ORTEC®

Micro-Detective-HX

Enhanced Capability, Ultra-Light, High-Fidelity
Hand-Held Radioisotope Identifier

AMETEK®
ADVANCED MEASUREMENT TECHNOLOGY

Micro-Detective-HX

• Wireless Remote Monitoring – Remotely control and monitor from a central location.

• Portable – Light weight, long battery life, "one-hand" operation with GPS location.

• Simple to Operate – Touchscreen or push button with audible and visual alarm indicators.

• Rugged – High or low temperatures, water proof, dust proof and drop hardened.

• Superior Algorithms – Low false alarm rates, more than 150 nuclide IDs and superior SNM search.

• Gamma and Neutron Detection – Identification, dose rate and count rate.

• Detects and Identifies x-rays and gamma rays from radioactive sources in any form (solid, liquid, or gas)

• Auto Calibration – Continuous real-time detector stabilization.

• Detective-Remote Compatible – Use as a mobile, transportable or choke point monitor.

Micro-Detective-HX is the latest development of high purity germanium (HPGe) based hand-held radioisotope identifiers "RID"s. The "-HX" is a commercially available version hand-held that includes additional features carried out under contract with the U.S. Department of Homeland Security.[1]

The Micro-Detective-HX Features

• 40% lighter than industry-leading ORTEC Detective-EX.

• 50% reduction in overall size.

• Simple to operate: Bright, clear, SUNLIGHT READABLE display, touch sensitive screen, and intuitive menus.

• Rugged: Enclosure, display, and all perforations are sealed against moisture and dust.

• Built in neutron detector.

• Built in GPS.

• Removable data storage SD card.

• WiFi 802.11 wireless communications.

• Wireless Mobile MCB Server software.

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 improved, silent running, low-power cryocooler.

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[1]The contract was awarded by the U.S. Department of Homeland Security (DHS) Domestic Nuclear Detection Office (DNDO) under the Human Portable Radiation Detection System (HPRDS). The HPRDS program began in 2006 in order to develop next-generation hand-held devices that would bring faster and more reliable means to detecting and identifying radioactive materials. Of the five contractors initially chosen to improve and enhance their radiation identification technology, AMETEK recently was selected by DHS to continue in the HPRDS program.

Micro-Detective-HX

Hardware

The Micro-Detective-HX features compact, light weight and rugged hardware. A 50 mm diameter HPGe crystal in a "hardened" cryostat is cooled by an integrated low-power Stirling-cycle cryocooler. The latest version Micro-Detective-HX features a new cooler, offering reduced levels of accoustic noise and vibration, and longer operation 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.

A built-in digital MCA system and powerful data processor are included. 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.

Gamma and neutron count rate and gamma dose rate are displayed continuously both numerically and in bar graph form.

In the latest version, the Micro-Detective-HX internal battery provides enough power for up to 5 hours of operation and is easily replaced in seconds, allowing continuous in-field operation. At just under 16 lbs. in weight, the Micro-Detective sets a world record for portable, high resolution nuclide identifiers, by a wide margin.

Exclusive to the -HX

• One-handed control of instrument through two handle-mounted buttons, or though touchscreen.

• Visual Alarms: LEDs provide clear and simple indication of nuclide type: threat, innocent or suspect, plus error indication.

• Vibrating alarm built into handle.

• 3-level auditory alarms can be routed through headphones.

-HX Software Approach

HPGe is already acknowledged as the "perfect" detector for a radioisotope identifier. It has ~40 times better energy resolution (selectivity) than the nearest alternative. Unlike lower-resolution detector types, HPGe crystals must operate at cryogenic temperatures — an engineering issue ORTEC solved 25 years ago. Several hundred Detective family instruments in the field attest to the reliability of today's miniature Stirling cycle coolers used for this purpose.

Beyond the intrinsic selectivity of the HPGe detector type, the ultimate performance in terms of its fidelity of identification (zero false positives or false negatives is the goal) depends on the software algorithms. Its practicality in use depends on reliable hardware and a user interface which is easy to learn and interpret.

The Micro-Detective-HX performance has been enhanced with the introduction of the new Detective-Pro user interface. Further reductions in both false positive and false negative results have been achieved, combined with a new design user interface and new modes of operation.

