

ORTEC[®]

Micro-trans-SPEC

Ultra-Light, Battery-Powered, Portable,
LN₂-Free, HPGe Gamma Spectrometer



“A Lightweight and Compact Solution
for Heavyweight Spectroscopic Problems”

AMETEK[®]
ADVANCED MEASUREMENT TECHNOLOGY

Micro-trans-SPEC

- **Amazingly Light** 15 lb (6.8 kg).
- **Tough** — Enclosure, Display, and all connections sealed against moisture and dust. Water spray resistant.
- **High Sensitivity** — 50 mm Ø x 33 mm ($\pm 10\%$) HPGe detector.
- **High Stability** — Digital electronics.
- **Bright and Clear** — VGA display with touch sensitive operator screen.
- **Smart** — On board ROI-based Nuclide ID and activity calculation.
- **Well Connected** — USB 2.0 and Wireless 802.11, GPS, and SD card storage of acquired spectra.
- **Flexible** — Multiple choice of power sources: internal and external battery, automobile power, line power; all with automatic switchover.
- **No LN₂ Required** — Miniature, high-efficiency, Stirling-cycle cooler; detector element is sealed in a high-reliability, low-loss cryostat.

Plus the latest improvements. . .

- Operating time of up to 5 hours on a single battery.
- “Snap-open” battery door for rapid battery exchange with minimal down-time.
- New wireless interface for mobile and remote applications (i.e., MAESTRO, GammaVision).

Micro-trans-SPEC Applications

- Nuclear Materials Hold-Up
- Nuclear Safeguards Inspection
- In-situ Waste Assay Measurements
- Emergency Response
- Reactor Maintenance, (e.g., corrosion product monitoring)
- Medical Physics

Micro-trans-SPEC is small and light, compared to all other portable HPGe spectrometers, (LN₂ cooled and electrically cooled). It extends the range of applicability of HPGe portable spectrometers.

Micro-trans-SPEC provides everything you need in a single easy-to-handle package. It delivers many advantages to any application: no need for liquid nitrogen, no long cables, one complete package and always ready for use.

In addition, Micro-trans-SPEC is an amazing 34% lighter than the previous trans-SPEC, weighing in at under 16 lbs, (a world record) and 20% smaller, and all with NO LOSS OF PERFORMANCE.



The snap-open battery compartment makes battery changing simple.



Desktop battery charger (MICRO-DET-ACC-CHGR).
Recharges battery (MICRO-DET-ACC-BAT)
in ~5 hours.

Micro-trans-SPEC

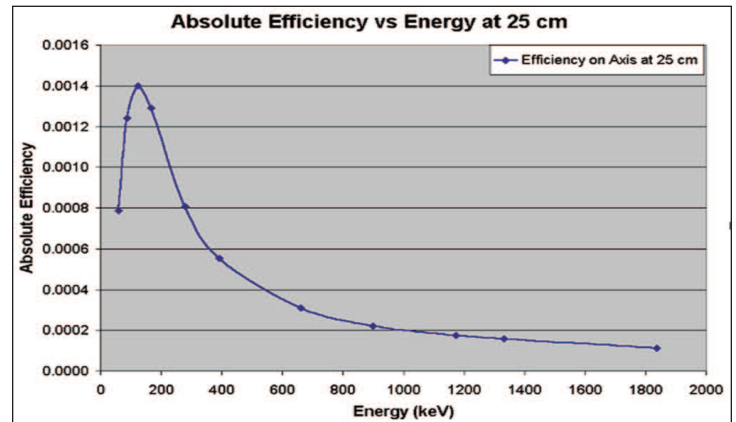
HPGe Detector and Cooler

The Micro-trans-SPEC HPGe detector is an ORTEC GEM Series P-type crystal that is 50 mm in diameter x 33 mm ($\pm 10\%$) in length with $\sim 13\%$ relative efficiency¹ in a "hardened" cryostat cooled by an integrated, low-power, Stirling-cycle cryo-cooler.

All Micro-trans-SPEC instruments use nominally identical germanium crystals. A cutaway drawing showing the construction materials is available on request from ORTEC and is suitable for most Monte-Carlo modeling programs.

