

**New**

**DT5215**

**Concentrator Board  
for FERS-5200**



## Features



- **Concentrator board** for multiboard management in **FERS-5200**, the CAEN platform for the readout of **large arrays of detectors** (SiPM, MA-PMTs, Gas Tubes, Si detectors, ...).
- **Scalability**: from a single **standalone** FERS unit for prototyping to many thousands of channels, with simple tree network structure.
- **Modularity**: multiple FERS units can be distributed on large detector volume and managed by a **single Concentrator board**.
- **8x TDlink** for event data building, processing and formatting.
- **Easy-synch**: one single optical link (TDlink) for data readout, slow control and boards synchronization.
- **Available also in single TDlink version (DT5216)**: supports up to 8 FERS units in daisy chain.

## Description

**FERS-5200** is a Front-End Readout System designed for large detector arrays, such as SiPMs, multi-anode PMTs, Silicon Strip detectors, Wire Chambers, GEM, Gas Tubes and others.

FERS is a **distributed** and **easy-scalable** platform, where each unit is a small card that houses 32 or 64 channels with Front End electronics, A/D converters, trigger logic, synchronization, local memory and readout interface.

FERS is a **flexible platform**: keeping the same readout and control infrastructure, that is the same user interface, different types of front-end can be developed to fit a variety of detectors. In most cases, the front-end is based on ASIC chips that allow for high density, cost-effective integration of multi-channel readout electronics into small size and low power modules. The Front End ASIC can implement an analog chain made of preamplifier, shaper, peak sensing and discriminator. In other cases, the ASIC is a fast flash ADC (1 GS/s or more) that records the waveform of the input pulses and makes it possible to apply digital algorithms providing timing, energy and pulse shape information.

One FERS unit can be used **stand alone**, without any additional hardware, just connected to the computer via USB 2.0 or Ethernet 10/100T. This is a cheap and an easy-to-use evaluation board of the specific ASIC chip housed on the FERS unit. Once the solution is validated, scaling up to thousands channels is immediate: multiple FERS units can be connected in a **tree network**, where the optical **TDlink** is the unique physical connection that guarantees high throughput data readout, slow control and accurate timing synchronization.

One **DT5215 (FERS Data Concentrator)** can manage up to **8 TDlinks**, each connected to 16 FERS units in daisy chain: in the case of the **A5202/A5203** FERS unit, it makes **8192 readout channels**. Multiple concentrator boards can be synchronized in order to further extend the total number of channels.

A Linux-based Single Board Computer is embedded in the Concentrator board. It manages the data readout from the network of FERS units and the event data building according to the time stamp and/or trigger ID of the event fragments acquired by each unit. Sorted and merged data packets are then stored to the local memory and finally sent to the host computers through **1/10 Gb Ethernet** connection or **USB 3.0** link. Custom algorithms for data processing and reduction can be easily uploaded by the user into the embedded CPU.

## One computer, one Concentrator, thousands of channels

**FERS-5200** is an extendable system: the same FERS unit can be used either as stand-alone or as part of the network tree for the readout of large arrays of detectors. In this way, the same card and same interface will be used, starting from the prototyping phase till the final implementation of the experiment.

The core of the scalability of the FERS-5200 is the optical **TDlink**, which manages data stream, slow control and synchronization at once.

The concentrator board DT5215 hosts 8 optical links, each one sustaining up to 16 FERS units in daisy chain. In the case of A5202 for SiPM readout, this means **8192** channels managed by a single Concentrator board.

Further scalability is possible synchronizing **more than one Concentrator board**.

# Technical Specifications

## Mechanical

Dimensions: 262 W × 66.2 H × 171.6 L mm<sup>3</sup> (without connectors)  
Weight: 1210 g

## Optical I/Os

8 Small Form Factor Pluggable (SFP+) transceiver components for optical connection (3.125 Gbit/s).  
**TDlink** CAEN proprietary protocol allows for multi-board synchronization, slow control and data readout

## Front Panel I/Os

### FI

- 8 digital Input LEMO connectors
- LVTTTL signals accepted
- Zin = 50 Ω

### FO

- 8 digital Output LEMO connector LVTTTL signals
- Must be terminated to 50 Ω

### FA/FB

- 2 digital Input/Output LEMO connectors:
- NIM/LVTTTL Input signals, Zin = 50 Ω
  - LVTTTL Output signals, must be terminated to 50 Ω

## Rear Panel I/Os

### RA/RB

- 2 digital Input/Output LEMO connectors:
- NIM/LVTTTL input signals, Zin = 50 Ω
  - LVTTTL output signals, must be terminated to 50 Ω

