked for frequencies of 1.33/2.67 GHz or 667 MHz. If this is the case, the achievable data rates are limited by the older modules. See also *"Hardware Enhancements" on page 24*.

E4866A/E4867A Modules

- These modules are capable of creating or analyzing data streams at 9.5 Gbit/s up to 10.8 Gbit/s. They are:
  - E4866A 10.8 Gbit/s data generator module
  - E4867A 10.8 Gbit/s data analyzer module

  They can only be used in conjunction with an E4808A clock module.

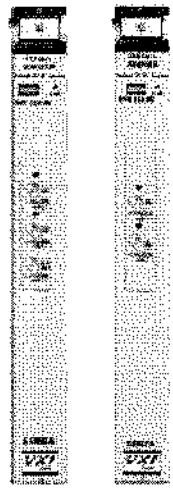


Figure 9 10.8 Gbit/s Data Generator/Analyzer Modules

These high-speed modules do not have frontends. Each has one pair of differential connectors which is identified by the software as one connector. For these modules, one channel means one module.

Both modules require a highly stable clock signal. If you are using an external source clock, make sure the clock source is stable enough to achieve a good jitter performance.

CLK OUT connector

The TRIGGER OUTPUT of an E4808A clock module is not stable enough to provide a suitable clock signal to a separate 10.8 G analyzer system.

For this purpose, the E4866A module has a CLK OUT connector. This connector provides a single-ended clock pulse of 9.5 GHz to 10.8 GHz which can be connected to the DUT or a separate analyzer system

(50 Ω impedance—for details see the *Agilent 81250 Technical Specifications*).

Note also, that unused CLK OUT connectors have to be terminated. A 50 Ω termination plug is delivered with the module. Signal performance degrades, if the CLK OUT connector is not properly terminated.

Special E4867A characteristics

The 10.8 Gbit/s analyzer E4867A has the block diagram shown below:

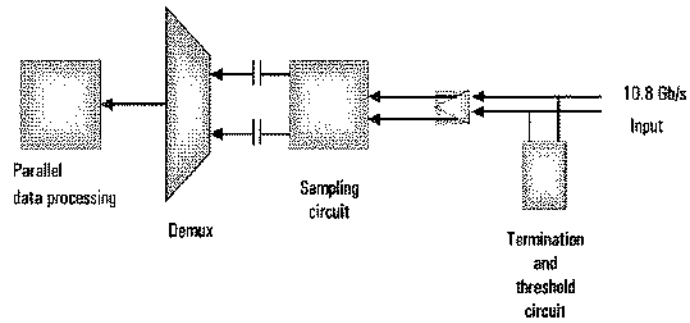


Figure 10 10.8 Gbit/s Data Analyzer Module Block Diagram

The E4867A has an internal AC coupling behind the sampling circuit. This is no problem for usual data communication, which is generally simulated using PRBS/PRWS.

However, when testing a device with the E4867A, long periods of zeros or ones have to be avoided.

The E4867A handles well:

- Pure PRBS
- Data that conforms to the following rule: On the average, the ratio of ones or zeros to the total number of bits must be within 9/19 and 11/19.
- Memory data with bursts of pure zeros or ones below 20,000 bits or 2 µs. On the average, the rule given above has to be observed.

After more than 2 us of non-activity, the module has to recover. This takes up to 200 µs. This happens each time a test is started.

TIP Consider this when setting up the test sequence:

- Enable automatic analyzer delay adjustment (see *"Automatic Delay Alignment" on page 77* and *"Automatic Bit Synchronization" on page 79*) and use suitable test data as described above. In this case, the settling time after starting the test is automatically considered.

- If automatic analyzer delay adjustment is not desired or possible, use an initialization block at the beginning of the sequence. This block must contain "balanced" data as described above and cover the settling time. At a data rate of 10 Gbit/s, at least 2 million bits should be generated and received.
- Ensure also that the data used for the test does not violate the limits stated above.

Frontends

The available frontends include data generator and data analyzer frontends.

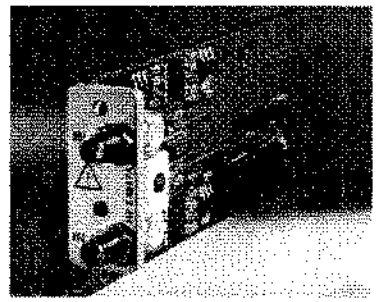


Figure 11 **Frontend With Two Connectors**

Note that the frontends have built-in protection circuits which automatically disconnect a frontend if an attempt is made to operate the frontend under intolerable conditions.

NOTE If this happens, the user interface is neither informed nor updated. In case of a problem, you should therefore always inspect the green LEDs above the frontend connectors. They clearly indicate the physical connection status.

Once the termination conditions have been corrected, the Connectors On/Off button of the toolbar can be used to re-establish the connection.

Generator Frontends

Generator Frontends for E4861A Modules

The generator frontends for the E4861A module are:

- E4862A, 2.7 GHz, differential output frontend
- E4864A, 1.35 GHz, differential output frontend

Generator Frontends for E4832A Modules

The generator frontends for the E4832A module are:

- E4838A, 675 MHz, differential output, low voltage amplitude/offset and variable slopes generator
- E4843A, 675 MHz, NRZ/RZ, differential output frontend

NOTE Your system may include older generator frontends, marked for frequencies of 2.67 GHz, 1.33 GHz, or 667 MHz. If this is the case, the achievable data rates are limited by the older frontends. See also *"Hardware Enhancements" on page 24*.

For details please refer to the *Agilent 81250 Technical Specifications*.

Analyzer Frontends

Analyzer Frontends for E4861A Modules

The analyzer frontends for the E4861A module are:

- E4863A, 2.7 Gsa/s, differential/single-ended input frontend
- E4865A, 1.35 Gsa/s, differential/single-ended input frontend

These analyzer frontends have an AUX OUT connector which provides the input signal as interpreted by the input comparator – either low or high.

This output can for example be used to synchronize a pure analyzing system. If the DUT (such as a deserializer or demultiplexer) generates a recovered clock, this clock signal may be fed into the frontend, and the AUX OUT signal can be used to provide the clock to the analyzing system via the EXT INPUT connector of the clock module.

Note that the AUX OUT connector has an internal impedance of 50 Ω which must be met by the receiver in order to achieve the specified characteristics. A termination voltage between 0 V and –2 V may be used. If these requirements are not met, the output is disabled.

See also *"How Do I Use the AUX OUT of E4863A/E4865A Frontends?" on page 354*.

Analyzer Frontends for E4832A Modules

The analyzer frontend for the E4832A module is:

- E4835A, 675 MSa/s, differential/single-ended input, high sensitivity analyzer

The E4835A frontends are always installed in pairs. Two E4835A frontends share a common memory plug-in and sequencer.

NOTE Your system may include older analyzer frontends, marked for frequencies of 2.67 GHz, 1.33 GHz, or 667 MHz. If this is the case, the achievable data rates are limited by the older frontends. See also *"Hardware Enhancements" on page 24*.

For details please refer to the *Agilent 81250 Technical Specifications*.

Trigger Pod

The Agilent 81200 Trigger Pod is an option of the E4805B or E4808A clock module. It can be used to detect external events and to react on them.

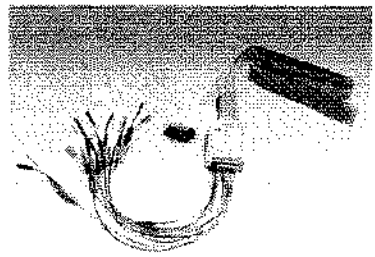


Figure 12 Agilent 81200 Trigger Pod

The ribbon cable has to be connected to the master clock module.

The Trigger Pod has 8 TTL compatible input lines (input threshold 1.5 V). The input lines are terminated by 4.7 kΩ pull-up resistors to +5 V.

Data acquisition and hence event recognition is triggered by the internal sequencer clock. The sequencer clock frequency is:

```
Sequ. clock = System clock frequency / Segment resolution
```

The maximum sequencer clock frequency is 42.188 MHz, corresponding to a period of 23.7 ns.

For technical details please refer to the *Agilent 81250 Technical Specifications*.

The input lines can be used to detect single, asynchronous events. If certain patterns (bit combinations) are to be detected, it is recommended to synchronize the incoming data with the system. This can be done by generating a clock signal at the TRIGGER OUTPUT of the clock module and applying that clock to the event source (see also *"How to Set the Characteristics of the Trigger Output" on page 167*).

Identification of Hardware Resources

The hardware resources pool is comparable to a traditional instrument. Here the instrument is seen as a collection of modules, which provide signal connectors.

An Agilent 81250 Parallel Bit Error Ratio Tester can consist of multiple **clockgroups**. Each clockgroup consists of **modules** which in turn have **connectors**.

The following figure illustrates the numbering system used to address the modules and connectors.

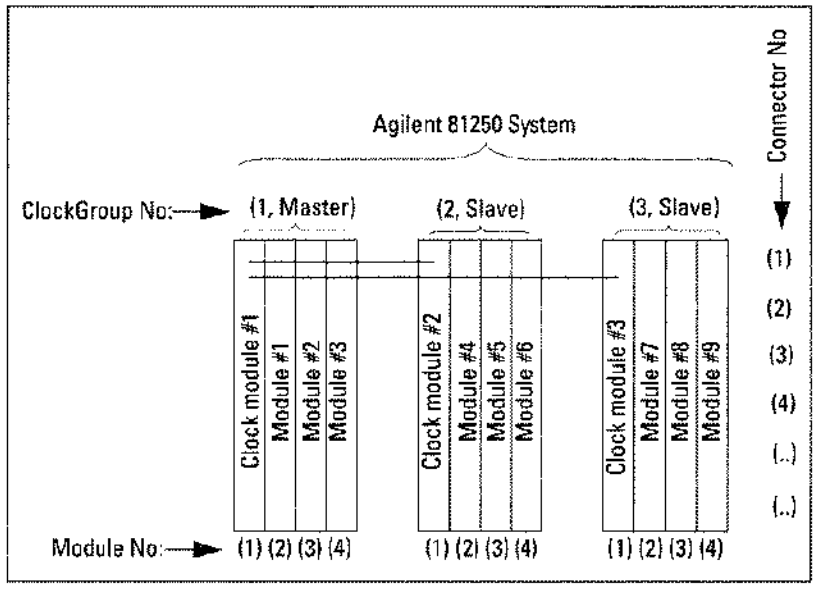


Figure 13 Numbering of Modules and Connectors Within One System

The identification of a generator or analyzer channel is:

Cx–My–Cz (ClockgroupNumber–ModuleNumber–ConnectorNumber), such as C1–M3–C5.

NOTE An Agilent 81250 Parallel Bit Error Ratio Tester can also house several systems. A **system** requires at least one independent master clock module and one or more data generator/analyzer modules.

Summary of Hardware-Related Terms

Module: One of the following:

- E4805B Central Clock Module
- E4808A Central Clock Module
- E4832A Data Generator/Analyzer Module
- E4861A Data Generator/Analyzer Module
- E4866A 10.8 Gbit/s Data Generator Module
- E4867A 10.8 Gbit/s Data Analyzer Module

Frontend: Generator or analyzer plug-in of a data generator/analyzer module.

Connector: An output or input connector of a frontend. Differential connectors are treated as one connector.

Channel: The circuitry behind a connector, which includes data generating or analyzing capabilities, data memory, frequency multiplexing and so on.

Trigger Pod: An option of the E4805B master clock module for detecting external events.

Master clock module: The clock module that controls clockgroup #1 of a system. It can additionally control up to two slave clock modules (clockgroup #2 and #3).

Applications above 2.7 Gbit/s require the E4808A High Performance Clock Module.

Clockgroup: The sum of modules connected to a single clock module.

ClockgroupNumber: Identifies the clock master (= 1) and up to two slaves (2 and 3).

ModuleNumber: Identifies the module within a clockgroup (1 to 11).

ConnectorNumber: Identifies the connector of a module and is counted from module top to bottom (1 to 4). Differential connectors are counted as one connector.

Operating Principles

The software of the Agilent 81250 Parallel Bit Error Ratio Tester is based on two concepts:

- The idea of **virtual systems**
- The idea of keeping **models** of the real world—a model of the present instrument configuration and a model of the DUT

This section explains the interdependencies and terms. See:

"Virtual Systems" on page 45

"Hardware and Setup Models" on page 47

"Software Structure" on page 49

Virtual Systems

A single Agilent 81250 system can comprise up to three clock modules in master-slave configuration. Such a configuration uses expander frames and has up to three clockgroups.

On the other hand, one mainframe can house several Agilent 81250 systems. They consist of *independent* clock modules with associated data generator/analyzer modules. Such a configuration makes it possible to test a device under asynchronous conditions using independent clock pulses.

The concept of the Agilent 81250 Parallel Bit Error Ratio Tester is to create so-called virtual systems from the system's present hardware resources (clock modules, data modules, generator and analyzer frontends).

The basic (default) system is called DSRA (DSR = digital stimulus and response, system A).

If the hardware comprises several independent clock modules—not connected as slaves—then additional systems are available. By default, they have ascending names, such as DSRB, DSRC, and so on.

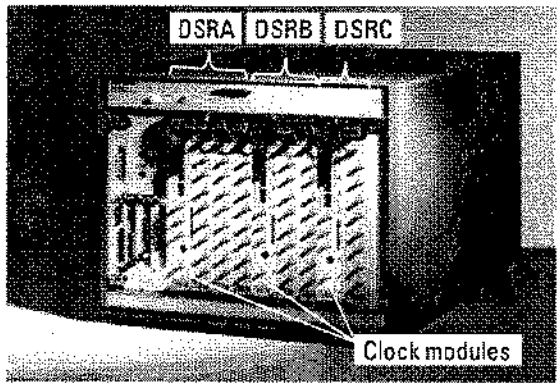


Figure 14 Virtual Systems in One Mainframe

Separate systems are widely used for testing multiplexers or demultiplexers. Such devices generally require different clock frequencies at the generating and analyzing sides. MUX/DEMUX tests can be performed by one system, if the ratio of these frequencies is 2^n, such as 2, 4, 8, 16, and so on. If it is not, separate data generating and data analyzing systems will do the job.

If the hardware has been changed by adding or removing modules or frontends, new virtual systems can be automatically created with the Agilent 81250 Configuration Tool (see also *"How to Set the Operating Mode" on page 117*).

The systems are identified in the file *dvtsys.txt*. By editing the *dvtsys.txt* file, they can be renamed. Their configurations are automatically detected and stored in the *dvtits.txt* configuration file.

NOTE The user interface and remote control commands enable you to load and operate any of the configured subsystems.

You can operate several virtual systems in parallel by starting the user interface more than once. Every user interface indicates the chosen system in the bottom line of the main window.

If the tester is operated remotely via SCPI commands, the system names are used to construct the **handles** for identifying the respective system.

Hardware and Setup Models

On power up, the system automatically checks and identifies the available modules and frontends. It creates an image of the system configuration and displays this image in the Connection Editor window.

The image of the DUT needs to be created. This can be done manually with the Connection Editor or by loading a stored setting.

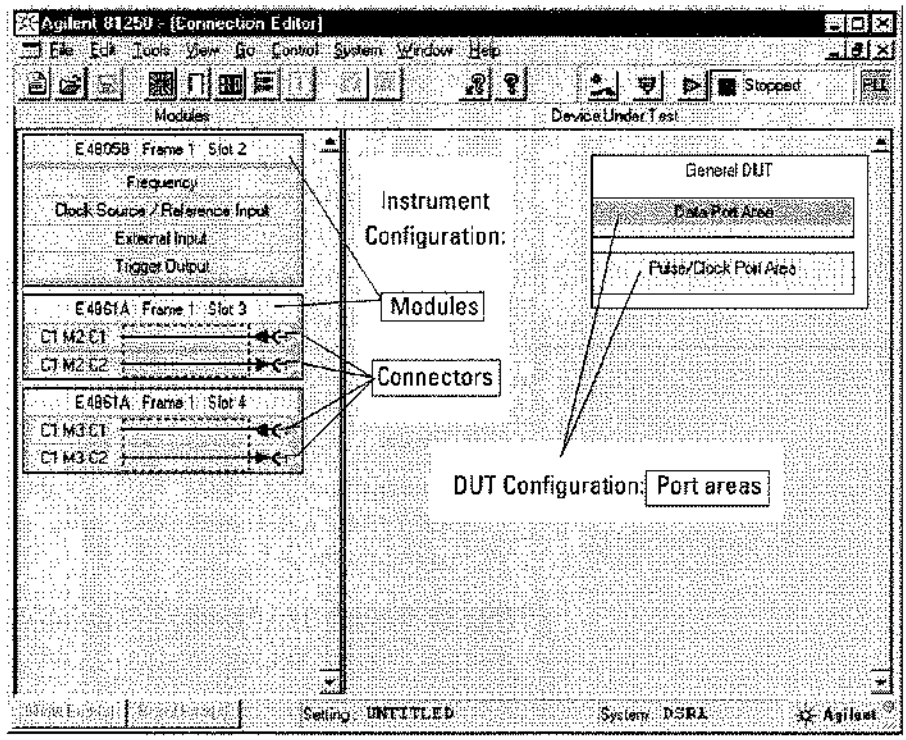


Figure 15 Connection Editor Window

System Configuration

The system configuration at the left-hand side of the Connection Editor window identifies all the available modules, frontends (there are generator and analyzer frontends), and frontend connectors.

Refer to *"Frontends" on page 40* for the available frontends.

A **connector** represents an output or input connector of the module. Differential connectors are treated as one connector.

A **channel** represents the circuitry behind a connector. It is identified by Cx–My–Cz (ClockgroupNumber–ModuleNumber–ConnectorNumber).

DUT Configuration

The image of the DUT is constructed from a template displayed on the right-hand side of the Connection Editor window. The Agilent 81250 system includes a general DUT template.

The general DUT template provides two types of **ports**:

- Data ports

  Data ports provide the ability to define data to be sent or analyzed. Data is handled in the form of segments. Two major data segment types are available: memory-based or PRBS/PRWS. Sequences of segments can be repeated or started upon events.

  A data port is usually an input or output bus, characterized by one common clock frequency.

- Pulse port

  Like traditional pulse generators, this port provides an easy way to have a pulse generated without the need to set up any data. The terminals of a pulse port can receive different clock signals.

Ports can be added for every group of pins with the same or similar behavior.

Ports consist of **terminals**. These are the DUT pins that must be physically connected to the connectors of the system's generator or analyzer channels.

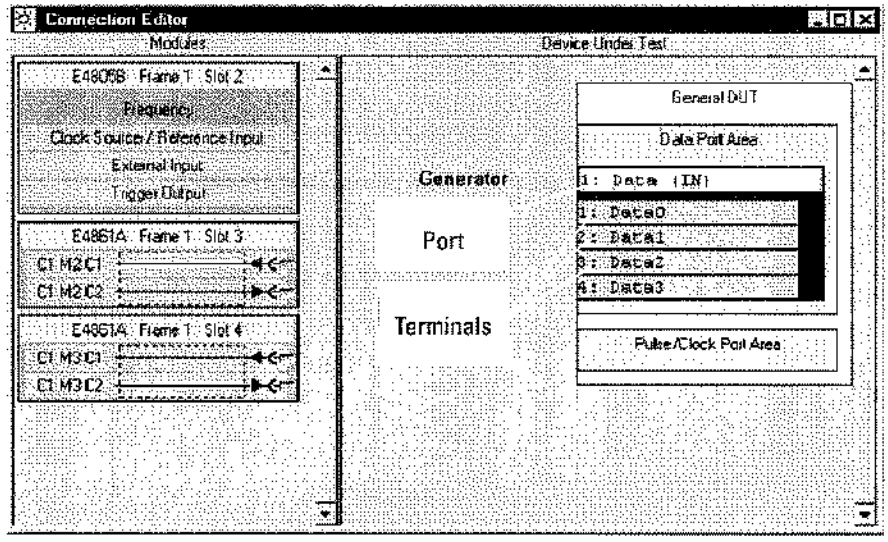


Figure 16 Display of Ports and Terminals

After the virtual DUT has been created and connected to the virtual system, signal parameters can be set, such as signal timings, voltages, signal termination characteristics, pulse delay, pulse width, and so on. Signal parameters may be set up globally for a whole port or individually for single terminals.

More complex signals can be produced by **digital addition** of two or four output channels. This allows to generate real-world signals with pulse displacement or width variation.

Another feature is **analog channel addition** which allows to generate signals with glitches, distorted transitions, and multiple levels.

Settings

The complete setup for a DUT including all parameters is called **setting**. Settings can be saved in the system's database. It is also possible to export/import a setting as a text file, either manually or under remote control.

Every saved setting can be reloaded at any time.

A setting also contains references to the signal patterns used for the test. These patterns are stored as segments. If a setting is exported to or imported from another system, the required segments have to be exported/imported as well. Therefore, all the segments required by a setting can be stored in a "local" segment pool which is associated with and only accessible from the setting.

NOTE Settings include the system configuration. Stored settings can therefore not be used on systems that do not provide the required hardware configuration.

Software Structure

The Agilent 81250 Parallel Bit Error Ratio Tester can be controlled from a variety of interfaces:

- Graphical user interface

  The graphical user interface allows to set up and execute device tests interactively using the keyboard and mouse.

- GPIB interface

  The GPIB interface allows remote control of the Agilent 81250 system via the General Purpose Instrument Bus interface.

- User-written programs

  The Agilent 81250 software provides application programming interfaces (APIs) for a couple of programming environments, such as Microsoft's C/C++, VisualBasic, Agilent's VEE, National Instruments' LabVIEW, and others.

- Local area network (LAN)

  The graphical user interface or user-written programs can be run on any Windows NT or Windows 2000 workstation. Once the Agilent 81250 ParBERT is connected to the LAN, its firmware server can be operated from any workstation via the LAN.

The software is based on a client-server architecture. All the interfaces communicate with the module firmware through one and the same software component—the **firmware server**.

The system can be remote-controlled via plug and play functions as illustrated below:

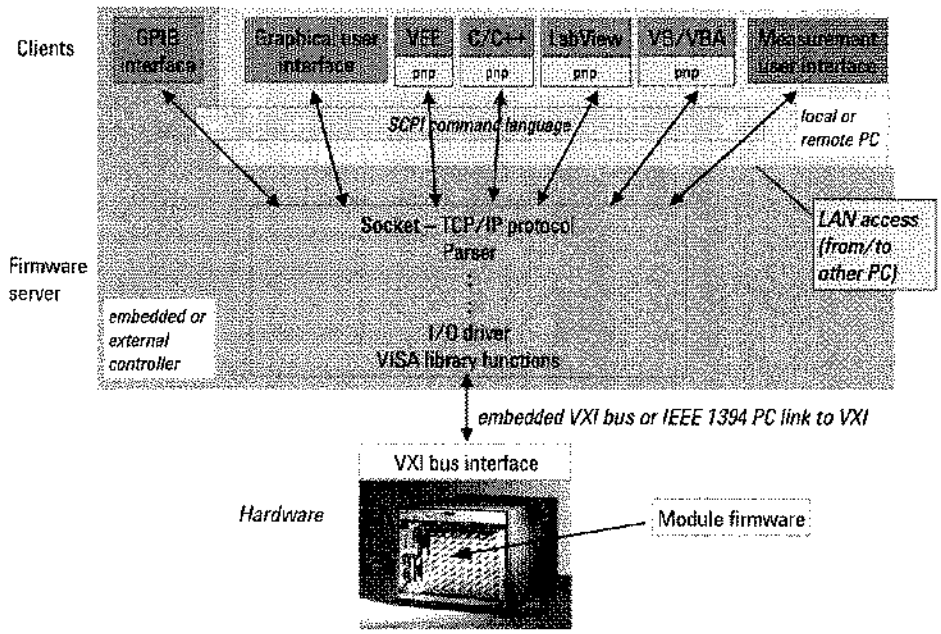


Figure 17 Remote Control Options

Plug and play functions The Agilent 81250 system software includes the Agilent 81200 plug and play (pnp) driver. The pnp functions can be called from a variety of programming environments, such as VEE, C/C++, VisualBasic, or others. VB/VBA, for example, is supported by Microsoft Excel or even Word. The Agilent 81200 pnp driver performs the protocol conversion to the SCPI command language.

GPIB access The system can also be controlled via the General Purpose Instrument Bus interface. This interface uses the SCPI command language.

The GPIB interface has to run on the same PC as the firmware server. All the other interfaces can also run on any suitable workstation of the LAN.

LAN access The built-in controller has a Local Area Network interface that can be accessed from any workstation. An 81250 user interface or a user-written program running on such a workstation can communicate with the firmware server running on the Agilent 81250 Parallel Bit Error Ratio Tester.

External controller The built-in controller can be replaced by an external PC using the IEEE 1394 PC link to VXI. In this case the firmware server runs on that PC.

Measurement Software The Agilent 81250 Measurement Software has been developed using the ActiveX concept of common, reusable software objects, generally called **ActiveX controls**. There are no SCPI commands that allow to control the measurements.

As the measurements are implemented as ActiveX controls—the measurement framework is just a "container"—the measurements can be easily imported into any program development environment that supports the component object model, such as Microsoft's Excel or Word.

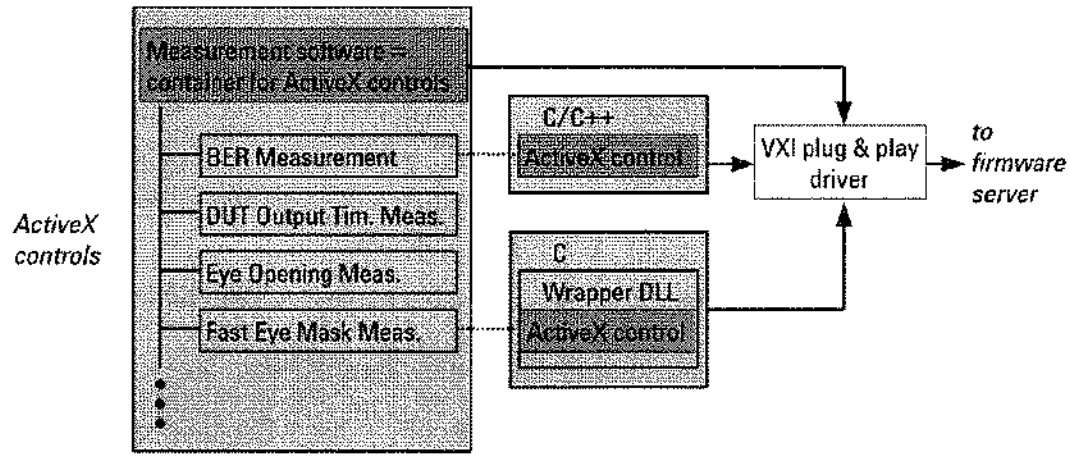


Figure 18 Measurement ActiveX Components

For compatibility reasons, the software provides also a Wrapper DLL. This library allows to embed ActiveX controls into pure C programs.

NOTE It is recommended to use the remote access generally via the plug and play functions. For the Agilent 81250 Measurement Software, no SCPI commands are provided.

SCPI command language All interfaces finally use an ASCII-driven serial interface protocol to communicate with the firmware server. The interface protocol is based on the SCPI command language.

In remote-controlled operation each virtual subsystem needs an individual handle so that the software knows which subsystem should receive the command for executing it. All SCPI commands and queries have to start with the subsystem's specific handle.

GPIB control By default, the GPIB interface is configured as a listener. If the Agilent 81250 system shall be used as a bus controller, the configuration has to be changed. For details see *Using the Agilent 81250 as a GPIB System Controller* in the *System Programming Guide and SCPI Reference*.

Summary of Setup-Related Terms

Port: A group of DUT input or output pins with identical or similar properties, such as a data or address bus.

Data port: A DUT port that receives or returns digital data.

Pulse port: A DUT port that receives parametric signals such as a clock pulse.

Terminal: A signal line assigned to a port (a DUT pin).

Setting: The complete setup for a DUT including all parameters and references to the test patterns (segments).

Handle: The identification of a subsystem, such as DSRA.

API: Application Programming Interface.

SCPI: Standard Command language for Programmable Instruments.

PNP: 81200 Plug and Play peripheral driver for VXI components.

BIOS: Basic I/O System—the microprocessor programs loaded into the modules' EEPROMs.

VISA: Virtual Instruments Software Architecture—a common standard of functional calls for controlling VXI-based instruments.

Agilent 81200 pnp driver: A plug and play driver for the 81200 platform based on the VISA standard.

ActiveX controls: Reusable software objects that can be pasted into many programming environments.

Timing Principles

Depending on the frontend it is possible to test devices at frequencies up to 2.7 GHz. Multiple frequencies and memory resolutions are achieved by multiplying the clock frequency. See:

"Choice of Clock Sources" on page 53

"Frequency Multiplier and Segment Resolution" on page 55

"Adding 675 Mbit/s Generator Signals" on page 60

"Signal Delay Compensation" on page 61

"Trigger-Controlled Start and Stop" on page 62

Choice of Clock Sources

The Agilent 81250 system has a built-in 10 MHz reference oscillator. But it can also be locked to an external clock source.

The external clock can be used to substitute the built-in reference. It can also be used to drive the system directly. It can be connected to the CLOCK/REF INPUT of the master clock module and set up with the Parameter Editor.

The Parameter Editor indicates the chosen clock source path as illustrated in the following figure.

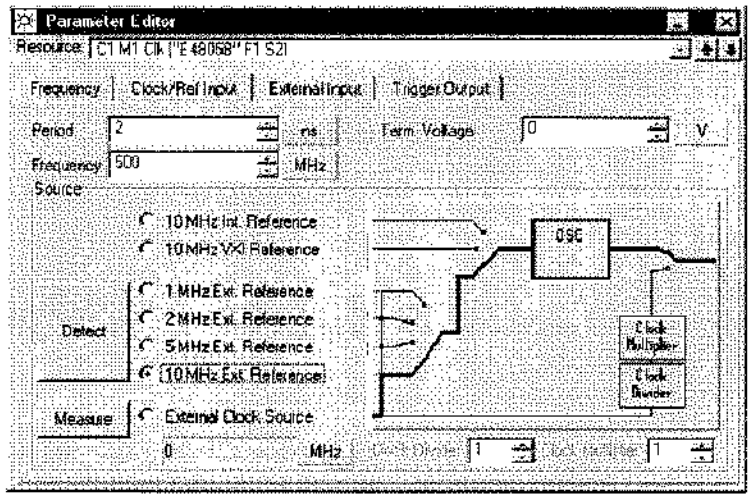


Figure 19 Clock /Reference Input Window

In this example, an external 10 MHz reference has been chosen.

You can see from the picture that the supported clock sources are grouped:

- Internal reference clock sources include the oscillator of the clock module and the VXI bus clock signal.
- External reference clock sources have to run at one of the supported clock frequencies.
- A completely independent external clock source can be applied, measured, and adjusted (multiplied/divided) for generating the system clock.

Independent from the clock source, the system can be started by an external signal applied to the EXT INPUT connector of the master clock module.

A system that contains only E4832A data generator/analyzer modules can also be stopped or gated (started and stopped) by an external signal.

For details see *"Setting Global System Parameters" on page 153.*

Frequency Multiplier and Segment Resolution

The internal data handling is based on words. The number of bits which are allocated to one word depends on the **segment resolution**.

Let us have a look at the architecture of a module and its frontends in order to understand the dependencies between

- the system clock frequency,
- the word length, and
- the available data memory,

The following figure illustrates the structure of a data generation channel of an E4861A module:

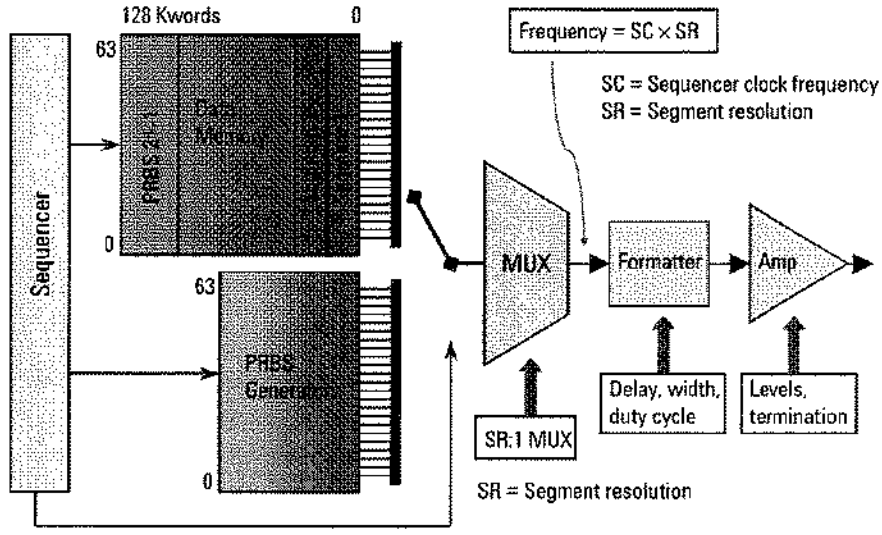


Figure 20 E4861A Hardware Architecture

Channel data memory Memorized data such as data segments or distorted PRBS is downloaded from the system controller and kept in the channel memory. The memory of an E4861A channel can hold 128 Kwords of 64 bits. The memory of an E4832A channel can hold 128 Kwords of 16 bits. The memory of an E4866A generator or E4867A analyzer module can hold 128 Kwords of 256 bits.

PRBS generator Pure PRBS/PRWS signals are generated by a hardware feedback shift register (see also *"Appendix B: PRBS/PRWS Data Segments" on page 357*).

Sequencer Both memory and PRBS generator are controlled and clocked by the built-in sequencer. The sequencer clock—generated and distributed by the master clock module of the system—has a maximum frequency of 42.1875 MHz.

Multiplexer Depending on the kind of data to be generated, either the memory or the PRBS generator is connected to a multiplexer. This multiplexer generates the data stream.

When you set a desired system clock frequency, then the sequencer clock is automatically adjusted so that the desired frequency is an integer multiple of the sequencer clock frequency.

This multiplexing factor determines the word length—the number of bits polled by the multiplexer—and hence the available memory capacity. It is called **segment resolution**.

NOTE There is one segment resolution with global scope. If the system generates multiple clock frequencies, then some ports or channels have individual segment resolutions.

Segment Resolution

The specified and generated data rate is:

```
System frequency = Sequencer clock frequency × Segment resolution
```

In case of a single frequency system, the segment resolution is the general segment resolution. In case of a system using multiple data rates, the segment resolution is the individual segment resolution of the channel.

If the segment resolution is lower than the maximum number of bits per word provided by a data generator/analyzer module, then the remaining bits are not used.

Segment resolution and memory depth The available frequencies and resolutions depend on the type of module and its frontends.

The E4832A module provides 128 K of 16-bit words of memory for each channel. Depending on how many bits are used, this results in 128 Kbit to 2 Mbit of usable memory.

If 16 bits are allocated to a word, it is possible to have signals with data rates up to 675 MHz and 2 Mbit data memory.

Table 1 Word Length, Memory Depth, and Frequency Range of an E4832A Module

Segment resolution (bits)	Max. memory depth (bits)	System clock frequency (Mbit/s)
1	131,008	≤ 42.1875
2	262,016	≤ 84.375
4	524,032	≤ 168.750
8	1,048,064	≤ 337.500
16	2,097,152	≤ 675.000

The E4861A module has a memory capacity of up to 8 MB per channel. Its minimum segment resolution is 16 bits (see the table below):

Table 2 Word Length, Memory Depth, and Frequency Range of an E4861A Module

Segment resolution (bits)	Max. memory depth (bits)	System clock frequency (Mbit/s)
16	2,097,152	333.334 to 675.000
32	4,194,304	≤ 1,350.000
64	8,388,608	≤ 2,700.000

Increasing the virtual memory

The desired system clock frequency determines the minimum segment resolution. As long as the segment resolution is less than 16 (or 64 for E4861A modules), it is possible to choose a higher general segment resolution. This increases the usable memory and simultaneously decreases the sequencer clock frequency.

NOTE For E4832A modules, the delay vernier and the functions for automatic analyzer sampling delay adjustment require that the minimum segment resolution of the desired system clock frequency is used.

The E4866A and E4867A modules have only one segment resolution:

Table 3 Word Length, Memory Depth, and Frequency Range of E4866A/E4867A Modules

Segment resolution (bits)	Max. memory depth (bits)	System clock frequency (Gbit/s)
256	33,554,432	9.5 to 10.8

Block length

The streams of generated or expected data are organized in blocks. Every block must contain a whole number of words. Therefore, the length of these blocks has to be a multiple of the segment resolution.

Multiple Frequencies and the Frequency Multiplier

The general segment resolution is a global system parameter. It determines the sequencer clock frequency.

FM factor and FMR

The data rate of individual channels or ports can be changed by changing the **frequency multiplier factor (FM factor)**.

The chosen FM factor for a port or channel determines not only its frequency but also the individual segment resolution of this port or channel. The individual segment resolution is

```
SR = General segment resolution × FM factor
```

Limitations:

```
For E4832A modules: 1 ≤ SR ≤ 16
For E4861A modules: 16 ≤ SR ≤ 64
```

The available multiplying factors are expressed by the **frequency multiplier range (FMR)**.

The system calculates the FMR of a channel automatically. The selection box provided for changing the FM factor offers only valid factors.

E4832A-Example

The following example refers to the E4832A module.

If the desired clock rate is 100 MHz, then the minimum segment resolution is 4, which leads to 512 Kbit memory depth and a frequency multiplier range of 1/4, 1/2, 1, 2, 4. That means, an individual channel can run at 25 MHz, 50 MHz, 100 MHz, 200 MHz, or 400 MHz.

Other possible segment resolutions for this clock rate are:

- 8, which leads to 1 Mbit memory depth and FMR = 1/8, 1/4, 1/2, 1, 2.
- 16, which leads to 2 Mbit memory depth, FMR = 1/16, 1/8, 1/4, 1/2, 1.

The relations are shown in the table below:.

Table 4 Matrix of Segment Resolution, FMR, Memory Depth and Clock Frequency

Segment Resolution	Frequency Multiplier Range[a]	Memory Depth[b]	Channel Clock Frequency
1 bit (=1)	1, 2, 4, 8, 16	128 Kbit	≤ 42.1875 MHz
2 bits (=2)	1/2, 1, 2, 4, 8	256 Kbit	≤ 84.375 MHz
4 bits (=4)	1/4, 1/2, 1, 2, 4	512 Kbit	≤ 168.75 MHz
8 bits (=8)	1/8, 1/4, 1/2, 1, 2	1 Mbit	≤ 337.5 MHz
16 bits (=16)	1/16, 1/8, 1/4, 1/2, 1	2 Mbit	≤ 675 MHz

[a] This is the range of multiples and fractions that can be used at individual connectors. If you have most of your signals at 40 MHz and your pattern lengths are less then 64 Kbit, then you can choose segment resolution 1. You have the chance to set individual connectors to a multiple of this general setting. For example, selecting 16 as the multiply factor for a connector gives you 1 Mbit memory depth and 640 MHz with a segment resolution of 16.

[b] Subtract 32 x segment resolution, as this memory space is occupied by a 2^5-1 PRxS and the sequencing initialization.

If, for example, most of the signals are at 200 MHz, then the available segment resolutions are either 8 or 16.

If you have chosen 8 as the general segment resolution, then each data port and each terminal of a pulse port can be set individually to frequencies of 1/8, 1/4, 1/2, 1 or 2 times the system clock frequency.

NOTE If the frequency multiplying factor is changed for individual ports or channels, then the frequency, word length, and memory depth also change for these connectors.

Mixing Low and High Speed Modules

The data generator/analyzer modules E4832A and E4861A have one frequency range in common: 333.334 MHz to 675 MHz.

If a system contains a mixture of E4832A and E4861A modules and the system clock frequency is set to a value within this range, then a general segment resolution of 16 is automatically set and used on all channels.

If a lower system clock frequency is set, then the frequencies of the high-speed channels are automatically multiplied. This is done by setting the frequency multiplier to a value higher than one.

The FM factor is chosen such that the high-speed channels operate with their minimum segment resolution, which is 16 for an E4861A module.

Example If a system clock frequency of 125 MHz has been chosen, then the minimum segment resolution for the E4832A modules is 4 (see also the table *"Word Length, Memory Depth, and Frequency Range of an E4832A Module" on page 57*). This is automatically set as the general segment resolution.

The frequency multipliers of the E4861A module channels are set to 4, resulting in individual segment resolutions of 16 and a channel frequency of 500 MHz.

For details see *"How to Use Multiple Frequencies" on page 158.*

Adding 675 Mbit/s Generator Signals

The outputs of 675 Mbit/s generator frontends can be digitally added. This allows to generate signals with varying pulse widths. It allows also to generate signals with data rates above 675 Mbit/s even with low-speed frontends.

The output of an E4838A generator frontend can also be added in analog mode to the output of the generator above. This allows to generate signals with spikes or multiple levels.

Digital Channel Addition

Two or four channels can be digitally added. The digital channel addition is an XOR addition (exclusive OR or modulo 2 addition). The addition takes place before levels are applied to the signals.

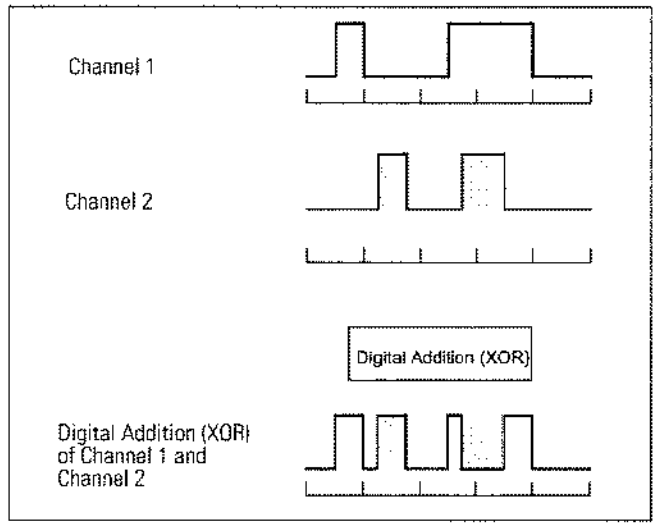
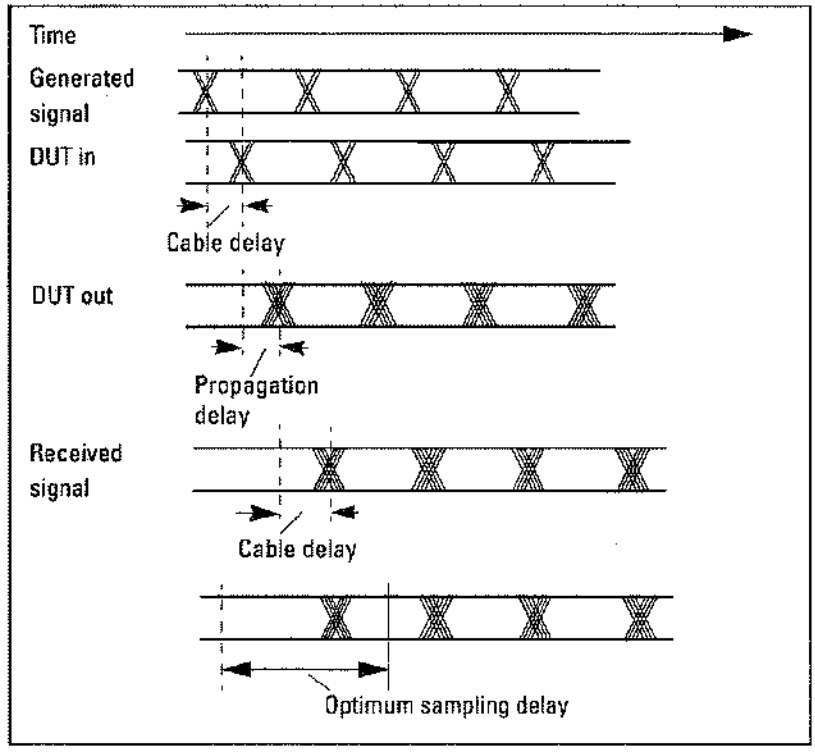


Figure 21 Digital Channel Addition

For details see *"How to Combine Generator Channels" on page 206.*

The various kinds of signal delay are illustrated in the figure below.



The procedures are menu driven and semi-automatic. For details see *"How to Compensate for Internal and External Delays" on page 308*.

Negative Delay

Apart from aligning signals it may be interesting and important to have some signals applied in advance to other signals.

Therefore the Agilent 81250 system provides the option to set a general time offset for all connectors, so that individual ones can be set to negative delays and hence start earlier than others.

The delay offset feature can be used in setup and hold time measurements. For details see *"How to Set the General System Frequency" on page 156*.

Trigger-Controlled Start and Stop

The EXT INPUT of the master clock module can be used to start the timing system of the Agilent 81250. The state of this input is sampled once every system period. If the system does not contain an E4861A module, this input can also be used to stop the system.

Summary of Timing-Related Terms

Segment resolution: The length of a data word. Range: 1 to 16 bits for E4832A modules, 16, 32, or 64 bits for E4861A modules. The minimum segment resolution depends on the chosen system clock frequency.

FM factor: Frequency Multiplier factor. The individual factor by which a channel or port frequency differs from the system clock frequency. Choices are restricted by the FMR.

FMR: Frequency Multiplier Range. The available factors for multiplying the system clock frequency. The actual range depends on the segment resolution and the type of module.

Block: A portion of a test sequence which references segments that define generated or expected data. A block refers to all data ports. Its length has to be a multiple of the segment resolution.

Digital channel addition: Exclusive OR (modulo 2) addition of two or four signal generator channels of one 675 Gbit/s data module.

Analog channel addition: Voltage addition of two signal generator channels of one 675 Gbit/s data module. Requires at least one E4838A frontend.

EXT INPUT: A connector of the clock module. It allows to start/stop the system by an external signal.

CLOCK/REF INPUT: A connector of the clock module. It allows to connect an external clock source.

Data Generation Principles

Once the general signal parameters have been set, the patterns of the data to be generated or expected can be defined. See:

"Emulate Real Pattern and Waveform Conditions" on page 65

"Data Sequences" on page 66

"Data Blocks" on page 67

"Data Segments" on page 67

"Properties of Real Segments" on page 69

"Loops" on page 71

"Hardware Dependencies" on page 72

Emulate Real Pattern and Waveform Conditions

Data patterns can be stored in the system database and output as part of a sequence with or without algorithmic data. A PRBS, for example, is algorithmic data.

Data segments

Data patterns for the signals sourced to or expected from the DUT can easily be set up in terms of data **segments** that span across several output or input connectors of the Agilent 81250 system.

Captured data or data produced by a simulation can be imported as an ASCII text file.

The Agilent 81250 system can be used to stimulate communication devices using its sequencing capability.

Packets or cells consisting of payload and control data can be produced by creating control segments and using a PRBS segment for the payload. Cell/packet sizes can be varied and control segments can be stored in the database and used in any number of different packets. A PRBS pattern may be used as the payload to test error rates. Intermittent data with long dead-times between bursts can easily be produced using the pause segment.

For testing multiplexers/demultiplexers it is possible to set up PRWS data and compare segments. Also, it is possible to run different ports at different frequencies.

Data sequence

The overall stream of generated and expected data is called a **sequence**. The Sequence Editor defines the structure of the data streams sent to or expected by the Agilent 81250 system.

NOTE A sequence includes all data ports of the device under test. It does not include pulse ports.

Data Sequences

A sequence specifies which data segments are generated or expected, on which ports, and in which timely order.

For details see *"Creating the Stream of Generated and Expected Data" on page 215.*

Data blocks A sequence consists of **blocks**. Loops are also part of a sequence.

Sequences are independent of data. This is achieved by defining the data to be generated or expected with the Segment Editor or externally as vectors in a text file and referencing these segments in the sequence blocks individually for each data port.

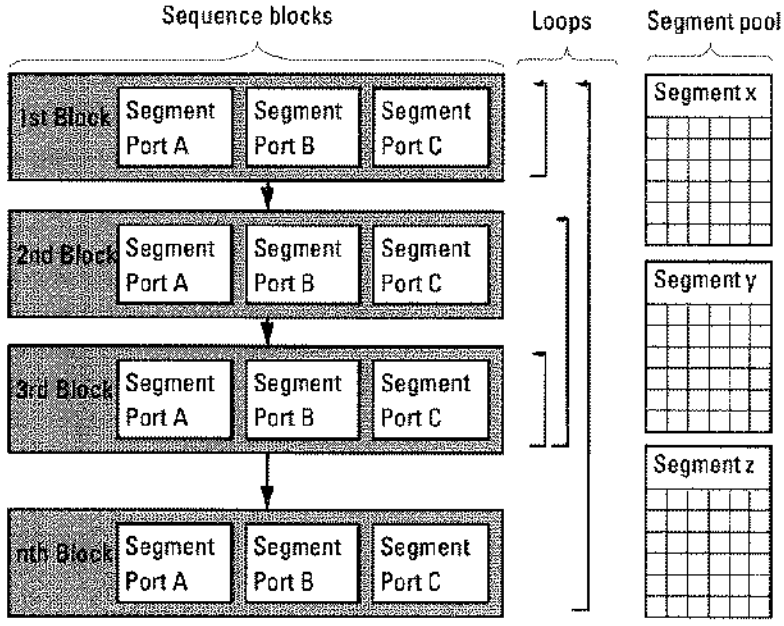


Figure 23 Sequence and Segments

Every block can reference an arbitrary segment for every data port.

Data Blocks

Blocks are portions of the sequence. A block spans across all data ports. For details see *"Contents of the Detail Mode Sequence Editor Window" on page 236*.

Every block references a **segment** for each DUT data port (not pulse ports). The segments contain the patterns of generated and expected data.

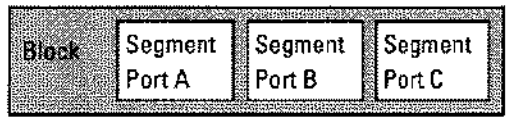


Figure 24 Block Structure

NOTE Segments are not included into but only referenced by the blocks.

The length of a block must be a multiple of the segment resolution.

Single, several or all blocks may be repeated a specified number of times or perpetually.

Such loops have an impact on the minimum blocklength and the allowed number of blocks (see *"Hardware Dependencies" on page 72*).

Trigger pulses can be specified to be generated at the beginning of a block and output by the TRIGGER OUTPUT connector of the master clock module. If certain **events** have been detected while a block is executed, actions can be performed immediately or at the end of the block. See *"Usage of Events" on page 89*.

A single block can also be used for synchronizing the analyzer frontends with the incoming data stream. See *"Principles of Analyzer Sampling Point Adjustment" on page 73*.

Data Segments

Segments can be freely created. A segment has a width and a length. The width defines the number of parallel signal lines (traces). The length defines the number of data words (vectors). The length of a segment must not remain under the length of the block into which it is going to be inserted.

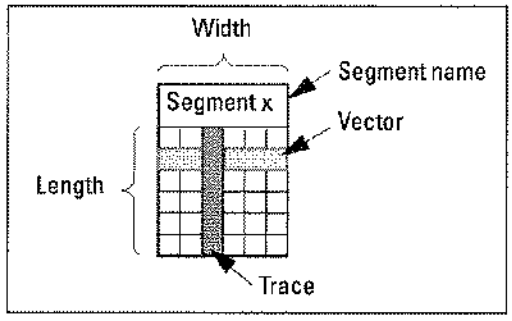


Figure 25 Segment Structure

Segments can be created separately or while editing the sequence. A segment may be larger than the block that references it.

If an existing segment is referenced by a block, the width of the port and the length of the block are automatically considered. Segment data that does not fit into the current block is ignored.

Segment Types There are real segments and pseudo segments.

- Real segments contain either free programmable memorized data, or the specification of PRBS or PRWS data.
- Pseudo segments are commands, such as Pause, Don't care, Expect 0, Acquire, and so on. A pseudo segment consumes only one word of channel memory if it is used on all channels of a module.

New segments are created with the Segment Editor or can be imported from vector-formatted text files.

Segment Pools Segments are stored in a segment pool, which is part of the system database. There is one segment pool with global scope and one segment pool per setting with local scope.

- Segments in the local segment pools can only be accessed if the appropriate setting is loaded.
- Segments in the global segment pool can be accessed from any setting.

Using the "local" segment pool makes it easy to export all the segments required by the current setting if the setting is going to be exported to another system.

Properties of Real Segments

We distinguish between memory segments and PRBS/PRWS segments.

- PRBS/PRWS segments are defined by the polynomial they are calculated from. The width of a PRWS segment (the number of bits per word) is automatically adjusted to the width of the port to which it is assigned (the number of terminals).
- Memory segments consist of vectors and traces. A **vector** specifies all the parallel bits of a port. The serial bit stream of a terminal line is called **trace**.

Data Memory Usage

To understand the data memory consumption of a sequence it is best to think in data words. A word of an E4832A module consists of 1 to 16 bits, depending on the general segment resolution and the frequency multiplier setting of the specific channel. A word of an E4861A module consists of 16 to 64 bits. A word of an E4866A or E4867A module consists of 256 bits.

- One word is reserved for internal use.
- A pure PRBS/PRWS segment does not consume memory. Pure PRBS/PRWS segments are directly generated by the built-in shift registers of these modules.
- A distorted PRBS/PRWS segment is produced by the software and downloaded. It is treated like a memory-type segment. It consumes as many words as its polynomial says. A distorted $2^{15}-1$ PRBS, for example, consumes 32767 words. Due to memory constraints, distorted PRBS/PRWS are not available for the polynomials $2^{23}-1$ and $2^{31}-1$.
- Even if you don't use a distorted PRBS, there is a 2^5-1 PRBS allocated internally, which means 31 words are allocated.
- A pseudo segment (Pause0/1, for example) consumes 1 word, if such a segment is used simultaneously at all channels of the module.
- The remaining memory is used for the programmable memory-type data segments.

Segment Type Combinations

The various data generator/analyzer modules have different capabilities.

E4832A Module The E4832A data generator/analyzer module has two sequencers, one for the upper two frontends and one for the lower two frontends. It can simultaneously execute memory type segments on one pair of frontends and pure PRBS/PRWS segments on the other pair of frontends.

PRBS/PRWS can be combined with Pause0/1, Expected0/1, or Don't Care.

E4861A Module The E4861A data generator/analyzer module has one sequencer for each of the two frontends. It can execute memory type segments and pure PRBS/PRWS segments in parallel.

Data to Connector Assignment

The algorithm of how the available segment data is assigned to the connectors is as follows:

- The first terminal within a port gets trace 0, the second gets trace 1 and so on.

  The assignment to the connectors depends on what connections you have selected from the terminals to the connectors in the Connection Editor.

- If a terminal is connected to a connector where channels are added, the connector that holds the connection gets the first trace. An added channel gets the next trace.

  In this case an exception to the rule "from top to bottom" is made. Added channels are assigned from bottom to top.

Loops

Loops are used to repeat data blocks. For details see *"How to Create and Change Loops" on page 245*.

Looping Example

A sequence looping infinitely 1 Kbit portions of a $2^{15}-1$ PRBS followed by a pause of 64 bits might look as follows:

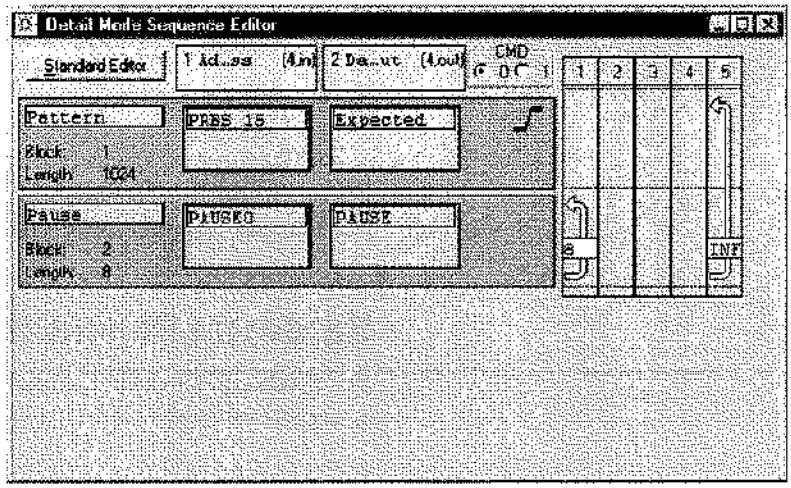


Figure 26 Simple Test Sequence With Loops

Here the pause is created by looping eight bits eight times.

If you had chosen a memory-type segment in block one, this segment would start from the beginning with every loop. If the segment is larger than the portion used in the sequence, then there is data that is never generated in this sequence.

However, this is different when looping blocks with PRBS/PRWS segments.

Looping Blocks With PRBS/PRWS Segments

If you do not use the complete PRxS you have chosen for your application but are looping it, then with each new loop cycle the next portion of the PRxS is used, when the looping is going on.

It can happen that the next portion is the rest of the PRxS and a bit of the beginning. The portioning of the PRxS will go on as long as the looping lasts.

The data representation in the channel memory—in case a distorted 2^{15}–1 PRBS was chosen—and the data stream output of one connector may look as follows:

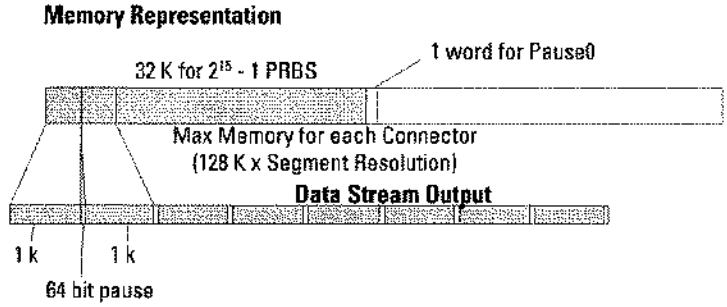


Figure 27 PRBS Memory Representation and Generated Data Stream

Hardware Dependencies

The number of blocks and loops that can be used depends on the selected sequencer type (incorporated in the clock module).

Generating Loops With the Clock Module

The E4805B and the E4808A clock module provide:

- 4 counted loop levels (1 performed by the data module, 3 by the clock module).
- Loop counts may be up to 2^{20}. Note that for loop level 1 there is a restriction:

  `LoopCount1 × (blocklength / segment resolution)` $\leq 2^{20}$.

  If this restriction is not met, the loop level 1 can not be used. In this case the looping has to be performed on a higher loop level.
- 1 infinite loop in level 5
- Number of blocks + number of loops on level 1 must be ≤ 60.
- Number of blocks + number of loops on levels 2, 3, or 4 must be ≤ 60.
- Minimum blocklength:
  - segment resolution, if no counted loop is used.
  - 2 × segment resolution, if one loop is starting on level 1, 2, 3, or 4.
  - 4 × segment resolution, if two loops are starting on level 2, 3, or 4.
  - 5 × segment resolution, if loops are starting on level 2, 3, and 4.

Summary of Data-Related Terms

Sequence: The overall stream of generated and expected data, formed by sequence blocks.

Block: A portion of a test sequence which references segments that define generated and expected data. A block refers to all data ports. Its length has to be a multiple of the segment resolution. Single blocks and groups of blocks can be repeated (loops). A trigger pulse can be issued at the beginning of a block.

Segment: Contains the data to be generated or expected: A certain pattern, PRBS, or PRWS. PRxS means algorithmic data. A pattern consists of vectors and traces.

PRBS/PRWS: Pseudo Random Bit/Word data Stream.

Vector: Specifies all the parallel, simultaneous bits of a port within a segment.

Trace: Specifies the serial data transmitted to or expected from a terminal.

Principles of Analyzer Sampling Point Adjustment

The proper comparison of received data with expected data requires that the analyzer captures the incoming data at the right point in time.

That means first of all that the analyzing frontends have to be triggered by a suitable clock frequency.

The sampling frequency may be an issue. Received data usually arrives with the frequency of the stimulating signal or an integer multiple or fraction thereof.

Frequency relations of 2^n If the analyzer sampling frequency is a 2^n-multiple or fraction of the system clock frequency, this can often be handled within one system. The frequency multiplier provides adequate choices for setting the frequencies of individual ports and channels.

Frequency relations not 2^n

If the sampling frequency is not a 2^n-multiple or fraction of the system frequency (such as 3, 5, 6, 7, 9, and so on), then systems with independent clock modules have to be installed.

They can reside in one and the same mainframe, but if they are to be operated manually, you have to start the user interface individually for each system.

Synchronizing separate systems

Separated generating and analyzing systems and the DUT can be frequency-synchronized to one clock source. The clock source can be the built-in oscillator of the master clock module, an external reference, or even an external source.

For adjusting the sampling start delay and phase, the Agilent 81250 Parallel Bit Error Ratio Tester offers three methods. These methods allow to set the delay before the measurement starts as well as to determine and set the optimum sampling delay automatically.

For details see:

"Manual Analyzer Sampling Delay Adjustment" on page 75

"Automatic Delay Alignment" on page 77

"Automatic Bit Synchronization" on page 79

The automated methods require a special synchronization block within the test sequence. This block should be the first block that specifies expected data.

The synchronization block may be preceded by Pause blocks. Such blocks can be used for establishing a certain delay before the synchronization starts. A delay may be required for giving a PLL time to settle. If the synchronization block is embedded somewhere in a sequence, it should be labeled "START" because the sequence execution begins with the START block.

The synchronization block is automatically repeated until the synchronization criteria are met. The sequencer continues after the analyzers are synchronized.

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial*.

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo
  In the *Tutorial*, select *"Analyzer Sampling Point Adjustment"*.

Manual Analyzer Sampling Delay Adjustment

For every analyzer channel, the Parameter Editor allows to specify the start delay between the start of the system clock (usually the start of the generators) and the start of the analyzer. The start delay can be specified as a certain amount of time plus a multiple or fraction of a clock period.

If one of these parameter is changed while a test is running, the test is aborted and restarted.

The analyzer frontends are also supported by a delay vernier. This vernier, implemented as a slider in the Parameter Editor, allows to shift the analyzer sampling delay by up to ±1 clock periods without interrupting a running test.

For E4832A data generator/analyzer modules, the delay vernier requires that the minimum segment resolution is set.

In the user interface, the timing setup looks as follows:

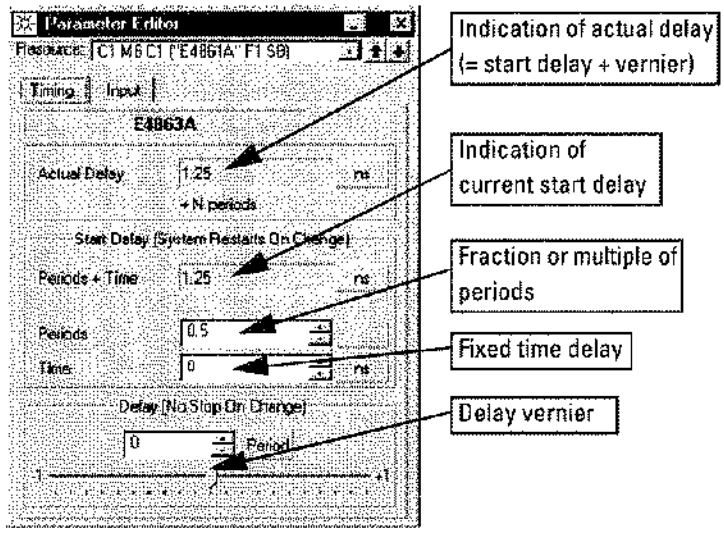


Figure 28 Timing Parameters for a Data Analyzer Frontend

How the Manual Delay Adjustment Works

Manual delay adjustment works as illustrated in the following figure:

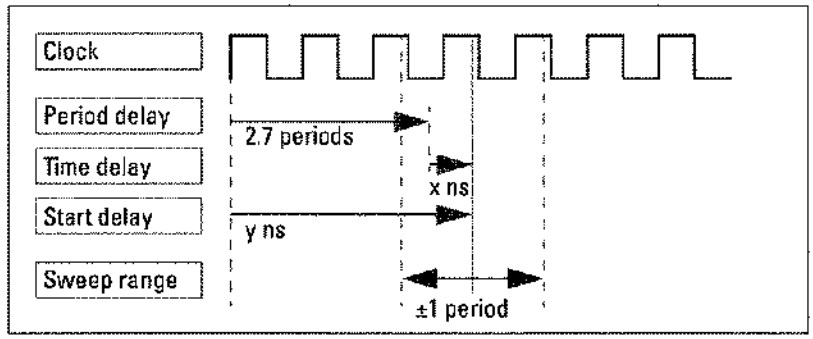


Figure 29 Analyzer Start Delay and Manual Delay Sweep Range

The start delay is composed of period delay and time delay. This delay is used as long as the delay vernier is in zero position.

