

# User's Guide

## TB3-TO-CMC-LP Thunderbolt™ 3 Expansion Adapter

Installation and Connection Guide Supporting Products:

QPM-1553-TB  
RAR-XMC-TB  
P-SER-TB

RXMC-1553-TB  
RCNIC-A2PA-TB  
P-DIS-TB

RCEI-830A-TB  
RAR15XF-TB  
RP-708-TB

Publication No. 1500-108 Rev. 1.1

Obtain the latest version of this manual at [https://www.abaco.com/TB3LP\\_Guide](https://www.abaco.com/TB3LP_Guide)



**THUNDERBOLT™**

**abaco**  
SYSTEMS

## Document History

Revision	Date	Description
1.0	23 April 2019	Original Release
1.1	27 August 2019	Added new "Troubleshooting" section. Added connection approval step to "Quick Start for Abaco Modules" section.

## Waste Electrical and Electronic Equipment (WEEE) Returns



Abaco Systems is registered with an approved Producer Compliance Scheme (PCS) and, subject to suitable contractual arrangements being in place, will ensure WEEE is processed in accordance with the requirements of the WEEE Directive.

Abaco Systems will evaluate requests to take back products purchased by our customers before August 13, 2005 on a case by case basis. A WEEE management fee may apply.

# About This Manual

## Conventions

### Notices

This manual may use the following types of notice:



#### **WARNING**

Warnings alert you to the risk of severe personal injury.



#### **CAUTION**

Cautions alert you to system danger or loss of data.



#### **NOTE**

Notes call attention to important features or instructions.



#### **TIP**

Tips give guidance on procedures that may be tackled in a number of ways.



#### **LINK**

[Links take you to other documents or websites.](#)

### Numbers

All numbers are expressed in decimal, except addresses and memory or register data, which are expressed in hexadecimal. Where confusion may occur, decimal numbers have a “D” subscript and binary numbers have a “b” subscript. The prefix “0x” shows a hexadecimal number, following the ‘C’ programming language convention. Thus:

$$\text{One dozen} = 12_D = 0x0C = 1100_b$$

The multipliers “k”, “M” and “G” have their conventional scientific and engineering meanings of  $\times 10^3$ ,  $\times 10^6$  and  $\times 10^9$ , respectively, and can be used to define a transfer rate. The only exception to this is in the description of the size of memory areas, when “K”, “M” and “G” mean  $\times 2^{10}$ ,  $\times 2^{20}$  and  $\times 2^{30}$  respectively.

In PowerPC terminology, multiple bit fields are numbered from 0 to n where 0 is the MSB and n is the LSB. PCI terminology follows the more familiar convention that bit 0 is the LSB and n is the MSB.

### Text

Signal names ending with a tilde (“~”) denote active low signals; all other signals are active high. “N” and “P” denote the low and high components of a differential signal respectively.

Use of the word “adapter” refers to the TB3-TO-CMC-LP Thunderbolt™ 3 Expansion Adapter.

Use of the word “module” refers to the hosted PMC or XMC circuit board assembly hosted on the TB3-TO-CMC-LP adapter.

## Further Information

### Abaco Website

You can find information regarding Abaco products on the following website:



LINK

<https://www.abaco.com>

### Abaco Documents

This document is distributed via the Abaco website. You may register for access to manuals via the website.



LINK

[https://www.abaco.com/TB3LP\\_Guide](https://www.abaco.com/TB3LP_Guide)

## Technical Support Contact Information

You can find technical assistance contact details on the website Support page.



LINK

<https://www.abaco.com/support>

Abaco will log your query in the Technical Support database and allocate it a unique Case number for use in any future correspondence.

Alternatively, you may also contact Abaco's Technical Support via:



LINK

[avionics.support@abaco.com](mailto:avionics.support@abaco.com)

## Returns

If you need to return a product, there is a Return Materials Authorization (RMA) form available via the website Support page.



LINK

<https://www.abaco.com/support>

Do not return products without first contacting the Abaco Repairs facility.

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# 1 • Introduction

This User's Guide applies to the products listed in the table below. Products designated with a "-T<x>" option in the part number are avionics data bus interface modules that are paired with Abaco's TB3-TO-CMC-LP device, a bus-powered Thunderbolt™ 3 expansion chassis for compatible XMC and PMC modules.