The Detective-Pro User Interface is

• Clear.

• Simple and intuitive.

• Informative.

• Based on simple-to-use hardware, even with one gloved hand.

The snap-open battery compartment makes battery changing simple.

Desktop battery charger (MICRO-DET-ACC-CHGR). Recharges battery (MICRO-DET-ACC-BAT) in 4 hours.

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The Micro-Detective-HX in Use: Overview

From the hardware standpoint the user interface comprises:

• Two buttons on the front of the handle, Navigate (N) and Select (S), with which all survey and sampling operations can be performed.

• A high-resolution, sunlight readable, color touchscreen provides an alternative way to choose menu options and enter data such as passwords and alarm limits.

• Audio-visual feedback:

Menus are designed to be operated with N and S buttons only, but if preferred, the touchscreen is always available.

On-screen help messages display radiation and system error alarms. The messages tell the user what the next press of the N and S buttons will do.

An audio alarm with three volume settings can be used with headphones and a vibration alarm is provided in the handle. Either, both, or neither can be enabled.

A 4-LED panel is used to further inform the operator of alarm conditions.

Color coding of the LEDs and screen borders match in order to make the instrument as intuitive as possible: red for threat, yellow for suspect and green for innocent.

Indicators at the top of the screen show the current dose rate in mrem/hr, the number of spectra that can be stored on the SD card, GPS co-ordinates, the power source (external power or battery), battery time remaining, and the on/off state of the audio and vibration alerts. The storage-space and battery-time-remaining readouts alternate every few seconds.

When radiation is detected and identified, the identification is posted to the real-time identification area of the screen. This area lists the names of any radioisotopes currently being detected and their classification as a threat (T), suspect (S), or innocent (I). It can also optionally show whether the identification is at high (H) or low (L) confidence.[2]

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[2]Note the only suspect alarm in standard sampling mode is "Elevated radiation or beta." This indicates the gamma count rate is higher than can be accounted for based on the peaks in the -HX library. The implication is that either an unexpected nuclide or a beta emitter is present.

Display and Control Buttons.

"Radiation Alarm."

Contextual Messages Give Function of the "S" and "N" Buttons.

Alarm LED Indicator.

Indicators at Top of Screen.

Real-Time Identification Area.

Neutron Alarm.

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The Micro-Detective-HX in Use: Modes of Operation

How the -HX Collects and Analyzes Data

• A flexible approach to minimize time and maximize effectiveness.

• Continuous running and fixed time modes with "end survey summary."

• Maximum flexibility, maximum sensitivity.

• Adaptable to the chosen CONOPS design.

The -HX monitors for radiation at all times. It collects one spectrum per second, then begins analyzing a rolling window of the eight most recent 1-second spectra for radioisotope identification and alarms.

• "Home" or "Passive Monitor" mode is the simplest form of operation. In this mode, the -HX is continuously "looking," but not storing data.

• In "Detect" or "Survey" mode, the instrument stores the 1-second data slices and attempts to make an ID based on the 8-second rolling windows.

• Optional "Long Samples" or "Fixed Samples," performed during the "Detect" mode survey, add longer spectrum acquisitions to the data stream of 8-second rolling-window analyses.

• The "End Survey Report" is a cumulative analysis of all 1-second data slices in the survey, providing increased detection sensitivity for weak or distant sources.

### Modes of Operation: Home (Passive Monitor) Mode: "Always Looking"

In Home (Passive Monitor) mode, the instrument is continuously "looking" but not storing data. Gamma dose-rate, battery life, storage space, and GPS co-ordinates are displayed. In this mode, the -HX acts like a survey meter in that if it is moved away from the source, the ID will be removed from the screen. However, any alarm posted persists and must be acknowledged (cleared). Data is gathered and processed in 1-second time slices. The -HX analyzes an 8-second rolling window of these slices and attempts to make an ID. Nuclide IDs are posted to the Real Time ID area.

