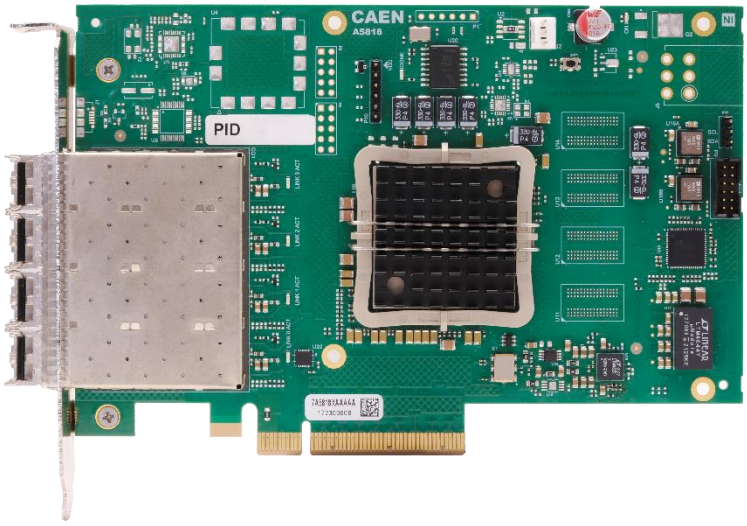
Rev. 1 - January 13th, 2025

A5818

PCI Express Gen 3 CONET2 Controller



CAEN
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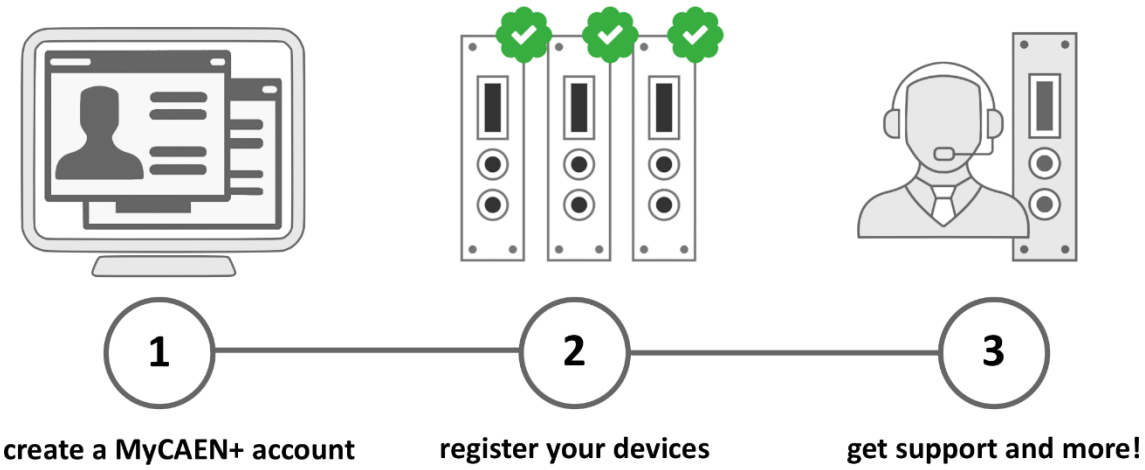
User Manual

UM10551

Register your device

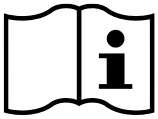
Register your device to your **MyCAEN+** account and get access to our customer services, such as notification for new firmware or software upgrade, tracking service procedures or open a ticket for assistance. **MyCAEN+** accounts have a dedicated support service for their registered products. A set of basic information can be shared with the operator, speeding up the troubleshooting process and improving the efficiency of the support interactions.

MyCAEN+ dashboard is designed to offer you a direct access to all our after sales services. Registration is totally free, to create an account go to https://www.caen.it/become-mycaenplus-user and fill the registration form with your data.



https://www.caen.it/become-mycaenplus-user/

Purpose of this User Manual



This User Manual contains the description of the A5818 PCI Express CONET Controller

Change Document Record

Date	Revision	Changes
February 6th, 2024	00	Initial release
January 13th, 2025	01	Added a note about reading the temperature on Linux systems.

Symbols, Abbreviated Terms and Notations

PCIe	Peripheral Component Interconnect Express
VME	VERSABUS Module Eurocard

Reference Documents

All CAEN documents can be downloaded at:

https://www.caen.it/support-services/documentation-area/ (**login required**)

Manufacturer Contacts

CAEN S.p.A.
Via Vetraia, 11 55049 Viareggio (LU) - ITALY
Tel. +39.0584.388.398 Fax +39.0584.388.959
www.caen.it | info@caen.it

Limitation of Responsibility

If the warnings contained in this manual are not followed, CAEN will not be responsible for damage caused by improper use of the device. The manufacturer declines all responsibility for damage resulting from failure to comply with the instructions for use of the product. The equipment must be used as described in the user manual, with particular regard to the intended use, using only accessories as specified by the manufacturer. No modification or repair can be performed.

Disclaimer

The information contained herein has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies. CAEN spa reserves the right to modify its products specifications without giving any notice; for up to date information please visit www.caen.it.

Made in Italy

We remark that all our boards have been designed and assembled in Italy. In a challenging environment where a competitive edge is often obtained at the cost of lower wages and declining working conditions, we proudly acknowledge that all those who participated in the production and distribution process of our devices were reasonably paid and worked in a safe environment (this is true for the boards marked "MADE IN ITALY", while we cannot guarantee for third-party manufactures).

