



Agilent E2928A Windows and Dialog Boxes

User Interface Reference



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The Main Window

The main window is always visible or iconified while the application is running. It contains several menus accessible from the menubar and several groups of icon buttons. Which menus are enabled and which button groups are visible in the main window depends on which hardware and software components are licensed.

- Menus** The items of the different menus give access to all the features of this application and its components.
- *File menu.* As with many applications you can select file handling actions from the File menu.
 - *Setup menu.* All settings concerning the testcard type and connection are made in the Setup menu.
 - *Exerciser menu.* If the PCI Exerciser is licensed with your testcard, you find all its settings and functions in the Exerciser menu.
 - *Analyzer menu.* If the PCI Analyzer is licensed with your testcard, you find all its settings and functions in the Analyzer menu.
 - *Performance menu.* If the Performance Optimizer is licensed with your testcard, you find all its settings and functions in the Performance menu.
 - *Run menu.* To control the specified test, use the items of the Run menu.
 - *Windows menu.* If you need to open the Command Line Interface window or close all windows and dialog boxes, you can do so in the Windows menu.

- Icon Button Groups** The main window contains a row of icon buttons, that are grouped together. Some of them might not be visible unless the respective hardware or software component is licensed.
- The Show Test Setup button far to the left with the globe icon is always visible. Clicking on it opens the Test Setup dialog box.
 - The File button group is located next to the Show Test Setup button and is always visible, too.

- The component-specific groups are labeled Exerciser, Analyzer and Performance. They are only visible if the respective component is licensed. The Performance button group appears disabled unless the capture mode “Performance” is selected.
- Far to the right you find the Run group. It appears if any of the Exerciser, Analyzer, or Performance group is visible.

All groups contain a number of icon buttons. The function of each button is explained in the sections where the menus are described. Every group also contains a status text field giving information about the current status of the respective component.

Status Line In the status line at the bottom of the main window you will find information about the selected hardware and the current type of connection to the hardware including the port number, if applicable.



File Menu

The File menu provides access to all file handling actions. The possible options are:

- *New*. This selection starts a new session.
- *Load*. In order to load a previously saved session select this item. Then choose the session file (bst file) from the file dialog box.
- *Save*. Clicking this item will save the current session.
- *Save As*. If you want to save the current test session with a new name and/or location, select this item.
- *Save As Power Up Default*. This item will open the Save As Power Up Default dialog box.
- *Exit*. Selecting this item will close the application.

Save As Power Up Default Dialog Box

This dialog box is used to write the settings made during this session to the power up memory of the Agilent E2928A testcard. These power up settings will then determine the testcard's behavior after it is restarted.

The registers and properties that are saved when clicking the OK button are:

- Master block property register.
- Master attribute property register.
- Master generic properties.
- Target generic properties.
- Target decoder properties.
- Target attribute property register.
- Observer rule mask.
- Analyzer trace trigger mode.
- Analyzer trace trigger patterns.
- Static I/O pin types and outputs.
- CPU port configuration.
- The state of the two additional power up properties described below.

You can manually select two additional properties of the power up behavior:

- *Start Trace Memory at Power Up*. This option will start the trace memory directly after a reset of the testcard is made. With the data recorded in the trace memory the PCI bus traffic can be evaluated. Protocol rule violations and timing errors can be used to trigger the trace memory.
- *Restore only Fixed Bits at Power Up (recommended)*. On restart, this option causes only the fixed bits in the configuration space header to be restored from the power up memory. Fixed bits are the ones that BIOS has no access to. All other bits will be set by the BIOS in the configuration phase after a restart.

Setup Menu

The items of this menu are used to either setup, modify, or check the hardware and the connection, or to simply present the current test configuration.

- *Show Test Setup*. To see an overview of the test configuration open the Test Setup window with this item.
- *Testcard Configuration*. If you want to modify the current testcard configuration, select this item to open the Testcard Configuration dialog box.
- *Mode*. If you want to modify the testcard mode, select this item to open the Mode dialog box.
- *PCI Bus*. The PCI bus properties are found in the PCI Bus dialog box.
- *Check Connection*. This option sends a test message to the testcard on the selected port. In reply you get a message telling whether the testcard was found on this port or not. It also resynchronizes the baud rate of the connection to the testcard.
- *Check Hardware*. This option compares the software (GUI) version to the current firmware version on the Agilent E2928A testcard. In case of a version mismatch a hardware update is necessary.
- *Update Hardware*. If the firmware version on the testcard is different from the GUI version, a hardware update is necessary. Select this item to open the Update Hardware dialog box.
- *Options*. Within this item you can select two user interface options.
 - Auto Polling*. If this option is activated, the status field below the globe icon button is green if the connection to the testcard is OK, and the other status lines display status information.
 - Tooltips*. With this option you can activate or deactivate the tool tips. Tool tips are small yellow boxes briefly explaining the use of buttons and other window components when placing the cursor on them.

Test Setup Window

The Test Setup dialog box is reached either via the menu item Show Test Setup or by clicking the Show Test Setup button (with the globe icon) in the main window.

You see an overview of the current test configuration. Displayed are three rectangles representing the host (top left), the selected testcard (top right), and the system under test (bottom). The dark lines between these items indicate the connections.

- The Host** The host is your control PC on which the graphical user interface is running. The button label shows the currently selected connection type. If the control software is running on the system under test, you can control the Agilent E2928A testcard directly via the PCI bus. If you use a remote control PC, then you must connect to the testcard either via an RS232 or with the included Fast Host Interface card. In Offline/Demo mode the host is not connected to the testcard and the button is labeled OFFLINE. You can change the current setting in the Testcard Configuration dialog box by clicking the button.
- The Testcard** The rectangle representing the hardware testcard is titled with the selected card's name including its bus width and clock speed. It contains a button for the PCI Exerciser (if it is registered) and a button for the PCI Analyzer (if either the PCI Analyzer or the Performance Optimizer is enabled). Clicking these buttons will open the Exerciser Overview window and the Analyzer Overview window, respectively.
- The System** The system rectangle at the bottom resembles the system under test and its clock speed and bus width. Clicking its button opens the PCI Bus dialog box, where you can adjust the PCI bus settings.

Testcard Configuration Dialog Box

This dialog box is used to set up the testcard configuration. This includes the selection of the connection type and the port as well as some information about the Agilent E2928A testcard.

HW Config Menu If you want to register new hardware components for the testcard, open the Register Product Options dialog box from the HW Config menu.

Ports The type of connection between your control PC and the Agilent E2928A testcard can be selected with the five radio buttons to the left. The possible choices are:

- *PCI*. The control software is running on the test system, and the testcard is accessed directly via the PCI bus. The Bus/Slot text field displays the port number. To view a list of all connected devices click the *PCI Browse* button. This opens the PCI Selection List dialog box.
- *RS232*. Mark this option if you have connected the testcard to the serial port of the control PC with the included RS232 cable. Select the COM port and the baud rate with the two selection lists next to the radio button.
- *Parallel*. This option is supported by the Agilent E2925A testcard only.
- *Fast Host Interface*. The fastest—and therefore recommended—connection to your testcard is via the included Fast Host Interface card (using the bi-directional Centronics cable). Starting at port 0, switch through the possible port numbers until the testcard type information section of this dialog displays “Testcard Found On Port”.
- *Offline/Demo Mode*. Choose this option, if you want to simulate any of the available testcard types or if you temporarily want to disconnect from a testcard. In this mode no connection to a testcard is established.

- Testcard Information** This section displays information about the type of the currently selected testcard (if any was found on the selected port). The check boxes can only be toggled manually when you are in Offline/Demo mode.
- If a testcard was found on the selected port, its name, maximum bus width, and clock speed are displayed in the first line of this section. In Offline/Demo mode you see a selection list to choose which of the available testcards you want to simulate.
 - *Location.* The PCI bus under test and the testcard can either be located in the host PC where the GUI runs or they are controlled from a remote machine. In the latter case they cannot be controlled via the PCI bus.
 - *Support/Licensing.* Here you see which of the hardware and software components are enabled with your testcard. Grayed items are not supported with your testcard and cannot be licensed. The licensed components are checked. In Offline/Demo mode you can select any component.
- Scan Ports Button** The Scan Ports button scans all ports (PCI, serial, parallel, Fast Host) and displays a list of all found testcards in the Scan All Ports dialog box.
- Ping Button** The Ping button sends a test message to the testcard via the selected port. In reply a message window opens telling whether the testcard responded on that port or whether it could not be found (for example Offline/Demo mode selected). If a proper connection to the testcard is established, its LEDs flash.

PCI Selection List Dialog Box

This dialog box displays a list of all devices that are connected to the PCI bus of the host machine. If this host PC is also the system to be tested, the Agilent E2928A testcard is shown here, too, and it can be controlled directly via the PCI bus.