Abaco Product	Description	Applicable Chapters
QPM-1553-TB	MIL-STD-1553 data bus interface adapter	All
RXMC-1553-TB	MIL-STD-1553 data bus interface adapter	All
RCEI-830A-TB	ARINC 429/717 data bus interface adapter	All
RAR-XMC-TB	ARINC 429/717 data bus interface adapter	All
RCNIC-A2PA-TB	AFDX data bus interface adapter	All
RAR15XF-TB	Multi-protocol MIL-STD-1553 and ARINC 429 data bus interface adapter	All
P-SER-TB	Serial data bus interface adapter	All
P-DIS-TB	Digital I/O interface adapter	All
RP-708-TB	ARINC 708 data bus interface adapter	All
TB3-TO-CMC-LP	Bus-powered Thunderbolt 3 expansion chassis for compatible XMC and PMC modules	1-2, 5-8

To be sure that you are accessing the most recent information available, it is strongly recommended that you obtain the latest version of this User's Guide at [https://www.abaco.com/TB3LP\\_Guide](https://www.abaco.com/TB3LP_Guide) before continuing.

## 2 • System Requirements and Thunderbolt 3 Port Setup

Your computer must satisfy the following minimum requirements:

- PC with a Thunderbolt 3 port
- Microsoft® Windows® 10 64-bit

**IMPORTANT:** Before connecting any Thunderbolt 3 devices to your computer, you must complete the following verification and system setup to properly support Thunderbolt:

1. Make sure that the port that you are planning to connect to supports Thunderbolt 3. The port must be labeled with the Thunderbolt 3 logo:



If the port is not labeled with the logo circled above, the port does not support Thunderbolt 3 and the adapter will not operate.

2. Consult your computer manufacturer's support group for the installation and configuration of the required software to support Thunderbolt. The following are the software packages that we recommend updating to the latest version:
  - a. BIOS
  - b. Chipset software
  - c. Thunderbolt firmware
  - d. Thunderbolt controller software

Be sure to check <https://thunderbolttechnology.net/updates> for additional Thunderbolt updates that may be required for your computer.

3. Install all available Windows updates by repeatedly checking for (and installing) any available Windows updates until no additional updates are available.



## 3 • Quick Start for Abaco Modules

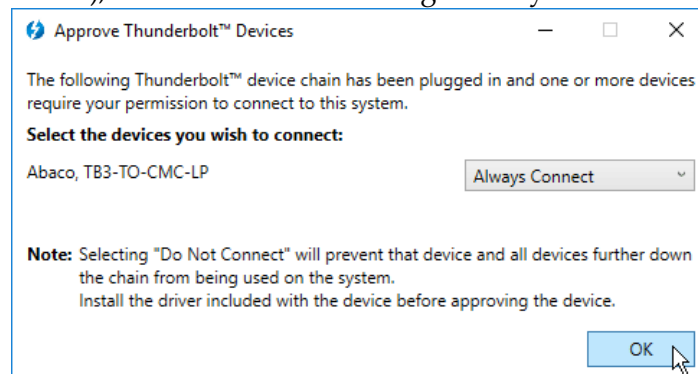
To quickly get up and running with your Abaco Avionics adapter and software, complete the following steps in order:

1. Before proceeding, be sure to complete all the Thunderbolt setup steps described in [System Requirements and Thunderbolt 3 Port Setup](#).
2. Install the Windows API/driver distribution for your Abaco module as described in the documentation listed in the table below.

All documentation referenced below is also available online – check the table in [Additional Documentation for Abaco Modules](#) to find the web page for your Abaco module.

Abaco Module	API/Driver Software Distribution	Installation Guide
RCEI-830A RAR-XMC	CEI-x30-SW	CEI-x30-SW Windows Installation Guide <CD>\CEI-x30-SW\Install.pdf
QPM-1553 RXMC-1553	BT-1553-API	MIL-STD-1553 Hardware Installation and Reference Manual (Chapter 2) <CD>\Documents\MIL-STD-1553 Hardware Installation and Reference Manual.pdf
RAR15XF	AR15-API	AR15-API Installation Manual <CD>\AR15-API Installation Guide vXXX.pdf
RCNIC-A2PA	CNIC-SW	CNIC Installation Manual <CD>\html\CNIC_Installation_Manual.pdf
P-SER	PIO-SW	P-SER Windows Installation Guide <CD>\PIO-SW\P-SER\Documentation\Install.txt
P-DIS	PIO-SW	P-DIS Windows Installation Guide <CD>\PIO-SW\P-DIS\Documentation\Install.txt
RP-708	P-708-SW	P-708-SW Windows Installation Guide <CD>\Documentation\Install.html