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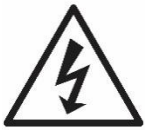
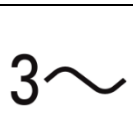
List of Tables

Safety Notices

N.B. Read carefully the "SAFETY, STORAGE AND SETUP INFORMATION, PRODUCT SUPPORT SERVICE AND REPAIR" document provided with the product before starting any operation.

The following HAZARD SYMBOLS may be reported on the unit:

	Caution, refer to product manual
	Caution, risk of electrical shock
	Protective conductor terminal
	Earth (Ground) Terminal
	Alternating Current
	Three-Phase Alternating Current

The following symbol may be reported in the present manual:

	General warning statement

The symbol could be followed by the following terms:

- **DANGER**: indicates a hazardous situation which, if not avoided, will result in serious injury or death.
- **WARNING**: indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**: indicates a situation or condition that, if not avoided, could cause physical injury or damage the product and / or its environment.

CAUTION: Do Not Operate in Wet/Damp Conditions

TO AVOID ELECTRIC SHOCK, DO NOT OPERATE THIS PRODUCT IN WET OR DAMP CONDITIONS

CAUTION: Do Not Operate in an Explosive Atmosphere

TO AVOID INJURY OR FIRE HAZARD, DO NOT OPERATE THIS PRODUCT IN AN EXPLOSIVE ATMOSPHERE

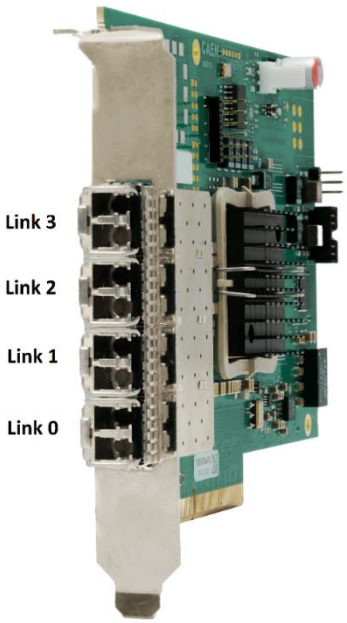
THIS DEVICE SHOULD BE INSTALLED AND USED BY SKILLED TECHNICIAN ONLY OR UNDER HIS SUPERVISION

DO NOT OPERATE WITH SUSPECTED FAILURES.
IF YOU SUSPECT THIS PRODUCT TO BE DAMAGED, PLEASE CONTACT THE TECHNICAL SUPPORT

See Chapter **10** for the Technical Support contacts.

1 Introduction

The Mod. A5818 is a PCI Express Gen 3 x8 card that can plug into x8 or x16 PCI Express slots, which allows the User to control up to 4 CONET2 independent networks (each network can be made of up to 8 CONET 2 slaves).
CONET2 is an optical link-based network with Daisy chain capabilities. Through the CONET2 it is possible to handle the VMEbus through the CAEN VMEbus Optical Link Bridges (such as the V3718, VX3718 or V4718, VX4718) or to control directly CAEN modules with built-in optical link (such as standard CAEN digitizers).
The communication path uses optical fiber cables as physical transmission line (AI2700 – Optical Fiber Series).



ARCHITECTURE	X8 PCI Express, half-length, specification v3.0 compliant
SLOT COMPATIBILITY	X8 and x16 PCI Express
SUPPORTED OPTICAL FIBERS	50/125 µm OM2 and OM3 (back-compliant with 62.5/125 µm OM1)
CHANNEL BANDWIDTH	1.25 Gb/s
DATA TRANSFER RATE	Up to 80 MB/s per link (**CONET2** CAEN proprietary protocol)
NUM. OF BOARDS / LINK	Up to 8 boards can be controlled by a single CONET2 link thanks to Daisy-Chain capability
NUM. OF OPTICAL LINKS	4
POWER RAILS	+12 V from PCIe
OPERATING SYSTEMS SUPPORTED	Linux Windows
OPERATING TEMPERATURE*	0°-40° Relative Humidity (non-condensing) 10 - 90 %

(*) The FPGA temperature can be readout on Linux OS with the cat /proc/a5818n_control command were n is the A5818 board number (0 for the first one, and so on).

2 Installing the device

The device installation can be performed with the following steps:

- Shut down the PC and disconnect it from the power source.

- Open the PC case.

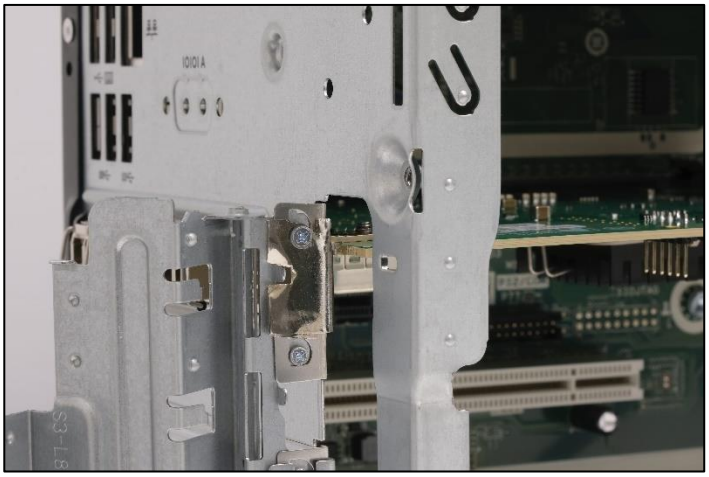
- Identify an available PCIe slot.

