

# ORION



The **ORION** is the most advanced digital signal processor developed by ITECH INSTRUMENTS. It is a 64K channel analyzer based with 100% digital signal processing. The **ORION** features a 100 MHz 16 bit sampling ADC, an internal Linux computer, and internal high voltage bias supply all supporting pulse height analysis, list and peak shape data acquisition.

The front panel of the **ORION** includes a 3.5" TFT touch screen with autoranging display of peak counts and a calibrated horizontal axis displaying energy.

LED's confirm serial or Ethernet communi-

cation with a PC. Other LED's confirm HV and warn of a system or detector problem.

The **ORION** for germanium, or the NaI version, are controlled by **InterWinner** software. **ORION** connects to a PC via USB or Ethernet but **ORION** is a fully functional stand-alone spectrometer with spectrum storage.

Together with the **InterWinner 7.0** software this makes the most advanced nuclear spectroscopy instrument on the market.

## Control software

The **ORION** system is usually used together with **InterWinner 7.0**, which allows the setting of all the parameters of the **ORION**. This includes analog gain settings, digital filters and thresholds, high voltage settings and mode settings for the digital inputs and outputs.

Displayed information includes the voltages of the preamplifier supply, the current value of the high voltage and the status or the integrated counters.

**InterWinner 7.0** with Germanium or NaI analysis option, allows to create calibration files which will be stored on the **ORION** itself. Such a calibration file includes an isotope table, an – optionally **WinnerTrack** created – efficiency curve and additional absorption corrections. The **ORION** then can autonomously calculate isotope activities using such a calibration.

The screenshot displays the InterWinner 7.0 software interface, showing several windows and a spectrum plot.

**Setup Detector DET1 - Orion** (top window):

- Settings | Voltages | TTL I/O | Calibration files | Display | Spectrum Stabilizer
- Calibration files table:

Name	Comment	Isotope table	Efficiency func...	Transmission f...	Shield
CoCsZnMnY		S1			
		K-40			
		EU-152			
		CS-137			

**Setup Detector DET1 - Orion** (middle window):

- Settings | Voltages | TTL I/O | Calibration files | Display | Spectrum Stabilizer
- Inputs table:

Pin	Mode	Status	Counter
I0	Digital Input	●	
I1	Trigger Input	●	
I2	Sync Input	●	
I3	Digital Input	●	
I4	Digital Input	●	

- Outputs table:

Mode	Status	Integration	Range	Duration[ns]
00 SCA	●		60000	1000
01 SCA	●		65535	100000
02 SYNC	●		65535	500
03 TTL	●		65535	500
04 TTL	●		65535	500

**Orion** (bottom window):

- Mode:  continuous  single shot
- Acquire button
- Sample interval: 12.5 ns
- Sample points: 4096
- Trigger:  enable  invert
- Threshold: 20000
- Delay: 20.0 μs
- Y Scale:  ADC Units  mV
- Options: Color: green
- Parameters: Decay time: 1127.37 μs, Threshold: 20.0
- Filter:  FFT, Energy:  W  T  B, Trigger:  W  T  B,  Threshold
- Files:  Store data, Read file button

**new calibration** (bottom-left window):

- Create new calibration
- Name: Sample
- Comments: Example for a calibration
- Activity unit: Bq
- Width of window: 1.0 - 2.0 keV
- Isotope table: STANDARD | ISO
- Efficiency function: GAMMA3 | EFF
- Transmission function: | ABS
- Absorption - Shield: Material: | ATT, Thickness: mm, Density: g/cm<sup>3</sup>
- Absorption - Matrix: Material: | ATT, Thickness: mm, Density: g/cm<sup>3</sup>
- Buttons: OK, Cancel

**Spectrum Plot:**

- Y-axis: 55000, 60000, 65000
- X-axis: 10, 20, 30, 40, 50 [μs]
- Plot shows a sharp peak at approximately 20 μs.

