CAEN
Tools for Discovery

DT5771

Smart Digital Multi-Channel Analyzer

WEB INTERFACE

USB 2.0

1 GbE

Developed in collaboration with Nuclear Instruments

Highlights

Function

Single input compact 64k Digital Multi-Channel Analyzer with a 14-bit 200 Msps ADC

Applications

- Nuclear Physics Research
- Homeland Security
- Environmental (Real-Time) Monitoring
- Non-Destructive Analysis
- Nuclear Safety & Safeguards
- Labs and Educational
- Low background measurements through active shielding and inter-input coincidence logic

Operability

Ideally suited for high resolution spectroscopy applications using HPGe, CZT, Silicon and scintillation detectors such as NaI and $LaBr_3$.

Supports:

- Resistive Feedback preamplifiers
- Transistor Reset preamplifiers
- PMT anode signals

User-selectable DC or AC coupling (includes three software-selectable time constants for acquisition rate matching), 1 kΩ or 50 Ω input termination and variable gain for maximum compatibility.

Multiple operating modes:

- Multi-Channel Analyzer (MCA) with trapezoidal filtering for energy spectrum analysis
- Peak & Hold for timing and amplitude analysis

Features

- BNC connector for Analog Input
- Lemo-00 for Digital Input provides signal for acquisition or processing (e.g. acquisition Start/Stop, External Trigger, External Reset, External Timestamp, Trigger Veto and Trigger Gate)
- Two Lemo-00 for Analog and Digital Output offer respectively processed analog waveforms (e.g. time and energy filter output) and digital signals (e.g. Trigger, Energy Valid, Pile-Up Reject Gate) for oscilloscope diagnostics
- DB9 connector provides ±12 V and ±24 V to power preamplifiers
- Front panel LCD Display for basic information and statistics
- Front panel status LEDs for quick diagnostics
- User-friendly Web Interface provides complete control and real-time spectral analysis
- On-board memory supports List and Spectrum data storage capability up to 20 Gbyte
- On-board user-accessible ARM processor running Linux® OS enables user to develop custom routines

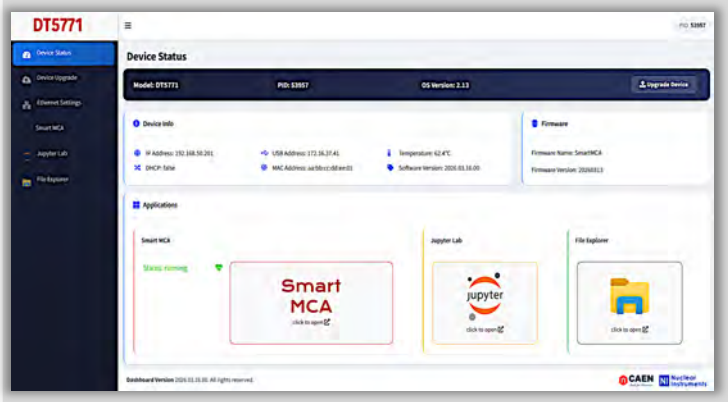
Communication

- 1 Gbit Ethernet and USB-C readout interfaces

Web Interface

Web-based GUI provides intuitive and exhaustive access to all device features, without additional software or installation

- Setup and retrieval of all processing parameters and device settings
- Analog and Digital Waveform inspector for real-time signal monitoring and easy processing parameter optimization
- Statistical information for ICR, OCR, Real Time, Live Time and Dead Time, and Multi-Channel Scaler (MCS) plot
- Energy and Time Histograms acquisition, together with the List of energy and time information of each event



Web Interface - Device Status page

- Real-time spectrum analysis with basic fitting functions and Energy spectrum calibration
- On-board MCS, Waveforms, List, Energy and Time Histograms data storage capability on a dedicated user partition
- User-friendly data and configuration files browsing, uploading and downloading with a File Explorer application
- Jupyter Lab application, in conjunction with a dedicated library, for easy Python-based scripting to modify setup parameters, monitor waveforms, and acquire, save and process data
- Network settings management
- Easy software and firmware upgrading
- Recovery Mode for advanced functions like Factory System Restoring or Operative System upgrade

Overview

DT5771 integrates a single input 64k channel Digital Multi-Channel Analyzer (MCA). This compact, high performance desktop MCA includes features such as an input stage for signal conditioning, a fast analog-to-digital converter (ADC) and digital signal processing algorithms. DT5771 is ideally suited for applications using high energy resolution semiconductor detectors such as HPGe, Silicon, CZT as well as scintillation detectors such as NaI and LaBr3.

It can manage both positive and negative signals from resistive feedback or transistor reset preamplifier detectors as well as signals coming from PMT anodes. It is equipped with variable gain, selectable input termination (1 kΩ/50 Ω) and input coupling (AC/DC) for maximum compatibility with detector output signals. DT5771 integrates on a DB9 connector two low voltage outputs (±12 V / 100 mA and ±24 V / 50 mA) to power preamplifiers.

Operating Modes

DT5771 can be configured to process data with a trapezoidal filtering for both trigger and energy measurement for spectra analysis purposes or with a leading edge trigger and peak detection for timing and amplitude analysis goals. For both data processing modes, it is possible to reconstruct the Energy Histogram and the Time Histogram of the inter-arrival events time. The histograms can be stored on the device or exported in various formats for further spectral analysis. The Time-Stamped List mode permits time stamp and energy events to be saved to on-board memory for offline analysis and post-processing.