At this point the A5818 can be inserted in the slot:

- Handle the A5818 carefully, avoiding contact with the connectors or circuitry.
- Align the device with the PCI slot, ensuring the notches match.

- Gently insert the A5818 into the slot, applying even pressure.

- Secure the device by fastening the retention screw or latch.



The A5818 is now installed:

- Reattach the PC case cover.
- Reconnect the power cable to the PC and switch on the power supply.
- Power on the PC using the power button.

Do not use the device and contact technical support if the indication led or display is not performing as required (e.g. led not working, display with incorrect graphic). For led description see **Chapter 7.2.**

ONLY QUALIFIED PERSONNEL SHOULD PERFORM INSTALLATION, OPERATIONS

THE SAFETY OF ANY SYSTEM THAT INCORPORATES THE DEVICE IS UNDER THE RESPONSIBILITY OF THE ASSEMBLER OF THE SYSTEM

STATIC ELECTRICITY MAY DAMAGE THE DEVICE. KEEP THE DEVICE IN ITS STATIC-PROTECTIVE BAG BEFORE INSTALLATION

DURING INSTALLATION, OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICE

3 Software Installation

3.1 Linux Drivers Installation

Drivers, essential for the proper functioning of the A5818 PCIe card, are provided in a tar-compressed package and include the following files: CHANGELOG, COPYING, dmks.conf.in, the include folder, INSTALL file, install.sh, README, and the xdma folder, as shown in figure ...

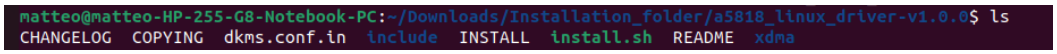


Figure 3.1: The contents of the A5818 Linux Drivers folder.

Before proceeding with the installation, ensure that the system meets the following requirements:

- Administrator privileges (sudo).
- DKMS (Dynamic Kernel Module Support) installed on the system.

Follow the steps below carefully to install the drivers:

1. Extract the contents of the tar package: *tar -xvf a5818_linux_driver-caen_a5818.tar.gz*
2. Navigate to the extracted directory.
3. Execute the installation command: *sudo ./install.sh*

This command will install the necessary drivers for the A5818 PCIe card to the system.

3.2 Linux Drivers Uninstallation

If you need to uninstall drivers, execute the following commands:

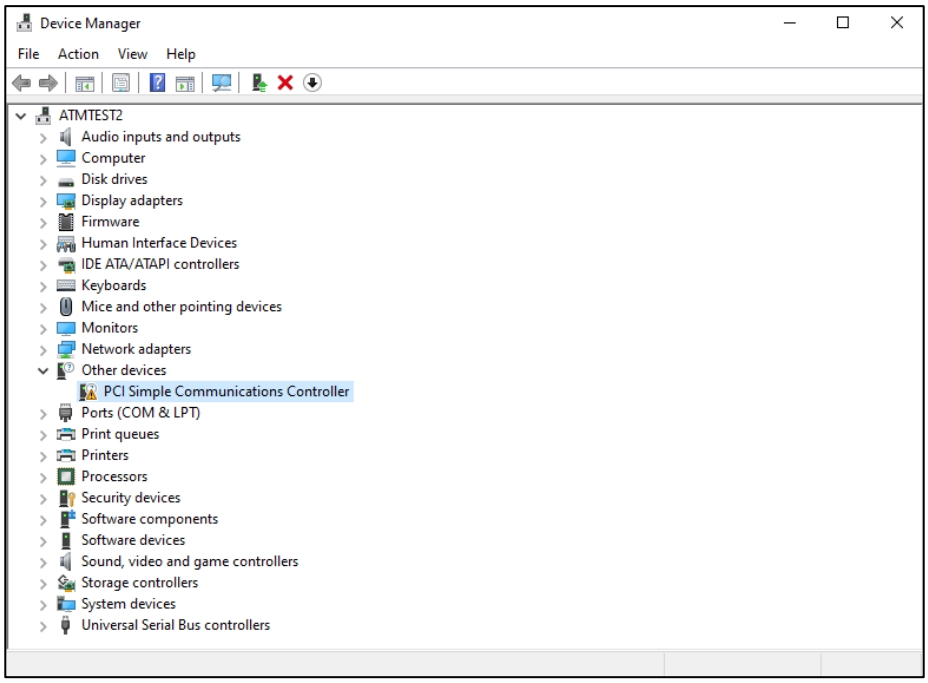
1. Uninstall the drivers using DKMS: *sudo dkms uninstall A5818/$VERSION*
2. Remove all the DKMS-installed modules for the A5818 card: *sudo dkms remove a5818/$VERSION –all*

Where *$VERSION* represents the specific version of the driver in use (e.g. 1.0.0).