When the sampling point is moved by means of the delay vernier while a bit error rate (BER) test is running, the BER changes. By observing the actual BER you can thus measure the eye opening of the received signal.

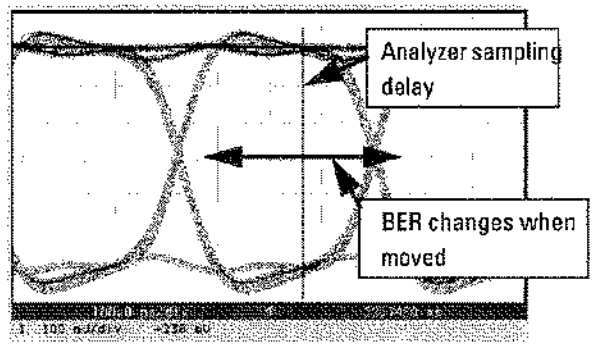


Figure 30 Eye Diagram of a 2.6 GHz Signal

The Parameter Editor always indicates the current delay. Once the width of the eye opening is known, the analyzer sampling delay can be put into optimum position which is in the middle.

Automatic Delay Alignment

Automatic Delay Alignment is used if the expected signal propagation delay can be coarsely specified. The same data must be generated and expected within one sequence block. Memory-based or PRBS data can be used.

How Automatic Delay Alignment Works

The analyzer subtracts a few nanoseconds from the specified start delay and then searches for a sampling point at which bit recognition has an adequate, adjustable accuracy. This accuracy is defined by a bit error rate threshold.

For an E4832A data generator/analyzer module, the search range is limited to ±50 ns from the start delay. For an E4861A module the search range is limited to ±10 ns.

As soon as the measured BER is below the threshold, the analyzer begins optimizing the sampling delay.

If during the whole search range the measured BER is higher than the threshold, then the BER counter of this analyzer becomes disabled. This means, a subsequent BER test shows no results for this channel.

The test does not continue unless all analyzers have reported synchronization pass or fail results.

Sampling delay optimization

For optimizing the sampling delay, the analyzer shifts the sampling point in steps and measures the BER at each step. The number and hence the width of these steps is adjustable. It is called **phase accuracy**. The analyzer thus measures the width of the eye diagram and finally positions the sampling point at the optimum which is in the middle. The duration and precision of this optimization depend on the chosen phase accuracy.

If the delay vernier is not in zero position, its setting is now added to or subtracted from the optimum sampling delay.

The whole process is illustrated in the following figure:

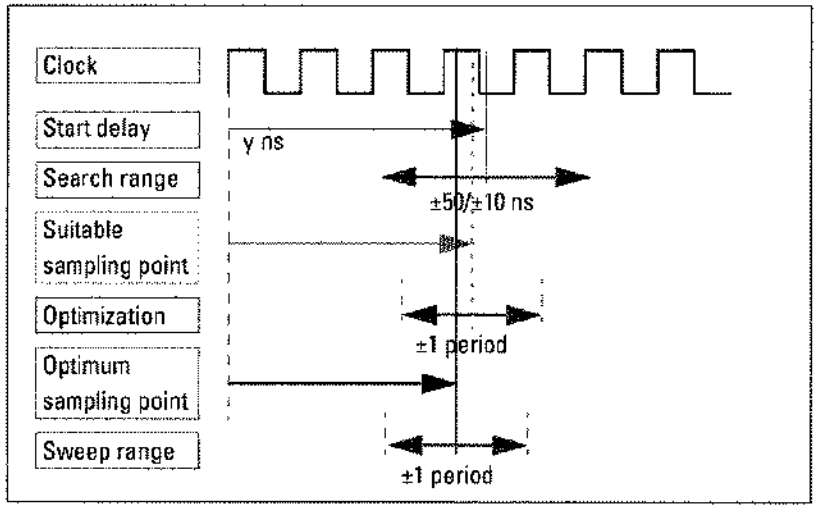


Figure 31 Automatic Analyzer Delay Alignment Process

Auto Delay Alignment result The resulting absolute delay since starting the test is indicated in the Parameter Editor window of the DUT output port or analyzer frontend (see figure *"Timing Parameters for a Data Analyzer Frontend" on page 75*).

Once the delay has been found, the delay vernier allows to shift the analyzer sampling point by up to ±1 clock periods while the test is running.

NOTE If you intend to perform measurements after Automatic Analyzer Delay Alignment using the Agilent 81250 Measurement Software, the delay vernier has to be kept in zero position.

Automatic Delay Alignment Flow Control

The flow of Automatic Delay Alignment is illustrated in the figure below:

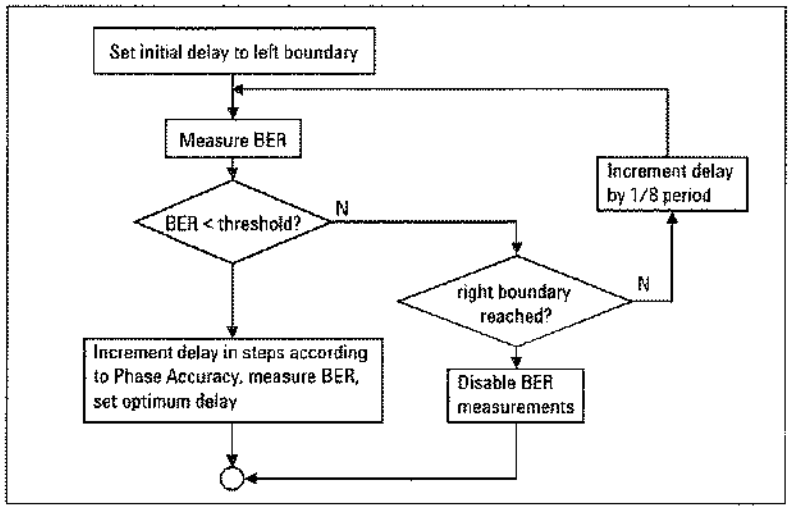


Figure 32 Automatic Analyzer Delay Alignment Flow Control

Automatic Bit Synchronization

Automatic Bit Synchronization is used to align the incoming data pattern with the expected pattern. This procedure differs from Automatic Delay Alignment as it considers only the phase shift between the analyzer clock and the received data.

Automatic Bit Synchronization offers the option to enable or disable Automatic Phase Alignment:

- Automatic Bit Synchronization without Automatic Phase Alignment is used if the total delay from test start is unknown but a certain edge delay relative to the analyzer clock is expected.
- Automatic Bit Synchronization with Automatic Phase Alignment is used if the delay is completely unknown.

How Automatic Bit Synchronization Works

The analyzer uses the start delay that has been specified with the Parameter Editor to determine the sampling point in relation to its clock. It calculates the sampling point position as "start delay modulo periods". That means, if the start delay includes a number of full periods, these periods are ignored.

The analyzer then samples the incoming data until the incoming data matches the expected pattern with an adequate, adjustable accuracy. This accuracy is defined by a bit error rate threshold.

In order to minimize the time needed for synchronization, the algorithm takes the kind of expected data—PRBS or memory—into account.

Once the desired accuracy is reached, then the incoming bits are aligned with the expected bits—the analyzer is synchronized with the incoming data.

Auto Bit Sync with Auto Phase Alignment

If Automatic Phase Alignment is enabled, then the analyzer fully automatically adjusts itself to capture the incoming data at the optimum sampling delay.

The analyzer measures the width of the eye diagram and positions the sampling point at the optimum which is in the middle. Actually, the same optimization procedure as for Automatic Delay Alignment is used.

If the delay vernier is not in zero position, its setting is now added to or subtracted from the optimum sampling point.

The process is illustrated in the following figure:

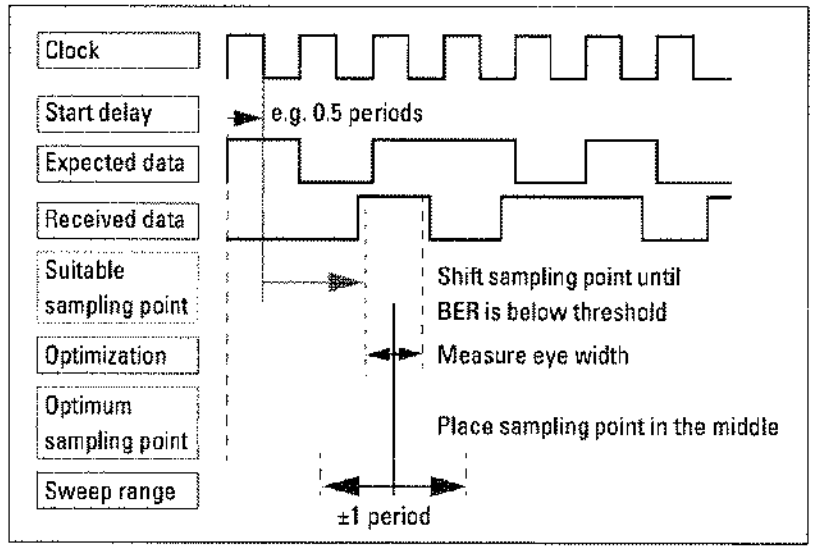


Figure 33 Automatic Bit Synchronization Process

Auto Bit Sync result

The delay found by Automatic Bit Synchronization is indicated by the Parameter Editor (see figure *"Timing Parameters for a Data Analyzer Frontend" on page 75*). This delay is relative to the analyzer's sampling clock. It does not report the absolute delay that would be required between the start of the generator and the analyzer for capturing a complete pattern.

Once the analyzer has been synchronized, the delay vernier allows to shift the analyzer sampling point by up to ±1 clock periods while the test is running.

NOTE If you intend to perform measurements after Automatic Bit Synchronization using the Agilent 81250 Measurement Software, you should enable Automatic Phase Alignment. The measurements require that the delay vernier is in zero position.

Synchronization data requirements

Pseudo random data can be sent and expected within one sequence block. A pure analyzing system may also expect memory-type data. Memory data cannot be used for Automatic Bit Synchronization on a single system that generates *and* analyzes data.

The reason is that Automatic Bit Synchronization works differently for PRBS and memory-type data.

The following figure shows the building blocks of an analyzer channel:

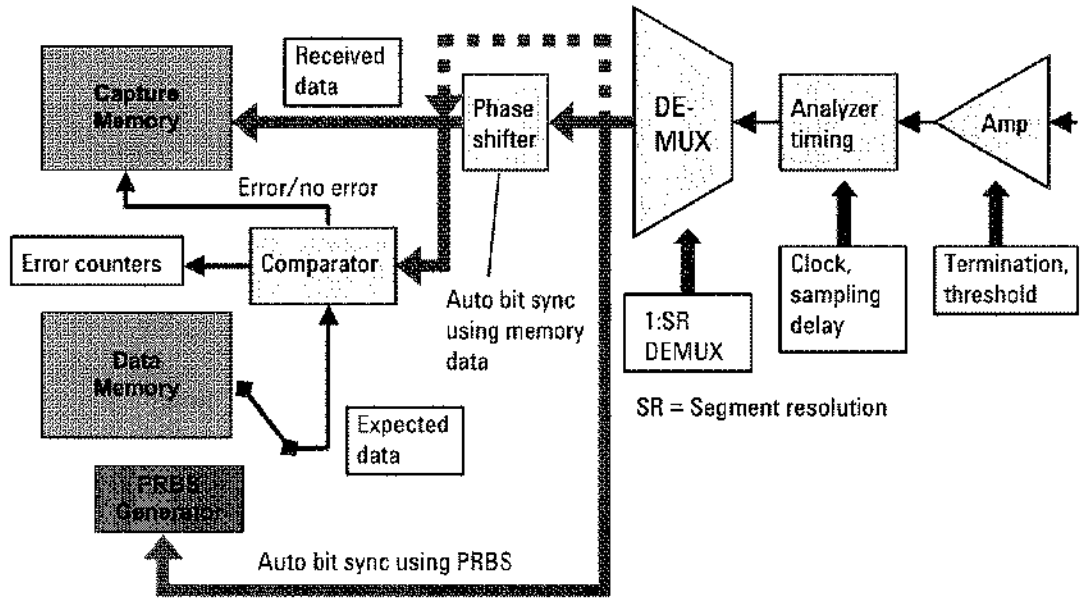


Figure 34 Hardware Architecture of an Analyzer Channel

For synchronizing on pure PRBS data, the built-in PRBS shift register generates the expected data. Note that a distorted PRBS is memory-type data.

For synchronizing on memory-type data, a dedicated phase shifter is used. It is bypassed if pure PRBS data is used for the synchronization.

NOTE Due to the different hardware paths used for the synchronization, it is not possible to synchronize on PRBS data and then analyze memory data.

If the test sequence contains a mixture of PRBS and memory data and Automatic Bit Synchronization is used, then the synchronization block must contain memory data. This, in turn, is only possible on a pure analyzing system.

Auto Bit Synchronization Using PRBS Data

The flow of Automatic Bit Synchronization using pure PRBS data is illustrated in the figure below:

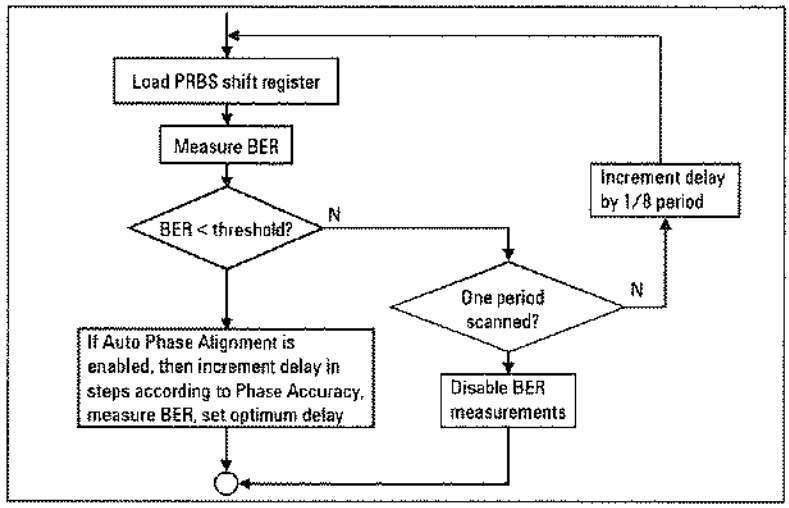


Figure 35 Automatic Bit Synchronization Using PRBS Data

The PRBS feedback shift register is preloaded by the setting. If the output of the shift register does not match the incoming data, the delay is incremented, and the shift register is loaded with n bits of the incoming 2^n–1 PRBS data. After loading the shift register, the expected data should match the incoming data, because identical shift registers are used on the generating and analyzing side.

If during a whole period the measured BER is still higher than the threshold, then the BER counter of this analyzer becomes disabled. This means, a subsequent BER test shows no results for this channel.

Auto Bit Synchronization Using Memory Data

Automatic Bit Synchronization on memory-type data can only be performed on an analyzer system that is independent from the generator system.

If memory-type data is used for Automatic Bit Synchronization, the first 48 expected bits of each analyzer channel have to be unequivocal. That means, this 48-bit word must not appear twice in the segment that is used for synchronization. It must not consist of only zeros or ones, but it may include don't care bits.

The minimum length of the synchronization block is 32 words which means *32 × segment resolution* bits.

NOTE A distorted PRBS can be used for Automatic Bit Synchronization. This is memory-type data that requires a block length of 2^n-1 words or $(2^n-1) \times$ *segment resolution* bits. This length ensures that every repetition of the block contains the same data.

If a data *port* is being synchronized, then all the detect words of all channels must be found within ±5 times the port's segment resolution. For example, if the segment resolution is 16, this range is ±80 bits.

Comparison of the Methods

Considering the test duration, manual adjustment of the analyzer sampling delay is the fastest method. When a test is started, all analyzers of the port are already in position.

If the necessary delay is unknown, this can be determined by an initial test using Automatic Delay Alignment.

However, the manual adjustment is only useful for devices with uniform delay at all output terminals.

Each of the two other methods, Automatic Delay Alignment and Automatic Bit Synchronization, has its advantages.

Table 5 Comparison of the Automatic Synchronization Methods

	Automatic Delay Alignment	Automatic Bit Synchronization
Sampling point find range:	±50/±10 ns, depending on type of module	unlimited
Delay after synchronization:	absolute delay	uncertainty of n periods
Sync data limitations:	none	Memory-based sync data requires: – two systems – first 48 bits unique – min. block length 32 x segment res. Mixed PRBS & memory test patterns require a memory-type sync segment
Synchronization speed:	slower	faster
Working with other PRBS generators:	no	yes

NOTE When testing a demultiplexer with memory-based data, demultiplexer rewiring should be used. For details see *"Automatic Rewiring of Demultiplexer Terminals" on page 102.*

Summary of Synchronization-Related Terms

Start delay: Analyzer sampling delay setting with Parameter Editor.

Delay vernier: A slider provided by the Parameter Editor for analyzer frontends plugged into a data generator/analyzer module.

Automatic Delay Alignment: Analyzer sampling point optimization if time window is known. Sets and shows the full delay since start.

Automatic Bit Synchronization: Analyzer sampling phase adjustment based on the BER. Sets and shows the phase delay with respect to the analyzer clock.

Data Capturing and Analysis Principles

The system provides four test and measurement modes. Tests can be preceded by a synchronization procedure during which the analyzer frontends optimize the position of the sampling delay.

See:

"Functional Tests" on page 85

"Error Analysis and Marginal Tests" on page 87

"Display of Test Results" on page 87

Functional Tests

The functional tests are chosen from the Measurement Configuration window. For details see *"Choosing the Kind of Measurement" on page 211*.

Figure 36 **Measurement Configuration Window**

The functional tests include:

Capture Data In capture mode, the analyzer frontends capture data until the sequence expires or their memory is filled. The result can be reviewed in a state list and also graphically. Depending on the data generator/analyzer module and the segment resolution, an analyzer can capture up to 2 or up to 8 Mbit of data.

Bit Error Rate Measurement

The Bit Error Rate Measurement scans the received data in real time and shows the resulting actual and accumulated number of bits, the actual and accumulated number of errors, and the actual and accumulated bit error rate. The display is updated approximately every second.

Compare and Acquire Around Error

The Compare and Acquire around Error mode compares and acquires data in real time. The memory capacity in words/channel and the number of bits per word depend on the type of module and the chosen segment resolution or frequency multiplying factor, respectively.

Table 6 Capture Memory

	E4832A	E4861A	E4862A/E4867A
Storage capacity:	128 K words	128 K words	128 K words
Bits/word:	1 to 16	16 to 64	256

If an error occurs, it is possible to define when the system should stop after the occurrence of the error.

If the system includes E4832A modules, then the minimum value to stop is 976; if E4861A modules are present, the minimum is 3904.

The maximum number is the usable memory, calculated as:

```
Memory (bits) = Storage capacity x Segment resolution
```

The captured data including the errors can be viewed as an Error State list and also graphically with the Waveform Viewer.

It is possible to load expected data segments which have been captured from a reference device or imported from a simulation.

Compare and Capture

The Compare and Capture mode compares and acquires data in real time. It continues until the sequence expires or the Stop button is pressed.

This mode is first of all intended to be used with event handling where the reaction on an error is specified within the sequence.

You can view the result in the Error State Display where errors are highlighted, and also graphically with the Waveform Viewer.

Error Analysis and Marginal Tests

A device can be stimulated with arbitrary input signals using the variable pulse parameters provided by the Agilent 81250 system. These functions are provided by the 675 MHz module and its generator frontends.

Parameters such as levels, delay, and width can be varied independently for each channel or for a DUT port as a whole.

Distorted signals as well as glitches and pulse delay variations can be emulated using the digital channel addition capabilities of the Agilent 81250 system. Up to four channels can be added to emulate a real-time pulse delay variation with up to four phases.

E4838A generator frontends are additionally supported by the analog channel add function which allows to generate signals with overshot and ringing.

For details see *"How to Set Up a DUT Input Port or Generator Channel" on page 192.*

Display of Test Results

Depending on the chosen measurement, several displays are available. For BER tests, use the BER window:

- The Bit Error Rate window shows the current and accumulated results and is continually updated.

Captured data and the results of real-time compare tests can be investigated with the Error State Display and the Waveform Viewer.

- The Error State Display shows the captured data and errors in tabular form. Auxiliary functions are provided that support quick navigation.
- The Waveform Viewer shows the captured data and errors in graphical form. It provides waveform selection as well as markers and zoom for precise waveform analysis.

For details see *"Viewing Generated and Captured Data" on page 295.*

Summary of Analysis-Related Terms

BER: Bit Error Rate. The number of errored bits divided by the number of received bits.

Error State Display: Shows captured data and errors in tabular form.

Waveform Viewer: Shows generated and captured data as well as errors in graphical form. Allows to investigate phase relationships.

Capture Data In capture mode, the analyzer frontends capture data until the sequence expires or their memory is filled.

Compare and Capture The Compare and Capture mode compares and acquires data in real time. It continues until the sequence expires or the Stop button is pressed.

Compare and Acquire Around Error The Compare and Acquire around Error mode compares and acquires data in real time. If an error occurs, it is possible to define when the system should stop after the occurrence of the error.

Event Handling Principles

The Agilent 81250 system can detect a variety of events and react on events.

The reaction may simply be a trigger pulse at the TRIGGER OUTPUT of the clock module, but can also be a change of the test sequence. See:

"Usage of Events" on page 89

"What is an Event?" on page 90

"Actions Upon an Event" on page 90

Usage of Events

The system provides several ways to react on events:

- Stop and go:

  This is useful for production tests, where data is sourced to the DUT, a measurement is performed with other equipment, the next data pattern is sourced, and so on.

- Block switching:

  The data sequence is no longer fixed. Based on certain events, certain portions of the overall sequence can be executed.

  This has the advantage that one and the same sequence can be created and downloaded once and then used for several tests. There is no need for re-programming the system.

- Trigger external devices:

  The event can generate a trigger signal at the TRIGGER OUTPUT of the clock module. This can be used to trigger an external instrument like a sampling oscilloscope or logic analyzer to sample the data at an error location.

- Bolt on:

  The Agilent 81250 system can be integrated into a large IC test system. The IC tester would issue a trigger to start the Agilent 81250 system for a special measurement. The Agilent 81250 system would perform the test and return pass/fail information that can be examined and evaluated by the IC tester.

- Match loop:

  PLL-based devices typically require an initialization segment that has to be repeated until the device is synchronized. The event that controls repetition would be "an error occurred".

For setup examples see *"How Do I Use Events?" on page 334*.

What is an Event?

An Agilent 81250 system equipped with the Agilent E4805B clock module has a whole bunch of options. It can react on:

- any bit combination of the 8-bit trigger pod (see *"Trigger Pod" on page 42*)
- any bit stream error detected by one of the analyzer frontends
- the status of the VXI ECL trigger lines T0 and T1
- an event triggering command issued locally or remotely

Ten events can be defined—five for immediate actions and five for deferred actions.

Events Causing Immediate Action

Actions on such events occur immediately (although there is an internal delay). They can be used to launch a trigger or to abort the test, for example.

Events Causing Deferred Action

Actions on such events occur at the end of the current sequence block. If the events come asynchronously, this feature ensures that the current block is properly executed and terminated.

These events are associated with priorities. Event number 5 has the highest priority, event number 1 the lowest.

NOTE Events for immediate action override events for deferred action.

Actions Upon an Event

If an event occurs, the system provides the following options:

- Go to:

  Goes to a certain block in the overall sequence and executes that block. The block is identified by its block label. The implicit "End" block (which is automatically assigned and does not need to be defined) terminates the sequence and hence the test.

- Trigger:

  Launches a trigger pulse to the TRIGGER OUTPUT of the central clock module.

- VXI-T01:

  Sets the VXI ECL trigger lines T0 and T1 to 01, 10, or 11.

All these options can be freely combined.

Summary of Event-Related Terms

Event: A signal that must be responded to.

Event causing deferred action: An event that causes an action at the end of the currently executed sequence block.

Event causing immediate action: An event that is serviced as fast as possible, without waiting for the end of the currently executed sequence block.

Action upon an event: Any combination of the following:

- Go to sequence block.
- Set the TRIGGER OUTPUT of the central clock module.
- Set the VXI ECL T0/T1 trigger lines.

ParBERT 43G Systems

The Agilent 81250 ParBERT 43G is a solution for generating and analyzing electrical data streams of 38 Gbit/s up to 43.2 Gbit/s.

It allows you to stimulate and analyze 16:1 multiplexers and 1:16 demultiplexers at data rates of 2.7 Gbit/s and 43.2 Gbit/s, according to the OC-768 and SFI-5 (SERDES Framer Interface 5) data range.

A ParBERT 43G error detector system allows you to determine the bit error rate of transmission lines or serial devices operated at 43.2 Gbit/s. It supports the investigation of FEC devices at 43.01841 Gbit/s including the FEC rate resulting from 255/236 overhead.

Using a ParBERT 43G pattern generator system, you can send a serial bit stream of up to 43.2 Gbit/s to an OC-768 demultiplexer component. Using four E4867A data analyzer modules, it is possible to analyze the parallel output of a 1:4 demultiplexer.

For data generation, sixteen 2.7 Gbit/s data generators are multiplexed to create a 43.2 Gbit/s data stream. On the analyzing side, a 43.2 Gbit/s data stream is demultiplexed and fed into sixteen 2.7 Gbit/s data analyzers.

The data streams to be generated or expected, as well as the signal frequencies and levels, are controlled by the ParBERT user software.

See:

"ParBERT 43G Components" on page 92

"ParBERT 43G Configurations" on page 94

"ParBERT 43G Software Support" on page 95

ParBERT 43G Components

Two preconfigured bundles are available for the most common 43.2 Gbit/s applications:

- Agilent E4894A 43.2 Gbit/s pattern generator bundle
- Agilent E4895A 43.2 Gbit/s error detector bundle

The bundles require an external PC as the system controller. This PC is not included.

43.2 Gbit/s Pattern Generator Bundle

The Agilent E4894A 43.2 Gbit/s pattern generator bundle multiplexes sixteen 2.7 Gbit/s data generators to create a 43.2 Gbit/s data stream. The bundle includes:

- One 13-slot VXI mainframe
- One IEEE 1394 PC link to VXI
- One E4808A high performance clock module
- Sixteen 2.7 Gbit/s generator frontends E4862A built into eight E4861A 2.7 Gbit/s data modules
- One 43.2 Gbit/s multiplexer module E4868A, including 32 cables to connect to the 2.7 Gbit/s channels (SMA to MCX), and a cable pair to connect to the DUT (1.85 mm to 1.85 mm)
- 15446A 8-line trigger input pod
- E4875A ParBERT software

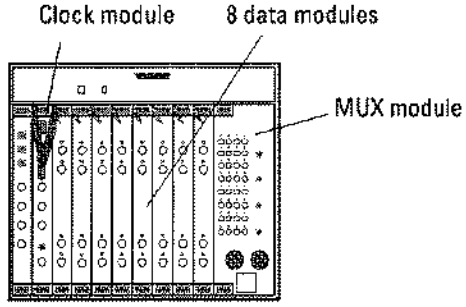


Figure 37 ParBERT 43G Pattern Generator Bundle

43.2 Gbit/s Error Detector Bundle

The Agilent E4895A 43.2 Gbit/s error detector bundle demultiplexes a 43.2 Gbit/s data stream and provides the data to sixteen 2.7 Gbit/s data analyzers. The bundle includes:

- One 13-slot VXI mainframe
- One IEEE 1394 PC link to VXI
- One E4808A high performance clock module
- Sixteen 2.7 Gbit/s analyzer frontends E4863A built into eight E4861A 2.7 Gbit/s modules
- One 43.2 Gbit/s demultiplexer module E4869A, including 32 cables to connect to the 2.7 Gbit/s channels (SMA to MCX), and a cable pair to connect to the DUT (1.85 mm to 1.85 mm)
- E4875A ParBERT software

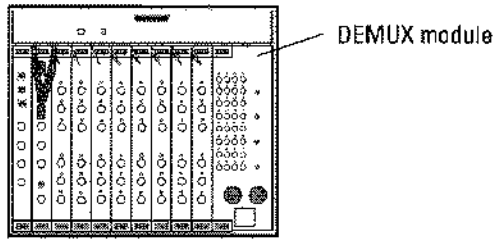


Figure 38 ParBERT 43G Error Detector Bundle

ParBERT 43G Configurations

A setup for testing high speed multiplexers and demultiplexers would require both bundles. This configuration is illustrated in the figure below.

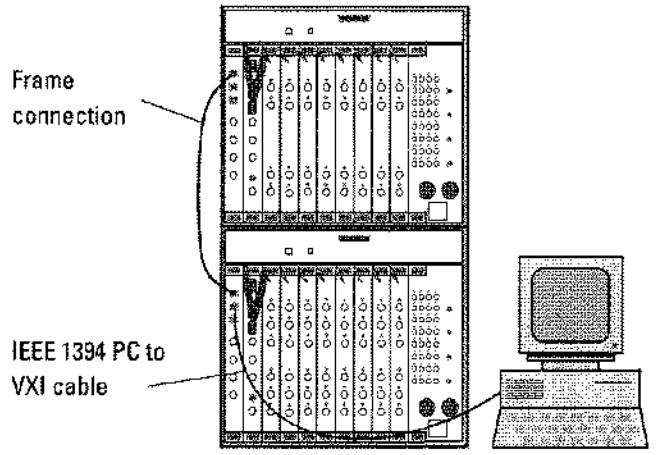


Figure 39 Configuration for Testing Multiplexers and Demultiplexers

A third VXI frame is needed if more than 16 data generators or analyzers are required.

For example, you may need an extra generator for sourcing a clock pulse to the device under test. Or, if you are testing a demultiplexer device with built-in clock recovery circuits, you may need an extra analyzer for conditioning the recovered clock signal.

In such cases it is recommended to add a third frame in the middle between the pattern generators and the analyzers. This frame should house the MUX and DEMUX modules.

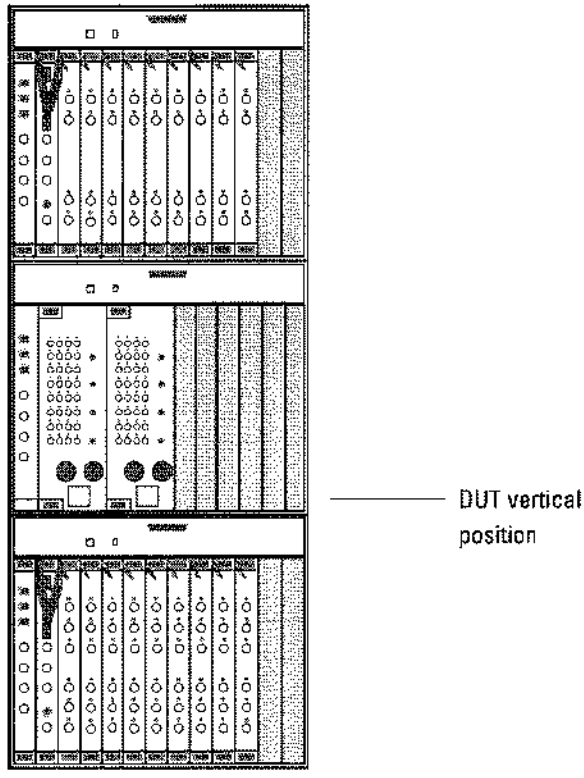


Figure 40 Setup Using More than 16 Data Modules

For the connections between the MUX/DEMUX modules and the generators and analyzers please refer to the *Agilent 81250 ParBERT Installation Guide*.

ParBERT 43G Software Support

The Agilent 81250 software recognizes a ParBERT 43G system automatically. The "Build Systems" process of the Agilent 81250 Configuration Tool identifies the installed E4868A or E4869A module and creates an appropriate system.

For ParBERT 43G systems, many features have been implemented in the software to support quick and easy test setup, and also to prevent the MUX/DEMUX module from damage due to illegal channel parameter settings.

NOTE A MUX or DEMUX module can hardly be compared with a clock or a data generator/analyzer module, although it combines some features of both basic categories.

You should consider a ParBERT 43G system as a self-contained unit for testing very high speed data multiplexing and demultiplexing components and devices. In this context, setting generator or analyzer channel parameters to individual values is useless and, worse, bears the risk of damaging the MUX or DEMUX module.

Therefore, most of the usual port and channel parameters are preset to fitting values and cannot be changed.

For setting up a ParBERT 43G system, two buttons shown in the Connection Editor (see below) provide easy access to the most relevant parameters.

If the system contains additional generator or analyzer channels, these can be configured as usual.

Automatic ParBERT 43G Connections

After starting the user software for a ParBERT 43G system, the Connection Editor window appears as shown in the following figure.

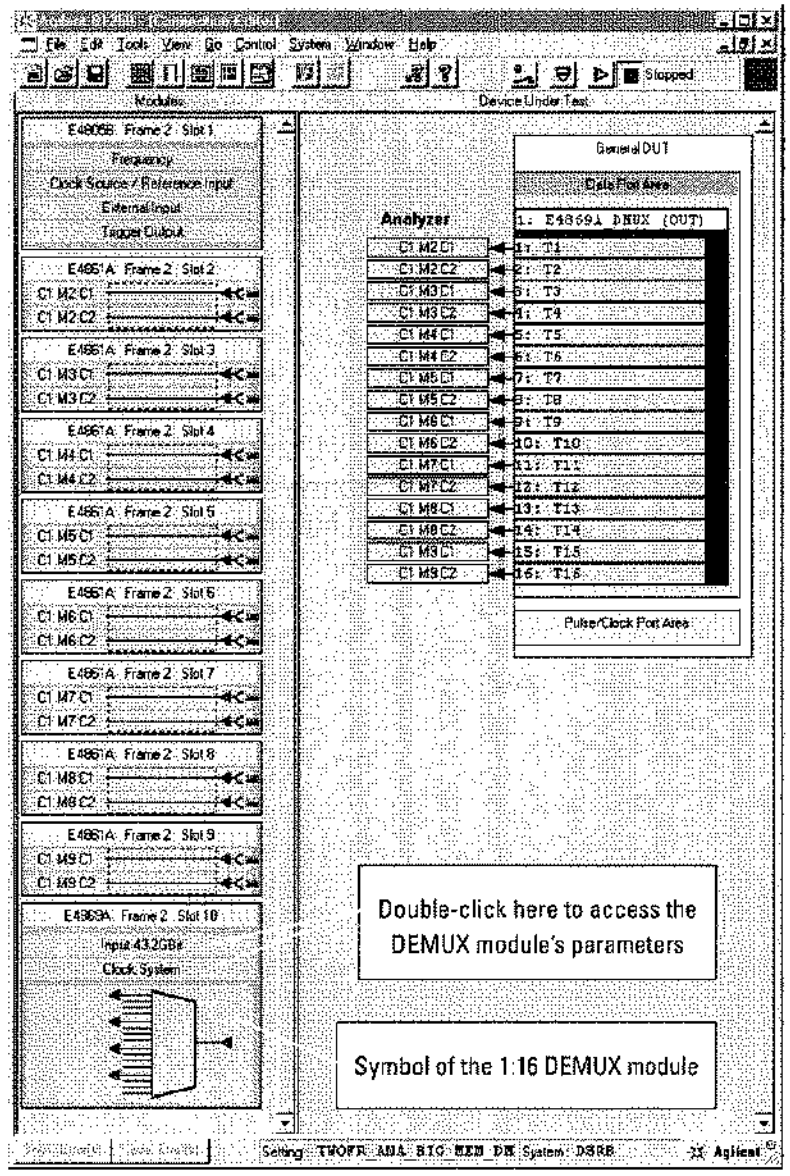


Figure 41 Connection Editor of a ParBERT 43G Error Detector System

The example above refers to a ParBERT 43G error detector system. The software grabs the first 16 analyzer frontends following the master clock module and connects them with the DEMUX module.

NOTE This is the way the ParBERT 43G hardware has to be connected, even if certain modules may contain analyzer *and* generator frontends!

The DUT section shows the parallel side of the DEMUX module, because this provides the signals to the analyzers. Sixteen differential output port terminals are readily connected to and will be analyzed by 16 differential analyzer frontends. Two buttons allow to access the properties of the DEMUX module.

This is a limited perspective, of course. The real DUT is the device that is connected to the DEMUX module and generates a serial data stream at up to 43.2 GBit/s.

The real DUT may also generate a recovered clock which has to be conditioned and used as an external source clock for the analyzing system. If this is the case, the analyzing system needs an additional analyzer. This, in turn, requires an additional data module and hence an expander frame.

But if the hardware is present, additional ports and terminals can be set up with the Connection Editor.

The Connection Editor window of a ParBERT 43G pattern generator system looks rather similar.

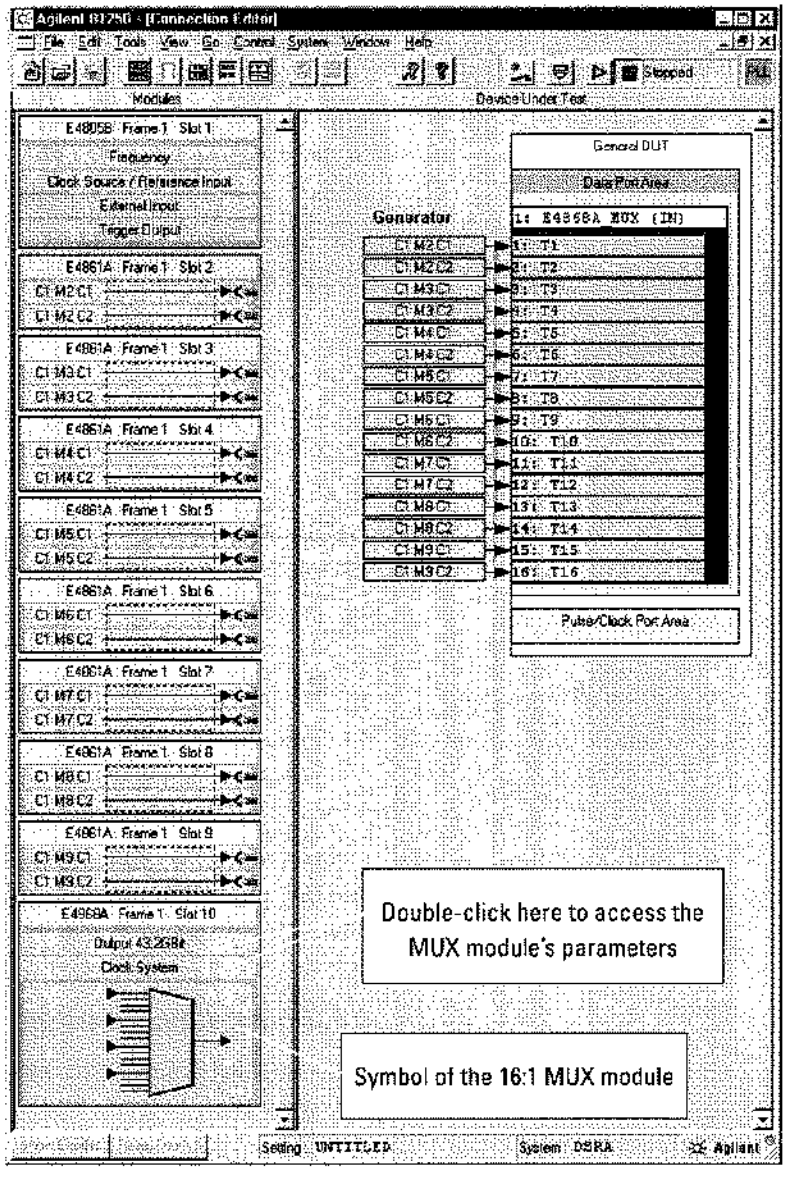


Figure 42 Connection Editor of a ParBERT 43G Pattern Generator System

Here, 16 differential generator frontends are connected to 16 differential MUX module input terminals.

NOTE The Connection Editor does not allow you to disconnect the frontends from the MUX/DEMUX module.

If you wish to use a ParBERT 43G pattern generator or error detector system for other purposes, you have to disconnect and de-install the MUX/DEMUX module completely and use the "Build Systems" function of the Agilent 81250 Configuration Tool (see the *Agilent 81250 Installation Guide* or *"How to Set the Operating Mode" on page 117*).

After that, you have a normal ParBERT system with 16 generator or analyzer channels which can be used for stimulating a multiplexer or measuring the output of a demultiplexer.

This approach has been taken to prevent the MUX/DEMUX module from damage and to protect your investment.

CAUTION

Never attempt to operate an E4868A MUX or E4869A DEMUX module in a general-purpose ParBERT system! These modules are highly susceptible to overvoltage and electrostatic discharge.

If you have re-installed a MUX/DEMUX module, make sure that you perform the "Build Systems" operation of the Agilent 81250 Configuration Tool before starting the Agilent 81250 user software.

ParBERT 43G Port and Channel Parameters

All parameters of the 16 channels connected to a MUX/DEMUX module are preset to fitting values, so that a quick test setup and start is ensured. Only a limited number of parameters can be changed.

For the parameters of the MUX/DEMUX module (basically frequency and amplitude) see *"How to Set Up a 43G MUX/DEMUX Module" on page 180*.

Additional Characteristics of ParBERT 43G Systems

Some auxiliary functions are also locked or preconfigured at ParBERT 43G systems:

- A global Delay Offset for the master clock module is not supported.
- On a ParBERT 43G pattern generator system, an individual start delay setting (data port timing) is not supported.
- On a ParBERT 43G error detector system, automatic sampling point adjustment is always enabled, including the modes Auto Bit Sync, Auto Phase Alignment, and DEMUX Rewiring.
  - Auto Bit Synchronization (see also *"Automatic Bit Synchronization" on page 79*) is always performed, independent of

the kind of expected data. Memory-type data must provide a suitable detect word for each channel.

Automatic Delay Alignment is not supported, because the signal delay caused by the E4869A DEMUX module is a priori unknown.

- DEMUX Rewiring (see also *"Automatic Rewiring of Demultiplexer Terminals" on page 102*) is enabled, but only performed if memory data is expected.

  If the DEMUX Rewiring parameters shall be checked or changed, this can be done by opening the Detail Mode Sequence Editor and selecting the *Sync* item from the context menu.

- In the Deskew Editor, the functions for Zero Adjust and Cable Delay measurements of analyzers are disabled.

  If deskewing is required (for example, after repair or exchange of a module or frontend), this can be done after removing the DEMUX module and performing the *Build Systems* operation of the Agilent 81250 Configuration Tool.

- The DEMUX module of a ParBERT error detector system contains also a clock data recovery circuit (CDR).

  The CDR allows to recover the demultiplexer clock from the incoming data stream. The CDR includes an own phase locked loop. If the CDR could not synchronize on the incoming data, the green PLL indicator on the user interface turns red and shows the letters "CDR" (see also *"PLL Lock Indicator" on page 132*).

Support of Multiple User Interfaces

Using both Agilent 81250 ParBERT 43G bundles means using two ParBERT user interfaces. This is required for independent clock generation and parameter setup.

The Agilent 81250 Configuration Tool and the ParBERT user software greatly support the use of a number of user interfaces:

- More than one user interface can be automatically started.
- Every user interface can be individually configured.

  The configuration parameters for each user interface include: Location of the firmware server (local or LAN address), name of the system to be operated, name of the setting to be automatically downloaded to the system.

- Every user interface can easily be switched to operate one of the configured systems.

- Tests can be started and stopped simultaneously on two or more user interfaces and hence systems.

  For this purpose, the software includes two utilities (see *"Major Changes from Rev. 3.5 to 4.0" on page 20*).

Automatic Rewiring of Demultiplexer Terminals

Demultiplexer rewiring is a special feature for testing demultiplexers. When testing demultiplexers, you apply serial data to one terminal and analyze parallel data from a number of terminals.

If you are sourcing pure PRBS data, then the demultiplexer generates a PRBS of the same polynomial at each of its terminals. These signals may have a time offset, but the system is able to handle this and synchronize the analyzers correctly.

NOTE DEMUX rewiring should be used when testing a demultiplexer with memory-based data. DEMUX rewiring is required for demultiplexers with "unpredictable behavior". That means, you do not know at which pin the first bit arrives.

The functions for automatic analyzer delay adjustment (Automatic Delay Alignment or Automatic Bit Synchronization) will not work and any test will fail if such demultiplexers are tested without DEMUX rewiring.

DEMUX rewiring has the following impact on a test:

- Rewiring increases the system's response time on test start.
- Rewiring changes the order of terminals in the output ports.
- All output ports are rewired (with the same scheme—therefore all output ports have to have a similar setup).

DEMUX Rewiring Overview

Many demultiplexers have the peculiarity that one cannot predict at which of its output terminals the first bit of the serial input bit stream appears. Moreover, stopping the test and starting it again with the same serial bit stream might designate another terminal as the bit number one output.

NOTE This is also a characteristic of the E4869A 43.2 Gbit/s DEMUX module built into ParBERT 43G error detector systems. Therefore DEMUX rewiring has to be used when testing high-speed demultiplexers with memory data on a ParBERT 43G error detector system.

This behavior does not affect the order of the bits at the outputs. The order is the same as in the input bit stream.

The Problem

A demultiplexer with a not predictable behavior causes a problem when specifying the data segments for the output port (for the analyzers of the test system). Every column (trace) of the segment refers to a terminal of the output port. Trace 1 of the segment is expected from the first terminal, trace 2 from the next, and so on.

If the terminal at which the bit number one appears is not known, it is also unknown which trace of the segment has to hold the expected data.

An example is illustrated in the figure below:

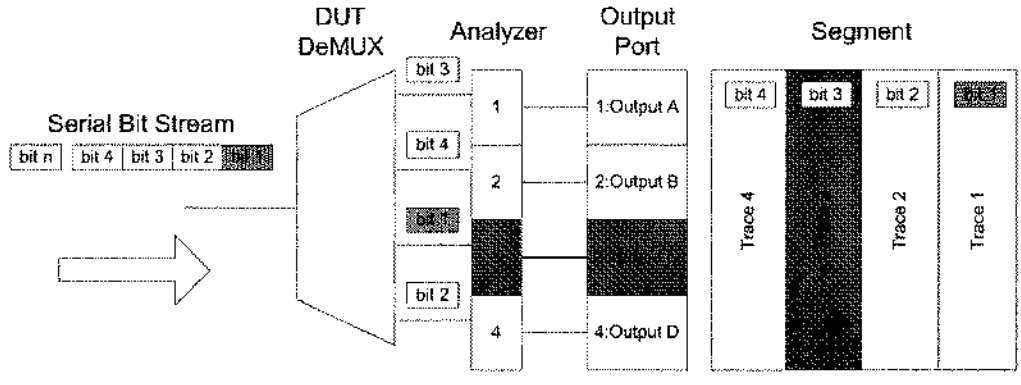


Figure 43 Result of Unpredictable Demultiplexer Behavior

Bit 1 of the serial bit stream was assumed to arrive in trace #1 of the segment. But the demultiplexer randomly assigned bit 1 to its third output terminal. The third analyzer receives the bit and assigns it to terminal #3 which is named "Output C". Terminal #3 in turn is associated with trace #3 of the segment. So the received bit does not match the expected.

The Solution

The solution is DEMUX rewiring. The expected data is specified as usual, assigning the bit number one to the first output terminal.

The software analyzes the current state of the demultiplexer and reacts in a way that establishes the connection between the constant definition of the expected data and the random output assignment of the demultiplexer.

Each time a test is started the system examines the current data flow. This examination is done in iterations until the current state of the demultiplexer is fully determined.

As a result, the order of the terminals is changed. This changes the assignment of the analyzer frontend connectors to the traces of the data segment. It ensures that the first terminal—the one numbered "1"—receives the bit number one and can thus be compared with trace 1 of the segment.

The principle is illustrated in the figure below:

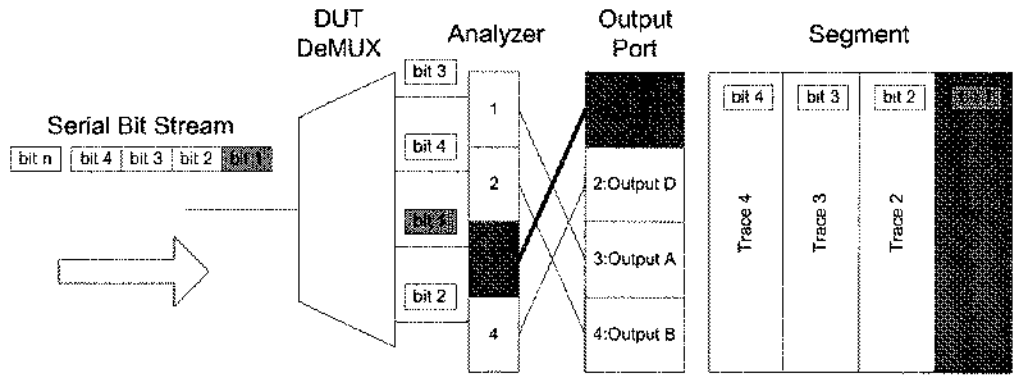


Figure 44 Principle of DEMUX Rewiring

Only the order of the terminals has changed. The connections between the connectors of the analyzers and the terminals of the port are still the same.

Bit 1 of the serial bit stream still arrives at the "Output C" of the demultiplexer (and hence at the same connector of the analyzer). But this time it arrives at terminal #1. This terminal addresses trace #1 of the segment. For this test, all the bits received from "Output C" will be compared with trace #1 and all the bits from "Output D" with trace #2. Then follow the remaining terminals.

Now the data received from the first terminal is compared to the data stored in the first trace of the segment.

DEMUX Rewiring Modes

Demultiplexer rewiring requires that Automatic Delay Alignment or Automatic Bit Synchronization is activated (see also *"Principles of Analyzer Sampling Point Adjustment" on page 73*). It needs and uses the synchronization block at the beginning of the test sequence.

Two algorithms have been implemented for detecting the correct order of the terminals:

- Terminal roundtrip
- Trace detection

Terminal Roundtrip

Terminal roundtrip checks one terminal sequence after the other in order to find coincidence between the expected and the received data.

For each repetition, the order of the terminals within the port is permutated. The possible permutations depend on the demultiplexer's architecture. For a simple (one stage) demultiplexer the order is just cyclically rotated. This is why this method is called *terminal roundtrip*. In case of a multi-stage demultiplexer architecture, all the possible permutations are tried out.

The process is repeated until all terminals synchronize properly.

Characteristics

The idea of this method is quite straightforward. There is nearly no optimization. This is the reason why this method takes its time, especially for a complicated demultiplexer architecture. New data is downloaded for every repetition. Multi-stage demultiplexers may require a large number of permutations.

If the demultiplexer has an illegal output assignment, this is detected in every case.

Trace Detection

Trace detection uses detect words, formed by the first 48 bits of every trace contained in the "DUT-out" segment of the synchronization block.

Prerequisites These first 48 bits of every trace have to be unique within the whole segment. Every trace has its own detect word. This is the same requirement that applies to Automatic Bit Synchronization with memory-based data. It is illustrated in the figure below.

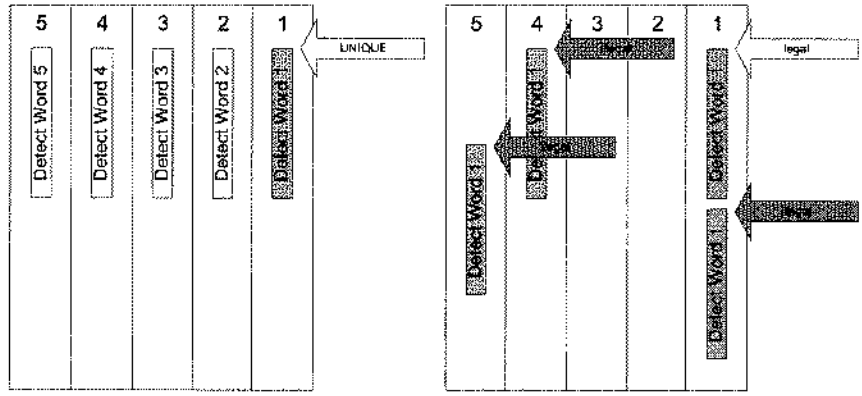


Figure 45 Unique and Unequivocal Detect Words

Note that every trace needs an own detect word. This means, the detect word must not appear twice, neither in its own trace nor in any other trace at any position.

Operating Principle The current detect word is attached to every output terminal. A measurement is started. That terminal which has proven to be successful is the output that carries the current detection trace. Depending on the demultiplexer architecture, further detection traces are selected and tested. Finally, the order of the output terminals is rearranged according to the insights made during the trace detect phase, and the user's test sequence is restored and started.

Characteristics Compared to the terminal roundtrip this is a strong optimization. The expected number of rewiring cycles is significantly lower. And the time for rewiring is much shorter.

Once the demultiplexer architecture is known, only the necessary traces are used for detection.

Also, if the demultiplexer assigns the detection traces to wrong outputs, the resulting order of rewired terminals can get into a state a correct demultiplexer never would work with. In such cases, terminal roundtrip is more effective.

Demultiplexer Architecture

A simple demultiplexer has just one stage—one rotating switch that assigns every incoming bit successively to the output terminals in fixed order.

Multi-Stage Demultiplexers

The DEMUX rewiring feature is also able to rewire multi-stage demultiplexers. An example is shown in the figure below:

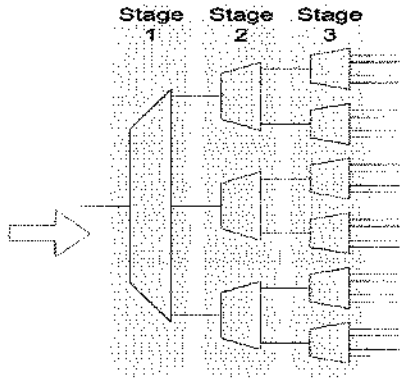


Figure 46 Three-Stage Demultiplexer

On stage one, the number of outputs per demultiplexer is three. On stage two, the number of outputs per demultiplexer is two. On stage three, the number of outputs is four.

This is the way to enter the demultiplexer architecture in the *DeMUX Architecture* panel of the Analyzer Synchronization dialog.

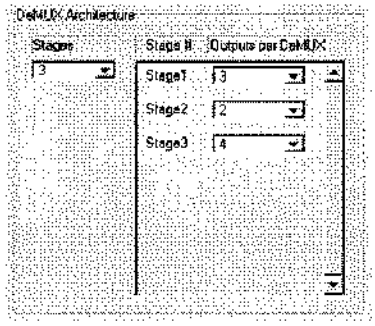


Figure 47 DeMUX Architecture Entry Panel

As you can see, you need to know the structure of the demultiplexer. The number of *Required Terminals* (which is 24 in the example above) is automatically calculated.

See also "How to Specify DEMUX Rewiring Parameters" on page 226.

Only symmetrical architectures are supported. This means that all demultiplexers of one stage have to be identical.

NOTE The number of *Stages* as well as the number of *Outputs per DeMUX* have an impact on the number of possible permutations and hence on the duration of the rewiring and synchronization process. The number of possible permutations is displayed as *Worst Case Rewiring Cycles*.

The expected duration that is also displayed is only a rough estimation, assuming a synchronization segment of moderate length. The actual duration may differ.

For the *trace detection* algorithm, the number of rewiring cycles for a multi-stage demultiplexer is calculated as *number of terminals + 1*.

For the *terminal roundtrip* algorithm, all possible permutations are taken into account. Every demultiplexer of every stage may exhibit that unpredictable behavior. Depending on the demultiplexer architecture, terminal roundtrip may take half a minute or even hours.

TIP As the user interface is blocked during that time, it is recommended to check the number of *Worst Case Rewiring Cycles* before starting the test.

Error messages are displayed if required parameters or terminals and/or analyzers are missing. *Overflow* is displayed if the estimated time exceeds 24 hours.

Rewiring a ParBERT 43G Error Detector System

A ParBERT 43G error detector system (see *"ParBERT 43G Systems" on page 91*) analyzes the output of an E4869A DEMUX module.

This 1:16 demultiplexer has the unpredictable output assignment behavior described above. Therefore, DEMUX rewiring has to be activated when using the E4869A module together with memory-based data.

The recommended rewiring options are:

- *Synchronization*: ON
- *Auto Bit Sync*: enabled
- *DeMUX rewiring*: ON
- *Rewiring Mode*: Trace Detection
- *DeMUX Architecture*: Number of *Stages*: 1
- *DeMUX Architecture*: *Outputs per DeMUX* on *Stage 1*: 16

Test Development Overview

The development of a device test is an iterative process:

1. Set up the test.
2. Run the test.
3. Check the test results.
4. Modify test parameters.
5. Repeat steps 2 to 4 until the results are adequate.
6. Save the final setting for reuse.

All these steps are supported and simplified by the graphical user interface of the Agilent 81250 Parallel Bit Error Ratio Tester.

This chapter provides an overview:

- *"Procedure for Setting Up the Test" on page 110*
- *"Procedure for Running the Test" on page 112*
- *"Procedure for Viewing Test Results" on page 113*
- *"Procedure for Saving the Test Setting" on page 114*

NOTE Once you have created a suitable test setting and verified that the bit error rate is below an acceptable level, you can also execute the measurements provided by the Agilent 81250 ParBERT Measurement Software. These measurements can be performed even if the Agilent 81250 User Software is not active.

Procedure for Setting Up the Test

To set up the test for a new device, it is recommended to perform the following steps in the given order:

1 Study the Device Under Test (DUT).

Identify its input, output, clock, and trigger or strobe terminals. Gather information about its electrical, logical, and frequency characteristics.

In fact, this is the most important step of all.

2 Start the Agilent 81250 system. It comes up with the Connection Editor and the default setting which is called "untitled".

If you had already set up the instrument and DUT, you would now load the appropriate setting.

For details see *"Open Setting" on page 133.*

3 To create a new setting, construct an image of the DUT on the screen and connect the DUT pins to the connectors of the generator and analyzer frontends.

This is supported by the Connection Editor, which by default shows an image of the instrument and an empty template for modeling DUT input and output pins.

For details see *"Connecting the DUT" on page 169.*

4 Set the global system parameters.

These parameters refer to the central clock module and cover items like clock source, clock frequency, use of an external trigger, control of the built-in trigger generator, etc. Data ports as well as pulse port terminals and unconnected channels can be set to fractions or multiples of the system clock rate.

The tool for setting all kinds of parameters is the Parameter Editor.

For details see *"Setting Global System Parameters" on page 153.*

5 Set the characteristics of the input and output connectors.

The characteristics include parameters like voltages, delays, impedances, binary data representation, and so on. This is also done with the Parameter Editor, which in turn can be run conveniently from the Connection Editor.

For details see *"Setting Up Ports and Channels" on page 189.*

6 Decide what kind of test you wish to perform.

Open the Measurement Configuration window. Choices are bit error rate measurement, capture and compare, or just capture DUT output data.

For details see *"Choosing the Kind of Measurement" on page 211.*

7 Create the stream of generated and expected data.

For this purpose, the software provides three Sequence Editors: the Standard Mode Sequence Editor, the Detail Mode Sequence Editor, and the Data/Sequence Editor. These editors enable you to create and maintain the data blocks that form the test sequence.

The Standard Mode Sequence Editor supports easy setup of bit error rate measurements. The other two editors allow to create an arbitrary sequence.

For details see *"Creating the Stream of Generated and Expected Data" on page 215.*

8 Create the data segments referenced by the blocks.

Each block of a sequence contains data segments that specify the generated and expected data. Stored segments can be chosen from lists. New segments can be created with the Segment Editor.

For details see *"Creating and Editing Segments" on page 259.*

9 Connect the DUT physically to the instrument.

Use the Connection Editor to ensure that all physical connections match the image on the screen.

10 Setting up the test of a new device sometimes requires that you change cables, add modules or frontends, or change the DUT board. In this case you should compensate the setup for different signal propagation and cable delays. This can be done with the Deskew Editor. See *"How to Compensate for Internal and External Delays" on page 308.*

Now you are ready to run the test.

Procedure for Running the Test

After you have finished the setup:

1 Download the test sequence to the modules.

This is done by clicking the Prepare button. The download procedure checks whether the test sequence is formally correct and can be executed.

As downloading a complex sequence can take some time, this is also recommended before running a test that is to be started by a trigger.

For details see *"How to Download the Test Sequence" on page 292*.

2 If the test has been set up for measuring the bit error rate, open the Bit Error Rate Measurement Display window.

For details see *"How to View BER Test Results" on page 292*.

3 Click the Run button.

If the test is set up to be controlled by an external start trigger, it will now wait for this trigger. If not, it starts immediately.

The test will run until the test sequence is executed or the capture memory is full or, if it is controlled by an external stop trigger, until the trigger is set—whichever comes first.

4 If the test sequence includes an infinite loop, stop the test by clicking the Stop button.

Procedure for Viewing Test Results

If you are running a bit error measurement, the Bit Error Rate Measurement Display window shows you actual and accumulated results. The display is updated every second.

For details see *"How to View BER Test Results" on page 292*.

If you have been running one of the other tests:

1 Open the Error State Display.

The Error State Display shows the captured DUT output data. If you have been running one of the compare tests, it shows also the deviations between the captured and expected data. Various address and data formats support the investigation.

For details see *"How to View Captured Test Results" on page 296*.

2 Open the Waveform Viewer.

The Waveform Viewer enables you to display generated and captured data as well as compare results graphically in a variety of formats.

For details see *"How to View Waveforms" on page 301*.

Procedure for Saving the Test Setting

It is recommended to save the test setting repeatedly during test development. This ensures that whatever occurs you can always return to the last saved test configuration.

As the system provides different options for different kinds of measurements, it is recommended to save every measurement configuration, such as bit error rate or compare and capture, in its own file.

To save a new setting:

1 Open the *File* menu.

2 Choose *Save Setting As*.

3 Enter a filename that gives some information about the purpose of the setting.

4 Confirm.

To save the current setting occasionally:

1 Click the Save Setting button.

NOTE Note that settings can also be exported to another directory or drive and imported from there (see also *"Export/Import of a Setting" on page 317*).

System Start and User Interface

The Agilent 81250 user interface basically consists of a window frame, several editors for test setup, and several windows for displaying the test results.

The menu bar on top of the window frame can be used to access the individual windows and to operate the system. Shortcuts are provided by the tool bar buttons.

This chapter provides basic information on both the windows and the options of the main menu:

How to Start the System

At a factory-configured Agilent 81250 system with built-in controller, the Windows NT automatic log-in script is enabled. After power on, you are automatically registered as user DVT and the Windows desktop appears.

How to Start the Agilent 81250 Software

The Agilent 81250 software can be run in one of three modes:

- Local
- Controlled
- Remote

How to Set the Operating Mode

To change the system's operating mode:

1 Double-click the Agilent 81250 Configuration icon.

Figure 48 Agilent 81250 Configuration Icon

This opens the Agilent 81250 Configuration Tool:

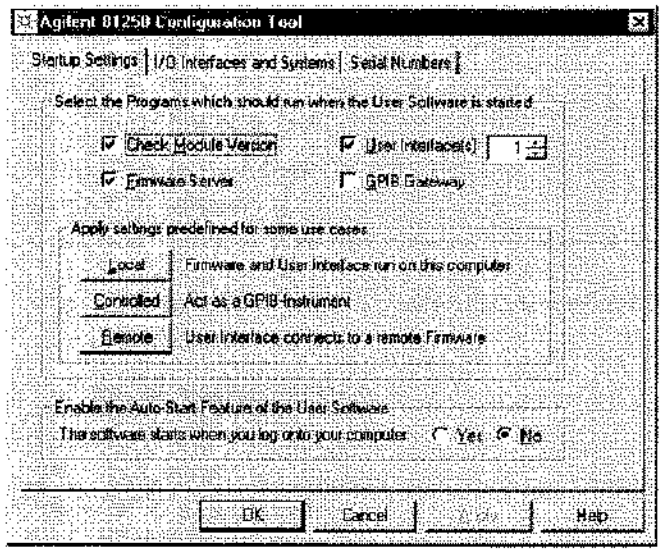


Figure 49 Agilent 81250 Configuration Window

Startup Settings

2 Select the operating mode you wish to use from now on. Click one of the predefined mode buttons.

Choices are: *Local*, *Controlled*, or *Remote*.

– *Local*

This mode starts both the Agilent 81250 firmware server and the user interface. It is used, if the hardware shall be controlled by and the user interface shall be run on the same computer.