Modes of Operation: Detect Mode (The Survey Concept)

Detect mode is used to better locate and identify sources. A Survey always begins with a Detect mode measurement, and can include Long and Fixed Sample mode (see below) operations also. The -HX can be set to automatically start a survey immediately after it is removed from charge or a survey may be started manually. 1-second data slices are saved to an ICD1/ICD2 file pair (see specification section) on the removable SD card. As in the Passive Monitor mode, the -HX attempts to make an ID based on an 8-second rolling window. At the upper part of the screen, the color-coded strip chart records Signal Index (cumulative activity of ALL nuclides identified). The chart peaks at the location of greatest activity. The lower chart shows the Threat Material Index similar to the Signal Index, but for threat material only. To the right of each strip chart, a vertical bar and numeric value is used to show the current value of the signal and threat indices. If appropriate to the measurement, alarm IDs are displayed in the Real Time ID area and must be acknowledged.
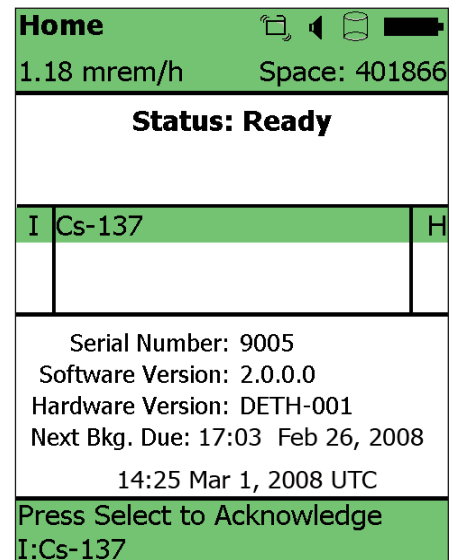
Home (Passive Monitor Mode), Innocent Cs-137 (Green Color Code).
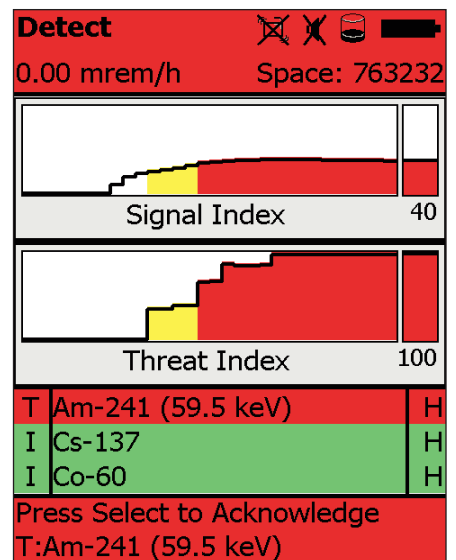
Detect Mode. Threat Am-241 (Red Color Code)

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Modes of Operation: Long and Fixed Sample Modes

During a Survey, in the Detect mode measurement, a source may have been located and closer scrutiny desired. Long or Fixed Sample modes may be used to achieve this. In Long Sample mode, a single spectrum is acquired for 30 or more seconds and analyzed once per second for alarms. Fixed Samples are treated similarly but have preset durations of 5, 10, 15, 20, 25, 30, 60, 120, or 300 seconds. In Long Sample mode, the live spectral display can be viewed. Long and Fixed Sample spectra and analyses are saved in the ICD1/ICD2 file pair for the Survey, along with the rolling-window and cumulative-analysis data.

"End Survey Report"

A Survey is started manually or automatically, as described above. Apart from the Detect mode operation, a survey may include either single or multiple long or fixed sample mode measurements. When a Survey is terminated by the operator, an "End Survey" summary report is displayed containing the following:

• Any alarms derived from the 8-second rolling window mode of operation which starts every survey,

• Any alarms derived from an analysis of a cumulative spectrum representing the summation of all the 1-second slices gathered during the survey, thereby attempting to ID any low intensity components which the rolling window analysis might have missed; the cumulative spectrum and analysis data are added to the ICD1/ICD2 file pair for the survey.

• Any alarms derived from those Long and Fixed Sample measurements included in the survey.

Modes of Operation: HX-LCX Operation — For the Expert

The LCX mode is "Low Confidence Expert" mode. This mode is password protected, and displays threat alarms and identifications at an approximately 30% lower confidence level than normal. This results in more "hits" on suspected threat nuclides, and is recommended for use by experienced personnel. Normal mode operation, in contrast, would either not post a threat alarm because the confidence level is too low, or would simply post an elevated radiation or beta alarm rather than listing a specific radionuclide.

