Rev. 1 - October 21th, 2025

10Gb Ethernet UDP Firmware User Guide

Firmware for the 10 Gb UDP communication link of the Digitizer x27XX series

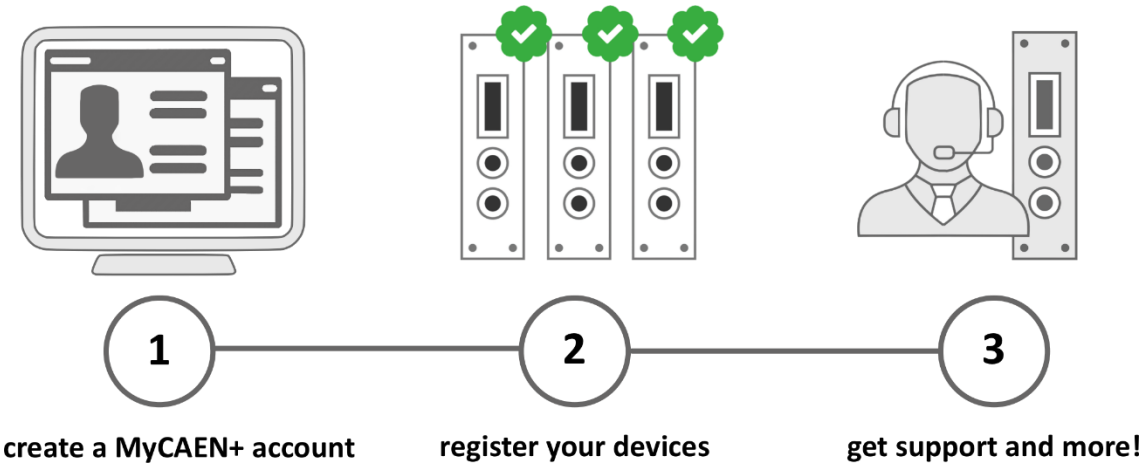
CAEN
Tools for Discovery

User Guide
GD11668

Register your device

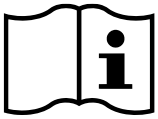
Register your device to your **MyCAEN+** account and get access to our customer services, such as notification for new firmware or software upgrade, tracking service procedures or open a ticket for assistance. **MyCAEN+** accounts have a dedicated support service for their registered products. A set 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 Guide



This User Guide contains the full description of 10 Gb Ethernet UDP firmware for Digitizer of the family x27XX

Change Document Record

Date	Revision	Changes
November 13th, 2024	00	Initial release.
October 21st, 2025	01	Added warnings on board accesses during data acquisition.

Symbols, Abbreviated Terms and Notations

FPGA	Field Programmable Gate Array
FTP	File Transfer Protocol
OS	Operating system
SDK	Software Development Kit

Reference Document

[RD1] UM9713 – 2730 Digitizer User Manual

[RD2] UM8717 – 2740 - 2745 Digitizer User Manual

All CAEN documents can be downloaded at:

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

Manufacturer Contacts

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Limitation of Responsibility

If the warnings contained in this guide 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

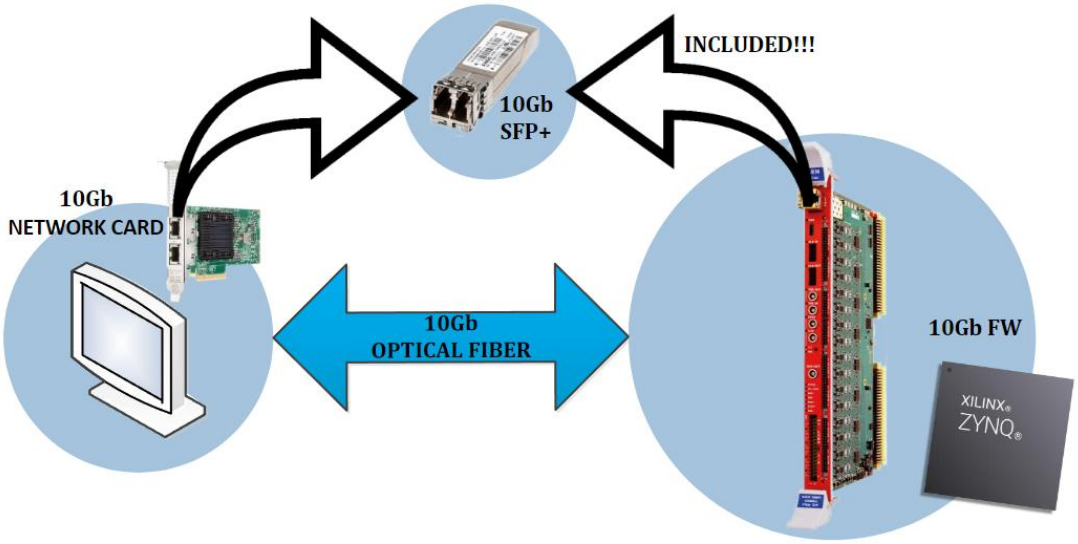
Made in Italy

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).