A typical relative efficiency curve is shown in figure 1. The crystal is housed in an all-metal sealed, ruggedized cryostat, and cooled by a highly reliable miniature Stirling-cycle cooler. This cooler is capable of approximately 1 W of heat lift at 100°K, and draws less than 25 W when operating.

The latest revision Micro-trans-SPEC features a new cooler offering reduced levels of acoustic noise and vibration, and longer operational life. The hardened cryostat is entirely free of conventional molecular sieve allowing the instrument to be turned off or on at any point in the detector cool down or warm up cycle without risk. This is impossible with conventional HPGe cryostat systems which require careful temperature cycling procedures to avoid damage.



Digital Electronics

A built-in digital MCA system and powerful data processor are included. An active digital noise reduction filter (LFR)² implemented in the digital spectrometer reduces the effect of mechanically generated microphonic noise on the detector output signal, resulting in good energy resolution. Full control of the electronics parameter settings is allowed from the user interface, under password control. All models feature the same bright and clear VGA resolution display, readable in direct sunlight, with a touch sensitive operator screen. Menu navigation is highly intuitive. The radionuclide gamma-ray spectrum may be displayed and manipulated (e.g., vertical scale, zoom) like a conventional multichannel analyzer.

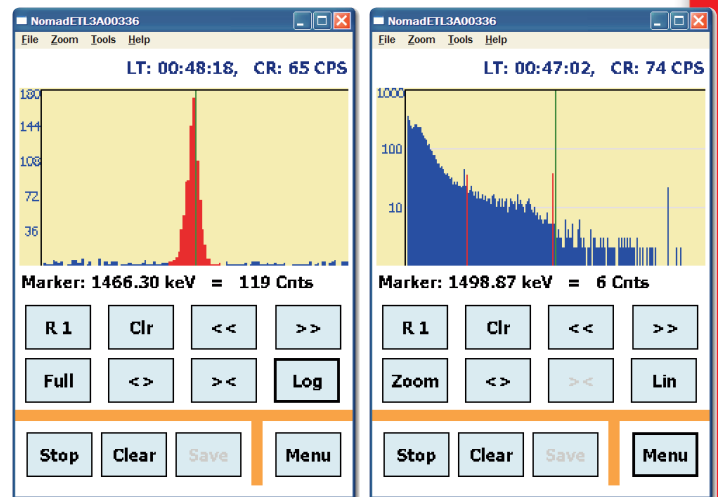
In the latest version, the Micro-trans-SPEC internal battery provides enough power for up to 5 hours of operation and is easily replaced in seconds, allowing continuous in-field operation.

Display and Control

The new Micro-trans-SPEC model features a bright and clear VGA resolution display with a touch sensitive operator screen. Menu navigation is highly intuitive. The overall design approach is one that will seem familiar to users of the previous generation of trans-SPEC instruments, but greatly enhanced.

The live radionuclide gamma-ray spectrum may be displayed and manipulated (e.g., vertical scale, zoom) similar to a conventional multichannel analyzer in both log and linear display modes.

There are three rows of buttons that are logically grouped together. The top row is used for ROI manipulation and navigation, the second row is used for spectrum display control and the bottom row is for hardware control, storing spectra, and navigation into the Menu Mode.



Expanded Spectrum Display

Full Spectrum Display

¹ ANSI/IEEE Std. 325-1996

² "Performance of Light-Weight, Battery-Operated, High Purity Germanium Detectors for Field Use," R.M. Keyser, T.R. Twomey, D.L. Upp, INMM 44th Annual Meeting, Phoenix, AZ, July 13-17, 2003.

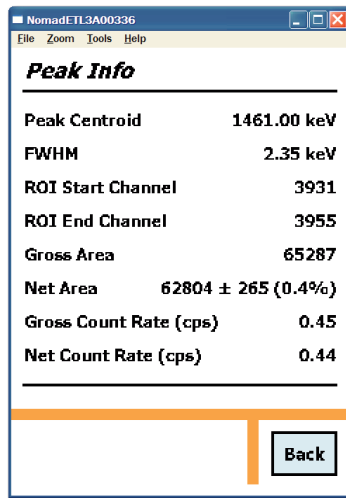
Micro-trans-SPEC

Menu items are designed to closely follow the original trans-SPEC logic. The menu structure, including all text menus and screens from the original design are converted to enhance operator familiarity, but with the attractiveness and utility of the new display technology.