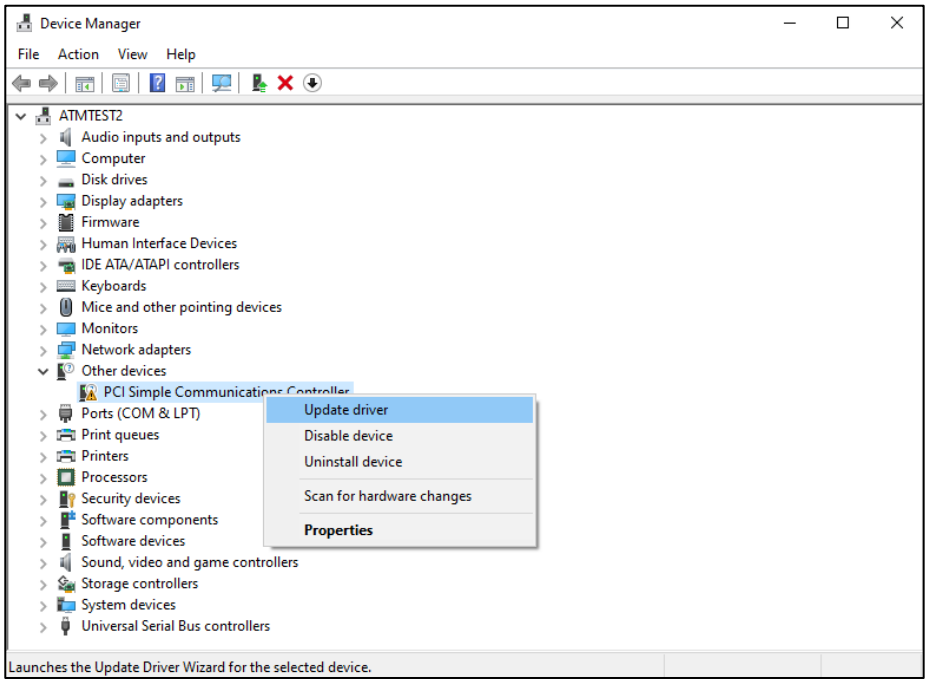
3.3 Windows Drivers Installation

The following steps include the A3818 driver installation based on Windows 10 OS. In case of different Windows operating systems, the displayed dialogue boxes, indications or operations may slightly be different.

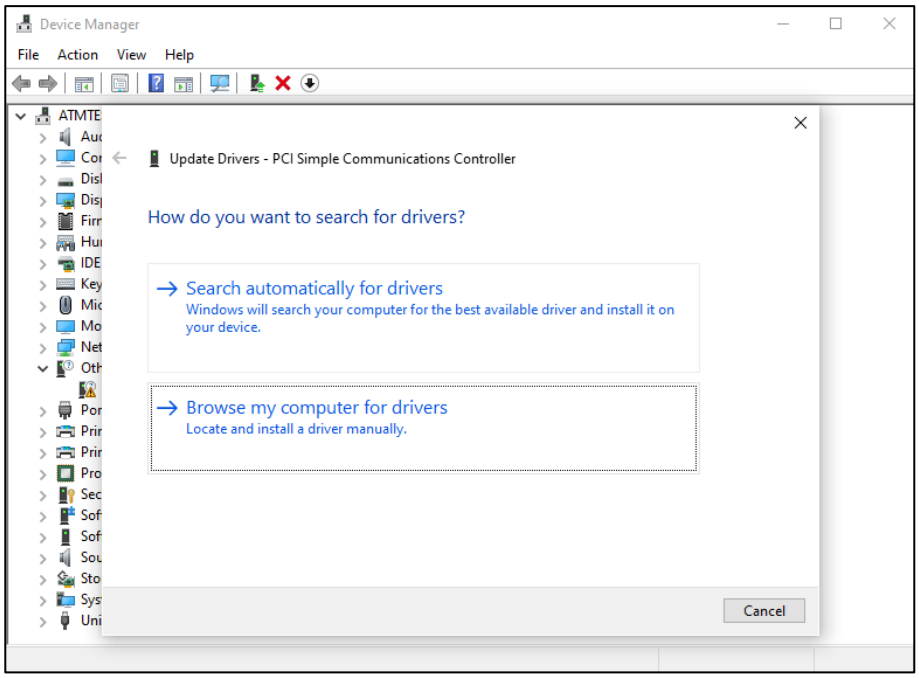
1. Download the drivers from CAEN website.
2. Unzip the downloaded package.
3. Go to the Windows Device Manager and right click the PCI Simple Communication Controller



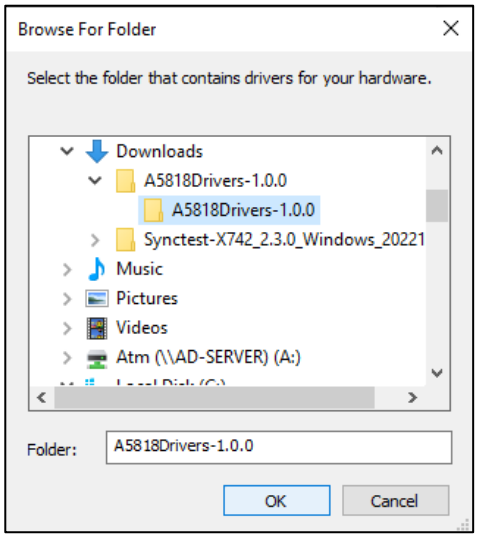
4. Left click on “Update Driver”.