3. Verify the port you are planning to use supports Thunderbolt 3 (look for the Thunderbolt logo – see [here](#) for details), then connect your Abaco adapter to the computer using the Thunderbolt 3 cable that was included with your adapter.
4. If you are prompted to allow connection of the device (see example window below), we recommend selecting “Always Connect” (or similar).



5. Open Device Manager (press and hold the Windows and R keys on your keyboard at the same time to display the Run window, then enter "devmgmt.msc" in the Open box and click OK) and verify that your Abaco module appears beneath the "Abaco Avionics Devices" group (or, for RCNIC-A2PA, beneath the "Abaco Avionics AFDX Devices" group). If the device does not appear, reboot the computer to complete the device installation and then verify that the device appears in Device Manager.
6. Run the installation verification test program for your Abaco module to verify that the device was successfully installed and is operational:

Abaco Module	Installation Verification Test Program
RCEI-830A RAR-XMC	Start → Abaco CEI-x30-SW → CEI-x30 Test Installation
QPM-1553 RXMC-1553 RAR15XF	Start → Abaco BusTools-1553-API → QuikView1553
RCNIC-A2PA	From a Command Prompt window, execute: C:\Program Files\CNIC-SW\cpcap_devpack\Utilities\resetboard.exe
P-SER	Start → Abaco PIO-SW → P-SER Test Installation
P-DIS	Start → Abaco PIO-SW → P-DIS Test Installation
RP-708	Start → Abaco P-708-SW → Test Configuration

7. If you purchased any additional Abaco software products with your Abaco module (e.g., BusTools/ARINC, BusTools/1553, etc.), insert the corresponding installation CD into your CD drive. The installation program launches automatically when the CD is inserted into the drive – follow the prompts to complete the installation. If the installer does not automatically launch after you insert the CD, double-click the **Installer** listed in the table below to launch the installer.

Product	Installer Location on CD
	User's Manual Location on CD
	Web Page
BusTools/ARINC	<CD>\setup.exe
	<CD>\BusTools-ARINC User's Manual.pdf
	<a href="https://www.abaco.com/products/bt-arinc-bustools-software-analyzer">https://www.abaco.com/products/bt-arinc-bustools-software-analyzer</a>
BusTools/1553	<CD>\setup.exe
	<CD>\BusTools-1553 User's Manual.pdf
	<a href="https://www.abaco.com/products/bt-1553-bustools-software-analyzer">https://www.abaco.com/products/bt-1553-bustools-software-analyzer</a>
CEI-DL	<CD>\Setup\Disk1\setup.exe
	<CD>\CEI-DL\Program Files\docs\CEI-DL User's Manual.pdf
	<a href="https://www.abaco.com/products/cei-dl-data-loader-software">https://www.abaco.com/products/cei-dl-data-loader-software</a>
CEI-LV	<CD>\Setup\setup.exe
	<CD>\Documentation\CEI-LV_Users_Manual.pdf
	N/A
LV-1553	<CD>\Setup\Disk1\setup.exe
	<CD>\LV-1553\Documentation\LV-1553 User's Manual.pdf
	<a href="https://www.abaco.com/products/lv-1553-software">https://www.abaco.com/products/lv-1553-software</a>

The User's Manual for the Abaco software product is automatically installed with the distribution, available on the product installation CD at the location

given in the above table, and available on the given web page for each product.

Additional documentation for your Abaco module is described in [Additional Documentation for Abaco Modules](#).

