ORTEC®

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trans-SPEC-DX-100T

Battery-Powered, Portable HPGe Gamma Spectrometer

"In-Situ High Purity Germanium Gamma Spectroscopy
in a digital, battery powered instrument."

trans-SPEC-DX-100T

- **No LN$_2$** — Miniature, high-reliability, Stirling-cycle cooler eliminates the need for LIQUID NITROGEN; detector element is encapsulated in high reliability, low loss, all-metal sealed cryostat.

- **High Sensitivity** — Large (>40% relative efficiency) HPGe detector.

- **High Stability** — Digital electronics give you the solution for the toughest analysis in the toughest conditions.

- **Bright and Clear** — VGA resolution display with touch sensitive operator screen.

- **All-in-one Integrated Package** — Rugged and compact with no interconnections — easy to setup and go.

- **Smart** — Nuclide ID and activity calculation for nine Regions of Interest (ROI).

- **Well Connected** — USB 2.0 and Wireless 802.11 Communications, built-in GPS, and Secure Digital Input/Output (SDIO) storage of acquired spectra.

- **Flexible** — A variety of power sources can be used, including internal battery, supplemental external battery, automobile battery (any 12 V dc), and line power; all with automatic switchover.

Trans-SPEC-DX-100T Applications

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

The trans-SPEC-DX-100T is a HPGe gamma-ray spectrometer with everything you need in a single easy-to-handle package. There is no need for liquid nitrogen and no long cables. Everything is complete in one package and ready for use.

The many ORTEC trans-SPEC and Detective instruments already in the field are demonstrating the reliability of the basic design and of the revolutionary miniature Stirling-cycle cooler which ensures reliable and efficient cooling of the integral HPGe detector.

trans-SPEC-DX-100T

HPGe Detector and Cooler

The trans-SPEC-DX-100T HPGe detector is an ORTEC GEM Series P-type crystal that is 65 mm in diameter x 50 mm in length and >40% relative efficiency.[1]

The large HPGe crystal increases sensitivity and reduces time-to-MDA. The "over-square" geometry means best absolute efficiency up to in excess of 2 MeV.

All trans-SPEC-100 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.
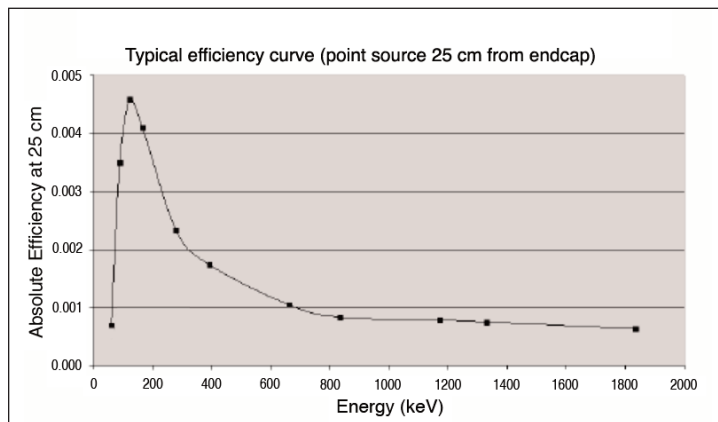
Digital Electronics

Detector signal processing is achieved by advanced digital electronics. 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.

Display and Control

The trans-SPEC-DX-100T features a bright and clear VGA resolution display with a touch sensitive operator screen. Menu navigation is highly intuitive.

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**
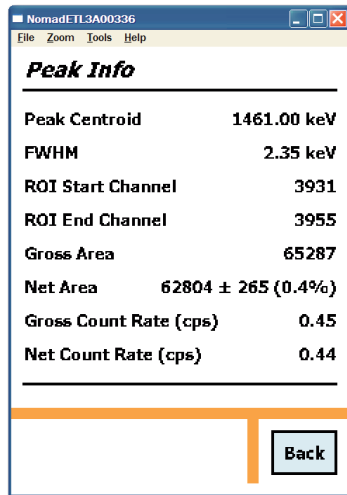
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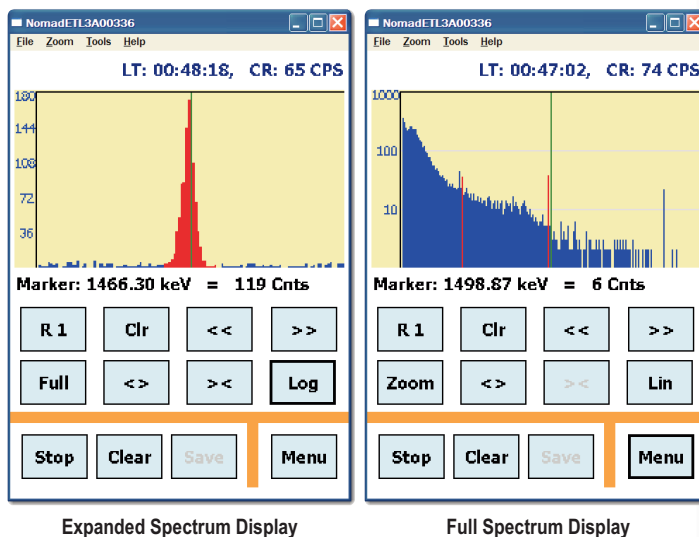
[1] ANSI/IEEE Std. 325-1996

[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.

trans-SPEC-DX-100T

Real Time Activity Calculations . . . NO PC Required!

