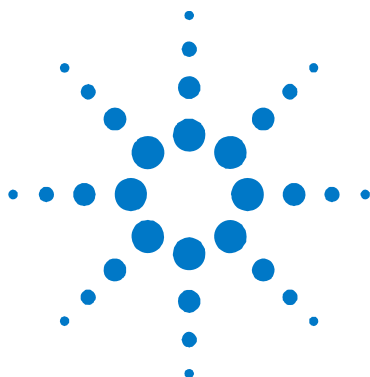




Agilent N4876A

**Setting up
the multiplexer
together with a
ParBERT 81250**

Getting Started Guide



Notices

© Agilent Technologies, Inc. 2011

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Agilent Technologies, Inc. as governed by United States and international copyright laws.

Edition

Version 1.00, December 20, 2010

Manual Part Number N4876-91011

Warranty

The material contained in this document is provided "as is," and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contractor subcontract, Software is delivered and licensed as "Commercial computer software" as defined in DFAR 252.227-7014 (June 1995), or as a "commercial item" as defined in FAR 2.101(a) or as "Restricted computer software" as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Agilent Technologies' standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

Content

1	SETTING UP THE SYSTEM	2
1.1	Required test equipment (ETE)	2
1.2	Measurement setup	2
2	SETTING UP THE PARBERT SYSTEM	3
2.1	ParBERT software setup	3
2.2	Hints to assign generators to a clock group (to get a PRBS)	5
3	CALIBRATING THE PARBERT OUTPUT TIMING	9
4	CALIBRATING THE PARBERT WITH THE N4876A MULTIPLEXER	10
4.1	Alignment at a specific frequency	14
4.2	Pictures of misaligned signals	16
4.3	Contact address	18
4.4	Document change log	18

1 Setting up the system

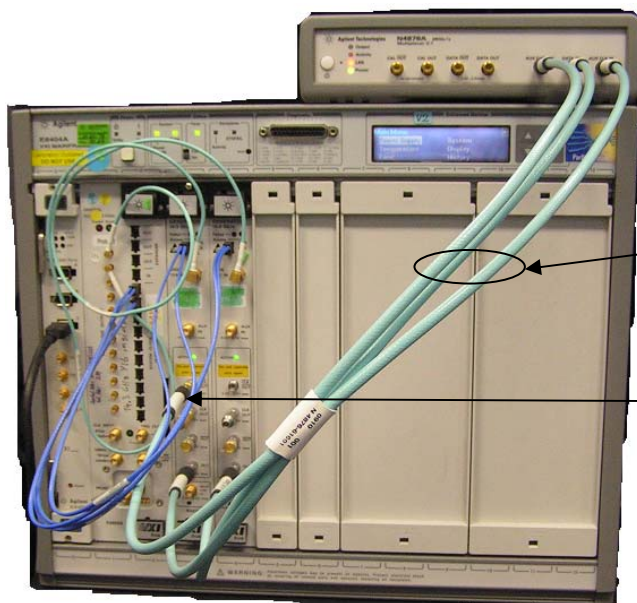
1.1 Required test equipment (ETE)

- A 81250A ParBERT System with at least 1 E4809A Clock module and 2 N4872A Generator modules
- An oscilloscope like the 86100C DCA-J with an appropriate oscilloscope module e.g. the 86117A 50 GHz electrical module
- One N4876A 28 GBs 2:1 Multiplexer
- 3 cables of about equal length (< 1 cm difference), 1 side 2.4mm Connector other side 3.5mm or SMA connector or cables with adapters. Higher cable difference will result in lower performance
or use the N4915A-011 cable set together with a 2.4mm (m) – 3.5mm (f) adapter for the clock output of the ParBERT module.

Note:

Use high performance cables/adapters only.

1.2 Measurement setup



Connect:

- OUT of 1st module to DATA IN of Multiplexer
- OUT of 2nd module to AUX DATA IN of Multiplexer
- CLK OUT/ of 1st module to AUX CLK IN of Multiplexer

using the N4915A-011 cable set

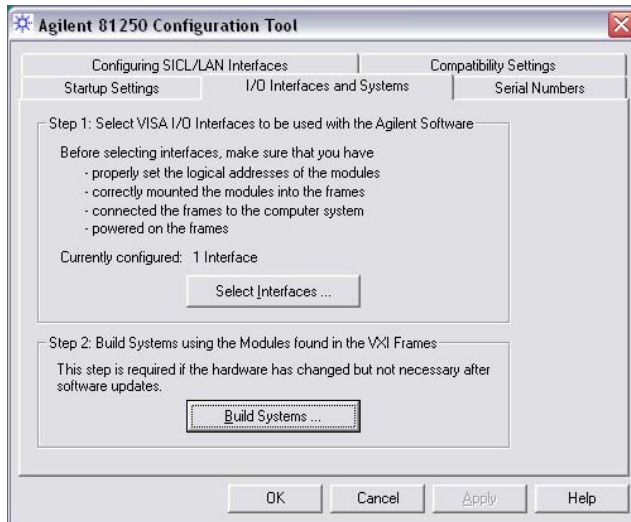
Use a 2.4mm (m) – 3.5mm (f) adapter here at CLK OUT/

Terminate unused inverted outputs with 50 Ohm Terminations

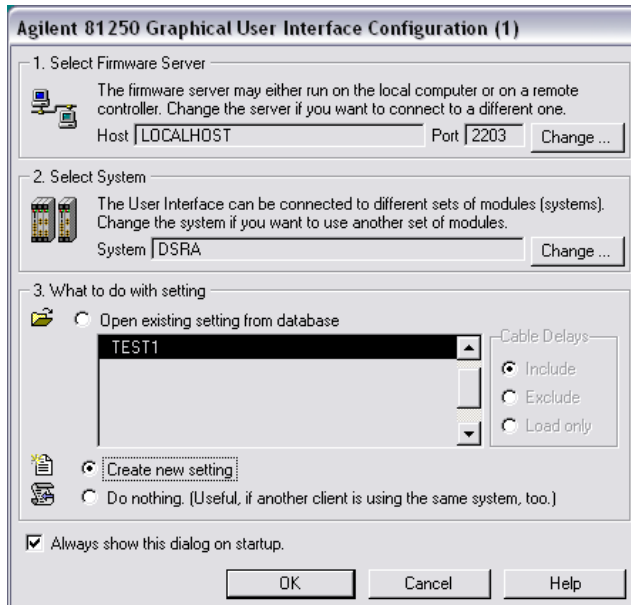
2 Setting up the ParBERT system

2.1 ParBERT software setup

Set up a ParBERT System with 1 E4809A Clock module and 2 N4872A Generator modules
Run the configuration tool and build the system



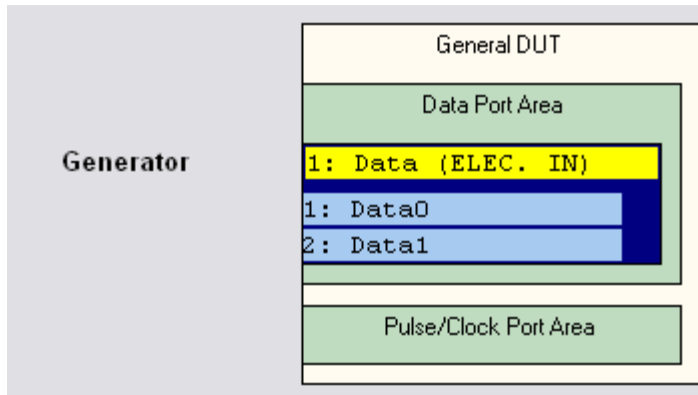
Run the Software, start with a new setting



The Multiplexer is operated externally using the **N4876A_GUI.exe** software.