– *Controlled*

This mode starts the Agilent 81250 firmware server only. It is used, if the hardware shall be controlled by the built-in or external controller, but the user interface shall run on a remote computer. The system can then be operated via GPIB or LAN.

If GPIB shall be used, the GPIB Gateway must be enabled. See also *"How to Control the GPIB Gateway" on page 124*.

– *Remote*

This mode starts the Agilent 81250 user interface only. It is used on a remote computer to operate an Agilent 81250 firmware server which is in controlled mode.

When you are clicking the mode buttons, the checkboxes indicate which software components will be started. You can also specify your own customized mode of operation by clicking the checkboxes.

3 Choose from the following options:

– *Number of User Interfaces*: You can specify that more than one user interface is opened as soon as the user software is started. This applies to manual as well as automatic start.

– *GPIB Gateway*: If you intend to start the system in controlled mode and operate it via LAN, you can disable the *GPIB Gateway*.

– *Start Automatically* starts the Agilent 81250 user software fully automatically. The setting takes effect as soon as the DVT user logs in.

I/O Interfaces and Systems

4 The second page of the Agilent 81250 Configuration window allows you to reconfigure the tester if the hardware has been changed.

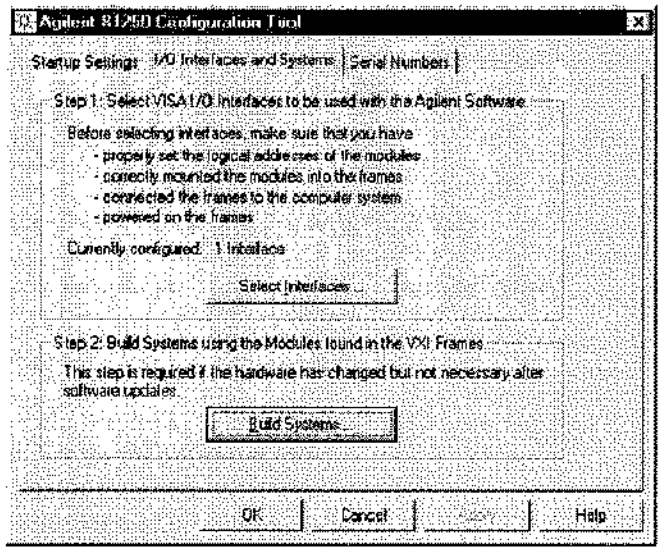


Figure 50 Configuring I/O Interfaces and Systems

– The default *VISA I/O interface* is VXI0. If you are using an external controller connected to more than one IEEE 1394 PC to VXI module, you have to select the interfaces you wish to control.

– *Build Systems* checks the available modules and creates new configuration files *dvtsys.txt* and *dvtits.txt*. The present files are

saved as *dvtsys.bak* and *dvtits.bak*. If the mainframe contains more than one master clock module, additional systems (DSRB, DSRC, ...) are automatically set up.

NOTE The Configuration Tool also creates also for each real system an offline system and additionally some demo systems.

An offline system reflects the actual system configuration. As it does not access the firmware server, it can be operated on any PC and used for training purposes.

The demo systems provide simple system configurations and can be used for demonstrating ParBERT features to newcomers.

For more details please refer to the *Agilent 81250 Installation Guide*.

Serial Numbers The Serial Numbers page of the Configuration Tool can be used to query and archive the serial numbers of the installed modules and frontends.

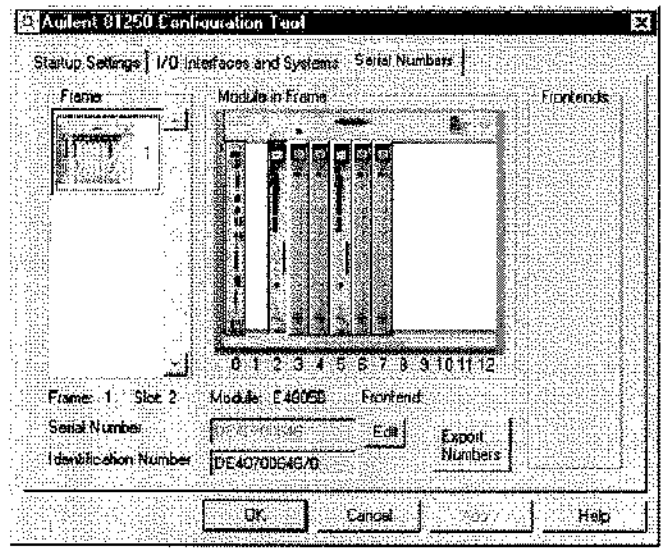


Figure 51 Serial and ID Numbers of the Master Clock Module

By default, the numbers of the master clock module are displayed.

The *Identification Number* is the hardware manufacturing number. The *Serial Number* can be edited. This may support your asset administration. If you have received a module from repair which has a new number, you can assign the old serial number to that module.

To view the type and numbers of a different module, click on that module.

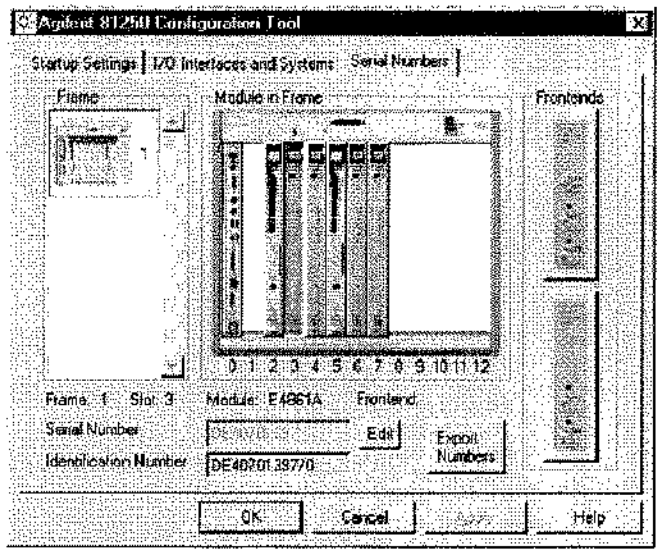


Figure 52 Serial and ID Numbers of a Data Generator/Analyzer Module

To view the type and numbers of a frontend plugged into a data module, click the frontend.

To archive the present system configuration in an ASCII file, click the Export Numbers button.

How to Start the System in the Chosen Operating Mode

To start the system:

1 Double-click the Agilent 81250 User Software icon.

Figure 53 Agilent 81250 Start Icon

When you start the user software for the first time, the User Interface Configuration dialog appears.

2 Configure the user interface.

TIP Once you have set the characteristics of the user interface, you can disable the User Interface Configuration dialog. Otherwise, it appears at every software start.

How to Configure the User Interface

You can start the user software more than once—either manually or automatically after logon. In this case you get several user interfaces, and each of them has to be configured.

For example, it is not possible to operate one and the same system from two user interfaces.

But using two user interfaces, you can operate two independent systems through one firmware server running on one ParBERT controller. You can also communicate with different firmware servers of different systems which are connected to the LAN.

The configuration window looks as shown below:

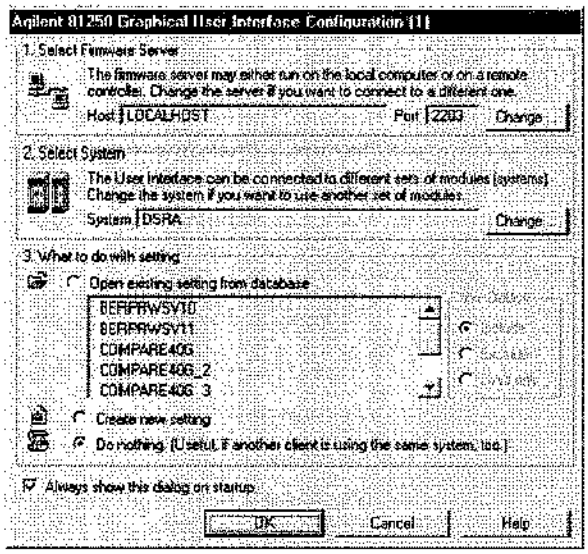


Figure 54 Agilent 81250 User Interface Configuration Window

How to Select the Firmware Server

If you are running the ParBERT user software in *local* mode, the firmware server is found on the same PC which is called LOCALHOST.

If you are running the ParBERT user software in *remote* mode, LOCALHOST is not available. You have to specify the network node on which the firmware server is running. This requires that the ParBERT controller has been connected to the LAN.

1 In the User Interface Configuration dialog, click the *Change* button.

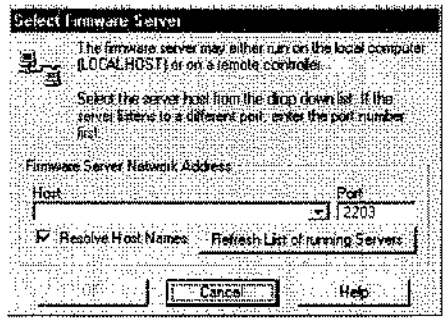


Figure 55 Selecting a PC on which the Firmware Server is Running

2 Choose the host from the drop-down list, or enter the computer name or the IP address of the ParBERT controller you wish to connect to.

3 Enter the port number to which the firmware server of that controller listens.

You can update the list of hosts by clicking *Refresh List of running Servers*. Depending on the checkbox, the list shows names or IP addresses. Note that only hosts running in the same subnet as the computer running the ParBERT user interface are recognized.

How to Select the System to be Operated

The basic (default) system is DSRA.

You may wish to operate a different ParBERT system from this user interface.

If you start the user interface more than once, you have to choose a different ParBERT system for each user interface.

To select the system:

1 In the User Interface Configuration dialog, click the *Change* button.

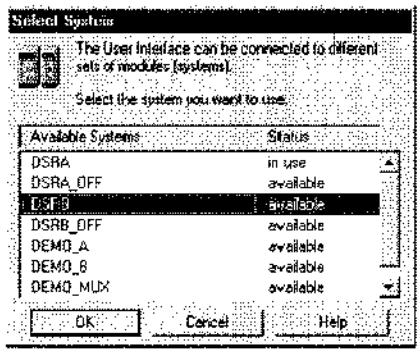


Figure 56 Selecting a System

2 Choose from the list of available systems.

The list includes also demo and offline systems (see *"How to Set the Operating Mode" on page 117*).

Systems already in use by an active user interface cannot be chosen.

How to Specify a Start Setting

This section of the Agilent 81250 User Interface Configuration dialog allows to load one of the stored settings of the chosen system automatically together with the user interface.

That means, you need only start the user software and all systems of the Agilent 81250 Parallel Bit Error Ratio Tester are ready for testing a particular device.

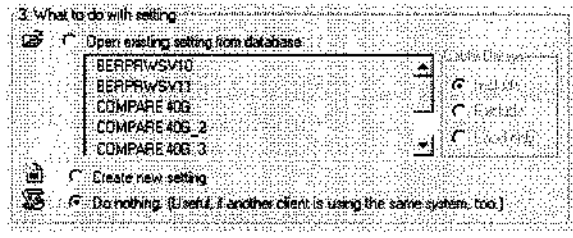


Figure 57 Selecting a Setting

To load one of the stored settings automatically:

1 Enable the checkbox.

2 Choose from the list.

3 Decide on loading also the cable delays.

How to Disable the User Interface Start Dialog

The user interface configurations are automatically stored. They are identified by numbers, starting from one.

Once the Agilent 81250 Parallel Bit Error Ratio Tester has been set up, you may wish to disable the User Interface Configuration dialog. Otherwise, it appears at every software start.

♦ Disable the *Always show this dialog on startup* checkbox.

When the user interface is active, the User Interface Configuration dialog can always be started from the *File* menu, item *Configuration*.

How to Control the GPIB Gateway

If the GPIB gateway has not been disabled, it is automatically activated when the system is configured to be controlled by another computer and then started.

When the GPIB gateway is active, the GPIB to Agilent 81250 Gateway control panel can be displayed from the Windows task bar.

Figure 58 GPIB to Agilent 81250 Gateway Control Panel

The options are:

- *Settings*: Used to specify the termination character for received commands. Transmitted commands and responses are automatically terminated with LF ($0A_{Hex}$), according to IEEE 488.2.

  Choices are *none* or any ASCII character between 0 and 127 (decimal). The current termination character is displayed in hex format and alphabetical notation.

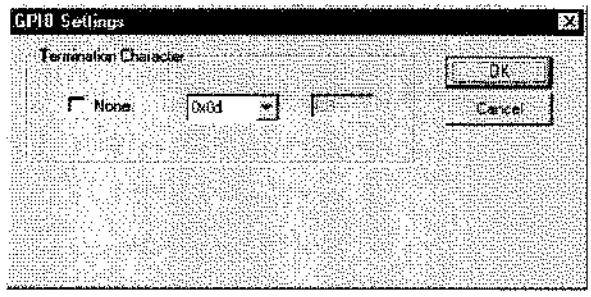


Figure 59 GPIB Settings

The desired character can be entered in decimal, hexadecimal, or octal format. Examples:

Table 7 Termination Characters

Character	Hex	Decimal	Octal
HT	0x09	9	011
LF	0x0a	10	012
FF	0x0c	12	014
CR	0x0d	13	015

These usual characters can also be chosen from the pull-down menu.

- *Monitor*: Used to monitor the command transfer in case of problems. Shows the commands passing through the receive and send buffers.
- *Close*: Terminates the GPIB to Agilent 81250 gateway.
  You will be asked whether you wish to terminate the Agilent 81250 server as well.

Overview of the Windows

There are windows for setting up a test and windows for displaying the test results.

Overview of Test Setup Windows

"Overview of Test Result Windows" on page 126

Overview of Test Setup Windows

The test setup windows are:

- Connection Editor—for reproducing (modeling) the properties of and physical connections to the device under test.
- Parameter Editor—for setting test parameters, such as frequencies, delays, voltages, etc.
- Measurement Configuration—for specifying the kind of test, such as bit error rate or capture and compare.
- Standard Mode Sequence Editor—for specifying one infinitely looped block of data containing the segments of generated and expected data for every data port.
- Detail Mode Sequence Editor—for specifying an individual sequence of blocks which contain the generated and expected data segments and loops. Also used for specifying events and reactions on events or triggers to be generated.
- Segment Editor—for creating the data segments to be generated or expected within the data blocks.
- Data/Sequence Editor—a combination of Sequence and Segment Editor.

- Channel Configuration Editor—for adding generator channels to produce a combined signal.
- Event Edit and Branch windows—for specifying events and actions upon events.
- Deskew Editor—for synchronizing the module connectors and compensating for signal propagation delays caused by cables or the DUT board.

NOTE Most of these windows can be opened by clicking a button of the tool bar, except:

- Channel Configuration Editor—a subfunction of the Connection Editor.
- The Sequence Editors—Standard Mode Sequence Editor, Detail Mode Sequence Editor, Data/Sequence Editor—all accessible from the *Go* menu.
- Parameter Editor and Deskew Editor—accessible from the *Go* menu.
- Event Edit and Branch windows—a subfunction of the Detail Mode Sequence Editor.

Overview of Test Result Windows

A set of windows is provided to present the test results in different views. To access these windows, open *Result Displays* in the *View* menu and select the desired item.

The available test result windows depend on the chosen type of measurement:

- Bit Error Rate—only available, if "Error Rate Measurement" has been selected. Shows the error rate and is updated every second.
- Compared Data—only available, if "Compare and Capture" or "Compare and Acquire around Error" has been selected. Shows captured data and highlights deviations from expected data.
- Captured Data—not available, if "Error Rate Measurement" has been selected. Shows captured data.
- Errored Data—only available, if "Compare and Capture" or "Compare and Acquire around Error" has been selected. Shows zeros (no error) and ones (errors).
- Waveform—not available, if "Error Rate Measurement" has been selected. Shows the captured waveform and indicates errors.

Compared Data, Captured Data, and Errored Data all use the Error State Display for presentation. You can switch between the three views within the window. Alternatively, you can open the window multiple times to inspect the contents concurrently.

Bit Error Rate Display, Error State Display, and Waveform Viewer are accessible by clicking buttons in the tool bar.

Operating the User Interface

The preferred instrument for operating the system is the mouse or the touchpad.

How to Use the Mouse or Touchpad

Some areas of the windows are "active" areas. They can be identified by the cursor changing its shape when placed over these areas.

If you press the right mouse button on an active area, a context menu pops up that lists the actions you can perform on the chosen item. If there is a default action defined for a context menu, this is indicated with bold text.

The default action is automatically executed if you double-click on an active area with the left mouse button.

NOTE If you have highlighted an item by clicking on it once with the left mouse button, you can also select the available actions from the menus of the menu bar on top of the window frame.

How to Navigate With the Keyboard

There are people who hate mice. They may use the keyboard instead:

- Tab and Shift+Tab move the cursor.
- Shift+F10 opens the context menu.
- To close the active window press Ctrl+F4.
- To switch between open windows press Ctrl+F6.
- To terminate the system run press Alt+F4.

If you type something into a data entry field, terminate your input with Enter. This causes the software to check the input and react.

How to Change Units and/or Vernier Steps

Some windows contain data entry fields with vernier buttons and units.

To change the default unit or vernier step size:

1 Click on the unit button to open the *Units and Step Size Adjust* window.

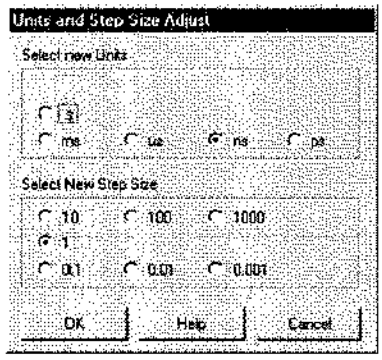


Figure 60 Units and Step Size Adjust Window

2 Change the unit and step size as desired.

3 Click OK.

NOTE You can also click with the right mouse button on the unit of a data entry field and change unit and step size from the context menu.

How to Use the Window Selection Box

This dialog box appears when you are opening the Parameter Editor or the Waveform Viewer from the respective menu item or icon in the main window. It appears also, if you open the Error State Display for a device that has more than one output port.

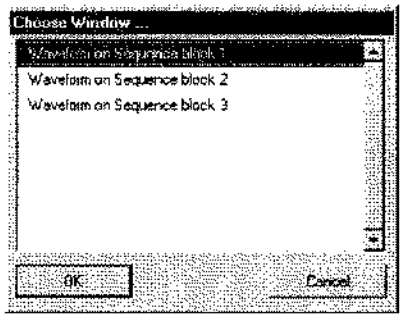


Figure 61 Window Selection Dialog Box Example

1 Click on an item in this dialog box to select this item to be presented in the respective editor/viewer.

2 Click OK.

The respective editor/viewer opens.

For information on the usage of the Parameter Editor, see *"How to Start the Parameter Editor for Global Parameters" on page 154* or *"How to Start the Parameter Editor for Ports/Channels" on page 190*.

For information on the Error State Display, see *"How to View Captured Test Results" on page 296*.

For information on the Waveform Viewer, see *"How to View Waveforms" on page 301*.

Items of the Main Menu

The main window of the Agilent 81250 Graphical User Interface provides easy access to and control of all features and functions of the system.

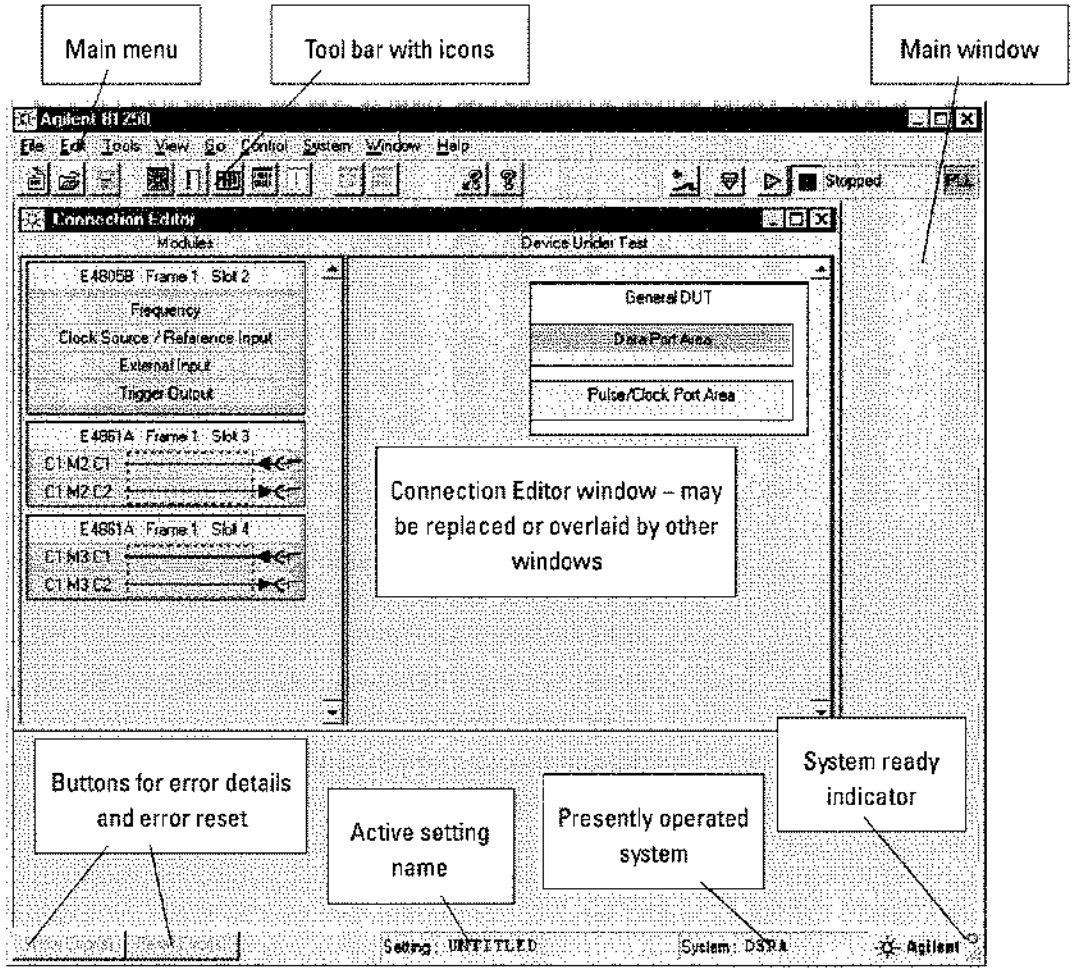


Figure 62 Agilent 81250 Main Window

The components of the main window are explained below.

Main menu The main menu is located at the top of the main window.

Figure 63 Agilent 81250 Main Menu

It provides access to the following menus:

"File Menu" on page 133

"Edit Menu" on page 138

"Tools Menu" on page 142

"View Menu" on page 143

"Go Menu" on page 145

"Control Menu" on page 147

"System Menu" on page 148

"Window Menu" on page 149

"Help Menu" on page 150

Tool Bar In the main window there is also a tool bar located at the top, which contains icon buttons providing shortcuts to windows and dialogs. They are explained along with the respective menus.

Figure 64 Tool Bar

NOTE Not all items of the menus and the tool bar are available at all times. Whether an item is available or not depends on the active window and the current situation.

For example, the error state display is not available, if you have decided to perform a bit error rate measurement, and vice versa.

The individual windows therefore provide context menus which can be opened by positioning the cursor to the area of interest and clicking the right mouse button.

Run Control Area In the upper right-hand corner of the main window you see the Run Control Area. Here you find a set of icon buttons and a status field showing the current test status.

Figure 65 Run Control Area

For an explanation of these buttons see *"Control Menu" on page 147*.

PLL Lock Indicator When an external clock source is used, the phase locked loop of the master clock module locks onto that source. In case the clock system could not lock or has lost its synchronization, the PLL lock indicator turns from green to red.

Figure 66 PLL Locked/Unlocked Indicator

If this happens while a test is runnung, the test is invalid.

At a ParBERT 43G DEMUX system, the PLL lock indicator can also appear as shown below:

Figure 67 CDR Unlocked Indicator

If this happens, then the clock data recovery (CDR) circuit of the E4869A DEMUX module could not synchronize on the incoming data stream. As the generated clock signal is undefined, it is useless to continue the test. You may consider using an external clock.

Status Line At the bottom of the main window you can see the status line.

Figure 68 Status Line

Located in the status line are:

- The *Show Error(s)* and the *Reset Error(s)* buttons.

  If you enter invalid data into a text field of an editor window or a dialog box, the software reports an error by highlighting all erroneous fields and the *Show Error(s)* button.

  Clicking this button opens an error window that explains the error. Clicking the *Reset Error(s)* button resets the invalid entry to the last valid value.

- The name of the loaded test setting.
- The name of the presently operated system.

File Menu

The *File* menu is primarily used for storing data in files and retrieving data from files.

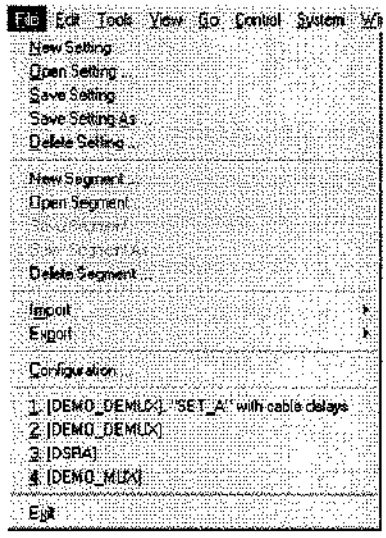


Figure 69 **File Menu**

New Setting

Closes the current setting and returns you to the default setting. The default setting is used for starting with a new device under test (DUT).

If the current setting has been changed and not saved, you will be asked whether you wish to save the current setting before the default setting is loaded. The current setting is indicated in the bottom line of the window frame.

Shortcut: New Setting icon in the tool bar.

Open Setting

Used to load one of the saved settings.

If the current setting has been changed and not saved, you will be asked whether you wish to save the current setting before the new setting is loaded. The current setting is indicated in the bottom line of the window frame.

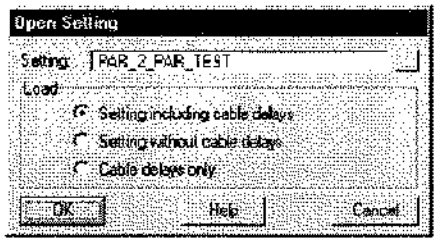


Figure 70 Open Setting Dialog

Default is the last opened setting. Others can be chosen from the list. The options for opening a setting are:

- Complete setting including cable delays
- Setting without cable delays (e.g. if connection cables to the DUT have been changed)
- Cable delays only (e.g. if the same cables are used for connecting to a new DUT)

Shortcut: Open Setting icon in the tool bar.

Save Setting

Saves the currently loaded setting on the disk, including all changes that have been made. Overwrites the previous version.

For saving or creating a new setting or keeping the original setting use *Save Setting As* instead.

Shortcut: Save Setting icon in the tool bar.

Save Setting As

Displays a list of the stored settings and enables you to overwrite one of these or to save the current setting under a new name on the disk.

Delete Setting

Displays a list of the stored settings and enables you to delete one or several of these.

New Segment

Enables you to create a new data segment. You need to select a pool (global or local) and enter a segment name. You can change width and length.

After that you enter the Segment Editor see *"Creating and Editing Segments" on page 259*.

The option *New Segment* can also be invoked from the Standard or Detail Mode Sequence Editor.

Open Segment

Displays a list of the stored segments. After choosing a segment, you enter the Segment Editor for investigating or changing the properties of the chosen segment.

Shortcut: Segment Editor icon in the tool bar.

Save Segment

Only available if the Segment Editor is active and the segment has been changed.

Saves the modified segment under its original name.

Shortcut: If the segment has been changed and you terminate the Segment Editor, you will be asked whether you wish to save your changes.

Save Segment As

Only available if the Segment Editor is active.

Displays a list of the stored segments. The list can be toggled to show the contents of the LocalSegments or GlobalSegments pool. Enables you to overwrite one of the existing segments or to save the current segment under a new name on the disk.

Delete Segment

Displays a list of the stored segments. The list can be toggled to show the contents of the LocalSegments or GlobalSegments pool. Enables you to delete one or several of the segments.

Import

Enables you to import settings or segments that have been exported to files.

Import Setting

Importing a setting replaces the current setting.

If the current setting has been changed and not saved, you will be asked whether you wish to save the current setting before the new setting is imported.

The file containing the setting can be found with the browser.

The imported setting can then be saved with the *Save Setting As* function.

Import Segments

Segments can be imported into the local or global segments pool.

The file containing the segments can be found with the browser.

The file can include more than one segment. You can therefore specify whether you wish to overwrite existing segments or not.

Export

Enables you to export settings or segments as files.

The destination path can be specified with the browser. Enter a new file name or select a file to overwrite.

Export Setting

When exporting a setting, the options are:

- Complete setting including cable delays
- Setting without cable delays (e.g. if connection cables to the DUT have been changed)
- Cable delays only (e.g. if the same cables are used for connecting to a new DUT)

The generated file is an ASCII file which can be investigated with a suitable text editor. A setting file contains all the firmware commands that establish that setting.

Export Segments

When exporting segments, the options are:

- all from GlobalSegments pool
- all from LocalSegments pool

- a single segment which can be chosen from the browser

The generated file is an ASCII file which can be investigated with a suitable text editor. Segment files are Vector Format text files.

Configuration

You may wish to operate a different ParBERT system.

You may also may wish to start and use two user interfaces in order to operate two ParBERT systems in parallel.

So, every user interface has to be configured.

This menu item enables you change the characteristics of the present user interface. It opens the User Interface Configuration dialog. For details see *"How to Configure the User Interface" on page 121*.

For system configurations please refer to the *Agilent 81250 Installation Guide*.

List of User Interface Configurations

The *File* menu includes a list of the most recent user interface configurations. This makes it easy to change the currently operated system against another one.

If you wish to operate a different ParBERT system from your present user interface, just choose from the list.

The following actions lead to a new entry:

- Closing the Agilent 81250 Graphical User Interface Configuration dialog with OK
- New Setting
- Open Setting
- Save Setting
- Save Setting As

The new entry is put in position 1. The numbers of the other entries are incremented by 1. If the entry is identical to another entry in the list, this entry is removed. The list keeps up to four entries.

The list of the recently used startup configurations is shared among all user interfaces, independent on the startup parameter set they use.

Exit

Closes the user interface and terminates the system run.

Shortcut: The Close button in the upper right-hand corner of the window frame or Alt+F4.

Edit Menu

The *Edit* menu is used for preparing a test. It contains the editing functions that can be used in the various test setup editors.

The appropriate menu items are enabled when the respective test setup editor window is active.

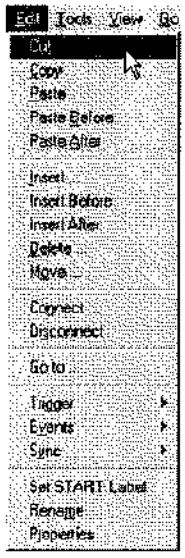


Figure 71 Edit Menu

Cut

Copies the highlighted item to the clipboard and removes it from the current window.

Shortcut: Ctrl+x

Copy

Copies the highlighted item to the clipboard.

Shortcut: Ctrl+c

Paste

Only available if data has been copied to the clipboard.

Inserts the clipboard contents at the specified location.

Shortcut: Ctrl+v

Paste before

An option of the Detail Mode and Data/Sequence Editors. Only available if a block has been copied to the clipboard.

Inserts the clipboard contents above the currently highlighted block.

Paste after

An option of the Detail Mode and Data/Sequence Editors. Only available if a block has been copied to the clipboard.

Inserts the clipboard contents below the currently highlighted block.

Insert

An option of the Connection Editor and the Segment Editor.

Inserts a new port, terminal, vector or trace at the specified location.

Insert before

An option of the Detail Mode and Data/Sequence Editors.

Inserts a new block above the currently highlighted block.

Insert after

An option of the Detail Mode and Data/Sequence Editors.

Inserts a new block below the currently highlighted block.

Delete

An option of the Connection Editor and the Segment Editor.

Deletes the highlighted object.

Move

An option of the Connection Editor.

Moves the highlighted terminal up or down.

Shortcut: Drag and drop.

Connect

An option of the Connection Editor.

Enables you to connect the highlighted terminal to a frontend connector.

Shortcut: Drag and drop.

Disconnect

An option of the Connection Editor.

Enables you to disconnect terminals from frontend connectors.

Shortcut: Drag the connection (i.e. the blue rectangle next to the terminal, labeled Cx My Cz) to the left somewhere into the modules area but not on a connector and release the mouse button.

Go to

An option of the Segment Editor and the Error State Display.

Enables you to jump to a specified vector address.

Find

An option of the Segment Editor.

Enables you to locate certain patterns in a memory-type data segment.

Trigger

An option of the Detail Mode and Data/Sequence Editors.

Used to enable or disable the generation of a trigger pulse associated with a block.

Events

An option of the Detail Mode and Data/Sequence Editors.

Enables you to specify events and define actions upon events (such as sequence branches). See *"How to Specify Events and Reactions Upon Events" on page 247*.

Sync

An option of the Detail Mode Sequence Editor.

Enables you to activate, disable, or change the automatic sampling point adjustment of the analyzer frontends connected to a DUT output port (see *"How to Specify DEMUX Rewiring Parameters" on page 226*).

Provides also the access to the DEMUX rewiring feature (see *"How to Specify DEMUX Rewiring Parameters" on page 226*).

Set Start

An option of the Sequence Editors.

Enables you to specify a start block of a sequence. When running the test, the start block will be the first to be executed. Any blocks above the start block are ignored when the test is executed. This option is useful to determine different entry points in a data sequence without the need of major modifications in the sequence content itself.

NOTE The start block is automatically named START. In order to avoid confusion, you should not assign that label manually to a block.

Rename

An option of the Connection Editor.

Enables you to rename the highlighted port or terminal of the DUT.

Properties

An option of several editors.

Shows the individual properties (parameters) of the highlighted object.

Tools Menu

The *Tools* menu contains additional options of the Segment Editor.

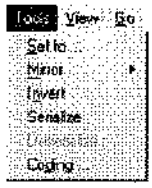


Figure 72 Tools Menu

Set to

With this option you can set a highlighted section in the Segment Editor to a specified value.

Mirror

With this option you can mirror a highlighted section in the Segment Editor either horizontally or vertically.

Invert

With this option you can invert a highlighted section in the Segment Editor—zeros to ones, ones to zeros.

Serialize

With this option of the Segment Editor you can convert a parallel memory segment holding multiple traces into a serial segment holding just one trace.

Deserialize

With this option of the Segment Editor you can convert a serial memory segment holding one trace into a parallel segment holding multiple traces.

Coding

With this option of the Segment Editor you can change the coding of the data segment. Selecting this option opens the Data Converter window.

View Menu

The options of the *View* menu allow you to change the appearance of data and waveform displays and to choose a suitable result display.

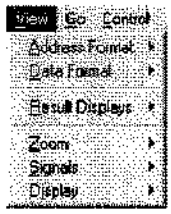


Figure 73 View Menu

Address Format

Enables you to change the displayed address format. Options are:

- Decimal
- Hexadecimal
- Octal

Data Format

Enables you to change the displayed data format. Options are:

- Binary
- Hexadecimal
- Octal

Additional options are available if the Segment Editor has been started from the Sequence Editor for editing or creating a segment within a block:

- Trace View: Shows trace numbers of the data segment
- Port View: Shows the data port to which the segment is assigned
- Terminal View: Shows the terminal names of the data port
- Connector View: Shows the identifications of the connected channels

Result Display

Enables you to choose a suitable display. Available options depend on the kind of test that has been specified in the Measurement Configuration window:

- Bit Error Rate—only available, if "Error Rate Measurement" has been selected. Opens the Bit Error Rate display window.

Shortcut: Bit Error Rate Display icon in the tool bar.

- Compared Data—only available, if "Compare and Capture" or "Compare and Acquire around Error" has been selected. Opens the Error State display window.

Shortcut: Error State Display icon in the tool bar.

- Captured Data—not available, if "Error Rate Measurement" has been selected. Opens the Error State display window.

Shortcut: Error State Display icon in the tool bar.

- Errored Data—only available, if "Compare and Capture" or "Compare and Acquire around Error" has been selected. Opens the Error State display window.

Shortcut: Error State Display icon in the tool bar.

- Waveform—not available, if "Error Rate Measurement" has been selected. Opens the Waveform Viewer.

Shortcut: Waveform Viewer icon in the tool bar.

NOTE Compared Data, Captured Data, and Errored Data all use the Error State Display for presentation. You can switch between the three views within the window. Alternatively, you can open the window multiple times to inspect the contents concurrently.

Zoom

An option of the Waveform Viewer.

Enables you to zoom into or out of the waveform display.

Signals

An option of the Waveform Viewer.

Enables you to change the waveform amplitudes in the display and to rearrange the signal order.

Display

An option of the Waveform Viewer.

Determines the display unit for the Waveform Viewer—either time (for DUT input ports) or number of samples (for output ports).

Go Menu

The options of the *Go* menu can be used to open the various test setup editors. They provide also access to functions which are not represented by tool bar buttons.

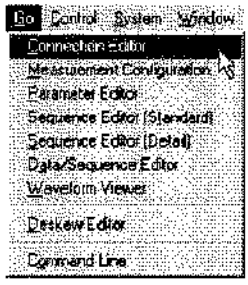


Figure 74 **Go Menu**

Connection Editor

Opens the Connection Editor. For details see *"Connecting the DUT" on page 169*.

Shortcut: Connection Editor icon in the tool bar.

Measurement Configuration

Opens the Measurement Configuration window. For details see *"Choosing the Kind of Measurement" on page 211*.

Shortcut: Measurement Configuration icon in the tool bar.

Parameter Editor

Opens the Parameter Editor. For details see *"How to Start the Parameter Editor for Global Parameters" on page 154* and *"How to Start the Parameter Editor for Ports/Channels" on page 190*.

Sequence Editor (Standard)

Opens the Standard Mode Sequence Editor, if applicable. If not, the Detail Mode Sequence Editor is started.

For details see *"Creating the Stream of Generated and Expected Data" on page 215*.

Shortcut: Sequence Editor icon in the tool bar.

Sequence Editor (Detail)

Opens the Detail Mode Sequence Editor.

This editor is always available. It is used for specifying the sequence of data blocks which reference the generated and expected data segments. The sequence can be straightforward or contain loops. See *"The Detail Mode Sequence Editor" on page 235*.

Shortcut: Sequence Editor icon in the tool bar.

Data/Sequence Editor

Opens the Data/Sequence Editor (see *"How to Start the Data/Sequence Editor" on page 282*).

Waveform Viewer

Opens the Waveform Viewer (see *"How to View Waveforms" on page 301*).

Shortcut: Waveform Viewer icon in the tool bar.

Deskew Editor

Opens the Deskew Editor. For details see *"How to Compensate for Internal and External Delays" on page 308*.

Command Line

Opens the Command Line input window. For details see *"How to Execute Firmware Commands" on page 320*.

Control Menu

The items in the *Control* menu are used to control the actual test run on the DUT.

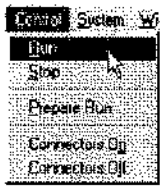


Figure 75 Control Menu

All control actions of this menu can be performed by clicking the respective buttons in the upper right-hand corner of the main window. The current status of the test is also displayed at the right-hand side of these buttons.

Run

Starts a test.

Shortcut: Run button in the tool bar.

Stop

Stops a running test.

Shortcut: Stop button in the tool bar.

Prepare Run

Downloads the test sequence to the modules. This is required for immediate reaction on a start trigger.

Shortcut: Prepare button of the tool bar.

Connectors On/Off

Switches relays inside the frontends:

- *Connectors Off* opens all input and output relays. This isolates the DUT electrically from the system.

  For channels with data rates above 675 Gbit/s, this behavior can be changed. It is possible to specify whether the relays shall be switched or whether the frontends shall be disconnected by grounding.

  For details see: *"How to Set the Global Disconnect Mode" on page 197.*

- *Connectors On* connects all module connectors with activated outputs or inputs electrically with the cables. Connector outputs or inputs can be activated or deactivated with the Parameter Editor.

Shortcut: Connectors On/Off button in the tool bar.

System Menu

The *System* menu has functions for testing the system's integrity. These tests can be performed at any time, as long as no test is running.

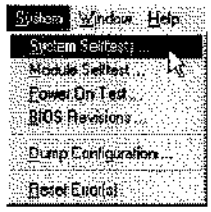


Figure 76 System Menu

Note, that the optional diagnostics software package provides additional tests which in case of problems can identify defective field replaceable units.

System Selftests

Provides a window, from which the complete selftest or subsets can be started. Ensures that all modules respond. Returns the current firmware revisions of the modules and the identification numbers of installed frontends.

Module Selftest

Enables you to check all or single modules. Checks the frontends built into the modules. For technical reasons, this test may take a minute.

Power On Test

Is automatically performed at power on. Checks all modules.

BIOS Revisions

Returns the current firmware revisions of the modules.

Dump Configuration

Enables you to write the current system configuration to a file. You have to specify the path and file name.

The file will receive a contiguous string of ASCII characters, showing the identifications of all modules and frontends.

Reset Error(s)

This menu item corresponds to the *Reset Error(s)* button in the lower left-hand corner of the main window. If invalid data was entered in any of the editor windows (e.g. the Parameter Editor), the software reports this error by highlighting all erroneous fields and the *Show Error(s)* button.

Reset Error(s) then resets the invalid input to the last correct value.

Window Menu

The *Window* menu contains standard functions provided by Microsoft Windows. You can use these items to rearrange the open windows or to switch between them.

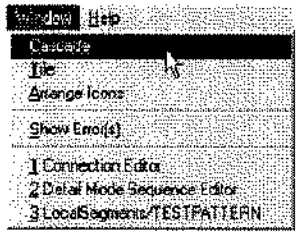


Figure 77 Window Menu

Shortcut for switching between windows: Ctrl+F6

Cascade

Superimposes all open windows. You can click any window title to bring that window to the front.

Tile

Arranges all open windows within the window frame.

Show Error(s)

This menu item corresponds to the *Show Error(s)* button in the lower left-hand corner of the main window. If invalid data was entered in any of the editor windows (e.g. Parameter Editor), the software reports this error by highlighting all erroneous fields and the *Show Error(s)* button.

Show Error(s) then displays an error window describing the error in detail.

Help Menu

The *Help* menu is supposed to be self-explanatory. You can start with the table of contents or search from the alphabetical index.

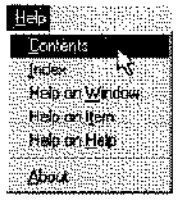


Figure 78 Help Menu

The options of the *Help* menu are:

- Contents.

  This opens the Help Desk window presenting an introduction to the system.

- Index.

  This opens the Help Desk window presenting an introduction to the system.

- Help on Window.

  This opens the Help Desk window presenting information on the currently active window.

- Help on Item.

  This option corresponds to the Help on Item button in the tool bar. When selected, the cursor changes its shape.

  Place the cursor on the item of interest an click the left mouse button. The Help Desk window presents information on the selected item.

- Help on Help.

  This opens the Help Desk window presenting an explanation how to use help.

- About.

  This opens a window telling the software version and contact and copyright information.

TIP For help on a specific item place the cursor on this item and press F1. The Help Desk window then presents information on this item.

Setting Global System Parameters

Global system parameters refer to the master clock module. If slaves are connected, they will follow the master.

The clock module has

- a built-in 10 MHz reference,
- a PLL-controlled oscillator,
- pulse delay circuits,
- a frequency multiplier/divider,
- two input connectors named CLOCK / REF INPUT and EXT INPUT,
- one output connector named TRIGGER OUTPUT.

The Parameter Editor is used for setting appropriate parameters.

This chapter provides instructions on how to set up the clock module:

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial*.

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo
- In the *Tutorial*, select *"Easy Frequency Setting"*.

How to Start the Parameter Editor for Global Parameters

There are global and channel-related system parameters. Both are set with the Parameter Editor. To support all kinds of parameters for the central clock module, data generator/analyzer modules, channels, ports, terminals and so on, the Parameter Editor has several modes of operation.

The global system parameters comprise the setup of:

- System, port, and channel frequencies,
- Clock source,
- External input,
- Trigger output.

The simplest way to access these setups is from the Connection Editor:

1 Double-click the corresponding fields in the *Modules* section.

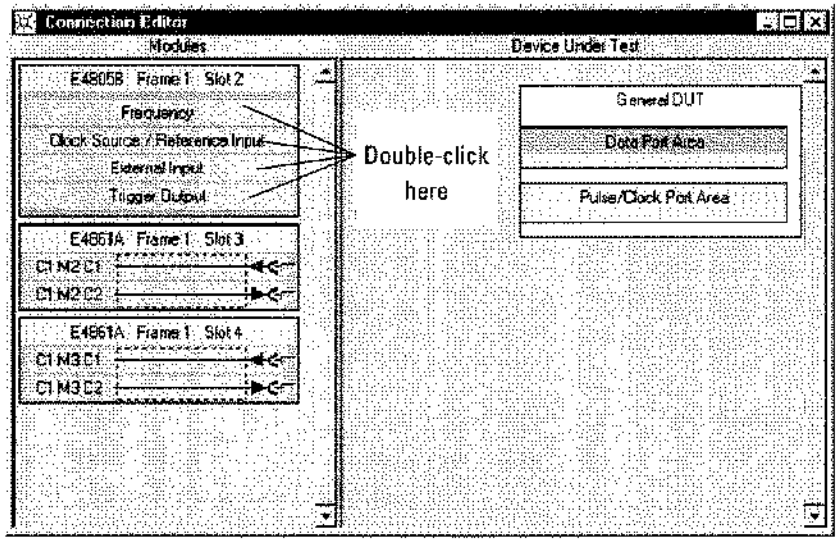


Figure 79 Accessing Global Parameters

If the Connection Editor is not displayed:

1 Choose *Parameter Editor* from the *Go* menu.

You get a list of all the items that have been configured and can have parameters. As long as you have not connected any DUT terminals with the Connection Editor, the list starts with the clock module.

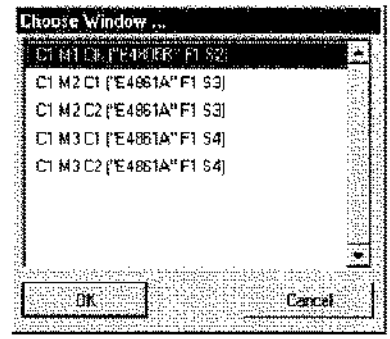


Figure 80 Parameter Editor Selection Window

2 Select the master clock module ("C1 M1 Clk") and click *OK*.

The Frequency setup window appears.

NOTE Once the Parameter Editor has been started, it provides on the top of the window a browser labeled *Resource* and up/down arrows that enable you to switch to another item.

How to Set the Clock Frequency

You have to set a general system clock frequency. Then you may set individual clock frequencies for:

- Unconnected instrument channels
- Connected DUT data ports
- Connected pulse port terminals

Individual clock frequencies can be generated by multiplying or dividing the system clock frequency by factors of 2. For details see:

"How to Set the General System Frequency" on page 156

"How to Use Multiple Frequencies" on page 158

How to Set the General System Frequency

1 Open the Parameter Editor for the clock module (see *"How to Start the Parameter Editor for Global Parameters" on page 154*). Choose the *Frequency* page.

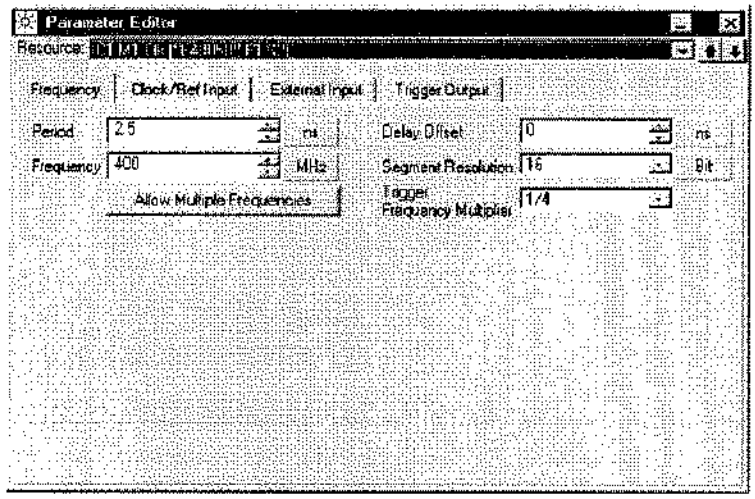


Figure 81 Setting the General System Frequency

You can specify the desired period or the desired frequency. Both are equivalent.

2 Accept or change the units.

The Parameter Editor displays default units (ns/MHz) and has default vernier steps. Both can be changed (see *"How to Change Units and/or Vernier Steps" on page 128*).

3 Set the desired general *Frequency* or *Period*.

If you have typed a number, terminate your input with the Enter or Return key. This updates the other field (Period or Frequency).

4 If desired, set a global *Delay Offset*.

A global delay offset enables you to specify negative time offsets for individual signals. Such signals then appear in advance of the regular clock pulse.

5 Check the *Segment Resolution*.

The segment resolution has an impact on the available memory resources for generating or capturing data. The default setting of the segment resolution is 4 bits for E4832A modules and 16 bits for E4861A modules.

The segment resolution is coupled with a certain Frequency Multiplier (FM) factor. The available multiplication factors that can be used for

multiplying the system clock are called Frequency Multiplier Range (FMR).

Table 8 Clock Rates, Segment Resolution, and Memory Depth for E4832A Modules

System Clock Frequency Mbit/s	Segment Resolution bits	Memory Depth bits	Frequency Multiplier Range
≤ 42.1875	1	131,008	1, 2, 4, 8, 16
≤ 84.375	2	262,016	1/2, 1, 2, 4, 8
≤ 168.750	4	524,032	1/4, 1/2, 1, 2, 4
≤ 337.500	8	1,048,064	1/8, 1/4, 1/2, 1, 2
≤ 675.000	16	2,097,152	1/16, 1/8, 1/4, 1/2, 1

Table 9 Clock Rates, Segment Resolution, and Memory Depth for E4861A Modules

System Clock Frequency Mbit/s	Segment Resolution bits	Memory Depth bits	Frequency Multiplier Range
333.334 to 675.000	16	2,097,152	1, 2, 4
≤ 1,350.000	32	4,294,304	1/2, 1, 2
≤ 2,700.000	64	8,388,608	1/4, 1/2, 1

NOTE Depending on the desired clock rate it is possible to choose a lower or higher segment resolution as shown in the tables above. If this is done for the analyzer frontends of an E4832A module, then the delay vernier and the functions for automatic sampling point adjustment are not available.

Table 10 Clock Rate, Segment Resolution, and Memory Depth for E4866A/E4867A Modules

System Clock Frequency Gbit/s	Segment Resolution bits	Memory Depth bits	Frequency Multiplier Range
9.5 to 10.8	256	33,554,432	1

For details please refer also to *"Frequency Multiplier and Segment Resolution" on page 55*.

NOTE Not all frequencies and hence frequency multiplier factors are supported by all modules and frontends. The system will report an error, if the chosen segment resolution or frequency multiplier factor does not fit to all the components. In this case you may wish to change the setup individually for some channels and use multiple frequencies.

6 Check the *Trigger Frequency Multiplier*.

The *Trigger Frequency Multiplier* refers to the TRIGGER OUTPUT of the clock module. The TRIGGER OUTPUT can be used to generate a continuous clock signal or single pulses.

By default, the trigger clock frequency equals the master clock frequency. By setting the *Trigger Frequency Multiplier* to a factor other than 1, you can change the trigger clock frequency. The factor takes effect if the TRIGGER OUTPUT is in *Clock Generator* mode.

NOTE The master clock frequency is limited to 675 MHz. If you have set a system clock frequency above 675 MHz, you have to adjust the *Trigger Frequency Multiplier*.

For example, if you have chosen a system clock frequency of 2.7 GHz, the maximum *Trigger Frequency Multiplier* setting is 1/4th.

See also *"How to Set the Characteristics of the Trigger Output" on page 167*.

How to Use Multiple Frequencies

Multiple frequencies can be required by the DUT, if some ports or pins are operated at different clock rates.

Multiple frequencies are also required if your ParBERT system is equipped with frontends which cannot be operated under one and the same frequency setup.

Additional clock frequencies can be generated by multiplying or dividing the system clock frequency by factors which are multiples of 2.

NOTE A ParBERT 43G system by default uses multiple frequencies—37 GHz to 43.2 GHz for the MUX/DEMUX module and 1/16th for the data generator/analyzer modules.

Setting Multiple Frequencies

1 Open the Parameter Editor for the clock module (see *"How to Start the Parameter Editor for Global Parameters" on page 154*). Choose the *Frequency* page.

2 Click *Allow Multiple Frequencies*.

As long as you have not connected any DUT terminals to frontends with the Connection Editor, the list shows all the connectors:

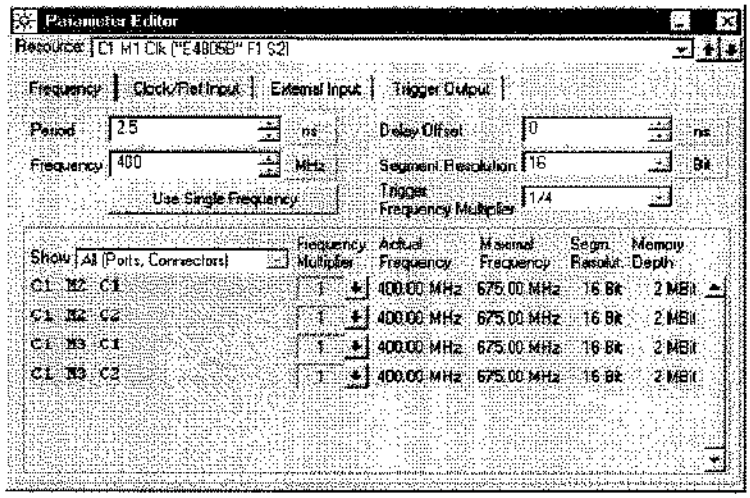


Figure 82 Setting Multiple Frequencies for Unconnected Channels

NOTE This list appears automatically if your system is composed of modules or frontends which require a multiple frequency setup.

If the DUT terminals have already been connected to frontends with the Connection Editor, the list shows all the data ports, pulse port terminals, and unconnected channels, as illustrated below:

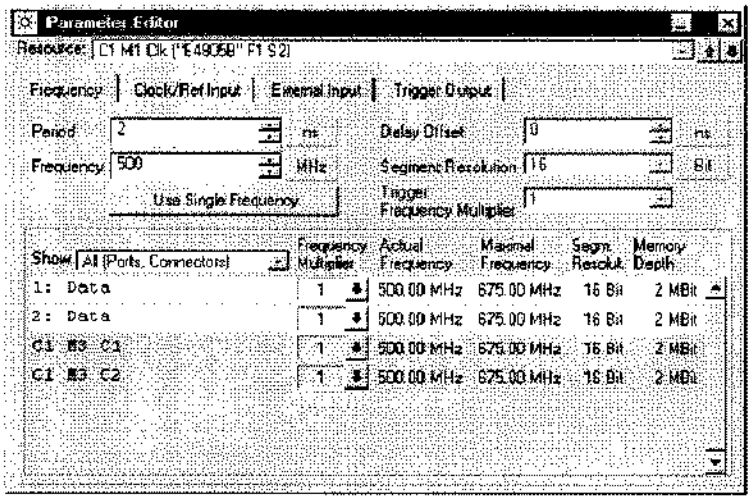


Figure 83 Setting Multiple Frequencies for Connected and Unconnected Channels

The terminals of the data ports are not displayed, because all terminals of a data port must use one and the same frequency. They have to be set up altogether. The terminals of a pulse port, however, can operate at different frequencies.

For a ParBERT 43G system, this looks as shown below:

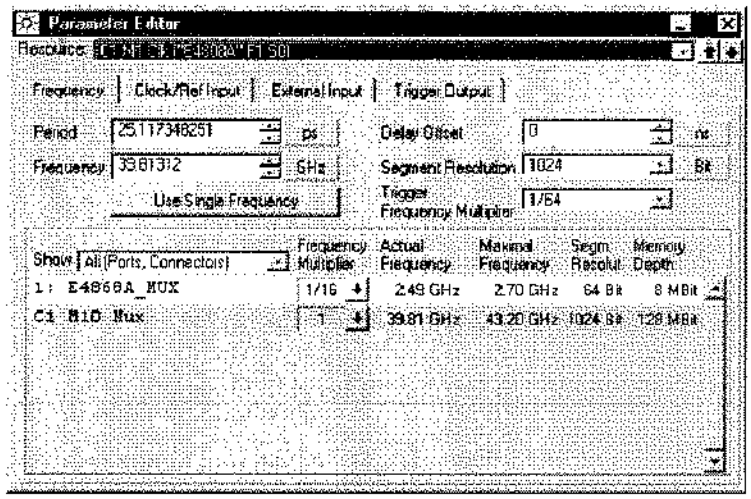


Figure 84 Frequency Setting for a ParBERT 43G Pattern Generator System

NOTE For a ParBERT 43G system, you may wish to use one of the standard frequencies, such as OC-768, G. 709, G. 975, and so on. Such frequencies can be chosen from the MUX/DEMUX module parameters (see *"How to Set Up a 43G MUX/DEMUX Module" on page 180*).

The *Show* menu allows to restrict the list to certain items.

3 To change the frequency of a port or channel, click the corresponding down-arrow in the *Frequency Multiplier* column. You get a list of the available FM factors:

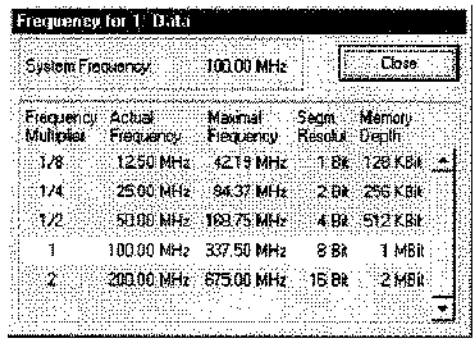


Figure 85 Individual Frequency Selection

4 Choose from the list and click *Close*.

In case of a problem please refer to the tables *"Clock Rates, Segment Resolution, and Memory Depth for E4832A Modules" on page 157* and *"Clock Rates, Segment Resolution, and Memory Depth for E4861A Modules" on page 157*.

Returning to one Single Frequency

If you wish to return to one system frequency for all channels, click *Use Single Frequency* and consider the following warning:

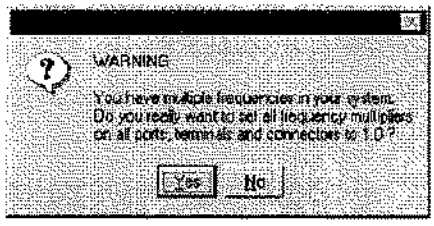


Figure 86 Return to Single Frequency Setup Warning

All frequency multipliers will be reset to one. This may conflict with your system configuration.

Troubleshooting

If an error occurs:

1 Click *Show Error(s)* and study the error messages.

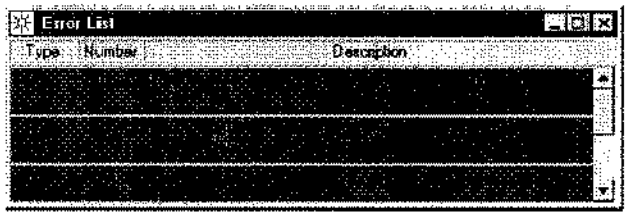


Figure 87 Frequency Multiplier Error Examples

2 Locate the connectors that are causing the problem.

3 Click the down-arrow of these connectors in the *Frequency Multiplier* column. You get a list of the available FM factors:

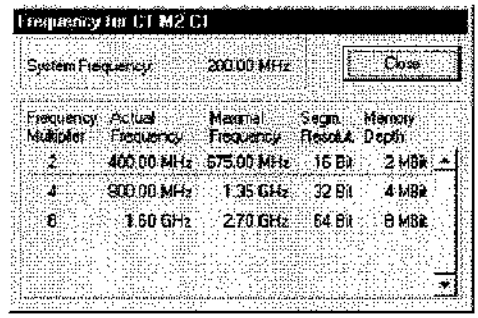


Figure 88 Frequency Multiplier Range

4 Choose valid FM factors for the connectors, and the error will disappear.

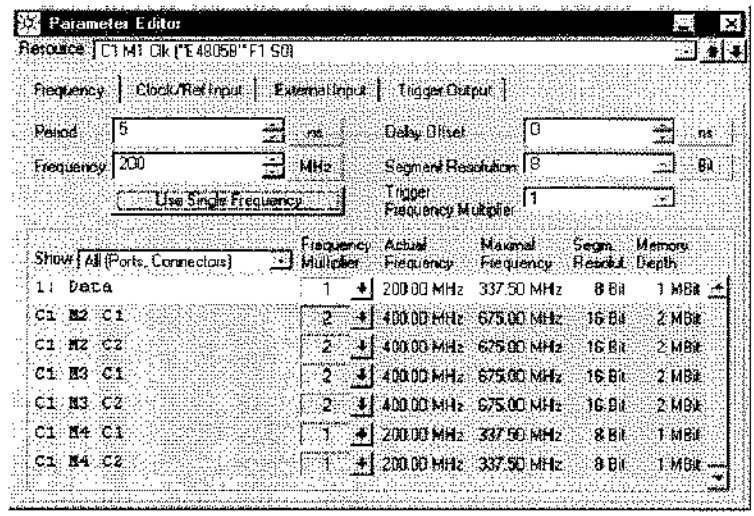


Figure 89 Frequency Setup for a System With E4861A and E4832A Modules

How to Choose the Clock Source

If you wish to use an external clock, this signal has to be connected to the CLOCK / REF INPUT of the central clock module. The external clock can be used as a reference (an input to the built-in PLL-controlled oscillator) or directly.

1 Open the Parameter Editor for the clock module (see *"How to Start the Parameter Editor for Global Parameters" on page 154*). Click the *Clock/Ref Input* tab.

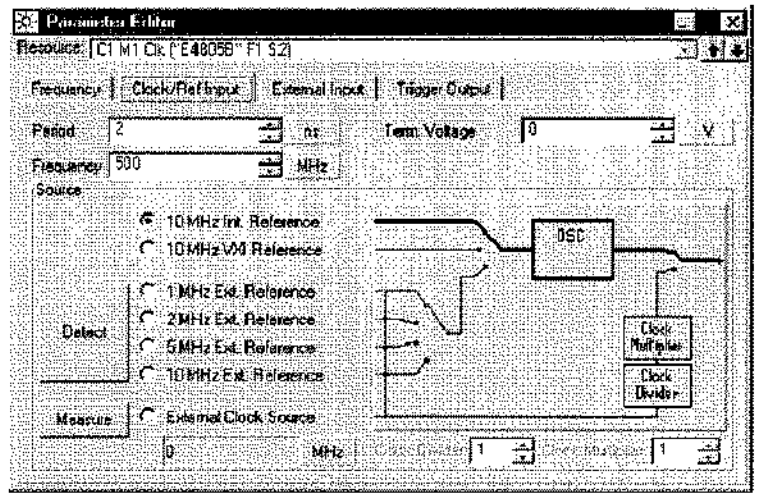


Figure 90 Clock /Reference Input page

2 Enable the type of clock.

External reference clock

External reference clocks can have a frequency of 1, 2, 5, or 10 MHz. To use an external clock as a reference to the PLL-oscillator:

1 Connect the clock signal to the CLOCK / REF INPUT .

2 Click the *Detect* button.

The clock is automatically identified and connected.

External source clock The frequency of the external source clock must exceed 1.302083 MHz. To use an external clock as a direct source:

1 Connect the clock signal to the CLOCK / REF INPUT .

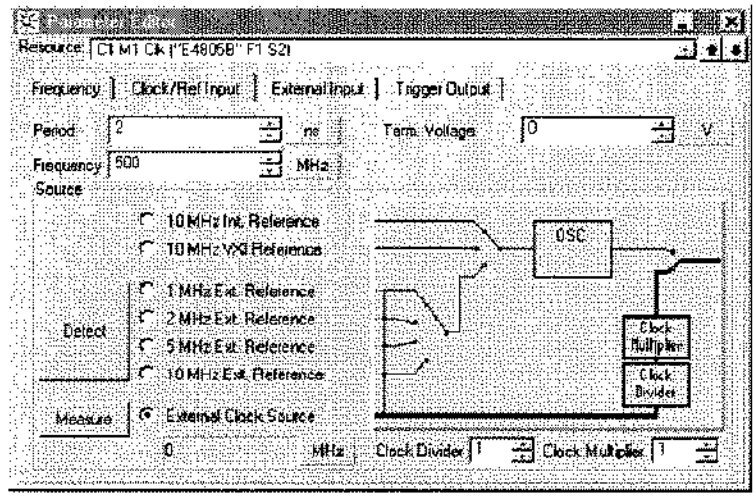


Figure 91 Using an External Source Clock

2 Click the *Measure* button.

The clock frequency is measured and the clock is automatically connected.