Real Time Activity Calculations . . . No PC Required!

A Micro-trans-SPEC can perform simple nuclide activity calculations using internally stored calibration information, at the touch of a button, and all without the use of an attached PC. Everything is easily managed: the library for analysis, displayed peak labels, unit labels and calibration parameters.

The parameters are all easily created and downloaded by MAESTRO (MCA emulation software) to the Micro-trans-SPEC, or entered directly. The parameters can be modified in the field to adapt to changing needs. Activity is calculated for the list of up to nine nuclides. The spectral data can be saved and later re-analyzed in more detail using a more sophisticated PC-based analysis package such as GammaVision.



Peak Info Function

Peak Info Function

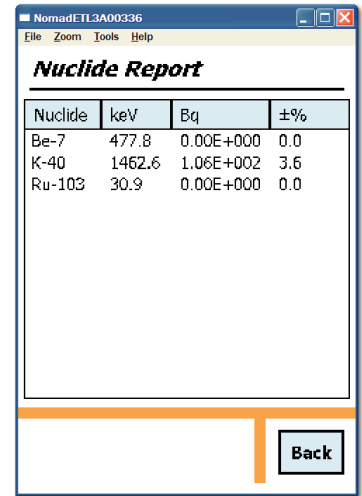
A peak information function allows the user to easily check that all is well with the data.

Data Security

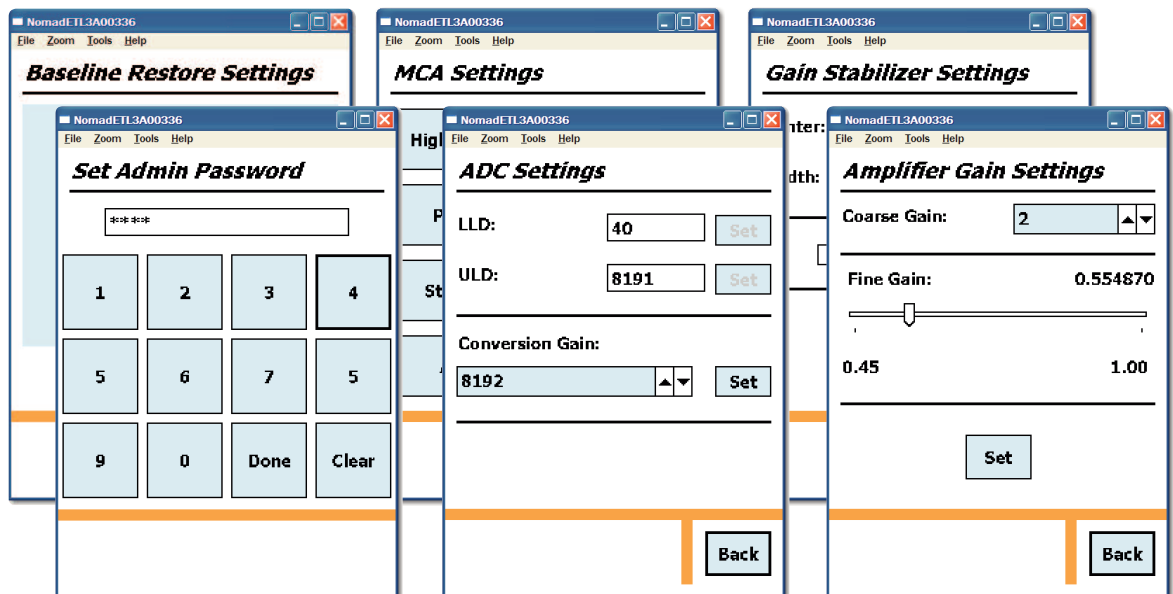
MCA Data Security is an important consideration. The MENU has numeric password or PIN protection. The operations are separated into two groups: USER and ADMINISTRATOR. The USER password protects the instrument from unauthorized use, allowing the user to protect data stored in the internal memory. The ADMIN or Setup functions are protected by a different administrator password. The ADMIN functions can only be changed by the Administrator ensuring that your results are based on the correct parameters.