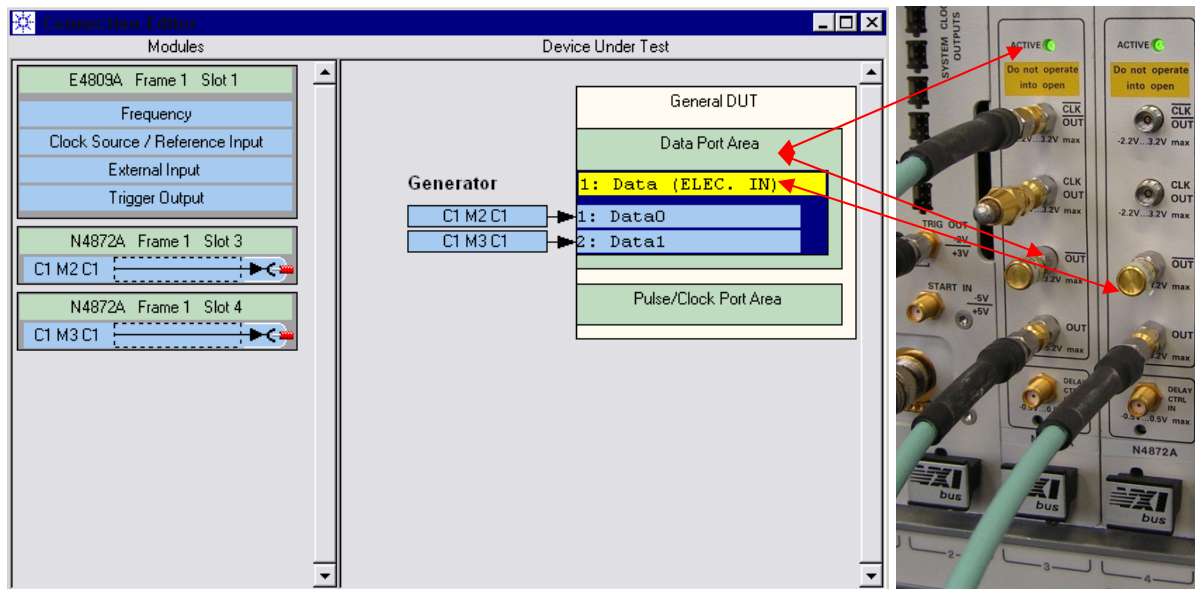
Getting Started Guide N4876A: ParBERT 81250 Setup (Version 1.0)

Set up a 2 bit data port



Save the setting (in this example the setting is named SINGLE_N4876A_SETUP)

In the Connection Editor connect the modules to the data ports (using drag and drop)



Note, that the clock output is tied to the corresponding data output

The following connections will be made later (after de-skew)

- Data0: connect **CLK OUT** to **AUX CLK IN** and **OUT** to **DATA IN**
- Data1: Connect **OUT** to **AUX DATA IN**

2.2 Hints to assign generators to a clock group (to get a PRBS)

When selecting PRWS as data, a 2 bit wide PRWS is generated that will be multiplexed to a PRBS. This is possible since PRBS data streams are self similar and by choosing the right tap multiplexing results in the same PRBS as the root.

Note:

If you wish to use 2 N4876A Multiplexers, set up the following:

Data0: connect **CLK OUT/** to **AUX CLK IN** and **OUT** to **DATA IN** of Multiplexer 1

Data1: connect **CLK OUT/** to **AUX CLK IN** and **OUT** to **DATA IN** of Multiplexer 2

Data2: Connect **OUT** to **AUX DATA IN** of Multiplexer 1

Data3: Connect **OUT** to **AUX DATA IN** of Multiplexer 2

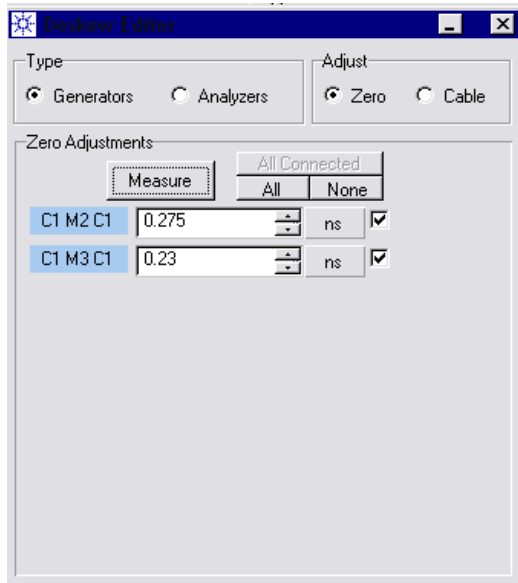
When selecting PRWS as data, a 4 bit wide PRWS is generated that will be multiplexed to a PRBS so that multiplexing the outputs of both N4876A will result in the selected PRBS

This is possible since the PRWS is set up so, that the resulting PRBS is generated.

Perform the steps as described here accordingly. You will need to calibrate both multiplexers separately.

Calibrate / de-skew ParBERT

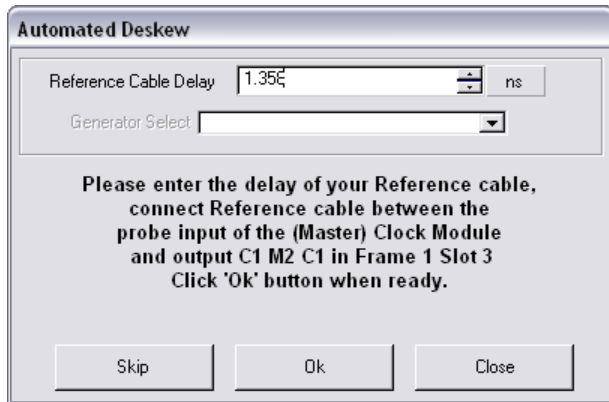
First calibrate the Zero delay. You will need a cable with known length.



