CORELIS

ScanTAP-32

ScanTAP-32
Multiple TAP Intelligent Pod

User's Manual

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Preface

PRINTING HISTORY

New editions are complete revisions of the manual. Update packages, which are issued between editions, contain additional and replacement pages to be merged into the manual by the customer. The dates on the title page change only when a new edition is published.

A software code may be printed before the date; this indicates the version of the software product at the time the manual or update was issued. Many product updates and fixes do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one to one correspondence between product updates and manual updates.

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Chapter 1
Product Overview

Introduction

The ScanTAP-32 Multiple TAP Intelligent Pod is a desk-top/rack-mountable instrument that expands the Corelis high-speed boundary-scan interface to up to 32 TAPs. With the ScanTAP-32, a single PC equipped with the Corelis PCI-1149.1/Turbo controller card can simultaneously perform Boundary-Scan Testing and In System Programming (ISP) on up to 32 targets, each equipped with IEEE-1149.1 Test Access Ports (TAPs).

The ScanTAP-32, shown in Figure 1-1, is configured to mount in a standard, laboratory 19-inch instrumentation rack. It can also be used on the desktop.

Figure 1-1. ScanTAP-32

Features of the ScanTAP-32

The Corelis ScanTAP-32 Multiple TAP Intelligent pod connects to the PCI-1149.1/Turbo boundary-scan controller via the 68-pin SCSI II type HOST connector. Differential signal driving supports cables of up to 30 feet. Automatic delay mechanisms compensate for transport delays through the cable. The 32 TAPs are individually configurable for interface voltages from 1.25V to 3.30V. 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 32 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.

ScanTAP-32 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 15339 15 foot (optional) - Corelis P/N 15328 30 foot (optional) - Corelis P/N 15329

TAP Interface

TAP Connector	20-pin header, 3M part no. 3428-6302 or equivalent
Mating TAP Connector	20-pin IDC (flat cable), 3M part no. 3421-6620 or equivalent
Number of Concurrent TAPs	32 max
Maximum TCK frequency	80 MHz
Maximum scanning data length	Unlimited
Programmable Output Voltage	1.25V to 3.3V in 0.05V increments
Independent Output Voltages	Four (4) independent output voltages can be set: The first output voltage is for TAPs: 1, 5, 9, …, 29. The second output voltage is for TAPs: 2, 6, 10, …, 30. The third output voltage is for TAPs: 3, 7, 11, …, 31. The fourth output voltage is for TAPs: 4, 8, 12, …, 32.
Programmable Input Voltage	0.50V to 2.0V in 0.05V increments
Independent Input Voltages	Four (4) independent input threshold voltages can be set: The first input voltage is for TAPs: 1, 5, 9, …, 29. The second input voltage is for TAPs: 2, 6, 10, …, 30. The third input voltage is for TAPs: 3, 7, 11, …, 31. The fourth input voltage is for TAPs: 4, 8, 12, …, 32.
Signals DC characteristics	See Table 1-1

Symbol	Test Conditions	Limit Min	Limit Max	Units
V_{IH}	Vdd >= 2.5V	2	Vdd + 0.5	V
	Vdd < 2.5V	0.65 × Vdd	Vdd + 0.5	V
V_{IL}	Vdd >= 2.0V		0.7	V
	Vdd <= 2.0V		0.35 × Vdd	V
V_{OH}	I_{OH} = -2 mA	Vdd – 0.35		V
V_{OL}	I_{OL} = 2 mA Vdd =1.65V		0.45	V
I_{OH}	Vdd = 1.65V - 1.95V		-4	mA
I_{OL}	Vdd = 1.65V - 1.95V		4	mA

Table 1-1. ScanTAP-32 DC Characteristics

For additional information please refer to the Advanced Low Voltage CMOS (AVC) family signal characteristics data available from TI and from other AVC device manufacturers.

Physical

Box Outline Dimensions 19" rack compatible (3U): 16.8 in. × 9..2 in. × 5.0 in.

Input Power

Nominal Voltage	115 VAC at 60 Hz
Input Range	90 to 264 VAC, 50 to 60 Hz
Peak Inrush Current	50 Amp max at 115 VAC 80 Amp max at 230 VAC
Input Line Current	5.0 Amp max at 115 VAC 2.5 Amp max at 230 VAC

Operating Environment

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

Storage Environment

Temperature	-40°C to 85°C

Concurrent scanning at all TAPs occurs at up to the full TCK rate capability of the PCI-1149.1/Turbo.

