

CORELIS

PCI-1149.1/Turbo

**PCI-1149.1/Turbo
High-Speed PCI Bus
Boundary-Scan Controller**

User's Manual

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Chapter 1

Product Overview

Introduction

The PCI-1149.1/Turbo High-Speed PCI Bus boundary-scan controller is a member of the Corelis ScanPlus™ family of scan-based test, analysis, and diagnostic tools. The PCI-1149.1/Turbo High-Speed PCI Bus Boundary-Scan Controller card, with memory-behind-the-pin architecture, interfaces between a PC and any IEEE Standard 1149.1 compatible target. The PCI-1149.1/Turbo is designed to control the operation of an IEEE Standard 1149.1 boundary-scan test path by generating the proper signals under software control to interface with the target device. It also supports remote operation of multiple boundary scan (JTAG) Test Access Ports (TAPs) using any of the Corelis ScanTAP family of Multiple TAP Intelligent pods such as the ScanTAP-4. The ScanTAP-4 provides up to 4 independent TAP connectors with a programmable low-voltage-compatible interface. It also supports simultaneous programming and verification of Flash memory devices at continuous scan clock (TCK) speeds of up to 80 MHz.

The PCI-1149.1/Turbo facilitates software-controlled boundary-scan operations per IEEE Standard 1149.1. It provides command access to the target's Test Access Port (TAP), to verify PCB interconnects, perform functional testing, and debug without manual probing. Furthermore, the JTAG interface gives access to internal device functions that are not accessible via external probing, enabling fault isolation within the device itself. The JTAG interface also enables programming target Flash and CPLD devices, as well as general down- and uploading of data blocks to and from various storage devices.

What Is IEEE Standard 1149.1?

The IEEE Standard 1149.1 test bus and boundary-scan architecture enable control of an IC, board, or system, via a standard four-signal interface. Each IEEE Standard 1149.1-compliant IC incorporates a feature known as boundary-scan, which ensures that a JTAG controller can control and observe each functional pin of the IC via the four-wire interface. A controller can load test, debug, or initialization patterns serially into the appropriate IC(s) via the IEEE Standard 1149.1 test bus. Thus, even with limited physical access, a user can observe or control IC, board, or system functions.

Two main elements comprise the IEEE Standard 1149.1 test bus: a Test Access Port (TAP), which interfaces internal IC logic with the external world via a four-signal (optionally five-signal) bus as shown in Figure 1-2, and a boundary-scan architecture, which defines standard boundary cells that drive and receive data at the IC pins. IEEE Standard 1149.1 also defines both mandatory and optional opcodes and test features. The test bus signals are: Test Clock (TCK), Test Mode Select (TMS), Test Data In (TDI), Test Data Out (TDO), and the optional Test Logic Reset (TRST).

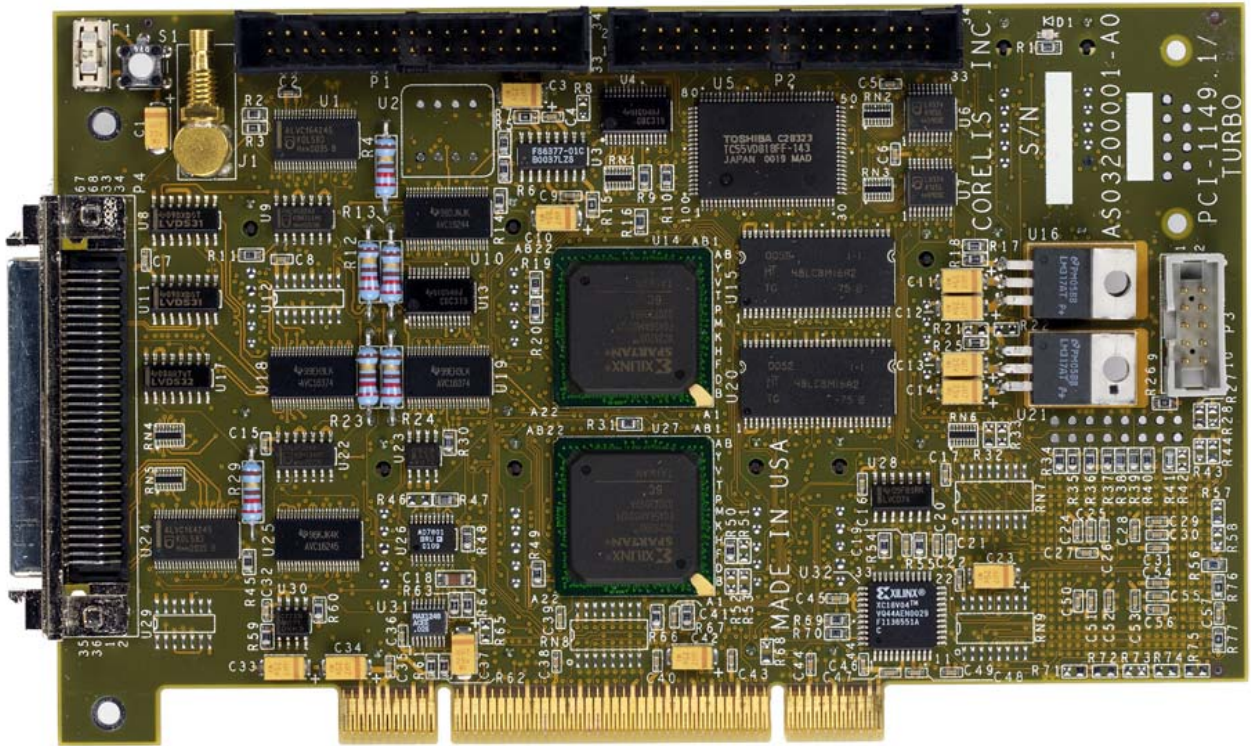


Figure 1-1. The Corelis PCI-1149.1/Turbo Boundary-Scan Controller

The IEEE-1149.1 Test Access Port Interface (TAP) consists of four required signals:

- Test Mode Select (TMS)
- Test Clock (TCK)
- Test Data In (TDI)
- Test Data Out (TDO)

A fifth signal is defined as optional:

- Test Reset (TRST*)

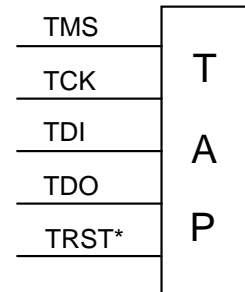


Figure 1-2. Test Access Port (TAP)

Features of the PCI-1149.1/Turbo

The Corelis PCI-1149.1/Turbo is a sophisticated test controller that can access devices, boards or systems compliant with IEEE Standard 1149.1. The PCI bus compatible card supports one JTAG boundary-scan chain (TAP). Two general purpose, 8-bit, parallel I/O ports can test or control non-boundary-scan areas of the unit under test (UUT). With its software-controlled voltage translating logic, the PCI-1149.1/Turbo can test low voltage systems. It supports signals including high-speed differential pairs that can operate external Corelis ScanTAP gang products, such as the ScanTAP-4, to remotely scan multiple Test Access Ports (TAP).

The PCI-1149.1/Turbo contains several performance enhancing functional sections aimed at increasing test vector throughput. A functional block diagram of the PCI-1149.1/Turbo is shown in Figure 1-3. Key functional elements include the TAP controller, and the memory resources that support it. The on-board memory provides scan data storage and can store the entire scan data for maximum performance, real-time scan operations.

A test system accesses the TAP controller and its associated memory through the host PCI bus memory-mapped I/O. This supports the high data rate of the PCI bus, regardless of actual test clock speeds. The ability to download information into these memory elements further decouples the scan operations from the host software. A state machine that contains status and control registers accessible through the PCI bus controls all functions of the PCI-1149.1/Turbo.

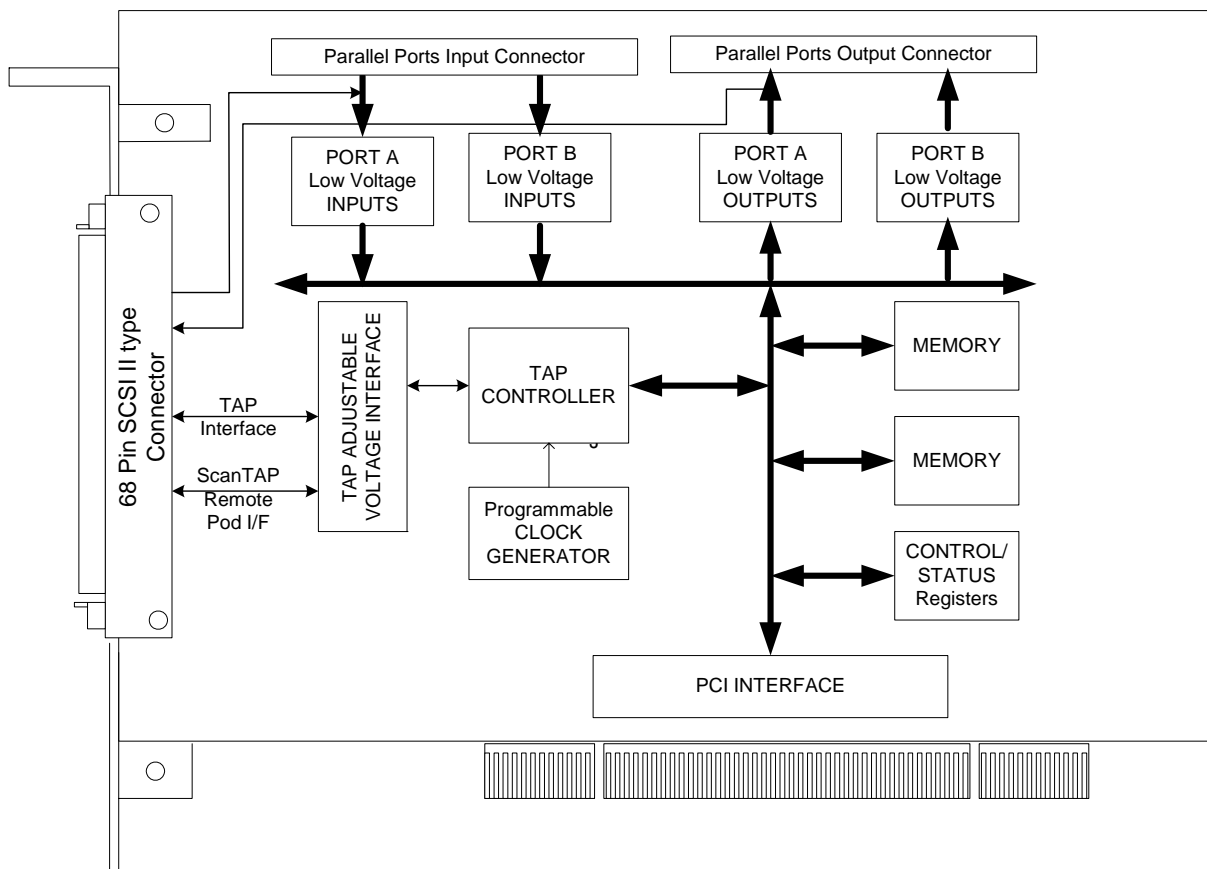


Figure 1-3. PCI-1149.1/Turbo Block Diagram

The PCI-1149.1/Turbo TAP controller contains special autonomous hardware accelerator mechanisms to greatly increase performance where scan patterns repeat numerous times. This applies to target download/upload sequences conveying large data blocks. As a result, time consuming tasks such as flash programming and emulator data transfers are more efficient for a given clock rate. This mechanism off-loads the host interaction requirements by generating repeated vectors internally, using host pre-loaded memory information. After host initialization, this mode of operation results in continuous, maximal scanning rates at all clock frequencies. The only exception occurs when the target paces the sequence by indicating a non-ready completion of data transfer, requiring a re-scan of the target's status. When not in this special mode, the scan stream bursts at the programmed TCK rate, as paced by the flow of vector bits from the host.

Another performance enhancement provides hardware expected-value verification of scanned-back data at programmable chain positions. Thus, the target output stream is evaluated without host intervention and accompanying process delays. This further supports the above autonomous operation enabling the scanning sequence to loop and rescan until the desired feedback is supplied, also without host intervention.

A programmable, time delay skew compensation mechanism supports the PCI-1149.1/Turbo's high clock rates. This accommodates the returned target scan stream delays due to signal travel time down and up the cables. It can also adjust for a target's on-board TCK-to-TDO response delay.

An auxiliary feature of the PCI-1149.1/Turbo is the target power-shortened detector for two voltages. With the target un-powered, this mechanism effectively measures the impedance of the target load for each of two possible connected voltages, determining if a short exists (some unacceptably low impedance). If this impedance is less than about 1 ohm (about an 11 watt target or greater at 3.3V, for example), it is deemed shorted.

Adjustable Voltage Interfaces

The software-programmable voltage level of the parallel I/O and TAP interfaces can be set to any voltage between 1.25 V and 3.30 V in increments of 0.05V minimum.

Parallel Input/Output Ports

The PCI-1149.1/Turbo contains 16 parallel inputs and 16 parallel outputs. The board groups these digital I/O into two 8-bit parallel input ports, and two 8-bit parallel output ports: Port A and Port B. The host computer can access the output ports via the Corelis ScanPlus Runner software. The input ports are for future use and are not currently available to the user.

The output ports are useful for providing discrete signals that control functions on the user target system such as reset, power control, and disable/enable signals for operating non-boundary-scan devices on target boards that include some non IEEE-1149.1 compliant components.

PCI Bus Interface

The PCI-1149.1/Turbo is a single-slot, universal 3.3 V or 5 V signaling level, 32-bit, 33 MHz PCI device, compliant with Revision 2.2 of the PCI Bus Specification. It is mapped to 132 MB of memory space of the host system as established during system initialization.

Programmable Clocks

The PCI-1149.1/Turbo's programmable TCK outputs to the IEEE Standard 1149.1 compatible target system can generate a wide range of TCK frequencies with onboard TCK generation circuitry. A programmable Phase Locked Loop (PLL) and counter dividers provide both a wide range and fine selection resolution. See Table 1-1 for the set of programmable values.