Click the radio buttons "Generators" and "Zero" Then click the button "Measure"

Getting Started Guide N4876A: ParBERT 81250 Setup (Version 1.0)

Enter the Delay of the cable used

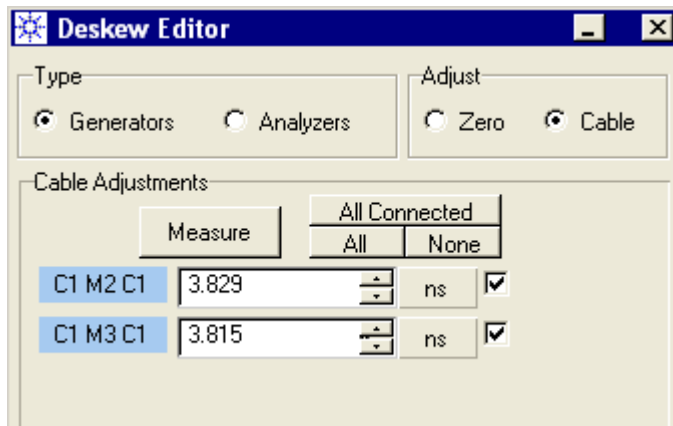


The 'Automated Deskew' dialog box contains a 'Reference Cable Delay' field with a value of 1.356 ns and a 'Generator Select' dropdown menu. Below these fields, a text block provides instructions: 'Please enter the delay of your Reference cable, connect Reference cable between the probe input of the (Master) Clock Module and output C1 M2 C1 in Frame 1 Slot 3. Click 'Ok' button when ready.' At the bottom are 'Skip', 'Ok', and 'Close' buttons.

Repeat the procedure with the final cables to the multiplexer. Follow the instructions given by the system.

After running the cable de-skew procedure manually correct the value of the connector to the aux data input. Reduce the value by 10 ps. This ensures the 10 ps timing difference (reducing the value means ParBERT will output this signal 10 ps later).

Here the measured value 3.825ns was reduced to 3.815 ns.



The 'Deskew Editor' window has a 'Type' section with 'Generators' selected and an 'Adjust' section with 'Cable' selected. The 'Cable Adjustments' section includes a 'Measure' button and a table of adjustments.

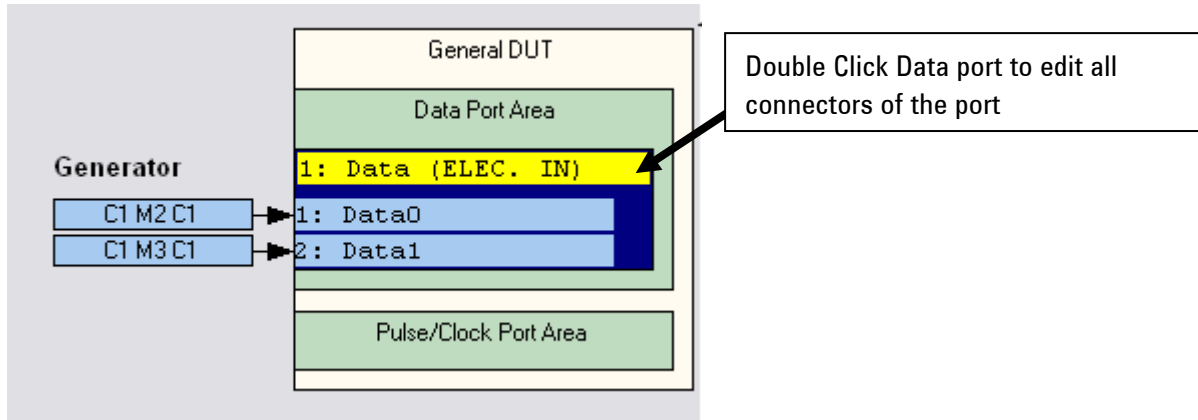
		All Connected	
		All	None
C1 M2 C1	3.829 ns	☒	
C1 M3 C1	3.815 ns	☒	

Save the setting to preserve the values found in the procedure

Getting Started Guide N4876A: ParBERT 81250 Setup (Version 1.0)

Set the levels in ParBERT before connecting Multiplexer

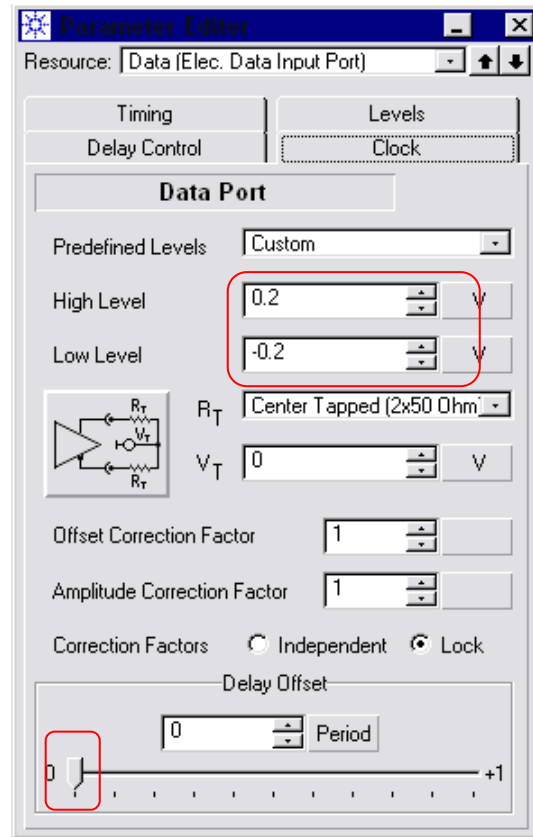
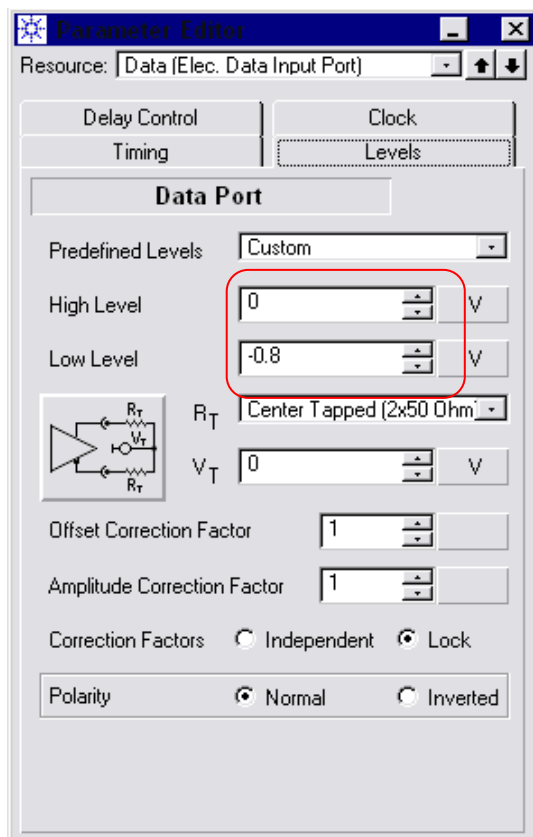
Select the **data port**:



