

Symphony Frequently Asked Questions

This document answers frequently asked questions about the Symphony boundary scan test option that is available for Teradyne's 228X and TestStation In-Circuit Test systems.

Q: What is Boundary Scan

A: Boundary Scan (IEEE standard 1149.1) is a technology that allows silicon manufacturers to design testability into the components that they manufacture. The first commercially available boundary scan components became widely available in 1990. GenRad and Teradyne were the first ICT vendors to supply boundary scan software solutions when the BasicSCAN, Scan Pathfinder, and Victory products were introduced in 1991.

The popularity of boundary scan solutions has grown and now many companies use boundary scan as an alternative or primary testing strategy. Many PC-based solutions are now available in the marketplace that allows manufacturers and designers to take advantage of the increasing use of boundary scan technology in their electronic board designs.

These PC-based boundary scan solutions can be used in the engineering lab as well as integrated into high volume production test equipment. This is appealing to test developers because a common boundary scan solution can be used to implement a strategy that supports diverse manufacturing facilities. Standardizing on a common boundary scan solution gives manufacturer's the ability to execute the same boundary scan tests regardless of which piece of test equipment they are using on their manufacturing lines (in-circuit, MDA, flying prober, or functional test systems). It also simplifies the test developer's job because the boundary scan tests developed for one target machine are portable and can be used on different tester types.

Teradyne's boundary scan strategy is to support their native BasicSCAN and Scan Pathfinder products as the preferred 1149.1 boundary scan test solutions on TestStation ICT test systems. These Teradyne developed boundary scan solutions have been specifically designed to perform 1149.1 tests in the in-circuit test environment and are tightly integrated with the in-circuit test generators. They use available tester instrumentation hardware to apply the boundary scan test vectors and to increase overall test fault coverage (no additional hardware is required to execute the boundary scan tests).

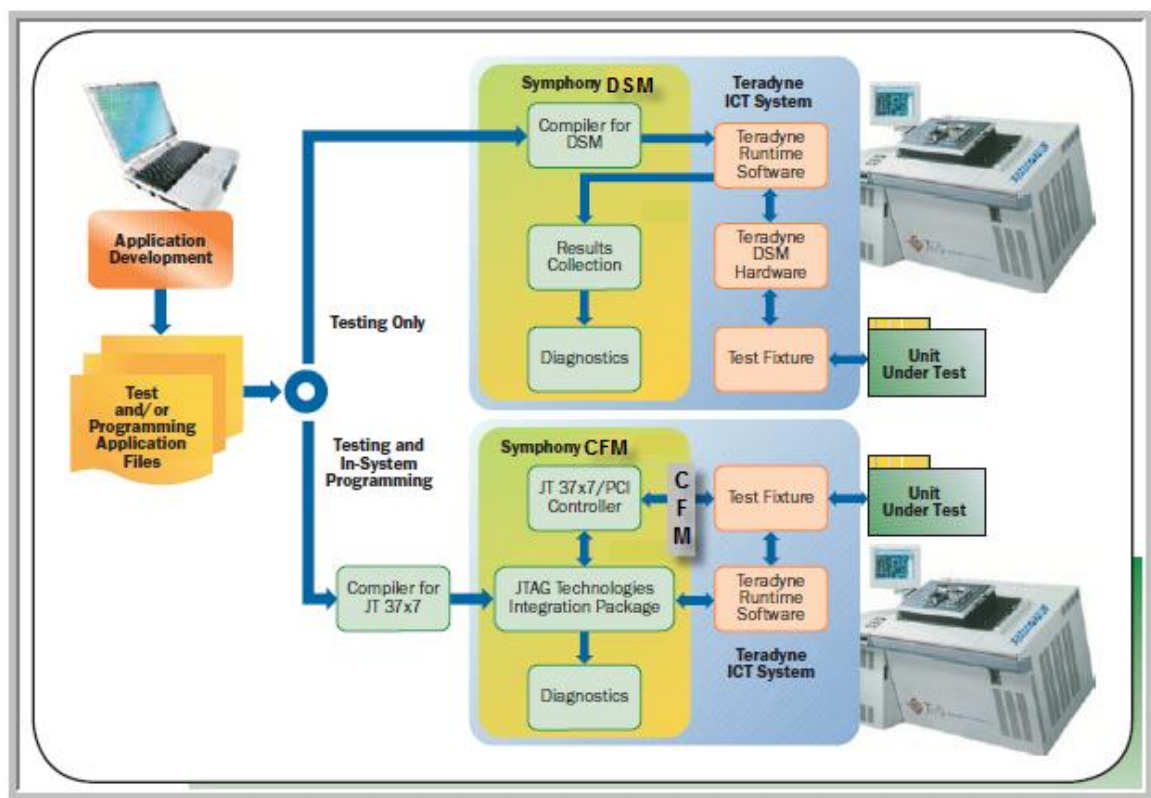
For those customers who prefer to use one of the popular PC-based boundary scan solutions that are available on the market (to re-use existing tests or take advantage of boundary scan capabilities that extend beyond 1149.1), Teradyne offers partnership based solutions with select vendors to accommodate the boundary scan testing preferences of our diverse customer base.