TCK range (MHz)	Rate Resolution (MHz)
25 to 80	1
12.5 to 25	0.5
6.25 to 12.5	0.25
5 to 6.25	0.125
2.5 to 5	0.10
1.25 to 2.5	0.05
0.62 to 1.25	0.025
0.39 to 0.62	0.0156
0.05 to 0.39	0.05

Table 1-1. Programmable TCK Frequencies

Features of the ScanTAP-4

The Corelis ScanTAP-4 Multiple TAP Intelligent pod connects to the PCI-1149.1/Turbo boundary-scan controller via the 68-pin SCSI II type HOST connector. No external power supply is required—the PCI-1149.1/Turbo card supplies it. Differential signal driving supports cables of up to 30 feet. Automatic delay mechanisms compensate for transport delays through the cable. The four TAPs are individually configurable for interface voltages from 1.25 to 3.3 V. On-board voltage translation logic allows a host to chain these TAPs together, or to configure them for gang programming. During gang programming each TAP drives the same data out to up to four targets, and simultaneously programs and verifies them. Optional Slow Slew rate (Voltages limited to 1.8 V to 3.3 V for slow slew) is provided. Each TAP can detect power shorts to ground for up to 2 voltages per TAP (with user-provided test software), allowing the ScanTAP-4 to detect potentially damaging conditions before the target system(s) is powered up.

Refer to Chapter 4 for further explanation on how to configure the ScanTAP-4 when using ScanPlus Runner software.

PCI-1149.1/Turbo Specifications

Host Computer

CPU	Pentium II @ 266 MHz or better
Operating System	Windows 95,98,NT, ME,2000, XP

PCI Interface

Bus Width	32-bit
Memory Space Size	132 MB

ScanTAP Interface

Maximum TCK frequency	80 MHz
TCK frequency steps	1.00 MHz increments between 25 and 80 MHz
TCK frequency steps (cont'd)	0.80 MHz increments between 12.5 and 25 MHz
TCK frequency steps (cont'd)	0.25 MHz increments (or less) below 12.5 MHz
Maximum scanning data length	unlimited

Physical

Card Outline Dimensions (PCB)	3.875 in. × 6.75 in.
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I/O Connectors

P4 - Boundary Scan Connector	68-pin SCSI II type (AMP P/N 787171-7 or equivalent)
P1 - Input Port Connector	34-pin header (3M part no. 2534-6002UB or equivalent)
P2 - Output Port Connector	34-pin header (3M part no. 2534-6002UB or equivalent)

Power Requirements (from host expansion bus)

5 V	1.5 Amps maximum
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On-board Fuse (feeds power from PCI-1149.1/Turbo to external pod)

1.5 Amp, SLO-BLO	Littelfuse part number 045401.5
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Operating Environment

Temperature	0°C to 55°C
Relative Humidity	10% to 90%, non condensing

Storage Environment

Temperature	-40°C to 85°C
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ScanTAP-4 Specifications

PCI-1149.1/Turbo Interface

Host Connector	68-pin SCSI type (AMP part no. 787171-7 or equivalent)
Host Cable Length:	6 foot (standard) - Corelis P/N 15314 15 foot (optional) - Corelis P/N 15328 30 foot (optional) - Corelis P/N 15329

TAP Interface

Connectors	Four 20-pin shrouded headers, 0.1 in. × 0.1 in. spacing
Number of TAPs	4
Maximum TCK frequency	80 MHz (Concurrent scanning at all TAPs occurs at up to the full TCK rate capability of the PCI-1149.1/Turbo)
Maximum scanning data length	unlimited
Programmable Interface Voltage	1.25 to 3.3 V in 0.05 V increments
Programmable TAPs	4, each TAP can have its own programmable voltage settings
Signals DC characteristics	See Table 1-2

Symbol	Test Conditions	Limit Min	Limit Max	Units
V_{IH}	Vdd Adjust ≥ 2.5 V	2	Vdd + 0.5	V
	Vdd Adjust < 2.50 V	$0.65 \times V_{dd}$	Vdd + 0.5	V
V_{IL}	Vdd Adjust ≥ 2.00		0.7	V
	Vdd Adjust ≤ 2.0		$0.35 \times V_{dd}$	V
V_{OH}	$I_{OH} = -2$ mA	Vdd - 0.35		V
V_{OL}	$I_{OL} = 2$ mA Vdd = 1.65 V		0.45	V
I_{OH}	Vdd = 1.65-1.95 V		-4	mA
I_{OL}	Vdd = 1.65-1.95 V		4	mA

Table 1-2. ScanTAP-4 DC Characteristics

Note: Also refer to Low Voltage CMOS (LVC) family signal characteristics data available from TI.

SPI Interface (ScanTAP-4 with Blue LED Only)

SCK frequency

1 MHz

Signal DC Characteristics

See Table 1-3:

Symbol	Test Conditions	Limit Min	Limit Max	Units
V_{IH}	Vdd Adjust ≥ 2.5 V	2	Vdd + 0.5	V
	Vdd Adjust < 2.50 V	$0.65 \times V_{dd}$	Vdd + 0.5	V
V_{IL}	Vdd Adjust ≥ 2.00		0.7	V
	Vdd Adjust ≤ 2.0		$0.35 \times V_{dd}$	V
V_{OH}	$I_{OH} = -2$ mA	Vdd - 0.35		V
V_{OL}	$I_{OL} = 2$ mA Vdd = 1.65 V		0.45	V
I_{OH}	Vdd = 1.65-1.95 V		-4	mA
I_{OL}	Vdd = 1.65-1.95 V		4	mA

Table 1-3. ScanTAP-4 SPI Interface DC Characteristics

Power Short Test Pins

Power (Vcc) Sense Pins	Two per TAP (Vcc1, Vcc2), 8 total
Vcc Measurement Type	Short to GND detect, Target un-Powered,
	Voltage sense/measurement of +/- 50 VDC
Voltage Sense Resolution	12-bit ADC
Voltage Sense Accuracy	+/- 50 mV

Physical

Box Outline Dimensions	4.00 in. × 4.60 in. × 0.75 in.
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Power Requirements

No external supply needed	Power is provided by the host controller
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Operating Environment

Temperature	0°C to 55°C
Relative Humidity	10% to 90%, non condensing

Storage Environment

Temperature	-40°C to 85°C
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Chapter 2

PCI-1149.1/Turbo Installation

The PCI-1149.1/Turbo product typically consists of the following components:

- PCI-1149.1/Turbo PCI based boundary-scan controller card
- PCI-1149.1/Turbo User's Manual

Ensure all materials listed are present and free from visible damage or defects before proceeding. If anything appears to be missing or damaged, contact Corelis at the number listed on the front cover immediately.

The ScanTAP-4 typically consists of the following components and is shown in Figure 2-1:

- ScanTAP-4 box
- Host Cable, 6-foot, 68-pin SCSI type, one-to-one Cable, Corelis P/N 15314
- A set of four 20-pin to 10-pin TAP cables, Corelis P/N 15310

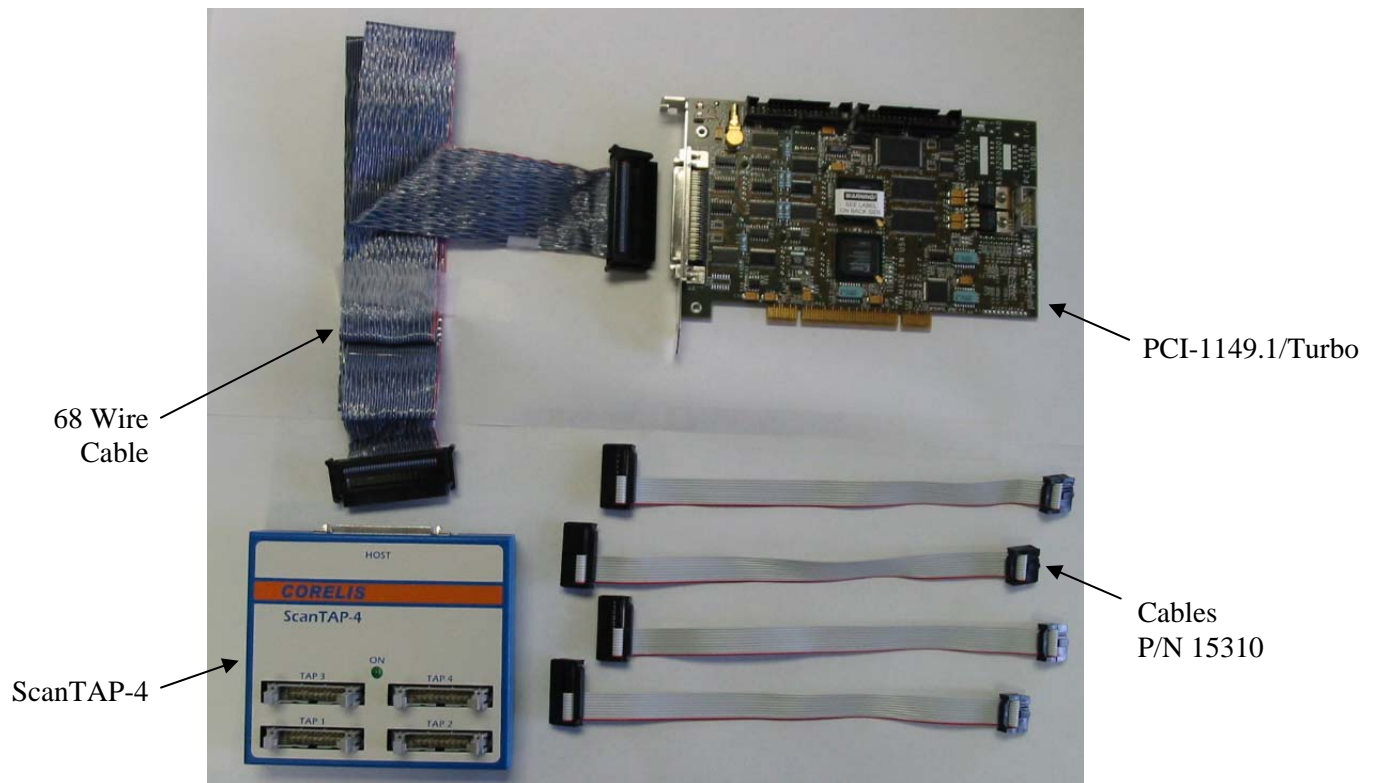


Figure 2-1. Picture of the PCI-1149.1/Turbo and ScanTAP-4 Hardware

NOTE: The actual hardware shipped to the customer may vary depending on the customer order.

When this manual was published the following optional target interface TAP cables were available from Corelis:

- Bag of 4 TAP cables, 20-pin to 16-pin TAP, Corelis P/N 15311
- Bag of 4 TAP cables, 20-pin to 20-pin TAP, Corelis P/N 15312
- Host Cable, 15-foot, 68-pin SCSI type, one-to-one cable, Corelis P/N 15328
- Host Cable, 30-foot, 68-pin SCSI type, one-to-one cable, Corelis P/N 15329

Software Installation First!

The installation procedure requires the use of software that contains the driver for the PCI-1149.1/Turbo card. Obtain the ScanPlus CD-ROM (or any other Corelis application that supports the PCI-1149.1/Turbo card) in order to proceed with installation. **Install the ScanPlus Application Software before installing the PCI-1149.1/Turbo controller.** The PCI-1149.1/Turbo controller is a plug-and-play device, and its drivers are installed with the ScanPlus Application Software. Windows will automatically recognize and configure the PCI-1149.1/Turbo the first time it is detected in your system.

WARNING !

You **MUST** install the software first – before installing the card. **Do not install the PCI-1149.1/Turbo card until you have successfully installed the application software** (ScanPlus, CodeRunner, etc.). Installing the software provides the plug-and-play driver for the card so that the operating system is able to properly detect and configure the card. Installing the card before the software may result in improper card configuration and operation.

Hardware Installation

Again, make sure to **install the ScanPlus Application Software before installing the PCI-1149.1/Turbo controller**. The PCI-1149.1/Turbo controller is a plug-and-play device, and its drivers are installed with the ScanPlus Application Software. Windows will automatically recognize and configure the PCI-1149.1/Turbo the first time it is detected in your system.

To install the PCI-1149.1/Turbo on a PC:

- Install ScanPlus Applications from the CD, and shut down the PC.
- Remove the PCI-1149.1/Turbo from its package.
- Disconnect the PC power cord from the power source and then remove the enclosure cover from the PC.
- Plug the PCI-1149.1/Turbo board into the PC in an available PCI slot.
- Use a screw to firmly attach the PCI-1149.1/Turbo card bracket to the PC chassis.
- Close the PC enclosure, apply power and verify that the PC boots up correctly.

Preserve the original packing material for future shipment or storage of the PCI-1149.1/Turbo.

In the event that you installed the PCI-1149.1/Turbo controller before installing the software, cancel the **Add/Remove Hardware Wizard** and install the ScanPlus Applications from the CD. The next time you start the PC, Windows will automatically recognize and configure the PCI-1149.1/Turbo.

Once the PCI-1149.1/Turbo is installed in the PC, connect the ScanTAP-4 to the PCI-1149.1/Turbo card using the 68-pin SCSI type host cable:

- Power down (shutdown) the PC
- Plug the 68-pin host cable to the mating connector on the PCI-1149.1/Turbo (that should not protrude from the back of your PC enclosure).
- Plug the other side of the 68-pin host cable to the HOST connector of the ScanTAP-4 box.
- Apply power and verify that the PC boots up correctly. The “ON” LED should be constantly illuminated when the PC is powered up.

Chapter 3

Connecting to the Target

Connecting to the Target

The connection to the user target (UUT) board/system is done from the ScanTAP-4 Intelligent Pod TAP connectors to mating connectors on the target. The ScanTAP-4 connects to the target via the supplied 1:1 TAP flat cables, P/N 15310, 15311 or 15312. Figure 3-1 shows the top view of the ScanTAP-4 box, including the four TAP connectors which are clearly marked: TAP 1, TAP 2, TAP 3 and TAP 4.