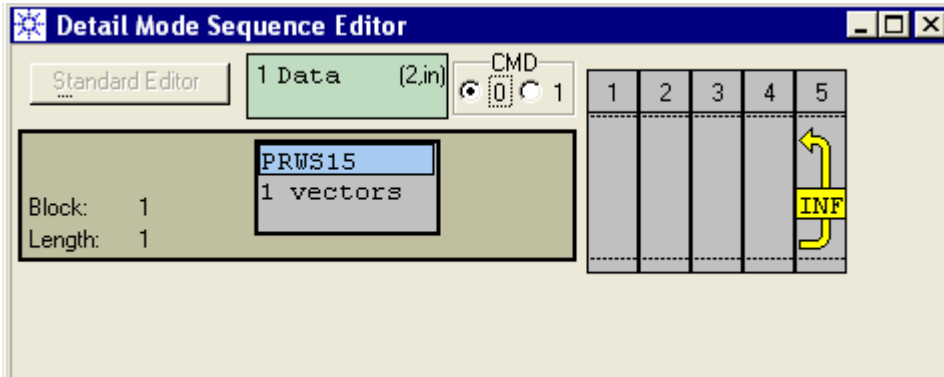
In the tabs set the following values:

High level = 0V, Low Level = -0.8V for Data outputs, High level = +0.2V, Low level = -0.2V for Clock outputs. It is the easiest way to select the entire port.

Using the Port Editor the clock outputs of both modules will be selected and changed. The output levels used are low enough that the unused clock output may remain unterminated even though levels are set also to this output.



Set up a sequence to get signals at the ParBERT outputs. Here as an example a PRWS 2¹⁵-1 is set up.



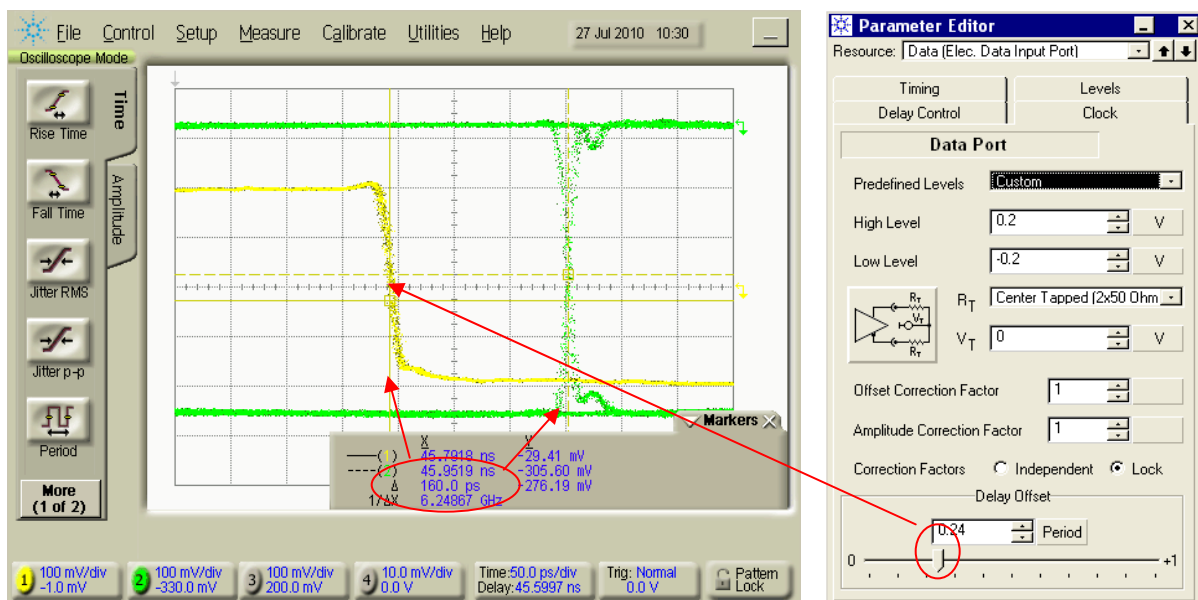
3 Calibrating the ParBERT output timing

You will need a high speed oscilloscope with at least 2 channels for the following steps.

De-skew the oscilloscope channels, so that the timing shown at the screen is the timing at the connectors. Use the cables you have already calibrated in the setup above.

The Clock output has no fixed timing to the data outputs, so it has to be positioned for each frequency.

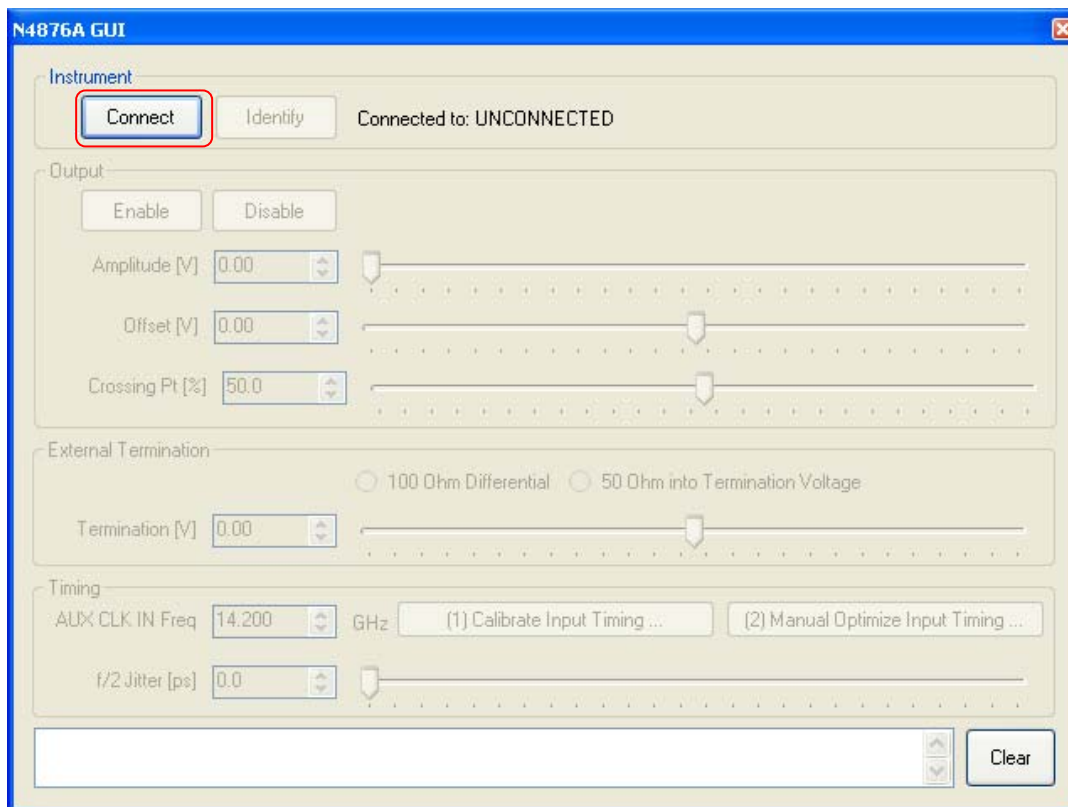
So for the used frequencies the Delay Offset slider value has to be determined to enable calibration. With the de-skewed Oscilloscope find the Slider values for the used frequency



Move slider until the falling edge of the clock is 160 ps ahead of the data transition.