Once you have connected an external source clock, you can use the *Clock Divider* and the *Clock Multiplier*.

The clock multiplier enables you to multiply the applied clock frequency by any integer factor between 1 and 256. The clock divider enables you to divide the applied clock frequency by any integer divisor between 1 and 10.

NOTE A built-in phase locked loop will lock onto the external source clock. This may take up to 100 ms. When using an external source clock, observe the PLL lock indicator in the upper right-hand corner of the user interface. It turns red if the PLL could not lock or has lost its synchronization.

How to Set the Characteristics of the External Input

The EXT INPUT connector of the master clock module can be used to start and stop the system.

1 Open the Parameter Editor for the clock module (see *"How to Start the Parameter Editor for Global Parameters" on page 154*). Choose the *External Input* page.

The External Input page shows the alternatives:

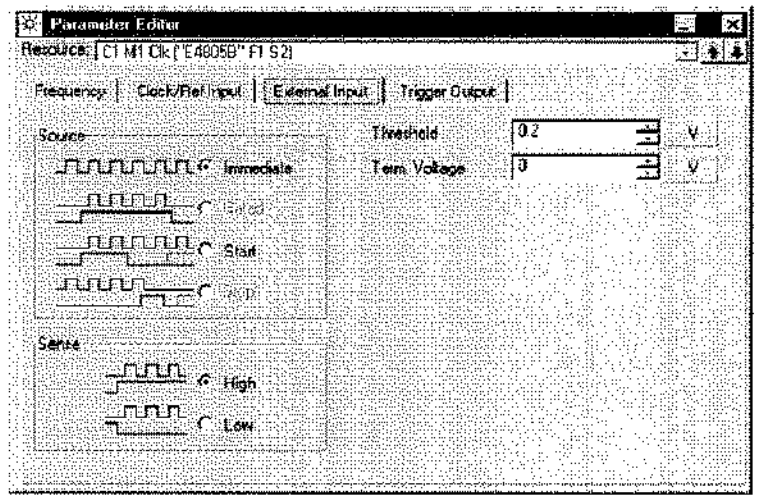


Figure 92 External Input Configuration Page

2 Choose the desired start/stop mode. Options are:

- *Immediate*:

  The timing system is not influenced by the EXTERNAL INPUT. It is started either manually by the user with a mouse click or by a software command.

- *Gated*:

NOTE Gated mode is only supported if the system contains exclusively E4832A modules.

The timing system is armed by pressing the *Run* icon. The user interface displays HALTED as long as the system is not started. The

timing system is started and stopped according to the chosen *Sense* polarity and *Threshold*.

The system is also stopped, if the sequence terminates. The user interface displays RUNNING, HALTED, or STOPPED. See also *"Trigger-Controlled Stop" on page 63*.

– *Start*:

The timing system is armed by pressing the *Run* icon. The user interface displays HALTED as long as the system is not yet started. The timing system is started with the first edge of the chosen *Sense* polarity that exceeds the *Threshold*. The system is stopped, if the *Stop* icon is pressed or the sequence terminates.

– *Stop*:

NOTE Stop mode is only supported if the system contains exclusively E4832A modules.

The timing system is started by pressing the *Run* icon. The timing system is halted by the first edge of the chosen *Sense* polarity that exceeds the *Threshold*. It is stopped, if the *Stop* icon is pressed or the sequence terminates. See also *"Trigger-Controlled Stop" on page 63*.

3 Specify the trigger *Sense* polarity.

4 Enter an appropriate *threshold* voltage for the external input.

5 Enter an appropriate *termination voltage*, if required.

How to Set the Characteristics of the Trigger Output

The TRIGGER OUTPUT connector of the central clock module can be used to inform other instruments upon an event. This event can be:

- Start of a data block within the overall test sequence
- An event detected by the system (see *"Event Handling Principles" on page 88*).

To set the trigger characteristics:

1 Open the Parameter Editor for the clock module (see *"How to Start the Parameter Editor for Global Parameters" on page 154*). Choose the *Trigger Output* page.

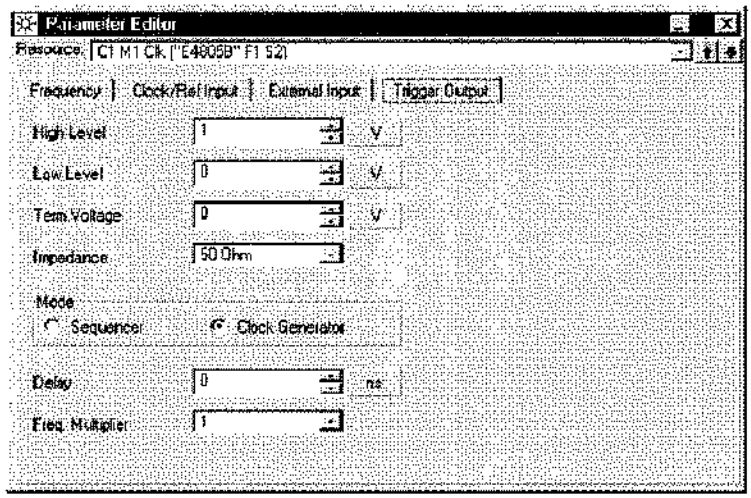


Figure 93 Trigger Output Configuration Page

2 Set the voltages and output impedance.

3 Select the Mode.

- *Clock Generator*: generates a clock signal derived from the system clock.
- *Sequencer*: Generates a transition from high to low or vice versa.

4 Set the *delay*, if desired. The delay refers to the system clock.

5 *Frequency Multiplier* is only available in Clock Generator mode. This is the *Trigger Frequency Multiplier*.

Below 675 MHz, the trigger clock frequency by default equals the system clock frequency. By setting the *Trigger Frequency Multiplier* to a factor other than 1, you can change the trigger clock frequency.

For example, if you have chosen a system clock frequency of 250 MHz, you can set the trigger clock frequency to 500 MHz.

You can choose one of the factors from the list. The list shows the FMR (see *"How to Set the Clock Frequency" on page 155*).

NOTE The master clock frequency is limited to 675 MHz. If you have set a system clock frequency above 675 MHz, you have to adjust the *Trigger Frequency Multiplier*.

For example, if you have chosen a system clock frequency of 2.7 GHz, the maximum *Trigger Frequency Multiplier* setting is 1/4th.

Connecting the DUT

To connect the device under test (DUT) with the Agilent 81250 system, you need to:

- Create signal ports for the DUT.

  There are data input ports, data output ports, and pulse ports.

- Specify the port characteristics.

  You can add terminals to ports. You can also remove terminals from a port, rename the port or delete it.

NOTE Terminals (individual pins) can only be defined within a port.

- Change terminal characteristics.

  You can connect the terminals with suitable module connectors. You can also move a terminal, rename it, or disconnect it.

All this can be done from the Connection Editor.

After at least one terminal has been connected, the Connection Editor is also used to access the Parameter Editor for setting port and terminal specific properties.

NOTE Of course, physical connections are required as well. But you need only take care that the physical connections match the setup shown in the Connection Editor.

ParBERT 43G systems You may be operating a ParBERT 43G system: These systems, usually delivered as bundles, are preconfigured (see also *"ParBERT 43G Systems" on page 91*), but can also be set up individually. Here, the frontends are connected to a MUX or DEMUX module. You can easily access the parameters of the MUX/DEMUX modules from the Connection Editor.

This chapter explains how to use the Connection Editor:

- *"How to Change the Characteristics of a Terminal" on page 175*
- *"How to Set Up a 43G MUX/DEMUX Module" on page 180*

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs - Agilent 81250 Tutorial*.

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo
- In the *Tutorial*, select *"Creating a Graphical Image of Your Test Setup"*.

How to Start the Connection Editor

The Connection Editor is the first window that comes up automatically after starting the user interface.

To start the Connection Editor if you have closed its window:

1 Click the Connection Editor icon in the tool bar.

Alternatively, you can also start the Connection Editor from the *Go* menu.

Contents of the Connection Editor Window

At the left-hand side is the *Modules* section. There the Connection Editor shows an image of the instrument, including all its modules, channels, and connectors. The following figure shows an example.

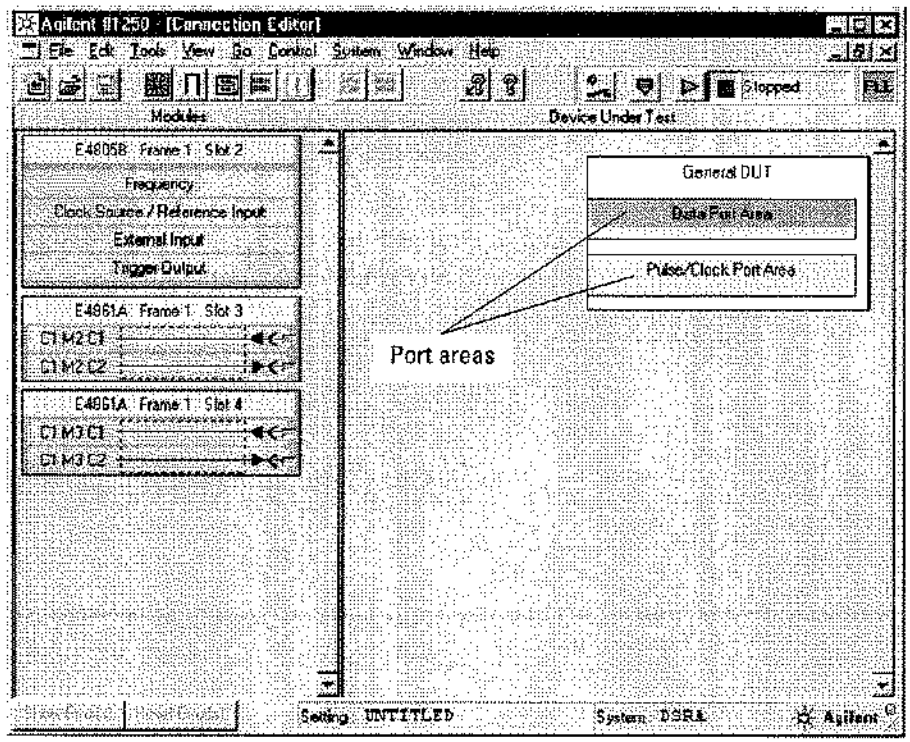


Figure 94 Connection Editor Window

The identification of the channels is:

Cx–My–Cz (ClockgroupNumber–ModuleNumber–ConnectorNumber), as for instance C1 M3 C2.

The connectors are also marked with arrows. So you know at a glance whether a connector belongs to an output channel (data generator) or an input channel (data analyzer).

At the right-hand side there is a template for setting up an image of the DUT. You can add:

- Data input ports
- Data output ports
- Pulse ports
- Port terminals representing the individual pins of the port

NOTE If you are operating a ParBERT 43G system, this is preconfigured.

The "DUT" that receives generated data is the E4868A multiplexer module. The "DUT" that returns the data to be analyzed is the E4869A demultiplexer module. The "DUT" has one port with 16 terminals. All the terminals are readily connected to generator or analyzer frontends, respectively.

For basic information on ParBERT 43G systems see *"ParBERT 43G Systems" on page 91*. For examples of the ParBERT 43G Connection Editor window see *"ParBERT 43G Software Support" on page 95*.

How to Create a Port

If you start from scratch, the DUT area of the Connection Editor shows only an empty template. You have to define ports (usually i/o buses, but also ports for clocks, latches, strobes, etc.) and terminals (DUT pins).

DUT data ports receive or return data streams. DUT pulse ports receive clocks and pulses from the Agilent 81250 system.

To create a port:

1 Click on the port area (either Data Port Area or Pulse Port Area) with the right mouse button to open the context menu.

2 For data ports you can choose the type of the port. Select either *Insert Input Port* or *Insert Output Port*. Pulse ports are always DUT input ports.

The Insert Data/Pulse Port dialog box is displayed.

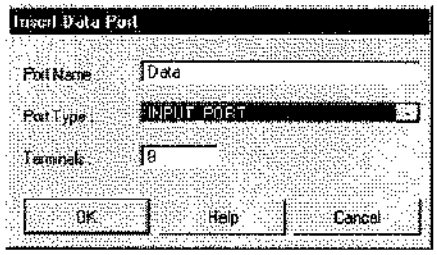


Figure 95 Insert Data Port Dialog

If you have chosen to insert a data port, you can still switch between DUT input and output port.

NOTE The terminals of an input port can only be connected to data generator channels, the terminals of an output port only to analyzer channels.

3 Enter a suitable port name and the number of terminals.

4 Click OK.

The Connection Editor shows the new port. The terminals get the port name and are automatically numbered.

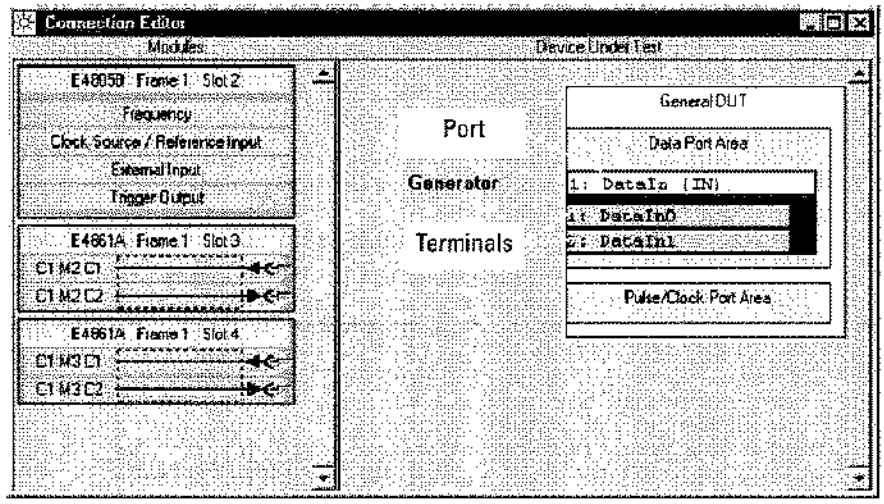


Figure 96 Display of Ports and Terminals

The terminals can be renamed or rearranged if required. See *"How to Rename a Terminal" on page 176* and *"How to Move a Terminal" on page 176*.

How to Change the Characteristics of a Port

Although all actions can also be selected from the menus in the main window, it is a lot more convenient to employ the individual context menu of each item.

To open the context menu of a certain port, place the cursor on the port's header and click the right mouse button.

The available options are to:

- Delete the port
- Rename the port
- Add terminals to the port

After one or several of the port terminals have been connected to instrument connectors, you have the additional options to:

- Disconnect all terminals
- Set or change the port properties

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial.*

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo

How to Delete a Port

To delete a port:

1 Open the port's context menu by clicking the port header with the right mouse button.

2 Choose *Delete.*

3 Confirm.

How to Rename a Port

To rename a port:

1 Open the port's context menu by clicking the port header with the right mouse button.

2 Choose *Rename.*

3 Specify a new name for the port.

4 Confirm with Enter or click *OK.*

How to Add a Terminal to a Port

To add a terminal to a port:

1 Open the port's context menu by clicking the port header with the right mouse button.

2 Choose *Insert Terminal*.

The window shows the default terminal name (port name plus number) and suggests the position at the end of the terminal list.

3 Specify the desired terminal name.

4 Accept the suggested position or enter one of the occupied positions to insert the new terminal there.

5 Confirm with Enter or click *OK*.

NOTE The terminal's name and position can be changed at any time. Although permitted, you should not use one name for several terminals of a port in order to avoid confusion.

How to Change the Characteristics of a Terminal

Although all actions can also be selected from the menus in the main window, it is a lot more convenient to employ the individual context menu of each item.

To open the context menu of a terminal, place the cursor on it and click the right mouse button.

The available options are to:

- Rename the terminal
- Delete the terminal
- Connect the terminal to the instrument
- Move the terminal

If a terminal has been connected to an instrument connector, you can also

- Disconnect the terminal
- Set or change the channel properties

How to Rename a Terminal

To rename a terminal:

1 Open the context menu by clicking the terminal with the right mouse button.

2 Choose *Rename*.

3 Enter a new name for the terminal.

4 Confirm with Enter or click *OK*.

How to Delete a Terminal

To delete a terminal:

1 Open the terminal's context menu by clicking it with the right mouse button.

2 Choose *Delete*.

3 Confirm.

How to Move a Terminal

To move a terminal within its port:

1 Open the terminal's context menu by clicking it with the right mouse button.

2 Choose *Move*.

3 Overwrite the present location by the desired location.

If the terminal is placed at the last position of the port, you can only move it upward.

4 Confirm with Enter or click *OK*.

Shortcut: Click the terminal with the left mouse button and drag it to the desired position.

How to Connect a Terminal

There are several ways to connect the terminals of the DUT to the connectors of the instrument frontends:

- *"Connecting a Terminal With the Keyboard" on page 177*
- *"Connecting a Terminal With the Mouse" on page 178*
- *"Inserting and Connecting a Single Terminal With the Mouse" on page 178*
- *"Inserting and Connecting Multiple Terminals With the Mouse" on page 178*

NOTE The terminals of a data input port or a pulse port can only be connected to generator channels. The terminals of a data output port can only be connected to analyzer channels.

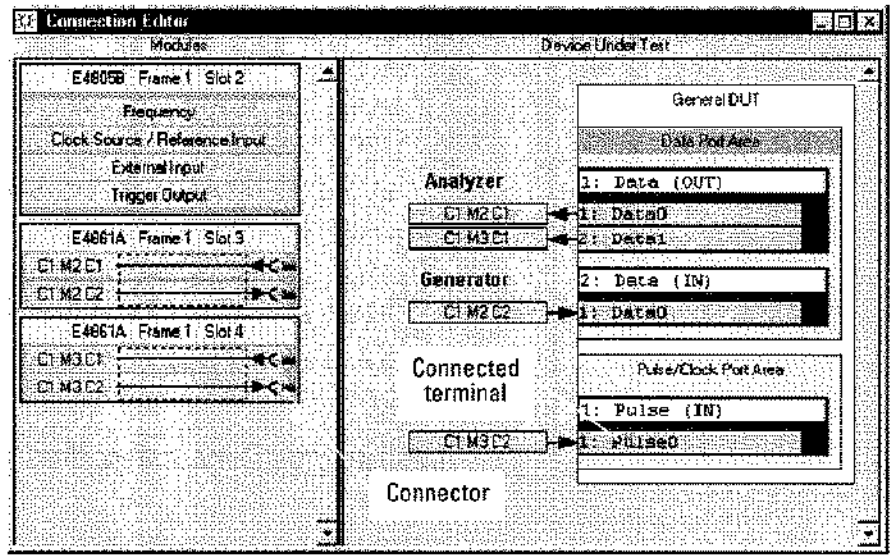


Figure 97 Display of Terminal Connections

Connecting a Terminal With the Keyboard

To connect a terminal with the keyboard:

1 Click the right mouse button to open the terminal's context menu.

2 Choose *Connect*.

3 Enter the identifier of the desired channel: ClockgroupNumber, ModuleNumber, and ConnectorNumber.

4 Confirm with Enter or click *OK*.

Connecting a Terminal With the Mouse

To connect a terminal with the mouse:

1 Position the cursor on the terminal.

2 Press the left mouse button. Hold the mouse button depressed and drag the cursor (which changes its shape) onto an empty connector of appropriate type.

3 Release the mouse button.

Inserting and Connecting a Single Terminal With the Mouse

You can create a new one-terminal port or insert a new terminal into an existing port and connect it in one go:

1 Position the cursor on the frontend connector in the *Modules* section.

2 Press the left mouse button. Hold the mouse button depressed and drag the cursor (which changes its shape) onto the DUT.

- If you place the cursor on the green header of the *Data Port Area*, a new port with a single terminal will be created.
- If you place the cursor on a terminal, this terminal will be connected to the module channel.
- If you place the cursor on the border line of a terminal (the border turns red), a new terminal will be inserted at this point.

3 Release the mouse button to establish the connection.

Inserting and Connecting Multiple Terminals With the Mouse

You can create new ports with multiple terminals or add multiple terminals to an existing port and connect them in one go:

1 In the *Modules* section place the cursor on a module label to connect all its connectors at once.

2 Press the left mouse button. Hold the mouse button depressed and drag the cursor (which changes its shape) onto the DUT.

- If you place the cursor on the green header of the *Data Port Area*, one or two new port(s)—an input or output port or both—will be created with all (matching) channel connectors being connected to terminals of this new port.

- If you place the cursor on an existing terminal, this terminal and the following ones will be connected to the module connectors. No new terminals will be created.
- If you place the cursor on the upper line of an existing terminal (the border turns red), new terminals will be inserted at this point. They will be connected to all matching connectors of the selected module.

3 Release the mouse button to establish the connections.

How to Disconnect a Terminal

To disconnect a terminal:

1 Open the terminal's context menu by clicking the terminal with the right mouse button.

2 Choose *Disconnect*.

3 Confirm.

To disconnect all terminals of a port, choose *Disconnect* from the port's context menu.

How to Set Up a 43G MUX/DEMUX Module

The simplest way to set up a multiplexer or demultiplexer module of a ParBERT 43G system is via the Connection Editor. For a ParBERT 43G pattern generator system, the Connection Editor appears as shown:

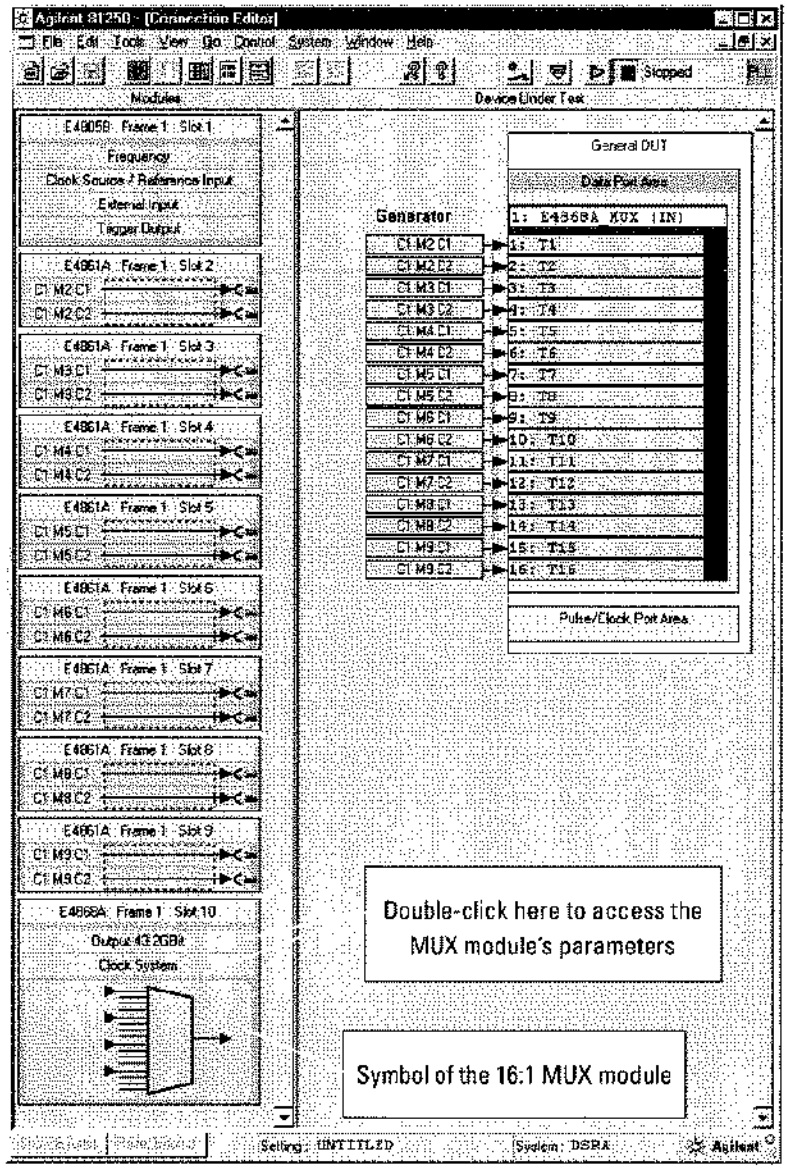


Figure 98 Connection Editor of a ParBERT 43G Pattern Generator System

A 43.2 GBit/s MUX or DEMUX module has two types of parameters:

- MUX module: *Output 43 GBit* and *Clock System* (as shown in the figure above)
- DEMUX module: *Input 43 GBit* and *Clock System*

Double-click one of the parameter types to check or change the module parameters. This opens the Parameter Editor for the module. The Parameter Editor window has two pages, and you can toggle between the two parameter types.

For details see:

- *"How to Change the Output Parameters of a MUX Module" on page 182*
- *"How to Change the Clock Routing of a MUX Module" on page 185*
- *"How to Change the Input Parameters of a DEMUX Module" on page 186*
- *"How to Change the Clock Routing of a DEMUX Module" on page 187*

NOTE A MUX or DEMUX module can hardly be compared with a clock or a data generator/analyzer module, although it combines some features of both basic categories.

You should consider a ParBERT 43G system as a self-contained unit for testing very high speed MUX/DEMUX devices. In this context, setting channel parameters to individual values is useless and, worse, bears the risk of damaging the MUX or DEMUX module.

Therefore, most of the usual port and channel parameters are preset to fitting values and cannot be changed. Some auxiliary functions are also disabled. See *"ParBERT 43G Software Support" on page 95*.

As long a you have not more than the required number of generator/analyzer modules and frontends installed, the two buttons shown in the Connection Editor provide easy access to all relevant parameters.

How to Change the Output Parameters of a MUX Module

A MUX module has the following output parameters:

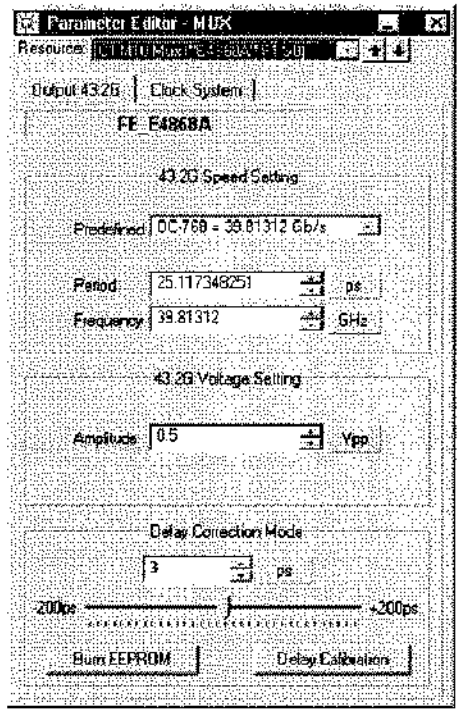


Figure 99 MUX Module Output Parameters

1 Set the output speed.

The displayed frequency and period are the same as in the Frequency window of the clock module. The *Period* is always the reciprocal of the *Frequency*.

Standard frequencies can be chosen from the list of predefined data rates.

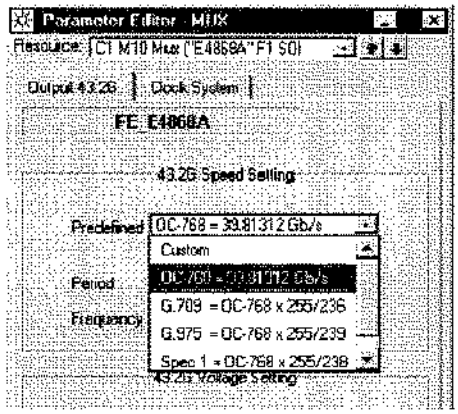


Figure 100 Predefined Frequencies

2 Set the output voltage.

The output of the MUX module is AC coupled. Therefore only the amplitude (peak-to-peak voltage) can be specified.

Delay Correction and Delay Calibration

Delay Correction and *Delay Calibration* are optional. You can click the corresponding button at the lower right-hand side of the page to toggle between these options.

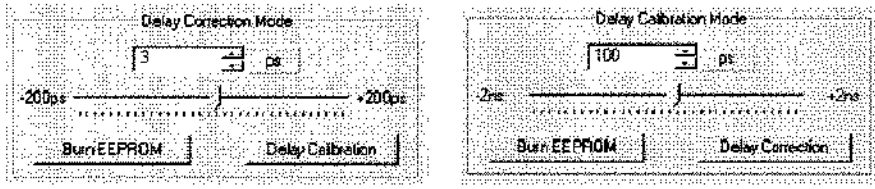


Figure 101 Delay Correction and Calibration Modes

If you receive one of the ParBERT 43G bundles, all frontends and MUX/DEMUX modules are factory-calibrated and ready to use.

These two options allow to add a common delay to all the generator frontends connected to the MUX module.

Delay Correction High-speed applications are generally sensitive to changes of the environmental conditions. *Delay Correction* allows to compensate for small changes that may be caused by operating temperatures that differ from the manufacturing temperature.

Delay Calibration *Delay Calibration* is used if a clock module or the cable set of the MUX module has been exchanged. This mode offers a wider timing range.

Delay Calibration sets the base value for the Delay Correction. If the Delay Calibration value is changed, the Delay Correction value is reset to zero.

The system stores two Delay Calibration values—one for an external clock source, one for the internal clock source. The value that is displayed depends on the currently selected clock source. Refer to the Clock/Ref Input page of the clock module.

The actual start delay of the MUX input port can be displayed by opening the Properties window of the port (double-click the yellow port area). This is shown in the figure below.

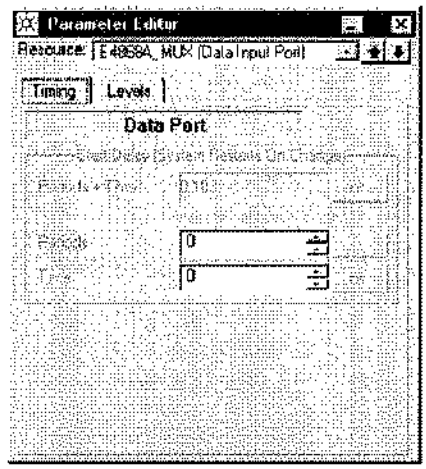


Figure 102 Timing Properties of a MUX Input Port

Burn EEPROM button If you change the delay values, your changes take effect until the system is switched off.

If you wish to keep the new values, click the Burn EEPROM button.

The reason is that the delay values of a MUX module are stored in the module itself. They are independent from the loaded setting.

How to Change the Clock Routing of a MUX Module

The Clock routing of a MUX Module can be changed on the Clock System page of the MUX module parameters.

The window clearly shows the capabilities and the present routing.

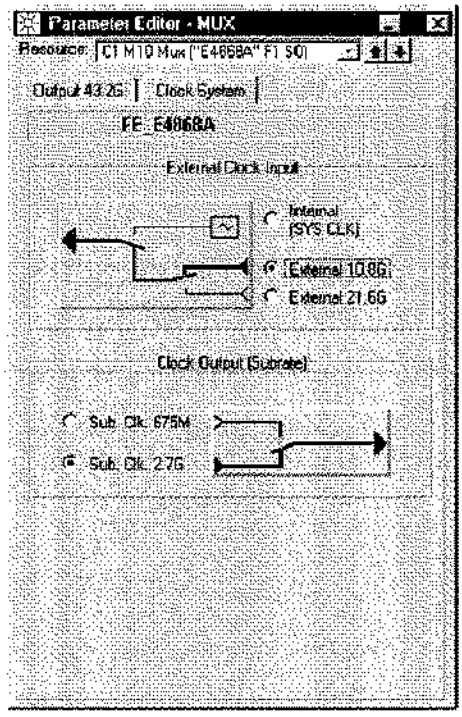


Figure 103 MUX Module Clock Routing

1 Set the clock input. Choices are:

- *Internal (SYS CLK)*

  The module uses internally a clock derived from the SYSTEM CLOCK OUTPUT signal provided by a central clock module. The SYS CLK output from the central clock module needs to be connected with the SYS CLK input of the MUX module.

- *External 10.8 G*

  To obtain more precision, the module uses an external signal in the range of 10 GHz provided by an external clock generator to its Ext. Clk. input connector.

- *External 21.6 G*

  The module uses an external signal in the range of 20 GHz.

2 Set the subrate clock output.

The subrate clock is derived from the multiplexer clock. The subrate clock is provided for general use at the subrate clock output connector of the MUX module. An internal clock divider allows to choose between two different speeds:

– *Sub. Clk. 675M*

A signal of up to 675 MHz is provided at the subrate clock output connector.

– *Sub. Clk. 2.7G*

A signal of up to 2.7 GHz is provided at the subrate clock output connector.

How to Change the Input Parameters of a DEMUX Module

A DEMUX module has the following input parameters:

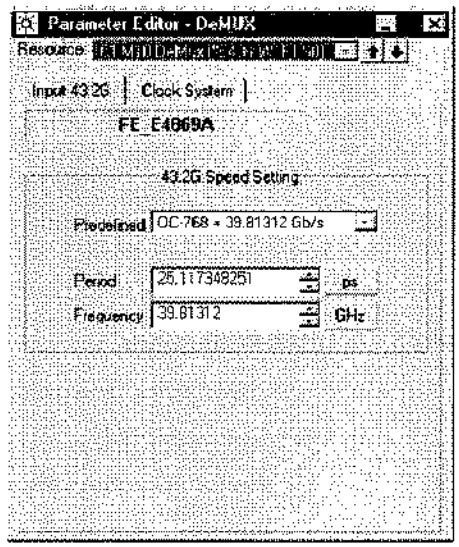


Figure 104 DEMUX Module Input Parameters

1 Set the expected data rate.

The displayed frequency and period are the same as in the Frequency window of the master clock module. The *Period* is always the reciprocal of the *Frequency*.

Standard frequencies can be chosen from the list of predefined data rates.

How to Change the Clock Routing of a DEMUX Module

The clock routing of a DEMUX Module can be changed on the Clock System page of the DEMUX module's parameters.

The window clearly shows the capabilities and the present routing.

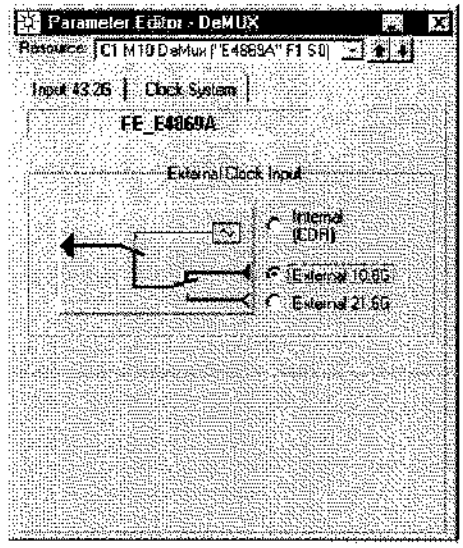


Figure 105 DEMUX Module Clock Routing

1 Set the clock source. Choices are:

- *Internal (CDR)*

  The module uses a clock signal derived from the incoming serial bit stream. The clock is recovered by the built-in Clock Data Recovery circuitry (CDR).

- *External 10.8 G*

  The DUT itself or an external clock generator may provide a clock signal in the range of 10 GHz which represents the timing of the serial bit stream. This signal can be attached to the external clock input connector of the DEMUX module.

- *External 21.6 G*

  The DUT provides a signal in the range of 20 GHz.

Setting Up Ports and Channels

After one or several terminals have been connected to the Agilent 81250 system, you can set up and modify port and channel properties, such as delays, signal formats, voltages, impedances, and so on.

Setting port parameters is an easy way to use the same settings for all connected terminals of that port. Before setting port parameters, **all** the terminals of that port should be connected with the instrument, because later connected terminals do not automatically get the same parameter settings.

Alternatively, you can set individual parameters for individual channels.

NOTE Individual channel parameters override port parameters.

To set and change port and channel parameters the Parameter Editor is used.

NOTE In addition to setting parameters, there is another function that determines channel properties: Two or four data generator channels can be added to produce a combined signal. This is done with the Channel Configuration Editor which can be invoked from the Connection Editor.

This chapter explains how to set up ports and channels:

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial*.

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo
- In the *Tutorial*, select *"Comfortable Control of Signal Parameters"*.

How to Start the Parameter Editor for Ports/Channels

The Parameter Editor has several modes of operation. It distinguishes between global system parameters and parameters for generator and analyzer channels. The setup of global parameters is described in *"Setting Global System Parameters" on page 153*.

To open the Parameter Editor you have the following options:

- Use the left mouse button and double-click a port header, a connected terminal of a port, or a channel identifier (Cx–My–Cz).

  The Parameter Editor opens and displays the properties of the selected item.

- Use the right mouse button and click on a port header, a terminal, or a channel identifier (Cx–My–Cz). Then select *Properties* from the context menu.

  The Parameter Editor opens and displays the properties of the selected item.

- Choose *Parameter Editor* from the *Go* menu.

  You get a list of all the items that have been configured so far and can have parameters. Such items are:

  – The clock module

  – Data and Pulse Ports

  – Connected port terminals (= connected channels)

  – Unconnected instrument channels

  Select an item from the list to open the Parameter Editor in the respective view.

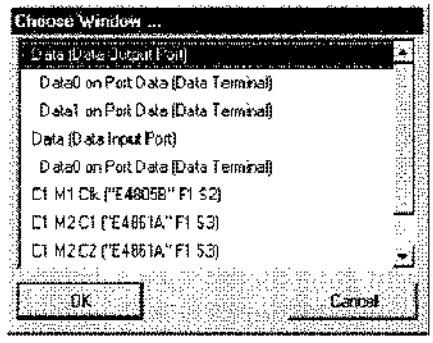


Figure 106 Parameter Editor Selection Window

The display mode of the Parameter Editor depends on the type of port or channel that has been selected. However, a selection list and arrow buttons in the editor window enable you to switch to the other items.

NOTE Port parameters refer to all channels connected to a port. Individual channel parameters override port parameters.

How to Set Up a DUT Input Port or Generator Channel

To set the parameters for a DUT port or terminal that receives generated signals or a channel that generates signals:

1 Open the Parameter Editor for the port or channel (see *"How to Start the Parameter Editor for Ports/Channels" on page 190*).

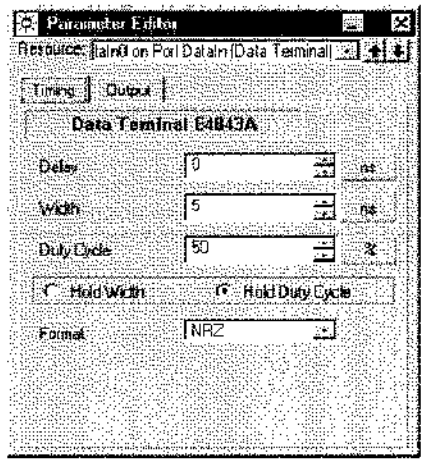


Figure 107 Timing Parameters for an E4843A Data Generator

NOTE The window always displays the properties of the frontend channel. This implies, that the settings for a channel also affect the connected DUT terminal and vice versa.

Depending on the type of the frontend, the editor can contain different parameters than shown in the figure above. For example, only the start delay can be set on the Timing page of an E4862A generator.

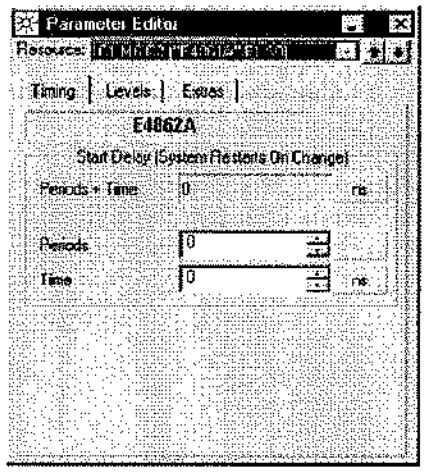


Figure 108 Timing Parameters for an E4862A Data Generator

How to Set Generator Timing Parameters

To set the timing parameters for a generator channel:

1 Check the units.

The Parameter Editor displays default units and has default vernier steps. Both can be adjusted according to your needs (see *"How to Change Units and/or Vernier Steps" on page 128*).

2 Set the timing options:

- *Start Delay*:

  The start delay is relative to the system clock start. You can specify a fixed time and/or a fraction of the system period. A negative delay can be set if the system clock has been delayed.

  The *Periods + Time* field displays the actual delay.

- *Width* or *Duty Cycle*:

  They are mutually dependent. If you have typed a number in one of the two fields, terminate your input with the Return or Enter key. This updates the other field (*Width* or *Duty Cycle*).

- *Hold Width* or *Hold Duty Cycle*:

  In case the clock frequency is changed, you can set one of the two values to be fixed.

– *Rise/Fall Time* (with E4838A only):

In the Parameter Editor the rise/fall time can be set in the range of 0.5 to 4.5 ns.

The rise and fall times are coupled. The resulting signal shape is illustrated below:

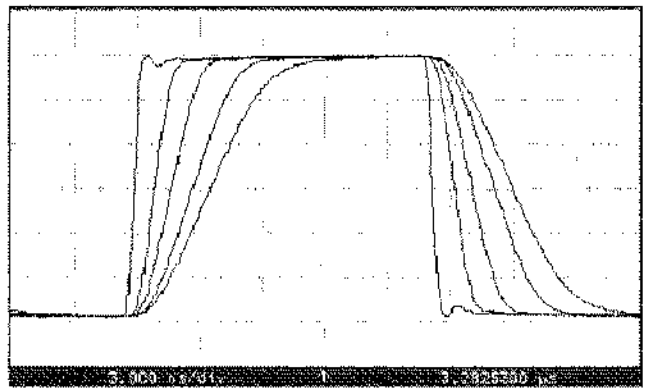


Figure 109 Variable Slopes Setting

– *Format*:

Choose from the list.

The default signal format for a data port and the channels connected to a data port is NRZ. The default format for a pulse port or an unconnected generator frontend is RZ.

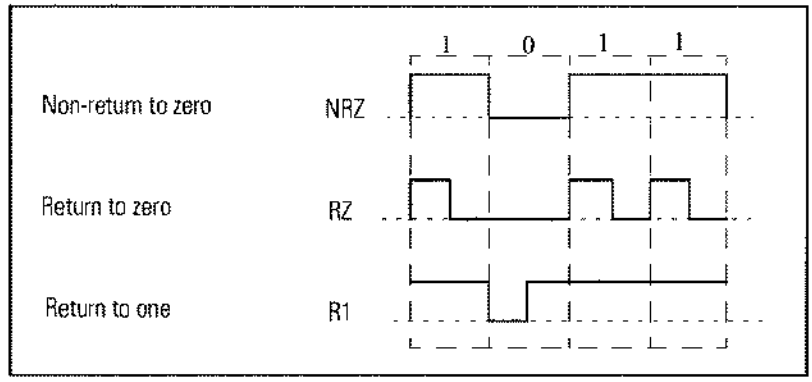


Figure 110 Signal Formats

How to Set Generator Level and Termination Parameters

1 In the Parameter Editor window, click on the second tab which is labeled *Levels*.

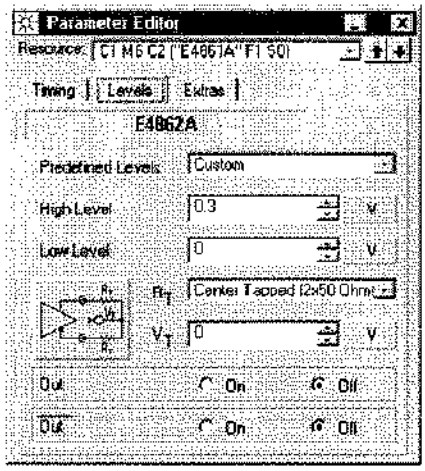


Figure 111 Level and Termination Parameters for a Connection With a Data Generator

2 Check the units.

The Parameter Editor displays default units and has default vernier steps. Both can be adjusted according to your needs (see *"How to Change Units and/or Vernier Steps" on page 128*).

3 Decide on the additional options. The additional options are:

– *Predefined Levels*: Use the levels shown or entered in the window (Custom) or use one of the predefined levels.

The predefined levels for a generator depend on the frontend. They are listed in the table below:

Table 11 Predefined Generator Signal Levels

Name	High Level	Low Level	Termination Voltage	Termination Impedance	E4836A	E4843A	E4862A E4864A	E4866A
TTL (into open)	2.5 V	0.0 V	0.0 V	Open		x		
TTL (into 50 Ω to GND)	2.5 V	0.0 V	0.0 V	2 * 50 Ω	x	x		
CMOS 5V (into open)	5.0 V	0.0 V	0.0 V	Open		x		
CMOS 3.3V (into open)	3.3 V	0.0 V	0.0 V	Open		x		
ECL (into 50 Ω to -2V)	-0.9 V	-1.7 V	-2.0 V	2 * 50 Ω	x	x	x	x
ECL (into 50 Ω to GND)	-0.9 V	-1.7 V	0.0 V	2 * 50 Ω	x	x	x	x
PECL (into 50 Ω to +3V)	4.1 V	3.3 V	3.0 V	2 * 50 Ω	x	x	x	x

– If you are using your own custom setting:

Termination impedance usually is the input impedance of the DUT.

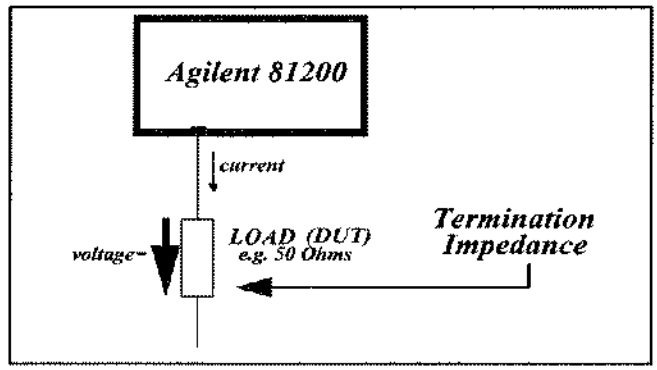


Figure 112 Termination Impedance

The *termination voltage* for a terminal that is not connected to ground must not remain below –2 V.

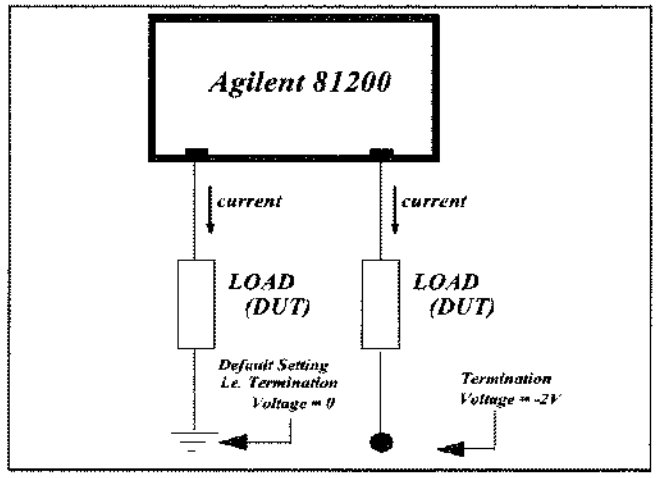


Figure 113 Termination Voltage

4 Special load options are supported by the differential generator frontends E4838A, E4843A, E4862A, and E4864A. For these frontends, you can select between center tapped and differential termination by clicking the graphical button.

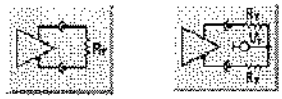


Figure 114 Termination Options for Differential Generators

Center tapped termination uses two 50 Ω resistors. The termination voltage range is –2 to +3 V.

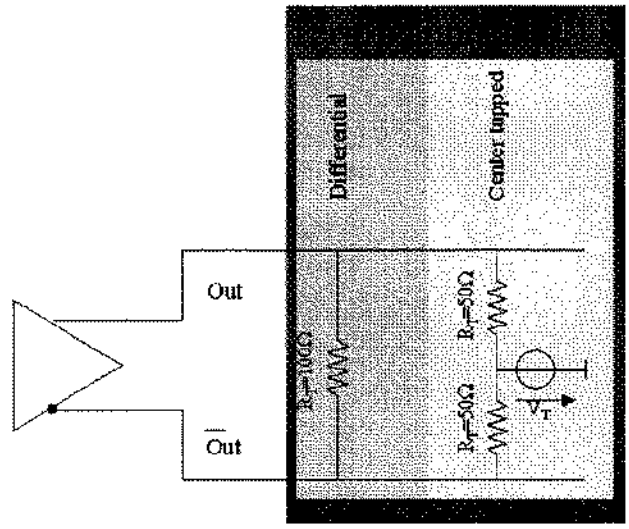


Figure 115 Supported Signal Termination Options at the DUT

5 Choose the polarity (E4838A frontend only): This allows to invert the polarity of the output signal.

6 Activate the connection by switching the output radio button to *On*. This is probably the most important step of all!

TIP When running a test, check the green LEDs on the frontends. They indicate whether the channel is enabled or disabled. If a channel is disconnected due to hardware constraints, correct its physical termination and then use the Connectors On/Off button to re-establish the connection.

How to Set the Global Disconnect Mode

If you have selected a port or channel that supports data rates above 675 Mbit/s, then the Parameter Editor shows an additional tab: *Extras*.

This page allows you to change the default behavior of the global Connectors Off/On button of the tool bar.

This button is used for disconnecting all frontends from the DUT. It is generally clicked before changing the DUT. Once the new DUT is mounted, it is clicked once more to re-establish all the previous connections.

The same functions are also provided by the *Control* menu.

By default, *Connectors Off* opens all input and output relays. It is now possible to specify whether the relays shall be switched or whether the frontends shall be disconnected by grounding.

Especially in a production environment, grounding is a way to increase the lifetime of the ParBERT relays.

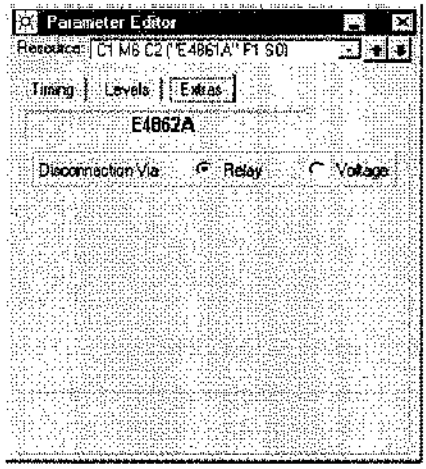


Figure 116 Extras Page for a Data Generator

Disconnection via Relay is the default.

Disconnection via Voltage means:

- For generators: The output voltage is set to 0 V.
- For analyzers: The comparator and termination voltages are set to 0 V.

You have to check whether this is in harmony with your DUT. The ParBERT generators and analyzers are connected via 50 Ω resistors. Currents will flow, if the DUT pins have not 0 V. You should also consider the possibility of static discharge.

NOTE This setting impacts only the global Connectors Off/On function. The relays are always switched, if you enable or disable connectors with the Parameter Editor.

How to Add Channels in Analog Mode

If you have selected an E4838A frontend, the Parameter Editor shows an additional tab: *Analog Channel Add*. This page provides additional parameters for combining two output channels.

NOTE These parameters are just set with the Parameter Editor. To activate them, you need to combine the channel with the channel above in the Channel Configuration Editor (see *"How to Combine Generator Channels" on page 206*).

An output channel of an E4838A frontend can only be combined with the channel above if this other channel is also an E4838A or an E4843A frontend.

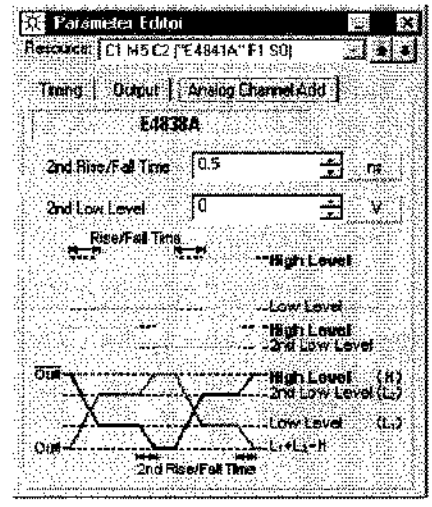


Figure 117 Analog Channel Add Parameters

The window illustrates how the analog channel addition works.

You are adding two differential signals. A differential signal consists of an OUT and a complementary \OUT\ voltage. Both signals can have different slew rates (rise/fall times) and amplitudes (the voltage difference between high and low level).

But the output voltage of the E4838A frontend at 50 Ω load is limited to –2.2 V to +4.4 V, and the output voltage swing must be in the range of 0.05 V to 3.5 V (for details refer to the *Agilent 81250 Technical Specifications*).

So we keep the high level voltage of the frontend that holds the connector. That means, the connected channel's high level voltage is only reached after adding the two OUT channels. The amplitudes Amp1 and Amp2 remain unchanged, and the resulting voltage swing of the signal is the sum of both amplitudes.

A similar scheme applies to the complementary \OUT\ connector.

To change the characteristics of the second channel:

1 Adjust the rise/fall time of the second channel (only E4838A or E4843A frontends, see also *"How to Set Generator Timing Parameters" on page 193*).

2 Set the low level of the second channel. This specifies the amplitude Amp2.

Error messages will be displayed if you try to override the physical limits of the E4838A frontend. If that occurs, you need to correct the amplitudes.

Example Assume the following setting:

High level = 1.5 V

First low level = 0 V

Second low level = 0 V

This results in the following OUT signal:

Table 12Output Voltage for Analog Channel Addition

Logic at Channel 1	Logic at Channel 2	Output Voltage
1	1	1.5 V
1	0	0 V
0	1	0 V
0	0	–1.5 V

The method is once more illustrated below:

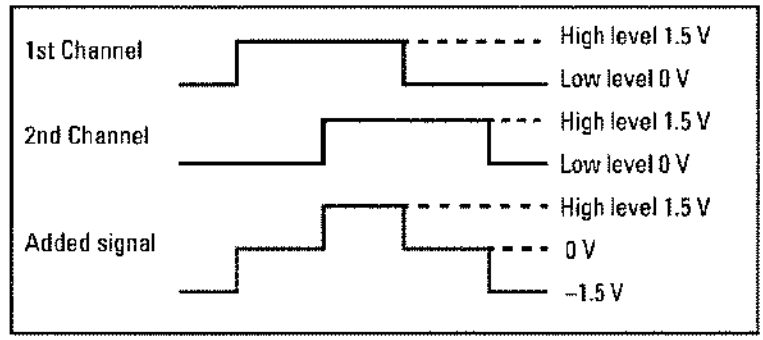


Figure 118 Analog Channel Addition

The above setting is accepted because the resulting amplitude and voltages can be generated by the E4838A frontend.

If you have chosen one of the predefined levels for the connected generator channel, you may need to change the second low level which is set to 0 V by default.

TTL into 50 Ω, for example, would yield a voltage swing of 5 V which is unacceptable. But if you change the second low level to for instance 2 V (for generating spikes of 0.5 V), this is well in the range of the E4838A frontend.

A voltage overshot could hence be generated as illustrated below.

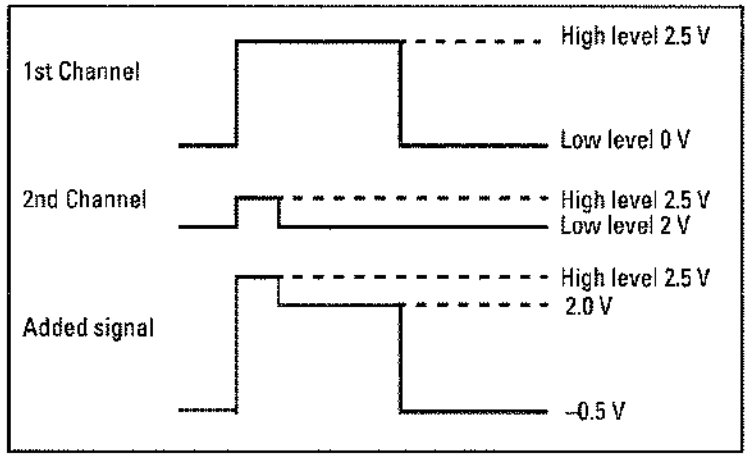


Figure 119 Overshot Generation

To generate real-world signals, you will also have to take the rise/fall times into account.

NOTE The Analog Channel Add setting only takes effect after the two channels have been added by means of the Channel Configuration Editor (see *"How to Combine Generator Channels" on page 206*).

Both channels can have different timing parameters, such as frequency, pulse width and delay. High level and expected load are determined by the channel that holds the connector.

How to Set Up a DUT Output Port or Analyzer Channel

To set the parameters for a port or terminal that returns signals or for a channel that receives signals:

1 Open the Parameter Editor for the port or channel (see *"How to Start the Parameter Editor for Ports/Channels" on page 190*).

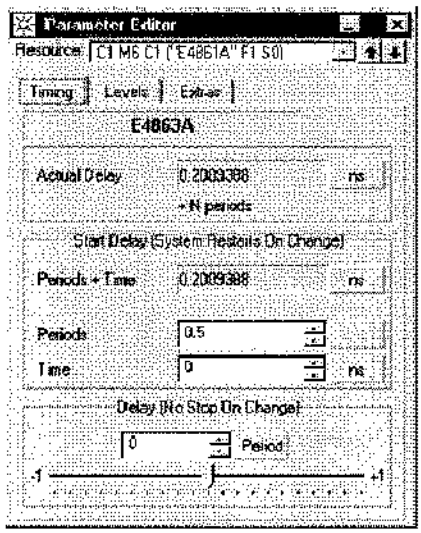


Figure 120 Timing Parameters for a Data Analyzer

NOTE The Parameter Editor always displays the identification of the connected frontend. Thus, changes done in the channel parameters will also appear in the settings of the connected port terminal and vice versa.

How to Set Analyzer Timing Parameters

1 Check the units.

The Parameter Editor displays default units and has default vernier steps. Both can be adjusted according to your needs (see *"How to Change Units and/or Vernier Steps" on page 128*).

2 Set the timing options:

- *Periods and Time*: The total delay for capturing received data is composed of a relative delay (in fractions of system clock cycles) and an absolute delay (independent of the system clock).

  If one of these parameters is changed while a test is running, the test is aborted and restarted.

- *Delay (No Stop On Change)*: The sampling delay of analyzer frontends can be fine-tuned within up to ±1 clock periods. The phase can be adjusted with the slider bar without interrupting a running test. See also *"Manual Analyzer Sampling Delay Adjustment" on page 75*.

How to Set Analyzer Level and Termination Parameters

1 Click the second tab of the analyzer parameter window. It is labeled *Levels*

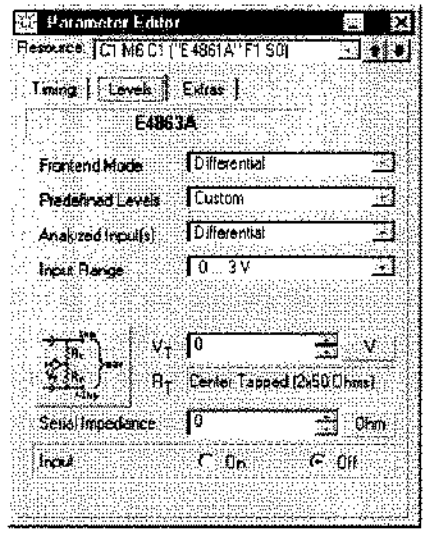
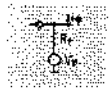


Figure 121 Additional Parameters for Data Analyzers

2 Select the frontend mode. Depending on the selected frontend the options are:

- *Differential* (E4835A, E4863A, and E4865A)

– *Single-ended Normal* (E4835A, E4863A, and E4865A)



– *Single-ended Complement* (E4835A, E4863A, and E4865A)

3 Decide on the additional options. The additional options are:

– A set of *Predefined Levels*: Choose one of the predefined levels, use the defaults values or specify your own settings using *Custom* in this field.

The predefined levels for analyzers are listed in the table below:

Table 13 Predefined Analyzer Signal Levels

Name	Threshold	Termination Voltage	Internal Impedance	E4835A	E4863A E4865A	E4867A
ECL (to -2V)	-1.3 V	-2.0 V	50 Ω	x	x	x
ECL (to GND)	-1.3 V	0.0 V	50 Ω	x	x	x
PECL (to +3V)	3.7 V	3.0 V	50 Ω	x		
TTL (to GND)	1.5 V	0.0 V	50 Ω	x	x	
CMOS 5V (to HiZ)	2.5 V		HiZ			
CMOS 3.3V (to HiZ)	1.6 V		HiZ			

– If you are using your own custom setting:

The minimum *Termination Voltage* for a terminal that is not connected to ground is –2 V.

The standard input *Impedance* of an analyzer frontend is 50 Ω. See the specifications for details.

4 The *Serial impedance* is usually the output impedance of the DUT.

5 Do not forget to activate the connection by switching the *Input* button to *On*.

NOTE When running a test, check the green LEDs on the frontends. They indicate whether the channel is enabled or disabled.

Differential Analyzer Frontends

Special options are available for the differential analyzer frontends E4835A, E4837A, E4863A, and E4865A.

For these frontends you can:

- Select the *Analyzed Input(s)*. Choices are: Normal input IN, complementary input \IN\, differential input.
- If the **frontend mode** is set to *Differential* (not the input type!), you can choose between center tapped or differential input signal termination by clicking the graphical button.

Figure 122 Termination Options for Differential Analyzers

Center tapped termination uses two 50 Ω resistors. The termination voltage range is –2 V to +3 V. Differential termination inserts a 100 Ω resistor.

Hence, these frontends provide the following input and measurement options:

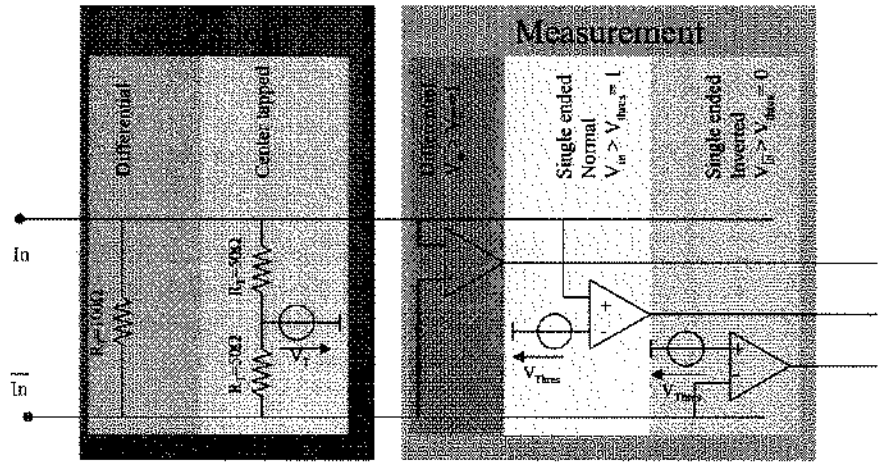


Figure 123 Termination and Measurement Options for Differential Analyzers

- For the analyzer frontends E4835A and E4837A, you can invert the signal polarity with the *Polarity* radio button.

  The settings of *Input Type* and *Polarity* have the following effects on data recognition:

Table 14 Data Acquisition with the E4835A or E4837A Differential Analyzer

Input Type	Input Signal Condition	Acquired Data	
		Normal Polarity	Inverted Polarity
Differential	Signal at IN > \IN\	1	0
	Signal at IN < \IN\	0	1
Normal Input	Signal at IN > Threshold	1	0
	Signal at IN < Threshold	0	1
Complementary Input	Signal at \IN\ > Threshold	0	1
	Signal at \IN\ < Threshold	1	0

How to Combine Generator Channels

Combining generator channels enables you to test devices with multiple edge timings or multi-level signals.

NOTE The channel add function enables you to combine two or four generator channels. The channels to be added must all reside in one module and must be contiguous. Adding channels reduces the number of active connectors.

Digital channel addition The digital channel addition is an XOR addition (exclusive OR or modulo 2 addition). For details see the figure below. The addition takes place before levels are applied to the signals. The final signal is routed to one output amplifier.