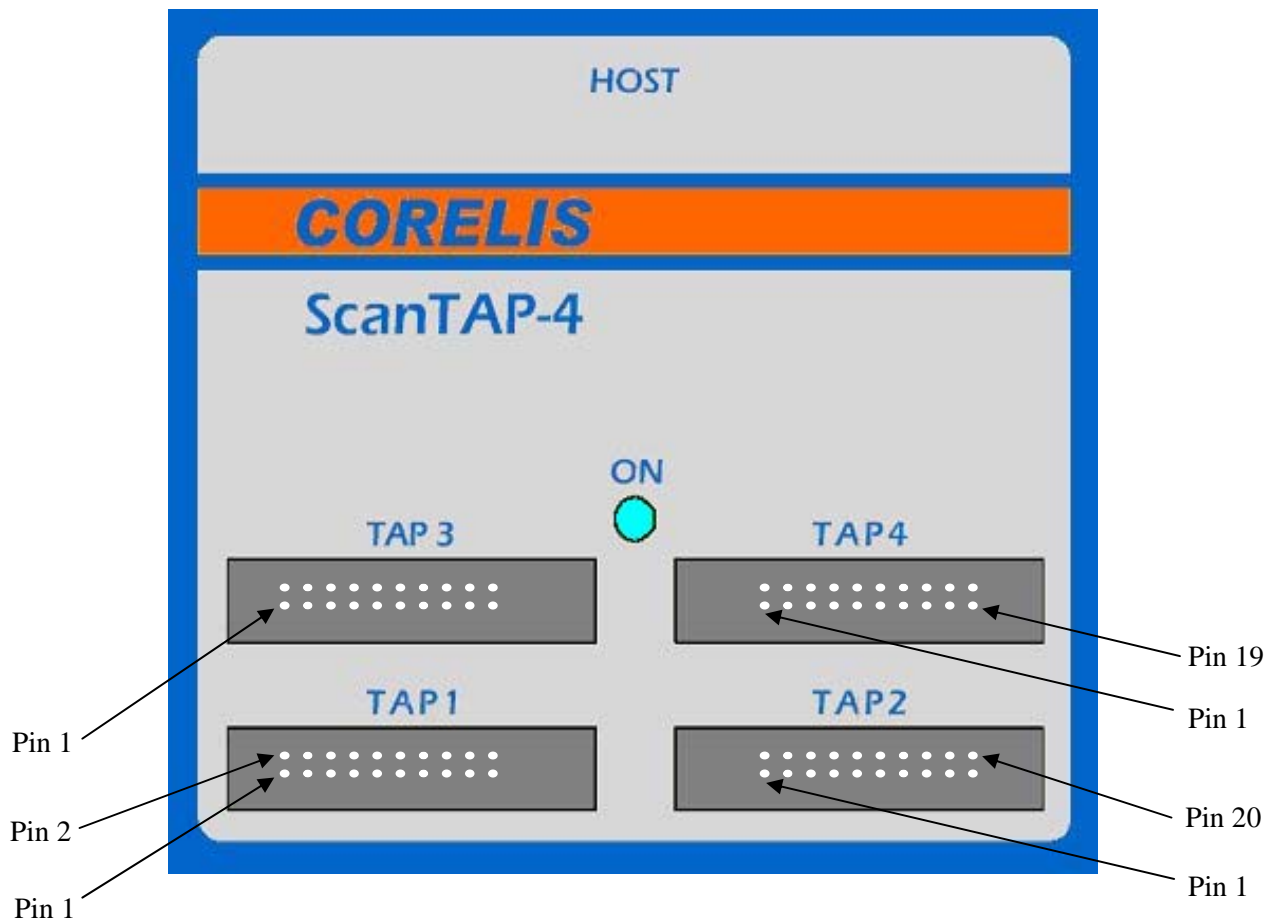


Figure 3-1. ScanTAP-4 20-pin TAP Header Connectors (top view)

While most targets use only a single TAP connector, it is not uncommon that targets contain multiple TAP connectors. Although the 4-connector ScanTAP-4 will accommodate the vast majority of multiple-TAP targets, a target board with more than 4 TAPs requires a different interface. Please contact Corelis for other available products.

The following ScanTAP-4 TAP connectors are connected to the target board:

TAP1	- when the target has a single TAP connector
TAP1 and TAP2	- when the target has 2 TAP interface connectors
TAP1, TAP2 and TAP3	- when the target has 3 TAP interface connectors
TAP1, TAP2, TAP3 and TAP4	- when the target has 4 TAP interface connectors

To connect the TAP connector(s) to the target (UUT):

- Make sure that the target power is OFF.
- Make sure that the **ON** LED on top of the ScanTAP-4 is illuminated.
- Install the TAP cable(s) on the ScanTAP-4 TAP connectors.
- Install the other side of the TAP cable(s) on the matching target TAP connectors.
- Now you can turn the target power ON.

Appendix A contains general recommendation for implementing compatible target TAP connector(s). Following these recommendations makes the connection to the target easy and straightforward. To accommodate target boards with TAP connectors other than this standard, Corelis offers short, custom adapter cables for connectors such as the Altera ByteBlaster connector, the Xilinx 9 pin header, the Lattice TAP connector or the TI 14 pin DSP connector)

20-Pin ScanTAP Connector

The ScanTAP-4 contains four 20-pin TAP connectors. All four connectors have the same signals and the same pinout. Each connector is a shrouded header (0.100 × 0.100 in. spacing) with long ejectors that are compatible with standard 20-pin IDC flat cable connectors (with strain relief). The pin assignment is shown in Table 3-1.

Pin	Signal	Direction	Termination
1	TRST*	Input to the UUT	1K pull-up
2	GND		
3	TDI	Input to the UUT	1K pull-up
4	GND		
5	TDO	Output of the UUT	33 ohm series
6	GND		
7	TMS	Input to the UUT	1K pull-up
8	GND		
9	TCK	Input to the UUT	1K pull-up
10	GND		
11	Write_Strobe* / GPIO1 / SPI_CS2*	Input to the UUT	1K pull-up
12	GND		
13	SPI_SCK / GPIO2	Input to the UUT	1K pull-up
14	GND		
15	Ready_Busy* / SPI_SDO (MISO) / GPIO3	Output of the UUT	1K pull-up
16	SPI_SDI (MOSI)	Input to the UUT	1K pull-up
17	VCC1	UUT Power Test Point 1	None
18	I2C_SCL	Input to the UUT	1K pull-up
19	VCC2	UUT Power Test Point 2	None
20	SPI_CS1* / I2C_SDA	Input to the UUT	1K pull-up

Table 3-1. ScanTAP-4 TAP Pin Assignment

Note that only the first 10 pins are required. For Flash Programming with external write or the Ready Busy signal, use the first 16 pins of the TAP. To build in support for power-to-ground short checking, use all 20 pins of the TAP.

Pins 17 and 19 of each ScanTAP-4 connector can be used to sense that the target power pin is not shorted to GND. Up to 2 different power pins can be checked on each of the four 20-pin connectors of the ScanTAP-4 box.

The 3 GPIO signals are general purpose output signals that are directly controlled by the Parallel I/O menu of ScanPlus Runner. Refer to the ScanPlus Runner manual for further information.

The dual purpose External Write* (GPIO1) signal is used for Flash programming, and if used will override the Parallel Output (GPIO1) function. Refer to the ScanPlus Flash Programmer manual for further information about this function.

The dual purpose Read/Busy* (GPIO3) signal is used for Flash programming, and if used will override the Parallel Output (GPIO3) function. Refer to the ScanPlus Flash Programmer manual for further information about this function.

The ScanTAP-4 comes standard with 4 short cables that connect it to a target system with up to 4 TAP connectors. These 20-pin to 10-pin cables, Corelis P/N 15310, are standard flat cables and can easily be made from off-the-shelf connectors. Each cable mates with a matching 10-pin header on the target system.

68-pin Host Connector

The PCI-1149.1/Turbo connects to the ScanTAP-4 using a 68-wire, one-to-one, twisted-pair ribbon cable, P/N 15314. Other HOST cables of longer lengths are also available.

Table 3-2 shows the part numbers for making custom length HOST flat cable. Note that this table is provided for reference only and Corelis recommends using only approved HOST cables that are provided with the product:

Description	Manufacturer	Part Number
68-pin .100 × .100 SCSI IDC Socket	Circuit Assembly	CA-68MDP-F
SCSI Strain Relief	Circuit Assembly	CA-LSR68MDP
0.25" Spectra-Strip twisted pair, 34-pair cable.	Amphenol	125-3099-999

Table 3-2. 68-Pin SCSI type Cable Parts

PCI-1149.1/Turbo Parallel I/O Connectors

The parallel output port connector (P2 on the PCI-1149.1/Turbo) is a 34-pin connector that includes all of the signals for the parallel output ports A and B. The connector is located near the top of the card. The pin-out of the P2 connector is shown in Table 3-3.

PCI Bus Data Alignment	Signal Name	Output Connector
D0	PORTA_OUT0	P2-1
D1	PORTA_OUT1	P2-3
D2	PORTA_OUT2	P2-5
D3	PORTA_OUT3	P2-7
D4	PORTA_OUT4	P2-9
D5	PORTA_OUT5	P2-11
D6	PORTA_OUT6	P2-13
D7	PORTA_OUT7	P2-15
D0	PORTB_OUT0	P2-17
D1	PORTB_OUT1	P2-19
D2	PORTB_OUT2	P2-21
D3	PORTB_OUT3	P2-23
D4	PORTB_OUT4	P2-25
D5	PORTB_OUT5	P2-27
D6	PORTB_OUT6	P2-29
D7	PORTB_OUT7	P2-31

Table 3-3. Connector P2 Parallel Output Pin Assignment

Note: All even pins of the connector (2, 4, 6, 8, ...34) are connected to ground. P2-33 is not connected.

The parallel input port connector (P1 on the PCI-1149.1/Turbo) is a 34-pin connector that includes all of the signals for the parallel input port. The connector is located near the top of the card. The pin-out of the P1 connector is shown in Table 3-4.

PCI Bus Data Alignment	Signal Name	Input Connector
D0	PORTA_IN0	P1-1
D1	PORTA_IN1	P1-3
D2	PORTA_IN2	P1-5
D3	PORTA_IN3	P1-7
D4	PORTA_IN4	P1-9
D5	PORTA_IN5	P1-11
D6	PORTA_IN6	P1-13
D7	PORTA_IN7	P1-15
D0	PORTB_IN0	P1-17
D1	PORTB_IN1	P1-19
D2	PORTB_IN2	P1-21
D3	PORTB_IN3	P1-23
D4	PORTB_IN4	P1-25
D5	PORTB_IN5	P1-27
D6	PORTB_IN6	P1-29
D7	PORTB_IN7	P1-31

Table 3-4. Connector P1 Parallel Input Pin Assignment

Note 1: All even pins of the connector (2, 4, 6, 8, ...34) are connected to ground. P1-33 is not connected.

Note 2: All input signals have a 4.7 K pull-up resistor to the programmed interface voltage (1.25 to 3.30 V). When the ScanTAP-4 is used, the 16 inputs and outputs interface at 3.3V.

Chapter 4

Using PCI-1149.1/Turbo with ScanPlus

Hardware Setup

You must configure the PCI-1149.1/Turbo controller in a ScanPlus application before the application can use it. This chapter uses ScanPlus Runner as an example to illustrate the configuration process.

Using PCI-1149.1/Turbo with ScanPlus Tools

The PCI-1149.1/Turbo card is compatible with ScanPlus Runner, ScanPlus Debugger and ScanPlus Flash Programmer. The following steps are provided for ScanPlus Runner. Selecting the card in ScanPlus Debugger or ScanPlus Flash Programmer is done in a similar fashion.

1. Invoke the ScanPlus Runner application.
2. Click the **Setup** menu item and then select the **Controller** entry to display the Controller Configuration screen shown in Figure 4-1.

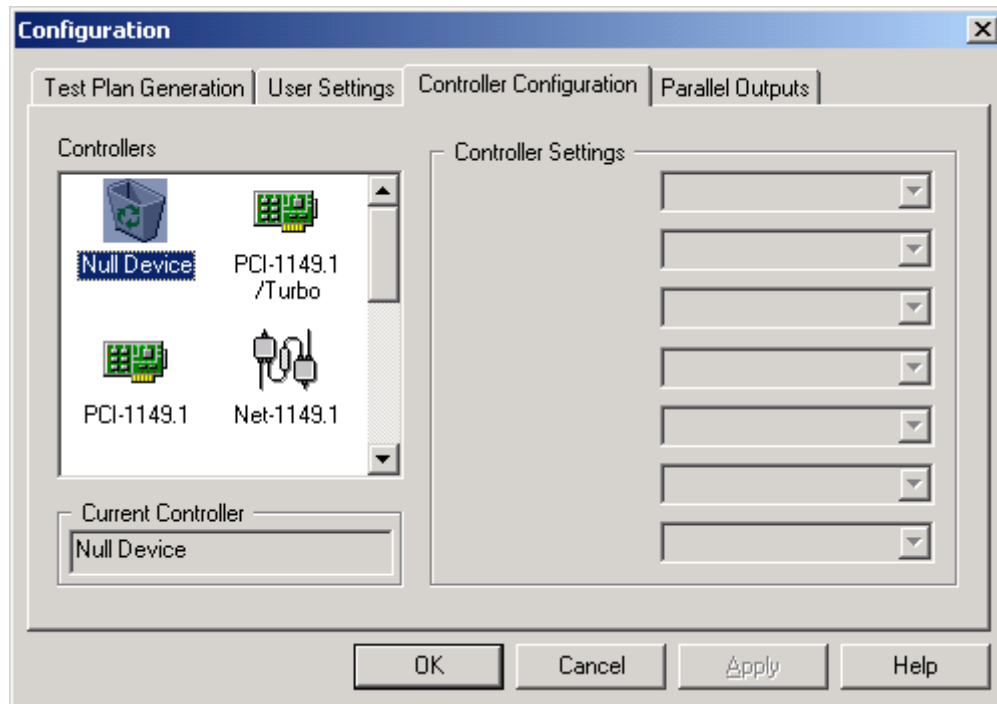


Figure 4-1. Controller Configuration Screen

3. Select the **PCI-1149.1/Turbo** controller from the icons on the left. Adjust the settings to the desired values.
4. After you have made your selections, click on the **Apply** button to test and save the settings. When the program saves the settings successfully, it displays the controller in the **Current Controller** box. If ScanPlus Runner cannot find the controller, it displays an error dialog.
5. Once ScanPlus Runner finds the PCI-1149.1/Turbo controller, **if for some reason the ScanTAP-4 is not connected to it**, it displays a screen similar to Figure 4-2. If the ScanTAP-4 is connected after seeing this screen you must exit this program and re-start at step 1.

