

Using Symphony TS/CFM to Integrate JTAG Technologies ProVision™ Boundary Scan Tests with TestStation Test Programs

Symphony TS/CFM combines JTAG Technologies ProVision software, JT 3717/PCI controller and JT 2147/CFM to execute JTAG Technologies tests on TestStation systems.

Application Overview

JTAG Technologies ProVision is a popular JTAG test development and execution tool used to test for basic shorts/opens/bad/missing defects and to perform memory and cluster tests and in-system programming of memory and CPLDs on circuit boards. ProVision tests are often developed during the engineering and prototype phases of board development and TestStation users would often like to be able to reuse these applications when moving to TestStation for production test.

This application brief describes a method for integrating the JTAG Technologies JT 3717/PCI controller and JT 2147/CFM with the TestStation, executing the ProVision tests from within the in-circuit test program and merging the resulting ProVision diagnostics with the TestStation diagnostic output.

Please note that if ProVision is not being used for in-system programming of Flash memory and CPLDs then the Symphony TS/DSM tool would be an alternative for this integration. Symphony TS/DSM differs in that the ProVision tests are converted to TestStation test language, eliminating the need for installing the JTAG Technologies hardware in the test system. For additional information on the Symphony TS/DSM product please see the Teradyne ICT Application Brief called “**Utilizing JTAG Symphony_DSM on TestStation**”

Also note that the Symphony tools are compatible with the JTAG Technologies Classic software tools.

Hardware Requirements

The JTAG Technologies JT 3717/PCI Controller is installed in the tester PC. The TAP port of the UUT is driven using JTAG Technologies JT 2147/CFM, which is connected to the JT 3717/PCI via a cable that is routed across the front of the tester pin bay. The JT 2147/CFM has been specially designed to mount in a single Custom Function Module (CFM) position on the TestStation Custom Function Board (CFB). Each JT 2147/CFM supports one TAP port

and two JT 2147/CFMs may be mounted per CFB. The JT 2147/CFM is cabled to the top half of the CFB where a user controlled relay matrix is used to route the TAP signals to the tester interface. The interface locations for the TAP port will be dependent on the CFM and CFB locations used.

The CFB has 4 CFM positions where user CFMs may be installed. If the user already has a CFB installed in their system then they must ensure that they have a spare CFM location in which to mount the JT 2147/CFM.

A dual-stage fixture is considered best practice when fixturing a UUT for 3rd party boundary scan test at ICT. A dual-stage fixture allows for two levels of nail contact to the UUT. When performing standard in-circuit tests, the full bed-of-nails will be in contact with the UUT. During the boundary scan test, a minimum set of nails will contact the UUT, typically power, ground, TAP and control. This provides better signal integrity for the boundary scan tests by removing the loading effects presented by the full bed-of-nails.

Summary:

- JTAG Technologies JT 3717/PCI Controller
- JTAG Technologies JT 2147/CFM
- JT 3717 to JT 2147 cable
- Teradyne Custom Function Board
- Dual-stage fixture for UUT

Software Requirements

JTAG Technologies ProVision consists of a number of licensed tools that perform various JTAG development, test, programming and diagnostic tasks. In order to execute basic JTAG tests, program flash and CPLDs and create diagnostics, the user must install the ProVision Symphony TS/CFM Software Integration Package on the TestStation. If the user wishes to perform other tasks such as JTAG test generation, debug, flash data preparation, etc. then additional ProVision tools will need to be installed and licensed. For the purpose of this application brief, we are only considering JTAG test execution and diagnostics. It is assumed the user has a passing ProVision test project and that no development or debug needs to be done on the TestStation.

Summary:

- JTAG Technologies ProVision Software Integration Package
 - o PIP 2176 (Production integration software)
 - o PM 3790 (Boundary-Scan Diagnostics software package)
- Passing ProVision Test Project

Application Examples

The JT 2147/CFM is mounted in a free CFM location on the CFB and is then cabled to the top half of the CFB, where the TAP signals are routed to the tester interface. There are four switched and four direct paths from each CFM to the interface. TRST is connected to the DIR1 signal, which is a direct connection from the CFM to the interface. The four remaining TAP signals are connected to the MUX1-MUX4 signals, which are switched to the interface via CFB relays. Where the TAP signals come up on the interface will depend on which CFM location is used and how the top board relays are switched. Once the

signal paths for the TAP signals have been determined, the user will need to add code to their test program to control the appropriate relays. Since the TRST line is a direct connection, if the user wishes to disconnect this signal from the UUT during standard ICT testing (recommended) then a relay will need to be mounted in the test fixture for this purpose.