If you want to search for testcards on all ports including serial and parallel ports, open the Scan All Ports dialog box by clicking the *Scan Ports* button instead of the *PCI Browse* button in the Testcard Configuration dialog box.

Scan All Ports Dialog Box

The Scan All Ports dialog box displays a list of all PCI Analyzer & Exerciser testcards found on any port. In contrast to the PCI Selection List dialog box, it does not show other devices than Agilent E2920 testcards. In addition, it searches not only all PCI ports, but also all serial and parallel ports and the Fast Host Interface if available.

You can select a port/testcard connection by double-clicking it in the list.

Register Product Options Dialog Box

In case you want to add new hardware or software components to your existing configuration, you need to register them in this dialog box. Pick the new component from the selection list and enter the license key that was supplied by your vendor in the text field below. After clicking *OK* this component's GUI functions are enabled.

Mode Dialog Box

The Mode dialog box is used to specify the behavior of the PCI testcard in various situations:

- *“Target Tab” on page 16*
Used to specify the behavior of the target on the PCI testcard. Available only if the PCI Exerciser option has been installed.
- *“Analyzer Tab” on page 16*
Used to control the PCI Analyzer's data capture.

Target Tab

This tab is only available if the PCI Exerciser option has been installed. The presented options define the behavior of the target on the PCI testcard.

- Respect values in config space set by BIOS** Unselect this option if you do not want BIOS to control the configuration space header. This is necessary if these values are programmed by the control software.
- New transaction restarts attributes** This option will cause the target attributes to be restarted with a new transaction claimed by a decoder.

Analyzer Tab

The Analyzer tab in the Mode dialog box is used to control the PCI Analyzer's data capture.

- Trace Memory** Choose a small trace memory size in order to minimize uploading time. Reducing the size has no effect on the amount of data actually captured on the testcard.
- Capture (Trigger & Storage Qualifier)** Choose from the following modes for the trigger and storage qualifier to control the data capture:
- *Standard*
In the standard mode, the trace memory trigger and storage qualifier are directly controlled by pattern terms. Pattern terms are programmable pattern recognizers. They are set up in the Capture dialog box.
 - *Sequencer*
In the sequencer mode, the trigger sequencer controls the trace memory trigger and storage qualifier. The sequencer detects sequences of patterns. The sequencer is set up in the Trigger Sequencer dialog box.
 - *Performance*
This mode is available only if the Performance Optimizer option has been installed. Choose this mode to enable the Performance Optimizer.
In the performance mode, the trace memory trigger and storage qualifier are automatically controlled as required for measuring performance.

PCI Bus Dialog Box

This dialog box is used to check the PCI bus properties. These properties are:

- The bus clock speed
- The bus bit width, either 32 bit or 64 bit

If you are in Offline/Demo mode, you can modify these properties.

Update Hardware Dialog Box

After a software update, a version conflict with the onboard firmware can occur. In this case, the hardware must be updated.

When connecting to the testcard and during program start, the hardware check is performed automatically. However, you can also start the check with the *Check Hardware* item in the *Setup* menu. This can be necessary, for example, when switching to another testcard without restarting the software.

Select the control interface to be used and enter the correct port number.

After pressing *OK* a message box pops up telling you, whether the update was successful.

Exerciser Menu

With the items of this menu you can access all windows and dialog boxes concerning the PCI Exerciser.

The *Exerciser* menu and the *Exerciser* icon button group are available only if the PCI Exerciser option has been installed.

Icon Button Group The four icon buttons in the main window provide an additional way to access the most frequently used windows of the Exerciser. Which window each button opens is listed below together with the menu items.

Menu Items Selecting any of the menu items, except for the last two, opens the respective window or dialog box.

- *Show Exerciser Overview*. Selecting this item opens the Exerciser Overview window.
- *Config Space*. Selecting this item opens the Configuration Space window.
- *Master Transactions*. Selecting this item opens the Master Transactions window. Identical to the Master Transactions icon button.
- *Master Attributes*. Selecting this item opens the Master Attributes window.
- *Master Cond. Start*. Selecting this item opens the Master Conditional Start dialog box.
- *Target Decode*. Selecting this item opens the Target Decode window. Identical to the Target Decode icon button.
- *Target Attributes*. Selecting this item opens the Target Attributes window. Identical to the Target Attributes icon button.
- *Data Memory*. Selecting this item opens the Data Memory Editor window. Identical to the Data Memory icon button.
- *Interrupt Generation*. Selecting this item opens the Interrupt Generator window.

- *Run*. Under this item you find three run options. With these options you can either initialize the target and subsequently start the master or you can perform these two actions separately.
- *Stop Master*. This item will stop the master.
Clicking the stop button in the main window will stop the master, too, and all other running components.

Exerciser Overview Window

This window gives an overview of all the components belonging to the PCI Exerciser. The black lines between the different components indicate how they interact. This window can also be used for navigation. Simply clicking on the buttons will open the respective windows and dialog boxes.

PCI Bus Down at the bottom you see a long button representing the PCI bus under test. This button is also displaying the clock speed and bus width. Clicking on it will open the PCI Bus dialog box.

Master The Agilent E2928A testcard uses a state machine to act as a master (or transaction initiator) on the PCI bus. This statemachine itself is not editable. It is generated when compiling a master transaction script. Additionally it is controlled by master attributes and conditional start parameters, if applicable.

- *Master Transactions*. To specify the master transactions use the Master Transactions window.
- *M. Attributes*. To define master attributes use the Master Attributes window.
- *M. Cond. Start*. To set up parameters for a conditional start of the master use the Master Conditional Start dialog box.

- Target** The Agilent E2928A testcard can also behave as a PCI target. For this purpose a configuration space header and a set of target decoders are provided. Furthermore a target statemachine is generated from target attributes during initialization of the target. This statemachine defines the target behavior according to target attributes and is not editable directly.
- *Config Space*. To inspect or modify the configuration space header open the Configuration Space window.
 - *Target Decode*. If you want to modify the target decoder settings open the Target Decode window.
 - *T. Attributes*. To specify attributes to control the target behavior open the Target Attributes window.
- Data Memory** Both master and target use the same data memory to store data that is sent and/or received over the PCI bus. To edit this data open the Data Memory Editor window.
- Interrupt Generator** Besides the master and target functionality the Agilent E2928A testcard also allows you to generate PCI interrupts. To do this open the Interrupt Generator window.
- Setup Menu** Some more options to change the target behavior are provided in the Target tab in the Mode dialog box accessible by selecting the item *Mode* in the *Setup* menu.

Configuration Space Window

This window displays the configuration space header of the target.

On the Agilent E2928A testcard it is implemented with two equally sized memories. One contains the actual value of the configuration space header, the other holds a mask, defining which bits are fixed (the value 0 or 1 is displayed) and which are changeable by the BIOS or another program routine (indicated by an x).

Basically any bit of the configuration space header is freely programmable. Nevertheless, a fair amount of knowledge is needed to make settings that are compliant to the PCI specification. The values in the Base Address register entries of the configuration space header can be modified by changing values in the Target Decode window.

- Table Contents** The lines of the table represent the different registers of the configuration space header. Some lines contain several registers, indicated by a vertical line separator in the *Register* column. The columns of the table show from left to right:
- The hexadecimal byte address relative to the first byte of the configuration space.
 - *Register*. The name(s) of the register(s) according to the PCI specification.
 - *Contents [BIOS view]*. The current values in the register(s) as shown to the BIOS.
 - *Capabilities [x=changeable]*. These fields contain a representation of the registers' programming mask.
 - 0 or 1 means: This bit is fixed (read-only) and its value cannot be changed by the BIOS or an other routine.
 - x means: This bit is programmable by the BIOS as well as by other routines.
- Read from card** If you click this button, the current settings in the configuration space header on the Agilent E2928A testcard—including the mask—are loaded into this window.
- Write to card** If you click this button, the current contents of this window will be written to the configuration space header and the mask memory of the Agilent E2928A testcard.
- If a bit has got a fixed value in the right column, a differing value in the *Contents* column will be ignored.
- Match Indicator** In the bottom line of this window you see the match indicator. If the indicator shows a red color, the current settings on the testcard and the contents of this window do not match.
- To load the current testcard settings into the GUI, click the *Read from card* button. To write the edited settings onto the testcard, click the *Write to card* button. After that, the match indicator is colored green again.
- Both actions will also update the Target Decode window. Furthermore, they will set the Target Decode window's match indicator to red, because no guarantee can be given to the correctness of settings that are not related to the configuration space.

When changes in the *Contents* column are made to bits that are set fixed in the right column, these changes will be ignored. In this case the match indicator keeps its color. If it was green, this may confuse, because the entries in the two fields do not match anymore. Click the *Read from card* button to reload the correct values.