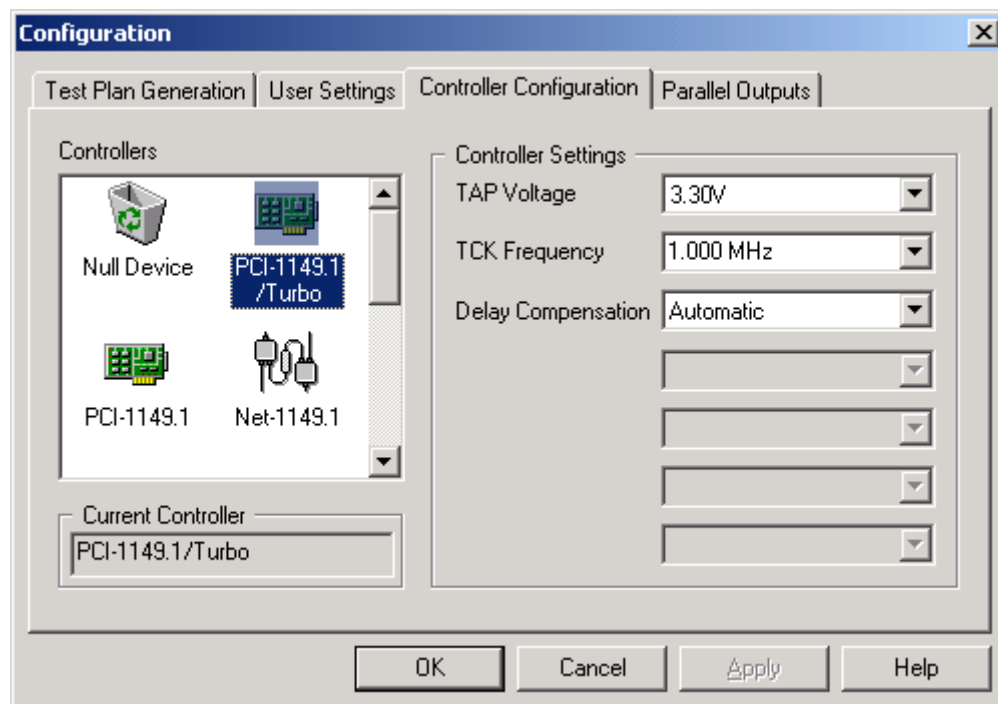


Figure 4-2. PCI-1149.1/Turbo Setup Screen (but ScanTAP-4 not connected)

6. Once ScanPlus Runner finds the PCI-1149.1/Turbo controller, **with the ScanTAP-4 connected to it**, it displays a screen similar to Figure 4-3. Note that saving the test plan (.tsp) file in ScanPlus Runner FILE menu also saves the settings in the system registry. The next time the .tsp file is loaded into ScanPlus Runner it will use these settings to initialize the controller.

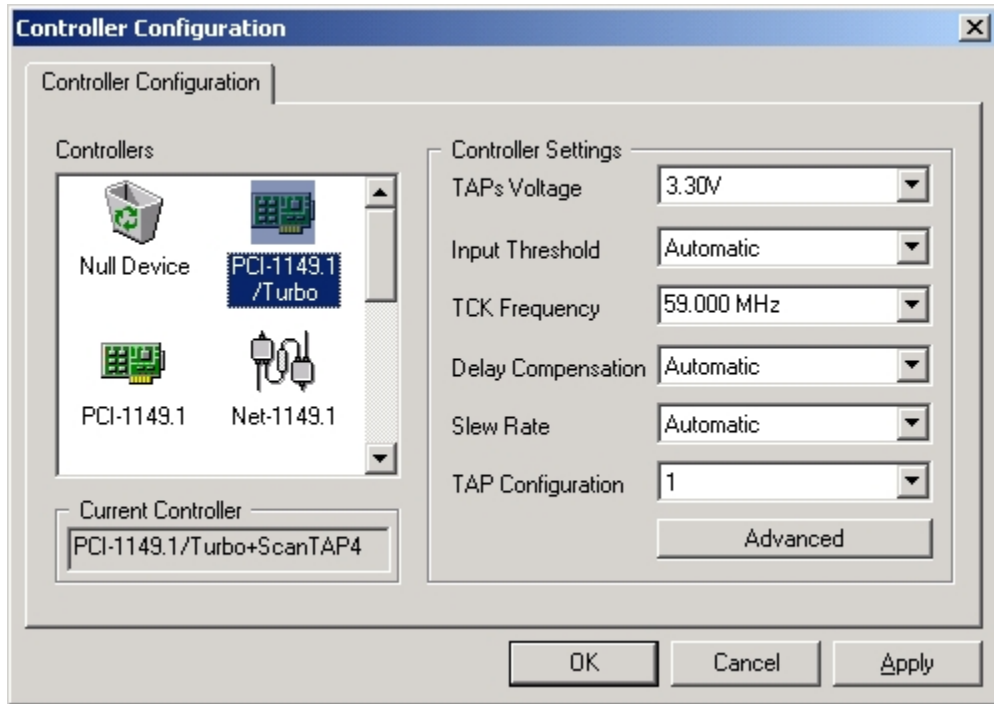


Figure 4-3. Successful PCI-1149.1/Turbo With ScanTAP Setup Screen

7. The **Advanced** button can be used for selecting different voltage settings for each individual TAP. While most targets with multiple TAPs use the same voltage settings for all the TAPs it is not uncommon to find targets that use, for example, the 3.3 V setting for one TAP, 2.5 V for another, and 1.8 V for one or two additional TAPs. The Advanced Configuration screen is shown in Figure 4-4.

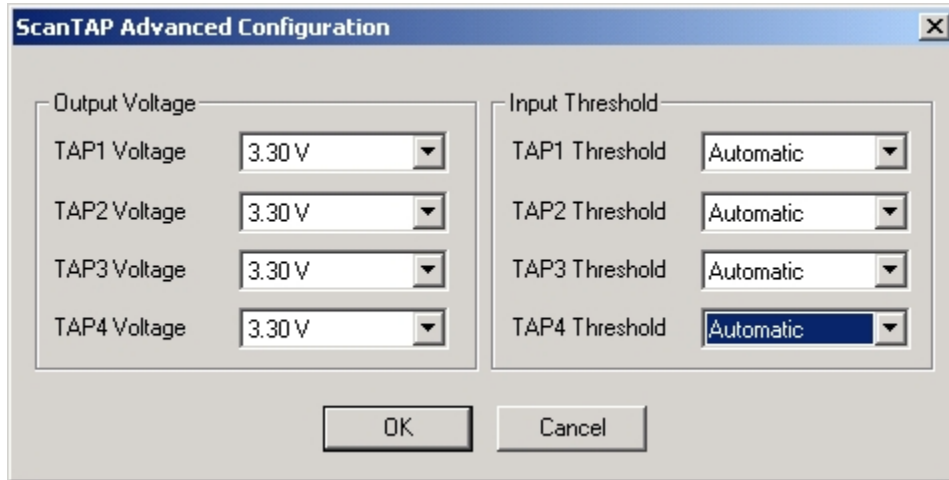


Figure 4-4. Advanced Configuration Setup Screen

ScanTAP-4 TAP Configuration

The ScanPlus Tools provide 3 different methods to specify the TAP(s) that connect the ScanTAP-4 to the target system:

- Method 1 The **TAP Configuration** select box in the **Controller Configuration** screen (see Figure 4-3). This is the preferred and most straightforward method for selecting which of the 4 ScanTAP-4 TAPs to use for connecting to the target.
- Method 2 Embedding the TAP selection text as part of the test step file name. This method is explained below and is primarily supported for upwards compatibility with legacy tools.
- Method 3 Using the ScanPlus Runner tool **Options** menu. Use this method only when specific test step(s) require TAP configuration settings different from the global settings selected in Method 1 above.

TAP Configuration - Method 1

The **TAP Configuration** select box in the **Controller Configuration** screen provides TAP selection options as shown in Figure 4-5. This is the preferred and most straightforward method for selecting which of the 4 ScanTAP-4 TAPs to use for connecting to the target. This feature is available in all relevant ScanPlus Tools, including ScanPlus Runner, ScanPlus Debugger and ScanPlus Flash Programmer.

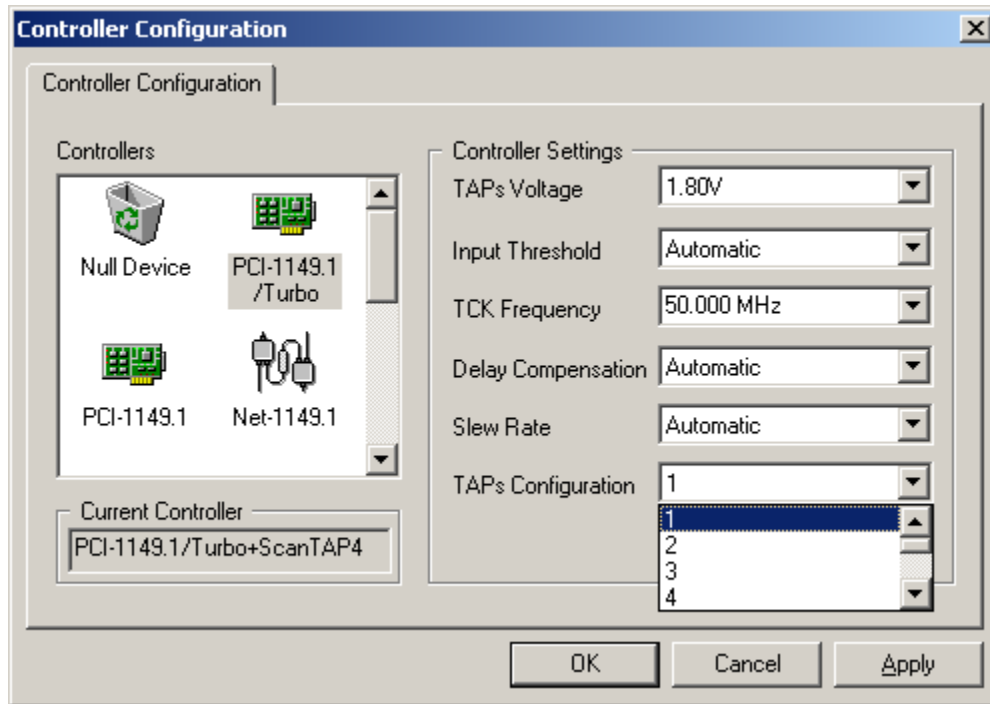


Figure 4-5. Controller Configuration TAP Configuration Options

Table 4-1 summarizes the different configuration options available in the **TAP Configuration** drop-down list.

Configuration	Meaning	TAP(s) Enabled
1	Enable TAP1 only	TAP1 only
2	Enable TAP2 only	TAP2 only
3	Enable TAP3 only	TAP3 only
4	Enable TAP4 only	TAP4 only
1+2	Serialize TAPs 1 through 2	TAPs 1 and 2 in series
1+2+3	Serialize TAPs 1 through 3	TAPs 1, 2, and 3 in series
1+2+3+4	Serialize TAPs 1 through 4	TAPs 1, 2, 3, and 4 in series

Table 4-1. ScanPlus Runner ScanTAP-4 Configuration

NOTE: Additional selection options are available for Flash Programming (.fpi) test steps as described later in this chapter.

TAP Configuration - Method 2

This method is primarily provided for upwards compatibility with legacy tools and is not recommended for new applications. It works by embedding the TAP selection text as part of the test step file name. This method will override any TAP configuration selected in Method 1. This feature is available in all relevant ScanPlus Tools, including ScanPlus Runner, ScanPlus Debugger and ScanPlus Flash Programmer.

File Name ID	Meaning	TAP(s) Enabled
_TAP1	Enable TAP1 only	TAP1 only
_TAP2	Enable TAP2 only	TAP2 only
_TAP3	Enable TAP3 only	TAP3 only
_TAP4	Enable TAP4 only	TAP4 only
_TAP1+2	Serialize TAPs 1 through 2	TAPs 1 and 2 in series
_TAP1+2+3	Serialize TAPs 1 through 3	TAPs 1, 2, and 3 in series
_TAP1+2+3+4	Serialize TAPs 1 through 4	TAPs 1, 2, 3, and 4 in series

Table 4-2. ScanPlus Runner Naming Conventions

For example, to execute a test or programming file on a target board that contains 3 TAPs using the file **myboard_inf.cvf**, change the file name to **myboard_TAP1+2+3_inf.cvf**. The ScanTAP-4 is configurable on the fly, and adding a filename suffix from Table 4-2 to a test file name will configure the system to run that test.

Note that since in most cases the file name already contains a suffix, the file name ID is inserted between the suffix and the rest of the file name. For example, **infrastructure_inf.cvf** becomes **infrastructure_TAP1+2+3+4_inf.cvf**.

NOTE: Additional selection options are available for Flash Programming (.fpi) test steps as described later in this chapter.

TAP Configuration - Method 3

This method is only available for ScanPlus Runner. It is available in the ScanPlus Runner **Options** menu. Use this method only when specific test step(s) require TAP configuration settings different from the global settings selected in Method 1.

A typical ScanPlus Runner main screen with multiple test steps is shown in Figure 4-6:

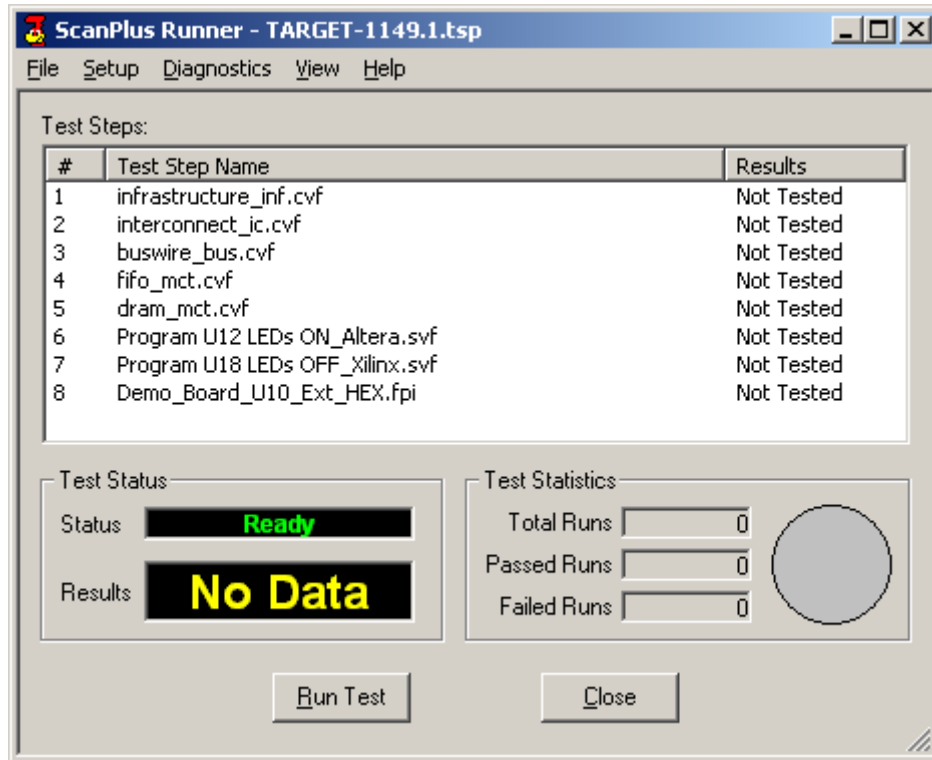


Figure 4-6. Typical ScanPlus Runner Test Plan

Highlight a test step by pointing to it with the mouse and then clicking once with the left mouse button. The test step is now highlighted. Right-click on the test step name to bring up a pop-up menu, and select **Options** as shown in Figure 4-7.