Full Settings Control

Full control of all relevant instrument settings is available under password protection.



Nuclide Report



Settings Menus

Micro-trans-SPEC

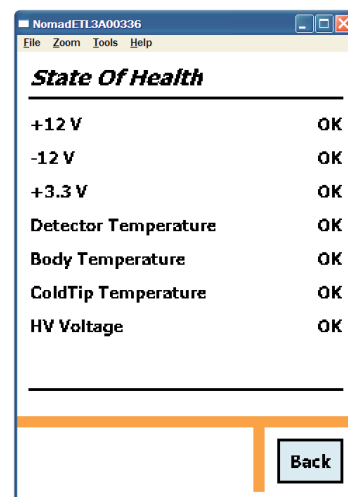
Instrument State-of-Health and Status

The Micro-trans-SPEC HPGe detector incorporates "SMART-1™" diagnostics, which verify that the instrument is operating properly. State-of-health and instrument status is available at a glance.

CONNECTIONS programs, such as MAESTRO which is included with the Micro-trans-SPEC, can read the state-of-health status parameters, and display them on a laptop, if connected. They may also be displayed on the Micro-trans-SPEC status screen. User-developed packages may read the status register through the Micro-trans-SPEC for maintaining the spectrum QA.

Flexibility in Choice of Power Sources

The Micro-trans-SPEC can draw power from a variety of sources. The charging circuitry is internal to the instrument. A mains power "brick" is included, which provides 15 V DC output from a mains input voltage of 90–264 V AC, 47–63 Hz, so it can be used anywhere in the world. Also, a cable is provided which allows the instrument to be charged via the accessory socket on a motor vehicle.



State-of-Health Display

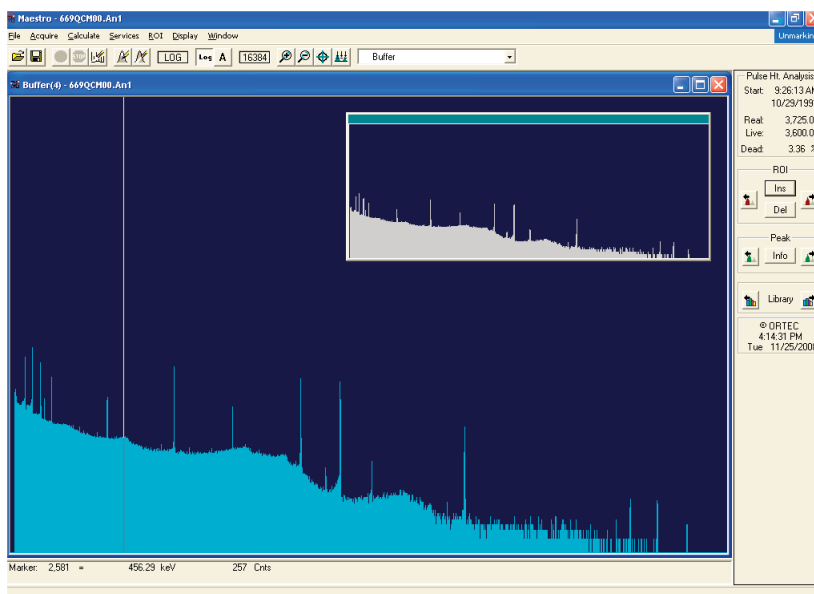
MCA Emulation and Spectral Analysis. . . MAESTRO MCA Emulator Included

The latest version MAESTRO MCA software is included to run on your PC or laptop. It provides a standard graphical user interface and can be used to control all system parameters from the convenient larger screen.

MAESTRO is a member of the ORTEC CONNECTIONS family of products, and provides full networking with other ORTEC spectrometers and supporting computers. MAESTRO includes features for identifying peaks, editing libraries, and creating, printing and saving Regions of Interest (ROI), performing energy calibrations, automating tasks via using simple "Job Streams," AND MORE!

