

EXTERNAL I/O MANAGEMENT

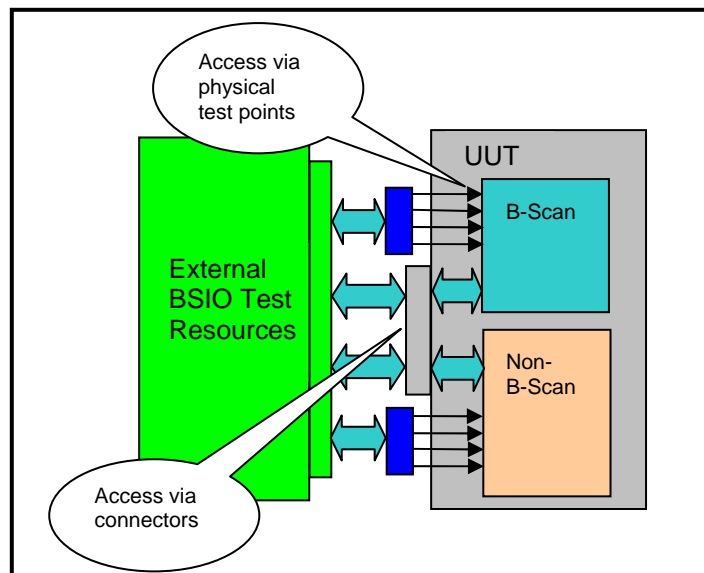
PRODUCT OVERVIEW

ScanWorks® External IO Management makes it easy to increase test coverage for signals that are not fully covered by the boundary-scan test resources built into the unit under test (UUT). Additional boundary scan input/output (BSIO) test resources can be connected to the UUT and included in some tests, providing coverage that would otherwise not be available. For example, signals that extend from an on-board boundary-scan device to a connector are typically covered for shorts only by interconnect tests. Coverage can be extended to include opens by connecting additional BSIO test resources to the connector. Signals that are not routed to a connector can be connected to the external BSIO test resources using a test fixture and physical test points. Non-

boundary scan signals can be covered for shorts by connecting them to external BSIO test resources either through a connector or test points in a fixture.

USING EXTERNAL I/O MANAGEMENT

ScanWorks provides two methods of assigning external IO test resources to UUT signals to add coverage to those signals. You can use the user interface dialog provided to define the design requirements and then assign the specific external IO resources to each requirement, or you can define both the requirements and make the resource assignments in a text file and import the file.



DEFINING DESIGN REQUIREMENTS FOR EXTERNAL IO TEST RESOURCES

The external IO test requirements are defined as part of the ScanWorks design description. The design description contains all of the information needed by ScanWorks to automatically generate test patterns for boundary-scan testing. By including the external IO test requirements in the design description, the assignment of the requirement to the actual test resources is independent of the design description and can be easily changed in the map resources dialog. The external IO requirements for a design are defined in the Design Requirements dialog as shown below.