During acquisition the data statistics are available, with information on measured Trigger Rate (also of a user defined energy ROI), Output Count Rate (OCR), Pileup Rejected Rate, Saturation Rate and calculated Input Count Rate (ICR). The same information is provided as integral number of counts during the acquisition, together with the Real Time, the Live Time and the Dead Time. The Multi-Channel Scaling (MCS) offers a plot of the ICR, OCR and Trigger ROI Rate as a function of a selectable dwell time. Analog input signals and internal digital filter outputs can be monitored simultaneously in real-time via the Waveform acquisition of multiple traces, allowing an easy way to visualize signals and optimize processing parameters.

I/O Equipment

DT5771 is equipped with a BNC connector for the Analog Input signal and with three Lemo-00 connectors dedicated to the Analog Output, Digital Input and Digital Output signals. The type of signals on the Lemo-00 connectors can be defined using the Web Interface. The Analog Output connector can be used with an external Oscilloscope for diagnostic purposes to inspect the analog signal after various stages of the processing, like the timing and the energy filters.

The Digital Input can be used to trigger events, to start/stop or reset data acquisition and to reset the event timestamp, or as a gate/veto for internal triggered events. The Digital Output provides a wide choice of digital signal generated during the data processing to easily follow and debug every stage: trigger, baseline hold, gate and valid signal for the energy measurement, inhibit and valid/rejected event for the pileup rejector, timestamp reset and data acquisition status. Front Panel LEDs inform the user of the I/O status. An LCD display provides general board information, real-time statistics on ICR, OCR, Real Time and Dead Time.

Connectivity

DT5771 can be controlled with a point-to-point direct connection through the USB 2.0 link and with a remote network connection by the Ethernet 10/100/1000T port.

The module is controlled uniquely by a web interface that supports all possible operations by simply opening a web browser. The web interface can be easily used to find basic board information (e.g. model type, serial number, firmware version, real memory occupancy), to manage network settings and upgrade firmware.

With the SmartMCA application it is possible to set all the processing and acquisition parameters, monitor analog and digital waveforms, check data statistics, build energy and time histograms, perform fit and calibration on energy spectra and save data and configuration on-board.

The File Explorer application allows to browse, upload and retrieve files saved on the on-board memory through a user-friendly graphical interface. All these operations can also be performed with the Jupyter Lab application and a dedicated python library, which offer the opportunity to create scripts for basically any desired process like setting operational functions for each run (e.g. order, copy/paste files, create/delete directories, etc.) and perform offline advanced data analysis.

Web Interface – SmartMCA

The SmartMCA is an accessible and comprehensive application, requiring only the use of a web browser, which incorporates signal monitoring, data acquisition and spectrum analysis.

The SmartMCA comprises the capability to set all the analog and digital signal parameters, the processing and the acquisition variables. The user can save, download, upload and load configuration files containing values for all the configurable settings. Some Preset files are already stored to help the user to identify the correct settings for various detector signals.

SmartMCA is supported by the most used web browsers:

SmartMCA - The Waveform Page

SmartMCA - Waveform Acquistion

The Waveform acquisition implemented by the SmartMCA facilitates the processing parameters optimization by allowing the simultaneous monitoring of analog and digital traces. By selecting the analog signal source, the signal decimation, the waveform trigger source and the waveform trigger position the SmartMCA permits to detect various type of events and to understand how every stage of the data processing chain behaves. The possibility to save and download multiple acquisitions allows the signal waveform offline analysis.

SmartMCA - Statistic Tool

The Statistics tool managed by the SmartMCA allows to measure the rates and the counts of trigger signals, output signals, pileup and saturation rejected signal during the data acquisition. The behavior of these rates as a function of time can also be visualized in the MCS plot. The statistics information can also be saved on file. In addition, even when the acquisition is not running, the SmartMCA calculates and reports the Input Count Rate. This gives the possibility to check in real-time the effect of parameter changes on the rate also before the data acquisition.

Hide Advanced

Name	Value	Percentage	Min Value	Max Value
ICR (cps)	7.09 k		6.92 k	17.80 k
TRIGGER RATE (cps)	7.04 k	99.308 %	0	17.41 k
ENERGY BAND RATE (cps)	750.00	10.584 %	0	1.55 k
OCR (cps)	7.04 k	99.308 %	0	17.41 k
PILEUP REJECT RATE (cps)	0	0 %	0	0
SATURATION RATE (cps)	0	0 %	0	0
LOST RATE (cps)	0	0 %	0	0
INPUT COUNT	2.43e+6		29	22.498e+6
TRIGGER COUNT	2.405e+6	98.942 %	29	22.407e+6
ENERGY BAND COUNT	215.467e+3	8.865 %	0	2.235e+6
OUTPUT COUNT	2.404e+6	98.904 %	0	22.407e+6
PILEUP REJECTED COUNT	0	0 %	0	0
SATURATED COUNT	0	0 %	0	0
LOST COUNT	0	0 %	0	0
CUT COUNT	0	0 %	0	0
REAL TIME	00:03:47	0 %		
LIVE TIME	00:02:21	62.409 %		
DEAD TIME	00:01:25	37.591 %		

SmartMCA - The Advanced Statistics Table

Nuclide Database

The SmartMCA incorporates the entire radionuclide decay emissions database. This isotopes decay library is based on the well-known "NuDat" nuclear data file, which is produced and certified by the international Nuclear Data Committee.