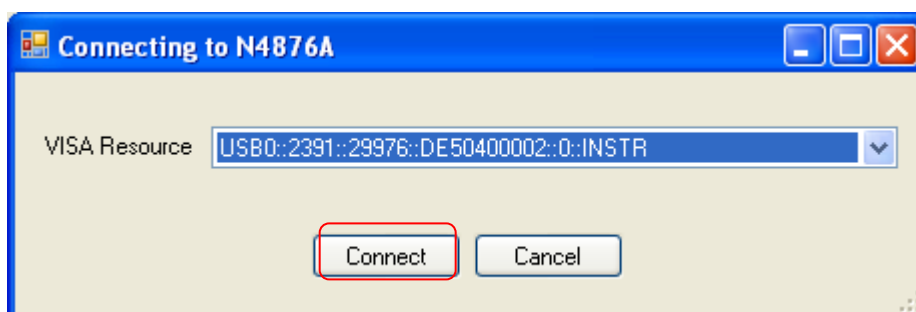
4 Calibrating the ParBERT with the N4876A Multiplexer

When starting the N4876A_GUI.exe the window looks like this:



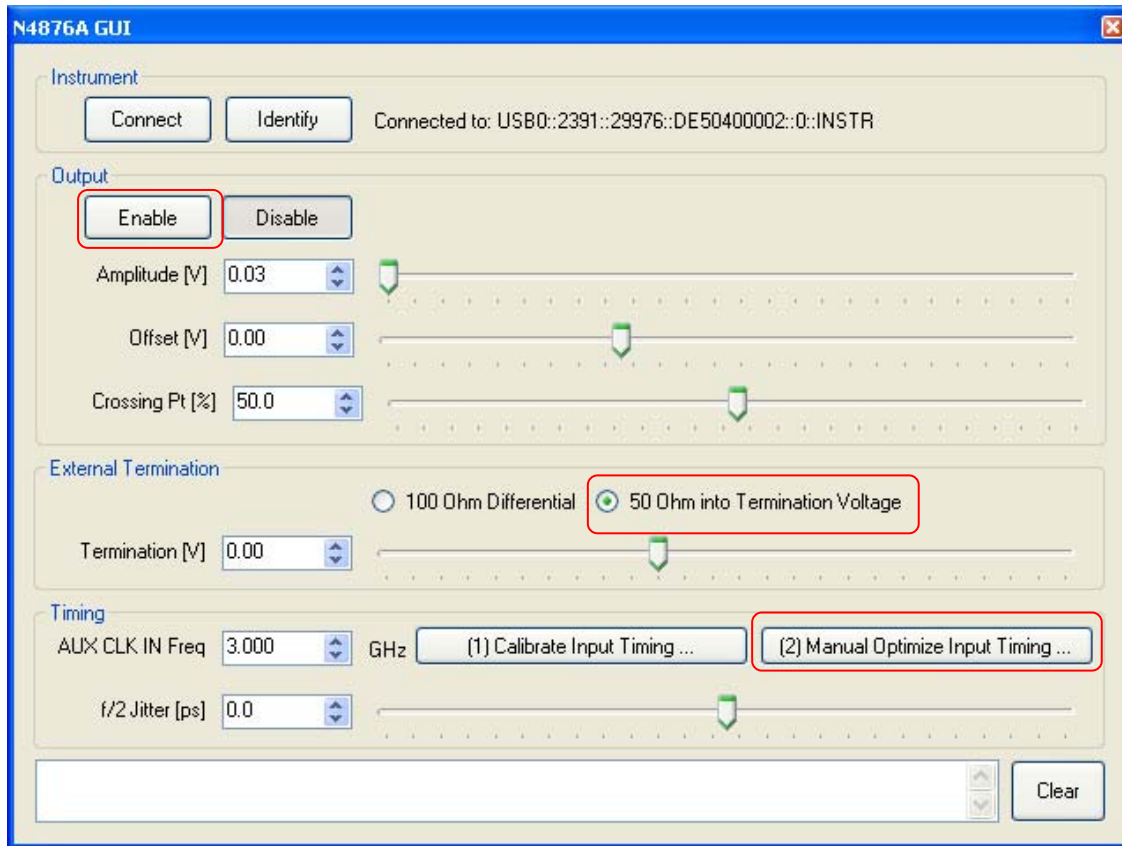
Press **Connect**

The following window pops up:



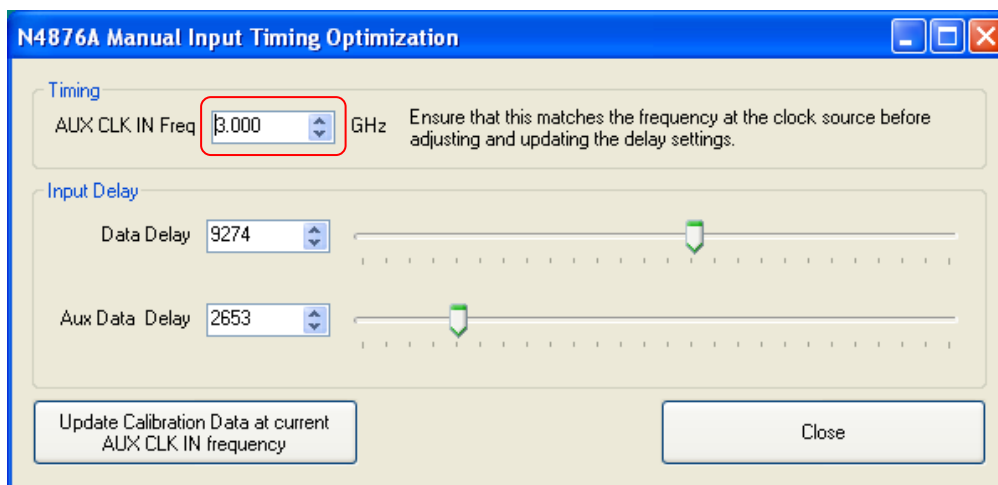
It displays the VISA resources of the N4876A multiplexers connected to the computer. If you have connected more than one Multiplexer the serial number (marked in the window above, it should match the serial number sticker of your unit) identifies the one to use. Select the desired Multiplexer, press **Connect**.