Setup Menu Some more options to change the target behavior are provided in the Target tab in the Mode dialog box accessible by selecting the item *Mode* in the *Setup* menu.

Transactions and Attributes Window

All three windows *Master Transaction Window*, *Master Attributes Window*, and *Target Attributes Window* look identical except for the window title.

They provide the same features as other simple text editors.

Bus Transaction Language All transaction and attribute definitions are written in Bus Transaction Language (BTL). For information about the syntax please refer to the *Agilent E2928A Opt. 300 PCI Exerciser User's Guide*.

Master Transactions The master transactions BTL scripts can contain the following commands:

- `m_block()`. This command transfers a block of data by driving an address phase and a number of data phases onto the bus.
With the optional parameter `attrpage` a protocol attribute page from the Master Attributes Window can be used. This provides more options for the control of the protocol behavior.
- `m_xact()`. This command starts a transaction by driving an address phase onto the bus, using the specified bus address and PCI bus command, for example `mem_write`. The transaction must be completed with a `m_last()` command. Optionally, there can be any number of `m_data()` commands before the `m_last()` command.
- `m_data()`. This command follows `m_xact()` and generates a data phase that is not the last or only data phase of a burst.

- `m_last()`. This command must be used for the last or only data phase of a burst. It completes the transaction, that was initiated by `m_xact()`.
- `m_xact64()`. This is the same command as `m_xact()`, but issues a dual address (64-bit) command.
- `m_data64()`. This is the same command as `m_data()`, but requests a 64-bit transfer.
- `m_last64()`. This is the same command as `m_last()`, but requests a 64-bit transfer.

Master Attributes The master attributes BTL script defines attribute pages that can be employed within the data block transfer `m_block()`. They can be used to cause delays, waits, release REQ#, parity and system errors.

- `m_attr()`. Every attribute page contains one or more `m_attr()` commands. Each of these commands contains the attributes that are assigned to one address or data phase in the block transfer.

The attribute commands are worked through sequentially. When the end of the attribute page is reached, it starts again with the first attribute command. This continues until the block transfer is completed.

Target Attributes The target attributes BTL script specifies the protocol behavior during target transactions. These attributes can be used to cause waits, target terminations, parity and system errors, etc.

- `t_attr()`. The command for defining an attribute line.

The attribute lines are worked through sequentially. When the end of the script is reached, it starts again with the first line.

NOTE If you want the target attributes to be restarted with every new transaction, check this option in the Target tab of the Mode dialog box accessible via the *Setup* menu in the main window.

File Menu In this menu you find the items needed to create a new script file (extension `bcy`) containing default transactions/attributes, to load a previously saved file, to save the current file, to save the current file with a new name, or to close the window.

Edit Menu This menu provides the functions Cut, Copy, and Paste. The shortcuts for these are Ctrl-X, Ctrl-C, and Ctrl-V respectively.

Search Menu With the items located here you can look for specific strings in your editor window. The search will be started at the current cursor position. Selecting *Find* first opens a dialog box to enter the search string. *Find Next* searches for the next occurrence of the previously entered string.

Master Conditional Start Dialog Box

With this dialog box you can specify a conditional start for the master transactions.

The options are:

- *Immediate*. This is the default option. The master transactions start immediately after the master is started.
- *Pattern*. With this option the transactions are not started until the specified pattern occurs on the PCI bus (or on the external trigger input ports if specified). To create the pattern expression click the Edit button. This opens the Pattern Editor dialog box.

After you finished specifying the start condition it appears in the text field. When this boolean expression is true, it means the pattern is found.

If you chose to set a pattern, you can define an additional delay before the transactions start. The possible selections here are:

- *No*. Select this option, if you want the transactions to be started immediately after the pattern was detected on the PCI bus.
- *Clock delay*. Select this option if you want the master to wait a specific delay after the pattern occurred on the bus. Enter the number of clock cycles in the text field. The valid value range is from 0 to 4294967295 (32 bit).

Target Decode Window

This window is used to view and edit the setup of the target decoders. These decoders are needed for the target to react to PCI transactions that are driven onto the bus by masters. A decoder claims a transaction if the address on the bus is within its address range.

Decoder Types The Agilent E2928A testcard provides the following decoders:

- 6 Standard Decoders responsible for decoding memory and I/O cycles. These decoders are titled *BAR 0* through *BAR 5*, which corresponds to the Base Address Registers 0 through 5 in the configuration space header. To decode 64-bit addresses (using dual address cycles, DAC), two standard decoders are used, titled for example *BAR 0-LO* and *BAR 0-HI*.
- A Configuration Decoder for configuration cycles.
- An Expansion ROM Decoder for accesses to the expansion ROM. This decoder can be used, for example, to test whether BIOS correctly accesses this memory, or to test power-on-self-tests or interrupt service routines stored in this memory.

Decoder Settings For the decoders the following settings are available. To change a setting, click the respective field in the table. Either a check box, a selection list or an editable text field turns up, allowing you to do the modification. If a field is gray, it cannot be modified.

- *Enable*. Enables or disables a decoder.
- *Speed*. Determines the decode speed. The options *fast* decode and *pfast* require at least 1 MB address range. Furthermore only the bus commands Memory Read, Memory Write, Memory Read Line, and Memory Write and Invalidate are accepted. The decoder is faster because less bits need to be checked when doing these restrictions on the address bits and command bits.

The option *fast* does not perform range checking as with other speeds. Bursts to a fast target decoder that overrun the upper bound of the decoded address range will not cause a target abort as they should.

The option *pfast* does not accept bursts. Every transaction is terminated with disconnect-B after the first data phase.

- *Resource*. Determines the resource to which the decoder is connected. Possible choices are:
 - *data, comp*. Data memory and compare unit, using the target attributes.
 - *datadef, compdef*. Data memory and compare unit, using default attributes.
 - *regfile*. The register file, meaning the configuration space, public and private section.
 - *cpuport0, cpuport1*. The CPU ports 0 and 1.
 - *exprom*. The expansion ROM.
 - *statio*. The static I/O port.

NOTE If master and target of the Agilent E2928A testcard are set up to transfer data between each other, the target has no access to the data memory. If the master writes to the target, data memory will remain unchanged. If the master reads from the target, it will receive dummy data.

- *Res. Base*. This specifies the start address of the data resource in the testcard's data memory.
- *Res. Size*. This value defines the size of the allocated resource memory.

If this size is smaller than the size of the decoded address range, then the resource contents will be overwritten/sent multiple times to fill the decoder address range.
- *Base Addr., Size*. Determine the address range of the decoder. They correspond to the base address registers in the configuration space.

If the *Base Addr.* row is gray, these registers were set by the BIOS during power up. This option is set by default and prevents these fields from being edited manually. You can change this behavior in the Target tab of the Mode dialog box accessible from the Setup menu.

CAUTION

If any changes to the address ranges were done manually, ensure that multiple targets do not decode overlapping address ranges. Multiple devices decoding overlapping address ranges may result in hardware damage.

- *Location, Prefetchable*. These parameters correspond to the last four bits in the BARs in the configuration space header and define where the BIOS must place the address range. *Prefetchable* is not available for the location in static I/O range.

- *Behavior*. This row displays the currently specified decoder behavior. The default is *normal*. Entries in the Configuration Space window, that are not compliant to the PCI specification, cause *custom* to be displayed here. The behavior can also be programmed using C program calls.
- *Default*. Resets all settings of a decoder to default values (not necessarily the settings currently stored on the testcard).

Read from card Button Click this button to load the current settings from the Agilent E2928A testcard into this window. This will cause the match indicator to turn green.

Write to card Button Click this button to write the current window contents to the Agilent E2928A testcard. If the entries are successfully written to the testcard, the match indicator turns green. BIOS relevant entries cannot be stored with this button. They can only be saved as power up settings for the next session.

Write PU to card Button Click this button if you want to save the current window contents as default values for the next power up (PU). If you have not already clicked the *Write to card* button with these settings, the match indicator now shows a yellow color.

Match Indicator In the bottom line of this window you see the match indicator. The indicator shows one of the following colors:

- Red. The current settings on the testcard and the contents of this window do not match.
- Yellow. The power up settings on the testcard match the window contents, but not the settings currently in use on the testcard.
- Green. The current settings on the testcard and the window contents are identical, but not necessarily the PU settings for the next power up.

Setup Menu Some more options to change the target behavior are provided in the Target tab in the Mode dialog box accessible by selecting the item *Mode* in the *Setup* menu.

Data Memory Editor Window

The data memory on the Agilent E2928A testcard is used by both the master and the target, both as data source and as a destination for received data. It has a size of 524 kB data.

If master and target of the Agilent E2928A testcard are set up to transfer data between each other, the target has no access to the data memory. If the master writes to the target, data memory will remain unchanged. If the master reads from the target, it will receive dummy data.