The -HX and Background Radiation — No more NORM alarms

The -HX can distinguish between radioactive materials in the environment and the sample, so it does not indicate the presence of activity which is actually due to background. It does this by making periodic background measurements according to a schedule. A user with password access can choose the number of days between required background checks. If the required background update is not performed, the -HX permits unlimited passive monitoring but will not enter Survey Mode. However, even with an expired background, the -HX provides proper, real-time identifications of SNM, RDD, and other threats.
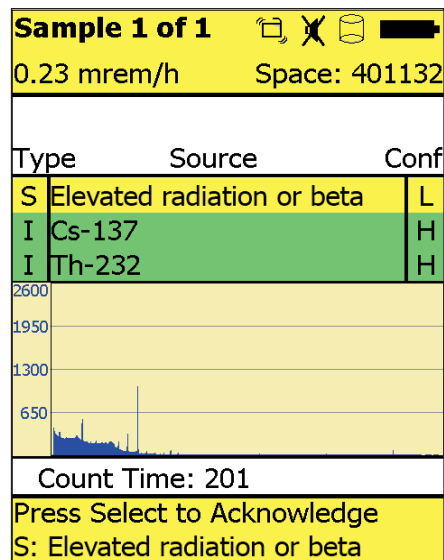
Long Sample Mode with Selectable Spectral Display.

Type	Source	Conf
T	Am-241 (59.5 keV)	H
S	U-235	L
I	Cs-137	H
I	Th-232	H

LCX Mode Real Time ID Area – Suspect Identification.

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The -HX and Digital Stabilization — Making the best of it

Although a digital germanium spectrometer is a highly stable instrument, even with varying temperatures, the -HX is designed for use in conditions that could be considered extreme (which certainly are not recommended but, within the specified mechanical and environmental limits, are not a barrier to correct operation). An automatic gain stabilizer system "locks onto" the natural background K-40 peak (if present) to ensure "perfect" calibration is maintained even in conditions of harsh handling. The stabilizer is "smart." If either the K-40 is determined as being absent, or if a potential gamma-ray interference with the K-40 peak is determined to be present, the stabilizer will be held at a constant setting.

The -HX Nuclide Library

The Micro-Detective-HX has a very comprehensive nuclide list. A subset of the entire nuclide library is the default "Threat Isotopes"; these are marked in RED in the table. The advanced user is able to add any of the nuclides marked in GREEN in Table 1 to the list of red-marked threat isotopes. The color coding in the table shows the default background screen colors and visual alarms the instrument will present when these nuclides are encountered. The YELLOW "suspect" alarm will be posted on the basis of excessive gamma count rate not consistent with the identified nuclides, in other words, either unknown nuclides are present or a beta emitter is present.

Table 1. -HX Nuclide Library.