Table of Contents

Introduction

The new generation of CAEN digitizers supports the 10 Gb Ethernet UDP communication protocol, providing a high-speed data transfer link for applications requiring rapid data throughput. The protocol requires the Digitizer to be equipped with the LC optical connector on SFP+ transceiver and a special firmware that can be request to the CAEN Support Team.



1.1 UDP Protocol

The User Datagram Protocol (UDP) is a lightweight transport layer protocol designed for fast and efficient communication. Unlike TCP, it is connectionless and does not guarantee delivery, order, or data integrity, making it simple and low-overhead. UDP transmits data in independent packets called datagrams, focusing on speed and minimal latency. While this design allows for rapid data transfer, it also means reliability and error handling are left to the application layer.

1.2 Technical Specifications

MAX THROUGHTPUT*	**Linux** Max throughput: 850 MB/s	**Windows** Max throughput: 750 MB/s
MAXIMUM TRANSMISSION UNIT (MTU)	1500 Bytes (fixed)	

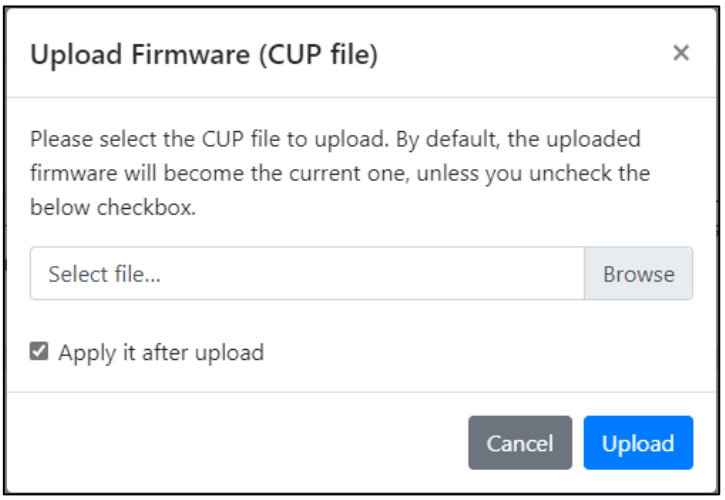
(*) The measurement has been performed with the following setup:
Digitizer connected point to point via SFP+ Transceiver Avago AFBR-710DMZ 10GBASE-S, Optical fiber OM3, and Intel X520-DA2 10Gb Ethernet adapter.

During data acquisition, Ethernet traffic on the board should be minimized, for example by closing the web interface connection or avoiding access to the onboard CPU.

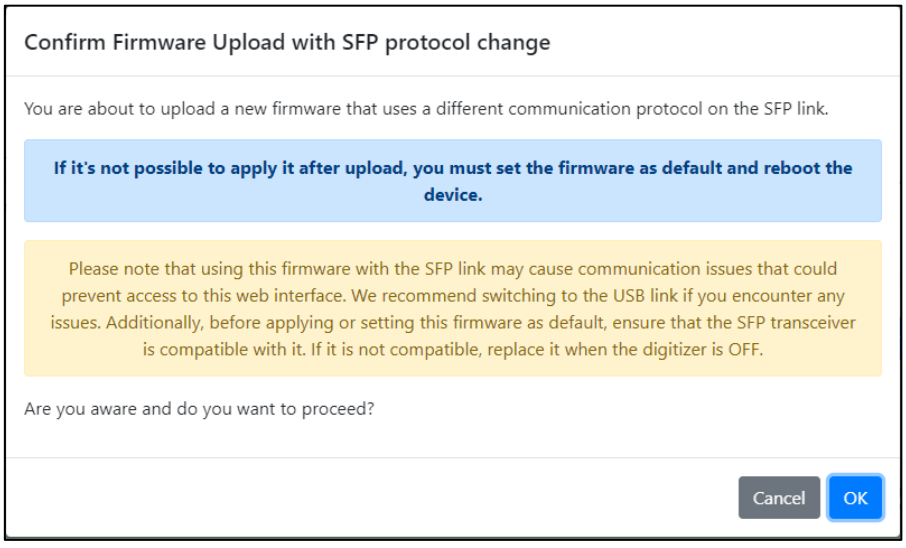
Firmware Installation

The 10 Gb Firmware can be installed via the Digitizer Web Interface. It is recommended to perform the installation via a USB connection.