Chapter 2
ScanTAP-32 Installation

When you receive the ScanTAP-32 Multiple TAP Intelligent Pod product it should contain the following items:

- ScanTAP-32 Multiple TAP Intelligent Pod unit
- 6-foot Cable to connect the PCI-1149.1/Turbo Controller to the ScanTAP-32, Corelis P/N 15339
- 115 VAC power cord
- This ScanTAP-32 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.

ScanTAP-32 Installation

Perform the following installation steps to connect the ScanTAP-32 intelligent pod to the PC System:

1. If you are installing the ScanTAP-32 in a 19" rack then make sure to connect the ground lug on the back panel of the ScanTAP-32 to the rack equipment ground according to local electric codes and safety practices.
2. Install the 115 VAC power cord into the ScanTAP-32 power connector on the back panel.
3. Connect one end of the 6-foot cable, Corelis P/N **15314,** to the HOST connector on the ScanTAP-32 front panel.
4. Make sure that the HOST PC is turned OFF. Connect the other end of the host cable to the mating connector on the PCI-1149.1/Turbo controller (previously installed in a PCI slot of the host computer motherboard).
5. Make sure that all UUTs (targets) are powered down.
6. Connect one or more of each TAP connectors to a UUT, following the instructions in the PCI-1149.1/Turbo User Manual.

System Power Up Sequence

1. Power up the ScanTAP-32 by plugging the other end of the power cord into a 115 VAC power outlet, avoiding contact with any of its electrodes.
2. Power-up the PC with the PCI-1149.1/Turbo.
3. Power-up each of the UUTs.

20 pin TAP Connectors

The connection to the user target (UUT) board/system is done from the ScanTAP-32 Intelligent Pod TAP connectors to mating connectors on the target. The ScanTAP-32 connects to the target via optional flat cables, P/N 15310, 15311 or 15312. Figure 2-1 shows the top view of first ten TAP connectors of the ScanTAP-32 box. The TAP connector number is clearly labeled at the top right corner of each connector as shown in Figure 2-1.

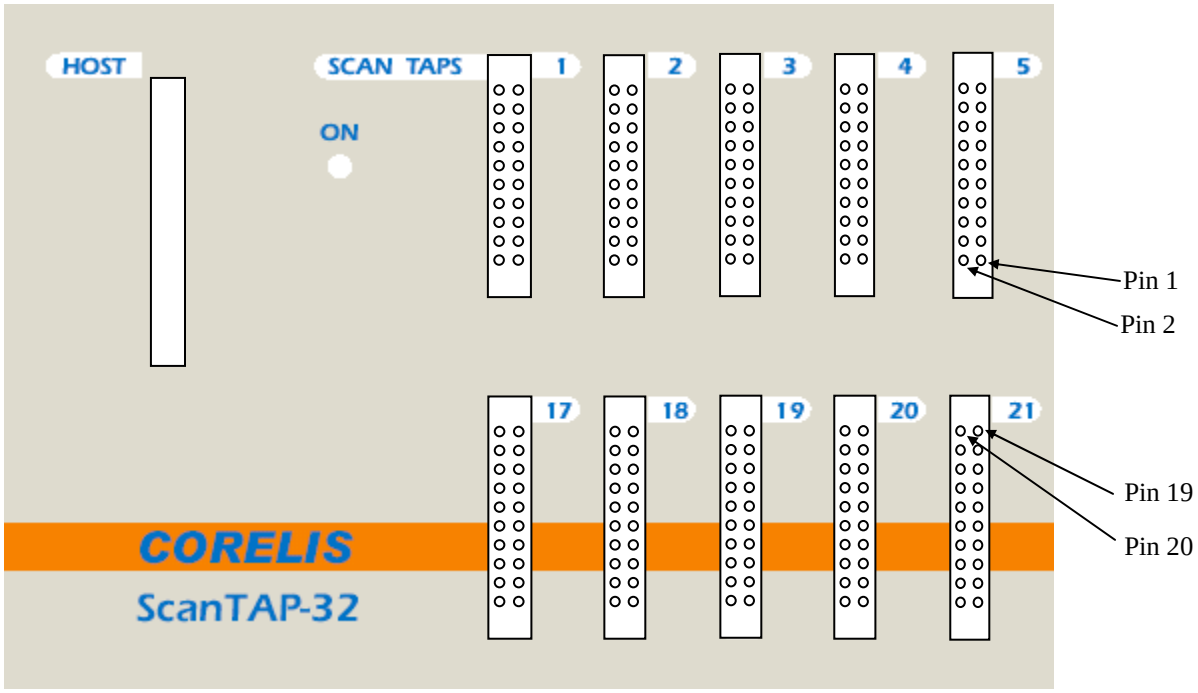

Figure 2-1. ScanTAP-32 TAP Header Connectors (top view)