SmartMCA - The Edit Region of Interest window with the double Gaussian performed fit

SmartMCA - FIT and Calibration Tools

The SmartMCA offers tools to analyze energy spectra, basically fitting and calibration tools with a wide range of analytical functions.

The FIT option allows to create a table of multiple Region of Interest (ROI), obtained by defining the interval from the energy spectrum. Each ROI menu allows also to choose the fit function applied to the ROI between Gauss, Lorentz, Voigt, Lognormal and Skew-gauss function in case of a peak or Compton function in case of the Compton edge. Each ROI can be fitted with multiple peak fit functions, one for each peak, creating a convolution function. In case of a single peak the fit parameters are automatically calculated, while, in case of multiple peaks, the user can easily click on the spectra in order to define the peak mean and FWHM. The ROI menu provides a full radionuclide library to easily associate the correct energy to a peak in the spectrum.

The function describing the background of the ROI can be selected from Constant, Linear, Quadratic, Cubic, Exponential, Error function, Linear Step and Bilinear Step. The background parameters are computed automatically or it is possible to specify the region of the ROI in which the background can be estimated. Once the fit has been performed, in the ROI menu a plot shows the fit result on the spectra, indicating the different contributions of all the peak and background components, a table reports the reduced chi-squared and all the parameters value with errors and another plot displays the residuals.

With the SmartMCA, the convoluted fit function displayed on the spectrum and the fit results reported on the FIT table, including information on the peak areas, can be updated in real-time during all the data acquisition.

SmartMCA - Energy Calibration

The Energy Calibration can be estimated from multiple fit by associating an energy to the peak/Compton edge channel value in the spectrum. The function that can be used to fit the behavior of the pairs of energy and channel can be selected from Linear, Quadratic, Cube, Exponential and Power. Once the Energy Calibration is applied to the energy spectrum, the SmartMCA provides the information of the Energy Resolution of each peak.

All the fit and calibration parameters can be saved to file and retrieved to be loaded and applied again in any moment.

ROI analysis

The SmartMCA performs a fit for each ROI and shows the number of counts, the mean, the standard deviation, the FWHM, the amplitude, the gross and the net areas, the energy and the resolution.

SmartMCA - The Energy Histogram Page with the double Gaussian fit

Technical Specifications

Performance

Signal Processing	
Throughput	tested up to 200 kcps
Integral Non-Linearity (INL)	0.04% from 14 keV to 1400 keV
Differential Non-Linearity (DNL)	< ±3% over the 99% of the full-scale range
Gain Non-Linearity (GNL)	< ±1.7% over the 99% of the full-scale range
Dynamics	down to 4 keV @ 3 MeV FSR (noise peak at the same height of Compton); measured with HPGe ORTEC GMX20P4-70-CW detector
Resolution	best result is 0.91 keV @ 122 keV, 1.71 keV @ 1332 keV, measured with HPGe ORTEC GMX20P4-70-CW detector

On-board CPU and Memory

CPU
1 ARM Cortex-A9 MP Core, Dual-Core, up to 1 GHz (SDRAM Memory 1 GB DDR3 800 MHz) running Linux Ubuntu 20.04 system
The embedded CPU is accessible for compiling customized routines and implementing unattended and automated operations by the provided SDK
Memory
64-GB embedded MMC, non-detachable, with a partition of 20 GB user-accessible dedicated to data and script storage

Inputs

ANALOG IN (front panel)	
Analog signal input connector	BNC type
Accepts positive or negative signals from PMT anode or both Resistive Feedback and Transistor Reset detector preamplifier; 1kΩ or 50Ω input impedance software selectable	
DC or AC coupling with 300 ns, 2 µs or 22 µs AC time constant options; input range is 2 Vpp or 10 Vpp with Analog Input Division activated and divided by the selected gain; *AC Gain: x5, x7.5, x12.5, x18, x30, x45, x60, x80*	*DC Gain: x1, x1.5, x2.5, x3, x4.5, x6, x7.5, x9, x12, x15, x18, x22, x27, x36, x45, x54*

Outputs

POWER SUPPLY (rear panel)		
Preamplifier power supply output connector		DB9 female type
Two power rails:	±12 V (± 2%) @ 100 mA	±24 V (± 2%) @ 50 mA
Ripple	< 5 mVpp	

ANALOG OUT (front panel)	
Analog output	Lemo-00 type

Provides a selection (software selectable) of internal analog probes:

- *A copy of the input signal (filtered and after polarity inversion)*
- *Timing Filter Output*
- *Energy Filter Output*
- *Baseline*
- *Energy Value*

LED Indicators

Front Panel LEDs			
Power:	Power LED	color green	illuminated when the board power is on
ANALOG IN:	Trigger LED	color green	turns on when a trigger is detected on the analog input
GPO:	Digital Output LED	color green	turns on when a digital output signal is generated
GPI:	Digital Input LED	color green	turns on when a digital input signal is provided