- Press the “Upload new firmware” key.
- Use the “Browse” key in the upgrade window to point to the CUP file.
- Press the “Upload” key to start the upgrade.



- Before the firmware upload process begins, a message will appear warning the user that the transceiver currently in use on the board is incompatible with the selected firmware. The firmware will be set as the default and will take effect after the next reboot. Be sure to replace the transceiver while the device is powered off.



- Wait until the process is completed.
- Power off the crate.
- Change the Copper RJ45 with the LC connector on SFP+ transceiver.
- Turn on the crate. The firmware is now applied and ready to be used.

WARNING: The MTU setting in the Network Setting page of the digitizer Web Interface doesn’t work with the 10 Gb UDP firmware.

2.1 Firmware Parameters

Given that the UDP protocol is connectionless and does not guarantee packet delivery, it becomes essential to monitor the number of packets transmitted by the firmware over the communication link to mitigate the risk of packet loss. To facilitate this, the CAEN FELib library provides two parameters, **UDPBandwidth** and **UDPDatagramSize**, enabling users to configure the board for optimal bandwidth performance.

UDPBandwidth: allows setting the maximum UDP bandwidth. Setting a bandwidth limit for UDP can be meaningful in controlling the amount of network bandwidth UDP traffic consumes. This can prevent UDP packets from overwhelming the network, leading to congestion, packet loss, or degraded performance. Additionally, limiting UDP bandwidth ensures fair network resource usage among various applications or users. However, it's crucial to note that unlike TCP, UDP lacks built-in congestion control mechanisms, necessitating careful management of these limits to avoid congestion or data loss issues.

UDPDatagramSize: define the size of the UDP datagram. UDP packets have a fixed header size, so the larger the datagram size, the more efficiently data can be transmitted since fewer packets are needed to send the same amount of information. However, excessively large datagram sizes can lead to fragmentation, where packets are divided into smaller units for transmission, potentially causing delays and performance issues. Unlike TCP (Transmission Control Protocol), UDP does not include mechanisms for error-checking, retransmission, or flow control. This makes UDP faster but less reliable. By carefully setting the datagram size, you can minimize overhead and reduce the likelihood of packet loss or congestion, especially in scenarios where low latency is critical.

The parameters can be configure through the CAEN FELib library calling the dedicated API CAEN_FELib_SetValue(). An example of how to configure the two parameters can be found inside the *caen-felib-demo-scope-udp*.

Linux Configuration

Achieving a high-speed transfer rate with the 10 Gb UDP protocol can be challenging. Primarily, performance depends heavily on the network adapter used in the PC. **Refer to the network adapter's manual to determine the optimal configuration for maximizing data transfer rates.**

The default Linux network settings may not deliver optimal throughput (bandwidth) and latency performance for large parallel jobs.
The script *10Gb_settings.sh* is designed to configure kernel parameters to optimize throughput. It requires Ethtool to work.
To run the script, use the following command:

sudo ./10Gb_settings.sh <network_interface_name>

where *<network_interface_name>* is the name of the network adapter connected with the digitizer.

Windows Configuration

For Windows operating systems, you can increase the ring buffer size and disable/setting low the interrupt moderation by adjusting the settings in the Device Manager. Follow these steps:

- Open the **Device Manage**r window.
- Locate and expand the **Network Adapters** section.
- Right-click on your network adapter and select **Properties**.
- Navigate to the **Advanced** tab.
- Find the **Receive Buffer** setting and adjust it to the maximum value allowed (4096).
- Set **Interrupt Moderation** as **Disabled**.

Your device is now configured and ready to operate.

Primarily, performance depends heavily on the network adapter used in the PC. **Refer to the network adapter's manual to determine the optimal configuration for maximizing data transfer rates.**

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/safety-information-product-support

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UM11668 - 10Gb Ethernet UDP Firmware User Guide rev. 1 - October 21th, 2025 00107-1700-x27XX-MUTX/1