There are 32 identical TAP connector on the front panel of the ScanTAP-32. Below is the top view of the target 20-pin connector header (0.100" x 0.100" spacing):

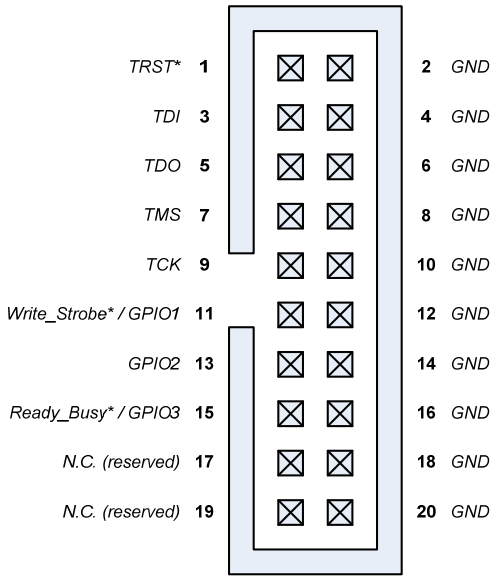

Figure 2-2. 20-Pin TAP Connector (top view)

The connector pinout is shown in Table 2-1. The first 5 signals on pins 1 through 9 are the standard IEEE-1149.1 signals. Corelis Flash Programming software supports two additional signals: the external write strobe signal (Write_Strobe*) and the external Ready/Busy* signal.

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 OR-ed with the flash Write-Enable (WE*) signal so that assertion of either the flash Write-Enable (WE*) signal or the external write strobe will assert the flash WE* input.

The Ready/Busy* signal is an open-collector/open-drain signal which is directly tied to the same signal(s) on the Flash device(s).

Pins 17 and 19 are not currently used and should not be connected.

Pin	Signal	Direction
1	TRST*	Input to the UUT
2	GND	
3	TDI	Input to the UUT
4	GND	
5	TDO	Output of the UUT
6	GND	
7	TMS	Input to the UUT
8	GND	
9	TCK	Input to the UUT
10	GND	
11	Write Strobe* (GPIO1)	Input to the UUT
12	GND	
13	GPIO2	Discrete Input to UUT
14	GND	
15	Ready/Busy* (GPIO3)	Output of the UUT
16	GND	
17	N.C.	Not connected (reserved)
18	GND	
19	N.C.	Not connected (reserved)
20	GND	

Table 2-1. 20 Pin Connector Pinout

The connector is a 3M part number 3428-6302. It is a 0.1" x 0.1" header with latch/ejector. Note that there are many other manufacturers who have similar parts.

Connecting Multiple UUTs

The ScanTAP-32 TAPs are configurable to match the number of TAPs per target system. If a target system has more than one TAP then the ScanTAP-32 can be configured to chain multiple TAPs together (i.e. connect TDO of one TAP to TDI of the next TAP). Up to 16 TAPs can be chained together. Table 2-2 shows how the TAPs are utilized for multiple TAP targets.

TAPs per Target	Max Number of Targets	ScanTAP-32 TAP Utilization
1	32	Full TAP utilization
2	16	Full TAP utilization
3	8	TAP4 of each 4 TAP group is unused
4	8	Full TAP utilization
5	4	TAP6-TAP8 of each 8 TAP group are unused
6	4	TAP7-TAP8 of each 8 TAP group are unused
7	4	TAP8, TAP16, TAP24 and TAP32 are unused
8	4	Full TAP utilization
9	2	TAP10-TAP16 of each 16 TAP group are unused
10	2	TAP11-TAP16 of each 16 TAP group are unused
11	2	TAP12-TAP16 of each 16 TAP group are unused
12	2	TAP13-TAP16 of each 16 TAP group are unused
13	2	TAP14-TAP16 of each 16 TAP group are unused
14	2	TAP15-TAP16 of each 16 TAP group are unused
15	2	TAP16 and TAP32 are unused
16	2	Full TAP utilization

Table 2-2. TAP Utilization

The following tables, Table 2-3 through Table 2-7, show the TAP connection for 1,2,4,8 and 16 TAP targets.