A trans-SPEC-DX-100T 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 trans-SPEC-DX-100T, or entered directly. The parameters can be changed in the field to adapt to changing needs. Activity is calculated for the list of up to 9 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.

Nuclide Report

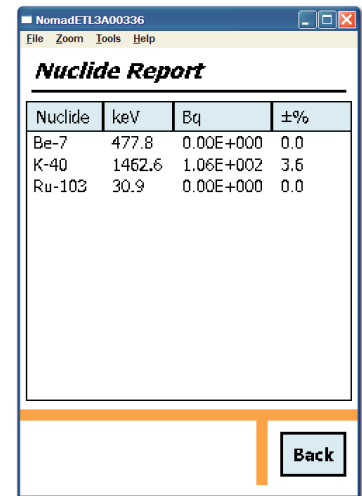| Nuclide	keV	Bq	±%
Be-7	477.8	0.00E+000	0.0
K-40	1462.6	1.06E+002	3.6
Ru-103	30.9	0.00E+000	0.0

Nuclide Report

Peak Info Function

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

Peak Info

Peak Centroid	1461.00 keV
FWHM	2.35 keV
ROI Start Channel	3931
ROI End Channel	3955
Gross Area	65287
Net Area	62804 ± 265 (0.4%)
Gross Count Rate (cps)	0.45
Net Count Rate (cps)	0.44

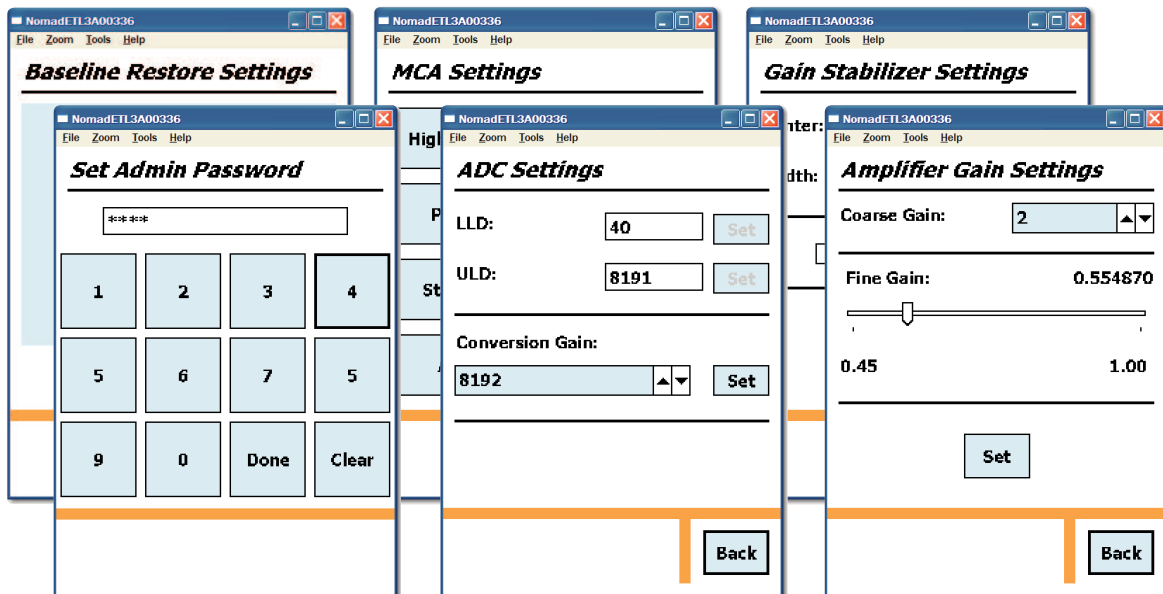**Peak Info Function**

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.