Table Contents The two columns of the table contain:

- *Address*. Displayed is the lowest byte address of the bytes shown in the data column. The addresses are relative to the first byte of the data memory.
- *Data*. This column contains the data located at the corresponding address. The value in brackets in the column title tells the amount of data per row.

Icon Buttons This window provides icon buttons that have the same functionality as the respective menu items.

- **Select View Of Data** button. If you want to change the data display mode, click this button to open the Select View Of Data dialog box.
- **Zero** button. Clicking this button will fill the complete data memory with zeros (0). This can take several minutes to finish.
- **Refresh Data** button. Clicking this button reloads the data from the data memory on the testcard into this window.
- **Print** button. Clicking this button opens a print dialog. Printed is always the currently visible part of the table only, not the complete data memory.

If you want to print more than the visible range, save the data to a file, open it with any word processor and print it from there.

- **Goto** text field. With this feature you can directly go to a specific address without using the scroll bar.

Select View Of Data Dialog Box

This dialog box is used to modify the view of the presented data in the Data Memory Editor window.

You can choose between two different ways available to display the data.

PCI view This view displays the data starting from the most significant bit (msb) down to the least significant bit (lsb). The data is grouped in words (four hex values) separated by underscores.

- *AD[31:0]*. Click this option to show 32 bit per row.
- *AD[63:0]*. Click this option to show 64 bit per row.

Data view Select this view if you want to display the data grouped by the data type. There are several additional choices to modify the view to match your needs.

- *Big-Endian*. If you click this radio button, the byte with the lowest address in this row will be displayed first.
- *Little-Endian*. If you click this radio button, the byte with the highest address in this row will be displayed first.
- *View Data As*. Use this selection list to determine the type the data is to be displayed as: one byte, one word, one double-word, or one quad-word.
- *Items per Row*. Use this selection list to determine the amount of data displayed per row. The available options depend on the selected data type, the maximum amount per row is 64 bit or one quad-word. The different items in a row are separated by a space.

Interrupt Generator Window

With the use of this window you can directly assert and deassert any combination of the PCI interrupts

- INTA# (default)
- INTB#
- INTC#
- INTD#

To assert certain interrupts, select the interrupts and click the *Assert* button. To deassert certain interrupts again, select them and click the *Deassert* button.

The reaction of your system under test to asserted interrupts strongly depends on its configuration.

NOTE Asserting interrupts can cause your system under test to crash. If you are running the control software on the same machine, all unsaved data will be lost.

Analyzer Menu

With the items of this menu you can access all dialog boxes and windows concerning the PCI Analyzer.

Icon Button Group The four icon buttons in the main window provide an additional way to access the most frequently used windows of the Analyzer. Which window each button opens is listed below together with the menu items.

- Menu Items**
- *Show Analyzer Overview*. Selecting this item opens the Analyzer Overview window.
 - *Timing Check*. Selecting this item opens the Timing Check window.
 - *Protocol Check*. Selecting this item opens the Protocol Check window.
 - *Real Time Counter Setup*. Selecting this item opens the Real Time Measurement Setup dialog box.
 - *Real Time Counter Result*. Selecting this item opens the Real Time Counter Result window.
 - *Capture*. Selecting this item opens the Capture dialog box. Identical to the Capture icon button.
 - *Waveform Viewer*. Selecting this item opens the Waveform Viewer window. Identical to the Waveform Lister icon button.
 - *Bus Cycle Lister*. Selecting this item opens the Bus Cycle Lister window. Identical to the Bus Cycle Lister icon button.
 - *Transaction Lister*. Selecting this item opens the Transaction Lister window. Identical to the Transaction Lister icon button.
 - *Run*. Choosing the run item starts the PCI Analyzer but none of the other components.
 - *Stop*. Choosing the stop item stops the PCI Analyzer.

Analyzer Overview Window

This window gives an overview of the Analyzer's components and how they interact. It can also be used for navigation. Simply clicking on the buttons will open the respective windows and dialog boxes.

PCI Bus Down at the bottom you see a long button representing the PCI bus under test. This button is also displaying the clock speed and bus width. Clicking on it will open the PCI Bus dialog box.

Timing Check The timing checker works on the PCI bus and is used to detect timing errors. A timing error occurs when a signal changes while the system requires a stable signal. Click the button to open the Timing Check window.

Protocol Check The protocol observer evaluates the bus states in real time and can detect violations of 53 different PCI protocol rules. Click this button to open the Protocol Check window.

Capture Capturing means to record PCI signals, bus states and other information in the trace memory. This is controlled by the trigger qualifier and the storage qualifier. You can modify these qualifiers in the Capture dialog box that opens when clicking this button.

Transaction, Bus Cycle, Waveform These three buttons open the Transaction Lister window, the Bus Cycle Lister window, and the Waveform Viewer window, respectively.

These windows provide the different views of the data stored in the trace memory.

Performance Buttons The buttons labeled *Perf. Setup*, *Perf. Chart*, *Perf. Report*, and *Bus Activity* are visible only if the Performance Optimizer is installed, and are enabled only if the capture mode is set to "Performance". Clicking them will open the respective window, all explained in detail in the section "*Performance Menu*" on page 51.

Setup Menu To change the capture mode go to the Analyzer tab in the Mode dialog box by selecting the item *Mode* in the *Setup* menu.

Timing Check Window

The timing checker reports an error when a PCI signal changes at a moment at which the PCI system requires a stable signal.

Status The *Status* group displays the accumulated number of signals that violated the timing requirements.

NOTE The timing checker is running permanently on the Agilent E2928A testcard. The information presented in this window will be incorrect if errors occurred after the last update of the list.

To update the list and the total number of violated signals click the *Read from card* button.

To reset the list (no more errors) and read again from the testcard click the *Clear* button.

Enable/Disable To avoid that errors on signals interfere with your test you can disable them by clicking on the fields in the *Mask* column. They will still be displayed (now yellow instead of red) but will be ignored. To enable a disabled signal click on the *Mask* field again.

To enable or disable all signals select the respective item from the *Signal* menu.

Setup and Hold Time At the bottom of the window the currently specified setup time and hold time are displayed together with the bus speed. If these settings match the PCI specification this is indicated by a label (*PCI spec*).

To change these settings open the Timing Parameters dialog box with the *Edit* button.

Timing Parameters Dialog Box

This dialog box is used to specify the setup and hold time during which signals are required to be stable according to the PCI specification.

Adjustment Two choices are offered for the adjustment radio buttons:

- *Auto (PCI Specification)*. This option will set the setup and hold time according to the PCI specification defaults. These values depend on the current bus speed.
- *Manual*. With this option you can change the setup and hold time manually. The valid value ranges depend on the current bus speed.

Setup and Hold Time If you selected to adjust manually, the text fields containing the setup and hold time are editable. Now you can set the values within the valid ranges depending on the current bus speed.

The bus speed is displayed for information only and cannot be modified here.

Protocol Check Window

The Agilent E2928A testcard checks the PCI bus for protocol violations in real time. Use this window to view the current protocol check results.

The table lists all 53 PCI protocol rules that the Agilent E2928A testcard checks for. To get a brief description of a rule double-click the name field. The *Mask* fields show whether a rule is enabled or disabled, while the *Status* fields show their status, either *OK* or *ERROR*.

Status In the *Status* section the total number of violated rules is displayed as well as the name of the rule that was violated first.

NOTE The protocol checker is running permanently on the Agilent E2928A testcard. The information presented in this window will be incorrect if errors occurred after the last update of this window.

To update the list and the total number of violated rules click the *Read from card* button.

To reset the list (no more errors) and read again from the testcard click the *Clear* button.

NOTE If a reported protocol error cannot be cleared with the *Clear* button, this indicates that the error still persists on the bus.

Enable/Disable If you want to trigger on a particular selection of protocol rules, you can enable and disable them by clicking on the fields in the *Mask* column. Disabled errors will not be reported in the berr signal. They will still be displayed (now yellow instead of red) but will be ignored. To enable a disabled signal click on the *Mask* field again.

To enable or disable all signals select the respective item from the *Signal* menu.

Real Time Measurement Setup Dialog Box

This dialog box allows you to set up two performance measures to be displayed in the Real Time Counter Result window. You can either select one of the predefined performance measures or program the performance counters manually to count certain events on the PCI bus.

There are four programmable counters available (A, B, C, and D) and one reference counter, which counts bus cycles. These programmable counters can be used to calculate the two performance measures, two counters for each measure.

Counter Display Set up the real-time counters to be displayed as

- *Relative Values (Ratios)*

This is the default. The measures shown in the Real Time Counter Result window are displayed as the ratios of the values A/B and C/D. Always use this display option when using one of the predefined measures.

- *Absolute Values (Event Count)*

This option is especially useful when programming the counters manually. The Real Time Counter Result window will show the absolute values of all four programmable counters, counting the bus events as programmed. Additionally, a reference counter is displayed that counts the total number of clock cycles to give an idea of how frequently the events occur relative to the number of bus cycles.