Single TAP Target	ScanTAP-32
Target 1	TAP1
Target 2	TAP2
Target 3	TAP3
Target 4	TAP4
Target 5	TAP5
Target 6	TAP6
Target 7	TAP7
Target 8	TAP8
Target 9	TAP9
Target 10	TAP10
Target 11	TAP11
Target 12	TAP12
Target 13	TAP13
Target 14	TAP14
Target 15	TAP15
Target 16	TAP16
Target 17	TAP17
Target 18	TAP18
Target 19	TAP19
Target 20	TAP20
Target 21	TAP21
Target 22	TAP22
Target 23	TAP23
Target 24	TAP24
Target 25	TAP25
Target 26	TAP26
Target 27	TAP27
Target 28	TAP28
Target 29	TAP29
Target 30	TAP30
Target 31	TAP31
Target 32	TAP32

Table 2-3. TAP Connection for Targets With One TAP

Target (with 2 TAPs)	ScanTAP-32
Target 1	TAP1, TAP2
Target 2	TAP3, TAP4
Target 3	TAP5, TAP6
Target 4	TAP7, TAP8
Target 5	TAP9, TAP10
Target 6	TAP11, TAP12
Target 7	TAP13, TAP14
Target 8	TAP15, TAP16
Target 9	TAP17, TAP18
Target 10	TAP19, TAP20
Target 11	TAP21, TAP22
Target 12	TAP23, TAP24
Target 13	TAP25, TAP26
Target 14	TAP27, TAP28
Target 15	TAP29, TAP30
Target 16	TAP31, TAP32

Table 2-4. TAP Connection for Targets With Two TAPs

Target (with 4 TAPs)	ScanTAP-32
Target 1	TAP1 - TAP4
Target 2	TAP5 - TAP8
Target 3	TAP9 - TAP12
Target 4	TAP13 - TAP16
Target 5	TAP17 - TAP20
Target 6	TAP21 - TAP24
Target 7	TAP25 - TAP28
Target 8	TAP29 - TAP32

Table 2-5. TAP Connection for Targets With Four TAPs

Target (with 8 TAPs)	ScanTAP-32
Target 1	TAP1 - TAP8
Target 2	TAP9 - TAP16
Target 3	TAP17 - TAP24
Target 4	TAP25 - TAP32

Table 2-6. TAP Connection for Targets With Eight TAPs

Target (with 16 TAPs)	ScanTAP-32
Target 1	TAP1 - TAP16
Target 2	TAP17 - TAP32

Table 2-7. TAP Connection for Targets With Sixteen TAPs

The ScanExpress Runner software will indicate how the TAPs are chained. Figure 2-3 below 16 targets with 2 TAPs each are being tested.

