CORELIS

ScanTAP IsoPod

ScanTAP IsoPod

TAP Signal Isolation Pod

User's Manual

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Chapter 1:
Product Overview

Introduction

The ScanTAP IsoPod is an add-on accessory that provides a complete electrical isolation barrier between a Corelis boundary-scan (JTAG) controller and target unit under test (UUT). The complete isolation helps prevent damage to the controller from harsh electrical environments where over-voltage and over-current can cause damage to components[1]. This feature is especially useful for new or untested targets where unknown faults may cause damage, and to protect against accidental misconnection of TAP signals through custom cabling or test fixtures. The ScanTAP IsoPod is compatible with all Corelis boundary-scan controllers and ScanTAP intelligent modules. The ScanTAP IsoPod supports continuous scan operations at JTAG test clock (TCK) frequencies up to 40 MHz.

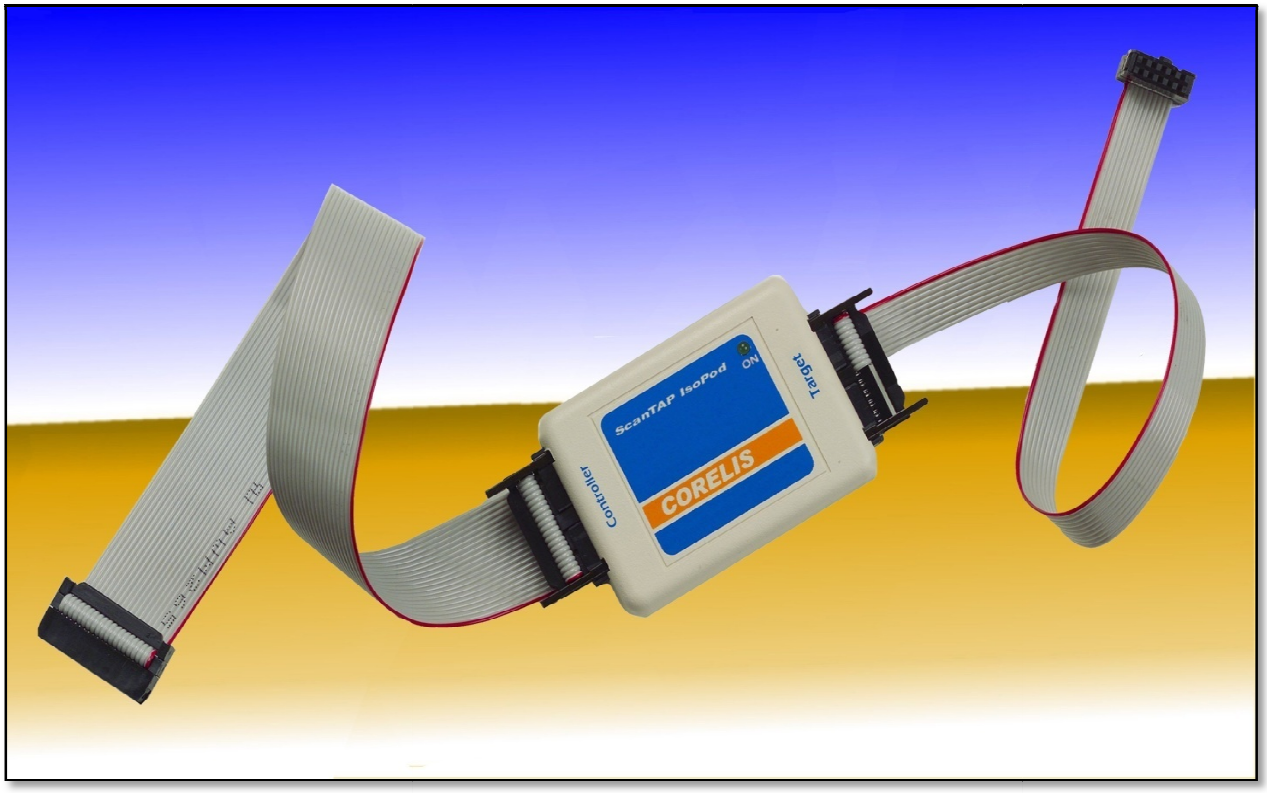

Figure 1-1. ScanTAP IsoPod Hardware

[1] Use of the ScanTAP IsoPod does not guarantee that damage will not occur to hardware that is subjected to extreme conditions. Damage may still be possible under certain circumstances that are beyond the scope of what is generally accepted as "normal operation".