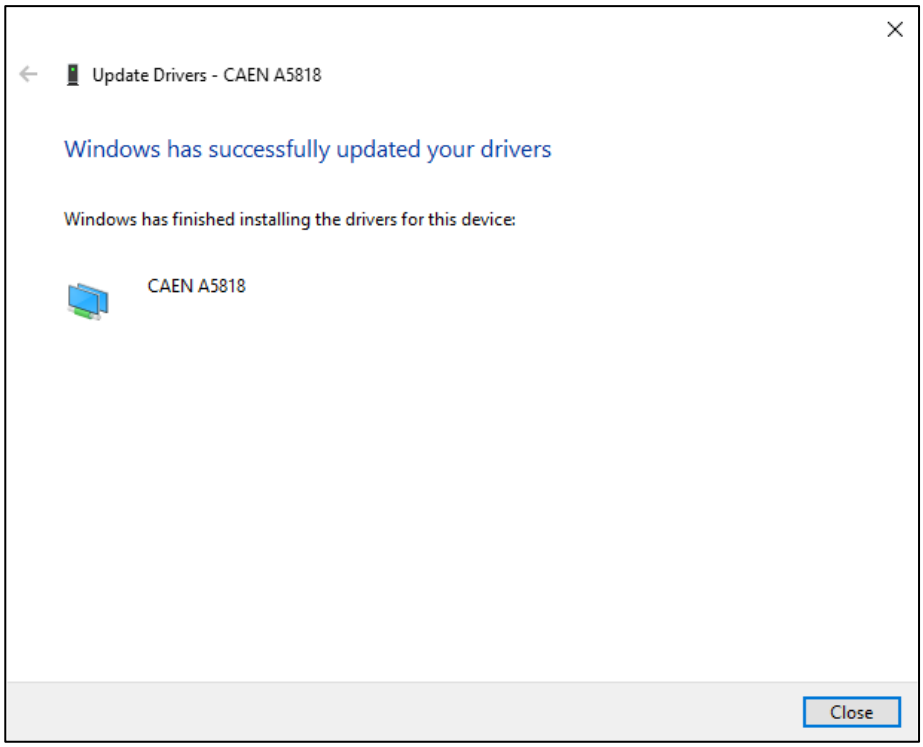
5. Select “Browse my computer for drivers”.



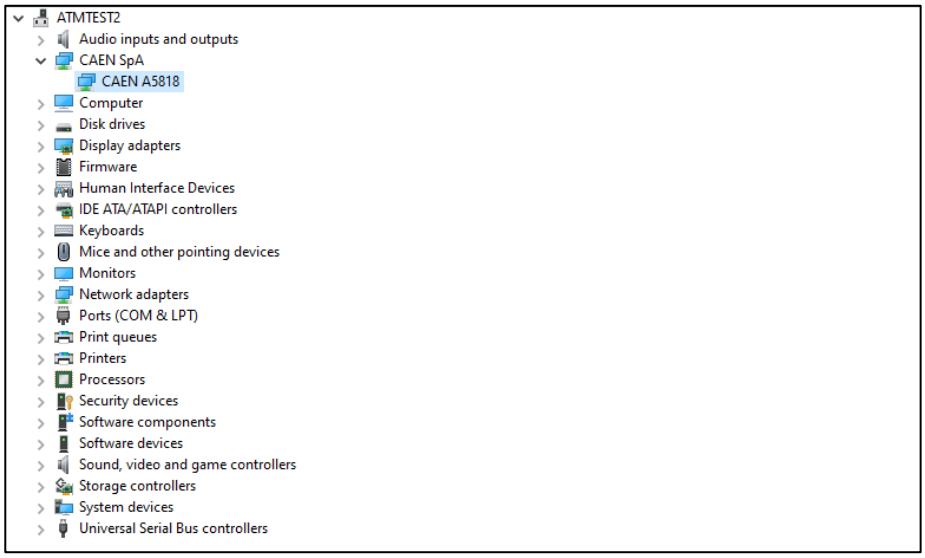
6. Point to the driver subfolder you unpacked in your PC.



7. Wait until the process is completed.



8. Find the hardware properly detected in Windows Device Manager.



3.4 Requirements

The operation of the A5818 requires the installation of CAENVMELib version 4.0.2 or higher, available on our website. No additional updates to CAEN Comm or specific high-level libraries (e.g. CAEN Digitizer or CAEN MCA lib for example) are necessary for the card's operation.
If A3818s or A2818s are also installed in the PC, they are assigned lower index numbers. It's important to note that regardless of the A3818's link count (1, 2, or 4), it always occupies the initial 4 links (from 0 to 3). In such instances, the A5818 link enumeration begins from 4.

A5818 requires CAENVMELib 4.0.2 or higher.

4 CONET2 Connection

To implement a daisy chain connection between multiple devices perform the following steps:

- Connect the TX connector of the A5818 to the RX connector of the first Module of the CONET2 network, via the optical fiber cable.
- Connect the TX connector of the first Module of the network to the RX connector of the second Module (if existing) and so on.
- The TX connector of last module in the chain must be connected to the A5818 RX connector; if only one Module is present, then its TX connector must be connected to the RX connector of the A5818.
- Now the network is ready for operation.

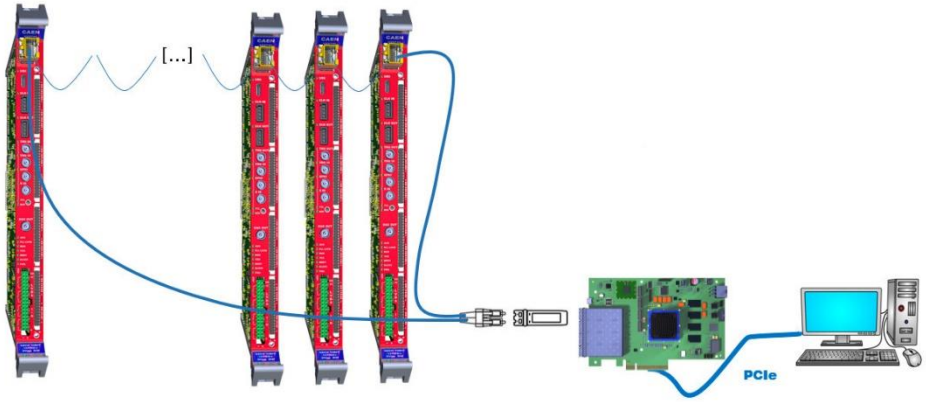


Figure 4.1: Daisy chain setup with CAEN Digitizers and A5818.

