Viareggio
27 May 2011

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Introduction

The **CONET1 Communication Protocol** is a CAEN proprietary serial protocol developed to allow the communication between a PC, through the PCI **A2818** Bridge (**CONET MASTER**), and a **CONET SLAVE**. The MASTER and the SLAVE communicate through optical fiber using Transceiver at 1.25Gbit/s. Up to 8 SLAVES can be connected in a CONET network.

Examples of CAEN CONET SLAVES are the **Controller VME V2718** and the Digitizers (**VME, NIM or DESKTOP**). The develop of the new A3818 Bridge (PCI Express to Optical Link) required a new Communication Protocol, called **CONET2**, that is 50% more efficient in the data rate transfer than the previous version.

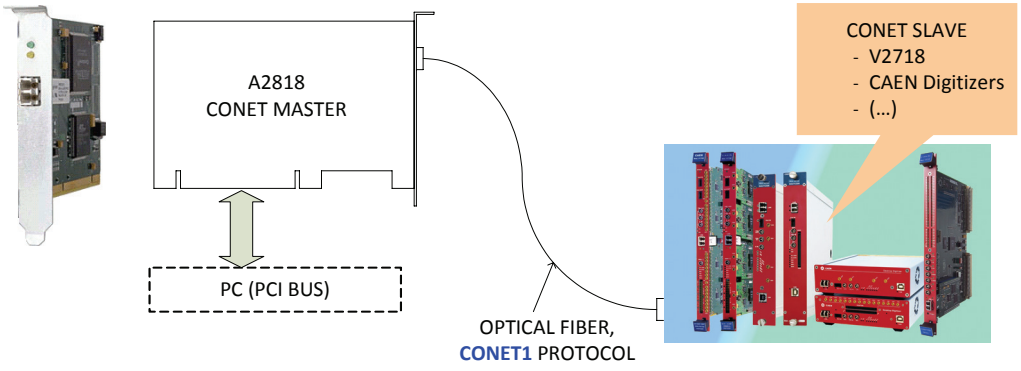

Fig. 1: A2818/CONET1

Two important remarks must be done introducing this new Bridge and its protocol:

WARNING

- **The A3818 CONET MASTER communicates with the OPTICAL SLAVEs only through the CONET2 Protocol.**
- **The CONET2 Protocol and the previous CONET1 Protocol are not compatible.**

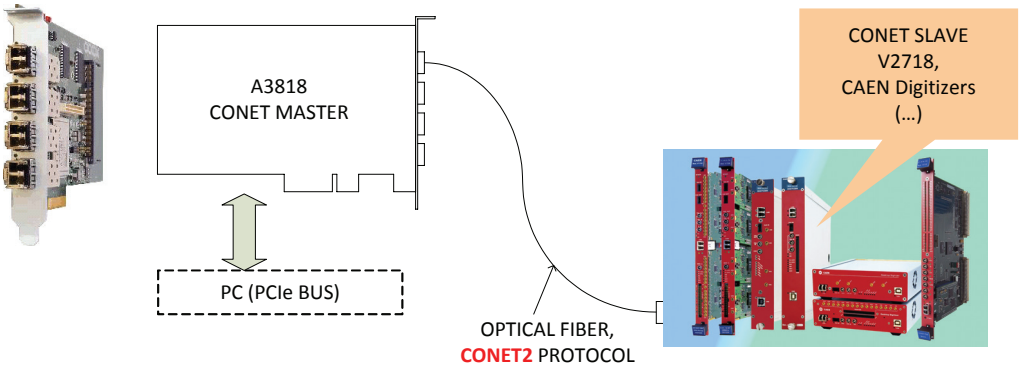

Fig. 2: A3818/CONET2

For the reasons above a **new firmware** compatible with the **CONET2** Protocol has been developed for all the **CAEN CONET SLAVES**. Moreover, a **dedicated firmware has been developed for the A2818 Bridge**, to make it compatible with the **CONET2** Protocol too.