Technical Specifications (continued)

General Purpose I/Os

GPI (front panel)	
Connector for TTL ;	Lemo-00 type
Input (TTL, Zin 1 kΩ/ 50Ω user selectable, polarity user selectable)	
External Time-Stamp Reset:	*External reset of the time stamp counter; minimum pulse width 15 ns*
External Acquisition:	*External Acquisition Start/Stop signal; minimum pulse width 15 ns*
External Reset:	*External Acquisition Reset signal; minimum pulse width 15 ns*
External Trigger:	*External Trigger signal; minimum pulse width 15 ns; software programmable trigger edge, width and delay; can be either a trigger for the channel or a trigger validation in case of acquisition in Coincidence or Anticoincidence mode with the Internal Trigger*
Veto:	*External Veto signal for the Internal Trigger; minimum pulse width 15 ns*
Gate:	*External Gate signal for the Internal Trigger; minimum pulse width 15 ns*

GPO (front panel)	
Connector for TTL ;	Lemo-00 type
Output (TTL, requires 50 Ω termination)	
Trigger:	*Generates a positive pulse of selectable width and delay at each input trigger event*
Energy Valid:	*Generates a positive pulse of 20 ns when the energy filter calculates a valid energy value for the input event*
Energy Gate:	*Generates a positive pulse that stays high for all the time needed to obtain the input event energy value*
Baseline Hold:	*Generates a positive pulse that stays high for all the time the baseline value is not updated*
Time over Threshold:	*Generates a positive pulse that stays high for all the time the input signal is higher than the Leading Edge Trigger Threshold*
PUR Valid:	*Generates a positive pulse of 20 ns when the Pileup Rejector considers the input event as a valid event*
PUR Inhibit:	*Generates a positive pulse that stays high for all the time the Pileup Rejector inhibits input events that will be rejected*
PUR Rejected:	*Generates a positive pulse of 20 ns when the Pileup Rejector rejects an input event*
Run:	*Generates a positive pulse that stays high for all the time the acquisition is running mode*
Reset:	*Generates a positive pulse that stays high for all the time the acquisition is in reset mode*
T0:	*Generates a positive pulse of 20 ns at each Time-Stamp Reset event*

Communication Interfaces

USB (rear panel)	
USB connector; USB 2.0 compliant;	type C
USB-C (multi-function): the USB-C connector provides both a serial communication port for debug and a virtual network connection (when connected to the host PC the device is automatically recognized as an RNDIS-compatible device, enabling USB-to-Ethernet networking)	
USB cable included in the kit	
10/100/1000 T (rear panel)	
Ethernet female connector;	RJ-45 type
10, 100 or 1000 Mbit/s connection to a PC or ETH hub	
FTP cable included in the kit	

ADC

Resolution:	14-bit	Sampling Rate:	200 MHz

Technical Specifications (continued)

Active Buttons

Power/Navigation Switch (front panel)	
Push when device is powered off Push for 4 seconds when device is powered on	Power on button Power off button
Push and lever when device is powered off Lever when device is powered on	Power on button for Recovery Mode Display navigation

Monitoring Display

Graphic Display (front panel)

262K-color 0.96" LCD display for monitoring usage and IP reset operation

The display has a static screen when the device is booting, is shutting down or when it is in recovery mode. During normal operation the display shows multiple screens that can be changed using the Navigation Switch. The RESET IP screen enables the user to use the default IP configuration, which is static IP with 192.168.50.20 address. This procedure requires the user confirmation to avoid undesired ethernet configuration resets.

Screen 1: HOME - Model and network addresses

Model: DT5771 | *IP: Ethernet address* | *USB: USB IP address*

Screen 2: STATUS - Data statistics

ICR [Hz], [kHz], [MHz] | *OCR [Hz], [kHz], [MHz]* | *Dead Time [%]* | *Real Time [hh mm ss]*

Screen 3: BOARD INFO - Basic board information

PID: Board Serial Number | *TEMP: FPGA temperature [°C]* | *SW: Framework release* | *FW: Firmware release*

Screen 4: Network Info – Network status

DHCP: DHCP Led status | *IP: Ethernet address/DISCONNECTED* | *USB: USB IP address/DISCONNECTED* | *MAC: MAC address*

Screen 5: RESET IP – Restore Ethernet configuration to default

A message explains to push the Navigation Switch to start the IP reset procedure. A second message asks for user confirmation to continue the procedure by pushing another time the Navigation Switch. The last message shows the exit status of the procedure (SUCCESS or ERROR).