Enable the output, select **50 Ohm into Termination Voltage**



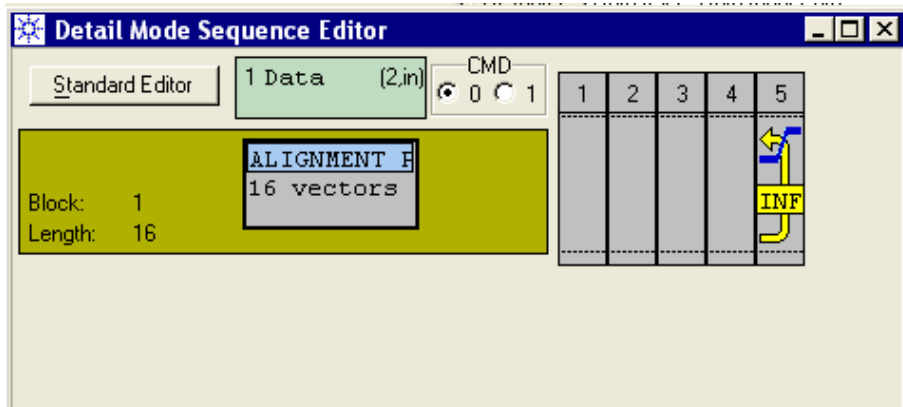
Press (2) Manual Optimize Input Timing

The following window pops up



Enter the actual frequency which is set in ParBERT. We use 10 GHz in the example.

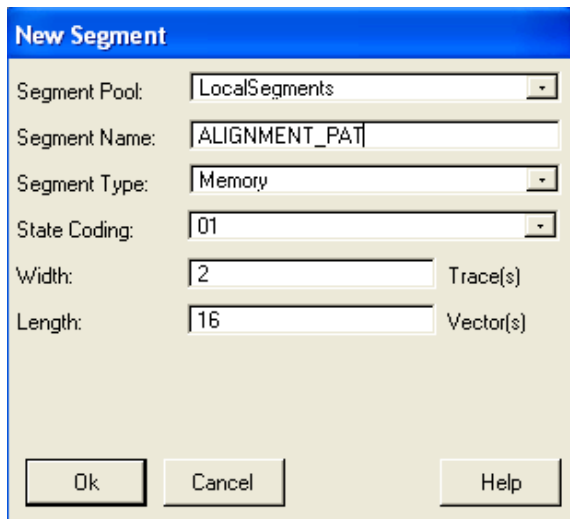
To set up an alignment pattern at the ParBERT outputs create a data segment with a length of 16:



Make sure the Segment length and block length is set to > 1, otherwise you will always see the 1st bit and no toggling pattern. We chose a length of 16 vectors.

Set the sequencer trigger at the loop (Pop Up Menu, right mouse key)

Let's call the segment ALIGNMENT_PAT



Press Ok

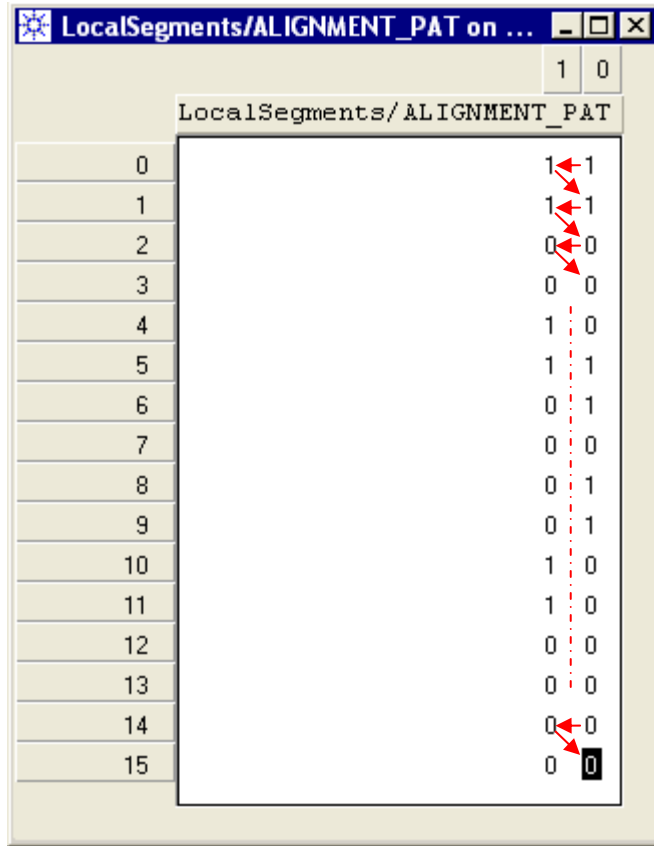
The segment editor opens.

A good choice for the **adjust pattern** is the following 32 bits long pattern:

1111 0000 0111 1000 1010 0101 0000 0000

This pattern is easy to set up and it allows identifying all misalignments and swapped bits.

When both 1111 – blocks are displayed correctly, the alignment is correct.



Here is how the bits are output

Trace 0 bit 0

Trace 1 bit 0

Trace 0 bit 1

Trace 1 bit 1

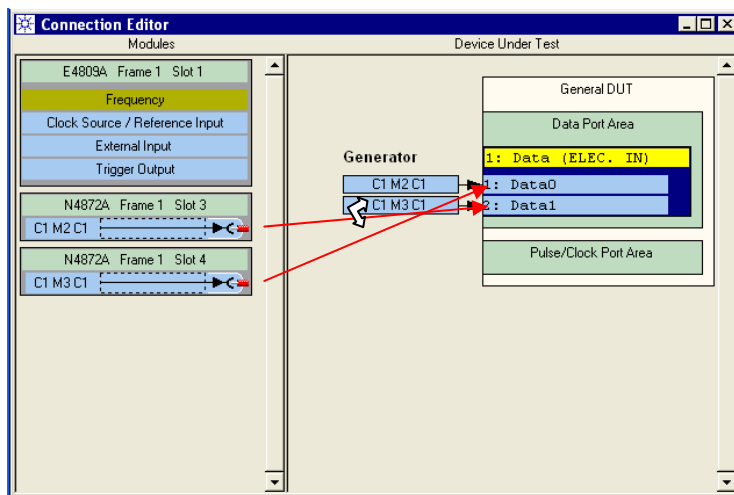
...

So this is the segment for the pattern described above.

The bit at the DATA IN connector of the MUX is first, the bit at the AUX DATA IN connector second.

Save the segment (File -> Save Segment) in the ParBERT main menu bar.

If you want to swap the traces for easier editing, you may swap the connection in the connection editor



Note that this also affects the bit order for the PRWS!

4.1 Alignment at a specific frequency

You will need an **oscilloscope with 2 de-skewed channels** and matched measurement cables.