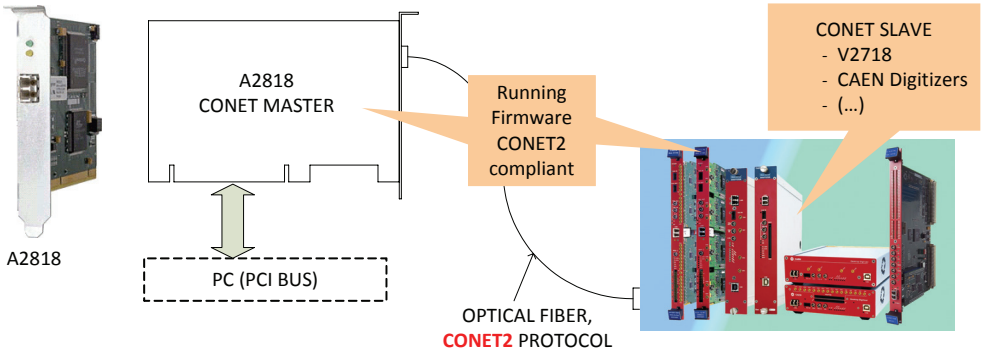

Fig. 3: A2818/CONET2

To avoid any misunderstanding, by now we will call the A2818 Board that "talk" through CONET1 protocol **A2818-CONET1**, while **A2818-CONET2** will be the same board that uses CONET2 Protocol. It's understood that the board is the same and the difference is only in the firmware implemented on it.

Concerning this issue is very important to note that:

WARNING

- **Firmware implementing CONET1 Protocol will not be supported anymore.**
- **Next release of MASTER and SLAVE firmware will support only CONET2 Protocol.**

CAEN Boards upgrade from CONET1 to CONET2

Since the two different Protocols are not compatible, it's clear that any mixing of boards with both CONET1 and CONET2 will cause the system to fail. In order to avoid this, it's extremely important to upgrade all the boards' firmware. This is particularly true if a new A3818 Bridge will be placed in the system, but not only in this case. In the present section will be presented some examples of typical set-up that need a total upgrade, and how to do it.

EXAMPLE 1: Replacement of an A2818 linked to a V2718 with an A3818

Let's suppose to have a setup based on a A2818-CONET1 and a V2718-CONET1. If an A3818 has been bought to replace the A2818-CONET1, you need to do the following steps to let the new board communicate with the V2718.

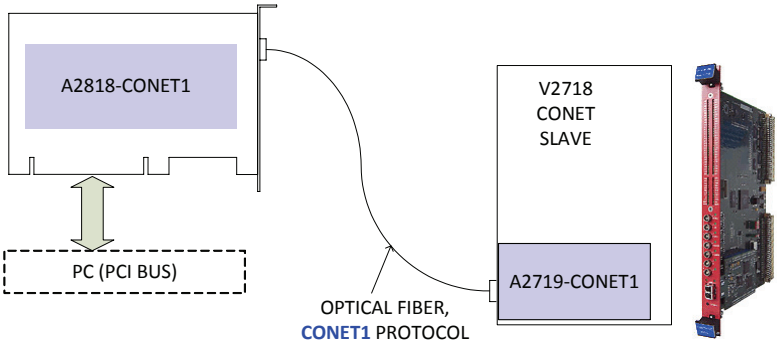

Fig. 4: A2818-CONET1/V2718-CONET1

V2718 Upgrade to CONET2

- Download the V2718-CONET2 firmware in the V2718 product page from the CAEN website The file name is structured as a2719ci_rev_x.y.rbf, where
  - a2719 is the name of the piggyback board inside the V2718
  - rev_x.y is the revision number
  - .rbf is the file extension
  - **CONET2 compatible versions has revision number starting from 1.0**
- Download the **CAENUpgrader** software from the Firmware/Software section of the CAEN Website and install it on your PC. This tool allows the upgrade of the CAEN Bridge Boards:
  - V1718/VX1718 (VME-USB Bridge)

- V2718/VX2718 (VME-PCI Optical Link Bridge) and its Piggy Back A2719.
- A2818 (PCI CONET Controller).
- A3818 (PCI Express CONET2 Controller).

