

# **Integrating Corelis ScanExpress Boundary Scan Tests with TestStation Test Programs**

Using Corelis ScanExpress software and USB-1149.1/CFM Boundary Scan controller to execute Corelis JTAG tests on TestStation systems.

## **Application Overview**

Corelis ScanExpress is a popular JTAG test development and execution tool used to test for basic shorts/opens/bad/missing defects and to perform in-system programming of memory and CPLDs on circuit boards. ScanExpress 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 Corelis USB-1149.1/CFM controller with the TestStation, executing the ScanExpress tests from within the in-circuit test program and merging the resulting ScanExpress diagnostics with the TestStation diagnostic output.

## **Hardware Requirements**

For this application the TAP port of the UUT is driven using the Corelis USB-1149.1/CFM controller. This is a version of the Corelis USB-1149.1/1E controller integrated on a custom CFM module. If multiple TAP ports are required, there are multi-TAP versions of the Corelis CFM module are available. The software integration would remain essentially unchanged.

The USB-1149.1/CFM is installed on a TestStation Custom Function Board (CFB) in order to route the TAP signals up to the tester interface. The CFB is installed in the tester pin bay and this makes the TAP port available to any fixture mounted on the tester, with the connections being under relay control. The user simply has to specify the TAP port to UUT wiring when having the fixture fabricated.

The CFB has 4 locations, called Custom Function Modules (CFMs), where user hardware may be installed. If the user already has a CFB installed in their system they must ensure that they have a spare CFM location on which to install the USB-1149.1/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:

- Corelis USB-1149.1/CFM Boundary Scan Controller
- Teradyne Custom Function Board
- Dual-stage fixture for UUT

## Software Requirements

Corelis ScanExpress consists of a number of modules 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 ScanExpress Runner and ScanExpress ADO on the TestStation. If the user wishes to perform other tasks such as JTAG test generation, debug, flash data preparation, etc. then additional ScanExpress modules will need to be installed. For the purpose of this application note, we will only be considering JTAG test and diagnostics. It is assumed the user has a passing ScanExpress test plan and that no development or debug needs to be done on the tester.

Summary:

- Corelis ScanExpress Runner
- Corelis ScanExpress ADO
- Passing ScanExpress Test Plan

## Application Examples

The USB-1149.1/CFM is mounted in a free CFM location on the CFB. The TAP signals are routed to the tester interface through the CFB top board. Each CFM is provided with 4 direct and 4 multiplexed connections to the tester interface. Four signals (TCK, TMS, TDI, TDO) use the direct path through the top board and their disconnect relays are mounted on the CFM. TRST is routed through a muxed path and CFB top board relays are used to connect this signal to the interface.

All user relays and relay control signals on the CFB / CFM 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');
```

The code below will energize relay driver signal 1 on CFM 3:

```
CALL CFMSETRLY (UNIT=3,OPERATION='CLOSE',RLYLIST='1');
```

Any relays used to isolate the TAP signals would be closed prior to the boundary scan test execution and opened when tests are completed. Which relay control signals need to be activated will depend on your application and in which CFM location the controller is located. Please consult the Corelis USB-1149.1/CFM and Teradyne CFB documentation for details.

The USB-1149.1/CFM Boundary Scan Controller is also connected to a USB port on the tester PC. This cable is routed across the front of the pin bay, into the PC bay.

Corelis ScanExpress Runner is a test executive that may be used to execute a predefined boundary scan test plan. A basic test plan would consist of Infrastructure, Interconnect, Buswire and Pull-up/Pull-down tests. The user may also add additional steps such as in-system or flash programming, memory and cluster tests.

Corelis ScanExpress Runner has a command line interface that may be used to execute a test plan from a third party application.

One form of the command line call is:

```
"C:\Program Files\Corelis\ScanExpress Runner v6\RunTestPlan.exe"  
"TestPlanFilename" "CONTROLLER, SETTINGS"
```

The first argument simply calls the executable to run the test plan. The second argument specifies the location and name of the test plan to be executed. The third argument specifies the controller type and parameters such as logic levels, clock speed, etc. If the controller specification and parameters are omitted then the test plan will be executed with the most recent controller parameters stored in the test plan, as shown below:

```
"C:\Program Files\Corelis\ScanExpress Runner v6\RunTestPlan.exe"  
"C:\MyTestPlan.tsp"
```

We chose to execute the command line from a DOS batch file that is spawned from the TestStation test program with the following command:

```
CALL SPAWN (ARG1='start /MIN /WAIT corelis.bat');
```

The command line will output status information (pass, fail, error) that can be redirected to a file to be read by the test program. Diagnostic messages will automatically be written to a log file by ScanExpress Runner. When a failure is detected, the log file will be opened and the results redirected to the standard in-circuit failure output.

An example of the batch file is shown below:

```
@echo off  
REM Set variables for project and ICT locations  
set a="C:\MyProjects\MyTestPlan.log"  
set b="C:\ MyProjects\MyTestPlan.tsp"  
set c="C:\Program Files\Corelis\ScanExpress Runner  
v6\RunTestPlan.exe"  
REM Clean up old status and log files  
if exist status.txt del status.txt  
if exist %a% del %a%  
REM Run test plan  
%c% %b%>status.txt  
EXIT
```

An example of the test program code to check test status and redirect diagnostic messages is shown below:

```
/* Check status of test */  
  
/* Open status file. Exit if failure. */
```

```

OPEN ID=STATUS DEV='STATUS.TXT' MODE='READ' [
  WRITE 'CORELIS STATUS FILE NOT FOUND%NL%';
  BITSET(FAIL,1);
  BRANCH BS_DONE;];

/* Read first line of Status file */
READ TIMEOUT=.2 FAIL(1) ID=STATUS '%R%'RECORD;

L3:
/* Check for passing condition. Exit if pass. */
LET N=INDEX(RECORD,'Passed');
IF N<>0 THEN [WRITE 'CORELIS TEST PASSED%NL%';
  BRANCH BS_DONE;];
L2:
/* Test did not pass. Check hardware and license. */
LET N=INDEX(RECORD,'Error');
IF N<>0 THEN [WRITE 'CORELIS ERROR DETECTED%NL%';
  WRITE 'POSSIBLE HARDWARE OR DONGLE PROBLEM%NL%';
  BITSET(FAIL,1);BRANCH BS_DONE;];
ELSE [WRITE 'CORELIS TEST FAILED%NL%';
  BITSET(FAIL,1);

OPEN ID=RESULTS DEV='MyTestPlan.LOG' MODE='READ';

  L1: READ ID=RESULTS '%R%'RECORD [BRANCH L1Z;];
  WRITE ID=MESFILE '%S%%NL%'RECORD;
  BRANCH L1;
  L1Z:CLOSE ID=RESULTS;];

BS_DONE:

CLOSE ID=STATUS;

```

## Additional Information

For additional information on Corelis ScanExpress and the USB-1149.1/CFM please visit the Corelis website at [www.corelis.com](http://www.corelis.com) or contact your Corelis representative.

For additional information on the Teradyne TestStation and Custom Function Board may please visit the Teradyne website at [www.teradyne.com](http://www.teradyne.com) or contact your Teradyne representative.