Mechanical

Enclosure:	Aluminium with solid plastic bezel and four rubber feet	Weight:	420 g
Size:	106.5 W x 34.0 H x 189.0 L mm³ (including connectors)	106.5 W x 34.0 H x 166.5 L mm³ (without connectors)	

Power In

12V DC power jack on rear panel; Typical power consumption: 15 W :

AC Adaptor (12 V, 3.75 A) included in the kit

Device Upgrade

The device software and firmware can be upgraded via USB/ETHERNET through the Web Interface using a .DUP file. The Operative System upgrade with the .nsys file, together with Factory System Restoring and other advanced functions are available in Recovery Mode. The upgrade files are available for free download on CAEN website: www.caen.it/download/

Environmental

Environmental	Indoor use	Storage Humidity	5% ÷ 90% RH non condensing
Operating Temperature	0°C ÷ +50°C	Pollution Degree	2
Storage Temperature	-10°C ÷ +60°C	Overvoltage Category	II
Operating Humidity	10% ÷ 90% RH non condensing	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

Technical Specifications (continued)

Monitoring and Acquisition Modes

Waveform

The Web Interface allows to inspect and plot the analog input signal and the digital signals waveforms to optimize the algorithm parameters and attain the best possible spectrum. For the analog traces, if the Peak Detection is selected as Energy Mode, it is possible to monitor the Baseline value, the Peak value and the Peak value with the Baseline subtraction. If the Energy Mode used is the Trapezoidal Filter, it is possible to check the Fast Trapezoidal Filter for the trigger and its derivative (on which the Threshold is applied), the Baseline value, the slow Energy Trapezoidal Filter and the same signal with baseline subtracted.

The digital signals comprise the Trigger signal, the Baseline Hold interval, the Energy Sample signal, the Pileup Inhibit interval, the Pileup Reject signal, the Saturation Inhibit interval, the Saturation Reject signal. It is possible to acquire 4096 samples and to apply a decimation factor. The Waveform acquisition can be triggered by using digital signals as Pileup Rejector, Internal Trigger, External Trigger, Energy Sample, Saturation Reject, Transistor Reset, Trigger ROI (input signal with an energy defined by a ROI of the spectrum) or it can be operated in free running mode. In addition, it is possible to trigger a single shot acquisition or use the continuous acquisition and to save a single waveform or trigger a user defined number of acquisitions to save multiple waveforms.

Energy Histogram

By setting the programmable processing parameters, the Energy Histogram can be built in real time during the acquisition. The spectrum in the firmware has 64k channels but it can be re-binned at a configurable number of channels (from 1k to 32k). It is also possible to perform the fit of the peaks in the spectrum in order to assign to them the correct energy and calibrate the Energy Histogram in keV. The Logarithmic mode is also available as visualization for the Count axis. The Energy Histogram can be automatically stored on the device at the end of the acquisition or can be manually saved to file and downloaded.

Time Histogram

The Time Histogram displays the inter arrival time of the valid events. The user can choose the number of channels of the histogram, from 1k to 16k and the Time Bin Resolution, which is the time value corresponding to each bin. The Logarithmic mode is also available as visualization for the Count axis. It is possible to automatically stored the histogram on the device at the end of the acquisition, or it can be manually saved to file and downloaded.

Time-Stamped List

Energy, Baseline and Time-Tag data are provided for each valid event (that is not saturated and has not been rejected by the Pileup Rejector) and can be stored automatically to file on the device during the acquisition. The Time-Tag is obtained with a 32-bit time tag counter and with 5 ns resolution.

Statistics

The calculated Input Count Rate (ICR) is always provided. During an acquisition the Trigger Rate, the Trigger ROI Rate, the Output Count Rate (OCR), the Pileup Reject Rate, the Saturation Rate and the Lost Event Rate, are also shown, each one obtained by counting the number of events in a time interval of 1 s. All these types of information are also available as the integral number of counts during the acquisition, together with the Real Time, the Live Time and the Dead Time.

MCS

The Multichannel Scaler mode is enabled during the acquisition: a plot shows the ICR, the OCR and the Trigger ROI Rate as a function of the time with the Dwell Time selectable by the user, from 1 s to 3600 s, with resolution of 1 s. The data can be stored on the device.

Unattended

Local storage of lists and spectra on the internal MMC memory can be handled using Jupyter Lab with python-based scripting or can be downloaded to the PC for more advanced offline analysis.

Technical Specifications (continued)

Settings

It is possible to save, load and download multiples configurations of all settings. There are also some preset configurations stored on the device that can be loaded to apply a default value to each parameter. Every time the settings are applied, the current configuration is automatically saved in order to reload the last settings value at power-on.

Analog Input

It is possible to select the Preamplifier Type between Resistive Feedback and Transistor Reset. Consequently, the DC/AC coupling selection is suggested.

Analog Input Coupling:
DC coupling option for Charge Sensitive Preamplifiers;
AC coupling option for Transistor Reset Preamplifier with three selectable shaping constants: 300 µs, 2 µs and 22 µs (the trapezoid Decay Time must then be set accordingly)

Reset Polarity: polarity of the reset discharge signal (AC coupling); applies to the Transistor Reset Preamplifier

Reset Threshold: threshold in LSB to determine the reset discharge signal (AC coupling); applies to the Transistor Reset Preamplifier

Reset Width and Delay: width and delay in ns of the reset discharge signal (AC coupling); applies to the Transistor Reset Preamplifier

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The Analog Input Impedance can be selected accordingly to the detector signal impedance
Analog Input Impedance: 1 kΩ / 50 Ω

By selecting the Analog Input Division, the input range can be extended to 2 Vpp or 10 Vpp preventing saturation conditions, particularly for preamp signals with large DC offsets or transistor reset preamplifiers with a large output ramp dynamic range
Analog Input Division: x0.2