- To do the Upgrade, follow the steps below:
  1. Launch the CAENUpraderGUI.jar file.
  2. Click on the “Bridge Upgrade” tab.
  3. Select “Upgrade Firmware” in the ‘Available actions’ scroll box.
  4. Insert A2719 in the appearing ‘Board’s Model’ menu.
  5. Use the “Browse” button to find the firmware file you previously downloaded on your PC, it will be inserted in the “Firmware binary file” box.
  6. ‘Connection type’ option is autoset to “PCI SLAVE”.
  7. Set the ‘LINK number’. This number refers to the PCI slot of the A2818 and depends on the PC host motherboard; the first A2818 plugged in the PC motherboard has LINK number = 0, whatever is the slot.
  8. Set the ‘Board number’. This number refers to the position of the V2718 in the CONET network and ranges from 0 to 7 (see Fig. 5).
  9. Check “Standard Page” as ‘Config Options’. Standard and Backup Pages refer to the two firmware versions stored in the A2719 piggy back board.
  10. Click on the “Upgrade” button to upload the firmware.

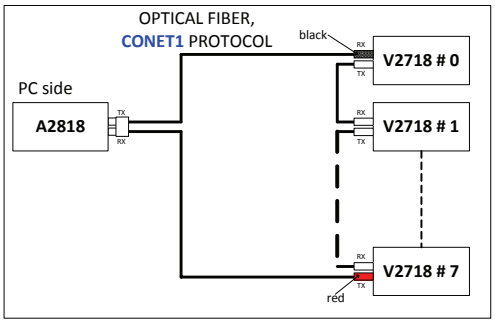

Fig. 5: VMEDevIndex in the CONET network

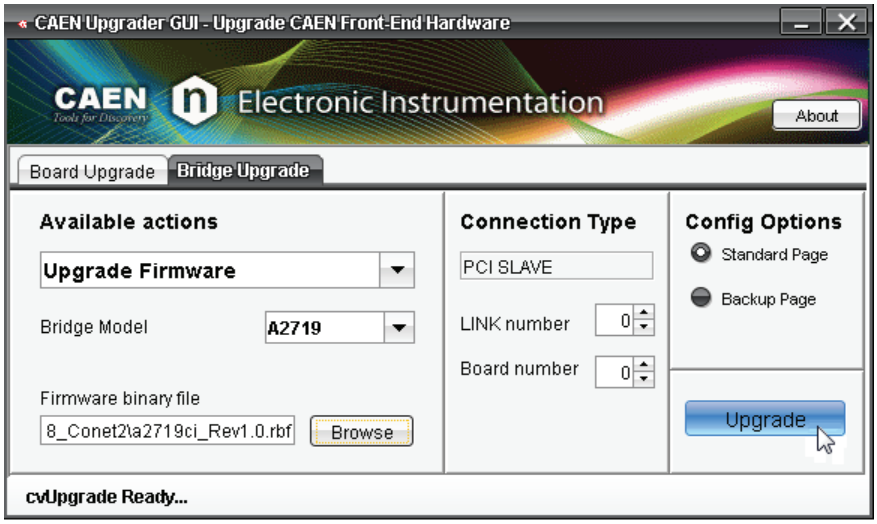

Fig. 6: CAENUpgrader settings for upgrading the V2718 bridge

- Upgrades become effective after a Power cycle (for both PC host and V2718).