### CLK-IN/OUT

- Input/Output LEMO connectors for the clock signal propagation:
- AC Coupled LVTTTL Input, Zin = 50 Ω
  - AC Coupled LVTTTL Output, must be terminated to 50 Ω

### SYNC IN/OUT

- 2 RJ-45 connectors for the transmission of the clock/sync signal in case of multi-boards synchronization

## FERS-5200 Units Synchronization via TDLINK

### Clock Propagation

- Via the TDlink:
- Clock jitter = 20 ps (Typ.)
  - Clock skew = fixed < 6.4 ns, depending on the optical fiber and daisy chain ring lengths.
  - Measured and compensated at software level

### Acquisition Synchronization

Sync signal propagated through the TDlink for simultaneous reset of the timestamps. Broadcast commands executed at the same time in all boards for Run Start/Stop, Trigger, etc.

*NOTE: After the synchronization command, a fixed clock skew of less than 1 clock cycle (6.4 ns) is present between the first group of four TDlinks 0-1-2-3 and the second group, 4-5-6-7. The clock skew may vary from run to run.*

## DT5215 Board Synchronization via S-LINK

### Clock Propagation

- LEMO CLK-IN/-OUT (10.000 MHz, e.g. from GPS)
  - RJ45 SYNC IN/OUT (A line)
  - LEMO RA (15.625 MHz)
- The SYNC A clock signal can be propagated (OUTPUT ONLY) via the front/rear panel I/Os

### Acquisition Synchronization

- Timestamp reset and Run Start/Stop through:
- RJ45 SYNC IN/OUT (B/C lines)
  - SYNC via software command sent to all the boards that need to be synchronized
  - PPS, from GPS receiver

## Communication Interfaces

### Ethernet

- Ethernet connector, type RJ-45. Supports 1 Gb/s connection to the PC
- MAX Readout Rate (1 GbE): 80 MB/s
- Ethernet connector, SFP+ Transceiver. Supports 10 Gb/s connection to the PC
- MAX Readout Rate (10 GbE): 300 MB/s (tested with iPerf)

### USB

- USB3.0 connector, type C
- MAX Readout Rate: 300 MB/s (tested with iPerf)

## Firmware

Firmware can be upgraded via USB or Ethernet through the Web Interface

## Software

Fully controlled by the Janus software on Windows ® and Linux ®

## Environmental

Environment: Indoor use  
Operating Temperature: 0°C to +40°C  
Storage Temperature: -10°C to +60°C  
Operating Humidity: 10% to 90% RH non condensing  
Storage Humidity: 5% to 90% RH non condensing  
Altitude: < 2000m  
Pollution Degree: 2  
Overvoltage Category: II  
EMC Environment: Commercial and light industrial  
IP Degree: IPX0 Enclosure, not for wet location

## Regulatory Compliance

EMC: CE 2014/30/EU Electromagnetic compatibility Directive  
Safety: CE 2014/35/EU Low Voltage Directive

## Power Requirements

Single power supply: +12 V. Accepted voltage range: MIN +7 V, MAX +15 V

## Power Consumptions

750 mA @ +12 V, i.e. ≈ 9 W

## Ordering Options

| Code        | Description                               | RoHS |
|-------------|---|------|
| WDT5215XAAA | DT5215 - Concentrator Board for FERS-5200 | RoHS |

## Accessories

### AI2700



Optical Fiber Series

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## Related Software Libraries

### CAEN FERSlib Library



High level library for FERS-5200 Boards

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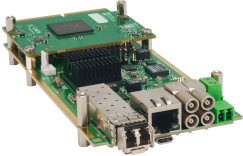
## Related Products

### DT5203



Desktop 64 Channel picoTDC unit for FERS-5200

### A5203



64/128 Channel picoTDC unit for FERS-5200

### DT5202



Desktop 64 Channel Citiroc unit for FERS-5200

### A5204



64 Channel Radioroc unit for FERS-5200

### A5202



64 Channel Citiroc unit for FERS-5200

## DT5204



64 Channel Radoroc unit for FERS-5200

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## DT5216



FERS Data Concentrator with 1 optical link

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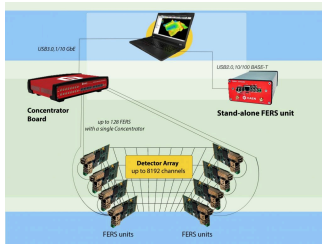
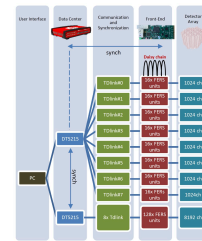
## JANUS



FERS-5200 DAQ SOFTWARE

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# Gallery



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