ScanTAP IsoPod Hardware Specifications

Physical

Mechanical Dimensions (box)	2.75 inches x 2.0 inches x 0.80 inches (+/- 0.10”)

Operating Environment

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

Storage Environment

Temperature	-40°C to 85°C

Controller Interface (Host)

Host Connector	20-pin header, AMP part no. 104130-4 or equivalent
Host Cable Length	20-pin to 20-pin (12”), Corelis P/N 15312-2 (standard). Other options are available.

Target Interface (TAP)

TAP Connector	20-pin header, AMP part no. 104130-4 or equivalent
Mating TAP Connector	20-pin IDC (flat cable), 3M part no. 3421-6620 or equivalent
TAP Cable Length	20-pin to 20-pin (12”), Corelis P/N 15312-2 (standard). Other options are available.

Power Requirements

5V	Provided by an external power supply, Corelis P/N 4000-05V4A1R3MM Only the included power supply from Corelis should be used.

ScanTAP IsoPod Electrical Specifications

Target TAP Interface

ScanTAP IsoPod Target TAP Connector	20-pin (2x10) header (0.100" x 0.100"), AMP part number: 104130-4
ScanTAP IsoPod Target TAP Connector Mating Connectors	20-pin (2x10) IDC receptacle (0.100" x 0.100"), 3M part number: 3421-6620
Minimum TCK Frequency	0.05 MHz
Maximum TCK Frequency	40 MHz[2]
TAP Voltage	3.3V

Absolute Maximum Ratings

Parameter	JTAG Signals	GPIO Signals
Maximum Transient Overvoltage Isolation (V_{IOTM})	4000V-peak	2500V-peak
Maximum Working Insulation Voltage (V_{IORM})	560V-peak	
Maximum V_{IN}	6.0V	3.8V
Maximum V_{OUT}	6.0V	3.8V

Table 1-1. ScanTAP IsoPod Absolute Maximum Ratings

NOTE: Use of the ScanTAP IsoPod does not guarantee that damage will not occur to hardware that is subjected to extreme conditions. Damage may still be possible under certain circumstances that are beyond the scope of what is generally accepted as "normal operation".

[2] TCK maximum of 40MHz is for JTAG signals and GPIO1 only using 12" cables between the controller and IsoPod and between the IsoPod and target (higher TCK frequencies are possible using shorter cables). The remaining GPIO, I2C, and SPI signals support a maximum clock rate of 1MHz, but these signals typically toggle at much slower rates than TCK. See **Table 2-1** for details on the pinout.

DC Specifications

Parameter	Test Conditions	Limit Min	Limit Max	Units
V_{IH}	V_{CC} = 3.3 V,	0.7 x V_{CC}	V_{CC}	V
V_{IL}	V_{CC} = 3.3 V	0	0.3 x V_{CC}	V
V_{OH}	V_{CC} = 3.3 V, I_{IH} = 4mA	V_{CC} – 0.4		V
V_{OL}	V_{CC} = 3.3 V, I_{IL} = 4mA		0.4	V

Table 1-2. ScanTAP IsoPod DC and Switching Characteristics

ScanTAP IsoPod Power Indicator LED

When the external power supply is plugged in, the blue LED on top of the ScanTAP IsoPod will turn on to indicate that the unit is receiving power.

Chapter 2:
ScanTAP IsoPod Installation and Usage

The ScanTAP IsoPod product consists of the following components:

- ScanTAP IsoPod Hardware, Corelis P/N ASF4020100
- ScanTAP IsoPod User's Manual (pdf version)
- Two 20-pin to 20-pin TAP Cables (12"), Corelis P/N 15312-2
- 5V Power Supply, Corelis P/N 4000-05V4A1R3MM
- Power Cord, Corelis P/N 6000-86537030

Please ensure that 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 shown on the title page immediately.

NOTE: The actual hardware shipped with the ScanTAP IsoPod may vary depending on the customer order.