- **ATTENTION: The V2718 Board now can't communicate with the A2818-CONET1 anymore. To allow the A2818 to work, a firmware upgrade to CONET2 is needed. In the next section the description of the procedure.**

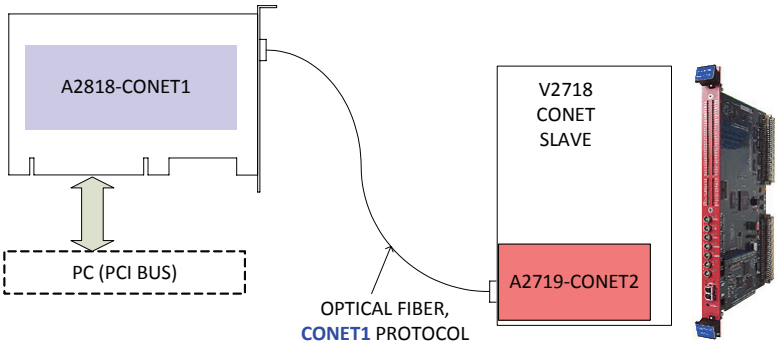

Fig. 7: A2818-CONET1/V2718-CONET2

A2818 upgrade to CONET2

- Download the A2818-CONET2 firmware from the A2818 product page on CAEN Website. The file name is structured as a2818pcb_rev_x.y.rbf, where:
  - rev_x.y is the revision number
  - .rbf is the file extension
  - **CONET2 compatible versions has revision number starting from 1.0**
- Download the **CAENUpgrader** software from the Firmware/Software section of the CAEN website and install it on your PC.
- To do the Upgrade, follow the steps below:
  1. Launch the CAENUpraderGUI.jar file.
  2. Click on the "Bridge Upgrade" tab.
  3. Select "Upgrade Firmware" in the 'Available actions' scroll box.
  4. Insert A2818 in the appearing 'Board's Model' menu.
  5. Use the "Browse" button to find the firmware file you previously downloaded on your PC, it will be inserted in the "Firmware binary file" box.
  6. 'Connection type' option is autoset to "PCI MASTER".
  7. Set the 'LINK number'. This number refers to the PCI slot of the A2818 and depends on the PC host motherboard; the first A2818 plugged in the PC motherboard has LINK number = 0, whatever is the slot.
  8. Check "Standard Page" as 'Config Options'.
  9. Click on the "Upgrade" button to upload the firmware.

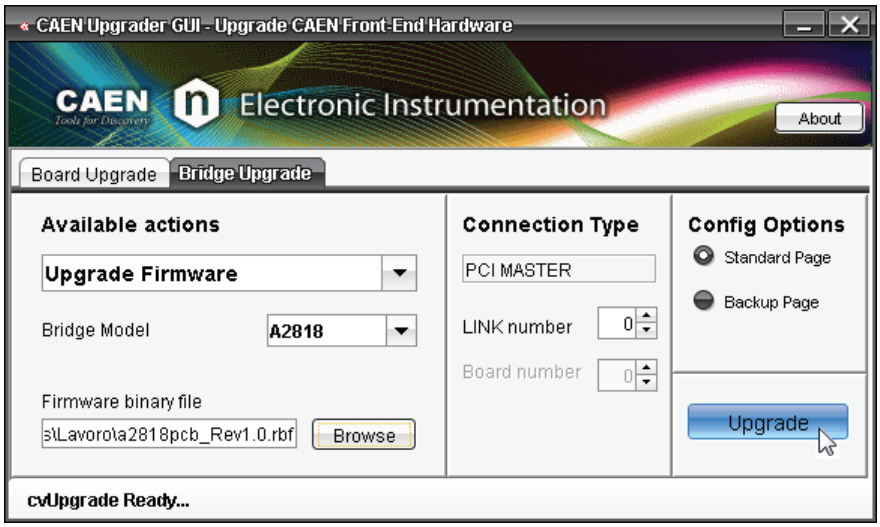

Fig. 8: CAENUpgrader settings for upgrading the A2818 controller

- After a power cycle the A2818 Board is ready to communicate with a SLAVE CONET2.