Wireless Remote Control and Monitoring with the Mobile MCB Server

The Mobile MCB Server software application enables any ORTEC portable instrument having a PDA to communicate with ORTEC software applications such as MAESTRO, GammaVision, and Detective-Remote. The Mobile MCB Server acts like a wireless version of the USB connection, allowing users to control and monitor any portable spectrometer through a wireless network.



Create Your Own Custom Software with the Optional A11 Toolkit

The A11 CONNECTIONS Programmer's Toolkit is optionally available for those who wish to integrate the Micro-trans-SPEC into their own software systems. The Toolkit offers ActiveX Controls to simplify programming with LabVIEW, Visual C++, and Visual Basic. For more information on the Toolkit, ask for the A11 Programmer's Toolkit brochure.

Micro-trans-SPEC

SPECIFICATIONS

INTERNAL HPG_e DETECTOR

Dimensions (nominal) 50 mm diameter x 33 mm ($\pm 10\%$) length. Coaxial construction. P-type high-purity germanium.

Relative Efficiency 13% typical (ANSI/IEEE 325-1996).

Resolution ≤ 1450 eV @ 122 keV and ≤ 2.15 keV @ 1332 keV (FWHM Warranted at optimum settings).

Peak Shape ≤ 1.9 typical (FWTM/FWHM).

Cryostat and Cooler "Hardened" cryostat with high-reliability, low-power Stirling-cycle cooler. The cryostat design is such that the Micro-trans-SPEC may be switched off at any time and power subsequently re-applied without having to wait for a full thermal cycle (full warm up before cool down), as is normal practice with a HPG_e detector system. This feature greatly increases system availability during measurement campaigns.

Digital Noise Suppression "LFR Filter."

DIGITAL MCA AND DATA PROCESSOR

Display VGA 640 x 480 TFT, sunlight readable, touch sensitive, operate with finger or stylus.

Data Processor Marvel 806 MHz XScale.

Control Interface Setup, control and display modes on touch sensitive screen.

- Simple to use menu operation.
- Digital MCA with internal storage of multiple spectral data.
- Maximum number of stored spectra unlimited on removable media.

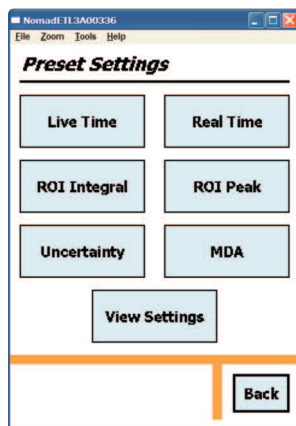
Full Display and Zoom Modes Display of multiple ROIs.

Main Display Configurable Status Line User-configurable parameter display allows two parameter choices from the following selection: cursor energy, location, live time, live time remaining, real time remaining, battery life remaining, count rate, count rate in ROI, and counts.

Energy Calibration Quadratic fit of energy versus channel.

On Line Activity Calculation Activity and uncertainty are calculated and reported on-screen, on-line for up to nine user-defined regions. Activity is calculated as net count rate divided by user supplied efficiency factor.

Multiple Presets Live time, real time, integral peak count, peak count, uncertainty and Multi-Nuclide MDA. Up to 20 nuclide ROIs may be specified. Acquisition halts when all MDA requirements have been satisfied. Real/Live Time in multiples of 1 sec.



Preset Types Settings

MENU FUNCTIONS

Pressing the Menu button while a spectrum is displayed brings up the Main Menu.

MAIN MENU OPTIONS

View Status Displays all of the major MCA settings, including: Live time, Real time, Dead time, Battery voltage, Bias voltage, Fine gain, Coarse gain, and Baseline restore [BLR] setting.

Sample ID Full alpha-numeric sample description may be entered; included in spectrum file.

Peak Info Reports centroid, FWHM, and net and gross counts for the region identified by the marker position.

MCA Settings Allows adjustment of MCA Controls.