Q: What is Symphony?

A: Symphony is the market name of a boundary scan partnership solution that was developed by JTAG Technologies specifically for the Teradyne TestStation and legacy GR228X In-Circuit Test systems.

As shown in the Symphony Block Diagram below, there are two implementations of Symphony that are supported. **Symphony CFM** directly uses JTAG Technologies' boundary scan Controller and TAP Interface modules. The JTAG Technologies boundary scan controller is installed in a PCI slot of the tester's PC controller and it is cabled over to a JTAG Custom Function Module (CFM) that is installed on Teradyne's Custom Function Board (CFB).

The second implementation, called **Symphony DSM**, uses a software converter to translate JTAG Technologies' boundary scan test vectors to Teradyne's native test programming language where they can be applied using Teradyne's standard in-circuit test instrumentation.



Q: Why is Teradyne partnering with other companies?

A: Teradyne has formed strategic partnerships with companies who have leading PC-based boundary scan solutions because it is in the best interest of our customers. The benefits that are derived from these strategic partnerships include the following:

- Partners provide our customers with access to best-in-class boundary scan solutions. Boundary scan is the primary focus of their business and they have developed the expertise and resources to update and improve their products over time as extensions to the 1149.x standards are announced by IEEE and implemented by the chip vendors.
- Many manufacturers are familiar with the leading PC-based boundary scan solutions and are already using them in their development labs and production facilities. Integrating

these boundary scan solutions into our test equipment allows our customers to re-use the boundary scan tests they have already developed and reduce their overall in-circuit test development effort.

- Leading PC-based boundary scan solutions support engineering development tools that make it easy to generate custom boundary scan tests and they have advanced debug tools that support bringing up boundary scan tests very quickly.
- The leading PC-based boundary scan solutions have options to support programming of on-board Programmable Logic Devices using the serial boundary scan interface.
- Utilizing partnership solutions to provide advanced boundary scan testing on our in-circuit testers allows Teradyne to focus their research and development resources on developing innovative solutions for other board test problems where our expertise provides the most value for our customers (i.e. Powered Framescan, Concurrent Test, Safetest Protection Technologies, D2B software, high pincount testing, etc.).

Q: What is the difference between Symphony and Teradyne's native Boundary Scan product offerings?

A: Teradyne includes two native boundary scan solutions, **BasicSCAN** and **Scan Pathfinder**, as part of their standard product software. **BasicSCAN** is a full access boundary scan solution that automatically creates a digital in-circuit test library model using the BSDL files that are supplied by device manufacturers. The **BasicSCAN** model uses D/S pins in the tester to verify that all the pins of the device are connected and it verifies that the correct device is placed by reading the device ID Code register. **BasicSCAN** is the simplest and most effective boundary scan test solution when the tester has physical test access to the pins of the boundary scan device.