HEU	Enriched Uranium	U-235	Pu-239	Np-237	U-233
Neutron CR (xx.x cps)	Neutrons Present	U-238	U-232	U-232/Th-232	Am-241
Am-241 (Shielded)	Am-241 (59.5 keV)	Ac-225	Ac-227	Ag-110m	Ar-41
As-72	As-74	At-211	Au-198	Ba-133	Ba-140
Be-7	Bi-207	Bi-212 (Th232/U232 daughter)	Bi-214 (Ra226 daughter)	Br-76	Br-76 (shielded)
Br-76 (heavily shielded)	Br-77	Ca-47	Cd-109	Cd-115	Ce-139
Ce-141	Ce-144	Cf-252/Cf-249	Cm-242	Cm-243	Cm-244
Co-56	Co-56 (shielded)	Co-55	Co-57	Co-58	Co-60
Cr-51	Cs-131	Cs-134	Cs-137	Cu-64	Cu-67/Ga-67
Eu-152	Eu-154	Eu-155	Eu-156	Fe-18	Neutrons on Fe
Fe-59	Elevated radiation or beta emitter	Ga-64	Ga-64 (shielded)	Ga-67	Ga-67 (shielded)
Ge-68/Ga-68	Gd-153	Gd-159	Hf-181	Hg-203	Ho-166m
Ho-166m (shielded)	Ho-166	I-123	I-123 (shielded)	I-124	I-125
I-126	I-126 (shielded)	I-131	I-131 (shielded)	I-132	I-133
I-134	I-135	In-111	Ir-192	Ir-192 (shielded)	Os-194/Ir-194
Ir-194 (shielded)	K-40	Kr-87	Kr-88	Kr-88 (shielded)	La-140
Lu-172	Lu-176	Lu-177	Lu-177m	Mn-52	Mn-54
Mn-56	Mo-99	Na-22	Na-24	Nb-94	Nb-95
Nb-96	Nb-96 (shielded)	Nd-147	Pa-231	Pb-203	Pd-103
Rh-105	Ru-97	Ru-106/Rh-106	Po-210	Pr-144	Ra-223
Ra-226	Ru-103	Sb-124	Sb-124 (shielded)	Sb-125	Sb-127
Sc-46	Se-75	Sm-153	Sm-153 (shielded)	Sn-113	Sr-82/Rb-82
Sr-85	Sr-89	Sr-90/Sr-89/Y-90	Ta-182	Tc-96	Tc-99m
Te-132	Tl-201	Tl-200	Tl-202	Tl-204	Th-229
Th-230	Th-232	Tm-170	Tm-171	W-188/Re-188	Xe-127
Xe-133	Xe-131m	Xe-135	Y-88	Y-91	Yb-169
Zn-65	Zn-62	Zr-95			

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Micro-Detective-HX Offline Analysis Program

• Views the spectral contents of -HX data files, real time and live time for each spectrum contained in each, radioactive sources identified (if any), and alarm types associated with each identification.

• Reanalyzes the data set with different nuclide libraries.

• Exports all spectra in an -HX file to a set of ORTEC .CHN format spectrum files. The .CHN files can then be viewed and analyzed in more detail with ORTEC applications such as the GammaVision Gamma-Ray Spectrum Analysis and MCA Emulator.

The Micro Detective-HX Offline Analysis Program is a utility supplied with every instrument. It is run on a PC and provides extended functionality for use post-analysis.

The key features of the program are listed below.

1 Toolbar — Click to issue the main program commands.

2 File Information Section — Displays the name of the ICD1/ICD2 file pair currently open; its Location; and the instrument with which it was acquired, including the firmware version and the unit serial number (ID).

3 Spectra List — Lists all the component spectra in the current ICD1/ICD2 file pair, including the background spectrum, any 8-second "rolling window" Detect Mode spectra, any Long or Fixed Sample spectra, and the final cumulative spectrum.

4 Export Button — Exports all the component spectra in the current ICD1/ICD2 file pair to a set of ORTEC .CHN format spectrum files.

5 Analysis Results Section — Lists the nuclides found (if any), including the threat type (innocent, suspect, or threat), dose rate in mrem/hr, and confidence level (H — high or L — low). In conjunction with this list, the three simulated LED readouts "light" according to the innocent (green), suspect (yellow), and/or red (threat) nuclides identified.

6 Spectrum Window — A full-scale display (0 to 8191 channels) of the currently selected spectrum, in counts per channel, with logarithmic vertical scaling. This window includes a vertical marker line which can be moved with the mouse.

7 Marker Information Line — Shows the energy, in keV, and counts per channel for the current marker position.

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Micro-Detective-HX Technical Specifications

Dose Rate Visual over range indication and continuous audible alarm, user settable. Over-ride alarm at dose rates >10,000 µSv/hr.

Internal HPGe Detector P-type high-purity germanium. Coaxial construction. Crystal Nominal Dimensions 50 mm diameter x 33 mm (±10%) length.

Cryostat and Cooler "Hardened" cryostat, with high-reliability, low-power Stirling cooler. The cryostat design is such that the Micro-Detective-HX 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 HPGe detector system. This feature greatly increases system availability during measurement campaigns.

Gamma Dose Rate Detector Two detectors determine the gamma dose rate over a wide range from <0.05 µSv/h to >10000 µSv/h, a dose-rate range of around six decades. For low dose rates, below ~20 µSv/h, the dose rate is determined from the Ge detector spectrum. For dose rates above this value, the internal compensated GM tube is used. Instrument switches between the two automatically.