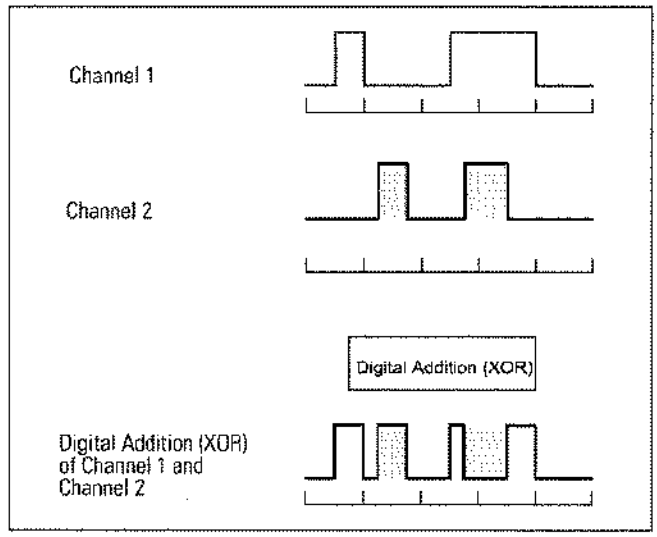


Figure 124 Digital Channel Addition

Analog channel addition The analog channel addition allows to add signal voltages. It is available if the module contains at least one E4838A generator module. You can thus produce signals or pulses with overshot, ringing, and so on.

Channels are added with the Channel Configuration Editor.

How to Start the Channel Configuration Editor

The Channel Configuration Editor is started from the Connection Editor.

To start the Channel Configuration Editor:

1 Double-click the configuration area of a generator frontend.

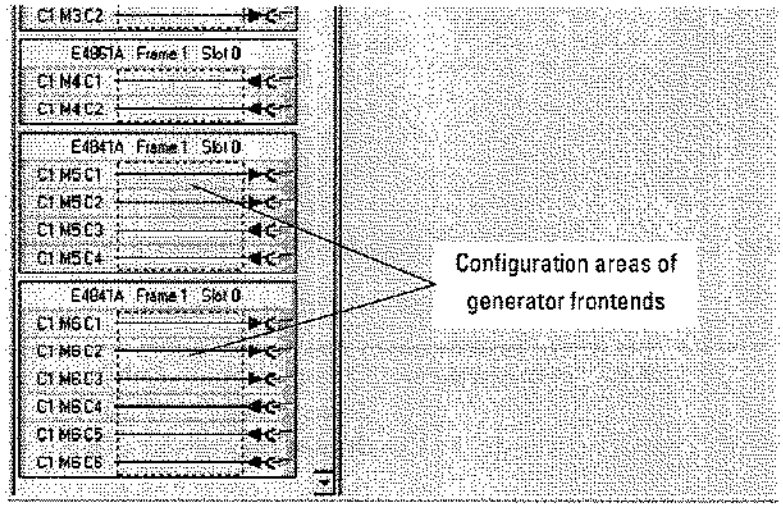


Figure 125 Module Configuration Area

Alternatively, you can also click on the configuration area with the right mouse button and select *Properties*.

How to Use the Channel Configuration Editor

The Channel Configuration Editor comes up with the following window:

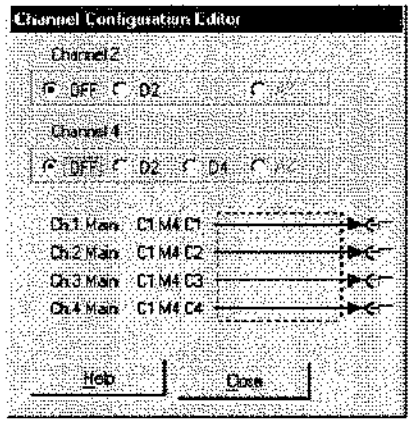


Figure 126 Channel Configuration Editor

With the options of the Channel Configuration Editor, you can affect the properties of channel 2 and/or channel 4.

Combining Channels in Digital Mode

To add channels 1 and 2 and channels 3 and 4 in digital mode:

1 Activate D2 for channel 2.

2 Activate D2 for channel 4.

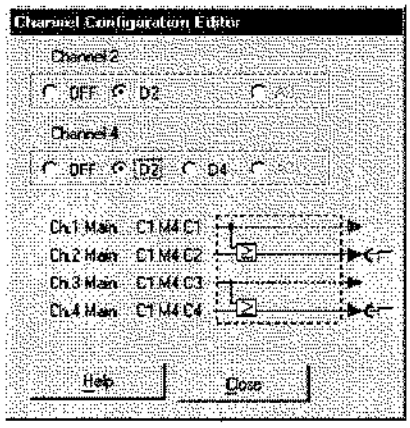


Figure 127 Channel Configuration Editor—Two Added Channels

Note that the connectors of channel 1 and channel 3 are no longer available for connections.

Combining Four Channels

To combine all four channels:

1 Activate D4 for channel 4.

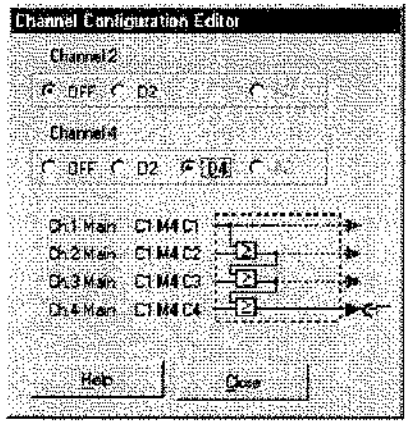


Figure 128 Channel Configuration Editor—Four Added Channels

Note that the connectors of channels 1 to 3 are no longer available for connections.

Combining Channels in Analog Mode

If the module contains one or several E4838A generator frontends in even-numbered slots (channel 2 or 4) and identical or E4843A frontends in the slots above, you can also add two channels in analog mode by clicking the A2 radio button.

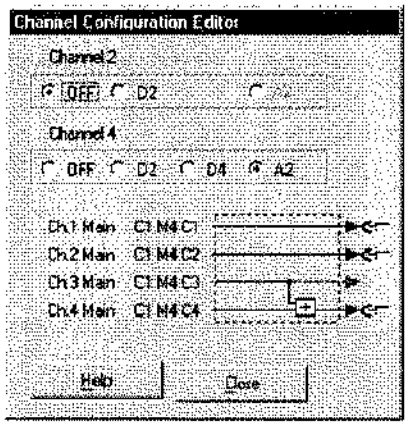


Figure 129 Channel Configuration Editor—Analog Added Channels

If this option is selected, the parameter settings of the E4838A frontend for "Analog Channel Add" take effect (see *"How to Add Channels in Analog Mode" on page 198*).

Choosing the Kind of Measurement

Once the DUT has been modeled, its pins have been connected to instrument channels, and the channel parameters have been specified, it is time to tell the system what kind of measurement is going to be performed.

This has to be done before setting up the stream of generated and expected data, because different tests require different settings. Although the procedure for setting up the data sequence is always the same, the available segment options and result displays depend on the selected kind of measurement.

NOTE It is recommended to save settings repeatedly during test setup. You should take care of the chosen measurement type and save the setting under a file name that indicates the kind of measurement.

The kind of measurement is chosen from the Measurement Configuration window.

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial*.

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo
- In the *Tutorial*, select *"Choosing the Test Measurement Mode"*.

How to Access the Measurement Configuration Window

To open the Measurement Configuration window:

1 Click the Measurement Configuration icon in the tool bar.

Alternatively, you can also use the corresponding option of the *Go* menu.

The Measurement Configuration window appears.

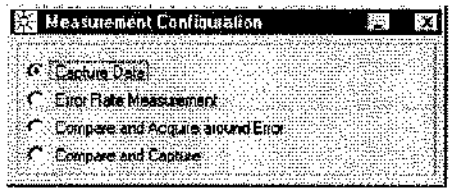


Figure 130 Measurement Configuration Window

How to Set the Measurement Configuration

The Measurement Configuration window provides four options:

- Capture Data
- Error Rate Measurement
- Compare and Acquire Around Error
- Compare and Capture

Capture Data

In this measurement mode the system captures the data received by the analyzer connectors until either the test sequence is finished, or until the memory is full, or the Stop button was clicked.

After the test has finished the recorded data can be viewed in the Error State Display and with the Waveform Viewer.

Error Rate Measurement

In this measurement mode the system continually samples incoming data applied to the analyzer connectors and compares the data in real time with expected data. The errors are counted and the bit error rate is calculated.

The result can be reviewed in the Bit Error Rate Display.

If you have chosen Error Rate Measurement, you have the following additional options:

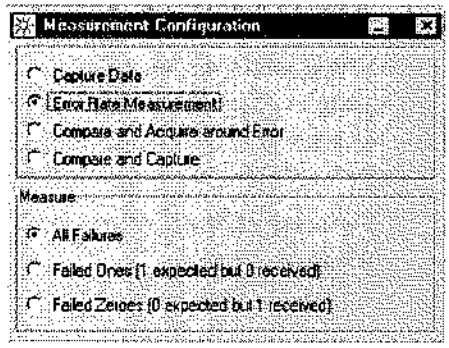


Figure 131 Measurement Configuration Window for Error Rate Measurement

Select the kind of errors you wish to be counted.

Compare and Acquire Around Error

In this measurement mode the system records the data applied to the analyzer connectors until the test sequence is completed. The acquired data is compared in real time with expected data. As soon as an error occurs the system starts a counter.

The advantage of this mode is, that it is possible to define how long data should be recorded after the failure occurred, so that a pre- and post history around the error is captured and can be analyzed. The result can be reviewed in the Error State Display and with the Waveform Viewer.

If you have chosen Compare and Acquire around Error, you have one additional option:

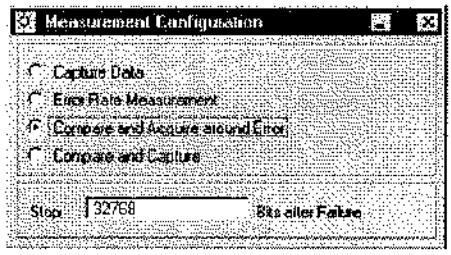


Figure 132 Measurement Configuration Window for Capture Around Error Measurement

You can set the number of bitstream vectors to be stored after the error occurred.

If an error occurs, the test will stop after the specified number of vectors has been acquired. The test will, of course, also stop if the test sequence expires before that number is reached.

Compare and Capture

In this measurement mode the system captures data applied to the analyzer connectors until the sequence is finished or the Stop button is pressed. While capturing, the system also compares the captured data with the expected data in real time.

The result can be reviewed in the Error State Display and with the Waveform Viewer.

Creating the Stream of Generated and Expected Data

After you have chosen the kind of measurement to be performed, you can build the test sequence.

The data to be generated or expected is embedded in a sequence. Three tools are provided for manipulating that sequence:

- Standard Mode Sequence Editor
- Detail Mode Sequence Editor
- Data/Sequence Editor

All the Sequence Editors can be started from the *Go* menu.

You can also click the Sequence Editor icon in the tool bar.

This opens the Standard Mode Sequence Editor, if the sequence conforms to the rules for a BER measurement. If not, the Detail Mode Sequence Editor is started.

NOTE If you are creating a sequence for an E4867A 10.8 Gbit/s data analyzer module, ensure that the sequence and test data conform to the special characteristics of that analyzer. See *"Special E4867A characteristics" on page 39*.

For details see:

- *"The Standard Mode Sequence Editor" on page 216*
- *"The Detail Mode Sequence Editor" on page 235*
- *"Using the Data/Sequence Editor" on page 281*

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial.*

If not, you can download it from the web through:

- http://www.agilent.com/find/81250demo
- In the *Tutorial*, select *"Creating a User-Defined Data Sequence"*.

The Standard Mode Sequence Editor

The Standard Mode Sequence Editor is first of all meant for quick and easy setup of tests where generated and expected data are infinitely looped, such as bit error rate measurements.

For a simple and straightforward bit error rate measurement there is no need to worry about all the details of sequence blocks, loops, data segments, triggers, events, and so on.

You need only specify the PRBS polynomial or the data pattern to be used and are ready to run the test. Once it is started, the test will run until the Stop button is clicked.

If you have set up a new device, the Standard Mode Sequence Editor shows a window like the following:

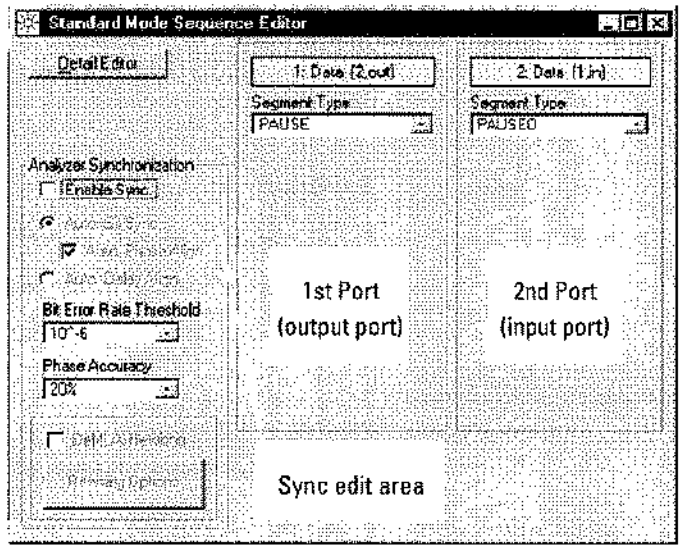


Figure 133 Standard Mode Sequence Editor Window

The window has one panel for each DUT data port. The default segments are PAUSE0 for DUT input ports (connected to generator frontends), and PAUSE for output ports (connected to analyzers).

How to Use the Standard Mode Sequence Editor

You can:

- Replace the current segments by new or existing segments
- Change segment properties
- Switch to the Detail Mode Sequence Editor
- Enable/Disable the automatic analyzer sampling point adjustment
- Edit the synchronization criteria

Replacing a Segment

To replace the current segment of a port by a different segment:

1 Open the *Segment Type* selection box.

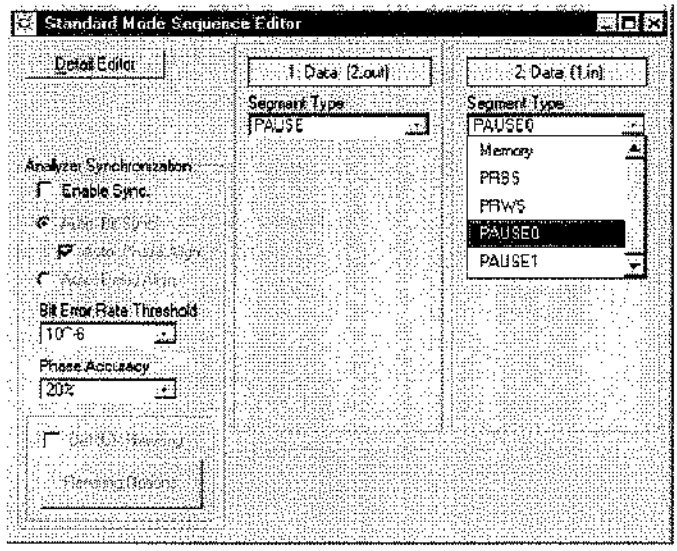


Figure 134 Segment Type Selection

2 Choose the segment type: Memory-based, PRBS, or PRWS.

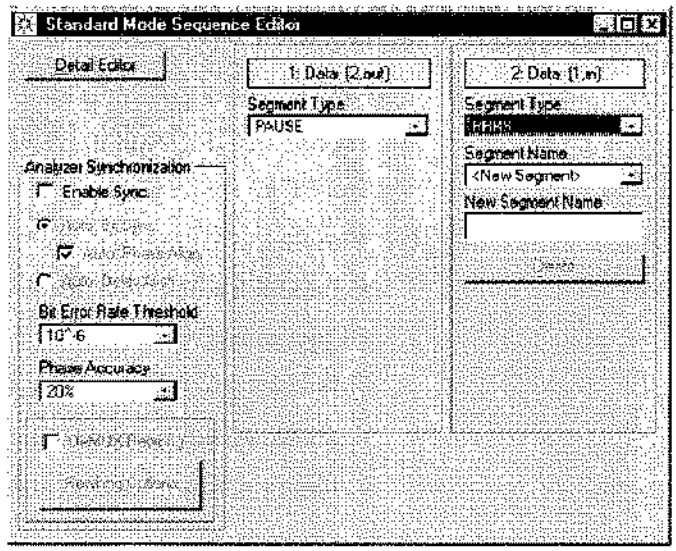


Figure 135 Search Existing or Create New Segment

3 Choose a segment from the *Segment Name* browser, if you wish to use a segment that has been created previously

or

enter a *New Segment Name*, if you wish to create a new segment, and click *Create.*

Changing a Segment

If you have created a new PRBS/PRWS segment or chosen a PRBS/PRWS segment from the **local segment pool** (see also *"Data Segments" on page 67*), you can now change its polynomial and type.

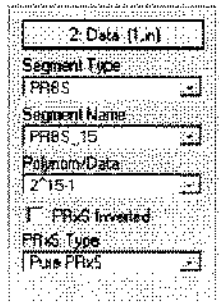


Figure 136 PRBS Parameters

For a description of pure and non-pure PRBS/PRWS please refer to *"Appendix B: PRBS/PRWS Data Segments" on page 357.*

NOTE For $2^{23}-1$ or $2^{31}-1$ polynomials only *pure PRxS* is supported.

If you are creating a new memory-type segment, you can specify its length. The minimum segment length is equal to the length of the block and indicated on the panel:

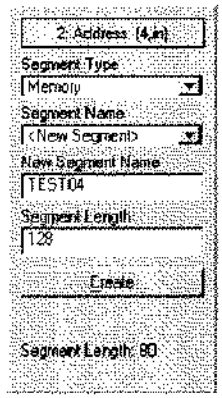


Figure 137 Creating a New Memory Segment

If you have created a new memory-type segment or chosen a memory segment from the local segment pool, you can now click *Edit* and change the contents of the segment.

For details see *"How to Create a New Segment" on page 260.*

A new segment is automatically stored in the **local segment pool** which is associated with the current setting. Local segments can be directly edited with the Standard Mode Sequence Editor.

TIP Use the Segment Editor, if you have chosen a segment from the **global segment pool** and wish to inspect or change its contents. See also *"Data Segments" on page 67.*

Note that the size of a memory-type segment (length and width) may exceed but must not remain under the size of the block. Additional restrictions apply, if *Automatic Bit Synchronization* is enabled (see *"Block Length and Segment Length" on page 233*).

If the segment is too large, only a portion is used. If the segment is too small and is a local segment, its size is automatically increased. You get a message like the following:

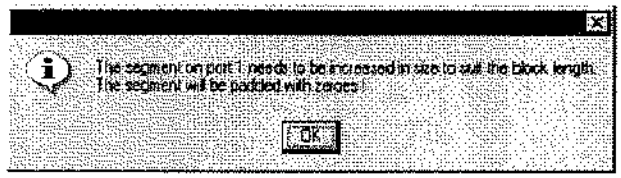


Figure 138 Segment-will-be-increased Message

To use the segment assigned to one port also for a different port:

1 Select the same *Segment Type*.

2 Choose the segment from the *Segment Name* browser.

The browser shows local as well as global segments.

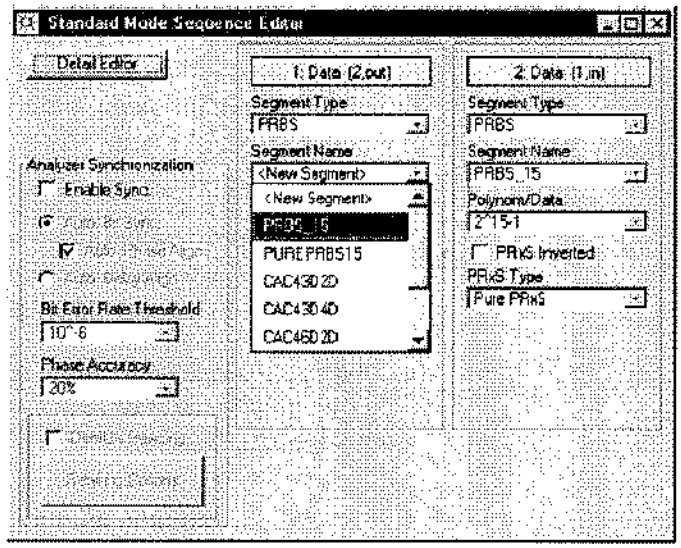


Figure 139 Segment Name Browser

Switching from Standard to Detail Mode Sequence Editor

You can always switch to the Detail Mode Sequence Editor by clicking the *Detail Editor* button.

The Detail Mode Sequence Editor gives you just another view:

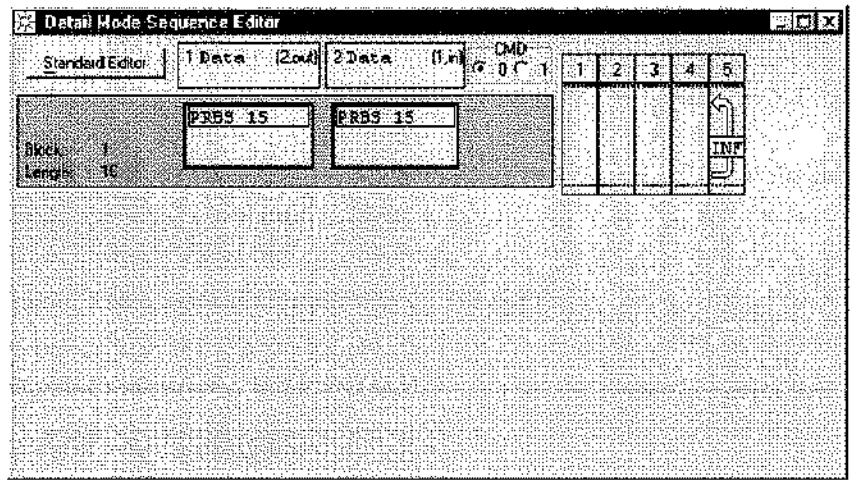


Figure 140 Sequence in Detail View

It shows that the generated and expected data will be infinitely repeated.

As long as you do not change the sequence with the Detail Mode Sequence Editor, you can always return to the Standard Mode Sequence Editor by clicking the Standard Editor button.

How to Synchronize an Analyzer With Incoming Data

The automatic analyzer sampling point adjustment with incoming data is available for both the Standard and the Detail Mode Sequence Editors.

For a detailed description of this feature please refer to *"Principles of Analyzer Sampling Point Adjustment" on page 73*.

Analyzer synchronization can be directly enabled/disabled and edited in the Standard Mode Sequence Editor window:

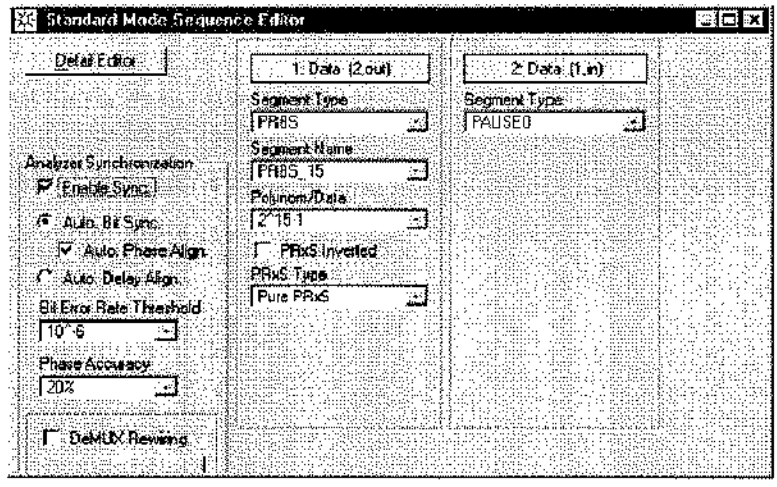


Figure 141 Synchronization Enabled in the Standard Mode Sequence Editor

For the Detail Mode Sequence Editor, the enable/disable function is an item found in the *Edit* menu and in the context menu of a block.

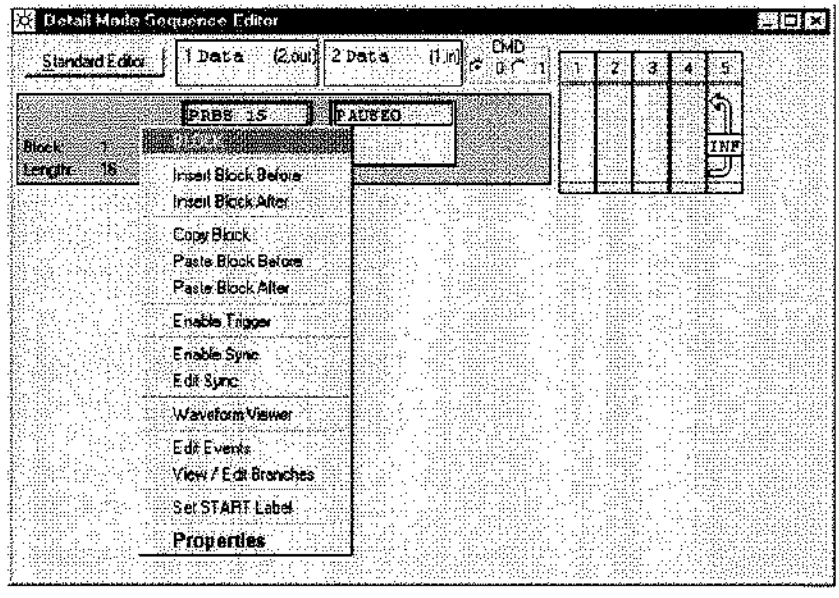


Figure 142 Block Context Menu

The *Edit Sync* item of the same menus provides the access to the synchronization parameters, as shown in the figure below:

Figure 143 General Synchronization Parameters

To use the automatic analyzer sampling point adjustment:

1 Enable the checkbox

or

click *Enable Sync*.

If you are using the Standard Mode Sequence Editor, a synchronization block is automatically inserted into the sequence. This block is placed ahead of the infinite loop. It has the same length and contains the same data as the test block.

If you are using the Detail Mode Sequence Editor, the currently highlighted block becomes the synchronization block. This should be the first block of the sequence that contains expected data.

When the test is run, the synchronization block is automatically repeated until the synchronization criteria are met. Then the sequencer continues with the next block.

The Detail Mode Sequence Editor uses two symbols to highlight the synchronization block:

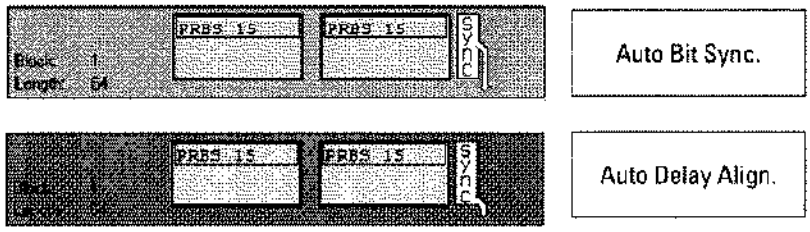


Figure 144 Synchronization Block Indicators

As shown in the figure, the symbols allow to identify the synchronization method that has been chosen.

2 If the automatic analyzer sampling point adjustment is enabled, you can click *Disable Sync* to deactivate it.

NOTE If you disable the automatic analyzer sampling point adjustment from the Standard Mode Sequence Editor, the synchronization block is removed from the sequence. Only the test block with the infinite loop remains.

If you disable the automatic analyzer sampling point adjustment from the Detail Mode Sequence Editor, only the sync label is removed from the block.

3 Select the synchronization method you wish to use. Choices are Automatic Bit Synchronization or Automatic Delay Alignment.

Automatic Bit Synchronization

Automatic Bit Synchronization has the option to enable or disable *Automatic Phase Alignment*:

Automatic Bit Synchronization without Automatic Phase Alignment is used if the total delay from test start is unknown but a certain edge delay relative to the analyzer clock is expected.

Automatic Bit Synchronization with Automatic Phase Alignment is used if the delay is completely unknown.

PRBS data may be sent and expected. Memory-based data may also be expected by a pure analyzing system.

The final delay status is indicated by the Parameter Editor.

Automatic Bit Synchronization does not report the number of clock periods that have passed since test start, but only the phase shift relative to the clock.

Auto Bit Sync without Auto Phase Alignment

If Automatic Phase Alignment is disabled, then the analyzer uses the start delay that has been specified with the Parameter Editor to determine the sampling point delay relative to its clock. It then samples the incoming data until the incoming data matches the expected pattern with an adequate accuracy.

Once this accuracy is reached, then the incoming bits are aligned with the expected bits—the analyzer is synchronized with the incoming data.

Auto Bit Sync with Auto Phase Alignment

If Automatic Phase Alignment is enabled, then the analyzer fully automatically adjusts itself to capture the incoming data at the optimum sampling point.

It shifts the sampling point stepwise in both directions until the specified bit error rate is reached. The width of these steps is adjustable. The analyzer then measures the width of the eye diagram and positions the sampling point at the optimum.

Automatic Delay Alignment

Automatic Delay Alignment is used if the delay between the start of the test and the incoming data is coarsely known and set as the start delay with the Parameter Editor. PRBS as well as memory-type data can be generated and expected.

The analyzer starts after the start delay has elapsed. It then shifts the sampling point within a certain range (±50 ns for an E4832A data generator/analyzer module and ±10 ns for an E4861A module) until it recognizes the expected pattern with an adequate accuracy.

After that, Automatic Delay Alignment measures the width of the eye diagram and positions the sampling point in the middle. The final delay status is indicated by the Parameter Editor.

Automatic Delay Alignment reports the full delay since test start.

4 Set the *Bit Error Rate Threshold*.

This threshold defines the "adequate accuracy" which depends on the DUT and the test requirements. The synchronization process is not complete unless the actual BER remains under this threshold.

5 Set the *Phase Accuracy*.

The phase accuracy can be set between 20 % and 1 %. This defines the number of steps performed by the phase optimizing algorithm (5 to 100) and has an impact on the speed of the synchronization process.

NOTE Once the test is started, the success or failure of the automatic delay adjustment can be seen in the BER display window: A terminal on which the connected analyzer could not synchronize shows no bit error rate at all.

6 Decide on using DEMUX Rewiring.

How to Specify DEMUX Rewiring Parameters

DEMUX rewiring is a special feature for synchronizing on the output of a demultiplexer. Many demultiplexers have the peculiarity that one cannot predict at which of the output terminals the first bit of the serial input bit stream appears.

DEMUX rewiring should always be used when testing a demultiplexer with memory-based data. DEMUX rewiring rearranges the order of the demultiplexer terminals so that the bits arriving at the analyzers can be compared with the data stored in the segment. This comparison, in turn, is necessary for both automatic delay adjustment and the test.

The principles of DEMUX rewiring are explained in *"Automatic Rewiring of Demultiplexer Terminals" on page 102*.

NOTE DEMUX rewiring has to be used at a ParBERT 43G error detector system, whenever the test data is not pure PRBS/PRWS.

If you have enabled DEMUX Rewiring, you must enter the DEMUX rewiring parameters.

To set the DEMUX rewiring parameters:

1 In the Standard Mode Sequence Editor, click the Rewiring Options button

or

in the Detail Mode Sequence Editor, choose *Edit Sync* from the *Edit* menu or the context menu of the synchronization block.

This opens the following window:

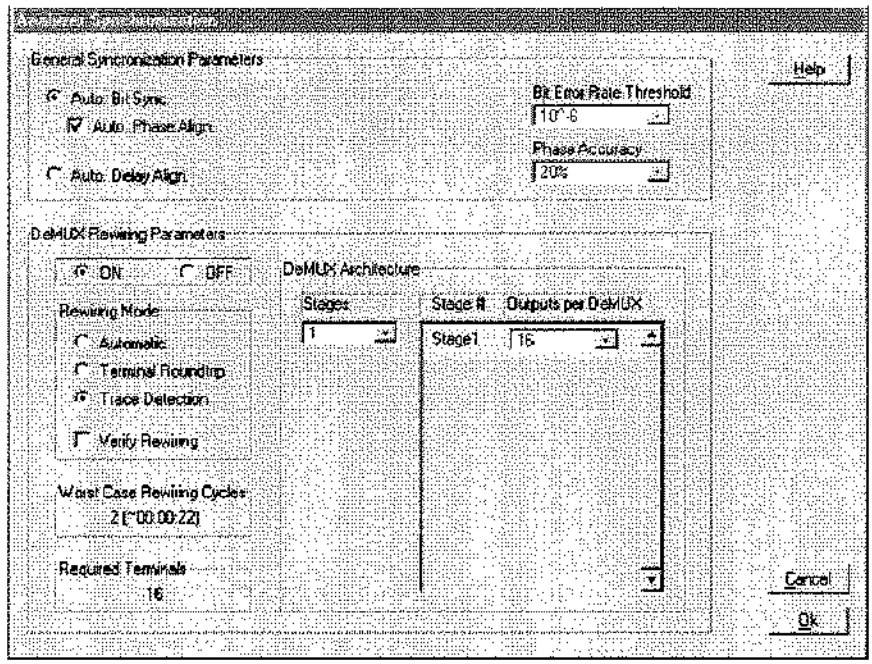


Figure 145 Automatic Analyzer Delay Adjustment Control Window

The default settings shown in the figure above are adequate to a ParBERT 43G error detector system using the E4869A DEMUX module.

2 Choose the rewiring mode. Choices are:

- *Automatic*—the automatic mode tries first to rewire with the trace detection method and then, if that failed, with the terminal roundtrip method.
- *Terminal Roundtrip*—tests all possible permutations and takes some time, especially for a multi-stage demultiplexer.
- *Trace Detection*—a speed-optimized approach.

  Trace Detection requires that the first 48 expected bits of each terminal are unequivocal and unique within the segment used for the synchronization. This is the same precondition that applies to Automatic Bit Synchronization with memory data.

3 Enable or disable *Verify Rewiring*.

If *Verify Rewiring* is enabled, the system informs you about problems that might arise.

4 Enter the DEMUX architecture.

The figure above refers to a simple, one-stage 1:16 demultiplexer. A multi-stage demultiplexer may have an architecture as illustrated below:

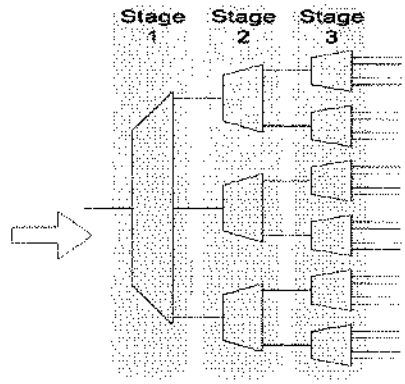


Figure 146 Three-Stage Demultiplexer

On stage one, the number of outputs per demultiplexer is three. On stage two, the number of outputs per demultiplexer is two. On stage three, the number of outputs is four.

This architecture is entered as shown in the following figure:

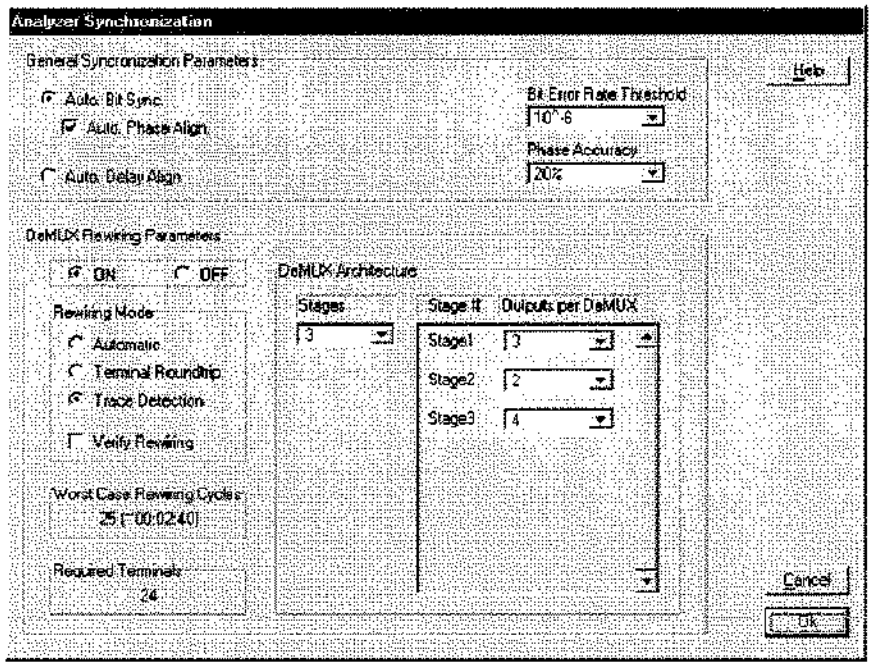


Figure 147 Parameters of a Three-Stage Demultiplexer

Only symmetrical architectures are supported. This means that all demultiplexers of one stage have to be identical.

5 Check the number of *Required Terminals*.

This number (24 in the example above) is automatically calculated. All these terminals have to be connected to analyzer frontends.

6 Check the number of *Worst Case Rewiring Cycles* and the expected time.

The number of *Stages* as well as the number of *Outputs per DeMUX* have an impact on the number of possible permutations and hence on the duration of the rewiring and synchronization process.

The expected duration that is also displayed is an estimation, assuming a synchronization segment of moderate length. The actual duration may differ.

For the *trace detection* algorithm, the number of rewiring cycles for a multi-stage demultiplexer is calculated as *number of terminals + 1*.

For the *terminal roundtrip* algorithm, all possible permutations are taken into account. Every demultiplexer of every stage may exhibit that unpredictable behavior. Depending on the demultiplexer architecture, terminal roundtrip may take half a minute or even hours.

"Overflow" is indicated, if the estimated time exceeds 24 hours. "Missing Parameters" is indicated, if the demultiplexer is not fully described. You cannot leave the dialog until such errors have been corrected.

NOTE Once the test is started, it begins with DEMUX rewiring and automatic analyzer delay adjustment. During this phase, the user interface does not respond.

After DEMUX rewiring, the Connection Editor displays the new terminal order. For an E4869A DEMUX module, this may look as shown in the following figure:

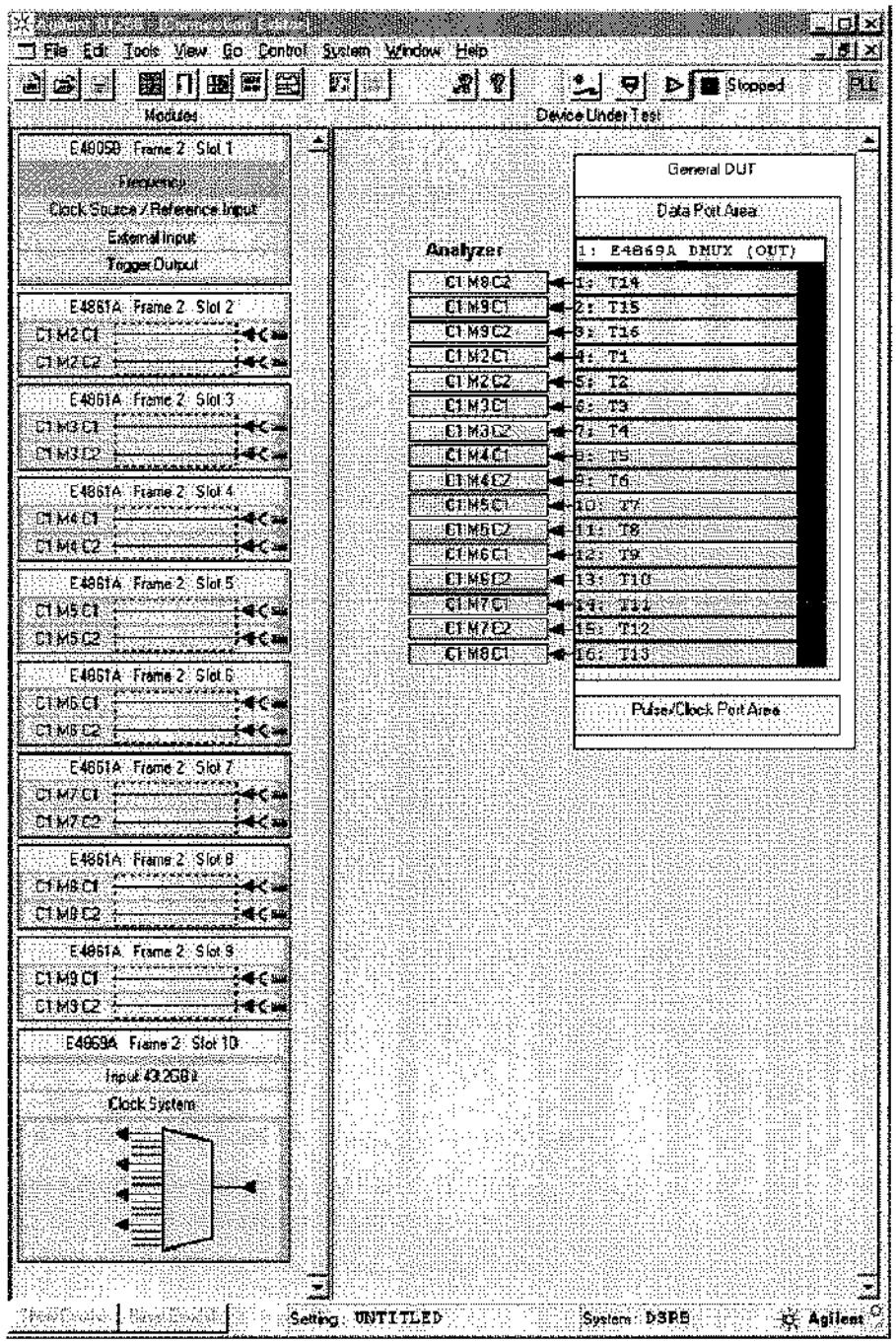


Figure 148 DEMUX Rewiring Result

Note that only the order of the terminals has changed, not the connections. Terminal T14 is now at the first place. This corresponds to the first trace of the data segment.

So, DEMUX rewiring ensures that the incoming data can be compared with the expected, no matter on which terminal the first bit arrives.

Special Characteristics of the Standard Mode Sequence Editor

If a test sequence was edited with the Detail Mode Sequence Editor or the Data/Sequence Editor, it can happen that the Standard Mode Sequence Editor cannot be opened from the *Go* menu.

The reason is that the sequence does not conform to the rules for a simple bit error rate measurement.

BER Measurement Sequences

A BER measurement requires one single test block which is infinitely repeated. If the automatic analyzer sampling point adjustment is enabled, this block is preceded by a synchronization block.

A valid sequence with Automatic Bit Synchronization may look like this:

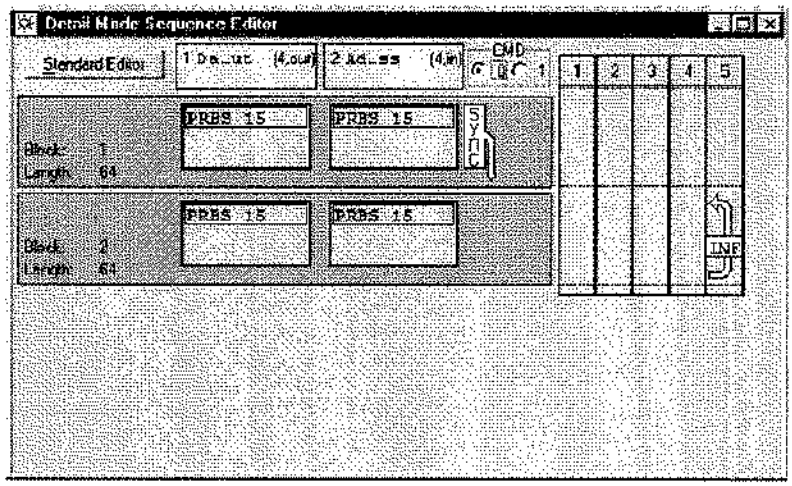


Figure 149 Test Sequence for BER Measurement With Bit Synchronization Enabled

The Standard Mode Sequence Editor can be used, if the test sequence meets the following criteria:

- The sequence contains one test block which is perpetually repeated.
- Different data segments may be used for different ports.
- The test block may be preceded by a synchronization block (a block with sync enabled and without loop). This block must be an unchanged copy of the test block (same size, same segments).
- The sequence does not process any internal or external events.

- A trigger (activated with the Detail Mode Sequence Editor) may be generated but is not shown in the Standard Mode Sequence Editor.
- The blocks have a certain length (which implies that the referenced segments must also have a corresponding minimum length).

Block Length and Segment Length

The Standard Mode Sequence Editor calculates the **block length** automatically. The block length has to be an integer multiple of the system-wide segment resolution (see *"How to Set the General System Frequency" on page 156*).

The **minimum length of a segment** is the product of the segment resolution times the FM factor of the port (SR × FM).

Example:
If the segment resolution is 4 and the FM factor of the port is 2, then the minimum segment length is 8.

If a segment with a user-defined length is entered into a port with the Standard Mode Sequence Editor, its length is automatically adjusted to the next integer multiple of SR × FM.

Example:
If you enter a segment with a length of 120 vectors and the minimum segment length is 16, then the segment length will be increased to 128.

NOTE Two special conditions apply to segments that specify expected data in conjunction with **Automatic Bit Synchronization** (not Auto Delay Alignment). If Automatic Bit Synchronization is enabled, then please observe:

- If a memory-based data segment is used for synchronization, the block length has to be a multiple of 32 × SR and the length of the segment has to be at least 32 × SR × FM.
- If a non-pure PRBS-type segment is used for synchronization, the block length has to be exactly SR × PL (where PL is the length of the polynomial—for example 2^{13}–1 means 8191).

All this is automatically considered by the Standard Mode Sequence Editor, but not by the Detail Mode Sequence Editor which allows all kinds of modifications.

The Standard Mode Sequence Editor automatically sets the correct segment length and adjusts the block length if necessary. This is especially important, if some of the ports are operated at different clock rates.

Switching From Detail to Standard Mode Sequence Editor

If you try to switch from the Detail Mode Sequence Editor to the Standard Mode Sequence Editor, the following question may appear:

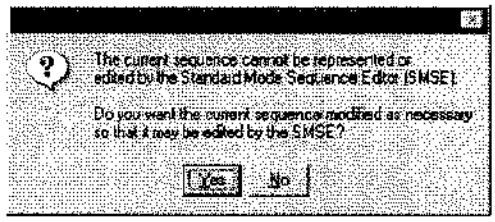


Figure 150 Transition From Detail to Standard Mode Sequence Editor

CAUTION

Click *No*, if you have created a sophisticated sequence.

Remember that the Standard Mode Sequence Editor is first of all meant for setting up a simple BER test, based on one block which is infinitely looped.

If the above question appears and you really wish to use the Standard Mode Sequence Editor, it may be a good idea to first save the current setting. If you have inadvertently clicked *Yes*, the only way to restore the previous sequence is to re-load the last setting.

If you click *Yes*, the following happens:

- All blocks of the sequence except the first one will be deleted.
- All events specified for the sequence are deleted.
- All loops are deleted.
- The remaining block is considered to be the test block. It gets an infinite loop.
- If automatic analyzer sampling point adjustment is enabled for the remaining block, the block is duplicated. The copy is inserted as block one and serves as a synchronization block (a block with sync enabled and without loop).

The Detail Mode Sequence Editor

The Detail Mode Sequence Editor allows to create and maintain individual test sequences.

A sequence consists of blocks. The blocks can be executed one after the other. Blocks and groups of blocks can also be repeated a specified number of times before the sequence continues. In addition, an endless loop can be specified – with the result that the sequence never ends.

If you activate the event recognition feature built into the system, the order of the block execution becomes variable. Based on specified events, you can leave a loop or even a block and continue with another block of the sequence.

The blocks reference data segments. These segments specify the generated and expected data patterns.

For details see:

"Contents of the Detail Mode Sequence Editor Window" on page 236

"How to Add, Move or Delete Blocks" on page 237

"How to Change Block Properties" on page 238

"How to Replace the Current Segment" on page 241

"How to Create and Change Loops" on page 245

"How to Specify Events and Reactions Upon Events" on page 247

"How to Specify DEMUX Rewiring Parameters" on page 226

TIP After the sequence has been set up, it can also be inspected in detail and changed with the Data/Sequence Editor (see *"Using the Data/Sequence Editor" on page 281*).

Contents of the Detail Mode Sequence Editor Window

For a new device, the Detail Mode Sequence Editor shows one single block:

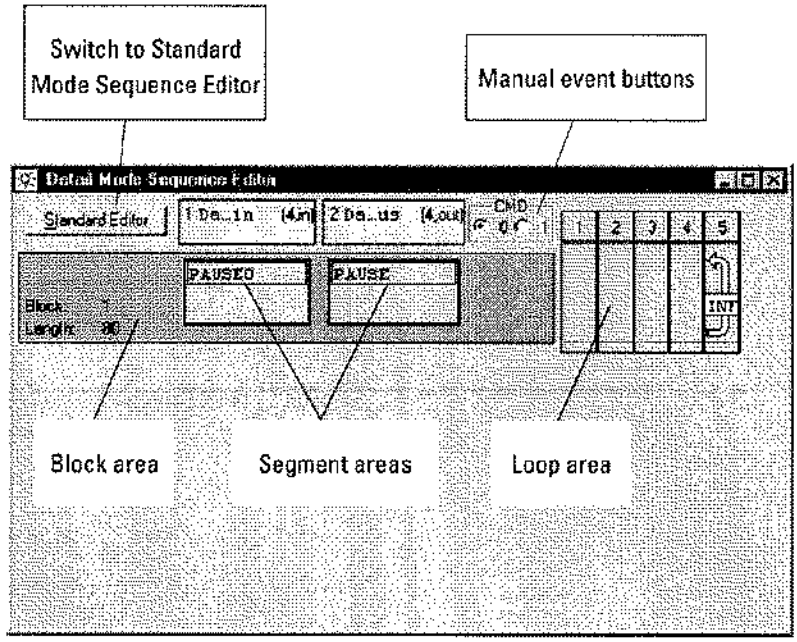


Figure 151 Default Sequence for a New Device With Two Data Ports

The block has a default length and includes default segments for all data input and data output ports that have been configured with the Connection Editor.

If the DUT setup includes more ports than can be shown, then a horizontal scroll bar is displayed to move to the hidden ports.

NOTE The default segments as well as the available pseudo segments depend on the type of port (DUT input or output) and on the kind of measurement.

At the right-hand side of the block is the loop area where repetitions can be specified.

How to Add, Move or Delete Blocks

A sequence often consists of more than one block. A sequence can contain up to 60 blocks. This number decreases if counted loops are used (see *"Hardware Dependencies" on page 72*).

You may wish to add blocks, delete blocks, or move blocks.

To manipulate the overall sequence:

1 Open the context menu of a block (right-click into the block area).

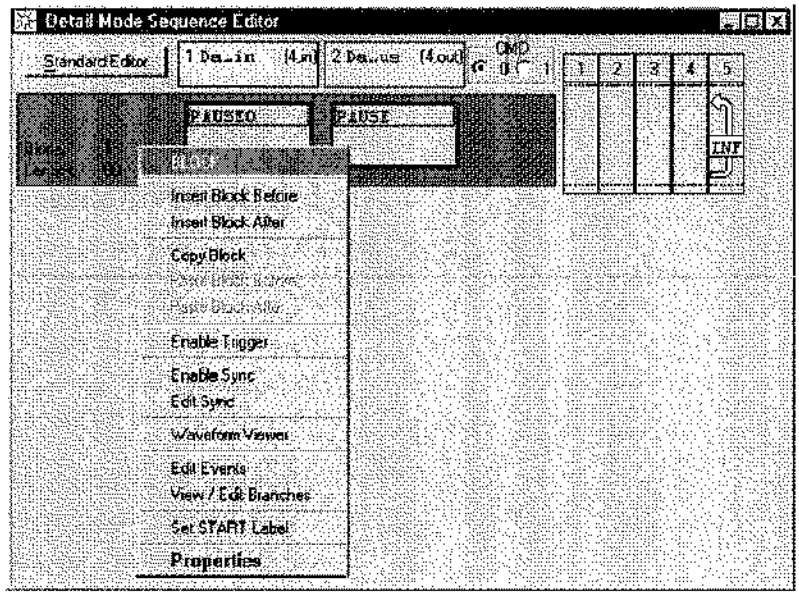


Figure 152 Block Menu

2 Choose the desired action:

- *Insert Block Before*: Inserts a new default block with default segments before the current block.
- *Insert Block After*: Inserts a new default block with default segments below the current block.
- *Copy Block*: Copies the chosen block to the clipboard.
- *Cut Block*: Copies the chosen block to the clipboard and removes it from the sequence (not available if the sequence contains only one block).
- *Paste Block Before*: Available, after a block has been copied or cut. Inserts the block from the clipboard above the current block.
- *Paste Block After*: Available, after a block has been copied or cut. Inserts the block from the clipboard below the current block.

How to Change Block Properties

Block characteristics include block length, block label, and trigger output.

To change the block characteristics:

1 Double-click on the block area.

Alternatively, you can also open the context menu of the block and select *Properties*.

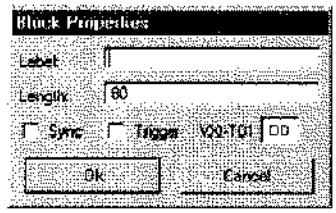


Figure 153 Block Properties Window

2 Enter appropriate data:

- *Label*: The block label should indicate the contents or purpose of the block. If the event recognition feature is used, the block label identifies the block that can be jumped to.

NOTE There are two block labels which have a special meaning:

The label START denotes the first block of a sequence. If this label is present, blocks above may exist, but are not processed when the test is run. The START label can also be assigned from the Block context menu by clicking *Set START label*.

The label END denotes the end of a sequence. This is an implicit label that should not be entered. The END label is used by the event recognition for terminating the test upon an event.

- *Length*: The length of the block must be a multiple of the segment resolution. For details see *"Frequency Multiplier and Segment Resolution" on page 55* and *"Block Length and Segment Length" on page 233*.
- *Sync*: The *Sync* enable button can be used to enable or disable automatic analyzer sampling point adjustment (see *"How to Use a Block for Analyzer Sampling Point Adjustment" on page 240*).
- *Trigger*: If you activate Trigger, a trigger is generated at the TRIGGER OUTPUT connector of the master clock module each time the block is started.

  When you set the trigger, you may get the following message:

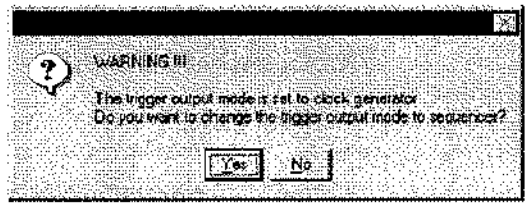


Figure 154 Wrong-Trigger-Mode Warning

By default, the TRIGGER OUTPUT of the master clock module is set up as a clock generator which generates a continuous clock pulse. If you wish to generate single trigger pulses, click *Yes*. See also *"How to Set the Characteristics of the Trigger Output" on page 167*.

The block area of the Sequence Editor indicates, whether a trigger is set.

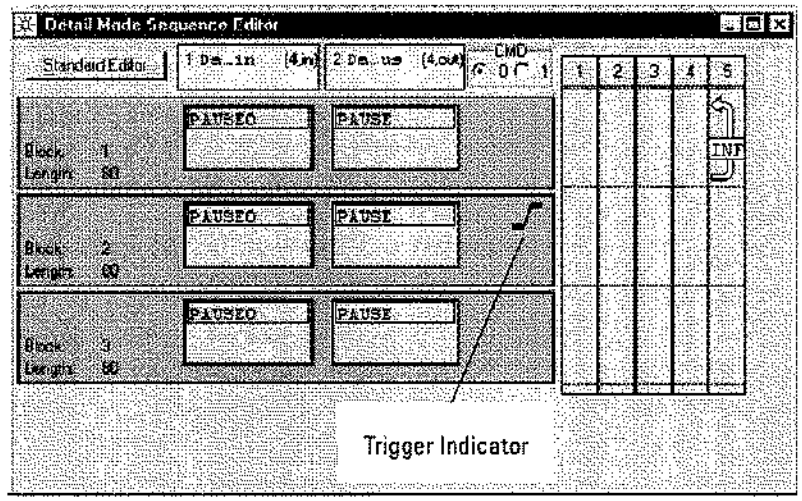


Figure 155 Block Trigger Indicator

– *VXI-T01*: You can also specify the setting of the VXI trigger lines T0/T1 at the beginning of the block.

If you don't wish to change their status, enter xx.

If you wish to activate the VXI triggers for controlling other VXI modules, ensure that you have not defined an event based on the status of the VXI trigger lines. See also *"How to Define Events" on page 252*.

How to Use a Block for Analyzer Sampling Point Adjustment

In principle, any block of the sequence can be used for synchronizing the analyzer channels with incoming data. But if automatic analyzer sampling point adjustment is required, measurements before synchronization usually don't make much sense.

Meaningful options are:

- Place the synchronization block at the beginning of the sequence.
- If a delay is needed before synchronization (for example to allow PLLs to settle), ensure that the synchronization block is only preceded by Pause blocks.
- If you wish to keep an existing sequence, set the START label to start the sequence execution at the synchronization block.

To create a synchronization block:

1 Select the block and open the block's context menu.

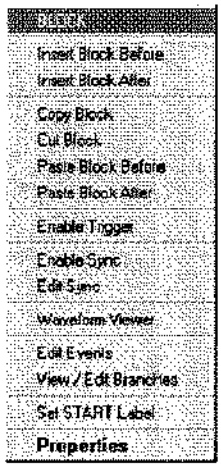


Figure 156 Block Context Menu

2 If it is not the first block, click *Set START Label* (not mandatory, but recommended).

The execution of the sequence will start with this block.

3 Click *Enable Sync*.

4 Click *Edit Sync* to check and eventually change the synchronization criteria. For details see *"How to Specify DEMUX Rewiring Parameters" on page 226*.

NOTE Especially if you wish to use Automatic Bit Synchronization, you may need special segments and may have to adjust the length of the block and the segments. See *"Block Length and Segment Length" on page 233*.

How to Replace the Current Segment

The segments contained in a block describe the data to be generated or expected.

The default segments that appear in new blocks are pseudo segments. They depend on the type of port (DUT input or output) and on the chosen kind of measurement. They can be replaced by a different pseudo segment or a real segment.

To change a segment:

1 Open the segment's context menu (right-click on the segment name).

You get a menu like the one shown below:

Figure 157 Segment Selection Menu of the Sequence Editor

2 Choose one of the options.

You can create a new segment, select an existing segment, or choose one of the available pseudo segments.

How to Replace a Segment by a New Real Segment

To replace the current segment by a new real segment:

1 Choose a segment and open the segment's context menu.

2 Select *New Segment*.

For details see *"How to Create a New Segment" on page 260*.

How to Replace a Segment by a Stored Segment

PRBS and memory segments that have been previously created are stored in the global or local segment pool.

To select a stored segment:

1 Select a segment and open the segment's context menu.

2 Choose *Select Segment*.

The segment selection window appears.

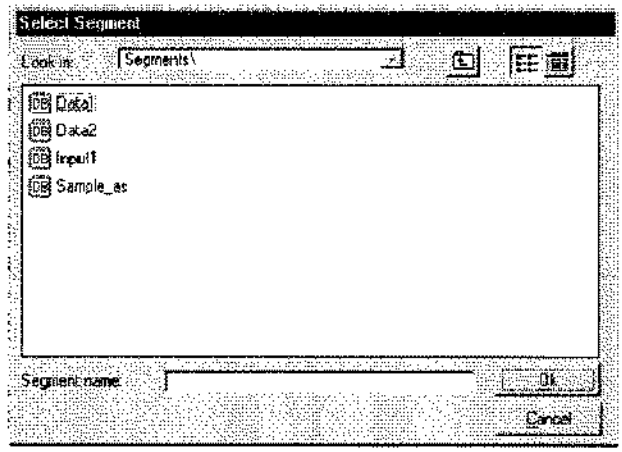


Figure 158 Select Segment Window

Per default, the window shows all accessible segments. You can change the directory to view only the global or local segment pool. Segments in the global segment pool can be accessed from all settings. Segments in the local segment pool can only be accessed from the current setting.

3 Select the segment you wish to insert into the block.

NOTE If you intend to use a stored segment, please note: Not every segment fits to every block.

If the length and/or width of a segment is smaller than the block length or port width, then an error message is displayed when the sequence is downloaded. It is necessary to edit the segment to match the block length and port width.

If the length or width of a segment is larger than the blocklength or port width, then only a portion of the segment will be generated or expected. This portion starts from trace 0 and vector 0 of the segment.

All traces which exceed the width of the port and all vectors which exceed the length of the block are ignored.

The lengths of the blocks have to be a multiple of the segment resolution which is a trade-off between the required system clock rate and the desired memory depth. For details see *"Frequency Multiplier and Segment Resolution" on page 55*.

See also *"Data Memory Usage" on page 69*, *"Segment Type Combinations" on page 70*, and *"How to Set the General System Frequency" on page 156*.

Additional restrictions apply for synchronization blocks if Automatic Bit Synchronization is used. See *"Block Length and Segment Length" on page 233*.

4 Confirm.

How to Replace a Segment by a Pseudo Segment

To select a pseudo segment in the Detail Mode Sequence Editor:

1 Select a segment and open the segment's context menu.

The lower part of the menu lists the available pseudo segments.

The available pseudo segments depend on the type of port (DUT input or output) and on the chosen kind of measurement.

They are listed in the table below.

Table 15 Default and Available Pseudo Segments

Kind of Measurement	DUT Data Input Port	DUT Data Output Port
Capture Data	Pause0 also available: Pause1	Pause also available: Acquire
Error Rate Measurement	Pause0 also available: Pause1	Pause also available: Expected 0 Expected 1

Table 15 Default and Available Pseudo Segments

Kind of Measurement	DUT Data Input Port	DUT Data Output Port
Compare and Acquire Around Error	Pause0 also available: Pause1	Pause also available: Expected 0 Expected 1 Don't Care
Compare and Capture	Pause0 also available: Pause1	Pause also available: Expected 0 Expected 1 Don't Care

Explanation

Pseudo segments for data generator channels:

- *Pause0*: Transmit logical zero (usually low level voltage) for the specified block length.
- *Pause1*: Transmit logical one for the specified block length.

Pseudo segments for data analyzer channels:

- *Pause*: Fall asleep for the specified block length.
- *Acquire*: Capture all DUT output data.
- *Expected 0*: Consider all non-zero data as errors.
- *Expected 1*: Consider all data that are not logical one as errors.
- *Don't Care*: Capture, but don't compare with expected data.

2 Choose from the menu.

How to Create and Change Loops

Loops can be specified in the columns at the right-hand side of the blocks. The right-most column is reserved for infinite loops.

A system equipped with the E4805A/B clock module provides 5 loop levels.

How to Create a Loop

To create a loop:

1 Click with the left mouse button into one of the columns.

Alternatively, you can also open the context menu of an empty column, choose *New Loop* and confirm the default loop properties.

This usually creates a one-block loop with 2 iterations. In the right-hand column, however, it creates an infinite loop.

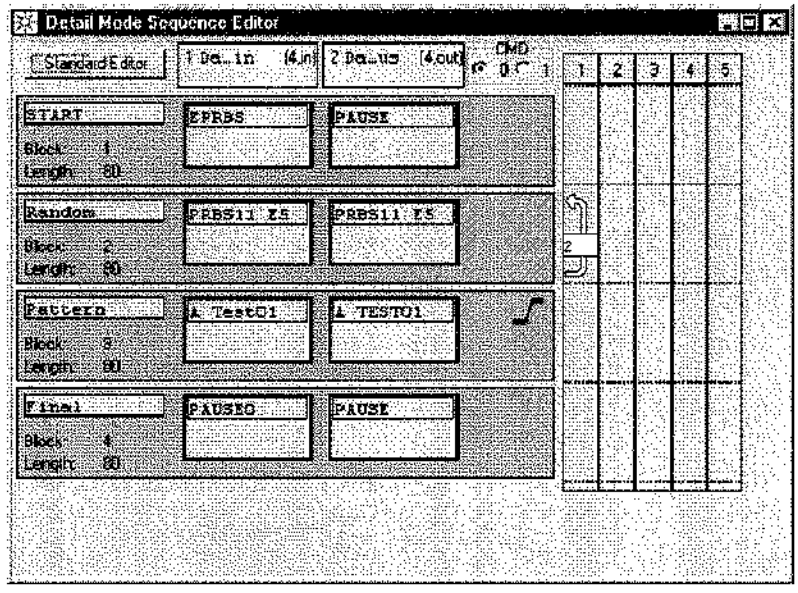


Figure 159 One-Block Loop

How to Change a Loop

Loops can be changed with the mouse and from the loop context menu.