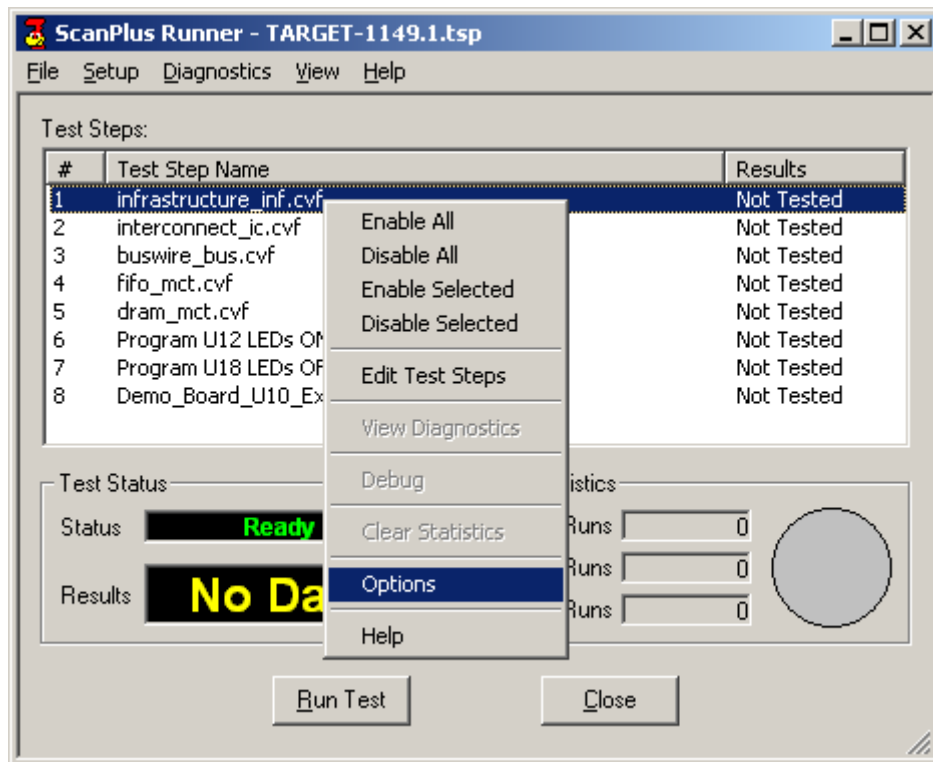


Figure 4-7. ScanPlus Runner Pop-up Menu

An **Options** dialog box similar to Figure 4-8 will appear. The appearance of the dialog box varies with the type of test step selected. Figure 4-8 illustrates an options dialog for an infrastructure test step. Consult the ScanPlus Runner User's Manual for more information on the **Options** dialog boxes.

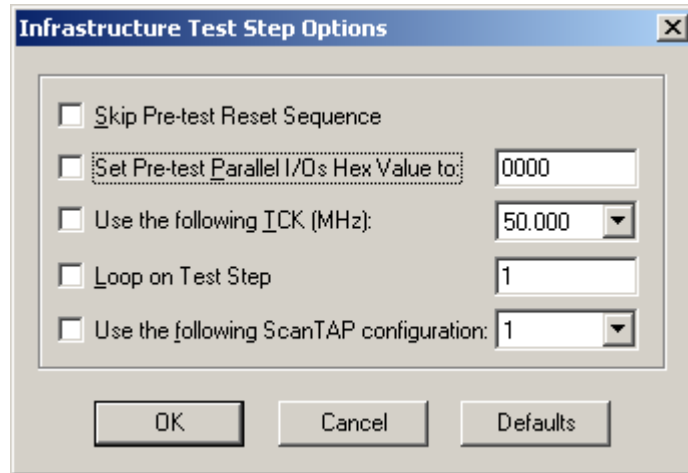


Figure 4-8. Infrastructure Test Options Dialog Box

Click the **Use the following ScanTAP configuration** check box and select the desired programming topology configuration from the drop-down list. Figure 4-9 shows the selections available from the configuration drop-down list.

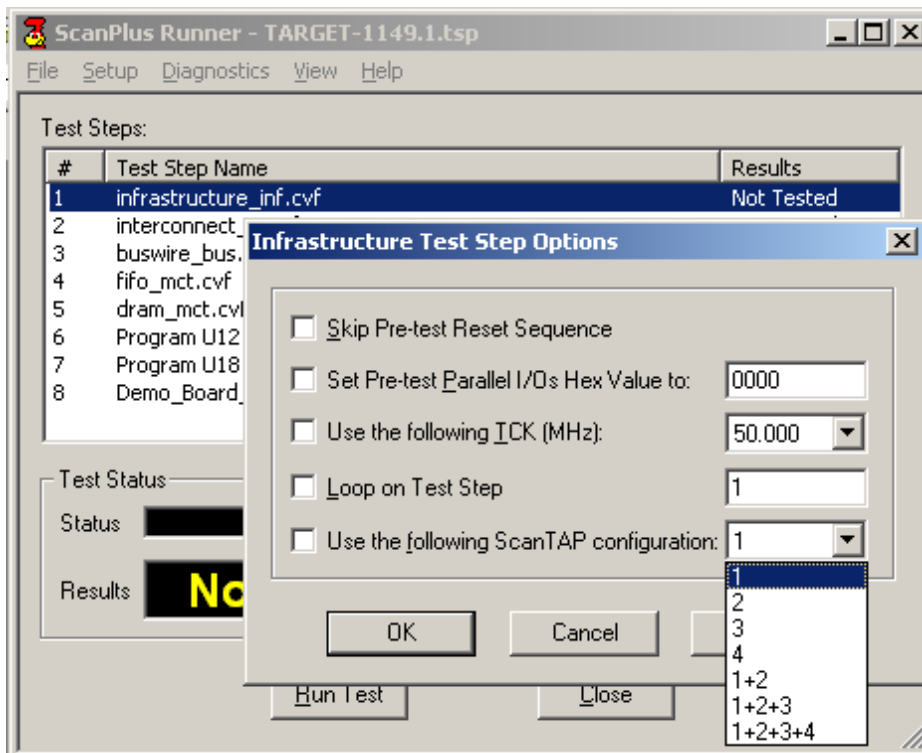


Figure 4-9. Available ScanTAP-4 Configuration

Gang Programming with ScanPlus Runner

Special TAP configuration features are provided for parallel (Gang) programming of Flash memories using .fpi files. ScanPlus Runner also supports gang programming, determining the configuration of the Flash programming topology from the .fpi file name. This is in addition to the TAP configuration options listed .

Table 4-3 lists suffixes to add to the file name for various cases:

File Name ID	Meaning	TAP(s) Enabled
_TAP1-2	Enable TAPs 1 through 2	Gang Programming of TAP1 and TAP2
_TAP1-3	Enable TAPs 1 through 3	Gang Programming of TAP1, TAP2 and TAP 3
_TAP1-4	Enable TAPs 1 through 4	Gang Programming of TAPs 1, 2, 3 and 4

Table 4-3. ScanPlus Runner Naming Conventions for Gang Programming

For example, to gang program all four target boards using the file **program U7.fpi**, change the file name to **program U7_TAP1-4.fpi**. The ScanTAP-4 is configurable on the fly, and adding a filename suffix from Table 4-3 to a test file name will configure the system to run that test.

In the test plan shown in Figure 4-10 below, the system first tests target TAPs 1 through 4 for infrastructure, then it programs the Altera CPLD on target TAPs 1 through 4, then it programs the Flash memory in parallel on all four targets.

Note that for files that already contain a suffix, the file name ID is inserted between the suffix and the rest of the file name. For example, **infrastructure_inf.cvf** becomes **infrastructure_TAP1-4_inf.cvf**.

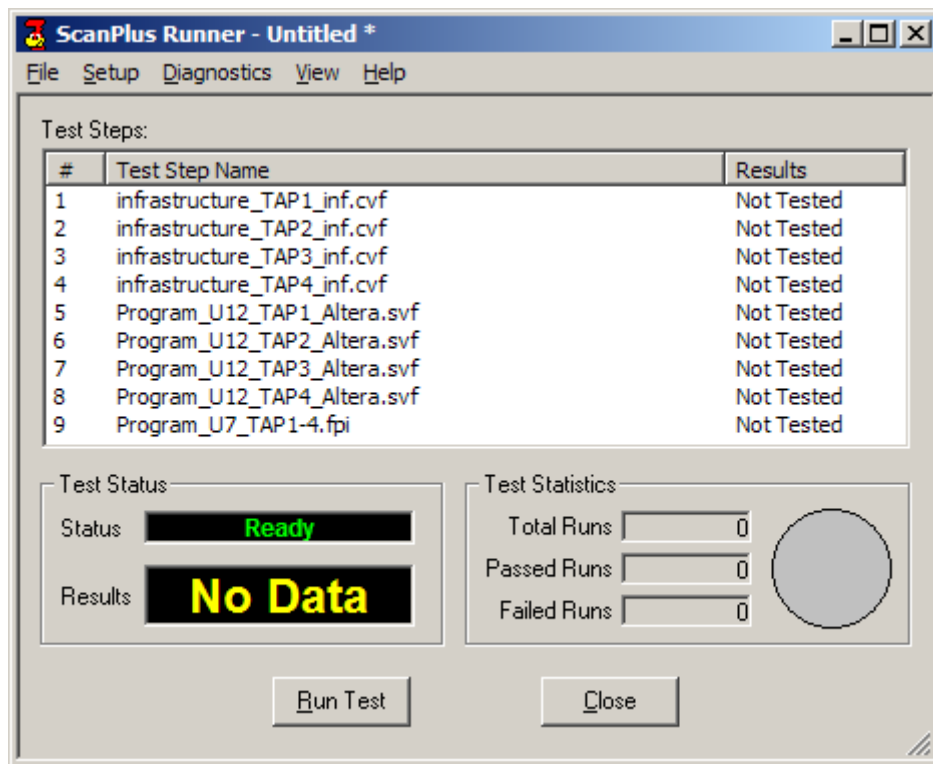


Figure 4-10. ScanPlus Runner Test Plan for Gang Programming

The **Options** dialog provides an alternate way to specify gang programming from ScanPlus Runner. Right-click on the test step name to bring up a pop-up menu, and select **Options** as shown in Figure 4-11.

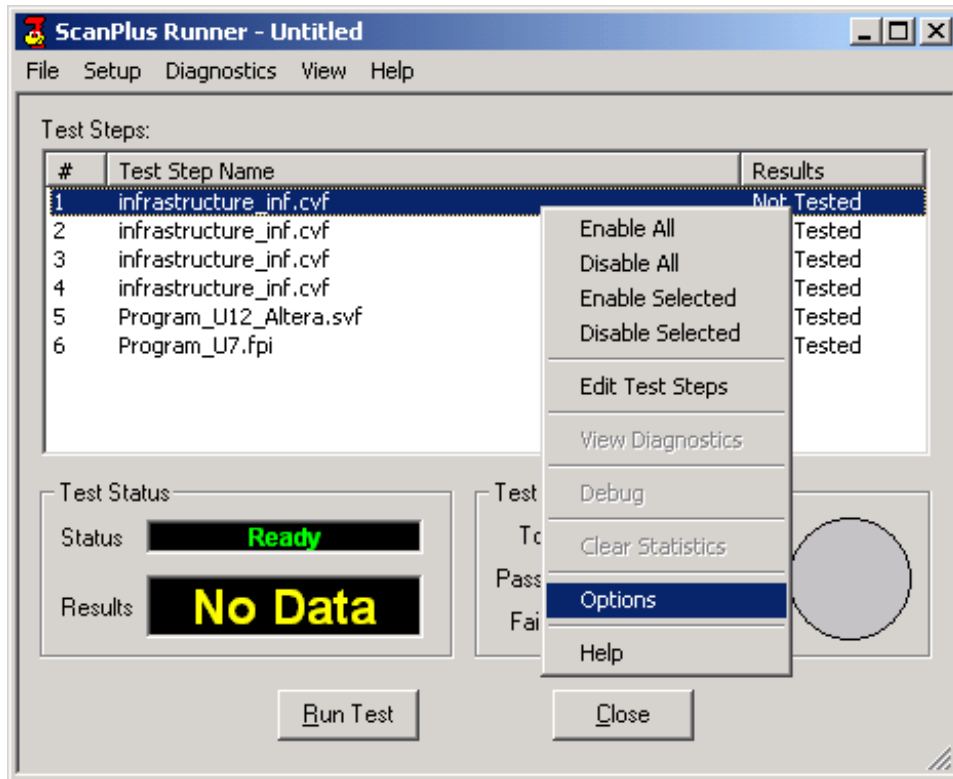


Figure 4-11. ScanPlus Runner Pop-up Menu

An **Options** dialog box similar to Figure 4-12 will appear. The appearance of the dialog box varies with the type of test step selected. Figure 4-12 illustrates an options dialog for an infrastructure test step. Consult the ScanPlus Runner User's Manual for more information on the **Options** dialog boxes.

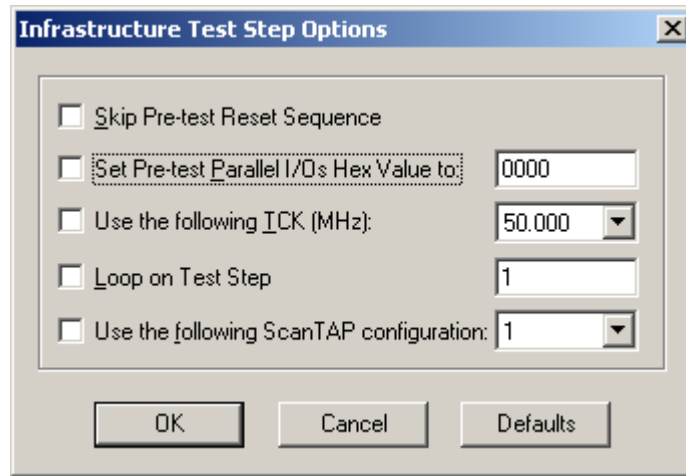


Figure 4-12. Infrastructure Test Options Dialog Box

Click the **Use the following ScanTAP configuration** check box and select the desired programming topology configuration from the drop-down list. Figure 4-13 shows the selections available from the configuration drop-down list.