Scan Pathfinder is Teradyne's limited access boundary scan test solution. It uses independent boundary scan test generation software to automatically analyze the circuit and BSDL files and determine the boundary scan parts and how they are interconnected. It then generates the appropriate Hardware, Opens, Interactions, Interconnect, and BIST tests using Teradyne's standard software and instrumentation. The **Scan Pathfinder** solution should be considered when the test application has limited access to D/S pins and the boundary scan parts do not require testability features beyond those described in the IEEE 1149.1 standard.

The benefits of Teradyne's native IEEE-1149.1 boundary scan solutions are:

- They are part of Teradyne's standard ICT software development software. Developers and manufacturers do not need to install any additional software or hardware.
- The in-circuit tester nails and bscan virtual nails are used in concert to maximize test coverage and repeatability.

There are, however, restrictions related to Teradyne's native boundary scan solutions that should be considered before deciding to use **BasicSCAN** or **Scan Pathfinder**.

- BasicSCAN and Scan Pathfinder tests must be developed independently and are not re-usable on other test platforms.
- BasicSCAN and Scan Pathfinder do not support boundary scan feature extensions beyond 1149.1.
- BasicSCAN and Scan Pathfinder do not support programming ISP and FLASH through the boundary scan chain (Teradyne has separate native solutions for programming FLASH and ISP components).

- BasicSCAN and Scan Pathfinder generate canned tests for detecting typical manufacturing faults – they do not support the generation of custom tests.

Symphony is a partnership boundary scan solution that can be integrated on Teradyne's in-circuit testers as an option. It is based on JTAG Technologies leading **ProVision** boundary scan development software. Using the **ProVision** development software, and JTAG Technologies' boundary scan controller and TAP module hardware, manufacturers can quickly develop and debug their boundary scan tests using an offline PC. When ready, those tests can then be transported to Teradyne's in-circuit testers using either the **Symphony /CFM** or **Symphony /DSM** solutions.

The benefits of using the Symphony partnership solution include:

- The boundary scan tests can be developed offline, prior to ICT fixture development which speeds up test development and eliminates tester time bottlenecks.
- The boundary scan tests that are developed during the engineering and NPI phases of board introduction can be leveraged during ICT production testing (no need to re-develop boundary scan tests on the ICT).
- The **Symphony /CFM** solution, in addition to executing boundary scan tests, can optionally be used to program most popular Programmable Logic Devices (PLDs).
- The **Symphony /DSM** solution uses standard Teradyne ICT instruments and does not require manufacturers to add any additional hardware to their in-circuit testers.

Keep in mind that you can install more than one boundary scan solution on the tester and decide for each application which one best suits your needs.

Q: How do I choose between Symphony /CFM and Symphony /DSM?

A: The **Symphony /CFM** package contains both hardware and software. The hardware consists of a PCI boundary scan controller that plugs into a PCI slot on the 228X or TestStation Windows-based PC Controller and a Custom Function Module (CFM) that contains JTAG TAP module hardware. The CFM is designed to fit onto Teradyne's Custom Function Board (CFB). The CFB can plug into an accessory or pin board slot inside the ICT receiver bay and a cable is provided to connect the JTAG boundary scan controller with the JTAG TAP CFM module. Specialized Teradyne test programming language for the CFB is utilized to control CFB relays that connect the boundary signals to the board under test.

Symphony /CFM uses the same JTAG **ProVision** run time test execution software and test project files to control the JTAG hardware and run the boundary scan tests as is used by the standalone benchtop **ProVision** development solution. Developers who are familiar with JTAG's **ProVision** development environment will find it easy to use the **Symphony /CFM** solution.

Symphony /DSM is a software only solution that does not require any JTAG hardware to be installed in the in-circuit test system. The software consists of a JTAG-to-Teradyne boundary scan vector converter and a boundary scan diagnostic module. The vector converter translates the test project vectors generated by **ProVision** on a standalone benchtop solution to standard Teradyne test programming language. For optimum performance, Teradyne's Deep Serial Memory option is used to store the boundary scan test vectors. If the boundary scan test vectors fail, the results are written to a file and interpreted by JTAG's boundary scan diagnostic software.