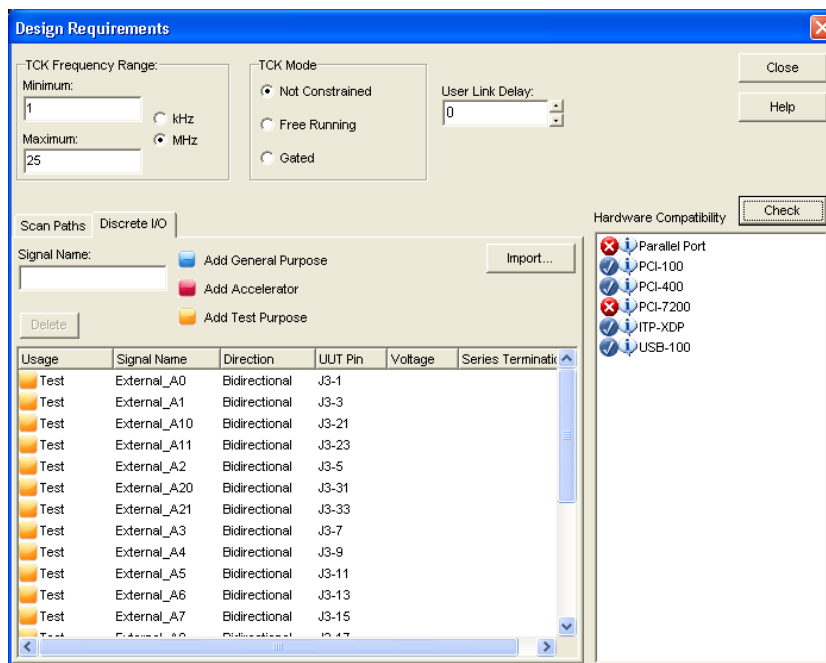
Under the Discrete IO tab, simply type in a signal name and click on the Add Test Purpose icon. The signal is added to the list where you specify signal direction, define the UUT pin to which the external IO resource will be connected, select a voltage and series termination requirements (if necessary). The requirements are checked for

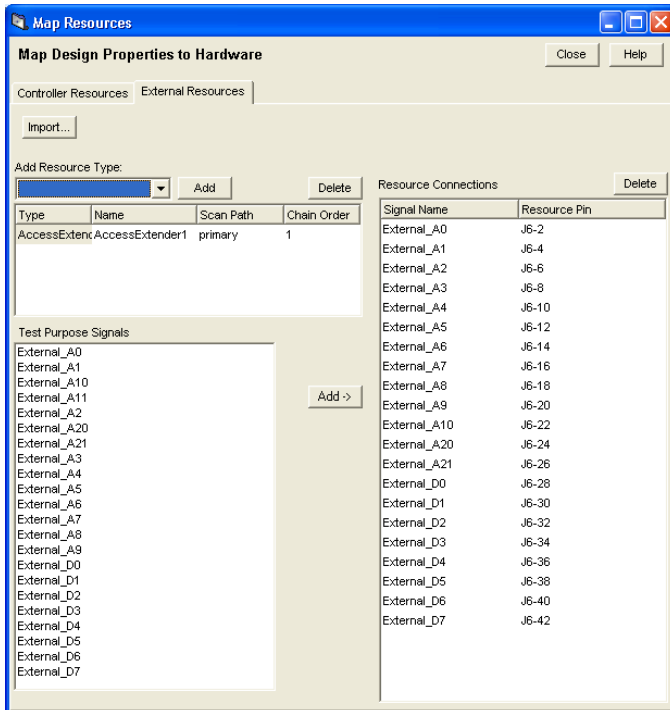
compatibility with the test resource when it is assigned. The Add General Purpose and Add Accelerator icons are used to assign ScanWorks Discrete IO signals for either static signal level control or for accelerating flash programming operations.

ASSIGNING EXTERNAL IO RESOURCES TO THE DESIGN

After defining the design requirements, each requirement is assigned to a specific external IO resource in the Map Resources dialog. Select the External Resources Tab, and then select the resources type from the Add Resource Type drop down list. The initial release of External IO Management includes support for the ScanWorks BSIO-400 and the AccessExtender™ from JEK Technical Services, <http://www.jek-tech.com/>. Other controllers will be added as they are defined. You can also define your own custom external IO test resources as described below.