Settings for Measures For setting up the measures to be displayed, select *Measure 1* or *Measure 2* from the *Setting for* selection list. For each measure you can either choose one of the *Predefined Measures* or select *Advanced Setup* to program the counters manually.

- *Predefined Measures*

From the selection list you can choose one of the standardized predefined measures *PCI Throughput*, *PCI Utilization*, *PCI Efficiency*, and *Retry Rate*.

- *Advanced Setup*

For more advanced measurements you can program the counters manually to count certain events on the bus.

Edit Sequencer. Clicking this button opens the Performance Counter Sequencer dialog box where you can program the counters.

Below the *Edit Sequencer* button you can enter a name for the measure to be displayed (if you have selected *Relative Values (Ratios)*), or names for the counters to be displayed (if you have selected *Absolute Values (Event Count)*).

Ctr A counts Byte Enable. Checking this option directs the first counter of the selected measure to count the amount of transferred data (not only data phases). If the programmed event is detected, the counter will be incremented by the number of byte enables currently set.

Accumulative. Check this option to accumulate the measured values over time, no matter whether you have selected *Predefined Measures* or *Advanced Setup*. Otherwise, each new measurement time interval will reset the measured values.

Performance Counter Sequencer Dialog Box

This dialog box allows you to program the performance counter manually in order to set up more advanced performance measures. The counters can count signals and bus states or sequences of signals and bus states.

The counters are controlled by a sequencer description table (*Transitions*) and programmable *Patterns*. The patterns define logical expressions used for counter and transaction conditions in the sequencer.

Transitions The sequencer description table consists of rows describing certain states and transitions like in a state diagram. Usually there will be more than one row for each state describing different transitions to other states. A maximum of 64 transitions can be programmed for up to four states.

TIP You can enlarge the dialog box to see more rows and columns at the same time.

Each row holds the following information:

- *Cur State*

The identity number of the state described by the row. There may be more than one row for one state.

- *Next State*

The identity number of the state to be taken when the transaction condition turns true.

- *XAct Cond.*

If this transaction condition turns true, the state specified by *Next State* is taken. All transaction conditions belonging to one *Cur State* must be mutually exclusive.

- *CtrA Cond.*

The condition describing the events to be counted by counter A.

- *CtrB Cond.*

The condition describing the events to be counted by counter B.

- *CtrC Cond.*

Counter C is a feedback counter allowing to count a sequence of events.

If this condition is true the feedback counter is decremented by one. If it is down to zero, the terminal count signal (*tc*) is set, which can be included in the counter A/B or transaction conditions.

- *Load C Cond.*

This condition defines when the loop variable is reset to the *preload value* specified below the table.

CAUTION

The *Clear* button clears the complete sequencer description table. All input will be lost immediately.

Patterns

In the *Patterns* group you can set up the patterns used to build the conditions in the sequencer description table. Patterns 4 to 7 are for performance measure 1, patterns 8 to 11 for measure 2 (patterns 0 to 3 are used by the trigger sequencer).

To set up or modify a pattern, click the appropriate *Edit* button. This will open the Pattern Editor dialog box.

Real Time Counter Result Window

This window displays the results calculated by means of the performance counters. To set up the measurements go to the Real Time Measurement Setup dialog box via the *Setup* menu.

Result View Tabs

Two result views are available on the *Momentary* tab and on the *Time History* tab. You can toggle between both tabs while the measurement is running:

- *Momentary Tab.* Shows the results in a bar diagram. It always shows the results of the last measurement time interval. If *Accumulative* is checked in the setup, the accumulated results up to this time interval are displayed.
- *Time History Tab.* Shows the result history over time, which is especially useful to detect peaks.

If *Relative Values (Ratios)* is selected in the setup, both measures 1 and 2 are displayed in either result view. Otherwise, the results of the four programmable performance counters and the reference counter are displayed.

- Start and Stop** The *Start* and *Stop* buttons control the performance measurement exclusively. The performance measurement is not controlled by the general run/stop buttons in the main window.
- Update Rate** The *Update Rate* specifies the measurement time interval, this is, how often the result display is updated. While the counters permanently count all relevant events on the bus, the display is only updated each time the update rate has expired.
- You can select the update rate in the range of 1 to 60 seconds.
- Update No.** The *Update No.* shows the number of measurement time intervals since the measurement was started.
- Print Button** The Print button allows to print a snapshot of the currently displayed result view.
- Setup Menu** The *Setup* menu provides a shortcut to the Real Time Measurement Setup dialog box.

Capture Dialog Box

This dialog box has two tabs in which you can define the settings for the trace memory.

- *Trigger Tab.* The trigger defines when to start and stop the recording of the trace memory. To define a pattern for the trigger qualifier goto the Trigger tab.
- *Storage Tab.* Only available if the capture mode *Standard* is selected. To specify which of the bus cycles on the PCI bus to record in the trace memory go to the Storage tab.

NOTE This dialog box has two different appearances depending on which capture mode was selected in the Analyzer tab of the Mode dialog box. If you select the capture mode *Sequencer*, this dialog box is called Trigger Sequencer dialog box.

Trigger Tab

Use this tab to set the trigger qualifier. This qualifier then defines when to start and stop the recording of the capture.

- *Immediate*. This is the default option. The capture will be triggered immediately after the Analyzer starts running.
- *Pattern*. This option uses a pattern for the trigger qualifier to decide when to trigger the capture. The pattern is a boolean expression that is compared to the bus signals. When the specified condition turns true, the capture is triggered. To enter the pattern use the Pattern Editor that opens when clicking the *Edit* button.

If a pattern is used for the trigger, you also need to specify whether the capture should be triggered after the pattern.

- *Occurred Once*. The trigger fires after the first occurrence of the pattern.
- *Did not repeat within x cycles*. With this option you can trigger on the absence of a pattern during the specified number of bus cycles. This way you can implement a kind of “watchdog”.

Triggerpoint This slider defines the position of the triggerpoint in the trace memory.

- 0 percent means no pre-trigger bus traffic is kept in the trace memory.
- 100 percent means that only pre-trigger traffic is stored.

Storage Tab

With this tab you can define which bus cycles are captured in the trace memory and which are ignored. The options are:

- *All*. Activating this radio button causes all bus cycles to be captured in the trace memory.
- *Selected Transactions/States*. This option allows you to specify a boolean expression for the storage qualifier. Then only transactions matching this pattern will be stored. Enter the expression in the text field or open the Pattern Editor by clicking the *Edit* button.

If you decided for *Selected Transactions/States* you can furthermore suppress certain bus states. The two choices are:

- *Suppress Idle Cycles*. This option filters out all idle cycles.
- *Suppress Wait States*. This option causes that no wait states are stored.

Pattern Editor Dialog Box

This dialog box is used to specify patterns used for conditional expressions. You see a table with two columns for the signals and their value of interest.

If specifying the storage qualifier only four different signals appear in the list. The trigger qualifier, however, can be made sensitive to a wide range of signal and bus state values.

- Entering Values** The way of entering the values for the desired signals depends on their type.
- If the signal is a bit vector, for example the address and data bus signal *AD32*, you can enter the value directly into the value field. Possible formats are hexadecimal (entry ends with *\h*), decimal (*\d*) and binary (*\b*).
 - If the signal is a single bit, for example the protocol violation signal *berry*, clicking on the value field will display a selection list containing 0, 1, and x (don't care).
 - The signal is of any other type that can take several different values, as for example the bus state *b_state* or the transaction command *x_act*. When clicking the value field the Selection List dialog box opens to present the possible options.
- Clearing Values** To remove a single value from the selected pattern, select *DON'T CARE* (or *x* for bits). To reset all signals click the *Clear* button.
- Creating the Pattern** The boolean expression that makes up the pattern is generated when leaving this dialog box by clicking the *OK* button. It then appears in the pattern line in the window from where you opened this dialog box.

Selection List Dialog Box

This dialog box helps you to specify a pattern in the Pattern Editor window. More specifically, it opens only when selecting the values of signals that are neither single bits nor bit vectors.

Displayed are two lists that contain all the states that this signal can take. All the available but not selected states are found in the left list and the selected states are in the right list.

Click on a state that you want to move to the other list and use the respective arrow button to move it.

Trigger Sequencer Dialog Box

This dialog box is used to specify the sequencer that controls the trigger and storage qualifier depending on the occurrence of a sequence of patterns.

Sequencer Example To see an example click the *Example* button to the right. This example is also explained in the PCI Analyzer User's Guide.

Transitions This transition table contains the definitions for the transitions between the current sequencer state *Cur State* and its *Next State*. This includes the conditions for the transition *XAct Cond.* and the output conditions for the trigger and storage qualifier (*Trig Cond.* and *SQ Cond.*).