Set Admin Password

ADC Settings
LLD: 40
ULD: 8191
Conversion Gain: 8192

Amplifier Gain Settings
Coarse Gain: 2
Fine Gain: 0.554870
0.45 — 1.00

Settings Menus
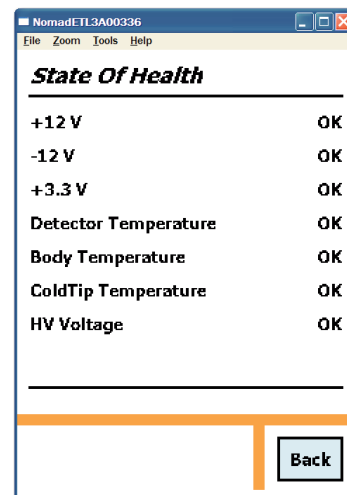
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Instrument State-of-Health and Status

The trans-SPEC-DX-100T 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 trans-SPEC-DX-100T, can read the state-of-health status parameters, and display them on a laptop, if connected, or they may be displayed on the trans-SPEC-DX-100T status screen. User-developed packages may read the status register through the trans-SPEC-DX-100T for maintaining the spectrum QA. (Ask for the ORTEC CONNECTIONS brochure.)

Flexibility in Choice of Power Sources

The trans-SPEC-DX-100T can draw power from a variety of sources. For initial cool down from ambient temperature, it is placed on the docking station, or attached to the compact AC/Power Adapter/Charger (PAC). The docking station provides small air movers to assist with initial cool down in conditions of high ambient temperature (>40°C).


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!
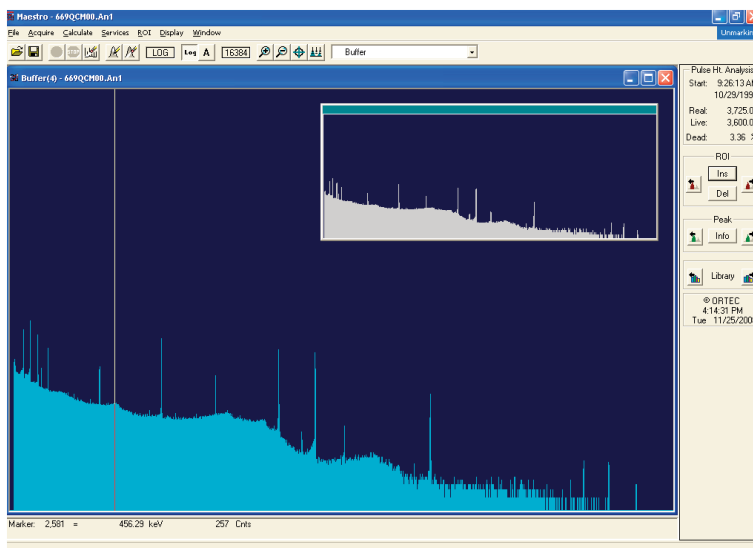
Wireless Remote Control and Monitoring with the Mobile MCB Server

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 trans-SPEC-DX-100T 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.

SPECIFICATIONS

INTERNAL HPGe DETECTOR

Dimensions 65 mm diameter x 50 mm length nominal. Coaxial construction. P-type high-purity germanium.

Relative Efficiency ≥40% typical (ANSI/IEEE 325-1996)

Resolution ≤1600 eV @ 122 keV and ≤2.3 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 cooler. The cryostat design is such that the trans-SPEC-DX-100T may be switched off at any time and power subsequently re-applied without waiting for a full thermal cycle (complete warm up before cool down), as is normal practice with a HPGe 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 touchsensitive, operate with finger or stylus.

Data Processor Marvel 806 MHz XScale.

Data Storage To internal RAM and removable SD card.

Computer Interfacing USB connection to laptop. Spectral transfer by Microsoft® ActiveSync. Remote control via Microsoft "remotedsp.exe" (supplied). Wi-fi (802.11) communication software optionally available.

GPS Internal NMEA compliant WAAS capable.

Digital MCA with Internal Storage of Multiple Spectral Data.

Digital Noise Suppression "LFR Filter" ORTEC (Patent Pending).

Conversion Gain 16k channel.

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 9 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.

MENU FUNCTIONS

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

Preset Types Settings

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. (A stylus or similar is recommended if this feature is to be used frequently.)

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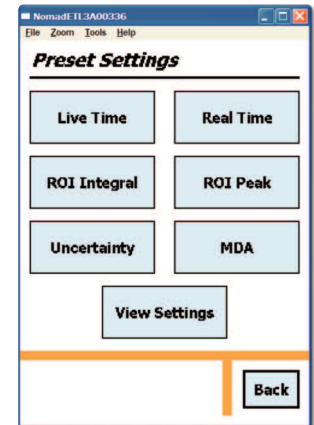
Status/Marker Line Sets up the Status Line at the top of the spectrum display and the marker line at the bottom to show a selection of the following parameters:

Status line, two of: Live time, Real time, Live time remaining, Real time remaining, Battery time remaining, Count rate, Count rate in ROI.