Compare the characteristics of each Symphony solution listed below to determine which one best suits your test application:

- **Symphony /DSM** is a software only solution that does not require the addition of any external hardware to the Teradyne in-circuit test system. This makes it a flexible low cost solution for OEMs who subcontract board manufacturing to multiple EMS providers.

- **Symphony /CFM** is a combined software/hardware solution that requires installation of JTAG Technology's boundary scan controller and TAP modules into Teradyne's in-circuit test systems. The JTAG boundary scan controller plugs into a PCI slot on the tester's PC Controller. To install the **Symphony /CFM** solution, the target tester PC must have an empty PCI slot available.
- **Symphony /DSM** is a lower cost solution compared to Symphony /CFM because it does not require manufacturers to purchase any hardware.
- **Symphony /DSM** utilizes tester D/S pins to drive and sense the TAP pins, so it cannot be used on Analog Only test systems that do not have any D/S resources.
- The boundary scan controller and CFM hardware available in the **Symphony /CFM** solution can also be used to perform In-System-Programming of Programmable Logic and Flash devices (separate software license required).
- The **Symphony /DSM** solution does not support Flash/ISP programming. Standard Teradyne tools or device models would have to be used to perform Flash/ISP programming.
- The ProVision Development software can be added to the **Symphony /CFM** solution which would give developers access to a rich variety of test and debug tools on the tester.
- The **Symphony /DSM** solution does not provide any debug tools – if boundary scan debug or test modification is required, it must be performed using a separate benchtop ProVision system and the ICT program must be updated using the vector conversion tools.
- The **Symphony /CFM** solution using a Boundary scan controller to apply the test vectors and unlike the **Symphony /DSM** solution it does not need to load and unload the boundary scan test vectors from the ICT pin memory. As a result, the **Symphony /CFM** boundary scan test execution time will be approximately 4 times faster than the equivalent **Symphony /DSM** test execution time.

Q: What fixture and tester hardware does Symphony require?

A: The **Symphony /DSM** solution uses the standard TestStation or 228X driver/sensor pins to drive and sense the boundary scan test access pins. The boundary scan vector data is stored in Teradyne's Deep Serial Memory module.

The **Symphony /CFM** solution uses JTAG Technology's **JT 3717 /PCI** boundary scan controller and the **JT 2147 /CFM** Custom Function Module to drive and sense the boundary scan test access pins. Connection of the CFM TAP signals to the board under test is controlled by relays in Teradyne's Multi-Function Application Board previously known as the Custom Function Board.

Q: How do I order the Symphony solution?

A: You can order the Symphony partnership solution directly from Teradyne. Below you will find the part numbers, list prices, and descriptions of the various Symphony and Teradyne solution components. Please be advised that all prices are subject to change:

PN Symphony TS / PCI-17 / CFM plus CFB Package:

Symphony package for boundary scan testing and FLASH/PLD programming on Teradyne's TestStation and 228X test systems. Requires Teradyne's CFB hardware option.

- **Symphony TS / PCI-17 / CFM Includes:**
 - JT 3717 / PCI Controller w / ETT module (only 1 needed per tester)
 - JT 2147 / CFM Custom Function Module with 1 TAP interface
 - JT3717 to JT2147 Cable
 - Symphony / Teradyne Software Integration Package (includes execution software for testing and Flash/PLD programming, Result Collector, and Bscan Diagnostics software)
 - TestStation Symphony Installation Disk for Windows XP
 - Symphony /TS Users manual
 - Boundary Scan Diagnostics User manual
 - Command Line Reference manual
 - JT3707 / JT3717 / JT3727 Boundary-scan Controllers User's manual