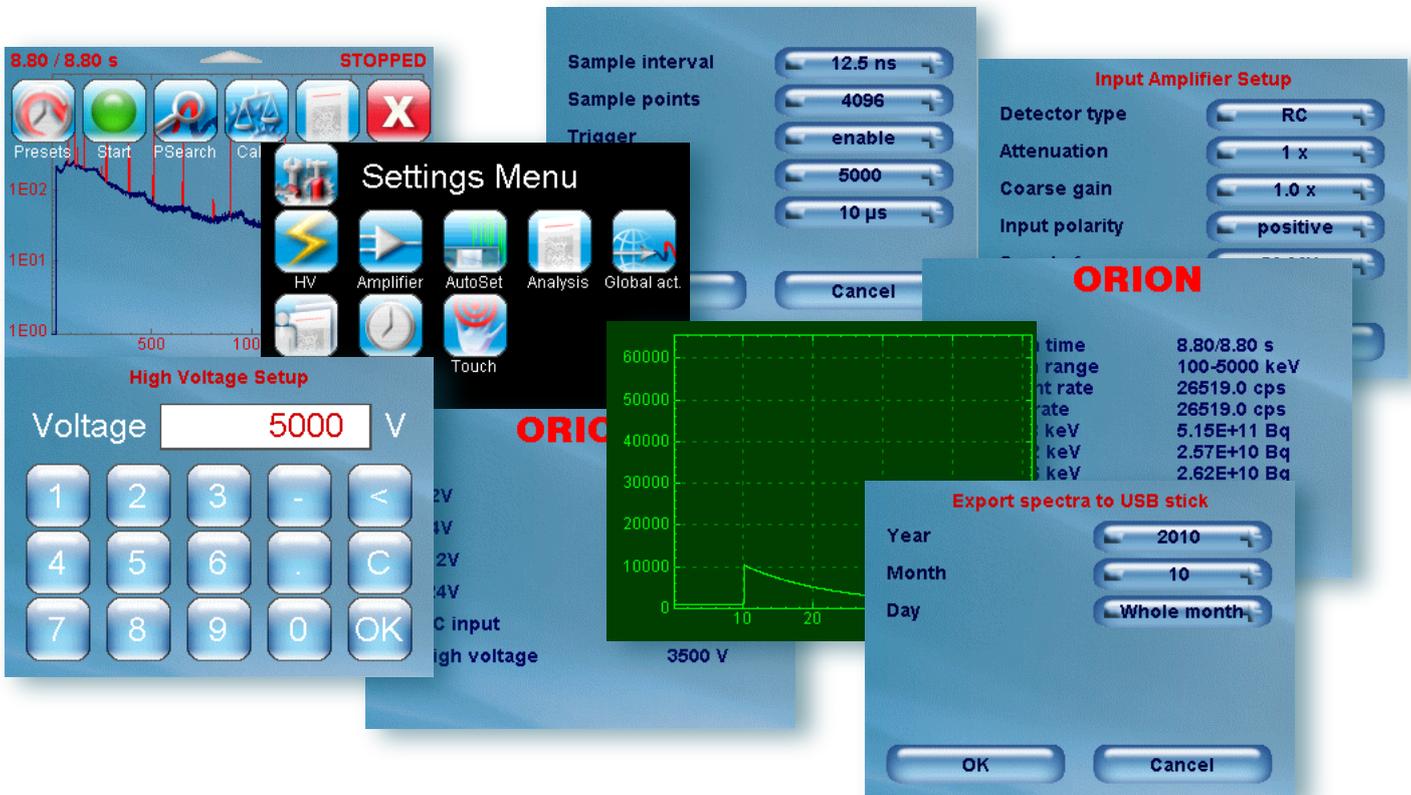
## Internal TFT screen

The **ORION** user interface is a modern smart-phone-style touch screen interface. It comes in several languages, English, French, German, Italian, Spanish, Russian, Chinese. (Other languages to come in future firmware releases.)