The feedback condition *CE Cond.* is used to decrement a loop variable that starts counting at the *preload value*. If this loop variable reaches zero the terminal count signal (*tc*) is set, which can be used as a variable in the other conditions.

The load condition *Load Cond.* defines when the loop variable is reset to the *preload value* specified below the transition table.

**CAUTION**

The *Clear* button clears all fields of the table and all input is lost.

Patterns You can specify up to four different signal patterns that can be used for the conditional transitions or outputs in the sequencer.

These patterns are boolean expressions that are set with the use of the Pattern Editor that opens when clicking the *Edit* button.

pt0 For the pattern 0 you can choose between editing a *Standard pattern term* and a *Transitional pattern term*. The latter returns TRUE for any signal that changes its state or value. Hence you can detect signal changes instead of signal states.

Triggerpoint This slider defines the position of the triggerpoint in the trace memory.

- 0 percent means no pre-trigger bus traffic is kept in the trace memory.
- 100 percent means that only pre-trigger traffic is stored.

NOTE This dialog box has two different appearances depending on which capture mode was selected in the Analyzer tab of the Mode dialog box. If you select the capture mode *Standard* or *Performance*, then this dialog box is called Capture dialog box.

Waveform Viewer Window

This window displays all signals stored in the trace memory in a waveform diagram. You can inspect the value of every signal at any point in the recorded capture. Two markers can be set in the timing diagram for easier navigation.

Signal List The left part of the diagram shows a list of all the displayed signals. For non-boolean signals the *Val(A)* column shows the value of this signal where marker A is set.

To rearrange the signals or to change the selection of displayed signals, open the Arrange Signals dialog box by selecting the *Arrange* item from the *Signals* menu.

Waveform Diagram The right part of the diagram shows the waveforms of the signals. Due to the large amount of data only a small section of the diagram can be shown at a time. Use the scroll bars to scroll through the diagram.

The values of the non-boolean signals are shown if the space is sufficient.

The text fields below the diagram show the first (left text field) and last (right text field) sample currently displayed. The selection list in-between is used to select the resolution. As an example, 5 sa/div means that there are 5 samples or clock cycles between two divisional marks in the top row of the diagram.

In the top row you can also see the markers A and B, and the triggerpoint T, if they are set in the currently displayed section.

The small white arrow buttons on both sides of the horizontal scroll bar are additional page increment/decrement buttons.

Vertical gray lines indicate gaps in the recorded data. This occurs if certain samples were filtered out by the storage qualifier during the capture. The storage qualifier is set in the Storage tab in the Capture dialog box.

Marker Positions Down to the left of the window you see three text fields. They contain the current positions of the two markers A and B and the distance between them. The unit *sa* stands for samples.

To modify them you can either use the small plus and minus buttons or enter the desired position manually in the text fields.

Slider Bar Down to the right there is a slider bar representing the complete range of samples stored in the trace memory. It shows the triggerpoint T (always located at sample 0) and the positions of the markers A and B, if they are set.

While the trigger T is always located at sample 0, you can drag the markers A and B to a new position.

Icon Buttons All functions provided by the icon buttons can also be called via the respective menu items (except for the Redraw button). They are listed from left to right and can be identified with the

- Run Analyzer. This button starts the Analyzer.
- Stop Analyzer. This button stops the Analyzer. This could be necessary if the trigger is not met at all or if the storage qualifier is limiting the captured data so that the trace memory is not filled within a reasonable time.
- Reload Trace Memory. This function reloads the waveforms from the memory.

- Goto Trigger. Clicking this button displays the signals around the trigger with the current resolution.
- Goto Marker A. Clicking this button displays the signals around marker A with the current resolution.
- Goto Marker B. Clicking this button displays the signals around marker B with the current resolution.
- Move Marker A into View. This button moves the marker A into the center of the current view.
- Move Marker B into View. This button moves the marker B into the center of the current view.
- View Range between Marker A and B. This button displays the range between the two markers if not too far apart.
- Move Marker B near to Marker A. This button sets marker B close to marker A. This means the distance then is 1 while the order of the markers is maintained as before.
- Zoom out. This button decrements the resolution of the view.
- Zoom in. This button increments the resolution of view.
- Cross Reference. Clicking the Cross Reference button will select the respective bus cycles in the range between the markers A and B in the Bus Cycle Lister and the Transaction Lister.
- Redraw. This button redraws the window.
- Print. This button opens a print dialog box in order to print the window.

Arrange Signals Dialog Box

This dialog box is used to rearrange the order of the signals in the Waveform Viewer window or to change the selection of the displayed signals.

Signal Lists The list to the left contains all the available signals that are not currently displayed in the waveform viewer.

The right list contains all the signals that are displayed in the waveform viewer.

- Arrow buttons** Use the left and right arrow buttons to move selected signals between the two signal lists.
- Use the up and down arrow buttons to move a selected signal in the right list one position up or down, respectively.
- Format** If a signal is selected that is not boolean, you can select the format in which the signal's value will be displayed in the waveform viewer. You can choose between displaying it as a decimal or hex number.

Bus Cycle Lister Window

This window presents the contents of the trace memory in terms of bus cycles. Each row represents one bus cycle and contains information as the cycle number, the duration, the bus states, the PCI commands, and the detected address and data signals.

Which bus cycles are stored in the trace memory is defined by the storage qualifier that is set in the Storage tab in the Capture dialog box.

- Icon Buttons** The first three icon buttons are used to run and stop the Analyzer, and to reload the trace memory, respectively.

With the Goto Triggerpoint button you can jump to the bus cycle numbered 0.

You can select a range of bus cycles by clicking on one and dragging the mouse over the desired range with the left mouse button held down. Clicking the Cross Reference button will then select the respective bus cycles in the Waveform Viewer and the Transaction Lister.

The Print button is used to print the data.

The *Goto* text field can be used to jump to a particular bus cycle number.

- Export to Text File** If you want to save the list of bus cycles as a text file, choose *Export to File* from the *File* menu. To save the currently selected range choose *Export selected Range*.

- Search Menu** With the items in the *Search* menu you can search for any string or for errors.

Transaction Lister Window

This window is used to display all the transactions that occurred on the PCI bus while the Analyzer was running and storing the capture. Because several bus cycles usually make up one transaction this view can be seen as a higher level of abstraction than the view of the Bus Cycle Lister.

The presented transactions give information about the number of the first bus cycle, the PCI command type, the first address, data information (if applicable), and the detected attributes including the occurred protocol errors.

Icon Buttons The first three icon buttons are used to run and stop the Analyzer, and to reload the trace memory, respectively.

With the Goto Triggerpoint button you can jump to the bus cycle numbered 0.

You can select a range of transactions by clicking on one and dragging the mouse over the desired range with the left mouse button held down. Clicking the Cross Reference button will then select the respective bus cycles in the Waveform Viewer and the Bus Cycle Lister.

The Print button is used to print the data.

The *Goto* text field can be used to jump to a particular transaction number.

Export to Text File If you want to save the list of transactions as a text file, choose *Export to File* from the *File* menu.

Search Menu With the items in the *Search* menu you can search for any string or for errors.

Performance Menu

The items of this menu provide access to the dialog boxes and windows concerning the Agilent E2972A Performance Optimizer.

The *Performance* menu is available only if the Performance Optimizer option has been installed. To activate the Performance Optimizer select *Performance* in the Analyzer tab of the Mode dialog box accessible from the Setup menu in the main window.

Icon Button Group The four icon buttons in the main window provide an additional way to access the most frequently used windows of the Performance Optimizer. Which window each button opens is listed below together with the menu items.

Menu Items The following list gives a brief overview of the use of the menu items.

- *Enable*. Selecting this item opens a message box telling you that you need to activate the Performance Optimizer before you can access any of its functions. This is done by selecting *Performance* in the Analyzer tab of the Mode dialog box. This dialog box automatically opens when clicking *OK* in the message box.
- *Show Analyzer Overview*. Selecting this item opens the Analyzer Overview window.
- *Performance Setup*. Selecting this item opens the Performance Setup window. This item is identical to the Performance Setup icon button.
- *Performance Charts*. If you want to see the results of the performance measurements presented in charts and diagrams select this item to open the Performance Charts window. Identical to the Performance Charts icon button.
- *Performance Report*. If you want to see the results of the performance measurements presented as a textual report select this item to open the Performance Report window. Identical to the Performance Report icon button.
- *Bus Activity Lister*. If you want to inspect the performance for particular bus cycles select this item to open the Bus Activity Lister window. Identical to the Bus Activity Lister icon button.