- **Optional:**
 - PN 093-101-00 Teradyne Custom Function Board kit (\$6,600)
 - At least 1 CFB with spare CFM location is required to run the Symphony /CFM solution. Second CFB will be needed if application requires more than 2 independent scan paths. Contact Teradyne Parts Sales if you need to add the CFB option to your in-circuit test system.
 - PN JT 2147 /CFM Custom Function Module w/ 1 TAP (\$1,175)
 - Additional CFMs (4 max) may be needed if test application requires more than 1 scan path (Only 2 JT 2147 CFM modules allowed per CFB)
 - PN JT 3717 /PCI Controller w / ETT module (\$7,750)
 - Optional spare controller to facilitate service and repair/exchange
 - PN JT 2116 Upgrade of JT 3717 to JT 3727 controller for increased FLASH Programming capacity (\$1,700).
 - PN ProV_AST /N ProVision TestStation development software node-locked license, licensed for test generation, compilation, and execution (\$12,425).

PN **Symphony TS / DSM plus DSM Package:**

Symphony boundary scan testing package for Teradyne's TestStation and 228X test systems. Requires Teradyne's DSM hardware option.

- **Symphony TS / DSM Includes:**
 - JTAG to Teradyne test vector conversion software
 - Result Collector software
 - Control module for result collector & diagnostics
 - Node locked boundary-scan diagnostics (BSD) software
 - TestStation Symphony Installation Disk for Windows XP
 - Boundary Scan Diagnostics User manual

- **Optional:**
 - Integrated Controller w/ DSM swap (\$6,600)
 - The **Symphony /DSM** software requires that the target tester have Teradyne's Deep Serial Memory hardware option. On newer TestStation systems the DSM is located on the Integrated System Controller. If the Integrated Controller does not have the DSM option it can be swapped out for a price of \$6,600. Older 228X test systems must have the stand-alone DSM II board (PN 9004-0610-xx) that plugs into a pin board slot. Older DSM I boards are not supported. Contact Teradyne Parts Sales if you need to add the DSM option to your in-circuit test system.
 - Offline Programming & Debug Kit (\$16,925)– Optional software and hardware kit that can be purchased by manufacturers who want the ability to generate and debug boundary scan tests on a stand-alone PC or laptop. Kit includes:
 - JTAG Technology **ProV_TST /N** software licensed for test generation, debug, and diagnostics
 - **JT 3707 / TSI Datablaster** – High speed controller / Triple Serial Interface that supports connections to PC Ethernet, USB, or Firewire ports.

PN **SWMT Symphony 1 Year Software Year Maintenance Contract:**

- Yearly software support maintenance contract (1st year included at no charge). The Symphony maintenance contract must be bundled with Teradyne's standard Software Support Agreement.

Q: How is Symphony licensed?

A: The Symphony solution is licensed similar to other Teradyne product features. Manufacturers who purchase the Symphony product must contact Teradyne customer support (cs1@teradyne.com) and send them a license registration file that was generated on the target tester where Symphony is installed.

Teradyne customer support will then obtain and send to the manufacturer a unique software license key that enables the running of the Symphony software on that specific target tester.

Q: What ICT tester models will support Symphony?

A: The ***Symphony /CFM*** solution is supported on older 228X Windows XP based test systems that are running software version 5.8.0. Supported tester types include 2280, 2281, 2281A, 2283, 2284, 2286, 2287, 2287A, 2287L, 2287LX, and all TS8X models. It is also supported on all the latest Teradyne TestStation UltraPin-based test systems (TS, TS-LH, TS-LX, TS-Duo & TSR).

The ***Symphony /DSM*** solution supports all of the systems listed above except the Analog Only 2281A, 2287A, and TS121A configurations. The DSM solution requires digital D/S resources; therefore, analog only tester configurations are not supported.

Symphony supports the TestStation Duo Concurrent Test System, but if manufacturers intend to run Symphony concurrently using both modules of the Duo, then they must purchase two Symphony packages and install them independently on each module of the Duo tester.