The following optional interface cables are also available from Corelis:

- 20-pin to 20-pin TAP Cable (8"), Corelis P/N 15312-1
- 20-pin HD (high-density) to 20-pin TAP Cable (12"), Corelis P/N 15392-2
- 20-pin HD (high-density) to 20-pin TAP Cable (8"), Corelis P/N 15392-1

ScanTAP IsoPod Hardware Installation

The Corelis ScanTAP IsoPod module connects to Corelis boundary-scan controllers through a 20-pin flat ribbon cable. External power is required and the required 5V power supply is included.

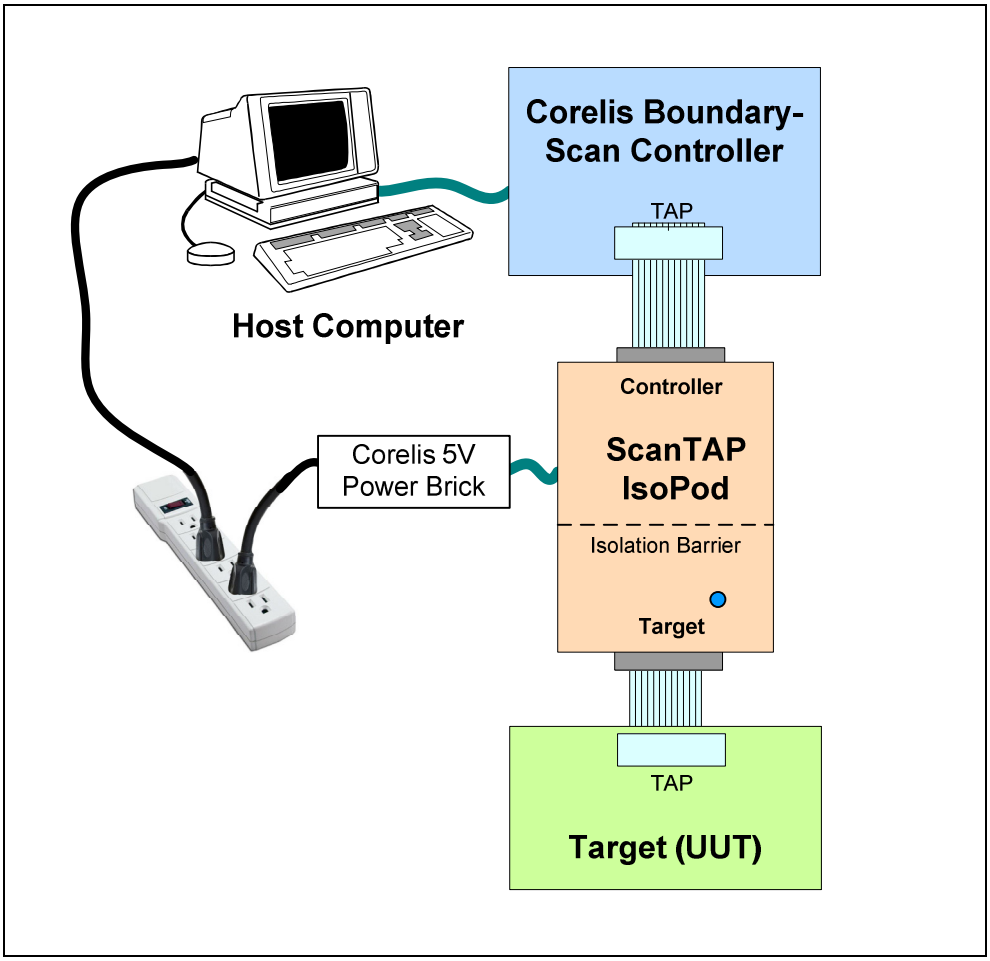

Figure 2-1. ScanTAP IsoPod System Connection Diagram

There are two 20-pin connectors on the ScanTAP IsoPod. The connector marked **Controller** connects to the Corelis boundary-scan controller and the connector marked **Target** connects to the target unit under test (UUT).

Connecting to the Controller and the Target

The Corelis ScanTAP IsoPod module connects to Corelis boundary-scan controllers and to targets through a 20-pin flat ribbon cable. The top view of the 20-pin controller connector (0.100" x 0.100" spacing), including the pin numbering, is shown in Figure 2-2 below.