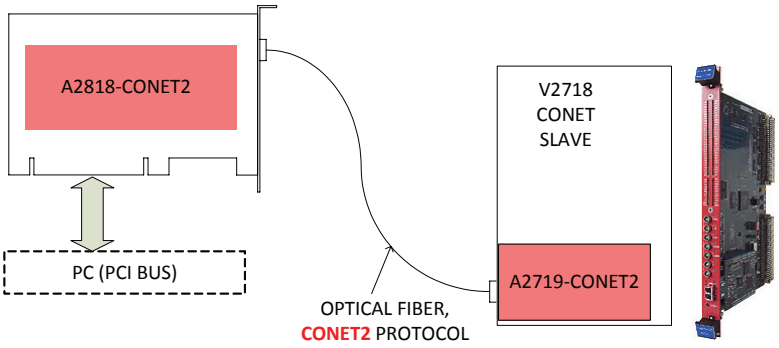

Fig. 9: A2818-CONET2/V2718-CONET2

A3818 installation

- Plug the A3818 into a free x8/x16 PCI Express slot (1.1or higher).
- Go to A3818 product page on CAEN Website, download and install the driver supporting the used Operating System.
- Download the CAENVMELib (rel. 2.22 or higher) from the Firmware/Software section of the CAEN website.

A2818 driver upgrade

- After A2818 upgrade to CONET2 and installation of CAENVMELib (2.22 or higher) is **mandatory** to upgrade A2818 driver to the last version available on CAEN website.

A3818 to V2718 Optical Fiber Connection

- Connect the V2718 CONET SLAVE to the A3818 CONET MASTER through an optical fiber cable.
- Reboot the system
- A3818 Board is ready to communicate with V2718.
- **ATTENTION**: Connect the CONET SLAVE to the CONET MASTER before the loading of the driver, i.e. before the PC Power On.

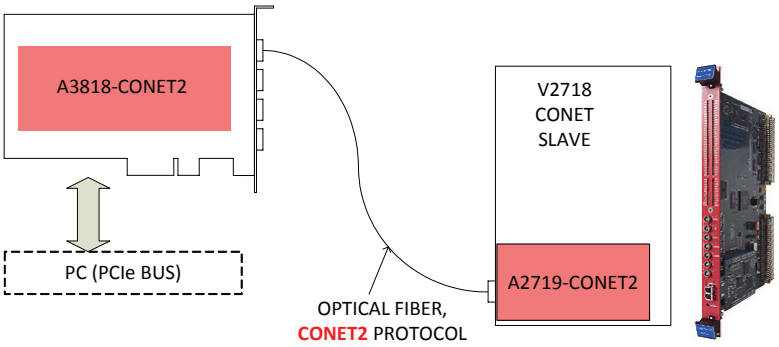

Fig. 10: A3818-CONET2/V2718-CONET2

EXAMPLE 2: Replacement of an A2818 linked to a DT5720 with an A3818

The remarks of the previous example are still valid with CONET SLAVES different from the V2718, like the Digitizers. As an example we consider a setup based on an **A2818-CONET1** with a Desktop Digitizer **DT5720** (4 Channel 12bit 250 MS/s Digitizer) that must be upgraded using a **A3818**. It's clear that the considerations in this example are valid for any CAEN digitizer in any form factor (VME, NIM, Desktop)

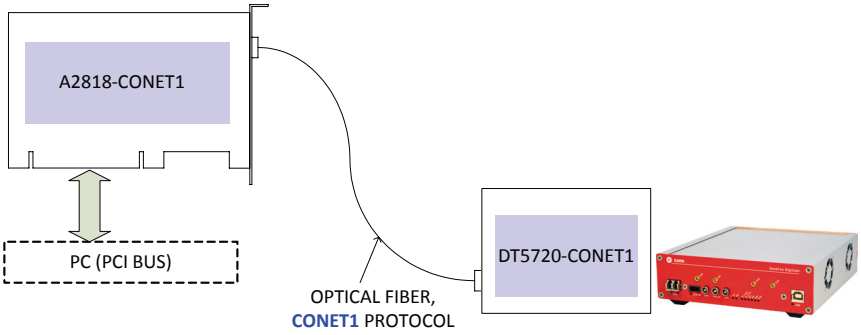

Fig. 11: A2818-CONET1/DT5720-CONET1

To make possible the communication between the DT5720 and the A3818, the following actions must be done.