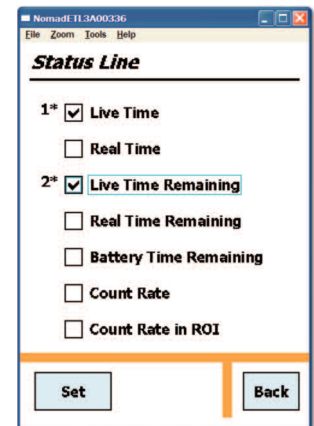
- 1 - HV Settings
- 2 - Amplifier Settings
- 3 - Presets Settings
- 4 - ADC Settings
- 5 - Stabilizer Settings
- 6 - Nuclide ROI Settings
- 7 - Audio Settings
- 8 - State of Health Status (read-only)

General Settings Control of instrument access, calibration, and the LCD display.

- 1 - Change User Password
- 2 - Change Admin Password
- 3 - Enter Admin Password
- 4 - Lock Spectral Display
- 5 - USB control
- 6 - Calibrate
- 7 - Set PHA mode
- 8 - Status/Marker Line

Status/Marker Line Sets up the Status Line at the top of the spectrum display and the marker line at the bottom to show a selection of the following parameters:

- 1) Status line, two of: Live time, Real time, Live time remaining, Real time remaining, Battery time remaining, Count rate, Count rate in ROI.
- 2) Marker line, two of: Marker location (energy), Marker location (channel), Marker channel counts.



Status Line Configuration

Micro-trans-SPEC

Spectra Settings

- 1) Ask for Sample Description on save
- 2) Set a default Sample Description
- 3) Set a data location
- 4) Set a file save format
- 5) Display a stored spectrum
- 6) Delete a spectrum

Nuclide Report Displays a list of predefined nuclides and reports the activity for each.

Cooler Settings Allows user to turn cooler on or off and reports any fault condition.

SYSTEM HARDWARE SETTINGS

Coarse Gain 1, 2, 4, 8, 16, or 32.

Fine Gain 0.45 to 1. With the available range of gain settings, the following FULL SCALE energy range is achievable ~40 keV to ~7 MeV.

Conversion Gain The Micro-trans-SPEC conversion gain is software controlled from 512 to 16k channels.

Dead-Time Correction Extended live-time correction according to Gedcke-Hale method. Accuracy: Area of reference peak changes $\pm 3\%$ from 0 to 50,000 counts per second.

Linearity

Integral Nonlinearity: $\leq \pm 0.025\%$ over top 99.5% of spectrum, measured with a mixed source.

Differential Nonlinearity: $\leq \pm 1\%$.

Digital Spectrum Stabilizer: Controlled via computer, stabilizes gain and zero errors.

Temperature Coefficient

Gain: < 35 ppm/ $^{\circ}\text{C}$. [Typically 30 ppm/ $^{\circ}\text{C}$.]

Offset: < 3 ppm/ $^{\circ}\text{C}$.

Overload Recovery At maximum gain, recovers to within 2% of rated output from X1000 overload in 2.5 non-overloaded pulse widths. (Measured using the MAESTRO InSight Oscilloscope.)

Pulse Pile-Up Rejector Automatically set threshold. Pulse-pair resolution typically 500 ns.

Digital Gated Baseline Restorer Computer controlled adjustment of the restorer rate (High, Low and Auto). U.S. Patent No. 5,912,825.

LLD Digital lower level discriminator set in channels. Hard cutoff of data in channels below the LLD setting.

ULD Digital upper level discriminator set in channels. Hard cutoff of data in channels above the ULD setting.

Ratemeter Count-rate display on MCA and/or PC screen.

PHYSICAL SPECIFICATIONS

Maximum Overall Dimensions (including handle, Ge detector endcap and shock absorbers) 14.7" L x 5.75" W x 11" H (37.4 cm L x 14.6 cm W x 27.9 cm H)

Height with handle removed 9.23" (23.4 cm).

Weight 15 lbs (6.8 kg).

Internal Battery Lithium Ion, 14.4 V, 6.2 Ah, 89 Wh, nominal. Up to 5 hours of battery life at 25°C when HPGe detector is cold. <4 hour time to charge. Internal battery is easily swapped through removal of snap shut battery door.

Input Power 10 to 17 V DC from battery or DC power supply (universal mains supply included). Battery charger circuit is inside instrument.