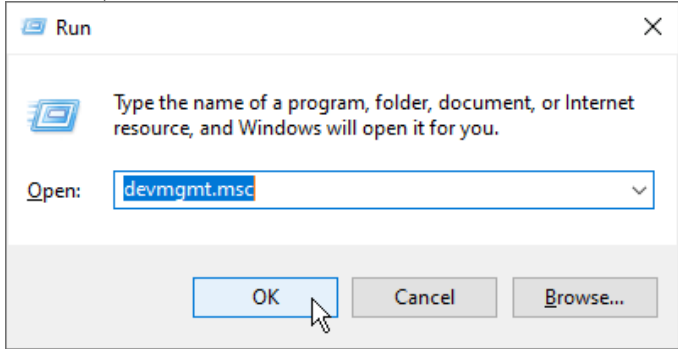
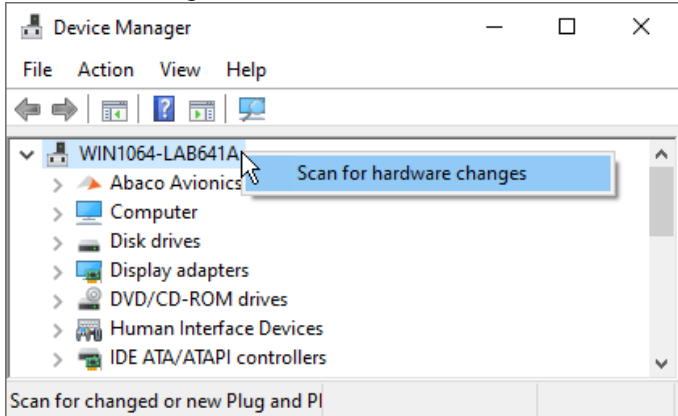
## 4 • Additional Documentation for Abaco Modules

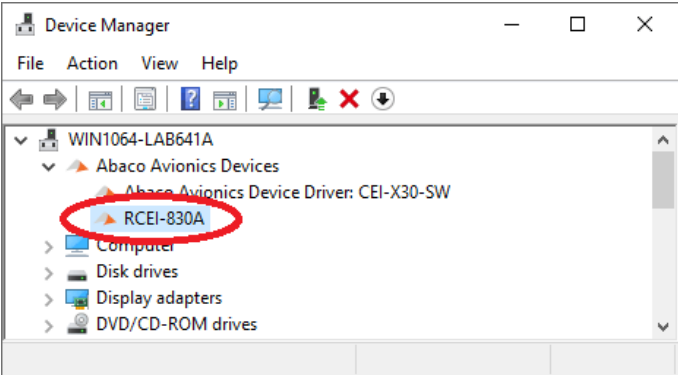
For more information on using Abaco Avionics modules, please consult the following documentation:

Abaco Module	Web Page
	Additional Documentation
QPM-1553	<a href="https://www.abaco.com/products/qpm-1553-interface">https://www.abaco.com/products/qpm-1553-interface</a>
	<i>MIL-STD-1553 Hardware Installation and Reference Manual</i>
	<i>BusTools/1553-API Reference Manual</i> <i>BusTools/1553-API User's Manual</i>
RXMC-1553	<a href="https://www.abaco.com/products/rxmc1553-interface">https://www.abaco.com/products/rxmc1553-interface</a>
	<i>MIL-STD-1553 Hardware Installation and Reference Manual</i>
	<i>BusTools/1553-API Reference Manual</i> <i>BusTools/1553-API User's Manual</i>
RAR15XF	<a href="https://www.abaco.com/products/rar15xf-interface">https://www.abaco.com/products/rar15xf-interface</a>
	<i>AR15-API Installation Manual</i>
	<i>MIL-STD-1553 Hardware Installation and Reference Manual</i>
	<i>BusTools/1553-API Reference Manual</i>
	<i>BusTools/1553-API User's Manual</i>
	<i>CEI-x30 Product Line Hardware User's Manual</i> <i>CEI-x30-SW Windows Installation Guide</i> <i>CEI-x30-SW Software User's Manual</i>
RCEI-830A	<a href="https://www.abaco.com/products/rcei-830a-interface">https://www.abaco.com/products/rcei-830a-interface</a>
	<i>CEI-x30 Product Line Hardware User's Manual</i>
	<i>CEI-x30-SW Windows Installation Guide</i>
	<i>CEI-x30-SW Software User's Manual</i> <i>RCEI-830A Pin-Out Guide</i>
RAR-XMC	<a href="https://www.abaco.com/products/rar-xmc-interface">https://www.abaco.com/products/rar-xmc-interface</a>
	<i>CEI-x30 Product Line Hardware User's Manual</i>
	<i>CEI-x30-SW Windows Installation Guide</i>
	<i>CEI-x30-SW Software User's Manual</i> <i>RAR-XMC Pin-Out Guide</i>
RCNIC-A2PA	<a href="https://www.abaco.com/products/rcnic-a2pa-interface">https://www.abaco.com/products/rcnic-a2pa-interface</a>
	<i>CNIC Installation Manual</i>
	<i>CNIC Hardware User's Manual</i>
	<i>AFDX-A User's Manual</i> <i>CNIC Cable Pinout</i>
P-SER	<a href="https://www.abaco.com/products/p-ser-interface">https://www.abaco.com/products/p-ser-interface</a>
	<i>P-SER User's Manual</i>
	<i>P-SER Windows Installation Guide</i> <i>P-SER I/O Connections and Cables</i>
P-DIS	<a href="https://www.abaco.com/products/p-dis-interface">https://www.abaco.com/products/p-dis-interface</a>
	<i>P-DIS User's Manual</i>
	<i>P-DIS Windows Installation Guide</i> <i>P-DIS I/O Connections and Cables</i>