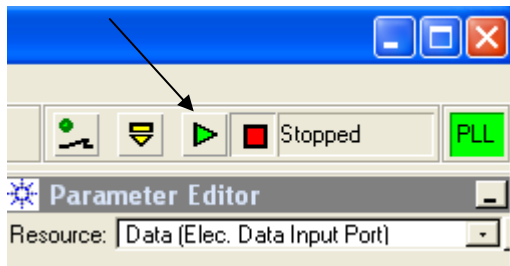
In the steps above we set up the 2 bits long pattern:

1111 0000 0111 1000 1010 0101 0000 0000

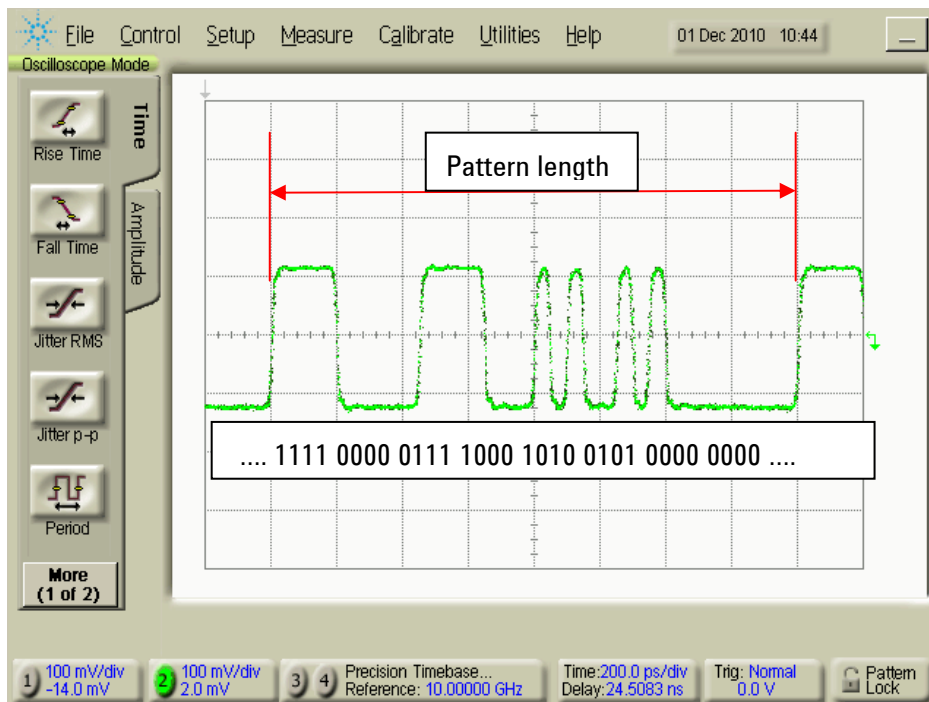
This pattern allows identifying all misalignments and swapped bits.

When both 1111 – blocks are displayed correctly, the alignment is correct.

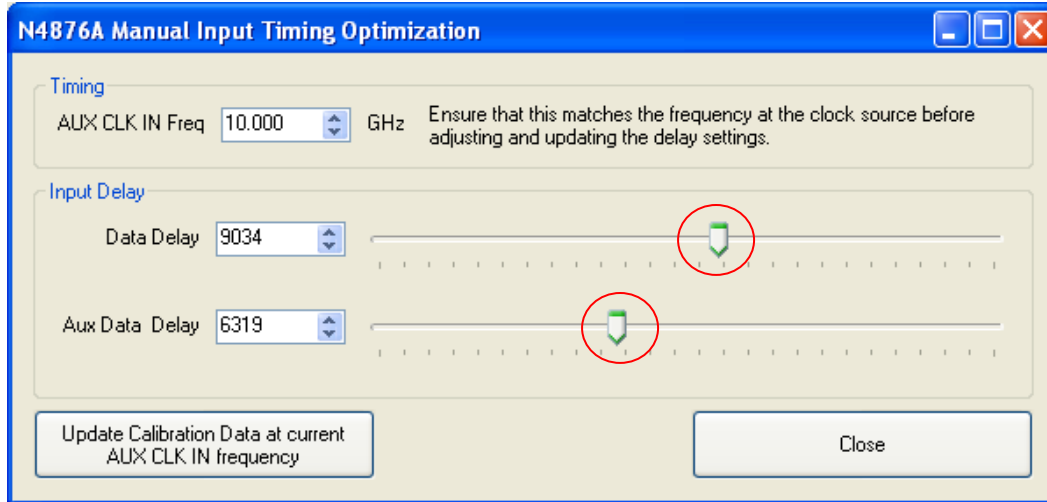
Set the ParBERT Trigger to pattern trigger and use it to trigger the oscilloscope. Press the Run Button in ParBERT



Now you should see the following pattern (if adjusted right)



Adjust the timing using the sliders in the Manual Input Timing Optimization window of the N4876A GUI

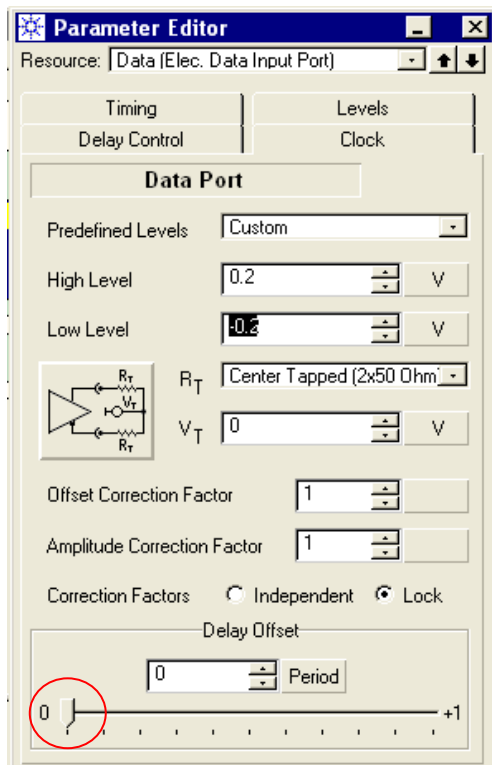


Make sure the frequency is set to the correct value. Press **Update Calibration Data at current AUX CLK IN frequency** to store the alignment permanently for this frequency. When entering the frequency in the N4876A main GUI again, these settings are restored.