Dose Rate Uncertainty <(–50% to +100%); continuous audible alarm at dose rates >10,000 µSv/h (fixed maximum threshold), user settable threshold below this.

Internal Neutron Detector Module Single tube: 4" active length, 0.5" diameter. High density Polyethylene moderator.

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.

Data Storage

> **Media** To internal RAM and removable SD card.

> **Storage Scheme** In passive monitor mode, no data files are saved. In Survey mode and Long and Fixed sample mode, ICD1 and ICD2 files are stored.

> **File Format** DNDO ICD format (similar to ANSI N42.42) for data and results.

> These files may be read, reanalyzed and exported to the Micro-Detective-HX Offline Analysis Program, which is included with the instrument. Exported files are in the well known ORTEC ".CHN" format and may be read by many programs used by Reachback teams such as CAMBIO and by ORTEC products such as GammaVision and the included MAESTRO-PRO software.

Computer Interfacing USB connection to laptop. Data transfer by Microsoft® ActiveSync. Wi-Fi (802.11) communication software. Wireless Mobile MCB Server software.

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** 8k channel.

> **Maximum Number of Stored Spectra** Unlimited on removable media.

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

Weight 16 lbs (7.25 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.

External Battery Battery lifetime may be extended indefinitely by the use of external battery packs. EXT-BAT-MICRO is recommended, weighs less than 3.25 lbs and extends lifetime to >10 hrs.

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 Strongest during cool down: <100 Watt. While charging Battery: 5A nominal. Cold with fully charged battery <2A.

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 Sealed against ingress of dust and water. All perforations are sealed by rubber plugs (connectors, memory cards, etc.). Instrument is not designed to tolerate immersion.

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.

> Wi-Fi 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 making 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.

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Communication Software

The Micro-Detective-HX is a member of the ORTEC *CONNECTIONS* family. Remote MCA control and individual spectrum download, even over a network, is achieved simply, by the use of the included MAESTRO-PRO Advanced Spectroscopy software.

MAESTRO-Pro is an advanced spectroscopy application which includes support for multiple languages, extensive calibration features, N42 spectrum file support, peak fit and analysis results display, expanded automation functions, and more.

Multiple spectra may be block-transferred from the instrument controller to external PCs by the use of Microsoft ActiveSync. Third party products such SOTI "Pocket Controller Enterprise" may be used to implement the 802.11 wireless feature to provide remote wireless control of the complete instrument.

Mobile MCB Server

The Mobile MCB Server software application enables any ORTEC portable instrument installed with a PDA to communicate wirelessly with ORTEC software applications such as MAESTRO, MAESTRO-PRO, 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.

Users can develop their own applications through the use of the optional A11 tool kit.

Micro-Detective-HX

Ordering Information

Model	Description
MICRO-DETECTIVE-HX	Enhanced Capability, Ultra-Light-Weight, Portable HPGe Identifier (Gamma and Neutron). Includes GPS, mains adapter, battery cable, shoulder strap, MAESTRO-PRO software, and softside carry case.
MICRO-DET-HX-PKG-1	Includes MICRO-DETECTIVE-HX Enhanced Capability, Ultra-Light-Weight, Portable HPGe Identifier (Gamma and Neutron), GPS, mains adapter, battery cable, and shoulder strap, MAESTRO-PRO software, and hardside wheeled transport case.
MICRO-DET-8-HX-PKG-1	Includes MICRO-DETECTIVE-HX Enhanced Capability, Ultra-Light-Weight, Portable HPGe Identifier (Gamma and Neutron), up to 8 MeV gamma energy range, GPS, mains adapter, battery cable, and shoulder strap, MAESTRO-PRO software, and hardside wheeled transport case.
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.
MICRO-DET-OPT-18	Low Energy Gamma Ray Filter.
EXT-BAT-MICRO	Ultra Battery Extender. Includes battery, charger, and cables for all Micro-Detective and Micro-trans-SPEC models.
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 Micro-Detective and Micro-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-Detective-HX Rev. N or later

Micro-Detective-HX

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