CAEN
Tools for Discovery

R5560SE
128 Channels 14-bit 125 MS/s Open FPGA Digitizer

Supported by **CAEN**
SCI-COMPILER

High Energy Physics

Multichannel Spectroscopy

Industrial

KEY FEATURES

♦ 128 channels, 14-bit @125 MS/s Digitizer

♦ Based on powerful Xilinx Zynq-7000 SoC with **open FPGA**

♦ Ideally suited to readout **large arrays of detectors** (^{3}He tubes, PMTs, segmented HPGe, etc.)

♦ 3U, 19" Rackmount unit

♦ **Single-ended** analog inputs on MCX connectors

♦ Programmable Front-End stage

♦ 2 V_{pp} input dynamic

♦ Board-to-board **synchronization** with a single CAT5e cable.

♦ Configurable digital I/Os to interface with external systems

♦ Maximum **flexibility**: USB3.0, Ethernet, and Optical Link connectivity , to support remote management as well as extreme fast data flow

♦ 2.4" touch screen display for quick configuration and status control

♦ Fully supported by **SCI-Compiler** for easy FPGA programming

DESCRIPTION

The R5560SE is a rack-mountable, 128 Channel, 14-bit 125MS/s Waveform Digitizer which features an **Open FPGA** format which offers the user vast programmable data processing capabilities

The R5560SE Open FPGA Digitizer is ideally suited to readout large **arrays of detectors** (^{3}He tubes, PMTs, segmented HPGe, …) using a **customizable platform** and an **advanced programmable front-end.** By taking advantage of the powerful SoC architecture the user can quickly and easily design **custom logic and pulse processing algorithms** on the open FPGA, as well as develop middleware/software which perfectly matches of the application of interest. No expertise in VHDL/Verilog is required for the user to utilize this powerful tool.

The board can simultaneously manage numerous a large **digital** (LVDS, NIM, TTL) and **analog** signals, thus supporting the implementation of a wide range of functionalities required by physics experiments: Signal Digitization, Complex Trigger Logic, Pulse Height Analysis with MCA capabilities, Time Tagging, Pulse Shape Discrimination, etc. R5560SE features single-ended analog inputs on MCX connectors.

The R5560SE is an ideal solution for **large experiments,** which often require fast digitization of analog signals and the use of several digital lines to interface with external systems. The board supports **multi-board synchronization** via a single CAT5e cable, and can be scaled up to thousands of channels**.** Additionally, the **rack-mount** form factor makes for a very clean and elegant multi-board environmental setup where effective space management is critical.

SCI-Compiler software, the CAEN block-diagram-based firmware generator and compiler, provides a simple yet powerful tool for programming the FPGA to develop intensive real-time data processing.

Free and open-source demo **readout software** also provided. This open-source demo software is designed to manage the standard pulse height analysis firmware implementing energy measurements using a trapezoidal filter.

Developed in collaboration with **Nuclear**Instruments

Powerful ...

The R5560SE is based on the Xilinx Zynq-7000, a powerful System-on-Chip that uses programmable logic to develop highly effective real-time signal processing capability. The R5560SE also houses a Dual Core 1GHz ARM processor for Ethernet communication and data post-processing.

The board core is organized into 4 sections, each supporting both **DAQ capabilities** and **Digital Interface**. Each section hosts 32 configurable digital LVDS I/Os on VHDCI connector and may be read out via 32 analog channels.

... and Flexible

The R5560SE has been designed to provide **maximum flexibility,** not only for detector arrays comprised of 1000s of channels, but also for smaller independent detector arrays as well. The 4 sections of the board core may be utilized as 4 completely independent 32-channel digitizers, providing the user with the option to read out data from 4 completely independent detector arrays.

The wide range of hosted communication protocols (Ethernet, Optical Link, USB3.0 shared connectivity for low rate data transfer) and the scalable architecture have been designed to be flexible enough to support the **development of new multi-board detector readout systems** as well as **integrate into and enhance readout capabilities within existing facilities**.

Critical to the R5560SE design is an **open-FPGA** architecture. Thanks to **SCI-Compiler** software, users can combine several processing blocks in a block diagram, supporting the quick and simple development of firmware algorithms critical to data processing. In few clicks, and without the knowledge of any FPGA programming language, it is possible to implement Pulse Height Analysis (PHA), highly accurate event timing and timestamping (TDC), mathematical operations (including data fitting), Pulse shape discrimination (PSD), and much more.
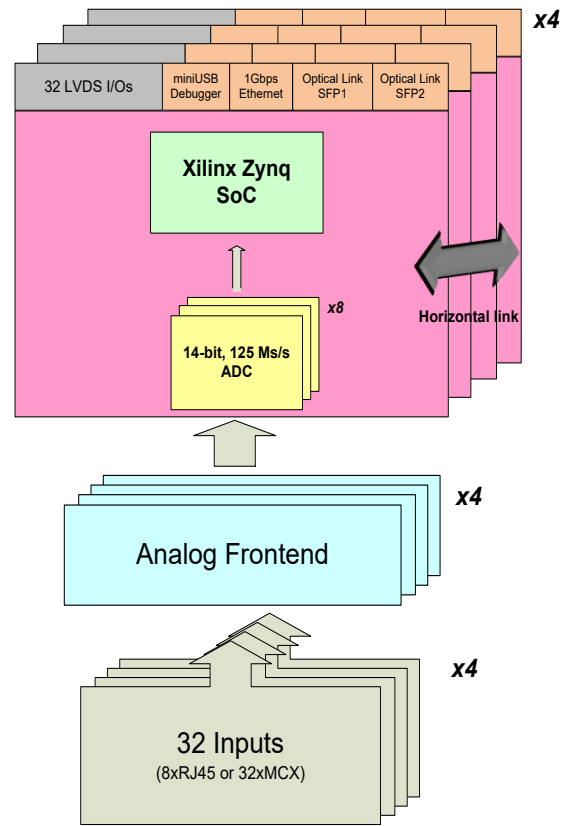
R5560SE is suitable for building an integrated multi-channel DAQ system for Position-Sensitive Detectors, Gaseous Detectors, PMTs, Germanium detectors, RPCs and other detectors.

A use case: the SANS technique

Small angle neutron scattering (SANS) is a technique which is applied across a wide spectrum of scientific disciplines such as chemistry, physics, biology, materials science, engineering and geoscience. The aim of SANS is probing materials on the molecular levels to extract critical information such as the size, shape and spatial correlation of nanoscale structures.

The CAEN R5560SE meets all requirements for the readout of **position-sensitive tubes** used for **neutron detection** in SANS instruments. The board can address the demand for **thousands of readout channels** and perform energy and time-of-flight measurements.

Ordering Option

Ordering code	Description
WR5560SEXAAA	R5560SE - 128 Ch. 14 bit 125 MS/s Digitizer single-ended (SciCompiler SW555 included)