DT5720 upgrade to CONET2

- Download the DT5720-CONET2 firmware from the DT5720 product page on CAEN website. The file name is composed in this way: dt5720_n6720_rev_x.y_a.b.rbf where
  - dt5720_n6720 is the name of the supported boards,
  - rev_x.y is the firmware revision of the motherboard FPGA of the Digitizer (ROC FPGA),
  - a.b is the firmware revision of the mezzanine FPGA of the Digitizer (AMC FPGA)
  - .rbf is the file extension.
  - **CONET2 compatible versions have main board revision number 3.0 or successive.**
- Download the **CAENUpgrader** software from the Firmware/Software section of the CAEN website. This tool allows the firmware upgrade of CAEN Front End's boards through a very simple graphical interface.
- Refer to the CAENUpgrader's Quick Start Guide to upgrade the firmware properly.
- After a power cycle the DT5720 is ready to communicate with any MASTER-CONET2, like the A3818.
- **ATTENTION: Now the DT5720 board is no longer able to communicate with the A2818-CONET1 Board. To make this possible the A2818 need to be upgraded too. The procedure is the same described in the Example1.**

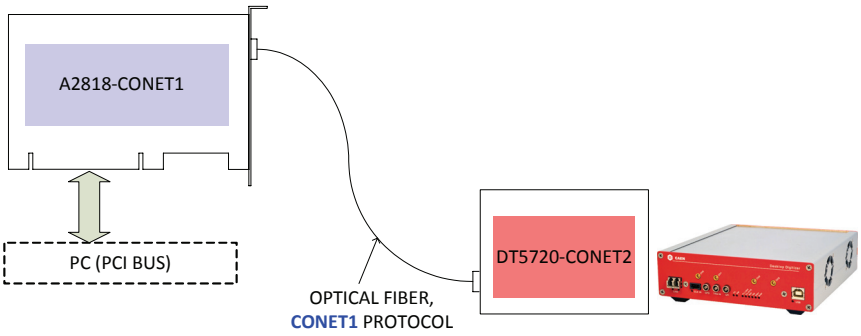

Fig. 6: A2818-CONET1/DT5720-CONET2

At this point the user must repeat the actions described in Example1:

- ***A2818 upgrade to CONET2***
- ***A3818 installation***
- ***A2818 driver upgrade***
- ***A3818 to V2718 Optical Fiber Connection***