Abaco Module	Web Page
	Additional Documentation
RP-708	<a href="https://www.abaco.com/products/rp-708-interface">https://www.abaco.com/products/rp-708-interface</a>
	<i>P-708 User's Manual</i> <i>P-708-SW Windows Installation Guide</i> <i>RP-708 I/O Connections and Cables</i>

## 5 • Troubleshooting

Problem	Solution
When using a Thunderbolt-based Abaco Avionics data bus interface device (e.g., RAR15XF-TB, QPM-1553-TB, RCEI-830A-TB, RCNIC-A2PA-TB, etc.), the device is not detected after connecting it to the computer's Thunderbolt port.	<p>Complete the following steps, in order, until the device is detected:</p> <ol style="list-style-type: none"> <li>1. Verify that you have already completed all steps described in the sections "System Requirements and Thunderbolt 3 Port Setup" and "Quick Start for Abaco Modules".</li> <li>2. Disconnect and re-connect the Thunderbolt cable from/to the TB3-TO-CMC-LP chassis.</li> <li>3. Disconnect and re-connect the Thunderbolt cable from/to the host computer.</li> <li>4. Scan for hardware changes in Device Manager:             <ol style="list-style-type: none"> <li>a. Open Device Manager (press and hold the Windows and R keys on your keyboard at the same time to display the Run window, then enter "devmgmt.msc" in the Open box and click OK).</li> </ol> </li> </ol>  <ol style="list-style-type: none"> <li>b. Right-click on the computer name and select "Scan for hardware changes".</li> </ol>  <ol style="list-style-type: none"> <li>c. Expand the "Abaco Avionics Devices" group (or, for RCNIC-A2PA, the "Abaco Avionics AFDX Devices" group) and verify that your Abaco module appears:</li> </ol>

Problem	Solution
	 <p>The screenshot shows the Windows Device Manager window for a system named WIN1064-LAB641A. Under the 'Abaco Avionics Devices' category, the 'RCEI-830A' device is highlighted with a red circle. Above it, the text 'Abaco Avionics Device Driver: CEI-X30-SW' is visible. Other categories like Computer, Disk drives, Display adapters, and DVD/CD-ROM drives are also listed.</p> <p>If your Abaco module does not appear, proceed to step 5.</p> <ol style="list-style-type: none"> <li>5. Reboot the computer.</li> <li>6. Open Device Manager (see step 4.a) and verify that the Abaco module appears (see step 4.c).</li> <li>7. If the Abaco module still does not appear after completing steps 1 through 6, contact Abaco Avionics Technical Support group at 805-883-6097 or <a href="mailto:avionics.support@abaco.com">avionics.support@abaco.com</a>.</li> </ol>