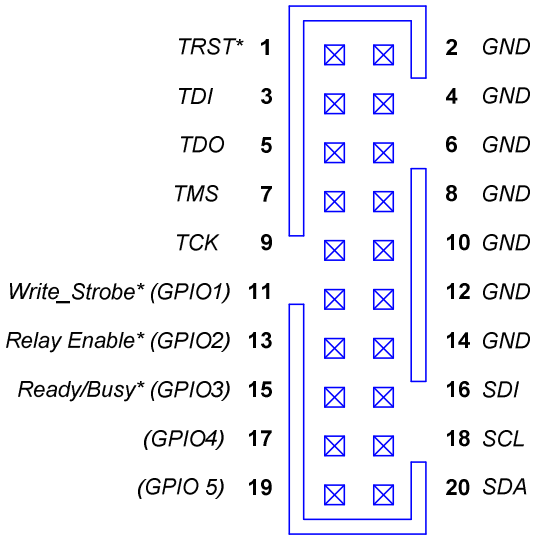

Figure 2-2. ScanTAP IsoPod 20-pin Controller Connector (top view)

The following steps for connecting the ScanTAP IsoPod to the boundary-scan controller and the target UUT should be performed in the order listed:

1. Before applying power to the ScanTAP IsoPod, connect the ScanTAP IsoPod to the Corelis boundary-scan controller using a standard 20-pin TAP cable. The Corelis boundary-scan controller should also be unpowered whenever the cable is connected/disconnected.
2. Verify that the target power is OFF.
3. Plug the TAP cable connector from the ScanTAP IsoPod into the mating target header on the UUT.
4. Make sure that the target is connected to ground.
5. Supply power to the ScanTAP IsoPod by plugging the provided 5V power adapter into the side of the box.
6. When you are ready to execute tests you can now turn the target power ON.

Applying Power

The ScanTAP IsoPod power must be supplied by the included 5V power supply provided by Corelis (Corelis P/N 4000-05V4A1R3MM). The power supply must be plugged into the same outlet or power strip as the host PC.

Signal Description

The connector pin descriptions are shown in Table 2-1. The ScanTAP IsoPod supports the 5 standard IEEE-1149.1 signals, an external write strobe signal (Write_Strobe*), an external Ready/Busy* signal, direct SPI and I^2C[3] programming signals, and other GPIO.

Pin	Signal Name	Signal Description
1	TRST*	Test Reset (Input to the UUT)
2	GND	
3	TDI	Test Data In (Input to the UUT)
4	GND	
5	TDO	Test Data Out (Output from the UUT)
6	GND	
7	TMS	Test Mode Select (Input to the UUT)
8	GND	
9	TCK	Test Clock (Input to the UUT)
10	GND	
11	Write_Strobe* / SPI_CS2* / GPIO1	Discrete Output (Input to the UUT)
12	GND	
13	SPI_SCK / GPIO2	Discrete Input/Output (Bidirectional)
14	GND	
15	Ready_Busy* / SPI_SDO (MISO) / GPIO3	Discrete Input/Output (Bidirectional)
16	SPI_SDI (MOSI)	Discrete Input/Output (Bidirectional)
17	GPIO4	Discrete Input/Output (Bidirectional)
18	I2C_SCL	Discrete Input/Output (Bidirectional)
19	GPIO5	Discrete Input/Output (Bidirectional)
20	SPI_CS1* / I2C_SDA	Discrete Input/Output (Bidirectional)

Table 2-1. ScanTAP IsoPod 20-pin Target Connector Pin Assignment

Note that while the signals routed through the ScanTAP IsoPod are 1:1, not all signals are bidirectional. TRST*, TDI, TDO, TMS, TCK, and GPIO1 are unidirectional, while the remaining non-GND signals are bidirectional.

[3] I2C address 0x40 is a reserved address.

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 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).

Using the ScanTAP IsoPod with ScanExpress Tools

The ScanTAP IsoPod module is compatible with ScanExpress Runner, ScanExpress Debugger and ScanExpress Programmer.