The most frequently used functions are implemented in this interface. This includes:

- ▶ Setting and enabling of the high voltage
- ▶ Oscilloscope with trigger
- ▶ Gain and input polarity setting

- ▶ Automatic setup, including automatic energy calibration
- ▶ Starting and stopping the acquisition
- ▶ Spectrum display, including zoom and ROI marking
- ▶ Peak search
- ▶ Analysis, including activity calculation (Isotope table and efficiency have to be prepared on the PC in advance)
- ▶ Automatic spectrum storage
- ▶ Recall stored spectra
- ▶ Global gamma analysis including calibration of efficiency and background
- ▶ Visualize the system health status
- ▶ Export spectra on a connected USB stick



## Specifications

### Front panel controls

- ▶ 3,5" TFT LCD touch screen
- ▶ 6 LEDs

### Back Panel connectors

- ▶ BNC Signal input
- ▶ BNC HV shut down input
- ▶ SHV Positive HV output
- ▶ SHV Negative HV output
- ▶ BNC HV shutdown input
- ▶ BNC TRP inhibit input
- ▶ BNC Gate input

- ▶ D-SUB9 Preamplifier power output
- ▶ D-SUB25 Digital I/O, counters, SCA output, serial interface etc.
- ▶ DC power input (9-18 V DC)
- ▶ RJ-45 Ethernet port
- ▶ USB-A USB host interface
- ▶ USB-B USB device interface

### Signal Input

- ▶ Coarse Gain range is 1x to 362x
- ▶ Input polarity can be positive or negative
- ▶ Conversion gain can be selected as 256,512,1024,

- ▶ 2048,4096,8192,16 384,32768 or 65536 channels
- ▶ Compatible with RC and TRP type detectors from different manufacturers

### Operation Modes

- ▶ PHA mode with up to 65536 channels
- ▶ Time stamped list mode: Every event is stored together with it's arrival time in units of 12.5 ns. The generated list also contains the status changes of up to eight digital trigger signals.
- ▶ Pulse shape mode: In this mode not only the event energy but also the whole ADC for a selectable time before and after the event is stored
- ▶ Multi-spectrum-scaling mode: This mode is implemented based on the list mode and the WinnerScan software. The events are sorted in different time slices after some external start event. The durations of the time slices are multiples of 12.5 ns, the number of time slices is practically unlimited. This mode is useful in decay studies.

### Control processor

- ▶ Internal Linux computer with 64MB RAM and 256 MB (optionally + 1 GB) flash memory.
- ▶ TFT Touch screen

### Internal spectrum storage

- ▶ The **ORION** contains live memory for several spectra and a flash memory for several thousand spectra internally.
- ▶ Spectra can be transferred to the PC over Ethernet or by exporting them on an USB stick

### Communication ports

- ▶ 10/100 BASE-TX Ethernet: Female RJ-45 connector for connection to an Ethernet switch/hub or directly to a computer using a crossover cable. TCP/IP protocol.
- ▶ USB: USB B type connector. Full speed connection.
- ▶ RS-232: An RS-232 port is available for special applications, for example control of external equipment or for telephone line control of the device.

### I/O Ports

- ▶ The ORION has two digital input on BNC connectors for TRP inhibit and gate.
- ▶ In addition, the ORION has 8 digital inputs for sample changer control, counting applications, external trigger signals, synchronization and other applications.
- ▶ The ORION has 5 digital outputs (TTL) which can also be configured as SCA outputs or synchronization.

### High voltage power supply

- ▶ Two SHV connectors for positive and negative high voltages
- ▶ Programmable high voltage output
- ▶ Setting resolution 12 bit.
- ▶ Voltage range  $\pm 500 - \pm 5000$  V (Germanium version) or  $\pm 500 - \pm 2000$  V (NaI version)
- ▶ HV inhibit signal polarity is computer selected

### Housing

- ▶ Metal enclosure
- ▶ Size: 173x84x180 mm
- ▶ Weight: 1900 g

### Power supply

- ▶ External power supply accepting 50/60 Hz and 100-240 V

### Environmental

- ▶ Operating temperature range 0-40 °C
- ▶ Humidity < 80%, non condensing

### Control software

- ▶ InterWinner 7 nuclear spectroscopy software

### Options

- ▶ Orion digital spectrometer as NIM module
- ▶ External battery package for Orion

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