Q: What will test developers need to develop Symphony boundary scan tests?

A: Program developers will typically develop and debug boundary scan tests using an offline PC workstation that is configured with JTAG Technologies' ***ProVision*** Development software and boundary scan hardware. Many programming service companies are familiar with JTAG Technologies' boundary scan product solutions and will have access to a development station at one of their development labs.

If a developer does not have access to JTAG Technologies' ProVision Development software and boundary scan hardware, it can be purchased from JTAG Technologies or from one of their authorized Sales representatives that are listed on their web site (http://www.itag.com/en/Support/How_to_contact_us).

JTAG Technologies also offers consulting and development services if you prefer to subcontract the development of your boundary scan test program. Their field application experts will work closely with you to define the scope of the work and provide you with a quotation for the project.

When the boundary scan test are up and running successfully on the offline development station, they can be moved to the tester and integrated into the standard in-circuit test program. Integration consists of editing the in-circuit test program to include the running of the converted test vectors (for ***Symphony /DSM***) or running the boundary scan test vectors using JTAG Technologies' run-time execution software (for ***Symphony /CFM***).

If the boundary scan tests fail on the in-circuit tester, additional debug may be required using the offline development station or modifications to the program or ICT test fixture may be required to minimize the electrical loading effect of the bed-of-nails fixture.

If you want to perform development and debug on the tester with the ***Symphony /CFM*** solution then the ProVision Development tools can be purchased and installed on the tester.

Q: What will Contract Manufacturers need to run boundary scan tests?

A: Most Contract Manufacturers are typically consigned an in-circuit test fixture and program by their OEM customer. They do not typically develop the in-circuit fixture or program. These Contract Manufacturers will be delivered a fixture and a test program that already has the in-circuit and JTAG boundary scan tests already integrated.

For these Contract Manufacturers all they need to do is make sure that the Symphony software is properly installed and licensed on their in-circuit test systems. If the program requires the ***Symphony /CFM*** solution, then the contract manufacturer must ensure that the PCI boundary scan controller and JTAG CFM hardware is installed in the target in-circuit testers. If the program

uses the **Symphony /DSM** solution, then the Contract Manufacturer must ensure that the in-circuit tester has the Deep Serial Memory hardware option.

If the Contract Manufacturer is authorized to make changes to the boundary scan production tests (to support ECO or part changes), then they will need the ProVision development tools installed on a tester with a **Symphony /CFM** solution or they will need a standalone ProVision test station. Refer to the question above on order and pricing for information on ordering these options.

Q: How does Teradyne support Symphony?

A: Teradyne provides the first level of support for the Symphony products, including repair and exchange of JTAG hardware, providing access to software patches, and answering technical questions directed to our customer support team.

Any problems or issues that Teradyne cannot resolve with their internal support team will be passed on to the JTAG Technologies' engineering team and tracked to ensure timely resolution.

Teradyne does not provide training for JTAG Technologies' **ProVision** development software and offline development station. Custom training classes for the ProVision development software are offered by JTAG and their authorized distributors. The typical charge for training is \$2,200 per day, for up to 6 students. Typical training courses are 2-3 days in duration. Travel and expenses are extra.

Q: What are the support/service costs?

A: The first year support costs for Symphony are included in the price of the product. Support for subsequent years requires the purchase of a Symphony software maintenance contract. The Symphony software maintenance contract is bundled into Teradyne's Software Support Agreement (SSA) so users have access to Teradyne's web support portal where they can download the latest Symphony software updates and patches, and get timely phone support from Teradyne's expert customer support team.

The additional cost to add a Symphony software maintenance contract to Teradyne's standard Software Support Agreement is \$975 per tester. Hardware support for the **Symphony /CFM** solution will be covered at no charge for those manufacturers that purchase a Full Service Agreement (FSA) from Teradyne.

For those test systems not covered by Teradyne's Full Service Agreement, we recommend that manufacturers purchase and keep on site spare **Symphony /CFM** hardware to avoid potential manufacturing down time.