The Analog Input Gain depends on the selected Analog Input Coupling and divides the input range, despite of the Analog Input Division
DC Gain: x1, x1.5, x2.5, x3, x4.5, x6, x7.5, x9, x12, x15, x18, x22, x27, x36, x45, x54
AC Gain: x5, x7.5, x12.5, x18, x30, x45, x60, x80

A filter can be applied to the analog input signal by using the Analog Input Smoothing
Analog Input Smoothing Samples: 2^1-2^9

By selecting the negative analog input polarity, the signal is inverted for the further processing
Analog Input Polarity: NEGATIVE or POSITIVE input polarity selection

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The DC offset of the analog input is adjustable in the whole input range and is expressed in percentage
Analog Input Offset: 0-100%

Processing

Trigger Mode: trigger can be internal, using the Leading Edge Trigger or the Fast Trapezoidal Trigger or external provided by Digital Input. In addition, some logic as the OR, the COINCIDENCE and the ANTI-COINCIDENCE can be applied between the external and the internal trigger. In these cases, it is possible to indicate the width and the delay of both trigger signals.

Tigger Algorithm: the Internal Trigger can be determined by using two different algorithms, the Leading Edge Trigger or the Fast Trigger, consisting in a threshold applied to the derivative of a fast trapezoidal filter applied to the input signal.

Threshold (Leading Edge):	*value in LSB that the Input Analog signal must exceeds to determine the trigger event*
Threshold Hysteresis (Leading Edge):	*value in LSB that the Input Analog signal must pass below with respect to the threshold to rearm the trigger in order to avoid spurious and double triggers*
Inhibit (Leading Edge):	*interval of time after a trigger event in which the trigger algorithm is inhibited and is not possible to have another trigger event; 5 ns resolution*
Shaping Time (Fast Trigger):	*time value indicating the rise time of the signal response to fast trapezoidal filter; 5 ns resolution; configurable between 20 ns and 5120 ns*
Flat Top (Fast Trigger):	*time value corresponding to the stable and constant portion of the signal shaped by trapezoidal filter; 5 ns resolution; configurable between 20 ns and 5120 ns*
Threshold (Fast Trigger):	*value in LSB that the derivative of the Fast Trapezoidal Filter applied to the signal must exceeds to determine the trigger event*

Technical Specifications (continued)

Energy: energy can be calculated with two different approaches, the Peak Detection and the Trapezoidal Filter. The first method is used in combination with the Leading Edge Trigger, while the second one corresponds to the Fast Trigger.

Energy Gate (Peak Detection):	*time interval of input signal peak search starting from the trigger and ending with the amplitude sampling, used as a measure for the signal energy*
Shaping Time (Trapezoidal Filter):	*time value indicating the rise time of the signal response to slow trapezoidal filter; 5 ns resolution; configurable values between 20 ns and 41 µs*
Flat Top(Trapezoidal Filter):	*the flat region of the trapezoid, in which the energy is calculated; 5 ns resolution; configurable values between 20 ns and 41 µs*
Energy Sampling (Trapezoidal Filter):	*adjusts the point of the flat top where the energy value is calculated; configurable values between 0% and 100%*
Tau (Trapezoidal Filter):	*exponential decay constant of the input signal that should be adjusted to avoid trapezoidal overshoot or undershoot for a correct evaluation of the energy; 5 ns resolution; configurable values between 20 ns and 320 µs*
Gain (Trapezoidal Filter):	*applied to the trapezoidal filtered signal to exploit all the energy spectrum dynamics; configurable value between 1 and 100*

Pileup Rejector: each Energy calculation method has a pileup rejector method. For the Peak Detection it is possible to use an External signal, to reject the event if the provided Digital Input signal happens during the Energy Gate, or to implement the Trigger Signal Mode, a simple rejection of all the trigger events occurring during the Energy Gate. In case of Trapezoidal Filter the Pileup rejection is implemented in the following way: each trigger occurring between the previous trigger event and the corresponding energy sampling is rejected and causes the rejection of the previous trigger (double pileup rejection), while the trigger occurring after the energy sampling and during the Pileup Rejection Guard time configurable by the user is simply rejected (single pileup rejection). In addition, each trigger event, even if rejected, extends the rejection time implementing a paralyzable behavior.

Pileup Rejection Guard (Trapezoidal filter):
starting at the energy sampling, indicates the single pileup rejection time interval; 5 ns resolution; configurable values between 0 µs and 320 µs

Baseline Restorer: In case of Trapezoidal Filter it operates on the trapezoidal filter output to calculate the baseline by averaging a programmable number of points before the start of the trapezoid and remaining stable during the Hold time. For the Peak Detection the baseline is a constant value that can be defined by the user or automatically determined by using the Analog Input Offset value.

Moving Average Baseline Length (samples): 2^1-2^{14}

Saturation: The automatic rejection of Saturation events can be set. In addition, it is possible to decide the Saturation Inhibit Time, the time interval after the signal saturation in which the trigger algorithm is inhibited.