- *Run*. Selecting this item starts a performance measurement according to the settings in the performance setup. When finished, the results are loaded into the respective windows.
- *Stop*. Selecting this item stops a running performance measurement and loads the recorded data into the result windows. The latter is done in any case, even if no measurement was running.
- *Real Time Counter Setup*. Selecting this item opens the Real Time Measurement Setup dialog box.
- *Real Time Counter Result*. Selecting this item opens the Real Time Counter Result window.
- *About Performance*. Selecting this item opens a message box containing information about the Agilent E2972A Performance Optimizer.

Performance Setup Window

This window is used to set up measurements to evaluate and optimize the performance of the system under test.

Setup Tabs The performance measurement setup is done in the five tabs of this window:

- *Report*. To specify which information you want to have listed in the textual report use the Report tab.
- *Target Identification*. To evaluate particular targets specify their identification in the Target Identification tab.
- *Master Identification*. To evaluate particular masters specify their identification in the Master Identification tab.
- *Pair Select*. To evaluate the performance of a particular master target pair use the Pair Select tab.
- *Capture*. To specify conditions for the start and the end of the performance measurements use the Capture tab.

Icon Buttons This window also provides some icon buttons that have the same functionality as the respective menu items.

- **Run.** Clicking this button runs the Performance Optimizer. When the measurements are finished, the results are loaded into the GUI.
- **Stop.** Clicking this button stops running measurements and loads the results into the GUI.
- **Rescan.** Clicking this button recalculates the performance measurement results from the trace memory using the current setup and loads them into the GUI.
- **Print.** Clicking this button opens a print dialog box. Printed is always the current view of the Performance Setup window.

Report Tab

In this tab you can define which of the measurement results you want to have reported in the Performance Report window.

By default all parts of the report are displayed. If, however, some parts are not relevant for your measurements, you can omit them by unticking the respective check box.

Target Identification Tab

In this tab you can specify the target identification. This is used if you want to do performance measurements on one or more particular target devices. Every target is identified by the address range that it decodes. You can monitor up to ten different address ranges.

Table Contents Every row contains the identification of one target decoder. The fields of the columns contain:

- *Target Name.* In this field you can enter an arbitrary name for the target decoder. This name will then appear in the report and the graphical displays.
- *Base Address.* This is the base address of the target's decoder. Use \h to indicate hex values.
- *Size.* This is the size of the target decoder's address range. Use \h to indicate hex values.

- *Command*. This field can be used to restrict the performance measurements on *I/O* commands or memory commands. *None* means that no measurements are made on this target.

NOTE If you need to know the address range of a target device, open the Command Line Interface from the Window menu in the main window and enter the commands `cscan` and then `cscanprnt`.

Master Identification Tab

In this tab you can specify the master identification. This is used if you want to do performance measurements on one or more particular master devices. Every master is identified by its GNT# pin. You can monitor up to ten different masters.

In PCI systems every slot has its own REQ# and GNT# pin. If you want to monitor a particular master, you need to make the GNT# signal available for the Agilent E2928A testcard by connecting a wire to one of the card's external trigger input pins.

If you also want to run latency tests on a particular master, the REQ# line of this master needs to be connected to the card as well.

Table Contents Every row contains the identification of a master device. The fields of the columns contain:

- *Master Name*. In this field you can enter an arbitrary name for the master. This name will then appear in the report and the graphical displays.
- *GNT# Pin*. Enter the card's external trigger port, to which the master's GNT# pin is connected to. Zero (0) means not connected.
- *REQ# Pin*. Enter the card's external trigger port, to which the master's REQ# pin is connected to. Zero (0) means not connected.

If this pin is not connected, arbitration considerations and latency measurements cannot be done for this master.

Pair Select Tab

Use this tab if you want to monitor the traffic between a particular master target pair.

- *Master*. Select the master you want to observe from the selection list. This list contains “All masters” and the masters that you have specified in the Master Identification tab of this window.
- *Target*. Select the target you want to observe from the selection list. This list contains “All targets” and the targets that you have specified in the Target Identification tab of this window.
- *Command Type*. Select which command types are of interest in your observation. You can either monitor read commands, write commands, or both types.
- *Title*. Enter an arbitrary title that represents your master target pair. This title will then appear in the report and the graphical displays.

Capture Tab

This tab is used to specify a trigger for the start of the performance measurements. Furthermore you can define how long the measurements will run.

Trigger The trigger defines when the performance measurements start. The trigger condition uses a boolean expression to determine if a certain pattern occurs on the PCI bus. To edit the pattern click the *Edit* button. This opens the Trigger tab in the Capture dialog box.

End of Analysis With these radio buttons you can specify the length of the performance measurements. The possible options are:

- *Stop at end of Tracememory*. The complete trace memory will be filled with data before the performance results are calculated.
- *Stop after x samples*. With this option you can measure the performance on a certain number of samples. Note, that idle states are not counted as samples. Thus, this value does not tell the number of bus cycles during this measurement. The maximum number of samples allowed is 1,048,575.
- *Stop after access to address*. With this option you can let the test stop after a certain address was accessed. This address must be entered in hex format in the range from 0x00000000 to 0xffffffff. Additionally, you have to select the bus command that is supposed to access this address to stop the test.

Upload and Trace Memory Run Control Down at the bottom of the *Capture* tab the radio buttons for the *Upload and Tracememory Run Control* are located. You can select one of two options:

- *Single Run and Upload from Tracememory* (default).

With this option the performance test runs only once.

- *Repetitive Run and Upload*.

Select this option if you need a large amount of samples to gain more reliable measurement results. The statistical calculations are done on the accumulated values. Enter the number of test repetitions in the text field.

If the measurements should run too long, you can always manually terminate the tests. The results presented then are calculated on the completed test repetitions only.

NOTE If you store the waveform file after a repetitive test run, only the data of the most recent test will be stored. Later analysis of this file will possibly yield results other than the statistics on the complete set of tests.

Performance Charts Window

This window presents the results of the performance measurements in different charts and diagrams.

- Chart Tabs** The charts and diagrams of this window are provided on the following five tabs:
- *PCI Usage*. General PCI usage statistics are presented in the PCI Usage tab.
 - *Burst Usage*. The use of bursts in the examined traffic is displayed in the Burst Usage tab.
 - *Command*. The distribution of the different bus commands in the examined traffic is shown in the Command tab.
 - *Latency*. Information on the different types of latencies that might occur on the bus is found in the Latency tab.
 - *Full Trans Clocks*. Information on the distribution of the total lengths of transactions is shown in the Full Transaction Clocks tab.

- Icon Buttons** This window also provides some icon buttons that have the same functionality as the respective menu items.
- **Run**. Clicking this button runs the Performance Optimizer. When the measurements are finished, the results are loaded into the GUI.
 - **Stop**. Clicking this button stops running measurements and loads the results into the GUI.
 - **Rescan**. Clicking this button recalculates the performance measurement results from the trace memory with the current setup and loads them into the GUI.
 - **Print**. Clicking this button opens a print dialog box. Printed is always the current view of the Performance Charts window.

- Setup** To view or modify the performance measurement setup go to the Performance Setup window by selecting *Setup Window* from the *Setup* menu.

PCI Usage Tab

This tab displays the general statistics on the usage of the PCI bus. In the lower right corner you see which master(s) and target(s) were considered in these measurements. The value in parentheses indicates whether only write commands, read commands or both contributed to the statistics.

The Diagrams On this tab you see the following four charts:

- *64Bit Data Usage*. Corresponds to the report section 8.3. This pie diagram shows the distribution of successful 64-bit transfers (green), 64-bit transfers initiated by the master, that were refused by the target (yellow), and 32-bit transfers (red). Place the mouse pointer on the chart to see the numerical values.
- *Command Usage*. Corresponds to the report section 8.3.3. This chart shows the distribution of the different bus commands in the data traffic. The green section represents the data phases, while the red part is the transaction overhead. The command abbreviations are:
 - IOR, IOW: I/O Read and I/O Write
 - MRD, MWR: plain Memory Read and Memory Write
 - CRD, CWR: Configuration Read and Configuration Write
 - MRM: Memory Read Multiple (extended)
 - MRL: Memory Read Line (extended)
 - MWI: Memory Write and Invalidate
- *Bus Utilization*. Corresponds to the report section 8.3. This diagram shows the distribution of idle cycles (blue), overhead (red), data (green), and retry overhead (yellow). If the traffic of a particular master target pair was measured, the communication of all other master target pairs is counted as idle here, too.
- *Efficiency*. Corresponds to the report section 8.4. This bar diagram shows the calculated efficiency of the communication of the selected master target pair. This is the actual amount of transferred data divided by the maximum amount of data theoretically transmittable during the used number of bus cycles.

Burst Usage Tab

The diagram in this tab shows the distribution of the burst lengths that contributed to the bus traffic. Burst lengths are displayed up to 65. All longer bursts appear as 66+.