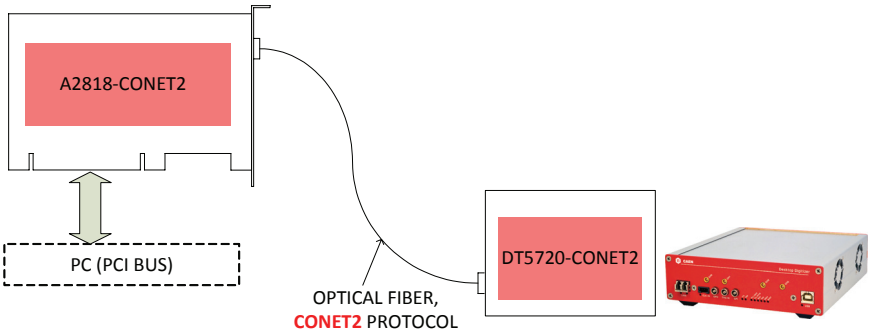

Fig. 7:A2818-CONET2/DT5720-CONET2

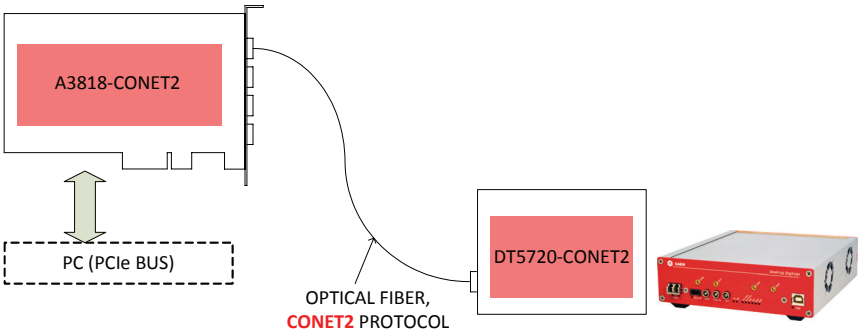

Fig. 8:A3818-CONET2/DT5720-CONET2

EXAMPLE 3: How to use a A3818 to replace a non-CAEN VME Master

Let's suppose to have a set-up based on a VME Digitizer, for example a V1720 (8 Channels, 12bit, 250 MS/s Digitizer) communicating with a VME Master of another manufacturer, and you want to replace the Master with a A3818 that communicates directly with the Digitizer.

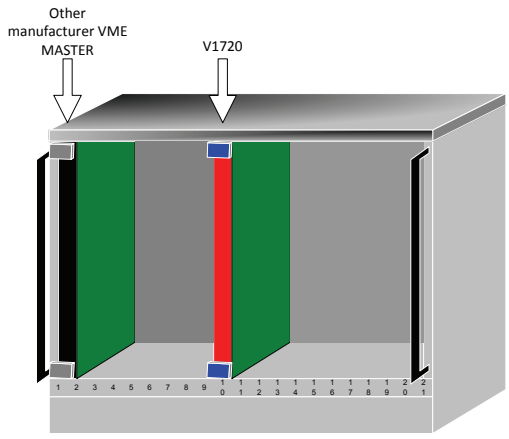

Fig. 9: VME crate with V1720 and VME Master

V1720 Upgrade to CONET2

- Download the V1720-CONET2 firmware from the V1720 product page on CAEN website. The file has a .rbf extension and the file name is structured as v1720_rev_X.Y_A.B.rbf, where:
  - v1720 is the name of the supported boards,
  - rev_x.y is the firmware revision of the motherboard FPGA of the Digitizer (ROC FPGA),
  - a.b is the firmware revision of the mezzanine FPGA of the Digitizer (AMC FPGA)
  - .rbf is the file extension.
  - **CONET2 compatible versions have main board revision number 3.0 or successive.**
- Download the **CAENUpgrader** software from the Firmware/Software section of the CAEN Website. This tool allows the firmware upgrade of CAEN Front End's boards through a very simple graphical interface.

- CAENUpgrader requires CAEN hardware (V1718 / V2718 / A2818) to communicate with CAEN VME slaves.
- To use CAENUpgrader in a set-up with a non-CAEN property's hardware, the user has to implement a proprietary version of the **software library CAENComm** (Interface library for CAEN Data Acquistion Modules).
- CAENComm functions to implement (for more information see "CAENComm User & Reference Manual") are:

Open /Close functions

```
CAENComm_OpenDevice(
        CAENComm_ConnectionType     LinkType,
        int                         LinkNum,
        int                         ConetNode,
        uint32_t                    VMEBaseAddress,
        int                         *handle);
```

```
CAENComm_CloseDevice(
        int             handle);
```

Data Transfer functions

```
CAENComm_Write16(
        int             handle,
        uint32_t        Address,
        uint16_t        Data);

CAENComm_Write32(
        int             handle,
        uint32_t        Address,
        uint32_t        Data);
```

```
CAENComm_Read16(
        int             handle,
        uint32_t        Address,
        uint16_t        *Data);

CAENComm_Read32(
        int             handle,
        uint32_t        Address,
        uint32_t        *Data);
```

CAENUpgrader uses also Multi Read/Write functions; the user can implement them by making loops of the read / write functions described above.