The Delay Compensation must be adjusted manually to account for the extra signal delay from the ScanTAP IsoPod and cabling. The following steps are provided for ScanExpress Runner. Adjusting the settings in ScanExpress Debugger or ScanExpress Programmer is done in a similar fashion.

1. Invoke the ScanExpress Runner application.
2. Click the **Setup** menu item and then select the **Controller** entry to display the controller *Configuration* screen shown in Figure 2-3.

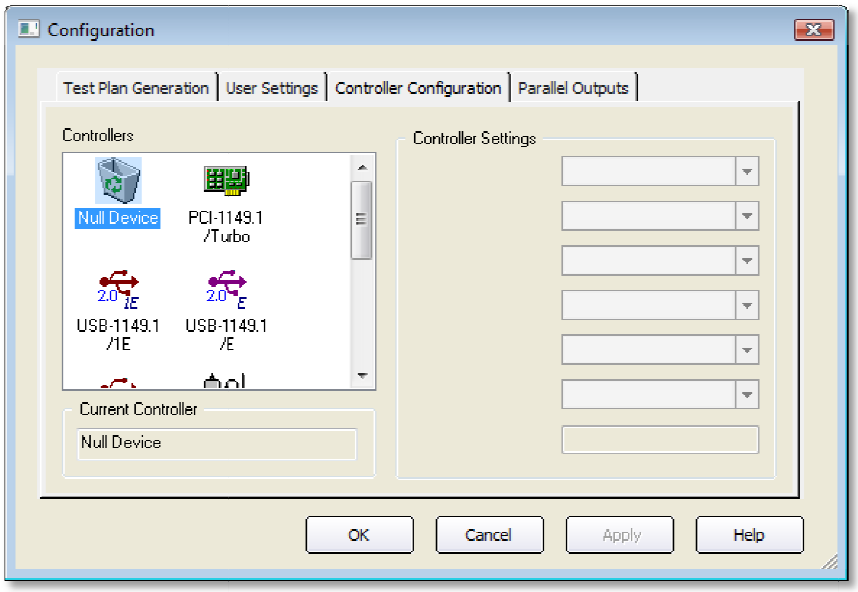

Figure 2-3. Controller Configuration Screen

3. Select the boundary-scan controller that will be used with the ScanTAP IsoPod from the *Controllers* section.
4. Under *Controller Settings*, set the **TAP Voltage** to **3.30V**. The TAP Voltage must be set to 3.30V to insure proper operation.

5. Using Table 2-2 as a reference, select the test plan's **TCK Frequency** and **Delay Compensation** under *Controller Settings*. The delay may need to be adjusted by ±0.5 clocks depending on the cable lengths and the selected boundary-scan controller.

TCK Frequency	Delay Compensation
1.0 MHz – 6.0 MHz	No Delay
7.5 MHz – 12.0 MHz	0.5 Clock
15.0 MHz – 19.0 MHz	1.0 Clock
20.0 MHz – 25.0 MHz	1.5 Clocks
28.0 MHz – 31.0 MHz	2.0 Clocks
34.0 MHz – 38.0 MHz	2.5 Clocks
41.0 MHz – 44.0 MHz	3.0 Clocks

Table 2-2. Recommended ScanTAP IsoPod Delay Compensation Settings

6. The remaining controller settings vary depending on the boundary-scan controller in use. If applicable, set the **Input Threshold** and **Slew Rate** to **Automatic**, and set the **TAP Off State** to **Active**.
7. After you have made your selections, click on the **Apply** button to save the settings. Figure 2-4 shows the ScanExpress Runner controller settings screen after the USB-1149.1/E is selected using a 10 MHz TCK frequency and 0.5 Clock delay compensation.