Saturation Inhibit:
starting at the end of signal saturation, indicates the trigger algorithm inhibit time interval; 5 ns resolution; configurable values between 0 µs and 320 µs

MCS: It is possible to select the rates to be shown and stores between Input Count Rate, Output Count Rate and Trigger ROI Rate

Dwell Time:
1 s up to 3600 s with resolution of 1s

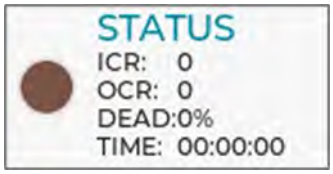
Screen Examples

Screen Loading

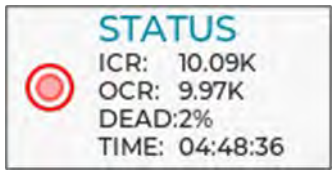
Screen Loading Recovery

Screen Recovery

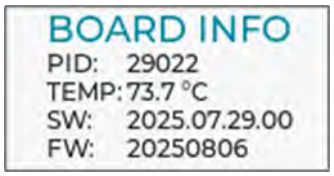
Screen1 Home



Screen2 - Idle mode STATUS



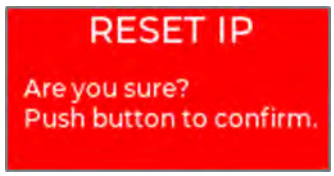
Screen2 - Running mode STATUS



Screen3 - BOARD INFO

Screen3 - NETWORK INFO

Screen5 - RESET IP

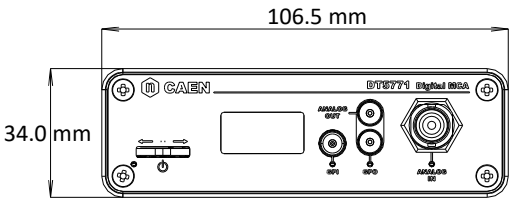


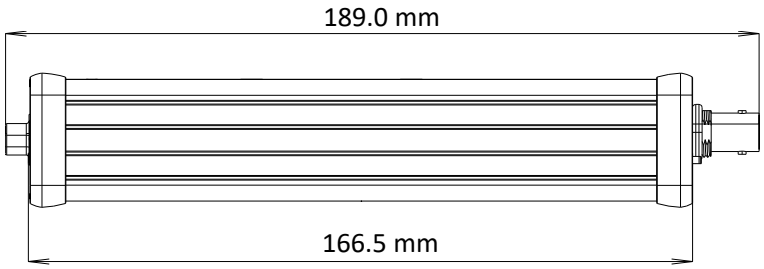
Screen5 - RESET IP confirmation