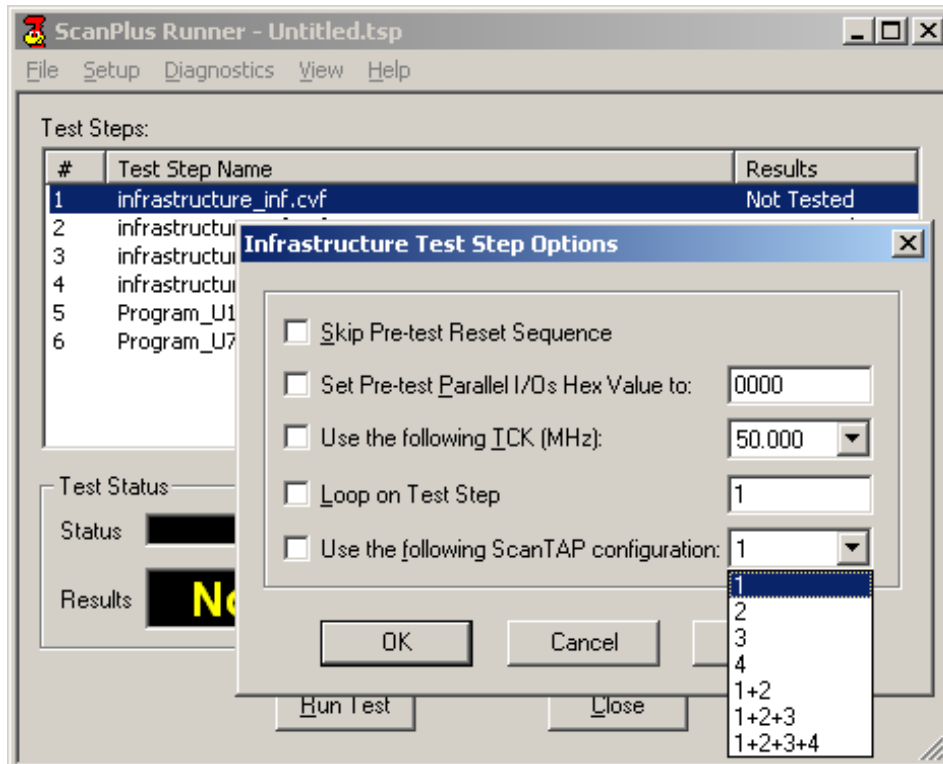


Figure 4-13. Available ScanTAP-4 TAP Configuration

Note that the same drop-down options list contains additional configuration options for the .fpi (programming) test steps. These additional configuration options are only available for Gang Flash programming of .fpi files and is not shown for regular test steps (.cvf files). See Figure 4-14.

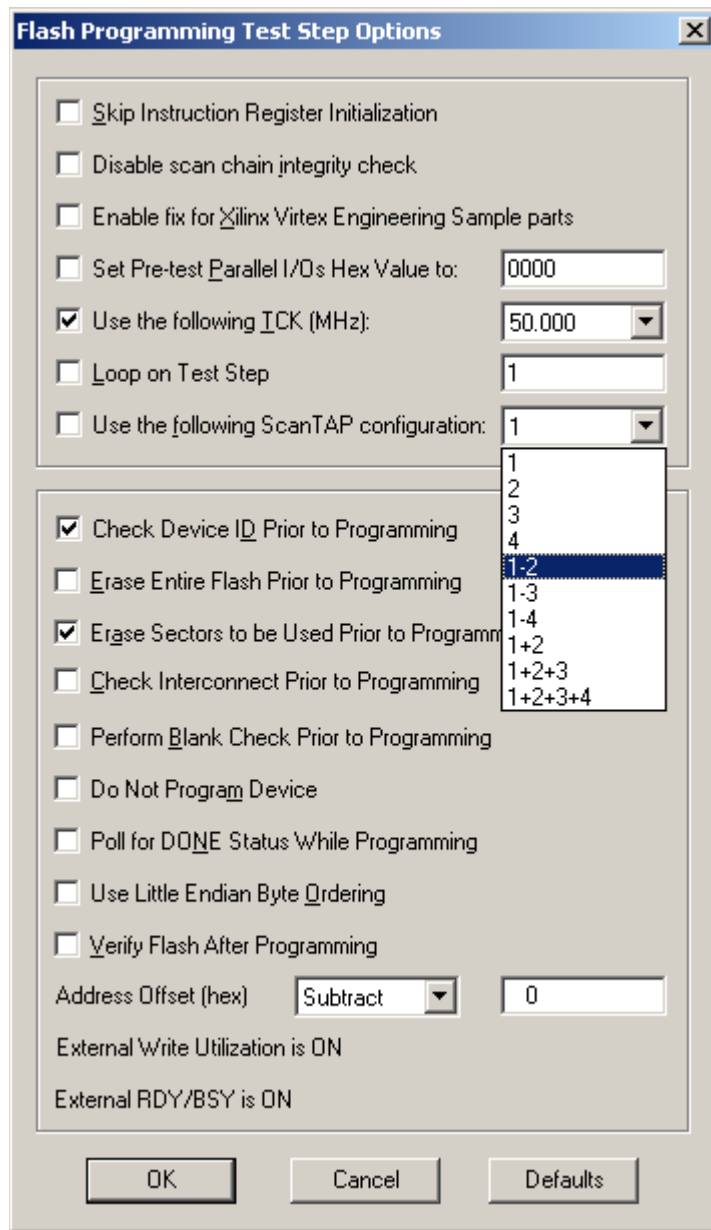


Figure 4-14. Available ScanTAP-4 TAP Configuration for .fpi files

Table 4-4 summarizes the additional, .fpi file-specific, configuration options available in the drop-down list.

Configuration	Meaning	TAP(s) Enabled
1-2	Enable TAPs 1 through TAP2 in parallel (Gang)	TAPs 1 and 2 are active
1-3	Enable TAPs 1 through TAP3 in parallel (Gang)	TAPs 1, 2 and 3 active
1-4	Enable TAPs 1 through TAP4 in parallel (Gang)	All 4 TAPs are active

Table 4-4. ScanPlus Runner ScanTAP-4 Configuration

Gang Programming with ScanPlus Flash Programmer

Version 1.73 or newer of the ScanPlus Flash Programmer software supports gang programming of multiple target boards using ScanTAP-4. Gang programming with the ScanTAP-4 requires an .fpi file that the ScanPlus Flash Generator generates. Gang programming applies the same .fpi file to identical targets concurrently via separate TAP connections.

Invoke ScanPlus Flash Programmer, select the **Setup** menu item, and the **Gang Programming** entry. Then check off the TAPs on which you are programming the Flash Devices.

Figure 4-15 below shows the setup for programming four targets in parallel.

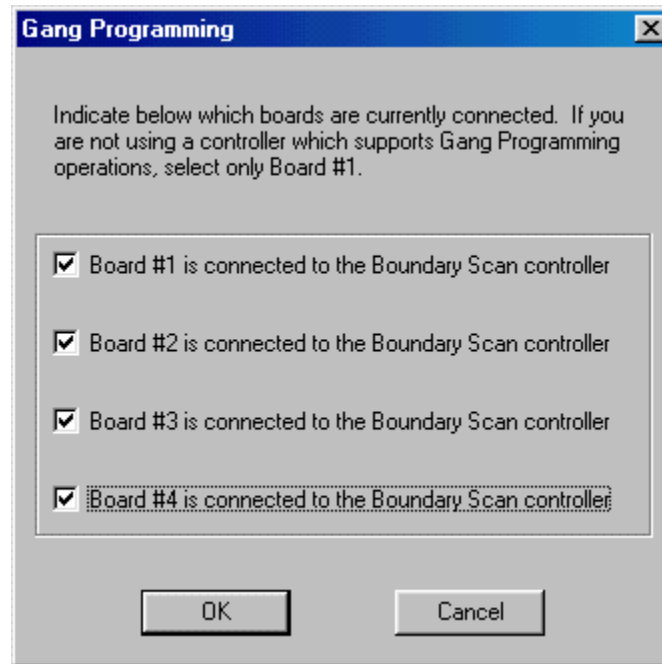


Figure 4-15. ScanPlus Flash Programmer Gang Programming Window

Chapter 5

Third Party Application Interface

ScanPlus Runner provides a general purpose, third-party application interface that includes specifying the correct controller card and settings. This section clarifies the requirements related to the PCI-1149.1/Turbo card and to the ScanTAP-4. Refer to the ScanPlus Runner manual for further information.

Using PCI-1149.1/Turbo with ScanPlus Runner Command-line

You can invoke ScanPlus Runner with special command line parameters to execute a Test Step file, provide test results and diagnostic messages in a log file (if you have the ScanPlus Runner ADO), and then terminate. The following table shows the controller identifiers and associated parameters. Consult the ScanPlus Runner User's Manual for more detail.

The PCI-1149.1/Turbo controller without ScanTAP4 uses three parameters and it uses up to fourteen parameters with ScanTAP4. The parameters are described in the table below.

Controller keyword: **PCI-1149.1/Turbo**, **PCI-1149.1/Turbo+ScanTAP4**

Position	Parameter	Value	Setting
1	TAPs Voltage	1	1.25 V
		2	1.30 V
		...	... (0.05 volts per step)
		41	3.25 V
		42	3.30 V
		43	Use advanced voltage settings in position 7 through 10
2	Clock Frequency	51	80 MHz
		...	... (1 MHz increment)
		76	25 MHz
		77	24.5 MHz
		...	... (0.5 MHz increment)
		101	12.5 MHz

Position	Parameter	Value	Setting
		102	12.25 MHz
	 (0.25 MHz increment)
		126	6.25 MHz
		127	6.125 MHz
	 (0.125 MHz increment)
		136	5 MHz
		137	4.9 MHz
	 (0.1 MHz increment)
		161	2.5 MHz
		162	2.45 MHz
	 (0.05 MHz increment)
		186	1.25 MHz
		187	1.225 MHz
	 (0.025 MHz increment)
		211	.625 MHz
		212	.609MHz
	 (0.0156 MHz increment)
		226	.391 MHz
		227	.350 MHz
	 (0.05 MHz increment)
		233	.050 MHz

Table 5-1. PCI-1149.1/Turbo Controller Parameters

Position	Parameter	Value	Setting
3	Delay Compensation	1	Automatic
		2	No Delay
		3	0.5 Clock Delay
		4	1.0 Clock Delay
		5	1.5 Clock Delay
		6	2.0 Clock Delay
		7	2.5 Clock Delay
			(the following are for PCI-1149.1/Turbo without ScanTAP only)
		8	3.0 Clock Delay
		...	... (0.5 clock increment)
	31	14.5 Clock Delay	
	32	15.0 Clock Delay	
4	Input Threshold	1	Automatic
		2	Use advanced input threshold settings in position 11 through 14
5	Slew Rate	1	Automatic
		2	Slow slew rate
		3	Normal slew rate
6	TAPs Configuration	1	Use TAP1
		2	Use TAP2
		3	Use TAP3
		4	Use TAP4
		5	Use TAPs 1 and 2 in series
		5	Use TAPs 1, 2, and 3 in series
		7	Use TAPs 1, 2, 3, and 4 in series

Position	Parameter	Value	Setting
7	TAP1 Voltage	1	1.25 V
		2	1.30 V
		3	1.35 V
		...	... (0.05 V per step)
		40	3.20 V
		41	3.25 V
		42	3.30 V
8	TAP2 Voltage	1	1.25 V
		2	1.30 V
		3	1.35 V
		...	... (0.05 V per step)
		40	3.20 V
		41	3.25 V
		42	3.30 V
9	TAP3 Voltage	1	1.25 V
		2	1.30 V
		3	1.35 V
		...	... (0.05 V per step)
		40	3.20 V
		41	3.25 V
		42	3.30 V
10	TAP4 Voltage	1	1.25 V
		2	1.30 V
		3	1.35 V
		...	... (0.05 V per step)
		40	3.20 V
		41	3.25 V
		42	3.30 V
11	TAP1 Input Threshold	1	Automatic
12	TAP2 Input Threshold	1	Automatic
13	TAP3 Input Threshold	1	Automatic
14	TAP4 Input Threshold	1	Automatic

Table 5-1. PCI-1149.1/Turbo Controller Parameters (continued)

Example:

To select a PCI-1149.1/Turbo controller card with a TAP1 voltage of 3.30 V, TCK frequency of 1 MHz, and automatic delay compensation, use this “controller specification” string:

```
-controller "PCI-1149.1/Turbo,42,196,1,,,,"
```

To select a PCI-1149.1/Turbo+ScanTAP4 controller card with all TAP voltages of 3.30 V, TCK frequency of 1 MHz, automatic delay compensation, automatic input threshold, slow slew rate and TAP1, use this “controller specification” string:

```
-controller "PCI-1149.1/Turbo+ScanTAP4,42,196,1,1,1,1,42,42,42,42,1,1,1,1"
```


Appendix A

Recommended Target Connectors

10-pin TAP Connector

The Boundary-Scan TAP is a well defined IEEE-1149.1-compatible electrical interface between boundary-scan test equipment and the boundary-scan compatible devices in the user's target board. Boundary-scan based test equipment, such as the Corelis ScanPlus family of products, utilize a single TAP to interface to the UUT. This section explains how to implement a TAP connector that is compatible with most standard test equipment.

The TAP contains 5 signals: TCK, TMS, TDO, TDI and optionally TRST*. It also contains ground signal(s). Corelis recommends the standard TAP connector shown in Figure A-1, which is widely regarded as the industry standard. Note that each signal is terminated with a resistor (discussed below) in order to improve noise immunity.

The connector on the user's target should have a standard flat cable compatible pinout to match the TAP connector described in Table A-1. Figure A-1 shows the top view of the basic target 10-pin connector header (0.100 × 0.100 in. spacing):

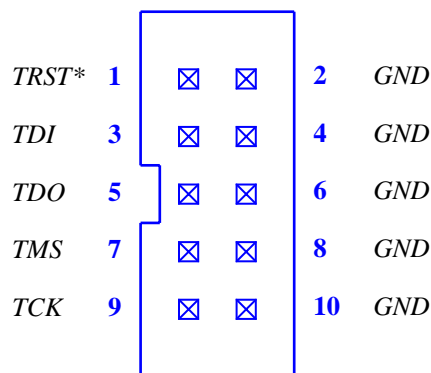


Figure A-1. Standard TAP connector (top view)

Table A-1 describes the 10 pin TAP connector signals and Corelis recommended values of terminating resistors:

Pin	Signal	Direction	Termination
1	TRST*	Input to the UUT	1K pull-up (or 1.5K pull-down)
2	GND		
3	TDI	Input to the UUT	1K pull-up
4	GND		
5	TDO	Output of the UUT	33 ohm series
6	GND		
7	TMS	Input to the UUT	1K pull-up
8	GND		
9	TCK	Input to the UUT	1K pull-up
10	GND		

Note: Some target boards may require a pull-down resistor on the TRST* signal to assure normal device operations when not in boundary-scan test mode.