5 Packaging and compliancy

The unit is inspected by CAEN before the shipment, and it is guaranteed to leave the factory free of mechanical or electrical defects.

The content of the delivered package standardly consists of the part list shown in the table below (**Table 5.1**). All the official documentation, firmware updates, software tools, and accessories are available on *www.caen.it* at the product web page.

	Part	Description	Qty
	A5818	PCI Express Gen 3 CONET2 Controller	x1
	SFP+	4.25 GB/S SFP Optical Transceiver Rate Selectable	X4

Table 5.1: Delivered Kit

CAUTION: to manage the product, consult the operating instructions provided.

When receiving the unit, the user is strictly recommended to:

- Inspect containers for damage during shipment. Report any damage to the freight carrier for possible insurance claims.
- Check that all the components received match those listed on the enclosed packing list as in **Table 5.1** CAEN cannot accept responsibility for missing items unless any discrepancy is promptly notified.)
- Open shipping containers; be careful not to damage contents.
- Inspect contents and report any damage. The inspection should confirm that there is no exterior damage to the unit such as broken knobs or connectors and that the front panel and display face are not scratched or cracked. Keep all packing material until the inspection has been completed.
- If damage is detected, file a claim with carrier immediately and notify CAEN service.
- If equipment must be returned, carefully repack equipment in the original shipping container with original packing materials, if possible. Please contact CAEN service.
- If equipment is not installed when unpacked, place equipment in original shipping container and store in a safe place until ready to install.

DO NOT SUBJECT THE ITEM TO UNDUE SHOCK OF VIBRATIONS

DO NOT BUMP, DROP OR SLIDE SHIPPING CONTAINERS

DO NOT LEAVE ITEMS OR SHIPPING CONTAINERS UNSUPERVISED IN AREAS WHERE UNTRAINED PERSONNEL MAY MISHANDLE THE ITEMS

USE ONLY ACCESSORIES WICH MEET THE MANUFACTURER SPECIFICATIONS

6 PID (Product Identifier)

PID is the CAEN product identifier, an incremental number greater than 10000 that is unique for each product[1]. The PID is on a label affixed to the product (**Figure 6.1**) and it is even stored in an on-board non-volatile memory.

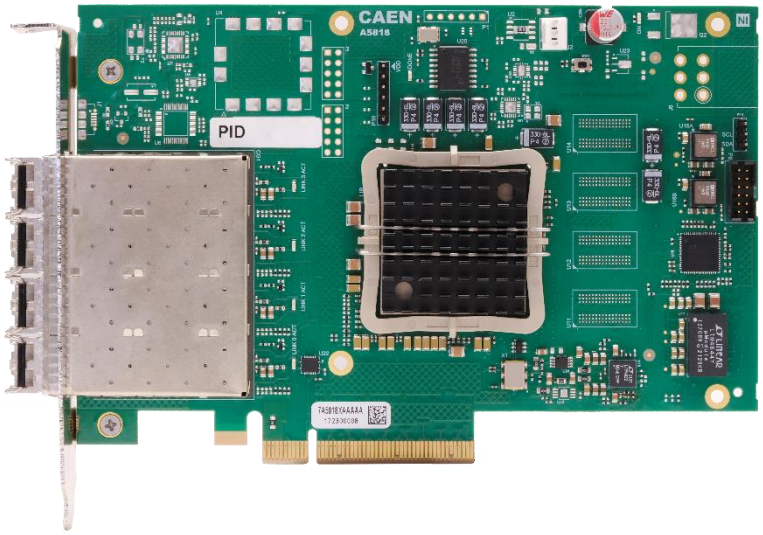


Figure 6.1: PID location

[1] The PID substitutes the serial number previously identifying the boards.

7 Hardware Description

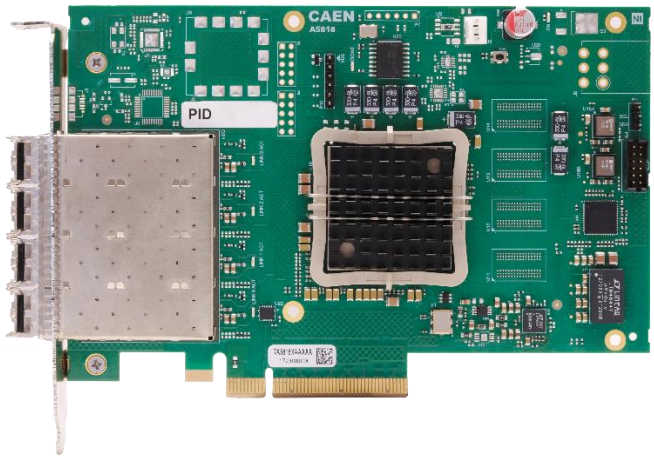


Figure 7.1: Front view.