## 6 • Specifications

External Connectors	<ul style="list-style-type: none"> <li>Thunderbolt enabled USB-C connector</li> <li>Front bezel I/O on XMC/PMC Bezel</li> </ul>
Expansion Slot	Standard single width XMC or PMC with front bezel I/O
Dimensions	165mm x 85mm x 25mm
Weight	390 grams without XMC/PMC module 440 grams without XMC/PMC (including heatsink)
Captive USB-C connector	Yes - The Sonnet ThunderLok 3 retainer clip is used
Operating Temperature	0 to +85 °C ambient at maximum XMC/PMC power
Storage Temperature	-40 to +125 °C excluding indicator LED (LED in non-critical and -40 to +85 °C)
RoHS Compliant	Adapter is RoHS
Maximum device power	15 Watts
XMC/PMC Supply Voltages	3.3V: +3.15V to +3.45V, 2.8A maximum 3.3VAUX: +3.15V to +3.45V, 375mA maximum VPWR/+5V: +4.75V to +5.25V, 3.0A maximum +12V: +11.5V to 12.5V, 400mA maximum -12V: -11.5V to -12.5V, 400mA maximum
Total Maximum XMC/PMC Power	8 Watts
XMC/PMC Thermal Interfaces	If the XMC/PMC module supports primary and secondary thermal interfaces as defined by ANSI/VITA 20-2001 (R2005), an optional heatsink may be used to transfer heat to the case.
XMC Host Interface	<ul style="list-style-type: none"> <li>Even though the TB3 controller supports Gen 3 PCIe speeds, XMC limits PCIe to Gen 1</li> <li>2 lanes (x2) are supported</li> <li>All I/O must be on the front bezel</li> <li>XMC mezzanine I/O is not supported, although if a P16 connector is installed on the XMC module, there will be no mechanical interference</li> </ul>
PMC Host Interface	<ul style="list-style-type: none"> <li>33MHz, 32-bit PCI</li> <li>Bus mastering is supported</li> <li>All I/O must be on the front bezel</li> <li>P14 mezzanine I/O is not supported, although if a P14 connector is installed on the PMC module, there will be no mechanical interference</li> </ul>
LED	Off = Unpowered Green = Powered and Power Delivery enabled Orange = Overtemperature condition ( $T_j > 105^{\circ}\text{C}$ )



## 7 • General Information

### **Keeping the TB3-TO-CMC-LP cool**

Under office ambient conditions with higher power modules, the case temperature can approach 60°C (140°F). Ensure air is able to circulate around the case to help mitigate the temperature; even slight airflow will significantly lower the case temperature.

### **Hot Plugging the Thunderbolt 3 device**

Abaco Thunderbolt 3 devices can be hot plugged. However, do not disconnect while an application communicating with the XMC/PMC module is running.

### **Installing or removing XMC/PMC modules from TB3-TO-CMC-LP**

Never install an XMC or PMC module into the TB3-TO-CMC-LP chassis while it is connected and potentially powered. If you do, you risk damage to both the TB3-TO-CMC-LP and the XMC/PMC module.

### **Drivers for any non-Abaco XMC/PMC module must be Thunderbolt compatible**

When using a non-Abaco XMC or PMC card within the TB3-TO-CMC-LP chassis, be sure to install Thunderbolt-compatible drivers for the XMC/PMC module.

### **Not All Host Computer's Thunderbolt 3 Performance is Equal**

While the TB3-TO-CMC-LP features a 40 Gbit/s Thunderbolt 3 interface, some Thunderbolt 3 ports on some computers may use an implementation of Thunderbolt 3 technology which limits PCIe performance to 20 Gbit/s.

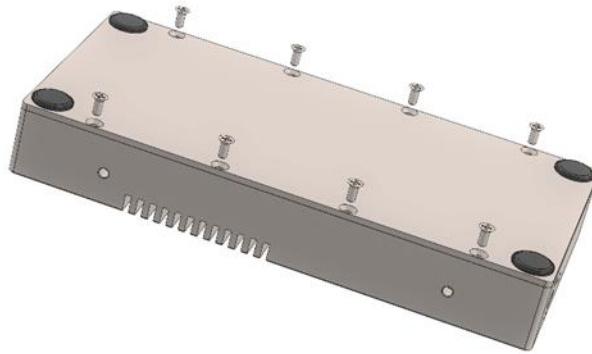
### **Not All Thunderbolt 3 Cables Deliver Full Performance**

The cable provided by Abaco will deliver full 40 Gbit/s performance. Some cables offer reduced (20 Gbit/s) performance, typically longer non-active cables.