Table A-1. Signal Description and Termination

Table A-2 summarizes the specifications for the 10-pin TAP connector. Equivalent connectors are available from other manufacturers.

Reference	Description	Manufacturer	Part Number
10-Pin Target TAP	Straight header, 10-pin, 4 wall, with center notch	3M	3473-6610

Table A-2. Standard 10-Pin TAP Connector

Figure A-2 shows a typical schematic of the target TAP connector with the recommended termination resistors. The 1K pull-up resistors should connect to the target Vcc supply corresponding to the interface voltage (programmable on the PCI-1149.1/Turbo from 1.25 to 3.3 V). Recommended resistor values are +/- 5%.

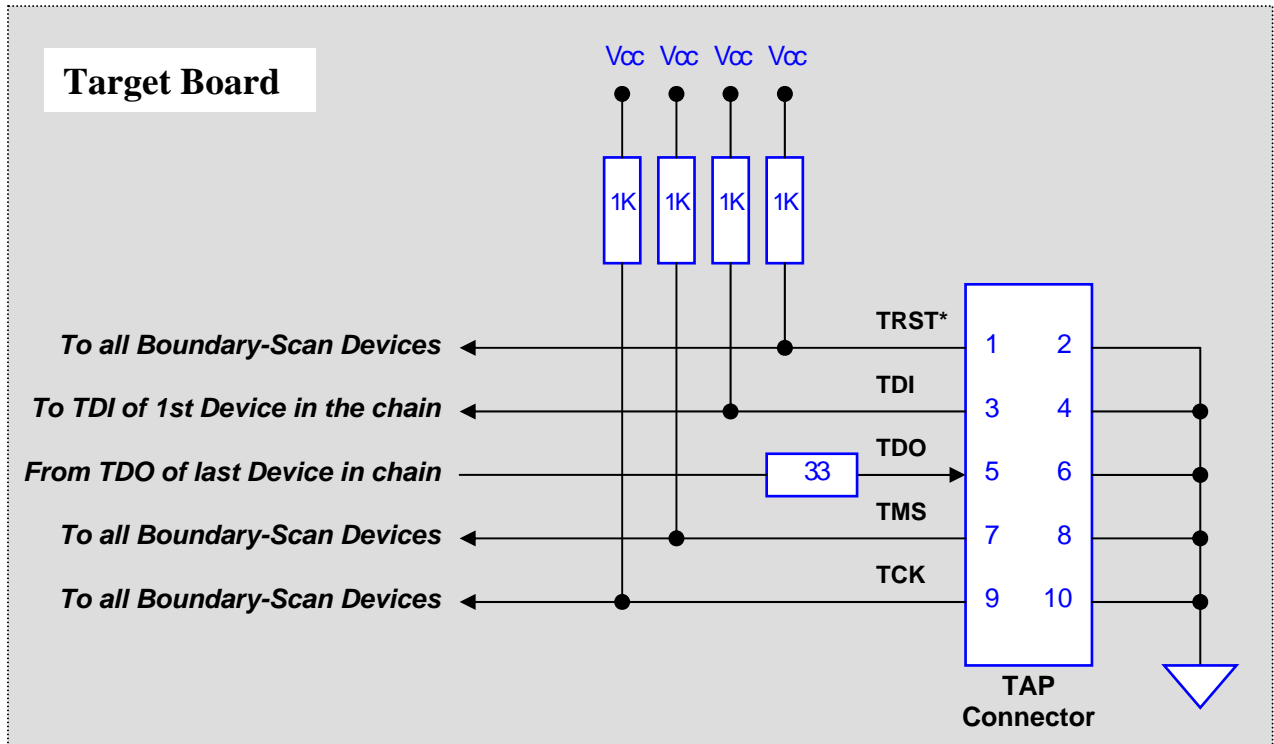


Figure A-2. TAP Connector Schematic

Flash Programming TAP Connector

To build in support for in-circuit programming of flash or microprocessor devices, Corelis recommends including supplemental control signals in the TAP interface. The ScanPlus Flash Programmer can use a 16-pin TAP, similar to Figure A-3, to improve programming time. This interface adds Write_Strobe*, Ready/Busy*, and ground signals to the standard 5-signal interface. Terminating resistors (see Table) can improve signal quality.

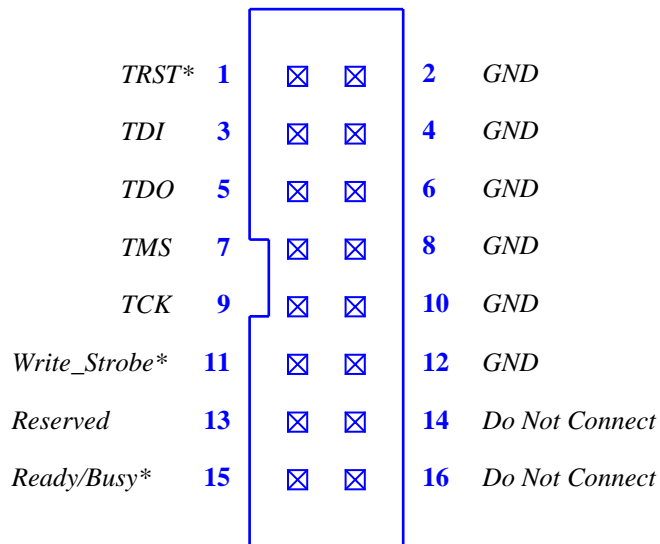


Figure A-3. Boundary-scan Flash Programming 16 Pin TAP Connector (top view)

Corelis' Flash Programming software supports the external signals Write_Strobe* and Ready/Busy*, in addition to the standard but slower scanned out/in signals approach.

The Write_Strobe* signal is active low and should be pulled up with a 1K resistor on the target board. It needs to be logically ORed with the flash Write-Enable (WE*) signal so that either the flash Write-Enable (WE*) signal or the external Write_Strobe* going low will assert the flash WE* input.

The active low Ready/Busy* signal is typically an open-collector/open-drain signal that ties directly to the same signal(s) on the Flash device(s). This enables multiple devices to drive it toward the PCI-1149.1/Turbo.

Table A-3 summarizes the specifications for a 16-pin TAP connector without latch ejector. Equivalent connectors are available from other manufacturers.

Reference	Description	Manufacturer	Part Number
Flash TAP	Straight header, 16-pin, 4 wall, with center notch	3M	2516-6002UG

Table A-3. Flash Programming TAP 16 Pin Connector

Table A-4 describes the signals and Corelis recommended values of terminating resistors:

Pin	Signal	Direction	Termination
1	TRST*	Input to the UUT	1K pull-up (or 1.5K pull-down)
2	GND		
3	TDI	Input to the UUT	1K pull-up
4	GND		
5	TDO	Output from UUT	33 ohm series
6	GND		
7	TMS	Input to the UUT	1K pull-up
8	GND		
9	TCK	Input to the UUT	1K pull-up
10	GND		
11	Write_Strobe*	Input to the UUT	1K pull-up
12	GND		
13	Reserved		
14	Reserved		
15	Ready/Busy*	Output from UUT	1K pull-up
16	Reserved		

Note: Some target boards may require a pull-down resistor on the TRST* signal to assure normal device operations when not in boundary-scan test mode

Note: The target TDI signal is driven by the TDO signal of the boundary-scan controller

Note: The target TDO signal drives the boundary scan controller's TDI signal

Table A-4. Signal Description and Termination

Figure A-4 shows a typical schematic of the target TAP connector with termination resistors. The 1K pull-up resistors should connect to the target Vcc supply corresponding to the interface voltage (programmable on the PCI-1149.1/Turbo from 1.25 to 3.3 V). Recommended resistor values are +/- 5%.

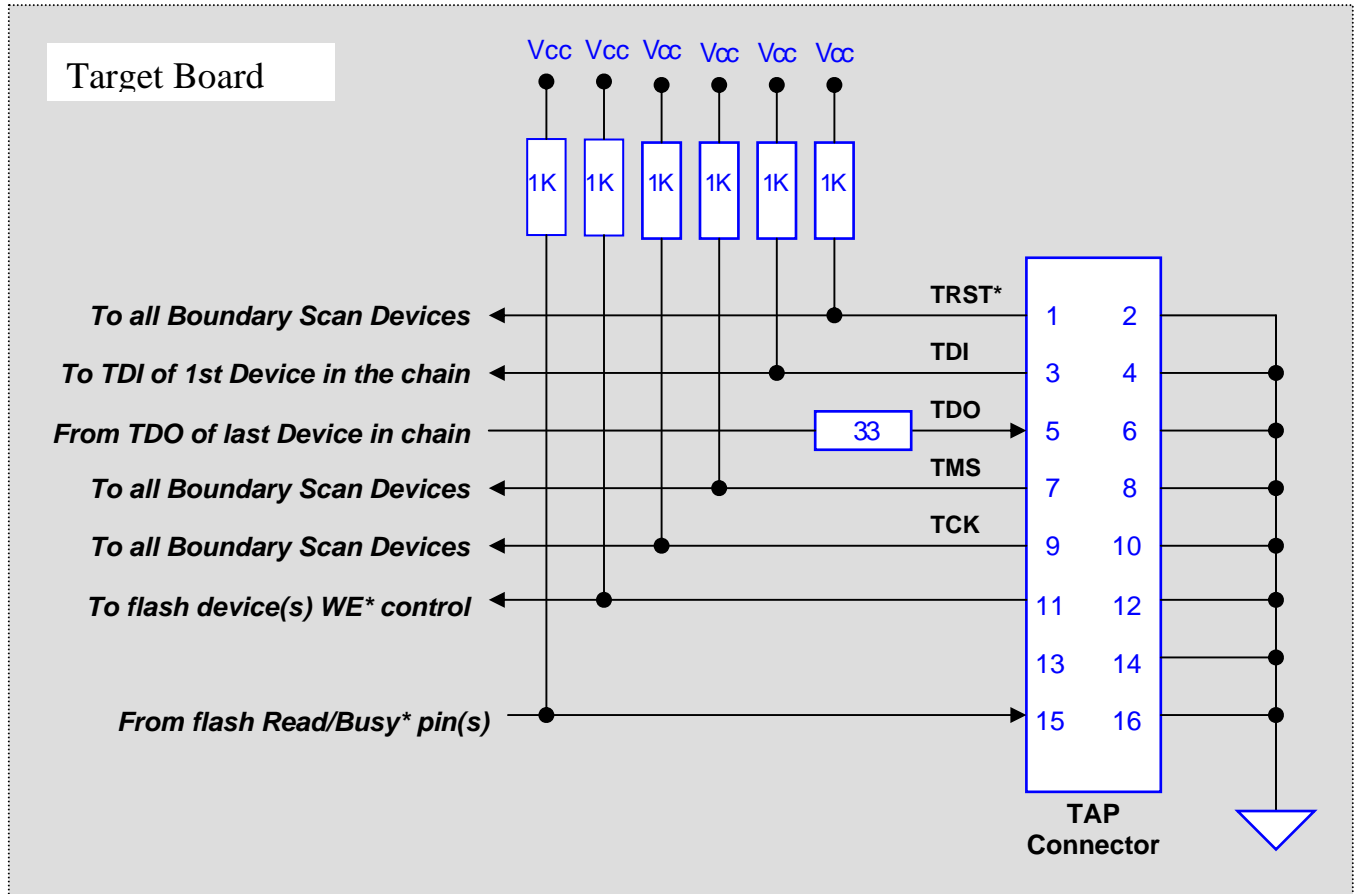


Figure A-4. Flash Programming TAP Connector Schematics

20-pin TAP Connector

To build in support for in-circuit programming of flash or microprocessor devices, Corelis recommends including supplemental control signals in the TAP interface. The ScanPlus Flash Programmer can use a 16-pin TAP, similar to Figure A-5, to improve programming time. This interface adds Write_Strobe*, Ready/Busy*, and ground signals to the standard 5-signal interface. Terminating resistors (see Table) can improve signal quality.

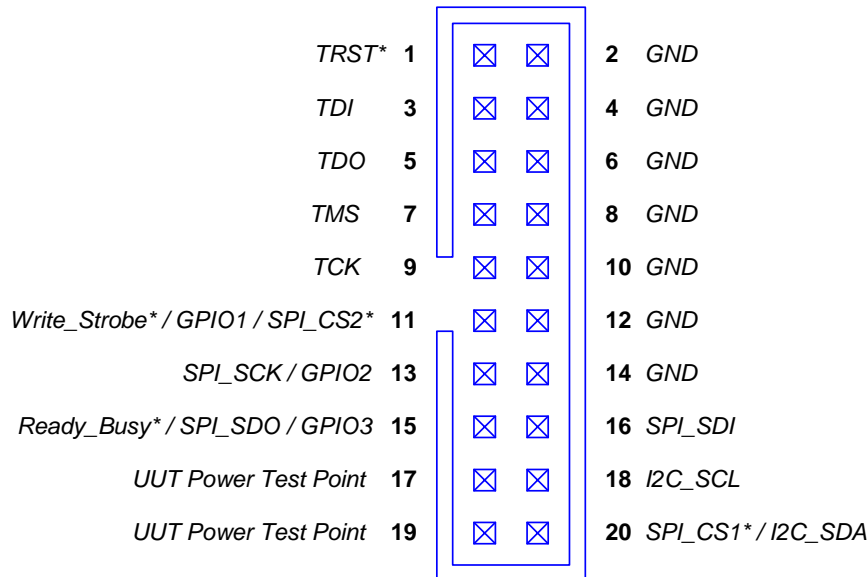


Figure A-5. Boundary-scan Flash Programming 20-Pin TAP Connector (top view)

Corelis' Flash Programming software supports the external signals Write_Strobe* and Ready/Busy*, in addition to the standard but slower scanned out/in signals approach.

The Write_Strobe* signal is active low and should be pulled up with a 1K resistor on the target board. It needs to be logically ORed with the flash Write-Enable (WE*) signal so that either the flash Write-Enable (WE*) signal or the external Write_Strobe* going low will assert the flash WE* input.