Marker line, two of: Marker location (energy), Marker location (channel), Marker channel counts

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 trans-SPEC-DX-100T 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 ±3% from 0 to 50,000 counts per second.

Linearity

Integral Nonlinearity: <±0.025% over top 99.5% of spectrum, measured with a mixed source.

Differential Nonlinearity: <±1%.

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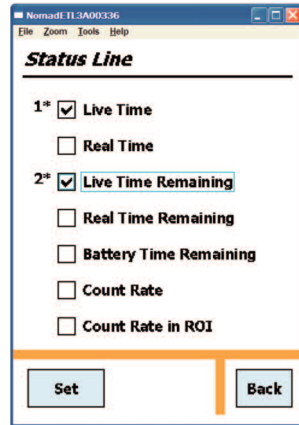
Status Line Configuration

Temperature Coefficient

Gain: <35 ppm/°C. [Typically 30 ppm/°C.]

Offset: <3 ppm/°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)
39.4 cm L x 16.3 cm W x 34.9 cm H
(15.5" L x 6.55" W x 13.75" H)

Weight 24.4 lb (11.1 kg)

Internal Battery Life >2 hours at 25°C with a cold detector on fully charged internal battery; battery lifetime may be extended indefinitely by the use of external battery packs which are available in "battery belt" formats. The unit is expected to be kept running once cold.

Input Power 10–17 V dc 30 Watt or via auto-sensing Mains powered Battery Charger.

Temperature Operation Range/Humidity –15 to +50°C, Relative Humidity <90% at 35°C, non-condensing.

Communications Ports

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 (ActiveSync and remote display software included).
• WiFi 802.11 communication software.
• Wireless Mobile MCB Server software.
• 1 Audio headphone jack.

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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.

UPGRADES

Existing trans-SPEC and trans-SPEC-100 instruments may be upgraded to the latest DX specifications. Contact your local ORTEC service center for details.

SOFTWARE

Trans-SPEC-DX-100T 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.

Ordering Information

Model	Description
TRANS-SPEC-DX-100T	Portable Integrated HPGe Spectrometer System. Includes docking station, universal mains supply, automobile power cables, shoulder strap, and MAESTRO software.
TSP-DX-100T-PKG-1	Includes TRANS-SPEC-DX-100T Portable Integrated HPGe Spectrometer System, docking station, universal mains supply, automobile power cables, shoulder strap, MAESTRO software and large wheeled transport case.
TSP-DX-100T-PAC	Portable Integrated HPGe Spectrometer System. Includes ac/dc power adapter/charger (PAC), automobile power cables, shoulder strap, and MAESTRO software.
TSP-DX-100T-PAC-PKG-1	Includes TSP-DX-100T-PAC Portable Integrated HPGe Spectrometer System, ac/dc power adapter/charger, automobile power cables, shoulder strap, MAESTRO software and compact wheeled transport case.
TSP-OPT-3	Automobile Power Adapter to Docking Station (4-pin)
TSP-OPT-4B	Docking Station AC Power Supply (4-pin)
TSP-OPT-7	Replacement Battery
TSP-OPT-8	Shoulder Strap
TSP-OPT-11	Automobile Power Adapter to Instrument or AC/DC Power Adapter/Charger
TSP-OPT-12	AC/DC Power Adapter/Charger (PAC-II)
TSP-OPT-16	Docking Station II with AC Power Supply
TSP-100-COL-ST	Steel Collimator, 4 mm thick
TSP-100-COL-W	Tungsten Collimator, 4 mm thick
TSP-ISO-SHLD-3	Lead Shield, 3" long x 2" thick. Provides 0.5" collimation. For use with trans-SPEC-DX-100T.
TSP-ISO-SHLD-2	Lead Shield, 2" long x 2" thick. For additional collimation with TSP-ISO-SHLD-3.
TSP-ISO-DCC	Carrier slide/plate and mounting adapter screws and bar for trans-SPEC-DX-100T and TSP-ISO-SHLD.
DETECTIVE-EX-OPT-2	Large Wheeled Transport Case with space for Docking Station
DETECTIVE-EX-OPT-3	Compact Wheeled Transport Case with space for AC/DC Power Adapter/Charger
DET-100-OPT-17	PSC TechniCART for use with trans-SPEC-DX-100. Includes ISO-DCC carrier slide/plate and ISO-ADAPT-100.
M-1-T2-100-VERT	Variable length tripod and mounting hardware for Detective and trans-SPEC 100 models.
M-1-T2	Variable length tripod for Detective and trans-SPEC 100 models
M-1-T2-BRKT-100-VERT	Vertical mounting bracket for Detective and trans-SPEC 100 models on M-1-T2 tripod

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ADVANCED MEASUREMENT TECHNOLOGY