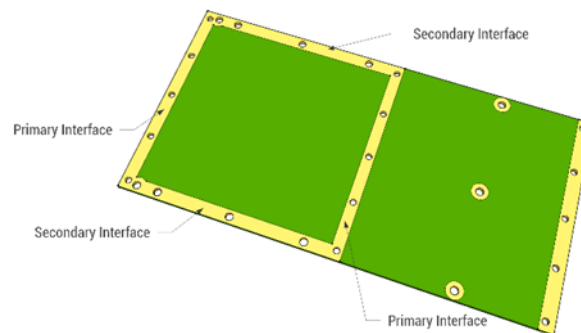
### **The performance of some modules may be affected by where they are connected in a Thunderbolt chain.**

## 8 • XMC/PMC Module Installation/Removal

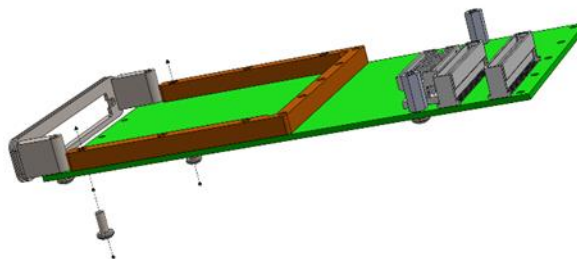
1. **Installing a module in the adapter**-Take off the bottom cover by removing the eight screws and set aside.



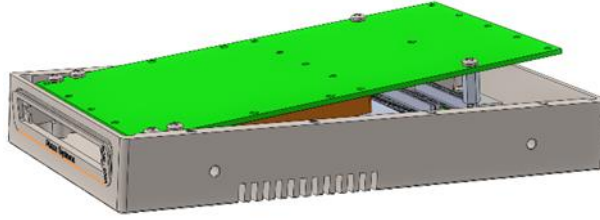
2. If the module to be installed is capable of conduction cooling and the heatsink kit was purchased with the adapter, then the heatsink must be attached to the module prior to installation in the adapter (non-conductively cooled modules cannot accept the heatsink).
  - a. Verify the module has the primary and secondary thermal interfaces as shown below.



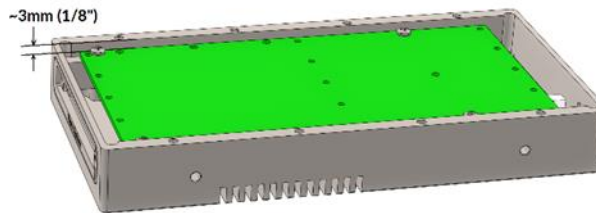
- b. Attach the heatsink to the conductively cooled module as shown using two pan head M2.5 x 0.45, 6 mm long screws (supplied with the heatsink kit).



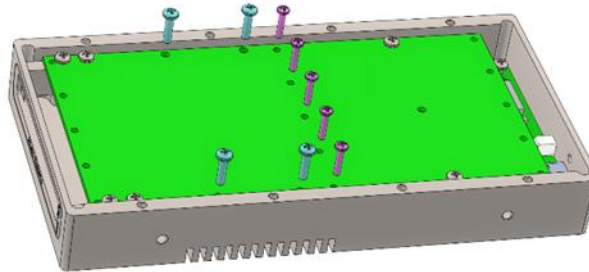
3. Insert the module at an angle, aligning the module bezel and adapter case edge as shown by the orange line (module with heatsink pictured). It is important the module has a front I/O bezel and two M2.5 x 10mm standoffs installed as the adapter relies on these for module attachment.



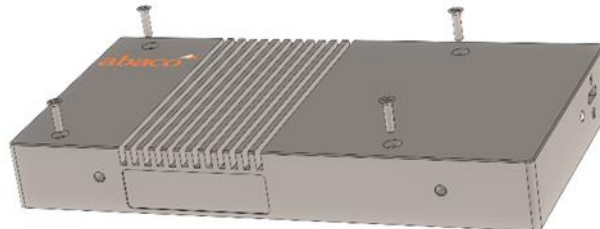
4. Lower the end of the module, keeping the bezel and case edge aligned (orange dashed line shown above) to ensure module and adapter connector alignment. Firmly seat the module in the adapter. The bottom of a properly installed module should be approximately 3mm (~1/8") below the edge of the case.



- a. For conductively cooled modules with the heatsink attached, fasten the module to the case as shown using four (4) M2.5 x 0.45 (shown blue) and five (5) M2.0 x 0.4 (shown pink), 10 mm long pan head screws (provided with heatsink kit). These screws bring the heatsink in firm contact with the adapter case and module thermal interface area.