How to Change a Loop With the Mouse

1 To change the length of a loop, click the upper or lower end of the loop and drag vertically.

2 To move a loop to a different level, click the loop and drag horizontally.

3 To change the number of repetitions of a loop, double-click the loop.

This opens the Loop Properties window. Type the desired number of repetitions and confirm.

How to Change Loop Characteristics With the Keyboard

1 Open the context menu of the loop.

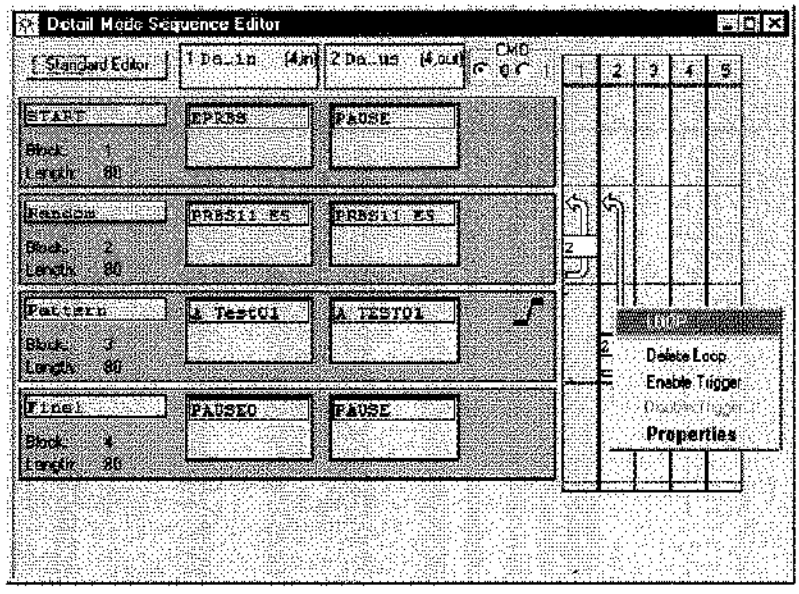


Figure 160 Loop Context Menu

2 Choose from the menu.

You can:

- Delete the loop.
- Enable/disable a trigger to be generated each time the loop is repeated.
- Select *Properties* to change the loop characteristics with the keyboard.

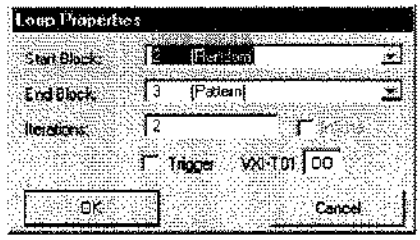


Figure 161 Loop Properties Window

You can change the start block, end block, number of repetitions, set a trigger, or set the VXI trigger lines (see also *"How to Change Block Properties" on page 238*).

How to Specify Events and Reactions Upon Events

The Agilent 81250 system is capable of reacting on events. The reaction can simply be a trigger pulse at the TRIGGER OUTPUT of the clock module, but also a change of the test sequence.

For general information see *"Event Handling Principles" on page 88*.

Events can be defined at any time. The reactions upon events can be specified if the Detail Mode Sequence Editor or the Data/Sequence Editor is active.

Examples can be found in *"How Do I Use Events?" on page 334*.

NOTE Event recognition is disabled when a synchronization block is executed.

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial*.

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo
- In the *Tutorial*, select *"Controlling the Test with Events"*.

Before You Start Using Events

You can define up to 5 events for immediate action and 5 events for deferred action.

Events for immediate action are serviced as soon as they occur. Events for deferred action are serviced at the end of the block. This is in contrast to a trigger associated with a block or loop. Those actions occur when the execution of the block is started.

Events for deferred action are prioritized. The event with the highest number has the highest priority.

What You Need to Find Out Before Using Events

1 Determine what you wish to achieve. Choices are:

- Issue a trigger pulse from the master clock module for starting/synchronizing an external instrument.
- Set the VXI trigger lines T0/T1 for triggering other VXI modules.
- Change the test sequence: Continue with another block, start all over, or terminate the test.

  If you wish to switch to another block, ensure that it is included in the overall sequence and labeled. You can only jump to labeled blocks.

2 Determine the release mechanism. Choices are:

- A command issued locally by clicking a button provided by the Detail Mode and Data/Sequence Editors or remotely.
- One or several bit combinations of the trigger pod (see also *"Trigger Pod" on page 42*).
- The status of the VXI trigger lines TX0 and TX1 which may be changed by an external VXI module.
- A bitstream error detected by one of the data generator/analyzer modules (not available in capture-only or BER mode).

3 Decide on the priorities.

- Do you need immediate reaction?
- In case of deferred reaction: Which event must be serviced under all circumstances? What is the minimum block length to guarantee reaction at the end of the block?

What You Need to Consider Before Using Events

There is of course a delay between the occurrence of an event and its recognition. There is also a delay between the recognition of an event and the reaction on that event.

Detection and Reaction Times

Detection of and reaction on events is controlled by an internal sequencer clock. The port-dependent frequency of that clock is:

```
Clkp_freq = system clock frequency / segment resolution
```

The maximum sequencer clock frequency is hence 41.67 MHz, corresponding to a period of 24 ns. If you had set a system clock rate of 100 MHz and a segment resolution of 4, the sequencer clock frequency would be 25 MHz, corresponding to a period of 40 ns.

A system equipped with E4832A and E4861A modules has the following delays:

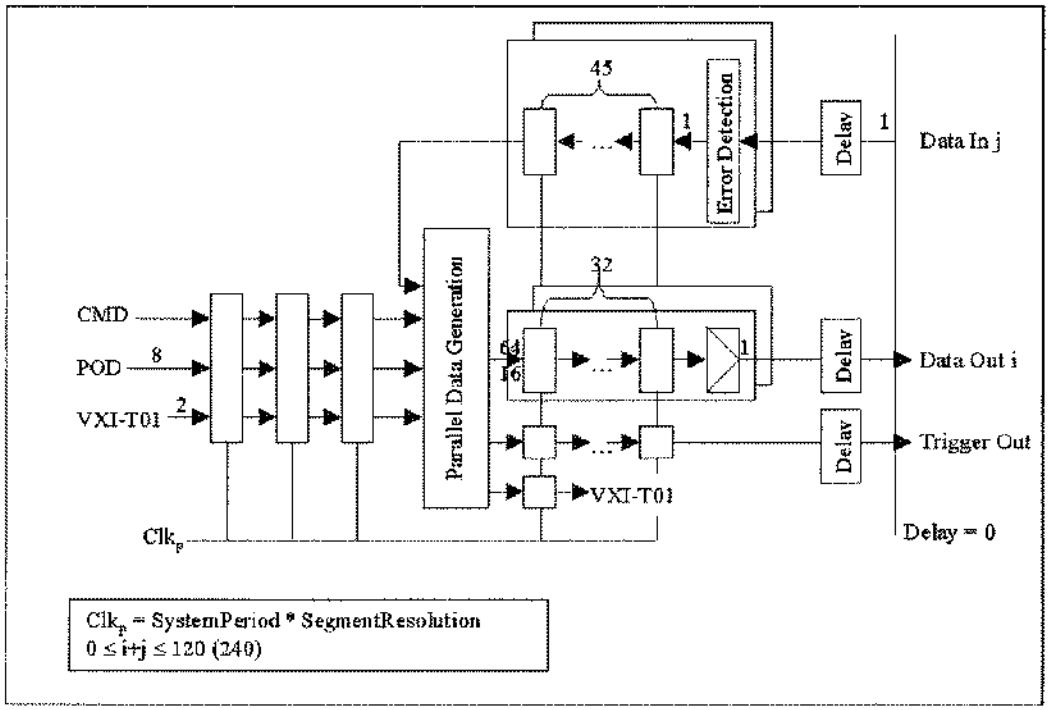


Figure 162 Delays Between Event Occurrence, Detection, and Reaction (System with E4832A, E4861A)

Explanation

Event commands as well as changes of trigger pod inputs or VXI trigger lines are processed after three periods of the sequencer clock Clk_p.

If bit stream errors (detected by one of the analyzer frontends) are included into an event definition, event processing takes 45 periods of the sequencer clock Clk_p if the system includes E4832A or E4861A modules.

Once the 11-bit event pattern has been set up, the VXI trigger signals (if specified) are set after one period of the sequencer clock.

Depending on the data module and the current segment resolution, up to 16 or 64 bits can be processed during one period of the sequencer clock.

Launching a trigger at the master clock module's TRIGGER OUTPUT requires additional 32 periods of the sequencer clock Clk_p at a system equipped with E4832A or E4861A modules.

Switching to another sequence block needs 33 periods.

NOTE Especially if you wish to react on errors, this behavior has to be taken into account. For triggering on errors, you should use the Compare and Capture mode, because Compare and Acquire Around Error stops automatically some time after an error and may terminate the test before you get a reaction (see also *"Choosing the Kind of Measurement" on page 211*).

Minimum Block Length The reactions on events are associated with blocks.

If you wish to react on an error by changing the sequence or setting a trigger and the respective block is **looped**, it must have a length of at least

```
79 × segment resolution
```

to ensure that the system can react during the next repetition of the block. 79 is the sum of 46 plus 33.

If the respective block is **not looped**, it must contain more data than compared. Proper triggering or sequence changing on errors during block execution is only ensured, if the block contains

```
79 × segment resolution
```

more generated vectors than are compared. Different segments may be needed for generated and expected data.

Example If you have a system equipped with E4832A modules, a system clock period of 10 ns (100 MHz), a segment resolution of 4, and a block length of 400, then error events within the first 4 vectors can directly lead to a trigger signal or sequence change while or after the block is executed (minimum length for sequence change is $79 \times 4 = 316$).

As the sequencer clock rate is 100 MHz / 4 = 25 MHz, the delay between error recognition and sequence change is 79 × 40 ns = 3.16 ms. Later error events (resulting from vectors 5 to 400) are only processed if the block is repeated, because the reaction on events is associated with the block.

To react on all possible errors within the execution of 400 vectors, the block must have a length of at least 716 vectors, and the last 316 vectors must not be evaluated.

Triggers If you intend to issue triggers, please note: Triggers have certain characteristics. The characteristics of the master clock module's TRIGGER OUTPUT are part of the global system parameters (see *"How to Set the Characteristics of the Trigger Output" on page 167*).

The width of the trigger at the clock module or the VXI bus corresponds to the period of the internal sequencer clock:

Clk_p_period = system clock period × segment resolution

Example: If you had set a system clock rate of 100 MHz and a segment resolution of 4, the trigger width would be 40 ns.

How to Define Events

To specify events:

1 Open the context menu of a block and choose *Edit Events*.

Alternatively, you can also choose *Events* from the Edit menu and select *Edit*. Actually, event definitions are independent of the chosen block.

The Module Events window appears.

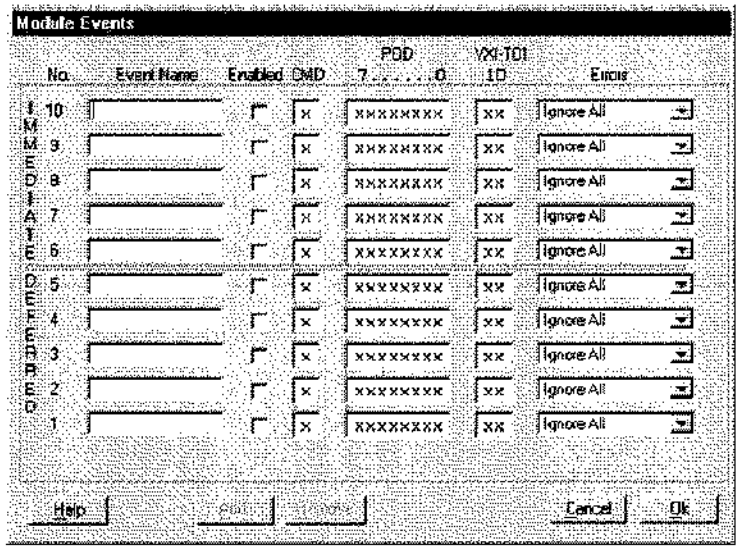


Figure 163 Module Events Window

2 Choose the type (deferred/immediate) and the priority of the event.

The types are explained in *"What is an Event?" on page 90*.

3 Enter the *Event Name*.

Every event requires its own, unique name.

4 Enable the event.

Click the corresponding checkbox or move with Tab and press the space bar.

5 Select and edit the details.

These items are logically ANDed. That means, the combination of whatever is activated and detected will cause an action.

- The *CMD* column refers to the manual or remote command that can cause an interrupt.

  Manual interrupts can be produced from the Detail Mode Sequence Editor and the Data/Sequence Editor windows by clicking *CMD0* or *CMD1*.

  Remote interrupts can be produced by the test program.

  Acceptable input values are x (don't care), 0, or 1.

- The *POD* column refers to the trigger pod (see also *"Trigger Pod" on page 42*). You can set the expected bits to x (don't care), 0, or 1.

- The *VXI* column refers to the VXI trigger lines T0/T1. Acceptable inputs are x (don't care), 01, 11, 10. Note: If you don't wish to react on their status, ensure they are set to xx.

  You can then set the VXI trigger lines as an answer to an event.

- The *Errors* column refers to the built-in analyzer channels. Open the pulldown menu and choose from the list.

A very simple event table which activates just the command-controlled events might look as shown below.

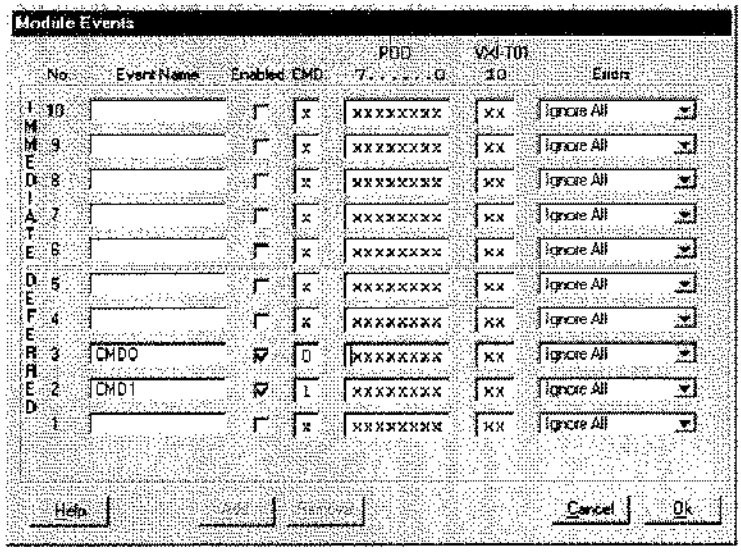


Figure 164 Simple Event Table

The event CMD0 occurs as soon as the *CMD* radio button of the Detail Mode Sequence Editor or the Data/Sequence Editor is identified as zero or after issuing the corresponding firmware command. Similarly, the event CMD1 occurs as soon as the *CMD* radio button of the Detail Mode Sequence Editor or the Data/Sequence Editor is identified as one.

Both are deferred events, which means that the system will react as soon as the presently executed sequence block has come to its end (assuming it is either repeated or long enough, see *"What You Need to Consider Before Using Events" on page 249*).

6 When you are done, click OK.

How to Specify the Reactions on Events

The reactions on events are block-related. You can specify individual reactions for each block of the sequence.

An example may be helpful to understand this procedure. It builds up on the event definition example shown above.

Stop and Go Example

We have set up the sequence shown below:

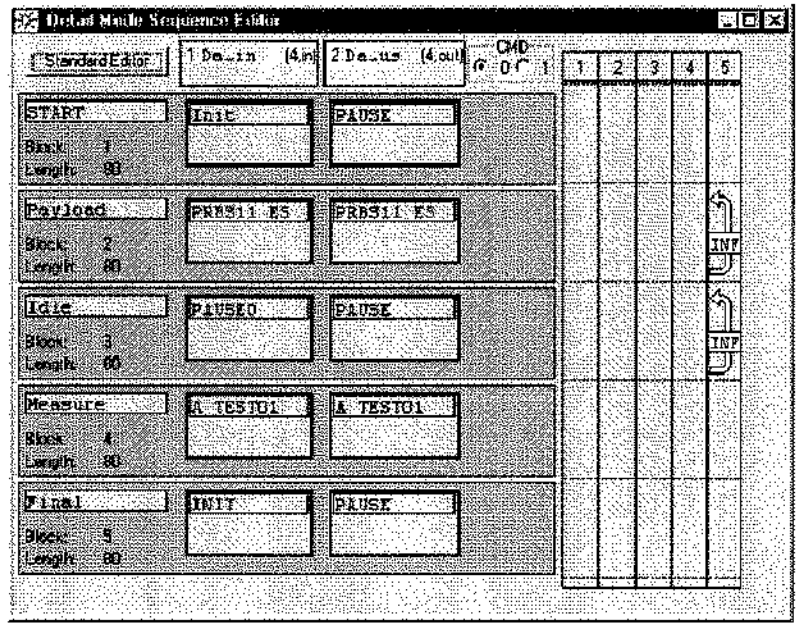


Figure 165 Sequence for the Stop and Go Example

We wish to run the Payload block until the result stabilizes. Then, upon a command, the test shall pause, so that we can examine the results.

A second command shall cause the test to continue with the Measure block and to finish.

We have defined the events CMD0 and CMD1 as shown in the example of *"How to Define Events" on page 252*.

How to Fill In the Branch Table

Each block has its own branch table.

1 Open the context menu of block 2.

2 Choose *View / Edit Branches*.

If no reactions have been specified so far, an empty branch table appears.

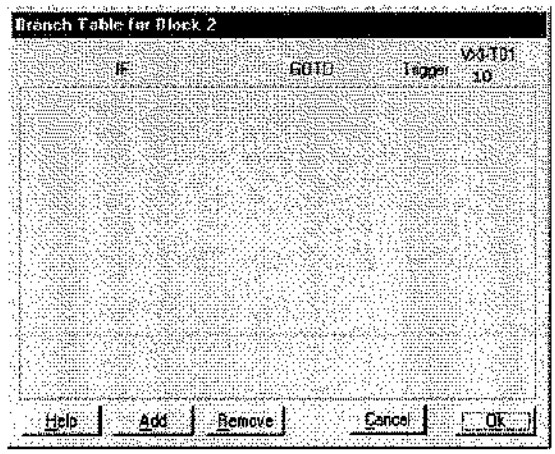


Figure 166 Empty Branch Table

3 Click the *Add* button.

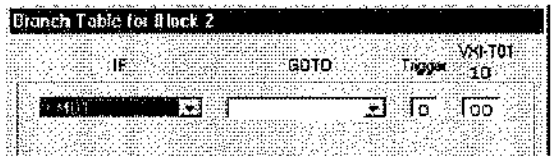


Figure 167 Branch Table Structure

Now you can see how the table is built up: If the specified event has occurred,

- go to a certain block of the sequence and/or
- output a trigger at the clock module and/or
- set the VXI trigger lines.

4 In the *IF* column, select one of the available events. The display starts with the lowest-priority event that has been defined (see also *"How to Define Events" on page 252*).

The pull-down menu offers also the DEFAULT event. This is a deferred event which occurs at the end of a block and must not be defined. It

has a lower priority than any user-defined event and can be used to change the normal flow (which is either continuation or iteration).

5 In the *GOTO* column, select one of the available blocks.

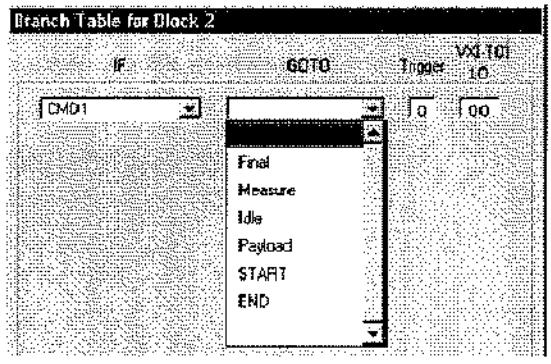


Figure 168 Branch Table – Block Selection

Note that the END block is an implicit block which is always available. It terminates the sequence.

The branch table of block 2 in our example is shown below:

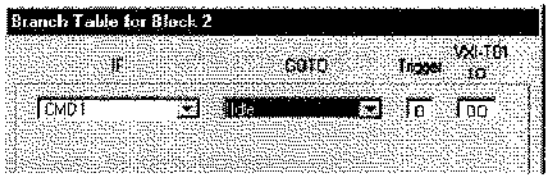


Figure 169 Branch Table – Block 2

As soon as CMD1 occurs, the block will not be repeated any more. The sequence will execute the Idle block.

6 Decide whether you wish to generate a trigger pulse. If you wish to activate the VXI triggers for controlling other VXI modules, ensure that you have not defined an event based on the status of the VXI trigger lines.

7 Click *OK*.

To complete the example, you have to repeat the steps 1 to 6 for block 3.

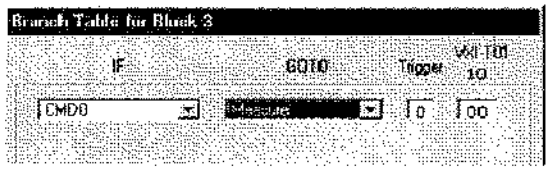


Figure 170 Branch Table – Block 3

As soon as CMD0 occurs, the infinite loop of the Idle block will be left, and the sequence will execute the Measure block

The sequence now shows that branches have been inserted.

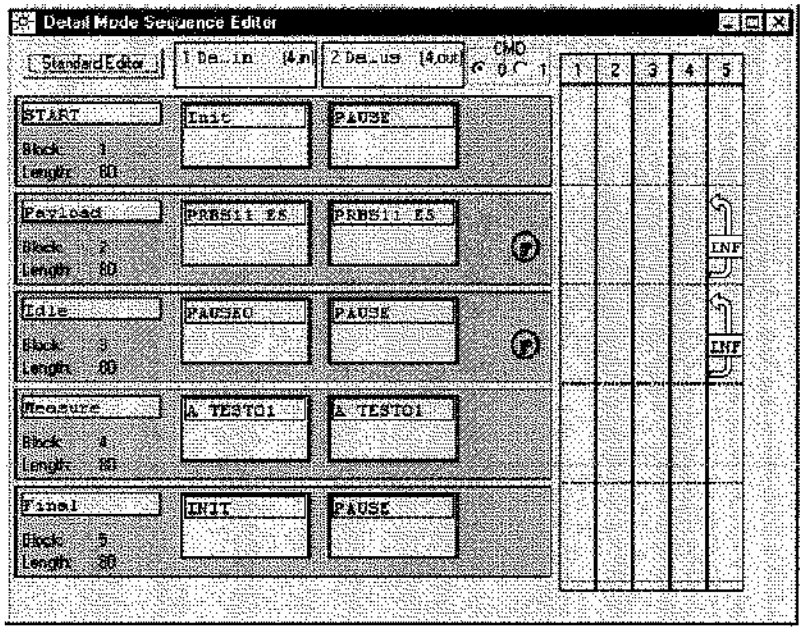


Figure 171 Sequence With Branches on Events

If you now run the test, you can terminate the Payload test by clicking the CMD 1 radio button. You can then resume the test by clicking the CMD 0 radio button. Block 4 and block 5 will be executed, and the test will finish.

More examples can be found in *"How Do I Use Events?" on page 334*.

Creating and Editing Segments

The stream of generated and expected data is defined by the data sequence. A sequence is built up of blocks. Each block references one data segment for each DUT data port.

The two different types of data segments are pseudo segments and real segments (see *"Data Segments" on page 67*).

Real segments can be created and modified manually. This chapter explains how this is done. See:

- *"How to Create a New Segment" on page 260*
- *"How to Edit a Stored Segment" on page 270*

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial*.

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo
- In the *Tutorial*, select *"Creating the Test Data Pattern"*.

How to Create a New Segment

Two types of real segments can be created and edited with the Segment Editor:

- PRBS/PRWS segments

  PRBS/PRWS segments contain pseudo random data in bit stream (PRBS) or word stream (PRWS) format. Pseudo random data is defined by the generating polynomial.

- Memory segments.

  Memory segments contain a user-defined data pattern.

NOTE Any new or modified segment needs to be saved on disk before it can be referenced in a block.

For details see:

- *"How to Start Creating a New Segment" on page 260*
- *"How to Create a Memory Segment" on page 262*
- *"How to Create a PRBS/PRWS Segment" on page 269*
- *"How to Save a New or Changed Segment" on page 270*

How to Start Creating a New Segment

To start the New Segment dialog:

1 Open the *File* menu and choose *New Segment.*

You start with the defaults as shown in the figure below.

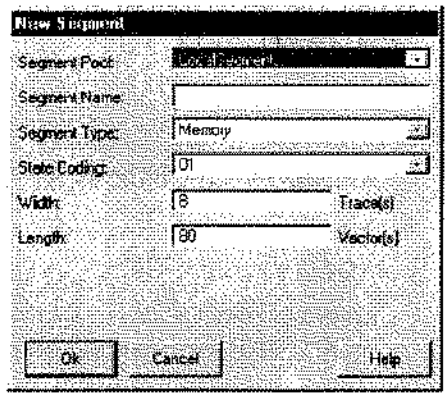


Figure 172 New Segment Window

If the Detail Mode Sequence Editor or the Data/Sequence Editor is displayed, you can also open the context menu of the segment you wish to replace and choose *New Segment*. If you enter the New Segment dialog this way, the block and port characteristics are already filled in.

2 Choose the *Segment Pool*.

Segments in the global segment pool can be accessed from all settings. Segments in the local segment pool can only be accessed from the current setting.

3 Enter or edit the *Segment Name*.

Enter a name that explains the contents or purpose of the segment.

4 Choose the *Segment Type*.

Type Memory means that a freely programmable pattern is stored in the database.

Type PRBS or PRWS means that an algorithm is used for generating a pseudo random bit or word stream. These segments are generated at runtime by hardware shift registers built into the modules.

NOTE PRWS segments are mainly used for testing multiplexers/demultiplexers. The first terminal of the DUT input port (counted from top to bottom as shown in the Connection Editor) gets the first state of the generated random sequence, followed by the next lower pin, and so on. If you had set up a 4-bit port and bit count starts with one, the first terminal would receive bit 1, 5, 9, and so on.

This fashion of sending the data to the channels requires that the connectors used are in the same module. If several modules are addressed, these modules have to be in adjacent slots.

For details see also *"Appendix B: PRBS/PRWS Data Segments" on page 357*.

How to Create a Memory Segment

Start the New Segment dialog (see *"How to Start Creating a New Segment" on page 260*).

Once you have decided to create a new memory segment and where to store it, fill in the remaining fields:

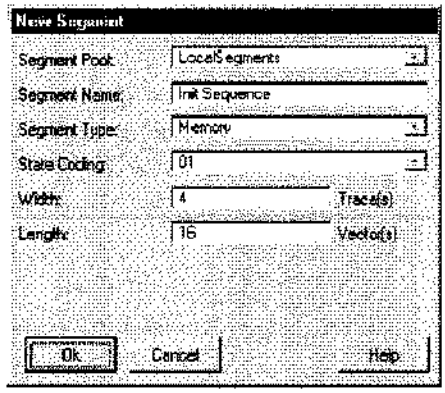


Figure 173 **New Segment Window for Creating a Memory Segment**

1 Specify the *State Coding*. Choices are 01 or 0x1.

The state coding 01 specifies that every bit of the segment occupies one bit in memory. This is adequate for all data segments to be downloaded to generator channels.

The state coding 0x1 can be used for expected data. This coding enables the x-character used to denote don't care bits. State coding 0x1 specifies that each bit of the segment occupies two bits in memory.

2 Set the *Width* and *Length* of the new data segment.

The width represents the number of pins included in a port and defines the number of traces.

The length is the pattern length and, thus, the number of vectors.

NOTE The length may exceed but must not be shorter than the length of the block where the segment is going to be inserted.

3 Click *OK*.

This opens the Segment Editor for the newly specified memory segment.

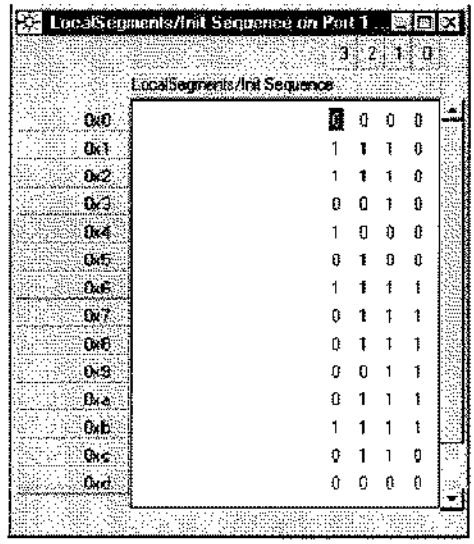


Figure 174 Segment Editor Window

The window shows the specified vectors (horizontal lines) and traces (vertical rows).

Characteristics of the Segment Editor Window

The Segment Editor window has three active areas:

- An area for vector operations
- An area for trace operations
- The data edit area

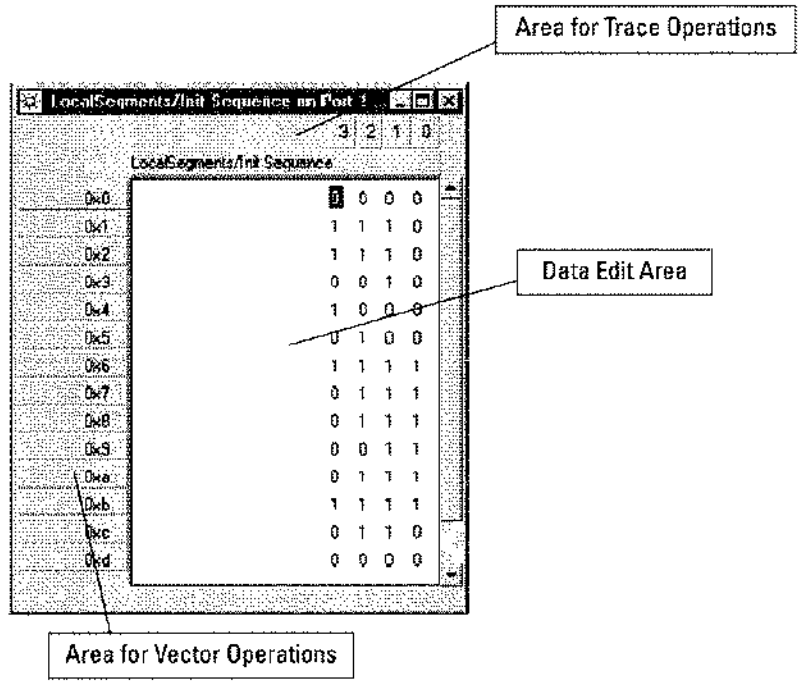


Figure 175 Segment Editor Window Areas

Each of these areas has its own context menu, indicated by the cursor changing its shape when placed over the areas.

How to Use the Segment Editor's Vector Operations Area

Clicking a vector address highlights that vector.

Dragging the cursor across several vector addresses highlights a block of vectors.

The context menu is opened by clicking with the right mouse button. It provides the following options:

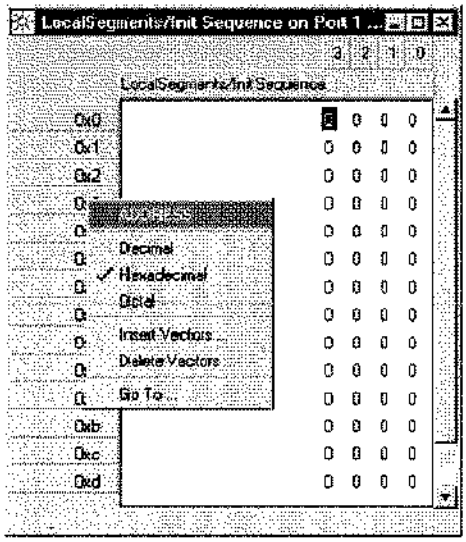


Figure 176 Segment Editor – Context Menu for Vector Operations

The available options are:

- Change the address display format (decimal, hex, or octal)
- Insert or delete highlighted vectors in the table
- Jump to a certain vector address

How to Use the Segment Editor's Trace Operations Area

Clicking a trace number highlights that trace.

Dragging the cursor across several trace numbers highlights a block of traces.

The context menu is opened by clicking with the right mouse button. It provides the following options:

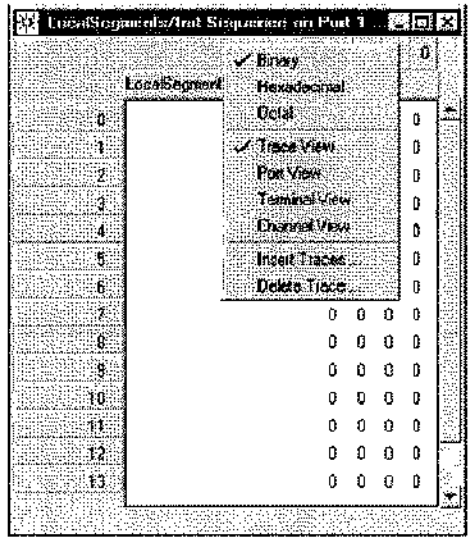


Figure 177 Segment Editor – Context Menu for Trace Operations

The available options are:

- Change the data display format.

  In binary mode, each trace has its own column. In hexadecimal mode, four traces are combined in one column (range 0 to F_{hex}). In octal mode, three traces are combined in one column (range 0 to 7_{oct}).

- Display the port, defined terminals or connected channels instead of trace numbers (available if you have started the Segment Editor by clicking a segment in the Sequence Editor).

- Insert new or delete highlighted traces in the table.

How to Use the Segment Editor's Data Edit Area

Clicking a bit highlights that bit. With the spacebar, you can toggle from zero to one and vice versa.

Dragging the cursor across several bits highlights a block.

The context menu provides the following options:

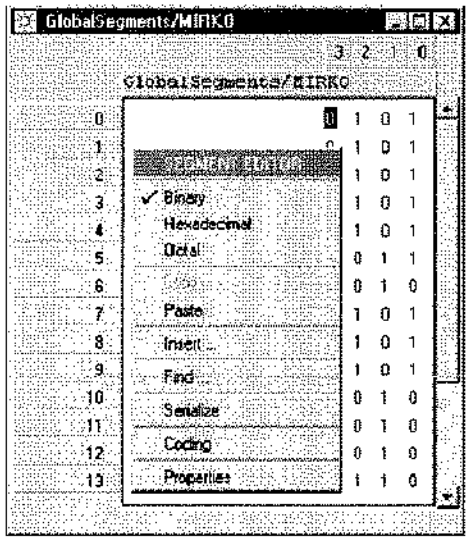


Figure 178 Segment Editor – Initial Context Menu for Editing Data

The available options are:

- Change the data display format (decimal, octal, or hex)
- Insert or delete highlighted vectors or traces
- Find a certain pattern within the segment
- Convert a parallel segment to serial or a serial segment to parallel
- Change the state coding
- Review the segment's setup information, but don't change it

If you have highlighted a block of data, the context menu provides additional options.

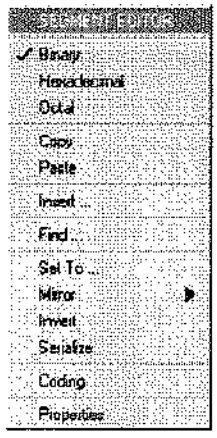


Figure 179 Segment Editor – Extended Context Menu for Editing Data

The additional options are:

- Copy the block to the clipboard (it can then be pasted somewhere else).
- Set the whole block to 1, or 0, or don't care (the latter only if the state coding is 0x1).
- Mirror the block contents horizontally or vertically.
- Invert the bits contained in the block.

NOTE You can also paste captured data from the Error State Display. For details see *"How to Transfer Captured Data Into a Segment" on page 298*.

Segment Editor Keyboard Shortcuts and Defaults

Cursor keys The cursor movement is from left to right and from top to down. If a block is highlighted, the cursor only moves within that block.

Page Up/Down keys The Page Up and Page Down keys allow to scroll vertically through the data segment. Step size is the number of lines actually visible in the editor window.

Home key The Home key moves the cursor to the vector number 0x0 in hexadecimal (equals decimal 0) and the highest trace number.

End key The End key moves the cursor to the highest vector number and trace number 0.

Insert key The Insert key can be used to insert vectors (rows) or traces (columns) in the table.

Delete key The Delete key can be used to delete highlighted vectors or traces.

Scroll Bar The Scroll Bar at the right side of the editor window helps to position the cursor in the middle portion of a large data segment.

Esc key To deselect a selection, press the Esc key or click outside the highlighted block.

To highlight the whole segment, click the segment label.

How to Create a PRBS/PRWS Segment

Start the New Segment dialog (see *"How to Start Creating a New Segment" on page 260*). Once you have decided to create a PRBS or PRWS segment, the window changes:

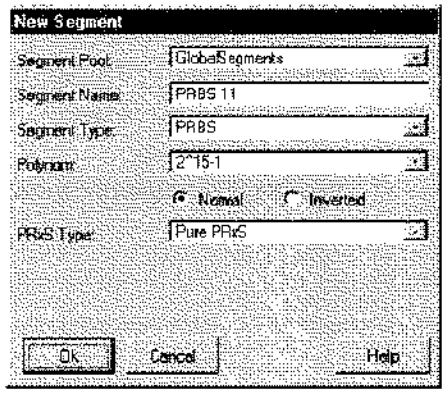


Figure 180 New PRBS/PRWS Segment Window

1 Choose one of the available *Polynomials*.

The polynomial defines the complexity of the pseudo random data segment. The available PRBS/PRWS polynomials are 2^5–1 through 2^{15}–1, 2^{23}–1, and 2^{31}–1.

2 Select *Normal* or *Inverted*.

If inverted is selected, the PRBS/PRWS is output in inverse mode.

3 Choose the *PRBS/PRWS Type*.

The options are:

– Pure PRxS

- Errored PRxS
- Variable Mark Density
- Extended Zeros/Ones

Pure PRxS do not consume data memory of the channels. They are generated at runtime by the hardware.

If you select a distorted PRBS/PRWS, the polynomial defines also its memory consumption. A distorted 2^{15}–1 PRBS/PRWS, for example, uses 32767 words of memory.

For the PRBS/PRWS polynomials 2^{23}–1 and 2^{31}–1 only pure PRxS is supported.

If you have chosen an non-pure PRxS, an additional parameter needs to be set. For details see *"Appendix B: PRBS/PRWS Data Segments" on page 357*.

4 Click *OK* to finish creating the PRBS/PRWS segment.

How to Save a New or Changed Segment

To save a new or changed segment:

1 Open the *File* menu

2 Select *Save Segment* to save the segment under its original name.

Alternatively, you can also click *Save Segment As* to save the segment under a new name.

See also *"Save Segment" on page 135* and *"Save Segment As" on page 135*.

How to Edit a Stored Segment

To view or edit a stored segment, you have to select that segment from the pool of segments.

For details see:

"How to Select a Segment" on page 271

"How to Edit a Memory Segment" on page 272

"How to Edit a PRBS/PRWS Segment" on page 280

How to Select a Segment

1 Click the Segment Editor icon.

Alternatively, you can also choose *Open Segment* from the *File* menu.

The Open Segment window appears:

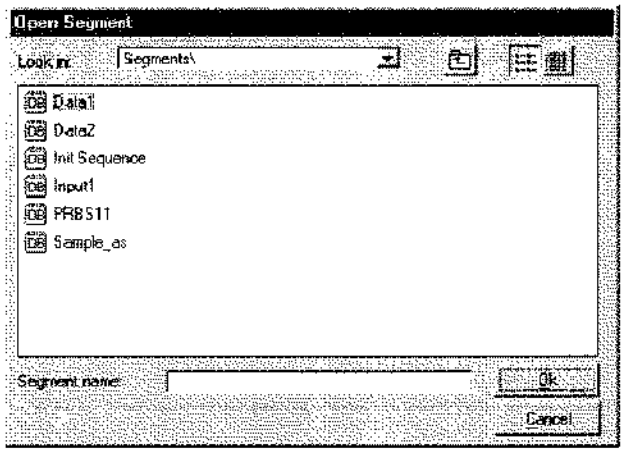


Figure 181 Open Segment Window

2 Select the Segment you wish to view or edit.

3 Click OK.

This opens the Segment Editor.

NOTE You can also open the Segment Editor directly by double-clicking a segment in the Detail Mode Sequence Editor or Data/Sequence Editor.

How to Edit a Memory Segment

After selecting a memory segment, the Segment Editor shows the data pattern:

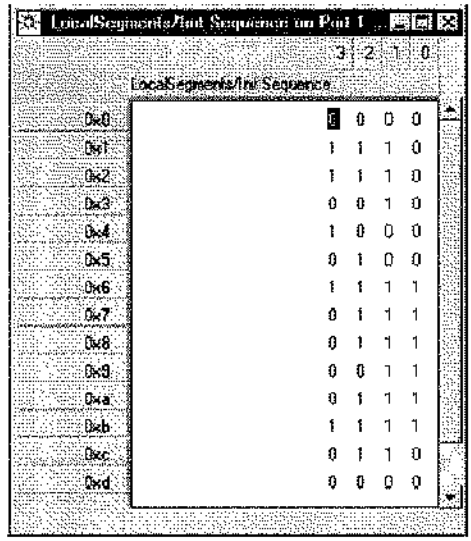


Figure 182 Segment Editor Window

For details on how to operate the Segment Editor see *"Characteristics of the Segment Editor Window" on page 264*.

How to Convert a Memory Segment from Parallel to Serial

This function largely supports the setup of multiplexer tests.

If you have opened a parallel segment (a segment holding more than one trace), you can convert its contents to serial format (a segment holding just one trace).

1 Open the context menu of the data edit area and choose *Serialize*.

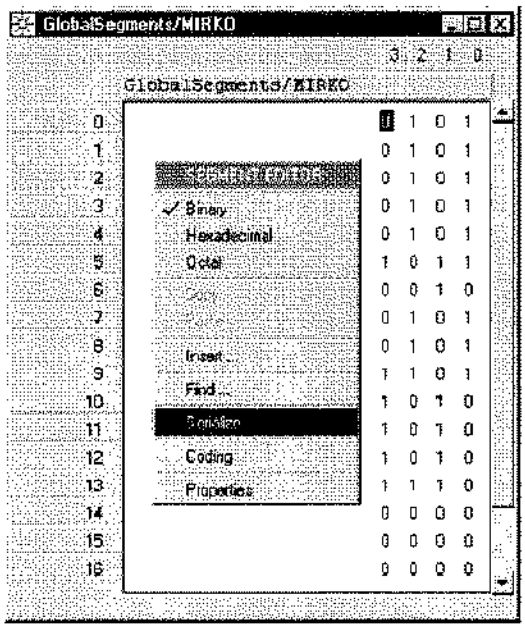


Figure 183 Context Window for Editing a Parallel Segment

Alternatively, you can also choose *Serialize* from the *Tools* menu.

2 Select the way you wish to sort the data. Choices are *Normal* or *Reverse*.

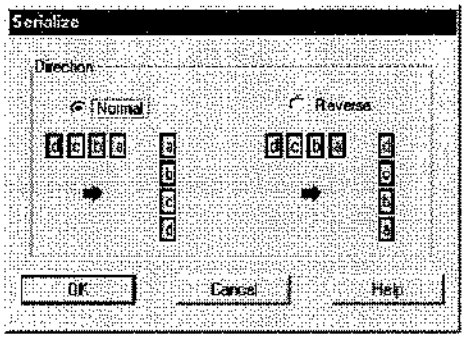


Figure 184 Serialize Window

Each vector forms a data word. Trace 0 usually holds the LSB. The leftmost trace holds the MSB.

- Normal: The data is sorted from LSB to MSB.
- Reverse: The data is sorted from MSB to LSB.

3 Click *OK*.

The following figure shows the result of a "normal" conversion:

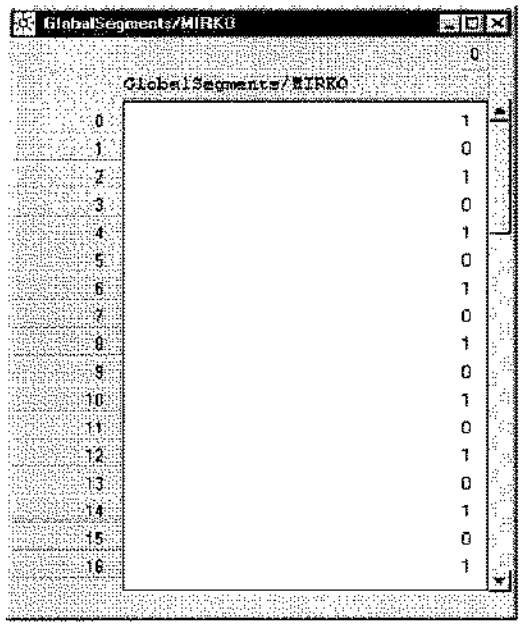


Figure 185 Serialized Segment

The segment length is now its original length times the number of traces.

4 Save the segment (see *"How to Save a New or Changed Segment" on page 270*).

How to Convert a Memory Segment from Serial to Parallel

This function largely supports the setup of demultiplexer tests.

If you have opened a serial segment (a segment holding just one trace), you can convert its contents to parallel format (a segment holding several traces).

1 Open the context menu of the data edit area and choose *Deserialize*.

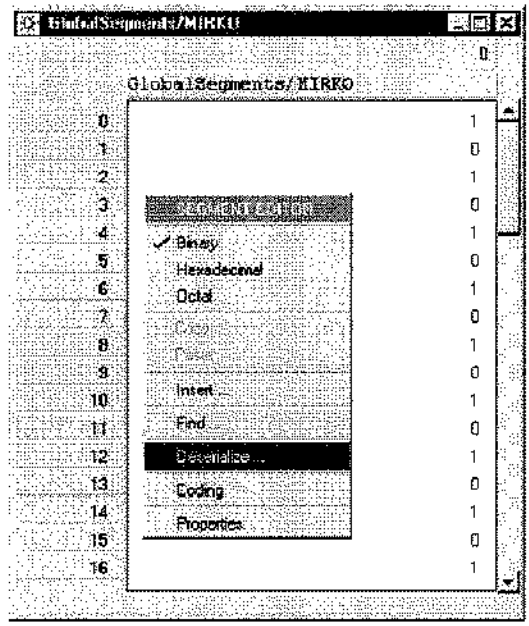


Figure 186 Context Window for Editing a Serial Segment

Alternatively, you can also choose *Deserialize* from the *Tools* menu.

2 Enter the number of traces you wish to split the data into.

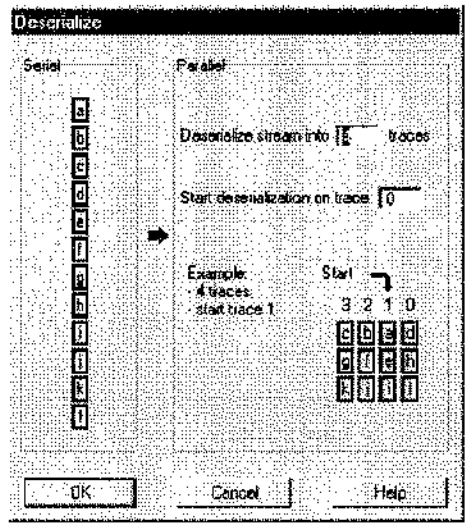


Figure 187 Deserialize Window

The number of traces has to be an integer fraction of the segment length. All the resulting traces will be of equal length. The converter does not patch any missing data.

3 Set the start position of the first bit.

You can start the deserialization at any of the specified traces. The example shown in the window illustrates what happens, if you do not start at trace 0.

Setting an individual start position allows you to adapt the conversion to a demultiplexer that does not provide the first bit of the serial data stream at the pin connected to trace 0.

4 Click *OK*.

The following figure shows the result of a conversion into four traces, starting at trace 0:

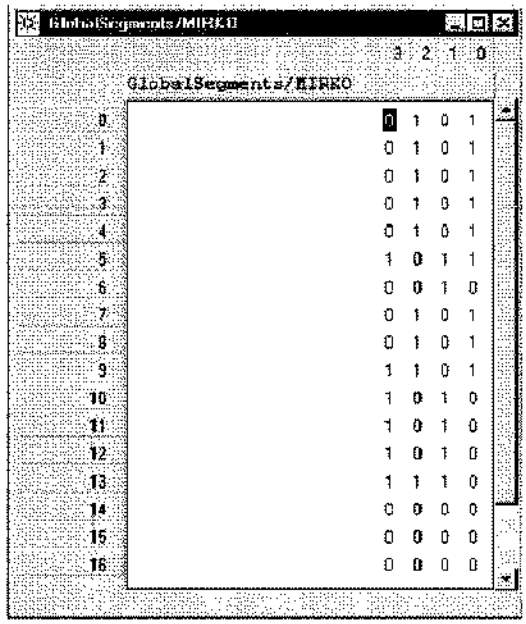


Figure 188 Deserialized Segment

The segment length is now its original length divided by the number of traces.

5 Save the segment (see *"How to Save a New or Changed Segment" on page 270*).

How to Locate a Data Pattern Within a Segment

With the Find function, you can locate data patterns contained in a memory segment.

1 Open the context menu of the data edit area and choose *Find*.

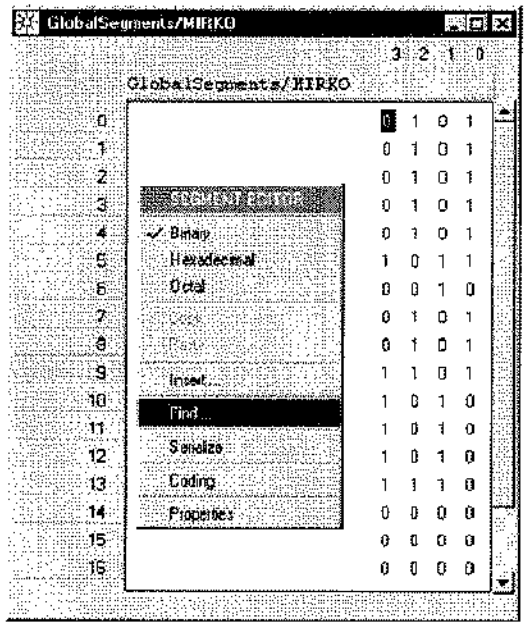


Figure 189 Context Window for Editing a Segment

Alternatively, you can also choose *Find* from the *Edit* menu.

2 Enter the pattern you wish to locate.

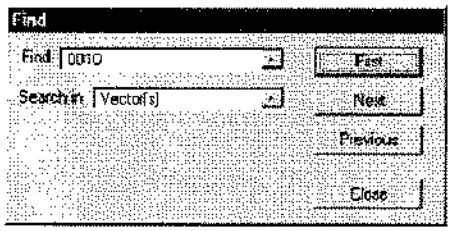


Figure 190 Find Window

Depending on the current data representation, you can search for binary, hexadecimal, or octal patterns.

3 Decide on searching in vectors or traces.

If you are searching vectors, the length of the search pattern must not exceed the width of the segment.

If you are searching traces, the length of the search pattern must not exceed the length of the segment.

4 Click *First*.

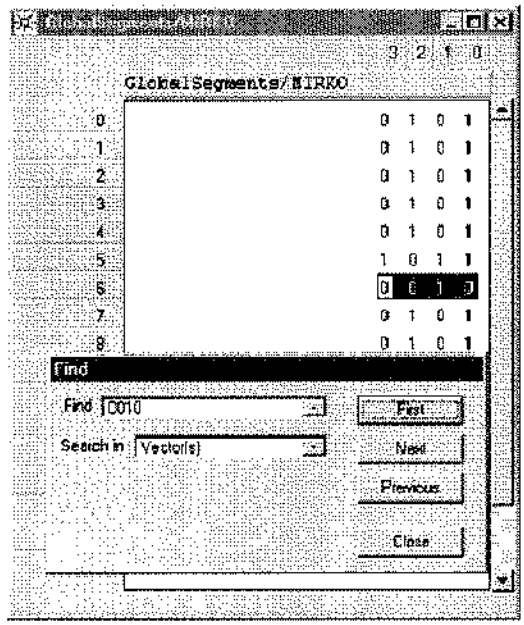


Figure 191 Searching Vectors

The first occurrence of the pattern is highlighted.

5 Click *Next* to search for the next occurrence, or *Previous* to move backward.

Searching traces returns the following result:

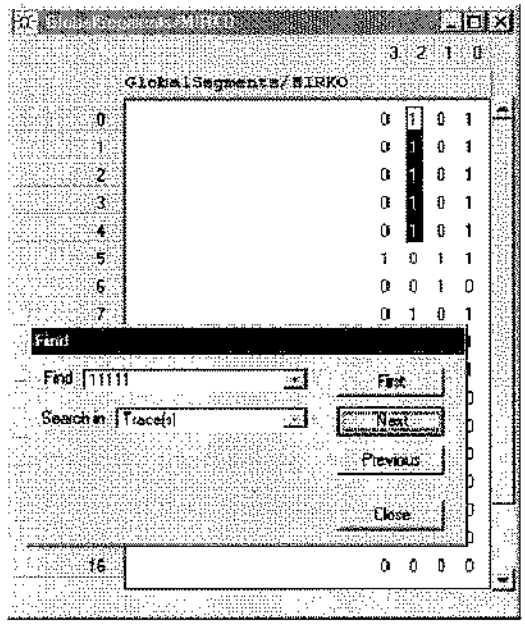


Figure 192 Searching Traces

Search direction

The search direction depends on whether you search in vectors or traces:

- Search vectors: Starts at vector 0, leftmost trace. Continues from left to right. After trace 0 is reached, the search proceeds to the next vector, leftmost trace.
- Search traces: Starts at leftmost trace, vector 0. Continues from top to bottom. After the last vector is reached, the search proceeds to the next lower trace.

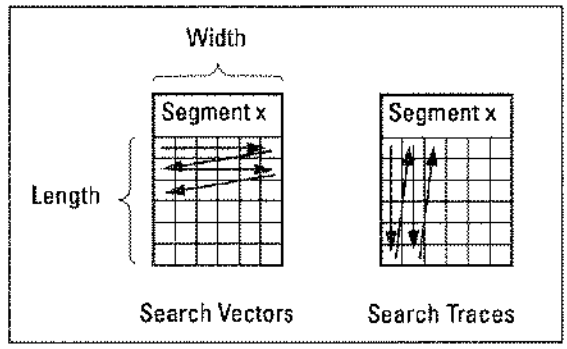


Figure 193 Search Algorithm

Search pattern memory

When you open the Find dialog, you may wish to search for a pattern you have already searched for in a previous session.

To support this, the software keeps a list of the previously used patterns:

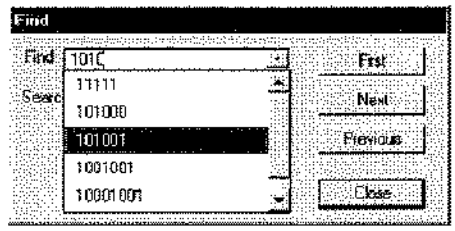


Figure 194 List of Previously Used Patterns

Simply choose from that list.

How to Edit a PRBS/PRWS Segment

After selecting a PRBS/PRWS segment, the Segment Properties window shows the specification:

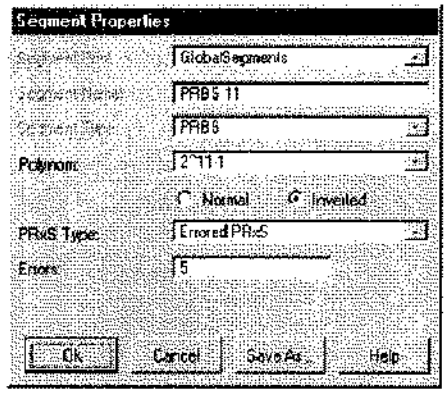


Figure 195 PRBS/PRWS Segment Properties Window

You can now change the parameters. For details see *"How to Create a PRBS/PRWS Segment" on page 269.*

Using the Data/Sequence Editor

The Data/Sequence Editor combines the functions of the Detail Mode Sequence Editor and the Segment Editor.

The Data/Sequence Editor can be used to:

- Inspect all details of the test sequence including data patterns
- Change the test sequence
- Change block characteristics
- Inspect and change the segments contained in the blocks

The Data/Sequence Editor is particularly useful on a system equipped with a high resolution video screen because it eliminates the need for switching between the two standard editors.

The procedures for editing data are basically the same as incorporated in the Sequence Editor and the Segment Editor.

This chapter comprises the sections:

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial*.

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo

♦ In the *Tutorial*, select *"How to Use the Data/Sequence Editor"*.

How to Start the Data/Sequence Editor

To start the Data/Sequence Editor:

1 Select *Data/Sequence Editor* from the *Go* menu.

Contents of the Data/Sequence Editor Window

The Data/Sequence Editor identifies:

- The DUT i/o ports that have been set up
- The terminals that have been set up within the ports
- The blocks that form the test sequence
- The block markers that indicate generated triggers, analyzer synchronization, and sequence changes on events
- The loops that repeat single or groups of blocks
- The segments that have been included in the blocks
- The data patterns stored in the segments

All this is shown in one window.

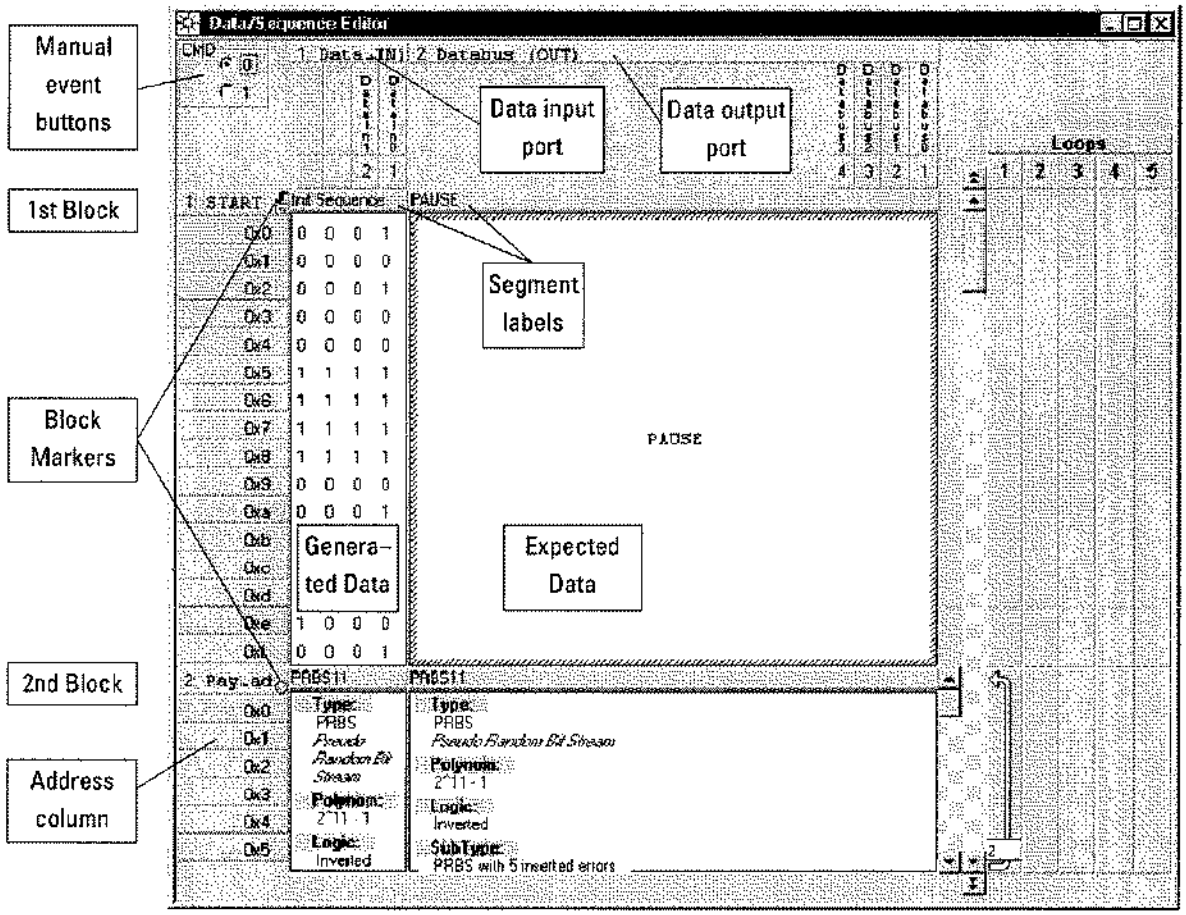


Figure 196 Data/Sequence Editor Window

NOTE Note that the Data/Sequence Editor provides vertical scroll bars for each block and an overall scroll bar for the sequence.

How to Customize the Data/Sequence Display

You can adapt the display to your preferences by changing:

- The width of the columns
- The height of the blocks
- The address display format
- The labeling of the displayed traces

How to Change the Width of the Columns

To view more or less columns (ports):

1 Move the cursor onto the vertical line that marks the column border.
The cursor changes its shape.

2 Hold the mouse button depressed and drag the border line horizontally.

How to Change the Height of a Block

To view more or less blocks:

1 Move the cursor onto the horizontal line that marks the lower block border.

The cursor changes its shape.

2 Hold the mouse button depressed and drag the border line vertically.

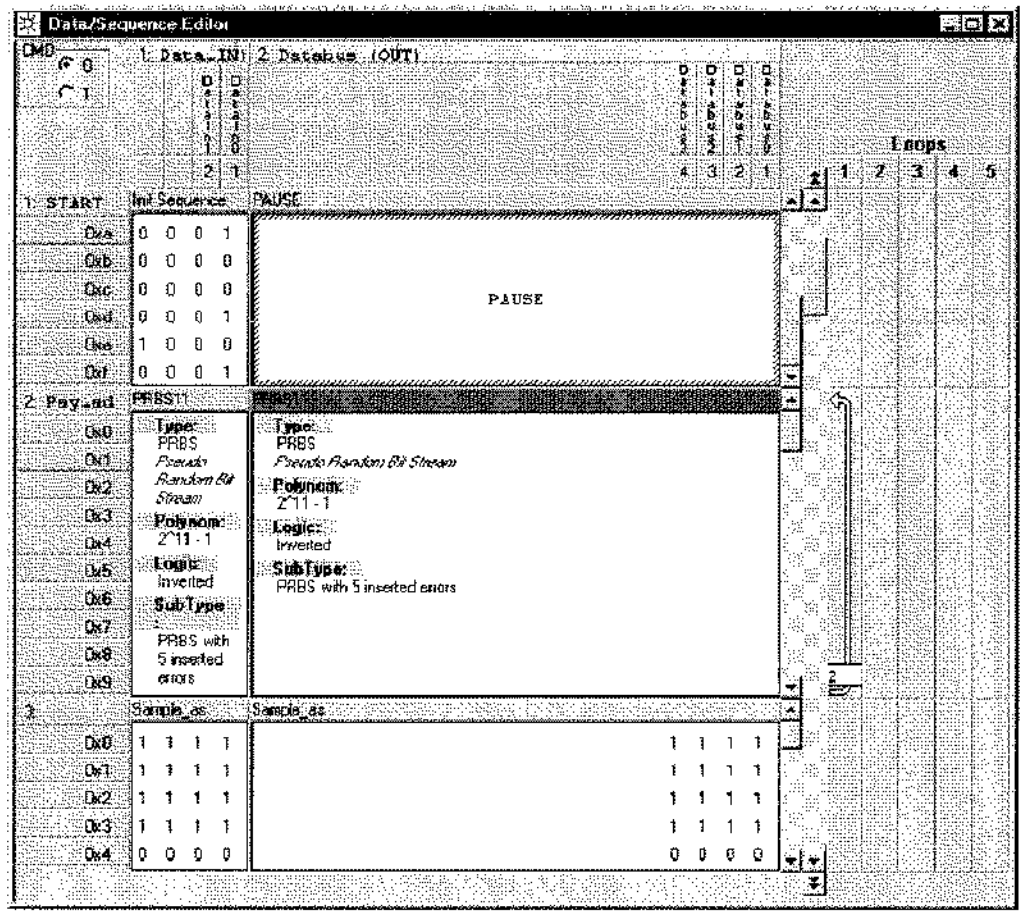


Figure 197 Customized Data/Sequence Editor Window

How to Change the Format of Displayed Addresses

An important difference between the Data/Sequence Editor and the Segment Editor is the meaning of the vector address column at the left-hand side. While the Segment Editor always displays the actual bit vector address in the segment, the Data Sequence Editor displays the clock cycle number at a certain point of time.