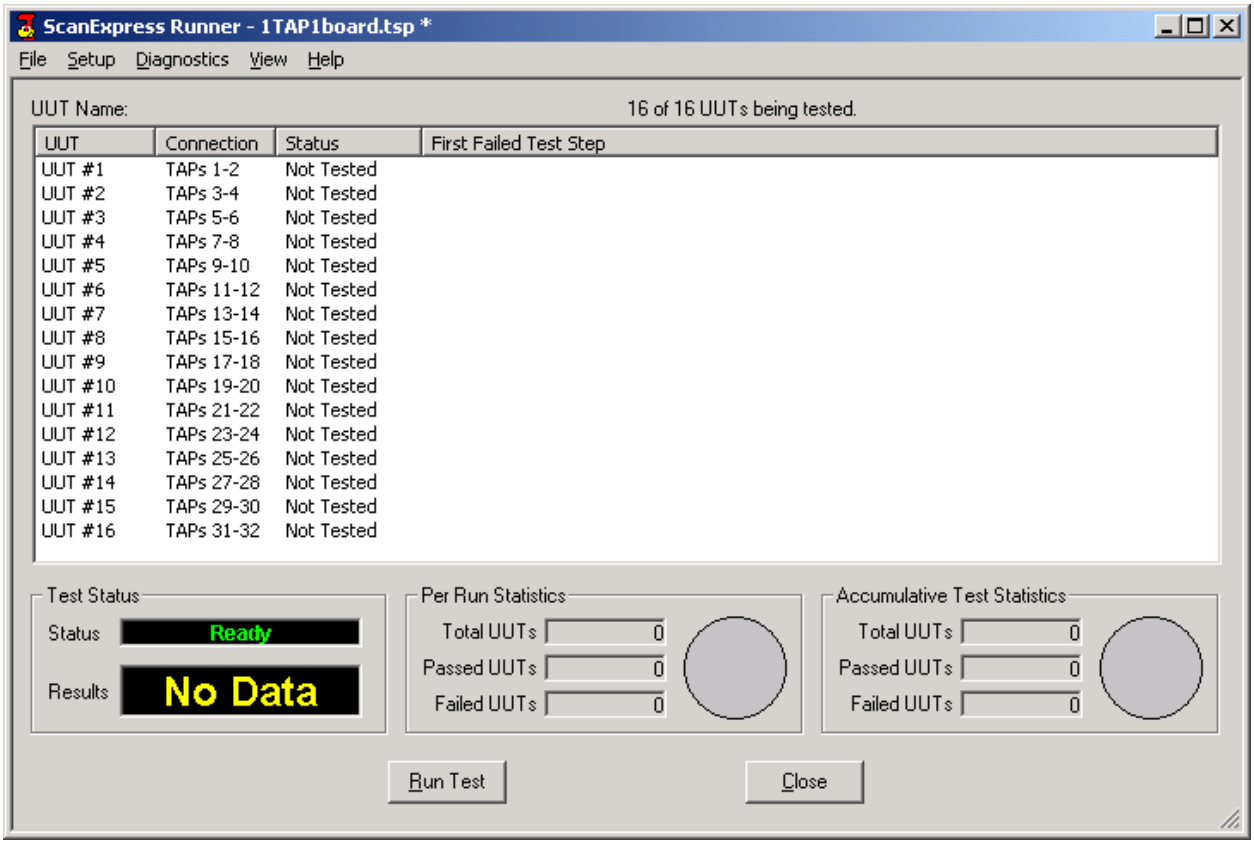

Figure 2-3. Target Configuration Window

TAP Voltage Configuration

The ScanTAP-32 implements a scaled architecture. One ScanTAP-32 module contains the logic of a ScanTAP-4 times eight (8). The TAP and I/O output voltage attribute is shared amongst each of the 8 blocks. There are four TAP output voltages, labeled TAP1, TAP2, TAP3, TAP4. These control TAP(4*N+1), TAP(4*N+2), TAP(4*N+3),TAP(4*N+4) for N=0,1,2,3,4,5,6,7. The TDO threshold voltage from the target may also be configured (although usually it is adequate to leave the setting as automatic. To set these voltages go to the ScanExpress Runner or ScanPlus Runner main window. Select ***Setup*** select ***Controller*** as shown in Figure 2-4