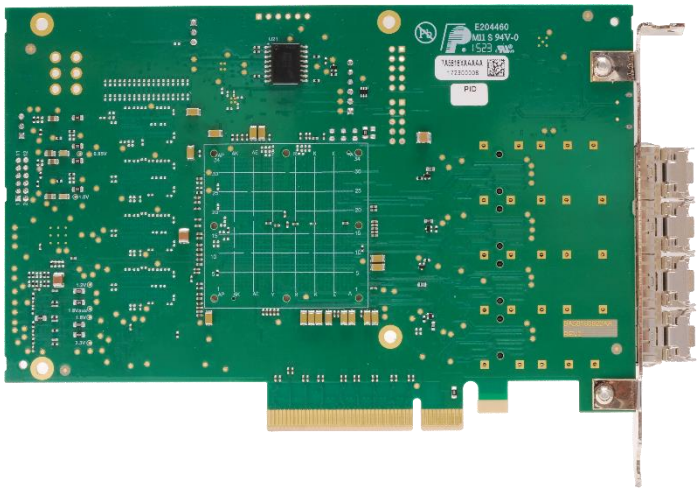


Figure 7.2: Rear view.

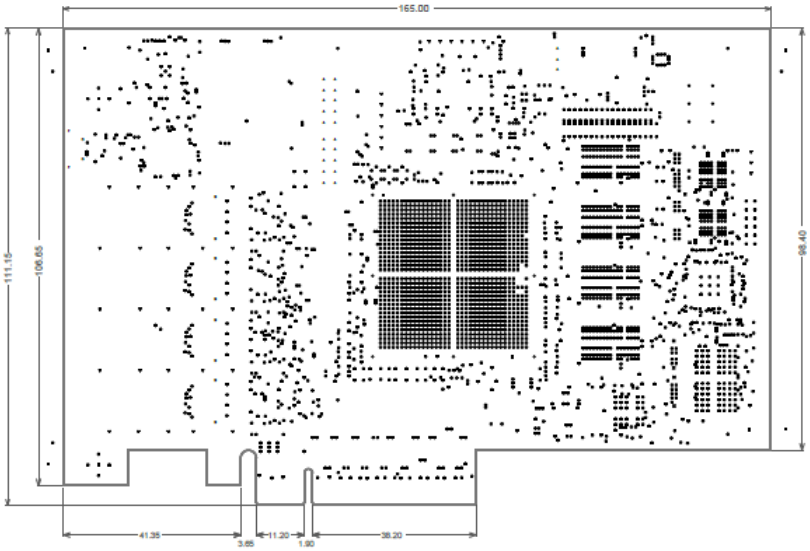


Figure 7.3: Quotes of the A5818 PCI Express CONET Controller

7.1 Transceiver Component

The A5818 boards mount the Small Form Factor Pluggable (SFP+) transceiver component shown in **Figure 7.4**. The PCIe Controller is delivered with its transceiver components already plugged in and mechanically tested.

Figure 7.4: SFP+ component

Note: Avoid removing the transceiver while disconnecting the fiber from the A5818 with the computer powered on, as it may lead to link malfunction.

7.1.1 Components Location

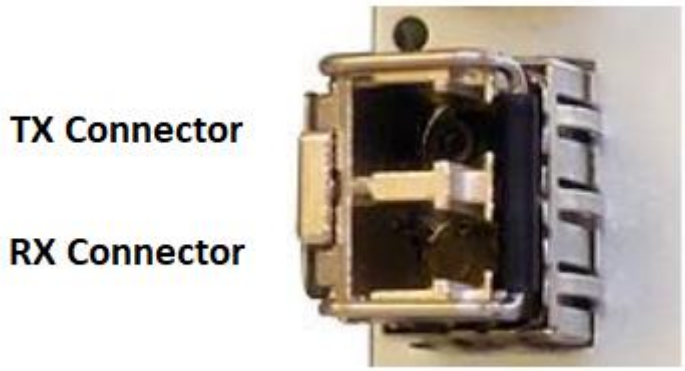


Figure 7.5: Tx and RX connectors.

The A5818 has the following external component:

- TX/RX: LC type connector (one per link); to complaint with 50/125 µm OM2 and OM3 (back-compliant with 62.5/125 µm OM1)

7.1.2 Troubleshooting

In case the transceiver results partially or totally unplugged for whatever reason, the procedure to plug it back in, restoring the full functionality of the optical communication, is to push the component along its guide, fixed on the board, until a click occurs to guarantee the proper plug (see **Figure 7.6**).

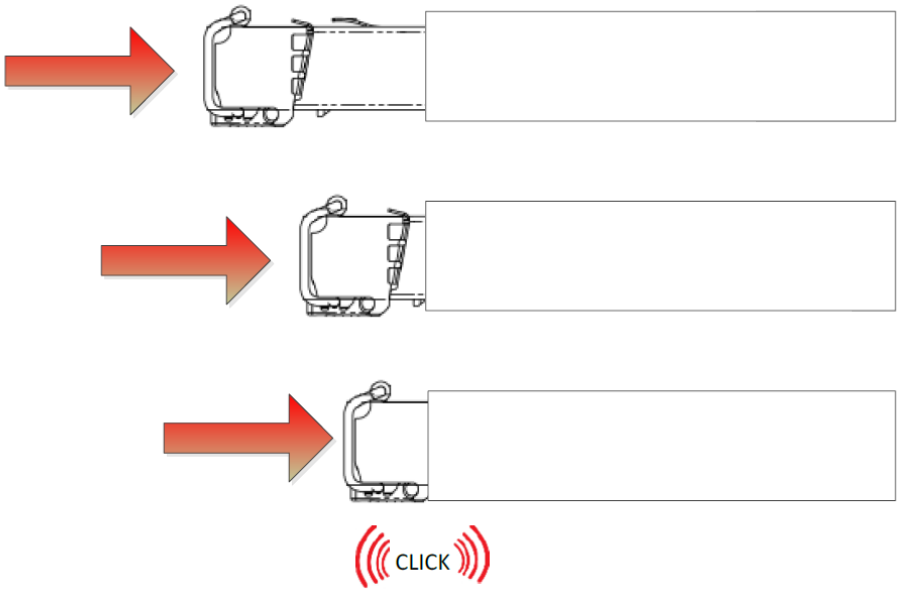


Figure 7.6: Steps to correctly insert the SFP+.