Once you have selected the resource type, the





resource is added to the list with a name, the scan path in which it is included (this is significant if your design has more than one scan path) and the order in which it appears in the scan path. Each Test Purpose Signal is added to the list of Resource Connections

Requirements Definition file DEFINING CUSTOM EXTERNAL IO TEST RESOURCES

```
External_A0,TEST,BIDIR,J3-1
External_A1,TEST,BIDIR,J3-3
External_A2,TEST,BIDIR,J3-5
External_A3,TEST,BIDIR,J3-7
External_A4,TEST,BIDIR,J3-9
External_A5,TEST,BIDIR,J3-11
External_A6,TEST,BIDIR,J3-13
External_A7,TEST,BIDIR,J3-15
External_A8,TEST,BIDIR,J3-17
External_A9,TEST,BIDIR,J3-19
External_A10,TEST,BIDIR,J3-21
External_A11,TEST,BIDIR,J3-23
External_A20,TEST,BIDIR,J3-31
External_A21,TEST,BIDIR,J3-33
External_D0,TEST,BIDIR,J3-2
External_D1,TEST,BIDIR,J3-4
External_D2,TEST,BIDIR,J3-6
External_D3,TEST,BIDIR,J3-8
External_D4,TEST,BIDIR,J3-10
External_D5,TEST,BIDIR,J3-12
External_D6,TEST,BIDIR,J3-14
External_D7,TEST,BIDIR,J3-16
```

and assigned to a specific resource pin by selecting the pin from a list of pins available on the resource.

The BSIO test resources must be included in a UUT scan path to be accessible to ScanWorks. ScanWorks automatically rebuilds the design description to include the test resources and displays the scan path in the Design Members window on the ScanWorks main page. However, the test resources are managed separately and are not included in the UUT coverage reports.

USING EXTERNAL IO MAPPING FILES

If you need to define a large number of external IO test resources it may be more convenient to create text files that defines the test resources needed and import it. Below are examples of a Design Requirements Definition file and a Test Resource definition file. Complete directions for creating the files are documented in the ScanWorks Help files.

Resource Definition file

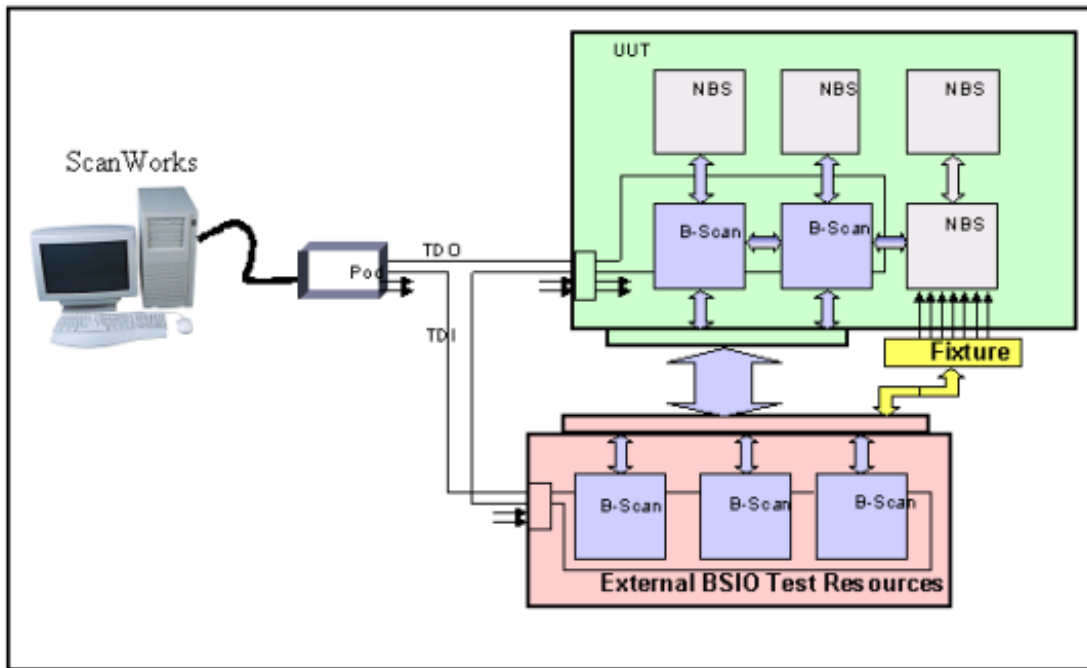
```
#EXTERNAL_IO,AccessExtender,
AccessExtender1,1,primary
External_A0,J6-2,AccessExtender1
External_A1,J6-4,AccessExtender1
External_A2,J6-6,AccessExtender1
External_A3,J6-8,AccessExtender1
External_A4,J6-10,AccessExtender1
External_A5,J6-12,AccessExtender1
External_A6,J6-14,AccessExtender1
External_A7,J6-16,AccessExtender1
External_A8,J6-18,AccessExtender1
External_A9,J6-20,AccessExtender1
External_A10,J6-22,AccessExtender1
External_A20,J6-24,AccessExtender1
External_A21,J6-26,AccessExtender1
External_D0,J6-28,AccessExtender1
External_D1,J6-30,AccessExtender1
External_D2,J6-32,AccessExtender1
External_D3,J6-34,AccessExtender1
External_D4,J6-36,AccessExtender1
External_D5,J6-38,AccessExtender1
External_D6,J6-40,AccessExtender1
External_D7,J6-42,AccessExtender1
```