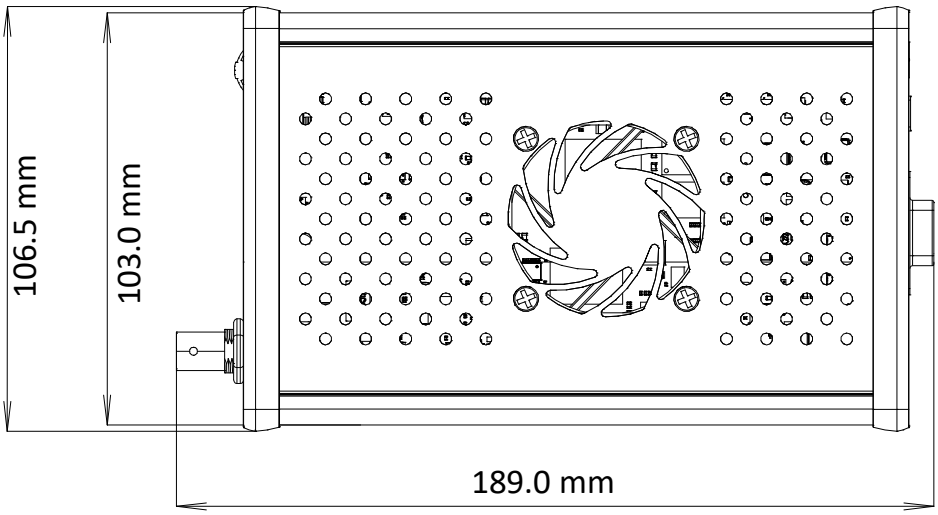
Screen5 - RESET IP result

Screen Shutdown

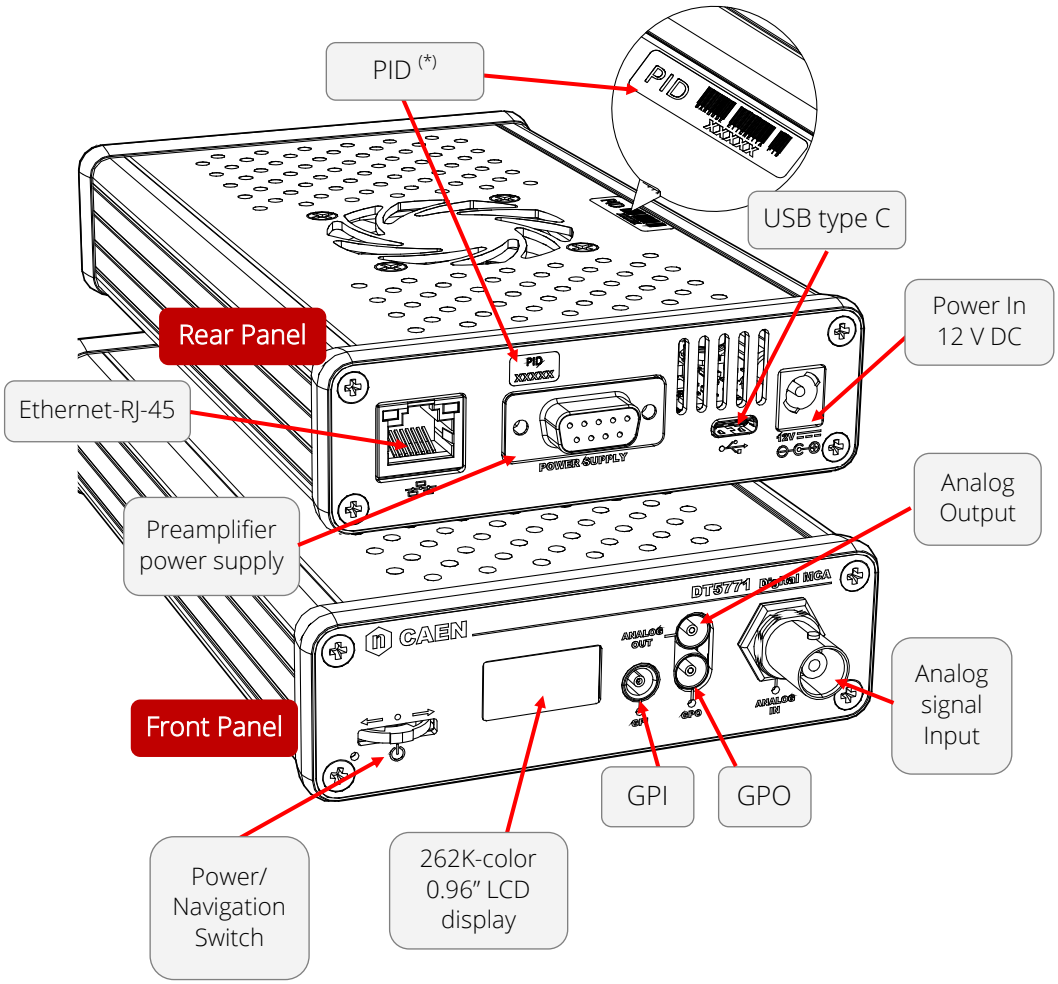
DT5771 Mechanical Dimension



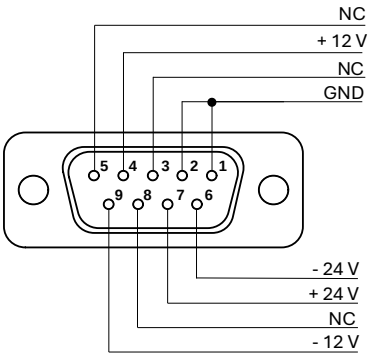


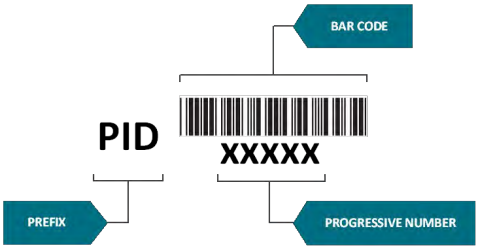


DT5771 Panels Description



POWER SUPPLY pinout





(*) PID (Product IDentifier)

The PID is a unique, incremental number greater than 10000 assigned to every CAEN product. This unique identifier is affixed to the product on an adhesive label composed of the "PID" prefix followed by the incremental number. The PID can also be read by the attached CODE39 barcode.

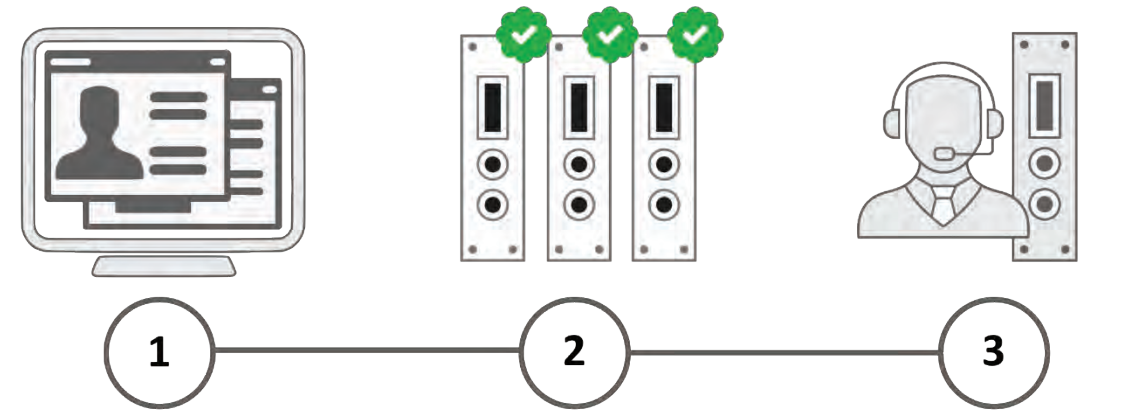
Ordering Option

DT5771 - 1 Channel Digital MCA	Ordering code: WDT5771XAAAA

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/

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