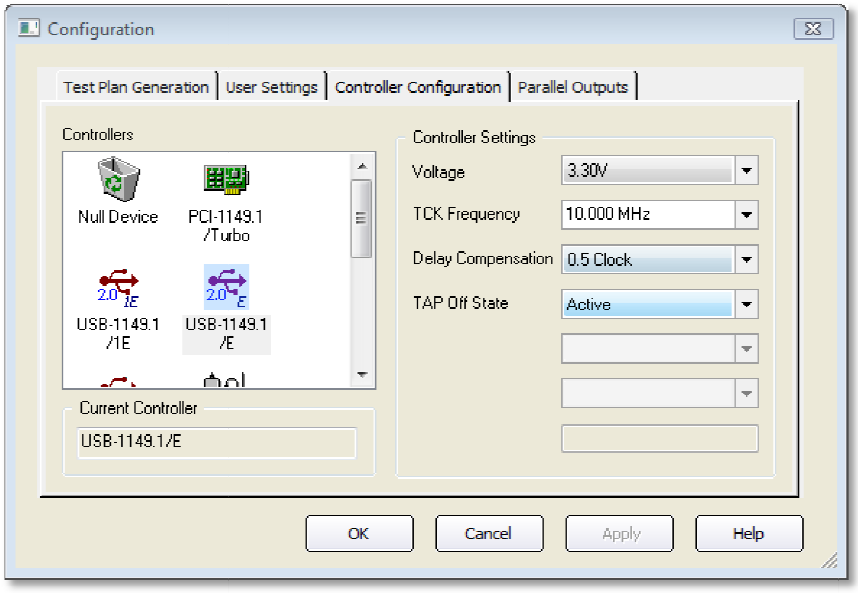

Figure 2-4. USB-1149.1/E Controller Configuration Screen in ScanExpress Runner

ScanTAP IsoPod Performance and Feature Tradeoffs

The ScanTAP IsoPod provides a hardware environment with higher fault tolerance at the expense of some of the more advanced features available in the Corelis boundary-scan controllers. The following list itemizes some of the tradeoffs to be aware of.

1. The ScanTAP IsoPod supports 3.3V TAP signals
2. The ScanTAP IsoPod and its cabling contributes to signal quality degradation, requiring the maximum TCK be reduce by 15% on average
3. The ScanTAP IsoPod supports JTAG test clock (TCK) frequencies up to 40 MHz
4. The ScanTAP IsoPod supports I^2C and SPI direct programming speeds up to 1 MHz
5. The ScanTAP IsoPod supports one TAP (additional ScanTAP IsoPod units can be added if support for more TAPs is required)
6. The ScanTAP IsoPod requires an external power supply
7. The ScanTAP IsoPod delay compensation is applied to each test step in a test plan. As a result test steps with different TCK rates configured in the options may fail. In order to ensure these steps do not fail, it is advised not to use the options to change the TCK rate for an individual test step.
8. The ScanTAP IsoPod has a fixed pinout and does not support the configurable TAP signal assignment feature
9. The ScanTAP IsoPod does not support any custom controller settings for Input Threshold, Slew Rate and TAP Off State features
10. The ScanTAP IsoPod completely isolates the UUT's signals from the boundary-scan controller's so it does not support voltage measurement or power/ground short testing
11. The ScanTAP IsoPod uses I^2C address 0x40 for internal communication with the Corelis boundary-scan controller so this address is not available for I^2C direct programming

Troubleshooting

Use the following general guidelines to troubleshoot problems such as boundary-scan tests failing during execution when the ScanTAP IsoPod is added to the test system.

1. Make sure power is being supplied to the ScanTAP IsoPod, the boundary-scan controller, and the target. The ScanTAP IsoPod's blue LED will be illuminated if power is being supplied to the ScanTAP IsoPod module.
2. Make sure that the controller's TAP voltage is set to **3.30V** and the delay compensation is set in the controller *Configuration* window correctly. Use Table 2-2 as a guideline for selecting the proper delay compensation. Sometimes delay can be introduced by long cables or buffering in the target board design and the default delay compensation settings will require some manual adjustment.
3. Reduce the test clock frequency (TCK) to **1 MHz**. The TCK frequency is commonly set too high for the chain and using a lower frequency will allow the test steps to pass. Once the scan chain is known to be stable the TCK frequency can then be increased to the maximum frequency that will allow the test steps to pass.

4. Make sure that the target interface is indeed a 3.3V interface. Probe the voltages on the target TAP to verify the voltages are being applied correctly.
5. Check the target connector to make sure that the pinout matches the ScanTAP IsoPod pinout.
6. You will need to revert the controller's **Delay Compensation** setting back to **Automatic** if you remove the ScanTAP IsoPod from the test setup.