Furthermore, for every burst length this diagram shows three small squares. These squares indicate:

- *Data Fraction* (red). A red square tells how many of all data phases were part of a burst of this particular length. The sum of all these fractions equals one.
- *Bus Fraction* (green). A green square tells how many of all bus cycles during bus activity (no idle states) were part of a burst of this particular length. The sum of all these fractions equals one.
- *Efficiency* (blue). A blue square tells the average efficiency of a burst of this particular length. The sum of all these fractions does not equal one.

Command Tab

The diagram in this tab displays the distribution of the different bus commands during the traffic (compare the PCI Usage tab of this window). More specifically, it is splitted up with respect to the different burst lengths. Burst lengths are displayed up to 65. All longer bursts appear as 66+.

The y-axis here tells how many of all transactions in the traffic were transactions of a particular burst length with a particular command. The sum of all bars in this diagram equals one.

The key above the diagram resolves the colors that represent each command.

Latency Tab

The diagram in this tab resolves the lengths of the different latencies measured in number of clock cycles.

The y-axis here tells how many of all latencies that occurred were of a particular type and length. The sum of all bars in this diagram equals one.

The different latencies that can occur during a burst are (in chronological order):

- *Arbiter Latency* (blue). This is the time between a master asserting the REQ# signal and the arbiter giving the GNT# signal to this master.
- *Bus Access Latency* (yellow). This is the time between the arbiter asserting the GNT# signal to a master and this master driving FRAME# and the address onto the bus.
- *First Word Latency* (red). This is the time from the start of the transaction until the begin of the first data phase.
- *Subsequent Word Latency* (green). This is the sum of all wait states that occurred between the first and the last data phase of a transaction. These wait states can be inserted both by the master and the target.

Full Transaction Clocks Tab

The diagram in this tab shows the length of the transactions that occurred in the communication between the selected master and target. The sum of all fractions equals one.

However, this diagram does not show whether a long transaction was a long burst (good performance) or whether it contained a lot of overhead (poor performance).

Performance Report Window

This window displays a textual report on the performance measurements. The report is generated by evaluating the data captured in the trace memory.

You can choose which parts of the report are shown or omitted. For this purpose go to the Report tab in the Performance Setup window. This window opens when selecting the item *Setup Window* in the *Setup* menu.

Clicking on figures displayed in blue color shows the report section that dissolves this performance value in more detail.

Icon Buttons The window provides some icon buttons that have the same functionality as the respective menu items.

- **Run.** Clicking this button runs the Performance Optimizer. When the data recording is finished, the measurement results are loaded into the GUI.
- **Stop.** Clicking this button stops running measurements and loads the results into the GUI.
- **Rescan.** Clicking this button recalculates the performance measurement results from the data in the trace memory and presents them in the GUI.
- **Go back.** With this button you can go back to the previously clicked blue value.
- **Print.** Clicking this button opens a print dialog box. There you can choose whether to print the whole report or only a selection of it.

File Menu In the *File* menu you can find additional features that cannot be accessed with any of the icon buttons:

- **Load.** This item loads a waveform file (wfm file) into the GUI.
Note, that the wfm file needs to be saved in performance mode to allow performance calculations.
- **Safe to File.** This item safes the contents of the trace memory as a wfm-file.
- **Export to File.** This item saves the performance report as a text file (txt file).
- **Close.** This item simply closes this window.

Bus Activity Lister Window

This window is used to inspect the activity on the PCI bus. It displays all initiated transactions on the bus, no matter if data was successfully transferred or not. The emphasis is put on the performance details of the transactions, while neglecting what data was sent.

Table Contents The bus cycles presented in this table contain the following information:

- *StartCycle*. This is the actual bus cycle at which the transaction was initiated by the master (counted from the trigger event).
Note, that in performance mode, the trace memory does not record all bus cycles. Since the Analyzer windows always display the line number of a transaction in the trace memory, this number differs from the start cycle number.
- *StartTime[ns]*. This is the time in nanoseconds at which this transaction was initiated (counted from the trigger event).
- *StopTime[ns]*. This is the time in nanoseconds at which this transaction was terminated (counted from the trigger event).
- *Command*. This is the bus command that the master was driving onto the bus.
- *Address*. This is the address that the master intended to access.
- *BurstLen*. This is the burst length, that is the number of data phases in the transaction.
- *ByteCount*. This is the number of bytes transferred during the transaction.
- *1st_Lat*. First word latency. This is the number of clock cycles during the transaction, that went by until the first data phase occurred.
- *Sum_SubLat*. Sum of subsequent latencies. This is the total number of wait cycles between the first and the last data phase of the transaction.
- *TotalClk*. This is the total number of clock cycles needed for the transaction.
- *Term*. This value is telling how the transaction was terminated. The possibilities are normal, retry, and disconnect.
- *Efficiency*. This value is the efficiency of the transaction. That is the number of transmitted bytes divided by the theoretically possible number of bytes transmittable during *TotalClk*.

- Icon Buttons** This window also provides some icon buttons that have the same functionality as the respective menu items.
- **Run.** Clicking this button runs the Performance Optimizer. When the measurements are finished, the results are loaded into the GUI.
 - **Stop.** Clicking this button stops running measurements and loads the results into the GUI.
 - **Reload.** Clicking this button recalculates the performance measurement results from the trace memory considering the current setup and loads them into the GUI.
 - **Cross Reference.** Select a transaction in the table and click this button to display the corresponding lines in the Bus Cycle Lister and the Transaction Lister (highlighted lines) and the Waveform Viewer (range between Markers A and B).
 - **Print.** Clicking this button opens a print dialog box. Printed is always the current view of the Performance Charts window.
 - **Goto text field.** Use this text field to directly go to a certain bus cycle in this window. With this feature you do not need to use the scroll bar.
- Setup** To view or modify the performance measurement setup go to the Performance Setup window by selecting *Setup Window* from the *Setup* menu.

Run Menu

In the *Run* menu you can make use of the following items:

- *Options*. If you want to specify some run options for your test, select this item to open the Run Options window.
- *Start*. This item starts the currently specified test with the selected options.
- *Stop*. Choose this item to stop the current test.
- *Compile*. This item is used to compile your input in the Master Transaction editor.
- *Reinit*. This item reinitializes the Exerciser.

Run Options Window

This window is used to set some options for the test run. The selected options then apply for the run button in this window, the run button in the main window, and the *Start* item in the *Run* menu.

- *Runs Analyzer*. Check this box if you want to run the PCI Analyzer in the test.
- *Runs Performance*. Check this box if you want to run the Performance Optimizer in the test.
- *Runs Master*. Check this box if you want to run the PCI Exerciser (master) in the test.
- *Repetitive*. Check this box if you want to let the master perform all its actions repetitively.
- *Inits Target*. Check this box if you want to initialize the target before the PCI Exerciser starts running.
- *Clears protocol and timing errors*. Check this box if you want to clear the protocol and timing error lists before starting the test.

The two buttons *Run* and *Stop* have the same function as the *Run* menu items *Start* and *Stop*, and the Run and Stop buttons in the main window, respectively.

- *Run*. This button starts the test with the selected options.
- *Stop*. Click this button to stop the current test.

Windows Menu

In the *Windows* menu you can make use of the following items:

- *Command Line*. This item opens the Command Line Interface window.
- *Close All*. Choose this item in order to close all dialogs and windows except for the main window.

Command Line Interface Window

This Command Line Interface (CLI) window can be used to directly call the Agilent E2928A testcard's C functions instead of writing a complete C program. For every C function there is a corresponding CLI command. Additionally, for every command there is an abbreviation provided for typing convenience.

Command Descriptions A complete description of all CLI commands and their abbreviations can be found in the *Agilent E2928A C-API Reference*.

Window Contents The window is divided into two areas. The large gray text area is the console output area. It is not editable and contains all your entries along with the results returned by the C functions.

The smaller white text area at the bottom holds your command line. Enter your function calls here with the required parameters and press return. This CLI also features command line history for reuse of previously entered commands. Press the up and down arrow keys to browse through the last 50 commands.

The *Clear* button to the right clears both text areas.

Menu Items There are some more features provided in the menus of this window.

In the *File* menu you can find:

- *New*. Selecting this item clears both text areas.
- *Save As*. Selecting this item allows you to save the contents of the output area as a text file for later use.
- *Start Logging*. Selecting this item allows you to specify a file name, where all your CLI commands will be stored (not the results returned by the C functions) as a CLI script.
- *Stop Logging*. Selecting this item stops logging the commands in the CLI script file.
- *Run Script*. Selecting this item allows you to run a previously logged CLI script file. Note, that execution stops at the first error that occurs, for example due to missing parameters in a function call.
- *Close*. Selecting this item closes the CLI window.

In the *Edit* menu you can find the items *Copy* and *Paste*. You can reuse commands or parts of them by selecting them in the output area with your mouse and then selecting the *Copy* and *Paste* items of this menu.

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