All user relays on the CFB are controlled from the test program using system subroutines. For example, in order to close relay 49 on the CFB top board you would use the following code:

```
CALL CFBSETRLY (UNIT=1, OPERATION='CLOSE', RLYLIST='49');
```

Fixture mounted relays are controlled using the PIO(1) relay drivers. For example, if RLY1 were used to control the TRST relay then the test language required to activate this relay would be:

```
SET PIO(1) RLY(CLOSE 1);
```

Any relays used to isolate the TAP signals would be closed prior to the boundary scan test execution and opened when they it is completed.

The Symphony/CFM package provides two command line executables that can be used to execute JTAG Technologies boundary scan tests and to program flash and PLDs. In order to integrate the JTAG Technologies tests with the TestStation test program, these executables will be called from the test program using the SPAWN command. The Pass/Fail condition of the tests will be captured and their diagnostics will be redirected to the TestStation standard output.

JTAG ProVision test and programming routines consist of a number of ASCII and binary files organized as “applications”. Each application is self contained and performs a particular task such as infrastructure or interconnect testing, programming a flash device, etc. Applications will be executed using individual calls to their appropriate executables. BEC37X7.EXE is used to execute boundary scan tests and to program flash. PRG37X7.EXE is used to program PLDs.

Some data preparation is required prior to execution. Applications must be compiled to produce binary .BSX files, flash devices must have data files prepared and PLDs must have programming files. It is assumed that the user has a working ProVision test set (JTAG Technologies Classic software is also supported) and that all compilation and data preparation has been done. This will allow the applications to be run directly from the command lines.

The command line executables provide options for controlling execution from both a hardware and software perspective, such as the test executed, diagnostic mode, TCK speed, etc. An example of a command line to execute the INFRA test is below.

```
bec37x7 -h -ut -apci0 -f5000 -jt2147 -L33,15 -ma -ssv infra infra
```

Note that when programming a flash device that the controller must first be loaded with a binary image of the flash data using the command line. Once this is done the flash application is run to program the flash.

Please see the JTAG Technologies Command Line Reference Manual for details.

When an application fails, the ProVision diagnostics software must be called to produce a detailed diagnostic. This is done by calling an executable named BSD.EXE. An example of calling the diagnostics for an INFRA test is below.

```
bsd -h -e infra infra
```

This will produce a file called INFRA.DIA which will contain the diagnostic messages for the INFRA test. The DIA file may be then passed to the TestStation diagnostic stream to be integrated with any other in-circuit failures.

One method for executing the ProVision applications from the TestStation program is to include the calls in a DOS batch file. The batch file is then called from the test program using the SPAWN command. Below is a batch file that executes the INFRA test and conditionally calls BSD if the test fails.

```
@echo off
REM clean up old files
if exist error.err del error.err
if exist infra.dia del infra.dia

REM execute INFRA test
bec37x7 -h -ut -apci0 -f5000 -jt2147 -L33,15 -ma -ssv infra infra >
nul

REM call BSD if INFRA fails
if %errorlevel% NEQ 0 (bsd -h -e infra infra >nul)
EXIT
```

Below is a section to TestStation test language that executes an INFRA and INTER test, opens their DIA files, if they exist, and direct them to the standard message output.

```
/* Execute JTAG tests */
RUN_INFRA: CALL SPAWN (ARG1='start /MIN /WAIT infra.bat');

/* Check results of infra test */
INFRA_RSLTS:

OPEN ID=RESULTS DEV='INFRA.DIA' MODE='READ' [
    WRITE 'INFRA TEST PASSED%NL%';
    BRANCH RUN_INTER;];

L1: READ ID=RESULTS '%R%'RECORD [BRANCH L1Z;];
    WRITE ID=MESFILE '%S%%NL%'RECORD;
    BRANCH L1;
L1Z:CLOSE ID=RESULTS;
    BITSET(FAIL,1);
    BRANCH BS_DONE;

RUN_INTER: CALL SPAWN (ARG1='start /MIN /WAIT inter.bat');

/* Check results of inter test */
INTER_RSLTS:

OPEN ID=RESULTS DEV='INTER.DIA' MODE='READ' [
    WRITE 'INTER TEST PASSED%NL%';
    BRANCH BS_DONE;];

L2: READ ID=RESULTS '%R%'RECORD [BRANCH L2Z;];
    WRITE ID=MESFILE '%S%%NL%'RECORD;
```

```
BRANCH L2;  
L2Z:CLOSE ID=RESULTS;  
BITSET (FAIL, 1);  
BRANCH BS_DONE;
```

```
BS_DONE:
```

Additional Information

Additional information on Symphony TS/CFM, TestStation and Custom Function Board may be found at the Teradyne website www.teradyne.com or by contacting your Teradyne representative.

Additional information on JTAG Technologies ProVision may be found at the JTAG Technologies website www.jtag.com or by contacting your JTAG Technologies representative.