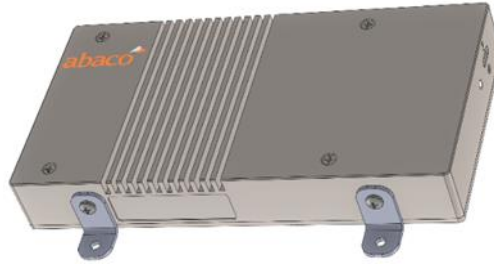


5. Flip the adapter over and install the four (4) M2.5 x 0.45, 10 mm flat head screws (provided) as shown. These screws fasten the module bezel and standoffs to the adapter case.

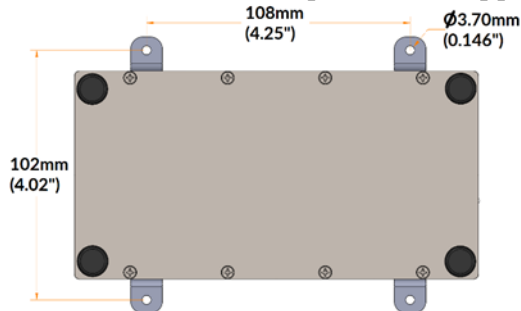


6. Fasten the cover in place with the 8 screws removed in step 1.

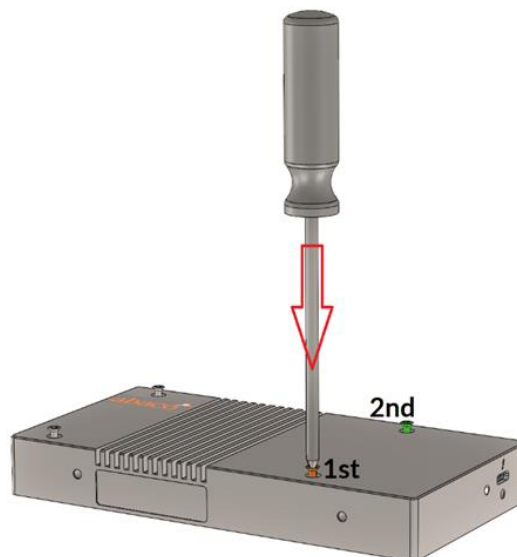
7. The optional bulkhead mount kit enables rigidly mounting the adapter.
- Fasten the brackets to the adapter with the M3.0 x 0.5, 6 mm long pan head screws supplied with the kit.



- Mounting the adapter to a bulkhead with the brackets installed requires the following hole pattern, the brackets will accommodate M3.5 or #6 screws (4 required, not supplied).



8. **Removing a module from the adapter**-The retention force of the module connectors can make it difficult to unseat a module from the adapter, the following procedure is recommended.
- Remove the cover as described in step 1.
  - If present remove the nine (9) screws installed in step 4.a.
  - Loosen completely the screws installed in step 5.
  - Insert the tip of the screwdriver in the orange highlighted screw and firmly press down, repeat for the green highlighted screw. The module should now be easily removed from the adapter.



## List of fasteners used on the TB3-TO-CMC-LP

Description	Cover	Module	Heatsink (optional)	Bulkhead Bracket (optional)
Flathead Philips Screw, M2.5 x 0.45, 6 mm, 90°, 316 SS	8			
Flathead Philips Screw, M2.5 x 0.45, 10 mm, 90°, 316 SS		4		
Panhead Philips Screw, M2.5 x 0.45, 10 mm Long, 316 SS			4	
Panhead Philips Machine Screw, M2.5 x 0.45, 6 mm Long, 316 SS			2	
Panhead Philips Machine Screw, M2.0 x 0.4, 10 mm Long, 316 SS			5	
Panhead Philips Machine Screw, M3.0 x 0.5, 6 mm Long, 316 SS				4

## Optional Accessories

Name	Description	Abaco Part Number
Heatsink Kit Heatsink Kit, TB3 CMC Adapter	Heatsink for conductively cooled modules with primary and secondary thermal interfaces	2220-010-8
Bulkhead Bracket Kit, TB3 CMC Adapter	Bracket kit for rigidly mounting adapter	2220-011-8

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## Additional Resources

For more information, please visit the Abaco Systems web site at:

[www.abaco.com](http://www.abaco.com)