Many ScanWorks users have built their own BSIO test resources boards and have built them into test fixtures or used them in design debug labs. An application note is available on the ScanWorks Maintenance Benefits web site to lead you through the process of defining a custom BSIO test resource and using it with External IO Management.

Connecting the external IO signals between the External IO Test Resources and UUT requires custom cabling for each application. The user is responsible for building the cables and connecting them properly.

COVERAGE IMPROVEMENTS

Improvements in coverage realized by using External



The external BSIO test resources must be connected to a scan path to enable ScanWorks to manage the resources. If the design includes multiple scan paths, the test resources should be included in series with the scan path used for interconnect test. This enables the interconnect test generation tools to include the external test resources as if they are part of the UUT. One method of connecting the external IO resource board to the UUT is shown below.

IO Management can vary significantly, depending on the configuration of the nets in your design. The table below shows the opens coverage for a design that uses external IO test resources and one that does not, as well as the opens coverage added by the Memory Access Verification test and by Flash Programming. Note that the overall opens coverage and boundary-scan opens coverage percentages have increased.

| Tests Included | Overall Pin Faults Coverage % | Boundary Scan Pin Faults Coverage % | Overall Pin Faults Coverage # | Boundary Scan Pin Faults Coverage # |
|----------------|-------------------------------|-------------------------------------|-------------------------------|-------------------------------------|
|----------------|-------------------------------|-------------------------------------|-------------------------------|-------------------------------------|

| Coverage | Full | Partial | None | Full | Partial | None | Full | Partial | None | Full | Partial | None |
|---|-------|---------|-------|-------|---------|-------|------|---------|------|------|---------|------|
| Interconnect with out External IO | 26.59 | 10.98 | 62.43 | 50.61 | 7.93 | 41.46 | 138 | 57 | 324 | 83 | 13 | 68 |
| Interconnect with External IO | 30.25 | 10.98 | 58.77 | 62.2 | 7.93 | 29.88 | 157 | 57 | 305 | 102 | 13 | 49 |
| Interconnect with ExIO, & Flash | 37.19 | 10.79 | 52.02 | 67.07 | 7.32 | 25.61 | 193 | 56 | 270 | 110 | 12 | 42 |
| Interconnect with ExIO, MAV, Flash | 42 | 10.6 | 47.4 | 67.68 | 6.71 | 25.61 | 218 | 55 | 246 | 111 | 11 | 42 |
| Interconnect with ExIO, MAV, Flash, SPV | 42 | 10.6 | 47.4 | 67.68 | 6.71 | 25.61 | 218 | 55 | 246 | 111 | 11 | 42 |

Highlights

- Extends coverage where on-UUT test resources are not available
- Easy assignment of external test resources to UUT signals
- Includes definition of commonly used BSIO test boards
- Easy definition of custom built BSIO test resources