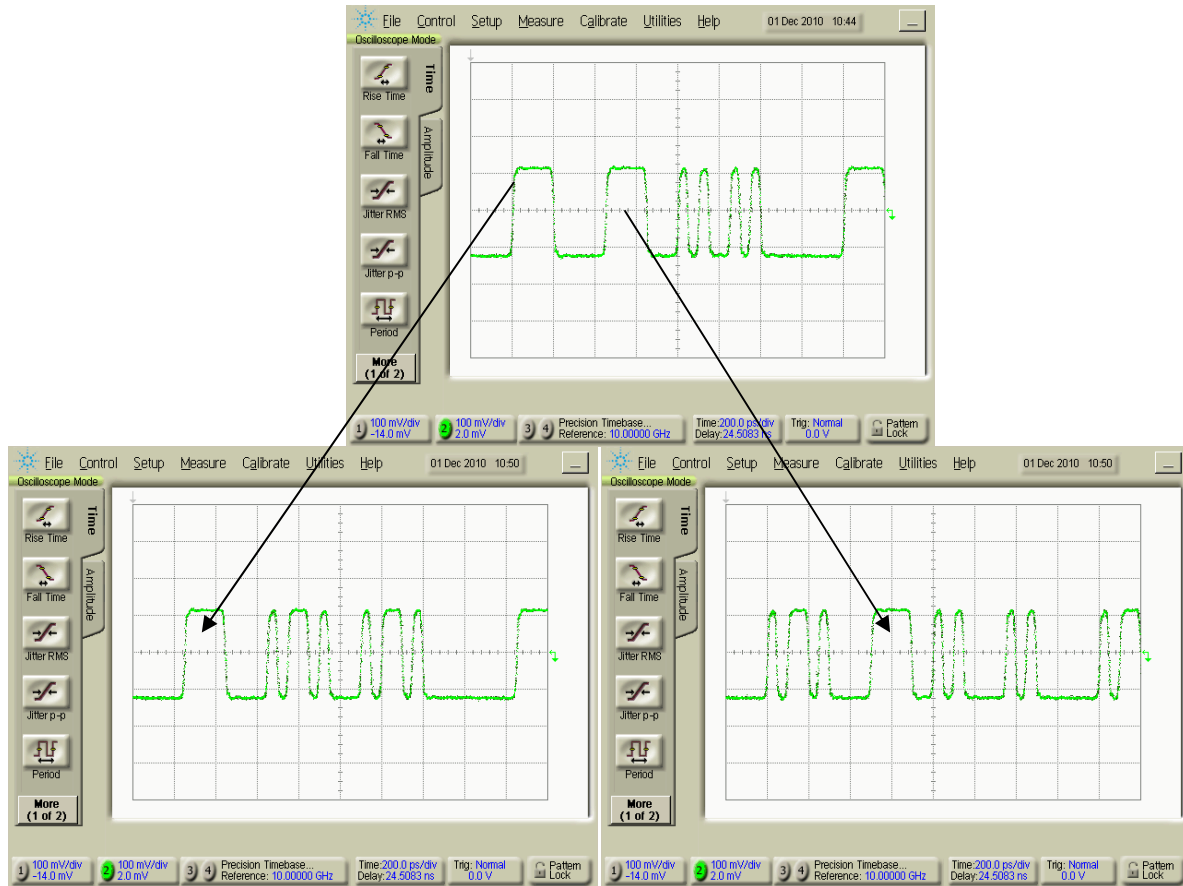
Note: 0 is maximum input delay, 16383 is minimum delay

As stated below:

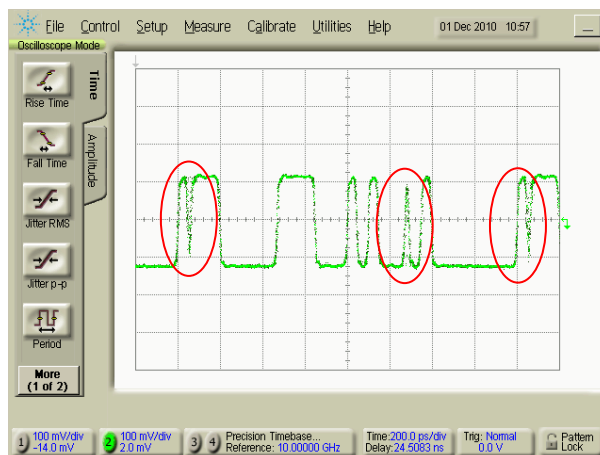
(Only) if no stable wave form can be achieved, change the clock output delay in ParBERT and retry.



4.2 Pictures of misaligned signals



In the lower pictures one of the 1111 blocks seems ok while the other has mutated to 101101 where the adjacent 0s have swapped in. In both cases bits are swapped partially in order.



Slight misalignments show in a kind of meta-stable behavior or glitches. Adjust the timing until they disappear.

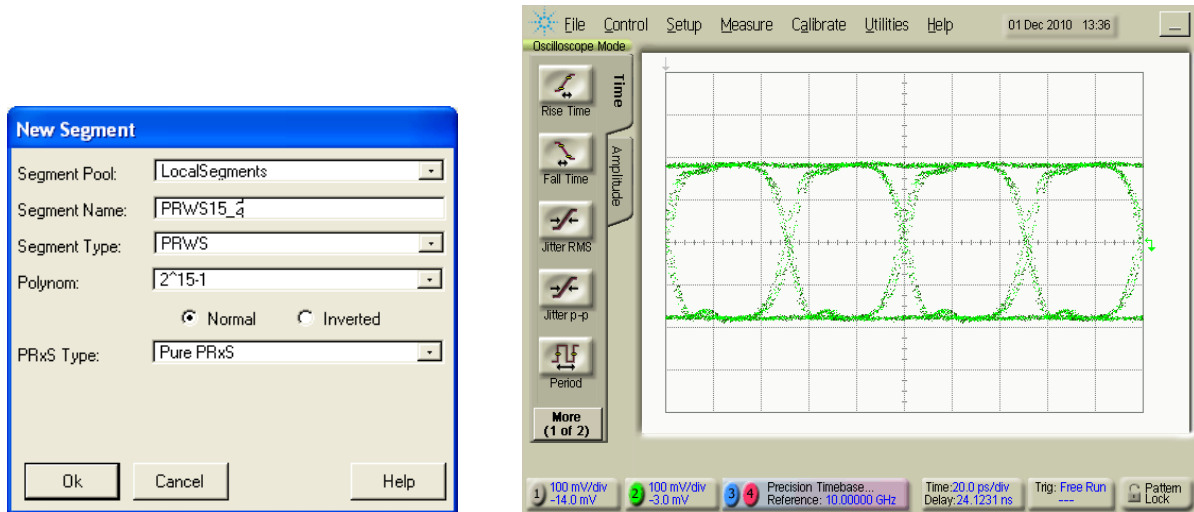
If no stable wave form can be achieved, move the CLK slider in ParBERT as described above and retry.

At most frequencies you will find a left and right border for each slider where you observe the bits getting narrower or find glitches. Set the slider in the middle between these points.

Done! Don't forget to press **Update Calibration Data at current AUX CLK IN frequency** to store the alignment permanently.

Getting Started Guide N4876A: ParBERT 81250 Setup (Version 1.0)

Now you can set up a PRWS or other data pattern for your tests. A PRWS $2^{15}-1$ is multiplexed to a PRBS $2^{15}-1$ due to the nature of the PRBS and PRWS data sequences.



For the picture above the oscilloscope precision time base was connected to the clock output of the N4876A module. The trigger was set to Clock Generator with a Freq. Multiplier of 1/32.

4.3 Contact address

Email: SUPPORT,BVS-PDGA (A-Germany,exgen1)

4.4 Document change log

Date and Revision	Description
Version 1.0 Dec 2010	Initial release