The active low Ready/Busy* signal is typically an open-collector/open-drain signal that ties directly to the same signal(s) on the Flash device(s). This enables multiple devices to drive it toward the PCI-1149.1/Turbo.

Table A-3 summarizes the specifications for a 16-pin TAP connector without latch ejector. Equivalent connectors are available from other manufacturers.

Reference	Description	Manufacturer	Part Number
Flash TAP	Straight header, 16-pin, 4 wall, with center notch	3M	2516-6002UG

Table A-5. Flash Programming TAP 16 Pin Connector

Table A-4 describes the signals and Corelis recommended values of terminating resistors:

Pin	Signal	Direction	Termination
1	TRST*	Input to the UUT	1K pull-up (or 1.5K pull-down)
2	GND		
3	TDI	Input to the UUT	1K pull-up
4	GND		
5	TDO	Output from UUT	33 ohm series
6	GND		
7	TMS	Input to the UUT	1K pull-up
8	GND		
9	TCK	Input to the UUT	1K pull-up
10	GND		
11	Write_Strobe* /GPIO1 / SPI_CS2*	Input to the UUT	1K pull-up
12	GND		
13	SPI_SCK /GPIO2	Input to the UUT	1K pull-up
14	GND		
15	Ready_Busy* / SPI_SDO (MISO) / GPIO3	Output from the UUT	1K pull-up
16	SPI_SDI (MOSI)	Input to the UUT	1K pull-up

Note: Some target boards may require a pull-down resistor on the TRST* signal to assure normal device operations when not in boundary-scan test mode

Note: The target TDI signal is driven by the TDO signal of the boundary-scan controller

Note: The target TDO signal drives the boundary scan controller's TDI signal

17	VCC1	UUT Power Test Point	
18	I2C_SCL	Input to the UUT	1K pull-up
19	VCC2	UUT Power Test Point	
20	SPI_CS1* / I2C_SDA	Input to the UUT	1K pull-up

Table A-6. Signal Description and Termination

Figure A-6 shows a typical schematic of the target TAP connector with termination resistors. The 1K pull-up resistors should connect to the target Vcc supply corresponding to the interface voltage (programmable on the PCI-1149.1/Turbo from 1.25 to 3.3 V). Recommended resistor values are +/- 5%.

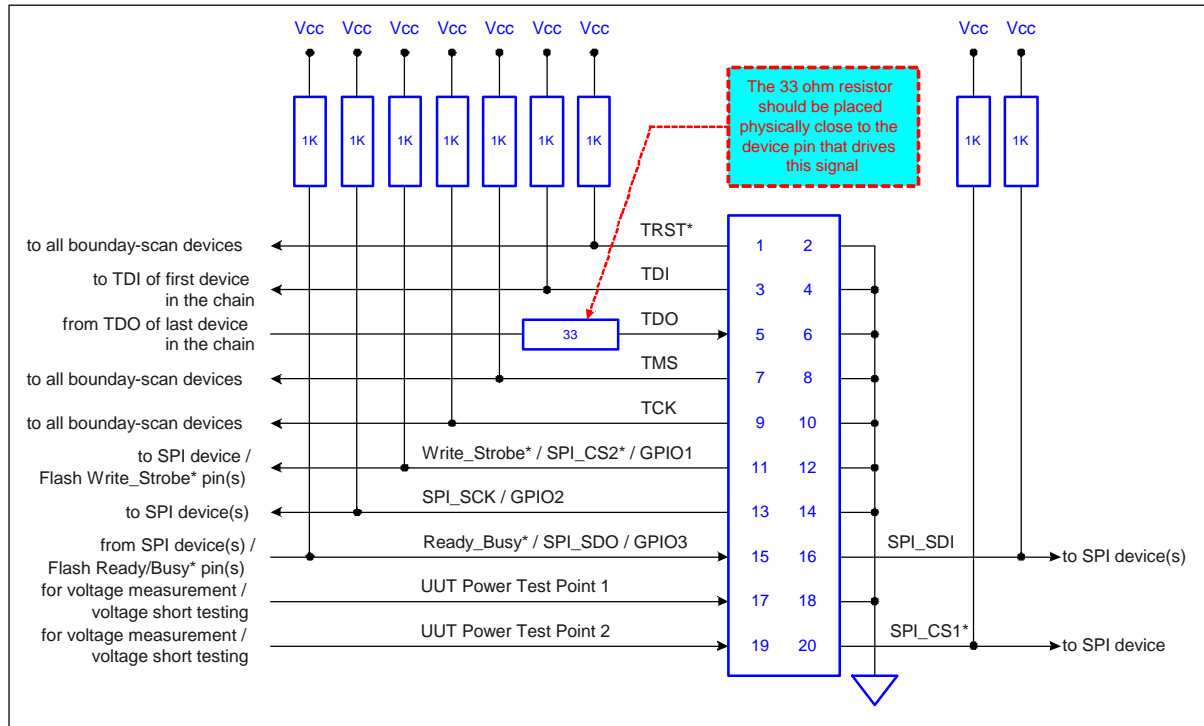


Figure A-6. 20-pin TAP Connector Schematic for SPI

Figure A-7 shows a typical schematic of the target TAP connector with termination resistors. The 1K pull-up resistors should connect to the target Vcc supply corresponding to the interface voltage (programmable on the PCI-1149.1/Turbo from 1.25 to 3.3 V). Recommended resistor values are +/- 5%.

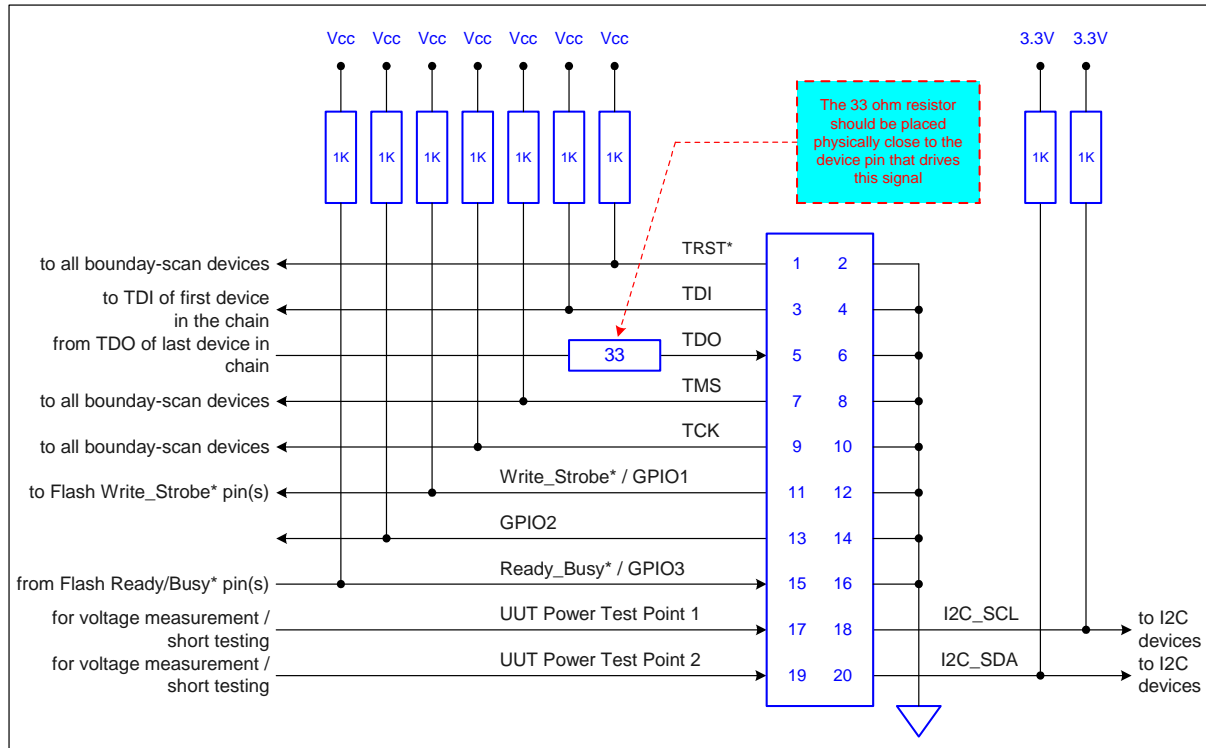


Figure A-7. 20-pin TAP Connector Schematic for I2C

Appendix B

Self Test Utility Software

The PCI-1149.1/Turbo has a self test utility that can be used to test the card and make sure that it is fully functional. Logic at the TAP connectors can read back data shifted out on TMS and TDO synchronously with the TCK. Using these signal paths, a host can test the TAP signals all the way to the connectors, verifying the overall functionality of the system.

Self-Test

The self-test utility is provided for off-line confidence test only and **under normal circumstances there is no need to run the self test utility software**. However, if you suspect that the board is damaged, you can run the self-test on the PCI-1149.1/Turbo card. The self-test utility is installed on your computer in the same folder where ScanPlus Applications (ScanPlus Runner, ScanPlus Debugger and ScanPlus Flash Programmer) are installed. Make sure to disconnect any ScanTAP-4 TAP cables before running the test.

Using the Windows Explorer, select and run the *pci1149_t_test.exe* file. A small pop-up should appear. The program checks for the presence of a ScanTAP-4, and runs the appropriate test. Make sure that there is no target connected to the controller or to the ScanTAP-4 before running the self-test, as they can cause the test to fail. Click on **Test** to run the self-test.

The program should respond with results similar to the screens shown in Figure B-1 and Figure B-2.

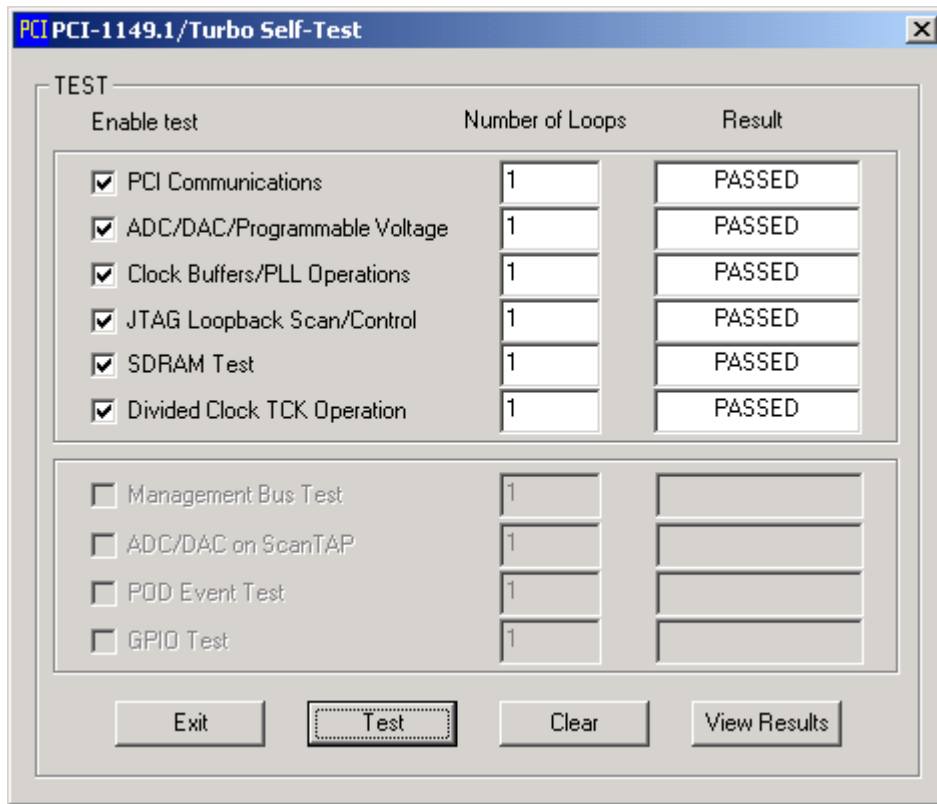


Figure B-1. Self-Test Result for the PCI-1149.1/Turbo when the ScanTAP-4 is NOT connected

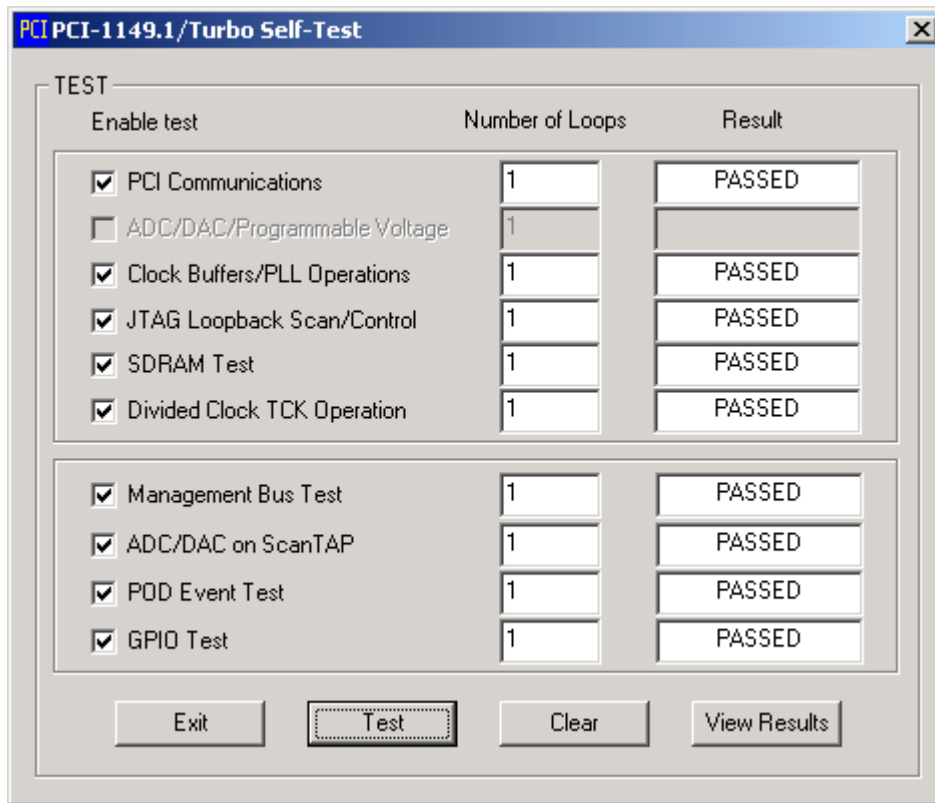


Figure B-2. Self-Test Results for the PCI-1149.1/Turbo with the ScanTAP-4 Connected