If a port uses clock frequency multiplier 1, one vector will be displayed per row (i.e. per cycle number). If another port uses frequency multiplier 4, then four rows of the data segment will occur per cycle for this port. In other words, this port will receive/send four bits for every terminal, while the first one only receives/sends one per terminal.

To change the bit vector/clock cycle number format:

1 Open the context menu of the address column by clicking on it with the right mouse button.

2 Choose from the menu one of the following options:

Decimal, *Hexadecimal*, or *Octal*.

Note, that this menu can also be used to jump to any address within the current block by choosing the *Go to* option.

How to Change the Labels of Displayed Traces

To change the view of traces:

1 Open the context menu of the port/terminal display area by clicking on it with the right mouse button.

2 Choose from the menu.

Choices are: *Trace View*, *Port View*, *Terminal View*, *Channel View* (see *"Data Format" on page 143*).

Note, that this menu can also be used to insert or delete highlighted traces.

How to Change the Sequence or Edit Segments

The Data/Sequence Editor combines all the functions of the

- Sequence Editor
- Segment Editor

That means, it does not only provide the same capabilities, it also works the same way. In fact, the Data/Sequence Editor just invokes procedures that are already known from the other two editors.

How to Change the Sequence Characteristics

To change the sequence:

1 Open the context menu of a block label by clicking on it with the right mouse button.

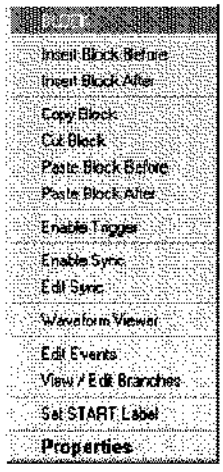


Figure 198 Block Context Menu

You have all the options the Sequence Editor provides.

2 Choose the required action from the menu.

For details please refer to *"How to Add, Move or Delete Blocks" on page 237*.

If you wish to change the loops in your sequence, please refer to *"How to Create and Change Loops" on page 245*.

How to Replace a Segment

To replace a segment by another one:

1 Open the context menu of a segment label by clicking on it with the right mouse button.

Figure 199 Segment Context Menu

You have all the options the Sequence Editor provides. They depend on the selected type of measurement and on the type of port – data input port or data output port.

2 Choose from the menu.

For details please refer to *"How to Replace the Current Segment" on page 241.*

How to Edit the Contents of a Segment

For changing the contents of a segment, you have all the options the Segment Editor provides.

You can change individual bits or highlight rows, columns, or selections and change their contents using the context menu.

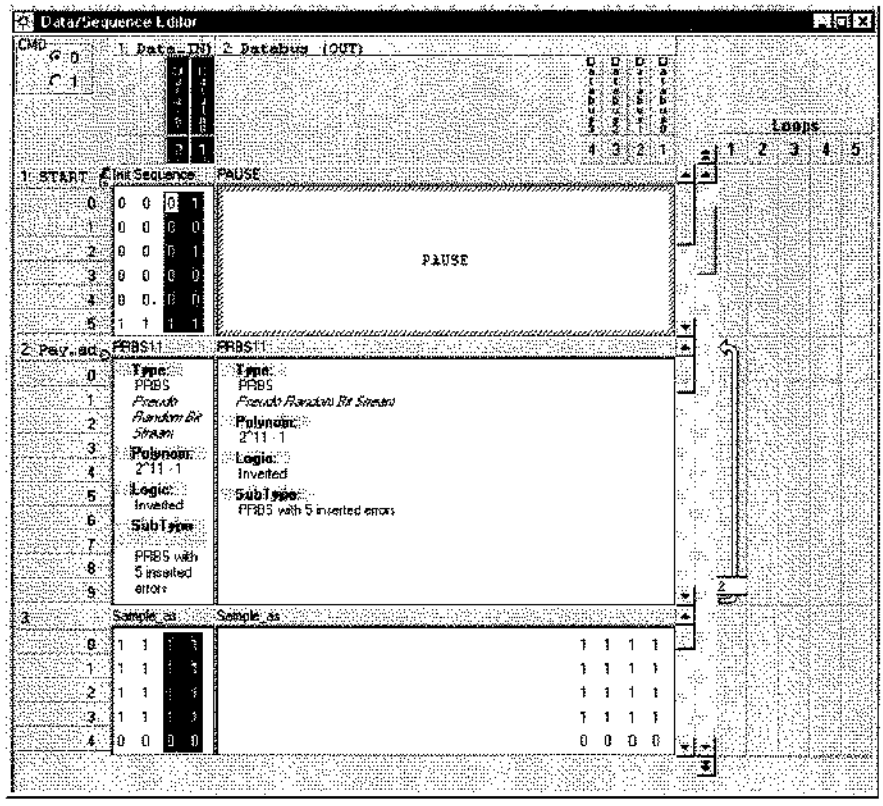


Figure 200 Data/Sequence Editor – Highlighted Column

For details please refer to *"How to Use the Segment Editor's Data Edit Area" on page 267.*

Running the Test

Once the Sequence is complete, you are ready to run the test.

Device Tests can be started and stopped from the user interface. They can also be started and stopped by an external signal applied to the EXT INPUT connector of the master clock module.

NOTE Before starting a test, it is recommended to check the parameter settings of the ports and channels.

To be successful, generated signals must fit to the data formats, voltages and impedances of the DUT. Analyzer sampling point delays must take the signal traveling and processing time of the DUT into account.

This chapter informs you about:

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial*.

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo
- In the *Tutorial*, select *"Running the Test and Displaying the Results"*.

How to Download the Test Sequence

To download a sequence to the modules:

1 Click the Prepare button of the tool bar.

Downloading ensures that the test sequence is formally correct and can be executed.

NOTE Downloading is especially important, if you have changed the type of measurement, because pseudo segments like Acquire, Expected 0 and so on apply only to certain tests (see *"How to Replace a Segment by a Pseudo Segment" on page 243*).

Downloading also prepares the Agilent 81250 system for immediate start on a trigger event.

The sequence is also downloaded to the modules when the Run button is pressed. But downloading a complex sequence can take some time. In the meantime there is no output signal generated, nor any input signal captured.

How to View BER Test Results

If the test has been set up for measuring the bit error rate:

1 Click the Bit Error Rate Display icon in the tool bar.

This opens the Bit Error Rate window.

2 Drag the right- or left-hand border to view all the columns.

Once the test is running, the window is continually updated. It is therefore recommended to open this window before starting the test.

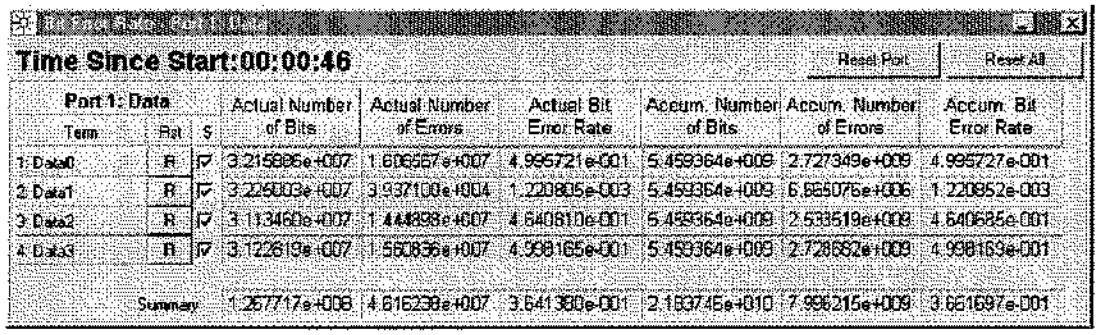


Figure 201 **Bit Error Rate Display**

The resulting BER is shown as actual and accumulated values per terminal and port. The elapsed time since start of the measurement is also displayed.

All counters can be reset at any time, either individually per terminal (*R* buttons in the *Rst* column), or per port (*Reset Port* button) or all at once (*Reset All* button).

There is a summary line at the bottom. By clicking the marker in the *S* column, terminals can be excluded from or included in the summary line.

TIP The sequence of the columns can be customized. To move a column to a different position, click the column header with the left mouse button and drag the column horizontally to the desired position.

How to Start/Stop the Test

To start the test:

1 Ensure that the frontends are connected to the DUT.

The Connectors On/Off button can be used to disconnect all frontends (by switching relays inside the frontends) and to re-establish the previously specified connections.

2 Click the Run button.

If the test has been set up to be controlled by an external start trigger, the user interface will display HALTED and the system will wait for that trigger. If not, it starts immediately.

The test will run until the test sequence is completely executed or the capture memory is full or, if it is controlled by an external stop trigger, until the trigger is set—whichever comes first.

If the test sequence includes an infinite loop, stop the test by clicking the Stop button.

Viewing Generated and Captured Data

After running one of the tests

- *Capture Data*
- *Compare and Acquire around Error*
- *Compare and Capture*

you can review the captured data.

After running one of the tests *Compare and Acquire around Error* or *Compare and Capture* you can also investigate errors, the pattern around errors, and generated data.

The results of a bit error rate measurement are displayed in the Bit Error Rate window (see *"How to View BER Test Results" on page 292*).

This chapter informs you about:

How to View Captured Test Results

Captured data as well as errors can be visually checked in the Error State Display.

How to Start the Error State Display

To open the Error State Display:

1 Click the Error State Display icon of the tool bar.

Alternatively, you can also open the *View* menu and choose *Result Displays*.

The Error State Display identifies the DUT output port and shows the memory contents of the analyzer channels.

How to Operate the Error State Display

The Error State Display has three display modes. It can show:

- Captured Data: Shows what has been captured.
- Compared Data: Shows captured data where errors are highlighted.
- Error Data: Shows errors only.

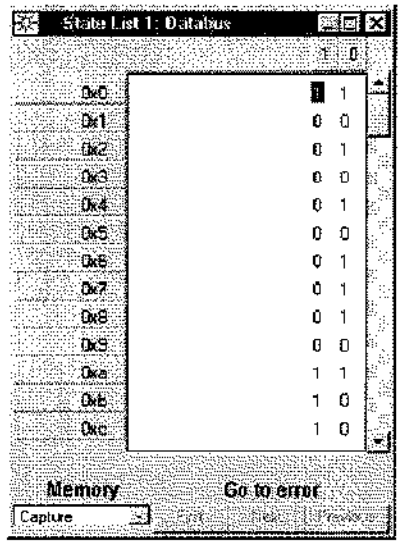


Figure 202 Error State Display in Capture Mode

The window has two active areas with context menus—the address column and the data display box.

In the address column, you can change the address display format (choices are *Decimal*, *Hexadecimal*, or *Octal*) or choose the *Go to* option to specify the start address of the display.

In the data display box, you can change the data display format. Choices are *Binary*, *Hexadecimal*, or *Octal*.

In binary mode, each trace has its own column. In hexadecimal mode, four traces are combined in one column (range 0 to F_{hex}). In octal mode, three traces are combined in one column (range 0 to 7_{oct}).

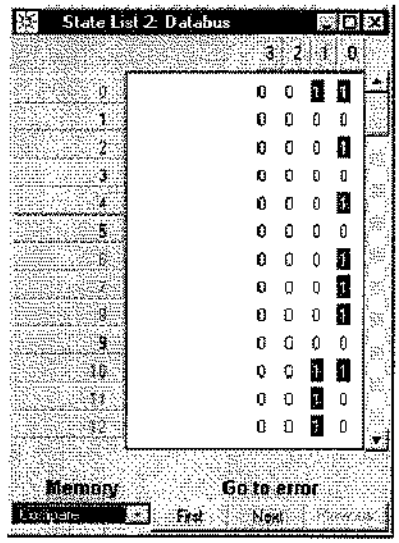


Figure 203 Error State Display in Compare Mode

In Compare mode, the window provides three Go-to-Error buttons to move quickly from one error to the next or previous.

How to Transfer Captured Data Into a Segment

Captured data can be saved in a data segment.

This makes it possible to use the response of a device as a reference for future devices of the same kind. If the segment with the captured data is used to specify the expected data for tests to come, the system precisely measures all deviations from the gold standard.

There are two ways to transfer captured data into a segment. You can:

- Save the captured data as a new segment
- Copy the captured data to the clipboard and then paste that data into a segment

How to Save Captured Data as a New Segment

To convert captured data to a new segment:

1 When the Error State Display is active, open the *File* menu and choose *Save Segment As*.

2 Enter the new segment's file name.

3 Click OK.

NOTE Before using the segment for interpreting received data, check and, if necessary, change the state coding (see *"How to Create a Memory Segment" on page 262*).

How to Copy Captured Data into a Segment

To copy captured data into a new or existing segment:

1 Put the Error State Display in Capture mode.

2 Drag the cursor across the trace numbers.

This highlights all the captured data. You can of course also highlight a data section.

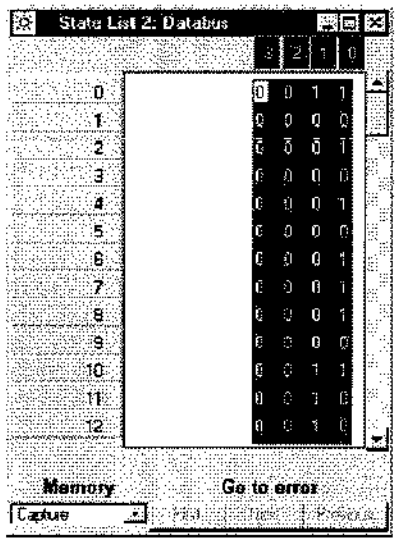


Figure 204 Highlighted Captured Data

3 Open the context menu and choose *Copy*.

This copies the data to the clipboard.

4 Create a new memory segment (see *"How to Create a New Segment" on page 260*).

When creating the segment, ensure that it is long and wide enough to hold the pattern you wish to include.

5 In the Segment Editor, highlight the traces that shall get the data pattern.

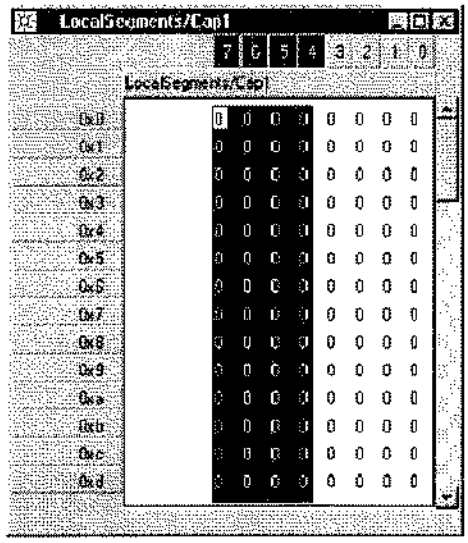


Figure 205 Empty Segment

6 Open the context menu and choose *Paste*.

The result is shown below:

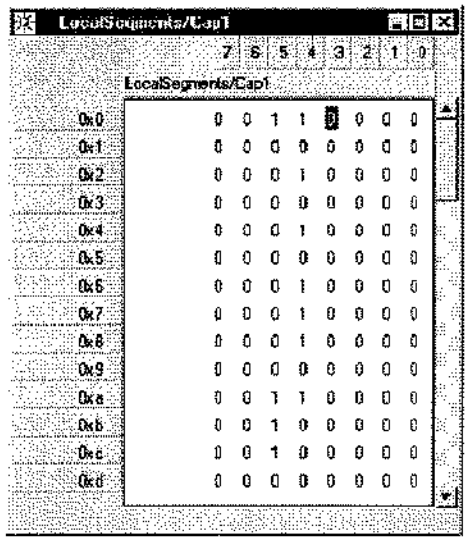


Figure 206 New Segment

Copied data that does not fit into the segment is ignored.

7 Save the segment.

How to View Waveforms

Generated, expected and captured data can be displayed in graphical form with the Waveform Viewer.

How to Start the Waveform Viewer

To open the Waveform Viewer:

1 Click the Waveform Viewer icon of the tool bar.

Alternatively, you can also open the View menu and choose *Result Displays*.

The Waveform Viewer identifies the test sequence and the ports:

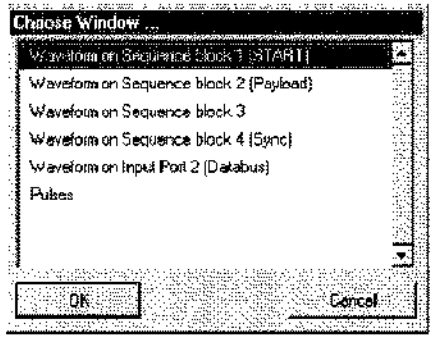


Figure 207 Waveform Viewer Selection Window

If you select a data block of the test sequence or a pulse port, generated and expected data will be displayed in **time mode**. The available resolution is the segment resolution, the unit is nanoseconds (ns). This enables you to check the delays that have been set up. Note that PRBS/PRWS data cannot be displayed in time mode.

If you select a DUT output port (= analyzer input), the data will be displayed in **sample mode**. This corresponds to the way the data has been acquired. The total number of samples is the number of captured vectors times the maximum factor of the FMR (see *"Frequency Multiplier and Segment Resolution" on page 55*).

2 Choose from the menu.

Description of the Waveform Viewer Display

The Waveform Viewer comes up with a default configuration which can be changed at will.

The figure below shows an example of a block which includes one data input port (DataIn) and one data output port (Databus).

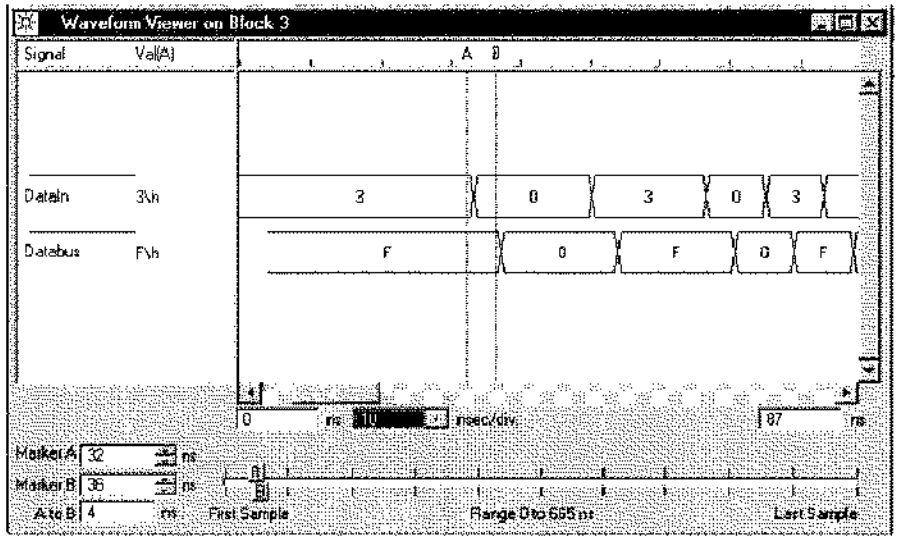


Figure 208 Waveform Viewer in Time Mode

Two traces show the code transitions and the generated and expected codes in hexadecimal format.

The display provides two markers, A and B. Their current position and distance is indicated in the lower left-hand corner. They can be moved with the verniers or by dragging their handles along the ruler.

The column *Val(A)* shows the codes at the position of marker A. The literal \h indicates that these are hex codes.

The current resolution is 10 ns/div but can be changed.

How to Operate the Waveform Viewer

The context menu provides the following options:

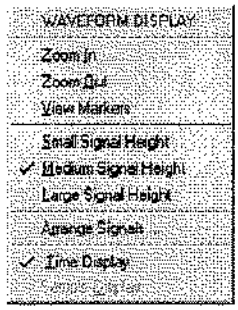


Figure 209 Waveform Viewer Context Menu

You can:

- Zoom in, zoom out, or view the area between the markers.
- Increase or decrease the waveform amplitudes.
- Rearrange the display.

To view additional or different data:

1 Click *Arrange Signals*.

The Arrange Signals Window appears.

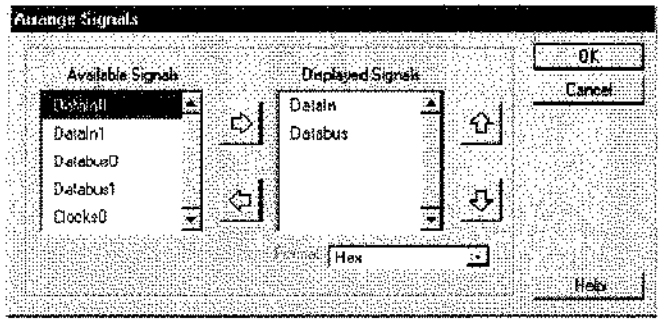


Figure 210 Waveform Viewer Arrange Signals Window

2 To view an item in the display, highlight it in the list of *Available Signals* and click the right-arrow.

3 To remove an item from the display, highlight it in the list of *Displayed Signals* and click the left-arrow.

4 To move an item in the list of *Displayed Signals*, highlight it and click the up- or down-arrow.

The result may look as shown below:

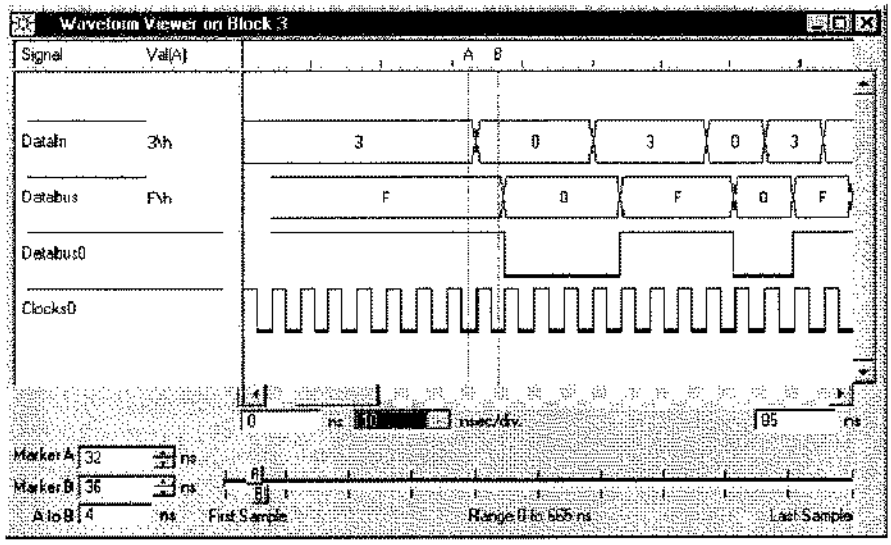


Figure 211 Waveform Viewer in Time Mode—Additional Waveforms

NOTE If you are viewing data input or pulse terminals and have sourced an added channel (see also *"How to Combine Generator Channels" on page 206*): The Waveform Viewer shows only the signal of the channel that has a connector.

If you have opened the Waveform Viewer for a data output port, it shows the summary of the captured data and the individual channels in **sample mode**. If error recognition was enabled, it shows also the deviations from expected data.

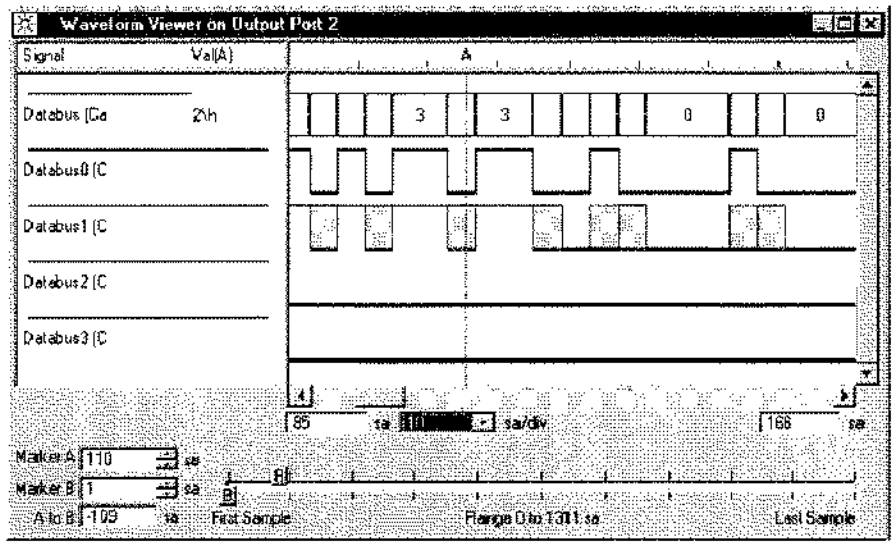


Figure 212 Waveform Viewer—Waveforms in Sample Mode

The signals are identified as

- (Capt)—captured data,
- (Comp)—compared data,
- (Err)—error data.

The display is presently limited to 10 characters.

A zero line tells you that nothing was received or expected.

The *Arrange Signals* menu now offers additional options: You can select between captured, compared, and error data, and, thus, compose an individual display.

The result may look as shown below:

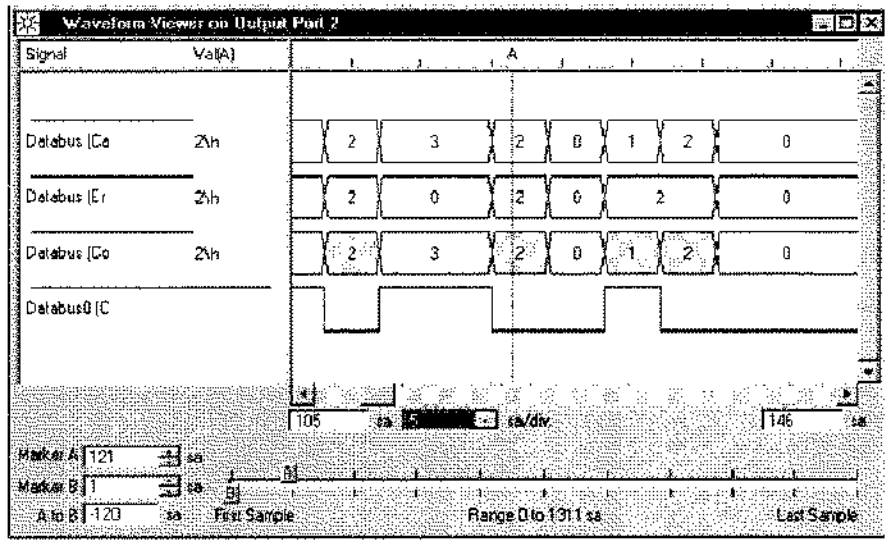


Figure 213 Waveform Viewer in Sample Mode—Additional Waveforms

Using Auxiliary Functions

This chapter provides information on auxiliary functions which are not directly related to test setup and execution. The following topics are covered:

- *"How to Compensate for Internal and External Delays" on page 308*—the description of the Deskew Editor
- *"How to Export/Import Settings or Segments" on page 317*—an explanation of the export and import functions
- *"How to Execute Firmware Commands" on page 320*—a nice feature which allows you to send firmware commands to the hardware and check the responses
- *"How to Use the SFI5 Frame Generator" on page 323*—a special tool used for generating test data that is formatted according to SFI5 standards

How to Compensate for Internal and External Delays

Precise measurements require exact timing. Generated signals must reach the DUT simultaneously, response signals must be captured at the same point of time by all analyzers.

The Agilent 81250 Parallel Bit Error Ratio Tester supports timing adjustments at the generator/analyzer connectors of the system, at the input and output connectors of the DUT board, and even at the pins of the DUT.

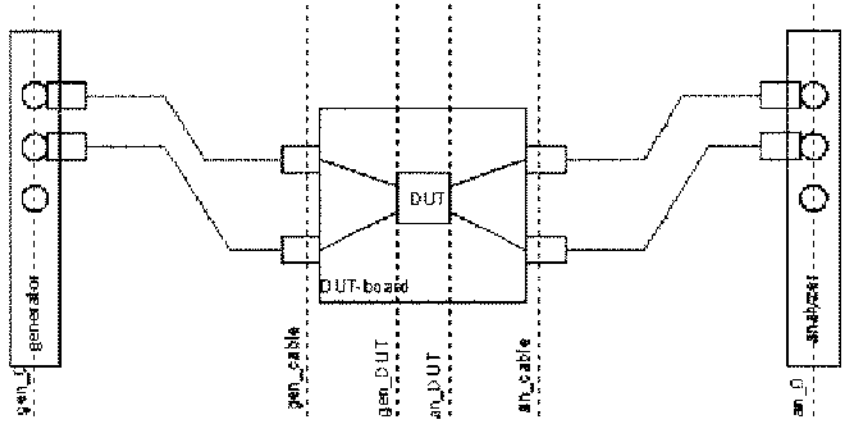


Figure 214 Supported Timing Adjustments

Zero adjust After installing new modules or after replacement of frontends a *zero adjust* procedure has to be performed to synchronize the new generators or analyzers with the ones already installed.

Cable delay To compensate for signal delays in the used cables, a *cable delay compensation* procedure can be performed.

Cable and propagation delay To compensate for both, propagation delays on the DUT board and delays in the cables, a *cable and propagation delay compensation* procedure can be performed.

Delay compensation is done with the Deskew Editor.

NOTE If you need to deskew a ParBERT 43G system because modules or frontends have been exchanged, some restrictions apply. See *"Additional Characteristics of ParBERT 43G Systems" on page 100.*

Multi-Media Guided Tour, Tutorial and Getting Started

As an additional source of information, the Multi-Media Guided Tour, Tutorial and Getting Started provide a comprehensive overview of the Agilent 81250 Parallel Bit Error Ratio Tester.

If installed on your system, you will find it in the Windows start menu under *Programs – Agilent 81250 Tutorial.*

If not, you can download it from the web through

- http://www.agilent.com/find/81250demo
- In the *Tutorial*, select *"Establishing Uniform Signal Delays".*

How to Start the Deskew Editor

To start the Deskew Editor:

1 Open the *Go* menu.

2 Click *Deskew Editor.*

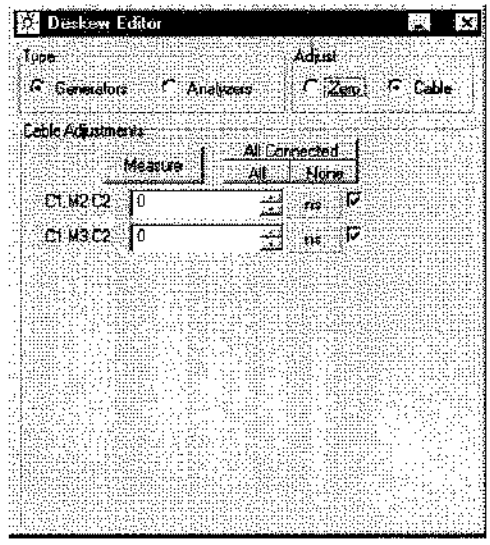


Figure 215 Deskew Editor—Start Window

By default, the Deskew Editor identifies all the installed generator channels and suggests a cable delay measurement.

The identification of a generator or analyzer channel is:

Cx–My–Cz (ClockgroupNumber–ModuleNumber–ConnectorNumber), such as C1–M3–C4. See also *"Identification of Hardware Resources" on page 43*.

How to Adjust the Instrument Connectors

Zero adjustment ensures that an edge produced by the generator channels appears simultaneously at all generator connectors, and that received data is sampled at all analyzer connectors at the same point of time.

Prerequisites To perform this procedure, you need a reference SMA cable with known signal delay.

Procedure Once the Deskew Editor has been started:

1 Decide whether you wish to measure generator or analyzer channels.

2 Click the *Zero* button in the *Adjust* field to select zero adjust.

The last measured delay values are displayed.

By default, all connectors are marked for the zero adjust. With the *None* button you can deselect all and then mark just the new connectors for the zero adjust procedure.

3 Click the *Measure* button.

For generators, the following window pops up:

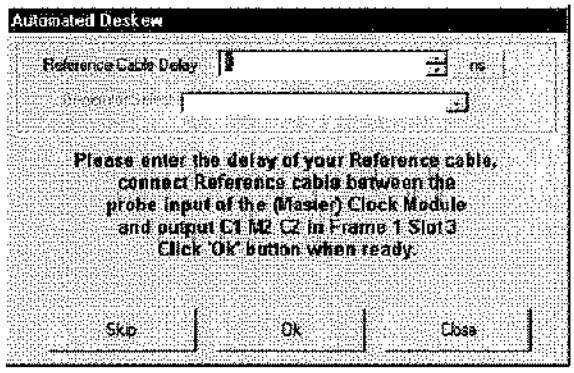


Figure 216 Deskew Editor—Zero Adjust Window for a Generator Channel

4 Follow the instructions given in this window.

Enter the reference cable delay in the provided field. The typical delay of a 1 m (3 feet) SMA cable is about 3.5 ns.

The instructions will guide you from one connector to the next.

5 Adjust also the analyzers.

The zero adjustment of analyzers requires a signal generator to be used as a reference channel. The system proposes the first of the installed generator channels. If there is no generator frontend installed, the TRIGGER OUTPUT of the clock module is suggested.

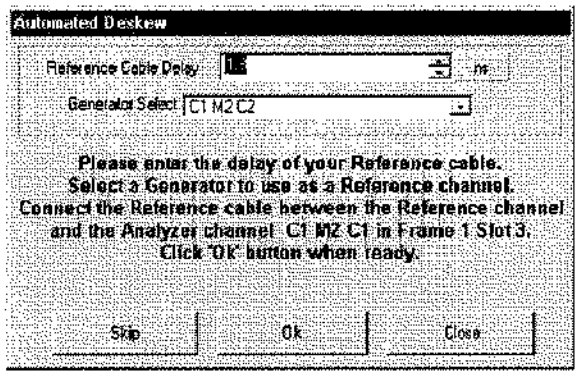


Figure 217 Deskew Editor—Zero Adjust Window for an Analyzer Channel

The instructions guide you from one connector to the next. Finally, the measured zero adjust values are automatically entered into the initial table.

How to Compensate for Cable Delays

The cable delay compensation for the generators assures that the edges of all generator outputs appear at the same time at the end of the cables used in the setup.

The cable delay compensation for the analyzers assures that all output signals of the DUT are sampled at the same time at the end of the cables, close to the DUT.

Prerequisites To perform this procedure, you need all the cables which are going to be used by your application of the system.

The cable delay compensation range is ±23 ns.

Perform the cable delay compensation first for the generator outputs, then for the analyzer inputs.

It is recommended to use cables of equal type and length for all inputs and outputs.

Procedure To compensate for cable delays:

1 Connect the cables you will use in your application to the system's generator connectors.

2 Create an image of your application in the Connection Editor. Group the signals to ports and make the connections in the scheme.

In this example, the following setup is used:

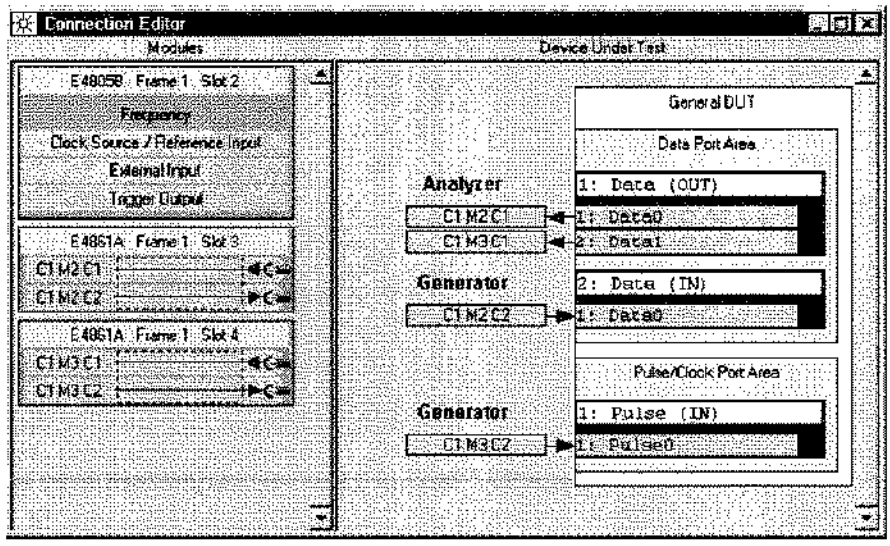


Figure 218 Connection Editor—Deskew Example Setup

3 In the Parameter Editor set the levels for all DUT input/output ports.

4 Open the Deskew Editor (see *"How to Start the Deskew Editor" on page 309*).

By default, generators are selected in the *Type* field and cable delay measurement is enabled.

If you have connected the generator outputs in the Connection Editor, then you can easily mark the generators for this measurement by clicking on *All connected*.

5 Click the *Measure* button.

The following window pops up.

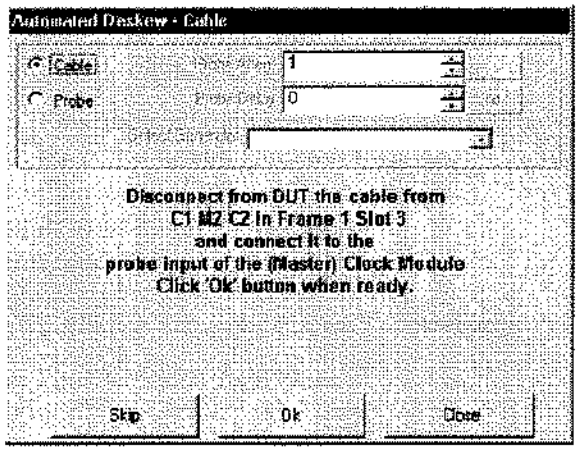


Figure 219 Deskew Editor—Cable Measurement Window for a Generator Channel

6 Follow the instructions given in this window.

The measured cable delay value is automatically entered into the table and the instruction to connect the next generator output is displayed.

7 Continue with the analyzer cables.

This is essentially the same procedure, except that you do not use the PROBE connector of the clock module, but one of the generator channels as a reference. The system proposes the first of the installed generator channels.

In our example, this is C1-M2-C2.

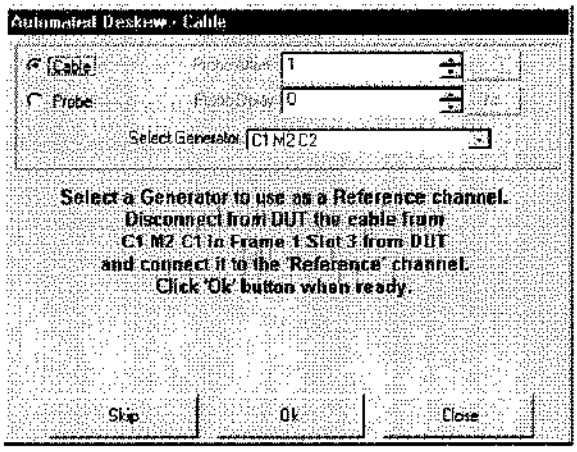


Figure 220 Deskew Editor—Cable Measurement Window for an Analyzer Channel

How to Compensate for Cable and DUT Board Delays

Performing a cable delay and propagation delay compensation assures that the edges of all generator outputs of the Agilent 81250 Parallel Bit Error Ratio Tester are applied to the DUT input pins at the same time. The procedure also assures that all output signals of the DUT are sampled at the same point of time at the DUT output pins.

Prerequisites This procedure uses the PROBE input of the master clock module.

To perform this procedure, you need all the cables which are going to be used. It is recommended to use cables of the same type and same length at all inputs and outputs. You need also an active probe, e.g. the Agilent 1144A, 800 MHz Active Probe, 10:1.

Procedure

1 To compensate for cable and propagation delays:

1 Connect the cables you will use in your application to the Agilent 81200 system's output connectors.

2 Create an image of your application in the Connection Editor. Group the signals to ports and make the connections in the scheme.

3 In the Parameter Editor set the levels for all DUT input and output ports.

4 Open the Deskew Editor (see *"How to Start the Deskew Editor" on page 309*).

Per default, generators are selected in the *Type* field and cable delay measurement is enabled.

If you have connected the generator outputs in the Connection Editor, then you can easily mark the outputs for this measurement by clicking on *All connected*.

5 Click the *Measure* button.

6 Activate *Probe*.

The following window pops up:

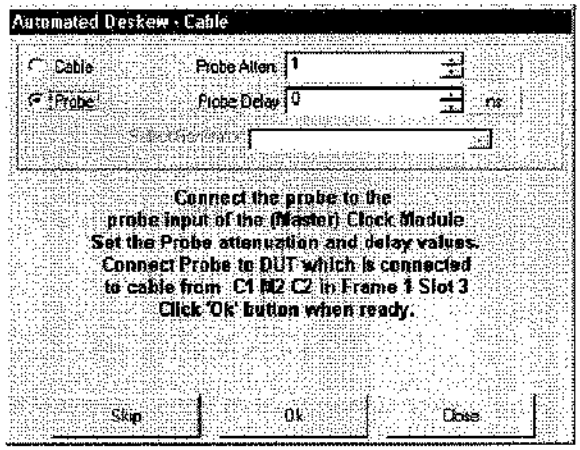


Figure 221 Deskew Editor—Probe Measurement Window for a Generator Channel

7 Enter the *Probe Attenuation* factor

For the Agilent 1144A Active Probe this is 10.

8 Enter the *Probe Delay*.

If you don't know the probe delay, you can make a first measurement by connecting the probe directly to the first generator output. Start the measurement by clicking OK. The result is the probe's propagation delay.

Close the Automated Deskew window. Click *Measure* again. Enter the resulting value as the probe delay and repeat the measurement. Now the resulting value for this output should be 0 ns.

9 Follow the instructions given in the window.

The measured delay value is automatically entered into the table, and the instruction to connect the next generator output is displayed.

10 Continue with the analyzers.

Here, you connect the analyzer inputs with one of the generator channels. This is the reference. Therefore, the generators have to be aligned first. The system proposes the first of the installed generator channels.

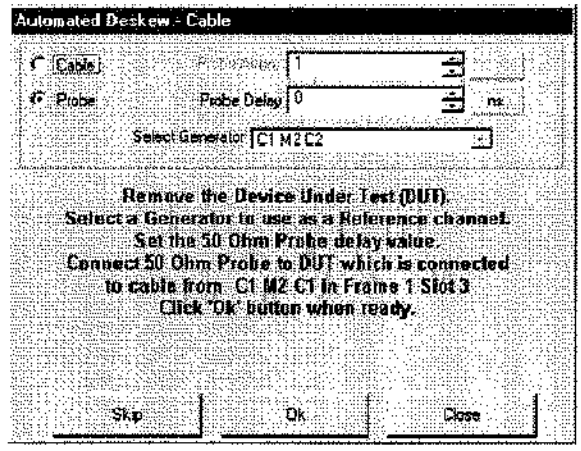


Figure 222 Deskew Editor—Probe Measurement Window for an Analyzer Channel

For analyzers, the "probes" are the 50 Ohm cables that fit to the DUT board and are going to be used for capturing the DUT output signals. The *Probe Attenuation* factor of these cables is 1. The *Probe Delay* depends on the cable length.

How to Export/Import Settings or Segments

Settings and segments can be exported as ASCII files. These files can be stored on disk or on diskette, for example.

Export/Import of a Setting

This function serves the following purposes:

- You can create an archive of settings and store it at a secure place.
- If you need one of the settings once again, you can import any of the settings from the archive.
- You can investigate the exported setting with an editor and use it as a template for programming a test.
- If you have downgraded your Agilent 81250 system or frontends have been changed, some of your stored settings may not work any more. Exported settings can be edited and re-imported to fit to the new configuration.

How to Export a Setting

1 Open the *File* menu.

2 Choose *Export Setting* (see *"Export Setting" on page 136*).

How to Import a Setting

1 Open the *File* menu.

2 Choose *Import Setting* (see *"Import Setting" on page 136*).

Contents of a Setting File

A setting file is organized in blocks of firmware commands. The blocks start with a comment line. An example is shown below:

```
// Reset
:MMEM:SETT:NEW


// Create and connect Ports and Terminals
:SGEN:PDAT1:APP "OUTPUT_PORT",2,"Databus"
:SGEN:PDAT1:TERM1:REN "Databus0"
:SGEN:CONN:PDAT1:TERM1:TO {@0102003}
:SGEN:PDAT1:TERM2:REN "Databus1"
:SGEN:CONN:PDAT1:TERM2:TO {@0102004}
:SGEN:PDAT2:APP "INPUT_PORT",1,"Input"
:SGEN:PDAT2:TERM1:REN "Input0"
:SGEN:PPUL1:APP "INPUT_PORT",1,"Clock"
:SGEN:PPUL1:TERM1:REN "Clock0"
:SGEN:CONN:PPUL1:TERM1:TO {@0105001}

// Module type: E4805A
:SGEN:GLOB:TRIG INT10;
:SGEN:GLOB:TRIG:TVOL 0.0E+0;
:SGEN:GLOB:PER 8.333333333333E-9;
:SGEN:GLOB:MUX 4;
:MCL:SOUR ON;
:SGEN:GLOB:DOFF 0.0E+0;
:SGEN:GLOB:ARM IMM;
:SGEN:GLOB:ARM:SENS PLEV;
:SGEN:GLOB:ARM:THR 2.0E-1;
:SGEN:GLOB:ARM:TVOL 0.0E+0;
:TRIG:DEL 0.0E+0;
:TRIG:MUX 1.0E+0;
:TRIG:VOLT 2.5E+0;
:TRIG:VOLT:LOW 0.0E+0;
:TRIG:TVOL 0.0E+0;
:TRIG:IMP 5.0E+1;
:TRIG:MODE CGEN;

// Term type: E4844A
:SGEN:PDAT1:TERM1:MUX 1.0E+0;
:SGEN:PDAT1:TERM1:INP:DEL 4.166667E-9;
:SGEN:PDAT1:TERM1:INP:DEL:CYCL 5.0E-1;
:SGEN:PDAT1:TERM1:INP:DEL:TIME 0.0E+0;
:SGEN:PDAT1:TERM1:INP:THR 0.0E+0;
:SGEN:PDAT1:TERM1:INP:TVOL 0.0E+0;
:SGEN:PDAT1:TERM1:INP:IMP 5.0E+1;
:SGEN:PDAT1:TERM1:INP:SER 0.0E+0;
:SGEN:PDAT1:TERM1:INP ON;
```

Export/Import of Segments

This function serves the following purposes:

- You can create an archive of segments and store it at a secure place.
- You can create segments with an editor and import them.
- Available data patterns can easily be inserted into the test sequence.
- Exported segments can be edited and re-imported.

How to Export Segments

1 Open the *File* menu.

2 Choose *Export Segments* (see *"Export Segments" on page 136*).

How to Import Segments

1 Open the *File* menu.

2 Choose *Import Segments* (see *"Import Segments" on page 136*).

Contents of a Segment File

A segment file can hold several segments. Each segment has a general structure as shown in the example below:

```
:vectorVariablesDefinitions:
{
   :paraPatternVar:

   {
      :name: Input1
      :statePar: {  {A "01"}  }
      :stateSet: A
      :vectorWidth: 1
      :vectors:
         {
      1
      0
      1
      0
      1
      0
      1
      1
      1
      0
      1
```

```
    0
        }
        :parameters:
        {
            { _Type (MEMORY) }
        }
    }
}
```

How to Execute Firmware Commands

The Command Line Editor allows control of an instrument through the command string interface. This window is intended as a test editor to test individual commands for a remote program.

How to Start the Command Line Editor

To start the Command Line Editor:

1 Open the *Go* menu.

2 Choose *Command Line.*

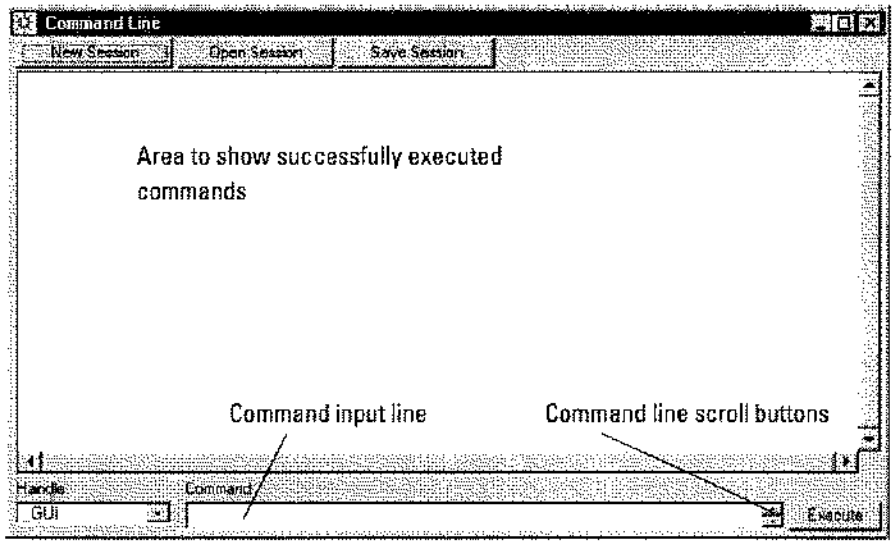


Figure 223 Command Line Editor

The Command Line window is divided into two areas:

- Display area, occupies the upper part of the window.
- Command entry area, occupies the lower part of the window.

Commands can be entered in the command input line. Successful commands and their results are displayed in the display area.

How to Use the Command Line Editor

The commands you enter are transmitted to and executed by the system to which the current user interface is connected (see also *"How to Configure the User Interface" on page 121*).

All commands available for the Agilent 81250 system can be entered. For details see the *Agilent 81250 SCPI Programming Reference*. Note that the first colon is automatically provided and must not be entered.

Once you have entered a command in the command entry area, click the *Execute* button. This downloads the command to the firmware where it is executed.

Commands which have been successfully executed are moved up to the display area.

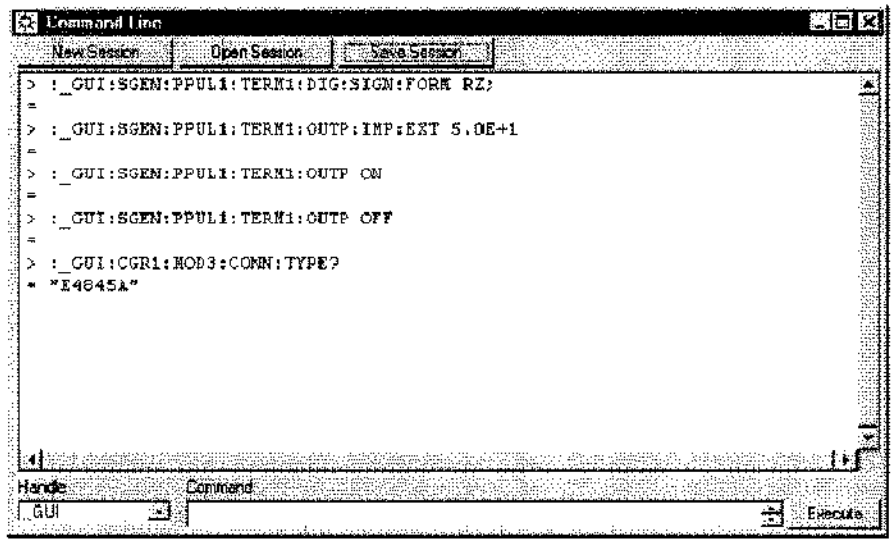


Figure 224 Command Line Editor – Executed Commands

Copy and Paste in the Command Line Editor

Selected text can be cut, copied or pasted from and to the command entry area. The Command Line Editor provides a context menu that supports these operations, and the editor reacts on common keyboard shortcuts (Ctrl+c, Ctrl+x, Ctrl+v). It uses the Windows Clipboard.

You can copy and paste parts of a command or a whole command line. Commands can thus be taken from the display area and entered in the command entry area.

The two arrow buttons at the right-hand side of the command entry line as well as the cursor up/down keys can be used for scrolling through the list of previously successful commands.

TIP You can also paste commands that have been copied to the clipboard from external program files, such as an exported setting file. This works in both directions and enables you also to create program files with any program editor that allows copy and paste.

Buttons of the Command Line Editor

The Command Line Editor provides the following buttons:

- *New Session*: Clears the display area.

  You can start to create a new sequence of commands to be combined in a new session.

- *Save Session*: Saves the commands shown in the display area in a file on disk.

  The files are saved as command session (*.dcs) files in the c:\hp81200\dsr\bin directory.

- *Open Session*: Used to open a previously saved session and execute it immediately.

Select from the list of available command session files.

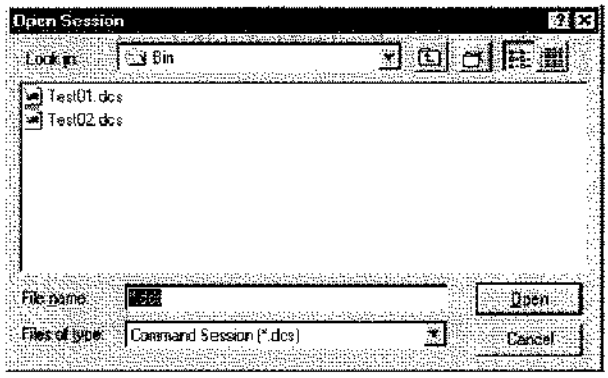


Figure 225 Command Line Editor – Selection of Saved Sessions

How to Use the SFI5 Frame Generator

SFI-5 (SERDES Framer Interface 5) describes the communication between the Framer, FEC, and serializer/deserializer (SERDES) used for data transmission (e.g. SONET, VSR-768).

The SFI5 Frame Generator generates data that is formatted according to SFI-5 standards.

The figure below shows the functional block diagram of the SERDES Framer Interface.

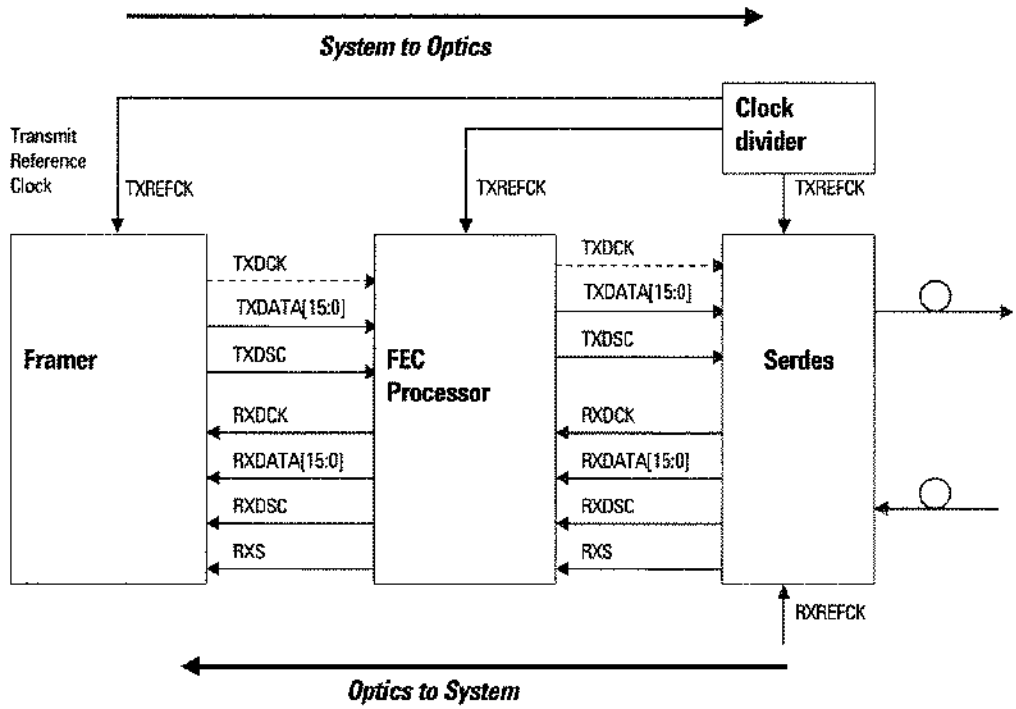


Figure 226 SFI-5 System Reference Model

The interesting fact is, that a 16:1/1:16 multiplexing/demultiplexing architecture is specified, so that the SFI-5 (OC-768) deals with 2.488 Gbit/s to 3.125 Gbit/s.

Some Characteristics of SFI-5

For SFI-5, the receiving devices must have a variable delay capability to deskew the 16 data channels. And the transmitting devices must supply an additional data channel (the 17th channel). This channel enables the receiving devices to find the proper timing for the data channels.

The respective clock and data signals are frequency-locked but the static phase offset is unspecified.

The maximum skew between the 16 data channels may be up to 4.25 unit intervals at the receiving end.

To allow the receiving circuits to properly adjust each data line, they need some reference or expected data of each data line, against which they can compare the incoming data on the 16 data lines. These 16 sets of expected data are provided by the 17th data channel in a round-robin fashion.

Each set contains eight sample bytes of each data line starting with data line 15. To mark the start of each 16 sets of samples, eight framing bytes are transmitted first, consisting of 4 framing bytes and 4 bytes of expansion header.

The framing bytes transmitted are two $F6_{hex}$ (1111 0110) and two 28_{hex} (0010 1000) bytes. The not yet defined expansion header bits are all AA_{hex} (1010 1010).

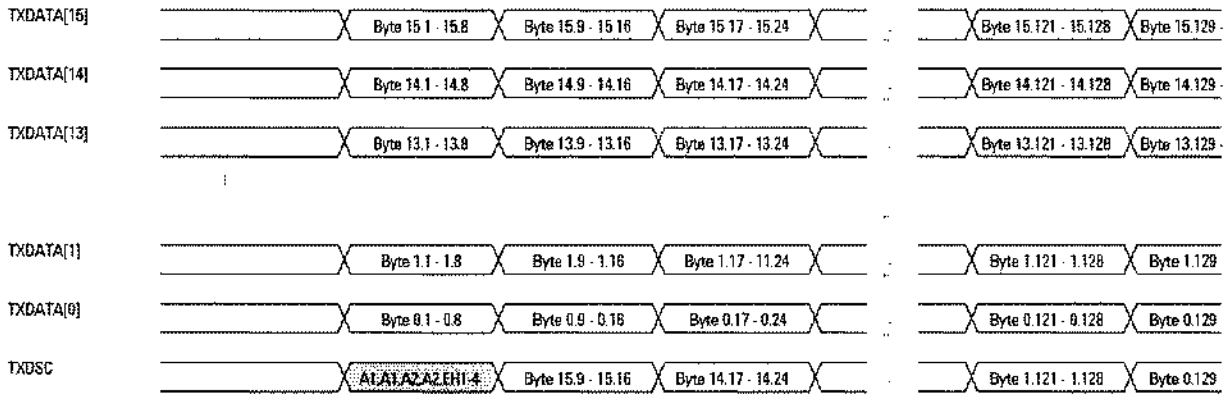


Figure 227 Signal on the TXDSC Channel

This framing/header signal is repeated after every 17 x 8 x 8 = 1088 bits.

Using the SFI5 Frame Generator

The SFI5 Frame Generator allows to create memory segments that can be imported into ParBERT.

After inserting such a segment into the test sequence, the ParBERT 2.7 Gbit/s generator frontends generate the data for the 16 data terminals and the appropriate data for 17th TXDSC channel.

A connected SFI-5-compatible multiplexer device receives the resulting 40 G serial signal as a true PRBS of exactly the same polynomial as chosen in the SFI5 Frame Generator. The SFI5 Frame Generator does not generate the clock signal.

To generate a segment with SFI-5-formatted data:

1 Start the SFI5 Frame Generator from the *Utilities* panel.

Figure 228 Utilities Panel

The following window appears:

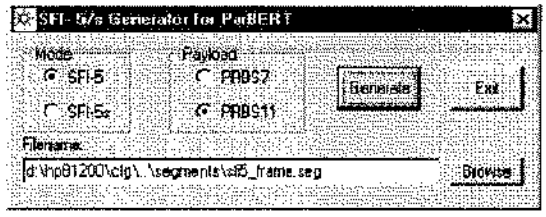


Figure 229 SFI5 Frame Generator Window

2 Choose the target application.

SFI-5s is no longer part of the standard but still supported.

3 Choose the PRBS polynomial to be generated.

4 Check or change the location and file name of the segment to be created.

5 Click Generate.

It is recommended to create both available data patterns for the target application. Once they have been created, there is no need to use the SFI5 Frame Generator any more.

6 Import the segment into the local or global segment pool (see *"How to Import Segments" on page 319*).

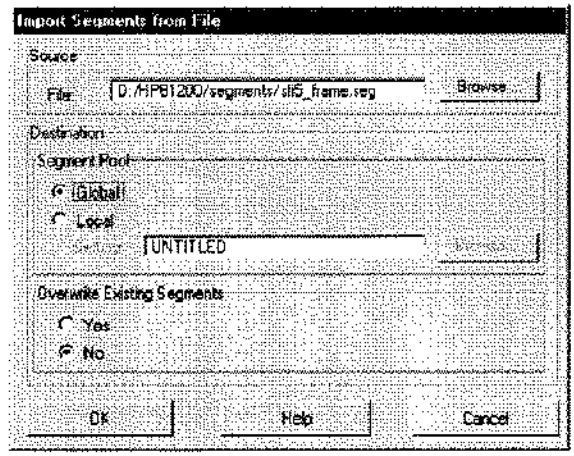


Figure 230 Segment Import Dialog

The segment has 17 traces and can be inspected with the Segment Editor.

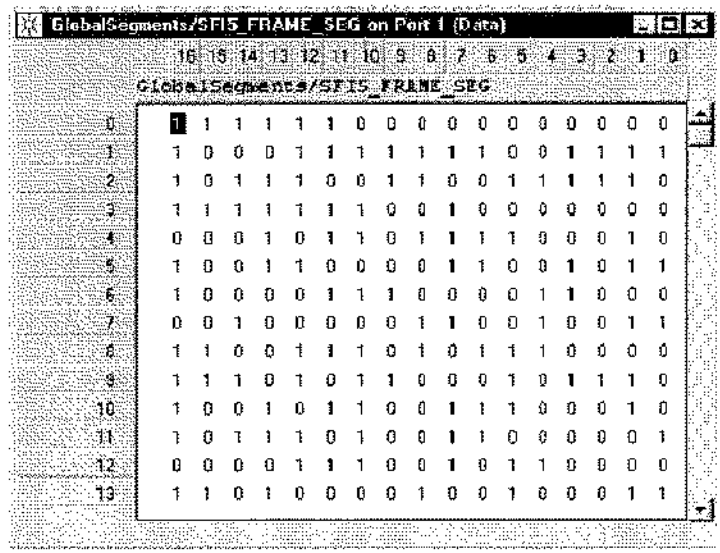


Figure 231 Segment Editor View

The leftmost trace contains the deskew data.

Setting Up the ParBERT 43G for SFI-5 Tests

Due to the required 17th channel, SFI-5 tests cannot be performed with the standard ParBERT 43G bundles.

A hardware setup for testing both sides of the SERDES–Framer communication may look as shown in the following figure:

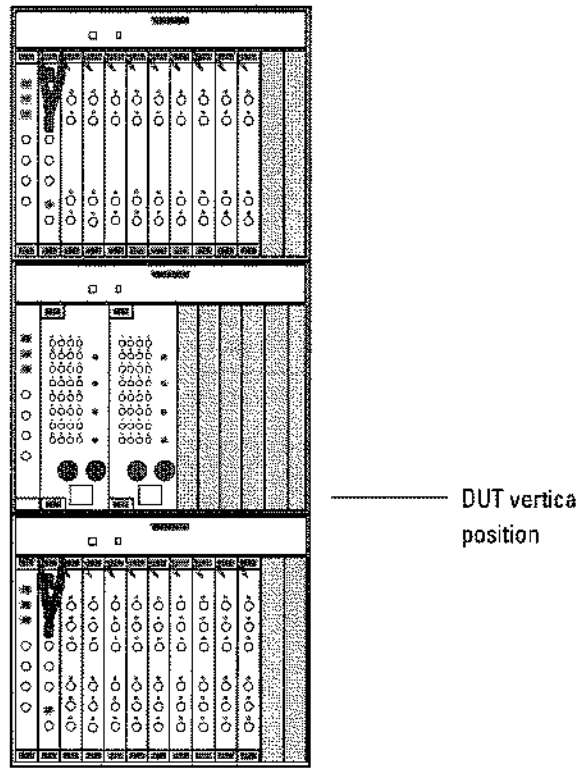


Figure 232 Setup for Testing both SFI-5 Multiplexers and Demultiplexers

In the Connection Editor, we have set up a 17 channel wide port containing the 16 data terminals and the deskew channel RXDSC.