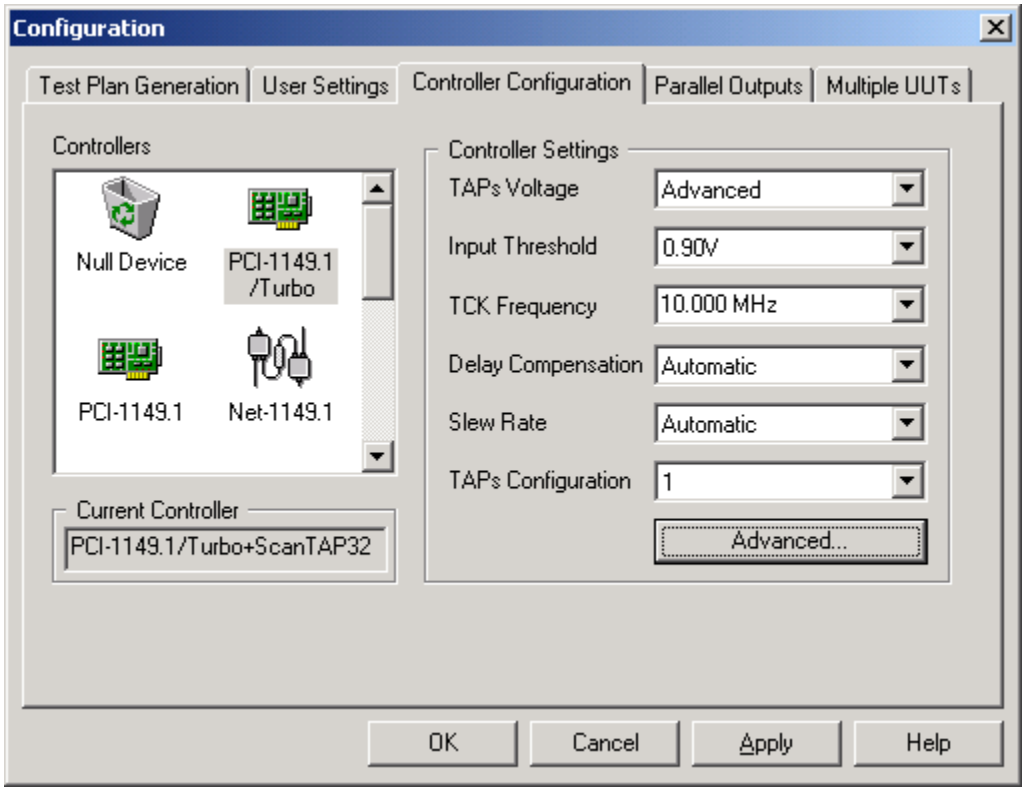

Figure 2-4. Controller Configuration Window

Select ***Advanced.*** Figure 2-5 contains the output driver voltage and input threshold voltage.

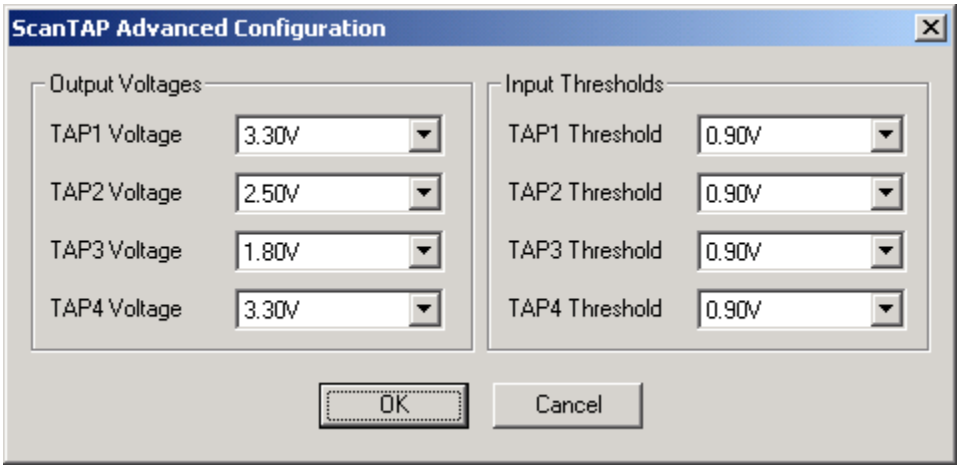

Figure 2-5. Voltage Configuration Window

Below is a table showing the voltages and threshold voltages set up in Figure 2-5.

TAP	Output Voltage	Threshold Voltage
TAP1, TAP5, TAP9, TAP13, TAP17, TAP21, TAP25, TAP29	3.3V	0.90V
TAP2, TAP6, TAP10, TAP14, TAP18, TAP22, TAP26, TAP30	2.5V	0.90V
TAP3, TAP7, TAP11, TAP15, TAP19, TAP23, TAP27, TAP31	1.8V	0.90V
TAP4, TAP8, TAP12, TAP16, TAP20, TAP24, TAP28, TAP32	3.3V	0.90V

Table 2-8. ScanTAP-32 TAP Voltages Table

Note that the Output Voltage setting sets the output voltage for the following signals:

- **TDI** (output of the ScanTAP-32 TAPs)
- **TMS**
- **TCK**
- **GPIO1**
- **GPIO2**
- **GPIO2**

and the Input Threshold Voltage setting sets the input threshold voltage for the **TDO** signal (input of the ScanTAP-32 TAPs)

Connecting and Removing UUTs

After the initial power up of the unit there is no further need to cycle power to the ScanTAP-32. To connect the TAP connector(s) to the target (UUT) perform these steps in the following order :

- Make sure that the target power is **OFF**.
- Make sure that the green **ON** LED on top of the ScanTAP-32 is illuminated.
- Install the TAP cable(s) on the ScanTAP-32 front panel SCAN 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.
-

Disconnecting the UUTs from the ScanTAP-32 is done in reverse order.

Appendix A in the PCI-1149.1/Turbo User's Manual 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)