- Once proprietary library CAENComm is ready, the user can use CAENUpgrader to upgrade all the CAEN VME slave boards (refer to the CAENUpgrader's Quick Start Guide).
- After the V1720 has been pgraded, the user must repeat the actions described in Example1:
  - ***A3818 installation***
  - ***A3818 to V2718 Optical Fiber Connection***

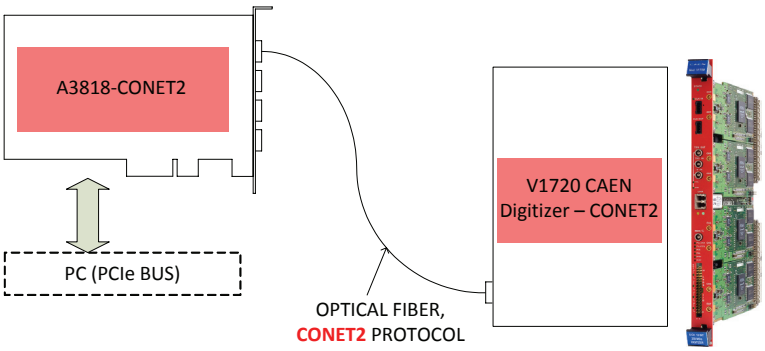

Fig. 10: A3818–CONET2/V1720-CONET2

CONET2 to CONET1 restoration

If the upgrade procedure fails, then is always possible to restore the previous configuration. In this section is explained how to do it.

- In each CAEN module, the Flash Memory for firmware is divided into 2 "Pages": **Standard** page and **Backup** page. Originally, both pages host the same version of the standard firmware.
- **CAENUpgrader** writes by default the **Standard** page and it is strongly recommended not to use this program to write the **Backup** page in any case.
- On every CAEN module (A2719, V2718, VME Digitizer...) **with the exception of the Desktop/NIM Digitizers**, there's a jumper or a switch that let the user select which Flash Memory page to load at the power on. By default, on every module this is the firmware of the **Standard** page.
- **ATTENTION**: the position of the jumper/switch has no effect on the choice of which page will be written by the CAENUpgrader software, but it affects only the Flash Memory page to be loaded at the power on.

- Following the procedure of the previous chapter, only the **Standard** pages have been upgraded with the CONET2 firmware. **To get back to CONET1 Version, just changes the position of the jumper/switch and after a power cycle the Backup page will be loaded.**

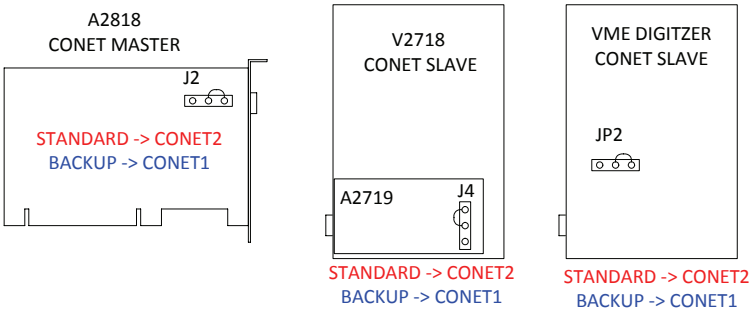

Fig. 11: Jumper/switch locations on the Modules

- The Desktop/NIM Digitizers have the "two page" memory configuration too, but no switch or jumper are implemented to select the page at the power on. In this case, please ask for CAEN support as reported below.
- For any question or trouble please contact support.nuclear@caen.it

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