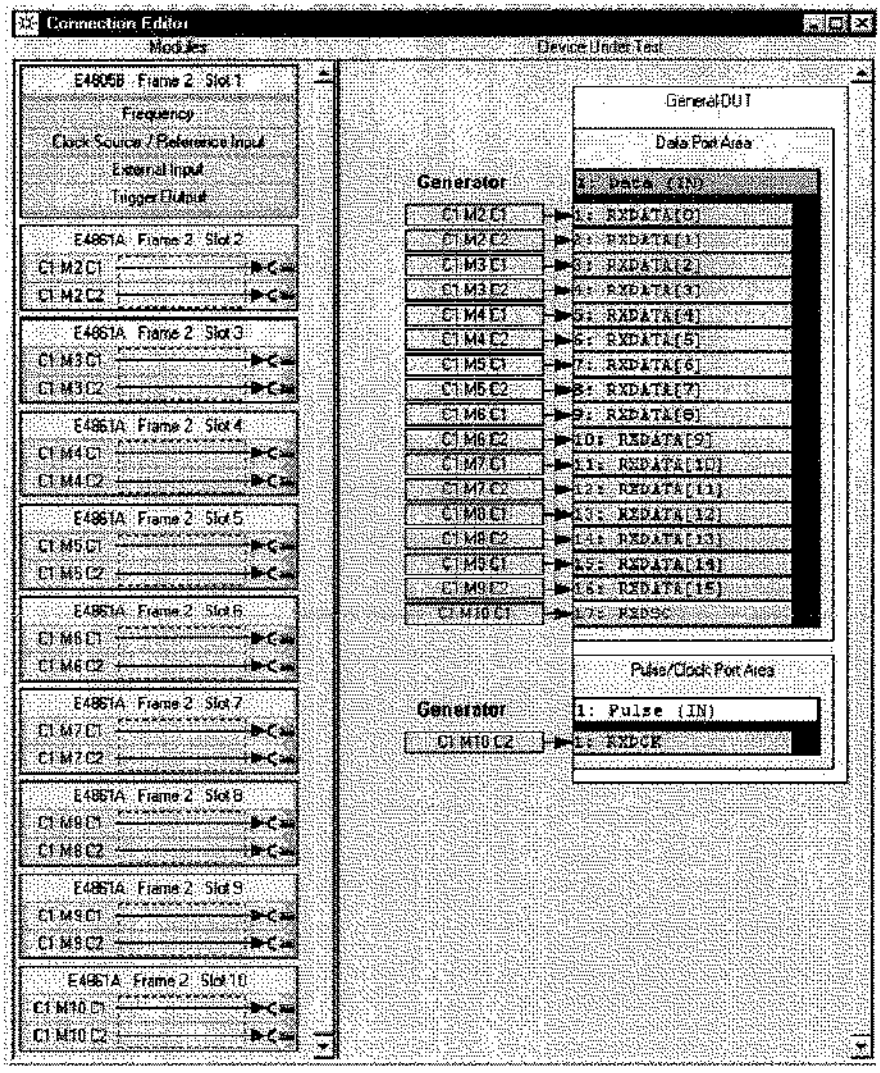


Figure 233 Data Port Connections for Sourcing SFI-5 data

There is a second port that receives the clock signal. We have chosen an extra port, because then it is simple to apply a different frequency (1/4th of the system clock).

Once you have made the connections:

1 Set the system clock frequency.

2 Correct the port timing and signal levels.

3 Create the test sequence.

Appendix A: How Do I ... ?

This section provides answers to frequently asked questions.

It can well happen that you have a certain problem and just don't know how to solve it quickly and efficiently with the Agilent 81250 Parallel Bit Error Ratio Tester. It is this kind of problems which is addressed in this chapter.

The chapter covers the following topics:

How Can I Generate a Clock Signal With a Data Module?

The data generator/analyzer module must be equipped with one of the generator frontends:

- E4838A, 675 MHz, differential output, low voltage amplitude/offset and variable slopes generator,
- E4843A, 675 MHz, NRZ/RZ, differential output frontend,
- E4862A, 2.6 Gbit/s, differential NRZ output frontend,
- E4864A, 1.3 Gbit/s, differential NRZ output frontend.

Alternatively, you can also use the E4866A 10.8 Gbit/s data generator module.

Using the Pulse Port

The most comfortable way to apply a clock signal to the DUT is:

1 Use the Connection Editor and create a **pulse port**.

2 Connect the pulse terminal to the generator connector you wish to use.

3 Use the Parameter Editor to adjust the channel properties, such as frequency, pulse width, delay, voltage levels, expected load, and so on. Keep the default RZ (Return to Zero) data format. Switch the generator output on.

Using a Data Input Port

On the other hand, you can also apply a clock signal to one or several terminals of a **data port**. This is useful if you need to generate a burst of clock pulses. In this case, the clock frequency is identical with the port frequency and applies to all terminals.

1 Create the sequence and insert the segments.

2 Use the Segment Editor (easily invoked from the Sequence Editor or Data/Sequence Editor) to set the data bits of the desired trace(s) to "1".

3 Use the Parameter Editor for the respective channel(s) and select "RZ" (Return to Zero) as the format.

NOTE The RZ data format is not supported by frontends with data rates greater than 675 Mbit/s. For these frontends, you would have to create a 1 0 1 0 1 0 1 0 1 0 ... segment.

In RZ format every logical 1 creates an electrical pulse, as illustrated in the figure below:

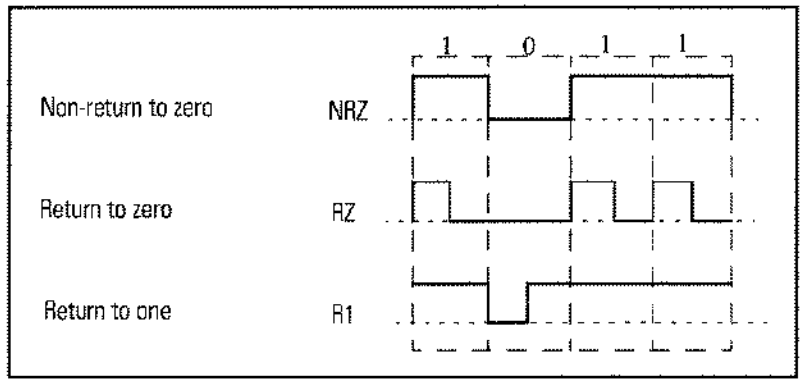


Figure 234 Signal Formats

4 If necessary, adjust the channel properties, such as pulse width, delay, voltage levels, termination resistors, and so on. Switch the generator output on.

NOTE This procedure covers one block of the overall test sequence. If the clock signal shall be output during execution of another block, the steps 2 and 3 have to be repeated for that block.

How Do I Use Events?

The built-in features for detecting events and reacting upon events provide many capabilities. This section shows and explains some examples.

How Do I Select Between Two Different Tests?

With this setup you can switch very fast between two different test sequences using the command control feature. With the trigger pod and external hardware even more blocks could be selected.

1 Define the deferred events CMD0 and CMD1.

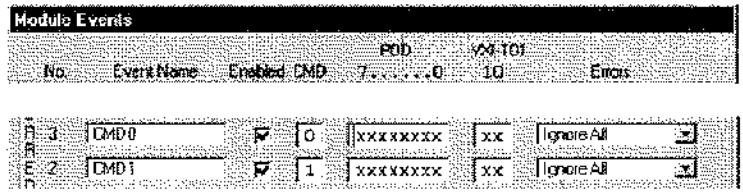
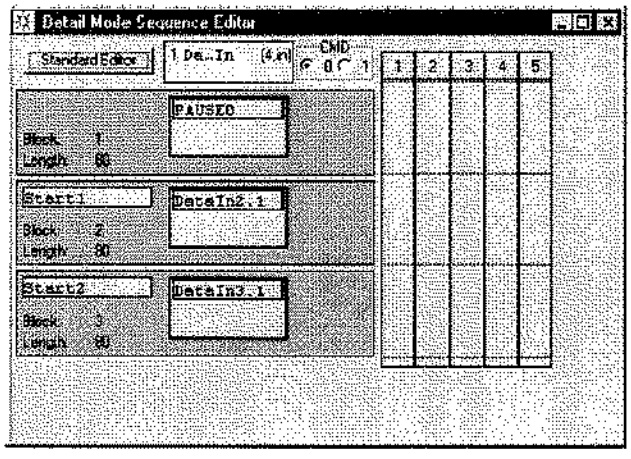


Figure 235 Definition of 2 Command Events

2 Create the sequence and fill in the branch tables of the blocks.



If	Go to	Trig.	VXI-T01
CMD0	Start1	0	00
CMD1	Start2	0	00

CMD0	END	0	00
CMD1	END	0	00

Figure 236 Sequence and Branch Tables for Selecting One of Two Tests

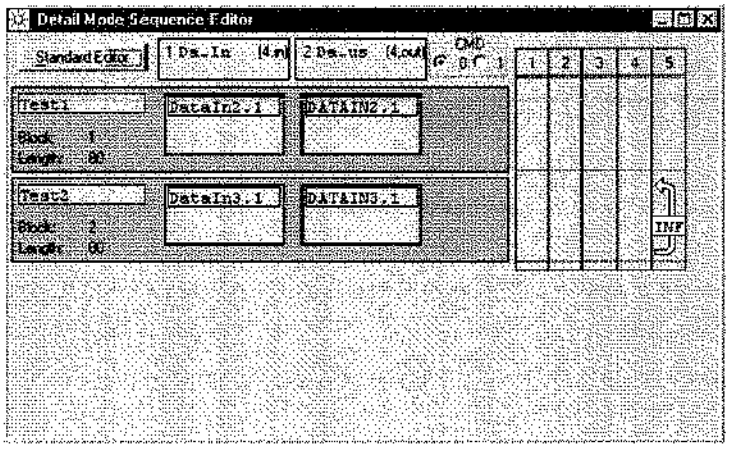
How Do I Set a Trigger on Error?

We simply want to issue a trigger signal out of the TRIGGER OUTPUT whenever an error is detected somewhere in the system. Note that we use an immediate event here.

1 Define the immediate error event.

Figure 237 Definition of an Immediate Error Event

2 Create the sequence and fill in the branch tables.



If	Go to	Trig.	VXI-T01
Error		1	00
Error		1	00

Figure 238 Sequence and Branch Tables for Triggering on Error

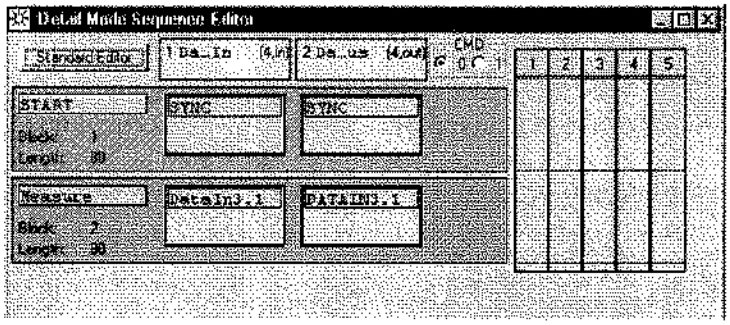
How Do I Allow the DUT to Stabilize?

Here we wait until we have no error condition for a certain time (determined by the block length).

1 Define a deferred error event.

Figure 239 Definition of a Deferred Error Event

2 Create the sequence and fill in the branch table of the START block.



If	Go to	Trig.	VXI-T01
Error	START	0	00

Figure 240 Sequence and Branch Table for a Test With Warm-Up

How Can I Return Pass/Fail Information to another Test System?

In this bolt-on example our instrument is integrated into a large IC test system. We shall run a measurement that is selected via the trigger input pod.

The result is a pass/fail signal that is returned to and examined by the large IC tester.

A generator frontend will be used to generate the pass/fail signal. The output of this generator (low or high) is defined by two memory segments. One of these segments contains only zeros, the other only ones.

In order to use the generator, we have specified a one-terminal data input port. This port does actually not belong to the DUT, because the generator's output is physically connected to a sense-pin of the IC test system.

1 Define four events.

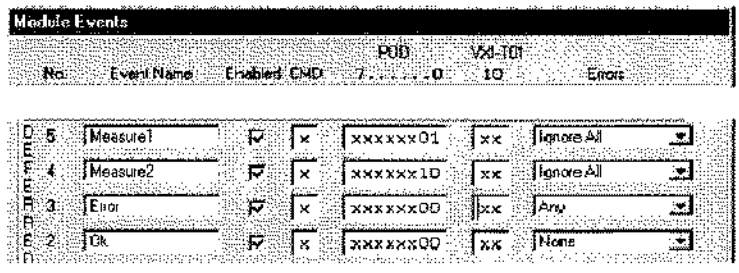
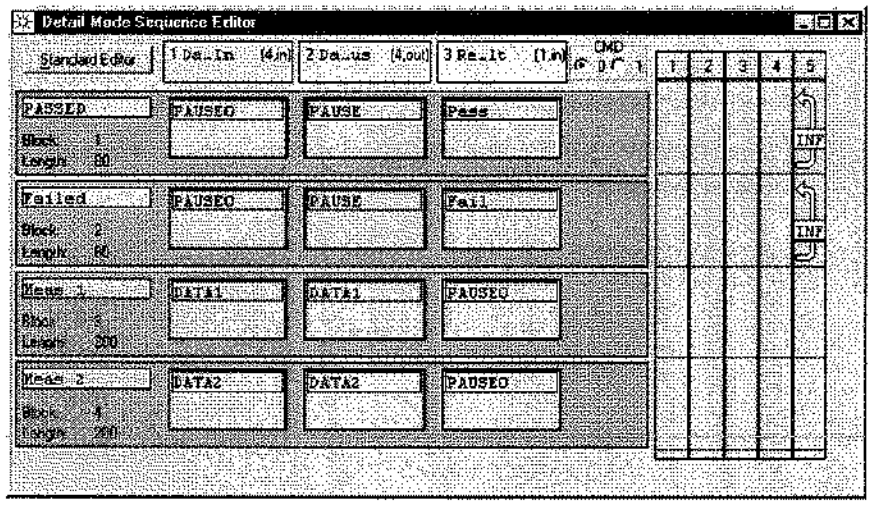


Figure 241 Definition of Pod and Error Events

2 Create the sequence and fill in the branch tables.

Remember that we use a one-terminal data input (= generator output) port and two segments to generate and return the pass/fail signal. The segments are called PASS and FAIL.



If	Go to
Measure1	Meas_1
Measure2	Meas_2

Measure1	Meas_1
Measure2	Meas_2

Error	Failed
Ok	PASSED

Error	Failed
Ok	PASSED

Figure 242 Sequence and Branch Tables

Remarks The MEAS_1 and MEAS_2 blocks need to be longer than the actual measurement so that all analyzer pipelines are toggled through and the events are completely processed.

The event definitions shown above require that the trigger pod inputs are driven with positive pulses to select the measurement blocks. During the measurement the pod input lines must be zero. Otherwise no errors are detected. This should not be a problem because due to the internal pipelining it takes already a couple of sequencer clock periods until the first error can be detected (see also *"What You Need to Consider Before Using Events" on page 249*).

The events that cause the jump to the different measurement blocks can be deferred or immediate. The Ok and Error events, however, must be deferred, and the Error event must have a higher priority than the Ok event.

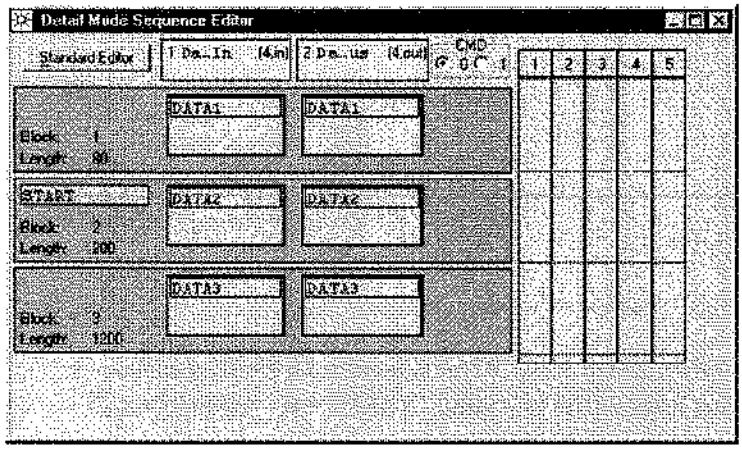
If you want to save events, the Ok event could be replaced by the DEFAULT event.

How Can I Execute Different Tests Embedded in One Sequence?

Starting at a certain block label is fairly simple—the CMD 0/1 command, the VXI trigger lines, or the trigger pod can be used to switch between several start blocks.

The following example shows how the sequence can be terminated after executing a certain block.

We use the DEFAULT event which needs not be defined. It occurs automatically at the end of the block.



If	Go to	Trig.	VXI-T01
DEFAULT	END	0	00
DEFAULT	END	0	00
DEFAULT	END	0	00

Figure 243 Sequence and Branch Tables

In this example just block 2 is executed. By moving the START label, any other block can be executed.

How Can I Change all Traces of a Port to Don't Care?

The simplest way to ignore incoming data is to use a Pause segment.

However, don't care setting is available for data output (= analyzer input) ports.

The following procedure can be used if the measurement mode is set to Compare and Capture or to Compare and Acquire around Error.

Use the Detail Mode Sequence Editor or the Data/Sequence Editor.

To replace the present segment by a Don't Care pseudo segment:

1 Open the segment's context menu.

2 Click *Don't Care*.

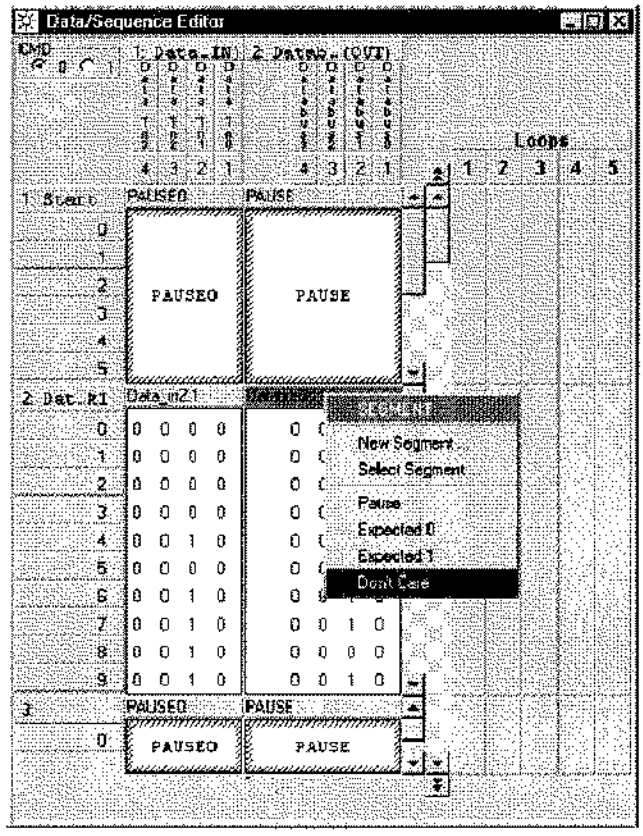


Figure 244 Segment Context Menu

To change individual or all traces:

1 Right-click the segment's edit area.

This opens the Segment Editor context menu.

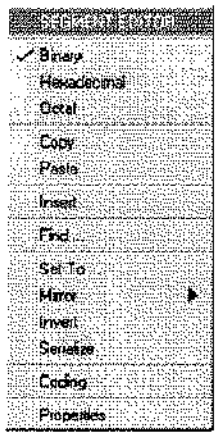


Figure 245 Segment Editor Context Menu

2 Click *Coding* or *Properties* and ensure that the state coding is set to 0x1. Only 0x1-segments can have don't care settings.

3 Highlight the traces or vectors you wish to change.

4 Open the Segment Editor context menu once more and click *Set To*.

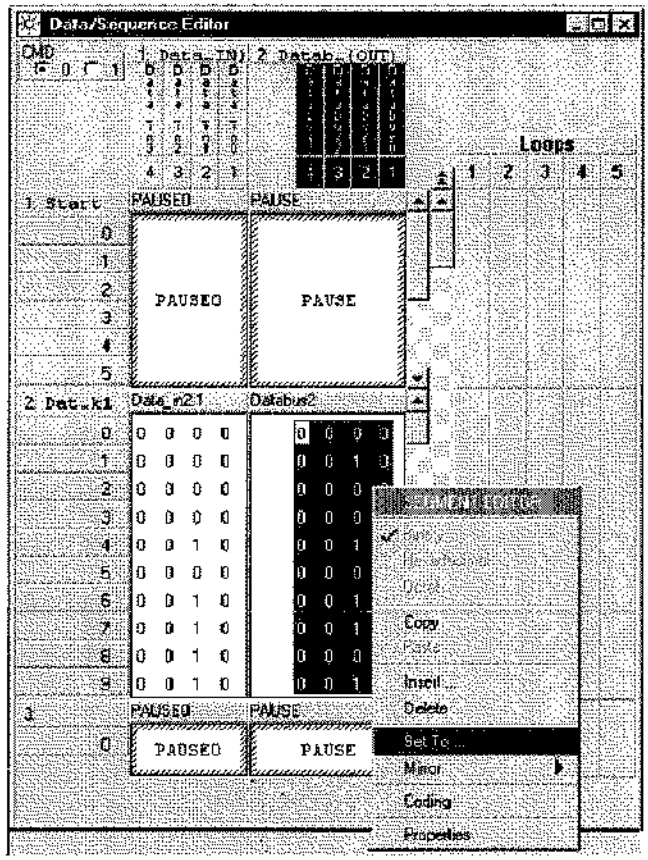


Figure 246 Segment Editor Context Menu after Highlighting Data

5 Choose *x* from the pull down menu.

How Do I Set Up a Multiplexer BER Test?

The bit error rate (BER) of a multiplexer can be measured by sourcing a PRWS (pseudo random word stream) segment to the DUT and comparing the serial output with a PRBS (pseudo random bit stream) segment of the same order.

The connections could be made as shown below:

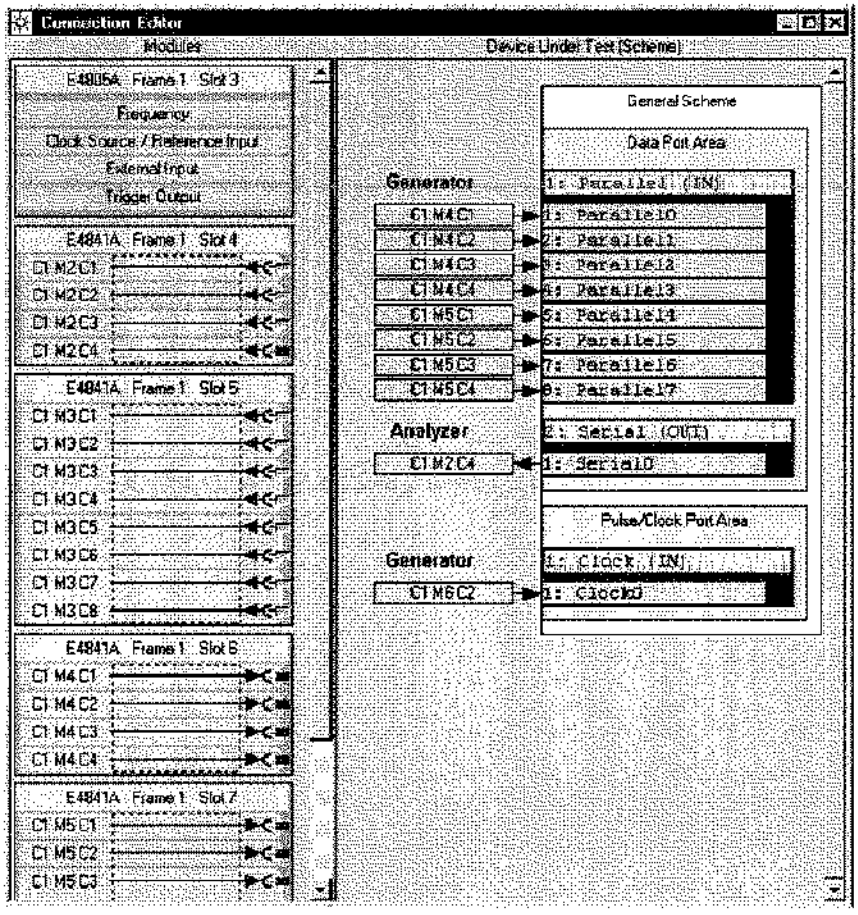


Figure 247 Connections for a Multiplexer Test

1 Create a PRWS segment to be used for the DUT input port.

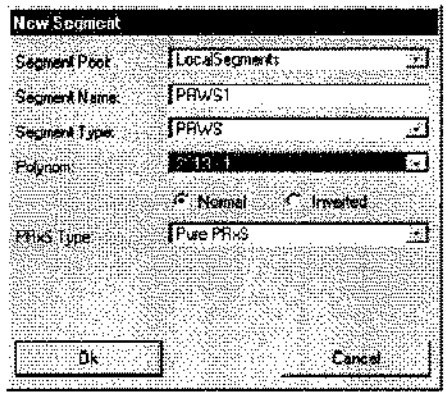


Figure 248 Segment Editor Window

2 Create a PRBS segment of the same order (the same polynomial) to be used for the DUT output port.

3 Use the Sequence Editor and insert the segments into the sequence.

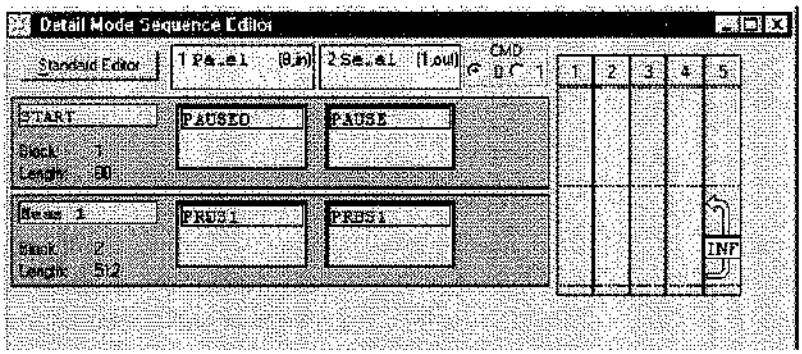


Figure 249 MUX Test Sequence

The correspondence between the generated PRWS and the expected PRBS is as follows:

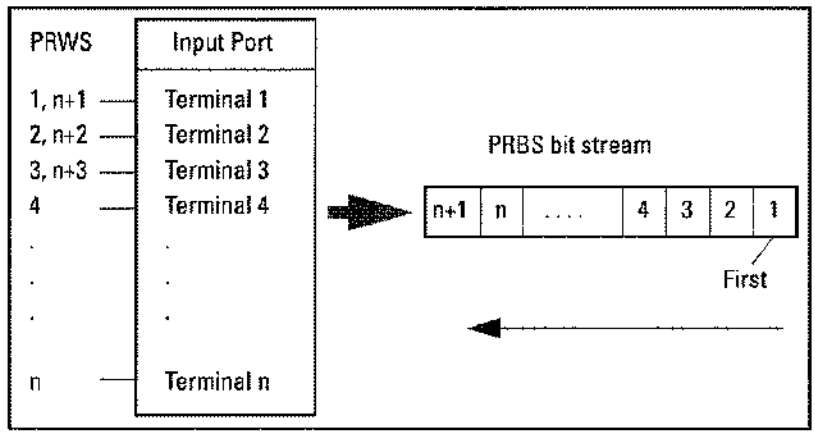


Figure 250 Correspondence Between Random Words and Random Bit Stream

The bits of the PRWS are assigned to the generator channels from top to bottom, as displayed by the Connection Editor.

The PRBS contains the same logical bit sequence just one-directional.

The same principle—only inverted—applies if you are testing a demultiplexer.

NOTE Note that the assignment of bits to generator channels is different, if you apply the PRWS to channels which have been digitally added.

In this case, the system assumes that the word length n is equal to the total number of channels involved. It assigns the first m bits to the connected channels and the remaining n–m bits to the added, unconnected channels.

Example If you had an input port with five terminals and the first two terminals were connected to two added channels, then terminal 1 would receive the XOR of bits 1 and 6 and terminal 2 the XOR of bits 2 and 7, as illustrated below:

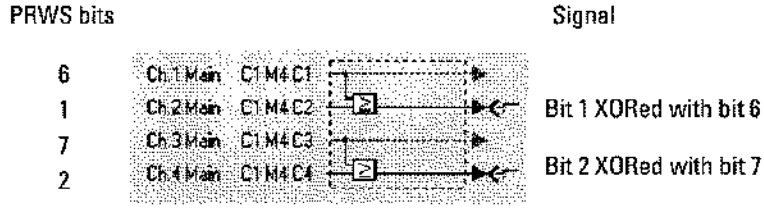


Figure 251 Bit Assignment to Digitally Added Channels

How Do I Use Automatic Sampling Point Adjustment?

The functions Automatic Bit Synchronization and Automatic Delay Alignment can be used to adjust the sampling point of the analyzers of an Agilent 81250 system that sources data to and simultaneously captures data from the DUT.

However, these functions can also be used for synchronizing two separate systems. Separate systems with individual clocks are required if, for example, multiplexers/demultiplexers are to be tested which have a mux-factor other than 2^n.

This section gives some examples of setups and procedures.

How Can I Synchronize a MUX Test With Two Systems?

The functions for automatic analyzer sampling point adjustment require that certain conditions are met.

Requirements for MUX tests with two systems:

Automatic Delay Alignment	Delay window is known and can be specified.
Automatic Bit Synchronization	PRxS data may be sent and expected. If memory-type data is used, then the first 48 bits must be unmistakable.

Using Automatic Delay Alignment

Setup The analyzer system is in the external clock mode and starts with an external trigger:

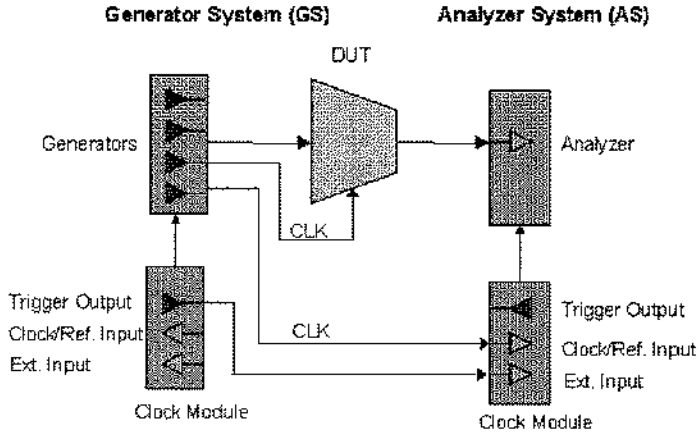


Figure 252 MUX Test Setup With Automatic Delay Alignment

Characteristics

- GS to AS frequency ratio flexible (using the clock module's clock input multiplier/divider).
- All kinds of patterns can be used.
- Delay window must be known (±10ns E4861A, ±50ns E4832A).
- Analyzer start delay can be set to roughly place delay window.
- Returns the absolute delay in the Parameter Editor window.

Procedure

1 Connect the DUT in the Connection window.

2 Set the appropriate levels.

3 Set up the data to be sent and expected.

The data of the first block should not be PRBS. If PRBS is required, set the block length to $(2^n-1) \times$ Segment Resolution to ensure GS and AS PRBS phases match.

4 Enable the Auto Delay Alignment.

The sequence flow is illustrated below.

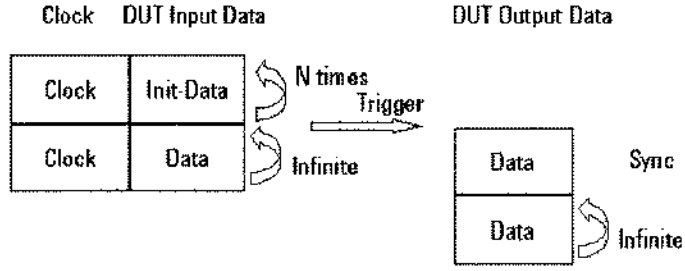


Figure 253 Sequence Flow for Automatic Delay Alignment

5 Set the repetition counter of the start block to a number (N) that suffices to allow the PLL of the analyzer to lock on the generator clock (see specifications).

6 Set the analyzer system to external start. Start the analyzer system. It now waits for the trigger.

7 Start the generator system.

The generator sends data and clock to the DUT and an additional clock to the analyzer. After N repetitions of the start block, the generator issues the start trigger and begins an infinite loop.

In the meantime, the analyzer's PLL had time to get locked to the external reference clock. When the trigger arrives, the analyzer becomes active. It waits for the specified start delay and then begins sampling the incoming data. The Automatic Delay Alignment assures that the incoming data is sampled at the optimum point of time.

Now the analyzer enters the second block and performs the measurement.

Using Automatic Bit Synchronization With PRBS Data

Setup A multiplexer test with two systems can be set up as shown below:

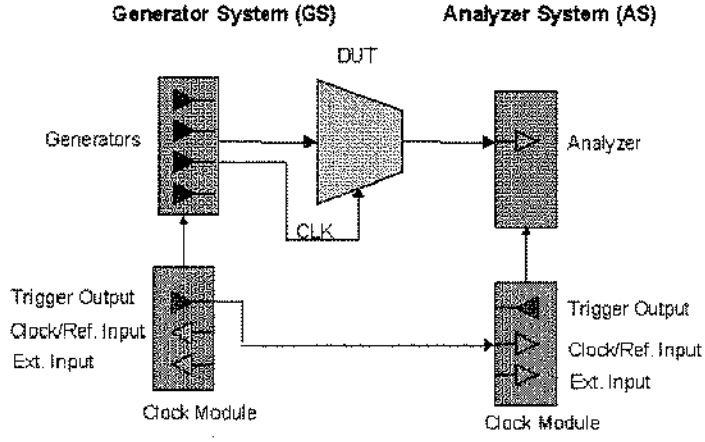


Figure 254 **MUX Test Setup With Automatic Bit Synchronization**

One system is used to source clock and data to the multiplexer and an additional clock to the analyzer. The other system is used for data analysis.

Characteristics

- GS to AS frequency ratio flexible (using the clock module's clock input multiplier/divider).
- No delay window must be known.
- No special initialization block is required.
- No special block length restrictions.
- No absolute delay known afterwards (uncertainty of n periods).
- The timing between analyzers can be compared for calculating skews.
- Usually faster than Automatic Delay Alignment

Procedure

1. Connect the DUT in the Connection window.
2. Set the appropriate levels.
3. Use the Standard Mode Sequence Editor to set up the data to be sent and expected.
4. Start the generator.
5. Wait until the PLL of the DUT has stabilized.
6. Start the analyzer system.

Using Automatic Bit Synchronization With Memory Data

Setup This is the same setup as in the previous example.

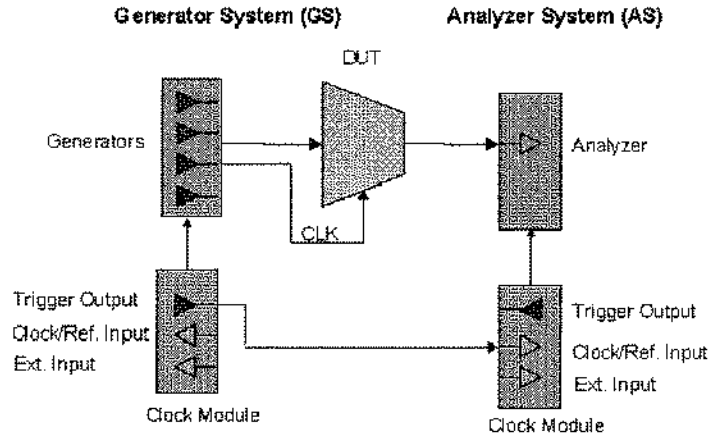


Figure 255 **MUX Test Setup With Automatic Bit Synchronization**

Characteristics Auto Bit Sync with memory data requires some attention:

- Non-pure PRBS are memory segments with a block length of $(2^n-1) \times$ segment resolution.
- The first 48 bits of each segment trace must be unique.
- No absolute timing information available after synchronization.
- Can only be performed on an independent analyzer system.
- Requires a minimum block length 32 × segment resolution × frequency multiplier.
- All detect words of all channels must be found within ±5 × segment resolution.

Procedure

1. Connect the DUT in the Connection Editor.
2. Set the appropriate levels.
3. Use the Detail Mode Sequence Editor to set up the data to be sent and expected. Take care of the block length.
4. Use the Trigger Pod, if you wish to react on external events.
5. Start the generator.
6. Wait until the PLL of the DUT has stabilized.
7. Start the analyzer system.

How Can I Synchronize a DEMUX Test With Two Systems?

The functions for automatic analyzer sampling point adjustment require that certain conditions are met.

Requirements for DEMUX tests with two systems:

Automatic Delay Alignment	Delay window is known and can be specified. Word phase delay is known.
Automatic Bit Synchronization	PRxS data may be sent and expected. If this is not pure PRxS, the word phase delay must be known. If memory-type data is used, then: • the first 48 bits must be unmistakable • the word phase delay must be known.

Using Automatic Delay Alignment

Setup The analyzer system is in the external clock mode and starts with an external trigger:

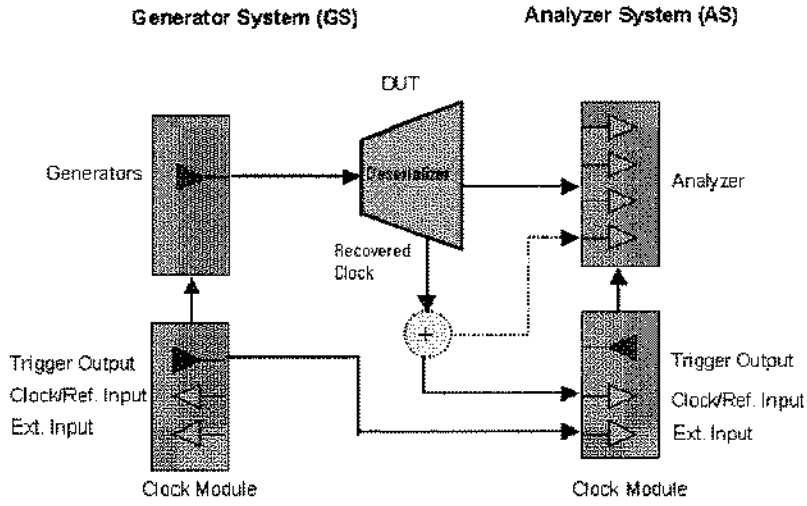


Figure 256 DEMUX Test Setup With Automatic Delay Alignment

Characteristics
- GS to AS frequency ratio flexible (using the clock module's clock input multiplier/divider).
- All kinds of patterns can be used.

- Delay window must be known (±10ns E4861A, ±50ns E4832A)
- Analyzer start delay can be set to roughly place delay window.
- Returns the absolute delay in the Parameter Editor window.

Procedure

1. Connect the DUT in the Connection window.
2. Set the appropriate levels.
3. Set up the data to be sent and expected.

   The data of the first block should not be PRBS. If PRBS is required, set the block length to $(2^n\text{-}1) \times$ Segment Resolution to ensure GS and AS PRBS phases match.
4. Enable the Auto Delay Alignment.

   The sequence flow is illustrated below.

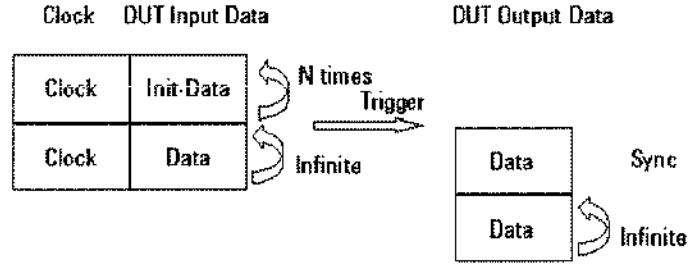


Figure 257 Sequence Flow for Automatic Delay Alignment

5. Set the repetition counter of the start block to a number (N) that suffices to allow the PLL of the analyzer to lock on the generator clock (see specifications).
6. Set the analyzer system to external start. Start the analyzer system. It now waits for the trigger.
7. Start the generator system.

The generator sends data and clock to the DUT and an additional clock to the analyzer.

The synchronization block is repeated until the DUT's and the analyzer's PLLs have stabilized.

Using Automatic Bit Synchronization With PRBS Data

Setup A demultiplexer test with two systems can be set up as shown below:

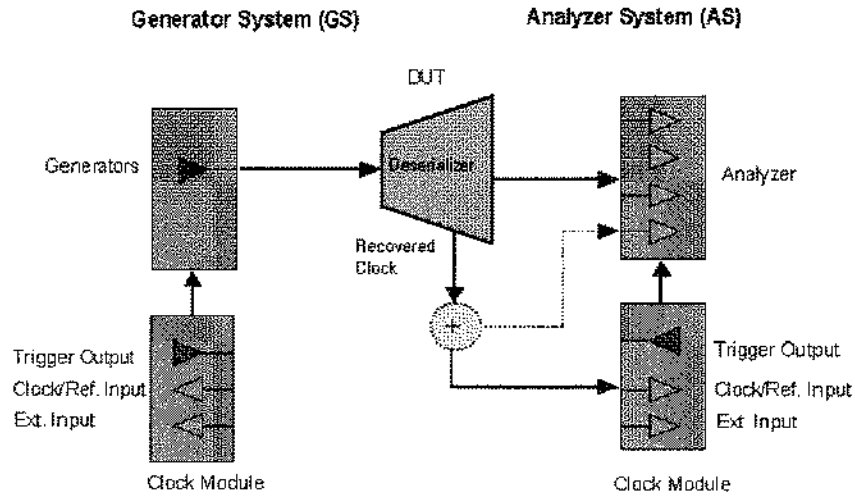


Figure 258 DEMUX Test Setup With Automatic Bit Synchronization

One system is used for data generation. The other system is used for data analysis.

The analyzer runs in "external clock" mode. The demultiplexer provides this clock. The frequency of the external clock has to be programmed or measured by the analyzer system to enable the system to establish the correct sample point delays.

If one wishes to obtain the timing of his measurements relative to the clock of his DUT, then he has to feed the clock of the demultiplexer via a power splitter into the clock module and an additional analyzer channel.

Characteristics

- No delay window must be known.
- No special initialization block is required.
- No special block length restrictions.
- No absolute delay known afterwards (uncertainty of n periods).
- The timing between analyzers can be compared for calculating skews.
- Usually faster than Automatic Delay Alignment

Procedure

1. Connect the DUT in the Connection window.
2. Set the appropriate levels.
3. Use the Standard Mode Sequence Editor to set up the data to be sent and expected.

4 Start the generator.

5 Wait until the PLL of the DUT has stabilized.

6 Start the analyzer system.

Using Automatic Bit Synchronization With Memory Data

Setup This is the same setup as in the previous example.

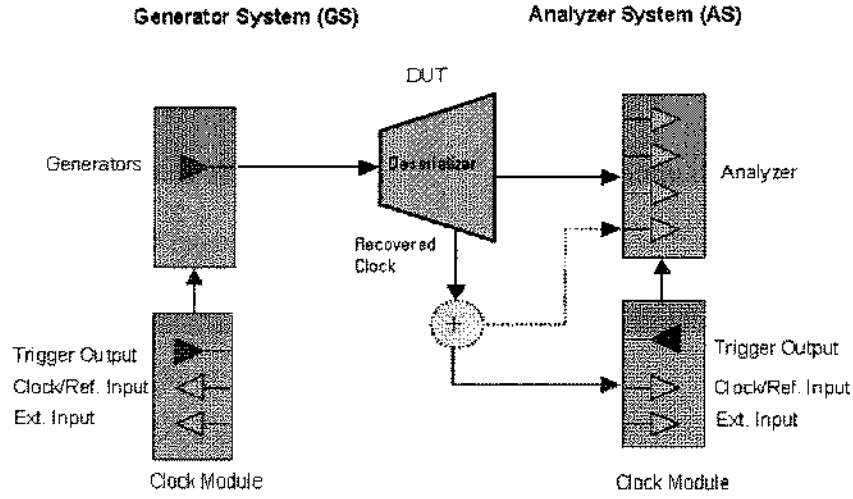


Figure 259 DEMUX Test Setup With Automatic Bit Synchronization

Characteristics Auto Bit Sync with memory data requires some attention:

- Non-pure PRBS are memory segments with a block length of $(2^n\text{-}1) \times$ segment resolution.
- The first 48 bits of each segment trace must be unique.
- No absolute timing information available after synchronization.
- Can only be performed on an independent analyzer system.
- Requires a minimum block length 32 × segment resolution × frequency multiplier.
- All detect words of all channels must be found within ±5 × segment resolution.

Procedure 1 Connect the DUT in the Connection Editor.

2 Set the appropriate levels.

3 Use the Detail Mode Sequence Editor to set up the data to be sent and expected. Take care of the block length.

4 Use the Trigger Pod, if you wish to react on external events.

5 Start the generator.

6 Wait until the PLL of the DUT has stabilized.

7 Start the analyzer system.

How Do I Use the AUX OUT of E4863A/E4865A Frontends?

The analyzer frontends E4863A and E4865A have an AUX OUT connector.

Setup Example This connector, for example, provides the option to route a recovered clock signal to the clock module.

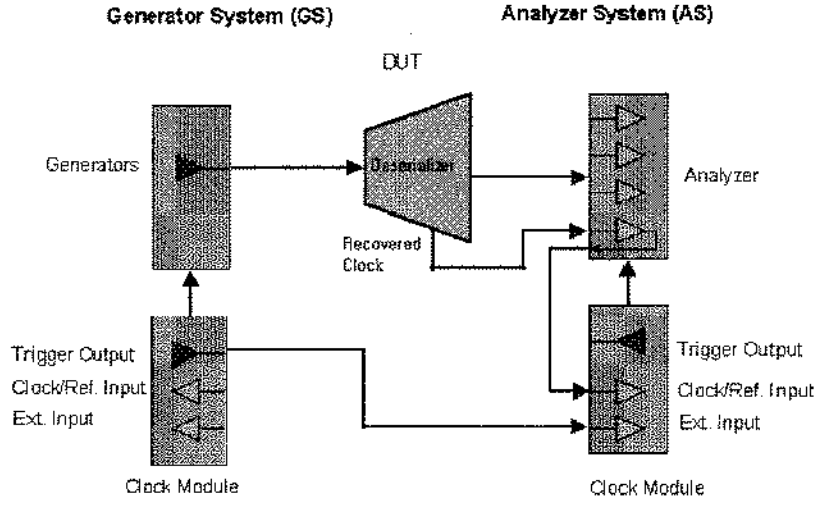


Figure 260 DEMUX Test Setup With Recovered Clock

The AUX OUT connector is connected to the output of the analyzer's comparators and delivers a unipolar signal.

In the example above, the analyzer system is started by a trigger issued from the generator system. It then uses the recovered clock of the DUT to set its own capturing frequency.

The AUX OUT has an internal impedance of 50 Ω and has to be terminated accordingly.

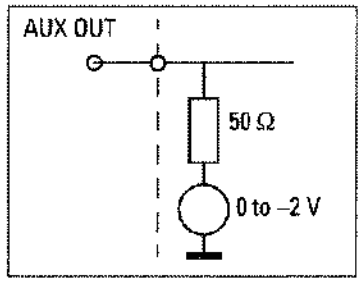


Figure 261 AUX OUT Termination

A termination voltage between 0 V and –2 V may be used.

Appendix B: PRBS/PRWS Data Segments

This appendix contains information how the Agilent 81250 Parallel Bit Error Ratio Tester generates Pseudo Random Bit/Word Streams (PRBS and PRWS). Furthermore, it describes the additional features available with PRBS/PRWS.

Pure and Distorted PRBS

The Agilent 81250 uses a shift register with appropriate feedback to generate the pseudo random data. An example is shown below.

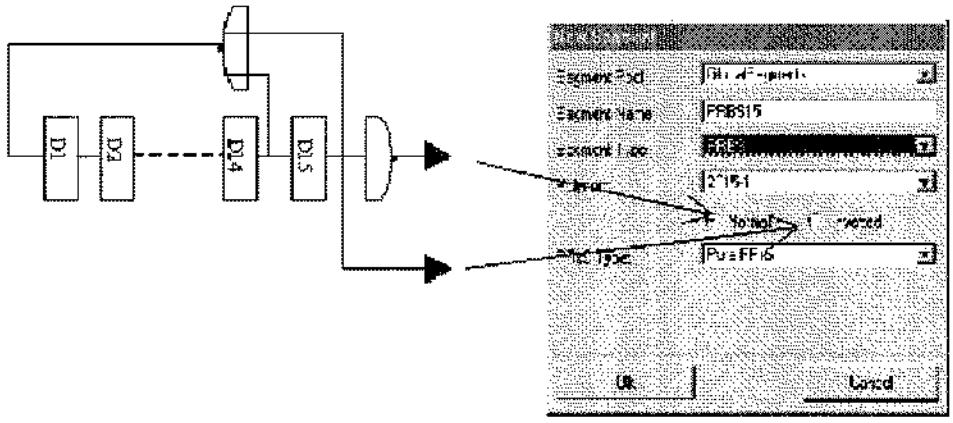


Figure 262 The Generation of a 2^{15}–1 PRBS Using a Shift Register

Here you can see, how an ITU-T O.151 compatible 2^{15}– 1 PRBS is generated.

If *Normal* is selected, the output of the inverter is used to generate the bit stream. The shift register starts with all flip-flops loaded to one. This causes the bit stream to start with the longest run of 15 zeros.

If *Inverted* is selected, the bit stream is sent to the DUT without the inverter. The shift register starts with all flip-flops loaded to one. This causes the bit stream to start with the longest run of 15 ones.

NOTE This implementation may be in contrast to other bit error rate testers. If you encounter problems when combining the Agilent 81250 with an undocumented PRBS generator or analyzer, you should try the inverted output.

The mathematical notation of the shift register with feedback taken from flip-flops 15 and 14 for the 2^{15}–1 PRBS is:

$$X^{15} + X^{14} + 1$$

A complete list of the available polynomials—using the mathematical notation—is given in the table below.

Table 16 PRBS Polynomials

PRBS	Polynomial	Comment
2^5-1	$X^5+X^4+X^2+X^1+1$	
2^6-1	$X^6+X^5+X^3+X^2+1$	
2^7-1	X^7+X^6+1	Compatible with Agilent 70841A and 70845A. ITU-T V.29
2^8-1	$X^8+X^7+X^3+X^2+1$	
2^9-1	X^9+X^5+1	CCITT 0.153 / ITU-T V.52
$2^{10}-1$	$X^{10}+X^7+1$	Compatible with Agilent 70841A and 70845A
$2^{11}-1$	$X^{11}+X^9+1$	CCITT 0.152 / ITU-T 0.152
$2^{12}-1$	$X^{12}+X^9+X^8+X^5+1$	
$2^{13}-1$	$X^{13}+X^{12}+X^{10}+X^9+1$	
$2^{14}-1$	$X^{14}+X^{13}+X^{10}+X^9+1$	
$2^{15}-1$	$X^{15}+X^{14}+1$	CCITT 0.151 / ITU-T 0.151
$2^{23}-1$	$X^{23}+X^{18}+1$	CCITT 0.151 / ITU-T 0.151
$2^{31}-1$	$X^{31}+X^{28}+1$	

All pure pseudo random bit/word streams are generated by hardware shift registers built into the data generator/analyzer modules.

Distorted PRBS are generated by simulating the shift register in the software and downloading the pattern into the channel memory. Due to memory constraints, only pure PRxS without any additional options is available for the two longest bit streams ($2^{23}-1$ and $2^{31}-1$).

Variable Mark Density

The ratio of ones to zeros of a pure pseudo random bit stream is approximately 1 to 1. That means, 1/2 of all bits are ones. You can modify this ratio by using the option Variable Mark Density.

A PRBS with marker density 1/8, 1/4, 3/4, 7/8 generates bit streams with the respective ratio of ones to the total number of bits. For example, 3/4 means that on the average 3 out of four bits are ones.

The generation of such a 2^m–1 PRBS is done by combining a bit at position n with the bits generated m bits and 2*m bits later. The following formulas are used:

Mark density	Formula
1/8	PRBS[n] = PRBS[n] & PRBS [n+m] & PRBS [n+m*2]
1/4	PRBS[n] = PRBS[n] & PRBS [n+m]
3/4	PRBS[n] = PRBS[n] | PRBS [n+m]
7/8	PRBS[n] = PRBS[n] | PRBS [n+m] | PRBS [n+m*2]

Extended Zeros/Ones

Normal Mode A pure pseudo random bit stream in normal mode generates the longest run of zeros as the first bits. Thus, for a 2^m– 1 PRBS the first m bits are zero. With the option Extended Zeros you can extend this sequence of m zeros.

Starting at bit position m+1 in the pattern memory a specified number of bits is set to zero. The following bit is then forced to be a one.

Inverted Mode The opposite applies for an inverted PRBS. Here you can extend the number of ones that are sent as the first bits.

Principle of Operation If ones shall be extended to a normal PRBS, the start phase of the PRBS is modified in such a way that the longest run of ones ends exactly at bit position m (first bit is zero, bit one to m are ones). Therefore, the insert position of the extending ones is again at index m+1.

The same applies for an inverted PRBS that shall be extended with zeros.

Error Insertion

To produce a distinct bit error rate in your test sequence, you can use the Error Insertion option. This option inserts errors into the pseudo random bit stream.

This is achieved by filling a pure PRBS stream into memory and then toggling as many bits as specified at random positions.

For example, 2 errors inserted into a 2^{15}–1 PRBS yields an error rate of

$2 / (2^{15}–1) = 6.1037e^{-5}$.

Pure and Distorted PRWS

A Pseudo Random Word Stream (PRWS) is used to send pseudo random data to a multiplexer (MUX) input port. PRWS is also used to specify the data expected from a demultiplexer (DEMUX) output port.

Pure PRWS

If the signals are connected to the MUX input pins in correct order, a PRBS appears at the output pin of the MUX. This is illustrated in the figure below. The numbers in the figure represent the nth bit of a PRBS data stream.

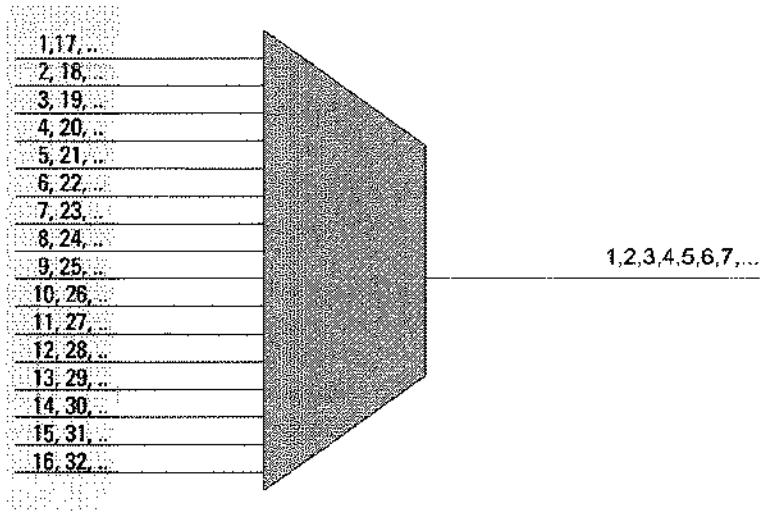


Figure 263 Sending a PRWS to a 16 : 1 MUX

If the MUX-width is a number in power of two, then the individual input data streams to the MUX are PRBS streams of the same polynomial as the resulting serial data stream at the MUX output. For a MUX with a width other than a power of two, PRBS using different polynomials must be provided to the MUX. This is done automatically by the software.

Restrictions However, there are a few invalid combinations of PRBS-lengths and MUX-widths. They are listed in the table below.

Table 17 Known Exceptions for MUX-Widths up to 256

PRWS	Invalid MUX-widths
2^5-1	31, 62, 93, 124, 155, 186, 217, 248
2^6-1	3, 7, 9, 18, 21, 27, 36, 42, 45, 54, 63, 72, 81, 84, 90, 99, 105, 108, 117, 126, 135, 144, 147, 153, 162, 168, 171, 180, 189, 198, 207, 210, 216, 225, 231, 234, 243, 252
2^7-1	127, 254
2^8-1	3, 5, 15, 17, 34, 51, 68, 85, 102, 119, 136, 153, 170, 187, 204, 221, 238, 255
2^9-1	7, 73, 146, 219
$2^{10}-1$	3, 11, 31, 33, 66, 93, 99, 132, 165, 198, 231
$2^{11}-1$	23, 89
$2^{12}-1$	3, 5, 7, 9, 13, 15, 21, 35, 39, 45, 63, 65, 91, 105, 117, 130, 195
$2^{13}-1$	No exceptions
$2^{14}-1$	3, 43, 86, 127, 129, 172, 215
$2^{15}-1$	7, 31, 151, 217
$2^{23}-1$	47
$2^{31}-1$	No exceptions

Some exceptions are obvious: For example, a 2^5–1 PRBS generates a bit stream that is repeated every 31 bits. A multiplexer with 31 inputs would then require constant signals at the input pins to provide a PRBS at the serial output. But as the pure PRBS is generated using a shift register, it is mandatory that the individual inputs to the MUX itself are also PRBS streams of a certain polynomial.

If you need to have a PRWS for a MUX-width that is listed in the exception table, use this workaround: Create a non-pure PRWS. For example, specify it as a PRWS with a variable marker density 1/2.

Distorted PRWS

The different types of non-pure Pseudo Random Words Streams (PRWS) are generated in a similar way as the various PRBS types. The PRWS generation is done in two steps:

1. A PRBS with the specified parameters is generated.
2. The data memories of the related channels are filled in such a way that at the serial side of the MUX the desired PRBS appears.

Appendix C: Glossary

This appendix provides a glossary of the terms used by the user interface and in the documentation.

Terms and Explanations

Action upon an event: Any combination of the following:

- Go to sequence block.
- Set the TRIGGER OUTPUT of the master clock module.
- Set the VXI ECL T0/T1 trigger lines.

ActiveX controls: Reusable software objects that can be pasted into many programming environments.

Agilent 81200 pnp driver: A plug and play driver for the 81200 platform based on the VISA standard.

Analog channel addition: Voltage addition of two 675 MHz signal generator channels of one module. Requires at least one E4838A frontend.

API: Application Programming Interface.

Automatic Bit Synchronization: Analyzer sampling phase adjustment based on measuring the BER. Sets and shows the phase delay with respect to the analyzer clock.

Automatic Delay Alignment: Analyzer sampling delay optimization if a time window is known. Sets and shows the full delay since start.

BER: Bit Error Rate. The number of errored bits divided by the number of received bits.

BIOS: Basic I/O System—the microprocessor programs loaded into the EEPROMs of the VXI modules.

Block: A portion of a test sequence which references segments that define generated and expected data. A block refers to all data ports. Its length has to be a multiple of the segment resolution. Single blocks and groups of blocks can be repeated (loops). A trigger pulse can be issued at the beginning of a block. Actions upon events can be associated with a block.

Capture Data In capture mode, the analyzer frontends capture data until the sequence expires or their memory is filled.

Channel: The circuitry behind a frontend connector, which includes data generating or analyzing capabilities, data memory, frequency multiplexing, and so on.

CLOCK/REF INPUT: A connector of the clock module. It allows to connect an external clock source.

Clockgroup: The sum of modules connected to a single clock module.

ClockgroupNumber: Identifies the clock master (= 1) and up to two slaves (2 and 3).

Compare and Acquire Around Error The Compare and Acquire around Error mode compares and acquires data in real time. If an error occurs, it is possible to define when the system should stop after the occurrence of the error.

Compare and Capture The Compare and Capture mode compares and acquires data in real time. It continues until the sequence expires or the Stop button is pressed.

Connector: An output or input connector of a frontend. Differential connectors are treated as one connector.

ConnectorNumber: Identifies the connector of a module and is counted from module top to bottom (1 to 4). Differential connectors are counted as one connector.

Data port: A DUT port that receives or returns digital data, such as a data or address bus.

DCE: Data Communication Equipment.

Delay vernier: A slider provided by the Parameter Editor for analyzer frontends plugged into an E4861A or E4832A data generator/analyzer module. Allows to move the sampling point while a test is running.

Digital channel addition: Exclusive OR (modulo 2) addition of two or four signal generator channels of one module.

DSR: Digital Stimulus/Response. A general term used for characterizing instruments that source digital data to a device and analyze the digital response.

DSRA: Default name of the basic ParBERT system with the first clock module. Additional independent systems are labeled in ascending order: DSRB, DSRC, etc.

Error State Display: Shows captured data and errors in tabular form.

Event: A signal that causes an action.

Event causing deferred action: An event that causes an action at the end of the currently executed sequence block.

Event causing immediate action: An event that is serviced as fast as possible, without waiting for the end of the currently executed sequence block.

EXT INPUT: A connector of the clock module. It allows to start/stop the system by an external signal.

FM factor: Frequency Multiplier factor. The individual factor by which a channel frequency differs from the system clock frequency. Choices are restricted by the FMR.

FMR: Frequency Multiplier Range. The available factors for multiplying the system clock frequency. The actual range depends on the segment resolution and the type of module.

Frontend: Generator or analyzer plug-in of a module.

Handle: The identification of a system, such as DSRA, in SCPI commands.

Master clock module: The E4805B or E4808A clock module that controls clockgroup #1 of a system. It can additionally control up to two slave clock modules (clockgroup #2 and #3).

Module: One of the following:

- E4805B Clock Module
- E4808A Clock Module
- E4832A Data Generator/Analyzer Module (up to 675 MHz)
- E4861A Data Generator/Analyzer Module (up to 2.7 GHz)
- E4868A 43.2 GBit/s Multiplexer (MUX) Module
- E4869A 43.2 GBit/s Demultiplexer (DEMUX) Module

ModuleNumber: Identifies the module within a clockgroup (range 1 to 11).

MUX/DEMUX: Multiplexer/Demultiplexer. Also used for identifying the E4868A multiplexer and the E4869A demultiplexer modules.

OC: Optical Carrier. Describes the optical characteristics of a SONET. OC-1 corresponds to STS-1, OC-768 to STS-768.

Parameter Editor: A versatile component of the ParBERT user software that allows to set the characteristics of the clock module, the DUT data ports, and selected generator frontends.

PNP: 81200 Plug and Play peripheral driver for VXI components.

Port: A group of DUT input or output pins with identical or similar properties. There are data ports and pulse ports.

PRBS/PRWS: Pseudo Random Bit/Word data Stream.

Pulse port: A DUT port that receives parametric signals, such as a clock pulse.

SCPI: Standard Command language for Programmable Instruments.

SDH: Synchronous Digital Hierarchy.

Segment resolution: The length of a data word in the memory. Range: 1 to 16 bits for E4832A modules, 16 to 64 bits for E4861A modules. The minimum segment resolution depends on the chosen system clock frequency.

Segment: Contains the data to be generated or expected: A certain pattern, PRBS, or PRWS. PRxS means algorithmic data. A pattern consists of vectors and traces.

Sequence: The overall stream of generated and expected data, formed by sequence blocks.

SERDES: Serializer/Deserializer. Multiplexers/demultiplexers used in SONET applications.

Setting: The complete setup for a DUT test, including all parameters and references to the test patterns (segments).

SFI-5: SERDES Framer Interface, spec #5.

SONET: Synchronous Optical Network. A standard from Bellcore and ITU-T (formerly CCITT).

Start delay: Analyzer sampling point setting with the Parameter Editor. Describes also the delayed start of generators after starting a test.

STM: Synchronous Transfer Mode. STM-1 is the base level of the SDH and refers to a data rate of 155.52 Mbit/s. This corresponds to STS-3.

STS: Synchronous Transport Signal. STS-1 is the base level of SONET and refers to a data rate of 51.84 Mbit/s.

System/Subsystem: An independent subsystem of the Agilent 81250 Parallel Bit Error Ratio Tester, consisting of one master clock module and at least one Data Generator/Analyzer Module. Several systems may share a common VXI frame.

Terminal: A signal line (a DUT pin) assigned to a port.

Trace: Specifies the serial data transmitted to or expected from a terminal.

Trigger Pod: An option of the E4805B or E4808A master clock module for detecting external events.

Vector: Specifies all the parallel, simultaneous bits of a port within a segment.

VISA: Virtual Instrument Software Architecture—a common standard of functional calls for controlling VXI-based instruments.

VXI: VME-bus eXtension for Instrumentation—a bus system for building modular instruments.

Waveform Viewer: Shows generated and captured data as well as errors in graphical form. Allows to investigate phase relationships.

Index

U

V

W

Z