7.2 LED Description

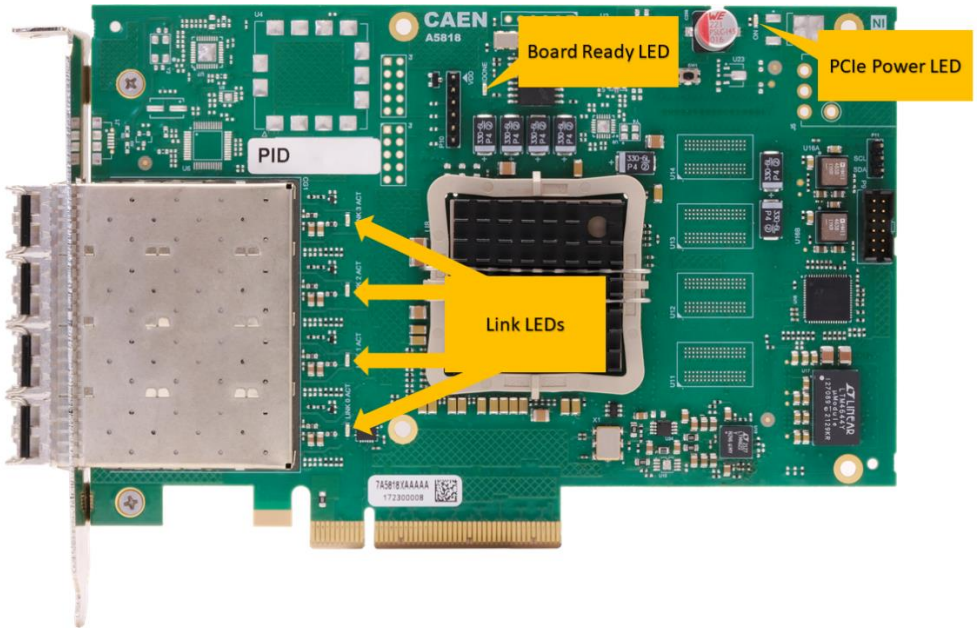


Figure 7.7: A5818 LEDs description.

Board Ready LED	The LED indicates that the board is ready
PCIe Power OK	The LED indicates that the A5818 is receiving the power from the PCIe
Link LEDs	The Link LEDs serve to convey crucial information: • Upon powering up the board, they illuminate briefly and then extinguish. • They signify successful communication with the board when lit. • During firmware upgrades, they exhibit periodic blinking.

Table 7.1: A5818 LEDs status.

If the Link LEDs remain illuminated after booting, please reboot the PC.

8 Accessories

Up to eight CONET2 slave nodes can be connected in Daisy chain on each link of the A5818 card optical controller. Therefore, up to thirty-two slave boards can be controlled by the four links of a single A5818 card. For this purpose, various types of cables are available:

WAI2703XAAAA	AI2703 - Optical Fibre 30 cm. simplex
WAI2705XAAAA	AI2703 - Optical Fibre 5 m. simplex
WAI2720XAAAA	AI2720 - Optical Fibre 20 m. simplex
WAI2730XAAAA	AI2730 - Optical Fibre 30 m. simplex
WAI2740XAAAA	AI2740 - Optical Fibre 40 m. simplex
WAY2705XAAAA	AY2705 - Optical Fibre 5 m.duplex (Rohs compliant)
WAY2720XAAAA	AY2720 - Optical Fibre 20 m. duplex
WAY2730XAAAA	AY2720 - Optical Fibre 30 m. duplex

Table 8.1: CONET2 cables specifications

9 Disposal

The disposal of the equipment must be managed in accordance with Directive 2012/19 / EU on waste electrical and electronic equipment (WEEE).

The crossed bin symbol indicates that the device shall not be disposed with regular residual waste.

10 Technical Support

To contact CAEN specialists for requests on the software, hardware, and board return and repair, it is necessary a MyCAEN+ account on www.caen.it:

https://www.caen.it/support-services/getting-started-with-mycaen-portal/

All the instructions for use the Support platform are in the document:

A paper copy of the document is delivered with CAEN boards.

The document is downloadable for free in PDF digital format at:

https://www.caen.it/wp-content/uploads/2022/11/Safety_information_Product_support_W.pdf

CAEN GmbH
Brunnenweg 9
64331 Weiterstadt
Germany
Phone +49 (0)212 254 4077
Fax +49 (0)151 16 548 484
info@caen-de.com
www.caen-de.com

CAEN Technologies, Inc.
1 Edgewater Street - Suite 101
Staten Island, NY 10305
USA
Phone: +1 (718) 981-0401
Fax: +1 (718) 556-9185
info@caentechnologies.com
www.caentechnologies.com

CAEN S.p.A.
Via Vetraia 11
55049 - Viareggio
Italy
Phone +39 0584 388 398
Fax +39 0584 388 959
info@caen.it
www.caen.it

CAENspa INDIA Private Limited
B205, BLDG42, B Wing,
Azad Nagar Sangam CHS,
Mhada Layout, Azad Nagar, Andheri (W)
Mumbai, Mumbai City,
Maharashtra, India, 400053
info@caen-india.in
www.caen-india.in

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