Power Usage <100 Watt during cool down. 5 Amp nominal while charging Battery. <2 Amp cold with fully charged battery.

External Power DC Input and battery Charge Input. 2.5 mm coaxial connector with locking screw on collar.

Temperature

Operation Range: -10°C to 40°C .

Relative Humidity: $< 90\%$ at 35°C , non-condensing.

Instrument Enclosure is sealed against ingress of dust and water. All perforations are sealed by rubber plugs (connectors, memory cards, etc.).

External Connectivity to System

1 SD (Secure Digital) card slot (3.3 V).

1 USB connection for "ActiveSync" capability or MCA operation with external computer.

WiFi 802.11 communication software.

Wireless Mobile MCB Server software.

1 Audio headphone jack.

Cool Down Time The high reliability cooler is designed for continuous operation. Between measurements the unit is powered from a DC supply, car battery or other high capacity device. Initial cool down time depends on ambient temperature, but is typically <12 hours at 25°C.

SOFTWARE

Micro-trans-SPEC is fully supported by the latest versions of the highly successful MAESTRO MCA Emulator (included) as well as ORTEC Gamma Spectroscopy packages such as GammaVision for generalized HPGe spectrum analysis, FRAM and MGAHI for Pu and U isotopic ratio analysis and ISOPlus for in-situ waste assay analysis.

The integral USB connection in the instrument hardware provides full PC control, real-time live MCA display, fast data transfer of single and multiple spectra to the PC, and full ORTEC CONNECTIONS network support.

Micro-trans-SPEC

Ordering Information

Model	Description
MICRO-TRANS-SPEC	Portable Integrated HPGe Spectrometer System. Includes mains adapter, battery cable, shoulder strap, soft side carry case, and MAESTRO software.
MICRO-TSP-PKG-1	Includes Micro-trans-SPEC Portable Integrated HPGe Spectrometer System, mains adapter, battery cable, shoulder strap, MAESTRO software and hard side wheeled transport case.
MICRO-UF6-PKG-1	Micro-trans-SPEC based portable UF6 Cylinder verification system. Includes customized Micro-trans-SPEC with reinforced structural frame, removable graded tungsten collimator and case, wheeled waterproof transport case, and UF6 software.
MICRO-UF6-STFC-PKG-1	Micro-trans-SPEC based portable UF6 Cylinder verification system. Includes customized Micro-trans-SPEC with reinforced structural frame and a Stable, Thin Front Contact on the detector, removable graded tungsten collimator and case, wheeled waterproof transport case, and UF6 software.
MICRO-DET-ACC-BAT	Lithium-Ion Battery.
MICRO-DET-ACC-BAT-DOR	Snap-Open Battery Door Upgrade Kit
MICRO-DET-ACC-BAT-UPG	Snap-Open Battery Door and Longer-Life SMART Battery Upgrade Kit for Micro-Detective and Micro-trans-SPEC models.
MICRO-DET-ACC-BAT-CHGR-UPG	Snap-Open Battery Door and Longer-Life SMART Battery Upgrade Kit with standard battery charger
MICRO-DET-ACC-CHGR	Standalone battery charger and calibrator kit.
MICRO-DET-ACC-SIXCHGR	6-Bay battery charger.
MICRO-DET-ACC-VEHCHGR	Vehicle powered battery charger.
MICRO-DET-ACC-PS	Universal AC mains power supply.
MICRO-DET-COL-ST	Steel Collimator.
MICRO-DET-COL-W	Tungsten Collimator.
MICRO-DET-OPT-1	Rugged, waterproof, wheeled transport case.
931286	Vehicle Power Supply Cable.
M-1-T2-MICRO-VERT	Variable length tripod and mounting hardware for Micro-Detective and Micro-trans-SPEC models.
M-1-T2	Variable length tripod for Detective and trans-SPEC models.
M-1-T2-BRKT-MICRO-VERT	Vertical mounting bracket for Micro-Detective and Micro-trans-SPEC models on M-1-T2 tripod.

Note: This brochure relates to instruments with the following revision levels:

Micro-trans-SPEC Rev.1.F or later

Specifications subject to change
012021

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